

## 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 2013. 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

■ PARTS NUMBER

\*Operating Temp.: -25~+105°C (Including self-generated heat)

|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C | A | L | △ | 4 | 5 | T | B | △ | 1 | R | 5 | K | △ | △ | △ | △ |
| ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |   |   |   |   |   |   |   |   |   |   |

△ = Blank space

① Series name

| Code | Series name                        |
|------|------------------------------------|
| CA   | High current axial leaded inductor |

② Characteristics

| Code | Characteristics |
|------|-----------------|
| L△   | Standard        |

③ Dimensions (L × D)

| Code | Dimensions (L × D) [mm] |
|------|-------------------------|
| 45   | 8.0 × 4.4               |

④ Lead configurations

| Code | Lead configurations                    |
|------|--|
| TB   | Axial lead (52mm lead space)/ammo pack |
| VB   | Formed lead/ammo pack                  |

⑤ Nominal inductance

| Code (example) | Nominal inductance [μH] |
|----------------|-------------------------|
| 1R5            | 1.5                     |
| 120            | 12                      |

※R=Decimal point

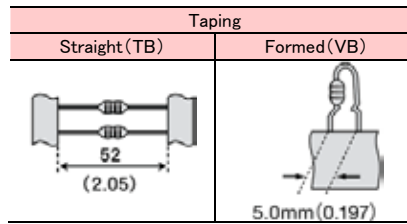
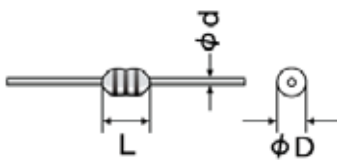
⑥ Inductance tolerance

| Code | Inductance tolerance |
|------|----------------------|
| K    | ±10%                 |

⑦ Internal code

| Code | Internal code |
|------|---------------|
| △△△△ | Standard      |

■ STANDARD EXTERNAL DIMENSIONS / STANDARD QUANTITY



| Type   | L                      | φD                     | φd                         | Standard quantity [pcs] |             |
|--------|------------------------|------------------------|----------------------------|-------------------------|-------------|
|        |                        |                        |                            | Taping                  |             |
|        |                        |                        |                            | Axial lead              | Formed lead |
| CAL 45 | 8.0 max<br>(0.315 max) | 4.4 max<br>(0.173 max) | 0.65±0.05<br>(0.026±0.002) | 2000                    | 1500        |

Unit: mm (inch)

► This catalog contains the typical specification only due to the limitation of space. When you consider the purchase of our products, please check our specification. For details of each product (characteristics graph, reliability information, precautions for use, and so on), see our Web site (<http://www.ty-top.com/>).

## ● CAL45

| Parts number | EHS  | Nominal inductance<br>[ $\mu$ H] | Inductance tolerance | Measuring frequency<br>[MHz] | DC ResistanceDC<br>[ $\Omega$ ] (max.) | Rated current ※) [mA] (max.) |                                  |
|--------------|------|----------------------------------|----------------------|------------------------------|--|------------------------------|----------------------------------|
|              |      |                                  |                      |                              |  | Saturation current<br>Idc1   | Temperature rise current<br>Idc2 |
| CAL 45□ 1R0K | RoHS | 1.0                              | ±10%                 | 7.96                         | 0.036                                  | 5600                         | 3300                             |
| CAL 45□ 1R2K | RoHS | 1.2                              | ±10%                 | 7.96                         | 0.039                                  | 5000                         | 3200                             |
| CAL 45□ 1R5K | RoHS | 1.5                              | ±10%                 | 7.96                         | 0.041                                  | 4400                         | 3000                             |
| CAL 45□ 1R8K | RoHS | 1.8                              | ±10%                 | 7.96                         | 0.048                                  | 4100                         | 2800                             |
| CAL 45□ 2R2K | RoHS | 2.2                              | ±10%                 | 7.96                         | 0.054                                  | 3900                         | 2700                             |
| CAL 45□ 2R7K | RoHS | 2.7                              | ±10%                 | 7.96                         | 0.058                                  | 3500                         | 2500                             |
| CAL 45□ 3R3K | RoHS | 3.3                              | ±10%                 | 7.96                         | 0.066                                  | 3100                         | 2400                             |
| CAL 45□ 3R9K | RoHS | 3.9                              | ±10%                 | 7.96                         | 0.072                                  | 3000                         | 2300                             |
| CAL 45□ 4R7K | RoHS | 4.7                              | ±10%                 | 7.96                         | 0.079                                  | 2800                         | 2200                             |
| CAL 45□ 5R6K | RoHS | 5.6                              | ±10%                 | 7.96                         | 0.089                                  | 2500                         | 2100                             |
| CAL 45□ 6R8K | RoHS | 6.8                              | ±10%                 | 7.96                         | 0.097                                  | 2200                         | 2000                             |
| CAL 45□ 8R2K | RoHS | 8.2                              | ±10%                 | 7.96                         | 0.110                                  | 2000                         | 1900                             |
| CAL 45□ 100K | RoHS | 10                               | ±10%                 | 2.52                         | 0.14                                   | 1700                         | 1800                             |
| CAL 45□ 120K | RoHS | 12                               | ±10%                 | 2.52                         | 0.17                                   | 1600                         | 1450                             |
| CAL 45□ 150K | RoHS | 15                               | ±10%                 | 2.52                         | 0.19                                   | 1400                         | 1430                             |
| CAL 45□ 180K | RoHS | 18                               | ±10%                 | 2.52                         | 0.24                                   | 1250                         | 1300                             |
| CAL 45□ 220K | RoHS | 22                               | ±10%                 | 2.52                         | 0.28                                   | 1200                         | 1220                             |
| CAL 45□ 270K | RoHS | 27                               | ±10%                 | 2.52                         | 0.33                                   | 1100                         | 1130                             |
| CAL 45□ 330K | RoHS | 33                               | ±10%                 | 2.52                         | 0.37                                   | 1000                         | 1080                             |
| CAL 45□ 390K | RoHS | 39                               | ±10%                 | 2.52                         | 0.47                                   | 920                          | 900                              |
| CAL 45□ 470K | RoHS | 47                               | ±10%                 | 2.52                         | 0.52                                   | 890                          | 870                              |
| CAL 45□ 560K | RoHS | 56                               | ±10%                 | 2.52                         | 0.75                                   | 790                          | 710                              |
| CAL 45□ 680K | RoHS | 68                               | ±10%                 | 2.52                         | 0.78                                   | 700                          | 700                              |
| CAL 45□ 820K | RoHS | 82                               | ±10%                 | 2.52                         | 0.92                                   | 620                          | 640                              |
| CAL 45□ 101K | RoHS | 100                              | ±10%                 | 0.796                        | 1.2                                    | 590                          | 630                              |
| CAL 45□ 121K | RoHS | 120                              | ±10%                 | 0.796                        | 1.6                                    | 550                          | 490                              |
| CAL 45□ 151K | RoHS | 150                              | ±10%                 | 0.796                        | 1.8                                    | 490                          | 470                              |
| CAL 45□ 181K | RoHS | 180                              | ±10%                 | 0.796                        | 2.3                                    | 420                          | 450                              |
| CAL 45□ 221K | RoHS | 220                              | ±10%                 | 0.796                        | 2.9                                    | 370                          | 425                              |
| CAL 45□ 271K | RoHS | 270                              | ±10%                 | 0.796                        | 3.4                                    | 350                          | 355                              |
| CAL 45□ 331K | RoHS | 330                              | ±10%                 | 0.796                        | 3.6                                    | 320                          | 330                              |
| CAL 45□ 391K | RoHS | 390                              | ±10%                 | 0.796                        | 4.9                                    | 290                          | 280                              |
| CAL 45□ 471K | RoHS | 470                              | ±10%                 | 0.796                        | 6.3                                    | 270                          | 240                              |
| CAL 45□ 561K | RoHS | 560                              | ±10%                 | 0.796                        | 7.0                                    | 250                          | 240                              |
| CAL 45□ 681K | RoHS | 680                              | ±10%                 | 0.796                        | 7.8                                    | 240                          | 220                              |
| CAL 45□ 821K | RoHS | 820                              | ±10%                 | 0.796                        | 11.0                                   | 220                          | 210                              |
| CAL 45□ 102K | RoHS | 1000                             | ±10%                 | 0.252                        | 13.2                                   | 190                          | 170                              |
| CAL 45□ 122K | RoHS | 1200                             | ±10%                 | 0.252                        | 17                                     | 170                          | 150                              |
| CAL 45□ 152K | RoHS | 1500                             | ±10%                 | 0.252                        | 22                                     | 150                          | 140                              |
| CAL 45□ 182K | RoHS | 1800                             | ±10%                 | 0.252                        | 27                                     | 140                          | 120                              |
| CAL 45□ 222K | RoHS | 2200                             | ±10%                 | 0.252                        | 36                                     | 130                          | 110                              |
| CAL 45□ 272K | RoHS | 2700                             | ±10%                 | 0.252                        | 45                                     | 110                          | 90                               |
| CAL 45□ 332K | RoHS | 3300                             | ±10%                 | 0.252                        | 65                                     | 100                          | 75                               |
| CAL 45□ 392K | RoHS | 3900                             | ±10%                 | 0.252                        | 69                                     | 95                           | 70                               |
| CAL 45□ 472K | RoHS | 4700                             | ±10%                 | 0.252                        | 80                                     | 90                           | 65                               |
| CAL 45□ 562K | RoHS | 5600                             | ±10%                 | 0.252                        | 90                                     | 90                           | 60                               |
| CAL 45□ 682K | RoHS | 6800                             | ±10%                 | 0.252                        | 100                                    | 80                           | 60                               |
| CAL 45□ 822K | RoHS | 8200                             | ±10%                 | 0.252                        | 125                                    | 75                           | 50                               |
| CAL 45□ 103K | RoHS | 10000                            | ±10%                 | 0.0796                       | 155                                    | 65                           | 45                               |

\* □ Please specify the Lead configuration code.

※) The saturation current value (Idc1) is the DC current value having inductance decrease down to 10%. (at 20°C)

※) The temperature rise current value (Idc2) is the DC current value having temperature increase up to 40°C. (at 20°C)

※) The rated current is the DC current value that satisfies both of current value saturation current value and temperature rise current value.

# AXIAL LEADED INDUCTORS

## PACKAGING

### ① Minimum Quantity

#### ● Taping for Straight Leads

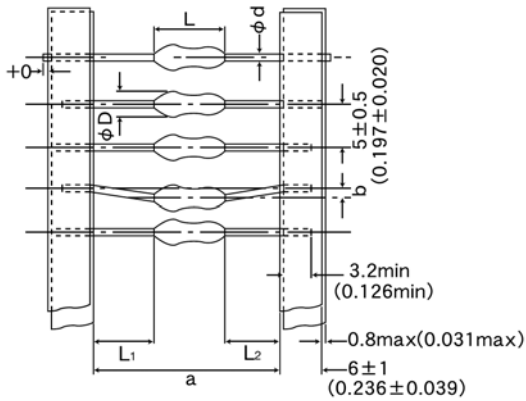
| Type  | Lead Configuration code | Standard quantity [pcs] |
|-------|-------------------------|-------------------------|
| CAL45 | TB                      | 2,000                   |

#### ● Taping for Formed Leads

| Type  | Lead Configuration code | Standard quantity [pcs] |
|-------|-------------------------|-------------------------|
| CAL45 | VB                      | 1,500                   |

### ② Dimension

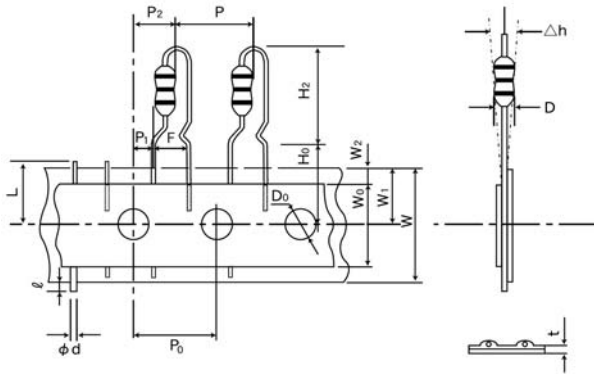
#### ● CAL 45 TB (a: 52mm lead space) (2.05 inches)



| Type  | Dimensions           |                      |  |                      |                      |                                    | Minimum insertion pitch |
|-------|----------------------|----------------------|--|----------------------|----------------------|------------------------------------|-------------------------|
|       | $\phi D$             | L                    | a  | b                    | $ L_1 - L_2 $        | $\phi d$                           |                         |
| CAL45 | 4.4max<br>(0.173max) | 8.0max<br>(0.315max) | $52 \pm 2 / -1$<br>(2.05 + 0.079 / -0.039) | 1.2max<br>(0.047max) | 1.0max<br>(0.039max) | $0.65 \pm 0.05$<br>(0.026 ± 0.002) | 10.0<br>(0.394)         |

Unit : mm (inch)

#### ● CAL 45VB



| Type   | Symbol | Dimensions                             | Symbol     | Dimensions                                      | Symbol   | Dimensions   |
|--------|--------|--|------------|---|----------|--|
| CAL 45 | D      | $\phi 4.4\text{max}$                   | $P_2$      | $6.35 \pm 1.3$<br>(0.250 ± 0.051)               | $W_2$    | $3.0\text{max}^{※2}$<br>(0.118max)                 |
|        | $H_2$  | 14.0max<br>(0.551max)                  | F          | $5.0 \pm 1.0$<br>(0.197 ± 0.039)                | $l$      | 2.0max<br>(0.079max)                               |
|        | $H_0$  | $16.0 \pm 1.0$<br>(0.630 ± 0.039)      | $\Delta h$ | $0.0 \pm 2.0$<br>(0.0 ± 0.079)                  | $D_0$    | $\phi 4.0 \pm 0.2$<br>( $\phi 0.157 \pm 0.008$ )   |
|        | P      | $12.7 \pm 1.0$<br>(0.500 ± 0.039)      | W          | $18.0 + 1.0 / -0.5$<br>(0.709 + 0.039 / -0.020) | $\phi d$ | $\phi 0.65 \pm 0.05$<br>( $\phi 0.026 \pm 0.002$ ) |
|        | $P_0$  | $12.7 \pm 0.3^{※1}$<br>(0.500 ± 0.012) | $W_0$      | 12.5min<br>(0.492min)                           | L        | 11.0max<br>(0.433max)                              |
|        | $P_1$  | $3.85 \pm 0.7$<br>(0.152 ± 0.028)      | $W_1$      | $9.0 + 0.75 / -0.5$<br>(0.354 + 0.030 / -0.020) | t        | 0.9max<br>(0.035max)                               |

Unit : mm (inch)

※1 Accumulated error for 20 pitches is  $\pm 1\text{mm}$ .

※2 Bonding tape must not protrude from the base tape.

# AXIAL LEADED INDUCTORS (CAL Type)、 RADIAL LEADED INDUCTORS (LH Type)、 LEADED FERRITE BEAD INDUCTORS ( FB Series A Type/R Type)

## RELIABILITY DATA

| 1. Operating temperature Range |  |               |
|--------------------------------|--|---------------|
| Specified Value                | CAL45 Type   | -25 ~ + 105°C |
|                                | LHL□□□   |               |
|                                | FBA/FBR  | -25 ~ + 85°C  |
| Test Methods and Remarks       | CAL45 Type : Including self-generated heat<br>LHL□□□ : Including self-generated heat |               |

| 2. Storage temperature Range |            |              |
|------------------------------|------------|--------------|
| Specified Value              | CAL45 Type | -40 ~ + 85°C |
|                              | LHL□□□     |              |
|                              | FBA/FBR    |              |

| 3. Rated current         |  |                                |
|--------------------------|--|--------------------------------|
| Specified Value          | CAL45 Type   | Within the specified tolerance |
|                          | LHL□□□   |                                |
|                          | FBA/FBR  |                                |
| Test Methods and Remarks | CAL45 Type :<br>The maximum DC value having inductance within 10% and temperature increase within 40°C by the application of DC bias.<br>LHL□□□ :<br>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.<br>Reference temperature : 25°C (LHL08, LHL10, LHL13)<br>: 30°C (LHL16, LHLP□□)<br>: 40°C (LHLC08, LHLC10)<br>FBA/FBR :<br>No disconnection or appearance abnormality by continuous current application for 30 min. Change after the application shall be within ±20% of the initial value.<br>This is not guaranteed for electrical characteristics during current application. |                                |

| 4. Impedance             |  |                                |
|--------------------------|--|--------------------------------|
| Specified Value          | CAL45 Type   | Within the specified tolerance |
|                          | LHL□□□   |                                |
|                          | FBA/FBR  |                                |
| Test Methods and Remarks | FBA/FBR :<br>Measuring equipment : Impedance analyzer (HP4191A) or its equivalent<br>Measuring frequency : Specified frequency |                                |

| 5. Inductance            |   |                                |
|--------------------------|---|--------------------------------|
| Specified Value          | CAL45 Type  | Within the specified tolerance |
|                          | LHL□□□  |                                |
|                          | FBA/FBR   |                                |
| Test Methods and Remarks | CAL45 Type :<br>Measuring equipment : LCR meter (HP4285A + HP42851A or its equivalent)<br>Measuring frequency : Specified frequency<br>LHL□□□ :<br>Measuring equipment : LCR meter (HP4285A + HP42851A or its equivalent)<br>: LCR meter (HP4263A) or its equivalent (at 1kHz)<br>Measuring frequency : Specified frequency |                                |

▶ This catalog contains the typical specification only due to the limitation of space. When you consider the purchase of our products, please check our specification. For details of each product (characteristics graph, reliability information, precautions for use, and so on), see our Web site (<http://www.ty-top.com/>).

| 6. Q                     |  |                                |
|--------------------------|--|--------------------------------|
| Specified Value          | CAL45 Type   |                                |
|                          | LHL□□□   | Within the specified tolerance |
|                          | FBA/FBR  |                                |
| Test Methods and Remarks | LHL□□□ (except LHLP) :<br>Measuring equipment : LCR meter (HP4285A + HP42851A or its equivalent)<br>: LCR meter (HP4263A) or its equivalent (at 1kHz)<br>Measuring frequency : Specified frequency |                                |

| 7. DC Resistance         |                                   |                                |
|--------------------------|-----------------------------------|--------------------------------|
| Specified Value          | CAL45 Type                        |                                |
|                          | LHL□□□                            | Within the specified tolerance |
|                          | FBA/FBR                           |                                |
| Test Methods and Remarks | Measuring equipment : DC ohmmeter |                                |

| 8. Self resonance frequency |  |                                |
|-----------------------------|--|--------------------------------|
| Specified Value             | CAL45 Type   |                                |
|                             | LHL□□□   | Within the specified tolerance |
|                             | FBA/FBR  |                                |
| Test Methods and Remarks    | LHL□□□(except LHLP) :<br>Measuring equipment : (HP4191A, 4192A) its equivalent |                                |

| 9. Temperature characteristic |   |   |      |                  |        |   |    |   |                               |   |                           |   |                               |   |    |
|-------------------------------|---|---|------|------------------|--------|---|----|---|-------------------------------|---|---------------------------|---|-------------------------------|---|----|
| Specified Value               | CAL45 Type  |   |      |                  |        |   |    |   |                               |   |                           |   |                               |   |    |
|                               | LHL□□□  | $\Delta L/L$ : Within $\pm 7\%$ (except LHL16 : Within $\pm 20\%$ ) |      |                  |        |   |    |   |                               |   |                           |   |                               |   |    |
|                               | FBA/FBR   |   |      |                  |        |   |    |   |                               |   |                           |   |                               |   |    |
| Test Methods and Remarks      | Change of maximum inductance deviation in step 1 to 5 <table border="1" style="margin-left: 20px;"> <thead> <tr> <th rowspan="2">Step</th> <th>Temperature (°C)</th> </tr> <tr> <th>LHL□□□</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>20</td> </tr> <tr> <td>2</td> <td>Minimum operating temperature</td> </tr> <tr> <td>3</td> <td>20 (Standard temperature)</td> </tr> <tr> <td>4</td> <td>Maximum operating temperature</td> </tr> <tr> <td>5</td> <td>20</td> </tr> </tbody> </table> |   | Step | Temperature (°C) | LHL□□□ | 1 | 20 | 2 | Minimum operating temperature | 3 | 20 (Standard temperature) | 4 | Maximum operating temperature | 5 | 20 |
| Step                          | Temperature (°C)  |   |      |                  |        |   |    |   |                               |   |                           |   |                               |   |    |
|                               | LHL□□□  |   |      |                  |        |   |    |   |                               |   |                           |   |                               |   |    |
| 1                             | 20  |   |      |                  |        |   |    |   |                               |   |                           |   |                               |   |    |
| 2                             | Minimum operating temperature   |   |      |                  |        |   |    |   |                               |   |                           |   |                               |   |    |
| 3                             | 20 (Standard temperature)   |   |      |                  |        |   |    |   |                               |   |                           |   |                               |   |    |
| 4                             | Maximum operating temperature   |   |      |                  |        |   |    |   |                               |   |                           |   |                               |   |    |
| 5                             | 20  |   |      |                  |        |   |    |   |                               |   |                           |   |                               |   |    |

| 10. Tensile strength test                   |   |  |           |              |    |    |   |           |              |                         |   |            |                         |    |                         |    |
|---|---|--|-----------|--------------|----|----|---|-----------|--------------|-------------------------|---|------------|-------------------------|----|-------------------------|----|
| Specified Value                             | CAL45 Type  |  |           |              |    |    |   |           |              |                         |   |            |                         |    |                         |    |
|   | LHL□□□  | No abnormality such as cut lead, or looseness. |           |              |    |    |   |           |              |                         |   |            |                         |    |                         |    |
|   | FBA/FBR   |  |           |              |    |    |   |           |              |                         |   |            |                         |    |                         |    |
| Test Methods and Remarks                    | CAL45 Type : Apply the stated tensile force progressively in the direction to draw terminal. <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>force (N)</th> <th>duration (s)</th> </tr> </thead> <tbody> <tr> <td>10</td> <td>10</td> </tr> </tbody> </table> LHL□□□ : Apply the stated tensile force progressively in the direction to draw terminal. <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>Nominal wire diameter tensile <math>\phi d</math> (mm)</th> <th>force (N)</th> <th>duration (s)</th> </tr> </thead> <tbody> <tr> <td><math>0.3 &lt; \phi d \leq 0.5</math></td> <td>5</td> <td rowspan="3">30<math>\pm</math>5</td> </tr> <tr> <td><math>0.5 &lt; \phi d \leq 0.8</math></td> <td>10</td> </tr> <tr> <td><math>0.8 &lt; \phi d \leq 1.2</math></td> <td>25</td> </tr> </tbody> </table> 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. |  | force (N) | duration (s) | 10 | 10 | 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 |
| force (N)                                   | duration (s)  |  |           |              |    |    |   |           |              |                         |   |            |                         |    |                         |    |
| 10  | 10  |  |           |              |    |    |   |           |              |                         |   |            |                         |    |                         |    |
| 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  |  |           |              |    |    |   |           |              |                         |   |            |                         |    |                         |    |

► This catalog contains the typical specification only due to the limitation of space. When you consider the purchase of our products, please check our specification. For details of each product (characteristics graph, reliability information, precautions for use, and so on), see our Web site (<http://www.ty-top.com/>).

| 11. Over current         |   |  |
|--------------------------|---|--|
| Specified Value          | CAL45 Type  | No emission of smoke no firing.  |
|                          | LHL□□□  | There shall be no scorch or short of wire.<br>LHLC08, LHLC10 : There shall be no firing. |
|                          | FBA/FBR   |  |
| Test Methods and Remarks | LHL□□□・CAL45 Type :<br>Measuring current : Rated current × 2<br>Duration : 5 min.<br>Number of measuring : one time |  |

| 12. Terminal strength : bending   |   |  |                               |               |                       |                         |     |      |                         |   |      |                         |    |     |
|---|---|--|-------------------------------|---------------|-----------------------|-------------------------|-----|------|-------------------------|---|------|-------------------------|----|-----|
| Specified Value   | CAL45 Type  | No abnormality such as cut lead, or looseness. |                               |               |                       |                         |     |      |                         |   |      |                         |    |     |
|   | LHL□□□  |  |                               |               |                       |                         |     |      |                         |   |      |                         |    |     |
|   | FBA/FBR   |  |                               |               |                       |                         |     |      |                         |   |      |                         |    |     |
| Test Methods and Remarks  | CAL45 Type :<br>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.<br>Number of bends : Two times.                         |  |                               |               |                       |                         |     |      |                         |   |      |                         |    |     |
|   | <table border="1"> <thead> <tr> <th>Nominal wire diameter tensile</th> <th>Bending force</th> <th>Mass reference weight</th> </tr> </thead> <tbody> <tr> <td><math>0.3 &lt; \phi d \leq 0.5</math></td> <td>2.5</td> <td>0.25</td> </tr> <tr> <td><math>0.5 &lt; \phi d \leq 0.8</math></td> <td>5</td> <td>0.50</td> </tr> </tbody> </table> |  | Nominal wire diameter tensile | Bending force | Mass reference weight | $0.3 < \phi d \leq 0.5$ | 2.5 | 0.25 | $0.5 < \phi d \leq 0.8$ | 5 | 0.50 |                         |    |     |
|   | Nominal wire diameter tensile   | Bending force                                  | Mass reference weight         |               |                       |                         |     |      |                         |   |      |                         |    |     |
| $0.3 < \phi d \leq 0.5$   | 2.5   | 0.25   |                               |               |                       |                         |     |      |                         |   |      |                         |    |     |
| $0.5 < \phi d \leq 0.8$   | 5   | 0.50   |                               |               |                       |                         |     |      |                         |   |      |                         |    |     |
| LHL□□□・FBA/FBR :<br>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.<br>Number of bends : Two times.   |   |  |                               |               |                       |                         |     |      |                         |   |      |                         |    |     |
| <table border="1"> <thead> <tr> <th>Nominal wire diameter tensile</th> <th>Bending force</th> <th>Mass reference weight</th> </tr> </thead> <tbody> <tr> <td><math>0.3 &lt; \phi d \leq 0.5</math></td> <td>2.5</td> <td>0.25</td> </tr> <tr> <td><math>0.5 &lt; \phi d \leq 0.8</math></td> <td>5</td> <td>0.5</td> </tr> <tr> <td><math>0.8 &lt; \phi d \leq 1.2</math></td> <td>10</td> <td>1.0</td> </tr> </tbody> </table> |   |  | Nominal wire diameter tensile | Bending force | Mass reference weight | $0.3 < \phi d \leq 0.5$ | 2.5 | 0.25 | $0.5 < \phi d \leq 0.8$ | 5 | 0.5  | $0.8 < \phi d \leq 1.2$ | 10 | 1.0 |
| Nominal wire diameter tensile   | Bending force   | Mass reference weight                          |                               |               |                       |                         |     |      |                         |   |      |                         |    |     |
| $0.3 < \phi d \leq 0.5$   | 2.5   | 0.25   |                               |               |                       |                         |     |      |                         |   |      |                         |    |     |
| $0.5 < \phi d \leq 0.8$   | 5   | 0.5  |                               |               |                       |                         |     |      |                         |   |      |                         |    |     |
| $0.8 < \phi d \leq 1.2$   | 10  | 1.0  |                               |               |                       |                         |     |      |                         |   |      |                         |    |     |

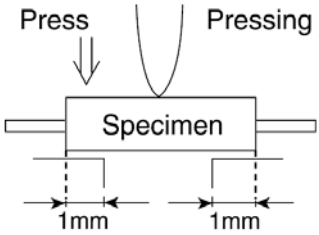
| 13. Insulation resistance : between the terminals and body |   |            |
|--|---|------------|
| Specified Value  | CAL45 Type  | 100MΩ min. |
|  | LHL□□□  |            |
|  | FBA/FBR   |            |
| Test Methods and Remarks                                   | LHL□□□ :<br>Applied voltage : 500 VDC<br>Duration : 60 sec. |            |

| 14. Insulation resistance : between terminals and core |  |          |
|--|--|----------|
| Specified Value  | CAL45 Type   | 1MΩ min. |
|  | LHL□□□   |          |
|  | FBA/FBR  |          |
| Test Methods and Remarks                               | FBA/FBR :<br>Applied voltage : 100 VDC<br>Duration : 60±5 sec. |          |

| 15. Withstanding : between the terminals and body |   |  |
|---|---|--|
| Specified Value                                   | CAL45 Type  | No abnormality such as insulation damage |
|   | LHL□□□  |  |
|   | FBA/FBR   |  |
| Test Methods and Remarks                          | LHL□□□ :<br>According to JIS C5102. 7. 1. 3 (C)<br>Metal global method<br>Applied voltage : 500 VDC<br>Duration : 60 sec. |  |

▶ This catalog contains the typical specification only due to the limitation of space. When you consider the purchase of our products, please check our specification. For details of each product (characteristics graph, reliability information, precautions for use, and so on), see our Web site (<http://www.ty-top.com/>).

| 16. DC bias characteristic |   |                               |
|----------------------------|---|-------------------------------|
| Specified Value            | CAL45 Type  | $\Delta L/L$ : Within $-10\%$ |
|                            | LHL□□□  |                               |
|                            | FBA/FBR   |                               |
| Test Methods and Remarks   | CAL45 Type : Measure inductance with application of rated current using LCR meter to compare it with the initial value. |                               |

| 17. Body strength        |  |  |
|--------------------------|--|--|
| Specified Value          | CAL45 Type   | No abnormality as damage.              |
|                          | LHL□□□   |  |
|                          | FBA/FBR  | No abnormality such as cracks on body. |
| Test Methods and Remarks | <p>CAL45 Type :</p> <p>Applied force : 50N<br/>Duration : 10 sec.<br/>Speed : Shall attain to specified force in 2 sec.</p> <p>FBA :</p> <p>Applied force : <math>50 \pm 3</math>N<br/>Duration : <math>30 \pm 1</math> sec.</p>  |  |

| 18. Resistance to vibration |   |  |
|-----------------------------|---|--|
| Specified Value             | CAL45 Type  | $\Delta L/L$ : Within $\pm 5\%$  |
|                             | LHL□□□  | Appearance : No abnormality<br>$\Delta L/L$ : Within $\pm 5\%$<br>Q change : Within $\pm 30\%$ (LHLP : only $\Delta L/L$ ) |
|                             | FBA/FBR   | Appearance : No abnormality<br>Impedance change : Within $\pm 20\%$  |
| Test Methods and Remarks    | <p>CAL45 Type :</p> <p>Directions : 2 hrs each in X, Y and Z directions total : 6hrs.<br/>Frequency range : 10 to 55 to 10Hz (1min.)<br/>Amplitude : 1.5mm<br/>Mounting method : Soldering onto printed board.<br/>Recovery : At least 1hr of recovery under the standard condition after the test, followed by the measurement within 2hrs.</p> <p>LHL□□□·FBA/FBR :</p> <p>Directions : 2 hrs each in X, Y and Z directions total : 6hrs.<br/>Frequency range : 10 to 55 to 10Hz (1min.)<br/>Amplitude : 1.5mm<br/>Mounting method : Soldering onto printed board.</p> |  |

| 19. Resistance to shock  |   |  |
|--------------------------|---|--|
| Specified Value          | CAL45 Type  | No significant abnormality in appearance |
|                          | LHL□□□  |  |
|                          | FBA/FBR   |  |
| Test Methods and Remarks | <p>CAL45 Type :</p> <p>Drop test</p> <p>Impact material : concrete or vinyl tile<br/>Height : 1m<br/>Total number of drops : 10 times</p> |  |



| 20. Solderability        |   |  |
|--------------------------|---|--|
| Specified Value          | 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. |
| Test Methods and Remarks | CAL45 Type :<br>Solder temperature : 230±5°C<br>Duration : 2±0.5 sec.<br>LHL□□□ :<br>Solder temperature : 235±5°C<br>Duration : 2±0.5 sec.<br>Immersion depth : Up to 1.5mm from bottom of case.<br>FBA/FBR :<br>Solder temperature : 230±5°C<br>Duration : 3±1 sec.<br>Immersion depth : Up to 1.5mm from terminal root. |  |

| 21. Resistance to soldering heat |   |  |
|----------------------------------|---|--|
| Specified Value                  | CAL45 Type  | ΔL/L : Within ±5%  |
|                                  | LHL□□□  | No significant abnormality in appearance<br>Inductance change : Within ±5%<br>Q change : Within ±30%(LHLP : only ΔL/L) |
|                                  | FBA/FBR   | No significant abnormality in appearance<br>Impedance change : Within ±20%   |
| Test Methods and Remarks         | CAL45 Type :<br>Solder temperature : 270±5°C<br>Duration : 5±0.5 sec. One time<br>Immersed conditions : Inserted into substrate with t=1.6mm<br>Recovery : At least 1hr of recovery under the standard condition after the test, followed by the measurement within 2hrs.<br>LHL□□□ :<br>Solder bath method : Solder temperature : 260±5°C<br>Duration : 10±1 sec.<br>: Up to 1.5mm from the bottom of case.<br>Manual soldering : Solder temperature : 350±10°C (At the tip of soldering iron)<br>Duration : 5±1 sec.<br>: Up to 1.5mm from the bottom of case.<br>Caution : No excessive pressing shall be applied to terminals.<br>Recovery : 4 to 24hrs of recovery under the standard condition after the test.<br>FBA/FBR :<br>Solder bath method:<br>Condition 1 : Solder temperature : 260±5°C<br>Duration : 10±1 sec.<br>Immersion depth : Up to 1.5mm from the terminal root.<br>Condition 2 : Solder temperature : 350±5°C<br>Duration : 3±1 sec.<br>Immersion depth : Up to 1.5mm from the terminal root.<br>Recovery : 3hrs of recovery under the standard condition after the test. |  |

| 22. Resistance to solvent |  |  |
|---------------------------|--|--|
| Specified Value           | CAL45 Type   | Please avoid the ultrasonic cleaning of this product.                      |
|                           | LHL□□□   |  |
|                           | FBA/FBR  | No significant abnormality in appearance<br>Impedance change : Within ±20% |
| Test Methods and Remarks  | FBA/FBR :<br>Solvent temperature : 20~25°C<br>Duration : 30±5 sec.<br>Solvent type : Acetone<br>Recovery : 3hrs of recovery under the standard condition after the test. |  |

▶ This catalog contains the typical specification only due to the limitation of space. When you consider the purchase of our products, please check our specification. For details of each product (characteristics graph, reliability information, precautions for use, and so on), see our Web site (<http://www.ty-top.com/>).

| 23. Thermal shock   |   |  |                  |                 |                                    |            |           |                  |                  |          |                                    |            |           |                  |                  |          |  |
|---|---|--|------------------|-----------------|------------------------------------|------------|-----------|------------------|------------------|----------|------------------------------------|------------|-----------|------------------|------------------|----------|--|
| Specified Value   | CAL45 Type  | $\Delta L/L$ : Within $\pm 10\%$   |                  |                 |                                    |            |           |                  |                  |          |                                    |            |           |                  |                  |          |  |
|   | LHL□□□  | Appearance : No abnormality<br>Inductance change : Within $\pm 10\%$<br>Q change : Within $\pm 30\%$ (LHLP:only $\Delta L/L$ ) |                  |                 |                                    |            |           |                  |                  |          |                                    |            |           |                  |                  |          |  |
|   | FBA/FBR   | Appearance : No abnormality<br>Impedance change : Within $\pm 20\%$  |                  |                 |                                    |            |           |                  |                  |          |                                    |            |           |                  |                  |          |  |
| Test Methods and Remarks  | CAL45 Type: Conditions for 1 cycle  |  |                  |                 |                                    |            |           |                  |                  |          |                                    |            |           |                  |                  |          |  |
|   | <table border="1"> <thead> <tr> <th>Step</th> <th>Temperature (°C)</th> <th>Duration (min.)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td><math>-25+0/-3</math></td> <td><math>30\pm 3</math></td> </tr> <tr> <td>2</td> <td>Room temperature</td> <td>Within 3</td> </tr> <tr> <td>3</td> <td><math>+85+2/-0</math></td> <td><math>30\pm 3</math></td> </tr> <tr> <td>4</td> <td>Room temperature</td> <td>Within 3</td> </tr> </tbody> </table> | Step   | Temperature (°C) | Duration (min.) | 1                                  | $-25+0/-3$ | $30\pm 3$ | 2                | Room temperature | Within 3 | 3                                  | $+85+2/-0$ | $30\pm 3$ | 4                | Room temperature | Within 3 |  |
|   | Step  | Temperature (°C)   | Duration (min.)  |                 |                                    |            |           |                  |                  |          |                                    |            |           |                  |                  |          |  |
|   | 1   | $-25+0/-3$   | $30\pm 3$        |                 |                                    |            |           |                  |                  |          |                                    |            |           |                  |                  |          |  |
|   | 2   | Room temperature   | Within 3         |                 |                                    |            |           |                  |                  |          |                                    |            |           |                  |                  |          |  |
|   | 3   | $+85+2/-0$   | $30\pm 3$        |                 |                                    |            |           |                  |                  |          |                                    |            |           |                  |                  |          |  |
| 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□□□·FBA/FBR: According to JIS C0025  |   |  |                  |                 |                                    |            |           |                  |                  |          |                                    |            |           |                  |                  |          |  |
| Conditions for 1 cycle  |   |  |                  |                 |                                    |            |           |                  |                  |          |                                    |            |           |                  |                  |          |  |
| <table border="1"> <thead> <tr> <th>Step</th> <th>Temperature (°C)</th> <th>Duration (min.)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Minimum operating temperature+0/-3</td> <td><math>30\pm 3</math></td> </tr> <tr> <td>2</td> <td>Room temperature</td> <td>Within 3</td> </tr> <tr> <td>3</td> <td>Minimum operating temperature+2/-0</td> <td><math>30\pm 3</math></td> </tr> <tr> <td>4</td> <td>Room temperature</td> <td>Within 3</td> </tr> </tbody> </table> | Step  | Temperature (°C)   | Duration (min.)  | 1               | Minimum operating temperature+0/-3 | $30\pm 3$  | 2         | Room temperature | Within 3         | 3        | Minimum operating temperature+2/-0 | $30\pm 3$  | 4         | Room temperature | Within 3         |          |  |
| Step  | Temperature (°C)  | Duration (min.)  |                  |                 |                                    |            |           |                  |                  |          |                                    |            |           |                  |                  |          |  |
| 1   | Minimum operating temperature+0/-3  | $30\pm 3$  |                  |                 |                                    |            |           |                  |                  |          |                                    |            |           |                  |                  |          |  |
| 2   | Room temperature  | Within 3   |                  |                 |                                    |            |           |                  |                  |          |                                    |            |           |                  |                  |          |  |
| 3   | Minimum operating temperature+2/-0  | $30\pm 3$  |                  |                 |                                    |            |           |                  |                  |          |                                    |            |           |                  |                  |          |  |
| 4   | Room temperature  | Within 3   |                  |                 |                                    |            |           |                  |                  |          |                                    |            |           |                  |                  |          |  |
| Number of cycles : 10 cycles [LHL□□□]   |   |  |                  |                 |                                    |            |           |                  |                  |          |                                    |            |           |                  |                  |          |  |
| Recovery : 5 cycles (FBA/ FBR)  |   |  |                  |                 |                                    |            |           |                  |                  |          |                                    |            |           |                  |                  |          |  |
| : 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)   |   |  |                  |                 |                                    |            |           |                  |                  |          |                                    |            |           |                  |                  |          |  |

| 24. Damp heat            |   |   |
|--------------------------|---|---|
| Specified Value          | CAL45 Type  | $\Delta L/L$ : Within $\pm 10\%$  |
|                          | LHL□□□  |   |
|                          | FBA/FBR   | Appearance : No abnormality<br>Impedance change : Within $\pm 20\%$   |
| Test Methods and Remarks | CAL45 Type :  |   |
|                          | Temperature   | : $40\pm 2^{\circ}\text{C}$   |
|                          | 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. |
|                          | FBA/FBR :   |   |
| Temperature              | : $60\pm 2^{\circ}\text{C}$   |   |
| Humidity                 | : 90~95%RH  |   |
| Duration                 | : 1000 hrs  |   |
| Recovery                 | : 1 to 2hrs of recovery under the standard condition after the removal from the test chamber. |   |

| 25. Loading under damp heat     |  |  |
|---------------------------------|--|--|
| Specified Value                 | CAL45 Type   | $\Delta L/L$ : Within $\pm 10\%$   |
|                                 | LHL□□□   | Appearance : No abnormality<br>Inductance change : Within $\pm 10\%$<br>Q change : Within $\pm 30\%$ (LHLP : only $\Delta L/L$ ) |
|                                 | FBA/FBR  |  |
| Test Methods and Remarks        | CAL45 Type :<br>Temperature : $40 \pm 2^\circ\text{C}$<br>Humidity : $90 \sim 95\%RH$<br>Duration : 1000 hrs<br>Applied current : Rated current<br>Recovery : At least 1hr of recovery under the standard removal from test chamber, followed by the measurement within 2hrs.<br>LHL□□□ :<br>Temperature : $40 \pm 2^\circ\text{C}$<br>Humidity : $90 \sim 95\%RH$<br>Duration : $1000 + 48 / -0$ hrs<br>Applied current : Rated current<br>Recovery : 1 to 2hrs of recovery under the standard condition after the removal from the test chamber. |  |
| 26. Loading at high temperature |  |  |
| Specified Value                 | CAL45 Type   | $\Delta L/L$ : Within $\pm 10\%$   |
|                                 | LHL□□□   |  |
|                                 | FBA/FBR  |  |
| Test Methods and Remarks        | CAL45 Type :<br>Temperature : $85 \pm 2^\circ\text{C}$<br>Duration : 1000 hrs<br>Applied current : Rated current<br>Recovery : At least 1hr of recovery under the standard removal from test chamber, followed by the measurement within 2hrs.   |  |
| 27. Low temperature life test   |  |  |
| Specified Value                 | CAL45 Type   | $\Delta L/L$ : Within $\pm 10\%$   |
|                                 | LHL□□□   | Appearance : No abnormality<br>Inductance change : Within $\pm 10\%$<br>Q change : Within $\pm 30\%$ (LHLP : only $\Delta L/L$ ) |
|                                 | FBA/FBR  |  |
| Test Methods and Remarks        | CAL45 Type :<br>Temperature : $-25 \pm 2^\circ\text{C}$<br>Duration : 1000 hrs<br>Recovery : At least 1hr of recovery under the standard removal from test chamber, followed by the measurement within 2hrs.<br>LHL□□□ :<br>Temperature : $-40 \pm 3^\circ\text{C}$<br>Duration : $1000 + 48 / -0$ hrs<br>Recovery : 1 to 2hrs of recovery under the standard condition after the removal from the test chamber.   |  |
| 28. High temperature life test  |  |  |
| Specified Value                 | CAL45 Type   |  |
|                                 | LHL□□□   | Appearance : No abnormality<br>Inductance change : Within $\pm 10\%$<br>Q change : Within $\pm 30\%$ (LHLP : only $\Delta L/L$ ) |
|                                 | FBA/FBR  |  |
| Test Methods and Remarks        | LHL□□□ :<br>Temperature : $105 \pm 2^\circ\text{C}$<br>Duration : $1000 + 48 / -0$ hrs<br>Recovery : 1 to 2hrs of recovery under the standard condition after the removal from the test chamber.   |  |

# AXIAL LEADED INDUCTORS (CAL Type)、 RADIAL LEADED INDUCTORS (LH Type)、 LEADED FERRITE BEAD INDUCTORS (FB Series A Type/R Type)

## ■ PRECAUTIONS

| 1. Circuit Design                         |  |
|---|--|
| Precautions                               | <p>◆Operating environment</p> <p>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.</p>   |
| 2. PCB Design                             |  |
| Precautions                               | <p>◆Design</p> <p>1. Please design insertion pitches as matching to that of leads of the component on PCBs.</p>  |
| Technical considerations                  | <p>◆Design</p> <p>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.</p>   |
| 3. Considerations for automatic placement |  |
| Precautions                               | <p>◆Adjustment of mounting machine</p> <p>1. Excessive impact load should not be imposed on the products when mounting onto the PC boards.<br/>2. Mounting and soldering conditions should be checked beforehand.</p>  |
| Technical considerations                  | <p>◆Adjustment of mounting machine</p> <p>1. When installing products, care should be taken not to apply distortion stress as it may deform the products.</p>  |
| 4. Soldering                              |  |
| Precautions                               | <p>◆Wave soldering</p> <p>1. Please refer to the specifications in the catalog for a wave soldering.<br/>2. Do not immerse the entire inductor in the flux during the soldering operation.</p> <p>◆Lead free soldering</p> <p>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.</p> <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> <p>◆Reflow soldering</p> <p>1. As for reflow soldering, please contact our sales staff.</p> |
| Technical considerations                  | <p>◆Lead free soldering</p> <p>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.</p> <p>◆Recommended conditions for using a soldering iron</p> <p>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.</p>   |
| 5. Cleaning                               |  |
| Precautions                               | <p>◆Cleaning conditions</p> <p>1. CAL type, LH type<br/>Please do not do cleaning by a supersonic wave.</p>  |
| Technical considerations                  | <p>◆Cleaning conditions</p> <p>1. CAL type, LH type,<br/>If washing by supersonic waves, supersonic waves may deform products.</p>   |

▶ This catalog contains the typical specification only due to the limitation of space. When you consider the purchase of our products, please check our specification. For details of each product (characteristics graph, reliability information, precautions for use, and so on), see our Web site (<http://www.ty-top.com/>).