

TO. : **Reference Sheet**

NO. : **A251223**



APPROVAL SHEET

MULTILAYER CERAMIC CAPACITOR

Commercial Grade

(General Type)



SAMWHA CAPACITOR .CO., LTD.

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* Notice

This sheet is for reference only and is subject to change or be discontinued without notice.
Please contact our sales representatives for detailed information.

< SPECIFICATION SUMMARY >			
SAMWHA Part no.	CS3216C0G104J500NRI		
Type	General		
Items	Specification	Unit	Test Conditions
Capacitance	100.0	nF	Testing Frequency : $1.0 \pm 0.1\text{KHz}$ Testing Voltage : $1.0 \pm 0.2\text{Vrms}$ Should be measured at 25°C
Capacitance Tolerance	± 5	%	
Dissipation Factor	Max. 0.1	%	
Insulation Resistance	More than 5,000	M Ω	Should be measured with a DC voltage not exceeding rated voltage at 25°C for 2 minutes of charging.
Chip Size	3.20 ± 0.30	L (mm)	Capacitance Tolerance Code ----- page 4/15 Chip size ----- page 5/15 Characteristics & Test Method ----- page 6/15~9/15
	1.60 ± 0.20	W (mm)	
	1.60 ± 0.20	T (mm)	

NO	REASON	CONTENTS	DATE OF APPROVAL	CHECKED	REMARKS
1	Initial written	full document	96. 03. 27		
2	Re-revision of approval document	full document	25. 02. 01		

General Description

1. General Article

Application Range

These specifications refer to the "Multilayer Ceramic Capacitors" mainly

used in various every products such as home appliances, audio/visual equipment, communication devices, and Etc.

*Caution : Industrial equipment / For the high reliability equipment / LED equipment / Etc.

Please contact sales representatives or product engineers before using the products.

(For details, please reference "Note" page)

2. General Code

(1) Type Designation

<u>CS</u>	<u>3216</u>	<u>C0G</u>	<u>104</u>	<u>J</u>	<u>500</u>	<u>N</u>	<u>R</u>	<u>I</u>
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

1) Multilayer Ceramic Capacitor (Commercial Grade)

2) Size Code : This is expressed in tens of a millimeter.

The first two digits are the length, The last two digits are width.

3) Temperature Coefficient Code

Classification	Code	Temperature Range	Capacitance Tolerance
Class I	C0G	-55 to +125°C	± 30 ppm / °C

4) Capacitance Tolerance Code

The nominal Capacitance Value in pF is expressed by three digit numbers.

The first two digits represents significant figures and the last digit denotes the number of zero

ex) 104 = 100000 pF / R denotes decimal / 8R2 = 8.2 pF

5) Capacitance Tolerance Code

Code	Tolerance
B	± 0.1 pF
C	± 0.25 pF
D	± 0.5 pF
F	± 1.0 %

Code	Code
G	± 2.0 %
J	± 5 %
K	± 10 %
M	± 20 %

6) Voltage Code

Code	2R5	040	6R3	100	160	250	350	500	101	201	251	501	631	102	202	302
Rate	DC	DC	DC	DC	DC	DC	DC	DC	DC	DC	DC	DC	DC	DC	DC	DC
Voltage	2.5V	4V	6.3V	10V	16V	25V	35V	50V	100V	200V	250V	500V	630V	1KV	2KV	3KV

7) Termination Code

N : Nickel-Tin Plate

A : Nickel-Tin Plate → Soft Termination Type

8) Packing Code

R : 7" Reel Type, L : 13" Reel Type, B : Bulk Type

General Description

9) Thickness option

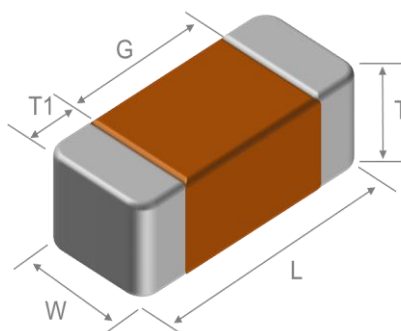
Thickness (mm)		Code
t	Tolerance	
1.60	± 0.20	I

3. Temperature Characteristics

See Page 9 (Specifications and Test Methods : No.14)

4. Constructions and Dimensions

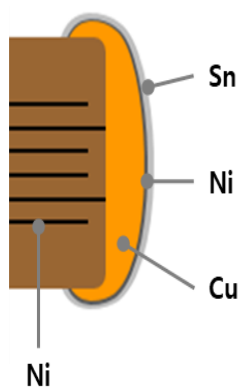
1) Dimensions



(Unit : mm)

Size Code	EIA Code	Dimension					
		Length		Width		T1(min.)	G(min.)
		L	Tol	W	Tol		
3216	1206	3.20	± 0.30	1.60	± 0.20	0.30	1.20

2) Construction of Termination



Specifications and Test Methods (For General)

(IEC-60384 Qualified)

No.	Test Item		Specification						Test Methods and Conditions			
			Class I		Class II							
1	Operating Temperature Range		-55 ~ 125℃	X7R, X7S, X7T : -55 to +125℃ X6S : -55 to +105℃ X5R : -55 to +85℃ Y5V : -30 to +85℃								
2	Insulation Resistance		More than 10,000 MΩ or 500Ω·F (Whichever is smaller)						Applied Voltage	Rated voltage		
									Charging Time	2min.		
									Charge/Discharge Current	50mA max.		
3	Voltage proof		No defects or abnormalities						Applied Voltage	x 300%		
									Applied Time	1 to 5sec.		
									Charge/Discharge Current	50mA max.		
4	Capacitance		Within the specified tolerance						Measurement Temperature	25℃		
									Applied Voltage	Whown in the table		
5	Dissipation Factor		Q≥1,000 (DF≤0.1%)									
				Char.	50V min	25V	16V	10V	6.3V	Cap	Frequency	Voltage
				X7R	≤2.5%/	≤3%/	≤3.5%/	≤5%/	≤5%/	C0G (C<1000pF)	1±0.1MHz	0.5 to 5 Vrms
				X5R	*≤5%	*≤7%	*≤7%	*≤10%	*≤10%	C0G (C≥ 1000pF)	1±0.1kHz	1 ± 0.2 Vrms
				Y5V	≤5%/	≤7%/	≤9%/	≤12.5%/	≤15%	X7R, X5R,Y5V (C≤ 10μF)	1±0.1kHz	1 ± 0.2 Vrms
					*≤9%	*≤9%	*≤12.5%	*≤15%		X7R, X5R, Y5V (C>10μF)	120±24Hz	0.5 ± 0.1 Vrms
6	Solderability		95% of the terminations is to be soldered evenly and continuously.						Solder	96.5Sn-3Ag-0.5Cu		
									Solder temperature	245±5℃		
									Immersion time	3±0.1sec.		
									Pre-Heating	80~120℃ for 10~30sec.		
7	Resistance to Soldering Heat	Appearance	No defects which may affect performance						Preheat Temperature	120 to 150℃		
									Preheat Time	1min.		
		Capacitance change	Within ±2.5% or ±0.25pF (whichever is larger)		Within ±7.5%				(3225,4520,4532 Size)			
									Preheat Temperature	100 to 120℃(Step1) 170 to 200℃(Step2)		
		Dissipation Factor (or Q)	Q≥1,000 (DF≤0.1%)							Preheat Time	1min.	
				Char.	50V min	25V	16V	10V	6.3V	Soldering Temp	260±5℃	
				X7R	≤2.5%/	≤3%/	≤3.5%/	≤5%/	≤5%/	Immersion Time	10±0.5sec.	
	X5R	*≤5%	*≤7%	*≤7%	*≤10%	*≤10%	Initial Measurement	Perform the initial measurement according to Note1 for Class II				
	Y5V	≤5%/	≤7%/	≤9%/	≤12.5%/	≤15%	Measurement after test	Take it out and set it for 24±2 hours (Class I) or 24±2 hours (Class II) then measure				
		*≤9%	*≤9%	*≤12.5%	*≤15%							
		I.R.	More than 10,000MΩ or 500Ω·F (whichever is smaller)									

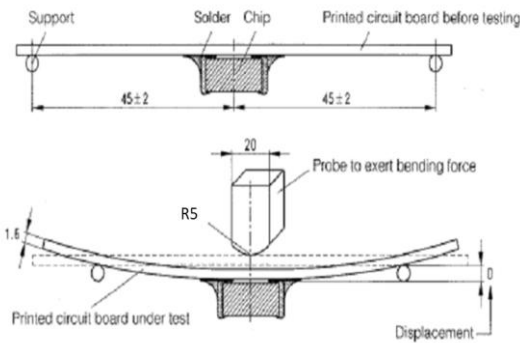
Specifications and Test Methods (For General)

(IEC-60384 Qualified)

No.	Test Item		Specification						Test Methods and Conditions																															
			Class I		Class II																																			
8	Rapid change of temperature	Appearance	No defects which may affect performance						Heat treatments Cycles Shown in the table 5cycles <table><tr><td>Step</td><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>Temp (℃)</td><td>Min. Operating temp. +0, -3</td><td>Room Temp</td><td>Max. Operating 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>		Step	1	2	3	4	Temp (℃)	Min. Operating temp. +0, -3	Room Temp	Max. Operating temp. +3, -0	Room Temp	Time (min)	30 ± 3	2 to 3	30 ± 3	2 to 3															
		Step	1	2	3	4																																		
		Temp (℃)	Min. Operating temp. +0, -3	Room Temp	Max. Operating 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 (whichever is larger)	Within ±7.5%																																						
Dissipation Factor (or Q)	Q≥1,000 (DF≤0.1%)	<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>≤5%/</td><td>≤5%/</td><td>≤5%/</td><td>≤7.5%/</td><td>≤7.5%/</td></tr><tr><td>X5R</td><td>*≤7.5%</td><td>*≤10%</td><td>*≤10%</td><td>*≤12.5</td><td>*≤12.5%</td></tr><tr><td>Y5V</td><td>≤7.5%/</td><td>≤10%/</td><td>≤12.5%/</td><td>≤15%/</td><td>≤20%</td></tr><tr><td></td><td>*≤12.5%</td><td>*≤12.5%</td><td>*≤15%</td><td>*≤20%</td><td></td></tr></table>	Char.	50V min	25V	16V	10V	6.3V	X7R	≤5%/	≤5%/	≤5%/	≤7.5%/	≤7.5%/	X5R	*≤7.5%	*≤10%	*≤10%	*≤12.5	*≤12.5%	Y5V	≤7.5%/	≤10%/	≤12.5%/	≤15%/	≤20%		*≤12.5%	*≤12.5%	*≤15%	*≤20%									
Char.		50V min	25V	16V	10V	6.3V																																		
X7R		≤5%/	≤5%/	≤5%/	≤7.5%/	≤7.5%/																																		
X5R	*≤7.5%	*≤10%	*≤10%	*≤12.5	*≤12.5%																																			
Y5V	≤7.5%/	≤10%/	≤12.5%/	≤15%/	≤20%																																			
	*≤12.5%	*≤12.5%	*≤15%	*≤20%																																				
I.R.	More than 10,000MΩ or 500Ω·F (whichever is smaller)																																							
9	Accelerated damp heat, steady state	Appearance	No defects which may affect performance						Temperature Humidity Test Time Applied Voltage Charge/Discharge Current 40±2℃ 90~95%RH 500+24/-0 hrs Rated Voltage 50mA max. Initial measurement Perform the initial measurement according to Note1 for Class II Measurement after test Perform the final measurement according to Note2																															
		Capacitance change	Within ±7.5% or ±0.75pF (whichever is larger)	Within ±12.5%																																				
		Dissipation Factor (or Q)	Q≥200(DF≤0.5%)	<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>≤5%/</td><td>≤5%/</td><td>≤5%/</td><td>≤7.5%/</td><td>≤7.5%/</td></tr><tr><td>X5R</td><td>*≤7.5%</td><td>*≤10%</td><td>*≤10%</td><td>*≤12.5</td><td>*≤12.5%</td></tr><tr><td>Y5V</td><td>≤7.5%/</td><td>≤10%/</td><td>≤12.5%/</td><td>≤15%/</td><td>≤20%</td></tr><tr><td></td><td>*≤12.5%</td><td>*≤12.5%</td><td>*≤15%</td><td>*≤20%</td><td></td></tr></table>	Char.	50V min	25V	16V			10V	6.3V	X7R	≤5%/	≤5%/	≤5%/	≤7.5%/	≤7.5%/	X5R	*≤7.5%	*≤10%	*≤10%	*≤12.5	*≤12.5%	Y5V	≤7.5%/	≤10%/	≤12.5%/	≤15%/	≤20%		*≤12.5%	*≤12.5%	*≤15%	*≤20%					
		Char.		50V min	25V	16V	10V	6.3V																																
X7R	≤5%/	≤5%/		≤5%/	≤7.5%/	≤7.5%/																																		
X5R	*≤7.5%	*≤10%	*≤10%	*≤12.5	*≤12.5%																																			
Y5V	≤7.5%/	≤10%/	≤12.5%/	≤15%/	≤20%																																			
	*≤12.5%	*≤12.5%	*≤15%	*≤20%																																				
I.R.	More than 500MΩ or 25Ω·F (whichever is smaller)																																							
10	Endurance	Appearance	No defects which may affect performance						Testing Time 1000+48/-0 hrs Applied Voltage Rated Voltage x200% Temperature 125±3℃ Charge/discharge current 50mA max. Initial measurement Perform the initial measurement according to Note1 for Class II Measurement after test Perform the final measurement according to Note2																															
		Capacitance change	Within ±3% or ±0.3pF (whichever is larger)	Within ±12.5%																																				
		Dissipation Factor (or Q)	Q≥350 (DF≤0.3%)	<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>≤5%/</td><td>≤5%/</td><td>≤5%/</td><td>≤7.5%/</td><td>≤7.5%/</td></tr><tr><td>X5R</td><td>*≤7.5%</td><td>*≤10%</td><td>*≤10%</td><td>*≤12.5</td><td>*≤12.5%</td></tr><tr><td>Y5V</td><td>≤7.5%/</td><td>≤10%/</td><td>≤12.5%/</td><td>≤15%/</td><td>≤20%</td></tr><tr><td></td><td>*≤12.5%</td><td>*≤12.5%</td><td>*≤15%</td><td>*≤20%</td><td></td></tr></table>	Char.	50V min	25V	16V			10V	6.3V	X7R	≤5%/	≤5%/	≤5%/	≤7.5%/	≤7.5%/	X5R	*≤7.5%	*≤10%	*≤10%	*≤12.5	*≤12.5%	Y5V	≤7.5%/	≤10%/	≤12.5%/	≤15%/	≤20%		*≤12.5%	*≤12.5%	*≤15%	*≤20%					
		Char.		50V min	25V	16V	10V	6.3V																																
X7R	≤5%/	≤5%/		≤5%/	≤7.5%/	≤7.5%/																																		
X5R	*≤7.5%	*≤10%	*≤10%	*≤12.5	*≤12.5%																																			
Y5V	≤7.5%/	≤10%/	≤12.5%/	≤15%/	≤20%																																			
	*≤12.5%	*≤12.5%	*≤15%	*≤20%																																				
I.R.	More than 1,000MΩ or 50Ω·F (whichever is smaller)																																							

Specifications and Test Methods (For General)

(IEC-60384 Qualified)

No.	Test Item		Specification		Test Methods and Conditions																																
			Class I	Class II																																	
11	Substrate bending test		 No cracking or defects shall occur			Substrate material Glass Epoxy Board Thickness 1.6 mm 0.8 mm (0603/1005size) Bending limit 1mm Pressurizing speed 1mm/sec. Holding time 5±1sec.																															
		Capacitance change	Within ±5% or ±0.5pF (whichever is larger)	Within ±10%																																	
12	Vibration	Appearance	No defects or abnormalities			After soldering and then let sit for 24±2hr at room temperature																															
		Capacitance	Within the specified tolerance			Type of Vibration From 10Hz to 55Hz then 10Hz again Vibration Time 1min. Total Amplitude 1.5mm																															
		Dissipation Factor (or Q)	Q≥1,000 (DF≤0.1%)	<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%/</td><td>≤5%/</td></tr><tr><td>X5R</td><td>*≤5%</td><td>*≤7%</td><td>*≤7%</td><td>*≤10%</td><td>*≤10%</td></tr><tr><td>Y5V</td><td>≤5%/</td><td>≤7%/</td><td>≤9%/</td><td>≤12.5%/</td><td>≤15%</td></tr><tr><td></td><td>*≤9%</td><td>*≤9%</td><td>*≤12.5%</td><td>*≤15%</td><td></td></tr></table>		Char.	50V min	25V	16V	10V	6.3V	X7R	≤2.5%/	≤3%/	≤3.5%/	≤5%/	≤5%/	X5R	*≤5%	*≤7%	*≤7%	*≤10%	*≤10%	Y5V	≤5%/	≤7%/	≤9%/	≤12.5%/	≤15%		*≤9%	*≤9%	*≤12.5%	*≤15%		Vibration directions and time This motion shall be applied for a period of 2 hours in each 3 mutually perpendicular directions (total is 6hours)	
Char.	50V min	25V	16V	10V	6.3V																																
X7R	≤2.5%/	≤3%/	≤3.5%/	≤5%/	≤5%/																																
X5R	*≤5%	*≤7%	*≤7%	*≤10%	*≤10%																																
Y5V	≤5%/	≤7%/	≤9%/	≤12.5%/	≤15%																																
	*≤9%	*≤9%	*≤12.5%	*≤15%																																	
13	Damp heat, steady state	Appearance	No defects which may affect performance			Temperature 40±2°C Humidity 90~95%RH Time 500+24/-0hrs																															
		Capacitance change	Within ±5% or ±0.5pF (whichever is larger)	Within ±12.5%		Initial measurement Perform the initial measurement according to Note1 for Class II																															
		Dissipation Factor (or Q)	Q≥350 (DF≤0.3%)	<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>≤5%/</td><td>≤5%/</td><td>≤5%/</td><td>≤7.5%/</td><td>≤7.5%/</td></tr><tr><td>X5R</td><td>*≤7.5%</td><td>*≤10%</td><td>*≤10%</td><td>*≤12.5%</td><td>*≤12.5%</td></tr><tr><td>Y5V</td><td>≤7.5%/</td><td>≤10%/</td><td>≤12.5%/</td><td>≤15%/</td><td>≤20%</td></tr><tr><td></td><td>*≤12.5%</td><td>*≤12.5%</td><td>*≤15%</td><td>*≤20%</td><td></td></tr></table>		Char.	50V min	25V	16V	10V	6.3V	X7R	≤5%/	≤5%/	≤5%/	≤7.5%/	≤7.5%/	X5R	*≤7.5%	*≤10%	*≤10%	*≤12.5%	*≤12.5%	Y5V	≤7.5%/	≤10%/	≤12.5%/	≤15%/	≤20%		*≤12.5%	*≤12.5%	*≤15%	*≤20%		Measurement after test Perform the final measurement according to Note2	
		Char.	50V min	25V	16V	10V	6.3V																														
X7R	≤5%/	≤5%/	≤5%/	≤7.5%/	≤7.5%/																																
X5R	*≤7.5%	*≤10%	*≤10%	*≤12.5%	*≤12.5%																																
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	*≤12.5%	*≤12.5%	*≤15%	*≤20%																																	
I.R.	More than 1,000MΩ or 50Ω·F (whichever is smaller)																																				

Specifications and Test Methods (For General)

(IEC-60384 Qualified)

No.	Test Item		Specification				Test Methods and Conditions															
			Class I		Class II																	
14	Temperature characteristic of capacitance	Capacitance Change			25°C		Char.	Temp Range	Reference Temp.	Cap Change												
							X7R	-55 to +125°C		Within ±15%												
							X7S	-55 to +125°C		Within ±22%												
							X7T	-55 to +125°C		Within +22% -33%												
							X6S	-55 to +105°C		Within ±22%												
							X6T	-55 to +105°C		Within +22% -33%												
							X8R	-55 to +150°C		Within ±15%												
							X8L	-55 to +150°C		Within +15%/-40%												
							X5R	-55 to +85°C		Within ±15%												
							Y5V	-30 to +85°C		Within +22% -82%												
		Temperature Coefficient																				
			Char.	Temp Range	Temperature Coefficient																	
			C0G	-55 to +125°C	±30 ppm/°C																	
							(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,(C0G: +25 to 125°C) 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															
							<table><tr><th>Step</th><th>Temperature(°C)</th></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 C0G)</td></tr><tr><td>5</td><td>25 ± 2</td></tr></table>				Step	Temperature(°C)	1	25 ± 2	2	-55 ± 3	3	25 ± 2	4	125 ± 3 (for C0G)	5	25 ± 2
Step	Temperature(°C)																					
1	25 ± 2																					
2	-55 ± 3																					
3	25 ± 2																					
4	125 ± 3 (for C0G)																					
5	25 ± 2																					
							(2) High Dielectric Constant Type															
							The ranges of capacitance change compared with the 25°C value over the temperature range shown in the table shall be in the specified range.															

*Note1. Initial Measurement for Class II

Perform a heat treatment at 150+0,-10°C for one hour and then let sit for 24±2 hours at room temperature, then measure.

*Note2. Measurement after test

1.Class I

Let sit for 24±2 hours at room temperature, then measure.

2.Class II

Perform a heat treatment at 150+0,-10°C for one hour and then let sit for 24±2 hours at room temperature, then measure.

"Following the International standards, the title of each test item is subject to change."

Packing

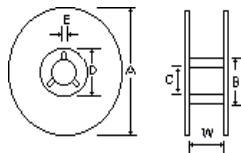
(1) Bulk Packing

- ① 1000 pcs per polybag
- ② 5 polybags per inner box
- ③ 10 inner boxes per out box

(2) Reel Packing

- ① 8~10 Reels per inner box
- ② 6 inner boxes per out box

(3) Reel Dimensions



(Unit : mm)

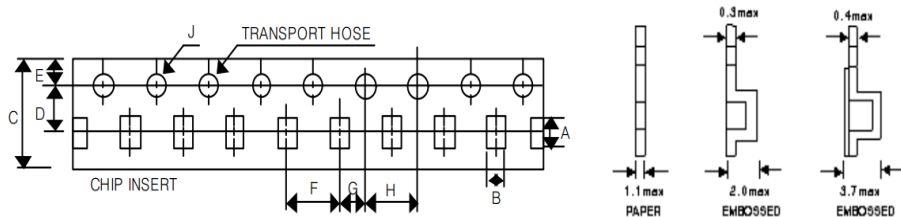
Mark	Size Code	EIA Code	A	B	C	D	E	W
7 " Reel	0603~3225	0201~1210	$\Phi 178 \pm 2$	$\Phi 50 \text{Min}$	$\Phi 13 \pm 0.5$	$\Phi 21 \pm 0.8$	2 ± 0.5	10 ± 1.5
	4520~4532	1808~1812	$\Phi 180 + 0, -3$	$\Phi 60 - 0, +1$	$\Phi 13 \pm 0.2$	$\Phi 57 - 0 + 1$	3 ± 0.2	13 ± 0.5
13 " Reel	1005~3225	0402~1210	$\Phi 330 \pm 2$	$\Phi 70 \text{Min}$	$\Phi 13 \pm 0.5$	$\Phi 21 \pm 0.8$	2 ± 0.5	10 ± 1.5

(4) Number of Package

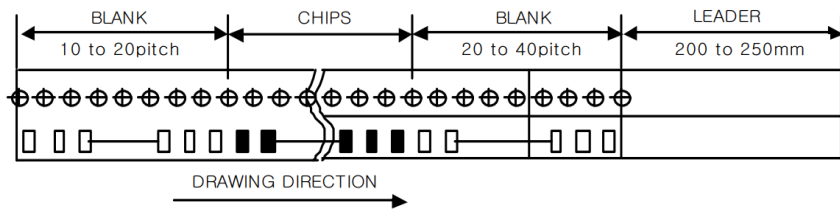
Size Code (mm)	EIA Code (inch)	7"	13"
		Quantity (pcs) / Reel	Quantity (pcs) / Reel
0603	0201	15,000	-
1005	0402	10,000	50,000
1608	0603	4,000	15,000
2012	0805	3,000 ~ 4,000	8,000 ~ 15,000
3216	1206	2,000 ~ 4,000	6,000 ~ 10,000
3225	1210	1,000 ~ 3,000	4,000 ~ 10,000
4520	1808	1,500 ~ 3,000	-
4532	1812	500 ~ 1,000	1,500 ~ 5,000

Packing

(5) Tape Dimensions



Size Code (mm)	EIA Code (inch)	Thickness	A	B	C	D	E	F	G	H	J
0603	0201	all	0.67±0.07	0.37±0.07	8±0.3	3.5±0.05	1.75±0.1	2±0.05	2±0.1	4±0.1	1.5±0.1
1005	0402	all	1.12±0.03	0.62±0.03	8±0.1	3.5±0.05	1.75±0.05	2±0.05	2±0.05	4±0.1	1.55±0.03
1005	0402	all	1.12±0.03	0.58±0.03	8±0.1	3.5±0.05	1.75±0.05	2±0.05	2±0.05	4±0.1	1.55±0.03
1005	0402	all	1.16±0.03	0.66±0.03	8±0.05	3.5±0.05	1.75±0.05	2±0.05	2±0.05	4±0.1	1.55±0.03
1005	0402	all	1.29±0.1	0.78±0.1	8±0.05	3.5±0.05	1.75±0.05	2±0.05	2±0.05	4±0.1	1.55±0.03
1608	0603	A, B	1.8±0.05	0.95±0.05	8±0.1	3.5±0.05	1.75±0.05	2±0.05	2±0.05	4±0.1	1.55±0.03
1608	0603	A, B	1.78±0.05	0.92±0.05	8±0.1	3.5±0.05	1.75±0.05	2±0.05	2±0.05	4±0.1	1.55±0.03
1608	0603	B	1.9±0.05	1.1±0.05	8±0.2	3.5±0.05	1.75±0.1	4±0.1	2±0.05	4±0.1	1.5±0.1
1608	0603	B	1.9±0.05	1.1±0.05	8±0.1	3.5±0.05	1.75±0.05	4±0.1	2±0.05	4±0.1	1.55±0.03
2012	0805	E	2.25±0.1	1.35±0.1	8±0.1	3.5±0.05	1.75±0.1	4±0.1	2±0.05	4±0.05	1.5±0.1
2012	0805	E	2.4±0.1	1.6±0.1	8±0.1	3.5±0.05	1.75±0.1	4±0.1	2±0.05	4±0.05	1.5±0.1
2012	0805	E	2.25±0.1	1.35±0.1	8±0.1	3.5±0.05	1.75±0.1	4±0.1	2±0.05	4±0.1	1.5±0.1
2012	0805	E	2.25±0.05	1.53±0.08	8±0.1	3.5±0.05	1.75±0.1	4±0.1	2±0.05	4±0.1	1.5±0.1
2012	0805	A	2.3±0.05	1.55±0.05	8±0.1	3.5±0.05	1.75±0.05	4±0.1	2±0.05	4±0.1	1.55±0.03
2012	0805	B	2.3±0.05	1.55±0.05	8±0.1	3.5±0.05	1.75±0.05	4±0.1	2±0.05	4±0.1	1.55±0.03
3216	1206	E	3.5±0.1	1.88±0.1	8±0.1	3.5±0.05	1.75±0.1	4±0.1	2±0.05	4±0.05	1.5±0.1
3216	1206	I	3.45±0.1	1.75±0.1	8±0.1	3.5±0.05	1.75±0.1	4±0.1	2±0.05	4±0.05	1.5±0.1
3216	1206	I	3.7±0.1	1.85±0.1	8±0.1	3.5±0.05	1.75±0.1	4±0.1	2±0.05	4±0.05	1.5±0.1
3225	1210	L	3.58±0.1	2.75±0.1	8±0.1	3.5±0.05	1.75±0.1	4±0.1	2±0.05	4±0.05	1.5±0.1
3225	1210	J	3.58±0.1	2.85±0.1	8±0.1	3.5±0.05	1.75±0.1	4±0.1	2±0.05	4±0.05	1.5±0.1
3225	1210	L	3.5±0.2	2.7±0.1	8±0.1	3.5±0.05	1.75±0.1	4±0.1	2±0.05	4±0.05	1.5±0.1
4532	1812	L	5.1±0.2	3.7±0.2	12±0.3	5.5±0.1	1.75±0.1	8±0.1	2±0.1	4±0.1	1.5±0.1
4532	1812	M	4.9±0.1	3.6±0.1	12±0.1	5.5±0.05	1.75±0.1	8±0.1	2±0.05	4±0.05	1.5±0.1

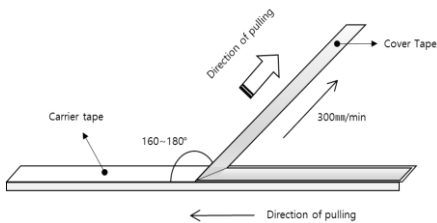


(6) Cover tape peel-off Strength

1. Peeling strength

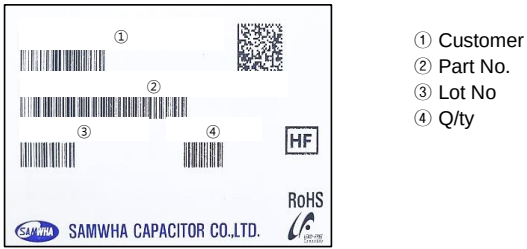
10 g.f to 70 g.f

2. Measurement Method

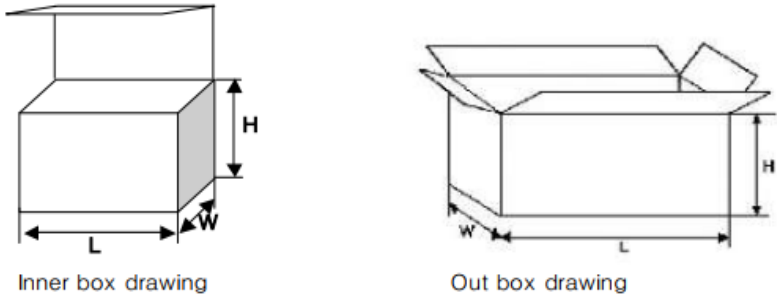


Packing

(7) Packing Label(* Reference image)



(8) Packing Box



Packing Box Dimensions

(Unit : mm)

Division		Size		
		L	W	H
Inner Box	7 " Reel Box (in 5 reels)	183	65	185
	7 " Reel Box (in 10 reels)	185	135	185
	13 " Reel Box	330	65	337
Out Box	7 " Reel Box	430	390	210
	13 " Reel Box	350	350	360

Caution

► Storage Condition

When solderability is considered, capacitor are recommended to be used in 12 months.
 MLCC should be stored at 5~40℃ with a relative humidity of 20~70%
 High humidity can reduce solderability due to oxidation.
 Use the product within 6 months of the outgoing delivery date, and check the packaging if more than 6 months have passed.
 It's recommended to use within 1 year to avoid solderability issues from long-term storage.
 If over 1 year, verify solderability before use.

► The Regulation of Environmental Pollution Materials

Never use materials mentioned below in MLCC products regulated this document.
 Pb, Cd, Hg, Cr+6, PBB(Polybrominated biphenyl), PBDE(Polybrominated diphenyl ethers), asbestos

► Reflow Soldering

1. The sudden temperature change easily causes mechanical damages to ceramic components. Therefore, the preheating procedures should be required for the soldering of ceramic components.
2. Please refer to the recommended soldering profiles as shown in figures, and keep the temperature difference(ΔT) within the range recommended in Table 1.

Table 1

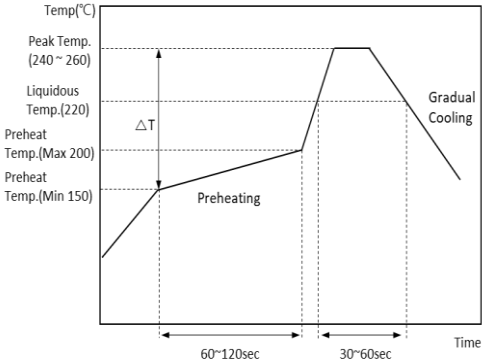
Size code (EIA Code)	Temperature Difference
0603, 1005, 1608, 2012, 3216	$\Delta T \leq 150^{\circ}\text{C}$
3225 size and over	$\Delta T \leq 130^{\circ}\text{C}$

Recommended Conditions

Size code (EIA Code)	Lead Free Solder
Peak Temperature	240 - 260℃
Atmosphere	Air or N ₂

* Compliant Standard JESD22

► Standard condition for reflow soldering



► Flow Soldering

1. The sudden temperature change easily causes mechanical damages to ceramic components. Therefore, the preheating procedures should be required for the soldering of ceramic components.
2. Please refer to the recommended soldering profiles as shown in figures, and keep the temperature difference(ΔT) within the range recommended in Table 2.

Table 2

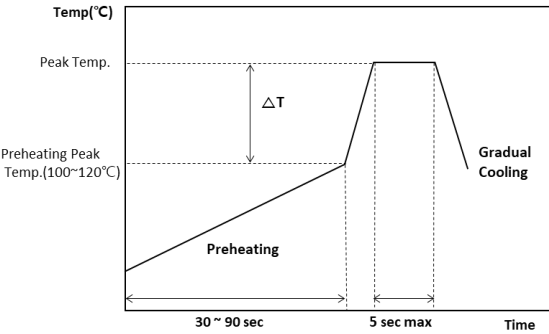
Size code	Temperature Difference
1608, 2012, 3216	$\Delta T \leq 150^{\circ}\text{C}$

Recommended Conditions

Conditions	Lead Free Solder
Soldering Peak Temperature	250 - 260℃
Atmosphere	Air or N ₂

*Lead Free Solder : Sn-3.0Ag-0.5Cu

► Flow Profile



Notice

► Land Dimension

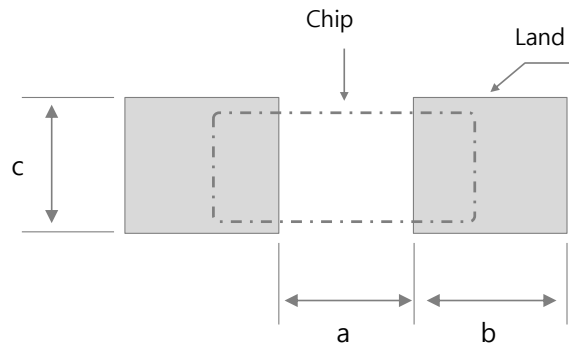


Table . Reflow Soldering Method

Chip size [mm]	Chip tol. [mm]	a [mm]	b [mm]	c [mm]
0603	±0.03	0.2~0.25	0.2~0.3	0.25~0.35
	±0.05/±0.09	0.23~0.3	0.25~0.35	0.3~0.4
1005	±0.1	0.3~0.5	0.35~0.45	0.4~0.6
	±0.2	0.4~0.6	0.4~0.5	0.5~0.7
1608	±0.1	0.6~0.8	0.6~0.7	0.6~0.8
	±0.2	0.7~0.9	0.7~0.8	0.8~1.0
2012	±0.1	0.9~1.3	0.6~0.8	1.2~1.4
	±0.2	1.0~1.4	0.6~0.8	1.2~1.4
3216	±0.2	1.8~2.0	0.9~1.2	1.5~1.7
	±0.3	1.9~2.1	1.0~1.3	1.7~1.9
3225		2.0~2.4	1.0~1.2	1.8~2.3
4532		3.0~3.5	1.2~1.4	2.3~3.0
5750		4.0~4.6	1.4~1.6	3.5~4.8

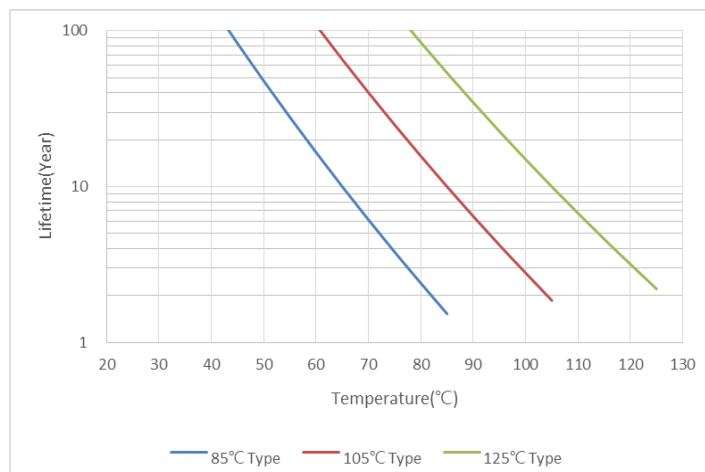
*Please confirm the suitable land dimensions, which are determined through the evaluation of the actual SET and PCB

► Lifetime

As a general MLCC from Samhwa Capacitor, the typical service life is 10 years.

When the product's operating conditions within a set are "Temperature 20°C lower than the maximum operating temperature and rated voltage at 80% or less," the product is designed to have an internal service life of 10 years or more.

※ The lifetime is provided for reference only and should be used as a guideline during design and usage (it does not guarantee the product's lifetime).



Note

(1) 'Aging'/'De-aging' behavior of high dielectric constant type MLCCs

(Typically represented by X7R temperature characteristic of which main composition is BaTiO₃)

'Aging' / 'De-aging' Behavior of high dielectric MLCCs Please note that high dielectric type dielectric ceramic capacitors have a "normal" 'aging' behavior / characteristic, that is; their capacitance value decreases with time from its value when it was first manufactured. From that date, the capacitance value begins to decrease at a logarithmic rate defined by :

$$C_t = C_{24} (1 - k \log_{10} t)$$

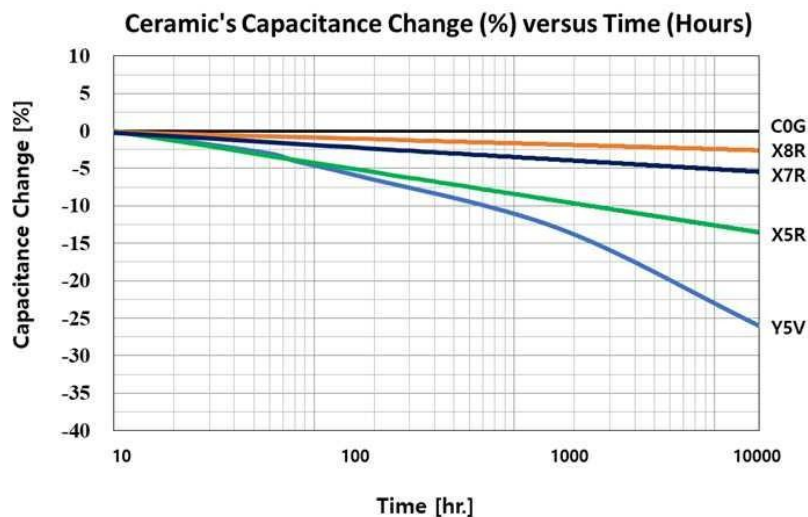
where,

C_t : Capacitance value, t hours after the start of 'aging

C_{24} : Capacitance value, 24 hours after its manufacture

k : Aging constant (capacitance decrease per decade-hour)

t : time, in hours, from the start of 'aging'



The capacitance value can be restored (also known as 'de-aged') by exposing the component to elevated temperatures approaching its curie temperature (approximately 120°C). This 'de-aging' can occur during the component's solder-assembly onto the PCB, during life or temperature cycle testing, or by baking at 150°C for about 1 hour.

(2) Caution of Application

Please contact our sales representatives or product engineers before using the products in this catalog for the applications listed below, which require especially high reliability for the prevention of defects which might directly damage a third party's life, body or property, or when one of our products is intended for use in applications other than those specified in this catalog.

- (a) Aircraft equipment
(b) Aerospace equipment
(c) Undersea equipment
(d) Power plant equipment
- (e) Medical equipment
(f) Transportation equipment (vehicles, trains, ships, etc.)
- (g) Traffic signal equipment
(h) Disaster prevention / crime prevention equipment
- (i) Industrial equipment (Conveyors, Robot equipment, etc)
(j) Led equipment
- (k) Application of similar complexity and/or reliability requirements to the applications listed above