

TO. : **Reference Sheet**

NO. : **A251229**



APPROVAL SHEET

MULTILAYER CERAMIC CAPACITOR

Commercial Grade

High Voltage Type (100V~3000V)



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.	CS3216X7R105K101NRI		
Type	General / High voltage type		
Items	Specification	Unit	Test Conditions
Capacitance	1.0	μF	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	± 10	%	
Dissipation Factor	Max. 2.5	%	
Insulation Resistance	More than 100	$\text{M}\Omega$	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>X7R</u>	<u>105</u>	<u>K</u>	<u>101</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 II	X7R	-55 to +125°C	± 15 %

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

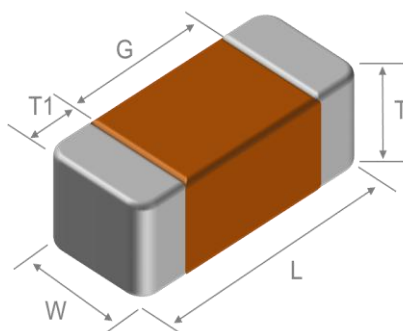
Thickness (mm)		Code
t	Tolerance	
1.60	± 0.20	I

3. Temperature Characteristics

See Page 6 (Specifications and Test Methods : No.7)

4. Constructions and Dimensions

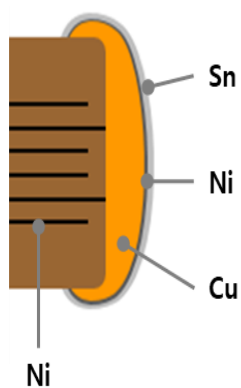
1) Dimensions



(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

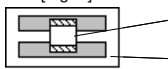
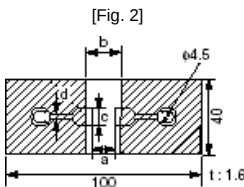
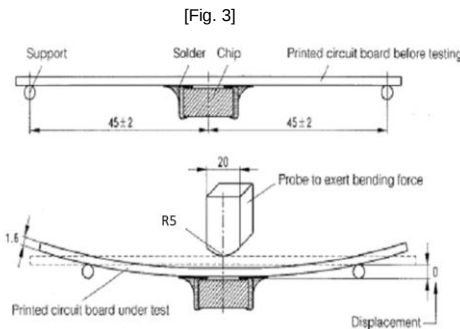
2) Construction of Termination



Specifications and Test Methods (High voltage type)						(IEC-60384 Qualified)																																													
No.	Test Item	Specification			Test Methods and Conditions																																														
		Class I		Class II																																															
1	Operating Temperature Range	-55 ~ 125℃		-55 ~ 125℃																																															
2	Dimensions	Within the specified dimension				Using calipers																																													
3	Voltage proof	No defects or abnormalities				Applied Voltage and Time Charge/Discharge Current Shown in the table 50mA max.																																													
						Cap.	Rated voltage	Test voltage	Time																																										
						C0G	DC100V ~ 630V	150% of the rated voltage	1 to 5 sec.																																										
							DC1kV, DC2kV, DC3kV, DC3.15kV	120% of the rated voltage																																											
							DC100V ~ 630V	150% of the rated voltage																																											
						X7R	DC1kV	120% of the rated voltage																																											
							DC2kV																																												
							DC3kV																																												
4	Insulation Resistance	More than 10,000 MΩ		C≥0.01μF:More than 100Ω·F C<0.01μF:More than 10,000MΩ		Applied Voltage (<DC500V) Applied Voltage (≥DC500V) Charging Time Rated Voltage DC500±50V 2min.																																													
5	Capacitance	Within the specified tolerance				Cap	Testing frequency	Testing Voltage	Measure temperature																																										
6	Dissipation Factor	30pFmin : Q≥1,000(DF≤0.1%) 30pFmax : Q≥400+20C (DF≤1/ (400+20C)) C: Nominal Capacitance (pF)	2.5% max	Initial measurement Perform the initial measurement according to Note1 for Class II																																															
				Measurement after test Take it out and set it for 24±2 hours (Class I) or 24±2 hours (Class II) then measure																																															
7	Temperature characteristic of capacitance	Temp. Coefficient C0G char. : 0±30ppm/°C Temp. Range : -55 to +125℃	C0G : 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 the capacitance should be within the specified tolerance for the temperature coefficient.																																																
			<table><tr><td>Step</td><td colspan="6">Temperature (°C)</td></tr><tr><td>1</td><td colspan="6">25 ± 2</td></tr><tr><td>2</td><td colspan="6">-55 ± 3</td></tr><tr><td>3</td><td colspan="6">25 ± 2</td></tr><tr><td>4</td><td colspan="6">125 ± 3 (for C0G)</td></tr><tr><td>5</td><td colspan="6">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)																																															
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			5	25 ± 2																																															
			X7R : The range of capacitance change compared with the 25℃ value should be within the specified range.																																																
			Pretreatment Perform a heat treatment at 150 -10, +0℃ for 60±5min. and then let sit for 24±2hrs.(Class I), 24±2hrs.(Class II) at room Temperature																																																
			<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="9">25℃</td><td>Within ±15%</td></tr><tr><td>X7S</td><td>-55 to +125℃</td><td>Within ±22%</td></tr><tr><td>X7T</td><td>-55 to +125℃</td><td>Within +22% -33%</td></tr><tr><td>X8S</td><td>-55 to +105℃</td><td>Within ±22%</td></tr><tr><td>X8T</td><td>-55 to +105℃</td><td>Within +22% -33%</td></tr><tr><td>X8R</td><td>-55 to +150℃</td><td>Within ±15%</td></tr><tr><td>X8L</td><td>-55 to +150℃</td><td>Within +15%/-40%</td></tr><tr><td>X5R</td><td>-55 to +85℃</td><td>Within ±15%</td></tr><tr><td>Y5V</td><td>-30 to +85℃</td><td>Within +22% -82%</td></tr></table>							Char.	Temp Range	Reference Temp.	Cap Change	X7R	-55 to +125℃	25℃	Within ±15%	X7S	-55 to +125℃	Within ±22%	X7T	-55 to +125℃	Within +22% -33%	X8S	-55 to +105℃	Within ±22%	X8T	-55 to +105℃	Within +22% -33%	X8R	-55 to +150℃	Within ±15%	X8L	-55 to +150℃	Within +15%/-40%	X5R	-55 to +85℃	Within ±15%	Y5V	-30 to +85℃	Within +22% -82%										
			Char.	Temp Range	Reference Temp.	Cap Change																																													
			X7R	-55 to +125℃	25℃	Within ±15%																																													
X7S	-55 to +125℃	Within ±22%																																																	
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X5R	-55 to +85℃	Within ±15%																																																	
Y5V	-30 to +85℃	Within +22% -82%																																																	

Specifications and Test Methods (High voltage type)

(IEC-60384 Qualified)

No.	Test Item		Specification		Test Methods and Conditions																																				
			Class I	Class II																																					
8	Adhesive Strength of Termination		No removal of the terminations or other defect should occur		Solder the capacitor to the testing jig(glass epoxy board) shown in Fig. 1 using a eutectic solder. Then apply 10N force in the direction of the arrow. The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock. [Fig. 1]  10N(5N:Size 1.6×0.8mm only), 10±1s Speed : 1.0mm/s Glass Epoxy Board																																				
9	Vibration	Appearance	No defects or abnormalities		Type of Vibration Vibration Time Total Amplitude	From 10Hz to 55Hz then 10Hz again 1min. 1.5mm																																			
		Capacitance	Within the specified tolerance		Vibration directions and time	This motion shall be applied for a period of 2 hours in each 3 mutually perpendicular directions (total is 6hours)																																			
		Dissipation Factor(or Q)	30pFmin : Q≥1,000(DF≤0.1%) 30pFmax : Q≥400+20C (DF≤1/ (400+20C)) C: Nominal Capacitance (pF)	2.5% max																																					
10	Substrate bending test		No cracking defects should occur.		Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 2 using a eutectic solder. Then apply a force in the direction shown in Fig. 3. The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.																																				
			[Fig. 2]  <table><tr><th rowspan="2">L×X (mm)</th><th colspan="4">Dimension(mm)</th></tr><tr><th>a</th><th>b</th><th>c</th><th>d</th></tr><tr><td>1.6×0.8</td><td>1.0</td><td>3.0</td><td>1.2</td><td rowspan="5">1.0</td></tr><tr><td>2.0×1.25</td><td>1.2</td><td>4.0</td><td>1.65</td></tr><tr><td>3.2×1.6</td><td>2.2</td><td>5.0</td><td>2.0</td></tr><tr><td>3.2×2.5</td><td>2.2</td><td>5.0</td><td>2.9</td></tr><tr><td>4.5×2.0</td><td>3.5</td><td>7.0</td><td>2.4</td></tr><tr><td>4.5×3.2</td><td>3.5</td><td>7.0</td><td>3.7</td><td></td></tr></table>		L×X (mm)	Dimension(mm)				a	b	c	d	1.6×0.8	1.0	3.0	1.2	1.0	2.0×1.25	1.2	4.0	1.65	3.2×1.6	2.2	5.0	2.0	3.2×2.5	2.2	5.0	2.9	4.5×2.0	3.5	7.0	2.4	4.5×3.2	3.5	7.0	3.7		[Fig. 3] 	
		L×X (mm)	Dimension(mm)																																						
a	b		c	d																																					
1.6×0.8	1.0	3.0	1.2	1.0																																					
2.0×1.25	1.2	4.0	1.65																																						
3.2×1.6	2.2	5.0	2.0																																						
3.2×2.5	2.2	5.0	2.9																																						
4.5×2.0	3.5	7.0	2.4																																						
4.5×3.2	3.5	7.0	3.7																																						
Capacitance Change	Within ±5% or ±0.5pF (whichever is larger)	Within ±10%	Bending limit Pressurizing speed Holding time	1mm 1mm/sec. 5±1sec.																																					
11	Solderability		95% of the terminations is to be soldered evenly and continuously.		Immerse the capacitor in a solution of ethanol and rosin(25% rosin in weight proportion). Immerse in eutectic solder solution for 2±0.5 sec. at 245±5 °C. Immersing speed : 25±2.5mm/s																																				

Specifications and Test Methods (High voltage type)

(IEC-60384 Qualified)

No.	Test Item		Specification		Test Methods and Conditions															
			Class I	Class II																
12	Resistance to Soldering Heat	Appearance	No defects which may affect performance		Preheat Temperature		120 to 150°C													
		Capacitance change	Within ±10%		Preheat Time		1 min.													
					Soldering Temp		260±5°C													
					Immersion Time		10±1sec.													
		Immersing Speed		25±2.5mm/s																
13	Rapid change of temperature	Initial Measurement	Perform the initial measurement according to Note1 for Class II																	
		Measurement after test	Let sit at room Temperature for 24±2hrs.(Class I), 24±2hrs.(Class II) then measure.																	
			*Preheating for more than 3.2×2.5mm																	
			<table><tr><td>Step</td><td colspan="2">Temperature</td><td colspan="2">Time</td></tr><tr><td>1</td><td colspan="2">100 to 120°C</td><td colspan="2">1 min</td></tr><tr><td>2</td><td colspan="2">170 to 200°C</td><td colspan="2">1 min</td></tr></table>				Step	Temperature		Time		1	100 to 120°C		1 min		2	170 to 200°C		1 min
		Step	Temperature		Time															
1	100 to 120°C		1 min																	
2	170 to 200°C		1 min																	
14	Damp heat, steady state	I.R.	More than 10,000MΩ	C≥0.01μF:More than 100Ω·F C<0.01μF:More than 10,000MΩ																
		Capacitance change	within ±2.5%or ±0.25pF (whichever is larger)		Within ±15%		Heat treatments Cycles			Shown in the table 5cycles										
							Step			1		2		3		4				
							Temp (°C)			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									
Initial measurement		Perform the initial measurement according to Note1 for Class II																		
Measurement after test		Perform the final measurement according to Note2																		

Specifications and Test Methods (High voltage type)					(IEC-60384 Qualified)	
No.	Test Item		Specification		Test Methods and Conditions	
			Class I	Class II		
15	Endurance	Appearance	No defects which may affect performance		Applied Voltage	Rated Voltage x150%
		Capacitance change	within $\pm 3\%$ or $\pm 0.3\text{pF}$ (Whichever is larger)	Within $\pm 15\%$	Test Time	1,000+48/-0hrs.
		Dissipation Factor (or Q)	$Q \geq 350$ ($DF \leq 0.3\%$)	5% max	Charge/Discharge current	50mA max.
					Initial measurement	Perform the initial measurement according to Note1 for Class II
		I.R.	More than 1,000M Ω	$C \geq 0.01\mu\text{F}$: More than $10\Omega \cdot \text{F}$ $C < 0.01\mu\text{F}$: More than 1,000M Ω	Measurement after test	Perform the final measurement according to Note2
16	Humidity Load (Application : DC250V item)	Appearance	No defects which may affect performance		Applied Voltage	Rated Voltage
		Capacitance change	Within $\pm 7.5\%$ or $\pm 0.75\text{pF}$ (whichever is larger)	Within $\pm 15\%$	Temperature	40 $\pm 2^\circ\text{C}$
		Dissipation Factor (or Q)	200 min	5% max	Humidity	90 to 95%RH
					Test Time	500+24/-0 hrs.
		I.R.	500 Ω or $25\Omega \cdot \text{F}$ (whichever is smaller)	$C \geq 0.01\mu\text{F}$: More than 10M $\Omega \cdot \mu\text{F}$ $C < 0.01\mu\text{F}$: More than 1,000M Ω	Initial measurement	Perform the initial measurement according to Note1 for Class II
					Measurement after test	Perform the final measurement according to Note2

*Note1. Initial Measurement for Class II

Perform a heat treatment at 150+0,-10 $^\circ\text{C}$ 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 $^\circ\text{C}$ 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."

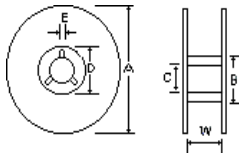
Packing

- (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)

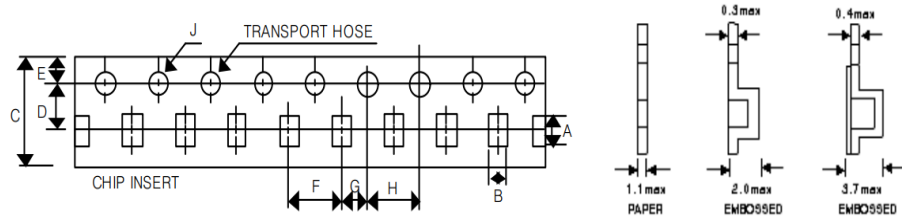
Mark	Size Code	EIA Code	A	B	C	D	E	W
7 " Reel	0603-3225	0201-1210	Φ178±2	Φ50Min	Φ13±0.5	Φ21±0.8	2±0.5	10±1.5
	4520-4532	1808-1812	Φ180+0,-3	Φ60-0,+1	Φ13±0.2	Φ57-0+1	3±0.2	13±0.5
13 " Reel	1005-3225	0402-1210	Φ330±2	Φ70Min	Φ13±0.5	Φ21±0.8	2±0.5	10±1.5

(4) Number of Package

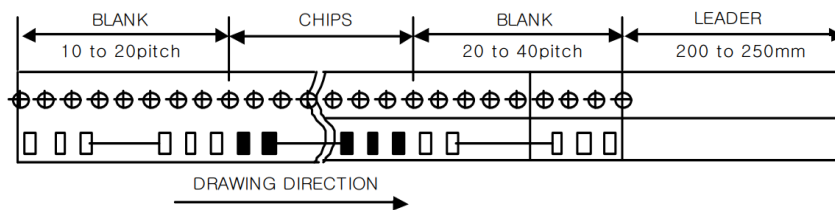
Size Code	EIA Code	7"	13"
		Quantity (pcs) / Reel	Quantity (pcs) / Reel
CS0603	CC0201	15,000	-
CS1005	CC0402	10,000	50,000
CS1608	CC0603	4,000	15,000
CS2012	CC0805	3,000 ~ 4,000	8,000 ~ 15,000
CS3216	CC1206	2,000 ~ 4,000	6,000 ~ 10,000
CS3225	CC1210	1,000 ~ 3,000	4,000 ~ 10,000
CS4520	CC1808	1,500 ~ 3,000	-
CS4532	CC1812	500 ~ 1,000	1,500 ~ 5,000

Packing

(5) Tape Dimensions



Size Code	EIA Code	Size	Thickness	A	B	C	D	E	F	G	H	J
CS0603	CC0201	0603	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
CS1005	CC0402	1005	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
CS1005	CC0402	1005	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
CS1005	CC0402	1005	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
CS1005	CC0402	1005	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
CS1005	CC0402	1005	all	1.40±0.1	0.90±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
CS1608	CC0603	1608	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
CS1608	CC0603	1608	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
CS1608	CC0603	1608	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
CS1608	CC0603	1608	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
CS1608	CC0603	1608	B	2.0±0.10	1.1±0.10	8±0.1	3.5±0.05	1.75±0.05	4±0.1	2±0.05	4±0.1	1.55±0.03
CS2012	CC0805	2012	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
CS2012	CC0805	2012	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
CS2012	CC0805	2012	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
CS2012	CC0805	2012	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
CS2012	CC0805	2012	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
CS2012	CC0805	2012	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
CS2012	CC0805	2012	E	2.3±0.2	1.5±0.2	8±0.1	3.5±0.05	1.75±0.05	4±0.1	2±0.05	4±0.1	1.55±0.03
CS3216	CC1206	3216	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
CS3216	CC1206	3216	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
CS3216	CC1206	3216	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
CS3225	CC1210	3225	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
CS3225	CC1210	3225	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
CS3225	CC1210	3225	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
CS4532	CC1812	4532	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
CS4532	CC1812	4532	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

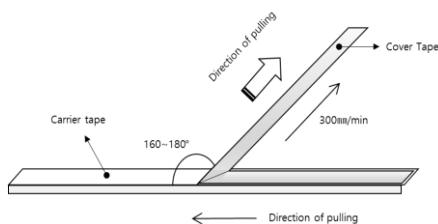


(6) Cover tape peel-off Strength

1. Peeling strength

10 g.f to 70 g.f

2. Measurement Method



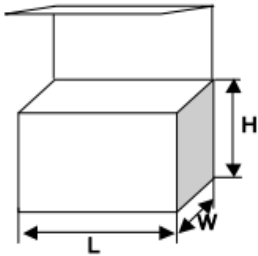
Packing

(7) Packing Label(* Reference image)

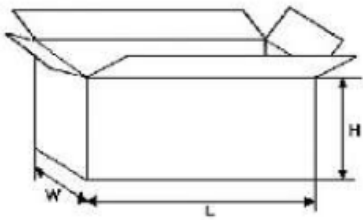


- ① Customer
- ② Part No.
- ③ Lot No
- ④ Q/ty

(8) Packing Box



Inner box drawing



Out box drawing

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

- The sudden temperature change easily causes mechanical damages to ceramic components. Therefore, the preheating procedures should be required for the soldering of ceramic components.
- 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

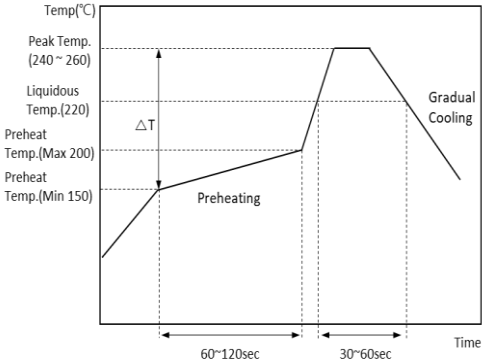
Size code (EIA Code)	Temperature Difference
0603, 1005, 1608, 2012, 3216	$\Delta T \leq 150^{\circ}\text{C}$
3225 size and over	$\Delta T \leq 130^{\circ}\text{C}$

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

- The sudden temperature change easily causes mechanical damages to ceramic components. Therefore, the preheating procedures should be required for the soldering of ceramic components.
- 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

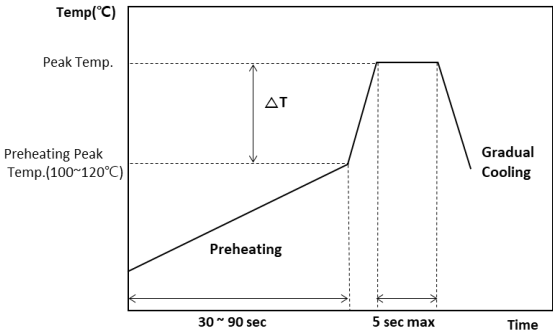
Size code	Temperature Difference
1608, 2012, 3216	$\Delta T \leq 150^{\circ}\text{C}$

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

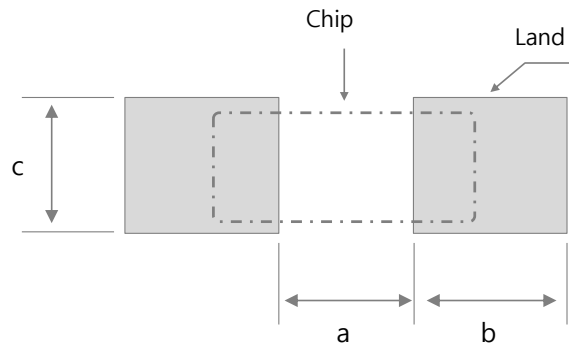


Table . Reflow Soldering Method

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

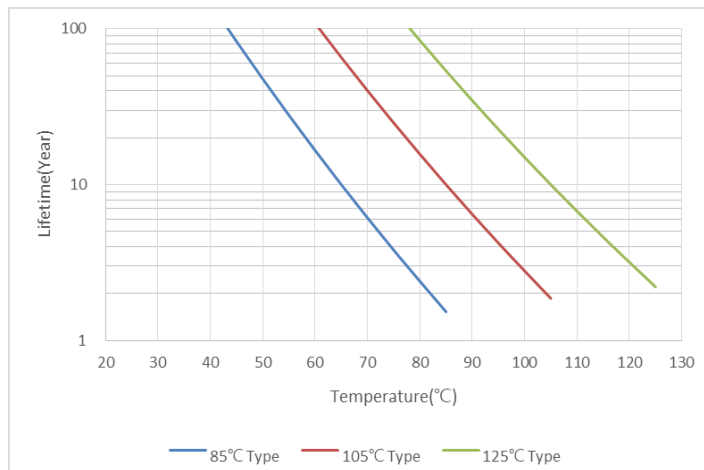
*Please confirm the suitable land dimensions, which are determined through the evaluation of the actual SET and PCB

► 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 :

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

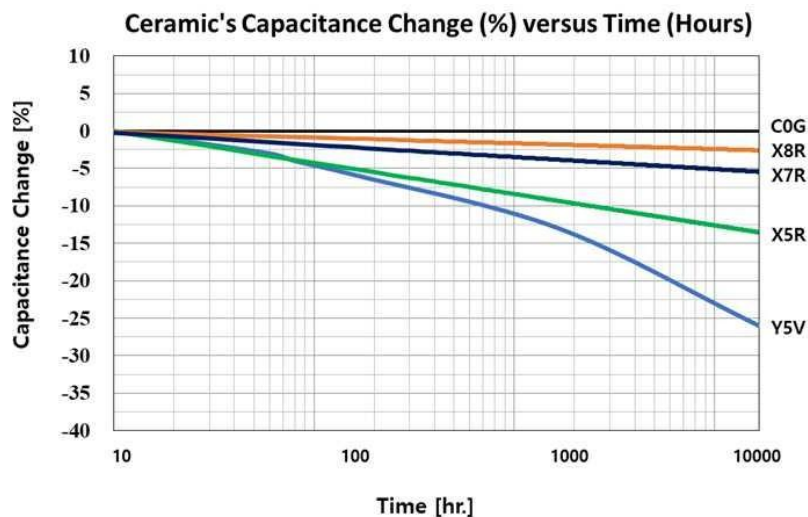
where,

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