

Industrial Grade Multilayer Ceramic Chip Capacitors

B0603X5R475K160NTK (0603,X5R,4.7 μF,DC 16 V)

1. Scope

This specification applies to high-reliability applications such as industrial control, communication base stations, and commercial equipment. specific scenarios include: communication power supplies, industrial power supplies, medical equipment, cloud services, and 48V high-efficiency power distribution architectures required for high-performance computing; systems utilizing wide-bandgap (SiC, GaN) power devices.

2. Part Number System

B	0603	X5R	475	K	160	N	T	K
①	②	③	④	⑤	⑥	⑦	⑧	⑨
Series Code	Size Code	Temperature Characteristics	Nominal Capacitance	Capacitance Tolerance	Rated Voltage	Termination Type	Packaging Code	Thickness Code

① Series Code B - Industrial Grade Multilayer Ceramic Chip Capacitors

② Size Code (Unit: mm)

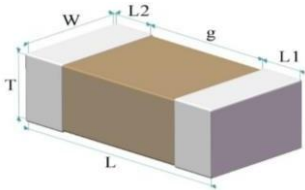


Fig.1: Structure & Dimension

Size Code	L	W	L1,L2	g	T	⑨ Thickness Code
0603	1.60 + 0.20/-0.10	0.80 + 0.20/-0.10	0.20-0.50	0.50 min	0.80 + 0.20/-0.10	K

③ Temperature Characteristics

Temperature Characteristics	Operating Temp. Range	Temperature Characteristics		
		Temp. coeff. or Cap. Change	Temp. Range	Ref. Temp.
X5R	-55 °C-85 °C	±15%	-55 °C-85 °C	25 °C

④ Nominal Capacitance

Code	Nominal Capacitance
475	4.7 μF

⑤ Capacitance Tolerance

Code	Capacitance Tolerance
K	±10%

⑥ Rated Voltage

Code	Voltage Values
160	DC 16V

⑦ Termination Type

Code	Terminal Electrodes	Plating Material
N	Cu	Ni/Sn

⑧ Packaging Code

Packaging Code	Square Hole Spacing	Disc Size	Carrier Tape	QTY (Kpcs)
T	4 mm	7 //	Paper	4

3. Technical Specifications and Test Methods

1. Operating Environment

Temp. Characteristics	Temp. Range	Relative Humidity	Atmospheric Pressure
X5R	-55 °C-85 °C	≤95% (25 °C)	86 Kpa-106 KPa

3.2 Reliability Test Specifications and Methods

Unless otherwise specified, the test methods in Table 1 are based on: GB/T 21041 and GB/T 21042 (IDT IEC 6038)

Table 1: Specifications and Methods

No.	Item	Specification	Test Method
1	Appearance	No obvious defects on ceramic body and termination.	Visual examination under a microscope
2	Size Code	See Fig.1 and ② Size Code	Measuring by gages which precision is not less than 0.01 mm.
3	Capacitance	Within the specified tolerance	Measurement Temperature 18 °C-28 °C Relative Humidity ≤RH 80%
4	Dissipation Factor (DF)	See Table 1-2	Measurement Frequency See Table 1-2 Measurement Voltage See Table 1-2 Post-treatment When the capacitor initial capacitance is lower than its tolerance value, the test sample need to perform a heat treatment at 150 °C + 0/-10 °C for 1hour and then sit for 24 ± 2 hours at room temperature, then measure.
5	Insulation Resistance (IR)	See Table 1-2	Measurement Temperature 18 °C-28 °C Relative Humidity ≤RH 80% Measurement Voltage Rated Voltage Charging Time 1 min Charge/discharge current ≤50 mA
6	Voltage proof	No defects or abnormalities.	Test Voltage $\geq 2.5 \times U_R$ Applied Time $t = 1 \sim 5 \text{ s}$ Charge/discharge current ≤50 mA
7	Temperature characteristic of capacitance	X5R: $\Delta C/C \leq \pm 15\%$	Pre-treatment Perform a heat treatment at 150 °C + 0/-10 °C for 1hour and then sit for 24 ± 2 hours at room temperature.then measure. Measure the capacitance separately in 25°C、θ1、25°C、θ2、25°C, should satisfied related Temperature Coefficient of Capacitance (αc) . X5R θ1=-55 °C, θ2=85 °C T.C. Measurement Voltage $\leq 1.0 \text{ Vrms}$ ※ [※ Please contact our technical support staff for more information.]

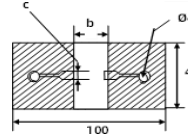
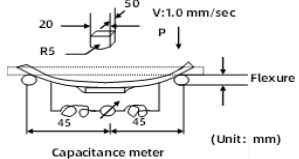
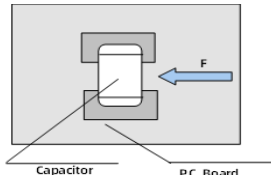
No.	Item	Specification	Test Method
8	Resistance to soldering heat	Appearance No visible damage and terminations uncovered shall be less than 25%. Cap. Change See Table 1-3 IR Initial specification DF Initial specification Voltage proof No defects or abnormalities.	Pre-treatment Perform a heat treatment at 150 °C + 0/-10 °C for 1hour and then sit for 24 ± 2 hours at room temperature.then measure. Pre-heating 120 °C-150 °C,Time: 60 s Test Method Solder bath method Solder alloy Sn-Ag-Cu (Lead Free Solder) Temperature (270 ± 5) °C Duration of immersion (10±1) s Depth of immersion 10 mm Post-treatment Let sit for 24 ± 2 hours at room temperature, then measure.
9	Solderability	Appearance 95% of the terminations is to be soldered evenly and continuously	Pre-heating 80 °C-120 °C,Time: 10-30 s Test Method Solder bath Flux Solution of rosin ethanol Solder alloy Sn-Ag-Cu (Lead Free Solder) Temperature (245 ± 5) °C Duration of immersion (2.0 ± 0.5) s Depth of immersion 10 mm
10	Substrate bending test	Appearance No defects or abnormalities Cap. Change See Table 1-3	Mounting method Solder the capacitor on the test substrate as shown in Fig 2 Pressurization Method as shown in Fig 3 Flexure 1 mm Holding Time (5±1) s then measure the capacitance   Fig. 2 Fig. 3
11	Adhesive strength of termination	Appearance No defects or abnormalities	Mounting method Solder the capacitor to the test substrate and apply the normal force F indicated in Fig. 4 Holding Time t = 10 ± 1 s Pushing force 0603:F = 5 N  Capacitor P.C. Board Fig. 4

Table 1: Specifications and Methods

No.	Item	Specification		Test Method																		
12	Vibration	Appearance	No defects or abnormalities	Mounting method	Solder the capacitor on the test substrate																	
		Cap. Change	See Table 1-3	Amplitude	1.5 mm																	
		IR	Initial specification	Kind of Vibration	A simple harmonic motion																	
		DF	Initial specification	Frequency	10 Hz-55 Hz-10 Hz																	
				Vibration Time	1 min																	
				Repeat this for 2hrs each in 3 perpendicular directions X, Y, Z, total 6 hours.																		
13	Rapid change of temperature	Appearance	No defects or abnormalities	Pre-treatment	Perform a heat treatment at 150 °C + 0/-10 °C for 1hour and then sit for 24 ± 2 hours at room temperature.then measure.																	
		Cap. Change	See Table 1-3	Mounting method	Solder the capacitor on the test substrate																	
		IR	Initial specification	The number of cycles	100 cycles																	
		DF	Initial specification	Temperature Step	<table><tr><td>Step</td><td>Temp.(°C)</td><td>Time (min)</td></tr><tr><td>1</td><td>-55</td><td>30±3</td></tr><tr><td>2</td><td>25</td><td>2-5</td></tr><tr><td>3</td><td>85</td><td>30±3</td></tr><tr><td>4</td><td>25</td><td>2-5</td></tr></table>			Step	Temp.(°C)	Time (min)	1	-55	30±3	2	25	2-5	3	85	30±3	4	25	2-5
		Step	Temp.(°C)	Time (min)																		
		1	-55	30±3																		
		2	25	2-5																		
3	85	30±3																				
4	25	2-5																				
Voltage proof	No defects or abnormalities.																					
14	Damp heat, steady state	Appearance	No defects or abnormalities	Pre-treatment	Perform a heat treatment at 150 °C + 0/-10 °C for 1hour and then sit for 24 ± 2 hours at room temperature.then measure.																	
		Cap. Change	See Table 1-3	Mounting method	Solder the capacitor on the test substrate																	
		IR	See Table 1-3	Test Temperature	60 °C ± 2 °C																	
		DF	See Table 1-3	Test Humidity	RH 90–95%																	
				Test Time	500 ± 12 h																	
				Post-treatment	Let sit for 24 ± 2 hours at room temperature, then measure.																	
15	High temperature high humidity (steady)	Appearance	No defects or abnormalities	Pre-treatment	Perform a heat treatment at 150 °C + 0/-10 °C for 1hour and then sit for 24 ± 2 hours at room temperature.then measure.																	
		Cap. Change	See Table 1-3	Mounting method	Solder the capacitor on the test substrate																	
		IR	See Table 1-3	Test Temperature	60 °C ± 2 °C																	
		DF	See Table 1-3	Test Humidity	RH 90–95%																	
				Test Voltage	1.0 × U _R																	
				Test Time	500 ± 12 h																	
				Charge/discharge curren	≤ 50 mA																	
				Post-treatment	Perform a heat treatment at 150 °C + 0/-10 °C for 1hour and then sit for 24 ± 2 hours at room temperature. then measure.																	

Table 1: Specifications and Methods

No.	Item	Specification		Test Method	
16	Endurance	Appearance	No defects or abnormalities	Pre-treatment	Perform a heat treatment at 150 °C + 0/-10 °C for 1hour and then sit for 24 ± 2 hours at room temperature. then measure.
		Cap. Change	See Table 1-3	Mounting method	Solder the capacitor on the test substrate
		IR	See Table 1-3	Test Temperature	85 °C ± 3 °C
		DF	See Table 1-3	Test Voltage	1.5 × UR
				Test Time	1000 ± 12 h
				Charge/discharge curren	≤ 50 mA
				Post-treatment	Perform a heat treatment at 150 °C + 0/-10 °C for 1hour and then sit for 24 ± 2 hours at room temperature. then measure.

Table 1-2: Electrical tests

Series	Size	Temp. Chara.	Rated Voltage (DC)	Thickness Code	Capacitance	Electrical tests			
						DF [max]	IR [min]	Measurement Frequency	Measurement Voltage [Vrms]
B	0603	X5R	16V	K	4.7 μF	0.125	100fi.F	1.0±0.1KHz	1.0±0.2

Table 1-3: Cap.¥ D.F¥ IR changes after test

Series	Size	Temp. Chara.	Rated Voltage (DC)	Thickness Code	Capacitance	Resistance to soldering heat	Substrate bending test	Vibration	Rapid change of temperature	Damp heat, steady state			High temperature high humidity (steady)			Endurance		
						Cap. Change [ΔC/C≤±%]	Cap. Change [ΔC/C≤±%]	Cap. Change [ΔC/C≤±%]	Cap. Change [ΔC/C≤±%]	Cap. Change [ΔC/C≤±%]	DF [max]	IR [min]	Cap. Change [ΔC/C≤±%]	DF [max]	IR [min]	Cap. Change [ΔC/C≤±%]	DF [max]	IR [min]
B	0603	X5R	16V	K	4.7 μF	15	10	15	15	15	0.2	25fi·F	15	0.2	25fi·F	15	0.2	10fi·F

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 ⑧ Packaging Code

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.

4.1.2 Carrier Tape size

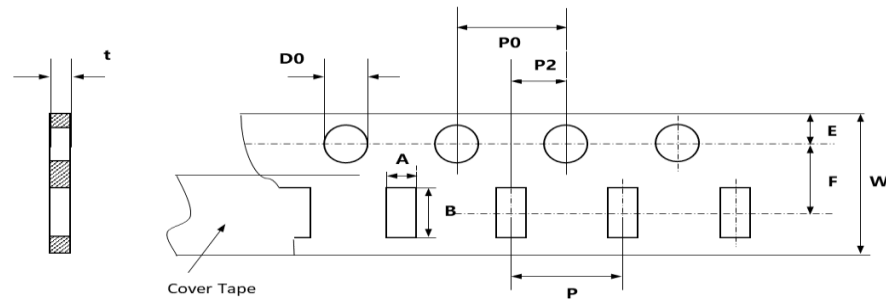


Fig. 5-1 0603, 0805, 1206, 1210 (Paper tape)

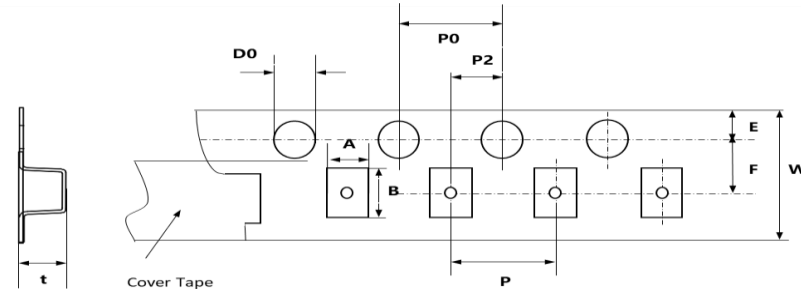


Fig. 5-2 0603, 0805, 1206, 1210 (Plastic tape)

Table 2-1: Carrier size (Size Code: 0603, 0805, 1206, 1210)

(Unit:mm)

Size Code	Thickness code	Carrier Tape Type	Packaging Code	A	B	F	P	E	D0	P2	K	W	P0	t
0603	S	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	0.70 max
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	1.15 max
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	1.15 max
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	1.15 max
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	1.15 max
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	1.15 max
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	1.15 max
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	1.15 max
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	1.15 max
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	1.15 max
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	1.15 max
0603	W	Plastic	R	1.10 ± 0.20	1.90 ± 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	1.35 max
0603	W	Plastic	O	1.10 ± 0.20	1.90 ± 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	1.35 max
0603	W	Plastic	Q	1.10 ± 0.20	1.90 ± 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	1.35 max

(Unit:mm)

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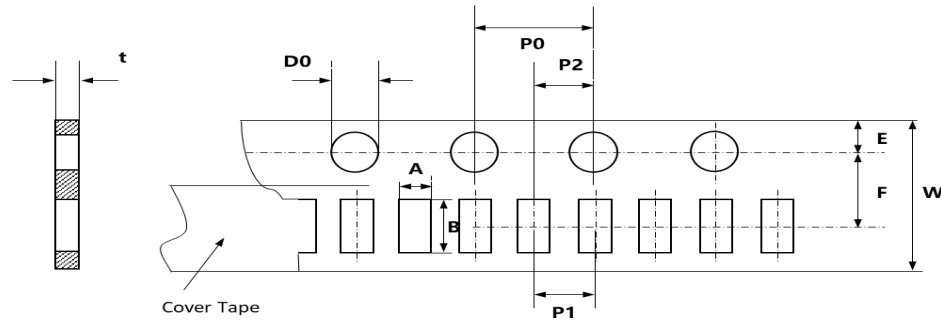


Fig. 5-3 0402 (Paper tape/ 2 mm pitch)

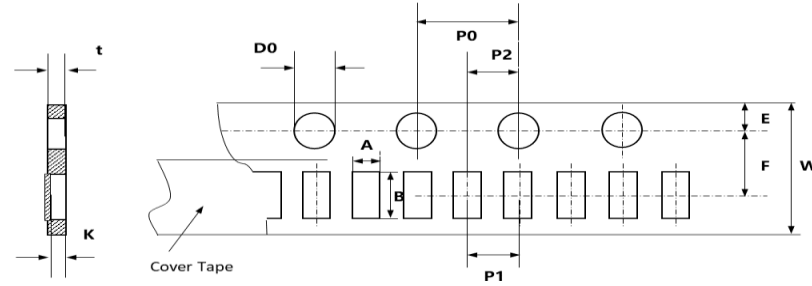


Fig. 5-4 0105, 0201 (Paper tape/ 2 mm pitch)

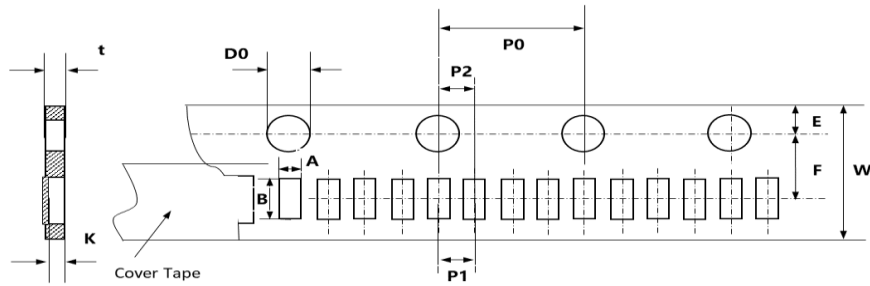


Fig. 5-5 0201 (Paper tape/ 1 mm pitch)

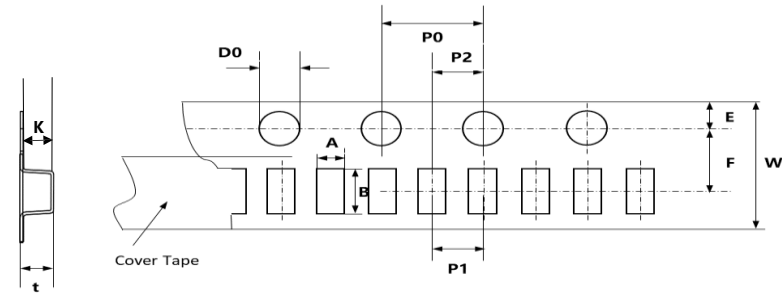


Fig. 5-6 0105 (Plastic tape/ 1 mm pitch)

Table 2-2: Carrier size (Size Code:0105,0201,0402)

(Unit:mm)

Size Code	Thickness code	Carrier Tape Type	Packaging Code	A	B	F	P1	E	D0	P2	K	W	P0	t
0105	Z	Paper	T	0.24 ± 0.02	0.45 ± 0.02	3.50 ± 0.05	2.00 ± 0.05	1.75 ± 0.10	1.55 ± 0.05	2.00 ± 0.05	0.24 ± 0.02	8.00 ± 0.10	4.00 ± 0.10	0.5 max
0105	Z	Paper	H	0.24 ± 0.02	0.45 ± 0.02	3.50 ± 0.05	2.00 ± 0.05	1.75 ± 0.10	1.55 ± 0.05	2.00 ± 0.05	0.24 ± 0.02	8.00 ± 0.10	4.00 ± 0.10	0.5 max
0105	Z	Plastic	P	0.24 ± 0.02	0.45 ± 0.02	1.80 ± 0.05	1.00 ± 0.05	0.90 ± 0.10	0.80 ± 0.05	1.00 ± 0.05	0.24 ± 0.02	4.00 ± 0.10	2.00 ± 0.10	0.5 max
0201	A	Paper	T	0.38 ± 0.03	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	0.5 max
0201	A	Paper	J	0.38 ± 0.03	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	0.5 max
0201	A	Paper	D	0.38 ± 0.03	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	0.5 max
0201	A	Paper	A	0.38 ± 0.03	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	0.5 max
0201	A	Paper	M	0.38 ± 0.03	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	0.5 max

Table 2-2: Carrier size (Size Code:0105,0201,0402)

(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	H	0.38 ± 0.03	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	0.5 max
0201	A	Paper	L	0.38 ± 0.03	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	0.5 max
0201	J	Paper	T	0.40 ± 0.04	0.70 ± 0.04	3.50 ± 0.05	2.00 ± 0.05	1.75 ± 0.10	1.55 ± 0.05	2.00 ± 0.05	0.38 ± 0.04	8.00 ± 0.10	4.00 ± 0.10	0.5 max
0201	J	Paper	J	0.40 ± 0.04	0.70 ± 0.04	3.50 ± 0.05	2.00 ± 0.05	1.75 ± 0.10	1.55 ± 0.05	2.00 ± 0.05	0.38 ± 0.04	8.00 ± 0.10	4.00 ± 0.10	0.5 max
0201	J	Paper	D	0.40 ± 0.04	0.70 ± 0.04	3.50 ± 0.05	1.00 ± 0.05	1.75 ± 0.10	1.55 ± 0.05	1.00 ± 0.05	0.38 ± 0.04	8.00 ± 0.10	4.00 ± 0.10	0.5 max
0201	J	Paper	A	0.40 ± 0.04	0.70 ± 0.04	3.50 ± 0.05	1.00 ± 0.05	1.75 ± 0.10	1.55 ± 0.05	1.00 ± 0.05	0.38 ± 0.04	8.00 ± 0.10	4.00 ± 0.10	0.5 max
0201	J	Paper	M	0.40 ± 0.04	0.70 ± 0.04	3.50 ± 0.05	2.00 ± 0.05	1.75 ± 0.10	1.55 ± 0.05	2.00 ± 0.05	0.38 ± 0.04	8.00 ± 0.10	4.00 ± 0.10	0.5 max
0201	J	Paper	H	0.40 ± 0.04	0.70 ± 0.04	3.50 ± 0.05	2.00 ± 0.05	1.75 ± 0.10	1.55 ± 0.05	2.00 ± 0.05	0.38 ± 0.04	8.00 ± 0.10	4.00 ± 0.10	0.5 max
0201	J	Paper	L	0.40 ± 0.04	0.70 ± 0.04	3.50 ± 0.05	1.00 ± 0.05	1.75 ± 0.10	1.55 ± 0.05	1.00 ± 0.05	0.38 ± 0.04	8.00 ± 0.10	4.00 ± 0.10	0.5 max
0201	X	Paper	T	0.44 ± 0.06	0.74 ± 0.06	3.50 ± 0.05	2.00 ± 0.05	1.75 ± 0.10	1.55 ± 0.05	2.00 ± 0.05	0.40 ± 0.05	8.00 ± 0.10	4.00 ± 0.10	0.6 max
0201	X	Paper	J	0.44 ± 0.06	0.74 ± 0.06	3.50 ± 0.05	2.00 ± 0.05	1.75 ± 0.10	1.55 ± 0.05	2.00 ± 0.05	0.40 ± 0.05	8.00 ± 0.10	4.00 ± 0.10	0.6 max
0201	X	Paper	H	0.44 ± 0.06	0.74 ± 0.06	3.50 ± 0.05	2.00 ± 0.05	1.75 ± 0.10	1.55 ± 0.05	2.00 ± 0.05	0.40 ± 0.05	8.00 ± 0.10	4.00 ± 0.10	0.6 max
0201	F	Paper	T	0.44 ± 0.06	0.74 ± 0.06	3.50 ± 0.05	2.00 ± 0.05	1.75 ± 0.10	1.55 ± 0.05	2.00 ± 0.05	0.40 ± 0.05	8.00 ± 0.10	4.00 ± 0.10	0.6 max
0201	B	Paper	H	0.44 ± 0.06	0.74 ± 0.06	3.50 ± 0.05	2.00 ± 0.05	1.75 ± 0.10	1.55 ± 0.05	2.00 ± 0.05	0.55 ± 0.05	8.00 ± 0.10	4.00 ± 0.10	0.7 max
0201	B	Paper	T	0.44 ± 0.06	0.74 ± 0.06	3.50 ± 0.05	2.00 ± 0.05	1.75 ± 0.10	1.55 ± 0.05	2.00 ± 0.05	0.55 ± 0.05	8.00 ± 0.10	4.00 ± 0.10	0.7 max
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	0.8 max
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	0.8 max
0402	N	Paper	T	0.70 ± 0.10	1.20 ± 0.10	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	0.8 max
0402	N	Paper	J	0.70 ± 0.10	1.20 ± 0.10	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	0.8 max
0402	C	Paper	T	0.75 ± 0.10	1.30 ± 0.10	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	0.8 max
0402	C	Paper	J	0.75 ± 0.10	1.30 ± 0.10	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	0.8 max
0402	U	Paper	C	0.85 ± 0.10	1.40 ± 0.10	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	0.95 max
0402	U	Paper	T	0.85 ± 0.10	1.40 ± 0.10	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	0.95 max

4.1.3 Disc size

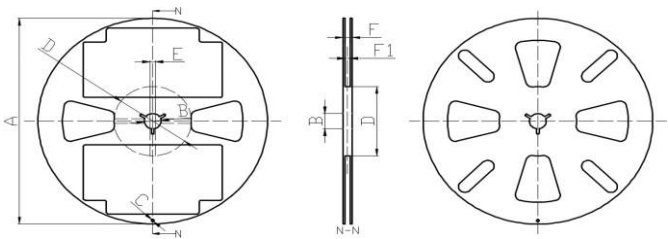


Fig. 6-1 Disc (Width of carrier-4 mm)

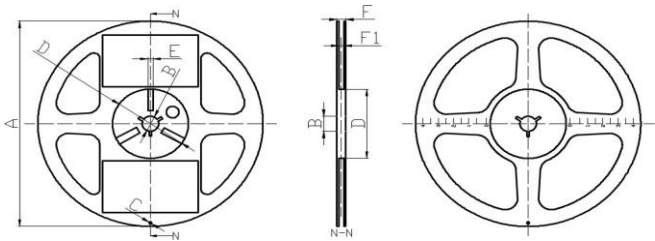


Fig. 6-2 Disc (Width of carrier-8 mm)

Table 3: 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	4.0 ± 1.0	11.5 ± 1.0	10.0 ± 2.0	All
13"	8.00 ± 0.10	Φ330 ± 2.0	Φ13 ± 1.0	Φ4.0 ± 0.5	Φ108 ± 2.0	4.0 ± 1.0	13.5 ± 2.0	10.0 ± 2.0	All
7"	4.00 ± 0.10	Φ178 ± 2.0	Φ13 ± 1.0	Φ4.0 ± 0.5	Φ60 ± 2.0	3.5 ± 0.5	7.3 ± 0.5	4.5 ± 1.0	0105

4.1.4 Carrier Tape specifications

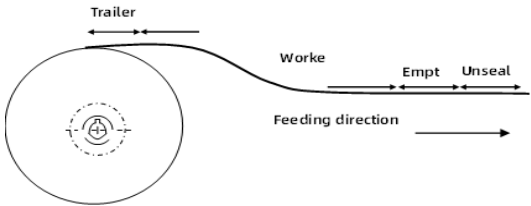


Fig. 7 Carrier

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

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

b. Top cover Tape

When a tensile force 1.02 kgf 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 gf to 71.4 gf when the top cover tape is pulled at a speed of 300 mm/min with the angle of 0° to 15° (see Fig.8).

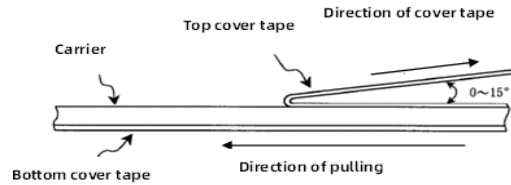


Fig.8 Cover tape peel-off force

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.

3. Storage

1. Storage conditions:

The recommended temperature is less than 30 °C.

A temperature is 5 °C to 40 °C 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 one year has elapsed since delivery, also check the solderability before use.

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

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

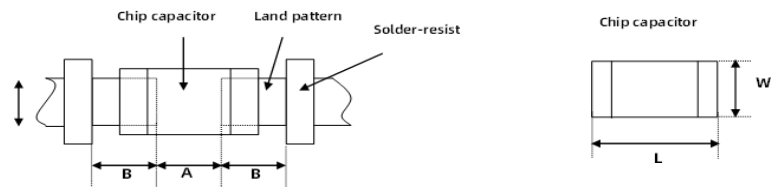
5.2 PCB Design

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.



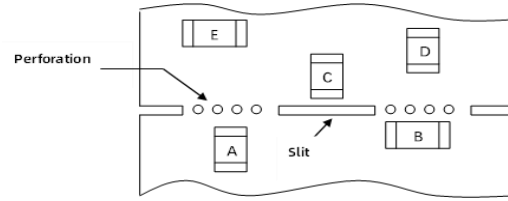
Recommended land dimensions for reflow-soldering

(unit: mm)

Size Code	Length	Width	Tolerance	A	B	C
0105	0.4	0.2	all	0.16-0.20	0.12-0.18	0.20-0.23
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	$\pm 0.09, \pm 0.1$	0.23-0.30	0.25-0.35	0.30-0.40
0402	1.0	0.5	± 0.05	0.30-0.50	0.35-0.45	0.40-0.60
0402	1.0	0.5	$\pm 0.15, \pm 0.20$	0.40-0.60	0.40-0.50	0.50-0.70
0402	1.0	0.5	± 0.30	0.40-0.60	0.40-0.50	0.50-0.80
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
0603	1.6	0.8	$\pm 0.25, \pm 0.30$	0.70-0.90	0.70-0.90	0.80-1.10
0805	2.0	1.25	$\pm 0.10, \pm 0.15, \pm 0.20$	1.00-1.40	0.60-0.80	1.20-1.40
0805	2.0	1.25	± 0.25	1.00-1.40	0.70-0.90	1.35-1.55
1206	3.2	1.6	$\pm 0.15, \pm 0.20$	1.80-2.00	0.90-1.20	1.50-1.70
1206	3.2	1.6	± 0.30	1.90-2.10	1.00-1.30	1.60-1.90
1210	3.2	2.5	± 0.20	2.00-2.40	1.00-1.20	2.50-2.70
1210	3.2	2.5	± 0.30	2.00-2.40	1.10-1.30	2.50-2.80

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

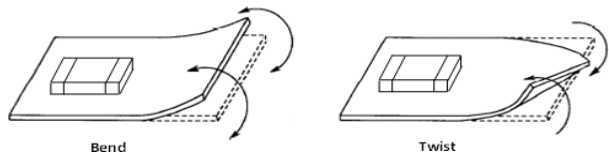


The stress in capacitors is in the following order: $A > B = C > D > E$

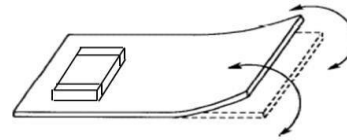
Pay attention not to bend or distort the PC board otherwise the capacitor may crack.

Please refer to the following examples of good and bad capacitors layout.

a. Not recommended

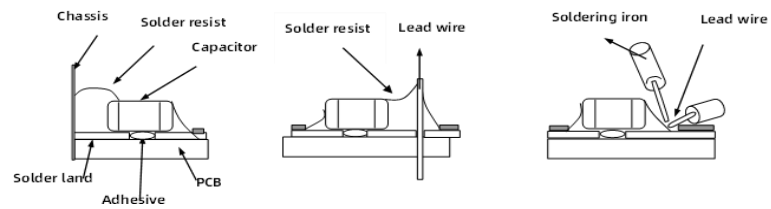


b. Recommended

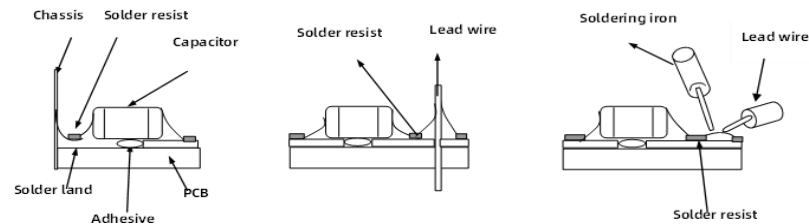


5.2.3 Solder Buildup and Soldering

a.Examples of soldering method not recommended



b.Examples of soldering method recommended

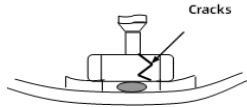
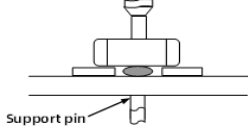
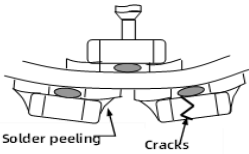
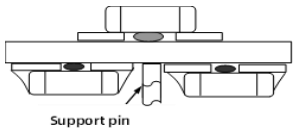


5.3 Consideration for Automatic Placement

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

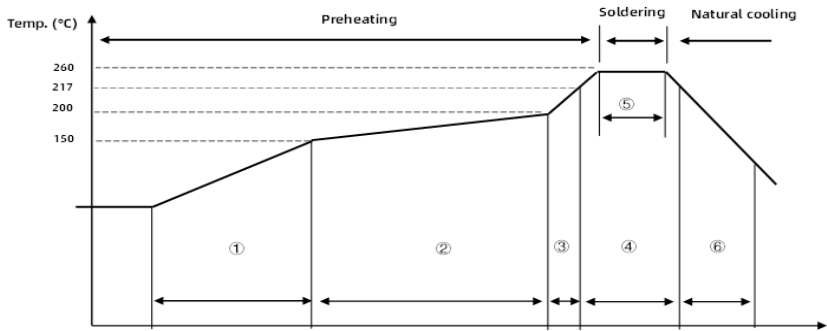
Mounting	Not recommended	Recommended
Singel-sided Mounting		
Double-sided Mounting		

4. Soldering

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

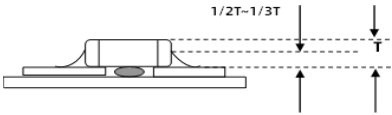


5.4.2.1 Reflow Soldering Condition

NO.	Reflow Soldering zone	Reflow Soldering Condition
①	Preheating 1	$\leq 3\text{ }^{\circ}\text{C/s}, \geq 60\text{ s}$
②	Constant temperature	$150^{\circ}\text{C}-200^{\circ}\text{C}, 60\text{ s}-120\text{ s}, \leq 1\text{ }^{\circ}\text{C/s}$
③	Preheating 1	$1-5\text{ }^{\circ}\text{C/s}$
④	Soldering 1	Above $217\text{ }^{\circ}\text{C}, 60-150\text{ s}$
⑤	Soldering 1	Above $260\text{ }^{\circ}\text{C}, \text{over } 10\text{ s}$
⑥	Natural cooling	$\leq 6\text{ }^{\circ}\text{C/s}$

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 capacitors.



- 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 $245\text{ }^{\circ}\text{C} \pm 15\text{ }^{\circ}\text{C}$.

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

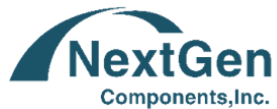
The EU RoHS Directive refers to the "Directive 2011/65/EU on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment" stipulated by the European Union.



PRODUCT NAME:	Industrial Grade MLCC B Series SMD 0603 X5R 4.7μF ±10% 16V
REVISION:	A3
NEXTGEN ORDER PART CODE*:	B0603W475K160K
CROSS REF. PART NO.:	
ORIGINAL MFG PART NO.:	B0603X5R475K160NTK
ORIGINAL MANUFACTURER:	EYang Technology/Eyang MLCC

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CODE	NAME	KEY SPECIFICATION OPTION
B	Series Code	B: Industrial Grade Multilayer Ceramic Chip Capacitors
0603	Case Size	0105 : L0.40*W0.20mm; 0201 : L0.60*W0.30mm; 0402 : L1.00*W0.50mm; 0603 : L1.60*W0.80mm 0805 : L2.00*W1.25mm; 1206 : L3.20*W1.60mm; 1210 : L3.20*W2.50mm
W	Temperature Characteristics	N: NP0 (COG); B: X7R; W: X5R; S: X6S; Y: Y5V; T: X7S; R: X7T
475	Capacitance	Two significant digits followed by number of Zero, The 3rd digit signifies the multiplying factor, and letter R is decimal point. 8R2: 8.2pF; 820: 82pF; 102: 1000pF; 680: 68pF; 471: 470pF; 475: 4.7μF
K	Capacitance Tolerance	A: ±0.05pF; B: ±0.1pF; C: ±0.25pF; D: ±0.5pF; F: ±1%; G: ±2%; J: ±5%; K: ±10% L: ±15%; M: ±20%; N: ±30%; P: ±0.02pF; X: ±40%; S: 50%/-20%; Y: 150%/-20% Z: 80%/-20%
160	Rated Voltage	Two significant digits followed by No. of zeros. "R" is in place of decimal point. 6R3: 6.3VDC; 160: 16 VDC; 250: 25 VDC; 100: 10 VDC; 500: 50 VDC; 101: 100VDC
K	Case Thickness	K: 1.15mm Max, See Page 6 (T's Symbol) for Different part code
XX	Internal Control Code	Blank: N/A; XX: Letter A~Z, a~z or digits (0~9) for Special/Custom Parameters

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