HITANO ENTERPRISE CORP.

Multilayer Ceramic Capacitors

APPROVAL SHEET

CONTENTS

HITANO ENTERPRISE CORP.

Multilayer Ceramic Capacitors

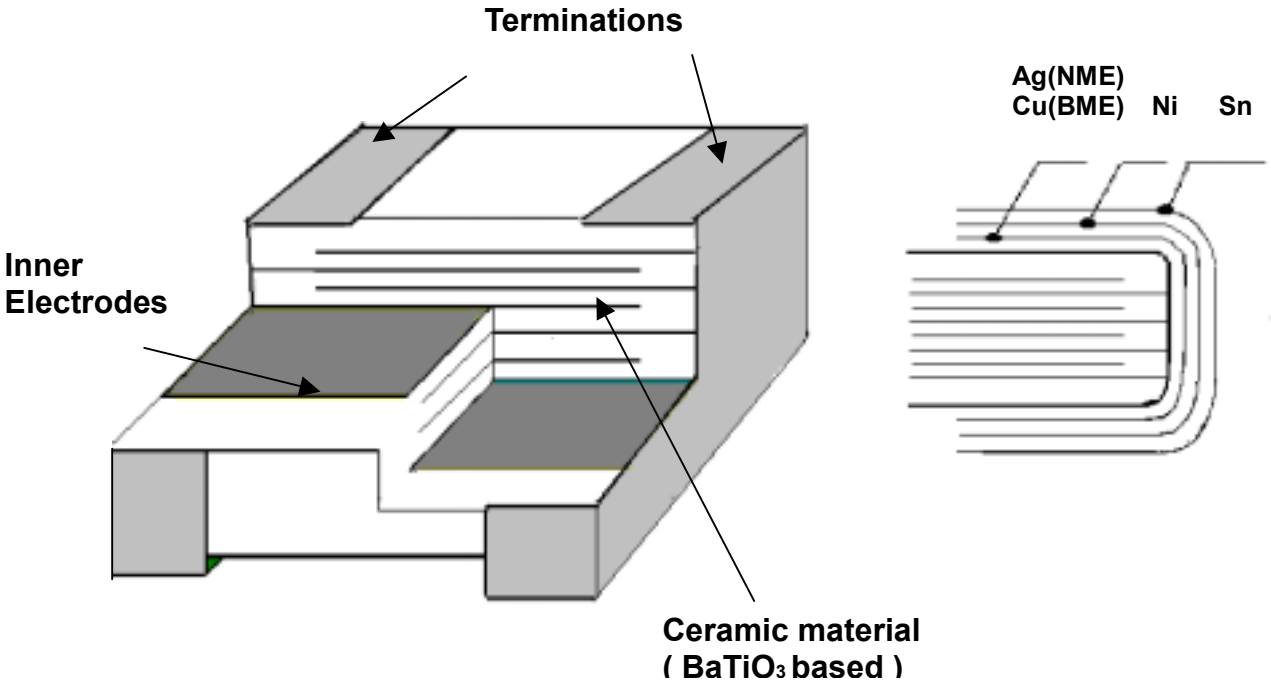
1. Features

Various temperature characteristics cover a wide range in small size.
Mounted either by flow or reflow soldering methods
Excellent dielectric strength due to uniform structure of dielectric layers

2. Applications

MLCC are becoming increasingly important key electronic applications, which are helpful in reducing the size of electronic circuitry. MLCC are used extensively in computers, communicative products, and the detail applications which including the followings:
Discharge of Stored Energy
Blockage of Direct Current
Coupling of Circuit Components
By-Passing of an AC Signal
Frequency Discrimination
Transient Voltage and Arc Suppression
Surge Protection

3. Construction of MLCC



Part Number Code

0805 N 102 J 500 N T

SIZE CODE

0402 = .04 X .02" 0603 = .06 X .03"

0805 = .08 X .05" 1206 = .12 X .06"

1210 = .12 X .10" 1808 = .18 X .08

1812 = .18 X .12" 2220 = .22 X .20

DIELECTRIC

N (COG) B (X7R)

Y (Y5V) X (X5R)

CAPACITANCE

Value in Pico farads: Two significant figures

Followed by number of zero. 0R5=0.5pF 2R0=2pF 102=1000pF.

CAPACITANCE TOLERANCE

A = ±0.05pF B = ±0.10pF (EIA Code)

C = ±0.25pF D = ±0.50pF

F = ±1.0% G = ±2.0%

H = ±3.0% J = ±5.0%

K = ±10% M = ±20%

Z = -20% ~+80% Tolerances may be restricted by dielectric type.

VOLTAGE

VDC：Two significant figures followed by number of zeros

063 = 6.3 VDC 100 = 10 VDC 160 = 16 VDC 250 = 25 VDC

500 = 50 VDC 101 = 100 VDC 251 = 250 VDC 501 = 500VDC

102 = 1 KVDC 202 = 2 KVDC 302 = 3 KVDC

TERMINATION

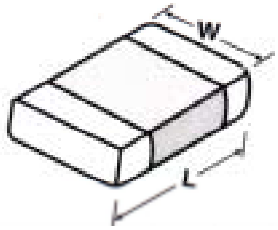
N = Nickel barrier with 100% Tin

PACKING CODE

B = Bulk in bag

05 = 500/Reel 1= 1K/Reel 2= 2K/Reel 3= 3K/Reel (for plastic tape only)

T= 4K/Reel U= 10K/ Reel V= 15K/ Reel W = 20K/Reel



Dimension : (UNIT mm)

	0402	0603	0805	1206	1210	1808	1812	2220
L	1.00±0.05	1.60±0.10	2.00±0.20	3.20±0.20	3.20±0.30	4.50±0.30	4.50±0.30	5.70±0.40
W	0.50±0.05	0.80±0.10	1.25±0.20	1.60±0.20	2.50±0.20	2.00±0.20	3.20±0.30	5.00±0.40

4. Capacitance range NPO

SIZE AND VALUES AVAILABLE (NPO) 25V – 100V

Size		0402		0603			0805			1206			1210		1812	
(L)Length	mm	1.00±0.05		1.60±0.10			2.00±0.20			3.20±0.20			3.20±0.30		4.50±0.30	
(W)Width	mm	0.50±0.05		0.80±0.10			1.25±0.20			1.60±0.20			2.50±0.20		3.20±0.30	
(T)Max. Thickness	mm	0.50±0.05		0.80±0.10			1.25±0.10			1.65±0.20			2.50±0.30		3.20±0.30	
(t)Terminal	mm	0.15±0.35		0.27~0.60			0.30~0.70			0.30~0.70			0.30~0.70		0.35~1.00	
Capacitance W.V.(DC)		25	50	25	50	100	25	50	100	25	50	100	50	100	50	100
0.47 – 0.82	pF		S		P	P		A	A		P	P				
1 – 9.1	pF		S		P	P		A	A		P	P				
10	pF		S		P	P		A	A		P	P				
12	pF		S		P	P		A	A		P	P				
15	pF		S		P	P		A	A		P	P				
18	pF		S		P	P		A	A		P	P				
22	pF		S		P	P		A	A		P	P				
27	pF		S		P	P		A	A		P	P				
33	pF		S		P	P		A	A		P	P				
39	pF		S		P	P		A	A		P	P				
47	pF		S		P	P		A	A		P	P				
56	pF		S		P	P		A	A		P	P				
68	pF		S		P	P		A	A		P	P				
82	pF		S		P	P		A	A		P	P				
100	pF		S		P	P		A	A		P	P				
120	pF		S		P	P		A	A		P	P				
150	pF		S		P	P		A	A		P	P				
180	pF		S		P	P		A	A		P	P				
220	pF		S		P	P		A	A		P	P				
270	pF		S		P	P		A	A		P	P				
330	pF	S	S		P	P		A	A		P	P				
390	pF	S	S		P	P		A	H		P	P				
470	pF	S	S		P	P		A	H		P	P				
560	pF	S			P	P		A	H		P	P				
680	pF	S			P	P		A	H		P	P				
820	pF	S			P			A	H		P	P				
1.0	nF	S			P			H	H		P	P				
1.2	nF				P			H	H		P	P				L
1.5	nF				P			H	H		P	P				L
1.8	nF				P			H	H		P	P				L
2.2	nF				P			H	H		P	P				L
2.7	nF				P			X	X		P	P				L
3.3	nF				P			X	X		P	P				L
3.9	nF			P			A	X	X		P	P				L
4.7	nF			P			A	X			P	P				L
5.6	nF			P			A	X			P	P				L
6.8	nF			P			A	X			C	X				L
8.2	nF			P			A	X		H	C	X		X		L
10	nF			P			A	X		H	X			X	L	L
15	nF						H			H	X		X		L	L
22	nF						X			H	X		X		L	
33	nF						X			X	L		X		L	
47	nF									X			Z		L	
68	nF									L			Z		L	
100	nF									L			G		Z	
220	nF														U	

Capacitance range NPO

SIZE AND VALUES AVAILABLE (NPO) 250V – 3000V

Size		0805		1206				1210					1808					1812				
(L)		2.00±0.20		3.20±0.20				3.20±0.30					4.50±0.30					4.50±0.30				
(W)		1.25±0.20		1.60±0.20				2.50±0.20					2.00±0.20					3.20±0.30				
(T)		0.80±0.10		1.65±0.20				1.65±0.20					2.00±0.20					2.00±0.20				
(t)		0.30~0.70		0.30~0.70				0.30~0.70					0.35~1.00					0.35~1.00				
Cap./ W.V.		250	500	250	500	1KV	2KV	250	500	1KV	2K	3K	250	500	1KV	2KV	3KV	250	500	1KV	2KV	3KV
10	pF	P	P	P	L	L	L			L	L	L			Z	Z	Z			L	L	L
12	pF	P	P	P	L	L	L			L	L	L			Z	Z	Z			L	L	L
15	pF	P	P	P	L	L	L			L	L	L			Z	Z	Z			L	L	L
18	pF	P	P	P	L	L	L			L	L	L			Z	Z	Z			L	L	L
22	pF	P	P	P	L	L	L			L	L	L			Z	Z	Z			L	L	L
27	pF	P	P	P	L	L	L			L	L	L			Z	Z	Z			L	L	L
33	pF	P	P	P	L	L	L			L	L	L			Z	Z	Z			L	L	L
39	pF	P	P	P	L	L	L			L	L	L			Z	Z	Z			L	L	L
47	pF	P	P	P	L	L	L			L	L	L			Z	Z	Z			L	L	L
56	pF	P	P	P	L	L	L			L	L	L			Z	Z	Z			L	L	L
68	pF	P	P	P	L	L	L			L	L	L			Z	Z	Z			L	L	L
82	pF	P	P	P	L	L	L			L	L	L			Z	Z	Z			L	L	L
100	pF	P	P	P	L	L	L			L	L	L			Z	Z	Z			L	L	L
120	pF	P	P	P	L	L	L			L	L	L			Z	Z	Z			L	L	L
150	pF	P	P	P	L	L	L			L	L	L			Z	Z	Z			L	L	L
180	pF	P	P	P	L	L	L			L	L	L			Z	Z	Z			L	L	L
220	pF	P	P	P	L	L	L			L	L	L			Z	Z	Z			L	L	L
270	pF	P	P	P	L	L	L			L	L				Z	Z	Z			L	L	L
330	pF	P	P	P	L	L				L	L				Z	Z	Z			L	L	L
390	pF	P	P	P	L	L				L	L				Z	Z				L	L	Z
470	pF	P		P	L	L				L	L				Z	Z				L	L	
560	pF	P		P	L	L				L	L				Z	Z				L	L	
680	pF	P		P	L	L				L					Z					L	L	
820	pF	P		X	L	L				L					Z					L	L	
1000	pF			X	L	L		L	L	L			Z	Z	Z			L	L	L	L	
1200	pF			X	L			L	L				Z	Z	Z			L	L	L	L	
1500	pF			X	L			L	L				Z	Z				L	L	L		
1800	pF			X	L			L	L				Z	Z				L	L	L		
2200	pF			X	L			L	L				Z	Z				L	L	L		
2700	pF							L	L				Z	Z				L	L			
3300	pF							L	L				Z	Z				L	L			
3900	pF							L										L	L			
4700	pF							L										L	L			
5600	pF							L										L	L			
6800	pF																	L	L			
8200	pF																	L				

5. X7R capacitance range

SIZE AND VALUES AVAILABLE (X7R) 10V – 100V

Size		0402				0603					0805					1206					1210				1812			2220		
(L)	mm	1.00±0.05				1.60±0.10					2.00±0.20					3.20±0.20					3.20±0.30				4.50±0.30			5.70±0.40		
(W)	mm	0.50±0.05				0.80±0.10					1.25±0.20					1.60±0.20					2.50±0.20				3.20±0.20			5.00±0.40		
(T)	mm	0.50±0.05				0.80±0.12					1.25±0.20					1.65±0.20					2.50±0.20				2.50±0.20			3.00±0.20		
(t)	mm	0.15~0.35				0.27~0.60					0.30~0.70					0.30~0.70					0.30~0.70				0.35~1.00			0.35~1.00		
Cap.\\ W.V.		10	16	25	50	10	16	25	50	100	10	16	25	50	100	10	16	25	50	100	16	25	50	100	25	50	100	25	50	100
100	pF				S				P	P				A	H					H										
120	pF				S				P	P				A	H					H										
150	pF				S				P	P				A	H					H										
180	pF				S				P	P				A	H					H										
220	pF				S				P	P				A	H				H	H										
270	pF				S				P	P				A	H				H	H										
330	pF				S				P	P				A	H				H	H										
390	pF				S				P	P				A	H				H	H										
470	pF				S				P	P				A	H				H	H										
560	pF				S				P	P				A	H				H	H										
680	pF				S				P	P				A	H				H	H										
820	pF				S				P	P				A	H				H	H										
1000	pF				S				P	P				A	H				H	H										
1200	pF				S				P	P				A	H				H	H										
1500	pF				S				P	P				A	H				H	H										
1800	pF				S				P	P				A	H				H	H										
2200	pF				S				P	P				A	H				H	H										
2700	pF				S				P	P				A	H				H	H										
3300	pF				S				P	P				A	H				H	H										
3900	pF				S				P	P				A	H				H	H										
4700	pF				S				P	P				A	H				H	H										
5600	pF				S				P	P				A	H				H	H										
6800	pF				S				P	P				A	H				H	H										
8200	pF				S				P	P				A	H				H	H										
10	nF		S	S	S				P	P				A	H				H	H										
12	nF		S	S					P					A	H				H	H										
15	nF		S	S					P					A	H				H	H										
18	nF		S	S					P					A	H				H	H										
22	nF		S	S					P					A	H				H	H										
27	nF		S						P					H	X				H	H										
33	nF	S	S						P					H	X				H	H										
39	nF								P					H	X				H	H										
47	nF	S	S	S				P	P					H	X				H	H										
56	nF							P	P					H	X				H	H										
68	nF	S						P	P					H	X				H	X										
82	nF							P	P					H	X				H	X										
100	nF	S					P	P	P					H	X				H	X				L		X	X			
150	nF					P	P	P				H	X	X					X	X				L		X	X			
220	nF					P	P	P				H	X	X					X	X				L		X	X			
330	nF					P	P					X	X	X				X	X					L		X	X			
470	nF					P	P					X	X					X	L	L				Z		X	Z			
680	nF					P	P					X	X				X	L	L					Z		Z	Z			L
1.0	uF					P	P				X	X	X				X	L	L				L	Z		Z	Z			G
2.2	uF										X	X					L	L					Z			Z	G			G
3.3	uF																					L	G			Z				G
4.7	uF															L	L	L				Z			L	Z			Z	G
10	uF															L	L				Z	G			G			Z		
22	uF																				G				G			G		

X7R capacitance range

SIZE AND VALUES AVAILABLE (X7R) 250V – 3000V

Size		0805		1206				1210				1808			1812					2220				
(L)	mm	2.00±0.20		3.20±0.20				3.20±0.30				4.50±0.30			4.50±0.30					5.70±0.40				
(W)	mm	1.25±0.20		1.60±0.20				2.50±0.20				2.00±0.20			3.20±0.20					5.00±0.40				
(T)	mm	1.25±0.20		1.65±0.20				2.00±0.20				2.00±0.20			2.50±0.20					2.50±0.20				
(t)	mm	0.30~0.70		0.30~0.70				0.30~0.70				0.35~1.00			0.35~1.00					0.35~1.00				
Cap.\\ W.V.		250	500	250	500	1K	2K	250	500	1K	2K	1K	2K	3K	250	500	1K	2K	3K	250	500	1K	2K	3K
100	pF	H	H	H	L	L	L							L										
150	pF	H	H	H	L	L	L							L										
220	pF	H	H	H	L	L	L			L	L			L										
330	pF	H	H	H	L	L	L			L	L			L										
470	pF	H	H	H	X	L	L			L	L	L	L	L			L	L	L					
680	pF	H	H	H	X	L	L			L	L	L	L	Z			L	L	L					
1000	pF	H	H	H	X	L	L			L	L	L	L	Z			L	L	L			Z	Z	Z
1500	pF	H	H	H	X	L				L	L	L	L	Z			L	L	L			Z	Z	Z
2200	pF	H	H	H	X	L				L		L	L				L	L	L			Z	Z	Z
3300	pF	H	H	H	X	L			X	L		L	L				L	L				Z	Z	Z
4700	pF	H	H	H	X	L			X	L		L				L	L	L				Z	Z	
6800	pF	H	H	H	X				X			L				L	L					Z	Z	
10	nF	H	H	H	X				L			L				L	L					Z	Z	
15	nF	H	X	X	L				L							L	Z					Z		
22	nF	H		X	L			L	L							L	Z					Z		
33	nF			X	L			L	L							L	Z					Z		
47	nF			X				L	L						L	L						Z		
68	nF			L				L							L	L					Z			
100	nF			L				L							L	L					Z			
150	nF							L							L	Z					Z			
220	nF							Z							L						Z			
330	nF														Z					L				
470	nF														Z					Z				
680	nF																			Z				

SIZE AND VALUES AVAILABLE (X5R) 6.3V – 50V

*Available in 20% tolerance only.

Size		0402		0603			0805				1206				1210				1812				2220		
(L)	mm	1.00±0.05		1.60±0.10			2.00±0.20				3.20±0.20				3.20±0.30				4.50±0.30				5.70±0.40		
(W)	mm	0.50±0.05		0.80±0.10			1.25±0.20				1.60±0.20				2.50±0.20				3.20±0.30				5.00±0.40		
(T)	mm	0.50±0.05		0.80±0.12			1.25±0.20				1.65±0.20				2.50±0.20				3.20±0.20				3.00±0.20		
(t)	mm	0.15~0.35		0.27~0.60			0.30~0.70				0.30~0.70				0.30~0.70				0.35~1.00				0.35~1.00		
Cap./ W.V.		6.3	10	6.3	10	16	6.3	10	16	25	6.3	10	16	25	6.3	10	16	25	6.3	10	16	25	16	25	50
100	nF		S																						
220	nF	S	S																						
330	nF	S																							
470	nF	S	S		P																				
680	nF	S			P																				
1.0	uF	S	S		P	P			X	X															
2.2	uF	S		P	P	P	X	X	X																
3.3	uF						X	X																	
4.7	uF			P	P		X	X	X				L	L			Z	Z							
10	uF			*P			X	X	X		L	L	L	L			Z	Z/G				G		Z	G
22	uF						*X				L	L				Z	Z/G	G		G	G			G	
47	uF										*L				*G	*G			*G	*N			*G		
100	uF														*G				*U						

6. Y5V capacitance range

SIZE AND VALUES AVAILABLE (Y5V)

Size		0402			0603					0805					1206					1210				1812			
(L)	mm	1.00±0.05			1.600±0.10					2.00±0.20					3.20±0.20					3.20±0.30				4.50±0.30			
(W)	mm	0.50±0.05			0.80±0.10					1.25±0.20					1.60±0.20					2.50±0.20				3.20±0.30			
(T)	mm	0.50±0.05			0.80±0.12					1.25±0.20					1.65±0.20					2.00±0.20				2.50±0.20			
(t)	mm	0.15~0.35			0.27~0.60					0.30~0.70					0.30~0.70					0.30~0.70				0.35~1.00			
Cap.// W.V.		6.3	10	16	6.3	10	16	25	50	6.3	10	16	25	50	6.3	10	16	25	50	6.3	10	16	25	10	16	25	50
10	nF			S					P					A					H								
15	nF			S					P					A					H								
22	nF			S					P					A					H								
33	nF			S					P					A					H								
47	nF			S					P					A					H								
68	nF			S					P					A					H								
100	nF			S					P				A	A					H								
150	nF							P	P				A	A					H								
220	nF		S				P	P	P				A	A					H								
330	nF		S				P	P					H	H					H								
470	nF	S	S			P	P	P				H	H	H					H								
680	nF	S				P	P					X	X	X				H	X								
1.0	uF	S				P	P					X	X	X				X	X								
2.2	uF				P	P					X	X	X				X	X	X								
3.3	uF				P						X	X					X	X									
4.7	uF				P						X	X					X	X									
10	uF									X	X					X	L				Z	X	L				G
22	uF									X					L	L					Z	Z				G	
47	uF														L					Z	Z				G		
100	uF																			G				G			

Thickness Code : Standard Packing Q'ty per reel

Thickness Code	Chip Size	Chip Thickness	Max Tape Thickness	Q'ty of carboard tape in		Q'ty of Embosses tape in	
				7" reel	13" reel	7" reel	13" reel
S	0402	0.50±0.05 mm	0.60 mm	10,000	50,000	--	--
P	0603	0.80±0.10 mm	0.95 mm	4,000	15,000	--	--
A	0805	0.60±0.10 mm	0.75 mm	4,000	15,000	--	--
H		0.85±0.10 mm	0.95 mm	4,000	15,000	--	--
X		1.25±0.10 mm	1.25 mm	--	--	3,000	10,000
H	1206	0.85±0.10 mm	0.90 mm	4,000	15,000	--	--
X		1.25±0.10 mm	1.25 mm	--	--	3,000	10,000
L		1.65±0.20 mm	1.80 mm	--	--	2,000	--
L	1210	1.65±0.20 mm	1.80 mm	--	--	2,000	--
Z		2.00±0.20 mm	2.20 mm	--	--	2,000	--
G		2.50±0.20 mm	2.75 mm	--	--	1,000	--
L	1808	1.65±0.20 mm	1.80 mm	--	--	2,000	--
Z		2.00±0.20 mm	2.20 mm	--	--	2,000	--
X	1812	1.25±0.20 mm	1.80 mm	--	--	1,000	--
L		1.65±0.20 mm	1.25 mm				
Z		2.00±0.20 mm	2.20 mm	--	--	1,000	--
G		2.50±0.20 mm	2.75 mm	--	--	500	--
N		2.80±0.30 mm	3.00 mm	--	--	500	--
U		3.20±0.20 mm	4.00 mm	--	--	500	--
Z	2220	2.00±0.20 mm	2.20 mm	--	--	500	--
G		2.50±0.20 mm	2.75 mm	--	--	500	--

7. SPECIFICATIONS AND TEST METHODS

<table>
<tr><th>No</th><th>Item</th><th>Test Method</th><th>Specification</th></tr>
<tr><td>1</td><td>Capacitance</td><td>The capacitance shall be measured at 25°C at the frequency and voltage shown below:
<table>
<tr><th>Type / Item</th><th>NPO (≦1nF)</th><th>NPO>1nF, Y5V, X7R/X5R</th><th>C＞10uF</th></tr>
<tr><td>Freq.</td><td>1±0.1Mhz</td><td>1±0.1KHz</td><td>120Hz</td></tr>
<tr><td>Voltage</td><td>1±0.2Vrms</td><td>1±0.2Vrms</td><td>0.5±0.2 Vrms</td></tr>
</table></td><td>Within the specified tolerance</td></tr>
<tr><td>2</td><td>Q value / Dissipation Factor</td><td>D.F. shall be measured at 25°C at the frequency and voltage shown as No. 1
EXCEPTION OF D.F.
X7R/X5R
<table>
<tr><th>Vr</th><th>D.F</th><th>Exception of D.F.</th></tr>
<tr><td>＞ 50V</td><td>≦3.5%</td><td>0603≧47nF, 0805≧0.18uF, 1206≧0.47uF, 1210≧1.0uF</td></tr>
<tr><td>25V</td><td>≦5%</td><td>0603&0805≧1.0uF, C≧4.7uF</td></tr>
<tr><td>16V</td><td>≦5%</td><td>0402≧33nF, 0603≧1.0uF
0805≧1.5uF, C≧4.7uF</td></tr>
<tr><td>10V</td><td>≦10%</td><td>≧10uF</td></tr>
</table>
Y5V
<table>
<tr><th>Vr</th><th>D.F</th><th>Exception of D.F.</th></tr>
<tr><td>50V</td><td>≦7%</td><td>0603≧0.1uF, 0805≧0.33uF, 1206≧1.0uF</td></tr>
<tr><td rowspan="2">25V</td><td>≦9%</td><td>0402≧47nF, 0805≧0.47uF</td></tr>
<tr><td>≦12.5%</td><td>1210/10uF</td></tr>
<tr><td rowspan="3">16V</td><td>≦9%</td><td>0402≧470nF, 0603≧0.68uF</td></tr>
<tr><td>≦12.5%</td><td>0805≧4.7uF, 1206/10uF</td></tr>
<tr><td>≦16%</td><td>1210/22uF</td></tr>
</table></td><td>NPO:
C＜30pF : Q value ≧400+20C
C≧30pF : Q value ≧ 1000

X7R/ X5R :
Vr=50V~3KV, DF≦2.5%
Vr=25V, DF≦3.5%
Vr=16V, DF≦3.5%
Vr=10V, DF≦5.0%
Vr=6.3V, DF≦10.0%

Y5V:
Vr=≧50V, DF≦5.0%
Vr =25V, DF≦7.0%
Vr=16V(C＜1.0uF), DF≦7.0%
Vr=16V(C≧1.0uF), DF≦9.0%
Vr=10V, DF≦12.5%
Vr=6.3V, DF≦20%
(see EXCEPTION at left side)</td></tr>
<tr><td>3</td><td>Insulation Resistance</td><td>Test voltage: rated voltage
Charge time: 2 minutes max.
Charge current: less than 50mA</td><td>NPO : ≧ 100GΩ or 1000ΩF (whichever is smaller)
X7R/X5R, Y5V : ≧ 10GΩ or 500Ω-F(whichever is smaller)</td></tr>
<tr><td>4</td><td>Dielectric Strength</td><td>Test voltage(Vt): (Duration 1～5 seconds.)
Vt= Vr X250% (Vr≦100V)
Charge current: less than 50mA

Vt= Vr X200% For product Vr=200V/250V
Vt= Vr X150% For product Vr=500V~999V
Vt= Vr X120% For product Vr=1KV~3KV
Cut-off, set at 10mA, Test = 15 sec. Ramp=0</td><td>No evidence of damage or flash over during test.</td></tr>
<tr><td>5</td><td>Solderability</td><td>*Solder temperature : 235±5°C
*Dipping time : 2±0.5 sec.</td><td>95% min. coverage of all metalized area</td></tr>
</table>

SPECIFICATIONS AND TEST METHODS

No	Item	Test Method	Specification
6	Vibration Resistance	*Vibration Frequency: 10 – 55 Hz.min. *Total amplitude: 1.5mm *Test Time: 6 hrs (Two hrs each in three mutually perpendicular direction)	No remarkable damage Cap. Change and Q/D.F.: To meet initial spec.
7	Resistance to Soldering Heat	Preheat the capacitor at 120~150°C for 1min. Have the capacitor dip into the solder bath at 270±5°C for 10±1 sec. Set it at room temperature for 48±4hrs, then measure. ■ Initial measurement for X7R/X5R and Y5V. Perform a heat treatment at 150±5°C for 1 hr and then set for 48±4 hrs at room temperature then measure.	Dielectric: NPO / X7R/X5R / Y5V Appearance: No defect Capacitance change: <±2.5% or±0.25 pf / ±7.5% / ±20% DF(or Q): C≧30pf : Q≧1000, C＜30pf : Q≧400+20C / Same as no.2 / Same as no.2 I.R.: More than 10GΩ or 500ΩF (Whichever is Smaller) Dielectric Strength: No failure
8	Adhesive Strength of Termination	*Pressurizing force: 5N(≦0603) and 10n(＞0603) *Test time: 10 ± 1 sec.	No remarkable damage or removal of the termination.
9	High Temperature Load	*Test Temp. : NPO, X7R : 125±3°C X5R, Y5V : 85±3°C *Test Voltage: (1) V＜500V : 2 X R.V. (2) 500≦V＜1000V: 1.5 X R.V. (3) V≧1000V : 1.2 X R.V. *Test Time: 1000 hrs *Measurement to be made after keeping at room temp. for 48±4 hr.	Dielectric: NPO / X7R/X5R / Y5V Appearance: No defect Capacitance change: <±3% or±0.3 pF whichever is larger / ≧10V: ±12.5%, 6.3V : ±25% / ±30% DF(or Q): SAME AS NO. 2 I.R.: ≧10V, ≧1GΩ or 50Ω-F (whichever is smaller), 6.3V: ≧10Ω-F Dielectric Strength: No failure

SPECIFICATIONS AND TEST METHODS

<table>
<tr><th>No</th><th>Item</th><th>Test Method</th><th colspan="3">Specification</th></tr>
<tr><td rowspan="4">10</td><td rowspan="4">Temperature Coefficient</td><td rowspan="4">(a) NPO
The temperature coefficient is determined using the capacitance measured in step 3 as a reference. When cycling the temperature sequentially from step 1 through 5. The capacitance shall be within the specified tolerance for the temperature coefficient.

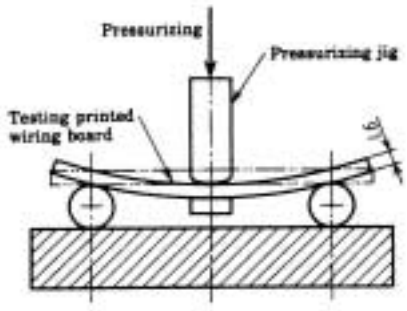
<table>
<tr><th>Step</th><th>Temperature(°C)</th></tr>
<tr><td>1</td><td>+25±2°C</td></tr>
<tr><td>2</td><td>-55±3°C</td></tr>
<tr><td>3</td><td>+25±2°C</td></tr>
<tr><td>4</td><td>+125±3°C(for NPO/X7R +85 ± 3°C(for X5R/Y5V))</td></tr>
<tr><td>5</td><td>+25±2°C</td></tr>
</table>

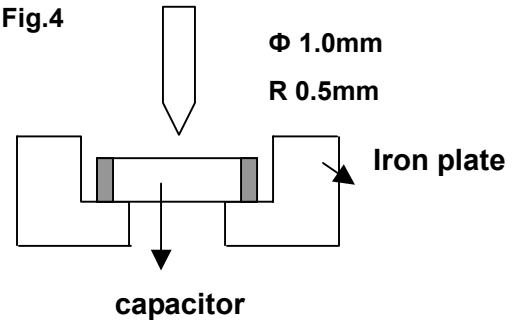
(b) X7R/X5R,Y5V
The ranges of capacitance change compared with the 25±2°C value over the temperature range shall be within the specified ranges</td><td>Dielectric</td><td>Temperature Range</td><td>Capacitance Change</td></tr>
<tr><td>NPO</td><td>-55°C to +125°C</td><td>0±30ppm/°C</td></tr>
<tr><td>X7R

X5R</td><td>-55°C to +125°C

-55°C to +85°C</td><td>Within ±15%

Within ±15%</td></tr>
<tr><td>Y5V</td><td>-25°C to+ 85°C</td><td>Within

+30%~-80%</td></tr>
<tr><td>11</td><td>Resistance to board bending</td><td>Mount the capacitor to the testing printed wiring board. Then apply force in the direction shown in Fig.3. The bending stroke shall be more than 1mm, Pressurizing is carried out at the rate of 1mm/s. After reaching the specified bending, keeping it for 5±1 seconds then measure the capacitance value.
Cap. Change :
NPO: ±5%or±0.5 pF whichever is larger
X7R, X5R: ±12.5%
Y5V: ±30%
(This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test)</td><td colspan="3">No cracking or marking defects shall occur
Fig.3
Unit: mm
 
</td></tr>
<tr><td>12</td><td>Chip Break Strength</td><td>Place the capacitor on an iron plate, And then gradually apply a load on the center of the chip until it breaks.

Tip of push-pull gauge is shown in Fig.4</td><td colspan="3">To load 2 kgf at least.
Fig.4
 
</td></tr>
</table>

SPECIFICATIONS AND TEST METHODS

<table>
<tr><th>No</th><th>Item</th><th>Test Method</th><th>Specification</th></tr>
<tr><td>13</td><td>Temperature cycle</td><td>Mount the capacitor on test board, then cycling the temperature sequentially from step 1 to step 5, and perform 25 cycles.
<table>
<tr><th rowspan="2">Step.</th><th>NPO</th><th>X7R</th><th>X5R/Y5V</th></tr>
<tr><th colspan="2">Temperature (°C) /time(min)</th><th>Temperature(°C) /time(min)</th></tr>
<tr><td>1</td><td colspan="2">+25±2°C / 3±1</td><td>+25±2°C / 3±1</td></tr>
<tr><td>2</td><td colspan="2">-55±2°C / 30±3</td><td>-30±2°C / 30±3</td></tr>
<tr><td>3</td><td colspan="2">+25±2°C / 3±1</td><td>+25±2°C / 3±1</td></tr>
<tr><td>4</td><td colspan="2">+125±3°C / 30±3</td><td>+85±3°C / 30±3</td></tr>
<tr><td>5</td><td colspan="2">+25±2°C / 3±1</td><td>+25±2°C / 3±1</td></tr>
</table>
Remove and let sit for 24±2hours(NPO) or 48±4hours(X7R/X5R,Y5V) at room temperature, then measure</td><td>*No remarkable damage.

*Cap. Change :
NPO:
±2.5% or ±0.5 pF whichever is larger

X7R, X5R: ±7.5%

Y5V: ±20%

*Q/D.F..I.R & dielectric strength :
To meet initial requirement.</td></tr>
<tr><td>14</td><td>Humidity (Damp Heat) Steady State</td><td>*Test temp.: 40±2°C
*Humidity: 90～95% RH
*Test time: 500 hrs
*Measurement to be made after keeping at room temperature for 48±4 hrs.
EXCEPTION OF D.F.
X7R/X5R:
<table>
<tr><th>Vr</th><th>D.F</th><th>Exception of D.F.</th></tr>
<tr><td>≧ 50V</td><td>≦6%</td><td>0603≧47nF, 0805≧0.18uF, 1206≧0.47uF, 1210≧1.0uF</td></tr>
<tr><td rowspan="2">25V</td><td>≦10%</td><td rowspan="2">0805≧1.0uF, C≧4.7Uf
0603≧0.33uF</td></tr>
<tr><td>≦14%</td></tr>
<tr><td>16V</td><td>≦10%</td><td>0402≧33nF, 0603≧0.15uF
0805≧0.68uF, C≧2.2uF</td></tr>
<tr><td>10V</td><td>≦15%</td><td>0402≧56nF, 0603≧0.33uF
C≧2.2uF</td></tr>
</table>
Y5V:
<table>
<tr><th>Vr</th><th>D.F</th><th>Exception of D.F.</th></tr>
<tr><td rowspan="2">25V</td><td>≦10%</td><td>0603≧0.1uF, 0805≧0.33uF
1206≧1.0 uF</td></tr>
<tr><td>≦12.5%</td><td>0402≧0.047uF</td></tr>
<tr><td>16V</td><td>≦12.5%</td><td>0402≧0.047uF</td></tr>
</table></td><td>*No remarkable damage

*Cap. Change :
NPO: ±5%or±0.5 pF
whichever is larger
X7R/X5R:≧10V: ±12.5%, 6.3V : ±25%
Y5V: ±30%

*Q value/D.F.
NPO : C≧30pf : Q≧350
10pF≦Cap＜30pF, Q≧275+2.5C
Cap＜10pF, Q≧200+10C
X7R, X5R :
Vr≧50V, D.F.≦3%
Vr=16/25V, D.F.≦5%
Vr=10V, D.F.≦7.5%
Y5V :
Vr≧25/50V, D.F.≦7.5%
Vr=16V(C＜1.0uF),DF≦10%
Vr=16V(C≧1.0uF),DF≦12.5%
Vr=10V, D.F.≦15%
Vr=6.3V, D.F.≦30%
(See EXCEPTION at left side)

≧10V, ≧1GΩ or 50Ω-F (whichever is smaller)
6.3V: ≧10Ω-F</td></tr>
<tr><td>14</td><td>Humidity (Damp Heat) Load</td><td>*Test temp.: 40±2°C
*Humidity: 90～95% RH
*Test time: 500 hrs
*Test Voltage : Rated Voltage (Max 500V)
*Measurement to be made after keeping at room temperature for 48±4 hrs.</td><td>*No remarkable damage

*Cap. Change :
NPO: ±7.5%or±0.75 pF
whichever is larger
X7R/X5R:≧10V: ±12.5%, 6.3V : ±25%
Y5V: ±30%
*Q value/D.F.
SAME AS No. 13</td></tr>
</table>

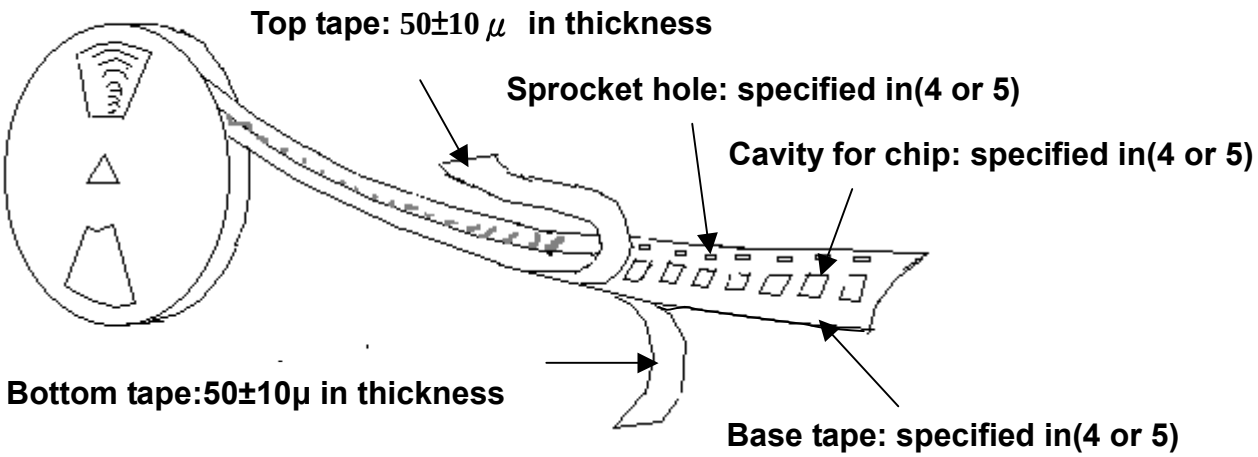
8. Packing

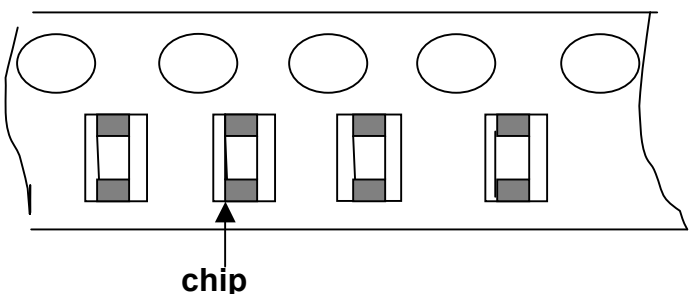
8-1. Bulk Packaging: Packing code(B)

8-2. Tape Packing: please specify the packing code when ordering.

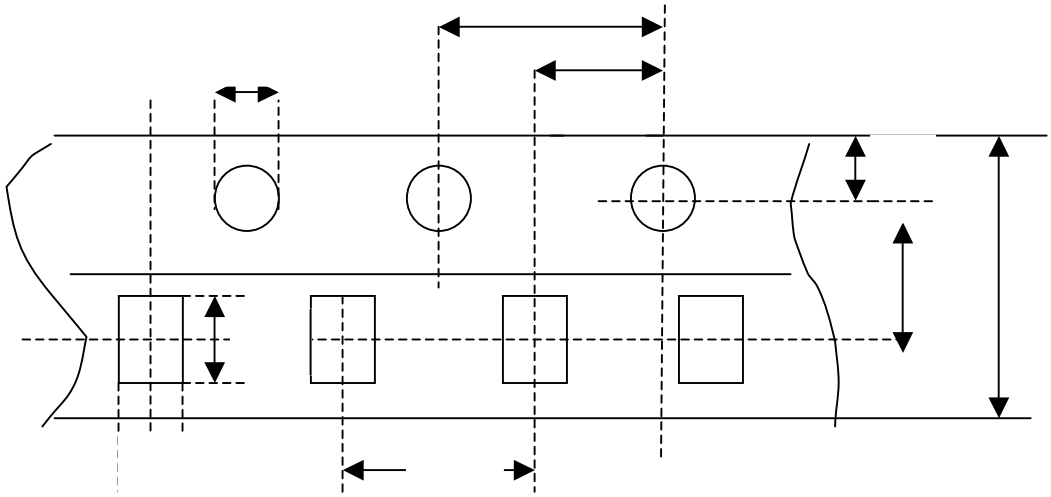
Packing code	Pcs/Reel	Reel size	
05	500	7”	
1	1000	7”	
2	2000	7”	
3	3000	7”	
T	4000	7”	
U	10000	0402	7”
		0603	10”
V	15000	13”	
W	20000	13”	

8-3. Appearance of taping





8-4 Dimensions of Paper Tape



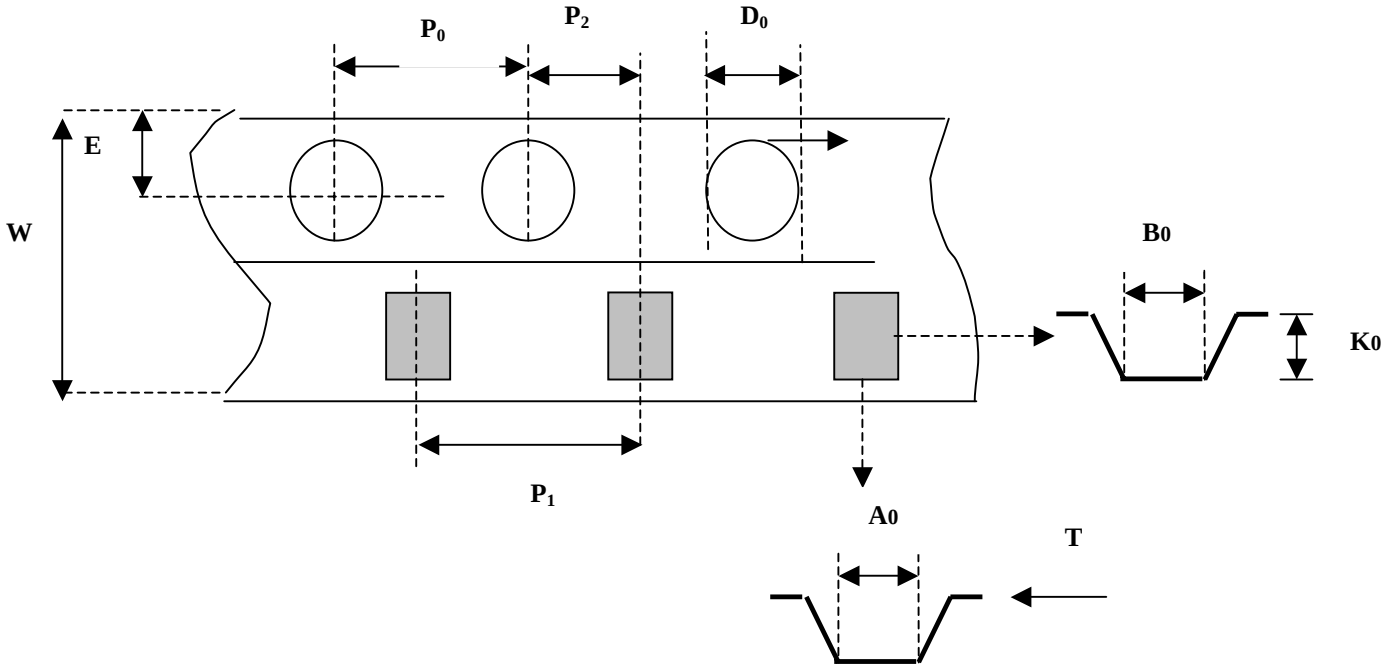
Unit: m/m

Chip size / Mark	0402	0603	0805	1206	Tolerance
A_0	0.61	1.02	1.50	2.00	±0.1
B_0	1.10	1.82	2.30	3.50	±0.1
W	8.0	8.0	8.0	8.0	±0.3
E	1.75	1.75	1.75	1.75	±0.1
F	3.5	3.5	3.5	3.5	±0.05
D_0	1.55	1.55	1.55	1.55	±0.1
P_1	2.0	4.0	4.0	4.0	±0.05
P_2	2.0	2.0	2.0	2.0	±0.05
P_0	4.0	4.0	4.0	4.0	±0.05

Paper thickness: T:0.65±0.05 mm (for 0402 product)
T:0.75±0.05 mm (for thickness code S)
T:0.95±0.05 mm (for thickness code P, H)

Note: （1） The top tape and bottom tape shall not protrude beyond the edges of the tape, and shall not cover sprocket holes.
（2） Cumulative tolerance of sprocket holes 10 pitch : ±0.3mm

8-5 Dimensions of Embossed Packing (plastic tape):

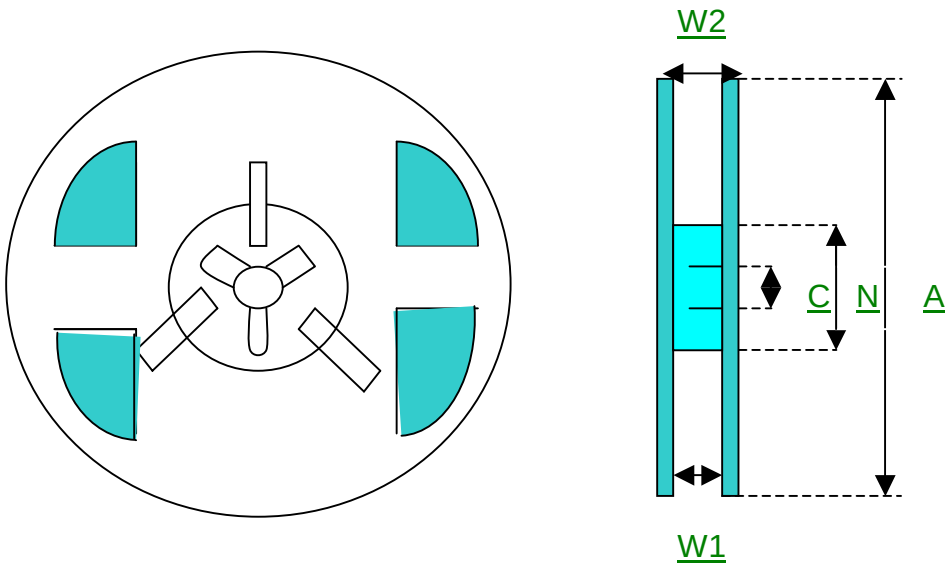


unit: m/m

Chip size / Mark	0805	1206	1210	1808	1812	2220
A_0	1.65±0.2	2.00±0.2	2.80±0.2	2.40±0.2	3.60±0.2	5.50±0.3
B_0	2.40±0.2	3.60±0.2	3.60±0.2	4.90±0.3	4.90±0.3	6.20±0.3
K_0	2.50 max	2.50 max	3.00 max	2.50 max	4.00 max	4.00 max
D_0	1.55±0.1	1.55±0.1	1.55±0.1	1.55±0.1	1.55±0.1	1.55±0.1
W	8.00±0.2	8.00±0.2	8.00±0.2	12.00±0.2	12.00±0.2	12.00±0.2
P_1	4.00±0.1	4.00±0.1	4.00±0.1	4.00±0.1	8.00±0.1	8.00±0.1
P_2	2.00±0.1	2.00±0.1	2.00±0.1	2.00±0.1	2.00±0.1	2.00±0.1
E	1.75±0.1	1.75±0.1	1.75±0.1	1.75±0.1	1.75±0.1	1.75±0.1
T	0.23±0.05	0.23±0.05	0.23±0.05	0.23±0.05	0.25±0.1	0.25±0.1
P_0	4.00±0.1	4.00±0.1	4.00±0.1	4.00±0.1	4.00±0.1	4.00±0.1

Emboss tape: for thickness code X, L, Z, G, N, U

8-6. Dimension of Reel.



unit: m/m

Reel size	A	N	C	W1	W2(max.)
7” 0402~1210	178 ±0.5	60.5±1.0	13.0+0.5/-0.2	8.4+1.5/-0	14.4
7” 1812~2220	178 ±0.5	60.5±1.0	13.0+0.5/-0.2	12.4+2.0/-0	16.0
10”	250 ±0.5	100 ±1.0	13.0+0.5/-0.2	8.4+1.5/-0	14.4
13”	330 ±0.5	100 ±1.0	13.0+0.5/-0.2	8.4+1.5/-0	14.4

9. Soldering Profile

Recommended Soldering Profile (Prevention of thermal shock)

Figure.(I) IR reflow soldering profile for SMT process with SnAgCu series solder paste , (lead free type)

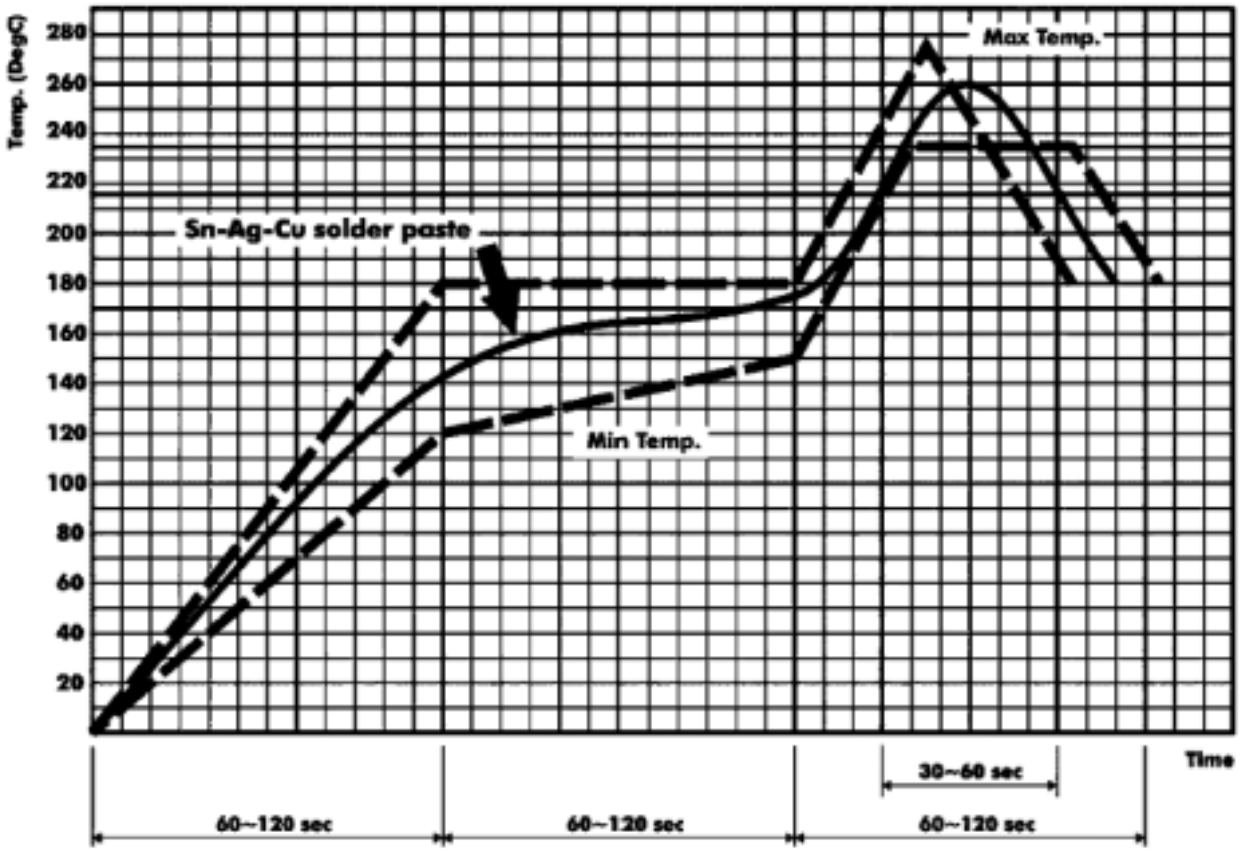
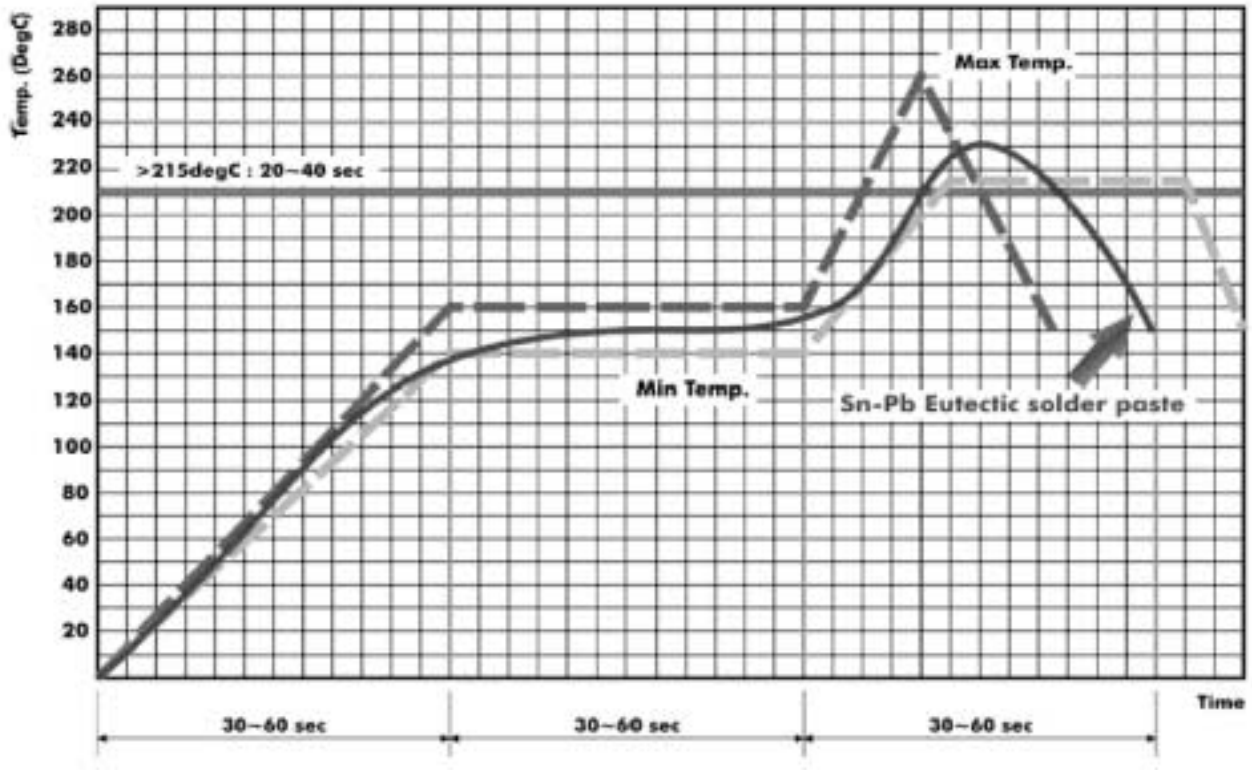


Figure. (II) IR reflow soldering profile for SMT process with SnPb series solder paste.



10. Storage

1. To store products at 5 to 40℃ ambient temperature and 20 to 70% related humidity conditions.
2. The product is recommended to be used within one year after shipment. Check solderability in case of shelf life extension is needed.

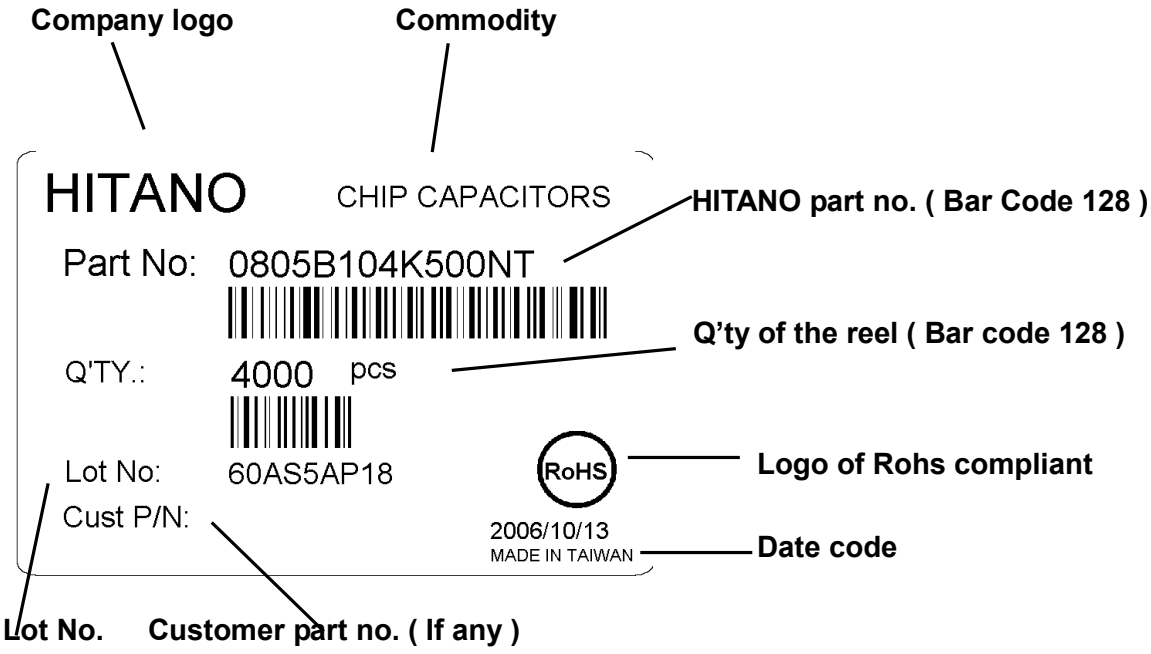
Caution:

A. Don't store products in a corrosive environment such as sulfide, chloride gas, or acid. It may cause oxidization of electrode, which easily be resulted in poor soldering.

B. To store products on the shelf and avoid exposure to moisture.

C. Don't expose products to excessive shock, vibration, direct sunlight and so on.

11 Label



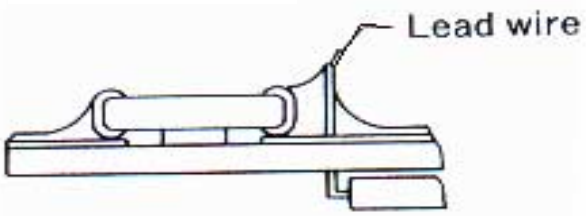
12. PCB design

Chip components are susceptible to board stress since the component itself is mounted directly on the board. They are also sensitive to mechanical and thermal stress when solder, which may cause chip cracked.
Please take solder form and component layout into consideration to eliminate stress.

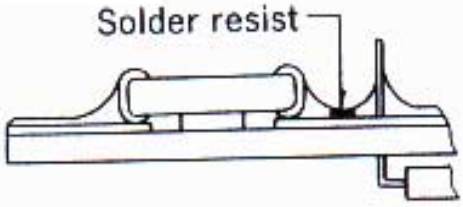
12.1. Pattern form

(1) Placing of chip components and component.

incorrect

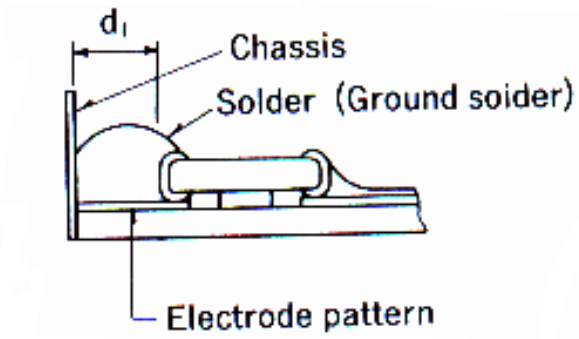


correct

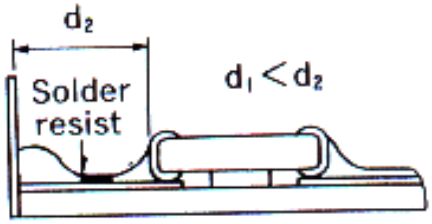


(2) Placing close to chassis.

incorrect

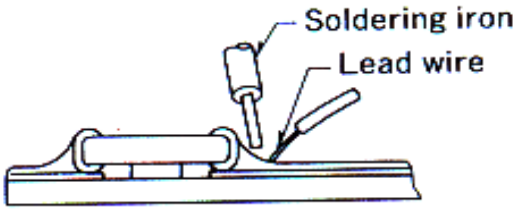


correct

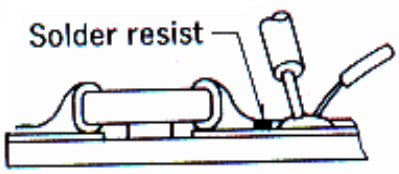


(3) Placing leaded components after chip component.

incorrect



correct



PCB design

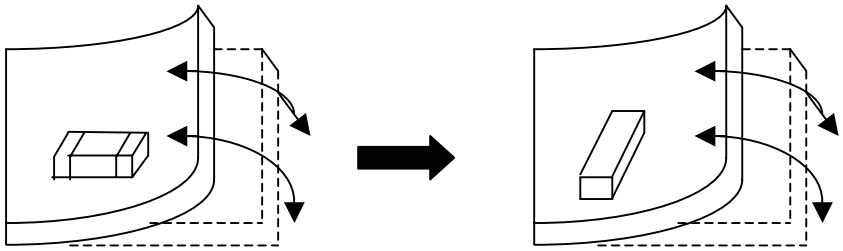
(4) Lateral mounting

incorrect **correct**

12-2. Component direction

To design a mounting position that minimizes the stress imposed on the chip during flexing or bending of the board.

(1) put the component lateral to the direction in which stress acts.



(2) Component layout close to board separation point.
Susceptibility to stress in the order: A＞C＞B＝D