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 October 2019. 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 (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.

TAIYO YUDEN has the line-up of the products intended for use in automotive electronic equipment, telecommunications infrastructure and industrial equipment, or medical devices classified as GHTF Classes A to C (Japan Classes I to III). 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.

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, underwater work 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 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.

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.

METAL WIRE-WOUND CHIP POWER INDUCTORS (MCOIL™ ME SERIES)

REFLOW

■PARTS NUMBER

＊Operating Temp.:−40〜+125℃(Including self-generated heat)

M	E	K	K	2	0	1	6	T	1	R	0	M	△	△
①		②		③				④	⑤			⑥	⑦	⑧

△=Blank space

①Series name

Code	Series name
ME	Metal Wire-wound Chip Power Inductor

②Dimensions(T)

Code	Dimensions(T)[mm]
KK	1.0

③Dimensions(L×W)

Code	Dimensions(L×W)[mm]
2016	2.0×1.6
2520	2.5×2.0

④Packaging

Code	Packaging
T	Taping

⑤Nominal inductance

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

※R=Decimal point

⑥Inductance tolerance

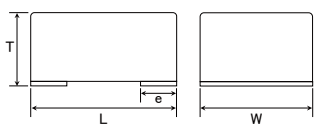
Code	Inductance tolerance
M	±20%

⑦Special code

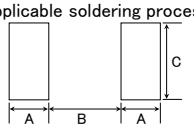
Code	Special code
△	Standard

⑧Internal code

■STANDARD EXTERNAL DIMENSIONS / STANDARD QUANTITY



Recommended Land Patterns
Surface Mounting
・Mounting and soldering conditions should be checked beforehand.
・Applicable soldering process to these products is reflow soldering only.



Type	A	B	C
2016	0.7	0.8	1.8
2520	0.9	1.0	2.2

Unit:mm

Type	L	W	T	e	Standard quantity[pcs] Taping
MEKK2016	2.0±0.2 (0.079±0.008)	1.6±0.2 (0.063±0.008)	1.0 max (0.039 max)	0.5±0.3 (0.020±0.012)	3000
MEKK2520	2.5±0.2 (0.098±0.008)	2.0±0.2 (0.079±0.008)	1.0 max (0.039 max)	0.65±0.3 (0.026±0.012)	3000

Unit:mm(inch)

■PARTS NUMBER

●MEKK2016 type 【Thickness:1.0mm max.】

Parts number	EHS	Nominal inductance [μH]	Inductance tolerance	Self-resonant frequency [MHz](min.)	DC Resistance [Ω](max.)	Rated current ※) [mA](max.)		Measuring frequency[MHz]
						Saturation current Idc1	Temperature rise current Idc2	
MEKK2016TR47M	RoHS	0.47	±20%	−	0.030	4,500	4,300	1
MEKK2016TR68M	RoHS	0.68	±20%	−	0.052	3,800	3,300	1
MEKK2016T1R0M	RoHS	1.0	±20%	−	0.060	3,600	3,100	1
MEKK2016T2R2M	RoHS	2.2	±20%	−	0.150	2,400	1,900	1

●MEKK2520 type 【Thickness:1.0mm max.】

Parts number	EHS	Nominal inductance [μH]	Inductance tolerance	Self-resonant frequency [MHz](min.)	DC Resistance [Ω](max.)	Rated current ※) [mA](max.)		Measuring frequency[MHz]
						Saturation current Idc1	Temperature rise current Idc2	
MEKK2520TR33M	RoHS	0.33	±20%	−	0.022	6,400	5,100	1
MEKK2520TR47M	RoHS	0.47	±20%	−	0.025	5,900	4,800	1
MEKK2520T1R0M	RoHS	1.0	±20%	−	0.053	4,300	3,300	1
MEKK2520T1R5M	RoHS	1.5	±20%	−	0.069	3,200	2,800	1
MEKK2520T2R2M	RoHS	2.2	±20%	−	0.097	3,100	2,400	1
MEKK2520T4R7M	RoHS	4.7	±20%	−	0.240	1,600	1,500	1

※) The saturation current value (Idc1) is the DC current value having inductance decrease down to 30%. (at 20℃)
※) The temperature rise current value (Idc2) is the DC current value having temperature increase up to 40℃. (at 20℃)
※) The rated current is the DC current value that satisfies both of current value saturation current value and temperature rise current value.
※) Idc2 Measurement board data Material:FR4
Board dimensions:100×50×1.6t mm
Pattern dimensions:45×45 mm (Double side board)
Pattern thickness:70μm

▶ 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/) .

METAL WIRE-WOUND CHIP POWER INDUCTORS (MCOIL™ ME-H SERIES)

REFLOW

■PARTS NUMBER

＊Operating Temp.: −40～+125℃ (Including self-generated heat)

M E	K K	2 0 1 6	H	1 R 0	M	△	△
①	②	③	④	⑤	⑥	⑦	⑧

△=Blank space

①Series name

Code	Series name
ME	Metal Wire-wound Chip Power Inductor

②Dimensions (T)

Code	Dimensions (T) [mm]
HK	0.8
KK	1.0

③Dimensions (L×W)

Code	Dimensions (L×W) [mm]
2012	2.0×1.2
2016	2.0×1.6
2520	2.5×2.0

④Packaging

Code	Packaging
H	Taping (special specification)

⑤Nominal inductance

Code (example)	Nominal inductance [μH]
R47	0.47
1R0	1.0
2R2	2.2

※R=Decimal point

⑥Inductance tolerance

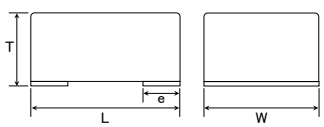
Code	Inductance tolerance
M	±20%

⑦Special code

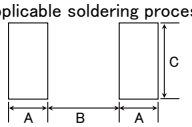
Code	Special code
△	Standard

⑧Internal code

■STANDARD EXTERNAL DIMENSIONS / STANDARD QUANTITY



Recommended Land Patterns
Surface Mounting
・Mounting and soldering conditions should be checked beforehand.
・Applicable soldering process to these products is reflow soldering only.



Type	A	B	C
2012	0.7	0.8	1.4
2016	0.7	0.8	1.8
2520	0.9	1.0	2.2

Unit: mm

Type	L	W	T	e	Standard quantity [pcs] Taping
MEHK2012H	2.0±0.2 (0.079±0.008)	1.2±0.2 (0.047±0.008)	0.8 max (0.031 max)	0.5±0.3 (0.020±0.012)	3000
MEKK2012H	2.0±0.2 (0.079±0.008)	1.2±0.2 (0.047±0.008)	1.0 max (0.039 max)	0.5±0.3 (0.020±0.012)	3000
MEKK2016H	2.0±0.2 (0.079±0.008)	1.6±0.2 (0.063±0.008)	1.0 max (0.039 max)	0.5±0.3 (0.020±0.012)	3000
MEKK2520H	2.5±0.2 (0.098±0.008)	2.0±0.2 (0.079±0.008)	1.0 max (0.039 max)	0.65±0.3 (0.026±0.012)	3000

Unit: mm (inch)

▶ This catalog contains the typical specification only due to the limitation of space. When you consider the purchase of our products, please check our 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/) .

■PARTS NUMBER

●MEHK2012H type 【Thickness : 0.8mm max.】

Parts number	EHS	Nominal inductance [μH]	Inductance tolerance	Self-resonant frequency [MHz] (min.)	DC Resistance [Ω] (max.)	Rated current ※) [mA] (max.)		Measuring frequency [MHz]
						Saturation current Idc1	Temperature rise current Idc2	
MEHK2012HR47M	RoHS	0.47	±20%	–	0.035	4,100	3,700	1

●MEKK2012H type 【Thickness : 1.0mm max.】

Parts number	EHS	Nominal inductance [μH]	Inductance tolerance	Self-resonant frequency [MHz] (min.)	DC Resistance [Ω] (max.)	Rated current ※) [mA] (max.)		Measuring frequency [MHz]
						Saturation current Idc1	Temperature rise current Idc2	
MEKK2012HR47M	RoHS	0.47	±20%	–	0.030	4,500	4,200	1

●MEKK2016H type 【Thickness : 1.0mm max.】

Parts number	EHS	Nominal inductance [μH]	Inductance tolerance	Self-resonant frequency [MHz] (min.)	DC Resistance [Ω] (max.)	Rated current ※) [mA] (max.)		Measuring frequency [MHz]
						Saturation current Idc1	Temperature rise current Idc2	
MEKK2016HR47M	RoHS	0.47	±20%	–	0.026	5,300	4,700	1
MEKK2016H1R0M	RoHS	1.0	±20%	–	0.048	4,000	3,500	1
MEKK2016H2R2M	RoHS	2.2	±20%	–	0.100	2,300	2,300	1

●MEKK2520H type 【Thickness : 1.0mm max.】

Parts number	EHS	Nominal inductance [μH]	Inductance tolerance	Self-resonant frequency [MHz] (min.)	DC Resistance [Ω] (max.)	Rated current ※) [mA] (max.)		Measuring frequency [MHz]
						Saturation current Idc1	Temperature rise current Idc2	
MEKK2520H1R0M	RoHS	1	±20%	–	0.039	4,400	3,800	1

※) The saturation current value (Idc1) is the DC current value having inductance decrease down to 30%. (at 20℃)
※) The temperature rise current value (Idc2) is the DC current value having temperature increase up to 40℃. (at 20℃)
※) The rated current is the DC current value that satisfies both of current value saturation current value and temperature rise current value.
※) Idc2 Measurement board data Material:FR4
Board dimensions : 100 × 50 × 1.6t mm
Pattern dimensions : 45 × 45 mm (Double side board)
Pattern thickness : 70 μm

METAL WIRE-WOUND CHIP POWER INDUCTORS (MCOIL™ ME SERIES／MCOIL™ ME-H SERIES)

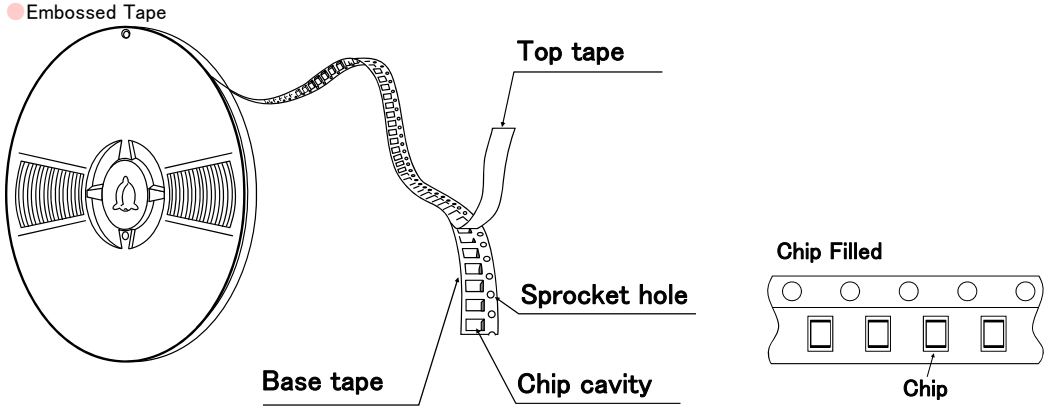
■PACKAGING

①Minimum Quantity

Type	Standard Quantity [pcs]
	Tape & Reel
MEHK2012	3000
MEKK2012	3000
MEKK2016	3000
MEKK2520	3000

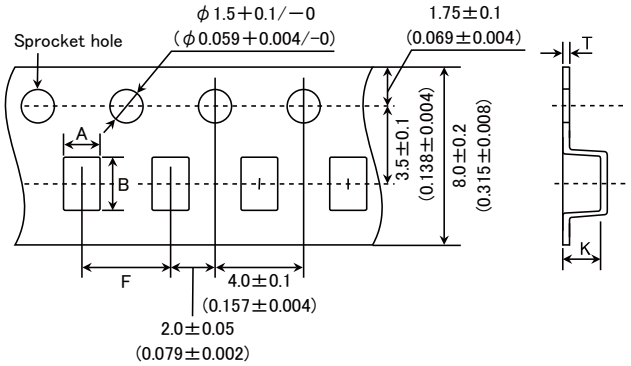
②Tape Material

●Embossed Tape



③Taping dimensions

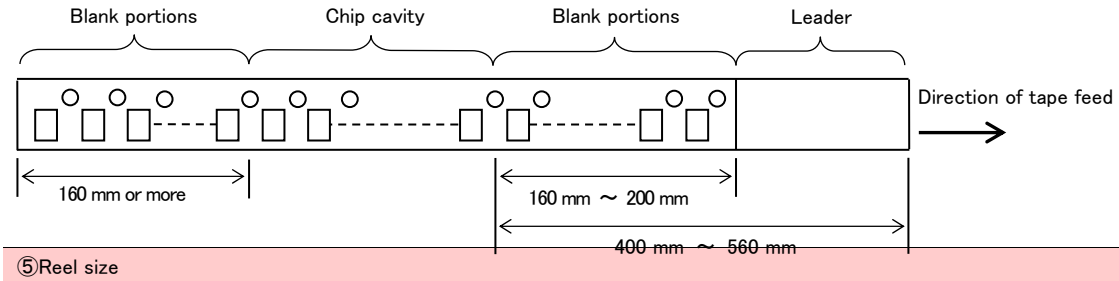
●Embossed tape 8mm wide (0.315 inches wide)



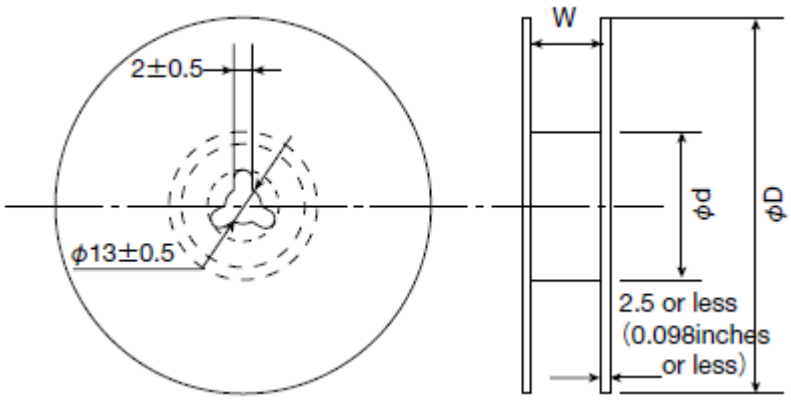
Type	Chip cavity		Insertion pitch	Tape thickness	
	A	B	F	T	K
MEHK2012	1.45±0.1 (0.057±0.004)	2.25±0.1 (0.089±0.004)	4.0±0.1 (0.157±0.004)	0.25±0.05 (0.009±0.002)	1.1±0.1 (0.043±0.004)
MEKK2012	1.45±0.1 (0.057±0.004)	2.25±0.1 (0.089±0.004)	4.0±0.1 (0.157±0.004)	0.25±0.05 (0.009±0.002)	1.1±0.1 (0.043±0.004)
MEKK2016	1.9±0.1 (0.075±0.004)	2.45±0.1 (0.097±0.004)	4.0±0.1 (0.157±0.004)	0.25±0.05 (0.009±0.002)	1.2±0.1 (0.047±0.004)
MEKK2520	2.4±0.1 (0.094±0.004)	2.9±0.1 (0.114±0.004)	4.0±0.1 (0.157±0.004)	0.25±0.05 (0.009±0.002)	1.1±0.1 (0.043±0.004)

Unit : mm (inch)

④Leader and Blank portion



⑤Reel size

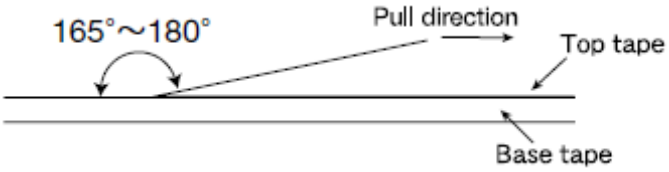


Type	Reel size (Reference values)		
	ϕD	ϕd	W
MEHK2012	180+0/−3 (7.087+0/−0.118)	60+1/−0 (2.36+0.039/0)	10.0±1.5 (0.394±0.059)
MEKK2012			
MEKK2016			
MEKK2520			

Unit : mm (inch)

⑥Top Tape Strength

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



METAL WIRE-WOUND CHIP POWER INDUCTORS (MCOIL™ ME SERIES／MCOIL™ ME-H SERIES)

■RELIABILITY DATA

1. Operating Temperature Range		
Specified Value	ME series ME-H series	−40～＋125℃
Test Methods and Remarks	Including self-generated heat	

2. Storage Temperature Range		
Specified Value	ME series ME-H series	−40～＋85℃
Test Methods and Remarks	0 to 40℃ for the product with taping.	

3. Rated current		
Specified Value	ME series ME-H series	Within the specified tolerance

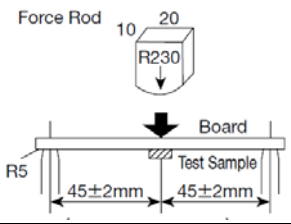
4. Inductance		
Specified Value	ME series ME-H series	Within the specified tolerance
Test Methods and Remarks	Measuring equipment : LCR Meter (HP 4294A or equivalent) Measuring frequency : 1MHz、0.5V	

5. DC Resistance		
Specified Value	ME series ME-H series	Within the specified tolerance
Test Methods and Remarks	Measuring equipment : DC ohmmeter (HIOKI 3227 or equivalent)	

6. Self resonance frequency		
Specified Value	ME series ME-H series	—

7. Temperature characteristic		
Specified Value	ME series ME-H series	Inductance change : Within ±15%
Test Methods and Remarks	Measurement of inductance shall be taken at temperature range within −40℃～＋125℃. With reference to inductance value at ＋20℃., change rate shall be calculated.	

8. Resistance to flexure of substrate		
Specified Value	ME series ME-H series	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 : 100×40×1.0 mm Test board material : Glass epoxy-resin Solder cream thickness : 0.12 mm	



9. Insulation resistance : between wires		
Specified Value	ME series	—
	ME-H series	

10. Insulation resistance : between wire and over-coating		
Specified Value	ME series	—
	ME-H series	

11. Withstanding voltage : between wire and over-coating		
Specified Value	ME series	—
	ME-H series	

12. Adhesion of terminal electrode		
Specified Value	ME series	No abnormality.
	ME-H series	
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 : 0.12mm.	

13. Resistance to vibration		
Specified Value	ME series	Inductance change : Within ±10% No significant abnormality in appearance.
	ME-H series	
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.	

Frequency Range	10～55Hz	
Total Amplitude	1.5mm (May not exceed acceleration 196m/s^2)	
Sweeping Method	10Hz to 55Hz to 10Hz for 1min.	
Time	X	For 2 hours on ach X, Y, and Z axis.
	Y	
	Z	

Recovery : At least 2hrs of recovery under the standard condition after the test, followed by the measurement within 48hrs.

14. Solderability		
Specified Value	ME series	At least 90% of surface of terminal electrode is covered by new solder.
	ME-H series	
Test Methods and Remarks	The test samples shall be dipped in flux, and then immersed in molten solder as shown in below table. Flux : Methanol solution containing rosin 25%.	

Solder Temperature	245±5℃
Time	5±0.5 sec.

※Immersion depth : All sides of mounting terminal shall be immersed.

15. Resistance to soldering heat		
Specified Value	ME series	Inductance change : Within ±10% No significant abnormality in appearance.
	ME-H series	
Test Methods and Remarks	The test sample shall be exposed to reflow oven at 230℃ for 40 seconds, with peak temperature at 260+0/−5℃ for 5 seconds, 2 times. Test board material : Glass epoxy-resin Test board thickness : 1.0mm Recovery : At least 2hrs of recovery under the standard condition after the test, followed by the measurement within 48hrs.	

16. Thermal shock

Specified Value	ME series ME-H series	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.	

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

Recovery : At least 2hrs of recovery under the standard condition after the test, followed by the measurement within 48hrs.

17. Damp heat

Specified Value	ME series ME-H series	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.	

Temperature	60±2℃
Humidity	90～95%RH
Time	500+24/−0 hour

Recovery : At least 2hrs of recovery under the standard condition after the test, followed by the measurement within 48hrs.

18. Loading under damp heat

Specified Value	ME series ME-H series	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 and applied the rated current continuously as shown in below table.	

Temperature	60±2℃
Humidity	90～95%RH
Applied current	Rated current
Time	500+24/−0 hour

Recovery : At least 2hrs of recovery under the standard condition after the test, followed by the measurement within 48hrs.

19. Low temperature life test

Specified Value	ME series ME-H series	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. After that, the test samples shall be placed at test conditions as shown in below table.	

Temperature	−40±2℃
Time	500+24/−0 hour

Recovery : At least 2hrs of recovery under the standard condition after the test, followed by the measurement within 48hrs.

20. High temperature life test

Specified Value	ME series ME-H series	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. After that, the test samples shall be placed at test conditions as shown in below table.	

Temperature	125±2℃
Time	500+24/−0 hour

Recovery : At least 2hrs of recovery under the standard condition after the test, followed by the measurement within 48hrs.

21. Loading at high temperature life test

Specified Value	ME series ME-H series	—

22. Standard condition		
Specified Value	ME series	Standard test condition : Unless otherwise specified, temperature is 20±15℃ and 65±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±2℃ of temperature, 65±5% relative humidity. Inductance is in accordance with our measured value.
	ME-H series	

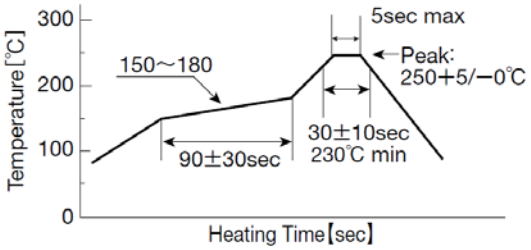
METAL WIRE-WOUND CHIP POWER INDUCTORS (MCOIL™ ME SERIES／MCOIL™ ME-H SERIES)

■PRECAUTIONS

1. Circuit Design	
Precautions	◆Operating environment 1. The products described in this specification are intended for use in general electronic equipment,(office supply equipment, telecommunications systems, measuring equipment, and household equipment). They are not intended for use in mission-critical equipment or systems requiring special quality and high reliability (traffic systems, safety equipment, aerospace systems, nuclear control systems and medical equipment including life-support systems,) where product failure might result in loss of life, injury or damage. For such uses, contact TAIYO YUDEN Sales Department in advance.

2. PCB Design	
Precautions	◆Land pattern design 1. Please refer to a recommended land pattern.
Technical considerations	◆Land pattern design Surface Mounting ・ Mounting and soldering conditions should be checked beforehand. ・ Applicable soldering process to this products is reflow soldering only.

3. Considerations for automatic placement	
Precautions	◆Adjustment of mounting machine 1. Excessive impact load should not be imposed on the products when mounting onto the PC boards. 2. Mounting and soldering conditions should be checked beforehand.
Technical considerations	◆Adjustment of mounting machine 1. When installing products, care should be taken not to apply distortion stress as it may deform the products.

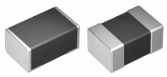
4. Soldering	
Precautions	◆Reflow soldering 1. Please contact any of our offices for a reflow soldering, and refer to the recommended condition specified. 2. The product shall be used reflow soldering only. 3. Please do not add any stress to a product until it returns in normal temperature after reflow soldering. ◆Lead free soldering 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.
Technical considerations	◆Reflow soldering 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. Recommended reflow condition (Pb free solder) 

5. Cleaning	
Precautions	◆Cleaning conditions 1. Washing by supersonic waves shall be avoided.
Technical considerations	◆Cleaning conditions 1. If washed by supersonic waves, the products might be broken.

6. Handling	
Precautions	◆Handling 1. Keep the product away from all magnets and magnetic objects. ◆Breakaway PC boards (splitting along perforations) 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. 2. Board separation should not be done manually, but by using the appropriate devices. ◆Mechanical considerations 1. Please do not give the product any excessive mechanical shocks. 2. Please do not add any shock and power to a product in transportation. ◆Pick-up pressure 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. ◆Packing 1. Please avoid accumulation of a packing box as much as possible.
Technical considerations	◆Handling 1. There is a case that a characteristic varies with magnetic influence. ◆Breakaway PC boards (splitting along perforations) 1. The position of the product on PCBs shall be carefully considered to minimize the stress caused from splitting of the PCBs. ◆Mechanical considerations 1. There is a case to be damaged by a mechanical shock. 2. There is a case to be broken by the handling in transportation. ◆Pick-up pressure 1. Damage and a characteristic can vary with an excessive shock or stress. ◆Packing 1. If packing boxes are accumulated, that could cause a deformation on packing tapes or a damage on the products.

7. Storage conditions	
Precautions	◆Storage 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. ・ Recommended conditions Ambient temperature : 0～40℃ Humidity : Below 70% RH ・ The ambient temperature must be kept below 30℃. Even under ideal storage conditions, solderability of products electrodes may decrease as time passes. For this reason, product should be used within 6 months from the time of delivery. In case of storage over 6 months, solderability shall be checked before actual usage.
Technical considerations	◆Storage 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.

METAL MULTILAYER CHIP POWER INDUCTORS (MCOIL™ MC SERIES)



REFLOW

■PARTS NUMBER

＊ Operating Temp.: −40～+125℃(Including self-generated heat)

M C	K K	2 0 1 2	T	1 R 0	M	△	△
①	②	③	④	⑤	⑥	⑦	⑧

△＝Blank space

①Series name

Code	Series name
MC	Metal base multilayer chip power inductor

②Thickness

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

③Dimensions(L×W)

Code	Type(inch)	Dimensions (L×W)[mm]
1005	1005(0402)	1.0×0.5
1210	1210(0504)	1.25 x 1.05
1608	1608(0603)	1.6×0.8
2012	2012(0805)	2.0×1.25

④Packaging

Code	Packaging
T	Taping

⑤Nominal inductance

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

※R＝Decimal point

⑥Inductance tolerance

Code	Inductance tolerance
M	±20%

⑦Special code1

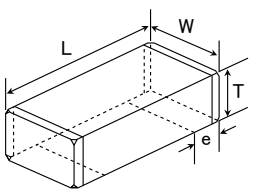
Code	Special code1
△	Standard
G	5 surface terminal
H	Standard (Internal Code)
K	

⑧Special code2

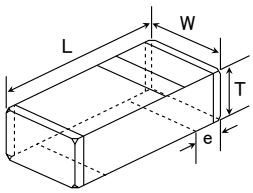
Code	Special code2
△	Non Polarity
N	Polarity Marking

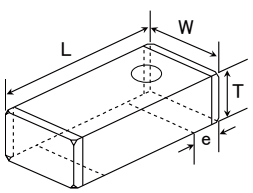
■STANDARD EXTERNAL DIMENSIONS / STANDARD QUANTITY

Standard

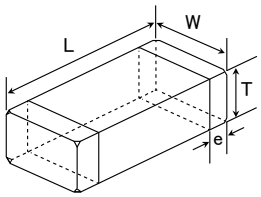


Polarity Marking





5 surface terminal



Type	L	W	T	e	Standard quantity[pcs]	
					Paper tape	Embossed tape
MCEE1005 (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	
MCEK1210 (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	—
MCFK1608 (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	—
MCFE1608 (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	—
MCHK1608 (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	—
MCKK1608 (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
MCHK2012 (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	—
MCKK2012 (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

Unit:mm(inch)

■PARTS NUMBER

●MC1005

Parts number	EHS	Nominal inductance [μH]	Inductance tolerance	DC Resistance [mΩ] (max.)	DC Resistance [mΩ] (typ.)	Rated current(Idc1) [A] (max.)	Rated current(Idc2) [A] (max.)	Measuring frequency [MHz]	Thickness [mm] (max.)
MCEE1005TR10MHN	RoHS	0.10	±20%	50	41	2.00	2.00	1	0.55
MCEE1005TR22MHN	RoHS	0.22	±20%	80	65	1.60	1.60	1	0.55
MCEE1005TR47MHN	RoHS	0.47	±20%	140	114	1.20	1.20	1	0.55
MCEE1005T1R0MHN	RoHS	1.0	±20%	300	244	1.00	0.80	1	0.55

●MC1210

Parts number	EHS	Nominal inductance [μH]	Inductance tolerance	DC Resistance [mΩ] (max.)	DC Resistance [mΩ] (typ.)	Rated current(Idc1) [A] (max.)	Rated current(Idc2) [A] (max.)	Measuring frequency [MHz]	Thickness [mm] (max.)
MCEK1210TR47MHN	RoHS	0.47	±20%	82	70	2.30	1.60	1	0.50
MCEK1210T1R0MHN	RoHS	1.0	±20%	179	157	1.50	1.10	1	0.50
MCEK1210T1R5MHN	RoHS	1.5	±20%	240	200	1.20	0.90	1	0.50

●MC1608

Parts number	EHS	Nominal inductance [μH]	Inductance tolerance	DC Resistance [mΩ] (max.)	DC Resistance [mΩ] (typ.)	Rated current(Idc1) [A] (max.)	Rated current(Idc2) [A] (max.)	Measuring frequency [MHz]	Thickness [mm] (max.)
MCFK1608TR24M	RoHS	0.24	±20%	50	40	2.30	2.10	1	0.60
MCFK1608TR47M	RoHS	0.47	±20%	85	69	1.90	1.60	1	0.60
MCFK1608T1R0M	RoHS	1.0	±20%	224	182	1.50	0.90	1	0.60
MCFE1608TR24MG	RoHS	0.24	±20%	100	75	2.60	1.50	1	0.65
MCFE1608TR47MG	RoHS	0.47	±20%	150	114	2.00	1.20	1	0.65
MCFE1608T1R0MG	RoHS	1.0	±20%	340	270	1.40	0.80	1	0.65
MCHK1608TR24MKN	RoHS	0.24	±20%	24	20	4.30	3.70	1	0.80
MCHK1608TR47MKN	RoHS	0.47	±20%	43	38	3.30	2.70	1	0.80
MCHK1608TR56MKN	RoHS	0.56	±20%	55	45	2.70	2.60	1	0.80
MCHK1608T1R0MKN	RoHS	1.0	±20%	110	89	2.20	1.60	1	0.80
MCHK1608T1R5MKN	RoHS	1.5	±20%	200	160	1.70	1.30	1	0.80
MCHK1608T2R2MKN	RoHS	2.2	±20%	292	237	1.50	1.20	1	0.80
MCKK1608TR24M N	RoHS	0.24	±20%	38	35	2.80	2.60	1	1.00
MCKK1608TR47M N	RoHS	0.47	±20%	55	44	2.40	2.00	1	1.00
MCKK1608T1R0M N	RoHS	1.0	±20%	123	100	2.00	1.30	1	1.00

●MC2012

Parts number	EHS	Nominal inductance [μH]	Inductance tolerance	DC Resistance [mΩ] (max.)	DC Resistance [mΩ] (typ.)	Rated current(Idc1) [A] (max.)	Rated current(Idc2) [A] (max.)	Measuring frequency [MHz]	Thickness [mm] (max.)
MCHK2012TR24M	RoHS	0.24	±20%	24	19	4.32	3.60	1	0.80
MCHK2012TR47M	RoHS	0.47	±20%	36	30	3.21	3.15	1	0.80
MCHK2012T1R0M	RoHS	1.0	±20%	111	90	2.26	1.47	1	0.80
MCKK2012TR24M	RoHS	0.24	±20%	25	20	6.20	4.00	1	1.00
MCKK2012TR47M	RoHS	0.47	±20%	39	32	4.50	3.10	1	1.00
MCKK2012T1R0M	RoHS	1.0	±20%	90	73	3.60	2.10	1	1.00

※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℃)

▶ 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/) .

Multilayer chip inductors
Multilayer chip inductors for high frequency, Multilayer chip bead inductors
Multilayer common mode choke coils (MC series F type)
Metal Multilayer Chip Power Inductors (MCOIL™ MC series)

■PACKAGING

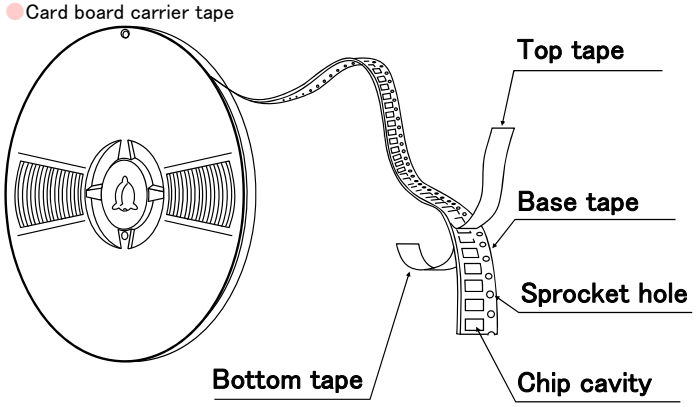
①Minimum Quantity

●Tape & Reel Packaging

Type	Thickness mm (inch)	Standard Quantity [pcs]	
		Paper Tape	Embossed Tape
CK1608 (0603)	0.8 (0.031)	4000	—
CK2125 (0805)	0.85 (0.033)	4000	—
	1.25 (0.049)	—	2000
CKS2125 (0805)	0.85 (0.033)	4000	—
	1.25 (0.049)	—	2000
CKP1608 (0603)	0.8 (0.031)	4000	—
CKP2012 (0805)	0.9 (0.035)	—	3000
CKP2016 (0806)	0.9 (0.035)	—	3000
CKP2520 (1008)	0.7 (0.028)	—	3000
	0.9 (0.035)	—	3000
	1.1 (0.043)	—	2000
LK1005 (0402)	0.5 (0.020)	10000	—
LK1608 (0603)	0.8 (0.031)	4000	—
LK2125 (0805)	0.85 (0.033)	4000	—
	1.25 (0.049)	—	2000
HK0603 (0201)	0.3 (0.012)	15000	—
HK1005 (0402)	0.5 (0.020)	10000	—
HK1608 (0603)	0.8 (0.031)	4000	—
HK2125 (0805)	0.85 (0.033)	—	4000
	1.0 (0.039)	—	3000
HKQ0603S (0201)	0.3 (0.012)	15000	—
HKQ0603U (0201)	0.3 (0.012)	15000	—
AQ105 (0402)	0.5 (0.020)	10000	—
BK0603 (0201)	0.3 (0.012)	15000	—
BK1005 (0402)	0.5 (0.020)	10000	—
BKH0603 (0201)	0.3 (0.012)	15000	—
BKH1005 (0402)	0.5 (0.020)	10000	—
BK1608 (0603)	0.8 (0.031)	4000	—
BK2125 (0805)	0.85 (0.033)	4000	—
	1.25 (0.049)	—	2000
BK2010 (0804)	0.45 (0.018)	4000	—
BK3216 (1206)	0.8 (0.031)	—	4000
BKP0603 (0201)	0.3 (0.012)	15000	—
BKP1005 (0402)	0.5 (0.020)	10000	—
BKP1608 (0603)	0.8 (0.031)	4000	—
BKP2125 (0805)	0.85 (0.033)	4000	—
MCF0605 (0202)	0.3 (0.012)	15000	—
MCF0806 (0302)	0.4 (0.016)	—	10000
MCF1210 (0504)	0.55 (0.022)	—	5000
MCF2010 (0804)	0.45 (0.018)	—	4000
MCEE1005 (0402)	0.55 (0.022)	10000	—
MCEK1210 (0504)	0.5 (0.020)	5000	—
MCFK1608 (0603)	0.6 (0.024)	4000	—
MCFE1608 (0603)	0.65 (0.026)	4000	—
MCHK1608 (0603)	0.8 (0.031)	4000	—
MCKK1608 (0603)	1.0 (0.039)		3000
MCHK2012 (0806)	0.8 (0.031)	4000	—
MCKK2012 (0805)	1.0 (0.039)	-	3000

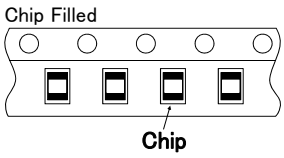
②Taping material

Card board carrier tape

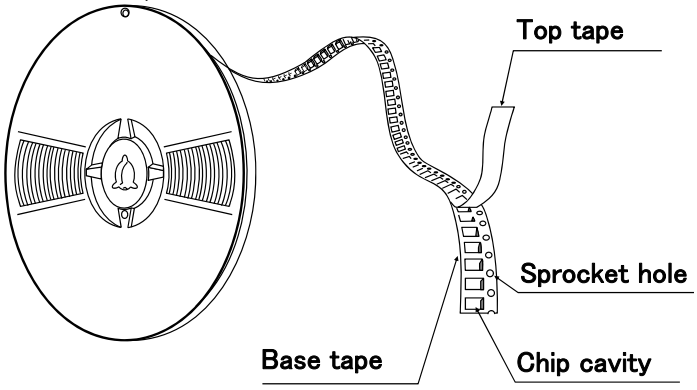


CK	1608
CKP	1608
CK	2125
CKS	2125
LK	1005
LK	1608
LK	2125
HK	0603
HK	1005
HK	1608
HKQ	0603
AQ	105

BK	0603
BK	1005
BK	1608
BK	2125
BK	2010
BKP	0603
BKP	1005
BKP	1608
BKP	2125
BKH	0603
BKH	1005
MCF	0605
MC	1005
MC	1210
MC	1608
MC	2012

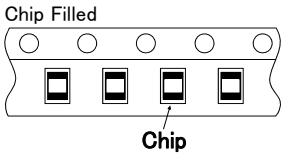


Embossed Tape



CK	2125
CKS	2125
CKP	2012
CKP	2016
CKP	2520
LK	2125
HK	2125

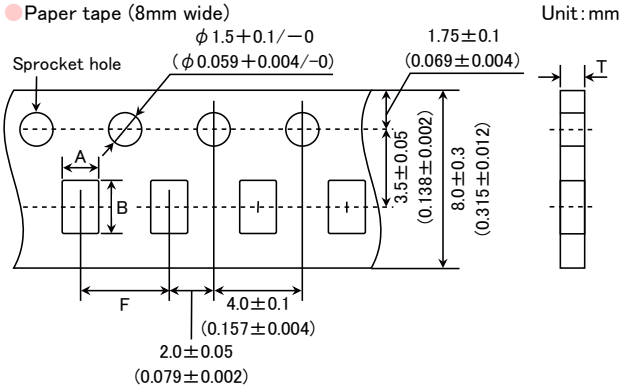
BK	2125
BK	3216
MCF	0806
MCF	1210
MCF	2010
MC	1608
MC	2012



③Taping Dimensions

Paper tape (8mm wide)

Unit : mm (inch)

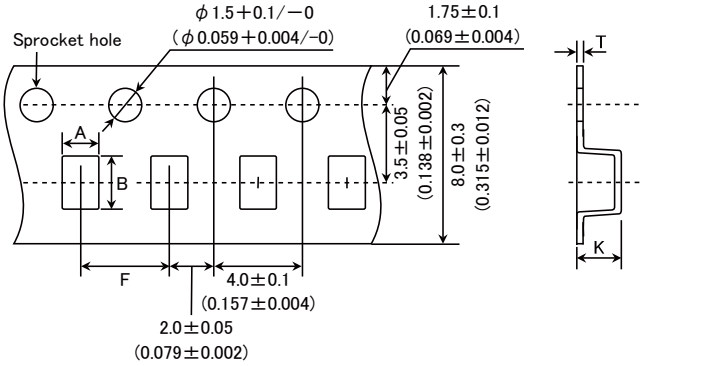


Type	Thickness mm(inch)	Chip cavity		Insertion Pitch	Tape Thickness
		A	B	F	T
CK1608(0603)	0.8 (0.031)	1.0±0.2 (0.039±0.008)	1.8±0.2 (0.071±0.008)	4.0±0.1 (0.157±0.004)	1.1max (0.043max)
CK2125(0805)	0.85(0.033)	1.5±0.2 (0.059±0.008)	2.3±0.2 (0.091±0.008)	4.0±0.1 (0.157±0.004)	1.1max (0.043max)
CKS2125(0805)	0.85(0.033)	1.5±0.2 (0.059±0.008)	2.3±0.2 (0.091±0.008)	4.0±0.1 (0.157±0.004)	1.1max (0.043max)
CKP1608(0603)	0.8 (0.031)	1.0±0.2 (0.039±0.008)	1.8±0.2 (0.071±0.008)	4.0±0.1 (0.157±0.004)	1.1max (0.043max)
LK1005(0402)	0.5 (0.020)	0.65±0.1 (0.026±0.004)	1.15±0.1 (0.045±0.004)	2.0±0.05 (0.079±0.002)	0.8max (0.031max)
LK1608(0603)	0.8 (0.031)	1.0±0.2 (0.039±0.008)	1.8±0.2 (0.071±0.008)	4.0±0.1 (0.157±0.004)	1.1max (0.043max)
LK2125(0805)	0.85(0.033)	1.5±0.2 (0.059±0.008)	2.3±0.2 (0.091±0.008)	4.0±0.1 (0.157±0.004)	1.1max (0.043max)
HK0603(0201)	0.3 (0.012)	0.40±0.06 (0.016±0.002)	0.70±0.06 (0.028±0.002)	2.0±0.05 (0.079±0.002)	0.45max (0.018max)
HK1005(0402)	0.5 (0.020)	0.65±0.1 (0.026±0.004)	1.15±0.1 (0.045±0.004)	2.0±0.05 (0.079±0.002)	0.8max (0.031max)
HK1608(0603)	0.8 (0.031)	1.0±0.2 (0.039±0.008)	1.8±0.2 (0.071±0.008)	4.0±0.1 (0.157±0.004)	1.1max (0.043max)
HKQ0603S(0201)	0.3 (0.012)	0.40±0.06 (0.016±0.002)	0.70±0.06 (0.028±0.002)	2.0±0.05 (0.079±0.002)	0.45max (0.018max)
HKQ0603U(0201)	0.3 (0.012)	0.40±0.06 (0.016±0.002)	0.70±0.06 (0.028±0.002)	2.0±0.05 (0.079±0.002)	0.45max (0.018max)
AQ105(0402)	0.5 (0.020)	0.75±0.1 (0.030±0.004)	1.15±0.1 (0.045±0.004)	2.0±0.05 (0.079±0.002)	0.8max (0.031max)
BK0603(0201)	0.3 (0.012)	0.40±0.06 (0.016±0.002)	0.70±0.06 (0.028±0.002)	2.0±0.05 (0.079±0.002)	0.45max (0.018max)
BK1005(0402)	0.5 (0.020)	0.65±0.1 (0.026±0.004)	1.15±0.1 (0.045±0.004)	2.0±0.05 (0.079±0.002)	0.8max (0.031max)
BK1608(0603)	0.8 (0.031)	1.0±0.2 (0.039±0.008)	1.8±0.2 (0.071±0.008)	4.0±0.1 (0.157±0.004)	1.1max (0.043max)
BK2125(0805)	0.85(0.033)	1.5±0.2 (0.059±0.008)	2.3±0.2 (0.091±0.008)	4.0±0.1 (0.157±0.004)	1.1max (0.043max)
BK2010(0804)	0.45(0.018)	1.2±0.1 (0.047±0.004)	2.17±0.1 (0.085±0.004)	4.0±0.1 (0.157±0.004)	0.8max (0.031max)
BKP0603(0201)	0.3 (0.012)	0.40±0.06 (0.016±0.002)	0.70±0.06 (0.028±0.002)	2.0±0.05 (0.079±0.002)	0.45max (0.018max)
BKP1005(0402)	0.5 (0.020)	0.65±0.1 (0.026±0.004)	1.15±0.1 (0.045±0.004)	2.0±0.05 (0.079±0.002)	0.8max (0.031max)
BKP1608(0603)	0.8 (0.031)	1.0±0.2 (0.039±0.008)	1.8±0.2 (0.071±0.008)	4.0±0.1 (0.157±0.004)	1.1max (0.043max)
BKP2125(0805)	0.85(0.033)	1.5±0.2 (0.059±0.008)	2.3±0.2 (0.091±0.008)	4.0±0.1 (0.157±0.004)	1.1max (0.043max)
BKH0603(0201)	0.3 (0.012)	0.40±0.06 (0.016±0.002)	0.70±0.06 (0.028±0.002)	2.0±0.05 (0.079±0.002)	0.45max (0.018max)
BKH1005(0402)	0.5 (0.020)	0.65±0.1 (0.026±0.004)	1.15±0.1 (0.045±0.004)	2.0±0.05 (0.079±0.002)	0.8max (0.031max)
MCF0605(0202)	0.3 (0.012)	0.62±0.03 (0.024±0.001)	0.77±0.03 (0.030±0.001)	2.0±0.05 (0.079±0.002)	0.45max (0.018max)
MCFK1608(0603)	0.6 (0.024)	1.1±0.05 (0.043±0.002)	1.9±0.05 (0.075±0.002)	4.0±0.1 (0.157±0.004)	0.72max (0.028max)
MCEE1005(0402)	0.55(0.021)	0.8±0.05 (0.031±0.002)	1.3±0.05 (0.051±0.002)	2.0±0.05 (0.079±0.002)	0.64max (0.025max)
MCEK1210(0504)	0.5 (0.020)	1.3±0.1 (0.051±0.004)	1.55±0.1 (0.061±0.004)	4.0±0.1 (0.157±0.004)	0.64max (0.025max)
MCFK1608(0603)	0.6 (0.024)	1.1±0.05 (0.043±0.002)	1.9±0.05 (0.075±0.002)	4.0±0.1 (0.157±0.004)	0.72max (0.028max)
MCFE1608(0603)	0.65(0.026)	1.1±0.05 (0.043±0.002)	1.9±0.05 (0.075±0.002)	4.0±0.1 (0.157±0.004)	0.72max (0.028max)
MCHK1608(0603)	0.8 (0.031)	1.2±0.05 (0.047±0.002)	2.0±0.05 (0.079±0.002)	4.0±0.1 (0.157±0.004)	0.9max (0.035max)
MCHK2012(0805)	0.8 (0.031)	1.65±0.1 (0.065±0.004)	2.4±0.1 (0.094±0.004)	4.0±0.1 (0.157±0.004)	0.9max (0.035max)

Unit : mm(inch)

● Embossed Tape (8mm wide)

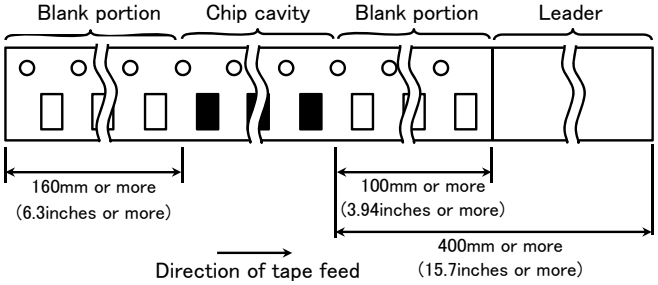
Unit : mm (inch)



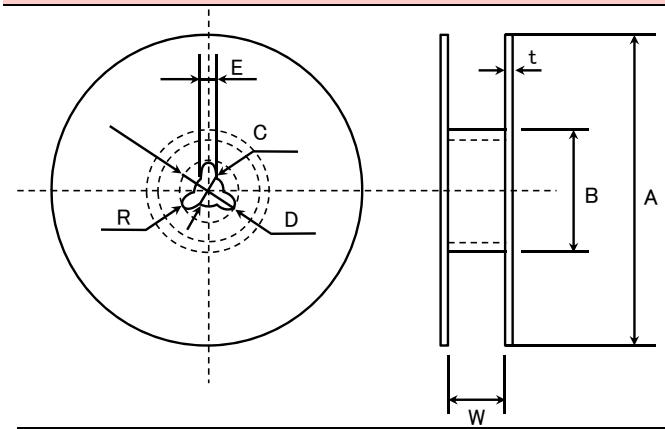
Type	Thickness mm (inch)	Chip cavity		Insertion Pitch	Tape Thickness	
		A	B	F	K	T
CK2125 (0805)	1.25 (0.049)	1.5±0.2 (0.059±0.008)	2.3±0.2 (0.091±0.008)	4.0±0.1 (0.157±0.004)	2.0 (0.079)	0.3 (0.012)
CKS2125 (0805)	1.25 (0.049)	1.5±0.2 (0.059±0.008)	2.3±0.2 (0.091±0.008)	4.0±0.1 (0.157±0.004)	2.0 (0.079)	0.3 (0.012)
CKP2012 (0805)	0.9 (0.035)	1.55±0.2 (0.061±0.008)	2.3±0.2 (0.091±0.008)	4.0±0.1 (0.157±0.004)	1.3 (0.051)	0.3 (0.012)
CKP2016 (0806)	0.9 (0.035)	1.8±0.1 (0.071±0.004)	2.2±0.1 (0.087±0.004)	4.0±0.1 (0.157±0.004)	1.3 (0.051)	0.25 (0.01)
CKP2520 (1008)	0.7 (0.028)	2.3±0.1 (0.091±0.004)	2.8±0.1 (0.110±0.004)	4.0±0.1 (0.157±0.004)	1.4 (0.055)	0.3 (0.012)
	0.9 (0.035)				1.4 (0.055)	
	1.1 (0.043)				1.7 (0.067)	
	1.1 (0.043)				1.7 (0.067)	
LK2125 (0805)	1.25 (0.049)	1.5±0.2 (0.059±0.008)	2.3±0.2 (0.091±0.008)	4.0±0.1 (0.157±0.004)	2.0 (0.079)	0.3 (0.012)
HK2125 (0805)	0.85 (0.033)	1.5±0.2 (0.059±0.008)	2.3±0.2 (0.091±0.008)	4.0±0.1 (0.157±0.004)	1.5 (0.059)	0.3 (0.012)
	1.0 (0.039)				2.0 (0.079)	
BK2125 (0805)	1.25 (0.049)	1.5±0.2 (0.059±0.008)	2.3±0.2 (0.091±0.008)	4.0±0.1 (0.157±0.004)	2.0 (0.079)	0.3 (0.012)
BK3216 (1206)	0.8 (0.031)	1.9±0.1 (0.075±0.004)	3.5±0.1 (0.138±0.004)	4.0±0.1 (0.157±0.004)	1.4 (0.055)	0.3 (0.012)
MCF0806 (0302)	0.4 (0.016)	0.75±0.05 (0.030±0.002)	0.95±0.05 (0.037±0.002)	2.0±0.05 (0.079±0.002)	0.55 (0.022)	0.3 (0.012)
MCF1210 (0504)	0.55 (0.022)	1.15±0.05 (0.045±0.002)	1.40±0.05 (0.055±0.002)	4.0±0.1 (0.157±0.004)	0.65 (0.026)	0.3 (0.012)
MCF2010 (0804)	0.45 (0.018)	1.1±0.1 (0.043±0.004)	2.3±0.1 (0.091±0.004)	4.0±0.1 (0.157±0.004)	0.85 (0.033)	0.3 (0.012)
MCKK1608 (0603)	1.0 (0.039)	1.1±0.1 (0.043±0.004)	1.95±0.1 (±0.004)	4.0±0.1 (0.157±0.004)	1.4 (0.055)	0.25 (0.01)
MCKK2012 (0805)	1.0 (0.039)	1.55±0.1 (0.061±0.004)	2.35±0.1 (0.093±0.004)	4.0±0.1 (0.157±0.004)	1.35 (0.053)	0.25 (0.010)

Unit : mm (inch)

④LEADER AND BLANK PORTION



⑤Reel Size



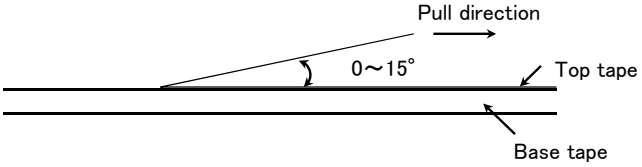
A	B	C	D	E	R
ϕ178±2.0	ϕ50 or more	ϕ13.0±0.2	ϕ21.0±0.8	2.0±0.5	1.0

	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 0.1～0.7N in the direction of the arrow as illustrated below.



Multilayer chip inductors
Multilayer chip inductors for high frequency, Multilayer chip bead inductors
Multilayer common mode choke coils (MC series F type)
Metal Multilayer Chip Power Inductors (MCOIL™ MC series)

■RELIABILITY DATA

1. Operating Temperature Range		
Specified Value	BK series	−55～＋125℃
	BKH series	
	BKP series	−55～＋85℃
	MCF series	−40～＋85℃
	CK series	−40～＋85℃
	CKS series	
	CKP series	
	LK series	
	HK0603, HK1005	−55～＋125℃
	HK1608, HK2125	−40～＋85℃
	HKQ0603	−55～＋125℃
	AQ105	
	MCOIL™ MC series	−40～＋125℃ (Including self-generated heat)

2. Storage Temperature Range		
Specified Value	BK series	−55～＋125℃
	BKH series	
	BKP series	−55～＋85℃
	MCF series	−40～＋85℃
	CK series	−40～＋85℃
	CKS series	
	CKP series	
	LK series	
	HK0603, HK1005	−55～＋125℃
	HK1608, HK2125	−40～＋85℃
	HKQ0603	−55～＋125℃
	AQ105	
	MCOIL™ MC series	−40～＋85℃

3. Rated Current		
Specified Value	BK series	The temperature of the element is increased within 20℃.
	BKH series	
	BKP series	The temperature of the element is increased within 40℃
	MCF series	Refer to each specification.
	CK series	The temperature of the element is increased within 20℃.
	CKS series	
	CKP series	The temperature of the element is increased within 40℃
	LK series	The decreasing-rate of inductance value is within 5 %
	HK0603, HK1005	The decreasing-rate of inductance value is within 5 %, or the temperature of the element is increased within 20℃
	HK1608, HK2125	
	HKQ0603	
	AQ105	
	MCOIL™ MC series	Idc1: The decreasing-rate of inductance value is within 30 % Idc2: The temperature of the element is increased within 40℃

4. Impedance		
Specified Value	BK series BKH series BKP series MCF series	Refer to each specification.
Test Methods and Remarks	BK0603Series, BKP0603Series, BKH Series Measuring frequency : 100±1MHz Measuring equipment : 4991A(or its equivalent) Measuring jig : 16193A(or its equivalent) BK1005Series, BKP1005Series ,BKH1005Series Measuring frequency : 100±1MHz Measuring equipment : 4291A(or its equivalent) Measuring jig : 16192A (or its equivalent) , HW:16193A (or its equivalent) BK1608・2125Series, BKP1608・2125Series Measuring frequency : 100±1MHz Measuring equipment : 4291A(or its equivalent), 4195A(or its equivalent) Measuring jig : 16192A(or its equivalent), HW:16193A(or its equivalent) BK2010・3216Series Measuring frequency : 100±1MHz Measuring equipment : 4291A(or its equivalent), 4195A(or its equivalent) Measuring jig : 16192A(or its equivalent) MCF Series Measuring frequency : 100±1MHz Measuring equipment : 4291A(or its equivalent)	

5. Inductance		
Specified Value	CK series CKS series CKP series LK series HK0603, HK1005 HK1608, HK2125 HKQ0603 AQ105 MCOIL™ MC series	Refer to each specification.
Test Methods and Remarks	CK、CKS、LK Series Measuring frequency : Refer to each specification. Measuring equipment /jig : 1608,2125⇒4294A＋16092A(or its equivalent) 1005⇒4291A＋16193A(or its equivalent) Measuring current : 047～4.7μH ⇒1mArms 、 5.6～33μH ⇒0.1mArms CKP、MCOIL™ MC Series Measuring frequency : 1MHz Measuring equipment : 4285A(or its equivalent) HK0603、HK1005、AQ Series Measuring frequency : 100MHz Measuring equipment /jig : HK0603⇒ E4991A+16197A(or its equivalent) , AQ105⇒4291A＋16197A(or its equivalent) HK1005⇒ 4291A＋16193A(or its equivalent) HK1608、HK2125 Series Measuring frequency : ～100nH⇒100MHz 、120nH～⇒50MHz Measuring equipment /jig : 4291A＋16092A(or its equivalent) HKQ Series Measuring frequency : 500MHz Measuring equipment /jig : E4991A＋16197A(or its equivalent)	

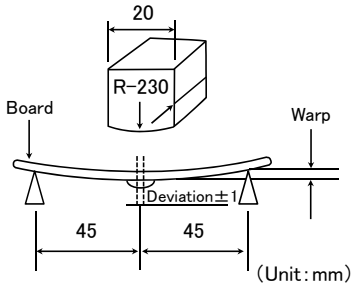
6. Q		
Specified Value	CK series	—
	CKS series	
	CKP series	
	LK series	Refer to each specification.
	HK0603, HK1005	
	HK1608, HK2125	
	HKQ0603	
	AQ105	
	MCOIL™ MC series	—
Test Methods and Remarks	LK Series Measuring frequency : Refer to each specification. Measuring equipment /jig : 1608,2125⇒4294A＋16092A(or its equivalent) 1005⇒4291A＋16193A(or its equivalent) Measuring current : 047～4.7 μH ⇒1mArms 、 5.6～33 μH ⇒0.1mArms HK0603、HK1005、AQ Series Measuring frequency : 100MHz Measuring equipment /jig : HK0603⇒E4991A＋16197A(or its equivalent) , AQ105⇒4291A＋16197A(or its equivalent) HK1005⇒4291A＋16193A(or its equivalent) HK1608、HK2125 Series Measuring frequency : ～100nH⇒100MHz 、120nH～⇒50MHz Measuring equipment /jig : 4291A＋16092A(or its equivalent) HKQ Series Measuring frequency : 500MHz Measuring equipment /jig : E4991A＋16197A(or its equivalent)	

7. DC Resistance		
Specified Value	BK series	Refer to each specification.
	BKH series	
	BKP series	
	MCF series	
	CK series	
	CKS series	
	CKP series	
	LK series	
	HK0603, HK1005	
	HK1608, HK2125	
	HKQ0603	
	AQ105	
	MCOIL™ MC series	
Test Methods and Remarks	Measuring equipment:IWATSU VOAC7512, HIOKI RM3545 (or its equivalent)	

8. Self Resonance Frequency(SRF)		
Specified Value	BK series	—
	BKH series	
	BKP series	
	MCF series	
	CK series	Refer to each specification.
	CKS series	
	CKP series	—
	LK series	Refer to each specification.
	HK0603, HK1005	
	HK1608, HK2125	
	HKQ0603	
	AQ105	
	MCOIL™ MC series	—
Test Methods and Remarks	LK、CK Series : Measuring equipment : 4195A(or its equivalent) Measuring jig : 16092A(or its equivalent) HK、HKQ、AQ Series : Measuring equipment : 8719C(or its equivalent)	

9. Resistance to Flexure of Substrate

Specified Value	BK series	No mechanical damage.
	BKH series	
	BKP series	
	MCF series	
	CK series	
	CKS series	
	CKP series	
	LK series	
	HK0603, HK1005	
	HK1608, HK2125	
	HKQ0603	
	AQ105	
	MCOIL™ MC series	
Test Methods and Remarks	Warp : 2mm (BK Series、BKP、BKH1005、CK、CKS、CKP、LK、HK、HKQ0603S、HKQ0603U、AQ Series、MCF1210、MC Series) : 1mm (BKH0603、MCF Series without 1210 size,) Testing board : glass epoxy-resin substrate Thickness : 0.8mm	



10. Solderability

Specified Value	BK series	At least 90% of terminal electrode is covered by new solder.
	BKH series	
	BKP series	
	MCF series	
	CK series	
	CKS series	
	CKP series	
	LK series	
	HK0603, HK1005	
	HK1608, HK2125	
	HKQ0603	
	AQ105	
	MCOIL™ MC series	
Test Methods and Remarks	Solder temperature : 230±5℃ (JIS Z 3282 H60A or H63A) Solder temperature : 245±3℃ (Sn/3.0Ag/0.5Cu) Duration : 4±1 sec.	

11. Resistance to Soldering

Specified Value	BK series BKH series BKP series	Appearance : No significant abnormality Impedance change : Within ±30%
	MCF series	Appearance : No significant abnormality Impedance change : Within ±20%
	CK series	Appearance : No significant abnormality Inductance change : R10～4R7⇒Within ±10%、 6R8～100⇒Within ±15%
	CKS series	Appearance : No significant abnormality Inductance change : Within ±20%
	CKP series	Appearance : No significant abnormality Inductance change : Within ±30%
	LK series	Appearance : No significant abnormality Inductance change : 1005⇒Within ±15% 1608,2125⇒ 47N～4R7: Within ±10% 5R6～330: Within ±15%
	HK0603, HK1005 HK1608, HK2125 HKQ0603 AQ105	Appearance : No significant abnormality Inductance change : Within ±5%
	MCOIL™ MC series	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 methanol 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)	

(Note 1) When there are questions concerning measurement result ; measurement shall be made after 48±2 hrs of recovery under the standard condition.

12. Thermal Shock

Specified Value	BK series BKH series BKP series	Appearance : No significant abnormality Impedance change : Within ±30%
	MCF series	Appearance : No significant abnormality Impedance change : Within ±20%
	CK series CKS series	Appearance : No significant abnormality Inductance change : Within ±20%
	CKP series	Appearance : No significant abnormality Inductance change : Within ±30%
	LK series	Appearance : No significant abnormality Inductance change : Within ±10% Q change : Within ±30%
	HK0603, HK1005 HK1608, HK2125 HKQ0603 AQ105	Appearance : No significant abnormality Inductance change : Within ±10% Q change : Within ±20%
	MCOIL™ MC series	Appearance : No significant abnormality Inductance change : Within ±10%
Test Methods and Remarks	Conditions for 1 cycle	

Step	temperature (℃)	time (min.)
1	Minimum operating temperature +0/−3	30±3
2	Room temperature	2～3
3	Maximum operating temperature +3/−0	30±3
4	Room temperature	2～3

Number of cycles : 5

Recovery : 2 to 3 hrs of recovery under the standard condition after the test. (See Note 1)

(Note 1) When there are questions concerning measurement result ; measurement shall be made after 48±2 hrs of recovery under the standard condition.

13. Damp Heat (Steady state)		
Specified Value	BK series BKH series BKP series	Appearance : No significant abnormality Impedance change : Within ±30%
	MCF series	Appearance : No significant abnormality Impedance change : Within ±20%
	CK series CKS series	Appearance : No significant abnormality Inductance change : Within ±20%
	CKP series	Appearance : No significant abnormality Inductance change : Within ±30%
	LK series	Appearance : No significant abnormality Inductance change : 1005,1608⇒Within ±10%　2125⇒Within ±20% Q change : Within ±30%
	HK0603, HK1005 HK1608, HK2125 HKQ0603 AQ105	Appearance : No significant abnormality Inductance change : Within ±10%　Q change : Within ±20%
	MCOIL™ MC series	Appearance : No significant abnormality Inductance change : Within ±10%
Test Methods and Remarks	BK、BKP、BKH、LK、CK、CKS、CKP、MCF Series : Temperature : 40±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) HK、HKQ、AQ、MCOIL™ MC series : 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)	

(Note 1) When there are questions concerning measurement result ; measurement shall be made after 48±2 hrs of recovery under the standard condition.

14. Loading under Damp Heat		
Specified Value	BK series BKH series BKP series	Appearance：No significant abnormality Impedance change： Within ±30%
	MCF series	—
	CK series CKS series	Appearance：No significant abnormality Inductance change： Within ±20%
	CKP series	Appearance：No significant abnormality Inductance change： Within ±30%
	LK series	Appearance：No significant abnormality Inductance change： 1005⇒Within ±10% 1608⇒0.047～12.0 μH： Within ±10%　15.0～33.0 μH： Within ±15% 2125⇒Within ±20% Q change： Within ±30%
	HK0603, HK1005 HK1608, HK2125 HKQ0603 AQ105	Appearance：No significant abnormality Inductance change： Within ±10%　Q change： Within ±20%
	MCOIL™ MC series※	Appearance：No significant abnormality Inductance change： Within ±10%
Test Methods and Remarks	BK、BKP、BKH、LK、CK、CKS、CKP Series： Temperature　：40±2℃ Humidity　：90 to 95%RH Applied current　：Rated current 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) HK、HKQ、AQ、MCOIL™ MC Series： Temperature　：60±2℃ Humidity　：90 to 95%RH Applied current　：Rated current ※MC series ; 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 on standard condition: "standard condition" referred to herein is defined as follows:
5 to 35℃ of temperature, 45 to 85% relative humidity, and 86 to 106kPa of air pressure.
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."
(Note 1) Measurement shall be made after 48±2 hrs of recovery under the standard condition.

15. Loading at High Temperature		
Specified Value	BK series BKH series BKP series	Appearance : No significant abnormality Impedance change : Within ±30%
	MCF series	Appearance : No significant abnormality Impedance change : Within ±20%
	CK series CKS series	Appearance : No significant abnormality Inductance change : Within ±20%
	CKP series	Appearance : No significant abnormality Inductance change : Within ±30%
	LK series	Appearance : No significant abnormality Inductance change : 1005⇒Within ±10% 1608⇒0.047～12.0 μH : Within ±10%　15.0～33.0 μH : Within ±15% 2125⇒Within ±20% Q change : Within ±30%
	HK0603, HK1005 HK1608, HK2125 HKQ0603 AQ105	Appearance : No significant abnormality Inductance change : Within ±10%　Q change : Within ±20%
	MCOIL™ MC series※	Appearance : No significant abnormality Inductance change : Within ±10%
Test Methods and Remarks	Temperature : Maximum operating temperature Applied current : Rated current ※MC series ; 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 on standard condition: "standard condition" referred to herein is defined as follows:
5 to 35℃ of temperature, 45 to 85% relative humidity, and 86 to 106kPa of air pressure.
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."
(Note 1) Measurement shall be made after 48±2 hrs of recovery under the standard condition.

Metal Multilayer Chip Power Inductors (MCOIL™ MC 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.

◆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.

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

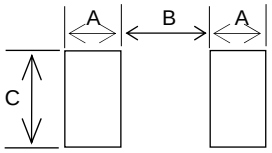
◆Pattern configurations (Design of Land-patterns)

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

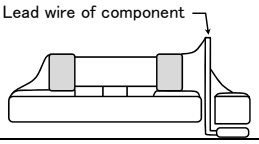
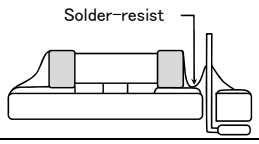
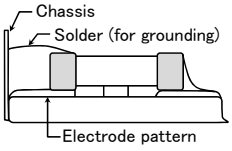
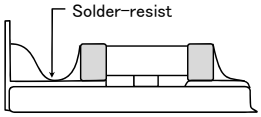
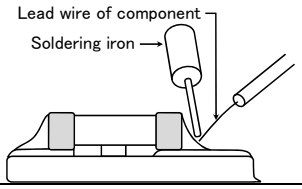
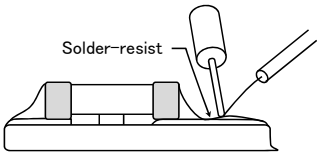
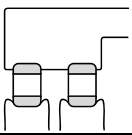
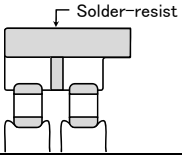
(1) Recommended land dimensions for a typical chip inductor land patterns for PCBs

(Unit : mm)

Type	1005	1210	1608 (Except MCHK)	1608 (MCHK)	2012
A	0.4	0.45	0.45	0.55	0.5
B	0.5	0.6	1.0	0.8	1.2
C	0.7	1.15	1.0	1.0	1.45

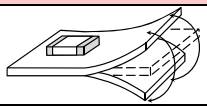
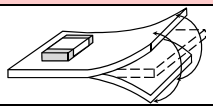


(2) Examples of good and bad solder application

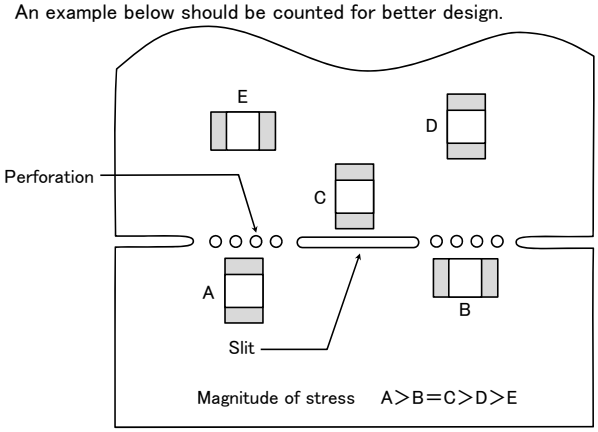
Item	Not recommended	Recommended
Mixed mounting of SMD and leaded components		
Component placement close to the chassis		
Hand-soldering of leaded components near mounted components		
Horizontal component placement		

◆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

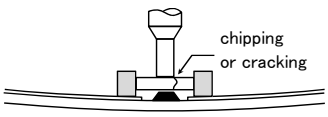
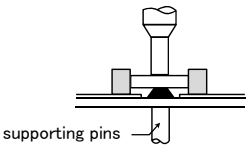
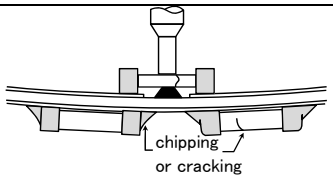
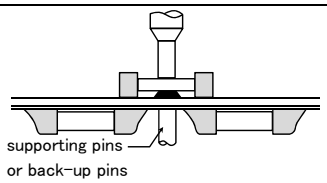
◆Adjustment of mounting machine

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.

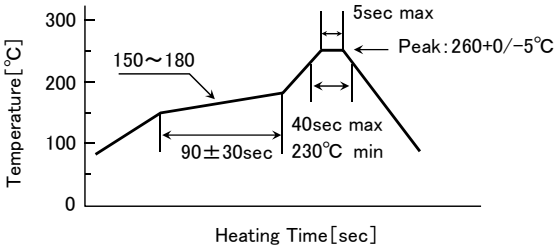
Technical considerations

◆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.
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) 

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.

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: 70% RH or below The ambient temperature must be kept below 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.

METAL CORE SMD POWER INDUCTORS (MCOIL™ MD SERIES)

REFLOW

■PARTS NUMBER

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

M D	K K	1 6 1 6	T	1 R 0	M	M	△
①	②	③	④	⑤	⑥	⑦	⑧

△=Blank space

①Series name

Code	Series name
MD	Metal base coil specification

②Dimensions (H)

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

③Dimensions (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

④Packaging

Code	Packaging
T	Taping

⑤Nominal inductance

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

※R=Decimal point

⑥Inductance tolerance

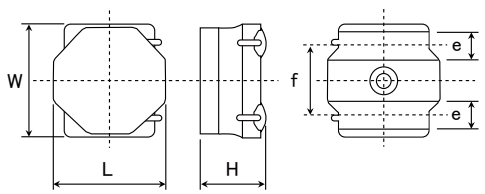
Code	Inductance tolerance
M	±20%
N	±30%

⑦Special code

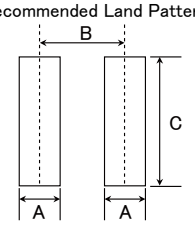
Code	Special code
F	Ferrite coating
M	Metal coating

⑧Internal 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
MDKK1616	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
MDJE2020	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
MDKK2020	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
MDMK2020	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
MDKK3030	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
MDMK3030	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
MDJE4040	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
MDMK4040	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
MDWK4040	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
MDPK5050	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)

▶ 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/) .

■PARTS NUMBER

●MDKK1616 type 【Thickness : 1.0mm max.】

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

●MDJE2020 type 【Thickness : 0.95mm max.】

Parts number	EHS	Nominal inductance [μH]	Inductance tolerance	DC Resistance [Ω]		Rated current ※) [mA]				Measuring frequency [MHz]
						Saturation current: Idc1		Temperature rise current: Idc2		
				Max.	Typ.	Max.	Typ.	Max.	Typ.	
MDJE2020T1R0MM	RoHS	1.0	±20%	0.121	0.106	3,100	3,800	1,550	1,800	1
MDJE2020T2R2MM	RoHS	2.2	±20%	0.266	0.230	1,550	1,900	1,050	1,200	1
MDJE2020T3R3MM	RoHS	3.3	±20%	0.340	0.290	1,350	1,600	950	1,100	1
MDJE2020T4R7MM	RoHS	4.7	±20%	0.475	0.410	1,200	1,550	850	950	1
MDJE2020T6R8MM	RoHS	6.8	±20%	0.630	0.550	800	1,100	750	850	1
MDJE2020T100MM	RoHS	10	±20%	1.040	0.910	700	900	550	600	1

●MDKK2020 type 【Thickness : 1.0mm max.】

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

●MDMK2020 type 【Thickness : 1.2mm max.】

Parts number	EHS	Nominal inductance [μH]	Inductance tolerance	DC Resistance [Ω]		Rated current ※) [mA]				Measuring frequency [MHz]
						Saturation current: Idc1		Temperature rise current: Idc2		
				Max.	Typ.	Max.	Typ.	Max.	Typ.	
MDMK2020TR47MM	RoHS	0.47	±20%	0.046	0.040	4,200	4,800	2,300	2,450	1
MDMK2020TR68MM	RoHS	0.68	±20%	0.058	0.050	3,500	4,100	2,000	2,200	1
MDMK2020T1R0MM	RoHS	1.0	±20%	0.064	0.056	2,550	2,900	1,900	2,050	1
MDMK2020T1R5MM	RoHS	1.5	±20%	0.086	0.075	2,000	2,300	1,650	1,750	1
MDMK2020T2R2MM	RoHS	2.2	±20%	0.109	0.095	1,750	2,000	1,450	1,550	1
MDMK2020T3R3MM	RoHS	3.3	±20%	0.178	0.155	1,350	1,550	1,150	1,200	1
MDMK2020T4R7MM	RoHS	4.7	±20%	0.242	0.210	1,150	1,300	950	1,050	1

●MDKK3030 type 【Thickness : 1.0mm max.】

Parts number	EHS	Nominal inductance [μH]	Inductance tolerance	DC Resistance [Ω]		Rated current ※) [mA]				Measuring frequency [MHz]
						Saturation current: Idc1		Temperature rise current: Idc2		
				Max.	Typ.	Max.	Typ.	Max.	Typ.	
MDKK3030TR47MM	RoHS	0.47	±20%	0.039	0.033	5,400	6,500	3,900	4,500	1
MDKK3030T1R0MM	RoHS	1.0	±20%	0.086	0.074	4,400	5,200	2,400	2,800	1
MDKK3030T1R5MM	RoHS	1.5	±20%	0.100	0.087	3,000	3,500	2,100	2,400	1
MDKK3030T2R2MM	RoHS	2.2	±20%	0.144	0.125	2,500	3,000	1,900	2,200	1
MDKK3030T3R3MM	RoHS	3.3	±20%	0.248	0.215	2,000	2,400	1,350	1,500	1
MDKK3030T4R7MM	RoHS	4.7	±20%	0.345	0.300	1,700	2,000	1,150	1,300	1
MDKK3030T6R8MM	RoHS	6.8	±20%	0.437	0.380	1,400	1,700	1,000	1,150	1
MDKK3030T100MM	RoHS	10	±20%	0.575	0.500	1,100	1,300	850	1,000	1

●MDMK3030 type 【Thickness : 1.2mm max.】

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

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■PARTS NUMBER

●MDJE4040 type 【Thickness : 0.95mm max.】

Parts number	EHS	Nominal inductance [μH]	Inductance tolerance	DC Resistance [Ω]		Rated current ※) [mA]				Measuring frequency [MHz]
						Saturation current: Idc1		Temperature rise current: Idc2		
				Max.	Typ.	Max.	Typ.	Max.	Typ.	
MDJE4040TR47MM	RoHS	0.47	±20%	0.040	0.035	6,000	7,900	4,000	4,500	1
MDJE4040T1R0MM	RoHS	1.0	±20%	0.069	0.060	4,700	5,700	3,000	3,500	1
MDJE4040T1R5MM	RoHS	1.5	±20%	0.084	0.073	3,000	4,000	2,700	3,100	1
MDJE4040T2R2MM	RoHS	2.2	±20%	0.115	0.100	2,400	3,100	2,400	2,700	1
MDJE4040T3R3MM	RoHS	3.3	±20%	0.200	0.175	2,000	2,600	1,800	2,000	1
MDJE4040T4R7MM	RoHS	4.7	±20%	0.250	0.220	1,900	2,300	1,600	1,900	1
MDJE4040T6R8MM	RoHS	6.8	±20%	0.370	0.320	1,500	1,800	1,300	1,500	1
MDJE4040T100MM	RoHS	10	±20%	0.510	0.440	1,400	1,700	1,100	1,300	1

●MDMK4040F type 【Thickness : 1.2mm max.】

Parts number	EHS	Nominal inductance [μH]	Inductance tolerance	DC Resistance [Ω]		Rated current ※) [mA]				Measuring frequency [kHz]
						Saturation current: Idc1		Temperature rise current: Idc2		
				Max.	Typ.	Max.	Typ.	Max.	Typ.	
MDMK4040TR47MF	RoHS	0.47	±20%	0.029	0.025	7,500	10,000	4,600	5,400	100
MDMK4040T1R0MF	RoHS	1.0	±20%	0.047	0.041	5,200	7,500	3,500	4,200	100
MDMK4040T1R2MF	RoHS	1.2	±20%	0.047	0.041	4,200	6,200	3,500	4,200	100
MDMK4040T1R5MF	RoHS	1.5	±20%	0.065	0.056	3,700	5,400	3,300	3,600	100
MDMK4040T2R2MF	RoHS	2.2	±20%	0.092	0.080	3,200	4,500	2,500	2,900	100

●MDMK4040 type 【Thickness : 1.2mm max.】

Parts number	EHS	Nominal inductance [μH]	Inductance tolerance	DC Resistance [Ω]		Rated current ※) [mA]				Measuring frequency [MHz]
						Saturation current: Idc1		Temperature rise current: Idc2		
				Max.	Typ.	Max.	Typ.	Max.	Typ.	
MDMK4040TR68MM	RoHS	0.68	±20%	0.029	0.025	6,700	7,800	5,000	5,700	1
MDMK4040T1R0MM	RoHS	1.0	±20%	0.036	0.031	5,000	6,200	4,500	5,100	1
MDMK4040T1R5MM	RoHS	1.5	±20%	0.065	0.056	4,500	5,600	3,200	3,600	1
MDMK4040T2R2MM	RoHS	2.2	±20%	0.079	0.069	3,800	4,500	2,800	3,200	1
MDMK4040T3R3MM	RoHS	3.3	±20%	0.130	0.113	3,200	4,000	2,200	2,500	1
MDMK4040T4R7MM	RoHS	4.7	±20%	0.160	0.140	2,500	3,000	1,900	2,200	1
MDMK4040T6R8MM	RoHS	6.8	±20%	0.230	0.200	1,900	2,200	1,600	1,800	1
MDMK4040T100MM	RoHS	10	±20%	0.330	0.280	1,700	2,000	1,400	1,600	1

●MDWK4040 type 【Thickness : 2.0mm max.】

Parts number	EHS	Nominal inductance [μH]	Inductance tolerance	DC Resistance [Ω]		Rated current ※) [mA]				Measuring frequency [MHz]
						Saturation current: Idc1		Temperature rise current: Idc2		
				Max.	Typ.	Max.	Typ.	Max.	Typ.	
MDWK4040TR33NM	RoHS	0.33	±30%	0.013	0.011	16,000	21,000	7,800	8,800	1
MDWK4040TR47NM	RoHS	0.47	±30%	0.013	0.011	10,000	15,000	7,800	8,800	1
MDWK4040TR56NM	RoHS	0.56	±30%	0.016	0.014	9,000	13,000	6,500	7,500	1
MDWK4040TR68MM	RoHS	0.68	±20%	0.016	0.014	8,000	12,000	7,300	8,300	1
MDWK4040T1R0MM	RoHS	1.0	±20%	0.027	0.023	7,000	9,400	5,100	5,800	1
MDWK4040T1R5MM	RoHS	1.5	±20%	0.041	0.035	7,000	9,400	4,100	4,700	1
MDWK4040T2R2MM	RoHS	2.2	±20%	0.054	0.047	5,400	7,500	3,500	4,000	1
MDWK4040T3R3MM	RoHS	3.3	±20%	0.075	0.066	3,700	5,200	3,000	3,300	1
MDWK4040T4R7MM	RoHS	4.7	±20%	0.107	0.093	3,500	5,000	2,500	2,800	1
MDWK4040T6R8MM	RoHS	6.8	±20%	0.158	0.138	2,900	4,000	2,000	2,300	1
MDWK4040T100MM	RoHS	10	±20%	0.194	0.169	2,200	3,100	1,600	1,900	1
MDWK4040T220MM	RoHS	22	±20%	0.460	0.400	1,500	2,100	1,200	1,400	1
MDWK4040T330MM	RoHS	33	±20%	0.720	0.625	1,200	1,700	800	1,000	1

●MDPK5050 type 【Thickness : 1.4mm max.】

Parts number	EHS	Nominal inductance [μH]	Inductance tolerance	DC Resistance [Ω]		Rated current ※) [mA]				Measuring frequency [MHz]
						Saturation current: Idc1		Temperature rise current: Idc2		
				Max.	Typ.	Max.	Typ.	Max.	Typ.	
MDPK5050T1R0MM	RoHS	1.0	±20%	0.040	0.034	8,500	10,000	4,300	4,700	1
MDPK5050T2R2MM	RoHS	2.2	±20%	0.055	0.047	4,100	5,000	3,600	4,200	1
MDPK5050T3R3MM	RoHS	3.3	±20%	0.086	0.073	3,800	4,500	2,900	3,400	1
MDPK5050T4R7MM	RoHS	4.7	±20%	0.102	0.088	3,500	4,200	2,500	3,000	1
MDPK5050T6R8MM	RoHS	6.8	±20%	0.138	0.12	2,700	3,200	2,200	2,500	1
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℃)
※) The temperature rise current value (Idc2) is the DC current value having temperature increase up to 40℃. (at 20℃)
※) The rated current is the DC current value that satisfies both of current value saturation current value and temperature rise current value.

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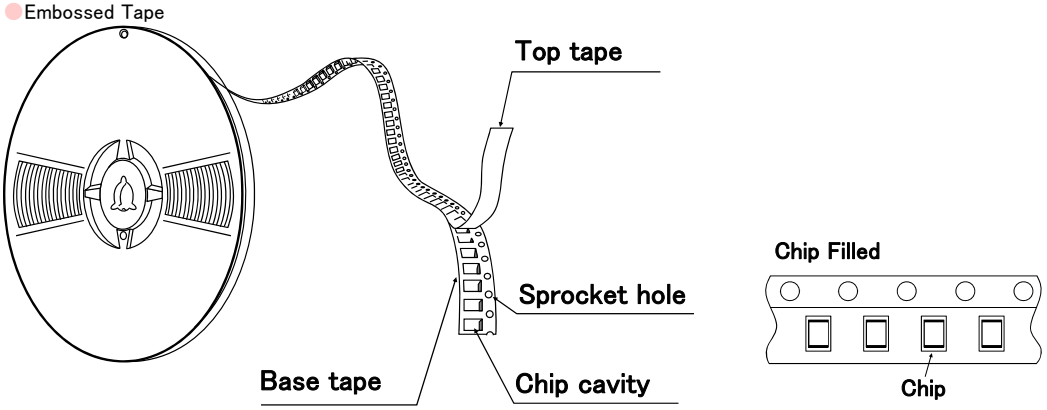
■PACKAGING

①Minimum Quantity

Type	Standard Quantity [pcs]
	Tape & Reel
MDKK1616	2500
MDJE2020 MDKK2020 MDMK2020	2500
MDKK3030 MDMK3030	2000
MDJE4040 MDMK4040	1000
MDWK4040	700
MDPK5050	1000

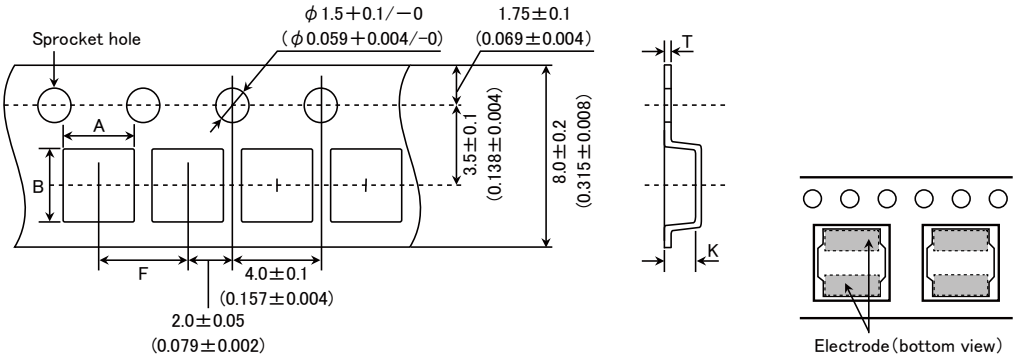
②Tape Material

●Embossed Tape



③Taping dimensions

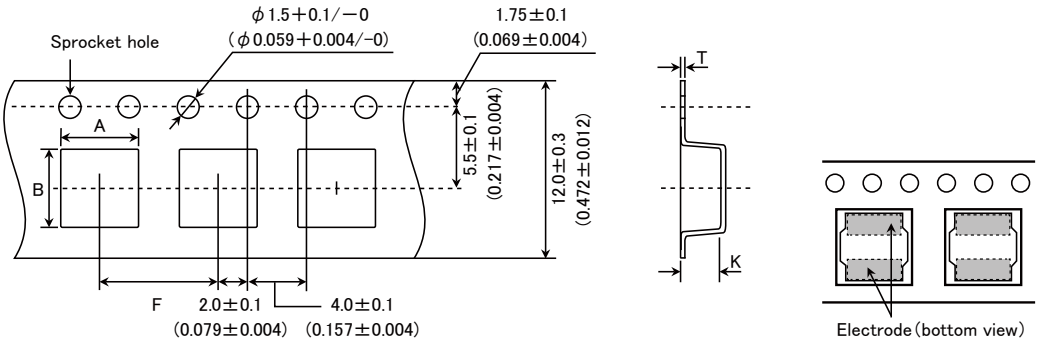
●Embossed tape 8mm wide (0.315 inches wide)



Type	Chip cavity		Insertion pitch	Tape thickness	
	A	B	F	T	K
MDKK1616	1.79±0.1 (0.071±0.004)	1.79±0.1 (0.071±0.004)	4.0±0.1 (0.157±0.004)	0.25±0.05 (0.010±0.002)	1.1±0.1 (0.043±0.004)
MDJE2020 MDKK2020 MDMK2020	2.2±0.1 (0.102±0.004)	2.2±0.1 (0.102±0.004)	4.0±0.1 (0.157±0.004)	0.25±0.05 (0.009±0.002)	1.3±0.1 (0.051±0.004)
MDKK3030 MDMK3030	3.2±0.1 (0.126±0.004)	3.2±0.1 (0.126±0.004)	4.0±0.1 (0.157±0.004)	0.3±0.05 (0.012±0.002)	1.4±0.1 (0.055±0.004)

Unit : mm (inch)

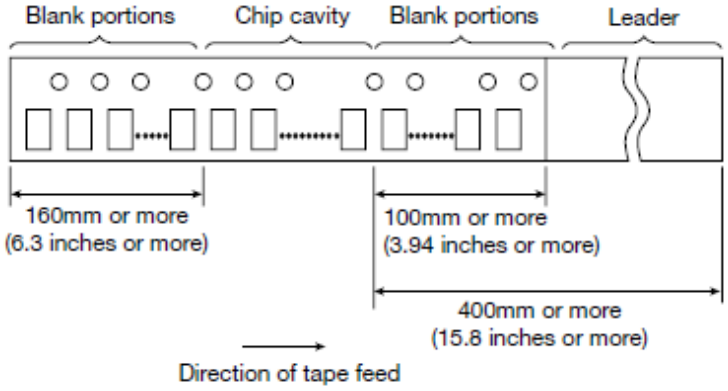
Embossed tape 12mm wide (0.47 inches wide)



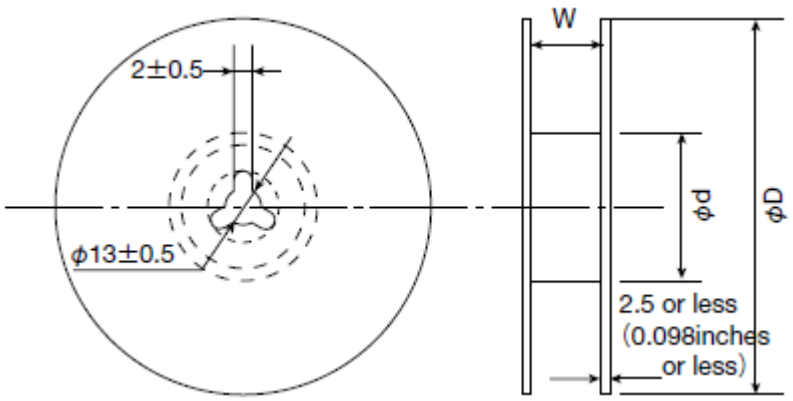
Type	Chip cavity		Insertion pitch	Tape thickness	
	A	B	F	T	K
MDJE4040 MDMK4040	4.3±0.1 (0.169±0.004)	4.3±0.1 (0.169±0.004)	8.0±0.1 (0.315±0.004)	0.3±0.05 (0.012±0.002)	1.6±0.1 (0.063±0.004)
MDWK4040	4.3±0.1 (0.169±0.004)	4.3±0.1 (0.169±0.004)	8.0±0.1 (0.315±0.004)	0.3±0.05 (0.012±0.002)	2.3±0.1 (0.091±0.004)
MDPK5050	5.25±0.1 (0.207±0.004)	5.25±0.1 (0.207±0.004)	8.0±0.1 (0.315±0.004)	0.3±0.1 (0.012±0.004)	1.6±0.1 (0.063±0.004)

Unit : mm (inch)

④Leader and Blank portion



⑤Reel size



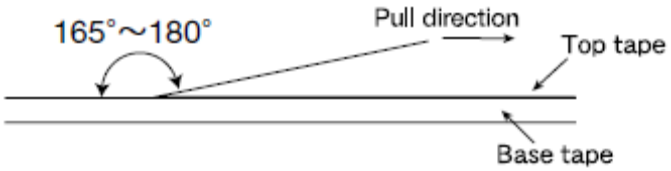
Type	Reel size (Reference values)		
	φD	φd	W
MDKK1616	180±0.5 (7.087±0.019)	60±1.0 (2.36±0.04)	10.0±1.5 (0.394±0.059)
MDJE2020 MDKK2020 MDMK2020			
MDKK3030 MDMK3030			
MDJE4040 MDMK4040 MDWK4040	180±3.0 (7.087±0.118)	60±2.0 (2.36±0.08)	14.0±1.5 (0.551±0.059)
MDPK5050			

Unit : mm (inch)

⑥Top Tape Strength

Top tape strength

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



METAL CORE SMD POWER INDUCTORS (MCOIL™ MD SERIES)

■RELIABILITY DATA

1. Operating Temperature Range		
Specified Value	MD series	−40～＋125℃
Test Methods and Remarks	Including self-generated heat	

2. Storage Temperature Range		
Specified Value	MD series	−40～＋85℃
Test Methods and Remarks	−5 to 40℃ for the product with taping.	

3. Rated current		
Specified Value	MD series	Within the specified tolerance

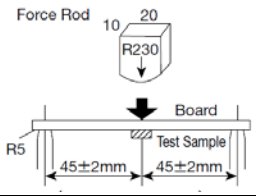
4. Inductance		
Specified Value	MD series	Within the specified tolerance
Test Methods and Remarks	Measuring equipment : LCR Meter (HP 4285A or equivalent) Measuring condition : Please see item list.	

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

6. Self resonance frequency		
Specified Value	MD series	—

7. Temperature characteristic		
Specified Value	MD series	Inductance change : Within ±10%
Test Methods and Remarks	Measurement of inductance shall be taken at temperature range within −40℃～＋125℃. With reference to inductance value at ＋20℃., change rate shall be calculated.	

8. Resistance to flexure of substrate		
Specified Value	MD series	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 : 100×40×1.0 mm Test board material : Glass epoxy-resin Solder cream thickness : 0.10 mm	



9. Insulation resistance : between wires		
Specified Value	MD series	—

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

11. Withstanding voltage : between wire and core		
Specified Value	MD series	—

12. Adhesion of terminal electrode

Specified Value	MD series	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	MD series	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.

Frequency Range	10～55Hz	
Total Amplitude	1.5mm (May not exceed acceleration 196m/s^2)	
Sweeping Method	10Hz to 55Hz to 10Hz for 1min.	
Time	X	For 2 hours on each X, Y, and Z axis.
	Y	
	Z	

Recovery : At least 2hrs of recovery under the standard condition after the test, followed by the measurement within 48hrs.

14. Solderability

Specified Value	MD series	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 : Methanol solution containing rosin 25%.

Solder Temperature	245±5℃
Time	5±1.0 sec.

※Immersion depth : All sides of mounting terminal shall be immersed.

15. Resistance to soldering heat

Specified Value	MD series	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	MD series	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.

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	MD series	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.

Temperature	60±2℃
Humidity	90～95%RH
Time	500+24/−0 hour

18. Loading under damp heat		
Specified Value	MD series	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 and applied the rated current continuously as shown in below table. Temperature: 60±2℃ Humidity: 90～95%RH Applied current: Rated current Time: 500+24/−0 hour	

19. Low temperature life test		
Specified Value	MD series	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. After that, the test samples shall be placed at test conditions as shown in below table. Temperature: −40±2℃ Time: 500+24/−0 hour	

20. High temperature life test		
Specified Value	MD series	—

21. Loading at high temperature life test		
Specified Value	MD series	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 applied the rated current continuously as shown in below table. Temperature: 85±2℃ Applied current: Rated current Time: 500+24/−0 hour	

22. Standard condition		
Specified Value	MD series	Standard test condition : Unless otherwise specified, temperature is 20±15℃ and 65±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±2℃ of temperature, 65±5% relative humidity. Inductance is in accordance with our measured value.

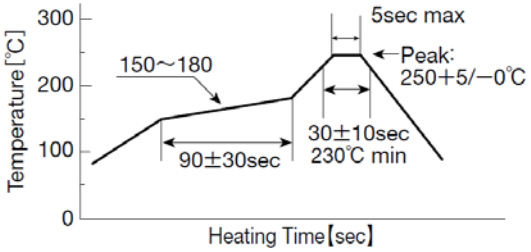
METAL CORE SMD POWER INDUCTORS (MCOIL™ MD SERIES)

■PRECAUTIONS

1. Circuit Design	
Precautions	◆Operating environment 1. The products described in this specification are intended for use in general electronic equipment,(office supply equipment, telecommunications systems, measuring equipment, and household equipment). They are not intended for use in mission-critical equipment or systems requiring special quality and high reliability (traffic systems, safety equipment, aerospace systems, nuclear control systems and medical equipment including life-support systems,) where product failure might result in loss of life, injury or damage. For such uses, contact TAIYO YUDEN Sales Department in advance.

2. PCB Design	
Precautions	◆Land pattern design 1. Please refer to a recommended land pattern.
Technical considerations	◆Land pattern design Surface Mounting ・ Mounting and soldering conditions should be checked beforehand. ・ Applicable soldering process to this products is reflow soldering only.

3. Considerations for automatic placement	
Precautions	◆Adjustment of mounting machine 1. Excessive impact load should not be imposed on the products when mounting onto the PC boards. 2. Mounting and soldering conditions should be checked beforehand.
Technical considerations	◆Adjustment of mounting machine 1. When installing products, care should be taken not to apply distortion stress as it may deform the products.

4. Soldering	
Precautions	◆Reflow soldering 1. Please contact any of our offices for a reflow soldering, and refer to the recommended condition specified. 2. The product shall be used reflow soldering only. 3. Please do not add any stress to a product until it returns in normal temperature after reflow soldering. ◆Lead free soldering 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. ◆Recommended conditions for using a soldering iron (NR10050 Type) ・ Put the soldering iron on the land-pattern. ・ Soldering iron's temperature – Below 350℃ ・ Duration – 3 seconds or less ・ The soldering iron should not directly touch the inductor.
Technical considerations	◆Reflow soldering 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. ・NR30/40/50/60/80, NRV20/30, NRH24/30, NRS20/40/50/60/80 Type, NR10050 Type, NS101/125 Type Recommended reflow condition (Pb free solder) 

5. Cleaning	
Precautions	◆Cleaning conditions 1. Washing by supersonic waves shall be avoided.
Technical considerations	◆Cleaning conditions 1. If washed by supersonic waves, the products might be broken.

6. Handling	
Precautions	◆Handling 1. Keep the product away from all magnets and magnetic objects. ◆Breakaway PC boards (splitting along perforations) 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. 2. Board separation should not be done manually, but by using the appropriate devices. ◆Mechanical considerations 1. Please do not give the product any excessive mechanical shocks. 2. Please do not add any shock and power to a product in transportation. ◆Pick-up pressure 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. ◆Packing 1. Please avoid accumulation of a packing box as much as possible. ◆Board mounting 1. There shall be no pattern or via between terminals at the bottom of product. 2. Components which are located in peripheral of product shall not make contact with surface (top, side) of product.
Technical considerations	◆Handling 1. There is a case that a characteristic varies with magnetic influence. ◆Breakaway PC boards (splitting along perforations) 1. The position of the product on PCBs shall be carefully considered to minimize the stress caused from splitting of the PCBs. ◆Mechanical considerations 1. There is a case to be damaged by a mechanical shock. 2. There is a case to be broken by the handling in transportation. ◆Pick-up pressure 1. Damage and a characteristic can vary with an excessive shock or stress. ◆Packing 1. If packing boxes are accumulated, that could cause a deformation on packing tapes or a damage on the products. ◆Board mounting 1. If there is pattern or via between terminals at the bottom of product, it may cause characteristics change. 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.

7. Storage conditions	
Precautions	◆Storage 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. ・ Recommended conditions Ambient temperature : －5～40℃ Humidity : Below 70% RH ・ The ambient temperature must be kept below 30℃. Even under ideal storage conditions, solderability of products electrodes may decrease as time passes. For this reason, product should be used within 6 months from the time of delivery. In case of storage over 6 months, solderability shall be checked before actual usage.
Technical considerations	◆Storage 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.

METAL CORE WIRE-WOUND CHIP POWER INDUCTORS (MCOIL™ MA SERIES)

REFLOW

■PARTS NUMBER

＊Operating Temp.:−40〜+105℃(Including self-generated heat)

M	A	K	K	2	0	1	6	T	1	R	0	M	△	△
①		②		③				④	⑤			⑥	⑦	⑧

△=Blank space

①Series name

Code	Series name
MA	Metal Core Wire-wound Chip Power Inductor

②Dimensions(T)

Code	Dimensions(T)[mm]
KK	1.0
MK	1.2

③Dimensions(L×W)

Code	Type(inch)	Dimensions (L×W)[mm]
2016	2016(0806)	2.0×1.6
2520	2520(1008)	2.5×2.0

④Packaging

Code	Packaging
T	Taping

⑤Nominal inductance

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

※R=Decimal point

⑥Inductance tolerance

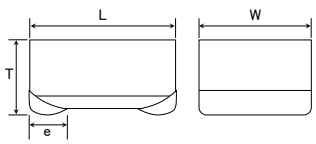
Code	Inductance tolerance
M	±20%

⑦Special code

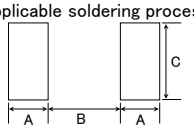
Code	Special code
△	Standard

⑧Internal code

■STANDARD EXTERNAL DIMENSIONS / STANDARD QUANTITY



Recommended Land Patterns
Surface Mounting
・Mounting and soldering conditions should be checked beforehand.
・Applicable soldering process to these products is reflow soldering only.



Type	A	B	C
2016	0.7	0.8	1.8
2520	0.8	1.2	2.0

Unit:mm

Type	L	W	T	e	Standard quantity[pcs] Taping
MAKK2016	2.0±0.1 (0.079±0.004)	1.6±0.1 (0.063±0.004)	1.0 max (0.039 max)	0.5±0.3 (0.020±0.012)	3000
MAKK2520	2.5±0.2 (0.098±0.008)	2.0±0.2 (0.079±0.008)	1.0 max (0.039 max)	0.5±0.3 (0.020±0.012)	3000
MAMK2520	2.5±0.2 (0.098±0.008)	2.0±0.2 (0.079±0.008)	1.2 max (0.047 max)	0.5±0.3 (0.020±0.012)	3000

Unit:mm(inch)

■PARTS NUMBER

●MAKK2016(0806) type 【Thickness:1.0mm max.】

Parts number	EHS	Nominal inductance [μH]	Inductance tolerance	Self-resonant frequency [MHz] (min.)	DC Resistance [Ω] (max.)	Rated current ※) [mA] (max.)		Measuring frequency [MHz]
						Saturation current Idc1	Temperature rise current Idc2	
MAKK2016TR24M	RoHS	0.24	±20%	–	0.037	4,200	3,000	2
MAKK2016TR33M	RoHS	0.33	±20%	–	0.040	3,600	3,200	2
MAKK2016TR47M	RoHS	0.47	±20%	–	0.460	3,200	2,800	2
MAKK2016TR68M	RoHS	0.68	±20%	–	0.065	2,500	2,500	2
MAKK2016T1R0M	RoHS	1.0	±20%	–	0.075	2,200	2,200	2
MAKK2016T1R5M	RoHS	1.5	±20%	–	0.130	1,600	1,650	2
MAKK2016T2R2M	RoHS	2.2	±20%	–	0.160	1,500	1,500	2
MAKK2016T3R3M	RoHS	3.3	±20%	–	0.255	1,150	1,200	2
MAKK2016T4R7M	RoHS	4.7	±20%	–	0.380	1,000	950	2

●MAKK2520(1008) type 【Thickness:1.0mm max.】

Parts number	EHS	Nominal inductance [μH]	Inductance tolerance	Self-resonant frequency [MHz] (min.)	DC Resistance [Ω] (max.)	Rated current ※) [mA] (max.)		Measuring frequency [MHz]
						Saturation current Idc1	Temperature rise current Idc2	
MAKK2520TR33M	RoHS	0.33	±20%	–	0.038	4,700	3,500	2
MAKK2520TR47M	RoHS	0.47	±20%	–	0.046	3,900	3,200	2
MAKK2520TR68M	RoHS	0.68	±20%	–	0.059	3,700	2,900	2
MAKK2520T1R0M	RoHS	1.0	±20%	–	0.072	2,700	2,500	2
MAKK2520T1R5M	RoHS	1.5	±20%	–	0.125	2,300	1,800	2
MAKK2520T2R2M	RoHS	2.2	±20%	–	0.156	1,900	1,500	2
MAKK2520T3R3M	RoHS	3.3	±20%	–	0.200	1,550	1,300	2
MAKK2520T4R7M	RoHS	4.7	±20%	–	0.300	1,300	1,100	2

●MAMK2520(1008) type 【Thickness:1.2mm max.】

Parts number	EHS	Nominal inductance [μH]	Inductance tolerance	Self-resonant frequency [MHz] (min.)	DC Resistance [Ω] (max.)	Rated current ※) [mA] (max.)		Measuring frequency [MHz]
						Saturation current Idc1	Temperature rise current Idc2	
MAMK2520TR47M	RoHS	0.47	±20%	–	0.039	4,200	3,400	2
MAMK2520TR68M	RoHS	0.68	±20%	–	0.048	3,200	3,200	2
MAMK2520T1R0M	RoHS	1.0	±20%	–	0.059	3,100	2,700	2
MAMK2520T2R2M	RoHS	2.2	±20%	–	0.110	2,000	1,900	2
MAMK2520T3R3M	RoHS	3.3	±20%	–	0.156	1,800	1,700	2
MAMK2520T4R7M	RoHS	4.7	±20%	–	0.260	1,500	1,300	2

※) The saturation current value (Idc1) is the DC current value having inductance decrease down to 30%. (at 20℃)
※) The temperature rise current value (Idc2) is the DC current value having temperature increase by 40℃. (at 20℃)
※) The rated current value is following either Idc1 or Idc2, which is the lower one.

METAL CORE WIRE-WOUND CHIP POWER INDUCTORS (MCOIL™ MA-H SERIES)

REFLOW

＊Operating Temp.:−40〜+125℃(Including self-generated heat)
＊Operating Temp.:−40〜+105℃(Including self-generated heat)※1Parts Number reference

■PARTS NUMBER

M	A	K	K	2	0	1	6	H	1	R	0	M	△	△
①		②		③				④	⑤			⑥	⑦	⑧

△=Blank space

①Series name

Code	Series name
MA	Metal Core Wire-wound Chip Power Inductor

②Dimensions(T)

Code	Dimensions(T)[mm]
KK	1.0
MK	1.2

③Dimensions(L×W)

Code	Type(inch)	Dimensions (L×W)[mm]
2016	2016(0806)	2.0×1.6
2520	2520(1008)	2.5×2.0

④Packaging

Code	Packaging or Special specification
H	Taping(High characteristics)

⑤Nominal inductance

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

※R=Decimal point

⑥Inductance tolerance

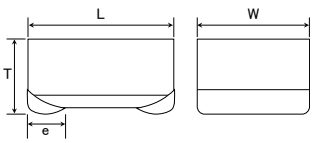
Code	Inductance tolerance
M	±20%

⑦Special code

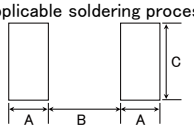
Code	Special code
△	Standard

⑧Internal code

■STANDARD EXTERNAL DIMENSIONS / STANDARD QUANTITY



Recommended Land Patterns
Surface Mounting
・Mounting and soldering conditions should be checked beforehand.
・Applicable soldering process to these products is reflow soldering only.



Type	A	B	C
2016	0.7	0.8	1.8
2520	0.8	1.2	2.0

Unit:mm

Type	L	W	T	e	Standard quantity[pcs] Taping
MAKK2016H	2.0±0.1 (0.079±0.004)	1.6±0.1 (0.063±0.004)	1.0 max (0.039 max)	0.5±0.3 (0.020±0.012)	3000
MAKK2520H	2.5±0.2 (0.098±0.008)	2.0±0.2 (0.079±0.008)	1.0 max (0.039 max)	0.5±0.3 (0.020±0.012)	3000
MAMK2520H	2.5±0.2 (0.098±0.008)	2.0±0.2 (0.079±0.008)	1.2 max (0.047 max)	0.5±0.3 (0.020±0.012)	3000

Unit:mm(inch)

■PARTS NUMBER

●MAKK2016H(0806) type 【Thickness:1.0mm max.】

Parts number	EHS	Nominal inductance [μH]	Inductance tolerance	Self-resonant frequency [MHz] (min.)	DC Resistance [Ω] (max.)	Rated current ※) [mA] (max.)		Measuring frequency [MHz]
						Saturation current Idc1	Temperature rise current Idc2	
MAKK2016HR22M	RoHS	0.22	±20%	–	0.026	5,800	4,000	2
MAKK2016HR24M	RoHS	0.24	±20%	–	0.026	5,800	4,000	2
MAKK2016HR33M	RoHS	0.33	±20%	–	0.030	4,700	3,500	2
MAKK2016HR47M	RoHS	0.47	±20%	–	0.036	4,300	3,300	2
MAKK2016HR68M	RoHS	0.68	±20%	–	0.050	3,200	2,700	2
MAKK2016H1R0M	RoHS	1.0	±20%	–	0.070	2,700	2,300	2
MAKK2016H1R5M	RoHS	1.5	±20%	–	0.105	2,100	1,800	2

●MAKK2520H(1008) type 【Thickness:1.0mm max.】

Parts number	EHS	Nominal inductance [μH]	Inductance tolerance	Self-resonant frequency [MHz] (min.)	DC Resistance [Ω] (max.)	Rated current ※) [mA] (max.)		Measuring frequency [MHz]
						Saturation current Idc1	Temperature rise current Idc2	
MAKK2520HR22M	RoHS	0.22	±20%	–	0.021	7500	4900	2
MAKK2520HR33M	RoHS	0.33	±20%	–	0.026	6200	4300	2
MAKK2520HR47M	RoHS	0.47	±20%	–	0.029	5700	4000	2
MAKK2520HR68M	RoHS	0.68	±20%	–	0.043	4300	3400	2
MAKK2520H1R0M	RoHS	1.0	±20%	–	0.053	3800	3000	2
MAKK2520H1R5M	RoHS	1.5	±20%	–	0.078	3000	2400	2
MAKK2520H2R2M	RoHS	2.2	±20%	–	0.120	2500	1800	2
MAKK2520H100M ※1	RoHS	10	±20%	–	0.650	1100	750	2

●MAMK2520H(1008) type 【Thickness:1.2mm max.】

Parts number	EHS	Nominal inductance [μH]	Inductance tolerance	Self-resonant frequency [MHz] (min.)	DC Resistance [Ω] (max.)	Rated current ※) [mA] (max.)		Measuring frequency [MHz]
						Saturation current Idc1	Temperature rise current Idc2	
MAMK2520HR22M	RoHS	0.22	±20%	–	0.021	7500	5000	2
MAMK2520HR33M	RoHS	0.33	±20%	–	0.023	6600	4400	2
MAMK2520HR47M	RoHS	0.47	±20%	–	0.026	5800	4100	2
MAMK2520HR68M	RoHS	0.68	±20%	–	0.036	5100	3500	2
MAMK2520H1R0M	RoHS	1.0	±20%	–	0.045	4300	3100	2
MAMK2520H1R5M	RoHS	1.5	±20%	–	0.065	3300	2600	2
MAMK2520H2R2M	RoHS	2.2	±20%	–	0.090	2800	2200	2

※) The saturation current value (Idc1) is the DC current value having inductance decrease down to 30%. (at 20℃)
※) The temperature rise current value (Idc2) is the DC current value having temperature increase by 40℃. (at 20℃)
※) The rated current value is following either Idc1 or Idc2, which is the lower one.

METAL CORE WIRE-WOUND CHIP POWER INDUCTORS (MCOIL™ MA SERIES / MCOIL™ MA-H SERIES)

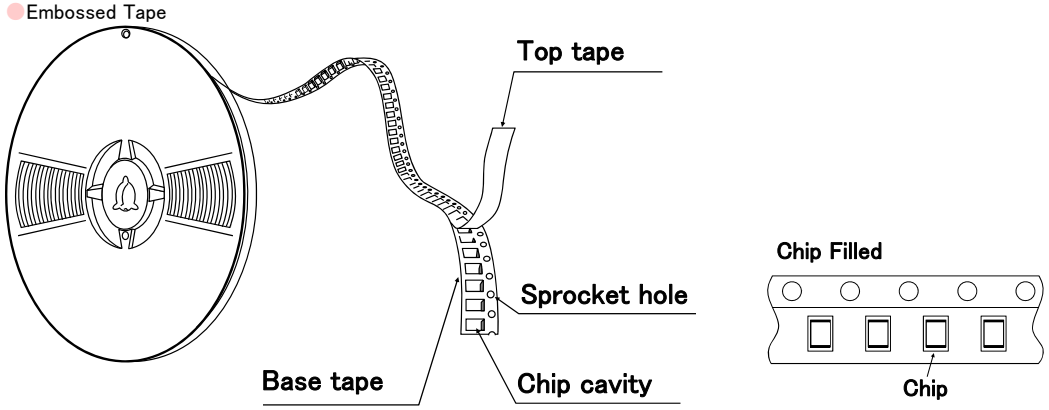
■PACKAGING

①Minimum Quantity

Type	Standard Quantity [pcs]
	Tape & Reel
MAKK2016	3000
MAKK2520	3000
MAMK2520	3000

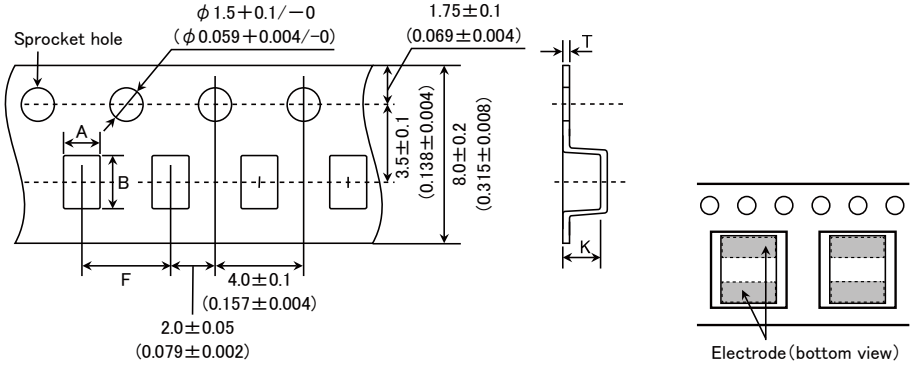
②Tape Material

●Embossed Tape



③Taping dimensions

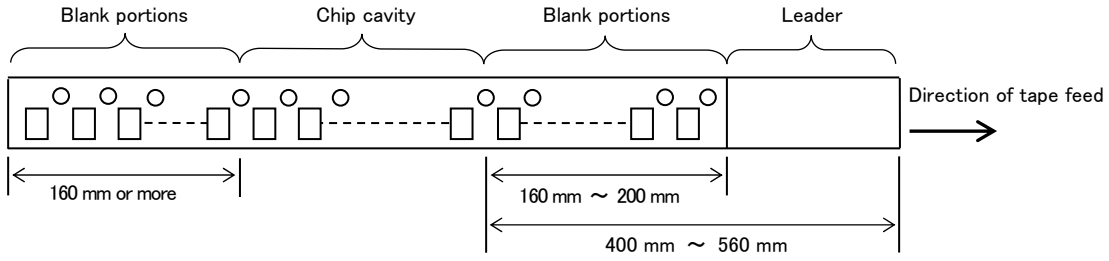
●Embossed tape 8mm wide (0.315 inches wide)



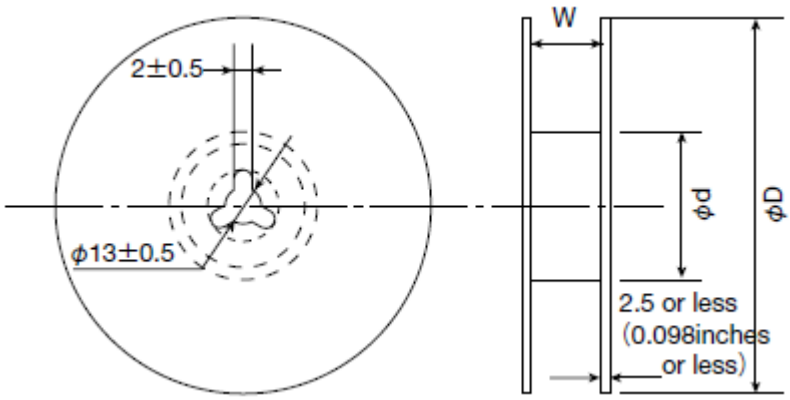
Type	Chip cavity		Insertion pitch	Tape thickness	
	A	B	F	T	K
MAKK2016	1.9±0.1 (0.075±0.004)	2.3±0.1 (0.091±0.004)	4.0±0.1 (0.157±0.004)	0.25±0.05 (0.009±0.002)	1.2 max (0.047 max)
MAKK2520	2.3±0.1 (0.091±0.004)	2.8±0.1 (0.110±0.004)	4.0±0.1 (0.157±0.004)	0.3±0.05 (0.012±0.002)	1.25 max (0.049 max)
MAMK2520	2.3±0.1 (0.091±0.004)	2.8±0.1 (0.110±0.004)	4.0±0.1 (0.157±0.004)	0.3±0.05 (0.012±0.002)	1.4 max (0.055 max)

Unit:mm(inch)

④Leader and Blank portion



⑤Reel size

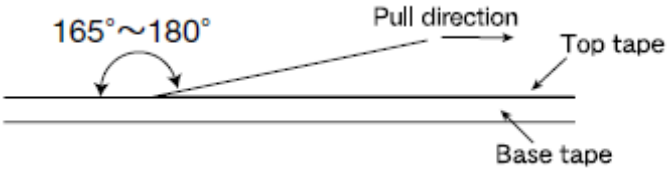


Type	Reel size (Reference values)		
	ϕD	ϕd	W
MAKK2016	180+0/−3 (7.087+0/−0.118)	60+1/−0 (2.36+0.039/0)	10.0±1.5 (0.394±0.059)
MAKK2520			
MAMK2520			

Unit : mm (inch)

⑥Top Tape Strength

The top The top tape requires a peel-off force of 0.1 to 1.2N in the direction of the arrow as illustrated below.



METAL CORE WIRE-WOUND CHIP POWER INDUCTORS (MCOIL™ MA SERIES / MCOIL™ MA-H SERIES)

■RELIABILITY DATA

1. Operating Temperature Range		
Specified Value	MA series	−40～＋105℃
	MA-H series	−40～＋125℃
Test Methods and Remarks	Including self-generated heat	

2. Storage Temperature Range		
Specified Value	MA series MA-H series	−40～＋85℃
Test Methods and Remarks	0 to 40℃ for the product with taping.	

3. Rated current		
Specified Value	MA series MA-H series	Within the specified tolerance

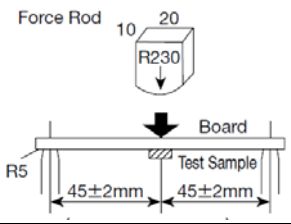
4. Inductance		
Specified Value	MA series MA-H series	Within the specified tolerance
Test Methods and Remarks	Measuring equipment : LCR Meter (HP 4285A or equivalent) Measuring frequency : 2MHz、1V	

5. DC Resistance		
Specified Value	MA series MA-H series	Within the specified tolerance
Test Methods and Remarks	Measuring equipment : DC ohmmeter (HIOKI 3227 or equivalent)	

6. Self resonance frequency		
Specified Value	MA series MA-H series	—

7. Temperature characteristic		
Specified Value	MA series MA-H series	Inductance change : Within ±15%
Test Methods and Remarks	Measurement of inductance shall be taken at temperature range within −40℃～＋85℃. With reference to inductance value at ＋20℃., change rate shall be calculated.	

8. Resistance to flexure of substrate		
Specified Value	MA series MA-H series	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 : 100×40×1.0 mm Test board material : Glass epoxy-resin Solder cream thickness : 0.12 mm	



9. Insulation resistance : between wires		
Specified Value	MA series MA-H series	—

10. Insulation resistance : between wire and core		
Specified Value	MA series MA-H series	—

11. Withstanding voltage : between wire and core		
Specified Value	MA series MA-H series	—

12. Adhesion of terminal electrode		
Specified Value	MA series MA-H series	No abnormality.
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 : 0.12mm.	

13. Resistance to vibration		
Specified Value	MA series MA-H series	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.	

Frequency Range	10～55Hz	
Total Amplitude	1.5mm (May not exceed acceleration 196m/s^2)	
Sweeping Method	10Hz to 55Hz to 10Hz for 1min.	
Time	X	For 2 hours on each X, Y, and Z axis.
	Y	
	Z	

Recovery : At least 2hrs of recovery under the standard condition after the test, followed by the measurement within 48hrs.

14. Solderability		
Specified Value	MA series MA-H series	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 : Methanol solution containing rosin 25%.	

Solder Temperature	245±5℃
Time	5±0.5 sec.

※Immersion depth : All sides of mounting terminal shall be immersed.

15. Resistance to soldering heat		
Specified Value	MA series MA-H series	Inductance change : Within ±10% No significant abnormality in appearance.
Test Methods and Remarks	The test sample shall be exposed to reflow oven at 230℃ for 40 seconds, with peak temperature at 260+0/−5℃ for 5 seconds, 3 times. Test board material : Glass epoxy-resin Test board thickness : 1.0mm Recovery : At least 2hrs of recovery under the standard condition after the test, followed by the measurement within 48hrs.	

16. Thermal shock

Specified Value	MA series MA-H series	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.

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

Recovery : At least 2hrs of recovery under the standard condition after the test, followed by the measurement within 48hrs.

17. Damp heat

Specified Value	MA series MA-H series	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.

Temperature	60±2℃
Humidity	90～95%RH
Time	500+24/−0 hour

Recovery : At least 2hrs of recovery under the standard condition after the test, followed by the measurement within 48hrs.

18. Loading under damp heat

Specified Value	MA series MA-H series	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 and applied the rated current continuously as shown in below table.

Temperature	60±2℃
Humidity	90～95%RH
Applied current	Rated current
Time	500+24/−0 hour

Recovery : At least 2hrs of recovery under the standard condition after the test, followed by the measurement within 48hrs.

19. Low temperature life test

Specified Value	MA series MA-H series	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. After that, the test samples shall be placed at test conditions as shown in below table.

Temperature	−40±2℃
Time	500+24/−0 hour

Recovery : At least 2hrs of recovery under the standard condition after the test, followed by the measurement within 48hrs.

20. High temperature life test

Specified Value	MA series MA-H series	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. After that, the test samples shall be placed at test conditions as shown in below table.

Temperature	85±2℃
Time	500+24/−0 hour

Recovery : At least 2hrs of recovery under the standard condition after the test, followed by the measurement within 48hrs.

21. Loading at high temperature life test

Specified Value	MA series MA-H series	—

22. Standard condition		
Specified Value	MA series	Standard test condition : Unless otherwise specified, temperature is 20±15℃ and 65±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±2℃ of temperature, 65±5% relative humidity. Inductance is in accordance with our measured value.
	MA-H series	

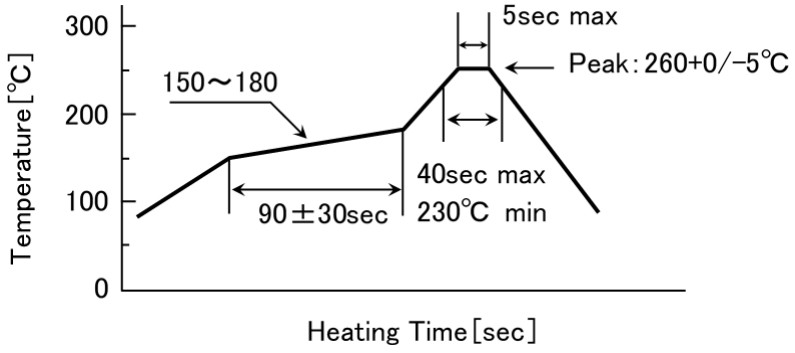
METAL CORE WIRE-WOUND CHIP POWER INDUCTORS (MCOIL™ MA SERIES / MCOIL™ MA-H SERIES)

■PRECAUTIONS

1. Circuit Design	
Precautions	◆Operating environment 1. The products described in this specification are intended for use in general electronic equipment,(office supply equipment, telecommunications systems, measuring equipment, and household equipment). They are not intended for use in mission-critical equipment or systems requiring special quality and high reliability (traffic systems, safety equipment, aerospace systems, nuclear control systems and medical equipment including life-support systems,) where product failure might result in loss of life, injury or damage. For such uses, contact TAIYO YUDEN Sales Department in advance.

2. PCB Design	
Precautions	◆Land pattern design 1. Please refer to a recommended land pattern.
Technical considerations	◆Land pattern design Surface Mounting ・ Mounting and soldering conditions should be checked beforehand. ・ Applicable soldering process to this products is reflow soldering only.

3. Considerations for automatic placement	
Precautions	◆Adjustment of mounting machine 1. Excessive impact load should not be imposed on the products when mounting onto the PC boards. 2. Mounting and soldering conditions should be checked beforehand.
Technical considerations	◆Adjustment of mounting machine 1. When installing products, care should be taken not to apply distortion stress as it may deform the products.

4. Soldering	
Precautions	◆Reflow soldering 1. Please contact any of our offices for a reflow soldering, and refer to the recommended condition specified. 2. The product shall be used reflow soldering only. 3. Please do not add any stress to a product until it returns in normal temperature after reflow soldering. ◆Lead free soldering 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.
Technical considerations	◆Reflow soldering 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. Recommended reflow condition (Pb free solder) 

5. Cleaning	
Precautions	◆Cleaning conditions 1. Washing by supersonic waves shall be avoided.
Technical considerations	◆Cleaning conditions 1. If washed by supersonic waves, the products might be broken.

6. Handling	
Precautions	◆Handling 1. Keep the product away from all magnets and magnetic objects. ◆Breakaway PC boards (splitting along perforations) 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. 2. Board separation should not be done manually, but by using the appropriate devices. ◆Mechanical considerations 1. Please do not give the product any excessive mechanical shocks. 2. Please do not add any shock and power to a product in transportation. ◆Pick-up pressure 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. ◆Packing 1. Please avoid accumulation of a packing box as much as possible.
Technical considerations	◆Handling 1. There is a case that a characteristic varies with magnetic influence. ◆Breakaway PC boards (splitting along perforations) 1. The position of the product on PCBs shall be carefully considered to minimize the stress caused from splitting of the PCBs. ◆Mechanical considerations 1. There is a case to be damaged by a mechanical shock. 2. There is a case to be broken by the handling in transportation. ◆Pick-up pressure 1. Damage and a characteristic can vary with an excessive shock or stress. ◆Packing 1. If packing boxes are accumulated, that could cause a deformation on packing tapes or a damage on the products.

7. Storage conditions	
Precautions	◆Storage 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. ・ Recommended conditions Ambient temperature : 0～40℃ Humidity : Below 70% RH ・ The ambient temperature must be kept below 30℃. Even under ideal storage conditions, solderability of products electrodes may decrease as time passes. For this reason, product should be used within 6 months from the time of delivery. In case of storage over 6 months, solderability shall be checked before actual usage.
Technical considerations	◆Storage 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.

METAL WIRE-WOUND CHIP POWER INDUCTORS (MCOIL™ MB SERIES)

REFLOW

■PARTS NUMBER

＊Operating Temp.：−40〜+105℃(Including self-generated heat)

M B	K K	1 6 0 8	T	1 R 0	M	△
①	②	③	④	⑤	⑥	⑦

△＝Blank space

①Series name

Code	Series name
MB	Metal Wire-Wound chip power inductor

②Dimensions(T)

Code	Dimensions(T)[mm]
KK	1.0
MK	1.2

③Dimensions(L×W)

Code	Type(inch)	Dimensions (L×W)[mm]
1608	1608(0603)	1.6×0.8
2012	2012(0805)	2.0×1.25
2520	2520(1008)	2.5×2.0

④Packaging

Code	Packaging
T	Taping

⑤Nominal inductance

Code (example)	Nominal inductance[μH]
R24	0.24
1R0	1.0
4R7	4.7

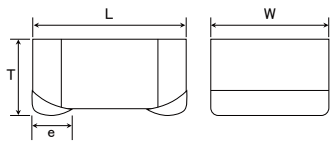
※R＝Decimal point

⑥Inductance tolerance

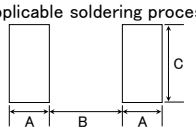
Code	Inductance tolerance
M	±20%
N	±30%

⑦Internal code

■STANDARD EXTERNAL DIMENSIONS / STANDARD QUANTITY



Recommended Land Patterns
Surface Mounting
・Mounting and soldering conditions should be checked beforehand.
・Applicable soldering process to these products is reflow soldering only.



Type	A	B	C
1608	0.55	0.70	1.00
2012	0.60	1.00	1.45
2520	0.60	1.50	2.00

Unit：mm

Type	L	W	T	e	Standard quantity[pcs]	
					Paper tape	Embossed tape
MBKK1608	1.6±0.2 (0.063±0.008)	0.8±0.2 (0.031±0.008)	1.0 max (0.040 max)	0.45±0.15 (0.016±0.006)	—	3000
MBKK2012	2.0±0.2 (0.079±0.008)	1.25±0.2 (0.049±0.008)	1.0 max (0.040 max)	0.5±0.2 (0.020±0.008)	—	3000
MBMK2520	2.5±0.2 (0.098±0.008)	2.0±0.2 (0.079±0.008)	1.2 max (0.047 max)	0.5±0.2 (0.020±0.008)	—	3000

Unit：mm(inch)

▶ This catalog contains the typical specification only due to the limitation of space. When you consider the purchase of our products, please check our 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/) .

■PARTS NUMBER

●MBKK1608(0603) type 【Thickness:1.0mm max.】

Parts number	EHS	Nominal inductance [μH]	Inductance tolerance	Self-resonant frequency [MHz] (min.)	DC Resistance [Ω] (max.)	Rated current ※) [mA] (max.)		Measuring frequency [MHz]
						Saturation current Idc1	Temperature rise current Idc2	
MBKK1608TR24N	RoHS	0.24	±30%	–	0.049	1,650	2,300	1.0
MBKK1608TR47N	RoHS	0.47	±30%	–	0.104	1,100	1,400	1.0
MBKK1608TR68N	RoHS	0.68	±30%	–	0.120	950	1,200	1.0
MBKK1608T1R0M	RoHS	1.0	±20%	–	0.150	800	1,150	1.0
MBKK1608T1R5M	RoHS	1.5	±20%	–	0.200	650	1,000	1.0
MBKK1608T2R2M	RoHS	2.2	±20%	–	0.345	520	750	1.0
MBKK1608T3R3M	RoHS	3.3	±20%	–	0.512	450	600	1.0
MBKK1608T4R7M	RoHS	4.7	±20%	–	0.730	370	500	1.0

●MBKK2012(0805) type 【Thickness:1.0mm max.】

Parts number	EHS	Nominal inductance [μH]	Inductance tolerance	Self-resonant frequency [MHz] (min.)	DC Resistance [Ω] (max.)	Rated current ※) [mA] (max.)		Measuring frequency [MHz]
						Saturation current Idc1	Temperature rise current Idc2	
MBKK2012TR24N	RoHS	0.24	±30%	–	0.041	3,000	2,400	1.0
MBKK2012TR47N	RoHS	0.47	±30%	–	0.078	2,000	1,650	1.0
MBKK2012TR68N	RoHS	0.68	±30%	–	0.090	1,800	1,500	1.0
MBKK2012T1R0M	RoHS	1.0	±20%	–	0.106	1,500	1,450	1.0
MBKK2012T1R5M	RoHS	1.5	±20%	–	0.173	1,200	1,100	1.0
MBKK2012T2R2M	RoHS	2.2	±20%	–	0.290	900	850	1.0
MBKK2012T3R3M	RoHS	3.3	±20%	–	0.500	700	650	1.0
MBKK2012T4R7M	RoHS	4.7	±20%	–	0.615	600	600	1.0

●MBMK2520(1008) type 【Thickness:1.2mm max.】

Parts number	EHS	Nominal inductance [μH]	Inductance tolerance	Self-resonant frequency [MHz] (min.)	DC Resistance [Ω] (max.)	Rated current ※) [mA] (max.)		Measuring frequency [MHz]
						Saturation current Idc1	Temperature rise current Idc2	
MBMK2520TR24N	RoHS	0.24	±30%	–	0.026	4,750	3,500	1.0
MBMK2520TR47N	RoHS	0.47	±30%	–	0.042	3,900	2,600	1.0
MBMK2520TR68N	RoHS	0.68	±30%	–	0.058	3,150	2,150	1.0
MBMK2520T1R0M	RoHS	1.0	±20%	–	0.072	2,350	1,850	1.0
MBMK2520T1R5M	RoHS	1.5	±20%	–	0.106	2,050	1,500	1.0
MBMK2520T2R2M	RoHS	2.2	±20%	–	0.159	1,800	1,250	1.0
MBMK2520T3R3M	RoHS	3.3	±20%	–	0.260	1,400	970	1.0
MBMK2520T4R7M	RoHS	4.7	±20%	–	0.380	1,150	800	1.0

※) The saturation current value (Idc1) is the DC current value having inductance decrease down to 30%. (at 20℃)
※) The temperature rise current value (Idc2) is the DC current value having temperature increase by 40℃. (at 20℃)
※) The rated current value is following either Idc1 or Idc2, which is the lower one.

METAL WIRE-WOUND CHIP POWER INDUCTORS (MCOIL™ MB-H SERIES)

REFLOW

■PARTS NUMBER

＊Operating Temp.: −40〜+125℃ (Including self-generated heat)

M B	K K	1 6 0 8	H	1 R 0	M	△
①	②	③	④	⑤	⑥	⑦

△=Blank space

①Series name

Code	Series name
MB	Metal Wire-Wound chip power inductor

②Dimensions (T)

Code	Dimensions (T) [mm]
KK	1.0
MK	1.2

③Dimensions (L×W)

Code	Type (inch)	Dimensions (L×W) [mm]
1608	1608 (0603)	1.6×0.8
2520	2520 (1008)	2.5×2.0

④Packaging

Code	Packaging
H	Taping (Special specification)

⑤Nominal inductance

Code (example)	Nominal inductance [μH]
R24	0.24
1R0	1.0
4R7	4.7

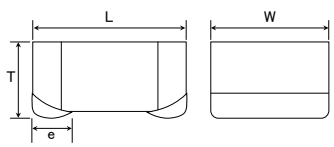
※R=Decimal point

⑥Inductance tolerance

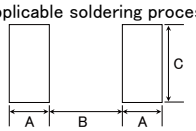
Code	Inductance tolerance
M	±20%
N	±30%

⑦Internal code

■STANDARD EXTERNAL DIMENSIONS / STANDARD QUANTITY



Recommended Land Patterns
Surface Mounting
・Mounting and soldering conditions should be checked beforehand.
・Applicable soldering process to these products is reflow soldering only.



Type	A	B	C
1608	0.55	0.70	1.00
2520	0.60	1.50	2.00

Unit: mm

Type	L	W	T	e	Standard quantity [pcs]	
					Paper tape	Embossed tape
MBKK1608	1.6±0.2 (0.063±0.008)	0.8±0.2 (0.031±0.008)	1.0 max (0.040 max)	0.45±0.15 (0.016±0.006)	—	3000
MBMK2520	2.5±0.2 (0.098±0.008)	2.0±0.2 (0.079±0.008)	1.2 max (0.047 max)	0.5±0.2 (0.020±0.008)	—	3000

Unit: mm (inch)

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■PARTS NUMBER

●MBKK1608H(0603) type 【Thickness:1.0mm max.】

Parts number	EHS	Nominal inductance [μH]	Inductance tolerance	Self-resonant frequency [MHz] (min.)	DC Resistance [Ω] (max.)	Rated current ※) [mA] (max.)		Measuring frequency [MHz]
						Saturation current Idc1	Temperature rise current Idc2	
MBKK1608HR24N	RoHS	0.24	±30%	–	0.049	1,650	2,300	1.0
MBKK1608HR47N	RoHS	0.47	±30%	–	0.104	1,100	1,400	1.0
MBKK1608HR68N	RoHS	0.68	±30%	–	0.120	950	1,200	1.0
MBKK1608H1R0M	RoHS	1.0	±20%	–	0.150	800	1,150	1.0
MBKK1608H1R5M	RoHS	1.5	±20%	–	0.200	650	1,000	1.0
MBKK1608H2R2M	RoHS	2.2	±20%	–	0.345	520	750	1.0
MBKK1608H3R3M	RoHS	3.3	±20%	–	0.512	450	600	1.0
MBKK1608H4R7M	RoHS	4.7	±20%	–	0.730	370	500	1.0

●MBMK2520H(1008) type 【Thickness:1.2mm max.】

Parts number	EHS	Nominal inductance [μH]	Inductance tolerance	Self-resonant frequency [MHz] (min.)	DC Resistance [Ω] (max.)	Rated current ※) [mA] (max.)		Measuring frequency [MHz]
						Saturation current Idc1	Temperature rise current Idc2	
MBMK2520HR24N	RoHS	0.24	±30%	–	0.026	4,750	3,500	1.0
MBMK2520HR47N	RoHS	0.47	±30%	–	0.042	3,900	2,600	1.0
MBMK2520HR68N	RoHS	0.68	±30%	–	0.058	3,150	2,150	1.0
MBMK2520H1R0M	RoHS	1.0	±20%	–	0.072	2,350	1,850	1.0
MBMK2520H1R5M	RoHS	1.5	±20%	–	0.106	2,050	1,500	1.0
MBMK2520H2R2M	RoHS	2.2	±20%	–	0.159	1,800	1,250	1.0
MBMK2520H3R3M	RoHS	3.3	±20%	–	0.260	1,400	970	1.0
MBMK2520H4R7M	RoHS	4.7	±20%	–	0.380	1,150	800	1.0

※) The saturation current value (Idc1) is the DC current value having inductance decrease down to 30%. (at 20℃)
※) The temperature rise current value (Idc2) is the DC current value having temperature increase by 40℃. (at 20℃)
※) The rated current value is following either Idc1 or Idc2, which is the lower one.

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METAL WIRE-WOUND CHIP POWER INDUCTORS (MCOIL™ MB SERIES／MCOIL™ MB-H SERIES)

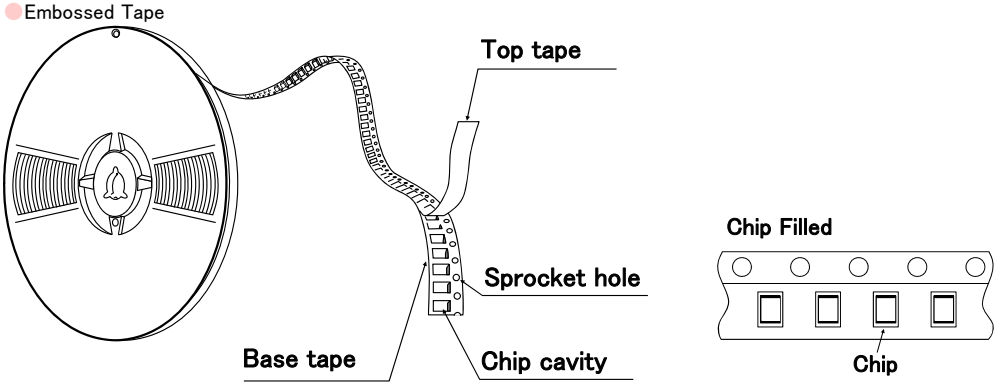
■PACKAGING

①Minimum Quantity

Type	Standard Quantity [pcs]
	Tape & Reel
MBKK1608／MBKK1608H	3000
MBKK2012	3000
MBMK2520／MBMK2520H	3000

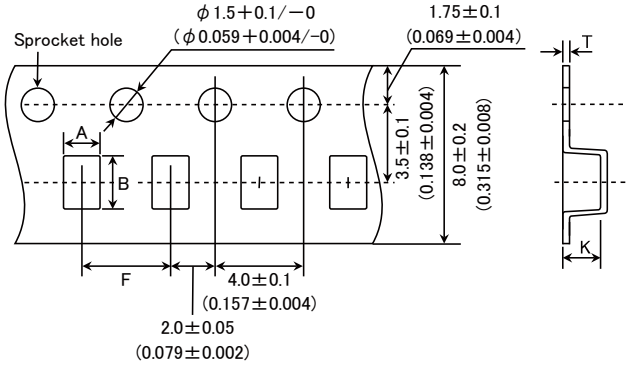
②Tape Material

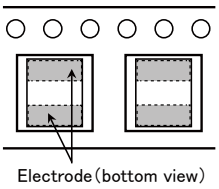
●Embossed Tape



③Taping dimensions

●Embossed tape 8mm wide (0.315 inches wide)

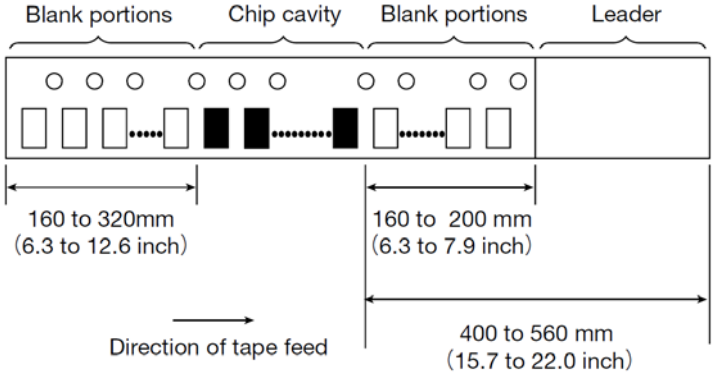




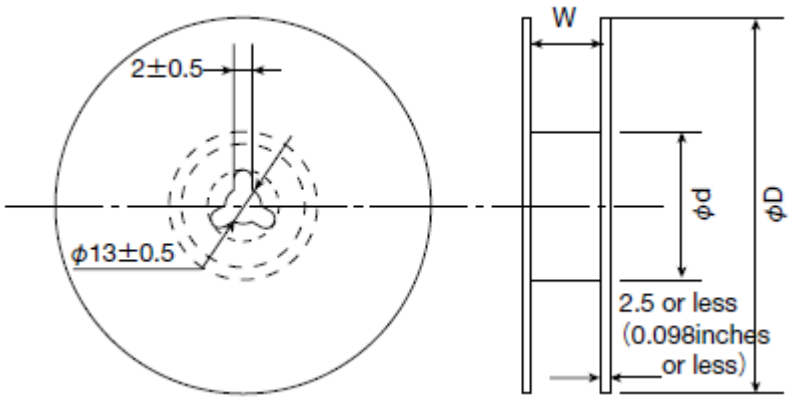
Type	Chip cavity		Insertion pitch	Tape thickness	
	A	B	F	T	K
MBKK1608／MBKK1608H	1.1 (0.043)	1.9 (0.075)	4.0±0.1 (0.157±0.004)	0.25±0.05 (0.010±0.002)	1.2 max (0.047 max)
MBKK2012	1.45 (0.057)	2.2 (0.087)	4.0±0.1 (0.157±0.004)	0.25±0.05 (0.010±0.002)	1.2 max (0.047 max)
MBMK2520／MBMK2520H	2.3 (0.091)	2.8 (0.110)	4.0±0.1 (0.157±0.004)	0.3±0.05 (0.012±0.002)	1.45 max (0.057 max)

Unit : mm (inch)

④Leader and Blank portion



⑤Reel size

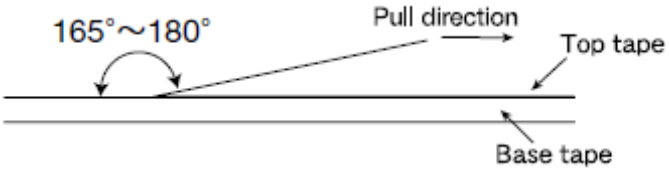


Type	Reel size (Reference values)		
	ϕD	ϕd	W
MBKK1608／MBKK1608H	180+0/−3 (7.087+0/−0.118)	60+1/−0 (2.36+0.039/0)	10.0±1.5 (0.394±0.059)
MBKK2012			
MBMK2520／MBMK2520H			

Unit : mm (inch)

⑥Top Tape Strength

The top The top tape requires a peel-off force of 0.2 to 0.7N in the direction of the arrow as illustrated below.



METAL WIRE-WOUND CHIP POWER INDUCTORS (MCOIL™ MB SERIES／MCOIL™ MB-H SERIES)

■RELIABILITY DATA

1. Operating Temperature Range		
Specified Value	MB series	−40～＋105℃
	MB-H series	−40～＋125℃
Test Methods and Remarks	Including self-generated heat	

2. Storage Temperature Range		
Specified Value	MB series MB-H series	−40～＋85℃
Test Methods and Remarks	0 to 40℃ for the product with taping.	

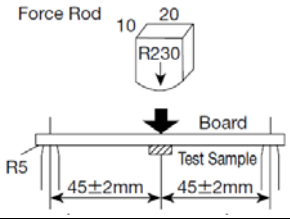
3. Rated current		
Specified Value	MB series MB-H series	Within the specified tolerance

4. Inductance		
Specified Value	MB series MB-H series	Within the specified tolerance
Test Methods and Remarks	Measuring equipment : LCR Meter (HP 4285A or equivalent) Measuring frequency : 1MHz、1V	

5. DC Resistance		
Specified Value	MB series MB-H series	Within the specified tolerance
Test Methods and Remarks	Measuring equipment : DC ohmmeter (HIOKI 3227 or equivalent)	

6. Self resonance frequency		
Specified Value	MB series MB-H series	−

7. Temperature characteristic		
Specified Value	MB series MB-H series	Inductance change : Within ±15%
Test Methods and Remarks	MB series : Measurement of inductance shall be taken at temperature range within −40℃～＋105℃. With reference to inductance value at ＋20℃., change rate shall be calculated.	
	MB-H series : Measurement of inductance shall be taken at temperature range within −40℃～＋125℃. With reference to inductance value at ＋20℃., change rate shall be calculated.	

8. Resistance to flexure of substrate		
Specified Value	MB series MB-H series	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 : 100×40×1.0 mm (1608:0.8mm) Test board material : Glass epoxy-resin Solder cream thickness : 0.1 mm 	

9. Insulation resistance : between wires		
Specified Value	MB series MB-H series	—

10. Insulation resistance : between wire and core		
Specified Value	MB series	DC25V 100kΩ min
	MB-H series	DC50V 100kΩ min

11. Withstanding voltage : between wire and core		
Specified Value	MB series MB-H series	—

12. Adhesion of terminal electrode		
Specified Value	MB series MB-H series	No abnormality.
Test Methods and Remarks	The test samples shall be soldered to the test board by the reflow. Applied force : 10N (1608:5N) to X and Y directions. Duration : 5s. Solder cream thickness : 0.1mm.	

13. Resistance to vibration		
Specified Value	MB series MB-H series	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.	

Frequency Range	10～55Hz	
Total Amplitude	1.5mm (May not exceed acceleration 196m/s^2)	
Sweeping Method	10Hz to 55Hz to 10Hz for 1min.	
Time	X	For 2 hours on each X, Y, and Z axis.
	Y	
	Z	

Recovery : At least 2hrs of recovery under the standard condition after the test, followed by the measurement within 48hrs.

14. Solderability		
Specified Value	MB series MB-H series	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 : Methanol solution containing rosin 25%.	

Solder Temperature	245±5℃
Immersing speed	25mm/s
Time	5±0.5 sec.

※Immersion depth : All sides of mounting terminal shall be immersed.

15. Resistance to soldering heat

Specified Value	MB series MB-H series	Inductance change : Within ±10% No significant abnormality in appearance.
Test Methods and Remarks	The test sample shall be exposed to reflow oven at 230℃ for 40 seconds, with peak temperature at 260+0/−5℃ for 5 seconds, 3 times. Test board material : Glass epoxy-resin Test board thickness : 1.0mm Recovery : At least 2hrs of recovery under the standard condition after the test, followed by the measurement within 48hrs.	

16. Thermal shock

Specified Value	MB series MB-H series	Inductance change : Within ±10% No significant abnormality in appearance.

Test Methods and Remarks

MB series:
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.

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

Recovery : At least 2hrs of recovery under the standard condition after the test, followed by the measurement within 48hrs.

MB-H series:
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.

Conditions of 1 cycle		
Step	Temperature (℃)	Duration (min)
1	−40±3	30±3
2	Room temperature	Within 3
3	+125±2	30±3
4	Room temperature	Within 3

Recovery : At least 2hrs of recovery under the standard condition after the test, followed by the measurement within 48hrs.

17. Damp heat

Specified Value	MB series MB-H series	Inductance change : Within ±10% No significant abnormality in appearance.

Test Methods and Remarks

MB series:
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.

Temperature	60±2℃
Humidity	90～95%RH
Time	1000+24/−0 hour

Recovery : At least 2hrs of recovery under the standard condition after the test, followed by the measurement within 48hrs.

MB-H series:
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.

Temperature	85±2℃
Humidity	85%RH
Time	1000+24/−0 hour

Recovery : At least 2hrs of recovery under the standard condition after the test, followed by the measurement within 48hrs.

18. Loading under damp heat

Specified Value	MB series MB-H series	Inductance change : Within ±10% No significant abnormality in appearance.

Test Methods and Remarks

MB series:
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±2℃
Humidity	90～95%RH
Applied current	Rated current
Time	1000+24/−0 hour

Recovery : At least 2hrs of recovery under the standard condition after the test, followed by the measurement within 48hrs.

MB-H series:
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	85±2℃
Humidity	85%RH
Applied current	Rated current
Time	1000+24/−0 hour

Recovery : At least 2hrs of recovery under the standard condition after the test, followed by the measurement within 48hrs.

19. Low temperature life test

Specified Value	MB series MB-H series	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. After that, the test samples shall be placed at test conditions as shown in below table. Temperature: −40±2℃ Time: 1000+24/−0 hour Recovery : At least 2hrs of recovery under the standard condition after the test, followed by the measurement within 48hrs.	

20. High temperature life test		
Specified Value	MB series MB-H series	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. After that, the test samples shall be placed at test conditions as shown in below table. Temperature: 85±2℃ Time: 1000+24/−0 hour Recovery : At least 2hrs of recovery under the standard condition after the test, followed by the measurement within 48hrs.	

21. Loading at high temperature life test		
Specified Value	MB series MB-H series	—

22. Standard condition		
Specified Value	MB series MB-H series	Standard test condition : Unless otherwise specified, temperature is 20±15℃ and 65±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±2℃ of temperature, 65±5% relative humidity. Inductance is in accordance with our measured value.

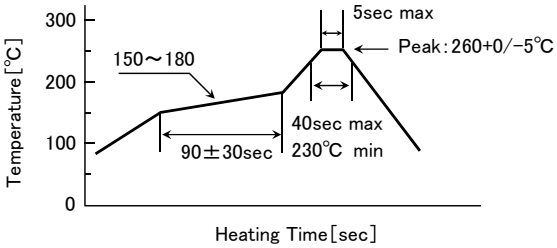
METAL WIRE-WOUND CHIP POWER INDUCTORS (MCOIL™ MB SERIES／MCOIL™ MB-H SERIES)

■PRECAUTIONS

1. Circuit Design	
Precautions	◆Operating environment 1. The products described in this specification are intended for use in general electronic equipment,(office supply equipment, telecommunications systems, measuring equipment, and household equipment). They are not intended for use in mission-critical equipment or systems requiring special quality and high reliability (traffic systems, safety equipment, aerospace systems, nuclear control systems and medical equipment including life-support systems,) where product failure might result in loss of life, injury or damage. For such uses, contact TAIYO YUDEN Sales Department in advance.

2. PCB Design	
Precautions	◆Land pattern design 1. Please refer to a recommended land pattern.
Technical considerations	◆Land pattern design Surface Mounting ・ Mounting and soldering conditions should be checked beforehand. ・ Applicable soldering process to this products is reflow soldering only.

3. Considerations for automatic placement	
Precautions	◆Adjustment of mounting machine 1. Excessive impact load should not be imposed on the products when mounting onto the PC boards. 2. Mounting and soldering conditions should be checked beforehand.
Technical considerations	◆Adjustment of mounting machine 1. When installing products, care should be taken not to apply distortion stress as it may deform the products.

4. Soldering	
Precautions	◆Reflow soldering 1. Please contact any of our offices for a reflow soldering, and refer to the recommended condition specified. 2. The product shall be used reflow soldering only. 3. Please do not add any stress to a product until it returns in normal temperature after reflow soldering. ◆Lead free soldering 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.
Technical considerations	◆Reflow soldering 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. Recommended reflow condition (Pb free solder) 

5. Cleaning	
Precautions	◆Cleaning conditions 1. Washing by supersonic waves shall be avoided.
Technical considerations	◆Cleaning conditions 1. If washed by supersonic waves, the products might be broken.

6. Handling	
Precautions	◆Handling 1. Keep the product away from all magnets and magnetic objects. ◆Breakaway PC boards (splitting along perforations) 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. 2. Board separation should not be done manually, but by using the appropriate devices. ◆Mechanical considerations 1. Please do not give the product any excessive mechanical shocks. 2. Please do not add any shock and power to a product in transportation. ◆Pick-up pressure 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. ◆Packing 1. Please avoid accumulation of a packing box as much as possible.
Technical considerations	◆Handling 1. There is a case that a characteristic varies with magnetic influence. ◆Breakaway PC boards (splitting along perforations) 1. The position of the product on PCBs shall be carefully considered to minimize the stress caused from splitting of the PCBs. ◆Mechanical considerations 1. There is a case to be damaged by a mechanical shock. 2. There is a case to be broken by the handling in transportation. ◆Pick-up pressure 1. Damage and a characteristic can vary with an excessive shock or stress. ◆Packing 1. If packing boxes are accumulated, that could cause a deformation on packing tapes or a damage on the products.

7. Storage conditions	
Precautions	◆Storage 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. ・ Recommended conditions Ambient temperature : 0～40℃ Humidity : Below 70% RH ・ The ambient temperature must be kept below 30℃. Even under ideal storage conditions, solderability of products electrodes may decrease as time passes. For this reason, product should be used within 6 months from the time of delivery. In case of storage over 6 months, solderability shall be checked before actual usage.
Technical considerations	◆Storage 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.