

# Thin Film Chip Inductors

## Type KL73 0402

ISO 9001:2000  
CERTIFIED  
TS-16949  
CERTIFIED

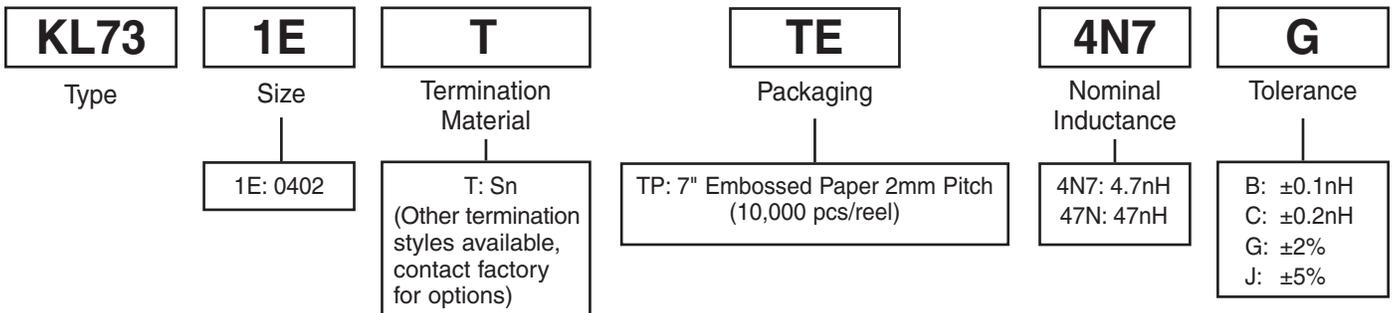
### 1. Scope

This specification applies to Thin Film Chip Inductors (KL73) 1E size produced by KOA Corporation.

### 2. Type Designation

The type designation shall be the following form:

#### New Type



### 3. Rating

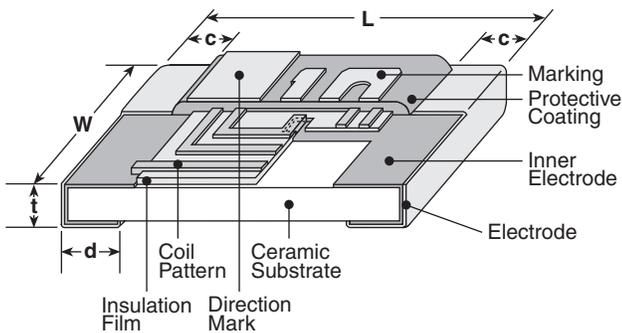
Item	Ratings
Nominal Inductance Range (nH)	0.56 ~ 27 (E12 series)
Inductance Tolerance	± 2%, ± 5%, (1.0nH ~ 4.7) ±0.01% (0.56nH ~ 0.82nH)
Quality Factor (min.)	10 ~ 7
Self Resonant Frequency (min.) (MHz)	14,000 ~ 1,500
DC Resistance (max.) (Ω)	0.10 ~ 5.00
Allowable Current (max.) (mA)	700 ~ 150
Operating Temperature Range (°C)	-40°C ~ +85°C
Storage Temperature Range (°C)	-40°C ~ +125°C

## Rating Table

Part Designation	Inductance (nH)	Inductance Tolerance	Quality Factor Minimum	Self Resonant Frequency Minimum (MHz)	DC Resistance Maximum ( $\Omega$ )	Allowable DC Current Maximum (mA)	Measured Frequency (MHz)	
KL731ETTPN56B	0.56	B: $\pm 0.1$ nH	7	14000	0.10	700	500	
KL731ETTPN68B	0.68							
KL731ETTPN82B	0.82							
KL731ETTP1N0*	1.0	B: $\pm 0.1$ nH C: $\pm 0.2$ nH	10	12000	0.15	650		
KL731ETTP1N2*	1.2			10000	0.20			
KL731ETTP1N5*	1.5			8000	0.25			600
KL731ETTP1N8*	1.8							
KL731ETTP2N2*	2.2			6000	0.30			550
KL731ETTP2N7*	2.7							5000
KL731ETTP3N3*	3.3			4000	1.00			
KL731ETTP3N9*	3.9							3000
KL731ETTP4N7*	4.7			2500	2.00			
KL731ETTP5N6*	5.6						2000	3.00
KL731ETTP6N8*	6.8	1500	5.00	200				
KL731ETTP8N2*	8.2				1000		150	
KL731ETTP10N*	10	7						
KL731ETTP12N*	12							
KL731ETTP15N*	15							
KL731ETTP18N*	18							
KL731ETTP22N*	22							
KL731ETTP27N*	27							
KL731ETTP33N*	33							

\* Add tolerance character (B, C, G, J)

## 4. Dimensions and Construction



(Inch Size Code)	L	W	c	d	t
<b>1E (0402)</b>	.039 $\pm$ .004 (1.0 $\pm$ 0.1)	.02 $\pm$ .002 (0.5 $\pm$ 0.05)	.006 $\pm$ .004 (0.15 $\pm$ 0.1)	.01 $\pm$ .004 (0.25 $\pm$ 0.1)	.014 $\pm$ .002 (0.35 $\pm$ 0.05)

## 5. Marking

Inductance value shall have no marking. Direction marking only.

Coating color: Dark blue

Direction mark color: Yellow

## 6. Characteristics

### 6-1 Test Condition

Unless otherwise specified, the standard range of atmospheric conditions for marking measurements and tests is as follows:

Ambient temperature:  $20 \pm 15^\circ\text{C}$   
 Relative humidity:  $65 \pm 20\%$

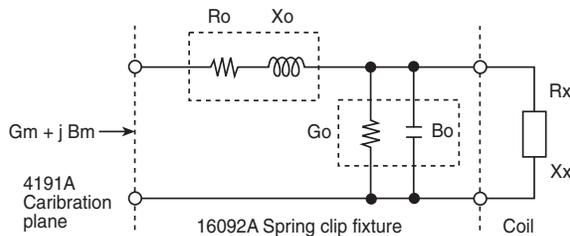
If there may be any doubt on results, measurements shall be made within the following limits:

Ambient temperature:  $20 \pm 2^\circ\text{C}$   
 Relative humidity:  $65 \pm 5\%$

### 7-2 Measurement Method of L and Q

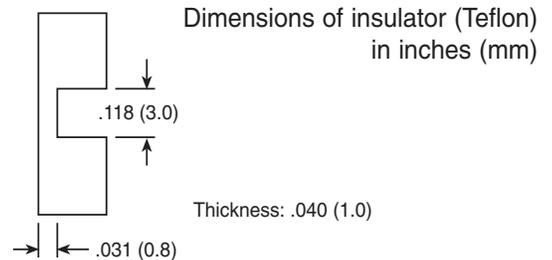
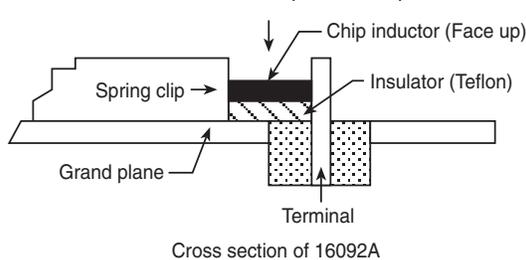
Test equipment: Hewlett Packard RF Impedance analyzer 4191A  
 Fixture: Hewlett Packard Test fixture 16092A  
 Measuring frequency: 500 MHz (1.0 nH ~ 15 nH)  
 200 MHz (18 nH ~ 27 nH)

1. Perform auto-calibration at the 4191A .275" (7mm) unknown connector connected 0Ω/0S/50Ω standard terminations.
2. Connected the test fixture 16092A.  
 Measure the open circuit admittance ( $G_o$ ,  $B_o$ ), and the short circuit impedance ( $R_o$ ,  $X_o$ ).



$G_m + jB_m$ : Measured admittance [S]  
 $R_o + jX_o$ : Residual impedance [ $\Omega$ ]  
 $G_o + jB_o$ : Stray admittance [S]  
 $R_x + jX_x$ : Unknown impedance [Q]

3. Set pattern up and ground side to direction mark on insulator.  
 Measure admittance ( $G_m$ ,  $B_m$ ).



4. The L and Q value shall be given the following equation.  
 (Compensated calculation)

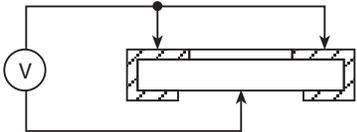
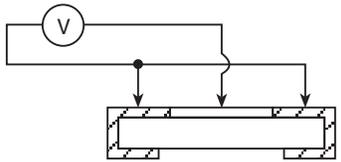
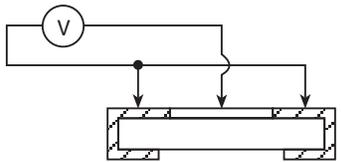
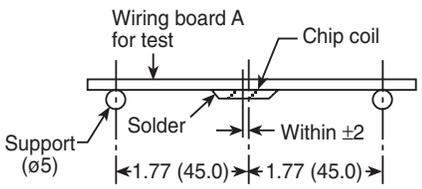
L: Inductance of coil  
 Q: Quality factor of coil  
 f: Measuring frequency

$$R_x = \frac{G_m - G_o}{(G_m - G_o)^2 + (B_m - B_o)^2} - R_o$$

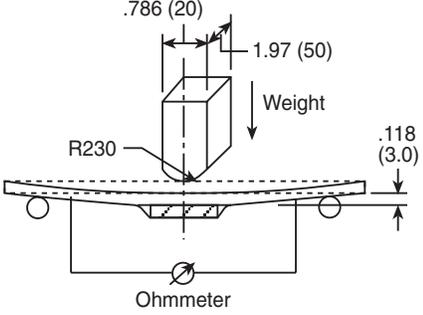
$$X_x = \frac{B_o - B_m}{(G_m - G_o)^2 - (B_m - B_o)^2} - X_o$$

$$L = \frac{X_x}{2\pi f}, \quad Q = \frac{X_x}{R_x} \quad \text{PAGE 3 OF 7}$$

### 7-3 Characteristics

Item	Requirement	Test Method
Insulation resistance	More than $10^4$ M $\Omega$	DC 500V, 1 minute Between both terminals and center of reverse side 
	More than $10^3$ M $\Omega$	DC 500V, 1 minute Between both terminals and center of protection coating 
Dielectric withstanding voltage	Without distinct damage	DC 500V, 1 minute Between both terminals and center of protection coating 
Terminal strength	$\Delta$ R/R: Within $\pm 1\%$ $\Delta$ L/L: Within $\pm 2\%$ $\Delta$ Q/Q: Within $\pm 20\%$ No mechanical damage by cracks or stripping, etc.	Soldered chip on wiring board A for test is to be bent down to .118" (3 mm) as below drawing (Set condition) Dimensions in inches (mm) 

### 7-3 Characteristics (continued)

Item	Requirement	Test Method
		 <p style="text-align: center;">Dimensions in inches (mm)</p>
Vibration	$\Delta$ L/L: Within $\pm 2\%$ $\Delta$ Q/Q: Within $\pm 20\%$ Without distinct damage in appearance and construction	Inflict 2 hours in each direction of X, Y, Z at vibration of 10 ~ 55Hz, amplitude .059" (1.5 mm)
Resistance to solder heat	$\Delta$ L/L: Within $\pm 2\%$ $\Delta$ Q/Q: Within $\pm 20\%$ Without distinct damage in appearance and construction	$260 \pm 5^\circ\text{C}$ , $10 \pm 1$ second
Solderability	95% of the terminal should be covered with new solder	$230 \pm 5^\circ\text{C}$ , $3 \pm 0.5$ second
Shock resistance	$\Delta$ L/L: Within $\pm 2\%$ $\Delta$ Q/Q: Within $\pm 20\%$ Without distinct damage in appearance and construction	Inflict the impulse 3 times to both direction (total 18 times) along perpendicular axis that 100G, 6 ms.
Low temperature operation	$\Delta$ L/L: Within $\pm 2\%$ $\Delta$ Q/Q: Within $\pm 20\%$ Without distinct damage in appearance and construction	$-40^\circ\text{C} \pm 3^\circ\text{C}$ , $1,000 \pm 4$ hours
Heat resisting property	$\Delta$ L/L: Within $\pm 2\%$ $\Delta$ Q/Q: Within $\pm 20\%$ Without distinct damage in appearance and construction	$125^\circ\text{C} \pm 2^\circ\text{C}$ , $1,000 \pm 4$ hours
Temperature cycling	$\Delta$ L/L: Within $\pm 2\%$ $\Delta$ Q/Q: Within $\pm 20\%$ Without distinct damage in appearance and construction	$-40 \pm 3^\circ\text{C}$ , 30 minutes/ $125 \pm 2^\circ\text{C}$ , 30 minutes 100 cycles

### 7-3 Characteristics (continued)

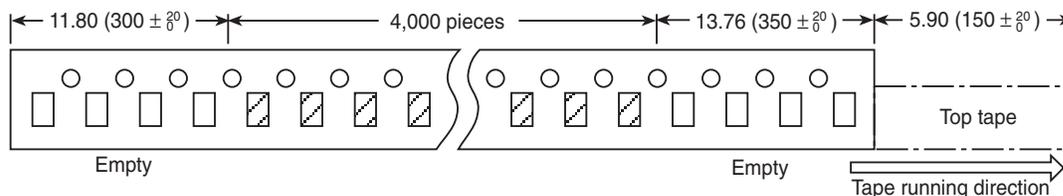
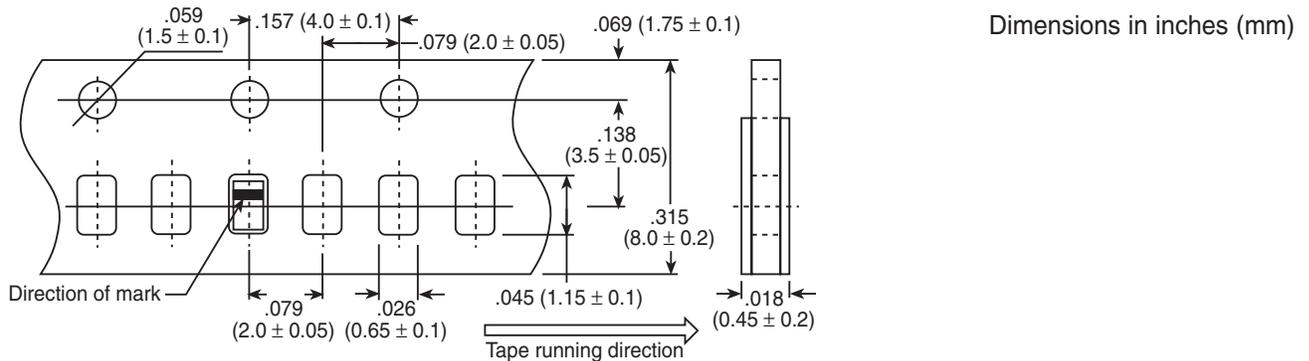
Item	Requirement	Test Method
Humidity	$\Delta$ L/L: Within $\pm 2\%$ $\Delta$ Q/Q: Within $\pm 20\%$ Without distinct damage in appearance and construction. Insulation resistance: more than $50M\Omega$	$40 \pm 2^\circ\text{C}$ , 90 ~ 95% RH $1,000 \pm 4$ hours
Resistance to solvent	$\Delta$ L/L: Within $\pm 2\%$ $\Delta$ Q/Q: Within $\pm 20\%$ Without distinct damage in appearance, construction and marking	Immerse $30 \pm 5$ seconds in the reagent ( $20 \sim 25^\circ\text{C}$ ) of JIS K 8839 (1995)

## 8. Packaging

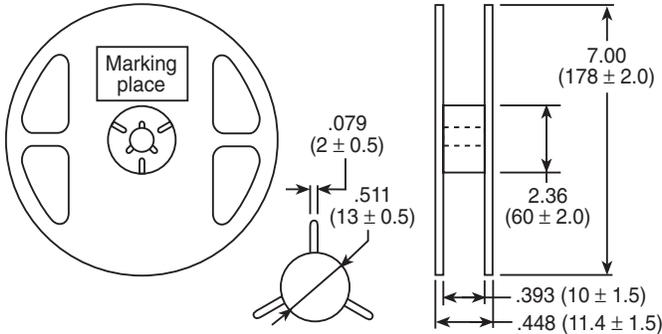
### 8-1 Taping

The tapes for taping shall be paper carrier tapes of .315" (8 mm) width and .079" (2 mm) pitches.

(1) Dimensions of carrier tape



(2) Reel dimensions



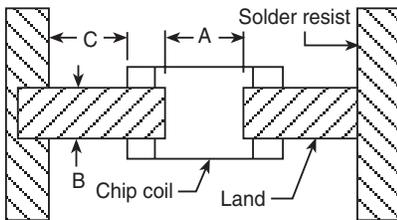
Dimensions in inches (mm)

(Marking item)

- (1) Type designation
- (2) Nominal inductance
- (3) Quantity
- (4) Production lot number
- (5) Manufacture's name

**9. Recommended Soldering Condition**

**9-1 Dimensions of Standard Land**

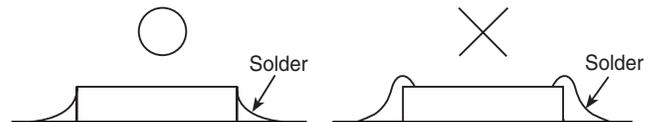


Dimensions in inches (mm)

Size	A	B	C
1E	.016 ~ .020 (0.4 ~ 0.5)	.012 ~ .020 (0.3 ~ 0.5)	.016 ~ .020 (0.4 ~ 0.5)

**9-2 Soldering Condition**

Reflow soldering should be done at 240°C within 20 seconds. Flow soldering should be done at 260°C within 10 seconds. Please use suitable solder quantity, too much solder may affect performance of product.



**10. Recommended Washing Condition**

Propil alcohol and methyl alcohol used for the washing process will not affect the part performance. Ultrasonic cleaning should be changed to condition for size of printed wiring board and type of oscillator. Overpowering of ultrasonic cleaning will cause problems according to resonant phenomenon. Condition of ultrasonic cleaner should be confirmed prior to use. We recommend the following conditions.

- Ultrasonic power: Within 20W/1
- Cleaning times: Within 5 minutes

**11. Storage**

Chip inductors should not be stored under high temperature and high humidity conditions. In particular, do not store **taping** where it is exposed to heat or direct sunlight. Otherwise, the packing material may be deformed, causing problems during mounting.