Class 2 X7R 10/16/25/50/100 V

Vishay BCcomponents

Surface Mount Multilayer Chip Capacitors

FEATURES

- Stable class 2 dielectric
- Four standard sizes
- High capacitance per unit volume
- Supplied in tape on reel
- For high frequency applications
- Ni-barrier with 100 % tin terminations

RoHS COMPLIANT

APPLICATIONS

- Consumer electronics
- Telecommunications
- Data processing

GENERAL SPECIFICATIONS

NOTE: Electrical characteristics values - temperature at 20 ± 1 °C, pressure at 86 to 106 kPa and humidity at 63 to 67 % unless otherwise stated

Rated Voltage U_R (DC): 10 V; 16 V; 25 V; 50 V; 100 V

Capacitance Range: 100 pF to 2.2 µF

Tolerance on Capacitance:

After 1000 hours; ± 5 %; ± 10 %, ± 20 %

Tan d:

50 V ≤ 2.5 %

25 V and 16 V ≤ 3.5 %

10 V ≤ 5 %

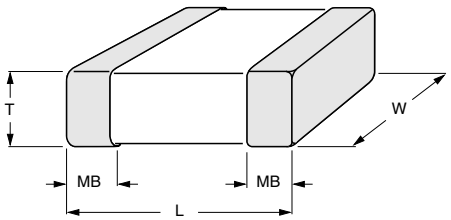
Temperature Coefficient: ± 15 %

Insulation Resistance after 120 seconds at U_R (DC):

R_{ins} 10 GW minimum or 500 WF minimum, whichever is less

Climatic Category (IEC 68): 55/125/56

DIMENSIONS in inches [millimeters]



SIZE CODE	L	W	T MAX.	MB
0402	0.040 ± 0.002 [1.0 ± 0.05]	0.020 ± 0.002 [0.5 ± 0.05]	0.022 [0.55]	0.010 + 0.002/- 0.004 [0.25 + 0.05/- 0.10]
0603	0.063 + 0.006/- 0.004 [1.6 + 0.15/- 0.10]	0.030 + 0.006/- 0.004 [0.8 + 0.15/- 0.10]	0.038 [0.95]	0.015 ± 0.006 [0.40 ± 0.15]
0805	0.080 ± 0.006 [2.0 ± 0.15]	0.050 ± 0.004 [1.25 ± 0.10]	0.053 [1.35]	0.020 ± 0.008 [0.50 ± 0.20]
1206	0.125 ± 0.006 [3.2 ± 0.15]	0.063 ± 0.008 [1.6 ± 0.20]	0.075 [1.90]	0.025 ± 0.008 [0.60 ± 0.20]

ORDERING INFORMATION

VJ0402	Y	101	J	X	Q	C	W1BC
SIZE CODE	DIELECTRIC	CAPACITANCE	TOLERANCE	TERMINATION	VOLTAGE	PACKAGING	PROCESS CODE FOR VISHAY BCC MLCCS
0402 0603 0805 1206	Y = X7R	two significant digits followed by the number of zeros: 101 = 100 pF 102 = 1000 pF 152 = 1500 pF 103 = 10 000 pF	J = ± 5 %[1)] K = ± 10 % M = ± 20 %	X = Ni Barrier	Q = 10 V J = 16 V X = 25 V A = 50 V B = 100 V	C = 7 inch reel/paper P = 13 inch reel/paper T = 7 inch reel/blister R = 13 inch reel/blister	

[1)] Not all values, see selection chart sizes 0603/0805/1206

For technical questions, contact: MLCC@vishay.com

SELECTION CHART FOR 10/16/25/50 AND 100 V

DIELECTRIC		X7R																			
EIA CAP	EIA SIZE	0402					0603					0805					1206				
CODE	CAP	10 V	16 V	25 V	50 V	100 V	10 V	16 V	25 V	50 V	100 V	10 V	16 V	25 V	50 V	100 V	10 V	16 V	25 V	50 V	100 V
101	100 pF	N	N	N	N		S +	S +	S +	S +	S +	B +	B +	B +	B +	B +					
121	120	N	N	N	N		S +	S +	S +	S +	S +	B +	B +	B +	B +	B +					
151	150	N	N	N	N		S +	S +	S +	S +	S +	B +	B +	B +	B +	B +	B* +	B* +	B* +	B* +	B* +
181	180	N	N	N	N		S +	S +	S +	S +	S +	B +	B +	B +	B +	B +	B* +	B* +	B* +	B* +	B* +
221	220	N	N	N	N		S +	S +	S +	S +	S +	B +	B +	B +	B +	B +	B* +	B* +	B* +	B* +	B* +
271	270	N	N	N	N		S +	S +	S +	S +	S +	B +	B +	B +	B +	B +	B* +	B* +	B* +	B* +	B* +
331	330	N	N	N	N		S +	S +	S +	S +	S +	B +	B +	B +	B +	B +	B* +	B* +	B* +	B* +	B* +
391	390	N	N	N	N		S +	S +	S +	S +	S +	B +	B +	B +	B +	B +	B* +	B* +	B* +	B* +	B* +
471	470	N	N	N	N		S	S	S	S	S	B	B	B	B	B	B*	B*	B*	B*	B*
561	560	N	N	N	N		S	S	S	S	S	B	B	B	B	B	B*	B*	B*	B*	B*
681	680	N	N	N	N		S	S	S	S	S	B	B	B	B	B	B*	B*	B*	B*	B*
821	820	N	N	N	N		S	S	S	S	S	B	B	B	B	B	B	B	B	B	B
102	1000 pF	N	N	N	N		S	S	S	S	S	B	B	B	B	B	B	B	B	B	B
122	1200	N	N	N	N		S	S	S	S	S	B	B	B	B	B	B	B	B	B	B
152	1500	N	N	N	N		S	S	S	S	S	B	B	B	B	B	B	B	B	B	B
182	1800	N	N	N	N		S	S	S	S	S	B	B	B	B	B	B	B	B	B	B
222	2200	N	N	N	N		S	S	S	S	S	B	B	B	B	B	B	B	B	B	B
272	2700	N	N	N	N		S	S	S	S	S	B	B	B	B	B	B	B	B	B	B
332	3300	N	N	N	N		S	S	S	S	S	B	B	B	B	B	B	B	B	B	B
392	3900	N	N	N	N		S	S	S	S	S	B	B	B	B	B	B	B	B	B	B
472	4700	N	N	N	N		S	S	S	S	S	B	B	B	B	B	B	B	B	B	B
562	5600	N	N	N			S	S	S	S	S	B	B	B	B	B	B	B	B	B	B
682	6800	N	N	N			S	S	S	S	S	B	B	B	B	B	B	B	B	B	B
822	8200	N	N	N			S	S	S	S	S	B	B	B	B	B	B	B	B	B	B
103	0.01 µF	N	N	N			S	S	S	S	S	B	B	B	B	B	B	B	B	B	B
123	0.012	N	N	N			S	S	S	S		B	B	B	B	B	B	B	B	B	B
153	0.015	N	N	N			S	S	S	S		B	B	B	B	B	B	B	B	B	B
183	0.018	N	N	N			S	S	S	S		B	B	B	B	B	B	B	B	B	B
223	0.022	N	N	N			S	S	S	S		B	B	B	B	B	B	B	B	B	B
273	0.027	N					S	S	S	S		B	B	B	B	D	B	B	B	B	B
333	0.033	N					S	S	S	X		B	B	B	B	D	B	B	B	B	B
393	0.039	N					S	S	S	X		B	B	B	B	D	B	B	B	B	B
473	0.047	N					S	S	S	X		B	B	B	B	D	B	B	B	B	B
563	0.056	N					S	S	S	X		B	B	B	B		B	B	B	B	B
683	0.068	N					S	S	S	X		B	B	B	B		B	B	B	B	B
823	0.082	N					S	S	S	X		B	B	B	B		B	B	B	B	D
104	0.1 µF	N					S	S	S	X		B	B	B	B		B	B	B	B	D
124	0.12						S	S				B	B	B	D		B	B	B	B	D
154	0.15						S	S				D	D	D	D		C	C	C	C	G
184	0.18						S	S				D	D	D			C	C	C	C	G
224	0.22						S	S				D	D	D			C	C	C	C	G
274	0.27						X					D	D	D			C	C	C	D	
334	0.33						X					D	D	D			C	C	C	D	
394	0.39						X					D	D	D			C	C	J	P	
474	0.47						X					D	D	D			J	J	J	P	
564	0.56						X					D	D	D			J	J	J	P	
684	0.68						X					D	D	D			J	J	J	P	
824	0.82						X					D	D	D			J	J	J	P	
105	1 µF						X					D	D	D			J	J	J	P	
155	1.5																J				
225	2.2																J				
335	3.3																				
475	4.7																				
685	6.8																				
106	10 µF																				

Letters indicate product thickness, see packaging quantities
* Items are made by NME (Nobel Metal Electrode)
+ Not in 5 % (Code “J ”) tolerance

PACKAGING QUANTITIES					
THICKNESS CLASSIFICATION (mm)		AMOUNT PER REEL			
		Δ180 mm; 7 inch			
		0402	0603	0805	1206
N =	0.50 ± 0.05	Paper 10 Kp/Reel	-	-	-
S =	0.8 ± 0.07	-	Paper 4 Kp/Reel	-	-
X =	0.8 + 0.15/- 0.10	-	Paper 4 Kp/Reel	-	-
A =	0.6 ± 0.1	-	-	Paper 4 Kp/Reel	-
B =	0.8 ± 0.1	-	-	Paper 4 Kp/Reel	Paper 4 Kp/Reel
C =	0.95 ± 0.1	-	-	-	Plastic 3 Kp/Reel
D =	1.25 ± 0.1	-	-	Plastic 3 Kp/Reel	Plastic 3 Kp/Reel
J =	1.15 ± 0.15	-	-	-	Plastic 3 Kp/Reel
I =	1.25 ± 0.2	-	-	Plastic 3 Kp/Reel	-
P =	1.60 + 0.30/- 0.10	-	-	-	Plastic 2 Kp/Reel
G =	1.60 ± 0.2	-	-	-	Plastic 2 Kp/Reel

PACKAGING QUANTITIES					
THICKNESS CLASSIFICATION (mm)		AMOUNT PER REEL			
		Δ330 mm; 13 inch			
		0402	0603	0805	1206
N =	0.50 ± 0.05	Paper 50 Kp/Reel	-	-	-
S =	0.8 ± 0.07	-	Paper 15 Kp/Reel	-	-
X =	0.8 + 0.15/- 0.10	-	Paper 15 Kp/Reel	-	-
A =	0.6 ± 0.1	-	-	Paper 15 Kp/Reel	-
B =	0.8 ± 0.1	-	-	Paper 15 Kp/Reel	Paper 15 Kp/Reel
C =	0.95 ± 0.1	-	-	-	Plastic 10 Kp/Reel
D =	1.25 ± 0.1	-	-	Plastic 10 Kp/Reel	Plastic 10 Kp/Reel
J =	1.15 ± 0.15	-	-	-	Plastic 10 Kp/Reel
I =	1.25 ± 0.2	-	-	Plastic 10 Kp/Reel	-
P =	1.60 + 0.30/- 0.10	-	-	-	-
G =	1.60 ± 0.2	-	-	-	-

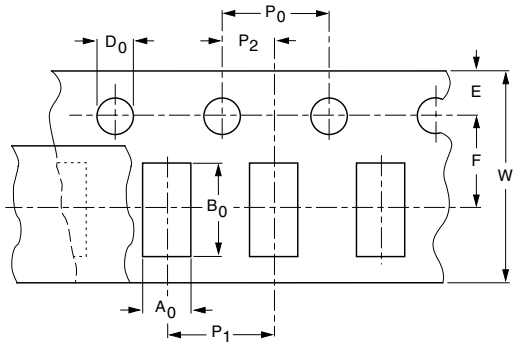
COVER TAPE (POLYESTER - ANTISTATIC)

PROPERTIES OF COVER TAPE	
PARAMETER	WIDTH
	5.5 ± 0.1 mm
Breaking force	≥ 10.7 N
Elongation at break	≥ 63 %
Surface resistance	< 10^{10} Ω /sq.
Softening point	71 ± 5 °C
Thickness	62 µm

CARRIER TAPE (POLYCARBONATE)

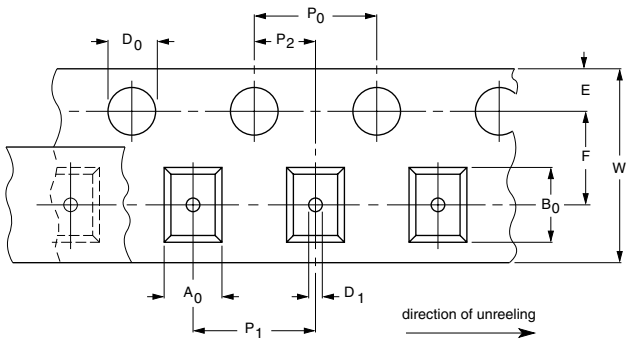
PROPERTIES OF CARRIER TAPE	
PARAMETER	WIDTH
	8.1 ± 0.2 mm
Thickness	190 to 280 µm
Tensile strength at break	> 60 N/mm^2
Elongation at break	100 to 150 %
Surface resistance	> 10^{12} Ω /sq.

PAPER TAPE SPECIFICATIONS



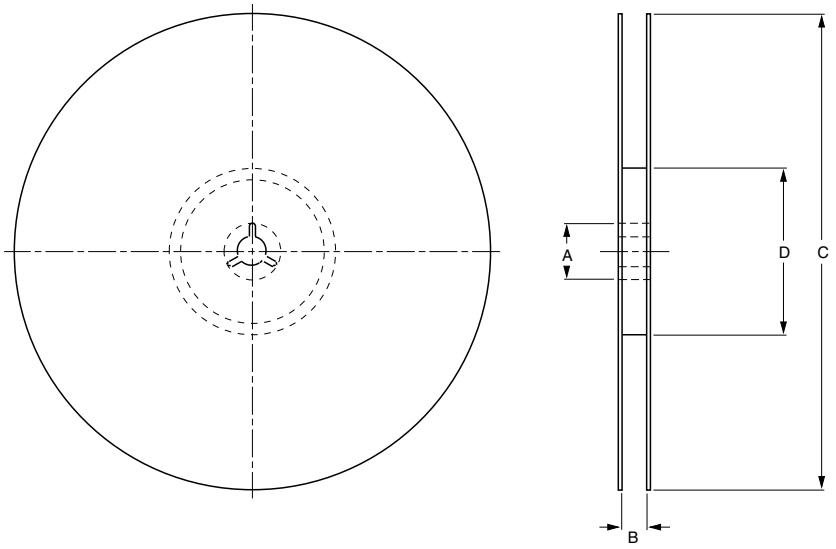
DIMENSIONS OF PAPER TAPE in millimeters								
SYMBOL	PRODUCT SIZE CODE							
	0402		0603		0805		1206	
	SIZE	TOL.	SIZE	TOL.	SIZE	TOL.	SIZE	TOL.
A_0	0.62	± 0.05	1.02	± 0.05	1.50	± 0.10	2.00	± 0.10
B_0	1.12	± 0.05	1.82	± 0.05	2.30	± 0.10	3.50	± 0.10
W	8.00	± 0.10	8.00	± 0.10	8.00	± 0.10	8.00	± 0.10
E	1.75	± 0.05	1.75	± 0.05	1.75	± 0.05	1.75	± 0.10
F	3.50	± 0.05	3.50	± 0.05	3.50	± 0.05	3.50	± 0.05
D_0	1.55	± 0.05	1.55	± 0.05	1.55	± 0.05	1.50	± 0.05
P_0	4.00	± 0.10	4.00	± 0.10	4.00	± 0.10	4.00	± 0.10
P_1	2.00	± 0.05	4.00	± 0.10	4.00	± 0.10	4.00	± 0.10
P_2	2.00	± 0.05	2.00	± 0.05	2.00	± 0.05	2.00	± 0.05

BLISTER TAPE SPECIFICATIONS



DIMENSIONS OF BLISTER TAPE in millimeters			
DIMENSION	PRODUCT		TOLERANCE
	0805	1206	
A_0	< 1.57	< 2.00	-
B_0	< 2.45	< 3.60	-
W	8.00	8.00	± 0.10
E	1.75	1.75	± 0.10
F	3.50	3.50	± 0.05
D_0	1.50	1.50	± 0.05
D_1	1.00	1.00	± 0.10
P_0	4.00	4.00	± 0.10
P_1	4.00	4.00	± 0.10
P_2	2.00	2.00	± 0.05

REEL SPECIFICATIONS



REEL DIMENSIONS AND TAPE WIDTH in millimeters		
	∅ 180 mm; 7 inch	∅ 330 mm; 13 inch
A	13.0 ± 1.0	13.0 ± 0.5
B	9.0 ± 1.0	9.0 ± 1.0
C	178.0 ± 1.0	330.0 ± 1.0
D	60.5 ± 1.0	100.0 ± 1.0

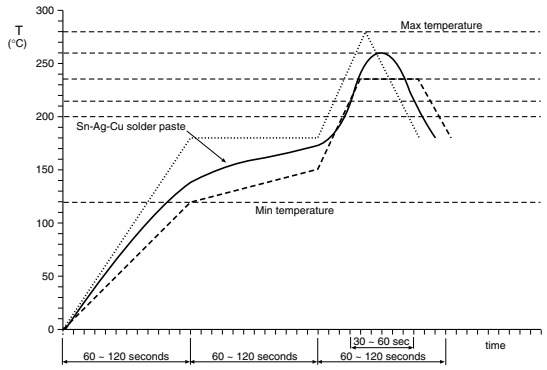
METHOD OF MOUNTING AND DIMENSIONS OF SOLDER LANDS

For normal use the capacitors may be mounted on printed-circuit boards or ceramic substrates by applying wave soldering and reflow soldering.

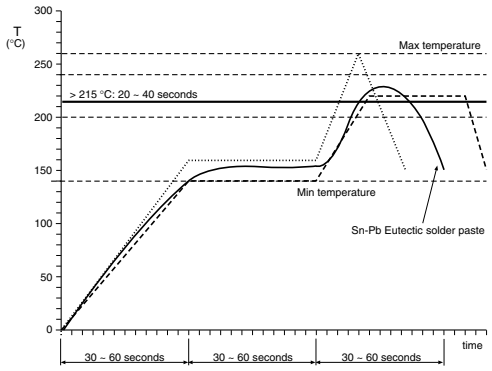
An improper combination of soldering, substrate and chip size can lead to a damaging of the component. The risk increases with the chip size and with temperature fluctuations (> 100 °C) Therefore, it is advised to use the smallest possible size and follow the dimensional recommendations given.

SOLDERING GRAPHS

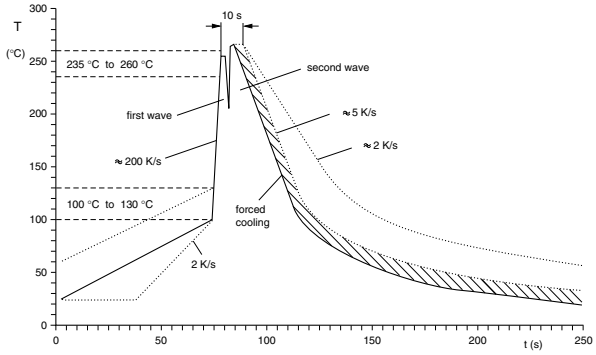
IR REFLOW WITH SnAgCu SOLDERING



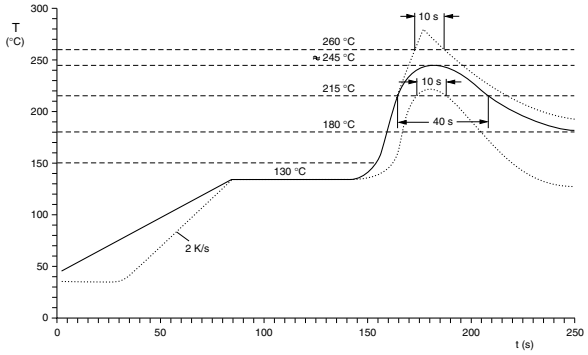
IR REFLOW WITH SnPb SOLDER



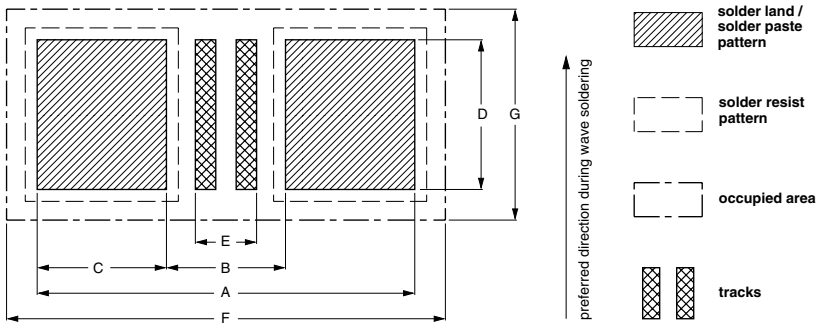
WAVE SOLDERING



REFLOW SOLDERING



RECOMMENDED DIMENSIONS OF SOLDER LANDS in millimeters



REFLOW SOLDERING

SIZE CODE	FOOTPRINT DIMENSIONS in mm							PROCESSING REMARKS	PLACEMENT ACCURACY
	A	B	C	D	E	F	G		
0402	1.50	0.50	0.50	0.50	0.10	1.75	0.95	IR or hot plate soldering	± 0.15
0603	2.30	0.70	0.80	0.80	0.20	2.55	1.40		± 0.25
0805	2.80	1.00	0.90	1.30	0.40	3.08	1.85		± 0.25
1206	4.00	2.20	0.90	1.60	1.60	4.25	2.25		± 0.25

WAVE SOLDERING

SIZE CODE	FOOTPRINT DIMENSIONS in mm							PROPOSED NUMBER AND DIMENSIONS OF DUMMY TRACKS (mm)	PLACEMENT ACCURACY (mm)
	A	B	C	D	E	F	G		
0603	2.40	1.00	0.70	0.80	0.20	3.10	1.90	1 x (0.2 x 0.8)	± 0.10
0805	3.20	1.40	0.90	1.30	0.36	4.10	2.50	1 x (0.3 x 1.3)	± 0.15
1206	4.80	2.30	1.25	1.70	1.25	5.90	3.20	3 x (0.25 x 1.7)	± 0.25

TEST CONDITIONS IN STATIC SOLDER BATH

PARAMETER	DESCRIPTION
SOLDERABILITY	
95 % covered with smooth and bright solder coating	CECC requirement: 235 ± 5 °C for 2 ± 0.5 seconds
	IEC requirement: 215 ± 3 °C for 3 ± 0.3 seconds
RESISTANCE TO LEACHING	
10 % of the metallization of the edges of the head face may be missing (inner electrodes are not visible)	260 ± 5 °C for 30 ± 1 second

TEST PROCEDURES AND REQUIREMENTS

TEST	PROCEDURE	REQUIREMENTS			
1) Visual and mechanical		• No remarkable defect • Dimensions should confirm to individual specification sheet			
2) Capacitance	Class I: NP0 Cap ≤ 1000 pF; 1.0 ± 0.2 V_{rms}; 1 MHz ± 10 % Cap > 1000 pF; 1.0 ± 0.2 V_{rms}; 1 kHz ± 10 % Class II: X7R, X5R, Y5V Cap ≤ 10 µF; 1.0 ± 0.2 V_{rms}; 1 kHz ± 10 % Cap > 10 µF; 0.5 ± 0.2 V_{rms}; 120 Hz ± 20 %	• Shall not exceed the limits given in the detailed specification			
3) Q/D.F (Dissipation Factor)		NP0: Cap ≥ 30 pF: Q ≥ 1000 Cap < 30 pF: Q ≥ 400 + 20C			
		X7R, X5R:			
		Rated Vol.	D.F.	Exception of D.F.	
		≥ 50 V	≤ 2.5 %	≤ 3 %	0603 ≥ 0.047 µF, 0805 ≥ 0.18 µF, 1206 ≥ 0.47 µF
		25 V	≤ 3.5 %	≤ 5 %	0805 ≥ 1 µF, 1210 ≥ 10 µF
				≤ 7%	0603 ≥ 0.33 µF
		16 V	≤ 3.5 %	≤ 5 %	0201 ≥ 0.0047 µF, 0402 ≥ 0.033 µF, 0603 ≥ 0.15 µF, 0805 ≥ 0.68 µF, 1206 ≥ 2.2 µF
		10 V	≤ 5.0 %	–	–
		6.3 V	≤ 10 %	≤ 15 %	0805 ≥ 10 µF
		Y5V:			
		Rated Vol.	D.F.	Exception of D.F.	
		≥ 50 V	≤ 5.0 %	–	–
		25 V	≤ 5.0 %	≤ 7 %	0603 ≥ 0.1 µF, 0805 ≥ 0.33 µF, 1206 ≥ 1 µF
				≤ 9 %	0402 ≥ 0.068 µF
		16 V (C < 1 µF)	≤ 7.0 %	≤ 9 %	0402 ≥ 0.068 µF
		16 V (C ≥ 1 µF)	≤ 9.0 %	–	–
		≤ 10 V	≤ 12.5	–	–
		≤ 6.3 V	≤ 20 %	–	–

TEST PROCEDURES AND REQUIREMENTS

TEST	PROCEDURE		REQUIREMENTS	
4) Dielectric strength	• To apply voltage (≤ 50 V) 250 % • Duration: 1 to 5 seconds • Charge and discharge current less than 50 mA		• No evidence of damage or flash-over during test	
	• To apply voltage: 100 V ≥ 3 times V DC 200 V ~ 300 V ≥ 2 times V DC 500 V ~ 999 V ≥ 1.5 times V DC 1000 V ~ 3000 V ≥ 1.2 times V DC • Cut-off, set at 10 mA • TEST = 15 seconds • RAMP = 0			
5) Insulation resistance	To apply rated voltage for max. 120 seconds		≥ 10 GΩ or R x C ≥ 500 Ω F whichever is smaller	
	Rated voltage: 100 ~ 500 V	To apply rated voltage for 60 seconds	≥ 10 GΩ	
	Rated voltage: > 500 V	To apply 500 V for 60 seconds	≥ 10 GΩ	
6) Temperature coefficient	With no electrical load:			
	T.C.	Operating Temp	T.C.	Capacitance Change
	NP0 (C0G)	- 55 ~ 125 °C at 25 °C	NP0 (C0G)	Within ± 30 ppm/°C
	NP0 (C0J)	- 55 ~ 125 °C at 25 °C	NP0 (C0J)	Within ± 120 ppm/°C
	X7R	- 55 ~ 125 °C at 25 °C	X7R	Within ± 15 %
	X5R	- 55 ~ 85 °C at 25 °C	X5R	Within ± 15 %
	Y5V	- 25 ~ 85 °C at 20 °C	Y5V	Within + 30 %/- 80 %
7) Adhesive strength of termination	• Pressurizing force: 0201: 2N 0402 and 0603: 5 N > 0603: 10 N • Test time 10 ± 1 second		• No remarkable damage or removal of the terminations	
8) Vibration resistance	• Vibration frequency: 10 to 55 Hz/minute • Total amplitude: 1.5 mm • Test time: 6 hours (2 hours each in 3 mutually perpendicular directions)		• No remarkable damage • Capacitance change and Q/D.F.: To meet initial specification	
9) Solderability	• Solder temperature: 235 ± 5 °C • Dipping time: 2 ± 0.5 seconds		95 % minimum coverage of all metallized area	
10) Bending test	• The middle part of the substrate shall be pressurized by means of the pressurizing rod at a rate of about 1 mm per second until the deflection becomes 1 mm and then the pressure shall be maintained for 5 ± 1 seconds • Measurement to be made after keeping at room temperature for 24 ± 2 hours		• No remarkable damage • Capacitance change: NP0: within ± 5.0 % or ± 0.5 pF whichever is larger X7R, X5R: within ± 12.5 % Y5V: within ± 30 % (This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test)	
11) Resistance to soldering heat	• Solder temperature: 270 ± 5 °C • Dipping time: 10 ± 1 second • 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 hour and then set for 48 ± 4 hours at room temperature • Measurement to be made after keeping at room temperature for 24 ± 2 hours (Class I) or 48 ± 4 hours (Class II)		• No remarkable damage • Capacitance change: NP0: within ± 2.5 % or ± 0.25 pF whichever is larger X7R, X5R: within ± 7.5 % Y5V: within ± 20 % • Q/D.F., I.R. and dielectric strength: To meet initial requirements • 25 % maximum leaching on each edge	

TEST PROCEDURES AND REQUIREMENTS

<table>
<tr><th>TEST</th><th>PROCEDURE</th><th>REQUIREMENTS</th></tr>
<tr><td>12) Temperature cycle</td><td>• Conduct the 5 cycles according to the temperatures and time.
<table><tr><th>Step</th><th>Temperature (°C)</th><th>Time</th></tr><tr><td>1</td><td>Min. operating temp. + 0/- 3</td><td>30 ± 3</td></tr><tr><td>2</td><td>Room temperature</td><td>2 ~ 3</td></tr><tr><td>3</td><td>Min. operating temp. + 3/- 0</td><td>30 ± 3</td></tr><tr><td>4</td><td>Room temperature</td><td>2 ~ 3</td></tr></table>• Before initial measurement (Class II only): Perform 150 + 0/- 10 °C for 1 hour and then set for 48 ± 4 hrs at room temperature
• Measurement to be made after keeping at room temperature for 24 ± 2 hours (Class I) or 48 ± 4 hours (Class II)</td><td>• No remarkable damage
• Capacitance change
NP0: within ± 2.5 % or ± 0.25 pF whichever is larger
X7R, X5R: within ± 7.5 %
Y5V: within ± 20 %
• Q/D.F., I.R. and dielectric strength: To meet initial requirements</td></tr>
<tr><td>13) Humidity (steady state)</td><td>• Test temperature: 40 ± 2 °C
• Humidity: 90 ~ 95 % RH
• Test time: 500 + 24/- 0 hours
• Measurement to be made after keeping at room temperature for 24 ± 2 hours (Class I) or 48 ± 4 hours (Class II)</td><td>• No remarkable damage
• Capacitance change:
NP0: within ± 5.0 % or ± 0.5 pF whichever is larger
X7R, X5R: ≥ 10 V, within ± 12.5 %
6.3 V, within ± 25 %
Y5V: within ± 30 %
• Q/D.F. value: NP0: Cap ≥ 30 pF: Q ≥ 350
10 pF ≤ Cap < 30 pF: Q ≥ 275 + 2.5C
Cap < 10 pF: Q ≥ 200 + 10C
X7R, X5R:
<table><tr><th>Rated Vol.</th><th>D.F.</th><th colspan="2">Exception of D.F.</th></tr><tr><td>≥ 50 V</td><td>≤ 3.0 %</td><td>≤ 6 %</td><td>0603 ≥ 0.047 µF, 0805 ≥ 0.18 µF, 1206 ≥ 0.47 µF</td></tr><tr><td rowspan="2">25 V</td><td rowspan="2">≤ 5.0 %</td><td>≤ 10 %</td><td>0805 ≥ 1 µF, 1210 ≥ 10 µF</td></tr><tr><td>≤ 14 %</td><td>0603 ≥ 0.33 µF</td></tr><tr><td>16 V</td><td>≤ 5.0 %</td><td>≤ 10 %</td><td>0402 ≥ 0.033 µF, 0603 ≥ 0.15 µF, 0805 ≥ 0.68 µF, 1206 ≥ 2.2 µF</td></tr><tr><td>10 V</td><td>≤ 7.5 %</td><td>≤ 15 %</td><td>0402 ≥ 0.056 µF, 0603 ≥ 0.33 µF, 0805 ≥ 2.2 µF, 1206 ≥ 2.2 µF</td></tr><tr><td>6.3 V</td><td>≤ 15 %</td><td>≤ 30 %</td><td>0805 ≥ 10 µF</td></tr></table>Y5V:
<table><tr><th>Rated Vol.</th><th>D.F.</th><th colspan="2">Exception of D.F.</th></tr><tr><td>≥ 50 V</td><td>≤ 7.5 %</td><td>–</td><td>–</td></tr><tr><td rowspan="2">25 V</td><td rowspan="2">≤ 7.5 %</td><td>≤ 10 %</td><td>0603 ≥ 0.1 µF, 0805 ≥ 0.33 µF, 1206 ≥ 1 µF</td></tr><tr><td>≤ 12.5</td><td>0402 ≥ 0.068 µF</td></tr><tr><td>16 V (C < 1 µF)</td><td>≤ 10 %</td><td>≤ 12.5</td><td>0402 ≥ 0.068 µF</td></tr><tr><td>16 V (C ≥ 1 µF)</td><td>≤ 12.5</td><td>–</td><td>–</td></tr><tr><td>10 V</td><td>≤ 15 %</td><td>–</td><td>–</td></tr><tr><td>≤ 6.3 V</td><td>≤ 30 %</td><td>–</td><td>–</td></tr></table>• I.R.: ≥ 1 GΩ or R x C ≥ 50 ΩF whichever is smaller</td></tr>
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TEST PROCEDURES AND REQUIREMENTS

<table>
<tr><th>TEST</th><th>PROCEDURE</th><th>REQUIREMENTS</th></tr>
<tr><td>14) Humidity load
(damp heat)</td><td>• Test temperature: 40 ± 2 °C
• Humidity: 90 ~ 95 % RH
• Test time: 500 + 24/- 0 hours
• To apply voltage: rated voltage (Max 500V)
• Measurement to be made after keeping at room temperature for 24 ± 2 hours (Class I) or 48 ± 4 hours (Class II)</td><td>• No remarkable damage
• Capacitance change:
NP0: within ± 7.5 % or ± 0.75 pF whichever is larger
X7R, X5R: ≥ 10 V, within ± 12.5 %
6.3 V, with ± 25 %
Y5V: ≥ 10 V, within ± 30 %
6.3 V, within + 30 to - 40 %
• Q/D.F. value: NP0: Cap ≥ 30 pF: Q ≥ 200
Cap < 30 pF: Q ≥ 100 + 10/3C
X7R, X5R:
<table>
<tr><th>Rated Vol.</th><th>D.F.</th><th colspan="2">Exception of D.F.</th></tr>
<tr><td>≥ 50 V</td><td>≤ 3.0 %</td><td>≤ 6 %</td><td>0603 ≥ 0.047 µF, 0805 ≥ 0.18 µF,
1206 ≥ 0.47 µF</td></tr>
<tr><td rowspan="2">25 V</td><td rowspan="2">≤ 5.0 %</td><td>≤ 10 %</td><td>0805 ≥ 1 µF, 1210 ≥ 10 µF</td></tr>
<tr><td>≤ 14 %</td><td>0603 ≥ 0.33 µF</td></tr>
<tr><td>16 V</td><td>≤ 5.0 %</td><td>≤ 10 %</td><td>0402 ≥ 0.033 µF, 0603 ≥ 0.15 µF,
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<tr><td>10 V</td><td>≤ 7.5 %</td><td>≤ 15 %</td><td>0402 ≥ 0.056 µF, 0603 ≥ 0.33 µF,
0805 ≥ 2.2 µF, 1206 ≥ 2.2 µF</td></tr>
<tr><td>6.3 V</td><td>≤ 15 %</td><td>≤ 30 %</td><td>0805 ≥ 10 µF</td></tr>
<tr><td colspan="4">Y5V:</td></tr>
<tr><td>Rated Vol.</td><td>D.F.</td><td colspan="2">Exception of D.F.</td></tr>
<tr><td>≥ 50 V</td><td>≤ 7.5 %</td><td>–</td><td>–</td></tr>
<tr><td rowspan="2">25 V</td><td rowspan="2">≤ 7.5 %</td><td>10 %</td><td>0603 ≥ 0.1 µF, 0805 ≥ 0.33 µF,
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<tr><td>12.5 %</td><td>0402 ≥ 0.068 µF</td></tr>
<tr><td>16 V (C < 1 µF)</td><td>≤ 10 %</td><td>–</td><td>–</td></tr>
<tr><td>16 V (C ≥ 1 µF)</td><td>≤ 12.5</td><td>–</td><td>–</td></tr>
<tr><td>10 V</td><td>≤ 15 %</td><td>–</td><td>–</td></tr>
<tr><td>6.3 V</td><td>≤ 30 %</td><td>–</td><td>–</td></tr>
<tr><td colspan="4">• I.R.: ≥ 500 MΩ or R x C ≥ 25 ΩF whichever is smaller</td></tr>
</table></td></tr>
<tr><td>15) High temperature
load (endurance)</td><td>• Test temperature:
NP0, X7R: 125 ± 3 °C
X5R, Y5V: 85 ± 3 °C
• To apply voltage:
(1) 6.3 V or C ≥ 10 µF (for X7R, X5R):
150 % of rated voltage
(2) 6.3 V < V < 500 V and C < 10 µF
(for X7R, X5R):
200 % of rated voltage
(3) 500 V:
150 % of rated voltage.
(4) V ≥ 630 V:
120 % of rated voltage. (Max. 3600 V)
• Test time: 1000 + 24/- 0 hours
• Measurement to be made after keeping at room temperature for 24 ± 2 hours (Class I) or 48 ± 4 hours (Class II).</td><td>• No remarkable damage
• Capacitance change:
NP0: within ± 3.0 % or ± 0.3 pF whichever is larger
X7R, X5R: ≥ 10 V, within ± 12.5 %
6.3 V, with ± 25 %
Y5V: ≥ 10 V, within ± 30 %
6.3 V, within + 30 to - 40 %
• Q/D.F. value: NP0: Cap ≥ 30 pF: Q ≥ 350
10 pF ≤ Cap < 30 pF: Q ≥ 275 + 2.5C
Cap < 10 pF: Q ≥ 200 + 10C
X7R, X5R:
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