Multi Layer Ceramic Capacitors

Introduction

SAMWHA's series of multilayer ceramic(MLC) chip capacitors is designed to meet a wide variety of need. Multilayer ceramic chip capacitors 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 ±15% over the temperature range of -55℃ to 125℃. The X5R provides intermediate capacitance values which vary ±15% over the temperature range of -55℃ to 85℃. The Y5V provides the highest capacitance value which vary from 22% to -82% over the temperature range of -30℃ to 85℃. 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 II .

Features

- Samwha's high density ceramic bodies offer 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

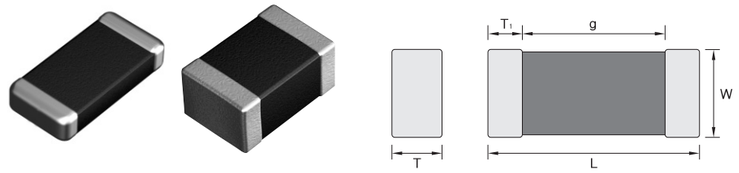
Applications

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

SMD Type

Shape & Dimensions



(Unit : mm)

Code(inch)	Dimensions				
	Length		Width		T1(min)
	L	Tol(±)	W	Tol(±)	
0603(0201)	0.60	0.03	0.30	0.03	0.05
1005(0402)	1.00	0.05	0.50	0.05	0.05
1608(0603)	1.60	0.15	0.80	0.10	0.10
2012(0805)	2.00	0.20	1.25	0.15	0.10
3216(1206)	3.20	0.30	1.60	0.20	0.15
3225(1210)	3.20	0.40	2.50	0.25	0.15
4520(1808)	4.50	0.40	2.00	0.25	0.20
4532(1812)	4.50	0.40	3.20	0.30	0.20
5750(2300)	5.70	0.50	5.00	0.40	0.30

*1608 Size ≥ 10㎌ ⇒ W : 0.8±0.15, T : 0.8±0.15

How to Order(Product Identification)

CS 1608 X7R 104 K 160 N R B

1 2 3 4 5 6 7 8 9

1 Type

CS : SMD

SA : ARRAY

2 Size Code

This is expressed in tens of a millimeter.

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

Size(mm)	0603	1005	1608	2012	3216	3225	4520	4532	5750

3 Temperature Coefficient Code

Temperature Characteristice	Temperature Range	Capacitance Change or Temperature Coefficient	Operating Temperature Range
C0G	−55 to 125℃	0±30ppm/℃	−55 to 125℃
X7R	−55 to 125℃	±15%	−55 to 125℃
X5R	−55 to 85℃	±15%	−55 to 85℃
Y5V	−30 to 85℃	+22, −82%	−30 to 85℃

4 Capacitance Code(Pico Farads)

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 = 100000pF R denotes decimal 8R2 = 8.2pF

5 Capacitance Tolerance Code

Code	Tolerance	Code	Tolerance
B	±0.1pF	M	±20%
C	±0.25pF	P	+100, −0%
D	±0.5pF	Z	+80, −20%
F	±1.0%	H	+0.25/−0pF
G	±2.0%	I	+0/−0.25pF
J	±5%	U	+5/−0%
K	±10%	V	+0/−5%

6 Voltage Code

Code	6R3	100	160	250	500	101	201	251	631	302
Vol.	DC 6.3V	DC 10V	DC 16V	DC 25V	DC 50V	DC 100V	DC 200V	DC 250V	DC 630V	DC 3000V

7 Termination Code

Ex.) N : Ni-Sn (Nickel-Tin Plate)

8 Packing Code

Ex.) R : Reel Type B : Bulk Type

9 Thickness Option

(Unit : mm)

Code	Thickness(mm) L	Dimensions Tol(±)	Code	Thickness(mm) W	Dimensions Tol(±)
Blank	0.30	0.03	E	1.30	0.20
Blank	0.50	0.05	H	1.35	0.20
A	0.60	0.10	I	1.60	0.20
B	0.80	0.10	J	1.80	0.20
B	0.85	0.15	K	2.00	0.25
E	1.00	0.15	L	2.50	0.25
E	1.10	0.15	M	2.80	0.30
E	1.15	0.15	N	3.20	0.30
E	1.25	0.15	O	5.00	0.40

Typical Performance Characteristics

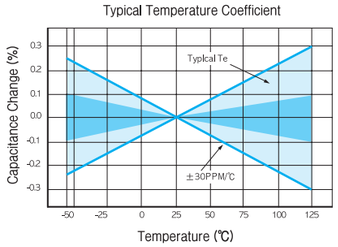
COG

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±30ppm/℃
Operating Temperature	−55~125℃
Capacitance Tolerance	>10pF : ±5%, ±10%, (±1%, ±2%, ±20%) ≤10pF : ±0.1pF, ±0.25pF, ±0.5pF
Dissipation Factor & Q	≥30pF : DF≤0.1%, Q≥1000 <30pF : Q≥400+20×C
Insulation Resistance	More than 10,000MΩ or 500ΩF (Whichever is smaller)
Dielectric Strength	>3×RVDC
Test Voltage	0.5 to 5Vrms(≤1000pF), 1±0.2Vrms(>1000pF)
Test Frequency	1±0.1MHz(≤1000pF), 1±0.1kHz(>1000pF)



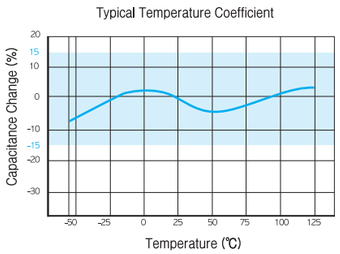
X7R

Application

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

Dielectric Characteristics

Temperature Characteristic	±15%
Operating Temperature	−55~125℃
Capacitance Tolerance	±10%, ±20%, (±5%, +80~−20%)
Dissipation Factor & Q	50V Min. : 2.5% Max. 25V Min. : 3.0% Max. 16V Min. : 3.5% Max. 10V Min. : 5.0% Max. 6.3V Min. : 5.0% Max.(<3.3μF), 10% Max.(≥3.3μF) Thin layer lange capacitors type 10% Max.
Insulation Resistance	More than 10,000MΩ or 500ΩF(Whichever is smaller) Thin layer lange capacitors type 50ΩF Min.
Dielectric Strength	>2.5×RVDC
Test Voltage	1±0.2Vrms(≤10μF, 10V Min.) 0.5±0.1Vrms(≤10μF, 6.3V Max.) 0.5±0.1Vrms(>10μF)
Test Frequency	1±0.1kHz(≤10μF, 10V Min.) 1±0.1kHz(≤10μF, 6.3V Max.) 120±24Hz(>10μF)



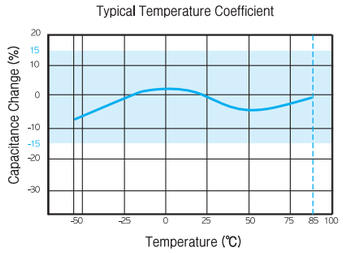
X5R

Application

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

Dielectric Characteristics

Temperature Characteristic	±15%
Operating Temperature	−55~85℃
Capacitance Tolerance	±10%, ±20%, (±5%, +80~−20%)
Dissipation Factor & Q	50V Min. : 2.5% Max. 25V Min. : 3.0% Max. 16V Min. : 3.5% Max. 10V Min. : 5.0% Max. 6.3V Min. : 5.0% Max.(<3.3㎌), 10% Max.(≥3.3㎌) Thin layer lange capacitors type 10% Max.
Insulation Resistance	More than 10,000MΩ or 500ΩF (Whichever is smaller) Thin layer lange capacitors type 50ΩF Min.
Dielectric Strength	>2.5×RVDC
Test Voltage	1±0.2Vrms(≤10㎌, 10V Min.) 0.5±0.1Vrms(≤10㎌, 6.3V Max.) 0.5±0.1Vrms(>10㎌)
Test Frequency	1±0.1kHz(≤10㎌, 10V Min.) 1±0.1kHz(≤10㎌, 6.3V Max.), 120±24Hz(>10㎌)



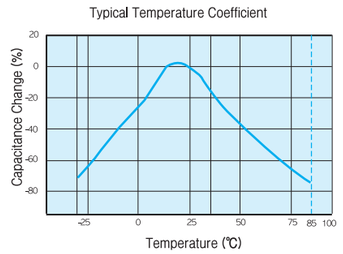
Y5V

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 tantalum capacitors. Typically applications include use 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℃
Capacitance Tolerance	−20~+80%(±20%)
Dissipation Factor & Q	50V Min. : 5% Max. 25V Min. : 7% Max. 16V Min. : 9% Max. 10V Min. : 12.5% Max. 6.3V Min. : 15% Max. Thin layer lange capacitors type 20% Max.
Insulation Resistance	More than 10,000MΩ or 500ΩF(Whichever is smaller) Thin layer lange capacitors type 50ΩF Min.
Dielectric Strength	>2.5×RVDC
Test Voltage	1±0.2Vrms(≤10㎌, 10V Min.) 0.5±0.1Vrms(≤10㎌, 6.3V Max.) 0.5±0.1Vrms(>10㎌)
Test Frequency	1±0.1kHz(≤10㎌, 10V Min.) 1±0.1kHz(≤10㎌, 6.3V Max.), 120±24Hz(>10㎌)



Appendix Ⅰ

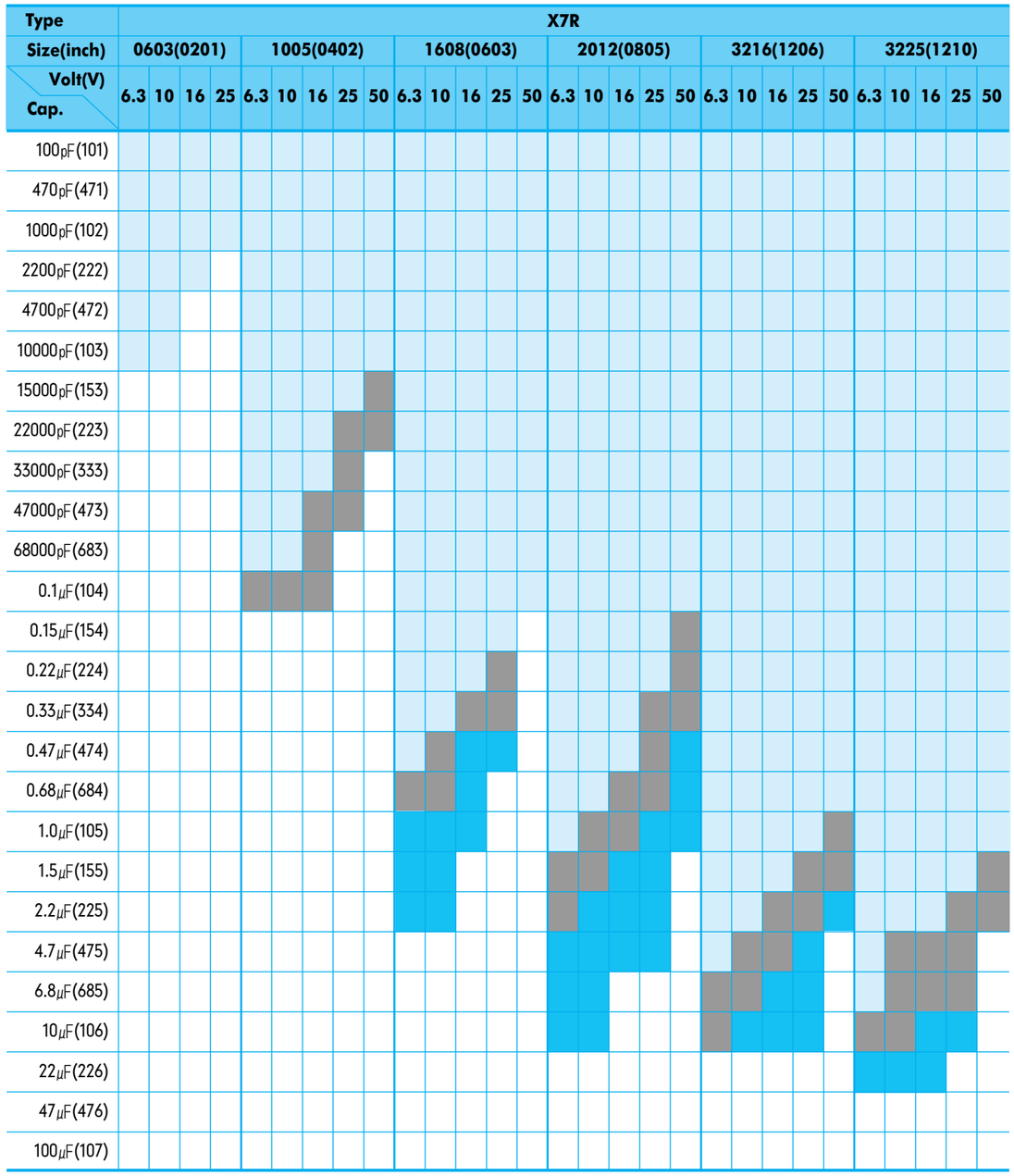
C0G-Temperature Compensating Type(0603~3216)

Type	C0G								
Size(inch)	0603(0201)	1005(0402)		1608(0603)		2012(0805)		3216(1206)	
Volt(V) / Cap.	25	25	50	25	50	25	50	25	50
0.5㎊(0R5)									
1㎊(010)									
2㎊(020)									
3㎊(030)									
4㎊(040)									
5㎊(050)									
6㎊(060)									
7㎊(070)									
8㎊(080)									
9㎊(090)									
10㎊(100)									
12㎊(120)									
15㎊(150)									
18㎊(180)									
22㎊(220)									
27㎊(270)									
33㎊(330)									
39㎊(390)									
47㎊(470)									
56㎊(560)									
68㎊(680)									
82㎊(820)									
100㎊(101)									
120㎊(121)									
150㎊(151)									
180㎊(181)									
220㎊(221)									
270㎊(271)									
330㎊(331)									
390㎊(391)									
470㎊(471)									
560㎊(561)									
680㎊(681)									
820㎊(821)									
1000㎊(102)									
1200㎊(122)									
1500㎊(152)									
1800㎊(182)									
2200㎊(222)									
2700㎊(272)									
3300㎊(332)									
3900㎊(392)									
4700㎊(472)									
5600㎊(562)									
6800㎊(682)									
8200㎊(822)									
10000㎊(103)									
12000㎊(123)									
15000㎊(153)									
18000㎊(183)									
22000㎊(223)									
27000㎊(273)									
33000㎊(333)									
47000㎊(473)									
56000㎊(563)									
68000㎊(683)									
82000㎊(823)									
0.1㎌(104)									

Temperature Compensating Type : Dissipation Factor Page 22 (No.5)

Appendix II

X7R-High Dielectric Constant Type(0603~3225) & Thin Layer Large-Capacitance Type

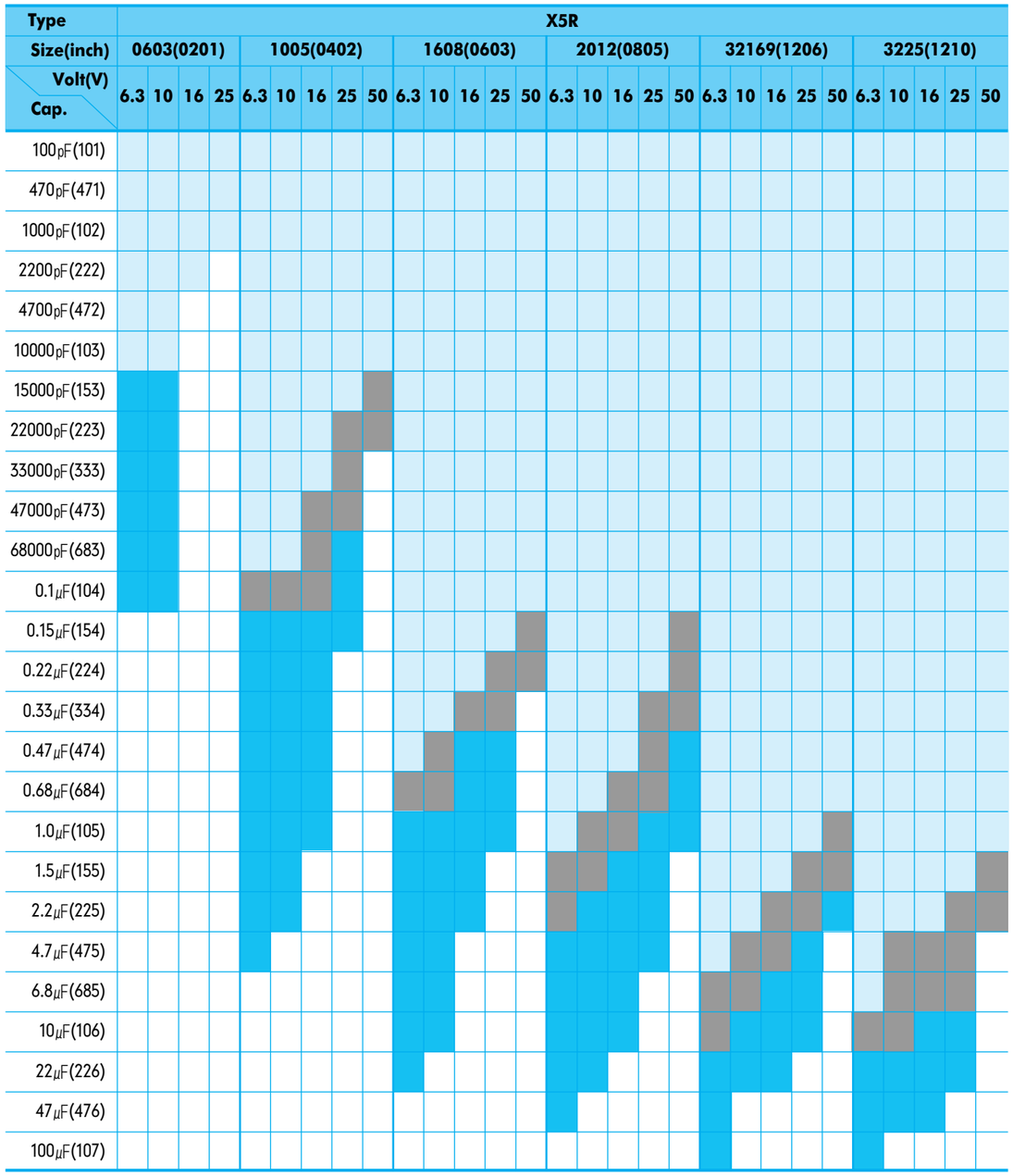


General Type : Dissipation Factor Page 22 (No.5)

∗General Type : Dissipation Factor Page 22 (No.5)

Thin Layer Large-Capacitance Type : Dissipation Factor Page 22 (No.5)

X5R-High Dielectric Constant Type(0603~3225) & Thin Layer Large-Capacitance Type



General Type : Dissipation Factor Page 22 (No.5)

∗General Type : Dissipation Factor Page 22 (No.5)

Thin Layer Large-Capacitance Type : Dissipation Factor Page 22 (No.5)

Y5V-High Dielectric Constant Type(0603~3225) & Thin Layer Large-Capacitance Type

Type	Y5V																								
Size(inch)	1005(0402)					1608(0603)					2012(0805)					3216(1206)					3225(1210)				
Volt(V) / Cap.	6.3	10	16	25	50	6.3	10	16	25	50	6.3	10	16	25	50	6.3	10	16	25	50	6.3	10	16	25	50
1000pF(102)																									
2200pF(222)																									
4700pF(472)																									
10000pF(103)					■																				
15000pF(153)					■																				
22000pF(223)				■	■																				
33000pF(333)				■																					
47000pF(473)			■	■																					
68000pF(683)		■	■	■																					
0.1μF(104)		■	■	■					■	■															
0.15μF(154)		■	■						■	■															
0.22μF(224)		■	■					■	■	■															
0.33μF(334)		■	■					■	■																
0.47μF(474)	■	■	■				■	■	■																
0.68μF(684)	■	■					■	■							■										
1.0μF(105)	■	■					■	■					■	■	■					■					
1.5μF(155)						■	■	■					■	■						■					
2.2μF(225)						■	■	■				■	■	■					■	■					■
3.3μF(335)						■	■					■	■	■					■	■					■
4.7μF(475)						■						■	■	■				■	■	■				■	■
6.8μF(685)											■	■						■	■					■	■
10μF(106)											■	■					■	■	■				■	■	■
22μF(226)																■	■					■			
47μF(476)																■					■				
100μF(107)																■					■				

General Type : Dissipation Factor Page 22 (No.5)

∗General Type : Dissipation Factor Page 22 (No.5)

Thin Layer Large-Capacitance Type : Dissipation Factor Page 22 (No.5)

SMD Type-High Voltage

Product Offering

SAMWHA high voltage MLCC products with COG(NPO) and X7R temperature characteristic are designed for commercial and industrial applications.

The products are power supply and voltage multiplier circuits applications in various sizes with working voltages up to DC 3.0 KV .

These high voltage capacitors feature a special internal electrode design which reduces voltage concentrations by distributing voltage gradients throughout the entire capacitor.

This unique design also affords that capacitance value is increased in a given case size and voltage rating.

Features

- High reliability
- High voltage ratings
- Wide voltage level : from 100V to 3000V
- Surface mount suited for Wave and Reflow Soldering
- Tape & reel surface mount assembly
- Suitable for Back-Lighting Inverter, DC-DC Converters, Ballast, Modems & Power Supply, LAN/WLAN interface... etc.

How to Order(Product Identification)

CS	4520	COG	150	J	302	N	R	E
1	2	3	4	5	6	7	8	9

1 Type

CS : SMD

2 Size Code

Size(mm)	1608	2012	3216	3225	4520	4532

3 Dielectric (Temp. Coefficient)

COG, X7R

4 Capacitance

1st two digits are value, 3rd digit denotes number of zeros;

331 = 330pF, 104 = 100000pF, 8R2C = 8.2pF

5 Tolerance

Code	Tolerance	Code	Tolerance
B	±0.1pF	C	±0.25pF
D	±0.50pF	F	±1%
G	±2%	J	±5%
K	±10%	M	±20%
Z	+80~-20%		

6 Rated Voltage Code

1st two digits are value, 3rd digit denotes number of zeros; 302 = 3000V, 251 = 250V

7 Plating

Ni / Sn Plated

8 Packing

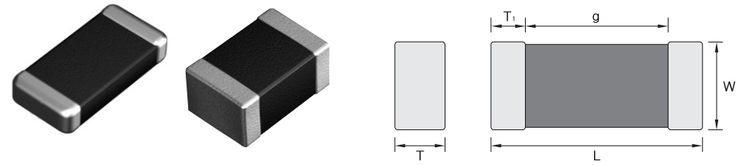
B : Bulk Pack R : Reel Pack

9 Thickness Option

(Unit : mm)

Code	Thickness(mm)	Dimensions	Code	Thickness(mm)	Dimensions
	L	Tol(±)		W	Tol(±)
Blank	0.30	0.03	E	1.30	0.20
Blank	0.50	0.05	H	1.35	0.20
A	0.60	0.10	I	1.60	0.20
B	0.80	0.10	J	1.80	0.20
B	0.85	0.15	K	2.00	0.25
E	1.00	0.15	L	2.50	0.25
E	1.10	0.15	M	2.80	0.30
E	1.15	0.15	N	3.20	0.30
E	1.25	0.15	O	5.00	0.40

Shape & Dimensions



(Unit : mm)

Code	Dimensions				
	Length		Width		T1(min)
	L	Tol(±)	W	Tol(±)	
1608(0603)	1.60	0.15	0.80	0.10	0.10
2012(0805)	2.00	0.20	1.25	0.15	0.10
3216(1206)	3.20	0.30	1.60	0.20	0.15
3225(1210)	3.20	0.40	2.50	0.25	0.15
4520(1808)	4.50	0.40	2.00	0.25	0.20
4532(1812)	4.50	0.40	3.20	0.30	0.20
5750(2300)	5.70	0.50	5.00	0.40	0.30

*1608 Size ≥ 10㎌ ⇒ W : 0.8±0.15, T : 0.8±0.15

Typical Performance Characteristics

Dielectric Characteristics	COG(NPO)	X7R
Dielectric Classification	Ultra Stable	Stable
Rated temperature range	-55℃ to +125℃	-55℃ to +125℃
TCC(Temperature Characteristics Coefficient)	0±30ppm	±15%
Dissifation Factor(tan δ)	C≥30pF : Q≥1,000 (DF:≤ 0.1%) C<30pF : Q≥400+20C(DF: ≤1/(400+20C)	2.5% Max.
IR(Insulation Resistance)	500V Below : Rated voltage 60sec 500V Above : 500V 60sec More than 10,000 MΩ	500V Below:Rated voltage 60sec 500V Above:500V 60sec -DC100V~1KV :C≥0.01㎌:More than 100MΩ㎌ :C<0.01㎌:More than 10,000MΩ -DC2~3KV:More than6,000 MΩ
Capacitance Tolerance	〈10pF : ±0.25pF, ±0.5pF ≥10pF : ±5%, ±0%	±10%, ±20%
Dielectric strength	630V:150% Rated Voltage 1kV~3.15kV:120% Rated Voltage	100V:150% Rated Voltage 630V:150% Rated Voltage 1kV~3.15kV: 120% Rated Voltage
Aging characteristics	0%	2.5% per decade hr, typical

Appendix High Voltage Type(100V~3000V)

COG-Temperature Compensation Type

Type	COG																							
Size(inch)	1608(0603)		2012(0805)		3216(1206)					3225(1210)					4520(1808)						4532(1812)					
Volt(V) / Cap.	100	250	100	250	100	250	630	1000	2000	100	250	630	1000	2000	100	250	630	1000	2000	3000	100	250	630	1000	2000	3000
4.7pF(4R7)																										
5pF(050)																										
7pF(070)																										
8pF(080)																										
9pF(090)																										
10pF(100)																										
12pF(120)																										
15pF(150)																										
18pF(180)																										
22pF(220)																										
47pF(470)																										
56pF(560)																										
68pF(680)																										
82pF(820)																										
100pF(101)																										
220pF(221)																										
330pF(331)																										
470pF(471)																										
560pF(561)																										
680pF(681)																										
1000pF(102)																										
1500pF(152)																										
2200pF(222)																										
2700pF(272)																										
3300pF(332)																										
4700pF(472)																										
5600pF(562)																										
6800pF(682)																										
10000pF(103)																										
15000pF(153)																										
22000pF(223)																										
33000pF(333)																										

High voltage type

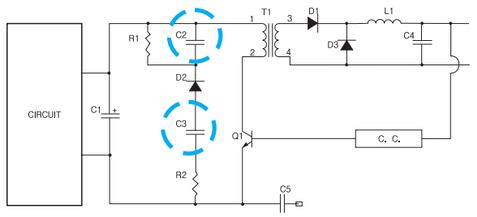
X7R-High Dielectric Type

Type	X7R																							
Size(inch)	1608(0603)		2012(0805)		3216(1206)					3225(1210)					4520(1808)						4532(1812)					
Volt(V) / Cap.	100	250	100	250	100	250	630	1000	2000	100	250	630	1000	2000	100	250	630	1000	2000	3000	100	250	630	1000	2000	3000
220pF(221)																										
330pF(331)																										
470pF(471)																										
680pF(681)																										
1000pF(102)																										
1500pF(152)																										
2200pF(222)																										
3300pF(332)																										
4700pF(472)																										
5600pF(562)																										
6800pF(682)																										
10000pF(103)																										
15000pF(153)																										
18000pF(183)																										
22000pF(223)																										
33000pF(333)																										
47000pF(473)																										
68000pF(683)																										
0.1μF(104)																										
0.15μF(154)																										
0.22μF(224)																										
0.33μF(334)																										
0.47μF(474)																										
0.68μF(684)																										
1.0μF(105)																										
2.2μF(225)																										

High voltage type

Application(Typical circuit)

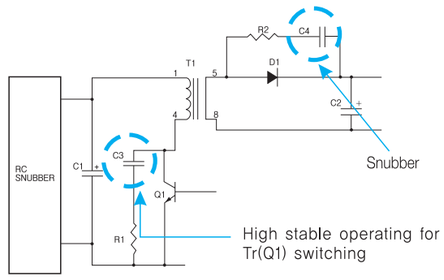
DC-DC Converter



High stable operating for Tr(Q1) switching

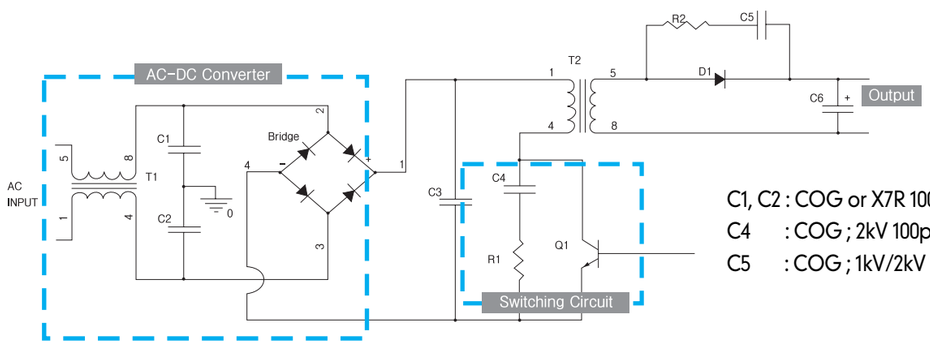
C2 : X7R ; 250V 10nF~47nF
C3 : COG ; 630V 47pF~100pF

Switching Power Supply



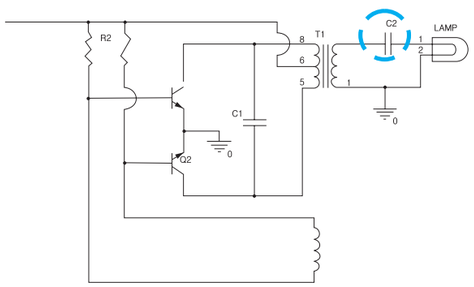
C3 : COG, X7R ; 2kV 100pF~1000pF
C4 : COG, X7R ; 2kV 100pF~1000pF

Primary circuit and Snubber switching power supply



C1, C2 : COG or X7R 1000pF~4700pF
C4 : COG ; 2kV 100pF~330pF
C5 : COG ; 1kV/2kV 100pF~470pF

LCD back light Inverter

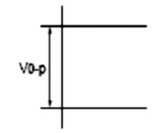
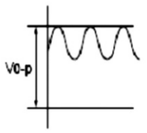
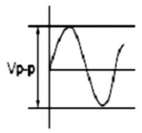
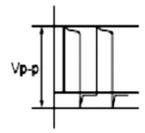
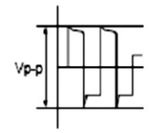


C2 : COG ; 3kV 10 ~100pF

Caution(Rating)

1. Operating Voltage

When DC-rated capacitors are to be used in AC or ripple current circuits, be sure to maintain the Vp-p Value of the applied voltage or the Vo-p which contains DC bias within the rated voltage range.
When the voltage is applied to the circuit, starting or stopping may generate irregular voltage for a transit period because of resonance or switching. Be sure to use a capacitor with a rated voltage range that includes these irregular voltages.

Voltage	DV Voltage	DC+AC Voltage	AC Voltage	Pulse Voltage(1)	Pulse Voltage(2)
Positional Measurement					

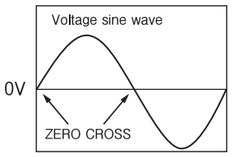
2. Test condition for AC withstanding Voltage

(1) Test Equipment

Tests for AC withstanding voltage should be made with equipment capable of creating a wave similar to a 50/60 Hz sine wave. If the distorted sine wave or overload exceeding the specified voltage value is applied, a defect may be caused.

(2) Voltage applied method

The capacitor's leads or terminals should be firmly connected to the output of the withstanding voltage test equipment, and then the voltage should be raised from near zero to the test voltage. If the test voltage is applied directly to the capacitor without raising it from near zero,it should be applied with the ***zero cross.** At the end of the test time, the test voltage should be reduced to near zero, and then the capacitor's leads or terminals should be taken off the output of the withstanding voltage test equipment. If the test voltage is applied directly to the capacitor without raising it from near zero, surge voltage may occur and cause a defect. ***ZERO CROSS** is the point where voltage sine wave



(3) Dielectric strength testing method

In case of dielectric strength test, the capacitor's is applied between the terminations for 1 to 5 sec., provided the charge/discharge current is less than 50mA.

3. Soldering

If a chip component is heated or cooled abruptly during soldering, it may crack due to the thermal shock. To prevent this, follow our recommendations below for adequate soldering conditions. Carefully perform preheating so that temperature difference (⊿T) between the solder and component surface is in the following range. The smaller the temperatures difference (⊿T) between the solder and component surface is, the smaller the influence on the chip is.

Chip Size / Slodering Method	3.2×1.6mm and under	3.2×2.5mm and over
Reflow Method or Soldering Lron Method	⊿T≦190℃	⊿T≦130℃

SAMWHA CAPACITOR CO., LTD offers a line of MLCC(Multilayer Ceramic Capacitor). These parts are rated at 3kV dc and safety approved and certified to UL (Underwriters Laboratories Inc. ®)

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NWGQ8.E304146
Information Technology Equipment Including Electrical Business Equipment Certified for Canada - Component

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Information Technology Equipment Including Electrical Business Equipment Certified for Canada - Component

See General Information for Information Technology Equipment Including Electrical Business Equipment Certified for Canada - Component

SAMWHA CAPACITOR CO LTD E304146
124 BUK-RI
NAMSA-MYEUN
YONGIN-SHI, KYONGGI-DO 449-880 REPUBLIC OF KOREA

Component Recognition, Model(s) CS45XXYYYTTTA302NRE.

Marking: Company name, model designation and Recognized Component Mark for Canada, .

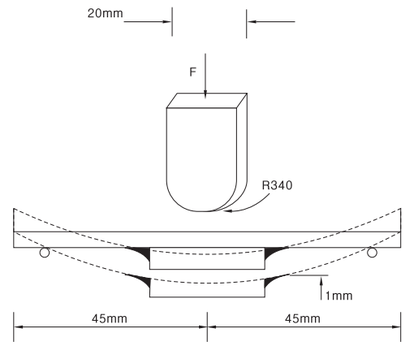
Last Updated on 2006-04-28

Questions? Notice of Disclaimer Page Top

Reliability and Test Conditions(General Type)

No.	Item	Characteristic		Test Methods and Conditions
		Temperature Compensating Type	High Dielectric Constant Type	
1	Operating Temperature Range	C0G : –55 to +125℃	X7R : –55 to +125℃ X5R : –55 to +85℃ Y5V : –30 to +85℃	
2	Insulation Resistance	More than 10,000MΩ or 500ΩF(Whichever is smaller)		- Applied the rated voltage for 2 minutes of charging. - The charge/discharge current is less than 50mA.
3	Dielectric Strength	No defects or abnormalities		- C0G : The rated voltage×300% - X7R, X5R, Y5V : 〃 ×250% - Applied between the terminations for 1 to 5 seconds. - The charge/discharge current is less than 50mA.
4	Capacitance	Within the specified tolerance		
5	Dissipation Factor	30pF Min. : Q≥1,000 (DF≤0.1%) 30pF Max. : Q≥400+20C (DF≤1/(400+20C))	Char. / 50V Min. / 25V / 16V / 10V / 6.3V X7R X5R: ≤2.5%/＊≤5% / ≤3%/＊≤7% / ≤3.5%/＊≤7% / ≤5%/＊≤10% / ≤5%/＊≤10% Y5V: ≤5%/＊≤9% / ≤7%/＊≤9% / ≤9%/＊≤12.5% / ≤12.5%/＊≤15% / ≤15% ＊ You can check the specification at the appendix for each product with mark	The capacitance/Q/D.F. should be measured at 25℃ at the frequency and voltage shown in the table. Cap. / Testing Frequency / Testing Voltage C0G (C≤1000pF) / 1±0.1MHz / 0.5 to 5Vrms C0G (C〉1000pF) / 1±0.1kHz / 1±0.2Vrms X7R, X5R, Y5V (C≤10μF 6.3V Min.) / 1±0.1kHz / 1±0.2Vrms X7R, X5R, Y5V (C〉10μF) / 120±24Hz / 0.5±0.1Vrms
6	Solderability of Termination	Termination should be covered with more than 75% of new solder		- Pb-Free Type Solder : 96.5Sn-3Ag-0.5Cu Solder Temperature : 260±5℃ Immersion Time : 3±0.1sec - Pre-Heating at 80~120℃ for 10~30sec
7	Resistance to Soldering Heat — Appearance	No marked defect		- Preheat the capacitor at 120 to 150℃ for 1 minute. (Preheating for 3225, 4520, 4532 Step1 : 100℃ to 120℃, 1min Step2 : 170℃ to 200℃, 1min) Immerse the capacitor in a eutectic solder solution - Soldering Temp. : 260±5℃ - Immersion Time : 10±0.5sec - Initial measurement Perform a heat treatment at 150+0, -10℃ for one hour and then let sit for 48±4 hours at room temperature. Perform the intial measurement. - Measurement after test Take it out and set it for 24±2 hours (temperature compensating type) or 48±4 hours (high dielectric constant type)then measure
	Capacitchange	Within ±2.5% or ±0.25pF (whichever is larger)	X7R, X5R : ≤ ±7.5% Y5V : ≤ ±20%	
	Dissipation Factor (or Q)	30pF Min. : Q≥1,000 (DF≤0.1%) 30pF Max. : Q≥400+20C (DF≤1/(400+20C))	Char. / 50V Min. / 25V / 16V / 10V / 6.3V X7R X5R: ≤2.5%/＊≤5% / ≤3%/＊≤7% / ≤3.5%/＊≤7% / ≤5%/＊≤10% / ≤5%/＊≤10% Y5V: ≤5%/＊≤9% / ≤7%/＊≤9% / ≤9%/＊≤12.5% / ≤12.5%/＊≤15% / ≤15%	
	I.R.	More than 10,000MΩ or 500Ω. F (Whichever is smaller)		

No.	Item		Characteristic: Temperature Compensating Type	Characteristic: High Dielectric Constant Type	Test Methods and Conditions
8	Temperature Cycle	Appearance	No marking defects		Perform the five cycles according to the four heat treatments listed in the following table.
		Capacitance Change	Within ±2.5% or ±0.25pF (whichever is larger)	X7R, X5R : Within ±7.5% Y5V : Within ±20%	
		Dissipation Factor (or Q)	30pF Min. : Q≥1,000 (DF≤0.1%) 30pF Max. : Q≥400+20C (DF≤1/(400+20C))	Char. 50V Min. 25V 16V 10V 6.3V X7R, X5R: ≤5%/∗≤7.5% ≤5%/∗≤10% ≤5%/∗≤10% ≤7.5%/∗≤12.5% ≤7.5%/∗≤12.5% Y5V: ≤7.5%/∗≤12.5% ≤10%/∗≤12.5% ≤12.5%/∗≤15% ≤15%/∗≤20% ≤20%	
		I.R.	More than 10,000MΩ or 500Ω.F(Whichever is smaller)		
9	Humidity Load	Appearance	No marking defects		- Temperature : 40±2℃ - Humidity : 90~95% - Hour : 500±12hrs - Test Voltage : The rated voltage - Take it out and set it for 24±2 hours (temperature compensating) 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 : Within ±12.5% Y5V : Within +30%, -40% (Y5V/1.0μF, 2.2μF, 4.7μF/10V) Within ±30% (others)	
		Dissipation Factor (or Q)	30pF Min. : Q≥200 (DF≤0.5%) 30pF Max. : Q≥100 +10/3C (DF≤1/(100+10/3C))	Char. 50V Min. 25V 16V 10V 6.3V X7R, X5R: ≤5%/∗≤7.5% ≤5%/∗≤10% ≤5%/∗≤10% ≤7.5%/∗≤12.5% ≤7.5%/∗≤12.5% Y5V: ≤7.5%/∗≤12.5% ≤10%/∗≤12.5% ≤12.5%/∗≤15% ≤15%/∗≤20% ≤20%	
		I.R.	More than 500MΩ or 25Ω.F(Whichever is smaller)		
10	High Temperature Load	Appearance	No marking defects		- Testing time : 1000±12hrs - Applied voltage : Rated voltage < DC250V : ×200% - Temperature : C0G, X7R → 125±3℃ X5R, Y5V → 85±3℃ - Measurement after test Take 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 : Within ±12.5% Y5V : Within ±30%(Cap. < 1.0μF) Within +30%, −40% (Cap. ≥ 1.0μF)	
		Dissipation Factor (or Q)	30pF Min. : Q≥350 (DF≤0.3%) 10pF≤Cp ≤30pF : Q≥275 +5/2C (DF≤1/(275+5/2C)) 10pF Max. : Q≥200+10C (DF≤1/(200+10C))	Char. 50V Min. 25V 16V 10V 6.3V X7R, X5R: ≤5%/∗≤7.5% ≤5%/∗≤10% ≤5%/∗≤10% ≤7.5%/∗≤12.5% ≤7.5%/∗≤12.5% Y5V: ≤7.5%/∗≤12.5% ≤10%/∗≤12.5% ≤12.5%/∗≤15% ≤15%/∗≤20% ≤20%	
		I.R.	More than 10,000MΩ or 50Ω.F(Whichever & Smaller)		

No.	Item		Characteristic: Temperature Compensating Type	Characteristic: High Dielectric Constant Type	Test Methods and Conditions
11	Bending Strength		 No cracking or marking defects shall occur		- Substrate Material : Glass EPOXY Board - Board Thickness : 1.6mm 0.8mm(0603/1005size) ※ Test Condition - Bending Limit : 1mm - Pressurizing Speed : 1mm/sec
		Capacitance Change	Within ±5% or ±0.5pF (whichever is larger)	X7R, X5R : Within ±12.5% Y5V : Within ±30%	
12	Vibration Resistance	Appearance	No defects or abnormalities		∗ Shown in Fig. After soldering and then let sit for 24+4hr(temperature compensating type), 48±4hr (high dielectric constant type) at room temperature. The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz, shall be traversed(from 10Hz to 55Hz then 10Hz again) in approximately 1 minute. This motion shall be applied for a period of 2 hours in each 3mutually perpendicular directions(total is 6hours).
		Capacitance	Whin the specified tolerance		
		Q/DF	30pF Min. : Q 1,000 (DF 0.1%) 30pF Max. : Q 400+20C (DF 1/ (400+20C))	Char. 50V Min. 25V 16V 10V 6.3V X7R, X5R: ≤2.5%/∗≤5% ≤3%/∗≤7% ≤3.5%/∗≤7% ≤5%/∗≤10% ≤5%/∗≤10% Y5V: ≤5%/∗≤9% ≤7%/∗≤9% ≤9%/∗≤12.5% ≤12.5%/∗≤15% ≤15%	
13	Humidity Steady State	Appearance	No marking defects		- Temperature : 40±2℃ - Humidity : 90~95% - Hour : 500±12hours - Measurement after test Take 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.
		Capacitance Change	Within ±5% or ±0.5pF (whichever is larger)	X7R, X5R : Within ±12.5% Y5V : Within ±30%	
		Dissipation (or Q)	30pF Min. : Q≥350 (DF≤0.3%) 10pF≤Cp ≤30pF : Q≥275 +5/2C (DF≤1/(275+5/2C)) 10pF Max. : Q≥200+10C (DF≤1/(200+10C))	Char. 50V Min. 25V 16V 10V 6.3V X7R, X5R: ≤5%/∗≤7.5% ≤5%/∗≤10% ≤5%/∗≤10% ≤7.5%/∗≤12.5% ≤7.5%/∗≤12.5% Y5V: ≤7.5%/∗≤12.5% ≤10%/∗≤12.5% ≤12.5%/∗≤15% ≤15%/∗≤20% ≤20%	
		I.R	More than 1,000MΩ or 50Ω.F (Whichever is Smaller)		

<table>
<tr><th rowspan="2">No.</th><th colspan="2" rowspan="2">Item</th><th colspan="2">Characteristic</th><th rowspan="2">Test Methods and Conditions</th></tr>
<tr><th>Temperature Compensating Type</th><th>High Dielectric Constant Type</th></tr>
<tr><td rowspan="2">14</td><td rowspan="2">Capacitance Temperature Characteristics</td><td>Capacitance Change</td><td></td><td><table><tr><th>Char.</th><th>Temp. Range</th><th>Reference Temp.</th><th>Cap. Change</th></tr><tr><td>X7R</td><td>−55 to +125℃</td><td rowspan="3">25℃</td><td>Within ±15%</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></td><td>(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℃) 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</td></tr>
<tr><td>Temperature Coefficient</td><td><table><tr><th>Char.</th><th>Temp. Range</th><th>Temperature Coefficient</th></tr><tr><td>C0G</td><td>-55 to +125℃</td><td>±30ppm/℃</td></tr></table></td><td></td><td><table><tr><th>Step</th><th>Temperature(℃)</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>
(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.</td></tr>
<tr><td>15</td><td colspan="2">Preservation(keeping)</td><td colspan="2">※When solderability is considered, capacitors are recommended to be used in 12 months</td><td>(1) Temperature : 25℃ ±10℃
(2) Relative Humidity : Below 70% RH</td></tr>
<tr><td>16</td><td colspan="2">The regulation of environmental pollution materials.</td><td colspan="3">※Never use materials mentioned below in MLCC products regulated this document.
Pb, Cd, Hg, Cr+6, PBB(polybromide biphenyl), PBDE(polybrominated diphenyl ethers), asbestos.</td></tr>
</table>

- In case of high Voltage and thin layer type Capacitor, it can be different from nomal specification.
So Please ask to our sales person.