

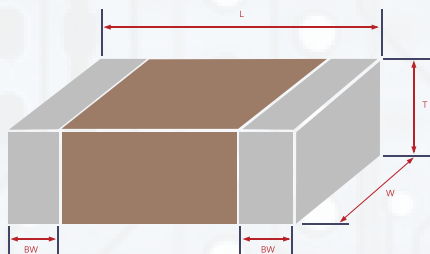
# AUTOMOTIVE MULTILAYER CERAMIC CHIP CAPACITORS

## - GMG SERIES -

### SCOPE

- Consists of conducting material and electrodes - to achieve chip-type SMT and small size, high density and high efficiency ceramic condensers are used.
- NPO, X7R, & X5R dielectrics provide product with high electrical precision, stability and reliability
- Assured quality performance in automotive applications

### CONSTRUCTION AND DIMENSIONS



SIZE INCH (MM)	L (MM)	W (MM)	T / SYMBOL (MM)	SOLDERING METHOD*	BW (MM)	
0201 (0603)	0.6±0.03	0.3±0.03	0.3±0.03	B	R	0.15±0.05
	0.6±0.05 <sup>#2</sup>	0.3±0.05 <sup>#2</sup>	0.3±0.05 <sup>#2</sup>	D		0.15±0.1/-0.05
	0.6±0.09 <sup>#3</sup>	0.3±0.09 <sup>#3</sup>	0.3±0.09 <sup>#3</sup>	D		
0402 (1005)	1.00±0.05	0.50±0.05	0.50±0.05	E	R	0.25±0.05/-0.10
	1.00±0.20	0.50±0.20	0.50±0.02/-0.05	D		
	1.00±0.20	0.50±0.20	0.50±0.20	C		
0603 (1608)	1.60±0.10	0.80±0.10	0.80±0.07	I	R/W	0.40±0.15
	1.60±0.15/-0.10	0.80±0.15/-0.10	0.50±0.10	F		
	1.60±0.20 <sup>#1</sup>	0.80±0.20 <sup>#1</sup>	0.80±0.15/-0.10	H		
	1.60±0.20 <sup>#1</sup>	0.80±0.20 <sup>#1</sup>	0.8±0.20 <sup>#1</sup>	H		
0805 (2012)	2.00±0.15	1.25±0.10	0.50±0.10	F	R/W	0.50±0.20
			0.60±0.10	G		
			0.80±0.10	J		
	2.00±0.20	1.25±0.20	1.25±0.10	N	R	
			0.85±0.10	K	R/W	
			1.25±0.20	O	R	
			0.80±0.10	L	R/W	
1206 (3216)	3.20±0.15	1.60±0.15	0.95±0.10	L	R	0.60±0.20 (0.5±0.25) <sup>***</sup>
			1.25±0.10	N		
	3.20±0.20	1.60±0.20	1.15±0.15	M		
			1.60±0.20	R		
			0.85±0.10	K	R/W	
3.20±0.30/-0.10	1.60±0.30/-0.10	1.60±0.30/-0.10	Q	R		
1210 (3225)	3.20±0.30	2.50±0.20	0.95±0.10	L	R	0.75±0.25
			0.85±0.10	K		
			1.25±0.10	N		
	2.00±0.20	2.50±0.30	1.60±0.20	R		
			2.00±0.20	S		
3.20±0.60 <sup>#4</sup>	2.50±0.50 <sup>#4</sup>	2.50±0.50 <sup>#4</sup>	T			
1812 (4532)	4.50±0.40 (4.5±0.5/-0.3) <sup>**</sup>	3.20±0.30	1.25±0.10	N	#	0.75±0.25 (0.5±0.25) <sup>***</sup>
			1.60±0.20	R		
			2.00±0.20	S		
	3.20±0.40	2.50±0.30	T	#		
		2.80±0.30	U			

\* R = Reflow soldering process ; W = Wave soldering process.  
 \*\* For 1808/1812/1825, 200V-4000V and safety certified products.  
 \*\*\* For 1206, ≥1000V, 1808/1812, 200V-4000V and safety certified products.  
 #1: For 0603/Cap=10µF or 0603(±6.3V)/Cap=4.7µF or 0603(±10V)/Cap=1µF products, Excluding 0603X225(16V/25V), 0603S225(6.3V/16V), 0603X475(6.3V/16V), 0603S475(4V/6.3V).  
 #2: For 0201/0.1µF < Cap < 0.68µF products, Excluding 0201X334-474(±6.3V) & 0201X224(±10V).  
 #3: For 0201/Cap=0.68µF products.  
 #4: For 1210/200V&250V/Cap>0.47µF products.  
 #5: For 1206(100V)/Cap≥1.2µF products.

### APPLICATIONS

- For navigation and information equipment
- For entertainment equipment
- For comfortable equipment

### FEATURES

- Wide selection of sizes available
- High capacitance in given case size
- Lead free termination (pure Tin)

### STD. ELECTRICAL SPECIFICATIONS

DILECTIC	NPO	X7R	X5R
SIZE	0402, 0603, 0805, 1206, 1210, 1812		
CAPACITANCE RANGE **	0.5pF to 0.033µF	100pF to 2.2µF	0.056µF to 10µF
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%)	J (±5%), K (±10%), M (±20%)	
RATED VOLTAGE (WVDC)	16V, 25V, 50V, 100V	10V, 16V, 25V, 50V, 100V, 200V, 250V	6.3V, 10V, 16V, 25V
TAN δ*	Cap<30pF: Qz400+20C Cap≥30pF: Qz1000	Note 1	
INSULATION RESISTANCE AT UR	≥10GΩ or RxCz≥500Ω - F whichever is less		
OPERATING TEMPERATURE	-55° to +125°C		-55° to +85°C
CAPACITANCE CHARACTERISTIC	±30ppm/°C		±15%
TERMINATION	Ni/Si (lead-free termination)		

\* Measured at the condition of 30-70% related humidity.  
 NPO: 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  
 Measured at 1.0±0.2Vrms, 1.0kHz±10% for Cs10uF; 0.5±0.2Vrms, 120Hz±20% for C> 10uF, 30-70% related humidity, 25°C ambient temperature for X7R, X5R  
 \*\* 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.  
 Note 1: X7R, X5R

RATED VOLTAGE	D.F. ≤	EXCEPTION OF D.F. ≤
≥50V	≤2.5%	≤3% 0603≥0.047uF; 0805≥0.18uF; 1206≥0.47uF ≤5% 1210≥4.7uF
	≤3.5%	≤10% 0603≥1uF; 0805≥1uF; 1206≥4.7uF; 1210≥10uF ≤10% 0805≥2uF; 1210≥10uF
35V	≤3.5%	≤5% 0805≥1uF; 1210≥10uF ≤7% 0603≥0.33uF; 1206≥4.7uF
	≤5%	≤10% 0402≥0.10uF; 0603≥0.47uF; 0805≥2.2uF; 1206≥6.8uF; 1210≥22uF
25V	≤3.5%	≤5% 0402≥0.033uF; 0603≥0.15uF; 0805≥0.68uF; 1206≥2.2uF; 1210≥4.7uF ≤10% 0402≥0.22uF; 0603≥0.68uF; 0805≥2.2uF; 1206≥4.7uF; 1210≥22uF
	≤5%	≤10% 0402≥0.33uF; 0603≥0.33uF; 0805≥2.2uF; 1206≥2.2uF; 1210≥22uF ≤15% 0402≥1uF
16V	≤3.5%	≤15% 0402≥1uF; 0603≥10uF; 0805≥4.7uF; 1206≥47uF; 1210≥100uF ≤20% 0402≥2.2uF
	10%	---
6.3V	10%	---
4V	≤15%	---

### PART NUMBER

GMG	04	CG	102	J	50	NT	4	
PRODUCT TYPE	SIZE	DIELECTRIC	CAPACITANCE	TOLERANCE	VOLTAGE	PACKAGING CODE	REEL SIZE	
Without AEC-Q200 qualification	04 - 0402 10 - 0603 21 - 0805 31 - 1206 32 - 1210 43 - 1812	CG - NPO (C0G) X7R - X7R	0R5: 0.5pF 5R0: 5pF 100: 10pF 101: 100pF 102: 1000pF 103: 0.01uF 104: 0.1uF 105: 1.0uF 106: 10uF	B: ± 0.1pF C: ± 0.25pF D: ± 0.5pF F: ± 1% G: ± 2% J: ± 5% K: ± 10% M: ± 20%	6R3: 6.3VDC 10: 10VDC 16: 16VDC 25: 25VDC 50: 50VDC 100: 100VDC 200: 200VDC 250: 250VDC	500: 50VDC 101: 100VDC 201: 200VDC 251: 250VDC 501: 500VDC 631: 630VDC 102: 1KVDC 302: 3KVDC	NT: Tape Reel	1: 1K 2: 2K 3: 3K 4: 4K 5: 5K 6: 6K 9: 9K 10: 10K 15: 15K 50: 50K







DIELECTRIC		X5R																			
DIMENSION (MM)		0402				0603				0805				1206				1210			
RATED VOLTAGE		6.3	10	16	25	6.3	10	16	25	6.3	10	16	25	6.3	10	16	25	10	16		
CAP. RANGE	0.022	223																			
	0.033	333																			
	0.047	473																			
	0.068	683		D																	
	0.10uF	104		D	D																
	0.15	154		D	D																
	0.22	224	D	D	D				J												
	0.33	334	D	D				J	J	J											
	0.47	474	D					J	J	J											
	0.68	684	D					J	J	J											
	1.00	105					J	J	J	J											
	1.50	155									O	O			M	M	Q	S	S		
	2.20	225									O	O	O	O	M	M	Q	S	S		
	3.3	335										O	O	Q	Q	Q	Q	S	S		
	4.70	475										O	O	Q	Q	Q	Q	S	S		
	6.8	685												Q							
	10	106												Q							
	22	226																			

D	E	J	M	O	Q	S
0.50±0.05	0.50±0.05	0.80+0.15/-0.10	1.15±0.15	1.25±0.20	1.60+0.30/-0.10	2.00±0.20



## RELIABILITY TEST CONDITIONS AND DIMENSIONS

NO.	TEST ITEM	TEST CONDITION	REQUIREMENTS																																
1.	Visual and Mechanical	---	- No remarkable defect. - Dimensions to conform to individual specification sheet.																																
2.	Capacitance	Class I: NP0 Cap≤1000pF, 1.0±0.2Vrms   1MHz±10% Cap>1000pF, 1.0±0.2Vrms   1KHz±10%	- Shall not exceed the limits given in the detailed spec.																																
3.	Q/D.F. (Dissipation Factor)	Class II: X7R, X5R Cap≤10μF, 1.0±0.2Vrms   1KHz±10% Cap>10μF, 0.5±0.2Vrms   120Hz±20%	- NP0: Cap≥30pF, Q≥1000; Cap≥30pF, Q≥400+20C X7R, X5R																																
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4.	Dielectric Strength	- To apply (≤100V) 250% - Duration 1 to 5 seconds - Charge and discharge current less than 50mA	- No evidence of damage or flas over during test.																																
5.	Insulation Resistance	- To apply rated voltage for max. 120 seconds	10GΩ or RxC≥500ΩF Whichever is smaller <table border="1"> <thead> <tr> <th>RATED VOLTAGE</th> <th>INSULATION RESISTANCE</th> </tr> </thead> <tbody> <tr> <td>100V: X7R</td> <td rowspan="4">10GΩ or RxC≥100 Ω-F whichever is smaller.</td> </tr> <tr> <td>16V: 0402≥0.22μF</td> </tr> <tr> <td>10V: 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206±4.7μF; 1210±22μF</td> </tr> <tr> <td>6.3V</td> </tr> </tbody> </table>	RATED VOLTAGE	INSULATION RESISTANCE	100V: X7R	10GΩ or RxC≥100 Ω-F whichever is smaller.	16V: 0402≥0.22μF	10V: 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206±4.7μF; 1210±22μF	6.3V																									
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6.	Temperature Coefficient	- With no electrical load <table border="1"> <thead> <tr> <th>T.C.</th> <th>CAPACITANCE CHANGE</th> </tr> </thead> <tbody> <tr> <td>NP0</td> <td>-55~125°C at 25°C</td> </tr> <tr> <td>X7R</td> <td>-55~125°C at 25°C</td> </tr> <tr> <td>X5R</td> <td>-55~85°C at 25°C</td> </tr> </tbody> </table>	T.C.	CAPACITANCE CHANGE	NP0	-55~125°C at 25°C	X7R	-55~125°C at 25°C	X5R	-55~85°C at 25°C	<table border="1"> <thead> <tr> <th>T.C.</th> <th>CAPACITANCE CHANGE</th> </tr> </thead> <tbody> <tr> <td>NP0</td> <td>Within ±33ppm/°C</td> </tr> <tr> <td>X7R</td> <td>Within ±15%</td> </tr> <tr> <td>X5R</td> <td>Withink ±15%</td> </tr> </tbody> </table>	T.C.	CAPACITANCE CHANGE	NP0	Within ±33ppm/°C	X7R	Within ±15%	X5R	Withink ±15%																
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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±2hrs.	- 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: NP0: within ±5% or 0.5pF whichever is larger X7R, X5R: within ±12.5% (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±2hrs.	- No remarkable damage - Cap change: NP0: within ±2.5% or ±0.25pF whichever is larger X7R, X5R: within ±7.5% - 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. (°C)</th> <th>TIME (MIN.)</th> </tr> </thead> <tbody> <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> </tbody> </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±2hrs	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: NP0: within ±2.5% or ±0.25pF whichever is larger X7R, X5R: within ±7.5% - 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																																	



## RELIABILITY TEST CONDITIONS AND DIMENSIONS

NO.	TEST ITEM	TEST CONDITION	REQUIREMENTS
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: NP0: within ±5% or ±0.5pF whichever is larger X7R, X5R: ≥10V**, within ±12.5%; 6.3V within ±25%; C≥ 1μF, within ±25% **10V: 0603≥4.7μF; 0402≥1μF; 0201≥0.1μF, within ±25%; - 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:  *I.R.: ≥10V, 1GΩ OR 50 Ω-F whichever is smaller Class II (X7R, X5R):
14.	Humidity (Damp Heat) Steady State	- 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 1 hr 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.	No remarkable damage - Cap change: NP0: within ±7.5% or ±0.75pF whichever is larger X7R, X5R: ≥10V**, within ±12.5%; 6.3V within ±25%; C≥ 1μF, within ±25% **10V: 0603≥4.7μF; 0402≥1μF; 0201≥0.1μF, within ±25%; - Q/D.F. value: NP0: More than 30pF Q≥200, C≤30pF, Q≥100+10/3C X7R, X5R:  *I.R.: ≥10V, 500MΩ OR 25 Ω-F whichever is smaller Class II (X7R, X5R):



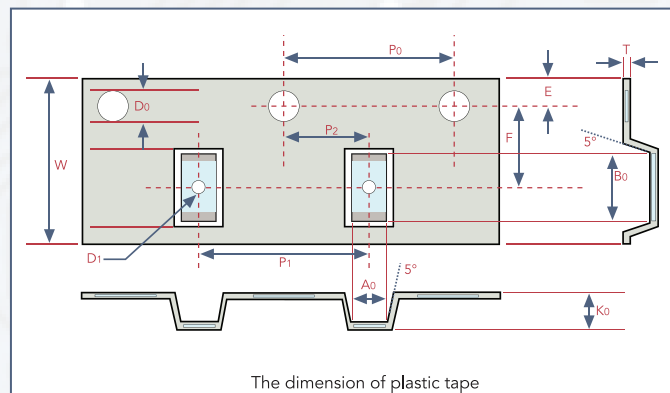
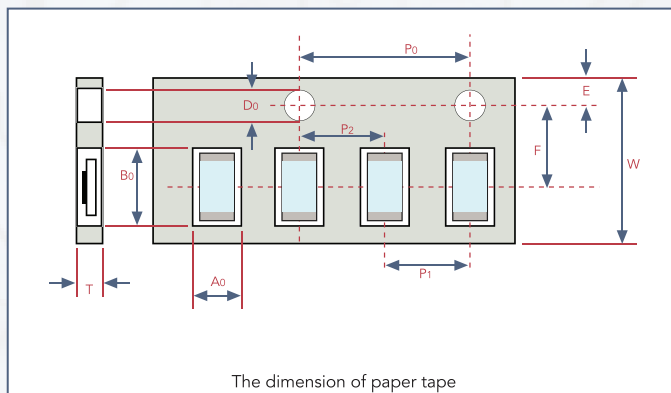
## RELIABILITY TEST CONDITIONS AND DIMENSIONS

NO.	TEST ITEM	TEST CONDITION	REQUIREMENTS																																																							
15.	High Temperature Load (Endurance)	- Test temp.: NP0, X7R: 125±3°C X5R: 85±3°C - Test time: 1000+24/-0 hrs - To apply voltage: (1) ≤6.3V or C≥10μF: 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, X7E, X5R: ≥10V**, within ±12.5%; ≤6.3V within ±25%; C≥ 1uF, within ±25% **10V: 0603≥4.7μF; 0402≥1μF; 0201≥0.1μF, within ±25%; Q/D.F. value: NP0: More than 30pF, Q≥350 10pF≤C<30pF, Q≥275+2.5C Less than 10pF, Q≥200+10C																																																							
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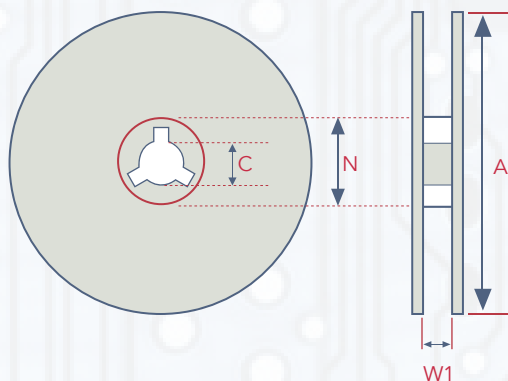
## PACKAGING STYLE AND QUANTITY

SIZE	THICKNESS (MM) / SYMBOL	PAPER TAPE		PLASTIC TAPE	
		7" REEL	13" REEL	7" REEL	13" REEL
0402 (1005)	0.50 ± 0.5	10k	50k		
0603 (1608)	0.80 ± 0.07	4k	15k		
	0.80 ± 0.15/-0.10	4k	15k		
0805 (2012)	0.60 ± 0.10	4k	15k		
	0.80 ± 0.10	4k	15k		
	1.25 ± 0.10			3k	10k
	1.25 ± 0.20			3k	10k
1206 (3216)	0.80±0.10	4k	15k		
	0.95±0.10			3k	10k
	1.15±0.15			3k	10k
	1.25±0.10			3k	10k
	1.60±0.20			2k	10k
	1.60±0.30/-0.10			2k	9k
1210 (3225)	0.95±0.10			3k	10k
	01.25±0.10			3k	10k
	01.60±0.20			2k	
	2.00±0.20			1k	6k
	2.50±0.30			1k	6k
1812 (4532)	1.25±0.10			1k	5k
	1.60±0.20			1k	

**PACKAGING**



SIZE	0402	0603	0805			1206			1210		1812
THICKNESS	N	S, B	A	X	M, C, I	X	M, J, C	E	M, C, E	G	C, F
A <sub>0</sub>	0.62 ± 0.05	1.02 ± 0.05	1.05 ± 0.10	1.05 ± 0.10	<1.57	2.00 ± 0.10	<1.85	<1.95	<2.97	<2.97	<2.97
B <sub>0</sub>	1.12 ± 0.05	1.80 ± 0.05	2.30 ± 0.10	2.30 ± 0.10	<2.40	3.50 ± 0.10	<3.43	<3.67	<3.73	<3.73	<3.73
T	0.60 ± 0.05	0.95 ± 0.05	0.75 ± 0.05	0.95 ± 0.05	0.23±0.05	0.95 ± 0.05	0.23 ± 0.05	0.23 ± 0.05	0.23 ± 0.5	0.23 ± 0.05	0.235±0.1
K <sub>0</sub>	-	-	-	-	<2.50	-	<2.50	<2.50	<2.50	<3.00	<3.00
W	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	8.00 ± 0.10	8.00 ± 0.10	8.00 ± 0.10
P <sub>0</sub>	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 <sub>0</sub>	40.00 ± 0.10	40.00 ± 0.10	40.00 ± 0.10	40.00 ± 0.10	40.00 ± 0.10	40.00 ± 0.10	40.00 ± 0.10	40.00 ± 0.10	40.00 ± 0.10	40.00 ± 0.10	40.00 ± 0.10
P <sub>1</sub>	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	4.00 ± 0.10
P <sub>2</sub>	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 ± 0.05
D <sub>0</sub>	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 ± 0.05
D <sub>1</sub>	-	-	-	-	1.00 ± 0.10	-	1.00 ± 0.10	1.00 ± 0.10	1.00 ± 0.10	1.00 ± 0.10	1.00 ± 0.10
E	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	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



SIZE	0402, 0603, 0805, 1206, 1210	1812	
REEL SIZE	7"	13"	7"
C	13.0+0.5/-0.2	13.0+0.5/-0.2	13.0+0.5/-0.2
W <sub>1</sub>	8.4+1.5/-0	8.4+1.5/-0	12.4+2.0/-0
A	178.0 ± 0.10	330.0 ± 1.0	178.0 ± 1.0
N	60.0+1.0/-0	100+1.0	60.0+1.0/-0





## 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.

