

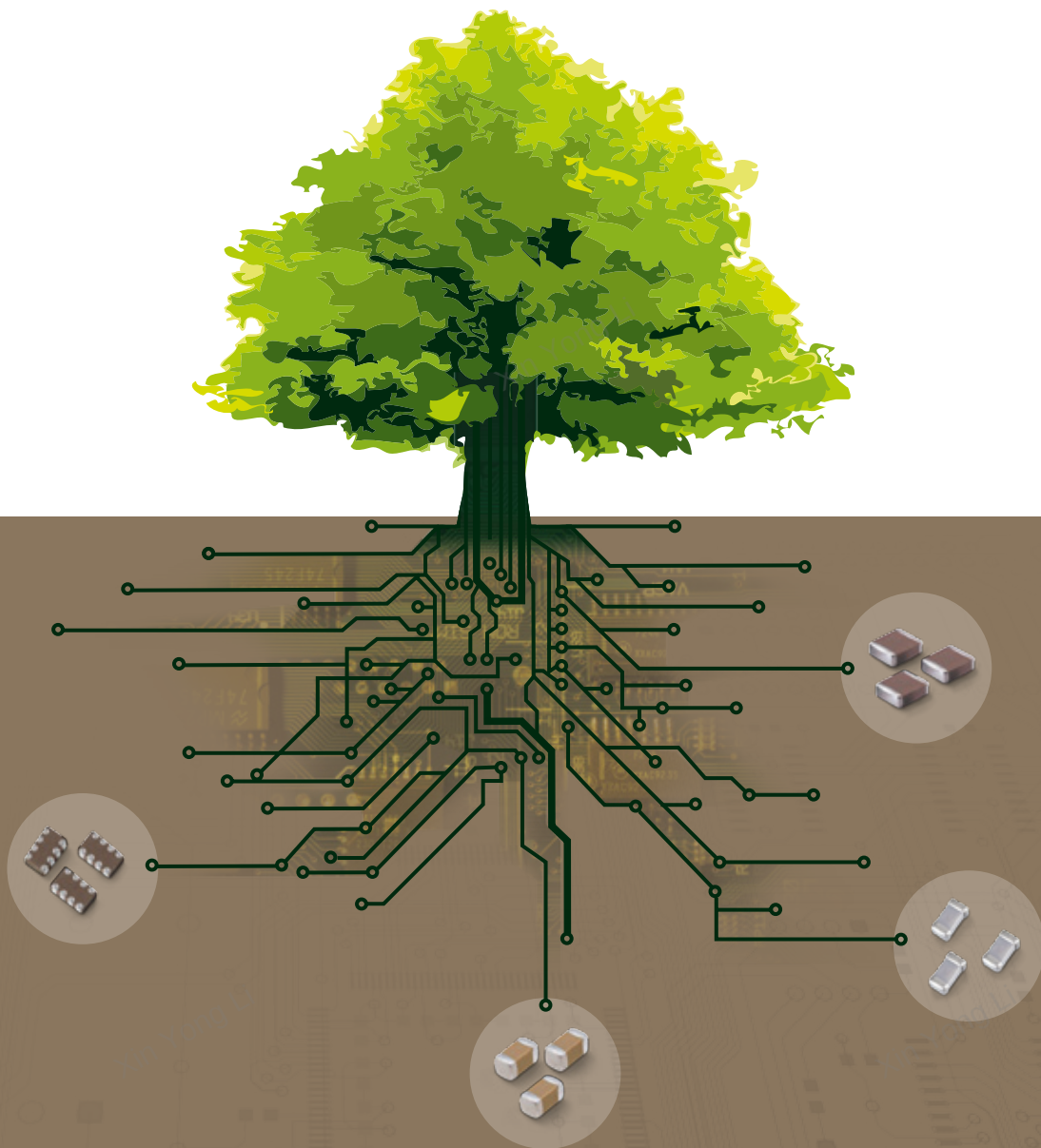
November 2015



Xin Yong Li

# MULTILAYER CERAMIC CAPACITORS

Xin Yong Li



SAMSUNG  
ELECTRO-MECHANICS

SAMSUNG



## We declare that all our MLCCs are produced in accordance with EU ROHS and REACH Directive.

### 1. RoHS Compliance and restriction of Br

The following restricted materials are not used in packaging materials as well as products in compliance with the law and restriction.  
- Cd, Pb, Hg, Cr6+, As, Br and the compounds, PCB, asbestos

### 2. No use of materials breaking Ozone layer

The following ODS materials are not used in our fabrication process.  
- ODS material : Freon, Haron, 1-1-1 TCE, CCl<sub>4</sub>, HCFC

If you want more detailed Information, Please Visit Samsung Electro-mechanics Website  
[<http://www.semlcr.com>]

## CONTENTS

|                                                      |    |                                                |
|------------------------------------------------------|----|------------------------------------------------|
| Part Numbering System .....                          | 4  | Part Numbering System                          |
| Standard & High Capacitors .....                     | 6  | Standard & High Capacitors                     |
| Super Small Size Capacitors .....                    | 30 | Super Small Size Capacitors                    |
| High-Q Capacitors .....                              | 35 | High-Q Capacitors                              |
| Medium-High Voltage Capacitors .....                 | 36 | Medium-High Voltage Capacitors                 |
| Array Type Capacitors .....                          | 47 | Array Type Capacitors                          |
| Low ESL Capacitors .....                             | 50 | Low ESL Capacitors                             |
| Reliability Test Condition .....                     | 53 | Reliability Test Condition                     |
| Premium Capacitors for Automotive Applications ..... | 60 | Premium Capacitors for Automotive Applications |
| Packaging Specification .....                        | 72 | Packaging Specification                        |
| Application Manual for Surface Mounting .....        | 76 | Application Manual for Surface Mounting        |

| <i>CL</i> | <i>10</i> | <i>A</i> | <i>106</i> | <i>M</i> | <i>P</i> | <i>8</i> | <i>N</i> | <i>N</i> | <i>N</i>  | <i>C</i>  |
|-----------|-----------|----------|------------|----------|----------|----------|----------|----------|-----------|-----------|
| <i>1</i>  | <i>2</i>  | <i>3</i> | <i>4</i>   | <i>5</i> | <i>6</i> | <i>7</i> | <i>8</i> | <i>9</i> | <i>10</i> | <i>11</i> |

CL = Multi layer Ceramic Capacitors

|                  |                 |                 |
|------------------|-----------------|-----------------|
| 02 = 01005(0402) | 21 = 0805(2012) | 43 = 1812(4532) |
| 03 = 0201(0603)  | 31 = 1206(3216) | 55 = 2220(5750) |
| 05 = 0402(1005)  | 32 = 1210(3225) |                 |
| 10 = 0603(1608)  | 42 = 1808(4520) |                 |

| Class I | Class II                                                       |
|---------|----------------------------------------------------------------|
| C = C0G | A = X5R    F = Y5V<br>B = X7R    X = X6S<br>Y = X7S    Z = X7T |

Capacitance expressed in pF. 2 significant digits plus number of zeros.  
example)  $106 = 10 \times 10^6 = 10000000 \text{ pF}$   
For Values  $< 10 \text{ pF}$ , Letter R denotes decimal point  
example)  $1R5 = 1.5 \text{ nF}$

B =  $\pm 0.1\text{pF}$       F =  $\pm 1\text{pF}, \pm 1\%^*$       K =  $\pm 10\%$   
C =  $\pm 0.25\text{pF}$       G =  $\pm 2\%$       M =  $\pm 20\%$   
D =  $\pm 0.5\text{pF}$       J =  $\pm 5\%$       Z =  $+80/-20\%$

\*For Values  $\leq 10\text{pF}$ ,  $F = \pm 1\text{pF}$   
Values  $> 10\text{pF}$ ,  $F = +1\%$

|          |         |          |          |           |           |
|----------|---------|----------|----------|-----------|-----------|
| R = 4V   | O = 16V | B = 50V  | E = 250V | H = 630V  | K = 3000V |
| Q = 6.3V | A = 25V | C = 100V | F = 350V | I = 1000V |           |
| P = 10V  | L = 35V | D = 200V | G = 500V | J = 2000V |           |

2 = 0.20mm A = 0.65mm F = 1.25mm L = 3.20mm S = 1.35mm  
3 = 0.30mm C = 0.85mm H = 1.60mm M = 1.15mm U = 1.80mm  
5 = 0.50mm D = 1.00mm I = 2.00mm P = 1.15mm V = 2.50mm  
8 = 0.80mm E = 1.10mm J = 2.50mm Q = 1.25mm Y = 1.25mm  
9 = 0.90mm

A = Normal Product Pd / Ag / Ni barrier / Sn 100%  
N = Normal Product Ni / Cu / Ni barrier / Sn 100%  
G = Normal Product Cu / Cu / Ni barrier / Sn 100%  
L = Low profile Ni / Cu / Ni barrier / Sn 100%  
S = Normal Product Ni / Cu / Soft termination / Ni barrier / Sn 100%

N = Normal  
A = Array(4-element)  
B = Array(4-element)  
L = LICC  
J = SLIC

| *Size tolerance |             |            |            |            |            |            |
|-----------------|-------------|------------|------------|------------|------------|------------|
| Size<br>Code    | 01005(0402) | 0201(0603) | 0402(1005) | 0603(1608) | 0805(2012) | 1206(3216) |
| S               | ±0.03       | ±0.05      | ±0.07      | ±0.07      |            | ±0.30      |
| Q               | ±0.05       | ±0.07      | ±0.10      | ±0.15      | ±0.15      |            |
| R               | ±0.07       | ±0.09      | ±0.15      | ±0.20      | ±0.20      |            |
| U               | ±0.09       |            | ±0.20      | ±0.25      | ±0.30      |            |
| Z               |             |            | ±0.40      | ±0.30      |            |            |
| 9               |             |            | ±0.30      |            |            |            |

N= Reserved for future use

B = Bulk  
P = Bulk Case  
C = Cardboard Tape, 7" Reel  
H = Cardboard Tape, 7" Reel (15,000ea)  
8 = Cardboard Tape, 7" Reel  
O = Cardboard Tape, 10" Reel  
D = Cardboard Tape, 13" Reel (10,000ea)  
L = Cardboard Tape, 13" Reel (15,000ea)  
Z = Cardboard Type, 7" Reel (Chip aligned for horizontal SMT)  
Y = Cardboard Type, 7" Reel (Chip aligned for vertical SMT)  
E = Embossed Type, 7" Reel  
G = Embossed Type, 7" Reel (3,000ea)  
F = Embossed Type, 13" Reel  
S = Embossed Type, 10" Reel

**Class I** (Temperature Compensation)

| Symbol | EIA Code | Operation Temperature Range(℃) | Temperature Coefficient Range(ppm/℃) |
|--------|----------|--------------------------------|--------------------------------------|
| C      | C0G      | -55 ~ +125                     | 0±30                                 |

\***Class II** (High Dielectric Constant)

| Symbol | EIA Code | Operation Temperature Range(℃) | Capacitance Change(Δ℃%) |
|--------|----------|--------------------------------|-------------------------|
| A      | X5R      | -55 ~ + 85                     | ±15                     |
| B      | X7R      | -55 ~ +125                     | ±15                     |
| X      | X6S      | -55 ~ +105                     | ±22                     |
| F      | Y5V      | -30 ~ + 85                     | -82 ~ +22               |
| Y      | X7S      | -55 ~ +125                     | ±22                     |
| Z      | X7T      | -55 ~ +125                     | -33 ~ +22               |

\*\*

| Series | TC  | Capacitance Step |     |     |     |     |     |     |     |     |     |     |     |
|--------|-----|------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| E-3    | Y5V | 1.0              |     |     |     | 2.2 |     |     |     | 4.7 |     |     |     |
| E-6    | X5R | 1.0              | 1.5 | 2.2 | 3.3 | 4.7 | 6.8 |     |     |     |     |     |     |
|        | X7R |                  |     |     |     |     |     |     |     |     |     |     |     |
|        | X6S |                  |     |     |     |     |     |     |     |     |     |     |     |
|        | X7S |                  |     |     |     |     |     |     |     |     |     |     |     |
|        | X7T |                  |     |     |     |     |     |     |     |     |     |     |     |
| E-12   | C0G | 1.0              | 1.2 | 1.5 | 1.8 | 2.2 | 2.7 | 3.3 | 3.9 | 4.7 | 5.6 | 6.8 | 8.2 |

\*\*\*

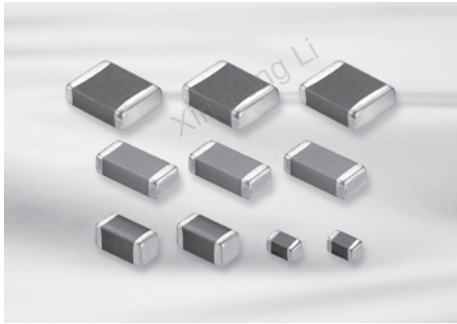
| Size        | Code | Thickness(mm) | Spec(mm)   | Size       | Code | Thickness(mm) | Spec(mm) |
|-------------|------|---------------|------------|------------|------|---------------|----------|
| 01005(0402) | 2    | 0.20          | ±0.02      | 1210(3225) | C    | 0.85          | ±0.10*   |
| 0201(0603)  | 3    | 0.30          | ±0.03      |            | g    | 0.90          | ±0.10*   |
| 0402(1005)  | 3    | 0.30          | ±0.03*     |            | F    | 1.25          | ±0.20    |
|             | 5    | 0.50          | ±0.05      |            | S    | 1.35          | ±0.15    |
| 0603(1608)  | 5    | 0.50          | +0.0/-0.1* |            | H    | 1.60          | ±0.20    |
|             | 8    | 0.80          | ±0.10      |            | U    | 1.80          | ±0.20*   |
| 0805(2012)  | A    | 0.65          | ±0.10      |            | I    | 2.00          | ±0.20    |
|             | C    | 0.85          | ±0.10      |            | J    | 2.50          | ±0.20    |
|             | C    | 0.85          | ±0.10*     |            | V    | 2.50          | ±0.30    |
|             | M    | 1.15          | ±0.10      | 1808(4520) | F    | 1.25          | ±0.20    |
|             | F    | 1.25          | ±0.10      |            | H    | 1.60          | ±0.20    |
|             | Q    | 1.25          | ±0.15      |            | I    | 2.00          | ±0.20    |
|             | Y    | 1.25          | ±0.20      | 1812(4532) | F    | 1.25          | ±0.20    |
| 1206(3216)  | C    | 0.85          | ±0.15      |            | H    | 1.60          | ±0.20    |
|             | C    | 0.85          | ±0.10*     |            | I    | 2.00          | ±0.20    |
|             | E    | 1.10          | ±0.15      |            | J    | 2.50          | ±0.20    |
|             | E    | 1.10          | ±0.10*     |            | L    | 3.20          | ±0.30    |
|             | P    | 1.15          | ±0.10*     | 2220(5750) | H    | 1.60          | ±0.20    |
|             | M    | 1.15          | ±0.15      |            | I    | 2.00          | ±0.20    |
|             | F    | 1.25          | ±0.15      |            | J    | 2.50          | ±0.20    |
|             | H    | 1.60          | ±0.20      |            | L    | 3.00          | ±0.30    |

■ \* Mark is only applicable to "L" code, 12<sup>th</sup> code in part number.

■ Please discuss with sales person with regard to Pd products.

Part Numbering  
SystemStandard &  
High CapacitorsSuper Small Size  
CapacitorsHigh-Q  
CapacitorsMedium-High  
Voltage CapacitorsArray Type  
CapacitorsLow ESL  
CapacitorsReliability Test  
ConditionPremium Capacitors  
for Automotive  
ApplicationsPackaging  
SpecificationApplication Manual  
for Surface Mounting

# Standard & High Capacitors



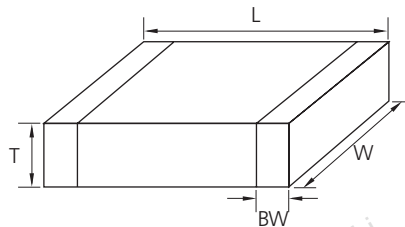
## Feature

- Wide selection of size : from 0402 to 2220
- Highly reliable tolerance and high speed automatic chip placement on PCBs
- Wide capacitance range
- Wide temperature compensation and voltage range : from C0G to Y5V and from 6.3V to 50V
- Highly reliable performance
- Highly resistant termination metal
- Tape & reel for surface mount assembly

## Application

- HHP, DSC, DVC, LCD, TV, Memory Module, PDA, Game Machine
- Desktop PC, Note PC, HHP, DC-DC Converter, DSC
- Tuner (Product code C is suitable.)

## Structure and Dimensions



| Size Code | EIA Code | Dimension(mm) |           |                  |                |              |
|-----------|----------|---------------|-----------|------------------|----------------|--------------|
|           |          | L             | W         | T                | Thickness Code | BW           |
| 05        | 0402     | 1.00±0.05     | 0.50±0.05 | 0.50±0.05        | 5              | 0.25±0.10    |
| 10        | 0603     | 1.60±0.10     | 0.80±0.10 | 0.50±0.0/-0.1(*) | 5              | 0.30±0.20    |
|           |          | 1.60±0.10     | 0.80±0.10 | 0.80±0.10        | 8              |              |
| 21        | 0805     | 2.00±0.10     | 1.25±0.10 | 0.85±0.10        | C              | 0.5±0.2/-0.3 |
|           |          | 2.00±0.10     | 1.25±0.10 | 1.15±0.10        | M              |              |
|           |          | 2.00±0.10     | 1.25±0.10 | 1.25±0.10        | F              |              |
|           |          | 2.00±0.15     | 1.25±0.15 | 1.25±0.15        | Q              |              |
|           |          | 2.00±0.20     | 1.25±0.20 | 1.25±0.20        | Y              |              |
| 31        | 1206     | 3.20±0.20     | 1.60±0.20 | 0.60±0.10(*)     | 6              | 0.50±0.30    |
|           |          | 3.20±0.15     | 1.60±0.15 | 0.85±0.15        | C              |              |
|           |          | 3.20±0.20     | 1.60±0.20 | 0.85±0.10(*)     | C              |              |
|           |          | 3.20±0.20     | 1.60±0.20 | 1.15±0.10(*)     | P              |              |
|           |          | 3.20±0.15     | 1.60±0.15 | 1.25±0.15        | F              |              |
|           |          | 3.20±0.20     | 1.60±0.20 | 1.60±0.20        | H              |              |
| 32        | 1210     | 3.20±0.30     | 2.50±0.20 | 0.85±0.10(*)     | C              | 0.60±0.30    |
|           |          | 3.20±0.30     | 2.50±0.20 | 0.90±0.10(*)     | 9              |              |
|           |          | 3.20±0.30     | 2.50±0.20 | 1.60±0.20        | H              |              |
|           |          | 3.20±0.30     | 2.50±0.20 | 1.80±0.20(*)     | U              |              |
|           |          | 3.20±0.30     | 2.50±0.20 | 2.00±0.20        | I              |              |
|           |          | 3.20±0.30     | 2.50±0.20 | 2.50±0.20        | J              |              |
| 42        | 1808     | 4.50±0.40     | 2.00±0.20 | 1.25±0.20        | F              | 0.80±0.30    |
|           |          | 4.50±0.40     | 2.00±0.20 | 1.40±0.20        | G              |              |
|           |          | 4.50±0.40     | 2.00±0.20 | 2.00±0.20        | I              |              |
|           |          | 4.50±0.40     | 2.00±0.20 | 2.50±0.20        | V              |              |
| 43        | 1812     | 4.50±0.40     | 3.20±0.30 | 1.25±0.20        | F              | 0.80±0.30    |
|           |          | 4.50±0.40     | 3.20±0.30 | 2.50±0.20        | J              |              |
|           |          | 4.50±0.40     | 3.20±0.30 | 3.20±0.30        | L              |              |
| 55        | 2220     | 5.70±0.40     | 5.00±0.40 | 2.50±0.20        | J              | 1.00±0.30    |
|           |          | 5.70±0.40     | 5.00±0.40 | 3.20±0.30        | L              |              |

■ \* Mark is only applicable to "L" code, 12<sup>th</sup> code in part number.

## Standard &amp; High Capacitance (C0G)

| Size(mm)   | Vr(V) | Capacitance |   |    |    |    |     |     |     |     |     |   |     |     |     |     |    |    |    |    |    |    |     |     |     |
|------------|-------|-------------|---|----|----|----|-----|-----|-----|-----|-----|---|-----|-----|-----|-----|----|----|----|----|----|----|-----|-----|-----|
|            |       | pF          |   |    |    |    |     |     |     |     |     |   |     | nF  |     |     |    |    |    |    |    |    |     |     |     |
|            |       | 0.5         | 1 | 10 | 22 | 47 | 100 | 220 | 330 | 470 | 560 | 1 | 2.2 | 3.3 | 4.7 | 6.8 | 10 | 22 | 27 | 33 | 47 | 68 | 100 | 120 | 150 |
| 0402(1005) | 25    |             |   |    |    |    |     |     |     |     |     |   |     |     |     |     |    |    |    |    |    |    |     |     |     |
|            | 50    |             |   |    |    |    |     |     |     |     |     |   |     |     |     |     |    |    |    |    |    |    |     |     |     |
| 0603(1608) | 25    |             |   |    |    |    |     |     |     |     |     |   |     |     |     |     |    |    |    |    |    |    |     |     |     |
|            | 50    |             |   |    |    |    |     |     |     |     |     |   |     |     |     |     |    |    |    |    |    |    |     |     |     |
| 0805(2012) | 25    |             |   |    |    |    |     |     |     |     |     |   |     |     |     |     |    |    |    |    |    |    |     |     |     |
|            | 50    |             |   |    |    |    |     |     |     |     |     |   |     |     |     |     |    |    |    |    |    |    |     |     |     |
| 1206(3216) | 16    |             |   |    |    |    |     |     |     |     |     |   |     |     |     |     |    |    |    |    |    |    |     |     |     |
|            | 25    |             |   |    |    |    |     |     |     |     |     |   |     |     |     |     |    |    |    |    |    |    |     |     |     |
|            | 50    |             |   |    |    |    |     |     |     |     |     |   |     |     |     |     |    |    |    |    |    |    |     |     |     |
| 1210(3225) | 50    |             |   |    |    |    |     |     |     |     |     |   |     |     |     |     |    |    |    |    |    |    |     |     |     |
| 1812(4532) | 25    |             |   |    |    |    |     |     |     |     |     |   |     |     |     |     |    |    |    |    |    |    |     |     |     |
|            | 50    |             |   |    |    |    |     |     |     |     |     |   |     |     |     |     |    |    |    |    |    |    |     |     |     |
| 2220(5750) | 50    |             |   |    |    |    |     |     |     |     |     |   |     |     |     |     |    |    |    |    |    |    |     |     |     |

Part Numbering  
SystemStandard &  
High CapacitorsSuper Small Size  
CapacitorsHigh-Q  
CapacitorsMedium-High  
Voltage CapacitorsArray Type  
CapacitorsLow ESL  
CapacitorsReliability Test  
ConditionPremium Capacitors  
for Automotive  
ApplicationsPackaging  
SpecificationApplication Manual  
for Surface Mounting

### Standard & High Capacitance (X5R)

| Size(mm)   | Vr(V) | Capacitance (μF) |      |      |   |     |     |    |    |    |     |     |  |
|------------|-------|------------------|------|------|---|-----|-----|----|----|----|-----|-----|--|
|            |       | 0.1              | 0.22 | 0.47 | 1 | 2.2 | 4.7 | 10 | 22 | 47 | 100 | 220 |  |
| 0402(1005) | 4     | 15               |      |      |   |     |     |    |    |    |     |     |  |
|            | 6.3   |                  |      |      |   |     |     |    |    |    |     |     |  |
|            | 10    |                  |      |      |   |     |     |    |    |    |     |     |  |
|            | 16    |                  |      |      |   |     |     |    |    |    |     |     |  |
|            | 25    |                  |      |      |   |     |     |    |    |    |     |     |  |
| 0603(1608) | 4     |                  |      |      |   |     |     |    |    |    |     |     |  |
|            | 6.3   |                  |      |      |   |     |     |    |    |    |     |     |  |
|            | 10    |                  |      |      |   |     |     |    |    |    |     |     |  |
|            | 16    |                  |      |      |   |     |     |    |    |    |     |     |  |
|            | 25    |                  |      |      |   |     |     |    |    |    |     |     |  |
|            | 50    |                  |      |      |   |     |     |    |    |    |     |     |  |
| 0805(2012) | 4     |                  |      |      |   |     |     |    |    |    |     |     |  |
|            | 6.3   |                  |      |      |   |     |     |    |    |    |     |     |  |
|            | 10    |                  |      |      |   |     |     |    |    |    |     |     |  |
|            | 16    |                  |      |      |   |     |     |    |    |    |     |     |  |
|            | 25    |                  |      |      |   |     |     |    |    |    |     |     |  |
|            | 50    |                  |      |      |   |     |     |    |    |    |     |     |  |
| 1206(3216) | 6.3   | 150              |      |      |   |     |     |    |    |    |     |     |  |
|            | 10    |                  |      |      |   |     |     |    |    |    |     |     |  |
|            | 16    |                  |      |      |   |     |     |    |    |    |     |     |  |
|            | 25    |                  |      |      |   |     |     |    |    |    |     |     |  |
|            | 50    |                  |      |      |   |     |     |    |    |    |     |     |  |
| 1210(3225) | 6.3   |                  |      |      |   |     |     |    |    |    |     |     |  |
|            | 10    |                  |      |      |   |     |     |    |    |    |     |     |  |
|            | 16    |                  |      |      |   |     |     |    |    |    |     |     |  |
|            | 25    |                  |      |      |   |     |     |    |    |    |     |     |  |

## Standard &amp; High Capacitance-Low Profile (X5R)

| Size(mm)   | Tmax<br>(mm) | Vr(V) | Capacitance (μF) |             |            |     |    |            |
|------------|--------------|-------|------------------|-------------|------------|-----|----|------------|
|            |              |       | 1                | 2.2         | 4.7        | 10  | 22 | 47         |
| 0402(1005) | 0.33         | 6.3   | X6S              | (Tmax=0.35) |            |     |    |            |
|            |              | 10    |                  |             |            |     |    |            |
|            |              | 16    |                  |             |            |     |    |            |
| 0603(1608) | 0.5          | 6.3   |                  |             |            |     |    |            |
|            |              | 10    |                  |             |            |     |    |            |
|            |              | 16    |                  |             |            |     |    |            |
|            |              | 25    |                  |             |            |     |    |            |
| 0805(2012) | 0.7          | 10    |                  |             |            |     |    |            |
|            |              | 16    |                  |             |            |     |    |            |
|            |              | 25    |                  |             |            |     |    |            |
|            | 0.85         | 25    |                  |             |            |     |    |            |
|            | 0.95         | 4     |                  |             |            |     |    | (Tmax=1.0) |
|            |              | 6.3   |                  |             |            |     |    | (Tmax=1.0) |
|            |              | 10    |                  |             |            |     |    |            |
|            |              | 16    |                  |             |            |     |    |            |
|            |              | 25    |                  |             |            | X6S |    |            |
| 1206(3216) | 0.7          | 10    |                  |             |            |     |    |            |
|            | 0.95         | 6.3   |                  |             |            |     |    |            |
|            |              | 10    |                  |             |            |     |    |            |
|            |              | 16    |                  |             |            |     |    |            |
|            |              | 25    |                  |             | X6S        |     |    |            |
|            |              | 50    |                  | (Tmax=1.0)  | (Tmax=1.0) |     |    |            |
|            |              | 100   |                  | (Tmax=1.0)  |            |     |    |            |
| 1210(3225) | 0.95         | 16    |                  |             |            |     |    |            |
|            | 2.0          | 25    |                  |             |            |     |    |            |
|            |              | 35    |                  |             |            |     |    |            |
|            |              | 50    |                  |             |            |     |    |            |

Part Numbering  
SystemStandard &  
High CapacitorsSuper Small Size  
CapacitorsHigh-Q  
CapacitorsMedium-High  
Voltage CapacitorsArray Type  
CapacitorsLow ESL  
CapacitorsReliability Test  
ConditionPremium Capacitors  
for Automotive  
ApplicationsPackaging  
SpecificationApplication Manual  
for Surface Mounting

## Standard & High Capacitance (X6S)

| Size(mm)   | Vr(V) | Capacitance (μF) |      |      |   |     |     |    |    |    |     |
|------------|-------|------------------|------|------|---|-----|-----|----|----|----|-----|
|            |       | 0.1              | 0.22 | 0.47 | 1 | 2.2 | 4.7 | 10 | 22 | 47 | 100 |
| 0402(1005) | 4     |                  |      |      |   |     |     |    |    |    |     |
|            | 6.3   |                  |      |      |   |     |     |    |    |    |     |
|            | 10    |                  |      |      |   |     |     |    |    |    |     |
| 0603(1608) | 4     |                  |      |      |   |     |     |    |    |    |     |
|            | 6.3   |                  |      |      |   |     |     |    |    |    |     |
|            | 10    |                  |      |      |   |     |     |    |    |    |     |
|            | 16    |                  |      |      |   |     |     |    |    |    |     |
|            | 25    |                  |      |      |   |     |     |    |    |    |     |
| 0805(2012) | 4     |                  |      |      |   |     |     |    |    |    |     |
|            | 6.3   |                  |      |      |   |     |     |    |    |    |     |
|            | 10    |                  |      |      |   |     |     |    |    |    |     |
|            | 16    |                  |      |      |   |     |     |    |    |    |     |
|            | 25    |                  |      |      |   |     |     |    |    |    |     |
| 1206(3216) | 6.3   |                  |      |      |   |     |     |    |    |    |     |
|            | 10    |                  |      |      |   |     |     |    |    |    |     |
|            | 16    |                  |      |      |   |     |     |    |    |    |     |
|            | 25    |                  |      |      |   |     |     |    |    |    |     |
| 1210(3225) | 6.3   |                  |      |      |   |     |     |    |    |    |     |
|            | 10    |                  |      |      |   |     |     |    |    |    |     |
|            | 16    |                  |      |      |   |     |     |    |    |    |     |
|            | 25    |                  |      |      |   |     |     |    |    |    |     |

Standard & High Capacitance (X7R)

| Size(mm)   | Vr(V) | Capacitance (μF) |      |      |   |     |     |    |    |     |     |
|------------|-------|------------------|------|------|---|-----|-----|----|----|-----|-----|
|            |       | 0.1              | 0.22 | 0.47 | 1 | 2.2 | 4.7 | 10 | 22 | 47  | 100 |
| 0402(1005) | 6.3   |                  |      |      |   |     |     |    |    |     |     |
|            | 10    |                  |      | X7S  |   |     |     |    |    |     |     |
|            | 16    |                  |      |      |   |     |     |    |    |     |     |
| 0603(1608) | 6.3   |                  |      |      |   |     |     |    |    |     |     |
|            | 10    |                  |      |      |   |     |     |    |    |     |     |
|            | 16    |                  |      |      |   |     |     |    |    |     |     |
|            | 25    |                  |      |      |   |     |     |    |    |     |     |
|            | 50    |                  |      |      |   |     |     |    |    |     |     |
| 0805(2012) | 6.3   |                  |      |      |   |     |     |    |    |     |     |
|            | 10    |                  |      |      |   |     |     |    |    |     |     |
|            | 16    |                  |      |      |   |     |     |    |    |     |     |
|            | 25    |                  |      |      |   |     | X7S |    |    |     |     |
|            | 35    |                  |      |      |   |     |     |    |    |     |     |
|            | 50    |                  |      |      |   |     |     |    |    |     |     |
| 1206(3216) | 6.3   |                  |      |      |   |     |     |    |    |     |     |
|            | 10    |                  |      |      |   |     |     |    |    |     |     |
|            | 16    |                  |      |      |   |     |     |    |    |     |     |
|            | 25    |                  |      |      |   |     |     |    |    |     |     |
|            | 35    |                  |      |      |   |     |     |    |    |     |     |
|            | 50    |                  |      |      |   |     |     |    |    |     |     |
| 1210(3225) | 6.3   |                  |      |      |   |     |     |    |    | X7T |     |
|            | 10    |                  |      |      |   |     |     |    |    |     |     |
|            | 16    |                  |      |      |   |     |     |    |    |     |     |
|            | 25    |                  |      |      |   |     |     |    |    |     |     |
|            | 50    |                  |      |      |   |     |     |    |    |     |     |

- Part Numbering System
- Standard & High Capacitors
- Super Small Size Capacitors
- High-Q Capacitors
- Medium-High Voltage Capacitors
- Array Type Capacitors
- Low ESL Capacitors
- Reliability Test Condition
- Premium Capacitors for Automotive Applications
- Packaging Specification
- Application Manual for Surface Mounting

### Standard & High capacitance (Y5V)

| Size(mm)   | Vr(V) | Capacitance (μF) |      |      |   |     |     |    |    |    |  |
|------------|-------|------------------|------|------|---|-----|-----|----|----|----|--|
|            |       | 0.1              | 0.22 | 0.47 | 1 | 2.2 | 4.7 | 10 | 22 | 47 |  |
| 0402(1005) | 6.3   |                  |      |      |   |     |     |    |    |    |  |
|            | 10    |                  |      |      |   |     |     |    |    |    |  |
|            | 16    |                  |      |      |   |     |     |    |    |    |  |
|            | 25    |                  |      |      |   |     |     |    |    |    |  |
| 0603(1608) | 6.3   |                  |      |      |   |     |     |    |    |    |  |
|            | 10    |                  |      |      |   |     |     |    |    |    |  |
|            | 16    |                  |      |      |   |     |     |    |    |    |  |
|            | 25    |                  |      |      |   |     |     |    |    |    |  |
|            | 50    |                  |      |      |   |     |     |    |    |    |  |
| 0805(2012) | 6.3   |                  |      |      |   |     |     |    |    |    |  |
|            | 10    |                  |      |      |   |     |     |    |    |    |  |
|            | 16    |                  |      |      |   |     |     |    |    |    |  |
|            | 25    |                  |      |      |   |     |     |    |    |    |  |
|            | 50    |                  |      |      |   |     |     |    |    |    |  |
| 1206(3216) | 10    |                  |      |      |   |     |     |    |    |    |  |
|            | 16    |                  |      |      |   |     |     |    |    |    |  |
|            | 25    |                  |      |      |   |     |     |    |    |    |  |
|            | 50    |                  |      |      |   |     |     |    |    |    |  |
| 1210(3225) | 6.3   |                  |      |      |   |     |     |    |    |    |  |
|            | 10    |                  |      |      |   |     |     |    |    |    |  |
|            | 16    |                  |      |      |   |     |     |    |    |    |  |
|            | 25    |                  |      |      |   |     |     |    |    |    |  |
|            | 35    |                  |      |      |   |     |     |    |    |    |  |
|            | 50    |                  |      |      |   |     |     |    |    |    |  |
|            | 50    |                  |      |      |   |     |     |    |    |    |  |

### Standard & High capacitance - Low Profile (Y5V)

| Size(mm)   | Vr(V) | Capacitance ( $\mu$ F) |     |     |    |    |    |
|------------|-------|------------------------|-----|-----|----|----|----|
|            |       | 1                      | 2.2 | 4.7 | 10 | 22 | 47 |
| 0805(2012) | 6.3   |                        |     |     |    |    |    |
|            | 10    |                        |     |     |    |    |    |

## Product Lineup (Standard &amp; High Capacitors-C0G)

|    | Part Number      | Size L x W<br>(mm) | Capacitance | Rated<br>Voltage<br>(Vdc) | Capacitance<br>Tolerance | Thickness<br>Max.(mm) |
|----|------------------|--------------------|-------------|---------------------------|--------------------------|-----------------------|
| 1  | CL05C0R5CB5NNN □ | 1.00×0.50          | 0.5pF       | 50                        | ±0.25pF                  | 0.55                  |
| 2  | CL05CR75CB5NNN □ |                    | 0.75pF      | 50                        | ±0.25pF                  | 0.55                  |
| 3  | CL05C010CB5NNN □ |                    | 1.0pF       | 50                        | ±0.25pF                  | 0.55                  |
| 4  | CL05C1R2CB5NNN □ |                    | 1.2pF       | 50                        | ±0.25pF                  | 0.55                  |
| 5  | CL05C1R5CB5NNN □ |                    | 1.5pF       | 50                        | ±0.25pF                  | 0.55                  |
| 6  | CL05C1R8CB5NNN □ |                    | 1.8pF       | 50                        | ±0.25pF                  | 0.55                  |
| 7  | CL05C020CB5NNN □ |                    | 2.0pF       | 50                        | ±0.25pF                  | 0.55                  |
| 8  | CL05C2R2CB5NNN □ |                    | 2.2pF       | 50                        | ±0.25pF                  | 0.55                  |
| 9  | CL05C2R4CB5NNN □ |                    | 2.4pF       | 50                        | ±0.25pF                  | 0.55                  |
| 10 | CL05C2R5CB5NNN □ |                    | 2.5pF       | 50                        | ±0.25pF                  | 0.55                  |
| 11 | CL05C2R7CB5NNN □ |                    | 2.7pF       | 50                        | ±0.25pF                  | 0.55                  |
| 12 | CL05C030CB5NNN □ |                    | 3.0pF       | 50                        | ±0.25pF                  | 0.55                  |
| 13 | CL05C3R3CB5NNN □ |                    | 3.3pF       | 50                        | ±0.25pF                  | 0.55                  |
| 14 | CL05C3R5CB5NNN □ |                    | 3.5pF       | 50                        | ±0.25pF                  | 0.55                  |
| 15 | CL05C3R6CB5NNN □ |                    | 3.6pF       | 50                        | ±0.25pF                  | 0.55                  |
| 16 | CL05C3R9CB5NNN □ |                    | 3.9pF       | 50                        | ±0.25pF                  | 0.55                  |
| 17 | CL05C040CB5NNN □ |                    | 4.0pF       | 50                        | ±0.25pF                  | 0.55                  |
| 18 | CL05C4R3CB5NNN □ |                    | 4.3pF       | 50                        | ±0.25pF                  | 0.55                  |
| 19 | CL05C4R7CB5NNN □ |                    | 4.7pF       | 50                        | ±0.25pF                  | 0.55                  |
| 20 | CL05C050DB5NNN □ |                    | 5.0pF       | 50                        | ±0.5pF                   | 0.55                  |
| 21 | CL05C5R6DB5NNN □ |                    | 5.6pF       | 50                        | ±0.5pF                   | 0.55                  |
| 22 | CL05C060DB5NNN □ |                    | 6.0pF       | 50                        | ±0.5pF                   | 0.55                  |
| 23 | CL05C6R2DB5NNN □ |                    | 6.2pF       | 50                        | ±0.5pF                   | 0.55                  |
| 24 | CL05C6R8DB5NNN □ |                    | 6.8pF       | 50                        | ±0.5pF                   | 0.55                  |
| 25 | CL05C070DB5NNN □ |                    | 7.0pF       | 50                        | ±0.5pF                   | 0.55                  |
| 26 | CL05C080DB5NNN □ |                    | 8.0pF       | 50                        | ±0.5pF                   | 0.55                  |
| 27 | CL05C8R2DB5NNN □ |                    | 8.2pF       | 50                        | ±0.5pF                   | 0.55                  |
| 28 | CL05C090DB5NNN □ |                    | 9.0pF       | 50                        | ±0.5pF                   | 0.55                  |
| 29 | CL05C9R1DB5NNN □ |                    | 9.1pF       | 50                        | ±0.5pF                   | 0.55                  |
| 30 | CL05C100JB5NNN □ |                    | 10pF        | 50                        | ±5%                      | 0.55                  |
| 31 | CL05C110JB5NNN □ |                    | 11pF        | 50                        | ±5%                      | 0.55                  |
| 32 | CL05C120JB5NNN □ |                    | 12pF        | 50                        | ±5%                      | 0.55                  |
| 33 | CL05C130JB5NNN □ |                    | 13pF        | 50                        | ±5%                      | 0.55                  |
| 34 | CL05C150JB5NNN □ |                    | 15pF        | 50                        | ±5%                      | 0.55                  |
| 35 | CL05C160JB5NNN □ |                    | 16pF        | 50                        | ±5%                      | 0.55                  |
| 36 | CL05C180JB5NNN □ |                    | 18pF        | 50                        | ±5%                      | 0.55                  |
| 37 | CL05C200JB5NNN □ |                    | 20pF        | 50                        | ±5%                      | 0.55                  |
| 38 | CL05C220JA5NNN □ |                    | 22pF        | 25                        | ±5%                      | 0.55                  |
| 39 | CL05C220JB5NNN □ |                    | 22pF        | 50                        | ±5%                      | 0.55                  |
| 40 | CL05C240JB5NNN □ |                    | 24pF        | 50                        | ±5%                      | 0.55                  |
| 41 | CL05C270JB5NNN □ |                    | 27pF        | 50                        | ±5%                      | 0.55                  |
| 42 | CL05C270JA5NNN □ |                    | 27pF        | 25                        | ±5%                      | 0.55                  |
| 43 | CL05C300JB5NNN □ |                    | 30pF        | 50                        | ±5%                      | 0.55                  |
| 44 | CL05C330JB5NNN □ |                    | 33pF        | 50                        | ±5%                      | 0.55                  |
| 45 | CL05C360JB5NNN □ |                    | 36pF        | 50                        | ±5%                      | 0.55                  |
| 46 | CL05C390JB5NNN □ |                    | 39pF        | 50                        | ±5%                      | 0.55                  |
| 47 | CL05C430JB5NNN □ |                    | 43pF        | 50                        | ±5%                      | 0.55                  |
| 48 | CL05C470JB5NNN □ |                    | 47pF        | 50                        | ±5%                      | 0.55                  |
| 49 | CL05C510JB5NNN □ |                    | 51pF        | 50                        | ±5%                      | 0.55                  |
| 50 | CL05C560JB5NNN □ |                    | 56pF        | 50                        | ±5%                      | 0.55                  |

※ □ mark means packaging code. If you want to learn the code or quantity in detail, please see p74.

Part Numbering  
SystemStandard &  
High CapacitorsSuper Small Size  
CapacitorsHigh-Q  
CapacitorsMedium-High  
Voltage CapacitorsArray Type  
CapacitorsLow ESL  
CapacitorsReliability Test  
ConditionPremium Capacitors  
for Automotive  
ApplicationsPackaging  
SpecificationApplication Manual  
for Surface Mounting

**Product Lineup (Standard & High Capacitors-C0G)**

|    | Part Number      | Size L x W<br>(mm) | Capacitance | Rated<br>Voltage<br>(Vdc) | Capacitance<br>Tolerance | Thickness<br>Max.(mm) |
|----|------------------|--------------------|-------------|---------------------------|--------------------------|-----------------------|
| 51 | CL05C620JB5NNN □ | 1.00×0.50          | 62pF        | 50                        | ±5%                      | 0.55                  |
| 52 | CL05C680JB5NNN □ |                    | 68pF        | 50                        | ±5%                      | 0.55                  |
| 53 | CL05C750JB5NNN □ |                    | 75pF        | 50                        | ±5%                      | 0.55                  |
| 54 | CL05C820JB5NNN □ |                    | 82pF        | 50                        | ±5%                      | 0.55                  |
| 55 | CL05C910JB5NNN □ |                    | 91pF        | 50                        | ±5%                      | 0.55                  |
| 56 | CL05C101JB5NNN □ |                    | 100pF       | 50                        | ±5%                      | 0.55                  |
| 57 | CL05C121JB5NNN □ |                    | 120pF       | 50                        | ±5%                      | 0.55                  |
| 58 | CL05C151JB5NNN □ |                    | 150pF       | 50                        | ±5%                      | 0.55                  |
| 59 | CL05C181JB5NNN □ |                    | 180pF       | 50                        | ±5%                      | 0.55                  |
| 60 | CL05C201JB5NNN □ |                    | 200pF       | 50                        | ±5%                      | 0.55                  |
| 61 | CL05C221JB5NNN □ |                    | 220pF       | 50                        | ±5%                      | 0.55                  |
| 62 | CL05C271JB5NNN □ |                    | 270pF       | 50                        | ±5%                      | 0.55                  |
| 63 | CL05C331JB5NNN □ |                    | 330pF       | 50                        | ±5%                      | 0.55                  |
| 64 | CL05C391JB5NNN □ |                    | 390pF       | 50                        | ±5%                      | 0.55                  |
| 65 | CL05C471JB5NNN □ |                    | 470pF       | 50                        | ±5%                      | 0.55                  |
| 66 | CL05C471JO5NNN □ |                    | 470pF       | 16                        | ±5%                      | 0.55                  |
| 67 | CL05C681JB5NNN □ |                    | 680pF       | 50                        | ±5%                      | 0.55                  |
| 68 | CL05C821JB5NNN □ |                    | 820pF       | 50                        | ±5%                      | 0.55                  |
| 69 | CL05C102JB5NNN □ |                    | 1nF         | 50                        | ±5%                      | 0.55                  |
| 70 | CL05C102JA5NNN □ |                    | 1nF         | 25                        | ±5%                      | 0.55                  |
| 71 | CL05C102JO5NNN □ |                    | 1nF         | 16                        | ±5%                      | 0.55                  |
| 1  | CL10C0R3CB8NNN □ | 1.60×0.80          | 0.3pF       | 50                        | ±0.25pF                  | 0.90                  |
| 2  | CL10C0R5CB8NNN □ |                    | 0.5pF       | 50                        | ±0.25pF                  | 0.90                  |
| 3  | CL10CR75CB8NNN □ |                    | 0.75pF      | 50                        | ±0.25pF                  | 0.90                  |
| 4  | CL10C010CB8NNN □ |                    | 1.0pF       | 50                        | ±0.25pF                  | 0.90                  |
| 5  | CL10C1R2CB8NNN □ |                    | 1.2pF       | 50                        | ±0.25pF                  | 0.90                  |
| 6  | CL10C1R5CB8NNN □ |                    | 1.5pF       | 50                        | ±0.25pF                  | 0.90                  |
| 7  | CL10C1R8CB8NNN □ |                    | 1.8pF       | 50                        | ±0.25pF                  | 0.90                  |
| 8  | CL10C020CB8NNN □ |                    | 2.0pF       | 50                        | ±0.25pF                  | 0.90                  |
| 9  | CL10C2R2CB8NNN □ |                    | 2.2pF       | 50                        | ±0.25pF                  | 0.90                  |
| 10 | CL10C2R4CB8NNN □ |                    | 2.4pF       | 50                        | ±0.25pF                  | 0.90                  |
| 11 | CL10C2R5CB8NNN □ |                    | 2.5pF       | 50                        | ±0.25pF                  | 0.90                  |
| 12 | CL10C2R7CB8NNN □ |                    | 2.7pF       | 50                        | ±0.25pF                  | 0.90                  |
| 13 | CL10C030CB8NNN □ |                    | 3.0pF       | 50                        | ±0.25pF                  | 0.90                  |
| 14 | CL10C3R3CB8NNN □ |                    | 3.3pF       | 50                        | ±0.25pF                  | 0.90                  |
| 15 | CL10C3R5CB8NNN □ |                    | 3.5pF       | 50                        | ±0.25pF                  | 0.90                  |
| 16 | CL10C3R6CB8NNN □ |                    | 3.6pF       | 50                        | ±0.25pF                  | 0.90                  |
| 17 | CL10C3R9CB8NNN □ |                    | 3.9pF       | 50                        | ±0.25pF                  | 0.90                  |
| 18 | CL10C040CB8NNN □ |                    | 4.0pF       | 50                        | ±0.25pF                  | 0.90                  |
| 19 | CL10C4R3CB8NNN □ |                    | 4.3pF       | 50                        | ±0.25pF                  | 0.90                  |
| 20 | CL10C4R7CB8NNN □ |                    | 4.7pF       | 50                        | ±0.25pF                  | 0.90                  |
| 21 | CL10C050DB8NNN □ |                    | 5.0pF       | 50                        | ±0.5pF                   | 0.90                  |
| 22 | CL10C5R6DB8NNN □ |                    | 5.6pF       | 50                        | ±0.5pF                   | 0.90                  |
| 23 | CL10C060DB8NNN □ |                    | 6.0pF       | 50                        | ±0.5pF                   | 0.90                  |
| 24 | CL10C6R2DB8NNN □ |                    | 6.2pF       | 50                        | ±0.5pF                   | 0.90                  |
| 25 | CL10C6R8DB8NNN □ |                    | 6.8pF       | 50                        | ±0.5pF                   | 0.90                  |
| 26 | CL10C070DB8NNN □ |                    | 7.0pF       | 50                        | ±0.5pF                   | 0.90                  |
| 27 | CL10C7R5DB8NNN □ |                    | 7.5pF       | 50                        | ±0.5pF                   | 0.90                  |
| 28 | CL10C080DB8NNN □ |                    | 8.0pF       | 50                        | ±0.5pF                   | 0.90                  |
| 29 | CL10C8R2DB8NNN □ |                    | 8.2pF       | 50                        | ±0.5pF                   | 0.90                  |

※ □ mark means packaging code. If you want to learn the code or quantity in detail, please see p74.

## Product Lineup (Standard &amp; High Capacitors-C0G)

|    | Part Number      | Size L x W<br>(mm) | Capacitance | Rated<br>Voltage<br>(Vdc) | Capacitance<br>Tolerance | Thickness<br>Max.(mm) |
|----|------------------|--------------------|-------------|---------------------------|--------------------------|-----------------------|
| 30 | CL10C090DB8NNN □ | 1.60×0.80          | 9.0 pF      | 50                        | ±0.5pF                   | 0.90                  |
| 31 | CL10C9R1DB8NNN □ |                    | 9.1 pF      | 50                        | ±0.5pF                   | 0.90                  |
| 32 | CL10C100JB8NNN □ |                    | 10 pF       | 50                        | ±5%                      | 0.90                  |
| 33 | CL10C110JB8NNN □ |                    | 11 pF       | 50                        | ±5%                      | 0.90                  |
| 34 | CL10C120JB8NNN □ |                    | 12 pF       | 50                        | ±5%                      | 0.90                  |
| 35 | CL10C130JB8NNN □ |                    | 13 pF       | 50                        | ±5%                      | 0.90                  |
| 36 | CL10C140JB8NNN □ |                    | 14 pF       | 50                        | ±5%                      | 0.90                  |
| 37 | CL10C150JB8NNN □ |                    | 15 pF       | 50                        | ±5%                      | 0.90                  |
| 38 | CL10C160JB8NNN □ |                    | 16 pF       | 50                        | ±5%                      | 0.90                  |
| 39 | CL10C180JB8NNN □ |                    | 18 pF       | 50                        | ±5%                      | 0.90                  |
| 40 | CL10C200JB8NNN □ |                    | 20 pF       | 50                        | ±5%                      | 0.90                  |
| 41 | CL10C220JB8NNN □ |                    | 22 pF       | 50                        | ±5%                      | 0.90                  |
| 42 | CL10C240JB8NNN □ |                    | 24 pF       | 50                        | ±5%                      | 0.90                  |
| 43 | CL10C250JB8NNN □ |                    | 25 pF       | 50                        | ±5%                      | 0.90                  |
| 44 | CL10C270JB8NNN □ |                    | 27 pF       | 50                        | ±5%                      | 0.90                  |
| 45 | CL10C300JB8NNN □ |                    | 30 pF       | 50                        | ±5%                      | 0.90                  |
| 46 | CL10C330JB8NNN □ |                    | 33 pF       | 50                        | ±5%                      | 0.90                  |
| 47 | CL10C360JB8NNN □ |                    | 36 pF       | 50                        | ±5%                      | 0.90                  |
| 48 | CL10C390JB8NNN □ |                    | 39 pF       | 50                        | ±5%                      | 0.90                  |
| 49 | CL10C430JB8NNN □ |                    | 43 pF       | 50                        | ±5%                      | 0.90                  |
| 50 | CL10C470JB8NNN □ |                    | 47 pF       | 50                        | ±5%                      | 0.90                  |
| 51 | CL10C510JB8NNN □ |                    | 51 pF       | 50                        | ±5%                      | 0.90                  |
| 52 | CL10C560JB8NNN □ |                    | 56 pF       | 50                        | ±5%                      | 0.90                  |
| 53 | CL10C620JB8NNN □ |                    | 62 pF       | 50                        | ±5%                      | 0.90                  |
| 54 | CL10C680JB8NNN □ |                    | 68 pF       | 50                        | ±5%                      | 0.90                  |
| 55 | CL10C750JB8NNN □ |                    | 75 pF       | 50                        | ±5%                      | 0.90                  |
| 56 | CL10C820JB8NNN □ |                    | 82 pF       | 50                        | ±5%                      | 0.90                  |
| 57 | CL10C910JB8NNN □ |                    | 91 pF       | 50                        | ±5%                      | 0.90                  |
| 58 | CL10C101JB8NNN □ |                    | 100 pF      | 50                        | ±5%                      | 0.90                  |
| 59 | CL10C111JB8NNN □ |                    | 110 pF      | 50                        | ±5%                      | 0.90                  |
| 60 | CL10C121JB8NNN □ |                    | 120 pF      | 50                        | ±5%                      | 0.90                  |
| 61 | CL10C131JB8NNN □ |                    | 130 pF      | 50                        | ±5%                      | 0.90                  |
| 62 | CL10C151JB8NNN □ |                    | 150 pF      | 50                        | ±5%                      | 0.90                  |
| 63 | CL10C161JB8NNN □ |                    | 160 pF      | 50                        | ±5%                      | 0.90                  |
| 64 | CL10C181JB8NNN □ |                    | 180 pF      | 50                        | ±5%                      | 0.90                  |
| 65 | CL10C201JB8NNN □ |                    | 200 pF      | 50                        | ±5%                      | 0.90                  |
| 66 | CL10C221JB8NNN □ |                    | 220 pF      | 50                        | ±5%                      | 0.90                  |
| 67 | CL10C241JB8NNN □ |                    | 240 pF      | 50                        | ±5%                      | 0.90                  |
| 68 | CL10C271JB8NNN □ |                    | 270 pF      | 50                        | ±5%                      | 0.90                  |
| 69 | CL10C301JB8NNN □ |                    | 300 pF      | 50                        | ±5%                      | 0.90                  |
| 70 | CL10C331JB8NNN □ |                    | 330 pF      | 50                        | ±5%                      | 0.90                  |
| 71 | CL10C361JB8NNN □ |                    | 360 pF      | 50                        | ±5%                      | 0.90                  |
| 72 | CL10C391JB8NNN □ |                    | 390 pF      | 50                        | ±5%                      | 0.90                  |
| 73 | CL10C431JB8NNN □ |                    | 430 pF      | 50                        | ±5%                      | 0.90                  |
| 74 | CL10C471JB8NNN □ |                    | 470 pF      | 50                        | ±5%                      | 0.90                  |
| 75 | CL10C511JB8NNN □ |                    | 510 pF      | 50                        | ±5%                      | 0.90                  |
| 76 | CL10C561JB8NNN □ |                    | 560 pF      | 50                        | ±5%                      | 0.90                  |
| 77 | CL10C621JB8NNN □ |                    | 620 pF      | 50                        | ±5%                      | 0.90                  |
| 78 | CL10C681JB8NNN □ |                    | 680 pF      | 50                        | ±5%                      | 0.90                  |
| 79 | CL10C751JB8NNN □ |                    | 750 pF      | 50                        | ±5%                      | 0.90                  |

※ □ mark means packaging code. If you want to learn the code or quantity in detail, please see p74.

Part Numbering  
System

Standard &  
High Capacitors

Super Small Size  
Capacitors

High-Q  
Capacitors

Medium-High  
Voltage Capacitors

Array Type  
Capacitors

Low ESL  
Capacitors

Reliability Test  
Condition

Premium Capacitors  
for Automotive  
Applications

Packaging  
Specification

Application Manual  
for Surface Mounting

**Product Lineup (Standard & High Capacitors-C0G)**

|    | Part Number      | Size L x W<br>(mm) | Capacitance | Rated<br>Voltage<br>(Vdc) | Capacitance<br>Tolerance | Thickness<br>Max.(mm) |
|----|------------------|--------------------|-------------|---------------------------|--------------------------|-----------------------|
| 80 | CL10C821JB8NNN □ | 1.60×0.80          | 820 pF      | 50                        | ±5%                      | 0.90                  |
| 81 | CL10C102JB8NNN □ |                    | 1 nF        | 50                        | ±5%                      | 0.90                  |
| 82 | CL10C182JB8NNN □ |                    | 1.8 nF      | 50                        | ±5%                      | 0.90                  |
| 83 | CL10C222JB8NNN □ |                    | 2.2 nF      | 50                        | ±5%                      | 0.90                  |
| 84 | CL10C562JB8NNN □ |                    | 5.6 nF      | 50                        | ±5%                      | 0.90                  |
| 85 | CL10C103JA8NNN □ |                    | 10 nF       | 25                        | ±5%                      | 0.90                  |
| 1  | CL21CR47CBANNN □ | 2.00×1.25          | 0.47 pF     | 50                        | ±0.25 pF                 | 0.75                  |
| 2  | CL21C0R5CBANNN □ |                    | 0.5 pF      | 50                        | ±0.25 pF                 | 0.75                  |
| 3  | CL21C010CBANNN □ |                    | 1.0 pF      | 50                        | ±0.25 pF                 | 0.75                  |
| 4  | CL21C1R2CBANNN □ |                    | 1.2 pF      | 50                        | ±0.25 pF                 | 0.75                  |
| 5  | CL21C1R5CBANNN □ |                    | 1.5 pF      | 50                        | ±0.25 pF                 | 0.75                  |
| 6  | CL21C1R8CBANNN □ |                    | 1.8 pF      | 50                        | ±0.25 pF                 | 0.75                  |
| 7  | CL21C020CBANNN □ |                    | 2.0 pF      | 50                        | ±0.25 pF                 | 0.75                  |
| 8  | CL21C2R2CBANNN □ |                    | 2.2 pF      | 50                        | ±0.25 pF                 | 0.75                  |
| 9  | CL21C2R4CBANNN □ |                    | 2.4 pF      | 50                        | ±0.25 pF                 | 0.75                  |
| 10 | CL21C2R5CBANNN □ |                    | 2.5 pF      | 50                        | ±0.25 pF                 | 0.75                  |
| 11 | CL21C2R7CBANNN □ |                    | 2.7 pF      | 50                        | ±0.25 pF                 | 0.75                  |
| 12 | CL21C030CBANNN □ |                    | 3.0 pF      | 50                        | ±0.25 pF                 | 0.75                  |
| 13 | CL21C3R2CBANNN □ |                    | 3.2 pF      | 50                        | ±0.25 pF                 | 0.75                  |
| 14 | CL21C3R3CBANNN □ |                    | 3.3 pF      | 50                        | ±0.25 pF                 | 0.75                  |
| 15 | CL21C3R6CBANNN □ |                    | 3.6 pF      | 50                        | ±0.25 pF                 | 0.75                  |
| 16 | CL21C3R9CBANNN □ |                    | 3.9 pF      | 50                        | ±0.25 pF                 | 0.75                  |
| 17 | CL21C040CBANNN □ |                    | 4.0 pF      | 50                        | ±0.25 pF                 | 0.75                  |
| 18 | CL21C4R7CBANNN □ |                    | 4.7 pF      | 50                        | ±0.25 pF                 | 0.75                  |
| 19 | CL21C5R6DBANNN □ |                    | 5.6 pF      | 50                        | ±0.5 pF                  | 0.75                  |
| 20 | CL21C060DBANNN □ |                    | 6.0 pF      | 50                        | ±0.5 pF                  | 0.75                  |
| 21 | CL21C6R8DBANNN □ |                    | 6.8 pF      | 50                        | ±0.5 pF                  | 0.75                  |
| 22 | CL21C070DBANNN □ |                    | 7.0 pF      | 50                        | ±0.5 pF                  | 0.75                  |
| 23 | CL21C7R5DBANNN □ |                    | 7.5 pF      | 50                        | ±0.5 pF                  | 0.75                  |
| 24 | CL21C080DBANNN □ |                    | 8.0 pF      | 50                        | ±0.5 pF                  | 0.75                  |
| 25 | CL21C8R2DBANNN □ |                    | 8.2 pF      | 50                        | ±0.5 pF                  | 0.75                  |
| 26 | CL21C090DBANNN □ |                    | 9.0 pF      | 50                        | ±0.5 pF                  | 0.75                  |
| 27 | CL21C100JBANNN □ |                    | 10 pF       | 50                        | ±5%                      | 0.75                  |
| 28 | CL21C120JBANNN □ |                    | 12 pF       | 50                        | ±5%                      | 0.75                  |
| 29 | CL21C130JBANNN □ |                    | 13 pF       | 50                        | ±5%                      | 0.75                  |
| 30 | CL21C140JBANNN □ |                    | 14 pF       | 50                        | ±5%                      | 0.75                  |
| 31 | CL21C150JBANNN □ |                    | 15 pF       | 50                        | ±5%                      | 0.75                  |
| 32 | CL21C160JBANNN □ |                    | 16 pF       | 50                        | ±5%                      | 0.75                  |
| 33 | CL21C180JBANNN □ |                    | 18 pF       | 50                        | ±5%                      | 0.75                  |
| 34 | CL21C200JBANNN □ |                    | 20 pF       | 50                        | ±5%                      | 0.75                  |
| 35 | CL21C220JBANNN □ |                    | 22 pF       | 50                        | ±5%                      | 0.75                  |
| 36 | CL21C240JBANNN □ |                    | 24 pF       | 50                        | ±5%                      | 0.75                  |
| 37 | CL21C250JBANNN □ |                    | 25 pF       | 50                        | ±5%                      | 0.75                  |
| 38 | CL21C270JBANNN □ |                    | 27 pF       | 50                        | ±5%                      | 0.75                  |
| 39 | CL21C300JBANNN □ |                    | 30 pF       | 50                        | ±5%                      | 0.75                  |
| 40 | CL21C330JBANNN □ |                    | 33 pF       | 50                        | ±5%                      | 0.75                  |
| 41 | CL21C360JBANNN □ |                    | 36 pF       | 50                        | ±5%                      | 0.75                  |
| 42 | CL21C390JBANNN □ |                    | 39 pF       | 50                        | ±5%                      | 0.75                  |
| 43 | CL21C430JBANNN □ |                    | 43 pF       | 50                        | ±5%                      | 0.75                  |
| 44 | CL21C470JBANNN □ |                    | 47 pF       | 50                        | ±5%                      | 0.75                  |
| 45 | CL21C510JBANNN □ |                    | 51 pF       | 50                        | ±5%                      | 0.75                  |

※ □ mark means packaging code. If you want to learn the code or quantity in detail, please see p74.

## Product Lineup (Standard &amp; High Capacitors-C0G)

|    | Part Number      | Size L x W<br>(mm) | Capacitance | Rated<br>Voltage<br>(Vdc) | Capacitance<br>Tolerance | Thickness<br>Max.(mm) |
|----|------------------|--------------------|-------------|---------------------------|--------------------------|-----------------------|
| 46 | CL21C560JBANNN □ | 2.00×1.25          | 56 pF       | 50                        | ±5%                      | 0.75                  |
| 47 | CL21C620JBANNN □ |                    | 62 pF       | 50                        | ±5%                      | 0.75                  |
| 48 | CL21C680JBANNN □ |                    | 68 pF       | 50                        | ±5%                      | 0.75                  |
| 49 | CL21C750JBANNN □ |                    | 75 pF       | 50                        | ±5%                      | 0.75                  |
| 50 | CL21C820JBANNN □ |                    | 82 pF       | 50                        | ±5%                      | 0.75                  |
| 51 | CL21C910JBANNN □ |                    | 91 pF       | 50                        | ±5%                      | 0.75                  |
| 52 | CL21C101JBANNN □ |                    | 100 pF      | 50                        | ±5%                      | 0.75                  |
| 53 | CL21C111JBANNN □ |                    | 110 pF      | 50                        | ±5%                      | 0.75                  |
| 54 | CL21C121JBANNN □ |                    | 120 pF      | 50                        | ±5%                      | 0.75                  |
| 55 | CL21C131JBANNN □ |                    | 130 pF      | 50                        | ±5%                      | 0.75                  |
| 56 | CL21C151JBANNN □ |                    | 150 pF      | 50                        | ±5%                      | 0.75                  |
| 57 | CL21C161JBANNN □ |                    | 160 pF      | 50                        | ±5%                      | 0.75                  |
| 58 | CL21C181JBANNN □ |                    | 180 pF      | 50                        | ±5%                      | 0.75                  |
| 59 | CL21C201JBANNN □ |                    | 200 pF      | 50                        | ±5%                      | 0.75                  |
| 60 | CL21C221JBANNN □ |                    | 220 pF      | 50                        | ±5%                      | 0.75                  |
| 61 | CL21C241JBANNN □ |                    | 240 pF      | 50                        | ±5%                      | 0.75                  |
| 62 | CL21C271JBANNN □ |                    | 270 pF      | 50                        | ±5%                      | 0.75                  |
| 63 | CL21C301JBANNN □ |                    | 300 pF      | 50                        | ±5%                      | 0.75                  |
| 64 | CL21C331JBANNN □ |                    | 330 pF      | 50                        | ±5%                      | 0.75                  |
| 65 | CL21C361JBANNN □ |                    | 360 pF      | 50                        | ±5%                      | 0.75                  |
| 66 | CL21C391JBANNN □ |                    | 390 pF      | 50                        | ±5%                      | 0.75                  |
| 67 | CL21C431JBANNN □ |                    | 430 pF      | 50                        | ±5%                      | 0.75                  |
| 68 | CL21C471JBANNN □ |                    | 470 pF      | 50                        | ±5%                      | 0.75                  |
| 69 | CL21C511JBANNN □ |                    | 510 pF      | 50                        | ±5%                      | 0.75                  |
| 70 | CL21C561JBANNN □ |                    | 560 pF      | 50                        | ±5%                      | 0.75                  |
| 71 | CL21C621JBCNNN □ |                    | 620 pF      | 50                        | ±5%                      | 0.95                  |
| 72 | CL21C681JBCNNN □ |                    | 680 pF      | 50                        | ±5%                      | 0.95                  |
| 73 | CL21C751JBCNNN □ |                    | 750 pF      | 50                        | ±5%                      | 0.95                  |
| 74 | CL21C821JBCNNN □ |                    | 820 pF      | 50                        | ±5%                      | 0.95                  |
| 75 | CL21C102JBCNNN □ |                    | 1 nF        | 50                        | ±5%                      | 0.95                  |
| 76 | CL21C122JBFNNN □ |                    | 1.2 nF      | 50                        | ±5%                      | 1.35                  |
| 77 | CL21C152JBFNNN □ |                    | 1.5 nF      | 50                        | ±5%                      | 1.35                  |
| 78 | CL21C182JBFNNN □ |                    | 1.8 nF      | 50                        | ±5%                      | 1.35                  |
| 79 | CL21C222JBFNNN □ |                    | 2.2 nF      | 50                        | ±5%                      | 1.35                  |
| 80 | CL21C332JAFNNN □ |                    | 3.3 nF      | 25                        | ±5%                      | 1.35                  |
| 81 | CL21C332JBFNNN □ |                    | 3.3 nF      | 50                        | ±5%                      | 1.35                  |
| 82 | CL21C392JAANNN □ |                    | 3.9 nF      | 25                        | ±5%                      | 0.75                  |
| 83 | CL21C392JBFNNN □ |                    | 3.9 nF      | 50                        | ±5%                      | 1.35                  |
| 84 | CL21C472JBFNNN □ |                    | 4.7 nF      | 50                        | ±5%                      | 1.35                  |
| 85 | CL21C562JBFNNN □ |                    | 5.6 nF      | 50                        | ±5%                      | 1.35                  |
| 86 | CL21C822JAFNNN □ |                    | 8.2 nF      | 25                        | ±5%                      | 1.35                  |
| 87 | CL21C103JBFNNN □ |                    | 10 nF       | 50                        | ±5%                      | 1.35                  |
| 88 | CL21C333JAFNNN □ |                    | 33 nF       | 25                        | ±5%                      | 1.35                  |
| 1  | CL31C0R5CBCNNN □ | 3.20×1.60          | 0.5 pF      | 50                        | ±0.25 pF                 | 1.00                  |
| 2  | CL31C010CBCNNN □ |                    | 1.0 pF      | 50                        | ±0.25 pF                 | 1.00                  |
| 3  | CL31C1R5CBCNNN □ |                    | 1.5 pF      | 50                        | ±0.25 pF                 | 1.00                  |
| 4  | CL31C1R8CBCNNN □ |                    | 1.8 pF      | 50                        | ±0.25 pF                 | 1.00                  |
| 5  | CL31C020CBCNNN □ |                    | 2.0 pF      | 50                        | ±0.25 pF                 | 1.00                  |
| 6  | CL31C2R2CBCNNN □ |                    | 2.2 pF      | 50                        | ±0.25 pF                 | 1.00                  |
| 7  | CL31C2R7CBCNNN □ |                    | 2.7 pF      | 50                        | ±0.25 pF                 | 1.00                  |

※ □ mark means packaging code. If you want to learn the code or quantity in detail, please see p74.

Part Numbering  
System

Standard &  
High Capacitors

Super Small Size  
Capacitors

High-Q  
Capacitors

Medium-High  
Voltage Capacitors

Array Type  
Capacitors

Low ESL  
Capacitors

Reliability Test  
Condition

Premium Capacitors  
for Automotive  
Applications

Packaging  
Specification

Application Manual  
for Surface Mounting

## Product Lineup (Standard & High Capacitors-C0G)

|    | Part Number      | Size L x W<br>(mm) | Capacitance | Rated<br>Voltage<br>(Vdc) | Capacitance<br>Tolerance | Thickness<br>Max.(mm) |
|----|------------------|--------------------|-------------|---------------------------|--------------------------|-----------------------|
| 8  | CL31C030CBCNNN □ | 3.20×1.60          | 3.0 pF      | 50                        | ±0.25 pF                 | 1.00                  |
| 9  | CL31C3R3CBCNNN □ |                    | 3.3 pF      | 50                        | ±0.25 pF                 | 1.00                  |
| 10 | CL31C040CBCNNN □ |                    | 4.0 pF      | 50                        | ±0.25 pF                 | 1.00                  |
| 11 | CL31C4R7CBCNNN □ |                    | 4.7 pF      | 50                        | ±0.25 pF                 | 1.00                  |
| 12 | CL31C100JBCNNN □ |                    | 10 pF       | 50                        | ±5%                      | 1.00                  |
| 13 | CL31C120JBCNNN □ |                    | 12 pF       | 50                        | ±5%                      | 1.00                  |
| 14 | CL31C150JBCNNN □ |                    | 15 pF       | 50                        | ±5%                      | 1.00                  |
| 15 | CL31C180JBCNNN □ |                    | 18 pF       | 50                        | ±5%                      | 1.00                  |
| 16 | CL31C200JBCNNN □ |                    | 20 pF       | 50                        | ±5%                      | 1.00                  |
| 17 | CL31C220JBCNNN □ |                    | 22 pF       | 50                        | ±5%                      | 1.00                  |
| 18 | CL31C270JBCNNN □ |                    | 27 pF       | 50                        | ±5%                      | 1.00                  |
| 19 | CL31C300JBCNNN □ |                    | 30 pF       | 50                        | ±5%                      | 1.00                  |
| 20 | CL31C330JBCNNN □ |                    | 33 pF       | 50                        | ±5%                      | 1.00                  |
| 21 | CL31C390JBCNNN □ |                    | 39 pF       | 50                        | ±5%                      | 1.00                  |
| 22 | CL31C470JBCNNN □ |                    | 47 pF       | 50                        | ±5%                      | 1.00                  |
| 23 | CL31C510JBCNNN □ |                    | 51 pF       | 50                        | ±5%                      | 1.00                  |
| 24 | CL31C560JBCNNN □ |                    | 56 pF       | 50                        | ±5%                      | 1.00                  |
| 25 | CL31C680JBCNNN □ |                    | 68 pF       | 50                        | ±5%                      | 1.00                  |
| 26 | CL31C750JBCNNN □ |                    | 75 pF       | 50                        | ±5%                      | 1.00                  |
| 27 | CL31C820JBCNNN □ |                    | 82 pF       | 50                        | ±5%                      | 1.00                  |
| 28 | CL31C101JBCNNN □ |                    | 100 pF      | 50                        | ±5%                      | 1.00                  |
| 29 | CL31C121JBCNNN □ |                    | 120 pF      | 50                        | ±5%                      | 1.00                  |
| 30 | CL31C151JBCNNN □ |                    | 150 pF      | 50                        | ±5%                      | 1.00                  |
| 31 | CL31C181JBCNNN □ |                    | 180 pF      | 50                        | ±5%                      | 1.00                  |
| 32 | CL31C221JBCNNN □ |                    | 220 pF      | 50                        | ±5%                      | 1.00                  |
| 33 | CL31C271JBCNNN □ |                    | 270 pF      | 50                        | ±5%                      | 1.00                  |
| 34 | CL31C331JBCNNN □ |                    | 330 pF      | 50                        | ±5%                      | 1.00                  |
| 35 | CL31C391JBCNNN □ |                    | 390 pF      | 50                        | ±5%                      | 1.00                  |
| 36 | CL31C471JBCNNN □ |                    | 470 pF      | 50                        | ±5%                      | 1.00                  |
| 37 | CL31C561JBCNNN □ |                    | 560 pF      | 50                        | ±5%                      | 1.00                  |
| 38 | CL31C681JBCNNN □ |                    | 680 pF      | 50                        | ±5%                      | 1.00                  |
| 39 | CL31C821JBCNNN □ |                    | 820 pF      | 50                        | ±5%                      | 1.00                  |
| 40 | CL31C102JBCNNN □ |                    | 1 nF        | 50                        | ±5%                      | 1.00                  |
| 41 | CL31C122JBCNNN □ |                    | 1.2 nF      | 50                        | ±5%                      | 1.00                  |
| 42 | CL31C152JBCNNN □ |                    | 1.5 nF      | 50                        | ±5%                      | 1.00                  |
| 43 | CL31C182JBCNNN □ |                    | 1.8 nF      | 50                        | ±5%                      | 1.00                  |
| 44 | CL31C222JBCNNN □ |                    | 2.2 nF      | 50                        | ±5%                      | 1.00                  |
| 45 | CL31C272JBFNNN □ |                    | 2.7 nF      | 50                        | ±5%                      | 1.40                  |
| 46 | CL31C332JBFNNN □ |                    | 3.3 nF      | 50                        | ±5%                      | 1.40                  |
| 47 | CL31C472JBFNNN □ |                    | 4.7 nF      | 50                        | ±5%                      | 1.40                  |
| 48 | CL31C682JBHNNN □ |                    | 6.8 nF      | 50                        | ±5%                      | 1.80                  |
| 49 | CL31C103JAFNNN □ |                    | 10 nF       | 25                        | ±5%                      | 1.40                  |
| 50 | CL31C223JBHNNN □ |                    | 22 nF       | 50                        | ±5%                      | 1.80                  |
| 51 | CL31C333JBHNNN □ |                    | 33 nF       | 50                        | ±5%                      | 1.80                  |
| 52 | CL31C473JBHNNN □ |                    | 47 nF       | 50                        | ±5%                      | 1.80                  |
| 53 | CL31C683JAHNNN □ |                    | 68 nF       | 25                        | ±5%                      | 1.80                  |
| 54 | CL31C104JAHNNN □ |                    | 100 nF      | 25                        | ±5%                      | 1.80                  |
| 1  | CL32C472JBFNNN □ | 3.20×2.50          | 4.7 nF      | 50                        | ±5%                      | 1.45                  |
| 2  | CL32C103JBFNNN □ |                    | 10 nF       | 50                        | ±5%                      | 1.45                  |
| 3  | CL32C223JBHNNN □ |                    | 22 nF       | 50                        | ±5%                      | 1.80                  |
| 4  | CL32C333JBHNNN □ |                    | 33 nF       | 50                        | ±5%                      | 1.80                  |
| 5  | CL32C473JBHNNN □ |                    | 47 nF       | 50                        | ±5%                      | 1.80                  |

※ □ mark means packaging code. If you want to learn the code or quantity in detail, please see p74.

## Product Lineup (Standard &amp; High Capacitors-X5R)

|    | Part Number     | Size L x W<br>(mm) | Capacitance | Rated<br>Voltage<br>(Vdc) | Capacitance<br>Tolerance | Thickness<br>Max.(mm) |
|----|-----------------|--------------------|-------------|---------------------------|--------------------------|-----------------------|
| 1  | CL05A223KO5NNN□ | 1.00×0.50          | 22 nF       | 16                        | ±10%                     | 0.55                  |
| 2  | CL05A104KA5NNN□ |                    | 0.1 μF      | 25                        | ±10%                     | 0.55                  |
| 3  | CL05A104KO5NNN□ |                    | 0.1 μF      | 16                        | ±10%                     | 0.55                  |
| 4  | CL05A104KP5NNN□ |                    | 0.1 μF      | 10                        | ±10%                     | 0.55                  |
| 5  | CL05A224KA5NNN□ |                    | 0.22 μF     | 25                        | ±10%                     | 0.55                  |
| 6  | CL05A224KP5NNN□ |                    | 0.22 μF     | 10                        | ±10%                     | 0.55                  |
| 7  | CL05A334KA5NNN□ |                    | 0.33 μF     | 25                        | ±10%                     | 0.55                  |
| 8  | CL05A334KP5NNN□ |                    | 0.33 μF     | 10                        | ±10%                     | 0.55                  |
| 9  | CL05A474KA5NNN□ |                    | 0.47 μF     | 25                        | ±10%                     | 0.55                  |
| 10 | CL05A474KO5NNN□ |                    | 0.47 μF     | 16                        | ±10%                     | 0.55                  |
| 11 | CL05A474KP5NNN□ |                    | 0.47 μF     | 10                        | ±10%                     | 0.55                  |
| 12 | CL05A474KQ5NNN□ |                    | 0.47 μF     | 6.3                       | ±10%                     | 0.55                  |
| 13 | CL05A474KR5NNN□ |                    | 0.47 μF     | 4                         | ±10%                     | 0.55                  |
| 14 | CL05A105KA5NQN□ |                    | 1 μF        | 25                        | ±10%                     | 0.60                  |
| 15 | CL05A105KO5NNN□ |                    | 1 μF        | 16                        | ±10%                     | 0.55                  |
| 16 | CL05A105KO3LQN□ |                    | 1 μF        | 16                        | ±10%                     | 0.33                  |
| 17 | CL05A105KP5NNN□ |                    | 1 μF        | 10                        | ±10%                     | 0.55                  |
| 18 | CL05A105KP3LNN□ |                    | 1 μF        | 10                        | ±10%                     | 0.33                  |
| 19 | CL05A105KQ5NNN□ |                    | 1 μF        | 6.3                       | ±10%                     | 0.55                  |
| 20 | CL05A105KQ3LNN□ |                    | 1 μF        | 6.3                       | ±10%                     | 0.33                  |
| 21 | CL05A105KR5NNN□ |                    | 1 μF        | 4                         | ±10%                     | 0.55                  |
| 22 | CL05A105KR3LNN□ |                    | 1 μF        | 4                         | ±10%                     | 0.33                  |
| 23 | CL05A225MA5NUN□ |                    | 2.2 μF      | 25                        | ±20%                     | 0.70                  |
| 24 | CL05A225KO5NQN□ |                    | 2.2 μF      | 16                        | ±10%                     | 0.60                  |
| 25 | CL05A225MP5NSN□ |                    | 2.2 μF      | 10                        | ±20%                     | 0.57                  |
| 26 | CL05A225KP3LRN□ |                    | 2.2 μF      | 10                        | ±10%                     | 0.33                  |
| 27 | CL05A225MQ5NNN□ |                    | 2.2 μF      | 6.3                       | ±20%                     | 0.55                  |
| 28 | CL05A225KQ3LRN□ |                    | 2.2 μF      | 6.3                       | ±10%                     | 0.33                  |
| 29 | CL05A225MR5NNN□ |                    | 2.2 μF      | 4                         | ±20%                     | 0.55                  |
| 30 | CL05A225KR3LRN□ |                    | 2.2 μF      | 4                         | ±10%                     | 0.33                  |
| 31 | CL05A475MO5NUN□ |                    | 4.7 μF      | 16                        | ±20%                     | 0.70                  |
| 32 | CL05A475MP5NRN□ |                    | 4.7 μF      | 10                        | ±20%                     | 0.65                  |
| 33 | CL05A475MQ5NRN□ |                    | 4.7 μF      | 6.3                       | ±20%                     | 0.65                  |
| 34 | CL05A475MQ3LUN□ |                    | 4.7 μF      | 6.3                       | ±20%                     | 0.35                  |
| 35 | CL05A106MP5NUN□ |                    | 10 μF       | 10                        | ±20%                     | 0.70                  |
| 36 | CL05A106MQ5NUN□ |                    | 10 μF       | 6.3                       | ±20%                     | 0.70                  |
| 37 | CL05A106MR5NRN□ |                    | 10 μF       | 4                         | ±20%                     | 0.65                  |
| 38 | CL05A156MR5NUN□ |                    | 15 μF       | 4                         | ±20%                     | 0.70                  |
| 39 | CL05A226MR5NZN□ |                    | 22 μF       | 4                         | ±20%                     | 0.90                  |
| 1  | CL10A474KB8NNN□ | 1.60×0.80          | 0.47 μF     | 50                        | ±10%                     | 0.90                  |
| 2  | CL10A474KA8NNN□ |                    | 0.47 μF     | 25                        | ±10%                     | 0.90                  |
| 3  | CL10A474KP8NNN□ |                    | 0.47 μF     | 10                        | ±10%                     | 0.90                  |
| 4  | CL10A474KQ8NNN□ |                    | 0.47 μF     | 6.3                       | ±10%                     | 0.90                  |
| 5  | CL10A474KR8NNN□ |                    | 0.47 μF     | 4                         | ±10%                     | 0.90                  |
| 6  | CL10A105KB8NNN□ |                    | 1 μF        | 50                        | ±10%                     | 0.90                  |
| 7  | CL10A105KA5LNN□ |                    | 1 μF        | 25                        | ±10%                     | 0.50                  |
| 8  | CL10A105KA8NNN□ |                    | 1 μF        | 25                        | ±10%                     | 0.90                  |
| 9  | CL10A105KO8NNN□ |                    | 1 μF        | 16                        | ±10%                     | 0.90                  |
| 10 | CL10A105KO5LNN□ |                    | 1 μF        | 16                        | ±10%                     | 0.50                  |
| 11 | CL10A105KP8NNN□ |                    | 1 μF        | 10                        | ±10%                     | 0.90                  |
| 12 | CL10A105KP5LNN□ |                    | 1 μF        | 10                        | ±10%                     | 0.50                  |
| 13 | CL10A105KQ8NNN□ |                    | 1 μF        | 6.3                       | ±10%                     | 0.90                  |
| 14 | CL10A105KQ5LNN□ |                    | 1 μF        | 6.3                       | ±10%                     | 0.50                  |

※ □ mark means packaging code. If you want to learn the code or quantity in detail, please see p74.

Part Numbering  
SystemStandard &  
High CapacitorsSuper Small Size  
CapacitorsHigh-Q  
CapacitorsMedium-High  
Voltage CapacitorsArray Type  
CapacitorsLow ESL  
CapacitorsReliability Test  
ConditionPremium Capacitors  
for Automotive  
ApplicationsPackaging  
SpecificationApplication Manual  
for Surface Mounting

### Product Lineup (Standard & High Capacitors-X5R)

|    | Part Number      | Size L x W<br>(mm) | Capacitance | Rated<br>Voltage<br>(Vdc) | Capacitance<br>Tolerance | Thickness<br>Max.(mm) |
|----|------------------|--------------------|-------------|---------------------------|--------------------------|-----------------------|
| 15 | CL10A105KR8NNN □ | 1.60×0.80          | 1 $\mu$ F   | 4                         | ±10%                     | 0.90                  |
| 16 | CL10A105KR5LNN □ |                    | 1 $\mu$ F   | 4                         | ±10%                     | 0.50                  |
| 17 | CL10A105KA5LNN □ |                    | 1 $\mu$ F   | 25                        | ±10%                     | 0.50                  |
| 18 | CL10A225KA8NNN □ |                    | 2.2 $\mu$ F | 25                        | ±10%                     | 0.90                  |
| 19 | CL10A225KA5LNN □ |                    | 2.2 $\mu$ F | 25                        | ±10%                     | 0.50                  |
| 20 | CL10A225KO8NNN □ |                    | 2.2 $\mu$ F | 16                        | ±10%                     | 0.90                  |
| 21 | CL10A225KO5LNN □ |                    | 2.2 $\mu$ F | 16                        | ±10%                     | 0.50                  |
| 22 | CL10A225KP8NNN □ |                    | 2.2 $\mu$ F | 10                        | ±10%                     | 0.90                  |
| 23 | CL10A225KP5LNN □ |                    | 2.2 $\mu$ F | 10                        | ±10%                     | 0.50                  |
| 24 | CL10A225KQ8NNN □ |                    | 2.2 $\mu$ F | 6.3                       | ±10%                     | 0.90                  |
| 25 | CL10A225KQ5LNN □ |                    | 2.2 $\mu$ F | 6.3                       | ±10%                     | 0.50                  |
| 26 | CL10A225KR8NNN □ |                    | 2.2 $\mu$ F | 4                         | ±10%                     | 0.90                  |
| 27 | CL10A225KR5LNN □ |                    | 2.2 $\mu$ F | 4                         | ±10%                     | 0.50                  |
| 28 | CL10A335KQ8NNN □ |                    | 3.3 $\mu$ F | 6.3                       | ±10%                     | 0.90                  |
| 29 | CL10A335KR8NNN □ |                    | 3.3 $\mu$ F | 4                         | ±10%                     | 0.90                  |
| 30 | CL10A475KA8NQN □ |                    | 4.7 $\mu$ F | 25                        | ±10%                     | 0.95                  |
| 31 | CL10A475KO8NNN □ |                    | 4.7 $\mu$ F | 16                        | ±10%                     | 0.90                  |
| 32 | CL10A475KP8NNN □ |                    | 4.7 $\mu$ F | 10                        | ±10%                     | 0.90                  |
| 33 | CL10A475KP5LNN □ |                    | 4.7 $\mu$ F | 10                        | ±10%                     | 0.50                  |
| 34 | CL10A475KQ5LNN □ |                    | 4.7 $\mu$ F | 6.3                       | ±10%                     | 0.50                  |
| 35 | CL10A475KQ8NNN □ |                    | 4.7 $\mu$ F | 6.3                       | ±10%                     | 0.90                  |
| 36 | CL10A475KR5LNN □ |                    | 4.7 $\mu$ F | 4                         | ±10%                     | 0.50                  |
| 37 | CL10A475KR8NNN □ |                    | 4.7 $\mu$ F | 4                         | ±10%                     | 0.90                  |
| 38 | CL10A106KR8NNN □ |                    | 10 $\mu$ F  | 4                         | ±10%                     | 0.90                  |
| 39 | CL10A106MR5LRN □ |                    | 10 $\mu$ F  | 4                         | ±20%                     | 0.50                  |
| 40 | CL10A106KQ8NNN □ |                    | 10 $\mu$ F  | 6.3                       | ±10%                     | 0.90                  |
| 41 | CL10A106MQ5LRN □ |                    | 10 $\mu$ F  | 6.3                       | ±20%                     | 0.50                  |
| 42 | CL10A106MP8NNN □ |                    | 10 $\mu$ F  | 10                        | ±20%                     | 0.90                  |
| 43 | CL10A106MO8NQN □ |                    | 10 $\mu$ F  | 16                        | ±20%                     | 0.95                  |
| 44 | CL10A106MA8NRN □ |                    | 10 $\mu$ F  | 25                        | ±20%                     | 1.00                  |
| 45 | CL10A226MR8NRN □ |                    | 22 $\mu$ F  | 4                         | ±20%                     | 1.00                  |
| 46 | CL10A226MQ8NRN □ |                    | 22 $\mu$ F  | 6.3                       | ±20%                     | 1.00                  |
| 47 | CL10A226MP8NRN □ |                    | 22 $\mu$ F  | 10                        | ±20%                     | 1.00                  |
| 48 | CL10A226MP8NUN □ |                    | 22 $\mu$ F  | 10                        | ±20%                     | 1.05                  |
| 49 | CL10A476MR8NZN □ |                    | 47 $\mu$ F  | 4                         | ±20%                     | 1.10                  |
| 50 | CL10A476MQ8CZN □ |                    | 47 $\mu$ F  | 6.3                       | ±20%                     | 1.10                  |
| 1  | CL21A105KBQNNN □ | 2.00×1.25          | 1 $\mu$ F   | 50                        | ±10%                     | 1.40                  |
| 2  | CL21A105KAFNNN □ |                    | 1 $\mu$ F   | 25                        | ±10%                     | 1.35                  |
| 3  | CL21A105KA6LNN □ |                    | 1 $\mu$ F   | 25                        | ±10%                     | 0.70                  |
| 4  | CL21A105KOFNNN □ |                    | 1 $\mu$ F   | 16                        | ±10%                     | 1.35                  |
| 5  | CL21A105KO6LNN □ |                    | 1 $\mu$ F   | 16                        | ±10%                     | 0.70                  |
| 6  | CL21A105KQFNNN □ |                    | 1 $\mu$ F   | 6.3                       | ±10%                     | 1.35                  |
| 7  | CL21A105KRFNNN □ |                    | 1 $\mu$ F   | 4                         | ±10%                     | 1.35                  |
| 8  | CL21A225KBQNNN □ |                    | 2.2 $\mu$ F | 50                        | ±10%                     | 1.40                  |
| 9  | CL21A225KAFNNN □ |                    | 2.2 $\mu$ F | 25                        | ±10%                     | 1.35                  |
| 10 | CL21A225KO6LNN □ |                    | 2.2 $\mu$ F | 16                        | ±10%                     | 0.70                  |
| 11 | CL21A225KOFNNN □ |                    | 2.2 $\mu$ F | 16                        | ±10%                     | 1.35                  |
| 12 | CL21A225KPFNNN □ |                    | 2.2 $\mu$ F | 10                        | ±10%                     | 1.35                  |
| 13 | CL21A225KQFNNN □ |                    | 2.2 $\mu$ F | 6.3                       | ±10%                     | 1.35                  |
| 14 | CL21A225KRFNNN □ |                    | 2.2 $\mu$ F | 4                         | ±10%                     | 1.35                  |
| 15 | CL21A475KBQNNN □ |                    | 4.7 $\mu$ F | 50                        | ±10%                     | 1.40                  |

※ □ mark means packaging code. If you want to learn the code or quantity in detail, please see p74.

## Product Lineup (Standard &amp; High Capacitors-X5R)

|    | Part Number      | Size L x W<br>(mm) | Capacitance | Rated<br>Voltage<br>(Vdc) | Capacitance<br>Tolerance | Thickness<br>Max.(mm) |
|----|------------------|--------------------|-------------|---------------------------|--------------------------|-----------------------|
| 16 | CL21A475KAQNNN□  | 2.00×1.25          | 4.7μF       | 25                        | ±10%                     | 1.40                  |
| 17 | CL21A475KACLRN□  |                    | 4.7μF       | 25                        | ±10%                     | 0.95                  |
| 18 | CL21A475KOFNNN□  |                    | 4.7μF       | 16                        | ±10%                     | 1.35                  |
| 19 | CL21A475KOCLNN□  |                    | 4.7μF       | 16                        | ±10%                     | 0.95                  |
| 20 | CL21A475KPFNNN□  |                    | 4.7μF       | 10                        | ±10%                     | 1.35                  |
| 21 | CL21A475KPC LNN□ |                    | 4.7μF       | 10                        | ±10%                     | 0.95                  |
| 22 | CL21A475KQFNNN□  |                    | 4.7μF       | 6.3                       | ±10%                     | 1.35                  |
| 23 | CL21A475KQCLNN□  |                    | 4.7μF       | 6.3                       | ±10%                     | 0.95                  |
| 24 | CL21A475KRFNNN□  |                    | 4.7μF       | 4                         | ±10%                     | 1.35                  |
| 25 | CL21A475KRCLNN□  |                    | 4.7μF       | 4                         | ±10%                     | 0.95                  |
| 26 | CL21A106KAYNNN□  |                    | 10μF        | 25                        | ±10%                     | 1.45                  |
| 27 | CL21A106KACLRN□  |                    | 10μF        | 25                        | ±10%                     | 0.95                  |
| 28 | CL21A106KA7LQN□  |                    | 10μF        | 25                        | ±10%                     | 0.80                  |
| 29 | CL21A106KOFNNN□  |                    | 10μF        | 16                        | ±10%                     | 1.35                  |
| 30 | CL21A106KOQNNN□  |                    | 10μF        | 16                        | ±10%                     | 1.40                  |
| 31 | CL21A106KOCLRN□  |                    | 10μF        | 16                        | ±10%                     | 0.95                  |
| 32 | CL21A106KOCL3R□  |                    | 10μF        | 16                        | ±10%                     | 0.95                  |
| 33 | CL21A106KPFNNN□  |                    | 10μF        | 10                        | ±10%                     | 1.35                  |
| 34 | CL21A106KPCLQN□  |                    | 10μF        | 10                        | ±10%                     | 0.95                  |
| 35 | CL21A106KQFNNN□  |                    | 10μF        | 6.3                       | ±10%                     | 1.35                  |
| 36 | CL21A106KQCLNN□  |                    | 10μF        | 6.3                       | ±10%                     | 0.95                  |
| 37 | CL21A106KRFNNN□  |                    | 10μF        | 4                         | ±10%                     | 1.35                  |
| 38 | CL21A106KRCLNN□  |                    | 10μF        | 4                         | ±10%                     | 0.95                  |
| 39 | CL21A226MAQNNN□  |                    | 22μF        | 25                        | ±20%                     | 1.40                  |
| 40 | CL21A226MPQNNN□  |                    | 22μF        | 10                        | ±20%                     | 1.40                  |
| 41 | CL21A226MPCLRN□  |                    | 22μF        | 10                        | ±20%                     | 0.95                  |
| 42 | CL21A226MQQNNN□  |                    | 22μF        | 6.3                       | ±20%                     | 1.40                  |
| 43 | CL21A226MQCLRN□  |                    | 22μF        | 6.3                       | ±20%                     | 0.95                  |
| 44 | CL21A226MRQNNN□  |                    | 22μF        | 4                         | ±20%                     | 1.40                  |
| 45 | CL21A226MRCLRN□  |                    | 22μF        | 4                         | ±20%                     | 0.95                  |
| 46 | CL21A336MQELNN□  |                    | 33μF        | 6.3                       | ±20%                     | 1.20                  |
| 47 | CL21A336MQ9LNN□  |                    | 33μF        | 6.3                       | ±20%                     | 1.00                  |
| 48 | CL21A336MRELNN□  |                    | 33μF        | 4                         | ±20%                     | 1.20                  |
| 49 | CL21A336MR9LNN□  |                    | 33μF        | 4                         | ±20%                     | 1.00                  |
| 50 | CL21A476MQYNNN□  |                    | 47μF        | 6.3                       | ±20%                     | 1.45                  |
| 51 | CL21A476MRYNNN□  |                    | 47μF        | 4                         | ±20%                     | 1.45                  |
| 52 | CL21A476MQ9LRN□  |                    | 47μF        | 6.3                       | ±20%                     | 1.00                  |
| 1  | CL31A225KC9LNN□  | 3.20×1.60          | 2.2μF       | 100                       | ±10%                     | 1.00                  |
| 2  | CL31A475KBHNNN□  |                    | 4.7μF       | 50                        | ±10%                     | 1.80                  |
| 3  | CL31A475KB9LNN□  |                    | 4.7μF       | 50                        | ±10%                     | 1.00                  |
| 4  | CL31A475KAHNNN□  |                    | 4.7μF       | 25                        | ±10%                     | 1.80                  |
| 5  | CL31A475KACLNN□  |                    | 4.7μF       | 25                        | ±10%                     | 0.95                  |
| 6  | CL31A475KOHNNN□  |                    | 4.7μF       | 16                        | ±10%                     | 1.80                  |
| 7  | CL31A475KOCLNN□  |                    | 4.7μF       | 16                        | ±10%                     | 0.95                  |
| 8  | CL31A475KPHNNN□  |                    | 4.7μF       | 10                        | ±10%                     | 1.80                  |
| 9  | CL31A475KQHNNN□  |                    | 4.7μF       | 6.3                       | ±10%                     | 1.80                  |
| 10 | CL31A475KRHNNN□  |                    | 4.7μF       | 4                         | ±10%                     | 1.80                  |
| 11 | CL31A106KBHNNN□  |                    | 10μF        | 50                        | ±10%                     | 1.80                  |
| 12 | CL31A106KAHNNN□  |                    | 10μF        | 25                        | ±10%                     | 1.80                  |
| 13 | CL31A106KACLNN□  |                    | 10μF        | 25                        | ±10%                     | 0.95                  |
| 14 | CL31A106KOHNNN□  |                    | 10μF        | 16                        | ±10%                     | 1.80                  |

※ □ mark means packaging code. If you want to learn the code or quantity in detail, please see p74.

Part Numbering  
SystemStandard &  
High CapacitorsSuper Small Size  
CapacitorsHigh-Q  
CapacitorsMedium-High  
Voltage CapacitorsArray Type  
CapacitorsLow ESL  
CapacitorsReliability Test  
ConditionPremium Capacitors  
for Automotive  
ApplicationsPackaging  
SpecificationApplication Manual  
for Surface Mounting

**Product Lineup (Standard & High Capacitors-X5R)**

|    | Part Number      | Size L x W<br>(mm) | Capacitance | Rated<br>Voltage<br>(Vdc) | Capacitance<br>Tolerance | Thickness<br>Max.(mm) |
|----|------------------|--------------------|-------------|---------------------------|--------------------------|-----------------------|
| 15 | CL31A106KOCLNN □ | 3.20×1.60          | 10 $\mu$ F  | 16                        | ±10%                     | 0.95                  |
| 16 | CL31A106KPHNNN □ |                    | 10 $\mu$ F  | 10                        | ±10%                     | 1.80                  |
| 17 | CL31A106KPCLNN □ |                    | 10 $\mu$ F  | 10                        | ±10%                     | 0.95                  |
| 18 | CL31A106KQHNNN □ |                    | 10 $\mu$ F  | 6.3                       | ±10%                     | 1.80                  |
| 19 | CL31A106KRHNNN □ |                    | 10 $\mu$ F  | 4                         | ±10%                     | 1.80                  |
| 20 | CL31A156KQHNNN □ |                    | 15 $\mu$ F  | 6.3                       | ±10%                     | 1.80                  |
| 21 | CL31A156KRHNNN □ |                    | 15 $\mu$ F  | 4                         | ±10%                     | 1.80                  |
| 22 | CL31A226KAHNNN □ |                    | 22 $\mu$ F  | 25                        | ±10%                     | 1.80                  |
| 23 | CL31A226KOHNNN □ |                    | 22 $\mu$ F  | 16                        | ±10%                     | 1.80                  |
| 24 | CL31A226KOCLNN □ |                    | 22 $\mu$ F  | 16                        | ±10%                     | 0.95                  |
| 25 | CL31A226KPHNNN □ |                    | 22 $\mu$ F  | 10                        | ±10%                     | 1.80                  |
| 26 | CL31A226KPCLNN □ |                    | 22 $\mu$ F  | 10                        | ±10%                     | 0.95                  |
| 27 | CL31A226KQHNNN □ |                    | 22 $\mu$ F  | 6.3                       | ±10%                     | 1.80                  |
| 28 | CL31A476KPHNNN □ |                    | 47 $\mu$ F  | 10                        | ±10%                     | 1.80                  |
| 29 | CL31A476MQHNNN □ |                    | 47 $\mu$ F  | 6.3                       | ±20%                     | 1.80                  |
| 30 | CL31A476MRHNNN □ |                    | 47 $\mu$ F  | 4                         | ±20%                     | 1.80                  |
| 31 | CL31A107MQHNNN □ |                    | 100 $\mu$ F | 6.3                       | ±20%                     | 1.80                  |
| 32 | CL31A107MRHNNN □ |                    | 100 $\mu$ F | 4                         | ±20%                     | 1.80                  |
| 33 | CL31A107MPHNNN □ |                    | 100 $\mu$ F | 10                        | ±20%                     | 1.80                  |
| 1  | CL32A106KQCLNN □ | 3.20×2.50          | 10 $\mu$ F  | 6.3                       | ±10%                     | 0.95                  |
| 2  | CL32A106KRCLNN □ |                    | 10 $\mu$ F  | 4                         | ±10%                     | 0.95                  |
| 3  | CL32A106KBULNN □ |                    | 10 $\mu$ F  | 50                        | ±10%                     | 2.00                  |
| 4  | CL32A106KAJNNN □ |                    | 10 $\mu$ F  | 25                        | ±10%                     | 2.70                  |
| 5  | CL32A106KAULNN □ |                    | 10 $\mu$ F  | 25                        | ±10%                     | 2.00                  |
| 6  | CL32A106KOJNNN □ |                    | 10 $\mu$ F  | 16                        | ±10%                     | 2.70                  |
| 7  | CL32A106KPJNNN □ |                    | 10 $\mu$ F  | 10                        | ±10%                     | 2.70                  |
| 8  | CL32A226KAJNNN □ |                    | 22 $\mu$ F  | 25                        | ±10%                     | 2.70                  |
| 9  | CL32A226KOJNNN □ |                    | 22 $\mu$ F  | 16                        | ±10%                     | 2.70                  |
| 10 | CL32A226KOCLNN □ |                    | 22 $\mu$ F  | 16                        | ±10%                     | 0.95                  |
| 11 | CL32A226KPJNNN □ |                    | 22 $\mu$ F  | 10                        | ±10%                     | 2.70                  |
| 12 | CL32A226KQJNNN □ |                    | 22 $\mu$ F  | 6.3                       | ±10%                     | 2.70                  |
| 13 | CL32A226MQCLNN □ |                    | 22 $\mu$ F  | 6.3                       | ±20%                     | 0.95                  |
| 14 | CL32A226KRJNNN □ |                    | 22 $\mu$ F  | 4                         | ±10%                     | 2.70                  |
| 15 | CL32A226MRCLNN □ |                    | 22 $\mu$ F  | 4                         | ±20%                     | 0.95                  |
| 16 | CL32A476KOJNNN □ |                    | 47 $\mu$ F  | 16                        | ±10%                     | 2.70                  |
| 17 | CL32A476KPJNNN □ |                    | 47 $\mu$ F  | 10                        | ±10%                     | 2.70                  |
| 18 | CL32A476MQJNNN □ |                    | 47 $\mu$ F  | 6.3                       | ±20%                     | 2.70                  |
| 19 | CL32A476MRJNNN □ |                    | 47 $\mu$ F  | 4                         | ±20%                     | 2.70                  |
| 20 | CL32A107MPVNNN □ |                    | 100 $\mu$ F | 10                        | ±20%                     | 2.80                  |
| 21 | CL32A107MQVNNN □ |                    | 100 $\mu$ F | 6.3                       | ±20%                     | 2.80                  |
| 22 | CL32A107MRVNNN □ |                    | 100 $\mu$ F | 4                         | ±20%                     | 2.80                  |
| 23 | CL32A157MQVNNN □ |                    | 150 $\mu$ F | 6.3                       | ±20%                     | 2.80                  |
| 24 | CL32A227MQVNNN □ |                    | 220 $\mu$ F | 6.3                       | ±20%                     | 2.80                  |
| 1  | CL43A476MQJNNN □ | 4.50×3.20          | 47 $\mu$ F  | 6.3                       | ±20%                     | 2.70                  |
| 2  | CL43A476MRJNNN □ |                    | 47 $\mu$ F  | 4                         | ±20%                     | 2.70                  |
| 3  | CL43A107KQLNNN □ |                    | 100 $\mu$ F | 6.3                       | ±10%                     | 3.50                  |
| 4  | CL43A107KRLNNN □ |                    | 100 $\mu$ F | 4                         | ±10%                     | 3.50                  |

※ □ mark means packaging code. If you want to learn the code or quantity in detail, please see p74.

## Product Lineup (Standard &amp; High Capacitors-X6S)

|    | Part Number      | Size L x W<br>(mm) | Capacitance  | Rated<br>Voltage<br>(Vdc) | Capacitance<br>Tolerance | Thickness<br>Max.(mm) |
|----|------------------|--------------------|--------------|---------------------------|--------------------------|-----------------------|
| 1  | CL05X224KP5NNN □ | 1.00×0.50          | 0.22 $\mu$ F | 10                        | ±10%                     | 0.55                  |
| 2  | CL05X224KQ5NNN □ |                    | 0.22 $\mu$ F | 6.3                       | ±10%                     | 0.55                  |
| 3  | CL05X474KP5NNN □ |                    | 0.47 $\mu$ F | 10                        | ±10%                     | 0.55                  |
| 4  | CL05X474KQ5NNN □ |                    | 0.47 $\mu$ F | 6.3                       | ±10%                     | 0.55                  |
| 5  | CL05X474MR5NNN □ |                    | 0.47 $\mu$ F | 4                         | ±20%                     | 0.55                  |
| 6  | CL05X684JQ5NNN □ |                    | 0.68 $\mu$ F | 6.3                       | ±5%                      | 0.55                  |
| 7  | CL05X105KA5NQN □ |                    | 1 $\mu$ F    | 25                        | ±10%                     | 0.60                  |
| 8  | CL05X105KP5NNN □ |                    | 1 $\mu$ F    | 10                        | ±10%                     | 0.55                  |
| 9  | CL05X105MQ3LNN □ |                    | 1 $\mu$ F    | 6.3                       | ±20%                     | 0.33                  |
| 10 | CL05X225MP5NUN □ |                    | 2.2 $\mu$ F  | 10                        | ±20%                     | 0.70                  |
| 11 | CL05X475MQ5NUN □ |                    | 4.7 $\mu$ F  | 6.3                       | ±20%                     | 0.70                  |
| 12 | CL05X106MR5NUN □ |                    | 10 $\mu$ F   | 4                         | ±20%                     | 0.70                  |
| 1  | CL10X474KA8NNN □ | 1.60×0.80          | 0.47 $\mu$ F | 25                        | ±10%                     | 0.90                  |
| 2  | CL10X474KO8NNN □ |                    | 0.47 $\mu$ F | 16                        | ±10%                     | 0.90                  |
| 3  | CL10X474KP8NNN □ |                    | 0.47 $\mu$ F | 10                        | ±10%                     | 0.90                  |
| 4  | CL10X474KQ8NNN □ |                    | 0.47 $\mu$ F | 6.3                       | ±10%                     | 0.90                  |
| 5  | CL10X474KR8NNN □ |                    | 0.47 $\mu$ F | 4                         | ±10%                     | 0.90                  |
| 6  | CL10X105KA8NNN □ |                    | 1 $\mu$ F    | 25                        | ±10%                     | 0.90                  |
| 7  | CL10X105KO8NNN □ |                    | 1 $\mu$ F    | 16                        | ±10%                     | 0.90                  |
| 8  | CL10X105KP8NNN □ |                    | 1 $\mu$ F    | 10                        | ±10%                     | 0.90                  |
| 9  | CL10X105KQ8NNN □ |                    | 1 $\mu$ F    | 6.3                       | ±10%                     | 0.90                  |
| 10 | CL10X105KR8NNN □ |                    | 1 $\mu$ F    | 4                         | ±10%                     | 0.90                  |
| 11 | CL10X225KO8NNN □ |                    | 2.2 $\mu$ F  | 16                        | ±10%                     | 0.90                  |
| 12 | CL10X225KP8NNN □ |                    | 2.2 $\mu$ F  | 10                        | ±10%                     | 0.90                  |
| 13 | CL10X225KQ8NNN □ |                    | 2.2 $\mu$ F  | 6.3                       | ±10%                     | 0.90                  |
| 14 | CL10X225KR8NNN □ |                    | 2.2 $\mu$ F  | 4                         | ±10%                     | 0.90                  |
| 15 | CL10X475KA8NQN □ |                    | 4.7 $\mu$ F  | 25                        | ±10%                     | 0.95                  |
| 16 | CL10X475KO8NQN □ |                    | 4.7 $\mu$ F  | 16                        | ±10%                     | 0.95                  |
| 17 | CL10X475KP5NNN □ |                    | 4.7 $\mu$ F  | 10                        | ±10%                     | 0.90                  |
| 18 | CL10X475KQ8NNN □ |                    | 4.7 $\mu$ F  | 6.3                       | ±10%                     | 0.90                  |
| 19 | CL10X475KR8NNN □ |                    | 4.7 $\mu$ F  | 4                         | ±10%                     | 0.90                  |
| 20 | CL10X106MP8NNN □ |                    | 10 $\mu$ F   | 10                        | ±20%                     | 0.90                  |
| 21 | CL10X106KQ8NNN □ |                    | 10 $\mu$ F   | 6.3                       | ±10%                     | 0.90                  |
| 22 | CL10X106KR8NNN □ |                    | 10 $\mu$ F   | 4                         | ±10%                     | 0.90                  |
| 1  | CL21X105KAFNNN □ | 2.00×1.25          | 1 $\mu$ F    | 25                        | ±10%                     | 1.35                  |
| 2  | CL21X105KOFNNN □ |                    | 1 $\mu$ F    | 16                        | ±10%                     | 1.35                  |
| 3  | CL21X105KPFNNN □ |                    | 1 $\mu$ F    | 10                        | ±10%                     | 1.35                  |
| 4  | CL21X105KQFNNN □ |                    | 1 $\mu$ F    | 6.3                       | ±10%                     | 1.35                  |
| 5  | CL21X105KRFNNN □ |                    | 1 $\mu$ F    | 4                         | ±10%                     | 1.35                  |
| 6  | CL21X225KAFNNN □ |                    | 2.2 $\mu$ F  | 25                        | ±10%                     | 1.35                  |
| 7  | CL21X225KOFNNN □ |                    | 2.2 $\mu$ F  | 16                        | ±10%                     | 1.35                  |
| 8  | CL21X225KPFNNN □ |                    | 2.2 $\mu$ F  | 10                        | ±10%                     | 1.35                  |
| 9  | CL21X225KQFNNN □ |                    | 2.2 $\mu$ F  | 6.3                       | ±10%                     | 1.35                  |
| 10 | CL21X225KRFNNN □ |                    | 2.2 $\mu$ F  | 4                         | ±10%                     | 1.35                  |
| 11 | CL21X475KAQNNN □ |                    | 4.7 $\mu$ F  | 25                        | ±10%                     | 1.40                  |
| 12 | CL21X475KOFNNN □ |                    | 4.7 $\mu$ F  | 16                        | ±10%                     | 1.35                  |
| 13 | CL21X475KPFNNN □ |                    | 4.7 $\mu$ F  | 10                        | ±10%                     | 1.35                  |
| 14 | CL21X475KQFNNN □ |                    | 4.7 $\mu$ F  | 6.3                       | ±10%                     | 1.35                  |

※ □ mark means packaging code. If you want to learn the code or quantity in detail, please see p74.

Part Numbering  
SystemStandard &  
High CapacitorsSuper Small Size  
CapacitorsHigh-Q  
CapacitorsMedium-High  
Voltage CapacitorsArray Type  
CapacitorsLow ESL  
CapacitorsReliability Test  
ConditionPremium Capacitors  
for Automotive  
ApplicationsPackaging  
SpecificationApplication Manual  
for Surface Mounting

## Product Lineup (Standard & High Capacitors-X6S)

|    | Part Number      | Size L x W<br>(mm) | Capacitance | Rated<br>Voltage<br>(Vdc) | Capacitance<br>Tolerance | Thickness<br>Max.(mm) |
|----|------------------|--------------------|-------------|---------------------------|--------------------------|-----------------------|
| 15 | CL21X475KRFNNN □ | 2.00×1.25          | 4.7 $\mu$ F | 4                         | ±10%                     | 1.35                  |
| 16 | CL21X106KACLRN □ |                    | 10 $\mu$ F  | 25                        | ±10%                     | 0.95                  |
| 17 | CL21X106KAYNNN □ |                    | 10 $\mu$ F  | 25                        | ±10%                     | 1.45                  |
| 18 | CL21X106KOYNNN □ |                    | 10 $\mu$ F  | 16                        | ±10%                     | 1.45                  |
| 19 | CL21X106KPCLNN □ |                    | 10 $\mu$ F  | 10                        | ±10%                     | 0.95                  |
| 20 | CL21X106KPYNNN □ |                    | 10 $\mu$ F  | 10                        | ±10%                     | 1.45                  |
| 21 | CL21X106KQQNNN □ |                    | 10 $\mu$ F  | 6.3                       | ±10%                     | 1.40                  |
| 22 | CL21X106KRQNNN □ |                    | 10 $\mu$ F  | 4                         | ±10%                     | 1.40                  |
| 23 | CL21X106KRCLNN □ |                    | 10 $\mu$ F  | 4                         | ±10%                     | 0.95                  |
| 24 | CL21X226MQQNNN □ |                    | 22 $\mu$ F  | 6.3                       | ±20%                     | 1.40                  |
| 25 | CL21X226MRQNNN □ |                    | 22 $\mu$ F  | 4                         | ±20%                     | 1.40                  |
| 26 | CL21X476MRYNNN □ |                    | 47 $\mu$ F  | 4                         | ±20%                     | 1.45                  |
| 1  | CL31X475KAHNNN □ | 3.20×1.60          | 4.7 $\mu$ F | 25                        | ±10%                     | 1.80                  |
| 2  | CL31X475KACLNN □ |                    | 4.7 $\mu$ F | 25                        | ±10%                     | 0.95                  |
| 3  | CL31X475KOHNNN □ |                    | 4.7 $\mu$ F | 16                        | ±10%                     | 1.80                  |
| 4  | CL31X475KPHNNN □ |                    | 4.7 $\mu$ F | 10                        | ±10%                     | 1.80                  |
| 5  | CL31X475MQHNNN □ |                    | 4.7 $\mu$ F | 6.3                       | ±20%                     | 1.80                  |
| 6  | CL31X475KRHNNN □ |                    | 4.7 $\mu$ F | 4                         | ±10%                     | 1.80                  |
| 7  | CL31X106KACLNN □ |                    | 10 $\mu$ F  | 25                        | ±10%                     | 0.95                  |
| 8  | CL31X106KAHNNN □ |                    | 10 $\mu$ F  | 25                        | ±10%                     | 1.80                  |
| 9  | CL31X106KOHNNN □ |                    | 10 $\mu$ F  | 16                        | ±10%                     | 1.80                  |
| 10 | CL31X106KPHNNN □ |                    | 10 $\mu$ F  | 10                        | ±10%                     | 1.80                  |
| 11 | CL31X106KQHNNN □ |                    | 10 $\mu$ F  | 6.3                       | ±10%                     | 1.80                  |
| 12 | CL31X106KRHNNN □ |                    | 10 $\mu$ F  | 4                         | ±10%                     | 1.80                  |
| 13 | CL31X226KOHNNN □ |                    | 22 $\mu$ F  | 16                        | ±10%                     | 1.80                  |
| 14 | CL31X226KPHNNN □ |                    | 22 $\mu$ F  | 10                        | ±10%                     | 1.80                  |
| 15 | CL31X226KQHNNN □ |                    | 22 $\mu$ F  | 6.3                       | ±10%                     | 1.80                  |
| 16 | CL31X226KRHNNN □ |                    | 22 $\mu$ F  | 4                         | ±10%                     | 1.80                  |
| 17 | CL31X107MQHNNN □ |                    | 100 $\mu$ F | 6.3                       | ±20%                     | 1.80                  |
| 18 | CL31X107MRHNNN □ |                    | 100 $\mu$ F | 4                         | ±20%                     | 1.80                  |
| 1  | CL32X106KAUNNN □ | 3.20×2.50          | 10 $\mu$ F  | 25                        | ±10%                     | 2.00                  |
| 2  | CL32X106KOJNNN □ |                    | 10 $\mu$ F  | 16                        | ±10%                     | 2.70                  |
| 3  | CL32X106KPJNNN □ |                    | 10 $\mu$ F  | 10                        | ±10%                     | 2.70                  |
| 4  | CL32X106KQJNNN □ |                    | 10 $\mu$ F  | 6.3                       | ±10%                     | 2.70                  |
| 5  | CL32X106KRJNNN □ |                    | 10 $\mu$ F  | 4                         | ±10%                     | 2.70                  |
| 6  | CL32X226KAJNNN □ |                    | 22 $\mu$ F  | 25                        | ±10%                     | 2.70                  |
| 7  | CL32X226KOJNNN □ |                    | 22 $\mu$ F  | 16                        | ±10%                     | 2.70                  |
| 8  | CL32X226KPJNNN □ |                    | 22 $\mu$ F  | 10                        | ±10%                     | 2.70                  |
| 9  | CL32X226KQJNNN □ |                    | 22 $\mu$ F  | 6.3                       | ±10%                     | 2.70                  |
| 10 | CL32X226KRJNNN □ |                    | 22 $\mu$ F  | 4                         | ±10%                     | 2.70                  |
| 11 | CL32X476MPJNNN □ |                    | 47 $\mu$ F  | 10                        | ±20%                     | 2.70                  |
| 12 | CL32X476KQJNNN □ |                    | 47 $\mu$ F  | 6.3                       | ±10%                     | 2.70                  |
| 13 | CL32X476KRJNNN □ |                    | 47 $\mu$ F  | 4                         | ±10%                     | 2.70                  |
| 14 | CL32X107MQVNNN □ |                    | 100 $\mu$ F | 6.3                       | ±20%                     | 2.80                  |
| 15 | CL32X107MRVNNN □ |                    | 100 $\mu$ F | 4                         | ±20%                     | 2.80                  |

※ □ mark means packaging code. If you want to learn the code or quantity in detail, please see p74.

## Product Lineup (Standard &amp; High Capacitors-X7R, X7S)

|    | Part Number      | Size L x W<br>(mm) | Capacitance | Rated<br>Voltage<br>(Vdc) | Capacitance<br>Tolerance | Thickness<br>Max.(mm) |
|----|------------------|--------------------|-------------|---------------------------|--------------------------|-----------------------|
| 1  | CL05B151KB5NNN □ | 1.00×0.50          | 150pF       | 50                        | ±10%                     | 0.55                  |
| 2  | CL05B181KB5NNN □ |                    | 180pF       | 50                        | ±10%                     | 0.55                  |
| 3  | CL05B221KB5NNN □ |                    | 220pF       | 50                        | ±10%                     | 0.55                  |
| 4  | CL05B271KB5NNN □ |                    | 270pF       | 50                        | ±10%                     | 0.55                  |
| 5  | CL05B331KB5NNN □ |                    | 330pF       | 50                        | ±10%                     | 0.55                  |
| 6  | CL05B391KB5NNN □ |                    | 390nF       | 50                        | ±10%                     | 0.55                  |
| 7  | CL05B471KB5NNN □ |                    | 470pF       | 50                        | ±10%                     | 0.55                  |
| 8  | CL05B561KB5NNN □ |                    | 560pF       | 50                        | ±10%                     | 0.55                  |
| 9  | CL05B681KB5NNN □ |                    | 680pF       | 50                        | ±10%                     | 0.55                  |
| 10 | CL05B102KB5NNN □ |                    | 1nF         | 50                        | ±10%                     | 0.55                  |
| 11 | CL05B122KB5NNN □ |                    | 1.2nF       | 50                        | ±10%                     | 0.55                  |
| 12 | CL05B152KB5NNN □ |                    | 1.5nF       | 50                        | ±10%                     | 0.55                  |
| 13 | CL05B182KB5NNN □ |                    | 1.8nF       | 50                        | ±10%                     | 0.55                  |
| 14 | CL05B222KB5NNN □ |                    | 2.2nF       | 50                        | ±10%                     | 0.55                  |
| 15 | CL05B272KB5NNN □ |                    | 2.7nF       | 50                        | ±10%                     | 0.55                  |
| 16 | CL05B332KB5NNN □ |                    | 3.3nF       | 50                        | ±10%                     | 0.55                  |
| 17 | CL05B472KB5NNN □ |                    | 4.7nF       | 50                        | ±10%                     | 0.55                  |
| 18 | CL05B562KB5NNN □ |                    | 5.6nF       | 50                        | ±10%                     | 0.55                  |
| 19 | CL05B682KB5NNN □ |                    | 6.8nF       | 50                        | ±10%                     | 0.55                  |
| 20 | CL05B822KB5NNN □ |                    | 8.2nF       | 50                        | ±10%                     | 0.55                  |
| 21 | CL05B103KB5NNN □ |                    | 10nF        | 50                        | ±10%                     | 0.55                  |
| 22 | CL05B123KA5NNN □ |                    | 12nF        | 25                        | ±10%                     | 0.55                  |
| 23 | CL05B153KA5NNN □ |                    | 15nF        | 25                        | ±10%                     | 0.55                  |
| 24 | CL05B223KA5NNN □ |                    | 22nF        | 25                        | ±10%                     | 0.55                  |
| 25 | CL05B273KO5NNN □ |                    | 27nF        | 16                        | ±10%                     | 0.55                  |
| 26 | CL05B333KO5NNN □ |                    | 33nF        | 16                        | ±10%                     | 0.55                  |
| 27 | CL05B393KO5NNN □ |                    | 39nF        | 16                        | ±10%                     | 0.55                  |
| 28 | CL05B473KO5NNN □ |                    | 47nF        | 16                        | ±10%                     | 0.55                  |
| 29 | CL05B563KO5NNN □ |                    | 56nF        | 16                        | ±10%                     | 0.55                  |
| 30 | CL05B683KO5NNN □ |                    | 68nF        | 16                        | ±10%                     | 0.55                  |
| 31 | CL05B823KO5NNN □ |                    | 82nF        | 16                        | ±10%                     | 0.55                  |
| 32 | CL05B104KO5NNN □ |                    | 100nF       | 16                        | ±10%                     | 0.55                  |
| 33 | CL05B224KO5NNN □ |                    | 220nF       | 16                        | ±10%                     | 0.55                  |
| 34 | CL05B474KP5NNN □ |                    | 470nF       | 10                        | ±10%                     | 0.55                  |
| 35 | CL05B105KQ5NQN □ |                    | 1μF         | 6.3                       | ±10%                     | 0.60                  |
| 1  | CL05Y474KP5NNN □ | 1.00×0.50          | 470nF       | 10                        | ±10%                     | 0.55                  |
| 37 | CL10B101KB8NNN □ | 1.60×0.80          | 100pF       | 50                        | ±10%                     | 0.90                  |
| 38 | CL10B121KB8NNN □ |                    | 120pF       | 50                        | ±10%                     | 0.90                  |
| 39 | CL10B151KB8NNN □ |                    | 150pF       | 50                        | ±10%                     | 0.90                  |
| 40 | CL10B181KB8NNN □ |                    | 180pF       | 50                        | ±10%                     | 0.90                  |
| 41 | CL10B201KB8NNN □ |                    | 200pF       | 50                        | ±10%                     | 0.90                  |
| 42 | CL10B221KB8NNN □ |                    | 220pF       | 50                        | ±10%                     | 0.90                  |
| 43 | CL10B271KB8NNN □ |                    | 270pF       | 50                        | ±10%                     | 0.90                  |
| 44 | CL10B331KB8NNN □ |                    | 330pF       | 50                        | ±10%                     | 0.90                  |
| 45 | CL10B391KB8NNN □ |                    | 390pF       | 50                        | ±10%                     | 0.90                  |
| 46 | CL10B471KB8NNN □ |                    | 470pF       | 50                        | ±10%                     | 0.90                  |
| 47 | CL10B561KB8NNN □ |                    | 560pF       | 50                        | ±10%                     | 0.90                  |
| 48 | CL10B681KB8NNN □ |                    | 680pF       | 50                        | ±10%                     | 0.90                  |
| 49 | CL10B751KB8NNN □ |                    | 750pF       | 50                        | ±10%                     | 0.90                  |
| 50 | CL10B821KB8NNN □ |                    | 820pF       | 50                        | ±10%                     | 0.90                  |
| 51 | CL10B102KB8NNN □ |                    | 1nF         | 50                        | ±10%                     | 0.90                  |
| 52 | CL10B122KB8NNN □ |                    | 1.2nF       | 50                        | ±10%                     | 0.90                  |

※ □ mark means packaging code. If you want to learn the code or quantity in detail, please see p74.

Part Numbering  
SystemStandard &  
High CapacitorsSuper Small Size  
CapacitorsHigh-Q  
CapacitorsMedium-High  
Voltage CapacitorsArray Type  
CapacitorsLow ESL  
CapacitorsReliability Test  
ConditionPremium Capacitors  
for Automotive  
ApplicationsPackaging  
SpecificationApplication Manual  
for Surface Mounting

**Product Lineup (Standard & High Capacitors-X7R)**

|    | Part Number      | Size L x W<br>(mm) | Capacitance | Rated<br>Voltage<br>(Vdc) | Capacitance<br>Tolerance | Thickness<br>Max.(mm) |
|----|------------------|--------------------|-------------|---------------------------|--------------------------|-----------------------|
| 53 | CL10B152KB8NNN □ | 1.60×0.80          | 1.5nF       | 50                        | ± 10%                    | 0.90                  |
| 54 | CL10B182KB8NNN □ |                    | 1.8nF       | 50                        | ± 10%                    | 0.90                  |
| 55 | CL10B202KB8NNN □ |                    | 2nF         | 50                        | ± 10%                    | 0.90                  |
| 56 | CL10B222KB8NNN □ |                    | 2.2nF       | 50                        | ± 10%                    | 0.90                  |
| 57 | CL10B332KB8NNN □ |                    | 3.3nF       | 50                        | ± 10%                    | 0.90                  |
| 58 | CL10B392KB8NNN □ |                    | 3.9nF       | 50                        | ± 10%                    | 0.90                  |
| 59 | CL10B472KB8NNN □ |                    | 4.7nF       | 50                        | ± 10%                    | 0.90                  |
| 60 | CL10B562KB8NNN □ |                    | 5.6nF       | 50                        | ± 10%                    | 0.90                  |
| 61 | CL10B682KB8NNN □ |                    | 6.8nF       | 50                        | ± 10%                    | 0.90                  |
| 62 | CL10B822KB8NNN □ |                    | 8.2nF       | 50                        | ± 10%                    | 0.90                  |
| 63 | CL10B103JB8NNN □ |                    | 10nF        | 50                        | ± 5%                     | 0.90                  |
| 64 | CL10B123KB8NNN □ |                    | 12nF        | 50                        | ± 10%                    | 0.90                  |
| 65 | CL10B153KB8NNN □ |                    | 15nF        | 50                        | ± 10%                    | 0.90                  |
| 66 | CL10B183KB8NNN □ |                    | 18nF        | 50                        | ± 10%                    | 0.90                  |
| 67 | CL10B223KB8NNN □ |                    | 22nF        | 50                        | ± 10%                    | 0.90                  |
| 68 | CL10B273KB8NNN □ |                    | 27nF        | 50                        | ± 10%                    | 0.90                  |
| 69 | CL10B333JB8NNN □ |                    | 33nF        | 50                        | ± 5%                     | 0.90                  |
| 70 | CL10B393KB8NNN □ |                    | 39nF        | 50                        | ± 10%                    | 0.90                  |
| 71 | CL10B473KB8NNN □ |                    | 47nF        | 50                        | ± 10%                    | 0.90                  |
| 72 | CL10B563KB8NNN □ |                    | 56nF        | 50                        | ± 10%                    | 0.90                  |
| 73 | CL10B683KB8NNN □ |                    | 68nF        | 50                        | ± 10%                    | 0.90                  |
| 74 | CL10B823KB8NNN □ |                    | 82nF        | 50                        | ± 10%                    | 0.90                  |
| 75 | CL10B104KB8NNN □ |                    | 100nF       | 50                        | ± 10%                    | 0.90                  |
| 76 | CL10B124KO8NNN □ |                    | 120nF       | 16                        | ± 10%                    | 0.90                  |
| 77 | CL10B154KA8NNN □ |                    | 150nF       | 25                        | ± 10%                    | 0.90                  |
| 78 | CL10B224KA8NNN □ |                    | 220nF       | 25                        | ± 10%                    | 0.90                  |
| 79 | CL10B474KA8NNN □ |                    | 470nF       | 25                        | ± 10%                    | 0.90                  |
| 80 | CL10B684KO8NNN □ |                    | 680nF       | 16                        | ± 10%                    | 0.90                  |
| 81 | CL10B105KA8NNN □ |                    | 1μF         | 25                        | ± 10%                    | 0.90                  |
| 82 | CL10B225KP8NNN □ |                    | 2.2μF       | 10                        | ± 10%                    | 0.90                  |
| 1  | CL21B151KBANNN □ | 2.00×1.25          | 150pF       | 50                        | ± 10%                    | 0.75                  |
| 2  | CL21B181KBANNN □ |                    | 180pF       | 50                        | ± 10%                    | 0.75                  |
| 3  | CL21B221KBANNN □ |                    | 220pF       | 50                        | ± 10%                    | 0.75                  |
| 4  | CL21B331KBANNN □ |                    | 330pF       | 50                        | ± 10%                    | 0.75                  |
| 5  | CL21B391KBANNN □ |                    | 390pF       | 50                        | ± 10%                    | 0.75                  |
| 6  | CL21B471KBANNN □ |                    | 470pF       | 50                        | ± 10%                    | 0.75                  |
| 7  | CL21B511KBANNN □ |                    | 510pF       | 50                        | ± 10%                    | 0.75                  |
| 8  | CL21B561KBANNN □ |                    | 560pF       | 50                        | ± 10%                    | 0.75                  |
| 9  | CL21B681KBANNN □ |                    | 680pF       | 50                        | ± 10%                    | 0.75                  |
| 10 | CL21B821KBANNN □ |                    | 820pF       | 50                        | ± 10%                    | 0.75                  |
| 11 | CL21B102KBANNN □ |                    | 1nF         | 50                        | ± 10%                    | 0.75                  |
| 12 | CL21B122KBANNN □ |                    | 1.2nF       | 50                        | ± 10%                    | 0.75                  |
| 13 | CL21B152KBANNN □ |                    | 1.5nF       | 50                        | ± 10%                    | 0.75                  |
| 14 | CL21B182KBANNN □ |                    | 1.8nF       | 50                        | ± 10%                    | 0.75                  |
| 15 | CL21B202KBANNN □ |                    | 2nF         | 50                        | ± 10%                    | 0.75                  |
| 16 | CL21B222KBANNN □ |                    | 2.2nF       | 50                        | ± 10%                    | 0.75                  |
| 17 | CL21B272KBANNN □ |                    | 2.7nF       | 50                        | ± 10%                    | 0.75                  |
| 18 | CL21B332KBANNN □ |                    | 3.3nF       | 50                        | ± 10%                    | 0.75                  |
| 19 | CL21B472KBANNN □ |                    | 4.7nF       | 50                        | ± 10%                    | 0.75                  |
| 20 | CL21B562KBANNN □ |                    | 5.6nF       | 50                        | ± 10%                    | 0.75                  |
| 21 | CL21B682KBANNN □ |                    | 6.8nF       | 50                        | ± 10%                    | 0.75                  |

※ □ mark means packaging code. If you want to learn the code or quantity in detail, please see p74.

## Product Lineup (Standard &amp; High Capacitors-X7R)

|    | Part Number      | Size L x W<br>(mm) | Capacitance | Rated<br>Voltage<br>(Vdc) | Capacitance<br>Tolerance | Thickness<br>Max.(mm) |
|----|------------------|--------------------|-------------|---------------------------|--------------------------|-----------------------|
| 22 | CL21B103KBANNN □ | 2.00×1.25          | 10nF        | 50                        | ±10%                     | 0.75                  |
| 23 | CL21B123KBANNN □ |                    | 12nF        | 50                        | ±10%                     | 0.75                  |
| 24 | CL21B153KBANNN □ |                    | 15nF        | 50                        | ±10%                     | 0.75                  |
| 25 | CL21B333KBANNN □ |                    | 33nF        | 50                        | ±10%                     | 0.75                  |
| 26 | CL21B393KBANNN □ |                    | 39nF        | 50                        | ±10%                     | 0.75                  |
| 27 | CL21B473KBANNN □ |                    | 47nF        | 50                        | ±10%                     | 0.75                  |
| 28 | CL21B563KBCNNN □ |                    | 56nF        | 50                        | ±10%                     | 0.95                  |
| 29 | CL21B683KAANNN □ |                    | 68nF        | 25                        | ±10%                     | 0.75                  |
| 30 | CL21B683JBCNNN □ |                    | 68nF        | 50                        | ±5%                      | 0.95                  |
| 31 | CL21B683KBFNNN □ |                    | 68nF        | 50                        | ±10%                     | 1.35                  |
| 32 | CL21B823KBCNNN □ |                    | 82nF        | 50                        | ±10%                     | 0.95                  |
| 33 | CL21B823KBFNNN □ |                    | 82nF        | 50                        | ±10%                     | 1.35                  |
| 34 | CL21B104KACNNN □ |                    | 100nF       | 25                        | ±10%                     | 0.95                  |
| 35 | CL21B104KBCNNN □ |                    | 100nF       | 50                        | ±10%                     | 0.95                  |
| 36 | CL21B104KBFNNN □ |                    | 100nF       | 50                        | ±10%                     | 1.35                  |
| 37 | CL21B124KBFNNN □ |                    | 120nF       | 50                        | ±10%                     | 1.35                  |
| 38 | CL21B124KACNNN □ |                    | 120nF       | 25                        | ±10%                     | 0.95                  |
| 39 | CL21B154KOANNN □ |                    | 150nF       | 16                        | ±10%                     | 0.75                  |
| 40 | CL21B154KBFNNN □ |                    | 150nF       | 50                        | ±10%                     | 1.35                  |
| 41 | CL21B224KBFNNN □ |                    | 220nF       | 50                        | ±10%                     | 1.35                  |
| 42 | CL21B334KAFNNN □ |                    | 330nF       | 25                        | ±10%                     | 1.35                  |
| 43 | CL21B474KAFNNN □ |                    | 470nF       | 25                        | ±10%                     | 1.35                  |
| 44 | CL21B684KOFNNN □ |                    | 680nF       | 16                        | ±10%                     | 1.35                  |
| 45 | CL21B105KBFNNN □ |                    | 1μF         | 50                        | ±10%                     | 1.35                  |
| 46 | CL21B155KAFNNN □ |                    | 1.5μF       | 25                        | ±10%                     | 1.35                  |
| 47 | CL21B225KAFNNN □ |                    | 2.2μF       | 25                        | ±10%                     | 1.35                  |
| 48 | CL21B475KQNNN □  |                    | 4.7μF       | 6.3                       | ±10%                     | 1.40                  |
| 49 | CL21B475KAFNNN □ |                    | 4.7μF       | 25                        | ±10%                     | 1.35                  |
| 50 | CL21B106KQNNN □  |                    | 10μF        | 16                        | ±10%                     | 1.40                  |
| 1  | CL31B221KBCNNN □ | 3.20×1.60          | 220pF       | 50                        | ±10%                     | 1.00                  |
| 2  | CL31B331KBCNNN □ |                    | 330pF       | 50                        | ±10%                     | 1.00                  |
| 3  | CL31B471KBCNNN □ |                    | 470pF       | 50                        | ±10%                     | 1.00                  |
| 4  | CL31B561KBCNNN □ |                    | 560pF       | 50                        | ±10%                     | 1.00                  |
| 5  | CL31B152KBCNNN □ |                    | 1.5nF       | 50                        | ±10%                     | 1.00                  |
| 6  | CL31B222KBCNNN □ |                    | 2.2nF       | 50                        | ±10%                     | 1.00                  |
| 7  | CL31B332KBCNNN □ |                    | 3.3nF       | 50                        | ±10%                     | 1.00                  |
| 8  | CL31B472KBCNNN □ |                    | 4.7nF       | 50                        | ±10%                     | 1.00                  |
| 9  | CL31B473KBCNNN □ |                    | 47nF        | 50                        | ±10%                     | 1.00                  |
| 10 | CL31B562KBCNNN □ |                    | 5.6nF       | 50                        | ±10%                     | 1.00                  |
| 11 | CL31B682KBCNNN □ |                    | 6.8nF       | 50                        | ±10%                     | 1.00                  |
| 12 | CL31B822KBCNNN □ |                    | 8.2nF       | 50                        | ±10%                     | 1.00                  |
| 13 | CL31B103KBCNNN □ |                    | 10nF        | 50                        | ±10%                     | 1.00                  |
| 14 | CL31B123KBCNNN □ |                    | 12nF        | 50                        | ±10%                     | 1.00                  |
| 15 | CL31B153KBCNNN □ |                    | 15nF        | 50                        | ±10%                     | 1.00                  |
| 16 | CL31B223KBCNNN □ |                    | 22nF        | 50                        | ±10%                     | 1.00                  |
| 17 | CL31B333KBCNNN □ |                    | 33nF        | 50                        | ±10%                     | 1.00                  |
| 18 | CL31B683KBCNNN □ |                    | 68nF        | 50                        | ±10%                     | 1.00                  |
| 19 | CL31B104KBCNNN □ |                    | 100nF       | 50                        | ±10%                     | 1.00                  |
| 20 | CL31B154KBCNNN □ |                    | 150nF       | 50                        | ±10%                     | 1.00                  |
| 21 | CL31B224KBFNNN □ |                    | 220nF       | 50                        | ±10%                     | 1.40                  |
| 22 | CL31B334KBFNNN □ |                    | 330nF       | 50                        | ±10%                     | 1.40                  |

※ □ mark means packaging code. If you want to learn the code or quantity in detail, please see p74.

Part Numbering  
SystemStandard &  
High CapacitorsSuper Small Size  
CapacitorsHigh-Q  
CapacitorsMedium-High  
Voltage CapacitorsArray Type  
CapacitorsLow ESL  
CapacitorsReliability Test  
ConditionPremium Capacitors  
for Automotive  
ApplicationsPackaging  
SpecificationApplication Manual  
for Surface Mounting

**Product Lineup (Standard & High Capacitors-X7R)**

|    | Part Number      | Size L x W<br>(mm) | Capacitance | Rated<br>Voltage<br>(Vdc) | Capacitance<br>Tolerance | Thickness<br>Max.(mm) |
|----|------------------|--------------------|-------------|---------------------------|--------------------------|-----------------------|
| 23 | CL31B334KACNNN □ | 3.20×1.60          | 330nF       | 25                        | ± 10%                    | 1.00                  |
| 24 | CL31B474KBHNNN □ |                    | 470nF       | 50                        | ± 10%                    | 1.80                  |
| 25 | CL31B474MAFNNN □ |                    | 470nF       | 25                        | ± 20%                    | 1.40                  |
| 26 | CL31B684KOCNNN □ |                    | 680nF       | 16                        | ± 10%                    | 1.00                  |
| 27 | CL31B684KBHNNN □ |                    | 680nF       | 50                        | ± 10%                    | 1.80                  |
| 28 | CL31B105KBHNNN □ |                    | 1 $\mu$ F   | 50                        | ± 10%                    | 1.80                  |
| 29 | CL31B225KAHNNN □ |                    | 2.2 $\mu$ F | 25                        | ± 10%                    | 1.80                  |
| 30 | CL31B335KAHNNN □ |                    | 3.3 $\mu$ F | 25                        | ± 10%                    | 1.80                  |
| 31 | CL31B475KBHNNN □ |                    | 4.7 $\mu$ F | 50                        | ± 10%                    | 1.80                  |
| 32 | CL31B106KBHNNN □ |                    | 10 $\mu$ F  | 50                        | ± 10%                    | 1.80                  |
| 33 | CL31B226KPHNNN □ |                    | 22 $\mu$ F  | 10                        | ± 10%                    | 1.80                  |
| 1  | CL32B104KBFNNN □ | 3.20×2.50          | 100nF       | 50                        | ± 10%                    | 1.45                  |
| 2  | CL32B154KBFNNN □ |                    | 150nF       | 50                        | ± 10%                    | 1.45                  |
| 3  | CL32B224KBFNNN □ |                    | 220nF       | 50                        | ± 10%                    | 1.45                  |
| 4  | CL32B334KBFNNN □ |                    | 330nF       | 50                        | ± 10%                    | 1.45                  |
| 5  | CL32B474KBFNNN □ |                    | 470nF       | 50                        | ± 10%                    | 1.45                  |
| 6  | CL32B105KBHNNN □ |                    | 1 $\mu$ F   | 50                        | ± 10%                    | 1.80                  |
| 7  | CL32B225KBJNNN □ |                    | 2.2 $\mu$ F | 50                        | ± 10%                    | 2.70                  |
| 8  | CL32B225KAINNN □ |                    | 2.2 $\mu$ F | 25                        | ± 10%                    | 2.20                  |
| 9  | CL32B475KBJNNN □ |                    | 4.7 $\mu$ F | 50                        | ± 10%                    | 2.70                  |
| 10 | CL32B475KBUYNN □ |                    | 4.7 $\mu$ F | 50                        | ± 10%                    | 2.00                  |
| 11 | CL32B475KOINNN □ |                    | 4.7 $\mu$ F | 16                        | ± 10%                    | 2.20                  |
| 12 | CL32B106KLJNNN □ |                    | 10 $\mu$ F  | 35                        | ± 10%                    | 2.70                  |
| 13 | CL32B106KAULNN □ |                    | 10 $\mu$ F  | 25                        | ± 10%                    | 2.00                  |
| 14 | CL32B106KPINNN □ |                    | 10 $\mu$ F  | 10                        | ± 10%                    | 2.20                  |
| 15 | CL32B226KAJNNN □ |                    | 22 $\mu$ F  | 25                        | ± 10%                    | 2.70                  |
| 16 | CL32B476MQJNN □  |                    | 47 $\mu$ F  | 6.3                       | ± 20%                    | 2.70                  |

※ □ mark means packaging code. If you want to learn the code or quantity in detail, please see p74.

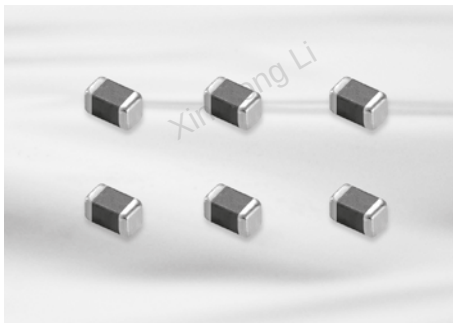
## Product Lineup (Standard &amp; High Capacitors-Y5V)

|    | Part Number      | Size L x W<br>(mm) | Capacitance  | Rated<br>Voltage<br>(Vdc) | Capacitance<br>Tolerance | Thickness<br>Max.(mm) |
|----|------------------|--------------------|--------------|---------------------------|--------------------------|-----------------------|
| 1  | CL05F224ZO5NNN □ | 1.00×0.50          | 0.22 $\mu$ F | 16                        | +80/-20%                 | 0.55                  |
| 2  | CL05F224ZP5NNN □ |                    | 0.22 $\mu$ F | 10                        | +80/-20%                 | 0.55                  |
| 3  | CL05F224ZQ5NNN □ |                    | 0.22 $\mu$ F | 6.3                       | +80/-20%                 | 0.55                  |
| 4  | CL05F474ZP5NNN □ |                    | 0.47 $\mu$ F | 10                        | +80/-20%                 | 0.55                  |
| 5  | CL05F474ZQ5NNN □ |                    | 0.47 $\mu$ F | 6.3                       | +80/-20%                 | 0.55                  |
| 6  | CL05F105ZQ5NNN □ |                    | 1 $\mu$ F    | 6.3                       | +80/-20%                 | 0.55                  |
| 1  | CL10F474ZB8NNN □ | 1.60×0.80          | 0.47 $\mu$ F | 50                        | +80/-20%                 | 0.90                  |
| 2  | CL10F474ZA8NNN □ |                    | 0.47 $\mu$ F | 25                        | +80/-20%                 | 0.90                  |
| 3  | CL10F474ZO8NNN □ |                    | 0.47 $\mu$ F | 16                        | +80/-20%                 | 0.90                  |
| 4  | CL10F474ZP8NNN □ |                    | 0.47 $\mu$ F | 10                        | +80/-20%                 | 0.90                  |
| 5  | CL10F105ZO8NNN □ |                    | 1 $\mu$ F    | 16                        | +80/-20%                 | 0.90                  |
| 6  | CL10F105ZP8NNN □ |                    | 1 $\mu$ F    | 10                        | +80/-20%                 | 0.90                  |
| 7  | CL10F225ZP8NNN □ |                    | 2.2 $\mu$ F  | 10                        | +80/-20%                 | 0.90                  |
| 8  | CL10F225ZQ8NNN □ |                    | 2.2 $\mu$ F  | 6.3                       | +80/-20%                 | 0.90                  |
| 9  | CL10F475ZQ8NNN □ |                    | 4.7 $\mu$ F  | 6.3                       | +80/-20%                 | 0.90                  |
| 1  | CL21F105ZBFNNN □ | 2.00×1.25          | 1 $\mu$ F    | 50                        | +80/-20%                 | 1.35                  |
| 2  | CL21F105ZAFNNN □ |                    | 1 $\mu$ F    | 25                        | +80/-20%                 | 1.35                  |
| 3  | CL21F105ZOFNNN □ |                    | 1 $\mu$ F    | 16                        | +80/-20%                 | 1.35                  |
| 4  | CL21F225ZAFNNN □ |                    | 2.2 $\mu$ F  | 25                        | +80/-20%                 | 1.35                  |
| 5  | CL21F225ZOFNNN □ |                    | 2.2 $\mu$ F  | 16                        | +80/-20%                 | 1.35                  |
| 6  | CL21F475ZQFNNN □ |                    | 4.7 $\mu$ F  | 6.3                       | +80/-20%                 | 1.35                  |
| 7  | CL21F475ZOFNNN □ |                    | 4.7 $\mu$ F  | 16                        | +80/-20%                 | 1.35                  |
| 8  | CL21F475ZPFNNN □ |                    | 4.7 $\mu$ F  | 10                        | +80/-20%                 | 1.35                  |
| 9  | CL21F106ZPFNNN □ |                    | 10 $\mu$ F   | 10                        | +80/-20%                 | 1.35                  |
| 10 | CL21F106ZPCLNN □ |                    | 10 $\mu$ F   | 10                        | +80/-20%                 | 0.95                  |
| 11 | CL21F106ZQFNNN □ |                    | 10 $\mu$ F   | 6.3                       | +80/-20%                 | 1.35                  |
| 12 | CL21F106ZQCLNN □ |                    | 10 $\mu$ F   | 6.3                       | +80/-20%                 | 0.95                  |
| 1  | CL31F475ZOFNNN □ | 3.20×1.60          | 4.7 $\mu$ F  | 16                        | +80/-20%                 | 1.40                  |
| 2  | CL31F475ZPFNNN □ |                    | 4.7 $\mu$ F  | 10                        | +80/-20%                 | 1.40                  |
| 3  | CL31F475ZQFNNN □ |                    | 4.7 $\mu$ F  | 6.3                       | +80/-20%                 | 1.40                  |
| 4  | CL31F106ZOHNNN □ |                    | 10 $\mu$ F   | 16                        | +80/-20%                 | 1.80                  |
| 5  | CL31F106ZPHNNN □ |                    | 10 $\mu$ F   | 10                        | +80/-20%                 | 1.80                  |
| 6  | CL31F106ZQHNNN □ |                    | 10 $\mu$ F   | 6.3                       | +80/-20%                 | 1.80                  |
| 7  | CL31F226ZPHNNN □ |                    | 22 $\mu$ F   | 10                        | +80/-20%                 | 1.80                  |
| 8  | CL31F226ZQHNNN □ |                    | 22 $\mu$ F   | 6.3                       | +80/-20%                 | 1.80                  |
| 1  | CL32F106ZAHNNN □ | 3.20×2.50          | 10 $\mu$ F   | 25                        | +80/-20%                 | 1.80                  |
| 2  | CL32F106ZOELNN □ |                    | 10 $\mu$ F   | 16                        | +80/-20%                 | 1.20                  |
| 3  | CL32F226ZPJNNN □ |                    | 22 $\mu$ F   | 10                        | +80/-20%                 | 2.70                  |
| 4  | CL32F226ZPJLNN □ |                    | 22 $\mu$ F   | 10                        | +80/-20%                 | 2.70                  |
| 5  | CL32F476ZQJNNN □ |                    | 47 $\mu$ F   | 6.3                       | +80/-20%                 | 2.20                  |
| 6  | CL32F107ZQJNNN □ |                    | 100 $\mu$ F  | 6.3                       | +80/-20%                 | 2.70                  |

※ □ mark means packaging code. If you want to learn the code or quantity in detail, please see p74.

Part Numbering  
SystemStandard &  
High CapacitorsSuper Small Size  
CapacitorsHigh-Q  
CapacitorsMedium-High  
Voltage CapacitorsArray Type  
CapacitorsLow ESL  
CapacitorsReliability Test  
ConditionPremium Capacitors  
for Automotive  
ApplicationsPackaging  
SpecificationApplication Manual  
for Surface Mounting

# Super Small Size Capacitors



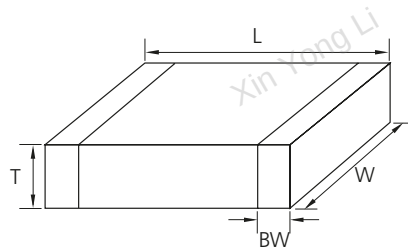
## Feature

- Small chip size
- 02 and 03 series (High-Q) MLCC shows very low ESR value.
- 02 and 03 Series are suited to only reflow soldering
- 02 and 03 Series are suited to miniature RF module, portable equipment and high frequency circuit

## Application

- VCO, Tuner, RF Module
- MCM Module
- Mobile phone, Wireless LAN, Note PC

## Structure and Dimensions



| Code | EIA Code | Dimension (mm) |                |                |                 |
|------|----------|----------------|----------------|----------------|-----------------|
|      |          | L              | W              | T              | BW              |
| 02   | 01005    | $0.4 \pm 0.02$ | $0.2 \pm 0.02$ | $0.2 \pm 0.02$ | $0.10 \pm 0.03$ |
| 03   | 0201     | $0.6 \pm 0.03$ | $0.3 \pm 0.03$ | $0.3 \pm 0.03$ | $0.15 \pm 0.05$ |

Super Small Size Capacitance Table (C0G)

| TC  | Size<br>(mm) | Vr(V) | Capacitance (pF) |   |    |    |    |     |         |
|-----|--------------|-------|------------------|---|----|----|----|-----|---------|
|     |              |       | 0.5              | 1 | 10 | 22 | 47 | 100 | 220 330 |
| C0G | 01005(0402)  | 6.3   |                  |   |    |    |    |     |         |
|     |              | 16    |                  |   |    |    |    |     |         |
|     | 0201(0603)   | 25    |                  |   |    |    |    |     |         |
|     |              | 50    |                  |   |    |    |    |     |         |

Super Small Size Capacitance Table (High-Q)

| TC  | Size<br>(mm) | Vr(V) | Capacitance (pF) |   |    |    |    |    |        |
|-----|--------------|-------|------------------|---|----|----|----|----|--------|
|     |              |       | 0.2              | 1 | 10 | 15 | 27 | 33 | 47 100 |
| C0G | 01005(0402)  | 25    |                  |   |    |    |    |    |        |
|     | 0201(0603)   | 25    |                  |   |    |    |    |    |        |
|     |              | 50    |                  |   |    |    |    |    |        |

Super Small Size Capacitance Table (X7R,X6S)

| TC  | Size<br>(mm) | Vr(V) | Capacitance (nF) |      |      |   |     |     |        |
|-----|--------------|-------|------------------|------|------|---|-----|-----|--------|
|     |              |       | 0.1              | 0.22 | 0.47 | 1 | 2.2 | 3.3 | 4.7 10 |
| X7R | 01005(0402)  | 10    |                  |      |      |   |     |     |        |
|     | 0201(0603)   | 10    |                  |      |      |   |     |     |        |
|     |              | 16    |                  |      |      |   |     |     |        |
|     |              | 25    |                  |      |      |   |     |     |        |
|     |              | 50    |                  |      |      |   |     |     |        |
| X6S | 0201(0603)   | 4     |                  |      |      |   |     |     |        |

Super Small Size Capacitance Table (X5R, Y5V)

| TC  | Size<br>(mm) | Vr(V) | Capacitance (μF) |     |      |      |   |     |        |
|-----|--------------|-------|------------------|-----|------|------|---|-----|--------|
|     |              |       | 0.01             | 0.1 | 0.22 | 0.47 | 1 | 2.2 | 4.7 10 |
| X5R | 01005(0402)  | 6.3   |                  |     |      |      |   |     |        |
|     |              | 10    |                  |     |      |      |   |     |        |
|     |              | 16    |                  |     |      |      |   |     |        |
|     | 0201(0603)   | 4     |                  |     |      |      |   |     |        |
|     |              | 6.3   |                  |     |      |      |   |     |        |
|     |              | 10    |                  |     |      |      |   |     |        |
|     |              | 16    |                  |     |      |      |   |     |        |
|     |              | 25    |                  |     |      |      |   |     |        |
| Y5V | 0201(0603)   | 6.3   |                  |     |      |      |   |     |        |

Part Numbering  
SystemStandard &  
High CapacitorsSuper Small Size  
CapacitorsHigh-Q  
CapacitorsMedium-High  
Voltage CapacitorsArray Type  
CapacitorsLow ESL  
CapacitorsReliability Test  
ConditionPremium Capacitors  
for Automotive  
ApplicationsPackaging  
SpecificationApplication Manual  
for Surface Mounting

**Product Lineup (Super Small Size Capacitors-C0G)**

|    | Part Number      | Size L x W<br>(mm) | Capacitance | Rated<br>Voltage<br>(Vdc) | Capacitance<br>Tolerance | Thickness<br>Max.(mm) |        |
|----|------------------|--------------------|-------------|---------------------------|--------------------------|-----------------------|--------|
| 1  | CL02C0R5CO2ANN □ | 0.40×0.20          | 0.5 pF      | 16                        | ±0.25 pF                 | 0.22                  |        |
| 2  | CL02C010CO2ANN □ |                    | 1.0 pF      | 16                        | ±0.25 pF                 | 0.22                  |        |
| 3  | CL02C1R2CO2ANN □ |                    | 1.2 pF      | 16                        | ±0.25 pF                 | 0.22                  |        |
| 4  | CL02C1R5CO2ANN □ |                    | 1.5 pF      | 16                        | ±0.25 pF                 | 0.22                  |        |
| 5  | CL02C1R8CO2ANN □ |                    | 1.8 pF      | 16                        | ±0.25 pF                 | 0.22                  |        |
| 6  | CL02C020CO2ANN □ |                    | 2.0 pF      | 16                        | ±0.25 pF                 | 0.22                  |        |
| 7  | CL02C2R2CO2ANN □ |                    | 2.2 pF      | 16                        | ±0.25 pF                 | 0.22                  |        |
| 8  | CL02C2R7CO2ANN □ |                    | 2.7 pF      | 16                        | ±0.25 pF                 | 0.22                  |        |
| 9  | CL02C030CO2ANN □ |                    | 3.0 pF      | 16                        | ±0.25 pF                 | 0.22                  |        |
| 10 | CL02C3R3CO2ANN □ |                    | 3.3 pF      | 16                        | ±0.25 pF                 | 0.22                  |        |
| 11 | CL02C3R9CO2ANN □ |                    | 3.9 pF      | 16                        | ±0.25 pF                 | 0.22                  |        |
| 12 | CL02C4R7CO2ANN □ |                    | 4.7 pF      | 16                        | ±0.25 pF                 | 0.22                  |        |
| 13 | CL02C5R6DO2ANN □ |                    | 5.6 pF      | 16                        | ±0.5 pF                  | 0.22                  |        |
| 14 | CL02C6R8DO2ANN □ |                    | 6.8 pF      | 16                        | ±0.5 pF                  | 0.22                  |        |
| 15 | CL02C8R2DO2ANN □ |                    | 8.2 pF      | 16                        | ±0.5 pF                  | 0.22                  |        |
| 16 | CL02C090DO2ANN □ |                    | 9.0 pF      | 16                        | ±0.5 pF                  | 0.22                  |        |
| 17 | CL02C100JO2ANN □ |                    | 10 pF       | 16                        | ±5%                      | 0.22                  |        |
| 18 | CL02C150JO2ANN □ |                    | 15 pF       | 16                        | ±5%                      | 0.22                  |        |
| 19 | CL02C180JO2ANN □ |                    | 18 pF       | 16                        | ±5%                      | 0.22                  |        |
| 20 | CL02C220JO2ANN □ |                    | 22 pF       | 16                        | ±5%                      | 0.22                  |        |
| 21 | CL02C270JO2ANN □ |                    | 27 pF       | 16                        | ±5%                      | 0.22                  |        |
| 22 | CL02C330JO2ANN □ |                    | 33 pF       | 16                        | ±5%                      | 0.22                  |        |
| 23 | CL02C390JO2ANN □ |                    | 39 pF       | 16                        | ±5%                      | 0.22                  |        |
| 24 | CL02C470JO2ANN □ |                    | 47 pF       | 16                        | ±5%                      | 0.22                  |        |
| 25 | CL02C560JQ2ANN □ |                    | 56 pF       | 6.3                       | ±5%                      | 0.22                  |        |
| 26 | CL02C680JQ2ANN □ |                    | 68 pF       | 6.3                       | ±5%                      | 0.22                  |        |
| 27 | CL02C820JQ2ANN □ |                    | 82 pF       | 6.3                       | ±5%                      | 0.22                  |        |
| 28 | CL02C101JO2ANN □ |                    | 100 pF      | 16                        | ±5%                      | 0.22                  |        |
| 29 | CL02C101JQ2ANN □ |                    | 100 pF      | 6.3                       | ±5%                      | 0.22                  |        |
| 1  | CL02C0R5BO2GNN □ | 0.40×0.20          | 0.5 pF      | 16                        | ±0.25 pF                 | 0.22                  | High-Q |
| 2  | CL02C010BO2GNN □ |                    | 1.0 pF      | 16                        | ±0.25 pF                 | 0.22                  | High-Q |
| 3  | CL02C1R2BO2GNN □ |                    | 1.2 pF      | 16                        | ±0.25 pF                 | 0.22                  | High-Q |
| 4  | CL02C1R5BO2GNN □ |                    | 1.5 pF      | 16                        | ±0.25 pF                 | 0.22                  | High-Q |
| 5  | CL02C1R8BO2GNN □ |                    | 1.8 pF      | 16                        | ±0.25 pF                 | 0.22                  | High-Q |
| 6  | CL02C2R2BO2GNN □ |                    | 2.2 pF      | 16                        | ±0.25 pF                 | 0.22                  | High-Q |
| 7  | CL02C2R7BO2GNN □ |                    | 2.7 pF      | 16                        | ±0.25 pF                 | 0.22                  | High-Q |
| 8  | CL02C3R3BO2GNN □ |                    | 3.3 pF      | 16                        | ±0.25 pF                 | 0.22                  | High-Q |
| 9  | CL02C3R9BO2GNN □ |                    | 3.9 pF      | 16                        | ±0.25 pF                 | 0.22                  | High-Q |
| 10 | CL02C4R7BO2GNN □ |                    | 4.7 pF      | 16                        | ±0.25 pF                 | 0.22                  | High-Q |
| 11 | CL02C5R6BO2GNN □ |                    | 5.6 pF      | 16                        | ±0.25 pF                 | 0.22                  | High-Q |
| 12 | CL02C6R8BO2GNN □ |                    | 6.8 pF      | 16                        | ±0.25 pF                 | 0.22                  | High-Q |
| 13 | CL02C8R2BO2GNN □ |                    | 8.2 pF      | 16                        | ±0.25 pF                 | 0.22                  | High-Q |
| 14 | CL02C100JO2GNN □ |                    | 10 pF       | 16                        | ±5%                      | 0.22                  | High-Q |
| 15 | CL02C120JO2GNN □ |                    | 12 pF       | 16                        | ±5%                      | 0.22                  | High-Q |
| 16 | CL02C150JO2GNN □ |                    | 15 pF       | 16                        | ±5%                      | 0.22                  | High-Q |
| 17 | CL02C180JO2GNN □ |                    | 18 pF       | 16                        | ±5%                      | 0.22                  | High-Q |
| 18 | CL02C220JO2GNN □ |                    | 22 pF       | 16                        | ±5%                      | 0.22                  | High-Q |
| 19 | CL02C270JO2GNN □ |                    | 27 pF       | 16                        | ±5%                      | 0.22                  | High-Q |
| 1  | CL03C0R5CA3GNN □ | 0.60×0.30          | 0.5 pF      | 25                        | ±0.25 pF                 | 0.33                  | High-Q |
| 2  | CL03C010CA3GNN □ |                    | 1.0 pF      | 25                        | ±0.25 pF                 | 0.33                  | High-Q |
| 3  | CL03C1R2CA3GNN □ |                    | 1.2 pF      | 25                        | ±0.25 pF                 | 0.33                  | High-Q |
| 4  | CL03C1R5CA3GNN □ |                    | 1.5 pF      | 25                        | ±0.25 pF                 | 0.33                  | High-Q |

※ □ mark means packaging code. If you want to learn the code or quantity in detail, please see p74.

## Product Lineup (Super Small Size Capacitors-C0G)

|    | Part Number      | Size L x W<br>(mm) | Capacitance | Rated<br>Voltage<br>(Vdc) | Capacitance<br>Tolerance | Thickness<br>Max.(mm) |        |
|----|------------------|--------------------|-------------|---------------------------|--------------------------|-----------------------|--------|
| 5  | CL03C1R8CA3GNN □ | 0.60×0.30          | 1.8 pF      | 25                        | ±0.25 pF                 | 0.33                  | High-Q |
| 6  | CL03C020CA3GNN □ |                    | 2.0 pF      | 25                        | ±0.25 pF                 | 0.33                  | High-Q |
| 7  | CL03C2R2CA3GNN □ |                    | 2.2 pF      | 25                        | ±0.25 pF                 | 0.33                  | High-Q |
| 8  | CL03C2R7CA3GNN □ |                    | 2.7 pF      | 25                        | ±0.25 pF                 | 0.33                  | High-Q |
| 9  | CL03C030CA3GNN □ |                    | 3.0 pF      | 25                        | ±0.25 pF                 | 0.33                  | High-Q |
| 10 | CL03C3R3CA3GNN □ |                    | 3.3 pF      | 25                        | ±0.25 pF                 | 0.33                  | High-Q |
| 11 | CL03C3R9CA3GNN □ |                    | 3.9 pF      | 25                        | ±0.25 pF                 | 0.33                  | High-Q |
| 12 | CL03C4R7CA3GNN □ |                    | 4.7 pF      | 25                        | ±0.25 pF                 | 0.33                  | High-Q |
| 13 | CL03C5R6DA3GNN □ |                    | 5.6 pF      | 25                        | ±0.5 pF                  | 0.33                  | High-Q |
| 14 | CL03C6R8DA3GNN □ |                    | 6.8 pF      | 25                        | ±0.5 pF                  | 0.33                  | High-Q |
| 15 | CL03C8R2DA3GNN □ |                    | 8.2 pF      | 25                        | ±0.5 pF                  | 0.33                  | High-Q |
| 16 | CL03C090DA3GNN □ |                    | 9.0 pF      | 25                        | ±0.5 pF                  | 0.33                  | High-Q |
| 17 | CL03C100JA3GNN □ |                    | 10 pF       | 25                        | ±5%                      | 0.33                  | High-Q |
| 18 | CL03C150JA3ANN □ |                    | 15 pF       | 25                        | ±5%                      | 0.33                  |        |
| 19 | CL03C180JA3ANN □ |                    | 18 pF       | 25                        | ±5%                      | 0.33                  |        |
| 20 | CL03C220JA3ANN □ |                    | 22 pF       | 25                        | ±5%                      | 0.33                  |        |
| 21 | CL03C270JA3ANN □ |                    | 27 pF       | 25                        | ±5%                      | 0.33                  |        |
| 22 | CL03C330JA3ANN □ |                    | 33 pF       | 25                        | ±5%                      | 0.33                  |        |
| 23 | CL03C390JA3ANN □ |                    | 39 pF       | 25                        | ±5%                      | 0.33                  |        |
| 24 | CL03C470JA3ANN □ |                    | 47 pF       | 25                        | ±5%                      | 0.33                  |        |
| 25 | CL03C101JB3ANN □ |                    | 100 pF      | 50                        | ±5%                      | 0.33                  |        |
| 26 | CL03C101JA3ANN □ |                    | 100 pF      | 25                        | ±5%                      | 0.33                  |        |

Part Numbering  
SystemStandard &  
High CapacitorsSuper Small Size  
CapacitorsHigh-Q  
CapacitorsMedium-High  
Voltage CapacitorsArray Type  
Capacitors

## Product Lineup (Super Small Size Capacitors-X7R,X6S)

|    | Part Number      | Size L x W<br>(mm) | Capacitance | Rated<br>Voltage<br>(Vdc) | Capacitance<br>Tolerance | Thickness<br>Max.(mm) |  |
|----|------------------|--------------------|-------------|---------------------------|--------------------------|-----------------------|--|
| 1  | CL02B101KP2NNN □ | 0.40×0.20          | 100 pF      | 10                        | ±10%                     | 0.22                  |  |
| 2  | CL02B221KP2NNN □ |                    | 220 pF      | 10                        | ±10%                     | 0.22                  |  |
| 3  | CL02B271KP2NNN □ |                    | 270 pF      | 10                        | ±10%                     | 0.22                  |  |
| 4  | CL02B331KP2NNN □ |                    | 330 pF      | 10                        | ±10%                     | 0.22                  |  |
| 5  | CL02B391KP2NNN □ |                    | 390 pF      | 10                        | ±10%                     | 0.22                  |  |
| 6  | CL02B471KP2NNN □ |                    | 470 pF      | 10                        | ±10%                     | 0.22                  |  |
| 7  | CL02B681KP2NNN □ |                    | 680 pF      | 10                        | ±10%                     | 0.22                  |  |
| 8  | CL02B102KP2NNN □ |                    | 1 nF        | 10                        | ±10%                     | 0.22                  |  |
| 1  | CL03B151KA3NNN □ | 0.60×0.30          | 150 pF      | 25                        | ±10%                     | 0.33                  |  |
| 2  | CL03B221KA3NNN □ |                    | 220 pF      | 25                        | ±10%                     | 0.33                  |  |
| 3  | CL03B271KO3NNN □ |                    | 270 pF      | 16                        | ±10%                     | 0.33                  |  |
| 4  | CL03B331KA3NNN □ |                    | 330 pF      | 25                        | ±10%                     | 0.33                  |  |
| 5  | CL03B471KA3NNN □ |                    | 470 pF      | 25                        | ±10%                     | 0.33                  |  |
| 6  | CL03B561KO3NNN □ |                    | 560 pF      | 16                        | ±10%                     | 0.33                  |  |
| 7  | CL03B681KA3NNN □ |                    | 680 pF      | 25                        | ±10%                     | 0.33                  |  |
| 8  | CL03B821KO3NNN □ |                    | 820 pF      | 16                        | ±10%                     | 0.33                  |  |
| 9  | CL03B102KA3NNN □ |                    | 1 nF        | 25                        | ±10%                     | 0.33                  |  |
| 10 | CL03B152KP3NNN □ |                    | 1.5 nF      | 10                        | ±10%                     | 0.33                  |  |
| 11 | CL03B332KP3NNN □ |                    | 3.3 nF      | 10                        | ±10%                     | 0.33                  |  |
| 12 | CL03B392KP3NNN □ |                    | 3.9 nF      | 10                        | ±10%                     | 0.33                  |  |
| 13 | CL03B472KP3NNN □ |                    | 4.7 nF      | 10                        | ±10%                     | 0.33                  |  |
| 14 | CL03B682KP3NNN □ |                    | 6.8 nF      | 10                        | ±10%                     | 0.33                  |  |
| 15 | CL03B103KP3NNN □ |                    | 10 nF       | 10                        | ±10%                     | 0.33                  |  |
| 1  | CL03X104KQ3NNN □ |                    | 100 nF      | 6.3                       | ±20%                     | 0.33                  |  |
| 2  | CL03X105MR3CSN □ |                    | 1 μF        | 4                         | ±20%                     | 0.35                  |  |
| 3  | CL03X105MR3NRN □ |                    | 1 μF        | 4                         | ±20%                     | 0.39                  |  |

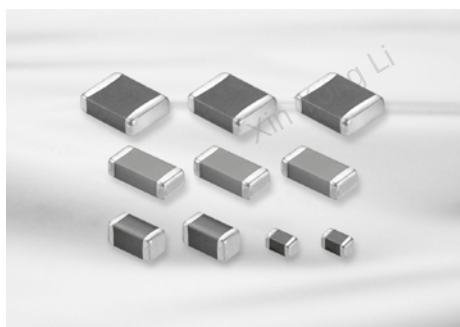
Low ESL  
CapacitorsReliability Test  
ConditionPremium Capacitors  
for Automotive  
ApplicationsPackaging  
SpecificationApplication Manual  
for Surface Mounting

※ □ mark means packaging code. If you want to learn the code or quantity in detail, please see p74.

**Product Lineup (Super Small Size Capacitors-X5R)**

|    | Part Number      | Size L x W<br>(mm) | Capacitance | Rated<br>Voltage<br>(Vdc) | Capacitance<br>Tolerance | Thickness<br>Max.(mm) |
|----|------------------|--------------------|-------------|---------------------------|--------------------------|-----------------------|
| 1  | CL02A151KQ2NNN □ | 0.40×0.20          | 150 pF      | 6.3                       | ±10%                     | 0.22                  |
| 2  | CL02A221KQ2NNN □ |                    | 220 pF      | 6.3                       | ±10%                     | 0.22                  |
| 3  | CL02A331KQ2NNN □ |                    | 330 pF      | 6.3                       | ±10%                     | 0.22                  |
| 4  | CL02A471KQ2NNN □ |                    | 470 pF      | 6.3                       | ±10%                     | 0.22                  |
| 5  | CL02A681KQ2NNN □ |                    | 680 pF      | 6.3                       | ±10%                     | 0.22                  |
| 6  | CL02A102KQ2NNN □ |                    | 1 nF        | 6.3                       | ±10%                     | 0.22                  |
| 7  | CL02A152KQ2NNN □ |                    | 1.5 nF      | 6.3                       | ±10%                     | 0.22                  |
| 8  | CL02A222KQ2NNN □ |                    | 2.2 nF      | 6.3                       | ±10%                     | 0.22                  |
| 9  | CL02A332KQ2NNN □ |                    | 3.2 nF      | 6.3                       | ±10%                     | 0.22                  |
| 10 | CL02A472KQ2NNN □ |                    | 4.7 nF      | 6.3                       | ±10%                     | 0.22                  |
| 11 | CL02A682KQ2NNN □ |                    | 6.8 nF      | 6.3                       | ±10%                     | 0.22                  |
| 12 | CL02A103KQ2NNN □ |                    | 10 nF       | 6.3                       | ±10%                     | 0.22                  |
| 13 | CL02A104KQ2NNN □ |                    | 100 nF      | 6.3                       | ±10%                     | 0.22                  |
| 14 | CL02A224MR2NNN □ |                    | 220 nF      | 4                         | ±20%                     | 0.22                  |
| 15 | CL02A224MQ2NNN □ |                    | 220 nF      | 6.3                       | ±20%                     | 0.22                  |
| 1  | CL03A103KA3NNN □ | 0.60×0.30          | 10 nF       | 25                        | ±10%                     | 0.33                  |
| 2  | CL03A223KQ3NNN □ |                    | 22 nF       | 6.3                       | ±10%                     | 0.33                  |
| 3  | CL03A473KQ3NNN □ |                    | 47 nF       | 6.3                       | ±10%                     | 0.33                  |
| 4  | CL03A104MA3NNN □ |                    | 100 nF      | 25                        | ±20%                     | 0.33                  |
| 5  | CL03A104KO3NNN □ |                    | 100 nF      | 16                        | ±10%                     | 0.33                  |
| 6  | CL03A104KP3NNN □ |                    | 100 nF      | 10                        | ±10%                     | 0.33                  |
| 7  | CL03A104KQ3NNN □ |                    | 100 nF      | 6.3                       | ±10%                     | 0.33                  |
| 8  | CL03A224KQ3NNN □ |                    | 220 nF      | 6.3                       | ±10%                     | 0.33                  |
| 9  | CL03A224KP3NNN □ |                    | 220 nF      | 10                        | ±10%                     | 0.33                  |
| 10 | CL03A105MO3NRR □ |                    | 1 nF        | 16                        | ±20%                     | 0.39                  |
| 11 | CL03A105MQ3CSN □ |                    | 1 μF        | 6.3                       | ±20%                     | 0.35                  |
| 12 | CL03A105MP3NSN □ |                    | 1 μF        | 10                        | ±20%                     | 0.35                  |
| 13 | CL03A225MR3CRN □ |                    | 2.2 μF      | 4                         | ±20%                     | 0.39                  |
| 14 | CL03A225MQ3CRN □ |                    | 2.2 μF      | 6.3                       | ±20%                     | 0.39                  |

※ □ mark means packaging code. If you want to learn the code or quantity in detail, please see p74.



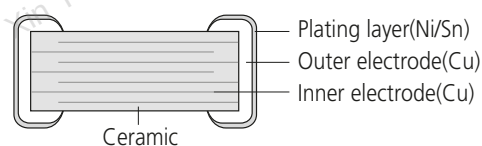
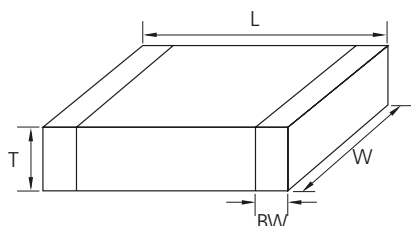
## Feature

- High Q and low ESR in high frequency range
- Tight tolerance available
- High efficiency and low power consumption in RF circuit
- Can be applied to power amplifier module for base-station and GHz range communications

## Application

- Base Station
- Set Top Box
- Wireless Equipment
- GPS, Bluetooth

## Structure and Dimensions



| Code | EIA Code | Rated Voltage | Dimension (mm)  |                 |                 |                        |
|------|----------|---------------|-----------------|-----------------|-----------------|------------------------|
|      |          |               | L               | W               | T               | BW                     |
| 05   | 0402     | 50V           | $1.00 \pm 0.05$ | $0.50 \pm 0.05$ | $0.50 \pm 0.05$ | $0.25 \pm 0.10$        |
| 10   | 0603     | 50/100V       | $1.60 \pm 0.10$ | $0.80 \pm 0.10$ | $0.80 \pm 0.10$ | $0.30 \pm 0.20$        |
|      |          | 250V          | $1.60 \pm 0.15$ | $0.80 \pm 0.15$ | $0.65 \pm 0.10$ | $0.30 \pm 0.20$        |
| 21   | 0805     | 250V          | $2.00 \pm 0.15$ | $1.25 \pm 0.15$ | $0.85 \pm 0.15$ | $0.50 + 0.20 / - 0.30$ |

## Capacitance Table (High-Q capacitor)

| TC  | Size (mm)  | Vr(V) | Capacitance (pF) |     |   |    |    |    |    |    |    |     |     |     |
|-----|------------|-------|------------------|-----|---|----|----|----|----|----|----|-----|-----|-----|
|     |            |       | 0.2              | 0.5 | 1 | 10 | 15 | 27 | 33 | 47 | 68 | 100 | 150 | 220 |
| COG | 0402(1005) | 50    |                  |     |   |    |    |    |    |    |    |     |     |     |
|     | 0603(1608) | 50    |                  |     |   |    |    |    |    |    |    |     |     |     |
|     |            | 100   |                  |     |   |    |    |    |    |    |    |     |     |     |
|     |            | 250   |                  |     |   |    |    |    |    |    |    |     |     |     |
|     | 0805(2012) | 250   |                  |     |   |    |    |    |    |    |    |     |     |     |

Part Numbering System

Standard & High Capacitors

Super Small Size Capacitors

High-Q Capacitors

Medium-High Voltage Capacitors

Array Type Capacitors

Low ESL Capacitors

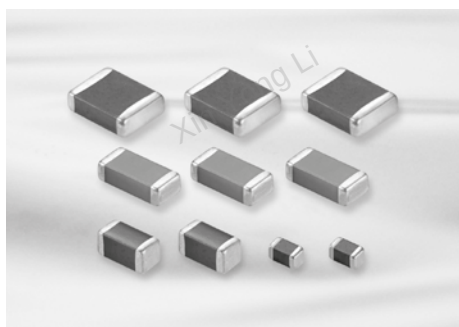
Reliability Test Condition

Premium Capacitors for Automotive Applications

Packaging Specification

Application Manual for Surface Mounting

# Medium-High Voltage Capacitors



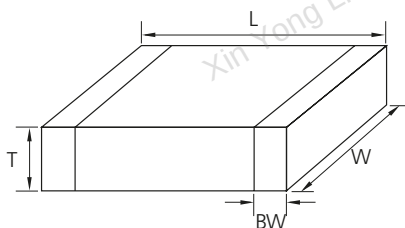
## Feature

- Highly reliable performance
- Operating at high voltage level
- Wide voltage level: from 100V to 3000V
- High withstanding voltage
- Tape & reel surface mount assembly

## Application

- Switching Power Circuit(SMPS)
- Lighting Ballast, LCD back lighting inverter
- DC-DC converter input filter, snubber circuit
- Phone, Fax, Modem
- Network(IEEE802.3)

## Structure and Dimensions



| Code | EIA Code | Dimension (mm)  |                 |                 |                |                    |
|------|----------|-----------------|-----------------|-----------------|----------------|--------------------|
|      |          | L               | W               | T               | Thickness Code | BW                 |
| 10   | 0603     | $1.60 \pm 0.10$ | $0.80 \pm 0.10$ | $0.80 \pm 0.10$ | 8              | $0.3 \pm 0.2$      |
| 21   | 0805     | $2.00 \pm 0.10$ | $1.25 \pm 0.10$ | $1.25 \pm 0.10$ | F              | $0.5 \pm 0.2/-0.3$ |
|      |          | $2.00 \pm 0.10$ | $1.25 \pm 0.10$ | $0.85 \pm 0.10$ | C              |                    |
|      |          | $2.00 \pm 0.10$ | $1.25 \pm 0.10$ | $0.65 \pm 0.10$ | A              |                    |
| 31   | 1206     | $3.20 \pm 0.20$ | $1.60 \pm 0.20$ | $1.60 \pm 0.20$ | H              | $0.5 \pm 0.3$      |
|      |          | $3.20 \pm 0.15$ | $1.60 \pm 0.15$ | $1.25 \pm 0.15$ | F              |                    |
|      |          | $3.20 \pm 0.15$ | $1.60 \pm 0.15$ | $0.85 \pm 0.15$ | C              |                    |
| 32   | 1210     | $3.20 \pm 0.30$ | $2.50 \pm 0.20$ | $2.50 \pm 0.20$ | J              | $0.6 \pm 0.3$      |
|      |          | $3.20 \pm 0.30$ | $2.50 \pm 0.20$ | $1.60 \pm 0.20$ | H              |                    |
|      |          | $3.20 \pm 0.30$ | $2.50 \pm 0.20$ | $1.25 \pm 0.20$ | F              |                    |
| 42   | 1808     | $4.50 \pm 0.40$ | $2.00 \pm 0.20$ | $2.00 \pm 0.20$ | I              | $0.8 \pm 0.3$      |
|      |          | $4.50 \pm 0.40$ | $2.00 \pm 0.20$ | $1.60 \pm 0.20$ | H              |                    |
|      |          | $4.50 \pm 0.40$ | $2.00 \pm 0.20$ | $1.25 \pm 0.20$ | F              |                    |
| 43   | 1812     | $4.50 \pm 0.40$ | $3.20 \pm 0.30$ | $2.50 \pm 0.20$ | J              | $0.8 \pm 0.3$      |
|      |          | $4.50 \pm 0.40$ | $3.20 \pm 0.30$ | $1.60 \pm 0.20$ | H              |                    |
|      |          | $4.50 \pm 0.40$ | $3.20 \pm 0.30$ | $1.25 \pm 0.20$ | F              |                    |
| 55   | 2220     | $5.70 \pm 0.40$ | $5.00 \pm 0.40$ | $2.50 \pm 0.20$ | J              | $1.0 \pm 0.3$      |
|      |          | $5.70 \pm 0.40$ | $5.00 \pm 0.40$ | $1.60 \pm 0.20$ | H              |                    |

Medium-High Voltage capacitance Table (C0G)

| Vr(V) | Size(mm)   | Capacitance |     |     |     |     |     |      |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |    |
|-------|------------|-------------|-----|-----|-----|-----|-----|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|----|----|----|----|----|----|----|----|----|
|       |            | (pF)        |     |     |     |     |     | (nF) |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |    |
|       |            | 330         | 390 | 470 | 560 | 680 | 820 | 1    | 1.2 | 1.5 | 1.8 | 2.2 | 2.7 | 3.3 | 3.9 | 4.7 | 5.6 | 6.8 | 8.2 | 10 | 12 | 15 | 18 | 22 | 27 | 33 | 47 | 56 | 68 |
| 100V  | 0603(1608) |             |     |     |     |     |     |      |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |    |
|       | 0805(2012) |             |     |     |     |     |     |      |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |    |
|       | 1206(3216) |             |     |     |     |     |     |      |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |    |
|       | 1210(3225) |             |     |     |     |     |     |      |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |    |
|       | 1812(4532) |             |     |     |     |     |     |      |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |    |
|       | 2220(5750) |             |     |     |     |     |     |      |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |    |
| 200V  | 0603(1608) |             |     |     |     |     |     |      |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |    |
|       | 0805(2012) |             |     |     |     |     |     |      |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |    |
|       | 1206(3216) |             |     |     |     |     |     |      |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |    |
|       | 1210(3225) |             |     |     |     |     |     |      |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |    |
|       | 1812(4532) |             |     |     |     |     |     |      |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |    |
|       | 2220(5750) |             |     |     |     |     |     |      |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |    |
| 250V  | 0603(1608) |             |     |     |     |     |     |      |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |    |
|       | 0805(2012) |             |     |     |     |     |     |      |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |    |
|       | 1206(3216) |             |     |     |     |     |     |      |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |    |
|       | 1210(3225) |             |     |     |     |     |     |      |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |    |
|       | 1812(4532) |             |     |     |     |     |     |      |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |    |
|       | 2220(5750) |             |     |     |     |     |     |      |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |    |
| 500V  | 1206(3216) |             |     |     |     |     |     |      |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |    |
|       | 1210(3225) |             |     |     |     |     |     |      |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |    |
|       | 1812(4532) |             |     |     |     |     |     |      |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |    |
|       | 2220(5750) |             |     |     |     |     |     |      |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |    |
| 630V  | 0805(2012) |             |     |     |     |     |     |      |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |    |
|       | 1206(3216) |             |     |     |     |     |     |      |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |    |
|       | 1210(3225) |             |     |     |     |     |     |      |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |    |
|       | 1812(4532) |             |     |     |     |     |     |      |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |    |
|       | 2220(5750) |             |     |     |     |     |     |      |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |    |

Part Numbering  
SystemStandard &  
High CapacitorsSuper Small Size  
CapacitorsHigh-Q  
CapacitorsMedium-High  
Voltage CapacitorsArray Type  
CapacitorsLow ESL  
CapacitorsReliability Test  
ConditionPremium Capacitors  
for Automotive  
ApplicationsPackaging  
SpecificationApplication Manual  
for Surface Mounting



Medium-High Voltage capacitance Table (C0G)

| Vr(V) | Size(mm)   | Capacitance |    |    |    |     |     |     |     |     |     |     |     |     |     |     |     |       |     |     |     |     |     |     |     |     |     |  |  |
|-------|------------|-------------|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|--|
|       |            | (pF)        |    |    |    |     |     |     |     |     |     |     |     |     |     |     |     | (nF)  |     |     |     |     |     |     |     |     |     |  |  |
|       |            | 47          | 56 | 68 | 82 | 100 | 120 | 150 | 180 | 220 | 270 | 330 | 390 | 470 | 560 | 680 | 820 | 1     | 1.2 | 1.5 | 1.8 | 2.2 | 2.7 | 3.3 | 3.9 | 4.7 | 5.6 |  |  |
| 1KV   | 1206(3216) |             |    |    |    |     |     |     |     |     |     |     |     |     |     |     |     |       |     |     |     |     |     |     |     |     |     |  |  |
|       | 1210(3225) |             |    |    |    |     |     |     |     |     |     |     |     |     |     |     |     |       |     |     |     |     |     |     |     |     |     |  |  |
|       | 1812(4532) |             |    |    |    |     |     |     |     |     |     |     |     |     |     |     |     |       |     |     |     |     |     |     |     |     |     |  |  |
|       | 2220(5750) |             |    |    |    |     |     |     |     |     |     |     |     |     |     |     |     | 3.6nF |     |     |     |     |     |     |     |     |     |  |  |
| 2KV   | 1206(3216) |             |    |    |    |     |     |     |     |     |     |     |     |     |     |     |     |       |     |     |     |     |     |     |     |     |     |  |  |
|       | 1210(3225) |             |    |    |    |     |     |     |     |     |     |     |     |     |     |     |     |       |     |     |     |     |     |     |     |     |     |  |  |
|       | 1808(4520) |             |    |    |    |     |     |     |     |     |     |     |     |     |     |     |     |       |     |     |     |     |     |     |     |     |     |  |  |
|       | 1812(4532) |             |    |    |    |     |     |     |     |     |     |     |     |     |     |     |     |       |     |     |     |     |     |     |     |     |     |  |  |
|       | 2220(5750) |             |    |    |    |     |     |     |     |     |     |     |     |     |     |     |     |       |     |     |     |     |     |     |     |     |     |  |  |
| 3KV   | 1808(4520) |             |    |    |    |     |     |     |     |     |     |     |     |     |     |     |     |       |     |     |     |     |     |     |     |     |     |  |  |
|       | 1812(4532) |             |    |    |    |     |     |     |     |     |     |     |     |     |     |     |     |       |     |     |     |     |     |     |     |     |     |  |  |
|       | 2220(5750) |             |    |    |    |     |     |     |     |     |     |     |     |     |     |     |     |       |     |     |     |     |     |     |     |     |     |  |  |

3.6nF

Medium-High Voltage capacitance Table (X7R)

| Vr(V) | Size(mm)   | Capacitance (nF) |    |    |    |    |    |    |     |     |     |     |     |     |      |      |      |      |
|-------|------------|------------------|----|----|----|----|----|----|-----|-----|-----|-----|-----|-----|------|------|------|------|
|       |            | 4.7              | 10 | 15 | 22 | 33 | 47 | 68 | 100 | 150 | 220 | 330 | 470 | 680 | 1000 | 1500 | 2200 | 4700 |
| 100V  | 0603(1608) |                  |    |    |    |    |    |    |     |     |     |     |     |     |      |      |      |      |
|       | 0805(2012) |                  |    |    |    |    |    |    |     |     |     |     |     |     |      |      |      |      |
|       | 1206(3216) |                  |    |    |    |    |    |    |     |     |     |     |     |     |      |      |      |      |
|       | 1210(3225) |                  |    |    |    |    |    |    |     |     |     |     |     |     |      |      |      |      |
|       | 1812(4532) |                  |    |    |    |    |    |    |     |     |     |     |     |     |      |      |      |      |
|       | 2220(5750) |                  |    |    |    |    |    |    |     |     |     |     |     |     |      |      |      |      |
| 200V  | 0805(2012) |                  |    |    |    |    |    |    |     |     |     |     |     |     |      |      |      |      |
|       | 1206(3216) |                  |    |    |    |    |    |    |     |     |     |     |     |     |      |      |      |      |
|       | 1210(3225) |                  |    |    |    |    |    |    |     |     |     |     |     |     |      |      |      |      |
|       | 1812(4532) |                  |    |    |    |    |    |    |     |     |     |     |     |     |      |      |      |      |
|       | 2220(5750) |                  |    |    |    |    |    |    |     |     |     |     |     |     |      |      |      |      |
| 250V  | 0805(2012) |                  |    |    |    |    |    |    |     |     |     |     |     |     |      |      |      |      |
|       | 1206(3216) |                  |    |    |    |    |    |    |     |     |     |     |     |     |      |      |      |      |
|       | 1210(3225) |                  |    |    |    |    |    |    |     |     |     |     |     |     |      |      |      |      |
|       | 1812(4532) |                  |    |    |    |    |    |    |     |     |     |     |     |     |      |      |      |      |
|       | 2220(5750) |                  |    |    |    |    |    |    |     |     |     |     |     |     |      |      |      |      |
| 350V  | 1206(3216) |                  |    |    |    |    |    |    |     |     |     |     |     |     |      |      |      |      |
| 500V  | 1206(3216) |                  |    |    |    |    |    |    |     |     |     |     |     |     |      |      |      |      |
|       | 1210(3225) |                  |    |    |    |    |    |    |     |     |     |     |     |     |      |      |      |      |
|       | 1812(4532) |                  |    |    |    |    |    |    |     |     |     |     |     |     |      |      |      |      |
|       | 2220(5750) |                  |    |    |    |    |    |    |     |     |     |     |     |     |      |      |      |      |
| 630V  | 1206(3216) |                  |    |    |    |    |    |    |     |     |     |     |     |     |      |      |      |      |
|       | 1210(3225) |                  |    |    |    |    |    |    |     |     |     |     |     |     |      |      |      |      |
|       | 1812(4532) |                  |    |    |    |    |    |    |     |     |     |     |     |     |      |      |      |      |
|       | 2220(5750) |                  |    |    |    |    |    |    |     |     |     |     |     |     |      |      |      |      |

- Part Numbering System
- Standard & High Capacitors
- Super Small Size Capacitors
- High-Q Capacitors
- Medium-High Voltage Capacitors
- Array Type Capacitors
- Low ESL Capacitors
- Reliability Test Condition
- Premium Capacitors for Automotive Applications
- Packaging Specification
- Application Manual for Surface Mounting

### Medium-High Voltage capacitance Table (X7R)

| Vr(V) | Size(mm)   | Capacitance (nF) |     |     |     |     |     |    |    |    |    |    |    |     |     |     |     |
|-------|------------|------------------|-----|-----|-----|-----|-----|----|----|----|----|----|----|-----|-----|-----|-----|
|       |            | 1                | 1.5 | 2.2 | 3.3 | 4.7 | 6.8 | 10 | 15 | 22 | 33 | 47 | 68 | 100 | 150 | 220 | 330 |
| 1KV   | 1206(3216) |                  |     |     |     |     |     |    |    |    |    |    |    |     |     |     |     |
|       | 1210(3225) |                  |     |     |     |     |     |    |    |    |    |    |    |     |     |     |     |
|       | 1812(4532) |                  |     |     |     |     |     |    |    |    |    |    |    |     |     |     |     |
|       | 2220(5750) |                  |     |     |     |     |     |    |    |    |    |    |    |     |     |     |     |
| 2KV   | 1206(3216) |                  |     |     |     |     |     |    |    |    |    |    |    |     |     |     |     |
|       | 1210(3225) |                  |     |     |     |     |     |    |    |    |    |    |    |     |     |     |     |
|       | 1808(4520) |                  |     |     |     |     |     |    |    |    |    |    |    |     |     |     |     |
|       | 1812(4532) |                  |     |     |     |     |     |    |    |    |    |    |    |     |     |     |     |
|       | 2220(5750) |                  |     |     |     |     |     |    |    |    |    |    |    |     |     |     |     |
| 3KV   | 1808(4520) |                  |     |     |     |     |     |    |    |    |    |    |    |     |     |     |     |

## Product Lineup (Medium-High Voltage Capacitors-C0G)

|    | Part Number      | Size L x W<br>(mm) | Capacitance | Rated<br>Voltage<br>(Vdc) | Capacitance<br>Tolerance | Thickness<br>Max.(mm) |
|----|------------------|--------------------|-------------|---------------------------|--------------------------|-----------------------|
| 1  | CL10C100JC8NNN □ | 1.60×0.80          | 10 pF       | 100                       | ±5%                      | 0.90                  |
| 2  | CL10C150JC8NNN □ |                    | 15 pF       | 100                       | ±5%                      | 0.90                  |
| 3  | CL10C330JC8NNN □ |                    | 33 pF       | 100                       | ±5%                      | 0.90                  |
| 4  | CL10C390JC8NNN □ |                    | 39 pF       | 100                       | ±5%                      | 0.90                  |
| 5  | CL10C470JC8NNN □ |                    | 47 pF       | 100                       | ±5%                      | 0.90                  |
| 6  | CL10C560JC8NNN □ |                    | 56 pF       | 100                       | ±5%                      | 0.90                  |
| 7  | CL10C101JC8NNN □ |                    | 100 pF      | 100                       | ±5%                      | 0.90                  |
| 8  | CL10C121JC8NNN □ |                    | 120 pF      | 100                       | ±5%                      | 0.90                  |
| 9  | CL10C151JC8NNN □ |                    | 150 pF      | 100                       | ±5%                      | 0.90                  |
| 10 | CL10C331JC8NNN □ |                    | 330 pF      | 100                       | ±5%                      | 0.90                  |
| 11 | CL10C331JD8NNN □ |                    | 330 pF      | 200                       | ±5%                      | 0.90                  |
| 12 | CL10C331JE8NNN □ |                    | 330 pF      | 250                       | ±5%                      | 0.90                  |
| 13 | CL10C391JD8NNN □ |                    | 390 pF      | 200                       | ±5%                      | 0.90                  |
| 14 | CL10C391JE8NNN □ |                    | 390 pF      | 250                       | ±5%                      | 0.90                  |
| 15 | CL10C471JC8NNN □ |                    | 470 pF      | 100                       | ±5%                      | 0.90                  |
| 16 | CL10C471JD8NNN □ |                    | 470 pF      | 200                       | ±5%                      | 0.90                  |
| 17 | CL10C471JE8NNN □ |                    | 470 pF      | 250                       | ±5%                      | 0.90                  |
| 18 | CL10C561JD8NNN □ |                    | 560 pF      | 200                       | ±5%                      | 0.90                  |
| 19 | CL10C561JE8NNN □ |                    | 560 pF      | 250                       | ±5%                      | 0.90                  |
| 20 | CL10C681JC8NNN □ |                    | 680 pF      | 100                       | ±5%                      | 0.90                  |
| 21 | CL10C681JD8NNN □ |                    | 680 pF      | 200                       | ±5%                      | 0.90                  |
| 22 | CL10C681JE8NNN □ |                    | 680 pF      | 250                       | ±5%                      | 0.90                  |
| 23 | CL10C821JC8NNN □ |                    | 820 pF      | 100                       | ±5%                      | 0.90                  |
| 24 | CL10C102JC8NNN □ |                    | 1 nF        | 100                       | ±5%                      | 0.90                  |
| 25 | CL10C122JC8NNN □ |                    | 1.2 nF      | 100                       | ±5%                      | 0.90                  |
| 1  | CL21C100JCANNN □ | 2.00×1.25          | 10 pF       | 100                       | ±5%                      | 0.75                  |
| 2  | CL21C120JCANNN □ |                    | 12 pF       | 100                       | ±5%                      | 0.75                  |
| 3  | CL21C150JCANNN □ |                    | 15 pF       | 100                       | ±5%                      | 0.75                  |
| 4  | CL21C150JDCNNN □ |                    | 15 pF       | 200                       | ±5%                      | 0.95                  |
| 5  | CL21C180JCANNN □ |                    | 18 pF       | 100                       | ±5%                      | 0.75                  |
| 6  | CL21C180JDCNNN □ |                    | 18 pF       | 200                       | ±5%                      | 0.95                  |
| 7  | CL21C220JCANNN □ |                    | 22 pF       | 100                       | ±5%                      | 0.75                  |
| 8  | CL21C270JCANNN □ |                    | 27 pF       | 100                       | ±5%                      | 0.75                  |
| 9  | CL21C270JHFNNN □ |                    | 27 pF       | 630                       | ±5%                      | 1.35                  |
| 10 | CL21C330JCANNN □ |                    | 33 pF       | 100                       | ±5%                      | 0.75                  |
| 11 | CL21C330JDCNNN □ |                    | 33 pF       | 200                       | ±5%                      | 0.95                  |
| 12 | CL21C330JHFNNN □ |                    | 33 pF       | 630                       | ±5%                      | 1.35                  |
| 13 | CL21C390JDCNNN □ |                    | 39 pF       | 200                       | ±5%                      | 0.95                  |
| 14 | CL21C470JCANNN □ |                    | 47 pF       | 100                       | ±5%                      | 0.75                  |
| 15 | CL21C470JDCNNN □ |                    | 47 pF       | 200                       | ±5%                      | 0.95                  |
| 16 | CL21C470JHFNNN □ |                    | 47 pF       | 630                       | ±5%                      | 1.35                  |
| 17 | CL21C560JCCNNN □ |                    | 56 pF       | 100                       | ±5%                      | 0.95                  |
| 18 | CL21C560JDCNNN □ |                    | 56 pF       | 200                       | ±5%                      | 0.95                  |
| 19 | CL21C680JCANNN □ |                    | 68 pF       | 100                       | ±5%                      | 0.75                  |
| 20 | CL21C680JDCNNN □ |                    | 68 pF       | 200                       | ±5%                      | 0.95                  |
| 21 | CL21C680JHFNNN □ |                    | 68 pF       | 630                       | ±5%                      | 1.35                  |
| 22 | CL21C820JCCNNN □ |                    | 82 pF       | 100                       | ±5%                      | 0.95                  |
| 23 | CL21C101JCANNN □ |                    | 100 pF      | 100                       | ±5%                      | 0.75                  |
| 24 | CL21C101JDCNNN □ |                    | 100 pF      | 200                       | ±5%                      | 0.95                  |
| 25 | CL21C101JECNNN □ |                    | 100 pF      | 250                       | ±5%                      | 0.95                  |

※ □ mark means packaging code. If you want to learn the code or quantity in detail, please see p74.

Part Numbering  
SystemStandard &  
High CapacitorsSuper Small Size  
CapacitorsHigh-Q  
CapacitorsMedium-High  
Voltage CapacitorsArray Type  
CapacitorsLow ESL  
CapacitorsReliability Test  
ConditionPremium Capacitors  
for Automotive  
ApplicationsPackaging  
SpecificationApplication Manual  
for Surface Mounting

## Product Lineup (Medium-High Voltage Capacitors-C0G)

|    | Part Number      | Size L x W<br>(mm) | Capacitance | Rated<br>Voltage<br>(Vdc) | Capacitance<br>Tolerance | Thickness<br>Max.(mm) |
|----|------------------|--------------------|-------------|---------------------------|--------------------------|-----------------------|
| 26 | CL21C121JDCNNN □ | 2.00×1.25          | 120pF       | 200                       | ±5%                      | 0.95                  |
| 27 | CL21C151JCANNN □ |                    | 150pF       | 100                       | ±5%                      | 0.75                  |
| 28 | CL21C151JHFNNN □ |                    | 150pF       | 630                       | ±5%                      | 1.35                  |
| 29 | CL21C221JCANNN □ |                    | 220pF       | 100                       | ±5%                      | 0.75                  |
| 30 | CL21C221JDCNNN □ |                    | 220pF       | 200                       | ±5%                      | 0.95                  |
| 31 | CL21C331JCANNN □ |                    | 330pF       | 100                       | ±5%                      | 0.75                  |
| 32 | CL21C471JCCNNN □ |                    | 470pF       | 100                       | ±5%                      | 0.95                  |
| 33 | CL21C561JCCNNN □ |                    | 560pF       | 100                       | ±5%                      | 0.95                  |
| 34 | CL21C561JHFNNN □ |                    | 560pF       | 630                       | ±5%                      | 1.35                  |
| 35 | CL21C681JCCNNN □ |                    | 680pF       | 100                       | ±5%                      | 0.95                  |
| 36 | CL21C102JCFNNN □ |                    | 1nF         | 100                       | ±5%                      | 1.35                  |
| 37 | CL21C102JDFNNN □ |                    | 1nF         | 200                       | ±5%                      | 1.35                  |
| 38 | CL21C272JDFNNN □ |                    | 2.7nF       | 200                       | ±5%                      | 1.35                  |
| 39 | CL21C272JEFNNN □ |                    | 2.7nF       | 250                       | ±5%                      | 1.35                  |
| 40 | CL21C472JCFNNN □ |                    | 4.7nF       | 100                       | ±5%                      | 1.35                  |
| 1  | CL31C150JGFNNN □ | 3.20×1.60          | 15pF        | 500                       | ±5%                      | 1.40                  |
| 2  | CL31C180JGFNNN □ |                    | 18pF        | 500                       | ±5%                      | 1.40                  |
| 3  | CL31C220JGFNNN □ |                    | 22pF        | 500                       | ±5%                      | 1.40                  |
| 4  | CL31C220JJHNNN □ |                    | 22pF        | 2000                      | ±5%                      | 1.80                  |
| 5  | CL31C270JGFNNN □ |                    | 27pF        | 500                       | ±5%                      | 1.40                  |
| 6  | CL31C330JGFNNN □ |                    | 33pF        | 500                       | ±5%                      | 1.40                  |
| 7  | CL31C390JGFNNN □ |                    | 39pF        | 500                       | ±5%                      | 1.40                  |
| 8  | CL31C470JGFNNN □ |                    | 47pF        | 500                       | ±5%                      | 1.40                  |
| 9  | CL31C470JHFNNN □ |                    | 47pF        | 630                       | ±5%                      | 1.40                  |
| 10 | CL31C470JIFNNN □ |                    | 47μF        | 1000                      | ±5%                      | 1.40                  |
| 11 | CL31C470JJHNNN □ |                    | 47pF        | 2000                      | ±5%                      | 1.80                  |
| 12 | CL31C560JGFNNN □ |                    | 56pF        | 500                       | ±5%                      | 1.40                  |
| 13 | CL31C680JCCNNN □ |                    | 68pF        | 100                       | ±5%                      | 1.00                  |
| 14 | CL31C680JGFNNN □ |                    | 68pF        | 500                       | ±5%                      | 1.40                  |
| 15 | CL31C680JHFNNN □ |                    | 68pF        | 630                       | ±5%                      | 1.40                  |
| 16 | CL31C680JIFNNN □ |                    | 68pF        | 1000                      | ±5%                      | 1.40                  |
| 17 | CL31C820JGFNCN □ |                    | 82pF        | 500                       | ±5%                      | 1.40                  |
| 18 | CL31C101JGFNNN □ |                    | 100pF       | 500                       | ±5%                      | 1.40                  |
| 19 | CL31C101JHFNNN □ |                    | 100pF       | 630                       | ±5%                      | 1.40                  |
| 20 | CL31C101JIFNNN □ |                    | 100pF       | 1000                      | ±5%                      | 1.40                  |
| 21 | CL31C101JJHNNN □ |                    | 100pF       | 2000                      | ±5%                      | 1.80                  |
| 22 | CL31C121JGFNNN □ |                    | 120pF       | 500                       | ±5%                      | 1.40                  |
| 23 | CL31C151JGFNNN □ |                    | 150pF       | 500                       | ±5%                      | 1.40                  |
| 24 | CL31C181JGFNNN □ |                    | 180pF       | 500                       | ±5%                      | 1.40                  |
| 25 | CL31C221JGFNNN □ |                    | 220pF       | 500                       | ±5%                      | 1.40                  |
| 26 | CL31C271JGFNNN □ |                    | 270pF       | 500                       | ±5%                      | 1.40                  |
| 27 | CL31C271JCCNNN □ |                    | 270pF       | 100                       | ±5%                      | 1.00                  |
| 28 | CL31C331JGFNNN □ |                    | 330pF       | 500                       | ±5%                      | 1.40                  |
| 29 | CL31C331JJHNNN □ |                    | 330pF       | 1000                      | ±5%                      | 1.80                  |
| 30 | CL31C391JCCNNN □ |                    | 390pF       | 100                       | ±5%                      | 1.00                  |
| 31 | CL31C471JGFNNN □ |                    | 470pF       | 500                       | ±5%                      | 1.40                  |
| 32 | CL31C471JHFNNN □ |                    | 470pF       | 630                       | ±5%                      | 1.40                  |
| 33 | CL31C471JIFNNN □ |                    | 470pF       | 1000                      | ±5%                      | 1.40                  |
| 34 | CL31C561JCCNNN □ |                    | 560pF       | 100                       | ±5%                      | 1.00                  |
| 35 | CL31C561JGFNNN □ |                    | 560pF       | 500                       | ±5%                      | 1.40                  |
| 36 | CL31C681JGFNNN □ |                    | 680pF       | 500                       | ±5%                      | 1.80                  |
| 37 | CL31C821JJHNNN □ |                    | 820pF       | 630                       | 5%                       | 1.80                  |

※ □ mark means packaging code. If you want to learn the code or quantity in detail, please see p74.

## Product Lineup (Medium-High Voltage Capacitors-C0G)

|    | Part Number      | Size L x W<br>(mm) | Capacitance | Rated<br>Voltage<br>(Vdc) | Capacitance<br>Tolerance | Thickness<br>Max.(mm) |
|----|------------------|--------------------|-------------|---------------------------|--------------------------|-----------------------|
| 36 | CL31C102JCCNNN □ | 3.20×1.60          | 1nF         | 100                       | ±5%                      | 1.00                  |
| 37 | CL31C102JGHNNN □ |                    | 1nF         | 500                       | ±5%                      | 1.80                  |
| 38 | CL31C152JCCNNN □ |                    | 1.5nF       | 100                       | ±5%                      | 1.00                  |
| 39 | CL31C222JCCNNN □ |                    | 2.2nF       | 100                       | ±5%                      | 1.00                  |
| 40 | CL31C332JGHNNN □ |                    | 3.3nF       | 500                       | ±5%                      | 1.80                  |
| 41 | CL31C332JHHNNN □ |                    | 3.3nF       | 630                       | ±5%                      | 1.80                  |
| 42 | CL31C392JCHNNN □ |                    | 3.9nF       | 100                       | ±5%                      | 1.80                  |
| 43 | CL31C822JDHNNN □ |                    | 8.2nF       | 200                       | ±5%                      | 1.80                  |
| 44 | CL31C822JEHNNN □ |                    | 8.2nF       | 250                       | ±5%                      | 1.80                  |
| 45 | CL31C183JCHNNN □ |                    | 18nF        | 100                       | ±5%                      | 1.80                  |
| 1  | CL32C101JJFNNN □ | 3.20×2.50          | 100pF       | 2000                      | ±5%                      | 1.45                  |
| 2  | CL32C471JJJNNN □ |                    | 470pF       | 2000                      | ±5%                      | 2.70                  |
| 3  | CL32C821JJJNNN □ |                    | 820pF       | 1000                      | ±5%                      | 2.70                  |
| 4  | CL32C103JGJNNN □ |                    | 10nF        | 500                       | ±5%                      | 2.70                  |
| 5  | CL32C103JHJNNN □ |                    | 10nF        | 630                       | ±5%                      | 2.70                  |
| 6  | CL32C273JDJNNN □ |                    | 27nF        | 200                       | ±5%                      | 2.70                  |
| 7  | CL32C273JEJNNN □ |                    | 27nF        | 250                       | ±5%                      | 2.70                  |
| 8  | CL32C563JCJNNN □ |                    | 56nF        | 100                       | ±5%                      | 2.70                  |
| 1  | CL42C100JFNNN □  | 4.50×2.00          | 10pF        | 3000                      | ±5%                      | 1.45                  |
| 2  | CL42C151JKINNN □ |                    | 150pF       | 3000                      | ±5%                      | 2.20                  |
| 3  | CL42C221JJHNNN □ |                    | 220pF       | 2000                      | ±5%                      | 1.80                  |
| 1  | CL43C391JKJNNN □ | 4.50×3.20          | 390pF       | 3000                      | ±5%                      | 2.70                  |
| 2  | CL43C102JHNNN □  |                    | 1nF         | 1000                      | ±5%                      | 1.80                  |
| 3  | CL43C122JHNNN □  |                    | 1.2nF       | 1000                      | ±5%                      | 2.20                  |
| 4  | CL43C182JHNNN □  |                    | 1.8nF       | 1000                      | ±5%                      | 2.70                  |
| 5  | CL43C182JJJNNN □ |                    | 1.8nF       | 2000                      | ±5%                      | 2.70                  |
| 6  | CL43C223JGJNNN □ |                    | 22nF        | 500                       | ±5%                      | 2.70                  |
| 7  | CL43C223JHJNNN □ |                    | 22nF        | 630                       | ±5%                      | 2.70                  |
| 8  | CL43C473JDJNNN □ |                    | 47nF        | 200                       | ±5%                      | 2.70                  |
| 9  | CL43C473JEJNNN □ |                    | 47nF        | 250                       | ±5%                      | 2.70                  |
| 10 | CL43C563JCJNNN □ |                    | 56nF        | 100                       | ±5%                      | 2.70                  |
| 1  | CL55C102JJJNNN □ | 5.70×5.00          | 1nF         | 2000                      | ±5%                      | 2.70                  |
| 2  | CL55C102JKJNNN □ |                    | 1nF         | 3000                      | ±5%                      | 2.70                  |
| 3  | CL55C362JJJNNN □ |                    | 3.6nF       | 1000                      | ±5%                      | 2.70                  |
| 4  | CL55C223JGJNNN □ |                    | 22nF        | 500                       | ±5%                      | 2.70                  |
| 5  | CL55C223JHJNNN □ |                    | 22nF        | 630                       | ±5%                      | 2.70                  |
| 6  | CL55C473JDJNNN □ |                    | 47nF        | 200                       | ±5%                      | 2.70                  |
| 7  | CL55C473JEJNNN □ |                    | 47nF        | 250                       | ±5%                      | 2.70                  |
| 8  | CL55C683JCJNNN □ |                    | 68nF        | 100                       | ±5%                      | 2.70                  |

※ □ mark means packaging code. If you want to learn the code or quantity in detail, please see p74.

Part Numbering  
SystemStandard &  
High CapacitorsSuper Small Size  
CapacitorsHigh-Q  
CapacitorsMedium-High  
Voltage CapacitorsArray Type  
CapacitorsLow ESL  
CapacitorsReliability Test  
ConditionPremium Capacitors  
for Automotive  
ApplicationsPackaging  
SpecificationApplication Manual  
for Surface Mounting

**Product Lineup (Medium-High Voltage Capacitors-X7R)**

|    | Part Number      | Size L x W<br>(mm) | Capacitance | Rated<br>Voltage<br>(Vdc) | Capacitance<br>Tolerance | Thickness<br>Max.(mm) |
|----|------------------|--------------------|-------------|---------------------------|--------------------------|-----------------------|
| 1  | CL10B102KC8NNN □ | 1.60 x 0.80        | 1nF         | 100                       | ±10%                     | 0.90                  |
| 2  | CL10B472KC8NNN □ |                    | 4.7nF       | 100                       | ±10%                     | 0.90                  |
| 3  | CL10B103KC8NNN □ |                    | 10nF        | 100                       | ±10%                     | 0.90                  |
| 4  | CL10B104KC8NNN □ |                    | 100nF       | 100                       | ±10%                     | 0.90                  |
| 1  | CL21B221KDCNNN □ | 2.00×1.25          | 220pF       | 200                       | ±10%                     | 0.95                  |
| 2  | CL21B221KCANNN □ |                    | 220pF       | 100                       | ±10%                     | 0.75                  |
| 3  | CL21B331KDCNNN □ |                    | 330pF       | 200                       | ±10%                     | 0.95                  |
| 4  | CL21B471KCANNN □ |                    | 470pF       | 100                       | ±10%                     | 0.75                  |
| 5  | CL21B102KDCNNN □ |                    | 1nF         | 200                       | ±10%                     | 0.95                  |
| 6  | CL21B102KCANNN □ |                    | 1nF         | 100                       | ±10%                     | 0.75                  |
| 7  | CL21B222KDCNNN □ |                    | 2.2nF       | 200                       | ±10%                     | 0.95                  |
| 8  | CL21B222KCANNN □ |                    | 2.2nF       | 100                       | ±10%                     | 0.75                  |
| 9  | CL21B332KCANNN □ |                    | 3.3nF       | 100                       | ±10%                     | 0.75                  |
| 10 | CL21B472KDCNNN □ |                    | 4.7nF       | 200                       | ±10%                     | 0.95                  |
| 11 | CL21B472KCANNN □ |                    | 4.7nF       | 100                       | ±10%                     | 0.75                  |
| 12 | CL21B682KCANNN □ |                    | 6.8nF       | 100                       | ±10%                     | 0.75                  |
| 13 | CL21B103KDCNNN □ |                    | 10nF        | 200                       | ±10%                     | 0.95                  |
| 14 | CL21B103KCANNN □ |                    | 10nF        | 100                       | ±10%                     | 0.75                  |
| 15 | CL21B153KEFNNN □ |                    | 15nF        | 250                       | ±10%                     | 1.35                  |
| 16 | CL21B153KDFNNN □ |                    | 15nF        | 200                       | ±10%                     | 1.35                  |
| 17 | CL21B153KCCNNN □ |                    | 15nF        | 100                       | ±10%                     | 0.95                  |
| 18 | CL21B223KCFNNN □ |                    | 22nF        | 100                       | ±10%                     | 1.35                  |
| 19 | CL21B473KCFNNN □ |                    | 47nF        | 100                       | ±10%                     | 1.35                  |
| 20 | CL21B683KCFNNN □ |                    | 68nF        | 100                       | ±10%                     | 1.35                  |
| 21 | CL21B154KCFNNN □ |                    | 150nF       | 100                       | ±10%                     | 1.35                  |
| 22 | CL21B224KCFNNN □ |                    | 220nF       | 100                       | ±10%                     | 1.35                  |
| 1  | CL31B221KGFNNN □ | 3.20×1.60          | 220pF       | 500                       | ±10%                     | 1.40                  |
| 2  | CL31B471KGFNNN □ |                    | 470pF       | 500                       | ±10%                     | 1.40                  |
| 3  | CL31B471KDCNNN □ |                    | 470pF       | 200                       | ±10%                     | 1.00                  |
| 4  | CL31B102KJHNNN □ |                    | 1nF         | 2000                      | ±10%                     | 1.80                  |
| 5  | CL31B102KIFNNN □ |                    | 1nF         | 1000                      | ±10%                     | 1.40                  |
| 6  | CL31B102KGFNNN □ |                    | 1nF         | 500                       | ±10%                     | 1.40                  |
| 7  | CL31B102KHFNNN □ |                    | 1nF         | 630                       | ±10%                     | 1.40                  |
| 8  | CL31B152KGFNNN □ |                    | 1.5nF       | 500                       | ±10%                     | 1.40                  |
| 9  | CL31B152KJHNNN □ |                    | 1.5nF       | 2000                      | ±10%                     | 1.80                  |
| 10 | CL31B222KIFNNN □ |                    | 2.2nF       | 1000                      | ±10%                     | 1.40                  |
| 11 | CL31B222KDCNNN □ |                    | 2.2nF       | 200                       | ±10%                     | 1.00                  |
| 12 | CL31B222KGFNNN □ |                    | 2.2nF       | 500                       | ±10%                     | 1.40                  |
| 13 | CL31B222KJHNNN □ |                    | 2.2nF       | 2000                      | ±10%                     | 1.80                  |
| 14 | CL31B332KGFNNN □ |                    | 3.3nF       | 500                       | ±10%                     | 1.40                  |
| 15 | CL31B332KIFNNN □ |                    | 3.3nF       | 1000                      | ±10%                     | 1.40                  |
| 16 | CL31B472KGFNNN □ |                    | 4.7nF       | 500                       | ±10%                     | 1.40                  |

※ □ mark means packaging code. If you want to learn the code or quantity in detail, please see p74.

## Product Lineup (Medium-High Voltage Capacitors-X7R)

|    | Part Number      | Size L x W<br>(mm) | Capacitance | Rated<br>Voltage<br>(Vdc) | Capacitance<br>Tolerance | Thickness<br>Max.(mm) |
|----|------------------|--------------------|-------------|---------------------------|--------------------------|-----------------------|
| 17 | CL31B472KDCNNN □ | 3.20×1.60          | 4.7nF       | 200                       | ±10%                     | 1.00                  |
| 18 | CL31B682KGFNNN □ |                    | 6.8nF       | 500                       | ±10%                     | 1.40                  |
| 19 | CL31B103KHFNNN □ |                    | 10nF        | 630                       | ±10%                     | 1.40                  |
| 20 | CL31B103KGFNNN □ |                    | 10nF        | 500                       | ±10%                     | 1.40                  |
| 21 | CL31B103KFCSNN □ |                    | 10nF        | 350                       | ±10%                     | 1.00                  |
| 22 | CL31B153KDCNNN □ |                    | 15nF        | 200                       | ±10%                     | 1.00                  |
| 23 | CL31B153KFCSNN □ |                    | 15nF        | 350                       | ±10%                     | 1.00                  |
| 24 | CL31B153KCCNNN □ |                    | 15nF        | 100                       | ±10%                     | 1.00                  |
| 25 | CL31B153KGFNNN □ |                    | 15nF        | 500                       | ±10%                     | 1.40                  |
| 26 | CL31B153KHFNNN □ |                    | 15nF        | 630                       | ±10%                     | 1.40                  |
| 27 | CL31B223KDCNNN □ |                    | 22nF        | 200                       | ±10%                     | 1.00                  |
| 28 | CL31B223KCCNNN □ |                    | 22nF        | 100                       | ±10%                     | 1.00                  |
| 29 | CL31B223KFCSNN □ |                    | 22nF        | 350                       | ±10%                     | 1.00                  |
| 30 | CL31B223KGHNNN □ |                    | 22nF        | 500                       | ±10%                     | 1.80                  |
| 31 | CL31B223KHHNNN □ |                    | 22nF        | 630                       | ±10%                     | 1.80                  |
| 32 | CL31B333KDFNNN □ |                    | 33nF        | 200                       | ±10%                     | 1.40                  |
| 33 | CL31B333KFESNN □ |                    | 33nF        | 350                       | ±10%                     | 1.25                  |
| 34 | CL31B333KCCNNN □ |                    | 33nF        | 100                       | ±10%                     | 1.00                  |
| 35 | CL31B333KGHNNN □ |                    | 33nF        | 500                       | ±10%                     | 1.80                  |
| 36 | CL31B333KHHNNN □ |                    | 33nF        | 630                       | ±10%                     | 1.80                  |
| 37 | CL31B473KDFNNN □ |                    | 47nF        | 200                       | ±10%                     | 1.40                  |
| 38 | CL31B473KFHSNN □ |                    | 47nF        | 350                       | ±10%                     | 1.80                  |
| 39 | CL31B473KCCNNN □ |                    | 47nF        | 100                       | ±10%                     | 1.00                  |
| 40 | CL31B473KEHNNN □ |                    | 47nF        | 250                       | ±10%                     | 1.80                  |
| 41 | CL31B683KEHNNN □ |                    | 68nF        | 250                       | ±10%                     | 1.80                  |
| 42 | CL31B104KDHNNN □ |                    | 100nF       | 200                       | ±10%                     | 1.80                  |
| 43 | CL31B104KCFNNN □ |                    | 100nF       | 100                       | ±10%                     | 1.40                  |
| 44 | CL31B104KEHNNN □ |                    | 100nF       | 250                       | ±10%                     | 1.80                  |
| 45 | CL31B154KCHNNN □ |                    | 150nF       | 100                       | ±10%                     | 1.80                  |
| 46 | CL31B105KCHNNN □ |                    | 1μF         | 100                       | ±10%                     | 1.80                  |
| 47 | CL31B155KCHNNN □ |                    | 1.5μF       | 100                       | ±10%                     | 1.80                  |
| 48 | CL31B225KCHNNN □ |                    | 2.2μF       | 100                       | ±10%                     | 1.80                  |
| 1  | CL32B102KJFNNN □ | 3.20×2.50          | 1nF         | 2000                      | ±10%                     | 1.45                  |
| 2  | CL32B472KHFNNN □ |                    | 4.7nF       | 630                       | ±10%                     | 1.45                  |
| 3  | CL32B472KIFNNN □ |                    | 4.7nF       | 1000                      | ±10%                     | 1.45                  |
| 4  | CL32B682KIFNNN □ |                    | 6.8nF       | 1000                      | ±10%                     | 1.45                  |
| 5  | CL32B103KCFNNN □ |                    | 10nF        | 100                       | ±10%                     | 1.45                  |
| 6  | CL32B153KGFNNN □ |                    | 15nF        | 500                       | ±10%                     | 1.45                  |
| 7  | CL32B223KGFNNN □ |                    | 22nF        | 500                       | ±10%                     | 1.45                  |
| 8  | CL32B333KHHNNN □ |                    | 33nF        | 630                       | ±10%                     | 1.80                  |
| 9  | CL32B333KGHNNN □ |                    | 33nF        | 500                       | ±10%                     | 1.80                  |
| 10 | CL32B473KHHNNN □ |                    | 47nF        | 630                       | ±10%                     | 1.80                  |

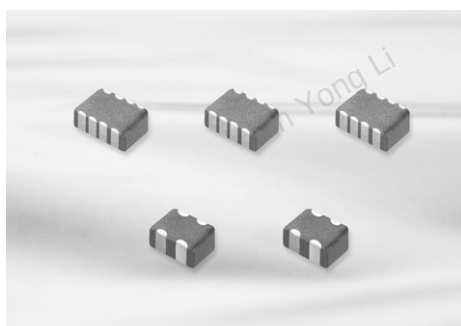
※ □ mark means packaging code. If you want to learn the code or quantity in detail, please see p74.

Part Numbering  
SystemStandard &  
High CapacitorsSuper Small Size  
CapacitorsHigh-Q  
CapacitorsMedium-High  
Voltage CapacitorsArray Type  
CapacitorsLow ESL  
CapacitorsReliability Test  
ConditionPremium Capacitors  
for Automotive  
ApplicationsPackaging  
SpecificationApplication Manual  
for Surface Mounting

## Product Lineup (Medium-High Voltage Capacitors-X7R)

|    | Part Number      | Size L x W<br>(mm) | Capacitance | Rated<br>Voltage<br>(Vdc) | Capacitance<br>Tolerance | Thickness<br>Max.(mm) |
|----|------------------|--------------------|-------------|---------------------------|--------------------------|-----------------------|
| 11 | CL32B473KDHNNN □ | 3.20×2.50          | 47nF        | 200                       | ±10%                     | 1.80                  |
| 12 | CL32B473KGHNNN □ |                    | 47nF        | 500                       | ±10%                     | 1.80                  |
| 13 | CL32B683KDINNN □ |                    | 68nF        | 200                       | ±10%                     | 2.20                  |
| 14 | CL32B104KEJNNN □ |                    | 100nF       | 250                       | ±10%                     | 2.70                  |
| 15 | CL32B104KDINNN □ |                    | 100nF       | 200                       | ±10%                     | 2.20                  |
| 16 | CL32B154KCFNNN □ |                    | 150nF       | 100                       | ±10%                     | 1.45                  |
| 17 | CL32B154KDJNNN □ |                    | 150nF       | 200                       | ±10%                     | 2.70                  |
| 18 | CL32B154KEJNNN □ |                    | 150nF       | 250                       | ±10%                     | 2.70                  |
| 19 | CL32B224KCHNNN □ |                    | 220nF       | 100                       | ±10%                     | 1.80                  |
| 20 | CL32B224KDJNNN □ |                    | 220nF       | 200                       | ±10%                     | 2.70                  |
| 21 | CL32B224KEJNNN □ |                    | 220nF       | 250                       | ±10%                     | 2.70                  |
| 22 | CL32B334KCHNNN □ |                    | 330nF       | 100                       | ±10%                     | 1.80                  |
| 23 | CL32B474KCIINN □ |                    | 470nF       | 100                       | ±10%                     | 2.20                  |
| 24 | CL32B105KCJNNN □ |                    | 1μF         | 100                       | ±10%                     | 2.70                  |
| 25 | CL32B155KCHNNN □ |                    | 1.5μF       | 100                       | ±10%                     | 1.80                  |
| 26 | CL32B225KCJNNN □ |                    | 2.2μF       | 100                       | ±10%                     | 2.70                  |
| 1  | CL43B102KJFNNN □ | 4.50×3.20          | 1nF         | 2000                      | ±10%                     | 1.45                  |
| 2  | CL43B152KJFNNN □ |                    | 1.5nF       | 2000                      | ±10%                     | 1.45                  |
| 3  | CL43B222KIFNNN □ |                    | 2.2nF       | 1000                      | ±10%                     | 1.45                  |
| 4  | CL43B222KJFNNN □ |                    | 2.2nF       | 2000                      | ±10%                     | 1.45                  |
| 5  | CL43B332KJFNNN □ |                    | 3.3nF       | 2000                      | ±10%                     | 1.45                  |
| 6  | CL43B103KIFNNN □ |                    | 10nF        | 1000                      | ±10%                     | 1.45                  |
| 7  | CL43B333KIJNNN □ |                    | 33nF        | 1000                      | ±10%                     | 2.70                  |
| 8  | CL43B473KGFNNN □ |                    | 47nF        | 500                       | ±10%                     | 1.45                  |
| 9  | CL43B473KHFNNN □ |                    | 47nF        | 630                       | ±10%                     | 1.45                  |
| 10 | CL43B104KGINNN □ |                    | 100nF       | 500                       | ±10%                     | 2.20                  |
| 11 | CL43B104KDFNNN □ |                    | 100nF       | 200                       | ±10%                     | 1.45                  |
| 12 | CL43B104KHINNN □ |                    | 100nF       | 630                       | ±10%                     | 2.20                  |
| 13 | CL43B224KCFNNN □ |                    | 220nF       | 100                       | ±10%                     | 1.45                  |
| 14 | CL43B334KCFNNN □ |                    | 330nF       | 100                       | ±10%                     | 1.45                  |
| 15 | CL43B474KEJNNN □ |                    | 470nF       | 250                       | ±10%                     | 2.70                  |
| 16 | CL43B474KCHNNN □ |                    | 470nF       | 100                       | ±10%                     | 1.80                  |
| 17 | CL43B474KDJNNN □ |                    | 470nF       | 200                       | ±10%                     | 2.70                  |
| 18 | CL43B105KCJNNN □ |                    | 1μF         | 100                       | ±10%                     | 2.70                  |
| 1  | CL55B103KJHNNN □ | 5.70×5.00          | 10nF        | 2000                      | ±10%                     | 1.80                  |
| 2  | CL55B473KIINNN □ |                    | 47nF        | 1000                      | ±10%                     | 2.20                  |
| 3  | CL55B224KGJNNN □ |                    | 220nF       | 500                       | ±10%                     | 2.70                  |
| 4  | CL55B224KHJNNN □ |                    | 220nF       | 630                       | ±10%                     | 2.70                  |
| 5  | CL55B105KCHNNN □ |                    | 1μF         | 100                       | ±10%                     | 1.80                  |
| 6  | CL55B105KDJNNN □ |                    | 1μF         | 200                       | ±10%                     | 2.70                  |
| 7  | CL55B105KEJNNN □ |                    | 1μF         | 250                       | ±10%                     | 2.70                  |
| 8  | CL55B475KCJNNN □ |                    | 4.7μF       | 100                       | ±10%                     | 2.70                  |

※ □ mark means packaging code. If you want to learn the code or quantity in detail, please see p74.



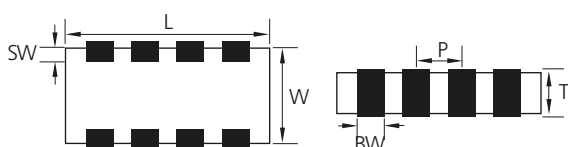
## Feature

- Reduction in required space (more than 50%)
- Reduction in cost and time for replacement of PCB
- Reduction in amount of solder joints
- Easier PCB design
- Reduced waste from tape and reel packaging process
- It protect EMI bypassing digital signal line nose

## Application

- A bypass for digital and analog signal line noise generated by telecommunication equipment and other common electronic circuits

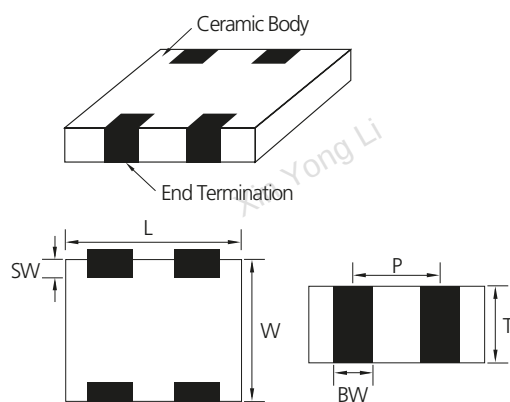
## Structure and Dimensions



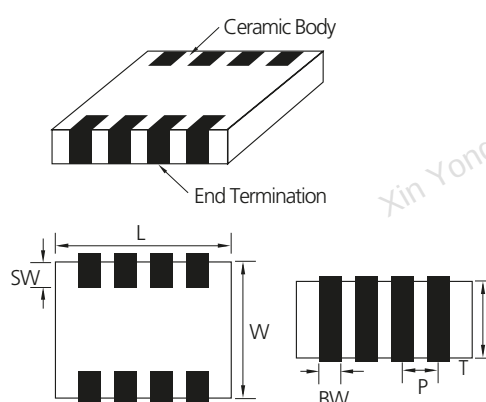
| Code | Size (mm) | EIA Code | Dimension (mm)  |                 |                                                                          |                 |                 |                 |
|------|-----------|----------|-----------------|-----------------|--------------------------------------------------------------------------|-----------------|-----------------|-----------------|
|      |           |          | L               | W               | T                                                                        | BW              | SW              | P               |
| A    | 0906      | 0302     | $0.90 \pm 0.05$ | $0.60 \pm 0.05$ | $0.45 \pm 0.05$                                                          | $0.25 \pm 0.05$ | $0.15 \pm 0.1$  | $0.45 \pm 0.05$ |
| A    | 1410      | 0504     | $1.37 \pm 0.15$ | $1.0 \pm 0.15$  | $0.35 \pm 0.05$<br>$0.50 \pm 0.05$<br>$0.60 \pm 0.06$<br>$0.80 \pm 0.08$ | $0.36 \pm 0.1$  | $0.2 \pm 0.1$   | $0.64 \pm 0.1$  |
| A    | 2012      | 0805     | $2.0 \pm 0.15$  | $1.25 \pm 0.15$ | $0.85 \pm 0.1$                                                           | $0.5 \pm 0.2$   | $0.25 \pm 0.15$ | $1.0 \pm 0.1$   |
| B    | 2012      | 0805     | $2.0 \pm 0.15$  | $1.25 \pm 0.15$ | $0.85 \pm 0.1$                                                           | $0.25 \pm 0.1$  | $0.25 \pm 0.15$ | $0.5 \pm 0.1$   |
| B    | 3216      | 1206     | $3.2 \pm 0.15$  | $1.6 \pm 0.15$  | $0.85 \pm 0.15$                                                          | $0.4 \pm 0.2$   | $0.3 \pm 0.15$  | $0.8 \pm 0.2$   |

## Structure and Control Code

### ■ A : ARRAY(2-element)



### ■ B : ARRAY(4-element)



Part Numbering System

Standard & High Capacitors

Super Small Size Capacitors

High-Q Capacitors

Medium-High Voltage Capacitors

Array Type Capacitors

Low ESL Capacitors

Reliability Test Condition

Premium Capacitors for Automotive Applications

Packaging Specification

Application Manual for Surface Mounting



## Product Lineup (Array Type Capacitors)

|    | Part Number      | Element Type | Size L x W (mm) | Capacitance | Rated Voltage (Vdc) | Capacitance Tolerance | Thickness Max.(mm) |
|----|------------------|--------------|-----------------|-------------|---------------------|-----------------------|--------------------|
| 1  | CL14C270KA6NAN □ | 2-Array      | 1.40×1.00       | 27pF        | 25                  | ± 10%                 | 0.66               |
| 1  | CL31C100JBCNBN □ | 4-Array      | 3.20×1.60       | 10pF        | 50                  | ± 5%                  | 1.00               |
| 2  | CL31C150JBCNBN □ |              |                 | 15pF        | 50                  | ± 5%                  | 1.00               |
| 3  | CL31C220JBCNBN □ |              |                 | 22pF        | 50                  | ± 5%                  | 1.00               |
| 4  | CL31C270JBCNBN □ |              |                 | 27pF        | 50                  | ± 5%                  | 1.00               |
| 5  | CL31C330KBCNBN □ |              |                 | 33pF        | 50                  | ± 10%                 | 1.00               |
| 6  | CL31C390KBCNBN □ |              |                 | 39pF        | 50                  | ± 10%                 | 1.00               |
| 7  | CL31C680JBCNBN □ |              |                 | 68pF        | 50                  | ± 5%                  | 1.00               |
| 8  | CL31C820JBCNBN □ |              |                 | 82pF        | 50                  | ± 5%                  | 1.00               |
| 9  | CL31C101JBCNBN □ |              |                 | 100pF       | 50                  | ± 5%                  | 1.00               |
| 10 | CL31C151KBCNBN □ |              |                 | 150pF       | 50                  | ± 10%                 | 1.00               |
| 11 | CL31C181JBCNBN □ |              |                 | 180pF       | 50                  | ± 5%                  | 1.00               |
| 12 | CL31C331JBCNBN □ |              |                 | 330pF       | 50                  | ± 5%                  | 1.00               |
| 13 | CL31C471JBCNBN □ |              |                 | 470pF       | 50                  | ± 5%                  | 1.00               |
| 1  | CL21B471KBCNBN □ | 4-Array      | 2.00×1.25       | 470pF       | 50                  | ± 10%                 | 0.95               |
| 2  | CL21B104KOCNBN □ |              |                 | 100nF       | 16                  | ± 10%                 | 0.95               |
| 3  | CL21B104MPCNBN □ |              |                 | 100nF       | 10                  | ± 20%                 | 0.95               |
| 1  | CL31B102MBCNBN □ | 4-Array      | 3.20×1.60       | 1nF         | 50                  | ± 20%                 | 1.00               |
| 2  | CL31B103MBCNBN □ |              |                 | 10nF        | 50                  | ± 20%                 | 1.00               |
| 3  | CL31B153KBCNBN □ |              |                 | 15nF        | 50                  | ± 10%                 | 1.00               |
| 4  | CL31B473KACNBN □ |              |                 | 47nF        | 25                  | ± 10%                 | 1.00               |
| 5  | CL31B104KACNBN □ |              |                 | 100nF       | 25                  | ± 10%                 | 1.00               |
| 6  | CL31B104KOCNBN □ |              |                 | 100nF       | 16                  | ± 10%                 | 1.00               |
| 1  | CL09A104KP4SAN □ | 2-Array      | 0.90×0.60       | 100nF       | 10                  | ± 10%                 | 0.50               |
| 2  | CL09A104KQ4SAN □ |              |                 | 100nF       | 6.3                 | ± 10%                 | 0.50               |
| 3  | CL09A105MQ4NAN □ |              |                 | 1μF         | 6.3                 | ± 20%                 | 0.50               |
| 4  | CL09A105MR4NAN □ |              |                 | 1μF         | 4                   | ± 20%                 | 0.50               |
| 1  | CL14A104KA6NAN □ | 2-Array      | 1.40×1.00       | 100nF       | 25                  | ± 10%                 | 0.66               |
| 2  | CL14A104KO6NAN □ |              |                 | 100nF       | 16                  | ± 10%                 | 0.66               |
| 3  | CL14A104KP6NAN □ |              |                 | 100nF       | 10                  | ± 10%                 | 0.66               |
| 4  | CL14A105MA5NAN □ |              |                 | 1μF         | 25                  | ± 20%                 | 0.55               |
| 5  | CL14A105KP8NAN □ |              |                 | 1μF         | 10                  | ± 10%                 | 0.88               |
| 6  | CL14A105MO3NAN □ |              |                 | 1μF         | 16                  | ± 20%                 | 0.40               |
| 7  | CL14A105MO8NAN □ |              |                 | 1μF         | 16                  | ± 20%                 | 0.88               |
| 8  | CL14A105MO5NAN □ |              |                 | 1μF         | 16                  | ± 20%                 | 0.55               |
| 9  | CL14A105MP3NAN □ |              |                 | 1μF         | 10                  | ± 20%                 | 0.40               |
| 10 | CL14A105MP5NAN □ |              |                 | 1μF         | 10                  | ± 20%                 | 0.55               |
| 11 | CL14A225KP8NAN □ |              |                 | 2.2μF       | 10                  | ± 10%                 | 0.88               |
| 12 | CL14A225KQ8NAN □ |              |                 | 2.2μF       | 6.3                 | ± 10%                 | 0.88               |
| 1  | CL21A105KOCNAN □ | 2-Array      | 2.00×1.25       | 1μF         | 16                  | ± 10%                 | 0.95               |
| 2  | CL21A105MPCNAN □ |              |                 | 1μF         | 10                  | ± 20%                 | 0.95               |
| 1  | CL31F473ZBCNBN □ | 4-Array      | 3.20×1.60       | 47nF        | 50                  | +80/-20%              | 1.00               |
| 2  | CL31F104ZACNBN □ |              |                 | 100nF       | 25                  | +80/-20%              | 1.00               |

※ □ mark means packaging code. If you want to learn the code or quantity in detail, please see p74.

Part Numbering System

Standard &amp; High Capacitors

Super Small Size Capacitors

High-Q Capacitors

Medium-High Voltage Capacitors

Array Type Capacitors

Low ESL Capacitors

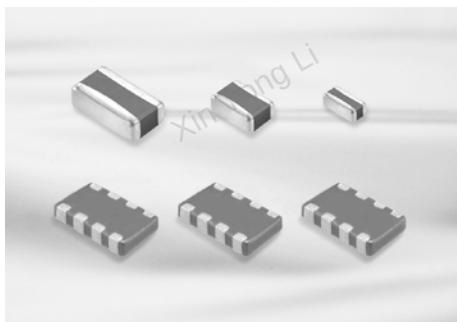
Reliability Test Condition

Premium Capacitors for Automotive Applications

Packaging Specification

Application Manual for Surface Mounting

# Low ESL Capacitors



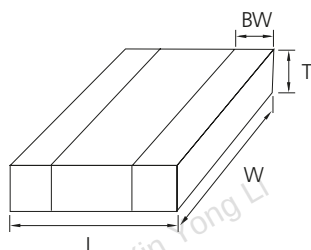
## Feature

- Low ESL, good for noise reduction for high frequency
- Highly reliable tolerance and high speed automatic chip placement on PCBs
- Highly reliable performance
- Highly resistant termination metal
- Tape & reel for surface mount assembly

## Application

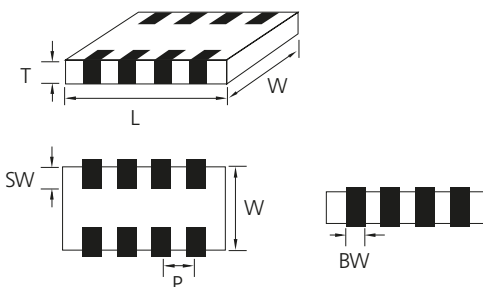
- High Speed Microprocessor
- High Frequency Digital Equipment

## LICC(Low Inductance Ceramic Capacitors)



| Code | Size (mm) | EIA Code | Dimension(mm)   |                |                      |                 |
|------|-----------|----------|-----------------|----------------|----------------------|-----------------|
|      |           |          | L               | W              | T                    | BW              |
| L5   | 0510      | 0204     | $0.52 \pm 0.05$ | $1.0 \pm 0.05$ | $0.3 \pm 0.05$       | $0.18 \pm 0.06$ |
| 01   | 0816      | 0306     | $0.8 \pm 0.15$  | $1.6 \pm 0.2$  | $0.5 + 0.05 / - 0.1$ | $0.25 \pm 0.15$ |

## SLIC(Super Low Inductance Capacitors)



| Code | Size (mm) | EIA Code | Dimension(mm) |                |                     |                     |                    |               |
|------|-----------|----------|---------------|----------------|---------------------|---------------------|--------------------|---------------|
|      |           |          | L             | W              | T                   | BW                  | SW                 | P             |
| 10   | 1608      | 0603     | $1.6 \pm 0.1$ | $0.8 \pm 0.1$  | $0.5 / +0.05 - 0.1$ | $0.25 \pm 0.1$      | $0.15 \pm 0.1$     | $0.4 \pm 0.1$ |
| 21   | 2012      | 0805     | $2.0 \pm 0.1$ | $1.25 \pm 0.1$ | $0.5 / +0.05 - 0.1$ | $0.25 + 0.15 - 0.1$ | $0.2 + 0.15 - 0.1$ | $0.5 \pm 0.1$ |

Low ESL capacitance Table (LICC)

| TC                  | Size(mm)   | Tmax(mm) | Vr(V) | Capacitance( $\mu$ F) |       |       |     |      |      |     |     |     |    |
|---------------------|------------|----------|-------|-----------------------|-------|-------|-----|------|------|-----|-----|-----|----|
|                     |            |          |       | 0.01                  | 0.022 | 0.047 | 0.1 | 0.22 | 0.47 | 1   | 2.2 | 4.7 | 10 |
| X6S<br>/X7S<br>/X7T | 0204(0510) | 0.35     | 2.5   |                       |       |       |     |      |      | X7T |     |     |    |
|                     |            |          | 4     |                       |       |       | X7S |      | X6S  |     |     |     |    |
|                     |            |          | 6.3   |                       |       |       | X7S |      |      |     |     |     |    |
|                     | 0306(0816) | 0.55     | 4     |                       |       |       |     |      |      | X7S |     |     |    |

| TC          | Size(mm)   | Tmax(mm) | Vr(V) | Capacitance( $\mu$ F) |       |       |     |      |      |     |     |     |    |
|-------------|------------|----------|-------|-----------------------|-------|-------|-----|------|------|-----|-----|-----|----|
|             |            |          |       | 0.01                  | 0.022 | 0.047 | 0.1 | 0.22 | 0.47 | 1   | 2.2 | 4.7 | 10 |
| X7R<br>/X5R | 0306(0816) | 0.55     | 6.3   |                       |       | X7R   |     |      |      | X5R |     |     |    |
|             |            |          | 10    |                       |       | X7R   |     |      |      |     |     |     |    |
|             |            |          | 16    |                       |       | X7R   |     |      |      |     |     |     |    |
|             |            |          | 25    |                       |       | X7R   |     |      |      |     |     |     |    |
|             |            |          | 50    |                       |       | X7R   |     |      |      |     |     |     |    |

Low ESL capacitance Table (SLIC)

| TC                  | Size(mm)   | Tmax(mm) | Vr(V) | Capacitance( $\mu$ F) |      |      |   |     |     |    |    |
|---------------------|------------|----------|-------|-----------------------|------|------|---|-----|-----|----|----|
|                     |            |          |       | 0.1                   | 0.47 | 0.68 | 1 | 2.2 | 4.7 | 10 | 22 |
| X7R<br>/X7S<br>/X7T | 0603(1608) | 0.55     | 4     |                       |      | X7S  |   |     |     |    |    |
|                     | 0805(2012) | 0.55     | 4     |                       |      | X7R  |   | X7S |     |    |    |
|                     |            |          | 6.3   |                       |      | X7R  |   |     |     |    |    |
|                     |            |          | 16    |                       |      | X7R  |   |     |     |    |    |

Part Numbering  
SystemStandard &  
High CapacitorsSuper Small Size  
CapacitorsHigh-Q  
CapacitorsMedium-High  
Voltage CapacitorsArray Type  
CapacitorsLow ESL  
CapacitorsReliability Test  
ConditionPremium Capacitors  
for Automotive  
ApplicationsPackaging  
SpecificationApplication Manual  
for Surface Mounting

**Product Lineup (Low ESL Capacitors-X7R, X6S, X7S, X7T)**

|   | Part Number      | Size L x W<br>(mm) | Capacitance | Rated<br>Voltage<br>(Vdc) | Capacitance<br>Tolerance | Thickness<br>Max.(mm) |
|---|------------------|--------------------|-------------|---------------------------|--------------------------|-----------------------|
| 1 | CL21B104M05N1N □ | 2.00×1.25          | 100nF       | 16                        | ± 20%                    | 0.55                  |
| 2 | CL21B684M05N1N □ |                    | 680nF       | 16                        | ± 20%                    | 0.55                  |
| 3 | CL21B684MQ5N1N □ |                    | 680nF       | 6.3                       | ± 20%                    | 0.55                  |
| 1 | CLL5X224MR3NLN □ | 0.50×1.00          | 220nF       | 4                         | ± 20%                    | 0.35                  |
| 2 | CLL5X474MR3NLN □ |                    | 470nF       | 4                         | ± 20%                    | 0.35                  |
| 3 | CLL5X105MR3NLN □ |                    | 1μF         | 4                         | ± 20%                    | 0.35                  |
| 1 | CLL5Y104MQ3NLN □ | 0.50×1.00          | 100nF       | 6.3                       | ± 20%                    | 0.35                  |
| 1 | CL01Y105MR5NLN □ | 0.80×1.60          | 1μF         | 4                         | ± 20%                    | 0.55                  |
| 2 | CL01Y225MR5NLN □ |                    | 2.2μF       | 4                         | ± 20%                    | 0.55                  |
| 1 | CL10Y474MR5N1N □ | 1.60×0.80          | 470nF       | 4                         | ± 20%                    | 0.55                  |
| 2 | CL10Y105MR5N1N □ |                    | 1μF         | 4                         | ± 20%                    | 0.55                  |
| 3 | CL10Y225MR5N1N □ |                    | 2.2μF       | 4                         | ± 20%                    | 0.55                  |
| 1 | CL21Y105MR5N1N □ | 2.00×1.25          | 1μF         | 4                         | ± 20%                    | 0.55                  |
| 2 | CL21Y225MR5N1N □ |                    | 2.2μF       | 4                         | ± 20%                    | 0.55                  |
| 1 | CLL5Z105MS3NLN □ | 0.50×1.00          | 1μF         | 2.5                       | ± 20%                    | 0.35                  |

※ □ mark means packaging code. If you want to learn the code or quantity in detail, please see p74.

# Reliability Test Capacitors

| No                                                                                                  | Item                              |                    | Performance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Test Condition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                   |                    |                       |     |                                   |     |                                   |            |                      |               |      |                        |                                   |     |                       |            |                      |               |      |                 |                                  |     |                                   |     |                       |             |          |             |           |         |
|-----------------------------------------------------------------------------------------------------|-----------------------------------|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|--------------------|-----------------------|-----|-----------------------------------|-----|-----------------------------------|------------|----------------------|---------------|------|------------------------|-----------------------------------|-----|-----------------------|------------|----------------------|---------------|------|-----------------|----------------------------------|-----|-----------------------------------|-----|-----------------------|-------------|----------|-------------|-----------|---------|
| 1                                                                                                   | Appearance                        |                    | No abnormal exterior appearance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Visual Inspection throughMicroscope(x10)                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                   |                    |                       |     |                                   |     |                                   |            |                      |               |      |                        |                                   |     |                       |            |                      |               |      |                 |                                  |     |                                   |     |                       |             |          |             |           |         |
| 2                                                                                                   | Insulation Resistance             |                    | 10,000M $\Omega$ min. or 500M $\Omega$ · $\mu$ F min.(or*100M $\Omega$ · $\mu$ F) product whichever is smaller<br>(Rated voltage $\leq$ 16V:10,000M $\Omega$ min. or 100M $\Omega$ · $\mu$ F min. product whichever is smaller)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Apply the rated voltage for 60~120 sec.<br>Rated voltage > 500V: Insulation Resistance shall be measured with 500 $\pm$ 50Vdc                                                                                                                                                                                                                                                                                                                                                                         |                                   |                    |                       |     |                                   |     |                                   |            |                      |               |      |                        |                                   |     |                       |            |                      |               |      |                 |                                  |     |                                   |     |                       |             |          |             |           |         |
| 3                                                                                                   | Withstanding Voltage              |                    | No dielectric breakdown or mechanical breakdown                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Apply the specified voltage* for 1~5 sec.<br>Charge / Discharge current limit: 50mA max.<br>*CLASS I (Rated Voltage < 100V) : 300% of the rated Voltage<br>CLASS II (Rated Voltage < 100V) : 250% of the rated Voltage<br><br>In the case of Vr $\geq$ 100V products, following condition should be applied.<br>100V $\leq$ Rated Voltage < 500V : 200% of the rated Voltage<br>500V $\leq$ Rated Voltage < 1000V :150% of the rated Voltage<br>Rated Voltage $\geq$ 1000V :120% of the rated Voltage |                                   |                    |                       |     |                                   |     |                                   |            |                      |               |      |                        |                                   |     |                       |            |                      |               |      |                 |                                  |     |                                   |     |                       |             |          |             |           |         |
| 4                                                                                                   | Capacitance                       | CLASS I            | Within the specified tolerance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Capacitance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Frequency                         | Voltage            |                       |     |                                   |     |                                   |            |                      |               |      |                        |                                   |     |                       |            |                      |               |      |                 |                                  |     |                                   |     |                       |             |          |             |           |         |
|                                                                                                     |                                   |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | $\leq$ 1,000 pF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 1MHz $\pm$ 10%                    | 0.5 ~ 5 Vrms       |                       |     |                                   |     |                                   |            |                      |               |      |                        |                                   |     |                       |            |                      |               |      |                 |                                  |     |                                   |     |                       |             |          |             |           |         |
|                                                                                                     |                                   |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | >1,000 pF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1KHz $\pm$ 10%                    |                    |                       |     |                                   |     |                                   |            |                      |               |      |                        |                                   |     |                       |            |                      |               |      |                 |                                  |     |                                   |     |                       |             |          |             |           |         |
|                                                                                                     |                                   | CLASS II           | Within the specified tolerance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Capacitance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Frequency                         | Voltage            |                       |     |                                   |     |                                   |            |                      |               |      |                        |                                   |     |                       |            |                      |               |      |                 |                                  |     |                                   |     |                       |             |          |             |           |         |
|                                                                                                     |                                   |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | $\leq$ 10 $\mu$ F                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1KHz $\pm$ 10%                    | 1.0 $\pm$ 0.2 Vrms |                       |     |                                   |     |                                   |            |                      |               |      |                        |                                   |     |                       |            |                      |               |      |                 |                                  |     |                                   |     |                       |             |          |             |           |         |
|                                                                                                     |                                   |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | >10 $\mu$ F                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 120Hz $\pm$ 20%                   | 0.5 $\pm$ 0.1Vrms  |                       |     |                                   |     |                                   |            |                      |               |      |                        |                                   |     |                       |            |                      |               |      |                 |                                  |     |                                   |     |                       |             |          |             |           |         |
|                                                                                                     |                                   |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | *                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1KHz $\pm$ 10%                    | 0.5 $\pm$ 0.1Vrms  |                       |     |                                   |     |                                   |            |                      |               |      |                        |                                   |     |                       |            |                      |               |      |                 |                                  |     |                                   |     |                       |             |          |             |           |         |
|                                                                                                     |                                   |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | * A capacitor prior to measuring the capacitance is heat treated at 150 $^{\circ}$ C+0/-10 $^{\circ}$ C and maintained in ambient air for 24 $\pm$ 2 hours.                                                                                                                                                                                                                                                                                                                                           |                                   |                    |                       |     |                                   |     |                                   |            |                      |               |      |                        |                                   |     |                       |            |                      |               |      |                 |                                  |     |                                   |     |                       |             |          |             |           |         |
| 5                                                                                                   | Q                                 | CLASS I            | Capacitance $\geq$ 30pF: Q $\geq$ 1,000<br>< 30pF: Q $\geq$ 400 + 20 $\times$ C<br>(C : Capacitance)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Capacitance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Frequency                         | Voltage            |                       |     |                                   |     |                                   |            |                      |               |      |                        |                                   |     |                       |            |                      |               |      |                 |                                  |     |                                   |     |                       |             |          |             |           |         |
|                                                                                                     |                                   |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | $\leq$ 1,000 pF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 1MHz $\pm$ 10%                    | 0.5 ~ 5 Vrms       |                       |     |                                   |     |                                   |            |                      |               |      |                        |                                   |     |                       |            |                      |               |      |                 |                                  |     |                                   |     |                       |             |          |             |           |         |
|                                                                                                     | > 1,000 pF                        | 1KHz $\pm$ 10%     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                   |                    |                       |     |                                   |     |                                   |            |                      |               |      |                        |                                   |     |                       |            |                      |               |      |                 |                                  |     |                                   |     |                       |             |          |             |           |         |
|                                                                                                     | Tan $\delta$                      | CLASS II           | 1. Characteristic : A(X5R)<br><table><tr><td>Rated Voltage</td><td>Spec</td></tr><tr><td>50V / 35V</td><td>0.025 max / 0.05 max*</td></tr><tr><td>25V</td><td>0.025 max / 0.05 max* / 0.10 max*</td></tr><tr><td>16V</td><td>0.035 max / 0.05 max* / 0.10 max*</td></tr><tr><td><math>\leq</math> 10V</td><td>0.05 max / 0.10 max*</td></tr></table><br>2. Characteristic : B(X7R), X(X6S), Y(X7S)<br><table><tr><td>Rated Voltage</td><td>Spec</td></tr><tr><td>50V<math>\geq</math> / 35V / 25V</td><td>0.025 max / 0.05 max* / 0.10 max*</td></tr><tr><td>16V</td><td>0.035 max / 0.10 max*</td></tr><tr><td><math>\leq</math> 10V</td><td>0.05 max / 0.10 max*</td></tr></table><br>3. Characteristic : F(Y5V)<br><table><tr><td>Rated Voltage</td><td>Spec</td></tr><tr><td>50V / 35V / 25V</td><td>0.05 max / 0.07 max* / 0.09 max*</td></tr><tr><td>16V</td><td>0.07 max / 0.09 max* / 0.125 max*</td></tr><tr><td>10V</td><td>0.125 max / 0.16 max*</td></tr><tr><td><math>\leq</math> 6.3V</td><td>0.16 max</td></tr></table> | Rated Voltage                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Spec                              | 50V / 35V          | 0.025 max / 0.05 max* | 25V | 0.025 max / 0.05 max* / 0.10 max* | 16V | 0.035 max / 0.05 max* / 0.10 max* | $\leq$ 10V | 0.05 max / 0.10 max* | Rated Voltage | Spec | 50V $\geq$ / 35V / 25V | 0.025 max / 0.05 max* / 0.10 max* | 16V | 0.035 max / 0.10 max* | $\leq$ 10V | 0.05 max / 0.10 max* | Rated Voltage | Spec | 50V / 35V / 25V | 0.05 max / 0.07 max* / 0.09 max* | 16V | 0.07 max / 0.09 max* / 0.125 max* | 10V | 0.125 max / 0.16 max* | $\leq$ 6.3V | 0.16 max | Capacitance | Frequency | Voltage |
|                                                                                                     |                                   |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Rated Voltage                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Spec                              |                    |                       |     |                                   |     |                                   |            |                      |               |      |                        |                                   |     |                       |            |                      |               |      |                 |                                  |     |                                   |     |                       |             |          |             |           |         |
|                                                                                                     |                                   |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 50V / 35V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0.025 max / 0.05 max*             |                    |                       |     |                                   |     |                                   |            |                      |               |      |                        |                                   |     |                       |            |                      |               |      |                 |                                  |     |                                   |     |                       |             |          |             |           |         |
|                                                                                                     |                                   |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 25V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0.025 max / 0.05 max* / 0.10 max* |                    |                       |     |                                   |     |                                   |            |                      |               |      |                        |                                   |     |                       |            |                      |               |      |                 |                                  |     |                                   |     |                       |             |          |             |           |         |
|                                                                                                     |                                   |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 16V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0.035 max / 0.05 max* / 0.10 max* |                    |                       |     |                                   |     |                                   |            |                      |               |      |                        |                                   |     |                       |            |                      |               |      |                 |                                  |     |                                   |     |                       |             |          |             |           |         |
|                                                                                                     |                                   |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | $\leq$ 10V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.05 max / 0.10 max*              |                    |                       |     |                                   |     |                                   |            |                      |               |      |                        |                                   |     |                       |            |                      |               |      |                 |                                  |     |                                   |     |                       |             |          |             |           |         |
|                                                                                                     |                                   |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Rated Voltage                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Spec                              |                    |                       |     |                                   |     |                                   |            |                      |               |      |                        |                                   |     |                       |            |                      |               |      |                 |                                  |     |                                   |     |                       |             |          |             |           |         |
| 50V $\geq$ / 35V / 25V                                                                              |                                   |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.025 max / 0.05 max* / 0.10 max*                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                   |                    |                       |     |                                   |     |                                   |            |                      |               |      |                        |                                   |     |                       |            |                      |               |      |                 |                                  |     |                                   |     |                       |             |          |             |           |         |
| 16V                                                                                                 | 0.035 max / 0.10 max*             |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                   |                    |                       |     |                                   |     |                                   |            |                      |               |      |                        |                                   |     |                       |            |                      |               |      |                 |                                  |     |                                   |     |                       |             |          |             |           |         |
| $\leq$ 10V                                                                                          | 0.05 max / 0.10 max*              |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                   |                    |                       |     |                                   |     |                                   |            |                      |               |      |                        |                                   |     |                       |            |                      |               |      |                 |                                  |     |                                   |     |                       |             |          |             |           |         |
| Rated Voltage                                                                                       | Spec                              |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                   |                    |                       |     |                                   |     |                                   |            |                      |               |      |                        |                                   |     |                       |            |                      |               |      |                 |                                  |     |                                   |     |                       |             |          |             |           |         |
| 50V / 35V / 25V                                                                                     | 0.05 max / 0.07 max* / 0.09 max*  |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                   |                    |                       |     |                                   |     |                                   |            |                      |               |      |                        |                                   |     |                       |            |                      |               |      |                 |                                  |     |                                   |     |                       |             |          |             |           |         |
| 16V                                                                                                 | 0.07 max / 0.09 max* / 0.125 max* |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                   |                    |                       |     |                                   |     |                                   |            |                      |               |      |                        |                                   |     |                       |            |                      |               |      |                 |                                  |     |                                   |     |                       |             |          |             |           |         |
| 10V                                                                                                 | 0.125 max / 0.16 max*             |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                   |                    |                       |     |                                   |     |                                   |            |                      |               |      |                        |                                   |     |                       |            |                      |               |      |                 |                                  |     |                                   |     |                       |             |          |             |           |         |
| $\leq$ 6.3V                                                                                         | 0.16 max                          |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                   |                    |                       |     |                                   |     |                                   |            |                      |               |      |                        |                                   |     |                       |            |                      |               |      |                 |                                  |     |                                   |     |                       |             |          |             |           |         |
| $\leq$ 10 $\mu$ F                                                                                   | 1KHz $\pm$ 10%                    | 1.0 $\pm$ 0.2 Vrms |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                   |                    |                       |     |                                   |     |                                   |            |                      |               |      |                        |                                   |     |                       |            |                      |               |      |                 |                                  |     |                                   |     |                       |             |          |             |           |         |
| > 10 $\mu$ F                                                                                        | 120Hz $\pm$ 20%                   | 0.5 $\pm$ 0.1Vrms  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                   |                    |                       |     |                                   |     |                                   |            |                      |               |      |                        |                                   |     |                       |            |                      |               |      |                 |                                  |     |                                   |     |                       |             |          |             |           |         |
| *                                                                                                   | 1KHz $\pm$ 10%                    | 0.5 $\pm$ 0.1Vrms  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                   |                    |                       |     |                                   |     |                                   |            |                      |               |      |                        |                                   |     |                       |            |                      |               |      |                 |                                  |     |                                   |     |                       |             |          |             |           |         |
| You can check the specification at the web site or contact sales people for each product with mark* |                                   |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                   |                    |                       |     |                                   |     |                                   |            |                      |               |      |                        |                                   |     |                       |            |                      |               |      |                 |                                  |     |                                   |     |                       |             |          |             |           |         |

※ The conditions of measurement may be altered upon request.

Part Numbering System

Standard & High Capacitors

Super Small Size Capacitors

High-Q Capacitors

Medium-High Voltage Capacitors

Array Type Capacitors

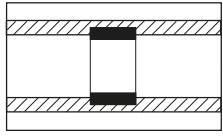
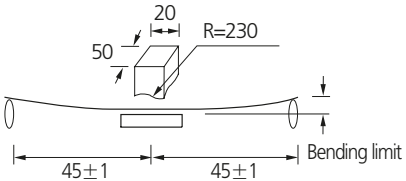
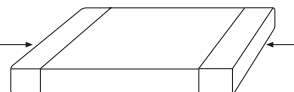
Low ESL Capacitors

Reliability Test Condition

Premium Capacitors for Automotive Applications

Packaging Specification

Application Manual for Surface Mounting

| No                                    | Item                                       |                                                                                                                                                                                                                                                                                                   | Performance                                                                                                                                                                                                                                                                                      | Test Condition                     |                          |                                        |                                     |                                                                                                                                                                                                                                                                                                                                                       |                                       |                                       |            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                    |   |        |   |                          |   |        |
|---------------------------------------|--------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|--------------------------|----------------------------------------|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|---------------------------------------|------------|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|---|--------|---|--------------------------|---|--------|
| 6                                     | Temperature Characteristics of Capacitance | CLASS I                                                                                                                                                                                                                                                                                           | <table><tr><th>Characteristic</th><th>Temp.Coefficient(PPM/°C)</th></tr><tr><td>C</td><td>0±30</td></tr></table>                                                                                                                                                                                 | Characteristic                     | Temp.Coefficient(PPM/°C) | C                                      | 0±30                                | Capacitance shall be measured by the steps shown in the following table. <table><tr><th>Step</th><th>Temperature (°C)</th></tr><tr><td>1</td><td>25 ± 2</td></tr><tr><td>2</td><td>Min. Operating Temp. ± 2</td></tr><tr><td>3</td><td>25 ± 2</td></tr><tr><td>4</td><td>Max. Operating Temp. ± 2</td></tr><tr><td>5</td><td>25 ± 2</td></tr></table> | Step                                  | Temperature (°C)                      | 1          | 25 ± 2      | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Min. Operating Temp. ± 2                                                                                                           | 3 | 25 ± 2 | 4 | Max. Operating Temp. ± 2 | 5 | 25 ± 2 |
|                                       |                                            | Characteristic                                                                                                                                                                                                                                                                                    | Temp.Coefficient(PPM/°C)                                                                                                                                                                                                                                                                         |                                    |                          |                                        |                                     |                                                                                                                                                                                                                                                                                                                                                       |                                       |                                       |            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                    |   |        |   |                          |   |        |
| C                                     | 0±30                                       |                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                  |                                    |                          |                                        |                                     |                                                                                                                                                                                                                                                                                                                                                       |                                       |                                       |            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                    |   |        |   |                          |   |        |
| Step                                  | Temperature (°C)                           |                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                  |                                    |                          |                                        |                                     |                                                                                                                                                                                                                                                                                                                                                       |                                       |                                       |            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                    |   |        |   |                          |   |        |
| 1                                     | 25 ± 2                                     |                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                  |                                    |                          |                                        |                                     |                                                                                                                                                                                                                                                                                                                                                       |                                       |                                       |            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                    |   |        |   |                          |   |        |
| 2                                     | Min. Operating Temp. ± 2                   |                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                  |                                    |                          |                                        |                                     |                                                                                                                                                                                                                                                                                                                                                       |                                       |                                       |            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                    |   |        |   |                          |   |        |
| 3                                     | 25 ± 2                                     |                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                  |                                    |                          |                                        |                                     |                                                                                                                                                                                                                                                                                                                                                       |                                       |                                       |            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                    |   |        |   |                          |   |        |
| 4                                     | Max. Operating Temp. ± 2                   |                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                  |                                    |                          |                                        |                                     |                                                                                                                                                                                                                                                                                                                                                       |                                       |                                       |            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                    |   |        |   |                          |   |        |
| 5                                     | 25 ± 2                                     |                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                  |                                    |                          |                                        |                                     |                                                                                                                                                                                                                                                                                                                                                       |                                       |                                       |            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                    |   |        |   |                          |   |        |
|                                       | CLASS II                                   | <table><tr><th>Characteristic</th><th>Capacitance Change(%) with No bias</th></tr><tr><td>A(X5R)/B(X7R)</td><td>±15%</td></tr><tr><td>X(X6S), Y(X7S)</td><td>±22%</td></tr><tr><td>Z(X7T)</td><td>+22%~-33%</td></tr><tr><td>F(Y5V)</td><td>+22%~-82%</td></tr></table>                           | Characteristic                                                                                                                                                                                                                                                                                   | Capacitance Change(%) with No bias | A(X5R)/B(X7R)            | ±15%                                   | X(X6S), Y(X7S)                      | ±22%                                                                                                                                                                                                                                                                                                                                                  | Z(X7T)                                | +22%~-33%                             | F(Y5V)     | +22%~-82%   | (1) CLASS I<br>Temperature Coefficient shall be calculated from the formula as below<br>$\text{Temp. Coefficient} = \frac{C_2 - C_1}{C_1 \times \Delta T} \times 10^6 [\text{ppm}/^\circ\text{C}]$<br>C1: Capacitance at step 3<br>C2: Capacitance at 125°C<br>ΔT: 100°C (=125°C -25°C)<br>(2) CLASS II<br>Capacitance Change shall be calculated from the formula as below<br>$\Delta C = \frac{C_2 - C_1}{C_1} \times 100(\%)$<br>C1: Capacitance at step 3<br>C2: Capacitance at step 2 or 4 |                                                                                                                                    |   |        |   |                          |   |        |
| Characteristic                        | Capacitance Change(%) with No bias         |                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                  |                                    |                          |                                        |                                     |                                                                                                                                                                                                                                                                                                                                                       |                                       |                                       |            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                    |   |        |   |                          |   |        |
| A(X5R)/B(X7R)                         | ±15%                                       |                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                  |                                    |                          |                                        |                                     |                                                                                                                                                                                                                                                                                                                                                       |                                       |                                       |            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                    |   |        |   |                          |   |        |
| X(X6S), Y(X7S)                        | ±22%                                       |                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                  |                                    |                          |                                        |                                     |                                                                                                                                                                                                                                                                                                                                                       |                                       |                                       |            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                    |   |        |   |                          |   |        |
| Z(X7T)                                | +22%~-33%                                  |                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                  |                                    |                          |                                        |                                     |                                                                                                                                                                                                                                                                                                                                                       |                                       |                                       |            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                    |   |        |   |                          |   |        |
| F(Y5V)                                | +22%~-82%                                  |                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                  |                                    |                          |                                        |                                     |                                                                                                                                                                                                                                                                                                                                                       |                                       |                                       |            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                    |   |        |   |                          |   |        |
| 7                                     | Adhesive Strength of Termination           | No indication of peeling shall occur on the terminal electrode                                                                                                                                                                                                                                    | Apply 500g.f* pressure for 10±1 sec. *200g.f for 0201<br>*100g.f for 01005<br>                                                                                                                                |                                    |                          |                                        |                                     |                                                                                                                                                                                                                                                                                                                                                       |                                       |                                       |            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                    |   |        |   |                          |   |        |
| 8                                     | Appearance                                 | No indication of peeling shall occur                                                                                                                                                                                                                                                              | • Bending Limit: 1mm • Test Speed: 1.0mm/sec.<br>• Keep the test board at the limit point in 5 sec.<br>• Then Measure Capacitance<br>                                                                        |                                    |                          |                                        |                                     |                                                                                                                                                                                                                                                                                                                                                       |                                       |                                       |            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                    |   |        |   |                          |   |        |
|                                       | Capacitance                                | <table><tr><th>Characteristic</th><th>Capacitance Change</th></tr><tr><td>CLASS I</td><td>±5% or ± 0.5 pF whichever is larger</td></tr><tr><td>CLASS II</td><td></td></tr><tr><td>A(X5R), B(X7R), X(X6S), Y(X7S) Z(X7T)</td><td>± 12.5%</td></tr><tr><td>F(Y5V)</td><td>± 30%</td></tr></table>   |                                                                                                                                                                                                                                                                                                  | Characteristic                     | Capacitance Change       | CLASS I                                | ±5% or ± 0.5 pF whichever is larger | CLASS II                                                                                                                                                                                                                                                                                                                                              |                                       | A(X5R), B(X7R), X(X6S), Y(X7S) Z(X7T) | ± 12.5%    | F(Y5V)      | ± 30%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                    |   |        |   |                          |   |        |
| Characteristic                        | Capacitance Change                         |                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                  |                                    |                          |                                        |                                     |                                                                                                                                                                                                                                                                                                                                                       |                                       |                                       |            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                    |   |        |   |                          |   |        |
| CLASS I                               | ±5% or ± 0.5 pF whichever is larger        |                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                  |                                    |                          |                                        |                                     |                                                                                                                                                                                                                                                                                                                                                       |                                       |                                       |            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                    |   |        |   |                          |   |        |
| CLASS II                              |                                            |                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                  |                                    |                          |                                        |                                     |                                                                                                                                                                                                                                                                                                                                                       |                                       |                                       |            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                    |   |        |   |                          |   |        |
| A(X5R), B(X7R), X(X6S), Y(X7S) Z(X7T) | ± 12.5%                                    |                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                  |                                    |                          |                                        |                                     |                                                                                                                                                                                                                                                                                                                                                       |                                       |                                       |            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                    |   |        |   |                          |   |        |
| F(Y5V)                                | ± 30%                                      |                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                  |                                    |                          |                                        |                                     |                                                                                                                                                                                                                                                                                                                                                       |                                       |                                       |            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                    |   |        |   |                          |   |        |
| 9                                     | Solderability                              | More than 75% of the terminal surface is to be soldered newly, so metal part does not come out or dissolve<br>                                                                                                 | <table><tr><td>Solder</td><td>Sn-3Ag-0.5Cu</td></tr><tr><td>Solder Temp.</td><td>245±5°C</td></tr><tr><td>Flux</td><td>RMA Type</td></tr><tr><td>Dip time</td><td>3±0.3 sec.</td></tr><tr><td>Pre-heating</td><td>at 80~120°C for 10~30 sec.</td></tr></table>                                   | Solder                             | Sn-3Ag-0.5Cu             | Solder Temp.                           | 245±5°C                             | Flux                                                                                                                                                                                                                                                                                                                                                  | RMA Type                              | Dip time                              | 3±0.3 sec. | Pre-heating | at 80~120°C for 10~30 sec.                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                    |   |        |   |                          |   |        |
| Solder                                | Sn-3Ag-0.5Cu                               |                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                  |                                    |                          |                                        |                                     |                                                                                                                                                                                                                                                                                                                                                       |                                       |                                       |            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                    |   |        |   |                          |   |        |
| Solder Temp.                          | 245±5°C                                    |                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                  |                                    |                          |                                        |                                     |                                                                                                                                                                                                                                                                                                                                                       |                                       |                                       |            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                    |   |        |   |                          |   |        |
| Flux                                  | RMA Type                                   |                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                  |                                    |                          |                                        |                                     |                                                                                                                                                                                                                                                                                                                                                       |                                       |                                       |            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                    |   |        |   |                          |   |        |
| Dip time                              | 3±0.3 sec.                                 |                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                  |                                    |                          |                                        |                                     |                                                                                                                                                                                                                                                                                                                                                       |                                       |                                       |            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                    |   |        |   |                          |   |        |
| Pre-heating                           | at 80~120°C for 10~30 sec.                 |                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                  |                                    |                          |                                        |                                     |                                                                                                                                                                                                                                                                                                                                                       |                                       |                                       |            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                    |   |        |   |                          |   |        |
| 10                                    | Appearance                                 | No mechanical damage shall occur                                                                                                                                                                                                                                                                  | Solder temperature: 270±5°C, DIP TIME:10±1 sec.<br>Each termination shall be fully immersed and preheated as below: <table><tr><th>Step</th><th>Temperature(°C)</th><th>Time (sec.)</th></tr><tr><td>1</td><td>80~100</td><td>60</td></tr><tr><td>2</td><td>150~180</td><td>60</td></tr></table> | Step                               | Temperature(°C)          | Time (sec.)                            | 1                                   | 80~100                                                                                                                                                                                                                                                                                                                                                | 60                                    | 2                                     | 150~180    | 60          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                    |   |        |   |                          |   |        |
|                                       | Step                                       | Temperature(°C)                                                                                                                                                                                                                                                                                   | Time (sec.)                                                                                                                                                                                                                                                                                      |                                    |                          |                                        |                                     |                                                                                                                                                                                                                                                                                                                                                       |                                       |                                       |            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                    |   |        |   |                          |   |        |
|                                       | 1                                          | 80~100                                                                                                                                                                                                                                                                                            | 60                                                                                                                                                                                                                                                                                               |                                    |                          |                                        |                                     |                                                                                                                                                                                                                                                                                                                                                       |                                       |                                       |            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                    |   |        |   |                          |   |        |
|                                       | 2                                          | 150~180                                                                                                                                                                                                                                                                                           | 60                                                                                                                                                                                                                                                                                               |                                    |                          |                                        |                                     |                                                                                                                                                                                                                                                                                                                                                       |                                       |                                       |            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                    |   |        |   |                          |   |        |
|                                       | Capacitance                                | <table><tr><th>Characteristic</th><th>Capacitance Change</th></tr><tr><td>CLASS I</td><td>±2.5% or ± 0.25 pF whichever is larger</td></tr><tr><td>CLASS II</td><td></td></tr><tr><td>A(X5R), B(X7R), X(X6S), Y(X7S) Z(X7T)</td><td>± 7.5%</td></tr><tr><td>F(Y5V)</td><td>± 20%</td></tr></table> | Characteristic                                                                                                                                                                                                                                                                                   | Capacitance Change                 | CLASS I                  | ±2.5% or ± 0.25 pF whichever is larger | CLASS II                            |                                                                                                                                                                                                                                                                                                                                                       | A(X5R), B(X7R), X(X6S), Y(X7S) Z(X7T) | ± 7.5%                                | F(Y5V)     | ± 20%       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Leave the capacitor in ambient condition for specified time* before measurement<br>*24 ± 2 hours(CLASS I)<br>24 ± 2 hours(CLASSII) |   |        |   |                          |   |        |
|                                       |                                            | Characteristic                                                                                                                                                                                                                                                                                    | Capacitance Change                                                                                                                                                                                                                                                                               |                                    |                          |                                        |                                     |                                                                                                                                                                                                                                                                                                                                                       |                                       |                                       |            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                    |   |        |   |                          |   |        |
|                                       | CLASS I                                    | ±2.5% or ± 0.25 pF whichever is larger                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                  |                                    |                          |                                        |                                     |                                                                                                                                                                                                                                                                                                                                                       |                                       |                                       |            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                    |   |        |   |                          |   |        |
| CLASS II                              |                                            |                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                  |                                    |                          |                                        |                                     |                                                                                                                                                                                                                                                                                                                                                       |                                       |                                       |            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                    |   |        |   |                          |   |        |
| A(X5R), B(X7R), X(X6S), Y(X7S) Z(X7T) | ± 7.5%                                     |                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                  |                                    |                          |                                        |                                     |                                                                                                                                                                                                                                                                                                                                                       |                                       |                                       |            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                    |   |        |   |                          |   |        |
| F(Y5V)                                | ± 20%                                      |                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                  |                                    |                          |                                        |                                     |                                                                                                                                                                                                                                                                                                                                                       |                                       |                                       |            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                    |   |        |   |                          |   |        |
| Q (CLASS I)                           | Within the specified initial value         |                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                  |                                    |                          |                                        |                                     |                                                                                                                                                                                                                                                                                                                                                       |                                       |                                       |            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                    |   |        |   |                          |   |        |
| Tanδ (CLASS II)                       | Within the specified initial value         |                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                  |                                    |                          |                                        |                                     |                                                                                                                                                                                                                                                                                                                                                       |                                       |                                       |            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                    |   |        |   |                          |   |        |
| Insulation resistance                 | Within the specified initial value         |                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                  |                                    |                          |                                        |                                     |                                                                                                                                                                                                                                                                                                                                                       |                                       |                                       |            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                    |   |        |   |                          |   |        |
| Withstanding voltage                  | Within the specified initial value         |                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                  |                                    |                          |                                        |                                     |                                                                                                                                                                                                                                                                                                                                                       |                                       |                                       |            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                    |   |        |   |                          |   |        |

| No                      | Item                                                                                                                      | Performance             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Test Condition                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                  |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|
| 11                      | Vibration Test                                                                                                            | Appearance              | No mechanical damage shall occur                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                             | The capacitor shall be subjected to a harmonic motion having a total amplitude of 1.5mm changing frequency from 10Hz to 55Hz and back to 10Hz in about 1 min.<br><br>Repeat this for 2hours each in 3 mutually perpendicular directions.                                                                                                                                                                                                                                                                                                                                                                             |                                                  |
|                         |                                                                                                                           | Capacitance             | Characteristic                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Capacitance Change                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                  |
|                         |                                                                                                                           |                         | CLASS I                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | $\pm 2.5\%$ or $\pm 0.25$ pF whichever is larger |
|                         |                                                                                                                           |                         | CLASS II                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | A(X5R), B(X7R)                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | $\pm 5\%$                                        |
|                         |                                                                                                                           |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | X(X6S), Y(X7S)<br>Z(X7T)                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | $\pm 10\%$                                       |
|                         |                                                                                                                           | F(Y5V)                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | $\pm 20\%$                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                  |
|                         |                                                                                                                           | Q (CLASS I)             | Within the specified initial value                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                  |
| Tan $\delta$ (CLASS II) | Within the specified initial value                                                                                        |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                  |
| Insulation resistance   | Within the specified initial value                                                                                        |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                  |
| 12                      | Moisture Resistance                                                                                                       | Appearance              | No mechanical damage shall occur                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                             | Applied Voltage: rated voltage<br>Temperature: 40 $\pm$ 2 $^{\circ}$ C<br>Humidity: 90~95% RH<br>Duration Time: 500+12/-0 Hr.<br>Charge/Discharge Current: 50mA max.<br><br>Perform the initial measurement according to Note1.<br>Perform the final measurement according to Note2.<br><br>This test is only applied to Vr $\leq$ 500V products.<br>You can check the specification at the web site or contact sales people for each product with mark*                                                                                                                                                             |                                                  |
|                         |                                                                                                                           | Capacitance             | Characteristic                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Capacitance Change                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                  |
|                         |                                                                                                                           |                         | CLASS I                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | $\pm 7.5\%$ or $\pm 0.75$ pF whichever is larger |
|                         |                                                                                                                           |                         | CLASS II                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | A(X5R), B(X7R),<br>X(X6S), Y(X7S)<br>Z(X7T)                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | $\pm 12.5\%$                                     |
|                         |                                                                                                                           |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | F(Y5V)                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | $\pm 30\%$                                       |
|                         |                                                                                                                           | Q (CLASS I)             | Capacitance $\geq 30$ pF : Q $\geq 200$<br>$< 30$ pF : Q $\geq 100+10/3 \times C$ (C: Capacitance)                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                  |
|                         |                                                                                                                           | Tan $\delta$ (CLASS II) | 1.Capacitance: A(X5R)<br>0.05 max / 0.075 max* (35V / 50V)<br>0.05 max / 0.075 max* / 0.125 max*(16V / 25V)<br>0.075 max / 0.125 max* ( $\leq 10$ V)<br>2.Capacitance: B(X7R), X(X6S)<br>0.05 max / 0.125 max* (16V / 25V / 35V / 50V $\geq$ )<br>0.075 max / 0.125 max* ( $\leq 10$ V)<br>3.Capacitance: F(Y5V)<br>0.09 max (50V)<br>0.09 max / 0.125 max* (25V / 35V)<br>0.09 max / 0.125 max* / 0.16 max* (16V)<br>0.16 max / 0.195 max* (10V)<br>0.195 max (4V / 6.3V)    |                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                  |
| Insulation resistance   | 500M $\Omega$ min. or 25M $\Omega \cdot \mu$ F min.<br>product whichever is smaller / 12.5M $\Omega \cdot \mu$ F or over* |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                  |
| 13                      | High Temperature Resistance                                                                                               | Appearance              | No mechanical damage shall occur                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                             | Temperature : max. operating temperature<br><br>Duration Time: 1000+48/-0 Hr.<br>Charge/Discharge Current: 50mA max.<br><br>Vr $\leq 200$ V : 200% of the rated Voltage<br>250V $\leq$ Vr $\leq 500$ V: 150% of the rated Voltage<br>Vr=630V : 120% of the rated Voltage<br>1000V $\leq$ Vr $\leq 3000$ V: 100% of the rated Voltage<br>* : 150% or 100% of the rated Voltage<br><br>Perform the initial measurement according to Note1 for class II<br>Perform the final measurement according to Note2.<br><br>You can check the specification at the web site or contact sales people for each product with mark* |                                                  |
|                         |                                                                                                                           | Capacitance             | Characteristic                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Capacitance Change                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                  |
|                         |                                                                                                                           |                         | CLASS I                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | $\pm 3\%$ or $\pm 0.3$ pF whichever is larger    |
|                         |                                                                                                                           |                         | CLASS II                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | A(X5R), B(X7R),<br>X(X6S), Y(X7S)<br>Z(X7T)                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | $\pm 12.5\%$                                     |
|                         |                                                                                                                           |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | F(Y5V)                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | $\pm 30\%$                                       |
|                         |                                                                                                                           | Q (CLASS I)             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Capacitance $\geq 30$ pF : Q $\geq 350$<br>10 $\leq$ Capacitance $< 30$ pF : Q $\geq 275+2.5 \times C$<br>Capacitance $< 10$ pF : Q $\geq 200+10 \times C$ (C: Capacitance) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                  |
|                         |                                                                                                                           | Tan $\delta$ (CLASS II) | 1.Capacitance : A(X5R)<br>0.05 max / 0.075 max* (35V / 50V)<br>0.05 max / 0.075 max* / 0.125 max*(16V / 25V)<br>0.075 max / 0.125 max* ( $\leq 10$ V)<br>2.Capacitance : B(X7R), X(X6S)<br>0.05 max / 0.125 max* (16V / 25V / 35V / 50V $\geq$ )<br>0.075 max / 0.125 max* ( $\leq 10$ V)<br>3.Capacitance : F(Y5V)<br>0.09 max (50V)<br>0.09 max / 0.125 max* (25V / 35V)<br>0.09 max / 0.125 max* / 0.16 max* (16V)<br>0.16 max / 0.195 max* (10V)<br>0.195 max (4V / 6.3V) |                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                  |
| Insulation resistance   | 1,000M $\Omega$ min. or 50M $\Omega \cdot \mu$ F min.<br>product whichever is smaller / 25M $\Omega \cdot \mu$ F or over* |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                  |

## Part Numbering System

### Standard & High Capacitors

## Super Small Size Capacitors

## High-Q Capacitors

### Medium-High Voltage Capacitors

### Array Type Capacitors

## Low ESL Capacitors

### Reliability Test Condition

## Premium Capacitors for Automotive Applications

### Packaging Specification

Application Manual  
for Surface Mounting

| No                    | Item                               |                            | Performance                        |                          | Test Condition                                                                                                                             |  |  |
|-----------------------|------------------------------------|----------------------------|------------------------------------|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|--|--|
| 14                    | Temperature Cycle                  | Appearance                 | No mechanical damage shall occur   |                          | Capacitor shall be subjected to 5 cycles.<br>Condition for 1 cycle:                                                                        |  |  |
|                       |                                    | Capacitance                | Characteristic                     |                          |                                                                                                                                            |  |  |
|                       |                                    |                            | CLASS I                            |                          | $\pm 2.5\%$ or $\pm 0.25\text{pF}$ whichever is larger                                                                                     |  |  |
|                       |                                    |                            | CLASS II                           | A(X5R), B(X7R)           | $\pm 7.5\%$                                                                                                                                |  |  |
|                       |                                    |                            |                                    | X(X6S), Y(X7S)<br>Z(X7T) | $\pm 15\%$                                                                                                                                 |  |  |
|                       |                                    |                            | F(Y5V)                             | $\pm 20\%$               |                                                                                                                                            |  |  |
|                       |                                    | Q<br>(CLASS I)             | Within the specified initial value |                          | Leave the capacitor in ambient condition for specified time* before measurement<br>*24 $\pm$ 2 hours(CLASS I)<br>24 $\pm$ 2 hours(CLASSII) |  |  |
|                       |                                    | Tan $\delta$<br>(CLASS II) | Within the specified initial value |                          |                                                                                                                                            |  |  |
| Insulation resistance | Within the specified initial value |                            |                                    |                          |                                                                                                                                            |  |  |

| No          | Recommended Soldering Method                          |                  |                               |                          |           |        |
|-------------|-------------------------------------------------------|------------------|-------------------------------|--------------------------|-----------|--------|
| 15          | Recommended Soldering Method<br>By Size & Capacitance | Size<br>inch(mm) | Temperature<br>Characteristic | Capacitance              | Condition |        |
|             |                                                       |                  |                               |                          | Flow      | Reflow |
|             |                                                       | 01005(0402)      | —                             | —                        | —         | ○      |
|             |                                                       | 0201 (0603)      |                               |                          |           |        |
|             |                                                       | 0402 (1005)      |                               |                          |           |        |
|             |                                                       | 0603(1608)       | Class I                       | —                        | ○         | ○      |
|             |                                                       |                  | Class II                      | $C < 1 \mu\text{F}$      | ○         | ○      |
|             |                                                       |                  |                               | $C \geq 1 \mu\text{F}$   | —         | ○      |
|             |                                                       | 0805 (2012)      | Class I                       | —                        | ○         | ○      |
|             |                                                       |                  | Class II                      | $C < 4.7 \mu\text{F}$    | ○         | ○      |
|             |                                                       |                  |                               | $C \geq 4.7 \mu\text{F}$ | —         | ○      |
|             |                                                       |                  |                               | Array                    | —         | —      |
|             |                                                       | 1206 (3216)      | Class I                       | —                        | ○         | ○      |
|             |                                                       |                  | Class II                      | $C < 10 \mu\text{F}$     | ○         | ○      |
|             |                                                       |                  |                               | $C \geq 10 \mu\text{F}$  | —         | ○      |
|             |                                                       |                  |                               | Array                    | —         | —      |
|             |                                                       | 1210 (3225)      | —                             | —                        | —         | ○      |
|             |                                                       | 1808 (4520)      |                               |                          |           | ○      |
| 1812 (4532) | ○                                                     |                  |                               |                          |           |        |
| 2220 (5750) | ○                                                     |                  |                               |                          |           |        |

**Note 1. Initial Measurement For Class II**

Perform the heat treatment at 150°C +0/-10°C for 1 hour. Then Leave the capacitor in ambient condition for 24  $\pm$  2 hours before measurement. Then perform the measurement.

**Note 2. Latter Measurement**
**1. CLASS I**

Leave the capacitor in ambient condition for 24  $\pm$  2 hours before measurement. Then perform the measurement.

**2. CLASS II**

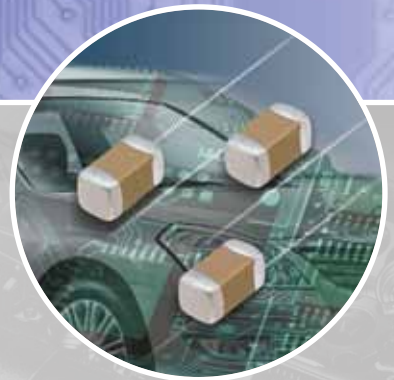
Perform the heat treatment at 150°C +0/-10°C for 1 hour. Then Leave the capacitor in ambient condition for 24  $\pm$  2 hours before measurement. Then perform the measurement.

Note 3. All Size in Reliability Test Condition Section is "inch"

Note 4. Camera Strobe Circuit Capacitors Should be Following a Special Reliability Test Condition.  
Please check with our sales representatives or product engineers.



*Premium Capacitors for Automotive Applications*



SAMSUNG  
ELECTRO-MECHANICS

SAMSUNG

[illegible]

\*  
Class I

| Symbol | EIA Code | Operation Temperature Range(°C) | Temperature Coefficient Range(ppm/°C) |
|--------|----------|---------------------------------|---------------------------------------|
| C      | C0G      | -55~+125                        | 0±30                                  |

## Class II

| Symbol | EIA Code | Operation Temperature Range(°C) | Capacitance Change(Δ°C %) |
|--------|----------|---------------------------------|---------------------------|
| B      | X7R      | -55~+125                        | 0±15                      |

\*\*  
Capacitance Tolerance

| Code | Capacitance Tolerance | TC  | Capacitance Step | Rated Capacitance |
|------|-----------------------|-----|------------------|-------------------|
| C    | ±0.25pF               | C0G | Under 5pF        | E-12 series *     |
| D    | ±0.5pF                | C0G | 6.0 to 9.0pF     | E-12 series *     |
| J    | ±5%                   | C0G | Over 10pF        | E-12 series       |
| K    | ±10%                  | X7R | Under 0.01μF     | E-3 series        |
|      |                       |     | Over 0.01μF      | E-6 series        |
| M    | ±20%                  | X7R | Under 0.01μF     | E-3 series        |
|      |                       |     | Over 0.01μF      | E-6 series        |

\* E-24 series is also available

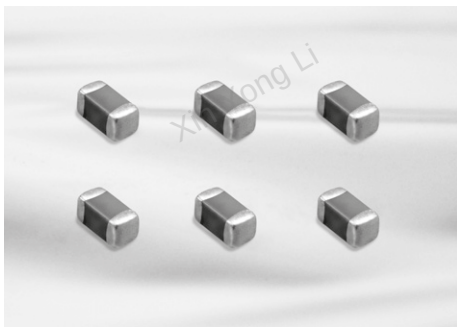
| Series | Capacitance Step |     |     |     |     |     |     |     |     |     |     |     |
|--------|------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|        | 1.0              |     |     |     | 2.2 |     |     |     | 4.7 |     |     |     |
| E-3    | 1.0              |     |     |     | 2.2 |     |     |     | 4.7 |     |     |     |
| E-6    | 1.0              |     | 1.5 |     | 2.2 |     | 3.3 |     | 4.7 |     | 6.8 |     |
| E-12   | 1.0              | 1.2 | 1.5 | 1.8 | 2.2 | 2.7 | 3.3 | 3.9 | 4.7 | 5.6 | 6.8 | 8.2 |
| E-24   | 1.0              | 1.1 | 1.2 | 1.3 | 2.2 | 2.4 | 2.7 | 3.0 | 4.7 | 5.1 | 5.6 | 6.2 |
|        | 1.5              | 1.6 | 1.8 | 2.0 | 3.3 | 3.6 | 3.9 | 4.3 | 6.8 | 7.5 | 8.2 | 9.1 |

\*\*\*

| Size       | Code | Thickness(mm) | Spec(mm) * |
|------------|------|---------------|------------|
| 0402(1005) | 5    | 0.50          | ±0.05      |
| 0603(1608) | 8    | 0.80          | ±0.10      |
| 0805(2012) | 6    | 0.60          | ±0.10      |
|            | C    | 0.85          | ±0.10      |
|            | F    | 1.25          | ±0.10      |
|            | Q    | 1.25          | ±0.15      |
| 1206(3216) | C    | 0.85          | ±0.15      |
|            | P    | 1.15          | ±0.10      |
|            | H    | 1.60          | ±0.20      |
| 1210(3225) | I    | 2.00          | ±0.20      |
|            | J    | 2.50          | ±0.20      |

Part Numbering  
SystemStandard &  
High CapacitorsSuper Small Size  
CapacitorsHigh-Q  
CapacitorsMedium-High  
Voltage CapacitorsArray Type  
CapacitorsLow ESL  
CapacitorsReliability Test  
ConditionPremium Capacitors  
for Automotive  
ApplicationsPackaging  
SpecificationApplication Manual  
for Surface Mounting

# Premium Capacitors for Automotive Applications



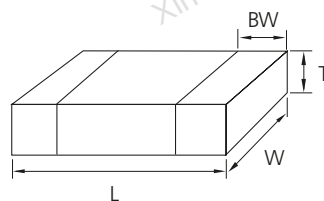
## Feature

- Automotive products are manufactured in state of the art facilities recommended for registration to ISO/TS 16949:2002.
- Automotive products meet AEC-Q-200 requirements.
- Automotive products are RoHS compliant.
- Samsung terminations are suitable for all flow and reflow soldering systems. (10/21/31 size type only)
- Automotive products meet JEDEC-020-D requirements.
- C0G dielectric components contain BME and copper terminations with a Ni/Sn plated overcoat.
- X7R dielectric components have BME and soft terminations with a Ni/Sn plated overcoat.

## Application

- Automotive Electronic Equipment  
(Powertrain, Safety, Body & Chassis, Convenience, Infotainment)

## Structure and Dimensions



| Code | EIA Code | Dimension(mm)   |                 |                   |                 |
|------|----------|-----------------|-----------------|-------------------|-----------------|
|      |          | L               | W               | T                 | BW              |
| 05   | 0402     | $1.00 \pm 0.05$ | $0.50 \pm 0.05$ | $0.50 (\pm 0.05)$ | $0.25 \pm 0.10$ |
| 10   | 0603     | $1.60 \pm 0.10$ | $0.80 \pm 0.10$ | $0.80 (\pm 0.10)$ | $0.30 \pm 0.20$ |
| 21   | 0805     | $2.00 \pm 0.10$ | $1.25 \pm 0.10$ | $0.60 (\pm 0.10)$ | $0.5+0.2/-0.3$  |
|      |          |                 |                 | $0.85 (\pm 0.10)$ |                 |
|      |          |                 |                 | $1.25 (\pm 0.10)$ |                 |
|      |          | $2.00 \pm 0.15$ | $1.25 \pm 0.15$ | $1.25 (\pm 0.15)$ |                 |
| 31   | 1206     | $3.20 \pm 0.20$ | $1.60 \pm 0.20$ | $0.85 (\pm 0.15)$ | $0.50 \pm 0.30$ |
|      |          |                 |                 | $1.15 (\pm 0.10)$ |                 |
|      |          |                 |                 | $1.60 (\pm 0.20)$ |                 |
| 32   | 1210     | $3.20 \pm 0.30$ | $2.50 \pm 0.20$ | $2.00 (\pm 0.20)$ | $0.60 \pm 0.30$ |
|      |          |                 |                 | $2.50 (\pm 0.20)$ |                 |

Automotive Capacitors Table (C0G, X7R)

| TC   | Size<br>(mm) | Thickness<br>(mm) | Vr  | Capacitance (pF) |     |     | Capacitance (nF) |     |     |                  |     |     |     |    |
|------|--------------|-------------------|-----|------------------|-----|-----|------------------|-----|-----|------------------|-----|-----|-----|----|
|      |              |                   |     | 100              | 220 | 470 | 1                | 2.2 | 4.7 | 10               | 22  | 47  | 100 |    |
| COG  | 0402(1005)   | 0.50              | 50  |                  |     |     |                  |     |     |                  |     |     |     |    |
|      |              |                   | 100 |                  |     |     |                  |     |     |                  |     |     |     |    |
|      | 0603(1608)   | 0.80              | 50  |                  |     |     |                  |     |     |                  |     |     |     |    |
|      |              |                   | 100 | 271              |     |     |                  |     |     |                  |     |     |     |    |
|      | 0805(2012)   | 0.60              | 50  |                  |     |     |                  |     |     |                  |     |     |     |    |
|      |              | 0.85              |     |                  |     |     |                  |     |     |                  |     |     |     |    |
|      |              | 1.25              | 100 |                  |     |     |                  |     |     |                  |     |     |     |    |
| TC   | Size<br>(mm) | Thickness<br>(mm) | Vr  | Capacitance (nF) |     |     |                  |     |     | Capacitance (μF) |     |     |     |    |
|      |              |                   |     | 10               | 22  | 47  | 100              | 220 | 470 | 1                | 2.2 | 4.7 | 10  | 22 |
| X7R  | 0402(1005)   | 0.50              | 10  |                  |     |     |                  |     |     |                  |     |     |     |    |
|      |              |                   | 16  |                  |     |     |                  |     |     |                  |     |     |     |    |
|      |              |                   | 25  |                  |     |     |                  |     |     |                  |     |     |     |    |
|      |              |                   | 50  |                  |     |     |                  |     |     |                  |     |     |     |    |
|      | 0603(1608)   | 0.80              | 10  |                  |     |     |                  |     |     |                  |     |     |     |    |
|      |              |                   | 16  |                  |     |     |                  |     |     |                  |     |     |     |    |
|      |              |                   | 25  |                  |     |     |                  |     |     |                  |     |     |     |    |
|      |              |                   | 50  |                  |     |     |                  |     |     |                  |     |     |     |    |
|      |              |                   | 100 |                  |     |     |                  |     |     |                  |     |     |     |    |
|      | 0805(2012)   | 1.25              | 10  |                  |     |     |                  |     |     |                  |     |     |     |    |
|      |              | 0.85              | 16  |                  |     |     |                  |     |     |                  |     |     |     |    |
|      |              | 1.25              |     |                  |     |     |                  |     |     |                  |     |     |     |    |
|      |              | 0.60              | 25  |                  |     |     |                  |     |     |                  |     |     |     |    |
|      |              | 0.85              |     |                  |     |     |                  |     |     |                  |     |     |     |    |
|      |              | 1.25              |     |                  |     |     |                  |     |     |                  |     |     |     |    |
|      |              | 0.60              | 50  |                  |     |     |                  |     |     |                  |     |     |     |    |
|      |              | 0.85              |     |                  |     |     |                  |     |     |                  |     |     |     |    |
|      |              | 1.25              |     |                  |     |     |                  |     |     |                  |     |     |     |    |
|      |              | 0.60              | 100 |                  |     |     |                  |     |     |                  |     |     |     |    |
|      |              | 0.85              |     |                  |     |     |                  |     |     |                  |     |     |     |    |
|      |              | 1.25              |     |                  |     |     |                  |     |     |                  |     |     |     |    |
|      | 1206(3216)   | 1.60              | 10  |                  |     |     |                  |     |     |                  |     |     |     |    |
|      |              | 1.15              | 16  |                  |     |     |                  |     |     |                  |     |     |     |    |
|      |              | 1.60              |     |                  |     |     |                  |     |     |                  |     |     |     |    |
|      |              | 0.85              | 25  |                  |     |     |                  |     |     |                  |     |     |     |    |
|      |              | 1.15              |     |                  |     |     |                  |     |     |                  |     |     |     |    |
|      |              | 1.60              |     |                  |     |     |                  |     |     |                  |     |     |     |    |
|      |              | 0.85              | 50  |                  |     |     |                  |     |     |                  |     |     |     |    |
|      |              | 1.15              |     |                  |     |     |                  |     |     |                  |     |     |     |    |
| 1.60 |              |                   |     |                  |     |     |                  |     |     |                  |     |     |     |    |
|      | 3225(1210)   | 2.70              | 16  |                  |     |     |                  |     |     |                  |     |     |     |    |

Part Numbering  
SystemStandard &  
High CapacitorsSuper Small Size  
CapacitorsHigh-Q  
CapacitorsMedium-High  
Voltage CapacitorsArray Type  
CapacitorsLow ESL  
CapacitorsReliability Test  
ConditionPremium Capacitors  
for Automotive  
ApplicationsPackaging  
SpecificationApplication Manual  
for Surface Mounting

**Product Lineup (Automotive Capacitors-COG)**

|    | Part Number      | Size L x W<br>(mm) | Capacitance | Rated<br>Voltage<br>(Vdc) | Capacitance<br>Tolerance | Thickness<br>Max.(mm) |
|----|------------------|--------------------|-------------|---------------------------|--------------------------|-----------------------|
| 1  | CL05C4R7CB51PN □ | 1.00×0.50          | 4.7pF       | 50                        | ±0.25pF                  | 0.55                  |
| 2  | CL05C4R7CC51PN □ |                    | 4.7pF       | 100                       | ±0.25pF                  | 0.55                  |
| 3  | CL05C6R8DB51PN □ |                    | 6.8pF       | 50                        | ±0.5pF                   | 0.55                  |
| 4  | CL05C6R8DC51PN □ |                    | 6.8pF       | 100                       | ±0.5pF                   | 0.55                  |
| 5  | CL05C100JB51PN □ |                    | 10pF        | 50                        | ±5%                      | 0.55                  |
| 6  | CL05C100JC51PN □ |                    | 10pF        | 100                       | ±5%                      | 0.55                  |
| 7  | CL05C120JB51PN □ |                    | 12pF        | 50                        | ±5%                      | 0.55                  |
| 8  | CL05C120JC51PN □ |                    | 12pF        | 100                       | ±5%                      | 0.55                  |
| 9  | CL05C150JB51PN □ |                    | 15pF        | 50                        | ±5%                      | 0.55                  |
| 10 | CL05C150JC51PN □ |                    | 15pF        | 100                       | ±5%                      | 0.55                  |
| 11 | CL05C180JB51PN □ |                    | 18pF        | 50                        | ±5%                      | 0.55                  |
| 12 | CL05C180JC51PN □ |                    | 18pF        | 100                       | ±5%                      | 0.55                  |
| 13 | CL05C220JB51PN □ |                    | 22pF        | 50                        | ±5%                      | 0.55                  |
| 14 | CL05C220JC51PN □ |                    | 22pF        | 100                       | ±5%                      | 0.55                  |
| 15 | CL05C270JB51PN □ |                    | 27pF        | 50                        | ±5%                      | 0.55                  |
| 16 | CL05C270JC51PN □ |                    | 27pF        | 100                       | ±5%                      | 0.55                  |
| 17 | CL05C330JB51PN □ |                    | 33pF        | 50                        | ±5%                      | 0.55                  |
| 18 | CL05C330JC51PN □ |                    | 33pF        | 100                       | ±5%                      | 0.55                  |
| 19 | CL05C390JB51PN □ |                    | 39pF        | 50                        | ±5%                      | 0.55                  |
| 20 | CL05C390JC51PN □ |                    | 39pF        | 100                       | ±5%                      | 0.55                  |
| 21 | CL05C470JB51PN □ |                    | 47pF        | 50                        | ±5%                      | 0.55                  |
| 22 | CL05C470JC51PN □ |                    | 47pF        | 100                       | ±5%                      | 0.55                  |
| 23 | CL05C560JB51PN □ |                    | 56pF        | 50                        | ±5%                      | 0.55                  |
| 24 | CL05C560JC51PN □ |                    | 56pF        | 100                       | ±5%                      | 0.55                  |
| 25 | CL05C680JB51PN □ |                    | 68pF        | 50                        | ±5%                      | 0.55                  |
| 26 | CL05C680JC51PN □ |                    | 68pF        | 100                       | ±5%                      | 0.55                  |
| 27 | CL05C820JB51PN □ |                    | 82pF        | 50                        | ±5%                      | 0.55                  |
| 28 | CL05C820JC51PN □ |                    | 82pF        | 100                       | ±5%                      | 0.55                  |
| 29 | CL05C101JB51PN □ |                    | 100pF       | 50                        | ±5%                      | 0.55                  |
| 30 | CL05C101JC51PN □ |                    | 100pF       | 100                       | ±5%                      | 0.55                  |
| 31 | CL05C121JB51PN □ |                    | 120pF       | 50                        | ±5%                      | 0.55                  |
| 32 | CL05C151JB51PN □ |                    | 150pF       | 50                        | ±5%                      | 0.55                  |
| 33 | CL05C221JB51PN □ |                    | 220pF       | 50                        | ±5%                      | 0.55                  |
| 1  | CL10C4R7CB81PN □ | 1.60×0.80          | 4.7pF       | 50                        | ±0.25pF                  | 0.90                  |
| 2  | CL10C4R7CC81PN □ |                    | 4.7pF       | 100                       | ±0.25pF                  | 0.90                  |
| 3  | CL10C6R8DB81PN □ |                    | 6.8pF       | 50                        | ±0.5pF                   | 0.90                  |
| 4  | CL10C6R8DC81PN □ |                    | 6.8pF       | 100                       | ±0.5pF                   | 0.90                  |
| 5  | CL10C100JB81PN □ |                    | 10pF        | 50                        | ±5%                      | 0.90                  |
| 6  | CL10C100JC81PN □ |                    | 10pF        | 100                       | ±5%                      | 0.90                  |
| 7  | CL10C120JB81PN □ |                    | 12pF        | 50                        | ±5%                      | 0.90                  |
| 8  | CL10C120JC81PN □ |                    | 12pF        | 100                       | ±5%                      | 0.90                  |
| 9  | CL10C150JB81PN □ |                    | 15pF        | 50                        | ±5%                      | 0.90                  |
| 10 | CL10C150JC81PN □ |                    | 15pF        | 100                       | ±5%                      | 0.90                  |
| 11 | CL10C180JB81PN □ |                    | 18pF        | 50                        | ±5%                      | 0.90                  |
| 12 | CL10C180JC81PN □ |                    | 18pF        | 100                       | ±5%                      | 0.90                  |
| 13 | CL10C220JB81PN □ |                    | 22pF        | 50                        | ±5%                      | 0.90                  |
| 14 | CL10C220JC81PN □ |                    | 22pF        | 100                       | ±5%                      | 0.90                  |
| 15 | CL10C270JB81PN □ |                    | 27pF        | 50                        | ±5%                      | 0.90                  |
| 16 | CL10C270JC81PN □ |                    | 27pF        | 100                       | ±5%                      | 0.90                  |
| 17 | CL10C330JB81PN □ |                    | 33pF        | 50                        | ±5%                      | 0.90                  |

※ □ mark means packaging code. If you want to learn the code or quantity in detail, please see p74.

## Product Lineup (Automotive Capacitors-COG)

|    | Part Number      | Size L x W<br>(mm) | Capacitance | Rated<br>Voltage<br>(Vdc) | Capacitance<br>Tolerance | Thickness<br>Max.(mm) |
|----|------------------|--------------------|-------------|---------------------------|--------------------------|-----------------------|
| 18 | CL10C330JC81PN □ | 1.60×0.80          | 33pF        | 100                       | ±5%                      | 0.90                  |
| 19 | CL10C390JB81PN □ |                    | 39pF        | 50                        | ±5%                      | 0.90                  |
| 20 | CL10C390JC81PN □ |                    | 39pF        | 100                       | ±5%                      | 0.90                  |
| 21 | CL10C470JB81PN □ |                    | 47pF        | 50                        | ±5%                      | 0.90                  |
| 22 | CL10C470JC81PN □ |                    | 47pF        | 100                       | ±5%                      | 0.90                  |
| 23 | CL10C560JB81PN □ |                    | 56pF        | 50                        | ±5%                      | 0.90                  |
| 24 | CL10C560JC81PN □ |                    | 56pF        | 100                       | ±5%                      | 0.90                  |
| 25 | CL10C680JB81PN □ |                    | 68pF        | 50                        | ±5%                      | 0.90                  |
| 26 | CL10C680JC81PN □ |                    | 68pF        | 100                       | ±5%                      | 0.90                  |
| 27 | CL10C820JB81PN □ |                    | 82pF        | 50                        | ±5%                      | 0.90                  |
| 28 | CL10C820JC81PN □ |                    | 82pF        | 100                       | ±5%                      | 0.90                  |
| 29 | CL10C101JB81PN □ |                    | 100pF       | 50                        | ±5%                      | 0.90                  |
| 30 | CL10C101JC81PN □ |                    | 100pF       | 100                       | ±5%                      | 0.90                  |
| 31 | CL10C121JB81PN □ |                    | 120pF       | 50                        | ±5%                      | 0.90                  |
| 32 | CL10C151JB81PN □ |                    | 150pF       | 50                        | ±5%                      | 0.90                  |
| 33 | CL10C221JB81PN □ |                    | 220pF       | 50                        | ±5%                      | 0.90                  |
| 34 | CL10C221JC81PN □ |                    | 220pF       | 100                       | ±5%                      | 0.90                  |
| 35 | CL10C271JB81PN □ |                    | 270pF       | 50                        | ±5%                      | 0.90                  |
| 36 | CL10C331JB81PN □ |                    | 330pF       | 50                        | ±5%                      | 0.90                  |
| 37 | CL10C391JB81PN □ |                    | 390pF       | 50                        | ±5%                      | 0.90                  |
| 38 | CL10C471JB81PN □ |                    | 470pF       | 50                        | ±5%                      | 0.90                  |
| 39 | CL10C561JB81PN □ |                    | 560pF       | 50                        | ±5%                      | 0.90                  |
| 40 | CL10C681JB81PN □ |                    | 680pF       | 50                        | ±5%                      | 0.90                  |
| 41 | CL10C821JB81PN □ |                    | 820pF       | 50                        | ±5%                      | 0.90                  |
| 42 | CL10C102JB81PN □ |                    | 1.0nF       | 50                        | ±5%                      | 0.90                  |
| 1  | CL21C100JB61PN □ | 2.00×1.25          | 10pF        | 50                        | ±5%                      | 0.70                  |
| 2  | CL21C100JC61PN □ |                    | 10pF        | 100                       | ±5%                      | 0.70                  |
| 3  | CL21C120JB61PN □ |                    | 12pF        | 50                        | ±5%                      | 0.70                  |
| 4  | CL21C120JC61PN □ |                    | 12pF        | 100                       | ±5%                      | 0.70                  |
| 5  | CL21C150JB61PN □ |                    | 15pF        | 50                        | ±5%                      | 0.70                  |
| 6  | CL21C150JC61PN □ |                    | 15pF        | 100                       | ±5%                      | 0.70                  |
| 7  | CL21C180JB61PN □ |                    | 18pF        | 50                        | ±5%                      | 0.70                  |
| 8  | CL21C180JC61PN □ |                    | 18pF        | 100                       | ±5%                      | 0.70                  |
| 9  | CL21C220JB61PN □ |                    | 22pF        | 50                        | ±5%                      | 0.70                  |
| 10 | CL21C220JC61PN □ |                    | 22pF        | 100                       | ±5%                      | 0.70                  |
| 11 | CL21C270JB61PN □ |                    | 27pF        | 100                       | ±5%                      | 0.70                  |
| 12 | CL21C330JB61PN □ |                    | 33pF        | 50                        | ±5%                      | 0.70                  |
| 13 | CL21C330JC61PN □ |                    | 33pF        | 100                       | ±5%                      | 0.70                  |
| 14 | CL21C390JB61PN □ |                    | 39pF        | 50                        | ±5%                      | 0.70                  |
| 15 | CL21C390JC61PN □ |                    | 39pF        | 100                       | ±5%                      | 0.70                  |
| 16 | CL21C470JB61PN □ |                    | 47pF        | 50                        | ±5%                      | 0.70                  |
| 17 | CL21C470JC61PN □ |                    | 47pF        | 100                       | ±5%                      | 0.70                  |
| 18 | CL21C560JB61PN □ |                    | 56pF        | 50                        | ±5%                      | 0.70                  |
| 19 | CL21C560JC61PN □ |                    | 56pF        | 100                       | ±5%                      | 0.70                  |
| 20 | CL21C680JB61PN □ |                    | 68pF        | 50                        | ±5%                      | 0.70                  |
| 21 | CL21C680JC61PN □ |                    | 68pF        | 100                       | ±5%                      | 0.70                  |
| 22 | CL21C820JB61PN □ |                    | 82pF        | 50                        | ±5%                      | 0.70                  |
| 23 | CL21C820JC61PN □ |                    | 82pF        | 100                       | ±5%                      | 0.70                  |
| 24 | CL21C101JB61PN □ |                    | 100pF       | 50                        | ±5%                      | 0.70                  |
| 25 | CL21C101JC61PN □ |                    | 100pF       | 100                       | ±5%                      | 0.70                  |

※ □ mark means packaging code. If you want to learn the code or quantity in detail, please see p74.

Part Numbering  
System

Standard &  
High Capacitors

Super Small Size  
Capacitors

High-Q  
Capacitors

Medium-High  
Voltage Capacitors

Array Type  
Capacitors

Low ESL  
Capacitors

Reliability Test  
Condition

Premium Capacitors  
for Automotive  
Applications

Packaging  
Specification

Application Manual  
for Surface Mounting



Product Lineup (Automotive Capacitors-COG)

|    | Part Number      | Size L x W<br>(mm) | Capacitance | Rated<br>Voltage<br>(Vdc) | Capacitance<br>Tolerance | Thickness<br>Max.(mm) |
|----|------------------|--------------------|-------------|---------------------------|--------------------------|-----------------------|
| 26 | CL21C121JB61PN □ | 2.00×1.25          | 120pF       | 50                        | ±5%                      | 0.70                  |
| 27 | CL21C121JC61PN □ |                    | 120pF       | 100                       | ±5%                      | 0.70                  |
| 28 | CL21C151JB61PN □ |                    | 150pF       | 50                        | ±5%                      | 0.70                  |
| 29 | CL21C151JC61PN □ |                    | 150pF       | 100                       | ±5%                      | 0.70                  |
| 30 | CL21C221JB61PN □ |                    | 220pF       | 50                        | ±5%                      | 0.70                  |
| 31 | CL21C221JC61PN □ |                    | 220pF       | 100                       | ±5%                      | 0.70                  |
| 32 | CL21C271JB61PN □ |                    | 270pF       | 50                        | ±5%                      | 0.70                  |
| 33 | CL21C271JC61PN □ |                    | 270pF       | 100                       | ±5%                      | 0.70                  |
| 34 | CL21C331JB61PN □ |                    | 330pF       | 50                        | ±5%                      | 0.70                  |
| 35 | CL21C331JC61PN □ |                    | 330pF       | 100                       | ±5%                      | 0.70                  |
| 36 | CL21C471JBC1PN □ |                    | 470pF       | 50                        | ±5%                      | 0.95                  |
| 37 | CL21C471JCC1PN □ |                    | 470pF       | 100                       | ±5%                      | 0.95                  |
| 38 | CL21C561JBC1PN □ |                    | 560pF       | 50                        | ±5%                      | 0.95                  |
| 39 | CL21C561JCC1PN □ |                    | 560pF       | 100                       | ±5%                      | 0.95                  |
| 40 | CL21C681JBC1PN □ |                    | 680pF       | 50                        | ±5%                      | 0.95                  |
| 41 | CL21C681JCC1PN □ |                    | 680pF       | 100                       | ±5%                      | 0.95                  |
| 42 | CL21C821JBC1PN □ |                    | 820pF       | 50                        | ±5%                      | 0.95                  |
| 43 | CL21C821JCC1PN □ |                    | 820pF       | 100                       | ±5%                      | 0.95                  |
| 44 | CL21C102JBF1PN □ |                    | 1.0nF       | 50                        | ±5%                      | 1.35                  |
| 45 | CL21C102JBC1PN □ |                    | 1.0nF       | 50                        | ±5%                      | 0.95                  |
| 46 | CL21C102JCF1PN □ |                    | 1.0nF       | 100                       | ±5%                      | 1.35                  |
| 47 | CL21C102JCC1PN □ |                    | 1.0nF       | 100                       | ±5%                      | 0.95                  |
| 48 | CL21C122JBF1PN □ |                    | 1.2nF       | 50                        | ±5%                      | 1.35                  |
| 49 | CL21C122JBC1PN □ |                    | 1.2nF       | 50                        | ±5%                      | 0.95                  |
| 50 | CL21C152JBF1PN □ |                    | 1.5nF       | 50                        | ±5%                      | 1.35                  |
| 51 | CL21C152JBC1PN □ |                    | 1.5nF       | 50                        | ±5%                      | 0.95                  |
| 52 | CL21C182JBF1PN □ |                    | 1.8nF       | 50                        | ±5%                      | 1.35                  |
| 53 | CL21C182JBC1PN □ |                    | 1.8nF       | 50                        | ±5%                      | 0.95                  |
| 54 | CL21C222JBF1PN □ |                    | 2.2nF       | 50                        | ±5%                      | 1.35                  |
| 55 | CL21C222JBC1PN □ |                    | 2.2nF       | 50                        | ±5%                      | 0.95                  |
| 56 | CL21C272JBF1PN □ |                    | 2.7nF       | 50                        | ±5%                      | 1.35                  |
| 57 | CL21C272JBC1PN □ |                    | 2.7nF       | 50                        | ±5%                      | 0.95                  |
| 58 | CL21C332JBF1PN □ |                    | 3.3nF       | 50                        | ±5%                      | 1.35                  |
| 59 | CL21C332JBC1PN □ |                    | 3.3nF       | 50                        | ±5%                      | 0.95                  |
| 60 | CL21C392JBF1PN □ |                    | 3.9nF       | 50                        | ±5%                      | 1.35                  |
| 61 | CL21C392JBC1PN □ |                    | 3.9nF       | 50                        | ±5%                      | 0.95                  |
| 62 | CL21C472JBF1PN □ |                    | 4.7nF       | 50                        | ±5%                      | 1.35                  |
| 63 | CL21C472JBC1PN □ |                    | 4.7nF       | 50                        | ±5%                      | 0.95                  |
| 64 | CL21C562JBF1PN □ |                    | 5.6nF       | 50                        | ±5%                      | 1.35                  |
| 65 | CL21C562JBC1PN □ |                    | 5.6nF       | 50                        | ±5%                      | 0.95                  |
| 66 | CL21C682JBF1PN □ |                    | 6.8nF       | 50                        | ±5%                      | 1.35                  |
| 67 | CL21C822JBF1PN □ |                    | 8.2nF       | 50                        | ±5%                      | 1.35                  |
| 68 | CL21C103JBF1PN □ |                    | 10nF        | 50                        | ±5%                      | 1.35                  |

※ □ mark means packaging code. If you want to learn the code or quantity in detail, please see p74.

## Product Lineup (Automotive Capacitors-X7R)

|    | Part Number      | Size L x W<br>(mm) | Capacitance | Rated<br>Voltage<br>(Vdc) | Capacitance<br>Tolerance | Thickness<br>Max.(mm) |
|----|------------------|--------------------|-------------|---------------------------|--------------------------|-----------------------|
| 1  | CL05B331KB5VPN □ | 1.00×0.50          | 330 pF      | 50                        | ±10%                     | 0.55                  |
| 2  | CL05B471KB5VPN □ |                    | 470 pF      | 50                        | ±10%                     | 0.55                  |
| 3  | CL05B681KB5VPN □ |                    | 680 pF      | 50                        | ±10%                     | 0.55                  |
| 4  | CL05B102KA5VPN □ |                    | 1.0 nF      | 25                        | ±10%                     | 0.55                  |
| 5  | CL05B102KB5VPN □ |                    | 1.0 nF      | 50                        | ±10%                     | 0.55                  |
| 6  | CL05B152KA5VPN □ |                    | 1.5 nF      | 25                        | ±10%                     | 0.55                  |
| 7  | CL05B152KB5VPN □ |                    | 1.5 nF      | 50                        | ±10%                     | 0.55                  |
| 8  | CL05B222KA5VPN □ |                    | 2.2 nF      | 25                        | ±10%                     | 0.55                  |
| 9  | CL05B222KB5VPN □ |                    | 2.2 nF      | 50                        | ±10%                     | 0.55                  |
| 10 | CL05B332KA5VPN □ |                    | 3.3 nF      | 25                        | ±10%                     | 0.55                  |
| 11 | CL05B332KB5VPN □ |                    | 3.3 nF      | 50                        | ±10%                     | 0.55                  |
| 12 | CL05B472KA5VPN □ |                    | 4.7 nF      | 25                        | ±10%                     | 0.55                  |
| 13 | CL05B472KB5VPN □ |                    | 4.7 nF      | 50                        | ±10%                     | 0.55                  |
| 14 | CL05B682KA5VPN □ |                    | 6.8 nF      | 25                        | ±10%                     | 0.55                  |
| 15 | CL05B682KB5VPN □ |                    | 6.8 nF      | 50                        | ±10%                     | 0.55                  |
| 16 | CL05B103KA5VPN □ |                    | 10 nF       | 25                        | ±10%                     | 0.55                  |
| 17 | CL05B103KB5VPN □ |                    | 10 nF       | 50                        | ±10%                     | 0.55                  |
| 18 | CL05B153KA5VPN □ |                    | 15 nF       | 25                        | ±10%                     | 0.55                  |
| 19 | CL05B153KB5VPN □ |                    | 15 nF       | 50                        | ±10%                     | 0.55                  |
| 20 | CL05B223KA5VPN □ |                    | 22 nF       | 25                        | ±10%                     | 0.55                  |
| 21 | CL05B223KB5VPN □ |                    | 22 nF       | 50                        | ±10%                     | 0.55                  |
| 22 | CL05B333KO5VPN □ |                    | 33 nF       | 16                        | ±10%                     | 0.55                  |
| 23 | CL05B473KO5VPN □ |                    | 47 nF       | 16                        | ±10%                     | 0.55                  |
| 24 | CL05B683KO5VPN □ |                    | 68 nF       | 16                        | ±10%                     | 0.55                  |
| 25 | CL05B104KO5VPN □ |                    | 100 nF      | 16                        | ±10%                     | 0.55                  |

※ □ mark means packaging code. If you want to learn the code or quantity in detail, please see p74.

Part Numbering  
SystemStandard &  
High CapacitorsSuper Small Size  
CapacitorsHigh-Q  
CapacitorsMedium-High  
Voltage CapacitorsArray Type  
CapacitorsLow ESL  
CapacitorsReliability Test  
ConditionPremium Capacitors  
for Automotive  
ApplicationsPackaging  
SpecificationApplication Manual  
for Surface Mounting

## Product Lineup (Automotive Capacitors-X7R)

|    | Part Number      | Size L x W<br>(mm) | Capacitance | Rated<br>Voltage<br>(Vdc) | Capacitance<br>Tolerance | Thickness<br>Max.(mm) |
|----|------------------|--------------------|-------------|---------------------------|--------------------------|-----------------------|
| 1  | CL10B221KC8WPN □ | 1.60×0.80          | 220pF       | 100                       | ±10%                     | 0.90                  |
| 2  | CL10B331KC8WPN □ |                    | 330pF       | 100                       | ±10%                     | 0.90                  |
| 3  | CL10B471KC8WPN □ |                    | 470pF       | 100                       | ±10%                     | 0.90                  |
| 4  | CL10B681KC8WPN □ |                    | 680pF       | 100                       | ±10%                     | 0.90                  |
| 5  | CL10B102KB8WPN □ |                    | 1.0nF       | 50                        | ±10%                     | 0.90                  |
| 6  | CL10B102KC8WPN □ |                    | 1.0nF       | 100                       | ±10%                     | 0.90                  |
| 7  | CL10B152KB8WPN □ |                    | 1.5nF       | 50                        | ±10%                     | 0.90                  |
| 8  | CL10B152KC8WPN □ |                    | 1.5nF       | 100                       | ±10%                     | 0.90                  |
| 9  | CL10B222KB8WPN □ |                    | 2.2nF       | 50                        | ±10%                     | 0.90                  |
| 10 | CL10B222KC8WPN □ |                    | 2.2nF       | 100                       | ±10%                     | 0.90                  |
| 11 | CL10B332KB8WPN □ |                    | 3.3nF       | 50                        | ±10%                     | 0.90                  |
| 12 | CL10B332KC8WPN □ |                    | 3.3nF       | 100                       | ±10%                     | 0.90                  |
| 13 | CL10B472KB8WPN □ |                    | 4.7nF       | 50                        | ±10%                     | 0.90                  |
| 14 | CL10B472KC8WPN □ |                    | 4.7nF       | 100                       | ±10%                     | 0.90                  |
| 15 | CL10B682KB8WPN □ |                    | 6.8nF       | 50                        | ±10%                     | 0.90                  |
| 16 | CL10B682KC8WPN □ |                    | 6.8nF       | 100                       | ±10%                     | 0.90                  |
| 17 | CL10B103KB8WPN □ |                    | 10nF        | 50                        | ±10%                     | 0.90                  |
| 18 | CL10B103KC8WPN □ |                    | 10nF        | 100                       | ±10%                     | 0.90                  |
| 19 | CL10B153KB8WPN □ |                    | 15nF        | 50                        | ±10%                     | 0.90                  |
| 20 | CL10B223KB8WPN □ |                    | 22nF        | 50                        | ±10%                     | 0.90                  |
| 21 | CL10B333KA8WPN □ |                    | 33nF        | 25                        | ±10%                     | 0.90                  |
| 22 | CL10B333KB8WPN □ |                    | 33nF        | 50                        | ±10%                     | 0.90                  |
| 23 | CL10B473KA8WPN □ |                    | 47nF        | 25                        | ±10%                     | 0.90                  |
| 24 | CL10B473KB8WPN □ |                    | 47nF        | 50                        | ±10%                     | 0.90                  |
| 25 | CL10B683KA8WPN □ |                    | 68nF        | 25                        | ±10%                     | 0.90                  |
| 26 | CL10B683KB8WPN □ |                    | 68nF        | 50                        | ±10%                     | 0.90                  |
| 27 | CL10B104KA8WPN □ |                    | 100nF       | 25                        | ±10%                     | 0.90                  |
| 28 | CL10B104KB8WPN □ |                    | 100nF       | 50                        | ±10%                     | 0.90                  |
| 29 | CL10B154KO8VPN □ |                    | 150nF       | 16                        | ±10%                     | 0.90                  |
| 30 | CL10B154KA8VPN □ |                    | 150nF       | 25                        | ±10%                     | 0.90                  |
| 31 | CL10B224KO8VPN □ |                    | 220nF       | 16                        | ±10%                     | 0.90                  |
| 32 | CL10B224KA8VPN □ |                    | 220nF       | 25                        | ±10%                     | 0.90                  |
| 33 | CL10B334KO8VPN □ |                    | 330nF       | 16                        | ±10%                     | 0.90                  |
| 34 | CL10B334KA8VPN □ |                    | 330nF       | 25                        | ±10%                     | 0.90                  |
| 35 | CL10B474KO8VPN □ |                    | 470nF       | 16                        | ±10%                     | 0.90                  |
| 36 | CL10B474KA8VPN □ |                    | 470nF       | 25                        | ±10%                     | 0.90                  |
| 37 | CL10B684KO8VPN □ |                    | 680nF       | 16                        | ±10%                     | 0.90                  |
| 38 | CL10B105KO8VPN □ |                    | 1.0μF       | 16                        | ±10%                     | 0.90                  |

※ □ mark means packaging code. If you want to learn the code or quantity in detail, please see p74.

## Product Lineup (Automotive Capacitors-X7R)

|    | Part Number      | Size L x W<br>(mm) | Capacitance | Rated<br>Voltage<br>(Vdc) | Capacitance<br>Tolerance | Thickness<br>Max.(mm) |
|----|------------------|--------------------|-------------|---------------------------|--------------------------|-----------------------|
| 1  | CL21B102KC6WPN □ | 2.00×1.25          | 1.0 nF      | 100                       | ±10%                     | 0.70                  |
| 2  | CL21B152KC6WPN □ |                    | 1.5 nF      | 100                       | ±10%                     | 0.70                  |
| 3  | CL21B222KC6WPN □ |                    | 2.2 nF      | 100                       | ±10%                     | 0.70                  |
| 4  | CL21B332KC6WPN □ |                    | 3.3 nF      | 100                       | ±10%                     | 0.70                  |
| 5  | CL21B472KC6WPN □ |                    | 4.7 nF      | 100                       | ±10%                     | 0.70                  |
| 6  | CL21B682KC6WPN □ |                    | 6.8 nF      | 100                       | ±10%                     | 0.70                  |
| 7  | CL21B103KC6WPN □ |                    | 10 nF       | 100                       | ±10%                     | 0.70                  |
| 8  | CL21B153KC6WPN □ |                    | 15 nF       | 100                       | ±10%                     | 0.70                  |
| 9  | CL21B223KC6WPN □ |                    | 22 nF       | 100                       | ±10%                     | 0.70                  |
| 10 | CL21B333KCCWPN □ |                    | 33 nF       | 100                       | ±10%                     | 0.95                  |
| 11 | CL21B473KCCWPN □ |                    | 47 nF       | 100                       | ±10%                     | 0.95                  |
| 12 | CL21B683KCCWPN □ |                    | 68 nF       | 100                       | ±10%                     | 0.95                  |
| 13 | CL21B104KBFWPN □ |                    | 100 nF      | 50                        | ±10%                     | 1.35                  |
| 14 | CL21B104KBCWPN □ |                    | 100 nF      | 50                        | ±10%                     | 0.95                  |
| 15 | CL21B104KCFWPN □ |                    | 100 nF      | 100                       | ±10%                     | 1.35                  |
| 16 | CL21B104KCCWPN □ |                    | 100 nF      | 100                       | ±10%                     | 0.95                  |
| 17 | CL21B154KAFVFN □ |                    | 150 nF      | 25                        | ±10%                     | 1.35                  |
| 18 | CL21B154KBFVFN □ |                    | 150 nF      | 50                        | ±10%                     | 1.35                  |
| 19 | CL21B224KAFVFN □ |                    | 220 nF      | 25                        | ±10%                     | 1.35                  |
| 20 | CL21B224KBFVFN □ |                    | 220 nF      | 50                        | ±10%                     | 1.35                  |
| 21 | CL21B334KAFVFN □ |                    | 330 nF      | 25                        | ±10%                     | 1.35                  |
| 22 | CL21B334KBFVFN □ |                    | 330 nF      | 50                        | ±10%                     | 1.35                  |
| 23 | CL21B474KOFVFN □ |                    | 470 nF      | 16                        | ±10%                     | 1.35                  |
| 24 | CL21B474KAFVFN □ |                    | 470 nF      | 25                        | ±10%                     | 1.35                  |
| 25 | CL21B474KBFVFN □ |                    | 470 nF      | 50                        | ±10%                     | 1.35                  |
| 26 | CL21B684KOFVFN □ |                    | 680 nF      | 16                        | ±10%                     | 1.35                  |
| 27 | CL21B684KAFVFN □ |                    | 680 nF      | 25                        | ±10%                     | 1.35                  |
| 28 | CL21B105KOFVFN □ |                    | 1.0 μF      | 16                        | ±10%                     | 1.35                  |
| 29 | CL21B105KAFVFN □ |                    | 1.0 μF      | 25                        | ±10%                     | 1.35                  |
| 30 | CL21B225KPFVFN □ |                    | 2.2 μF      | 10                        | ±10%                     | 1.35                  |
| 31 | CL21B225KOFVFN □ |                    | 2.2 μF      | 16                        | ±10%                     | 1.35                  |
| 32 | CL21B335KPQVFN □ |                    | 3.3 μF      | 10                        | ±10%                     | 1.40                  |
| 33 | CL21B475KPQVFN □ |                    | 4.7 μF      | 10                        | ±10%                     | 1.40                  |
| 1  | CL31B104KBPWPN □ | 3.20×1.60          | 100 nF      | 50                        | ±10%                     | 1.25                  |
| 2  | CL31B104KBCVFN □ |                    | 100 nF      | 50                        | ±10%                     | 1.00                  |
| 3  | CL31B154KBPWPN □ |                    | 150 nF      | 50                        | ±10%                     | 1.25                  |
| 4  | CL31B224KBPWPN □ |                    | 220 nF      | 50                        | ±10%                     | 1.25                  |
| 5  | CL31B334KBHWPN □ |                    | 330 nF      | 50                        | ±10%                     | 1.80                  |
| 6  | CL31B474KBHWPN □ |                    | 470 nF      | 50                        | ±10%                     | 1.80                  |
| 7  | CL31B684KBHWPN □ |                    | 680 nF      | 50                        | ±10%                     | 1.80                  |
| 8  | CL31B105KAPWPN □ |                    | 1.0 μF      | 25                        | ±10%                     | 1.25                  |
| 9  | CL31B105KBHWPN □ |                    | 1.0 μF      | 50                        | ±10%                     | 1.80                  |
| 10 | CL31B155KAHVFN □ |                    | 1.5 μF      | 25                        | ±10%                     | 1.80                  |
| 11 | CL31B155KBHVFN □ |                    | 1.5 μF      | 50                        | ±10%                     | 1.80                  |
| 12 | CL31B225KOHVFN □ |                    | 2.2 μF      | 16                        | ±10%                     | 1.80                  |
| 13 | CL31B225KAHVFN □ |                    | 2.2 μF      | 25                        | ±10%                     | 1.80                  |
| 14 | CL31B225KBHVFN □ |                    | 2.2 μF      | 50                        | ±10%                     | 1.80                  |
| 15 | CL31B335KOHVFN □ |                    | 3.3 μF      | 16                        | ±10%                     | 1.80                  |
| 16 | CL31B335KAHVFN □ |                    | 3.3 μF      | 25                        | ±10%                     | 1.80                  |
| 17 | CL31B475KOHVFN □ |                    | 4.7 μF      | 16                        | ±10%                     | 1.80                  |
| 18 | CL31B475KAHVFN □ |                    | 4.7 μF      | 25                        | ±10%                     | 1.80                  |
| 19 | CL31B685KOHVFN □ |                    | 6.8 μF      | 16                        | ±10%                     | 1.80                  |
| 20 | CL31B106KOHVFN □ |                    | 10.0 μF     | 16                        | ±10%                     | 1.80                  |
| 1  | CL32B226KOJVPN □ | 3.20×2.50          | 22 μF       | 16                        | ±10%                     | 2.70                  |

Part Numbering  
SystemStandard &  
High CapacitorsSuper Small Size  
CapacitorsHigh-Q  
CapacitorsMedium-High  
Voltage CapacitorsArray Type  
CapacitorsLow ESL  
CapacitorsReliability Test  
ConditionPremium Capacitors  
for Automotive  
ApplicationsPackaging  
SpecificationApplication Manual  
for Surface Mounting

※ □ mark means packaging code. If you want to learn the code or quantity in detail, please see p74.

### Reliability Test Condition (Automotive Capacitors)

| No                 | Item                                |                                                                                                                                          | Performance                                                 | Test Condition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                               |                |              |     |                        |        |     |      |        |     |                        |        |     |      |        |     |    |        |      |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |
|--------------------|-------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|----------------|--------------|-----|------------------------|--------|-----|------|--------|-----|------------------------|--------|-----|------|--------|-----|----|--------|------|----|--------|-------|----|--------|-------|----|--------|-------|----|--------|-------|----|--------|-------|----|--------|-------|----|--------|-------|----|--------|-------|----|--------|-------|----|--------|-------|----|--------|-------|----|--------|-------|----|--------|
| 1                  | Pre-and Post-Stress Electrical Test |                                                                                                                                          | —                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                               |                |              |     |                        |        |     |      |        |     |                        |        |     |      |        |     |    |        |      |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |
| 2                  | High Temperature Exposure           | Appearance                                                                                                                               | No abnormal exterior appearance                             | Unpowered, 1000hrs@T=125℃<br>Measurement at 24±2hrs after test conclusion<br><br>Initial Measurement<br>Perform a heat treatment at 150+0/-10℃ for 1hr after soldering process. And then let sit for 24±2hrs at room temperature. Perform the initial measurement.<br>Final Measurement<br>Let sit for 24±2hrs at room temperature after test conclusion, then measure.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                               |                |              |     |                        |        |     |      |        |     |                        |        |     |      |        |     |    |        |      |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |
|                    |                                     | Capacitance Change                                                                                                                       | CLASS I                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Within ± 2.5% or 0.25pF, (Whichever is larger)                                |                |              |     |                        |        |     |      |        |     |                        |        |     |      |        |     |    |        |      |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |
|                    |                                     |                                                                                                                                          | CLASS II                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Within ± 10%                                                                  |                |              |     |                        |        |     |      |        |     |                        |        |     |      |        |     |    |        |      |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |
|                    |                                     | Q                                                                                                                                        | CLASS I                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Capacitance ≥ 30pF : Q ≥ 1,000<br>< 30pF : Q ≥ 400 + 20 × C (C : Capacitance) |                |              |     |                        |        |     |      |        |     |                        |        |     |      |        |     |    |        |      |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |
|                    |                                     | Tanδ                                                                                                                                     | CLASS II                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Rated Voltage ≥ 25V : 0.03 max<br>≥ 16V : 0.05 max<br>≥ 10V : 0.075 max *1)   |                |              |     |                        |        |     |      |        |     |                        |        |     |      |        |     |    |        |      |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |
|                    | IR                                  |                                                                                                                                          | More than 10,000MΩ or 500MΩ × μF (Whichever is smaller) *1) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                               |                |              |     |                        |        |     |      |        |     |                        |        |     |      |        |     |    |        |      |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |
| 3                  | Temperature Cycling                 | Appearance                                                                                                                               | No abnormal exterior appearance                             | 1000Cycles<br>Initial Measurement<br>Perform a heat treatment at 150+0/-10℃ for 1hr after soldering process. And then let sit for 24±2hrs at room temperature. Perform the initial measurement.<br>Final Measurement<br>Let sit for 24±2hrs at room temperature after test conclusion, then measure.<br>Measurement at 24±2hrs after test conclusion <table><tr><th>Step</th><th>Temperature(℃)</th><th>Time(min.)</th></tr><tr><td>1</td><td>Min. operating Temp.±2</td><td>15±3</td></tr><tr><td>2</td><td>25±2</td><td>1</td></tr><tr><td>3</td><td>Max. operating Temp.±2</td><td>15±3</td></tr><tr><td>4</td><td>25±2</td><td>1</td></tr></table>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Step                                                                          | Temperature(℃) | Time(min.)   | 1   | Min. operating Temp.±2 | 15±3   | 2   | 25±2 | 1      | 3   | Max. operating Temp.±2 | 15±3   | 4   | 25±2 | 1      |     |    |        |      |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |
|                    |                                     | Step                                                                                                                                     | Temperature(℃)                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Time(min.)                                                                    |                |              |     |                        |        |     |      |        |     |                        |        |     |      |        |     |    |        |      |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |
|                    |                                     | 1                                                                                                                                        | Min. operating Temp.±2                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 15±3                                                                          |                |              |     |                        |        |     |      |        |     |                        |        |     |      |        |     |    |        |      |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |
|                    |                                     | 2                                                                                                                                        | 25±2                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 1                                                                             |                |              |     |                        |        |     |      |        |     |                        |        |     |      |        |     |    |        |      |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |
|                    |                                     | 3                                                                                                                                        | Max. operating Temp.±2                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 15±3                                                                          |                |              |     |                        |        |     |      |        |     |                        |        |     |      |        |     |    |        |      |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |
| 4                  | 25±2                                | 1                                                                                                                                        |                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                               |                |              |     |                        |        |     |      |        |     |                        |        |     |      |        |     |    |        |      |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |
| Capacitance Change | CLASS I                             | Within ± 2.5% or 0.25pF, (Whichever is larger)                                                                                           |                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                               |                |              |     |                        |        |     |      |        |     |                        |        |     |      |        |     |    |        |      |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |
|                    | CLASS II                            | Within ± 10%                                                                                                                             |                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                               |                |              |     |                        |        |     |      |        |     |                        |        |     |      |        |     |    |        |      |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |
| Q                  | CLASS I                             | Capacitance ≥ 30pF : Q ≥ 1,000<br>< 30pF : Q ≥ 400 + 20 × C (C : Capacitance)                                                            |                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                               |                |              |     |                        |        |     |      |        |     |                        |        |     |      |        |     |    |        |      |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |
| Tanδ               | CLASS II                            | Rated Voltage ≥ 25V : 0.03 max<br>≥ 16V : 0.05 max<br>≥ 10V : 0.075max *1)                                                               |                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                               |                |              |     |                        |        |     |      |        |     |                        |        |     |      |        |     |    |        |      |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |
|                    | IR                                  |                                                                                                                                          | More than 10,000MΩ or 500MΩ × μF (Whichever is smaller) *1) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                               |                |              |     |                        |        |     |      |        |     |                        |        |     |      |        |     |    |        |      |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |
| 4                  | Destructive Physical Analysis       |                                                                                                                                          | No defects or abnormalities                                 | Per EIA 469                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                               |                |              |     |                        |        |     |      |        |     |                        |        |     |      |        |     |    |        |      |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |
| 5                  | Moisture Resistance                 | Appearance                                                                                                                               | No abnormal exterior appearance                             | 10Cycles, t=24hrs/cycle<br>Heat (25~65℃) and humidity (80~98%), Unpowered measurement at 24±2hrs after test conclusion <table><tr><th>Time[Hours]</th><th>Temperature[℃]</th><th>Humidity[RH]</th></tr><tr><td>0-3</td><td>25</td><td>90-100</td></tr><tr><td>3-6</td><td>65</td><td>90-100</td></tr><tr><td>6-7</td><td>65</td><td>90-100</td></tr><tr><td>7-8</td><td>25</td><td>80-100</td></tr><tr><td>8-9</td><td>25</td><td>90-100</td></tr><tr><td>9-12</td><td>65</td><td>90-100</td></tr><tr><td>12-13</td><td>65</td><td>90-100</td></tr><tr><td>13-14</td><td>25</td><td>80-100</td></tr><tr><td>14-15</td><td>25</td><td>90-100</td></tr><tr><td>15-16</td><td>65</td><td>90-100</td></tr><tr><td>16-17</td><td>65</td><td>90-100</td></tr><tr><td>17-18</td><td>25</td><td>80-100</td></tr><tr><td>18-19</td><td>25</td><td>90-100</td></tr><tr><td>19-20</td><td>65</td><td>90-100</td></tr><tr><td>20-21</td><td>65</td><td>90-100</td></tr><tr><td>21-22</td><td>25</td><td>80-100</td></tr><tr><td>22-23</td><td>25</td><td>90-100</td></tr><tr><td>23-24</td><td>65</td><td>90-100</td></tr></table> | Time[Hours]                                                                   | Temperature[℃] | Humidity[RH] | 0-3 | 25                     | 90-100 | 3-6 | 65   | 90-100 | 6-7 | 65                     | 90-100 | 7-8 | 25   | 80-100 | 8-9 | 25 | 90-100 | 9-12 | 65 | 90-100 | 12-13 | 65 | 90-100 | 13-14 | 25 | 80-100 | 14-15 | 25 | 90-100 | 15-16 | 65 | 90-100 | 16-17 | 65 | 90-100 | 17-18 | 25 | 80-100 | 18-19 | 25 | 90-100 | 19-20 | 65 | 90-100 | 20-21 | 65 | 90-100 | 21-22 | 25 | 80-100 | 22-23 | 25 | 90-100 | 23-24 | 65 | 90-100 |
|                    |                                     | Time[Hours]                                                                                                                              | Temperature[℃]                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Humidity[RH]                                                                  |                |              |     |                        |        |     |      |        |     |                        |        |     |      |        |     |    |        |      |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |
|                    |                                     | 0-3                                                                                                                                      | 25                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 90-100                                                                        |                |              |     |                        |        |     |      |        |     |                        |        |     |      |        |     |    |        |      |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |
|                    |                                     | 3-6                                                                                                                                      | 65                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 90-100                                                                        |                |              |     |                        |        |     |      |        |     |                        |        |     |      |        |     |    |        |      |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |
|                    |                                     | 6-7                                                                                                                                      | 65                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 90-100                                                                        |                |              |     |                        |        |     |      |        |     |                        |        |     |      |        |     |    |        |      |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |
| 7-8                | 25                                  | 80-100                                                                                                                                   |                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                               |                |              |     |                        |        |     |      |        |     |                        |        |     |      |        |     |    |        |      |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |
| 8-9                | 25                                  | 90-100                                                                                                                                   |                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                               |                |              |     |                        |        |     |      |        |     |                        |        |     |      |        |     |    |        |      |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |
| 9-12               | 65                                  | 90-100                                                                                                                                   |                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                               |                |              |     |                        |        |     |      |        |     |                        |        |     |      |        |     |    |        |      |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |
| 12-13              | 65                                  | 90-100                                                                                                                                   |                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                               |                |              |     |                        |        |     |      |        |     |                        |        |     |      |        |     |    |        |      |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |
| 13-14              | 25                                  | 80-100                                                                                                                                   |                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                               |                |              |     |                        |        |     |      |        |     |                        |        |     |      |        |     |    |        |      |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |
| 14-15              | 25                                  | 90-100                                                                                                                                   |                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                               |                |              |     |                        |        |     |      |        |     |                        |        |     |      |        |     |    |        |      |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |
| 15-16              | 65                                  | 90-100                                                                                                                                   |                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                               |                |              |     |                        |        |     |      |        |     |                        |        |     |      |        |     |    |        |      |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |
| 16-17              | 65                                  | 90-100                                                                                                                                   |                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                               |                |              |     |                        |        |     |      |        |     |                        |        |     |      |        |     |    |        |      |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |
| 17-18              | 25                                  | 80-100                                                                                                                                   |                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                               |                |              |     |                        |        |     |      |        |     |                        |        |     |      |        |     |    |        |      |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |
| 18-19              | 25                                  | 90-100                                                                                                                                   |                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                               |                |              |     |                        |        |     |      |        |     |                        |        |     |      |        |     |    |        |      |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |
| 19-20              | 65                                  | 90-100                                                                                                                                   |                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                               |                |              |     |                        |        |     |      |        |     |                        |        |     |      |        |     |    |        |      |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |
| 20-21              | 65                                  | 90-100                                                                                                                                   |                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                               |                |              |     |                        |        |     |      |        |     |                        |        |     |      |        |     |    |        |      |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |
| 21-22              | 25                                  | 80-100                                                                                                                                   |                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                               |                |              |     |                        |        |     |      |        |     |                        |        |     |      |        |     |    |        |      |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |
| 22-23              | 25                                  | 90-100                                                                                                                                   |                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                               |                |              |     |                        |        |     |      |        |     |                        |        |     |      |        |     |    |        |      |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |
| 23-24              | 65                                  | 90-100                                                                                                                                   |                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                               |                |              |     |                        |        |     |      |        |     |                        |        |     |      |        |     |    |        |      |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |
| Capacitance Change | CLASS I                             | Within ± 2.5% or 0.25pF, (Whichever is larger)                                                                                           |                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                               |                |              |     |                        |        |     |      |        |     |                        |        |     |      |        |     |    |        |      |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |
|                    | CLASS II                            | Within ± 12.5%                                                                                                                           |                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                               |                |              |     |                        |        |     |      |        |     |                        |        |     |      |        |     |    |        |      |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |
| Q                  | CLASS I                             | Capacitance ≥ 30pF : Q ≥ 350<br>10 ≤ Capacitance < 30pF : Q ≥ 275 + (5/2) × C<br>Capacitance < 10pF : Q ≥ 200 + 10 × C (C : Capacitance) |                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                               |                |              |     |                        |        |     |      |        |     |                        |        |     |      |        |     |    |        |      |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |
| Tanδ               | CLASS II                            | Rated Voltage ≥ 25V : 0.03 max<br>≥ 16V : 0.05 max<br>≥ 10V : 0.075max *1)                                                               |                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                               |                |              |     |                        |        |     |      |        |     |                        |        |     |      |        |     |    |        |      |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |
|                    | IR                                  |                                                                                                                                          | More than 10,000MΩ or 500MΩ × μF (Whichever is smaller) *1) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                               |                |              |     |                        |        |     |      |        |     |                        |        |     |      |        |     |    |        |      |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |       |    |        |

※ \*1) : Indicates typical specification. Please refer to individual specifications.

| No   | Item                            |                                                                              | Performance                                                 | Test Condition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                     |          |      |        |       |           |
|------|---------------------------------|------------------------------------------------------------------------------|-------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|----------|------|--------|-------|-----------|
| 6    | Biased Humidity                 | Appearance                                                                   | No abnormal exterior appearance                             | 1000hrs 85℃/85%RH, Rated Voltate and 1.3~1.5V, (add 100kohm resistor)<br>Initial Measurement<br>Perform a heat treatment at 150+0/−10℃ for 1hr after soldering process. And then let sit for 24±2hrs at room temperature. Perform the initial measurement.<br>Final measurement<br>Perform a heat treatment at 150+0/−10℃ for 1hr after soldering process. And then let sit for 24±2hrs at room temperature. Perform the initial measurement.<br>Perform the initial measurement.<br>Measurement at 24±2hrs after test conclusion<br>The charge/discharge current is less than 50mA |                                                                                                     |          |      |        |       |           |
|      |                                 | Capacitance Change                                                           | CLASS I                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Within ±2.5% or 0.25pF, (Whichever is larger)                                                       |          |      |        |       |           |
|      |                                 |                                                                              | CLASS II                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Within ±12.5%                                                                                       |          |      |        |       |           |
|      |                                 | Q                                                                            | CLASS I                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Capacitance ≥ 30pF : Q ≥ 200<br>< 30pF : Q ≥ 100+(10/3)×C (C : Capacitance)                         |          |      |        |       |           |
|      |                                 | Tanδ                                                                         | CLASS II                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Rated Voltage ≥ 25V : 0.035 max<br>≥ 16V : 0.05 max<br>≥ 10V : 0.075max *1)                         |          |      |        |       |           |
|      | IR                              |                                                                              | More than 500 MΩ or 25 MΩ×μF (Whichever is Smaller) *1)     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                     |          |      |        |       |           |
| 7    | High Temperature Operating Life | Appearance                                                                   | No abnormal exterior appearance                             | 1000hrs @ TA=125℃, 200% Rated Voltage, *2)<br>Initial Measurement<br>Perform a heat treatment at 150+0/−10℃ for 1hr after soldering process. And then let sit for 24±2hrs at room temperature. Perform the initial measurement.<br>Final measurement<br>Perform a heat treatment at 150+0/−10℃ for 1hr after soldering process. And then let sit for 24±2hrs at room temperature. Perform the initial measurement.<br>Perform the initial measurement.<br>Measurement at 24±2hrs after test conclusion<br>The charge/discharge current is less than 50mA.                           |                                                                                                     |          |      |        |       |           |
|      |                                 | Capacitance Change                                                           | CLASS I                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Within ± 3.0% or 0.3pF, (Whichever is larger)                                                       |          |      |        |       |           |
|      |                                 |                                                                              | CLASS II                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Within ±12.5%                                                                                       |          |      |        |       |           |
|      |                                 | Q                                                                            | CLASS I                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Capacitance ≥ 30pF : Q ≥ 350<br>≥ 10pF : Q ≥ 275+(5/2)×C<br>< 10pF : Q ≥ 200+10×C (C : Capacitance) |          |      |        |       |           |
|      |                                 | Tanδ                                                                         | CLASS II                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Rated Voltage ≥ 25V : 0.035 max<br>≥ 16V : 0.05 max<br>≥ 10V : 0.075max *1)                         |          |      |        |       |           |
|      | IR                              |                                                                              | More than 1,000 MΩ or 50 MΩ×μF (Whichever is smaller) *1)   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                     |          |      |        |       |           |
| 8    | External Visual                 |                                                                              | No abnormal exterior appearance                             | Microscope (x10)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                     |          |      |        |       |           |
| 9    | Physical Dimensions             |                                                                              | Within the specified dimensions                             | Using the calipers                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                     |          |      |        |       |           |
| 10   | Mechanical Shock                | Appearance                                                                   | No abnormal exterior appearance                             | Three shocks in each direction should be applied along 3 mutually perpendicular axes of the test specimen (18 shocks)<br><table><tr><td>Peakvalue</td><td>Duration</td><td>Wave</td></tr><tr><td>1,500G</td><td>0.5ms</td><td>Half sine</td></tr></table><br>Initial Measurement<br>Perform a heat treatment at 150+0/−10℃ for 1hr after soldering process. And then let sit for 24±2hrs at room temperature. Perform the initial measurement.<br>Final measurement<br>Let measure within 24hrs at room temperature after test conclusion.                                          | Peakvalue                                                                                           | Duration | Wave | 1,500G | 0.5ms | Half sine |
|      |                                 | Peakvalue                                                                    | Duration                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Wave                                                                                                |          |      |        |       |           |
|      |                                 | 1,500G                                                                       | 0.5ms                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Half sine                                                                                           |          |      |        |       |           |
|      |                                 | Capacitance Change                                                           | CLASS I                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Within ±2.5% or 0.25pF, (Whichever is larger)                                                       |          |      |        |       |           |
|      |                                 |                                                                              | CLASS II                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Within ±10%                                                                                         |          |      |        |       |           |
| Q    | CLASS I                         | Capacitance ≥ 30pF : Q ≥ 1,000<br>< 30pF : Q ≥ 400+20×C (C : Capacitance)    |                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                     |          |      |        |       |           |
| Tanδ | CLASS II                        | Rated Voltage ≥ 25V : 0.025 max<br>≥ 16V : 0.035 max<br>≥ 10V : 0.05 max *1) |                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                     |          |      |        |       |           |
|      | IR                              |                                                                              | More than 10,000 MΩ or 500 MΩ×μF (Whichever is smaller) *1) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                     |          |      |        |       |           |

※ \*1) : Indicates typical specification. Please refer to individual specifications.

\*2) : Some of the parts are applicable in rated voltage 150%, Please refer to individual specifications.

Part Numbering  
SystemStandard &  
High CapacitorsSuper Small Size  
CapacitorsHigh-Q  
CapacitorsMedium-High  
Voltage CapacitorsArray Type  
CapacitorsLow ESL  
CapacitorsReliability Test  
ConditionPremium Capacitors  
for Automotive  
ApplicationsPackaging  
SpecificationApplication Manual  
for Surface Mounting

| No | Item                         |                       | Performance                                                                             | Test Condition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----|------------------------------|-----------------------|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 11 | Vibration                    | Appearance            | No abnormal exterior appearance                                                         | 5g's for 20min., 12cycles each of 3 orientations,<br>Use 8"×5" PCB 0.031" Thick 7 secure points on one long side<br>and 2 secure points at corners of opposite sides. Parts mounted<br>within 2" from any secure point. Test from 10~2000Hz.<br>Initial Measurement<br>Perform a heat treatment at 150+0/-10°C for 1hr after<br>soldering process. And then let sit for 24±2hrs at room<br>temperature. Perform the initial measurement.<br>Final measurement<br>Let measure within 24hrs at room temperature after<br>test conclusion. |
|    |                              | Capacitance<br>Change | CLASS I<br>Within ±2.5% or 0.25pF,<br>(Whichever is larger)                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|    |                              |                       | CLASS II<br>Within ±10%                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|    |                              | Q                     | CLASS I<br>Capacitance ≥ 30pF : Q ≥ 1,000<br>< 30pF : Q ≥ 400+20×C<br>(C : Capacitance) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|    |                              | Tanδ                  | CLASS II<br>Rated Voltage ≥ 25V : 0.025 max<br>≥ 16V : 0.035 max<br>≥ 10V : 0.05max *1) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 12 | Resistance to<br>Solder Heat | IR                    | More than 10,000MΩ or 500MΩ × μF<br>(Whichever is smaller) *1)                          | Solder pot : 260±5°C, 10±1sec.<br>Initial Measurement<br>Perform a heat treatment at 150+0/-10°C for 1hr after<br>soldering process. And then let sit for 24±2hrs at room<br>temperature. Perform the initial measurement.<br>Final Measurement<br>Let sit for 24±2hrs at room temperature after test conclusion,<br>then measure.                                                                                                                                                                                                      |
|    |                              | Appearance            | No abnormal exterior appearance                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|    |                              | Capacitance<br>Change | CLASS I<br>Within ±2.5% or 0.25pF,<br>(Whichever is larger)                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|    |                              |                       | CLASS II<br>Within ±10%                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|    |                              | Q                     | CLASS I<br>Capacitance ≥ 30pF : Q ≥ 1,000<br>< 30pF : Q ≥ 400+20×C<br>(C : Capacitance) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 13 | Thermal Shock                | Tanδ                  | CLASS II<br>Rated Voltage ≥ 25V : 0.025 max<br>≥ 16V : 0.035 max<br>≥ 10V : 0.05max *1) | -55°C/+125°C<br>Note: Number of cycles required—300,<br>Maximum transfer time—20 sec,<br>Dwell time—15min. Air—Air                                                                                                                                                                                                                                                                                                                                                                                                                      |
|    |                              | IR                    | More than 10,000MΩ or 500MΩ × μF<br>(Whichever is smaller) *1)                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|    |                              | Appearance            | No abnormal exterior appearance                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|    |                              | Capacitance<br>Change | CLASS I<br>Within ±2.5% or 0.25pF,<br>(Whichever is larger)                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|    |                              |                       | CLASS II<br>Within ±10%                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 14 | ESD                          | Q                     | CLASS I<br>Capacitance ≥ 30pF : Q ≥ 1,000<br>< 30pF : Q ≥ 400+20×C<br>(C : Capacitance) | AEC-Q200-002<br>Initial Measurement<br>Perform a heat treatment at 150+0/-10°C for 1hr after<br>soldering process. And then let sit for 24±2hrs at room<br>temperature. Perform the initial measurement.<br>Final measurement<br>Perform a heat treatment at 150+0/-10°C for 1hr after<br>soldering process. And then let sit for 24±2hrs at room<br>temperature. Perform the initial measurement.<br>Perform the initial measurement.                                                                                                  |
|    |                              | Tanδ                  | CLASS II<br>Rated Voltage ≥ 25V : 0.025 max<br>≥ 16V : 0.035 max<br>≥ 10V : 0.05max *1) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|    |                              | IR                    | More than 10,000MΩ or 500MΩ × μF<br>(Whichever is smaller) *1)                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|    |                              | Appearance            | No abnormal exterior appearance                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|    |                              | Capacitance<br>Change | CLASS I<br>Within ±2.5% or 0.25pF,<br>(Whichever is larger)                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|    |                              |                       | CLASS II<br>Within ±10%                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

※ \*1) : Indicates typical specification. Please refer to individual specifications.

| No                      | Item                                    |                                                                |                                                   | Performance                                                                                                                                                                                                                     | Test Condition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |             |                 |           |        |         |                         |           |           |          |                         |             |          |         |           |             |         |           |             |
|-------------------------|-----------------------------------------|----------------------------------------------------------------|---------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-----------------|-----------|--------|---------|-------------------------|-----------|-----------|----------|-------------------------|-------------|----------|---------|-----------|-------------|---------|-----------|-------------|
| 15                      | Solderability                           |                                                                |                                                   | 95% of the terminations is to be soldered evenly and continuously                                                                                                                                                               | a) Preheat at 155°C for 4 hrs, Immerse in solder for 5s at 235±5°C<br>b) Steam aging for 8 hrs, Immerse in solder for 5s at 235±5°C<br>c) Steam aging for 8 hrs, Immerse in solder for 120s at 260±5°C<br>solder : a solution ethanol and rosin                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |             |                 |           |        |         |                         |           |           |          |                         |             |          |         |           |             |         |           |             |
| 16                      | Electrical Characterization             | Capacitance                                                    |                                                   | Within specified tolerance                                                                                                                                                                                                      | The Capacitance /D.F. should be measured at 25°C,<br>*A capacitor prior to measuring the capacitance is heat treated at 150+0/-10°C and maintained in ambient air for 24±2hrs.<br><table><tr><td>Class</td><td>Capacitance</td><td>Frequency</td><td>Vrms</td></tr><tr><td rowspan="2">Class I</td><td>1000pF ↓</td><td>1kHz ±10%</td><td>0.5~5Vrms</td></tr><tr><td>1000pF ↑</td><td>1kHz ±10%</td><td>1.0±0.2Vrms</td></tr><tr><td rowspan="2">Class II</td><td>10 μF ↓</td><td>1kHz ±10%</td><td>1.0±0.2Vrms</td></tr><tr><td>10 μF ↑</td><td>120Hz±20%</td><td>0.5±0.1Vrms</td></tr></table><br>Initial measurement<br>Perform a heat treatment at 150+0/-10°C for one hour after soldering process. And then let sit for 24±2hrs at room temperature. Perform the initial measurement.<br><br>I.R. should be measured with a DC voltage not exceeding Rated Voltage @25°C , @125°C for 60~120 sec.<br><br>Dielectric Strength : 250% of the rated voltage for 1~5 seconds<br>The charge/discharge current is less than 50mA. | Class       | Capacitance     | Frequency | Vrms   | Class I | 1000pF ↓                | 1kHz ±10% | 0.5~5Vrms | 1000pF ↑ | 1kHz ±10%               | 1.0±0.2Vrms | Class II | 10 μF ↓ | 1kHz ±10% | 1.0±0.2Vrms | 10 μF ↑ | 120Hz±20% | 0.5±0.1Vrms |
|                         |                                         | Class                                                          | Capacitance                                       | Frequency                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Vrms        |                 |           |        |         |                         |           |           |          |                         |             |          |         |           |             |         |           |             |
|                         |                                         | Class I                                                        | 1000pF ↓                                          | 1kHz ±10%                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0.5~5Vrms   |                 |           |        |         |                         |           |           |          |                         |             |          |         |           |             |         |           |             |
|                         |                                         |                                                                | 1000pF ↑                                          | 1kHz ±10%                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1.0±0.2Vrms |                 |           |        |         |                         |           |           |          |                         |             |          |         |           |             |         |           |             |
|                         |                                         | Class II                                                       | 10 μF ↓                                           | 1kHz ±10%                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1.0±0.2Vrms |                 |           |        |         |                         |           |           |          |                         |             |          |         |           |             |         |           |             |
|                         |                                         |                                                                | 10 μF ↑                                           | 120Hz±20%                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0.5±0.1Vrms |                 |           |        |         |                         |           |           |          |                         |             |          |         |           |             |         |           |             |
|                         |                                         | Q                                                              | CLASS I                                           | Capacitance ≥ 30pF : Q ≥ 1,000<br>< 30pF : Q ≥ 400+20×C<br>(C: Capacitance)                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |             |                 |           |        |         |                         |           |           |          |                         |             |          |         |           |             |         |           |             |
|                         |                                         | Tanδ                                                           | CLASS II                                          | Rated Voltage ≥ 25V : 0.025 max<br>≥ 16V : 0.035 max<br>≥ 10V : 0.05max *1)                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |             |                 |           |        |         |                         |           |           |          |                         |             |          |         |           |             |         |           |             |
| IR@25°C                 | CLASS I                                 | More than 100,000MΩ or 1,000 MΩ × μF<br>(Whichever is smaller) |                                                   |                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |             |                 |           |        |         |                         |           |           |          |                         |             |          |         |           |             |         |           |             |
|                         | CLASS II                                | More than 10,000MΩ or 500 MΩ × μF<br>(Whichever is smaller)    |                                                   |                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |             |                 |           |        |         |                         |           |           |          |                         |             |          |         |           |             |         |           |             |
| IR@125°C                | CLASS I                                 | More than 10,000MΩ or 100 MΩ × μF<br>(Whichever is smaller)    |                                                   |                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |             |                 |           |        |         |                         |           |           |          |                         |             |          |         |           |             |         |           |             |
|                         | CLASS II                                | More than 1,000MΩ or 10 MΩ × μF<br>(Whichever is smaller)      |                                                   |                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |             |                 |           |        |         |                         |           |           |          |                         |             |          |         |           |             |         |           |             |
| Dielectric Strength     |                                         |                                                                | No dielectric breakdown or mechanical breakdown   |                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |             |                 |           |        |         |                         |           |           |          |                         |             |          |         |           |             |         |           |             |
| 17                      | Board Flex                              | Appearance                                                     |                                                   | No abnormal exterior appearance                                                                                                                                                                                                 | Bending to the limit for 60 seconds<br>Limit : Class I –3mm<br>Class II – 3mm<br><br>The figure indicates typical specification.<br>Please refer to individual specifications<br>Initial Measurement<br>Perform a heat treatment at 150+0/-10°C for 1hr after soldering process. And then let sit for 24±2hrs at room temperature. Perform the initial measurement.<br>Final measurement<br>Let measure within 24hrs at room temperature after test conclusion.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |             |                 |           |        |         |                         |           |           |          |                         |             |          |         |           |             |         |           |             |
|                         |                                         | Capacitance Change                                             | CLASS I                                           | Within ± 5.0% or 0.5pF,<br>(Whichever is larger)                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |             |                 |           |        |         |                         |           |           |          |                         |             |          |         |           |             |         |           |             |
|                         |                                         |                                                                | CLASS II                                          | Within ± 10%                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |             |                 |           |        |         |                         |           |           |          |                         |             |          |         |           |             |         |           |             |
| 18                      | Terminal Strength(SMD)                  | Appearance                                                     |                                                   | No abnormal exterior appearance                                                                                                                                                                                                 | 18N, for 60 ± 1 sec.<br>* 0603(1608) –10N,<br>0402(1005) –2N<br>Initial Measurement<br>Perform a heat treatment at 150+0/-10°C for 1hr after soldering process. And then let sit for 24±2hrs at room temperature. Perform the initial measurement.<br>Final measurement<br>Let measure within 24hrs at room temperature after test conclusion.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |             |                 |           |        |         |                         |           |           |          |                         |             |          |         |           |             |         |           |             |
|                         |                                         | Capacitance Change                                             | CLASS I                                           | Within ± 2.5% or 0.25pF,<br>(Whichever is larger)                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |             |                 |           |        |         |                         |           |           |          |                         |             |          |         |           |             |         |           |             |
|                         |                                         |                                                                | CLASS II                                          | Within ± 10%                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |             |                 |           |        |         |                         |           |           |          |                         |             |          |         |           |             |         |           |             |
| 19                      | Beam Load                               |                                                                |                                                   | Destruction value should be exceed<br>Chip Length ≤ 2.5mm<br>a) Chip Thickness > 0.5mm : 20N<br>b) Chip Thickness ≤ 0.5mm : 8N<br>Chip Length ≥ 3.2mm<br>a) Chip Thickness ≥ 1.25mm : 54.5N<br>b) Chip Thickness < 1.25mm : 15N | Beam speed<br>Chip Length ≤ 2.5mm , 0.5±0.05mm/sec<br>Chip Length ≥ 3.2mm , 2.5±0.25mm/sec                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |             |                 |           |        |         |                         |           |           |          |                         |             |          |         |           |             |         |           |             |
| 20                      | Capacitance Temperature Characteristics | Capacitance Change                                             | CLASS I                                           | 0±30 ppm/°C                                                                                                                                                                                                                     | <table><tr><td>Step</td><td>Temperature(°C)</td></tr><tr><td>1</td><td>25 ± 2</td></tr><tr><td>2</td><td>Min. Operating Temp. ±2</td></tr><tr><td>3</td><td>25 ± 2</td></tr><tr><td>4</td><td>Max. Operating Temp. ±2</td></tr><tr><td>5</td><td>25 ± 2</td></tr></table>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Step        | Temperature(°C) | 1         | 25 ± 2 | 2       | Min. Operating Temp. ±2 | 3         | 25 ± 2    | 4        | Max. Operating Temp. ±2 | 5           | 25 ± 2   |         |           |             |         |           |             |
|                         |                                         |                                                                | Step                                              | Temperature(°C)                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |             |                 |           |        |         |                         |           |           |          |                         |             |          |         |           |             |         |           |             |
|                         |                                         | 1                                                              | 25 ± 2                                            |                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |             |                 |           |        |         |                         |           |           |          |                         |             |          |         |           |             |         |           |             |
|                         |                                         | 2                                                              | Min. Operating Temp. ±2                           |                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |             |                 |           |        |         |                         |           |           |          |                         |             |          |         |           |             |         |           |             |
|                         |                                         | 3                                                              | 25 ± 2                                            |                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |             |                 |           |        |         |                         |           |           |          |                         |             |          |         |           |             |         |           |             |
| 4                       | Max. Operating Temp. ±2                 |                                                                |                                                   |                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |             |                 |           |        |         |                         |           |           |          |                         |             |          |         |           |             |         |           |             |
| 5                       | 25 ± 2                                  |                                                                |                                                   |                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |             |                 |           |        |         |                         |           |           |          |                         |             |          |         |           |             |         |           |             |
| CLASS II                | Within ± 15%                            |                                                                |                                                   |                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |             |                 |           |        |         |                         |           |           |          |                         |             |          |         |           |             |         |           |             |
| Temperature Coefficient | CLASS I                                 | 0±30 ppm/°C                                                    |                                                   |                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |             |                 |           |        |         |                         |           |           |          |                         |             |          |         |           |             |         |           |             |
|                         | Capacitance Drift                       | CLASS I                                                        | Within ± 0.2% or 0.05pF,<br>(Whichever is larger) |                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |             |                 |           |        |         |                         |           |           |          |                         |             |          |         |           |             |         |           |             |

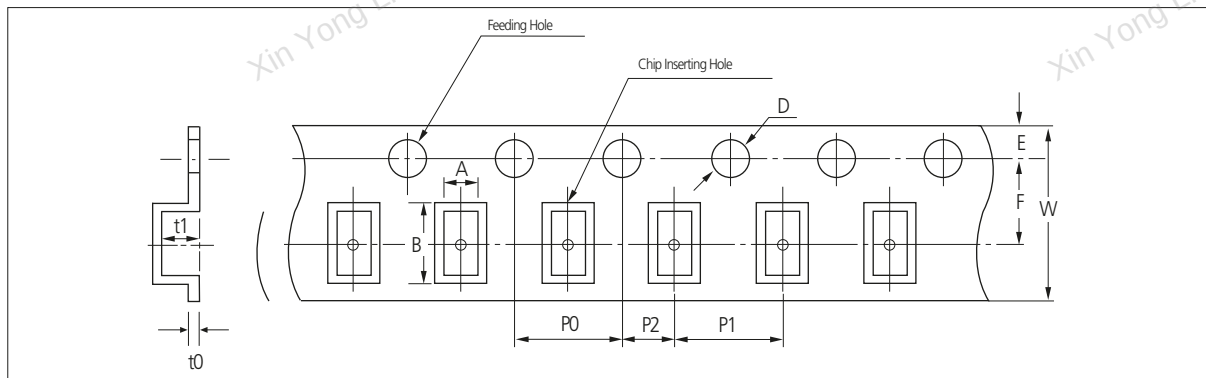
※ \*1) : Indicates typical specification. Please refer to individual specifications.

\*If you want more detailed information, Please Visit Samsung Electro-mechanics website (www.semclcr.com)

Part Numbering  
SystemStandard &  
High CapacitorsSuper Small Size  
CapacitorsHigh-Q  
CapacitorsMedium-High  
Voltage CapacitorsArray Type  
CapacitorsLow ESL  
CapacitorsReliability Test  
ConditionPremium Capacitors  
for Automotive  
ApplicationsPackaging  
SpecificationApplication Manual  
for Surface Mounting

| Symbol    |                 | A                       | B                       | W           | F            | E            | P1           | P2           | P0          | D                      | t             |
|-----------|-----------------|-------------------------|-------------------------|-------------|--------------|--------------|--------------|--------------|-------------|------------------------|---------------|
| Type      |                 |                         |                         |             |              |              |              |              |             |                        |               |
| Dimension | 01005<br>(0402) | 0.25<br>±0.02           | 0.45<br>±0.02           | 8.0<br>±0.3 | 3.5<br>±0.05 | 1.75<br>±0.1 | 2.0<br>±0.05 | 2.0<br>±0.05 | 4.0<br>±0.1 | Ø1.5<br>+0.1<br>/-0.03 | 0.25<br>±0.02 |
|           | 0201<br>(0603)  | 0.38<br>±0.03           | 0.68<br>±0.03           |             |              |              |              |              |             |                        | 0.37<br>±0.03 |
|           | 0402<br>(1005)  | 0.62<br>±0.05           | 1.12<br>±0.05           |             |              |              |              |              |             |                        | 0.37<br>±0.05 |
|           |                 |                         |                         |             |              |              |              |              |             |                        | 0.60<br>±0.05 |
|           | 0204<br>(0510)  | 0.62<br>+0.05<br>/-0.10 | 1.12<br>+0.05<br>/-0.10 |             |              |              |              |              |             |                        | 0.37<br>±0.03 |

## Embossed Plastic Tape

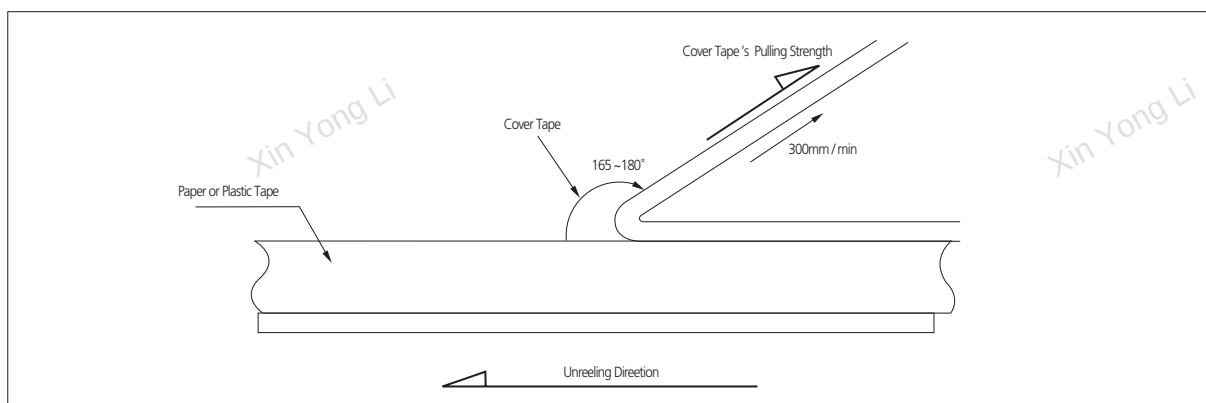


Unit: inch(mm)

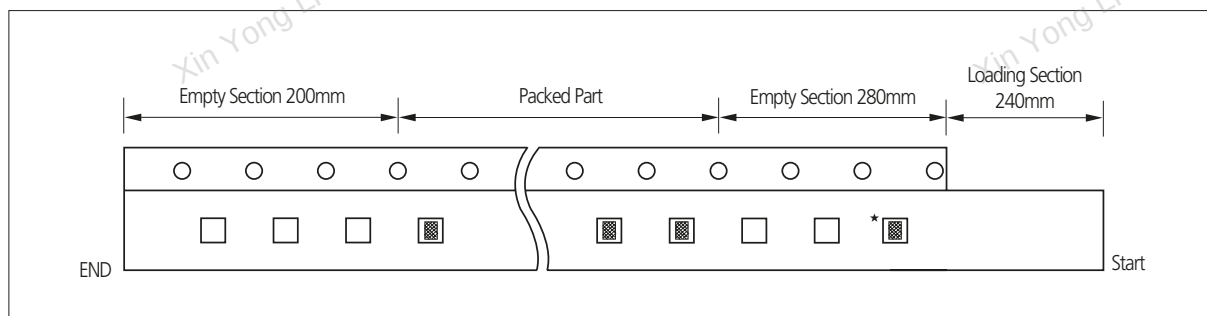
| Symbol    |                 | A                      | B                      | W            | F             | E            | P1           | P2           | P0           | D                      | t1            | t0           |
|-----------|-----------------|------------------------|------------------------|--------------|---------------|--------------|--------------|--------------|--------------|------------------------|---------------|--------------|
| Type      |                 |                        |                        |              |               |              |              |              |              |                        |               |              |
| Dimension | 01005<br>(0402) | 0.25<br>±0.02          | 0.45<br>±0.02          | 4.0<br>±0.05 | 1.8<br>±0.02  | 0.9<br>±0.05 | 1.0<br>±0.02 | 1.0<br>±0.02 | 2.0<br>±0.04 | Ø0.8<br>±0.04          | 0.25<br>±0.02 | 0.5<br>max   |
|           | 0603<br>(1608)  | 1.05<br>±0.15          | 1.9<br>±0.15           | 8.0<br>±0.3  | 3.5<br>±0.05  | 1.75<br>±0.1 | 4.0<br>±0.1  |              |              | Ø1.5<br>+0.1/<br>−0.03 | 2.9<br>max    | 0.6<br>Below |
|           | 0805<br>(2012)  | 1.45<br>±0.2           | 2.3<br>±0.2            |              |               |              |              |              |              |                        |               |              |
|           | 1206<br>(3216)  | 1.9<br>±0.2            | 3.5<br>±0.2            |              |               |              |              |              |              |                        |               |              |
|           | 1210<br>(3225)  | 2.8<br>±0.2            | 3.6<br>±0.2            |              |               |              |              |              |              |                        |               |              |
|           | 1808<br>(4520)  | 2.3<br>±0.2            | 4.9<br>±0.2            | 12.0<br>±0.3 | 5.60<br>±0.05 |              | 8.0<br>±0.1  | 2.0<br>±0.05 | 4.0<br>±0.1  |                        |               |              |
|           | 1812<br>(4532)  | 3.6<br>±0.2            | 4.9<br>±0.2            |              |               |              |              |              |              |                        |               |              |
|           | 2220<br>(5750)  | 5.5<br>±0.2            | 6.2<br>±0.2            |              |               |              |              |              |              |                        |               |              |
|           | 0204<br>(5010)  | 0.62<br>+0.05<br>−0.10 | 1.12<br>+0.05<br>−0.10 | 0.8<br>±0.3  | 3.5<br>±0.05  | 4.0<br>±0.1  |              |              |              |                        |               |              |
|           | 0306<br>(0816)  | 1.1<br>±0.2            | 1.9<br>±0.2            |              |               |              |              |              |              |                        |               |              |
|           | 0508<br>(1220)  | 1.45<br>±0.2           | 2.3<br>±0.2            |              |               |              |              |              |              |                        |               |              |
|           | 0612<br>(1632)  | 2.0<br>±0.2            | 3.6<br>±0.2            |              |               |              |              |              |              |                        |               |              |

## Peeling off of Cover Tape

- 10 g.f ≤ Peel off force ≤ 70 g.f

Part Numbering  
SystemStandard &  
High CapacitorsSuper Small Size  
CapacitorsHigh-Q  
CapacitorsMedium-High  
Voltage CapacitorsArray Type  
CapacitorsLow ESL  
CapacitorsReliability Test  
ConditionPremium Capacitors  
for Automotive  
ApplicationsPackaging  
SpecificationApplication Manual  
for Surface Mounting

### Taping Size

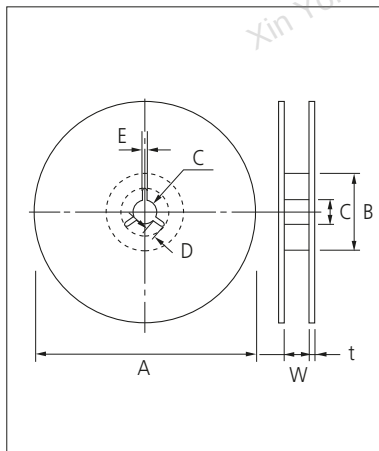


- The chip is only use for identifying the label and packaged products. Please don't use the chip.

Unit: kpcs

[illegible]

## Reel Dimensions



Unit: mm

| Symbol   | Tape Width | A                        | B                       | C                       | D          |
|----------|------------|--------------------------|-------------------------|-------------------------|------------|
| 7" Reel  | 8mm        | $\varnothing 180+0/-3$   | $\varnothing 60\pm 1.0$ | $\varnothing 13\pm 0.3$ | $4\pm 0.2$ |
|          | 12mm       | $\varnothing 180+0/-3$   | $\varnothing 60+1/-0$   | $\varnothing 13\pm 0.3$ | $4\pm 0.2$ |
| 10" Reel | 8mm        | $\varnothing 258+0/-3$   | $\varnothing 80+1/-0$   | $\varnothing 13\pm 0.3$ | $4\pm 0.2$ |
|          | 12mm       | $\varnothing 258+0/-3$   | $\varnothing 80+1/-0$   | $\varnothing 13\pm 0.3$ | $4\pm 0.2$ |
| 13" Reel | 8mm        | $\varnothing 330\pm 2.0$ | $\varnothing 80\pm 1.0$ | $\varnothing 13\pm 0.3$ | $4\pm 0.2$ |
|          | 12mm       | $\varnothing 330\pm 2.0$ | $\varnothing 80\pm 1.0$ | $\varnothing 13\pm 0.3$ | $4\pm 0.2$ |

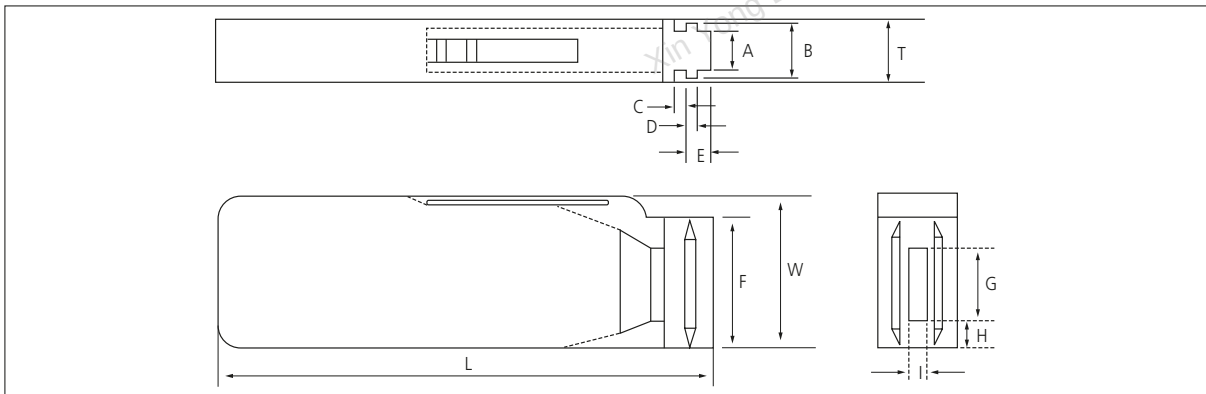
  

| Symbol   | Tape Width | E            | W           | t            |
|----------|------------|--------------|-------------|--------------|
| 7" Reel  | 8mm        | $2.0\pm 0.5$ | $9\pm 0.5$  | $1.2\pm 0.2$ |
|          | 12mm       | $2.0\pm 0.5$ | $13\pm 0.5$ | $1.2\pm 0.2$ |
| 10" Reel | 8mm        | $2.0\pm 0.5$ | $9\pm 0.5$  | $1.8\pm 0.2$ |
|          | 12mm       | $2.0\pm 0.5$ | $13\pm 0.5$ | $1.8\pm 0.2$ |
| 13" Reel | 8mm        | $2.0\pm 0.5$ | $9\pm 0.5$  | $2.2\pm 0.2$ |
|          | 12mm       | $2.0\pm 0.5$ | $13\pm 0.5$ | $2.2\pm 0.2$ |

Part Numbering  
SystemStandard &  
High CapacitorsSuper Small Size  
CapacitorsHigh-Q  
CapacitorsMedium-High  
Voltage CapacitorsArray Type  
CapacitorsLow ESL  
CapacitorsReliability Test  
ConditionPremium Capacitors  
for Automotive  
ApplicationsPackaging  
SpecificationApplication Manual  
for Surface Mounting

## Bulk Case Packaging

- Bulk case packaging can reduce the stock space and transportation costs.
- The bulk feeding system can increase the productivity.
- It can eliminate the components loss.



Unit: mm

| Symbol    | A            | B            | T           | C            | D          | E            |
|-----------|--------------|--------------|-------------|--------------|------------|--------------|
| Dimension | $6.8\pm 0.1$ | $8.8\pm 0.1$ | $12\pm 0.1$ | $1.5+0.1/-0$ | $2+0/-0.1$ | $3.0+0.2/-0$ |

| Symbol    | F             | W           | G            | H           | L            | I           |
|-----------|---------------|-------------|--------------|-------------|--------------|-------------|
| Dimension | $31.5+0.2/-0$ | $36+0/-0.2$ | $19\pm 0.35$ | $7\pm 0.35$ | $110\pm 0.7$ | $5\pm 0.35$ |

## • QUANTITY

Unit: inch(mm) and pcs

| Size     | 0402(1005) | 0603(1608)       | 0805(2012)            |                      |
|----------|------------|------------------|-----------------------|----------------------|
|          |            |                  | $T\leq 0.85\text{mm}$ | $T\geq 1.0\text{mm}$ |
| Quantity | 50,000     | 10,000 or 15,000 | 10,000                | 5,000                |

# Application Manual for Surface Mounting

## 1.Storage of products

### 1-1. Storage Environment

Tape packing materials are designed to withstand long-term storage, but they will degrade more rapidly in the presence of high temperature or high humidity. Therefore, the products must be stored in an ambient 5~40℃ with a relative humidity of 20~70%. Allowable storage period is within 6 months from the outgoing date of delivery.

### 1-2. Corrosive Gases

Since sulfur and chlorine may degrade the solderability of the end termination, it is important to store the capacitors in an environment free of these gases

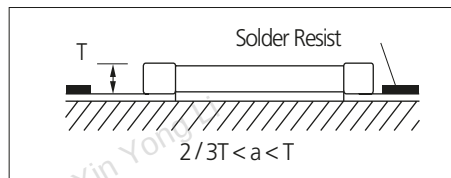
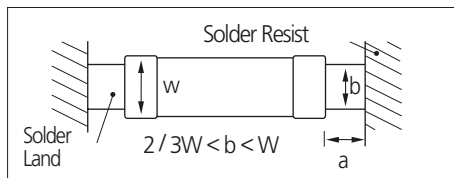
### 1-3. Temperature Fluctuations

Since dew condensation may occur by the differences in temperature when the products are taken out of storage, it is important to maintain a temperature-controlled environment.

## 2.Design of Solder Land Pattern

When designing printed circuit boards, the shape and size of the solder lands must allow for the proper amount of solder on the capacitor. The amount of solder at the end terminations has a direct effect on the probability that the chip will crack. The greater amount of solder, the larger amount of stress on the chip, and the more likely that it will break. Use the following illustrations as guidelines for proper Solder land design.

Recommendation of solder Land Shape and Size



## 3.Adhesives

MLCCs generally require the use of an adhesive to position the chips to the circuit board prior to soldering.

### 3-1. Requirements for Adhesives

They must have enough adhesion so that the chips will not fall off or move during the handling of the circuit board.

They must maintain their adhesive strength when exposed to soldering temperatures.

They should not spread or run when applied to the circuit board.

They should have a long pot life.

They should harden quickly.

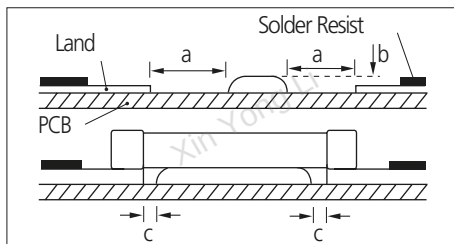
They should not corrode the circuit board or chip material.

They should be a good insulator.

They should be non-toxic, and not produce harmful gases, nor be harmful when touched.

### 3-2. Application Method

It is important to use the proper amount of adhesive. Too little will cause poor adhesion to the circuit board, and too much may strain the conductor pattern, thereby causing defective soldering. The following illustrations show the proper quantity of adhesive.



| Unit: mm |           |           |
|----------|-----------|-----------|
| Type     | 21        | 31        |
| a        | 0.2min    | 0.2min    |
| b        | 70~100 μm | 70~100 μm |
| c        | >0        | >0        |

### 3-3. Adhesive hardening Characteristics

To prevent oxidation of the terminations, the adhesive must harden at 160℃ or less, within 2 minutes or less.

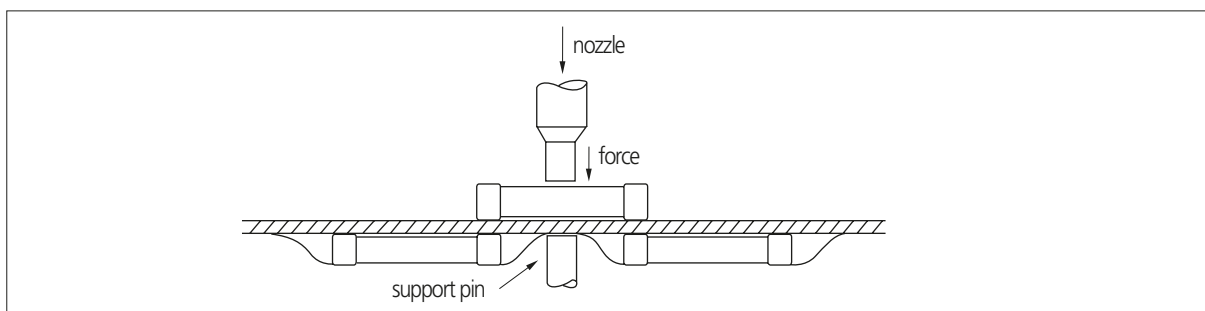
## 4. Mounting

### 4-1. Mounting Head Pressure

Excessive pressure will cause chip capacitors to crack. The pressure between nozzle and chip capacitor will be 300g maximum during mounting.

### 4-2. Bending Stress

Bending of printed circuit board by mounting head when double-sided circuit boards are used, chip capacitors first are mounted and soldered onto one side of the board. When the capacitors are mounted onto the other side, it is important to support the board as shown in the illustration. If the circuit board is not supported, it may bend, causing the already-installed capacitors to crack.



## 5. Flux

Although highly-activated flux gives better solderability, substances which increase activity may also degrade the insulation of the chip capacitors. To avoid such degradation, it is recommended that a mildly activated rosin flux (less than 0.2% chlorine) be used.

## 6. Soldering

Since a multilayer ceramic chip capacitor comes into direct contact with melted solder during soldering, it is exposed to potentially mechanical stress caused by the sudden temperature change. The capacitor may also be subject to silver migration, and to contamination by the flux. Because of these factors, soldering technique is critical.

### 6-1. Soldering Methods

| Method           | Classification                 |                                                       |
|------------------|--------------------------------|-------------------------------------------------------|
| Reflow soldering | · Overall heating              | · Infrared rays<br>· Hot plate<br>· VPS (Vapor phase) |
|                  | · Local heating                | · Air heater<br>· Laser<br>· Light beam               |
| Flow soldering   | · Single wave<br>· Double wave |                                                       |

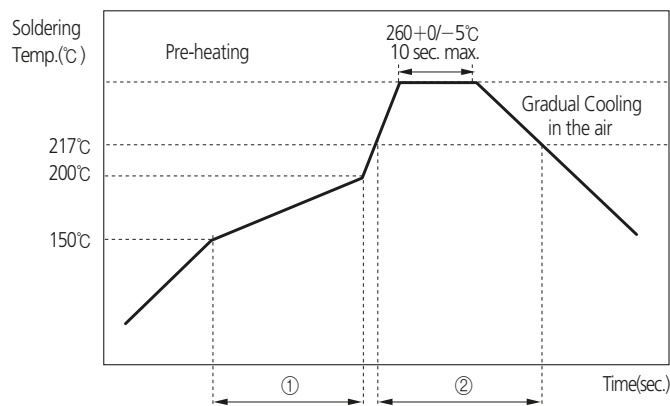
### 6-2. Soldering Profile

To avoid the crack problem by sudden temperature change, follow the temperature profile in the adjacent graph.

Part Numbering  
SystemStandard &  
High CapacitorsSuper Small Size  
CapacitorsHigh-Q  
CapacitorsMedium-High  
Voltage CapacitorsArray Type  
CapacitorsLow ESL  
CapacitorsReliability Test  
ConditionPremium Capacitors  
for Automotive  
ApplicationsPackaging  
SpecificationApplication Manual  
for Surface Mounting

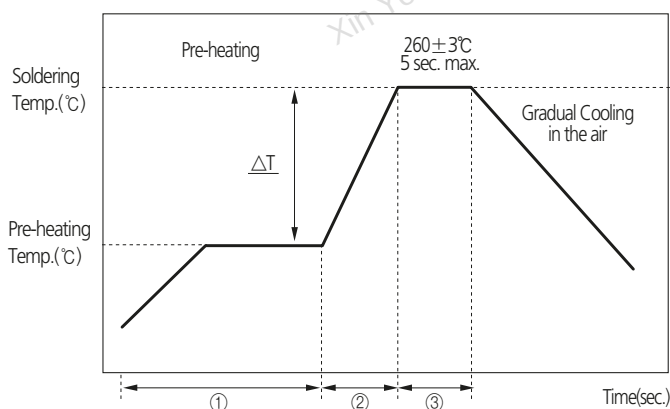
## 6-2-1 Pb-Free (Sn 100%) Plating

### ■ REFLOW SOLDERING



| Soldering Temp.<br>(°C) | Pre-heating Time<br>(①, sec.) | Soldering Time<br>(②, sec.) |
|-------------------------|-------------------------------|-----------------------------|
| 260+0/-5°C              | 60~120                        | 60~150                      |

### ■ FLOW SOLDERING



| ΔT (°C)                       | Soldering Temp.<br>(°C) | Pre-heating Time<br>(①+②, sec.) | Soldering Time<br>(③, sec.) |
|-------------------------------|-------------------------|---------------------------------|-----------------------------|
| ≤150<br>(1206 and below size) | 260±3                   | ≥120                            | ≤5                          |

### ■ SOLDER IRON(Hand Soldering)

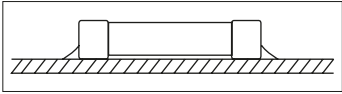
| Variation of Temp.(°C) | Soldering Temp.(°C) | Pre-heating Time(sec.) | Soldering Time(sec.) | Cooling Time(sec.) | Condition of Iron Facilities |              |                |
|------------------------|---------------------|------------------------|----------------------|--------------------|------------------------------|--------------|----------------|
|                        |                     |                        |                      |                    | Wattage                      | Tip Diameter | Soldering Time |
| ΔT≤130                 | 300±10°C max.       | ≥ 60 sec.              | ≤ 4 sec.             | —                  | 20W max.                     | 3mm max.     | 4 sec max.     |

※ Caution - Iron tip should not contact with ceramic body directly

6-3. Manual Soldering

Manual soldering can pose a great risk of creating thermal cracks in chip capacitors. The hot soldering iron tip comes into direct contact with the end terminations, and operator’s carelessness may cause the tip of the soldering iron to come into direct contact with the ceramic body of the capacitor. Therefore the soldering iron must be handled carefully, and close attention must be paid to the selection of the soldering iron tip and to temperature control of the tip.

6-4. Amount of Solder

|                   |                                                                                   |                                                                            |
|-------------------|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------|
| Too much Solder   |  | Cracks tend to occur due to large stress.                                  |
| Not enough solder |  | Weak holding force may cause bad connections or detaching of the capacitor |

6-5. Cooling

Natural cooling using air is recommended. If the chips are dipped into solvent for cleaning, the temperature difference ( $\Delta T$ ) must be less than 100°C

6-6. Cleaning

If rosin flux is used, cleaning usually is unnecessary. When strongly activated flux is used, chlorine in the flux may dissolve into some types of cleaning fluids, thereby affecting the chip capacitors. This means that the cleaning fluid must be carefully selected, and should always be new.

7. Notes for Separating Multiple, Shared PC Boards

A multi-PC board is separated into many individual circuit boards after soldering has been completed. If the board is bent or distorted at the time of separation, cracks may occur in the chip capacitors. Carefully choose a separation method that minimizes the bending of the circuit board.

Part Numbering System

Standard & High Capacitors

Super Small Size Capacitors

High-Q Capacitors

Medium-High Voltage Capacitors

Array Type Capacitors

Low ESL Capacitors

Reliability Test Condition

Premium Capacitors for Automotive Applications

Packaging Specification

Application Manual for Surface Mounting

**Attention**

1. This catalogue is valid only to the products purchased either from us or through our official distributors.
2. Product specifications included in this catalogue are effective as of Nov 1, 2015.  
Please be advised that they are standard product specifications for reference only.  
We may change, modify or discontinue the product specifications without notice at any time.  
So, you need to approve the product specifications before placing an order. Should you have any question regarding our product specifications, please contact our sales personnel or application engineers.
3. We may modify or cease to produce the products listed in this catalogue without notice. Should you have any question, please contact our sales personnel or application engineers.
4. Without obtaining our permission, you should not be allowed to reproduce, copy, use or transfer any content or information contained this catalogue in any manner whatsoever for any purpose.
5. In no event, will we be responsible for any claim, dispute, damage or liability whatsoever arising from, relating to or in connection with your misuse of the products or/and information included in this catalogue.  
We will also not assume any responsibilities whatsoever for any claim, dispute, damage or liability with regards to the intellectual property rights or other related rights of ours or any third party associated with your use of our products and/or information contained in this catalogue. We expressly disclaim that no license is granted regarding the aforementioned rights.
6. Please note that the products in this catalogue are not designed or intended to use for the applications set forth below. So, if you intend to use the products in this catalogue for the applications listed below, you should contact our sales personnel or application engineers before using.  
Please be aware that any misuse of the products deviating from product specifications or information provided in this catalogue may cause a serious property damage or a personal injury.
  - ① Aerospace/Aviation equipment
  - ② Transportation equipment (vehicles, trains, ships, etc)
  - ③ Medical equipment
  - ④ Military equipment
  - ⑤ Disaster prevention/crime prevention equipment
  - ⑥ Any other applications with the same as or similar complexity or reliability to the applications set forth above.



## Xin Yong Li



...the ...  
...the ...  
...the ...  
...the ...

...the ...  
...the ...  
...the ...  
...the ...



**Quality System Certification status for each factory site**

| <b>Certification</b>                          | <b>Suwon<br/>(Korea)</b>      | <b>Busan<br/>(Korea)</b>      | <b>Calamba<br/>(Philippines)</b> | <b>Tianjin<br/>(China)</b>    | <b>Binhai<br/>(China)</b>     |
|-----------------------------------------------|-------------------------------|-------------------------------|----------------------------------|-------------------------------|-------------------------------|
| <b>ISO / TS 16949</b>                         | <b>BSI<br/>TS 91430 - 000</b> | <b>BSI<br/>TS 91430 - 001</b> | <b>BSI<br/>TS 91430 - 005</b>    | <b>BSI<br/>TS 91430 - 007</b> | <b>BSI<br/>TS 91430 - 007</b> |
| Date<br>Validity                              | 2013-10-25<br>~2016-10-24     | 2013-08-08<br>~2016-08-07     | 2012-08-03<br>~2015-08-02        | 2011-11-29<br>~2014-11-28     | 2011-11-29<br>~2014-11-28     |
| <b>ISO 14001</b>                              | <b>BSI<br/>EMS 599427</b>     | <b>BSI<br/>EMS 599427</b>     | <b>BSI<br/>EMS 77354</b>         | <b>BSI<br/>EMS 585363</b>     | <b>BSI<br/>EMS 585363</b>     |
| Date<br>Validity                              | 2013-06-25<br>~2016-06-24     | 2013-06-25<br>~2016-06-24     | 2012-07-13<br>~2015-07-12        | 2012-04-17<br>~2015-04-16     | 2012-04-17<br>~2015-04-16     |
| <b>OHSAS 18001</b>                            | <b>BSI<br/>OHS 599428</b>     | <b>BSI<br/>OHS 599428</b>     | <b>BSI<br/>OHS 568723</b>        | <b>BSI<br/>OHS 585364</b>     | <b>BSI<br/>OHS 585364</b>     |
| Date<br>Validity                              | 2013-06-25<br>~2016-06-24     | 2013-06-25<br>~2016-06-24     | 2013-10-14<br>~2016-10-13        | 2012-04-17<br>~2015-04-16     | 2012-04-17<br>~2015-04-16     |
| <b>Sony Green Partner</b><br>Date<br>Validity | 2012-06-01<br>~2014-05-31     | 2012-06-01<br>~2014-05-31     | 2012-06-01<br>~2014-05-31        | 2012-06-01<br>~2014-05-31     | 2012-06-01<br>~2014-05-31     |
| <b>QC 080000</b>                              | <b>UL<br/>KR-HSPM-1011</b>    | <b>UL<br/>KR-HSPM-1012</b>    | <b>UL<br/>PI-HSPM-1001</b>       | <b>UL<br/>PRC-HSPM-1767</b>   | <b>UL<br/>PRC-HSPM-1767-2</b> |
| Date<br>Validity                              | 2013-06-17<br>~2016-07-01     | 2013-06-27<br>~2016-07-19     | 2013-06-27<br>~2016-07-04        | 2013-07-08<br>~2016-07-26     | 2013-07-08<br>~2016-07-26     |



Note

Xin Yong Li

Xin Yong Li

Xin Yong Li

Xin Yong Li

Xin Yong Li



## Passive components sales offices

### • Head office

150, Meayoungro(Maetan-dong)  
Yeongtong-gu, Suwon-city,  
Gyeonggi province, Korea,443-743  
Tel : +82-31-210-5114

#### Europe

Tel : +82-31-210 -6328  
E-mail : james.pyun@samsung.com

#### America

Tel : +82-31-210 -6803  
E-mail : wesley.roh@samsung.com

#### China

Tel : +82-31-210-3476  
E-mail : james.h.lee@samsung.com

#### Japan

Tel : +82-31-210-6304  
E-mail : jdkim1@samsung.com

#### Domestic

Tel : +82-31-210-3692  
E-mail : jeongki.um@samsung.com

### • Manufacturing sites

#### Suwon Plant(Korea)

150,Meayoungro(Maetan-dong)  
Yeongtong-gu, Suwon-city,  
Gyeonggi province, Korea,443-743  
Tel : +82-31-210-5114

#### Busan Plant (Korea)

333,Noksan Sanupjoongro(Songjeong-  
dong,)Gangseo-gu, Busan, Korea,  
618-270  
Tel : +82-51-970-7114

#### Tianjin Plant (China)

27, Heiniucheng-Road,Tianjin,  
China 300210  
Tel : +86-22-2830-3333

#### Binhai Plant(China)

No 80 xiaqing road,  
TEDA west District, China  
Tel : +86-22-6686-3333

#### Philippines Plant (Philippines)

Block 5 Calamba Premiere Industrial Park  
Calamba City, Philippines  
Tel : +63-49-508-8311

### • Asia sales offices

#### Shenzhen office

46 F, New World Center, Yitian Road, Futian  
District,Shenzhen, China 518026  
Tel : +86-755-8608-5579  
E-mail : andy.li@samsung.com

#### Shanghai office

Rm. 1211, Shanghai International Trade  
CenterNo.2201 Yan An(W) Rd., Shanghai, China  
200335  
Tel : +86-21-2231-4341  
E-mail : koogi@samsung.com

#### Beijing office

'12/F China Merchants Tower No. 118, Jian Guo  
Lu, Chao Yang District, Beijing, China  
Tel : +86-10-6566-8100-6606  
E-mail : kiko.wang@samsung.com

#### Qingdao Office

Rm 1201. Growne Plaza Qingdao 76,  
Xiang Gang Zhong Rd, Qingdao,  
266071 China  
Tel : +86-532-85779102  
E-mail : zhengguo.cui@samsung.com

#### Taipei Office

9F-1, Np. 399 Ruey Kuang Rd., Neihsu  
District, Taipei City, Taiwan, 114  
Tel : +886-2-2656-8350  
E-mail : kevin0130.wang@samsung.com

#### Singapore office

Samsung Electro-Mechanics Private LimitedP  
3 Church Street Samsung Hub #23-01  
Singapore 049483  
Tel : +65-6933-2630  
E-mail : alvin.koh@samsung.com

#### Bangkok office

24180 Wellgrow Industrial Estate, 93 Moo 5,  
Bangsamak A. Bangpakong, Chachoensao,  
Thailand  
Tel : +66-38-562-110  
E-mail : kyunghoon1.lee@samsung.com

#### Japan office

108-0075 Minato-ku Tokyo Kounan 2-16-4  
Shinagawa Grand Cnetral Tower 9F, Japan  
Tel : +81-3-6369-6452  
E-mail : hikota.suga@samsung.com

### • America sales office

#### Irvine office

3333 Michelson Drive, Suite 500, Irvine, CA  
92612, USA  
Tel : +1-949-797-8016  
E-mail : andrew.skelly@samsung.com

#### San Jose office

601, McCarthy Blvd., San Jose, CA 95035, USA  
Tel : +1-408-544-4552  
E-mail : jay.pauer@samsung.com

#### Chicago office

1870 West Winchester Rd, Suite 247,  
Libertyville IL 60048, USA  
Tel : +1-847-549-9424  
E-mail : sweetly@samsung.com

### • Europe sales offices

#### Frankfurt office

Samsung, Haus, Am Kronberger Hang 6,  
D-65824 Schwalbach/Ts. Germany  
Tel : +49-6196-66-7255  
E-mail : frank.goebel@samsung.com

#### London office

KT130NY 2nd floor, No 5. No 5. The Heights,  
Brooklands, Weybridge Surrey, England  
Tel : +44-1932-826-811  
E-mail : river.lee@samsung.com

#### Helsinki office

02600, Lars Sonckin Kaari 14, Espoo, Finland  
Tel : +358-9-853-1132  
E-mail : jouni.riuttanen@samsung.com

### • Domestic Distributors

#### Korchip Corporation

359, Manan-ro, Manan-gu, Anyang-si,  
Gyeonggi-do, Korea  
Tel : +82-31-361-8100  
E-mail : parts@korchip.com

#### SAMT

315, Yeongdong-daero, Gangnam-gu, Seoul,  
Korea  
Tel : +82-2-3458-9000  
E-mail : info@isamt.com

#### CHUNGMAC

40-3, Gokseon-ro 49beon-gil, Gwonseon-gu,  
Suwon-si, Gyeonggi-do, Korea  
Tel : +82-31-234-2367  
E-mail : webmaster@chungmac.co.kr

#### YOUNGDUK

632, Seobusaet-gil, Geumcheon-gu, Seoul,  
Korea  
Tel : +82-2-2107-7860  
E-mail : dryblood@hanmail.net

All information indicated in this catalog is as of November. 2015

\* The specifications and designs contained herein may be subject to change without notice.