Chip Inductors
Type KL32 Series

ISO 9002 CERTIFIED

1. Scope

This specification applies to Chip Inductors (KL32) produced by KOA Corporation.

2. Type Designation

The type designation shall be the following form:

KL	32	TE	221	K
Type	Chip Size	Packaging	Nominal Inductance	Tolerance
Winding Form	0.126 X .098 X 0.087 in. (3.2 X 2.5 X 2.2 mm)	TE: Embossed Taping No Designation: Bulk		J: ± 5% K: ±10% M: ±20%

3. Rating

Item	Ratings
Nominal Inductance Range (μH)	0.005 μH ~ 330 μH (E-12 series)
Nominal Inductance Tolerance	The rating shall be shown in the Table-1.
Quality Factor (typ.)	
Self Resonant Frequency (typ.) (MHz)	
DC Resistance (typ.) (Ω)	
Allowable Current (max.) (mA)	
Measuring Frequency (MHz)	
Operating Temperature Range (°C)	-25°C ~ +100°C
Storage Temperature Range (°C)	-40°C ~ +100°C

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Rating Table-1

Ordering Code*	Nominal Inductance (µH)	Inductance Tolerance	Quality Factor (Min.)	Self Resonant Frequency (Min.) (MHz)	DC Resistance (Max.) (Ω)	Allowable DC Current (Max.) (mA)	Measuring Frequency (MHz)
KL32TE005M	0.005	M (± 20%)	11	2700	0.12	450	100
KL32TE010 □	0.010	K (± 10%) M (± 20%)	15	2500	0.13		
KL32TE012 □	0.012		17	2300	0.14		
KL32TE015 □	0.015		19	2100	0.16		
KL32TE018 □	0.018		21	1900	0.18		
KL32TE022 □	0.022		23	1700	0.20		
KL32TE027 □	0.027			1500	0.22		
KL32TE033 □	0.033	J (± 5%) K (± 10%) M (± 20%)	25	1400	0.24		
KL32TE039 □	0.039			1300	0.27		
KL32TE047 □	0.047		26	1200	0.30		
KL32TE056 □	0.056			1100	0.33		
KL32TE068 □	0.068		27	1000	0.36		
KL32TE082 □	0.082			900	0.40		
KL32TER10 □	0.10		28	700	0.44		
KL32TER12 □	0.12		30	500	0.22		25.2
KL32TER15 □	0.15			450	0.25		
KL32TER18 □	0.18			400	0.28		
KL32TER22 □	0.22			350	0.32		
KL32TER27 □	0.27			320	0.36		
KL32TER33 □	0.33			300	0.40		
KL32TER39 □	0.39			250	0.45		
KL32TER47 □	0.47			220	0.50		
KL32TER56 □	0.56			180	0.55		
KL32TER68 □	0.68			160	0.60		
KL32TER82 □	0.82			140	0.65		
KL32TE1R0 □	1.0			120	0.70	400	7.96
KL32TE1R2 □	1.2			100	0.75	390	
KL32TE1R5 □	1.5			85	0.85	370	
KL32TE1R8 □	1.8			80	0.90	350	
KL32TE2R2 □	2.2			75	1.0	320	
KL32TE2R7 □	2.7			70	1.1	290	
KL32TE3R3 □	3.3			60	1.2	260	
KL32TE3R9 □	3.9			55	1.3	250	
KL32TE4R7 □	4.7			50	1.5	220	
KL32TE5R6 □	5.6			47	1.6	200	
KL32TE6R8 □	6.8			43	1.8	180	
KL32TE8R2 □	8.2			40	2.0	170	
KL32TE100 □	10			36	2.1	150	2.52

□ : Inductance tolerance (J, K or M)

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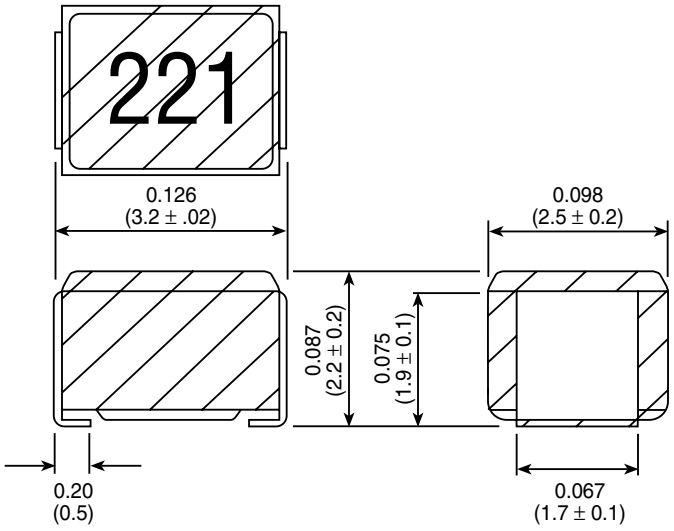
Rating Table-1 ***Continued***

Ordering Code*	Nominal Inductance (μH)	Inductance Tolerance	Quality Factor (typ.)	Self Resonant Frequency (typ.) (MHz)	DC Resistance (typ.) (Ω)	Allowable DC Current (typ.) (mA)	Measuring Frequency (MHz)
KL32TE120 ☐	12	J (± 5%) K (± 10%) M (± 20%)	30	33	2.5	140	2.52
KL32TE150 ☐	15			30	2.8	130	
KL32TE180 ☐	18			27	3.3	120	
KL32TE220 ☐	22			25	3.7	110	
KL32TE270 ☐	27			20	5.0	80	
KL32TE330 ☐	33			17	5.6	70	
KL32TE390 ☐	39			16	6.4	65	
KL32TE470 ☐	47			15	7.0	60	
KL32TE560 ☐	56			13	8.0	55	
KL32TE680 ☐	68			12	9.0	50	
KL32TE820 ☐	82			11	10	45	
KL32TE101 ☐	100		20	10		40	0.796
KL32TE121 ☐	120					70	
KL32TE151 ☐	150			8	15	65	
KL32TE181 ☐	180			7	17	60	
KL32TE221 ☐	220				21	50	
KL32TE271 ☐	270			6	28		
KL32TE331 ☐	330			5	34		

☐ : Inductance tolerance (J, K or M)

4. Dimensions



Dimensions: Inches (mm)

Weight: Approximately 50 mg

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5. Marking

Marking Method

The nominal inductance shall be expressed in "μH" and consist of a number of three figures. No tolerance of inductance shall be indicated.

0.005 to 0.082μH

The three figures express three decimal places.

0.10 to 8.2μH

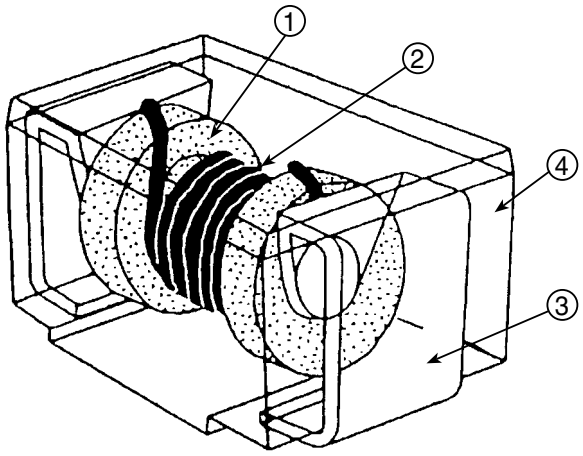
A decimal point replaced by an alphabetical letter "R" shall be significant figures.

10 to 330μH

The first two figures are significant figures while the last figure shall show the number zero.

(Example of marking)
- 005 → 0.005μH
- 1R0 → 1.0μH
- 010 → 0.010μH
- 100 → 10μH
- R10 → 0.10μH
- 101 → 100μH

6. Construction



No.	Name	Material
1	Magnetic Core	High stability ferrite core
2	Winding Material	Polyurethane copper wire
3	Electrode Terminal	Solder plated high cond. heat resistant copper alloys
4	Mold Enclosure	Low stress epoxy resin system (UL94-VO)

7. Measurement Method of L and Q

Nominal Inductance Range (μH)	Measurement Method	Measuring Frequency (MHz)
0.005 ~ 0.10	Please see Method-1	100
0.12 ~ 0.82		25.2
1.0 ~ 8.2		7.96
10 ~ 82	Please see Method-2	2.52
100 ~ 330		0.796

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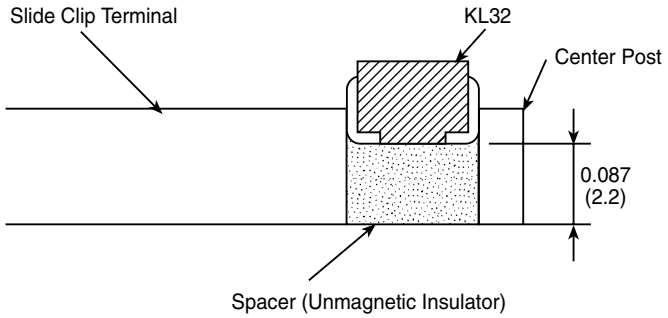
7. Measurement Method of L and Q *Continued*

Method-1

Test Equipment: Hewlett Packard RF Impedance analyzer 4191A
Fixture: Hewlett Packard Spring clip fixture 16092A
Electrical Length: 2.10 cm
Setting: Please see the following figure



Method-2

Test Equipment: Hewlett Packard LF Impedance analyzer 4192
Fixture: Hewlett Packard Test fixture 16034E
OSC Level: 0.3 V

8. Test Condition

Unless otherwise specified, the test shall be performed in accordance with JIS-C-5202 specifying marking measurements as follows:

Ambient temperature: 20 ± 15°C
Relative humidity: 65 ± 20%

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

Ambient temperature: 20 ± 2°C
Relative humidity: 65 ± 5%

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9. Reliability Data

9-1 Electrical Characteristics

Item	Requirement	Test Method
DC Bias Characteristic	Δ L/L: Within - 10%	Measure inductance with application of rated current using LCR meter to compare it with the initial value.
Dielectric Withstanding Voltage	No fuming, flaming, or breakdown	5 seconds at DC 1000V between terminal 1 (one electrode of inductor) and terminal 2 (the thin copper wire which is wound around the inductor more than twice).
Insulation Resistance	More than 1000MΩ	Measure resistance immediately after 1 minute passed since DC 500V was applied between terminal 1 and 2.

9-2 Mechanical Characteristics

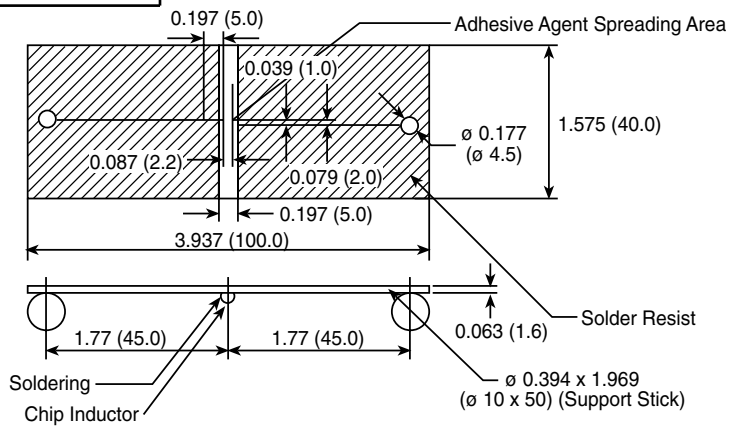
Item	Requirement	Test Method
Terminal Pull Strength	No damage	Terminals shall withstand a pull of 0.5kgf in a horizontal direction.
Terminal Bending Strength	No damage	Specimen shall be soldered on PCB-A (see figure below) and support by applying strength so that the bending width becomes 10 mm.

Thickness: 1.6 mm
Material: Paper Phenol

(a) Board

(b) Install

Units: inches (mm)



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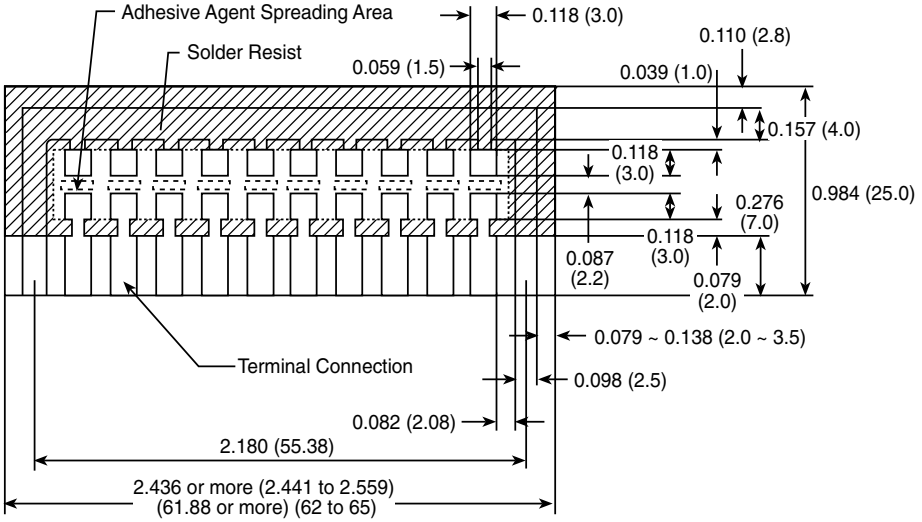
9-2 Mechanical Characteristics *Continued*

Item	Requirement	Test Method
Vibration	No significant abnormality in appearance Δ L/L: Within ± 3%	2 hours in each X, Y and Z directions on PCB-B (see figure below) at a frequency range of 10 to 55 to 10 Hz (1 min.) with 1.5 mm amplitude.
Thickness: 1.6 mm Material: Glass Epoxy  Units: inches (mm)		
Resistance to Solder Heat	No significant abnormality in appearance Δ L/L: Within ± 3%	Immerse in the solder (H63A) of 260 ± 5°C for 10 ± 1 sec.
Solderability	Over 95% of electrode surface shall be covered with solder	Immerse in the solder (H63A) of 230 ± 5°C for 3 ± 0.5 sec.
Drop Test	No significant abnormality in appearance Δ L/L: Within ± 3%	Drop from a height of 1 m to the ground of concrete or tile 1 time.

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9-3 Environmental Characteristics *

Item	Requirement	Test Method
Low Temperature Life Test	Δ L/L: Within ± 5% Δ Q/Q: Within ± 20%	Store at -40 ± 2°C for 1000 hours.
High Temperature Life Test	Δ L/L: Within ± 5% Δ Q/Q: Within ± 30%	Store at 100 ± 2°C for 1000 hours.
Thermal Shock	Δ L/L: Within ± 5%	100 cycles between -25 ± 2°C / 1 hour and +100 ± 2°C.
Temperature Characteristic	Δ L/L: Within ± 10%	Measure Δ L/L at the temperature of between -25°C and +100°C as based on the temperature of 20°C.
Humidity	Δ L/L: Within ± 5% Δ Q/Q: Within ± 30%	Store at 40 ± 2°C, 90 to 95% RH for 1000 hours.
Humidity Loading Test	Δ L/L: Within ± 5% Δ Q/Q: Within ± 30%	Apply rated current continuously at 40 ± 2°C, 90 to 95% RH for 1000 hours.
High Temperature Loading Test	Δ L/L: Within ± 5% Δ Q/Q: Within ± 30%	Apply rated current continuously at 100 ± 2°C for 1000 hours.
Solvent Resistance	No outstanding damage and markings can be easily judged	According to MIL-STD-202F Method 215 (1990).

* Unless otherwise specified, at least one hour of recovery under the normal temperature and normal humidity after the test, followed by the measurement within two hours.

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10. Packaging

10-1 Bulk Packaging

Bulk products shall be packed 1,000 pieces in a poly bag.
Marking item for bag shall be following form.
(Marking item)

(1) Type designation (3) Quantity (5) Manufacturer's name
(2) Nominal inductance (4) Production lot number (6) Tolerance

10-2 Taping

The tapes for taping shall be embossed carrier tapes of .315" (8 mm) width and .157" (4 mm) pitch. The standard quantity per reel shall be 2,000 pieces.

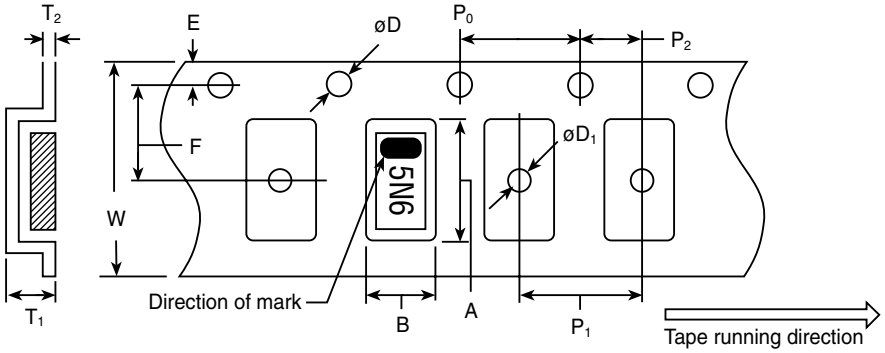
(1) Dimensions of carrier tape Dimensions in inches (mm)

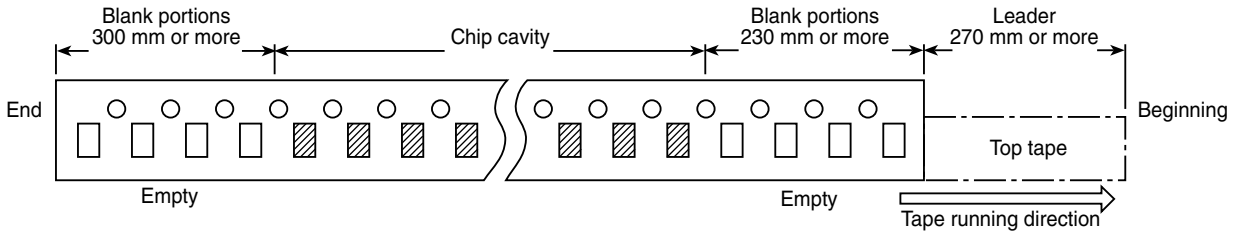
A	.140 (3.55 ± 0.10)
B	.106 (2.70 ± 0.10)
W	.315 (8.00 ± 0.10)
E	.069 (1.75 ± 0.10)
F	.138 (3.50 ± 0.05)
T_1	.106 (2.70 ± 0.15)

T_2	.011 (0.28 ± 0.05)
P_0	.157 (4.00 ± 0.10)
P_1	.157 (4.00 ± 0.10)
P_2	.079 (2.00 ± 0.05)
øD*	.059 ($1.50 \pm {}^{0.1}_{0}$)
øD_1	.039 ($1.00 \pm {}^{0.2}_{0}$)

The top tape requires a peel-off force of 15 to 60 gf.

* 20 pitches accumulation of sprocket holes shall be 80.00 ± 0.15 mm.





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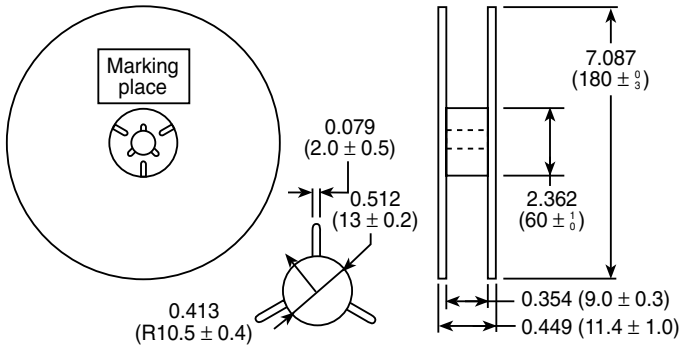
(2) Reel dimensions



Dimensions in inches (mm)

(Marking item)

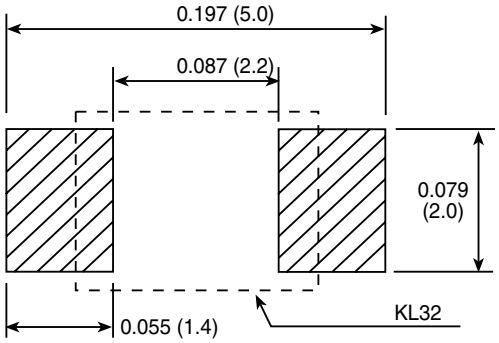
(1) Type designation
(2) Nominal inductance and tolerance
(3) Quantity
(4) Production lot number
(5) Manufacturer's name

11. Recommended Soldering Condition

11-1 Dimensions of Standard Land

The following figure is recommended land dimensions.

When two or more chip inductors are closely mounted, they must be separated by means of solder resists to prevent excessive solder.



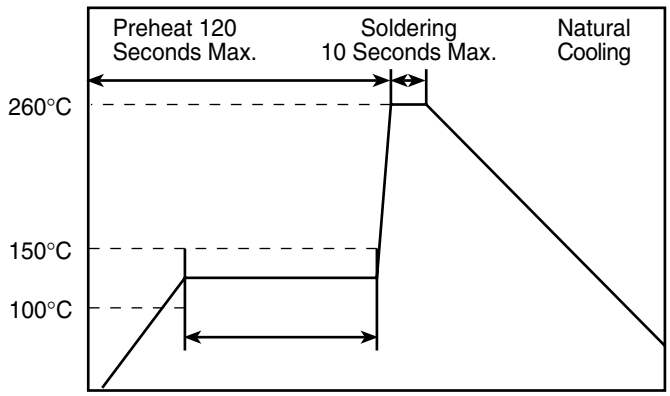
Dimensions in inches (mm)

11-2 Soldering Condition

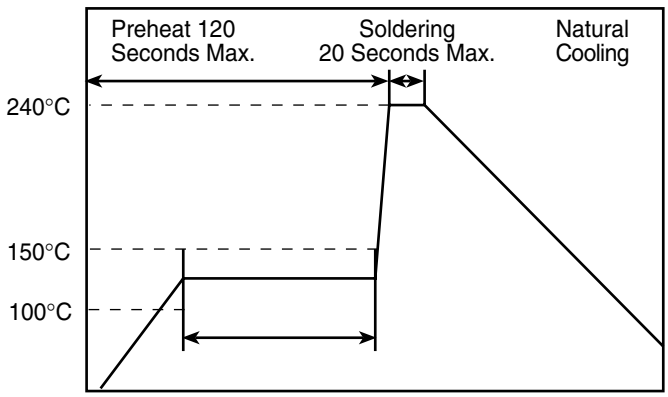
Wave soldering should be done at 260°C for less than 10 seconds. Reflow soldering should be done at 240°C for less than 20 seconds. (Please see the following figures.)

When using a soldering iron, temperature shall not exceed 350°C and within three seconds. Soldering iron time shall be allowed only one time. After soldering, chip inductors shall not be stressed excessively.

Recommended Temperature Profile for Wave Soldering



Recommended Temperature Profile for Reflow Soldering



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12. Mounting

Placement force should not be excessive.

13. Recommended Washing Condition

Since this chip inductor is a coil of ultra-thin wire, it is susceptible to vibration.

If an ultrasonic cleaning unit is used for cleaning, check for any possibility of problem generation before practical use since such cleaning units considerably differ in vibration level and mode. Although the conditions differ depending on the printed board size, ultrasonic cleaning is generally used in the conditions described below as examples:

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

14. 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.

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