Notice for TAIYO YUDEN products

Please read this notice before using the TAIYO YUDEN products.

⚠ REMINDERS

- Product information in this catalog is as of October 2016. All of the contents specified herein are subject to change without notice due to technical improvements, etc. Therefore, please check for the latest information carefully before practical application or 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 specification.

- Please contact TAIYO YUDEN for further details of product specifications as the individual specification is available.

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

- The products listed in this catalog are intended for 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). Please be sure to contact TAIYO YUDEN for further information before using the products for any equipment which may directly cause loss of human life or bodily injury (e.g., transportation equipment including, without limitation, automotive powertrain control system, train control system, and ship control system, traffic signal equipment, disaster prevention equipment, medical equipment, highly public information network equipment including, without limitation, telephone exchange, and base station).

  Please do not incorporate our products into any equipment requiring high levels of safety and/or reliability (e.g., aerospace equipment, aviation equipment, nuclear control equipment, undersea equipment, military equipment).

  When our products are used even for high safety and/or reliability-required devices or circuits of general electronic equipment, it is strongly recommended to perform a thorough safety evaluation prior to use of our products and to install a protection circuit as necessary.

  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 requiring inquiry to TAIYO YUDEN or prohibited for use by TAIYO YUDEN as described above.

- Please note that TAIYO YUDEN shall have no responsibility for any controversies or disputes that may occur in connection with a third party's intellectual property rights and other related rights arising from use of our products. TAIYO YUDEN grants no license for such rights.

- Please note that unless otherwise agreed in writing, 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 fault or defect in our products.

- 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 CORE SMD POWER INDUCTORS(MCOIL™ MD SERIES)

REFLOW

■PARTS NUMBER

*Operating Temp.:−40〜+125℃(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

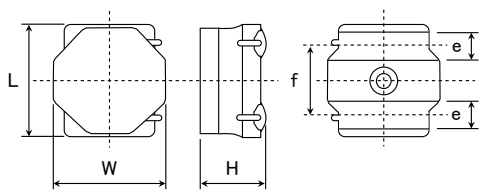
Code	Inductance tolerance
M	±20%
N	±30%

⑦Special code

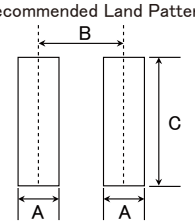
Code	Special code
F	Ferrite coating
M	Metal coating

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 (0.0374 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 (0.0374 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 (0.0787 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)

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●MDKK1616 type 【Thickness : 1.0mm max.】

Parts number	EHS	Nominal inductance [μH]	Inductance tolerance	Self-resonant frequency [MHz] (min.)	DC Resistance [Ω]		Rated current ※) [mA]				Measuring frequency [kHz]
							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	Self-resonant frequency [MHz] (min.)	DC Resistance [Ω]		Rated current ※) [mA]				Measuring frequency [kHz]
							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	Self-resonant frequency [MHz] (min.)	DC Resistance [Ω]		Rated current ※) [mA]				Measuring frequency [kHz]
							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	Self-resonant frequency [MHz] (min.)	DC Resistance [Ω]		Rated current ※) [mA]				Measuring frequency [kHz]
							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	Self-resonant frequency [MHz] (min.)	DC Resistance [Ω]		Rated current ※) [mA]				Measuring frequency [kHz]
							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	Self-resonant frequency [MHz] (min.)	DC Resistance [Ω]		Rated current ※) [mA]				Measuring frequency [kHz]
							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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●MDJE4040 type 【Thickness : 0.95mm max.】

Parts number	EHS	Nominal inductance [μH]	Inductance tolerance	Self-resonant frequency [MHz] (min.)	DC Resistance [Ω]		Rated current ※) [mA]				Measuring frequency [kHz]
							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	Self-resonant frequency [MHz] (min.)	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

●MDMK4040M type 【Thickness : 1.2mm max.】

Parts number	EHS	Nominal inductance [μH]	Inductance tolerance	Self-resonant frequency [MHz] (min.)	DC Resistance [Ω]		Rated current ※) [mA]				Measuring frequency [kHz]
							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

●MDWK4040M type 【Thickness : 2.0mm max.】

Parts number	EHS	Nominal inductance [μH]	Inductance tolerance	Self-resonant frequency [MHz] (min.)	DC Resistance [Ω]		Rated current ※) [mA]				Measuring frequency [kHz]
							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
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

●MDPK5050 type 【Thickness : 1.4mm max.】

Parts number	EHS	Nominal inductance [μH]	Inductance tolerance	Self-resonant frequency [MHz] (min.)	DC Resistance [Ω]		Rated current ※) [mA]				Measuring frequency [kHz]
							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.

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

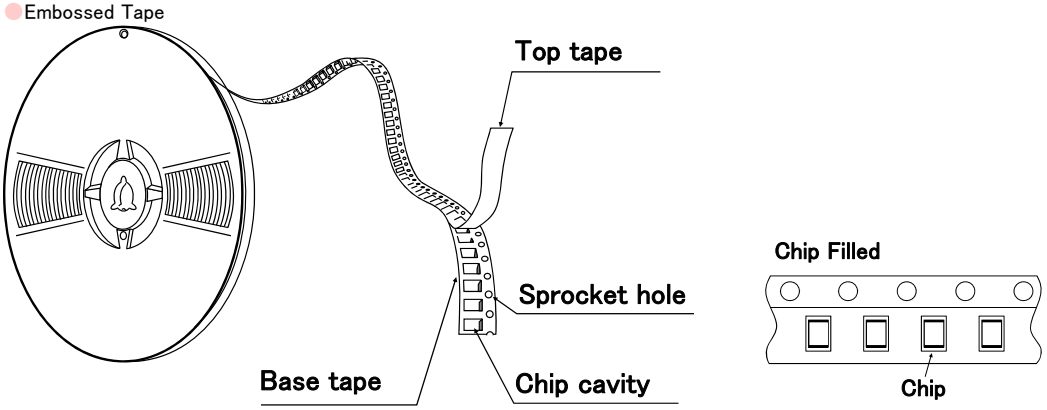
■PACKAGING

①Minimum Quantity

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

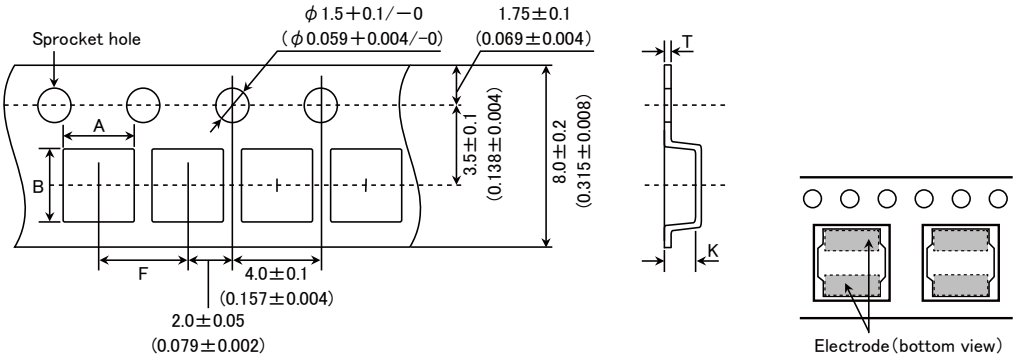
②Tape Material

●Embossed Tape



③Taping dimensions

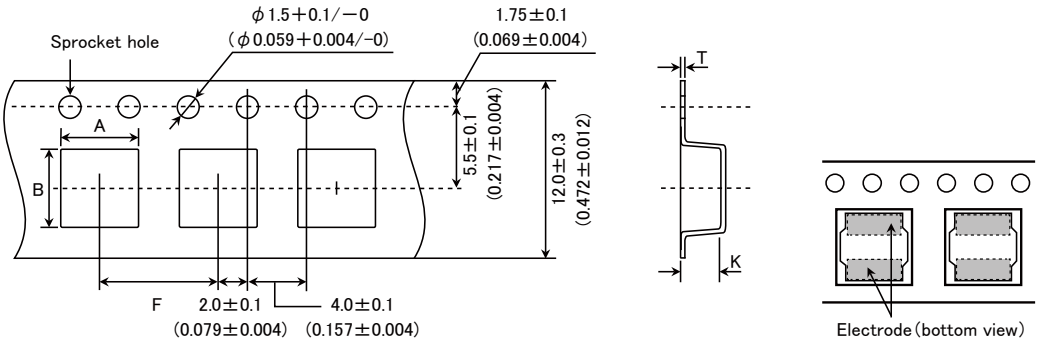
●Embossed tape 8mm wide (0.315 inches wide)



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)

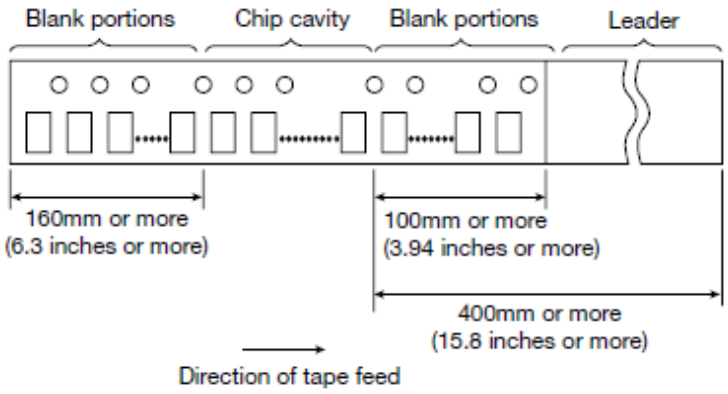
Embossed tape 12mm wide (0.47 inches wide)



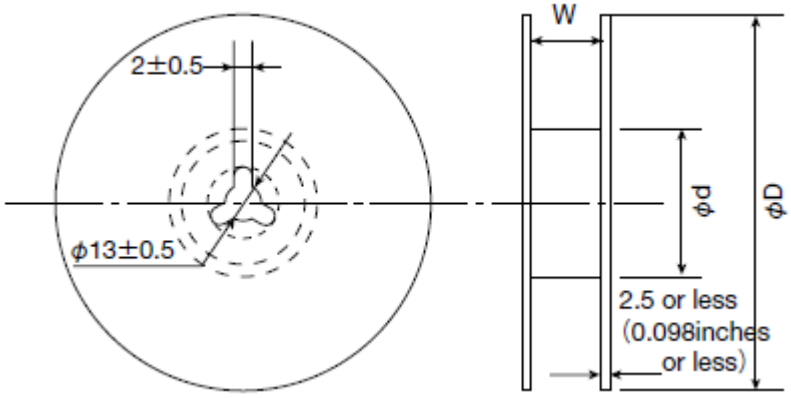
Type	Chip cavity		Insertion pitch	Tape thickness	
	A	B	F	T	K
MDJE4040 MDMK4040 MDWK4040	4.3±0.1 (0.169±0.004)	4.3±0.1 (0.169±0.004)	8.0±0.1 (0.315±0.004)	0.3±0.1 (0.012±0.004)	1.6±0.1 (0.063±0.004)
MDPK5050	5.25±0.1 (0.207±0.004)	5.25±0.1 (0.207±0.004)	8.0±0.1 (0.315±0.004)	0.3±0.1 (0.012±0.004)	1.6±0.1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

Unit : mm (inch)

④Leader and Blank portion



⑤Reel size



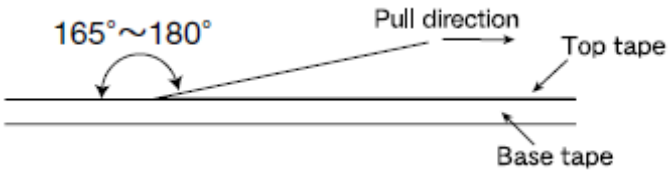
Type	Reel size (Reference values)		
	φD	φd	W
MDKK1616	180±0.5 (7.087±0.019)	60±1.0 (2.36±0.04)	10.0±1.5 (0.394±0.059)
MDJE2020 MDKK2020 MDMK2020			
MDKK3030 MDMK3030			
MDJE4040 MDMK4040 MDWK4040	180±3.0 (7.087±0.118)	60±2.0 (2.36±0.08)	14.0±1.5 (0.551±0.059)
MDPK5050			

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

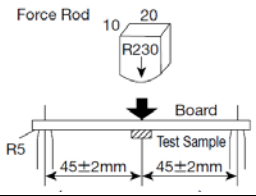
4. Inductance		
Specified Value	MD series	Within the specified tolerance
Test Methods and Remarks	Measuring equipment : LCR Meter (HP 4285A or equivalent) Measuring condition : Please see item list.	

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.

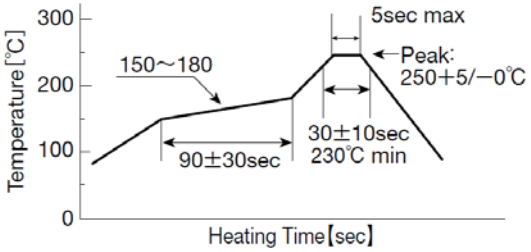
METAL CORE SMD POWER INDUCTORS (MCOIL™ MD SERIES)

■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	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

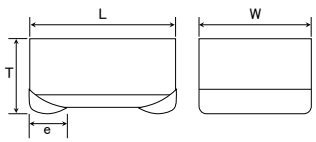
Code	Inductance tolerance
M	±20%

⑦Special code

Code	Special code
△	Standard

⑧Internal code

■STANDARD EXTERNAL DIMENSIONS / STANDARD QUANTITY

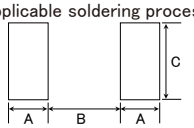


Recommended Land Patterns

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	0.8	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)

●MAKK2016 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 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 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

■PARTS NUMBER

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

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

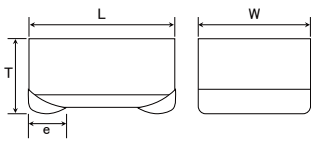
Code	Inductance tolerance
M	±20%

⑦Special code

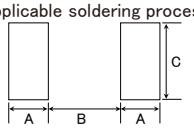
Code	Special code
△	Standard

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)

●MAKK2016H 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	
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 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

●MAMK2520H 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)

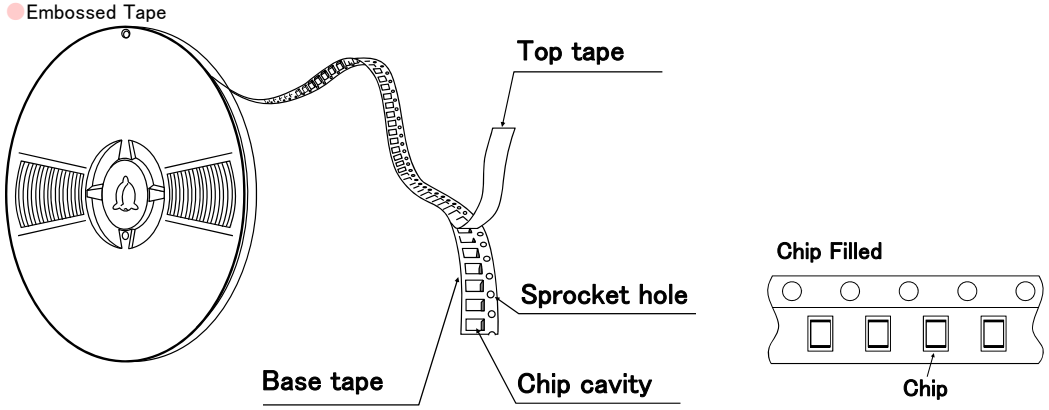
■PACKAGING

①Minimum Quantity

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

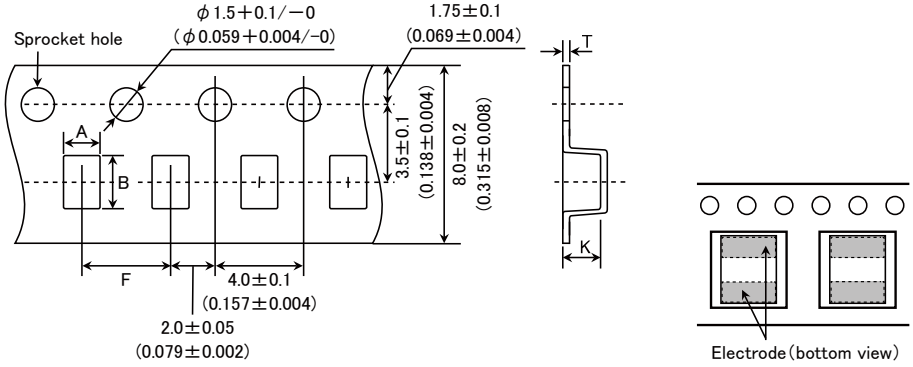
②Tape Material

●Embossed Tape



③Taping dimensions

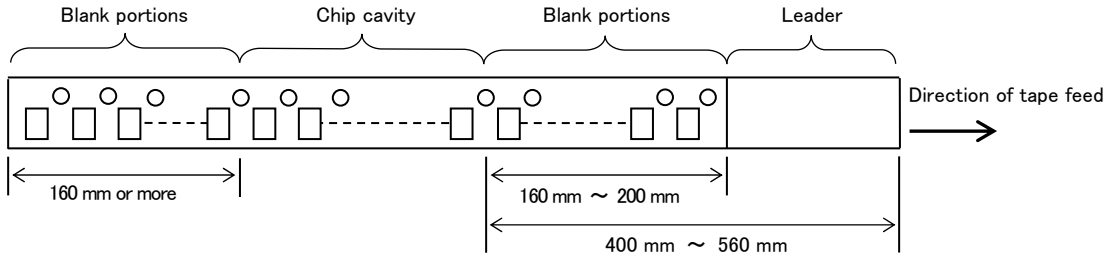
●Embossed tape 8mm wide (0.315 inches wide)



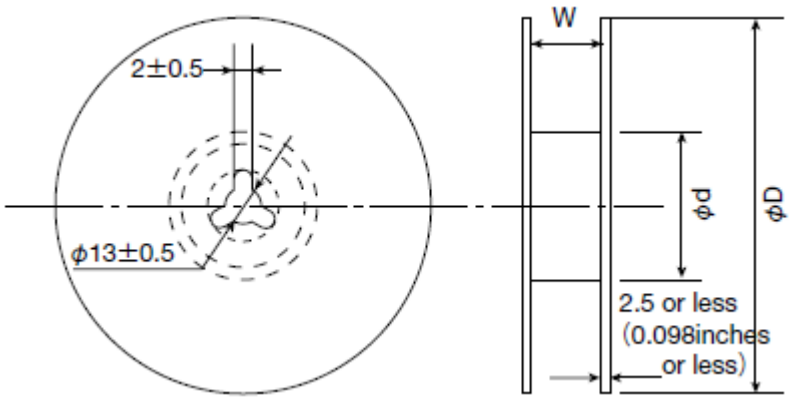
Type	Chip cavity		Insertion pitch	Tape thickness	
	A	B	F	T	K
MAKK2016	1.9±0.1 (0.075±0.004)	2.3±0.1 (0.091±0.004)	4.0±0.1 (0.157±0.004)	0.25±0.05 (0.009±0.002)	1.2 max (0.047 max)
MAKK2520	2.3±0.1 (0.091±0.004)	2.8±0.1 (0.110±0.004)	4.0±0.1 (0.157±0.004)	0.3±0.05 (0.012±0.002)	1.25 max (0.049 max)
MAMK2520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

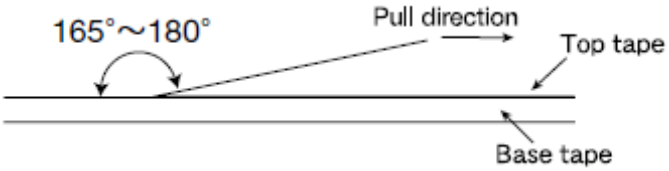


Type	Reel size (Reference values)		
	ϕD	ϕd	W
MAKK2016	180+0/−3 (7.087+0/−0.118)	60+1/−0 (2.36+0.039/0)	10.0±1.5 (0.394±0.059)
MAKK2520			
MAMK2520			

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

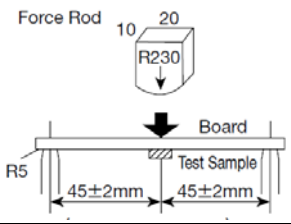
4. Inductance		
Specified Value	MA series MA-H series	Within the specified tolerance
Test Methods and Remarks	Measuring equipment : LCR Meter (HP 4285A or equivalent) Measuring frequency : 2MHz、1V	

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	DC25V 100kΩ min

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	

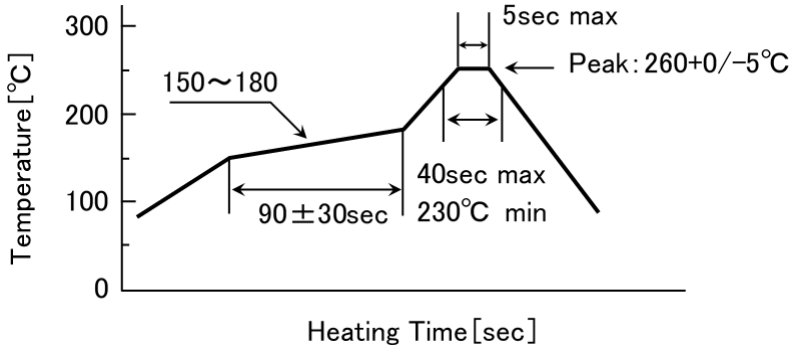
METAL CORE WIRE-WOUND CHIP POWER INDUCTORS (MCOIL™ MA SERIES / MCOIL™ MA-H SERIES)

■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

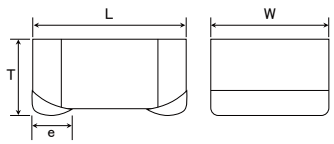
※R=Decimal point

⑥Inductance tolerance

Code	Inductance tolerance
M	±20%
N	±30%

⑦Internal code

■STANDARD EXTERNAL DIMENSIONS / STANDARD QUANTITY

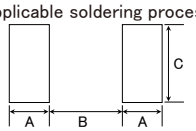


Recommended Land Patterns

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)

●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]		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]		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]		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.

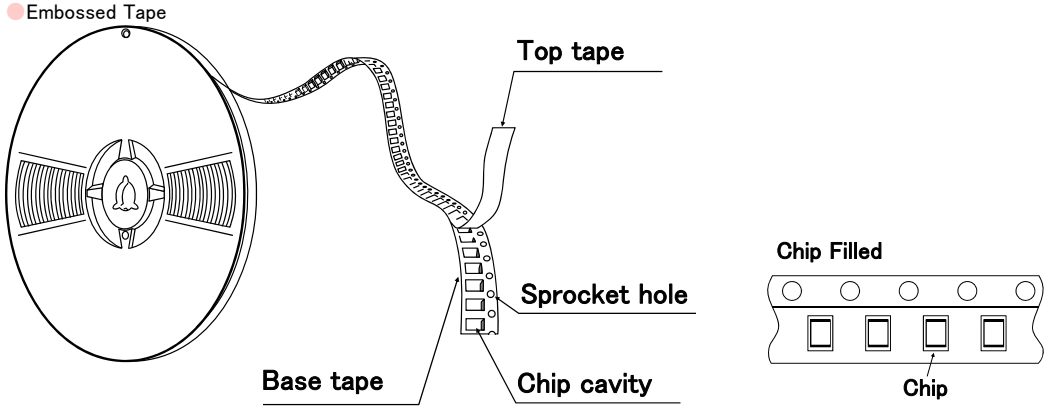
■PACKAGING

①Minimum Quantity

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

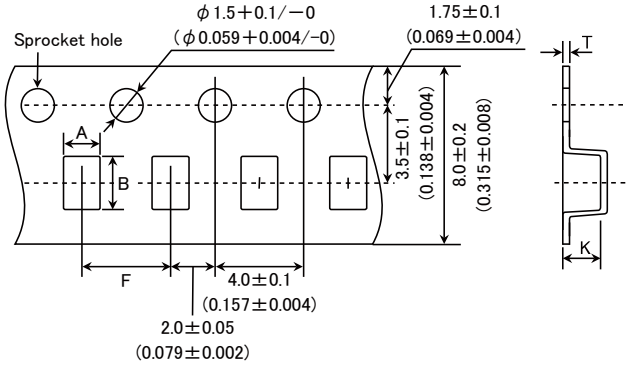
②Tape Material

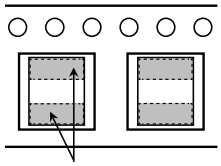
●Embossed Tape



③Taping dimensions

●Embossed tape 8mm wide (0.315 inches wide)

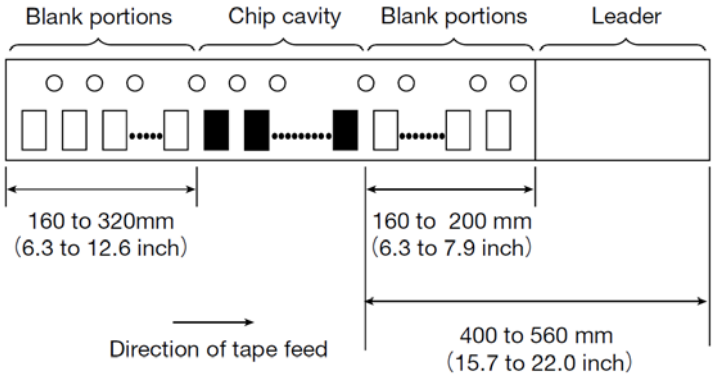




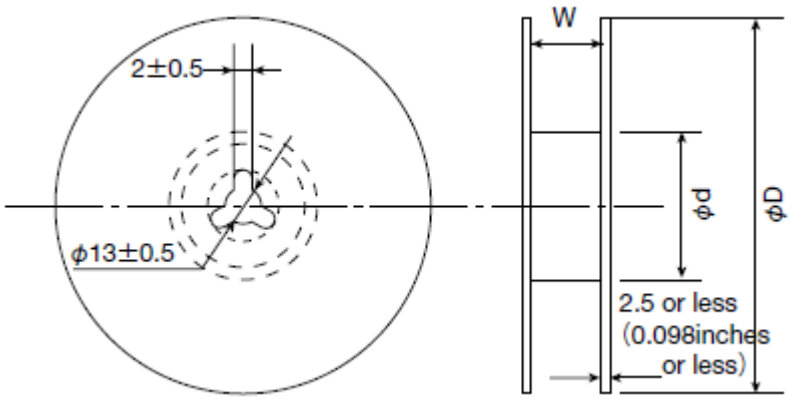
Type	Chip cavity		Insertion pitch	Tape thickness	
	A	B	F	T	K
MBKK1608	1.1 (0.043)	1.9 (0.075)	4.0±0.1 (0.157±0.004)	0.25±0.05 (0.010±0.002)	1.2 max (0.047 max)
MBKK2012	1.45 (0.057)	2.2 (0.087)	4.0±0.1 (0.157±0.004)	0.25±0.05 (0.010±0.002)	1.2 max (0.047 max)
MBMK2520	2.3 (0.091)	2.8 (0.110)	4.0±0.1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

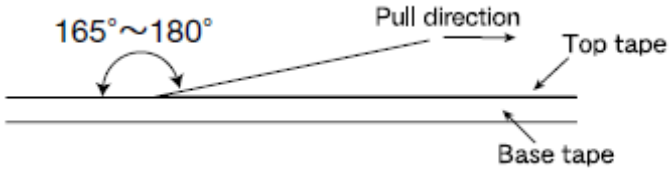


Type	Reel size (Reference values)		
	ϕD	ϕd	W
MBKK1608	180+0/−3 (7.087+0/−0.118)	60+1/−0 (2.36+0.039/0)	10.0±1.5 (0.394±0.059)
MBKK2012			
MBMK2520			

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)

■RELIABILITY DATA

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

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

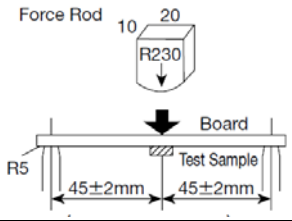
3. Rated current		
Specified Value	MB series	Within the specified tolerance

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

6. Self resonance frequency		
Specified Value	MB series	—

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

8. Resistance to flexure of substrate		
Specified Value	MB 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	—

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

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

12. Adhesion of terminal electrode

Specified Value	MB 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	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	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	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	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	MB 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	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	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: 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	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	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	—

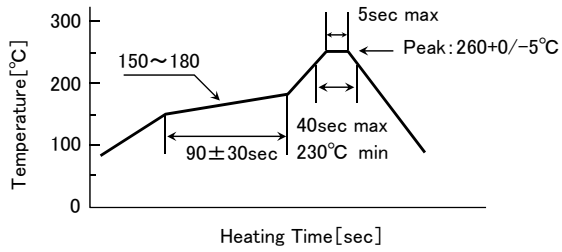
22. Standard condition		
Specified Value	MB series	Standard test condition : Unless otherwise specified, temperature is 20±15℃ and 65±20%of relative humidity. When there is any question concerning measurement result: In order to provide correlation data, the test shall be condition of 20±2℃ of temperature, 65±5% relative humidity. Inductance is in accordance with our measured value.

■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™ 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

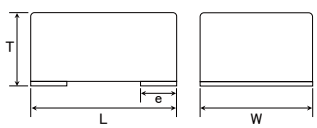
Code	Inductance tolerance
M	±20%

⑦Special code

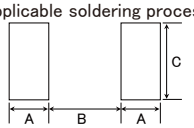
Code	Special code
△	Standard

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
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

※) 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 specification. 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 SERIES)

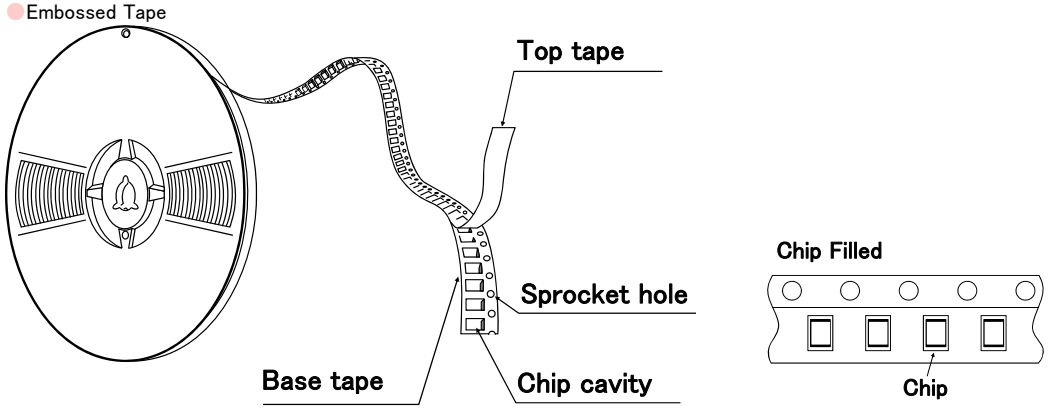
■PACKAGING

①Minimum Quantity

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

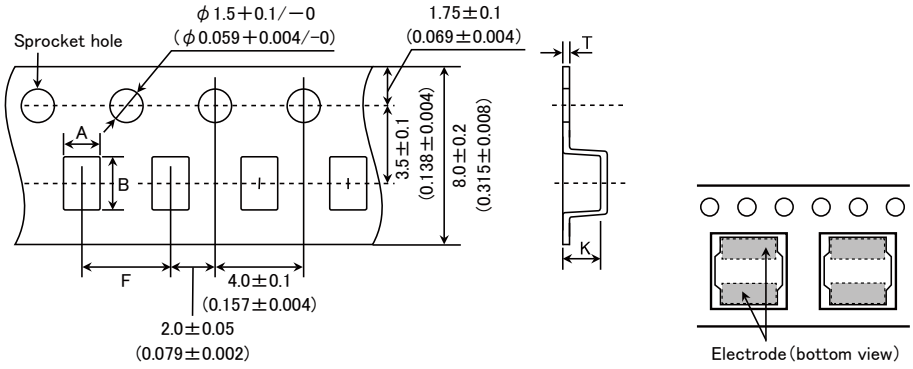
②Tape Material

●Embossed Tape



③Taping dimensions

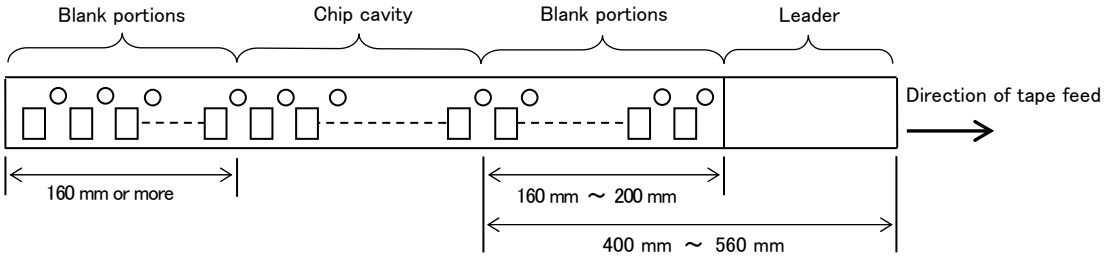
●Embossed tape 8mm wide (0.315 inches wide)



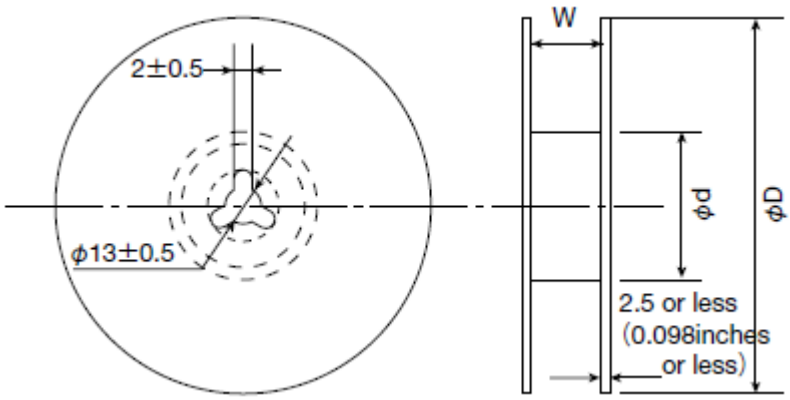
Type	Chip cavity		Insertion pitch	Tape thickness	
	A	B	F	T	K
MEKK2016	1.9±0.1 (0.075±0.004)	2.45±0.1 (0.097±0.004)	4.0±0.1 (0.157±0.004)	0.25±0.05 (0.009±0.002)	1.2 max (0.047 max)
MEKK2520	2.4±0.1 (0.094±0.004)	2.9±0.1 (0.114±0.004)	4.0±0.1 (0.157±0.004)	0.25±0.05 (0.009±0.002)	1.1 max (0.043 max)

Unit : mm (inch)

④Leader and Blank portion



⑤Reel size

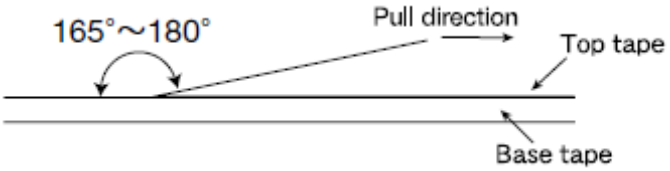


Type	Reel size (Reference values)		
	ϕD	ϕd	W
MEKK2016	180+0/−3 (7.087+0/−0.118)	60+1/−0 (2.36+0.039/0)	10.0±1.5 (0.394±0.059)
MEKK2520			

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)

■RELIABILITY DATA

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

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

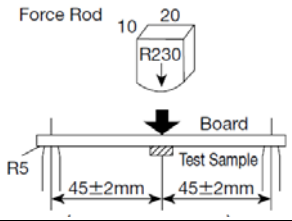
3. Rated current		
Specified Value	ME series	Within the specified tolerance

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

6. Self resonance frequency		
Specified Value	ME series	—

7. Temperature characteristic		
Specified Value	ME 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	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	—

10. Insulation resistance : between wire and over-coating		
Specified Value	ME series	DC25V 100k Ωmin

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

12. Adhesion of terminal electrode

Specified Value	ME 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	ME 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 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.

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.

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	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	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	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	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	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	—

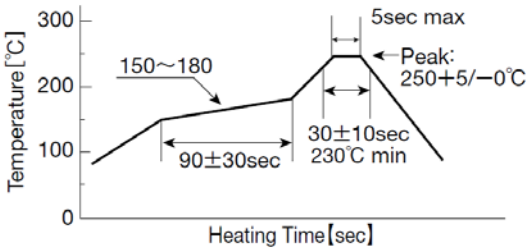
22. Standard condition		
Specified Value	ME series	Standard test condition : Unless otherwise specified, temperature is 20±15℃ and 65±20%of relative humidity. When there is any question concerning measurement result: In order to provide correlation data, the test shall be condition of 20±2℃ of temperature, 65±5% relative humidity. Inductance is in accordance with our measured value.

■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

△＝Blank space

①Series name

Code	Series name
MC	Metal base multilayer chip power inductor

②Thickness

Code	Thickness[mm]
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]
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

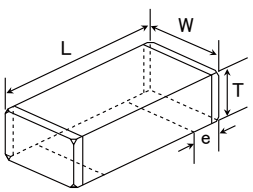
Code	Inductance tolerance
M	±20%

⑦Special code

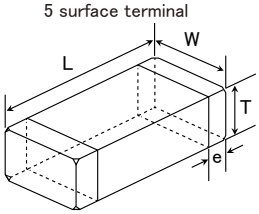
Code	Special code
△	Standard
G	5 surface terminal

■STANDARD EXTERNAL DIMENSIONS / STANDARD QUANTITY

Standard



5 surface terminal



Type	L	W	T	e	Standard quantity[pcs]	
					Paper tape	Embossed tape
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	—
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)

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

●MC1608

Parts number	EHS	Nominal inductance [μH]	Inductance tolerance	DC Resistance [Ω]		Rated current(Idc1) [A] (max.)	Rated current(Idc2) [A] (max.)	Measuring frequency [MHz]	Thickness [mm] (max.)
				(max.)	(typ.)				
MCFK1608TR24M	RoHS	0.24	±20%	0.050	0.040	2.30	2.10	1	0.60
MCFK1608TR47M	RoHS	0.47	±20%	0.085	0.069	1.90	1.60	1	0.60
MCFE1608TR24MG	RoHS	0.24	±20%	0.100	0.075	2.60	1.50	1	0.65
MCFE1608TR47MG	RoHS	0.47	±20%	0.150	0.114	2.00	1.20	1	0.65
MCFE1608T1R0MG	RoHS	1.0	±20%	0.340	0.270	1.40	0.80	1	0.65

●MC2012

Parts number	EHS	Nominal inductance [μH]	Inductance tolerance	DC Resistance [Ω]		Rated current(Idc1) [A] (max.)	Rated current(Idc2) [A] (max.)	Measuring frequency [MHz]	Thickness [mm] (max.)
				(max.)	(typ.)				
MCHK2012TR24M	RoHS	0.24	±20%	0.024	0.019	4.32	3.60	1	0.80
MCHK2012TR47M	RoHS	0.47	±20%	0.036	0.030	3.21	3.15	1	0.80
MCKK2012TR24M	RoHS	0.24	±20%	0.025	0.020	6.20	4.00	1	1.00
MCKK2012TR47M	RoHS	0.47	±20%	0.039	0.032	4.50	3.10	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℃)

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

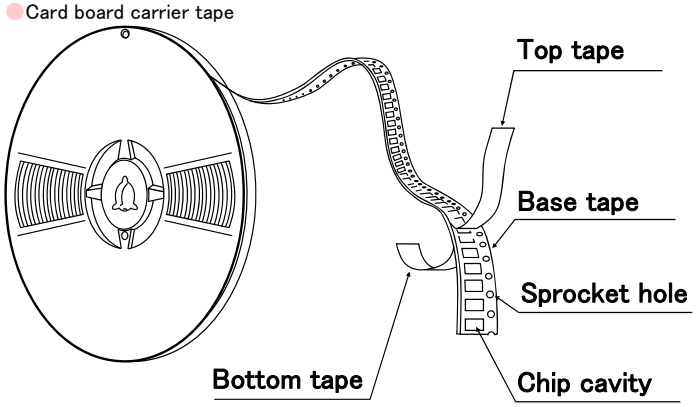
①Minimum Quantity

●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
NM2012 (0805)	0.9 (0.035)	—	3000
NM2520 (1008)	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
HKQ0402 (01005)	0.2 (0.008)	20000	40000
HKQ0603W (0201)	0.3 (0.012)	15000	—
HKQ0603C (0201)	0.3 (0.012)	15000	—
HKQ0603S (0201)	0.3 (0.012)	15000	—
HKQ0603U (0201)	0.3 (0.012)	15000	—
AQ105 (0402)	0.5 (0.020)	10000	—
BK0402 (01005)	0.2 (0.008)	20000	—
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
BKP0402 (01005)	0.2 (0.008)	20000	—
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
MCFK1608 (0603)	0.6 (0.024)	4000	—
MCFE1608 (0603)	0.65 (0.026)	4000	—
MCHK2012 (0806)	0.8 (0.031)	4000	—
MCKK2012 (0805)	1.0 (0.039)	–	3000

②Taping material

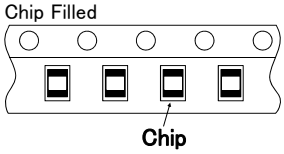
Card board carrier tape



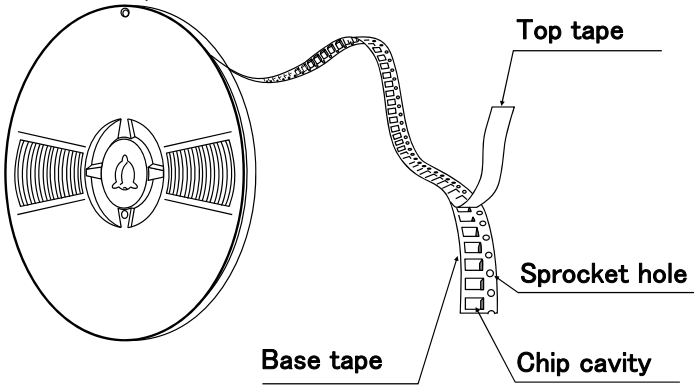
CK	1608
CKP	1608
CK	2125
CKS	2125
LK	1005
LK	1608
LK	2125
HK	0603
HK	1005
HK	1608
HKQ	0402
HKQ	0603
AQ	105

BK	0402
BK	0603
BK	1005
BK	1608
BK	2125
BK	2010
BKP	0402
BKP	0603
BKP	1005
BKP	1608
BKP	2125
BKH	0603
BKH	1005
MCF	0605
MC	1608
MC	2012

Chip Filled



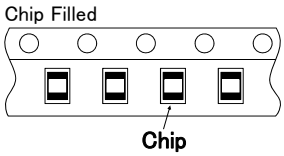
Embossed Tape



CK	2125
CKS	2125
CKP	2012
CKP	2016
CKP	2520
NM	2012
NM	2520
LK	2125
HKQ	0402
HK	2125

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

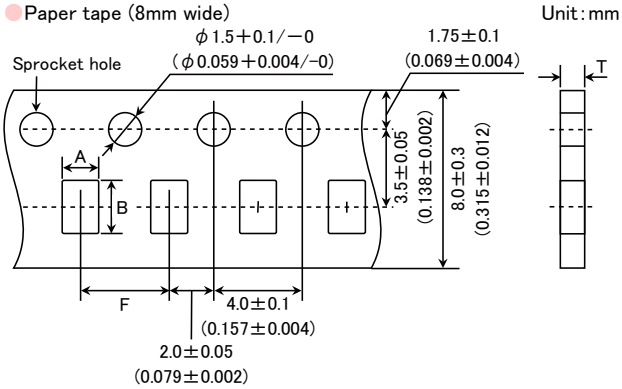
Chip Filled



③Taping Dimensions

Paper tape (8mm wide)

Unit : mm (inch)

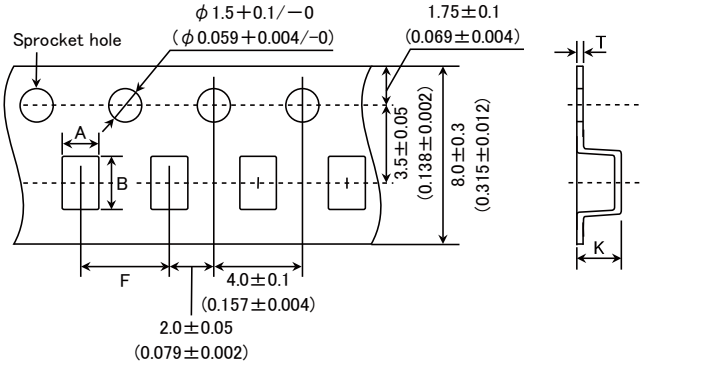


Type	Thickness mm(inch)	Chip cavity		Insertion Pitch	Tape Thickness
		A	B	F	T
CK1608(0603)	0.8 (0.031)	1.0±0.2 (0.039±0.008)	1.8±0.2 (0.071±0.008)	4.0±0.1 (0.157±0.004)	1.1max (0.043max)
CK2125(0805)	0.85(0.033)	1.5±0.2 (0.059±0.008)	2.3±0.2 (0.091±0.008)	4.0±0.1 (0.157±0.004)	1.1max (0.043max)
CKS2125(0805)	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)
HKQ0402(01005)	0.2 (0.008)	0.25±0.04 (0.010±0.002)	0.45±0.04 (0.018±0.002)	2.0±0.05 (0.079±0.002)	0.36max (0.014max)
HKQ0603W(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)
HKQ0603C(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)
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)
BK0402(01005)	0.2 (0.008)	0.25±0.04 (0.010±0.002)	0.45±0.04 (0.018±0.002)	2.0±0.05 (0.079±0.002)	0.36max (0.014max)
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)
BKP0402(01005)	0.2 (0.008)	0.25±0.04 (0.010±0.002)	0.45±0.04 (0.018±0.002)	2.0±0.05 (0.079±0.002)	0.36max (0.014max)
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)
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)	0.9max (0.035max)
MCHK2012(0805)	0.8 (0.031)	1.55±0.2 (0.061±0.008)	2.3±0.2 (0.091±0.008)	4.0±0.1 (0.157±0.004)	0.9max (0.035max)

Unit : mm(inch)

● Embossed Tape (8mm wide)

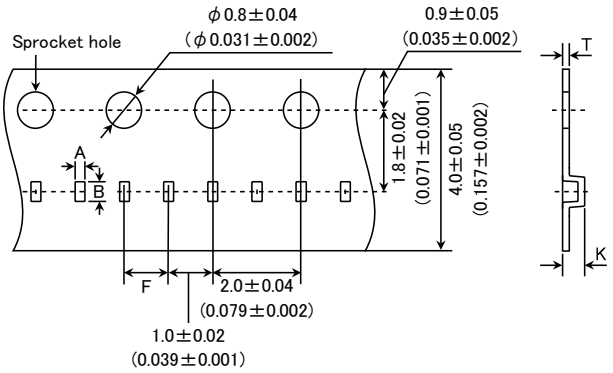
Unit : mm (inch)



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)	
NM2012 (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)
NM2520 (1008)	0.9 (0.035)	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)
	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)
MCKK2012 (0805)	1.0 (0.039)	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)	0.25 (0.010)

Unit : mm (inch)

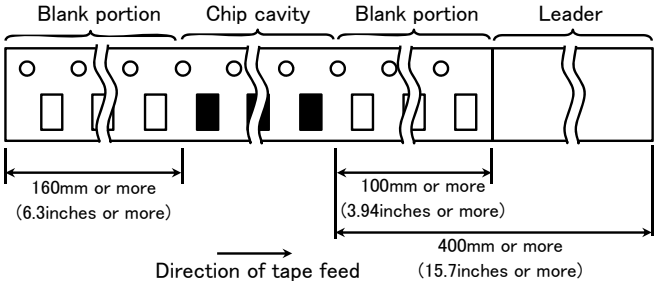
Embossed Tape (4mm wide)　　Unit : mm (inch)



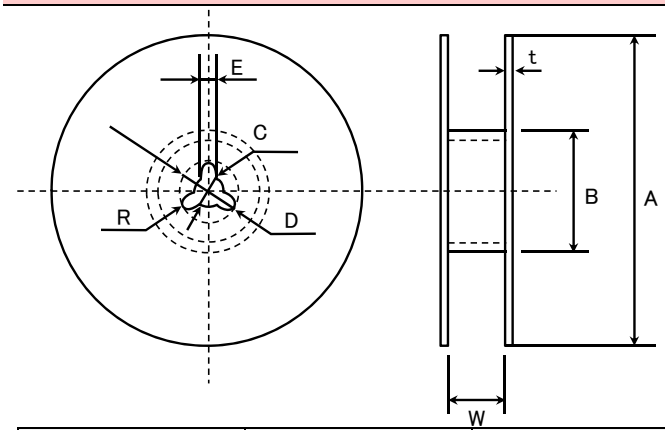
Type	Thickness mm (inch)	Chip cavity		Insertion Pitch	Tape Thickness	
		A	B	F	K	T
HKQ0402 (01005)	0.2 (0.008)	0.23	0.43	1.0±0.02	0.5max.	0.25max.

Unit : mm

④LEADER AND BLANK PORTION



⑤Reel Size



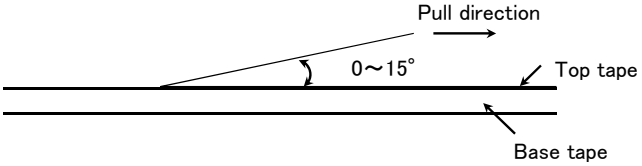
A	B	C	D	E	R
φ178±2.0	φ50 or more	φ13.0±0.2	φ21.0±0.8	2.0±0.5	1.0

	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	BK0402		−55～＋125℃
	BK0603		
	BK1005		
	BKH0603		
	BKH1005		
	BK1608		
	BK2125		
	ARRAY	BK2010	
		BK3216	
	BKP0402		−55～＋85℃
	BKP0603		
	BKP1005		
	BKP1608		
	BKP2125		
	MCF 0605		−40～＋85℃
	MCF 0806		
	MCF 1210		
	MCF 2010		
	CK1608		−40～＋85℃
	CK2125		
	CKS2125		
	CKP1608		
	CKP2012		
	CKP2016		
	CKP2520		
	NM2012		
	NM2520		
	LK1005		
	LK1608		
	LK2125		
	HKQ0402		−55～＋125℃
	HK0603		
	HK1005		
	HK1608		−40～＋85℃
	HK2125		
	HKQ0603W/HKQ0603C/HKQ0603S/ HKQ0603U/		−55～＋125℃
	AQ105		
	MCFK1608		
	MCFE1608		−40～＋125℃(Including self-generated heat)
	MCHK2012		
	MCKK2012		

2. Storage Temperature Range			
Specified Value	BK0402		−55～＋125℃
	BK0603		
	BK1005		
	BKH0603		
	BKH1005		
	BK1608		
	BK2125		
	ARRAY	BK2010	
		BK3216	
	BKP0402		−55～＋85℃
	BKP0603		
	BKP1005		
	BKP1608		
	BKP2125		
	MCF 0605		−40～＋85℃
	MCF 0806		
	MCF 1210		
	MCF 2010		
	CK1608		−40～＋85℃
	CK2125		
	CKS2125		
	CKP1608		
	CKP2012		
	CKP2016		
	CKP2520		
	NM2012		
	NM2520		
	LK1005		
	LK1608		
	LK2125		
	HKQ0402		−55～＋125℃
	HK0603		
	HK1005		
	HK1608		−40～＋85℃
	HK2125		
	HKQ0603W/HKQ0603C/HKQ0603S/ HKQ0603U/		−55～＋125℃
	AQ105		
	MCFK1608		
	MCFE1608		−40～＋85℃
	MCHK2012		
	MCKK2012		

3. Rated Current			
Specified Value	BK0402		150～750mA DC
	BK0603		100～500mA DC
	BK1005		120～1000mA DC
	BKH0603		115～450mA DC
	BKH1005		200～300mA DC
	BK1608		150～1500mA DC
	BK2125		200～1200mA DC
	ARRAY	BK2010	100mA DC
		BK3216	100～200mA DC
	BKP0402		0.55～1.1A DC
	BKP0603		0.8～1.8A DC
	BKP1005		0.8～2.4A DC
	BKP1608		1.0～3.0A DC
	BKP2125		1.5～4.0A DC
	MCF 0605		0.05A DC
	MCF 0806		0.1～0.13A DC
	MCF 1210		0.1～0.15A DC
	MCF 2010		0.1A DC
	CK1608		50～60mA DC
	CK2125		60～500mA DC
	CKS2125		110～280mA DC
	CKP1608		0.35～0.9A DC
	CKP2012		0.7～1.7A DC
	CKP2016		0.9～1.6A DC
	CKP2520		1.1～1.8A DC
	NM2012		1.0～1.2A DC
	NM2520		0.9～1.2A DC
	LK1005		20～25mA DC
	LK1608		1～150mA DC
	LK2125		5～300mA DC
	HK0603		60～470mA DC
	HK1005		110～300mA DC (−55～+125℃) 200～900mA DC (−55～+85℃)
	HK1608		150～300mA DC
	HK2125		300mA DC
	HKQ0402		100～500mA DC
	HKQ0603W		100～850mA DC
	HKQ0603C		160～850mA DC
	HKQ0603S		130～600mA DC
	HKQ0603U		190～900mA DC
	AQ105		280～710mA DC
	MCFK1608		Idc1 : 1900～2300mA DC, Idc2 : 1600～2100mA DC
	MCFE1608		Idc1 : 1400～2600mA DC, Idc2 : 800～1500mA DC
	MCHK2012		Idc1 : 3210～4320mA DC, Idc2 : 3240～3600mA DC
	MCKK2012		Idc1 : 4500～6200mA DC, Idc2 : 3100～4000mA DC

Definition of rated current:

・In the CK, CKS and BK Series, the rated current is the value of current at which the temperature of the element is increased within 20℃.

・In the BK Series P type, CK Series P type, NM Series, the rated current is the value of current at which the temperature of the element is increased within 40℃.

・In the LK, HK, HKQ0603, and AQ Series, the rated current is either the DC value at which the initial L value is decreased within 5% with the application of DC bias, or the value of current at which the temperature of the element is increased within 20℃.

・In the HKQ0402(～9N1), the rated current is either the DC value at which the initial L value is decreased within 5% with the application of DC bias, or the value of current at which the temperature of the element is increased within 20℃.

・In the HKQ0402(10N～), the rated current is either the DC value at which the initial L value is decreased within 5% with the application of DC bias, or the value of current at which the temperature of the element is increased within 25℃.

・In the MC Series, Idc1 is the DC value at which the initial L value is decreased within 30% and Idc2 is the DC value at which the temperature of element is increased within 40℃ by the application of DC bias. (at 20℃)

4. Impedance			
Specified Value	BK0402		10～330Ω ±5Ω(10Ω), ±25%(Other)
	BK0603		10～1200Ω ±25%
	BK1005		10～1800Ω ±25%
	BKH0603		25～1500Ω ±25%
	BKH1005		600～1800Ω ±25%
	BK1608		22～2500Ω ±25%
	BK2125		15～2500Ω ±25%
	ARRAY	BK2010	5～1000Ω ±25%
		BK3216	60～1000Ω ±25%
	BKP0402		10～33Ω ±5Ω(10Ω)、±25%(Other)
	BKP0603		10～120Ω ±5Ω(10Ω), ±25%(Other)
	BKP1005		10～330Ω ±5Ω(EM100), ±25%(Other)
	BKP1608		33～470Ω ±25%
	BKP2125		33～330Ω ±25%
	MCF 0605		12～90Ω ±5Ω(12Ω), ±20%(35Ω), ±25%(Other)
	MCF 0806		12～90Ω ±5Ω(12Ω), ±20%(Other)
	MCF 1210		40～90Ω ±20%(2H900),±25%(Other)
	MCF 2010		90Ω ±25%
	CK1608		–
	CK2125		
	CKS2125		
	CKP1608		
	CKP2012		
	CKP2016		
	CKP2520		
	NM2012		
	NM2520		
	LK1005		
	LK1608		
	LK2125		
	HKQ0402		
	HK0603		
	HK1005		
	HK1608		
	HK2125		
	HKQ0603W/HKQ0603C/HKQ0603S/ HKQ0603U		
	AQ105		
	MCFK1608		
	MCFE1608		
	MCHK2012		
	MCKK2012		

Test Methods and Remarks	BK0402Series, BKP0402Series Measuring frequency : 100±1MHz Measuring equipment : E4991A(or its equivalent) Measuring jig : 16197A(or its equivalent) BK0603Series, BKP0603Series Measuring frequency : 100±1MHz Measuring equipment : 4291A(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), 16193A(or its equivalent) BK1608・2125Series, BKP1608・2125Series Measuring frequency : 100±1MHz Measuring equipment : 4291A(or its equivalent), 4195A(or its equivalent) Measuring jig : 16092A(or its equivalent) or 16192A(or its equivalent)/HW BK2010・3216Series, MCF Series Measuring frequency : 100±1MHz Measuring equipment : 4291A(or its equivalent), 4195A(or its equivalent) Measuring jig : 16192A(or its equivalent)

5. Inductance

Specified Value	BK0402		—
	BK0603		
	BK1005		
	BKH0603		
	BKH1005		
	BK1608		
	BK2125		
	ARRAY	BK2010	
		BK3216	
	BKP0402		
	BKP0603		
	BKP1005		
	BKP1608		
	BKP2125		
	MCF 0605		
	MCF 0806		
	MCF 1210		
	MCF 2010		
	CK1608		4.7～10.0 μH: ±20%
	CK2125		0.1～10.0 μH: ±20%
	CKS2125		1.0～10.0 μH: ±20%
	CKP1608		0.33～2.2 μH: ±20%
	CKP2012		0.47～4.7 μH: ±20%
	CKP2016		0.47～4.7 μH: ±20%
	CKP2520		0.47～4.7 μH: ±20%
	NM2012		0.82～1.0 μH: ±20%
	NM2520		1.0～2.2 μH: ±20%
	LK1005		0.12～2.2 μH: ±10 or 20%
	LK1608		0.047～33.0 μH: ±20%　0.10～12.0 μH: ±10%
	LK2125		0.047～33.0 μH: ±20%　0.10～12.0 μH: ±10%
	HK0603		1.0～6.2nH: ±0.3nH　6.8～100nH: ±5%
	HK1005		1.0～6.2nH: ±0.3nH　6.8～270nH: ±5%
	HK1608		1.0～5.6nH: ±0.3nH　6.8～470nH: ±5%
	HK2125		1.5～5.6nH: ±0.3nH　6.8～470nH: ±5%
	HKQ0402		0.5～3.9nH: ±0.1 or 0.2 or 0.3nH　4.3～5.6nH: ±0.3nH or 3% or 5% 6.2～47nH: ±3 or 5%
	HKQ0603W		0.6～3.9nH: ±0.1 or 0.2 or 0.3nH　4.3～6.2nH: ±0.2 or 0.3nH or 3 or 5% 6.8～30nH: ±3 or 5%　33～100nH: ±5%
	HKQ0603C		0.6～3.9nH: ±0.1 or 0.2 or 0.3nH　4.3～6.2nH: ±0.2 or 0.3nH　6.8～22nH: ±3 or 5%
	HKQ0603S		0.6～6.2nH: ±0.2 or 0.3nH　6.8～22nH: ±3 or 5%
	HKQ0603U		0.6～4.2nH: ±0.1 or 0.2 or 0.3nH　4.3～6.5nH: ±0.2 or 0.3nH　6.8～22nH: ±3 or 5%
	AQ105		1.0～6.2nH: ±0.3nH　6.8～15nH: ±5%
	MCFK1608		0.24～0.47H: ±20%
	MCFE1608		0.24～1.0 μH: ±20%
	MCHK2012		0.24～0.47H: ±20%
	MCKK2012		0.24～0.47H: ±20%

Test Methods and Remarks

CK、LK、CKP、NM、MC Series

- Measuring frequency : 2～4MHz(CK1608)
- Measuring frequency : 2～25MHz(CK2125)
- Measuring frequency : 2～10MHz(CKS2125)
- Measuring frequency : 10～25MHz(LK1005)
- Measuring frequency : 1～50MHz(LK1608)
- Measuring frequency : 0.4～50MHz(LK2125)
- Measuring frequency : 1MHz(CKP1608・CKP2012・CKP2016・CKP2520・NM2012・NM2520・MCFK1608・MCFE1608・MCHK2012・MCKK2012)
- Measuring equipment /jig :・4194A＋16085B＋16092A(or its equivalent)　・4195A＋41951＋16092A(or its equivalent)
  ・4294A＋16192A(or its equivalent)　・4291A＋16193A(or its equivalent)/LK1005
  ・4285A＋42841A＋42842C＋42851－61100(or its equivalent)/CKP1608・CKP2012・CKP2016・CKP2520・NM2012・NM2520・MCFK1608・MCFE1608・MCHK2012・MCKK2012
- Measuring current :・1mA rms(0.047～4.7 μH)
  ・0.1mA rms(5.6～33 μH)

HK、HKQ、AQ Series

- Measuring frequency : 100MHz(HK0603・HK1005・AQ105)
- Measuring frequency : 50/100MHz(HK1608・HK2125)
- Measuring frequency : 500MHz(HKQ0603C・HKQ0603S・HKQ0603U)
- Measuring frequency : 300/500MHz(HKQ0603W)
- Measuring frequency : 100/500MHz(HKQ0402)
- Measuring equipment /jig :・4291A＋16197A(or its equivalent)/HK0603・AQ105
  ・4291A＋16193A(or its equivalent)/HK1005
  ・E4991A＋16197A(or its equivalent)/HKQ0603S・HKQ0603U・HKQ0603W・HKQ0603C
  ・4291A＋16092A ＋ in-house made jig(or its equivalent)/HK1608・HK2125
  ・E4991A＋16196D(or its equivalent)/HKQ0402

6. Q		
Specified Value	BK0402	—
	BK0603	
	BK1005	
	BKH0603	
	BKH1005	
	BK1608	
	BK2125	
	ARRAY BK2010	
	ARRAY BK3216	
	BKP0402	
	BKP0603	
	BKP1005	
	BKP1608	
	BKP2125	
	MCF 0605	
	MCF 0806	
	MCF 1210	
	MCF 2010	
	CK1608	—
	CK2125	
	CKS2125	
	CKP1608	
	CKP2012	
	CKP2016	
	CKP2520	
	NM2012	
	NM2520	
	LK1005	10～20 min.
	LK1608	10～35 min.
	LK2125	15～50 min.
	HK0603	4～5 min.
	HK1005	8 min.
	HK1608	8～12 min.
	HK2125	10～18 min.
	HKQ0402	3～8 min.
	HKQ0603W	6～15 min.
	HKQ0603C	14～15 min.
	HKQ0603S	10～13 min.
	HKQ0603U	14 min.
	AQ105	8 min.
	MCFK1608	—
	MCFE1608	
	MCHK2012	
	MCKK2012	
Test Methods and Remarks	LK Series Measuring frequency : 10～25MHz(LK1005) Measuring frequency : 1～50MHz(LK1608) Measuring frequency : 0.4～50MHz(LK2125) Measuring equipment /jig :・4194A＋16085B＋16092A(or its equivalent) ・4195A＋41951＋16092A(or its equivalent) ・4294A＋16192A(or its equivalent) ・4291A＋16193A(or its equivalent)/LK1005 Measuring current ・1mA rms(0.047～4.7 μH) ・0.1mA rms(5.6～33 μH) HK、HKQ、AQ Series Measuring frequency : 100MHz(HK0603・HK1005・AQ105) Measuring frequency : 50/100MHz(HK1608・HK2125) Measuring frequency : 500MHz(HKQ0603C・HKQ0603S・HKQ0603U) Measuring frequency : 300/500MHz(HKQ0603W) Measuring frequency : 100/500MHz(HKQ0402) Measuring equipment /jig :・4291A＋16197A(or its equivalent)/HK0603・AQ105 ・4291A＋16193A(or its equivalent)/HK1005 ・E4991A＋16197A(or its equivalent)/HKQ0603S・HKQ0603U・HKQ0603W・HKQ0603C ・4291A＋16092A ＋ in-house made jig(or its equivalent)/HK1608, HK2125 ・E4991A＋16196D(or its equivalent)HKQ0402	

7. DC Resistance			
Specified Value	BK0402		0.07～1.2Ω max.
	BK0603		0.065～1.50Ω max.
	BK1005		0.03～0.90Ω max.
	BKH0603		0.26～3.20Ω max.
	BKH1005		0.85～2.00Ω max.
	BK1608		0.05～1.10Ω max.
	BK2125		0.05～0.75Ω max.
	ARRAY	BK2010	0.10～0.90Ω max.
		BK3216	0.15～0.80Ω max.
	BKP0402		0.05～0.15Ω max.
	BKP0603		0.030～0.180Ω max.
	BKP1005		0.0273～0.220Ω max.
	BKP1608		0.025～0.18Ω max.
	BKP2125		0.020～0.075Ω max.
	MCF 0605		2.5～6.5Ω max
	MCF 0806		2.5～5.0Ω max.
	MCF 1210		2.5～4.5Ω max.
	MCF 2010		4.5Ω max.
	CK1608		0.45～0.85Ω(±30%)
	CK2125		0.16～0.65Ω max.
	CKS2125		0.12～0.52Ω max.
	CKP1608		0.15～0.35Ω max.
	CKP2012		0.08～0.28Ω max.
	CKP2016		0.075～0.20Ω max
	CKP2520		0.05～0.16Ω max.
	NM2012		0.10～0.15Ω max.
	NM2520		0.11～0.22Ω max.
	LK1005		0.41～1.16Ω max.
	LK1608		0.2～2.2Ω max.
	LK2125		0.1～1.1Ω max.
	HK0603		0.11～3.74Ω max.
	HK1005		0.08～4.8Ω max.
	HK1608		0.05～2.6Ω max.
	HK2125		0.10～1.5Ω max.
	HKQ0402		0.08～5.0Ω max.
	HKQ0603W		0.07～4.1Ω max.
	HKQ0603C		0.07～1.6Ω max.
	HKQ0603S		0.06～1.29Ω max.
	HKQ0603U		0.06～1.29Ω max.
	AQ105		0.07～0.45Ω max.
	MCFK1608		0.050～0.085Ω max.
	MCFE1608		0.100～0.340Ω max.
	MCHK2012		0.024～0.036Ω max.
	MCKK2012		0.025～0.039Ω max.
Test Methods and Remarks	Measuring equipment：VOAC-7412, VOAC-7512, VOAC-7521 (made by Iwasaki Tsushinki), HIOKI3227 (or its equivalent)		

8. Self Resonance Frequency (SRF)			
Specified Value	BK0402		—
	BK0603		
	BK1005		
	BKH0603		
	BKH1005		
	BK1608		
	BK2125		
	ARRAY	BK2010	
		BK3216	
	BKP0402		
	BKP0603		
	BKP1005		
	BKP1608		
	BKP2125		
	MCF 0605		
	MCF 0806		
	MCF 1210		
	MCF 2010		
	CK1608		17～25MHz min.
	CK2125		24～235MHz min.
	CKS2125		24～75MHz min.
	CKP1608		—
	CKP2012		
	CKP2016		
	CKP2520		
	NM2012		
	NM2520		
	LK1005		40～180MHz min.
	LK1608		9～260MHz min.
	LK2125		13～320MHz min.
	HK0603		900～10000MHz min.
	HK1005		400～10000MHz min.
	HK1608		300～10000MHz min.
	HK2125		200～4000MHz min.
	HKQ0402		1200～10000MHz min.
	HKQ0603W		800～10000MHz min.
	HKQ0603C		2500～10000MHz min.
	HKQ0603S		1900～10000MHz min.
	HKQ0603U		1900～10000MHz min.
	AQ105		2300～10000MHz min.
	MCFK1608		—
	MCFE1608		
	MCHK2012		
	MCKK2012		
Test Methods and Remarks	LK、CK Series : Measuring equipment : 4195A (or its equivalent) Measuring jig : 41951＋16092A (or its equivalent) HK、HKQ、AQ Series : Measuring equipment : 8719C (or its equivalent)・8753D (or its equivalent)/HK2125		

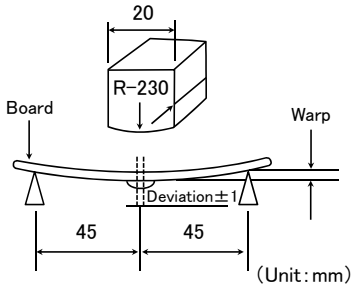
9. Temperature Characteristic			
Specified Value	BK0402		—
	BK0603		
	BK1005		
	BKH0603		
	BKH1005		
	BK1608		
	BK2125		
	ARRAY	BK2010	
		BK3216	
	BKP0402		
	BKP0603		
	BKP1005		
	BKP1608		
	BKP2125		
	MCF 0605		
	MCF 0806		
	MCF 1210		
	MCF 2010		
	CK1608		
	CK2125		
	CKS2125		
	CKP1608		
	CKP2012		
	CKP2016		
	CKP2520		
	NM2012		
	NM2520		
	LK1005		
	LK1608		
	LK2125		
	HK0603		Inductance change : Within ±10%
	HK1005		
	HK1608		
	HK2125		
	HKQ0402		
	HKQ0603W		
	HKQ0603C		
	HKQ0603S		
	HKQ0603U		
	AQ105		
	MCFK1608		
	MCFE1608		
	MCHK2012		
	MCKK2012		
Test Methods and Remarks	HK、HKQ、AQ Series: Temperature range : −30～+85℃ Reference temperature : +20℃		
	MC Series: Temperature range : −40～+85℃ Reference temperature : +20℃		

10. Resistance to Flexure of Substrate

Specified Value	BK0402		No mechanical damage.
	BK0603		
	BK1005		
	BKH0603		
	BKH1005		
	BK1608		
	BK2125		
	ARRAY	BK2010	
		BK3216	
	BKP0402		
	BKP0603		
	BKP1005		
	BKP1608		
	BKP2125		
	MCF 0605		
	MCF 0806		
	MCF 1210		
	MCF 2010		
	CK1608		
	CK2125		
	CKS2125		
	CKP1608		
	CKP2012		
	CKP2016		
	CKP2520		
	NM2012		
	NM2520		
	LK1005		
	LK1608		
	LK2125		
	HK0603		
	HK1005		
	HK1608		
	HK2125		
	HKQ0402		
	HKQ0603W		
	HKQ0603C		
	HKQ0603S		
	HKQ0603U		
	AQ105		
	MCFK1608		
	MCFE1608		
	MCHK2012		
	MCKK2012		

Test Methods and Remarks

Warp : 2mm(BK Series without 0402size、BKP、BKH1005、CK、CKS、CKP、LK、HK、HKQ0603S、HKQ0603U、AQ Series、MCF1210、MC Series)
: 1mm(BK0402、BKP0402、BKH0603、HKQ0402、HKQ0603W、HKQ0603C Series、MCF Series without 1210 size,)
Testing board : glass epoxy-resin substrate
Thickness : 0.8mm



11. Solderability		
Specified Value	BK0402	At least 75% of terminal electrode is covered by new solder.
	BK0603	
	BK1005	
	BKH0603	
	BKH1005	
	BK1608	
	BK2125	
	ARRAY: BK2010	
	ARRAY: BK3216	
	BKP0402	
	BKP0603	
	BKP1005	
	BKP1608	
	BKP2125	
	MCF 0605	
	MCF 0806	
	MCF 1210	
	MCF 2010	
	CK1608	
	CK2125	
	CKS2125	
	CKP1608	
	CKP2012	
	CKP2016	
	CKP2520	
	NM2012	
	NM2520	
	LK1005	
	LK1608	
	LK2125	
	HK0603	
	HK1005	
	HK1608	
	HK2125	
	HKQ0402	
	HKQ0603W	
	HKQ0603C	
	HKQ0603S	
	HKQ0603U	
	AQ105	
	MCFK1608	
	MCFE1608	
	MCHK2012	
	MCKK2012	
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.	

12. Resistance to Soldering			
Specified Value	BK0402		Appearance : No significant abnormality Impedance change : Within ±30%
	BK0603		
	BK1005		
	BKH0603		
	BKH1005		
	BK1608		
	BK2125		
	ARRAY	BK2010	
		BK3216	
	BKP0402		
	BKP0603		
	BKP1005		
	BKP1608		
	BKP2125		
	MCF 0605		Appearance : No significant abnormality Impedance change : Within ±20%
	MCF 0806		
	MCF 1210		
	MCF 2010		
	CK1608		No mechanical damage. Remaining terminal electrode : 70% min Inductance change R10～4R7 : Within ±10% 6R8～100 : Within ±15% CKS2125 : Within ±20% CKP1608、CKP2012、CKP2016、CKP2520、NM2012、NM2520 : Within ±30%
	CK2125		
	CKS2125		
	CKP1608		
	CKP2012		
	CKP2016		
	CKP2520		
	NM2012		
	NM2520		
	LK1005		No mechanical damage. Remaining terminal electrode : 70% min. Inductance change : Within ±15%
	LK1608		No mechanical damage. Remaining terminal electrode : 70% min. Inductance change 47N～4R7 : Within ±10% 5R6～330 : Within ±15%
	LK2125		
	HK0603		No mechanical damage. Remaining terminal electrode : 70% min. Inductance change : Within ±5%
	HK1005		
	HK1608		
	HK2125		
	HKQ0402		
	HKQ0603W		
	HKQ0603C		
	HKQ0603S		
	HKQ0603U		
	AQ105		
	MCFK1608		No mechanical damage. Remaining terminal electrode : 70% min. Inductance change : Within ±10%
	MCFE1608		
	MCHK2012		
	MCKK2012		
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.			

13. Thermal Shock

Specified Value	BK0402		Appearance：No significant abnormality Impedance change： Within ±30%
	BK0603		
	BK1005		
	BKH0603		
	BKH1005		
	BK1608		
	BK2125		
	ARRAY	BK2010	
		BK3216	
	BKP0402		
	BKP0603		
	BKP1005		
	BKP1608		
	BKP2125		
	MCF 0605		Appearance：No significant abnormality Impedance change： Within ±20%
	MCF 0806		
	MCF 1210		
	MCF 2010		
	CK1608		No mechanical damage. Inductance change：Within ±20% Q change：Within ±30%
	CK2125		
	CKS2125		Inductance change：Within ±20% (CKS2125)
	CKP1608		No mechanical damage. Inductance change： Within ±30%
	CKP2012		
	CKP2016		
	CKP2520		
	NM2012		
	NM2520		
	LK1005		No mechanical damage. Inductance change： Within ±10% Q change： Within ±30%
	LK1608		
	LK2125		
	HK0603		No mechanical damage. Inductance change： Within ±10% Q change： Within ±20%
	HK1005		
	HK1608		
	HK2125		
	HKQ0402		
	HKQ0603W		
	HKQ0603C		
	HKQ0603S		
	HKQ0603U		
	AQ105		
	MCFK1608		Appearance：No significant abnormality Inductance change： Within ±10%
	MCFE1608		
	MCHK2012		
	MCKK2012		

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.

14. Damp Heat(Steady state)			
Specified Value	BK0402		Appearance:No significant abnormality Impedance change: Within ±30%
	BK0603		
	BK1005		
	BKH0603		
	BKH1005		
	BK1608		
	BK2125		
	ARRAY	BK2010	
		BK3216	
	BKP0402		
	BKP0603		
	BKP1005		
	BKP1608		
	BKP2125		
	MCF 0605		Appearance:No significant abnormality Impedance change: Within ±20%
	MCF 0806		
	MCF 1210		
	MCF 2010		
	CK1608		No mechanical damage. Inductance change: Within ±20% Q change: Within ±30%
	CK2125		
	CKS2125		Inductance change: Within ±20%
	CKP1608		No mechanical damage. Inductance change: Within ±30%
	CKP2012		
	CKP2016		
	CKP2520		
	NM2012		
	NM2520		
	LK1005		No mechanical damage. Inductance change: Within ±10% Q change: Within ±30%
	LK1608		
	LK2125		No mechanical damage. Inductance change: Within ±20% Q change: Within ±30%
	HK0603		No mechanical damage. Inductance change: Within ±10% Q change: Within ±20%
	HK1005		
	HK1608		
	HK2125		
	HKQ0402		
	HKQ0603W		
	HKQ0603C		
	HKQ0603S		
	HKQ0603U		
	AQ105		
	MCFK1608		Appearance:No significant abnormality Inductance change: Within ±10%
	MCFE1608		
	MCHK2012		
	MCKK2012		
Test Methods and Remarks	BK、BKP、BKH Series、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) LK、CK、CKS、CKP、NM、HK、HKQ、AQ、MC Series: Temperature :40±2℃(LK、CK、CKS、CKP Series) :60±2℃(HK、HKQ、AQ、MC Series) Humidity :90 to 95%RH Duration :500±12 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.

15. Loading under Damp Heat			
Specified Value	BK0402		Appearance：No significant abnormality Impedance change： Within ±30%
	BK0603		
	BK1005		
	BKH0603		
	BKH1005		
	BK1608		
	BK2125		
	ARRAY	BK2010	
		BK3216	
	BKP0402		
	BKP0603		
	BKP1005		
	BKP1608		
	BKP2125		
	CK1608		No mechanical damage. Inductance change： Within ±20% Q change： Within ±30%
	CK2125		
	CKS2125		No mechanical damage. Inductance change： Within ±20%
	CKP1608		No mechanical damage. Inductance change： Within ±30%
	CKP2012		
	CKP2016		
	CKP2520		
	NM2012		
	NM2520		
	LK1005		No mechanical damage. Inductance change： Within ±10% Q change： Within ±30%
	LK1608		No mechanical damage. Inductance change： 0.047～12.0 μH： Within ±10% 15.0～33.0 μH： Within ±15% Q change： Within ±30%
	LK2125		No mechanical damage. Inductance change： Within ±20% Q change： Within ±30%
	HK0603		No mechanical damage. Inductance change： Within ±10% Q change： Within ±20%
	HK1005		
	HK1608		
	HK2125		
	HKQ0402		
	HKQ0603W		
	HKQ0603C		
	HKQ0603S		
	HKQ0603U		
	AQ105		
	MCFK1608※		Appearance：No significant abnormality Inductance change： Within ±10%
	MCFE1608※		
	MCHK2012※		
	MCKK2012※		
Test Methods and Remarks	BK、BKP、BKH 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) LK、CK、CKS、CKP、NM、HK、HKQ、AQ、MC Series： Temperature ：40±2℃(LK、CK、CKS、CKP、NM Series) ：60±2℃(HK、HKQ、AQ、MC Series) Humidity ：90 to 95%RH Applied current ：Rated current ※MC series ; Idc2max Duration ：500±12 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.

16. Loading at High Temperature			
Specified Value	BK0402		Appearance：No significant abnormality Impedance change： Within ±30%
	BK0603		
	BK1005		
	BKH0603		
	BKH1005		
	BK1608		
	BK2125		
	ARRAY	BK2010	
		BK3216	
	BKP0402		
	BKP0603		
	BKP1005		
	BKP1608		
	BKP2125		
	MCF 0605		Appearance：No significant abnormality Impedance change： Within ±20%
	MCF 0806		
	MCF 1210		
	MCF 2010		
	CK1608		No mechanical damage. Inductance change： Within ±20% Q change： Within ±30%
	CK2125		
	CKS2125		No mechanical damage. Inductance change： Within ±20%
	CKP1608		No mechanical damage. Inductance change： Within ±30%
	CKP2012		
	CKP2016		
	CKP2520		
	NM2012		
	NM2520		
	LK1005		No mechanical damage. Inductance change： Within ±10% Q change： Within ±30%
	LK1608		No mechanical damage. Inductance change： 0.047～12.0 μH： Within ±10% 15.0～33.0 μH： Within ±15% Q change： Within ±30%
	LK2125		No mechanical damage. Inductance change： Within ±20% Q change： Within ±30%
	HK0603		No mechanical damage. Inductance change： Within ±10% Q change： Within ±20%
	HK1005		
	HK1608		
	HK2125		
	HKQ0402		
	HKQ0603W		
	HKQ0603C		
	HKQ0603S		
	HKQ0603U		
	AQ105		
	MCFK1608※		Appearance：No significant abnormality Inductance change： Within ±10%
	MCFE1608※		
	MCHK2012※		
	MCKK2012※		
Test Methods and Remarks	BK、BKH、BKP Series、MCF Series： Temperature ：125±3℃(BK、BKH Series) ：85±3℃(BKP、MCF Series) 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) LK、CK、CKS、CKP、NM、HKQ、AQ、MC Series： Temperature ：85±2℃(LK、CK、CKS、CKP、NM、MC Series) ：85±2℃(HK1608, 2125) ：85±2℃(HK1005, AQ105 operating temperature range－55～＋85℃) ：125±2℃(HKQ0402, HK0603, HK1005, HKQ0603S, HKQ0603U, HKQ0603W, HKQ0603C, AQ105 operating temperature range－55～＋125℃) Applied current ：Rated current ※MC series ; Idc2max Duration ：500±12 hrs Recovery ：2 to 3 hrs of recovery under the standard condition after the test.(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.

Precautions on the use of 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)

■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)

1. 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.
   (3) The larger size of land patterns and amount of solder, the smaller Q value after mounting on PCB. It makes higher the Q value to design land patterns smaller than terminal electrode of chips.

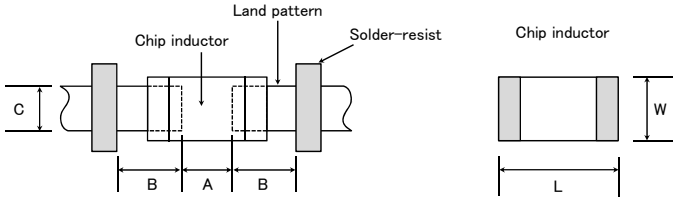
◆Pattern configurations (Inductor layout on panelized[breakaway] PC boards)

1. 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)

1. The following diagrams and tables show some examples of recommended patterns to prevent excessive solder amounts (larger fillets which extend above the component end terminations). Examples of improper pattern designs are also shown.
   (1) Recommended land dimensions for a typical chip inductor land patterns for PCBs



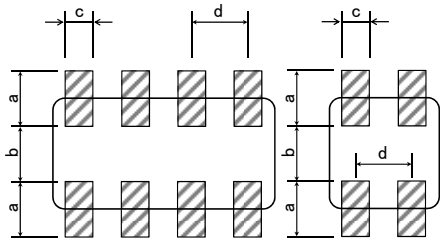
Recommended land dimensions for wave-soldering (Unit: mm)

Type		1608	2012	2125	2016	2520	3216
Size	L	1.6	2.0	2.0	2.0	2.5	3.2
	W	0.8	1.25	1.25	1.6	2.0	1.6
A		0.8～1.0	1.0～1.4	1.0～1.4	1.0～1.4	1.0～1.4	1.8～2.5
B		0.5～0.8	0.8～1.5	0.8～1.5	0.8～1.5	0.6～1.0	0.8～1.7
C		0.6～0.8	0.9～1.2	0.9～1.2	1.3～1.6	1.6～2.0	1.2～1.6

Recommended land dimensions for reflow-soldering (Unit: mm)

Type		0402	0603	1005	105	1608	2012	2125	2016	2520	3216
Size	L	0.4	0.6	1.0	1.0	1.6	2.0	2.0	2.0	2.5	3.2
	W	0.2	0.3	0.5	0.6	0.8	1.25	1.25	1.6	2.0	1.6
A		0.15～0.25	0.20～0.30	0.45～0.55	0.50～0.55	0.8～1.0	0.8～1.2	0.8～1.2	0.8～1.2	1.0～1.4	1.8～2.5
B		0.10～0.20	0.20～0.30	0.40～0.50	0.30～0.40	0.6～0.8	0.8～1.2	0.8～1.2	0.8～1.2	0.6～1.0	0.6～1.5
C		0.15～0.30	0.25～0.40	0.45～0.55	0.60～0.70	0.6～0.8	0.9～1.6	0.9～1.6	1.2～2.0	1.8～2.2	1.2～2.0

Excess solder can affect the ability of chips to withstand mechanical stresses. Therefore, please take proper precautions when designing land-patterns.

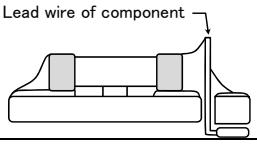
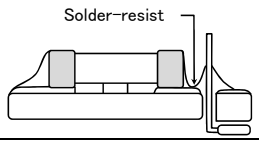
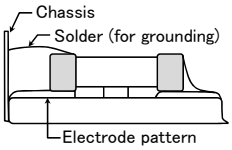
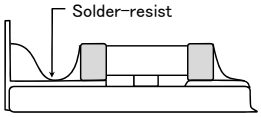
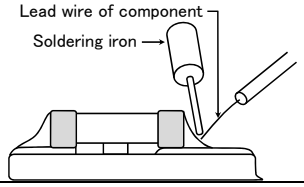
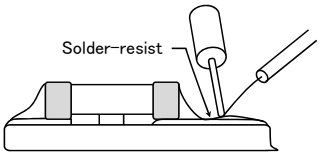
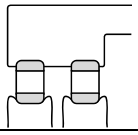
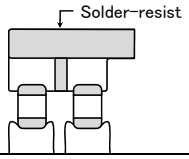


Recommended land dimension for Reflow-soldering

Type		3216	2010	1210	0806	0605
Size	L	3.2	2.0	1.25	0.85	0.65
	W	1.6	1.0	1.0	0.65	0.50
a		0.7～0.9	0.5～0.6	0.45～0.55	0.25～0.35	0.27～0.33
b		0.8～1.0	0.5～0.6	0.7～0.8	0.25～0.35	0.17～0.23
c		0.4～0.5	0.2～0.3	0.25～0.35	0.25～0.35	0.20～0.26
d		0.8	0.5	0.55	0.5	0.4

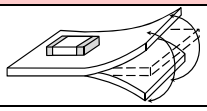
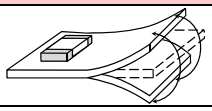
(Unit : mm)

((2) Examples of good and bad solder application

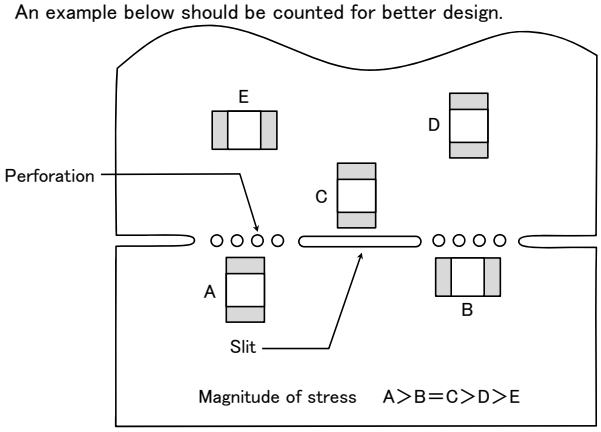
Item	Not recommended	Recommended
Mixed mounting of SMD and leaded components		
Component placement close to the chassis		
Hand-soldering of leaded components near mounted components		
Horizontal component placement		

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

1-1. 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.

1-2. 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.



1-3. 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.

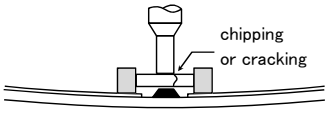
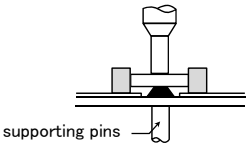
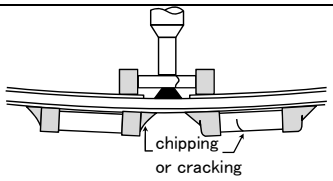
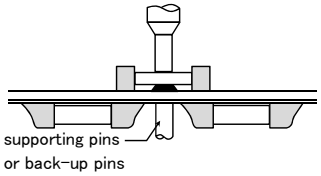
◆Selection of Adhesives

1. Mounting inductors with adhesives in preliminary assembly, before the soldering stage, may lead to degraded inductor characteristics unless the following factors are appropriately checked; the size of land patterns, type of adhesive, amount applied, hardening temperature and hardening period. Therefore, it is imperative to consult the manufacturer of the adhesives on proper usage and amounts of adhesive to use.

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.

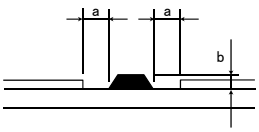
◆Selection of Adhesives

1. Some adhesives may cause reduced insulation resistance. The difference between the shrinkage percentage of the adhesive and that of the inductors may result in stresses on the inductors and lead to cracking. Moreover, too little or too much adhesive applied to the board may adversely affect component placement, so the following precautions should be noted in the application of adhesives.
   (1) Required adhesive characteristics
      a. The adhesive should be strong enough to hold parts on the board during the mounting & solder process.
      b. The adhesive should have sufficient strength at high temperatures.
      c. The adhesive should have good coating and thickness consistency.
      d. The adhesive should be used during its prescribed shelf life.
      e. The adhesive should harden rapidly.
      f. The adhesive must not be contaminated.
      g. The adhesive should have excellent insulation characteristics.
      h. The adhesive should not be toxic and have no emission of toxic gasses.
   (2) When using adhesives to mount inductors on a PCB, inappropriate amounts of adhesive on the board may adversely affect component placement. Too little adhesive may cause the inductors to fall off the board during the solder process. Too much adhesive may cause defective soldering due excessive flow of adhesive on to the land or solder pad.

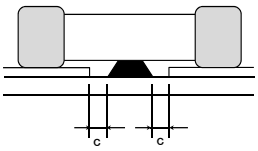
[Recommended conditions]

Figure	0805 case sizes as examples
a	0.3mm min
b	100～120 μm
c	Area with no adhesive

Amount of adhesives



After inductors are bonded



4. Soldering

Precautions

◆Selection of Flux

1. Since flux may have a significant effect on the performance of inductors, it is necessary to verify the following conditions prior to use;
   (1) Flux used should be with less than or equal to 0.1 wt% (Chlorine conversion method) of halogenated content. Flux having a strong acidity content should not be applied.
   (2) When soldering inductors on the board, the amount of flux applied should be controlled at the optimum level.
   (3) When using water-soluble flux, special care should be taken to properly clean the boards.

◆Soldering

1. Temperature, time, amount of solder, etc. are specified in accordance with the following recommended conditions, and please contact us about peak temperature when you use lead-free paste.

Technical considerations

◆Selection of Flux

1-1. When too much halogenated substance (Chlorine, etc.) content is used to activate the flux, or highly acidic flux is used, an excessive amount of residue after soldering may lead to corrosion of the terminal electrodes or degradation of insulation resistance on the surface of the Inductor.

1-2. Flux is used to increase solderability in flow soldering, but if too much is applied, a large amount of flux gas may be emitted and may detrimentally affect solderability. To minimize the amount of flux applied, it is recommended to use a flux-bubbling system.

1-3. Since the residue of water-soluble flux is easily dissolved by water content in the air, the residue on the surface of Inductor in high humidity conditions may cause a degradation of insulation resistance and therefore affect the reliability of the components. The cleaning methods and the capability of the machines used should also be considered carefully when selecting water-soluble flux.

◆Soldering

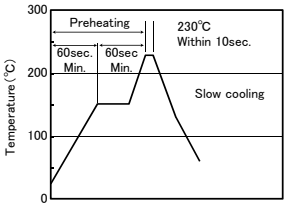
1-1. Preheating when soldering

Heating: Chip inductor components should be preheated to within 100 to 130℃ of the soldering. Cooling: The temperature difference between the components and cleaning process should not be greater than 100℃.

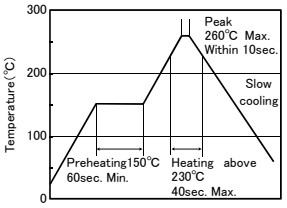
Chip inductors are susceptible to thermal shock when exposed to rapid or concentrated heating or rapid cooling. Therefore, the soldering process must be conducted with a great care so as to prevent malfunction of the components due to excessive thermal shock.

[Reflow soldering]

【Recommended conditions for eutectic soldering】



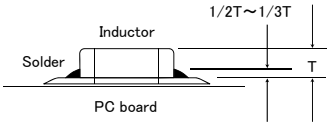
【Recommended condition for Pb-free soldering】



※Ceramic chip components should be preheated to within 100 to 130℃ of the soldering.
※Assured to be reflow soldering for 2 times.
※MC series; Peak 230℃(eutectic soldering)、260℃(Pb-free soldering)max within 5sec.

Caution

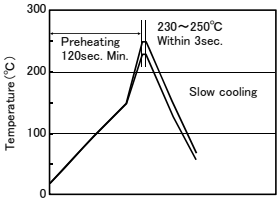
1. The ideal condition is to have solder mass (fillet) controlled to 1/2 to 1/3 of the thickness of the inductor, as shown below:



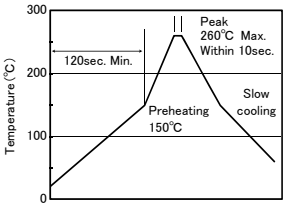
2. Because excessive dwell times can detrimentally affect solderability, soldering duration should be kept as close to recommended times as possible.

[Wave soldering]

【Recommended conditions for eutectic soldering】



【Recommended condition for Pb-free soldering】



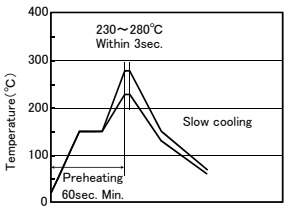
※Ceramic chip components should be preheated to within 100 to 130℃ of the soldering.
※Assured to be wave soldering for 1 time.
※Except for reflow soldering type.

Caution

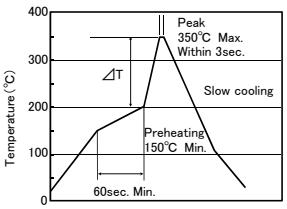
1. Make sure the inductors are preheated sufficiently.
2. The temperature difference between the inductor and melted solder should not be greater than 100 to 130℃.
3. Cooling after soldering should be as gradual as possible.
4. Wave soldering must not be applied to the inductors designated as for reflow soldering only.

[Hand soldering]

【Recommended conditions for eutectic soldering



【Recommended condition for Pb-free soldering】



(※⊿T≦190℃(3216Type max), ⊿T≦130℃(3225 Type min)
※It is recommended to use 20W soldering iron and the tip is 1φ or less.
※The soldering iron should not directly touch the components.
※Assured to be soldering iron for 1 time.
Note: The above profiles are the maximum allowable soldering condition, therefore these profiles are not always recommended.

	Caution 1. Use a 20W soldering iron with a maximum tip diameter of 1.0 mm. 2. The soldering iron should not directly touch the inductor.

5. Cleaning	
Precautions	◆Cleaning conditions 1. When cleaning the PC board after the Inductors are all mounted, select the appropriate cleaning solution according to the type of flux used and purpose of the cleaning(e.g. to remove soldering flux or other materials from the production process.) 2. Cleaning conditions should be determined after verifying, through a test run, that the cleaning process does not affect the inductor's characteristics.
Technical considerations	◆Cleaning conditions 1. The use of inappropriate solutions can cause foreign substances such as flux residue to adhere to the inductor, resulting in a degradation of the inductor's electrical properties(especially insulation resistance). 2. Inappropriate cleaning conditions(insufficient or excessive cleaning)may detrimentally affect the performance of the inductors. (1) Excessive cleaning a. In the case of ultrasonic cleaning, too much power output can cause excessive vibration of the PC board which may lead to the cracking of the inductor or the soldered portion, or decrease the terminal electrodes' strength. Thus the following conditions should be carefully checked; Ultrasonic output Below 20W/ℓ Ultrasonic frequency Below 40kHz Ultrasonic washing period 5 min. or less

6. Post cleaning processes	
Precautions	◆Application of resin coatings, moldings, etc. to the PCB and components. 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. When a resin's hardening temperature is higher than the inductor's operating temperature, the stresses generated by the excess heat may lead to inductor damage or destruction. 3. Stress caused by a resin's temperature generated expansion and contraction may damage inductors. The use of such resins, molding materials etc. is not recommended.

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 1. Always wear static control bands to protect against ESD. 2. Keep the inductors away from all magnets and magnetic objects. 3. Use non-magnetic tweezers when handling inductors. 4. Any devices used with the inductors(soldering irons, measuring instruments) should be properly grounded. 5. Keep bare hands and metal products(i.e., metal desk)away from chip electrodes or conductive areas that lead to chip electrodes. 6. Keep inductors away from items that generate magnetic fields such as speakers or coils. ◆Mechanical considerations 1. 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 1. 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 Below 30℃ Humidity Below 70% RH The ambient temperature must be kept below 40℃. Even under ideal storage conditions inductor electrode solderability decreases as time passes, so inductors should be used within 6 months from the time of delivery. *The packaging material should be kept where no chlorine or sulfur exists in the air.
Technical considerations	◆Storage 1. 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.