

## ■ 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.

## ■ KYOCERA PART NUMBER

CM 03 X5R 225 M 06 A H □□□

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ OPTION :  
Above digits are used to track individual specification or thickness.

(Example)

- ① Series : CM Series(General)
- ② Size : 0201
- ③ Dielectric : X5R
- ④ Capacitance : 2.2μF
- ⑤ Tolerance : ±20%
- ⑥ Voltage : 6.3Vdc
- ⑦ Termination : Sn
- ⑧ Packaging : Cavity pitch 2mm / Reel Size φ180

### ① SERIES CODE

CODE	Type
CM	General
CT	Low Profile
CU	High-Q
KNH	Three Terminal Capacitors

### ② SIZE CODE

CODE	EIA	JIS
02	01005	0402
03	0201	0603
05	0402	1005
105	0603	1608
21	0805	2012
316	1206	3216
32	1210	3225

### ③ DIELECTRIC CODE

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

- All parts of COG 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 max. (%)	Standard Temperature (°C)
X5R	-55 to 85	±15	25
X6S	-55 to 105	±22	
X6T		+22/-33	
X7R		±15	
X7S	-55 to 125	±22	
X7T		+22/-33	

### ④ CAPACITANCE CODE

Capacitance expressed in pF.  
Two significant digits plus number of zeros.  
For Values < 10pF, Letter R denotes decimal point,  
< 1,000pF= 1nF, 1,000nF= 1μF>

(Example)

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

E STANDARD NUMBER					
CODE	E3	E6	E12	E24	
1.0	1.0	1.0	1.0	1.1	
		1.2	1.2	1.3	
		1.5	1.5	1.6	
2.2	2.2	2.2	2.2	2.4	
		2.7	2.7	3.0	
		3.3	3.3	3.6	
4.7	4.7	4.7	4.7	5.1	
		5.6	5.6	6.2	
		6.8	6.8	7.5	
	6.8	8.2	8.2	9.1	

### ⑤ TOLERANCE CODE

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

\* : Option

### ⑥ VOLTAGE CODE

CODE	Rated Vltage
02	2.5Vdc
04	4Vdc
06	6.3Vdc
10	10Vdc
16	16Vdc
25	25Vdc
35	35Vdc
50	50Vdc
100	100Vdc

### ⑦ TERMINATION CODE

CODE	Termination
A	Nickel Barrier/ Tin

\* Please contact us if Au termination is needed.

### ⑧ PACKAGING CODE

CODE	Size Code	Cavity pitch	Reel size
T	105 to 32	4mm	φ180
H	02 to 05	2mm	
Q	03/05	1mm	
P	02	1mm	
L	105 to 32	4mm	φ330
N	02 to 05	2mm	
W	03/05	1mm	

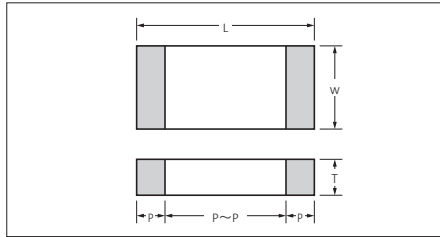
High Dielectric Constant Type (X5R/X6S/X6T/X7R/X7S/X7T)	
CODE	Tolerance
J*	±5%
K	±10%
M	±20%

\* : Option

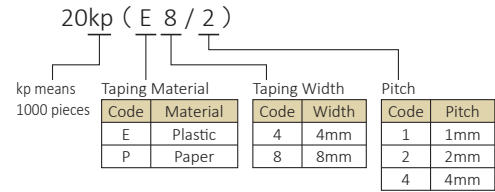


## Dimension

### CM/CT/CU Series

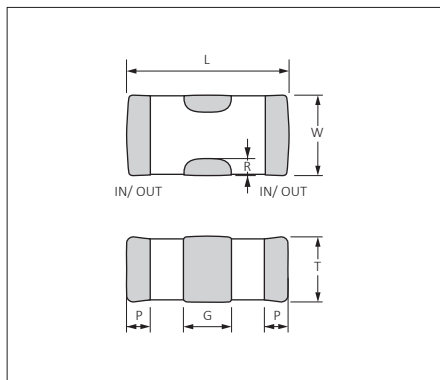


### Packaging Code



Size	Code		Dimension Code	Dimension (mm)						Quantity per reel	
	EIA	JIS		L	W	T	P min.	P max.	P to 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	A	0.6±0.03	0.3±0.03	0.22 max.	0.10	0.20	0.20	30kp(P8/1) 15kp(P8/2)	150kp(P8/1) 50kp(P8/2)
			B			0.3±0.03					
			C	0.6±0.05	0.3±0.05	0.3±0.05	0.13	0.23	0.19	15kp(P8/2)	50kp(P8/2)
			D			0.22 max.					
			E			0.3±0.09					
F	0.5±0.05										
05	0402	1005	A	1.0±0.05	0.5±0.05	0.22 max.	0.15	0.35	0.30	20kp(P8/1) 10kp(P8/2)	100kp(P8/1) 50kp(P8/2)
			B			0.33 max.					
			C			0.5±0.05					
			D	1.0±0.10	0.5±0.05	0.22 max.	0.15	0.35	0.30	10kp(P8/2)	50kp(P8/2)
			E			0.5±0.15					
			F	1.0±0.15	0.5±0.15	0.33 max.	0.15	0.35	0.30	10kp(P8/2)	—
			G			0.50 max.					
			H			0.55 max.					
			J			0.5±0.20					
			K			0.80 max.					
			105	0603	1608	A	1.6±0.10	0.8±0.10	0.55 max.	0.20	0.60
B	0.8±0.10										
C	1.6±0.15	0.8±0.15				0.8±0.15	0.20	0.60	0.50	4kp(P8/4)	10kp(P8/4)
D						0.8±0.20					
21	0805	2012	B	2.0±0.10	1.25±0.10	1.25±0.10	0.20	0.75	0.70	3kp(E8/4) 4kp(P8/4)	10kp(E8/4) 10kp(P8/4)
			C			0.95 max.					
			E	2.0±0.20	1.25±0.20	0.95 max.	0.20	0.75	0.70	4kp(P8/4)	10kp(P8/4)
			F			1.25±0.20					
			F			—					
316	1206	3216	A	3.2±0.20	1.6±0.15	1.6±0.15	0.30	0.85	1.40	2.5kp(E8/4)	5kp(E8/4)
			B			1.6±0.20					
			C	3.2±0.30	1.6±0.30	1.6±0.30	0.30	0.85	1.90	2kp(E8/4)	—
C	—										
32	1210	3225	A	3.2±0.30	2.5±0.20	2.5±0.20	0.30	1.00	1.40	1kp(E8/4)	4kp(E8/4)

### KNH Series



Size	Code		Dimension Code	Dimension (mm)						Packaging	
	EIA	JIS		L	W	T	G	P	R	φ180 Reel	φ330 Reel
KNH 05	0402	1005	A	1.0±0.10	0.5±0.20	0.5 max.	0.3±0.10	0.15±0.10	≥0.05	10kp(P8/2)	—
			B	1.0±0.15	0.5±0.15	0.5±0.15					
			C	1.0±0.20	0.5±0.20	0.5±0.20					



Three Terminal Capacitor

## KNH Series

【RoHS Compliant Products】

### ■ Features

0402 Size. Rated current up to 2A MAX.  
 With unique circuit structure, this three terminal capacitor enables noise reduction in wide frequency range. With its high capacitance, it is possible to reduce the number of components being used.

### ■ Applications

- Decoupling applications of power supply lines around high-speed operating processors such as smartphones, tablets, and wearable devices

### X5R Dielectric

● Capacitance chart   Standard Spec.2

Size (EIA Code)	KNH05 (0402)	
Rated Voltage(Vdc)	4	
Capacitance		
105	1.0 $\mu$ F	
435	4.3 $\mu$ F	A
106	10 $\mu$ F	C
156	15 $\mu$ F	B

• Storage condition  
 Temperature: -10 to +45°C  
 Humidity: 45 to 75%RH

Please refer [here](#) for the test method and specifications of Standard Specification 2.

Alphabets in capacitance chart denote dimensions. Please refer to the below table for detail.

(Example) In case of "A" for KNH05;

L: 1.0±0.10mm, W: 0.5±0.20mm, T: 0.5mm max.

Size	Dimension Code	Dimension (mm)						Packaging $\phi$ 180 Reel				
		L	W	T	G	P	R	Code	Quantity	Taping Material	Taping Width	Cavity Pitch
KNH05	A	1.0±0.10	0.5±0.20	0.5 max.	0.3±0.10	0.15±0.10	≥0.05	H	10,000	Paper	8mm	2mm
	B	1.0±0.15	0.5±0.15	0.5±0.15	0.3±0.10	0.15±0.10	≥0.05	H	10,000	Paper	8mm	2mm
	C	1.0±0.20	0.5±0.20	0.5±0.20	0.3±0.10	0.15±0.10	≥0.05	H	10,000	Paper	8mm	2mm

### X6S Dielectric

● Capacitance chart   Standard Spec.2

Size (EIA Code)	KNH05 (0402)	
Rated Voltage(Vdc)	2.5	4
Capacitance		
105	1.0 $\mu$ F	
435	4.3 $\mu$ F	A
106	10 $\mu$ F	
156	15 $\mu$ F	

• Storage condition  
 Temperature: -10 to +45°C  
 Humidity: 45 to 75%RH

Please refer [here](#) for the test method and specifications of Standard Specification 2.

Alphabets in capacitance chart denote dimensions. Please refer to the below table for detail.

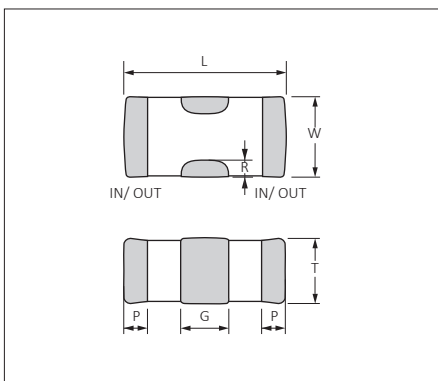
(Example) In case of "A" for KNH05;

L: 1.0±0.10mm, W: 0.5±0.20mm, T: 0.5mm max.

Size	Dimension Code	Dimension (mm)						Packaging $\phi$ 180 Reel				
		L	W	T	G	P	R	Code	Quantity	Taping Material	Taping Width	Cavity Pitch
KNH05	A	1.0±0.10	0.5±0.20	0.5 max.	0.3±0.10	0.15±0.10	≥0.05	H	10,000	Paper	8mm	2mm

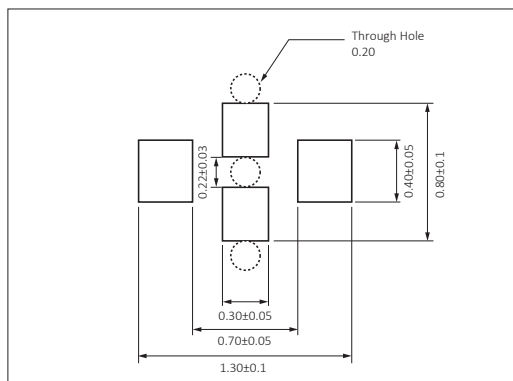
### ■ Dimension

(Unit: mm)



### ■ Recommended Land Pattern

(Unit: mm)





## Test Conditions and Standards

### Test Conditions and Specifications for High Dielectric Type (X5R, X6S) KNH Series (Standard Spec.2)

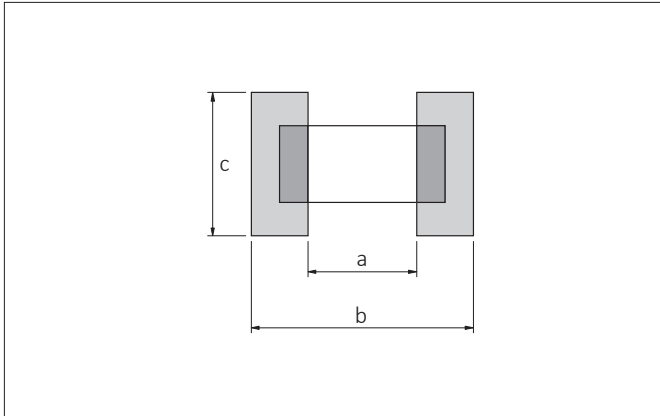
Test Items		Test Conditions	Specifications												
Capacitance Value (C)		Measure after heat treatment <table border="1"> <thead> <tr> <th>Capacitance</th> <th>Frequency</th> <th>Volt</th> </tr> </thead> <tbody> <tr> <td>C ≤ 10μF</td> <td>1kHz±10%</td> <td>1.0±0.2Vrms</td> </tr> <tr> <td></td> <td>*1kHz±10%</td> <td>0.5±0.2Vrms</td> </tr> <tr> <td>C &gt; 10μF</td> <td>120Hz±10%</td> <td>0.5±0.2Vrms</td> </tr> </tbody> </table> *KNH05X5R106 The charge and discharge current of the capacitor must not exceed 50mA.	Capacitance	Frequency	Volt	C ≤ 10μF	1kHz±10%	1.0±0.2Vrms		*1kHz±10%	0.5±0.2Vrms	C > 10μF	120Hz±10%	0.5±0.2Vrms	Within tolerance
Capacitance	Frequency	Volt													
C ≤ 10μF	1kHz±10%	1.0±0.2Vrms													
	*1kHz±10%	0.5±0.2Vrms													
C > 10μF	120Hz±10%	0.5±0.2Vrms													
Insulation Resistance (IR)		Apply the rated voltage for 1 minute, and measure it in normal temperature and humidity. The charge and discharge current of the capacitor must not exceed 50mA.	Over 50MΩ•μF												
Direct current resistance			0.03Ω max.												
Rated current			2A(DC)												
Dielectric Resistance		Apply 2.5 times of the rated voltage for 1 to 5 seconds. The charge and discharge current of the capacitor must not exceed 50mA.	No problem observed												
Appearance		Microscope	No problem observed												
Bending Strength		Glass epoxy PCB: Fulcrum spacing: 90mm, duration time 10 seconds.	No significant damage with 1mm bending												
Vibration Test	Appearance	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, and place in normal temperature and humidity, then measure the sample after heat treatment.	No problem observed												
	ΔC		Within tolerance												
Soldering Heat Resistant	Appearance	Take the initial value after heat treatment. Soak the sample in 260°C±5°C solder for 10±0.5 seconds and place in normal temperature and humidity, and measure after heat treatment.	No problem observed												
	ΔC	(Pre-heating conditions)	Within±30.0%												
	IR	<table border="1"> <thead> <tr> <th>Order</th> <th>Temperature</th> <th>Time</th> </tr> </thead> <tbody> <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> </tbody> </table>	Order	Temperature	Time	1	80 to 100°C	2 minutes	2	150 to 200°C	2 minutes	Over 50MΩ•μF			
	Order	Temperature	Time												
1	80 to 100°C	2 minutes													
2	150 to 200°C	2 minutes													
Withstanding Voltage	The charge and discharge current of the capacitor must not exceed 50mA for IR and withstanding voltage measurement.	Resist without problem													
Solderability		Soaking condition <table border="1"> <thead> <tr> <th>Sn-3Ag-0.5Cu</th> <th>Temperature</th> <th>Time</th> </tr> </thead> <tbody> <tr> <td></td> <td>245±5°C</td> <td>3±0.5 sec.</td> </tr> <tr> <th>Sn63 Solder</th> <th>Temperature</th> <th>Time</th> </tr> <tr> <td></td> <td>235±5°C</td> <td>2±0.5 sec.</td> </tr> </tbody> </table>	Sn-3Ag-0.5Cu	Temperature	Time		245±5°C	3±0.5 sec.	Sn63 Solder	Temperature	Time		235±5°C	2±0.5 sec.	Solder coverage : 95% min.
Sn-3Ag-0.5Cu	Temperature	Time													
	245±5°C	3±0.5 sec.													
Sn63 Solder	Temperature	Time													
	235±5°C	2±0.5 sec.													
Temperature Cycle	Appearance	Take the initial value after heat treatment. (Cycle)	No problem observed												
	ΔC	Room temperature (3 min.)→ Lowest operation temperature (30 min.)→ Room temperature (3 min.)→ Highest operation temperature(30 min.)	Within±30.0%												
	IR	After 5 cycles, measure after heat treatment.	Over 50MΩ•μF												
	Withstanding Voltage	The charge and discharge current of the capacitor must not exceed 50mA for IR and withstanding voltage measurement.	Resist without problem												
Moisture Resistant Load	Appearance	Take the initial value after heat treatment. After applying rated voltage for 500+12/ -0 hours in the condition of 40°C±2°C and 90 to 95%RH, and place in normal temperature and humidity, then measure the sample after heat treatment.	No problem observed												
	ΔC	The charge and discharge current of the capacitor must not exceed 50mA for IR measurement.	Within±30.0%												
	IR		Over 10MΩ•μF												
High-Temperature Load	Appearance	Take the initial value after heat treatment. After applying 1.0 times the rated voltage at the highest operation temperature for 1000+12/ -0 hours, and measure the sample after heat treatment in normal temperature and humidity.	No problem observed												
	ΔC	The charge and discharge current of the capacitor must not exceed 50mA for IR measurement.	Within±30.0%												
	IR		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.													



## Test Conditions and Standards

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	0.50	0.20
03 (0201)	0.26	0.92	0.32
05 (0402)	0.4	1.4	0.5
105 (0603)	1.0	3.0	1.2
21 (0805)	1.2	4.0	1.65
316 (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 (CE4 or FR4)  
 Testing Board Thickness : 1.6±0.2mm\*  
 Circuit Thickness : 0.04±0.01mm

\*02, 03, 05 size 0.8±0.1mm

## Structure

**Plated Termination**

Internal Electrodes (Pd or Ni or Cu)  
 Dielectric Ceramic Layer  
 Temperature compensation:  
 Titanate family  
 Zirconate family  
 High dielectric constant:  
 Barium Titanate family

External Termination Electrodes (Ag or Cu or CuNi)  
 Ni Plating  
 Sn Plating

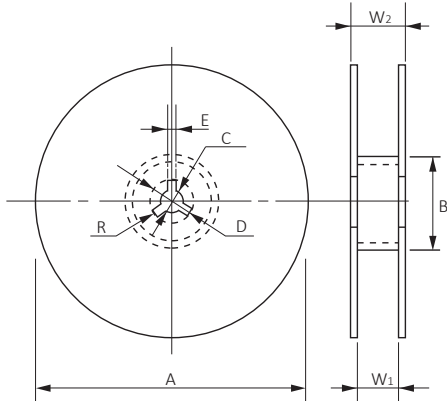
### About official Standards Certification

- The sites that manufacture the products listed in this catalog have acquired ISO 9001 quality management system (certification).
- The production site is Kagoshima Kokubu Plant.



## Packaging Options Tape and Reel

### Reel



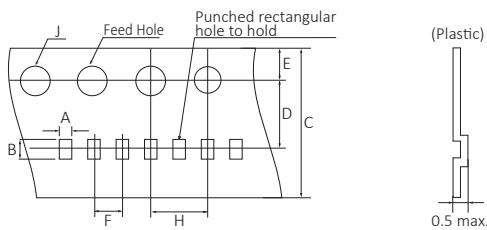
(Unit: mm)

Code Reel	A	B	C	D
7-inch Reel (CODE: T, H, Q)	180 <sup>+0</sup> <sub>-2.0</sub>	φ60 min.	13±0.5	21±0.8
7-inch Reel (CODE: P)	178±2.0			
13-inch Reel (CODE: L, N, W)	330±2.0			
Code Reel	E	W1	W2	R
7-inch Reel (CODE: T, H, Q)	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, N, W)		9.5±1.0	16.5 max.	

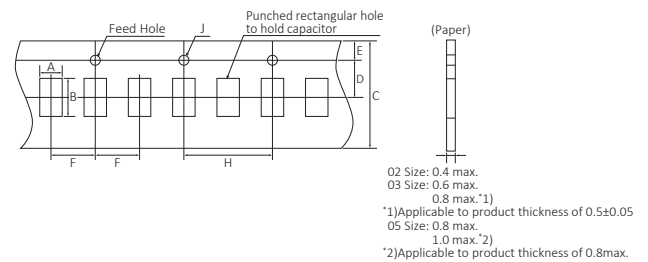
### Carrier Tape

(Unit: mm)

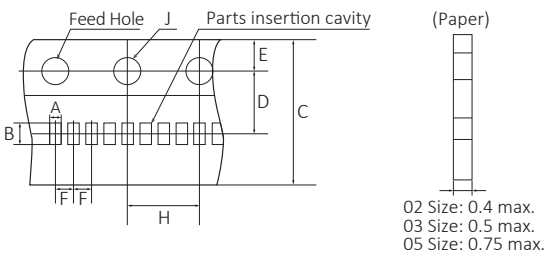
F=1mm (02 Size)



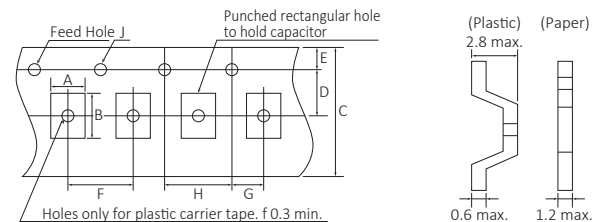
F=2mm (02, 03, 05 Size)



F=1mm (02, 03, 05 Size)



F=4mm (105, 21, 316, 32 Size)



(Unit: mm)

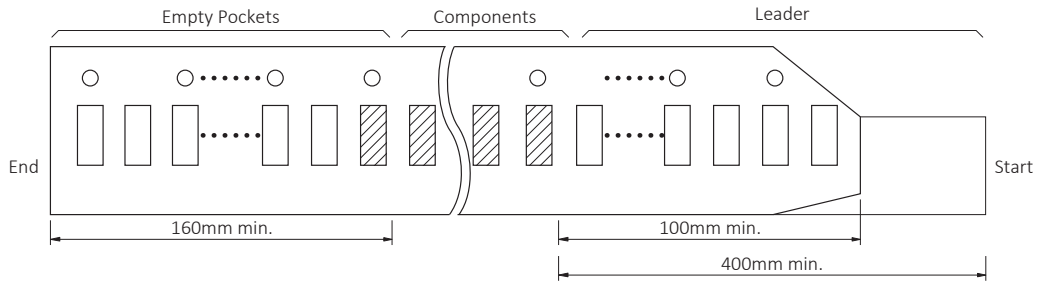
Size (EIA Code)	A	B	C	D	E	F	G	H	J	Carrier Tape	
										Width	Material
02 (01005)*	0.24±0.02	0.44±0.02	4.0±0.08	1.8±0.02	0.9±0.05	1.0±0.02	—	2.0±0.04	0.8±0.04	4mm	Plastic
	0.25±0.03	0.45±0.03	8.0±0.3	3.5±0.05	1.75±0.1	2.0±0.05	—	4.0±0.1	1.5±0.1/-0	8mm	Paper
03 (0201)*	0.37±0.03	0.67±0.03	8.0+0.3/-0.1	3.5±0.05	1.75±0.1	1.0±0.05	—	4.0±0.05	1.5±0.1/-0	8mm	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		
05 (0402)*	0.65±0.1	1.15±0.1	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	8mm	Paper
			8.0±0.3			2.0±0.05		4.0±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		
105 (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	8mm	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	8mm	Paper
										8mm	Plastic
316 (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	8mm	Paper
										8mm	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	8mm	Plastic

\* Option



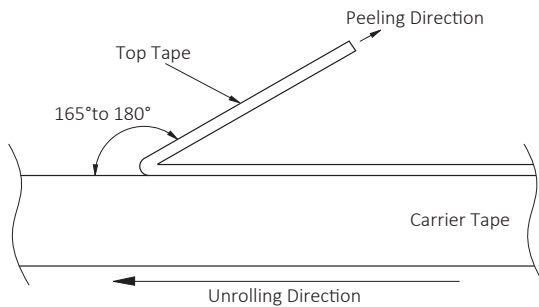
## Packaging Options

### 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.

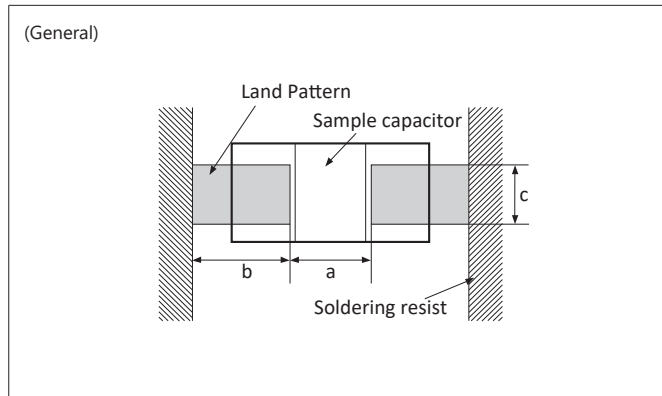


## Surface Mounting Information

### 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.



### General

(Unit: mm)

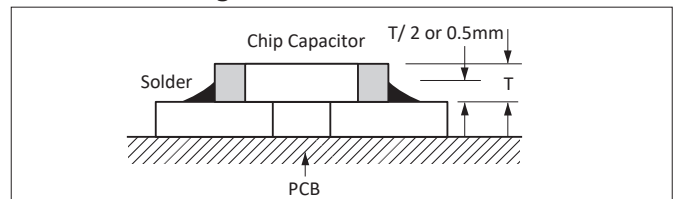
Size (EIA Code)	Dimension		Recommended land dimensions		
	L	W	a	b	c
02 (01005)	0.4±0.02	0.2±0.02	0.13 to 0.20	0.12 to 0.18	0.20 to 0.23
	0.6±0.03	0.3±0.03	0.20 to 0.25	0.25 to 0.35	0.30 to 0.40
03 (0201)	0.6±0.05	0.3±0.05	0.23 to 0.30	0.25 to 0.35	0.30 to 0.45
	0.6±0.09	0.3±0.09	0.30 to 0.50	0.35 to 0.45	0.40 to 0.60
05 (0402)	1.0±0.05	0.5±0.05	0.40 to 0.60	0.40 to 0.50	0.50 to 0.75
	1.0±0.15	0.5±0.15	0.70 to 1.00	0.80 to 1.00	0.60 to 0.90
105 (0603)	1.6±0.10	0.8±0.10	0.80 to 1.00	0.80 to 1.00	0.80 to 1.10
	1.6±0.15	0.8±0.15			
	1.6±0.20	0.8±0.20			
21 (0805)	1.6±0.25	0.8±0.25			
	2.0±0.10	1.25±0.10	1.00 to 1.30	1.00 to 1.20	1.00 to 1.45
	2.0±0.15	1.25±0.15			
316 (1206)	2.0±0.20	1.25±0.20			
	3.2±0.20	1.6±0.15	2.10 to 2.50	1.10 to 1.30	1.40 to 1.90
	3.2±0.20	1.6±0.20			
32 (1210)	3.2±0.30	1.6±0.30	2.10 to 2.50	1.10 to 1.30	1.60 to 2.00
	3.2±0.30	2.5±0.20	2.10 to 2.50	1.10 to 1.30	1.90 to 2.80

\* 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		





## Surface Mounting Information

### Mounting Design

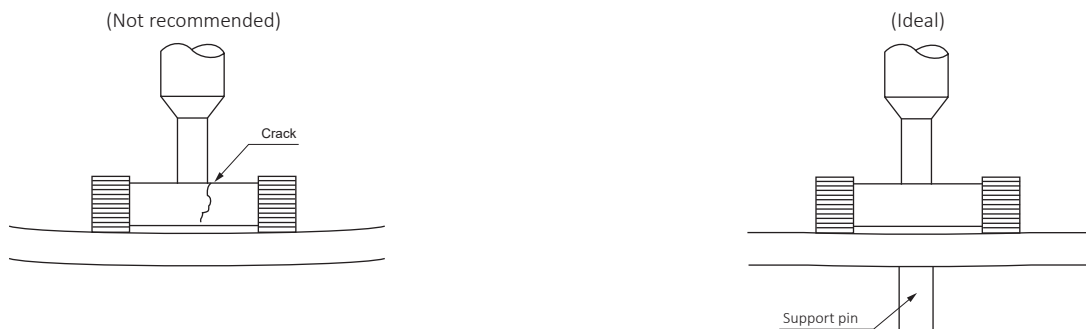
The chip could crack if the PCB warps during processing after the chip has been soldered.

Recommended chip position on PCB to minimize stress from PCB warpage



### 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.

### 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.



## Surface Mounting Information

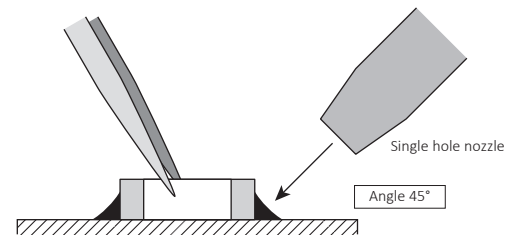
### Soldering Method

- 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

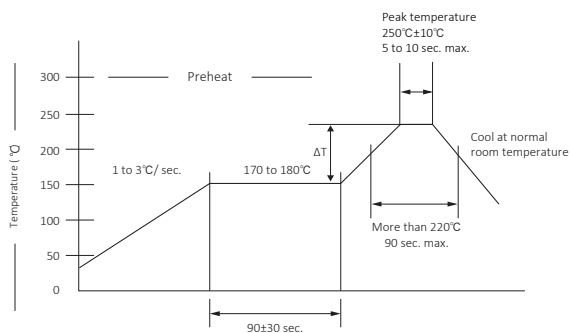
Item	Condition
Distance	5mm min.
Angle	45°
Projection Temp.	400°C max.
Flow rate	Set at the minimum
Nozzle diameter	2φ to 4φ (Single hole type)
Application time	10 sec. max. (1206 and smaller) 30 sec. max. (1210 and larger)

#### How to point spot heater



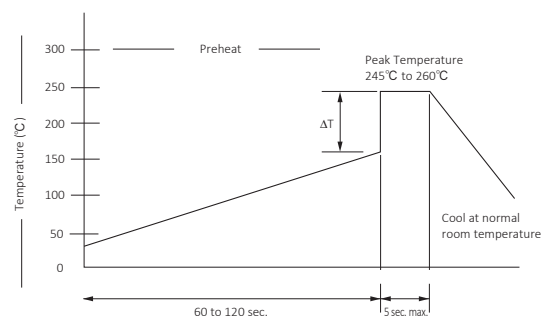
#### Recommended Temperature Profile (Sn-3Ag-0.5Cu)

##### Reflow



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

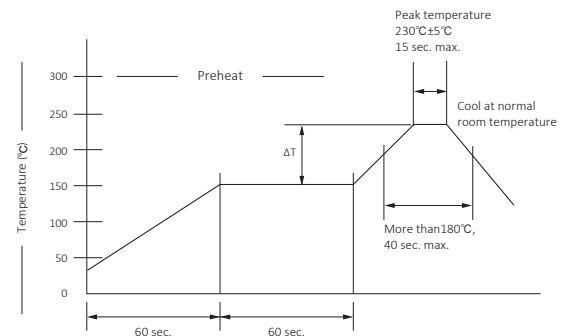
##### Wave



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

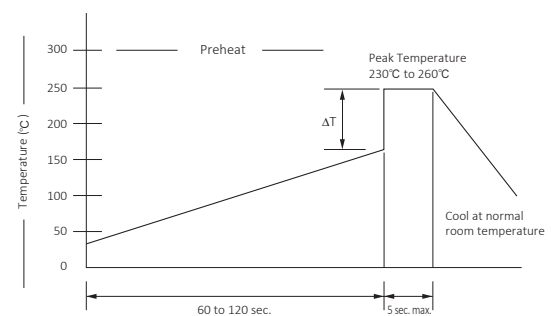
#### Recommended Temperature Profile (63Sn Solder)

##### Reflow



- ① Minimize soldering time.
- ② Ensure that the temperature difference (ΔT) does not exceed 150°C.
- ③ Ensure that the temperature difference (ΔT) does not exceed 130°C for 3.2×2.5mm size or larger.
- ④ MLCC can withstand the above reflow conditions up to 3 times.

##### Wave



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



## Precautions

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### 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<sub>2</sub>S, SO<sub>2</sub>, NO<sub>2</sub>, Cl<sub>2</sub>, 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/>



Three Terminal Capacitors KNH05 Series Size (JIS Code) : 0402(1005) Packaging Code (Packaging quantity) : H(10,000pcs.)

Dielectric code	Capacitance	□:Tolerance	Voltage [V]	Part Number	Tanδ [%]	Dimension			Packaging Code (quantity)	
						L[mm]	W[mm]	T[mm]		
X5R	4.3μF	M:±20%	4	KNH05X5R435M04AH	—	1.0±0.10	0.5±0.20	0.50 max.	H	
	10μF			KNH05X5R106M04AH		1.0±0.20	0.5±0.20	0.5±0.20		
	15μF			KNH05X5R156M04AH		1.0±0.15	0.5±0.15	0.5±0.15		
X6S	4.3μF	M:±20%	4	KNH05X6S435M04AH	—	1.0±0.10	0.5±0.20	0.50 max.	H	
				2.5		KNH05X6S435M02AH	1.0±0.10	0.5±0.20		0.50 max.



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