

# Notice for TAIYO YUDEN Products

Please read this notice before using the TAIYO YUDEN products.



## REMINDERS

### Product Information in this Catalog

Product information in this catalog is as of March 2023. All of the contents specified herein and production status of the products listed in this catalog are subject to change without notice due to technical improvement of our products, etc. Therefore, please check for the latest information carefully before practical application or use of our products.

Please note that TAIYO YUDEN shall not be in any way responsible for any damages and defects in products or equipment incorporating our products, which are caused under the conditions other than those specified in this catalog or individual product specification sheets.

### Approval of Product Specifications

Please contact TAIYO YUDEN for further details of product specifications as the individual product specification sheets are available. When using our products, please be sure to approve our product specifications or make a written agreement on the product specification with TAIYO YUDEN in advance.

### Pre-Evaluation in the Actual Equipment and Conditions

Please conduct validation and verification of our products in actual conditions of mounting and operating environment before using our products.

### Limited Application

#### 1. Equipment Intended for Use

The products listed in this catalog are intended for general-purpose and standard use in general electronic equipment for consumer (e.g., AV equipment, OA equipment, home electric appliances, office equipment, information and communication equipment including, without limitation, mobile phone, and PC) and other equipment specified in this catalog or the individual product specification sheets, or the equipment approved separately by TAIYO YUDEN.

TAIYO YUDEN has the product series intended for use in the following equipment. Therefore, when using our products for these equipment, please check available applications specified in this catalog or the individual product specification sheets and use the corresponding products.

Application	Product Series		Quality Grade <sup>*3</sup>
	Equipment <sup>*1</sup>	Category (Part Number Code <sup>*2</sup> )	
Automotive	Automotive Electronic Equipment (POWERTRAIN, SAFETY)	A	1
	Automotive Electronic Equipment (BODY & CHASSIS, INFOTAINMENT)	C	2
Industrial	Telecommunications Infrastructure and Industrial Equipment	B	2
Medical	Medical Devices classified as GHTF Class C (Japan Class III)	M	2
	Medical Devices classified as GHTF Classes A or B (Japan Classes I or II)	L	3
Consumer	General Electronic Equipment	S	3
	Only for Mobile Devices <sup>*4</sup>	E	4

\*Notes: 1. Based on the general specifications required for electronic components for such equipment, which are recognized by TAIYO YUDEN, the use of each product series for the equipment is recommended. Please be sure to contact TAIYO YUDEN before using our products for equipment other than those covered by the product series.

2. On each of our part number, the 2nd code from the left is a code indicating the "Category" as shown in the above table. For details, please check the explanatory materials regarding the part numbering system of each of our products.

3. Each product series is assigned a "Quality Grade" from 1 to 4 in order of higher quality. Please do not incorporate a product into any equipment with a higher Quality Grade than the Quality Grade of such product without the prior written consent of TAIYO YUDEN.

4. The applications covered by this product series are limited to mobile devices (smartphone, tablet PC, smartwatch, handheld game console, etc.) among general electronic equipment for consumer. The design, specifications and operating environment, etc. differ from those of the product series for "General Electronic Equipment" (Category: S), so please check the individual product specification sheets for details. The product series for "General Electronic Equipment" (Category: S) can also be used for mobile devices.

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

## 2. Equipment Requiring Inquiry

Please be sure to contact TAIYO YUDEN for further information before using the products listed in this catalog for the following equipment (excluding intended equipment as specified in this catalog or the individual product specification sheets) which may cause loss of human life, bodily injury, serious property damage and/or serious public impact due to a failure or defect of the products and/or malfunction attributed thereto.

- (1) Transportation equipment (automotive powertrain control system, train control system, and ship control system, etc.)
- (2) Traffic signal equipment
- (3) Disaster prevention equipment, crime prevention equipment
- (4) Medical devices classified as GHTF Class C (Japan Class III)
- (5) Highly public information network equipment, data-processing equipment (telephone exchange, and base station, etc.)
- (6) Any other equipment requiring high levels of quality and/or reliability equal to the equipment listed above

## 3. Equipment Prohibited for Use

Please do not incorporate our products into the following equipment requiring extremely high levels of safety and/or reliability.

- (1) Aerospace equipment (artificial satellite, rocket, etc.)
- (2) Aviation equipment <sup>\*1</sup>
- (3) Medical devices classified as GHTF Class D (Japan Class IV), implantable medical devices <sup>\*2</sup>
- (4) Power generation control equipment (nuclear power, hydroelectric power, thermal power plant control system, etc.)
- (5) Undersea equipment (submarine repeating equipment, etc.)
- (6) Military equipment
- (7) Any other equipment requiring extremely high levels of safety and/or reliability equal to the equipment listed above

\*Notes: 1. There is a possibility that our products can be used only for aviation equipment that does not directly affect the safe operation of aircraft (e.g., in-flight entertainment, cabin light, electric seat, cooking equipment) if such use meets requirements specified separately by TAIYO YUDEN. Please be sure to contact TAIYO YUDEN for further information before using our products for such aviation equipment.

2. Implantable medical devices contain not only internal unit which is implanted in a body, but also external unit which is connected to the internal unit.

## 4. Limitation of Liability

Please note that unless you obtain prior written consent of TAIYO YUDEN, TAIYO YUDEN shall not be in any way responsible for any damages incurred by you or third parties arising from use of the products listed in this catalog for any equipment that is not intended for use by TAIYO YUDEN, or any equipment requiring inquiry to TAIYO YUDEN or prohibited for use by TAIYO YUDEN as described above.

### Safety Design

When using our products for high safety and/or reliability-required equipment or circuits, please fully perform safety and/or reliability evaluation. In addition, please install (i) systems equipped with a protection circuit and a protection device and/or (ii) systems equipped with a redundant circuit or other system to prevent an unsafe status in the event of a single fault for a failsafe design to ensure safety.

### Intellectual Property Rights

Information contained in this catalog is intended to convey examples of typical performances and/or applications of our products and is not intended to make any warranty with respect to the intellectual property rights or any other related rights of TAIYO YUDEN or any third parties nor grant any license under such rights.

### Limited Warranty

Please note that the scope of warranty for our products is limited to the delivered our products themselves conforming to the product specifications specified in the individual product specification sheets, and TAIYO YUDEN shall not be in any way responsible for any damages resulting from a failure or defect in our products. Notwithstanding the foregoing, if there is a written agreement (e.g., supply and purchase agreement, quality assurance agreement) signed by TAIYO YUDEN and your company, TAIYO YUDEN will warrant our products in accordance with such agreement, provided, however, that our products shall be used for general-purpose and standard use in the equipment specified in this catalog or the individual product specification sheets.

### TAIYO YUDEN's Official Sales Channel

The contents of this catalog are applicable to our products which are purchased from our sales offices or authorized distributors (hereinafter "TAIYO YUDEN's official sales channel"). Please note that the contents of this catalog are not applicable to our products purchased from any seller other than TAIYO YUDEN's official sales channel.

### Caution for Export

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

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

# Automotive Application Guide

We classify automotive electronic equipment into the following four application categories and set usable application categories for each of our products. Therefore, we have the corresponding product series (the 2nd code from the left side of the part number is “A” or “C”). When using our products for automotive electronic equipment, please be sure to check such application categories and use the corresponding product series accordingly. Should you have any questions on this matter, please contact us.

Product Series (The 2nd Code from the Left Side of the Part Number)	Category	Automotive Electronic Equipment (Typical Example)
A	POWERTRAIN	<ul style="list-style-type: none"><li>• Engine ECU (Electronically Controlled Fuel Injector)</li><li>• Cruise Control Unit</li><li>• 4WS (4 Wheel Steering)</li><li>• Transmission</li><li>• Power Steering</li><li>• HEV/PHV/EV Core Control (Battery, Inverter, DC-DC)</li><li>• Automotive Locator (Car location information providing device), etc.</li></ul>
	SAFETY	<ul style="list-style-type: none"><li>• ABS (Anti-Lock Brake System)</li><li>• ESC (Electronic Stability Control)</li><li>• Airbag</li><li>• ADAS (Equipment that directly controls running, turning and stopping), etc.</li></ul>
C	BODY & CHASSIS	<ul style="list-style-type: none"><li>• Wiper</li><li>• Automatic Door</li><li>• Power Window</li><li>• Keyless Entry System</li><li>• Electric Door Mirror</li><li>• Automobile Digital Mirror</li><li>• Interior Lighting</li><li>• Automobile Air Conditioning System</li><li>• TPMS (Tire Pressure Monitoring System)</li><li>• Anti-Theft Device (Immobilizer)</li><li>• ADAS (Sensor, Equipment that is not interlocked with safety equipment or powertrain), etc.</li></ul>
	INFOTAINMENT	<ul style="list-style-type: none"><li>• Car Infotainment System</li><li>• ITS/Telematics System</li><li>• Instrument Cluster Panel</li><li>• Dashcam (genuine products for automotive manufacturer), etc.</li></ul>

# Wire-wound Ferrite Power Inductors LAYP series for Automotive Powertrain and Safety

Code in front of Series have been extracted from Part number, which describes the segment of products, such as kinds and characteristics.

AEC-Q200 Grade 1 (We conduct the evaluation at the test condition of Grade1.)

\*Operating environment Temp:-55~125°C

REFLOW

AEC-Q200

## ■ PART NUMBER

\*Operating Temp. : -55~150°C(Including self-generated heat)

L	A	Y	P	H	1	0	0	6	0	D	L	1	0	0	M	G	A
①	②	③	④	⑤	⑥	⑦	⑧	⑨									

### ①Series

Part number	Type
LAYP	Wire-wound Ferrite Power Inductor for Automotive Powertrain and Safety

### (1) Product Group

Code	
L	Inductors

### (2) Category

Code	Recommended equipment	Quality Grade
A	Automotive Electronic Equipment (Powertrain, Safety)	1

### ②Features

Code	Feature
H	Bottom electrode (Frame type)

### ③Dimensions (L × W)

Code	Dimensions (L × W) [mm]
060	6.3 × 6.0
100	10.1 × 10.0

### ④Dimensions (H)

Code	Dimensions (H) [mm]
40	4.0
45	4.5
60	6.0

### ⑤Operating temperature

Code	Operating temperature [°C]
D	-55~150

### (3) Type

Code	
Y	Ferrite Wire-wound (Drum-sleeve type)

### (4) Features, Characteristics

Code	
P	High current power choke

### ⑥Packaging

Code	Packaging
L	Taping

### ⑦Nominal inductance

Code (example)	Nominal inductance [μH]
1R0	1.0
100	10
101	100

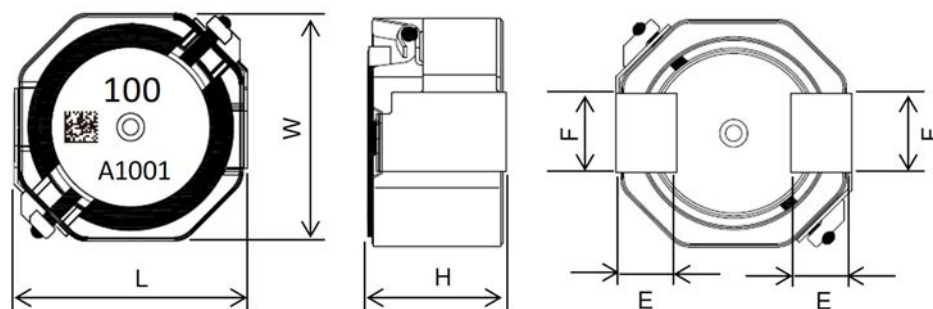
※R=Decimal point

### ⑧Inductance tolerance

Code	Inductance tolerance
M	±20%
N	±30%

### ⑨Internal code

■ STANDARD EXTERNAL DIMENSIONS / MINIMUM QUANTITY



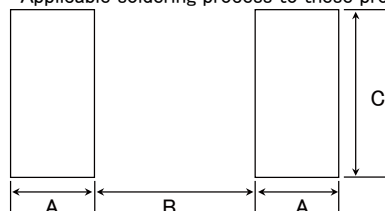
Type	L	W	H	E	F	Minimum quantity [pcs]
06045	$6.3 \pm 0.3$ ( $0.248 \pm 0.012$ )	$6.0 \pm 0.3$ ( $0.236 \pm 0.012$ )	$4.5 \pm 0.3$ ( $0.177 \pm 0.012$ )	$1.7 \pm 0.2$ ( $0.067 \pm 0.008$ )	$2.0 \pm 0.15$ ( $0.079 \pm 0.006$ )	1000
10040	$10.1 \pm 0.3$ ( $0.398 \pm 0.012$ )	$10.0 \pm 0.3$ ( $0.394 \pm 0.012$ )	$4.0 \pm 0.3$ ( $0.157 \pm 0.012$ )	$2.65 \pm 0.2$ ( $0.104 \pm 0.008$ )	$3.5 \pm 0.15$ ( $0.138 \pm 0.006$ )	700
10060	$10.1 \pm 0.3$ ( $0.398 \pm 0.012$ )	$10.0 \pm 0.3$ ( $0.394 \pm 0.012$ )	$6.0 \pm 0.3$ ( $0.236 \pm 0.012$ )	$2.65 \pm 0.2$ ( $0.104 \pm 0.008$ )	$3.5 \pm 0.15$ ( $0.138 \pm 0.006$ )	500

Unit: mm (inch)

Recommended Land Patterns

Surface Mounting

- Mounting and soldering conditions should be checked beforehand.
- Applicable soldering process to these products is reflow soldering only.



Type	A	B	C
06045	2.2	2.8	2.3
10040	3.2	4.6	3.8
10060	3.2	4.6	3.8

Unit: mm

## PART NUMBER

- All the Wire-wound Ferrite Power Inductors of the catalog lineup are RoHS compliant.

## Notes)

- The exchange of individual specifications is necessary depending on your application and/or circuit condition. Please contact TAIYO YUDEN's official sales channel.
- For Automotive (AEC-Q200 Qualified) products for POWERTRAIN, and SAFETY. Please check "Automotive Application Guide" for further details before using the products.  
 < AEC-Q200 :AEC-Q200 qualified>  
 All the Wire-wound Ferrite Power Inductors for Automotive products are tested based on the test conditions and methods defined in AEC-Q200 by family item.  
 Please consult with TAIYO YUDEN's official sales channel for the details of the product specifications and AEC-Q200 test results, etc.,  
 and please review and approve the product specifications before ordering.

## 06045 type

New part number	Old part number (for reference)	Nominal Inductance [μH]	Inductance tolerance	DC Resistance [mΩ] Typ	Rated current ※) [A]			Measuring frequency [kHz]
					Saturation current Idc1 Max (Typ)	Temperature rise current① Idc2 Max (Typ)	Temperature rise current② Idc2 Max (Typ)	
LAYPH06045DL1R0NGA	EST0645T1R0NDGA	1	±30%	9±30%	6.70 (8.00)	3.50 (4.00)	4.20 (5.30)	100
LAYPH06045DL1R5NGA	EST0645T1R5NDGA	1.5	±30%	10±30%	5.50 (6.40)	3.20 (3.80)	4.00 (5.10)	100
LAYPH06045DL2R2NGA	EST0645T2R2NDGA	2.2	±30%	13±30%	4.20 (5.40)	2.80 (3.30)	3.60 (4.40)	100
LAYPH06045DL3R3NGA	EST0645T3R3NDGA	3.3	±30%	15±30%	3.50 (4.00)	2.50 (3.00)	3.30 (4.15)	100
LAYPH06045DL4R7NGA	EST0645T4R7NDGA	4.7	±30%	20±30%	3.10 (3.50)	2.30 (2.80)	3.00 (3.50)	100
LAYPH06045DL6R8NGA	EST0645T6R8NDGA	6.8	±30%	29±30%	2.50 (3.00)	2.00 (2.40)	2.60 (3.00)	100
LAYPH06045DL100MGA	EST0645T100MDGA	10	±20%	38±20%	2.00 (2.30)	1.70 (2.00)	2.10 (2.50)	100
LAYPH06045DL150MGA	EST0645T150MDGA	15	±20%	64±20%	1.70 (2.00)	1.40 (1.60)	1.70 (1.90)	100
LAYPH06045DL220MGA	EST0645T220MDGA	22	±20%	79±20%	1.30 (1.60)	1.10 (1.30)	1.50 (1.75)	100
LAYPH06045DL330MGA	EST0645T330MDGA	33	±20%	100±20%	1.10 (1.30)	0.95 (1.10)	1.40 (1.60)	100
LAYPH06045DL470MGA	EST0645T470MDGA	47	±20%	135±20%	0.85 (1.10)	0.86 (1.00)	1.20 (1.35)	100
LAYPH06045DL680MGA	EST0645T680MDGA	68	±20%	210±20%	0.80 (0.92)	0.73 (0.84)	0.90 (1.10)	100
LAYPH06045DL101MGA	EST0645T101MDGA	100	±20%	320±20%	0.55 (0.77)	0.56 (0.65)	0.70 (0.86)	100
LAYPH06045DL151MGA	EST0645T151MDGA	150	±20%	475±20%	0.50 (0.64)	0.49 (0.56)	0.65 (0.72)	100
LAYPH06045DL221MGA	EST0645T221MDGA	220	±20%	670±20%	0.44 (0.53)	0.36 (0.42)	0.50 (0.59)	100
LAYPH06045DL331MGA	EST0645T331MDGA	330	±20%	950±20%	0.36 (0.43)	0.30 (0.34)	0.40 (0.48)	100

※) The saturation current value (Idc1) is the DC current value having inductance decrease down to 30%. (at 20°C)

※) The temperature rise current value (Idc2)① is the DC current value having temperature increase up to 25°C. (at 20°C)

※) The temperature rise current value (Idc2)② is the DC current value having temperature increase up to 40°C. (at 20°C)

※) The temperature rise current value (Idc2)② is a reference value.

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

## 10040 type

New part number	Old part number (for reference)	Nominal Inductance [μH]	Inductance tolerance	DC Resistance [mΩ] Typ	Rated current ※) [A]			Measuring frequency [kHz]
					Saturation current Idc1 Max (Typ)	Temperature rise current① Idc2 Max (Typ)	Temperature rise current② Idc2 Max (Typ)	
LAYPH10040DL1R0NGA	EST1040T1R0NDGA	1	±30%	8.0±30%	10.70 (11.70)	3.60 (4.60)	5.00 (5.50)	100
LAYPH10040DL1R5NGA	EST1040T1R5NDGA	1.5	±30%	9.6±30%	8.60 (9.80)	3.30 (4.30)	4.60 (5.10)	100
LAYPH10040DL2R2NGA	EST1040T2R2NDGA	2.2	±30%	11.0±30%	7.50 (8.30)	3.10 (4.00)	4.30 (4.70)	100
LAYPH10040DL3R3NGA	EST1040T3R3NDGA	3.3	±30%	13.0±30%	6.60 (7.20)	2.90 (3.60)	3.90 (4.20)	100
LAYPH10040DL4R7NGA	EST1040T4R7NDGA	4.7	±30%	19.0±30%	5.20 (5.70)	2.70 (3.40)	3.60 (3.90)	100
LAYPH10040DL6R8NGA	EST1040T6R8NDGA	6.8	±30%	24.0±30%	4.30 (4.80)	2.30 (2.90)	3.10 (3.40)	100
LAYPH10040DL100MGA	EST1040T100MDGA	10	±20%	29.0±20%	3.70 (3.90)	2.00 (2.60)	2.70 (3.00)	100
LAYPH10040DL150MGA	EST1040T150MDGA	15	±20%	43.0±20%	2.90 (3.40)	1.60 (2.10)	2.20 (2.50)	100
LAYPH10040DL220MGA	EST1040T220MDGA	22	±20%	62.0±20%	2.50 (2.90)	1.50 (1.80)	2.00 (2.10)	100
LAYPH10040DL330MGA	EST1040T330MDGA	33	±20%	96.0±20%	2.00 (2.30)	1.10 (1.40)	1.50 (1.60)	100
LAYPH10040DL470MGA	EST1040T470MDGA	47	±20%	135.0±20%	1.70 (2.00)	0.76 (1.10)	1.15 (1.30)	100
LAYPH10040DL680MGA	EST1040T680MDGA	68	±20%	180.0±20%	1.40 (1.60)	0.74 (1.00)	1.10 (1.20)	100
LAYPH10040DL101MGA	EST1040T101MDGA	100	±20%	285.0±20%	1.10 (1.30)	0.59 (0.77)	0.83 (0.91)	100
LAYPH10040DL151MGA	EST1040T151MDGA	150	±20%	395.0±20%	0.94 (1.10)	0.44 (0.61)	0.66 (0.74)	100
LAYPH10040DL221MGA	EST1040T221MDGA	220	±20%	530.0±20%	0.77 (0.88)	0.41 (0.54)	0.59 (0.65)	100
LAYPH10040DL331MGA	EST1040T331MDGA	330	±20%	960.0±20%	0.61 (0.70)	0.29 (0.38)	0.41 (0.45)	100
LAYPH10040DL471MGA	EST1040T471MDGA	470	±20%	1200.0±20%	0.53 (0.61)	0.25 (0.35)	0.38 (0.40)	100

※) 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)① is the DC current value having temperature increase up to 25°C. (at 20°C)

※) The temperature rise current value (Idc2)② is the DC current value having temperature increase up to 30°C. (at 20°C)

※) The temperature rise current value (Idc2)② is a reference value.

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

## PART NUMBER

## 10060 type

New part number	Old part number (for reference)	Nominal Inductance [ $\mu$ H]	Inductance tolerance	DC Resistance [m $\Omega$ ] Typ	Rated current ※) [A]			Measuring frequency [kHz]
					Saturation current Idc1 Max (Typ)	Temperature rise current① Idc2 Max (Typ)	Temperature rise current② Idc2 Max (Typ)	
LAYPH10060DL1R0NGA	EST1060T1R0NDGA	1	±30%	4.5±30%	9.70 (15.00)	6.00 (7.00)	9.00 (11.00)	100
LAYPH10060DL1R5NGA	EST1060T1R5NDGA	1.5	±30%	5.6±30%	9.00 (14.00)	5.60 (6.40)	8.00 (10.00)	100
LAYPH10060DL2R2NGA	EST1060T2R2NDGA	2.2	±30%	6.6±30%	7.50 (11.00)	5.20 (6.00)	7.50 (9.00)	100
LAYPH10060DL3R3NGA	EST1060T3R3NDGA	3.3	±30%	9.0±30%	7.00 (9.50)	4.70 (5.50)	6.50 (8.00)	100
LAYPH10060DL4R7NGA	EST1060T4R7NDGA	4.7	±30%	11.0±30%	5.80 (8.00)	4.20 (4.90)	5.50 (6.80)	100
LAYPH10060DL6R8NGA	EST1060T6R8NDGA	6.8	±30%	16.0±30%	5.50 (6.60)	3.50 (4.20)	5.00 (6.10)	100
LAYPH10060DL100MGA	EST1060T100MDGA	10	±20%	22.0±20%	4.30 (5.20)	3.00 (3.70)	4.30 (5.10)	100
LAYPH10060DL150MGA	EST1060T150MDGA	15	±20%	31.0±20%	3.70 (4.40)	2.50 (3.20)	3.60 (4.30)	100
LAYPH10060DL220MGA	EST1060T220MDGA	22	±20%	44.0±20%	3.10 (3.60)	2.10 (2.60)	2.80 (3.30)	100
LAYPH10060DL330MGA	EST1060T330MDGA	33	±20%	61.0±20%	2.40 (3.10)	1.80 (2.10)	2.60 (3.10)	100
LAYPH10060DL470MGA	EST1060T470MDGA	47	±20%	82.0±20%	2.10 (2.35)	1.40 (1.80)	2.20 (2.60)	100
LAYPH10060DL680MGA	EST1060T680MDGA	68	±20%	101.0±20%	1.70 (2.05)	1.30 (1.60)	2.00 (2.40)	100
LAYPH10060DL101MGA	EST1060T101MDGA	100	±20%	169.0±20%	1.40 (1.65)	0.93 (1.20)	1.50 (1.70)	100
LAYPH10060DL151MGA	EST1060T151MDGA	150	±20%	246.0±20%	1.20 (1.35)	0.72 (0.95)	1.30 (1.50)	100
LAYPH10060DL221MGA	EST1060T221MDGA	220	±20%	320.0±20%	0.95 (1.15)	0.66 (0.86)	1.00 (1.30)	100
LAYPH10060DL331MGA	EST1060T331MDGA	330	±20%	458.0±20%	0.75 (0.90)	0.58 (0.72)	0.90 (1.00)	100
LAYPH10060DL471MGA	EST1060T471MDGA	470	±20%	775.0±20%	0.65 (0.75)	0.39 (0.50)	0.70 (0.80)	100

※) The saturation current value (Idc1) is the DC current value having inductance decrease down to 30%. (at 20°C)

※) The temperature rise current value (Idc2)① is the DC current value having temperature increase up to 25°C. (at 20°C)

※) The temperature rise current value (Idc2)② is the DC current value having temperature increase up to 40°C. (at 20°C)

※) The temperature rise current value (Idc2)② is a reference value.

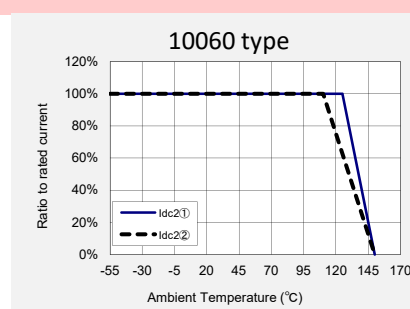
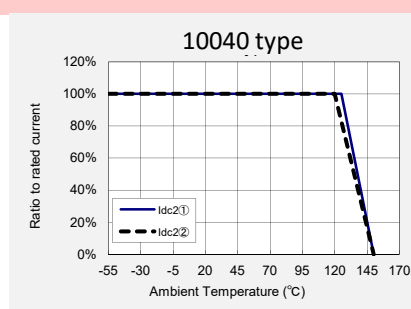
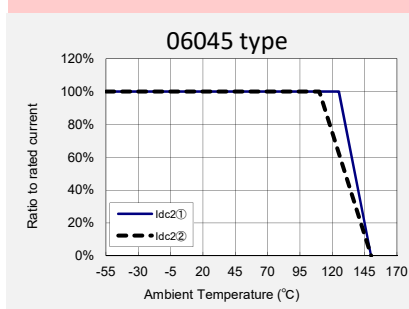
※) The rated current is the DC current value that satisfies both of current value saturation current value and temperature rise current value.

## Derating of Rated Current

## LAYP series

Derating of current is necessary for LAYP series depending on ambient temperature.

Please refer to the chart shown below for appropriate derating of current.



Wire-wound Ferrite Power Inductors LAYP series

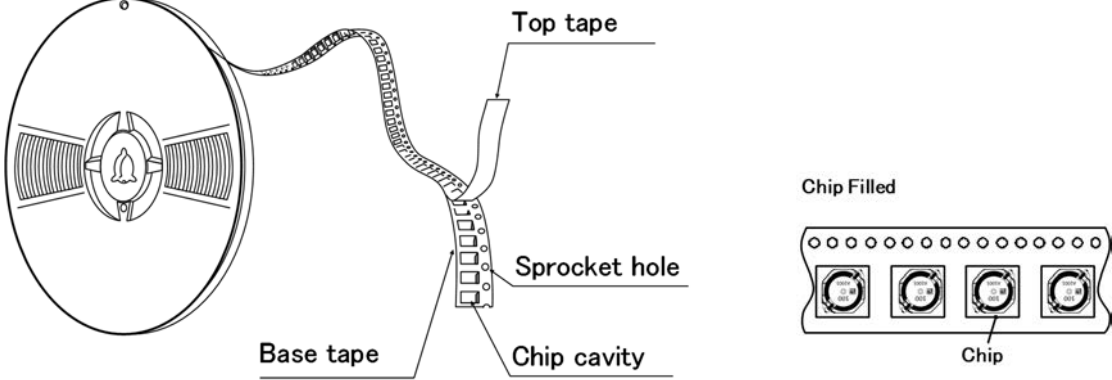
PACKAGING

①Packing Quantity

Type	Standard Quantity (1reel) [pcs]	Minimum Quantity [pcs]
	Embossed Tape	Embossed Tape
06045	1000	1000
10040	700	700
10060	500	500

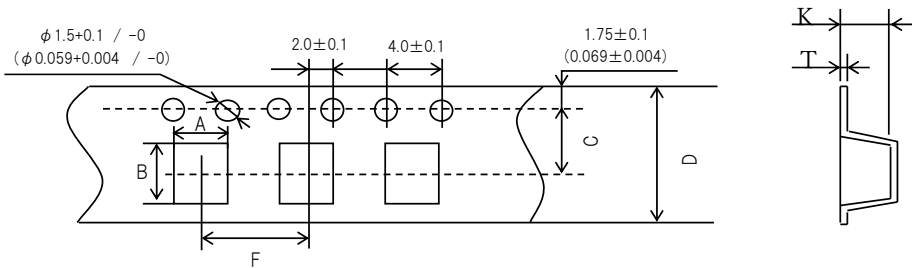
②Tape Material

Embossed Tape



③Taping dimensions

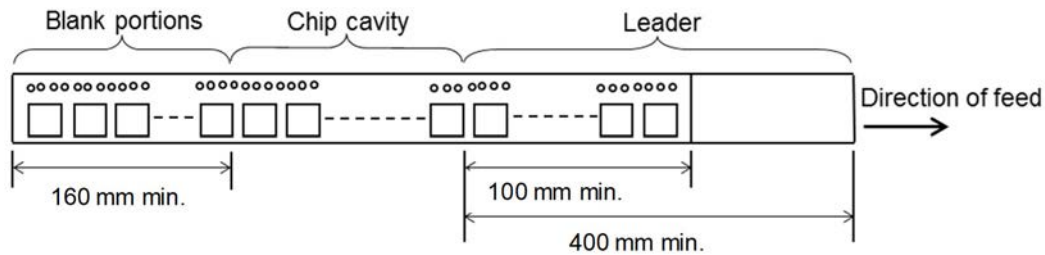
Embossed tape



Type	Chip cavity		C	D	Insertion pitch	Tape thickness	
	A	B			F	T	K
06045	6.5±0.1 (0.256±0.004)	6.1±0.1 (0.240±0.004)	7.5±0.1 (0.295±0.004)	16.0±0.2 (0.630±0.008)	12.0±0.1 (0.472±0.004)	0.5±0.05 (0.020±0.002)	4.8±0.1 (0.189±0.004)
10040	10.5±0.1 (0.413±0.004)	10.5±0.1 (0.413±0.004)	11.5±0.1 (0.453±0.004)	24.0±0.2 (0.945±0.008)	16.0±0.1 (0.630±0.004)	0.5±0.05 (0.020±0.002)	4.6±0.1 (0.181±0.004)
10060	10.5±0.1 (0.413±0.004)	10.5±0.1 (0.413±0.004)	11.5±0.1 (0.453±0.004)	24.0±0.2 (0.945±0.008)	16.0±0.1 (0.630±0.004)	0.5±0.05 (0.020±0.002)	6.5±0.1 (0.256±0.004)

Unit: mm (inch)

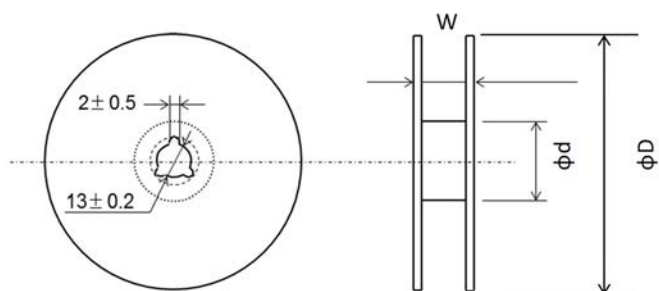
④Leader and Blank portion



►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/>) .



## ⑤ Reel size

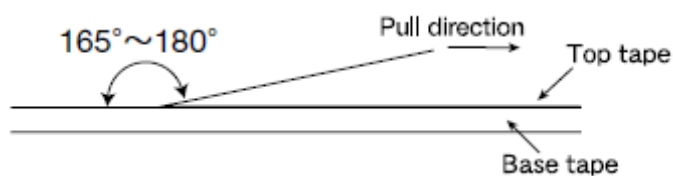


Type	Reel size (Reference values)		
	$\phi D$	$\phi d$	W
06045	$330 \pm 2.0$ ( $12.99 \pm 0.079$ )	$80 \pm 1.0$ ( $3.15 \pm 0.039$ )	$21.5 \pm 1.0$ ( $0.846 \pm 0.039$ )
10040	$330 \pm 2.0$ ( $12.99 \pm 0.079$ )	$100 \pm 1.0$ ( $3.937 \pm 0.039$ )	$29.5 \pm 1.0$ ( $1.161 \pm 0.039$ )
10060	$330 \pm 2.0$ ( $12.99 \pm 0.079$ )	$100 \pm 1.0$ ( $3.937 \pm 0.039$ )	$29.5 \pm 1.0$ ( $1.161 \pm 0.039$ )

Unit : mm (inch)

## ⑥ Top Tape Strength

The top tape requires a peel-off force of 0.1 to 1.3N in the direction of the arrow as illustrated below.



# Wire-wound Ferrite Power Inductors LAYP series for Automotive Powertrain and Safety

## RELIABILITY DATA

### 1. Operating Temperature Range

Specified Value	−55~+150°C (Including self-generated heat)
Test Methods and Remarks	Including self-generated heat

### 2. Storage Temperature Range

Specified Value	−40~+85°C
Test Methods and Remarks	−5 to 40°C for the product with taping.

### 3. Rated current

Specified Value	Within the specified tolerance
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### 4. Inductance

Specified Value	Within the specified tolerance
Test Methods and Remarks	Measuring equipment : LCR Meter (HP 4285A or equivalent) Measuring frequency : 100kHz, 1V

### 5. DC Resistance

Specified Value	Within the specified tolerance
Test Methods and Remarks	Measuring equipment : DC ohmmeter (HIOKI 3541 or equivalent)

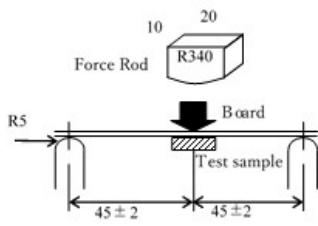
### 6. Self resonance frequency

Specified Value	—
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### 7. Temperature characteristic

Specified Value	Inductance change : Within $\pm 20\%$
Test Methods and Remarks	Measurement of inductance shall be taken at temperature range within $-55^{\circ}\text{C} \sim +150^{\circ}\text{C}$ . With reference to inductance value at $+20^{\circ}\text{C}$ ., change rate shall be calculated.

### 8. Board Flex

Specified Value	No damage
Test Methods and Remarks	<p>AEC-Q200 Test No.21 qualified (AEC-Q200-005)</p> <p>The test samples shall be soldered to the test board by the reflow. As illustrated below, apply force in the direction of the arrow indicating until deflection of the test board reaches to 2 mm for 60 s.</p> <p>Test board size : <math>100 \times 40 \times 1.6</math></p> <p>Test board material : glass epoxy-resin</p> 

### 9. Insulation resistance : between wires

Specified Value	—
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### 10. Insulation resistance : between top side of sample and the terminal

Specified Value	DC100V 100M $\Omega$ minimum
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11. Withstanding voltage : between top side of sample and the terminal																	
Specified Value	AC100V      No break of insulation																
12. Terminal Strength																	
Specified Value	Inductance change : Within ±10%																
Test Methods and Remarks	AEC-Q200 Test No.22 qualified (AEC-Q200-006)																
	The test samples shall be soldered to the test board by the reflow soldering.																
	Applied force    : 17.7N																
	Duration            : 60 s																
13. Vibration																	
Specified Value	Inductance change : Within ±10%																
Test Methods and Remarks	No significant abnormality in appearance.																
	AEC-Q200 Test No.14 qualified (MIL-STD-202 Method 204)																
	The test samples shall be soldered to the test board by the reflow.																
	Then it shall be submitted to below test conditions.																
	<table><tr><td>Frequency Range</td><td colspan="2">10~2000Hz</td></tr><tr><td>Total Amplitude</td><td colspan="2">5G</td></tr><tr><td>Sweeping Method</td><td colspan="2">10Hz to 2000Hz to 10Hz for 20min.</td></tr><tr><td rowspan="3">Number of cycle</td><td>X</td><td rowspan="3">For 12 cycles on each X, Y, and Z axis.</td></tr><tr><td>Y</td></tr><tr><td>Z</td></tr></table>			Frequency Range	10~2000Hz		Total Amplitude	5G		Sweeping Method	10Hz to 2000Hz to 10Hz for 20min.		Number of cycle	X	For 12 cycles on each X, Y, and Z axis.	Y	Z
	Frequency Range	10~2000Hz															
	Total Amplitude	5G															
	Sweeping Method	10Hz to 2000Hz to 10Hz for 20min.															
Number of cycle	X	For 12 cycles on each X, Y, and Z axis.															
	Y																
	Z																
14. Mechanical Shock																	
Specified Value	Inductance change : Within ±10%																
Test Methods and Remarks	No significant abnormality in appearance.																
	AEC-Q200 Test No.13qualified (MIL-STD-202 Method213)																
	The test samples shall be soldered to the test board by the reflow.																
	Then it shall be submitted to below test conditions.																
	<table><tr><td>Acceleration</td><td colspan="2">981m/s<sup>2</sup></td></tr><tr><td>Duration</td><td colspan="2">6msec(Half sine pulse)</td></tr><tr><td>Direction</td><td colspan="2">+X, +Y, +Z, -X, -Y, -Z</td></tr><tr><td>Number of time</td><td colspan="2">Each 3 times, Total 18 times</td></tr></table>			Acceleration	981m/s <sup>2</sup>		Duration	6msec(Half sine pulse)		Direction	+X, +Y, +Z, -X, -Y, -Z		Number of time	Each 3 times, Total 18 times			
	Acceleration	981m/s <sup>2</sup>															
	Duration	6msec(Half sine pulse)															
	Direction	+X, +Y, +Z, -X, -Y, -Z															
Number of time	Each 3 times, Total 18 times																
15. Solderability																	
Specified Value	At least 90% of surface of terminal electrode is covered by new solder.																
Test Methods and Remarks	AEC-Q200 Test No.18qualified (J-STD-002)																
	<table><tr><td></td><td>(a) Method B</td><td>(c) Method D</td></tr><tr><td>Preconditioning</td><td>155°C 4hrs</td><td>Steam 8hrs±15min</td></tr><tr><td>Solder Temperature</td><td>235±5°C</td><td>260±5°C</td></tr><tr><td>Time</td><td>5+0/-0.5 sec</td><td>30+0/-0.5 sec.</td></tr></table>				(a) Method B	(c) Method D	Preconditioning	155°C 4hrs	Steam 8hrs±15min	Solder Temperature	235±5°C	260±5°C	Time	5+0/-0.5 sec	30+0/-0.5 sec.		
		(a) Method B	(c) Method D														
	Preconditioning	155°C 4hrs	Steam 8hrs±15min														
	Solder Temperature	235±5°C	260±5°C														
Time	5+0/-0.5 sec	30+0/-0.5 sec.															
16. Resistance to Soldering Heat																	
Specified Value	Inductance change : Within ±10%																
Test Methods and Remarks	No significant abnormality in appearance.																
	AEC-Q200 Test No.15 qualified (MIL-STD-202 Method210)																
	Condition:K																
	The test sample shall be exposed to reflow oven at 183°C for 90-120 seconds, with peak temperature at 250±5°C for 30±5 seconds, 3 times.																

17. Temperature Cycling							
Specified Value	Inductance change : Within $\pm 10\%$ No significant abnormality in appearance.						
Test Methods and Remarks	<p>AEC-Q200 Test No.04 qualified (JESD22 Method JA-104) The test samples shall be soldered to the test board by the reflow. The test samples shall be placed at specified temperature for specified time by following condition.</p> <table border="1"> <tr> <td>1 Cycle</td><td><math>-55 \pm 3^{\circ}\text{C}/30 \text{ min} \leftrightarrow 150 \pm 3^{\circ}\text{C}/30 \text{ min}</math></td></tr> <tr> <td>Number of cycle</td><td>1000 cycles</td></tr> </table>	1 Cycle	$-55 \pm 3^{\circ}\text{C}/30 \text{ min} \leftrightarrow 150 \pm 3^{\circ}\text{C}/30 \text{ min}$	Number of cycle	1000 cycles		
1 Cycle	$-55 \pm 3^{\circ}\text{C}/30 \text{ min} \leftrightarrow 150 \pm 3^{\circ}\text{C}/30 \text{ min}$						
Number of cycle	1000 cycles						
18. Biased Humidity							
Specified Value	Inductance change : Within $\pm 10\%$ No significant abnormality in appearance.						
Test Methods and Remarks	<p>AEC-Q200 Test No.07 qualified (MIL-STD-202 Method 103) The test samples shall be soldered to the test board by the reflow. The test samples shall be placed in thermostatic oven set at specified temperature and humidity as shown in below table.</p> <table border="1"> <tr> <td>Temperature</td><td><math>85 \pm 2^{\circ}\text{C}</math></td></tr> <tr> <td>Humidity</td><td>85%RH</td></tr> <tr> <td>Time</td><td>1000 + 24 / - 0 hour</td></tr> </table>	Temperature	$85 \pm 2^{\circ}\text{C}$	Humidity	85%RH	Time	1000 + 24 / - 0 hour
Temperature	$85 \pm 2^{\circ}\text{C}$						
Humidity	85%RH						
Time	1000 + 24 / - 0 hour						
19. High Temperature Exposure							
Specified Value	Inductance change : Within $\pm 10\%$ No significant abnormality in appearance.						
Test Methods and Remarks	<p>AEC-Q200 Test No.03 qualified (MIL-STD-202 Method 108) The test samples shall be soldered to the test board by the reflow soldering.</p> <table border="1"> <tr> <td>Temperature</td><td><math>150 \pm 3^{\circ}\text{C}</math></td></tr> <tr> <td>Time</td><td>1000 + 24 / - 0 hour</td></tr> </table>	Temperature	$150 \pm 3^{\circ}\text{C}$	Time	1000 + 24 / - 0 hour		
Temperature	$150 \pm 3^{\circ}\text{C}$						
Time	1000 + 24 / - 0 hour						
20. Operational Life							
Specified Value	Inductance change : Within $\pm 10\%$ No significant abnormality in appearance.						
Test Methods and Remarks	<p>AEC-Q200 Test No.08 qualified (MIL-PRF-27) The test samples shall be soldered to the test board by the reflow soldering.</p> <table border="1"> <tr> <td>Temperature</td><td><math>125 \pm 3^{\circ}\text{C}</math></td></tr> <tr> <td>Applied current</td><td>Rated current</td></tr> <tr> <td>Time</td><td>1000 + 24 / - 0 hour</td></tr> </table>	Temperature	$125 \pm 3^{\circ}\text{C}$	Applied current	Rated current	Time	1000 + 24 / - 0 hour
Temperature	$125 \pm 3^{\circ}\text{C}$						
Applied current	Rated current						
Time	1000 + 24 / - 0 hour						
21. Standard condition							
Specified Value	<p>Standard test condition : Unless otherwise specified, temperature is <math>20 \pm 15^{\circ}\text{C}</math> and <math>65 \pm 20\%</math> of relative humidity. When there is any question concerning measurement result: In order to provide correlation data, the test shall be condition of <math>20 \pm 2^{\circ}\text{C}</math> of temperature, <math>65 \pm 5\%</math> relative humidity. Inductance is in accordance with our measured value.</p>						

Wire-wound Ferrite Power Inductors LAYP series for Automotive Powertrain and safety  
Wire-wound Ferrite Power Inductors LAXH series for Automotive Powertrain and safety  
Wire-wound Ferrite Power Inductors LCXN/LCXP series for Automotive Body & Chassis and Infotainment  
Wire-wound Ferrite Power Inductors LCXH series for Automotive Body & Chassis and Infotainment  
Wire-wound Ferrite Inductors for Class D Amplifier LCXA for Automotive Body & Chassis and Infotainment  
Wire-wound Ferrite Power Inductors LCRN series for Automotive Body & Chassis and Infotainment  
Wire-wound Ferrite Power Inductors LBXN/LBXP series  
for Telecommunications Infrastructure and Industrial Equipment  
Wire-wound Ferrite Power Inductors LBXH series  
for Telecommunications Infrastructure and Industrial Equipment  
Wire-wound Ferrite Power Inductors LBRN series  
for Telecommunications Infrastructure and Industrial Equipment  
Wire-wound Ferrite Power Inductors LMXN/LMXP series  
for Medical Devices classified as GHTF Class C (Japan Class III)  
Wire-wound Ferrite Power Inductors LMXH series  
for Medical Devices classified as GHTF Class C (Japan Class III)  
Wire-wound Ferrite Power Inductors LMRN series  
for Medical Devices classified as GHTF Class C (Japan Class III)

## ■ PRECAUTIONS

### 1. Circuit Design

#### Precautions

- ◆ Verification of operating environment, electrical rating and performance
  1. A malfunction in medical equipment, spacecraft, nuclear reactors, etc. may cause serious harm to human life or have severe social ramifications. As such, any inductors to be used in such equipment may require higher safety and/or reliability considerations and should be clearly differentiated from components used in general purpose applications.
  2. When inductors are used in places where dew condensation develops and/or where corrosive gas such as hydrogen sulfide, sulfurous acid, or chlorine exists in the air, characteristic deterioration may occur. Please do not use inductors under such environmental conditions.
- ◆ Operating Current (Verification of Rated current)
  1. The operating current including inrush current for inductors must always be lower than their rated values.
  2. Do not apply current in excess of the rated value because the inductance may be reduced due to the magnetic saturation effect.
- ◆ Temperature rise

Temperature rise of power choke coil depends on the installation condition in end products.  
Make sure that temperature rise of power choke coils in actual end products is within the specified temperature range.

### 2. PCB Design

#### Precautions

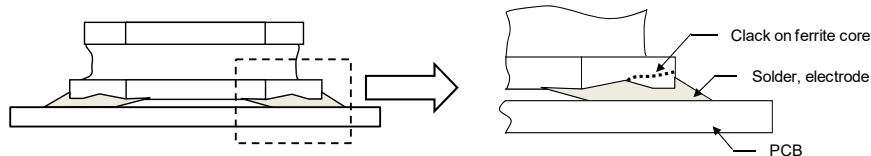
- ◆ Land pattern design
  1. Please refer to a recommended land pattern.
  2. There is stress, which has been caused by distortion of a PCB, to the inductor.  
(LAXH/LCXN/LCXP/LBXN/LBXP/LMXN/LMXP, LCXH/LCXA/LBXH/LMXH)
  3. Please consider the arrangement of parts on a PCB.  
(LAXH/LCXN/LCXP/LBXN/LBXP/LMXN/LMXP, LCXH/LCXA/LBXH/LMXH)

#### Technical considerations

- ◆ Land pattern design

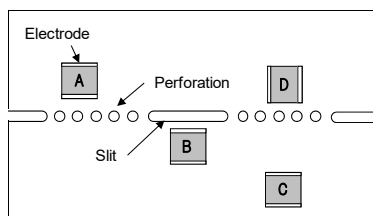
Surface Mounting

  1. Mounting and soldering conditions should be checked beforehand.
  2. Applicable soldering process to this products is reflow soldering only.
  3. Please use the recommended land pattern shown as below. Electrical characteristics and the mounting ability of the product are being considered in the recommended land pattern. If a PCB is designed with other dimensions, defective soldering and stress to a product may occur due to misalignment. The performance of the product may not be brought out. If an adopted land pattern is different from the recommended land pattern, stress to the product will increase. It may cause cracks or defective electrical characteristics of the product. Please conduct validation completely before studying adoption of this product and please judge the pros and cons of adoption of this product with taking on responsibility.  
(LAXH/LCXN/LCXP/LBXN/LBXP/LMXN/LMXP, LCXH/LCXA/LBXH/LMXH)
  4. As coefficients of thermal expansion between an inductor and a PCB differs, cracks may occur on a ferrite core when thermal stress is applied to them after mounting an inductor. (Please refer to the drawings below.) Please conduct validation completely before studying adoption of this product and please judge the pros and cons of adoption of this product with taking on responsibility.  
(LAXH/LCXN/LCXP/LBXN/LBXP/LMXN/LMXP, LCXH/LCXA/LBXH/LMXH)



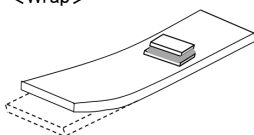
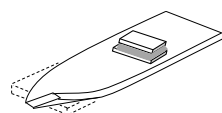
5. SMD inductors should be located to minimize any possible mechanical stresses from board warp or deflection. When splitting the PC board after mounting inductors and other components, care is required so as not to give any stresses of deflection or twisting to the board.

(LAXH/LCXN/LCXP/LBXN/LBXP/LMXN/LMXP, LCXH/LCXA/LBXH/LMXH)

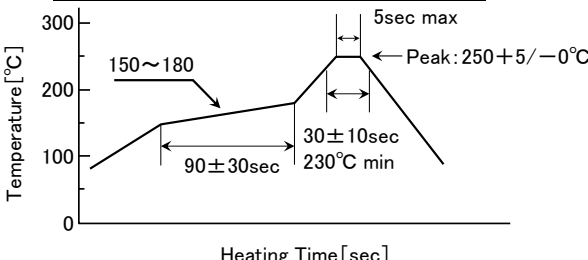
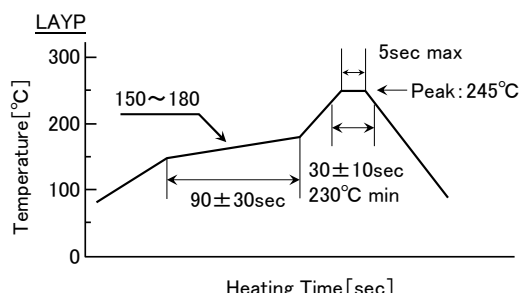


A product tends to undergo stress in order "A>C>B≡D". Please consider the layouts of a product to minimize any stresses.

### 3. Considerations for automatic placement

Precautions	<p>◆ Adjustment of mounting machine</p> <ol style="list-style-type: none"> <li>Excessive impact load should not be imposed on the products when mounting onto the PC boards.</li> <li>Mounting and soldering conditions should be checked beforehand.</li> </ol>
Technical considerations	<p>◆ Adjustment of mounting machine</p> <ol style="list-style-type: none"> <li>When installing products, care should be taken not to apply distortion stress as it may deform the products.</li> <li>Stress may be applied to a product with a warp or a twist in handling of the product. Please conduct validation completely before studying adoption of this product and please judge the pros and cons of adoption of this product with taking on responsibility.</li> </ol> <p>(LAXH/LCXN/LCXP/LBXN/LBXP/LMXN/LMXP, LCXH/LCXA/LBXH/LMXH)</p> <p>&lt;Wrap&gt; </p> <p>&lt;Twist&gt; </p>

### 4. Soldering

Precautions	<p>◆ Reflow soldering</p> <ol style="list-style-type: none"> <li>Please contact any of our offices for a reflow soldering, and refer to the recommended condition specified.</li> <li>The product shall be used reflow soldering only.</li> <li>Please do not add any stress to a product until it returns in normal temperature after reflow soldering.</li> </ol> <p>◆ Lead free soldering</p> <ol style="list-style-type: none"> <li>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> </ol> <p>◆ Recommended conditions for using a soldering iron(Repair)</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>
Technical considerations	<p>◆ Reflow soldering</p> <ol style="list-style-type: none"> <li>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> </ol> <p>Recommended reflow condition (Pb free solder)</p> <p><u>LAXH/LCXN/LCXP/LBXN/LBXP/LMXN/LMXP,</u>  <u>LCXH/LCXA/LBXH/LMXH, LCRN/LBRN/LMRN</u></p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  <p>Temperature [°C]</p> <p>Heating Time [sec]</p> </div> <div style="text-align: center;">  <p>Temperature [°C]</p> <p>Heating Time [sec]</p> </div> </div>

5. Cleaning	
Precautions	<ul style="list-style-type: none"> <li>◆Cleaning conditions               <ol style="list-style-type: none"> <li>1. Washing by supersonic waves shall be avoided.</li> </ol> </li> </ul>
Technical considerations	<ul style="list-style-type: none"> <li>◆Cleaning conditions               <ol style="list-style-type: none"> <li>1. If washed by supersonic waves, the products might be broken.</li> </ol> </li> </ul>
6. Handling	
Precautions	<ul style="list-style-type: none"> <li>◆Handling               <ol style="list-style-type: none"> <li>1. Keep the product away from all magnets and magnetic objects.</li> </ol> </li> <li>◆Breakaway PC boards (splitting along perforations)               <ol style="list-style-type: none"> <li>1. When splitting the PC board after mounting product, care should be taken not to give any stresses of deflection or twisting to the board.</li> <li>2. Board separation should not be done manually, but by using the appropriate devices.</li> </ol> </li> <li>◆Mechanical considerations               <ol style="list-style-type: none"> <li>1. Please do not give the product any excessive mechanical shocks.</li> <li>2. Please do not add any shock and power to a product in transportation.</li> </ol> </li> <li>◆Pick-up pressure               <ol style="list-style-type: none"> <li>1. Please do not push to add any pressure to a winding part. Please do not give any shock and push into a ferrite core exposure part.</li> </ol> </li> <li>◆Packing               <ol style="list-style-type: none"> <li>1. Please avoid accumulation of a packing box as much as possible.</li> </ol> </li> </ul>
Technical considerations	<ul style="list-style-type: none"> <li>◆Handling               <ol style="list-style-type: none"> <li>1. There is a case that a characteristic varies with magnetic influence.</li> </ol> </li> <li>◆Breakaway PC boards (splitting along perforations)               <ol style="list-style-type: none"> <li>1. The position of the product on PCBs shall be carefully considered to minimize the stress caused from splitting of the PCBs.</li> </ol> </li> <li>◆Mechanical considerations               <ol style="list-style-type: none"> <li>1. There is a case to be damaged by a mechanical shock.</li> <li>2. There is a case to be broken by the handling in transportation.</li> </ol> </li> <li>◆Pick-up pressure               <ol style="list-style-type: none"> <li>1. Damage and a characteristic can vary with an excessive shock or stress.</li> </ol> </li> <li>◆Packing               <ol style="list-style-type: none"> <li>1. If packing boxes are accumulated, that could cause a deformation on packing tapes or a damage on the products.</li> </ol> </li> </ul>
7. Storage conditions	
Precautions	<ul style="list-style-type: none"> <li>◆Storage               <ol style="list-style-type: none"> <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.                   <ul style="list-style-type: none"> <li>▪ Storage conditions                       <ul style="list-style-type: none"> <li>Ambient temperature : <math>-5\sim 40^{\circ}\text{C}</math></li> <li>Humidity : Below 70% RH</li> </ul> </li> <li>▪ The recommended ambient temperature is below <math>30^{\circ}\text{C}</math>. Even under ideal storage conditions, solderability of products electrodes may decrease as time passes.                           <ul style="list-style-type: none"> <li>For this reason, product should be used within 6 months from the time of delivery.</li> <li>In case of storage over 6 months, solderability shall be checked before actual usage.</li> </ul> </li> </ul> </li> </ol> </li> </ul>
Technical considerations	<ul style="list-style-type: none"> <li>◆Storage               <ol style="list-style-type: none"> <li>1. Under a high temperature and humidity environment, problems such as reduced solderability caused by oxidation of terminal electrodes and deterioration of taping/packaging materials may take place.</li> </ol> </li> </ul>