SOFT TERMINATION
- GMX 6.3V~200V -

INTRODUCTION

- Cal-Chip's soft termination series MLCC is designed and with a polymer layer within end terminations of product, which can absorb mechanical stress caused by PCB handling in SMT line and reduce the mechanical impact for product. It will offer more robust and reliable performance in applications.

FEATURES

- MLCC's termination are with a soft & flexible polymer layer to withstand high bending stress in SMT line.
- Available for any item in standard series range.

APPLICATIONS

- Automotive industry.
- Power supply and related industries.
- Lighting industry.
- The other mechanical stress concerned products

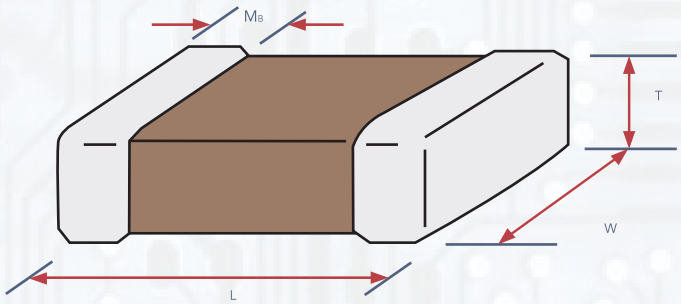
ORDERING INFORMATION

GMX	31	CG	104	K	50	C	T
SERIES	SIZE	DIELECTRIC	CAPACITANCE	TOLERANCE	RATED VOLTAGE	TERMINATION	PACKAGING
GMX - Soft Termination	04 - 0402 (1005) 10 - 0603 (1608) 21 - 0805 (2012) 31 - 1206 (3216) 32 - 1210 (3225) 43 - 1812 (4532) 45 - 1825 (4563) 55 - 2220 (5750) 57 - 2225 (5763)	CG - NPO (C0G) X7R - X7R X5R - X5R Y5V - Y5V	Two significant digits followed by no. of zeros. And R in place of decimal point. EG. 104 - $10X10^4$ - 100nF	B: ± 0.1pF C: ± 0 25pF D: ± 0 5pF F: ± 1% G: ± 2% J: ± 5% K: ± 10% M: ± 20% Z: -20/+80%	6R3 - 6.3 VDC 10 - 10 VDC 16 - 16 VDC 25 - 25 VDC 50 - 50 VDC 100 - 100 VDC 200 - 200 VDC	C - Cu/Polymer/Ni/Sn	T - 7" reeled G - 13" reeled

EXTERNAL DIMENSIONS & CONSTRUCTIONS

SIZE INCH (MM)	L (MM)	W (MM)	T (MM)	SYMBOL	REMARK	M_B (MM)
0402 (1005)	1.00±0.20	0.50±0.20	0.50±0.20	E		0.25 +0.05/-0.10
0603 (1608)	1.60±0.20	0.80±0.10	0.80±0.07	S		0.40±0.15
	1.60±0.30	0.80±0.30	0.80±0.30	X		
0805 (2012)	2.00±0.20	1.25±0.10	0.60±0.10	A		0.50±0.20
			0.80±0.10	B		
			1.25±0.10	D	#	
	2.00±0.30	1.25±0.30	1.25±0.30	I	#	
1206 (3216)	3.20+0.4/-0.1	1.60±0.15	0.80±0.10	B		0.60±0.20
			0.95±0.10	C	#	
			1.15±0.15	J	#	
			1.25±0.10	D	#	
	3.20+0.4/-0.1	1.60±0.20	1.60±0.20	G	#	
	3.20+0.50	1.60±0.50	1.60±0.50	P	#	
1210 (3225)	3.20+0.20	2.50+0.20	0.95±0.10	C	#	0.75±0.25
			1.25±0.10	D	#	
	3.20+0.60	2.50+0.50	1.60±0.20	G	#	
			2.00±0.20	K	#	
			2.50±0.30	M	#	
1812 (4532)	4.50+0.6/-0.4	3.20+0.30	1.25±0.10	D	#	0.75±0.25
			1.60±0.20	G	#	
			2.00±0.20	K	#	
		3.20+0.40	2.50±0.50	M	#	
1825 (4563)	4.50+0.6/-0.4	6.30±0.40	2.00±0.20 (K)		#	0.75±0.35
2220 (5750)	5.70±0.50	5.00±0.40	2.50±0.30 (M)		#	0.85±0.35
2225 (5763)	5.70±0.50	6.30±0.40	2.80±0.30 (U)		#	0.85±0.35

#REFLOW SOLDERING ONLY IS RECOMMENDED



GENERAL ELECTRICAL DATA

DIALECTRIC	NP0	X7R	X5R	Y5V
SIZE	0402, 0603, 0805, 1206, 1210, 1812			
CAPACITANCE RANGE*	0.1pF to 0.039μF	100pF to 22μF	0.027μF to 10μF	0.01μF to 4.7μF
CAPACITANCE TOLERANCE**	Cap≤5pF: B (±0.1pF), C (±0.25pF) 5pF<Cap<10pF: C (±0.25pF), D (±0.5pF) Cap≥10pF: F (±1%), G (±2%), J (±5%), K (±10%)	K (±10%), M (±20%)		Z (-20/+80%)
RATED VOLTAGE (WVDC)	6.3V, 10V, 16V, 25V, 50V, 100V			
OPERATING TEMPERATURE	-55 TO +125°C	-55 TO +125°C	-55 TO +85°C	-25 TO +85°C
CAPACITANCE CHARACTERISTIC	±30ppm	±15%	±15%	+30%/-80%
TERMINATION	Ni/Sn (lead-free termination)			

* Measured at the condition of 30~70% related humidity.
NP0: Apply 1.0±0.2Vrms, 1.0MHz±10% for Cap≤1000pF and 1.0±0.2Vrms, 1.0kHz±10% for Cap>1000pF, 25°C at ambient temperature X7R, X5R: Apply 1.0±0.2Vrms, 1.0kHz±10%, at 25°C ambient temperature.
Y5V: Apply 1.0±0.2Vrms, 1.0kHz±10%, at 20°C ambient temperature.
** Preconditioning for Class II MLCC: Perform a heat treatment at 150±10°C for 1 hour, then leave in ambient condition for 24±2 hours before measurement.

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CAPACITANCE RANGE (NPO DIELECTRIC)

DIELECTRIC		NPO														
SIZE		0402					0603					0805				
RATED VOLTAGE		10	16	25	50	100	10/16	25	50	100	200	10/16	25	50	100	200
CAP. RANGE																
0.1pF	0R1	E	E	E	E											
0.2pF	0R2	E	E	E	E											
0.3pF	0R3	E	E	E	E		S	S	S							
0.4pF	0R4	E	E	E	E		S	S	S							
0.5pF	0R5	E	E	E	E	E	S	S	S	S	S	A	A	A	A	A
0.6pF	0R6	E	E	E	E	E	S	S	S	S	S	A	A	A	A	A
0.7pF	0R7	E	E	E	E	E	S	S	S	S	S	A	A	A	A	A
0.8pF	0R8	E	E	E	E	E	S	S	S	S	S	A	A	A	A	A
0.9pF	0R9	E	E	E	E	E	S	S	S	S	S	A	A	A	A	A
1.0pF	1R0	E	E	E	E	E	S	S	S	S	S	A	A	A	A	A
1.2pF	1R2	E	E	E	E	E	S	S	S	S	S	A	A	A	A	A
1.5pF	1R5	E	E	E	E	E	S	S	S	S	S	A	A	A	A	A
1.8pF	1R8	E	E	E	E	E	S	S	S	S	S	A	A	A	A	A
2.2pF	2R2	E	E	E	E	E	S	S	S	S	S	A	A	A	A	A
2.7pF	2R7	E	E	E	E	E	S	S	S	S	S	A	A	A	A	A
3.3pF	3R3	E	E	E	E	E	S	S	S	S	S	A	A	A	A	A
3.9pF	3R9	E	E	E	E	E	S	S	S	S	S	A	A	A	A	A
4.7pF	4R7	E	E	E	E	E	S	S	S	S	S	A	A	A	A	A
5.6pF	5R6	E	E	E	E	E	S	S	S	S	S	A	A	A	A	A
6.8pF	6R8	E	E	E	E	E	S	S	S	S	S	A	A	A	A	A
8.2pF	8R2	E	E	E	E	E	S	S	S	S	S	A	A	A	A	A
10pF	100	E	E	E	E	E	S	S	S	S	S	A	A	A	A	A
12pf	120	E	E	E	E	E	S	S	S	S	S	A	A	A	A	A
15pf	150	E	E	E	E	E	S	S	S	S	S	A	A	A	A	A
18pf	180	E	E	E	E	E	S	S	S	S	S	A	A	A	A	A
22pf	220	E	E	E	E	E	S	S	S	S	S	A	A	A	A	A
27pf	270	E	E	E	E	E	S	S	S	S	S	A	A	A	A	A
33pf	330	E	E	E	E	E	S	S	S	S	S	A	A	A	A	A
39pf	390	E	E	E	E	E	S	S	S	S	S	A	A	A	A	A
47pf	470	E	E	E	E	E	S	S	S	S	S	A	A	A	A	A
56pf	560	E	E	E	E	E	S	S	S	S	S	A	A	A	A	A
68pf	680	E	E	E	E	E	S	S	S	S	S	A	A	A	A	A
82pf	820	E	E	E	E	E	S	S	S	S	S	A	A	A	A	A
100pf	101	E	E	E	E	E	S	S	S	S	S	A	A	A	A	A
120pf	121	E	E	E	E	E	S	S	S	S	S	A	A	A	A	A
150pf	151	E	E	E	E	E	S	S	S	S	S	A	A	A	A	B
180pf	181	E	E	E	E	E	S	S	S	S	S	A	A	A	A	B
220pf	221	E	E	E	E	E	S	S	S	S	S	A	A	A	A	D
270pf	271	E	E	E	E		S	S	S	S	X	A	A	A	A	D
330pf	331	E	E	E	E		S	S	S	S	X	A	A	A	A	D
470pf	471	E	E	E	E		S	S	S	S	X	B	B	B	B	D
560pf	561	E	E	E	E		S	S	S	S		B	B	B	B	D
680pf	681	E	E	E	E		S	S	S	S		B	B	B	B	D
820pf	821	E	E	E	E		S	S	S	S		B	B	B	B	D
1,000pf	102	E	E	E	E		S	S	S	S		B	B	B	B	D
1,200pf	122						X	X	X			B	B	B	B	D
1,500pf	152						X	X	X			B	B	B	B	D
1,800pf	182						X	X	X			B	B	B	B	D
2,200pf	222						X	X	X			B	B	B	B	D
2,700pf	272						X	X	X			D	D	D	D	
3,300pf	332						X	X	X			D	D	D	D	
3,900pf	392											D	D	D	D	
4,700pf	472											D	D	D	D	
5,600pf	562											D	D	D	D	
6,800pf	682											D	D	D	D	
8,200pf	822											D	D	D		
0.010uf	103											D	D	D		
0.012uf	123															

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CAPACITANCE RANGE (NPO DIELECTRIC)

		NPO														
SIZE		1206					1210					1812				
RATED VOLTAGE		10/16	25	50	100	200	10/16	25	50	100	200	10/16	25	50	100	200
CAP. RANGE																
1.0pf	1R0															
1.2pf	1R2	B	B	B	B											
1.5pf	1R5	B	B	B	B	B										
1.8pf	1R8	B	B	B	B	B										
2.2pf	2R2	B	B	B	B	B										
2.7pf	2R7	B	B	B	B	B										
3.3pF	3R3	B	B	B	B	B										
3.9pf	3R9	B	B	B	B	B										
4.7pf	4R7	B	B	B	B	B										
5.6pF	5r6	B	B	B	B	B										
6.8pf	6r8	B	B	B	B	B										
8.2pf	8r2	B	B	B	B	B										
10pf	100	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
12pF	120	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
15pF	150	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
18pF	180	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
22pF	220	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
27pF	270	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
33pF	330	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
39pF	390	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
47pF	470	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
56pF	560	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
68pF	680	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
82pF	820	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
100pF	101	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
120pF	121	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
150pF	151	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
180pF	181	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
220pF	221	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
270pF	271	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
330pF	331	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
390pF	391	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
470pF	471	B	B	B	B	C	C	C	C	C	C	D	D	D	D	D
560pF	561	B	B	B	B	C	C	C	C	C	C	D	D	D	D	D
680pF	681	B	B	B	B	C	C	C	C	C	C	D	D	D	D	D
820pF	821	B	B	B	B	C	C	C	C	C	C	D	D	D	D	D
1000pF	102	B	B	B	B	C	C	C	C	C	C	D	D	D	D	D
1200pF	122	B	B	B	B	C	C	C	C	C	D	D	D	D	D	D
1500pF	152	B	B	B	B	D	C	C	C	C	D	D	D	D	D	D
1800pF	182	B	B	B	B	D	C	C	C	C	D	D	D	D	D	D
2200pF	222	B	B	B	B	D	C	C	C	C	D	D	D	D	D	D
2700pF	272	B	B	B	B	D	C	C	C	C	D	D	D	D	D	D
3300pF	332	B	B	B	B	D	C	C	C	C	D	D	D	D	D	D
3900pF	392	B	B	B	B	D	C	C	C	C	D	D	D	D	D	D
4700pF	472	B	B	B	B	D	C	C	C	C	G	D	D	D	D	D
5600pF	562	B	B	B	B		C	C	C	C	G	D	D	D	D	D
6800pF	682	C	C	C	C		C	C	C	C	G	D	D	D	D	D
8200pF	822	D	D	D	D		C	C	C	C	G	D	D	D	D	
0.010uF	103	D	D	D	D		C	C	C	C	G	D	D	D	D	
0.012uF	123	P	P	P	P		D	D	D	D		D	D	D	D	
0.015uF	153	P	P	P	P		D	D	D	D		D	D	D	D	
0.018uF	183	P	P	P	P							D	D	D	D	
0.022uF	223	P	P	P	P							D	D	D	D	
0.027uF	273	P	P		P							D	D	D	D	
0.033uF	333	P	P		P							D	D	D	D	
0.039uF	393	P	P													

CAPACITANCE RANGE (NPO DIELECTRIC)

		NPO								
SIZE		1825			2220			2225		
RATED VOLTAGE		50	100	200	50	100	200	50	100	200
CAP. RANGE										
10pf	100	K	K	K	K	K	K	K	K	K
12pF	120	K	K	K	K	K	K	K	K	K
15pF	150	K	K	K	K	K	K	K	K	K
18pF	180	K	K	K	K	K	K	K	K	K
22pF	220	K	K	K	K	K	K	K	K	K
27pF	270	K	K	K	K	K	K	K	K	K
33pF	330	K	K	K	K	K	K	K	K	K
39pF	390	K	K	K	K	K	K	K	K	K
47pF	470	K	K	K	K	K	K	K	K	K
56pF	560	K	K	K	K	K	K	K	K	K
68pF	680	K	K	K	K	K	K	K	K	K
82pF	820	K	K	K	K	K	K	K	K	K
100pF	101	K	K	K	K	K	K	K	K	K
120pF	121	K	K	K	K	K	K	K	K	K
150pF	151	K	K	K	K	K	K	K	K	K
180pF	181	K	K	K	K	K	K	K	K	K
220pF	221	K	K	K	K	K	K	K	K	K
270pF	271	K	K	K	K	K	K	K	K	K
330pF	331	K	K	K	K	K	K	K	K	K
390pF	391	K	K	K	K	K	K	K	K	K
470pF	471	K	K	K	K	K	K	K	K	K
560pF	561	K	K	K	K	K	K	K	K	K
680pF	681	K	K	K	K	K	K	K	K	K
820pF	821	K	K	K	K	K	K	K	K	K
1000pF	102	K	K	K	K	K	K	K	K	K
1200pF	122	K	K	K	K	K	K	K	K	K
1500pF	152	K	K	K	K	K	K	K	K	K
1800pF	182	K	K	K	K	K	K	K	K	K
2200pF	222	K	K	K	K	K	K	K	K	K
2700pF	272	K	K	K	K	K	K	K	K	K
3300pF	332	K	K	K	K	K	K	K	K	K
3900pF	392	K	K	K	K	K	K	K	K	K
4700pF	472	K	K	K	K	K	K	K	K	K
5600pF	562	K	K	K	K	K	K	K	K	K
6800pF	682	K	K	K	K	K	K	K	K	K
8200pF	822	K	K	K	K	K	K	K	K	K
0.010uF	103	K	K	K	K	K	K	K	K	K
0.012uF	123	K	K	K	K	K	K	K	K	K
0.015uF	153	K	K	K	K	K	K	K	K	K
0.018uF	183	K	K	K	K	K	K	K	K	K
0.022uF	223	K	K	K	K	K	K	K	K	K
0.027uF	273	K	K	K	K	K	K	K	K	K
0.033uF	333	K	K	K	K	K	K	K	K	K
0.039uF	393	K	K	K	K	K	K	K	K	K
0.047uF	473	K	K	K	K	K	M	K	K	M
0.056uF	563	K	K	M	K	K	M	K	K	M
0.068uF	683	K	K	M	K	K	M	K	K	M
0.082uF	823	M	M		M	M		K	K	M
0.1uF	104	M	M		M	M		M	M	
0.12uF	124									

CAPACITANCE RANGE (X7R DIELECTRIC)

DIELECTRIC		X7R														
SIZE		0402					0603					0805				
RATED VOLTAGE		10	16	25	50	100	10/16	25	50	100	200	10/16	25	50	100	200
CAP. RANGE																
100pF	101	E	E	E	E	E	S	S	S	S	X	D	D	D	D	D
120pF	121	E	E	E	E	E	S	S	S	S	X	D	D	D	D	D
150pF	151	E	E	E	E	E	S	S	S	S	X	D	D	D	D	D
180pF	181	E	E	E	E	E	S	S	S	S	X	D	D	D	D	D
220pF	221	E	E	E	E	E	S	S	S	S	X	D	D	D	D	D
270pF	271	E	E	E	E	E	S	S	S	S	X	D	D	D	D	D
330pF	331	E	E	E	E	E	S	S	S	S	X	D	D	D	D	D
390pF	391	E	E	E	E	E	S	S	S	S	X	D	D	D	D	D
470pF	471	E	E	E	E	E	S	S	S	S	X	D	D	D	D	D
560pF	561	E	E	E	E	E	S	S	S	S	X	D	D	D	D	D
680pF	681	E	E	E	E	E	S	S	S	S	X	D	D	D	D	D
820pF	821	E	E	E	E	E	S	S	S	S	X	D	D	D	D	D
1000pF	102	E	E	E	E	E	S	S	S	S	X	D	D	D	D	D
1200pF	122	E	E	E	E	E	S	S	S		X	D	D	D	D	D
1500pF	152	E	E	E	E	E	S	S	S	S	X	D	D	D	D	D
1800pF	182	E	E	E	E	E	S	S	S	S	X	D	D	D	D	D
2200pF	222	E	E	E	E	E	S	S	S	S	X	D	D	D	D	D
2700pF	272	E	E	E	E	E	S	S	S	S	X	D	D	D	D	D
3300pF	332	E	E	E	E	E	S	S	S	S	X	D	D	D	D	D
3900pF	392	E	E	E	E	E	S	S	S	S	X	D	D	D	D	D
4700pF	472	E	E	E	E	E	S	S	S	S	X	D	D	D	D	D
5600pF	562	E	E	E	E		S	S	S	S	X	D	D	D	D	D
6800pF	682	E	E	E	E		S	S	S	S	X	D	D	D	D	D
8200pF	822	E	E	E	E		S	S	S	S	X	D	D	D	D	D
0.010uF	103	E	E	E	E		S	S	S	S	X	D	D	D	D	D
0.012uF	123	E	E	E			S	S	S	X		D	D	D	D	D
0.015uF	153	E	E	E			S	S	S	X		D	D	D	D	D
0.018uF	183	E	E	E			S	S	S	X		D	D	D	D	D
0.022uF	23	E	E	E			S	S	S	X		D	D	D	D	D
0.027uF	273	E	E	E			S	S	S	X		D	D	D	D	D
0.033uF	333	E	E	E			S	S	X	X		D	D	D	D	D
0.039uF	393	E	E	E			S	S	X	X		D	D	D	D	D
0.047uF	473	E	E	E			S	S	X	X		D	D	D	D	D
0.056uF	563	E	E				S	S	X	X		D	D	D	D	D
0.068uF	683	E	E				S	S	X	X		D	D	D	D	D
0.082uF	823	E	E				S	S	X	X		D	D	D	D	D
0.10uF	104	E	E				S	S	X	X		D	D	D	D	D
0.12uF	124						S	X				D	D	D	I	
0.15uF	154						S	X				D	D	D	I	
0.18uF	184						S	X				D	D	D	I	
0.22uF	224						S	X				D	D	D	I	
0.27uF	274						X	X				I	I	I		
0.33uF	334						X	X				I	I	I		
0.39uF	394						X	X				I	I	I		
0.47uF	474						X	X				I	I	I		
0.56uF	564						X					I	I			
0.68uF	684						X					I	I			
0.82uF	824						X					I	I			
1.0uF	105						X					I	I	I		
1.5uF	155											I	I			
2.2uF	225											I	I			
4.7uF	475											I				

CAPACITANCE RANGE (X7R DIELECTRIC)

DIELECTRIC		X7R																		
SIZE		1206					1210					1812					2220			
RATED VOLTAGE		10/16	25	50	100	200	10/16	25	50	100	200	10/16	25	50	100	200	25	50	100	200
CAP. RANGE																				
100pF	101				D	D														
120pF	121				D	D														
150pF	151	D	D	D	D	D														
180pF	181	D	D	D	D	D														
220pF	221	D	D	D	D	D														
270pF	271	D	D	D	D	D														
330pF	331	D	D	D	D	D														
390pF	391	D	D	D	D	D														
470pF	471	D	D	D	D	D														
560pF	561	D	D	D	D	D														
680pF	681	D	D	D	D	D														
820pF	821	D	D	D	D	D														
1000pF	102	D	D	D	D	D	C	C	C	C	C	D	D	D	D	D	K	K	K	K
1200pF	122	D	D	D	D	D	C	C	C	C	C	D	D	D	D	D	K	K	K	K
1500pF	152	D	D	D	D	D	C	C	C	C	C	D	D	D	D	D	K	K	K	K
1800pF	182	D	D	D	D	D	C	C	C	C	C	D	D	D	D	D	K	K	K	K
2200pF	222	D	D	D	D	D	C	C	C	C	C	D	D	D	D	D	K	K	K	K
2700pF	272	D	D	D	D	D	C	C	C	C	C	D	D	D	D	D	K	K	K	K
3300pF	332	D	D	D	D	D	C	C	C	C	C	D	D	D	D	D	K	K	K	K
3900pF	392	D	D	D	D	D	C	C	C	C	C	D	D	D	D	D	K	K	K	K
4700pF	472	D	D	D	D	D	C	C	C	C	C	D	D	D	D	D	K	K	K	K
5600pF	562	D	D	D	D	D	C	C	C	C	C	D	D	D	D	D	K	K	K	K
6800pF	682	D	D	D	D	D	C	C	C	C	C	D	D	D	D	D	K	K	K	K
8200pF	822	D	D	D	D	D	C	C	C	C	C	D	D	D	D	D	K	K	K	K
0.010uF	103	D	D	D	D	D	C	C	C	C	C	D	D	D	D	D	K	K	K	K
0.012uF	123	D	D	D	D	D	C	C	C	C	C	D	D	D	D	D	K	K	K	K
0.015uF	153	D	D	D	D	D	C	C	C	C	C	D	D	D	D	D	K	K	K	K
0.018uF	183	D	D	D	D	D	C	C	C	C	C	D	D	D	D	D	K	K	K	K
0.022uF	223	D	D	D	D	D	C	C	C	C	C	D	D	D	D	D	K	K	K	K
0.027uF	273	D	D	D	D	D	C	C	C	C	C	D	D	D	D	D	K	K	K	K
0.033uF	333	D	D	D	D	G	C	C	C	C	C	D	D	D	D	D	K	K	K	K
0.039uF	393	D	D	D	D	G	C	C	C	C	C	D	D	D	D	D	K	K	K	K
0.047uF	473	D	D	D	D	G	C	C	C	C	D	D	D	D	D	D	K	K	K	K
0.056uF	563	D	D	D	D	G	C	C	C	C	D	D	D	D	D	D	K	K	K	K
0.068uF	683	D	D	D	D	G	C	C	C	C	D	D	D	D	D	D	K	K	K	K
0.082uF	823	D	D	D	D	G	C	C	C	C	G	D	D	D	D	D	K	K	K	K
0.10uF	104	D	D	D	D	G	C	C	C	C	G	D	D	D	D	D	K	K	K	K
0.12uF	124	D	D	D	D		C	C	C	C	G	D	D	D	D	D	K	K	K	K
0.15uF	154	C	C	C	C		C	C	C	D	G	D	D	D	D	K	K	K	K	K
0.18uF	184	C	C	C	G		C	C	C	D	M	D	D	D	D	K	K	K	K	K
0.22uF	224	C	C	C	G		C	C	C	D	M	D	D	D	D	K	K	K	K	K
0.27uF	274	C	C	D	G		C	C	C	G	M	D	D	D	D	K	K	K	K	K
0.33uF	334	C	C	D	G		C	C	C	G	M	D	D	D	D	K	K	K	K	K
0.39uF	394	C	J	J	G		C	C	D	M	M	D	D	D	D	K	K	K	K	K
0.47uF	474	J	J	J	G		C	C	D	M	M	D	D	D	K	K	K	K	K	K
0.56uF	564	J	J	P	P		D	D	D	M	M	D	D	D	K	M	K	K	K	K
0.68uF	684	J	J	P	P		D	D	D	K	M	D	D	K	K	M	K	K	K	K
0.82uF	824	J	J	P	P		D	D	D	K		D	D	K	K	M	K	K	K	K
1.0uF	105	J	J	P	P		D	D	D	K		D	D	K	K	M	K	K	K	K
1.5uF	155	J	P				K	G	M	M					K		K	K	K	M
2.2uF	225	J	P	P			K	G	M	M				M	M		K	K	K	M
3.3uF	335	P	P				K	G	M									K	K	
4.7uF	475	P	P				M	M	M									K	M	
6.8uF	685																	M	U	
10uF	106	P	P				K	M	M									U	U	
22uF	226	P					M													
47uF	476																			

CAPACITANCE RANGE (X5R DIELECTRIC)

DIELECTRIC		X5R																						
SIZE		0402				0603					0805					1206					1210				
RATED VOLTAGE		6.3	10	16	25	6.3	10	16	25	50	6.3/10	16	25	50	100	6.3	10	16	25	50	6.3	10	16	25	50
CAP. RANGE																									
0.027uF	273			E																					
0.033uF	333			E																					
0.039uF	393			E																					
0.047uF	473			E																					
0.056uF	563		E	E																					
0.068uF	683		E	E																					
0.082uF	823	E	E	E																					
0.10uF	104	E	E	E	E																				
0.15uF	154	E	E	E	E																				
0.22uF	224	E	C	E	E			X	X																
0.27uF	274						X	X	X																
0.33uF	334	E	E			X	X	X	X																
0.39uF	394						X	X	X																
0.47uF	474	E	E				X	X	X																
0.68uF	684	E	E			X	X	X	X																
0.82uF	824					X	X	X																	
1.0uF	105	E	E			X	X	X	X		D	D	D	D	D										
1.5uF	155					X					I	I	I				J	J				K	K		
2.2uF	225					X	X	X			I	I	I				J	J	P			K	K		
3.3uF	335					X					I	I	I				P	P	P						
4.7uF	475					X										P	P	P	P			K	K	K	
6.8uF	685															P	P								
10uF	106															P	P	P			K	K	K		
22uF	226																								

CAPACITANCE RANGE (Y5V DIELECTRIC)

DIELECTRIC		Y5V								
SIZE		0402					0603			
RATED VOLTAGE		6.3	10	16	25	50	10	16	25	50
CAP. RANGE										
0.010uF	103		E	E	E	E	S	S	S	S
0.015uF	153		E	E	E	E	S	S	S	X
0.022uF	23		E	E	E	E	S	S	S	X
0.033uF	333		E	E	E	E	S	S	S	X
0.047uF	473		E	E	E		S	S	S	X
0.068uF	683		E	E	E		S	S	S	X
0.10uF	104		E	E	E		S	S	S	S
0.15uF	154		E	E			S	S	S	S
0.22uF	224	E	E	E			S	S	S	S
0.33uF	334	E	E	E			S	S	S	
0.47uF	474						S	S	X	X
0.68uF	684						S	X		
1.0uF	105						S	X	X	
2.2uF	225						S	X		
4.7uF	475						X			

PACKAGING STYLE AND QUANTITY

SIZE	THICKNESS (mm)/SYMBOL		PAPER TAPE		PLASTIC TAPE	
			7" REEL	13" REEL	7" REEL	13" REEL
0402 (1005)	0.50±0.20	E	10k	-	-	-
0603 (1608)	0.80±0.07	S	4k	15k	-	-
	0.80±0.30	X	4k	15k	-	-
0805 (2012)	0.60±0.10	A	4k	15k	-	-
	0.80±0.10	B	4k	15k	-	-
	1.25±0.10	D	-	-	3k	10k
	1.25±0.30	I	-	-	3k	10k
1206 (3216)	0.80±0.10	B	4k	4k	-	-
	0.95±0.10	C	-	-	3k	10k
	1.15±0.15	J	-	-	3k	10k
	1.25±0.10	D	-	-	3k	10k
	1.60±0.20	G	-	-	2k	10k
	1.60±0.50	P	-	-	2k	9k
1210 (3225)	0.95±0.10	C	-	-	3k	10k
	01.25±0.10	D	-	-	3k	10k
	01.60±0.20	G	-	-	2k	-
	2.00±0.20	K	-	-	1k	6k
	2.50±0.30	M	-	-	1k	6k
1812 (4532)	1.25±0.10	D	-	-	1k	5k
	1.60±0.20	G	-	-	1k	-
	2.00±0.20	K	-	-	1k	-
	2.50±0.50	M	-	-	0.5k	3k
1825 (4563)	2.00±0.20	K	-	-	1k	-
2220 (5750)	2.50±0.30	M	-	-	0.5k	-
2225 (5763)	2.80±0.30	U	-	-	0.5k	-

UNIT: PIECES

59 Steamwhistle Drive, Ivyland, PA 18974 | p. 215.942.8900 | www.calchip.com | quotes@calchip.com

RELIABILITY TEST CONDITIONS AND REQUIREMENTS

1. Visual and Mechanical

TEST CONDITION: ----

REQUIREMENTS:
- No remarkable defect.
- Dimensions to conform to individual specification sheet.

2. Capacitance

TEST CONDITION:
Class I: (NPO) ≤1000pF, 1.0±0.2Vrms | 1MHz±10% >1000pF, 1.0±0.2Vrms | 1KHz±10%
Class II: (X7R, X7E, X6S, X5R, Y5V)
C≤10μF, 1.0±0.2Vrms | 1KHz±10% ** C>10μF, 0.5±0.2Vrms | 120Hz±20%

** Test condition: 0.5±0.2Vrms, 1KHz±10%
X7R: 0805=106(6.3V&10V)
X5R: 01R5≥103, 0201≥224 (6.3V,10V)#1, 0402≥475 (6.3V,16V), 0402≥225(10V),
0603=106 (6.3V,10V), TT18X≥475(10V) , TT15X series
X6S:0201≥104 (6.3V),0402≥225 (6.3V),
0603≥106 (6.3V), #1 Excluding 0201X105K6R3(1.0±0.2Vrms, 1KHz±10%)

REQUIREMENTS:
- Shall not exceed the limits given in the detailed spec.

3. Q/D.F. (Dissapation Factor)

REQUIREMENTS:

NP0: Cap≥30pF, Q≥1000; Cap≥30pF, Q≥400+20C

X7R, X5R, X6S:

RATED VOL.	D.F. ≤	EXCEPTION OF D.F. ≤	
≥100V	≤2.5%	≤3%	1206≥0.47uF
		≤5%	0805>0.1μF, 0603≥0.068μF, 1206>1μF; 1210≥2.2μF; TT series
50V	≤2.5%	≤3%	0201(50V); 0603≥0.047μF; 0805≥0.18μF;1206≥0.47μF
		≤5%	1206≥0.47uF
		≤10%	0402≥0.1μF;0603>0.1μF; 0805≥1μF; 1206≥2.2μF; 1210≥10μF; TT series
35V	≤3.5%	≤10%	0603≥1μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥10μF
25V	≤3.5%	≤3%	0201≥0.01μF; 0805≥1μF; 1210≥10μF
		≤7%	0603≥0.33μF; 1206≥4.7μF
		≤10%	0201≥0.1μF; 0402≥0.10μF; 0603≥0.47μF; 0805≥2.2μF; 1206≥6.8μF; 1210≥22μF; TT series
		≤12.5%	0402≥0.47uF
16V	≤3.5%	≤5%	0201≥0.01μF; 0402≥0.033μF; 0603≥0.15μF; 0805≥0.68μF; 1206≥2.2μF; 1210≥4.7μF
		≤10%	0201≥0.1uF; 0402≥ 0.22uF; 0603≥0.68μF; 0805≥2.2μF; 1206≥4.7μF; 1210≥22μF; TT series
10V	≤5%	≤10%	0201≥0.012μF; 0402≥0.33μF(0402/X7R≥0.22μF); TT series 0603≥0.33μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥22μF; 01R5
		≤15%	0201≥0.1μF; 0402≥1μF
6.3V	≤10%	≤15%	0201≥0.1μF; 0402≥1μF; 0603≥10μF; 0805≥4.7μF; 1206≥47μF; 1210≥100μF; TT series
		≤20%	0402≥2.2μF
4V	≤15%	---	---

75V:

RATED VOL.	D.F. ≤	EXCEPTION OF D.F. ≤	
≥50V	≤5%	≤7%	0603≥0.1μF; 0805≥0.47μF; 1206≥4.7μF; TT series
		≤12.5%	1210≥6.8μF
35V	≤7%	---	---
50V	≤2.5%	≤7%	0402≥0.047μF; 0603≥0.1μF; 0805≥0.33μF; 1206≥1μF; 1210≥4.7μF
35V	≤3.5%	≤9%	0402≥0.068μF; 0603≥0.47μF; 1206≥4.7μF; 1210≥22μF; TT series
16V (C<1.0μF)	≤7%	≤9%	0402≥0.068μF; 0603≥0.68μF
		≤12.5%	0402≥0.22μF
16V (C<1.0μF)	≤9%	≤12.5%	0603≥2.2μF; 0805≥3.3μF; 1206≥10μF; 1210≥22μF; 1812≥47μF; TT series
10V	≤12.5%	≤20%	0402≥0.47μF
6.3V	≤20%	---	---

4. Dielectric Strength

TEST CONDITION:
- To apply (≤100V) 250%
- Duration 1 to 5 seconds
- Charge and discharge current less than 50mA.

REQUIREMENTS:
- No evidence of damage or flas over during test.

5. Insulation Resistance

TEST CONDITION:
- To apply rated voltage for max. 120 seconds

REQUIREMENTS:

≥10GΩ or RxC≥500ΩF Whichever is smaller

Class II: (X7R, X5R, X6S, Y5V)

RATED VOLTAGE	INSULATION RESISTANCE
100V: X7R 50V: 0402>0.01μF; 0603≥1μF; 0805≥1μF; 1206≥4.7μF; 1210≥4.7μF 35V: 0805≥2.2μF; 1206≥2.2μF; 1210≥10μF 25V:0402≥1μF; 0603≥2.2μF; 0805≥2.2μF; 1206≥10μF; 1210≥10μF 16V: 0201≥0.1μF, 0402≥0.22μF; 0603≥1μF 10V: 00201≥47nF; 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥0.47μF; 1210≥0.47μF 6.4V; 4V; TT series	10GΩ or RxC≥100 Ω-F whichever is smaller.

RATED VOLTAGE	INSULATION RESISTANCE
All X6S items 50V: 0402≥0.1μF; 0603≥2.2μF; 0805≥10μF; 1206≥10μF 35V: 0603≥1μF 25V: 0201≥0.1μF; 0402≥0.22μF; 0603≥10μF; 0805≥10μF; 1206≥22μF 16V: 0603≥10μF 10V: 0201>0.1μF; 0603≥10μF; 0805≥47μF; TT21>4.7μF 6.3V: 0201≥0.1μF; 0603>4.7μF; 1206≥10μF 4V:0603≥22μF; 0805≥47μF; 1206≥100μF	RxC≥100 Ω-F

6. Temperature Coefficient

TEST CONDITION:
- With no electrical load.

T.C.	OPERATING TEMP
NP0	-55~125°C at 25°C
X7R	-55~125°C at 25°C
X5R	-25~85°C at 25°C
X6S	-55~105°C at 25°C
Y5V	-25~85°C at 20°C

- To apply voltage:

01005	0201
Cap≤0.01μF: 0.5V	Cap<0.1μF:1V
Cap>0.01μF: 0.2V	0.1μF≤Cap<1μF: 0.2V
	Cap≥1μF: 0.1V
0402	**0603**
Cap<1μF: 1V	Cap<1μF: 1V
Cap=1μF: 0.5V	1μF<Cap≤4.7μF: 0.5V
1μF<Cap<10μF: 0.2V	Cap>4.7μF: 0.2V
Cap≥10μF: 0.1V	
0805	**1206/1210**
Cap<10μF: 1V	Cap≤10μF: 1V
Cap=10μF: 0.5V	10μF<Cap≤100μF: 0.5V
Cap>10μF: 0.2V	Cap>100μF: 0.2V

REQUIREMENTS:

T.C.	CAPACITANCE CHANGE
NP0	Within ±30ppm/°C
X7R	Within ±15%
X5R	Within +15%
X6S	Within +22%
Y5V	Within +30%/-80%

7. Adhesive Strength of Termination

TEST CONDITION:
- Pressurizing force: 5N (≤0603) and 10N (>0603)
- Test time: 10±1 sec.

REQUIREMENTS:
- No remarkable damage or removal of the terminations.

RELIABILITY TEST CONDITIONS AND REQUIREMENTS

<table>
<tr><th>NO.</th><th>ITEM</th><th>TEST CONDITION</th><th>REQUIREMENTS</th></tr>
<tr><td>8.</td><td>Vibration Resistance</td><td>- Vibration frequency: 10-55 Hz/min.
- Total amplitude: 1.5mm
- Test time: 6hrs. (Two hrs each in three mutually perpendicular directions.)
- Measurement to be made after keeping at room temp. for 24±2 hrs.</td><td>- No remarkable damage
- Cap change and Q/D.F.: To meet initial spec.</td></tr>
<tr><td>9.</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>
<tr><td>10.</td><td>Bending Test</td><td>- The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1 mm per second until the deflection becomes : 5 mm and then the pressure shall be maintained for 5±1 sec.
- Measurement to be made after keeping at room temp. for 24±2 hrs..

**SH21B224_101/SH31B226_100/SH31B106_160/SH31B106_250/SH31B225_500/SH31B474_101/SH31B105_101/SH32B476_6R3/SH32B226_160/SH32B106_250/SH32B225_500/SH32B475_500/SH32B106_500/SH32B225_101/SH21B105_500/SH21B225_250/SH21B475_160</td><td>- No remarkable damage
- Cap change:
NP0: within ±2.5% or ±0.5pF whichever is larger
X7R, X5R, X6S : within ±12.5%
Y5V: within ±30%
(This capacitance change the means change of capacitance under specified flexure of substrate from the capacitance measured before the test.)</td></tr>
<tr><td>11.</td><td>Resistance to Soldering Heat</td><td>- Solder temperature: 260±5°C
- Dipping time: 10±1sec
- Preheating: 120 to 150°C for 1 minute before immerse the capacitor in a eutectic solder
- Before initial measurement (Class II only): Perform 150+0/-10°C for 1 hr and then set for 24±2 hrs at room temp.
- Measurement to be made after keeping at room temp. for 24±2 hrs.</td><td>- No remarkable damage
- Cap change:
NP0: within ±2.5% or ±0.5pF whichever is larger
X7R, X5R, X6S : within ±7.5%
Y5V: within ±20%
- Q/D.F., I.R. and dielectric strength: To meet initial requirements.
- 25% max. leaching on each edge.</td></tr>
<tr><td>12.</td><td>Temperature Cycle</td><td>- Conduct the five cycles according to the temperatures and time.
<table>
<tr><th>STEP</th><th>TEMP. (°C)</th><th>TIME (MIN.)</th></tr>
<tr><td>1</td><td>Min. operating temp. +0/-3</td><td>30±3</td></tr>
<tr><td>2</td><td>Room Temp</td><td>2~3</td></tr>
<tr><td>3</td><td>Min. operating temp. +0/-3</td><td>30±3</td></tr>
<tr><td>4</td><td>Room Temp</td><td>2~3</td></tr>
</table>
- Before initial measurement (class ii only): perform 150+0/-10°C for 1 hr and then set for 24±2 hrs at room temp.
- Measurement to be made after keeping at room temp. for 24±2 hrs</td><td>- No remarkable damage
- Cap change:
NP0: within ±2.5% or ±0.25pF whichever is larger
X7R, X5R, X6S : within ±7.5%
Y5V: within ±20%
- Q/D.F., I.R. and dielectric strength: To meet initial requirements.</td></tr>
<tr><td>13.</td><td>Humidity (Damp Heat) Steady State</td><td>- Test temp.: 40±2°C
- Humidity 90~95% RH
- Test time: 500+24/-0 hrs
- Before initial measurement (Class II only): Perform 150+0/-10C for 1 hr and then set for 24±2 hrs at room temp.
- Measurement to be made after keeping at room temp. for 24±2 hrs.</td><td>- No remarkable damage
- Cap change:
NP0: within ±5% or ±0.5pF whichever is larger
X7R, X5R, X6S: ≥10V**, within ±12.5%; ≤6.3V within ±25%;
TT series & C≥ 1μF, within ±25%
**10V: 0603≥4.7μF;0402≥1μF;0201≥0.1μF, within ±25%;
Y5V: ≥10V, within ±30%; ≤6.3V, within +30/-40%
- Q/D.F. value:
NP0: More than 30pF Q≥350, 10pF≤C≤30pF, Q≥275+2.5C
Less than 10pF Q≥200+10C
X7R, X5R, X6S:
<table>
<tr><th>RATED</th><th>D.F. ≤</th><th>EXCEPTION OF D.F. ≤</th><th></th></tr>
<tr><td>≥100V</td><td>≤3%</td><td>≤6%</td><td>1206≥0.47μF</td></tr>
<tr><td></td><td></td><td>≤7.5%</td><td>0805>0.1μF, 0603≥0.068μF, 1206>1μF; 1210≥2.2μF; TT series</td></tr>
<tr><td>≥50V</td><td>≤3%</td><td>≤6%</td><td>0201(50V); 0603≥0.047μF; 0805≥0.18μF; 1206≥0.47μF</td></tr>
<tr><td></td><td></td><td>≤10%</td><td>0201(50V); 0603≥0.047μF; 0805≥0.18μF; 1206≥0.47μF</td></tr>
<tr><td></td><td></td><td>≤20%</td><td>0402≥0.1μF; 0603>0.1μF; 0805≥1μF; 1206≥2.2μF; 1210≥10μF; TT series</td></tr>
<tr><td>35V</td><td>≤5%</td><td>≤20%</td><td>1210≥0.047μF</td></tr>
<tr><td>25V</td><td>≤5%</td><td>≤10%</td><td>0201≥0.01μF; 0805≥0.01μF; 1210≥10μF</td></tr>
<tr><td></td><td></td><td>≤14%</td><td>0603≥0.33μF; 1206≥4.7μF</td></tr>
<tr><td></td><td></td><td>≤15%</td><td>0201≥0.1μF; 0402≥0.10μF; 0603≥0.47μF; 0805≥2.2μF; 1206≥6.8μF; 1210≥22μF; TT series</td></tr>
<tr><td>16V</td><td>≤5%</td><td>≤10%</td><td>0603≥0.5μF; 0805≥0.68μF; 1206≥2.2μF, 1210≥4.7μF</td></tr>
<tr><td></td><td></td><td>≤15%</td><td>0201≥0.01μF; 0402≥0.33μF; 0603≥0.68μF; 0805≥2.2μF; 1206≥4.7μF; 1210≥22μF;TT series</td></tr>
<tr><td>10V</td><td>≤7.5%</td><td>≤15%</td><td>0201≥0.012μF; 0402≥0.33μF (0402/X7R≥0.22μF); 0603≥0.33μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥22μF</td></tr>
<tr><td></td><td></td><td>≤20%</td><td>0201≥0.1μF; 0402≥1μF; TT series; 01R5</td></tr>
<tr><td>6.3V</td><td>≤15%</td><td>≤30%</td><td>0201≥0.1μF; 0402≥1μF; 0603≥10μF; 0805≥4.7μF; 1206≥47μF; 1210≥100μF; TT series</td></tr>
<tr><td>4V</td><td>≤20%</td><td>---</td><td>---</td></tr>
</table>
Y5V:
<table>
<tr><th>RATED VOL.</th><th>D.F. ≤</th><th>EXCEPTION OF D.F. ≤</th><th></th></tr>
<tr><td>≥50V</td><td>≤7.5%</td><td>≤10%</td><td>0603≥0.1μF; 0805≥0.47μF; 1206≥4.7μF</td></tr>
<tr><td></td><td></td><td>≤20%</td><td>1201≥6.8μF</td></tr>
<tr><td>35V</td><td>≤10%</td><td>---</td><td>---</td></tr>
<tr><td>25V</td><td>≤7.5%</td><td>≤10%</td><td>0402≥0.047μF; 0603≥0.1μF; 0805≥0.33μF;1206≥1μF; 1210≥4.7μF</td></tr>
<tr><td></td><td></td><td>≤15%</td><td>0402≥0.068μF; 0603≥0.47μF; 1206≥4.7μF; 1210≥22μF</td></tr>
<tr><td>16V (C<1.0 μF)</td><td>≤10%</td><td>≤12.5%</td><td>0402≥0.068μF; 0603≥0.68μF</td></tr>
<tr><td></td><td></td><td>≤20%</td><td>0402≥2.2μF</td></tr>
<tr><td>16V (C≥1.0 μF)</td><td>≤12.5%</td><td>≤20%</td><td>0603≥2.2μF; 0805≥3.3μF; 1206≥10μF;1210≥22μF; 1812≥47μF;</td></tr>
<tr><td>10V</td><td>≤20%</td><td>≤30%</td><td>0402≥0.47μF</td></tr>
<tr><td>10V</td><td>≤20%</td><td>---</td><td>---</td></tr>
</table>
*I.R.: ≥10V, 1GΩ OR 50 Ω-F whichever is smaller
Class II (X7R, X5R, X6S, Y5V):
<table>
<tr><th>RATED VOL.</th><th>INSULATION RESISTANCE</th></tr>
<tr><td>100V: X7R</td><td rowspan="8">1GΩ or RxC≥10 Ω-F whichever is smaller.</td></tr>
<tr><td>50V: 0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF</td></tr>
<tr><td>35V:0603≥1μF;0805≥2.2μF; 1206≥2.2μF;1210≥10μF</td></tr>
<tr><td>25V:0201≥0.1uF; 0402≥0.22μF; 0603≥2.2μF;0805≥2.2μF; 1206≥10μF;1210≥10μF</td></tr>
<tr><td>16V: 0201≥0.1uF;0402≥0.22μF;0603≥1μF;0805≥2.2μF; 1206≥10μF;1210≥47μF</td></tr>
<tr><td>10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF; 1206≥4.7μF;1210≥47μF</td></tr>
<tr><td>6.3V; 4V; TT series; All X6S items</td></tr>
</table></td></tr>
</table>

RELIABILITY TEST CONDITIONS AND REQUIREMENTS

<table>
<tr><th>NO.</th><th>ITEM</th><th>TEST CONDITION</th><th>REQUIREMENTS</th></tr>
<tr><td>14.</td><td>Humidity (Damp Heat) Load</td><td>- Test temp.: 40±2°C
- Humidity: 90~95%RH
- Test time: 500+24/-0 hrs.
- To apply voltage:rated voltage.
- Before initial measurement (Class II only): To apply test voltage for 1hr at 40°C and then set for 24±2 hrs at room temp.
- Measurement to be made after keeping at room temp. for 24±2 hrs.</td><td>- No remarkable damage
- Cap change:
NP0: ±7.5% or 0.75pF whichever is larger.
X7R, X5R, X6S: ≥10V**,within ±12.5%; ≤6.3V within ±25%;
TT series & C≥ 1uF,within ±25%
**10V: 0603≥4.7μF; 0402≥1μF; 0201≥0.1μF, within ±25%;
Y5V: ≥10V, within ±30%; ≤6.3V, within +30/-40%
Q/D.F. value:
NP0: C≥30pF,Q≥200;C<30pF, Q≥100+10/3C
X7R, X5R, X6S:
<table>
<tr><th>RATED</th><th>D.F. ≤</th><th>EXCEPTION OF D.F. ≤</th></tr>
<tr><td rowspan="2">≥100V</td><td rowspan="2">≤3%</td><td>≤6%</td><td>1206≥0.47μF</td></tr>
<tr><td>≤7.5%</td><td>0805>0.1μF, 0603≥0.068μF, 1206>1μF; 1210≥2.2μF; TT series</td></tr>
<tr><td rowspan="3">≥50V</td><td rowspan="3">≤3%</td><td>≤6%</td><td>0201(50V); 0603>0.047μF; 0805>0.18μF; 1206>0.47μF</td></tr>
<tr><td>≤10%</td><td>1210>4.7μF</td></tr>
<tr><td>≤20%</td><td>0402≥0.1μF; 0603>0.1μF; 0805≥1μF; 1206≥2.2μF; 1210≥10μF; TT series</td></tr>
<tr><td>35V</td><td>≤5%</td><td>≤20%</td><td>0603≥1μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥10μF</td></tr>
<tr><td rowspan="4">25V</td><td rowspan="4">≤5%</td><td>≤10%</td><td>0201≥0.01μF; 0805≥0.01μF; 1210≥10μF</td></tr>
<tr><td>≤14%</td><td>0603≥0.33μF; 1206≥4.7μF</td></tr>
<tr><td>≤15%</td><td>0201≥0.1μF; 0402≥0.10μF; 0603≥0.47μF; 0805≥2.2μF; 1206≥6.8μF; 1210≥22μF; TT series</td></tr>
<tr><td>≤20%</td><td>0402≥0.47μF</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">≤5%</td><td>≤10%</td><td>0603≥0.15μF; 0805≥0.68μF; 1206≥2.2μF, 1210≥4.7μF</td></tr>
<tr><td>≤15%</td><td>0201≥0.01μF; 0402≥0.33μF; 0603≥0.68μF; 0805≥2.2μF; 1206≥4.7μF; 1210≥22μF;TT series</td></tr>
<tr><td rowspan="2">10V</td><td rowspan="2">≤7.5%</td><td>≤15%</td><td>0201≥0.012μF; 0402≥0.33μF (0402/X7R≥0.22μF); 0603≥0.33μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥22μF</td></tr>
<tr><td>≤20%</td><td>0201≥0.1μF; 0402≥1μF; TT series; 01R5</td></tr>
<tr><td>6.3V</td><td>≤15%</td><td>≤30%</td><td>0201≥0.1μF; 0402≥1μF; 0603≥10μF; 0805≥4.7μF; 1206≥47μF; 1210≥100μF; TT series</td></tr>
<tr><td>4V</td><td>≤20%</td><td>---</td><td>---</td></tr>
</table>
Y5V
<table>
<tr><th>RATED VOL.</th><th>D.F. ≤</th><th>EXCEPTION OF D.F. ≤</th></tr>
<tr><td rowspan="2">≥50V</td><td rowspan="2">≤7.5%</td><td>≤10%</td><td>0603≥0.1μF; 0805≥0.47μF; 1206≥4.7μF</td></tr>
<tr><td>≤20%</td><td>1201≥6.8μF</td></tr>
<tr><td>35V</td><td>≤10%</td><td>---</td><td>---</td></tr>
<tr><td rowspan="2">25V</td><td rowspan="2">≤7.5%</td><td>≤10%</td><td>0402≥0.047μF; 0603≥0.1μF; 0805≥0.33μF;1206≥1μF; 1210≥4.7μF</td></tr>
<tr><td>≤15%</td><td>0402≥0.068μF; 0603≥0.47μF; 1206≥4.7μF; 1210≥22μF</td></tr>
<tr><td rowspan="2">16V (C<1.0 μF)</td><td rowspan="2">≤10%</td><td>≤12.5%</td><td>0402≥0.068μF; 0603≥0.68μF</td></tr>
<tr><td>≤20%</td><td>0402≥2.2μF</td></tr>
<tr><td>16V (C≥1.0 μF)</td><td>≤12.5%</td><td>≤20%</td><td>0603≥2.2μF; 0805≥3.3μF; 1206≥10μF;1210≥22μF; 1812≥47μF;</td></tr>
<tr><td>10V</td><td>≤20%</td><td>≤30%</td><td>0402≥0.47μF</td></tr>
<tr><td>6.3V</td><td>≤30%</td><td>---</td><td>---</td></tr>
</table>
*I.R.: ≥10V, 1GΩ OR 50 Ω-F whichever is smaller
Class II (X7R, X5R, X6S, Y5V)
<table>
<tr><th>RATED VOL.</th><th>INSULATION RESISTANCE</th></tr>
<tr><td>100V: X7R</td><td rowspan="8">500MΩ or RxC≥5 Ω-F whichever is smaller.</td></tr>
<tr><td>50V: 0402>0.01μF; 0603≥1μF; 0805≥1μF; 1206≥4.7μF; 1210≥4.7μF</td></tr>
<tr><td>35V: 0603≥1μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥10μF</td></tr>
<tr><td>25V:0201≥0.1uF; 0402≥0.22μF; 0603≥2.2μF;0805≥2.2μF; 1206≥10μF;1210≥10μF</td></tr>
<tr><td>16V: 0201≥0.1uF;0402≥0.22μF;0603≥1μF;0805≥2.2μF; 1206≥10μF;1210≥47μF</td></tr>
<tr><td>10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF; 1206≥4.7μF;1210≥47μF</td></tr>
<tr><td>6.3V; 4V; TT series; All X6S items</td></tr>
</table></td></tr>
</table>

RELIABILITY TEST CONDITIONS AND REQUIREMENTS

NO.	ITEM	TEST CONDITION	REQUIREMENTS
15.	High Temperature Load (Endurance)	- Test temp.: NP0, X7R/X7E: 125±3°C X6S: 105±3°C X5R, Y5V: 85±3°C - Test time: 1000+24/-0 hrs - To apply voltage: (1) ≤6.3V or C≥10μF or TT series:150% of rated voltage. (2) 10V≤Ur<500V: 200% of rated voltage. (3) 500V: 150% of rated voltage. (4) Ur≥630V: 120% of rated voltage. (5) 100% of rated voltage for below range.	- No remarkable damage - Cap change: NP0: ±3.0% or ±0.3pF whichever is larger X7R, X5R, X6S: ≥10V**,within ±12.5%; ≤6.3V within ±25%; TT series & C≥ 1uF,within ±25% **10V: 0603≥4.7μF; 0402≥1μF; 0201≥0.1μF, within ±25%; Y5V: ≥10V, within ±30%; ≤6.3V, within +30/-40% Q/D.F. value: NP0: More than 30pF, Q≥350 10pF≤C<30pF, Q≥275+2.5C Less than 10pF, Q≥200+10C

SIZE	DIALECTRIC	RATED VOLTAGE	CAPACITANCE RANGE
0201	X5R/X7R/X6S	≤10V	C≥0.1μF
0402	X5R/X7R/X6S/Y5V	6.3V, 10V, 16V, 25V	C≥1.0μF
0603	X5R/X7R/X6S	4V	C≥22μF
		6.3V, 10V	C≥4.7μF
		25V, 35V	C≥1.0μF
0805	X5R/X7R/X6S	4V	C≥47μF
		6.3V	C≥22μF
		10V~50V	C≥10μF
1206	X5R/X7R/X6S	≤6.3V	C≥47μF
	NP0	3000V	C≥1.5μF
1210	X5R/X7R/X6S	16V	C≥47μF
TT18	Y5V	6.3V, 10V	C≥2.2μF
TT21	Y5V	6.3V	C≥10μF
TT31	Y5V	6.3V	C≥22μF

**1WV items must follow de-rating conditions

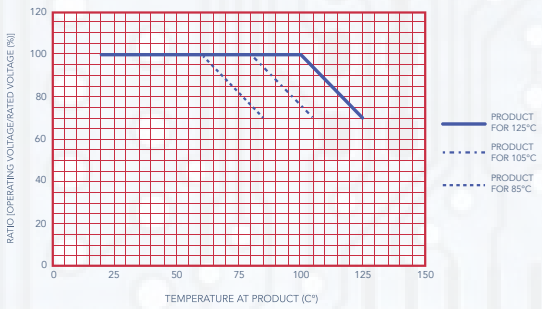
(6) 150% of rated voltage for below range.

SIZE	DIALECTRIC	RATED VOLTAGE	CAPACITANCE RANGE
0201	X5R/X7R/X6S	16V/25V	C≥0.1μF
0402	X5R/X7R/X6S	50V	C≥0.1μF
		10~25V	C≥0.22μF
	Y5V	16V	C≥0.47μF
0603	X7R	50V	C≥0.1μF
	X5R/X7R/X6S	10V, 16V, 50V	C≥1.0μF
	Y5V	16V	C≥2.2μF
0805	X5R/X7R/X6S	10~50V	C≥4.7μF
	X5R/X7R	50V	C≥2.2μF
		100V	C≥0.47μF
	Y5V	16V	C≥4.7μF
1206	X5R/X7R/X6S	100V	C≥1.0μF
1210	X5R/X7R/X6S	50~100V	C≥2.2μF
1825	X7R	100V~250V	C≥1.0μF
2220			
2225			

*Before initial measurement (Class II only): To apply test voltage for 1hr at test temp. and then set for 24±2 hrs at room temp.

*Measurement to be made after keeping at room temp. for 24±2 hrs

**De-rating conditions:



X7R, X5R, X6S:

RATED	D.F. ≤	EXCEPTION OF D.F. ≤	
≥100V	≤3%	≤6%	1206≥0.47μF
		≤7.5%	0805>0.1μF, 0603≥0.068μF, 1206>1μF; 1210≥2.2μF; TT series
≥50V	≤3%	≤6%	0201(50V); 0603>0.047μF; 0805>0.18μF; 1206>0.47μF
		≤10%	1210>4.7μF
		≤20%	0402≥0.1μF; 0603>0.1μF; 0805≥1μF; 1206≥2.2μF; 1210≥10μF; TT series
35V	≤5%	≤20%	0603≥1μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥10μF
25V	≤5%	≤10%	0201≥0.01μF; 0805≥0.01μF; 1210≥10μF
		≤14%	0603≥0.33μF; 1206≥4.7μF
		≤15%	0201≥0.1μF; 0402≥0.10μF; 0603≥0.47μF; 0805≥2.2μF; 1206≥6.8μF; 1210≥22μF; TT series
		≤20%	0402≥0.47μF
16V	≤5%	≤10%	0603≥0.15μF; 0805≥0.68μF; 1206≥2.2μF, 1210≥4.7μF
		≤15%	0201≥0.01μF; 0402≥0.33μF; 0603≥0.68μF; 0805≥2.2μF; 1206≥4.7μF; 1210≥22μF;TT series
10V	≤7.5%	≤15%	0201≥0.012μF; 0402≥0.33μF (0402/X7R≥0.22μF); 0603≥0.33μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥22μF
		≤20%	0201≥0.1μF; 0402≥1μF; TT series; 01R5
6.3V	≤15%	≤30%	0201≥0.1μF; 0402≥1μF; 0603≥10μF; 0805≥4.7μF; 1206≥47μF; 1210≥100μF; TT series
4V	≤20%	---	---

Y5V

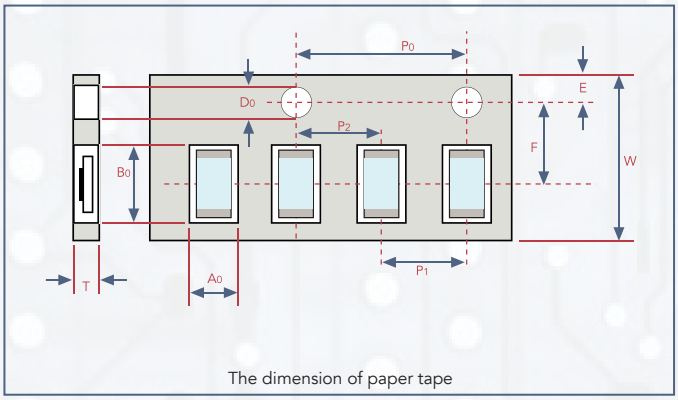
RATED VOL.	D.F. ≤	EXCEPTION OF D.F. ≤	
≥50V	≤7.5%	≤10%	0603≥0.1μF; 0805≥0.47μF; 1206≥4.7μF
		≤20%	1201≥6.8μF
35V	≤10%	---	---
25V	≤7.5%	≤10%	0402≥0.047μF; 0603≥0.1μF; 0805≥0.33μF;1206≥1μF; 1210≥4.7μF
		≤15%	0402≥0.068μF; 0603≥0.47μF; 1206≥4.7μF; 1210≥22μF
16V (C<1.0 μF)	≤10%	≤12.5%	0402≥0.068μF; 0603≥0.68μF
		≤20%	0402≥2.2μF
16V (C≥1.0 μF)	≤12.5%	≤20%	0603≥2.2μF; 0805≥3.3μF; 1206≥10μF;1210≥22μF; 1812≥47μF;
10V	≤20%	≤30%	0402≥0.47μF
6.3V	≤30%	---	---

*I.R.: ≥10V, 1GΩ OR 50 Ω-F whichever is smaller

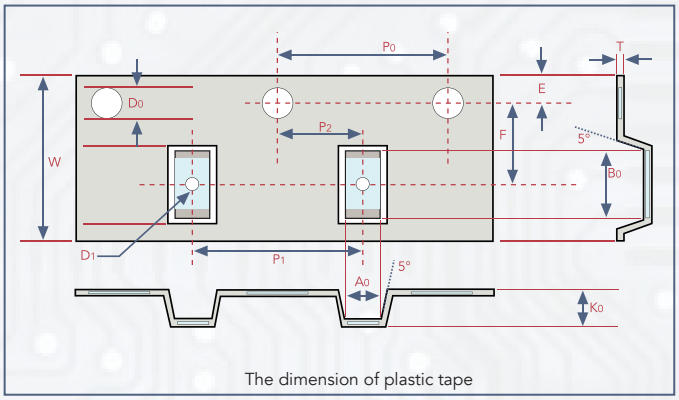
Class II (X7R, X5R, X6S, Y5V)

RATED VOL.	INSULATION RESISTANCE
100V: X7R	1GΩ or RxC≥10 Ω-F whichever is smaller.
50V: 0402>0.01μF; 0603≥1μF; 0805≥1μF; 1206≥4.7μF; 1210≥4.7μF	
35V: 0603≥1μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥10μF	
25V:0201≥0.1uF; 0402≥0.22μF; 0603≥2.2μF;0805≥2.2μF; 1206≥10μF;1210≥10μF	
16V: 0201≥0.1uF;0402≥0.22μF;0603≥1μF;0805≥2.2μF; 1206≥10μF;1210≥47μF	
10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF; 1206≥4.7μF;1210≥47μF	
6.3V; 4V; TT series; All X6S items	

TAPE & REEL DIMENSIONS

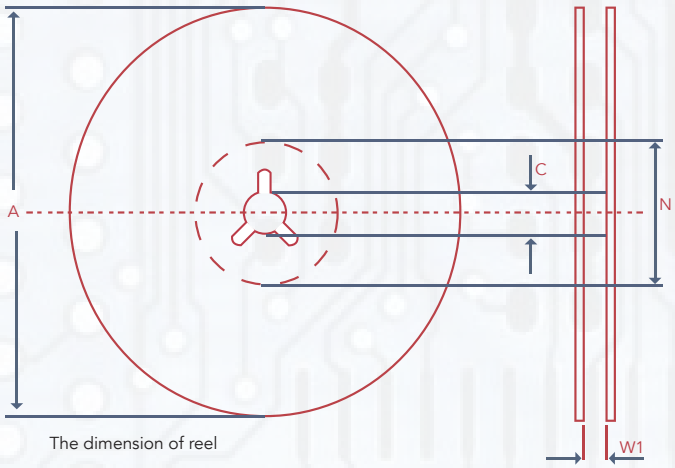


The dimension of paper tape



The dimension of plastic tape

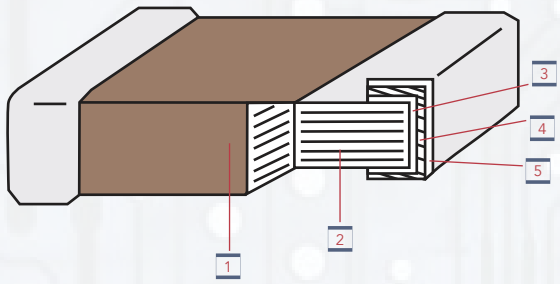
SIZE	0402	0603	0805			1206			1210		1812		1825		2220		2225	
THICKNESS	E	S, X	A	B	C, D, I	B	C, J, D	G, P	C, D, G, K	M	D, G, K	M , U	K	M , U	K	M , U	K	M , U
A_0	0.70+/-0.2	1.05+/-0.30	1.05+/-0.20	1.05+/-0.20	<1.80	1.90+/-0.50	<2.00	<2.30	<3.05	<3.20	<3.90	<3.90	<6.80	<6.80	<5.80	<5.80	<6.80	<6.80
B_0	1.20+/-0.2	1.80+/-0.30	2.30+/-0.20	2.30+/-0.20	<2.70	3.50+/-0.50	<3.70	<4.00	<3.80	<3.95	<5.30	<5.30	<5.30	<5.30	<6.50	<6.50	<6.50	<6.50
T	≤0.80	≤1.20	≤1.15		0.23+/-0.1	≤1.30	0.23+/-0.1	0.23+/-0.1	0.23+/-0.1	0.23+/-0.1	0.25+/-0.1	0.25+/-0.1	0.30+/-0.1	0.30+/-0.1	0.30+/-0.1	0.30+/-0.1	0.30+/-0.1	0.30+/-0.1
K_0	-	-	-	-	<2.50	-	<2.50	<2.50	<2.50	<3.00	<2.50	<3.50	<2.50	<3.50	<2.50	<3.50	<2.50	<3.50
W	8.00+/-0.10	8.00+/-0.10	8.00+/-0.10	8.00+/-0.10	8.00+/-0.20	8.00+/-0.10	8.00+/-0.20	8.00+/-0.20	8.00+/-0.20	8.00+/-0.20	12.00+/-0.20	12.00+/-0.20	12.00+/-0.30	12.00+/-0.30	12.00+/-0.30	12.00+/-0.30	12.00+/-0.30	12.00+/-0.30
P_0	4.00+/-0.10	4.00+/-0.10	4.00+/-0.10	4.00+/-0.10	4.00+/-0.10	4.00+/-0.10	4.00+/-0.10	4.00+/-0.10	4.00+/-0.10	4.00+/-0.10	4.00+/-0.10	4.00+/-0.10	4.00+/-0.10	4.00+/-0.10	4.00+/-0.10	4.00+/-0.10	4.00+/-0.10	4.00+/-0.10
10 X P_0	40.00+/-0.10	40.00+/-0.20	40.00+/-0.20	40.00+/-0.20	40.00+/-0.20	40.00+/-0.20	40.00+/-0.20	40.00+/-0.20	40.00+/-0.20	40.00+/-0.20	40.00+/-0.20	40.00+/-0.20	40.00+/-0.20	40.00+/-0.20	40.00+/-0.20	40.00+/-0.20	40.00+/-0.20	40.00+/-0.20
P_1	2.00+/-0.05	4.00+/-0.10	4.00+/-0.10	4.00+/-0.10	4.00+/-0.10	4.00+/-0.10	4.00+/-0.10	4.00+/-0.10	4.00+/-0.10	4.00+/-0.10	8.00+/-0.10	8.00+/-0.10	8.00+/-0.10	8.00+/-0.10	8.00+/-0.10	8.00+/-0.10	8.00+/-0.10	8.00+/-0.10
P_2	2.00+/-0.05	2.00+/-0.05	2.00+/-0.05	2.00+/-0.05	2.00+/-0.05	2.00+/-0.05	2.00+/-0.05	2.00+/-0.05	2.00+/-0.05	2.00+/-0.05	2.00+/-0.10	2.00+/-0.10	2.00+/-0.10	2.00+/-0.10	2.00+/-0.10	2.00+/-0.10	2.00+/-0.10	2.00+/-0.10
D_0	1.55+/-0.05	1.55+/-0.05	1.55+/-0.05	1.55+/-0.05	1.55+/-0.05	1.55+/-0.05	1.50+/-0.05	1.50+/-0.05	1.50+/-0.05	1.50+/-0.05	1.50+/-0.05	1.50+/-0.05	1.50+0.1/-0	1.50+.1/-0	1.50+0.1/-0	1.50+.1/-0	1.50+0.1/-0	1.50+.1/-0
D_1	-	-	-	-	1.00+/-0.10	-	1.00+/-0.10	1.00+/-0.10	1.00+/-0.10	1.00+/-0.10	1.50+/-0.10	1.50+/-0.10	1.50+/-0.10	1.50+/-0.10	1.50+/-0.10	1.50+/-0.10	1.50+/-0.10	1.50+/-0.10
E	1.75+/-0.05	1.75+/-0.05	1.75+/-0.05	1.75+/-0.05	1.75+/-0.05	1.75+/-0.05	1.75+/-0.05	1.75+/-0.05	1.75+/-0.05	1.75+/-0.05	1.75+/-0.05	1.75+/-0.05	1.75+/-0.10	1.75+/-0.10	1.75+/-0.10	1.75+/-0.10	1.75+/-0.10	1.75+/-0.10
F	3.50+/-0.05	3.50+/-0.05	3.50+/-0.05	3.50+/-0.05	3.50+/-0.05	3.50+/-0.05	3.50+/-0.05	3.50+/-0.05	3.50+/-0.05	3.50+/-0.05	5.50+/-0.10	5.50+/-0.10	5.50+/-0.05	5.50+/-0.05	5.50+/-0.05	5.50+/-0.05	5.50+/-0.05	5.50+/-0.05



The dimension of reel

SIZE	0402, 0603, 0805, 1206, 1210			1812, 1825, 2220, 2225
REEL SIZE	7″	10″	13″	7″
C	13.0+0.5/-0.2	13.0+0.5/-0.2	13.0+0.5/-0.2	13.0+0.5/-0.2
W_1	8.4+1.5/-0	8.4+1.5/-0	8.4+1.5/-0	12.4+2.0/-0
A	178.0±1.0	250.0±1.0	330.0±1.0	178.0±1.0
N	60.0+1.0/-0	100+1.0	100+1.0	60.0+1.0/-0

CONSTRUCTION



	NAME		NP0, X7R, X5R, Y5V
1	Ceramic Material		$BaTiO_3$ based
2	Inner electrode		Ni
3	Termination	Inner layer	Cu
4		Middle layer	Ni
5		Outer layer	Sn

STORAGE AND HANDLING CONDITIONS

(1) To store products at 5 to 40°C 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.

Cautions:

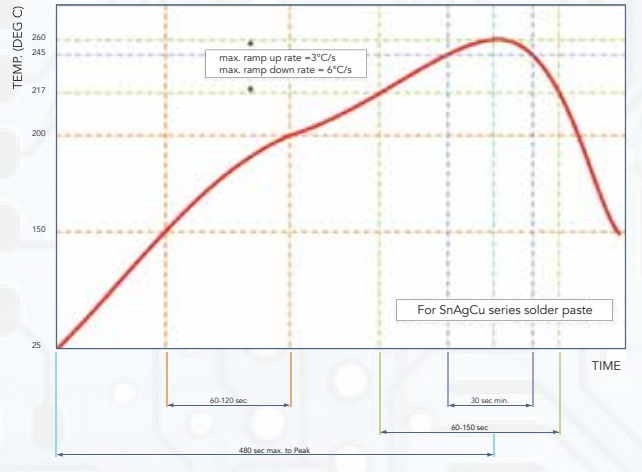
a. The corrosive gas reacts on the terminal electrodes of capacitors, and results in the poor solderability. Do not store the capacitors in the ambience of corrosive gas (e.g., hydrogen sulfide, sulfur dioxide, chlorine, ammonia gas etc.)

b. In corrosive atmosphere, solderability might be degraded, and silver migration might occur to cause low reliability.

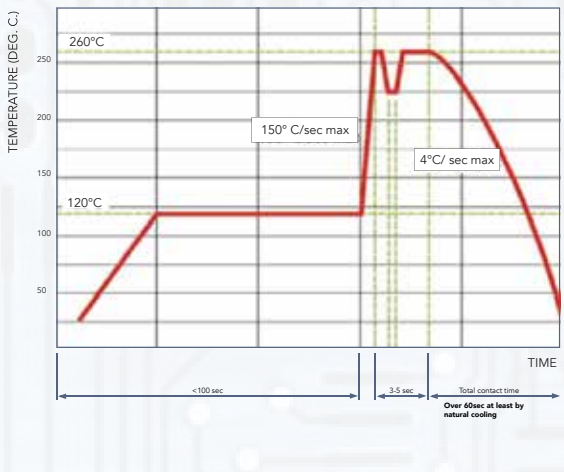
c. Due to the dewing by rapid humidity change, or the photochemical change of the terminal electrode by direct sunlight,the solderability and electrical performance may deteriorate. Do not store capacitors under direct sunlight or dewing condition. To store products on the shelf and avoid exposure to moisture.

RECOMMENDED SOLDERING CONDITIONS

The lead-free termination MLCCs are not only to be used on SMT against lead-free solder paste, but also suitable against lead-containing solder paste. If the optimized solder joint is requested, increasing soldering time, temperature and concentration of N_2 within oven are recommended.



Recommeded reflow soldering profile for SMT process with SnAgCu series paste.



Recommeded reflow soldering profile for SMT process with SnAgCu series paste.

59 Steamwhistle Drive, Ivyland, PA 18974 | p. 215.942.8900 | www.calchip.com | quotes@calchip.com