

MLCC Application Notes

Packaging, mounting, soldering, handling and storage of KOME multilayer chip ceramic capacitors



This document contains the packaging details (section 7), the precautions for use (section 8) and the characteristic curves of the KOME chip MLCC full specification; the section numbers are those of the full specification. Ratings, capacitance ranges and requirements: see the datasheet and the full specification.

7. Packaging

7.1 Bulk packaging

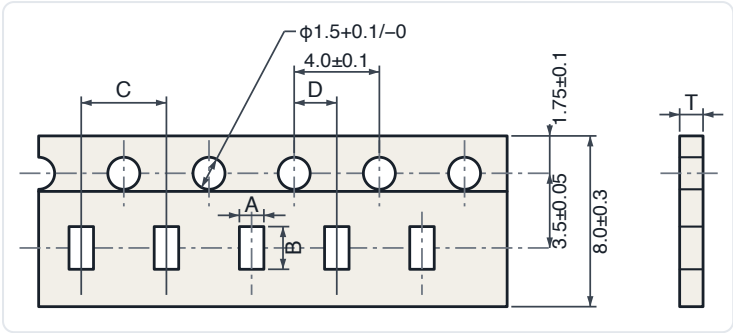
Standard packing: 10000 pcs (10 Kpcs) per bag; other quantities according to customer request.

7.2 Tape packaging

Size	Chip size (mm)			Quantity (pcs/reel)			
	L	W	T	Small reel, paper tape	Small reel, plastic tape	Large reel, paper tape	Large reel, plastic tape
0105	0.4	0.2	0.2	20,000	—	—	—
0201	0.6	0.3	0.3	15,000	—	60,000 (0201, 105 and above); 70,000 (others)	—
0402	1.0	0.5	0.5	10,000	—	50,000	—
0603	1.6	0.8	0.8	4,000	—	15,000	—
0805	2.0	1.25	≤ 0.85	4,000	—	15,000	—
			> 0.85	—	3,000	—	15,000 (thickness E); 10,000 (thickness F)
1206	3.2	1.6	≤ 0.85	4,000	—	15,000	—
			0.85 < T ≤ 1.25	—	3,000	—	10,000
			1.6	—	2,000	—	8,000
1210	3.2	2.5	≤ 2.0	—	2,000	—	—
			> 2.0	—	1,000	—	—
1812	4.5	3.2	≤ 2.0	—	1,000	—	—
			> 2.0	—	1,000	—	—
2220	5.7	5.0	≤ 1.25	—	1,000	—	—
			> 1.25	—	700	—	—

— = not offered in this reel / tape type (printed as "N/A" in the KOME original).

7.2.1 Paper tape dimensions

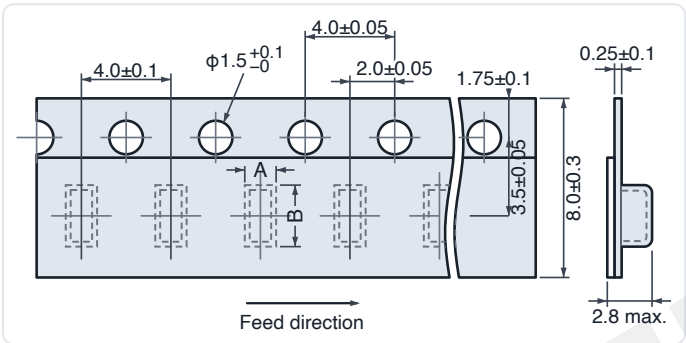


Paper tape (8 mm): top view and side view, dimensions as drawn in the source

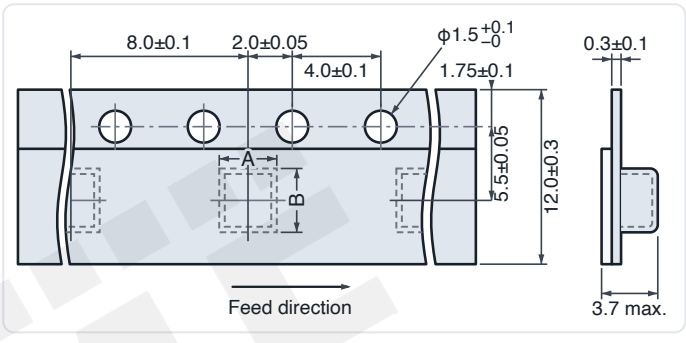
Type	A	B	C	D	T
0105	0.23±0.03	0.43±0.03	2.0±0.05	2.0±0.05	0.50 max.
0201	0.40±0.09	0.70±0.09	2.0±0.05	2.0±0.05	0.60 max.
0402	0.65±0.15	1.20±0.15	2.0±0.05	2.0±0.05	0.80 max.
0603	1.05±0.15	1.90±0.15	4.0±0.10	2.0±0.10	1.10 max.
0805	1.55±0.15	2.3±0.15	4.0±0.10	2.0±0.10	1.10 max.
1206	2.00±0.04	3.5±0.04	4.0±0.10	2.0±0.10	1.10 max.

Unit: mm

7.2.2 Embossed (plastic) tape dimensions ①



8 mm wide tape, 4 mm pitch

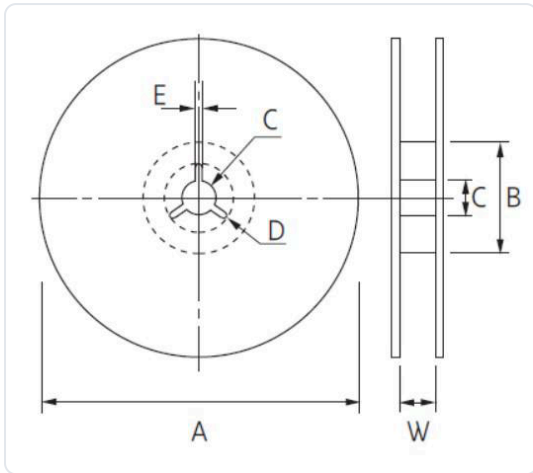


12 mm wide tape, 8 mm / 4 mm pitch

Size	A	B
0805	1.40±0.20	2.25±0.20
1206	1.90±0.20	3.50±0.20
1210	2.90±0.30	3.60±0.30
1812	3.60±0.20	5.00±0.20
2220	5.60±0.20	6.10±0.20

Unit: mm

7.2.3 Reel dimensions

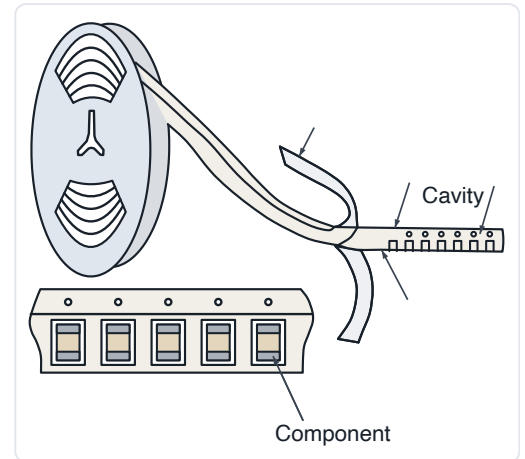


Reel, front view and side view

Reel	Tape width	A	B	C	D	E	W
7" reel	8 mm	$\phi 178 \pm 2.0$	min. $\phi 50$	$\phi 13 \pm 0.5$	21 ± 0.8	2.0 ± 0.5	10 ± 1.5
	12 mm	$\phi 178 \pm 2.0$	min. $\phi 50$	$\phi 13 \pm 0.5$	21 ± 0.8	2.0 ± 0.5	13 ± 0.5
13" reel	8 mm	$\phi 330 \pm 2.0$	min. $\phi 70$	$\phi 13 \pm 0.5$	21 ± 0.8	2.0 ± 0.5	10 ± 1.5
	12 mm	$\phi 330 \pm 2.0$	min. $\phi 70$	$\phi 13 \pm 0.5$	21 ± 0.8	2.0 ± 0.5	13 ± 0.5

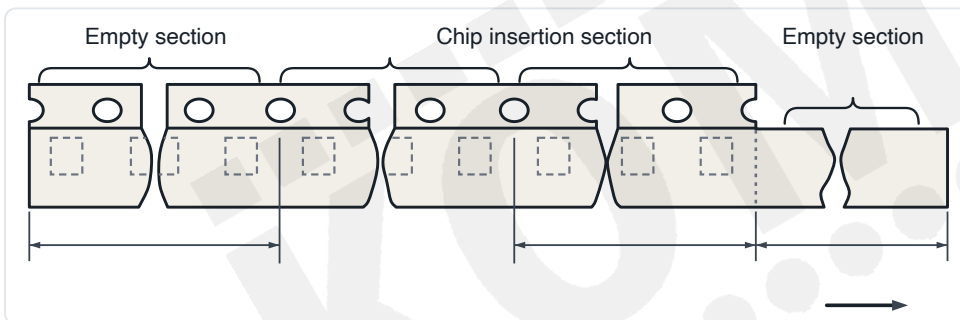
Unit: mm

7.2.4 Taping



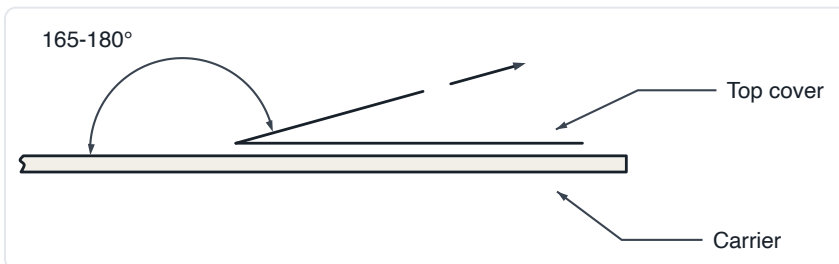
Components in the cavities of the carrier tape

7.2.5 Taping method



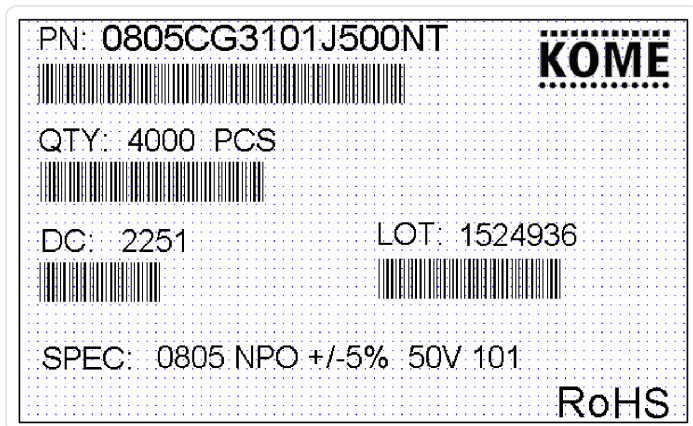
Leader and trailer: empty sections and chip insertion section

- (1) The tape is wound clockwise. The sprocket holes are on the right when the tape is pulled towards the user.
- (2) The top tape and base tape are not attached at the end of the tape for a minimum of 5 pitches. ②
- (3) A leader and empty tape sections are provided at the ends of the tape as shown above.
- (4) The top tape and bottom tape shall not protrude beyond the edges of the tape and shall not cover the sprocket holes.
- (5) Cumulative tolerance of the sprocket holes over 10 pitches: ± 0.3 mm.
- (6) Peel-off force of the top tape: 0.1 to 0.6 N, in the direction shown below. ②



Peel-off direction: top cover tape peeled at 165–180° from the carrier tape

7.2.6 Reel label



Sample reel label (excerpt of the original sheet)

Label field	Example (as printed on the sample label)
PN	0805CG3101J500NT
QTY	4000 PCS
DC	2251
LOT	1524936
SPEC	0805 NPO +/-5% 50V 101

PN, QTY, DC and LOT are each followed by a barcode; the label also carries the KOME logo and the RoHS mark.

Part number on the label (PN), positions as in the part numbering of the datasheet and of the full specification (section 3):

1	2	3	4	5	6	7	8
0805	CG	3	101	J	500	N	T
Size	Dielectric	Digits	Capacitance	Tolerance	Rated voltage	Termination	Packaging

7.2.7 Outer packaging ③

7.2.7.1 Carton

7.2.7.1.1 Carton size	L	W	H
Dimensions	41.0 cm	38.5 cm	20.2 cm

7.2.7.1.2 Quantity: 240 Kpcs per carton.

1 inner box = 40,000 pcs; 1 carton = 40,000 pcs × 6 inner boxes = 240,000 pcs.

RoHS label applied according to customer request.

7.2.7.2 Inner box

7.2.7.2.1 Inner box size	L	W	H
Dimensions	18.5 cm	6.5 cm	19 cm

7.2.7.2.2 Quantity: 40 Kpcs per box.

1 reel = 4,000 pcs; 1 inner box = 4,000 pcs × 10 reels = 40,000 pcs.

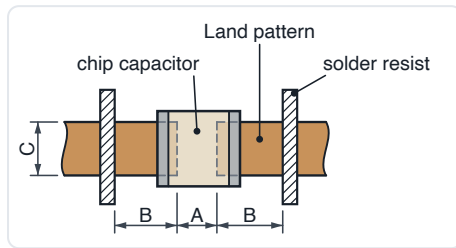
8. Precautions for use

8.1 PCB design

8.1.1 Land pattern design

The following drawings and tables show examples of recommended land patterns that prevent excessive solder (fillets higher than the component terminations). Examples of incorrect pattern designs are also shown.

Recommended land dimensions for typical chip capacitor land patterns on PCBs:



Land pattern: chip capacitor, land pattern, solder resist



Chip capacitor outline

Wave soldering (unit: mm)

Size		0603	0805	1206
Chip size	L	1.6	2.0	3.2
	W	0.8	1.25	1.6
A		0.8~1.0	1.0~1.4	1.8~2.5
B		0.5~0.8	0.8~1.5	0.8~1.7
C		0.6~0.8	0.9~1.2	1.2~1.6

Reflow soldering (unit: mm)

Size		0201	0402	0603	0805	1206	1210
Chip size	L	0.6	1.0	1.6	2.00	3.2	3.2
	W	0.3	0.5	0.8	1.25	1.6	2.5
A		0.20~0.25	0.35~0.45	0.6~0.8	0.8~1.2	1.8~2.5	1.8~2.5
B		0.20~0.30	0.40~0.50	0.6~0.8	0.8~1.2	1.0~1.5	1.0~1.5
C		0.25~0.35	0.45~0.55	0.6~0.8	0.9~1.6	1.2~2.0	1.6~3.2

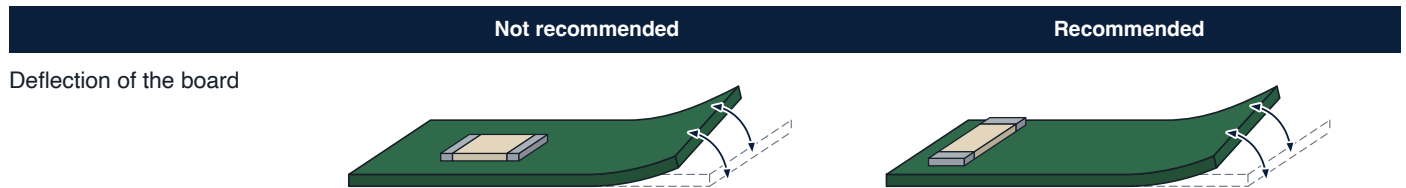
Excess solder can affect the ability of chips to withstand mechanical stress. Therefore, take proper precautions when designing land patterns.

Examples of good and bad solder application:

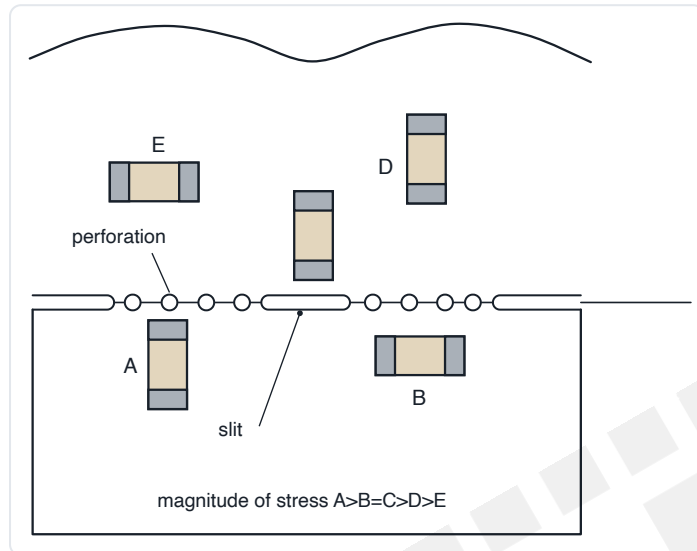
Item	Not recommended	Recommended
Mixed mounting of SMD and leaded components		
Component placement close to the chassis		
Hand soldering of leaded components near mounted components		

8.1.2 Pattern configurations ④

The following are examples of good and bad capacitor layouts. SMD capacitors should be located so as to minimise any mechanical stress from board warp or deflection.



When laying out capacitors on a breakaway PC board, note that the mechanical stress depends on the capacitor layout. The example below shows recommendations for better design.



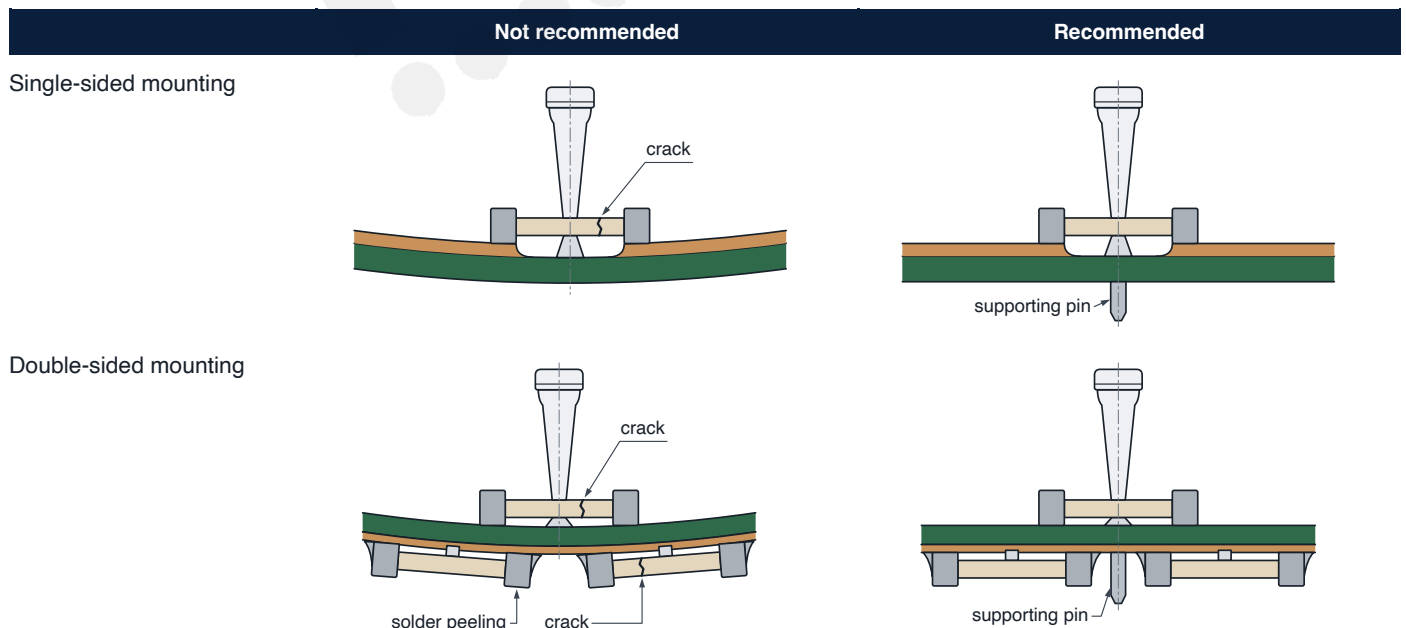
Capacitor positions A–E relative to the perforation and the slit; magnitude of stress $A > B = C > D > E$

When breaking PC boards along their perforations, the mechanical stress on the capacitors varies with the method used. The following methods are listed in order from least to most stressful: push-back, slit, V-grooving and perforation. Any SMD capacitor layout should therefore also take the PCB splitting procedure into account.

8.2 Automatic placement

Adjustment of the mounting machine:

- (1) Excessive impact load should not be imposed on the capacitors when they are mounted on the PC board.
- (2) The suction nozzles and positioning claws of the mounter must be inspected, maintained and replaced periodically.

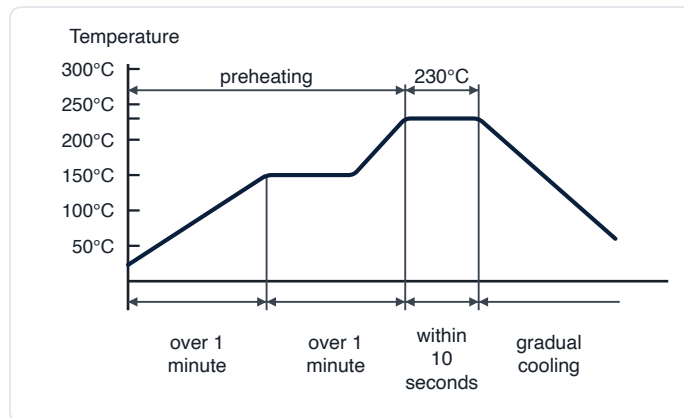


8.3 Recommended soldering profiles

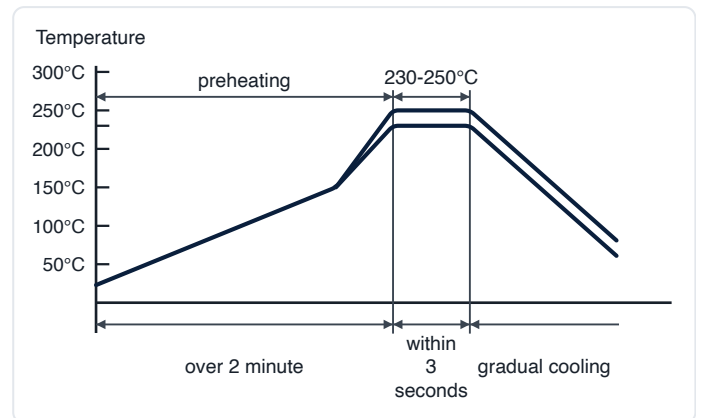
8.3.1 Notes

(1) Reflow soldering is recommended for these products. (2) Larger case sizes are suitable for reflow soldering.

8.3.2 Sn-Pb soldering profiles



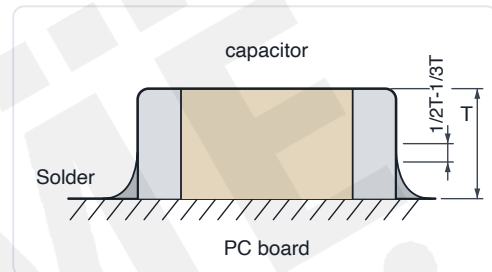
Reflow soldering (Sn-Pb)



Wave soldering (Sn-Pb)

Caution (reflow soldering):

- (1) Ideally, the solder fillet height is $1/2$ to $1/3$ of the capacitor thickness, as shown.
- (2) Excessive dwell times can impair solderability; keep the soldering time as close to the recommended times as possible.



Solder fillet height $1/2T-1/3T$

Caution (wave soldering) ⑤:

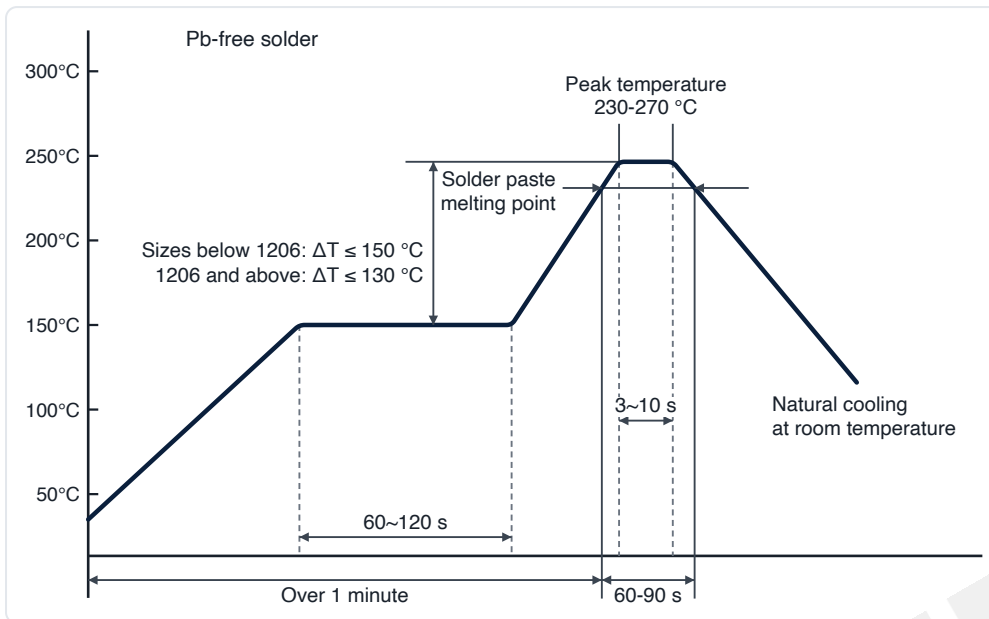
- (1) Make sure the capacitors are preheated sufficiently.
- (2) The temperature difference between preheating and soldering shall not exceed $150\text{ }^{\circ}\text{C}$.
- (3) Cooling after soldering should be as gradual as possible.

Hand soldering

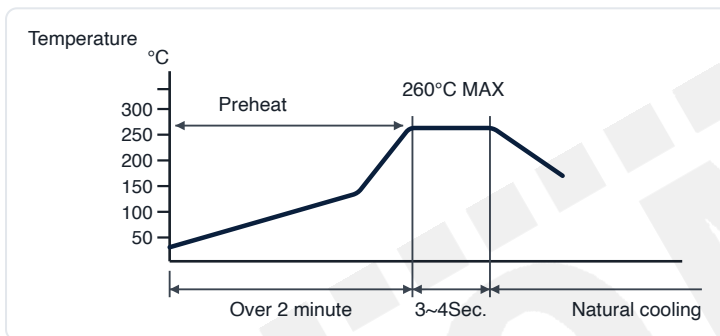
Preheating	Iron tip temperature	Iron power	Tip diameter	Soldering time	Amount of solder	Restriction
$\Delta T \leq 130\text{ }^{\circ}\text{C}$	$350\text{ }^{\circ}\text{C}$ max.	20 W max.	1 mm recommended	5 s max.	$\leq 1/2$ of chip thickness	Do not touch the ceramic body directly with the iron tip.

Caution: (1) Use a 20 W soldering iron with a maximum tip diameter of 1.0 mm. (2) The soldering iron should not directly touch the capacitor.

8.3.3 Pb-free soldering profiles ⑤



Reflow soldering (Pb-free)



Wave soldering

Capacitance range for wave and reflow soldering:

Soldering	0402 and below	0603	0805	1206	1210 and above
Wave soldering	—	105 and below	225 and below	475 and below	—
Reflow soldering	All	All	All	All	All

8.4 Handling

Breakaway PC boards (splitting along perforations):

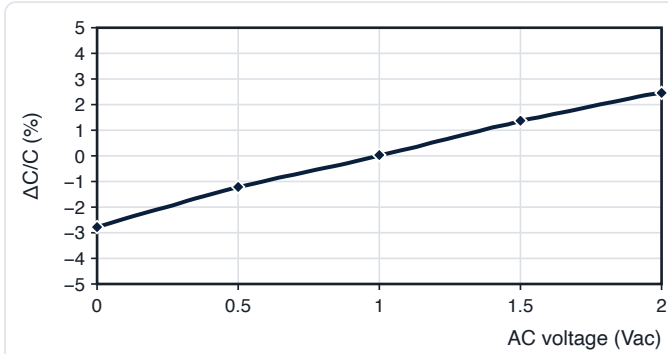
- (1) When splitting the PC board after mounting capacitors and other components, take care not to subject the board to deflection or twisting stress.
- (2) Board separation should not be done manually, but with an appropriate fixture.

8.5 Storage

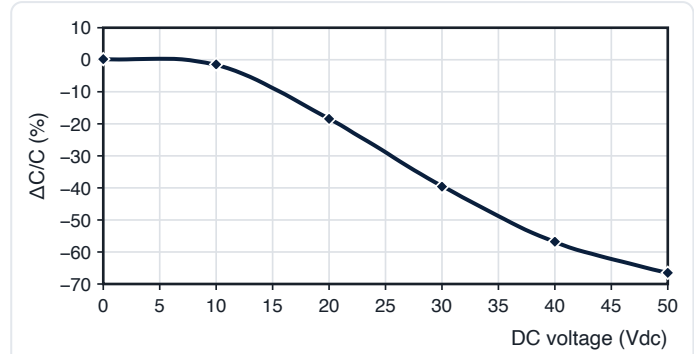
- (1) Storage conditions: temperature 5 ~ 40 °C; humidity $\leq 70\%$ RH.
- (2) Do not open the tape until the parts are to be used, and use them within one year of the date printed on the reel.
- (3) Use the chips within 3 months after the tape is opened.
- (4) The capacitance of high-dielectric-constant capacitors (X7R, X7S, X7T, X6S, X5R) decreases gradually with time; take this into account in circuit design. If such a capacitance reduction occurs, a heat treatment at 150 °C for 1 hour will return the capacitance to its initial value.

Characteristic curves (example) ③

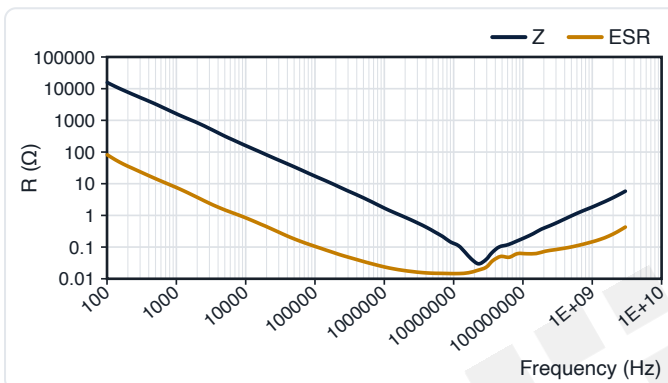
Example: 0603B6104K500NT (0603, X7R, 104 = 100 nF, $\pm 10\%$, 50 V, nickel barrier, taping).



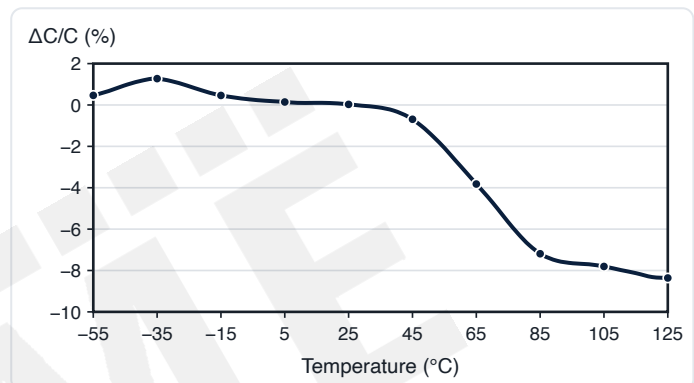
AC voltage characteristic: capacitance change vs AC voltage



DC bias characteristic: capacitance change vs DC voltage



Frequency characteristic: impedance Z and ESR vs frequency



Temperature characteristic: capacitance change vs temperature

Notes

- ① Tape drawings: in 7.2.2 the sprocket-hole pitch is 4.0 ± 0.05 in the 8 mm drawing but 4.0 ± 0.1 in the 12 mm drawing — subject to manufacturer confirmation.
- ② The Chinese text differs from the English in: 7.2.5 (2) (a leader of at least 5 pitches at the start of the tape); 7.2.5 (6) (peel torque). The English is printed — subject to manufacturer confirmation.
- ③ Section numbering: the numbers 7.2.7.1 and 7.2.7.2 are printed with overlapping characters (they look like “7221” and “722”), and the curves page has no section number — subject to manufacturer confirmation.
- ④ Drawings: in the breakaway drawing (8.1.2) the chip above the slit has no letter (a stray “C” is printed in the page margin) — subject to manufacturer confirmation.
- ⑤ Soldering: the wave-soldering caution gives a preheating–soldering temperature difference of $\leq 150^\circ\text{C}$, $\Delta T \leq 130^\circ\text{C}$ for hand soldering, and $\Delta T \leq 150^\circ\text{C}$ (below 1206) / $\leq 130^\circ\text{C}$ (1206 and above) in the Pb-free reflow profile. The wave profile after 8.3.3 (260 $^\circ\text{C}$ max., 3~4 s) is not labelled lead-free — subject to manufacturer confirmation.