

## SMD Type-High Voltage

### Product Offering

SAMWHA high voltage MLCC products with the temperature characteristics of C0G and X7R are designed for commercial and industrial applications. The products are applied to DC-DC converters and ballast circuit to reduce ripple noise and diverting potentially unsafe transients in various sizes with working voltage up to DC 7kV. These high voltage capacitors feature a special internal electrode design which has capacitor network to reduce voltage concentrations by distributing voltage throughout the entire capacitor.

### Features

- High reliability
- The highest voltage rating by the special internal electrode design
- Wide voltage level : from 100V<sub>DC</sub> to 7,000V<sub>DC</sub>
- Surface mount suited for wave and reflow soldering
- RoHS compliant

### Applications

- DC-DC Converters
  - Network Equipments
  - Back-Lighting Inverter
  - Lighting Ballast
  - Modem & Power Supply
  - LAN/WLAN Interface
- ※ special specification like a Automobile, Medical, Military, Aviation should be discuss with our sales representatives

### Special Options for the Safety

- Inset electrode margins to prevent short mode failure resulted from the crack by mechanical bending stress
- Soft termination is optionally available to reduce possibility for the crack of MLCCs by mechanical bending stress

## How to Order (Product Identification)

# CS 4532 X7R 471 K 302 N R K

1

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### 1 Type

CS : SMD

### 2 Size Code

Size(mm)	1608	2012	3216	3225	4520	4532	5750	7566	9595
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### 3 Dielectric (Temp. Coefficient)

COG, X7R

### 4 Capacitance

1st two digits are value, 3rd digit denotes number of zeros;  
 331 = 330pF, 104 = 100000pF, 8R2 = 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 = 3,000V, 502 = 5,000V, 722 = 7,200V

### 7 Plating

Ni / Sn Plated

### 8 Packing

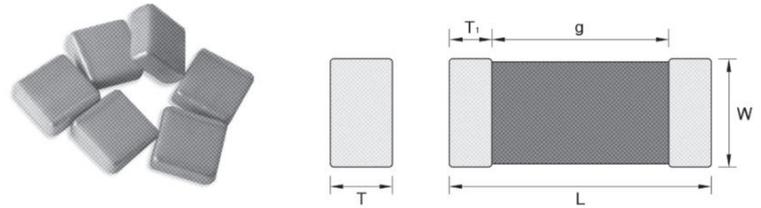
B : Bulk Pack R : Reel Pack C : Case Box

### 9 Thickness Option

Size(mm)	Thickness(mm)		Code	Size(mm)	Thickness(mm)		Code
	t	Tol(±)			t	Tol(±)	
0603/1005	0.3	0.03	-	3216	1.15	0.15	E
1005	0.5	0.05	-	3216/3225	1.6	0.2	I
2012	0.6	0.1	A	3225	1.8	0.2	J
1608	0.8	0.1	B	3225/4532/5750	2	0.25	K
2012/3216	0.85	0.15	B	3225/4532/5750	2.5	0.25	L
2012	1.25	0.15	E				

Size(mm)	Code	Packaging	Size(mm)	Code	Packaging
0603/1005	-	Paper Taping	3216	E	Embossed Taping
1005	-	Paper Taping	3216/3225	I	Embossed Taping
2012	A	Paper Taping	3225	J	Embossed Taping
1608	B	Paper Taping	3225/4532/5750	K	Embossed Taping
2012/3216	B	Paper Taping	3225/4532/5750	L	Embossed Taping
2012	E	Embossed Taping			

## 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(2220)	5.70	0.50	5.00	0.40	0.30
7566(3026)	7.50	0.50	6.60	0.50	0.30
9595(3838)	9.50	0.50	9.50	0.50	0.30

\*1608 Size  $\geq 10\mu\text{F} \Rightarrow W : 0.8\pm 0.15, T : 0.8\pm 0.15$

## Typical Performance Characteristics

### Dielectric Characteristics

### COG(NPO)

### X7R

Dielectric Classification	Ultra Stable	Stable
Rated temperature range	-55°C to +125°C	-55°C to +125°C
TCC(Temperature Characteristics Coefficient)	0±30ppm	±15%
Dissipation 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 2Min 500V Above : 500V 2Min More than 10,000 MΩ	500V Below:Rated voltage 2Min 500V Above:500V 2Min -DC100V~1KV :C≥0.01μF:More than 100MΩμF :C<0.01μF: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~7.2kV:120% Rated Voltage	100V:150% Rated Voltage 630V:150% Rated Voltage 1kV~7.2kV: 120% Rated Voltage
Aging characteristics	0%	2.5% per decade hr, typical

## Appendix High Voltage Type(100V~3000V)

### COG-Temperature Compensation Type

High voltage type

Type	COG																															
	1608(0603)		2012(0805)		3216(1206)					3225(1210)					4520(1808)					4532(1812)					7066(3026)		9595(3838)					
Size(inch)	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	3000	4000	3000	4000	5000	7000
Volt(V) Cap.																																
4.7 pF(4R7)																																
5 pF(050)																																
7 pF(070)																																
8 pF(080)																																
9 pF(090)																																
10 pF(100)																																
12 pF(120)																																
15 pF(150)																																
18 pF(180)																																
22 pF(220)																																
47 pF(470)																																
56 pF(560)																																
68 pF(680)																																
82 pF(820)																																
100 pF(101)																																
180 pF(180)																																
220 pF(221)																																
330 pF(331)																																
470 pF(471)																																
560 pF(561)																																
680 pF(681)																																
1000 pF(102)																																
1500 pF(152)																																
2200 pF(222)																																
2700 pF(272)																																
3300 pF(332)																																
4700 pF(472)																																
5600 pF(562)																																
6800 pF(682)																																
10000 pF(103)																																
15000 pF(153)																																
22000 pF(223)																																
33000 pF(333)																																

## X7R-High Dielectric Type

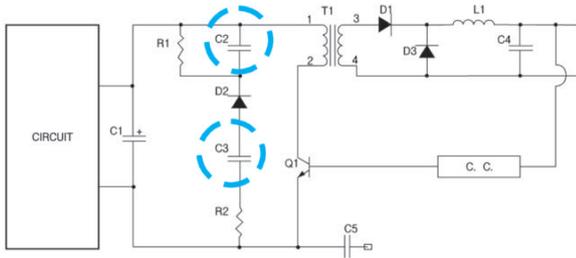
High voltage type

Type	X7R																									
	1608(0603)		2012(0805)		3216(1206)					3225(1210)					4520(1808)					4532(1812)						
Size(inch)	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
Volt(V) Cap.																										
220pF(221)																										
330pF(331)																										
470pF(471)																										
680pF(681)																										
1000pF(102)																										
1500pF(152)																										
2200pF(222)																										
3300pF(332)																										
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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)																										

Size	Vr(V)	100pF	470pF	1.0nF	2.2nF	10nF	47nF	100nF	150nF
3026	3,000								
	4,000								
3838	3,000								
	4,000								
	5,000								
	7,000								

## Application(Typical circuit)

### DC-DC Converter

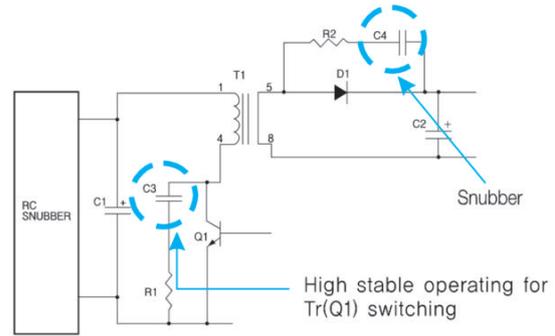


High stable operating for Tr(Q1) switching

C2 : X7R ; 250V 10nF~47nF

C3 : COG ; 630V 47pF~100pF

### Switching Power Supply

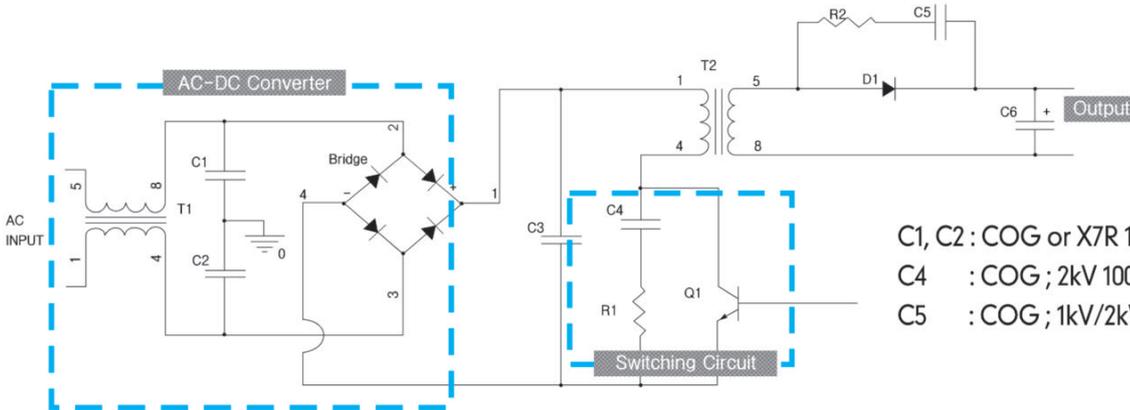


High stable operating for Tr(Q1) switching

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

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

### Primary circuit and Snubber switching power supply

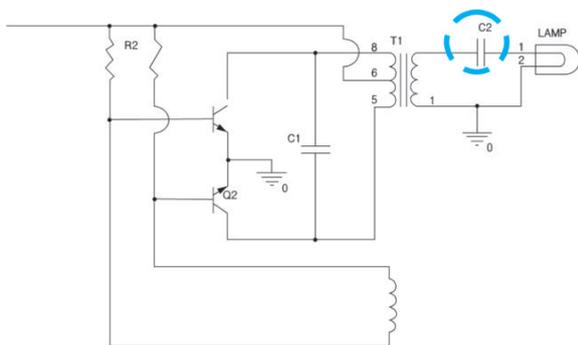


C1, C2 : COG or X7R 1000pF~4700pF

C4 : COG ; 2kV 100pF~330pF

C5 : COG ; 1kV/2kV 100pF~470pF

### LCD back light Inverter



C2 : COG ; 3kV 10 ~100pF

## MLCC Applications for DC-DC Converter Modules

High voltage MLCCs are mainly used to DC-DC converter modules for industrial applications which have high input voltage of typical 48V. These are used as functions of high frequency noise filtering(decoupling) of power line and snubber capacitor to protect switching device from unsafe transients by inductance of transformer or connection line due to switching operation.

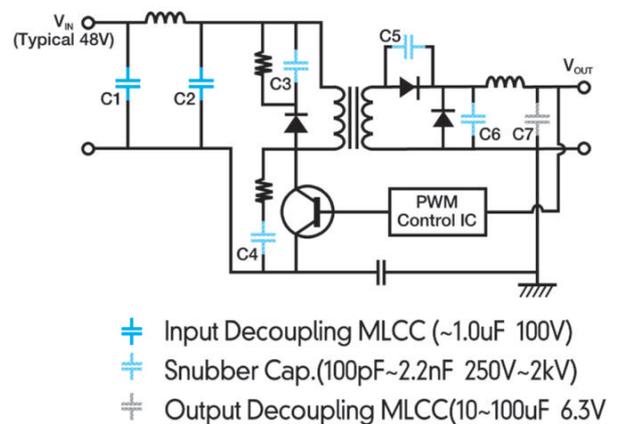
For these applications, MLCCs have merits for high allowable ripple current and high reliability.

Figure 2 shows isolated DC-DC converter circuit diagram and MLCC applications such as decoupling and snubber. Input voltage is 36~75V<sub>DC</sub>(typical 48V<sub>DC</sub>) for general industrial applications such as base station, server and network equipments. Decoupling MLCCs are applied to input and output(based on viewpoint of switch or transformer) power line to reduce ripple voltage, and MLCCs for snubber application used to absorb surge energy. SAMWHA MLCCs are recommended for each application as shown in Table 1.

**Table 1. MLCC recommendation for isolated type DC-DC converter module**

Items	MLCC Recommendation
*Input (C1, C2)	1210 X7R 470nF 100V 1812 X7R 1.0uF 100V
Snubber (C3~C6)	Available wide range of products 250V ~2kV (Available up to 7.2 kV) 100pF~2.2nF(Available up to 470nF)
Output (C7)	(High Capacitance Application) 1210 X5R 100uF 6.3V 1206 X5R 47uF 6.3V 0805 X5R 47uF 6.3V

\*Typical input voltage of 48V for industrial application



## MLCC Applications for Ballast Circuits

High voltage MLCCs are suitable for the ballast circuit as a function of resonant capacitor as presented in Figure 3. MLCCs with high voltage rating from 1kV to 3kV(available up to 7.2kV) are mainly used for these application. SAMWHA offers wide range of capacitance and rated voltage with high reliability.

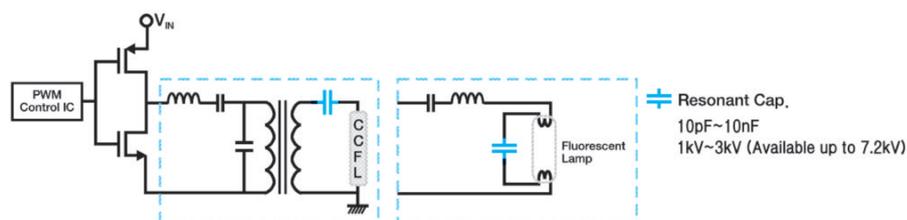


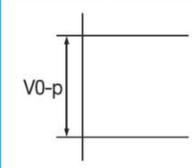
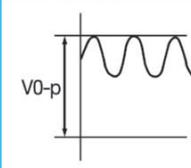
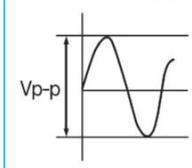
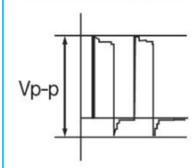
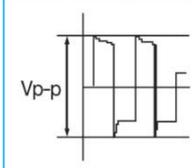
Fig. 3. Typical electronic ballast circuit and MLCC application

## Caution(Rating)

### 1. Operating Voltage

When DC-rated capacitors are to be used in AC or ripple current circuits, be sure to maintain the  $V_{p-p}$  Value of the applied voltage or the  $V_{0-p}$  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					

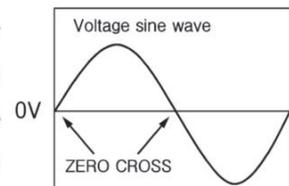
### 2. Test condition for AC withstanding Voltage

#### (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 ( $\Delta T$ ) between the solder and component surface is in the following range. The smaller the temperatures difference ( $\Delta T$ ) between the solder and component surface is, the smaller the influence on the chip is.

Soldering Method	Chip Size	
	3.2×1.6mm and under	3.2×2.5mm and over
Reflow Method or Soldering Iron Method	$\Delta T \leq 190^{\circ}\text{C}$	$\Delta T \leq 130^{\circ}\text{C}$

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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**SAMWHA CAPACITOR CO LTD** E304146  
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NAMSА-MYEUN  
YONGIN-SHI, KYONGGI-DO 449-880 REPUBLIC OF KOREA

**Component Recognition, Model(s)** CS45XXYYTTA302NRE.



Marking: Company name, model designation and Recognized Component Mark for Canada,  . [Last Updated](#) on 2006-04-28

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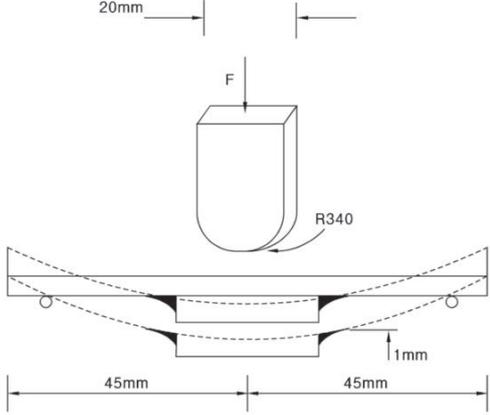
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## Reliability and Test Conditions (General Type)

No.	Item	Characteristic		Test Methods and Conditions																																													
		Temperature Compensating Type	High Dielectric Constant Type																																														
1	Operating Temperature Range	C0G : -55 to +125°C	X7R : -55 to +125°C X5R : -55 to +85°C Y5V : -30 to +85°C																																														
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))	<table border="1"> <thead> <tr> <th>Char.</th> <th>50V Min.</th> <th>25V</th> <th>16V</th> <th>10V</th> <th>6.3V</th> </tr> </thead> <tbody> <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> </tbody> </table> <p>* You can check the specification at the appendix for each product with mark</p>	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%		<table border="1"> <thead> <tr> <th>Cap.</th> <th>Testing Frequency</th> <th>Testing Voltage</th> </tr> </thead> <tbody> <tr> <td>C0G (C ≤ 1000pF)</td> <td>1 ± 0.1MHz</td> <td>0.5 to 5Vrms</td> </tr> <tr> <td>C0G (C &gt; 1000pF)</td> <td>1 ± 0.1kHz</td> <td>1 ± 0.2Vrms</td> </tr> <tr> <td>X7R, X5R, Y5V (C ≤ 10μF)</td> <td>1 ± 0.1kHz</td> <td>1 ± 0.2Vrms</td> </tr> <tr> <td>X7R, X5R, Y5V (C &gt; 10μF)</td> <td>120 ± 24Hz</td> <td>0.5 ± 0.1Vrms</td> </tr> </tbody> </table> <p>The capacitance/Q/D.F. should be measured at 25°C at the frequency and voltage shown in the table.</p>	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)	1 ± 0.1kHz	1 ± 0.2Vrms	X7R, X5R, Y5V (C > 10μF)	120 ± 24Hz	0.5 ± 0.1Vrms
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%																																													
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)	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°C Immersion Time : 3 ± 0.1sec  - Pre-Heating at 80~120°C for 10~30sec																																													
7	Resistance to Soldering Heat	Appearance	No marked defect		- Preheat the capacitor at 120 to 150°C for 1 minute. (Preheating for 3225, 4520, 4532 Step1: 100°C to 120°C, 1min Step2: 170°C to 200°C, 1min) Immerse the capacitor in a eutectic solder solution - Soldering Temp. : 260 ± 5°C - Immersion Time : 10 ± 0.5sec - Initial measurement Perform the initial measurement according to Note1 for Class II - Measurement after test Perform the final measurement according to Note2 for Class I and Class II																																												
		Capacitance change	Within ± 2.5% or ± 0.25pF (whichever is larger)	X7R, X5R : ≤ ± 7.5% Y5V : ≤ ± 20%																																													
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8	Temperature Cycle	Appearance	No marking defects				Perform the five cycles according to the four heat treatments listed in the following table. <table border="1" style="margin-top: 10px;"> <thead> <tr> <th>Step</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> </thead> <tbody> <tr> <td>Temp. (°C)</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> </tbody> </table> - Initial measurement Perform the initial measurement according to Note1 for Class II - Measurement after test Perform the final measurement according to Note2 for Class I and Class II	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														
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9	Humidity Load	Appearance	No marking defects				- Temperature : 40±2°C - Humidity : 90~95% - Hour : 500±12hrs - Test Voltage : The rated voltage - Initial measurement Perform the initial measurement according to Note1 for Class II - Measurement after test Perform the final measurement according to Note2 for Class I and Class II																													
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10	High Temperature Load	Appearance	No marking defects				- Testing time : 1000±12hrs - Applied voltage : Rated voltage < DC250V : ×200% - Temperature : C0G, X7R → 125±3°C X5R, Y5V → 85±3°C - Initial measurement Perform the initial measurement according to Note1 for Class II - Measurement after test Perform the final measurement according to Note2 for Class I and Class II																													
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11	Bending Strength	 <p style="text-align: center;">No cracking or marking defects shall occur</p>		<ul style="list-style-type: none"> <li>- Substrate Material : Glass EPOXY Board</li> <li>- Board Thickness : 1.6mm 0.8mm(0603/1005size)</li> <li>※ Test Condition</li> <li>- Bending Limit : 1mm</li> <li>- Pressurizing Speed : 1mm/sec</li> <li>- Holding Time: 5±1 sec</li> </ul>																															
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12	Vibration Resistance	Appearance	No defects or abnormalities		<ul style="list-style-type: none"> <li>* After soldering and then let sit for 24hr+4hr (temperature compensating type), 24hr+4hr(high dielectric constant type) at room temperature.</li> <li>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.</li> <li>This motion shall be applied for a period of 2 hours in each 3mutually perpendicular directions(total is 6hours).</li> </ul>																														
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13	Humidity Steady State	Appearance	No marking defects		<ul style="list-style-type: none"> <li>- Temperature : 40±2℃</li> <li>- Humidity : 90~95%</li> <li>- Hour : 500±12hours</li> <li>- Initial measurement</li> <li>Perform the initial measurement according to Note1 for Class II</li> <li>- Measurement after test</li> <li>Perform the final measurement according to Note2 for Class I and Class II</li> </ul>																														
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14	Capacitance Temperature Change Characteristics			<table border="1"> <thead> <tr> <th>Char.</th> <th>Temp. Range</th> <th>Reference Temp.</th> <th>Cap. Change</th> </tr> </thead> <tbody> <tr> <td>X7R</td> <td>-55 to +125°C</td> <td rowspan="3">25°C</td> <td>Within ±15%</td> </tr> <tr> <td>X5R</td> <td>-55 to +85°C</td> <td>Within ±15%</td> </tr> <tr> <td>Y5V</td> <td>-30 to +85°C</td> <td>Within 22% -82%</td> </tr> </tbody> </table>	Char.	Temp. Range	Reference Temp.	Cap. Change	X7R	-55 to +125°C	25°C	Within ±15%	X5R	-55 to +85°C	Within ±15%	Y5V	-30 to +85°C	Within 22% -82%	<p>(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 within 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</p> <table border="1"> <thead> <tr> <th>Step</th> <th>Temperature(°C)</th> </tr> </thead> <tbody> <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> </tbody> </table> <p>(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.</p>	Step	Temperature(°C)	1	25±2	2	-55±3	3	25±2	4	125±3(for C0G)	5	25±2
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15	Preservation(keeping)	※ When solderability is considered, capacitors are recommended to be used in 12 months			<p>(1) Temperature : 25°C ±10°C</p> <p>(2) Relative Humidity : Below 70% RH</p>																										
16	The regulation of environmental pollution materials.	※ Never use materials mentioned below in MLCC products regulated this document. Pb, Cd, Hg, Cr <sup>+6</sup> , PBB(polybrominated biphenyl), PBDE(polybrominated diphenyl ethers), asbestos.																													

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

- 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 measurement

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