

Multi Layer Ceramic Capacitors

■ Introduction

SAMHA's series of Multi Layer Ceramic(MLC) chip Capacitor is designed to meet a wide variety of need. Multilayer ceramic chip capacitor are available in both Class I and Class II formulations. Temperature compensation formulations are Class I and temperature stable and general application formulations are classified at Class II. The Class I multilayer ceramic capacitors are COG with negligible dependence of electrical properties on temperature, voltage, frequency. The most of commonly used Class II dielectric are X7R, X5R and Y5V. The X7R provides intermediate capacitance values which vary $\pm 15\%$ over the temperature range of -55°C to 125°C . The X5R provides intermediate capacitance value which vary $\pm 15\%$ over the temperature range of -55°C to 85°C . The Y5V provides the highest capacitance value which vary from 22% to 82% over the temperature range of -30°C to 85°C .

All Class II capacitors vary in capacitance value under the influence of temperature, operating voltage and frequency. We offer a complete line of products for both Class I and Class II.

■ Features

- Samwha's high density ceramic bodies superior performance and reliability
- Samwha offer various temperature characteristics, rated voltage and packing method
- Material with high dielectric constant and superior manufacturing technology allows very high values in a small size
- Solder coated terminals offer superior solderability

■ Applications

Wide applications throughout commercial and industrial market

- Communication products like Cellular phone, Pager, Codeless phone
- Multimedia products like DVD, CD-ROM, FDD, HDD, Game machine, Computer, Note book, Digital camera, LCD
- Audio visual products like TV, Camcorder, minidisk, MP3 player
- Communication products like Electronic tuner, Duplexer, VCXO, TCXO, Modem
- OA equipment products like Printer, Copy machine, Fax machine

Multi Layer Ceramic Capacitors

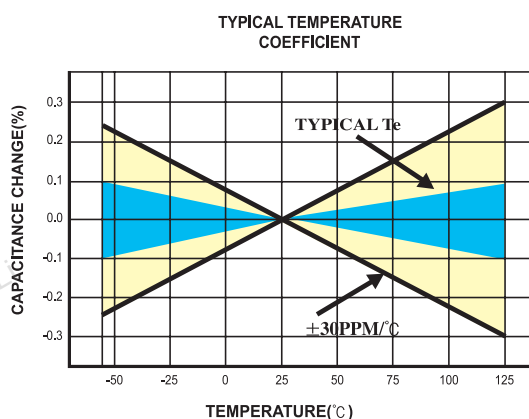
Typical Performance Characteristics

COG

APPLICATION - Suited for precision circuits, Requiring stable dielectric characteristics,
Negligible dependence of capacitance and dissipation factor on time, voltage and frequency.

DIELECTRIC CHARACTERISTICS

Temperature Characteristic	$0 \pm 30 \text{ ppm/}^{\circ}\text{C}$
Operating Temperature	$-55 \sim 125^{\circ}\text{C}$
Capacitance tolerance	$> 10\text{pF} : \pm 5\%, \pm 10\%, (\pm 1\%, \pm 2\%, \pm 20\%)$ $\leq 10\text{pF} : \pm 0.1\text{pF}, \pm 0.25\text{pF}, \pm 0.5\text{pF}$
Dissipation Factor & Q	$> 30\text{pF} : \text{DF} \leq 0.1\%, Q \geq 1000$ $\leq 30\text{pF} : \text{DF} \leq 1/(400+20\text{C}), Q \geq 400+20 \times \text{C}$
Insulation Resistance	More than $10,000\text{M}\Omega$ or $500\Omega\cdot\text{F}$ (whichever is smaller)
Dielectric Strength	$> 3 \times \text{RVDC}$
Test Voltage	$0.5 \text{ to } 5\text{Vrms}(<1000\text{pF}), 1 \pm 0.2 \text{ Vrms}(\geq 1000\text{pF})$
Test Frequency	$1 \pm 0.1\text{MHz}(<1000\text{pF}), 1 \pm 0.1 \text{ MHz}(\geq 1000\text{pF})$



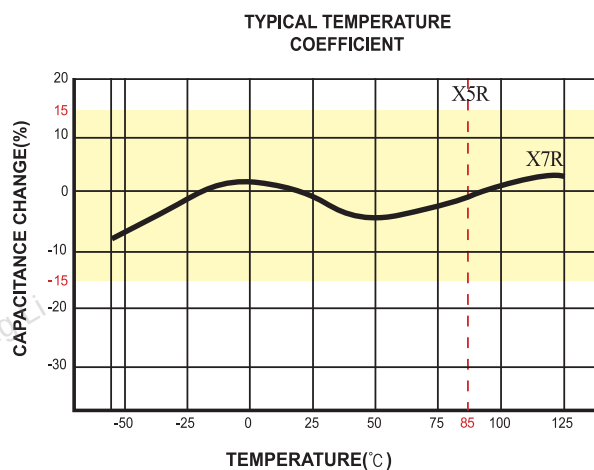
Multi Layer Ceramic Capacitors

X7R / X5R

APPLICATION - Stable Class II dielectric properties, suited for by-pass and coupling purpose, filtering, frequency discrimination, DC blockage and as voltage transient suppression elements.

DIELECTRIC CHARACTERISTICS

Temperature Characteristic	$\pm 15\%$
Operating Temperature	-55 ~ 125 °C (X7R) / -55 ~ 85 °C (X5R)
Capacitance tolerance	$\pm 10\%$, $\pm 20\%$
Dissipation Factor & Q	50V Min : 2.5% Max 25V : 3.0% Max 16V : 3.5% Max 10V : 5.0% Max 6.3V : 5.0% Max(<3.3), 10%Max(≥ 3.3)
Insulation Resistance	More than 10,000M Ω or 500 Ω F (whichever is smaller)
Dielectric Strength	$> 2.5 \times RVDC$
Test Voltage	$1 \pm 0.2V_{rms}$ (<10), $0.5 \pm 0.1V_{rms}$ (≥ 10)
Test Frequency	$1 \pm 0.1kHz$ (<10), $120 \pm 24Hz$ (≥ 10)



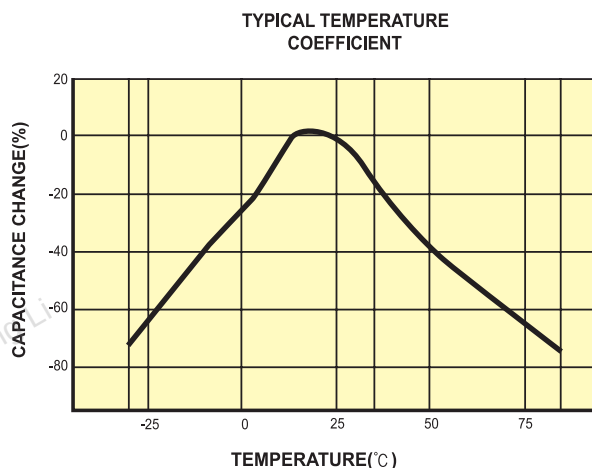
Multi Layer Ceramic Capacitors

Y5V

APPLICATION - The Hi-K(Y5V) dielectrics deliver high capacitance density and are ideally suited for applications where space is at a premium, or as replacement for tanalum capacitors. Typical applications include uses as by-pass or decoupling elements. Best performance is obtained at or near room temperature, with low DC bias.

DIELECTRIC CHARACTERISTICS

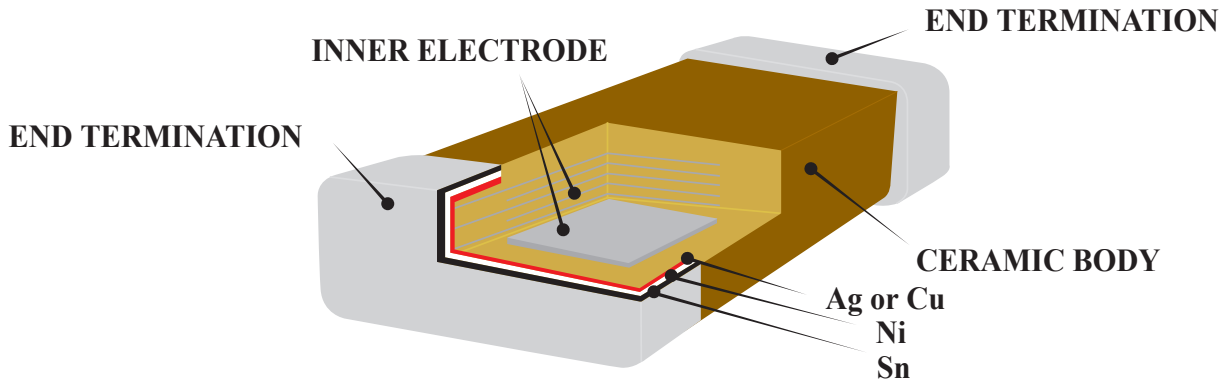
Temperature Characteristic	+22 ~ -82%
Operating Temperature	-30 ~ +85 °C
Capacitance Tolerance	-20 ~ +80% (±20%)
Dissipation Factor & Q	50V Min : 5% Max 25V : 7% Max 16V : 9% Max 10V Min : 12.5% Max
Insulation Resistance	More than 10,000MΩMin or 500Ω F (whichever is smaller)
Dielectric Strength	$> 2.5 \times RVDC$
Test Voltage	$1 \pm 0.2V_{rms}(<10)$, $0.5 \pm 0.1V_{rms}(\geq 10)$)
Test Frequency	$1 \pm 0.1kHz(<10)$, $120 \pm 24Hz(\geq 10)$)



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Multi Layer Ceramic Capacitors

General Description



Type Designation (How To Order)

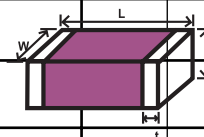
CS	1608	Y5V	104	Z	500	N	R	B
Type		Dielectric		Tolerance		Termination		Thickness
CS : SMD SA : ARRAY		C0G X7R Z5U Y5V		B=±0.1pF C=±0.25pF D=±0.50pF F=±1% G=±2% J=±5% K=±10% M=±20% Z=+80%~-20% P=+100%~0%		N : Ni Plate		A : 0.75mm Max B : 0.95mm Max E : over 0.95mm
	Size		Capacitance		Rated Voltage		Packing	
	1005 1608 2012 3216 3225		1st two digits are value, 3rd digit denotes number of zeros; 331=330pF 104=100000pF 8R2=8.2pF		1st two digits are value, 3rd digit denotes number of zeros; 500=50V 250=25V 101=100V		B : Bulk Pack R : Reel Pack	

Multi Layer Ceramic Capacitors

Capacitance Range

COG

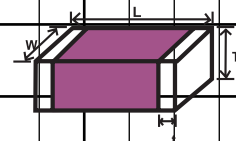
SIZE	1005		1608			2012			3216	
(L) Length	1.0±0.05		1.6±0.1			2.0±0.1			3.2±0.25	
(W) Width	0.5±0.05		0.8±0.1			1.25±0.1			1.6±0.2	
(T) Max. Thickness	0.5±0.05		0.8±0.1			1.35 Max			1.8 Max	
(t) Termination	0.15~0.3		0.35±0.15			0.45±0.2			0.55±0.25	
RVDC	25	50	25	50	100	25	50	100	25	50
Cap (pF)	0.5									
	1.0									
	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									
	39									
	47									
	56									
	68									
	82									
	100									
	120									
	150									
	180									
	220									
	270									
	300									
	330									
	390									
	470									
	510									
	560									
	680									
	820									
	1.000									
	1.200									
	1.500									
	1.800									
	2.200									
	3.300									
	3.900									
	4.700									
	5.600									
	6.800									
	8.200									
	10.000									



Multi Layer Ceramic Capacitors

X7R

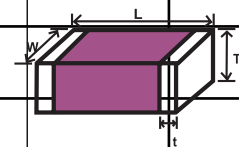
SIZE	1005				1608				2012				3216					3225				
(L) Length	1.0±0.05				1.6±0.1				2.0±0.1				3.2±0.25					3.2±0.25				
(W) Width	0.5±0.05				0.8±0.1				1.25±0.1				1.6±0.2					2.5±0.2				
(T) Max. Thickness	0.5±0.05				0.8±0.1				1.35Max				1.8Max					2.7Max				
(t) Termination	0.15~0.3				0.35±0.15				0.45±0.2				0.55±0.25					0.55±0.25				
RVDC	10	16	25	50	10	16	25	50	100	16	25	50	10	16	25	50	250	16	25	50	100	250
Cap. (pF)	220																					
	270																					
	330																					
	390																					
	470																					
	560																					
	680																					
	820																					
	1,000																					
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X5R

SIZE	1005	1608	2012		3216		3225
(L) Length	1.0 ± 0.05	1.6 ± 0.1	2.0 ± 0.1		3.2 ± 0.25		3.2 ± 0.25
(W) Width	0.5 ± 0.05	0.8 ± 0.1	1.25 ± 0.1		1.6 ± 0.2		2.5 ± 0.2
(T) Max. Thickness	0.5 ± 0.05	0.8 ± 0.1	1.35Max		1.8Max		2.7Max
(t) Termination	$0.15 \sim 0.3$	0.35 ± 0.15	0.45 ± 0.2		0.55 ± 0.25		0.55 ± 0.25
RVDC	10	6.3	6.3	10	6.3	10	10
Cap. (pF)	220						
	270						
	330						
	390						
	470						
	560						
	680						
	820						
	1,000						
	1,200						
	1,500						
	1,800						
	2,200						
	2,700						
	3,300						
	3,900						
	4,700						
	5,600						
	6,800						
	8,200						
	10,000						
	12,000						
	15,000						
	18,000						
	22,000						
	27,000						
	33,000						
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	68,000						
	82,000						
	100,000						
	120,000						
	150,000						
	180,000						
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	270,000						
	330,000						
	470,000						
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	2,200,000						
	4,700,000						
	10,000,000						

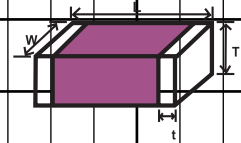


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Y5V

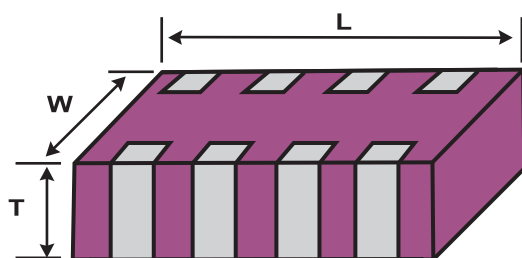
SIZE	1005					1608					2012					3216					3225				
(L) Length	1.0±0.05					1.6±0.1					2.0±0.1					3.2±0.25					3.2±0.25				
(W) Width	0.5±0.05					0.8±0.1					1.25±0.1					1.6±0.2					2.5±0.2				
(T) Max. Thickness	0.5±0.05					0.8±0.1					1.35Max					1.8Max					2.7Max				
(t) Termination	0.15~0.3					0.35±0.15					0.45±0.2					0.55±0.25					0.55±0.25				
RVDC	6.3	10	16	25	50	10	16	25	50	100	10	16	25	50	6.3	10	16	25	50	10	16	25	50		
Cap. (pF)	220																								
	270																								
	330																								
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	22,000,000																								



Multi Layer Ceramic Capacitors

Chip Capacitor Arrays

Shape & Dimension



(L) Length	3.2 ± 0.25
(W) Width	1.6 ± 0.2
(T) Max. Thickness	1.25Max

Capacitance Range

DIELECTRICS		C0G	DIELECTRICS		X7R	Y5V
RVDC		50	RVDC		50	50
Cap. (pF)	10		Cap. (pF)	220		
	12			240		
	15			270		
	18			300		
	22			330		
	27			390		
	33			470		
	36			560		
	39			680		
	47			820		
	51			1,000		
	56			1,200		
	62			1,500		
	68			1,800		
	82			2,200		
	100			2,700		
	120			3,300		
	150			3,900		
	180			4,700		
	220			5,600		
	270			6,800		
	300		Cap. (pF)	8,200		
	330			10		
	360			12		
	390			15		
	470			18		
	510			22		
	560			27		
	680			33		
				39		
				47		
				68		
				100		
				150		
				220		
				270		

Multi Layer Ceramic Capacitors

Reliability and Test conditions

No.	Item	Specification					Test Methods and Conditions																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
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1	Operating Temperature Range	COG : -55 to +125℃ SL : -55 to 85℃	X7R : -55 to + 125℃ X5R : -55 to + 85℃ Y5V : -30 to + 85℃																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
2	Insulation Resistance	More than 10,000MΩ or 500 Ω F (Whichever is smaller)					UApplied the rated voltage for 2 minutes of charging																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
3	Dielectric Strength	No defects or abnormalities					COG : The rated voltage × 300% X7R, X5R, Y5V : × 250%																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
4	Capaciance	within the specified tolerance																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
5	Dissipation Factor	30pF min : Q [1000 (DF≤0.1%) 30pF max : Q [400 +20C (DF≤1/ (400+20C)	<table><tr><td>Char</td><td>50V min</td><td>25V</td><td>16V</td><td>10V</td><td>6.3V</td></tr><tr><td>X7R</td><td rowspan="2">≤2.5%</td><td rowspan="2">≤3%</td><td rowspan="2">≤3.5%</td><td rowspan="2">≤5.0%</td><td>≤3.5%</td></tr><tr><td>X5R</td><td>($<3.3\mu\text{F}$)</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td>≤10%</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td>($\geq 3.3\mu\text{F}$)</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></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min	25V	16V	10V	6.3V	X7R	≤2.5%	≤3%	≤3.5%	≤5.0%	≤3.5%	X5R	($<3.3\mu\text{F}$)						≤10%						($\geq 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Multi Layer Ceramic Capacitors

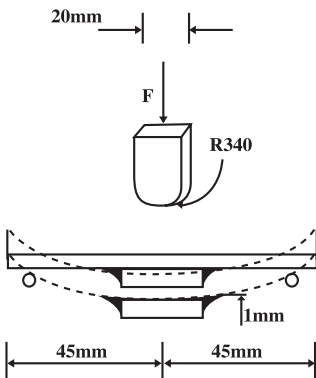
Reliability and Test conditions

No.	Item	Specification						Test Methods and Conditions																									
		Temperature Compensating Type	High Dielectric Constant Type																														
8	Temperature cycle	Appearance	No marking defects						<table><tr><td>Step</td><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>Temp (°C)</td><td>Min. temp. +0, -3</td><td>Room Temp</td><td>Max. temp. +3, -0</td><td>Room Temp</td></tr><tr><td>Time (min)</td><td>30 ± 3</td><td>2 to 3</td><td>30 ± 3</td><td>2 to 3</td></tr></table> UTake it out and set it for 24 ± 2 hours (temperature compensating Type) or 48 ± 4 hours (high dielectric constant Type) at room temperature, then measure					Step	1	2	3	4	Temp (°C)	Min. temp. +0, -3	Room Temp	Max. temp. +3, -0	Room Temp	Time (min)	30 ± 3	2 to 3	30 ± 3	2 to 3					
		Step	1	2	3	4																											
		Temp (°C)	Min. temp. +0, -3	Room Temp	Max. temp. +3, -0	Room Temp																											
		Time (min)	30 ± 3	2 to 3	30 ± 3	2 to 3																											
Capacitance Change	within ± 2.5% or ± 0.25pF	X7R, X5R : Whthin ± 7.5% Y5V : Whthin ± 20%																															
Dissipation Factor (or Q)	30pFmin : Q [1,000 (DF ≤ 0.1%) 30pFmax : Q [400 +20C (DF ≤ 1/(400+20C))	<table><tr><td>Char</td><td>50V min</td><td>25V</td><td>16V</td><td>10V</td><td>6.3V</td></tr><tr><td>X7R</td><td>≤2.5%</td><td>≤3%</td><td>≤3.5%</td><td>≤5.0%</td><td>≤5.0% (<3.3μF) ≤10% (≥3.3μF)</td></tr><tr><td>X5R</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Y5V</td><td>≤5%</td><td>≤7%</td><td>≤9%</td><td>≤12.5%</td><td>≤12.5%</td></tr></table>	Char	50V min	25V	16V	10V	6.3V	X7R	≤2.5%	≤3%	≤3.5%	≤5.0%	≤5.0% (<3.3μF) ≤10% (≥3.3μF)	X5R						Y5V	≤5%	≤7%	≤9%	≤12.5%	≤12.5%							
Char	50V min	25V	16V	10V	6.3V																												
X7R	≤2.5%	≤3%	≤3.5%	≤5.0%	≤5.0% (<3.3μF) ≤10% (≥3.3μF)																												
X5R																																	
Y5V	≤5%	≤7%	≤9%	≤12.5%	≤12.5%																												
I.R	More than 10,000MΩ or 500 Ω F (whichever is smaller)																																
9	Humidity Load	Appearance	No marking defects						UTemperature : 40 ± 2 °C UHumidity : 90 ~ 95% UHour : 500 ± 12hours UTest Voltage : The rated Voltage UTake it out and set it for 24 ± 2 hours (temperature compensating Type) or 48 ± 4 hours (high dielectric constant Type) at room temperature, then measure The charge/discharge current is less than 50mA																								
		Capacitance Change	within ± 7.5% or ± 0.75pF (whichever is larger)	X7R, X5R : Whthin ± 12.5% Y5V : Whthin+30%, -40% (Y5V/10μF, 2.2μF, 4.7μF/10V) Within ± 30% (others)																													
		Dissipation Factor (or Q)	30pFmin : Q ≥ 200 (DF ≤ 0.5%) 30pFmax : Q ≥ 100 +10/3C (DF ≤ 1/(100+10/3C))	<table><tr><td>Char</td><td>100V 50V</td><td>25V</td><td>16V</td><td>10V</td><td>6.3V</td></tr><tr><td>X7R</td><td>≤5%</td><td>≤5%</td><td>≤5%</td><td>≤5%</td><td>≤5.0% (<3.3μF) ≤10% (≥3.3μF)</td></tr><tr><td>X5R</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Y5V</td><td>≤7.5%</td><td>≤12.5% (≥1μF)</td><td>≤12.5%</td><td>≤15%</td><td>≤15%</td></tr></table>	Char	100V 50V	25V	16V						10V	6.3V	X7R	≤5%	≤5%	≤5%	≤5%	≤5.0% (<3.3μF) ≤10% (≥3.3μF)	X5R						Y5V	≤7.5%	≤12.5% (≥1μF)	≤12.5%	≤15%	≤15%
		Char	100V 50V	25V	16V	10V	6.3V																										
X7R	≤5%	≤5%	≤5%	≤5%	≤5.0% (<3.3μF) ≤10% (≥3.3μF)																												
X5R																																	
Y5V	≤7.5%	≤12.5% (≥1μF)	≤12.5%	≤15%	≤15%																												
I.R	More than 500MΩ or 25 Ω .F (whichever is smaller)																																
10	High Temperature Load	Appearance	No marking defects						UTesting time : 1000 ± 12hrs UApplied Voltage : Rated Voltage 200% UTemperature COG,X7R,X5R 125 ± 3 °C Y5V 85 ± 3 °C UTake it out and set it for 24 ± 2 hours (temperature compensating Type) or 48 ± 4 hours (high dielectric constant Type) at room temperature, then measure. The charge/discharge current is less than 50mA																								
		Capacitance Change	within ± 3% or ± 0.3pF (whichever is larger)	X7R, X5R : Whthin ± 12.5% Y5V : Whthin ± 30% (cap<1.0μF) Whthin +30%, -40% (cap ≥ 1.0μF)																													
		Dissipation Factor (or Q)	30pFmin : Q ≥ 350 (DF ≤ 0.3%) 10pF ≤ Cp ≤ 30pF Q ≥ 275+5/2C (DF ≤ 1/(275+5/2C)) 10pFmax : Q ≥ 200+10C (DF ≤ 1/(200+10C))	<table><tr><td>Char</td><td>100V 50V</td><td>25V</td><td>16V</td><td>10V</td><td>6.3V</td></tr><tr><td>X7R</td><td>≤5%</td><td>≤5%</td><td>≤5%</td><td>≤5%</td><td>≤5.0% (<3.3μF) ≤10% (≥3.3μF)</td></tr><tr><td>X5R</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Y5V</td><td>≤7.5%</td><td>≤12.5% (≥1μF)</td><td>≤12.5%</td><td>≤15%</td><td>≤15%</td></tr></table>	Char	100V 50V	25V	16V						10V	6.3V	X7R	≤5%	≤5%	≤5%	≤5%	≤5.0% (<3.3μF) ≤10% (≥3.3μF)	X5R						Y5V	≤7.5%	≤12.5% (≥1μF)	≤12.5%	≤15%	≤15%
		Char	100V 50V	25V	16V	10V	6.3V																										
X7R	≤5%	≤5%	≤5%	≤5%	≤5.0% (<3.3μF) ≤10% (≥3.3μF)																												
X5R																																	
Y5V	≤7.5%	≤12.5% (≥1μF)	≤12.5%	≤15%	≤15%																												
I.R	More than 1,000MΩ or 50 Ω .F (whichever & smaller)																																



Multi Layer Ceramic Capacitors

Reliability and Test conditions

No.	Item	Specification		Test Methods and Conditions																										
		Temperature Compensating Type	High Dielectric Constant Type																											
11	Bending strength	 No cracking or marking defects shall occur		USubstrate material : Glass EPOXY Board. UThickness : 1.6mm																										
	Capacitance change	within $\pm 5\%$ or $\pm 0.5\text{pF}$	X7R, X5R : Whthin $\pm 12.5\%$ Y5V : Whthin $\pm 30\%$																											
12	Humidity Steady State	Appearance	No marking defect		UTemperature : $40 \pm 2\text{ }^{\circ}\text{C}$ UHumidity : 90 ~ 95% UHour : $500 \pm 12\text{hours}$ UTake it out and set it for $24 \pm 2\text{ hours}$ (temperature compensating Type) or $48 \pm 4\text{ hours}$ (high dielectric constant Type) at room temperature, then measure																									
		Capacitance change	within $\pm 5\%$ or $\pm 0.5\text{pF}$ (whichever is larger)	X7R, X5R : Whthin $\pm 12.5\%$ Y5V : Whthin $\pm 30\%$																										
		Dissipation (or Q)	30pF min : [Q350 (DF $\leq 0.3\%$) 10pF $\leq C_p\leq 30\text{pF}$ Q [275+5/2C (DF $\leq 1/(275+5/2C)$) 10pFmax : Q [200+10C (DF $\leq 1/(200+10C)$)	<table><tr><th>Char</th><th>50V min</th><th>25V</th><th>16V</th><th>10V</th><th>6.3V</th></tr><tr><td>X7R</td><td></td><td></td><td></td><td></td><td>$\leq 7.5\%$ ($<3.3\mu\text{F}$)</td></tr><tr><td>X5R</td><td>$\leq 5\%$</td><td>$\leq 5\%$</td><td>$\leq 5\%$</td><td>$\leq 5\%$</td><td>$\leq 12.5\%$ ($\geq 3.3\mu\text{F}$)</td></tr><tr><td>Y5V</td><td>$\leq 7.5\%$</td><td>$\leq 12.5\%$ ($\geq 1\mu\text{F}$)</td><td>$\leq 10\%$</td><td>$\leq 15\%$</td><td>$\leq 15\%$</td></tr></table>		Char	50V min	25V	16V	10V	6.3V	X7R					$\leq 7.5\%$ ($<3.3\mu\text{F}$)	X5R	$\leq 5\%$	$\leq 5\%$	$\leq 5\%$	$\leq 5\%$	$\leq 12.5\%$ ($\geq 3.3\mu\text{F}$)	Y5V	$\leq 7.5\%$	$\leq 12.5\%$ ($\geq 1\mu\text{F}$)	$\leq 10\%$	$\leq 15\%$	$\leq 15\%$	
		Char	50V min	25V		16V	10V	6.3V																						
X7R					$\leq 7.5\%$ ($<3.3\mu\text{F}$)																									
X5R	$\leq 5\%$	$\leq 5\%$	$\leq 5\%$	$\leq 5\%$	$\leq 12.5\%$ ($\geq 3.3\mu\text{F}$)																									
Y5V	$\leq 7.5\%$	$\leq 12.5\%$ ($\geq 1\mu\text{F}$)	$\leq 10\%$	$\leq 15\%$	$\leq 15\%$																									
I.R.	More than 1,000M Ω or 50 Ω F (whichever is smaller)																													
* The initial value of High Dielectric Constant types shall be measured after the heat temperature of $150^{\circ}\text{C} \text{ }+0/-10^{\circ}\text{C}$, 1hr and sitting of $48\text{hr} \pm 4\text{hr}$ at room temperature & room humidity.																														

Multi Layer Ceramic Capacitors

Reliability and Test conditions

No.	Item		Specification				Test Methods and Conditions													
			Temperature Compensating Type		High Dielectric Constant Type															
13	Capacitance Temperature Characteristics	Capacitance Change	<table><tr><td>Char.</td><td>Temp Range</td><td>Reference Temp.</td><td>Cap Change</td></tr><tr><td>X7R</td><td>-55 to +125℃</td><td rowspan="3">25℃</td><td>Withim ± 15%</td></tr><tr><td>X5R</td><td>-55 to +85℃</td><td>Withim ± 15%</td></tr><tr><td>Y5V</td><td>-30 to +85℃</td><td>Withim +22% -82%</td></tr></table>				Char.	Temp Range	Reference Temp.	Cap Change	X7R	-55 to +125℃	25℃	Withim ± 15%	X5R	-55 to +85℃	Withim ± 15%	Y5V	-30 to +85℃	Withim +22% -82%
		Char.	Temp Range	Reference Temp.	Cap Change															
X7R	-55 to +125℃	25℃	Withim ± 15%																	
X5R	-55 to +85℃		Withim ± 15%																	
Y5V	-30 to +85℃		Withim +22% -82%																	
		Temperature Coefficient	<table><tr><td>Char.</td><td>Temp Range</td><td>Temperature Coefficient</td></tr><tr><td>SL</td><td>+25 to +85℃</td><td>350~ -1000ppm</td></tr><tr><td>COG</td><td>-55 to +125℃</td><td>0±30 ppm/℃</td></tr></table>				Char.	Temp Range	Temperature Coefficient	SL	+25 to +85℃	350~ -1000ppm	COG	-55 to +125℃	0±30 ppm/℃					
Char.	Temp Range	Temperature Coefficient																		
SL	+25 to +85℃	350~ -1000ppm																		
COG	-55 to +125℃	0±30 ppm/℃																		
			<table><tr><td>Char.</td><td>Temperature(℃)</td></tr><tr><td>1</td><td>25 ± 2</td></tr><tr><td>2</td><td>-55 ± 3</td></tr><tr><td>3</td><td>25 ± 2</td></tr><tr><td>4</td><td>125 ± 3(for COG) 85 ± 3(for SL)</td></tr><tr><td>5</td><td>25 ± 2</td></tr></table>				Char.	Temperature(℃)	1	25 ± 2	2	-55 ± 3	3	25 ± 2	4	125 ± 3(for COG) 85 ± 3(for SL)	5	25 ± 2		
Char.	Temperature(℃)																			
1	25 ± 2																			
2	-55 ± 3																			
3	25 ± 2																			
4	125 ± 3(for COG) 85 ± 3(for SL)																			
5	25 ± 2																			
			(1) Temperature Compensating Type The temperature coefficient is determined using the capacitance measured in step 3 as a reference, When cycling the temperature sequentially from step 1 through 5,(COG: +25 to 125℃, SL: +25 to 85℃) the capacitance shall be with in the specified tolerance for the temperature coefficient. The capacitance drift is calculated by dividing the difference between the maximum measured values in the step 1, 3 and 5 by the cap. value in step 3.																	
			(2) High Dielectric Constant Type The ranges of capacitance change. compared with the 25℃ value over the temperature range shown in the table shall be in the specified range.																	
14	Reservation (Keeping)		* When Solderability is considered, Capacitor are recommended to be used in 12 months.																	
			(1) Temperature: 25℃ ± 10℃ (2) Relative Humidity: Below 70% RH																	



Multi Layer Ceramic Capacitors

Packing

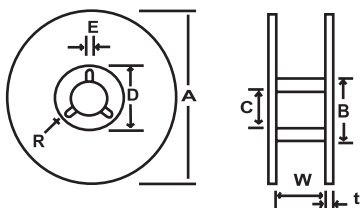
Bulk packing

- ① 1000 pcs per Polybag
- ② 5 Polybags per Inner BOX
- ③ 10 Inner BOXES per Out BOX

Reel packing

- ① 4000 pcs(standard) per Reel(option)
- ② 10 Reels per Inner BOX
- ③ 10 Inner BOXES per Out BOX

Reel Dimension



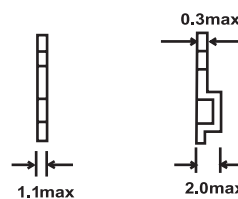
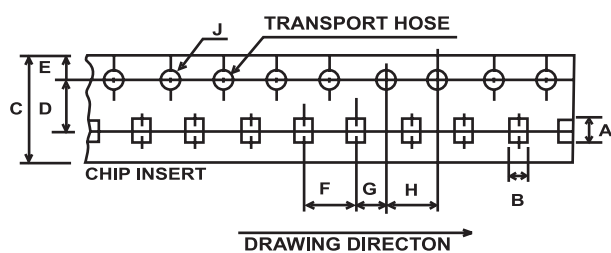
(Unit : mm)

기호	A	B	C	D
7" REEL	$\varnothing 178 \pm 2$	$\varnothing 50 \text{Min}$	$\varnothing 13 \pm 0.5$	21 ± 0.8
13" REEL	$\varnothing 330 \pm 2$	$\varnothing 70 \text{Min}$	$\varnothing 13 \pm 0.5$	21 ± 0.8
기호	E	W	T	R
7" REEL	2 ± 0.5	10 ± 1.5	0.8 ± 0.2	1
13" REEL	2 ± 0.5	10 ± 1.5	0.8 ± 0.2	1

Number of packages

TYPE	EIA COED	7"	13"
		QT/REEL	QT/REEL
CS1005	CC0402	10,000pcs	15,000 ~ 16,000pcs or Option
CS1608	CC0603	4,000pcs	
CS2012	CC0805	4,000pcs	
CS3216	CC1206	3,000pcs 4,000pcs	
CS3225	CC1210	1,000~4,000pcs	

Tape Dimensions



PAPER

EMBOSSD

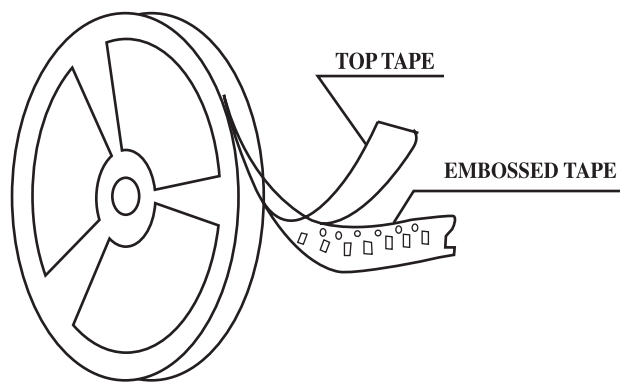
(Unit : mm)

TYPE	EIA CODE	A	B	C	D	E	F	G	H	J
CS1005	CC0402	1.15 ± 0.1	0.65 ± 0.1	8.0 ± 0.3	3.5 ± 0.005	1.75 ± 0.1	2.0 ± 0.05	2.0 ± 0.05	4.0 ± 0.1	1.5 ± 0.1 -0
CS1608	CC0603	2.0 ± 0.2	1.20 ± 0.2	8.0 ± 0.3	3.5 ± 0.005	1.75 ± 0.1	4.0 ± 0.05	2.0 ± 0.05	4.0 ± 0.1	1.5 ± 0.1 -0
CS2012	CC0805	2.4 ± 0.2	1.65 ± 0.2	8.0 ± 0.3	3.5 ± 0.005	1.75 ± 0.1	4.0 ± 0.05	2.0 ± 0.05	4.0 ± 0.1	1.5 ± 0.1 -0
CS3216	CC1206	3.6 ± 0.2	2.00 ± 0.2	8.0 ± 0.3	3.5 ± 0.005	1.75 ± 0.1	4.0 ± 0.05	2.0 ± 0.05	4.0 ± 0.1	1.5 ± 0.1 -0
CS3225	CC1210	3.6 ± 0.2	2.90 ± 0.2	8.0 ± 0.3	3.5 ± 0.005	1.75 ± 0.1	4.0 ± 0.05	2.0 ± 0.05	4.0 ± 0.1	1.5 ± 0.1 -0

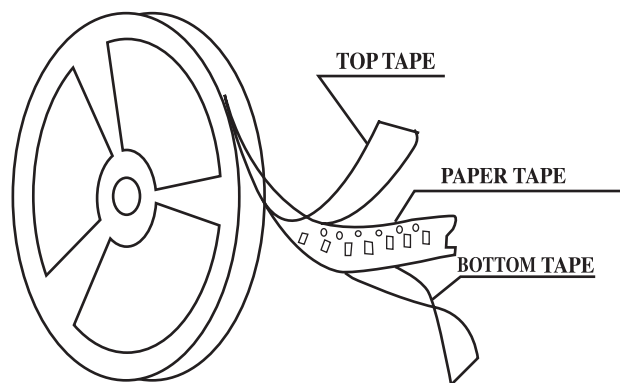
Multi Layer Ceramic Capacitors

Taping

EMBOSED TAPE



PAPER TAPE



CHIP INSERTING

