

# MULTILAYER CERAMIC CAPACITORS

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**QS 9000/ISO 9001**  
 Registered by BSI to QS 9000 or ISO 9001 under BSI's accreditation by UKAS for Certification.  
 Registration NO : FM25309(2002. 2. 28)  
**WE WILL PROVIDE A CUSTOMER WITH HIGH RELIABLE PRODUCTS AND SERVICES**



**We, Samsung, declare that our component MLCC is produced in accordance with EU RoHS directive.**

**1. RoHS Compliance and restriction of Br**

The following restricted materials are not used in packaging materials as well as products in compliance with the law and restriction.  
 - Cd, Pb, Hg, Cr+6, As, Br and the compounds, PCB, asbestos  
 - Bromic materials : PBBs, PBBOs, PBDO, PBDE, PBB

**2. No use of materials breaking Ozone layer**

The following ODS materials are not used in our fabrication process.  
 - ODS material : Freon, Haron, 1-1-1 TCE, CCl4, HCFC

If you want more detailed Information, Please Visit Samsung Electro-mechanics Website [http://www.sem.samsung.com]

**Certification list of Samsung Factory**

QS 9000 is included ISO9001:1994  
 TS 16949 is included ISO9001:2000

	SUWON	BUSAN	PHILIPPINES	TIANJIN	MEXICO	THAILAND	HUNGARY
ISO 9001:2000 (Product)				BSI FM25309	BSI FM25309		BSI FM25309
QS 9001:1998 (Product)	BSI FM62262		BSI FM62262	2005 Upgrade QS9000 → ISO/TS 16949			
TL 9000 (Product)		BSI FM90588					
ISO 14001(Factory)	BSI 66454	BSI 66454	BSI 77354	CCEMS 01-2001-95			BSI FMS69298
ISO / TS16949:2002 (Product)	BSI FM91430						

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9. Solderability
10. Resistance to Soldering Heat
11. Vibration Test
12. Humidity (Steady State)
13. Moisture Resistance
14. High Temperature Resistance
15. Thermal Cycle
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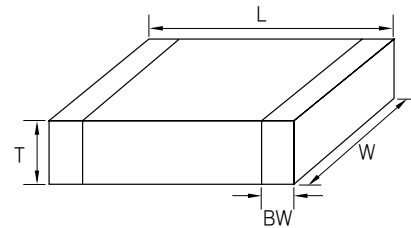
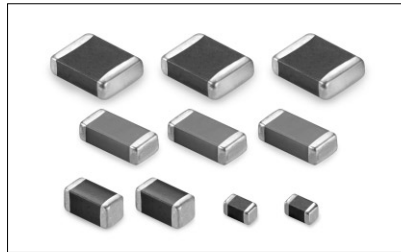
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GENERAL CAPACITORS

Dimensions



Code	EIA Code	Dimension(mm)			
		L	W	T	BW
05	0402	1.0±0.05	0.5±0.05	0.5±0.05	0.2+0.15/-0.1
10	0603	1.6±0.1	0.8±0.1	0.8±0.1	0.3±0.2
21	0805	2.0±0.1	1.25±0.1	1.25±0.1	0.5+0.2/-0.3
		2.0±0.15	1.25±0.15	1.25±0.15	0.5+0.2/-0.3
31	1206	3.2±0.2	1.6±0.2	1.6±0.2	0.5±0.3
		3.2±0.15	1.6±0.15	1.25±0.15	
				0.85±0.15	
32	1210	3.2±0.3	2.5±0.2	2.5±0.2	0.6±0.3
		3.2±0.4	2.5±0.3	2.5±0.3	0.6±0.3
42	1808	4.5±0.4	2.0±0.2	2.0±0.2	0.8±0.3
43	1812	4.5±0.4	3.2±0.3	3.2±0.3	0.8±0.3
55	2220	5.7±0.4	5.0±0.4	3.2±0.3	1.0±0.3

Feature and Application

Feature

- Wide selection of size : from 0402 to 2220
- Highly reliable tolerance and high speed automatic chip placement on PCBs
- Wide capacitance range
- Wide temperature compensation and voltage range : from C0G to Y5V and from 6.3V to 50V
- Highly reliable performance
- Highly resistant termination metal
- Tape & reel for surface mount assembly

Application

- General electronic equipment

Pd MLCC (12<sup>th</sup> code in part number of pd MLCC = A)

- Class I type  
Capacitance < 10pF(Class I, 0402, 0603, 0805 case size)  
Capacitance < 18pF(Class I, 1206 case size)

\* Except the capacitance range mentioned as above, All other the capacitance range is using Ni inner electrode for Class I, Class II type(12<sup>th</sup> code in part number of Ni MLCC = N)

GENERAL CAPACITORS

Capacitance Table

Size	0402(05)					0603(10)				
	TC X7R(B) / X5R(A)									
Rated V	6.3(Q)	10(P)	16(O)	25(A)	50(B)	6.3(Q)	10(P)	16(O)	25(A)	50(B)
Capacitance -nF- (part numbering code) and thickness -mm-										
0.22(221)										
0.33(331)										
0.39(391)										
0.47(471)										
0.56(561)										
0.68(681)										
0.82(821)										
1.0(102)										
1.5(152)										
2.2(222)										
3.3(332)										
4.7(472)										
6.8(682)										
10(103)										
15(153)										
22(223)										
33(333)										
39(393)										
47(473)										
56(563)										
68(683)										
82(823)										
100(104)										
120(124)										
150(154)										
220(224)										
330(334)										
470(474)										
680(684)										
1000(105)										
2200(225)										
3300(335)										
4700(475)										

Legend: :X7R(B) :X5R(A) :X7R(B), X5R(A)

GENERAL CAPACITORS

Size TC	0805(21)				
	X7R(B) / X5R(A)				
Rated V	6.3(Q)	10(P)	16(O)	25(A)	50(B)
Capacitance -nF- (part numbering code) and thickness -mm-					
0.22(221)					
0.33(331)					
0.47(471)					
0.68(681)					
0.82(821)					
1.0(102)					
1.5(152)					
2.2(222)					
2.7(272)					
3.3(332)					0.65 (A)
4.7(472)					
5.6(562)					
6.8(682)					
10(103)					
15(153)					
22(223)					
27(273)					
33(333)					
39(393)					
47(473)				0.65 (A)	0.85 (C)
56(563)					
68(683)					
82(823)					
100(104)			0.65 (A)	0.85 (C)	
120(124)					1.25 (F)
150(154)					
180(184)					
220(224)		0.65 (A)			
270(274)			0.85 (C)	1.25 (F)	
330(334)		0.85 (C)			
390(394)					
470(474)					
560(564)			1.25 (F)		
680(684)		1.25 (F)		1.25 (F)	
1000(105)	1.25 (F)	1.25 (F)		1.25 (F)	
2200(225)	1.25 (F)		1.25 (F)		
3300(335)	1.25 (F)			0.85 (C)	
4700(475)	1.25 (F)	1.25 (F)			
10000(106)					
22000(226)	1.25 (Q)				

■ :X7R(B) ■ :X5R(A) ■ :X7R(B), X5R(A)

GENERAL CAPACITORS

Size TC	1206(31)					1210(32)				
	X7R(B) / X5R(A)					X7R(B) / X5R(A)				
Rated V	6.3(Q)	10(P)	16(O)	25(A)	50(B)	6.3(Q)	10(P)	16(O)	25(A)	50(B)
Capacitance -nF- (part numbering code) and thickness -mm-										
1.0(102)										
2.2(222)										
3.3(332)										
4.7(472)										
10(103)										
15(153)										
27(273)										
33(333)										
47(473)										
100(104)										
150(154)										
220(224)				0.85 (C)						
330(334)										
390(394)										
470(474)										
560(564)				0.85 (C)						
680(684)										
820(824)										
1000(105)		0.85 (C)								
1200(125)				1.25 (F)						
1500(155)										
1800(185)		1.25 (F)								
2200(225)				1.6 (H)						
3300(335)										
3900(395)										
4700(475)		1.6 (H)								
6800(685)	1.6 (H)			1.6 (H)						
10000(106)	1.6 (H)	1.6 (H)								
22000(226)	1.6 (H)									
47000(476)										
100000(107)										

Size TC	1812(43)					2220(55)				
	X7R(B) / X5R(A)					X7R(B) / X5R(A)				
Rated V	6.3(Q)	10(P)	16(O)	25(A)	50(B)	6.3(Q)	10(P)	16(O)	25(A)	50(B)
Capacitance -nF- (part numbering code) and thickness -mm-										
10(103)										
1000(105)										
2200(225)										
4700(475)										
10000(106)										
22000(226)										
47000(476)										
100000(107)										

■ :X7R(B) ■ :X5R(A) ■ :X7R(B), X5R(A)

**GENERAL CAPACITORS**

Size	0402(05)					0603(10)				
TC	Y5V(F)									
Rated V	6.3(Q)	10(P)	16(O)	25(A)	50(B)	6.3(Q)	10(P)	16(O)	25(A)	50(B)
Capacitance -nF- (part numbering code) and thickness -mm-										
2.2(222)										
3.3(332)										
4.7(472)										
6.8(682)					0.50 (5)					
10(103)										
15(153)				0.50 (5)						
22(223)										
33(333)										0.80 (8)
47(473)			0.50 (5)							
68(683)										
100(104)									0.80 (8)	
150(154)										
220(224)	0.50 (5)									
330(334)		0.50 (5)								
470(474)							0.80 (8)	0.80 (8)		
680(684)										
1000(105)										
2200(225)						0.80 (8)				

Size	0805(21)				
TC	Y5V(F)				
Rated V	6.3(Q)	10(P)	16(O)	25(A)	50(B)
Capacitance -nF- (part numbering code) and thickness -mm-					
2.2(222)					
4.7(472)					
6.8(682)					0.65 (A)
10(103)					
22(223)					
68(683)				0.65 (A)	
100(104)					0.85 (C)
150(154)			0.65 (A)		
220(224)					
270(274)					
470(474)				0.85 (C)	1.25 (F)
680(684)					
1000(105)			0.85 (C)		
1500(155)				1.25 (F)	
2200(225)			1.25 (F)		
3300(335)					
4700(475)					
6800(685)					
10000(106)	1.25 (F)	1.25 (F)			

**GENERAL CAPACITORS**

Size	1206(31)					1210(32)					
TC	Y5V(F)										
Rated V	6.3(Q)	10(P)	16(O)	25(A)	50(B)	6.3(Q)	10(P)	16(O)	25(A)	35(L)	50(B)
Capacitance -nF- (part numbering code) and thickness -mm-											
10(103)											
15(153)											
22(223)											
33(333)											
47(473)											
68(683)											
100(104)											
150(154)											
220(224)											
330(334)											1.25 (F)
470(474)											
680(684)											
1000(105)											
1500(155)											
2200(225)											
3300(335)											
4700(475)											
6800(685)											
10000(106)											
15000(156)											
22000(226)											
33000(336)											
47000(476)											
100000(107)											

※① 1.1(E) & 1.6(H)  
 ② 1.15(M) & 2.5(J)  
 ③ 1.15(M) & 1.6(H)

Size	1812(43)			2220(55)	
TC	Y5V(F)				
Rated V	16(O)	25(A)	50(B)	10(P)	
Capacitance -pF- (part numbering code) and thickness -mm-					
10000(106)		2.5(J)	2.5(J)		
15000(156)					
22000(226)	2.0(I)				
33000(336)					
47000(476)					
68000(686)					
100000(107)					2.5(J)

GENERAL CAPACITORS

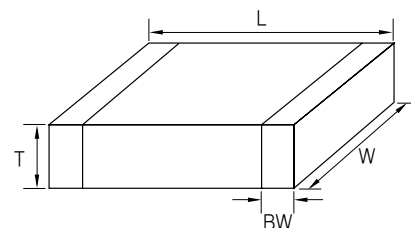
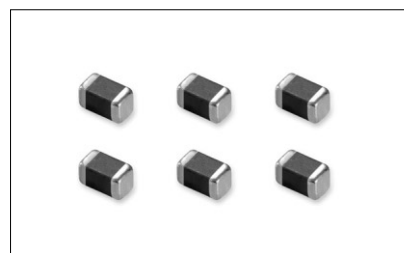
Size	0402(05)		0603(10)		0805(21)		1206(31)		1210(32)	1812(43)		2220(55)	
TC	COG(C)												
Rated V	6.3(Q)	25(A)	50(B)	25(A)	50(B)	25(A)	50(B)	25(A)	50(B)	50(B)	25(A)	50(B)	50(B)
Capacitance -pF- (part numbering code) and thickness -mm-													
0.5(0R5)													
1(010)													
10(100)													
18(180)													
33(330)													
47(470)													
56(560)	0.5(5)	0.5(5)											
100(101)								0.65(A)					
150(151)													
180(181)				0.8(8)	0.8(8)								
220(221)													
330(331)													
470(471)	0.5(5)												
560(561)													
680(681)								0.85(C)					
1000(102)													
1200(122)													
1500(152)													
1800(182)													
2200(222)								0.85(C)					
3300(332)													
3900(392)								1.25(F)					
4700(472)													
5600(562)								1.25(F)					
6800(682)													
8200(822)													
10000(103)								1.25(F)					
12000(123)													
15000(153)													
18000(183)													
22000(223)								1.6(H)					
27000(273)													
33000(333)													
43000(433)													1.6(H)
47000(473)													
62000(623)													
68000(683)													2.5(J)
91000(913)													2.0(I)
100000(104)											1.6(H)		
130000(134)													2.5(J)

GENERAL CAPACITORS

Size	0402(05)	0603(10)	0805(21)	0402(05)	0603(10)	0805(21)	0402(05)	0603(10)	0805(21)	0603(10)	0805(21)	0603(10)	0805(21)
TC	U2J(U), S2L(L)			T2H(T)			R2H(R)			S2H(S)		P2H(P)	
Rated V	50(B)	50(B)	50(B)	50(B)	50(B)	50(B)	50(B)	50(B)	50(B)	50(B)	50(B)	50(B)	50(B)
Capacitance -pF- (part numbering code) and thickness -mm-													
0.5(0R5)													
1(010)													
10(100)													
12(120)													
15(150)													
24(240)													
33(330)													
47(470)	0.5(5)						0.5(5)						
56(560)													
68(680)													
82(820)													
100(101)													
120(121)													
150(151)													
180(181)													
220(221)													
270(271)													
330(331)													
390(391)													
470(471)													
560(561)													
680(681)													
820(821)													
910(911)													
1000(102)													
1200(122)													
1500(152)													
2200(222)													
2700(272)													
3300(332)													
3900(392)													

**SUPER SMALL CAPACITORS**

**Dimensions**



Code	EIA Code	Dimension (mm)			
		L	W	T	BW
03	0201	0.6±0.03	0.3±0.03	0.3±0.03	0.15±0.05

**Feature and Application**

**Feature**

- Small chip size (0.6×0.3×0.3 mm)
- 03 Series (COG) MLCC shows very low ESR value.
- 03 Series are suited to only reflow soldering
- 03 Series are suited to miniature RF module, portable equipment and high frequency circuit

**Application**

- VCO, Tuner, RF Module
- MCM Module
- Mobile phone, Wireless LAN, Note PC

**SUPER SMALL CAPACITORS**

**Capacitance Table**

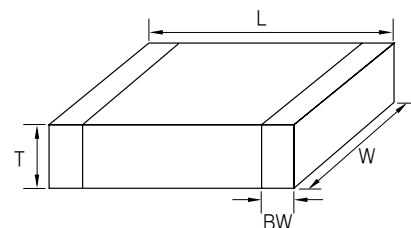
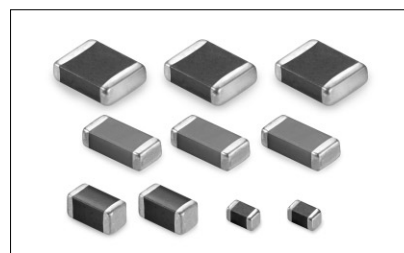
Size TC Rated V	0201(03)						
	COG(C)		X7R(B) / X5R(A)				Y5V(F)
	25(A)	50(B)	6.3(Q)	10(P)	16(O)	25(A)	6.3(Q)
Capacitance -pF- (part numbering code) and thickness -mm- (part numbering code)							
0.5(0R5)							
0.75(R75)							
1.0(010)							
2.0(020)							
3.0(030)							
4.0(040)							
5.0(050)							
6.0(060)		0.3 (3)					
7.0(070)							
8.0(080)							
9.0(090)							
10(100)							
12(120)							
15(150)							
18(180)							
20(200)							
22(220)							
27(270)							
33(330)							
39(390)							
47(470)	0.3 (3)						
56(560)							
68(680)							
82(820)							
100(101)							
150(151)							
220(221)							
330(331)							
470(471)							
680(681)							
1000(102)							
1500(152)							
2200(222)							
3300(332)							
4700(472)							
6800(682)							
10000(103)							
22000(223)							
47000(473)							
100000(104)							

Legend: :X7R(B) (light blue), :X5R(A) (teal), :Y5V(F) (grey)



## LOW PROFILE CAPACITORS

### Dimensions



Code	EIA Code	Dimension (mm)				
		L	W	T	Thickness code	BW
10	0603	1.6±0.1	0.8±0.1	0.5±0.05	5	0.3±0.2
					6C	0.6±0.1
21	0805	2.0±0.1	1.25±0.1	0.85±0.1	C	0.5+0.2/-0.3
				0.60±0.1	6	0.5+0.2/-0.3
31	1206	3.2±0.2	1.6±0.2	0.85±0.15	C	0.5±0.3
				1.15±0.1	P	
				0.6±0.1	6	
32	1210	3.2±0.3	2.5±0.2	0.85±0.1	C	0.6±0.3
				0.90±0.1	9	
				1.15±0.1	P	
				1.35±0.15	S	
				1.60±0.1	T	
				1.80±0.2	U	

### Feature and Application

#### Feature

- Thinner MLCC than general product (Same length and width of general product)

#### Application

- LCD Module
- Hard Disc Drive
- CPU socket
- Mobile Product etc

### Capacitance Table

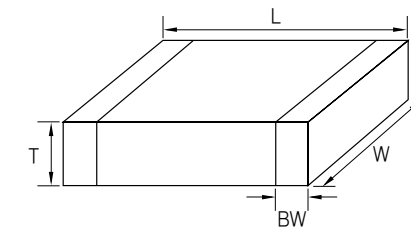
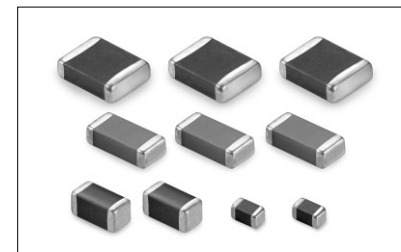
Size	0603(10)				0805(21)				1206(31)				1210(32)					
TC	X5R(A)				X5R(A)				X5R(A)				X5R(A)					
Rated V	6.3(Q)	10(P)	16(O)	25(A)	6.3(Q)	10(P)	16(O)	25(A)	6.3(Q)	10(P)	16(O)	25(A)	25(A)	6.3(Q)	10(P)	16(O)	25(A)	35(L)
Capacitance -nF- (part numbering code) and thickness -mm-																		
100(104)		(5)	(5)	(6)														
1000(105)	(5)				(6)	(6)							(P)					
1500(155)					(6)	(6)												
2200(225)													(C)					
3300(335)																		
4700(475)				(6)	(C)	(C)		(6)	(6)	(C)								
10000(106)				(C)					(C)				(C)	(C)	(9)	(T)		
22000(226)								(C)					(C)	(S)	(T)			

■ :X7R(B) ■ :X5R(A)

\*The thickness code in the product line up is available minimum thickness. If you need the thicker product, we can also support your needs.

## HIGH VOLTAGE CAPACITORS

### Dimensions



Code	EIA Code	Dimension (mm)			
		L	W	T	BW
10	0603	1.6±0.1	0.8±0.1	0.8±0.1	0.3±0.2
21	0805	2.0±0.1	1.25±0.1	1.25±0.1	0.5+0.2/-0.3
		3.2±0.2	1.6±0.2	1.6±0.2	
31	1206	3.2±0.15	1.6±0.15	1.25±0.15	0.5±0.3
				0.8±0.15	
32	1210	3.2±0.3	2.5±0.2	2.5±0.2	0.6±0.3
42	1808	4.5±0.4	2.0±0.2	2.0±0.2	0.8±0.3
43	1812	4.5±0.4	3.2±0.3	3.2±0.3	0.8±0.3
55	2220	5.7±0.4	5.0±0.4	3.2±0.3	1.0±0.3

### Feature and Application

#### Feature

- Highly reliable performance
- Operating at high voltage level
- Wide voltage level: from 100V to 3000V
- High withstanding voltage
- Tape & reel surface mount assembly

#### Application

- Switching Power Circuit (SMPS)
- Lighting Ballast, LCD back lighting inverter
- DC-DC converter input filter, snubber circuit
- Tip & Ring (Phone, Fax, Modem)
- Network (IEEE802.3)

### Capacitance Table

Size	0603(10)			0805(21)			1206(31)						
TC	X5R(A)			X5R(A)			COG(C)						
Rated V	100(C)	200(D)	250(E)	100(C)	200(D)	250(E)	100(C)	200(D)	250(E)	500(G)	630(H)	1000(I)	2000(J)
Capacitance -pF- (part numbering code) and thickness -mm-													
0.5(0R5)													
~9.1(9R1)													
10(100)													
~27(270)													
33(330)													
39(390)													
47(470)													
56(560)													
68(680)													
82(820)													
~180(181)	0.80												
220(221)													
~390(391)													
470(471)													
560(561)													
680(681)													
820(821)													
1000(102)													
1200(122)													
1500(152)													
2200(222)													
2700(272)													
3300(332)													
3900(392)													
4700(472)													
8200(822)													
10000(103)													
~18000(183)													

( ) : Possible to accept an order for 250/630 voltage parts, but in case of the maximum capacitance part among them, consult with a person in charge of product development before you order.

**HIGH VOLTAGE CAPACITORS**

Size TC Rated V	1210(32)						1808(42)		
	COG(C)								
	100(C)	200(D)	250(E)	500(G)	630(H)	1000(I)	2000(J)	2000(J)	3000(K)
Capacitance -pF- (part numbering code) and thickness -mm-									
10(100)									
12(120)									
15(150)									
22(220)									
33(330)									1.25 (F)
47(470)								1.25 (F)	
56(560)									
68(680)									
82(820)							1.25 (F)		
100(101)									
120(121)									1.6 (H)
150(151)									2.0 (I)
180(181)								1.6 (H)	
220(221)							1.6 (H)		
270(271)							2.0 (I)		
330(331)									
390(391)							2.5 (J)		
470(471)						1.6 (H)			
560(561)									
680(681)				1.25 (F)	1.25 (F)	2.0 (I)			
820(821)						2.5 (J)			
1000(102)									
1200(122)				1.6 (H)	1.6 (H)				
1500(152)									
2200(222)				2.5 (J)					
2700(272)									
3300(332)			1.25 (F)	1.25 (F)					
3900(392)			1.6 (H)	1.6 (H)					
4700(472)			2.0 (I)	2.0 (I)		2.5 (J)			
5600(562)	1.25 (F)								
6800(682)									
8200(822)	1.6 (H)								
10000(103)		2.5 (J)	2.5 (J)						
12000(123)	2.0 (I)								
15000(153)									
18000(183)	2.5 (J)								
27000(273)									
56000(563)									

( ): Possible to accept an order for 250/630 voltage parts, but in case of the maximum capacitance part among them, consult with a person in charge of product development before you order.

**HIGH VOLTAGE CAPACITORS**

Size TC Rated V	1812(43)						2220(55)								
	COG(C)														
	100(C)	200(D)	250(E)	500(G)	630(H)	1000(I)	2000(J)	3000(K)	100(C)	200(D)	250(E)	500(G)	630(H)	1000(I)	3000(K)
Capacitance -pF- (part numbering code) and thickness -mm-															
47(470)															
82(820)								1.25 (F)							
100(101)															
120(121)															
150(151)								1.6 (H)							
180(181)															
220(221)								2.0 (I)	2.0 (I)						
270(271)															
390(391)															
470(471)								1.25 (F)	2.5 (J)						
680(681)															2.5 (J)
820(821)				1.25 (F)	1.25 (F)	1.6 (H)									
1000(102)															
1200(122)								2.0 (I)							
1500(152)															
1800(182)				1.6 (H)	1.6 (H)			2.5 (J)							
2200(222)															
2700(272)				2.0 (I)	2.0 (I)										2.5 (J)
3300(332)															
4700(472)				2.5 (J)											362
5600(562)															
6800(682)												2.0 (I)	2.0 (I)		
8200(822)												2.5 (J)	2.5 (J)		
10000(103)															
12000(123)	1.25 (F)														
15000(153)															
18000(183)	1.6 (H)														
22000(223)	2.0 (I)	2.5 (J)	2.5 (J)								2.5 (J)				
27000(273)	2.5 (J)														
33000(333)															
39000(393)											2.5 (J)				
47000(473)															
68000(683)											2.5 (J)				

( ): Possible to accept an order for 250/630 voltage parts, but in case of the maximum capacitance part among them, consult with a person in charge of product development before you order.

**HIGH VOLTAGE CAPACITORS**

Size	0603(10)			0805(21)			1206(31)					
TC	X7R(B)											
Rated V	100(C)	100(C)	200(D)	250(E)	100(C)	200(D)	250(E)	500(G)	630(H)	1000(I)	2000(J)	
Capacitance -pF- (part numbering code) and thickness -mm-												
220(221)												
330(331)												
470(471)												
680(681)												
1000(102)												
1500(152)		0.65(A)	0.85(C)	0.85(C)								1.6(H)
2200(222)												
3300(332)	0.80(8)					0.85(C)		1.25(F)	1.25(F)			
4700(472)												
6800(682)				1.25(F)	0.85(C)							
10000(103)												
15000(153)		0.85(C)										
22000(223)								1.25(F)	1.6(H)	1.6(H)		
33000(333)												
47000(473)	393	1.25(F)										
68000(683)					1.25(F)	1.6(H)						
100000(104)												
150000(154)					1.6(H)							

Size	1210(32)						1808(42)
TC	X7R(B)						
Rated V	100(C)	250(E)	500(G)	630(H)	1000(I)	2000(J)	2000(J)
Capacitance -nF- (part numbering code) and thickness -mm-							
470(471)							1.25(F)
1000(102)							1.25(F)
2200(222)							
3300(332)						1.25(F)	
6800(682)						1.6(H)	
10000(103)							
15000(153)						1.25(F)	
22000(223)	1.25(F)						
33000(333)							
47000(473)			1.6(H)				
68000(683)		2.0(I)				2.5(J)	
100000(104)							
150000(154)		2.5(J)					
220000(224)	1.6(H)						
330000(334)							
470000(474)	2.0(I)						
680000(684)	2.5(J)						
1000000(105)							

\* ( ) Tip & Ring: A special CODE will be applicable.

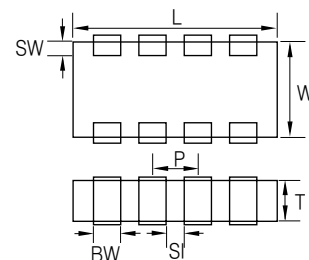
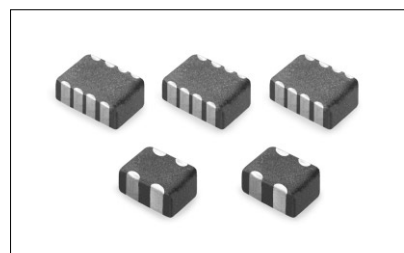
**HIGH VOLTAGE CAPACITORS**

Size	1812(43)						2220(55)									
TC	X7R(B)															
Rated V	100(C)	200(D)	250(E)	500(G)	630(H)	1000(I)	2000(J)	3000(K)	100(C)	250(E)	500(G)	630(H)	1000(I)	2000(J)	3000(K)	
Capacitance -pF- (part numbering code) and thickness -mm-																
1000(102)																
1200(122)																
1500(152)																
2200(222)																
2700(272)																
3300(332)																
3900(392)																
4700(472)																
5600(562)																
6800(682)																1.6(H)
8200(822)																
10000(103)																
12000(123)																
15000(153)																2.5(J)
18000(183)																
22000(223)																
27000(273)																
33000(333)																
39000(393)																
47000(473)																2.0(I)
56000(563)																
68000(683)																2.5(J)
82000(823)																
100000(104)																
120000(124)																
150000(154)																1.6(H)
180000(184)																
220000(224)																2.5(J)
270000(274)																2.5(J)
330000(334)																
470000(474)																2.5(J)
560000(564)																
680000(684)																1.6(H)
820000(824)																2.5(J)
1000000(105)																2.5(J)
1500000(155)																2.0(I)
2200000(225)																
3300000(335)																2.5(J)
4700000(475)																

\* ( ) Tip & Ring: A special CODE will be applicable.

## ARRAY CAPACITORS

### Dimensions



Code	EIA Code	Dimension (mm)					
		L	W	T	BW	SW	P
A	0504	1.37±0.15	1.0±0.15	0.60±0.06 0.80±0.08	0.36±0.1	0.2±0.1	0.64±0.1
A	0805	2.0±0.15	1.25±0.15	0.85±0.1	0.5±0.2	0.25±0.15	1.0±0.1
B	0805	2.0±0.15	1.25±0.15	0.85±0.1	0.25±0.1	0.25±0.15	0.5±0.1
B	1206	3.2±0.15	1.6±0.15	0.85±0.15	0.4±0.2	0.3±0.15	0.8±0.2

### Feature and Application

#### Feature

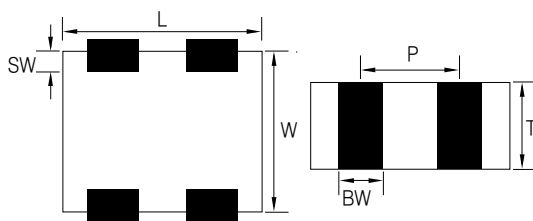
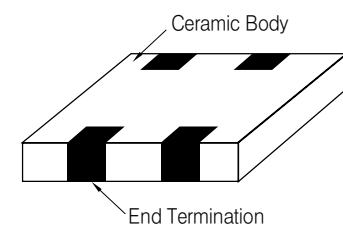
- Reduction in required space (more than 50%)
- Reduction in cost and time for replacement of PCB
- Reduction in amount of solder joints
- Easier PCB design
- Reduced waste from tape and reel packaging process

#### Application

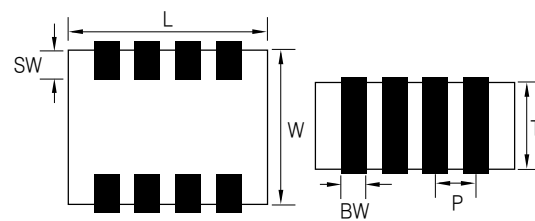
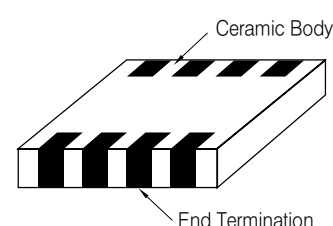
- A bypass for digital and analog signal line noise generated by telecommunications equipment and other common electronic circuits

### Structure and control code

#### A: ARRAY(2-element)



#### B: ARRAY(4-element)



## ARRAY CAPACITORS

### Capacitance Table

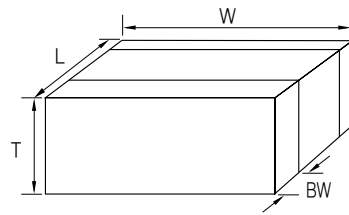
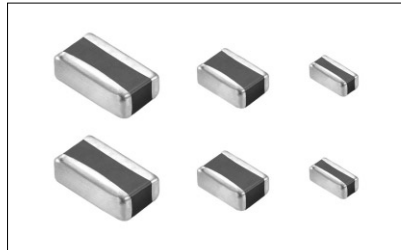
Size	0504(14)				0805(21)				1206(31)						
	TC		X7R(B) / X5R(A)		COG(C)		X7R(B)		COG(C)	X7R(B)		Y5V(F)			
Element	2 Element		2 Element		2 Element	4 Element		4 Element		4 Element	4 Element				
Rated V	25(A)	50(B)	6.3(Q)	10(P)	16(O)	25(A)	25(A)	50(B)	25(A)	50(B)	16(O)	25(A)	50(B)	25(A)	50(B)
Capacitance -pF- (part numbering code) and thickness -mm- (part numbering code)															
10(100)															
15(150)															
22(220)			0.60 (6)					0.85 (C)		0.85 (C)					
33(330)		0.60 (6)													
47(470)															
68(680)								0.85 (C)		0.85 (C)					
100(101)															
150(151)															
220(221)															
330(331)															
470(471)															
680(681)															
1000(102)															
2200(222)															
3300(332)															
4700(472)							0.60 (6)					0.85 (C)		0.85 (C)	
10000(103)															
15000(153)															
22000(223)							0.60 (6)								
47000(473)												0.85 (C)	0.85 (C)		
100000(104)			0.60 (6)				0.60 (6)							0.85 (C)	0.85 (C)
100000(105)							0.8(8)						0.85 (C)	0.85 (C)	0.85 (C)

■ :X7R(B) ■ :X5R(A)

※ Please consult us for special capacitance and high voltage(100V)

## LOW ESL CAPACITORS

### Dimensions



Code	EIA Code	Dimension (mm)			
		L	W	T	BW
01	0306	0.8±0.1	1.6±0.1	0.5±0.1	0.15 min.
12	0508	1.25±0.1	2.0±0.1	0.5±0.1 0.85±0.1	0.2 min.
13	0612	1.6±0.2	3.2±0.2	0.85±0.1 1.25±0.15	0.2 min.

### Feature and Application

#### Feature

- Low ESL, good for noise reduction for high frequency
- Highly reliable tolerance and high speed automatic chip placement on PCBs
- Highly reliable performance
- Highly resistant termination metal
- Tape & reel for surface mount assembly

#### Application

- High Speed Microprocessor
- High Frequency Digital Equipment

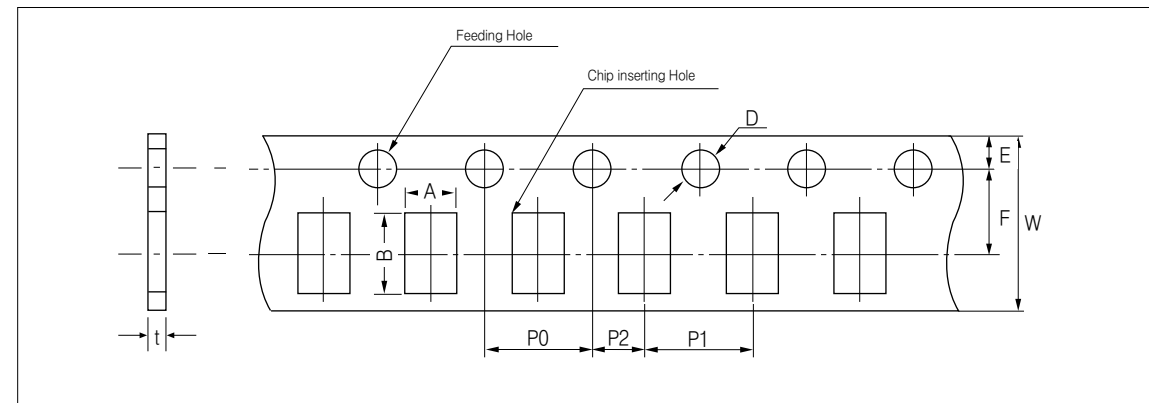
### Capacitance Table

Size	0306(01)					0508(12)					0612(13)				
	X5R(A) / X7R(B)														
TC															
Rated V	6.3(Q)	10(P)	16(O)	25(A)	50(B)	6.3(Q)	10(P)	16(O)	25(A)	50(B)	6.3(Q)	10(P)	16(O)	25(A)	50(B)
Capacitance -uF- (part numbering code)															
0.01(103)				0.5(5)	0.5(5)					0.5(5)					
0.1(104)			0.5(5)					0.5(5)	0.85(C)						0.85(C)
0.22(224)		0.5(5)						0.5(5)	0.85(C)						1.25(F)
0.33(334)								0.85(C)							
0.47(474)	0.5(5)						0.5(5)	0.85(C)						0.85(C)	
0.68(684)							0.85(C)								
1.0(105)													0.85(C)	1.25(F)	
1.5(115)					0.5(5)								1.25(F)		
2.2(225)					0.85(C)						0.85(C)				
4.7(475)											1.25(F)	1.25(F)			
10(106)											1.25(F)				

■ :X7R(B) ■ :X5R(A)

## PACKAGING SPECIFICATIONS

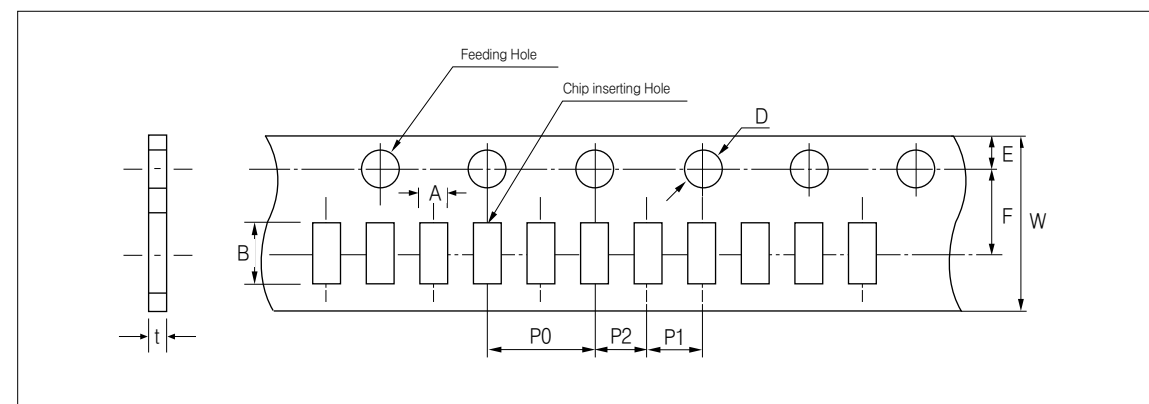
### Cardboard Paper Tape(4mm)



Unit: inch(mm)

Symbol Type	A	B	W	F	E	P1	P2	P0	D	t
0603 (1608)	1.1 ±0.2	1.9 ±0.2								
0805 (2012)	1.6 ±0.2	2.4 ±0.2	8.0 ±0.3	3.5 ±0.05	1.75 ±0.1	4.0 ±0.1	2.0 ±0.05	4.0 ±0.1	Ø1.5 +0.1/-0	1.1 Below
1206 (3216)	2.0 ±0.2	3.6 ±0.2								

### Cardboard Paper Tape(2mm)

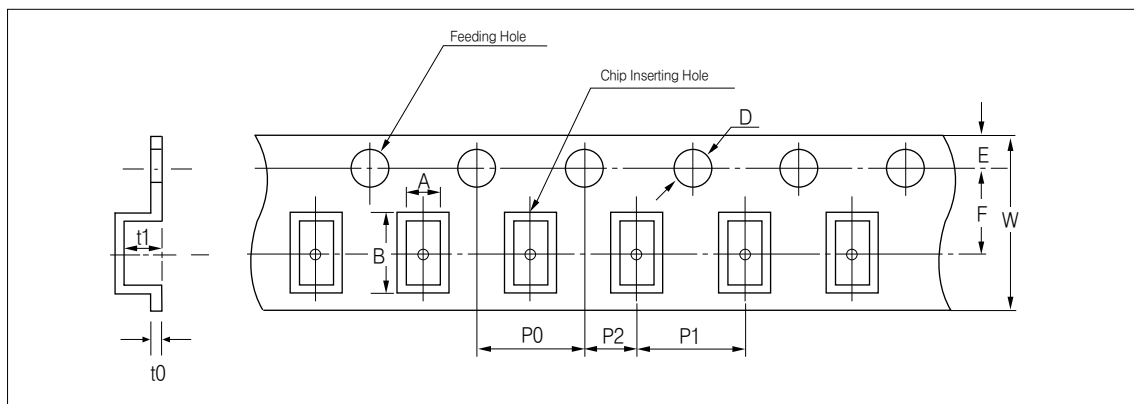


Unit: inch(mm)

Symbol Type	A	B	W	F	E	P1	P2	P0	D	t
0201 (0603)	0.38 ±0.03	0.68 ±0.03								0.37 ±0.03
0402 (1005)	0.62 ±0.04	1.12 ±0.04	8.0 ±0.3	3.5 ±0.05	1.75 ±0.1	2.0 ±0.05	2.0 ±0.05	4.0 ±0.1	Ø1.5 +0.1/-0.03	0.6 ±0.05

## PACKAGING SPECIFICATIONS

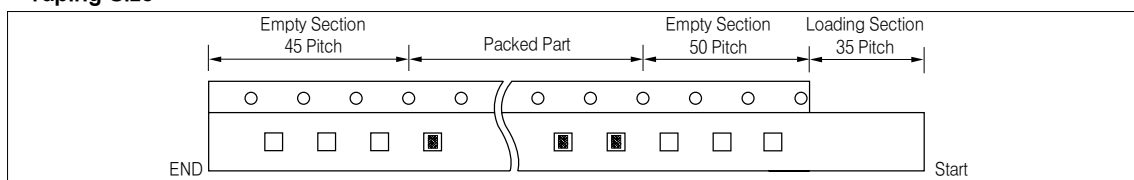
### • Embossed Plastic Tape



Unit: inch(mm)

Symbol Type	A	B	W	F	E	P1	P2	Po	D	t1	to
Dimension	0805 (2012)	1.45 ±0.2	2.3 ±0.2								
	1206 (3216)	1.9 ±0.2	3.5 ±0.2	8.0 ±0.3	3.5 ±0.05	4.0 ±0.1				2.5 max	
	1210 (3225)	2.9 ±0.2	3.7 ±0.2			1.75 ±0.1					0.6 BELOW
	1808 (4520)	2.3 ±0.2	4.9 ±0.2				2.0 ±0.05	4.0 ±0.1	Ø1.5 +0.1/-0		
	1812 (4532)	3.6 ±0.2	4.9 ±0.2	12.0 ±0.3	5.60 ±0.05	8.0 ±0.1				3.8 max	
	2220 (5750)	5.5 ±0.2	6.2 ±0.2								

### • Taping Size



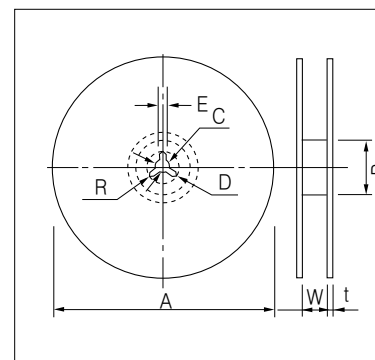
Unit: inch(mm) and pcs

Type	Symbol	Size	Cardboard Paper Tape	Symbol	Size	Embossed Plastic Tape
7" Reel	C	0201(0603)	10,000	E	All Size ≤3216 1210(3225), 1808(4520) (t ≤ 1.6mm)	2,000
		0402(1005)	10,000		1210(3225) (t ≥ 2.0mm)	1,000
		OTHERS	4,000		1808(4520) (t ≥ 2.0mm)	1,000
10" Reel	O	-	10,000	-	-	-
13" Reel	D	0402(1005)	50,000	F	All Size ≤3216 1210(3225), 1808(4520) (t < 1.6mm)	10,000
		OTHERS	10,000		1210(3225) (1.6 ≤ t < 2.0mm)	8,000
	L	0603(1608)	10,000 or 15,000		1210(3225) (t ≥ 2.0mm)	4,000
		0805 (t ≤ 0.85mm) (2012)	15,000 or 10,000 (Option)		1808(4520) (t ≥ 2.0mm)	4,000
		1206 (t ≤ 0.85mm) (3216)	10,000		1812(4532) (t ≤ 2.0mm)	4,000
					1812(4532) (t > 2.0mm)	2,000
			5750(2220)	2,000		

## PACKAGING SPECIFICATIONS

### • Reel Dimensions

Unit: mm



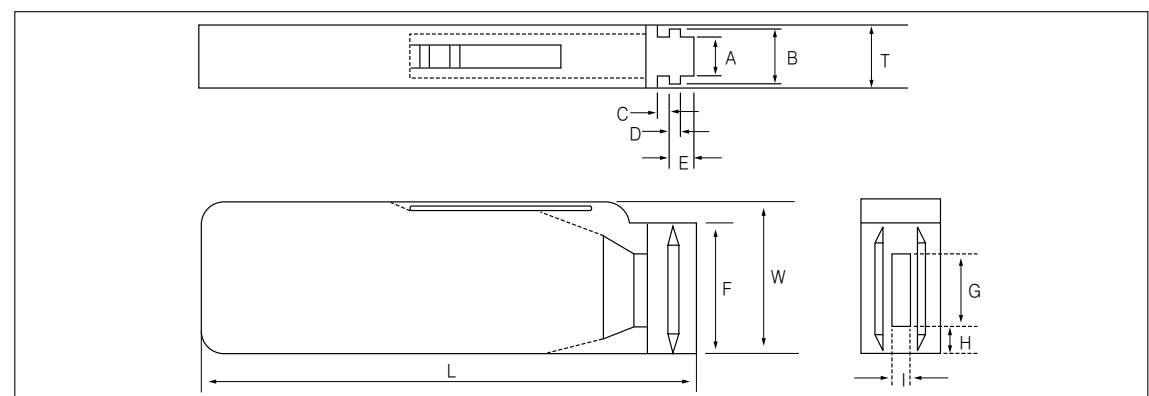
Symbol	Tape Width	A	B	C	D
7" Reel	8mm	Ø180+0/-3	Ø60+1/-0	Ø13±0.3	25±0.5
	12mm	Ø180+0/-3	Ø60+1/-0	Ø13±0.3	25±0.5
13" Reel	8mm	Ø330±2.0	Ø80±1.0	Ø13±0.3	25±0.5
	12mm	Ø330±2.0	Ø80±1.0	Ø13±0.3	25±0.5

Symbol	Tape Width	E	W	t	R
7" Reel	8mm	2.0±0.5	9±0.5	1.2±0.2	1.0
	12mm	2.0±0.5	13±0.5	1.2±0.2	1.0
13" Reel	8mm	2.0±0.5	9±0.5	2.2±0.2	1.0
	12mm	2.0±0.5	13±0.5	2.2±0.2	1.0

## BULK CASE PACKAGING

- Bulk case packaging can reduce the stock space and transportation costs.
- The bulk feeding system can increase the productivity.
- It can eliminate the components loss.



Unit: mm

Symbol	A	B	T	C	D	E
Dimension	6.8±0.1	8.8±0.1	12±0.1	1.5 +0.1/-0	2 +0/-0.1	3.0+0.2/-0

Symbol	F	W	G	H	L	I
Dimension	31.5+0.2/-0	36 +0/-0.2	19±0.35	7±0.35	110±0.7	5±0.35

### • QUANTITY

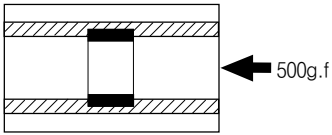
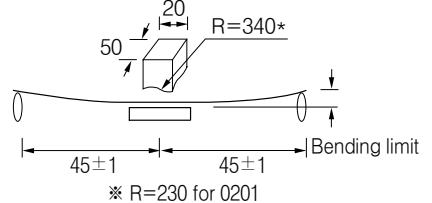
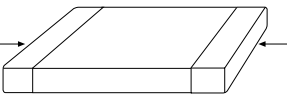
Unit: inch(mm) and pcs

Size	0402(1005)	0603(1608)	0805(2012)	
			T=0.65mm	T=0.85mm
Quantity	50,000	10,000 or 15,000	10,000	5,000 or 10,000

RELIABILITY TEST CONDITION

No	Item	Performance	Test Condition
1	Appearance	No abnormal exterior appearance	Visual Inspection through Microscope (×10)
2	Insulation Resistance	10,000MΩ min. or 500MΩ·μF min. product whichever is smaller (Rated voltage ≤16V:10,000MΩ min. or 100MΩ·μF min. product whichever is smaller)	Apply the rated voltage for 60~120 sec. *Rated voltage >500V: Insulation Resistance shall be measured with 500±50Vdc
3	Withstanding Voltage	No dielectric breakdown or mechanical breakdown	Apply the specified voltage* for 1~5 sec. Charge/Discharge current limit:50mA max. *CLASS I (Rated Voltage <100V):300% of the rated Voltage CLASS II (Rated Voltage <100V): 250% of the rated Voltage  In the case of Vr ≥100V products, following condition should be applied. 100V≤Rated Voltage<500V: 200% of the rated Voltage 500V≤Rated Voltage<1000V: 150% of the rated Voltage Rated Voltage≥1000V: 120% of the rated Voltage
4	Capacitance	CLASS I Within the specified tolerance	Capacitance      Frequency      Voltage ≤1,000pF      1MHz±10%      0.5 ~ 5 Vrms >1,000pF      1KHz±10%
		CLASS II Within the specified tolerance	Capacitance      Frequency      Voltage ≤10μF      1KHz±10%      1.0±0.2Vrms >10μF      120Hz±20%      0.5±0.1Vrms
Q	CLASS I	Capacitance ≥ 30pF : Q ≥1,000 <30pF:Q ≥400 +20C (C : Capacitance)	Capacitance      Frequency      Voltage ≤1,000pF      1MHz±10%      0.5 ~ 5Vrms >1,000pF      1KHz±10%
			Capacitance      Frequency      Voltage ≤10μF      1KHz±10%      1.0±0.2Vrms >10μF      120Hz±20%      0.5±0.1Vrms
5	Tanδ	CLASS I 1. Characteristic: A(X5R), B(X7R), X(X6S) Rated Voltage      Spec ≥25V      0.025 max 16V      0.035 max 10V      0.05max 6.3V      0.05 max/0.10 max*1	*1. 0201 C ≥0.022μF, 0402 C ≥0.22μF, 0603 C ≥2.2μF, 0805 C ≥4.7μF, 1206 C ≥10μF, 1210 C ≥22μF, 1812 C ≥47μF, 2220 C ≥100μF All Low Profile Capacitors (P.16). *2. 0603 C ≥0.47μF, 0805 C ≥1μF *3. 0402 C ≥0.033μF, 0603 C >0.1μF All 0805, 1206 size, 1210 C ≤6.8μF *4. 1210 C >6.8μF *5. 0402 C ≥0.22μF *6. All 1812 size
		CLASS II 2. Characteristic: F(Y5V) Rated Voltage      Spec 50V      0.05 max, 0.07 max*2 35V      0.07 max 25V      0.05 max/ 0.07 max*3/0.09 max*4 16V      0.09 max/0.125 max*5 10V      0.125 max/0.16 max*6 6.3V      0.16 max	
6	Temperature Characteristics of Capacitance	CLASS I Characteristic      Temp. Coefficient(PPM/°C) C      0 ± 30 P      -150 ± 60 R      -220 ± 60 S      -330 ± 60 T      -470 ± 60 U      -750 ± 120 S      +350 ~ -1000	Capacitance shall be measured by the steps shown in the following table. Step      Temperature(°C) 1      25 ± 2 2      Min. Operating Temp. ±2 3      25 ± 2 4      Max. Operating Temp. ±2 5      25 ± 2
		CLASS II Characteristic      Capacitance Change(%) with No bias A(X5R), B(X7R)      ±15% X(X6S)      ±22% F(Y5V)      +22%~-82%	(1) CLASS I Temperature Coefficient shall be calculated from the formula as below Temp. Coefficient= $\frac{C2 - C1}{C1 \times \Delta T} \times 10^6$ [ppm/°C] C1: Capacitance at step 3 C2: Capacitance at 85°C ΔT:60°C (=85°C -25°C)  (2) CLASS II Capacitance Change shall be calculated from the formula as below ΔC= $\frac{C2 - C1}{C1} \times 100$ (%) C1: Capacitance at step 3 C2: Capacitance at step 2 or 4

RELIABILITY TEST CONDITION

No	Item	Performance	Test Condition															
7	Adhesive Strength of Termination	No indication of peeling shall occur on the terminal electrode	Apply 500g.f* pressure for 10±1 sec. *200g.f for 0201 															
8	Bending Strength	Appearance No indication of peeling shall occur	• Bending Limit: 1mm • Test Speed: 1.0mm/sec. • Keep the test board at the limit point in 5 sec. • Then Measure Capacitance 															
		Capacitance CLASS I      Characteristic      Capacitance Change ±5% or ± 0.5 pF whichever is larger CLASS II      A(X5R), B(X7R), X(X6S)      ±12.5% F(Y5V)      ±30%																
9	Solderability	More than 95% of the terminal surface is to be soldered newly, so metal part does not come out or dissolve 	<table border="1"> <tr> <td>Solder</td> <td>Sn-3Ag-0.5Cu</td> <td>63Sn-37Pb</td> </tr> <tr> <td>Solder Temp.</td> <td>245±5°C</td> <td>235±5°C</td> </tr> <tr> <td>Flux</td> <td colspan="2">RMA Type</td> </tr> <tr> <td>Dip time</td> <td>3±0.3 sec.</td> <td>5±0.5 sec.</td> </tr> <tr> <td>Pre-heating</td> <td colspan="2">at 80~120°C for 10~30 sec.</td> </tr> </table>	Solder	Sn-3Ag-0.5Cu	63Sn-37Pb	Solder Temp.	245±5°C	235±5°C	Flux	RMA Type		Dip time	3±0.3 sec.	5±0.5 sec.	Pre-heating	at 80~120°C for 10~30 sec.	
Solder	Sn-3Ag-0.5Cu	63Sn-37Pb																
Solder Temp.	245±5°C	235±5°C																
Flux	RMA Type																	
Dip time	3±0.3 sec.	5±0.5 sec.																
Pre-heating	at 80~120°C for 10~30 sec.																	
10	Resistance to Soldering Heat	Appearance No mechanical damage shall occur	Solder temperature: 270±5°C DIP TIME:10±1 sec. Each termination shall be fully immersed and preheated as below: <table border="1"> <tr> <th>Step</th> <th>Temperature(°C)</th> <th>Time(sec.)</th> </tr> <tr> <td>1</td> <td>80~100</td> <td>60</td> </tr> <tr> <td>2</td> <td>150~180</td> <td>60</td> </tr> </table> Leave the capacitor in ambient condition for specified time* *24 ± 2 hours(CLASS I) 48 ± 4 hours(CLASS II)	Step	Temperature(°C)	Time(sec.)	1	80~100	60	2	150~180	60						
		Step		Temperature(°C)	Time(sec.)													
		1		80~100	60													
		2		150~180	60													
Capacitance CLASS I      Characteristic      Capacitance Change ±2.5% or ± 0.25 pF whichever is larger CLASS II      A(X5R), B(X7R), X(X6S)      ±7.5% F(Y5V)      ±15% F(Y5V)      ±20%																		
Q (CLASS I) Within the specified initial value																		
Tanδ (CLASS II) Within the specified initial value																		
Insulation resistance Within the specified initial value																		
Withstanding voltage Within the specified initial value																		
11	Vibration Test	Appearance No mechanical damage shall occur	The capacitor shall be subjected to a harmonic motion having a total amplitude of 1.5mm changing frequency from 10Hz to 55Hz and back to 10Hz in about 1 min.  Repeat this for 2hours each in 3 mutually perpendicular directions.															
		Capacitance CLASS I      Characteristic      Capacitance Change ±2.5% or ± 0.25 pF whichever is larger CLASS II      A(X5R), B(X7R), X(X6S)      ±5% F(Y5V)      ±10% F(Y5V)      ±20%																
		Q (CLASS I) Within the specified initial value																
		Tanδ (CLASS II) Within the specified initial value																
Insulation resistance Within the specified initial value																		

RELIABILITY TEST CONDITION

No	Item	Performance	Test Condition		
12	Humidity (Steady state)	Appearance	No mechanical damage shall occur		
		Capacitance	Characteristic	Capacitance Change	
			CLASS I	±5% or ± 0.5 pF whichever is larger	
			CLASS II	A(X5R), B(X7R), X(X6S) ±12.5% F(Y5V) ±30%	
		Q (CLASS I)	Capacitance ≥ 30pF : Q ≥ 350 10 ≤ Capacitance < 30pF : Q ≥ 275 + 2.5 × C Capacitance < 10pF : Q ≥ 200 + 10 × C (C: Capacitance)	Temperature: 40 ± 2°C Humidity: 90~95% RH Duration Time: 500+12/-0 Hr.  Leave the capacitor in ambient condition for specified time* before measurement *24 ± 2 hours(CLASS I) 48 ± 4 hours(CLASSII)	
		Tanδ (CLASSII)	1.Capacitance: A, B 0.05max(16V and over) 0.075max(10V) 0.075max (6.3V except Table 1) 0.125max* (refer to Table 1) 2.Capacitance: F 0.075max(50V, 25V) 0.1max(16V C < 1.0μF) 0.125max(16V C ≥ 1.0μF) 0.15max (10V) 0.195max (6.3V)		
Insulation resistance	1,000MΩ or 50MΩ · μF product whichever is smaller				
13	Moisture Resistance	Appearance	No mechanical damage shall occur		
		Capacitance	Characteristic		Capacitance Change
			CLASS I		±7.5% or ± 0.75pF whichever is larger
			CLASS II	A(X5R), B(X7R), X(X6S) ±12.5% F(Y5V) ±30% in case of Table 2* +30~ -40%	
		Q (CLASS I)	Capacitance ≥ 30pF : Q ≥ 200 < 30pF : Q ≥ 100 + 10/3 × C (C: Capacitance)	Applied Voltage: rated voltage Temperature: 40 ± 2°C Humidity: 90~95% RH Duration Time: 500+12/-0 Hr. Charge/Discharge Current: 50mA max.  Perform the initial measurement according to Note1. Perform the final measurement according to Note2.	
		Tanδ (CLASSII)	1.Capacitance: A, B 0.05max(16V and over) 0.075max(10V) 0.075max (6.3V except Table 1) 0.125max* (refer to Table 1) 2.Capacitance: F 0.075max(50V, 25V) 0.1max(16V C < 1.0μF) 0.125max(16V C ≥ 1.0μF) 0.15max (10V) 0.195max (6.3V) X(X6S) 0.11max (6.3V and below)		
Insulation resistance	500MΩ min. or 25MΩ · μF min. product whichever is smaller				
14	High Temperature Resistance	Appearance	No mechanical damage shall occur		
		Capacitance	Characteristic		Capacitance Change
			CLASS I		±3% or ± 0.3 pF whichever is larger
			CLASS II	A(X5R), B(X7R) ±12.5% X(X6S) ±25% F(Y5V) ±30% * in case of Table 2 +30~ -40%	
		Q (CLASS I)	Capacitance ≥ 30pF : Q ≥ 350 10 ≤ Capacitance < 30pF : Q ≥ 275 + 2.5 × C Capacitance < 10pF : Q ≥ 200 + 10 × C (C: Capacitance)	Applied Voltage: 200%* of the rated voltage Temperature: max. operating temperature Duration Time: 1000+48/-0 Hr. Charge/Discharge Current: 50mA max.  *Rated Voltage < 250V: 200% of the rated Voltage 500V ≤ rated voltage < 1000V: 120% of the rated Voltage 1000V ≤ rated voltage ≤ 3000V: 100% of the rated Voltage Refer to table(3): 150%/100% of the rated Voltage	
		Tanδ (CLASSII)	1.Capacitance: A, B 0.05max(16V and over) 0.075max(10V) 0.075max (6.3V except Table 1) 0.125max* (refer to Table 1) 2.Capacitance: F 0.075max(25V and over) 0.1max(16V, C < 1.0μF) 0.125max(16V, C ≥ 1.0μF) 0.15max (10V) 0.195max (6.3V) X(X6S) 0.11max (6.3V and below)		
Insulation resistance	1,000MΩ or 50MΩ · μF product whichever is smaller				

RELIABILITY TEST CONDITION

No	Item	Performance	Test Condition																
15	Temperature Cycle	Appearance	No mechanical damage shall occur																
		Capacitance	Characteristic	Capacitance Change															
			CLASS I	±2.5% or ± 0.25pF whichever is larger															
			CLASS II	A(X5R), B(X7R) ±7.5% X(X6S) ±15% F(Y5V) ±20%															
		Q (CLASS I)	Within the specified initial value	Capacitor shall be subjected to 5 cycles. Condition for 1 cycle: <table border="1"> <thead> <tr> <th>Step</th> <th>Temperature(°C)</th> <th>Time(min.)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>min. operating temperature +0/-3</td> <td>30</td> </tr> <tr> <td>2</td> <td>25</td> <td>2~3</td> </tr> <tr> <td>3</td> <td>max. operating temperature +0/-3</td> <td>30</td> </tr> <tr> <td>4</td> <td>25</td> <td>2~3</td> </tr> </tbody> </table> Leave the capacitor in ambient condition for specified time* before measurement *24 ± 2 hours(CLASS I) 48 ± 4 hours(CLASSII)	Step	Temperature(°C)	Time(min.)	1	min. operating temperature +0/-3	30	2	25	2~3	3	max. operating temperature +0/-3	30	4	25	2~3
		Step	Temperature(°C)		Time(min.)														
1	min. operating temperature +0/-3	30																	
2	25	2~3																	
3	max. operating temperature +0/-3	30																	
4	25	2~3																	
Tanδ (CLASSII)	Within the specified initial value																		
Insulation resistance	Within the specified initial value																		
16	Recommended Soldering Method By Size & Capacitance	Recommended Soldering Method																	
		Size inch(mm)	Temperature Characteristic	Capacitance	Condition														
					Flow	Reflow													
		0201 (0603)	-	-	-	○													
		0402 (1005)	-	-	-	○													
		0603(1608)	Class I	-	○	○													
			Class II	C < 1μF C ≥ 1μF	-	○													
		0805 (2012)	Class I	-	○	○													
			Class II	C < 4.7μF C ≥ 4.7μF	-	○													
		Array	-	-	-	○													
			-	-	-	○													
1206 (3216)	Class I	-	○	○															
	Class II	C < 10μF C ≥ 10μF	-	○															
Array	-	-	-	○															
1210 (3225)	-	-	-	○															
1808 (4520)	-	-	-	○															
1812 (4532)	-	-	-	○															
2220 (5750)	-	-	-	○															

Note1. Initial Measurement For Class II

Perform the heat treatment at 150°C+0/-10°C for 1 hour. Then Leave the capacitor in ambient condition for 48 ± 4 hours before measurement. Then perform the measurement.

Note2. Latter Measurement

- CLASS I  
Leave the capacitor in ambient condition for 24 ± 2 hours before measurement. Then perform the measurement.
- CLASS II  
Perform the heat treatment at 150°C+0/-10°C for 1 hour. Then Leave the capacitor in ambient condition for 48 ± 4 hours before measurement. Then perform the measurement.

Table1.

Tanδ	0.125 max*	
CLASSII A(X5R), B(X7R)	0201 C ≥ 0.022μF	
	0402 C ≥ 0.22μF	
	0603 C ≥ 2.2μF	
	0805 C ≥ 4.7μF	
	1206 C ≥ 10.0μF	
	1210 C ≥ 22.0μF	
	1812 C ≥ 47.0μF	
	2220 C ≥ 100.0μF	
	All Low Profile Capacitors (P.16)	

Table2.

High Temperature Resistance test	
ΔC(Y5V)	+30~-40%
CLASSII F(Y5V)	0402 C ≥ 0.47μF
	0603 C ≥ 2.2μF
	0805 C ≥ 4.7μF
	1206 C ≥ 10.0μF
	1210 C ≥ 22.0μF
	1812 C ≥ 47.0μF
2220 C ≥ 100.0μF	

Table3.

High Temperature Resistance test		
Applied Voltage	100% of the rated voltage	150% of the rated voltage
CLASSII A(X5R), B(X7R), X(X6S), F(Y5V)	0201 C ≥ 0.1μF	0201 C ≥ 0.022μF
	0402 C ≥ 1.0μF	0402 C ≥ 0.47μF
	0603 C ≥ 4.7μF	0603 C ≥ 2.2μF
	0805 C ≥ 22.0μF	0805 C ≥ 4.7μF
	1206 C ≥ 47.0μF	1206 C ≥ 10.0μF
	1210 C ≥ 100.0μF	1210 C ≥ 22.0μF
	All Low Profile Capacitors (P.16)	
	1812 C ≥ 47.0μF	1812 C ≥ 47.0μF
	2220 C ≥ 100.0μF	2220 C ≥ 100.0μF

Note3. All size in reliability test condition section is "inch"



## APPLICATION MANUAL FOR SURFACE MOUNTING

### 1. Storage of products.

#### 1-1. Storage Environment

Tape packing materials are designed to withstand long-term storage, but they will degrade more rapidly in the presence of high temperature or high humidity. Therefore, the products must be stored in an ambient 5~40°C with a relative humidity of 20~70%. Allowable storage period is within 6 months from the outgoing date of delivery.

#### 1-2. Corrosive Gases

Since sulfur and chlorine may degrade the solderability of the end termination, it is important to store the capacitors in an environment free of these gases.

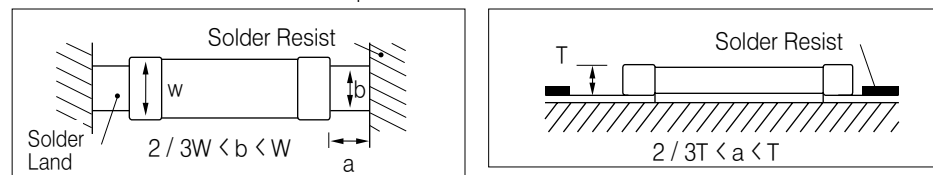
#### 1-3. Temperature Fluctuations

Since dew condensation may occur by the differences in temperature when the products are taken out of storage, it is important to maintain a temperature-controlled environment.

### 2. Design of Solder Land Pattern

When designing printed circuit boards, the shape and size of the solder lands must allow for the proper amount of solder on the capacitor. The amount of solder at the end terminations has a direct effect on the probability that the chip will crack. The greater amount of solder, the larger amount of stress on the chip, and the more likely that it will break. Use the following illustrations as guidelines for proper Solder land design.

Recommendation of solder Land Shape and Size



### 3. Adhesives

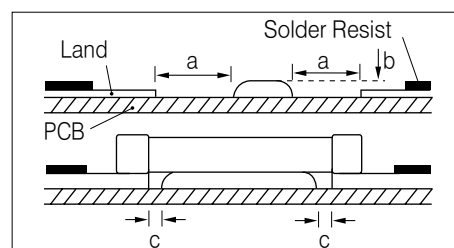
MLCCs generally require the use of an adhesive to position the chips to the circuit board prior to soldering.

#### 3-1. Requirements for Adhesives

- They must have enough adhesion so that the chips will not fall off or move during the handling of the circuit board.
- They must maintain their adhesive strength when exposed to soldering temperatures.
- They should not spread or run when applied to the circuit board.
- They should have a long pot life.
- They should harden quickly.
- They should not corrode the circuit board or chip material.
- They should be a good insulator.
- They should be non-toxic, and not produce harmful gases, nor be harmful when touched.

#### 3-2. Application Method

It is important to use the proper amount of adhesive. Too little will cause poor adhesion to the circuit board, and too much may strain the conductor pattern, thereby causing defective soldering. The following illustrations show the proper quantity of adhesive.



Unit: mm

Type	21	31
a	0.2min	0.2min
b	70~100μm	70~100μm
c	>0	>0

#### 3-3. Adhesive hardening Characteristics

To prevent oxidation of the terminations, the adhesive must harden at 160°C or less, within 2 minutes or less.

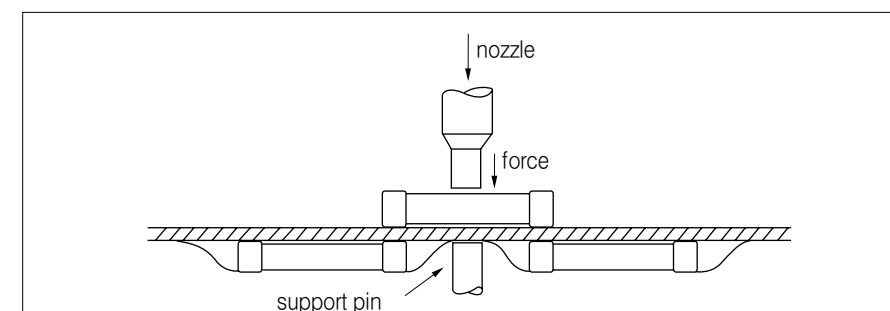
### 4. Mounting

#### 4-1. Mounting Head Pressure

Excessive pressure will cause chip capacitors to crack. The pressure between nozzle and chip capacitor will be 300g maximum during mounting.

#### 4-2. Bending Stress

Bending of printed circuit board by mounting head when double-sided circuit boards are used, chip capacitors first are mounted and soldered onto one side of the board. When the capacitors are mounted onto the other side, it is important to support the board as shown in the illustration. If the circuit board is not supported, it may bend, causing the already-installed capacitors to crack.



### 5. Flux

Although highly-activated flux gives better solderability, substances which increase activity may also degrade the insulation of the chip capacitors. To avoid such degradation, it is recommended that a mildly activated rosin flux (less than 0.2% chlorine) be used.

### 6. Soldering

Since a multilayer ceramic chip capacitor comes into direct contact with melted solder during soldering, it is exposed to potentially mechanical stress caused by the sudden temperature change. The capacitor may also be subject to silver migration, and to contamination by the flux. Because of these factors, soldering technique is critical.

#### 6-1. Soldering Methods

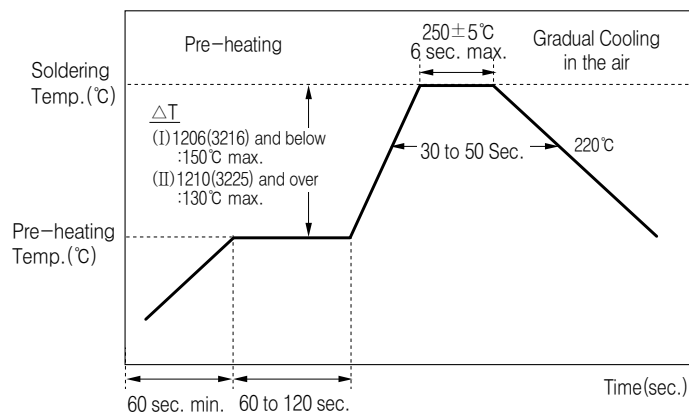
Method	Classification	
Reflow soldering	· Overall heating	· Infrared rays · Hot plate · VPS (Vapor phase)
	· Local heating	· Air heater · Laser · Light beam
Flow Soldering	· Single wave · Double wave	

#### 6-2. Soldering Profile

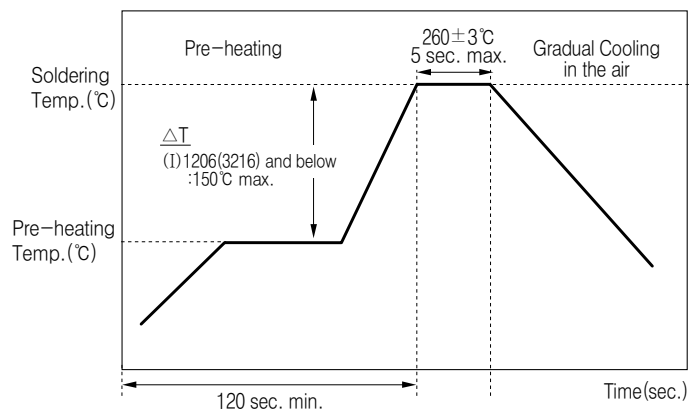
To avoid the crack problem by sudden temperature change, follow the temperature profile in the adjacent graph.

6-2-1 Pb-Free (Sn 100%) Plating

REFLOW SOLDERING



FLOW SOLDERING



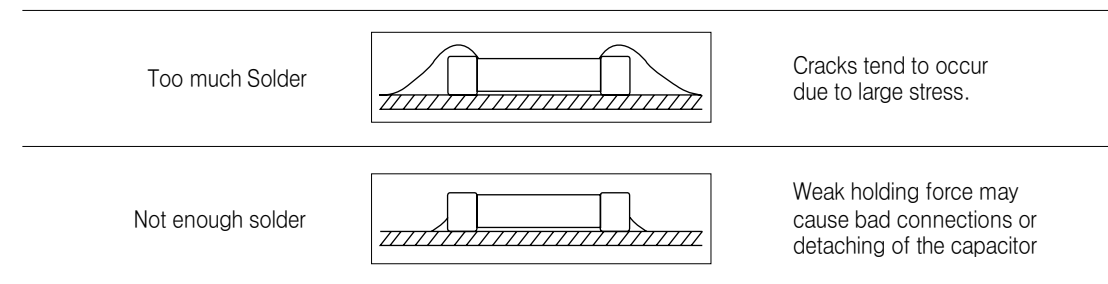
SOLDER IRON(Hand Soldering)

Variation of Temp.(°C)	Soldering Temp(°C)	Pre-heating Time(sec)	Soldering Time(sec)	Cooling Time(sec)	Condition of Iron Facilities		
					Wattage	Tip Diameter	Soldering Time
ΔT≤130	300±10°Cmax	≥ 60 sec.	≤ 4 sec.	—	20W max	3mm max	4 sec max

6-3. Manual Soldering

Manual soldering can pose a great risk of creating thermal cracks in chip capacitors. The hot soldering iron tip comes into direct contact with the end terminations, and operator's carelessness may cause the tip of the soldering iron to come into direct contact with the ceramic body of the capacitor. Therefore the soldering iron must be handled carefully, and close attention must be paid to the selection of the soldering iron tip and to temperature control of the tip.

6-4. Amount of Solder



6-5. Cooling

Natural cooling using air is recommended. If the chips are dipped into solvent for cleaning, the temperature difference (ΔT) must be less than 100°C

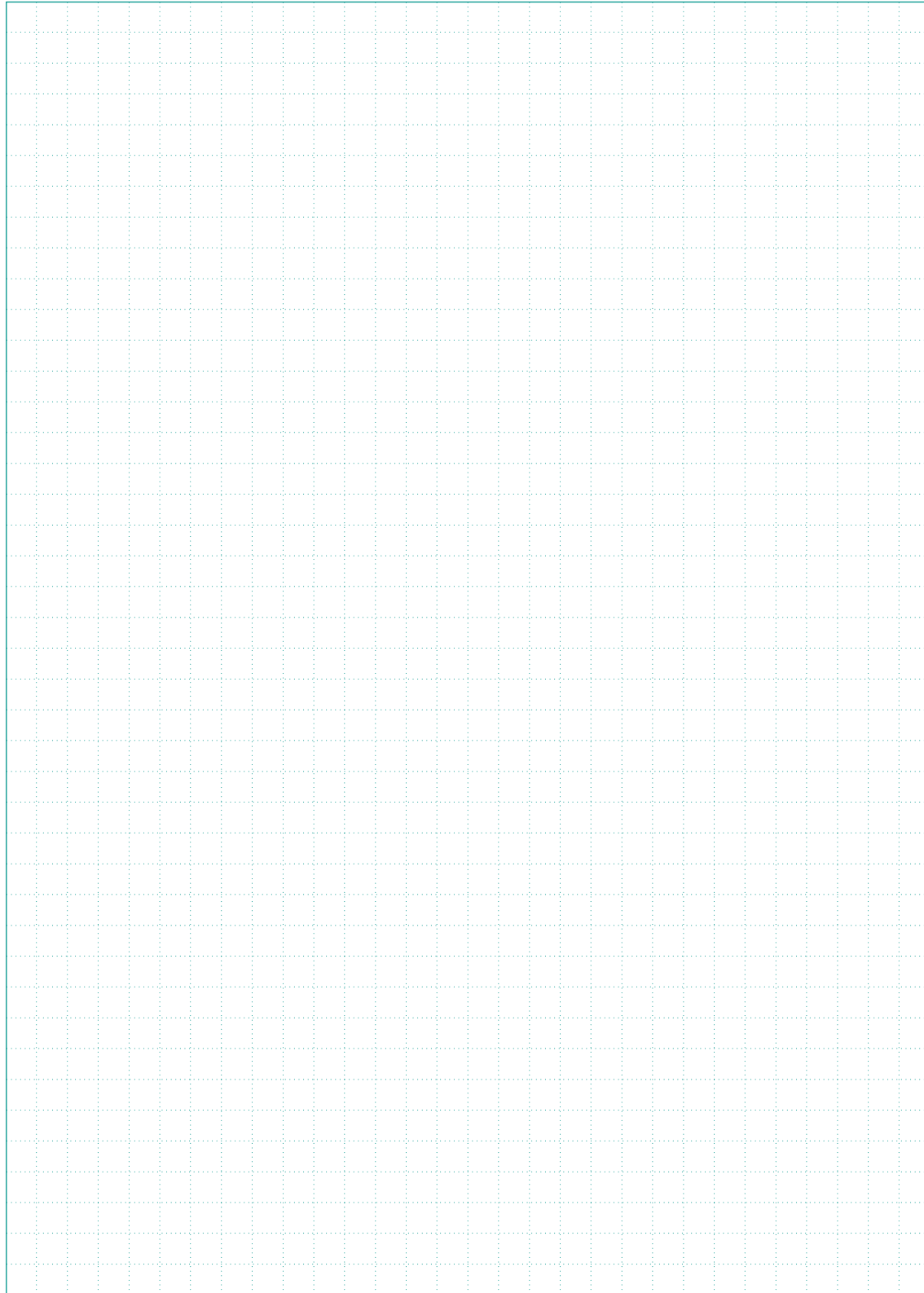
6-6. Cleaning

If rosin flux is used, cleaning usually is unnecessary. When strongly activated flux is used, chlorine in the flux may dissolve into some types of cleaning fluids, thereby affecting the chip capacitors. This means that the cleaning fluid must be carefully selected, and should always be new.

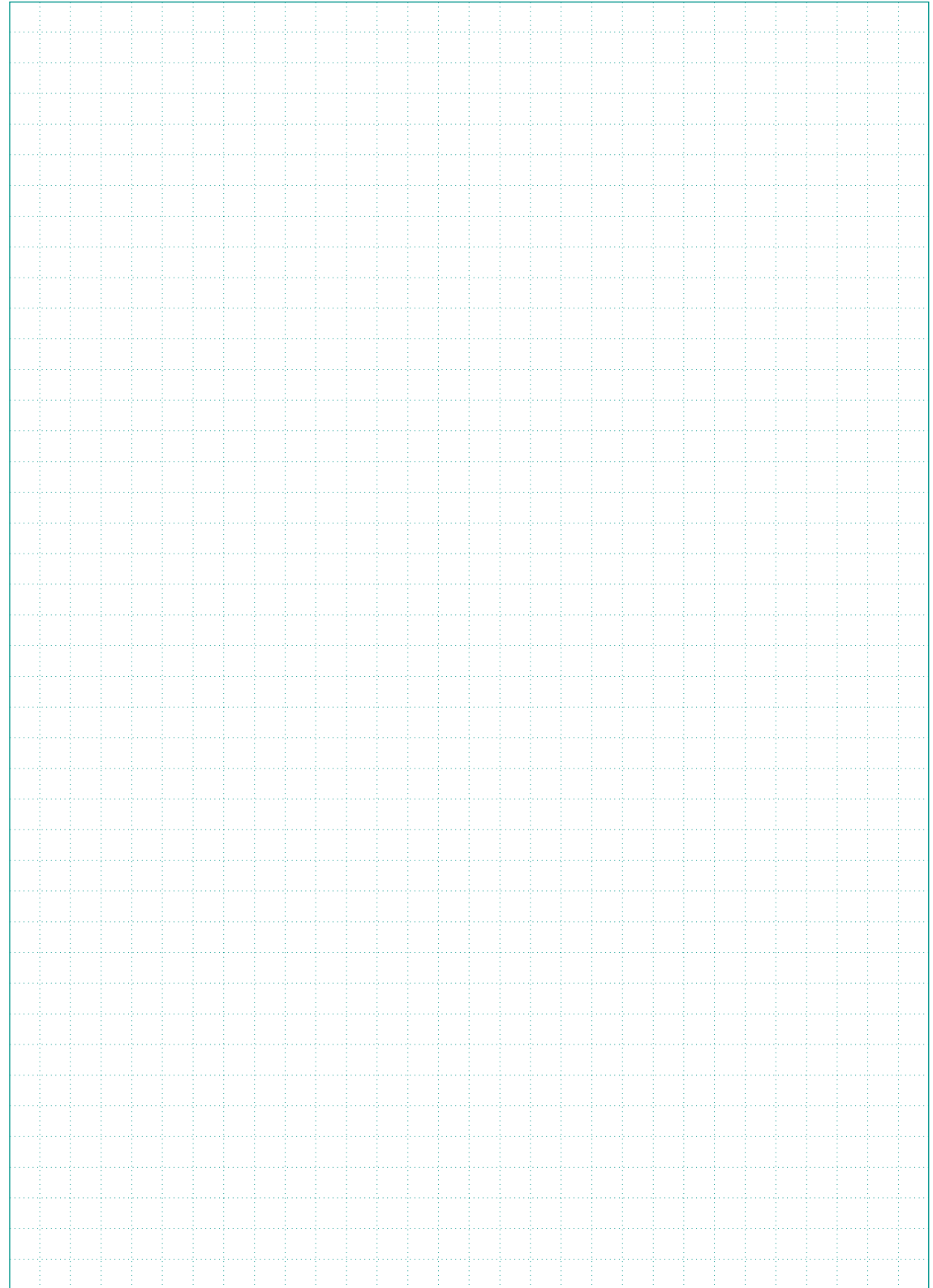
7. Notes for Separating Multiple, Shared PC Boards.

A multi-PC board is separated into many individual circuit boards after soldering has been completed. If the board is bent or distorted at the time of separation, cracks may occur in the chip capacitors. Carefully choose a separation method that minimizes the bending of the circuit board.

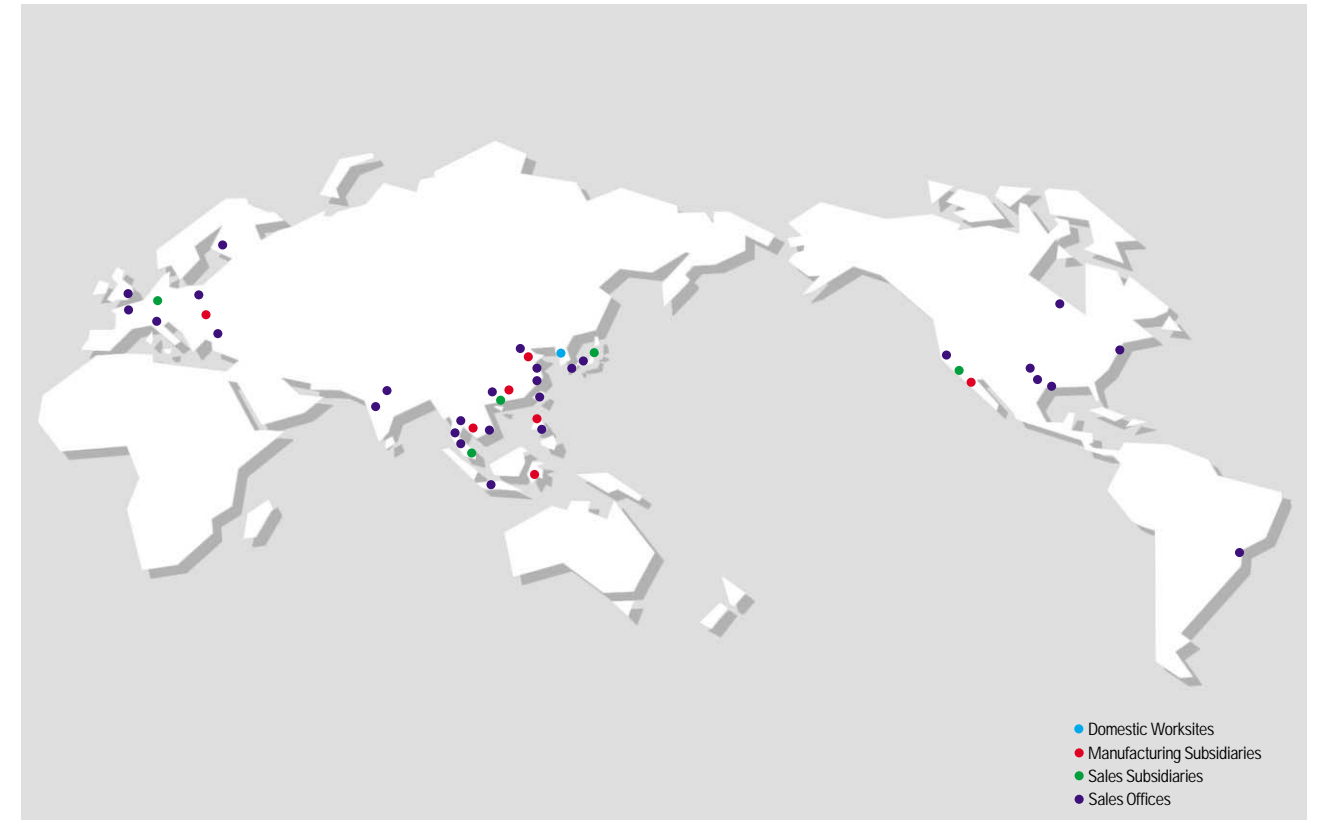
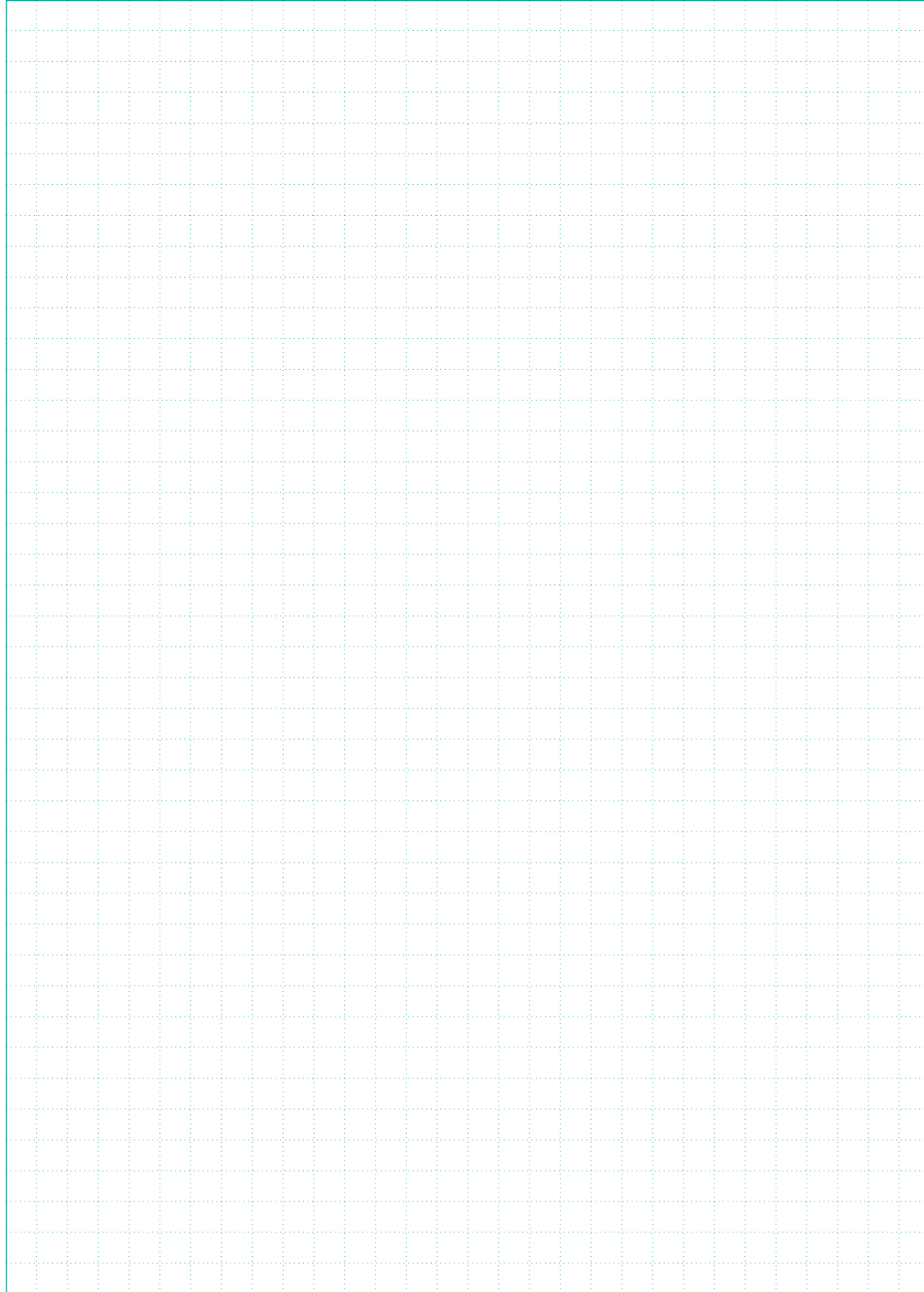
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