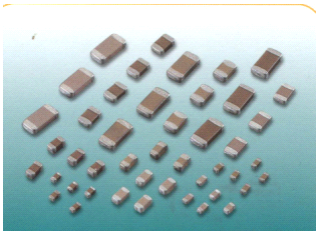
1 Part Number Information

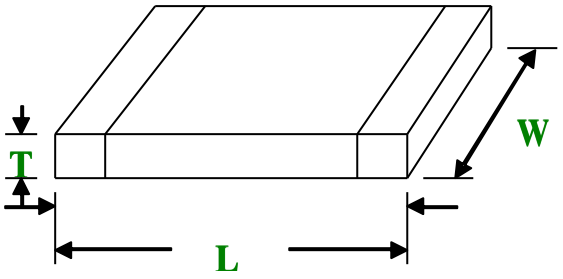
How to order

CC	1206	X7R	P	K	102	R	L
Type CC = Chip Capacitor	Size 0603 0805 1206 1210 1808 1812 2220 2225	Dielectric X7R	Dielectric Voltage 4 = 25V 5 = 50V 6 = 100V 7 = 200V 8 = 250V 9 = 500V p= 1 KV R= 2 KV S=2.5 KV T= 3 KV W=5KV	Tolerance D=±0.50pF F=±1.0% G=±2.0% J=±5.0% K=±10% M=±20%	Capacitance 1st two digits are significant; third digit denotes number of zeros, And A is in place of decimal point. example : 47A=4.7pF 102=10*10²pF =1000pF =1nF	Packing Quantity B : Bulk P : 4K/reel R: 3K/reel 2K/reel 1K/reel eel	RoHS complia{nce

Tolerance	Capacitance for dielectric			
	NP0		X7R	Y5V
A=±0.05pF B=±0.10pF C=±0.25pF D=±0.50pF F=±1.0% G=±2.0% J=±5.0% K=±10% M=±20% Z=-20~+80%	10pF and below	More than 10pF	100pF~1μF (101~105)	10nF~10uF (103~106)
	B,C,D	G,J	J,K,M	M,Z

2 Dimension Specification





Product dimensions in mm.

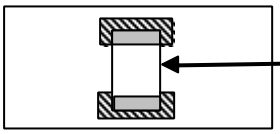
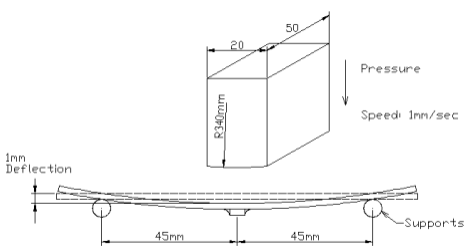
Case size	Length (L)	Width (W)	Thickness (T)	Symbol
0402	1.0±0.05	0.50±0.05	0.50±0.05	A
0603	1.6±0.10	0.80±0.10	0.80±0.10	C
0805	2.0±0.10	1.25±0.10	0.60±0.10	B
			0.80±0.10	C
			1.25±0.20	E
1206	3.20±0.15	1.60±0.15	0.80±0.10	C
			1.25±0.20	E
			1.60±0.20	G
1210	3.2±0.15	2.50±0.20	1.25±0.20	E
			1.60±0.20	G
			2.00±0.20	K
1808	4.60±0.30	2.00±0.30	1.25±0.20	E
			1.60±0.20	G
			2.00±0.20	K
1812	4.60±0.30	3.20±0.30	1.25±0.20	E
			1.60±0.20	G
			2.00±0.20	K

X7R

DIELECTRIC		X7R																	
SIZE		0603		0805			1206			1210			1808			1812		
CAP	CODE	50	100V	50V	100V	250V	50V	100V	250V	50V	100V	250V	50V	100V	250V	50V	100V	250V
180pF	181	C	C	C	C	C												
220pF	221	C	C	C	C	C												
270pF	271	C	C	C	C	C	C	C	C									
330pF	331	C	C	C	C	C	C	C	C									
390pF	391	C	C	C	C	C	C	C	C									
470pF	471	C	C	C	C	C	C	C	C									
560pF	561	C	C	C	C	C	C	C	C									
680pF	681	C	C	C	C	C	C	C	C									
820pF	821	C	C	C	C	C	C	C	C									
1nF	102	C	C	C	C	C	C	C	C									
1.2nF	122	C	C	C	C	C	C	C	C									
1.5nF	152	C	C	C	C	C	C	C	C									
1.8nF	182	C	C	C	C	C	C	C	C									
2.2nF	222	C	C	C	C	C	C	C	E									
2.7nF	272	C	C	C	C	C	C	C	E				E	E	E			
3.3nF	332	C	C	C	C	C	C	C	E				E	E	E			
3.9nF	392	C	C	C	C	C	C	C	E	E	E	E	E	E	E			
4.7nF	472	C	C	C	C	C	C	C	E	E	E	E	E	E	E			
5.6nF	562	C	C	C	C	C	C	C	E	E	E	E	E	E	E			
6.8nF	682	C	C	C	C	C	C	C	E	E	E	E	E	E	E			
8.2nF	822	C	C	C	C	C	C	C	E	E	E	E	E	E	E			
10nF	103	C	C	C	C	C	C	C	E	E	E	E	E	E	E	E	E	E
12nF	123	C		C	C	C	C	C	E	E	E	E	E	E	E	E	E	E
15nF	153	C		C	C	C	C	C	E	E	E	E	E	E	E	E	E	E
18nF	183	C		C	C	E	C	C	E	E	E	E	E	E	E	E	E	E
22nF	223	C		C	C	E	C	C	E	E	E	E	E	E	E	E	E	E
27nF	273	C		C	E	E	C	C	E	E	E	E	E	E	E	E	E	E
33nF	333			C	E		C	C	E	E	E	E	E	E	E	E	E	E
39nF	393			C	E		C	C	E	E	E	E	E	E	E	E	E	E
47nF	473			C	E		C	C	E	E	E	E	E	E	E	E	E	E
56nF	563			C	B		C	E	E	E	E	E	E	E	E	E	E	E
68nF	683			E	B		C	E	E	E	E	E	E	E	E	E	E	E
82nF	823			E	B		C	E	E	E	E	E	E	E	E	E	E	E
100nF	104			E	B		C	E	E	E	E	E	E	E	E	E	E	E
120nF	124						E	E		E	E	E	E	E	E	E	E	E
150nF	154						E	E		E	E	E	E			E	E	E
180nF	184						E	E		E	G	E	E			E	E	G
220nF	224						E	E		E	G	E	E			E	E	G
270nF	274							E		E	K	E	E			E	G	K
330nF	334									E	K		E			E	G	K
390nF	394									E	K					E	K	K
470nF	474							E		K	K					E	K	K
560nF	564									K	K					E	K	K
680nF	684									K	K					G	K	K
820nF	824									K	K					G	K	K
1uF	105							E		K	K					G	K	K
2.2uF	225									k	k					g	K	
4.7uF	475									k	k					K		
10uF	106									K	K					K		

DIELECTRIC		X7R																			
SIZE		0805		1206					1210				1808					1812				
CAP	CODE	250V	500V	250V	500V	1KV	2KV	2.5KV	250V	500V	1KV	2KV	250V	500V	1KV	2KV	3KV	250V	500V	1KV	2KV	3KV
150pF	151	C	C														G					
180pF	181	C	C														G					
220pF	221	C	C														G					
270pF	271	C	C	C	C	C	E	E									G				E	
330pF	331	C	C	C	C	C	E	E									G				E	
390pF	391	C	C	C	C	C	E	E									G				E	
470pF	471	C	C	C	C	C	E	E								E	G				E	
560pF	561	C	C	C	C	C	E	E								E	G				E	
680pF	681	C	C	C	C	C	E	E								E	G				E	
820pF	821	C	C	C	C	C	E	E								E	K				E	
1nF	102	C	C	C	C	C	E	E			E	E			E	E	K				E	G
1.2nF	122	C	C	C	C	C	E	G			E	E			E	G	K				E	K
1.5nF	152	C	C	C	C	C	E	G			E	E			E	G	K				E	K
1.8nF	182	C	C	C	C	E					E	E			E	G					E	K
2.2nF	222	C	C	E	E	E					E	G			E	G				E	E	K
2.7nF	272	C	C	E	E	E					E		E	E	E					E	G	K
3.3nF	332	C	C	E	E	E					E		E	E	E					E	G	
3.9nF	392	C	C	E	E	E			E	E	E		E	E	E					E	G	
4.7nF	472	C	C	E	E	E			E	E	E		E	E	E					E	G	
5.6nF	562	C	C	E	E	E			E	E	E		E	E	G					E	G	
6.8nF	682	C	C	E	E	E			E	E	E		E	E	G					E	G	
8.2nF	822	C	E	E	E	E			E	E	E		E	E	G					E	K	
10nF	103	C	E	E	E	E			E	E	E		E	E	G			E	E	E	K	
12nF	123	C		E	E				E	E	E		E	E	G			E	E	E		
15nF	153	C		E	E				E	E	E		E	E				E	E	E		
18nF	183	E		E	E				E	E	E		E	E				E	E	E		
22nF	223	E		E	E				E	E	G		E	E				E	E	E		
27nF	273	E		E	G				E	E	K		E	E				E	E	G		
33nF	333			E	G				E	E	K		E	E				E	E	G		
39nF	393			E	G				E	E			E	E				E	E	G		
47nF	473			E	G				E	E			E	E				E	E	G		
56nF	563			E	G				E				E					E	E			
68nF	683			E					E				E					E	E			
82nF	823			E					E				E					E	G			
100nF	104			E					E				E					E	G			
120nF	124								E				E					E	k			
150nF	154								E									E	k			
180nF	184								E									G	k			
220nF	224								E									G	k			
270nF	274																	K				
330nF	334																	K				
390nF	394																	K				
470nF	474																	K				
680nF	684																	K				
1uF	105																	K				

4 Specification and Test Method

<table>
<tr><th></th><th>Test item</th><th>Conditions</th><th>Requirements</th></tr>
<tr><td>1</td><td>Capacitance</td><td rowspan="2">The Capacitance and DF shall be measured at 25℃ with HP-4288A
NP0：C ≤ 1000 pF 1±0.2Vrm, f = 1 MHz
C > 1000 pF 1±0.2Vrm, f = 1 kHz
X7R/Y5V：
C≦10μF 1.0±0.2Vrm f = @ 1kHz
C > 10μF 0.5±0.2Vrm f = @ 120Hz</td><td>Within specified tolerance</td></tr>
<tr><td>2</td><td>Dissipation Factor (tan δ)</td><td>NP0：
C＜10pF DF=(30+7C)/100C(%),max 0.3%
C≧10pF DF≦0.1%
X7R：
<table>
<tr><th>Rated volt.</th><th>DF≦</th><th colspan="2">Exception of DF≦</th></tr>
<tr><td>≧50V</td><td>2.5%</td><td>3%</td><td>0603≧47nF</td></tr>
<tr><td>25V</td><td>3.5%</td><td>---</td><td>---</td></tr>
<tr><td>16V</td><td>3.5%</td><td>5%</td><td>0402≧33nF
0603≧150nF
0805≧680nF</td></tr>
<tr><td>10V</td><td>5.0%</td><td>---</td><td>---</td></tr>
<tr><td>6.3V</td><td>7.5%</td><td>---</td><td>---</td></tr>
</table>
Y5V：
<table>
<tr><th>Rated volt.</th><th>DF≦</th></tr>
<tr><td>25~250V</td><td>7%</td></tr>
<tr><td>16V</td><td>9%</td></tr>
<tr><td>10V</td><td>12.5%</td></tr>
</table></td></tr>
<tr><td>3</td><td>Insulation resistance</td><td>The IR shall be measured with HP-4339B at room temperature.
Vr (rated voltage) ≤ 500V
At Vr (rated voltage) for 1 minute
Vr (rated voltage)＞500V
At 500V for 1 minute</td><td>NP0：IR≧10GΩmin
X7R/Y5V: 10GΩmin. Or500Ω-F，whichever is smaller</td></tr>
<tr><td>4</td><td>Dielectric Strength</td><td>The withstanding voltage should be measured with Zentech 9072A.
Vr ≤ 500V at 2Vr for 5 seconds
LEAKAGE CURRENT < 0.3mA
500V≤ Vr ≤1000V at 1.5Vr for 5 seconds
LEAKAGE CURRENT < 0.3mA
Vr ＞1000V at 1.2Vr for 5 seconds
LEAKAGE CURRENT < 0.3mA</td><td>No breakdown
No flashover</td></tr>
<tr><td>5</td><td>Adhesion</td><td>A force of 5 N shall be applied to the line joining the terminations and in a plane parallel to the substrate time: 10 ± 1 s
 
</td><td>No visible damage</td></tr>
<tr><td>6</td><td>Bending Strength</td><td>Mounting in accordance with IEC 384 10, para 4.4 conditions: bending 1 mm at a rate of 1 mm/s
 
</td><td>No visible damage
NPO: ΔC/C within ±5 %
X7R: ΔC/C within ±10 %
Y5V: ΔC/C within ±30 %</td></tr>
</table>

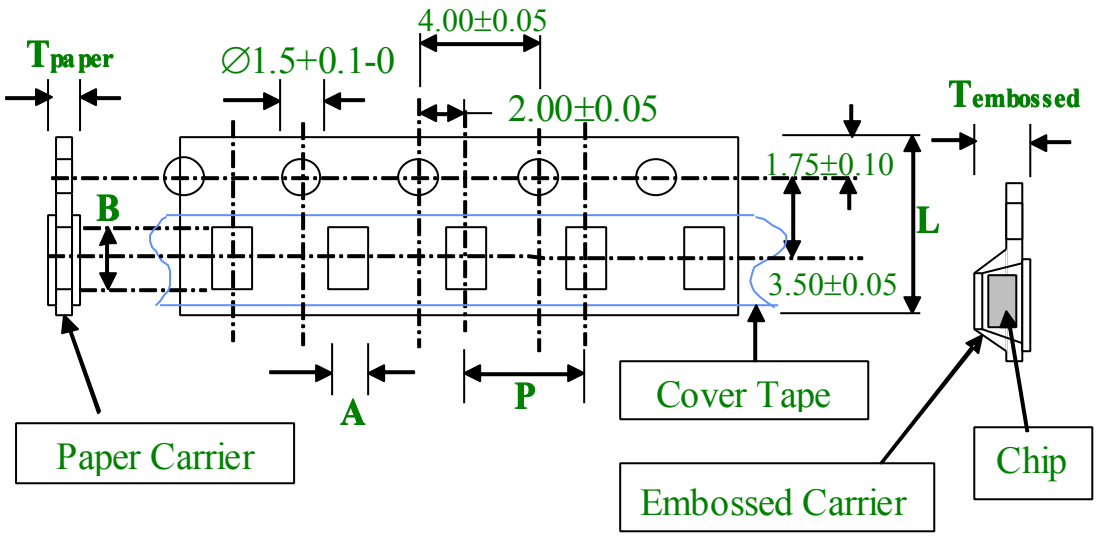
<table>
<tr><td>7</td><td>Resistance to soldering heat</td><td>Preheat the capacitor at 120℃ to 150℃ for 1 minute. Immerse the capacitor in an eutectic solder solution at 270±5℃ for 10±1seconds. After set it at room temperature for 24±2hours (temperature compensation type) or 48±4hours (high dielectric constant type), then measure.

*High dielectric constant type :
Initial measurement of X7R and Y5V.
Perform a heat treatment at 150±5℃ for one hour and then set it at room temperature for 48±4hours.
Perform the initial measurement.</td><td>
<table>
<tr><td>Dielectric</td><td>NP0</td><td>X7R</td><td>5YV</td></tr>
<tr><td>Appearance</td><td colspan="3">No defect</td></tr>
<tr><td>Capacitance Change</td><td>＜±2.5% or ＜±0.25pF</td><td>±7.5%</td><td>±20%</td></tr>
<tr><td>DF</td><td colspan="3">The same as No.2</td></tr>
<tr><td>IR</td><td colspan="3">More than 500Ω-F (whichever is smaller)</td></tr>
<tr><td>Dielectric Strength</td><td colspan="3">No failure</td></tr>
</table>
</td></tr>
<tr><td>8</td><td>Resistance to leaching</td><td>The capacitors are dipped into the solder at 260±5℃ for 30±1 seconds, and then check the soldering by measuring the areas covered with solder.</td><td>95% of the terminations are to be soldered evenly and continuously.</td></tr>
<tr><td>9</td><td>Solder ability of termination</td><td>1.Plating material：Pure Sn(MATTE TIN)
2.Zero hour test, and test after storage (20 to 24 months) in original atmosphere in normal atmosphere; un-mounted chips completely immersed for 2 ± 0.5 s in a solder bath of 235 ± 5℃.</td><td>95% of the termination is to be soldered evenly and continuously.</td></tr>
<tr><td>10</td><td>Rapid change of temperature</td><td>NPO/X7R: -55℃ to +125℃, 5 cycle
Y5V: -25℃ to +85℃, 5 cycle
Duration: 30 mins.
Recovery: 24 ± 2 hrs.</td><td>No visible damage after 24 h recovery
Class I NPO: ΔC/C ≤ 2.5 % or ± 0.25 pF
Class Ⅱ X7R: ΔC/C ≤ ±15 %
Y5V: ΔC/C ≤ ±20 %</td></tr>
<tr><td>11</td><td>Damp heat, steady state</td><td>500±12hours at 40±2℃;+1Ur
90 to 95 % RH</td><td>No visible damage after 24 ± 2 (NPO) or 48 ± 4 hours recovery
Class Ⅰ (NPO)
1. ΔC/C ± 5 % or 1 pF, whichever is greater
2. C<10pF；Q ≥ 200+10C
10≤C≤30pF；Q≥275+5/2C
C>30pF；Q≥350
3. IR ≥ 4000 MΩ or
RiCR≥ 40ΩF, whichever is less
Class Ⅱ (X7R)
1.ΔC/C within ± 15 %
2.tan δ ≤ 7%
3.R ≥ 2000 MΩ or
RiCR≥50ΩF, whichever is less
Class Ⅱ (Y5V)
1.ΔC/C within ± 30 %
2.50/25V: tan δ ≤ 9%
16V: tan δ ≤ 12.5%
10V: tan δ ≤ 15%
3.IR ≥ 2000 MΩ or
RiCR≥50ΩF, whichever is less</td></tr>
<tr><td>12</td><td>Endurance</td><td>For General Capacitors:
1000 hrs at maximum temperature
Vr (for general product) ＜500V
At 2Ur
Vr ≦500V～＜ 1000V
At 1. 3Ur
Vr ≧1000V
At 1.2Ur</td><td>No visible damage after 24 ± 2 (NPO) or 48 ± 4 hours recovery
Class 1 (NPO)
1. ΔC/C ± 2 % or 1 pF, whichever is greater
2. tan δ ≤ 2 x specified value
3. IR ≥ 4000 MΩ or RiCR ≥40ΩF, whichever is less
Class 2 (X7R)
1.ΔC/C within ± 15 %
2.tan δ ≤ 7%
3.IR ≥ 2000 MΩ or RiCR≥50ΩF,whichever is less
Class 2 (Y5V)
1.ΔC/C within ± 30 %
2.50/25V: tan δ ≤ 9%
16V: tan δ ≤ 12.5%
3.IR ≥ 2000 MΩ or RiCR ≥50ΩF, whichever is less</td></tr>
</table>

5 Packing

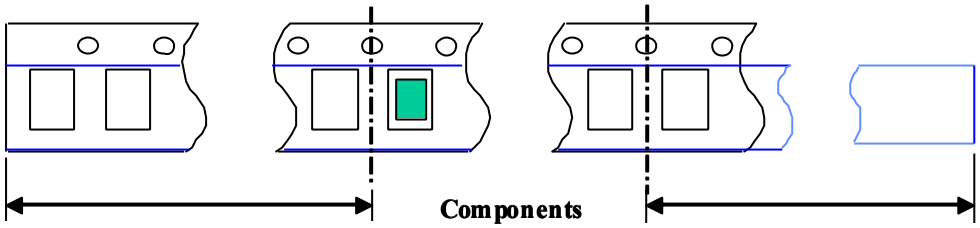
Paper Tape T≦1.1 mm

Embossed Tape T≦2.60 mm



All dimensions in mm

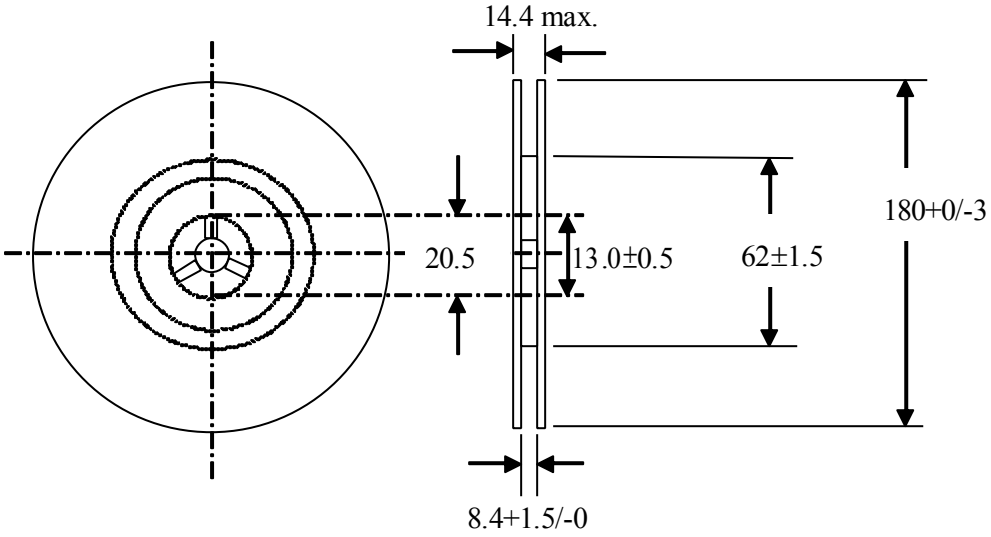
Size	Symbol					
	A	B	P	L	T(Paper)	T(Embossed)
0402	0.62±0.05	1.12±0.05	2.00±0.05	8.00±0.20	0.60±0.05	N/A
0603	1.10±0.10	1.90±0.10	4.00±0.10	8.00±0.20	1.00±0.05	N/A
0805	1.65±0.05	2.40±0.05	4.00±0.10	8.00±0.20	1.00±0.05	N/A
1206	2.00±0.10	3.50±0.10	4.00±0.10	8.00±0.20	1.00±0.05	Max.2.0
1210	2.80±0.20	3.70±0.20	4.00±0.10	8.00±0.20	N/A	Max.2.0
1808	2.50±0.30	4.90±0.30	4.00±0.10	12.0±0.20	N/A	Max.2.5
1812	3.60±0.30	4.90±0.30	8.00±0.10	12.0±0.20	N/A	Max.2.5



No Components, 180~220 mm sealed with cover tape

No Components, 220~260 mm

EIA Reel Dimension



All dimensions in mm

Standard Packing Quantity per Reel

Chip Size	Thickness(mm)	Code	Amount per reel	
			Paper	Embossed
0402	0.50±0.05	A	10K	—
0603	0.80±0.10	C	4K	—
0805	0.60±0.10	B	4K	—
	0.80±0.10	C	4K	—
	1.25±0.20	E	—	3K
1206	0.60±0.10	B	4K	—
	0.80±0.10	C	4K	—
	1.25±0.20	E	—	3K
	1.60±0.20	G	—	2K
1210	1.25±0.20	E	—	3K
	1.60±0.20	G	—	2K
	2.00±0.20	K	—	2K
1808	1.25±0.20	E	—	3K
	1.60±0.20	G	—	2K
	2.00±0.20	K	—	2K
1812	1.25±0.20	E	—	1K
	1.60±0.20	G	—	1K
	2.00±0.20	K	—	1K

6 Reference Data

6.1 Capacitor Classification

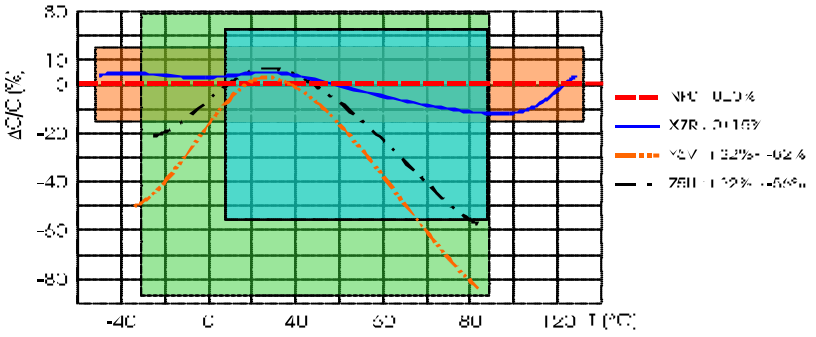
Multi-layer ceramic capacitors are available in wide range of characteristics. Electronic Industries Association (EIA) and the military have established categories to help divide the basic characteristics into more easily specified classes. The basic industry specification for ceramic capacitor is EIA specification RS-198 and as noted in the general section, it specifies temperature-compensating capacitors as class I capacitors. These are specified by the military under specification MIL-C-20. General-purpose capacitors with non-linear temperature coefficients are called Class II capacitors by EIA and specified by military under MIL-C-11015 and MIL-C-39014. The new high reliability military specification, MIL-C-123 covers both class I and class II dielectrics.

Class I — Class I capacitors or temperature-compensating capacitors are usually made from mixtures of titanates where barium titanate is normally not a major part of mix. They have predictable temperature coefficients and in general, do not have an aging characteristic. Thus they are the most stable capacitor available. Normally the T.C.s of Class I temperature-compensating capacitors are NP0 (±30 ppm/℃).

Class II — General-purpose ceramic capacitors are called Class II capacitors and have become extremely popular because of the high capacitance values available in very small size. These capacitors are ferroelectrics and vary in capacitance value under the influence of the environmental and electrical operating conditions. Class II capacitors are affected by temperature、voltage、 frequency and time. Temperature effects for Class II ceramic capacitors are exhibited as non-linear capacitance changes with temperature. Industry standards for Mid-K dielectrics, such as X7R and High-K dielectrics, such as Z5U.

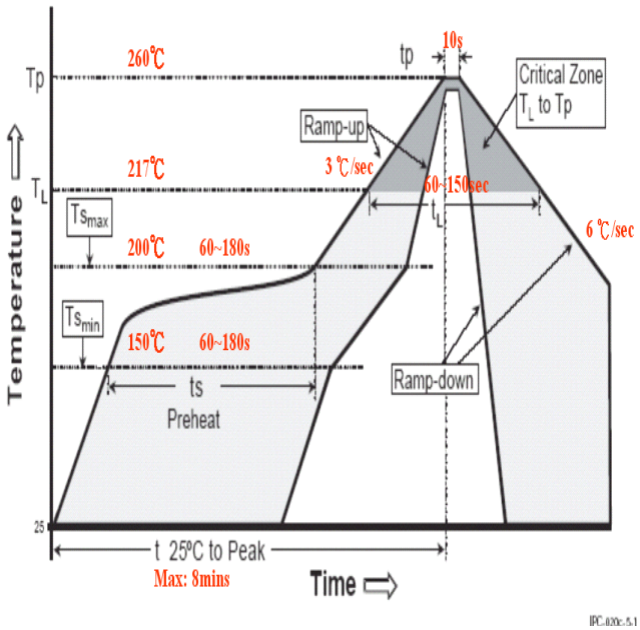
6.2 The Characterization of Materials

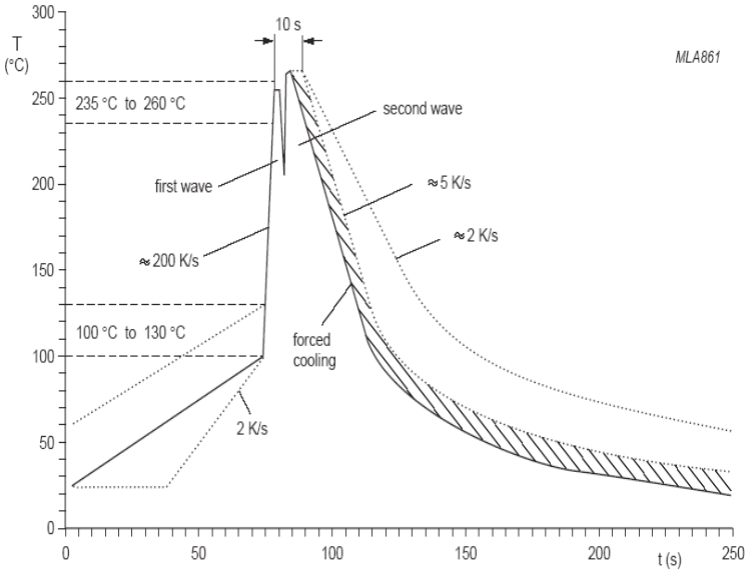
Designation	Class	Temperature Range (℃)	Temp. Characteristics
NPO(COG)	I	-55 ~ +125	± 30 ppm/℃
X7R	II	-55 ~ +125	± 15 %
Y5V	II	-25 ~ +85	-82 ~ +22 %



The T.C curve of each material (for reference)

6.3 Recommend IR reflow and wave soldering profile(Pb-Free)





Typical profile band of IR reflow **Typical profile band of wave soldering**