

HIGH Q/LOW ESR MULTILAYER CERAMIC CHIP CAPACITORS

- GHQ SERIES -

SCOPE

- Used at high frequencies, small temperature coefficient of capacitance, typical within $\pm 30\text{ppm}/^\circ\text{C}$ required for NPO (COG) classification.
- Excellent conductivity internal electrode

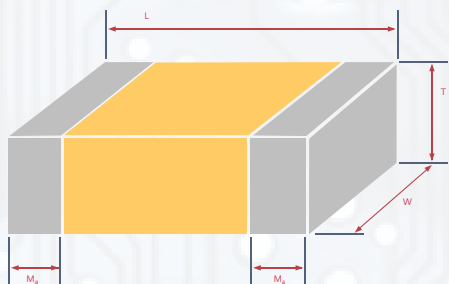
FEATURES

- High Q and low ESR performance at high frequency.
- Quality improvement of telephone calls for low power loss and better performance

APPLICATIONS

- Mobile telecommunication; mobile phones, WLAN
- RF module: power amplifier, VCO
- Tuners

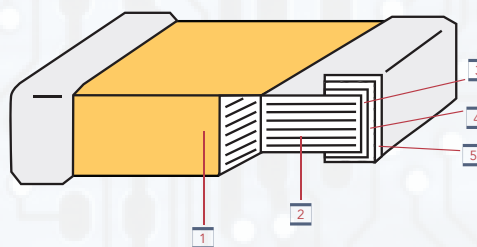
CONSTRUCTION AND DIMENSIONS



SIZE INCH (MM)	L (MM)	W (MM)	T (MM)	REMARK	M ₀ (MM)
0201 (0603)	0.6 \pm 0.03	0.3 \pm 0.03	0.3 \pm 0.03	#	0.15 \pm 0.05
0402 (1005)	1.00 \pm 0.05	0.50 \pm 0.05	0.50 \pm 0.05	#	0.25 \pm 0.05/-0.10
0603 (1608)	1.60 \pm 0.10	0.80 \pm 0.10	0.80 \pm 0.07		0.40 \pm 0.15
	1.60 \pm 0.15/-0.10	0.80 \pm 0.15/-0.10	0.80 \pm 0.15/-0.10		
0805 (2012)	2.00 \pm 0.15	1.25 \pm 0.10	0.80 \pm 0.10		0.50 \pm 0.20
			1.25 \pm 0.10	#	

#Reflow soldering only is recommended

NO.	NAME	NPO	
1	Ceramic Material	CaZrO ₃	
2	Inner electrode	Ni	
3	Termination	Inner layer	Cu
4		Middle layer	Ni
5		Outer layer	Sn



ORDERING INFORMATION

GHQ	10	CG	101	J	100	N	T
PRODUCT TYPE	SIZE	DIELECTRIC	CAPACITANCE	TOLERANCE	RATED VOLTAGE	TERMINATION	PACKAGING
	02 - 0201 (0603) 04 - 0402 (1005) 10 - 0603 (1608) 21 - 0805 (2012)	CG - NPO (C0G)	Two significant digits followed by no. of zeros. Use R in place of decimal point.	A: $\pm 0.05\text{pF}$ B: $\pm 0.1\text{pF}$ C: $\pm 0.25\text{pF}$ D: $\pm 0.5\text{pF}$ F: $\pm 1\%$ G: $\pm 2\%$ J: $\pm 5\%$	25 - 25 VDC 50 - 50 VDC 100 - 100 VDC 200 - 200 VDC 250 - 250 VDC 500 - 500 VDC 630 - 630 VDC	N: Cu/Ni/Sn	T: 7" reel TD: 13" reel



CAPACITANCE RANGE

DIMENSION (MM)		GHQ02			GHQ04			GHQ10				GHQ21						
L(L1)		0.6+/-0.03			1.00±0.05			1.60±-.10		1.60+0.15/-0.10		2.00±0.15						
W		0.3+/-0.03			0.50±0.05			0.80±0.10		0.80+0.15/-0.10		1.25±0.10						
BW(L2/L3)		0.15+/-0.05			0.25+0.05/-0.10			0.40±0.15				0.50±0.20						
Dielectric		NPO			COG			COG				COG						
H (max)			0.33		0.55			0.87		0.95		0.9			1.35			
Rated Voltage		10	16	25	16	25	50	16	25	50	100	50	100	200	250	500	630	
Cap. Range																		
0.3pF	0R3																	
0.4pF	0R4																	
0.5	0R5																	
0.6	0R6																	
0.7	0R7																	
0.8	0R8																	
0.9	0R9																	
1	1R0																	
1.2	1R2																	
1.5	1R5																	
1.8	1R8																	
2.2	2R2																	
2.7	2R7																	
3.3	3R3																	
3.9	3R9																	
4.7	4R7																	
5.6	5R6																	
6.8	6R8																	
8.2	8R2																	
10pF	100																	
12	120																	
15	150																	
18	180																	
22	220																	
27	270																	
33	330																	
39	390																	
47	470																	
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																	
1000	102																	
1200	122																	
1500	152																	
1800	182																	
2200	222																	
2700	272																	
3300	332																	

1. 0402, Capacitance <0.5pF, on request

2. For more information about products with special capacitance or other data, please contact your Cal-Chip Sales Representative



Cal-Chip
Electronics Inc.



GENERAL ELECTRICAL DATA

DIELECTRIC	NP0
SIZE	0201, 0402, 0603, 0805
CAPACITANCE RANGE	0201: 0.1pF to 3300pF 0402: 0.5pF to 470pF** 0603: 0.5pF to 3300pF 0805: 0.5pF to 390pF
CAPACITANCE TOLERANCE**	Cap≤5pF: A(±0.05pF), B(±0.1pF), C(±0.25pF) 5pF<Cap<10pF: C(±0.25pF), D(±0.5pF) Cap≥10pF: F(±1%), G(±2%), J(±5%)
RATED VOLTAGE (WVDC)	16V, 25V, 50V, 100V, 200V, 250V, 500V, 630V
Q*	Cap<30pF: Q≥400+20C Cap≥30pF: Q≥1000
INSULATION RESISTANCE AT UR	≥10GΩ or RxC≥100Ω - F whichever is smaller
OPERATING TEMPERATURE	-55° to +125°C
CAPACITANCE CHARACTERISTIC	±30ppm/°C
TERMINATION	Ni/Si (lead-free termination)

#1: NP0, 0.1pF product only provide B tolerance

*Measured at the condition of 25°C ambient temperature 30~70% related humidity.

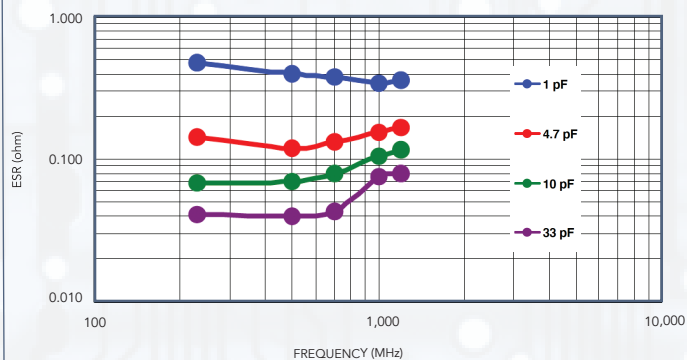
Apply 1.0±0.2Vrms, 1.0MHz±10% for Caps1000pF and 1.0±0.2Vrms, 1.0kHz±10% for Cap>1000pF.

**0402, Capacitance <0.5pF: On request.

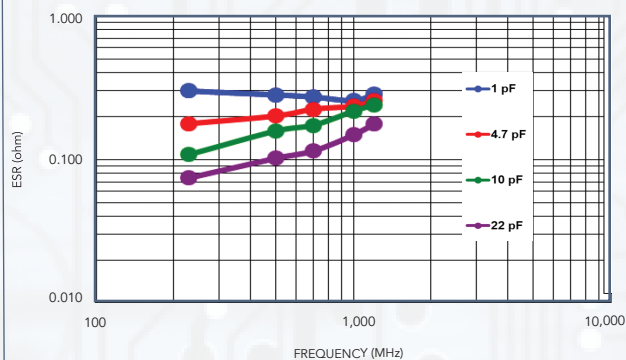


ELECTRICAL CHARACTERISTICS

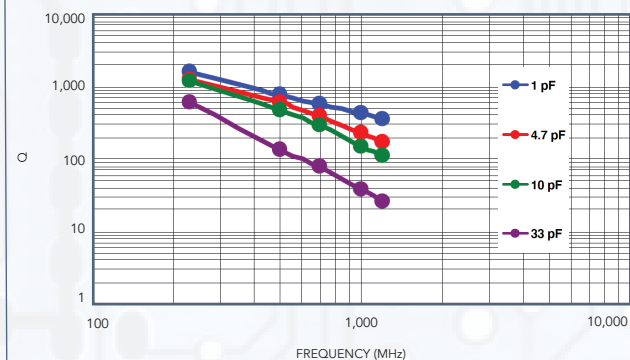
ESR vs FREQUENCY 0201



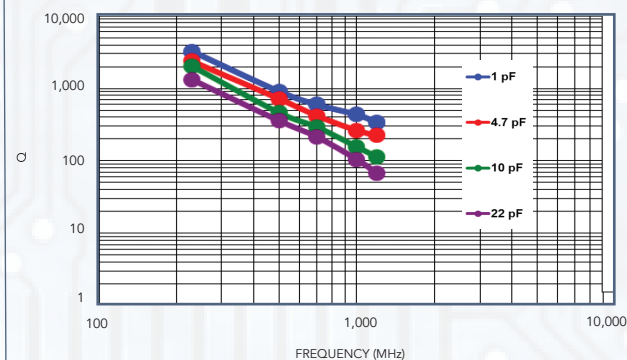
ESR vs FREQUENCY 0402



Q vs FREQUENCY 0201



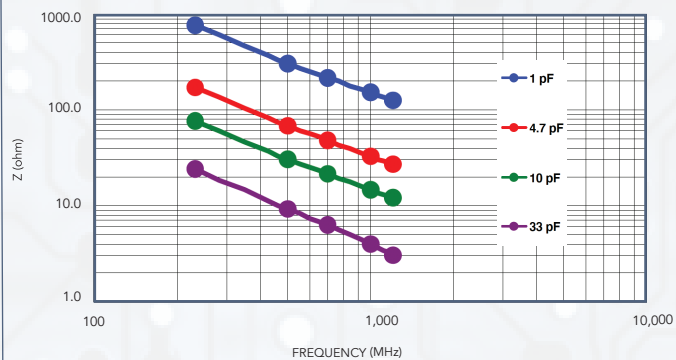
Q vs FREQUENCY 0402



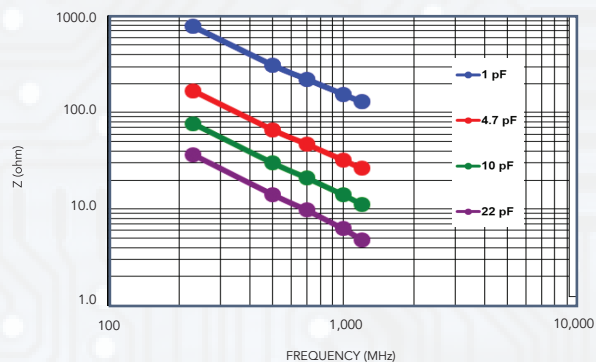


ELECTRICAL CHARACTERISTICS

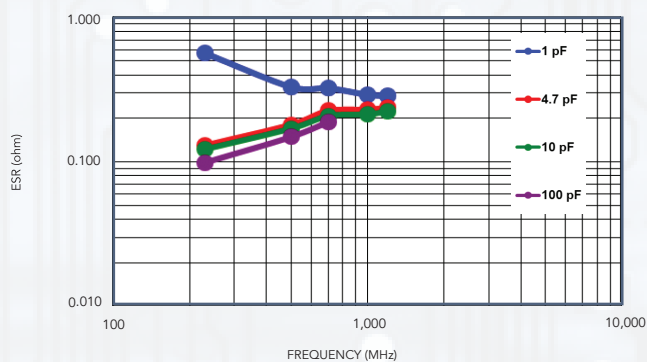
Z vs FREQUENCY 0201



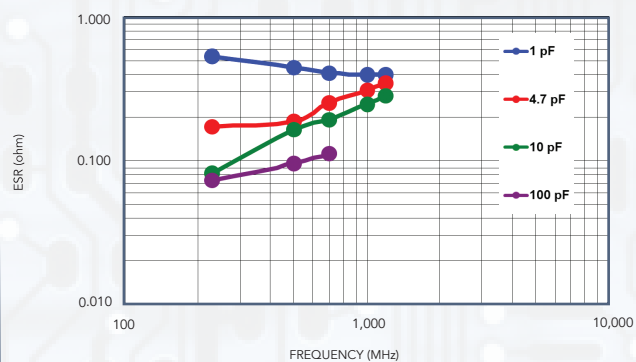
Z vs FREQUENCY 0402



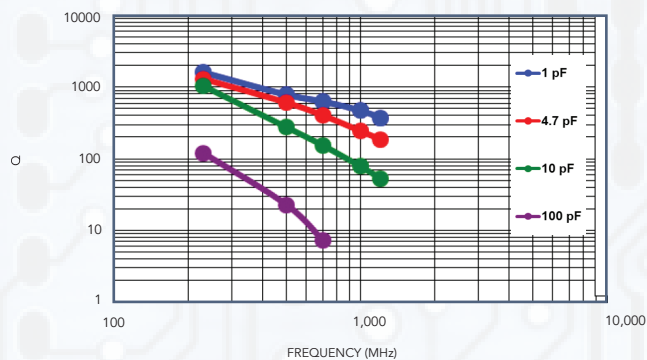
ESR vs FREQUENCY 0603



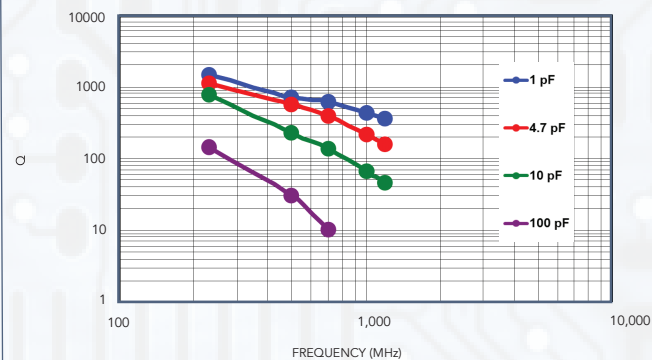
ESR vs FREQUENCY 0805



Q vs FREQUENCY 0603

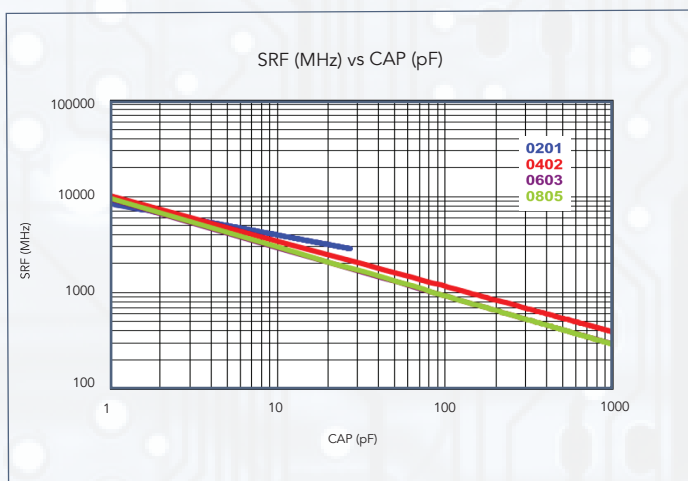
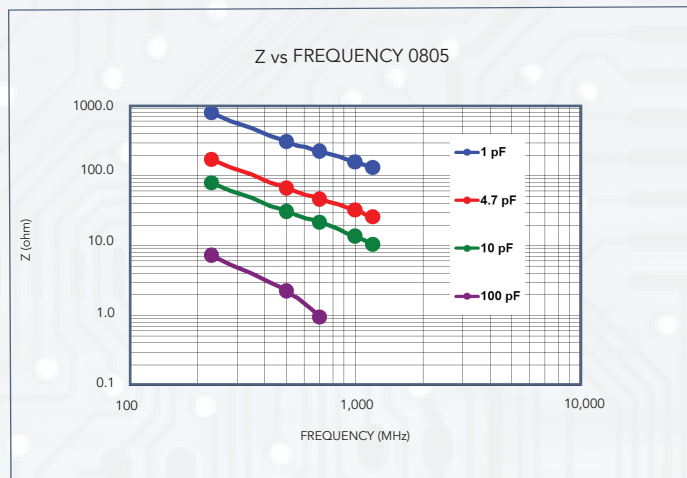
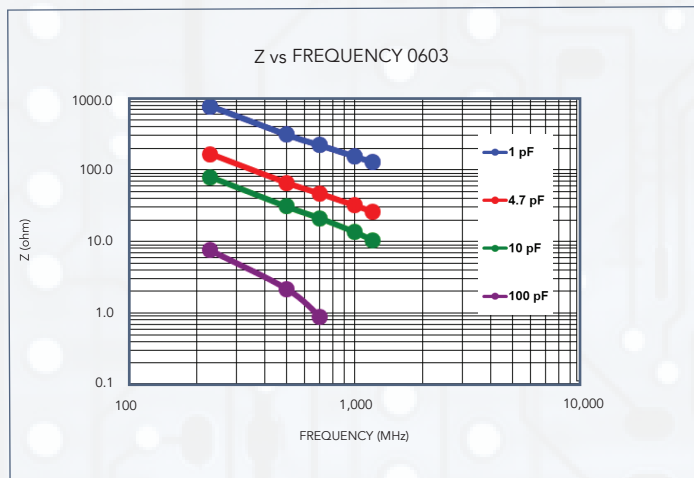


Q vs FREQUENCY 0805





ELECTRICAL CHARACTERISTICS



RELIABILITY TEST CONDITIONS AND REQUIREMENTS

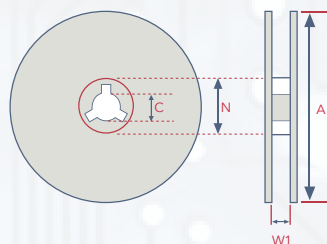
NO.	ITEM	TEST CONDITION	REQUIREMENTS															
1.	Visual and Mechanical	----	- No remarkable defect. - Dimensions to conform to individual specification sheet.															
2.	Capacitance	Cap≤1000pF, 1.0±0.2Vrms I 1MHz±10% Cap>1000pF, 1.0±0.2Vrms I 1KHz±10% At 25°C ambient temperature.	- Shall not exceed the limits given in the detailed spec.															
3.	Q/D.F. (Dissapation Factor)		NP0: Cap≥30pF, Q≥1000; Cap<30pF, Q≥400+20C															
4.	Dielectric Strength	- To apply (≤100V) 250% of rated voltage. - Duration 1 to 5 seconds - Charge and discharge current less than 50mA. - To apply (≤100V) 250% 200V - 300V ≥2 times VDC 500V - 999V ≥1.5 times VDC - Cut-off, set at 10mA - TEST = 15 sec. - RAMP = 0	- No evidence of damage or flas over during test.															
5.	Insulation Resistance	- Rated Voltage: <200V - To Apply rated voltage for max. 120 sec.	≥10GΩ															
		- Rated Voltage: 200~630V - To Apply rated voltage (500V max.) for 60 sec.	≥10GΩ or RxC≥100Ω-F whichever is smaller															
6.	Temperature Coefficient	- With no electrical load. - Operating temperature: -55°~125°C at 25°C	- Capacitance change: within ±30ppm/°C															
7.	Adhesive Strength of Termination	- Pressurizing force: 5N (≤0603) and 10N (>0603) - Test time: 10±1 sec.	- No remarkable damage or removal of the terminations.															
8.	Vibration Resistance	- 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.	- No remarkable damage - Cap change and Q/D.F.: To meet initial spec.															
9.	Solderability	- Solder temperature: 235±5°C - Dipping time 2±0.5 sec.	- 95% min. coverage of all metalized area.															
10.	Bending Test	- 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 1 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..	- No remarkable damage - Cap change: within ±5% or 0.5pF whichever is larger (This capacitance change the means change of capacitance under specified flexure of substrate from the capacitance measured before the test.)															
11.	Resistance to Soldering Heat	- 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.	- No remarkable damage - Cap change: within ±2.5% or ±0.25pF whichever is larger - Q/D.F., I.R. and dielectric strength: To meet initial requirements. - 25% max. leaching on each edge.															
12.	Temperature Cycle	- 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	STEP	TEMP. (°C)	TIME (MIN.)	1	Min. operating temp. +0/-3	30±3	2	Room Temp	2~3	3	Min. operating temp. +0/-3	30±3	4	Room Temp	2~3	- No remarkable damage - Cap change: within ±2.5% or ±0.25pF whichever is larger - Q/D.F., I.R. and dielectric strength: To meet initial requirements.
STEP	TEMP. (°C)	TIME (MIN.)																
1	Min. operating temp. +0/-3	30±3																
2	Room Temp	2~3																
3	Min. operating temp. +0/-3	30±3																
4	Room Temp	2~3																
13.	Humidity (Damp Heat) Steady State	- 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.	- No remarkable damage - Cap change: within ±5% or ±0.5pF whichever is larger - Q/D.F. value NP0: Cap≥30pF, Q≥350, 10pF≤Cap≤30pF, Q≥275+2.5C Cap<10pF, Q≥200+10C -I.R.: ≥1GΩ or RxC≥50Ω -F whichever is smaller															



RELIABILITY TEST CONDITIONS AND REQUIREMENTS

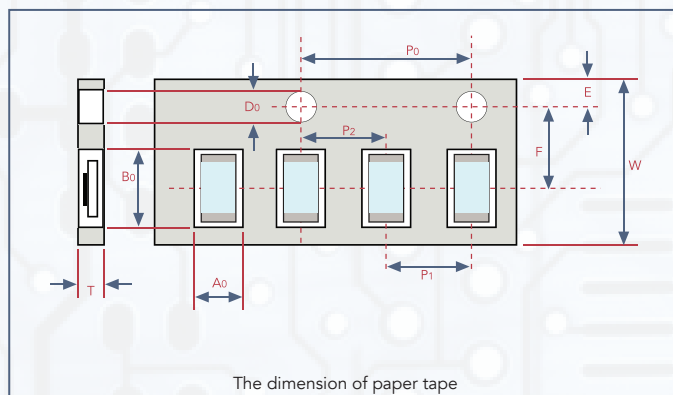
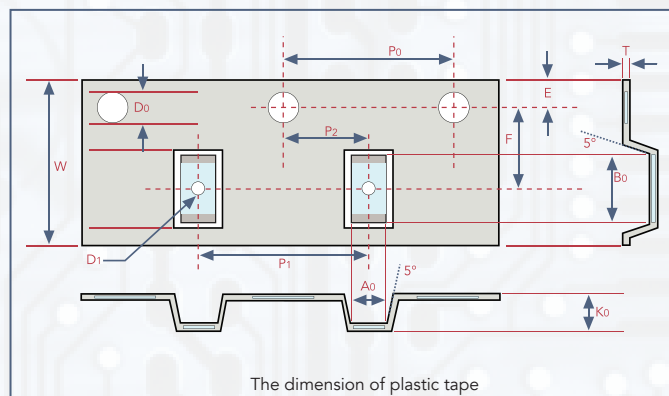
NO.	ITEM	TEST CONDITION	REQUIREMENTS
14.	Humidity (Damp Heat) Load	<ul style="list-style-type: none"> - Test temp.: $40\pm 2^{\circ}\text{C}$ - Humidity 90~95% RH - Test time: 500+24/-0 hrs - To apply voltage: rated voltage (Max. 500V) - Before initial measurement (Class II only): To apply test voltage for 1 hr at 40°C and then set for 24\pm2 hrs at room temp. - Measurement to be made after keeping at room temp. for 24\pm2 hrs. 	<ul style="list-style-type: none"> - No remarkable damage - Cap change: within $\pm 7.5\%$ or $\pm 0.75\text{pF}$ whichever is larger - Q/D.F. value: NP0: Cap$\geq 30\text{pF}$, Q≥ 350; 10pF\leqCap$< 30\text{pF}$, Q$\geq 100+10/3\text{C}$ - I.R.: $\geq 1\text{G}\Omega$ or RxC$\geq 25\Omega\cdot\text{F}$ whichever is smaller
15	Humidity Temperature Load (Endurance)	<ul style="list-style-type: none"> - Test temp.: NP0: $125\pm 3^{\circ}\text{C}$ - To Apply Voltage: <ol style="list-style-type: none"> (1) $< 500\text{V}$: 200% of rated voltage. (2) 500V: 150% of rated voltage. (3) $\geq 630\text{V}$: 120% of rated voltage. - Test time: 1000+24/-0 hrs - To apply voltage : rated voltage. - Before initial measurement (Class II only): To apply test voltage for 1 hr at test temp. and then set for 24\pm2 hrs at room temp. - Measurement to be made after keeping at room temp. for 24\pm2 hrs. 	<ul style="list-style-type: none"> - No remarkable damage - Cap change: within $\pm 3.0\%$ or $\pm 0.3\text{pF}$ whichever is larger - Q/D.F. value: NP0: Cap$\geq 30\text{pF}$ Q≥ 350 10pF\leqCap$< 30\text{pF}$, Q$\geq 275+2.5\text{C}$ Cap$< 10\text{pF}$, q$\geq 200+10\text{C}$ - I.R.: $\geq 1\text{G}\Omega$ or RxC$\geq 50\Omega\cdot\text{F}$ whichever is smaller.

PACKAGING



SIZE	0201, 0402, 0603, 0805		
REEL SIZE	7"	10"	13"
C	13.0+0.5/-0.2	13.0+0.5/-0.2	13.0+0.5/-0.2
W1	8.4+1.5/-0	8.4+1.5/-0	8.4+1.5/-0
A	178.0 \pm 0.10	250.0 \pm 1.0	330.0 \pm 1.0
N	60.0+1.0/-0	100+1.0	100+1.0

SIZE	THICKNESS (mm) /SYMBOL	PAPER TAPE		PLASTIC TAPE	
		7" REEL	13" REEL	7" REEL	13" REEL
0201	0.30 \pm 0.3	15k	70k		
0402	0.50 \pm 0.5	10k	50k		
0603	0.80 \pm 0.07	4k	15k		
	0.80 \pm 0.15/-0.10	4k	15k		
0805	0.80 \pm 0.10	4k	15k		
	1.25 \pm 0.10			3k	10k





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 N₂ within oven are recommended.

