有关敝公司产品的注意事项

请务必在使用敝公司产品之前阅读。

⚠ 注 意

产品目录中的记载内容

本产品目录中所记载的内容为2021年1月的内容。因产品改良等原因，可能会不经预告而变更其记载内容，或是停止供应本产品目录中所记载的产品。所以，请务必在使用前先确认最新的产品信息。

未按照本产品目录中所记载的内容或交货规格说明书使用敝公司产品，即便其致使用设备发生损害、不良情况等时，敝公司也不承担任何责任，敬请知悉。

签署交货规格说明书

就本产品目录中所记载产品的产品规格等相关内容，敝公司备有交货规格说明书，详情请向敝公司咨询。在使用敝公司产品前请务必就交货规格说明书之内容确认并批准之。

实装前的事前评估

使用敝公司产品时，请务必事先安装到使用设备之后，在实际使用的环境下进行评估和确认。

用途的限定

1．可以使用的设备

本产品目录中所记载的产品预设为使用于一般电子设备 [音像设备、办公自动化设备、家电产品、办公设备、信息通讯设备 (手机、电脑等)] 以及面向本产品目录或是交货规格说明书中另行注明的设备的通用性、标准性用途。

另外，面向汽车用电子设备、电信基础设施 / 工业设备、医疗设备 (国际 (GHTF) 第一类、第二类、第三类) 方面的应用，敝公司也备有预设的产品线，请参考本产品目录或是交货规格说明书的内容，使用相对应的产品。

2．需要另行确认的设备

若考虑将本产品目录中所记载的产品使用于当产品发生故障、品质不良，或是由此引起的运转失常而可能会危及生命、身体或是财产，以及有可能给社会造成深刻影响的以下设备 (不包括本产品目录或是交货规格说明书中另行注明可以使用设备) 等时，请务必事先向敝公司咨询。

(1) 运输用设备 (汽车驱动控制设备、火车控制设备、船舶控制设备等)
(2) 交通信号设备
(3) 防灾 / 保安设备
(4) 医疗设备 (国际 (GHTF) 第三类)
(5) 高公共性信息通讯设备 / 信息处理设备 (电话交换机、电话 / 无线 / 广播电视基站等)
(6) 其他与上述设备有同等品质与可靠性要求的设备

3．禁止使用的设备

请勿将敝公司产品使用于对安全性和可靠性有着极高要求的以下设备。

(1) 航天设备 (人工卫星、火箭等)
(2) 航空设备 (注释1)
(3) 医疗设备 (国际 (GHTF) 第四类)、植体 (体内植入型) 医疗设备 (注释2)
(4) 发电控制设备 (面向核能 / 水力 / 火力发电厂等的设备)
(5) 海底设备 (海底中继设备、海中的作业设备等)
(6) 军事设备
(7) 其他与上述设备有同等品质与可靠性要求的设备

注释 1 ：仅限于对航空设备的安全运行不产生直接干扰的设备 [机内娱乐设备、机内照明设备、电动座椅、餐饮设备等]，在满足敝公司另行指定的相关条件时，亦可将敝公司产品用于以上用途。在贵公司考虑将敝公司的产品用于以上用途时，请务必事先向敝公司咨询相关的信息。

注释 2 ：包括注入人体内的部分和与此相连接的体外部分。

4．责任的限制

未经敝公司的事先书面同意，把本产品目录中所记载的产品使用于非敝公司预设用途的设备、前述需要向敝公司咨询的设备或敝公司禁止使用的设备，从而给客户或第三方造成损害的，敝公司不承担任何责任，敬请知悉。

安全设计

需将敝公司的产品使用于对安全性和可靠性要求较高的设备、电路上时，请进行充分的安全性评估和可靠性评估。另外，请通过设置保护电路、保护装置的系统，设置冗余电路不会被单一故障影响安全性的系统等失效导向安全 (fail-safe) 设计，确保充分的安全性。

有关知识产权

本产品目录中所记载的信息是用于说明相关产品的典型操作以及相关应用。此类信息的使用不代表对于敝公司以及第三方的知识产权以及其他权利的使用许可或是不侵权保证。

保证范围

敝公司产品的保证范围仅限于已经交付的敝公司产品本身，由敝公司产品的故障或不良情况所诱发的损害，敝公司不承担任何责任，敬请知悉。但是，以书面形式另行签署了交易基本合同书、品质保证协定书等时，敝公司将根据该合同的条件提供保证。

正规销售渠道

本产品目录中所记载的内容适用于从敝公司营业所、销售子公司、销售代理店 (即“正规销售渠道”) 购买的敝公司产品，并不适用于从其他渠道购买的敝公司产品，敬请知悉。

出口时的注意事项

本产品目录中所记载的部分产品在出口时须事先确认《外汇和对外贸易法》以及美国在出口管理方面的相关法规，并办理相关手续。如有不明之处，请向敝公司咨询。

▶由于篇幅有限，本产品目录中只记载了有代表性的产品规格，若考虑使用敝公司产品时，请确认交货规格说明书中的详细规格。
另外，有关各产品的详细信息 (特性图、可靠性信息、使用时的注意事项等)，请参阅敝公司网站 (http://www.ty-top.com/)。

车载用途使用指引

敝公司将汽车用电子设备划分为如下四个分类。而对于敝公司的每个产品，敝公司都设定了其可以被使用的分类。需在汽车用电子设备上使用敝公司的产品之前，请务必要事先确认该产品是否适合使用在该用途上。如有不明之处，请与敝公司取得联系。

分　类	汽车用电子设备（代表实例）
控制系	・发动机引擎控制装置（ECU） ・巡航定速控制装置 ・四轮转向系统（4WS） ・变速箱 ・动力转向装置 ・HEV ／ PHV ／ EV 基础控制（电池／逆变器／ DC-DC） ・汽车定位器（车辆位置情报提供装置）　等
安全系	・防锁死刹车系统（ABS） ・车身动态稳定系统（ESC） ・安全气囊 ・ADAS（直接控制走动／转向／停车的装置）　等
车身系	・雨刷 ・自动门锁 ・电动车窗 ・无钥匙进入系统（智能钥匙） ・电动后视镜 ・汽车电子后视镜 ・车内照明 ・车内空调系统 ・LED 车头／车尾灯 ・轮胎压力监测系统（TPMS） ・防盗装置　等
情报系	・车载信息娱乐装置（汽车导航／音响等） ・情报通讯装置（ITS ／ T-BOX） ・汽车仪表 ・ADAS（与传感、安全／传动系统没有关联的装置） ・行车记录仪（车厂原装配件）　等

▶ 由于篇幅有限，本产品目录中只记载了有代表性的产品规格，若考虑使用敝公司产品时，请确认交货规格说明书中的详细规格。
另外，有关各产品的详细信息(特性图、可靠性信息、使用时的注意事项等)，请参阅敝公司网站(http://www.ty-top.com/)。

金属多层片状功率电感器（MCOIL ™ MC 系列）

回流焊
AEC-Q200

■型号标示法

*使用温度范围：-40 ~ +125℃（包含产品本身发热）

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

△＝空格

①类型

代码	类型
MC	金属多层片状功率电感器

②产品厚度

代码	产品厚度［mm］
KK	1.0 max

③尺寸（L×W）

代码	外型（inch）	尺寸（L×W）［mm］
1608	1608(0603)	1.6×0.8
2012	2012(0805)	2.0×1.25

④包装

代码	包装
T	卷盘带装

⑤标称阻抗值

代码（例）	标称阻抗值［μH］
R47	0.47
1R0	1.0

※R = 小数点

⑥阻抗值公差

代码	阻抗值公差
M	±20%

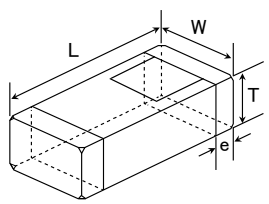
⑦本公司管理记号

代码	本公司管理记号
V	车载用品
8	电信基础设施 / 工业设备、医疗设备用途

⑧个别规格

代码	个别规格
C	有极性标示

■标准外型尺寸 / 标准数量



Type	L	W	T	e	标准数量［pcs］	
					纸带	压模带
MCKK1608 (0603)	1.6±0.2 (0.063±0.008)	0.8±0.2 (0.031±0.008)	1.0 max (0.039 max)	0.3±0.2 (0.012±0.008)	–	3000
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

单位：mm（inch）

■型号一览

・产品目录中的金属多层片状功率电感器全部属于RoHS对应品

注）
・根据使用电路和机器，需要按照相应规格处理。请务必咨询正规销售渠道。
・车载(车身系 / 情报系)用途（AEC-Q200 Qualified）的产品。有关更多的, 内容，请务必于"车载用途使用指引"中确认。
< AEC-Q200 ： AEC-Q200 qualified >
车载(车身系 / 情报系)用途的金属多层片状功率电感器，已就其代表性产品实施了对应AEC-Q200标准的评价测试。
关于本产品的详细规格和评估测试结果等信息，请咨询正规销售渠道。
此外，订购时请索取产品规格书，就其内容进行确认并批准之。

●MC1608

型号	EHS	标称电感值 [μH]	电感量公差	直流电阻 [mΩ]		额定电流 (Idc1) [A] (max.)	额定电流 (Idc2) [A] (max.)	测试频率 [MHz]	厚度 [mm] (max.)	注释
				(max.)	(typ.)					
MCKK1608TR47MVC	RoHS	0.47	±20%	65	54	2.60	3.00	1	1.00	

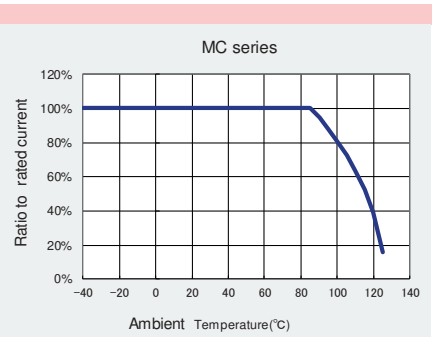
●MC2012

型号	EHS	标称电感值 [μH]	电感量公差	直流电阻 [mΩ]		额定电流 (Idc1) [A] (max.)	额定电流 (Idc2) [A] (max.)	测试频率 [MHz]	厚度 [mm] (max.)	注释
				(max.)	(typ.)					
MCKK2012T1R0MVC	RoHS	1.0	±20%	85	71	2.70	2.70	1	1.00	

※）额定电流（Idc1）在直流电流负荷时，电感值变化率为30%以内的电流值（at 20℃）
※）额定电流（Idc2）在直流电流负荷时，因自身发热导致温度上升至40℃以下的电流值（at 20℃）

■降低额定电流值

●MC系列
MC系列，根据周围温度的状况，需要降低额定电流值。
请参照下图，降低使用电流值。



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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

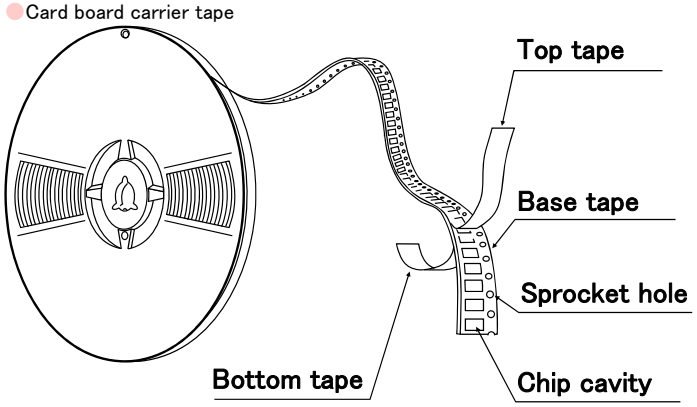
①Minimum Quantity

●Tape & Reel Packaging

Type	Thickness mm(inch)	Standard Quantity [pcs]	
		Paper Tape	Embossed Tape
CK 1608 (0603)	0.8 (0.031)	4000	—
CK 2125 (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)	0.95 max (0.037 max)	4000	—
CKP2012 (0805)	1.0 max (0.039 max)	—	3000
CKP2016 (0806)	1.0 max (0.039 max)	—	3000
CKP2520 (1008)	0.8 max (0.031 max)	—	3000
	1.0 max (0.039 max)	—	3000
	1.2 max (0.047 max)	—	2000
LK 1005 (0402)	0.5 (0.020)	10000	—
LK 1608 (0603)	0.8 (0.031)	4000	—
LK 2125 (0805)	0.85 (0.033)	4000	—
	1.25 (0.049)	—	2000
HK 0603 (0201)	0.3 (0.012)	15000	—
HK 1005 (0402)	0.5 (0.020)	10000	—
HK 1608 (0603)	0.8 (0.031)	4000	—
HK 2125 (0805)	0.85 (0.033)	—	4000
	1.0 (0.039)	—	3000
HKQ0603S (0201)	0.3 (0.012)	15000	—
HKQ0603U (0201)	0.3 (0.012)	15000	—
AQ 105 (0402)	0.5 (0.020)	10000	—
BK 0603 (0201)	0.3 (0.012)	15000	—
BK 1005 (0402)	0.5 (0.020)	10000	—
BKH0603 (0201)	0.3 (0.012)	15000	—
BKH1005 (0402)	0.5 (0.020)	10000	—
BK 1608 (0603)	0.8 (0.031)	4000	—
BK 2125 (0805)	0.85 (0.033)	4000	—
	1.25 (0.049)	—	2000
BK 2010 (0804)	0.45 (0.018)	4000	—
BK 3216 (1206)	0.8 (0.031)	—	4000
BKP0603 (0201)	0.3 (0.012)	15000	—
BKP1005 (0402)	0.5 (0.020)	10000	—
BKP1608 (0603)	0.8 (0.031)	4000	—
BKP2125 (0805)	0.85 (0.033)	4000	—
MCF0605 (0202)	0.3 (0.012)	15000	—
MCF0806 (0302)	0.4 (0.016)	—	10000
MCF1210 (0504)	0.55 (0.022)	—	5000
MCF2010 (0804)	0.45 (0.018)	—	4000
MCEE1005 (0402)	0.55 max (0.022 max)	10000	—
MCEK1210 (0504)	0.5 max (0.020 max)	5000	—
MCFK1608 (0603)	0.6 max (0.024 max)	4000	—
MCFE1608 (0603)	0.65 max (0.026 max)	4000	—
MCHK1608 (0603)	0.8 max (0.031 max)	4000	—
MCKK1608 (0603)	1.0 max (0.039 max)	–	3000
MCHK2012 (0806)	0.8 max (0.031 max)	4000	—
MCKK2012 (0805)	1.0 max (0.039 max)	–	3000
MCFE2016 (0806)	0.65 max (0.026 max)	4000	—

②Taping material

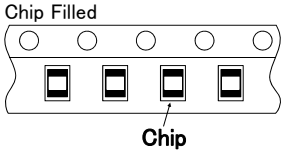
Card board carrier tape



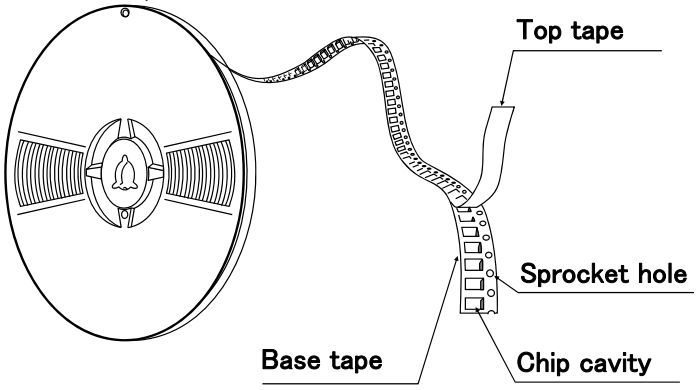
CK	1608
CKP	1608
CK	2125
CKS	2125
LK	1005
LK	1608
LK	2125
HK	0603
HK	1005
HK	1608
HKQ	0603
AQ	105

BK	0603
BK	1005
BK	1608
BK	2125
BK	2010
BKP	0603
BKP	1005
BKP	1608
BKP	2125
BKH	0603
BKH	1005
MCF	0605
MC	1005
MC	1210
MC	1608
MC	2012
MC	2016

Chip Filled



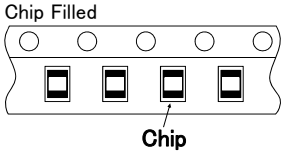
Embossed Tape



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

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

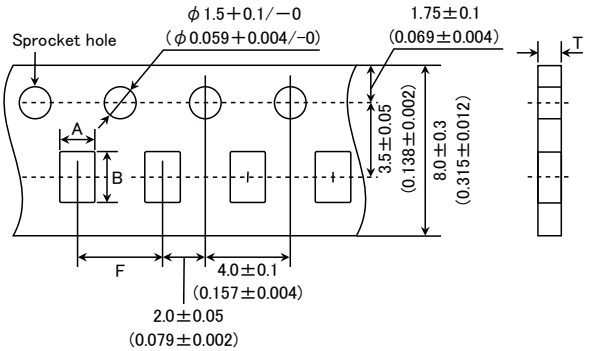
Chip Filled



③Taping Dimensions

Paper tape (8mm wide)

Unit : mm (inch)



CK、CKS、CKP、LK、HK、HKQ、AQ、BK、BKP、BKH series

Type	Thickness	Chip cavity		Insertion Pitch	Tape Thickness
		A	B	F	T
HK 0603 (0201) HKQ0603S (0201) HKQ0603U (0201) BK 0603 (0201) BKH0603 (0201) BKP0603 (0201)	0.3 (0.012)	0.40 (0.016)	0.70 (0.028)	2.0±0.05 (0.079±0.002)	0.45max (0.018max)
LK 1005 (0402) HK 1005 (0402) BK 1005 (0402) BKH1005 (0402) BKP1005 (0402)	0.5 (0.020)	0.65 (0.026)	1.15 (0.045)	2.0±0.05 (0.079±0.002)	0.8max (0.031max)
CK 1608 (0603) LK 1608 (0603) HK 1608 (0603) BK 1608 (0603) BKP1608 (0603)	0.8 (0.031)	1.0 (0.039)	1.8 (0.071)	4.0±0.1 (0.157±0.004)	1.1max (0.043max)
CKP1608 (0603)	0.95 max (0.037max)				
BK 2010 (0804)	0.45 (0.018)	1.2 (0.047)	2.17 (0.085)	4.0±0.1 (0.157±0.004)	0.8max (0.031max)
CK 2125 (0805) CKS2125 (0805) LK 2125 (0805) BK 2125 (0805) BKP2125 (0805)	0.85 (0.033)	1.5 (0.059)	2.3 (0.091)	4.0±0.1 (0.157±0.004)	1.1max (0.043max)
AQ 105 (0402)	0.5 (0.020)	0.75 (0.030)	1.15 (0.045)	2.0±0.05 (0.079±0.002)	0.8max (0.031max)

Unit : mm (inch)

MC series F type

Type	Thickness	Chip cavity		Insertion Pitch	Tape Thickness
		A	B	F	T
MCF0605 (0202)	0.3 (0.012)	0.62 (0.024)	0.77 (0.030)	2.0±0.05 (0.079±0.002)	0.45max (0.018max)

Unit : mm (inch)

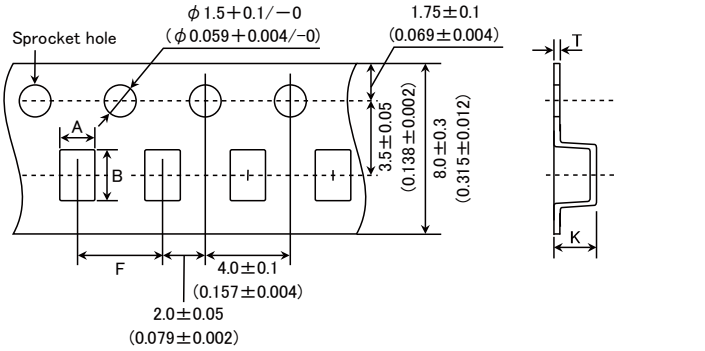
MCOIL™ MC series

Type	Thickness	Chip cavity		Insertion Pitch	Tape Thickness
		A	B	F	T
MCEE1005 (0402)	0.55 max (0.021 max)	0.8 (0.031)	1.3 (0.051)	2.0±0.05 (0.079±0.002)	0.64max (0.025max)
MCEK1210 (0504)	0.5 max (0.020 max)	1.3 (0.051)	1.55 (0.061)	4.0±0.1 (0.157±0.004)	0.64max (0.025max)
MCFK1608 (0603)	0.6 max (0.024 max)	1.1 (0.043)	1.9 (0.075)	4.0±0.1 (0.157±0.004)	0.72max (0.028max)
MCFE1608 (0603)	0.65 max (0.026 max)	1.1 (0.043)	1.9 (0.075)	4.0±0.1 (0.157±0.004)	0.72max (0.028max)
MCHK1608 (0603)	0.8 max (0.031 max)	1.2 (0.047)	2.0 (0.079)	4.0±0.1 (0.157±0.004)	0.9max (0.035max)
MCHK2012 (0805)	0.8 max (0.031 max)	1.65 (0.065)	2.4 (0.094)	4.0±0.1 (0.157±0.004)	0.9max (0.035max)
MCFE2016 (0806)	0.65 max (0.026 max)	1.95 (0.077)	2.3 (0.091)	4.0±0.1 (0.157±0.004)	0.72max (0.028max)

Unit : mm (inch)

● Embossed Tape (8mm wide)

Unit : mm (inch)



CK、CKS、CKP、LK、HK、BK series

Type	Thickness	Chip cavity		Insertion Pitch	Tape Thickness	
		A	B	F	K	T
HK 2125 (0805)	0.85 (0.033)	1.5 (0.059)	2.3 (0.091)	4.0±0.1 (0.157±0.004)	1.5max (0.059 max)	0.3max (0.012 max)
	1.0 (0.039)				2.0 max (0.079 max)	
CK 2125 (0805) CKS2125 (0805) LK 2125 (0805) BK 2125 (0805)	1.25 (0.049)				2.0 max (0.079 max)	
BK 3216 (1206)	0.8 (0.031)	1.9 (0.075)	3.5 (0.138)	4.0±0.1 (0.157±0.004)	1.4 max (0.055 max)	0.3 max (0.012 max)
CKP2012 (0805)	1.0 max (0.039 max)	1.55 (0.061)	2.3 (0.091)	4.0±0.1 (0.157±0.004)	1.3 max (0.051 max)	0.3 max (0.012 max)
CKP2016 (0806)	1.0 max (0.039 max)	1.8 (0.071)	2.2 (0.087)	4.0±0.1 (0.157±0.004)	1.3 max (0.051 max)	0.25 max (0.01 max)
CKP2520 (1008)	0.8 max (0.031 max)	2.3 (0.091)	2.8 (0.110)	4.0±0.1 (0.157±0.004)	1.4 max (0.055 max)	0.3 max (0.012 max)
	1.0 max (0.039 max)				1.4 max (0.055 max)	
	1.2 max (0.047 max)				1.7 max (0.067 max)	

単位 : mm (inch)

MC series F type

Type	Thickness	Chip cavity		Insertion Pitch	Tape Thickness	
		A	B	F	K	T
MCF0806 (0302)	0.4 (0.016)	0.75 (0.030)	0.95 (0.037)	2.0±0.05 (0.079±0.002)	0.55 max (0.022 max)	0.3 max (0.012 max)
MCF1210 (0504)	0.55 (0.022)	1.15 (0.045)	1.40 (0.055)	4.0±0.1 (0.157±0.004)	0.65 max (0.026 max)	0.3 max (0.012 max)
MCF2010 (0804)	0.45 (0.018)	1.1 (0.043)	2.3 (0.091)	4.0±0.1 (0.157±0.004)	0.85 max (0.033 max)	0.3 max (0.012 max)

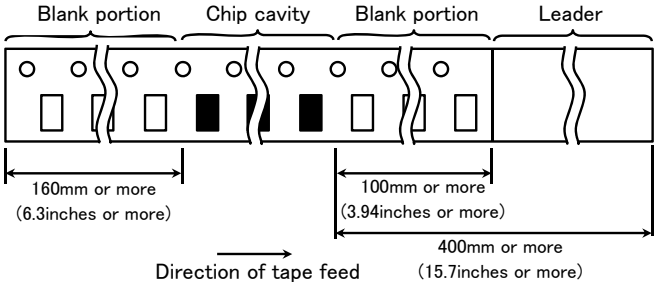
Unit : mm (inch)

MCOIL™ MC series

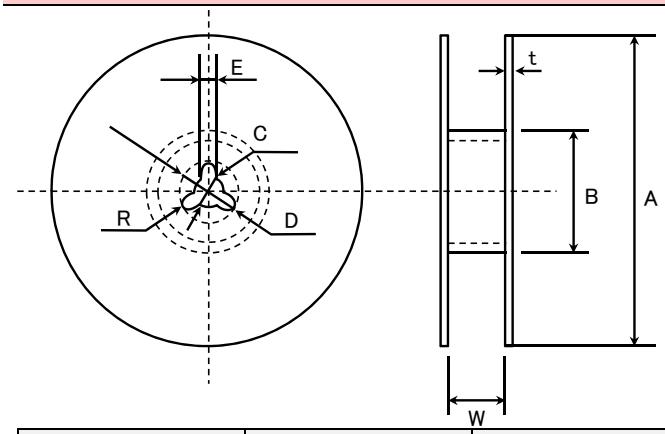
Type	Thickness	Chip cavity		Insertion Pitch	Tape Thickness	
		A	B	F	K	T
MCKK1608 (0603)	1.0 max (0.039 max)	1.1 (0.043)	1.95 (0.077)	4.0±0.1 (0.157±0.004)	1.5 max (0.059 max)	0.3 max (0.012 max)
MCKK2012 (0805)	1.0 max (0.039 max)	1.55 (0.061)	2.35 (0.093)	4.0±0.1 (0.157±0.004)	1.45 max (0.057 max)	0.3 max (0.012 max)

Unit : mm (inch)

④LEADER AND BLANK PORTION



⑤Reel Size



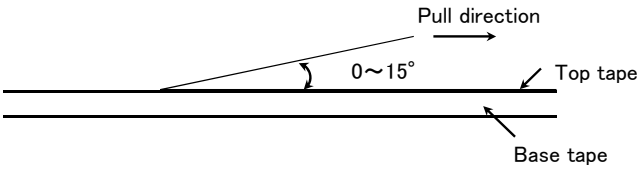
A	B	C	D	E	R
ϕ178±2.0	ϕ50 or more	ϕ13.0±0.2	ϕ21.0±0.8	2.0±0.5	1.0

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

(Unit : mm)

⑥Top tape strength

The top tape requires a peel-off force of 0.1 to 0.7N (*) in the direction of the arrow as illustrated below. *) MCOIL™ MC series is 0.1 to 1.0N.



Multilayer chip inductors
Multilayer chip inductors for high frequency, Multilayer chip bead inductors
Metal Multilayer Chip Power Inductors (MCOIL™ MC series)

■RELIABILITY DATA

1. Operating Temperature Range		
Specified Value	BK series	−55～＋125℃
	BKP series	−55～＋125℃(BKP0603: Including self-generated heat)
	LK series	−40～＋85℃
	HK series	−55～＋125℃
	MCOIL™ MC series	−40～＋125℃(Including self-generated heat)

2. Storage Temperature Range		
Specified Value	BK series	−55～＋125℃
	BKP series	−55～＋125℃(BKP0603: −55～＋85℃)
	LK series	−40～＋85℃
	HK series	−55～＋125℃
	MCOIL™ MC series	−40～＋85℃

3. Rated Current		
Specified Value	BK series	The temperature of the element is increased within 20℃.
	BKP series	The temperature of the element is increased within 40℃
	LK series	The decreasing-rate of inductance value is within 5 %
	HK series	The decreasing-rate of inductance value is within 5 %, or the temperature of the element is increased within 20℃
	MCOIL™ MC series	Idc1: The decreasing-rate of inductance value is within 30 % Idc2: The temperature of the element is increased within 40℃

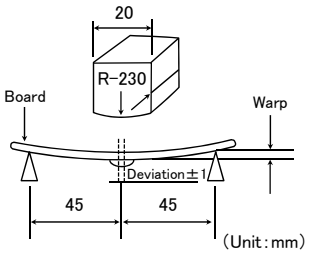
4. Impedance		
Specified Value	BK series BKP series	Refer to each specification.
Test Methods and Remarks	Measuring frequency : 100±1MHz Measuring equipment : 4291A(or its equivalent) Measuring jig : 16192A(or its equivalent), HW:16193A(or its equivalent)	

5. Inductance		
Specified Value	LK series HK series MCOIL™ MC series	Refer to each specification.
Test Methods and Remarks	LK Series Measuring frequency : 10～25MHz Measuring equipment /jig : 4291A＋16193A(or its equivalent) Measuring current : 1mA rms HK Series Measuring frequency : 100MHz Measuring equipment /jig : 4291A＋16193A(or its equivalent) MCOIL™ MC Series Measuring frequency : 1MHz Measuring equipment : E4991+16197A(or its equivalent)	

6. Q		
Specified Value	LK series HK series	Refer to each specification.
Test Methods and Remarks	LK Series Measuring frequency : Refer to each specification. Measuring equipment /jig : 4291A＋16193A(or its equivalent) Measuring current : 1mA rms HK Series Measuring frequency : 100MHz Measuring equipment /jig : 4291A＋16193A(or its equivalent)	

7. DC Resistance		
Specified Value	BK series	Refer to each specification.
	BKP series	
	LK series	
	HK series	
	MCOIL™ MC series	
Test Methods and Remarks	Measuring equipment: IWATSU VOAC7512(or its equivalent)	

8. Self Resonance Frequency(SRF)		
Specified Value	LK series	Refer to each specification.
	HK series	
Test Methods and Remarks	LK Series Measuring equipment : 4291A(or its equivalent) Measuring jig : 16193A(or its equivalent) HK Series Measuring equipment : 8719C(or its equivalent)	

9. Resistance to Flexure of Substrate		
Specified Value	BK series	No mechanical damage.
	BKP series	
	LK series	
	HK series	
	MCOIL™ MC series	
Test Methods and Remarks	Warp : 2mm Testing board : glass epoxy-resin substrate Thickness : 0.8mm  	

10. Solderability		
Specified Value	BK series	At least 90% of terminal electrode is covered by new solder.
	BKP series	
	LK series	
	HK series	
	MCOIL™ MC series	
Test Methods and Remarks	Solder temperature :230±5℃ (JIS Z 3282 H60A or H63A) Solder temperature :245±3℃ (Sn/3.0Ag/0.5Cu) Duration :4±1 sec.	

11. Resistance to Soldering		
Specified Value	BK series	Appearance:No significant abnormality Impedance change:Within ±30%
	BKP series	
	LK series	Appearance:No significant abnormality Inductance change: Within ±15%
	HK series	Appearance:No significant abnormality Inductance change: Within ±5%
	MCOIL™ MC series	Appearance:No significant abnormality Inductance change: Within ±10%
Test Methods and Remarks	Solder temperature :260±5℃ Duration :10±0.5 sec. Preheating temperature :150 to 180℃ Preheating time :3 min. Flux :Immersion into methanol solution with colophony for 3 to 5 sec. Recovery :2 to 3 hrs of recovery under the standard condition after the test.(See Note 1)	

12. Thermal Shock

Specified Value	BK series BKP series	Appearance : No significant abnormality Impedance change : Within ±30%
	LK series	Appearance : No significant abnormality Inductance change : Within ±10% Q change : Within ±30%
	HK series	Appearance : No significant abnormality Inductance change : Within ±10% Q change : Within ±20%
	MCOIL™ MC series	Appearance : No significant abnormality Inductance change : Within ±10%

Test Methods and Remarks

BK、HK、BKP Series
Conditions for 1 cycle

Step	temperature (℃)	time (min.)
1	−55℃ +0/−3	30±3
2	Room temperature	2～3
3	+125℃(BKP0603: +85℃) +3/−0	30±3
4	Room temperature	2～3

Number of cycles : 100

LK Series
Conditions for 1 cycle

Step	temperature (℃)	time (min.)
1	−40℃ +0/−3	30±3
2	Room temperature	2～3
3	+85℃ +3/−0	30±3
4	Room temperature	2～3

Number of cycles : 100

MCOIL™ MC series
Conditions for 1 cycle

Step	temperature (℃)	time (min.)
1	−40℃ +0/−3	30±3
2	Room temperature	2～3
3	+85℃ +3/−0	30±3
4	Room temperature	2～3

Number of cycles : 1000

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

13. Damp Heat (Steady state)

Specified Value	BK series BKP series	Appearance : No significant abnormality Impedance change : Within ±30%
	LK series	Appearance : No significant abnormality Inductance change : Within ±10% Q change : Within ±30%
	HK series	Appearance : No significant abnormality Inductance change : Within ±10% Q change : Within ±20%
	MCOIL™ MC series	Appearance : No significant abnormality Inductance change : Within ±10%

Test Methods and Remarks

BK, BKP, LK series
Temperature : 40±2℃
Humidity : 90 to 95%RH
Duration : 1000+24/−0 hrs
Recovery : 2 to 3 hrs of recovery under the standard condition after the removal from test chamber. (See Note 1)

HK, MCOIL™ MC series
Temperature : 60±2℃
Humidity : 90 to 95%RH
Duration : 1000+24/−0 hrs
Recovery : 2 to 3 hrs of recovery under the standard condition after the removal from test chamber. (See Note 1)

14. Loading under Damp Heat		
Specified Value	BK series BKP series	Appearance：No significant abnormality Impedance change： Within ±30%
	LK series	Appearance：No significant abnormality Inductance change： Within ±10% Q change： Within ±30%
	HK series	Appearance：No significant abnormality Inductance change： Within ±10% Q change： Within ±20%
	MCOIL™ MC series	Appearance：No significant abnormality Inductance change： Within ±10%
Test Methods and Remarks	BK, BKP, LK series Temperature ：40±2℃ Humidity ：90 to 95%RH Applied current ：Rated current Duration ：1000＋24/－0 hrs Recovery ：2 to 3 hrs of recovery under the standard condition after the removal from test chamber.(See Note 1) HK, MCOIL™ MC series Temperature ：60±2℃ Humidity ：90 to 95%RH Applied current ：Rated current Duration ：1000＋24/－0 hrs Recovery ：2 to 3 hrs of recovery under the standard condition after the removal from test chamber.(See Note 1)	

15. Loading at High Temperature		
Specified Value	BK series BKP series	Appearance：No significant abnormality Impedance change： Within ±30%
	LK series	Appearance：No significant abnormality Inductance change： Within ±10% Q change： Within ±30%
	HK series	Appearance：No significant abnormality Inductance change： Within ±10% Q change： Within ±20%
	MCOIL™ MC series	Appearance：No significant abnormality Inductance change： Within ±10%
Test Methods and Remarks	BK、BKP(except 0603)*、HK* series Temperature ：125±2℃ Applied current ：Rated current(＊ BKP series and HK series apply the rated current of 125℃) Duration ：1000 +24/−0 hrs Recovery ：2 to 3 hrs of recovery under the standard condition after the removal from test chamber.(See Note 1) BKP0603、LK、MCOIL™ MC**series Temperature ：85±2℃ Applied current ：Rated current(** MCOIL™ MC series : Idc2max) Duration ：1000 +24/−0 時間 Recovery ：2 to 3 hrs of recovery under the standard condition after the removal from test chamber.(See Note 1)	

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

■PRECAUTIONS

1. Circuit Design

Precautions

◆Verification of operating environment, electrical rating and performance

1. A malfunction in medical equipment, spacecraft, nuclear reactors, etc. may cause serious harm to human life or have severe social ramifications. As such, any inductors to be used in such equipment may require higher safety and/or reliability considerations and should be clearly differentiated from components used in general purpose applications.
2. When inductors are used in places where dew condensation develops and/or where corrosive gas such as hydrogen sulfide, sulfurous acid, or chlorine exists in the air, characteristic deterioration may occur. Please do not use inductors under such environmental conditions.

◆Operating Current (Verification of Rated current)

1. The operating current including inrush current for inductors must always be lower than their rated values.
2. Do not apply current in excess of the rated value because the inductance may be reduced due to the magnetic saturation effect.

◆Temperature rise

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

2. PCB Design

Precautions

◆Pattern configurations (Design of Land-patterns)

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

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

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

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

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

Technical considerations

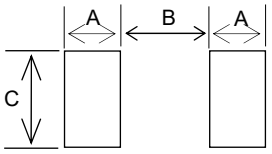
◆Pattern configurations (Design of Land-patterns)

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

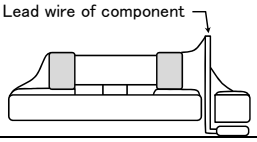
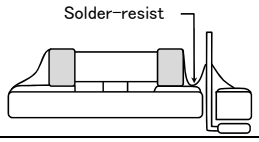
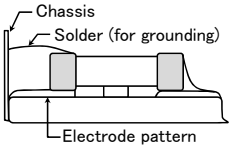
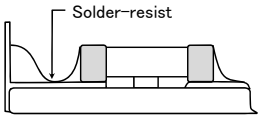
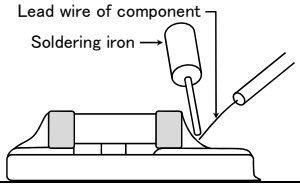
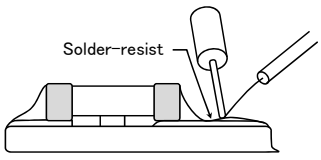
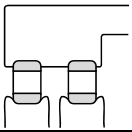
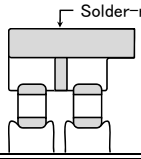
(1) Recommended land dimensions for a typical chip inductor land patterns for PCBs

(Unit : mm)

Type	1608	2012
A	0.7	0.95
B	0.9	0.8
C	1.0	1.4

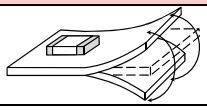
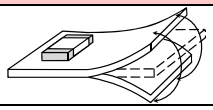


(2) Examples of good and bad solder application

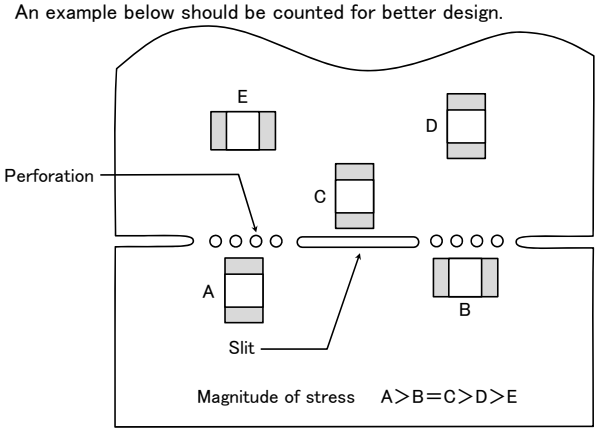
Item	Not recommended	Recommended
Mixed mounting of SMD and leaded components		
Component placement close to the chassis		
Hand-soldering of leaded components near mounted components		
Horizontal component placement		

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

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

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

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



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

3. Considerations for automatic placement

Precautions

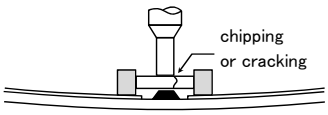
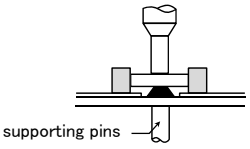
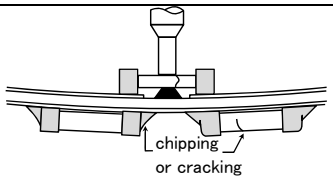
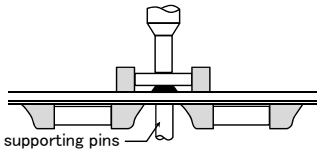
◆Adjustment of mounting machine

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

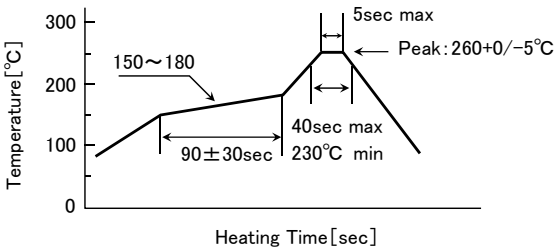
Technical considerations

◆Adjustment of mounting machine

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

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

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

4. Soldering	
Precautions	◆Reflow soldering ・ Please contact any of our offices for a reflow soldering, and refer to the recommended condition specified. ・ The product shall be used reflow soldering only. ・ Please do not add any stress to a product until it returns in normal temperature after reflow soldering. ◆Lead free soldering ・ When using products with lead free soldering, we request to use them after confirming adhesion, temperature of resistance to soldering heat, soldering etc sufficiently. ◆The conditions for Reworking with soldering irons ・Put the soldering iron on the land-pattern and don't touch it to the inductor directly. Soldering iron's temperature below 350 degC , Duration 3 seconds or less
Technical considerations	◆Reflow soldering ・ If products are used beyond the range of the recommended conditions, heat stresses may deform the products, and consequently degrade the reliability of the products. Recommended reflow condition (Pb free solder)  The allowable number of reflow soldering is 3 times.

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

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

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

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

金属磁芯 SMD 功率电感器 (MCOIL ™ MD 系列)

回流焊
AEC-Q200

AEC-Q200 Grade 3 （已完成 Grade 3 条件下的评价测试。）
*使用环境温度：-40～85℃

■型号标示法

*使用温度范围：-40 ~ 125℃（包含产品本身发热）

M D	M K	2 0 2 0	T	1 R 0	M	M	△ △	V
①	②	③	④	⑤	⑥	⑦	⑧	⑨

△＝空格

①类型

代码	类型
MD	基本金属线圈规格

②尺寸（H）

代码	尺寸（H）[mm]
KK	1.0
MK	1.2
WK	2.0

③尺寸（L×W）

代码	尺寸（L×W）[mm]
2020	2.0×2.0
3030	3.0×3.0
4040	4.0×4.0

④包装

代码	包装
T	卷盘带装

⑤标称电感值

代码（例）	标称电感值［μH］
R47	0.47
1R0	1.0
4R7	4.7

※R = 小数点

⑥电感量公差

代码	电感量公差
M	±20%
N	±30%

⑦个别规格 1

代码	个别规格 1
F	铁氧体外涂品
M	金属外涂品

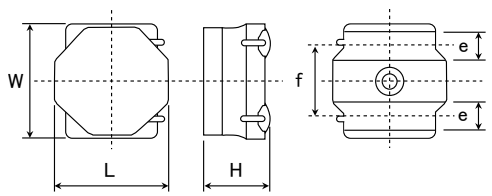
⑧个别规格 2

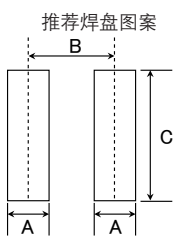
代码	个别规格 2
△△	标准品

⑨本公司管理记号

代码	本公司管理记号
V	车载用品
8	电信基础设施 / 工业设备、医疗设备用途

■标准外型尺寸





Type	A	B	C
MDKK2020	0.65	1.35	2.0
MDMK2020			
MDKK3030	0.8	2.2	2.7
MDMK3030			
MDMK4040/ MDWK4040	1.2	2.8	3.7

单位：mm

Type	L	W	H	e	f	标准数量［pcs］卷盘带装
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
MDMK4040	4.0±0.2 (0.157±0.008)	4.0±0.2 (0.157±0.008)	1.2 max (0.047 max)	1.1±0.2 (0.043±0.008)	2.5±0.2 (0.098±0.008)	1000
MDWK4040	4.0±0.2 (0.157±0.008)	4.0±0.2 (0.157±0.008)	2.0 max (0.079 max)	1.1±0.2 (0.043±0.008)	2.5±0.2 (0.098±0.008)	700

单位：mm（inch）

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另外，有关各产品的详细信息（特性图、可靠性信息、使用时的注意事项等），请参阅敝公司网站（http://www.ty-top.com/）。

■型号一览

・产品目录中的金属磁芯SMD功率电感器全部属于RoHS对应品

注）
・根据使用电路和机器，需要按照相应规格处理。请务必咨询正规销售渠道。
・车载(车身系 / 情报系)用途(AEC-Q200 qualified)的产品。有关更多的内容，请务必于"车载用途使用指引"中确认。
< AEC-Q200 : AEC-Q200 qualified >
车载(车身系 / 情报系)用途的金属磁芯SMD功率电感器，已就其代表性产品实施了对应AEC-Q200标准的评价测试。
关于本产品的详细规格和评估测试结果等信息，请咨询正规销售渠道。
此外，订购时请索取产品规格书，就其内容进行确认并批准之。

●MDKK2020 型 【厚度：1.0mm max】

型号	标称电感值 [μH]	电感量公差	直流电阻 [Ω] (max.)	额定电流 ※) [mA]		测试频率 [MHz]	注释
				直流重叠允许电流 Idc1 Max (Typ)	温度上升允许电流 Idc2 Max (Typ)		
MDKK2020TR47MM V	0.47	±20%	0.046	3,500 (4,150)	2,200 (2,500)	1	
MDKK2020TR68MM V	0.68	±20%	0.060	3,200 (3,650)	2,000 (2,100)	1	
MDKK2020T1R0MM V	1.0	±20%	0.085	2,900 (3,400)	1,700 (1,900)	1	
MDKK2020T1R5MM V	1.5	±20%	0.133	1,900 (2,250)	1,350 (1,500)	1	
MDKK2020T2R2MM V	2.2	±20%	0.165	1,650 (1,950)	1,200 (1,350)	1	
MDKK2020T3R3MM V	3.3	±20%	0.275	1,300 (1,550)	940 (1,050)	1	
MDKK2020T4R7MM V	4.7	±20%	0.435	1,050 (1,250)	750 (850)	1	
MDKK2020T100MM V	10	±20%	0.690	750 (900)	630 (680)	1	

绝对最大电压：DC20V (Typ)：参考值

●MDMK2020 型 【厚度：1.2mm max】

型号	标称电感值 [μH]	电感量公差	直流电阻 [Ω] (max.)	额定电流 ※) [mA]		测试频率 [MHz]	注释
				直流重叠允许电流 Idc1 Max (Typ)	温度上升允许电流 Idc2 Max (Typ)		
MDMK2020TR47MM V	0.47	±20%	0.046	4,200 (4,800)	2,300 (2,450)	1	
MDMK2020TR68MM V	0.68	±20%	0.058	3,500 (4,100)	2,000 (2,200)	1	
MDMK2020T1R0MM V	1.0	±20%	0.064	2,550 (2,900)	1,900 (2,050)	1	
MDMK2020T1R5MM V	1.5	±20%	0.086	2,000 (2,300)	1,650 (1,750)	1	
MDMK2020T2R2MM V	2.2	±20%	0.109	1,750 (2,000)	1,450 (1,550)	1	
MDMK2020T3R3MM V	3.3	±20%	0.178	1,350 (1,550)	1,150 (1,200)	1	
MDMK2020T4R7MM V	4.7	±20%	0.242	1,150 (1,300)	950 (1,050)	1	

绝对最大电压：DC20V (Typ)：参考值

●MDKK3030 型 【厚度：1.0mm max】

型号	标称电感值 [μH]	电感量公差	直流电阻 [Ω] (max.)	额定电流 ※) [mA]		测试频率 [MHz]	注释
				直流重叠允许电流 Idc1 Max (Typ)	温度上升允许电流 Idc2 Max (Typ)		
MDKK3030TR47MM V	0.47	±20%	0.039	5,400 (6,500)	3,900 (4,500)	1	
MDKK3030T1R0MM V	1.0	±20%	0.086	4,400 (5,200)	2,400 (2,800)	1	
MDKK3030T1R5MM V	1.5	±20%	0.100	3,000 (3,500)	2,100 (2,400)	1	
MDKK3030T2R2MM V	2.2	±20%	0.144	2,500 (3,000)	1,900 (2,200)	1	
MDKK3030T3R3MM V	3.3	±20%	0.248	2,000 (2,400)	1,350 (1,500)	1	
MDKK3030T4R7MM V	4.7	±20%	0.345	1,700 (2,000)	1,150 (1,300)	1	
MDKK3030T6R8MM V	6.8	±20%	0.437	1,400 (1,700)	1,000 (1,150)	1	
MDKK3030T100MM V	10	±20%	0.575	1,100 (1,300)	850 (1,000)	1	

绝对最大电压：DC20V (Typ)：参考值

●MDMK3030 型 【厚度：1.2mm max】

型号	标称电感值 [μH]	电感量公差	直流电阻 [Ω] (max.)	额定电流 ※) [mA]		测试频率 [MHz]	注释
				直流重叠允许电流 Idc1 Max (Typ)	温度上升允许电流 Idc2 Max (Typ)		
MDMK3030TR30MM V	0.30	±20%	0.020	7,600 (9,200)	5,500 (6,400)	1	
MDMK3030TR33MM V	0.33	±20%	0.020	6,400 (8,700)	5,500 (6,400)	1	
MDMK3030TR47MM V	0.47	±20%	0.027	6,300 (7,500)	4,700 (5,500)	1	
MDMK3030T1R0MM V	1.0	±20%	0.050	4,300 (5,100)	3,300 (3,900)	1	
MDMK3030T1R5MM V	1.5	±20%	0.074	3,400 (4,100)	2,500 (3,000)	1	
MDMK3030T2R2MM V	2.2	±20%	0.112	2,800 (3,600)	2,100 (2,400)	1	
MDMK3030T3R3MM V	3.3	±20%	0.173	2,100 (2,700)	1,650 (1,900)	1	
MDMK3030T4R7MM V	4.7	±20%	0.263	1,800 (2,300)	1,350 (1,550)	1	

绝对最大电压：DC20V (Typ)：参考值

※）直流重叠允许电流（Idc1）为直流重叠导致电感值下降至30%以内的直流电流值（at 20℃）
※1-1）温度上升允许电流（Idc2）为装配FR4t=1.0mm高放热基板（基板外形：110×30×1.0mm、焊盘：12.6×19.6mm、铜箔：0.035mm）后，接通直流电流，且温度上升至40℃时的直流电流值（at 20℃）
※1-2）温度上升允许电流（Idc2）为装配FR4t=1.6mm高放热基板（基板外形：100×100×1.6mm、焊盘：14.6×43mm、铜箔：0.050mm）后，接通直流电流，且温度上升至40℃时的直流电流值（at 20℃）
※1-3）温度上升允许电流（Idc2）为装配FR4t=1.6mm高放热基板（基板外形：100×100×1.6mm、焊盘：44.5×90mm、铜箔：0.050mm）后，接通直流电流，且温度上升至40℃时的直流电流值（at 20℃）
※）额定电流值为能够满足直流重叠允许电流和温度上升允许电流的直流电流值

※1-1） MDKK2020, MDMK2020型
※1-2） MDKK3030, MDMK3030型
※1-3） MDMK4040, MDWK4040型

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■型号一览

●MDMK4040F 型　【厚度：1.2mm max】

型号	标称电感值 [μH]	电感量公差	直流电阻 [Ω] (max.)	额定电流 ※) [mA] 直流重叠允许电流 Idc1 Max (Typ)	额定电流 ※) [mA] 温度上升允许电流 Idc2 Max (Typ)	测试频率 [kHz]	注释
MDMK4040TR47MF V	0.47	±20%	0.029	7,500 (10,000)	4,600 (5,400)	100	
MDMK4040T1R0MF V	1.0	±20%	0.047	5,200 (7,500)	3,500 (4,200)	100	
MDMK4040T1R2MF V	1.2	±20%	0.047	4,200 (6,200)	3,500 (4,200)	100	
MDMK4040T1R5MF V	1.5	±20%	0.065	3,700 (5,400)	3,300 (3,600)	100	
MDMK4040T2R2MF V	2.2	±20%	0.092	3,200 (4,500)	2,500 (2,900)	100	

绝对最大电压：DC25V　　(Typ)：参考值

●MDMK4040 型　【厚度：1.2mm max】

型号	标称电感值 [μH]	电感量公差	直流电阻 [Ω] (max.)	额定电流 ※) [mA] 直流重叠允许电流 Idc1 Max (Typ)	额定电流 ※) [mA] 温度上升允许电流 Idc2 Max (Typ)	测试频率 [MHz]	注释
MDMK4040TR68MM V	0.68	±20%	0.029	6,700 (7,800)	5,000 (5,700)	1	
MDMK4040T1R0MM V	1.0	±20%	0.036	5,000 (6,200)	4,500 (5,100)	1	
MDMK4040T1R5MM V	1.5	±20%	0.065	4,500 (5,600)	3,200 (3,600)	1	
MDMK4040T2R2MM V	2.2	±20%	0.079	3,800 (4,500)	2,800 (3,200)	1	
MDMK4040T3R3MM V	3.3	±20%	0.130	3,200 (4,000)	2,200 (2,500)	1	
MDMK4040T4R7MM V	4.7	±20%	0.160	2,500 (3,000)	1,900 (2,200)	1	
MDMK4040T6R8MM V	6.8	±20%	0.230	1,900 (2,200)	1,600 (1,800)	1	
MDMK4040T100MM V	10	±20%	0.330	1700 (2,000)	1,400 (1,600)	1	

绝对最大电压：DC25V　　(Typ)：参考值

●MDWK4040 型　【厚度：2.0mm max】

型号	标称电感值 [μH]	电感量公差	直流电阻 [Ω] (max.)	额定电流 ※) [mA] 直流重叠允许电流 Idc1 Max (Typ)	额定电流 ※) [mA] 温度上升允许电流 Idc2 Max (Typ)	测试频率 [MHz]	注释
MDWK4040TR56NM V	0.56	±30%	0.016	9,000 (13,000)	6,500 (7,500)	1	
MDWK4040TR68MM V	0.68	±20%	0.016	8,000 (12,000)	7,300 (8,300)	1	
MDWK4040T1R0MM V	1.0	±20%	0.027	7,000 (9,400)	5,100 (5,800)	1	
MDWK4040T1R5MM V	1.5	±20%	0.041	7,000 (9,400)	4,100 (4,700)	1	
MDWK4040T2R2MM V	2.2	±20%	0.054	5,400 (7,500)	3,500 (4,000)	1	
MDWK4040T3R3MM V	3.3	±20%	0.075	3,700 (5,200)	3,000 (3,300)	1	
MDWK4040T4R7MM V	4.7	±20%	0.107	3,500 (5,000)	2,500 (2,800)	1	
MDWK4040T6R8MM V	6.8	±20%	0.158	2,900 (4,000)	2,000 (2,300)	1	
MDWK4040T100MM V	10	±20%	0.194	2,200 (3,100)	1,600 (1,900)	1	

绝对最大电压：DC25V　　(Typ)：参考值

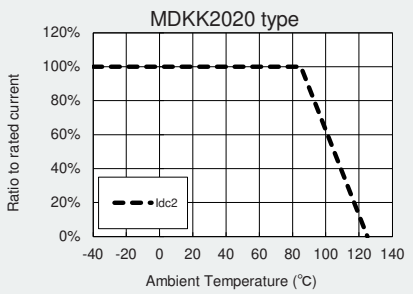
※）直流重叠允许电流（Idc1）为直流重叠导致电感值下降至30%以内的直流电流值（at 20℃）
※1-1）温度上升允许电流（Idc2）为装配FR4t=1.0mm高放热基板（基板外形：110×30×1.0mm、焊盘：12.6×19.6mm、铜箔：0.035mm）后，接通直流电流，且温度上升至40℃时的直流电流值（at 20℃）
※1-2）温度上升允许电流（Idc2）为装配FR4t=1.6mm高放热基板（基板外形：100×100×1.6mm、焊盘：14.6×43mm、铜箔：0.050mm）后，接通直流电流，且温度上升至40℃时的直流电流值（at 20℃）
※1-3）温度上升允许电流（Idc2）为装配FR4t=1.6mm高放热基板（基板外形：100×100×1.6mm、焊盘：44.5×90mm、铜箔：0.050mm）后，接通直流电流，且温度上升至40℃时的直流电流值（at 20℃）
※）额定电流值为能够满足直流重叠允许电流和温度上升允许电流的直流电流值

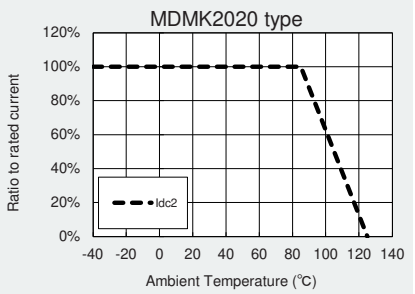
※1-1） MDKK2020, MDMK2020型
※1-2） MDKK3030, MDMK3030型
※1-3） MDMK4040, MDWK4040型

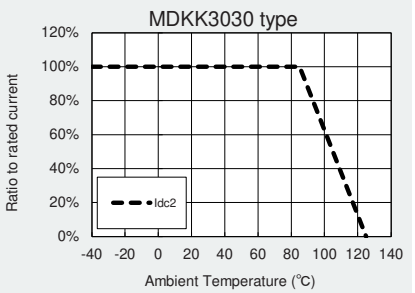
■降低额定电流值

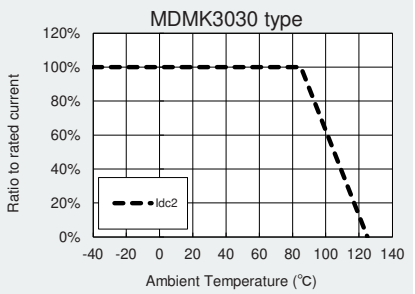
●MD 系列

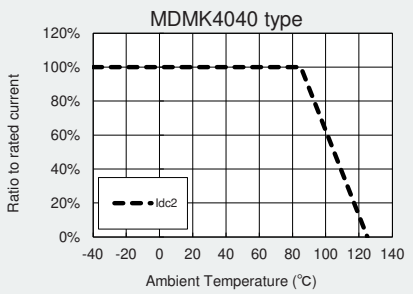
MD系列，根据周围温度的状况，需要降低额定电流值。
请参照下图，降低使用电流值。

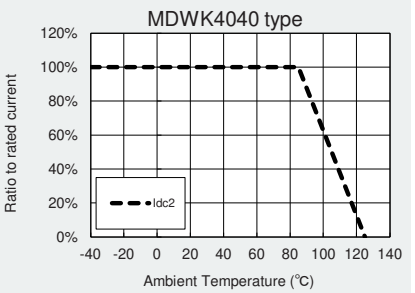












▶由于篇幅有限，本产品目录中只记载了有代表性的产品规格，若考虑使用敝公司产品时，请确认交货规格说明书中的详细规格。
另外，有关各产品的详细信息(特性图、可靠性信息、使用时的注意事项等)，请参阅敝公司网站(http://www.ty-top.com/)。

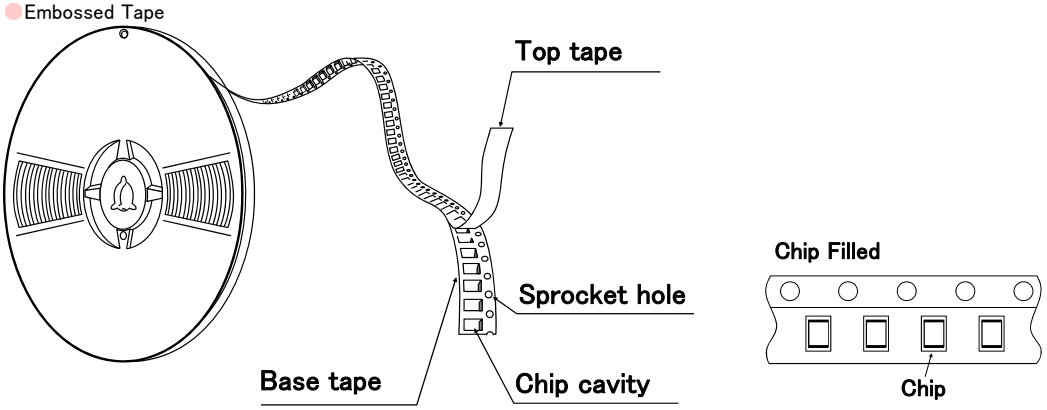
■PACKAGING

①Minimum Quantity

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

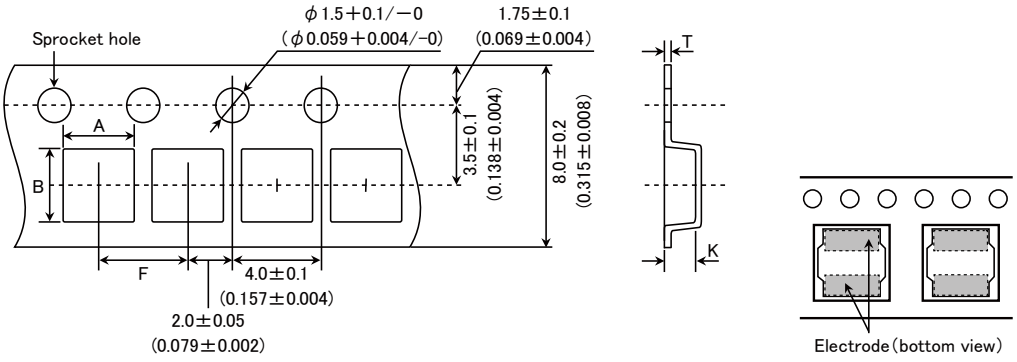
②Tape Material

●Embossed Tape



③Taping dimensions

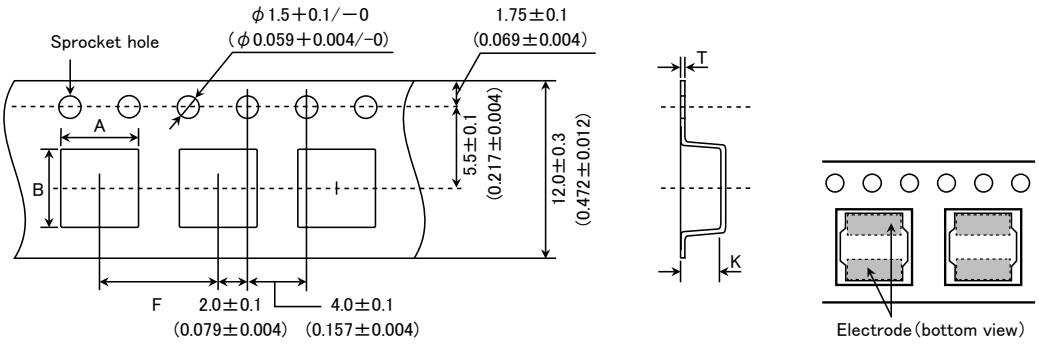
●Embossed tape 8mm wide (0.315 inches wide)



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)

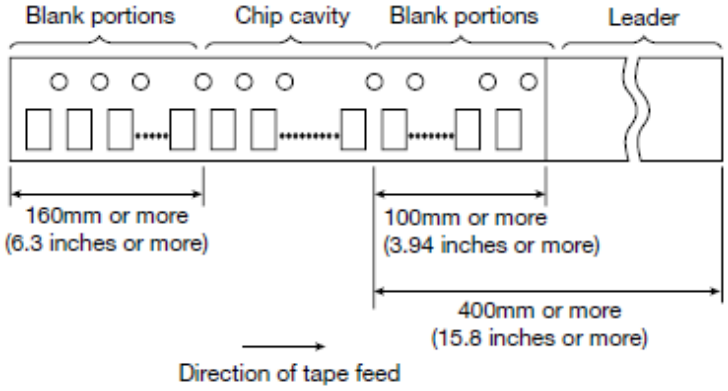
Embossed tape 12mm wide (0.47 inches wide)



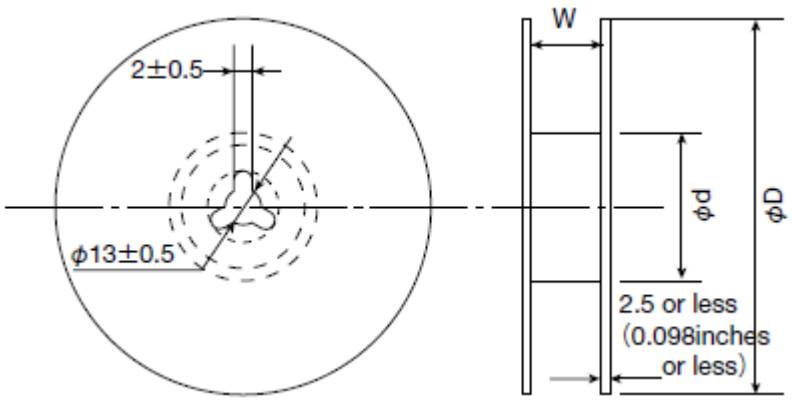
Type	Chip cavity		Insertion pitch	Tape thickness	
	A	B	F	T	K
MDJE4040 MDMK4040	4.3±0.1 (0.169±0.004)	4.3±0.1 (0.169±0.004)	8.0±0.1 (0.315±0.004)	0.3±0.05 (0.012±0.002)	1.6±0.1 (0.063±0.004)
MDWK4040	4.3±0.1 (0.169±0.004)	4.3±0.1 (0.169±0.004)	8.0±0.1 (0.315±0.004)	0.3±0.05 (0.012±0.002)	2.3±0.1 (0.091±0.004)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

Unit : mm (inch)

④Leader and Blank portion



⑤Reel size



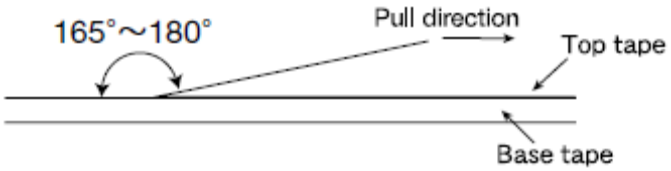
Type	Reel size (Reference values)		
	φD	φd	W
MDKK1616	180±0.5 (7.087±0.019)	60±1.0 (2.36±0.04)	10.0±1.5 (0.394±0.059)
MDJE2020 MDKK2020 MDMK2020			
MDKK3030 MDMK3030			
MDJE4040 MDMK4040 MDWK4040	180±3.0 (7.087±0.118)	60±2.0 (2.36±0.08)	14.0±1.5 (0.551±0.059)
MDPK5050			

Unit : mm (inch)

⑥Top Tape Strength

Top tape strength

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



METAL CORE SMD POWER INDUCTORS (MCOIL™ MD SERIES)

■RELIABILITY DATA

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

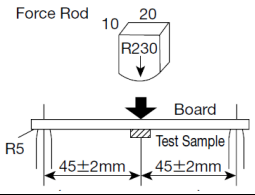
3. Rated current		
Specified Value	MD series	Within the specified tolerance

4. Inductance		
Specified Value	MD series	Within the specified tolerance
Test Methods and Remarks	MDKK2020、MDMK2020、MDKK3030、MDMK3030、MDMK4040M、MDWK4040 Measuring equipment : LCR Meter (HP 4285A or equivalent) Measuring frequency : 1MHz 1V MDMK4040F Measuring equipment : LCR Meter (HP 4285A or equivalent) Measuring frequency : 100kHz 1V	

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 : 100×40×1.6 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 : 0.1mm.	

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 1000 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	1000+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: 1000＋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: 1000＋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: 1000＋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.

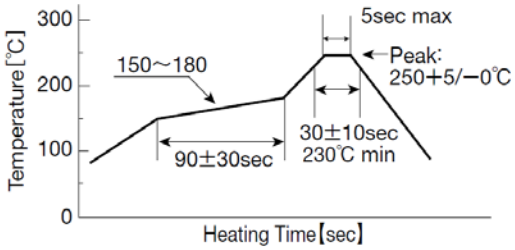
METAL CORE SMD POWER INDUCTORS (MCOIL™ MD SERIES)

■PRECAUTIONS

1. Circuit Design	
Precautions	◆Operating environment 1. The products listed in this catalogue are intended for use in general electronic equipment (e.g., AV equipment, OA equipment, home electric appliances, office equipment, information and communication equipment), general medical equipment, industrial equipment, and automotive interior applications, etc. 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., specially controlled medical equipment, transportation equipment including, without limitation, automotive powertrain control system, train control system, and ship control system, traffic signal equipment). 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, etc.).

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.