

# 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.

## 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 \*1
- (3) Medical devices classified as GHTF Class D (Japan Class IV), implantable medical devices \*2
- (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


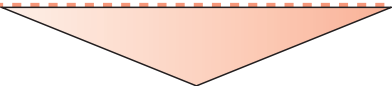
Some of our products listed in this catalog may require specific procedures for export according to "U.S. Export Administration Regulations", "Foreign Exchange and Foreign Trade Control Law" of Japan, and other applicable regulations. Should you have any questions on this matter, please contact our sales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

# Medical Application Guide

According to the medical devices classified as GHTF Classes A to C (Japan Classes I to III), we have the corresponding product series (the 2nd code from the left side of the part number is “M” or “L”) intended for use in the medical devices. Therefore, when using our products for the medical devices, please be sure to check the classification based on the GHTF Rules and use the corresponding product series.

On the other hand, we don't have the product series intended for use in (i) all medical devices classified as GHTF Class D (Japan Class IV) and (ii) implantable medical devices (bone-anchored hearing aid, artificial retina system, and external unit which is connected to internal unit which is implanted in a body, etc.). Therefore, please do not incorporate our products into these medical devices. Should you have any questions on this matter, please contact us.

Risk Level		Low  High			
Japan	Classification according to the PMD Act of Japan (based on the GHTF Rules)	<b>Class I</b> General Medical Devices (GHTF Class A)	<b>Class II</b> Controlled Medical Devices (GHTF Class B)	<b>Class III</b> Specially-controlled Medical Devices (GHTF Class C)	<b>Class IV</b> Specially-controlled Medical Devices (GHTF Class D)
		Medical devices with extremely low risk to the human body in case of problems	Medical devices with relatively low risk to the human body in case of problems	Medical devices with relatively high risk to the human body in case of problems	Medical devices highly invasive to patients and with life-threatening risk in case of problems
		[Ex.] <ul style="list-style-type: none"><li>• In Vitro Diagnostic Devices</li><li>• Nebulizer</li><li>• Blood Gas Analyzer</li><li>• Plethysmographs</li><li>• Breathing Sensor</li><li>• AC-powered Operating Table</li><li>• Surgical Light</li><li>• Cholesterol Analysis Device</li><li>• Blood Type Analysis Device, etc.</li></ul>	[Ex.] <ul style="list-style-type: none"><li>• Electronic Thermometer</li><li>• Electronic Blood Pressure Gauge</li><li>• Electronic Endoscope</li><li>• Hearing Aid</li><li>• Electrocardiograph</li><li>• MRI</li><li>• Ultrasonic Diagnostic System</li><li>• Diagnostic Imaging Equipment</li><li>• X-ray Diagnostic Equipment</li><li>• Central Monitor</li><li>• Pulse Oximeter, etc.</li></ul>	[Ex.] <ul style="list-style-type: none"><li>• Dialysis Machine</li><li>• Radiation Therapy Equipment</li><li>• Infusion Pump</li><li>• Respirator</li><li>• Glucose Monitoring System</li><li>• AED (Automated External Defibrillator)</li><li>• Skin Laser Scanner</li><li>• Electric Surgical Unit</li><li>• Insulin Pump, etc.</li></ul>	[Ex.] <ul style="list-style-type: none"><li>• Cardiac Pacemaker</li><li>• Video Flexible Angioscope</li><li>• Implantable Infusion Pump</li><li>• Cardiac Electrosurgical Unit</li><li>• Inspection Device with Cardiac Catheter</li><li>• Defibrillator, etc.</li></ul>
U.S.A.	FDA Classification	<b>Class I</b> General Controls	<b>Class II</b> General Controls and Special Controls	<b>Class III</b> General Controls and Premarket Approval	
		Medical devices without the possibility of causing serious injury or harm to the patient or user even if there is a defect or malfunction in such medical devices	Medical devices with the possibility of causing injury or harm to the patient or user if there is a defect or malfunction in such medical devices	Medical devices with the possibility of causing serious injury, disability or death to the patient or user if a defect or malfunction occurs in such medical devices	
					
Corresponding TAIYO YUDEN Product Series		<b>Product Series for Medical Devices classified as GHTF Classes A or B (Japan Classes I or II)</b> (The 2nd Code from the Left Side of the Part Number: “L”)		<b>Product Series for Medical Devices classified as GHTF Class C (Japan Class III)</b> (The 2nd Code from the Left Side of the Part Number: “M”) (See the Note below.)	N / A

\* Note : It is prohibited that our products are used in some medical devices such as implantable medical devices even if such medical devices are classified as GHTF Class C (Japan Class III).

► 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/>).

# Wire-wound Metal Power Inductors MCOIL™ LLDN series

## for Medical Devices classified as GHTF Classes A or B (Japan Classes I or II)

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

REFLOW

PART NUMBER

\* Operating Temp.: -40~+125°C (Including self-generated heat)

L	L	D	N	D	1	6	1	6	K	K	T	1	R	0	M	M	
①	②	③	④	⑤	⑥	⑦	⑧	⑨									

## ① Series

Code (1)(2)(3)(4)	
LLDN	Wire-wound Metal Power Inductor for Medical Devices classified as GHTF Classes A or B (Japan Classes I or II)

## (1) Product Group

Code	
L	Inductors

## (2) Category

Code	Recommended equipment	Quality Grade
L	Medical Devices classified as GHTF Classes A or B (Japan Classes I or II)	3

## (3) Type

Code	
D	Metal Wire-wound (Drum type)

## (4) Features, Characteristics

Code	
N	Standard Power choke

## ② Features

Code	Feature
D	Bottom electrode (Ag × solder)

## ③ Dimensions (L × W)

Code	Dimensions (L × W) [mm]
1616	1.6 × 1.6
2020	2.0 × 2.0
3030	3.0 × 3.0
4040	4.0 × 4.0
5050	4.9 × 4.9

## ④ Dimensions (H)

Code	Dimensions (H) [mm]
JE	0.95
KK	1.0
MK	1.2
PK	1.4
WK	2.0

## ⑤ Packaging

Code	Packaging
T	Taping

## ⑥ Nominal inductance

Code (example)	Nominal inductance [μH]
R47	0.47
1R0	1.0
4R7	4.7

※R=Decimal point

## ⑦ Inductance tolerance

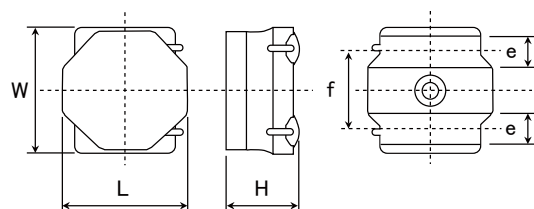
Code	Inductance tolerance
M	±20%
N	±30%

## ⑧ Special code

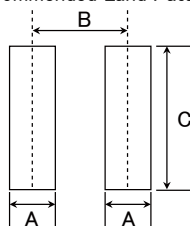
Code	Special code
F	Ferrite coating
M	Metal coating

## ⑨ Internal code

# STANDARD EXTERNAL DIMENSIONS / STANDARD QUANTITY



Recommended Land Patterns



Type	A	B	C
1616	0.5	1.10	1.65
2020	0.65	1.35	2.0
3030	0.8	2.2	2.7
4040	1.2	2.8	3.7
5050	1.5	3.6	4.2

Unit: mm

Type	L	W	H	e	f	Standard quantity [pcs] Taping
1616KK	1.64±0.1 (0.065±0.004)	1.64±0.1 (0.065±0.004)	1.0 max (0.039 max)	0.40 +0.2/-0.1 (0.016 +0.008/-0.004)	1.0±0.2 (0.039±0.008)	2500
2020JE	2.0±0.15 (0.079±0.006)	2.0±0.15 (0.079±0.006)	0.95 max (0.037 max)	0.50±0.2 (0.02±0.008)	1.25±0.2 (0.049±0.008)	2500
2020KK	2.0±0.15 (0.079±0.006)	2.0±0.15 (0.079±0.006)	1.0 max (0.039 max)	0.50±0.2 (0.02±0.008)	1.25±0.2 (0.049±0.008)	2500
2020MK	2.0±0.15 (0.079±0.006)	2.0±0.15 (0.079±0.006)	1.2 max (0.047 max)	0.50±0.2 (0.02±0.008)	1.25±0.2 (0.049±0.008)	2500
3030KK	3.0±0.1 (0.118±0.004)	3.0±0.1 (0.118±0.004)	1.0 max (0.039 max)	0.90±0.2 (0.035±0.008)	1.9±0.2 (0.075±0.008)	2000
3030MK	3.0±0.1 (0.118±0.004)	3.0±0.1 (0.118±0.004)	1.2 max (0.047 max)	0.90±0.2 (0.035±0.008)	1.9±0.2 (0.075±0.008)	2000
4040JE	4.0±0.2 (0.157±0.008)	4.0±0.2 (0.157±0.008)	0.95 max (0.037 max)	1.1±0.2 (0.043±0.008)	2.5±0.2 (0.098±0.008)	1000
4040MK	4.0±0.2 (0.157±0.008)	4.0±0.2 (0.157±0.008)	1.2 max (0.047 max)	1.1±0.2 (0.043±0.008)	2.5±0.2 (0.098±0.008)	1000
4040WK	4.0±0.2 (0.157±0.008)	4.0±0.2 (0.157±0.008)	2.0 max (0.079 max)	1.1±0.2 (0.043±0.008)	2.5±0.2 (0.098±0.008)	700
5050PK	4.9±0.2 (0.193±0.008)	4.9±0.2 (0.193±0.008)	1.4 max (0.055 max)	1.20±0.2 (0.047±0.008)	3.3±0.2 (0.130±0.008)	1000

Unit: mm (inch)

## PART NUMBER

## 1616KK type 【Thickness: 1.0mm max.】

New part number	Old part number (for reference)	EHS	Nominal inductance [ $\mu$ H]	Inductance tolerance	DC Resistance[ $\Omega$ ]		Rated current ※) [mA]				Measuring frequency [MHz]
							Saturation current: Idc1		Temperature rise current: Idc2		
					Max.	Typ.	Max.	Typ.	Max.	Typ.	
LLDND1616KKT47MM	MDKK1616TR47MM	RoHS	0.47	±20%	0.095	0.080	3,300	4,100	1,500	1,780	1
LLDND1616KKT1R0MM	MDKK1616T1R0MM	RoHS	1.0	±20%	0.140	0.120	2,200	2,750	1,200	1,490	1
LLDND1616KKT1R5MM	MDKK1616T1R5MM	RoHS	1.5	±20%	0.185	0.160	1,750	2,200	1,100	1,330	1
LLDND1616KKT2R2MM	MDKK1616T2R2MM	RoHS	2.2	±20%	0.250	0.215	1,500	1,800	950	1,110	1
LLDND1616KKT3R3MM	MDKK1616T3R3MM	RoHS	3.3	±20%	0.515	0.450	1,150	1,450	650	730	1
LLDND1616KKT4R7MM	MDKK1616T4R7MM	RoHS	4.7	±20%	0.640	0.550	950	1,200	550	630	1
LLDND1616KKT6R8MM	MDKK1616T6R8MM	RoHS	6.8	±20%	0.820	0.710	630	880	520	600	1
LLDND1616KKT100MM	MDKK1616T100MM	RoHS	10	±20%	1.120	0.970	550	800	450	500	1
LLDND1616KKT150MM	MDKK1616T150MM	RoHS	15	±20%	1.800	1.600	460	640	400	440	1

## 2020JE type 【Thickness: 0.95mm max.】

New part number	Old part number (for reference)	EHS	Nominal inductance [ $\mu$ H ]	Inductance tolerance	DC Resistance [ $\Omega$ ]		Rated current ※) [ mA ]				Measuring frequency [ MHz ]
							Saturation current: Idc1		Temperature rise current: Idc2		
					Max.	Typ.	Max.	Typ.	Max.	Typ.	
LLDND2020JET1R0MM	MDJE2020T1R0MM	RoHS	1.0	±20%	0.121	0.106	3,100	3,800	1,550	1,800	1
LLDND2020JET2R2MM	MDJE2020T2R2MM	RoHS	2.2	±20%	0.266	0.230	1,550	1,900	1,050	1,200	1
LLDND2020JET3R3MM	MDJE2020T3R3MM	RoHS	3.3	±20%	0.340	0.290	1,350	1,600	950	1,100	1
LLDND2020JET4R7MM	MDJE2020T4R7MM	RoHS	4.7	±20%	0.475	0.410	1,200	1,550	850	950	1
LLDND2020JET6R8MM	MDJE2020T6R8MM	RoHS	6.8	±20%	0.630	0.550	800	1,100	750	850	1
LLDND2020JET100MM	MDJE2020T100MM	RoHS	10	±20%	1.040	0.910	700	900	550	600	1

## 2020KK type 【Thickness: 1.0mm max.】

New part number	Old part number (for reference)	EHS	Nominal inductance [ $\mu$ H ]	Inductance tolerance	DC Resistance[ $\Omega$ ]		Rated current ※) [mA]				Measuring frequency [MHz]
							Saturation current: Idc1		Temperature rise current: Idc2		
					Max.	Typ.	Max.	Typ.	Max.	Typ.	
LLDND2020KKT47MM	MDKK2020TR47MM	RoHS	0.47	±20%	0.046	0.040	3,500	4,150	2,200	2,500	1
LLDND2020KKT6R8MM	MDKK2020TR68MM	RoHS	0.68	±20%	0.060	0.052	3,200	3,650	2,000	2,100	1
LLDND2020KKT1R0MM	MDKK2020T1R0MM	RoHS	1.0	±20%	0.085	0.074	2,900	3,400	1,700	1,900	1
LLDND2020KKT1R5MM	MDKK2020T1R5MM	RoHS	1.5	±20%	0.133	0.115	1,900	2,250	1,350	1,500	1
LLDND2020KKT2R2MM	MDKK2020T2R2MM	RoHS	2.2	±20%	0.165	0.139	1,650	1,950	1,200	1,350	1
LLDND2020KKT3R3MM	MDKK2020T3R3MM	RoHS	3.3	±20%	0.275	0.240	1,300	1,550	940	1,050	1
LLDND2020KKT4R7MM	MDKK2020T4R7MM	RoHS	4.7	±20%	0.435	0.375	1,050	1,250	750	850	1
LLDND2020KKT100MM	MDKK2020T100MM	RoHS	10	±20%	0.690	0.600	750	900	630	680	1
LLDND2020KKT150MM	MDKK2020T150MM	RoHS	15	±20%	1.180	1.020	550	750	480	550	1

## 2020MK type 【Thickness: 1.2mm max.】

New part number	Old part number (for reference)	EHS	Nominal inductance [ $\mu$ H ]	Inductance tolerance	DC Resistance [ $\Omega$ ]		Rated current ※) [mA]				Measuring frequency [MHz]
							Saturation current: Idc1		Temperature rise current: Idc2		
					Max.	Typ.	Max.	Typ.	Max.	Typ.	
LLDND2020MKT47MM	MDMK2020TR47MM	RoHS	0.47	±20%	0.046	0.040	4,200	4,800	2,300	2,450	1
LLDND2020MKT68MM	MDMK2020TR68MM	RoHS	0.68	±20%	0.058	0.050	3,500	4,100	2,000	2,200	1
LLDND2020MKT1R0MM	MDMK2020T1R0MM	RoHS	1.0	±20%	0.064	0.056	2,550	2,900	1,900	2,050	1
LLDND2020MKT1R5MM	MDMK2020T1R5MM	RoHS	1.5	±20%	0.086	0.075	2,000	2,300	1,650	1,750	1
LLDND2020MKT2R2MM	MDMK2020T2R2MM	RoHS	2.2	±20%	0.109	0.095	1,750	2,000	1,450	1,550	1
LLDND2020MKT3R3MM	MDMK2020T3R3MM	RoHS	3.3	±20%	0.178	0.155	1,350	1,550	1,150	1,200	1
LLDND2020MKT4R7MM	MDMK2020T4R7MM	RoHS	4.7	±20%	0.242	0.210	1,150	1,300	950	1,050	1

## 3030KK type 【Thickness: 1.0mm max.】

New part number	Old part number (for reference)	EHS	Nominal inductance [ $\mu$ H ]	Inductance tolerance	DC Resistance[ $\Omega$ ]		Rated current ※) [mA]				Measuring frequency [MHz]
							Saturation current: Idc1		Temperature rise current: Idc2		
					Max.	Typ.	Max.	Typ.	Max.	Typ.	
LLDND3030KKT47MM	MDKK3030TR47MM	RoHS	0.47	±20%	0.039	0.033	5,400	6,500	3,900	4,500	1
LLDND3030KKT1R0MM	MDKK3030T1R0MM	RoHS	1.0	±20%	0.086	0.074	4,400	5,200	2,400	2,800	1
LLDND3030KKT1R5MM	MDKK3030T1R5MM	RoHS	1.5	±20%	0.100	0.087	3,000	3,500	2,100	2,400	1
LLDND3030KKT2R2MM	MDKK3030T2R2MM	RoHS	2.2	±20%	0.144	0.125	2,500	3,000	1,900	2,200	1
LLDND3030KKT3R3MM	MDKK3030T3R3MM	RoHS	3.3	±20%	0.248	0.215	2,000	2,400	1,350	1,500	1
LLDND3030KKT4R7MM	MDKK3030T4R7MM	RoHS	4.7	±20%	0.345	0.300	1,700	2,000	1,150	1,300	1
LLDND3030KKT6R8MM	MDKK3030T6R8MM	RoHS	6.8	±20%	0.437	0.380	1,400	1,700	1,000	1,150	1
LLDND3030KKT100MM	MDKK3030T100MM	RoHS	10	±20%	0.575	0.500	1,100	1,300	850	1,000	1

## 3030MK type 【Thickness: 1.2mm max.】

New part number	Old part number (for reference)	EHS	Nominal inductance [ $\mu$ H ]	Inductance tolerance	DC Resistance[ $\Omega$ ]		Rated current ※) [mA]				Measuring frequency [MHz]
							Saturation current: Idc1		Temperature rise current: Idc2		
					Max.	Typ.	Max.	Typ.	Max.	Typ.	
LLDND3030MKT3R30MM	MDMK3030TR30MM	RoHS	0.30	±20%	0.020	0.017	7,600	9,200	5,500	6,400	1
LLDND3030MKT3R33MM	MDMK3030TR33MM	RoHS	0.33	±20%	0.020	0.017	6,400	8,700	5,500	6,400	1
LLDND3030MKT4R7MM	MDMK3030TR47MM	RoHS	0.47	±20%	0.027	0.023	6,300	7,500	4,700	5,500	1
LLDND3030MKT1R0MM	MDMK3030T1R0MM	RoHS	1.0	±20%	0.050	0.043	4,300	5,100	3,300	3,900	1
LLDND3030MKT1R5MM	MDMK3030T1R5MM	RoHS	1.5	±20%	0.074	0.064	3,400	4,100	2,500	3,000	1
LLDND3030MKT2R2MM	MDMK3030T2R2MM	RoHS	2.2	±20%	0.112	0.097	2,800	3,600	2,100	2,400	1
LLDND3030MKT3R3MM	MDMK3030T3R3MM	RoHS	3.3	±20%	0.167	0.145	2,100	2,700	1,650	1,900	1
LLDND3030MKT4R7MM	MDMK3030T4R7MM	RoHS	4.7	±20%	0.263	0.228	1,800	2,300	1,350	1,550	1

## PART NUMBER

## ● 4040JE type 【Thickness: 0.95mm max.】

New part number	Old part number (for reference)	EHS	Nominal inductance [ $\mu$ H ]	Inductance tolerance	DC Resistance [ $\Omega$ ]		Rated current ※) [mA]				Measuring frequency [MHz]
							Saturation current: Idc1		Temperature rise current: Idc2		
					Max.	Typ.	Max.	Typ.	Max.	Typ.	
LLDND4040JETR47MM	MDJE4040TR47MM	RoHS	0.47	±20%	0.040	0.035	6,000	7,900	4,000	4,500	1
LLDND4040JET1R0MM	MDJE4040T1R0MM	RoHS	1.0	±20%	0.069	0.060	4,700	5,700	3,000	3,500	1
LLDND4040JET1R5MM	MDJE4040T1R5MM	RoHS	1.5	±20%	0.084	0.073	3,000	4,000	2,700	3,100	1
LLDND4040JET2R2MM	MDJE4040T2R2MM	RoHS	2.2	±20%	0.115	0.100	2,400	3,100	2,400	2,700	1
LLDND4040JET3R3MM	MDJE4040T3R3MM	RoHS	3.3	±20%	0.200	0.175	2,000	2,600	1,800	2,000	1
LLDND4040JET4R7MM	MDJE4040T4R7MM	RoHS	4.7	±20%	0.250	0.220	1,900	2,300	1,600	1,900	1
LLDND4040JET6R8MM	MDJE4040T6R8MM	RoHS	6.8	±20%	0.370	0.320	1,500	1,800	1,300	1,500	1
LLDND4040JET100MM	MDJE4040T100MM	RoHS	10	±20%	0.510	0.440	1,400	1,700	1,100	1,300	1

## ● 4040MK F type 【Thickness: 1.2mm max.】

New part number	Old part number (for reference)	EHS	Nominal inductance [ $\mu$ H ]	Inductance tolerance	DC Resistance [ $\Omega$ ]		Rated current ※) [ mA ]				Measuring frequency [ kHz ]
							Saturation current: Idc1		Temperature rise current: Idc2		
					Max.	Typ.	Max.	Typ.	Max.	Typ.	
LLDND4040MKTR47MF	MDMK4040TR47MF	RoHS	0.47	±20%	0.029	0.025	7,500	10,000	4,600	5,400	100
LLDND4040MKT1R0MF	MDMK4040T1R0MF	RoHS	1.0	±20%	0.047	0.041	5,200	7,500	3,500	4,200	100
LLDND4040MKT1R2MF	MDMK4040T1R2MF	RoHS	1.2	±20%	0.047	0.041	4,200	6,200	3,500	4,200	100
LLDND4040MKT1R5MF	MDMK4040T1R5MF	RoHS	1.5	±20%	0.065	0.056	3,700	5,400	3,300	3,600	100
LLDND4040MKT2R2MF	MDMK4040T2R2MF	RoHS	2.2	±20%	0.092	0.080	3,200	4,500	2,500	2,900	100

## ● 4040MK type 【Thickness: 1.2mm max.】

New part number	Old part number (for reference)	EHS	Nominal inductance [ $\mu$ H ]	Inductance tolerance	DC Resistance [ $\Omega$ ]		Rated current ※) [mA]				Measuring frequency [MHz]
							Saturation current: Idc1		Temperature rise current: Idc2		
					Max.	Typ.	Max.	Typ.	Max.	Typ.	
LLDND4040MKT6R8MM	MDMK4040T6R8MM	RoHS	0.68	±20%	0.029	0.025	6,700	7,800	5,000	5,700	1
LLDND4040MKT1R0MM	MDMK4040T1R0MM	RoHS	1.0	±20%	0.036	0.031	5,000	6,200	4,500	5,100	1
LLDND4040MKT1R5MM	MDMK4040T1R5MM	RoHS	1.5	±20%	0.065	0.056	4,500	5,600	3,200	3,600	1
LLDND4040MKT2R2MM	MDMK4040T2R2MM	RoHS	2.2	±20%	0.079	0.069	3,800	4,500	2,800	3,200	1
LLDND4040MKT3R3MM	MDMK4040T3R3MM	RoHS	3.3	±20%	0.130	0.113	3,200	4,000	2,200	2,500	1
LLDND4040MKT4R7MM	MDMK4040T4R7MM	RoHS	4.7	±20%	0.160	0.140	2,500	3,000	1,900	2,200	1
LLDND4040MKT6R8MM	MDMK4040T6R8MM	RoHS	6.8	±20%	0.230	0.200	1,900	2,200	1,600	1,800	1
LLDND4040MKT100MM	MDMK4040T100MM	RoHS	10	±20%	0.330	0.280	1,700	2,000	1,400	1,600	1

## ● 4040WK type 【Thickness: 2.0mm max.】

New part number	Old part number (for reference)	EHS	Nominal inductance [ $\mu$ H]	Inductance tolerance	DC Resistance[ $\Omega$ ]		Rated current ※) [mA]				Measuring frequency [MHz]
							Saturation current: Idc1		Temperature rise current: Idc2		
					Max.	Typ.	Max.	Typ.	Max.	Typ.	
LLDND4040WKTR33NM	MDWK4040TR33NM	RoHS	0.33	±30%	0.013	0.011	16,000	21,000	7,800	8,800	1
LLDND4040WKTR47NM	MDWK4040TR47NM	RoHS	0.47	±30%	0.013	0.011	10,000	15,000	7,800	8,800	1
LLDND4040WKTR56NM	MDWK4040TR56NM	RoHS	0.56	±30%	0.016	0.014	9,000	13,000	6,500	7,500	1
LLDND4040WKTR68MM	MDWK4040TR68MM	RoHS	0.68	±20%	0.016	0.014	8,000	12,000	7,300	8,300	1
LLDND4040WKT1R0MM	MDWK4040T1R0MM	RoHS	1.0	±20%	0.027	0.023	7,000	9,400	5,100	5,800	1
LLDND4040WKT1R5MM	MDWK4040T1R5MM	RoHS	1.5	±20%	0.041	0.035	7,000	9,400	4,100	4,700	1
LLDND4040WKT2R2MM	MDWK4040T2R2MM	RoHS	2.2	±20%	0.054	0.047	5,400	7,500	3,500	4,000	1
LLDND4040WKT3R3MM	MDWK4040T3R3MM	RoHS	3.3	±20%	0.075	0.066	3,700	5,200	3,000	3,300	1
LLDND4040WKT4R7MM	MDWK4040T4R7MM	RoHS	4.7	±20%	0.107	0.093	3,500	5,000	2,500	2,800	1
LLDND4040WKT6R8MM	MDWK4040T6R8MM	RoHS	6.8	±20%	0.158	0.138	2,900	4,000	2,000	2,300	1
LLDND4040WKT100MM	MDWK4040T100MM	RoHS	10	±20%	0.194	0.169	2,200	3,100	1,600	1,900	1
LLDND4040WKT220MM	MDWK4040T220MM	RoHS	22	±20%	0.460	0.400	1,500	2,100	1,200	1,400	1
LLDND4040WKT330MM	MDWK4040T330MM	RoHS	33	±20%	0.720	0.625	1,200	1,700	800	1,000	1

## ● 5050PK type 【Thickness: 1.4mm max.】

New part number	Old part number (for reference)	EHS	Nominal inductance [ $\mu$ H]	Inductance tolerance	DC Resistance[ $\Omega$ ]		Rated current ※) [mA]				Measuring frequency [MHz]
							Saturation current: Idc1		Temperature rise current: Idc2		
					Max.	Typ.	Max.	Typ.	Max.	Typ.	
LLDND5050PKT1R0MM	MDPK5050T1R0MM	RoHS	1.0	±20%	0.040	0.034	8,500	10,000	4,300	4,700	1
LLDND5050PKT2R2MM	MDPK5050T2R2MM	RoHS	2.2	±20%	0.055	0.047	4,100	5,000	3,600	4,200	1
LLDND5050PKT3R3MM	MDPK5050T3R3MM	RoHS	3.3	±20%	0.086	0.073	3,800	4,500	2,900	3,400	1
LLDND5050PKT4R7MM	MDPK5050T4R7MM	RoHS	4.7	±20%	0.102	0.088	3,500	4,200	2,500	3,000	1
LLDND5050PKT6R8MM	MDPK5050T6R8MM	RoHS	6.8	±20%	0.138	0.12	2,700	3,200	2,200	2,500	1
LLDND5050PKT100MM	MDPK5050T100MM	RoHS	10	±20%	0.225	0.19	2,200	2,600	1,700	2,000	1

※) 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) 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.



# Wire-wound Metal Power Inductors MCOIL™ LSDN/LCDN/LBDN/LLDN/LMDN series

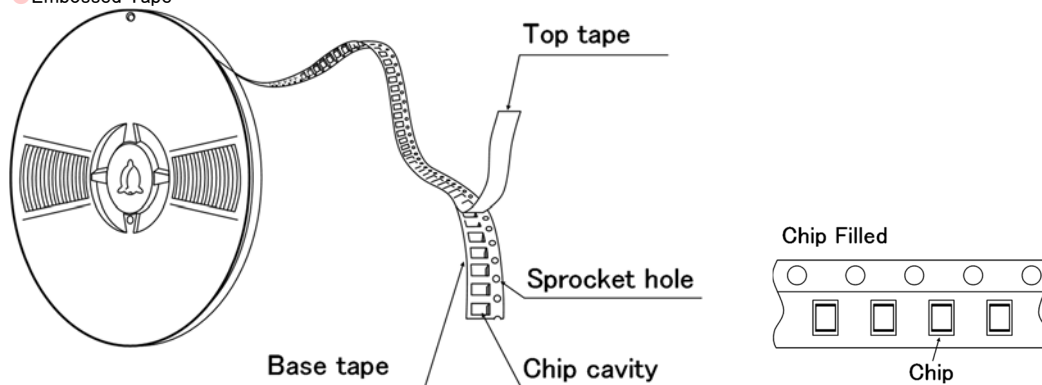
## PACKAGING

### ① Minimum Quantity

Type	Standard Quantity [pcs]
	Tape & Reel
1616KK	2500
2020JE	2500
2020KK	
2020MK	
3030KK	2000
3030MK	
4040JE	1000
4040MK	
4040WK	700
5050PK	1000

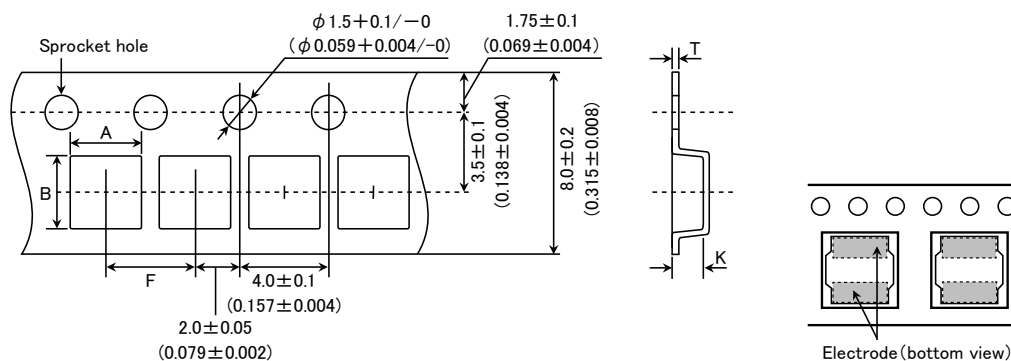
### ② Tape Material

#### ● Embossed Tape



### ③ Taping dimensions

#### ● Embossed tape 8mm wide (0.315 inches wide)

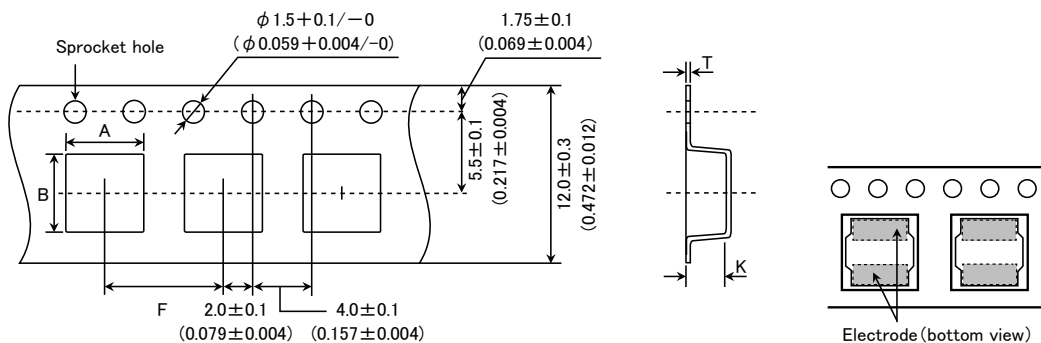


Type	Chip cavity		Insertion pitch	Tape thickness	
	A	B	F	T	K
1616KK	$1.79 \pm 0.1$ ( $0.071 \pm 0.004$ )	$1.79 \pm 0.1$ ( $0.071 \pm 0.004$ )	$4.0 \pm 0.1$ ( $0.157 \pm 0.004$ )	$0.25 \pm 0.05$ ( $0.010 \pm 0.002$ )	$1.1 \pm 0.1$ ( $0.043 \pm 0.004$ )
2020JE	$2.2 \pm 0.1$ ( $0.102 \pm 0.004$ )	$2.2 \pm 0.1$ ( $0.102 \pm 0.004$ )	$4.0 \pm 0.1$ ( $0.157 \pm 0.004$ )	$0.25 \pm 0.05$ ( $0.009 \pm 0.002$ )	$1.3 \pm 0.1$ ( $0.051 \pm 0.004$ )
2020KK					
2020MK					
3030KK	$3.2 \pm 0.1$ ( $0.126 \pm 0.004$ )	$3.2 \pm 0.1$ ( $0.126 \pm 0.004$ )	$4.0 \pm 0.1$ ( $0.157 \pm 0.004$ )	$0.3 \pm 0.05$ ( $0.012 \pm 0.002$ )	$1.4 \pm 0.1$ ( $0.055 \pm 0.004$ )
3030MK					

Unit : mm (inch)



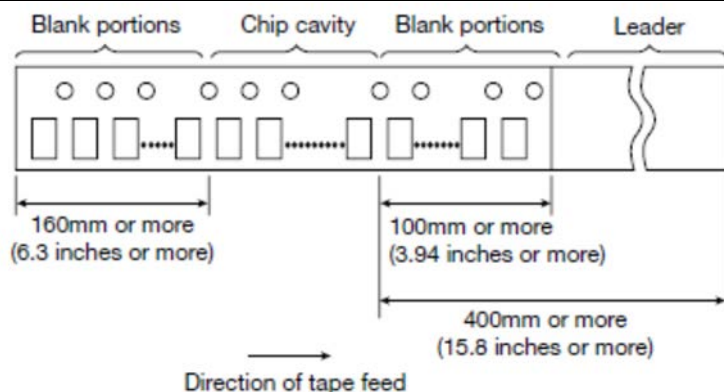
● Embossed tape 12mm wide (0.47 inches wide)



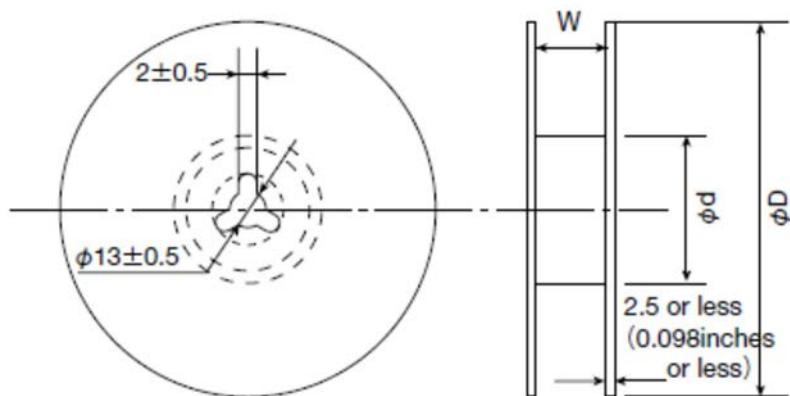
Type	Chip cavity		Insertion pitch	Tape thickness	
	A	B		T	K
4040JE	$4.3 \pm 0.1$ ( $0.169 \pm 0.004$ )	$4.3 \pm 0.1$ ( $0.169 \pm 0.004$ )	$8.0 \pm 0.1$ ( $0.315 \pm 0.004$ )	$0.3 \pm 0.05$ ( $0.012 \pm 0.002$ )	$1.6 \pm 0.1$ ( $0.063 \pm 0.004$ )
4040MK	$4.3 \pm 0.1$ ( $0.169 \pm 0.004$ )	$4.3 \pm 0.1$ ( $0.169 \pm 0.004$ )	$8.0 \pm 0.1$ ( $0.315 \pm 0.004$ )	$0.3 \pm 0.05$ ( $0.012 \pm 0.002$ )	$2.3 \pm 0.1$ ( $0.091 \pm 0.004$ )
5050PK	$5.25 \pm 0.1$ ( $0.207 \pm 0.004$ )	$5.25 \pm 0.1$ ( $0.207 \pm 0.004$ )	$8.0 \pm 0.1$ ( $0.315 \pm 0.004$ )	$0.3 \pm 0.1$ ( $0.012 \pm 0.004$ )	$1.6 \pm 0.1$ ( $0.063 \pm 0.004$ )

Unit: mm (inch)

#### ④ Leader and Blank portion



## ⑤ Reel size



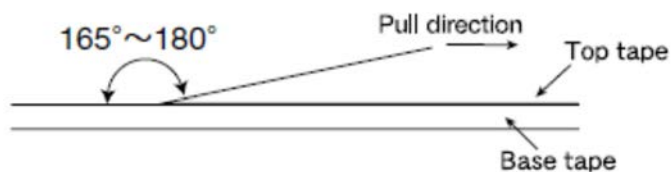
Type	Reel size (Reference values)		
	$\phi D$	$\phi d$	W
1616KK	$180 \pm 0.5$ ( $7.087 \pm 0.019$ )	$60 \pm 1.0$ ( $2.36 \pm 0.04$ )	$10.0 \pm 1.5$ ( $0.394 \pm 0.059$ )
2020JE			
2020KK			
2020MK			
3030KK	$180 \pm 3.0$ ( $7.087 \pm 0.118$ )	$60 \pm 2.0$ ( $2.36 \pm 0.08$ )	$14.0 \pm 1.5$ ( $0.551 \pm 0.059$ )
3030MK			
4040JE			
4040MK			
4040WK	$180 \pm 3.0$ ( $7.087 \pm 0.118$ )	$60 \pm 2.0$ ( $2.36 \pm 0.08$ )	$14.0 \pm 1.5$ ( $0.551 \pm 0.059$ )
5050PK			

Unit: mm (inch)

## ⑥ Top Tape Strength

Top tape strength

Type	Peel-off strength
MDKK1616	0.1N~1.0N
MDJE2020	
MDKK2020	
MDMK2020	
MDKK3030	
MDMK3030	0.1N~1.3N
MDJE4040	
MDMK4040	
MDWK4040	
MDPK5050	



**Wire-wound Metal Power Inductors MCOIL™ LSDN series**  
**for General Electronic Equipment for Consumer**  
**Wire-wound Metal Power Inductors MCOIL™ LLDN series**  
**for Medical Devices classified as GHTF Classes A or B (Japan Classes I or II)**

■ RELIABILITY DATA

1. Operating Temperature Range

Specified Value	−40~+125°C
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 condition : Please see item list.

5. DC Resistance

Specified Value	Within the specified tolerance
Test Methods and Remarks	Measuring equipment : DC ohmmeter (HIOKI 3227 or equivalent)

6. Self resonance frequency

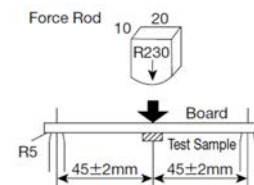
Specified Value	—
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7. Temperature characteristic

Specified Value	Inductance change : Within $\pm 10\%$
Test Methods and Remarks	Measurement of inductance shall be taken at temperature range within $-40^{\circ}\text{C} \sim +125^{\circ}\text{C}$ . With reference to inductance value at $+20^{\circ}\text{C}$ ., change rate shall be calculated.

8. Resistance to flexure of substrate

Specified Value	No damage
Test Methods and Remarks	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. Test board size : $100 \times 40 \times 1.0$ mm Test board material : Glass epoxy-resin Solder cream thickness : 0.10 mm



9. Insulation resistance : between wires

Specified Value	—
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10. Insulation resistance : between wire and core

Specified Value	—
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11. Withstanding voltage : between wire and core																				
Specified Value	—																			
12. Adhesion of terminal electrode																				
Specified Value	Shall not come off PC board																			
Test Methods and Remarks	The test samples shall be soldered to the test board by the reflow. Applied force : 10N to X and Y directions. Duration : 5s. Solder cream thickness : 0.10mm.																			
13. Resistance to vibration																				
Specified Value	Inductance change : Within ±10% No significant abnormality in appearance.																			
Test Methods and Remarks	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">10~55Hz</td></tr><tr><td>Total Amplitude</td><td colspan="2">1.5mm (May not exceed acceleration 196m/s²)</td></tr><tr><td>Sweeping Method</td><td colspan="2">10Hz to 55Hz to 10Hz for 1min.</td></tr><tr><td rowspan="3">Time</td><td>X</td><td rowspan="3">For 2 hours on each X, Y, and Z axis.</td></tr><tr><td>Y</td></tr><tr><td>Z</td></tr></table> Recovery : At least 2hrs of recovery under the standard condition after the test, followed by the measurement within 48hrs.		Frequency Range	10~55Hz		Total Amplitude	1.5mm (May not exceed acceleration 196m/s²)		Sweeping Method	10Hz to 55Hz to 10Hz for 1min.		Time	X	For 2 hours on each X, Y, and Z axis.	Y	Z				
Frequency Range	10~55Hz																			
Total Amplitude	1.5mm (May not exceed acceleration 196m/s²)																			
Sweeping Method	10Hz to 55Hz to 10Hz for 1min.																			
Time	X	For 2 hours on each X, Y, and Z axis.																		
	Y																			
	Z																			
14. Solderability																				
Specified Value	At least 90% of surface of terminal electrode is covered by new solder.																			
Test Methods and Remarks	The test samples shall be dipped in flux, and then immersed in molten solder as shown in below table. Flux : Ethanol solution containing rosin 25%. <table><tr><td>Solder Temperature</td><td>245±5℃</td></tr><tr><td>Time</td><td>5±1.0 sec.</td></tr></table> ※Immersion depth : All sides of mounting terminal shall be immersed.		Solder Temperature	245±5℃	Time	5±1.0 sec.														
Solder Temperature	245±5℃																			
Time	5±1.0 sec.																			
15. Resistance to soldering heat																				
Specified Value	Inductance change : Within ±10% No significant abnormality in appearance.																			
Test Methods and Remarks	The test sample shall be exposed to reflow oven at 230±5℃ for 40 seconds, with peak temperature at 260±5℃ for 5 seconds, 2 times. Test board material : Glass epoxy-resin Test board thickness : 1.0mm																			
16. Thermal shock																				
Specified Value	Inductance change : Within ±10% No significant abnormality in appearance.																			
Test Methods and Remarks	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 step 1 to step 4 as shown in below table in sequence. The temperature cycle shall be repeated 100 cycles. <table><tr><td colspan="3">Conditions of 1 cycle</td></tr><tr><td>Step</td><td>Temperature (℃)</td><td>Duration (min)</td></tr><tr><td>1</td><td>－40±3</td><td>30±3</td></tr><tr><td>2</td><td>Room temperature</td><td>Within 3</td></tr><tr><td>3</td><td>+85±2</td><td>30±3</td></tr><tr><td>4</td><td>Room temperature</td><td>Within 3</td></tr></table>		Conditions of 1 cycle			Step	Temperature (℃)	Duration (min)	1	－40±3	30±3	2	Room temperature	Within 3	3	+85±2	30±3	4	Room temperature	Within 3
Conditions of 1 cycle																				
Step	Temperature (℃)	Duration (min)																		
1	－40±3	30±3																		
2	Room temperature	Within 3																		
3	+85±2	30±3																		
4	Room temperature	Within 3																		
17. Damp heat																				
Specified Value	Inductance change : Within ±10% No significant abnormality in appearance.																			
Test Methods and Remarks	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. <table><tr><td>Temperature</td><td>60±2℃</td></tr><tr><td>Humidity</td><td>90~95%RH</td></tr><tr><td>Time</td><td>500+24/－0 hour</td></tr></table>		Temperature	60±2℃	Humidity	90~95%RH	Time	500+24/－0 hour												
Temperature	60±2℃																			
Humidity	90~95%RH																			
Time	500+24/－0 hour																			

18. Loading under damp heat		
Specified Value	Inductance change : Within $\pm 10\%$ No significant abnormality in appearance.	
Test Methods and Remarks	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 and applied the rated current continuously as shown in below table.	
	Temperature	$60\pm 2^{\circ}\text{C}$
	Humidity	$90\sim 95\%\text{RH}$
	Applied current	Rated current
	Time	$500+24/-0$ hour
19. Low temperature life test		
Specified Value	Inductance change : Within $\pm 10\%$ No significant abnormality in appearance.	
Test Methods and Remarks	The test samples shall be soldered to the test board by the reflow. After that, the test samples shall be placed at test conditions as shown in below table.	
	Temperature	$-40\pm 2^{\circ}\text{C}$
	Time	$500+24/-0$ hour
20. High temperature life test		
Specified Value	—	
21. Loading at high temperature life test		
Specified Value	Inductance change : Within $\pm 10\%$ No significant abnormality in appearance.	
Test Methods and Remarks	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 applied the rated current continuously as shown in below table.	
	Temperature	$85\pm 2^{\circ}\text{C}$
	Applied current	Rated current
	Time	$500+24/-0$ hour
22. Standard condition		
Specified Value	Standard test condition :	
	Unless otherwise specified, temperature is $20\pm 15^{\circ}\text{C}$ and $65\pm 20\%$ of relative humidity.	
	When there is any question concerning measurement result: In order to provide correlation data, the test shall be condition of $20\pm 2^{\circ}\text{C}$ of temperature, $65\pm 5\%$ relative humidity.	
	Inductance is in accordance with our measured value.	

# Wire-wound Metal Power Inductors MCOIL™ LSDN/LCDN/LBDN/LLDN/LMDN series

## ■ 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

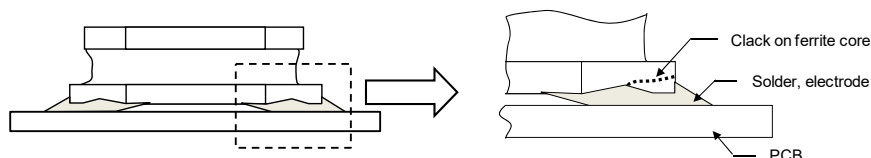
- ◆ Land pattern design
  1. Please refer to a recommended land pattern.
  2. There is stress, which has been caused by distortion of a PCB, to the inductor.
  3. Please consider the arrangement of parts on a PCB.

#### Technical considerations

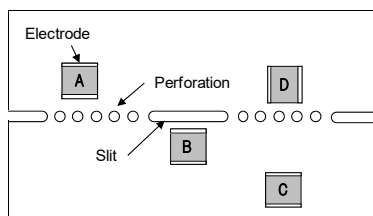
- ◆ Land pattern design
 

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.
  4. As coefficients of thermal expansion between an inductor and a PCB differs, cracks may occur on a 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.

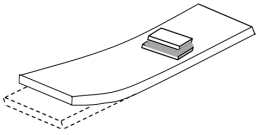
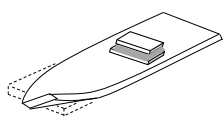


5. SMD inductors should be located to minimize any possible mechanical stresses from board warp or deflection. When splitting the PCB board after mounting inductors and other components, care is required so as not to give any stresses of deflection or twisting to the board.

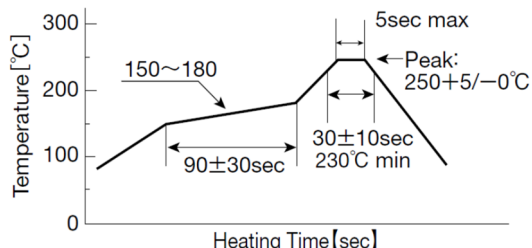


A product tends to undergo stress in order "A>C>B≡D".  
Please consider the layouts of a product to minimize any stresses.

### 3. Considerations for automatic placement

Precautions	<p>◆Adjustment of mounting machine</p> <ol style="list-style-type: none"> <li>1. Excessive impact load should not be imposed on the products when mounting onto the PC boards.</li> <li>2. Mounting and soldering conditions should be checked beforehand.</li> </ol>
Technical considerations	<p>◆Adjustment of mounting machine</p> <ol style="list-style-type: none"> <li>1. When installing products, care should be taken not to apply distortion stress as it may deform the products.</li> <li>2. 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> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p>&lt;Wrap&gt;</p>  </div> <div style="text-align: center;"> <p>&lt;Twist&gt;</p>  </div> </div>

### 4. Soldering

Precautions	<p>◆Reflow soldering</p> <ol style="list-style-type: none"> <li>1. Please contact any of our offices for a reflow soldering, and refer to the recommended condition specified.</li> <li>2. The product shall be used reflow soldering only.</li> <li>3. 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>1. When using products with lead free soldering, we request to use them after confirming adhesion, temperature of resistance to soldering heat, soldering etc sufficiently.</li> </ol>
Technical considerations	<p>◆Reflow soldering</p> <ol style="list-style-type: none"> <li>1. If products are used beyond the range of the recommended conditions, heat stresses may deform the products, and consequently degrade the reliability of the products.</li> </ol> <p>Recommended reflow condition (Pb free solder)</p> 

### 5. Cleaning

Precautions	<p>◆Cleaning conditions</p> <ol style="list-style-type: none"> <li>1. Washing by supersonic waves shall be avoided.</li> </ol>
Technical considerations	<p>◆Cleaning conditions</p> <ol style="list-style-type: none"> <li>1. If washed by supersonic waves, the products might be broken.</li> </ol>



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> <li>◆Board mounting               <ol style="list-style-type: none"> <li>1. There shall be no pattern or via between terminals at the bottom of product.</li> <li>2. Components which are located in peripheral of product shall not make contact with surface (top, side) of product.</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> <li>◆Board mounting               <ol style="list-style-type: none"> <li>1. If there is pattern or via between terminals at the bottom of product, it may cause characteristics change.</li> <li>2. If components which are located in peripheral of product make contact with surface (top, side) of product, it may cause damage or characteristics change.</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.</li> </ul> </li> </ol> </li> </ul> <p style="margin-left: 40px;">For this reason, product should be used within 6 months from the time of delivery.</p> <p style="margin-left: 40px;">In case of storage over 6 months, solderability shall be checked before actual usage.</p>
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>