

# HIGH Q/LOW ESR MULTILAYER CERAMIC CHIP CAPACITORS

## - GHQ SERIES -

### SCOPE

- Used at high frequencies, small temperature coefficient of capacitance, typical within +/-30ppm/C required for NPO (COG) classification.
- Excellent conductivity internal electrode

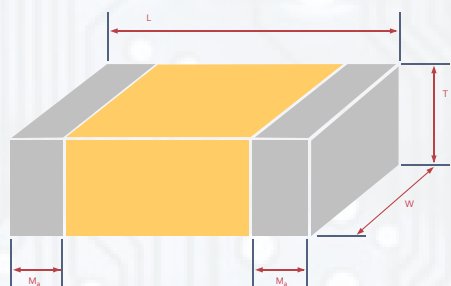
### FEATURES

- 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

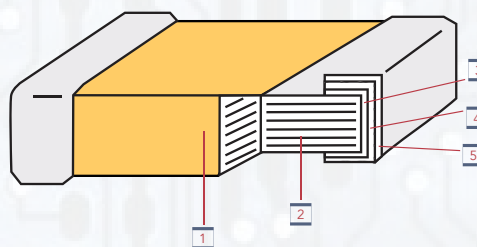
### CONSTRUCTION AND DIMENSIONS



SIZE INCH (MM)	L (MM)	W (MM)	T (MM)	REMARK	M <sub>2</sub> (MM)
0201 (0603)	0.6±0.03	0.3±0.03	0.3±0.03	#	0.15±0.05
0402 (1005)	1.00±0.05	0.50±0.05	0.50±0.05	#	0.25±0.05/-0.10
0603 (1608)	1.60±0.10	0.80±0.10	0.80±0.07		0.40±0.15
	1.60±0.15/-0.10	0.80±0.15/-0.10	0.80±0.15/-0.10		
0805 (2012)	2.00±0.15	1.25±0.10	0.80±0.10		0.50±0.20
			1.25±0.10	#	

#Reflow soldering only is recommended

NO.	NAME	NPO	
1	Ceramic Material	CaZrO <sub>3</sub>	
2	Inner electrode	Ni	
3	Termination	Inner layer	Cu
		Middle layer	Ni
		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 (COG)	Two significant digits followed by no. of zeros. Use R in place of decimal point.	A: ± 0.05pF B: ± 0.1pF C: ± 0.25pF D: ± 0.5pF F: ± 1% G: ± 2% J: ± 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																

- 0402, Capacitance <0.5pF, on request
- For more information about products with special capacitance or other data, please contact your Cal-Chip Sales Representative

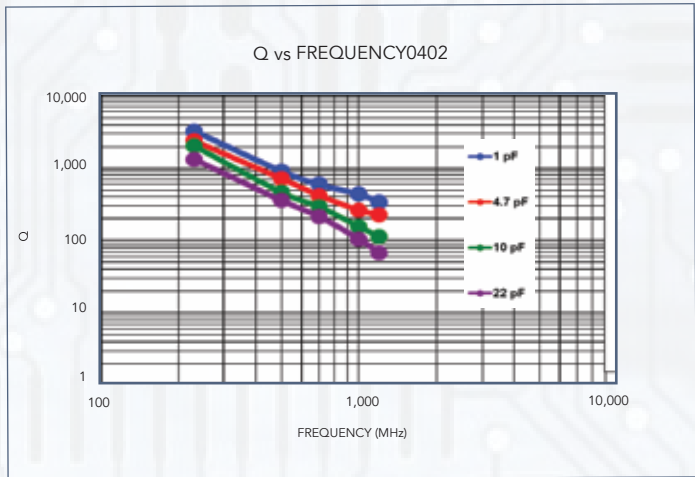
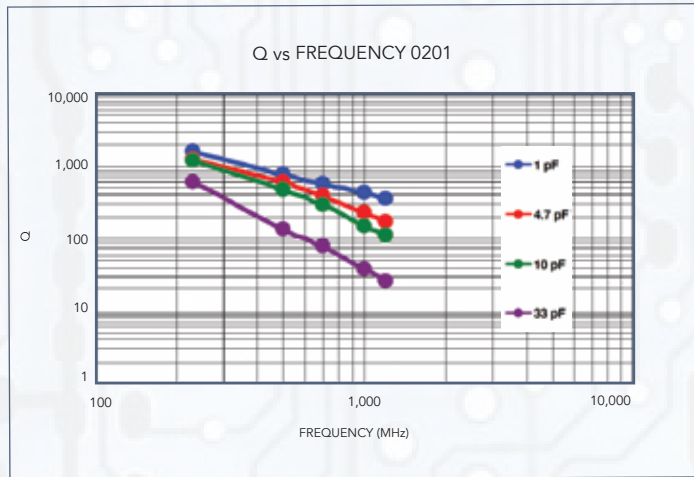
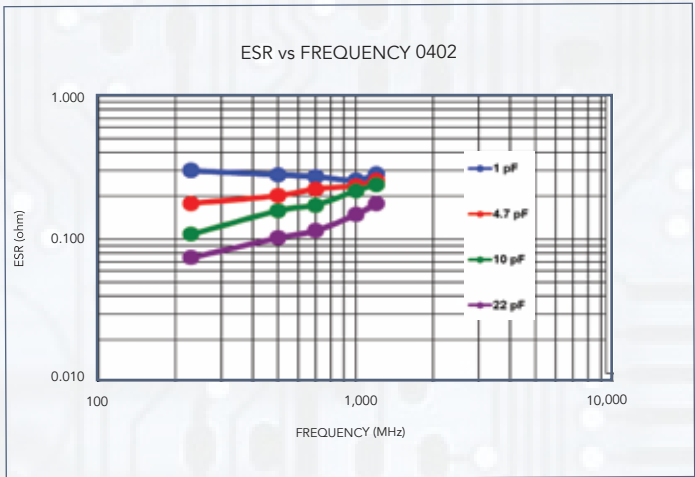
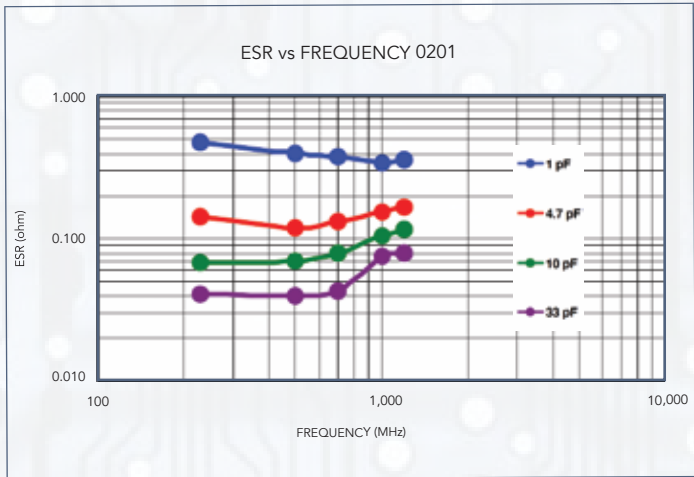


## GENERAL ELECTRICAL DATA

DIELECTRIC	NPO
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)

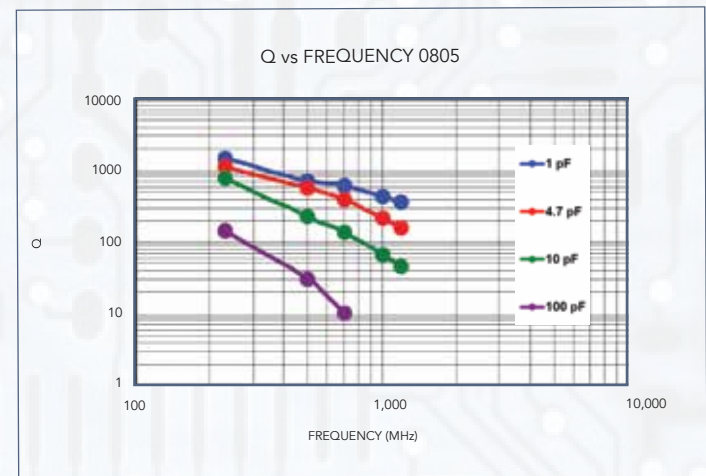
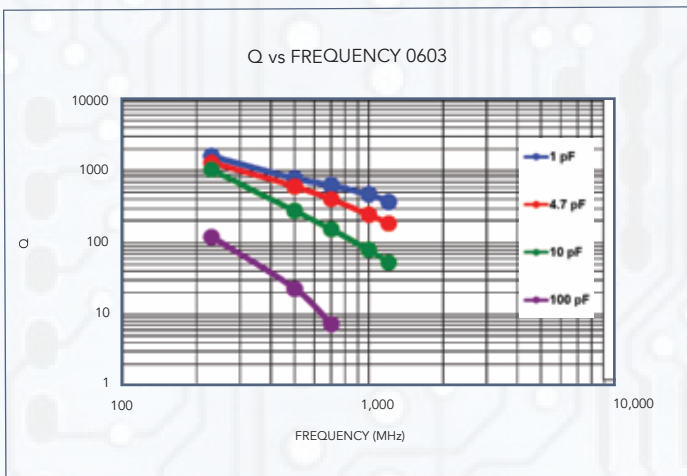
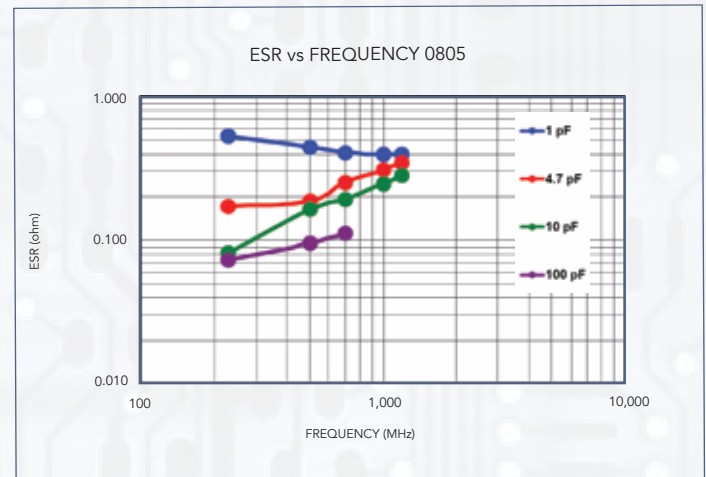
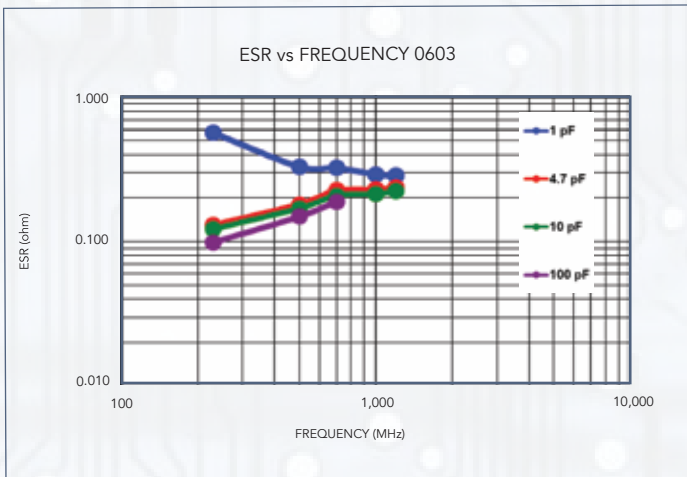
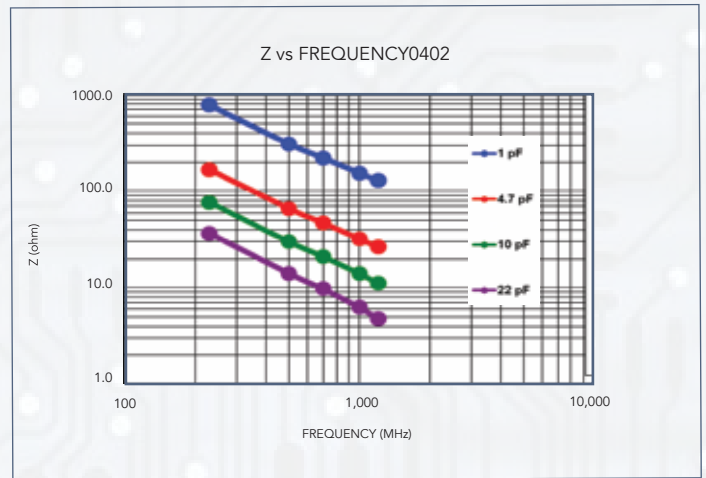
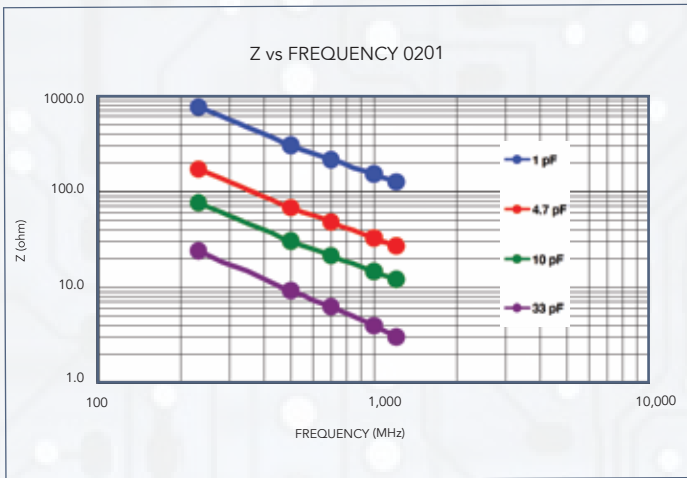
#1: NPO, 0.1pF product only provide B tolerance  
 \*Measured at the condition of 25°C ambient temperature 30-70% related humidity.  
 Apply 1.0±0.2Vrms, 1.0MHz±10% for Caps1000pF and 1.0±0.2Vrms, 1.0kHz±10% for Cap>1000pF.  
 \*\*0402, Capacitance <0.5pF: On request.

## ELECTRICAL CHARACTERISTICS



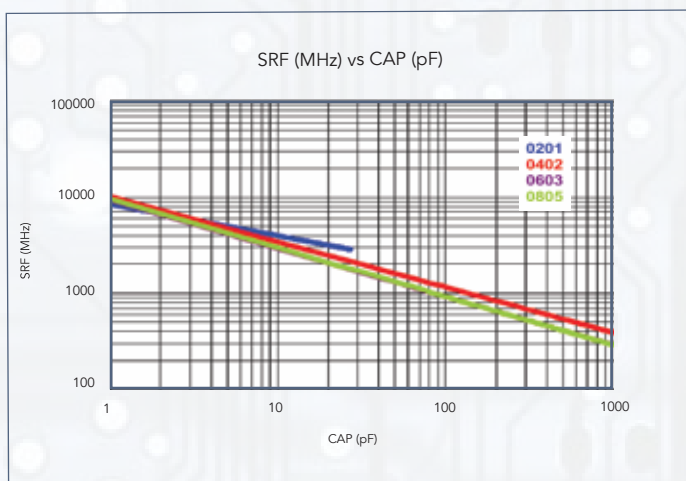
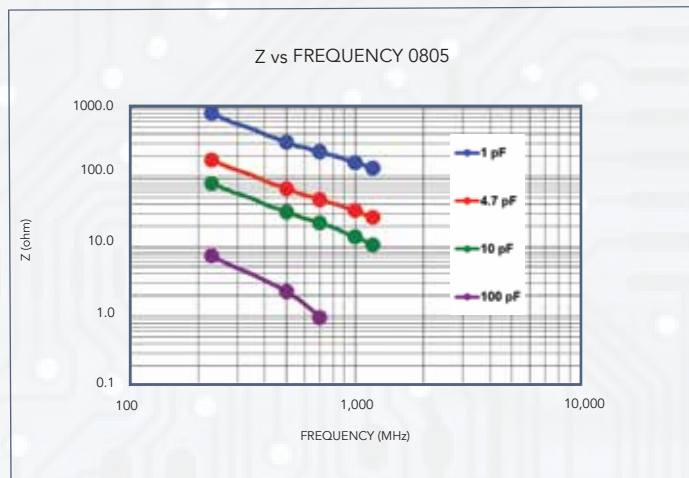
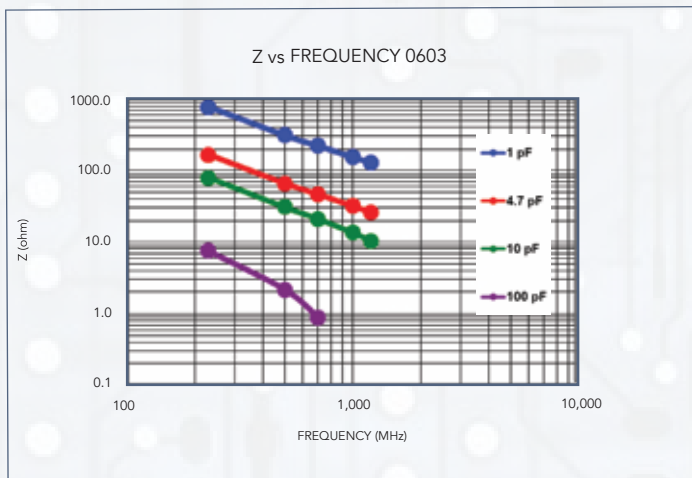


# ELECTRICAL CHARACTERISTICS





# ELECTRICAL CHARACTERISTICS



## RELIABILITY TEST CONDITIONS AND REQUIREMENTS

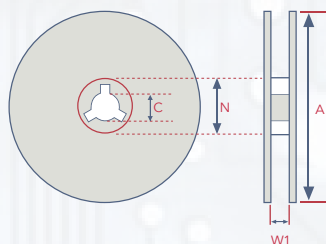
NO.	ITEM	TEST CONDITION	REQUIREMENTS															
1.	Visual and Mechanical	----	- No remarkable defect. - Dimensions to conform to individual specification sheet.															
2.	Capacitance	Cap $\leq$ 1000pF, 1.0 $\pm$ 0.2Vrms   1MHz $\pm$ 10% Cap $>$ 1000pF, 1.0 $\pm$ 0.2Vrms   1KHz $\pm$ 10% At 25°C ambient temperature.	- Shall not exceed the limits given in the detailed spec.															
3.	Q/D.F. (Dissipation Factor)		NPO: Cap $\geq$ 30pF, Q $\geq$ 1000; Cap $<$ 30pF, Q $\geq$ 400+20C															
4.	Dielectric Strength	- To apply ( $\leq$ 100V) 250% of rated voltage. - Duration 1 to 5 seconds - Charge and discharge current less than 50mA.  - To apply ( $\leq$ 100V) 250% 200V - 300V $\geq$ 2 times VDC 500V - 999V $\geq$ 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.	$\geq$ 10G $\Omega$															
		- Rated Voltage: 200~630V - To Apply rated voltage (500V max.) for 60 sec.	$\geq$ 10G $\Omega$ or RxC $\geq$ 100 $\Omega$ -F whichever is smaller															
6.	Temperature Coefficient	- With no electrical load. - Operating temperature: -55 $^{\circ}$ ~125 $^{\circ}$ C at 25 $^{\circ}$ C	- Capacitance change: within $\pm$ 30ppm/ $^{\circ}$ C															
7.	Adhesive Strength of Termination	- Pressurizing force: 5N ( $\leq$ 0603) and 10N ( $>$ 0603) - Test time: 10 $\pm$ 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 $\pm$ 2 hrs.	- No remarkable damage - Cap change and Q/D.F.: To meet initial spec.															
9.	Solderability	- Solder temperature: 235 $\pm$ 5 $^{\circ}$ C - Dipping time 2 $\pm$ 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 $\pm$ 1 sec. - Measurement to be made after keeping at room temp. for 24 $\pm$ 2 hrs..	- No remarkable damage - Cap change: within $\pm$ 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 $\pm$ 5 $^{\circ}$ C - Dipping time: 10 $\pm$ 1sec - Preheating: 120 to 150 $^{\circ}$ C for 1 minute before immerse the capacitor in a eutectic solder - Before initial measurement (Class II only): Perform 150+0/-10 $^{\circ}$ C for 1 hr and then set for 24 $\pm$ 2 hrs at room temp. - Measurement to be made after keeping at room temp. for 24 $\pm$ 2 hrs.	- No remarkable damage - Cap change: within $\pm$ 2.5% or $\pm$ 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 border="1"> <thead> <tr> <th>STEP</th> <th>TEMP. (<math>^{\circ}</math>C)</th> <th>TIME (MIN.)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Min. operating temp. +0/-3</td> <td>30<math>\pm</math>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<math>\pm</math>3</td> </tr> <tr> <td>4</td> <td>Room Temp</td> <td>2~3</td> </tr> </tbody> </table> - Before initial measurement (Class II only): perform 150+0/-10 $^{\circ}$ C for 1 hr and then set for 24 $\pm$ 2 hrs at room temp. - Measurement to be made after keeping at room temp. for 24 $\pm$ 2 hrs	STEP	TEMP. ( $^{\circ}$ C)	TIME (MIN.)	1	Min. operating temp. +0/-3	30 $\pm$ 3	2	Room Temp	2~3	3	Min. operating temp. +0/-3	30 $\pm$ 3	4	Room Temp	2~3	- No remarkable damage - Cap change: within $\pm$ 2.5% or $\pm$ 0.25pF whichever is larger - Q/D.F., I.R. and dielectric strength: To meet initial requirements.
STEP	TEMP. ( $^{\circ}$ C)	TIME (MIN.)																
1	Min. operating temp. +0/-3	30 $\pm$ 3																
2	Room Temp	2~3																
3	Min. operating temp. +0/-3	30 $\pm$ 3																
4	Room Temp	2~3																
13.	Humidity (Damp Heat) Steady State	- Test temp.: 40 $\pm$ 2 $^{\circ}$ 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 $\pm$ 2 hrs at room temp. - Measurement to be made after keeping at room temp. for 24 $\pm$ 2 hrs.	- No remarkable damage - Cap change: within $\pm$ 5% or $\pm$ 0.5pF whichever is larger - Q/D.F. value NPO: Cap $\geq$ 30pF, Q $\geq$ 350, 10pF $\leq$ Cap $\leq$ 30pF, Q $\geq$ 275+2.5C Cap $<$ 10pF, Q $\geq$ 200+10C -I.R.: $\geq$ 1G $\Omega$ or RxC $\geq$ 50 $\Omega$ -F whichever is smaller															



## RELIABILITY TEST CONDITIONS AND REQUIREMENTS

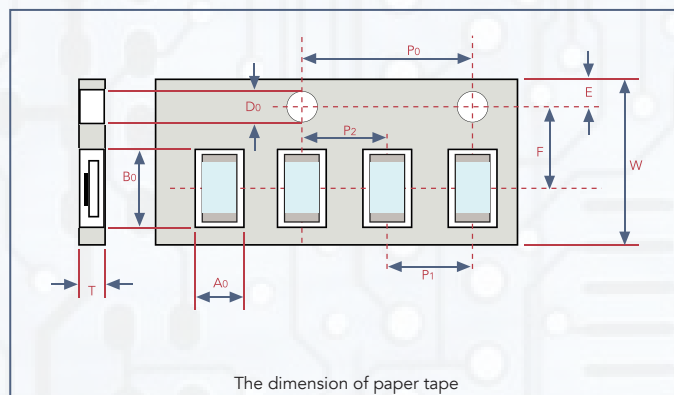
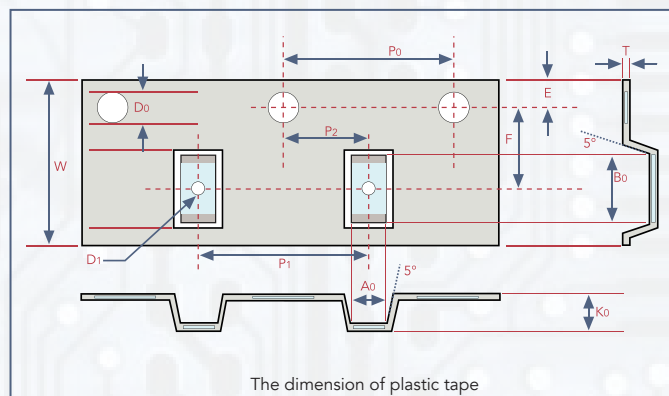
NO.	ITEM	TEST CONDITION	REQUIREMENTS
14.	Humidity (Damp Heat) Load	<ul style="list-style-type: none"> <li>- Test temp.: 40±2°C</li> <li>- Humidity 90~95% RH</li> <li>- Test time: 500+24/-0 hrs</li> <li>- To apply voltage: rated voltage (Max. 500V)</li> <li>- Before initial measurement (Class II only): To apply test voltage for 1hr at 40°C and then set for 24±2 hrs at room temp.</li> <li>- Measurement to be made after keeping at room temp. for 24±2 hrs.</li> </ul>	<ul style="list-style-type: none"> <li>- No remarkable damage</li> <li>- Cap change: within ±7.5% or ±0.75pF whichever is larger</li> <li>- Q/D.F. value: NPO: Cap≥30pF, Q≥350; 10pF≤Cap&lt;30pF, Q≥100+10/3C I.R.: ≥1GΩ or RxC≥25Ω- F whichever is smaller</li> </ul>
15	Humidity Temperature Load (Endurance)	<ul style="list-style-type: none"> <li>- Test temp.: NPO: 125±3°C</li> <li>- To Apply Voltage: (1) &lt;500V: 200% of rated voltage. (2) 500V: 150% of rated voltage. (3) ≥630V: 120% of rated voltage.</li> <li>- Test time: 1000+24/-0 hrs</li> <li>- To apply voltage : rated voltage.</li> <li>- Before initial measurement (Class II only): To apply test voltage for 1 hr at test temp. and then set for 24±2 hrs at room temp.</li> <li>- Measurement to be made after keeping at room temp. for 24±2 hrs.</li> </ul>	<ul style="list-style-type: none"> <li>- No remarkable damage</li> <li>- Cap change: within ±3.0% or ±0.3pF whichever is larger</li> <li>- Q/D.F. value: NPO: Cap30pF Q≥350 10pF≤Cap&lt;30pF, Q≥275+2.5C Cap&lt;10pF, q≥200+10C I.R.: ≥1GΩ or RxC≥50Ω-F whichever is smaller.</li> </ul>

## 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±0.10	250.0±1.0	330.0±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±0.3	15k	70k		
0402	0.50±0.5	10k	50k		
0603	0.80±0.07	4k	15k		
	0.80±0.15/-0.10	4k	15k		
0805	0.80±0.10	4k	15k		
	1.25±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 N<sub>2</sub> within oven are recommended.

