



FEATURES:

- Multi-layer Ceramic Capacitors are safety standard approved by IEC60384-14 and UL 60950-1 and UL60384-14
- UL Certified: E511154 & E511217
- TUV Certified: R50450826



PART NUMBER STRUCTURE

SAFC	1808	X7R	502	—	102	K	N	E
Series Safety Approved MLCC	Size 1808 1812 2211 2208 2220	Temperature Characteristic (Dielectric) COG X7R	Class 202 = X2 502 = X1/Y2		Capacitance (picofarads) 1st two digits are significant, followed by number of zeroes. R denotes decimal e.g: 101 = 100pF 333 = 0.033uF, etc	Tolerance J = 5% K = 10% M = 20%	Termination/Special N = standard termination X = Soft/Flex Termination S = Arc Prevention Coating Z = Arc Prevention Coating + Soft/Flex Termination	Packaging E = Embossed Tape (7" reels)
Example P/N: SAFC1808X7R502-102KNE								

APPLICATIONS

The X2 and X1/Y2 (250Vac) are specially designed for use in modems, telephone and telecommunication equipment, electronic equipment for lighting and surge protection, EMI filtering and Isolation.

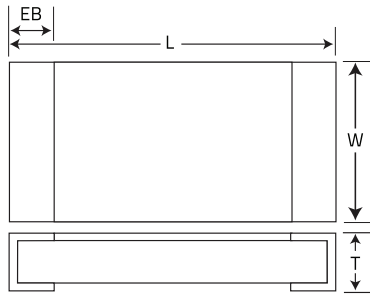
PERFORMANCE SPECIFICATIONS

Rated Voltage (Ur)	250V _{Ac}
Temperature Coefficient	COG: < 30ppm/°C , -55°C ~ +125°C (EIA Class I) X7R: < ±15% , -55°C ~ +125°C (EIA Class II)
Capacitance Range	X1/Y2, 250V_{Ac}: 2pF - 4700pF X2, 250V_{Ac}: 2pF ~ 56nF
Quality and Dissipation Factor	COG: Q ≥ 1000 , X7R : D.F. ≤ 2.5%
Environmental Testing	-55°C (cold); +125°C (hot); 21 days under damp heat (steady state)
Insulation Resistance	≥ 10GΩ
Voltage Rating DC	X1/Y2: 2KV V _{dc} X2: 1.5KV V _{dc}
Voltage Proof (Dielectric Withstanding Voltage)	X2 Capacitor: 1075V _{dc} (4.3Ur) X1/Y2 Capacitor: 1500V _{ac} min.
Peak Impulse Voltage	X2: 2.5KV , X1/Y2: 5KV, each per IEC60384-14:2013
Operating Temperature	-55°C to +125°C
Dielectric Aging	COG: 0 % , X7R: 1.0 % per decade hr., typical
Test Conditions per IEC60384-14	Voltage: 1.0 V _{rms} C < 100pF at 1MHz C ≥ 100pF at 1KHz

SAFETY DETAILS OF SPECIFICATIONS

IEC 660384-14: 2013, 4th Edition	Meets the electrical requirements and certification for equipment requiring Class X1/Y2 and X2 devices.
EN 60384-1 4: 2013, 4th Edition	
UL 60384-14 : 2014, 2nd Edition	Component certified for equipment requiring UL-60384-14 compliance
UL 60950-1 : 2007, 2nd Edition	TNV/SELV isolation capacitors certified To UL 60950-1

DIMENSIONS



Unit: inches (mm)

SIZE	L	W	T (MAX)	EB (MIN)
1808	0.18 ± 0.011 (4.60 ± 0.30)	0.08 ± 0.008 (2.00 ± 0.20)	0.088 (2.20)	0.008 (0.20)
1812	0.18 ± 0.011 (4.60 ± 0.30)	0.12 ± 0.012 (3.20 ± 0.30)	0.104 (2.60)	0.008 (0.20)
2208	0.22 ± 0.016 (5.70 ± 0.40)	0.08 ± 0.008 (2.00 ± 0.20)	0.088 (2.20)	0.012 (0.30)
2211	0.22 ± 0.016 (5.70 ± 0.40)	0.11 ± 0.012 (2.80 ± 0.30)	0.120 (3.00)	0.012 (0.30)
2220	0.22 ± 0.016 (5.70 ± 0.40)	0.20 ± 0.016 (5.00 ± 0.40)	0.120 (3.00)	0.012 (0.30)

VOLTAGE AND CAPACITANCE RANGE

X2 CLASS - COG DIELECTRIC

Values that are typically available.

SIZE				1808	1812	2208	2211	2220
Code	Value	Rated Max Voltage (Vac)	Certificate					
2R0	2pF	250	TUV/UL					
5R0	5pF	250	TUV/UL					
6R8	6.8pF	250	TUV/UL					
8R2	8.2pF	250	TUV/UL					
100	10pF	250	TUV/UL					
120	12pF	250	TUV/UL					
150	15pF	250	TUV/UL					
180	18pF	250	TUV/UL					
220	22pF	250	TUV/UL					
270	27pF	250	TUV/UL					
330	33pF	250	TUV/UL					
360	36pF	250	TUV/UL					
390	39pF	250	TUV/UL					
470	47pF	250	TUV/UL					
560	56pF	250	TUV/UL					
680	68pF	250	TUV/UL					
820	82pF	250	TUV/UL					
101	100pF	250	TUV/UL					
121	120pF	250	TUV/UL					
131	130pF	250	TUV/UL					
151	150pF	250	TUV/UL					
181	180pF	250	TUV/UL					
221	220pF	250	TUV/UL					
271	270pF	250	TUV/UL					
331	330pF	250	TUV/UL					
391	390pF	250	TUV/UL					
471	470pF	250	TUV/UL					
561	560pF	250	TUV/UL					
681	680pF	250	TUV/UL					
821	820pF	250	TUV/UL					
102	1000pF	250	TUV/UL					
122	1200pF	250						
152	1500pF	250						
182	1800pF	250						
222	2200pF	250						
272	2700pF	250						
332	3300pF	250						
472	4700pF	250						

Note: Additional values may be available. Please contact us for more information. Due to demand and raw material fluctuations, specific values may not be available.

VOLTAGE AND CAPACITANCE RANGE

X2 CLASS - X7R DIELECTRIC

Values that are typically available.

SIZE				1808	1812	2208	2211	2220
Code	Value	Rated Max Voltage (Vac)	Certificate					
151	150pF	250	TUV/UL					
181	180pF	250	TUV/UL					
221	220pF	250	TUV/UL					
271	270pF	250	TUV/UL					
331	220pF	250	TUV/UL					
391	390pF	250	TUV/UL					
471	470pF	250	TUV/UL					
561	560pF	250	TUV/UL					
681	680pF	250	TUV/UL					
821	820pF	250	TUV/UL					
102	1000pF	250	TUV/UL					
122	1200pF	250	TUV/UL					
152	1500pF	250	TUV/UL					
182	1800pF	250	TUV/UL					
222	2200pF	250	TUV/UL					
272	2700pF	250	TUV/UL					
332	3300pF	250	TUV/UL					
472	4700pF	250	TUV/UL					
103	0.01uF	250	TUV/UL					
153	0.015uF	250	TUV/UL					
223	0.022uF	250	TUV/UL					
333	0.033uF	250	TUV/UL					
473	0.047uF	250						
563	0.056uF	250						

Note: Additional values may be available. Please contact us for more information. Due to demand and raw material fluctuations, specific values may not be available.

VOLTAGE AND CAPACITANCE RANGE

X1/Y2 CLASS - COG DIELECTRIC

Values that are typically available.

SIZE				1808	1812	2208	2211	2220
Code	Value	Rated Max Voltage (Vac)	Certificate					
2R0	2pF	250	TUV/UL					
5R0	5pF	250	TUV/UL					
6R8	6.8pF	250	TUV/UL					
8R2	8.2pF	250	TUV/UL					
100	10pF	250	TUV/UL					
120	12pF	250	TUV/UL					
150	15pF	250	TUV/UL					
180	18pF	250	TUV/UL					
220	22pF	250	TUV/UL					
270	27pF	250	TUV/UL					
330	33pF	250	TUV/UL					
360	36pF	250	TUV/UL					
390	39pF	250	TUV/UL					
470	47pF	250	TUV/UL					
560	56pF	250	TUV/UL					
680	68pF	250	TUV/UL					
820	82pF	250	TUV/UL					
101	100pF	250	TUV/UL					
121	120pF	250	TUV/UL					
131	130pF	250	TUV/UL					
151	150pF	250	TUV/UL					
181	180pF	250	TUV/UL					
221	220pF	250	TUV/UL					
271	270pF	250	TUV/UL					
331	330pF	250	TUV/UL					
391	390pF	250	TUV/UL					
471	470pF	250	TUV/UL					
561	560pF	250	TUV/UL					
681	680pF	250	TUV/UL					
821	820pF	250	TUV/UL					
102	1000pF	250	TUV/UL					
122	1200pF	250	TUV/UL					

Note: Additional values may be available. Please contact us for more information. Due to demand and raw material fluctuations, specific values may not be available.

VOLTAGE AND CAPACITANCE RANGE

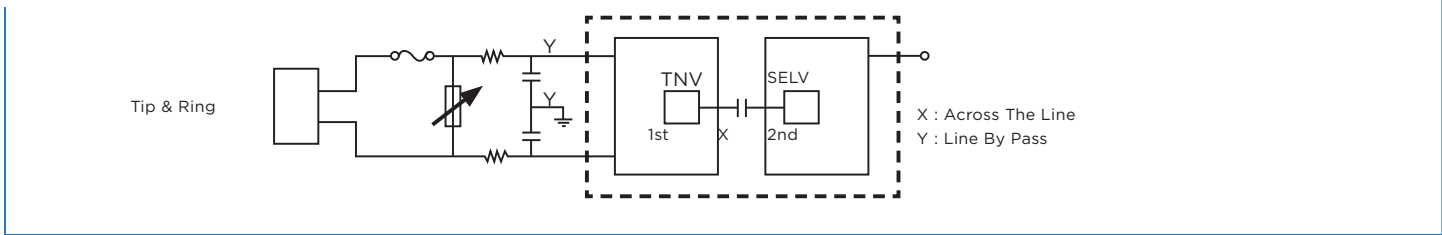
X1/Y2 CLASS - X7R DIELECTRIC

Values that are typically available.

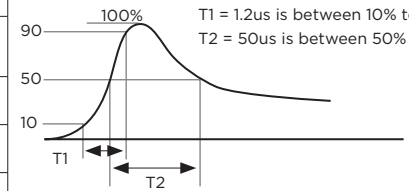
SIZE				1808	1812	2208	2211	2220
Code	Value	Rated Max Voltage (Vac)	Certificate					
2R0	2pF	250						
5R0	5pF	250						
6R8	6.8pF	250						
8R2	8.2pF	250						
100	10pF	250						
120	12pF	250						
150	15pF	250						
180	18pF	250						
220	22pF	250						
270	27pF	250						
330	33pF	250						
360	36pF	250	TUV/UL					
390	39pF	250	TUV/UL					
470	47pF	250	TUV/UL					
560	56pF	250	TUV/UL					
680	68pF	250	TUV/UL					
820	82pF	250	TUV/UL					
101	100pF	250	TUV/UL					
121	120pF	250	TUV/UL					
131	130pF	250	TUV/UL					
151	150pF	250	TUV/UL					
181	180pF	250	TUV/UL					
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182	1800pF	250	TUV/UL					
222	2200pF	250	TUV/UL					
272	2700pF	250	TUV/UL					
332	3300pF	250	TUV/UL					
472	4700pF	250	TUV/UL					

Note: Additional values may be available. Please contact us for more information. Due to demand and raw material fluctuations, specific values may not be available.

APPLICATION - EXAMPLE CIRCUIT



TEST SPECIFICATIONS

NO.	ITEM	SPECIFICATION	TEST CONDITION	
1	Resistance to soldering heat	Appearance	No mechanical damage shall occur	
		Capacitance	Characteristic	Cap. Change
			Class I (COG)	$\leq \pm 10\%$ of initial value
			Class II (X7R)	$\leq \pm 20\%$ of initial value
		Q/Tan δ	To satisfy the specified initial value	
Voltage Proof (Dielectric Withstanding Voltage)	More than 1,000M Ω			
2	Damp Heat / Steady State	Appearance	No mechanical damage shall occur	
		Capacitance	Characteristic	Cap. Change
			Class I (COG)	$\leq \pm 15\%$ of initial value
			Class II (X7R)	$\leq \pm 20\%$ of initial value
		Q Class I	More Than 30pF : $Q \geq 350$ 30pF and below: $Q \geq 275 + 2.5 \times C$ (C;pF)	
		Tan δ Class II	Maximum 5.0%	
Voltage Proof (Dielectric Withstanding Voltage)	More than 1,000M Ω			
3	Endurance	Appearance	No mechanical damage shall occur	
		Capacitance	Characteristic	Cap. Change
			Class I (COG)	$\leq \pm 20\%$ of initial value
			Class II (X7R)	$\leq \pm 25\%$ of initial value
		Q Class I	More Than 30pF : $Q \geq 350$ 30pF and below: $Q \geq 275 + 2.5 \times C$ (C;pF)	
		Tan δ Class II	Maximum 5.0%	
Voltage Proof (Dielectric Withstanding Voltage)	More than 1,000M Ω			
			Impulse Voltage Each individual capacitor shall be subjected to a 2.5KV(X2) and 5KV(X1/Y2) impulse for three times. Then the capacitors are applied to life test.	
			 <p>$T1 = 1.2\mu s$ is between 10% to 90% $T2 = 50\mu s$ is between 50% to 50%</p>	
			Temperature : 125°C Test Time : 1 000hrs Applied Voltage : Class X Capacitors :1.25Ur (312.5Vac) Class Y Capacitors :1.70Ur (425Vac) Except that once every hour the voltage shall be increased to 1 000Vrms for 0.1 s.	

TEST SPECIFICATIONS

FIG.1

P.C.Board for Bending Strength Test (referring to IEC384-14 and EN132400)

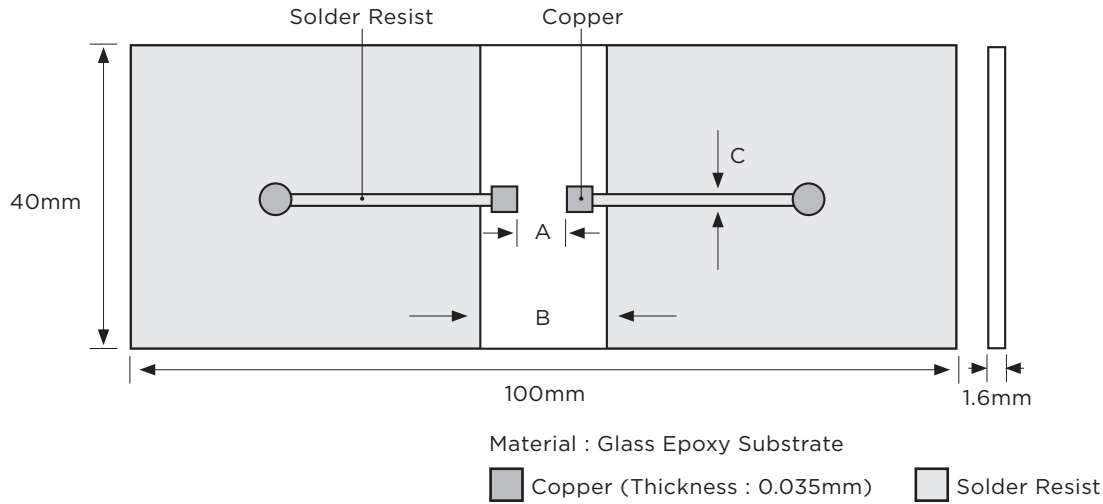
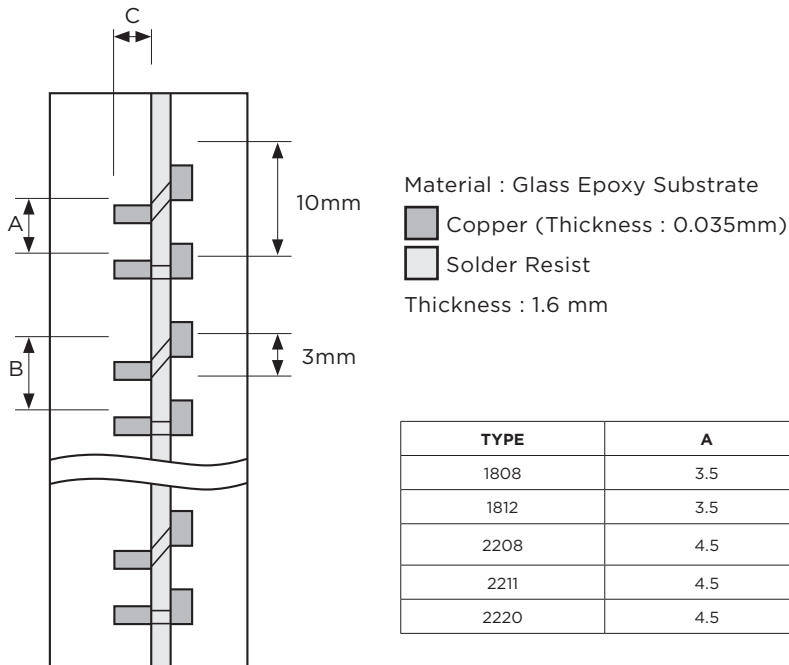


FIG.2

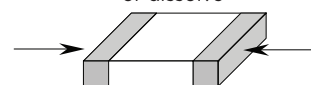
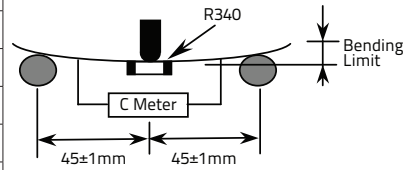
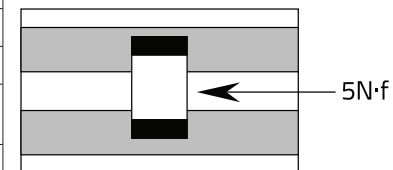
Test Substrate



Unit: mm

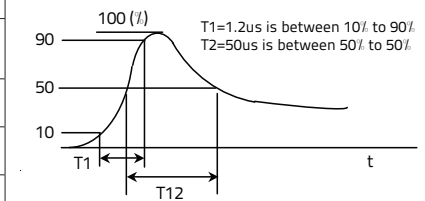
TYPE	A	B	C
1808	3.5	7.0	2.5
1812	3.5	7.0	3.7
2208	4.5	8.0	2.5
2211	4.5	8.0	3.0
2220	4.5	8.0	5.6

PERFORMANCE SPECIFICATIONS

NO.	ITEM	SPECIFICATION	TEST CONDITION	
1	Visual	No abnormal exterior appearance	Visual Inspection	
2	Dimension	See Page2	Visual Inspection	
3	Capacitance	Within the specified tolerance	Char. Frequency Voltage	
4	Q and Dissipation Factor	Class I (COG) More than 30pF : $Q \geq 1000$ 30pF & below: $Q \geq 400 + 20C$ (C;pF)	COG $C_s \leq 100pF$ 1MHz $\pm 10\%$ $C_s \leq 100pF$ 1KHz $\pm 10\%$ 1.0 $\pm 0.2V_{rms}$	
		Class II (X7R) Maximum : 2.5% (0.025)	X7R 1KHz $\pm 10\%$ 1.0 $\pm 0.2V_{rms}$	
			After performing deage at 150 $\pm 5\%$ for 30min. and placement room temperature for 24 \pm 2hr.	
5	Insulation Resistance	Minimum 10,000M Ω	Applied Voltage: Applied Voltage: 500V Charge Time : 60sec.	
6	Voltage Proof (Dielectric Withstanding Voltage)	No dielectric breakdown or mechanical breakdown	Applied Voltage: X Capacitor: Applied Voltage 1075Vdc(4.3Ur) Y Capacitor: Applied Voltage 1500Vac For 1min. Is Applied Less Than 50mA Current	
7	Solderability	More than 90% of the terminal surface is to be soldered newly, so metal part does not come out or dissolve 	Solder Temperature: 245 $\pm 5^\circ C$ Dip Time: 5 ± 0.5 sec. Immersing Speed: 25 $\pm 10\%$ mm/s Solder: H63A Flux: Rosin Preheat : At 80 -120 $^\circ C$ For 10 -30sec.	
8	Resistance to Flexure of Substrate	Appearance	No mechanical damage shall occur	
		Capacitance	Characteristic	Cap. Change
			Class I (COG)	$\leq \pm 5.0\%$ of initial value
			Class II (X7R)	$\leq \pm 12.5\%$ of initial value
		Q / Tan δ	To satisfy the specified initial value	
		Insulation Resistance	To satisfy the specified initial value	
Voltage Proof (Dielectric Withstanding Voltage)	To satisfy the specified initial value			
			Bending shall be applied to the 1.0 mm with 1.0 mm/sec.  Solder the capacitor on P.C. board shown in Fig 1. before testing.	
9	Robustness of Shear	Appearance	No indication of peeling shall occur on the terminal electrode.	
		Capacitance	Characteristic	Cap. Change
			Class I (COG)	$\leq \pm 5\%$ of initial value
			Class II (X7R)	$\leq \pm 12.5\%$ of initial value
		Q Class I	More Than 30pF : $Q \geq 350$ 30pF and below: $Q \geq 275 + 2.5 \times C$ (C;pF)	
		Q / Tan δ	To satisfy the specified initial value	
Insulation Resistance	To satisfy the specified initial value			
Voltage Proof (Dielectric Withstanding Voltage)	To satisfy the specified initial value			
			A 5N·f ($\approx 0.5Kg\cdot f$) pull force shall be applied for 10 ± 1 second. 	
			Solder the capacitor on P.C. board shown in Fig 1. before testing.	
10	Resistance to Soldering Heat	Appearance	No mechanical damage shall occur	
		Capacitance	Characteristic	Cap. Change
			Class I (COG)	$\leq \pm 10\%$ of initial value
			Class II (X7R)	$\leq \pm 20\%$ of initial value
		Q / Tan δ	To satisfy the specified initial value	
		Insulation Resistance	More than 1,000M Ω	
Voltage Proof (Dielectric Withstanding Voltage)	To satisfy the specified initial value			
			Class II capacitor shall be set for 48 ± 4 hours at room temperature after one hour heat treatment at 150 + 0/-10 $^\circ C$ before initial measure. Preheat: At 150 $\pm 10^\circ C$ For 60 -120sec. Dip: Solder Temperature of 260 $\pm 5^\circ C$ Dip Time: 10 ± 1 sec. Solder: H63A Flux: Rosin Measure at room temp. after cooling for: Class I: 24 ± 2 Hours Class II: 48 ± 4 Hours	

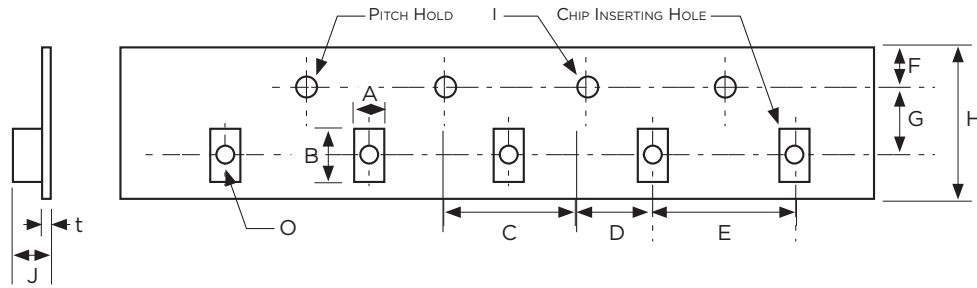
PERFORMANCE SPECIFICATIONS

NO.	ITEM	SPECIFICATION	TEST CONDITION	
11	Damp Heat/Steady State	Appearance	No mechanical damage shall occur	
		Capacitance	Characteristic	Cap. Change
			Class I (COG)	$\leq \pm 15\%$ of initial value
			Class II (X7R)	$\leq \pm 20\%$ of initial value
		Q Class I	More Than 30pF: $Q \geq 350$ 30pF & Below: $Q \geq 275 + 2.5 \times C$ (C:pF)	
		Tan δ Class II	Maximum 5.0%	
		Insulation Resistance	More than 1,000M Ω	
Voltage Proof (Dielectric Withstanding Voltage)	To satisfy the specified initial value			
12	Endurance	Appearance	No mechanical damage shall occur	
		Capacitance	Characteristic	Cap. Change
			Class I (COG)	$\leq \pm 20\%$ of initial value
			Class II (X7R)	$\leq \pm 25\%$ of initial value
		Q Class I	More Than 30pF : $Q \geq 350$ 30pF and below: $Q \geq 275 + 2.5 \times C$ (C:pF)	
		Tan δ Class II	Maximum 5.0%	
		Insulation Resistance	More than 1,000M Ω	
Voltage Proof (Dielectric Withstanding Voltage)	To satisfy the specified initial value			
13	Passive Flammability	Capacitor didn't burnt at all	Volume Sample : 21.56mm ³ Flame exposure time : 5 sec.Max.	
	Active Flammability	The cheese cloth shall not burn with a flame	The capacitors of class X2 each test capacitors applied U_r (250Vac). Then each sample shall be subjected to 20 discharges from a tank capacitor, charge to a voltage that, when discharged, places U_i (2500V) across the capacitor under test. The interval between successive discharges shall be 5s.	



TAPE & REEL SPECIFICATIONS

PLASTIC TAPE

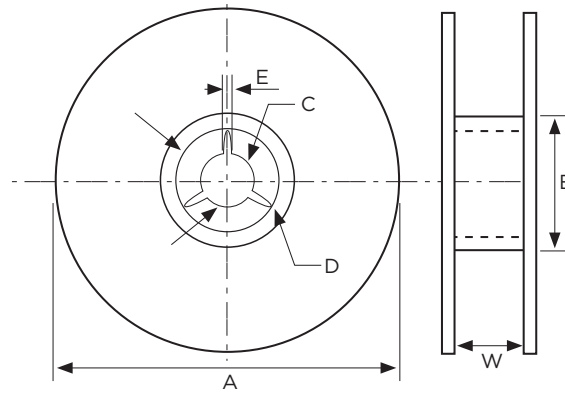


Unit: mm

TYPE	A	B	C	D	E	F
1808	2.5±0.2	4.9±0.2	8.0±0.1	4.0±0.05	4.0±0.1	1.75±0.1
1812	3.6±0.2	4.9±0.2				
2208	2.5±0.2	6.1±0.2				
2211	3.2±0.2	6.1±0.2				
2220	5.4±0.2	6.1±0.2				
TYPE	G	H	I	J	T	O
1808	5.5±0.05	12.0±0.3	1.5±0.1/-0	3.7 max.	0.3 max.	0.5 min.
1812						
2208						
2211						
2220						

REEL DIMENSIONS

Reel Material: Polystyrene



Unit: mm

TYPE	A	B	C	D	E	W
1808	178±2.0	∅50 min.	∅13±0.5	∅21±0.8	2.0±0.5	14±0.15
1812						
2208						
2211						
2220						

TAPE & REEL QUANTITIES (EMBOSSED PLASTIC TAPE)

SIZE	THICKNESS (T)	QTY PER REEL
1808, 1812, 2208, 2211, 2220	0.9mm < T ≤ 1.25mm	3000
	1.25mm < T ≤ 2.0mm	2000
	1.25mm < T ≤ 2.2mm	1000
	T > 2.2mm	700