

1. DESCRIPTION

MLCC consists of a conducting material and electrodes. To manufacture a chip-type SMT and achieve miniaturization, high density and high efficiency, ceramic condensers are used.

WTC high capacitance MLCC offers low ESR and excellent frequency characteristics to be suited for coupling and decoupling applications in circuit. The high dielectric constant material X7R, X5R and Y5V are used for this series product.

2. FEATURES

- a. Small size with high capacitance.
- b. Capacitor with lead-free termination (pure Tin).

3. APPLICATIONS

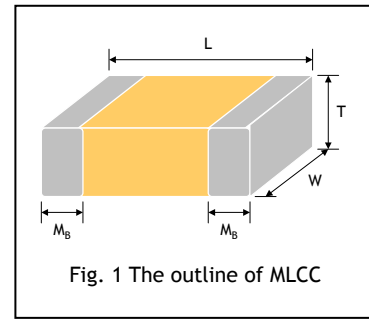
- a. Digital circuit coupling or decoupling applications.
- b. For high frequency and high-density type power suppliers.
- c. For bypassing.

4. HOW TO ORDER

<u>MA</u>	<u>1206</u>	<u>YV</u>	-	<u>106</u>	<u>Z</u>	-	<u>100</u>	<u>ER</u>	<u>G</u>
<u>PDC Family</u>	<u>Size</u> Inch (mm) 0402 (1005) 0603 (1608) 0805 (2012) 1206 (3216) 1210 (3225) 1808 (4520) 1812 (4532)	<u>Dielectric</u> XR: X7R or X5R YV: Y5V		<u>Capacitance</u> Two significant digits followed by no. of zeros. And R is in place of decimal point. eg.: 106=10x10 ⁶ =10μF	<u>Tolerance</u> K =±10% M =±20% Z =-20/+80%		<u>Rated voltage</u> Two significant digits followed by no. of zeros. And R is in place of decimal point. 6R3 =6.3 VDC 100 =10 VDC 160 =16 VDC 250 =25 VDC 500 =50 VDC	<u>Packaging</u> ER: Tape and Reel, Embossed Tape PR: Tape and Reel, Paper Tape No Code: Bulk	<u>Control Code</u> G: RoHS compliant

5. EXTERNAL DIMENSIONS

Size Inch (mm)	L (mm)	W (mm)	Tmax (mm)	M _b (mm)
0402 (1005)	1.00±0.05	0.50±0.05	0.55	0.25 +0.05/-0.10
0603 (1608)	1.60±0.10	0.80±0.10	0.87	0.40±0.15
	1.60+0.15/-0.10	0.80+0.15/-0.10	0.95	
0805 (2012)	2.00±0.15	1.25±0.10	0.90	0.50±0.20
			1.35	
	2.00±0.20	1.25±0.20	1.45	
1206 (3216)	3.20±0.15	1.60±0.15	1.05	0.60±0.20
			1.35	
	3.20±0.20	1.60±0.20	1.80	
			1.40	
	3.20+0.30/-0.10	1.60+0.30/-0.10	1.90	
1210 (3225)	3.20±0.30	2.50±0.20	1.05	0.75±0.25
			1.35	
	3.20±0.40	2.50±0.30	1.80	
			2.20	
1812 (4532)	4.50±0.40	3.20±0.30	2.80	0.75±0.25
			1.25	
			2.20	
			3.10	



Reflow soldering only is recommended if the thickness is thicker than 1.05mm except 0402

6. GENERAL ELECTRICAL DATA

Dielectric	X7R	X5R	Y5V
Size	0402, 0603, 0805, 1206, 1210, 1812		
Capacitance range*	100nF to 10μF	100nF to 100μF	150nF to 100μF
Capacitance tolerance	K (±10%), M (±20%)		Z (-20/+80%)
Rated voltage (WVDC)	6.3V, 10V, 16V, 25V, 50V		
Tan δ*	Note 1		
Insulation resistance at Ur	RxC≥500ΩxF		
Operating temperature	-55 to +125 °C	-55 to +85 °C	-25 to +85 °C
Capacitance characteristic	±15%		+30/-80%
Termination	Ni/Sn (lead-free termination)		

* Measured at 1.0±0.2Vrms, 1.0kHz±10% for C≤10μF; 0.5±0.2Vrms, 120Hz±20% for C>10μF, 30-70% related humidity, 25 °C ambient temperature for X7R, X5R and at 20 °C for Y5V.

* Note 1

Rated vol.	D.F.	Exception of D.F.
≥50V	≤2.5%	≤3% 0603≥0.047μF; 0805≥0.18μF; 1206≥0.47μF
25V	≤3.5%	≤5% 0805≥1μF; 1210≥10μF
		≤7% 0402≥0.10μF; 0603≥0.33μF; 0805≥2.2uF; 1206≥4.7uF
		≤10% 0603≥0.68uF; 0805≥4.7uF; 1206≥6.8uF
16V	≤3.5%	≤5% 0402≥0.033μF; 0603≥0.15μF; 0805≥0.68μF; 1206≥2.2μF; 1210≥4.7uF
		≤10% 0603≥0.68uF; 0805≥2.2uF; 1206≥6.8uF; 1210≥22μF
10V	≤5.0%	≤10% 0603≥1μF; 0805≥2.2μF; 1206≥6.8uF; 1210≥22μF
6.3V	≤10%	≤15.0% 0603≥10μF; 0805≥10μF; 1210≥100μF

Y5V

Rated vol.	D.F.	Exception of D.F.
≥50V	≤5.0%	≤7% 0603≥0.1uF; 0805≥0.47μF
35V	≤7%	---
25V	≤5.0%	≤7% 0805≥0.33μF; 1206≥1μF; 1210≥4.7μF
		≤9% 0402≥0.068μF; 0603≥0.47μF 1206≥4.7uF
16V (C<1.0μF)	≤7.0%	≤9% 0402≥0.068μF; 0603≥0.68μF
16V (C≥1.0μF)	≤9.0%	≤12.5% 0805≥4.7μF; 1206≥10μF; 1210≥22μF; 1812≥47μF
10V	≤12.5%	---
6.3V	≤20%	---

7. CAPACITANCE RANGE

7-1 X7R Dielectric

DIELECTRIC		X7R																							
SIZE		0402				0603				0805			1206					1210				1812			
RATED VOLTAGE (VDC)		10	6.3	10	16	25	50	10	16	25	6.3	10	16	25	50	10	16	25	50	10	16	25	50		
Capacitance	0.10µF (104)																								
	0.15µF (154)																								
	0.22µF (224)																								
	0.33µF (334)																								
	0.47µF (474)																								
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	4.7µF (475)																								
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	10µF (106)																								
22µF (226)																									

7-2 X5R Dielectric

DIELECTRIC		X5R																		
SIZE		0402			0603				0805				1206				1210			
RATED VOLTAGE (VDC)		6.3	10	16	6.3	10	16	25	6.3	10	16	25	6.3	10	16	25	6.3	10	16	25
Capacitance	0.027µF (273)																			
	0.033µF (333)																			
	0.039µF (393)																			
	0.047µF (473)																			
	0.056µF (563)																			
	0.068µF (683)																			
	0.082µF (823)																			
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22µF (226)																				
47µF (476)																				
100µF (107)																				

7-3 Y5V Dielectric

DIELECTRIC		Y5V									
SIZE		0402		0603				0805			
RATED VOLTAGE (VDC)		6.3	10	6.3	10	16	25V	10	16	25	50
Capacitance	0.15μF (154)										
	0.22μF (224)										
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22μF (226)											

DIELECTRIC		Y5V																
SIZE		1206					1210					1812						
RATED VOLTAGE (VDC)		6.3	10	16	25	35	50	6.3	10	16	25	35	50	6.3	10	16	25	50
Capacitance	1.0μF (105)																	
	1.5μF (155)																	
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8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

No.	Item	Test Condition	Requirements																																																																
1.	Visual and Mechanical	---	* No remarkable defect. * Dimensions to conform to individual specification sheet.																																																																
2.	Capacitance	Cap \leq 10 μ F, 1.0 \pm 0.2Vrms, 1kHz \pm 10%	* Shall not exceed the limits given in the detailed spec.																																																																
3.	Q/ D.F. (Dissipation Factor)	Cap $>$ 10 μ F, 0.5 \pm 0.2Vrms, 120Hz \pm 20%	X7R, X5R: <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F.</th> <th colspan="2">Exception of D.F.</th> </tr> </thead> <tbody> <tr> <td>\geq50V</td> <td>\leq2.5%</td> <td>\leq3%</td> <td>0603\geq0.047 μ F; 0805\geq0.18 μ F, 1206\geq0.47 μ F</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">\leq3.5%</td> <td>\leq5%</td> <td>0805\geq1 μ F; 1210\geq10 μ F</td> </tr> <tr> <td>\leq7%</td> <td>0402\geq0.10 μ F; 0603\geq0.33 μ F; 0805\geq2.2μF; 1206\geq4.7μF</td> </tr> <tr> <td>\leq10%</td> <td>0603\geq0.68μF;0805\geq4.7μF;1206\geq6.8 μ F</td> </tr> <tr> <td rowspan="2">16V</td> <td rowspan="2">\leq3.5%</td> <td>\leq5%</td> <td>0402\geq0.033 μ F; 0603\geq0.15 μ F; 0805\geq0.68 μ F; 1206\geq2.2 μ F; 1210\geq4.7μF</td> </tr> <tr> <td>\leq10%</td> <td>0603\geq0.68μF;0805\geq2.2μF; 1206\geq6.8μF;1210\geq22 μ F</td> </tr> <tr> <td>10V</td> <td>\leq5.0%</td> <td>\leq10%</td> <td>0603\geq1 μ F; 0805\geq2.2 μ F; 1206\geq6.8μF; 1210\geq22 μ F</td> </tr> <tr> <td>6.3V</td> <td>\leq10%</td> <td>\leq15.0%</td> <td>0603\geq10 μ F;0805\geq10 μ F; 1210\geq100 μ F</td> </tr> </tbody> </table> Y5V: <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F.</th> <th colspan="2">Exception of D.F.</th> </tr> </thead> <tbody> <tr> <td>\geq50V</td> <td>\leq5.0%</td> <td>\leq7%</td> <td>0603\geq0.1μF; 0805\geq0.47μF</td> </tr> <tr> <td>35V</td> <td>\leq7%</td> <td>---</td> <td>---</td> </tr> <tr> <td rowspan="2">25V</td> <td rowspan="2">\leq5.0%</td> <td>\leq7%</td> <td>0805\geq0.33μF; 1206\geq1μF; 1210\geq4.7μF</td> </tr> <tr> <td>\leq9%</td> <td>0402\geq0.068μF;0603\geq0.47μF;1206\geq4.7μF</td> </tr> <tr> <td>16V (C$<$1.0μF)</td> <td>\leq7.0%</td> <td>\leq9%</td> <td>0402\geq0.068μF; 0603\geq0.68μF</td> </tr> <tr> <td>16V (C\geq1.0μF)</td> <td>\leq9.0%</td> <td>\leq12.5%</td> <td>0805\geq4.7μF; 1206\geq10μF;1210\geq22μF 1812\geq47μF</td> </tr> <tr> <td>10V</td> <td>\leq12.5%</td> <td>---</td> <td>---</td> </tr> <tr> <td>6.3V</td> <td>\leq20%</td> <td>---</td> <td>--</td> </tr> </tbody> </table>	Rated vol.	D.F.	Exception of D.F.		\geq 50V	\leq 2.5%	\leq 3%	0603 \geq 0.047 μ F; 0805 \geq 0.18 μ F, 1206 \geq 0.47 μ F	25V	\leq 3.5%	\leq 5%	0805 \geq 1 μ F; 1210 \geq 10 μ F	\leq 7%	0402 \geq 0.10 μ F; 0603 \geq 0.33 μ F; 0805 \geq 2.2 μ F; 1206 \geq 4.7 μ F	\leq 10%	0603 \geq 0.68 μ F;0805 \geq 4.7 μ F;1206 \geq 6.8 μ F	16V	\leq 3.5%	\leq 5%	0402 \geq 0.033 μ F; 0603 \geq 0.15 μ F; 0805 \geq 0.68 μ F; 1206 \geq 2.2 μ F; 1210 \geq 4.7 μ F	\leq 10%	0603 \geq 0.68 μ F;0805 \geq 2.2 μ F; 1206 \geq 6.8 μ F;1210 \geq 22 μ F	10V	\leq 5.0%	\leq 10%	0603 \geq 1 μ F; 0805 \geq 2.2 μ F; 1206 \geq 6.8 μ F; 1210 \geq 22 μ F	6.3V	\leq 10%	\leq 15.0%	0603 \geq 10 μ F;0805 \geq 10 μ F; 1210 \geq 100 μ F	Rated vol.	D.F.	Exception of D.F.		\geq 50V	\leq 5.0%	\leq 7%	0603 \geq 0.1 μ F; 0805 \geq 0.47 μ F	35V	\leq 7%	---	---	25V	\leq 5.0%	\leq 7%	0805 \geq 0.33 μ F; 1206 \geq 1 μ F; 1210 \geq 4.7 μ F	\leq 9%	0402 \geq 0.068 μ F;0603 \geq 0.47 μ F;1206 \geq 4.7 μ F	16V (C $<$ 1.0 μ F)	\leq 7.0%	\leq 9%	0402 \geq 0.068 μ F; 0603 \geq 0.68 μ F	16V (C \geq 1.0 μ F)	\leq 9.0%	\leq 12.5%	0805 \geq 4.7 μ F; 1206 \geq 10 μ F;1210 \geq 22 μ F 1812 \geq 47 μ F	10V	\leq 12.5%	---	---	6.3V	\leq 20%	---	--
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4.	Dielectric Strength	* To apply voltage (\leq 50V) 250%. * Duration: 1 to 5 sec. * Charge and discharge current less than 50mA.	* No evidence of damage or flash over during test.																																																																
5.	Insulation Resistance	To apply rated voltage for max. 120 sec.	\geq 10G Ω or Rx $C \geq$ 500 Ω -F whichever is smaller. Class II (X5R, X6S, X7R, Y5V) <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>Insulation Resistance</th> </tr> </thead> <tbody> <tr> <td>10V: 0603\geq0.47μF; 0805\geq2.2 μ F; 1206\geq6.8μF;</td> <td rowspan="2">100 Ω-F</td> </tr> <tr> <td>6.3V</td> </tr> </tbody> </table>	Rated voltage	Insulation Resistance	10V: 0603 \geq 0.47 μ F; 0805 \geq 2.2 μ F; 1206 \geq 6.8 μ F;	100 Ω -F	6.3V																																																											
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7.	Adhesive Strength of Termination	* Pressurizing force : 5N (\leq 0603) and 10N ($>$ 0603) * Test time: 10 \pm 1 sec.	* No remarkable damage or removal of the terminations.																																																																
8.	Vibration Resistance	* Vibration frequency: 10-55 Hz/min. * Total amplitude: 1.5mm * Test time: 6 hrs. (Two hrs each in three mutually perpendicular directions.)	* No remarkable damage. * Cap change and Q/D.F.: To meet initial spec.																																																																
9.	Solderability	* Solder temperature: 235 \pm 5 $^{\circ}$ C * Dipping time: 2 \pm 0.5 sec.	95% min. coverage of all metalized area.																																																																
10.	Bending Test	* The middle part of 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 \pm 1 sec. * Measurement to be made after keeping at room temp. for 24 \pm 2 hrs.	* No remarkable damage. * Cap change : X7R, X5R: within \pm 12.5% Y5V: within \pm 30% (This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.)																																																																

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS (Cont.)

No.	Item	Test Condition	Requirements																																														
11.	Resistance to Soldering Heat	<p>* Solder temperature: 270±5°C</p> <p>* Dipping time: 10±1 sec</p> <p>* Preheating: 120 to 150°C for 1 minute before immerse the capacitor in a eutectic solder.</p> <p>* Before initial measurement (Class II only): Perform 150+0/-10°C for 1 hr and then set for 48±4 hrs at room temp.</p> <p>* Measurement to be made after keeping at room temp. for 48±4 hrs.</p>	<p>* No remarkable damage.</p> <p>* Cap change: X7R, X5R: within ±7.5% Y5V: within ±20%</p> <p>* Q/D.F., I.R. and dielectric strength: To meet initial requirements.</p> <p>* 25% max. leaching on each edge.</p>																																														
12.	Temperature Cycle	<p>* Conduct the five cycles according to the temperatures and time.</p> <table border="1"> <thead> <tr> <th>Step</th> <th>Temp. (°C)</th> <th>Time (min.)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Min. operating temp. +0/-3</td> <td>30±3</td> </tr> <tr> <td>2</td> <td>Room temp.</td> <td>2-3</td> </tr> <tr> <td>3</td> <td>Max. operating temp. +3/-0</td> <td>30±3</td> </tr> <tr> <td>4</td> <td>Room temp.</td> <td>2-3</td> </tr> </tbody> </table> <p>* Before initial measurement (Class II only): Perform 150+0/-10°C for 1 hr and then set for 48±4 hrs at room temp.</p> <p>* Measurement to be made after keeping at room temp. for 48±4 hrs.</p>	Step	Temp. (°C)	Time (min.)	1	Min. operating temp. +0/-3	30±3	2	Room temp.	2-3	3	Max. operating temp. +3/-0	30±3	4	Room temp.	2-3	<p>* No remarkable damage.</p> <p>* Cap change : X7R, X5R: within ±7.5% Y5V: within ±20%</p> <p>* Q/D.F., I.R. and dielectric strength: To meet initial requirements.</p>																															
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13.	Humidity (Damp Heat) Steady State	<p>* Test temp.: 40±2°C</p> <p>* Humidity: 90-95% RH</p> <p>* Test time: 500+24/-0hrs.</p> <p>* Measurement to be made after keeping at room temp. for 48±4 hrs.</p>	<p>* No remarkable damage.</p> <p>* Cap change: X7R, X5R: ≥10V, within ±12.5%; 6.3V, within ±25% Y5V: ≥10V, within ±30%; 6.3V, within +30/-40%</p> <p>* Q/D.F. value: X7R, X5R:</p> <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F.</th> <th>Exception of D.F.</th> </tr> </thead> <tbody> <tr> <td>≥50V</td> <td>≤3.0%</td> <td>≤6.0% 0603≥0.047μF; 0805≥0.18μF; 1206≥0.47μF</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">≤5.0%</td> <td>≤7.0% 0402 0.10μF; 1206 4.7μF</td> </tr> <tr> <td>≤10.0% 0805≥1μF; 1210≥10μF;</td> </tr> <tr> <td>≤14.0% 0603≥0.33 μF; 1206≥10μF</td> </tr> <tr> <td rowspan="2">16V</td> <td rowspan="2">≤5.0%</td> <td>≤10.0% 0402≥0.033μF; 0603≥0.15μF; 0805≥0.68μF; 1206≥2.2μF; 1210≥4.7μF</td> </tr> <tr> <td>≤15.0% 1210≥22μF</td> </tr> <tr> <td>10V</td> <td>≤7.5%</td> <td>≤15.0% 0402≥0.056μF; 0603≥0.33μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥22μF</td> </tr> <tr> <td>6.3V</td> <td>≤15.0%</td> <td>≤30.0% 0603≥10μ; 0805≥10μF; 1210≥100μF</td> </tr> </tbody> </table> <p>Y5V:</p> <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F.</th> <th>Exception of D.F.</th> </tr> </thead> <tbody> <tr> <td>≥50V</td> <td>≤7.5%</td> <td>---</td> </tr> <tr> <td>35V</td> <td>≤10%</td> <td>---</td> </tr> <tr> <td rowspan="2">25V</td> <td rowspan="2">≤7.5%</td> <td>≤10.0% 0402≥0.047uF; 0603≥0.1μF; 0805≥0.33μF; 1206≥1μF; 1210≥4.7μF</td> </tr> <tr> <td>≤12.5% 0402≥0.068μF; 0603≥0.47μF</td> </tr> <tr> <td>16V (C<1.0μF)</td> <td>≤10.0%</td> <td>≤12.5% 0402≥0.068μF; 0603≥0.68μF</td> </tr> <tr> <td>16V (C≥1.0μF)</td> <td>≤12.5%</td> <td>≤20% 0805≥4.7μF; 1206≥10μF; 1210≥22μF; 1812≥47μF</td> </tr> <tr> <td>10V</td> <td>≤15.0%</td> <td>---</td> </tr> <tr> <td>6.3V</td> <td>≤30%</td> <td>---</td> </tr> </tbody> </table> <p>* I.R.: ≥10V, ≥1GΩ or RxC≥500-F whichever is smaller. 6.3V, RxC≥10Ω-F</p>	Rated vol.	D.F.	Exception of D.F.	≥50V	≤3.0%	≤6.0% 0603≥0.047μF; 0805≥0.18μF; 1206≥0.47μF	25V	≤5.0%	≤7.0% 0402 0.10μF; 1206 4.7μF	≤10.0% 0805≥1μF; 1210≥10μF;	≤14.0% 0603≥0.33 μF; 1206≥10μF	16V	≤5.0%	≤10.0% 0402≥0.033μF; 0603≥0.15μF; 0805≥0.68μF; 1206≥2.2μF; 1210≥4.7μF	≤15.0% 1210≥22μF	10V	≤7.5%	≤15.0% 0402≥0.056μF; 0603≥0.33μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥22μF	6.3V	≤15.0%	≤30.0% 0603≥10μ; 0805≥10μF; 1210≥100μF	Rated vol.	D.F.	Exception of D.F.	≥50V	≤7.5%	---	35V	≤10%	---	25V	≤7.5%	≤10.0% 0402≥0.047uF; 0603≥0.1μF; 0805≥0.33μF; 1206≥1μF; 1210≥4.7μF	≤12.5% 0402≥0.068μF; 0603≥0.47μF	16V (C<1.0μF)	≤10.0%	≤12.5% 0402≥0.068μF; 0603≥0.68μF	16V (C≥1.0μF)	≤12.5%	≤20% 0805≥4.7μF; 1206≥10μF; 1210≥22μF; 1812≥47μF	10V	≤15.0%	---	6.3V	≤30%	---
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8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS (Cont.)

No.	Item	Test Condition	Requirements																																																																		
14.	Humidity (Damp Heat) Load	<ul style="list-style-type: none"> * Test temp.: 40±2°C * Humidity: 90-95%RH * Test time: 500+24/-0 hrs. * To apply voltage : rated voltage. * Measurement to be made after keeping at room temp. for 48±4 hrs. 	<ul style="list-style-type: none"> * No remarkable damage. * Cap change: X7R, X5R: ≥10V, within ±12.5%; 6.3V, within ±25% Y5V: ≥10V, within ±30%; 6.3V, within +30/-40% * Q/D.F. value: X7R, X5R: <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F.</th> <th colspan="2">Exception of D.F.</th> </tr> </thead> <tbody> <tr> <td>≥50V</td> <td>≤3.0%</td> <td>≤6.0%</td> <td>0603≥0.047μF; 0805≥0.18μF; 1206≥0.47μF</td> </tr> <tr> <td rowspan="2">25V</td> <td rowspan="2">≤5.0%</td> <td>≤7.0%</td> <td>0402 0.10μF; 1206 4.7μF</td> </tr> <tr> <td>≤10.0%</td> <td>0805≥1μF; 1210≥10μF;</td> </tr> <tr> <td rowspan="2">16V</td> <td rowspan="2">≤5.0%</td> <td>≤14.0%</td> <td>0603≥0.33μF; 1206≥10μF</td> </tr> <tr> <td>≤10.0%</td> <td>0402≥0.033μF; 0603≥0.15μF;</td> </tr> <tr> <td rowspan="2">10V</td> <td rowspan="2">≤7.5%</td> <td>≤15.0%</td> <td>0805≥0.68μF; 1206≥2.2μF; 1210≥4.7μF</td> </tr> <tr> <td>≤15.0%</td> <td>1210≥22μF</td> </tr> <tr> <td>6.3V</td> <td>≤15.0%</td> <td>≤30.0%</td> <td>0402≥0.056μF; 0603≥0.33μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥22μF</td> </tr> <tr> <td>6.3V</td> <td>≤15.0%</td> <td>≤30.0%</td> <td>0603≥10μF ;0805≥10μF; 1210≥100μF</td> </tr> </tbody> </table> <p>Y5V:</p> <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F.</th> <th colspan="2">Exception of D.F.</th> </tr> </thead> <tbody> <tr> <td>≥50V</td> <td>≤7.5%</td> <td>---</td> <td>---</td> </tr> <tr> <td>35V</td> <td>≤10%</td> <td>---</td> <td>---</td> </tr> <tr> <td rowspan="2">25V</td> <td rowspan="2">≤7.5%</td> <td>≤10.0%</td> <td>0402≥0.047uF;0603≥0.1μF; 0805≥0.33μF</td> </tr> <tr> <td>≤12.5%</td> <td>1206≥1μF; 1210≥4.7μF</td> </tr> <tr> <td rowspan="2">16V (C<1.0μF)</td> <td rowspan="2">≤10.0%</td> <td>≤12.5%</td> <td>0402≥0.068μF; 0603≥0.68μF</td> </tr> <tr> <td>≤20%</td> <td>0805≥4.7μF; 1206≥10μF; 1210≥22μF; 1812≥47μF</td> </tr> <tr> <td>10V</td> <td>≤15.0%</td> <td>---</td> <td>---</td> </tr> <tr> <td>6.3V</td> <td>≤30%</td> <td>---</td> <td>---</td> </tr> </tbody> </table> <ul style="list-style-type: none"> * I.R.: ≥10V, ≥500MΩ or RxC≥25Ω-F whichever is smaller. 6.3V, RxC≥5Ω-F 	Rated vol.	D.F.	Exception of D.F.		≥50V	≤3.0%	≤6.0%	0603≥0.047μF; 0805≥0.18μF; 1206≥0.47μF	25V	≤5.0%	≤7.0%	0402 0.10μF; 1206 4.7μF	≤10.0%	0805≥1μF; 1210≥10μF;	16V	≤5.0%	≤14.0%	0603≥0.33μF; 1206≥10μF	≤10.0%	0402≥0.033μF; 0603≥0.15μF;	10V	≤7.5%	≤15.0%	0805≥0.68μF; 1206≥2.2μF; 1210≥4.7μF	≤15.0%	1210≥22μF	6.3V	≤15.0%	≤30.0%	0402≥0.056μF; 0603≥0.33μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥22μF	6.3V	≤15.0%	≤30.0%	0603≥10μF ;0805≥10μF; 1210≥100μF	Rated vol.	D.F.	Exception of D.F.		≥50V	≤7.5%	---	---	35V	≤10%	---	---	25V	≤7.5%	≤10.0%	0402≥0.047uF;0603≥0.1μF; 0805≥0.33μF	≤12.5%	1206≥1μF; 1210≥4.7μF	16V (C<1.0μF)	≤10.0%	≤12.5%	0402≥0.068μF; 0603≥0.68μF	≤20%	0805≥4.7μF; 1206≥10μF; 1210≥22μF; 1812≥47μF	10V	≤15.0%	---	---	6.3V	≤30%	---	---
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15.	High Temperature Load (Endurance)	<ul style="list-style-type: none"> * Test temp.: X7R: 125±3°C X5R, Y5V: 85±3°C * To apply voltage: 200% of rated voltage. * Test time: 1000+24/-0 hrs. * Measurement to be made after keeping at room temp. for 48±4 hrs. 	<ul style="list-style-type: none"> * No remarkable damage. * Cap change: X7R, X5R: ≥10V, within ±12.5%; 6.3V, within ±25% Y5V: ≥10V, within ±30%; 6.3V, within +30/-40% * Q/D.F. value: X7R, X5R: <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F.</th> <th colspan="2">Exception of D.F.</th> </tr> </thead> <tbody> <tr> <td>≥50V</td> <td>≤3.0%</td> <td>≤6.0%</td> <td>0603≥0.047μF; 0805≥0.18μF; 1206≥0.47μF</td> </tr> <tr> <td rowspan="2">25V</td> <td rowspan="2">≤5.0%</td> <td>≤7.0%</td> <td>0402 0.10μF; 1206 4.7μF</td> </tr> <tr> <td>≤10.0%</td> <td>0805≥1μF; 1206 ≥10μF ; 1210≥10μF;</td> </tr> <tr> <td rowspan="2">16V</td> <td rowspan="2">≤5.0%</td> <td>≤14.0%</td> <td>0603≥0.33μF</td> </tr> <tr> <td>≤10.0%</td> <td>0402≥0.033μF; 0603≥0.15μF; 0805≥0.68μF;</td> </tr> <tr> <td rowspan="2">10V</td> <td rowspan="2">≤7.5%</td> <td>≤15.0%</td> <td>1206≥2.2μF; 1210≥4.7uF</td> </tr> <tr> <td>≤15.0%</td> <td>1210≥22μF</td> </tr> <tr> <td>6.3V</td> <td>≤15.0%</td> <td>≤30.0%</td> <td>0402≥0.056μF; 0603≥0.33μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥22μF</td> </tr> <tr> <td>6.3V</td> <td>≤15.0%</td> <td>≤30.0%</td> <td>0603≥10uF; 0805≥10μF; 1210≥100μF</td> </tr> </tbody> </table> <p>Y5V:</p> <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F.</th> <th colspan="2">Exception of D.F.</th> </tr> </thead> <tbody> <tr> <td>≥50V</td> <td>≤7.5%</td> <td>---</td> <td>---</td> </tr> <tr> <td>35V</td> <td>≤10%</td> <td>---</td> <td>---</td> </tr> <tr> <td rowspan="2">25V</td> <td rowspan="2">≤7.5%</td> <td>≤10.0%</td> <td>0402≥0.047uF;0603≥0.1μF; 0805≥0.33μF;</td> </tr> <tr> <td>≤12.5%</td> <td>1206≥1μF; 1210≥4.7μF</td> </tr> <tr> <td rowspan="2">16V (C<1.0μF)</td> <td rowspan="2">≤10.0%</td> <td>≤12.5%</td> <td>0402≥0.068μF; 0603≥0.68μF</td> </tr> <tr> <td>≤20%</td> <td>0805≥4.7μF; 1206≥10μF; 1210≥22μF; 1812≥47μF</td> </tr> <tr> <td>10V</td> <td>≤15.0%</td> <td>---</td> <td>---</td> </tr> <tr> <td>6.3V</td> <td>≤30%</td> <td>---</td> <td>---</td> </tr> </tbody> </table> <ul style="list-style-type: none"> * I.R.: ≥10V, ≥1GΩ or RxC≥50Ω-F whichever is smaller. 6.3V, RxC≥10Ω-F 	Rated vol.	D.F.	Exception of D.F.		≥50V	≤3.0%	≤6.0%	0603≥0.047μF; 0805≥0.18μF; 1206≥0.47μF	25V	≤5.0%	≤7.0%	0402 0.10μF; 1206 4.7μF	≤10.0%	0805≥1μF; 1206 ≥10μF ; 1210≥10μF;	16V	≤5.0%	≤14.0%	0603≥0.33μF	≤10.0%	0402≥0.033μF; 0603≥0.15μF; 0805≥0.68μF;	10V	≤7.5%	≤15.0%	1206≥2.2μF; 1210≥4.7uF	≤15.0%	1210≥22μF	6.3V	≤15.0%	≤30.0%	0402≥0.056μF; 0603≥0.33μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥22μF	6.3V	≤15.0%	≤30.0%	0603≥10uF; 0805≥10μF; 1210≥100μF	Rated vol.	D.F.	Exception of D.F.		≥50V	≤7.5%	---	---	35V	≤10%	---	---	25V	≤7.5%	≤10.0%	0402≥0.047uF;0603≥0.1μF; 0805≥0.33μF;	≤12.5%	1206≥1μF; 1210≥4.7μF	16V (C<1.0μF)	≤10.0%	≤12.5%	0402≥0.068μF; 0603≥0.68μF	≤20%	0805≥4.7μF; 1206≥10μF; 1210≥22μF; 1812≥47μF	10V	≤15.0%	---	---	6.3V	≤30%	---	---
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APPENDIXES

■ Tape & reel dimensions

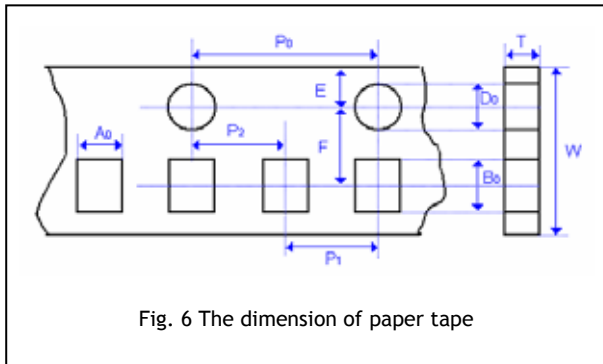


Fig. 6 The dimension of paper tape

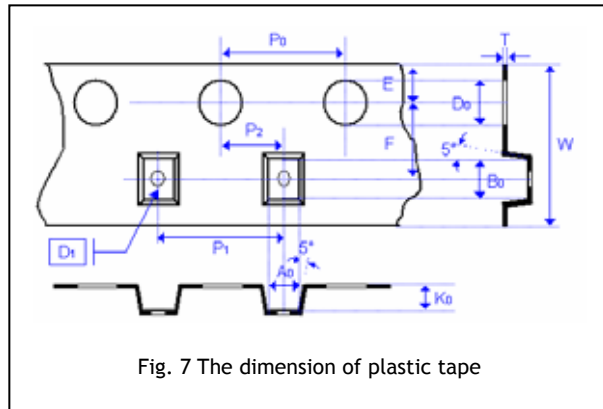


Fig. 7 The dimension of plastic tape

Size	0402	0603	0805			1206			1210			1812	
Thickness	N	S, X	A	B	C, D, I	B	C, J, D	G, P	C, D	G, K	M	D, K	M
A ₀	0.62±0.05	1.02±0.05	1.50±0.10	1.50±0.10	<1.57	2.00±0.10	<1.85	<1.95	<2.97	<2.97	<2.97	<3.81	<3.81
B ₀	1.12±0.05	1.82±0.05	2.30±0.10	2.30±0.10	<2.40	3.50±0.10	<3.46	<3.67	<3.73	<3.73	<3.73	<5.30	<5.30
T	0.60±0.05	0.95±0.05	0.75±0.05	0.95±0.05	0.23±0.05	0.95±0.05	0.23±0.05	0.23±0.05	0.23±0.05	0.23±0.05	0.23±0.05	0.25±0.05	0.25±0.05
K ₀	-	-	-	-	<2.50	-	<2.50	<2.50	<2.50	<2.50	<3.00	<2.50	<3.00
W	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	12.0±0.20	12.0±0.20
P ₀	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10
10xP ₀	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10
P ₁	2.00±0.05	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	8.00±0.10	8.00±0.10
P ₂	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05
D ₀	1.55±0.05	1.55±0.05	1.55±0.05	1.55±0.05	1.50±0.05	1.50±0.05	1.50±0.05	1.50±0.05	1.50±0.05	1.50±0.05	1.50±0.05	1.50±0.05	1.50±0.05
D ₁	-	-	-	-	1.00±0.10	-	1.00±0.10	1.00±0.10	1.00±0.10	1.00±0.10	1.00±0.10	1.50±0.10	1.50±0.10
E	1.75±0.05	1.75±0.05	1.75±0.05	1.75±0.05	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10
F	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	5.50±0.05	5.50±0.05

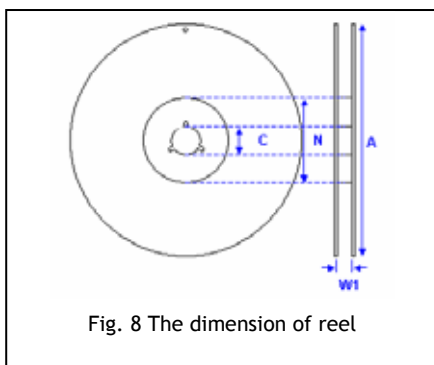


Fig. 8 The dimension of reel

Size	0402, 0603, 0805, 1206, 1210			1812
Reel size	7"	10"	13"	7"
C	13.0+0.5/-0.2	13.0+0.5/-0.2	13.0+0.5/-0.2	13.0+0.5/-0.2
W ₁	8.4+1.5/-0	8.4+1.5/-0	8.4+1.5/-0	12.4+2.0/-0
A	178.0±0.10	250.0±1.0	330.0±1.0	178.0±0.10
N	60.5±1.0	100.0±1.0	100±1.0	60.5±1.0

Constructions

No.	Name	X7R, X5R, Y5V	
①	Ceramic material	BaTiO ₃ based	
②	Inner electrode	Ni	
③	Termination	Inner layer	Cu
④		Middle layer	Ni
⑤		Outer layer	Sn (Matt)

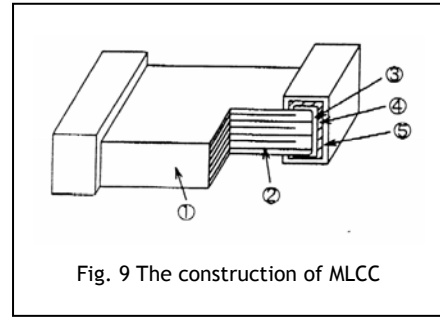


Fig. 9 The construction of MLCC

Storage and handling conditions

- (1) To store products at 5 to 40°C ambient temperature and 20 to 70% related humidity conditions.
- (2) The product is recommended to be used within one year after shipment. Check solderability in case of shelf life extension is needed.

Cautions:

- a. Don't store products in a corrosive environment such as sulfide, chloride gas, or acid. It may cause oxidization of electrode, which easily be resulted in poor soldering.
- b. To store products on the shelf and avoid exposure to moisture.
- c. Don't expose products to excessive shock, vibration, direct sunlight and so on.

Recommended soldering conditions

The lead-free termination MLCCs are not only to be used on SMT against lead-free solder paste, but also suitable against lead-containing solder paste. If the optimized solder joint is requested, increasing soldering time, temperature and concentration of N₂ within oven are recommended.

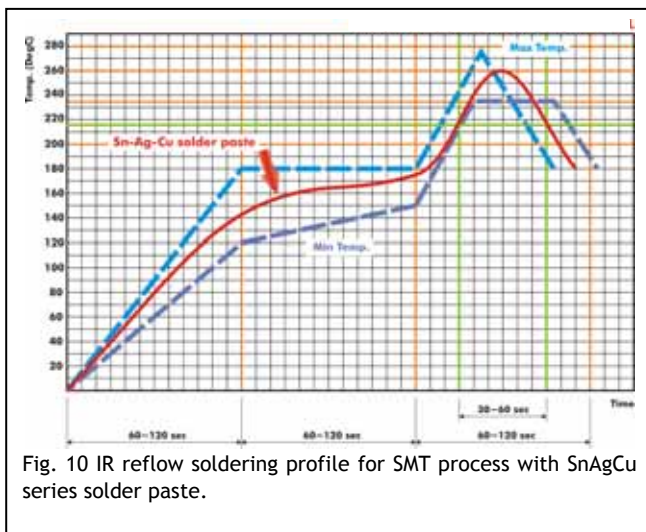


Fig. 10 IR reflow soldering profile for SMT process with SnAgCu series solder paste.

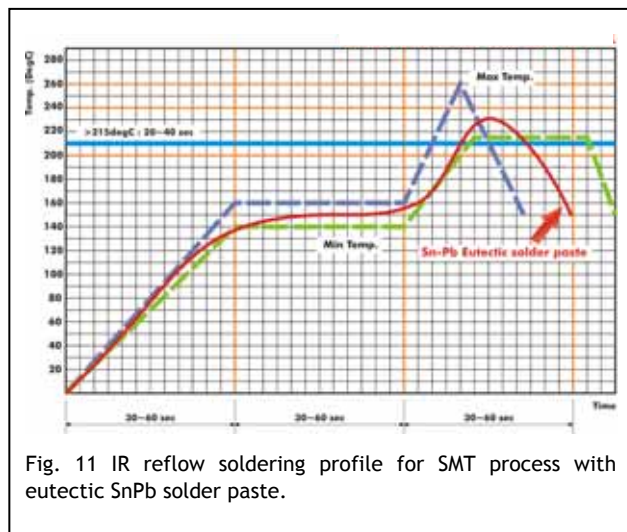


Fig. 11 IR reflow soldering profile for SMT process with eutectic SnPb solder paste.