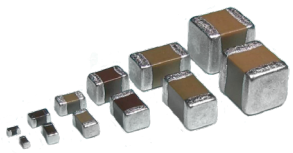
Multilayer Ceramic Chip Capacitors

How to Order

■Features

- Kyocera's series of Multilayer Ceramic Chip Capacitors are designed to meet a wide variety of needs. We offer a complete range of products for both general and specialized applications.
- We have a network worldwide in order to supply our global customer bases quickly and efficiently.
- All our products are highly reliable due to their monolithic structure of high-purity and superfine uniform ceramics and their integral internal electrodes.
- Our stringent quality control in every phase of production from material procurement to shipping ensures consistent manufacturing and superior quality.
- Kyocera components are available in a wide choice of dimensions, temperature characteristics, rated voltages, and terminations to meet specific configurational requirements.



e.g.)

KGM	03	C	R5	0J	225	M	H	□□□□
①	②	③	④	⑤	⑥	⑦	⑧	Option Code (When needed)

① Series : KGM Series(General)
② Size (EIA) : 0201
③ Thickness (max.) : 0.39mm
④ Dielectric : Operating Temperature Range: -55 to 85°C/ ΔC max.: ±15%/ Standard Temperature: 25°C
⑤ Rated Voltage : 6.3Vdc
⑥ Capacitance : 2.2μF
⑦ Tolerance : ±20%
⑧ Packaging : Taping Material Paper/ Taping Width 8mm/ Cavity Pitch 2mm/ Reel Size φ180

① Series Code

CODE	Type
KGM	General
KGT	Low Profile
KGU	High-Q
KAM	Automotive
KGN	Three Terminal Capacitors

② Size Code

CODE	EIA	JIS
02	01005	0402
03	0201	0603
05	0402	1005
15	0603	1608
21	0805	2012
31	1206	3216
32	1210	3225

③ Thickness (max.)

CODE	EIA	JIS	Thickness Code	Thickness(max.)
02	01005	0402	A	0.22
03	0201	0603	A	0.33
			B	0.35
			C	0.39
			D	0.55
			Y	0.22
05	0402	1005	A	0.55
			B	0.65
			C	0.7
			D	0.8
			X	0.22
			Y	0.33
			Z	0.5
15	0603	1608	A	0.9
			C	1.0
21	0805	2012	A	1.45
			C	0.95
31	1206	3216	A	1.8
			F	1.75
			H	1.9
			L	0.95
32	1210	3225	A	2.7

④ Dielectric Code

Temperature Compensation Type			
CODE	Temperature Range(°C)	ppm/°C	
CG	−55 ～ 125	0	±30
CH			±60

·All parts of C0G will be marked as "CG" but will conform to the above table.
·Temperature coefficients are determined by calculation based on measurement at 20°C and 85°C.

High Dielectric Constant Type			
CODE	Temperature Range(°C)	ΔC (%)	Reference Temp.°C
R5	−55 ～ 85	±15	25
S6	−55 ～ 105	±22	
T6		+22/−33	
R7	−55 ～ 125	±15	
K7*		±15	
S7		±22	
T7		+22/−33	

*Special spec: Change in capacitance under 50% of rated voltage applied.

Measurement conditions for temperature characteristics K7.
Applied voltage and Temperature step

Step	C	Applying Voltage	Temperature°C
1	C0	No bias	Reference Temp.
2	—	50% of Rated voltage	Reference Temp.
3	C1		Min. Operating Temp.
4	C2		Reference Temp.
5	C1		Max. Operating Temp.

ΔC/C(%)=(C1-C2)/C0 × 100
C0:Capacitance value at step 1
C1:Capacitance value from step 3 to 5
C2:Capacitance value at step 4

⑤ Voltage Code

CODE	Rated Voltage	CODE	Rated Voltage
0E	2.5Vdc	1E	25Vdc
0G	4Vdc	1V	35Vdc
0J	6.3Vdc	1H	50Vdc
1A	10Vdc	2A	100Vdc
1C	16Vdc		

⑥ Capacitance Code

Capacitance expressed in pF.
Two significant digits plus number of zeros.
For Values < 10pF, Letter R denotes decimal point,

(Example)

CODE	Capacitance	CODE	Capacitance
R50	0.5pF	103	10000pF
1R0	1pF	104	0.1μF
100	10pF	105	1μF
101	100pF	106	10μF
102	1000pF	107	100μF

⑦ Tolerance Code

Temperature Compensation Type(CG/CH)	
CODE	Tolerance
A	±0.05pF
B	±0.1pF
C	±0.25pF
D	±0.5pF
G	±2%
J	±5%
K	±10%

High Dielectric Constant Type (R5/S6/T6/R7/K7/S7/T7)	
CODE	Tolerance
J*	±5%
K	±10%
M	±20%

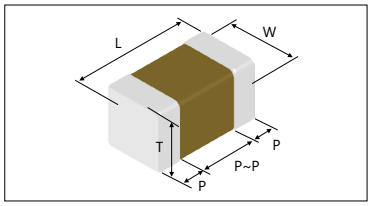
* : Option

⑧ Packaging Code

CODE	Size Code	Material	Width	Pitch	Reel size
T	15 to 31	Paper	8mm	4mm	φ180
H	02 to 05	Paper	8mm	2mm	
Q	03	Paper	8mm	1mm	
U	21 to 32	Plastic	8mm	4mm	
P	02	Plastic	4mm	1mm	
M	15 / 21	Paper	8mm	4mm	φ330
N	02 to 05	Paper	8mm	2mm	
W	03	Paper	8mm	1mm	
L	21 to 32	Plastic	8mm	4mm	

CATM2501RH29120E
As of Apr. 2025

■KGM/KGT/KGU/KAM Series (Two Terminal Capacitors)



■Packaging Code

20kp（E 8 / 2）

kp means 1000 pieces

Taping Material	
Code	Material
E	Plastic
P	Paper

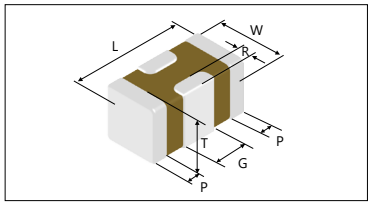
Taping Width	
Code	Width
4	4mm
8	8mm

Pitch	
Code	Pitch
1	1mm
2	2mm
4	4mm

Size	Code		Thickness	Dimension (mm)						Quantity per reel	
	EIA	JIS	Code	L	W	T	P min.	P max.	P ～ P min.	φ180 Reel	φ330 Reel
02	01005	0402	A	0.4±0.02	0.2±0.02	0.2±0.02	0.07	0.14	0.13	40kp(E4/1) 20kp(P8/2)	— 80kp(P8/2)
03	0201	0603	Y	0.6±0.03	0.3±0.03	0.22 max.	0.1	0.2	0.2	30kp(P8/1) 15kp(P8/2)	150kp(P8/1) 50kp(P8/2)
			A			0.3±0.03					
			B	0.6±0.05	0.3±0.05	0.3±0.05	0.13	0.23	0.19		
			Y*	0.6±0.09	0.3±0.09	0.22 max.				15kp(P8/2)	50kp(P8/2)
			C			0.3±0.09					
			D			0.5±0.05				10kp(P8/2)	—
			D*				0.1	0.25	0.19		
05	0402	1005	Y	1.0±0.05	0.5±0.05	0.33 max.	0.15	0.35	0.3	10kp(P8/2)	50kp(P8/2)
			A			0.5±0.05					
			X	1.0±0.1	0.5±0.05	0.22 max.				10kp(P8/2)	50kp(P8/2)
			B	1.0±0.15	0.5±0.15	0.5±0.15				10kp(P8/2)	40kp(P8/2)
			Y*	1.0±0.2	0.5±0.2	0.33 max.				10kp(P8/2)	—
			Z			0.5 max.				10kp(P8/2)	50kp(P8/2)
			A*			0.55 max.				10kp(P8/2)	50kp(P8/2)
			C			0.5±0.2				10kp(P8/2)	40kp(P8/2)
			D			0.8 max.				10kp(P8/2)	30kp(P8/2)
15	0603	1608	A	1.6±0.1	0.8±0.1	0.8±0.1	0.2	0.6	0.5	4kp(P8/4)	10kp(P8/4)
			C	1.6±0.2	0.8±0.2	0.8±0.2					
21	0805	2012	C	2.0±0.2	1.25±0.2	0.95 max.	0.2	0.75	0.7	4kp(P8/4)	10kp(P8/4)
			A			1.25±0.2				3kp(E8/4)	10kp(E8/4)
31	1206	3216	L	3.2±0.2	1.6±0.2	0.95 max.	0.3	0.85	1.4	4kp(P8/4)	—
			F		1.6±0.15	1.6±0.15				2.5kp(E8/4)	5kp(E8/4)
			A		1.6±0.2	1.6±0.2					
			H	3.2±0.3	1.6±0.3	1.6±0.3	0.3	0.85	1.9	2kp(E8/4)	—
32	1210	3225	A	3.2±0.3	2.5±0.2	2.5±0.2	0.3	1.0	1.4	1kp(E8/4)	4kp(E8/4)

※If there is a "*" in the thickness code indicates the same thickness (T-dimension) but different L/W or P-dimension. Please refer to the part number list for details.

■KGN Series (Three Terminal Capacitors)



Size	Code		Thickness	Dimension (mm)						Quantity per reel	
	EIA	JIS	Code	L	W	T	G	P	R	φ180 Reel	φ330 Reel
KGN 05	0402	1005	Z	1.0±0.1	0.5±0.2	0.5 max.	0.3±0.1	0.15±0.1	≧0.05	10kp(P8/2)	—
			B	1.0±0.15	0.5±0.15	0.5±0.15					
			C	1.0±0.2	0.5±0.2	0.5±0.2					

Multilayer Ceramic Chip Capacitors

Low Profile **KGT Series**

■Features

This low profile series is ideal where height clearance is limited

■Applications

Circuits requiring a compact, low-profile design, such as module and memory cards.

Temperature Compensation Dielectric

RoHS

●Capacitance chart ■ Standard Spec.1

CG/CH						
Capacitance		103	223	473	104	134
Size/Voltage(Vdc)		10000pF	22000pF	47000pF	0.1μF	0.13μF
KGT31 (1206)	50					L

Please contact for capacitance value other than standard.

Please refer to here for the test method and specifications of Standard Specification 1.

The code in the capacity range table means product thickness (T-dimension).

(Example) In case of "L" for KGT31;
T: 0.95max.

Parts number list

Thin KGT31 Series Temperature Characteristic: CΔ: CG/CH Tolerance: J : ±5%

Thickness code	Part Number	Capacitance	Tolerance	Voltage [V]	Dimension[mm]			Packaging							
								Φ180				Φ330			
					L	W	T	code	QTY	code	QTY	code	QTY	code	QTY
L	KGT31LCΔ1H134JT	0.13μF	J	50	3.2±0.2	1.6±0.2	0.95max.	T	4kp	–	–	–	–	–	–

R5 Dielectric

●Capacitance chart ■ Standard Spec.1 ▒ Standard Spec.2

R5								
Capacitance		104	224	474	105	225	475	106
Size/Voltage(Vdc)		0.1μF	0.22μF	0.47μF	1μF	2.2μF	4.7μF	10μF
KGT03 (0201)	6.3	Y8			Y*7			
KGT05 (0402)	6.3				Y8	Y8	Y*9	Z9
KGT21 (0805)	50					C3		

Please contact for capacitance value other than standard.
Please refer to here for the test method and specifications of Standard Specification 1.
Please refer to here for the test method and specifications of Standard Specification 2

The code in the capacity range table means product thickness (T-dimension) and Tan delta. For details about T dimensions, please refer to the Dimension section in the parts number list below. For Tan delta, please refer to the list on the right.

(Example) In case of "Y8" for KGT03;
T: 0.22max., Tanδ: 12.5% max.

Tan δ Code	Tan δ
3	5.0% max.
7	10.0% max.
8	12.5% max.
9	15.0% max.

Parts number list Thin KGT03~21 Series Temperature Characteristic: R5 Tolerance □: K: ±10%/ M: ±20%

Thickness code	Part Number	Capacitance	Tolerance :□	Voltage [V]	Dimension[mm]			Packaging: #							
								Φ180				Φ330			
					L	W	T	code	QTY	code	QTY	code	QTY	code	QTY
Y8	KGT03YR50J104□#	0.1μF	K/M	6.3	0.6±0.03	0.3±0.03	0.22max.	H	15kp	Q	30kp	N	50kp	W	150kp
Y*7	KGT03YR50J105□#	1μF	K/M	6.3	0.6±0.09	0.3±0.09	0.22max.	H	15kp	–	–	N	50kp	–	–
Y8	KGT05YR50J105□#	1μF	K/M	6.3	1.0±0.05	0.5±0.05	0.33max.	H	10kp	–	–	N	50kp	–	–
Y8	KGT05YR50J225M#	2.2μF	M	6.3	1.0±0.05	0.5±0.05	0.33max.	H	10kp	–	–	N	50kp	–	–
Y*9	KGT05YR50J475MH	4.7μF	M	6.3	1.0±0.2	0.5±0.2	0.33max.	H	10kp	–	–	–	–	–	–
Z9	KGT05ZR50J106M#	10μF	M	6.3	1.0±0.2	0.5±0.2	0.5max.	H	10kp	–	–	N	50kp	–	–
C3	KGT21CR51H225□#	2.2μF	K/M	50	2.0±0.2	1.25±0.2	0.95max.	T	4kp	–	–	M	10kp	–	–

S6/T6 Dielectric

●Capacitance chart ▒ Standard Spec.2 ▨ Optional Spec.

S6								
Capacitance		104	224	474	105	225	475	106
Size/Voltage(Vdc)		0.1μF	0.22μF	0.47μF	1μF	2.2μF	4.7μF	10μF
KGT03 (0201)	4	Y8						

T6								
Capacitance		104	224	474	105	225	475	106
Size/Voltage(Vdc)		0.1μF	0.22μF	0.47μF	1μF	2.2μF	4.7μF	10μF
KGT03 (0201)	4				Y*8			
KGT05 (0402)	2.5							Z8
	4				X8			

Please contact for capacitance value other than standard.
Please refer to here for the test method and specifications of Standard Specification 2.

The code in the capacity range table means product thickness (T-dimension) and Tan delta. For details about T dimensions, please refer to the Dimension section in the parts number list below. For Tan delta, please refer to the list on the right.

(Example) In case of "Y8" for KGT03;
T: 0.22max., Tanδ: 12.5% max.

Tan δ Code	Tan δ
8	12.5% max.

Parts number list Thin KGT03 Series Temperature Characteristic: S6 Tolerance □: K: ± 10%/ M: ±20%

Thickness code	Part Number	Capacitance	Tolerance :□	Voltage [V]	Dimension[mm]			Packaging: #							
								Φ180				Φ330			
					L	W	T	code	QTY	code	QTY	code	QTY	code	QTY
Y8	KGT03YS60G104□#	0.1μF	K/M	4	0.6±0.03	0.3±0.03	0.22max.	H	15kp	Q	30kp	N	50kp	W	150kp

Parts number list Thin KGT03~05 Series Temperature Characteristic: T6 Tolerance : M: ±20%

Thickness code	Part Number	Capacitance	Tolerance	Voltage [V]	Dimension[mm]			Packaging: #							
								Φ180				Φ330			
					L	W	T	code	QTY	code	QTY	code	QTY	code	QTY
Y*8	KGT03YT60G105M#	1μF	M	4	0.6±0.09	0.3±0.09	0.22max.	H	15kp	–	–	N	50kp	–	–
X8	KGT05XT60G105M#	1μF	M	4	1.0±0.1	0.5±0.05	0.22max.	H	10kp	–	–	N	50kp	–	–
Z8	KGT05ZT60E106M#	10μF	M	2.5	1.0±0.2	0.5±0.2	0.5max.	H	10kp	–	–	N	50kp	–	–

Specifications and Test Conditions for Temperature Compensation Type (CΔCharacteristics)
KGM/KGT/KGU Series (Standard Spec.1)

<table>
<tr><th colspan="2">Test Items</th><th>Specifications</th><th>Test Conditions (Complies with JIS C5101/ IEC60384)</th></tr>
<tr><td colspan="2">Capacitance</td><td>Within tolerance</td><td rowspan="2"><table><tr><th>Capacitance</th><th>Frequency</th><th>Voltage</th></tr><tr><td>C≤1000pF</td><td>1MHz±10%</td><td rowspan="2">0.5 to 5Vrms</td></tr><tr><td>C>1000pF</td><td>1kHz±10%</td></tr></table></td></tr>
<tr><td colspan="2">Q</td><td>C≥30pF : Q≥1000
C<30pF : Q≥400+20C</td></tr>
<tr><td colspan="2">Insulation Resistance</td><td>Over 10000MΩ or 500MΩ・μF, whichever is less</td><td>Measure after applying rated voltage for 1 minute in normal temperature and humidity.
The charge and discharge current of the capacitor must not exceed 50mA.</td></tr>
<tr><td colspan="2">Dielectric Strength</td><td>Resist without problem</td><td>Apply*3 times of the rated voltage for 1 to 5 seconds.
*KGU02ACΔ1ER20-120 : twice
The charge and discharge current of the capacitor must not exceed 50mA.</td></tr>
<tr><td colspan="2">Appearance</td><td>No problem observed</td><td>Microscope</td></tr>
<tr><td colspan="2">Termination Strength</td><td>No problem observed</td><td>Apply a sideward force of 5N to a PCB-mounted sample.
note: 1N for 01005 size.</td></tr>
<tr><td colspan="2">Bending Strength</td><td>No significant damage with 1mm bending.</td><td>Glass epoxy PCB (90mm fulcrum spacing), 10 seconds duration time.</td></tr>
<tr><td rowspan="3">Vibration</td><td>Appearance</td><td>No problem observed</td><td rowspan="3">Vibration frequency: 10 to 55 (Hz)
Amplitude: 1.5mm
Sweeping condition: 10→55→10Hz/ 1 minute in X, Y and Z directions: 2 hours each, 6 hours in total.</td></tr>
<tr><td>Capacitance</td><td>Within Tolerance</td></tr>
<tr><td>Q</td><td>C≥30pF : Q≥1000
C<30pF : Q≥400+20C</td></tr>
<tr><td rowspan="4">Resistance to Solder Heat</td><td>Appearance</td><td>No problem observed</td><td rowspan="4">Soak the sample in 260±5°C solder for 10±0.5 seconds, and measure after resting in normal temperature and humidity for 24±2 hours.
(Pre-heating conditions before soak)<table><tr><th>Order</th><th>Temperature</th><th>Time</th></tr><tr><td>1</td><td>80 to 100°C</td><td>2 minutes</td></tr><tr><td>2</td><td>150 to 200°C</td><td>2 minutes</td></tr></table>The charge and discharge current of the capacitor must not exceed 50mA for IR and dielectric strength measurement.</td></tr>
<tr><td>Capacitance Variation</td><td>Within±2.5% or±0.25pF, whichever is larger</td></tr>
<tr><td>Q</td><td>C≥30pF : Q≥1000
C<30pF : Q≥400+20C</td></tr>
<tr><td>Insulation Resistance</td><td>Over 10000MΩ or 500MΩ・μF whichever is less</td></tr>
<tr><td>Dielectric strength</td><td>Resist without problem</td><td></td></tr>
<tr><td colspan="2">Solderability</td><td>Solder coverage : 95% min.</td><td>Soaking condition<table><tr><th>Solder Type</th><th>Temperature</th><th>Time</th></tr><tr><td>Sn-3Ag-0.5Cu</td><td>245±5°C</td><td>3±0.5 sec.</td></tr></table></td></tr>
<tr><td rowspan="4">Temperature Cycle</td><td>Appearance</td><td>No problem observed</td><td rowspan="4">(Cycle)
Lowest operation temperature (30 min.)→
Room temperature (3 min.)→
Highest operation temperature (30 min.)→
Room temperature (3 min.)
After 5 cycles, measure after 24±2 hours.
The charge and discharge current of the capacitor must not exceed 50mA for IR and dielectric strength measurement.</td></tr>
<tr><td>Capacitance Variation</td><td>Within±2.5% or ±0.25pF, whichever is larger</td></tr>
<tr><td>Q</td><td>C≥30pF : Q≥1000
C<30pF : Q≥400+20C</td></tr>
<tr><td>Insulation Resistance</td><td>Over 10000MΩ or 500MΩ・μF, whichever is less</td></tr>
<tr><td>Dielectric Strength</td><td>Resist without problem</td><td></td></tr>
<tr><td rowspan="4">Load Humidity</td><td>Appearance</td><td>No problem observed</td><td rowspan="4">Apply the rated voltage for 500+12/ −0 hours in the condition of 40±2°C and 90 to 95%RH, and measure after resting in normal temperature and humidity for 24±2 hours.
The charge and discharge current of the capacitor must not exceed 50mA for IR measurement.</td></tr>
<tr><td>Capacitance Variation</td><td>Within±7.5% or ±0.75pF, whichever is larger</td></tr>
<tr><td>Q</td><td>C≥30pF : Q≥200
C<30pF : Q≥100+10C/ 3</td></tr>
<tr><td>Insulation Resistance</td><td>Over 500MΩ or 25MΩ・μF, whichever is less</td></tr>
<tr><td rowspan="4">Load Life</td><td>Appearance</td><td>No problem observed.</td><td rowspan="4">Apply *twice the rated voltage in 125±3°C for 1000+12/ −0 hours, and measure after resting in normal temperature and humidity for 24±2 hours.
The charge and discharge current of the capacitor must not exceed 50mA for IR measurement.
*Products listed below shall apply each indicated voltage.</td></tr>
<tr><td>Capacitance Variation</td><td>Within ±3% or ±0.3pF, whichever is larger</td></tr>
<tr><td>Q</td><td>C≥30pF : Q≥350
10pF<C<30pF : Q≥275+5C/ 2
C<10pF : Q≥200+10C</td></tr>
<tr><td>Insulation Resistance</td><td>Over 1000MΩ or 50MΩ・μF, whichever is less</td></tr>
</table>

Voltage to be applied in the Load Life (Applied voltage is the multiple of the rated voltage)

Applied Voltage	Rated Voltage	Products
×1.2	25V	KGU02ACΔ1ER20-120

Specifications and Test Conditions for High Dielectric Type (R5, R7, S7)
KGM/KGT Series (Standard Spec.1)

Test Items		Specifications	Test Conditions (Complies with JIS C5101/ IEC60384)
Capacitance		Within tolerance	Measure after heat treatment Capacitance / Frequency / Voltage C≤10μF: 1kHz±10% / 1.0±0.2Vrms; *1kHz±10% / 0.5±0.1Vrms C>10μF: 120Hz±10% / 0.5±0.1Vrms *KGM02AR50J104□# The charge and discharge current of the capacitor must not exceed 50mA.
Tanδ		Refer to capacitance chart	
Insulation Resistance		Over 10000MΩ or 500MΩ・μF, whichever is less	Measure after applying rated voltage for 1 minute in normal temperature and humidity. The charge and discharge current of the capacitor must not exceed 50mA.
Dielectric Strength		Resist without problem	Apply *2.5 times of the rated voltage for 1 to 5 seconds. *KGM31AR52A225, KGM31AS72A225 : twice The charge and discharge current of the capacitor must not exceed 50mA.
Appearance		No problem observed	Microscope
Termination Strength		No problem observed	Apply a sideward force of 5N to a PCB-mounted sample. note : 2N for 0201 size, and 1N for 01005 size. Exclude KGT series with thickness of less than 0.66mm.
Bending Strength		No significant damage with 1mm bending	Glass epoxy PCB (90mm fulcrum spacing), 10 seconds duration time. Exclude KGT series with thickness of less than 0.66mm.
Vibration	Appearance	No problem observed	Take the initial value after heat treatment. Vibration frequency: 10 to 55 (Hz) Amplitude: 1.5mm Sweeping condition: 10→55→10Hz/ 1 minute in X, Y and Z directions: 2 hours each, 6 hours in total, then measure the sample after heat treatment.
	Capacitance	Within tolerance	
	Tanδ	Within tolerance	
Resistance to Solder Heat	Appearance	No problem observed	Take the initial value after heat treatment. Soak the sample in 260±5°C solder for 10±0.5 seconds, and measure after heat treatment. (Pre-heating conditions before soak) Order / Temperature / Time 1: 80 to 100°C / 2 minutes 2: 150 to 200°C / 2 minutes The charge and discharge current of the capacitor must not exceed 50mA for IR and dielectric strength measurement.
	Capacitance Variation	Within±7.5%	
	Tanδ	Within tolerance	
	Insulation Resistance	Over 10000MΩ or 500MΩ・μF, whichever is less	
	Dielectric Strength	Resist without problem	
Solderability		Solder coverage : 95% min.	Soaking condition Solder Type / Temperature / Time Sn-3Ag-0.5Cu / 245±5°C / 3±0.5 sec.
Temperature Cycle	Appearance	No problem observed	Take the initial value after heat treatment. (Cycle) Lowest operation temperature (30 min.)→ Room temperature (3 min.)→ Highest operation temperature (30 min.)→ Room temperature (3 min.) After 5 cycles, measure after heat treatment. The charge and discharge current of the capacitor must not exceed 50mA for IR and dielectric strength measurement.
	Capacitance Variation	Within±7.5%	
	Tanδ	Within tolerance	
	Insulation Resistance	Over 10000MΩ or 500MΩ・μF, whichever is less	
	Dielectric Strength	Resist without problem	
Load Humidity	Appearance	No problem observed	Take the initial value after heat treatment. Apply rated voltage for 500+12/ −0 hours in 40°C±2°C and 90 to 95%RH, and measure after heat treatment. The charge and discharge current of the capacitor must not exceed 50mA for IR measurement.
	Capacitance Variation	Within±12.5%	
	Tanδ	200% max. of initial value	
	Insulation Resistance	Over 500MΩ or 25MΩ・μF, whichever is less	
Load Life	Appearance	No problem observed	Take the initial value after heat treatment. Apply *1.5 times the rated voltage at the highest operation temperature for 1000+12/ −0 hours, and measure after heat treatment. The charge and discharge current of the capacitor must not exceed 50mA for IR measurement. *Products listed below shall apply each indicated voltage.
	Capacitance Variation	Within±12.5%	
	Tanδ	200% max. of initial value	
	Insulation Resistance	Over 1000MΩ or 50MΩ・μF, whichever is less	

Heat treatment	Expose sample in the temperature of 150+0/ −10°C for 1 hour and leave the sample in normal temperature and humidity for 24±2 hours.

Voltage to be applied in the Load Life (Applied voltage is the multiple of the rated voltage)

Applied Voltage	Rated Voltage	Products
×1.0	100V	KGM31AR52A225, KGM31AS72A225
	10V	KGM02AR51A104
	16V	KGM21AR71C106
×1.3	6.3V	KGM02AR50J153-104, KGT03YR50J104

Please contact us for the optional specifications of the capacitance chart.

Specifications and Test Conditions for High Dielectric Type (R5, S6, T6, R7, S7, T7, K7)
KGM/KGT Series (Standard Spec.2)

<table>
<tr><th colspan="2">Test Items</th><th>Specifications</th><th>Test Conditions (Complies with JIS C5101/ IEC60384)</th></tr>
<tr><td colspan="2">Capacitance</td><td>Within tolerance</td><td rowspan="2">Measure after heat treatment
<table><tr><th>Capacitance</th><th>Frequency</th><th>Voltage</th></tr><tr><td rowspan="2">C≤10μF</td><td>1kHz±10%</td><td>1.0±0.2Vrms</td></tr><tr><td>*1kHz±10%</td><td>0.5±0.1Vrms</td></tr><tr><td>C>10μF</td><td>120Hz±10%</td><td>0.5±0.1Vrms</td></tr></table>*KGM02AR50J474, KGM03CR50J225, KGM03BR50J225, KGM03DR50J475, KGM03CR50G475,KGM03DR50G106, KGM05CR50J106, KGM05CS60J106, KGM03DS60E475, KGM03BT60E105, KGM05AR70J474, KGT03YR50J105, KGT05ZR50J106, KGT03YT60G105, KGT05YR50J475
The charge and discharge current of the capacitor must not exceed 50mA.</td></tr>
<tr><td colspan="2">Tanδ</td><td>Refer to capacitance chart</td></tr>
<tr><td colspan="2">Insulation Resistance</td><td>Over 50MΩ・μF</td><td>Measure after applying rated voltage for 1 minute in normal temperature and humidity.
The charge and discharge current of the capacitor must not exceed 50mA.</td></tr>
<tr><td colspan="2">Dielectric Strength</td><td>Resist without problem</td><td>Apply *2.5 times of the rated voltage for 1 to 5 seconds.
*KGM21AS72A105, KGM31HS72A475
KGM31AK72A225, KGM31HK72A475 : twice
The charge and discharge current of the capacitor must not exceed 50mA.</td></tr>
<tr><td colspan="2">Appearance</td><td>No problem observed</td><td>Microscope</td></tr>
<tr><td colspan="2">Termination Strength</td><td>No problem observed</td><td>Apply a sideward force of 5N to a PCB-mounted sample.
note : 2N for 0201 size, and 1N for 01005 size.
Exclude KGT series with thickness of less than 0.66mm.</td></tr>
<tr><td colspan="2">Bending Strength</td><td>No significant damage with 1mm bending</td><td>Glass epoxy PCB (90mm fulcrum spacing), 10 seconds duration time.
Exclude KGT series with thickness of less than 0.66mm.</td></tr>
<tr><td rowspan="3">Vibration</td><td>Appearance</td><td>No problem observed</td><td rowspan="3">Take the initial value after heat treatment.
Vibration frequency: 10 to 55 (Hz)
Amplitude: 1.5mm
Sweeping condition: 10→55→10Hz/ 1 minute in X, Y and Z directions: 2 hours each, 6 hours in total, then measure the sample after heat treatment.</td></tr>
<tr><td>Capacitance</td><td>Within tolerance</td></tr>
<tr><td>Tanδ</td><td>Within tolerance</td></tr>
<tr><td rowspan="5">Resistance to Solder Heat</td><td>Appearance</td><td>No problem observed</td><td rowspan="5">Take the initial value after heat treatment.
Soak the sample in 260±5°C solder for 10±0.5 seconds and measure after heat treatment.
(Pre-heating conditions before soak)
<table><tr><th>Order</th><th>Temperature</th><th>Time</th></tr><tr><td>1</td><td>80 to 100°C</td><td>2 minutes</td></tr><tr><td>2</td><td>150 to 200°C</td><td>2 minutes</td></tr></table>The charge and discharge current of the capacitor must not exceed 50mA for IR and dielectric strength measurement.</td></tr>
<tr><td>Capacitance Variation</td><td>Within±7.5%</td></tr>
<tr><td>Tanδ</td><td>Within tolerance</td></tr>
<tr><td>Insulation Resistance</td><td>Over 50MΩ・μF</td></tr>
<tr><td>Dielectric Strength</td><td>Resist without problem</td></tr>
<tr><td colspan="2">Solderability</td><td>Solder coverage : 95% min.</td><td>Soaking condition
<table><tr><th>Solder Type</th><th>Temperature</th><th>Time</th></tr><tr><td>Sn-3Ag-0.5Cu</td><td>245±5°C</td><td>3±0.5 sec.</td></tr></table></td></tr>
</table>

Specifications and Test Conditions for High Dielectric Type (R5, S6, T6, R7, S7, T7, K7)
KGM/KGT Series (Standard Spec.2)

Test Items		Specifications	Test Conditions (Complies with JIS C5101/ IEC60384)
Temperature Cycle	Appearance	No problem observed	Take the initial value after heat treatment. (Cycle) Lowest operation temperature (30 min.)→ Room temperature (3 min.)→ Highest operation temperature (30 min.)→ Room temperature (3 min.) After 5 cycles, measure after heat treatment. The charge and discharge current of the capacitor must not exceed 50mA for IR and dielectric strength measurement.
	Capacitance Variation	Within±7.5%	
	Tanδ	Within tolerance	
	Insulation Resistance	Over 50MΩ・μF	
	Dielectric Strength	Resist without problem	
Load Humidity	Appearance	No problem observed	Take the initial value after heat treatment. Apply rated voltage for 500+12/ −0 hours in 40±2°C and 90 to 95%RH, and measure after heat treatment. The charge and discharge current of the capacitor must not exceed 50mA for IR measurement.
	Capacitance Variation	Within±12.5%	
	Tanδ	200% max. of initial value	
	Insulation Resistance	Over 10MΩ・μF	
Load Life	Appearance	No problem observed	Take the initial value after heat treatment. Apply *One time the rated voltage at the highest operation temperature for 1000+12/ −0 hours, and measure after heat treatment. The charge and discharge current of the capacitor must not exceed 50mA for IR measurement. *Products listed below shall apply each indicated voltage.
	Capacitance Variation	Within±12.5%	
	Tanδ	200% max. of initial value	
	Insulation Resistance	Over 10MΩ・μF	

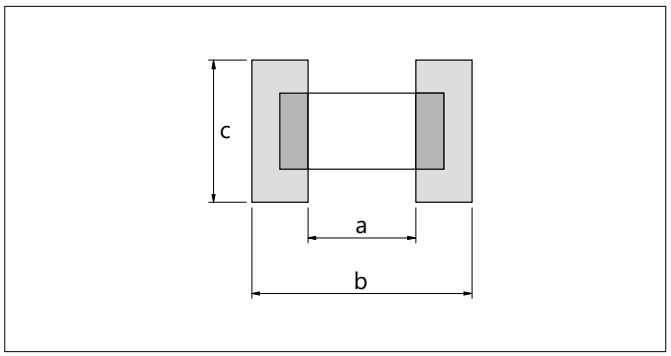
Heat treatment	Expose sample in the temperature of 150+0/ −10°C for 1 hour and leave the sample in normal temperature and humidity for 24±2 hours.

Voltage to be applied in the Load Life (Applied voltage is the multiple of the rated voltage)

Applied Voltage	Rated Voltage	Products
×1.2	6.3V	KGM03BR50J105
×1.3	10V	KGM03AR51A223-224
	6.3V	KGM03AR50J474
×1.5	50V	KGM31AR71H475
	25V	KGM15AR71E105, KGM21AR71E475,KGM31AR71E106
	16V	KGM05AR51C105, KGM15CR51C106
	10V	KGM03CR51A105, KGM05AR51A474-225, KGM05CR51A475,KGM21AR51A226, KGM15CS61A106, KGM15CT71A475
	6.3V	KGM05AR50J225, KGM05CS60J475, KGM21AS60J226,KGM05AR70J474, KGM05AR70J105, KGM05AS70J105
		KGM15CT70J106, KGM21AT70J226
×2.0	25V	KGM31AR71E475

Substrate for Adhesion Strength Test, Vibration Test, Soldering Heat Resistance Test, Temperature Cycle Test, Load Humidity Test, High-Temperature with Loading Test.

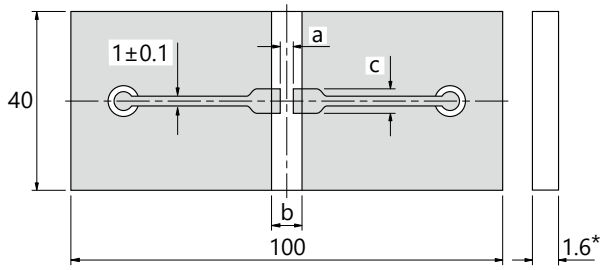
(Unit: mm)

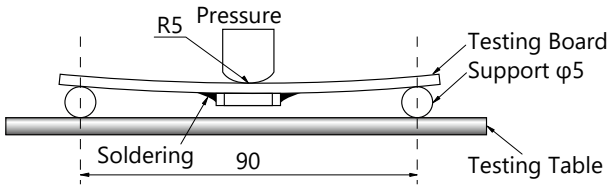


Size (EIA Code)	a	b	c
02 (01005)	0.15	0.5	0.2
03 (0201)	0.26	0.92	0.32
05 (0402)	0.4	1.4	0.5
15 (0603)	1.0	3.0	1.2
21 (0805)	1.2	4.0	1.65
31 (1206)	2.2	5.0	2.0
32 (1210)	2.2	5.0	2.9

Substrate for Bending Test

(Unit: mm)



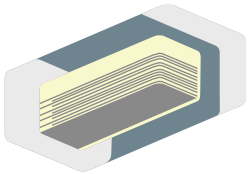


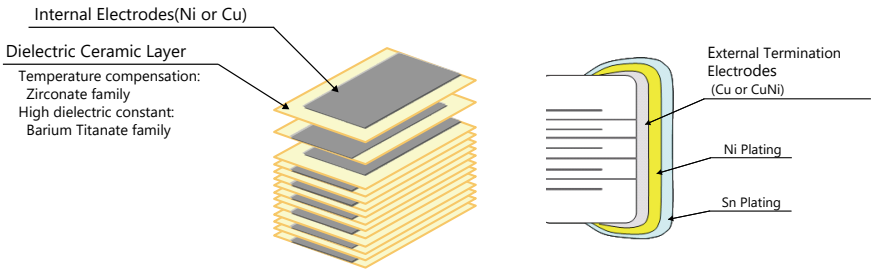
Testing Board : Glass Epoxy Board (GE4 or FR4)
Testing Board Thickness : 1.6±0.2*
Circuit Thickness : 0.04±0.01

*02, 03, 05 size 0.8±0.1mm

Structure

Plated Termination





■Certification status

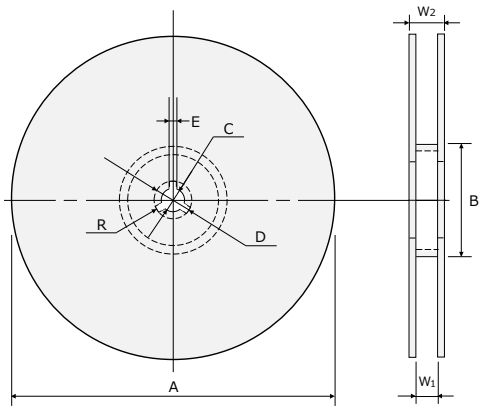
<ISO>
Acquired ISO 9001 quality management system certification.
<IATF>
Acquired IATF 16949 quality management system certification.

■Production plant

Kagoshima Kokubu plant

Reel

(Unit: mm)



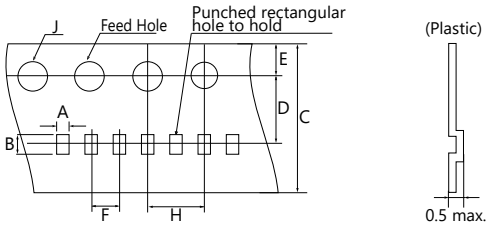
Code / Reel	A	B	C	D
7-inch Reel (CODE: T, H, Q, U)	180 $^{+0}_{-2.0}$	φ60 min.	13±0.5	21±0.8
7-inch Reel (CODE: P)	178±2.0			
13-inch Reel (CODE: L, M, N, W)	330±2.0			

Code / Reel	E	W1	W2	R
7-inch Reel (CODE: T, H, Q, U)	2.0±0.5	10.5±1.5	16.5 max.	1.0
7-inch Reel (CODE: P)		4.35±0.3	6.95±1.0	
13-inch Reel (CODE: L, M, N, W)		9.5±1.0	16.5 max.	

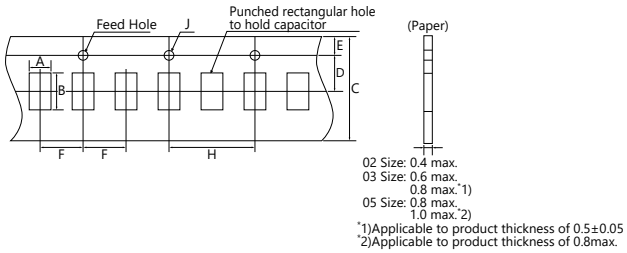
Carrier Tape

(Unit: mm)

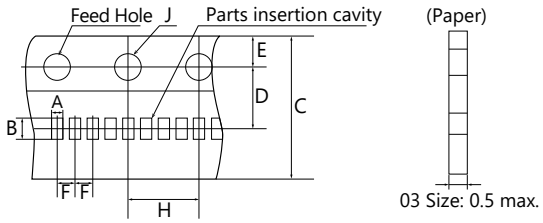
F=1mm (02 Size)



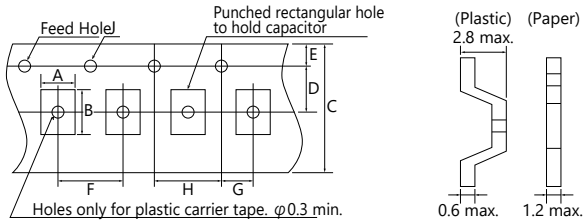
F=2mm (02, 03, 05 Size)



F=1mm (03 Size)



F=4mm (15, 21, 31, 32 Size)

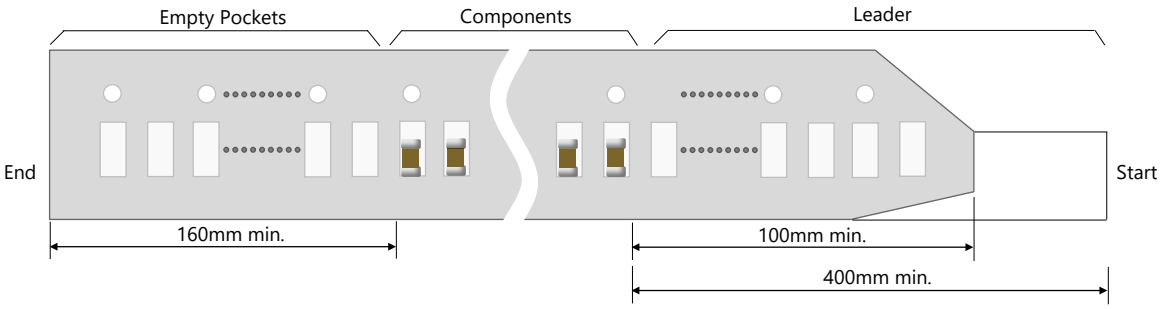


(Unit: mm)

Size (EIA Code)	A	B	C	D	E	F	G	H	J	Carrier Tape Width	Carrier Tape Material
02 (01005)*	0.24±0.02	0.44±0.02	4.0±0.08	1.8±0.02	0.9±0.05	1.0±0.02	—	2.0±0.04	0.8±0.04	4	Plastic
	0.25±0.03	0.45±0.03	8.0±0.3	3.5±0.05	1.75±0.1	2.0±0.05		4.0±0.1	1.5+0.1/-0	8	Paper
03 (0201)*	0.37±0.03	0.67±0.03	8.0+0.3/-0.1	3.5±0.05	1.75±0.1	1.0±0.05	—	4.0±0.05	1.5+0.1/-0	8	Paper
			8.0±0.3			2.0±0.05		4.0±0.1			
	0.39±0.03	0.69±0.03	8.0±0.3	3.5±0.05	1.75±0.1	2.0±0.05	—	4.0±0.1	1.5+0.1/-0		
	0.42±0.03	0.72±0.03	8.0±0.3	3.5±0.05	1.75±0.1	2.0±0.05	—	4.0±0.1	1.5+0.1/-0		
	0.44±0.05	0.74±0.05	8.0±0.3	3.5±0.05	1.75±0.1	2.0±0.05	—	4.0±0.1	1.5+0.1/-0		
05 (0402)*	0.65±0.1	1.15±0.1	8.0±0.3	3.5±0.05	1.75±0.1	2.0±0.05	—	4.0±0.1	1.5+0.1/-0	8	Paper
	0.75±0.1										
	0.8±0.1	1.3±0.1	8.0±0.3	3.5±0.05	1.75±0.1	2.0±0.05	—	4.0±0.1	1.5+0.1/-0		
15 (0603)*	1.0±0.2	1.8±0.2	8.0±0.3	3.5±0.05	1.75±0.1	4.0±0.1	2.0±0.05	4.0±0.1	1.5+0.1/-0	8	Paper
	1.1±0.2	1.9±0.2	8.0±0.3	3.5±0.05	1.75±0.1	4.0±0.1	2.0±0.05	4.0±0.1	1.5+0.1/-0		
21 (0805)	1.5±0.2	2.3±0.2	8.0±0.3	3.5±0.05	1.75±0.1	4.0±0.1	2.0±0.05	4.0±0.1	1.5+0.1/-0	8	Paper
										8	Plastic
31 (1206)	2.0±0.2	3.6±0.2	8.0±0.3	3.5±0.05	1.75±0.1	4.0±0.1	2.0±0.05	4.0±0.1	1.5+0.1/-0	8	Paper
										8	Plastic
32 (1210)	2.9±0.2	3.6±0.2	8.0±0.3	3.5±0.05	1.75±0.1	4.0±0.1	2.0±0.05	4.0±0.1	1.5+0.1/-0	8	Plastic

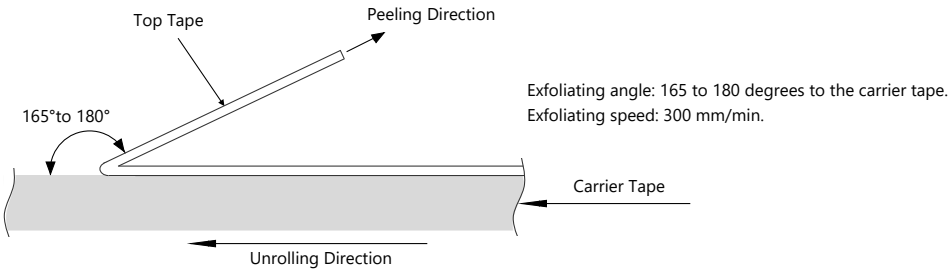
* Option

Detail of leader and trailer



Adhesive tape

1) The exfoliative strength when peeling off the top tape from the carrier tape by the method of the following figure shall be *0.1 to 0.7N. *02 Size: 0.1 to 0.5N
2) When the top tape is peeled off, the adhesive stays on the top tape.
3) Chip capacitors will be in a state free without being stuck on the thermal adhesive tape.



Exfoliating angle: 165 to 180 degrees to the carrier tape.
Exfoliating speed: 300 mm/min.

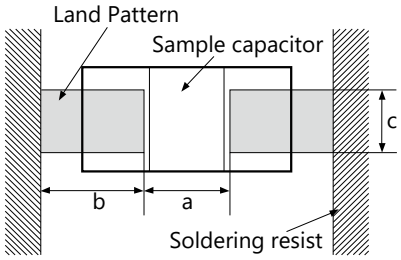
Carrier tape

1) Chip will not fall off from carrier tape or carrier tape will not be damaged by bending than within a radius of 25mm.
2) The chip are inserted continuously without any empty pocket.
3) Chip will not be mis-mounted because of too big clearance between components and cavity. Also the waste of carrier tape will not fill a nozzle hole of mounting machine.

Dimensions for recommended typical land

Since the amount of solder (size of fillet) to be used has direct influence on the capacitor after mounting, the sufficient consideration is necessary.
When the amounts of solder is too much, the stress that a capacitor receives becomes larger. It may become the cause of a crack in the capacitor. When the land design of printed wiring board is considered, it is necessary to set up the form and size of land pattern so that the amount of solder is suitable.

(Two Terminal Capacitors)



Two Terminal Capacitors (Unit: mm)

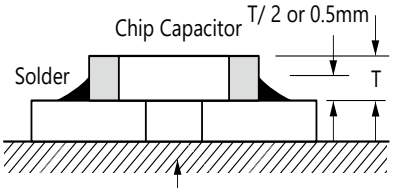
Size (EIA Code)	Dimension		Recommended land dimensions		
	L	W	a	b	c
02 (01005)	0.4±0.02	0.2±0.02	0.13 to 0.2	0.12 to 0.18	0.2 to 0.23
03 (0201)	0.6±0.03	0.3±0.03	0.2 to 0.25	0.25 to 0.35	0.3 to 0.4
	0.6±0.05	0.3±0.05			
	0.6±0.09	0.3±0.09	0.23 to 0.3	0.25 to 0.35	0.3 to 0.45
05 (0402)	1.0±0.05	0.5±0.05	0.3 to 0.5	0.35 to 0.45	0.4 to 0.6
	1.0±0.15	0.5±0.15	0.4 to 0.6	0.4 to 0.5	0.5 to 0.75
	1.0±0.2	0.5±0.2			
15 (0603)	1.6±0.1	0.8±0.1	0.7 to 1.0	0.8 to 1.0	0.6 to 0.9
	1.6±0.2	0.8±0.2	0.8 to 1.0	0.8 to 1.0	0.8 to 1.1
21 (0805)	2.0±0.2	1.25±0.2	1.0 to 1.3	1.0 to 1.2	1.25 to 1.55
31 (1206)	3.2±0.2	1.6±0.15	2.1 to 2.5	1.1 to 1.3	1.4 to 1.9
	3.2±0.2	1.6±0.2	2.1 to 2.5	1.1 to 1.3	1.6 to 2.0
	3.2±0.3	1.6±0.3			
32 (1210)	3.2±0.3	2.5±0.2	2.1 to 2.5	1.1 to 1.3	1.9 to 2.8

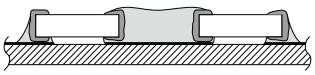
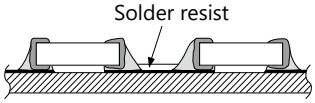
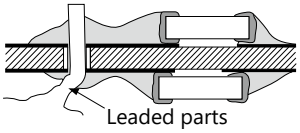
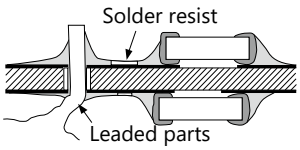
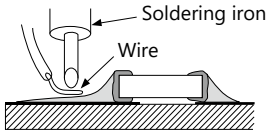
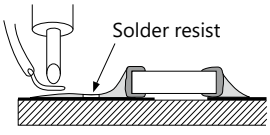
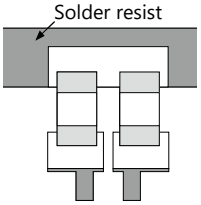
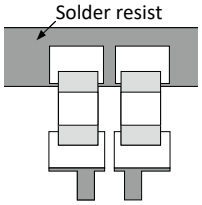
* Recommended land dimensions may differ depending on dimensional tolerance.

Design of printed circuit and Soldering

The recommended fillet height shall be 1/2 of the thickness of capacitors or 0.5mm. When mounting two or more capacitors in the common land, it is necessary to separate the land with the solder resist strike so that it may become the exclusive land of each capacitor.

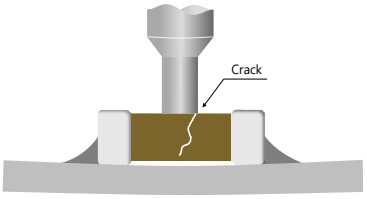
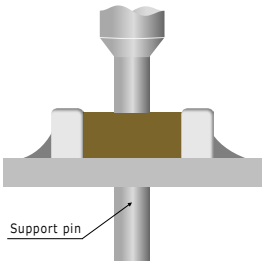
Ideal Solder Height



Item	Prohibited	Recommended example : Separation by solder resist
Multiple parts mount		
Mount with leaded parts		
Wire soldering after mounting		
Side by side layout		

Actual Mounting

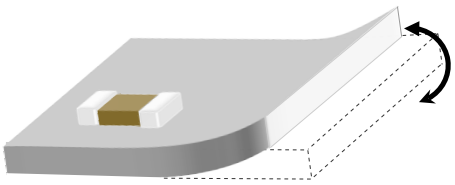
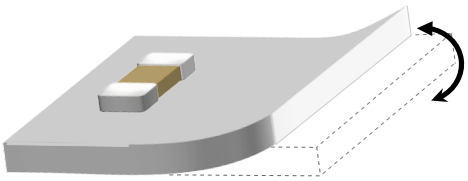
1) If the position of the vacuum nozzle is too low, a large force may be applied to the chip capacitor during mounting, resulting in cracking.
2) During mounting, set the nozzle pressure to a static load of 1 to 3 N.
3) To minimize the shock of the vacuum nozzle, provide a support pin on the back of the PCB to minimize PCB flexure.
4) Bottom position of pick up nozzle should be adjusted to the top surface of a substrate which camber is corrected.

Not recommended	Ideal
	

Mounting Design

The chip could crack if the PCB warps during processing after the chip has been soldered.

Recommended chip position on PCB to minimize stress from PCB warpage

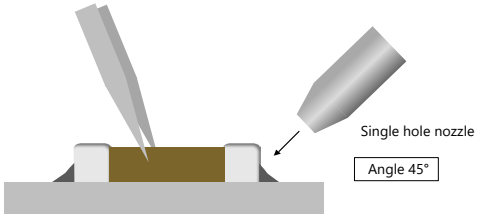
Not recommended	Ideal
	

Soldering Method

1) Ceramic is easily damaged by rapid heating or cooling. If some heat shock is unavoidable, preheat enough to limit the temperature difference (Delta T) to within 150 degree Celsius.
2) The product size 1.6×0.8mm to 3.2×1.6mm can be used in reflow and wave soldering, and the product size of bigger than 3.2×1.6mm, or smaller than 1.6×0.8mm can be used in reflow.
   Circuit shortage and smoking can be created by using capacitors which are used neglecting the above caution.
3) Please see our recommended soldering conditions.
4) In case of using Sn-Zn Solder, please contact us in advance.
5) The following condition is recommended for spot heater application.

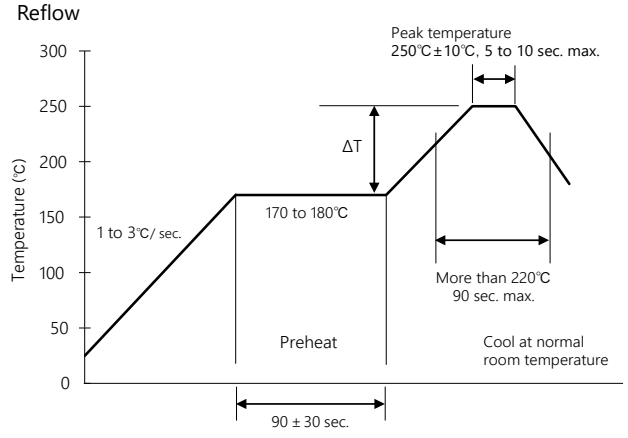
・Recommended spot heater condition

Item	Condition
Distance	5mm min.
Angle	45°
Projection Temp.	400°C max.
Flow rate	Set at the minimum
Nozzle diameter	2φ to 4φ (Single hole type)
Application time	10 sec. max. (1206 and smaller) 30 sec. max. (1210 and larger)

How to point spot heater


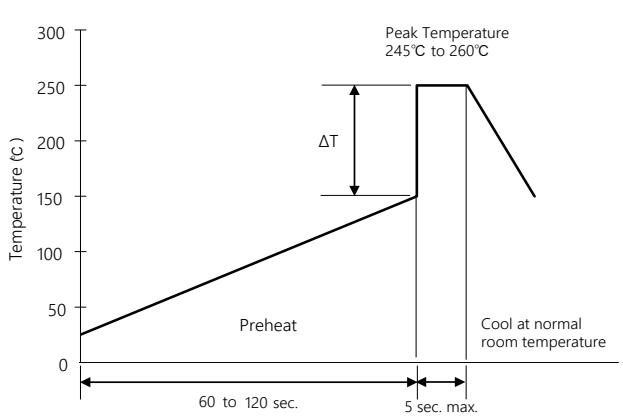
■ Recommended Temperature Profile (Sn-3Ag-0.5Cu)

Reflow



① Minimize soldering time.
② Ensure that allowable temperature difference does not exceed 150℃.
③ Ensure that allowable temperature difference does not exceed 130℃ for 3.2×2.5mm size or larger.
④ MLCC can withstand the above reflow conditions up to 3 times.
⑤ N_2 atmosphere is recommended for reflow of products of 0.4mm×0.2mm size or smaller.

Wave



① Ensure that the chip capacitor is preheated adequately.
② Ensure that the temperature difference (ΔT) does not exceed 150℃.
③ Cool naturally after soldering.
④ Wave soldering is not applicable for chips with size of 3.2×2.5mm or larger of 1.0×0.5 mm or smaller and capacitor arrays.

Resin Mold

1) If a large amount of resin is used for molding the chip, cracks may occur due to contraction stress during curing. To avoid such cracks, use a low shrinkage resin.
2) The insulation resistance of the chip will degrade due to moisture absorption. Use a low moisture absorption resin.
3) Check carefully that the resin does not generate a decomposition gas or reaction gas during the curing process or during normal storage. Such gases may crack the chip capacitor or damage the device itself.

Circuit Design

1. Once application and assembly environments have been checked, the capacitor may be used in conformance with the rating and performance which are provided in both the catalog and the specifications. Use exceeding that which is specified may result in inferior performance or cause a short, open, smoking, or flaming to occur, etc.

2. Please consult the manufacturer in advance when the capacitor is used in devices such as: devices which deal with human life, i.e. medical devices; devices which are highly public orientated; and devices which demand a high standard of liability.
   Accident or malfunction of devices such as medical devices, space equipment and devices having to do with atomic power could generate grave consequence with respect to human lives or, possibly, a portion of the public. Capacitors used in these devices may require high reliability design different from that of general purpose capacitors.

3. Please use the capacitors in conformance with the operating temperature provided in both the catalog and the specifications.
   Be especially cautious not to exceed the maximum temperature. In the situation the maximum temperature set forth in both the catalog and specifications is exceeded, the capacitor's insulation resistance may deteriorate, power may suddenly surge and short-circuit may occur.
   The capacitor has a loss, and may self-heat due to equivalent series resistance when alternating electric current is passed therethrough. As this effect becomes especially pronounced in high frequency circuits, please exercise caution.
   When using the capacitor in a (self-heating) circuit, please make sure the surface of the capacitor remains under the maximum temperature for usage. Also, please make certain temperature rises remain below 20°C.

4. Please keep voltage under the rated voltage which is applied to the capacitor. Also, please make certain the peak voltage remains below the rated voltage when AC voltage is super-imposed to the DC voltage.
   In the situation where AC or pulse voltage is employed, ensure average peak voltage does not exceed the rated voltage.
   Exceeding the rated voltage provided in both catalog and specifications may lead to defective withstanding voltage or, in worst case situations, may cause the capacitor to smoke or flame.

5. When the capacitor is to be employed in a circuit in which there is continuous application of a high frequency voltage or a steep pulse voltage, even though it is within the rated voltage, please inquire to the manufacturer.
   In the situation the capacitor is to be employed using a high frequency AC voltage or a extremely fast rising pulse voltage, even though it is within the rated voltage, it is possible capacitor reliability will deteriorate.

6. It is a common phenomenon of high-dielectric products to have a deteriorated amount of static electricity due to the application of DC voltage.
   Due caution is necessary as the degree of deterioration varies depending on the quality of capacitor materials, capacity, as well as the load voltage at the time of operation.

7. Do not use the capacitor in an environment where it might easily exceed the respective provisions concerning shock and vibration specified in the catalog and specifications.
   In addition, it is a common piezo phenomenon of high dielectric products to have some voltage due to vibration or to have noise due to voltage change. Please contact sales in such case.

8. If the electrostatic capacity value of the delivered capacitor is within the specified tolerance, please consider this when designing the respective product in order that the assembled product function appropriately.

9. Please contact us upon using conductive adhesives.

Storage

Please note the following regarding the storage of delivered products.

1. Set the storage temperature to + 5 to + 40 °C and humidity to 20 ~ 70% RH. Other meteorological conditions are in accordance with classification 1 K2 of JIS C 60721 -3 -1.

2. Store in a place where corrosive gas (H_2S, SO_2, NO_2, Cl_2, etc.) does not exist in the atmosphere. Also, avoid exposure to salty moisture. In either case, this may cause oxidation corrosion of the terminal electrode, reducing solderability.

If you store the above delivered products according to the conditions listed above, it will satisfy the solderability standard for 6 months from the shipping date.

Safety application guideline and detailed information of electrical properties are also provided in kyocera web site;

URL: https://ele.kyocera.com/en/product/capacitor/

Notes for Using the Catalog

1. Contents described herein are as of April 2025.

2. Contents in this catalog are subject to change without notice. It is recommended to confirm the latest information at the time of usage. We may not be able to accept requests based on old catalogs.

3. The products described in this catalog are intended for use in general electronic equipment (Information equipment, communication equipment, audio and video equipment, measurement equipment, home appliances, automotive equipment, etc.). If you plan to use the product in any equipment or system that requires special quality and reliability of those beyond catalog spec and whose failure or malfunction may directly threaten human life or cause physical harm (Safety equipment, aerospace, nuclear power control, medical equipment including life support equipment, etc.), please contact our company sales representative before using the product.

4. Even though we strive for improvements of quality and reliability of products, it is requested to design with enough safety margin in equipment or systems in order not to threaten human lives directly or damage human bodies or properties by an accidental result of products.

5. It is requested to design based on guaranteed specifications for such as maximum ratings, operating voltage and operating temperature. It is not the scope of our guarantee for unsatisfactory results due to misuse or inadequate usage of products in this catalog.

6. Operation summaries and circuit examples in this catalog are intended to explain typical operation and usage of the product. It is recommended to perform circuit and assembly design considering surrounding conditions upon using products in this catalog.

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