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EYANG TECHNOLOGY DEVELOPMENT CO.,LTD

Industrial Grade Medium-High voltage Multilayer Ceramic Chip Capacitors Model selection reference book

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Mark：The Model selection reference book is for design reference only.

Industrial Grade Medium-High voltage Multilayer Ceramic Chip Capacitors

1. Scope

This specification is applicable to theIndustrial Grade Medium-High voltage Multilayer Ceramic Chip Capacitors (MLCC) .

1.1 Temperature Characteristics:

Class1 (Temperature Compensating Type): C0G

Class2 (High dielectric constant type): X7R\X7S\X6S\X5R

1.2 Size Code: 0201\0402\0603\0805\1206\1210\2220

1.3 Capacitance : 0.1pF~4.7μF

2. Part Number System

B	0402	C0G	330	J	101	N	T	B
① Series Code	② Size Code	③Temperature Characteristics	④Nominal Capacitance	⑤Capacitance Tolerance	⑥Rated Voltage	⑦Termination Type	⑧Packaging Code	⑨Thickness Code

① Series Code B - Industrial Grade Multilayer Ceramic Chip Capacitors

② Size Code (Unit:mm)

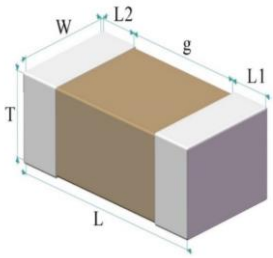


Fig.1 Structure & Dimension

Size Code	L	W	L1,L2	g	T	Thickness Code
0201	0.60±0.03	0.30±0.03	0.10～0.20	0.20min.	0.30±0.03	A
0402	1.00±0.05	0.50±0.05	0.15～0.35	0.30min.	0.50±0.05	B
0603	1.60±0.10	0.80±0.10	0.20～0.50	0.50min.	0.80±0.10	D
0603	1.60+0.20/-0.1	0.80+0.20/-0.1	0.20～0.50	0.50min.	0.80+0.20/-0.10	K
0805	2.00±0.10	1.25±0.10	0.20～0.70	0.70min.	0.60±0.10	C
0805	2.00±0.20	1.25±0.20	0.20～0.70	0.70min.	0.85±0.15	K
0805	2.00±0.20	1.25±0.20	0.20～0.70	0.70min.	0.85+0.15/-0.35	Y
0805	2.00±0.10	1.25±0.10	0.20～0.70	0.70min.	1.25±0.10	G
0805	2.00±0.20	1.25±0.20	0.20～0.70	0.70min.	1.25±0.20	H
1206	3.20±0.15	1.60±0.15	0.30~0.80	1.50 min.	0.85±0.10	E
1206	3.20±0.20	1.60±0.20	0.30~0.80	1.50 min.	1.15±0.15	O
1206	3.20±0.20	1.60±0.20	0.30~0.80	1.50 min.	1.60±0.20	L
1210	3.20±0.20	2.50±0.20	0.30~0.90	1.50 min.	2.00±0.20	Q
1210	3.20±0.30	2.50±0.20	0.30~0.90	1.50 min.	2.50±0.20	R
1210	3.20±0.40	2.50±0.30	0.30~0.90	1.50 min.	2.50±0.30	3
2220	5.70±0.40	5.00±0.40	0.30min.	2.0 min.	2.50±0.20	R

③ Temperature Characteristics

Temperature Characteristics	Operating Temp. Range	Temperature Characteristics		
		Temp. coeff. or Cap. Change	Temp. Range	Ref. Temp.
C0G	~55℃~ 125℃	0±30ppm/℃	25℃~125℃	25℃
X7R	-55℃~125℃	±15%	-55℃~125℃	25℃
X7S	-55℃~125℃	±22%	-55℃~125℃	25℃
X6S	-55℃~105℃	±22%	-55℃~105℃	25℃
X5R	-55℃~85℃	±15%	-55℃~85℃	25℃

④ Nominal Capacitance (Unit: pF) 1pF=10^{-3}nF =10^{-6}μF

Example :R47=0.47 pF ,2R2=2.2 pF ,120=12×10^{0}=12pF, 104=10×10^{4}=100000 pF=100 nF

Class1(C0G)Capacitance Step in E24 series. Capacitance: See Table3-1

Class2(X7R\X7S\X6S\X5R)Capacitance Step in E12 series.Capacitance: See Table3-2

⑤ Capacitance Tolerance

Code	Capacitance Tolerance	Code	Capacitance Tolerance
P	±0.02pF	K	±10%
A	±0.05pF	L	±15%
B	±0.1pF	M	±20%
C	±0.25pF	N	±30%
D	±0.5pF	X	±40%
F	±1%	S	+50%/-20%
G	±2%	Z	+80%/-20%
J	±5%	Y	+150%/-20%

⑥ Rated Voltage

Code	Voltage Values	Code	Voltage Values
101	100V	501	500V
201	200V	631	630V
251	250V	102	1000V
451	450V	202	2000V

⑦ Termination Type

Code	Terminal Electrodes	Plating Material
N	Cu	Ni/Sn
P	Cu+AgPd or Cu+AgPdCu	-
C	Cu	Cu
K	Cu	Ni/Au
R	Cu/Ag (Resin)	Ni/Sn

⑧ Packaging Code See Table 4.

⑨ Thickness Code See ② Size Code

Table 3-1 Capacitance Table (Class1-C0G)

NO.	Series Code	Temperature Characteristics	Size Code	Rated Voltage	Thickness code	Capacitance
1	B	C0G	0201	100V	A	0.1pF~100pF
2	B	C0G	0402	200V	B	0.1pF~100pF
3	B	C0G	0402	100V	B	0.1pF~1.0nF
4	B	C0G	0603	250V	D	10pF~2.2nF
5	B	C0G	0603	200V	D	10pF~2.2nF
6	B	C0G	0603	100V	D	10pF~10nF
7	B	C0G	0805	630V	K	10pF~560pF
8	B	C0G	0805	630V	H	680pF~2.2nF
9	B	C0G	0805	630V	G	680pF~2.2nF
10	B	C0G	0805	500V	K	10pF~560pF
11	B	C0G	0805	500V	H	680pF~2.2nF
12	B	C0G	0805	500V	G	680pF~2.2nF
13	B	C0G	0805	250V	K	10pF~3.9nF
14	B	C0G	0805	250V	H	4.7nF~10nF
15	B	C0G	0805	250V	G	4.7nF~10nF
16	B	C0G	0805	200V	K	10pF~3.9nF
17	B	C0G	0805	200V	H	4.7nF~10nF
18	B	C0G	0805	200V	G	4.7nF~10nF
19	B	C0G	0805	100V	C	10pF~3.9nF
20	B	C0G	0805	100V	K	4.7nF~15nF
21	B	C0G	0805	100V	G	18nF~33nF
22	B	C0G	1206	2000V	O	10pF~100pF
23	B	C0G	1206	2000V	L	120pF~220pF
24	B	C0G	1206	1000V	E	10pF~470pF
25	B	C0G	1206	1000V	O	10pF~750pF
26	B	C0G	1206	1000V	L	820pF~1nF
27	B	C0G	1206	630V	E	10pF~1.8nF
28	B	C0G	1206	630V	O	2.2nF~3.3nF
29	B	C0G	1206	630V	L	3.6nF~10nF
30	B	C0G	1206	500V	O	2.2nF~3.3nF
31	B	C0G	1206	250V	O	6.8nF~12nF
32	B	C0G	1206	250V	L	15nF~22nF
33	B	C0G	1206	200V	O	6.8nF~12nF
34	B	C0G	1206	200V	L	15nF~22nF
35	B	C0G	1206	100V	E	10pF~39nF
36	B	C0G	1206	100V	O	47nF
37	B	C0G	1206	100V	L	56nF~100nF
38	B	C0G	1210	1000V	Q	1nF~8.2nF
39	B	C0G	1210	1000V	R	10nF~22nF
40	B	C0G	1210	630V	Q	6.8nF~18nF
41	B	C0G	1210	630V	R	22nF~27nF
42	B	C0G	1210	630V	3	33nF
43	B	C0G	2220	450V	R	100nF

Table 3-2 Capacitance Table (Class 2-X7R\X7T\X7S\X6S\X5R)

NO.	Series Code	Temperature Characteristics	Size Code	Rated Voltage	Thickness code	Capacitance
1	B	X7R	0402	100V	B	120pF~10nF
2	B	X7R	0603	100V	D	220pF~100nF
3	B	X7R	0603	100V	K	47nF~100nF
4	B	X7R	0603	250V	D	220pF~2.2nF
5	B	X7R	0603	200V	D	220pF~2.2nF
6	B	X7R	0805	630V	Y	100pF~3.9nF
7	B	X7R	0805	630V	H	4.7nF~10nF
8	B	X7R	0805	500V	Y	100pF~6.8nF
9	B	X7R	0805	500V	H	10nF~22nF
10	B	X7R	0805	250V	Y	1nF~22nF
11	B	X7R	0805	250V	H	10nF~22nF
12	B	X7R	0805	200V	Y	1nF~22nF
13	B	X7R	0805	200V	H	10nF~22nF
14	B	X7R	0805	100V	Y	220pF~330nF
15	B	X7R	0805	100V	H	1nF~470nF
16	B	X7R	1206	2000V	O	150pF~2.2nF
17	B	X7R	1206	1000V	O	150pF~10nF
18	B	X7R	1206	1000V	L	5.6nF~10nF
19	B	X7R	1206	630V	O	1nF~10nF
20	B	X7R	1206	630V	L	15nF ~22nF
21	B	X7R	1206	500V	O	15nF~22nF
22	B	X7R	1206	500V	L	33nF~47nF
23	B	X7R	1206	250V	O	15nF~68nF
24	B	X7R	1206	250V	L	33nF~220nF
25	B	X7R	1206	200V	O	15nF~68nF
26	B	X7R	1206	200V	L	33nF~220nF
27	B	X7R	1206	100V	O	220pF~220nF
28	B	X7R	1206	100V	L	330nF~470nF
29	B	X7R	1206	100V	L	1.0μF
30	B	X7R	1210	100V	R	1.0μF
31	B	X7R	1210	100V	R	2.2μF
32	B	X7S	1210	100V	Q	4.7μF
33	B	X6S	0603	100V	D	100nF
34	B	X5R	0402	100V	B	120pF~4.7nF
35	B	X5R	0603	250V	D	220pF~2.2nF
36	B	X5R	0603	200V	D	220pF~2.2nF
37	B	X5R	0603	100V	D	220pF~100nF
38	B	X5R	0603	100V	K	100nF
39	B	X5R	0805	630V	Y	100pF~3.9nF
40	B	X5R	0805	630V	H	4.7nF~10nF

Table 3-2 Capacitance Table (Class 2-X7R\X7T\X7S\X6S\X5R)

NO.	Series Code	Temperature Characteristics	Size Code	Rated Voltage	Thickness code	Capacitance
41	B	X5R	0805	500V	Y	100pF~6.8nF
42	B	X5R	0805	500V	H	10nF~22nF
43	B	X5R	0805	250V	Y	1nF~6.8nF
44	B	X5R	0805	250V	H	10nF~22nF
45	B	X5R	0805	200V	Y	1nF~6.8nF
46	B	X5R	0805	200V	H	10nF~22nF
47	B	X5R	0805	100V	Y	220pF~330nF
48	B	X5R	0805	100V	H	1nF~470nF
49	B	X5R	1206	2000V	O	150pF~2.2nF
50	B	X5R	1206	1000V	O	150pF~4.7nF
51	B	X5R	1206	1000V	L	5.6nF~10nF
52	B	X5R	1206	630V	O	1nF~10nF
53	B	X5R	1206	630V	L	15nF ~22nF
54	B	X5R	1206	500V	O	15nF~22nF
55	B	X5R	1206	500V	L	33nF~47nF
56	B	X5R	1206	250V	O	15nF~68nF
57	B	X5R	1206	250V	L	33nF~220nF
58	B	X5R	1206	200V	O	15nF~68nF
59	B	X5R	1206	200V	L	33nF~220nF
60	B	X5R	1206	100V	O	220pF~220nF
61	B	X5R	1206	100V	L	330nF~470nF

Table 4 Packaging (Minimum Quantity)

NO.	Size Code	Thickness Code	Square hole spacing	Disc Size	Carrier Tape Type	QTY (Kpcs)	Packaging Code
1	0201	A	2mm	7〃	Paper	15	T
2	0201	A	2mm	13〃	Paper	50	J
3	0201	A	1mm	13〃	Paper	100	D
4	0201	A	2mm	7〃	Paper	10	H
5	0201	A	1mm	7〃	Paper	30	L
6	0402	B	2mm	7〃	Paper	10	T
7	0402	B	2mm	13〃	Paper	50	J
8	0603	D	4mm	7〃	Paper	4	T
9	0603	D	4mm	13〃	Paper	15	A
10	0603	D	4mm	13〃	Plastic	10	O
11	0603	D	4mm	7〃	Paper	3	W
12	0603	K	4mm	7〃	Paper	4	T
13	0603	K	4mm	13〃	Paper	15	A
14	0603	K	4mm	13〃	Plastic	10	O
15	0603	K	4mm	7〃	Paper	3	W
16	0603	K	4mm	7〃	Plastic	4	Q
17	0603	K	4mm	7〃	Plastic	3	R
18	0805	C	4mm	7〃	Paper	4	T
19	0805	C	4mm	7〃	Plastic	3	R
20	0805	K	4mm	7〃	Paper	4	T
21	0805	K	4mm	7〃	Plastic	3	R
22	0805	K	4mm	13〃	Plastic	15	E
23	0805	Y	4mm	7〃	Paper	4	T
24	0805	Y	4mm	13〃	Plastic	15	E
25	0805	Y	4mm	7〃	Plastic	2	P
26	0805	Y	4mm	7〃	Plastic	3	R
27	0805	G	4mm	7〃	Plastic	3	R
28	0805	G	4mm	7〃	Plastic	2	P
29	0805	G	4mm	13〃	Plastic	10	O
30	0805	H	4mm	7〃	Plastic	3	R
31	0805	H	4mm	7〃	Plastic	2	P
32	0805	H	4mm	13〃	Plastic	10	O
33	1206	E	4mm	7〃	Plastic	3	R
34	1206	E	4mm	7〃	Plastic	2	P
35	1206	O	4mm	7〃	Plastic	3	R
36	1206	O	4mm	7〃	Plastic	2	P
37	1206	L	4mm	7〃	Plastic	2	P
38	1206	L	4mm	7〃	Plastic	3	R
39	1206	L	4mm	13〃	Plastic	8	E

Table 4 Packaging (Minimum Quantity)

NO.	Size Code	Thickness Code	Square hole spacing	Disc Size	Carrier Tape Type	QTY (Kpcs)	Packaging Code
40	1210	Q	4mm	7〃	Plastic	1.5	F
41	1210	Q	4mm	7〃	Plastic	0.5	S
42	1210	Q	4mm	7〃	Plastic	1	Z
43	1210	R	4mm	7〃	Plastic	1	Z
44	1210	R	4mm	7〃	Plastic	0.5	S
45	1210	3	4mm	7〃	Plastic	1	Z
46	2220	R	8mm	13〃	Plastic	0.8	S

First packaging: Each multi-disc material is packed into a box.

The second packaging: the first packaged packaging box is loaded into the paper packaging box,and the remaining space in the box is filled with light auxiliary materials.

The above packaging forms can also be packaged according to user needs.

3. Technical Specifications and Test Methods

3.1 Operating Environment

Temp. Characteristics	Temp. Range	Relative Humidity	Atmospheric Pressure
C0G/X7R/X7S	-55℃～125℃	≤95% (25℃)	86 KPa～106KPa
X6S	-55℃～105℃	≤95% (25℃)	86 KPa～106KPa
X5R	-55℃～85℃	≤95% (25℃)	86 KPa～106KPa

3.2 Reliability Test Specifications and Methods

Without specific note, the "test method" in Table 5 is based on GB/T 21041/21042 IDT IEC60384 .

Table 5: Specifications and Test Methods

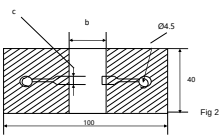
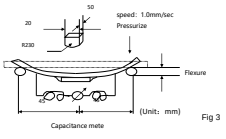
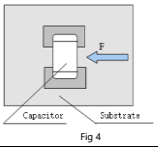
<table>
<tr><th>No.</th><th>Item</th><th>Specification
Class1 (Temperature Compensating Type)-C0G
Class2 (High dielectric constant type): X7R\X7S\X6S\X5R</th><th>Test Method</th></tr>
<tr><td>1</td><td>Appearance</td><td>No obvious defects on ceramic body and termination.</td><td>Visual examination under a microscope.</td></tr>
<tr><td>2</td><td>Size Code</td><td>See Fig.1 and ② Size Code</td><td>Measuring by gages which precision is not less than 0.01 mm .</td></tr>
<tr><td>3</td><td>Capacitance</td><td>Within the specified tolerance</td><td>Measurement Temperature: 18～28℃
Relative Humidity: ≤RH 80%
Measurement Frequency: Class 1: C≤1nF, f=1.0±0.1MHz ; C>1nF, f=1.0±0.1KHz
Class 2: See Table 5-1
Measurement Voltage: Class 1: 1.0±0.2Vrms
Class 2: See Table 5-1
Post-treatment: When the capacitor initial capacitance is lower than its tolerance value, the test sample need to Perform a heat treatment at 150℃+0/-10℃for 1hour and then sit for 24±2 hours at room temperature.then measure.</td></tr>
<tr><td>4</td><td>Dissipation Factor (D.F.) or Q</td><td>Class 1: C≥30pF, Q≥1000
C＜30pF, Q≥400+20C
C: Nominal Capacitance (pF)
Class 2: See Table 5-1</td><td></td></tr>
<tr><td>5</td><td>Insulation Resistance (I.R.)</td><td>Class 1: ≥10,000MΩ or 500Ω·F (Whichever is smaller)
Class 2: See Table 5-1</td><td>Measurement Temperature: 18～28℃
Relative Humidity: ≤RH 80%
Measurement Voltage: 1.0×U_R±10%U_R (U_R=100V/200V/250V/450V)
500±50V (U_R=500V/630V/1KV/2KV)
Charging Time: 1min
Charge/discharge current: 50mA or lower</td></tr>
<tr><td>6</td><td>Voltage proof</td><td>No defects or abnormalities.</td><td>Test Voltage
Class 1 / Class 2:
Size Code | U_R | Capacitance | Test Voltage
0201 0402 0603 0805 1206 | ＜250V | -- | ≥2.5×U_R ; ≥2.5×U_R (U_R=100V)
0201 0402 0603 0805 1206 | 250V | -- | ≥2.0×U_R ; ≥2.0×U_R (U_R=200V/250V)
0201 0402 0603 0805 1206 | 630V | -- | ≥1.5×U_R ; ≥1.5×U_R (U_R=450V/500V/630V)
0201 0402 0603 0805 1206 | 1KV | -- | ≥1.3×U_R ; ≥1.2×U_R (U_R=1KV/2KV)
0201 0402 0603 0805 1206 | 2KV | -- | ≥1.3×U_R
1210 | 630V | -- | ≥1.3×U_R
1210 | 1KV | ≤2.2nF | ≥1.3×U_R
1210 | 1KV | 2.2nF＜C≤15nF | ≥1.2×U_R
1210 | 1KV | ＞15nF | ≥1.1×U_R
2220 | 450V | -- | ≥1.3×U_R
Applied Time: t=1s～5s
Charge/discharge current: 50mA or lower</td></tr>
<tr><td>7</td><td>Temperature Characteristics of Capacitance</td><td>Class 1: C0G: αc≤±30ppm/℃ (125℃);
-72≤αc≤+30ppm/℃ (-55℃)
Class 2: X7R/X5R: ΔC/C≤±15%
X7S/X6S: ΔC/C≤±22%</td><td>Pre-treatment: Class 2: Perform a heat treatment at 150℃+0/-10℃for 1 hour and then sit for 24±2 hours at room temperature. then measure.
Pre-drying: Class 1: 16-24 hours
Measure the capacitance separately in 25℃、θ1、25℃、θ2、25℃, should satisfied relatived capacitance change characteristics.
C0G\X7R\X7S: θ1=-55℃, θ2=125℃
X6S: θ1=-55℃, θ2=105℃
X5R: θ1=-55℃, θ2=85℃
T.C Measurement Voltage: Class 1: 1.0±0.2Vrms
Class 2: ≤1.0±0.2Vrms ※ 【※ Please contact our technical support staff for more information.】</td></tr>
<tr><td>8</td><td>Resistance to Soldering Heat</td><td>Appearance: No visible damage and terminations uncovered shall be less than 25%.
Cap. Change: Class 1: ΔC/C≤±2.5% or ±0.25pF, (Whichever is larger)
Class 2: See Table 5-1
I.R.: initial specification
D.F. or Q: initial specification
Voltage proof: No defects or abnormalities.</td><td>Pre-treatment: Class 2: Perform a heat treatment at 150℃+0/-10℃for 1 hour and then sit for 24±2 hours at room temperature. then measure.
Test Method: Solder bath method
Pre-heating: 1206 size max.: Temp.120～150℃/Time:60s
1210 size min.: Temp.100～120℃/Time:60s and Temp.170～200℃/Time:60s
Solder alloy: Sn-3.0Ag-0.5Cu(Lead Free Solder)
Solder temp.: (270±5)℃
Duration of immersion: (10±1)s
Depth of immersion: 10 mm
Post-treatment: Let sit for 24±2 hours at room temperature, then measure.</td></tr>
<tr><td>9</td><td>Solderability</td><td>Appearance: 95% of the terminations is to be soldered evenly and continuously</td><td>Pre-heating: 80℃～120℃,Time:10s～30s
Test Method: Solder bath method
Flux: Solution of rosin ethanol
Solder alloy: Sn-Ag-Cu(Lead Free Solder)
Solder temp.: (245±5)℃
Duration of immersion: (2.0±0.5)s
Depth of immersion: 10 mm</td></tr>
<tr><td>10</td><td>Substrate Bending test</td><td>Appearance: No defects or abnormalities
Cap. Change: Class 1: ΔC/C≤±5% or ±0.5pF, (Whichever is larger)
Class 2: See Table 5-1</td><td>Mounting method: Solder the capacitor on the test substrate shown in Fig.2
Pressurization Method: Shown in Fig.3
Flexure: 1mm
Holding Time: (5±1)s
then measure the capacitance
  Fig 2
  Fig 3</td></tr>
<tr><td>11</td><td>Adhesive Strength of Termination</td><td>Appearance: No defects or abnormalities</td><td>Mounting method: Solder the capacitor on the test substrate shown in Fig.4
Apply a pushing force of F for 10±1secs.
Pushing force: 0201:F=2N
0402/0603: 5N
0805/1206/1210/2220:F=10N
  Fig 4</td></tr>
<tr><td>12</td><td>Vibration</td><td>Appearance: No defects or abnormalities
Cap. Change: Class 1: initial specification
Class 2: See Table 5-1
I.R.: initial specification
D.F. or Q: initial specification</td><td>Mounting method: Solder the capacitor on the test substrate
Amplitude: 1.5mm
Kind of Vibration: A simple harmonic motion
Frequency: 10Hz-55Hz-10Hz
Vibration Time: 1 min
Repeat this for 2hrs each in 3 perpendicular directions X, Y, Z, total 6hrs.</td></tr>
</table>

Table 5: Specifications and Test Methods

<table>
<tr><th>No.</th><th>Item</th><th>Specification
Class1 (Temperature Compensating Type)-C0G
Class2 (High dielectric constant type): X7R\X7S\X6S\X5R</th><th>Test Method</th></tr>
<tr><td>13</td><td>Rapid change of temperature</td><td>Appearance: No defects or abnormalities
Cap. Change: Class 1: ΔC/C≤±2.5% or ±0.25pF, (Whichever is larger)
Class 2: See Table 5-1
I.R.: initial specification
D.F. or Q: initial specification
Voltage proof: No defects or abnormalities.</td><td>Pre-treatment: Class 2: Perform a heat treatment at 150℃+0/-10℃for 1 hour and then sit for 24±2 hours at room temperature. then measure.
Mounting method: Solder the capacitor on the test substrate
The number of cycles: 100 cycles
Temperature Step
<table>
<tr><th>Step.</th><th>Temp.(℃)</th><th>Time (min.)</th></tr>
<tr><td>1</td><td>θ1</td><td>30±3</td></tr>
<tr><td>2</td><td>25</td><td>2~5</td></tr>
<tr><td>3</td><td>θ2</td><td>30±3</td></tr>
<tr><td>4</td><td>25</td><td>2~5</td></tr>
</table>
C0G\X7R\X7S θ1=-55℃, θ2=125℃
X6S θ1=-55℃, θ2=105℃
X5R θ1=-55℃, θ2=85℃
Post-treatment: Let sit for 24±2 hours at room temperature, then measure.</td></tr>
<tr><td>14</td><td>Damp heat (steady state)</td><td>Appearance: No defects or abnormalities
Cap. Change: Class 1: ΔC/C≤±7.5% or 0.75pF, (Whichever is larger)
Class 2: See Table 5-1
I.R.: Class 1: ≥500MΩ or 25Ω·F, (Whichever is smaller)
Class 2: See Table 5-1
D.F. or Q: Class 1: C≥30pF, Q≥200
C＜30pF, Q≥100+10C/3
C: Nominal Capacitance (pF)
Class 2: See Table 5-1</td><td>Pre-treatment: Class 2: Perform a heat treatment at 150℃+0/-10℃for 1 hour and then sit for 24±2 hours at room temperature. then measure.
Mounting method: Solder the capacitor on the test substrate
Test Temperature: 60±2℃
Test Humidity: RH 90～95%
Test Time: 500±12h
Post-treatment: Let sit for 24±2 hours at room temperature, then measure.</td></tr>
<tr><td>15</td><td>High Temperature High Humidity (Steady)
(The test is applicable to Capacitors with U_R≤ 500V)</td><td>Appearance: No defects or abnormalities
Cap. Change: Class 1: ΔC/C≤±7.5% or 0.75pF, (Whichever is larger)
Class 2: See Table 5-1
I.R.: Class 1: .≥500MΩ or 25Ω·F, (Whichever is smaller)
Class 2: See Table 5-1
D.F. or Q: Class 1: C≥30pF, Q≥200
C＜30pF, Q≥100+10C/3
C: Nominal Capacitance (pF)
Class 2: See Table 5-1</td><td>Pre-treatment: Class 2: Perform a heat treatment at 150℃+0/-10℃for 1 hour and then sit for 24±2 hours at room temperature. then measure.
Mounting method: Solder the capacitor on the test substrate
Test Temperature: 60±2℃
Test Humidity: RH 90～95%
Test Voltage: 1.0×U_R
Test Time: 500±12h
Charge/discharge current: 50mA or lower
Post-treatment: Class 1: Let sit for 24±2 hours at room temperature, then measure.
Class 2: Perform a heat treatment at 150℃+0/-10℃for 1 hour and then sit for 24±2 hours at room temperature. then measure.</td></tr>
<tr><td>16</td><td>Endurance</td><td>Appearance: No defects or abnormalities
Cap. Change: Class 1: ΔC/C≤±2% or 0.2pF, (Whichever is larger)
Class 2: See Table 5-1
I.R.: Class 1: ≥500MΩ or 25Ω·F, (Whichever is smaller)
Class 2: See Table 5-1
D.F. or Q: Class 1: C≥30pF, Q≥350
10pF＜C＜30pF, Q≥275+5C/2
C≤10pF: Q≥200+10C
C: Nominal Capacitance (pF)
Class 2: See Table 5-1</td><td>Pre-treatment: Class 2: Perform a heat treatment at 150℃+0/-10℃for 1 hour and then sit for 24±2 hours at room temperature. then measure.
Mounting method: Solder the capacitor on the test substrate
Test Temperature: θ2±3℃ [C0G\X7R\X7S:θ2=125℃, X6S=θ2=105℃, X5R=θ2=85℃]
Test Time: 1000±12h
Test Voltage
Class 1
<table>
<tr><th>Size Code</th><th>U_R</th><th>Capacitance</th><th>Test Voltage</th></tr>
<tr><td>0201,0402</td><td>-</td><td>-</td><td>2×U_R</td></tr>
<tr><td rowspan="5">0603</td><td>≤100V</td><td>≤1.5nF</td><td>2×U_R</td></tr>
<tr><td>≤100V</td><td>＞1.5nF</td><td>1.5×U_R</td></tr>
<tr><td>≤200V</td><td>-</td><td>1.5×U_R</td></tr>
<tr><td>≤250V</td><td>-</td><td>1.5×U_R</td></tr>
<tr><td rowspan="5">0805</td><td>≤100V</td><td>-</td><td>2×U_R</td></tr>
<tr><td>≤200V</td><td>-</td><td>1.5×U_R</td></tr>
<tr><td>≤250V</td><td>-</td><td>1.5×U_R</td></tr>
<tr><td>≤500V</td><td>-</td><td>1.2×U_R</td></tr>
<tr><td>≤630V</td><td>-</td><td>1.2×U_R</td></tr>
</table>
<table>
<tr><th>Size Code</th><th>U_R</th><th>Capacitance</th><th>Test Voltage</th></tr>
<tr><td rowspan="7">1206</td><td>≤100V</td><td>≤56nF</td><td>2×U_R</td></tr>
<tr><td>≤100V</td><td>＞56nF</td><td>1.5×U_R</td></tr>
<tr><td>≤200V</td><td>-</td><td>1.5×U_R</td></tr>
<tr><td>≤250V</td><td>-</td><td>1.5×U_R</td></tr>
<tr><td>≤500V</td><td>-</td><td>1.2×U_R</td></tr>
<tr><td>≤630V</td><td>-</td><td>1.2×U_R</td></tr>
<tr><td>≤1000V</td><td>-</td><td>1.2×U_R</td></tr>
<tr><td>≤2000V</td><td>-</td><td>1.0×U_R</td></tr>
<tr><td rowspan="3">1210</td><td>≤630V</td><td>-</td><td>1.2×U_R</td></tr>
<tr><td>≤1000V</td><td>≤2.2nF</td><td>1.2×U_R</td></tr>
<tr><td></td><td>＞2.2nF</td><td>1×U_R</td></tr>
<tr><td>2220</td><td>≤450V</td><td>-</td><td>1×U_R</td></tr>
</table>
Class 2
1.5×U_R (U_R=100V/200V/250V)
1.2×U_R (U_R=500V/630V)
1.1×U_R (U_R=1KV/2KV)
Charge/discharge current: 50mA or lower
Post-treatment: Class 1: Let sit for 24±2 hours at room temperature, then measure.
Class 2: Perform a heat treatment at 150℃+0/-10℃for 1 hour and then sit for 24±2 hours at room temperature. then measure.</td></tr>
</table>

4. Packaging,Shipment and storage

4.1 Packaging

4.1.1 packaging type

Reel Packaging (standard carrier tape disc packaging), single disc smallest package See Table 4

4.1.2 Carrier Tape size

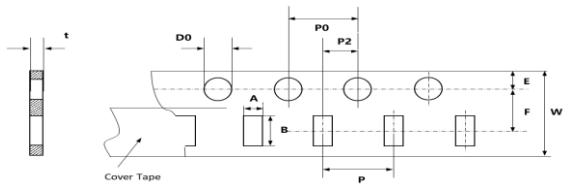


Fig. 5-1:0603,0805,1206,1210（Paper tape）

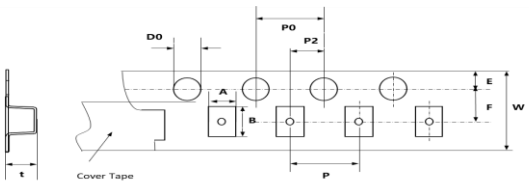


Fig. 5-2:0603,0805,1206,1210,2220（Plastic tape）

Table 6-1 Carrier size (Size Code:0603,0805,1206,1210,2220) (Unit:mm)

Size Code	Thickness code	Carrier Tape Type	Packaging Code	A	B	F	P	E	D0	P2	K	W	P0	t
0603	D	Paper	T	1.00±0.10	1.80±0.10	3.50±0.05	4.00±0.10	1.75±0.10	1.55±0.05	2.00±0.05	/	8.00±0.20	4.00±0.10	1.15max
0603	D	Paper	A	1.00±0.10	1.80±0.10	3.50±0.05	4.00±0.10	1.75±0.10	1.55±0.05	2.00±0.05	/	8.00±0.20	4.00±0.10	1.15max
0603	D	Plastic	O	1.00±0.10	1.80±0.10	3.50±0.05	4.00±0.10	1.75±0.10	1.55±0.05	2.00±0.05	/	8.00±0.20	4.00±0.10	1.15max
0603	D	Paper	W	1.00±0.10	1.80±0.10	3.50±0.05	4.00±0.10	1.75±0.10	1.55±0.05	2.00±0.05	/	8.00±0.20	4.00±0.10	1.15max
0603	K	Paper	T	1.10±0.10	1.90±0.10	3.50±0.05	4.00±0.10	1.75±0.10	1.55±0.05	2.00±0.05	/	8.00±0.20	4.00±0.10	1.15max
0603	K	Paper	A	1.10±0.10	1.90±0.10	3.50±0.05	4.00±0.10	1.75±0.10	1.55±0.05	2.00±0.05	/	8.00±0.20	4.00±0.10	1.15max
0603	K	Plastic	O	1.10±0.10	1.90±0.10	3.50±0.05	4.00±0.10	1.75±0.10	1.55±0.05	2.00±0.05	/	8.00±0.20	4.00±0.10	1.15max
0603	K	Paper	W	1.10±0.10	1.90±0.10	3.50±0.05	4.00±0.10	1.75±0.10	1.55±0.05	2.00±0.05	/	8.00±0.20	4.00±0.10	1.15max
0603	K	Plastic	Q	1.10±0.10	1.90±0.10	3.50±0.05	4.00±0.10	1.75±0.10	1.55±0.05	2.00±0.05	/	8.00±0.20	4.00±0.10	1.15max
0603	K	Plastic	R	1.10±0.10	1.90±0.10	3.50±0.05	4.00±0.10	1.75±0.10	1.55±0.05	2.00±0.05	/	8.00±0.20	4.00±0.10	1.15max
0805	C	Paper	T	1.45±0.10	2.20±0.10	3.50±0.05	4.00±0.10	1.75±0.10	1.55±0.05	2.00±0.05	/	8.00±0.20	4.00±0.10	0.9max
0805	C	Plastic	R	1.45±0.10	2.20±0.10	3.50±0.05	4.00±0.10	1.75±0.10	1.55±0.05	2.00±0.05	/	8.00±0.20	4.00±0.10	0.9max
0805	K	Paper	T	1.45±0.20	2.20±0.20	3.50±0.05	4.00±0.10	1.75±0.10	1.55±0.05	2.00±0.05	/	8.00±0.20	4.00±0.10	1.15max
0805	K	Plastic	R	1.45±0.20	2.20±0.20	3.50±0.05	4.00±0.10	1.75±0.10	1.55±0.05	2.00±0.05	/	8.00±0.20	4.00±0.10	1.15max
0805	K	Plastic	E	1.45±0.20	2.20±0.20	3.50±0.05	4.00±0.10	1.75±0.10	1.55±0.05	2.00±0.05	/	8.00±0.20	4.00±0.10	1.15max
0805	Y	Paper	T	1.45±0.20	2.20±0.20	3.50±0.05	4.00±0.10	1.75±0.10	1.55±0.05	2.00±0.05	/	8.00±0.20	4.00±0.10	1.15max
0805	Y	Plastic	E	1.45±0.20	2.20±0.20	3.50±0.05	4.00±0.10	1.75±0.10	1.55±0.05	2.00±0.05	/	8.00±0.20	4.00±0.10	1.15max
0805	Y	Plastic	P	1.45±0.20	2.20±0.20	3.50±0.05	4.00±0.10	1.75±0.10	1.55±0.05	2.00±0.05	/	8.00±0.20	4.00±0.10	1.15max
0805	Y	Plastic	R	1.45±0.20	2.20±0.20	3.50±0.05	4.00±0.10	1.75±0.10	1.55±0.05	2.00±0.05	/	8.00±0.20	4.00±0.10	1.15max
0805	G	Plastic	R	1.45±0.10	2.20±0.10	3.50±0.05	4.00±0.10	1.75±0.10	1.55±0.05	2.00±0.05	/	8.00±0.20	4.00±0.10	1.75max
0805	G	Plastic	P	1.45±0.10	2.20±0.10	3.50±0.05	4.00±0.10	1.75±0.10	1.55±0.05	2.00±0.05	/	8.00±0.20	4.00±0.10	1.75max
0805	G	Plastic	O	1.45±0.10	2.20±0.10	3.50±0.05	4.00±0.10	1.75±0.10	1.55±0.05	2.00±0.05	/	8.00±0.20	4.00±0.10	1.75max
0805	H	Plastic	R	1.45±0.20	2.20±0.20	3.50±0.05	4.00±0.10	1.75±0.10	1.55±0.05	2.00±0.05	/	8.00±0.20	4.00±0.10	2.00max
0805	H	Plastic	P	1.45±0.20	2.20±0.20	3.50±0.05	4.00±0.10	1.75±0.10	1.55±0.05	2.00±0.05	/	8.00±0.20	4.00±0.10	2.00max
0805	H	Plastic	O	1.45±0.20	2.20±0.20	3.50±0.05	4.00±0.10	1.75±0.10	1.55±0.05	2.00±0.05	/	8.00±0.20	4.00±0.10	2.00max
1206	E	Plastic	R	1.80±0.20	3.40±0.20	3.50±0.05	4.00±0.10	1.75±0.10	1.55±0.05	2.00±0.05	/	8.00±0.20	4.00±0.10	1.15max
1206	E	Plastic	P	1.80±0.20	3.40±0.20	3.50±0.05	4.00±0.10	1.75±0.10	1.55±0.05	2.00±0.05	/	8.00±0.20	4.00±0.10	1.15max
1206	O	Plastic	R	1.80±0.20	3.40±0.20	3.50±0.05	4.00±0.10	1.75±0.10	1.55±0.05	2.00±0.05	/	8.00±0.20	4.00±0.10	1.45max
1206	O	Plastic	P	1.80±0.20	3.40±0.20	3.50±0.05	4.00±0.10	1.75±0.10	1.55±0.05	2.00±0.05	/	8.00±0.20	4.00±0.10	1.45max
1206	L	Plastic	P	1.80±0.20	3.40±0.20	3.50±0.05	4.00±0.10	1.75±0.10	1.55±0.05	2.00±0.05	/	8.00±0.20	4.00±0.10	2.50max
1206	L	Plastic	R	1.80±0.20	3.40±0.20	3.50±0.05	4.00±0.10	1.75±0.10	1.55±0.05	2.00±0.05	/	8.00±0.20	4.00±0.10	2.50max
1206	L	Plastic	E	1.80±0.20	3.40±0.20	3.50±0.05	4.00±0.10	1.75±0.10	1.55±0.05	2.00±0.05	/	8.00±0.20	4.00±0.10	2.50max
1210	Q	Plastic	F	2.70±0.20	3.50±0.20	3.50±0.05	4.00±0.10	1.75±0.10	1.55±0.05	2.00±0.05	/	8.00±0.20	4.00±0.10	2.50max
1210	Q	Plastic	S	2.70±0.20	3.50±0.20	3.50±0.05	4.00±0.10	1.75±0.10	1.55±0.05	2.00±0.05	/	8.00±0.20	4.00±0.10	2.50max
1210	Q	Plastic	Z	2.70±0.20	3.50±0.20	3.50±0.05	4.00±0.10	1.75±0.10	1.55±0.05	2.00±0.05	/	8.00±0.20	4.00±0.10	2.50max
1210	R	Plastic	Z	2.70±0.20	3.50±0.30	3.50±0.05	4.00±0.10	1.75±0.10	1.55±0.05	2.00±0.05	/	8.00±0.20	4.00±0.10	3.00max
1210	R	Plastic	S	2.70±0.20	3.50±0.30	3.50±0.05	4.00±0.10	1.75±0.10	1.55±0.05	2.00±0.05	/	8.00±0.20	4.00±0.10	3.00max
1210	3	Plastic	Z	2.70±0.30	3.50±0.40	3.50±0.05	4.00±0.10	1.75±0.10	1.55±0.05	2.00±0.05	/	8.00±0.20	4.00±0.10	3.10max
2220	R	Plastic	S	2.70±0.20	5.80±0.20	5.5±0.10	8.00±0.10	1.75±0.10	1.50+0.10/-0	2.0±0.10	/	16.00±0.30	4.00±0.10	6.50max.

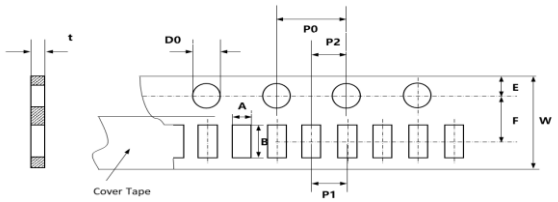


Fig. 5-3:0402（Paper tape/ 2mm pitch）

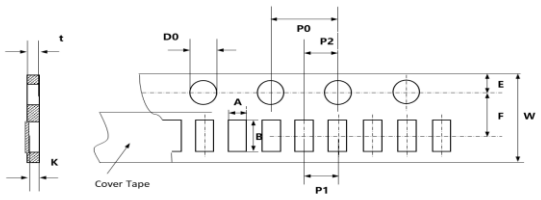


Fig. 5-4:0201（Paper tape/ 2mm pitch）

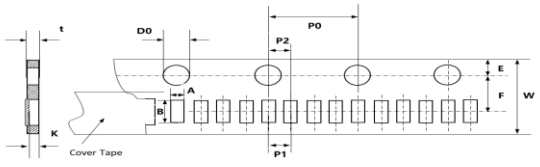


Fig. 5-5:0201（Paper tape/ 1mm pitch）

Table 6-2 Carrier size (Size Code:0201,0402) (Unit:mm)

Size Code	Thickness code	Carrier Tape Type	Packaging Code	A	B	F	P1	E	D0	P2	K	W	P0	t
0201	A	Paper	T	0.38±0.02	0.68±0.03	3.50±0.05	2.00±0.05	1.75±0.10	1.55±0.05	2.00±0.05	0.36±0.02	8.00±0.10	4.00±0.10	0.5max
0201	A	Paper	J	0.38±0.02	0.68±0.03	3.50±0.05	2.00±0.05	1.75±0.10	1.55±0.05	2.00±0.05	0.36±0.02	8.00±0.10	4.00±0.10	0.5max
0201	A	Paper	D	0.38±0.02	0.68±0.03	3.50±0.05	1.00±0.05	1.75±0.10	1.55±0.05	1.00±0.05	0.36±0.02	8.00±0.10	4.00±0.10	0.5max
0201	A	Paper	H	0.38±0.02	0.68±0.03	3.50±0.05	2.00±0.05	1.75±0.10	1.55±0.05	2.00±0.05	0.36±0.02	8.00±0.10	4.00±0.10	0.5max
0201	A	Paper	L	0.38±0.02	0.68±0.03	3.50±0.05	1.00±0.05	1.75±0.10	1.55±0.05	1.00±0.05	0.36±0.02	8.00±0.10	4.00±0.10	0.5max
0402	B	Paper	T	0.63±0.05	1.13±0.05	3.50±0.05	2.00±0.05	1.75±0.10	1.55±0.05	2.00±0.05	/	8.00±0.10	4.00±0.10	0.8max
0402	B	Paper	J	0.63±0.05	1.13±0.05	3.50±0.05	2.00±0.05	1.75±0.10	1.55±0.05	2.00±0.05	/	8.00±0.10	4.00±0.10	0.8max

4.1.3 Disc size

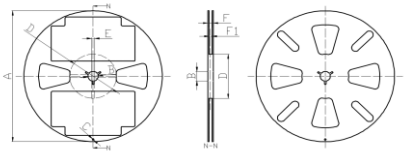


Fig. 6-1: disc (Width of carrier-4mm)

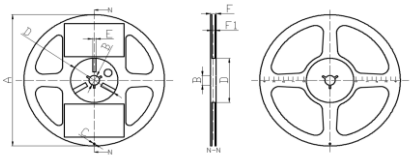


Fig. 6-2: disc (Width of carrier-8mm)

Table 7: Disc size (Unit:mm)

Disc size	Width of carrier	A	B	C	D	E	F	F1	Size Code
7"	8.00±0.10	Φ178±2.0	Φ13±1.0	Φ4.0±0.5	Φ60±2.0	4±1.0	11.5±1.0	10±2	All
13"	8.00±0.10	Φ330±2.0	Φ13±1.0	Φ4.0±0.5	Φ108±2.0	4±1.0	13.5±2.0	10±2	All
13"	16.00±0.10	Φ330±2.0	Φ13±1.0	/	/	/	/	/	2220

4.1.4 Carrier Tape specifications

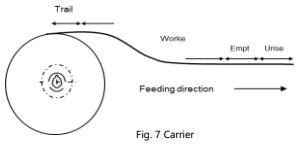


Fig. 7 Carrier

Packaging	The minimum length of the reserved spaces		
Carrier	Trailer	Empty	Unseal
	60 mm	200mm	160mm

4.1.5 Performance of Carrier Taping

4.1.5.1 Strength of Carrier Tape and Top Cover Tape

a. Carrier Tape

When a tensile force 1.02kgf is applied in the direction to unreel the tape, the tape shall withstand this force.

b. Top cover Tape

When a tensile force 1.02kgf is applied to the tape, the tape shall withstand this force.

4.1.5.2 Peeling Strength of Top Cover Tape

Unless otherwise specified, the peeling strength of top cover tape shall be within 10.2 to 71.4 gf when the top cover tape is pulled at a speed of 300mm/min with the angle of 0 to 15°(see Fig.8).

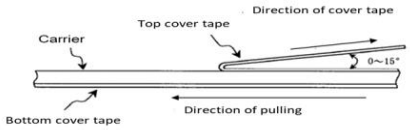


Fig.8 Cover tape peel-off force

4.2 Shipment

Transport packaging products to adapt to the modern means of transport, but the product in the process of transport to prevent rain and acid and alkali corrosion, shall not be whipped extrusion casting and gravity.

4.3 Storage

4.3.1 Storage conditions:

The recommended temperature is less than 30℃.

A temperature is +5℃ to +40℃ and a relative humidity is 20% to 70% as a standard condition.(MSL Level 1)

MLCC may be affected by the storage conditions. Please use them promptly after delivery.

High temperature and humidity conditions and/or prolonged storage may cause deterioration of the packaging materials.

If more than six months have elapsed since delivery, check packaging, mounting, etc. before use.

4.3.2 Corrosive gas can react with the termination (external) electrodes or lead wires of capacitors, and result in poor solderability.

Do not store the capacitors in an atmosphere consisting of corrosive gas (e.g.,hydrogen sulfide, sulfur dioxide, chlorine, ammonia gas etc.)

5. MLCC Application of Technical Requirements

5.1 Circuit Design

5.1.1 Operating Temperature

a. Do not use capacitor above the maximum allowable operating temperature.

b. Surface temperature including self-heating should be below maximum operating temperature.

5.1.2 Operating Voltage

The operating voltage for capacitors must always be lower than their rated voltage.

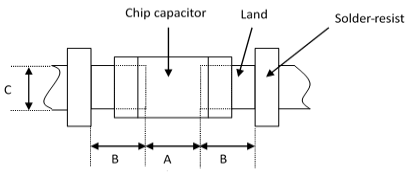
5.2 PCB Design

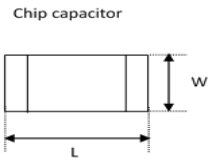
5.2.1 Design of Land-patterns

When the capacitors are mounted on a PCB, the amount of solder at the terminations has a direct effect on the performance of the capacitors.

The greater the amount of solder, the higher the stress on the capacitor. Therefore, when designing land-patterns, it is necessary to consider the appropriate size and configuration of the solder pads.

Size and recommended land dimensions are shown in the following figure and table:



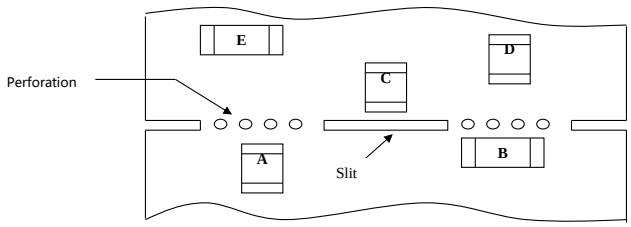


Recommended land dimensions for reflow-soldering (unit: mm)

Size Code	Length	Width	Tolerance	A	B	C
0201	0.6	0.3	±0.03	0.20~0.25	0.20~0.30	0.20~0.35
0201	0.6	0.3	±0.05	0.20~0.25	0.25~0.35	0.30~0.40
0201	0.6	0.3	±0.09/±0.1	0.23~0.30	0.25~0.35	0.30~0.40
0402	1	0.5	±0.05	0.30~0.50	0.35~0.45	0.40~0.60
0402	1	0.5	±0.15 or ±0.20	0.40~0.60	0.40~0.50	0.50~0.70
0603	1.6	0.8	±0.10	0.60~0.80	0.60~0.70	0.60~0.80
0603	1.6	0.8	±0.20	0.70~0.90	0.70~0.80	0.80~1.00
0805	2.0	1.25	±0.10 or ±0.20	1.00~1.40	0.60~0.80	1.20~1.40
1206	3.2	1.6	±0.20	1.80~2.00	0.90~1.20	1.50~1.70
1210	3.2	2.5	±0.20	2.00~2.40	1.00~1.20	1.80~2.30
2220	5.7	5.0	±0.40	4.10~4.80	1.20~1.40	4.00~5.00

5.2.2 Capacitor Layout on PC Board

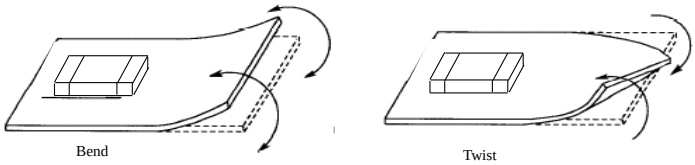
Mechanical stress varies according to the location of capacitors on PC board. The recommendation for better design is as follows



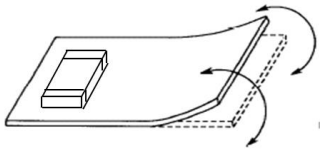
The stress in capacitors is in the following order: A>B=C>D>E

Pay attention not to bend or distort the PC board otherwise the capacitor may crack. Please refer to the following examples of good and bad capacitor layout.

a. Not recommended

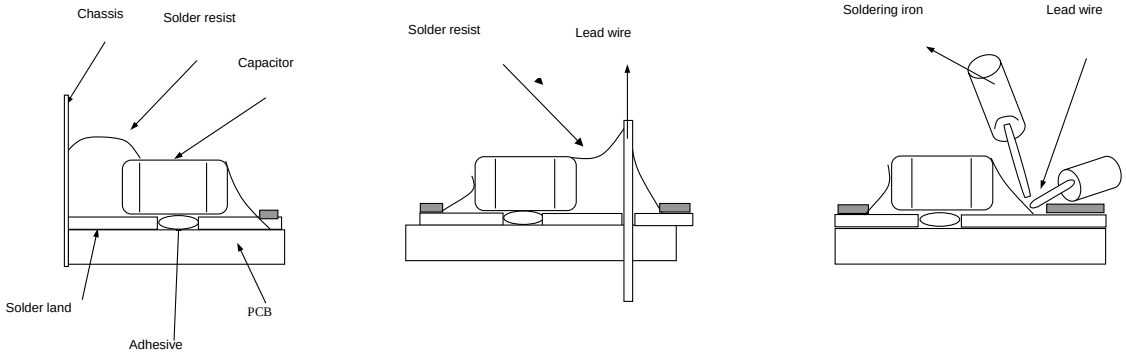


b.Recommended

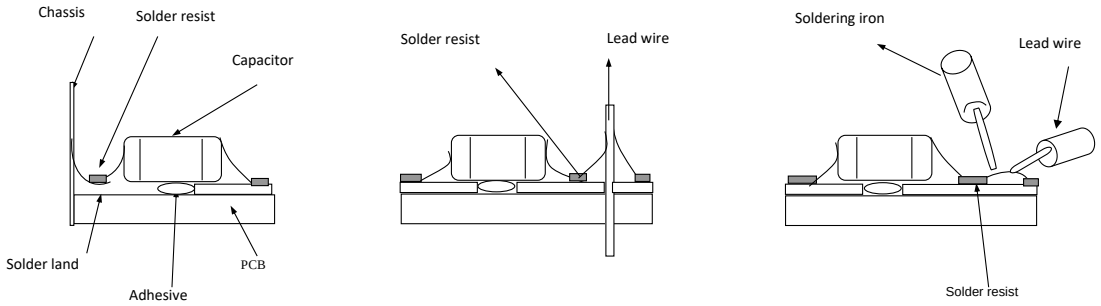


5.2.3Solder Buildup and Soldering

a.Examples of soldering method not recommended



b.Examples of soldering method recommended



5.3 Consideration for Automatic Placement

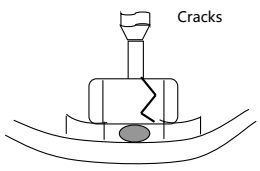
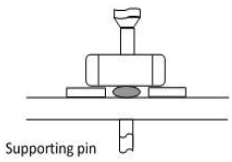
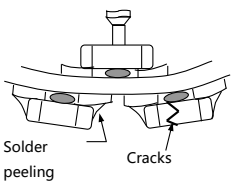
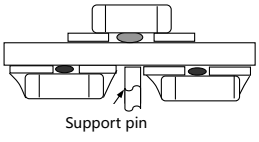
If the mounting head is adjusted too low, it may induce excessive stress in the chip capacitor to result in cracking. Please take following precautions

a.Adjust the bottom dead center of the mounting head to reach on the PC board surface and not press it;

b.Adjust the mounting head pressure to be 1N to 3N of static weight;

c.To minimize the impact energy from mounting head, it is important to provide support from the bottom side of the PC board.

Please refer to the following samples:

Mounting	Not recommended	Recommended
Singel-sided Mounting		
Double-sided Mounting		

5.4 Soldering

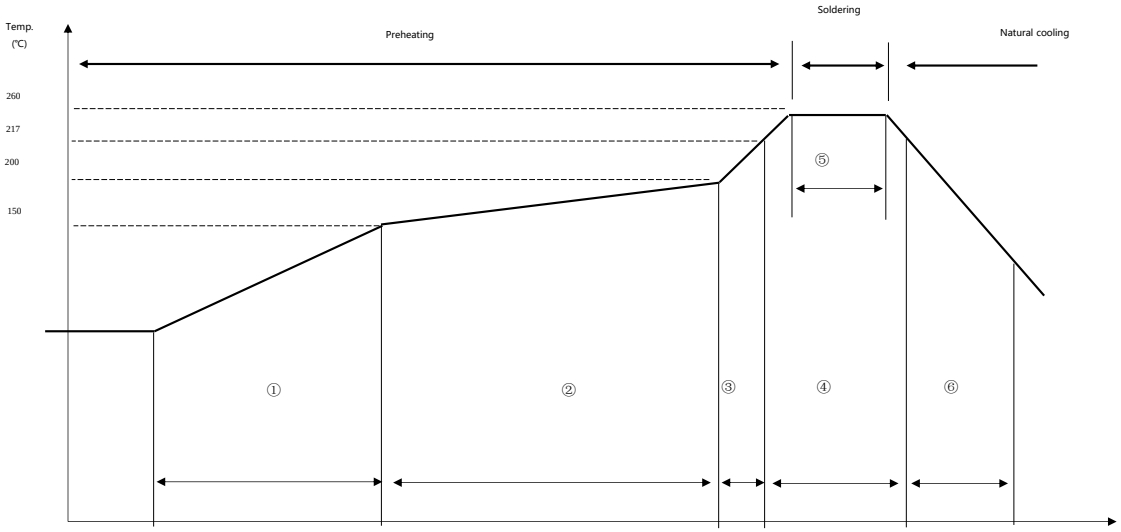
5.4.1 Flux Selection

a.It is recommended to use a mildly activated rosin flux (less than 0.1wt% chlorine). Strong flux is not recommended.

b.Please provide proper amount of flux. Excessive flux must be avoided.

c.When water-soluble flux is used, enough washing is necessary.

5.4.2 Recommended Soldering Profile



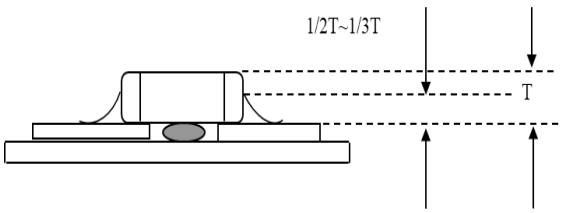
5.4.2.1 Reflow Soldering Condition

NO.	Reflow Soldering zone	Reflow Soldering Condition
①	Preheating 1	≤3℃/s;≥60s
②	Constant temperature	150 ~ 200℃;60~120s;≤1℃/s
③	Preheating 1	1~5℃/s
④	Soldering 1	Above 217℃, 60~150s
⑤	Soldering 1	Above 260℃,over 10s
⑥	Natural cooling	≤6℃/s

Caution

a.Excessive solder will induce higher tensile force in chip capacitor when temperature changes and result in cracking. Insufficient solder may detach the capacitor from the PC board.

The ideal condition is to have solder mass controlled to 1/2 to 1/3 of the thickness of the capacitor



b.Soldering duration should be kept as close to recommended times as possible, because excessive duration can detrimentally affect solderability.

c.The peak temperature of reflow soldering is 245±15℃。

6. All products in this specification comply with the EU RoHS directive

The EU RoHS Directive refers to the "Directive 2011/65/EU on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment" stipulated by the European Union.

Table 5-1 Cap. \ D.F \ I.R. changes after test

No.	Series	Temp. Chara.	Size	Rated Voltage (DC)	Thickness Code	Capacitance	Electrical tests				Resistance to soldering heat	Substrate Bending test	Vibration	Rapid change of temperature	Damp heat (steady state)			High Temperature High Humidity (Steady)			Endurance		
							D.F. [max.]	I.R. [min.]	Measurement Frequency	Measurement Voltage [Vrms]	Cap. [ΔC/C≤±%]	Cap. [ΔC/C≤±%]	Cap. [ΔC/C≤±%]	Cap. [ΔC/C≤±%]	Cap. [ΔC/C≤±%]	D.F. [max.]	I.R. [min.]	Cap. [ΔC/C≤±%]	D.F. [max.]	I.R. [min.]	Cap. [ΔC/C≤±%]	D.F. [max.]	I.R. [min.]
1	B	X7R	0402	100V	B	120pF~10nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
2	B	X7R	0603	100V	D	220pF~100nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
3	B	X7R	0603	100V	K	47nF~100nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
4	B	X7R	0603	250V	D	220pF~2.2nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
5	B	X7R	0603	200V	D	220pF~2.2nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
6	B	X7R	0805	630V	Y	100pF~3.9nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
7	B	X7R	0805	630V	H	4.7nF~10nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
8	B	X7R	0805	500V	Y	100pF~6.8nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
9	B	X7R	0805	500V	H	10nF~22nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
10	B	X7R	0805	250V	Y	1nF~22nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
11	B	X7R	0805	250V	H	10nF~22nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
12	B	X7R	0805	200V	Y	1nF~22nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
13	B	X7R	0805	200V	H	10nF~22nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
14	B	X7R	0805	100V	Y	220pF~330nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
15	B	X7R	0805	100V	H	1nF~470nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
16	B	X7R	1206	2000V	O	150pF~2.2nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
17	B	X7R	1206	1000V	O	150pF~10nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
18	B	X7R	1206	1000V	L	5.6nF~10nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
19	B	X7R	1206	630V	O	1nF~10nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
20	B	X7R	1206	630V	L	15nF ~22nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
21	B	X7R	1206	500V	O	15nF~22nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
22	B	X7R	1206	500V	L	33nF~47nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
23	B	X7R	1206	250V	O	15nF~68nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
24	B	X7R	1206	250V	L	33nF~220nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
25	B	X7R	1206	200V	O	15nF~68nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
26	B	X7R	1206	200V	L	33nF~220nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
27	B	X7R	1206	100V	O	220pF~220nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
28	B	X7R	1206	100V	L	330nF~470nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
29	B	X7R	1206	100V	L	1.0μF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
30	B	X7R	1210	100V	R	1.0μF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
31	B	X7R	1210	100V	R	2.2μF	0.035	10000MΩ or 100Ω·F	1.0±0.1KHz	1.0±0.2	15	12.5	10	15	15	0.075	500 MΩ or 10Ω·F	15	0.075	500 MΩ or 10Ω·F	0.15	0.075	500 MΩ or 25Ω·F
32	B	X7S	1210	100V	Q	4.7μF	0.035	10000MΩ or 100Ω·F	1.0±0.1KHz	1.0±0.2	15	12.5	15	15	15	0.07	500 MΩ or 25Ω·F	15	0.07	500MΩ or 10Ω·F	15	0.07	1000MΩ or 50Ω·F
33	B	X6S	0603	100V	D	100nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F

Table 5-1 Cap. \ D.F \ I.R. changes after test

No.	Series	Temp. Chara.	Size	Rated Voltage (DC)	Thickness Code	Capacitance	Electrical tests				Resistance to soldering heat	Substrate Bending test	Vibration	Rapid change of temperature	Damp heat (steady state)			High Temperature High Humidity (Steady)			Endurance		
							D.F. [max.]	I.R. [min.]	Measurement Frequency	Measurement Voltage [Vrms]	Cap. [ΔC/C≤±%]	Cap. [ΔC/C≤±%]	Cap. [ΔC/C≤±%]	Cap. [ΔC/C≤±%]	Cap. [ΔC/C≤±%]	D.F. [max.]	I.R. [min.]	Cap. [ΔC/C≤±%]	D.F. [max.]	I.R. [min.]	Cap. [ΔC/C≤±%]	D.F. [max.]	I.R. [min.]
34	B	X5R	0402	100V	B	120pF~4.7nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
35	B	X5R	0603	250V	D	220pF~2.2nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
36	B	X5R	0603	200V	D	220pF~2.2nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
37	B	X5R	0603	100V	D	220pF~100nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
38	B	X5R	0603	100V	K	100nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
39	B	X5R	0805	630V	Y	100pF~3.9nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
40	B	X5R	0805	630V	H	4.7nF~10nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
41	B	X5R	0805	500V	Y	100pF~6.8nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
42	B	X5R	0805	500V	H	10nF~22nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
43	B	X5R	0805	250V	Y	1nF~6.8nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
44	B	X5R	0805	250V	H	10nF~22nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
45	B	X5R	0805	200V	Y	1nF~6.8nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
46	B	X5R	0805	200V	H	10nF~22nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
47	B	X5R	0805	100V	Y	220pF~330nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
48	B	X5R	0805	100V	H	1nF~470nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
49	B	X5R	1206	2000V	O	150pF~2.2nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
50	B	X5R	1206	1000V	O	150pF~4.7nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
51	B	X5R	1206	1000V	L	5.6nF~10nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
52	B	X5R	1206	630V	O	1nF~10nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
53	B	X5R	1206	630V	L	15nF ~22nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
54	B	X5R	1206	500V	O	15nF~22nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
55	B	X5R	1206	500V	L	33nF~47nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
56	B	X5R	1206	250V	O	15nF~68nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
57	B	X5R	1206	250V	L	33nF~220nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
58	B	X5R	1206	200V	O	15nF~68nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
59	B	X5R	1206	200V	L	33nF~220nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
60	B	X5R	1206	100V	O	220pF~220nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F
61	B	X5R	1206	100V	L	330nF~470nF	0.025	10000MΩ or 500Ω·F	1.0±0.1KHz	1.0±0.2	10	12.5	7.5	15	12.5	0.05	500 MΩ or 25Ω·F	12.5	0.05	500 MΩ or 25Ω·F	15	0.05	1000MΩ or 50Ω·F