CONTENT (MLCC)

E STANDARD NUMBER **3**

STRUCTURE **4**

ORDERING CODE **4**

SUPER SMALL SIZE (EIA 01005) **5**

CLASS I: TEMPERATURE COMPENSATING TYPE 6

NP0 Series *6*

CLASS II: HIGH DIELECTRIC CONSTANT TYPE 7

X7R Series *7*

X5R Series *7*

TEST SPEC. 8

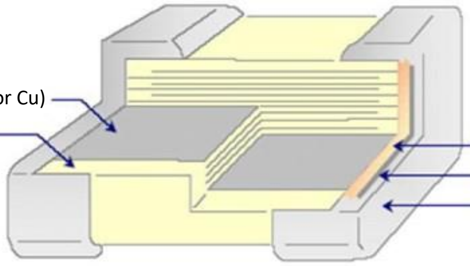
PACKAGE **12**

OTHERS **15**

E Standard Number

E3	1.0								2.2								4.7							
E6	1.0				1.5				2.2				3.3				4.7				6.8			
E12	1.0		1.2		1.5		1.8		2.2		2.7		3.3		3.9		4.7		5.6		6.8		8.2	
E24	1.0	1.1	1.2	1.3	1.5	1.6	1.8	2.0	2.2	2.4	2.7	3.0	3.3	3.6	3.9	4.3	4.7	5.1	5.6	6.2	6.8	7.5	8.2	9.1

Structure



Ordering Code

C 0402 NP0 100 J E T S △

PRODUCT CODE

C = MLCC

SIZE in mm (EIA CODE, in inch)

0402(01005) 0603(0201) 1005 (0402) 1608 (0603) 2012 (0805)
3216 (1206) 3225(1210) 4520 (1808) 4532 (1812)

T. C.

NP0: 0 ± 30ppm/℃ -55℃ to +125℃
X7R: ±15% -55℃ to +125℃ X6S: ±22% -55℃ to +105℃
X5R: ±15% -55℃ to +85℃ Y5V: +22%/-82% -30℃ to +85℃

CAPACITANCE CODE

Expressed in pico-farads and identified by a three-digit number.
First two digits represent significant figures.
Last digit specifies the number of zeros.
(Use 9 for 1.0 through 9.9pF； Use 8 for 0.20 through 0.99pF)

Examples:

Code	Cap (pF)
478	0.47
229	2.2
101	100
102	1000

TOLERANCE CODE

A: ± 0.05pF B: ± 0.1pF C: ± 0.25pF D: ± 0.5pF F: ±1% G: ±2%
J: ±5% K: ±10% M: ±20% Z: +80/-20%

VOLTAGE CODE

B: 4V C: 6.3V D: 10V E: 16V F: 25V N: 35V G: 50V H: 100V
J: 200V K: 250V L: 500V M: 630V P: 1KV Q: 2KV R: 3KV S: 4KV

PACKAGING CODE

T: Paper tape reel Ø180mm (7”)
N: Paper tape reel Ø250mm (10”)
A: Paper tape reel Ø330mm (13”)
W: Special Packing
P: Embossed tape reel Ø180mm (7”)
D: Embossed tape reel Ø250mm (10”)
E: Embossed tape reel Ø330mm (13”)

Application Code

S: Standard Q: High Q/Low ESR F: Microwave A: Automotive Infotainment with AEC-Q200

Thickness Code

Code	Thick (mm)	Code	Thick(mm)	Code	Thick (mm)
(blank)	Standard Thick	M	0.70	H	1.50
Z	0.20	D	0.80	L	1.60
A	0.30	E	0.85	N	2.00
Q	0.45	I	0.95	P	2.50
B	0.50	F	1.15	R	3.20
C	0.60	G	1.25		

Super Small Size (EIA 01005)

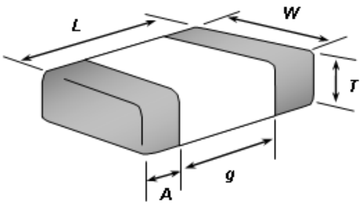
■ Feature

1. Small chip size (LxWxT: 0.4x0.2x0.2mm)
2. No polarity
3. Suited to only reflow soldering
4. RoHS compliant
5. Halogen Free

■ Application

1. Microwave module
2. Potable equipment

■ Standard External Dimensions



TYPE	Dimension (mm)				
(EIA Size)	L (Length)	W (Width)	T (Max.)	g (Min)	A (Min/Max)
C0402 (01005)	0.4±0.02	0.2±0.02	0.22	0.13	0.07/0.14

DARFON

Class I: Temperature Compensating Type

- NP0 Series
- **Part Number & Characteristic**
- C0402NP0_S Series (EIA01005)

RV	DARFON P/N	DARFON P/N 2	Measuring Condition	Capacitance		Available Tolerance	Thick. (mm)	Tolerance(mm)		DF (max.)	Standard Packing	Test Spec.
				Value	Unit			L/W	Thick.			
25V	C0402NP0109□FTS	C0402NP0109□FT	1V, 1MHz	1.0	pF	±0.25pF,±0.1pF	0.20	±0.02	±0.02	0.24%	Paper, 20Kpcs (W8P2)	(I)
	C0402NP0129□FTS	C0402NP0129□FT	1V, 1MHz	1.2	pF	±0.25pF,±0.1pF,±0.05pF	0.20	±0.02	±0.02	0.24%		(I)
	C0402NP0100JFTS	C0402NP0100JFT	1V, 1MHz	10	pF	±5%	0.20	±0.02	±0.02	0.17%		(I)
	C0402NP0120□FTS	C0402NP0120□FT	1V, 1MHz	12	pF	±5%,±2%	0.20	±0.02	±0.02	0.16%		(I)
	C0402NP0150JFTS	C0402NP0150JFT	1V, 1MHz	15	pF	±5%	0.20	±0.02	±0.02	0.14%		(I)
	C0402NP0330□FTS	C0402NP0330□FT	1V, 1MHz	33	pF	±5%,±2%	0.20	±0.02	±0.02	0.10%		(I)
	C0402NP0560□FTS	C0402NP0560□FT	1V, 1MHz	56	pF	±5%,±2%	0.20	±0.02	±0.02	0.10%		(I)
	C0402NP0101□FTS	C0402NP0101□FT	1V, 1MHz	100	pF	±10%,±5%,±2%	0.20	±0.02	±0.02	0.10%		(I)
16V	C0402NP0508□ETS	C0402NP0508□ET	1V, 1MHz	0.5	pF	±0.25pF,±0.1pF	0.20	±0.02	±0.02	0.24%	Paper, 20Kpcs (W8P2)	(I)
	C0402NP0608□ETS	C0402NP0608□ET	1V, 1MHz	0.6	pF	±0.25pF,±0.1pF	0.20	±0.02	±0.02	0.24%		(I)
	C0402NP0708□ETS	C0402NP0708□ET	1V, 1MHz	0.7	pF	±0.25pF,±0.1pF	0.20	±0.02	±0.02	0.24%		(I)
	C0402NP0808□ETS	C0402NP0808□ET	1V, 1MHz	0.8	pF	±0.25pF,±0.1pF	0.20	±0.02	±0.02	0.24%		(I)
	C0402NP0908□ETS	C0402NP0908□ET	1V, 1MHz	0.9	pF	±0.25pF,±0.1pF	0.20	±0.02	±0.02	0.24%		(I)
	C0402NP0109□ETS	C0402NP0109□ET	1V, 1MHz	1.0	pF	±0.25pF,±0.1pF	0.20	±0.02	±0.02	0.24%		(I)
	C0402NP0119□ETS	C0402NP0119□ET	1V, 1MHz	1.1	pF	±0.25pF,±0.1pF	0.20	±0.02	±0.02	0.24%		(I)
	C0402NP0129□ETS	C0402NP0129□ET	1V, 1MHz	1.2	pF	±0.25pF,±0.1pF	0.20	±0.02	±0.02	0.24%		(I)
	C0402NP0139□ETS	C0402NP0139□ET	1V, 1MHz	1.3	pF	±0.25pF,±0.1pF	0.20	±0.02	±0.02	0.23%		(I)
	C0402NP0159□ETS	C0402NP0159□ET	1V, 1MHz	1.5	pF	±0.25pF,±0.1pF	0.20	±0.02	±0.02	0.23%		(I)
	C0402NP0169□ETS	C0402NP0169□ET	1V, 1MHz	1.6	pF	±0.25pF,±0.1pF	0.20	±0.02	±0.02	0.23%		(I)
	C0402NP0189□ETS	C0402NP0189□ET	1V, 1MHz	1.8	pF	±0.25pF,±0.1pF	0.20	±0.02	±0.02	0.23%		(I)
	C0402NP0209□ETS	C0402NP0209□ET	1V, 1MHz	2.0	pF	±0.25pF,±0.1pF	0.20	±0.02	±0.02	0.23%		(I)
	C0402NP0229□ETS	C0402NP0229□ET	1V, 1MHz	2.2	pF	±0.25pF,±0.1pF	0.20	±0.02	±0.02	0.23%		(I)
	C0402NP0249□ETS	C0402NP0249□ET	1V, 1MHz	2.4	pF	±0.25pF,±0.1pF	0.20	±0.02	±0.02	0.22%		(I)
	C0402NP0259□ETS	C0402NP0259□ET	1V, 1MHz	2.5	pF	±0.25pF,±0.1pF	0.20	±0.02	±0.02	0.22%		(I)
	C0402NP0279□ETS	C0402NP0279□ET	1V, 1MHz	2.7	pF	±0.25pF,±0.1pF	0.20	±0.02	±0.02	0.22%		(I)
	C0402NP0309□ETS	C0402NP0309□ET	1V, 1MHz	3.0	pF	±0.25pF,±0.1pF	0.20	±0.02	±0.02	0.22%		(I)
	C0402NP0339□ETS	C0402NP0339□ET	1V, 1MHz	3.3	pF	±0.25pF,±0.1pF	0.20	±0.02	±0.02	0.21%		(I)
	C0402NP0369□ETS	C0402NP0369□ET	1V, 1MHz	3.6	pF	±0.25pF,±0.1pF	0.20	±0.02	±0.02	0.21%		(I)
	C0402NP0399□ETS	C0402NP0399□ET	1V, 1MHz	3.9	pF	±0.25pF,±0.1pF	0.20	±0.02	±0.02	0.21%		(I)
	C0402NP0479□ETS	C0402NP0479□ET	1V, 1MHz	4.7	pF	±0.25pF,±0.1pF	0.20	±0.02	±0.02	0.20%		(I)
	C0402NP0569□ETS	C0402NP0569□ET	1V, 1MHz	5.6	pF	±0.5pF, ±0.25pF	0.20	±0.02	±0.02	0.20%		(I)
	C0402NP0609□ETS	C0402NP0609□ET	1V, 1MHz	6.0	pF	±0.5pF, ±0.25pF,±0.1pF	0.20	±0.02	±0.02	0.19%		(I)
	C0402NP0629□ETS	C0402NP0629□ET	1V, 1MHz	6.2	pF	±0.5pF, ±0.25pF	0.20	±0.02	±0.02	0.19%		(I)
	C0402NP0689□ETS	C0402NP0689□ET	1V, 1MHz	6.8	pF	±0.5pF, ±0.25pF	0.20	±0.02	±0.02	0.19%		(I)
	C0402NP0709□ETS	C0402NP0709□ET	1V, 1MHz	7.0	pF	±0.5pF, ±0.25pF	0.20	±0.02	±0.02	0.19%		(I)
	C0402NP0759□ETS	C0402NP0759□ET	1V, 1MHz	7.5	pF	±0.5pF, ±0.25pF	0.20	±0.02	±0.02	0.18%		(I)
	C0402NP0829□ETS	C0402NP0829□ET	1V, 1MHz	8.2	pF	±0.5pF, ±0.25pF	0.20	±0.02	±0.02	0.18%		(I)
	C0402NP0919□ETS	C0402NP0919□ET	1V, 1MHz	9.1	pF	±0.5pF, ±0.25pF	0.20	±0.02	±0.02	0.17%		(I)
	C0402NP0100JETS	C0402NP0100JET	1V, 1MHz	10	pF	±5%	0.20	±0.02	±0.02	0.17%		(I)
	C0402NP0150□ETS	C0402NP0150□ET	1V, 1MHz	15	pF	±5%,±2%	0.20	±0.02	±0.02	0.14%		(I)
	C0402NP0180JETS	C0402NP0180JET	1V, 1MHz	18	pF	±5%	0.20	±0.02	±0.02	0.13%		(I)
	C0402NP0220JETS	C0402NP0220JET	1V, 1MHz	22	pF	±5%	0.20	±0.02	±0.02	0.12%		(I)
	C0402NP0270JETS	C0402NP0270JET	1V, 1MHz	27	pF	±5%	0.20	±0.02	±0.02	0.11%		(I)
	C0402NP0330JETS	C0402NP0330JET	1V, 1MHz	33	pF	±5%	0.20	±0.02	±0.02	0.10%		(I)
	C0402NP0390□ETS	C0402NP0390□ET	1V, 1MHz	39	pF	±5%,±2%	0.20	±0.02	±0.02	0.10%		(I)
	C0402NP0470JETS	C0402NP0470JET	1V, 1MHz	47	pF	±5%	0.20	±0.02	±0.02	0.10%		(I)
	C0402NP0560JETS	C0402NP0560JET	1V, 1MHz	56	pF	±5%	0.20	±0.02	±0.02	0.10%		(I)
	C0402NP0680JETS	C0402NP0680JET	1V, 1MHz	68	pF	±5%	0.20	±0.02	±0.02	0.10%		(I)
	C0402NP0820JETS	C0402NP0820JET	1V, 1MHz	82	pF	±5%	0.20	±0.02	±0.02	0.10%		(I)
	C0402NP0101JETS	C0402NP0101JET	1V, 1MHz	100	pF	±5%	0.20	±0.02	±0.02	0.10%		(I)
10V	C0402NP0560JDTS	C0402NP0560JDT	1V, 1MHz	56	pF	±5%	0.20	±0.02	±0.02	0.10%	Paper, 20Kpcs	(I)
	C0402NP0820JDTS	C0402NP0820JDT	1V, 1MHz	82	pF	±5%	0.20	±0.02	±0.02	0.10%		(I)
6.3V	C0402NP0101JCTS	C0402NP0101JCT	1V, 1MHz	100	pF	±5%	0.20	±0.02	±0.02	0.10%	Paper, 20Kpcs	(I)

● Class II: High Dielectric Constant Type

■ X7R Series

● C0402X7R_S Series (EIA01005)

RV	DARFON P/N	DARFON P/N 2	Measuring Condition	Capacitance Value	Unit	Available Tolerance	Thick. (mm)	Tolerance(mm) L/W	Thick.	DF (max.)	Standard Packing	Test Spec.
10V	C0402X7R101KDTS	C0402X7R101KDT	1V, 1kHz	100	pF	±10%	0.20	±0.02	±0.02	5.0%	Paper, 20Kpcs (W8P2)	(I)
	C0402X7R121KDTS	C0402X7R121KDT	1V, 1kHz	120	pF	±10%	0.20	±0.02	±0.02	5.0%		(I)
	C0402X7R151KDTS	C0402X7R151KDT	1V, 1kHz	150	pF	±10%	0.20	±0.02	±0.02	5.0%		(I)
	C0402X7R181KDTS	C0402X7R181KDT	1V, 1kHz	180	pF	±10%	0.20	±0.02	±0.02	5.0%		(I)
	C0402X7R221KDTS	C0402X7R221KDT	1V, 1kHz	220	pF	±10%	0.20	±0.02	±0.02	5.0%		(I)
	C0402X7R271KDTS	C0402X7R271KDT	1V, 1kHz	270	pF	±10%	0.20	±0.02	±0.02	5.0%		(I)
	C0402X7R331KDTS	C0402X7R331KDT	1V, 1kHz	330	pF	±10%	0.20	±0.02	±0.02	5.0%		(I)
	C0402X7R391KDTS	C0402X7R391KDT	1V, 1kHz	390	pF	±10%	0.20	±0.02	±0.02	5.0%		(I)
	C0402X7R471KDTS	C0402X7R471KDT	1V, 1kHz	470	pF	±10%	0.20	±0.02	±0.02	5.0%		(I)
	C0402X7R561KDTS	C0402X7R561KDT	1V, 1kHz	560	pF	±10%	0.20	±0.02	±0.02	5.0%		(I)
	C0402X7R681KDTS	C0402X7R681KDT	1V, 1kHz	680	pF	±10%	0.20	±0.02	±0.02	5.0%		(I)
	C0402X7R821KDTS	C0402X7R821KDT	1V, 1kHz	820	pF	±10%	0.20	±0.02	±0.02	5.0%		(I)
	C0402X7R102KDTS	C0402X7R102KDT	1V, 1kHz	1.0	nF	±10%	0.20	±0.02	±0.02	5.0%		(I)
6.3V	C0402X7R102KCTS	C0402X7R102KCT	1V, 1kHz	1.0	nF	±10%	0.20	±0.02	±0.02	5.0%	Paper, 20Kpcs	(I)

■ X5R Series

● C0402X5R_S Series (EIA01005)

RV	DARFON P/N	DARFON P/N 2	Measuring Condition	Capacitance Value	Unit	Available Tolerance	Thick. (mm)	Tolerance(mm) L/W	Thick.	DF (max.)	Standard Packing	Test Spec.
10V	C0402X5R102KDTS	C0402X5R102KDT	1V, 1kHz	1.0	nF	±10%	0.20	±0.02	±0.02	10.0%	Paper, 20Kpcs (W8P2)	(I)
	C0402X5R332KDTS	C0402X5R332KDT	1V, 1kHz	3.3	nF	±10%	0.20	±0.02	±0.02	10.0%		(I)
	C0402X5R392KDTS	C0402X5R392KDT	1V, 1kHz	3.9	nF	±10%	0.20	±0.02	±0.02	10.0%		(II)
	C0402X5R472KDTS	C0402X5R472KDT	1V, 1kHz	4.7	nF	±10%	0.20	±0.02	±0.02	10.0%		(II)
	C0402X5R562KDTS	C0402X5R562KDT	1V, 1kHz	5.6	nF	±10%	0.20	±0.02	±0.02	10.0%		(II)
	C0402X5R682KDTS	C0402X5R682KDT	1V, 1kHz	6.8	nF	±10%	0.20	±0.02	±0.02	10.0%		(II)
	C0402X5R822KDTS	C0402X5R822KDT	1V, 1kHz	8.2	nF	±10%	0.20	±0.02	±0.02	10.0%		(II)
	C0402X5R103KDTS	C0402X5R103KDT	1V, 1kHz	10	nF	±10%	0.20	±0.02	±0.02	10.0%		(II)
	C0402X5R104MDTS	C0402X5R104MDT	1V, 1kHz	100	nF	±20%	0.20	±0.02	±0.02	10.0%		(II)*
6.3V	C0402X5R332KCTS	C0402X5R332KCT	1V, 1kHz	3.3	nF	±10%	0.20	±0.02	±0.02	10.0%	Paper, 20Kpcs (W8P2)	(I)
	C0402X5R392KCTS	C0402X5R392KCT	1V, 1kHz	3.9	nF	±10%	0.20	±0.02	±0.02	10.0%		(II)
	C0402X5R472KCTS	C0402X5R472KCT	1V, 1kHz	4.7	nF	±10%	0.20	±0.02	±0.02	10.0%		(II)
	C0402X5R562KCTS	C0402X5R562KCT	1V, 1kHz	5.6	nF	±10%	0.20	±0.02	±0.02	10.0%		(II)
	C0402X5R682KCTS	C0402X5R682KCT	1V, 1kHz	6.8	nF	±10%	0.20	±0.02	±0.02	10.0%		(II)
	C0402X5R822KCTS	C0402X5R822KCT	1V, 1kHz	8.2	nF	±10%	0.20	±0.02	±0.02	10.0%		(II)
	C0402X5R103KCTS	C0402X5R103KCT	0.5V, 1kHz	10	nF	±10%	0.20	±0.02	±0.02	10.0%		(II)
	C0402X5R223□CTS	C0402X5R223□CT	0.5V, 1kHz	22	nF	±10% , ±20%	0.20	±0.02	±0.02	10.0%		(II)
	C0402X5R473KCTS	C0402X5R473KCT	0.5V, 1kHz	47	nF	±10%	0.20	±0.02	±0.02	10.0%		(II)
	C0402X5R104□CTS	C0402X5R104□CT	0.5V, 1kHz	100	nF	±10% , ±20%	0.20	±0.02	±0.02	10.0%		(II)*
	C0402X5R224MCTS	C0402X5R224MCT	0.5V, 1kHz	220	nF	±20%	0.20	±0.02	±0.02	10.0%		(II)*

□Tolerance Code: B=±0.1pF, C=±0.25pF ,D=±0.5pF, J=±5%, M=±20%; Special tolerance on the request.

(II)* High temperature load life test are applicable in rated voltage *100%. (II)/(II)* are applied with derating voltage.

DARFON

● Test Spec.

● General Purpose (I)

No	Item	Specification: Class I (NP0)	Specification: Class II (X5R/X7R)	Test Method
1	**Operating Temperature Range**	NP0: -55 to 125 ℃	X7R: -55 to 125 ℃ X5R: -55 to 85 ℃	Standard Temperature: 25℃
2	**Rated Voltage**	Shown in the table of "Part Number & Characteristic"		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 with Microscope.
4	**Dimensions**	Within the specified dimension.		Using calipers or Microscope.
5	**Dielectric Strength**	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.
6	**Insulation Resistance (I.R.)**	To apply rated voltage I.R. ≧10GΩ or R_iC_R≧500Ω-F (whichever is smaller) * Some of the parts are R_iC_r≧50 Ω-F. Please refer to table 1.		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 * X7R, X5R at 1000 hours		The capacitance / D.F. shall be measured at 25℃ at the frequency and voltage shown in the table of "Part Number & Characteristic".
8	**Q/Dissipation Factor (D.F.)**	If C≦30pF, DF≦1/(400+20C), C in pF If C >30pF, DF≦0.1%.	Shown in the table of "Part Number & Characteristic"	
9	**Capacitance Temperature Characteristics**	Capacitance change NP0 within 0±30ppm/℃ under operating temperature range.	Capacitance change X7R/X5R within ±15%	1.Class I (NP0) 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}*ΔT*10^6(PPM/℃) 2.Class II (X5R/X7R) The ranges of capacitance change compared with the 25℃ value over the temperature ranges shall be within the specified ranges.
10	**Termination Strength**	No removal of the terminations or marking defect.		Apply a parallel force of 1N to a PCB mounted sample for 10±1sec
11	**Deflection (Bending Strength)**	No cracking or marking defects shall occur at 1mm deflection. Capacitance change: NP0: within ±5% or ± 0.5pF. (whichever is larger) X7R, X5R:within ±10%		Solder the capacitor to the test jig (Glass epoxy boards) shown in Fig.a using a SAC305(Sn96.5Ag3.0Cu0.5) solder (then let sit for 24±2 hours for X7R X5R). 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.

(Unit in mm)

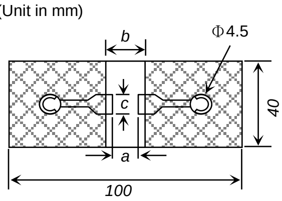


Fig a.

Size	a	b	c
0402	0.2	0.56	0.23

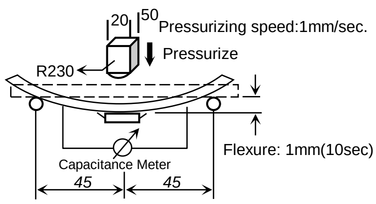


Fig.b.

No	Item	Specification: Class I (NP0)	Specification: Class II (X5R/X7R)	Test Method
12	**Solderability of Termination**	75% of the terminations are 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 SAC305(Sn96.5Ag3.0Cu0.5) solder of 245 ± 5℃ for 3±1seconds.
13	**Temperature cycle (Thermal shock)** — **Appearance**	No marking defects		Solder the capacitor to supporting jig (Glass epoxy board) and perform the five cycles according to the four heat treatments listed in the following table. Let sit for 24±2hrs at room temperature, then measure. Step 1: Minimum operating temperature 30±3min Step 2: Room temperature 2~3 min Step 3: Maximum operating temperature 30±3min Step 4: Room temperature 2~3min *Class II: Initial measurement: perform a heat treatment at 150±10℃ for one hour and then let sit for 24±2 hours at room temp. Perform the initial measurement.
	Cap. Change	NP0 within ±2.5% or 0.25pF (whichever is larger)	X7R/X5R within ±7.5%	
	Q/D.F.	If C≦30pF, DF≦1/(400+20C) If C >30pF, DF≦0.1%	To satisfy the specified initial spec.	
	I.R.	I.R.≧10,000MΩ or R_iC_R≧500Ω-F. (whichever is smaller)	I.R.≧10,000MΩ or R_iC_R≧500Ω-F. (whichever is smaller) * Some of the parts are R_iC_r≧50 Ω-F. Please refer to table 1.	

DARFON

No	Item		Specification		Test Method
			Class I (NP0)	Class II (X5R/X7R)	
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 at room temperature, then measure. The charge / discharge current is less than 50mA. *Class II: Initial measurement: perform a heat treatment at 150±10℃ for one hour and then let sit for 24±2hours at room temperature. Perform the initial measurement. *Measurement after test Perform a heat treatment and then let sit for 24±2 hours at room temperature, then measure.
		Cap. Change	NP0 within ±7.5% or 0.75pF (whichever is larger)	X7R/X5R within ±12.5%	
		Q/D.F.	If C＞30pF, DF≦0.5% If C≦30pF,DF≦ 1/(100+10xC/3) C in pF	X7R/X5R 200% max of initial spec.	
		I.R.	I.R.≧500MΩ or R_iC_R≧25Ω-F. (whichever is smaller)	I.R.≧500MΩ or R_iC_R≧25Ω-F. (whichever is smaller) * Some of the parts are R_iC_r≧12.5. Please refer to table 1.	
15	High temperature load life test	Appearance	No marking defects		Apply 200% of the rated voltage for 1,000±12 hours at the maximum operating temperature ± 3℃. Let sit for 24± 2 hours at room temperature, then measure. The charge/discharge current is less than 50mA. *High dielectric constant type: Initial measurement: perform a heat treatment at 150±10℃ for one hour and then let sit for 24±2hours at room temperature. Perform the initial measurement. * Some of the parts are applicable in different voltage. Please refer to table 1. *Measurement after test Perform a heat treatment and then let sit for 24±2 hours at room temperature, then measure.
		Cap. Change	NP0 within ±7.5% or 0.75pF (whichever is larger)	X7R/X5R within ±12.5%	
		Q/D.F.	If C＞30pF, DF≦0.3% If 10pF<C≦30pF, DF≦1/(275+5xC/2) If C≦10pF, DF≦1/(200+10C), C in pF	X7R/X5R 200% max of initial value	
		I.R.	More than 1GΩ or R_iC_r≧50 Ω-F (whichever is less.)	More than 1GΩ or R_iC_r≧50 Ω-F (whichever is less.) * Some of the parts are R_iC_r≧25Ω-F. Please refer to table 1.	

MLCC

Super Small Size

General Purpose (II)

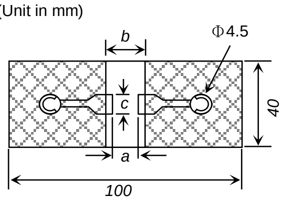
<table>
<tr><th rowspan="2">No</th><th rowspan="2" colspan="2">Item</th><th colspan="2">Specification</th><th rowspan="2">Test Method</th></tr>
<tr><th>Class I (NP0)</th><th>Class II (X5R/X7R)</th></tr>
<tr><td>1</td><td colspan="2">Operating Temperature Range</td><td>NP0: -55 to 125 ℃</td><td>X7R: -55 to 125 ℃
X5R: -55 to 85 ℃</td><td>Standard Temperature: 25℃</td></tr>
<tr><td>2</td><td colspan="2">Rated Voltage</td><td colspan="2">Shown in the table of “Part Number & Characteristic”</td><td>The rated voltage is defined as the maximum voltage, which may be applied continuously to the capacitor.</td></tr>
<tr><td>3</td><td colspan="2">Appearance</td><td colspan="2">No defects or abnormalities.</td><td>Visual inspection with Microscope.</td></tr>
<tr><td>4</td><td colspan="2">Dimensions</td><td colspan="2">Within the specified dimension.</td><td>Using calipers or Microscope.</td></tr>
<tr><td>5</td><td colspan="2">Dielectric Strength</td><td colspan="2">No defects or abnormalities.</td><td>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.</td></tr>
<tr><td>6</td><td colspan="2">Insulation Resistance (I.R.)</td><td colspan="2">To apply rated voltage
I.R. ≧10GΩ or R_iC_R≧500Ω-F (whichever is smaller)
* Some of the parts are R_iC_r≧50 Ω-F. Please refer to table 1.</td><td>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.</td></tr>
<tr><td>7</td><td colspan="2">Capacitance</td><td colspan="2">Within the specified tolerance
* X7R, X5R at 1000 hours</td><td rowspan="2">The capacitance / D.F. shall be measured at 25℃ at the frequency and voltage shown in the table of “Part Number & Characteristic”.</td></tr>
<tr><td>8</td><td colspan="2">Q/Dissipation Factor (D.F.)</td><td>If C≦30pF, DF≦1/(400+20C), C in pF
If C >30pF, DF≦0.1%.</td><td>Shown in the table of “Part Number & Characteristic”</td></tr>
<tr><td>9</td><td colspan="2">Capacitance Temperature Characteristics</td><td>Capacitance change
NP0 within 0±30ppm/℃ under operating temperature range.</td><td>Capacitance change
X7R/X5R within ±15%</td><td>1.Class I (NP0)
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}*ΔT*10^6(PPM/℃)
2.Class II (X5R/X7R)
The ranges of capacitance change compared with the 25℃ value over the temperature ranges shall be within the specified ranges.</td></tr>
<tr><td>10</td><td colspan="2">Termination Strength</td><td colspan="2">No removal of the terminations or marking defect.</td><td>Apply a parallel force of 1N to a PCB mounted sample for 10±1sec</td></tr>
<tr><td rowspan="2">11</td><td rowspan="2" colspan="2">Deflection (Bending Strength)</td><td colspan="2">No cracking or marking defects shall occur at 1mm deflection.
Capacitance change:
NP0: within ±5% or ± 0.5pF. (whichever is larger)
X7R, X5R:within ±10%</td><td>Solder the capacitor to the test jig (Glass epoxy boards) shown in Fig.a using a SAC305(Sn96.5Ag3.0Cu0.5) solder (then let sit for 24±2 hours for X7R X5R).
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.</td></tr>
<tr><td colspan="3">(Unit in mm)


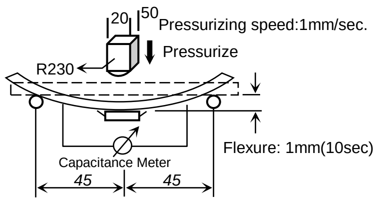
Fig a.
<table><tr><th>Size</th><th>a</th><th>b</th><th>c</th></tr><tr><td>0402</td><td>0.2</td><td>0.56</td><td>0.23</td></tr></table>


Fig.b.</td></tr>
<tr><td>12</td><td colspan="2">Solderability of Termination</td><td colspan="2">75% of the terminations are to be soldered evenly and continuously.</td><td>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 SAC305(Sn96.5Ag3.0Cu0.5) solder of 245 ± 5℃ for 3±1seconds.</td></tr>
<tr><td rowspan="4">13</td><td rowspan="4">Temperature cycle (Thermal shock)</td><td>Appearance</td><td colspan="2">No marking defects</td><td rowspan="4">Solder the capacitor to supporting jig (Glass epoxy board) and perform the five cycles according to the four heat treatments listed in the following table. Let sit for 24±2hrs at room temperature, then measure.
Step 1: Minimum operating temperature 30±3min
Step 2: Room temperature 2~3 min
Step 3: Maximum operating temperature 30±3min
Step 4: Room temperature 2~3min
*Class II: Initial measurement: perform a heat treatment at 150±10℃ for one hour and then let sit for 24±2 hours at room temp. Perform the initial measurement.</td></tr>
<tr><td>Cap. Change</td><td>NP0 within ±2.5% or 0.25pF (whichever is larger)</td><td>X7R/X5R within ±7.5%</td></tr>
<tr><td>Q/D.F.</td><td>If C≦30pF, DF≦1/(400+20C)
If C >30pF, DF≦0.1%</td><td>To satisfy the specified initial spec.</td></tr>
<tr><td>I.R.</td><td>I.R.≧10,000MΩ or R_iC_R≧500Ω-F.
(whichever is smaller)</td><td>I.R.≧10,000MΩ or R_iC_R≧500Ω-F.
(whichever is smaller)
* Some of the parts are R_iC_r≧50 Ω-F. Please refer to table 1.</td></tr>
</table>

No	Item		Specification		Test Method
			Class I (NP0)	Class II (X5R/X7R)	
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 at room temperature, then measure. The charge / discharge current is less than 50mA. *Class II: Initial measurement: perform a heat treatment at 150±10℃ for one hour and then let sit for 24±2hours at room temperature. Perform the initial measurement. *Measurement after test Perform a heat treatment and then let sit for 24±2 hours at room temperature, then measure.
		Cap. Change	NP0 within ±7.5% or 0.75pF (whichever is larger)	X7R/X5R within ±12.5%	
		Q/D.F.	If C＞30pF, DF≦0.5% If C≦30pF,DF≦ 1/(100+10xC/3) C in pF	X7R/X5R 200% max of initial spec.	
		I.R.	I.R.≧500MΩ or R_iC_R≧25Ω-F. (whichever is smaller)	I.R.≧500MΩ or R_iC_R≧25Ω-F. (whichever is smaller) * Some of the parts are R_iC_r≧12.5. Please refer to table 1.	
15	High temperature load life test	Appearance	No marking defects		Apply 150% of the rated voltage for 1000±12 hours at the maximum operating temperature ± 3℃. The charge / discharge current is less than 50mA. *Initial measurement Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement. *Measurement after test Perform a heat treatment and then let sit for 24±2 hours at room temperature, then measure. * Some of the parts are applicable in rated voltage *100%. Please refer to “Part Number & Characteristic” with (II)* labeled in “Test Spec.”
		Cap. Change	NP0 within ±7.5% or 0.75pF (whichever is larger)	X7R/X5R within ±12.5%	
		Q/D.F.	If C＞30pF, DF≦0.3% If 10pF<C≦30pF, DF≦1/(275+5xC/2) If C≦10pF, DF≦1/(200+10C), C in pF	X7R/X5R 200% max of initial value	
		I.R.	More than 1GΩ or R_iC_r≧50 Ω-F (whichever is less.)	More than 1GΩ or R_iC_r≧50 Ω-F (whichever is less.) * Some of the parts are R_iC_r≧25Ω-F. Please refer to table 1.	

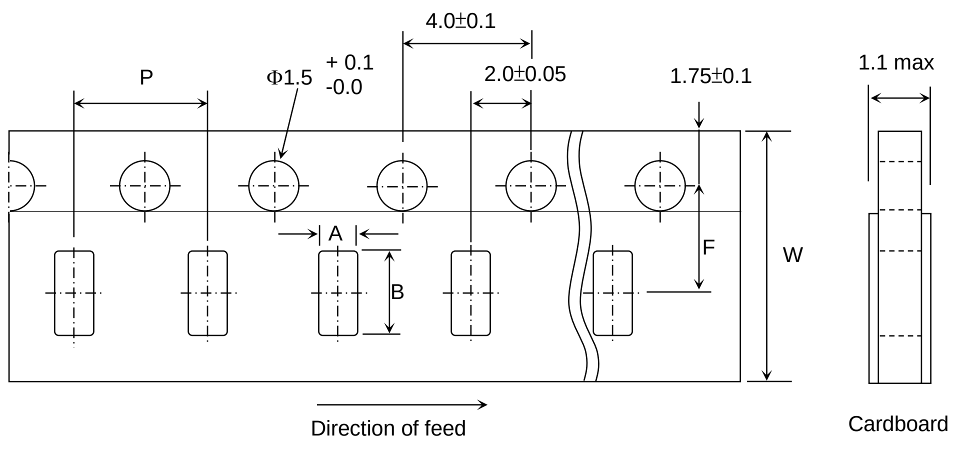
Package

- **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】

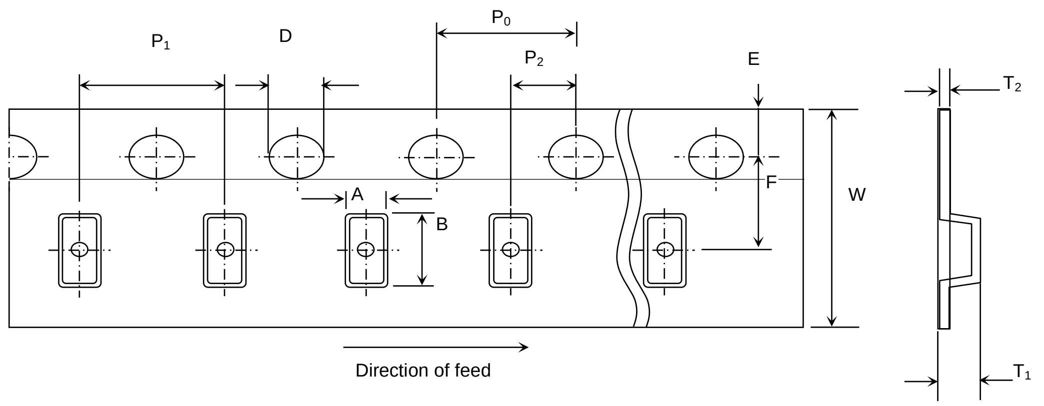
2mm and 4mm pitch tape



SYMBOL	PRODUCT SIZE CODE		UNIT
	0402(01005)		
	SIZE	TOL.	
A	0.23	± 0.02	mm
B	0.43	± 0.02	mm
F	3.5	± 0.05	mm
P	2	± 0.05	mm
W	8	± 0.20	mm

【Embossed tape specifications】

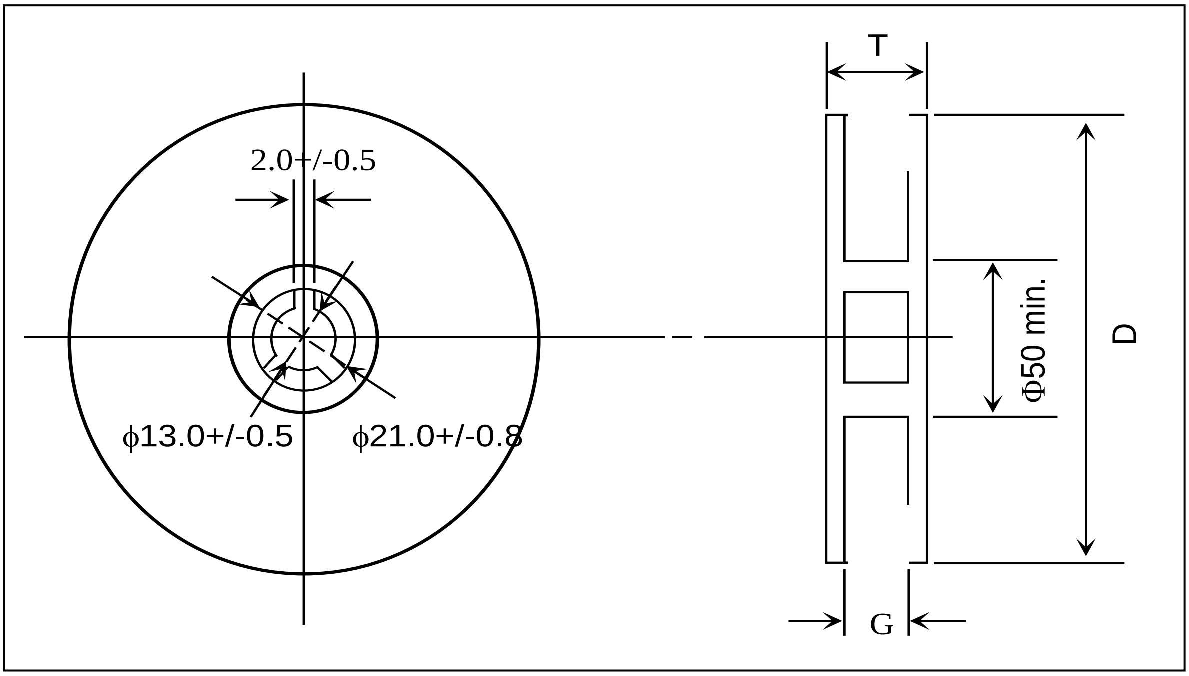
1mm and 4mm and 8mm pitch tape



For W= 8mm: T_1=2.5mm max.
For W= 12mm: T_1= 4.5mm

DIMENSION (mm)	PRODUCT SIZE CODE
	1mm tape
	0402 (01005)
P_1	1±0.02
P_O	2±0.04
P_2	1±0.02
A	0.23±0.02
B	0.43±0.02
W	4±0.05
E	0.9±0.05
F	1.8±0.02
D	0.8±0.04
T_1	0.5 max
T_2	0.15~0.40

【Reel specifications】



TAPE WIDTH (mm)	G (mm)	T max. (mm)	D (mm)
4	5.0 ± 1.5	8.0	180
8	10.0 ± 1.5	14.5	180
8	10.0 ± 1.5	14.5	250
8	10.0 ± 1.5	14.5	330
12	14.0 ± 1.5	18.5	180

【Thickness and Packing Amount】

Thickness			Amount per reel			
			180 mm (7")		330 mm (13")	
Code	Spec.(mm)	Size (EIA)	Paper	Embossed	Paper	Embossed
Z	0.20	0402 (01005)	20K	40K[#1]		

#1: 4mm width 1mm pitch Embossed Taping

【Packing Rule】

EIA SIZE	Tape type	Reel Size	Max Reels/Box
0402 (01005)	Emboss	7"	16
0402 (01005)	Paper	7"	10

*Maximum 60 reels in one carton.

Others

【Storage】

1. The chip capacitors shall be packaged in carrier tapes or bulk cases.
2. Too high temperatures or humidity may deteriorate the quality of the product rapidly. Recommended products storage with temperatures from +5℃ to +35℃, 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. In consideration of solderability, an allowable storage period should be within 12 months from the outgoing date of delivery. As for products in storage over 12 months, please check solderability before use.

【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 loss of capacitance will occur, and may self-heat due to equivalent series resistance when alternating electric current is passed through. As this effect becomes critical in high frequency circuits, please exercise with 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 burn out.
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.

【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.

【Flux】

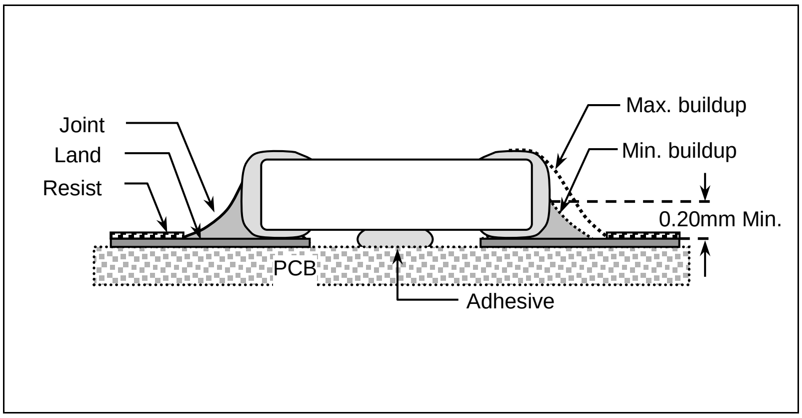
1. An excessive amount of flux or too rapid temperature rise can causes solvent burst, solder can generate a large quantity of gas. The gas can spreads small solder particles to cause solder balling effect or bridging problem.
2. Flux containing too high of a percentage of halide may cause corrosion of termination unless sufficient cleaning is applied.
3. Use rosin-type flux. Highly acidic flux (halide content less than 0.2wt%) is not recommended.
4. The water soluble flux causes deteriorated insulation resistance between outer terminations unless sufficiently cleaned.

【Component Spacing】

For wave soldering components, the spacing must be sufficient far apart to prevent bridging or shadowing. This is not so important for reflow process but enough space for rework should be considered. The suggested spacing for reflow soldering and wave soldering is 0.5mm and 1.0mm, respectively.

【Solder Fillet】

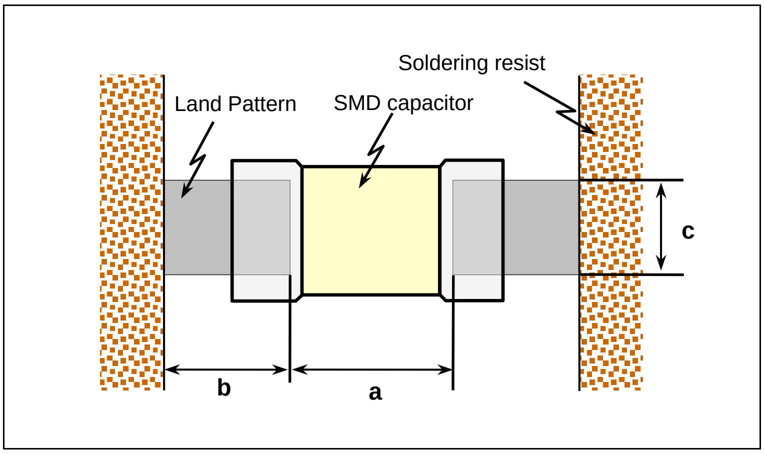
Too much solder amount may increase solder stress and cause crack risk. Insufficient solder amount may reduce adhesive Strength and cause parts falling off PCB. When soldering, confirm that the solder is placed over 0.2mm of the surface of the terminations.



【Recommended Land Pattern Dimensions】

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

1. The greater the amount of solder, the greater the stress to the elements, as this may cause the substrate to break or crack.
2. In the situation where two or more devices are mounted onto a common land, separate the device into exclusive pads by using soldering resist.
3. Land width equal to or less than component. It is permissible to reduce land width to 80% of component width.



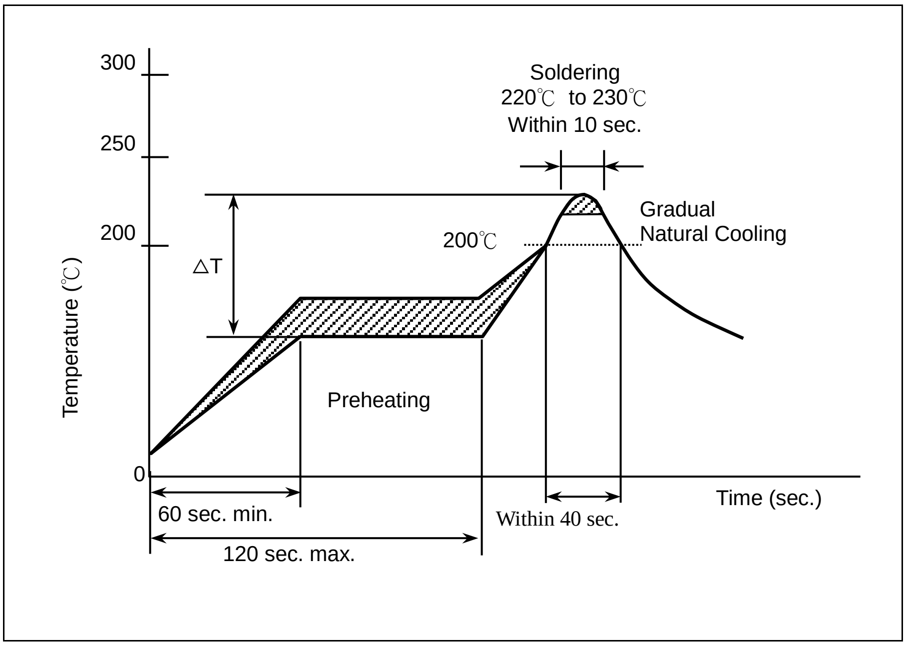
Size mm (EIA)	L x W (mm) (Dimension tolerance)	a (mm)	b (mm)	c (mm)
0402 (01005)	0.4*0.2	0.16 to 0.20	0.12 to 0.18	0.20 to 0.23

【Resin Mold】

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. The insulation resistance of the chip will degrade due to moisture absorption. Use a low moisture absorption resin. 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.

【Soldering Profile for SMT Process with SnPb Solder Paste】

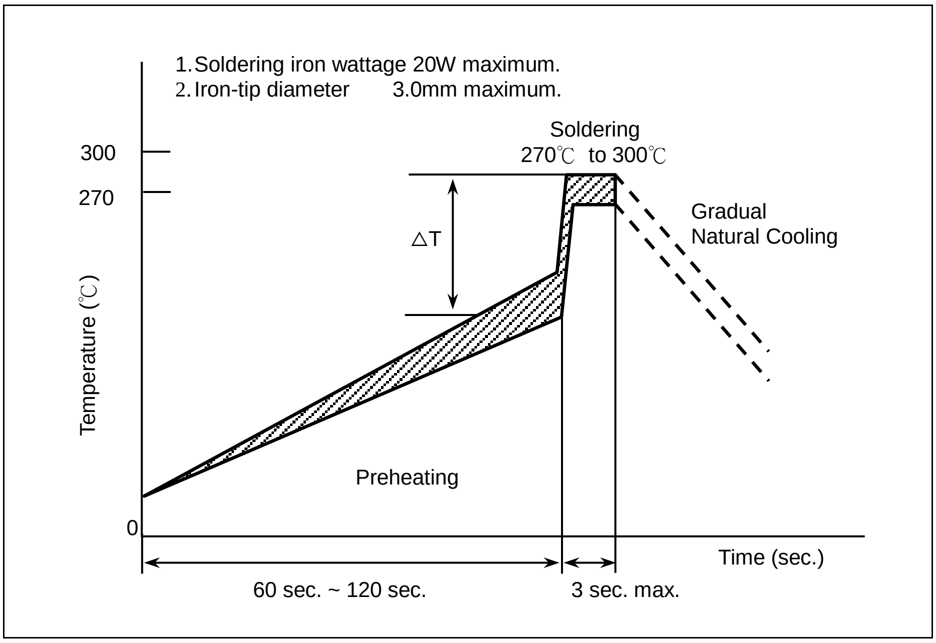
Reflow Soldering



The difference between solder and chip surface should be controlled as following table. The rate of preheat should not exceed 4℃/sec and a target of 2℃/sec is preferred.

Chip Size	3216 and smaller	3225 and above
Preheating	△T≦150℃	△T≦130℃

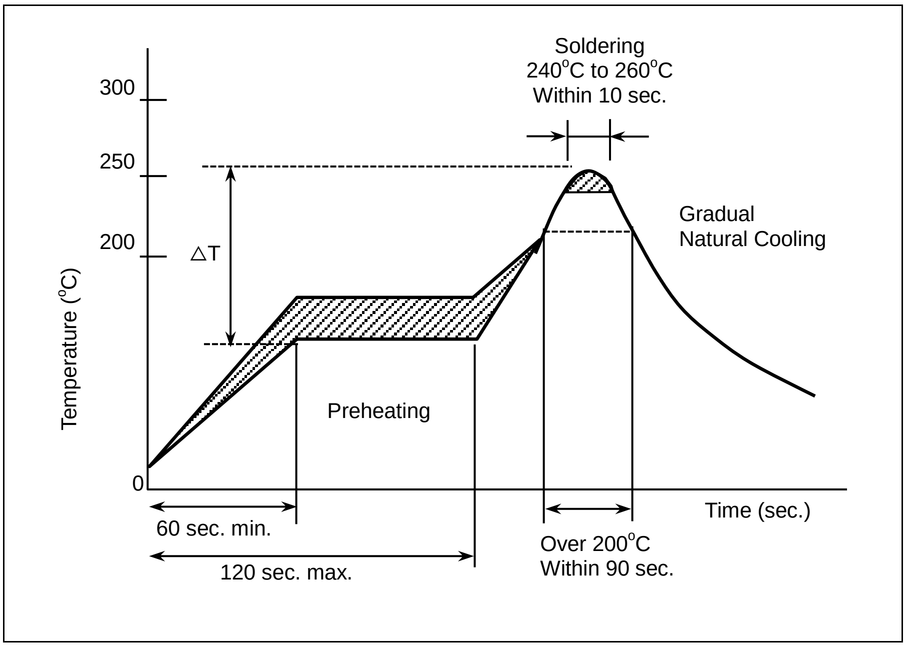
Soldering Iron



Chip Size	3216 and smaller	3225 and above
Preheating	△T≦190℃	△T≦130℃

【Soldering】

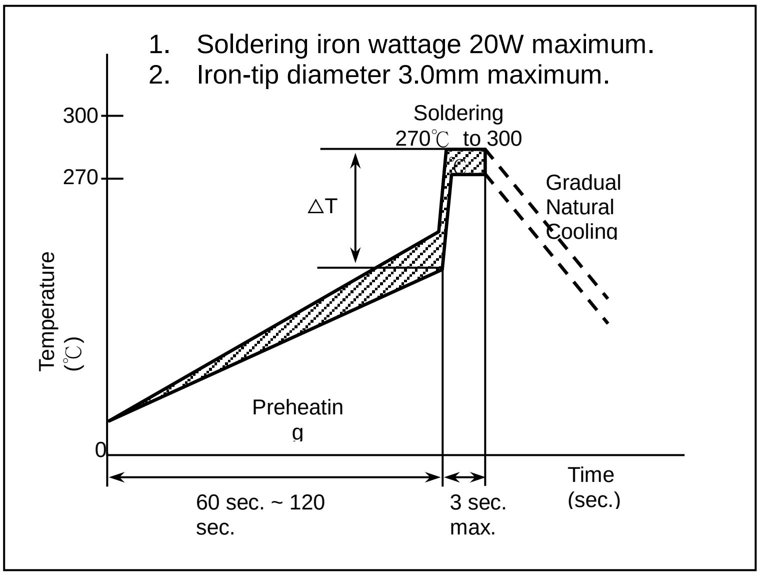
Reflow Soldering for Lead free Termination



The difference between solder and chip surface should be controlled as following table. The rate of preheat should not exceed 4℃/sec and a target of 2℃/sec is preferred.

Chip Size	3216 and smaller	3225 and above
Preheating	△T≦150℃	△T≦130℃

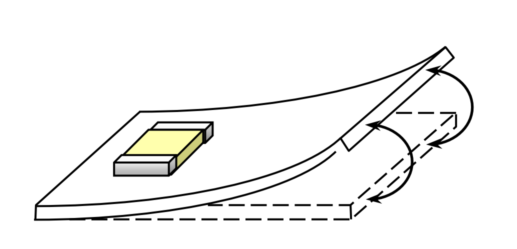
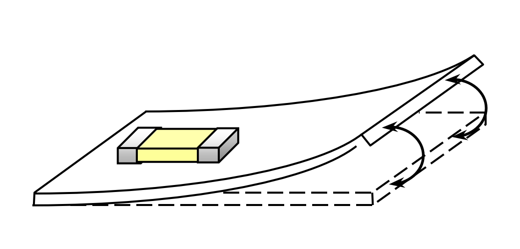
Soldering Iron



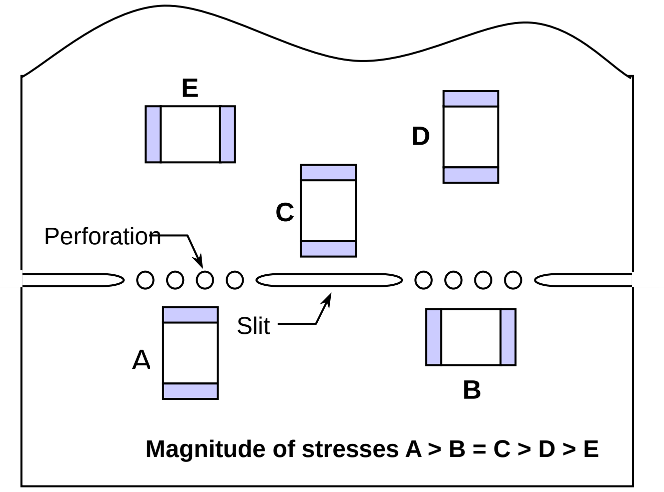
Chip Size	3216 and smaller	3225 and above
Preheating	△T≦190℃	△T≦130℃

【Chip Layout and Breaking PCB】

1. To layout the SMD capacitors for reducing bend stress from board deflection of PCB. The following are examples of Hood and bad layout.

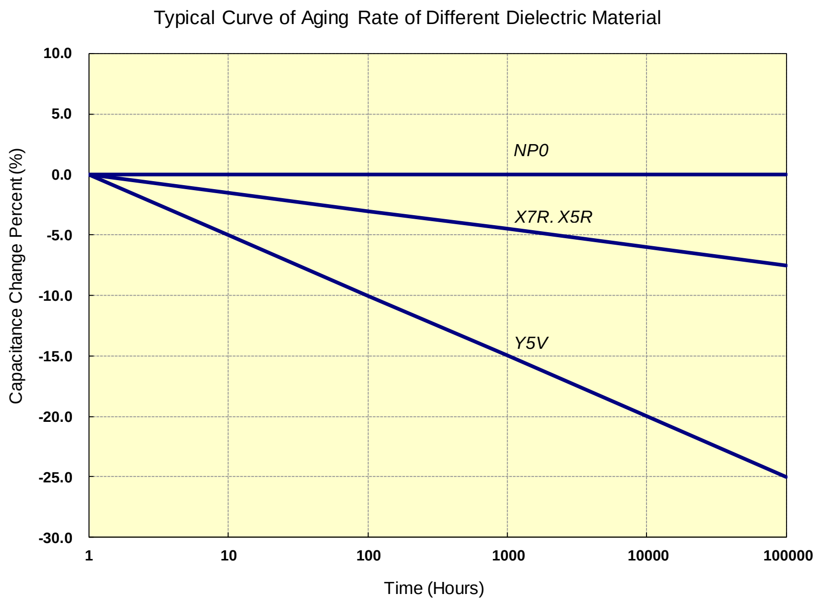
Recommended	Not Recommended
	

2. When breaking PCB, the layout should be noted that the mechanical stresses are depending on the position of capacitors. The following example shows recommendation for better design.



【Aging Rate】

The capacitance and dissipation factor of class 2 capacitors decreases with time. It is known as ‘aging’ that follows a logarithmic low and expressed in terms of an aging constant. Aging is caused by a gradual re-alignment of the crystalline structure of the ceramic. The aging constant is defined as the percentage loss of capacitance at a ‘time decade’. The law of capacitance aging is expressed as following equation:



$C_{t2} = C_{t1} \times (1 - k \times \log_{10}(t_2/t_1))$

C_{t1}: Capacitance after t1 hours of start aging.

C_{t2}: Capacitance after t2 hours of start aging.

k: aging constant (capacitance decrease per decade)

t1, t2: time in hours from start of aging.

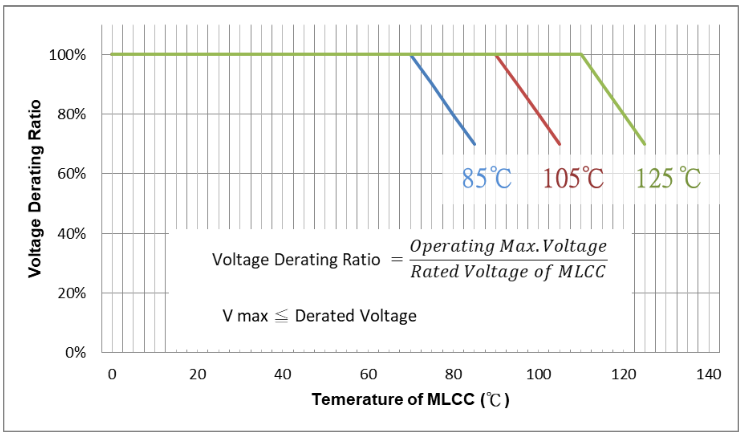
A typical curve of aging rate is shown in following figure.

When heating the capacitors above Curie temperature (130℃~150℃) the capacitance can be re-new. So capacitance of class 2 capacitors will be complete de-aged by soldering process; subsequently a new aging process begins.

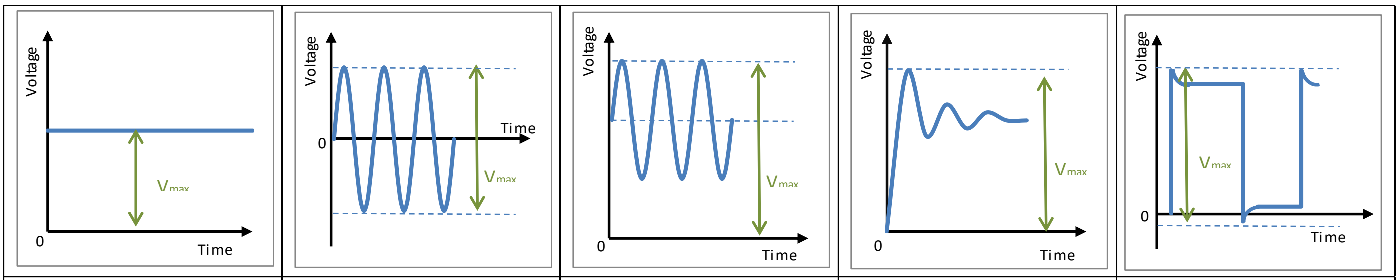
Because of aging, it is specified an age for measurement to meet the prescribed tolerance for class 2 capacitors. Normally, 1000 hours (t_2=1000 hrs) is defined.

【Voltage Derating & Applied Voltage】

The derated MLCC should be applied with the derating voltage. The “Temperature of MLCC” is the surface temperature of MLCC including self-heating effect. The maximum operating voltage of MLCC with reference to the maximum voltage (Vmax) is as shown in the following graph.



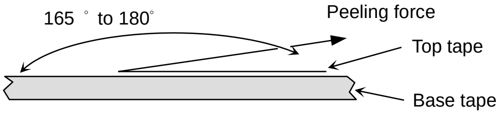
Cautions by types of voltage applied to MLCC · For DC voltage or DC+AC voltage, DC voltage or the maximum value of DC + AC voltage should not exceed the rated voltage of MLCC. · For AC voltage or pulse voltage, the peak-to-peak value of AC voltage or pulse voltage should not exceed the rated voltage of MLCC. · Abnormal voltage such as surge voltage, static electricity should not exceed the rated voltage of MLCC.



DC Voltage	AC Voltage	DC+AC Voltage	DC+AC Voltage	DC+Pulse Voltage

【Peeling Off Force】

Peeling off force: 0.1N to 1.0 N* in the direction shown as below.
The peeling speed: 300±10 mm/min



1. The taped tape on reel is wound clockwise. The sprocket holes are to the right as the tape is pulled toward the user.
2. There are minimum 150 mm as the leader and minimum 40 mm empty tape as the tail is attached to the end of the tape.