

TNQ Series RF High Q Multilayer Chip Ceramic Capacitor

1. Capacitor characteristics and applications

1.1 Characteristics

- Size specifications are standardized and suitable for surface mount components in hybrid integrated circuits or printed circuits;
- High Q value, ultra low ESR, high reliability;
- Low loss, high capacitance stability, high operating frequency;
- Suitable for high-frequency circuits, VHF-microwave bands, RF and amplification circuits in various equipment;



1.2 Main performance indicators

- Temperature coefficient: C0G: $0 \pm 30 \text{ ppm}/^\circ\text{C}$
- Capacitance drift: no more than $\pm 0.2\%$ or $\pm 0.05 \text{ pF}$, whichever is larger.
- Quality factor (Q value): greater than 2,000 at a frequency of 1MHz/1KHz
- Insulation resistance: $\geq 100000 \text{ M}\Omega$ at 20°C
- Operating temperature: $-55 \sim 125^\circ\text{C}$

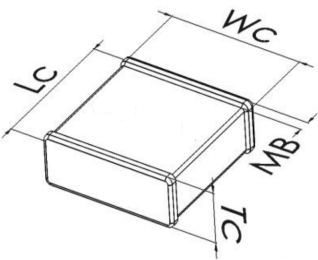
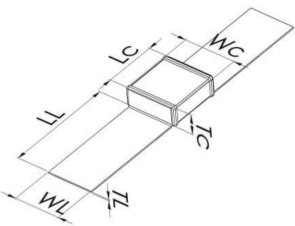
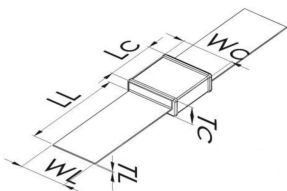
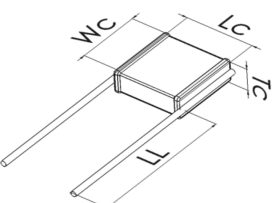
2. How to order

<u>TNQ</u>	<u>1111</u>	<u>CG</u>	<u>1R0</u>	<u>B</u>	<u>501</u>	<u>N</u>	<u>R</u>
Product series	Size (mm)	Dielectric	Capacitance (unit: pF)	Tolerance	Rated Voltage	Termination	Packaging style
TNQ series RF high capacitor	0402 1111 0603 2525 3838 0805 0505 0709	CG=C0G: $+30 \text{ ppm}/^\circ\text{C}$	Two significant digits followed by no. of zeros. And R is in place of decimal point. eg.: 0R5=0.5pF 1R0=1.0pF 104=10x104=100nF	A: $\pm 0.05 \text{ pF}$ B: $\pm 0.10 \text{ pF}$ C: $\pm 0.25 \text{ pF}$ D: $\pm 0.50 \text{ pF}$ F: $\pm 1.0\%$ G: $\pm 2.0\%$ J: $\pm 5.0\%$ K: $\pm 10.0\%$	Two significant digits followed by no. of zeros. And R is in place of decimal point. eg.: 6R3=6.3V 500=50V 501=500 VDC	N: Leading-out Terminal: Ag/Ni/Sn;	R: Tape & reel C: Cut Tray B: Bulk

2.1 Cross to

UF Capacitors Series	Cross to ATC Series
TNQ-0402	ATC600L
TNQ-0603	ATC600S
TNQ-0805	ATC600F
TNQ-0505	ATC100A/ATC800A
TNQ-1111	ATC100B/ATC800B
TNQA-0709	ATC180R/ATC800R

3. Product dimension

Product type	Size specifications (imperial)	Capacitor size(mm)			Terminal size(mm)			
		Lc	Wc	Tc max	MB	L _L min	W _L	T _L
Terminal code:N \ Z \ E 	0402	1.00±0.20	0.50±0.20	0.55	0.25±0.10	—		
	0603	1.52±0.25	0.76±0.25	1.01	0.30±0.15			
	0805	2.00±0.25	1.25±0.25	1.45	0.50±0.20			
	0505	1.40 -0.25~+0.38	1.40±0.38	1.45	0.40±0.15			
	0709	1.78±0.25	2.29±0.25	2.92	0.50±0.20			
	1111	2.79 -0.25~+0.51	2.79±0.38	2.59	0.60±0.20			
	2525	5.84 -0.25~+0.51	6.35±0.38	3.68	0.80±0.30			
	3838	9.65 -0.25~+0.38	9.65±0.25	5.00	1.00±0.50			
Terminal code:M 	1111	3.50±0.38	2.79±0.25	2.54	—	6.35	2.36±0.13	0.20±0.05
	2525	6.35±0.38	6.35±0.38	3.68		12.70	6.10±0.13	0.20±0.05
	3838	9.65 -0.25~+0.89	9.65±0.25	5.00		19.05	8.64±0.25	0.25±0.10
Terminal code:A 	2525	6.35±0.38	6.35±0.38	3.68		12.70	6.10±0.13	0.20±0.05
	3838	9.65 -0.25~+0.89	9.65±0.25	5.00		19.05	8.64±0.25	0.25±0.10
Terminal code: RW \ RN 	1111	3.90±0.51	2.79±0.38	2.59		12.70	Lead diameter 0.40±0.05	
	2525	5.84 -0.25~+1.91	6.35±0.38	3.68		25.40	Lead diameter 0.80±0.05	
	3838	9.65 -0.25~+2.16	9.65±0.25	5.00				

4 . Capacity range

4.1 0402 specification capacitance table

Capac- itance code	Capac- itance (pF)	Accuracy	Max DC working voltage(V)	Capac- itance code	Capac- itance (pF)	Accuracy	Max DC working voltage(V)	Capac- itance code	Capac- itance (pF)	Accuracy	Max DC working voltage(V)
0R1 0R2 0R3 0R4	0.1 0.2 0.3 0.4	A, B, C.	250	2R1 2R2 2R4 2R7 3R0 3R3	2.1 2.2 2.4 2.7 3 3.3	B, C, D.	250	130 150 160 180 200 220	13 15 16 18 20 22	F, G, J.	200
0R5 0R6 0R7 0R8 0R9 1R0 1R1 1R2 1R3 1R4 1R5 1R6 1R7 1R8 1R9 2R0	0.5 0.6 0.7 0.8 0.9 1 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2	A, B, C, D.		3R6 3R9 4R3 4R7 5R1 5R6 6R2 6R8 7R5 8R2 9R1	3.6 3.9 4.3 4.7 5.1 5.6 6.2 6.8 7.5 8.2 9.1			240 270 300 330	24 27 30 33		
				100 110 120	10 11 12		200				

4.2 0603 specification capacitance table

Capac- itance code	Capac- itance (pF)	Accuracy	Max DC working voltage(V)	Capac- itance code	Capac (pF)	Accuracy	Max DC working voltage(V)	Capac- itance code	Capac- itance (pF)	Accuracy	Max DC working voltage(V)
0R2	0.2	A, B, C.	250	3R3	3.3	B, C, D.	250	360	36	F, G, J, K, M.	250
0R3	0.3			3R6	3.6			390	39		
0R4	0.4			3R9	3.9			430	43		
				4R3	4.3			470	47		
0R5	0.5	A, B, C, D.		4R7	4.7			510	51		
0R6	0.6			5R1	5.1			560	56		
0R7	0.7			5R6	5.6			620	62		
0R8	0.8			6R2	6.2			680	68		
0R9	0.9			6R8	6.8			750	75		
1R0	1			7R5	7.5			820	82		
1R1	1.1			8R2	8.2			910	91		
1R2	1.2			9R1	9.1			101	100		
1R3	1.3			100	10	111		110			
1R4	1.4			110	11	121		120			
1R5	1.5			120	12	131		130			
1R6	1.6			130	13	151		150			
1R7	1.7			150	15						
1R8	1.8			160	16						
1R9	1.9			180	18						
2R0	2			200	20						
2R1	2.1			220	22						
2R2	2.2			240	24						
2R4	2.4			270	27						
2R7	2.7			300	30						
3R0	3	330		33							

4.3 0505 specification capacitance table

Capac- itance code	Capac- itance (pF)	Accuracy	Max DC working voltage(V)	Capac- itance code	Capac- itance (pF)	Accuracy	Max DC working voltage(V)	Capac- itance code	Capac- itance (pF)	Accuracy	Max DC working voltage(V)
0R2	0.2	B, C.		3R6	3.6			390	39		300
0R3	0.3			3R9	3.9			430	43		
0R4	0.4			4R3	4.3			470	47		
0R5	0.5	B, C, D.	250	4R7	4.7	B, C, D.	250	510	51	F, G, J, K, M.	250
0R6	0.6			5R1	5.1			560	56		
0R7	0.7			5R6	5.6			620	62		
0R8	0.8			6R2	6.2			680	68		
0R9	0.9			6R8	6.8			750	75		
1R0	1			7R5	7.5			820	82		
1R1	1.1			8R2	8.2			910	91		
1R2	1.2			9R1	9.1			101	100		
1R3	1.3			100	10	111		110			
1R4	1.4			110	11	121		120			
1R5	1.5			120	12	131		130			
1R6	1.6			130	13	151		150			
1R7	1.7			150	15	161		160			
1R8	1.8			160	16	181		180			
1R9	1.9			180	18	201		200			
2R0	2			200	20	221		220			
2R1	2.1			220	22	241		240			
2R2	2.2			240	24	271		270	200		
2R4	2.4			270	27	301		300			
2R7	2.7			300	30	331		330	150		
3R0	3			330	33	361		360			
3R3	3.3			360	36	391		390			

4.4 0805 specification capacitance table

Capac- itance code	Capac- itance (pF)	Accuracy	Max DC working voltage(V)	Capac- itance code	Capac- itance (pF)	Accuracy	Max DC working voltage(V)	Capac- itance code	Capac- itance (pF)	Accuracy	Max DC working voltage(V)
0R3	0.3	A, B, C.	250	3R9	3.9	B, C, D.	250	430	43	F, G, J, K.	250
0R4	0.4			4R3	4.3			470	47		
0R5	0.5	B, C, D.		4R7	4.7			510	51		
0R6	0.6			5R1	5.1			560	56		
0R7	0.7			5R6	5.6			620	62		
0R8	0.8			6R2	6.2			680	68		
0R9	0.9			6R8	6.8			750	75		
1R0	1			7R5	7.5			820	82		
1R1	1.1			8R2	8.2			910	91		
1R2	1.2			9R1	9.1			101	100		
1R3	1.3				111	110					
1R4	1.4			100	10	121		120			
1R5	1.5			110	11	131		130			
1R6	1.6			120	12	151		150			
1R7	1.7			130	13	161		160			
1R8	1.8			150	15	181		180			
1R9	1.9			160	16	201		200			
2R0	2			180	18	221		220			
2R1	2.1			200	20	241		240			
2R2	2.2			220	22	271		270			
2R4	2.4			240	24	301		300			
2R7	2.7			270	27	331		330			
3R0	3			300	30						
3R3	3.3			330	33						
3R6	3.6			360	36						
				390	39						
				361	360	150					
				391	390						
				431	430						

4.5 1111 specification capacitance table

Capac- itance code	Capac- itance (pF)	Accuracy	Max DC working voltage(V)	Capac- itance code	Capac- itance (pF)	Accuracy	Max DC working voltage(V)	Capac- itance code	Capac- itance (pF)	Accuracy	Max DC working voltage(V)	Capac- itance code	Capac- itance (pF)	Accuracy	Max DC working voltage(V)			
0R5	0.5	A, B, C, D.	1500	4R7	4.7	B, C, D.	1500	510	51	F, G, J, K.	1500	561	560	F, G, J.	600			
0R6	0.6			5R1	5.1			560	56			621	620					
0R7	0.7			5R6	5.6			620	62			681	680					
0R8	0.8			6R2	6.2			680	68			751	750					
0R9	0.9			6R8	6.8			750	75			821	820					
1R0	1			7R5	7.5			820	82			911	910					
1R1 1R2 1R3 1R4 1R5 1R6 1R7 1R8 1R9 2R0 2R1 2R2 2R4 2R7 3R0 3R3 3R6 3R9 4R3	1.1	B, C, D.		1500	8R2	8.2		F, G, J, K.	1500	910		91	F, G, J, K.	1000	102	1000	F, G, J.	150
	1.2				9R1	9.1				101		100			112	1100		
	1.3				100	10				111		110			122	1200		
	1.4				110	11				121		120			132	1300		
	1.5				120	12				131	130	1000			152	1500		
	1.6				130	13				151	150				162	1600		
	1.7				150	15				161	160				182	1800		
	1.8				160	16				181	180							
	1.9				180	18				201	200							
	2				200	20				221	220							
	2.1				220	22				241	240							
	2.2				240	24				271	270							
	2.4				270	27				301	300							
	2.7				300	30				331	330							
	3				330	33				361	360							
	3.3				360	36				391	390							
	3.6				390	39				431 471 511	430 470 510	600						
	3.9				430	43												
4.3	470	47																

4.6 2525 specification capacitance table

Capac- itance code	Capac- itance (pF)	Accuracy	Max DC working voltage(V)	Capac- itance code	Capac- itance (pF)	Accuracy	Max DC working voltage(V)	Capac- itance code	Capac- itance (pF)	Accuracy	Max DC working voltage(V)	Capac- itance code	Capac- itance (pF)	Accuracy	Max DC working voltage(V)			
1R0	1.0	B, C.	3600	7R5	7.5	B, C, D.	3600	820	82	F, G, J, K, M.	3600	911	910	F, G, J, K, M.	1500			
1R1	1.1			8R2	8.2			910	91			102	1000					
1R2	1.2			9R1	9.1			101	100			112	1100		1000			
1R3	1.3			100	10	111		110	122			1200						
1R4	1.4	110		11	121	120		132	1300									
1R5	1.5	120		12	131	130		152	1500									
1R6	1.6	130		13	151	150		162	1600									
1R7	1.7	150		15	161	160		182	1800									
1R8	1.8	160		16	181	180		202	2000									
1R9	1.9	180		18	201	200		222	2200									
2R0	2.0	200		20	221	220		242	2400									
2R1	2.1	220		22	241	240		272	2700		500							
2R2	2.2	240		24	271	270		302	3000									
2R4	2.4	270		27	301	300		332	3300									
2R7	2.7	300		30	331	330		362	3600									
3R0	3	330		33	361	360		392	3900									
3R3	3.3	360		36	391	390		432	4300									
3R6	3.6	390		39	431	430		472	4700									
3R9	3.9	430		43	471	470		512	5100									
4R3	4.3	470		47	511	510		562	5600			250						
4R7	4.7	510		51	561	560												
5R1	5.1	560		56	621	620												
5R6	5.6	620		62	681	680												
6R2	6.2	B, C, D.		3600	680	68		F, G, J, K, M.	3600		751	750	F, G, J, K, M.	2000				
6R8	6.8				750	75					821	820			1500			

4.7 3838 specification capacitance table

Capac- itance code	Capac- itance (pF)	Accuracy	Max DC working voltage(V)	Capac- itance code	Capac- itance (pF)	Accuracy	Max DC working voltage(V)	Capac- itance code	Capac- itance (pF)	Accuracy	Max DC working voltage(V)	Capac- itance code	Capac- itance (pF)	Accuracy	Max DC working voltage(V)	
1R0	1.0	B, C.	7200	7R5	7.5	B, C, D.	7200	820	82	F, G, J, K, M.	7200	911	910	F, G, J, K, M.	2500	
1R1	1.1			8R2	8.2			910	91			102	1000			
1R2	1.2			9R1	9.1			101	100			112	1100			
1R3	1.3							111	110			122	1200			
1R4	1.4	B, C, D.		110	11			121	120			132	1300		1500	
1R5	1.5			120	12			131	130			152	1500			
1R6	1.6			130	13			151	150			162	1600			
1R7	1.7			150	15			161	160			182	1800			
1R8	1.8			160	16			181	180			202	2000			
1R9	1.9			180	18			201	200		222	2200	1000			
2R0	2.0			200	20			221	220		242	2400				
2R1	2.1			220	22			241	240		272	2700				
2R2	2.2			240	24			271	270		302	3000				
2R4	2.4			270	27			301	300		332	3300				
2R7	2.7			300	30			331	330		362	3600				
3R0	3			330	33			361	360		392	3900				
3R3	3.3			360	36			391	390		432	4300				
3R6	3.6			390	39			431	430		472	4700				
3R9	3.9			430	43			471	470		512	5100				
4R3	4.3			470	47			511	510		562	5600				
4R7	4.7			510	51			561	560		622	6200	500			
5R1	5.1			560	56			621	620		682	6800				
5R6	5.6			620	62			681	680							
6R2	6.2				680	68			751		750					
6R8	6.8				750	75			821		820					

4.8 0709specification capacitance table

Capac- itance code	Capac- itance (pF)	Accuracy	Max DC working voltage(V)	Capac- itance code	Capac- itance (pF)	Accuracy	Max DC working voltage(V)	Capac- itance code	Capac- itance (pF)	Accuracy	Max DC working voltage(V)
1R0	1	B, C, D.	500	6R2	6.2	B, C, D.	500	560	56	F, G, J.	500
1R1	1.1			6R8	6.8			620	62		
1R2	1.2			7R5	7.5			680	68		
1R3	1.3			8R2	8.2			750	75		
1R4	1.4			9R1	9.1			820	82		
1R5	1.5			100	10	F, G, J.		910	91		
1R6	1.6			110	11			101	100		
1R7	1.7			120	12						
1R8	1.8			130	13						
1R9	1.9			150	15						
2R0	2			160	16						
2R1	2.1			180	18						
2R2	2.2			200	20						
2R4	2.4			220	22						
2R7	2.7			240	24						
3R0	3			270	27						
3R3	3.3			300	30						
3R6	3.6			330	33						
3R9	3.9			360	36						
4R3	4.3			390	39						
4R7	4.7			430	43						
5R1	5.1			470	47						
5R6	5.6			510	51						

4.9 0709specification capacitance table

Capac- itance code	Capac- itance (pF)	Accuracy	Max DC working voltage(V)	Capac- itance code	Capac- itance (pF)	Accuracy	Max DC working voltage(V)	Capac code	Capac- itance (pF)	Accuracy	Max DC working voltage(V)
2R0	2	B, C, D.	500	160	16	B, C, D.	500	151	150	F, G, J.	500
2R1	2.1			180	18			161	160		
2R2	2.2			200	20			181	180		
2R4	2.4			220	22			201	200		
2R7	2.7			240	24			221	220		
3R0	3			270	27	F, G, J.		241	240		
3R3	3.3			300	30			271	270		
3R6	3.6			330	33			301	300		
3R9	3.9			360	36						
4R3	4.3			390	39						
4R7	4.7			430	43						
5R1	5.1			470	47						
5R6	5.6			510	51						
6R2	6.2			560	56						
6R8	6.8			620	62						
7R5	7.5			680	68						
8R2	8.2			750	75						
9R1	9.1			820	82						
100	10			910	91						
110	11			101	100						
120	12			111	110						
130	13			121	120						
150	15			131	130						

5. Technical requirements and test condition

5.1 General specifications

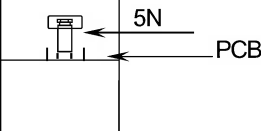
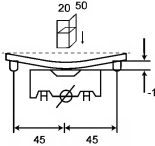
General specification GB/T 21041-2007 «Fixed capacitors for use in electronic equipment Part 21:Sectional specification: Fixed surface mount multilayer capacitors of ceramic dielectric, class 1»

5.2 Conventional technical indicators and test me

Program	Technical specifications		Test method			
Temperature	(-55 ~ +125)℃					
Appearance	No obvious defects		Visual inspection			
Capacitance	Within the specification error range		Nominal capacitance	Test frequency	Test voltage	Environment
			≤1000pF	1MHz(±10%)	(1.0±0.2)Vrms	Temperature (25±2)℃ Humidity<75%
			>1000 pF	1KHz(±10%)	(1.0±0.2)Vrms	
Quality factor (Q value)	Greater than 2000 when the frequency is 1MHz		Test method: Same as 'Capacitance'			
Loss angle tangent	Less than 0.0005 when the frequency is 1MHz					
Insulation Resistance	≥100000MΩ		Test voltage	Test time	Charge and discharge current	Environment
			Ur or 1000V, take the smaller or the two	≤60 sec	≤50mA	Temperature (25±2)℃ Humidity<75%
Dielectric Withstanding Voltage	There should be no dielectric breakdown or damage		Rated voltage	Test voltage	Time	Charge and discharge current
			Ur<200V	2.5Ur	(1~5) sec	≤50mA
			200V≤Ur≤1000V	1.5Ur		
			Ur>1000V	1.2Ur		
Capacitance temperature coefficient or temperature characteristics	C0G: (0±30) ppm/℃		Measured after the temperature is stable for 30 minutes in the following temperature order (△C is based on T3)			
			Step	Temperature (℃)		
			T1	20±2		
			T2	-55±3		
			T3	20±2		
			T4	125±2		
			T1	20±2		
Solderability	Appearance	No visible damage, inning rate ≥95%	Immerse the capacitor in a solution of ethanol and rosin (25% by weight), take it out and preheat it at a temperature of (80~120)℃ for (10~30)sec, then immerse it in a solder solution. Soldering temperature:(235±5)℃; Soldering speed:(25±			
Note: When testing the dielectric strength of capacitors, in order to eliminate the influence of the external environment, when the test voltage exceeds 1000Vdc, the capacitor should be immersed in insulating oil for testing.						

Note: When testing the dielectric strength of capacitors, in order to eliminate the influence of the external environment, when the test voltage exceeds 1000Vdc, the capacitor should be immersed in insulating oil for testing.

5.3 Reliability indicators and period

Program	Technical specifications		Test method		
Resistance to soldering heat	Appearance	No visible damage,inning rate $\geq 95\% \leq$	The capacitor is immersed in a solution of ethanol and rosin(25% byweight), taken out and preheated at a temperature of 100-200°C for 10+2min, then immersed in a soldering solution. Soldering temperature:260+5°C; Soldering speed:25+0.25mm/s Soldering time: 10+1sec After being taken out, it is cleaned with a solvent and observed under a microscope with a magnification of at least 10x. The test is performed again after the capacitor has been placed in a room for 24+2hrs		
	$\Delta C/C$	$\pm 0.5\%$ or $\pm 0.5pF$,take the larger			
	D.F.	Same as the initial standard			
	I.R.	Same as the initial standard			
Terminal electrode adhesion strength	The end electrode does not peel off Appearance: no visible damage		Apply thrust: 5N Time: 10±1sec Speed: 1±0.5mm/sec		
Bending strength	Appearance	No visible damage	Test substrate: PCB board Bending depth: 1mm Application speed: 1±0.5mm/sec. Measurement should be performed bent 		
	$\Delta C/C$	$\leq \pm 5\%$			
Temperature cycling	Appearance	No visible damage	Number of cycles: 5 times, one cycle is divided into the following 4 steps:		
	$\Delta C/C$	$\leq \pm 1\%$ or $\pm 1pF$ Take the larger of the two	Step	Temperature(°C)	Time(min)
	D.F.	Same as the initial standard	Step 1	-55±3	30
			Step 2	20±3	3
	I.R.	Same as the initial standard	Step 3	125±3	30
			Step 4	20±3	3
			After the test, place it at room temperature for 24±2 hrs before measuring again.		
Resistance to soldering heat	Appearance	No visible damage	Temperature: 40±2°C Humidity: 90~95%RH Time: 500+24/-0hrs After the test, place it at room temperature for 24±2 hrs before measuring again.		
	$\Delta C/C$	$\leq \pm 2\%$ or $\pm 1pF$ Take the larger of the two			
	D.F.	Same as the initial standard			
	I.R.	$R_i \geq 2500M\Omega$ or $R_i \cdot C_R > 25S$ Take the smaller of the two			
Life test	Appearance	No visible damage	Rated voltage	Applied voltage	Time
			$U_r \leq 200V$	2Ur	1000h
	$\Delta C/C$	$\leq \pm 2\%$ or $\pm 1pF$ Take the larger of the two	200V<Ur ≤500V	1.5Ur	1500h
			500V<Ur ≤1000V	1.2Ur	2000h
	D.F.	Twice the initial standard	$U_r > 1000V$	Ur	2000h
	I.R.	$R_i \geq 4000M\Omega$ or $R_i \cdot C_R > 40S$ Take the smaller of the two	Charging and discharging current : ≤ 50mA		
Temperature: (125±3)°C After the test, place it at room temperature for 24±2 hrs before measuring again.					

6. Precautions for use

1. Precautions before use

In harsh working environments or under external mechanical overpressure that exceeds the use conditions described it, first may be damaged, so when consider applying according to the relevant instructions in this approval using

2. PCB board design

2.1 The amount of solder used will affect the chip's ability to resist mechanical stress, which may cause RF-MLCC to break or crack. Therefore, when designing the substrate, the size and configuration of the pads must be carefully considered, which has a decisive effect on the amount of solder that makes up the substrate.

2.2 When designing the pads and the position of the SMD MLCC, consider reducing the stress to the lowest point and install the MLCC in the least affected position on the PC board.

3. Issues to consider for automatic installation

If the suction pipe is lowered beyond the minimum limit, it will exert excessive pressure on the MLCC and cause it to rupture. When lowering the suction pipe, pay attention to the following points:

3.1 After correcting the deviation of the PC board, adjust the lower limit of the suction pipe to the surface level of the PC board.

3.2 The suction pressure should be adjusted between iN and $3N$.

3.3 In order to reduce the deformation of the PC board caused by the impact force of the suction pipe, support nails should be placed under the PC board.

4. Welding

4.1 MLCC is a combination of ceramics and metal. As a ceramic body, especially a large sized ceramic body, its thermal plasticity is poor and its response to heat is slow. Under sudden cooling and sudden heating conditions, ceramic bodies are prone to cracking. it is recommended to preheat continuously for more than 1 minute before welding.

4.2 The interior of MLCC is a metal electrode with good thermal plasticity and fast response to heat. Therefore, Under heating conditions, there must be a certain degree of inconsistency in expansion between metal parts and ceramic parts, This will cause internal stress and easily cause ceramic body cracking. It is recommended to preheat continuously for more than 1 minute before welding.

4.3 When manual welding, use a constant temperature soldering iron with a maximum diameter of 1.0mm at the tip of its tip and a maximum power of 25 watts; do not touch MLCC components directly with a soldering iron.

4.4 It is recommended to avoid using wave soldering for specifications above 1206. 4.5 The manual welding temperature for tape/lead products should be below $350^{\circ}C$.

5. Cleaning

5.1 The temperature difference between components and cleaning process cannot be greater than $100^{\circ}C$

5.2 In case of ultrasonic cleaning, if the output power is too high, it will cause excessive vibration on the PC board, This will cause MLCC or solder joints to crack or reduce terminal electrode strength, Therefore pay special attention to the following points. Ultrasonic output: less than 20W/L: Ultrasonic frequency: less than 40KHz: Ultrasonic cleaning time: 5 minutes or less

6. Cutting PCB board

6.1 After installing MLCC and other components, when dividing PC boards, be careful not to apply any force on them. Do not let MLCC bear excessive mechanical impact.

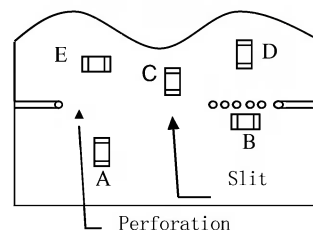
6.2 The division of boards cannot be divided manually and should use appropriate equipment.

7. Storage method

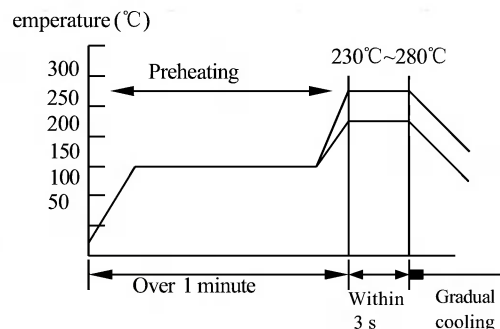
In order to maintain terminal electrode weldability and ensure that packaging materials are in good condition, recommended storage conditions are as follows. Storage temperature: $5-40^{\circ}C$; Storage relative humidity: 20-70%RH Even if stored under ideal storage conditions, MLCC terminal weldability will decrease over time, Therefore MLCC should be used within 6 months from date of shipment.

Soldering temperature: $260 \pm 5^{\circ}C$; Soldering speed: $25 \pm 0.25mm/s$; Soldering time: 10 ± 1 seconds, After being taken out, it is cleaned with a solvent and observed under a microscope with a magnification of at least 10x, The test is performed again after the capacitor has been placed in a room for 24 ± 2 hours immerse the capacitor in a solution of ethanol and rosin 125% by weight. take it out and reheat it at a temperature of $(80-120)^{\circ}C$ for $(10-30)$ sec. then immerse it in a solder solution. Soldering temperature: $(235 \pm 5)^{\circ}C$; Soldering speed: $(25 \pm 0.25)mm/sec$; Soldering time: $(2 \pm 0.5)sec$

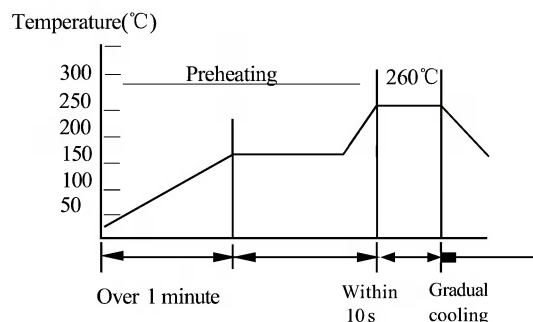
Stress value : $A > B > C > D > E$



Hand soldering temperature



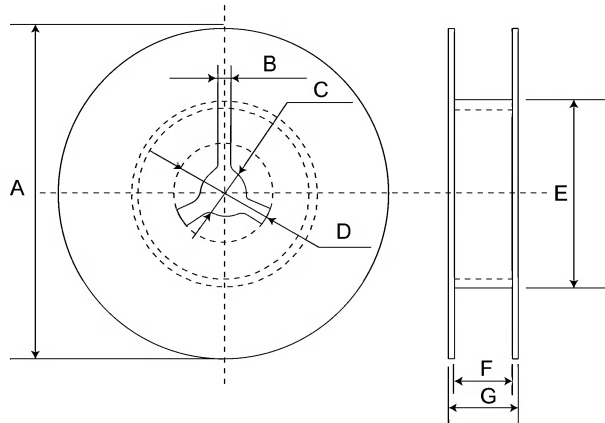
Recommended temperature for lead-free soldering



7. Product packaging

7.1 Reel dimension

Reel dimension (unit:mm)



A	B	C	D	E	F	G
$\Phi 178.00 \pm 2.00$	3.00	$\Phi 13.00 \pm 0.50$	$\Phi 21.00 \pm 0.80$	$\Phi 50.00$ or larger	10.00 ± 1.50	12Max
$\Phi 330.00 \pm 2.00$	3.00	$\Phi 13.00 \pm 0.50$	$\Phi 21.00 \pm 0.80$	$\Phi 50.00$ or larger	10.00 ± 1.50	12Max

7.2 Taping method

7.2.1 The tape for packaging capacitors is wound clockwise. When pulling out the tape from top to bottom, the feed hole is on the right side of the tape.

7.2.2 At the front end of the tape, at least 5 lead spacings should be left.

7.2.3 When taping, the lead part or blank part must be left as shown in the figure below.

7.2.4 The number of products installed incorrectly in the tape must be less than 0.1% or 1 per reel, and errors must not occur continuously.

7.2.5 The upper and lower adhesive tapes should not exceed the edge of the tape and should not block the feed hole.

7.2.6 The cumulative error of the feed hole is within +0.3 mm for 10 spacings.

8. Inspection results of prohibited substances in products About RoHS

All products meet the requirements of the RoHS directive:

- Lead(pb) (<1000ppm)
- Mercury (Hg) (<1000ppm)
- Cadmium(cd) (<100ppm)
- Hexavalent Chromium Content(Cr6+) (<1000ppm)
- Polybrominated Biphenyls(PBBs) (<1000ppm)
- Polybrominated diphenyl ethers(PBDE) (<1000ppm)