

# Notice for TAIYO YUDEN products

Please read this notice before using the TAIYO YUDEN products.

## REMINDERS

- Product information in this catalog is as of October 2010. All of the contents specified herein are subject to change without notice due to technical improvements, etc. Therefore, please check for the latest information carefully before practical application or usage of the Products.

Please note that Taiyo Yuden Co., Ltd. shall not be responsible for any defects in products or equipment incorporating such products, which are caused under the conditions other than those specified in this catalog or individual specification.

- Please contact Taiyo Yuden Co., Ltd. for further details of product specifications as the individual specification is available.
- Please conduct validation and verification of products in actual condition of mounting and operating environment before commercial shipment of the equipment.

- All electronic components or functional modules listed in this catalog are developed, designed and intended for use in general electronics equipment.(for AV, office automation, household, office supply, information service, telecommunications, (such as mobile phone or PC) etc.). Before incorporating the components or devices into any equipment in the field such as transportation,( automotive control, train control, ship control), transportation signal, disaster prevention, medical, public information network (telephone exchange, base station) etc. which may have direct influence to harm or injure a human body, please contact Taiyo Yuden Co., Ltd. for more detail in advance. Do not incorporate the products into any equipment in fields such as aerospace, aviation, nuclear control, submarine system, military, etc. where higher safety and reliability are especially required.

In addition, even electronic components or functional modules that are used for the general electronic equipment, if the equipment or the electric circuit require high safety or reliability function or performances, a sufficient reliability evaluation check for safety shall be performed before commercial shipment and moreover, due consideration to install a protective circuit is strongly recommended at customer's design stage.

- The contents of this catalog are applicable to the products which are purchased from our sales offices or distributors (so called "TAIYO YUDEN' s official sales channel"). It is only applicable to the products purchased from any of TAIYO YUDEN' s official sales channel.

- Please note that Taiyo Yuden Co., Ltd. shall have no responsibility for any controversies or disputes that may occur in connection with a third party's intellectual property rights and other related rights arising from your usage of products in this catalog. Taiyo Yuden Co., Ltd. grants no license for such rights.

- Caution for export

Certain items in this catalog may require specific procedures for export according to "Foreign Exchange and Foreign Trade Control Law" of Japan, "U.S. Export Administration Regulations", and other applicable regulations. Should you have any question or inquiry on this matter, please contact our sales staff.

# AXIAL LEADED INDUCTORS

WAVE

## FEATURES

- Extremely reliable inductors that are ideal for automatic insertion.
- Highly efficient automated production processes can provide high quality inductors in large volumes.
- Wide selection of configurations including axial leaded, formed radial leads and bulk products to meet most manufacturing needs.

## APPLICATIONS

- Use for TVs, DVD, audio equipment, communication instrument, tuner, and general electrical instrument.

## ORDERING CODE

L A L  $\triangle$  0 2 T B R 2 2 K  $\bigcirc$   $\bigcirc$   $\bigcirc$   $\bigcirc$   $\bigcirc$

**1 Type**

LA	Axial leaded inductor
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**2 Product Specification**

L $\triangle$	Standard type
N $\triangle$	High current type
P $\triangle$	Standard type (Lead diameter : 0.45 $\phi$ mm)

$\triangle$ =Blank space

**3 Dimensions (LxD) (mm) max**

02	3.4x2.3(LAL/LAP) 3.6x2.4(LAN)
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**4 Lead configurations**

KR	Formed lead/bulk
NA	Axial lead/bulk
TA	Axial lead (26mm lead space) /ammo pack
TB	Axial lead (52mm lead space) /ammo pack
VD	Formed lead/ammo pack

**5 Nominal inductance [ $\mu$ H]**

example	
1R5	1.5
120	12

※R=decimal point

**6 Inductance tolerance [%]**

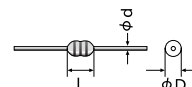
J	$\pm 5$
K	$\pm 10$

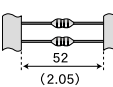


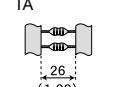
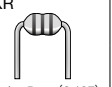
**7 Internal code**

$\triangle\triangle\triangle\triangle$	Standard product
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$\triangle$ =Blank space

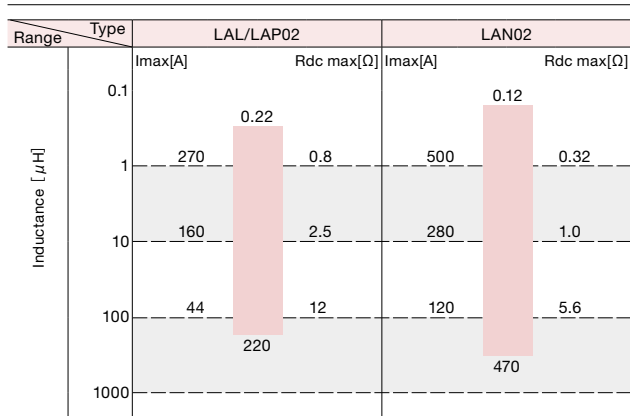
## EXTERNAL DIMENSIONS/STANDARD QUANTITY



Type	Dimensions [mm] (inch)			Taped		Bulk		Standard Quantity (pcs)				
	L	$\phi D$	$\phi d$	Straight	Formed	Straight	Formed	Lead Configuration Code				
								TA	TB	VD	NA	KR
LAL02	3.4max. (0.134max.)	2.3max. (0.091max.)	0.5 $\pm$ 0.05 (0.018 $\pm$ 0.002)	TB 	VD  Pitch : 5mm (0.197)	NA 	---	2,000			500	2,000
LAP02	3.4max. (0.134max.)	2.3max. (0.091max.)	0.45 $\pm$ 0.05 (0.018 $\pm$ 0.002)	TA 	---	---	KR  Pitch : 5mm (0.197)	2,000				2,000
LAN02	3.6max. (0.142max.)	2.4max. (0.094max.)										

Unit : mm (inch)

## AVAILABLE INDUCTANCE RANGE



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**PART NUMBERS**

**LAL/LAP02**

Ordering code	EHS (Environmental Hazardous Substances)	Inductance [ $\mu$ H]	Inductance Tolerance	Q (min.)	Measuring frequency [MHz]	Self-resonant frequency [MHz] (min.)	DC Resistance [ $\Omega$ ] (max.)	Rated current [mA] (max.)	
LA□ 02 ○ R22K	RoHS	0.22	±10%	35	25.2	450	0.40	400	
LA□ 02 ○ R27K	RoHS	0.27				410	0.43	380	
LA□ 02 ○ R33K	RoHS	0.33				360	0.48	370	
LA□ 02 ○ R39K	RoHS	0.39				300	0.51	350	
LA□ 02 ○ R47K	RoHS	0.47				230	0.56	330	
LA□ 02 ○ R56K	RoHS	0.56				210	0.61	320	
LA□ 02 ○ R68K	RoHS	0.68				190	0.67	310	
LA□ 02 ○ R82K	RoHS	0.82				170	0.74	290	
LA□ 02 ○ 1R0K	RoHS	1.0				150	0.80	270	
LA□ 02 ○ 1R2K	RoHS	1.2				110	0.9	260	
LA□ 02 ○ 1R5K	RoHS	1.5				80	1.0	250	
LA□ 02 ○ 1R8K	RoHS	1.8				60	1.1	240	
LA□ 02 ○ 2R2K	RoHS	2.2				45	1.2	230	
LA□ 02 ○ 2R7K	RoHS	2.7				40	1.3	220	
LA□ 02 ○ 3R3K	RoHS	3.3				38	1.4	210	
LA□ 02 ○ 3R9K	RoHS	3.9				35	1.6	200	
LA□ 02 ○ 4R7K	RoHS	4.7				32	1.7	190	
LA□ 02 ○ 5R6K	RoHS	5.6				30	1.9	180	
LA□ 02 ○ 6R8K	RoHS	6.8		28	2.0	175			
LA□ 02 ○ 8R2K	RoHS	8.2		26	2.2	165			
LA□ 02 ○ 100K	RoHS	10		24	2.5	160			
LA□ 02 ○ 120K	RoHS	12		22	2.5	150			
LA□ 02 ○ 150K	RoHS	15		20	2.8	145			
LA□ 02 ○ 180K	RoHS	18		18	3.1	140			
LA□ 02 ○ 220K	RoHS	22		17	3.4	130			
LA□ 02 ○ 270K	RoHS	27		16	4.3	80			
LA□ 02 ○ 330K	RoHS	33		14	4.7	76			
LA□ 02 ○ 390K	RoHS	39		13	5.2	74			
LA□ 02 ○ 470K	RoHS	47		12	5.8	70			
LA□ 02 ○ 560K	RoHS	56		11	6.4	68			
LA□ 02 ○ 680K	RoHS	68		10	7.2	64			
LA□ 02 ○ 820K	RoHS	82		9.5	11	46			
LA□ 02 ○ 101K	RoHS	100		9.0	12	44			
LA□ 02 ○ 121K	RoHS	120		8.0	13	42			
LA□ 02 ○ 151K	RoHS	150		6.0	16	39			
LA□ 02 ○ 181K	RoHS	180		5.5	18	37			
LA□ 02 ○ 221K	RoHS	220		5.0	20	35			
					40	0.796			

□ Please specify the Product Specification (Lead) code. (L:standard 0.5mm or P:0.45mm)  
 ○ Please specify the Lead configuration code.

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**PART NUMBERS**

**FAN02**

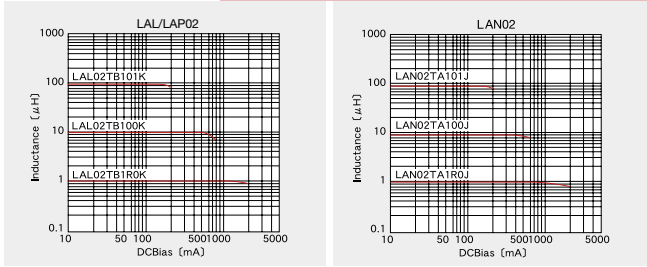
Ordering code	EHS (Environmental Hazardous Substances)	Inductance [ $\mu$ H]	Inductance Tolerance	Q (min.)	Measuring frequency [MHz]	Self-resonant frequency [MHz] (min.)	DC Resistance [ $\Omega$ ] (max.)	Rated current [mA] (max.)
LAN02 ○ R12K	RoHS	0.12	±10%	50	25.2	500	0.12	850
LAN02 ○ R15K	RoHS	0.15				500	0.14	800
LAN02 ○ R18K	RoHS	0.18				500	0.15	760
LAN02 ○ R22K	RoHS	0.22				500	0.16	730
LAN02 ○ R27K	RoHS	0.27				500	0.18	690
LAN02 ○ R33K	RoHS	0.33				480	0.19	660
LAN02 ○ R39K	RoHS	0.39				430	0.21	640
LAN02 ○ R47K	RoHS	0.47				380	0.23	610
LAN02 ○ R56K	RoHS	0.56				350	0.25	580
LAN02 ○ R68K	RoHS	0.68				310	0.27	550
LAN02 ○ R82K	RoHS	0.82				270	0.29	520
LAN02 ○ 1R0J	RoHS	1.0				240	0.32	500
LAN02 ○ 1R2J	RoHS	1.2				210	0.35	480
LAN02 ○ 1R5J	RoHS	1.5				190	0.38	450
LAN02 ○ 1R8J	RoHS	1.8	140	0.42	430			
LAN02 ○ 2R2J	RoHS	2.2	90	0.47	410			
LAN02 ○ 2R7J	RoHS	2.7	70	0.52	390			
LAN02 ○ 3R3J	RoHS	3.3	50	0.57	370			
LAN02 ○ 3R9J	RoHS	3.9	35	0.63	360			
LAN02 ○ 4R7J	RoHS	4.7	32	0.69	340			
LAN02 ○ 5R6J	RoHS	5.6	30	0.75	320			
LAN02 ○ 6R8J	RoHS	6.8	28	0.84	310			
LAN02 ○ 8R2J	RoHS	8.2	26	0.92	290			
LAN02 ○ 100J	RoHS	10	24	1.0	280			
LAN02 ○ 120J	RoHS	12	22	1.0	280			
LAN02 ○ 150J	RoHS	15	20	1.2	265			
LAN02 ○ 180J	RoHS	18	18	1.3	250			
LAN02 ○ 220J	RoHS	22	17	1.5	235			
LAN02 ○ 270J	RoHS	27	15	1.7	220			
LAN02 ○ 330J	RoHS	33	14	2.2	180			
LAN02 ○ 390J	RoHS	39	13	2.4	170			
LAN02 ○ 470J	RoHS	47	12	2.8	160			
LAN02 ○ 560J	RoHS	56	10	4.1	140			
LAN02 ○ 680J	RoHS	68	9.2	4.5	130			
LAN02 ○ 820J	RoHS	82	8.8	5.0	125			
LAN02 ○ 101J	RoHS	100	8.0	5.6	120			
LAN02 ○ 121J	RoHS	120	6.6	9.2	90			
LAN02 ○ 151J	RoHS	150	5.8	10.5	85			
LAN02 ○ 181J	RoHS	180	5.4	11.5	80			
LAN02 ○ 221J	RoHS	220	4.8	13	75			
LAN02 ○ 271J	RoHS	270	3.6	16	70			
LAN02 ○ 331J	RoHS	330	3.4	18	66			
LAN02 ○ 391J	RoHS	390	3.2	20	63			
LAN02 ○ 471J	RoHS	470	3.0	22	60			

○ Please specify the Lead configuration code.

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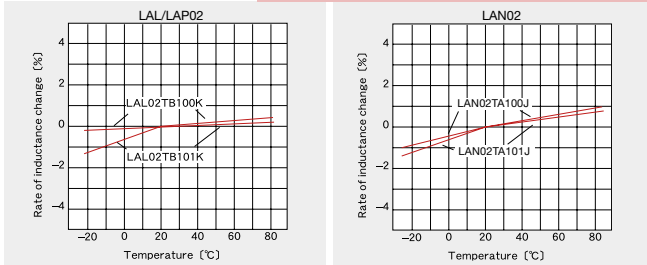
DC Bias characteristics

(Measured by HP4285A)



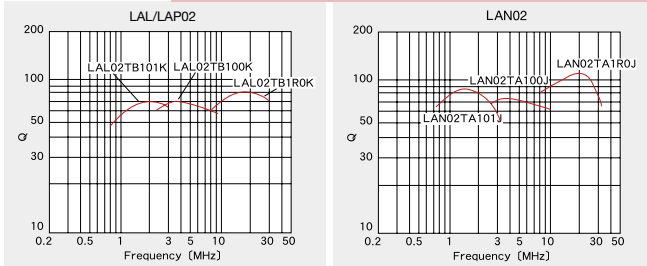
Temperature characteristics

(Measured by HP4285A)



Q-Characteristics

(Measured by HP4285A+HP42851A)



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# PACKAGING

## ① Minimum Quantity

### ● Taping for Straight Leads

Type	Lead Configuration code	Standard quantity (pcs.)
LAL02	TB	2,000
LAP02	TA	2,000
LAN02	TA	2,000

### ● Taping for Formed Leads

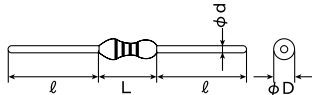
Type	Lead Configuration code	Standard quantity (pcs.)
LAL02	VD	2,000

### ● Bulk

Type	Lead Configuration code	Standard quantity (pcs.)
LAL02	NA	500
LAP02	KR	2,000
LAN02	KR	2,000

## ② Dimension

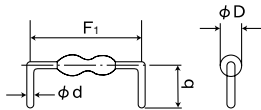
### ● NA



Type	Dimensions				Minimum insertion pitch
	$\phi D$	L	$\phi d$	$l$	
LAL02	2.3max (0.091max)	3.4max (0.134max)	0.50±0.05 (0.020±0.002)	24±2.0 (0.945±0.079)	5.0 (0.197)

Unit : mm (inch)

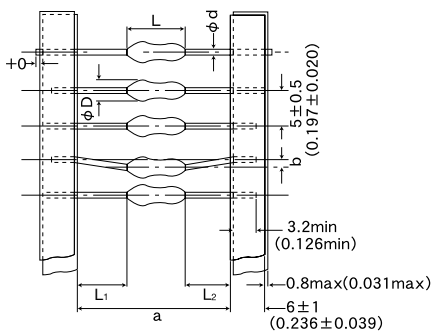
### ● KR



Type	Lead configuration code	Dimensions			
		$\phi D$	$F_1$	$\phi d$	b
LAP02	KR	2.3max (0.091max)	5.0±0.5 (0.197±0.020)	0.45±0.05 (0.018±0.002)	7.0±1.0 (0.276±0.039)
LAN02	KR	2.4max (0.094max)	5.0±0.5 (0.197±0.020)	0.45±0.05 (0.018±0.002)	7.0±1.0 (0.276±0.039)

Unit : mm (inch)

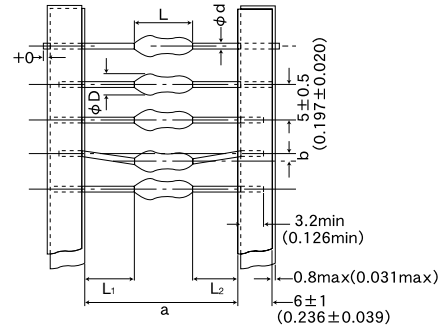
### ● TA (a : 26mm lead space) (1.02 inch)



Type	Dimensions						Minimum insertion pitch
	$\phi D$	L	a	b	$ L_1-L_2 $	$\phi d$	
LAP02	2.3max (0.091max)	3.4max (0.134max)	26 <sup>+0.5</sup> <sub>-0</sub> (1.02 <sup>+0.020</sup> )	0.8max (0.031max)	0.5max (0.020max)	0.45±0.05 (0.018±0.002)	5.0 (0.197)
LAN02	2.4max (0.094max)	3.6max (0.142max)	26 <sup>+0.5</sup> <sub>-0</sub> (1.02 <sup>+0.020</sup> )	0.8max (0.031max)	0.5max (0.020max)	0.45±0.05 (0.018±0.002)	5.0 (0.197)

Unit : mm (inch)

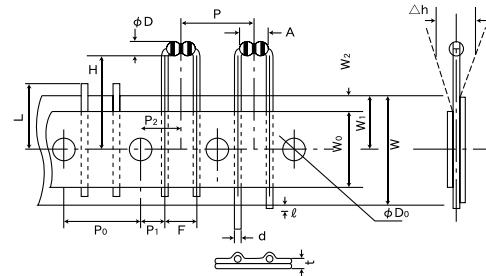
### ● TB (a : 52mm lead space) (2.05 inches)



Type	Dimensions						Minimum insertion pitch
	$\phi D$	L	a	b	$ L_1-L_2 $	$\phi d$	
LAL02	2.3max (0.091max)	3.4max (0.134max)	52 <sup>+2</sup> <sub>-1</sub> (2.05 <sup>+0.079</sup> -0.039)	1.2max (0.047max)	1.0max (0.039max)	0.5±0.05 (0.020±0.002)	5.0 (0.197)

Unit : mm (inch)

### ● VD



Type	Symbol	Dimensions	Symbol	Dimensions
LAL02	A	3.9max (0.154max)	W	18.0 <sup>+1.0</sup> <sub>-0.5</sub> (0.709 <sup>+0.039</sup> -0.026)
	$\phi D$	2.3max (0.091max)	$W_0$	12.5 min. (0.492 min.)
	H	19.5±0.5 (0.768±0.020)	$W_1$	9.0 <sup>+0.75</sup> <sub>-0.5</sub> (0.354 <sup>+0.039</sup> -0.026)
	P	12.7±1.0 (0.500±0.039)	$W_2$	3.0 max. (0.118 max.)
	$P_0$	12.7±0.3 (0.500±0.012)	$l$	2.0 max. (0.079 max.)
	$P_1$	3.85±0.7 (0.152±0.028)	$\phi D_0$	4.0±0.3 (0.157±0.012)
	$P_2$	6.35±0.5 (0.250±0.020)		
	F	5.08±0.5 (0.200±0.020)	$\phi d$	0.50±0.05 (0.020±0.002)
	$\Delta h$	0±1.0 (0±0.039)	L	11.0 max. (0.433 max.)
	-	-	t	0.5±0.2 (0.020±0.008)

Unit : mm (inch)

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## RELIABILITY DATA

1. Operating temperature Range	
LA Type	-25~+105°C
CAL45 Type	
LHL□□□	
FBA/FBR	-25~+85°C
FL05□ Type	-25~+105°C
FL06BT Type	

**[Test Method and Remarks]**  
 LA·CA·FL : Including self-generated heat  
 LHL□□□ : Including self-generated heat

2. Storage temperature Range	
LA Type	-40~+85°C
CAL45 Type	
LHL□□□	
FBA/FBR	
FL05□ Type	
FL06BT Type	

3. Rated current	
LA Type	Within the specified tolerance
CAL45 Type	
LHL□□□	
FBA/FBR	
FL05□ Type	
FL06BT Type	

**[Test Method and Remarks]**  
 LA, CA : The maximum DC value having inductance within 10% and temperature increase within 40°C (LA:20°C) by the application of DC bias.  
 LHL□□□ : The maximum DC value having inductance decrease within 10% (LHLC08, LHLC10 : within 30%) and temperature increase within the following specified temperature by the application of DC bias.  
     Reference temperature : 25°C (LHL08, LHL10, LHL13)  
                                   : 30°C (LHL16, LHLP□□)  
                                   : 40°C (LHLC08, LHLC10)  
 FB : No disconnection or appearance abnormality by continuous current application for 30 min. Change after the application shall be within ±20% of the initial value.  
     This is not guaranteed for electrical characteristics during current application.  
 FL : The maximum DC value having temperature rise within specified value.

4. Impedance	
LA Type	Within the specified tolerance
CAL45 Type	
LHL□□□	
FBA/FBR	
FL05□ Type	
FL06BT Type	

**[Test Method and Remarks]**  
 FB : Measuring equipment : Impedance analyzer (HP4191A) or its equivalent  
     Measuring frequency : Specified frequency  
 FL06BT : Measuring equipment : 4291A (HP) or its equivalent  
     Measuring frequency : Specified frequency

5. Inductance	
LA Type	Within the specified tolerance
CAL45 Type	
LHL□□□	
FBA/FBR	
FL05□ Type	
FL06BT Type	

**[Test Method and Remarks]**  
 LA, CA : Measuring equipment : LCR meter (HP4285A + HP42851A or its equivalent)  
     Measuring frequency : Specified frequency  
 LHL□□□ : Measuring equipment : LCR meter (HP4285A+HP42851A or its equivalent)  
                                   LCR meter (HP4263A) or its equivalent (at 1kHz)  
     Measuring frequency : Specified frequency  
 FL05R□ : Measuring equipment : HP4262A or its equivalent  
     Measuring frequency : 1kHz

6. Q	
LA Type	Within the specified tolerance
CAL45 Type	
LHL□□□	
FBA/FBR	
FL05□ Type	
FL06BT Type	

**[Test Method and Remarks]**  
 LA : Measuring equipment : LCR meter (HP4285A + HP42851A or its equivalent)  
     Measuring frequency : Specified frequency  
 LHL□□□ (except LHLP) : Measuring equipment : LCR meter (HP4285A+HP42851A or its equivalent)  
                                   LCR meter (HP4263A) or its equivalent (at 1kHz)  
     Measuring frequency : Specified frequency

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## RELIABILITY DATA

### 7. DC Resisittance

LA Type	Within the specified tolerance
CAL45 Type	
LHL□□□	
FBA/FBR	
FL05□ Type	
FL06BT Type	

#### [Test Method and Remarks]

LA, CA : Measuring equipment : low ohmmeter (A&D AD5812 or its equivalent)  
 LHL□□□・FB・FL : Measuring equipment : DC ohmmeter

### 8. Self resonance frequency

LA Type	Within the specified tolerance
CAL45 Type	
LHL□□□	
FBA/FBR	
FL05□ Type	
FL06BT Type	

#### [Test Method and Remarks]

LA : Measuring equipment : Network analyzer (Anritsu MS620J or its equivalent)  
 LHL□□□ (except LHLP) : Measuring equipment : (HP4191A, 4192A) its equivalent

### 9. Temperature characteristic

LA Type	$\Delta L/L$ : Within $\pm 5\%$
CAL45 Type	
LHL□□□	$\Delta L/L$ : Within $\pm 7\%$ (except LHLP16 : Within $\pm 20\%$ )
FBA/FBR	
FL05□ Type	
FL06BT Type	

#### [Test Method and Remarks]

LA : Change of maximum inductance deviation in step 1 to 5

Step	Temperature (°C)
1	20
2	-25 (Minimum operating temperature)
3	20 (Standard temperature)
4	+85 (Maximum operating temperature)
5	20

LHL□□□ : Change of maximum inductance deviation in step 1 to 5

Temperature at step 1 : 20°C  
 Temperature at step 2 : Minimum operating temperature  
 Temperature at step 3 : 20°C (Standard temperature)  
 Temperature at step 4 : Maximum operating temperature  
 Temperature at step 5 : 20°C

### 10. Tensile strength test

LA Type	No abnormality such as cut lead, or looseness.
CAL45 Type	
LHL□□□	
FBA/FBR	
FL05□ Type	
FL06BT Type	

#### [Test Method and Remarks]

LA : Apply the stated tensile force progressively in the direction to draw terminal.

force (N)	duration (s)
25	5

CA : Apply the stated tensile force progressively in the direction to draw terminal.

force (N)	duration (s)
10	10

LHL□□□ : Apply the stated tensile force progressively in the direction to draw terminal.

Nominal wire diameter tensile $\phi d$ (mm)	force (N)	duration (s)
$0.3 < \phi d \leq 0.5$	5	30 $\pm$ 5
$0.5 < \phi d \leq 0.8$	10	
$0.8 < \phi d \leq 1.2$	25	

FBA/FBR : The body of a component shall be fixed and a tensile force of 20 $\pm$ 1N shall be applied to the lead wire in the axial direction of the component during 10 $\pm$ 1 seconds.

FL05R□ : Fix the body of a component in the direction to draw terminal, and gradually apply the tensile force of 4.9N.

### 11. Over current

LA Type	No emission of smoke no firing.
CAL45 Type	
LHL□□□	
FBA/FBR	
FL05□ Type	
FL06BT Type	

#### [Test Method and Remarks]

LHL□□□/LA・CAL45 Type : Measuring current : Rated current $\times$ 2  
 Duration : 5 min.  
 Number of measuring : one time



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### 12. Terminal strength : bending

LA Type	No abnormality such as cut lead, or looseness.
CAL45 Type	
LHL□□□	
FBA/FBR	
FL05□ Type	
FL06BT Type	

#### 【Test Method and Remarks】

LA, CA : Suspend a weight of specified mass at the end of the terminals and incline the body through the angle of 90 degrees and return it to the initial position. This operation is done over a period of 2-3 sec. Then second bend in the opposite direction shall be made.

Number of bends : Two times.

Nominal wire diameter tensile $\phi d$ (mm)	Bending force (N)	Mass reference weight (kg)
$0.3 < \phi d \leq 0.5$	2.5	0.25
$0.5 < \phi d \leq 0.8$	5	0.50

LH·FB : Suspend a weight of specified mass at the end of the terminals and incline the body through the angle of 90 degrees and return it to the initial position. This operation is done over a period of 2-3 sec. Then second bend in the opposite direction shall be made.

Number of bends : Two times.

Nominal wire diameter tensile $\phi d$ (mm)	Bending force (N)	Mass reference weight (kg)
$0.3 < \phi d \leq 0.5$	2.5	0.25
$0.5 < \phi d \leq 0.8$	5	0.5
$0.8 < \phi d \leq 1.2$	10	1.0

### 13. Insulation resistance : between the terminals and body

LA Type	100M $\Omega$ min.
CAL45 Type	
LHL□□□	
FBA/FBR	
FL05□ Type	
FL06BT Type	

#### 【Test Method and Remarks】

LHL□□□ : Applied voltage : 500 VDC  
Duration : 60 sec.

### 14. Insulation resistance : between terminals and core

LA Type	1M $\Omega$ min. (Other than materail code MA)
CAL45 Type	
LHL□□□	
FBA/FBR	
FL05□ Type	
FL06BT Type	

#### 【Test Method and Remarks】

FBA·FBR : Applied voltage : 100 VDC  
Duration : 60±5 sec.

### 15. Withstanding : between the terminals and body

LA Type	No abnormality such as insulation damage
CAL45 Type	
LHL□□□	
FBA/FBR	
FL05□ Type	
FL06BT Type	

#### 【Test Method and Remarks】

LHL□□□ : Accoding to JIS C5102. 7. 1. 3 (C)  
Metal global method  
Applied voltage : 500 VDC  
Duration : 60 sec.

### 16. DC bias characteristic

LA Type	$\Delta L/L$ : Within -10%
CAL45 Type	
LHL□□□	
FBA/FBR	
FL05□ Type	
FL06BT Type	

#### 【Test Method and Remarks】

LA, CA : Measure inductance with application of rated current using LCR meter to compare it with the initial value.

### 17. Body strength

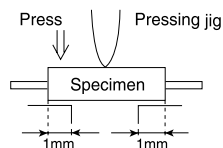
LA Type	No abnormality as damage.
CAL45 Type	
LHL□□□	No abnormality such as cracks on body.
FBA/FBR	
FL05□ Type	
FL06BT Type	

#### 【Test Method and Remarks】

LA : Applied force : 30N  
Duration : 10 sec.  
Speed : Shall attain to specified force in 2 sec.

CAL45 : Applied force : 50N  
Duration : 10 sec.  
Speed : Shall attain to specified force in 2 sec.

FBA : Applied force : 50±3N  
Duration : 30±1 sec.



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## RELIABILITY DATA

18. Resitance to vibration	
LA Type	$\Delta L/L$ : Within $\pm 5\%$ Q : 30min
CAL45 Type	$\Delta L/L$ : Within $\pm 5\%$
LHL□□□	Appearance : No abnormality $\Delta L/L$ : Within $\pm 5\%$ Q change : Within $\pm 30\%$ (LHLP : only $\Delta L/L$ )
FBA/FBR	Appearance : No abnormality Impedance change : Within $\pm 20\%$
FL05□ Type	
FL06BT Type	
[Test Method and Remarks]	
LA, CA	: Directions : 2 hrs each in X, Y and Z directions total : 6hrs. Frequency range : 10 to 55 to 10Hz (1min.) Amplitude : 1.5mm Mounting method : Soldering onto printed board. Recovery : At least 1hr of recovery under the standard condition after the test, followed by the measurement within 2hrs.
LHL□□□·FB	: Directions : 2 hrs each in X, Y and Z directions total : 6hrs. Frequency range : 10 to 55 to 10Hz (1min.) Amplitude : 1.5mm (But don't exceed acceleration $196\text{m/s}^2$ (two power)) Mounting method : Soldering onto printed board.
19. Resistance to shock	
LA Type	No significant abnormality in appearance
CAL45 Type	
LHL□□□	
FBA/FBR	
FL05□ Type	
FL06BT Type	
[Test Method and Remarks]	
LA, CA	: Drop test Impact material : concrete or vinyl tile Height : 1m Total number of drops : 10 times
20. Solderability	
LA Type	At least 75% of terminal electrode is covered by new solder.
CAL45 Type	At least 75% of terminal electrode is covered by new solder.
LHL□□□	At least 75% of terminal electrode is covered by new solder.
FBA/FBR	At least 90% of terminal electrode is covered by new solder.
FL05□ Type	At least 75% of terminal electrode is covered by new solder.
FL06BT Type	At least 75% of terminal electrode is covered by new solder.
[Test Method and Remarks]	
LA, CA	: Solder temperature : $230\pm 5^\circ\text{C}$ Duration : $2\pm 0.5$ sec.
LHL□□□	: Solder temperature : $235\pm 5^\circ\text{C}$ Duration : $2\pm 0.5$ sec. Immersion depth : Up to 1.5mm from bottom of case.
FB	: Solder temperature : $230\pm 5^\circ\text{C}$ Duration : $3\pm 1$ sec. Immersion depth : Up to 1.5mm from terminal root.
FL05R□	: Solder temperature : $230\pm 5^\circ\text{C}$ Duration : $2\pm 0.5$ sec. Immersion depth : Up to 2 to 2.5mm from terminal root.
FL06BT	: Solder temperature : $230\pm 5^\circ\text{C}$ Duration : $3\pm 1$ sec. Immersion depth : Up to 0.5 to 1.0mm from terminal root.
21. Resitance to soldering heat	
LA Type	No significant abnormality in appearance
CAL45 Type	$\Delta L/L$ : Within $\pm 5\%$
LHL□□□	No significant abnormality in appearance Inductance change : Within $\pm 5\%$ Q change : Within $\pm 30\%$ (LHLP : only $\Delta L/L$ )
FBA/FBR	No significant abnormality in appearance Impedance change : Within $\pm 20\%$
FL05□ Type	Refer to individual specification
FL06BT Type	No significant abnormality in appearance Impedance change : Within $\pm 20\%$
[Test Method and Remarks]	
LA, CA	: Solder temperature : (CA) $270\pm 5^\circ\text{C}$ , (LA) $260\pm 5^\circ\text{C}$ Duration : $5\pm 0.5$ sec. One time Immersed conditions : Inserted into substrate with $t=1.6\text{mm}$ Recovery : At least 1hr of recovery under the standard condition after the test, followed by the measurement within 2hrs.
LHL□□□	: Solder bath method : Solder temperature : $260\pm 5^\circ\text{C}$ Duration : $10\pm 1$ sec. Up to 1.5mm from the bottom of case. Manual soldering : Solder temperature : $350\pm 10^\circ\text{C}$ (At the tip of soldering iron) Duration : $5\pm 1$ sec. Up to 1.5mm from the bottom of case. Caution : No excessive pressing shall be applied to terminals. Recovery : 4 to 24hrs of recovery under the standard condition after the test.
FB	: Solder bath method : Condition 1 : Solder temperature : $260\pm 5^\circ\text{C}$ Duration : $10\pm 1$ sec. Immersion depth : Up to 1.5mm from the terminal root. Condition 2 : Solder temperature : $350\pm 5^\circ\text{C}$ Duration : $3\pm 1$ sec. Immersion depth : Up to 1.5mm from the terminal root. Recovery : 3hrs of recovery under the standard condition after the test.
FL	: Solder condition : $260\pm 5^\circ\text{C}$ $10\pm 1$ sec. Immersion depth : Up to 0.5 to 1.0mm from the terminal root. Recovery : 3hrs of recovery under the standard condition after the test.

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## RELIABILITY DATA

22. Resisistance to solvent	
LA Type	Please avoid the ultrasonic cleaning of this product.
CAL45 Type	
LHL□□□	
FBA/FBR	No significant abnormality in appearance      Impedance change : Within ±20%
FL05□ Type	
FL06BT Type	

**[Test Method and Remarks]**

FB : Solvent temperature : 20~25°C  
 Duration : 30±5 sec.  
 Solvent type : Acetone, trichloroethylene  
 Recovery : 3hrs of recovery under the standard condition after the test.

23. Thermal shock	
LA Type	△L/L : Within ±10%    Q : 30min
CAL45 Type	△L/L : Within ±10%
LHL□□□	Appearance : No abnormality      Inductance change : Within ±10%      Q change : Within ±30% (LHLP : only △L/L)
FBA/FBR	Appearance : No abnormality      Impedance change : Within ±20%
FL05□ Type	Refer to individual specification
FL06BT Type	Appearance : No abnormality      Impedance change : Within ±20%

**[Test Method and Remarks]**

LA, CA : Conditions for 1cycle

Step	Temperature (°C)	Duration (min.)
1	-25 <sup>+0</sup> <sub>-3</sub>	30±3
2	Room temperature	Within 3
3	+85 <sup>+2</sup> <sub>-0</sub>	30±3
4	Room temperature	Within 3

Number of cycles : 5 cycles  
 Recovery : At least 1hr of recovery under the standard condition after the removal from test chamber, followed by the measurement within 2hrs.

LHL□□□·FB : Accoding to JIS C0025

Conditions for 1 cycle

Step	Temperature (°C)	Duration (min.)
1	Minimum operating temperature <sup>+0</sup> <sub>-3</sub>	30±3
2	Room temperature	Within 3
3	Minimum operating temperature <sup>+2</sup> <sub>-0</sub>	30±3
4	Room temperature	Within 3

Number of cycles : 10 cycles (LHL□□□)  
 : 5 cycles (FBA, FBR)  
 Recovery : 4 to 24hrs of recovery under the standard condition after the removal from the test chamber. (LHL□□□)  
 : 3hrs of recovery under the standard condition after the removal from the test chamber. (FBA, FBR)

FL : Accoding to JIS C0025

Conditions for 1 cycle

Step	Temperature (°C)	Duration (min.)
1	-25 <sup>+0</sup> <sub>-3</sub>	30±3
2	Room temperature	Within 3
3	+85 <sup>+2</sup> <sub>-0</sub>	30±3
4	Room temperature	Within 3

Number of cycles : 10 cycles  
 Recovery : 1 to 2hrs of recovery under the standard condition after the removal from the test chamber.

24. Damp heat	
LA Type	△L/L : Within ±10%    Q : 30min
CAL45 Type	△L/L : Within ±10%
LHL□□□	
FBA/FBR	Appearance : No abnormality      Impedance change : Within ±20%
FL05□ Type	
FL06BT Type	

**[Test Method and Remarks]**

LA, CA : Temperature : 40±2°C  
 Humidity : 90~95%RH  
 Duration : 1000 hrs  
 Recovery : At least 1hr of recovery under the standard removal from test chamber, followed by the measurement within 2hrs.

FB : Temperature : 60±2°C  
 Humidity : 90~95%RH  
 Duration : 1000 hrs  
 Recovery : 1 to 2hrs of recovery under the standard condition after the removal from the test chamber.

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## RELIABILITY DATA

25. Loading under damp heat	
LA Type	$\Delta L/L$ : Within $\pm 10\%$ Q : 30min
CAL45 Type	$\Delta L/L$ : Within $\pm 10\%$
LHL□□□	Appearance : No abnormality Inductance change : Within $\pm 10\%$ Q change : Within $\pm 30\%$ (LHLP : only $\Delta L/L$ )
FBA/FBR	
FL05□ Type	Refer to individual specification
FL06BT Type	Appearance : No abnormality Impedance change : Within $\pm 20\%$
[Test Method and Remarks]	
LA, CA	Temperature : $40 \pm 2^\circ\text{C}$ Humidity : $90 \sim 95\% \text{RH}$ Duration : 1000 hrs Applied current : Rated current Recovery : At least 1hr of recovery under the standard removal from test chamber, followed by the measurement within 2hrs.
LHL□□□	Temperature : $40 \pm 2^\circ\text{C}$ Humidity : $90 \sim 95\% \text{RH}$ Duration : $1000 \pm 24$ hrs Applied current : Rated current Recovery : 1 to 2hrs of recovery under the standard condition after the removal from the test chamber.
FL	Temperature : $60 \pm 3^\circ\text{C}$ Humidity : $90 \sim 95\% \text{RH}$ Duration : 500 (+12, -0) hrs Applied current : Rated current Recovery : 1 to 2hrs of recovery under the standard condition after the removal from the test chamber.
26. Loading at high temperature	
LA Type	$\Delta L/L$ : Within $\pm 10\%$ Q : 30min
CAL45 Type	$\Delta L/L$ : Within $\pm 10\%$
LHL□□□	
FBA/FBR	
FL05□ Type	
FL06BT Type	
[Test Method and Remarks]	
LA, CA	Temperature : $85 \pm 2^\circ\text{C}$ Duration : 1000 hrs Applied current : Rated current Recovery : At least 1hr of recovery under the standard removal from test chamber, followed by the measurement within 2hrs.
27. Low temperature life test	
LA Type	$\Delta L/L$ : Within $\pm 10\%$ Q : 30min
CAL45 Type	$\Delta L/L$ : Within $\pm 10\%$
LHL□□□	Appearance : No abnormality Inductance change : Within $\pm 10\%$ Q change : Within $\pm 30\%$ (LHLP : only $\Delta L/L$ )
FBA/FBR	
FL05□ Type	Refer to individual specification
FL06BT Type	Appearance : No abnormality Impedance change : Within $\pm 20\%$
[Test Method and Remarks]	
LA, CA	Temperature : $-25 \pm 2^\circ\text{C}$ Duration : 1000 hrs Recovery : At least 1hr of recovery under the standard removal from test chamber, followed by the measurement within 2hrs.
LHL□□□	Temperature : $-40 \pm 3^\circ\text{C}$ Duration : $1000 \pm 24$ hrs Recovery : 1 to 2hrs of recovery under the standard condition after the removal from the test chamber.
FL	Temperature : $-40 \pm 3^\circ\text{C}$ Duration : 500 (+12, -0) hrs Recovery : 1 to 2hrs of recovery under the standard condition after the removal from the test chamber.
28. High temperature life test	
LA Type	
CAL45 Type	
LHL□□□	Appearance : No abnormality Inductance change : Within $\pm 10\%$ Q change : Within $\pm 30\%$ (LHLP : only $\Delta L/L$ )
FBA/FBR	
FL05□ Type	Refer to individual specification
FL06BT Type	Appearance : No abnormality Impedance change : Within $\pm 20\%$
[Test Method and Remarks]	
LHL□□□	Temperature : $105 \pm 3^\circ\text{C}$ Duration : $1000 \pm 24$ hrs Recovery : 1 to 2hrs of recovery under the standard condition after the removal from the test chamber.
FL	Temperature : $85 \pm 3^\circ\text{C}$ Duration : 500 (+12, -0) hrs Recovery : 1 to 2hrs of recovery under the standard condition after the removal from the test chamber.

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## PRECAUTIONS

CAL Type, LH Type, FB Type, FL Type, LA Type

1. Circuit Design	
Precautions	<ul style="list-style-type: none"> <li>◆ Operating environment</li> <li>1. The products described in this specification are intended for use in general electronic equipment, (office supply equipment, telecommunications systems, measuring equipment, and household equipment). They are not intended for use in mission-critical equipment or systems requiring special quality and high reliability (traffic systems, safety equipment, aerospace systems, nuclear control systems and medical equipment including life-support systems,) where product failure might result in loss of life, injury or damage. For such uses, contact TAIYO YUDEN Sales Department in advance.</li> </ul>
2. PCB Design	
Precautions	<ul style="list-style-type: none"> <li>◆ Design</li> <li>1. Please design insertion pitches as matching to that of leads of the component on PCBs.</li> </ul>
Technical considerations	<ul style="list-style-type: none"> <li>◆ Design</li> <li>1. When Inductors are mounted onto a PC board, hole dimensions on the board should match the lead pitch of the component, if not, it will cause breakage of the terminals or cracking of terminal roots covered with resin as excess stress travels through the terminal legs.</li> </ul>
3. Considerations for automatic placement	
Precautions	<ul style="list-style-type: none"> <li>◆ Adjustment of mounting machine</li> <li>1. Excessive impact load should not be imposed on the products when mounting onto the PC boards.</li> <li>2. Mounting and soldering conditions should be checked beforehand.</li> </ul>
Technical considerations	<ul style="list-style-type: none"> <li>◆ Adjustment of mounting machine</li> <li>1. When installing products, care should be taken not to apply distortion stress as it may deform the products.</li> </ul>
4. Soldering	
Precautions	<ul style="list-style-type: none"> <li>◆ Wave soldering</li> <li>1. Please refer to the specifications in the catalog for a wave soldering.</li> <li>2. Do not immerse the entire inductor in the flux during the soldering operation.</li> </ul>
	<ul style="list-style-type: none"> <li>◆ Lead free soldering</li> <li>1. When using products with lead free soldering, we request to use them after confirming adhesion, temperature of resistance to soldering heat, soldering etc sufficiently.</li> </ul> <p>Recommended conditions for using a soldering iron:</p> <ul style="list-style-type: none"> <li>· Put the soldering iron on the land-pattern.</li> <li>· Soldering iron's temperature - Below 350°C</li> <li>· Duration - 3 seconds or less</li> <li>· The soldering iron should not directly touch the inductor.</li> </ul>
	<ul style="list-style-type: none"> <li>◆ Reflow soldering</li> <li>1. As for reflow soldering, please contact our sales staff.</li> </ul>
Technical considerations	<ul style="list-style-type: none"> <li>◆ Lead free soldering</li> <li>1. If products are used beyond the range of the recommended conditions, heat stresses may deform the products, and consequently degrade the reliability of the products.</li> </ul>
5. Cleaning	
Precautions	<ul style="list-style-type: none"> <li>◆ Cleaning conditions</li> <li>1. CAL type, LH type, LA Type</li> <li>Please do not do cleaning by a supersonic wave.</li> </ul>
Technical considerations	<ul style="list-style-type: none"> <li>◆ Cleaning conditions</li> <li>1. CAL type, LH type, LA Type</li> <li>If washing by supersonic waves, supersonic waves may deform products.</li> </ul>
6. Handling	
Precautions	<ul style="list-style-type: none"> <li>◆ Handling</li> <li>1. Keep the inductors away from all magnets and magnetic objects.</li> </ul>
	<ul style="list-style-type: none"> <li>◆ Mechanical considerations</li> <li>1. Please do not give the inductors any excessive mechanical shocks.</li> <li>2. LH type</li> <li>If inductors are dropped onto the floor or a hard surface they should not be used.</li> </ul>
	<ul style="list-style-type: none"> <li>◆ Packing</li> <li>1. Please do not give the inductors any excessive mechanical shocks.</li> <li>In loading, please pay attention to handling indication mentioned in a packing box (a loading direction / number of maximum loading / fragile item).</li> </ul>
Technical considerations	<ul style="list-style-type: none"> <li>◆ Handling</li> <li>1. There is a case that a characteristic varies with magnetic influence.</li> <li>◆ Mechanical considerations</li> <li>1. There is a case to be damaged by a mechanical shock.</li> <li>2. LH type</li> <li>There is a case to be broken by a fall.</li> <li>◆ Packing</li> <li>1. There is a case that a lead wire could be deformed by a fall or an excessive shock.</li> </ul>
7. Storage conditions	
Precautions	<ul style="list-style-type: none"> <li>◆ Storage</li> <li>1. To maintain the solderability of terminal electrodes and to keep the packing material in good condition, temperature and humidity in the storage area should be controlled.</li> </ul> <p>Recommended conditions</p> <ul style="list-style-type: none"> <li>· Ambient temperature 0~40°C</li> <li>· Humidity Below 70% RH</li> </ul> <p>The ambient temperature must be kept below 30°C. Even under ideal storage conditions, solderability of products electrodes may decrease as time passes. For this reason, inductors should be used within one year from the time of delivery. In case of storage over 6 months, solderability shall be checked before actual usage.</p>
	Technical considerations

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