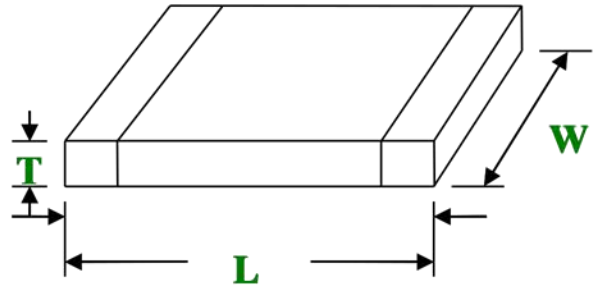
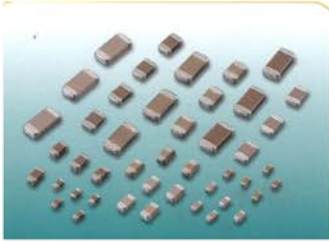


	CL	10	A	106	M	100	8	N	N	N	C																																																																
	1	2	3	4	5	6	7	8	9	10	11																																																																
1. SERIES CODE _____ CL=Multi layer Ceramic Capacitors																																																																											
2. SIZE CODE — inch(mm) _____ 02=01005(0402) 21=0805(2012) 43=1812(4532) 03=0201(0603) 31=1206(3216) 55=2220(5750) 05=0402(1005) 32=1210(3225) 10=0603(1608) 42=1808(4520)																																																																											
* 3. DIELECTRIC CODE _____																																																																											
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** 4. CAPACITANCE CODE _____ Capacitance expressed in pF. 2 significant digits plus number of zeros. example) 106=10 × 10 ⁶ =10000000pF For Values < 10pF, Letter R denotes decimal point example) 1R5=1.5pF																																																																											
5. TOLERANCE CODE _____ B=±0.1pF F=±1pF, ±1%* K=±10% C=±0.25pF G=±2% M=±20% D=±0.5pF J=±5% Z=+80/-20% *For Values ≤ 10pF, F=±1pF Values > 10pF, F=±1%																																																																											
6. RATED VOLTAGE CODE _____ 100=100V 200=200V 300=250V 400=500V 500=630V 102=1000V 202=2000V 302=3000V																																																																											
*** 7. THICKNESS CODE _____ 2=0.20mm A=0.65mm F=1.25mm L=3.20mm S=1.35mm 3=0.30mm C=0.85mm H=1.60mm M=1.15mm U=1.80mm 5=0.50mm D=1.00mm I=2.00mm P=1.15mm V=2.50mm 8=0.80mm E=1.10mm J=2.50mm Q=1.25mm Y=1.25mm 9=0.90mm																																																																											
8. INNER ELECTRODE / TERMINATION / PLATING CODE _____ A= Normal Product Pd / Ag / Ni barrier / Sn 100% N= Normal Product Ni / Cu / Ni barrier / Sn 100% G= Normal Product Cu / Cu / Ni barrier / Sn 100% L= Low profile Ni / Cu / Ni barrier / Sn 100% S= Normal Product Ni / Cu / Soft termination / Ni barrier / Sn 100%																																																																											
9. PRODUCT CODE _____																																																																											
N= Normal A= Array(2-element) B= Array(4-element) L= LICC J= SLIC																																																																											
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10. CONTROL CODE _____ N= Reserved for future use																																																																											
11. PACKAGING CODE _____																																																																											
B= Bulk P= Bulk Case C= Cardboard Tape, 7" Reel H= Cardboard Tape, 7" Reel(15,000ea)	O= Cardboard Tape, 10" Reel D= Cardboard Tape, 13" Reel(10,000ea) L= Cardboard Tape, 13" Reel(15,000ea)	E= Embossed Type, 7" Reel G= Embossed Type, 7" Reel(3,000ea) F= Embossed Type, 13" Reel S= Embossed Type, 10" Reel																																																																									

* Note : This catalog has only typical specifications because there is no space for detailed specifications.
Please approve our product specifications or transact the approval sheet for product specifications before ordering.

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	D
1210	3.2±0.15	2.50±0.20	1.25±0.20	E
			1.60±0.20	D
			2.00±0.20	K
			2.40±0.20	G
1808	4.60±0.30	2.00±0.30	1.25±0.20	E
			1.60±0.20	D
			2.00±0.20	K
1812	4.60±0.30	3.20±0.30	1.25±0.20	E
			1.60±0.20	D
			2.00±0.20	K
			2.40±0.20	G
			2.80±0.20	H
2220	5.70±0.40	5.00±0.40	1.25±0.20	E
			1.60±0.20	G
			2.00±0.20	K
			2.40±0.20	G
			2.80±0.20	H
2225	5.70±0.30	6.35±0.40	1.25±0.20	E
			1.60±0.20	D
			2.00±0.20	K
			2.40±0.20	G
			2.80±0.20	H

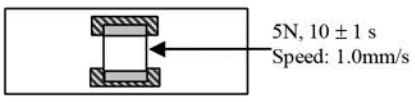
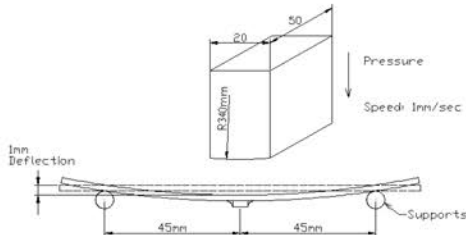
X7R/X5R Series

DIELECTRIC		X7R/X5R																															
SIZE		0402			0603			0805				1206				1210				1812				2220									
CAP	CODE	6.3V	10V	10V	25V	50V	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V	6.3V	16V	25V	35V	50V	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V		
1uF	105	A		C	C	E		C	E	E	E			D	D	D					K					K					K		
1.5uF	155							C	E	E	E		E	D	D	D					K					K					K		
2.2uF	225			C	C	C		C	C	E	E	E		E	D	D	D			K	K	K			D	K	K			D	D	K	
3.3uF	335							C	C	E	E	E		E	D	D	D			K	K	K			K	K	K			K	K	K	
4.7uF	475			C	C			C	C	E	E	E	E	E	D	D	D			K	K	K	K		K	K	K	G		K	K	K	G
10uF	106			C				C	C	E	E	E	E	E	D	D	D			K	K	K	K		K	K	K	G		K	K	K	G
22uF	226							C						E	E	D	D			K	G	G	G		G	G	G	G	G	G	G	G	G
47uF	476													E	E	D				K	G				G	G	G	G	G	G	G	G	G

Y5V Series

DIELECTRIC		Y5V																
SIZE		0402			0603				0805				1206					
CAP	CODE	10V	16V	25V	10V	16V	25V	50V	10V	16V	25V	50V	10V	16V	25V	50V		
10nF	103	A	A	A	C	C	C	C				C	C			C	C	C
15nF	153	A	A	A	C	C	C	C				C	C			C	C	C
22nF	223	A	A	A	C	C	C	C				C	C			C	C	C
33nF	333	A	A		C	C	C	C				C	C			C	C	C
47nF	473	A	A		C	C	C	C				C	C			C	C	C
68nF	683	A	A		C	C	C	C				C	C			C	C	C
100nF	104	A	A		C	C	C	C				C	C			C	C	C
150nF	154	A			C	C	C					C	C			C	C	C
180nF	184	A			C	C	C					C	C			C	C	C
220nF	224	A			C	C	C					C	C			C	C	C
330nF	334				C	C	C					C	C			C	C	C
470nF	474				C	C						C				C	C	C
680nF	684				C	C						E	C			C	C	C
820nF	824				C	C						E	C			C	E	
1uF	105				C	C						E	E			C	E	
1.5uF	155											E	E			C	E	
2.2uF	225											E				E	E	E
3.3uF	335											E				E	E	E
4.7uF	475											E				E	E	E
10uF	106											G				E		

4 Specification and Test Method

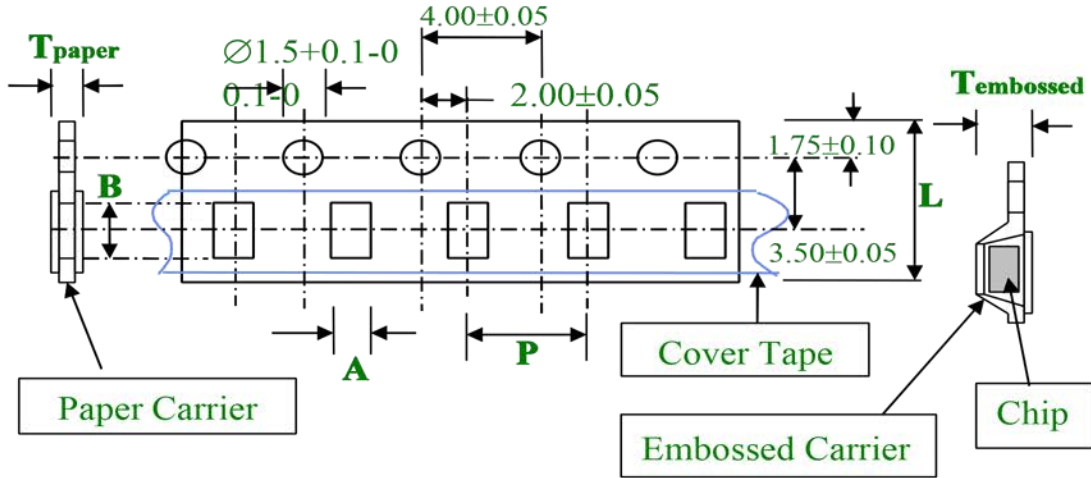
No	Test item	Conditions	Requirements																																
1	Capacitance		Within specified tolerance																																
2	Dissipation Factor (tan δ)	<p>The Capacitance and DF shall be measured at 25°C with HP-4288A</p> <p>NP0 : C ≤ 1000 pF 1±0.2V_{rm}, f = 1 MHz; C > 1000 pF 1±0.2V_{rm}, f = 1 kHz;</p> <p>X5R/ X7R/Y5V : C ≤ 10 μF 1.0±0.2V_{rm} f = @ 1kHz C > 10 μF 0.5±0.2V_{rm} f = @ 120Hz</p>	<p>NP0 :</p> <p>More than 30 pF: Q ≥ 1000 (DF ≤ 0.1%)</p> <p>Less than 30 pF: Q ≥ 400+20 C (Q=1/DF)</p> <p>X7R/X5R :</p> <table border="1"> <thead> <tr> <th>Rated volt.</th> <th>DF ≤</th> <th colspan="2">Exception of DF ≤</th> </tr> </thead> <tbody> <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> </tbody> </table> <p>Y5V :</p> <table border="1"> <thead> <tr> <th>Rated volt.</th> <th>DF ≤</th> </tr> </thead> <tbody> <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> </tbody> </table>	Rated volt.	DF ≤	Exception of DF ≤		≥ 50V	2.5%	3%	0603 ≥ 47nF	25V	3.5%	—	—	16V	3.5%	5%	0402 ≥ 33nF 0603 ≥ 150nF 0805 ≥ 680nF	10V	5.0%	—	—	6.3V	7.5%	—	—	Rated volt.	DF ≤	25-250V	7%	16V	9%	10V	12.5%
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16V	9%																																		
10V	12.5%																																		
3	Insulation resistance	<p>The IR shall be measured with HP-4339B at room temperature.</p> <p>V_r (rated voltage) ≤ 500V At V_r (rated voltage) for 1 minute V_r (rated voltage) > 500V At 500V for 1 minute</p>	RiCr ≥ 500Ω·F, whichever is smaller.																																
4	Dielectric Strength	<p>The withstanding voltage shall be measured with Zentech 9072A.</p> <p>V_r (rated voltage) ≤ 100V At 2.5V_r for 5 seconds V_r (rated voltage) ≅ 250V At 2V_r+100V for 5 seconds V_r (rated voltage) ≅ 500V At 1.5V_r for 5 seconds V_r (rated voltage) ≅ 1000V At 1.2V_r for 5 seconds</p>	<p>No breakdown</p> <p>No flashover</p>																																
5	Adhesion	<p>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</p> 	No visible damage																																
6	Bending Strength	<p>Mounting in accordance with IEC 384 10, para 4.4 conditions: bending 1 mm at a rate of 1 mm/s</p> 	<p>No visible damage</p> <p>NPO: ΔC/C within ±5 %</p> <p>X7R/X5R: ΔC/C within ±10 %</p> <p>Y5V: ΔC/C within ±30 %</p>																																

7	Resistance to soldering heat	<p>Preheat the capacitor at 120°C to 150°C for 1 minute. Immerse the capacitor in an eutectic solder solution at 270±5°C for 10±1seconds. After set it at room temperature for 24±2hours (temperature compensation type) or 48±4hours (high dielectric constant type), then measure.</p> <p>*High dielectric constant type : Initial measurement of X7R/X5R and Y5V. Perform a heat treatment at 150±5°C for one hour and then set it at room temperature for 48±4hours. Perform the initial measurement.</p>	<table border="1"> <tr> <td>Dielectric</td> <td>NP0</td> <td>X7R/ X5R</td> <td>Y5V</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>	Dielectric	NP0	X7R/ X5R	Y5V	Appearance	No defect			Capacitance Change	<±2.5% or <±0.25pF	±7.5%	±20%	DF	The same as No.2			IR	More than 500Ω-F (whichever is smaller)			Dielectric Strength	No failure		
Dielectric	NP0	X7R/ X5R	Y5V																								
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8	Resistance to leaching	The capacitors are dipped into the solder at 260±5°C for 30±1 seconds, and then check the soldering by measuring the areas covered with solder.	95% of the terminations are to be soldered evenly and continuously.																								
9	Solder ability of termination	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°C.	95% of the termination is to be soldered evenly and continuously.																								
10	Rapid change of temperature	<p>NPO/X7R: -55°C to +125°C, 5 cycle X5R: -55°C to +85°C, 5 cycle Y5V: -25°C to +85°C, 5 cycle Duration: 30 mins. Recovery: 24 ± 2 hrs.</p>	<p>No visible damage after 24 h recovery Class I NPO: ΔC/C ≤ 2.5 % or ± 0.25 pF Class II X7R/X5R: ΔC/C ≤ ±15 % Y5V: ΔC/C ≤ ±20 %</p>																								
11	Damp heat, steady state	500±12hours at 40±2°C; 90 to 95 % RH	<p>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/X5R) 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</p>																								
12	Endurance	<p>1000 h at maximum temperature Vr (rated voltage) ≤ 250V At 2×Vr Vr (rated voltage) = 500V At 1.5Vr Vr (rated voltage) > 500V At 1.2Vr C>0..1UF,At1.5Vr</p>	<p>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/X5R) 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</p>																								

5 Packing

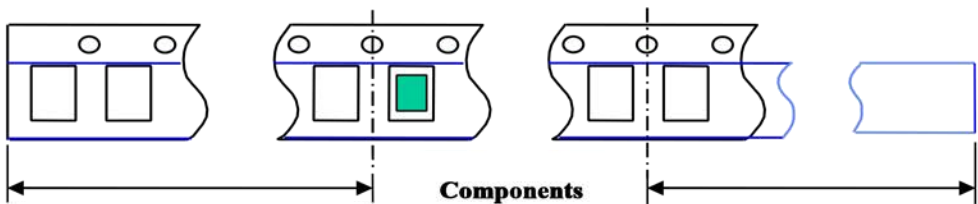
Paper Tape $T \leq 1.1 \text{ mm}$

Embossed Tape $T \leq 2.60 \text{ mm}$



All dimensions in mm

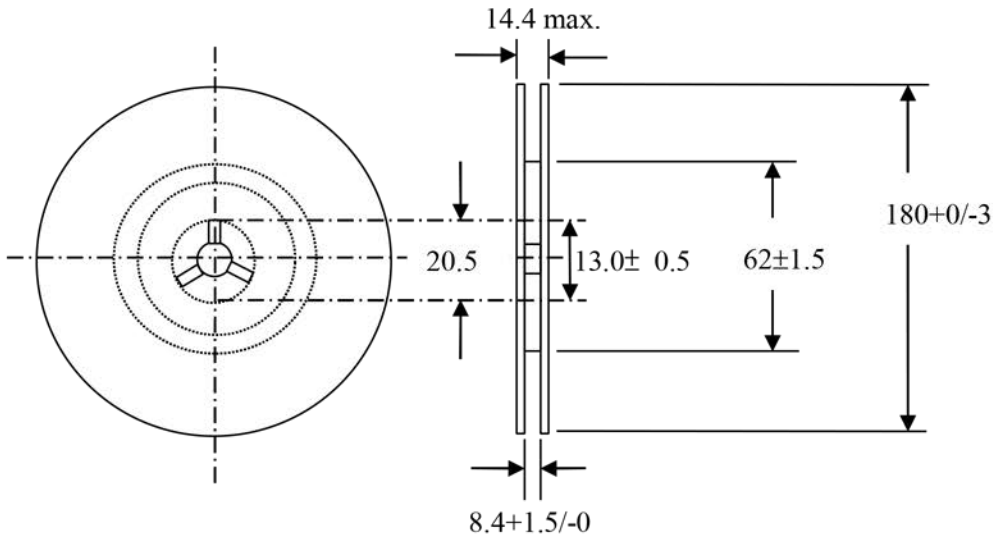
Size	Symbol					
	A	B	P	L	T(Paper)	T(Embossed)
0402	0.62±0.05	1.12±0.05	2.00±0.05	8.00±0.20	0.60±0.05	N/A
0603	1.10±0.10	1.90±0.10	4.00±0.10	8.00±0.20	1.00±0.05	N/A
0805	1.65±0.05	2.40±0.05	4.00±0.10	8.00±0.20	1.00±0.05	N/A
1206	2.00±0.10	3.50±0.10	4.00±0.10	8.00±0.20	1.00±0.05	Max.2.0
1210	2.80±0.20	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	—	2K/3K
1206	0.60±0.10	B	4K	—
	0.80±0.10	C	4K	—
	1.25±0.20	E	—	2K/3K
	1.60±0.20	D	—	2K
1210	1.25±0.20	E	—	2K/3K
	1.60±0.20	D	—	2K
	2.00±0.20	K	—	2K
1808	1.25±0.20	E	—	2K/3K
	1.60±0.20	D	—	2K
	2.00±0.20	K	—	2K
1812/2220/2225	1.25±0.20	E	—	1K
	1.60±0.20	D	—	1K
	2.00±0.20	K	—	1K
	2.40±0.20	G	—	700PCS
	2.80±0.20	H	—	500PCS

6 Reference Data

6.1 Capacitor Classification

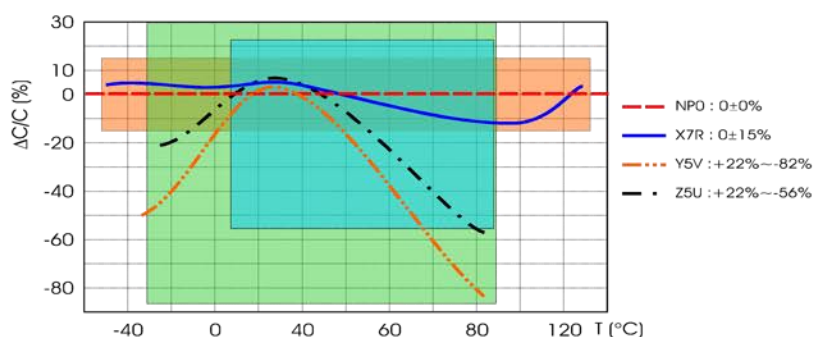
Multi-layer ceramic capacitors are available in wide range of characteristics. Electronic Industries Association (EIA) and the military have established categories to help divide the basic characteristics into more easily specified classes. The basic industry specification for ceramic capacitor is EIA 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 ($\pm 30 \text{ ppm}/^\circ\text{C}$).

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/X5R and High-K dielectrics, such as Z5U.

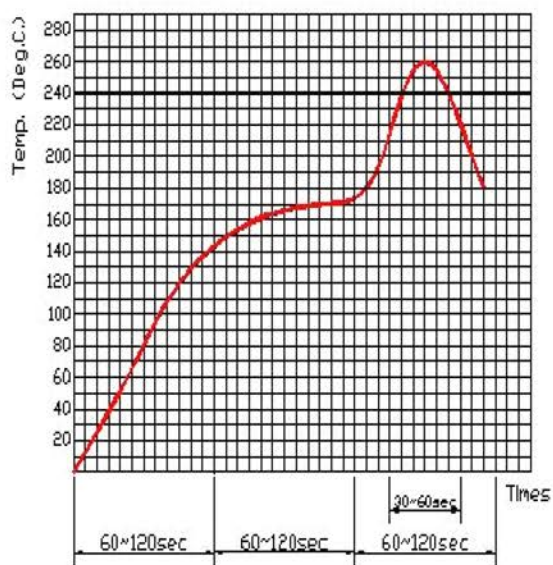
6.2 The Characterization of Materials

Designation	Class	Temperature Range ($^\circ\text{C}$)	Temp. Characteristics
NPO(COG)	I	-55 ~ +125	$\pm 30 \text{ ppm}/^\circ\text{C}$
X7R	II	-55 ~ +125	$\pm 15 \%$
X5R	II	-55 ~ +85	$\pm 15 \%$
Y5V	II	-25 ~ +85	-82 ~ +22 %

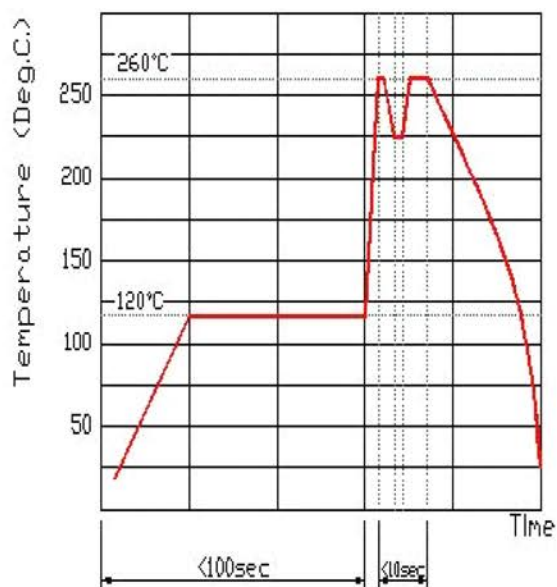


The T.C curve of each material (for reference)

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



Typical profile band of IR reflow



Typical profile band of wave soldering