

# Safety Certified Multilayer Ceramic Chip Capacitor



MSK/MSH Series  
(X1/Y2, X2/Y3)

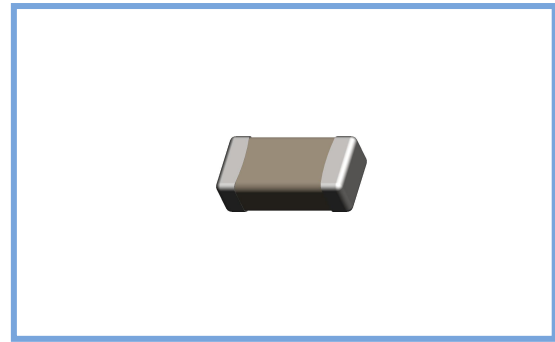
MERITEK

## FEATURES

- X1Y2/X2Y3 class, size 1808~2220, COG(NPO)/X7R, 250V<sub>AC</sub>
- High reliability and stability.
- Small size and high capacitance.
- Safety standard approval by UL60384-14.
- HALOGEN compliant

## APPLICATION

- Modem, Facsimile, Telephone
- Other electronic equipment for lighting or surge protection and isolation.



## PART NUMBER SYSTEM

**MSK 08 X 101 K 302**

Series number \_\_\_\_\_

Code	MSK	MSH
Type	X1/Y2	X2/Y3

Dimension \_\_\_\_\_

Code	08	12	21
Size (inch)	1808	1812	2211

Dielectric \_\_\_\_\_

Code	N	X
	NPO	X7R

Capacitance \_\_\_\_\_  
Capacitance express in microfarads (pF)  
First two digits are significant figures  
Third digit denoted number of zero  
i.e. 101=100pF

Capacitance Tolerance \_\_\_\_\_

Code	F	G	J	K	M
Tolerance	±1.0%	±2.0%	±5.0%	±10%	±20%

Safety Class \_\_\_\_\_

Code	302	502
	X2/Y3 (impulse 2.5kV)	X1/Y2 (impulse 5.0kV)

MERITEK capacitors are designed for surge or lightning immunity in modern facsimile and other equipments. The capacitors of series MSK are class X1/Y2 compliant respectively. The green type capacitors in MSK and MSH series are manufactured by using environmentally friendly materials without lead or cadmium. The terminations are composed of plated nickel and pure tin to feature the superior leaching resistance during soldering



File Number - E197475

## SPECIFICATIONS

	COG(NPO)	X7R
<b>Dielectric</b>	COG(NPO)	X7R
<b>Size</b>	1808	1808, 1812, 2211
<b>Rated voltage (WVDC)</b>	250V <sub>AC</sub>	250V <sub>AC</sub>
<b>Capacitance range*</b>	X1/Y2 Class 3pF ~ 270pF X2/Y3 Class 3pF ~ 1000pF	X1/Y2 Class 130pF ~ 2200pF X2/Y3 Class 150pF ~ 5600pF
<b>Capacitance tolerance</b>	Cap≤5pF: B (±0.1pF), C (±0.25pF) 5pF<Cap<10pF: C (±0.25pF), D (±0.5pF) Cap≥10pF: F (±1%), G (±2%), J (±5%), K (±10%)	K (±10%), M (±20%)
<b>Tan δ*(Tangent of loss angle)</b>	Cap<30pF: D.F≤1/(400+20C) Cap≥30pF: D.F≤0.10%	≤2.5%
<b>Insulation resistance at 500V<sub>DC</sub> for 60 seconds</b>	≥100GΩ or R·C≥1000 whichever is smaller	≥10GΩ or R·C≥500Ω·F whichever is smaller
<b>Operating temperature</b>	-55 to +125°C	
<b>Capacitance characteristic</b>	±30ppm / °C	±15%
<b>Termination</b>	(Cu or Ag) / Ni / Sn (lead-free termination)	

\* COG(NPO): Apply 1.0±0.2Vrms, 1.0MHz±10%, at 25°C ambient temperature

X7R: Apply 1.0±0.2Vrms, 1.0kHz±10%, at 25°C ambient temperature

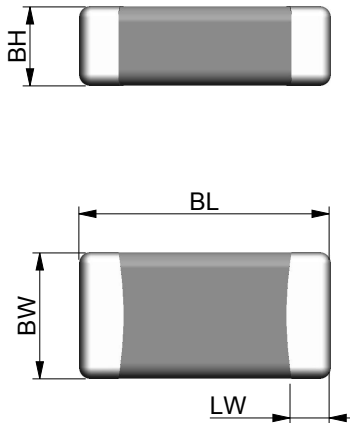
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## DIMENSIONS



Size inch(mm)	BL	BW	BH		LW
<b>1808(4520)</b>	4.6±0.3	2.0±0.2	1.25±0.1	C	0.26
			1.40±0.15	D	
			1.60±0.20	E	
			2.00±0.20	F	
<b>1812(4532)</b>	4.6±0.3	3.2±0.3	1.25±0.10	C	0.26
			1.60±0.20	E	
			2.00±0.20	F	
			2.50±0.30	G	
<b>2211(5728)</b>	5.7±0.4	2.8±0.3	1.60±0.20	E	0.30
			2.00±0.20	F	
			2.50±0.30	G	
			2.80±0.30	H	

All dimension is mm

## CAPACITANCE RANGE

Class	X1/Y2(MSK series)			X2/Y3(MSH series)		
Rated Voltage	250V <sub>AC</sub>					
Dielectric	C0G(NPO)		X7R		COG(NPO) X7R	
Certificated	UL		UL	UL	UL	UL
Size	1808	1812	2211	1808	1808	1812
Impulse	5kV		5kV		2.5kV	
3.0pF (3R0)	D			D		
3.3pF (3R3)	D			D		
4.0pF (4R0)	D			D		
4.7pF (4R7)	D			D		
5.0pF (5R0)	D			D		
5.6pF (5R6)	D			D		
6.8pF (6R8)	D			D		
8.2pF (8R2)	D			D		
10pF (100)	D			D		
12pF (120)	D			D		
15pF (150)	D			D		
18pF (180)	D			D		
22pF (220)	D			D		
27pF (270)	D			D		
33pF (330)	D			D		
39pF (390)	E			E		
47pF (470)	E			E		
56pF (560)	E			E		
68pF (680)	E			E		
82pF (820)	E			E		
100pF (101)	F			F		
120pF (121)	F			F		
130pF (131)	F		E	F		
150pF (151)	F	E	E	F	E	
160pF (161)	F	E	E	F	E	
180pF (181)	F	E	E	F	E	
220pF (221)	F	E	E	F	E	
270pF (271)	F	E	E	F	E	E
330pF (331)		E	E	F	E	E
390pF (391)		E	E	F	E	E
470pF (471)		E	F	F	E	E
560pF (561)		E	F	F	E	E
680pF (681)		F	F	F	E	E
720pF (721)		F	F	F	E	E
820pF (821)		F	F	F	E	E
1,000pF (102)		G	G	F	F	E
1,200pF (122)			G		F	E
1,500pF (152)			G		F	F
1,800pF (182)			G		F	F
2,200pF (222)			G		F	G
2,700pF (272)						G

# Safety Certified Multilayer Ceramic Chip Capacitor



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	3,300pF (332)						G
	3,900pF (392)						G
	2,700pF (272)						G
	4,700pF (472)						G
	5,600pF (562)						G

## RELIABILITY

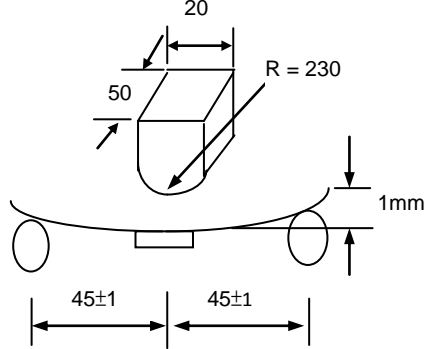
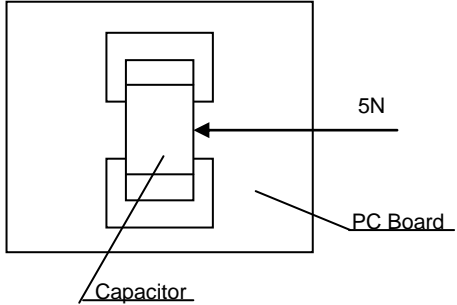
No.	Item	Standard Method	Test Condition	Requirements												
1.	Visual examination and Dimensions	IEC 60384-1 4.1		* No remarkable defect. * Dimensions to confirm to individual specification sheet.												
2.	Capacitance	IEC 60384-1 4.2.2	Class I (C0G/NPO): 1.0±0.2Vrms, 1MHz±10% For C <sub>R</sub> ≤100pF 1KHz±10% For C <sub>R</sub> > 100pF	* Capacitance is within specified tolerance * C <sub>R</sub> means rated capacitance for conform to the E6 series of preferred values given in IEC 60063.												
3.	D.F. (Dissipation Factor) Tangent of loss angle	IEC 60384-1 4.2.3	Class II (X7R): 1.0±0.2Vrms, 1KHz±10%	Class I (C0G/NPO): Cap≥30pF, D.F≤0.1%; Cap<30pF, D.F≤1/(400+20C) Class II (X7R): ≤2.5%												
4.	Temperature Coefficient	IEC 60384-21/22 4.6	With no electrical load. <table border="1"> <thead> <tr> <th>T.C.</th> <th>Operating Temp</th> </tr> </thead> <tbody> <tr> <td>C0G(NPO)</td> <td>-55~125°C at 25°C</td> </tr> <tr> <td>X7R</td> <td>-55~125°C at 25°C</td> </tr> </tbody> </table>	T.C.	Operating Temp	C0G(NPO)	-55~125°C at 25°C	X7R	-55~125°C at 25°C	<table border="1"> <thead> <tr> <th>T.C.</th> <th>Capacitance C angle</th> </tr> </thead> <tbody> <tr> <td>C0G(NPO)</td> <td>Within ±30ppm/°C</td> </tr> <tr> <td>X7R</td> <td>Within ±15%</td> </tr> </tbody> </table>	T.C.	Capacitance C angle	C0G(NPO)	Within ±30ppm/°C	X7R	Within ±15%
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T.C.	Capacitance C angle															
C0G(NPO)	Within ±30ppm/°C															
X7R	Within ±15%															
5.	Insulation Resistance	IEC 60384-21/22 4.5.3	* To apply voltage at 500V <sub>DC</sub> for 60 sec. * The charge current shall not exceed 0.05A.	Class I (NP0) : ≥ 100GΩ or RxC ≥ 1000 Ω-F whichever is smaller. Class II (X7R) : ≥ 10GΩ or RxC ≥ 500 Ω-F whichever is smaller.												
6.	Voltage proof (Dielectric Strength)	IEC 60384-14 4.2.1	* To apply voltage: X Capacitor: 1075V <sub>DC</sub> (4.3U <sub>R</sub> ) Y Capacitor: 1500V <sub>AC</sub> * Duration: 60 sec. * The charge current shall not exceed 0.05A.	* No evidence of damage or flashover during test. * The voltage shall be raised from the near zero to the test voltage a rate not exceeding 150V(r.m.s.)/sec.												
7.	Solderability	IEC 60384-21/22 4.10	* Solder temperature: 245±5°C * Dipping time: 2±0.2 sec.	75% min. coverage of all metalized area.												
8.	Resistance to Soldering Heat	IEC 60384-14 4.4 IEC 60384-21/22 4.9	* Solder temperature: 260±5°C * Dipping time: 10±1 sec * Preheating: 120 to 150°C for 1 minute before immerse the capacitor in a eutectic solder. * Before initial measurement (Class II only): Perform 150+0/-10°C for 1 hr and then set for 48±4 hrs at room temp. * Measurement to be made after keeping at room temp. for 24±2 hrs (Class I) and 48±4 hrs (Class II)	* No visible damage. * Cap change: NP0: within ±2.5% or ±0.25pF whichever is larger. I.R: More than 1GΩ  X7R: within ±10% I.R: More than 1GΩ												
9.	Humidity (Damp Heat) Steady State	IEC 60384-14 4.12	* Test temp.: 40±2°C * Humidity: 90~95% RH * Test time: 500+24/-0hrs. * Applied Voltage:250V <sub>AC</sub> * Measurement to be made after keeping at room temp. for 24±2 hrs (Class I) and 48±4 hrs (Class II)	* No remarkable damage. * Cap change: NP0 within ±5% or ±0.5pF whichever is larger X7R within ±15% * D.F Value: NP0 ≤ 0.25% X7R: ≤5.0% * I.R. ≥1GΩ * Dielectric strength satisfies the specified initial value												

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No.	Item	Standard Method	Test Condition	Requirements
10.	<b>Endurance</b>	IEC 60384-14 4.14	<p>* Impulse Voltage: Each individual capacitor shall be subjected to a <math>V_p = 5.0kV</math> (X1Y2 Class Impulse 5kV) &amp; <math>V_p = 6.0kV</math> (X1Y2 Class Impulse 6kV) impulse for three times before applied to endurance test. Additional pulse test 10/700<math>\mu s</math> before endurance test for Y3 class (IEC60950) *Test Temp.: 125<math>\pm</math>3°C * Test time:: 1000+48/-0 hrs. * Applied Voltage: X capacitor: 1.25<math>U_R</math> (312.5<math>V_{AC}</math>) Y capacitor: 1.70<math>U_R</math> (425<math>V_{AC}</math>) Once every hour the voltage shall be increased to 1000Vrms for 0.1 sec. * Measurement to be made after keeping at room temp. for 24<math>\pm</math>2 hrs (Class I) and 48<math>\pm</math>4 hrs (Class II)</p>	<p>* Appearance : No mechanical damage. * Cap change: NP0 within <math>\pm 5\%</math> or <math>\pm 0.5pF</math> whichever is larger X7R within <math>\pm 20\%</math> * D.F Value: NP0 <math>\leq 0.25\%</math> X7R: <math>\leq 5.0\%</math> * I.R. <math>\geq 1G\Omega</math> * Dielectric strength satisfies the specified initial value</p>
11.	<b>Resistance to Flexure of Substrate</b>	IEC 60384-21/22 4.8	<p>* Capacitors mounted on a substrate. The board shall be bent 1mm with a rate of 1mm/sec.</p> 	<p>* No remarkable damage. * Cap change is less than 10%. (This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.)</p>
12.	<b>Robustness of terminations (Adhesive Strength of Termination)</b>	IEC 60384-21/22 4.15 IEC 60384-1 4.13	<p>* Capacitors mounted on a substrate. A force of 5N applied perpendicular to the place of substrate and parallel the line joining the center of terminations for 10<math>\pm</math>1 sec.</p> 	<p>* No remarkable damage or removal of the terminations.</p>
13.	<b>Passive Flammability</b>	IEC 60384-14 4.17 IEC 60384-1 4.38	<p>* Volume sample: 21.56 mm<sup>3</sup> * Flame exposure time: 5 sec Max. * Category of flammability : C.</p>	<p>* Capacitor didn't burn at all</p>
14.	<b>Active Flammability</b>	IEC 60384-21/22 4.18	<p>* The capacitors applied <math>U_R</math> (250<math>V_{AC}</math>). Then each sample shall be subjected to 20 discharges from a tank capacitor, charge to a voltage that, when discharged, place <math>U_i</math> 2500V for X2Y3, <math>U_i</math> 5000V for X1Y2 across the capacitor under test. The interval between successive discharges shall be 5 sec.</p>	<p>* The cheese cloth shall not burn with a flame.</p>
15.	<b>Impulse Voltage</b>	IEC 60384-14 4.13	<p>* X1 : 4.0kV, X2 : 2.5kV. * Y2 : 5.0kV, Y3 : None. * Number of impulse : 24 max.</p>	<p>* There shall be no permanent breakdown or flashover.</p>

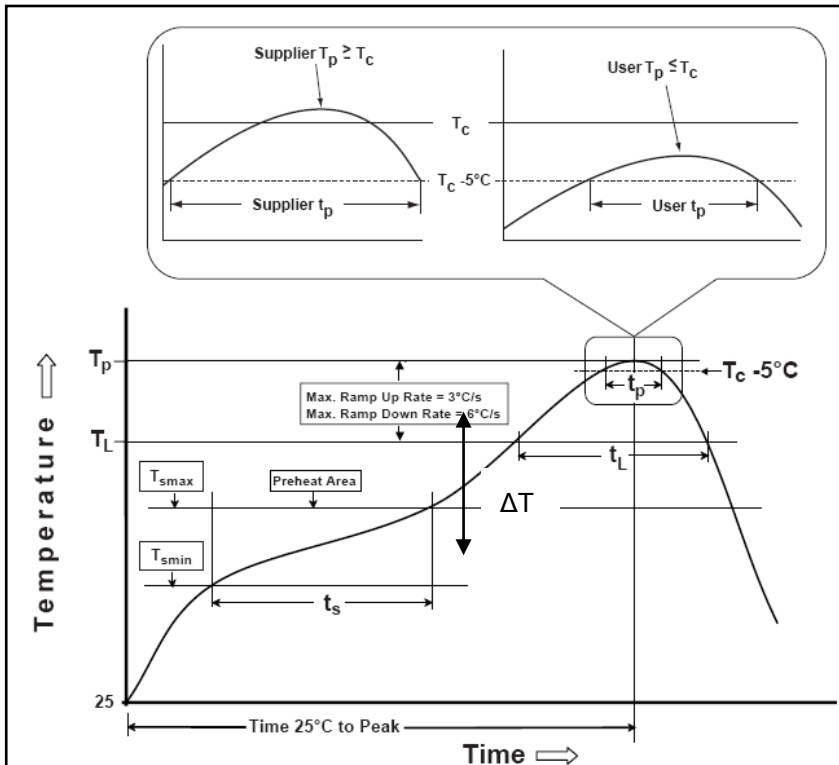
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## REFLOW PROFILES



Chip Size	$\Delta T$
1808, 1812, 2211, 2220	50°C

Soldering	Solder Temp. ( $T_c$ )	Soldering Time ( $t_p$ )
Reflow	235 – 260°C	< 15 sec.

Note : For example ,  $T_c$  is 260°C and time  $t_p$  is 15sec.  
for user : The peak temperature must not exceed 260°C. The time above 255°C must not exceed 15 seconds.

### Cooling

After soldering, cool the chips and the substrate gradually to room temperature. Natural cooling in air is recommended to minimize stress in the solder joint. A cooling rate not exceeding  $4^\circ\text{C}$  per second should be used when forced cooling is necessary.

### Cleaning

All flux residues must be removed by using suitable electronic-grade vapor-cleaning solvents to eliminate contamination that could cause electrolytic surface corrosion. Good results can be obtained by using ultrasonic cleaning of the solvent. The choice of the proper system is depends upon many factors such as component mix, flux, and solder paste and assembly method. The ability of the cleaning system to remove flux residues and contamination from under the chips is very important.