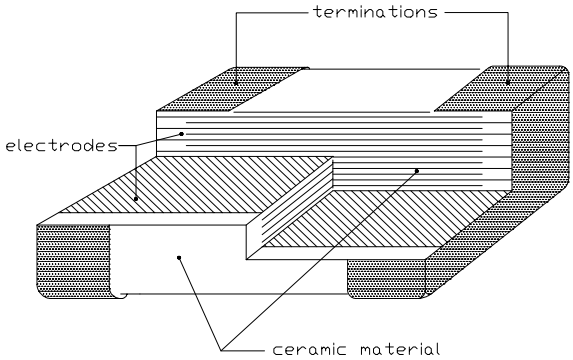
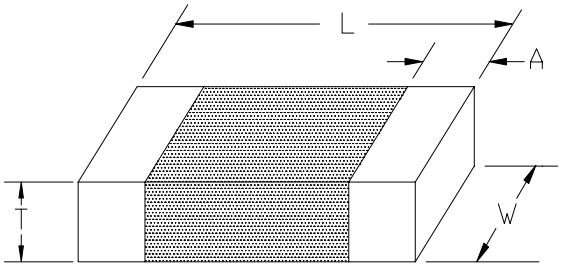
SUNSTAR微波光电 http://www.rfoe.net/ TEL:0755-83396822 FAX:0755-83376182 E-MAIL:szss20@163.com

STRUCTURE AND DIMENSIONS

MLCC STRUCTURE



DIMENSIONS



SIZE CODE	L	W	A(Min/Max)	UNIT
0603	0.6+/-0.03	0.3+/-0.03	0.10/0.20	mm
(0201)	(0.024+/-0.001)	(0.012+/-0.001)	(0.004/0.008)	(inch)
1005	1.0 +/- 0.05	0.5 +/- 0.05	0.20 / 0.30	mm
(0402)	(0.040 +/- 0.002)	(0.020 +/- 0.002)	(0.008 / 0.012)	(inch)
1608	1.6 +/- 0.10	0.8 +/- 0.10	0.25 / 0.65	mm
(0603)	(0.063 +/- 0.004)	(0.031 +/- 0.004)	(0.010 / 0.026)	(inch)
2012	2.0 +/- 0.10	1.25 +/- 0.10	0.25 / 0.75	mm
(0805)	(0.079 +/- 0.004)	(0.049 +/- 0.004)	(0.010 / 0.030)	(inch)
3216	3.2 +/- 0.15	1.6 +/- 0.15	0.25 / 0.75	mm
(1206)	(0.126 +/- 0.006)	(0.063 +/- 0.006)	(0.010 / 0.030)	(inch)
3225	3.2 +/- 0.20	2.5 +/- 0.20	0.25 / 0.75	mm
(1210)	(0.126 +/- 0.008)	(0.098 +/- 0.008)	(0.010 / 0.030)	(inch)
4520	4.5 +/- 0.20	2.0 +/- 0.20	0.25 / 0.75	mm
(1808)	(0.177 +/- 0.008)	(0.079 +/- 0.008)	(0.010 / 0.030)	(inch)
4532	4.5 +/- 0.20	3.2 +/- 0.20	0.25 / 0.75	mm
(1812)	(0.177 +/- 0.008)	(0.126 +/- 0.008)	(0.010 / 0.030)	(inch)

SUNSTAR射频通信 http://www.rfoe.net/ TEL:0755-83397033 FAX:0755-83376182 E-MAIL:szss20@163.com

PRODUCT RANGE NPO

CLASS	Class I																		
T.C.	NPO																		
TYPE	Standard															HV			Array
SIZE	0201	0402			0603			0805				1206				1206		1808	1206
RV	25V	25V	50V	100V	25V	50V	100V	25V	50V	100V	200V	50V	100V	200V	500V	1KV	2KV	3KV	50V
0.47 p		B	B	B	D	D	D	C	C	C	C								
0.56 p		B	B	B	D	D	D	C	C	C	C								
0.68 p		B	B	B	D	D	D	C	C	C	C								
0.82 p		B	B	B	D	D	D	C	C	C	C								
1.0 p	A	B	B	B	D	D	D	C	C	C	C	D	D	D	D				
1.2 p	A	B	B	B	D	D	D	C	C	C	C	D	D	D	D				D
1.5 p	A	B	B	B	D	D	D	C	C	C	C	D	D	D	D	D	D		D
1.8 p	A	B	B	B	D	D	D	C	C	C	C	D	D	D	D	D	D		D
2.2 p	A	B	B	B	D	D	D	C	C	C	C	D	D	D	D	D	D		D
2.7 p	A	B	B	B	D	D	D	C	C	C	C	D	D	D	D	D	D		D
3.3 p	A	B	B	B	D	D	D	C	C	C	C	D	D	D	D	D	D		D
3.9 p	A	B	B	B	D	D	D	C	C	C	C	D	D	D	D	D	D		D
4.7 p	A	B	B	B	D	D	D	C	C	C	C	D	D	D	D	D	D		D
5.6 p	A	B	B	B	D	D	D	C	C	C	C	D	D	D	D	D	D	H	D
6.8 p	A	B	B	B	D	D	D	C	C	C	C	D	D	D	D	D	D	H	D
8.2 p	A	B	B	B	D	D	D	C	C	C	C	D	D	D	D	D	D	H	D
10 p	A	B	B	B	D	D	D	C	C	C	C	D	D	D	D	D	D	H	D
12 p	A	B	B	B	D	D	D	C	C	C	C	D	D	D	D	D	D	H	D
15 p	A	B	B	B	D	D	D	C	C	C	C	D	D	D	D	D	D	H	D
18 p	A	B	B	B	D	D	D	C	C	C	C	D	D	D	D	D	D	H	D
22 p	A	B	B	B	D	D	D	C	C	C	C	D	D	D	D	D	K	H	D
27 p	A	B	B	B	D	D	D	C	C	C	C	D	D	D	D	D	K	H	D
33 p	A	B	B	B	D	D	D	C	C	C	C	D	D	D	D	D	K	H	D
39 p	A	B	B	B	D	D	D	C	C	C	C	D	D	D	D	D	K	H	D
47 p	A	B	B	B	D	D	D	C	C	C	C	D	D	D	D	D	K	H	D
56 p	A	B	B	B	D	D	D	C	C	C	C	D	D	D	D	D	K	H	D
68 p	A	B	B	B	D	D	D	C	C	C	C	D	D	D	D	D	K	H	D
82 p	A	B	B	B	D	D	D	C	C	C	C	D	D	D	D	D	K	H	D
100 p	A	B	B	B	D	D	D	C	C	C	C	D	D	D	D	D	K	H	D
120 p		B	B	B	D	D	D	C	C	C	C	D	D	D	D	K	K		D
150 p		B	B		D	D	D	C	C	C	C	D	D	D	D	K	K		D
180 p		B	B		D	D	D	C	C	C	C	D	D	D	D	K	K		D
220 p		B	B		D	D	D	C	C	C	E	D	D	D	D	K	K		D
270 p					D	D	D	C	C	C	E	D	D	D	D	K	H		D
330 p					D	D	D	C	C	C	E	D	D	D	D	K	H		D
390 p					D	D	D	C	C	C	E	D	D	D	D	K	**H**		D
470 p					D	D	D	C	C	C	E	D	D	D	E	H	**H**		D
560 p					D	D	D	C	C	C	G	D	D	D	E				D
680 p					D	D	D	C	C	C		D	D	D	E				D
820 p					D	D		C	C	C		D	D	E	F				D
1.0 n					D	D		C	C	C		D	D	E	F				D
1.2 n					D	D		E	E	E		C	D	E					D
1.5 n					D			E	E	E		C	D	F					
1.8 n								E	E	E		C	D						
2.2 n								E	E	E		C	D						
2.7 n								E	E			C	D						
3.3 n								E	E			C	E						
3.9 n								E	E			E	E						
4.7 n								E	E			E	E						
5.6 n								E	E			E							
6.8 n								G	G			F							
8.2 n								G	G			F							
10 n												L							
12 n												L							
15 n																			

NME

BME

Certain Types may be available in the alternate material.
Ask for details

Code	Thickness : (mm)	Code	Thickness : (mm)
A	0.30+/-0.03	F	1.15+/-0.10
B	0.50+/-0.05	G	1.25+/-0.10
C	0.60+/-0.10	H	1.50+/-0.15
D	0.80+/-0.10	K	0.90~1.30
E	0.85+/-0.10	L	1.60+/-0.15

PRODUCT RANGE X7R

CLASS	Class II																									
T.C.	X7R																									
TYPE	Standard																						HV			
SIZE	0402				0603					0805						1206							1206		1808	1812
RV	10V	16V	25V	50V	10V	16V	25V	50V	100V	10V	16V	25V	50V	100V	200V	10V	16V	25V	50V	100V	200V	500V	1KV	2KV	2KV	2KV
47 p																										
56 p																										
68 p																										
82 p																										
100 p	B	B	B	B			D	D	D																	
120 p	B	B	B	B			D	D	D																	
150 p	B	B	B	B			D	D	D																	
180 p	B	B	B	B			D	D	D			C	C	C	E				D	D	D	D	E	E		
220 p	B	B	B	B			D	D	D			C	C	C	E				D	D	D	D	E	E	H	
270 p	B	B	B	B			D	D	D			C	C	C	E				D	D	D	D	E	E	H	
330 p	B	B	B	B			D	D	D			C	C	C	E				D	D	D	D	E	E	H	
390 p	B	B	B	B			D	D	D			C	C	C	E				D	D	D	D	E	E	H	
470 p	B	B	B	B			D	D	D			C	C	C	E				D	D	D	F	K	K	H	
560 p	B	B	B	B			D	D	D			C	C	C	E				D	D	D	F	K	K	H	
680 p	B	B	B	B			D	D	D			C	C	C	E				E	E	E	F	K	K	H	
820 p	B	B	B	B			D	D	D			C	C	C	E				E	E	E	F	K	H	H	
1.0 n	B	B	B	B			D	D	D			C	C	C	E				E	E	E	F	K	H	H	H
1.2 n	B	B	B	B			D	D	D			C	C	C	E				E	E	E	F	K	H	H	
1.5 n	B	B	B	B			D	D	D			C	C	C	E				E	E	E	F	K		H	
1.8 n	B	B	B	B			D	D	D			C	C	C	E				E	E	E	F	K		H	
2.2 n	B	B	B	B			D	D	D			C	C	C	E				E	E	E	F	K		H	
2.7 n	B	B	B	B			D	D	D			C	C	C	E				E	E	E	F	K		H	
3.3 n	B	B	B	B			D	D	D			C	C	C	E				E	E	E	F	K		H	
3.9 n	B	B	B	B			D	D	D			C	C	C	E				E	E	E	F	K		H	
4.7 n	B	B	B	B			D	D	D			C	C	C	E				E	E	E	F	H		H	
5.6 n	B	B	B	B			D	D	D			C	C	C	E				E	E	E	F				
6.8 n	B	B	B	B			D	D	D			C	C	C	G				E	E	E	F				
8.2 n	B	B	B				D	D	D			C	C	C	G				E	E	E	F				
10 n	B	B	B				D	D	D			C	C	C					E	E	E	F				
12 n	B	B					D	D	D			C	C	E					E	E	E					
15 n	B	B					D	D	D			C	C	E					E	E	E					
18 n	B	B					D	D				C	C	E					E	E	F					
22 n	B	B					D	D				C	C	E					E	E	F					
27 n	B	B					D	D				C	C	E					E	E	F					
33 n	B	B					D	D				C	C						E	E						
39 n	B	B					D					C	C						E	E						
47 n	B	B				D	D					C	E						E	E						
56 n						D						C	E						E	E						
68 n						D						C	E						E	F						
82 n						D						E	E						E	F						
100 n					D	D					E	E	G						E	F						
120 n					D						F	F	G						F							
150 n					D						E	G	G					E	F							
180 n					D						E							E	F							
220 n					D					E	E							E	F							
270 n										E	G							E								
330 n										E	G						E	E								
390 n										E	G						E	E								
470 n										E	G						E	E								
560 n										E	G							E								
680 n										E	G							F								
820 n										G	G							F								
1.0 u										G	G						E	F								
1.2 u																	F									
1.5 u																	F									
1.8 u																	L									
2.2 u																	L									

NME BME

Certain Types may be available in the alternate material.
Ask for details

PRODUCT RANGE X5R/Y5V

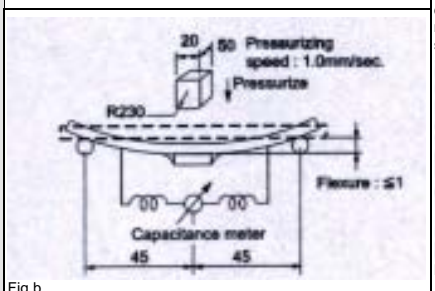
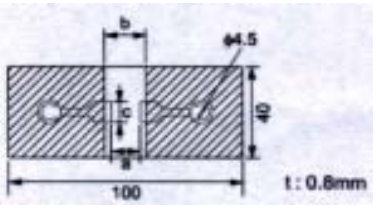
CLASS	ClassII																
T.C.	X5R			Y5V													
TYPE	Standard			Standard													
SIZE	0402		0603	0402			0603			0805			1206				1210
RV	10V	16V	10V	10V	16V	25V	16V	25V	50V	16V	25V	50V	10V	16V	25V	50V	16V
10 n					B	B		D	D						C	C	
12 n	B	B			B	B		D	D						C	C	
15 n	B	B			B	B		D	D						C	C	
18 n	B	B			B	B		D	D						C	C	
22 n	B	B			B	B		D	D						C	C	
27 n	B	B			B			D	D						C	C	
33 n	B	B			B			D	D						C	C	
39 n	B				B			D	D						C	C	
47 n	B				B			D	D		C	C			C	C	
56 n	B				B			D	D		C	C			C	C	
68 n	B				B			D	D		C	C			C	C	
82 n	B				B			D	D		C	C			C	C	
100 n	B			B	B		D	D	D		C	C			C	C	
120 n				B			D				E	E			C	C	
150 n			D	B			D				E	E			C	C	
180 n			D	B			D				E	E			C	C	
220 n			D	B			D			C	E	E			C	C	
270 n			D				D			C	E				C	C	
330 n			D				D			E	G				C	C	
390 n			D				D			E	G				C	C	
470 n			D				D			E	G				E	E	
560 n							D			E	G				E	E	
680 n							D			E	G				E	E	
820 n							D			G	G				E	E	
1.0 u							D			G	G			E	F	F	
1.2 u										G				E	F		
1.5 u										G				E	F		
1.8 u										G				F	F		
2.2 u										G				F	F		
2.7 u														F	F		
3.3 u														F	L		
3.9 u														L	L		
4.7 u													L	L	L		E
5.6 u													L				F
6.8 u													L				F
8.2 u													L				H
10 u													L				H
12 u																	
15 u																	
18 u																	
22 u																	

NME BME

Certain Types may be available in the alternate material.
Ask for details

Code	Thickness : (mm)	Code	Thickness : (mm)
A	0.30+/-0.03	F	1.15+/-0.10
B	0.50+/-0.05	G	1.25+/-0.10
C	0.60+/-0.10	H	1.50+/-0.15
D	0.80+/-0.10	K	0.90~1.30
E	0.85+/-0.10	L	1.60+/-0.15

ELECTRICAL SPECIFICATIONS

	Item	Specification		Test Method
		Temperature compensating type	High dielectric constant type	
1	Operating Temperature Range	NP0: -55 to 125 degree C	X7R: -55 to 125 degree C X5R: -55 to 85 degree C Y5V: -30 to 85 degree C	---
2	Rated Voltage	Please refer to page 5 ~ page 7		The rated voltage is defined as the maximum voltage, which may be applied continuously to the capacitor.
3	Appearance	No defects or abnormalities.		Visual inspection
4	Dimensions	Within the specified dimension.		Using calipers
5	Dielectric Strength (Flash)	No defects or abnormalities.		No failure shall be observed when 250% of the rated voltage is applied between the terminations for 1 to 5 seconds, the charge and discharge current is less than 50mA. HV: V ≧ 1KV : 120% of rated voltage for 1 to 5 seconds. 500V≦V<1KV: 150% of rated voltage for 1 to 5 seconds 250V≦V<500V: 200% of rated voltage for 1 to 5 seconds No greater than 200V:250% of rated voltage for 1 to 5 seconds The charge and discharge current is less than 50mA.
6	Insulation Resistance (I.R.)	I.R. ≧100GΩ or R*C ≧ 1000 Ω-F (whichever is smaller) BME: I.R. ≧10GΩ or R*C ≧ 500 Ω-F (whichever is smaller) HV: I.R. ≧100GΩ or R*C ≧ 1000 Ω-F (whichever is smaller)		The insulation resistance shall be measured with a DC voltage not exceeding the rated voltage at 25℃ and 75%RH max, and within 1 minute of charging.
7	Capacitance	Within the specified tolerance at 5000 hours		The capacitance / D.F. shall be measured at 25℃ at the frequency and voltage shown in the tables. Item / Class I (≦1,000pF) / Class I (>1,000pF) / Class II Frequency: 1±0.2MHz / 1±0.2KHz / 1±0.2KHz Voltage: 1±0.2Vrms / 1±0.2Vrms / 1±0.2Vrms
8	Dissipation Factor (D.F.)	For NP0, If C≦30pF, DF≦1/(400+20C) If C >30pF, DF≦0.1%. For high dielectric constant type please see table 1. Table 1 Char./max / 50Vmin / 25V / 16V / 10V X7R / 2.5% Max / 3.5% Max / 3.5% Max / 5% Max Y5V / 5%, 7%#1 / 5%, 7%#1 / 9%, 12.5%#2 / 12.5% X5R / 3.5% Max / 3.5% Max / 3.5% Max / 5% Max		
9	Capacitance Temperature Characteristics	Capacitance change NPO within ± 30 PPM/℃	Capacitance change X7R within ±15% Y5V: -82 to + 22% X5R within ±15%	1. Temperature compensating type: The capacitance value at 25℃ and 85℃ shall be measured and calculated from the formula given below. $T.C.=(C_{85}-C_{25})/C_{25}*\Delta T*10^6$(PPM/℃) 2. High dielectric constant type: The ranges of capacitance change compared with the 25℃ value over the temperature ranges shall be within the specified ranges.
10	Bending Strength	No cracking or marking defects shall occur at 1mm deflection.  Fig.b		Solder the capacitor to the test jig(glass epoxy boards) shown in Fig.a using an eutectic solder. Then apply a force in the direction shown in Fig.b. The soldering shall be done with the reflow method and shall be conducted with care so that the soldering is uniform and free of defects such as heat shock.  Fig.a

ELECTRICAL SPECIFICATIONS

11	Solderability of Termination		90% of the terminations is to be soldered evenly and continuously.		Immerse the test capacitor into a methanol solution containing rosin for 3 to 5 seconds, preheat it 150 to 180℃ for 2 to 3 minutes and immerse it into molten solder of 230 ± 5℃ for 5±1seconds.
12	Resistance to Soldering Heat	Appearance	No marking defects		Preheat the capacitor at 120 to 150℃ for 1 minute. Immerse the capacitor in a eutectic solder solution at 270±5℃ for 10±0.5 seconds. Let sit at room temperature for 24±2 hours (temperature compensating type) or 48±4 hours (high dielectric constant type), then measure. HV : Preheat the capacitor at 120 to 150℃ for 1 minute and 170 to 200℃ for 1 minute.
		Cap. Change	NP0 within ±2.5% or 0.25pF (whichever is larger)	X7R within ±7.5% Y5V within ±20% X5R within ±7.5%	
		D.F.	If C≦30pF, DF≦1/(400+20C) If C >30pF, DF≦0.1%	Please see table 1 above.	
		I.R.	To satisfy the specified initial value		
13	Temperature cycle (Thermal shock)	Appearance	No marking defects		1. Fix the capacitor to supporting jig (glass epoxy board) and perform the five cycles according to the four heat treatments listed in the following table. 2. Initial measurement for high dielectric constant type, perform a heat treatment at 150℃ for one hour and then let sit for 48±4 hours at room temperature then perform the initial measurement.
		Cap. Change	NP0 within ±2.5% or 0.25pF (whichever is larger)	X7R within ±7.5% Y5V within ±20% X5R within ±7.5%	
		D.F.	If C≦30pF, DF≦1/(400+20C) If C >30pF, DF≦0.1%	X7R 200% max of initial value Y5V 150% max of initial value X5R 200% max of initial value	
		I.R.	More than 10G Ω or R_iC_r >100sec(whichever is smaller)	More than 1 G Ω or R_iC_R >10sec(whichever is smaller) BME: More than 500MΩ or R* C ≧ 25 Ω-F (whichever is smaller)	
14	Humidity load	Appearance	No marking defects		Apply the rated voltage at 40±2℃ and 90 to 95% humidity for 500±12 hours. Remove and let sit for 24±2 hours (temperature compensating type) or 48±4 hours (high dielectric constant type) at room temperature, then measure. The charge/discharge current is less than 50mA. BME Initial measurement for high dielectric type. Apply the rated DC voltage for 1 hour at 40±2℃. Remove and let sit for 48±4 hours at room temperature then perform initial measurement.
		Cap. Change	NP0 within ±7.5% or 0.75pF (whichever is larger)	X7R within ±12.5% Y5V within ±30% X5R within ±12.5%	
		D.F.	2* specified value	X7R 200% max of initial value Y5V 150% max of initial value X5R 200% max of initial value	
		I.R.	More than 2.5 GΩ or R_iC_r≧25 sec (whichever is smaller)	More than 1 GΩ or R_iC_R≧10 sec (whichever is smaller) BME More than 500MΩ or R* C ≧ 25 Ω-F (whichever is smaller)	
15	High temperature load life test	Appearance	No marking defects		Apply 200% of the rated voltage (HV:100%) for 500±12 hours at the maximum operating temperature ± 3℃. Let sit for 24± 2 hours (temperature compensating type) or 48±4 hours (high dielectric constant type) at room temperature, then measure. The charge/discharge current is less than 50mA. BME Initial measurement for high dielectric constant type. Apply 200% of the rated DC voltage for one hour at the maximum operating temperature ± 3℃. Remove and let sit for 48±4 hours at room temperature then perform initial measurement.
		Cap. Change	NP0 within ±7.5% or 0.75pF (whichever is larger)	X7R within ±20% Y5V within ±30% BME/HV : X7R within ±12.5%	
		D.F.	2* specified value	X7R 200% max of initial value Y5V 150% max of initial value X5R 200% max of initial value	
		I.R.	More than 5 GΩ or R_iC_r≧50 sec (whichever is smaller)	More than 1 GΩ or R_iC_R≧10 sec (whichever is smaller) BME: More than 500MΩ or R* C ≧ 25 Ω-F (whichever is smaller)	

Type / Step		1	2	3	4
NP0&X7R	Temp.(℃)	-55℃	Room temp.	+125	Room temp.
	Time (min)	30±3	1 to 2	30±3	1 to 2
Y5V	Temp.(℃)	-30℃	Room temp.	+85℃	Room temp.
	Time (min)	30±3	1 to 2	30±3	1 to 2

Notice: When mounting capacitor on 500V rated voltage, perform the epoxy resin coating (min. 1.0mm thickness)

#1: 7% max for Y5V 0603 25V and 50V products.

#2: 12.5% max for Y5V 0402 16V ≦100nF and Y5V 0603 16V 220nF~1uF products.

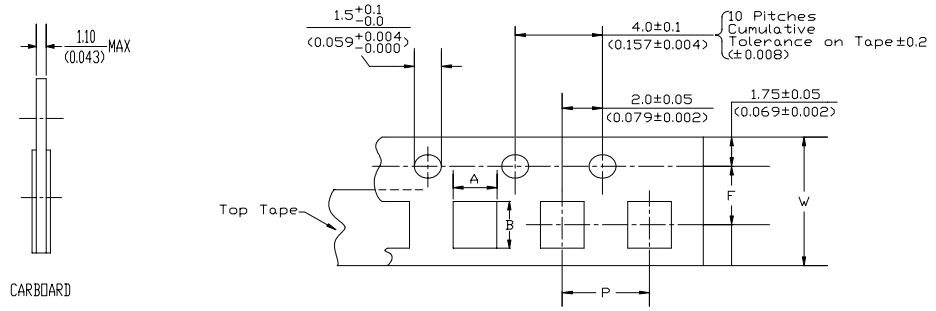
PACKAGING

■ Packing

- **Tape and reel packaging**

  Tape and reel packaging is currently the most promising system for high-speed production. A typical 180mm (7 inch) diameter reel contains 1,500 to 15,000 capacitors, 250mm (10 inch) contains 10,000 capacitors, and 330mm(13 inch) contains 10,000 to 50,000 capacitors. Three standard sizes are available in taped and reeled package either with paper carrier tapes or embossed tapes.

- **Paper tape specifications**



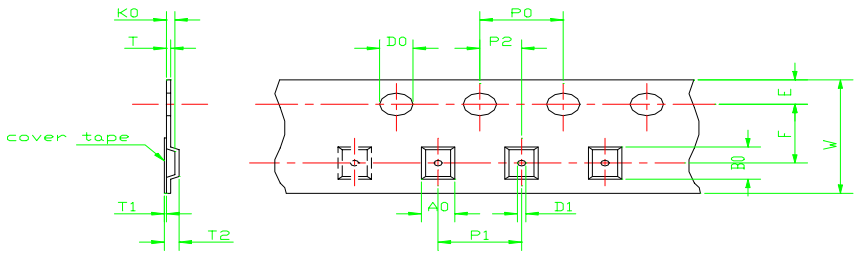
For dimensions, please see table below.

Paper tape

SYMBOL	PRODUCT SIZE CODE										UNIT
	0603(0201)		1005(0402)		1608(0603)		2012(0805)		3216(1206)		
	SIZE	TOL.	SIZE	TOL.	SIZE	TOL.	SIZE	TOL.	SIZE	TOL.	
A	0.37	+/- 0.03	0.62	+/- 0.05	1.0	+/- 0.2	1.5	+/- 0.2	1.9	+/- 0.2	mm
B	0.67	+/- 0.03	1.12	+/- 0.05	1.8	+/- 0.2	2.3	+/- 0.2	3.5	+/- 0.2	mm
F	3.50	+/- 0.05	3.50	+/- 0.05	3.5	+/- 0.05	3.5	+/- 0.05	3.5	+/- 0.05	mm
P	2.00	+/- 0.10	2.00	+/- 0.10	4.0	+/- 0.1	4.0	+/- 0.1	4.0	+/- 0.1	mm
W	8.00	+/- 0.20	8.00	+/- 0.20	8.0	+/- 0.2	8.0	+/- 0.2	8.0	+/- 0.2	mm

PACKAGING

- **Embossed tape specifications**



k_o: so chosen that the orientation of the component cannot change.

For W= 8mm: T_2=2.5mm max.

For W= 12mm: T_2= 4.5mm

For dimensions, please see table below.

Embossed tape

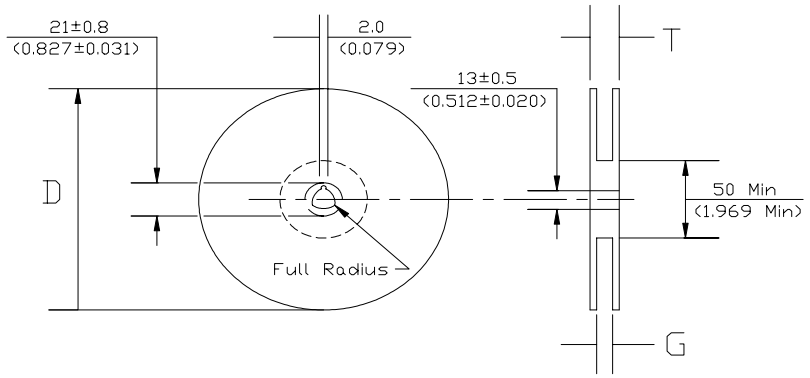
DIMENSION (mm)	PRODUCT SIZE CODE					TOLERANCE (mm)
	2012(0805)	3216(1206)	3225(1210)	4520(1808)	4532(1812)	
A_O nominal clearance; note1	0.2	0.3	0.3	0.4	0.4	-
B_O nominal clearance; note1	0.2	0.3	0.3	0.4	0.4	-
K_O minimum clearance; note1	0.05	0.05	0.05	0.05	0.05	-
W	8.1	8.1	8.1	12.0	12.0	+/- 0.20
E	1.75	1.75	1.75	1.75	1.75	+/- 0.10
F	3.5	3.5	3.5	5.5	5.5	+/- 0.05
D_O	1.5	1.5	1.5	1.5	1.5	+0.1/-0.0
D_1	1 min	1 min	1 min	1.5 min	1.5 min	+0.1/-0.0
P_O; note 2	4	4	4	4	4	+/- 0.10
P_1	4	4	4	8	8	+/- 0.10
P_2	2	2	2	2	2	+/- 0.05

Notes 1. Typical capacitors displace in pocket.

2. P_0 pitch tolerance over any 10 pitches is +/- 0.2mm.

PACKAGING

- **Reel specifications**



For dimensions, please see table below.

Reel

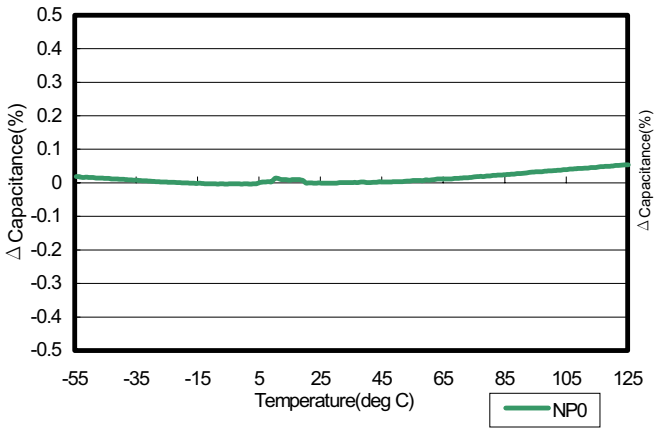
TAPE WIDTH (mm)	G (mm)	T MAX (mm)	D (mm)
8	10.0 +/- 1.5	14.4	180
8	10.0 +/- 1.5	14.4	250
8	10.0 +/- 1.5	14.4	330
12	14.0 +/- 1.5	18.4	180

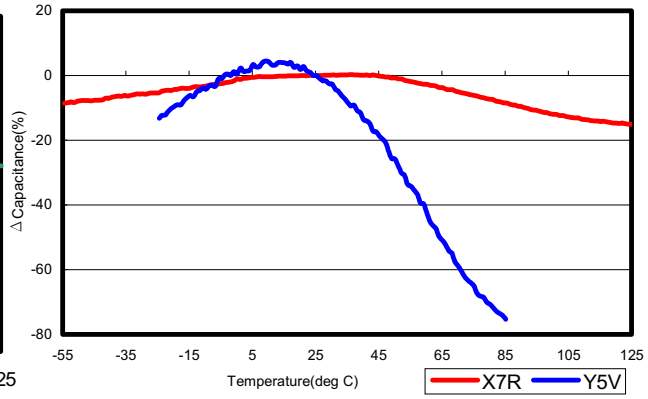
- **Thickness and Packing Amount**

Thickness		Amount per reel					
		180 mm (7")		250mm (10")		330mm (13")	
Code	Class(mm)	Paper	Embossed	Paper	Embossed	Paper	Embossed
A	0.30+/-0.03	15K					
B	0.50 +/- 0.05	10K				50K	
C	0.60 +/- 0.10	4K	4K	10K	10K	15K	15K
D	0.80 +/- 0.10	4K	4K	10K	10K	15K	15K
E	0.85 +/- 0.10	4K	4K	10K	10K	15K	15K
F	1.15 +/- 0.10		3K				10K
G	1.25 +/- 0.10		3K				10K
H	1.50 +/- 0.20		1.5K				
K	0.90 ~ 1.30		3K				
L	1.60 +/- 0.20		2K				

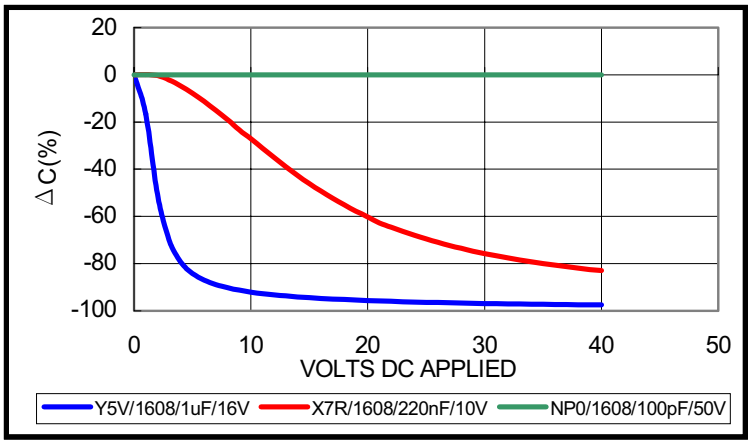
TYPICAL PERFORMANCE CURVES

TEMPERATURE COEFFICIENT

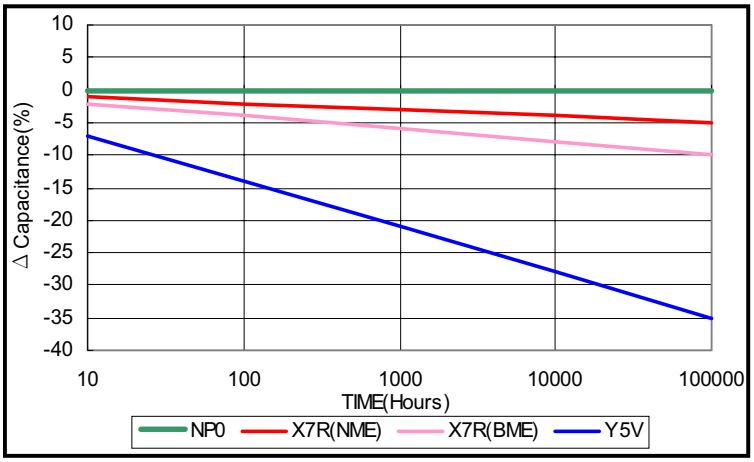




DC VOLTAGE COEFFICIENT



AGING RATE



APPLICATION NOTES

CIRCUIT DESIGN

1. Once application and assembly environments have been checked, the capacitor may be used in conformance with the rating and performance, which are provided in both the catalog and the specifications. Exceeding the specifications listed may result in inferior performance. It may also cause a short, open, smoking, or flaming to occur, etc.
2. Please use the capacitors in conformance with the operating temperature provided in both the catalog and the specifications. Be especially cautious not to exceed the maximum temperature. In the situation the maximum temperature set forth in both the catalog and specifications is exceeded, the capacitor's insulation resistance may deteriorate, power may suddenly surge and short-circuit may occur. The capacitor has a loss, and may self-heat due to equivalent series resistance when alternating electric current is passed therethrough. As this effect becomes especially pronounced in high frequency circuits, please exercise caution. When using the capacitor in a (self-heating) circuit, please make sure the surface of the capacitor remains under the maximum temperature for usage. Also, please make certain temperature rise remain below 20℃.
3. Please keep voltage under the rated voltage, which is applied to the capacitor. Also, please make certain the peak voltage remains below the rated voltage when AC voltage is super-imposed to the DC voltage.
   In the situation where AC or pulse voltage is employed, ensure average peak voltage does not exceed the rated voltage.
   Exceeding the rated voltage provided in both catalog and specifications may lead to defective withstanding voltage or, in worse case situations, may cause the capacitor to smoke or flame.
4. It's is a common phenomenon of high-dielectric products to have a deteriorated amount of static electricity due to the application of DC voltage.

STORAGE

1. The chip capacitors shall be packaged in carrier tapes or bulk cases.
2. Keep storage place temperatures from +5 to 35 degree C, humidity from 45 to 70% RH.
3. The storage atmosphere must be free of gas containing sulfur and chlorine. Also, avoid exposing the product to saline moisture. If the product is exposed to such atmospheres, the terminations will oxidize and solderability will be affected.
4. The solderability is assured for 12 months from our final inspection date if the above storage condition is followed.

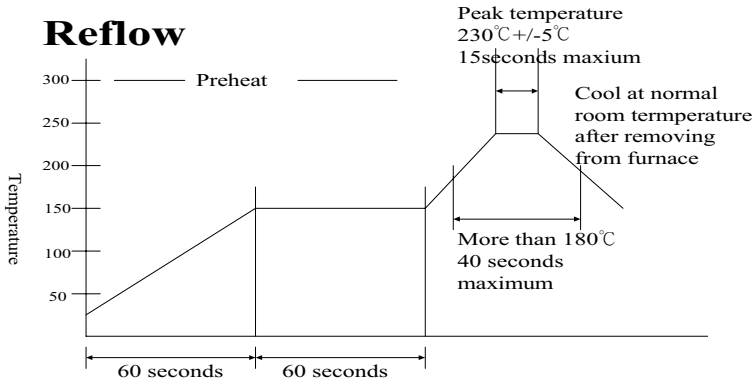
HANDLING

Chip capacitors should be handled with care to avoid contamination or damage. The use of vacuum pick-up or plastic tweezers is recommended for manual placement. Tape and reeled packages are suitable for automatic pick and placement machine.

APPLICATION NOTES

SOLDERING

1. Resin Mold:
   a. If a large amount of resin is used for molding the chip, cracks may occur due to contraction stress during curing. To avoid such cracks, use a low shrinkage resin.
   b. The insulation resistance of the chip will degrade due to moisture absorption. Use a low moisture absorption resin.
   c. Check carefully that the resin does not generate a decomposition gas or reaction gas during the curing process or during normal storage. Such gases may crack the chip capacitor or damage the device itself.
2. Soldering Method:
   a. Ceramic is easily damaged by rapid heating or cooling. If some heat shock is unavoidable, limit the temperature difference (ΔT) to within 130 degree C.
   b. Recommended soldering profile is shown as follows.



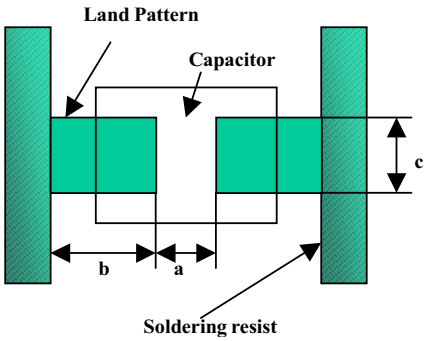
   c. Special precautions for using soldering irons: Preheat the capacitor to approx. 150 degree C then solder quickly on a hot plate using a soldering iron adjusted to 250 to 280 degree C.

RECOMMENDED PAD DIMENSIONS

When mounting the capacitor to substrate, it's important to consider carefully that the amount of solder (size of fillet) used has a direct effect upon the capacitor once it's mounted.

a. The greater the amount of solder, the greater the stress to the elements. As this may cause the substrate to break or crack.
b. In the situation where two or more devices are mounted onto a common land separate the device into exclusive pads by using soldering resist.

APPLICATION NOTES



(Unit: mm)

Size	LxW	a	b	c
0603(0201)	0.6*0.3	0.20 to 0.30	0.20 to 0.35	0.20 to 0.40
1005(0402)	1.0*0.5	0.30 to 0.50	0.35 to 0.45	0.40 to 0.60
1608(0603)	1.6*0.8	0.70 to 1.00	0.80 to 1.00	0.60 to 0.80
2012(0805)	2.0*1.25	1.00 to 1.30	1.00 to 1.20	0.80 to 1.00
3216(1206)	3.2*1.6	2.10 to 2.50	1.10 to 1.30	1.00 to 1.30
3225(1210)	3.2*2.5	2.10 to 2.50	1.10 to 1.30	1.90 to 2.30
4520(1808)	4.5*2.0	2.50 to 3.20	1.80 to 2.30	2.60 to 1.80
4532(1812)	4.5*3.2	2.50 to 3.20	1.80 to 2.30	2.60 to 3.00

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