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 *3
	Equipment *1	Category (Part Number Code *2)	
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 *4	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 *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.

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Multilayer Metal Power Inductors MCOIL™ LSCN series for General Electronic Equipment for Consumer

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℃(Including self-generated heat)

L	S	C	N	A	2	0	1	2	H	K	T	1	R	0	M	
①				②	③				④		⑤	⑥			⑦	⑧

①Series

Code (1)(2)(3)(4)	
LSCN	Multilayer Metal Power Inductor for General Electronic Equipment for Consumer

(1) Product Group

Code	
L	Inductors

(2) Category

Code	Recommended equipment	Quality Grade
S	General Electronic Equipment for Consumer	3

(3) Type

Code	
C	Metal Multilayer

(4) Features, Characteristics

Code	
N	Standard Power choke

②Features

Code	Feature
A	L-shape electrode
B	L-shape electrode with polarity marking
D	Bottom electrode with polarity marking
E	5-surface electrode

③Dimensions (L×W)

Code	Type (inch)	Dimensions (L×W) [mm]
1005	1005(0402)	1.0×0.5
1210	1210(0504)	1.25×1.05
1412	1412(0505)	1.4×1.2
1608	1608(0603)	1.6×0.8
2012	2012(0805)	2.0×1.25
2016	2016(0806)	2.0×1.6

④Thickness

Code	Thickness [mm]
EK	0.50 max
EE	0.55 max
FK	0.60 max
FE	0.65 max
HK	0.80 max
KK	1.0 max

⑤Packaging

Code	Packaging
T	Taping

⑥Nominal inductance

Code (example)	Nominal inductance [μH]
R24	0.24
R47	0.47
1R0	1.0

※R=Decimal point

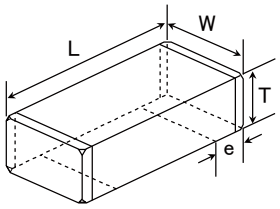
⑦Inductance tolerance

Code	Inductance tolerance
M	±20%

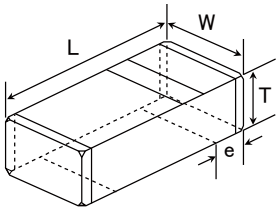
⑧Internal code

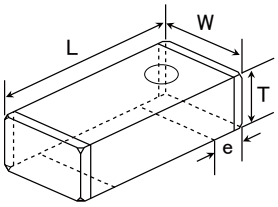
■STANDARD EXTERNAL DIMENSIONS / STANDARD QUANTITY

L-shape electrode

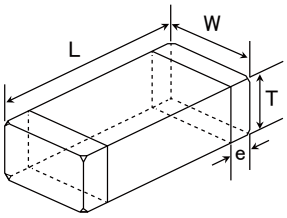


L-shape electrode with polarity marking

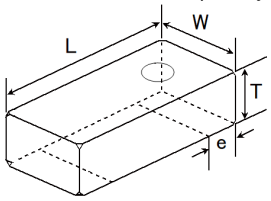




5-surface electrode



Bottom electrode with polarity marking



Type	L	W	T	e	Standard quantity[pcs]	
					Paper tape	Embossed tape
1005EE (0402)	1.0±0.2 (0.039±0.008)	0.5±0.2 (0.020±0.008)	0.55 max (0.022 max)	0.25±0.15 (0.010±0.006)	10000	—
1210EK (0504)	1.25±0.1 (0.049±0.004)	1.05±0.1 (0.041±0.004)	0.50 max (0.020 max)	0.30±0.2 (0.012±0.008)	5000	—
1412FE (0505)	1.4±0.2 (0.055±0.008)	1.2±0.2 (0.047±0.008)	0.65 max (0.026 max)	0.50±0.2 (0.02±0.008)	4000	—
1608FK (0603)	1.6±0.2 (0.063±0.008)	0.8±0.2 (0.031±0.008)	0.60 max (0.024 max)	0.3±0.2 (0.012±0.008)	4000	—
1608FE (0603)	1.6±0.2 (0.063±0.008)	0.8±0.2 (0.031±0.008)	0.65 max (0.026 max)	0.3±0.2 (0.012±0.008)	4000	—
1608HK (0603)	1.6±0.2 (0.063±0.008)	0.8±0.2 (0.031±0.008)	0.80 max (0.031 max)	0.4±0.2 (0.016±0.008)	4000	—
1608KK (0603)	1.6±0.2 (0.063±0.008)	0.8±0.2 (0.031±0.008)	1.0 max (0.039 max)	0.3±0.2 (0.012±0.008)	–	3000
2012HK (0805)	2.0±0.2 (0.079±0.008)	1.25±0.2 (0.049±0.008)	0.80 max (0.031 max)	0.5±0.3 (0.02±0.012)	4000	—
2012KK (0805)	2.0±0.2 (0.079±0.008)	1.25±0.2 (0.049±0.008)	1.0 max (0.039 max)	0.5±0.3 (0.02±0.012)	—	3000
2016FE (0806)	2.0±0.2 (0.079±0.008)	1.6±0.2 (0.063±0.008)	0.65 max (0.026 max)	0.5±0.3 (0.02±0.012)	4000	—

Unit : mm (inch)

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■PART NUMBER

●1005 type

New part number	Old part number (for reference)	EHS	Nominal inductance [μH]	Inductance tolerance	DC Resistance [mΩ]		Rated current(Idc1) [A] (max.)	Rated current(Idc2) [A] (max.)	Measuring frequency [MHz]	Thickness [mm] (max.)
					(max.)	(typ.)				
LSCNB1005EETR10MB	MCEE1005TR10MHN	RoHS	0.10	±20%	50	41	2.0	2.0	1	0.55
LSCNB1005EETR22MB	MCEE1005TR22MHN	RoHS	0.22	±20%	80	65	1.6	1.6	1	0.55
LSCNB1005EETR47MB	MCEE1005TR47MHN	RoHS	0.47	±20%	140	114	1.2	1.2	1	0.55
LSCNB1005EET1R0MB	MCEE1005T1R0MHN	RoHS	1.0	±20%	300	244	1.0	0.8	1	0.55

●1210 type

New part number	Old part number (for reference)	EHS	Nominal inductance [μH]	Inductance tolerance	DC Resistance [mΩ]		Rated current(Idc1) [A] (max.)	Rated current(Idc2) [A] (max.)	Measuring frequency [MHz]	Thickness [mm] (max.)
					(max.)	(typ.)				
LSCNB1210EKTR47MB	MCEK1210TR47MHN	RoHS	0.47	±20%	82	70	2.3	1.6	1	0.50
LSCNB1210EKT1R0MB	MCEK1210T1R0MHN	RoHS	1.0	±20%	179	157	1.5	1.1	1	0.50
LSCNB1210EKT1R5MB	MCEK1210T1R5MHN	RoHS	1.5	±20%	240	200	1.2	0.9	1	0.50

●1412 type

New part number	Old part number (for reference)	EHS	Nominal inductance [μH]	Inductance tolerance	DC Resistance [mΩ]		Rated current(Idc1) [A] (max.)	Rated current(Idc2) [A] (max.)	Measuring frequency [MHz]	Thickness [mm] (max.)
					(max.)	(typ.)				
LSCND1412FETR33MC	MCFE1412TR33MJB	RoHS	0.33	±20%	32	29	5.0	3.7	1	0.65
LSCND1412FETR47MC	MCFE1412TR47MJB	RoHS	0.47	±20%	42	39	3.0	3.1	1	0.65

●1608 type

New part number	Old part number (for reference)	EHS	Nominal inductance [μH]	Inductance tolerance	DC Resistance [mΩ]		Rated current(Idc1) [A] (max.)	Rated current(Idc2) [A] (max.)	Measuring frequency [MHz]	Thickness [mm] (max.)
					(max.)	(typ.)				
LSCNA1608FKTR24MA	MCFK1608TR24M	RoHS	0.24	±20%	50	40	2.3	2.1	1	0.60
LSCNA1608FKTR47MA	MCFK1608TR47M	RoHS	0.47	±20%	85	69	1.9	1.6	1	0.60
LSCNA1608FKT1R0MA	MCFK1608T1R0M	RoHS	1.0	±20%	224	182	1.5	0.9	1	0.60
LSCNE1608FETR24MA	MCFE1608TR24MG	RoHS	0.24	±20%	100	75	2.6	1.5	1	0.65
LSCNE1608FETR47MA	MCFE1608TR47MG	RoHS	0.47	±20%	150	114	2.0	1.2	1	0.65
LSCNE1608FET1R0MA	MCFE1608T1R0MG	RoHS	1.0	±20%	340	270	1.4	0.8	1	0.65
LSCNB1608HKTR24MD	MCHK1608TR24MKN	RoHS	0.24	±20%	24	20	4.3	3.7	1	0.80
LSCNB1608HKTR47MD	MCHK1608TR47MKN	RoHS	0.47	±20%	43	38	3.3	2.7	1	0.80
LSCNB1608HKTR56MD	MCHK1608TR56MKN	RoHS	0.56	±20%	55	45	2.7	2.6	1	0.80
LSCNB1608HKT1R0MD	MCHK1608T1R0MKN	RoHS	1.0	±20%	110	89	2.2	1.6	1	0.80
LSCNB1608HKT1R5MD	MCHK1608T1R5MKN	RoHS	1.5	±20%	200	160	1.7	1.3	1	0.80
LSCNB1608HKT2R2MD	MCHK1608T2R2MKN	RoHS	2.2	±20%	292	237	1.5	1.2	1	0.80
LSCNB1608KKTR24MA	MCKK1608TR24M N	RoHS	0.24	±20%	38	35	2.8	2.6	1	1.00
LSCNB1608KKTR47MA	MCKK1608TR47M N	RoHS	0.47	±20%	55	44	2.4	2.0	1	1.00
LSCNB1608KKT1R0MA	MCKK1608T1R0M N	RoHS	1.0	±20%	123	100	2.0	1.3	1	1.00

●2012 type

New part number	Old part number (for reference)	EHS	Nominal inductance [μH]	Inductance tolerance	DC Resistance [mΩ]		Rated current(Idc1) [A] (max.)	Rated current(Idc2) [A] (max.)	Measuring frequency [MHz]	Thickness [mm] (max.)
					(max.)	(typ.)				
LSCNA2012HKTR24MA	MCHK2012TR24M	RoHS	0.24	±20%	24	19	4.32	3.60	1	0.80
LSCNA2012HKTR47MA	MCHK2012TR47M	RoHS	0.47	±20%	36	30	3.21	3.15	1	0.80
LSCNA2012HKT1R0MA	MCHK2012T1R0M	RoHS	1.0	±20%	111	90	2.26	1.47	1	0.80
LSCNA2012KKTR24MA	MCKK2012TR24M	RoHS	0.24	±20%	25	20	6.2	4.0	1	1.00
LSCNA2012KKTR47MA	MCKK2012TR47M	RoHS	0.47	±20%	39	32	4.5	3.1	1	1.00
LSCNA2012KKT1R0MA	MCKK2012T1R0M	RoHS	1.0	±20%	90	73	3.6	2.1	1	1.00
LSCNE2012HKTR11MD	MCHK2012TR11MKG	RoHS	0.11	±20%	12	9.1	6.9	5.8	1	0.80
LSCNE2012HKTR24MD	MCHK2012TR24MKG	RoHS	0.24	±20%	17	14	6.0	4.8	1	0.80
LSCNE2012HKTR47MD	MCHK2012TR47MKG	RoHS	0.47	±20%	32	26	4.8	4.0	1	0.80
LSCND2012HKTR47MD	MCHK2012TR47MKB	RoHS	0.47	±20%	26	21	4.8	4.0	1	0.80

●2016 type

New part number	Old part number (for reference)	EHS	Nominal inductance [μH]	Inductance tolerance	DC Resistance [mΩ]		Rated current(Idc1) [A] (max.)	Rated current(Idc2) [A] (max.)	Measuring frequency [MHz]	Thickness [mm] (max.)
					(max.)	(typ.)				
LSCNE2016FETR47MCB	MCFE2016TR47MJG B	RoHS	0.47	±20%	45	40	4.0	3.2	1	0.65
LSCNE2016FETR68MCB	MCFE2016TR68MJG B	RoHS	0.68	±20%	60	50	3.0	2.5	1	0.65
LSCNE2016FET1R0MCB	MCFE2016T1R0MJG B	RoHS	1.0	±20%	70	60	2.8	2.3	1	0.65

※Idc1 is the DC value at which the initial L value is decreased within 30% by the application of DC bias. (at 20℃)
※Idc2 is the DC value at which the temperature of element is increased within 40℃ by the application of DC bias. (at 20℃)

■PACKAGING

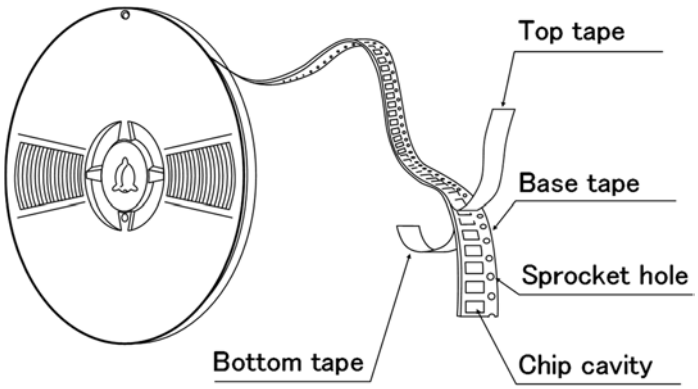
①Minimum Quantity

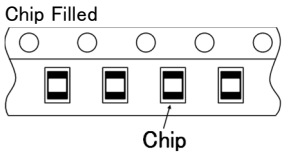
●Tape & Reel Packaging

Type	Thickness		Standard Quantity [pcs]	
	Code	mm (inch)	Paper Tape	Embossed Tape
1005 (0402)	EE	0.55 max (0.022 max)	10000	—
1210 (0504)	EK	0.5 max (0.020 max)	5000	—
1412 (0505)	FE	0.65 max (0.026 max)	4000	—
1608 (0603)	FK	0.6 max (0.024 max)	4000	—
1608 (0603)	FE	0.65 max (0.026 max)	4000	—
1608 (0603)	HK	0.8 max (0.031 max)	4000	—
1608 (0603)	KK	1.0 max (0.039 max)	–	3000
2012 (0806)	HK	0.8 max (0.031 max)	4000	—
2012 (0805)	KK	1.0 max (0.039 max)	–	3000
2016 (0806)	FE	0.65 max (0.026 max)	4000	—

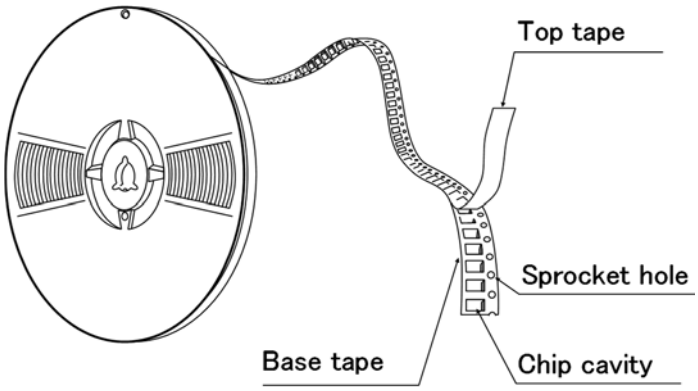
②Taping material

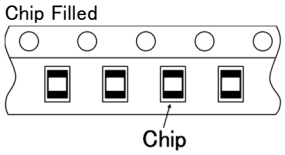
●Card board carrier tape 1005/1210/1412/1608/2012/2016 type





●Embossed Tape 1608/2012 type

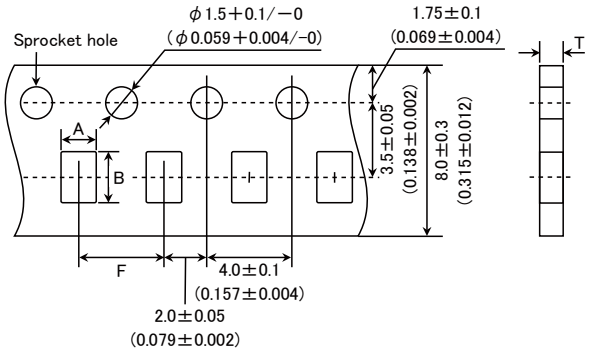




③Taping Dimensions

Paper tape (8mm wide)

Unit : mm (inch)

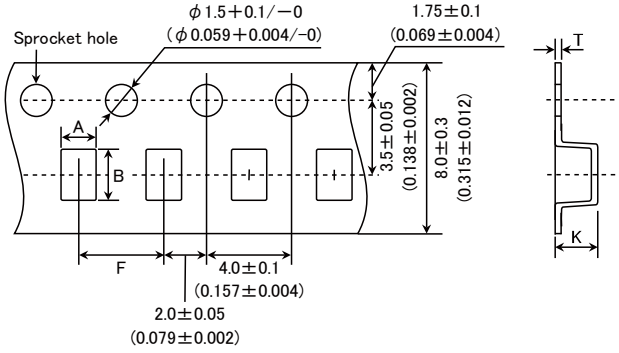


Type	Thickness		Chip cavity		Insertion Pitch	Tape Thickness
	Code	mm (inch)	A	B	F	T
1005 (0402)	EE	0.55 max (0.021 max)	0.8 (0.031)	1.3 (0.051)	2.0±0.05 (0.079±0.002)	0.64max (0.025max)
1210 (0504)	EK	0.5 max (0.020 max)	1.3 (0.051)	1.55 (0.061)	4.0±0.1 (0.157±0.004)	0.64max (0.025max)
1412 (0505)	FE	0.65 max (0.026 max)	1.6 (0.063)	1.8 (0.071)	4.0±0.1 (0.157±0.004)	0.72max (0.028max)
1608 (0603)	FK	0.6 max (0.024 max)	1.1 (0.043)	1.9 (0.075)	4.0±0.1 (0.157±0.004)	0.72max (0.028max)
1608 (0603)	FE	0.65 max (0.026 max)	1.1 (0.043)	1.9 (0.075)	4.0±0.1 (0.157±0.004)	0.72max (0.028max)
1608 (0603)	HK	0.8 max (0.031 max)	1.2 (0.047)	2.0 (0.079)	4.0±0.1 (0.157±0.004)	0.9max (0.035max)
2012 (0805)	HK	0.8 max (0.031 max)	1.65 (0.065)	2.4 (0.094)	4.0±0.1 (0.157±0.004)	0.9max (0.035max)
2016 (0806)	FE	0.65 max (0.026 max)	1.95 (0.077)	2.3 (0.091)	4.0±0.1 (0.157±0.004)	0.72max (0.028max)

Unit : mm (inch)

Embossed Tape (8mm wide)

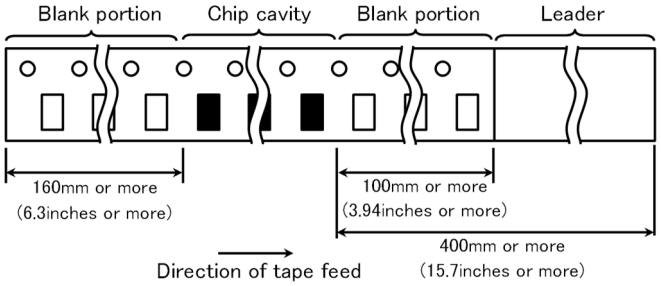
Unit : mm (inch)



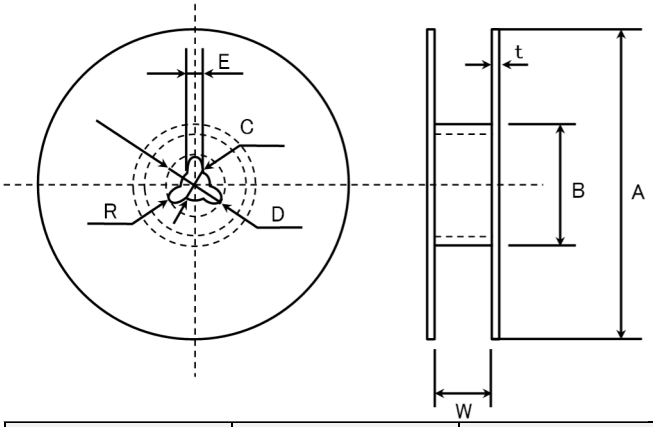
Type	Thickness		Chip cavity		Insertion Pitch	Tape Thickness	
	Code	mm (inch)	A	B	F	K	T
1608 (0603)	KK	1.0 max (0.039 max)	1.15 (0.045)	1.95 (0.077)	4.0±0.1 (0.157±0.004)	1.5 max (0.059 max)	0.3 max (0.012 max)
2012 (0805)	KK	1.0 max (0.039 max)	1.55 (0.061)	2.35 (0.093)	4.0±0.1 (0.157±0.004)	1.5 max (0.059 max)	0.3 max (0.012 max)

Unit : mm (inch)

④LEADER AND BLANK PORTION



⑤Reel Size



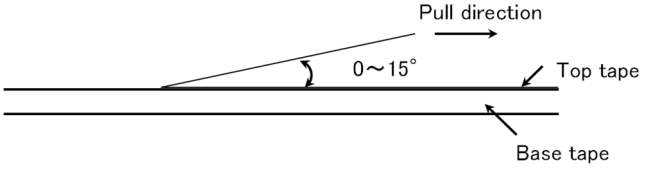
A	B	C	D	E	R
ϕ178±2.0	ϕ50 or more	ϕ13.0±0.2	ϕ21.0±0.8	2.0±0.5	1.0

	t	W
4mm width tape	1.5max.	5±1.0
8mm width tape	2.5max.	10±1.5

(Unit : mm)

⑥Top tape strength

The top tape requires a peel-off force of 0.1 to 1.0N in the direction of the arrow as illustrated below.



Multilayer Metal Power Inductors MCOIL™ LSCN series
for General Electronic Equipment for Consumer
Multilayer Metal Power Inductors MCOIL™ LLCN series
for Medical Devices classified as GHTF Classes A or B (Japan Classes I or II)

■RELIABILITY DATA

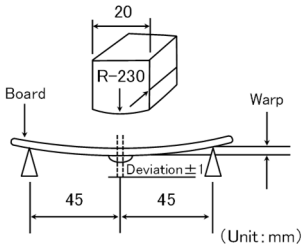
1. Operating Temperature Range	
Specified Value	−40～＋125℃(Including self-generated heat)

2. Storage Temperature Range	
Specified Value	−40～＋85℃

3. Rated Current	
Specified Value	Idc1: The decreasing-rate of inductance value is within 30 % Idc2: The temperature of the element is increased within 40℃

4. Inductance	
Specified Value	Refer to each specification.
Test Methods and Remarks	Measuring frequency : 1MHz Measuring equipment : E4991(or its equivalent)

5. DC Resistance	
Specified Value	Refer to each specification.
Test Methods and Remarks	Measuring equipment: HIOKI RM3545 (or its equivalent)

6. Resistance to Flexure of Substrate	
Specified Value	No mechanical damage.
Test Methods and Remarks	Warp : 2mm Testing board : glass epoxy-resin substrate Thickness : 0.8mm 

7. Solderability	
Specified Value	At least 90% of terminal electrode is covered by new solder.
Test Methods and Remarks	Solder temperature : 245±3℃ (Sn/3.0Ag/0.5Cu) Duration : 4±1 sec.

8. Resistance to Soldering	
Specified Value	Appearance: No significant abnormality Inductance change: Within ±10%
Test Methods and Remarks	Solder temperature : 260±5℃ Duration : 10±0.5 sec. Preheating temperature : 150 to 180℃ Preheating time : 3 min. Flux : Immersion into ethanol solution with colophony for 3 to 5 sec. Recovery : 2 to 3 hrs of recovery under the standard condition after the test.(See Note 1)

9. Thermal Shock	
Specified Value	Appearance: No significant abnormality Inductance change: Within ±10%
Test Methods and Remarks	Conditions for 1 cycle Step / temperature(℃) / time(min.) 1 / −40 +0/−3 / 30±3 2 / Room temperature / 2〜3 3 / +85 +3/−0 / 30±3 4 / Room temperature / 2〜3 Number of cycles: 100 Recovery: 2 to 3 hrs of recovery under the standard condition after the test.(See Note 1)

10. Damp Heat(Steady state)	
Specified Value	Appearance: No significant abnormality Inductance change: Within ±10%
Test Methods and Remarks	Temperature : 60±2℃ Humidity : 90 to 95%RH Duration : 500 +24/−0 hrs Recovery : 2 to 3 hrs of recovery under the standard condition after the removal from test chamber.(See Note 1)

11. Loading under Damp Heat	
Specified Value	Appearance: No significant abnormality Inductance change: Within ±10%
Test Methods and Remarks	Temperature : 60±2℃ Humidity : 90 to 95%RH Applied current : Idc2max Duration : 500 +24/−0 hrs Recovery : 2 to 3 hrs of recovery under the standard condition after the removal from test chamber.(See Note 1)

12. Loading at High Temperature	
Specified Value	Appearance: No significant abnormality Inductance change: Within ±10%
Test Methods and Remarks	Temperature : 85±2℃ Applied current : Idc2max Duration : 500 +24/−0 hrs Recovery : 2 to 3 hrs of recovery under the standard condition after the removal from test chamber. (See Note 1)

(Note 1) Measurement shall be made after 48±2 hrs of recovery under the standard condition.
"standard condition" referred to herein is defined as follows:
5 to 35℃ of temperature, 25 to 85% relative humidity.
When there are questions concerning measurement results:
In order to provide correlation data, the test shall be conducted under condition of 20±2℃ of temperature, 60 to 70% relative humidity, and 86 to 106kPa of air pressure. Unless otherwise specified, all the tests are conducted under the "standard condition."

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■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

◆Pattern configurations (Design of Land-patterns)

When inductors are mounted on a PCB, the size of land patterns and the amount of solder used (size of fillet) can directly affect inductor performance. Therefore, the following items must be carefully considered in the design of solder land patterns:

(1) The amount of solder applied can affect the ability of chips to withstand mechanical stresses which may lead to breaking or cracking. Therefore, when designing land-patterns it is necessary to consider the appropriate size and configuration of the solder pads which in turn determines the amount of solder necessary to form the fillets.

(2) When more than one part is jointly soldered onto the same land or pad, the pad must be designed so that each component's soldering point is separated by solder-resist.

◆Pattern configurations (Inductor layout on panelized[breakaway] PC boards)

After inductors have been mounted on the boards, chips can be subjected to mechanical stresses in subsequent manufacturing processes (PCB cutting, board inspection, mounting of additional parts, assembly into the chassis, wave soldering the reflow soldered boards etc.) For this reason, planning pattern configurations and the position of SMD inductors should be carefully performed to minimize stress.

Technical considerations

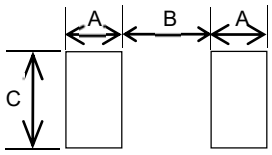
◆Pattern configurations (Design of Land-patterns)

The following diagrams and tables show some examples of recommended patterns to prevent excessive solder amounts. Examples of improper pattern designs are also shown.

(1) Recommended land dimensions for a typical chip inductor land patterns for PCBs

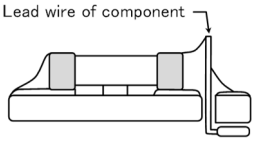
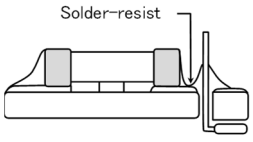
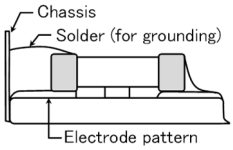
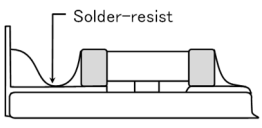
(Unit : mm)

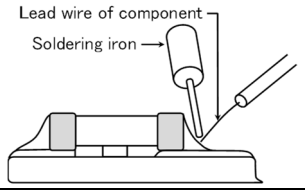
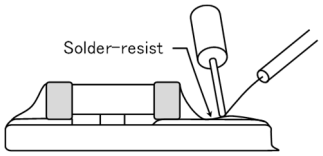
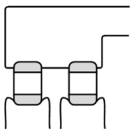
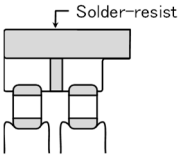
Type	1005	1210	1412	1608	2012	2016
A	0.4	0.45	0.55	0.45	0.5	0.7
B	0.5	0.6	0.4	1.0	1.2	0.8
C	0.7	1.15	1.3	1.0	1.45	1.8



Note: The values in the table above are representative. Recommended land dimensions are different by part numbers.

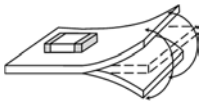
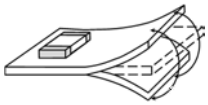
(2) Examples of good and bad solder application

Item	Not recommended	Recommended
Mixed mounting of SMD and leaded components		
Component placement close to the chassis		

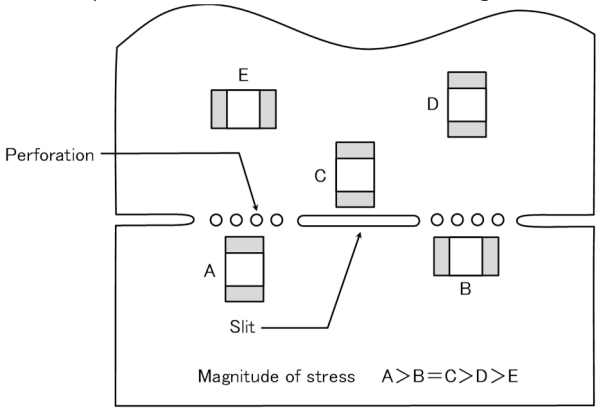
Hand-soldering of leaded components near mounted components		
Horizontal component placement		

◆Pattern configurations (Inductor layout on panelized[breakaway] PC boards)

1. The following are examples of good and bad inductor layout; SMD inductors should be located to minimize any possible mechanical stresses from board warp or deflection.

Item	Not recommended	Recommended
Deflection of the board		 Position the component at a right angle to the direction of the mechanical stresses that are anticipated.

2. To layout the inductors for the breakaway PC board, it should be noted that the amount of mechanical stresses given will vary depending on inductor layout.
   An example below should be counted for better design.



3. When breaking PC boards along their perforations, the amount of mechanical stress on the inductors can vary according to the method used. The following methods are listed in order from least stressful to most stressful: push-back, slit, V-grooving, and perforation. Thus, any ideal SMD inductor layout must also consider the PCB splitting procedure.

3. Considerations for automatic placement

Precautions

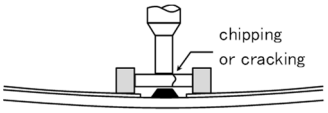
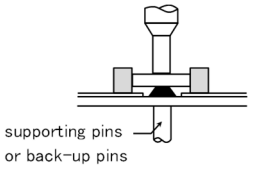
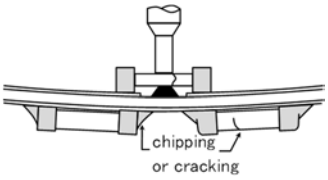
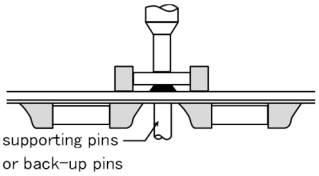
◆Adjustment of mounting machine

1. Excessive impact load should not be imposed on the inductors when mounting onto the PC boards.
2. The maintenance and inspection of the mounter should be conducted periodically.

Technical considerations

◆Adjustment of mounting machine

1. If the lower limit of the pick-up nozzle is low, too much force may be imposed on the inductors, causing damage. To avoid this, the following points should be considered before lowering the pick-up nozzle:
   (1) The lower limit of the pick-up nozzle should be adjusted to the surface level of the PC board after correcting for deflection of the board.
   (2) The pick-up pressure should be adjusted between 1 and 3N static loads.
   (3) To reduce the amount of deflection of the board caused by impact of the pick-up nozzle, supporting pins or back-up pins should be used under the PC board. The following diagrams show some typical examples of good pick-up nozzle placement:

Item	Improper method	Proper method
Single-sided mounting		
Double-sided mounting		

2. As the alignment pin wears out, adjustment of the nozzle height can cause chipping or cracking of the inductors because of mechanical impact on the inductors. To avoid this, the monitoring of the width between the alignment pin in the stopped position, and maintenance, inspection and replacement of the pin should be conducted periodically.

4. Soldering

Precautions

◆Reflow soldering

- Please contact any of our offices for a reflow soldering, and refer to the recommended condition specified.
- The product shall be used reflow soldering only.
- Please do not add any stress to a product until it returns in normal temperature after reflow soldering.

◆Lead free soldering

- When using products with lead free soldering, we request to use them after confirming adhesion, temperature of resistance to soldering heat, soldering etc sufficiently.

◆The conditions for Reworking with soldering irons

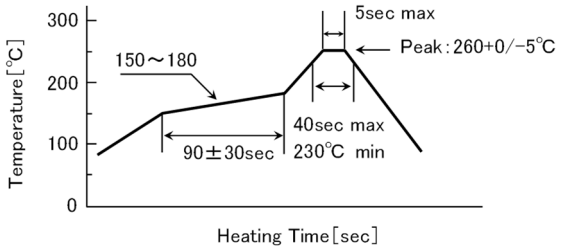
・Put the soldering iron on the land-pattern and don't touch it to the inductor directly.
Soldering iron's temperature below 350 ℃ , Duration 3 seconds or less

Technical considerations

◆Reflow soldering

- 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.

Recommended reflow condition (Pb free solder)



The allowable number of reflow soldering is 3 times.

5. Cleaning

Precautions

◆Cleaning conditions

- Washing by supersonic waves shall be avoided.

Technical considerations

◆Cleaning conditions

- If washed by supersonic waves, the products might be broken.

6. Resin coating and mold	
Precautions	1. With some type of resins a decomposition gas or chemical reaction vapor may remain inside the resin during the hardening period or while left under normal storage conditions resulting in the deterioration of the inductor's performance. 2. Thermal expansion and thermal shrinkage characteristics of resins may lead to the deterioration of inductors' performance. 3. When a resin hardening temperature is higher than inductor operating temperature, the stresses generated by the excessive heat may lead to damage in inductors. 4. In prior to use, please make the reliability evaluation with the product mounted in your application set.

7. Handling	
Precautions	◆Breakaway PC boards (splitting along perforations) 1. 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. 2. Board separation should not be done manually, but by using the appropriate devices. ◆General handling precautions ・Always wear static control bands to protect against ESD. ・ Keep the inductors away from all magnets and magnetic objects. ・ Use non-magnetic tweezers when handling inductors. ・ Any devices used with the inductors (soldering irons, measuring instruments) should be properly grounded. ・ Keep bare hands and metal products (i.e., metal desk) away from inductor electrodes or conductive areas that lead to chip electrodes. ・ Keep inductors away from items that generate magnetic fields such as speakers or coils. ◆Mechanical considerations Be careful not to subject the inductors to excessive mechanical shocks. (1) If inductors are dropped on the floor or a hard surface they should not be used. (2) When handling the mounted boards, be careful that the mounted components do not come in contact with or bump against other boards or components.

8. Storage conditions	
Precautions	◆Storage To maintain the solderability of terminal electrodes and to keep the packaging material in good condition, care must be taken to control temperature and humidity in the storage area. Humidity should especially be kept as low as possible. ・Recommended conditions Ambient temperature: 30℃ or below Humidity: 30% to 70% The ambient temperature must be kept −5℃ to +40℃. Even under ideal storage conditions, solderability of inductor is deteriorated as time passes, so inductors should be used within 6 months from the time of delivery. ・Inductor should be kept where no chlorine or sulfur exists in the air.
Technical considerations	◆Storage If the parts are stocked in 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. For this reason, components should be used within 6 months from the time of delivery. If exceeding the above period, please check solderability before using the inductors.