Excelpoint®

EMC电路保护器件设计选型指南(2022版)

BOURNS®

世健公司介绍

世健科技有限公司是亚太区领先的电子元器件分销商，能为亚洲电子厂商，包括原设备生产商（OEMs）、原设计生产商（ODMs）和电子制造服务提供商（EMS）提供优质的元器件、工程设计及供应链管理服务。世健科技有限公司分别被EBN（针对全球供应链专业人士的权威在线社区）和EPSNews（美国电子及供应链行业首屈一指的新闻、信息和数据资源中心）列入“全球电子元器件分销商25强”和“全球领先分销商榜单”。

世健与供应商及电子厂商紧密协作，为新的科技与趋势做出定位，并帮助客户把这些最先进的科技揉合于他们的产品当中。集团分别在新加坡、中国及越南设有研发中心，专业的研发团队不断创造崭新的解决方案，以帮助客户提高成本效益并缩短产品上市时间。世健研发的完整解决方案及参考设计方案可应用于工业、无线通信以及消费电子等领域。

世健是新加坡的主板上市公司，总部设于新加坡，拥有超过650名员工，世健的业务已扩展至亚太区的50个城市和地区，遍及新加坡、马来西亚、泰国、越南、中国、印度、印度尼西亚、菲律宾及澳大利亚等十多个国家。

世健在中国

1993年，世健在香港设立区域总部——世健系统（香港）有限公司，正式开始发展中国业务。目前，世健在中国拥有十多家分公司和办事处，遍及中国主要大中型城市。凭借专业的研发团队、顶尖的现场应用支持以及丰富的市场经验，世健在中国业内享有领先地位。

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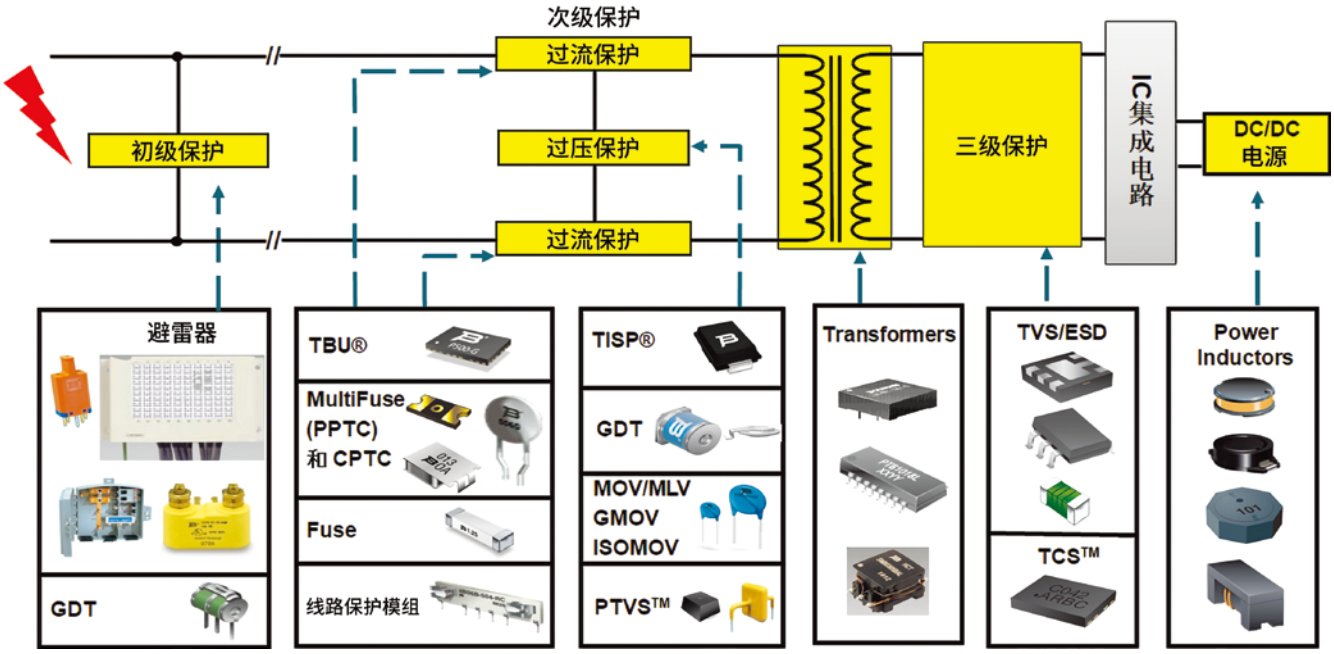
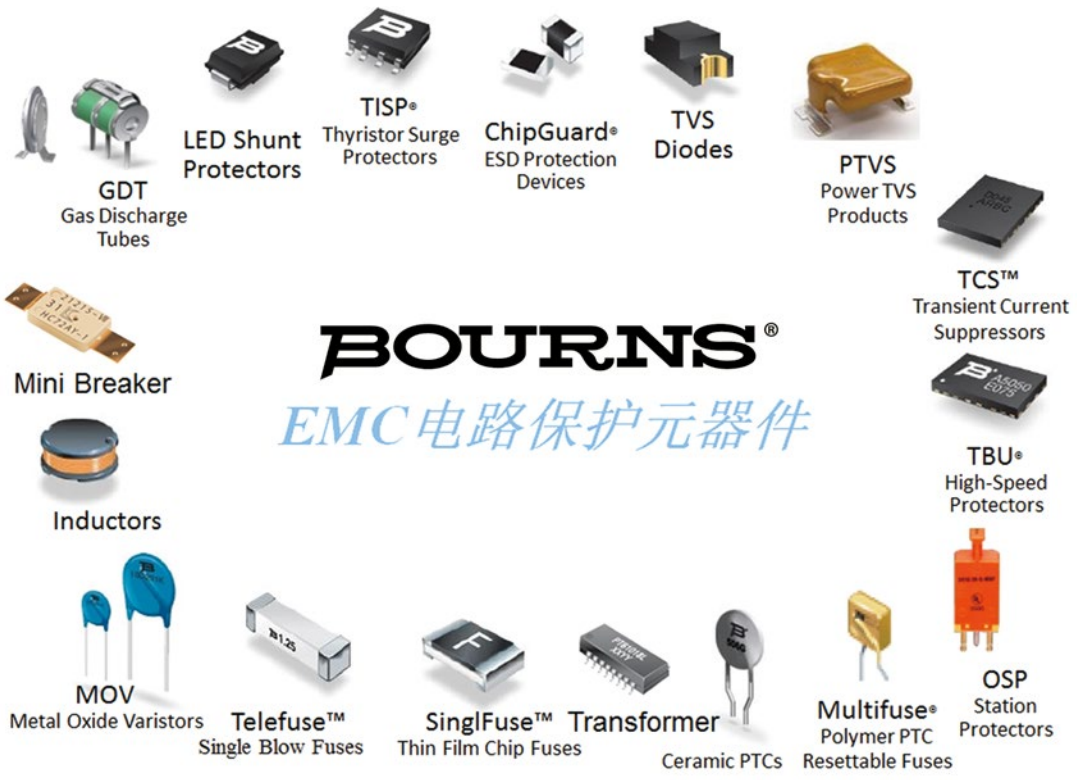
第一部分: 端口EMC电路保护器件类型介绍

1. 完整的EMC电路保护方案及Bourns®保护器件简介





2.Mini-Breaker微型可恢复热断路器
(TCO, Miniature Thermal Cutoff)

器件概述

Bourns的TCO器件融合了双金属片和PTC的两种工艺的保护技术，可在多种关断温度下(72°C到135°C)提供过热及过流保护产品，通过改变双金属片和内嵌的PTC的动作特性，可以提供定制化关断和恢复温度产品。尤其是在锂电池过电流保护应用上，TCO可以通过几乎瞬时控制的动作特性，保护锂电池设计的可靠性。

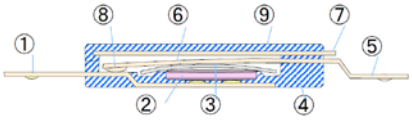
关键的产品特性

- 微型的热保护器件
- 可恢复，6000到10000次以上的开关动作寿命
- 锂电池过流及过温保护器件
- 混合了双金属片和并联瓷片PTC的设计
- 几乎瞬时地控制温度异常及过电流保护
- 耐腐蚀特性产品
- 72°C到135°C的宽温度范围选择

主要应用产品领域

- 锂电池过流及过温保护
- 笔记本/平板电脑
- TWS耳机充电盒过温保护
- USB Type-C端口过流/过温保护
- 可穿戴式电子设备(耳机、VR等)
- 电子烟
- 储能BMS
- 汽车空调调速模块温度保护开关

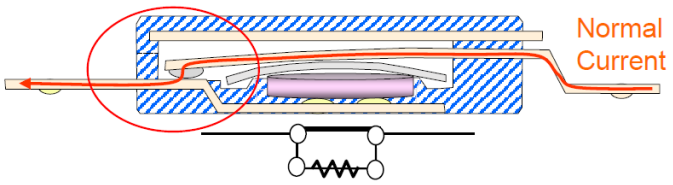
TCO结构原理



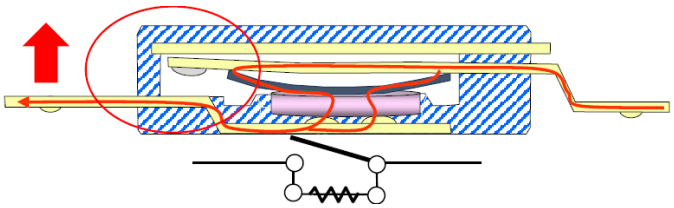
①	Base terminal	⑥	Arm
②	CPTC	⑦	Cover plate
③	Bimetal disc	⑧	Contact
④	Base	⑨	Cover
⑤	Arm terminal		

TCO工作原理

· TCO正常工作状态



· TCO动作后状态



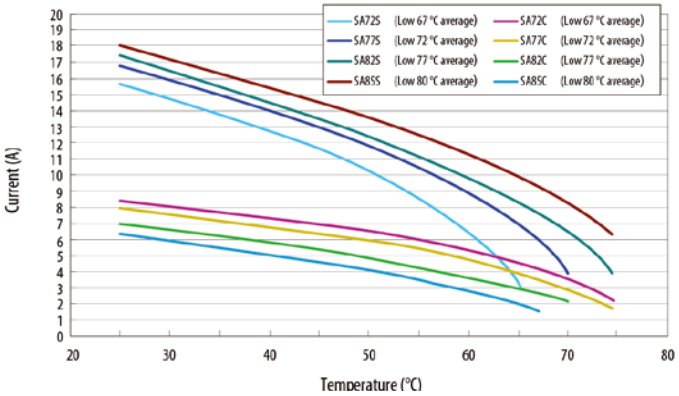


图 不同温度下动作曲线图
(以SAXXX系列为例)

3. TBU®高速保护器

器件概述

Bourns®的TBU®高速保护产品是基于MOSFET半导体工艺技术的电路保护器件。当把TBU®保护器件串行放置在系统中,可以监视流过线路的电流。针对浪涌器件的巨大的 、具有破坏性的电压或电流,一旦线路电流超过TBU®器件触发电流Itrigger(比如R3777-TBU,200mA),TBU®器件可以在1us之内动作。之后,TBU®器件一般限制电流到小于1mA,同时阻止包括浪涌在内的电压到额定限制值。TBU®保护器件触发提供一个有效的隔离,从而保护敏感的电子元器件。

浪涌过后,当TBU®两端的电压降落到Vreset或之下,TBU®自复位。因此,在没有直流偏置或者直流偏置在Vreset以下(比如没有上电的信号线),TBU®会自复位。

浪涌过后,当线路上存在一个正常的大于Vreset的直流偏置,TBU®的两端电压不会降低到Vreset以下,像这样的设计,尤其要考虑确保TBU®器件的复位, 软件监视不能保证解决这个问题。

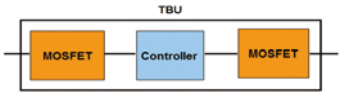


图 TBU®内部原理框图

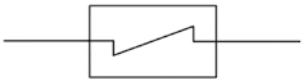
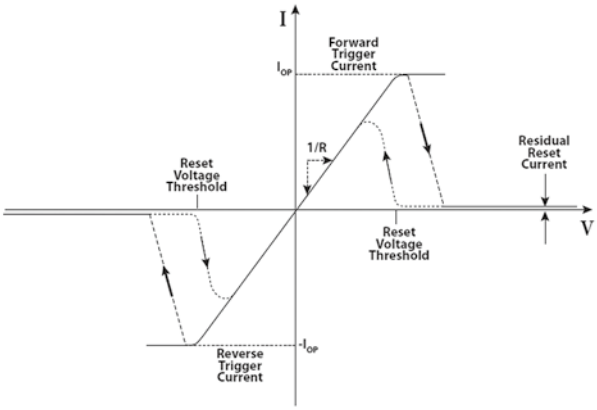


图 TBU®符号



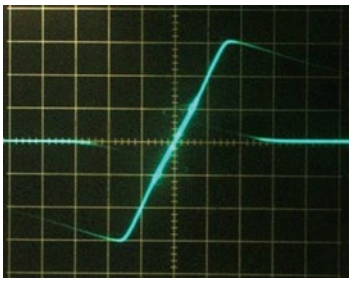


图 TBU® V/I曲线图

关键的产品特性

- 高速动作特性(< 1 us,一般在200 ns)
- 串行在线路中保护电压和电流
- 通过监视电流上升进行触发
- 可以阻挡高达850 V的电压
- 瞬间阻断浪涌能量进入负载电路, 而非转移
- 在没有直流偏置时自复位
- 仅产生线路上极低的容性,高达3 Ghz的带宽
- 最小的封装面积, DFN小封装
- 工作温度:-55°C到+125°C
- 提供满足AEC-Q101兼容器件

基于TBU®器件器件方案设计及选型

步骤1: 电流特性

判断系统峰值电流和最大的工作温度。利用TBU®器件数据手册的触发电流与温度降额曲线决定TBU®器件的降额值;

步骤2:过压选择

选择一个过压器件需要它具有的DC击穿电压大于正常工作的系统电压和任何预期的AC电源故障。选择的器件必须能够操作需求的闪电/浪涌电流;

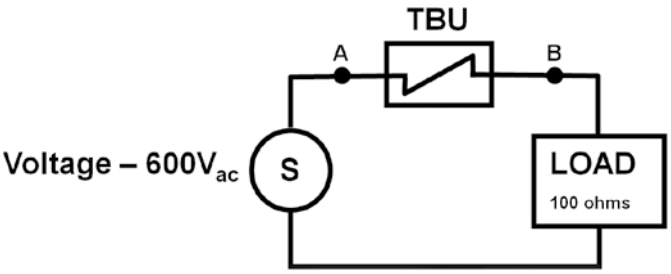
步骤3:TBU®器件选择

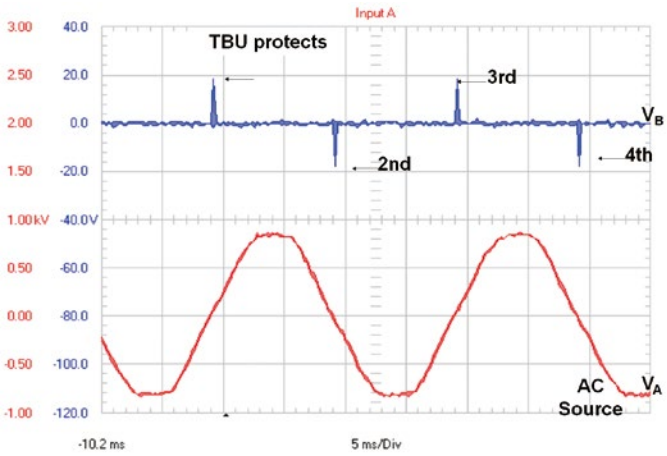
选择的TBU®器件的最大冲击电压(Vimp)要大于选择的过压保护器的最大冲击导通或者钳位电压。选择的TBU®器件的最小Itrigger参数必须在温度降额的最大峰值系统启动电流之上;

步骤4:其他保护注意事项

在大部分的应用中,被保护电路产生足够的电流去触发TBU®器件。如果被保护电路的阻抗是高的,在TBU®器件之后,可以放置一个小的雪崩二极管到地或者小的信号二极管钳位到电源轨,这样可以确保TBU®器件触发, 避免电压上升到不安全等级;

TBU®AC Power Cross交流电搭接测试分析

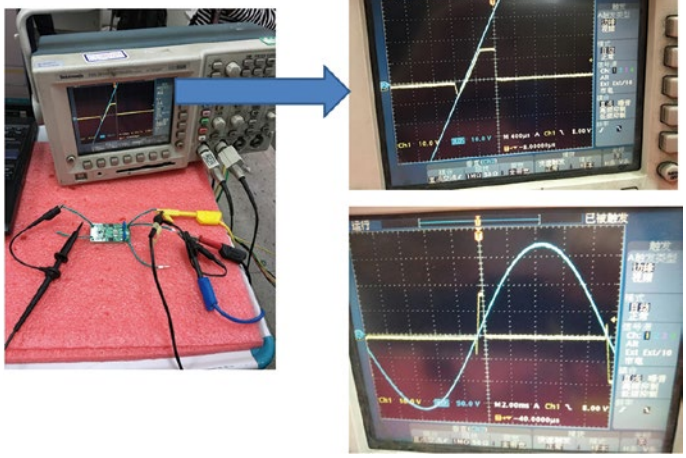




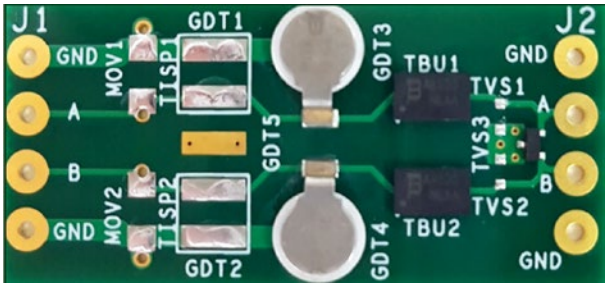
TBU和可恢复保险丝PTC的优势

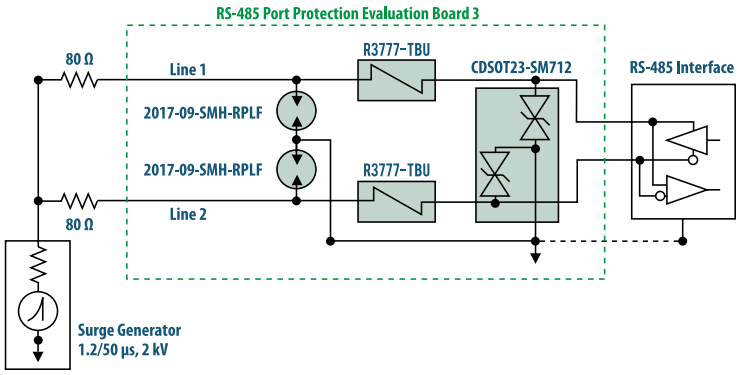
保护产品类型	TBU	PTC
动作响应时间	纳秒级(小于 1 us)	毫秒级
内阻	自恢复后内阻不变	每一次增大
耐压	最高850 V	几十 V
触发精度	精确	随工作环境温度改变

在信号线上,对比过串接电阻的方式来降低浪涌的冲击电流方式,要保证电阻的功率应足够大,避免在过电流冲击中,容易损坏电阻,导致保护电路失效。采用TBU的的方式,在一定的电压(高达850V)范围内,TBU可以迅速阻断电路中的电流,起到保护电路器件的作用。



基于TBU®的评估板和测试原理图

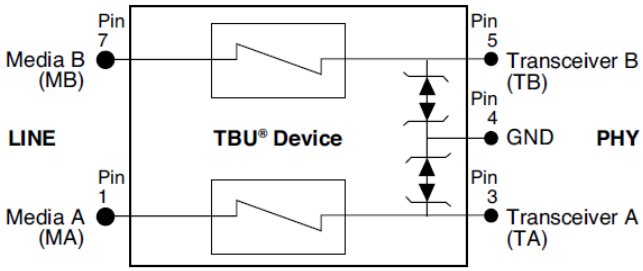




浪涌测试 2kV (1.2/50us, Rext = 80 ohms)

TBU-RS系列新产品介绍

Model	Size	Description	Max. Impulse Voltage	Max. RMS Voltage	Trigger Current Levels	Trigger Time
TBU-RS085-300-WH	8 x 5.5 mm	Dual Bidirectional	850 V	425 V	300 mA	1 µs



4.TCS™高速保护器

器件概述

Bourns®TCS™ DL系列高速保护器件(High-Speed Protector,简称HSP)产品包含双通道,完美匹配、低阻抗、双向瞬态电流抑制器件。Bourns® TCS™ DL器件通过限制最大电流到一个安全等级,为超高速数据差分线抑制由于瞬间短路、感抗和浪涌导致的错误提供了超级保护。TCS™器件会在特定的电流等级进行触发。

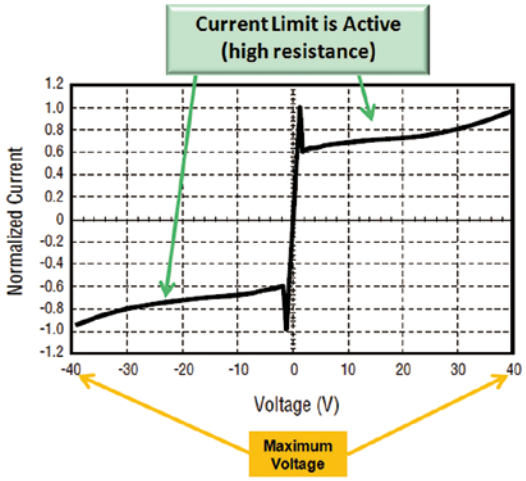


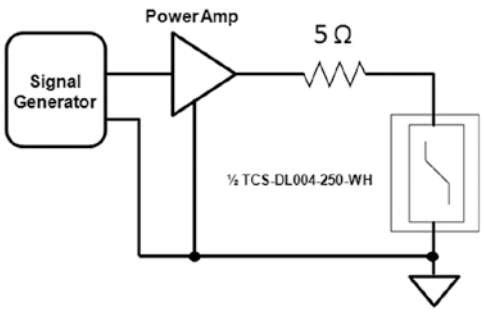
图 TCS™保护器件的V/I曲线

关键的产品特性

- 50 ns 响应时间
- 低的允许通过能量
- 低的串行阻抗
- 通道与通道的阻抗完美匹配
- 低的插入损耗
- 当前具有3个触发电流等级产品

关键的产品亮点

- 创建理想二极管响应最大化的保护
- 支持高达6 Ghz频率信号的应用
- 相比较独立的过压保护(OVP)减少多达90%的应力
- 对差分信号的平衡影响微乎其微
- 相比较独立的OVP提高了产品可靠性
- 减少产品的返修成本



基于TCS™器件方案选型

步骤1:电流特性

判断系统应用最大的信号电流和最高的工作温度(例如100mA, 65度);

步骤2:过压选择

根据数据手册上的曲线判断动作电流降额系数,然后用最大的工作电流值除以该系数;利(例如:100mA/0.75 = 133mA)

步骤3:TCS™器件选择

选择一个在25度工作温度条件下的最小动作电流值大于步骤2中计算得到的计算值的TCS™器件(例如:TCS-DL004-250-WH具有250mA的最小动作电流,其最低的动作电流器件可以满足当前的例子)

步骤4:其他保护注意事项

判断是否选择的器件的串行阻抗会极大的影响电路性能。如果需要的是一个较低阻抗的器件,那么应该选择更高动作电流的器件。

TCS™器件的基本保护原理

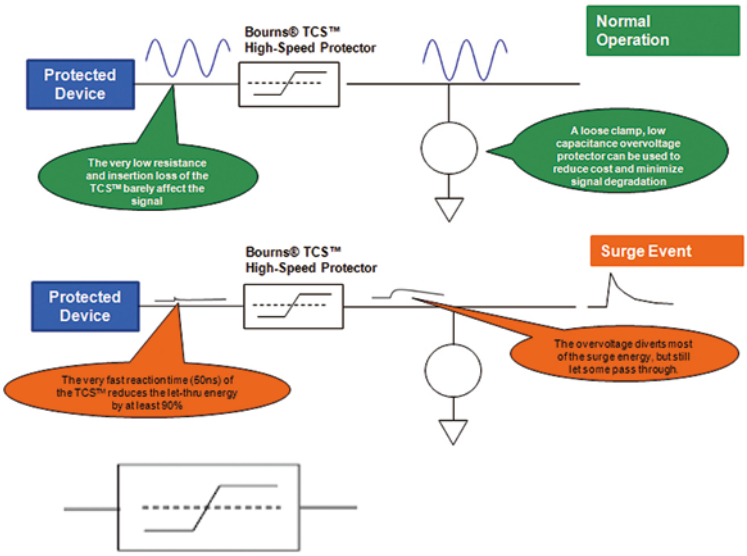
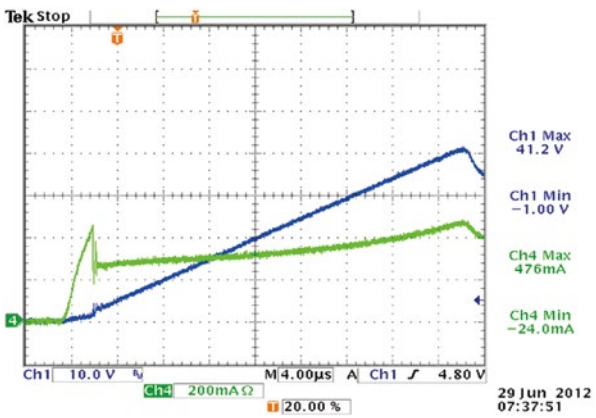


图 TCS™符号

测试(1V/uS电压上升率的TCS™器件响应)



5.GDT气体放电管

器件概述

GDT（GasDischargeTube）气体放电管器件又称为过电压保护器 、浪涌吸收器,工作原理是气体放电。通常是放置在一个电路中限制电压和转移冲击电流到地面(共模)或一个源(差模)。GDT器件具有非常高的阻抗(>1Gohm),极间电容值非常小(一般<5pF),极间漏电流非常小,为nA级,因此它对电路的正常工作几乎不会影响。当电压干扰或浪涌超过GDT的火花放电电压(Sparkover Voltage,或称为击穿电压)值,GDT将离子化,切换到一个虚拟短路模式,称为弧光模式(Arc Voltage),使冲击电流转移到接地点从而保护设备正常工作。 GDT响应时间可以达到数百纳秒到数秒。当干扰或者浪涌结束且系统电压返回正常时,GDT会恢复到高阻抗状态。

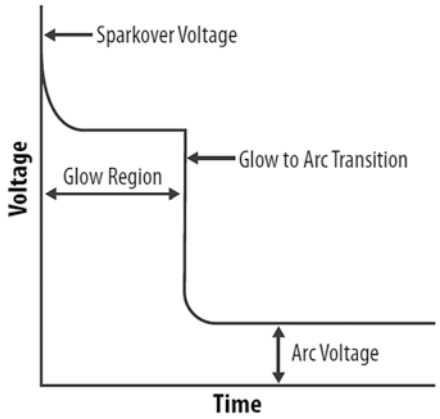


图 GDT特性曲线

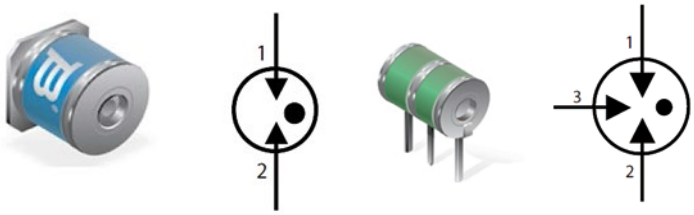


图 两电极气体放电管及其符号　　图 三电极气体放电管及其符号

传统GDT器件的尺寸大小由其整体直径和长度决定。这些尺寸是GDT设备处理浪涌能量的能力以及其保持电力的隔离能力的关键。典型GDT截面设计被认为是今天的传统技术最先进的。红色箭头描绘了绝缘电流通路为爬电距离。这个距离是在提供高水平的电气隔离GDT设计中至关重要的。GDT的直径及其热性能提供了该GDT电流承受能力。

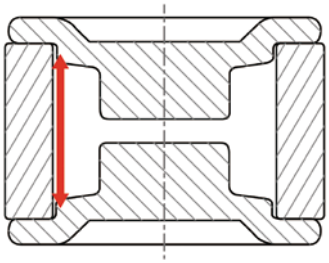


图 基于传统工艺的GDT的内部截面

Bourns®已经开发了一个创新的FLAT®皱接工艺GDT,有效地减少了GDT的尺寸大小,同时保持其电气隔离的能力和电流处理能力。基于FLAT®横截面图显示了绝缘用红色通道。Bourns®的FLAT®GDT技术的关键设计特征是弯曲爬电路径,允许GDT“皱接（squeezed）”。当比较Bourns®FLAT®工艺GDT的皱接的通路和传统GDT长度将是相似的。然而,Bourns®FLAT®工艺GDT通过皱接配置,高度 、重量和整体体积明显减少。

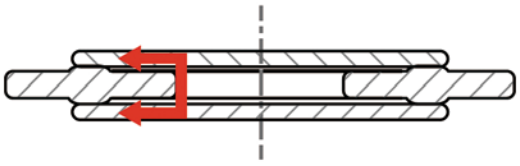


图 基于FLAT® 皱接工艺GDT的内部截面

图 水平焊接图

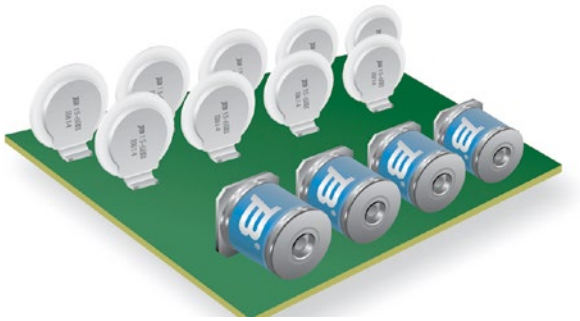


图 垂直焊接对比图

GDT的设计

在防雷电路设计中,需要注意GDT的直流击穿电压 、冲击击穿电压 、通流容量等参数的选取。设置在普通交流线路上的GDT,要求它在线路正常运行电压及其允许的波动范围内不能动作,它的直流击穿电压应满足:UDC（min） ≧1.8 Up, 其中,UDC为直流击穿电压（DC sparkover voltage）, UDC（min）为直流击穿电压的最小值,UP为线路正常运行电压的峰值。

GDT主要用于交流电源口相线 、中线的对地保护,直流电源口的信号地和保护地之间的保护,信号口中线对地的保护等场合。

GDT的失效模式在大多情况下为开路,也有可能由于设计原因或者其他因素导致烧毁而引起短路的失效模式。气体放电管的寿命相对较短,经过多次冲击后性能会下降。

Impulse Discharge Current	12000 A, 8/20 μs	1 operation
	10000 A, 8/20 μs	>10 operations
	2500 A, 10/350 μs	1 operation
	100 A, 10/1000 μs	>300 operations
	10 A, 10/1000 μs	>1500 operations

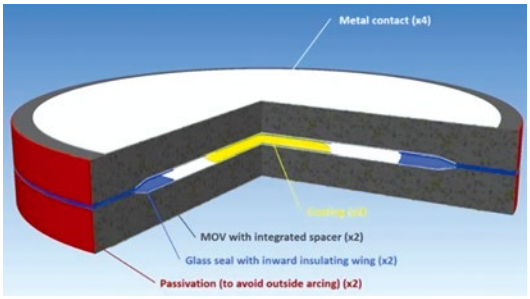
图 2017系列FLAT® GDT关于寿命的描述

6.IsoMOV过压组合式保护器

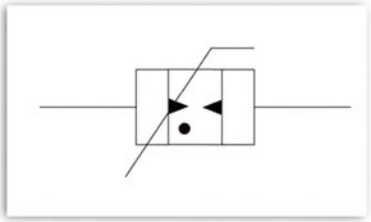
器件概述

Bourns公司创新地将自有专利节省空间地扁平式气体放电管（Flat-GDT®）嵌入到两颗金属氧化物压敏电阻EdgeMOV™技术元件之间。 isoMOV系列产品的GDT和MOV串联后，解决了单独采用MOV的漏电流，以及单独采用GDT的续流遮断问题，大大提高了MOV的寿命，减小了极间电容，抬高了DC/AC的击穿电压；同时，isoMOV和MOV的具有几乎相同的封装和尺寸，兼容10mm，14mm，20mm的直径的MOV产品，可以直接兼容替代。

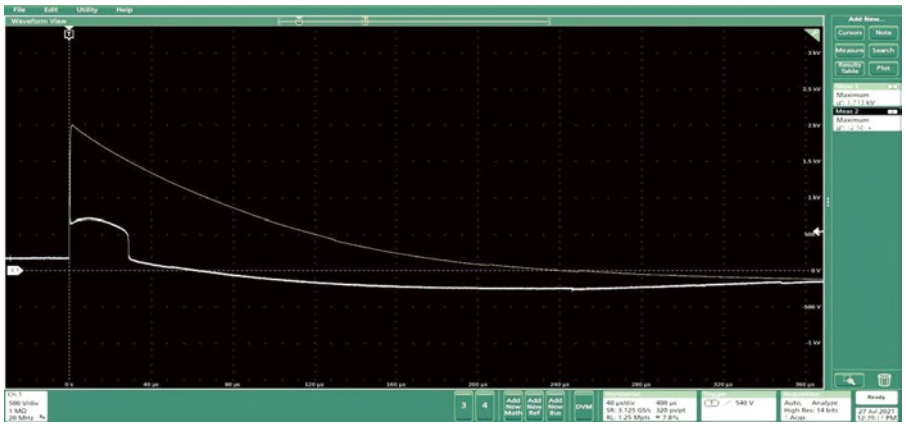
isoMOV的内部结构



isoMOV的符号

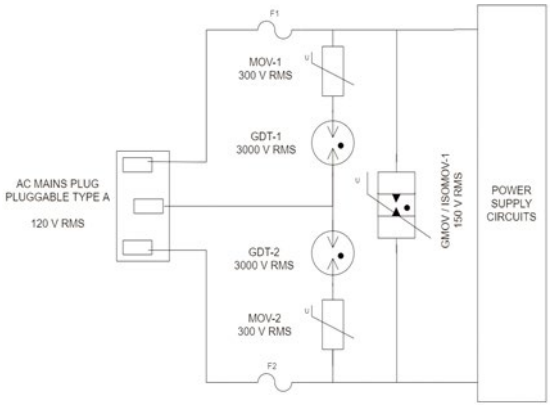


IsoMOV在浪涌8/20us波形的钳位特性



isoMOV的AC/DC应用

- 用于保护持续过电压导致MOV老化问题以及需要浪涌保护的应用场景
- 高品质电源、白电、昂贵/高价格的消费类电器
- LED类：交通灯、照明灯
- 智能电表
- 光伏逆变器，风电变流器
- 储能BMS，双向变流器
- 通信基站电源
- 基于能源之星（Energy Star）的交流线保护
- 电力线载波（PLC: Power Line Communication）



7.TISP 晶闸管

器件概述

TISP®(Totally Integrated Surge Protector, 简称TISP®)全集成浪涌保护器,也称为固体放电管,或者晶闸管浪涌保护器,或者瞬态抑制二极管,是利用半导体工艺制成的限压保护器件,其工作原理与GDT类似,而与MOV和TVS不同。当TISP®两端的电压超过其击穿电压时,TISP®将以ns级的响应时间把过电压钳位到比击穿电压更低的接近0V的水平上,之后,TISP®持续保持这种短路状态,直到流过TISP®的过电流降到临界值以下后,TISP®恢复到开路状态。

TISP®的非线性电压-电流特性通过转移产生的电流来限制过压。作为晶闸管,TISP®具有非连续电压-电流特性,它是由于高电压区和低电压区之间的切换动作而导致的。从TISP®器件的电压-电流特性可以看出,在TISP®器件切换到低电压状态之前,它具有低阻抗接地路径以分流瞬变能量,雪崩击穿区域则导致了钳位动作。在限制过压的过程中,受保护电路短暂暴露在高压下,因而在切换到低压保护打开状态之前,TISP®器件处在击穿区域。电路设计上可以组合TBU®等器件保护后端电路,防止由于高电压导致的高电流造成电路损坏。当转移电流降低到临界值以下时,TISP®器件自动重置,以便恢复正常系统运行。

TISP®的设计选择

TISP®的击穿电压VBO 、通流容量是电路设计时应重点考虑的。在信号回路中时,TISP®的击穿电压VBO应大于(1.2~1.5)Vmax,其中,Vmax为信号回路的峰值电压。在使用TISP®需要注意:TISP®在过电压作用下击穿后,当流过TISP®管的电流值下降到临界值以下后,TISP®管才恢复开路状态,因此,TISP®管在信号线路中使用时,信号线路的常态电流应小于TISP®管的临界恢复电流。

TISP®的应用

TISP®主要应用在信号回路中的防雷保护应用。失效模式一般为短路。但是在通过的过电流太大时,也可能造成TISP®开路失效。TISP®由于其半导体工艺设计,寿命相对GDT较长,但动作响应时间相对较快。

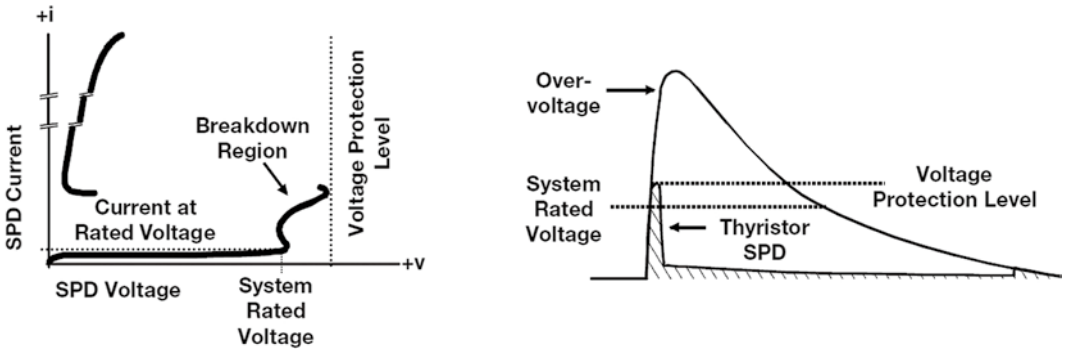


图 TISP®器件切换浪涌能量V/I曲线及电压限制波形图

Fixed Voltage TISP® Configurations						
Protection Points	Protection Modes	Integrated Protection Elements	Class			
			Bidirectional		Unidirectional	
			Symmetrical	Asymmetrical	Conducting	Blocking
2	1	1	TISP4xxx Series		TISP5xxx Series	Custom
3	2	2	TISP3xxx Series	Custom	TISP1xxx Series	
3	3	3	TISP7xxx Series			
Protection Mode Terminal Pair VI Characteristic						

图 TISP®产品的符号及V/I特性曲线

8.PTVS大功率瞬态电压抑制器

器件概述

Bourns®的大功率瞬态电压抑制器二极管(Power TVS,简称PTVS)设计针对保护敏感的电子元器件,使他们免受高电能、高电压和高电流的瞬变影响,尤其是针对AC和DC电源线路提供了全方位的超级防护。为1、3、6、10和15kA浪涌电流条件下提供不同电压范围器件。

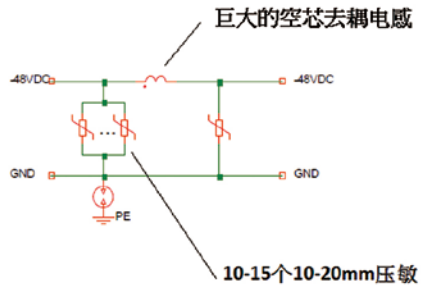
产品特性

- 卓越的防浪涌和防雷击保护产品
- 高电流吸收能力
  - 1、3、6、10、15 kA峰值电耐受等级选择
- 严格的电压钳位(浪涌残压)性能
  - 从15 V到470 V的电压选择
- 简单实用的设计
- 具有轴向引线管脚封装和表贴封装
- 所有轴向引线管脚封装器件符合常见的PCB封装
- 符合RoHS规范
- 工作温度: -55°C到+125°C

PTVS解决方案与MOV方案的比较

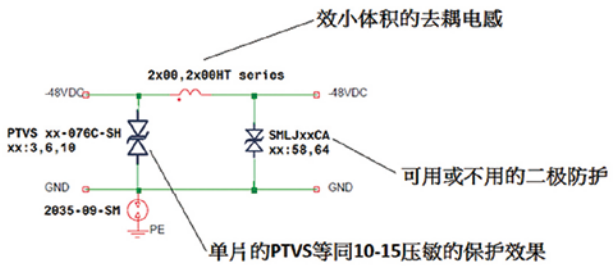
浪涌等级	应用	PTVS解决方案	MOV方案	说明
高	交流电源输入主保护 直流电源 工业设备的浪涌保护	PTVS3系列	7 mm or 10 mm MOV	相对于MOV，PTVS提供了更加严格的钳位电压； 不同于MOV，PTVS没有损耗机制，PTVS对比多个MOV的并联应用，可以提供更加可靠的保护
非常高		PTVS6系列	14 mm or 20 mm MOV	
超级高		PTVS10系列	多个20 mm MOV并联	
超级高		PTVS15系列	多个20 mm MOV并联	

传统的48V DC电源保护电路:



传统的48VDC 防护电路

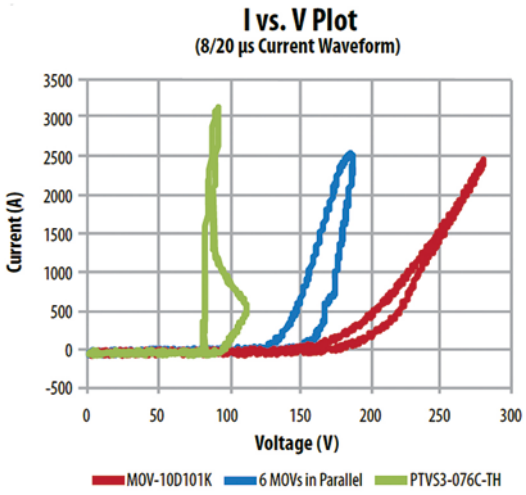
对比传统的采用压敏电阻的方式, 采用了PTVS的48V DC电源保护电路,有效的减少了器件数量,提高了整体电路可靠性。

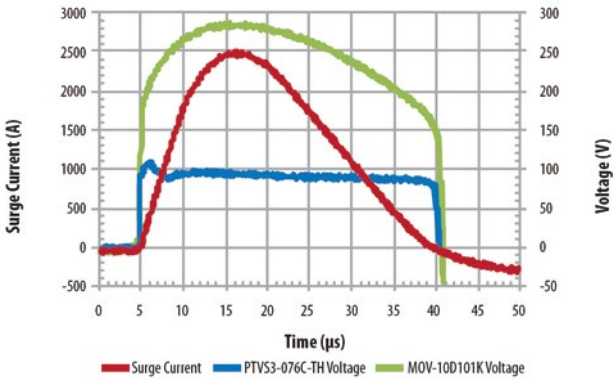


使用PTVS 之48V DC 防护电路

1.2/50, 8/20 us浪涌对比测试

从电压响应和I/V曲线图进行对比,PTVS比MOV提供了更好的保护,也说明了PTVS可以提供更高的电流(3 kA vs. 2.5 kA)。6个MOV进行并联,钳位电压有减小到约190 V, 但是比PTVS还是要高出约100 V。





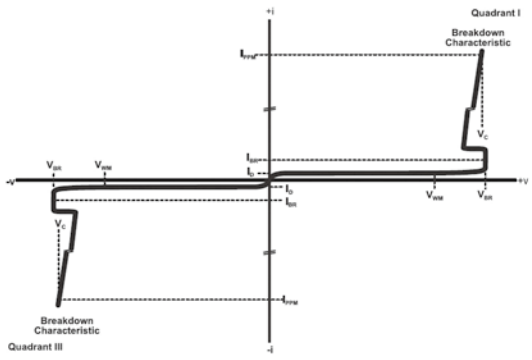


图 PTVS的V/I曲线

9.SPD浪涌保护器

器件概述

SPD(SurgeProtective Devices)浪涌保护器是独立保护装置,用来保护敏感的电子设备和人员来自浪涌和其他电子干扰的瞬态电压不被伤害和破坏。Bourns®的SPD产品采用标准DIN导轨安装,符合IEC61643-1,EN61643-11,UL14493rd版本,CSAC22.2(No.8-m1986)标准规范。

交流和直流SPD产品

AC Surge Protective Devices

1210 Series
- Type 2-pole DIN Rail AC SPD
- 1-pole and multi-pole surge protectors
- Pluggable
- 100 kA rated

1250 Series
- Type 2-pole DIN Rail AC SPD
- 1-pole and multi-pole surge protectors
- Pluggable
- 50 kA rated

1200TA
- Terminal adapters for 1210 and 1250 Series

Bus Bar
- Bus Bar in configurations of 2, 3 and 4

DC Power Surge Protective Devices

1320 Series
- DIN Rail SPD for 48 V, 75 V or 110 V DC powered equipment

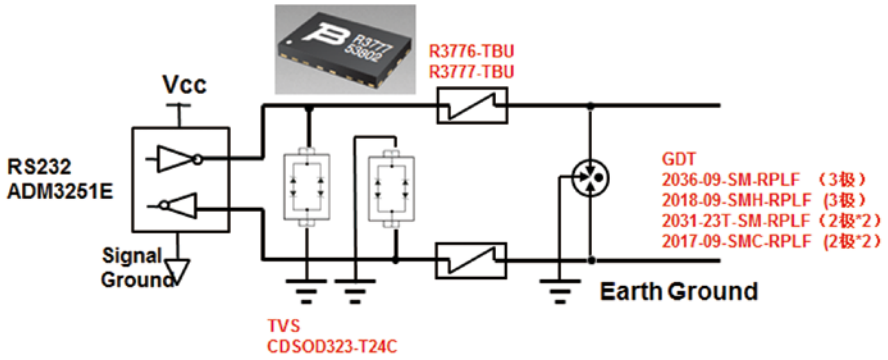
20 Series
- DIN Rail SPD for photovoltaic systems

Device	Series	Configuration	Type	Part Numbers	AC Network	Imax*	Description
AC Surge Protective Devices (SPDs)	1210 Series	1-Pole	Type 4 construction, Type 2 application per UL 1449 3rd Edition: Type 2 per EN61643-11 and IEC61643-11	1210-1S-120 1210-1S-230 1210-1S-400 1210-1S-600	120/240 V, 120/208 V - Single Phase 220/380 V, 240/415 V - Single Phase 220/380 V, 277/480 V, 347/600V - Single Phase 480 V/600 V - Single Phase	100 kA	Heavy duty SPD designed to be installed at the beginning of the installation, in the main switchboard, or close to sensitive terminals, on installations without LPS (Lightning Protection System)
		2-Pole		1210-2S-120 1210-2S-230 1210-2S-400 1210-2S-600	120/240 V, 120/208 V - Single Phase 220/380 V, 240/415 V - Single Phase 220/380 V, 277/480 V, 347/600 V - Single Phase 480 V/600 V - Single Phase		
		3-Pole		1210-3S-120 1210-3S-230 1210-3S-400 1210-3S-600	120/240 V, 120/208 V - 3-Phase 220/380 V, 240/415 V - 3-Phase 220/380 V, 277/480 V, 347/600 V - 3-Phase 480 V/600 V - 3-Phase		
		4-Pole		1210-2S-120 1210-2S-230 1210-2S-400 1210-2S-600	120/240 V, 120/208 V - 3-Phase + N 220/380 V, 240/415 V - 3-Phase + N 220/380 V, 277/480 V, 347/600 V - 3-Phase + N 480 V/600 V - 3-Phase + N		
	1250 Series	1-Pole	Type 4 construction, Type 2 application per UL 1449 3rd Edition: Type 2 per EN61643-11 and IEC61643-11	1250-1S-120 1250-1S-230 1250-1S-400 1250-1S-600	120/240 V, 120/208 V - Single Phase 220/380 V, 240/415 V - Single Phase 220/380 V, 277/480 V, 347/600 V - Single Phase 480 V/600 V - Single Phase	50 kA	General duty SPD designed to be installed at the beginning of the installation, in the main switchboard, or close to sensitive terminals, on installations without LPS (Lightning Protection System)
		2-Pole		1250-2S-120 1250-2S-230 1250-2S-400 1250-2S-600	120/240 V, 120/208 V - Single Phase 220/380 V, 240/415 V - Single Phase 220/380 V, 277/480 V, 347/600 V - Single Phase 480 V/600 V - Single Phase		
		3-Pole		1250-3S-120 1250-3S-230 1250-3S-400 1250-3S-600	120/240 V, 120/208 V - 3-Phase 220/380 V, 240/415 V - 3-Phase 220/380 V, 277/480 V, 347/600 V - 3-Phase 480 V/600 V - 3-Phase		
		4-Pole		1250-2S-120 1250-2S-230 1250-2S-400 1210-2S-600	120/240 V, 120/208 V - 3-Phase + N 220/380 V, 240/415 V - 3-Phase + N 220/380 V, 277/480 V, 347/600 V - 3-Phase + N 480 V/600 V - 3-Phase + N		
DC Power Surge Protective Devices (SPDs)	1320 Series	1-Pole	Type 4 construction, Type 2 application per UL 1449 3rd Edition: Low Voltage SPD Test Class II per EN61643-11 and IEC61643-11	1320-S-48 1320-S-75 1320-S-110	48 VDC 75 VDC 110 VDC	30 kA 40 kA 40 kA	SPD designed to protect DC power systems from damage due to lightning and power surges
	1420 Series	1-Pole	Type 4 construction, Type 2 application per UL 1449 3rd Edition: Low Voltage SPD Test Class II per EN61643-11 and IEC61643-11	1420-PV-1000	1000 VDC	40 kA	DC powered SPD designed to protect photovoltaic systems operating up to 1200 VDC

第二部分: 端口保护系统级推荐方案

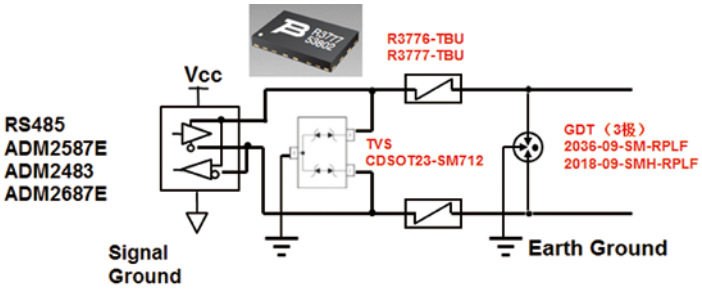
1.RS-232

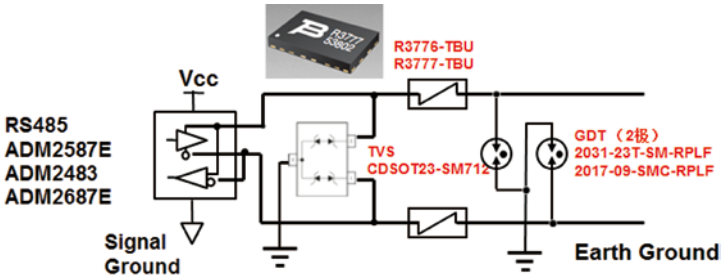
IEC61000-4-2 ESD (8kV/15kV) , IEC61000-4-4 EFT, IEC61000-4-5 Surge Level4

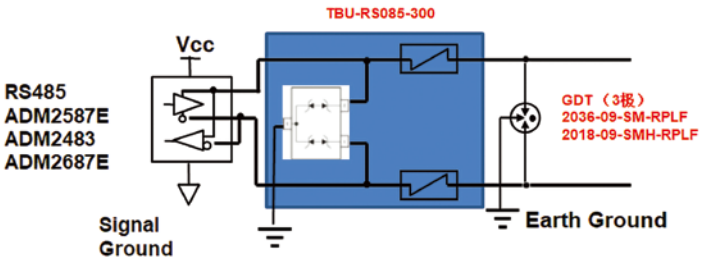


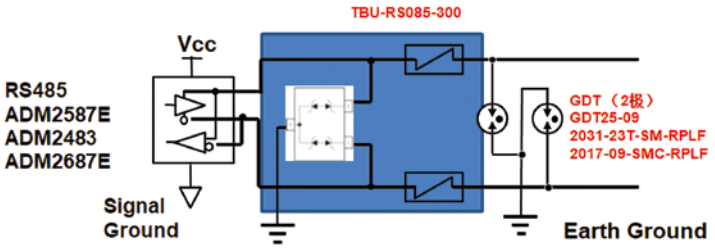
2.RS-485

IEC61000-4-2 ESD (8kV/15kV) , IEC61000-4-4 EFT, IEC61000-4-5 Surge Level4



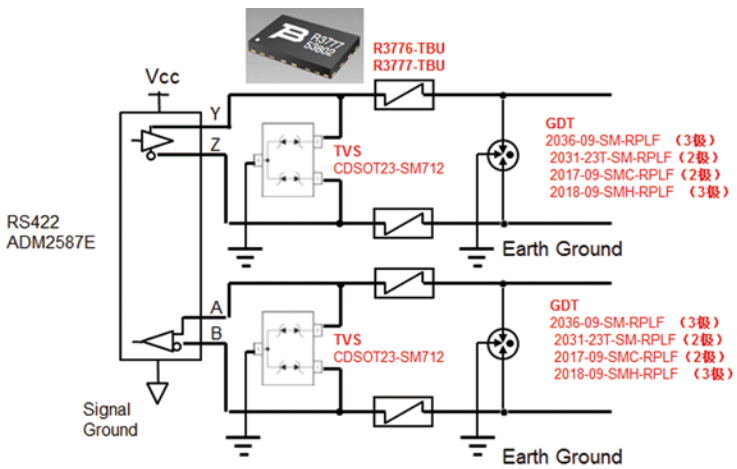






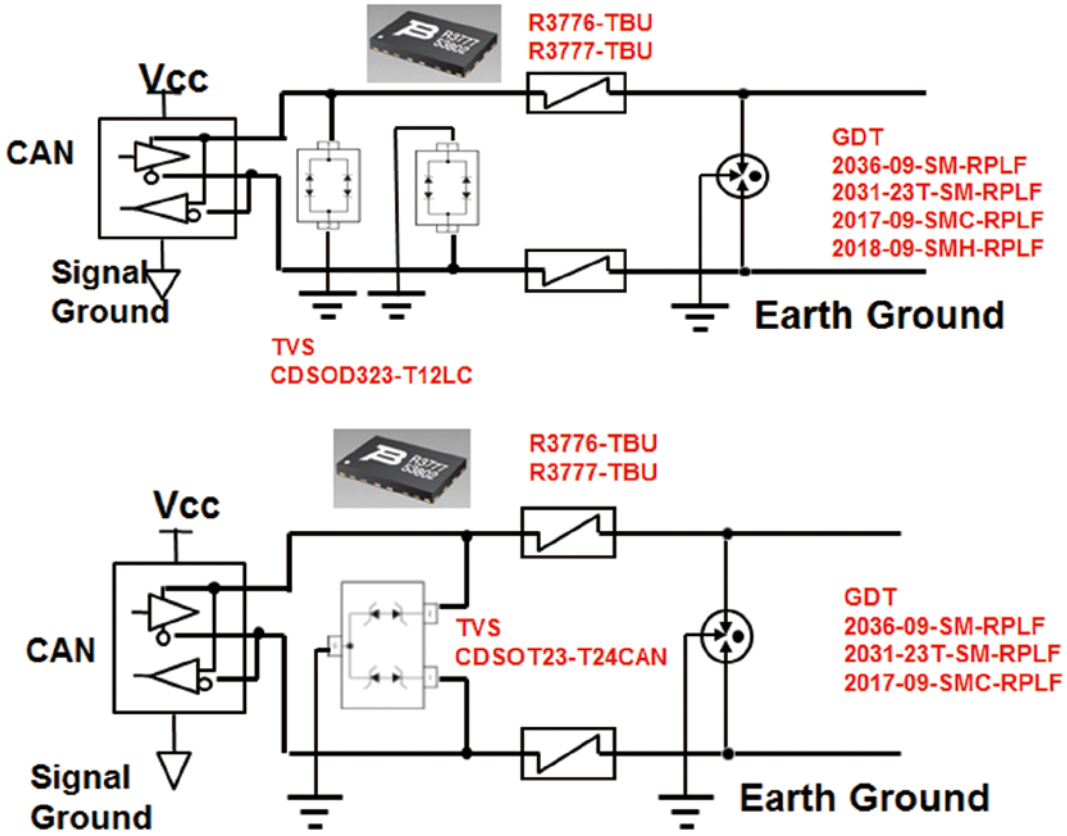
3.RS-422

IEC61000-4-2 ESD (8kV/15kV) ,
IEC61000-4-4 EFT, IEC61000-4-5 Surge Level4

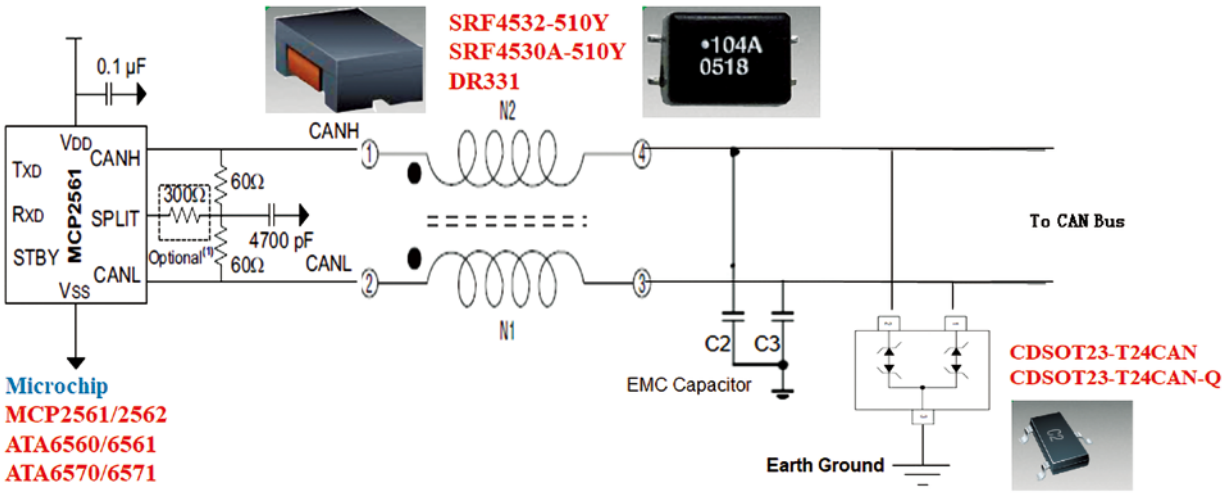


4.CANBus

IEC61000-4-2 ESD (8kV/15kV) , IEC61000-4-4 EFT, IEC61000-4-5 Surge Level4



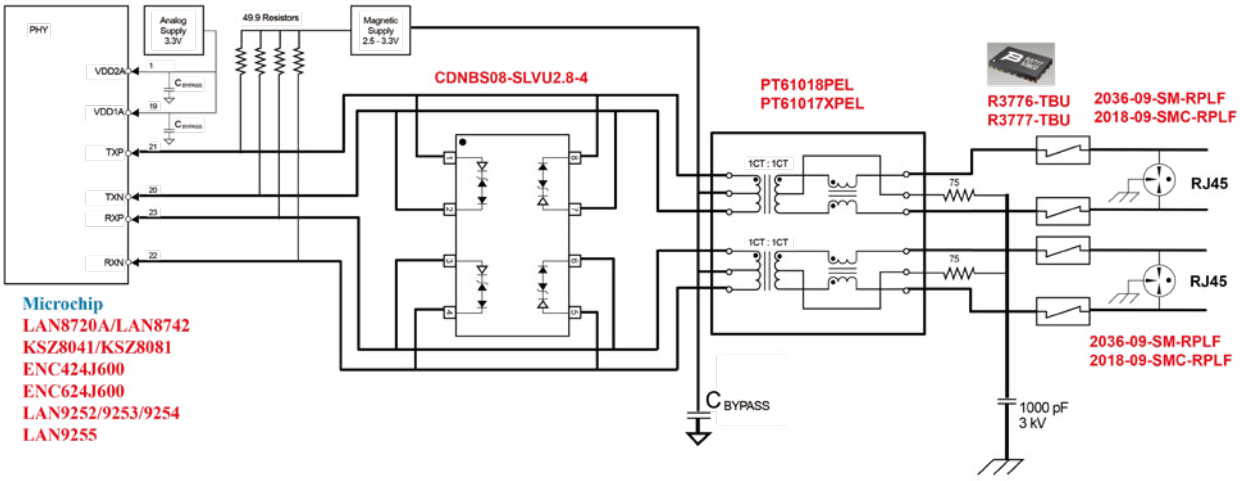
IEC61000-4-2 ESD (8kV/15kV) Level4, EMI



5.Ethernet

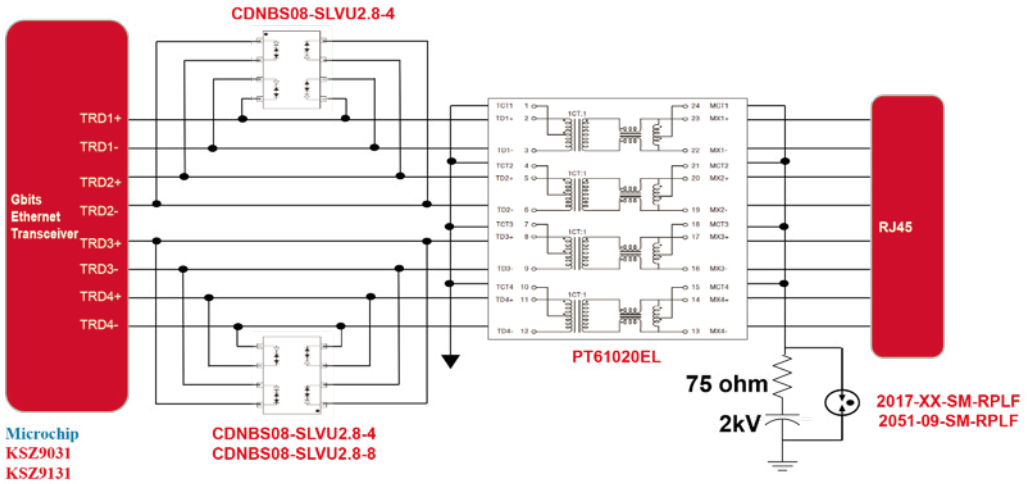
10/100M Ethernet/EtherCat

IEC61000-4-2 ESD(8kV/15kV), IEC61000-4-4 EFT, IEC61000-4-5 Surge Level 4, Power Cross

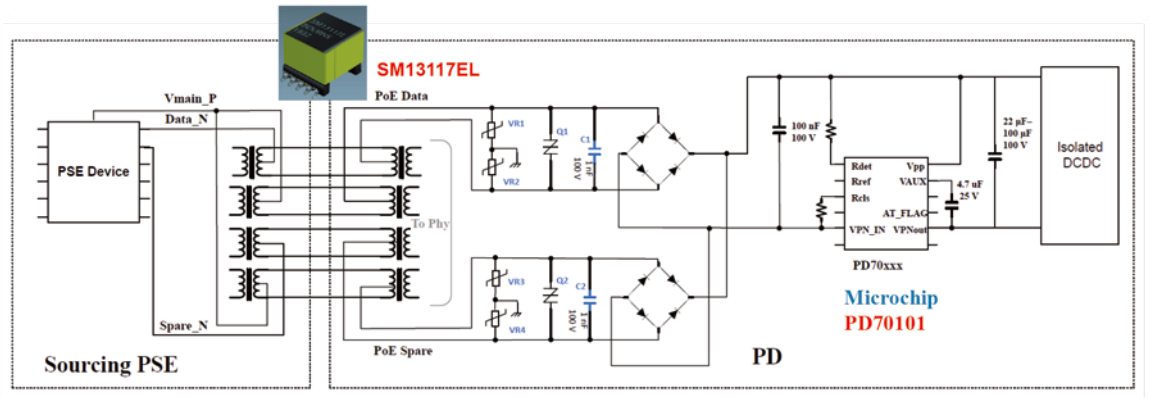


10/100/1000 Ethernet

IEC61000-4-2 ESD(8kV/15kV), IEC61000-4-4 EFT, IEC61000-4-5 Surge Level 4



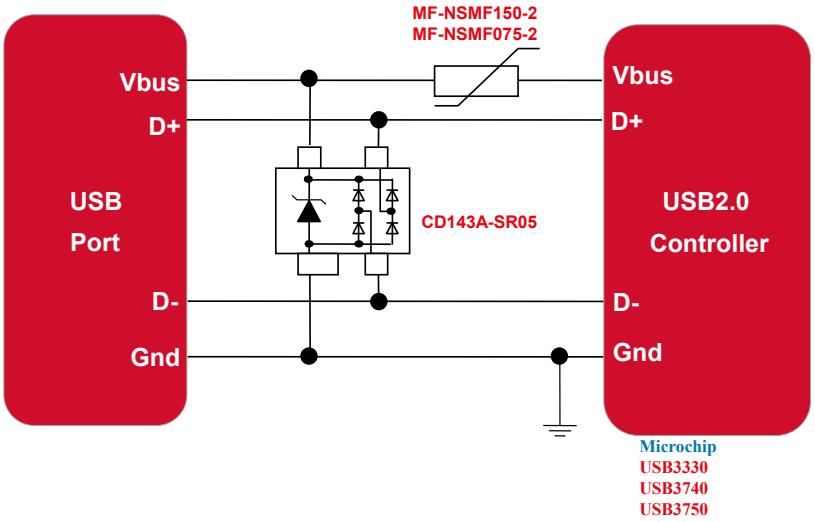
POE/PD 浪涌及隔离防护



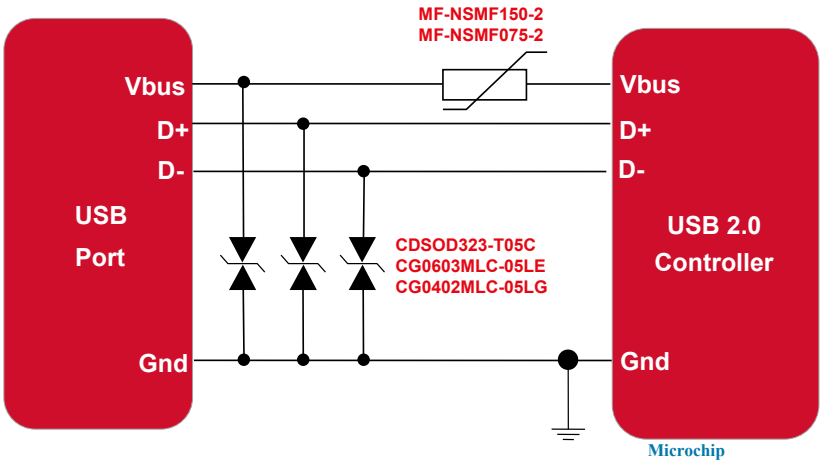
6.USB

USB2.0

IEC61000-4-2 ESD(8kV/15kV) Level4保护



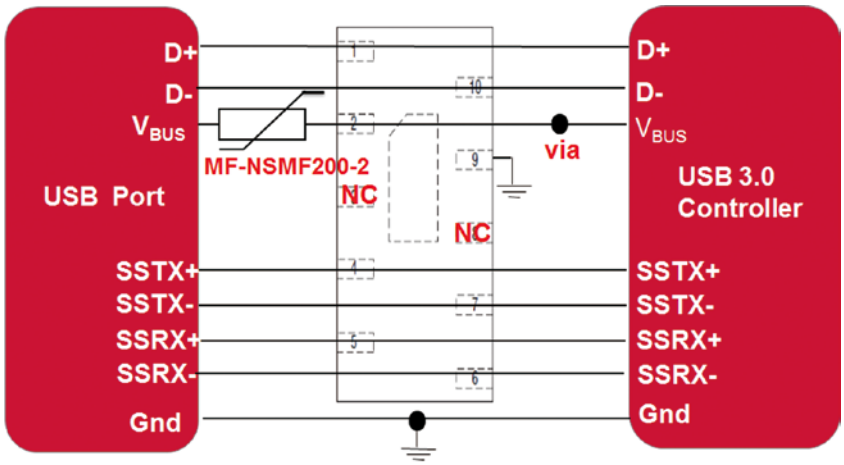
Microchip
USB3330
USB3740
USB3750



Microchip
USB3330
USB3740
USB3750

USB3.0

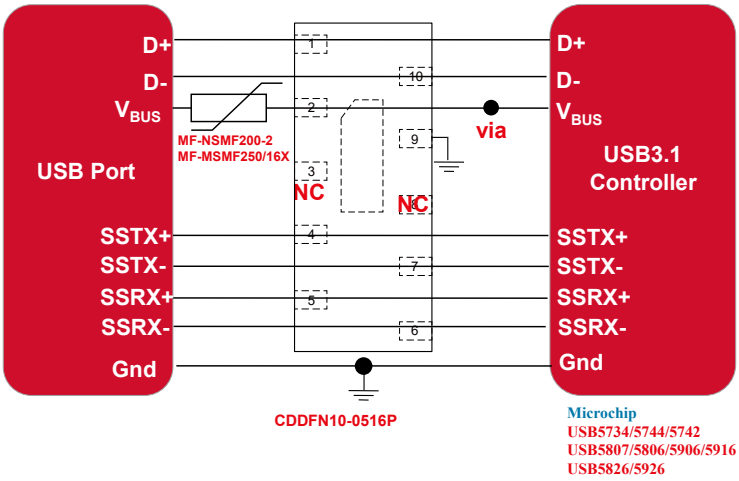
IEC61000-4-2 ESD(8kV/15kV) Level4保护



CDDFN10-0506N
CDDFN10-0516P

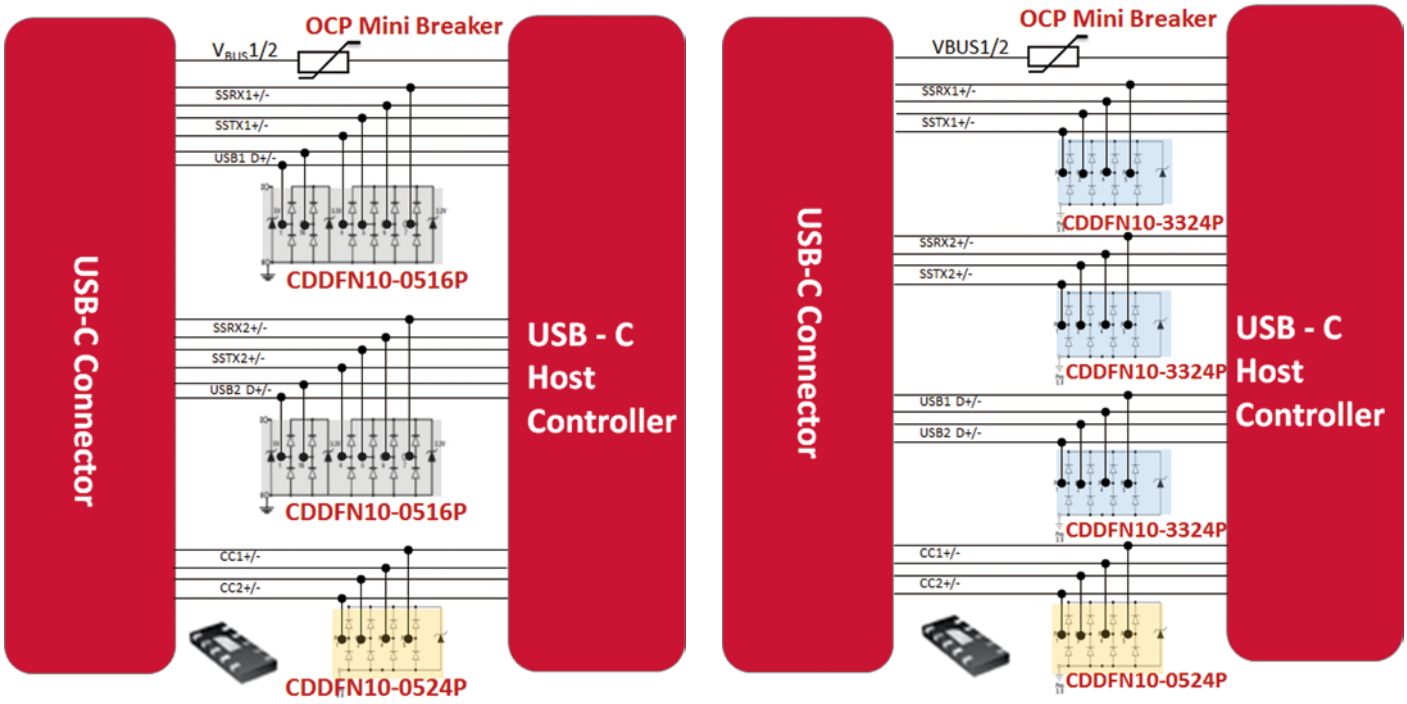
USB3.1标准接口

IEC61000-4-2 ESD
(8kV/15kV) Level4保护



USB3.1 TypeC接口保护

IEC61000-4-2 ESD(8kV/15kV)保护及过压过流保护



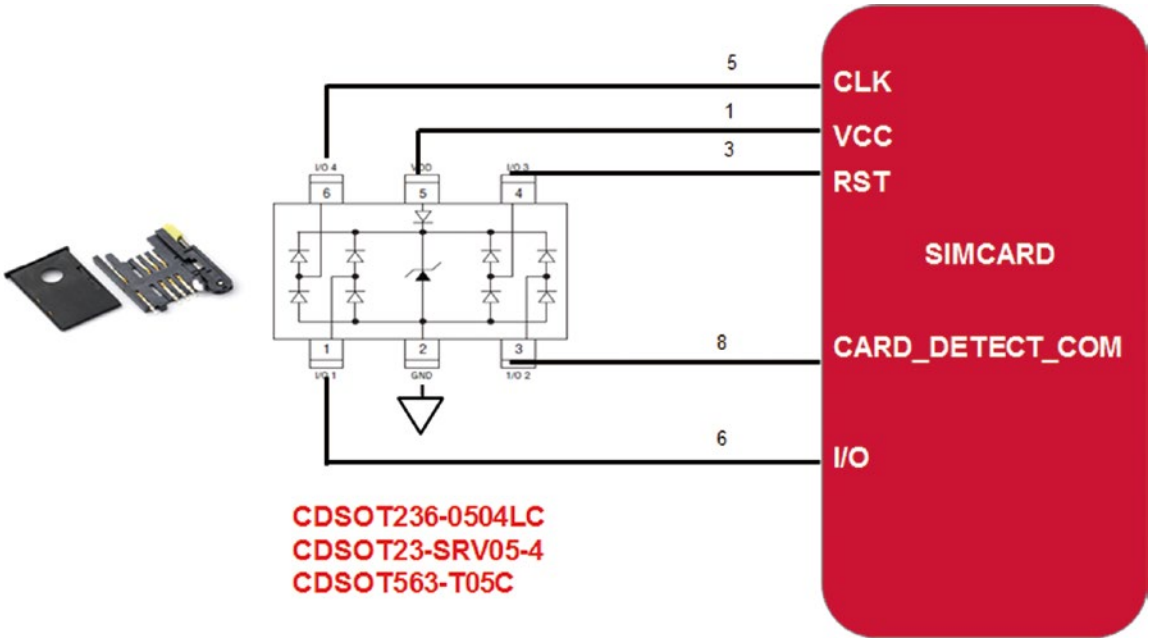
USB端口ESD防护的TVS推荐

Device	Configuration	Pkg. size (mm x mm)	Capacitance (pF)	Contact Discharge Rating (kV)
CDDFN2-T5.0LC	Discrete	1.0 x 0.6	0.5	8
CG0402MLU-05G	Discrete	1.0 x 0.5	0.05	8
CG0603MLU-05E	Discrete	1.6 x 0.8	0.05	8
CDSOD323-T05LC*	Discrete	2.6 x 1.3	1	30
CDSOT563-0502*	Array	1.6 x 1.6	2	15
CDSOT236-0502*	Array	2.95 X 2.8	2	15
CD143A-SR05LC*	Array	3.0 x 2.3	3	16

*$8/20\,\mu s\ I_{pp}$ rating > 6 A

7.Simcard

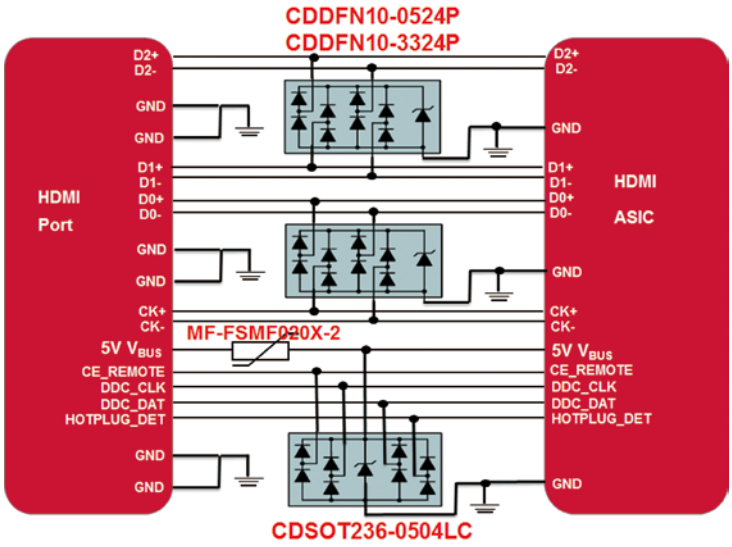
IEC61000-4-2 ESD(8kV/15kV) Level4保护



8.HDMI

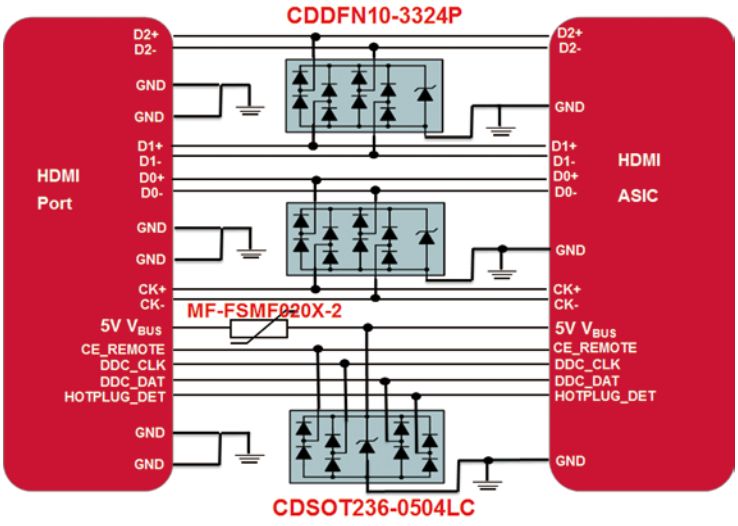
HDMI1.4

IEC61000-4-2 ESD(8kV/15kV) Level4和过流保护



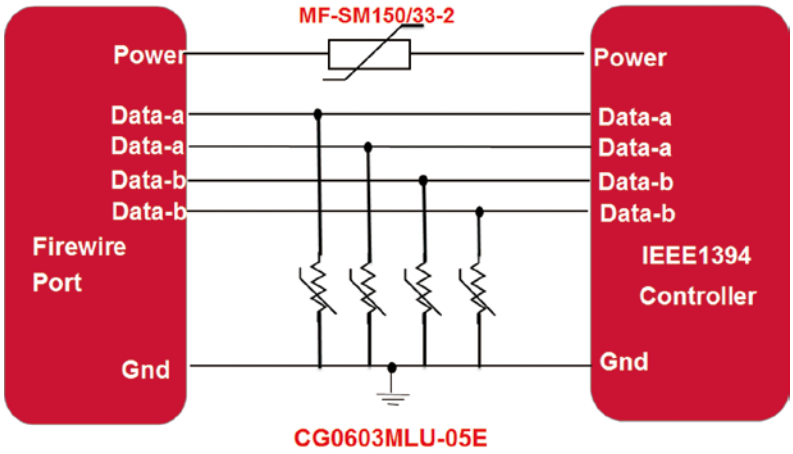
HDMI2.0

IEC61000-4-2 ESD(8kV/15kV)和过流保护



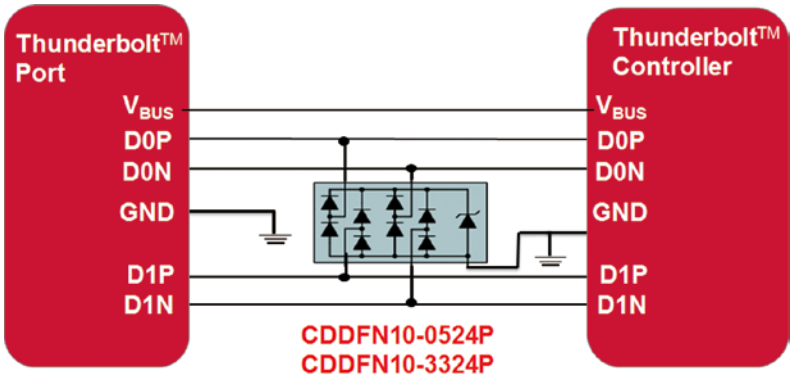
9.IEEE1394 (Firewire, i.Link)

IEEE1394B(2002), IEC61000-4-2 ESD(8kV/15kV)



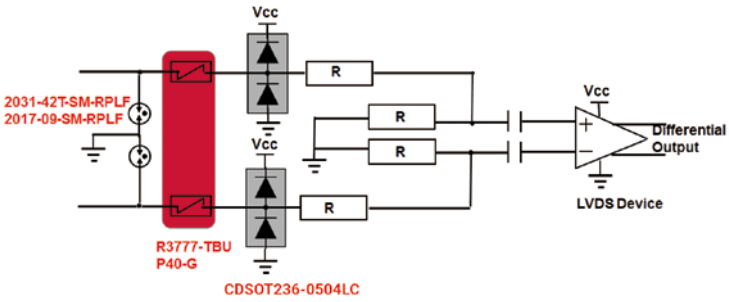
10.Thunderbolt

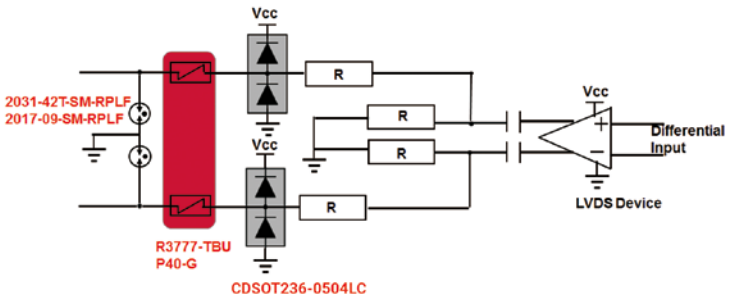
IEC61000-4-2 ESD(8kV/15kV)



11.LVDS

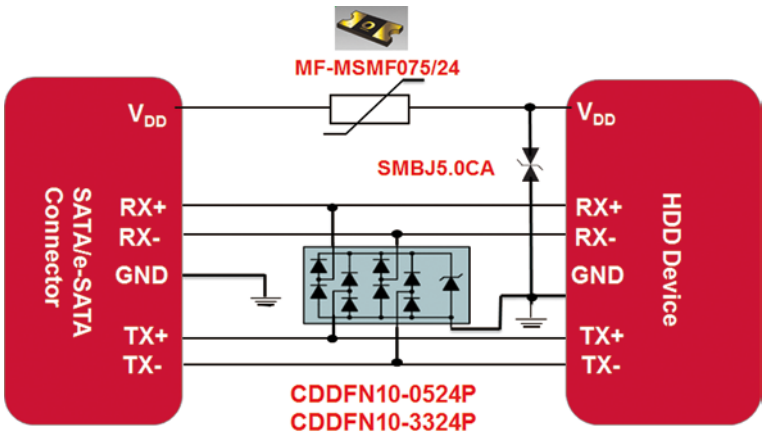
IEC61000-4-2 ESD(8kV/15kV), IEC61000-4-4 EFT, IEC61000-4-5 Surge Level4





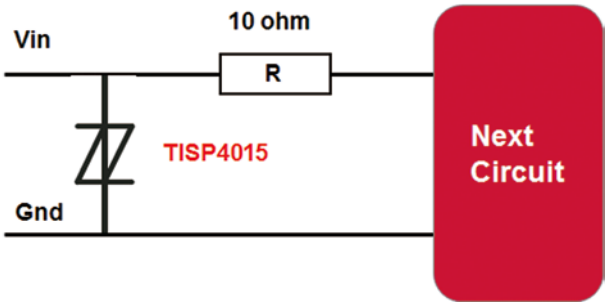
12.SATA HDD

IEC61000-4-2 ESD (8kV/15kV) Level4

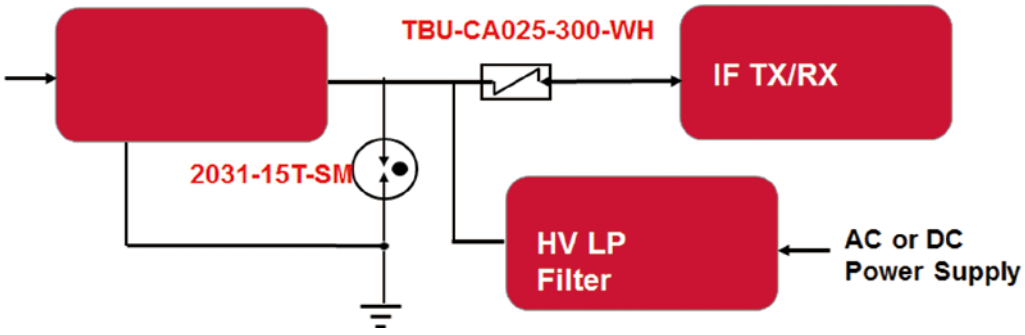


13.BNC

IEC61000-4-2 ESD (8kV/15kV) ,IEC61000-4-5 Surge Level4，过流保护

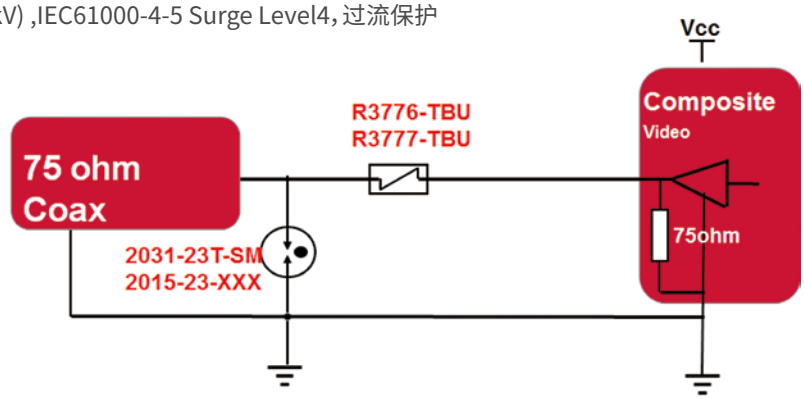


14.微波Microwave Port



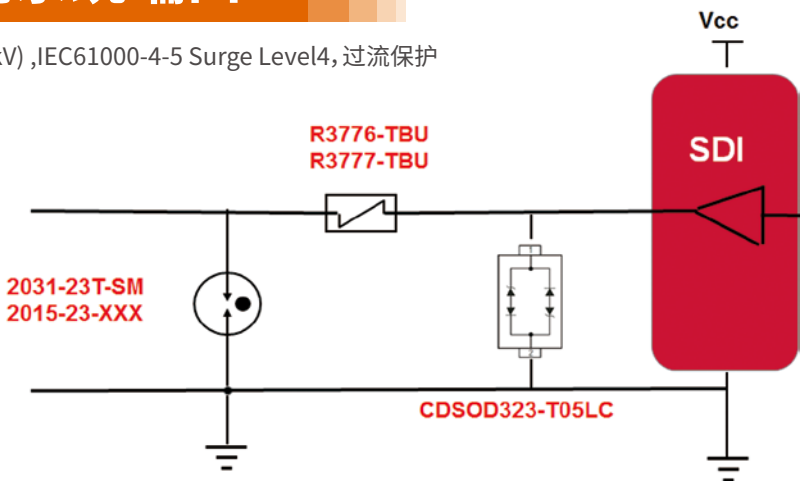
15.视频Video口

IEC61000-4-2 ESD (8kV/15kV) ,IEC61000-4-5 Surge Level4，过流保护



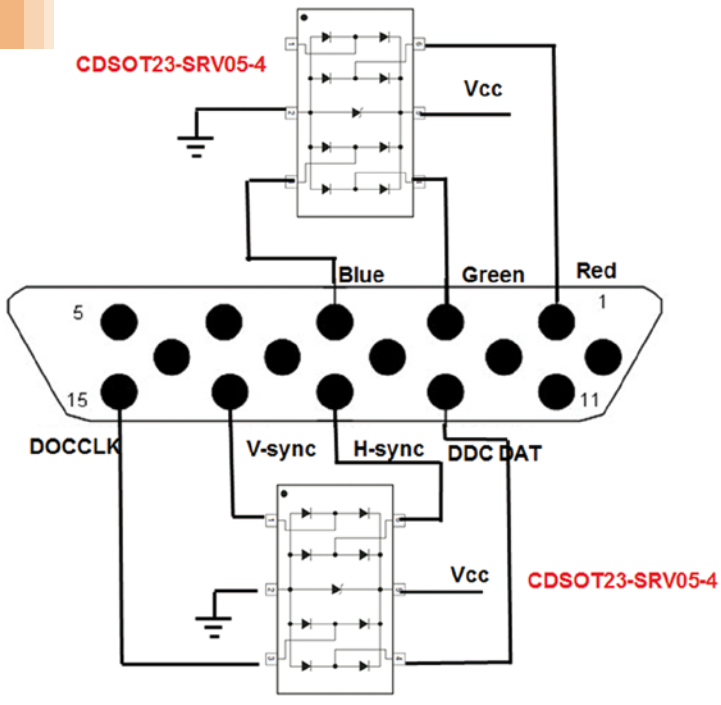
16.智能传输系统端口

IEC61000-4-2 ESD (8kV/15kV) ,IEC61000-4-5 Surge Level4，过流保护



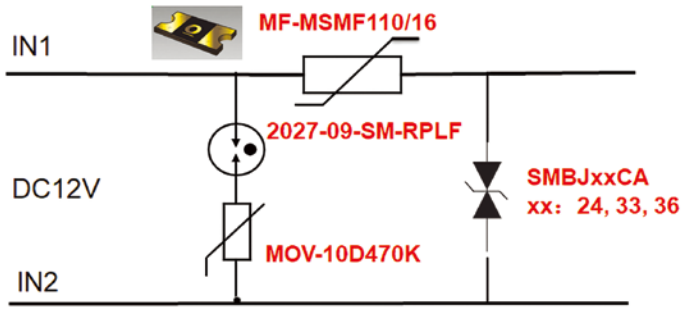
17.VGA

ESD防护

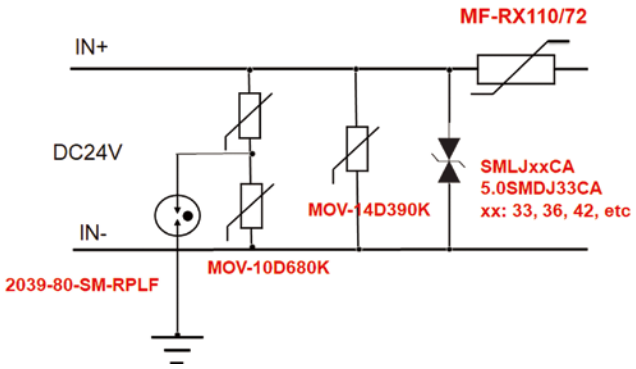


18.电源口

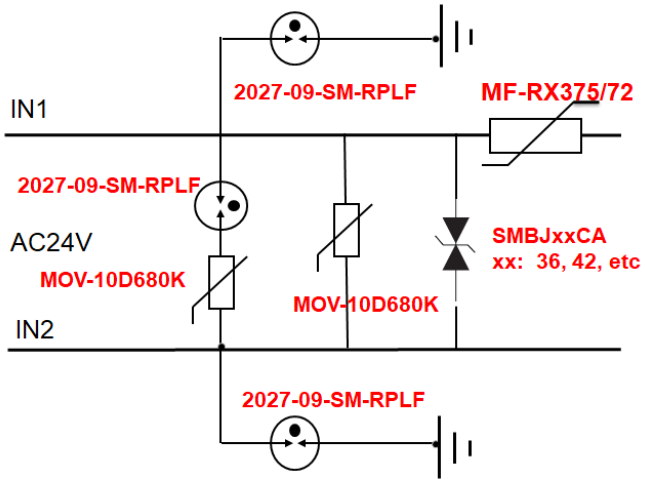
DC12V电源保护



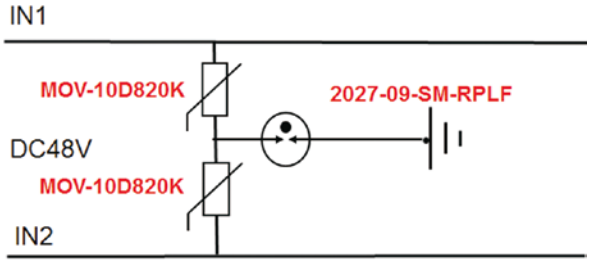
DC24V电源保护



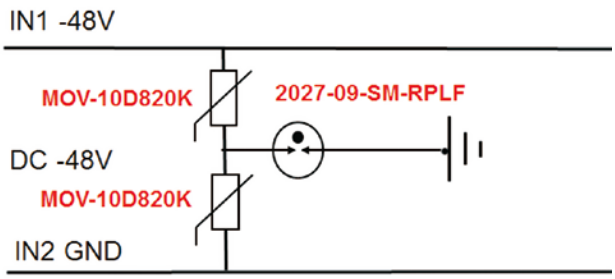
AC24V电源保护

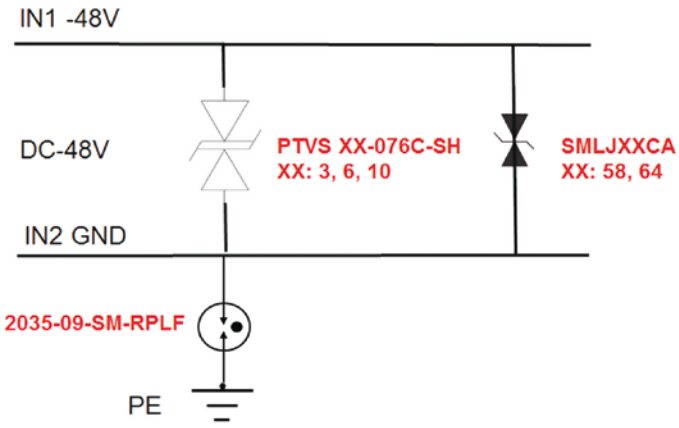


DC48V电源保护

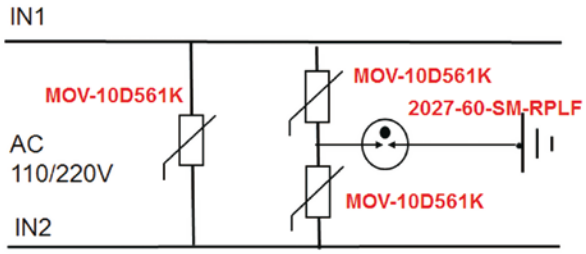


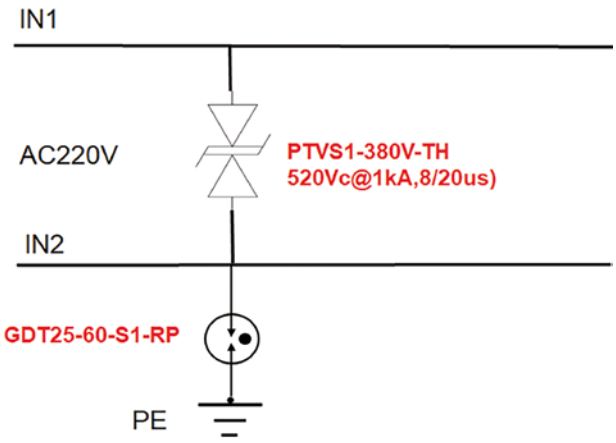
DC -48V电源保护

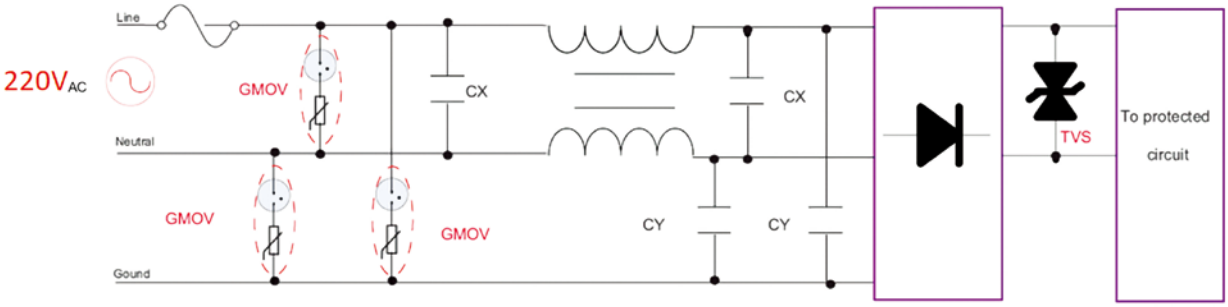




AC 110/220V电源保护





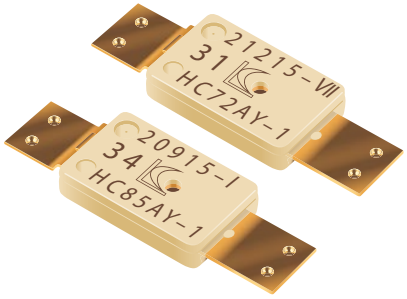


isoM3-320
isoM5-380

第三部分: Bourns公司保护器件分类选型表

1.Mini-Breaker / TCO

HC系列--标准封装/大电流系列



FEATURES

- High current capacity, low impedance
- Overtemperature and overcurrent protection for lithium polymer and prismatic cells
- Controls abnormal, excessive current virtually instantaneously, up to rated limits
- Wide range of temperature options
- Original TCO package size

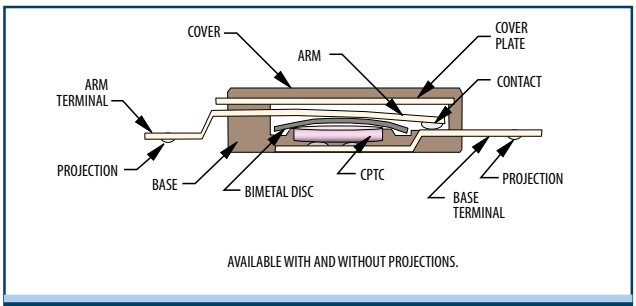
APPLICATIONS

Battery cell protection for:

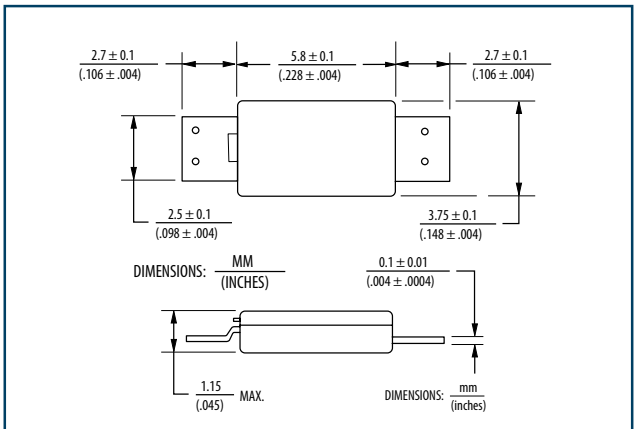
- Notebook PCs
- Tablet PCs
- Smartphones
- Power Banks

HC Series – Standard Package / High Current Series

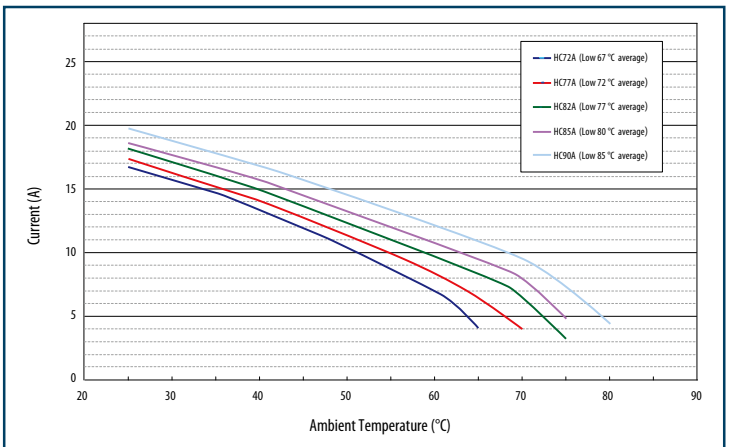
Model	Trip Temperature	Reset Temperature	Maximum Breaking Current	Maximum Voltage	Maximum Leakage Current	Resistance
HC72AY-1	72 °C ± 5 °C	40 °C min.	DC5 V / 80 A,100 cycles	DC28 V / 25 A, 100 cycles	200 mA max. @ 25 °C	2.0 milliohms typ. 5.0 milliohms max.
HC77AY-1	77 °C ± 5 °C					
HC82AY-1	82 °C ± 5 °C					
HC85AY-1	85 °C ± 5 °C					
HC90AY-1	90 °C ± 5 °C					



Product Structure



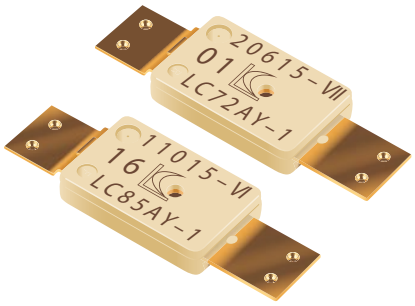
Dimensions



Ambient Temperature Impact on Mini-breaker Operating Currents

The above curves were derived from placing test samples in an oven at 25 °C, 40 °C, 60 °C and 70 °C, increasing current flow through the sample at a rate of 0.1 A/minute and recording the current value when the sample trips. The curves represent the lower tolerance (e.g. -5 °C) of the trip temperature range.

LC系列-- 标准封装/小电流系列



FEATURES

- Low current capacity type
- Overtemperature and overcurrent protection for lithium polymer and prismatic cells
- Controls abnormal, excessive current virtually instantaneously, up to rated limits
- Wide range of temperature options
- Original TCO package size

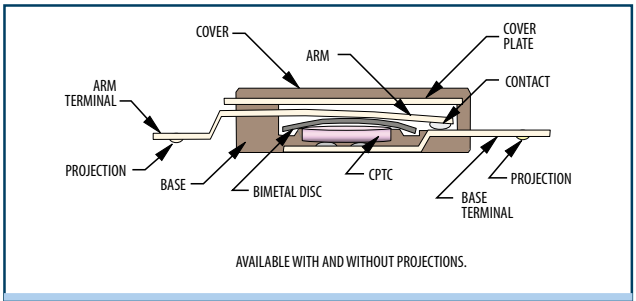
APPLICATIONS

Battery cell protection for:

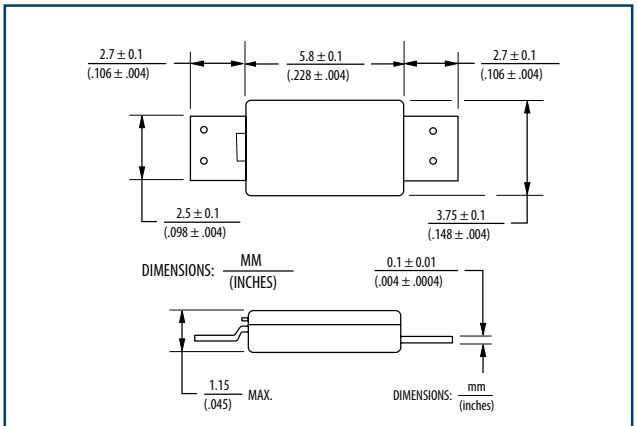
- Notebook PCs
- Tablet PCs
- Smartphones
- Game Consoles
- Rechargeable Mice

LC Series – Standard Package / Low Current Series

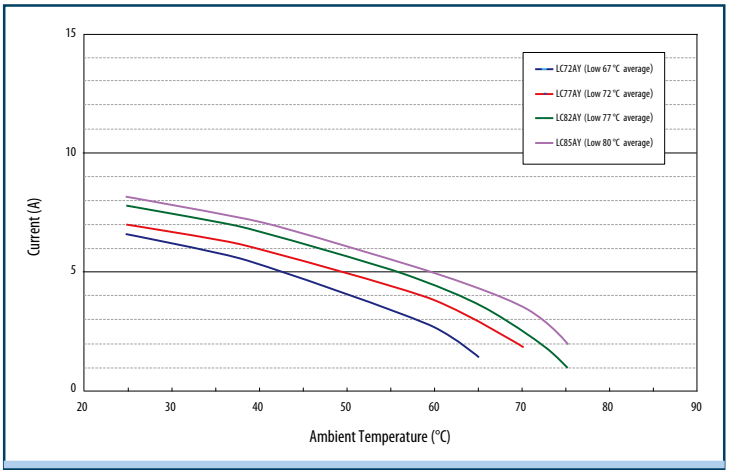
Model	Trip Temperature	Reset Temperature	Maximum Breaking Current	Maximum Voltage	Maximum Leakage Current	Resistance
LC72AY-1	72 °C ± 5 °C	40 °C min.	DC5 V / 40 A,100 cycles	DC28 V / 5 A, 100 cycles	150 mA max. @ 25 °C	7.2 milliohms typ. 15.0 milliohms max.
LC77AY-1	77 °C ± 5 °C					
LC82AY-1	82 °C ± 5 °C					
LC85AY-1	85 °C ± 5 °C					



Product Structure



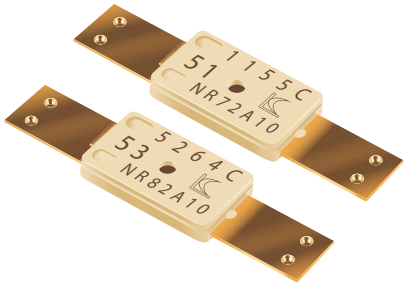
Dimensions



Ambient Temperature Impact on Mini-breaker Operating Currents

The above curves were derived from placing test samples in an oven at 25 ˚C, 40 ˚C, 60 ˚C and 70 ˚C, increasing current flow through the sample at a rate of 0.1 A/minute and recording the current value when the sample trips. The curves represent the lower tolerance (e.g. -5 ˚C) of the trip temperature range.

NRxxA系列--Mini小封装/大电流系列



FEATURES

- High current capacity, low impedance
- Overtemperature and overcurrent protection for lithium polymer and prismatic cells
- Controls abnormal, excessive current virtually instantaneously, up to rated limits
- Wide range of temperature options
- Miniature size, 52 % smaller than the HC Series

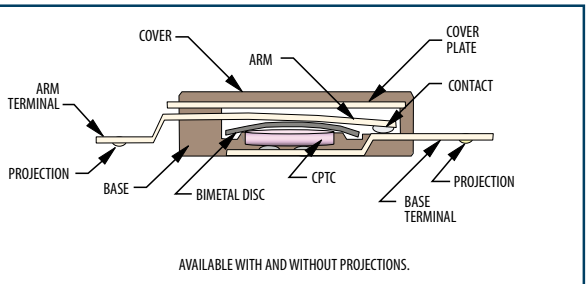
APPLICATIONS

Battery cell protection for:

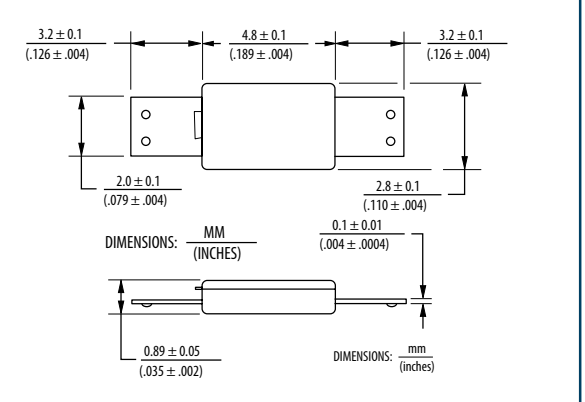
- Notebook PCs
- Tablet PCs
- Smartphones
- Power Banks
- Wearable electronics (Headphones, VR Systems, Body Cameras)

NRxxA Series – Miniature Package / High Current Series

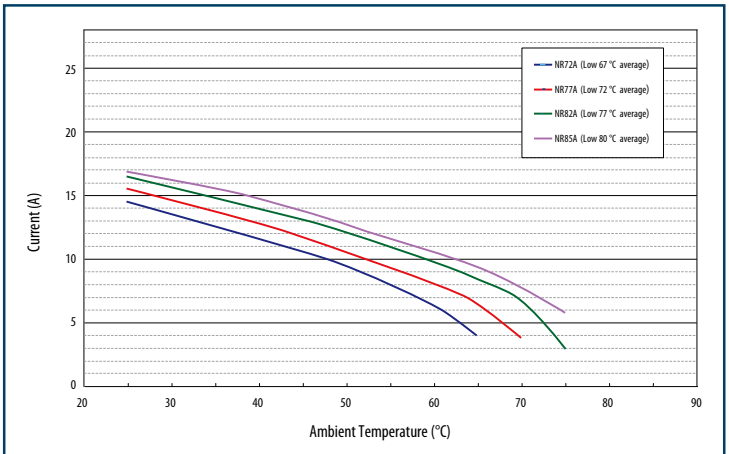
Model	Trip Temperature	Reset Temperature	Maximum Breaking Current	Maximum Voltage	Maximum Leakage Current	Resistance
NR72ABH	72 °C ± 5 °C	40 °C min.	DC5 V / 60 A,100 cycles	DC28 V / 25 A, 100 cycles	200 mA max. @ 25 °C	2.1 milliohms typ. 5.0 milliohms max.
NR77ABH	77 °C ± 5 °C					
NR82ABH	82 °C ± 5 °C					
NR85ABH	85 °C ± 5 °C					



Product Structure



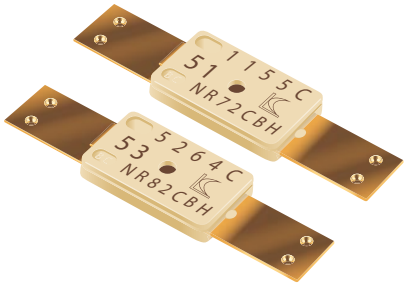
Dimensions



Ambient Temperature Impact on Mini-breaker Operating Currents

The above curves were derived from placing test samples in an oven at 25 °C, 40 °C, 60 °C and 70 °C, increasing current flow through the sample at a rate of 0.1 A/minute and recording the current value when the sample trips. The curves represent the lower tolerance (e.g. -5 °C) of the trip temperature range.

NRxxC系列--Mini小封装/小电流系列



FEATURES

- Low current capacity type
- Overtemperature and overcurrent protection for lithium polymer and prismatic cells
- Controls abnormal, excessive current virtually instantaneously, up to rated limits
- Wide range of temperature options
- Miniature size, 52 % smaller than the LC series

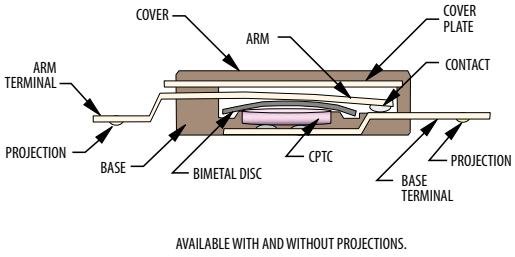
APPLICATIONS

Battery cell protection for:

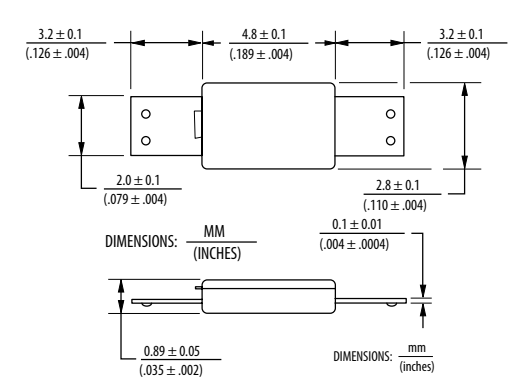
- Notebook PCs
- Tablet PCs
- Smartphones

NRxxC Series – Miniature Package / Low Current Series

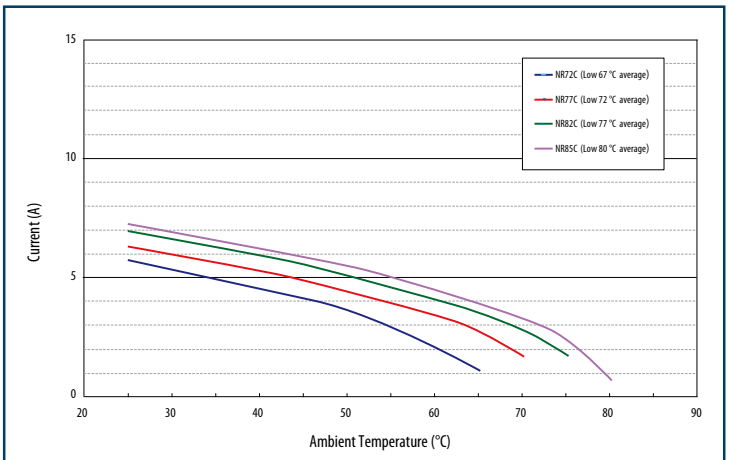
Model	Trip Temperature	Reset Temperature	Maximum Breaking Current	Maximum Voltage	Maximum Leakage Current	Resistance
NR72CBH	72 °C ± 5 °C	40 °C min.	DC5 V / 30 A,100 cycles	DC28 V / 12 A, 100 cycles	150 mA max. @ 25 °C	8.4 milliohms typ. 15.0 milliohms max.
NR77CBH	77 °C ± 5 °C					
NR82CBH	82 °C ± 5 °C					
NR85CBH	85 °C ± 5 °C					



Product Structure



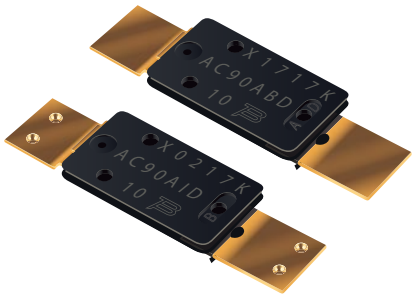
Dimensions



Ambient Temperature Impact on Mini-breaker Operating Currents

The above curves were derived from placing test samples in an oven at 25 °C, 40 °C, 60 °C and 70 °C, increasing current flow through the sample at a rate of 0.1 A/minute and recording the current value when the sample trips. The curves represent the lower tolerance (e.g. -5 °C) of the trip temperature range.

AC系列--大电流/低阻抗系列



FEATURES

- High current capacity, low impedance
- Overtemperature and overcurrent protection for lithium polymer and prismatic cells
- Controls abnormal, excessive current virtually instantaneously, up to rated limits
- Wide range of temperature options
- Latest generation of the high current series

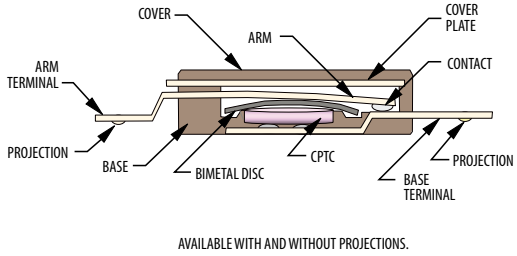
APPLICATIONS

Battery cell protection for:

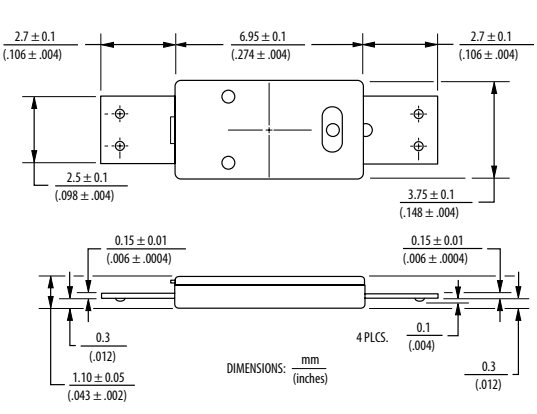
- Notebook PCs
- Tablet PCs
- Smartphones
- Gaming Notebooks
- High End & Business Notebooks
- Power Banks

AC Series – Very High Current Series

Model	Trip Temperature	Reset Temperature	Maximum Breaking Current	Maximum Voltage	Maximum Leakage Current	Resistance
AC72ABD	72 °C ± 5 °C	40 °C min.	DC5 V / 60 A,100 cycles	DC28 V / 35 A, 100 cycles	200 mA max. @ 25 °C	1.0 milliohms typ. 2.0 milliohms max.
AC77ABD	77 °C ± 5 °C					
AC82ABD	82 °C ± 5 °C					
AC85ABD	85 °C ± 5 °C					
AC90ABD	90 °C ± 5 °C					



Product Structure



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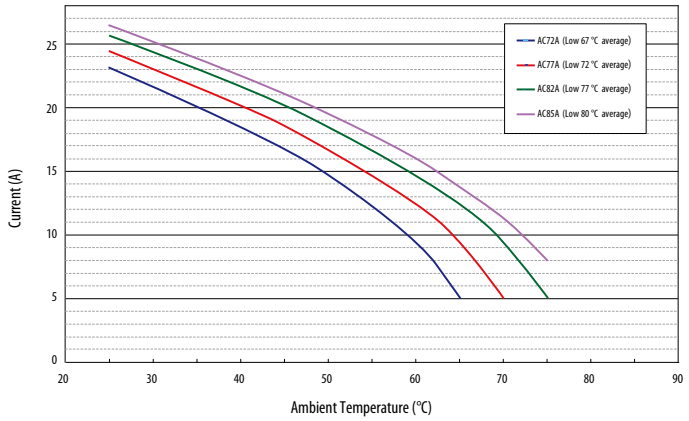

Ambient Temperature Impact on Mini-breaker Operating Currents

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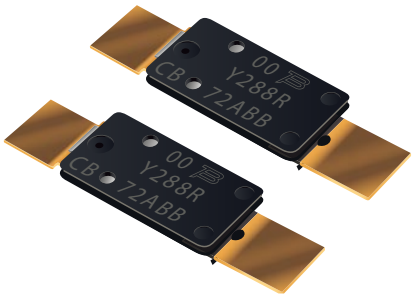
CB系列——大电流/最小尺寸系列



FEATURES

- High current capacity, low impedance
- Overtemperature and overcurrent protection for lithium polymer and prismatic cells
- Controls abnormal, excessive current virtually instantaneously, up to rated limits
- Wide range of temperature options
- Smallest TCO on the market (65 % smaller than the HC series, 26.5 % smaller than the NR Series)

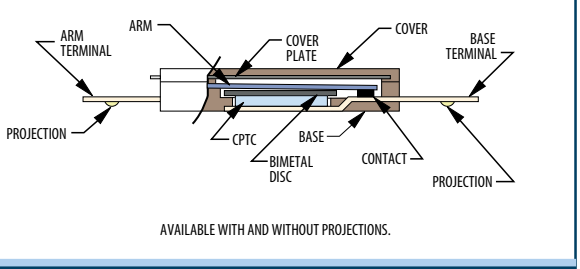
APPLICATIONS

Battery cell protection for:

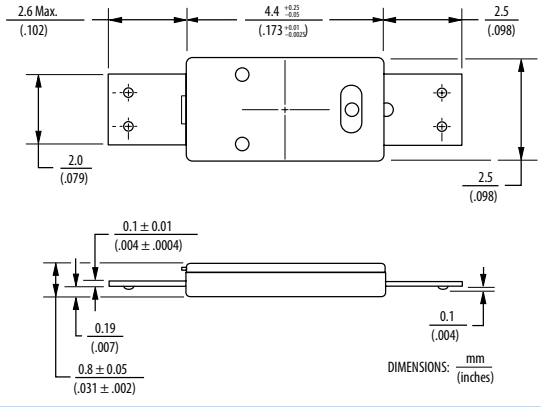
- Notebook PCs
- Tablet PCs
- Smartphones
- Wearable Electronics (Headphones, VR Systems, Body Cameras)

CB Series – High Current/Smallest Size

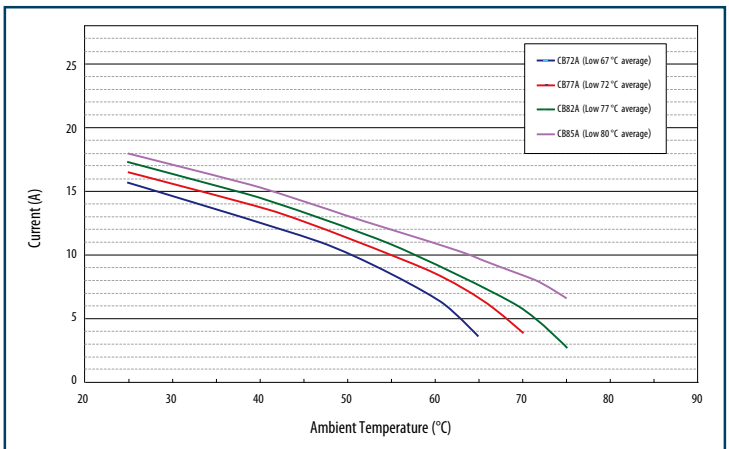
Model	Trip Temperature	Reset Temperature	Maximum Breaking Current	Maximum Voltage	Maximum Leakage Current	Resistance
CB72ABB	72 °C ± 5 °C	40 °C min.	DC5 V / 50 A,100 cycles	DC28 V / 25 A, 100 cycles	200 mA max. @ 25 °C	2.2 milliohms typ. 5 milliohms max.
CB77ABB	77 °C ± 5 °C					
CB82ABB	82 °C ± 5 °C					
CB85ABB	85 °C ± 5 °C					



Product Structure



Dimensions



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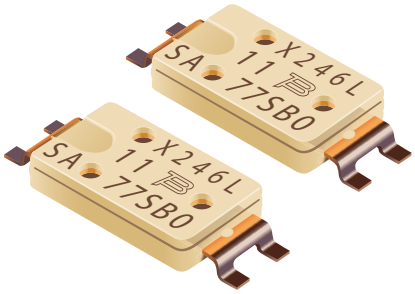
SA系列——表贴/大电流系列



FEATURES

- Surface mount series, first of its kind
- Overtemperature and overcurrent protection for lithium polymer and prismatic cells
- Controls abnormal, excessive current virtually instantaneously, up to rated limits
- Wide range of temperature options
- High and low current options available

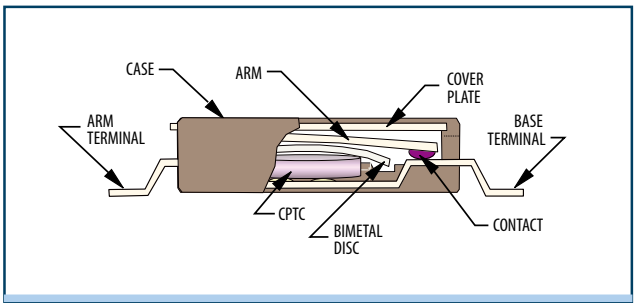
APPLICATIONS

Battery cell protection for:

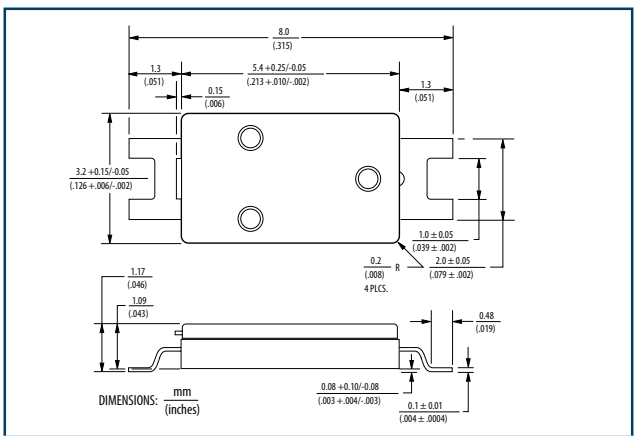
- Notebook PCs
- Tablet PCs
- Smartphones
- PCB Thermal Protection

SA Series – Surface Mount / High Current

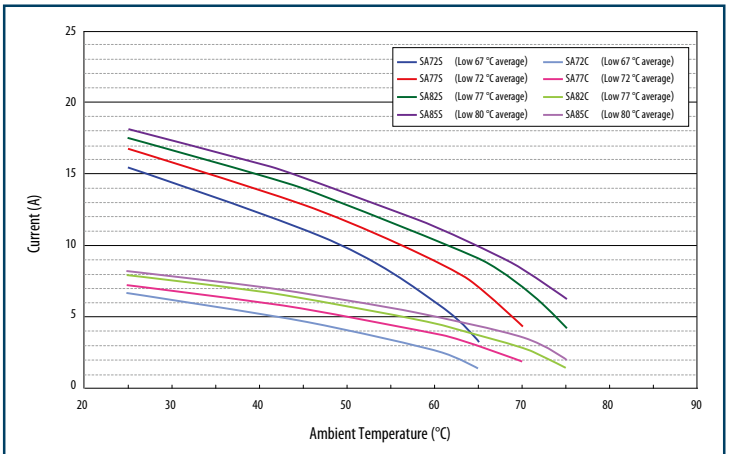
Model	Trip Temperature	Reset Temperature	Maximum Breaking Current	Maximum Voltage	Maximum Leakage Current	Resistance
High Current						
SA72SB0	72 °C ± 5 °C	40 °C min.	DC5 V / 60 A,100 cycles	DC28 V / 25 A, 100 cycles	200 mA max. @ 25 °C	2.2 milliohms typ. 7.0 milliohms max.
SA77SB0	77 °C ± 5 °C					
SA82SB0	82 °C ± 5 °C					
SA85SB0	85 °C ± 5 °C					
Low Current						
SA72CB0	72 °C ± 5 °C	40 °C min.	DC5 V / 30 A,100 cycles	DC28 V / 12 A, 100 cycles	200 mA max. @ 25 °C	7.2 milliohms typ. 15.0 milliohms max.
SA77CB0	77 °C ± 5 °C					
SA82CB0	82 °C ± 5 °C					
SA85CB0	85 °C ± 5 °C					



Product Structure



Dimensions



Ambient Temperature Impact on Mini-breaker Operating Currents

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*RoHS Directive 2015/863, Mar 31, 2015 and Annex.

SC系列——新一代表贴系列

FEATURES

- Surface mount
- Overtemperature and overcurrent protection for lithium polymer and prismatic cells
- Controls abnormal, excessive current virtually instantaneously, up to rated limits
- Wide range of temperature options
- AAA version is designed to withstand high injection molding pressure during USB cable assembly
- AAB version is low profile for smartphone applications

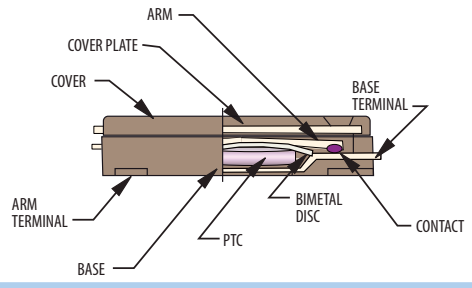
APPLICATIONS

Battery cell protection for:

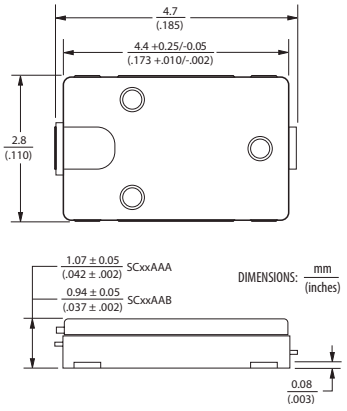
- Notebook PCs
- Tablet PCs
- Smartphones
- USB Cable Protection for Smartphones
- PCB Thermal Protection

SC Series – Next Generation Surface Mount

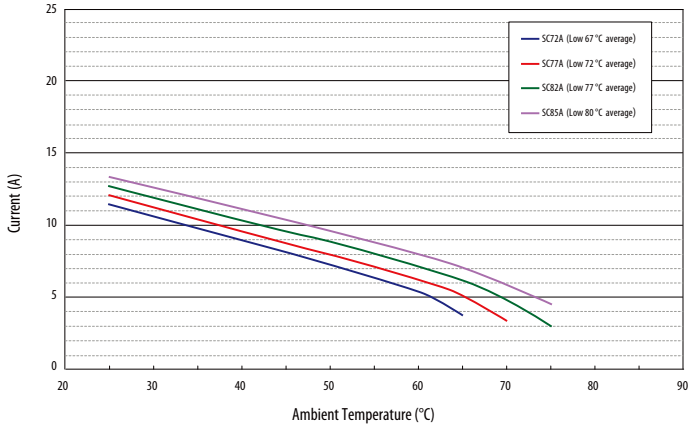
Model	Trip Temperature	Reset Temperature	Maximum Breaking Current	Maximum Voltage	Maximum Leakage Current	Resistance
SC72AAA SC72AAB	72 °C ± 5 °C	40 °C min.	DC5 V / 50 A, 100 cycles	DC28 V / 25 A, 100 cycles	200 mA max. @ 25 °C	1.7 milliohms typ. 5.0 milliohms max.
SC77AAA SC77AAB	77 °C ± 5 °C					
SC82AAA SC82AAB	82 °C ± 5 °C					
SC85AAA SC85AAB	85 °C ± 5 °C					



Product Structure



Dimensions



Ambient Temperature Impact on Mini-breaker Operating Currents

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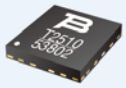
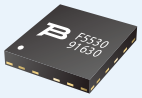
*RoHS Directive 2015/863, Mar 31, 2015 and Annex.

2.TBU

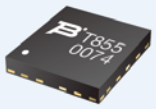
TBU-DB系列双向双通道产品（满足AEC-Q101）

Part Number	Maximum Ratings		Operating Characteristics				Device Size (mm)	Form Factor
	V_{imp} (V)	V_{dc} (V)	$I_{trigger}$ Min. (mA)	$I_{trigger}$ Max. (mA)	t_{block} (µs)	R_{typ} (Ω)		
TBU-DB055-100-WH-Q	550	450	100	200	1	13.5	5.50 x 6.50	

TBU-DF系列双向双通道产品

Part Number	Maximum Ratings		Operating Characteristics				Device Size (mm)	Form Factor
	V_{imp} (V)	V_{rms} (V)	$I_{trigger}$ Min. (mA)	$I_{trigger}$ Max. (mA)	t_{block} (µs)	R_{typ} (Ω)		
TBU-DF055-050-WH	550	250	50	100	1	19	6.50 x 5.50	
TBU-DF055-100-WH	550	250	100	200	1	14		
TBU-DF055-200-WH	550	250	200	400	1	11.5		
TBU-DF055-300-WH	550	250	300	600	1	10		
TBU-DF055-500-WH	550	250	500	1000	1	9		
TBU-DF085-050-WH	850	425	50	100	1	30.5		
TBU-DF085-100-WH	850	425	100	200	1	20.5		
TBU-DF085-200-WH	850	425	200	400	1	17.5		
TBU-DF085-300-WH	850	425	300	600	1	20.5		
TBU-DF085-500-WH	850	425	500	1000	1	18.5		

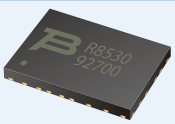
TBU-DT单向双通道产品

Part Number	Maximum Ratings		Operating Characteristics				Device Size (mm)	Form Factor
	V_{imp} (V)	V_{rms} (V)	$I_{trigger}$ Min. (mA)	$I_{trigger}$ Max. (mA)	t_{block} (µs)	R_{typ} (Ω)		
TBU-DT065-100-WH	650	300	100	200	1	8.5	5.00 x 5.00	
TBU-DT065-200-WH	650	300	200	400	1	5.6		
TBU-DT065-300-WH	650	300	300	600	1	4.6		
TBU-DT065-500-WH	650	300	500	1000	1	4.0		
TBU-DT085-100-WH	850	425	100	200	1	10.3		
TBU-DT085-200-WH	850	425	200	400	1	7.4		
TBU-DT085-300-WH	850	425	300	600	1	6.8		
TBU-DT085-500-WH	850	425	500	1000	1	5.8		

TBU-CA系列双向单通道产品

Part Number	Maximum Ratings		Operating Characteristics				Device Size (mm)	Form Factor
	V_{imp} (V)	V_{rms} (V)	$I_{trigger}$ Min. (mA)	$I_{trigger}$ Max. (mA)	t_{block} (µs)	R_{typ} (Ω)		
TBU-CA025-050-WH	250	100	50	100	1	13.3	6.50 x 4.00	
TBU-CA025-100-WH	250	100	100	200	1	7.1		
TBU-CA025-200-WH	250	100	200	400	1	4.2		
TBU-CA025-300-WH	250	100	300	600	1	3.2		
TBU-CA025-500-WH	250	100	500	1000	1	2.6		
TBU-CA040-050-WH	400	200	50	100	1	14.3		
TBU-CA040-100-WH	400	200	100	200	1	8.1		
TBU-CA040-200-WH	400	200	200	400	1	5.2		
TBU-CA040-300-WH	400	200	300	600	1	4.3		
TBU-CA040-500-WH	400	200	500	1000	1	3.6		
TBU-CA050-050-WH	500	250	50	100	1	15.7		
TBU-CA050-100-WH	500	250	100	200	1	9.5		
TBU-CA050-200-WH	500	250	200	400	1	6.6		
TBU-CA050-300-WH	500	250	300	600	1	5.6		
TBU-CA050-500-WH	500	250	500	1000	1	5.0		
TBU-CA065-050-WH	650	300	50	100	1	17.7		
TBU-CA065-100-WH	650	300	100	200	1	11.5		
TBU-CA065-200-WH	650	300	200	400	1	8.6		
TBU-CA065-300-WH	650	300	300	600	1	7.6		
TBU-CA065-500-WH	650	300	500	1000	1	7.0		
TBU-CA085-050-WH	850	425	50	100	1	21.4		
TBU-CA085-100-WH	850	425	100	200	1	15.2		
TBU-CA085-200-WH	850	425	200	400	1	12.3		
TBU-CA085-300-WH	850	425	300	600	1	11.3		
TBU-CA085-500-WH	850	425	500	1000	1	10.7		

TBU-RS 系列双向双通道集成TVS产品

Part Number	Maximum Ratings		Operating Characteristics				Device Size (mm)	Form Factor
	V_{imp} (V)	V_{rms} (V)	$I_{trigger}$ Min. (mA)	$I_{trigger}$ Max. (mA)	t_{block} (µs)	R_{typ} (Ω)		
TBU-RS055-300-WH	550	250	300	600	1	10	8 x 5.5	
TBU-RS085-300-WH	850	425	300	600	1	21.5		

P40-G, TBU-PL&P850双向双通道产品

Part Number	Maximum Ratings		Operating Characteristics				Device Size (mm)	Form Factor
	V_{imp} (V)	V_{rms} (V)	$I_{trigger}$ Min. (mA)	$I_{trigger}$ Max. (mA)	t_{block} (µs)	R_{typ} (Ω)		
P40-G240-WH	40	28	240	480	0.2	3.6	4.00 x 4.00	
TBU-PL050-100-WH	500	300	100	200	1	50	6.50 x 4.00	
TBU-PL050-200-WH	500	300	200	400	1	50		
TBU-PL060-100-WH	600	350	100	200	1	50		
TBU-PL060-200-WH	600	350	200	400	1	50		
TBU-PL075-100-WH	750	400	100	200	1	50		
TBU-PL075-200-WH	750	400	200	400	1	50		
TBU-PL085-100-WH	850	425	100	200	1	50		
TBU-PL085-200-WH	850	425	200	400	1	50		
P850-G120-WH	850	425	100	200	1	50	4.00 x 8.25	
P850-G200-WH	850	425	200	400	1	50	4.00 x 8.25	

TBU工业增强型单通道产品

Part Number	V_{imp} (V)	$I_{trigger}$ (mA) (typ)	t_{block} (µs) (max)	R device (ohm) (max)	AC Power Cross
R3777-TBU	850	200	0.8	14	Yes
R3776-TBU	650	100	0.8	13.2	Yes

Notes:
Vimp: Maximum peak impulse voltage withstand with duration less than 10 ms.
Vrms: Maximum continuous alternating current RMS voltage.
Itrigger: Minimum and maximum current required for the device to go from operating state to protected state.
tblock: Maximum time for the device to go from normal operating state to protected state.
Rtyp: Typical series resistance of the TBU® device.

3.TCS

TCS系列高速保护器

Part Number	Maximum Ratings	Operating Characteristics					Device Size (mm)	Form Factor
	V_{imp} (V)	$I_{trigger}$ (mA)			t_{limit} (ns)	R_{on} (Ω)		
		Min.	Typ.	Max.		Typ.		
TCS-DL004-250-WH	40	250	375	500	50	2.3	4.00 x 2.50	
TCS-DL004-500-WH	40	500	750	1000	50	1.4	4.00 x 3.50	
TCS-DL004-750-WH	40	750	1100	1500	50	1.0	4.00 x 4.50	

Note:
Vimp: Maximum peak impulse voltage withstand with duration less than 10 ms.
Itrigger: Current required for the device to go from operating state to protected state.
tlimit: Time for the device to go from normal operating state to current limiting state.
Ron: Series resistance of the TCS™ device.

4.GDT

FLAT扁平式GDT产品

2017-xx-SMC — 2-Electrode SMD GDT with FLAT® Technology

Size (mm)	DC Breakdown Range (V)	Nominal 8/20 µs Impulse Discharge Current (kA) 10 Applications	Maximum 8 x 20 µs Impulse Current (kA) 1 Application	Maximum 10 x 350 µs Impulse Current (kA) 1 Application	Capacitance (pF)	Operating Temperature Range (°C)	Packaging Options
see data sheet	90 - 500	10	12	2.5	< 2.5	-55 to +85	Tape & Reel Bulk

2017-xx-SMH — 2-Electrode SMD GDT with FLAT® Technology

Size (mm)	DC Breakdown Range (V)	Nominal 8/20 µs Impulse Discharge Current (kA) 10 Applications	Maximum 8 x 20 µs Impulse Current (kA) 1 Application	Maximum 10 x 350 µs Impulse Current (kA) 1 Application	Capacitance (pF)	Operating Temperature Range (°C)	Packaging Options
see data sheet	90 - 500	10	12	2.5	< 2.5	-55 to +85	Tape & Reel Bulk

2018-xx-SMH — 3-Electrode SMD GDT with FLAT® Technology

Size (mm)	DC Breakdown Range (V)	Nominal 8/20 µs Impulse Discharge Current (kA) 10 Applications	Maximum 8 x 20 µs Impulse Current (kA) 1 Application	Maximum 10 x 350 µs Impulse Current (kA) 1 Application	Capacitance (pF)	Operating Temperature Range (°C)	Packaging Options
see data sheet	90 - 500	20	24	5	< 2.5	-55 to +105	Tape & Reel

2019-xx-SMH — 2-Electrode SMD GDT with FLAT® Technology

Size (mm)	DC Breakdown Range (V)	Nominal 8/20 µs Impulse Discharge Current (kA) 10 Applications	Maximum 8 x 20 µs Impulse Current (kA) 1 Application	Maximum 10 x 350 µs Impulse Current (kA) 1 Application	Capacitance (pF)	Operating Temperature Range (°C)	Packaging Options
see data sheet	90 - 230	20	25	5	< 4	-55 to +105	Tape & Reel

2电极标准表贴SMD GDT产品

2003-xx-SM Light Duty Miniature GDT

Size (mm)	DC Breakdown Range (V)	Nominal 8/20 µs Impulse Discharge Current (kA) 10 Applications	Maximum 8 x 20 µs Impulse Current (kA) 1 Application	Maximum 10 x 350 µs Impulse Current (kA) 1 Application	Capacitance (pF)	Operating Temperature Range (°C)	Packaging Options
see data sheet	75 - 470	1	2	Not Rated	< 0.5	-40 to +90	Tape & Reel

2051-xx-SM Light Duty Micro Duty GDT - *Extended Temperature Range*

Size (mm)	DC Breakdown Range (V)	Nominal 8/20 µs Impulse Discharge Current (kA) 10 Applications	Maximum 8 x 20 µs Impulse Current (kA) 1 Application	Maximum 10 x 350 µs Impulse Current (kA) 1 Application	Capacitance (pF)	Operating Temperature Range (°C)	Packaging Options
see data sheet	90 - 600	2	Not Rated	Not Rated	< 1	-40 to +125	Tape & Reel Bulk

2053-xx-SM Light Duty Miniature GDT

Size (mm)	DC Breakdown Range (V)	Nominal 8/20 µs Impulse Discharge Current (kA) 10 Applications	Maximum 8 x 20 µs Impulse Current (kA) 1 Application	Maximum 10 x 350 µs Impulse Current (kA) 1 Application	Capacitance (pF)	Operating Temperature Range (°C)	Packaging Options
see data sheet	75 - 600	3	5	Not Rated	< 1	-30 to +85	Tape & Reel Bulk

2035-xx-SM Long Life Medium Duty Miniature GDT

Size (mm)	DC Breakdown Range (V)	Nominal 8/20 µs Impulse Discharge Current (kA) 10 Applications	Maximum 8 x 20 µs Impulse Current (kA) 1 Application	Maximum 10 x 350 µs Impulse Current (kA) 1 Application	Capacitance (pF)	Operating Temperature Range (°C)	Packaging Options
see data sheet	90 - 600	5	10	1	< 1	-55 to +85	Tape & Reel Bulk

2055-xx-SM Medium Duty Miniature GDT

Size (mm)	DC Breakdown Range (V)	Nominal 8/20 µs Impulse Discharge Current (kA) 10 Applications	Maximum 8 x 20 µs Impulse Current (kA) 1 Application	Maximum 10 x 350 µs Impulse Current (kA) 1 Application	Capacitance (pF)	Operating Temperature Range (°C)	Packaging Options
see data sheet	90 - 600	5	8	Not Rated	< 1	-30 to +85	Tape & Reel Bulk

2027-xx-SM Long Life Heavy Duty SMD GDT - *Extended Temperature Range*

Size (mm)	DC Breakdown Range (V)	Nominal 8/20 µs Impulse Discharge Current (kA) 10 Applications	Maximum 8 x 20 µs Impulse Current (kA) 1 Application	Maximum 10 x 350 µs Impulse Current (kA) 1 Application	Capacitance (pF)	Operating Temperature Range (°C)	Packaging Options
see data sheet	75 - 600	10	25	2.5	< 1	-55 to +125	Tape & Reel Bulk

2029-xx-SMLF Long Life Heavy Duty SMD GDT - *Extended Temperature Range*

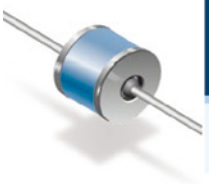
Size (mm)	DC Breakdown Range (V)	Nominal 8/20 µs Impulse Discharge Current (kA) 10 Applications	Maximum 8 x 20 µs Impulse Current (kA) 1 Application	Maximum 10 x 350 µs Impulse Current (kA) 1 Application	Capacitance (pF)	Operating Temperature Range (°C)	Packaging Options
see data sheet	90 - 420	20	25	5	< 1	-55 to +105	Tape & Reel Bulk

2电极标准插装GDT产品

2057-xx-XX Medium Duty Through-Hole Micro GDT

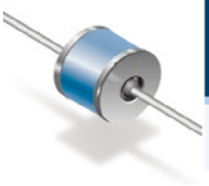
Size (mm)	DC Breakdown Range (V)	Nominal 8/20 µs Impulse Discharge Current (kA) 10 Applications	Maximum 8 x 20 µs Impulse Current (kA) 1 Application	Maximum 10 x 350 µs Impulse Current (kA) 1 Application	Capacitance (pF)	Operating Temperature Range (°C)	Packaging Options
see data sheet	75 - 470	5	10	Not Rated	< 1	-40 to +90	Tape & Reel Bulk

2035-xx-XX Long Life Medium Duty Through-Hole Miniature GDT



Size (mm)	DC Breakdown Range (V)	Nominal 8/20 µs Impulse Discharge Current (kA) 10 Applications	Maximum 8 x 20 µs Impulse Current (kA) 1 Application	Maximum 10 x 350 µs Impulse Current (kA) 1 Application	Capacitance (pF)	Operating Temperature Range (°C)	Packaging Options
see data sheet	90 - 600	5	10	1	< 1	-55 to +85	Tape & Reel Bulk

2037-xx-XX Long Life Medium Duty Through-Hole Miniature GDT



Size (mm)	DC Breakdown Range (V)	Nominal 8/20 µs Impulse Discharge Current (kA) 10 Applications	Maximum 8 x 20 µs Impulse Current (kA) 1 Application	Maximum 10 x 350 µs Impulse Current (kA) 1 Application	Capacitance (pF)	Operating Temperature Range (°C)	Packaging Options
see data sheet	90 - 600	5	10	1	< 1	-55 to +85	Tape & Reel Bulk

2045-xx-XX Medium Duty Through-Hole GDT

Size (mm)	DC Breakdown Range (V)	Nominal 8/20 µs Impulse Discharge Current (kA) 10 Applications	Maximum 8 x 20 µs Impulse Current (kA) 1 Application	Maximum 10 x 350 µs Impulse Current (kA) 1 Application	Capacitance (pF)	Operating Temperature Range (°C)	Packaging Options
see data sheet	75 - 470	10	15	Not Rated	< 1.5	-30 to +85	Tape & Reel Bulk

2049-xx-XX Heavy Duty Through-Hole GDT

Size (mm)	DC Breakdown Range (V)	Nominal 8/20 µs Impulse Discharge Current (kA) 10 Applications	Maximum 8 x 20 µs Impulse Current (kA) 1 Application	Maximum 10 x 350 µs Impulse Current (kA) 1 Application	Capacitance (pF)	Operating Temperature Range (°C)	Packaging Options
see data sheet	75 - 600	15	20	Not Rated	< 1.5	-30 to +85	Tape & Reel Bulk

2027-xx-XX Long Life Heavy Duty Through-Hole GDT - *Extended Temperature Range*

Size (mm)	DC Breakdown Range (V)	Nominal 8/20 µs Impulse Discharge Current (kA) 10 Applications	Maximum 8 x 20 µs Impulse Current (kA) 1 Application	Maximum 10 x 350 µs Impulse Current (kA) 1 Application	Capacitance (pF)	Operating Temperature Range (°C)	Packaging Options
see data sheet	75 - 600	10	25	2.5	< 1	-55 to +125	Tape & Reel Bulk

2电极高压GDT产品

2087-xxx-SM — High Voltage Miniature SMD GDT

Size (mm)	DC Breakdown Range (V)	Nominal 8/20 µs Impulse Discharge Current (kA) 10 Operations	Maximum 8 x 20 µs Impulse Current (kA) 1 Application	Capacitance (pF)	Operating Temperature Range (°C)	Packaging Options
see data sheet	800 - 2000	2	3	< 0.5	-30 to +85	Tape & Reel Bulk

2039-xxx-XX — High Voltage Miniature Through-Hole GDT

Size (mm)	DC Breakdown Range (V)	Nominal 8/20 µs Impulse Discharge Current (kA) 10 Operations	Maximum 8 x 20 µs Impulse Current (kA) 1 Application	Capacitance (pF)	Operating Temperature Range (°C)	Packaging Options
see data sheet	800 - 1100	2.5	5	< 1	-55 to +85	Tape & Reel Bulk

2039-xxx-SM — High Voltage Miniature SMD GDT

Size (mm)	DC Breakdown Range (V)	Nominal 8/20 µs Impulse Discharge Current (kA) 10 Operations	Maximum 8 x 20 µs Impulse Current (kA) 1 Application	Capacitance (pF)	Operating Temperature Range (°C)	Packaging Options
see data sheet	900 - 1100	2.5	5	< 1	-55 to +85	Tape & Reel Bulk

2089-xxx-XX — High Voltage Miniature Through-Hole GDT

Size (mm)	DC Breakdown Range (V)	Nominal 8/20 µs Impulse Discharge Current (kA) 10 Operations	Maximum 8 x 20 µs Impulse Current (kA) 1 Application	Capacitance (pF)	Operating Temperature Range (°C)	Packaging Options
see data sheet	1000 - 3600	1.5	3	< 1.5	-30 to +85	Tape & Reel Bulk

2093-xxx-SM — High Voltage SMD GDT

Size (mm)	DC Breakdown Range (V)	Nominal 8/20 µs Impulse Discharge Current (kA) 10 Operations	Maximum 8 x 20 µs Impulse Current (kA) 1 Application	Capacitance (pF)	Operating Temperature Range (°C)	Packaging Options
see data sheet	1000 - 3000	3	5	< 0.8	-30 to +85	Tape & Reel Bulk

2095-xxx-XX — High Voltage Through-Hole GDT

Size (mm)	DC Breakdown Range (V)	Nominal 8/20 µs Impulse Discharge Current (kA) 10 Operations	Maximum 8 x 20 µs Impulse Current (kA) 1 Application	Capacitance (pF)	Operating Temperature Range (°C)	Packaging Options
see data sheet	800 - 6000	5 / 3	8 / 5	< 1.5	-30 to +90	Tape & Reel Bulk

2097-xxx-D — Heavy Duty High Voltage Through-Hole GDT

Size (mm)	DC Breakdown Range (V)	Nominal 8/20 µs Impulse Discharge Current (kA) 10 Operations	Maximum 8 x 20 µs Impulse Current (kA) 1 Application	Capacitance (pF)	Operating Temperature Range (°C)	Packaging Options
see data sheet	1000 - 2200	20 5 Operations	25	< 1	-30 to +85	Bulk

SA2-xxxx-xxx-STD — High Voltage Through-Hole GDT - ***Extended Temperature Range***

Size (mm)	DC Breakdown Range (V)	Nominal 8/20 µs Impulse Discharge Current (kA) 10 Operations	Maximum 8 x 20 µs Impulse Current (kA) 1 Application	Capacitance (pF)	Operating Temperature Range (°C)	Packaging Options
see data sheet	2000 - 7200	5	10	< 1	-40 to +125	Tape & Reel Bulk

2电极大电流GDT产品

2047-xx-XX Long Life High Current Heavy Duty GDT

Size (mm)	DC Breakdown Range (V)	Nominal 8/20 µs Impulse Discharge Current (kA)	Maximum 8 x 20 µs Impulse Current (kA) 1 Application	Maximum 10 x 350 µs Impulse Current (kA) 1 Application	Capacitance (pF)	Operating Temperature Range (˚C)	Packaging Options
see data sheet	90 - 350	40 10 Operations	40	8	< 5	-40 to +90	Bulk

2061-xx-A High Current Heavy Duty 2-Electrode GDT

Size (mm)	DC Breakdown Range (V)	Nominal 8/20 µs Impulse Discharge Current (kA)	Maximum 8 x 20 µs Impulse Current (kA) 1 Application	Maximum 10 x 350 µs Impulse Current (kA) 1 Application	Capacitance (pF)	Operating Temperature Range (˚C)	Packaging Options
see data sheet	230 - 800	40 5 Operations	60	Not Rated	< 10	-30 to +85	Bulk

2063-xx-A High Current Heavy Duty 2-Electrode GDT

Size (mm)	DC Breakdown Range (V)	Nominal 8/20 µs Impulse Discharge Current (kA)	Maximum 8 x 20 µs Impulse Current (kA) 1 Application	Maximum 10 x 350 µs Impulse Current (kA) 1 Application	Capacitance (pF)	Operating Temperature Range (˚C)	Packaging Options
see data sheet	230 - 800	60 5 Operations	100	Not Rated	< 10	-30 to +85	Bulk

2电极和3电极快速响应GDT产品

2020-xxT Fast Acting 3-Electrode Miniature Through-Hole GDT

Size (mm)	Optional Fail-Short	Min. DC Breakdown Range (V)	Max. 8 x 20 µs Impulse Current (kA) 1 Application*	Capacitance (pF)	Operating Temperature Range (˚C)	Packaging Options
see data sheet	No	60 - 360	10	< 1	-40 to +90	Bulk

2030-xxT-SM Fast Acting 3-Electrode Miniature SMD GDT - *with optional Fail-Short*

Size (mm)	Optional Fail-Short	Min. DC Breakdown Range (V)	Max. 8 x 20 µs Impulse Current (kA) 1 Application*	Capacitance (pF)	Operating Temperature Range (˚C)	Packaging Options
see data sheet	Yes	185, 360	4	< 1	-40 to +90	Tape & Reel Bulk

2031-xxT-SM Fast Acting 2-Electrode Miniature SMD GDT

Size (mm)	Optional Fail-Short	Min. DC Breakdown Range (V)	Max. 8 x 20 µs Impulse Current (kA) 1 Application*	Capacitance (pF)	Operating Temperature Range (˚C)	Packaging Options
see data sheet	No	60 - 360	1	< 1	-40 to +90	Tape & Reel Bulk

2011-xxT-SM Fast Acting 2-Electrode SMD GDT with FLAT® Technology

Size (mm)	Optional Fail-Short	Min. DC Breakdown (V)	Max. 8 x 20 µs Impulse Current (kA) 1 Application*	Capacitance (pF)	Operating Temperature Range (˚C)	Packaging Options
see data sheet	No	60	1	< 2.9	-40 to +90	Tape & Reel Bulk

2电极新一代快速响应GDT产品

GDT25-xx-S1 Next-Generation Fast Acting GDT

Size (mm)	DC Breakdown Range (V)	Nominal 8/20 µs Impulse Discharge Current (kA) 10 Applications*	Max. 8 x 20 µs Impulse Current (kA) 1 Application*	Max. 10 x 350 µs Impulse Current (kA) 1 Application*	Capacitance (pF)	Operating Temperature Range (˚C)	Packaging Options
see data sheet	75, 90, 350, 600	5: (75V & 90V) 7: (350V and 600V)"	10	1	< 0.7	-55 to +125	Bulk, Tape and Reel

3电极标准SMD GDT产品

2052-xx-SM Light Duty Symmetrical Miniature SMD GDT

Size (mm)	DC Breakdown Range (V)	Nominal 8/20 µs Impulse Discharge Current (kA) 10 Applications*	Maximum 8 x 20 µs Impulse Current (kA) 1 Application*	Maximum 10 x 350 µs Impulse Current (kA) 1 Application*	Capacitance (pF)	Operating Temperature Range (˚C)	Packaging Options
see data sheet	230 - 600	5	10	Not Rated	< 2	-30 to +85	Tape & Reel, Bulk

2054-xx-SM Light Duty Miniature SMD GDT

Size (mm)	DC Breakdown Range (V)	Nominal 8/20 µs Impulse Discharge Current (kA) 10 Applications*	Maximum 8 x 20 µs Impulse Current (kA) 1 Application*	Maximum 10 x 350 µs Impulse Current (kA) 1 Application*	Capacitance (pF)	Operating Temperature Range (˚C)	Packaging Options
see data sheet	230 - 470	5	Not Rated	Not Rated	< 2	-30 to +85	Tape & Reel, Bulk

2038-xx-SM Long Life Light Duty Symmetrical Miniature SMD GDT

Size (mm)	DC Breakdown Range (V)	Nominal 8/20 µs Impulse Discharge Current (kA) 10 Applications*	Maximum 8 x 20 µs Impulse Current (kA) 1 Application*	Maximum 10 x 350 µs Impulse Current (kA) 1 Application*	Capacitance (pF)	Operating Temperature Range (˚C)	Packaging Options
see data sheet	150 - 600	5	10	Not Rated	< 1	-40 to +90	Tape & Reel, Bulk

2036-xx-SM Long Life Medium Duty Miniature SMD GDT - *Extended Temperature Range*

Size (mm)	DC Breakdown Range (V)	Nominal 8/20 µs Impulse Discharge Current (kA) 10 Applications*	Maximum 8 x 20 µs Impulse Current (kA) 1 Application*	Maximum 10 x 350 µs Impulse Current (kA) 1 Application*	Capacitance (pF)	Operating Temperature Range (˚C)	Packaging Options
see data sheet	75 - 600	10	20	2	< 2	-55 to +105	Tape & Reel, Bulk

2036-xx-SM-H Long Life Medium Duty Miniature SMD GDT - *High Temperature Range*

Size (mm)	DC Breakdown Range (V)	Nominal 8/20 µs Impulse Discharge Current (kA) 10 Applications*	Maximum 8 x 20 µs Impulse Current (kA) 1 Application*	Maximum 10 x 350 µs Impulse Current (kA) 1 Application*	Capacitance (pF)	Operating Temperature Range (˚C)	Packaging Options
see data sheet	75 - 600	10	20	2	< 2	-55 to +125	Tape & Reel, Bulk

**The rated current is the total current equally divided between each line to ground (ELTG).*

3电极高压SMD GDT产品

2052-xx-SM High Voltage Symmetrical Miniature SMD GDT

Size (mm)	DC Breakdown Range (V)	Nominal 8/20 µs Impulse Discharge Current (kA) 10 Applications*	Maximum 8 x 20 µs Impulse Current (kA) 1 Application*	Maximum 10 x 350 µs Impulse Current (kA) 1 Application*	Capacitance (pF)	Operating Temperature Range (˚C)	Packaging Options
see data sheet	800	5	10	Not Rated	< 2	-30 to +85	Tape & Reel

2038-xx-SM High Voltage Symmetrical Miniature SMD GDT

Size (mm)	DC Breakdown Range (V)	Nominal 8/20 µs Impulse Discharge Current (kA) 10 Applications*	Maximum 8 x 20 µs Impulse Current (kA) 1 Application*	Maximum 10 x 350 µs Impulse Current (kA) 1 Application*	Capacitance (pF)	Operating Temperature Range (˚C)	Packaging Options
see data sheet	800, 1100	5	10	Not Rated	< 1	-40 to +90	Tape & Reel, Bulk

3电极高压插装GDT产品

2056-xx-XX Light Duty Through-Hole GDT

Size (mm)	Optional Fail-Short	DC Breakdown Range (V)	Nominal 8/20 µs Impulse Discharge Current (kA) 10 Applications*	Max. 8 x 20 µs Impulse Current (kA) 1 Application*	Max. 10 x 350 µs Impulse Current (kA) 1 Application*	Capacitance (pF)	Operating Temperature Range (˚C)	Packaging Options
see data sheet	Yes	90 - 600	5	Not Rated	Not Rated	< 2	-30 to +85	Bulk

2046-xx-XX Medium Duty Through-Hole GDT

Size (mm)	Optional Fail-Short	DC Breakdown Range (V)	Nominal 8/20 µs Impulse Discharge Current (kA) 10 Applications*	Max. 8 x 20 µs Impulse Current (kA) 1 Application*	Max. 10 x 350 µs Impulse Current (kA) 1 Application*	Capacitance (pF)	Operating Temperature Range (˚C)	Packaging Options
see data sheet	Yes	90 - 600	10	20	Not Rated	< 2	-30 to +85	Bulk

2036-xx-XX Long Life Medium Duty Miniature Through-Hole GDT - *Extended Temperature Range*

Size (mm)	Optional Fail-Short	DC Breakdown Range (V)	Nominal 8/20 µs Impulse Discharge Current (kA) 10 Applications*	Max. 8 x 20 µs Impulse Current (kA) 1 Application*	Max. 10 x 350 µs Impulse Current (kA) 1 Application*	Capacitance (pF)	Operating Temperature Range (˚C)	Packaging Options
see data sheet	Yes Switch-Grade	75 - 600	10	20	2	< 2	-55 to +105	Bulk

2026-xx-XX Long Life Heavy Duty Through-Hole GDT

Size (mm)	Optional Fail-Short	DC Breakdown Range (V)	Nominal 8/20 µs Impulse Discharge Current (kA) 10 Applications*	Max. 8 x 20 µs Impulse Current (kA) 1 Application*	Max. 10 x 350 µs Impulse Current (kA) 1 Application*	Capacitance (pF)	Operating Temperature Range (˚C)	Packaging Options
see data sheet	Yes Switch-Grade	75 - 600	20	40	5	< 2	-40 to +90	Bulk

2026-xx-XX-MSP Heavy Duty Multi-Stage Through-Hole GDT

Size (mm)	Optional Fail-Short	DC Breakdown Range (V)	Nominal 8/20 µs Impulse Discharge Current (kA) 10 Applications*	Max. 8 x 20 µs Impulse Current (kA) 1 Application*	Max. 10 x 350 µs Impulse Current (kA) 1 Application*	Capacitance (pF)	Operating Temperature Range (˚C)	Packaging Options
see data sheet	Yes Switch-Grade	300 - 400	20	40	5	< 20	-55 to +85	Bulk

电力线GDT产品（无续流GDT）

2033-xx-A Powerline GDT

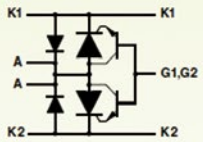
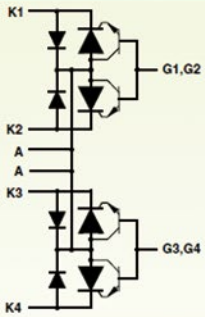
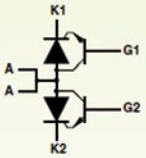
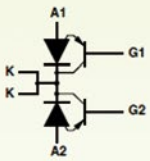
Size (mm)	DC Breakdown Range (V)	Nominal 8/20 µs Impulse Discharge Current (kA)	Maximum 8 x 20 µs Impulse Current (kA) 1 Application	Maximum 10 x 350 µs Impulse Current (kA) 1 Application	Capacitance (pF)	Operating Temperature Range (˚C)	Packaging Options
see data sheet	800 - 1400	20, 10 Operations	N/A	4	< 1	-40 to +125	Tape & Bulk

5.TISP

固定电压型TISP

Series				
TISP1xxx Dual Unidirectional	TISP3xxx Dual Bidirectional	TISP4xxx Single Bidirectional	TISP5xxx Single Unidirectional	TISP7xxx Triple Element Bidirectional
Device Symbol				
				
Applications				
• SLIC Linecard	• 3-Wire Ground Backed Ringer • Solid State Relay • Surge Bars	• 2-Wire System • ISDN Subset • Modems • Telephones • Fax Machines • xDSL • Set Top Boxes • Surge Bars	• SLIC Linecard • ISDN	• 3-Wire Battery Backed Ringer • ISDN / Interwire

门控型（可编程型）

Series			
TISP6xxxx TISPPBL3 Dual Programmable	TISP6NTP2x Quad Programmable	TISP8200M (Typically used as a complimentary pair) Dual Programmable Unidirectional for Negative Polarity	TISP8201M Dual Programmable Unidirectional for Positive Polarity
Device Symbol			
			
Applications			
• SLIC Linecard • Ericsson PBL 3xx SLIC	• Dual SLIC Lines • Cable Modems • ISDN Power Feeds • Smart NT • Set Top Boxes	• POTS Linecard • Dual Supply Ringing SLIC	

TISP1xxx系列——双体单向型过压保护器

Device	Delivery Options	Standoff Voltage V_{DRM} V	Protection Voltage $V_{(BO)}$ V	I_{PPSM} Ratings for Lightning Surge Standards			
				GR-1089-CORE 2/10 µs A	GR-1089-CORE 10/1000 µs A	ANSI C62.41 8/20 µs A	ITU-T K.20/45/21 5/310 µs A
TISP1072F3	DR, P, SL	58	72	80	35	70	50
TISP1082F3	DR, P, SL	66	82	80	35	70	50

TISP3xxx系列——双体双向型过压保护器

Device	Delivery Options	Standoff Voltage V_{DRM} V	Protection Voltage $V_{(BO)}$ V	I_{PPSM} Ratings for Lightning Surge Standards			
				GR-1089-CORE 2/10 µs A	GR-1089-CORE 10/1000 µs A	ANSI C62.41 8/20 µs A	ITU-T K.20/45/21 5/310 µs A
TISPL758LF3	DR	105, 180	130, 220	175	35	120	50
TISP3072F3	DR, P, SL	58	72	80	35	70	50
TISP3082F3	DR, P, SL	66	82	80	35	70	50
TISP3125F3	DR, P, SL	100	125	175	35	120	50
TISP3150F3	DR, P, SL	120	150	175	35	120	50
TISP3180F3	DR, P, SL	145	180	175	35	120	50
TISP3240F3	DR, P, SL	180	240	175	35	120	50
TISP3260F3	DR, P, SL	200	260	175	35	120	50
TISP3290F3	DR, P, SL	220	290	175	35	120	50
TISP3320F3	DR, P, SL	240	320	175	35	120	50
TISP3380F3	DR, P, SL	270	380	175	35	120	50
TISP3600F3	SL	420	600	190	45	175	70
TISP3700F3	SL	500	700	190	45	175	70
TISP3070H3	SL	58	70	500	100	300	200
TISP3080H3	SL	65	80	500	100	300	200
TISP3095H3	SL	75	95	500	100	300	200
TISP3115H3	SL	90	115	500	100	300	200
TISP3125H3	SL	100	125	500	100	300	200
TISP3135H3	SL	110	135	500	100	300	200
TISP3145H3	SL	120	145	500	100	300	200
TISP3180H3	SL	145	180	500	100	300	200
TISP3210H3	SL	160	210	500	100	300	200
TISP3250H3	SL	190	250	500	100	300	200
TISP3290H3	SL	220	390	500	100	300	200
TISP3350H3	SL	275	350	500	100	300	200
TISP3070T3	BJR	58	70	250	80	250	120
TISP3080T3	BJR	65	80	250	80	250	120
TISP3095T3	BJR	75	95	250	80	250	120
TISP3115T3	BJR	90	115	250	80	250	120
TISP3125T3	BJR	100	125	250	80	250	120
TISP3145T3	BJR	120	145	250	80	250	120
TISP3165T3	BJR	135	165	250	80	250	120
TISP3180T3	BJR	145	180	250	80	250	120
TISP3200T3	BJR	155	200	250	80	250	120
TISP3219T3	BJR	180	219	250	80	250	120
TISP3250T3	BJR	190	250	250	80	250	120
TISP3290T3	BJR	220	290	250	80	250	120
TISP3350T3	BJR	275	350	250	80	250	120
TISP3395T3	BJR	320	395	250	80	250	120

TISP4xxxHx系列（35A 10/1000us，150mA IH）——单体双向型过压保护器

Device	Delivery Options	Standoff Voltage V_{DRM} V	Protection Voltage $V_{(BO)}$ V	I_{PPSM} Ratings for Lightning Surge Standards			
				GR-1089-CORE 2/10 µs A	GR-1089-CORE 10/1000 µs A	TIA/EIA-IS-968 (FCC PART 68) 10/560 µs A	ITU-T K.20/45/21 5/310 µs A
TISP4072F3	LM, LMR, LMFR	58	72	80	35	60	50
TISP4082F3	LM, LMR, LMFR	66	82	80	35	60	50
TISP4125F3	LM, LMR, LMFR	100	125	175	35	60	50
TISP4150F3	LM, LMR, LMFR	120	150	175	35	60	50
TISP4180F3	LM, LMR, LMFR	145	180	175	35	60	50
TISP4240F3	LM, LMR, LMFR	180	240	175	35	60	50
TISP4260F3	LM, LMR, LMFR	200	260	175	35	60	50
TISP4290F3	LM, LMR, LMFR	220	290	175	35	60	50
TISP4320F3	LM, LMR, LMFR	240	320	175	35	60	50
TISP4380F3	LM, LMR, LMFR	270	380	175	35	60	50
TISP4600F3	LM, LMR, LMFR	420	600	190	45	110	70
TISP4700F3	LM, LMR, LMFR	500	700	190	45	110	70

TISP4xxxJx系列（35A 10/1000us，150mA IH）——单体双向型过压保护器

Device	Delivery Options	Standoff Voltage V_{DRM} V	Protection Voltage $V_{(BO)}$ V	Holding Current I_H mA	I_{PPSM} Ratings for Lightning Surge Standards			
					GR-1089-CORE 2/10 µs A	GR-1089-CORE 10/1000 µs A	TIA/EIA-IS-968 (FCC PART 68) 10/560 µs A	ITU-T K.20/45/21 5/310 µs A
TISP4015L1	AJR, BJR	8	15	50	150	30	35	45
TISP4030L1	AJR, BJR	15	30	50	150	30	35	45
TISP4040L1	AJR, BJR	25	40	50	150	30	35	45
TISP4070L3	AJR	58	70	150	125	30	40	50
TISP4080L3	AJR	65	80	150	125	30	40	50
TISP4090L3	AJR	70	90	150	125	30	40	50
TISP4125L3	AJR	100	125	150	125	30	40	50
TISP4145L3	AJR	120	145	150	125	30	40	50
TISP4165L3	AJR	135	165	150	125	30	40	50
TISP4180L3	AJR	145	180	150	125	30	40	50
TISP4220L3	AJR	160	220	150	125	30	40	50
TISP4240L3	AJR	180	240	150	125	30	40	50
TISP4260L3	AJR	200	260	150	125	30	40	50
TISP4290L3	AJR	230	290	150	125	30	40	50
TISP4320L3	AJR	240	320	150	125	30	40	50
TISP4350L3	AJR	275	350	150	125	30	40	50
TISP4360L3	AJR	290	360	150	125	30	40	50
TISP4395L3	AJR	320	395	150	125	30	40	50
TISP4070L3	BJR	58	70	150			30	40
TISP4350L3	BJR	275	350	150			30	40

TISP4xxxMx系列（35A 10/1000us，150mA IH）——单体双向型过压保护器

Device	Delivery Options	Standoff Voltage V_{DRM} V	Protection Voltage $V_{(BO)}$ V	I_{PPSM} Ratings for Lightning Surge Standards			
				GR-1089-CORE 2/10 µs A	GR-1089-CORE 10/1000 µs A	TIA/EIA-IS-968 (FCC PART 68) 10/560 µs A	ITU-T K.20/45/21 5/310 µs A
TISP4070M3	AJR, BJR, LM, LMR, LMFR	58	70	300	50	75	100
TISP4080M3	AJR, BJR, LM, LMR, LMFR	65	80	300	50	75	100
TISP4095M3	AJR, BJR, LM, LMR, LMFR	75	95	300	50	75	100
TISP4115M3	AJR, BJR, LM, LMR, LMFR	90	115	300	50	75	100
TISP4125M3	AJR, BJR, LM, LMR, LMFR	100	125	300	50	75	100
TISP4145M3	AJR, BJR, LM, LMR, LMFR	120	145	300	50	75	100
TISP4165M3	AJR, BJR, LM, LMR, LMFR	135	165	300	50	75	100
TISP4180M3	AJR, BJR, LM, LMR, LMFR	145	180	300	50	75	100
TISP4200M3	AJR, BJR	155	200	300	50	75	100
TISP4219M3	BJR	180	219	300	50	75	100
TISP4220M3	AJR, BJR, LM, LMR, LMFR	160	220	300	50	75	100
TISP4240M3	AJR, BJR, LM, LMR, LMFR	180	240	300	50	75	100
TISP4250M3	AJR, BJR, LM, LMR, LMFR	190	250	300	50	75	100
TISP4260M3	LM, LMR, LMFR	200	260	300	50	75	100
TISP4265M3	AJR, BJR, LM, LMR, LMFR	200	265	300	50	75	100
TISP4290M3	AJR, BJR, LM, LMR, LMFR	220	290	300	50	75	100
TISP4300M3	AJR, BJR, LM, LMR, LMFR	230	300	300	50	75	100
TISP4350M3	AJR, BJR, LM, LMR, LMFR	275	350	300	50	75	100
TISP4360M3	AJR, BJR, LM, LMR, LMFR	290	360	300	50	75	100
TISP4395M3	AJR, BJR, LM, LMR, LMFR	320	395	300	50	75	100
TISP4400M3	BJR, LM, LMR, LMFR	300	400	300	50	75	100
TISP4350MM	AJR, BJR	230	300	250	50	55	65
TISP4350MM	AJR, BJR	275	350	250	50	55	65
TISP4360MM	AJR, BJR	290	360	250	50	55	65

TISP4xxxTx系列（35A 10/1000us，150mA IH）——单体双向型过压保护器

Device	Delivery Options	Standoff Voltage V_{DRM} V	Protection Voltage $V_{(BO)}$ V	I_{PPSM} Ratings for Lightning Surge Standards			
				GR-1089-CORE 2/10 µs A	GR-1089-CORE 10/1000 µs A	TIA/EIA-IS-968 (FCC PART 68) 10/560 µs A	ITU-T K.20/45/21 5/310 µs A
TISP4290T3	BJR	220	290	250	80	100	120
TISP4350T3	BJR	275	350	250	80	100	120

TISP4xxxHx系列 (35A 10/1000us，150mA IH) ——单体双向型过压保护器

Device	Delivery Options	Standoff Voltage V_{DRM} V	Protection Voltage $V_{(BO)}$ V	Holding Current I_H mA	I_{PPSM} Ratings for Lightning Surge Standards			
					GR-1089-CORE 2/10 µs A	GR-1089-CORE 10/1000 µs A	TIA/EIA-IS-968 (FCC PART 68) 10/560 µs A	ITU-T K.20/45/21 5/310 µs A
TISP4015H1	BJR	8	15	50	500	100	125	150
TISP4030H1	BJR	15	30	50	500	100	125	150
TISP4040H1	BJR	25	40	50	500	100	125	150
TISP4070H3	BJR, LM, LMR, LMFR	58	70	150	500	100	160	200
TISP4080H3	BJR, LM, LMR, LMFR	65	80	150	500	100	160	200
TISP4095H3	BJR, LM, LMR, LMFR	75	95	150	500	100	160	200
TISP4115H3	BJR, LM, LMR, LMFR	90	115	150	500	100	160	200
TISP4125H3	BJR, LM, LMR, LMFR	100	125	150	500	100	160	200
TISP4145H3	BJR, LM, LMR, LMFR	120	145	150	500	100	160	200
TISP4165H3	BJR, LM, LMR, LMFR	135	165	150	500	100	160	200
TISP4180H3	BJR, LM, LMR, LMFR	145	180	150	500	100	160	200
TISP4200H3	BJR, LM, LMR, LMFR	155	200	150	500	100	160	200
TISP4219H3	BJR	180	219	150	500	100	160	200
TISP4220H3	BJR	160	220	150	500	100	160	200
TISP4240H3	BJR, LM, LMR, LMFR	180	240	150	500	100	160	200
TISP4250H3	BJR, LM, LMR, LMFR	190	250	150	500	100	160	200
TISP4260H3	LM, LMR, LMFR	200	260	150	500	100	160	200
TISP4265H3	BJR	200	265	150	500	100	160	200
TISP4290H3	BJR, LM, LMR, LMFR	220	290	150	500	100	160	200
TISP4300H3	BJR, LM, LMR, LMFR	230	300	150	500	100	160	200
TISP4350H3	BJR, LM, LMR, LMFR	275	350	150	500	100	160	200
TISP4360H3	BJR	290	360	150	500	100	160	200
TISP4395H3	BJR, LM, LMR, LMFR	320	395	150	500	100	160	200
TISP4400H3	BJR, LM, LMR, LMFR	300	400	150	500	100	160	200
TISP4500H3	BJR	350	500	150	-	-	-	200
TISP4165H4	BJR	135	165	225	500	100	160	200
TISP4180H4	BJR	145	180	225	500	100	160	200
TISP4200H4	BJR	155	200	225	500	100	160	200
TISP4265H4	BJR	200	265	225	500	100	160	200
TISP4300H4	BJR	230	300	225	500	100	160	200
TISP4350H4	BJR	270	350	225	500	100	160	200

TISP4xxxJx系列 (35A 10/1000us，150mA IH) ——单体双向型过压保护器

Device	Delivery Options	Standoff Voltage V_{DRM} V	Protection Voltage $V_{(BO)}$ V	I_{PPSM} Ratings for Lightning Surge Standards			
				GR-1089-CORE 2/10 µs A	GR-1089-CORE 10/1000 µs A	TIA/EIA-IS-968 (FCC PART 68) 10/560 µs A	ITU-T K.20/45/21 5/310 µs A
TISP4070J1	BJR	58	70	1000	200	300	350
TISP4080J1	BJR	65	80	1000	200	300	350
TISP4095J1	BJR	75	95	1000	200	300	350
TISP4115J1	BJR	90	115	1000	200	300	350
TISP4125J1	BJR	100	125	1000	200	300	350
TISP4145J1	BJR	120	145	1000	200	300	350
TISP4165J1	BJR	135	165	1000	200	300	350
TISP4180J1	BJR	145	180	1000	200	300	350
TISP4200J1	BJR	155	200	1000	200	300	350
TISP4219J1	BJR	180	219	1000	200	300	350
TISP4250J1	BJR	190	250	1000	200	300	350
TISP4290J1	BJR	220	290	1000	200	300	350
TISP4350J1	BJR	275	350	1000	200	300	350
TISP4395J1	BJR	320	395	1000	200	300	350

TISP5xxxHx系列——单体单向型过压保护器

Device	Delivery Options	Standoff Voltage V_{DRM} V	Protection Voltage $V_{(BO)}$ V	I_{PPSM} Ratings for Lightning Surge Standards			
				GR-1089-CORE 2/10 µs A	GR-1089-CORE 10/1000 µs A	TIA/EIA-IS-968 (FCC PART 68) 10/160 µs A	ITU-T K.20/45/21 5/310 µs A
TISP5070H3	BJR	-58	-70	500	100	250	200
TISP5080H3	BJR	-65	-80	500	100	250	200
TISP5095H3	BJR	-75	-95	500	100	160	200
TISP5110H3	BJR	-80	-110	500	100	250	200
TISP5115H3	BJR	-90	-115	500	100	250	200
TISP5150H3	BJR	-120	-150	500	100	250	200

TISP7xxx系列——三元件双向型过压保护器

Device	Delivery Options	Standoff Voltage V_{DRM} V	Protection Voltage $V_{(BO)}$ V	I_{PPSM} Ratings for Lightning Surge Standards			
				GR-1089-CORE 2/10 µs A	GR-1089-CORE 10/1000 µs A	ANSI C62.41 8/20 µs A	ITU-T K.20/45/21 5/310 µs A
TISP7015	DR	8	15		30	150	40
TISP7038	DR	28	38		30	150	40
TISP7072F3	DR, P, SL	58	72	85	45	80	70
TISP7082F3	DR, P, SL	66	82	85	45	80	70
TISP7125F3	DR, P, SL	100	125	190	45	175	70
TISP7150F3	DR, P, SL	120	150	190	45	175	70
TISP7180F3	DR, P, SL	145	180	190	45	175	70
TISP7240F3	DR, P, SL	180	240	190	45	175	70
TISP7260F3	DR, P, SL	200	260	190	45	175	70
TISP7290F3	DR, P, SL	220	290	190	45	175	70
TISP7320F3	DR, P, SL	240	320	190	45	175	70
TISP7350F3	DR, P, SL	275	350	190	45	175	70
TISP7380F3	DR, P, SL	270	380	190	45	175	70
TISP7070H3	SL	58	70	500	100	350	200
TISP7080H3	SL	65	80	500	100	350	200
TISP7095H3	SL	75	95	500	100	350	200
TISP7125H3	SL	100	125	500	100	350	200
TISP7135H3	SL	110	135	500	100	350	200
TISP7145H3	SL	120	145	500	100	350	200
TISP7165H3	SL	130	165	500	100	350	200
TISP7180H3	SL	145	180	500	100	350	200
TISP7200H3	SL	150	200	500	100	350	200
TISP7210H3	SL	160	210	500	100	350	200
TISP7220H3	SL	160	210	500	100	350	200
TISP7250H3	SL	200	250	500	100	350	200
TISP7290H3	SL	230	290	500	100	350	200
TISP7350H3	SL	275	350	500	100	350	200
TISP7400H3	SL	300	400	500	100	350	200

TISP6xxx系列——双体可编程型过压保护器

Device	Delivery Options	Standoff Voltage V_{DRM} V	Protection Voltage $V_{(BO)}$ V	I_{PPSM} Ratings for Lightning Surge Standards GR-1089-CORE 2/10 µs A	GR-1089-CORE 10/1000 µs A	ANSI C62.41 8/20 µs A	ITU-T K.20/45/21 5/310 µs A
TISP61060	DR, P	Programmable -5 to -85		50	30	-	
TISP61089	DR, P	Programmable 0 to -85		120	30	-	40
TISP61089S	DR	Programmable 0 to -85		120	30	-	40
TISP61089A	DR, P	Programmable 0 to -120		120	30	-	40
TISP61089AS	DR	Programmable 0 to -120		120	30	-	40
TISP61089B	DR	Programmable 0 to -170		120	30	-	40
TISP61511	DR	Programmable 0 to -85		170	30	90	40
TISP61512	P	Programmable 0 to -85		170	30	90	40
TISP61521	DR	Programmable 0 to -170		170	30	100	40
TISPPBL1	DR, P, SE	Programmable 0 to -90		100	30	-	40
TISPPBL2	DR, P	Programmable 0 to -90		100	30	-	40
TISPPBL2S	DR	Programmable 0 to -90		100	30	-	40
TISPPBL3	DR	Programmable 0 to -170		100	30	-	40

TISP6NTP2x系列—双体可编程型过压保护器

Device	Delivery Options	Standoff Voltage V_{DRM} V	Protection Voltage $V_{(BO)}$ V	I_{PPSM} Ratings for Lightning Surge Standards GR-1089-CORE 2/10 µs A	GR-1089-CORE 10/1000 µs A	ANSI C62.41 8/20 µs A	ITU-T K.20/45/21 5/310 µs A
TISP6NTP2A	DR	Programmable 0 to -90		85	20	60	25
TISP6NTP2B	DR	Programmable 0 to -120		70	20	60	25

TISP8250—可编程单向型过压保护器

Device	Delivery Options	Standoff Voltage V_{DRM} V	Protection Voltage $V_{(BO)}$ V	I_{PPSM} Ratings for Lightning Surge Standards GR-1089-CORE 2/10 µs A	GR-1089-CORE 10/1000 µs A	ITU-T K.20/45/21 5/310 µs A
TISP8250	DR	250	340	75	30	40

TISP820xM系列—双体单向型反向阻塞可编程过压保护器

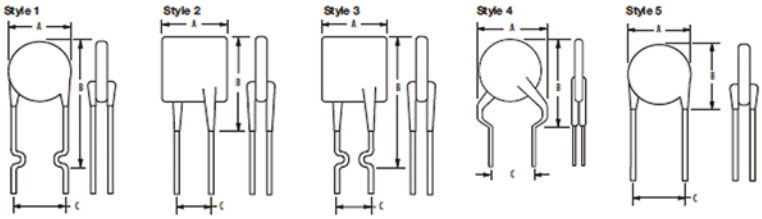
Device	Delivery Options	Standoff Voltage V_{DRM} V	Protection Voltage $V_{(BO)}$ V	Holding Current I_H mA	I_{PPSM} Ratings for Lightning Surge Standards GR-1089-CORE 2/10 µs A	GR-1089-CORE 10/1000 µs A	ITU-T K.20/45/21 5/310 µs A
TISP8200M	DR	Programmable 0 to -90		-150	-45	-210	-70
TISP8201M	DR	Programmable 0 to +90		+20	+45	+210	+70

TISP83121系列—双门控单向型过压保护器

Device	Delivery Options	Standoff Voltage V_{DRM} V	Protection Voltage $V_{(BO)}$ V	I_{PPSM} Ratings for Lightning Surge Standards GR-1089-CORE 10/1000 µs A	ANSI C62.41 8/20 µs A	ITU-T K.20/45/21 5/310 µs A
TISP83121	DR	Programmable 0 to ±100		150	500	150

6.PTC

径向引线型低压PPTC



Features

- Bulk or tape & reel packaging
- Industry standard sizes

Applications

- Computers and peripherals
- General electronics
- Automotive
- Consumer appliances
- Electronic toys

MF-R Series
Radial Leaded

16-60 Volts
0.05 – 11 Amps Hold Current

Model	I_{hold} Amperes at 23 °C	V max. Volts	I max. Amps	Initial Resistance Ohms at 23 °C Min.	Initial Resistance Ohms at 23 °C Max.	1 Hour (R_1) Post-Trip Resistance Ohms at 23 °C Max.	Dimensions mm/(in) A Max.	Dimensions mm/(in) B Max.	Dimensions mm/(in) C Nom.	Style
MF-R005	0.05	60	40	7.3	22.0	8.0 (0.315)	8.3 (0.327)	5.1 (0.201)		4
MF-R010	0.10	60	40	2.50	7.50	7.4 (0.291)	12.7 (0.500)	5.1 (0.201)		1
MF-R017	0.17	60	40	2.00	8.00	7.4 (0.291)	12.7 (0.500)	5.1 (0.201)		1
MF-R020	0.20	60	40	1.50	4.40	7.4 (0.291)	12.7 (0.500)	5.1 (0.201)		1
MF-R025	0.25	60	40	1.00	3.00	7.4 (0.291)	12.7 (0.500)	5.1 (0.201)		1
MF-R030	0.30	60	40	0.76	2.10	7.4 (0.291)	13.4 (0.528)	5.1 (0.201)		1
MF-R040	0.40	60	40	0.52	1.29	7.4 (0.291)	13.7 (0.539)	5.1 (0.201)		1
MF-R050	0.50	60	40	0.41	1.17	7.9 (0.311)	13.7 (0.539)	5.1 (0.201)		1
MF-R065	0.65	60	40	0.27	0.72	9.7 (0.382)	15.2 (0.598)	5.1 (0.201)		1
MF-R075	0.75	60	40	0.18	0.60	10.4 (0.409)	16.0 (0.630)	5.1 (0.201)		1
MF-R090	0.90	60	40	0.14	0.47	11.7 (0.461)	16.7 (0.657)	5.1 (0.201)		1
MF-R090-0-9	0.90	30	40	0.07	0.22	7.4 (0.291)	12.2 (0.480)	5.1 (0.201)		3
MF-R110	1.10	30	40	0.10	0.27	8.9 (0.350)	14.0 (0.551)	5.1 (0.201)		1
MF-R135	1.35	30	40	0.065	0.17	8.9 (0.350)	18.9 (0.744)	5.1 (0.201)		1
MF-R160	1.60	30	40	0.055	0.15	10.2 (0.402)	16.8 (0.661)	5.1 (0.201)		1
MF-R185	1.85	30	40	0.040	0.11	12.0 (0.472)	18.4 (0.724)	5.1 (0.201)		1
MF-R250	2.50	30	40	0.025	0.07	12.0 (0.472)	18.3 (0.720)	5.1 (0.201)		2
MF-R250-0-10	2.50	30	40	0.025	0.07	12.0 (0.472)	18.3 (0.720)	5.1 (0.201)		3
MF-R300	3.00	30	40	0.020	0.08	12.0 (0.472)	18.3 (0.720)	5.1 (0.201)		2
MF-R400	4.00	30	40	0.010	0.05	14.4 (0.567)	24.8 (0.976)	5.1 (0.201)		2
MF-R500	5.00	30	40	0.010	0.05	17.4 (0.685)	24.9 (0.980)	10.2 (0.402)		2
MF-R600	6.00	30	40	0.005	0.04	19.3 (0.760)	31.9 (1.256)	10.2 (0.402)		2
MF-R700	7.00	30	40	0.005	0.03	22.1 (0.870)	29.8 (1.173)	10.2 (0.402)		2
MF-R800	8.00	30	40	0.005	0.03	24.2 (0.953)	32.9 (1.295)	10.2 (0.402)		2
MF-R900	9.00	30	40	0.005	0.02	24.2 (0.953)	32.9 (1.295)	10.2 (0.402)		2
MF-R1100	11.00	16	100	0.003	0.014	24.2 (0.953)	32.9 (1.295)	10.2 (0.402)		2

MF-RG Series
Radial Leaded 16 V

Operating Temperature
-40 °C ~ 85 °C

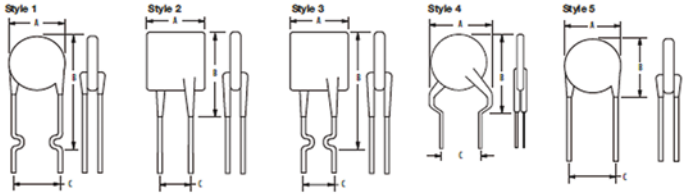
Model	I_{hold} Amperes at 23 °C	V max. Volts	I max. Amps	Initial Resistance Ohms at 23 °C Min.	Initial Resistance Ohms at 23 °C Max.	1 Hour (R_1) Post-Trip Resistance Ohms at 23 °C Max.	Dimensions mm/(in) A Max.	Dimensions mm/(in) B Max.	Dimensions mm/(in) C Nom.	Style
MF- RG300	3.0	16	100	38	64.5	7.1 (0.28)	11.0 (0.443)	5.1 ±0.7 (0.201 ±0.028)		2
MF- RG400	4.0	16	100	21	38.5	8.9 (0.35)	12.8 (0.443)	5.1 ±0.7 (0.201 ±0.028)		2
MF- RG500	5.0	16	100	15	23	10.4 (0.409)	14.3 (0.563)	5.1 ±0.7 (0.201 ±0.028)		2
MF- RG600	6.0	16	100	10	18.5	10.7 (0.421)	17.1 (0.673)	5.1 ±0.7 (0.201 ±0.028)		2
MF- RG650	6.5	16	100	8.8	15.8	11.24 (0.441)	19.7 (0.776)	5.1 ±0.7 (0.201 ±0.028)		2
MF- RG700	7.0	16	100	7.7	13.0	11.2 (0.441)	19.7 (0.776)	5.1 ±0.7 (0.201 ±0.028)		2
MF- RG800	8.0	16	100	5.6	11	12.7 (0.500)	20.9 (0.823)	5.1 ±0.7 (0.201 ±0.028)		2
MF- RG900	9.0	16	100	4.7	9.2	14.0 (0.551)	21.7 (0.854)	5.1 ±0.7 (0.201 ±0.028)		2
MF- RG1000	10.0	16	100	4.0	7.1	16.5 (0.650)	21.7 (0.854)	5.1 ±0.7 (0.201 ±0.028)		2
MF- RG1100	11.0	16	100	3.7	6.2	17.5 (0.689)	26 (1.024)	5.1 ±0.7 (0.201 ±0.028)		2

MF-RHT Series
Radial Leaded High Temperature

Operating Temperature
-40 °C ~ +125 °C

Model	I_{hold} Amperes at 23 °C	V max. Volts	I max. Amps	Initial Resistance Ohms at 23 °C Min.	Initial Resistance Ohms at 23 °C Max.	1 Hour (R_1) Post-Trip Resistance Ohms at 23 °C Max.	Dimensions mm/(in) A Max.	Dimensions mm/(in) B Max.	Dimensions mm/(in) C Nom.	Style
MF-RHT050	0.5	16	40	0.48	1.1	7.4 (0.291)	12.7 (0.5)	5.1 (0.201)		3
MF-RHT070	0.7	16	40	0.3	0.8	6.86 (0.27)	10.8 (0.425)	5.1 (0.201)		3
MF-RHT200	2.0	16	100	0.045	0.110	9.4 (0.37)	14.0 (0.55)	5.1 (0.201)		1
MF-RHT200/32	2.0	32	50	0.045	0.110	9.4 (0.37)	14.0 (0.55)	5.1 (0.201)		1
MF-RHT450	4.5	16	100	0.022	0.054	10.4 (0.41)	15.6 (0.61)	5.1 (0.201)		2
MF-RHT650	6.5	16	100	0.011	0.026	12.7 (0.5)	22.2 (0.88)	5.1 (0.201)		2
MF-RHT750	7.5	16	100	0.0094	0.022	14.0 (0.55)	23.5 (0.93)	5.1 (0.201)		2
MF-RHT1300	13.0	16	100	0.0041	0.01	23.5 (0.925)	28.7 (1.17)	10.2 (0.402)		2

径向引线型低压PPTC



Features

- Bulk or tape & reel packaging
- Industry standard sizes

Applications

- Computers and peripherals
- General electronics
- Automotive
- Consumer appliances
- Electronic toys

MF-RX/72 Series
Radial Leaded

72 Volts
0.20 – 3.75 Amps Hold Current

Model	I_{hold} Amperes at 23 °C	V max. Volts	I max. Amps	Initial Resistance Ohms at 23 °C Min.	Initial Resistance Ohms at 23 °C Max.	1 Hour (R_1) Post-Trip Resistance Ohms at 23 °C Max.	Dimensions mm/(in) A Max.	Dimensions mm/(in) B Max.	Dimensions mm/(in) C Nom.	Style
MF-RX020/72	0.20	72	40	1.50	4.40	7.4 (0.291)	12.7 (0.500)	5.1 (0.201)		1
MF-RX025/72	0.25	72	40	1.00	3.00	7.4 (0.291)	12.7 (0.500)	5.1 (0.201)		1
MF-RX030/72	0.30	72	40	0.76	2.10	7.4 (0.291)	13.4 (0.528)	5.1 (0.201)		1
MF-RX040/72	0.40	72	40	0.52	1.29	7.4 (0.291)	13.7 (0.539)	5.1 (0.201)		1
MF-RX050/72	0.50	72	40	0.41	1.17	7.9 (0.311)	13.7 (0.539)	5.1 (0.201)		1
MF-RX065/72	0.65	72	40	0.27	0.72	9.7 (0.382)	15.2 (0.598)	5.1 (0.201)		1
MF-RX075/72	0.75	72	40	0.18	0.60	10.4 (0.409)	16.0 (0.630)	5.1 (0.201)		1
MF-RX090/72	0.90	72	40	0.14	0.47	11.7 (0.461)	16.7 (0.657)	5.1 (0.201)		1
MF-RX110/72	1.10	72	40	0.15	0.38	10.84 (0.427)	16.84 (0.662)	5.1 (0.201)		2
MF-RX135/72	1.35	72	40	0.12	0.30	12.26 (0.483)	18.26 (0.718)	5.1 (0.201)		2
MF-RX160/72	1.60	72	40	0.09	0.22	13.94 (0.549)	19.94 (0.785)	5.1 (0.201)		2
MF-RX185/72	1.85	72	40	0.08	0.19	15.18 (0.598)	21.18 (0.833)	5.1 (0.201)		2
MF-RX250/72	2.50	72	40	0.05	0.13	17.84 (0.702)	23.84 (0.938)	10.2 (0.402)		2
MF-RX300/72	3.00	72	40	0.04	0.10	20.67 (0.814)	26.67 (1.050)	10.2 (0.402)		2
MF-RX375/72	3.75	72	40	0.03	0.08	23.51 (0.926)	29.51 (1.161)	10.2 (0.402)		2

MF-RX Series*
Radial Leaded

60 Volts
1.10 – 3.75 Amps Hold Current

Model	I_{hold} Amperes at 23 °C	V max. Volts	I max. Amps	Initial Resistance Ohms at 23 °C Min.	Initial Resistance Ohms at 23 °C Max.	1 Hour (R_1) Post-Trip Resistance Ohms at 23 °C Max.	Dimensions mm/(in) A Max.	Dimensions mm/(in) B Max.	Dimensions mm/(in) C Nom.	Style
MF-RX110	1.10	60	40	0.15	0.38	13.0 (0.512)	18.0 (0.709)	5.1 (0.201)		5
MF-RX135	1.35	60	40	0.12	0.30	14.5 (0.571)	19.6 (0.772)	5.1 (0.201)		5
MF-RX160	1.60	60	40	0.09	0.22	16.3 (0.642)	21.3 (0.839)	5.1 (0.201)		5
MF-RX185	1.85	60	40	0.08	0.19	17.8 (0.701)	22.9 (0.902)	5.1 (0.201)		5
MF-RX250	2.50	60	40	0.05	0.13	21.3 (0.839)	26.4 (1.039)	10.2 (0.402)		5
MF-RX300	3.00	60	40	0.04	0.10	24.9 (0.980)	30.0 (1.181)	10.2 (0.402)		5
MF-RX375	3.75	60	40	0.03	0.08	28.4 (1.118)	33.5 (1.319)	10.2 (0.402)		5

Not recommended for new designs, suggest using new MF-RX/72 Series

MF-RM Series
Radial Leaded

60 Volts
1.10 – 3.75 Amps Hold Current

Model	I_{hold} Amperes at 23 °C	V max. Volts	I max. Amps	Initial Resistance Ohms at 23 °C Min.	Initial Resistance Ohms at 23 °C Max.	1 Hour (R_1) Post-Trip Resistance Ohms at 23 °C Max.	Dimensions mm/(in) A Max.	Dimensions mm/(in) B Max.	Dimensions mm/(in) C Nom.	Style
MF-RM005/240	0.05	240	1.0	18.50	65.00	8.3 (0.327)	12.9 (0.508)	5.1 (0.201)		2
MF-RM008/240	0.08	240	1.2	7.40	26.00	8.3 (0.327)	12.9 (0.508)	5.1 (0.201)		2
MF-RM012/240	0.12	240	1.2	3.00	12.00	8.3 (0.327)	12.9 (0.508)	5.1 (0.201)		2
MF-RM016/240	0.16	240	2.0	2.50	7.80	9.9 (0.390)	13.8 (0.543)	5.1 (0.201)		2
MF-RM025/240	0.25	240	3.5	1.30	3.80	10.0 (0.394)	20.0 (0.787)	5.1 (0.201)		2
MF-RM033/240	0.33	240	4.5	0.77	2.60	11.4 (0.449)	20.0 (0.787)	5.1 (0.201)		2
MF-RM040/240	0.40	240	5.5	0.60	1.90	11.5 (0.453)	20.9 (0.823)	5.1 (0.201)		2
MF-RM055/240	0.55	240	7.0	0.45	1.45	14.0 (0.551)	22.4 (0.882)	5.1 (0.201)		2

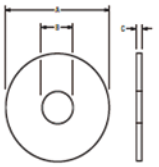
圆盘和芯片型PPTC

MF-D Series*
Disc Configuration

15 Volts
2.5 – 12.2 Amps Hold Current

Model	I_{hold} Amperes at 23 °C	V max. Volts	I max. Amps	Initial Resistance Ohms at 23 °C Min.	Initial Resistance Ohms at 23 °C Max.	1 Hour (R_1) Post-Trip Resistance Ohms at 23 °C Max.	Dimensions mm/(in) A Max.	Dimensions mm/(in) B Max.	Dimensions mm/(in) C Max.	Style
MF-D	2.5	15	10	0.015	0.032	14.4 (0.567)	6.3 (0.248)	0.36 (0.014)		1
MF-D	3.5	15	20	0.015	0.032	16.4 (0.646)	10.0 (0.394)	0.36 (0.014)		1
MF-D	5.5	15	40	0.014	0.30	16.08 (0.633)	9.0 (0.354)	0.36 (0.014)		1
MF-D	12.2	15	50	0.007	0.017	2.4 (0.945)	–	0.36 (0.014)		1

For ordering information, contact your Bourns representative.



Features

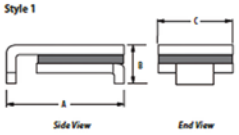
- Custom designs to meet appropriate applications
- Compatible with current industry standards
- Overcurrent and overtemperature protection
- Standard and low temperature material
- Patents pending

Applications

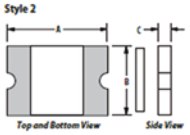
- Lithium cells
- Battery cells
- Powered toys
- Motors

表贴型低压PPTC

Style 1



Style 2



Features
- Tape & reel packaging
- Industry standard sizes

Applications
- Computers and peripherals
- General electronics
- Automotive

MF-SM Series (3425 package) 15 - 33 Volts
Surface Mount (8763 mm) 1.50 – 2.50 Amps Hold Current

Model	I_{hold} Amperes at 23 °C	V max. Volts	I max. Amps	Initial Resistance Ohms at 23 °C Min.	Initial Resistance Ohms at 23 °C Max.	1 Hour (R_1) Post-Trip Resistance Ohms at 23 °C Max.	Dimensions mm/(in) A Max.	Dimensions mm/(in) B Max.	Dimensions mm/(in) C Max.	Style
MF-SM150	1.50	15	100	0.06	0.25		9.50 (0.374)	3.0 (0.118)	6.71 (0.264)	1
MF-SM150/33	1.50	33	40	0.06	0.23		9.50 (0.374)	3.0 (0.118)	6.71 (0.264)	1
MF-SM185/33	1.80	33	40	0.04	0.15		9.50 (0.374)	3.0 (0.118)	6.71 (0.264)	1
MF-SM200	2.00	15	100	0.045	0.125		9.50 (0.374)	3.0 (0.118)	6.71 (0.264)	1
MF-SM250	2.50	15	100	0.024	0.085		9.50 (0.374)	3.0 (0.118)	6.71 (0.264)	1

MF-SM Series (2920 package) 6-60 Volts
Surface Mount (7555 mm) 0.30 – 3.00 Amps Hold Current

Model	I_{hold} Amperes at 23 °C	V max. Volts	I max. Amps	Initial Resistance Ohms at 23 °C Min.	Initial Resistance Ohms at 23 °C Max.	1 Hour (R_1) Post-Trip Resistance Ohms at 23 °C Max.	Dimensions mm/(in) A Max.	Dimensions mm/(in) B Max.	Dimensions mm/(in) C Nom.	Style
MF-SM030	0.30	60	40	0.90	4.80		7.98 (0.314)	3.18 (0.125)	5.44 (0.214)	1
MF-SM050	0.50	60	40	0.35	1.40		7.98 (0.314)	3.18 (0.125)	5.44 (0.214)	1
MF-SM075	0.75	30	80	0.23	1.00		7.98 (0.314)	3.18 (0.125)	5.44 (0.214)	1
MF-SM075/60	0.75	60	10	0.23	1.00		7.98 (0.314)	3.18 (0.125)	5.44 (0.214)	1
MF-SM100	1.10	30	80	0.12	0.48		7.98 (0.314)	3.0 (0.118)	5.44 (0.214)	1
MF-SM100/33	1.10	33	40	0.12	0.41		7.98 (0.314)	3.0 (0.118)	5.44 (0.214)	1
MF-SM125	1.25	15	100	0.07	0.25		7.98 (0.314)	3.0 (0.118)	5.44 (0.214)	1
MF-SM260	2.60	6	100	0.025	0.075		7.98 (0.314)	3.0 (0.118)	5.44 (0.214)	1
MF-SM300	3.00	6	100	0.015	0.048		7.98 (0.314)	3.0 (0.118)	5.44 (0.214)	1

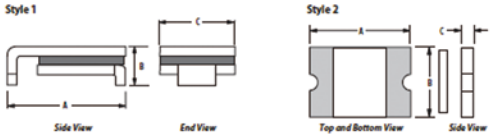
MF-NSMF Series (1206 package) 6 - 30 Volts
Surface Mount (3216 mm) 0.12 – 2.00 Amps Hold Current

Model	I_{hold} Amperes at 23 °C	V max. Volts	I max. Amps	Initial Resistance Ohms at 23 °C Min.	Initial Resistance Ohms at 23 °C Max.	1 Hour (R_1) Post-Trip Resistance Ohms at 23 °C Max.	Dimensions mm/(in) A Max.	Dimensions mm/(in) B Max.	Dimensions mm/(in) C Max.	Style
MF-NSMF012	0.12	30	10	1.35	8.50		3.4 (0.134)	1.8 (0.071)	1.1 (0.043)	2
MF-NSMF020	0.20	24	10	0.60	2.60		3.4 (0.134)	1.8 (0.071)	0.85 (0.033)	2
MF-NSMF035	0.35	6	100	0.30	1.20		3.4 (0.134)	1.8 (0.071)	0.85 (0.033)	2
MF-NSMF050	0.50	13.2	100	0.15	0.70		3.4 (0.134)	1.8 (0.071)	0.85 (0.033)	2
MF-NSMF075	0.75	6	100	0.10	0.40		3.4 (0.134)	1.8 (0.071)	0.7 (0.028)	2
MF-NSMF110	1.10	6	100	0.06	0.20		3.4 (0.134)	1.8 (0.071)	0.7 (0.028)	2
MF-NSMF150	1.50	6	100	0.03	0.13		3.4 (0.134)	1.8 (0.071)	0.7 (0.028)	2
MF-NSMF200	2.00	6	100	0.02	0.085		3.5 (0.138)	1.8 (0.071)	1.6 (0.063)	2

MF-MSMF Series (1812 package) 6 – 60 Volts
Surface Mount (4532 mm) 0.10 – 2.60 Amps Hold Current

Model	I_{hold} Amperes at 23 °C	V max. Volts	I max. Amps	Initial Resistance Ohms at 23 °C Min.	Initial Resistance Ohms at 23 °C Max.	1 Hour (R_1) Post-Trip Resistance Ohms at 23 °C Max.	Dimensions mm/(in) A Max.	Dimensions mm/(in) B Max.	Dimensions mm/(in) C Max.	Style
MF-MSMF010	0.10	60	40	0.70	15.0		4.73 (0.186)	3.41 (0.134)	1.10 (0.043)	2
MF-MSMF014	0.14	60	40	0.40	6.50		4.73 (0.186)	3.41 (0.134)	1.10 (0.043)	2
MF-MSMF020	0.20	30	80	0.40	6.00		4.73 (0.186)	3.41 (0.134)	1.10 (0.043)	2
MF-MSMF020/60	0.20	60	40	0.40	6.00		4.73 (0.186)	3.41 (0.134)	1.10 (0.043)	2
MF-MSMF030	0.30	30	10	0.30	3.00		4.73 (0.186)	3.41 (0.134)	1.10 (0.043)	2
MF-MSMF050	0.50	15	100	0.15	1.00		4.73 (0.186)	3.41 (0.134)	0.85 (0.033)	2
MF-MSMF050/30X	0.50	30	100	0.15	1.00		4.73 (0.186)	3.41 (0.134)	0.85 (0.033)	2
MF-MSMF050/40X	0.50	40	100	0.15	1.00		4.73 (0.186)	3.41 (0.134)	0.85 (0.033)	2
MF-MSMF075	0.75	13.2	100	0.11	0.45		4.73 (0.186)	3.41 (0.134)	0.85 (0.033)	2
MF-MSMF075/24	0.75	24	40	0.11	0.45		4.73 (0.186)	3.41 (0.134)	0.85 (0.033)	2
MF-MSMF110	1.10	6	100	0.04	0.21		4.73 (0.186)	3.41 (0.134)	0.85 (0.033)	2
MF-MSMF110/16	1.10	16	100	0.04	0.21		4.73 (0.186)	3.41 (0.134)	0.85 (0.033)	2
MF-MSMF125	1.25	6	100	0.035	0.14		4.73 (0.186)	3.41 (0.134)	0.85 (0.033)	2
MF-MSMF150	1.50	6	100	0.03	0.12		4.73 (0.186)	3.41 (0.134)	0.85 (0.033)	2
MF-MSMF150/12	1.50	12	100	0.03	0.12		4.73 (0.186)	3.41 (0.134)	0.85 (0.033)	2
MF-MSMF160	1.60	8	100	0.035	0.099		4.73 (0.186)	3.41 (0.134)	0.85 (0.033)	2
MF-MSMF200	2.00	8	40	0.020	0.08		4.73 (0.186)	3.41 (0.134)	0.85 (0.033)	2
MF-MSMF250/16	2.50	16	100	0.015	0.1		4.73 (0.186)	3.41 (0.134)	2.00 (0.078)	2
MF-MSMF260	2.60	6	100	0.015	0.08		4.73 (0.186)	3.41 (0.134)	0.85 (0.033)	2

表贴型低压PPTC



Features
- Tape & reel packaging
- Industry standard sizes

Applications
- Computers and peripherals
- General electronics
- Automotive

MF-SMDF Series (2018 package)
Surface Mount (5050 mm)

10 – 60 Volts
0.30 – 2.00 Amps Hold Current

Model	I_{hold} Amperes at 23 °C	V max. Volts	I max. Amps	Initial Resistance Ohms at 23 °C Min.	Initial Resistance Ohms at 23 °C Max.	Dimensions mm/(in) A Max.	B Max.	C Max.	Style
MF-SMDF030	0.30	60	20	0.45	2.150	5.44 (0.214)	4.93 (0.194)	1.09 (0.043)	2
MF-SMDF050	0.55	60	10	0.20	1	5.44 (0.214)	4.93 (0.194)	1.09 (0.043)	2
MF-SMDF100/33X	1.00	32	50	0.045	0.110	5.44 (0.214)	4.93 (0.194)	1.25 (0.049)	2
MF-SMDF150	1.50	15	40	0.05	0.17	5.44 (0.214)	4.93 (0.194)	0.85 (0.033)	2
MF-SMDF200	2.00	10	40	0.03	0.1	5.44 (0.214)	4.93 (0.194)	0.85 (0.033)	2
MF-SMDF260/24X	2.60	32	50	0.045	0.110	5.44 (0.214)	4.93 (0.194)	2.00 (0.079)	2

MF-PSMF Series (0805 package)
Surface Mount (7555 mm)

6-33 Volts
1.85 – 3.00 Amps Hold Current

Model	I_{hold} Amperes at 23 °C	V max. Volts	I max. Amps	Initial Resistance Ohms at 23 °C Min.	Initial Resistance Ohms at 23 °C Max.	Dimensions mm/(in) A Max.	B Max.	C Max.	Style
MF-PSMF010/24X	0.10	24	80	1.00	7.500	2.30 (0.091)	1.50 (0.059)	0.85 (0.033)	2
MF-PSMF020X	0.20	9	40	0.65	3.500	2.30 (0.091)	1.50 (0.059)	0.85 (0.033)	2
MF-PSMF035X	0.35	6	40	0.25	1.200	2.30 (0.091)	1.50 (0.059)	0.85 (0.033)	2
MF-PSMF050X	0.50	6	40	0.15	0.900	2.30 (0.091)	1.50 (0.059)	0.85 (0.033)	2
MF-PSMF075X	0.75	6	40	0.09	0.350	2.30 (0.091)	1.50 (0.059)	1.25 (0.049)	2
MF-PSMF110X	1.10	6	40	0.06	0.210	2.30 (0.091)	1.50 (0.059)	1.25 (0.049)	2

MF-USMF Series (1210 package)
Surface Mount (3225 mm)

6 - 30 Volts
0.05 – 1.75 Amps Hold Current

Model	I_{hold} Amperes at 23 °C	V max. Volts	I max. Amps	Initial Resistance Ohms at 23 °C Min.	Initial Resistance Ohms at 23 °C Max.	Dimensions mm/(in) A Max.	B Max.	C Max.	Style
MF-USMF005	0.05	30	10	2.80	50.0	3.43 (0.135)	2.8 (0.11)	1.1 (0.043)	2
MF-USMF010	0.10	30	10	0.80	15.0	3.43 (0.135)	2.8 (0.11)	1.1 (0.043)	2
MF-USMF020	0.20	30	10	0.40	5.00	3.43 (0.135)	2.8 (0.11)	1.1 (0.043)	2
MF-USMF035	0.35	6.0	40	0.20	1.30	3.43 (0.135)	2.8 (0.11)	0.85 (0.033)	2
MF-USMF050	0.50	13.2	40	0.18	0.90	3.43 (0.135)	2.8 (0.11)	0.85 (0.033)	2
MF-USMF075	0.75	6.0	40	0.07	0.45	3.43 (0.135)	2.8 (0.11)	0.85 (0.033)	2
MF-USMF110	1.10	6.0	40	0.05	0.21	3.43 (0.135)	2.8 (0.11)	0.85 (0.033)	2
MF-USMF150	1.50	6.0	40	0.03	0.11	3.43 (0.135)	2.8 (0.11)	0.85 (0.033)	2
MF-USMF175	1.75	6.0	40	0.02	0.09	3.43 (0.135)	2.8 (0.11)	0.85 (0.033)	2

MF-LSMF Series (2920 package)
Surface Mount (7555 mm)

6-33 Volts
1.85 – 4.00 Amps Hold Current

Model	I_{hold} Amperes at 23 °C	V max. Volts	I max. Amps	Initial Resistance Ohms at 23 °C Min.	Initial Resistance Ohms at 23 °C Max.	Dimensions mm/(in) A Max.	B Max.	C Max.	Style
MF-LSMF185/33X	1.85	33	40	0.045	0.150	7.98 (0.314)	5.44 (0.214)	1.60 (0.63)	2
MFLSMF260X	2.6	24	20	0.020	0.075	7.98 (0.314)	5.44 (0.214)	1.60 (0.63)	2
MF-LSMF300X	3.0	6	40	0.020	0.075	7.98 (0.314)	5.44 (0.214)	0.85 (0.033)	2
MF-LSMF300/24X	3.0	24	20	0.020	0.075	7.98 (0.314)	5.44 (0.214)	1.60 (0.63)	2
MF-LSMF400/12X	4.0	12	20	0.005	0.050	7.98 (0.314)	5.44 (0.214)	1.60 (0.63)	2

MF-SMHT Series
Surface Mount/High Temperature

16 Volts
1.36 – 1.60 Amps Hold Current
(Working temp: -40 ~ +125 °C)

Model	I_{hold} Amperes at 23 °C	V max. Volts	I max. Amps	Initial Resistance Ohms at 23 °C Min.	Initial Resistance Ohms at 23 °C Max.	Dimensions mm/(in) A Max.	B Max.	C Max.	Style
MF-SMHT136	1.36	16	100	0.085	0.330	7.98 (0.314)	3.0 (0.118)	5.44 (0.214)	1
MF-SMHT160	1.60	16	100	0.050	0.150	9.5 (0.374)	3.0 (0.118)	6.71 (0.264)	1

MF-USHT Series (1210 package)
Surface Mount/High Temperature

0.35 – 0.50 Amps Hold Current
(Working Temp: -40 °C ~ +125 °C)

Model	Ihold Amperes at 23 °C	V max. Volts	I max. Amps	Initial Resistance Ohms at 23 °C Min.	Initial Resistance Ohms at 23 °C Max.	Dimensions mm/(in) A Max.	B Max.	C Max.	Style
MF-USHT035KX	0.35	30	80	0.4	2.2	3.43 (0.135)	2.80 (0.110)	0.85 (0.033)	2
MF-USHT050KX	0.50	30	80	0.3	1.6	3.43 (0.135)	2.80 (0.110)	0.85 (0.033)	2

MF-NSHT Series (1206 package)
Surface Mount/High Temperature

0.16 – 0.35 Amps Hold Current
(Working Temp: -40 °C ~ +125 °C)

Model	Ihold Amperes at 23 °C	V max. Volts	I max. Amps	Initial Resistance Ohms at 23 °C Min.	Initial Resistance Ohms at 23 °C Max.	Dimensions mm/(in) A Max.	B Max.	C Max.	Style
MF-NSHT016KX	0.16	30	80	0.7	6.0	3.40 (0.134)	1.80 (0.071)	0.85 (0.033)	2
MF-NSHT035KX	0.35	30	80	0.4	2.6	3.40 (0.134)	1.80 (0.071)	0.85 (0.033)	2

MF-PSHT Series (0805 package)
Surface Mount/High Temperature

0.35 – 0.50 Amps Hold Current
(Working Temp: -40 °C ~ +125 °C)

Model	Ihold Amperes at 23 °C	V max. Volts	I max. Amps	Initial Resistance Ohms at 23 °C Min.	Initial Resistance Ohms at 23 °C Max.	Dimensions mm/(in) A Max.	B Max.	C Max.	Style
MF-PSHT010X	0.10	16	40	1.00	12.00	2.30 (0.091)	1.50 (0.059)	0.80 (0.031)	2

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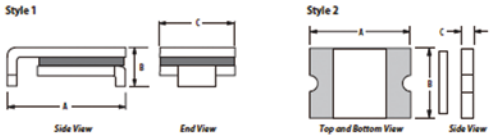

Features
- Tape & reel packaging
- Industry standard sizes

Applications
- Computers and peripherals
- General electronics
- Automotive

MF-SMDF Series (2018 package)
Surface Mount (5050 mm)

10 – 60 Volts
0.30 – 2.00 Amps Hold Current

Model	I_{hold} Amperes at 23 °C	V max. Volts	I max. Amps	Initial Resistance Ohms at 23 °C Min.	Initial Resistance Ohms at 23 °C Max.	1 Hour (R_1) Post-Trip Resistance Ohms at 23 °C Max.	Dimensions mm/(in) A Max.	Dimensions mm/(in) B Max.	Dimensions mm/(in) C Max.	Style
MF-SMDF030	0.30	60	20	0.45	2.150		5.44 (0.214)	4.93 (0.194)	1.09 (0.043)	2
MF-SMDF050	0.55	60	10	0.20	1		5.44 (0.214)	4.93 (0.194)	1.09 (0.043)	2
MF-SMDF100/33X	1.00	32	50	0.045	0.110		5.44 (0.214)	4.93 (0.194)	1.25 (0.049)	2
MF-SMDF150	1.50	15	40	0.05	0.17		5.44 (0.214)	4.93 (0.194)	0.85 (0.033)	2
MF-SMDF200	2.00	10	40	0.03	0.1		5.44 (0.214)	4.93 (0.194)	0.85 (0.033)	2
MF-SMDF260/24X	2.60	32	50	0.045	0.110		5.44 (0.214)	4.93 (0.194)	2.00 (0.079)	2

MF-PSMF Series (0805 package)
Surface Mount (7555 mm)

6-33 Volts
1.85 – 3.00 Amps Hold Current

Model	I_{hold} Amperes at 23 °C	V max. Volts	I max. Amps	Initial Resistance Ohms at 23 °C Min.	Initial Resistance Ohms at 23 °C Max.	1 Hour (R_1) Post-Trip Resistance Ohms at 23 °C	Dimensions mm/(in) A Max.	Dimensions mm/(in) B Max.	Dimensions mm/(in) C Max.	Style
MF-PSMF010/24X	0.10	24	80	1.00	7.500		2.30 (0.091)	1.50 (0.059)	0.85 (0.033)	2
MF-PSMF020X	0.20	9	40	0.65	3.500		2.30 (0.091)	1.50 (0.059)	0.85 (0.033)	2
MF-PSMF035X	0.35	6	40	0.25	1.200		2.30 (0.091)	1.50 (0.059)	0.85 (0.033)	2
MF-PSMF050X	0.50	6	40	0.15	0.900		2.30 (0.091)	1.50 (0.059)	0.85 (0.033)	2
MF-PSMF075X	0.75	6	40	0.09	0.350		2.30 (0.091)	1.50 (0.059)	1.25 (0.049)	2
MF-PSMF110X	1.10	6	40	0.06	0.210		2.30 (0.091)	1.50 (0.059)	1.25 (0.049)	2

MF-USMF Series (1210 package)
Surface Mount (3225 mm)

6 - 30 Volts
0.05 – 1.75 Amps Hold Current

Model	I_{hold} Amperes at 23 °C	V max. Volts	I max. Amps	Initial Resistance Ohms at 23 °C Min.	Initial Resistance Ohms at 23 °C Max.	1 Hour (R_1) Post-Trip Resistance Ohms at 23 °C	Dimensions mm/(in) A Max.	Dimensions mm/(in) B Max.	Dimensions mm/(in) C Max.	Style
MF-USMF005	0.05	30	10	2.80	50.0		3.43 (0.135)	2.8 (0.11)	1.1 (0.043)	2
MF-USMF010	0.10	30	10	0.80	15.0		3.43 (0.135)	2.8 (0.11)	1.1 (0.043)	2
MF-USMF020	0.20	30	10	0.40	5.00		3.43 (0.135)	2.8 (0.11)	1.1 (0.043)	2
MF-USMF035	0.35	6.0	40	0.20	1.30		3.43 (0.135)	2.8 (0.11)	0.85 (0.033)	2
MF-USMF050	0.50	13.2	40	0.18	0.90		3.43 (0.135)	2.8 (0.11)	0.85 (0.033)	2
MF-USMF075	0.75	6.0	40	0.07	0.45		3.43 (0.135)	2.8 (0.11)	0.85 (0.033)	2
MF-USMF110	1.10	6.0	40	0.05	0.21		3.43 (0.135)	2.8 (0.11)	0.85 (0.033)	2
MF-USMF150	1.50	6.0	40	0.03	0.11		3.43 (0.135)	2.8 (0.11)	0.85 (0.033)	2
MF-USMF175	1.75	6.0	40	0.02	0.09		3.43 (0.135)	2.8 (0.11)	0.85 (0.033)	2

MF-LSMF Series (2920 package)
Surface Mount (7555 mm)

6-33 Volts
1.85 – 4.00 Amps Hold Current

Model	I_{hold} Amperes at 23 °C	V max. Volts	I max. Amps	Initial Resistance Ohms at 23 °C Min.	Initial Resistance Ohms at 23 °C Max.	1 Hour (R_1) Post-Trip Resistance Ohms at 23 °C	Dimensions mm/(in) A Max.	Dimensions mm/(in) B Max.	Dimensions mm/(in) C Max.	Style
MF-LSMF185/33X	1.85	33	40	0.045	0.150		7.98 (0.314)	5.44 (0.214)	1.60 (0.63)	2
MFLSMF260X	2.6	24	20	0.020	0.075		7.98 (0.314)	5.44 (0.214)	1.60 (0.63)	2
MF-LSMF300X	3.0	6	40	0.020	0.075		7.98 (0.314)	5.44 (0.214)	0.85 (0.033)	2
MF-LSMF300/24X	3.0	24	20	0.020	0.075		7.98 (0.314)	5.44 (0.214)	1.60 (0.63)	2
MF-LSMF400/12X	4.0	12	20	0.005	0.050		7.98 (0.314)	5.44 (0.214)	1.60 (0.63)	2

MF-SMHT Series
Surface Mount/High Temperature

16 Volts
1.36 – 1.60 Amps Hold Current
(Working temp: -40 ~ +125 °C)

Model	I_{hold} Amperes at 23 °C	V max. Volts	I max. Amps	Initial Resistance Ohms at 23 °C Min.	Initial Resistance Ohms at 23 °C Max.	1 Hour (R_1) Post-Trip Resistance Ohms at 23 °C	Dimensions mm/(in) A Max.	Dimensions mm/(in) B Max.	Dimensions mm/(in) C Max.	Style
MF-SMHT136	1.36	16	100	0.085	0.330		7.98 (0.314)	3.0 (0.118)	5.44 (0.214)	1
MF-SMHT160	1.60	16	100	0.050	0.150		9.5 (0.374)	3.0 (0.118)	6.71 (0.264)	1

MF-USHT Series (1210 package)
Surface Mount/High Temperature

0.35 – 0.50 Amps Hold Current
(Working Temp: -40 °C ~ +125 °C)

Model	Ihold Amperes at 23 °C	V max. Volts	I max. Amps	Initial Resistance Ohms at 23 °C Min.	Initial Resistance Ohms at 23 °C Max.	1 Hour (R1) Post-Trip Resistance Ohms at 23 °C	Dimensions mm/(in) A Max.	Dimensions mm/(in) B Max.	Dimensions mm/(in) C Max.	Style
MF-USHT035KX	0.35	30	80	0.4	2.2		3.43 (0.135)	2.80 (0.110)	0.85 (0.033)	2
MF-USHT050KX	0.50	30	80	0.3	1.6		3.43 (0.135)	2.80 (0.110)	0.85 (0.033)	2

MF-NSHT Series (1206 package)
Surface Mount/High Temperature

0.16 – 0.35 Amps Hold Current
(Working Temp: -40 °C ~ +125 °C)

Model	Ihold Amperes at 23 °C	V max. Volts	I max. Amps	Initial Resistance Ohms at 23 °C Min.	Initial Resistance Ohms at 23 °C Max.	1 Hour (R1) Post-Trip Resistance Ohms at 23 °C	Dimensions mm/(in) A Max.	Dimensions mm/(in) B Max.	Dimensions mm/(in) C Max.	Style
MF-NSHT016KX	0.16	30	80	0.7	6.0		3.40 (0.134)	1.80 (0.071)	0.85 (0.033)	2
MF-NSHT035KX	0.35	30	80	0.4	2.6		3.40 (0.134)	1.80 (0.071)	0.85 (0.033)	2

MF-PSHT Series (0805 package)
Surface Mount/High Temperature

0.35 – 0.50 Amps Hold Current
(Working Temp: -40 °C ~ +125 °C)

Model	Ihold Amperes at 23 °C	V max. Volts	I max. Amps	Initial Resistance Ohms at 23 °C Min.	Initial Resistance Ohms at 23 °C Max.	1 Hour (R1) Post-Trip Resistance Ohms at 23 °C	Dimensions mm/(in) A Max.	Dimensions mm/(in) B Max.	Dimensions mm/(in) C Max.	Style
MF-PSHT010X	0.10	16	40	1.00	12.00		2.30 (0.091)	1.50 (0.059)	0.80 (0.031)	2

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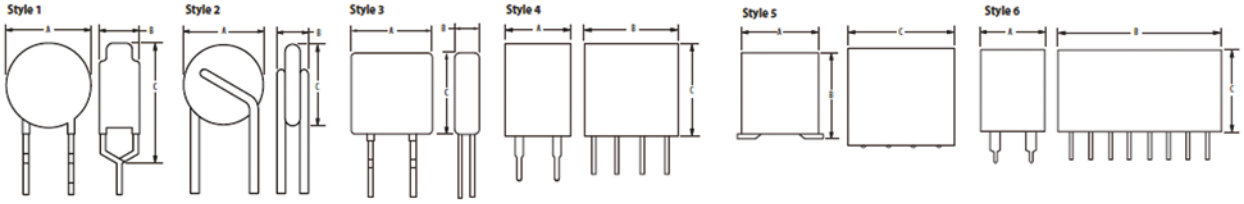


Features

- Ceramic PTCs for telecom overcurrent protection
- Wide range of form factors for most applications
- Aids telecom compliance with:
  - ITU-T K.20/21/45
  - Telcordia GR-1089-CORE
  - UL 60950, 3rd Edition
- Narrow and matched resistance tolerances

Applications

Used as secondary overcurrent protection devices in:

- Customer Premise Equipment (CPE)
- Central Office Equipment (CO)
- Access equipment

CMF-RL Series
Radial Leaded

230 Volts
±0.5 Ohms Packaging Resistance Matching

Model	Induction Voltage Withstand VAC	Rated Resistance (RN)		Hold Current Amps at 25 °C	Trip Current Amps at 25 °C	Dimensions mm/(in)			Style
		Ohms	Tolerance			A Max.	B Max.	C Nom.	
CMF-RL10	650	10	±20 %	0.14	0.3	9.5 (0.374)	4.5 (0.177)	13.5 (0.531)	1
CMF-RL10-10	650	10	±10 %	0.14	0.3	9.5 (0.374)	4.5 (0.177)	13.5 (0.531)	1
CMF-RL25U	650	35	±20 %	0.060	0.15	5.2 (0.205)	3.5 (0.138)	5.2 (0.205)	2
CMF-RL35	650	35	±20 %	0.075	0.15	9.8 (0.386)	5.0 (0.197)	13.5 (0.531)	1
CMF-RL35-10	650	35	±10 %	0.075	0.15	9.8 (0.386)	5.0 (0.197)	13.5 (0.531)	1
CMF-RL35A	650	35	±10 %	0.075	0.15	7.5 (0.295)	5.6 (0.220)	13.0 (0.512)	1
CMF-RL35A-10	650	35	±10 %	0.075	0.15	7.5 (0.295)	5.6 (0.220)	13.0 (0.512)	1
CMF-RL50	650	50	±20 %	0.065	0.15	9.8 (0.386)	5.0 (0.197)	13.5 (0.531)	1
CMF-RL50-10	650	50	±10 %	0.065	0.15	9.8 (0.386)	5.0 (0.197)	13.5 (0.531)	1
CMF-RL50A	650	50	±20 %	0.05	0.10	7.5 (0.295)	5.6 (0.220)	13.0 (0.512)	1
CMF-RL50A-10	650	50	±10 %	0.05	0.10	7.5 (0.295)	5.6 (0.220)	13.0 (0.512)	1
CMF-RL55	650	55	±20 %	0.065	0.15	9.8 (0.386)	5.0 (0.197)	13.5 (0.531)	1
CMF-RL55-10	650	55	±10 %	0.065	0.15	9.8 (0.386)	5.0 (0.197)	13.5 (0.531)	1
CMF-RL55A	650	55	±20 %	0.05	0.10	7.5 (0.295)	5.6 (0.220)	13.0 (0.512)	1
CMF-RL55A-10	650	55	±10 %	0.05	0.10	7.5 (0.295)	5.6 (0.220)	13.0 (0.512)	1

CMF-RLC Series
Through-hole/Ceramic Case

Ceramic Housing
±0.5 Ohms Packaging
Resistance Matching

Model	Induction Voltage Withstand VAC	Rated Resistance (RN)		Hold Current Amps at 25 °C	Trip Current Amps at 25 °C	Dimensions mm/(in)			Style
		Ohms	Tolerance			A Max.	B Max.	C Nom.	
CMF-RLC50	650	50	±20 %	0.065	0.15	9.2 (0.362)	4.7 (0.185)	9.6 (0.378)	3
CMF-RLC50-10	650	50	±10 %	0.065	0.15	9.2 (0.362)	4.7 (0.185)	9.6 (0.378)	3

CMF-SD Series
Twin Pack/SMD

230 V Rated
±0.5 Ohms Resistance
Matching In Housing

Model	Induction Voltage Withstand VAC	Rated Resistance (RN)		Hold Current Amps at 25 °C	Trip Current Amps at 25 °C	Dimensions mm/(in)			Style
		Ohms	Tolerance			A Max.	B Max.	C Nom.	
CMF-SD25	600	25	±20 %	0.13	0.26	9.0 (0.354)	10.8 (0.425)	10.2 (0.402)	5
CMF-SD25-10	600	25	±10 %	0.13	0.26	9.0 (0.354)	10.8 (0.425)	10.2 (0.402)	5
CMF-SD25A	600	25	±20 %	0.13	0.26	7.15 (0.281)	8.5 (0.335)	8.1 (0.319)	5
CMF-SD25A-10	600	25	±10 %	0.13	0.26	7.15 (0.281)	8.5 (0.335)	8.1 (0.319)	5
CMF-SD35	600	35	±20 %	0.10	0.20	9.0 (0.354)	10.8 (0.425)	10.2 (0.402)	5
CMF-SD35-10	600	35	±10 %	0.10	0.20	9.0 (0.354)	10.8 (0.425)	10.2 (0.402)	5
CMF-SD35A	600	35	±20 %	0.10	0.20	7.15 (0.281)	8.5 (0.335)	8.1 (0.319)	5
CMF-SD35A-10	600	35	±10 %	0.10	0.20	7.15 (0.281)	8.5 (0.335)	8.1 (0.319)	5
CMF-SD50	600	50	±20 %	0.09	0.19	9.0 (0.354)	10.8 (0.425)	10.2 (0.402)	5
CMF-SD50-10	600	50	±10 %	0.09	0.19	9.0 (0.354)	10.8 (0.425)	10.2 (0.402)	5
CMF-SD50A	600	50	±20 %	0.09	0.19	7.15 (0.281)	8.5 (0.335)	8.1 (0.319)	5
CMF-SD50A-10	600	50	±10 %	0.09	0.19	7.15 (0.281)	8.5 (0.335)	8.1 (0.319)	5

CMF-RD Series
Twin Pack/Through-hole

230 Volts
±0.5 Ohms Packaging
Resistance Matching

Model	Induction Voltage Withstand VAC	Rated Resistance (RN)		Hold Current Amps at 25 °C	Trip Current Amps at 25 °C	Dimensions mm/(in)			Style
		Ohms	Tolerance			A Max.	B Max.	C Nom.	
CMF-RD50	600	50	±20 %	0.09	0.19	9.0 (0.354)	10.2 (0.402)	9.5 (0.446)	4
CMF-RD50-10	600	50	±10 %	0.09	0.19	9.0 (0.354)	10.2 (0.402)	9.5 (0.446)	4

CMF-RQ Series
Quad Pack/Through-hole

Four CPTCs In One Package
±0.5 Ohms Resistance
Matching In Housing

Model	Induction Voltage Withstand VAC	Rated Resistance (RN)		Hold Current Amps at 25 °C	Trip Current Amps at 25 °C	Dimensions mm/(in)			Style
		Ohms	Tolerance			A Max.	B Max.	C Nom.	
CMF-RQ50	600	50	±20 %	0.09	0.19	10.0 (0.393)	21.0 (0.826)	11.0 (0.433)	6
CMF-RQ50-10	600	50	±10 %	0.09	0.19	10.0 (0.393)	21.0 (0.826)	11.0 (0.433)	6

7.MOV、MLV和混合元件

MOV-TH

Series	Description	Product Photo	Device Symbol	Technology & Package	Sizes (mm) or Package	Max Continuous Voltage (V_{rms})	Max Continuous Voltage (V_{dc})	Peak Single Pulse Current 8/20 µs (I_{max})	Temperature Rating °C	Agency Listing
SV	Special medium voltage varistors			MOV square disk	5, 7, 10, 14, 20, 23	60 – 550 V	85 – 745 V	600 – 15,000 A	–40 to +85	UL 1449
CVQ	Extended medium voltage varistors disk			MOV round disk	7, 10, 14, 20, 23	60 – 550 V	85 – 745 V	1,750 – 15,000 A	–40 to +85	UL 1449
CV	Medium voltage disk varistors			MOV round disk	5, 7, 10, 14, 20, 23	50 – 680 V	65 – 895 V	400 – 6,500 A	–40 to +85	UL 1449
MOV-07DxxxK	Extended temperature and voltage varistors			MOV round disk	7	11 – 510 V	14 – 675 V	250 – 1,200 A	–40 to +105	UL 1449
MOV-10DxxxK	Extended temperature and voltage varistors			MOV round disk	10	11 – 510 V	14 – 675 V	500 – 2500 A	–40 to +105	UL 1449
MOV-14DxxxK	Extended temperature and voltage varistors			MOV round disk	14	11 – 1100 V	14 – 1465 V	1,000 – 4,500 A	–40 to +105	UL 1449
MOV-20DxxxK	Extended temperature and voltage varistors			MOV round disk	20	11 – 1100 V	14 – 1465 V	2,000 – 6,500 A	–40 to +105	UL 1449
ZV	Low voltage leaded style varistors			MLV leaded	5, 7, 10, 14, 20	11 – 40 V	14 – 56 V	100 – 2,000 A	–55 to +125	UL 1449

SMD

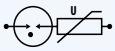
Series	Description	Product Photo	Device Symbol	Technology & Package	Sizes (mm) or Package	Max Continuous Voltage (V_{rms})	Max Continuous Voltage (V_{dc})	Peak Single Pulse Current 8/20 µs (I_{max})	Temperature Rating °C	Agency Listing
DV	Low & medium voltage varistors			MOV SMD	2220, 3225, 4032	11 – 300 V	14 – 385 V	100 – 1200 A	–55 to +125	UL 1449
PV	Low & medium encapsulated varistors			MOV SMD	3225, 4032	60 – 300 V*	85 – 385 V*	100 – 1200 A	–40 to +85	UL 1449
ZV	Low voltage varistors			MLV SMD	0603, 0805, 1206, 1210, 1812, 2220	11 – 130 V*	14 – 170 V*	30 – 1200 A	–55 to +125	N/A
ZV HT	High temperature low voltage varistors			MLV SMD	0603, 0805, 1206, 1210, 1812, 2220	11 – 130 V*	14 – 170 V*	30 – 1200 A	–55 to +150	N/A
ZVX	Low capacitance & low energy varistors			MLV SMD	0603, 0805, 1206	11 – 30 V*	14 – 38 V*	30 – 40 A	–55 to +125	N/A
ZVE	EDS suppression varistors			MLV SMD	0603, 0805, 1206,1210	14 V	18 V	2 A	–55 to +125	N/A

**Lower voltage available upon request*

HIGH ENERGY

Series	Description	Product Photo	Device Symbol	Technology & Package	Sizes (mm) or Package	Max Continuous Voltage (V_{rms})	Max Continuous Voltage (V_{dc})	Peak Single Pulse Current 8/20 µs (I_{max})	Temperature Rating °C	Agency Listing
ZOV	High energy square shaped			Epoxy coated with rigid terminals and metalized blocks	23, 25, 32, 40, 60	60 – 680 V	85 – 895 V	18 – 80 kA	–40 to +85	UL 1449
ZOVR	High energy round shape			Epoxy coated with rigid terminals and metalized blocks	25, 32, 40	60 – 680 V	85 – 895 V	18 – 40 kA	–40 to +85	UL 1449
ZOVS/ZOVH	Square shaped high energy stacked			Epoxy coated with rigid terminals	40	275 – 440 V	350 – 385 V	40 kA	–40 to +85	UL 1449

HYBRID

Series	Description	Product Photo	Device Symbol	Technology & Package	Sizes (mm) or Package	Max Continuous Voltage (V_{rms})	Max Continuous Voltage (V_{dc})	Peak Single Pulse Current 8/20 µs (I_{max})	Temperature Rating °C	Agency Listing
MV	Dual function MLV & filter cap			MLV capacitor through-hole	9 mm	11 – 95 V	14 – 125 V	150 A	–55 to +125	N/A
0V	Automotive dual function MLV & filter cap			MLV capacitor through-hole	9 mm, 12 mm	14 – 40 V	16 – 56 V	800 A, 1200 A	–55 to +125	N/A
GMOV14	Hybrid MOV-GDT			MOV-GDT through-hole	14 mm	45 – 320 V	56 – 415 V	6 kA	–40 to +85	UL 1449
GMOV20	Hybrid MOV-GDT			MOV-GDT through-hole	20 mm	45 – 320 V	56 – 415 V	10 kA	–40 to +85	UL 1449

AUTOMOTIVE

Series	Description	Product Photo	Device Symbol	Technology & Package	Sizes (mm) or Package	Max Continuous Voltage (V_{rms})	Max Continuous Voltage (V_{dc})	Peak Single Pulse Current 8/20 µs (I_{max})	Temperature Rating °C	Agency Listing
0V	Automotive grade dual-function varistor			MLV capacitor through-hole	9 mm, 12 mm	14 – 40 V	16 – 56 V	800 A, 1200 A	–55 to +125	Grade 1 qualified
AV-TH	Automotive grade through-hole multilayer			MLV Leaded	602, 802, 902, 1103	14 – 40 V	16 – 56 V	400 – 2000 A	–55 to +125	Grade 1 qualified
AV-SMD	Automotive grade varistors			SMD	0805, 1206, 1812, 2220, 3225	14 – 40 V	16 – 56 V	200 – 1200 A	–55 to +125	Grade 1 qualified
AV HT-SMD	Automotive grade varistors high temperature rated			SMD	0805, 1206, 1812, 2220, 3225	14 – 40 V	16 – 56 V	200 – 1200 A	–55 to +150	Grade 1 qualified

8.isoMOV

Bourns Part No.	Operating				Protection					
	Max. Continuous Operating Voltage (MCOV)		Max. Leakage @ MCOV(2)	Nominal Capacitance	I_{nom} (3)(4)		I_{max} (4)	Ring Wave Surge IEEE 62.41	Max. Clamping Voltage	
	V_{rms}	V_{dc}	A_{dc}	20 kHz	15 Operations	10 Operations	1 Operation	200 A	V_c	I_c
	V	V	µA	pF	A	A	A	Operations	V	A
IsoM3-175	175	225	< 10	30	3,000		6,000	± 250	470	50
IsoM3-230	230	300	< 10	30	3,000		6,000	± 250	620	50
IsoM3-250	250	320	< 10	30	3,000		6,000	± 250	675	50
IsoM3-275	275	350	< 10	30	3,000		6,000	± 250	730	50
IsoM3-300	300	385	< 10	30	3,000		6,000	± 250	800	50
IsoM3-320	320	415	< 10	30	3,000		6,000	± 250	875	50
IsoM5-175	175	225	< 10	40	5,000		10,000	± 250	470	100
IsoM5-230	230	300	< 10	40	5,000		10,000	± 250	620	100
IsoM5-250	250	320	< 10	40	5,000		10,000	± 250	675	100
IsoM5-275	275	350	< 10	40	5,000		10,000	± 250	730	100
IsoM5-300	300	385	< 10	40	5,000		10,000	± 250	800	100
IsoM5-320	320	415	< 10	40	5,000		10,000	± 250	875	100
IsoM5-380	385	505	< 10	40	5,000		10,000	± 250	1000	100
IsoM5-420	420	560	< 10	40	5,000		10,000	± 250	1100	100
IsoM5-510	510	670	< 10	40	5,000		10,000	± 250	1300	100
IsoM5-555	555	745	< 10	40	5,000		10,000	± 250	1400	100
IsoM8-250	250	320	< 10	50		8,000	15,000	± 250	675	200
IsoM8-275	275	350	< 10	50		8,000	15,000	± 250	730	200
IsoM8-300	300	385	< 10	50		8,000	15,000	± 250	800	200
IsoM8-320	320	415	< 10	50		8,000	15,000	± 250	875	200
IsoM8-380	385	505	< 10	50		8,000	15,000	± 250	1000	200
IsoM8-420	420	560	< 10	50		8,000	15,000	± 250	1100	200
IsoM8-510	510	670	< 10	50		8,000	15,000	± 250	1300	200
IsoM8-555	555	745	< 10	50		8,000	15,000	± 250	1400	200

(1) *At delivery AQL 0.65 Level II, DIN ISO 2859.*
(2) *Max. leakage limits after life ratings may exceed 10 µA, but will continue to protect at MCOV.*
(3) *I_{nom} service life specified at 3-minute time intervals between surges with rated MCOV applied during the entire resting period and 15 minutes after the last surge.*
(4) *Surge profile 8/20 µs per IEC 61000-4-5.*

9.TVS

分立标准容值TVS二极管

Part Number	Pkg. Size	Electrical Characteristics (T_A = 25 °C)					
		I_{pp} (A)	V_C (V)	I_{pp} (A)	P_{pk} (W)	V_{br} min. (V)	C_t Typ (pF)
CD0201-T20C	0201	20	34			22.8	10
CDS0D323-T05S*	SOD-323	5	13.5	42	500	6	350
CDS0D323-T08S	SOD-323	8	16.9	34	500	8.5	250
CDS0D323-T12S	SOD-323	12	25.9	21	500	13.3	150
CDS0D323-T15S	SOD-323	15	30	17	500	16.7	100
CDS0D323-T18S	SOD-323	18	40	9	500	20	90
CDS0D323-T24S	SOD-323	24	49	12	500	26.7	88
CDS0D323-T36S	SOD-323	36	75	5	500	40	75
CDS0D323-T03SC	SOD-323	3.3	10.9	43	400	4	200
CDS0D323-T05SC	SOD-323	5	14.5	28	400	6	175
CDS0D323-T08SC	SOD-323	8	18.5	17	400	8.5	150
CDS0D323-T12SC	SOD-323	12	29.5	14	400	13.3	50
CDS0D323-T15SC	SOD-323	15	33	12	400	16.7	40
CDS0D323-T18SC	SOD-323	18	40	9	400	20	40
CDS0D323-T24SC	SOD-323	24	46.2	9	400	26.7	40
CDS0D323-T36SC	SOD-323	36	75	5	400	40	35

*"Q" suffix for AEC-Q101 compliance.

Symbols & Terms

C_t	Diode Capacitance
I_o	Average Rectified Current
I_f	Forward Current
I_r	Reverse Current
I_{surge}	Non-Repetitive Current
I_{rsm}	Reverse Surge Current
I_L	Leakage Voltage
P_{pk}	Peak Pulse Power Dissipation
T_d	Response Time
V_f	Forward Voltage
V_r	Reverse Voltage
V_{rrm}	Repetitive Reverse Peak Voltage
V_{rwm}	Working Peak Reverse Voltage
V_{rsm}	Reverse Voltage @ I_{rsm}
V_{br}	Breakdown Voltage
V_{wm}	Working Peak Voltage
V_{DC}	Operating Voltage
V_C	Clamping Voltage
V_t	Trigger Voltage

分立低容值TVS二极管

Part Number	Pkg. Size	Electrical Characteristics ($T_A = 25^\circ C$)					
		V_{wm} (V)	V_c (V)	I_{pp} (A)	P_{pk} (W)	V_{br} min. (V)	C_t Typ (pF)
CDSOD323-T03	SOD-323	3.3	19	20	350	4	3
CDSOD323-T05	SOD-323	5	18.3	17	350	6	3
CDSOD323-T08	SOD-323	8	18.5	17	350	8.5	3
CDSOD323-T12	SOD-323	12	28.3	11	350	13.3	3
CDSOD323-T15	SOD-323	15	31.8	10	350	16.7	3
CDSOD323-T18	SOD-323	18	45	8	350	20	3
CDSOD323-T24	SOD-323	24	56	6	350	26.7	3
CDSOD323-T03C	SOD-323	3.3	19	20	350	4	3
CDSOD323-T05C	SOD-323	5	18.3	17	350	6	3
CDSOD323-T08C	SOD-323	8	18.5	17	350	8.5	3
CDSOD323-T12C	SOD-323	12	28.3	11	350	13.3	3
CDSOD323-T15C	SOD-323	15	31.8	10	350	16.7	3
CDSOD323-T18C	SOD-323	18	45	8	350	20	3
CDSOD323-T24C	SOD-323	24	56	6	350	26.7	3
CDSOD323-T12C-DSL*	SOD-323	12	28.3	11	350	13.3	3
CDSOD323-T24C-DSL*	SOD-323	24	56	6	350	26.7	3

*"Q" suffix for AEC-Q101 compliance.

分立超低容值TVS二极管

Part Number	Pkg. Size	Electrical Characteristics ($T_A = 25^\circ C$)					
		V_{wm} (V)	V_c (V)	I_{pp} (A)	P_{pk} (W)	V_{br} min. (V)	C_t Typ (pF)
CDDFN2-T5.0LC	DFN-2	5	25			7	0.5
CDSOD323-T05L	SOD-323	5	18.3	15	350	6	1
CDSOD323-T08L	SOD-323	8	18.3	15	350	8.5	1
CDSOD323-T12L	SOD-323	12	28.6	11	350	13.3	1
CDSOD323-T15L	SOD-323	15	31.8	10	350	16.7	1
CDSOD323-T18L	SOD-323	18	45	8	350	20	1
CDSOD323-T24L	SOD-323	24	56	6	350	26.7	1
CDSOD323-T05LC	SOD-323	5	18.3	15	250	6	1
CDSOD323-T08LC	SOD-323	8	18.3	15	250	8.5	1
CDSOD323-T12LC	SOD-323	12	28.6	11	250	13.3	1
CDSOD323-T15LC	SOD-323	15	31.8	10	250	16.7	1
CDSOD323-T18LC	SOD-323	18	45	8	250	20	1
CDSOD323-T24LC	SOD-323	24	56	6	250	26.7	1

分立400W TVS二极管

Unidirectional Part Number	Bidirectional Part Number	Pkg. Size	Electrical Characteristics (T_A = 25 °C)				
			V_{rwm} (V)	V_{rsm} (V)	I_{rsm} (A)	P_{pk} (W)	V_{br} min. (V)
SMAJ5.0A*	SMAJ5.0CA*	SMA	5	9.2	43.5	400	6.4
SMAJ6.0A*	SMAJ6.0CA*	SMA	6	10.3	38.8	400	6.67
SMAJ6.5A*	SMAJ6.5CA*	SMA	6.5	11.2	35.7	400	7.22
SMAJ7.0A*	SMAJ7.0CA*	SMA	7	12	33.3	400	7.78
SMAJ7.5A*	SMAJ7.5CA*	SMA	7.5	12.9	31	400	8.33
SMAJ8.0A*	SMAJ8.0CA*	SMA	8	13.6	29.4	400	8.89
SMAJ8.5A*	SMAJ8.5CA*	SMA	8.5	14.4	27.8	400	9.44
SMAJ9.0A*	SMAJ9.0CA*	SMA	9	15.4	26	400	10
SMAJ10A*	SMAJ10CA*	SMA	10	17	23.5	400	11.1
SMAJ11A*	SMAJ11CA*	SMA	11	18.2	22	400	12.2
SMAJ12A*	SMAJ12CA*	SMA	12	19.9	20.1	400	13.3
SMAJ13A*	SMAJ13CA*	SMA	13	21.5	18.6	400	14.4
SMAJ14A*	SMAJ14CA*	SMA	14	23.2	17.2	400	15.6
SMAJ15A*	SMAJ15CA*	SMA	15	24.4	16.4	400	16.7
SMAJ16A*	SMAJ16CA*	SMA	16	26	15.3	400	17.8
SMAJ17A*	SMAJ17CA*	SMA	17	27.6	14.5	400	18.9
SMAJ18A*	SMAJ18CA*	SMA	18	29.2	13.7	400	20
SMAJ20A*	SMAJ20CA*	SMA	20	32.4	12.3	400	22.2
SMAJ22A*	SMAJ22CA*	SMA	22	35.5	11.3	400	24.4
SMAJ24A*	SMAJ24CA*	SMA	24	38.9	10.3	400	26.7
SMAJ26A*	SMAJ26CA*	SMA	26	42.1	9.5	400	28.9
SMAJ28A*	SMAJ28CA*	SMA	28	45.4	8.8	400	31.1
SMAJ30A*	SMAJ30CA*	SMA	30	48.4	8.3	400	33.3
SMAJ33A*	SMAJ33CA*	SMA	33	53.3	7.5	400	36.7
SMAJ36A*	SMAJ36CA*	SMA	36	58.1	6.9	400	40
SMAJ40A*	SMAJ40CA*	SMA	40	64.5	6.2	400	44.4
SMAJ43A*	SMAJ43CA*	SMA	43	69.4	5.8	400	47.8
SMAJ45A*	SMAJ45CA*	SMA	45	72.7	5.5	400	50
SMAJ48A*	SMAJ48CA*	SMA	48	77.4	5.2	400	53.3
SMAJ51A*	SMAJ51CA*	SMA	51	82.4	4.9	400	56.7
SMAJ54A*	SMAJ54CA*	SMA	54	87.1	4.6	400	60
SMAJ58A*	SMAJ58CA*	SMA	58	93.6	4.3	400	64.4
SMAJ60A*	SMAJ60CA*	SMA	60	96.8	4.1	400	66.7
SMAJ64A*	SMAJ64CA*	SMA	64	103	3.9	400	71.1
SMAJ70A*	SMAJ70CA*	SMA	70	113	3.5	400	77.8
SMAJ75A*	SMAJ75CA*	SMA	75	121	3.3	400	83.3
SMAJ78A*	SMAJ78CA*	SMA	78	126	3.2	400	86.7
SMAJ85A*	SMAJ85CA*	SMA	85	137	2.9	400	94.4
SMAJ90A*	SMAJ90CA*	SMA	90	146	2.7	400	100
SMAJ100A*	SMAJ100CA*	SMA	100	162	2.5	400	111
SMAJ110A*	SMAJ110CA*	SMA	110	177	2.3	400	122
SMAJ120A*	SMAJ120CA*	SMA	120	193	2	400	133
SMAJ130A*	SMAJ130CA*	SMA	130	209	1.9	400	144
SMAJ150A*	SMAJ150CA*	SMA	150	243	1.6	400	167
SMAJ160A*	SMAJ160CA*	SMA	160	259	1.5	400	178
SMAJ170A*	SMAJ170CA*	SMA	170	275	1.5	400	189
SMAJ180A*	SMAJ180CA*	SMA	180	292	1.4	400	201
SMAJ200A*	SMAJ200CA*	SMA	200	324	1.2	400	224
SMAJ220A*	SMAJ220CA*	SMA	220	356	1.1	400	246
SMAJ250A	SMAJ250CA	SMA	250	405	1.0	400	279
SMAJ300A	SMAJ300CA	SMA	300	486	0.8	400	335
SMAJ350A	SMAJ350CA	SMA	350	567	0.7	400	391
SMAJ400A	SMAJ400CA	SMA	400	648	0.6	400	447
SMAJ434A	SMAJ434CA	SMA	434	698	0.6	400	485
SMAJ440A	SMAJ440CA	SMA	440	713	0.6	400	492
SMAJ495A	SMAJ495CA	SMA	495	760	0.5	400	522

*"Q" suffix for AEC-Q101 compliance.

Unidirectional Part Number	Bidirectional Part Number	Pkg. Size	Electrical Characteristics ($T_A = 25^\circ C$)				
			V_{rwm} (V)	V_{rsm} (V)	I_{rsm} (A)	P_{pk} (W)	V_{br} min. (V)
P4SMA6.8A*	P4SMA6.8CA*	SMA	6	10.5	39.0	400	6.5
P4SMA7.5A*	P4SMA7.5CA*	SMA	6	11.3	36.3	400	7.13
P4SMA8.2A*	P4SMA8.2CA*	SMA	7.0	12.1	33.9	400	7.79
P4SMA9.1A*	P4SMA9.1CA*	SMA	8	13	30.6	400	8.65
P4SMA10A*	P4SMA10CA*	SMA	8.6	14.5	28	400	9.50
P4SMA11A*	P4SMA11CA*	SMA	9	15.6	26.3	400	10.50
P4SMA12A*	P4SMA12CA*	SMA	10.2	16.7	24.6	400	11.40
P4SMA13A*	P4SMA13CA*	SMA	11	18.2	23	400	12
P4SMA15A*	P4SMA15CA*	SMA	13	21	19.3	400	14.3
P4SMA16A*	P4SMA16CA*	SMA	14	22.5	18	400	15.2
P4SMA18A*	P4SMA18CA*	SMA	15	25.5	16.1	400	17.1
P4SMA20A*	P4SMA20CA*	SMA	17	27.7	14.8	400	19.0
P4SMA22A*	P4SMA22CA*	SMA	19	30.6	13.4	400	20.9
P4SMA24A*	P4SMA24CA*	SMA	21	33.2	12.3	400	22.8
P4SMA27A*	P4SMA27CA*	SMA	23	38	10.9	400	25.7
P4SMA30A*	P4SMA30CA*	SMA	26	41.4	9.9	400	28.5
P4SMA33A*	P4SMA33CA*	SMA	28	45.7	9.0	400	31
P4SMA36A*	P4SMA36CA*	SMA	31	49.9	8.2	400	34.2
P4SMA39A*	P4SMA39CA*	SMA	33	53.9	7.6	400	37.1
P4SMA43A*	P4SMA43CA*	SMA	37	59.3	6.9	400	40.9
P4SMA47A*	P4SMA47CA*	SMA	40	64.8	6.3	400	44.7
P4SMA51A*	P4SMA51CA*	SMA	44	70.1	5.8	400	48.5
P4SMA56A*	P4SMA56CA*	SMA	48	77.0	5.3	400	53.2
P4SMA62A*	P4SMA62CA*	SMA	53	85.0	4.8	400	58.9
P4SMA68A*	P4SMA68CA*	SMA	58	92.0	4.5	400	65
P4SMA75A*	P4SMA75CA*	SMA	64	103.0	4.0	400	71.3
P4SMA82A*	P4SMA82CA*	SMA	70	113.0	3.6	400	77.9
P4SMA91A*	P4SMA91CA*	SMA	78	125.0	3.3	400	87
P4SMA100A*	P4SMA100CA*	SMA	86	137.0	3.0	400	95.0
P4SMA110A*	P4SMA110CA*	SMA	94	152.0	2.7	400	105.0
P4SMA120A*	P4SMA120CA*	SMA	102	165.0	2.5	400	114
P4SMA130A*	P4SMA130CA*	SMA	111	179.0	2.3	400	124.0
P4SMA150A*	P4SMA150CA*	SMA	128	207.0	2.0	400	143.0
P4SMA160A*	P4SMA160CA*	SMA	136	219	1.9	400	152.0
P4SMA170A*	P4SMA170CA*	SMA	145	234	1.8	400	162.0
P4SMA180A*	P4SMA180CA*	SMA	154	246	1.7	400	171.0
P4SMA200A*	P4SMA200CA*	SMA	171	274	1.5	400	190.0
P4SMA220A*	P4SMA220CA*	SMA	185	328	1.3	400	209.0
P4SMA250A*	P4SMA250CA*	SMA	214	344	1.2	400	237
P4SMA300A	P4SMA300CA	SMA	256	414	1.0	400	285
P4SMA350A	P4SMA350CA	SMA	300	482	0.9	400	332
P4SMA400A	P4SMA400CA	SMA	342	548	1	400	380
P4SMA440A	P4SMA440CA	SMA	376	602	0.7	400	418
P4SMA480A	P4SMA480CA	SMA	408	658	0.6	400	456
P4SMA510A	P4SMA510CA	SMA	434	698	0.6	400	485
P4SMA530A	P4SMA530CA	SMA	477	725	0.6	400	504
P4SMA540A	P4SMA540CA	SMA	486	740	0.5	400	513
P4SMA550A	P4SMA550CA	SMA	495	760	0.5	400	523

*"Q" suffix for AEC-Q101 compliance.

分立600W TVS二极管

Unidirectional Part Number	Bidirectional Part Number	Pkg. Size	Electrical Characteristics ($T_A = 25\,^{\circ}C$)				
			V_{rwm} (V)	V_{rsm} (V)	I_{rsm} (A)	P_{pk} (W)	V_{br} min. (V)
SMBJ5.0A	SMBJ5.0CA	SMB	5	9.2	65.2	600	6.4
SMBJ6.0A	SMBJ6.0CA	SMB	6	10.3	58.3	600	6.67
SMBJ6.5A	SMBJ6.5CA	SMB	6.5	11.2	53.6	600	7.22
SMBJ7.0A	SMBJ7.0CA	SMB	7	12	50	600	7.78
SMBJ7.5A	SMBJ7.5CA	SMB	7.5	12.9	46.5	600	8.33
SMBJ8.0A	SMBJ8.0CA	SMB	8	13.6	44.1	600	8.89
SMBJ8.5A	SMBJ8.5CA	SMB	8.5	14.4	41.7	600	9.44
SMBJ9.0A	SMBJ9.0CA	SMB	9	15.4	39	600	10
SMBJ10A	SMBJ10CA	SMB	10	17	35.3	600	11.1
SMBJ11A	SMBJ11CA	SMB	11	18.2	33	600	12.2
SMBJ12A*	SMBJ12CA*	SMB	12	19.9	30.2	600	13.3
SMBJ13A*	SMBJ13CA*	SMB	13	21.5	27.9	600	14.4
SMBJ14A*	SMBJ14CA*	SMB	14	23.2	25.8	600	15.6
SMBJ15A*	SMBJ15CA*	SMB	15	24.4	24	600	16.7
SMBJ16A*	SMBJ16CA*	SMB	16	26	23.1	600	17.8
SMBJ17A*	SMBJ17CA*	SMB	17	27.6	21.7	600	18.9
SMBJ18A*	SMBJ18CA*	SMB	18	29.2	20.5	600	20
SMBJ20A*	SMBJ20CA*	SMB	20	32.4	18.5	600	22.2
SMBJ22A*	SMBJ22CA*	SMB	22	35.5	16.9	600	24.4
SMBJ24A*	SMBJ24CA*	SMB	24	38.9	15.4	600	26.7
SMBJ26A*	SMBJ26CA*	SMB	26	42.1	14.2	600	28.9
SMBJ28A*	SMBJ28CA*	SMB	28	45.4	13.2	600	31.1
SMBJ30A*	SMBJ30CA*	SMB	30	48.4	12.4	600	33.3
SMBJ33A*	SMBJ33CA*	SMB	33	53.3	11.3	600	36.7
SMBJ36A*	SMBJ36CA*	SMB	36	58.1	10.3	600	40
SMBJ40A*	SMBJ40CA*	SMB	40	64.5	9.3	600	44.4
SMBJ43A*	SMBJ43CA*	SMB	43	69.4	8.6	600	47.8
SMBJ45A*	SMBJ45CA*	SMB	45	72.7	8.3	600	50
SMBJ48A*	SMBJ48CA*	SMB	48	77.4	7.7	600	53.3
SMBJ51A*	SMBJ51CA*	SMB	51	82.4	7.3	600	56.7
SMBJ54A*	SMBJ54CA*	SMB	54	87.1	6.9	600	60
SMBJ58A*	SMBJ58CA*	SMB	58	93.6	6.4	600	64.4
SMBJ60A	SMBJ60CA	SMB	60	96.8	6.2	600	66.7
SMBJ64A	SMBJ64CA	SMB	64	103	5.8	600	71.1
SMBJ70A	SMBJ70CA	SMB	70	113	5.3	600	77.8
SMBJ75A	SMBJ75CA	SMB	75	121	4.9	600	83.3
SMBJ78A	SMBJ78CA	SMB	78	126	4.7	600	86.7
SMBJ85A	SMBJ85CA	SMB	85	137	4.4	600	94.4
SMBJ90A	SMBJ90CA	SMB	90	146	4.1	600	100
SMBJ100A	SMBJ100CA	SMB	100	162	3.7	600	111
SMBJ110A	SMBJ110CA	SMB	110	177	3.4	600	122
SMBJ120A	SMBJ120CA	SMB	120	193	3.1	600	133
SMBJ130A	SMBJ130CA	SMB	130	209	2.9	600	144
SMBJ150A	SMBJ150CA	SMB	150	243	2.5	600	167
SMBJ160A	SMBJ160CA	SMB	160	259	2.3	600	178
SMBJ170A	SMBJ170CA	SMB	170	275	2.2	600	189

*"Q" suffix for AEC-Q101 compliance.

Unidirectional Part Number	Bidirectional Part Number	Pkg. Size	Electrical Characteristics (T_A = 25 °C)				
			V_{rwm} (V)	V_{rsm} (V)	I_{rsm} (A)	P_{pk} (W)	V_{br} min. (V)
P6SMB6.8A	P6SMB6.8CA	SMB	5.8	10.5	58.1	600	6.45
P6SMB7.5A	P6SMB7.5CA	SMB	6.4	11.3	54	600	7.13
P6SMB8.2A	P6SMB8.2CA	SMB	7.02	12.1	50.4	600	7.79
P6SMB9.1A	P6SMB9.1CA	SMB	7.78	13.4	45.5	600	8.65
P6SMB10A	P6SMB10CA	SMB	8.55	14.5	42.1	600	9.5
P6SMB11A	P6SMB11CA	SMB	9.4	15.6	39.1	600	10.5
P6SMB12A	P6SMB12CA	SMB	10.2	16.7	36.5	600	11.4
P6SMB13A	P6SMB13CA	SMB	11.1	18.2	33.5	600	12.4
P6SMB15A	P6SMB15CA	SMB	12.8	21.2	28.8	600	14.3
P6SMB16A	P6SMB16CA	SMB	13.6	22.5	27.1	600	15.2
P6SMB18A	P6SMB18CA	SMB	15.3	25.5	24.2	600	17.1
P6SMB20A	P6SMB20CA	SMB	17.1	27.7	22	600	19
P6SMB22A	P6SMB22CA	SMB	18.8	30.6	19.9	600	20.9
P6SMB24A	P6SMB24CA	SMB	20.5	33.2	18.4	600	22.8
P6SMB27A	P6SMB27CA	SMB	23.1	37.5	16.3	600	25.7
P6SMB30A	P6SMB30CA	SMB	25.6	41.4	14.7	600	28.5
P6SMB33A	P6SMB33CA	SMB	28.2	45.7	13.3	600	31.4
P6SMB36A	P6SMB36CA	SMB	30.8	49.9	12.2	600	34.2
P6SMB39A	P6SMB39CA	SMB	33.3	53.9	11.3	600	37.1
P6SMB43A	P6SMB43CA	SMB	36.8	59.3	10.3	600	40.9
P6SMB47A	P6SMB47CA	SMB	40.2	64.8	9.4	600	44.7
P6SMB51A	P6SMB51CA	SMB	43.6	70.1	8.7	600	48.5
P6SMB56A	P6SMB56CA	SMB	47.8	77	7.9	600	53.2
P6SMB62A	P6SMB62CA	SMB	53	85	7.2	600	58.9
P6SMB68A	P6SMB68CA	SMB	58.1	92	6.6	600	64.6
P6SMB75A	P6SMB75CA	SMB	64.1	103	5.9	600	71.3
P6SMB82A	P6SMB82CA	SMB	70.1	113	5.4	600	77.9
P6SMB91A	P6SMB91CA	SMB	77.8	125	4.9	600	86.5
P6SMB100A	P6SMB100CA	SMB	85.5	137	4.5	600	95
P6SMB110A	P6SMB110CA	SMB	94	152	4	600	105
P6SMB120A	P6SMB120CA	SMB	102	165	3.7	600	114
P6SMB130A	P6SMB130CA	SMB	111	179	3.4	600	124
P6SMB150A	P6SMB150CA	SMB	128	207	2.9	600	143
P6SMB160A	P6SMB160CA	SMB	136	219	2.8	600	152
P6SMB170A	P6SMB170CA	SMB	145	234	2.6	600	162
P6SMB180A	P6SMB180CA	SMB	154	246	2.5	600	171
P6SMB200A	P6SMB200CA	SMB	171	274	2.2	600	190
P6SMB220A	P6SMB220CA	SMB	185	328	1.9	600	209
P6SMB250A	P6SMB250CA	SMB	214	344	1.8	600	237
P6SMB300A	P6SMB300CA	SMB	256	414	1.5	600	285
P6SMB350A	P6SMB350CA	SMB	300	482	1.3	600	332
P6SMB400A	P6SMB400CA	SMB	342	548	1.1	600	380
P6SMB440A	P6SMB440CA	SMB	376	602	1	600	418
P6SMB480A	P6SMB480CA	SMB	408	658	0.9	600	456
P6SMB510A	P6SMB510CA	SMB	434	698	0.9	600	485
P6SMB530A	P6SMB530CA	SMB	477	725	0.8	600	503.5
P6SMB540A	P6SMB540CA	SMB	486	740	0.8	600	513
P6SMB550A	P6SMB550CA	SMB	495	760	0.8	600	522.5

分立1500W TVS二极管

Unidirectional Part Number	Bidirectional Part Number	Pkg. Size	Electrical Characteristics ($T_A = 25\,^{\circ}C$)				
			V_{rwm} (V)	V_{rsm} (V)	I_{rsm} (A)	P_{pk} (W)	V_{br} min. (V)
SMCJ5.0A	SMCJ5.0CA	SMC	5	9.2	163	1500	6.4
SMCJ6.0A	SMCJ6.0CA	SMC	6	10.3	145.6	1500	6.67
SMCJ6.5A	SMCJ6.5CA	SMC	6.5	11.2	133.9	1500	7.22
SMCJ7.0A	SMCJ7.0CA	SMC	7	12	125	1500	7.78
SMCJ7.5A	SMCJ7.5CA	SMC	7.5	12.9	116.3	1500	8.33
SMCJ8.0A	SMCJ8.0CA	SMC	8	13.6	110.3	1500	8.89
SMCJ8.5A	SMCJ8.5CA	SMC	8.5	14.4	104.2	1500	9.44
SMCJ9.0A	SMCJ9.0CA	SMC	9	15.4	97.4	1500	10
SMCJ10A	SMCJ10CA	SMC	10	17	88.2	1500	11.1
SMCJ11A	SMCJ11CA	SMC	11	18.2	82.4	1500	12.2
SMCJ12A*	SMCJ12CA*	SMC	12	19.9	75.3	1500	13.3
SMCJ13A*	SMCJ13CA*	SMC	13	21.5	69.7	1500	14.4
SMCJ14A*	SMCJ14CA*	SMC	14	23.2	64.7	1500	15.6
SMCJ15A*	SMCJ15CA*	SMC	15	24.4	61.5	1500	16.7
SMCJ16A*	SMCJ16CA*	SMC	16	26	57.7	1500	17.8
SMCJ17A*	SMCJ17CA*	SMC	17	27.6	53.3	1500	18.9
SMCJ18A*	SMCJ18CA*	SMC	18	29.2	51.4	1500	20
SMCJ20A*	SMCJ20CA*	SMC	20	32.4	46.3	1500	22.2
SMCJ22A*	SMCJ22CA*	SMC	22	35.5	42.2	1500	24.4
SMCJ24A*	SMCJ24CA*	SMC	24	38.9	38.6	1500	26.7
SMCJ26A*	SMCJ26CA*	SMC	26	42.1	35.6	1500	28.9
SMCJ28A*	SMCJ28CA*	SMC	28	45.4	33	1500	31.1
SMCJ30A*	SMCJ30CA*	SMC	30	48.4	31	1500	33.3
SMCJ33A*	SMCJ33CA*	SMC	33	53.3	28.1	1500	36.7
SMCJ36A*	SMCJ36CA*	SMC	36	58.1	25.8	1500	40
SMCJ40A*	SMCJ40CA*	SMC	40	64.5	23.3	1500	44.4
SMCJ43A*	SMCJ43CA*	SMC	43	69.4	21.6	1500	47.8
SMCJ45A*	SMCJ45CA*	SMC	45	72.7	20.6	1500	50
SMCJ48A*	SMCJ48CA*	SMC	48	77.4	19.4	1500	53.3
SMCJ51A*	SMCJ51CA*	SMC	51	82.4	18.2	1500	56.7
SMCJ54A*	SMCJ54CA*	SMC	54	87.1	17.2	1500	60
SMCJ58A*	SMCJ58CA*	SMC	58	93.6	16	1500	64.4
SMCJ60A	SMCJ60CA	SMC	60	96.8	15.5	1500	66.7
SMCJ64A	SMCJ64CA	SMC	64	103	14.6	1500	71.1
SMCJ70A	SMCJ70CA	SMC	70	113	13.3	1500	77.8
SMCJ75A	SMCJ75CA	SMC	75	121	12.4	1500	83.3
SMCJ78A	SMCJ78CA	SMC	78	126	11.4	1500	86.7
SMCJ85A	SMCJ85CA	SMC	85	137	10.4	1500	94.4
SMCJ90A	SMCJ90CA	SMC	90	146	10.3	1500	100
SMCJ100A	SMCJ100CA	SMC	100	162	9.3	1500	111
SMCJ110A	SMCJ110CA	SMC	110	177	8.4	1500	122
SMCJ120A	SMCJ120CA	SMC	120	193	7.9	1500	133
SMCJ130A	SMCJ130CA	SMC	130	209	7.2	1500	144
SMCJ150A	SMCJ150CA	SMC	150	243	6.2	1500	167
SMCJ160A	SMCJ160CA	SMC	160	259	5.8	1500	178
SMCJ170A	SMCJ170CA	SMC	170	275	5.5	1500	189

*"Q" suffix for AEC-Q101 compliance.

Unidirectional Part Number	Bidirectional Part Number	Pkg. Size	Electrical Characteristics ($T_A = 25^\circ C$)				
			V_{rwm} (V)	V_{rsm} (V)	I_{rsm} (A)	P_{pk} (W)	V_{br} min. (V)
1.5SMC6.8A	1.5SMC6.8CA	SMC	5.8	10.5	144.8	1500	6.45
1.5SMC7.5A	1.5SMC7.5CA	SMC	6.4	11.3	134.5	1500	7.13
1.5SMC8.2A	1.5SMC8.2CA	SMC	7.02	12.1	125.6	1500	7.79
1.5SMC9.1A	1.5SMC9.1CA	SMC	7.78	13.4	113.4	1500	8.65
1.5SMC10A	1.5SMC10CA	SMC	8.55	14.5	104.8	1500	9.5
1.5SMC11A	1.5SMC11CA	SMC	9.4	15.6	97.4	1500	10.5
1.5SMC12A	1.5SMC12CA	SMC	10.2	16.7	91	1500	11.4
1.5SMC13A	1.5SMC13CA	SMC	11.1	18.2	83.5	1500	12.4
1.5SMC15A	1.5SMC15CA	SMC	12.8	21.2	71.7	1500	14.3
1.5SMC16A	1.5SMC16CA	SMC	13.6	22.5	67.6	1500	15.2
1.5SMC18A	1.5SMC18CA	SMC	15.3	25.2	60.3	1500	17.1
1.5SMC20A	1.5SMC20CA	SMC	17.1	27.7	54.9	1500	19
1.5SMC22A	1.5SMC22CA	SMC	18.8	30.6	49.7	1500	20.9
1.5SMC24A	1.5SMC24CA	SMC	20.5	33.2	45.8	1500	22.8
1.5SMC27A	1.5SMC27CA	SMC	23.1	37.5	40.5	1500	25.7
1.5SMC30A	1.5SMC30CA	SMC	25.6	41.4	36.7	1500	28.5
1.5SMC33A	1.5SMC33CA	SMC	28.2	45.7	33.3	1500	31.4
1.5SMC36A	1.5SMC36CA	SMC	30.8	49.9	30.5	1500	34.2
1.5SMC39A	1.5SMC39CA	SMC	33.3	53.9	28.2	1500	37.1
1.5SMC43A	1.5SMC43CA	SMC	36.8	59.3	25.6	1500	40.9
1.5SMC47A	1.5SMC47CA	SMC	40.2	64.8	23.5	1500	44.7
1.5SMC51A	1.5SMC51CA	SMC	43.6	70.1	21.7	1500	48.5
1.5SMC56A	1.5SMC56CA	SMC	47.8	77	19.7	1500	53.2
1.5SMC62A	1.5SMC62CA	SMC	53	85	17.9	1500	58.9
1.5SMC68A	1.5SMC68CA	SMC	58.1	92	16.5	1500	64.6
1.5SMC75A	1.5SMC75CA	SMC	64.1	103	14.8	1500	71.3
1.5SMC82A	1.5SMC82CA	SMC	70.1	113	13.5	1500	77.9
1.5SMC91A	1.5SMC91CA	SMC	77.8	125	12.2	1500	86.5
1.5SMC100A	1.5SMC100CA	SMC	85.5	137	11.1	1500	95
1.5SMC110A	1.5SMC110CA	SMC	94	152	10	1500	105
1.5SMC120A	1.5SMC120CA	SMC	102	165	9.2	1500	114
1.5SMC130A	1.5SMC130CA	SMC	111	179	8.5	1500	124
1.5SMC150A	1.5SMC150CA	SMC	128	207	7.3	1500	143
1.5SMC160A	1.5SMC160CA	SMC	136	219	6.9	1500	152
1.5SMC170A	1.5SMC170CA	SMC	145	234	6.5	1500	162
1.5SMC180A	1.5SMC180CA	SMC	154	246	6.2	1500	171
1.5SMC200A	1.5SMC200CA	SMC	171	274	5.5	1500	190
1.5SMC220A	1.5SMC220CA	SMC	185	328	4.6	1500	209
1.5SMC250A	1.5SMC250CA	SMC	214	344	4.4	1500	237
1.5SMC300A	1.5SMC300CA	SMC	256	414	3.7	1500	285
1.5SMC350A	1.5SMC350CA	SMC	300	482	3.2	1500	332
1.5SMC400A	1.5SMC400CA	SMC	342	548	2.8	1500	380
1.5SMC440A	1.5SMC440CA	SMC	376	602	2.5	1500	418
1.5SMC480A	1.5SMC480CA	SMC	408	658	2.3	1500	456
1.5SMC510A	1.5SMC510CA	SMC	434	698	2.1	1500	485
1.5SMC530A	1.5SMC530CA	SMC	477	725	2.1	1500	503.5
1.5SMC540A	1.5SMC540CA	SMC	486	740	2	1500	513
1.5SMC550A	1.5SMC550CA	SMC	495	760	2	1500	522.5

分立3000W TVS二极管

Unidirectional Part Number	Bidirectional Part Number	Pkg. Size	Electrical Characteristics ($T_A = 25\,^{\circ}C$)				
			V_{rwm} (V)	V_{rsm} (V)	I_{rsm} (A)	P_{pk} (W)	V_{br} min. (V)
SMLJ5.0A	SMLJ5.0CA	SMC	5	9.2	326	3000	6.4
SMLJ6.0A	SMLJ6.0CA	SMC	6	10.3	291.3	3000	6.67
SMLJ6.5A	SMLJ6.5CA	SMC	6.5	11.2	267.9	3000	7.22
SMLJ7.0A	SMLJ7.0CA	SMC	7	12	250	3000	7.78
SMLJ7.5A	SMLJ7.5CA	SMC	7.5	12.9	232.6	3000	8.33
SMLJ8.0A	SMLJ8.0CA	SMC	8	13.6	220.6	3000	8.89
SMLJ8.5A	SMLJ8.5CA	SMC	8.5	14.4	208.4	3000	9.44
SMLJ9.0A	SMLJ9.0CA	SMC	9	15.4	194.8	3000	10
SMLJ10A	SMLJ10CA	SMC	10	17	176.4	3000	11.10
SMLJ11A	SMLJ11CA	SMC	11	18.2	164.8	3000	12.2
SMLJ12A*	SMLJ12CA*	SMC	12	19.9	150.6	3000	13.3
SMLJ13A*	SMLJ13CA*	SMC	13	21.5	139.4	3000	14.4
SMLJ14A*	SMLJ14CA*	SMC	14	23.2	129.4	3000	15.6
SMLJ15A*	SMLJ15CA*	SMC	15	24.4	123	3000	16.7
SMLJ16A*	SMLJ16CA*	SMC	16	26	115.4	3000	17.8
SMLJ17A*	SMLJ17CA*	SMC	17	27.6	106.6	3000	18.9
SMLJ18A*	SMLJ18CA*	SMC	18	29.2	102.8	3000	20
SMLJ20A*	SMLJ20CA*	SMC	20	32.4	92.6	3000	22.2
SMLJ22A*	SMLJ22CA*	SMC	22	35.5	84.4	3000	24.4
SMLJ24A*	SMLJ24CA*	SMC	24	38.9	77.2	3000	26.7
SMLJ26A*	SMLJ26CA*	SMC	26	42.1	71.2	3000	28.9
SMLJ28A*	SMLJ28CA*	SMC	28	45.4	66	3000	31.1
SMLJ30A*	SMLJ30CA*	SMC	30	48.4	62	3000	33.3
SMLJ33A*	SMLJ33CA*	SMC	33	53.3	56.2	3000	36.7
SMLJ36A*	SMLJ36CA*	SMC	36	58.1	51.6	3000	40
SMLJ40A*	SMLJ40CA*	SMC	40	64.5	46.4	3000	44.4
SMLJ43A*	SMLJ43CA*	SMC	43	69.4	43.2	3000	47.8
SMLJ45A*	SMLJ45CA*	SMC	45	72.7	41.2	3000	50
SMLJ48A*	SMLJ48CA*	SMC	48	77.4	38.8	3000	53.3
SMLJ51A*	SMLJ51CA*	SMC	51	82.4	36.4	3000	56.7
SMLJ54A*	SMLJ54CA*	SMC	54	87.1	34.4	3000	60
SMLJ58A*	SMLJ58CA*	SMC	58	93.6	32	3000	64.4
SMLJ60A	SMLJ60CA	SMC	60	96.8	31	3000	66.7
SMLJ64A	SMLJ64CA	SMC	64	103	29.2	3000	71.1
SMLJ70A	SMLJ70CA	SMC	70	113	26.6	3000	77.8
SMLJ75A	SMLJ75CA	SMC	75	121	24.8	3000	83.3
SMLJ78A	SMLJ78CA	SMC	78	126	22.8	3000	86.7
SMLJ85A	SMLJ85CA	SMC	85	137	20.8	3000	94.4
SMLJ90A	SMLJ90CA	SMC	90	146	20.6	3000	100
SMLJ100A	SMLJ100CA	SMC	100	162	18.6	3000	111
SMLJ110A	SMLJ110CA	SMC	110	177	16.8	3000	122
SMLJ120A	SMLJ120CA	SMC	120	193	15.60	3000	133
SMLJ130A	SMLJ130CA	SMC	130	209	14.4	3000	144
SMLJ150A	SMLJ150CA	SMC	150	243	12.4	3000	167
SMLJ160A	SMLJ160CA	SMC	160	259	11.6	3000	178
SMLJ170A	SMLJ170CA	SMC	170	275	11.00	3000	189

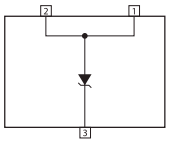
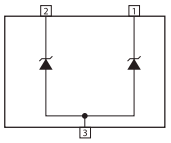
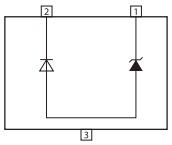
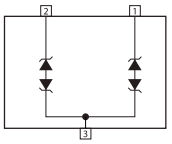
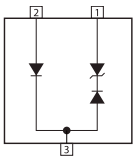
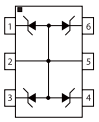
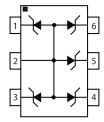
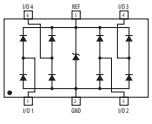
*"Q" suffix for AEC-Q101 compliance.

分立5000W 到7000W TVS二极管

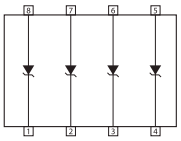
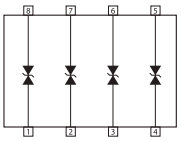
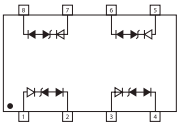
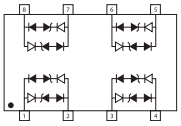
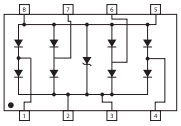
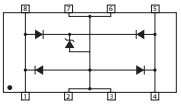
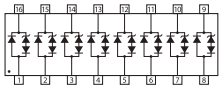
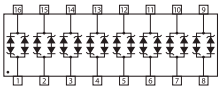
Unidirectional Part Number	Bidirectional Part Number	Pkg. Size	Electrical Characteristics ($T_A = 25^\circ C$)			
			V_{rwm} (V)	I_{PP} (A)	P_{pk} (W)	V_{br} min. (V)
5.0SMDJ5.0A	5.0SMDJ5.0CA	SMC	5	543.6	5000	6.4
5.0SMDJ6.0A	5.0SMDJ6.0CA	SMC	6	485.5	5000	6.67
5.0SMDJ6.5A	5.0SMDJ6.5CA	SMC	6.5	446.5	5000	7.22
5.0SMDJ7.0A	5.0SMDJ7.0CA	SMC	7	416.8	5000	7.78
5.0SMDJ7.5A	5.0SMDJ7.5CA	SMC	7.5	387.7	5000	8.33
5.0SMDJ8.0A	5.0SMDJ8.0CA	SMC	8	367.7	5000	8.89
5.0SMDJ8.5A	5.0SMDJ8.5CA	SMC	8.5	347.3	5000	9.44
5.0SMDJ9.0A	5.0SMDJ9.0CA	SMC	9	324.8	5000	10
5.0SMDJ10A	5.0SMDJ10CA	SMC	10	294.2	5000	11.1
5.0SMDJ11A	5.0SMDJ11CA	SMC	11	274.8	5000	12.2
5.0SMDJ12A*	5.0SMDJ12CA*	SMC	12	252	5000	13.3
5.0SMDJ13A*	5.0SMDJ13CA*	SMC	13	233.0	5000	14.40
5.0SMDJ14A*	5.0SMDJ14CA*	SMC	14	216.0	5000	15.60
5.0SMDJ15A*	5.0SMDJ15CA*	SMC	15	205	5000	16.70
5.0SMDJ16A*	5.0SMDJ16CA*	SMC	16	193.0	5000	17.80
5.0SMDJ17A*	5.0SMDJ17CA*	SMC	17	181.0	5000	18.90
5.0SMDJ18A*	5.0SMDJ18CA*	SMC	18	172.0	5000	20.00
5.0SMDJ20A*	5.0SMDJ20CA*	SMC	20	155.0	5000	22
5.0SMDJ22A*	5.0SMDJ22CA*	SMC	22	141.0	5000	24.40
5.0SMDJ24A*	5.0SMDJ24CA*	SMC	24	129.0	5000	26.7
5.0SMDJ26A*	5.0SMDJ26CA*	SMC	26	119.0	5000	28.9
5.0SMDJ28A*	5.0SMDJ28CA*	SMC	28	110.0	5000	31.1
5.0SMDJ30A*	5.0SMDJ30CA*	SMC	30	103.0	5000	33.3
5.0SMDJ33A*	5.0SMDJ33CA*	SMC	33	94	5000	36.7
5.0SMDJ36A*	5.0SMDJ36CA*	SMC	36	86.1	5000	40.0
5.0SMDJ40A*	5.0SMDJ40CA*	SMC	40	77.6	5000	44.4
5.0SMDJ43A*	5.0SMDJ43CA*	SMC	43	72.1	5000	48
5.0SMDJ45A*	5.0SMDJ45CA*	SMC	45	68.8	5000	50.0
5.0SMDJ48A*	5.0SMDJ48CA*	SMC	48	64.7	5000	53.3
5.0SMDJ51A*	5.0SMDJ51CA*	SMC	51	60.7	5000	56.7
5.0SMDJ54A*	5.0SMDJ54CA*	SMC	54	57.5	5000	60.0
5.0SMDJ58A*	5.0SMDJ58CA*	SMC	58	54	5000	64.4
5.0SMDJ60A*	5.0SMDJ60CA*	SMC	60	52	5000	66.7
5.0SMDJ64A*	5.0SMDJ64CA*	SMC	64	48.6	5000	71.1
5.0SMDJ70A*	5.0SMDJ70CA*	SMC	70	44.3	5000	78
5.0SMDJ75A*	5.0SMDJ75CA*	SMC	75	41.4	5000	83.3
5.0SMDJ78A*	5.0SMDJ78CA*	SMC	78	39.7	5000	86.7
5.0SMDJ85A*	5.0SMDJ85CA*	SMC	85	36.5	5000	94
5.0SMDJ90A	-	SMC	90	34.3	5000	100.0
5.0SMDJ100A	-	SMC	100	30.9	5000	111.0
5.0SMDJ110A	-	SMC	110	28.3	5000	122
5.0SMDJ120A	-	SMC	120	26	5000	133.0
5.0SMDJ130A	-	SMC	130	24	5000	144.0
5.0SMDJ150A	-	SMC	150	20.6	5000	167.0
5.0SMDJ160A	-	SMC	160	19.3	5000	178.0
5.0SMDJ170A	-	SMC	170	18.2	5000	189.0
SM8S16A*	SM8S16CA*	15.5 mm x 10.0 mm	16	254	6600	17.8
SM8S17A*	SM8S17CA*	15.5 mm x 10.0 mm	17	239	6600	18.9
SM8S18A*	SM8S18CA*	15.5 mm x 10.0 mm	18	226	6600	20.0
SM8S20A*	SM8S20CA*	15.5 mm x 10.0 mm	20	204	6600	22.2
SM8S22A*	SM8S22CA*	15.5 mm x 10.0 mm	22	186	6600	24.4
SM8S24A*	SM8S24CA*	15.5 mm x 10.0 mm	24	170	6600	26.7
SM8S26A*	SM8S26CA*	15.5 mm x 10.0 mm	26	157	6600	28.9
SM8S28A*	SM8S28CA*	15.5 mm x 10.0 mm	28	145	6600	31.1
SM8S30A*	SM8S30CA*	15.5 mm x 10.0 mm	30	136	6600	33.3
SM8S33A*	SM8S33CA*	15.5 mm x 10.0 mm	33	124	6600	36.7
SM8S36A*	SM8S36CA*	15.5 mm x 10.0 mm	36	114	6600	40.0
SM8S40A*	SM8S40CA*	15.5 mm x 10.0 mm	40	102	6600	44.4
SM8S43A*	SM8S43CA*	15.5 mm x 10.0 mm	43	95	6600	47.8
SM8SF24A*	SM8SF24CA*	10.5 mm x 8.1 mm	24	180	7000	26.7
SM8SF28A*	SM8SF28CA*	10.5 mm x 8.1 mm	28	154	7000	31.1
SM8SF30A*	SM8SF30CA*	10.5 mm x 8.1 mm	30	145	7000	33.3
SM8SF33A*	SM8SF33CA*	10.5 mm x 8.1 mm	33	131	7000	36.7
SM8SF36A*	SM8SF36CA*	10.5 mm x 8.1 mm	36	120	7000	40.0

*"Q" suffix for AEC-Q101 compliance.

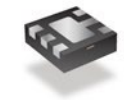
TVS二极管阵列

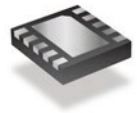
Part Number	Pkg. Size	Absolute Max. Ratings (T_A = 25 °C)			Electrical Characteristics (T_A = 25 °C)		Schematic
		V_{wm} (V)	V_C (V)	I_{pp} (A)	V_{br} min. (V)	C_t typ (pF)	
CDSOT23-T03	SOT23	3.3	10.9	43	4.0	500	
CDSOT23-T03-Q	SOT23	3.3	10.9	43	4.0	500	
CDSOT23-T05	SOT23	5.0	13.5	42	6.0	350	
CDSOT23-T08	SOT23	8.0	16.9	34	8.5	250	
CDSOT23-T08-Q	SOT23	8.0	16.9	34	8.5	150	
CDSOT23-T12	SOT23	12.0	25.9	21	13.3	150	
CDSOT23-T15	SOT23	15.0	30.0	17	16.7	100	
CDSOT23-T24	SOT23	24.0	49.0	12	26.7	88	
CDSOT23-T36	SOT23	36.0	76.8	9	40.0	80	
CDSOT23-T03C	SOT23	3.3	10.9	43	4.0	300	
CDSOT23-T05C	SOT23	5.0	13.5	42	6.0	210	
CDSOT23-T08C	SOT23	8.0	16.9	34	8.5	150	
CDSOT23-T08C-Q	SOT23	8.0	16.9	34	8.5	150	
CDSOT23-T12C	SOT23	12.0	25.9	21	13.3	90	
CDSOT23-T15C	SOT23	15.0	30.0	17	16.7	60	
CDSOT23-T15C-Q	SOT23	15.0	25.0	15	16.7	60	
CDSOT23-T24C	SOT23	24.0	49.0	12	26.7	63	
CDSOT23-T24C-Q	SOT23	24.0	41.0	8	26.7	88	
CDSOT23-T36C	SOT23	36.0	76.8	9	40.0	60	
CDSOT23-T03LC	SOT23	3.3	10.9	43	4.0	5	
CDSOT23-T03LC-Q	SOT23	3.3	16.9	43	4.0	5	
CDSOT23-T05LC	SOT23	5.0	13.5	42	6.0	5	
CDSOT23-T05LC-Q	SOT23	5.0	17.0	42	6.0	5	
CDSOT23-T08LC	SOT23	8.0	16.9	34	8.5	5	
CDSOT23-T08LC-Q	SOT23	8.0	19.5	34	8.5	5	
CDSOT23-T12LC	SOT23	12	25.9	27	13.3	5	
CDSOT23-T15LC	SOT23	15	30.0	17	16.7	5	
CDSOT23-T24LC	SOT23	24.0	26.7	12	26.7	5	
CDSOT23-T36LC	SOT23	36.0	76.8	9	40.0	5	
CDSOT23-T24CAN	SOT23	24.0	40.0	8	26.2	22	
CDSOT23-T24CAN-Q	SOT23	24.0	40.0	8	26.2	22	
CDSOT23-SM712	SOT23	7.0/12.0	14.0/26.0	17	7.5/13.3	75	
CDSOT23-SLVU2.8	SOT23	2.8	21	30	3.0	2.5/20	
CDSOT236-T05	SOT23-6	5.0	21.0	17	6.0	150	
CDSOT236-T12	SOT23-6	12.0	29.2	12	13.3	80	
CDSOT236-T15	SOT23-6	15.0	34.6	10	16.7	50	
CDSOT236-T24	SOT23-6	24.0	58.3	6	26.7	40	
CDSOT236-T05C	SOT23-6	5.0	21.0	17	6.0	150	
CDSOT236-T12C	SOT23-6	12.0	29.2	12	13.3	80	
CDSOT236-T15C	SOT23-6	15.0	34.6	10	16.7	50	
CDSOT236-T24C	SOT23-6	24.0	58.3	6	26.7	40	
CDSOT23-SRV05-4	SOT23-6	5.0	15.0	30	6.0	3.5	

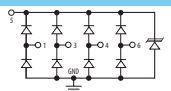
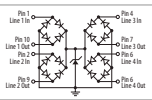
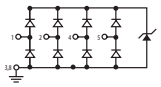
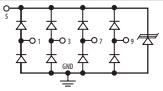
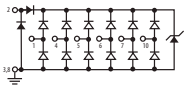
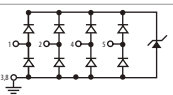
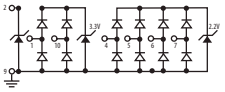
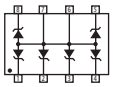
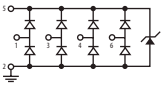
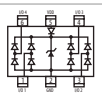
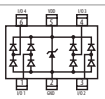
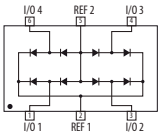


Part Number	Pkg. Size	Absolute Max. Ratings ($T_A = 25\,^{\circ}C$)			Electrical Characteristics ($T_A = 25\,^{\circ}C$)		Schematic
		V_{wm} (V)	V_C (V)	I_{pp} (A)	V_{br} min. (V)	C_t typ (pF)	
CDNBS08-T03	8L NSOIC	3.0	10.9	43	3.3	450	
CDNBS08-T05	8L NSOIC	5.0	13.5	42	6.0	308	
CDNBS08-T08	8L NSOIC	8.0	16.9	34	8.5	300	
CDNBS08-T12	8L NSOIC	12.0	25.9	27	13.3	105	
CDNBS08-T15	8L NSOIC	15.0	30.0	17	16.7	80	
CDNBS08-T24	8L NSOIC	24.0	49.0	12	26.7	50	
CDNBS08-T36	8L NSOIC	36.0	76.8	9	40.0	45	
CDNBS08-T03C	8L NSOIC	3.0	10.9	43	3.3	450	
CDNBS08-T05C	8L NSOIC	5.0	13.5	42	6.0	308	
CDNBS08-T08C	8L NSOIC	8.0	16.9	34	8.5	300	
CDNBS08-T12C	8L NSOIC	12.0	25.9	27	13.3	105	
CDNBS08-T15C	8L NSOIC	15.0	30.0	17	16.7	80	
CDNBS08-T24C	8L NSOIC	24.0	49.0	12	26.7	50	
CDNBS08-T36C	8L NSOIC	36.0	76.8	9	40.0	45	
CDSOT23-SLVU2.8-4	8L NSOIC	2.8	21.0	30	3.0	6	
CDSOT23-SLVU2.8-8	8L NSOIC	2.8	17.0	30	3.0	6	
CDNBS08-SRDA3.3-4	8L NSOIC	3.3	10.9	43	4.0	15	
CDNBS08-SRDA05-4	8L NSOIC	5.0	13.5	42	6.0	15	
CDNBS08-SRDA12-4	8L NSOIC	12.0	25.9	27	13.3	15	
CDNBS08-SRDA15-4	8L NSOIC	15.0	30.0	17	16.7	15	
CDNBS08-PLC03-6	8L NSOIC	6.0	20.0	100	6.8	6	
CDNB16-T03	16L NSOIC	3.0	23.0	43	4.5	15	
CDNB16-T05	16L NSOIC	5.0	24.0	42	6.0	15	
CDNB16-T08	16L NSOIC	8.0	26.0	30	8.5	15	
CDNB16-T12	16L NSOIC	12.0	33.0	21	13.3	15	
CDNB16-T15	16L NSOIC	15.0	39.0	15	16.7	15	
CDNB16-T24	16L NSOIC	24.0	57.0	10	26.7	15	
CDNB16-T36	16L NSOIC	36.0	72.0	7	40.0	15	
CDNB16-T03C	16L NSOIC	3.0	23.0	43	4.5	15	
CDNB16-T05C	16L NSOIC	5.0	24.0	42	6.0	15	
CDNB16-T08C	16L NSOIC	8.0	26.0	30	8.5	15	
CDNB16-T12C	16L NSOIC	12.0	33.0	21	13.3	15	
CDNB16-T15C	16L NSOIC	15.0	39.0	15	16.7	15	
CDNB16-T24C	16L NSOIC	24.0	57.0	10	26.7	15	
CDNB16-T36C	16L NSOIC	36.0	72.0	7	40.0	15	

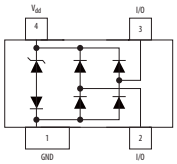
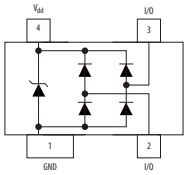
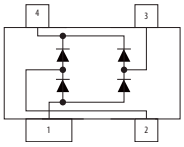





Part Number	Pkg. Size	Absolute Max. Ratings (T_A = 25 °C)			Electrical Characteristics (T_A = 25 °C)		Schematic
		V_{wm} (V)	V_C (V)	I_{pp} (A)	V_{br} min. (V)	C_t typ (pF)	
CDDFN6-0504P	DFN6	5.0	8.1	6.5	6.0	1.2	
CDDFN10-2574N	DFN10	2.5	11.0	45	3.0	1.7	
CDDFN10-3324P	DFN10	3.3	7.5	4	4.5	0.45	
CDDFN10-3304NA	DFN10	3.3	18.0	25	3.9	4	
CDDFN10-0506N	DFN10	5.0	10.0	3.5	6.0	0.25	
CDDFN10-0524P	DFN10	5.0	12.0	3.8	6.0	0.5	
CDDFN10-0516P	DFN10	5.0	7.2	4	6.0	0.35	
CDMSP10-0504M	MSOP-10L	5.0			6.0	0.55	
CDNBS08-SMDA05-6	SO-8	5.0	9.8	1	6.0	120	
CDSC706-0504C	SC70-6L	5.0	9.0	5	6.0	1.6	
CDSOT23-0502B	SOT23-3L	5.0	8.0	5	6.0	15	
CDSOT23-0502U	SOT23-3L	5.0	8.0	5	6.0	65	
CDSOT236-0502	SOT23-6L	5.0	7.5	5	6.0	2.8	
CDSOT236-0504LC	SOT23-6L	5.0	8.1	4.7	6.0	0.65	
CDSOT236-0504C	SOT23-6L	5.0	10.0	5	6.0	1.2	
CDSOT23-SR208	SOT23-6L	20.0		0.7		5	
CDSOT563-0502	SOT563	5.0	9.0	5	6.0	2.8	

控向二极管阵列

Part Number	Pkg. Size	Electrical Characteristics (T_A = 25 °C)					Schematic
		V_{wm} (V)	V_c (V)	I_{pp} (A)	V_{br} min. (V)	C_t typ (pF)	
CD143A-SR2.8	SOT-143	2.8	5.0	12	4.5	4.5	
CD143A-SR3.3	SOT-143	3.3	7.0	12	4.5	4.5	
CD143A-SR05	SOT-143	5.0	20.0	30	6.0	10	
CD143A-SR05LC	SOT-143	5.0	12.5	13	6.1	3	
CD143A-SR12	SOT-143	12.0	30.0	16	13.3	10	
CD143A-SR70	SOT-143	70.0	7.0	24	85.0	10	

10.PTVS

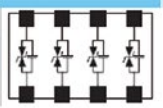
Part Number	Pkg. Type	Package Size (mm)			Electrical Characteristics (T_A = 25 °C)						
		Length	Width	Height	V_{wm} (V)	V_{br} min. (V)	V_c (V)	I_{pp} (kA)	I_D (µA)	C_t typ (nF)	UL
PTVS3-066C-M	Surface Mount	18.72	14.6	7.24	66.0	72.0	120.0	3	10	2	✓
PTVS3-076C-M	Surface Mount	18.72	14.6	7.24	76.0	85.0	135.0	3	10	1.7	✓
PTVS6-066C-M	Surface Mount	18.72	14.6	7.24	66.0	72.0	120.0	6	10	4.1	✓
PTVS6-076C-M	Surface Mount	18.72	14.6	7.24	76.0	85.0	135.0	6	10	3.3	✓
PTVS10-066C-M	Surface Mount	18.72	14.6	7.24	66.0	72.0	120.0	10	10	6.7	✓
PTVS10-076C-M	Surface Mount	18.72	14.6	7.24	76.0	85.0	135.0	10	10	5.5	✓
PTVS10-086C-M	Surface Mount	18.72	14.6	7.24	86.0	101.0	157.0	10	10	5	

Part Number	Pkg. Type	Package Size (mm)			Electrical Characteristics (T_A = 25 °C)						
		Length	Width	Height	V_{wm} (V)	V_{br} min. (V)	V_c (V)	I_{pp} (kA)	I_D (µA)	C_t typ (nF)	UL
PTVS3-058C-SH	Surface Mount	10.8	9	7	58.0	64.0	110.0	3	10	2.3	✓
PTVS3-076C-SH	Surface Mount	10.8	9	7.9	76.0	85.0	140.0	3	10	1.7	✓
PTVS6-058C-SH	Surface Mount	13	11.5	7	58.0	64.0	110.0	6	10	4.5	
PTVS6-076C-SH	Surface Mount	13	11.5	7.9	76.0	85.0	140.0	6	10	3.3	
PTVS10-058C-SH	Surface Mount	18.6	14.5	11	58.0	64.0	110.0	10	10	8	
PTVS10-076C-SH	Surface Mount	18.6	14.5	12	76.0	85.0	140.0	10	10	6	
PTVS15-058C-SH	Surface Mount	21	16	11	58.0	64.0	110.0	15	10	12	✓
PTVS15-076C-SH	Surface Mount	21	16	12	76.0	85.0	150.0	15	10	9	✓

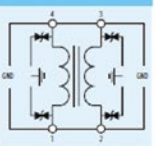
Part Number	Pkg. Type	Package Size (mm)			Electrical Characteristics (T_A = 25 °C)						
		Length	Width	Height	V_{WM} (V)	V_{br} min. (V)	V_C (V)	I_{pp} (kA)	I_D (µA)	C_t typ (pF)	
PTVS1-066C-TH	Through-Hole	24.15	7	14.5	66.0	71.0	86.0	1	10	0.744	
PTVS1-190C-TH	Through-Hole	24.15	7	14.5	190.0	200.0	227.0	1	10	0.274	
PTVS1-380C-TH	Through-Hole	24.15	8	14	380.0	422.0	520.0	1	10	0.12	✓
PTVS3-015C-TH	Through-Hole	24.15	9.3	16.8	15.0	16.0	28.0	3	10	7.5	
PTVS3-058C-TH	Through-Hole	24.15	9.3	16.8	58.0	64.0	110.0	3	10	2.3	✓
PTVS3-076C-TH	Through-Hole	24.15	9.3	16.8	76.0	85.0	140.0	3	10	1.7	✓
PTVS3-380C-TH	Through-Hole	24.15	9.3	16.8	380.0	401.0	520.0	3	10	0.35	
PTVS3-430C-TH	Through-Hole	24.15	9.3	16.8	430.0	440.0	580.0	3	10	0.4	
PTVS6-058C-TH	Through-Hole	24.15	11.5	18	58.0	64.0	110.0	6	10	4.5	
PTVS6-076C-TH	Through-Hole	24.15	11.5	18	76.0	85.0	140.0	6	10	3.3	
PTVS6-380C-TH	Through-Hole	24.15	11.5	18	380.0	401.0	520.0	6	10	0.65	
PTVS6-430C-TH	Through-Hole	24.15	11.5	18	430.0	440.0	580.0	6	10	0.7	
PTVS10-058C-TH	Through-Hole	24.15	14	21	58.0	64.0	110.0	10	10	7.50	
PTVS10-076C-TH	Through-Hole	24.15	14	21	76.0	85.0	140.0	10	10	5.6	
PTVS10-170C-TH	Through-Hole	24.15	14	21	170.0	190.0	260.0	10	10	2.5	
PTVS10-320C-TH	Through-Hole	24.15	14	21	320.0	336.0	440.0	10	10	1.4	
PTVS10-380C-TH	Through-Hole	24.15	14	21	380.0	401.0	520.0	10	10	1.2	
PTVS10-430C-TH	Through-Hole	24.15	14	21	430.0	440.0	580.0	10	10	1.1	
PTVS10-470C-TH	Through-Hole	24.15	14	21	470.0	470.0	630.0	10	10	1	
PTVS15-058C-TH	Through-Hole	24.15	16	23.5	58.0	64.0	110.0	15	10	12	✓
PTVS15-076C-TH	Through-Hole	24.15	16	23.5	76.0	85.0	150.0	15	10	9	✓

11.Chipguard® ESD

4通道Chipguard®阵列

Part Number	Pkg.	Pkg. Size (mm x mm)	Electrical Characteristics (T_a = 25 °C)									
			V_{WM} (V)	V_{BR} Min. (V) @1 mA	I_{PPM} (A) 8/20 µs Current	V_C Typ. (V) @I_{PP} = 1 A	I_R Max. (nA) @V_R = V_{WM}	C_{typ} (pF) V_R = 0 V f = 1 MHz	ESD Rating per IEC 61000-4-2, Contact Discharge (kV)	V_T (V) See Note 1	V_C (V) See Note 2	Additional Information
CG0805MLA-5.5ME	0805	2.0 x 1.25	5.5	9.6	10	28	10 µA	33	8	-	-	
CG0805MLA-18KE			18	25.2	5	58		15		-	-	
CG1206MLC-12E	1206	3.2 x 1.6	12	-	-	-	10	0.5		150	30	

带EMI滤波器的Chipguard®阵列

Part Number	Pkg.	Pkg. Size (mm x mm)	Max Ratings		Typical Electrical Characteristics (Ta = 25 °C)							
			Max. (V)	Current (mA)	Z_{CM} (Ω) @ 100 MHz	Cut-off Frequency (GHz)	Typical DC Resistance (Ω)	C_{typ} (pF) VR = 0 V f = 1 MHz	ESD Rating per IEC 61000-4-2, Contact Discharge (kV)	V_C (V) See Note 3	I_L (µA) @ 5 V	Additional Information
CGF0804TFH-900-2L	-	0.85 x 0.65	5	100	90	3	2.7	0.6	8	20	1	

符号:

C_{typ}	Typical Diode Capacitance	V_{BR}	Breakdown Voltage
I_F	Forward Current	V_C	Clamping Voltage
I_{FRM}	Maximum Repetitive Forward Current	V_f	Forward Voltage
I_{FSM}	Maximum Forward Surge Current	V_{RRM}	Maximum Repetitive Reverse Current
I_L	Leakage Current	V_T	Trigger Voltage
I_{PPM}	Maximum Peak Pulse Current	V_{WM}	Maximum Working Voltage
I_R	Reverse Current	Z_{CM}	Common Mode Impedance

Chipguard® ESD 抑制器

Part Number	Pkg.	Pkg. Size (mm x mm)	Electrical Characteristics (T_a = 25 °C)								
			V_{WM} (V)	V_{BR} Min. (V) @1 mA	I_{PPM} (A) 8/20 µs Current	V_C Typ. (V) @I_{PP} = 1 A	I_R Max. (nA) @V_R = VWM	C_{typ} (pF) V_R = 0 V f = 1 MHz	ESD Rating per IEC 61000-4-2, Contact Discharge (kV)	V_T (V) See Note 1	V_C (V) See Note 2
CG0201MLA-5.5MG	0201	0.6 x 0.3	5.5	8	-	-	10 µA	32	2	-	-
CG0402MLA-5.5MG	0402	1.0 x 0.5	5.5	6.4	20	19	50 µA	270	8	-	-
CG0402MLA-14KG			14	16.2		38		90			
CG0402MLA-14LG			14	15.3		30		100			
CG0402MLA-18KG			18	19.8		45		85			
CG0603MLA-5.5ME	0603	1.6 x 0.8	5.5	6.4	30	19		270			
CG0603MLA-14KE			14	16.2		35		150			
CG0603MLA-18KE			18	19.8		40		130			
CG0603MLA-26KE			26	27.9		58		100			
CG0402MLC-3.3LG	0402	1.0 x 0.5	3.3	-	-	-	5	0.5	8	250	25
CG0402MLC-05LG			5								
CG0402MLC-12LG			12								
CG0402MLC-24LG			24								
CG0402MLC-3.3LGA			3.3								
CG0402MLC-05LGA			5								
CG0402MLC-12LGA			12								
CG0402MLC-24LGA			24								
CG0603MLC-3.3LE	0603	1.6 x 0.8	3.3	-	-	-	5	0.5	8	250	25
CG0603MLC-05E*			5				50			150	20
CG0603MLC-05LE			5				5			250	25
CG0603MLC-12E*			12				50			150	30
CG0603MLC-12LE			12				5			250	25
CG0603MLC-24LE			24								
CG0603MLC-3.3LEA			3.3								
CG0603MLC-05LEA			5								
CG0603MLC-12LEA			12								
CG0603MLC-24LEA			24								
CG0402MLD-12G	0402	1.0 x 0.5	12	50 Typ.	-	140	1000	5	8	-	-
CG0603MLD-12E	0603	1.6 x 0.8	12		-	140				-	-
CG0402MLE-18G	0402	1.0 x 0.5	18	-	15	100	10 µA	9	8	-	-
CG0603MLE-18E	0603	1.6 x 0.8	18	-	20	60		50		-	-
CG0402MLU-3.3G	0402	1.0 x 0.5	3.3	-	-	-	5	0.05	8	250	25
CG0402MLU-05G			5								
CG0402MLU-12G			12								
CG0402MLU-24G			24								
CG0603MLU-3.3E	0603	1.6 x 0.8	3.3								
CG0603MLU-05E			5								
CG0603MLU-12E			12								
CG0603MLU-24E			24								

** AEC-Q200 Approved*

Notes:
(1) Typical trigger voltage for 8 kV contact discharge, per IEC 61000-4-2. Maximum response time is 1 ns.
(2) Typical clamp voltage 30 ns after start of 8 kV contact discharge, per IEC 61000-4-2.

满足AEC-Q200认证的Chipguard® ESD抑制器

Part Number	Pkg.	Pkg. Size (mm x mm)	Electrical characteristics (T_a = 25 °C)								
			V_{WM} (V)	V_{BR} Min. (V) @1 mA	I_{PPM} (A) 8/20 µs Current	V_C Typ. (V) @ I_{PP}= 1 A	I_R Max. (µA) @V_R = V_{WM}	C_{typ} (pF) V_R = 0 V f = 1 kHz	ESD Rating per IEC 61000-4-2, Contact Discharge (kV)	V_T (V), See Note 1	V_C (V) See Note 2
CGA0603MLA-16150E	0603	1.6 x 0.8	16	23.0	5	70	10	15	8	-	-
CGA0603MLA-16121E			16	22.0	30	46		120			
CGA0603MLA-17300E			17	21.6	2	70		30			
CGA0603MLA-18101E			18	19.0	30	44		100			
CGA0603MLA-19161E			19	8.0	20	64		160			
CGA0603MLA-22750E			22	24.0	30	54		75			
CGA0603MLA-22500E			22	25.0	10	54		50			
CGA0603MLA-22101E			22	24.3	30	50		100			
CGA0603MLA-22161E			22	24.3	30	50		160			
CGA0603MLA-26800E			26	30.0	30	67		80			
CGA0603MLA-31900E			31	35.0	30	71		90			
CGA0603MLA-32120E			32	51.9	5	124		12			
CGA0805MLA--16401E	0805	2.0 x 1.25	16	22.0	120	46	10	400	8	-	-
CGA0805MLA-18351E			18	19.8	120	44		350			
CGA0805MLA-22101E			22	25.0	30	54		100			
CGA0805MLA-22401E			22	24.3	120	50		400			
CGA0805MLA-26221E			26	29.7	80	56		220			
CGA0805MLA-31251E			31	35.1	80	71		250			
CGA0805MLA-38201E			38	42.3	80	81		200			
CGA1206MLA-16801E	1206	3.2 x 1.6	16	22.0	200	44	10	800	8	-	-
CGA1206MLA-16701E			16	19.8	200	42		700			
CGA1206MLA-22651E			22	24.3	200	48		650			
CGA1206MLA-22841E			22	24.3	100	50		840			
CGA1206MLA-26601E			26	29.7	200	58		600			
CGA1206MLA-31551E			31	35.1	200	69		550			
CGA1206MLA-38501E			38	42.3	200	81		500			
CGA1206MLA-40181E			56	63.0	200	110		180			
CGA0402MLC-05G	0402	1.0 x 0.5	5	-	-	-	0.01	0.2	8	300	30
CGA0402MLC-12G			12								
CGA0402MLC-24G			24								
CGA0603MLC-05E	0603	1.6 x 0.8	5	-	-	-	0.01	0.2	8	300	30
CGA0603MLC-12E			12					0.2			
CGA0603MLC-24E			24					0.05			

Notes:
(1) VT measured using TLP (Transmission Line Pulse) method.
(2) Peak voltage measured under ESD test conditions: IEC 61000-4-2, 8 kV contact discharge.

12.整流二极管

Symbol	Parameter	Unit	Description
V_{RRM}	Maximum Repetitive Peak Reverse Voltage	V	Maximum allowable repetitive instantaneous value of the diode's reverse voltage
I_F	Maximum Average Forward Rectified Current	A	Maximum allowable average forward current
I_{FSM}	Maximum Peak Forward Surge Current	A	Maximum allowable non-repetitive half-sine wave surge current
V_F	Forward Voltage	V	Voltage of the diode at I_F
I_R	Reverse Leakage Current	μA	Reverse leakage current at V_{RRM}
C_J	Junction Capacitance	pF	Junction capacitance of the diode
T_{rr}	Reverse Recovery Time	ns	Duration of time for diode to "turn off" when alternating current is from forward-bias to reverse-bias polarity
$R_{\theta JA}$	Thermal Resistance to Air	°C/W	Temperature difference between junction and outside air per watt

桥式整流二极管

Features

High current capability

Low profile package

Applications

Switch Mode Power Supplies (SMPS)

Power Supplies

Part Number	V_{RRM} (V)	I_F (A)	I_{FSM} (A)	V_F @ I_F (V)	I_R (μA)	Capacitance (pF)	Compliant Package	Length (mm)	Width (mm)	$R_{\theta JA}$ (°C/W)
CD-MBL102S	200	1	30	1	5	25	MBLS	5.9	5.4	95
CD-MBL104S	400	1	30	1	5	25	MBLS	5.9	5.4	95
CD-MBL106S	600	1	30	1	5	25	MBLS	5.9	5.4	95
CD-MBL106SL	600	1	45	0.95	5	25	MBLS	5.9	5.4	95
CD-MBL108S	800	1	30	1	5	25	MBLS	5.9	5.4	95
CD-MBL108SL	800	1	45	0.95	5	25	MBLS	5.9	5.4	95
CD-MBL110S	1000	1	30	1	5	25	MBLS	5.9	5.4	95
CD-MBL110SL	1000	1	45	0.95	5	25	MBLS	5.9	5.4	95
CD-MBL206S	600	2	50	1	5	25	MBLS	5.9	5.4	95
CD-MBL206SL	600	2	60	0.96	5	35	MBLS	5.9	5.4	95
CD-MBL208S	800	2	50	1	5	25	MBLS	5.9	5.4	95
CD-MBL208SL	800	2	60	0.96	5	35	MBLS	5.9	5.4	95
CD-MBL210S	1000	2	50	1	5	25	MBLS	5.9	5.4	95
CD-MBL210SL	1000	2	60	0.96	5	35	MBLS	5.9	5.4	95
CD-DF406S	600	4	150	0.95	5	45	DFS-4	10.6	8.2	35
CD-DF406SL	600	4	150	0.9	5	45	DFS-4	10.6	8.2	35
CD-DF408S	800	4	150	0.95	5	45	DFS-4	10.6	8.2	35
CD-DF408SL	800	4	150	0.9	5	45	DFS-4	10.6	8.2	35
CD-DF410S	1000	4	150	0.95	5	45	DFS-4	10.6	8.2	35
CD-DF410SL	1000	4	150	0.9	5	45	DFS-4	10.6	8.2	35

肖特基整流二极管

Features

High current capability

Low forward voltage

Low profile package

Applications

Switch Mode Power Supplies (SMPS)

Power Supplies

Part Number	V_{RRM} (V)	I_F (A)	I_{FSM} (A)	V_F @ I_F (V)	I_R (μA)	Capacitance (pF)	Compliant Package	Length (mm)	Width (mm)	$R_{\theta JA}$ (°C/W)
CD-HD004	40	1	30	0.5	200	250	TO-269AA	6.25	4.85	110
CD-HD006	60	1	30	0.7	200	250	TO-269AA	6.25	4.85	110
CD-HD01	100	1	30	0.85	200	250	TO-269AA	6.25	4.85	110
CD-HD2004	40	2	50	0.5	200	250	TO-269AA	6.25	4.85	110
CD-HD2006	60	2	50	0.7	200	250	TO-269AA	6.25	4.85	110
CD-HD2006L	60	2	50	0.55	200	250	TO-269AA	6.25	4.85	110
CD-HD201	100	2	50	0.85	200	250	TO-269AA	6.25	4.85	110
CD-HD201L	100	2	60	0.8	100	250	TO-269AA	6.25	4.85	145

快速响应整流二极管

Features

High current capability
Fast reverse recovery time

Applications

High Frequency
Switch Mode Power Supplies
Inverters

Part Number	V_{RRM} (V)	I_F (A)	T_{rr} (ns)	I_{FSM} (A)	V_F @ I_F (V)	I_R (μA)	Capacitance (pF)	Compliant Package	Length (mm)	Width (mm)	$R_{\theta JA}$ (°C/W)
CD1408-FU1200	200	1	35	30	0.93	2	10	SOD-123	3.4	1.9	80
CD1408-FU1400	400	1	35	30	1.05	5	10	SOD-123	3.4	1.9	80
CD1408-FU1600	600	1	35	30	1.25	5	10	SOD-123	3.4	1.9	80
CD1408-FU1800	800	1	35	25	2.5	5	10	SOD-123	3.4	1.9	80
CD1408-FF1200	200	1	50	30	1.7	5	10	SOD-123	3.4	1.9	95
CD1408-FF1400	400	1	50	30	1.7	5	10	SOD-123	3.4	1.9	95
CD1408-FF1600	600	1	50	30	1.7	5	10	SOD-123	3.4	1.9	95
CD1408-FF1800	800	1	50	30	1.7	5	10	SOD-123	3.4	1.9	95
CD1408-FF11500	1500	1	50	16	6	5	10	SOD-123	3.4	1.9	95
CD1408-FF11000	1000	1	75	25	1.7	5	10	SOD-123	3.4	1.9	95
CD1408-F1200	200	1	300	30	1.3	5	15	SOD-123	3.4	1.9	80
CD1408-F1400	400	1	300	30	1.3	5	15	SOD-123	3.4	1.9	80
CD1408-F1600	600	1	300	30	1.3	5	15	SOD-123	3.4	1.9	80
CD1408-F1800	800	1	300	30	1.3	5	15	SOD-123	3.4	1.9	80
CD1408-F11000	1000	1	300	30	1.3	5	15	SOD-123	3.4	1.9	80
CD214A-FS1D	200	1	35	30	0.94	0.2	8	DO-214AC (SMA)	4.5	2.2	70
CD214A-FS1G	400	1	35	30	1.15	0.2	8	DO-214AC (SMA)	4.5	2.2	70
CD214A-FS1J	600	1	35	25	1.4	0.2	8	DO-214AC (SMA)	4.5	2.2	70
CD214A-FS1K	800	1	35	25	1.65	0.2	8	DO-214AC (SMA)	4.5	2.2	70
CD214A-RS1D	200	1	150	30	1.05	0.1	8.2	DO-214AC (SMA)	4.5	2.2	61
CD214A-RS1G	400	1	150	30	1.05	0.1	8.2	DO-214AC (SMA)	4.5	2.2	61
CD214A-RS1J	600	1	250	30	1.05	0.1	8.2	DO-214AC (SMA)	4.5	2.2	61
CD214A-RS1K	800	1	300	30	1.05	0.1	8.2	DO-214AC (SMA)	4.5	2.2	61
CD214A-RS1M	1000	1	500	30	1.05	0.1	8.2	DO-214AC (SMA)	4.5	2.2	61
CD214B-FS2D	200	2	35	50	0.94	0.2	19	DO-214AA (SMB)	5.2	3.6	66
CD214B-FS2G	400	2	35	50	1.15	0.2	19	DO-214AA (SMB)	5.2	3.6	66
CD214B-FS2J	600	2	35	50	1.4	0.2	19	DO-214AA (SMB)	5.2	3.6	66
CD214B-FS2K	800	2	35	50	1.65	0.2	19	DO-214AA (SMB)	5.2	3.6	66
CD214B-FS3D	200	3	35	90	0.93	5	19	DO-214AA (SMB)	5.2	3.6	66
CD214B-FS3G	400	3	35	90	1.2	5	19	DO-214AA (SMB)	5.2	3.6	66
CD214B-FS3J	600	3	35	90	1.5	5	19	DO-214AA (SMB)	5.2	3.6	66
CD214B-FS3K	800	3	35	90	1.9	5	19	DO-214AA (SMB)	5.2	3.6	66
CD214C-FS3D	200	3	35	100	0.93	0.2	19	DO-214AB (SMC)	8	5	60
CD214C-FS3G	400	3	35	100	1.2	0.2	19	DO-214AB (SMC)	8	5	60
CD214C-FS3J	600	3	35	100	1.4	0.2	19	DO-214AB (SMC)	8	5	60

高压整流二极管

Features

High current capability
Low reverse leakage current

Applications

Switch Mode Power Supplies (SMPS)
Inverters

Part Number	V_{RRM} (V)	I_F (A)	I_{FSM} (A)	V_F @ I_F (V)	I_R (μA)	Capacitance (pF)	Compliant Package	Length (mm)	Width (mm)	$R_{\theta JA}$ (°C/W)
CD1408-R1200	200	1	30	1	1	12	SOD-123	3.4	1.9	80
CD1408-R1400	400	1	30	1	1	12	SOD-123	3.4	1.9	80
CD1408-R1600	600	1	30	1	1	12	SOD-123	3.4	1.9	80
CD1408-R1800	800	1	30	1	1	12	SOD-123	3.4	1.9	80
CD1408-R11000	1000	1	30	1	1	12	SOD-123	3.4	1.9	80
CD214A-S1D	200	1	30	0.94	0.1	12	DO-214AC (SMA)	4.5	2.2	115
CD214A-S1G	400	1	30	0.94	0.1	12	DO-214AC (SMA)	4.5	2.2	115
CD214A-S1J	600	1	30	0.94	0.1	12	DO-214AC (SMA)	4.5	2.2	115
CD214A-S1K	800	1	30	0.94	0.1	12	DO-214AC (SMA)	4.5	2.2	115
CD214A-S1M	1000	1	30	0.94	0.1	12	DO-214AC (SMA)	4.5	2.2	115
CD214A-S1Q	1200	1	30	1.1	0.1	12	DO-214AC (SMA)	4.5	2.2	115
CD214A-S1Y	1600	1	30	1.1	0.1	12	DO-214AC (SMA)	4.5	2.2	115
CD214A-R12000R	2000	1	30	1.1	5	6	DO-214AC (SMA)	4.5	2.2	65
CD214B-S2D	200	2	50	0.96	0.1	14	DO-214AA (SMB)	5.2	3.6	130
CD214B-S2G	400	2	50	0.96	0.1	14	DO-214AA (SMB)	5.2	3.6	130
CD214B-S2J	600	2	50	0.96	0.1	14	DO-214AA (SMB)	5.2	3.6	130
CD214B-S2K	800	2	50	0.96	0.1	14	DO-214AA (SMB)	5.2	3.6	130
CD214B-S2M	1000	2	50	0.96	0.1	14	DO-214AA (SMB)	5.2	3.6	130
CD214B-S3D	200	3	96	0.94	0.1	23	DO-214AA (SMB)	5.2	3.6	74
CD214B-S3G	400	3	96	0.94	0.1	23	DO-214AA (SMB)	5.2	3.6	74
CD214B-S3J	600	3	96	0.94	0.1	23	DO-214AA (SMB)	5.2	3.6	74
CD214B-S3K	800	3	96	0.94	0.1	23	DO-214AA (SMB)	5.2	3.6	74
CD214B-S3M	1000	3	96	0.94	0.1	23	DO-214AA (SMB)	5.2	3.6	74
CD214C-S3D	200	3	100	0.96	0.1	23	DO-214AB (SMC)	8	5	118
CD214C-S3G	400	3	100	0.96	0.1	23	DO-214AB (SMC)	8	5	118
CD214C-S3J	600	3	100	0.96	0.1	23	DO-214AB (SMC)	8	5	118
CD214C-S3K	800	3	100	0.96	0.1	23	DO-214AB (SMC)	8	5	118
CD214C-S3M	1000	3	100	0.96	0.1	23	DO-214AB (SMC)	8	5	118

13.功率电感和磁性器件

大电流屏蔽型功率电感

Power Inductors - SRP Series, SMD High Current, Shielded

Model	Photo	Size (mm)			Core		Inductance Range (µH)				I_{rms} Current Range (A)			Operating Temperature Range (°C)	AEC-Q200 Compliant, Automotive Grade
		Length	Width	Height	Ferrite	Metal Alloy	0.1	1	10	100	1	10	100		
SRP2010		2	1.6	1		•	0.24		2.2		1.7	4.5		-40 to +125	No
SRP2510A		2.5	2	1		•	0.22		4.7		1.36	5.9		-40 to +125	Yes
SRP2512		2.5	2	1.2		•	0.47		2.2		2.1	4.5		-40 to +125	No
SRP2512A		2.5	2	1.2		•	0.47		4.7		2.1	4.5		-40 to +125	Yes
SRP3012TA		3.5	3.2	1.2		•	0.15			10	1		10	-40 to +150	Yes
SRP3020TA		3.5	3.2	2		•	0.1			10	1.4		10.5	-40 to +150	Yes
SRP4020FA		4.1	4.1	2.1		•	0.47			4.7		5.1	13.2	-55 to +155	Yes
SRP4030FA		4.1	4.1	3		•		0.9		6.8		4	11.2	-55 to +155	Yes
SRP4012TA		4.45	4.06	1		•	0.1			10	1.3		11.5	-40 to +150	Yes
SRP4020TA		4.45	4.06	1.8		•	0.1			22	1.2		12	-40 to +150	Yes
SRP5030CA		5.4	5.3	3.1		•	0.15			4.7		5.9	22.2	-55 to +155	Yes
SRP5050FA		5.5	5.3	4.8		•		5.6		8.2		6.1	7.2	-55 to +155	Yes
SRP5015TA		5.7	5.2	1.3		•	0.15			22	1.2		16	-40 to +150	Yes
SRP5020TA		5.7	5.2	1.8		•	0.33			10	2.3		12	-40 to +150	Yes
SRP5030TA		5.7	5.2	2.8		•	0.33			15	2.1		14	-40 to +150	Yes
SRP6030CA		6.6	6.4	3		•	0.18			4.5		7	32	-55 to +155	Yes
SRP6050CA		6.6	6.4	5		•		1		4.7		8.5	20	-55 to +155	Yes
SRP6060FA		6.6	6.4	6		•		4.7		22		5	11	-55 to +155	Yes
SRP7028C		7.1	6.6	2.8		•	0.1			22	2.2		37	-40 to +125	No
SRP6540		7.2	6.5	4		•	0.56			47	1.6		18	-55 to +125	No
SRP7028A		7.3	6.6	2.8		•	0.1			33	2		32	-40 to +150	Yes
SRP7050TA		7.3	6.6	4.8		•	0.33			68	1.2		25	-40 to +150	Yes
SRP7030CA		7.8	7.6	2.9		•		1		8.2		5.9	21	-55 to +150	Yes
SRP1038A		11	10	3.8		•	0.2			47	3		35	-40 to +150	Yes
SRP1038C		11	10	3.8		•	0.1			47	3.2		53	-40 to +125	No
SRP1204		12.5	12.5	4	•		0.75		2			10	13	-40 to +125	No
SRP1205		12.5	12.5	5.6	•		0.54			7.4		8.3	18	-40 to +125	No
SRP1206		12.5	12.5	5.7	•		0.7		3.5			14	30	-55 to +150	No
SRP1238A		13.5	12.5	3.3		•	0.1			10		7	43	-40 to +150	Yes
SRP1245A		13.5	12.5	4.8		•	0.2			22		6.5	52	-40 to +150	Yes
SRP1265A		13.5	12.5	6.2		•	0.15			47		6.5	55	-40 to +150	Yes
SRP1770TA		17.6	16.9	6.7		•		1		100		5.3	52	-40 to +150	Yes
SRP1770C		17.8	16.9	6.7		•	0.47			47		8.7	60	-40 to +125	No
SRP2313AA		23.5	22	12.6		•		1		68		12	70	-55 to +155	Yes
PQ2614BHA		28	28	16	•			2.2		33			30	-40 to +155	Yes
PQ2614BLA		28	28	16	•			1		33			30	-40 to +155	Yes
PQ2617BHA		28	28	19	•			3.3		33			28	-40 to +155	Yes

表贴屏蔽型功率电感

Power Inductors - SRR & SRU Series, SMD Shielded

Model	Photo	Size (mm)			Core	Inductance Range (µH)							I_{rms} Current Range (A)				Operating Temperature Range (°C)	AEC-Q200 Compliant, Automotive Grade
		Length	Width	Height	Ferrite	0.1	1	10	100	1,000	10.000	100,000	0.01	0.1	1	10		
SRU2009		2.8	2.8	0.9	•		1		22					0.22		1.45	-40 to +125	No
SRU2011		2.8	2.8	1.1	•		1		33					0.23		1.65	-40 to +125	No
SRU2013		2.8	2.8	1.35	•		1			47				0.25		2.2	-40 to +125	No
SRU2016		2.8	2.8	1.65	•		1			100				0.19		2.2	-40 to +125	No
SRU3011		3.5	3.3	1.1	•		1.5		10					0.4		1.1	-40 to +125	No
SRU3014		3.5	3.3	1.4	•		1.2		22					0.32		1.85	-40 to +125	No
SRU3017		3.5	3.3	1.8	•		2.2			47				0.36		1.7	-40 to +125	No
SRU3028		3.5	3.3	2.8	•			10		100				0.19		0.72	-40 to +125	No
SRU3028A		3.5	3.3	2.8	•			10	33					0.47		0.72	-40 to +125	Yes
SRR3011		3.8	3.8	1.15	•		1.5			100				0.18		1.6	-40 to +125	No
SRR3818A		3.8	3.8	1.8	•		1			100				0.34		3.6	-40 to +150	Yes
SRR4011		4.8	4.8	1.15	•	0.47				150				0.25		3.2	-40 to +125	No
SRR4018		4.8	4.8	1.8	•		1			180				0.18		2.7	-40 to +125	No
SRR4818A		4.8	4.8	1.8	•		1			47				0.75		5.1	-40 to +150	Yes
SRR4028		4.8	4.8	2.8	•		1.2				560			0.22		3.1	-40 to +125	No
SRR4828A		4.8	4.8	2.8	•		1.2			220				0.5		5	-40 to +150	Yes
SRU5011		5.2	5.2	1.1	•		1.5			100				0.2		1.8	-40 to +125	No
SRU5016		5.2	5.2	1.6	•		1.8			100				0.3		1.75	-40 to +125	No
SRU5018		5.2	5.2	1.8	•		1			100				0.32		2.8	-40 to +125	No
SRU5028		5.2	5.2	2.8	•		1.2			100				0.47		3.5	-40 to +125	No
SRU5028A		5.2	5.2	2.8	•		1.2			100				0.47		3.5	-40 to +125	Yes
SRR5018		5.8	5.8	1.8	•		1.2			220				0.23		3	-40 to +125	No
SRR5028		5.8	5.8	2.8	•		2.6				680			0.13		3	-40 to +125	No
SRR0603		6.5	6.5	3.3	•		1.5				1000			0.1		2.2	-40 to +125	No
SRR0604		6.5	6.5	4.6	•		1.5				2200			0.1		2.8	-40 to +125	No
SRU6011		6.5	6.2	1.1	•		1.4			68				0.46		2.6	-40 to +125	No
SRU6013		6.5	6.2	1.4	•		1			68				0.6		3.2	-40 to +125	No
SRU6018		6.5	6.2	1.8	•		1.2			100				0.5		3.6	-40 to +125	No
SRU6025		6.5	6.2	2.5	•		1.2			220				0.42		4	-40 to +125	No
SRU6025A		6.5	6.2	2.5	•		1.2			220				0.42		4	-40 to +125	Yes
SRR6603		6.6	4.4	3	•		1					10000	0.02			3	-55 to +125	No
SRR6040A		6.7	6.7	4	•		1			100				0.65		5	-40 to +125	Yes
SRR6028		6.8	6.8	2.8	•		1.5				1000			0.15		3.4	-40 to +125	No
SRR6038		6.8	6.8	3.8	•		3.3			100				0.65		3.5	-40 to +125	No

Power Inductors - SRR & SRU Series, SMD Shielded

Model	Photo	Size (mm)			Core	Inductance Range (µH)						I_{rms} Current Range (A)				Operating Temperature Range (°C)	AEC-Q200 Compliant, Automotive Grade
		Length	Width	Height	Ferrite	1	10	100	1,000	10,000	100,000	0.1	1	10	100		
SRR7032		7	7	3.2	•	2.2			1000			0.15	2.65			-40 to +125	No
SRR7045		7	7	4.5	•	1			1000			0.25	3.5			-40 to +125	No
SRR0735A		7.3	7.3	3.5	•		10		680			0.21	2.1			-40 to +125	Yes
SRR0745A		7.3	7.3	4.5	•		10		1000			0.2	2.1			-40 to +125	Yes
SRU8028		8	8	2.8	•	1		100					0.75		7	-40 to +125	No
SRU8028A		8	8	2.8	•	2.5		100					0.75		4.5	-40 to +125	Yes
SRU8043		8	8	4.3	•	2.2		100					1		5.4	-40 to +125	No
SRU8045A		8	8	4.5	•	3.5		100					1		5	-40 to +125	Yes
SRR0905		9.9	9.9	4.5	•		10		470			0.33	2.1			-40 to +125	No
SRR0906		10	9.5	6	•	2.7				10000		0.07	3.2			-40 to +125	No
SRR0908		10	9.5	7.5	•	1.5				15000		0.08			5.6	-40 to +125	No
SRU1028		10	10	2.8	•	1			150				0.7		7	-40 to +125	No
SRU1028A		10	10	2.8	•	1			150			0.65			7	-40 to +125	Yes
SRU1038		10	10	3.8	•	1.5			330			0.55			7.2	-40 to +125	No
SRU1038A		10	10	3.8	•	1.5			330			0.55			7.2	-40 to +125	Yes
SRU1048		10	10	4.8	•	0.8			560			0.47			7.8	-40 to +125	No
SRU1048A		10	10	4.8	•	1.5			330				0.65		7	-40 to +125	Yes
SRU1063		10	10	6.5	•	1.6			100				1.1		8	-40 to +125	No
SRU1063A		10	10	6.5	•	4.7			100				1.1		5.5	-40 to +125	Yes
SRR1050A		10.2	10	4.8	•	0.68			330				0.73		9.5	-40 to +125	Yes
SRR0804		10.5	8	3.8	•		5		470			0.16	1.7			-40 to +125	No
SRR0805		10.5	8	4.7	•	2.2			1000			0.15	2.5			-40 to +125	No
SRR1210		12	12	10	•	1			1000				0.75		11	-40 to +125	No
SRR1210A		12	12	10	•	1			1000				0.75		11	-40 to +125	Yes
SRR1240		12.5	12.5	4	•	1			1000			0.42			9.3	-40 to +125	No
SRR1260		12.5	12.5	6	•	1			1000				0.68		9.4	-40 to +125	No
SRR1260A		12.5	12.5	6	•	1			1000				0.68		9.4	-40 to +125	Yes
SRR1280		12.5	12.5	7.5	•	1.1			1000				0.68		10.2	-40 to +125	No
SRR1280A		12.5	12.5	7.5	•	4.7			1000				0.68		8.2	-40 to +125	Yes
SRR1305		12.5	12.5	5	•	0.9	2.7							6	20	-40 to +125	No
SRR1005		12.7	10	5.2	•	1			3300			0.1	4.5			-40 to +125	No
SRR1003		12.7	10.3	3	•	1.8			470			0.16	3			-40 to +125	No
SRR1205		12.7	12.7	5.5	•	2.5			820			0.3	5			-40 to +125	No
SRR1206		12.7	12.7	6.5	•	2.5			1500			0.2			6.2	-40 to +125	No
SRR1208		12.7	12.7	8.5	•	2.5				10000		0.18			7.5	-40 to +125	No
SRR1806		18.3	14	6.8	•		10		1000			0.45	4			-40 to +125	No

功率电感和CMC电感

Power Inductors - SRN Series, SMD Semi-Shielded

Model	Photo	Size (mm)			Core	Inductance Range (µH)					I_{rms} Current Range (A)				Operating Temperature Range (°C)	AEC-Q200 Compliant, Automotive Grade
		Length	Width	Height	Ferrite	0.1	1	10	100	1,000	0.1	1	10	100		
SRN2009T		2	1.6	0.95	•	0.33		10			0.55	2.1			-40 to +125	No
SRN2010TA		2	1.6	1	•	0.47		22			0.27	2.3			-40 to +125	Yes
SRN2010		2	1.6	1.02	•	0.24	2.2					1.7	4.4		-55 to +125	No
SRN2508A		2.5	2	0.8	•	0.47		10			0.45	1.45			-55 to +125	Yes
SRN2510F		2.5	2	1	•	0.24	4.7					1.7	5.5		-40 to +125	No
SRN2510		2.5	2	1.02	•	0.24	2.2					1.5		3.1	-55 to +125	No
SRN3010		3	3	1	•		1			47	0.35	2.3			-40 to +125	No
SRN3010TA		3	3	1	•		1	22			0.6	2.1			-40 to +125	Yes
SRN3012TA		3	3	1.2	•		1	22			0.61	2.0			-40 to +125	Yes
SRN3015		3	3	1.5	•		1		100		0.29	2.35			-40 to +125	No
SRN3015TA		3	3	1.5	•		1			47	0.4	2.2			-40 to +125	Yes
SRN4012T		4	4	1.2	•	0.47		22			0.62			3.2	-40 to +125	No
SRN4012TA		4	4	1.2	•	0.47		22			0.62			3.2	-40 to +125	Yes
SRN4018		4	4	1.8	•	0.82				330	0.2	4			-40 to +125	No
SRN4018TA		4	4	1.8	•		1			220	0.3	3.7			-55 to +125	Yes
SRN4026		4	4	2.5	•		1			220	0.2	3			-40 to +125	No
SRN5020		5	5	2	•		1		33			0.9	3.6		-25 to +120	No
SRN5020TA		5	5	2	•		1		47			0.7	4.1		-55 to +125	Yes
SRN5040		5	5	4	•		1.5			47		0.9	3.6		-40 to +125	No
SRN5040TA		5	5	4	•		0.6		100			0.72	8		-55 to +125	Yes
SRN6028		6	6	2.8	•		0.9		100		0.66			4.6	-40 to +125	No
SRN6045TA		6	6	4.2	•		1			470	0.4			8	-55 to +125	Yes
SRN6045		6	6	4.5	•		1			220	0.6			4.2	-40 to +125	No
SRN8040		8	8	4	•	0.5			100			1		10	-40 to +125	No
SRN8040TA		8	8	4.2	•	0.5				330		0.7		12	-55 to +125	Yes
SRN1060		10	9.8	6	•			10		470		0.8		5.4	-40 to +125	No

Common Mode Chokes & Line Filters - SRF & DR Series, SMD Shielded

Model	Photo	Size (mm)			Core		Inductance Range (µH)						Impedance Range (Ω)					I_{rms} Current Range (mA)					Operating Temp Range (°C)	AEC-Q200 Compliant, Automotive Grade
		Length	Width	Height	Ferrite	Metal Alloy	0.1	1	10	100	1,000	10,000	10	100	1,000	10,000	100,000	10	100	1,000	10,000	100,000		
SRF0504		5	4.8	4.8	•		0.6		2.8					190			4000		200			5000	-40 to +125	No
DR221		6	3.3	3.3	•				11		470		450		1100			100	250				-40 to +125	No
SRF0602		6.5	3.6	1.65	•				10	330			140		900						300		-40 to +125	No
SRF0703A		7.6	7.6	3.4	•			8.2			1335								211			2190	-40 to +125	Yes
DR331		9	5.4	4.7	•				11		4700								200		500		-40 to +135	No
SRF0905		9.2	6	5	•				10		6500		200				5000		300		1600		-40 to +105	No
SRF0905A		9.2	6	5	•				10		6500		200				5000		300		1600		-40 to +105	Yes
SRF1006		10	8.7	6.5	•					120	5000		200				6200		250		1400		-40 to +105	No
SRF1010DA		12	9.6	11.3		•	0.43		15									4.6	27				-55 to +155	Yes
SRF1260A		12.5	12.5	6	•		0.47				4000								283			17600	-40 to +125	Yes
SRF1280A		12.5	12.5	8	•		0.47				4000								307			17900	-40 to +125	Yes
SRF1306		12.7	10.5	5.75	•				35		1000		400				2200		350			2700	-40 to +105	No

Power Inductors - SDE & SDR Series, SMD Non-Shielded

Model	Photo	Size (mm)			Core	Inductance Range (µH)						I_{rms} Current Range (A)					Operating Temperature Range (°C)	AEC-Q200 Compliant, Automotive Grade
		Length	Width	Height	Ferrite	1	10	100	1,000	10,000	100,000	0.01	0.1	1	10	100		
SDR0302		3	2.8	2.5	•	1				1200		0.06			2.1		-40 to +125	No
SDE0403A		4.5	4	3.2	•	1			68					0.4	2.7		-40 to +125	Yes
SDR0403		4.5	4	3.2	•	1				1000			0.09		3.8		-40 to +125	No
SDR0503		5	4.8	3	•		10				15000	0.02			1.3		-40 to +125	No
SDE0604A		5.8	5.2	4.5	•	1.2			150					0.52		5.3	-40 to +125	Yes
SDR0603		5.8	5.8	3.9	•	1.5				470		0.15			3		-40 to +125	No
SDR0604		5.8	5.8	4.8	•	1.2				1000		0.12				4.2	-40 to +125	No
SDR0703		6.5	4.5	2.7	•	1				1000			0.08		2.2		-40 to +125	No
SDR6603		6.6	4.45	2.92	•	1				1000			0.07		2.9		-40 to +125	No
SDE0805A		7.8	7	5	•	1.5				470				0.55		5.8	-40 to +125	Yes
SDR7030		7	7	3	•	1				1000			0.15		3		-40 to +125	No
SDR7045		7	7	4.5	•	1.2				1000				0.22		3.8	-40 to +125	No
SDR0805		7.8	7.8	5.3	•	1.5					4700		0.08			6	-40 to +125	No
SDR1006		9.8	9.8	5.8	•	1.5					4700		0.1			6.4	-40 to +125	No
SDE1006A		10	9	5.4	•	1.5				820			0.45			7.2	-40 to +125	Yes
SDR1030		10	10	3	•	2.7				1000			0.2		3		-40 to +125	No
SDR1045		10	10	4.5	•	2.7				1000			0.38			4.8	-40 to +125	No
SDR1105		11.1	10	4.8	•		10		200					1	4		-40 to +125	No
SDR0906		12.5	10.5	6.3	•	2.2					10000		0.04		4		-40 to +125	No
SDR1005		12.7	10	5	•	0.68					10000		0.1			8.5	-40 to +125	No
SDR1305		12.7	12.7	4.8	•	2.5				1000			0.46			7.2	-40 to +125	No
SDR1307		13	13	7	•	1.5				1000			0.65			9.5	-40 to +125	No
SDR1307A		13	13	7	•	1.5				1000			0.65			9.5	-40 to +125	Yes
SDR1806		18.3	14	6.6	•	1				1000				0.5		10	-40 to +125	No
SDR2207		22	15	7	•	0.78				1000				0.6		15	-40 to +125	No

Common Mode Chip Inductors - SRF Series, SMD Non-Shielded

Model	Photo	Size (mm)			Core	Inductance Range (µH)				Impedance Range (Ω)				I_{rms} Current Range (mA)			Operating Temperature Range (°C)	AEC-Q200 Compliant, Automotive Grade
		Length	Width	Height	Ferrite	1	10	100	1,000	10	100	1,000	10,000	100	1,000	10,000		
SRF2012A		2	1.2	1.2	•					30			900	100		400	-55 to +125	No
SRF2012AA		2	1.2	1.2	•					67			360	300		400	-55 to +125	Yes
SRF3216		3.2	1.6	2	•						90		2200	200		400	-40 to +125	No
SRF3216A		3.2	1.6	2	•						90		2200	200		400	-55 to +125	Yes
SRF4532		4.5	3.2	2.8	•	1			100		68		5000	200		1200	-40 to +125	No

通信信号变压器和功率变压器产品

产品系列型号	外形封装图片	产品性能及应用简介
LM-NP/-LP		Line matching, Fax modem application
PT61017PEL		LAN 10/100 Base-Tx,EtherCAT
PT61017XPEL		LAN 10/100 Base-Tx with Extended Temperature Range
PT61018PEL		LAN 10/100 Base-Tx,EtherCAT
PT61020EL		LAN 10/100/1000 Base-T Transformer Modules (PoE)
PT61022XEL		10/100/1000 Base-T Transformer
SM13100EL		LAN 10/100 Base-T, +85 °C, 250 Vrms
SM13126PEL		10/100 BASE TX LAN PoE +85 °C, IEEE802.3
SM353230-181N7Y		Chip LAN Transformer, 1/2.5/5G, 3.5 x 3.2 x 2.9 mm
SM41126EL		Chip LAN Transformer Module, 10/100 Base-Tx with Common Mode Chokes
SM42002EL		Chip LAN Transformer Module, 2.5 GbE, with Common Mode Chokes
SM42P01EL		Chip LAN Transformer Module, 5 GbE, PoE+, with Common Mode Chokes
SM43001EL		Chip LAN Transformer Module, 10 GbE, with Common Mode Chokes
SM43P01EL		Chip LAN Transformer Module, 10 GbE, PoE+, with Common Mode Chokes
SM453229-231N7Y		Chip LAN, 10/100/1000 Transformer, PoE, 4.7 x 3.2 mm
SM453229-381N7Y		Chip LAN, 10/100/1000 Transformer, 4.7 x 3.2 mm
SM453230-121N7Y		Chip LAN Transformer, 1/2.5/5/10G, 4.7 x 3.2 x 2.9 mm
SM453230-181N7Y		Chip LAN Transformer, 1/2.5/5G, 4.7 x 3.2 x 2.9 mm
SM51108PEL		10/100 Base Tx VoIP Module (PoE)
SM51430EL		G.Fast Transformer
SM51589PEL		10/100/1000 Base-T Transformer (PoE)
SM51625EL		10/100/1000 Base-T Transformer (PoE+)
SM75056PEL		T1/E1 Transformer
SM75057PEL		T1/E1 Transformer
SM91071AL		LAN 10/100 Base-T, 125 °C, AEC-Q200 Compliant, Common Mode Choke on Cable Side
SM91072AL		LAN 10/100 Base-T, 125 °C, AEC-Q200 Compliant, Common Mode Choke on Chip Side
SM91073AL		LAN 10/100 Base-T, 125 °C, AEC-Q200 Compliant, Common Mode Choke on Chip Side, with Wire Pre-Soldering for Higher Reliability
SM91074AL		LAN 10/100 Base-T, 125 °C, AEC-Q200 Compliant, Common Mode Choke on Cable Side, With Wire Pre-Soldering for Higher Reliability
SM-LP-5001		Modems(V32),Laptop Computers, Telecomm and Instrumentations application
SM-LP-5002		Modems(V32),Laptop Computers, Telecomm and Instrumentations application

产品系列型号	外形封装图片	尺寸	输入电压	输出电压	输出电流	频率	主副边变比
BS64042CS		9.8 x 10.5 x 11 mm	4.5 - 60 V	6 - 28 V	25 mA	100 kHz	1:1
HCT		15.2 x 10.8 x 6.5 mm	3.3 - 5 VDC	3.3 - 15 VDC	0.35 A Peak	250 - 550 kHz	可变
SM13117EL		17.8 x 13.5 x 12.7 mm	36 - 72 VDC	12 V DC	1.08 A	250 kHz	1 : 0.5 : 0.5 : 0.5
SM91047EL		17.8 x 13.5 x 12.7 mm	100 - 375 VDC	5 V DC	0.4 A	50kHz	1:11.875

定制化磁性器件

Bourns公司可以提供广泛的满足汽车及工业的定制化功率转换磁性器件、电感、共模电感等产品。目前主要的客户应用为：电池管理系统（BMS）、车载充电机（OBC）、能源存储系统（ESS）、高频开关电源（SMPS）以及电动汽车用电机驱动的IGBT驱动类产品等。Bourns的定制化磁性器件符合IATF 16949和ISO14000认证工厂规范要求。

1 kW Transformers

- LLC Converter
- High Isolation from Primary to Secondary
- UL and IEC Compliant

2.8 kW Transformers

- Phase Shifted Full Bridge
- Separate Resonant Inductor
- Very Low DCR for High Current Output

5.5 kW Transformers

- LLC Resonant Converter
- Low Leakage in Transformer
- Integrated Resonant Inductor

Transformers for High Power (<7 kW)

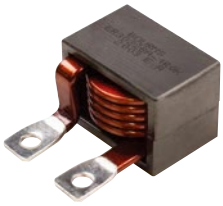
- For Half Bridge and Full Bridge LLC Converters
- Working Voltages of Up to 1000 V
- Reinforced Isolation
- Ultra-low Copper and Core Losses
- High Frequency (3 MHz) Cores

SMT Inductors

- Flat Wire Construction
- Low AC Resistance
- High Saturation Currents
- Low Core Loss
- SMT Leads
- Mechanical Terminals Available

Vertical Inductors

- High Density
- Lower Power Loss
- Design for Automation
- Better DCR Performance
- Helical Wound Coil
- AEC-Q200 Compliant



High Current Inductors

- Very Stable Performance Versus Temperature
- High Self-resonance Frequency
- AEC-Q200 Compliant

• PFC Inductors

- Power Factor Chokes
- For Boost Circuits
- 500 W to 10 kW
- High Saturation Current

Common Mode Chokes

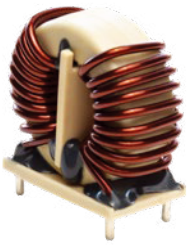
- EMI Output Filter
- High Current
- DC Line Voltage
- AEC-Q200 Compliant

CM and DMC Chokes

- UL Licensed Materials
- Lower Power Loss
- High Isolation
- Better DCR Performance
- AEC-Q200 Compliant

4-Phase Common Mode Chokes

- EMI Filter Inductors
- High Current
- AC Line Voltage
- AEC-Q200 Compliant

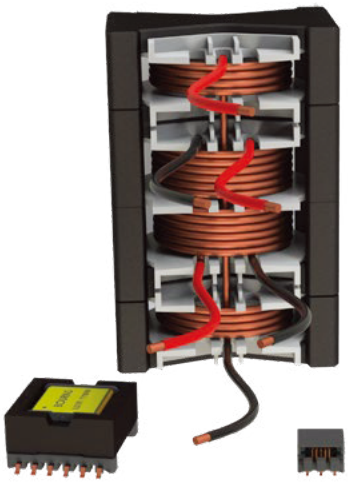


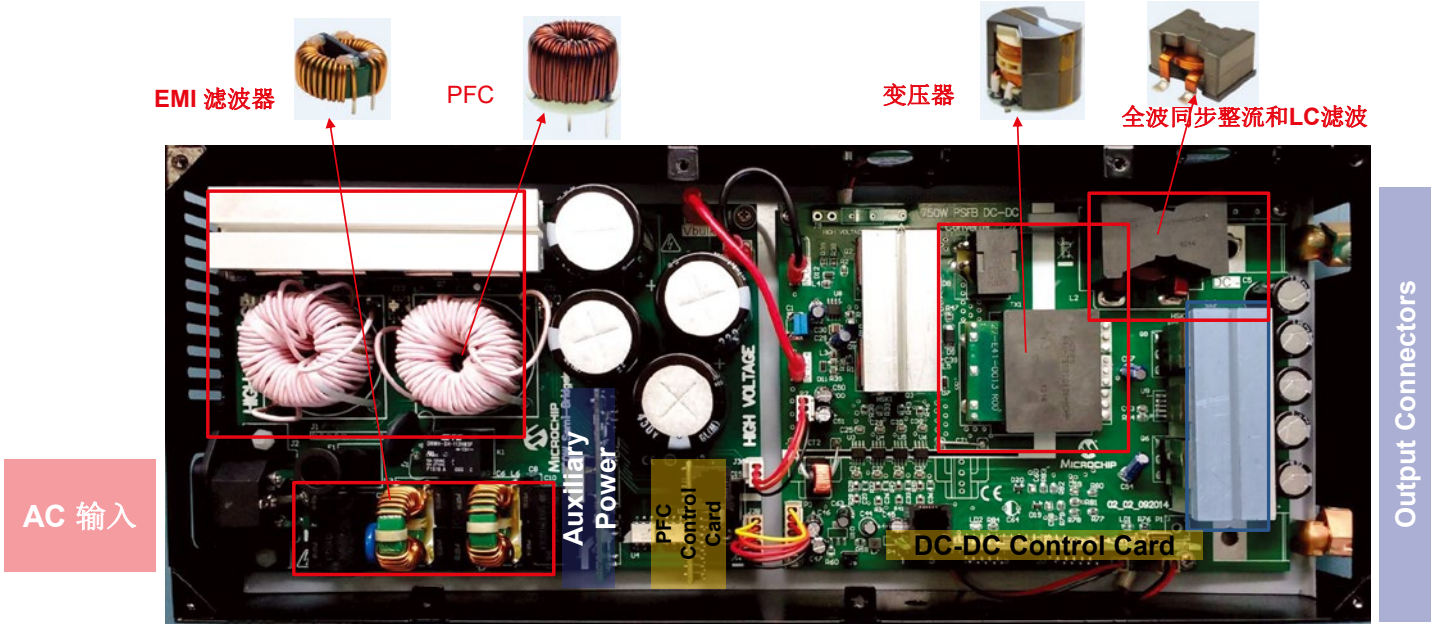
Common Mode Chokes

- Inductance: 125 µH ±35 %
- Irated: 15.4 A
- Up to 2.0 KVrms Isolation
- AEC-Q200 Compliant

Design Capabilities

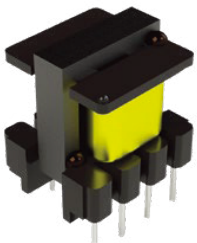
- EMI Reduction
- Design Services
- Finite Element Analysis
- 1 kW, 5 kW, 10 kW, >50 kW
- Thermal Management
- Aluminum Heatsinks and Thermal Compounds
- AEC-Q200 Compliance Testing Available
- Custom Cores
- Custom Bobbins
- Aluminum Housings
- Thermal Potting
- Flat Wire Windings
- Design Verification Test Facilities





Input AC Common Mode Chokes

- UL and IEC Compliant
- Very High Permeability core materials
- High Current

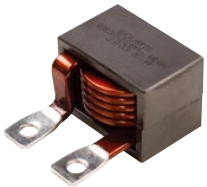


Transformers

- LLC Resonant Converter
- High Isolation
- UL and IEC Approvals
- Litz wire Winding

Common Mode Chokes

- Inductance: 125 µH ±35 %
- Irated: 15.4 A
- Up to 2.0 KVrms Isolation
- AEC-Q200 Compliant



Output Inductors

- High Current Inductor
- Flat Wire for low DC Resistance
- High Efficiency

附件

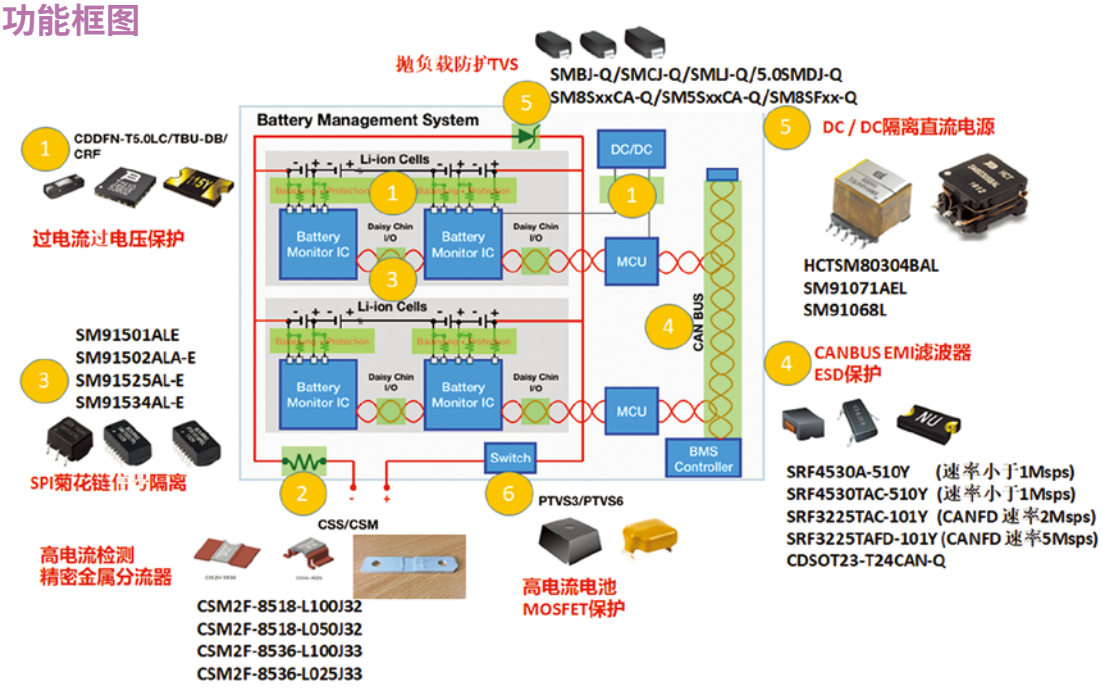
1.电动汽车BMS系统防护设计选型

内容摘要

电动汽车的BMS电池管理系统主要功能是为了能够提高电池的利用率，防止电池出现过度充电和过度放电，延长电池的使用寿命，针对电动汽车的动力电池参数进行实时监控、故障诊断、SOC/SOH估算（电流监视）、行驶里程估算、短路保护、绝缘漏电监测，显示报警、充放电模式选择等功能，并通过CANBUS/LINBUS总线的方式与车辆集成控制器T-BOX和充电机进行信息交互，保障电动汽车高效、可靠、安全运行，并保证在车辆使用过程中的安全。

针对BMS的电路保护系统，Bourns公司为客户提供了一整套的满足AEC-Q101/Q200的汽车级认证需求的系统级电子元器件保护解决方案。

BMS防护功能框图



1.PPTC/SinglFuse/TBU

Multifuse® PPTC Resettable Fuses

Model	Photo	Size (EIA, mm)	Hold Current (A)	Max. Operating Voltage (V)	Max. Operating Current (A)	AEC-Q200 Compliant	PPAP Documentation	IATF 16949 Factory
MF-DC		Custom	Custom	16	50	Yes	Level 3	Yes
MF-LSMF		2920, 7555	1.85 - 4.0	6 - 33	20 - 40	Yes	Level 3	Yes
MF-MSMF		1812, 4532	0.1 - 2.6	6 - 60	10 - 100	Yes	Level 3	Yes
MF-MSHT		1812	0.20 - 1.75	9 - 42	40	Yes	Level 3	Yes
MF-NSHT		1206, 3216	0.10 - 0.75	12 - 30	20 - 40	Yes	Level 3	Yes
MF-NSMF		1206, 3216	0.12 - 2.0	6 - 30	10 -100	Yes	Level 3	Yes
MF-PSHT		0805, 2012	0.05 - 0.50	12 - 16	40	Yes	Level 3	Yes
MF-RG		Various	3.0 - 11.0	16	100	Yes	Level 3	Yes
MF-RHT		Various	0.50 - 13.0	16 - 32	40, 100	Yes	Level 3	Yes
MF-SMHT		3425, 8763 / 2920, 7555	1.36, 1.6	16	100	Yes	Level 3	Yes
MF-USHT		1210, 3225	0.10 - 1.50	12 - 30	20 - 40	Yes	Level 3	Yes
MF-USMF		1210, 3225	.05 - 1.75	6 - 30	10 - 40	Yes	Level 3	Yes

SingIFuse™ SMD Fuses

Model	Photo	Size (EIA, mm)	Rated Current (A)	Rated Voltage (V)	Operating Temperature (˚C)	AEC-Q200 Compliant	PPAP Documentation	IATF 16949 Factory
SF-0603HIA-M		0603, 1608	1 - 5	32	–55 - +125	Yes	Level 3	Yes
SF-1206HIA-M		1206, 3216	0.5 - 6	24 - 65	–55 - +150	Yes	Level 3	Yes
SF-1206SA-W		1206, 3216	1.5 - 15	32 - 110	–55 - +125	Yes	Level 3	Yes
SF-2410FA-W		2410, 6125	1 - 10	125 - 250	–55 - +125	Yes	Level 3	Yes
SF-2410FPA-W		2410, 6125	12 - 20	65	–55 - +125	Yes	Level 3	Yes

TBU® High-Speed Protectors

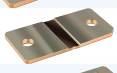
Model	Photo	Size (mm)	V_{imp}	V_{rms}	AEC-Q101 Compliant	PPAP Documentation	IATF 16949 Factory
TBU-CA-Q		6.5 mm x 4 mm	250 - 850 V	100 - 425 V	Yes	Level 3	Yes
TBU-DB-Q		6.5 mm x 5.5 mm	550 V	100 V	Yes	Level 3	Yes

2.功率电阻及Shunt分流器

Fixed Resistors

Model	Photo	Tolerances	Temperature Coefficient, (ppm/ °C)	Power (W)	Resistance Range (Ω)	AEC-Q200 Compliant	PPAP Documentation	IATF 16949 Factory
CHP-A		1 %, 5 %	±100, ±200	0.33 - 3	10 - 1M	Yes	Level 3	Yes
CMP-A		1 %, 5 %	±100, ±200	0.25 - 1.5	10 - 1M	Yes	Level 3	Yes
CR0201A-AS		1 %, 5 %	±100, ±200, -200+600	0.05	1 - 10 M	Yes	Level 3	Yes
CR0402A-AS		1 %, 5 %	±100, ±200, -200+500	0.063	1 - 20 M	Yes	Level 3	Yes
CR0603A-AS		1 %, 5 %	±100, ±200, ±400	0.1	1 - 20 M	Yes	Level 3	Yes
CR0805A-AS		1 %, 5 %	±100, ±200, ±400	0.125	1 - 20 M	Yes	Level 3	Yes
CR1206A-AS		1 %, 5 %	±100, ±200, ±400	0.25	1 - 20 M	Yes	Level 3	Yes
CR1210A-AS		1 %, 5 %	±100, ±200, ±400	0.33	1 - 20 M	Yes	Level 3	Yes
CR2010A-AS		1 %, 5 %	±100, ±200, ±400	0.5	1 - 20 M	Yes	Level 3	Yes
CR2512A-AS		1 %, 5 %	±100, ±200, ±400	1	1 - 20 M	Yes	Level 3	Yes
CRA2512		1 %, 5 %	±50	3	10 m - 100 m	Yes	Level 3	Yes
CRE2512		1 %	±50	2/3	1 m - 9 m	Yes	Level 3	Yes
CRF0805		1 %, 5 %	±50	0.5	3 m - 20 m	Yes	Level 3	Yes
CRF1206		1 %, 5 %	±50	1	1 m - 30 m	Yes	Level 3	Yes
CRF2512		1 %, 5 %	±50	1 ; 2	1 m - 50 m	Yes	Level 3	Yes
CRM0603A		0.5 %, 1 %, 5 %	±100, ±200	0.125	50 m - 1 M	Yes	Level 3	Yes
CRM0805A		0.5 %, 1 %, 5 %	±100, ±200	0.25	50 m - 1 M	Yes	Level 3	Yes
CRM1206A		0.5 %, 1 %, 5 %	±100, ±200	0.5	50 m - 1 M	Yes	Level 3	Yes
CRM1210A		0.5 %, 1 %, 5 %	±100, ±200	0.5	50 m - 1 M	Yes	Level 3	Yes
CRM2010A		0.5 %, 1 %, 5 %	±100, ±200	1	50 m - 1 M	Yes	Level 3	Yes
CRM2512A		0.5 %, 1 %, 5 %	±100, ±200	2	50 m - 1 M	Yes	Level 3	Yes
CRS0603A		1 %, 5 %	±100, ±200	0.125	1 - 1 M	Yes	Level 3	Yes
CRS0805A		1 %, 5 %	±100, ±200	0.25	1 - 1 M	Yes	Level 3	Yes
CRS1206A		1 %, 5 %	±100, ±200	0.5	1 - 1 M	Yes	Level 3	Yes
CRS1210A		1 %, 5 %	±100, ±200	0.5	1 - 1 M	Yes	Level 3	Yes
CRS2010A		1 %, 5 %	±100, ±200	1	1 - 1 M	Yes	Level 3	Yes
CRS2512A		1 %, 5 %	±100, ±200	2	1 - 1 M	Yes	Level 3	Yes

Fixed Resistors

Model	Photo	Tolerances	Temperature Coefficient, (ppm/ °C)	Power (W)	Resistance Range (Ω)	AEC-Q200 Compliant	PPAP Documentation	IATF 16949 Factory
CSM2F-6918		5 %	±50	36	0.05 m - 0.1 m	Yes	Level 3	Yes
CSM2F-7036		1 %, 5 %	±50	50	0.05 m - 0.1 m	Yes	Level 3	Yes
CSM2F-8518		5 %	±50	36	0.05 m - 0.1 m	Yes	Level 3	Yes
CSM2F-8536		5 %	±150, ±200	50	25 - 100 µ	Yes	Level 3	Yes
CSS2H-2512		1 %, 5 %	±50	1.5 - 6	0.3 m - 5 m	Yes	Level 3	Yes
CSS2H-3920		1 %, 5 %	±50	2 - 12	0.2 m - 5 m	Yes	Level 3	Yes
CSS2H-5930		1 %, 5 %	±50	4 - 15	0.2 m - 3 m	Yes	Level 3	Yes
CSS4J-4026		1 %, 5 %	±50	3 - 5	0.2 - 5 m	Yes	Level 3	Yes
CST0612		1 %	±100, ±200	1	0.5 m - 5 m	Yes	Level 3	Yes
PWR163		1 %, 5 %	±100	25	20 m - 130 K	Yes	Level 3	Yes
PWR220T-20		1 %, 5 %	±100	20	0.02 - 130K	Yes	Level 3	Yes
PWR220T-35		1 %, 5 %	±100	35	0.02 - 130K	Yes	Level 3	Yes
PWR221T-30		1 %, 5 %	±100, ±300, ±600	30	0.02 - 130K	Yes	Level 3	Yes
PWR263S-20		1 %, 5 %	±100	20	20 m - 130 K	Yes	Level 3	Yes
PWR263S-35		1 %, 5 %	±100	35	20 m - 130 K	Yes	Level 3	Yes

3.信号隔离变压器（菊花链通信）

Bourns产品型号	封装外形	对接AFE模拟前端	竞品型号	通道数	工作电压/隔离	HI-POT隔离(1mA,60s)	Primary Inductance (100kHz/0.1V)	中心抽头	内含Chock	AEC-Q200	工作温度范围
SM91501ALE		LTC6811-1/-2,LTC6813,LTC6804, MC33771/MC33772	HM2102NL/HMU2102NL	2	1600Vdc	4300Vdc/3100Vac	150-450uH	Yes	Yes	Yes	-40-125°C
SM91502ALA-E		ADBMS1818,ADBMS6815, ADBMS6830,LTC6811-1/-2, LTC6813,LTC6804, MC33771/MC33772	HM2103NL/HMU2103NL	1	1000Vdc	4300Vdc	150-450uH	Yes	Yes	Yes	-40-125°C
SM91507ALE		MAX17823	HM1237NL	2	600Vdc	2500Vrms	500uH(min)	Yes	Yes	Yes	-40-125°C
SM91508ALE		MAX17823	HM1238NL	1	1000Vdc	3000Vrms	300uH(min)	Yes	Yes	Yes	-40-150°C
SM91509ALE		BQ79606	Same layout 501/600uH(min)	2	1600Vdc	4300Vdc或3100Vrms	600uH(min)	Yes	Yes	Yes	-40-125°C
SM91514ALE		MC33771,MAX17853		1	1000Vdc	4300Vdc	300uH(min)	Yes	Yes	Yes	-40~125°C
SM91534AL-E		ADBMS1818,ADBMS6815, ADBMS6830,LTC6811-1/-2, LTC6813,LTC6804, MC33771/MC33772		1	1500Vdc	6400Vdc	150uH(min)	Yes	Yes	Yes	-40~125°C

4.功率电感及CMC共模电感

Power Inductors

Model	Photo	Size (mm)	Shielded	Inductance Range (µH)	Current Range (A)	AEC-Q200 Compliant	PPAP Documentation	IATF 16949 Factory
SRP2313AA		23.5 x 22 x 12.6	Yes	1.5 - 68	21 - 57	-1R5M, -6R8M, -330M	Level 3	Yes
SRP2510A		2.5 x 2 x 1	Yes	0.22 - 4.7	1.36 - 5.9	-R47M, -1R0M, -4R7M	Level 3	Yes
SRP2512A		2.5 x 2 x 1.2	Yes	0.47 - 4.7	1.55 - 4.6	-R47M, -1R0M, -4R7M	Level 3	Yes
SRP3012TA		3.5 x 3.2 x 1.2	Yes	0.15 - 10	1 - 10	-1R0M, -100M, -R33M	Level 3	Yes
SRP3020TA		3.5 x 3.2 x 2	Yes	0.1 - 10	1.4 - 10.5	-2R2M, -6R8M, -R33M	Level 3	Yes
SRP4012TA		4.45 x 4 x 1	Yes	0.1 - 10	1.3 - 11.5	-1R0M, -4R7M, -100M	Level 3	Yes
SRP4020TA		4.45 x 4 x 1.8	Yes	0.1 - 22	1.2 - 12	-R47M, -2R2M, -100M	Level 3	Yes
SRP5015TA		5.7 x 5.2 x 1.3	Yes	0.15 - 22	1.2 - 16	-R47M, -3R3M, -100M	Level 3	Yes
SRP5020TA		5.7 x 5.2 x 1.8	Yes	0.33 - 10	2.3 - 12	-R47M, -2R2M, -100M	Level 3	Yes
SRP5030TA		5.7 x 5.2 x 2.8	Yes	0.33 - 10	2.75 - 14	-R47M, -2R2M, -100M	Level 3	Yes
SRP6030VA		7.1 x 6.6 x 2.8	Yes	0.47 - 22	3.4 - 20	-R68M, -4R7M, -150M	Level 3	Yes
SRP7028A		7.3 x 6.6 x 2.8	Yes	0.15 - 33	2 - 27	-R33M, -2R2M, -100M	Level 3	Yes
SRP7050TA		7.3 x 6.6 x 4.8	Yes	0.33 - 68	1.2 - 25	-R33M, -1R5M, -680M	Level 3	Yes
SRR3818A		3.8 x 3.8 x 1.8	Yes	1 - 100	0.34 - 3.6	-2R2Y, -3R3Y, -100M	Level 3	Yes
SRR4818A		4.8 x 4.8 x 1.8	Yes	1 - 47	0.75 - 5.1	-1R0Y, -100M, -220M	Level 3	Yes
SRR4828A		4.8 x 4.8 x 2.8	Yes	1.2 - 220	0.5 - 5	-1R2Y, -220M, -470M, -221M	Level 3	Yes
SRU1028A		10 x 10 x 2.8	Yes	1 - 150	0.6 - 7	-100Y, -220Y, -330Y	Level 3	Yes
SRU1038A		10 x 10 x 3.8	Yes	1.5 - 330	0.55 - 7.2	-3R5Y, -330Y, -101Y	Level 3	Yes
SRU1048A		10 x 10 x 4.8	Yes	1.5 - 330	0.65 - 7	-R47M, -2R2M, -100M	Level 3	Yes
SRU1063A		10 x 10 x 6.8	Yes	4.7 - 100	1.1 - 5.5	-4R7Y, -220M, -680M	Level 3	Yes
SRU3028A		3.5 x 3.3 x 2.8	Yes	10 - 33	0.47 - 0.72	-100Y, -220Y, -330Y	Level 3	Yes
SRU5028A		5.2 x 5.2 x 2.8	Yes	1.2 - 100	0.47 - 3.5	-2R2Y, -150Y, -101Y	Level 3	Yes
SRU6025A		6.2 x 6.5 x 2.5	Yes	1.2 - 220	0.42 - 4	-2R2Y, -220Y, -221Y	Level 3	Yes
SRU8028A		8 x 8 x 2.8	Yes	2.5 - 100	0.75 - 4.5	-6R8Y, -220Y, -101Y	Level 3	Yes
SRU8045A		8 x 8 x 4.8	Yes	3.5 - 100	1 - 5	-6R2Y, -330M, -101M	Level 3	Yes

Power Inductors

Model	Photo	Size (mm)	Shielded	Inductance Range (µH)	Current Range (A)	AEC-Q200 Compliant	PPAP Documentation	IATF 16949 Factory
PQ2614BHA		28 x 28 x 16	Yes	2.2 - 33	30	-2R2K, -330K	Level 3	Yes
PQ2614BLA		28 x 28 x 16	Yes	1 - 33	30	-330K	Level 3	Yes
PQ2617BHA		28 x 28 x 19	Yes	3.3 - 33	30	-220K	Level 3	Yes
SDE0403A		4.5 x 4 x 3.2	No	1 - 68	0.4 - 2.7	-2R2M, -150M, -680K	Level 3	Yes
SDE0604A		5.8 x 5.2 x 4.5	No	1.2 - 150	0.52 - 5.3	-3R3M, -330M, -101K	Level 3	Yes
SDE0805A		7.8 x 7 x 5	No	1.5 - 470	0.55 - 5.8	-100M, -101K, -471K	Level 3	Yes
SDE1006A		10 x 9 x 5.4	No	1.5 - 820	0.45 - 7.2	-2R2M, -150M, -680K	Level 3	Yes
SRF1010DA		12 x 9.6 x 11.6	Yes	0.43 - 15	4.6 - 27	-R43M, -150M, -7R5M	Level 3	Yes
SRN2508A		2.5 x 2 x 0.8	Yes	0.47 - 10	0.45 - 1.45	-R47M, -2R2M, -6R8M	Level 3	Yes
SRN2010TA		2 x 1.6 x 1	Yes	0.47 - 22	0.27 - 2.35	-3R3M, -150M, -R47Y	Level 3	Yes
SRN3010TA		3 x 3 x 1	Yes	1 - 22	0.6 - 2.1	-1R5Y, -6R8M, 220M	Level 3	Yes
SRN3012TA		3 x 3 x 1.2	Yes	1 - 22	0.61 - 2	-3R3M, -150M, -1R0Y	Level 3	Yes
SRN3015TA		3 x 3 x 1.5	Yes	1 - 47	0.4 - 2.2	-2R2M, -100M, -330M	Level 3	Yes
SRN4012TA		4 x 4 x 1.2	Yes	0.47 - 22	0.62 - 3.2	-2R2M, -150M, -R47M	Level 3	Yes
SRN4018TA		4 x 4 x 1.8	Yes	1 - 150	0.27 - 3.2	-1R0M, -150M, -101M	Level 3	Yes
SRN5020TA		5 x 5 x 2	Yes	1 - 47	0.7 - 4.1	-1R0M, -220M, -6R8M	Level 3	Yes
SRN5040TA		5 x 5 x 4.1	Yes	0.6 - 100	0.72 - 8	-1R0M, -330M, -4R7M	Level 3	Yes
SRN6045TA		6 x 6 x 4.5	Yes	1 - 470	0.4 - 8	-1R0M, -220M, -221M	Level 3	Yes
SRN8040TA		8 x 8 x 4.5	Yes	0.5 - 330	0.7 - 12	-1R0Y, -221M, -470M, -6R8M	Level 3	Yes
SRP1038A		11 x 10 x 3.8	Yes	0.22 - 47	3 - 35	-2R2Y, -150Y, -101Y	Level 3	Yes
SRP1040VA		11 x 10 x 3.8	Yes	1 - 68	3.5 - 27	-3R3M, -100M, -470M	Level 3	Yes
SRP1238A		13.5 x 12.5 x 3.3	Yes	0.1 - 10	7 - 43	-1R0Y, -100M, -101M	Level 3	Yes
SRP1245A		13.5 x 12.5 x 4.8	Yes	0.33 - 18	7.5 - 42	-R33M, -2R2M, -100M	Level 3	Yes
SRP1265A		13.5 x 12.5 x 6.2	Yes	0.15 - 68	6.5 - 55	-R33M, -1R5M, -680M	Level 3	Yes
SRP1770TA		17.3 x 16.9 x 6.7	Yes	1 - 100	5.3 - 52	-330M, -331M, -681M	Level 3	Yes

Chip Inductors

Model	Photo	Size (mm)	Inductance Range (µH)	Current Range (A)	AEC-Q200 Compliant	PPAP Documentation	IATF 16949 Factory
CC322522A		3.2 x 2.9 x 2.4	1 - 100	0.18 - 1.45	-4R7K, -101K, -470K	Level 3	Yes
CC453232A		4.5 x 3.2 x 3.2	1 - 1000	0.09 - 2.30	-330KL, -101KL -102KL	Level 3	Yes

Common Mode Chip Inductors

Model	Photo	Size (mm)	Inductance Range (Ohms)	Inductance Range (µH)	Current Range (A)	AEC-Q200 Compliant	PPAP Documentation	IATF 16949 Factory
SRF2012AA		2 x 1.2 x 1.2	67 - 360	300 - 400	0.25 - 0.5	-670Y, -161Y, -361Y	Level 3	Yes
SRF2012A-801Y		2 x 1.2 x 1.2	800	—	0.3	-801Y	Level 3	Yes
SRF3216A		3.2 x 1.6 x 2	90 - 2200	200 - 400	0.3 - 1.2	-900Y, -261Y, -222Y	Level 3	Yes
SRF4530A		4.5 x 3.2 x 3	—	11 - 100	0.20 - 0.36	-110Y, -220Y, -101Y	Level 3	Yes
SRF4530AG-201Y		4.5 x 3.2 x 3	—	200	0.1	-201Y	Level 3	Yes

5.压敏、抛负载保护TVS及功率变压器

Varistor Products

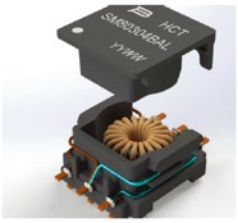
Model	Photo	Size (EIA, mm)	Peak Single Pulse Current 8/20 µs (A)	Operating Temperature (˚C)	AEC-Q200 Compliant	PPAP Documentation	IATF 16949 Factory
AVHT-SMD		0805, 1206, 1812, 2220, 3225	200 - 2000	–55 - +150	Yes	Level 3	Yes
AV-TH		602, 802, 902, 1103	400 - 2000	–55 - +125	Yes	Level 3	Yes
AV-SMD		0805, 1206, 1812, 2220, 3225	200 - 2000	–55 - +125	Yes	Level 3	Yes
0V		9, 12	800, 1200	–55 - +125	Yes	Level 3	Yes

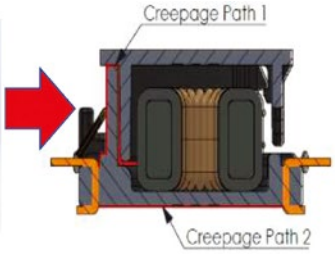
Transient Voltage Suppressor (TVS) Diodes

Model	Photo	Package	Size	P_{pp} (W)		V_{RWM} (V)	AEC-Q101 Compliant	PPAP Documentation	IATF 16949 Factory
				8/20 µs	10/1000 µs				
5.0SMDJ-Q		DO-214AB (SMC)	7.9 mm x 5.9 mm		5000	5 - 170	Yes	Level 3	Yes
15KPA-SD-Q		DO-218	15.5 mm x 10.0 mm		1500	16 - 66	Yes	Level 3	Yes
CDSOD323-TxxS-Q		SOD-323	Various		500	5 - 18	Yes	Level 3	Yes
CDSOD323-T12C-DSLQ		SOD-323	2.5 mm x 1.3 mm	350		12	Yes	Level 3	Yes
CDSOD323-T24C-DSLQ		SOD-323	2.5 mm x 1.3 mm	350		24	Yes	Level 3	Yes
CDSOT23-T03-Q ~ T15C-Q		SOT-23	2.9 mm x 2.3 mm	500		3.3 / 8 / 15	Yes	Level 3	Yes
CDSOT23-T24CAN-Q		SOT-23	2.9 mm x 2.3 mm	200		24	Yes	Level 3	Yes
SM8S-Q		DO-218	15.5 mm x 10.0 mm		6000	16 - 43	Yes	Level 3	Yes
SM8SF-Q		DFN	10.5 mm x 8.1 mm		7000	24 - 36	Yes	Level 3	Yes
SMA6J-Q		DO-214AC (SMA)	5.1 mm x 2.3 mm		600	5 - 130	Yes	Level 3	Yes
SMAJ-Q / P4SMA-Q		DO-214AC (SMA)	5.1 mm x 2.3 mm		400	5 - 220	Yes	Level 3	Yes
SMBJ-Q / P6SMB-Q		DO-214AA (SMB)	5.4 mm x 3.6 mm		600	5 - 220 / 5.8 - 214	Yes	Level 3	Yes
SMCJ-Q / 1.5SMC-Q		DO-214AB (SMC)	7.9 mm x 5.9 mm		1500	5 - 120 / 5.8 - 111	Yes	Level 3	Yes
SMLJ-Q		DO-214AB (SMC)	7.9 mm x 5.9 mm		3000	12 - 58	Yes	Level 3	Yes
SMF4L-Q		SOD-123F	3.70 mm x 1.65 mm		600	12 - 58	Yes	Level 3	Yes
SM5S-Q		DO-218	15.5 mm x 10.0 mm		3000	16 - 43	Yes	Level 3	Yes

HCT 系列功率变压器产品特点及选型

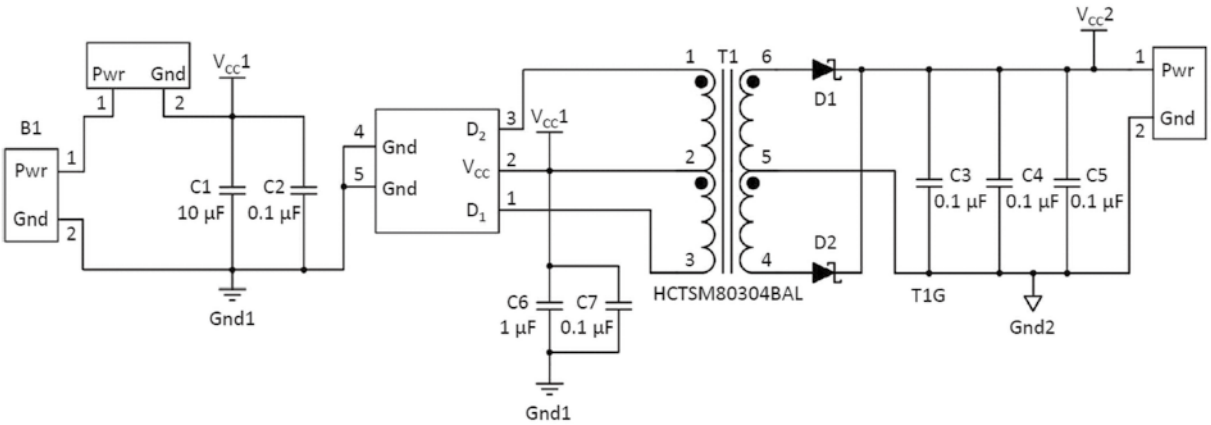
- 低高度化(6.5 mm) 以及最小8mm的电气间距和爬电距离
- 满足IEC 60950-1, IEC 62368-1, IEC 60664-1
- 加强绝缘, 额定电压800VAC
- 专门针对TI SN6501, SN6505B-Q1 and SN6505D-Q1 DC/DC开发
- AEC-Q200 Compliant
- RoHS compliant
- Halogen free
- 工作温度范围:-40 °C to +125 °C
- 3.3 - 5 V input, 3.3 - 15 V output
- 最高350 mA output





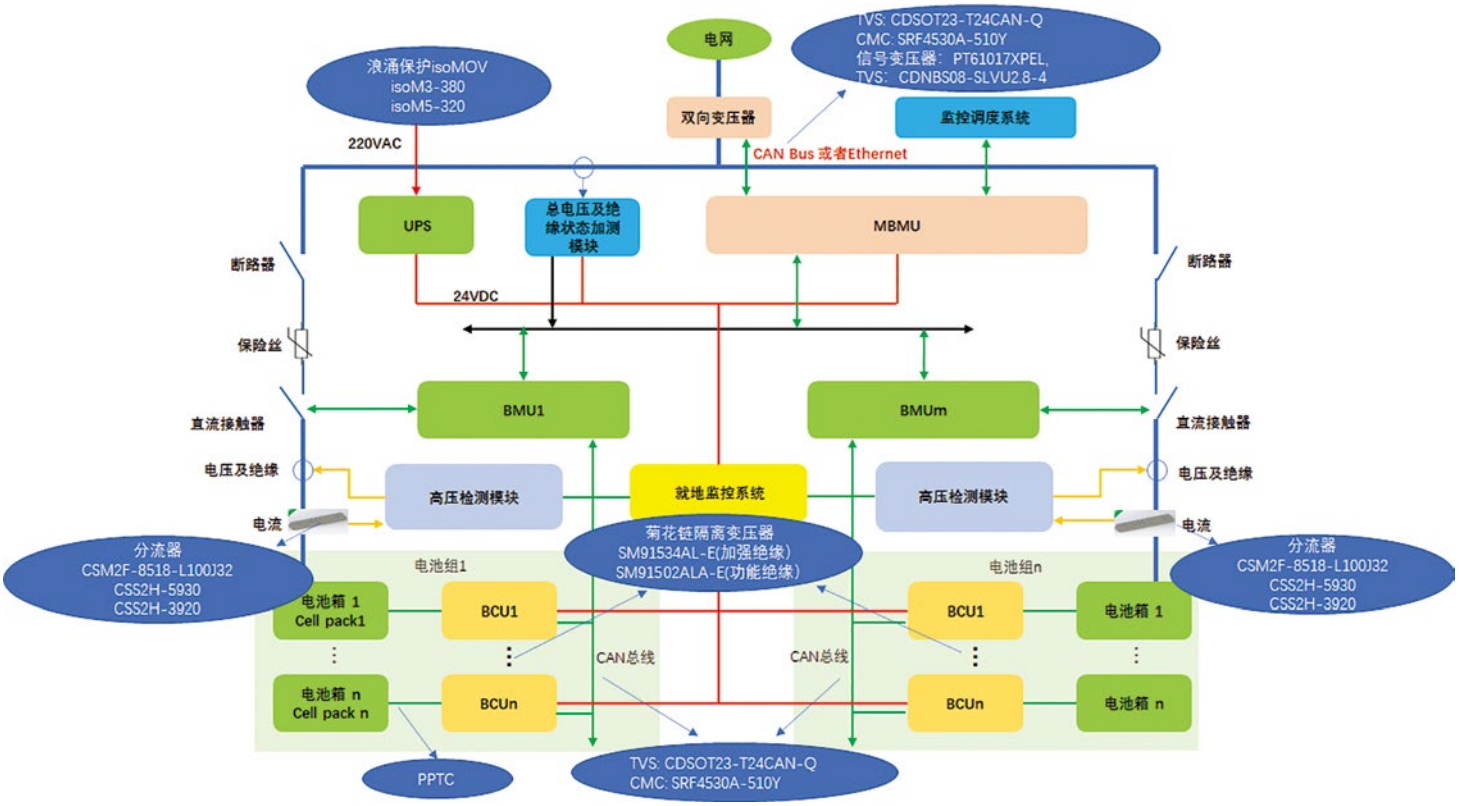
Bourns Part Number**	Primary Inductance @ 100 kHz	Leakage Inductance @ 100 kHz / 0.1 V (All Sec. Pins Shorted)	Turns Ratio P(1-3) : S(6-4)	Pri. (1-3) DCR (Ω) Max.	Sec. (6-4) DCR (Ω) Max.
	L 1-3 (μH) Min.	Lk 1-3 (μH) Max.			
HCTSM80101AAL	250	0.8	1 : 1	0.30	0.20
HCTSM80102AAL	250	0.6	1 : 2	0.30	0.35
HCTSM80201AAL	250	1.2	2 : 1	0.30	0.15
HCTSM80304BAL	300	0.6	3 : 4	0.30	0.30
HCTSM80305BAL	300	0.6	3 : 5	0.30	0.30
HCTSM80308BAL	300	0.7	3 : 8	0.50	0.85
HCTSM80403AAL	250	0.8	4 : 3	0.30	0.20
HCTSM80803AAL	250	1.8	8 : 3	0.30	0.15
HCTSM80809AAL	250	0.6	8 : 9	0.30	0.25
HCTSM80910BAL	300	0.9	9 : 10	0.30	0.25
HCTSM81017CAL	350	0.9	10 : 17	0.42	0.48

采用HCT变压器的推挽式电源设计



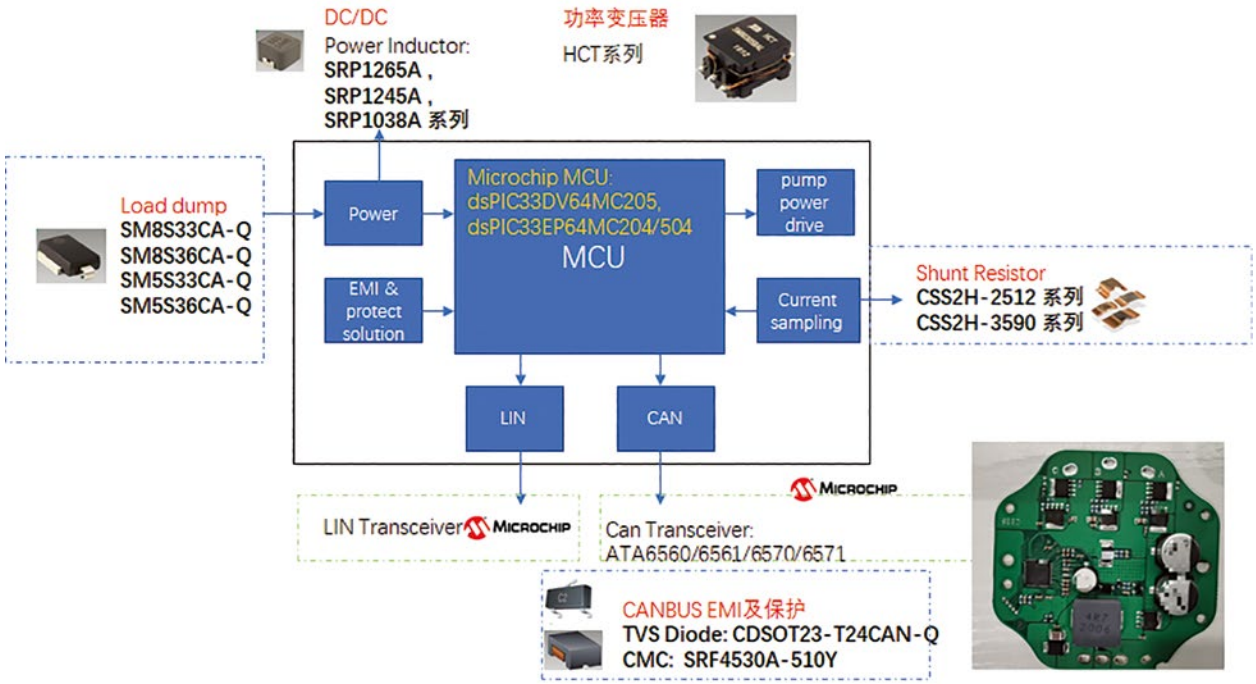
附件

2.储能ESS的防护推荐



附件

3.汽车水泵及油泵控制器防护推荐



附件

4.基于SHUNT分流器的电流检测参考设计方案

内容摘要

BMS（Battery Management System）是连接新能源车核心部件电池与整车的桥梁。受益于新能源车的发展，作为核心部件的BMS也得到了飞速的发展。BMS根据控制的结构不同分为主从式BMS和一体机BMS。无论哪种控制结构，总电流检测是必不可少的。BMS的电流检测分为传统霍尔传感器检测方式和分流器的检测方式。分流器检测方式，一方面是由于其较高的测量精度和相对较低的成本，另一方面是因为它测量方法简单，使用设备少、方便快捷。其测量原理是直接测量分流器两端的电压，再根据欧姆定律，用测得的电压除以分流器的电阻值，从而得到电路中的电流值。而霍尔传感器检测方式虽然结构简单，但其测量值随温度的变化较大。经过分析，基于分流器的直接式电流采样技术的电流传感器方案成本更低、精度更高，不断的成为汽车和能源存储系统BMS应用的首选。

方案采用了Bourns的大电流分流器CSM2F－8518－L100J32、Microchip的MCUUATSAMC21E18A、ADC MCP3421、仪表放大器MCP6N16、电压基准MCP1501以及Microchip的CAN接口ATA6560。仪表放大器MCP6N16与电压基准MCP1501将分流器的采集信号放大和抬升，再由18bits内置PGA ΔΣADC MCP3421将放大的模拟信号转成数字信号，通过I2C接口传给Microchip MCU ATSAMC21E18A，然后MCU进行数据的读取、处理和标定，Microchip的CAN接口ATA6560用于数据通讯。该方案除了用于BMS系统，还可用于电动和混动汽车、母线电流检测和焊接设备的大电流检测等相关应用。

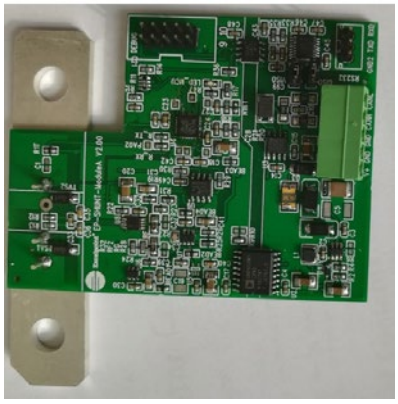


图 SHUNT分流器电流检测方案PCBA

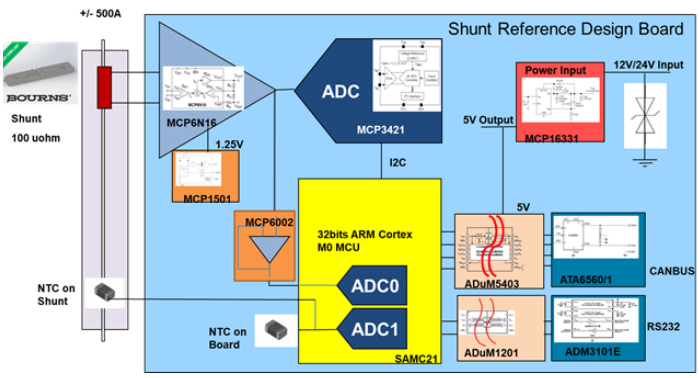
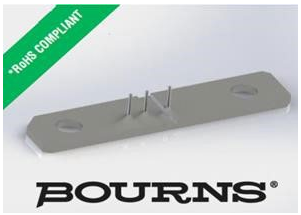


图 方案功能框图

Bourns SHUNT分流器参数简介

Parameters	Specification
Resistance Range/ Power Rating@70C (Terminal Temperature)	50uohm/36W 100uohm/36W
Operating Temperature	-40C to +170C
T.C.R. on test points	+/-150 ppm/C for 50 uohm +/-125 ppm/C for 100 uohm
T.C.R Resistive Alloy	<50 ppm/C
Thermal EMF (uV/K)	<0.25 for 50 uohm <1.50 for 100 uohm
Resistance Tolerance	+/- 5%



方案性能指标

Parameters	Specification
Sensor Type	Shunt (Resistive)
Shunt Value	100 uohm （CSM2F-8518-L100J32 ）
High-end and Low-end Sensing	Low-end Sensing
Unidirectional or Bidirectional	Bidirectional
Accuracy	<0.2% FSR @25C
Maximum current through the shunt	+/- 500A
Module Power Supply	12V, 24V (MCP16331)
ADC	18bits Sigma-Delta ADC (MCP3421)
Over Current Detection Function	Yes (MCP6002)
Temperature Compensation	NTC
Reverse Polarity Protection	Yes
Calibration	Offset and gain calibration
Transient Immunity	Designed to meet ISO7637-3 specifications
Output	CANBUS (ATA6560), I2C
Operating Temperature	-40 C to +125 C

附件

5.保护RS485通信网络不受有害EMC事件影响

内容摘要

在实际工业和仪器仪表(I&I)应用中，RS-485接口链路需要在恶劣电磁环境下工作。雷击、静电放电和其他电磁现像引起的大瞬变电压可能损坏通信端口。为了确保这些数据端口能够在最终安装环境中正常工作，它们必须符合某些电磁兼容性(EMC)法规。

这些要求包括三个主要瞬变抗扰度标准：静电放电、电快速瞬变和电涌。

许多EMC问题并不简单或明显，因此必须在产生设计开始时予以考虑。如果把这些问题留到设计周期后期去解决，可能导致工程预算和计划超限。

本文介绍各主要瞬变类型，并针对RS-485通信端口的三种不同成本/保护级别，提出并演示三种不同的EMC兼容解决方案。

RS-485标准

工业与仪器仪表(I&I)应用常常需要在距离很远的多个系统之间传输数据。RS-485电气标准是的I&I应用中使用最广泛的物理层规范之一，I&I应用包括：工业自动化、过程控制、电机控制和运动控制、远程终端、楼宇自动化(暖通空调HVAC等)、安保系统和再生能源等。

使RS-485成为I&I通信应用理想之选的一些关键特性如下：

- 长距离链路——最长4000英尺
- 可在一对绞线电缆上双向通信
- 差分传输可提高共模噪声抗扰度，减少噪声辐射
- 可将多个驱动器和接收器连接至同一总线
- 宽共模范围(-7 V至+12 V)允许驱动器与接收器之间存在正常工地电位差异
- TIA/EIA-485-A允许数据速率达到数十Mbps

TIA/EIA-485-A描述RS-485接口的物理层，通常与Profibus、Interbus、Modbus或BACnet等更高层协议配合使用，能够在相对较长的距离内实现稳定的数据传输。

但在实际应用中，雷击、功率感应、直接接触、电源波动、感应开关和静电放电可能产生较大瞬变电压，对RS-485收发器造成损害。设计人员必须确保设备不仅能在理想条件下工作，而且能够在实际可能遇到的恶劣环境下正常工作。为了确保这些设计能够在电气条件恶劣的环境下工作，各个政府机构和监管机构实施了EMC法规。如果设计符合这些法规，可以让最终用户确信它们在恶劣环境下也能正常工作。

电磁兼容性

电磁环境由辐射和传导两种能量组成，因此EMC包括两个方面：发射和耐受性。EMC是指电气系统在目标电磁环境下保持良好性能且不会向该环境引入大量电磁干扰的能力。本文讨论如何提高RS-485端口的EMC耐受性以防范三种主要EMC瞬变。

国际电工委员会(IEC)是致力于制定和发布所有电气、电子和相关技术国际标准的全球领先组织。自1996年以来，向欧盟出售或在欧盟范围内出售的所有电子设备都必须达到规范IEC61000-4-x定义的EMC级别。

IEC61000规范定义了一组EMC耐受要求，适用于在住宅、商业和轻工业环境中使用的电气和电子设备。这组规范包括以下三类高电压瞬变，电子设计人员必须确保数据通信线路不受它们损害：

- IEC 61000-4-2静电放电(ESD)
- IEC 61000-4-4电快速瞬变(EFT)
- IEC 61000-4-5电涌耐受性

所有这些规范都定义了测试方法，用以评估电子和电气设备对指定现像的耐受性。下面概要说明各种测试。

静电放电

ESD是指静电荷在不同电位的实体之间的突然传输，由靠近接触或电场感应引起。其特征是在短时间内产生高电流。IEC61000-4-2测试的主要目的是确定系统在工作中对外部ESD事件的抗扰度。 IEC61000-4-2描述了两种耦合测试方法，即所谓接触放电和气隙放电。接触放电要求放电枪与受测单元直接接触。在气隙放电测试期间，放电枪的充电电极朝向受测单元移动，直到气隙上发生电弧放电。放电枪不与受测单元直接接触。气隙测试的结果和可重复性会受到多种因素的影响，包括湿度、温度、气压、距离和放电枪逼近受测单元的速率。

这种方法能够更好地反映实际ESD事件，但可重复性较差。因此，接触放电是首选测试方法。测试期间，数据端口须经受至少10次正极放电和10次负极放电，脉冲之间间隔1秒。测试电压的选择取决于系统端环境。规定的最高测试为4级，要求接触放电电压为±8kV，气隙电压为±15kV。图1显示了规范所述的8kV接触放电电流波形。一些关键波形参数包括小于1ns的上升时间和大约60ns的脉冲宽度。这说明脉冲总能量约为数十mJ。

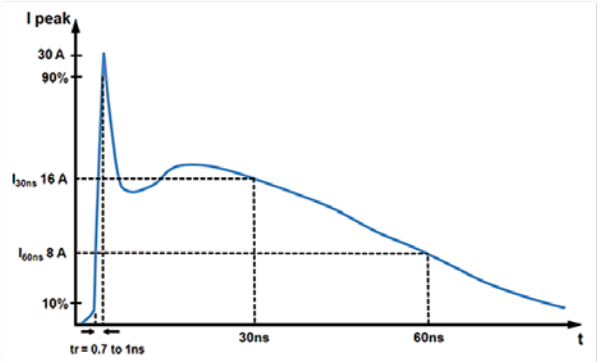


图1. IEC61000-4-2 ESD波形(8 kV)

电快速瞬变

电快速瞬变测试要求将数个极端快速的瞬变脉冲耦合到信号线上，以代表容性耦合到通信端口的外部开关电路的瞬态干扰，这种干扰可能包括继电器和开关触点抖动，以及切换感性或容性负载引起的瞬变，所有这些在工业环境中非常常见。IEC61000-4-4定义的EFT测试试图模拟此类事件造成的干扰。图2显示EFT50Ω负载波形。EFT波形用具有50Ω输出阻抗的发生器在50Ω阻抗上产生的电压来描述。输出波形由15ms的2.5kHz至5kHz突发高压瞬变脉冲组成，以300ms间隔重复。每个脉冲具有5ns的上升时间和50ns的持续时间，在波形的上升和下降沿的50%点之间测量。单个EFT脉冲的总能量与ESD脉冲相似。单个脉冲的总能量典型值为4mJ。施加于数据端口的电压可以高达2 kV。

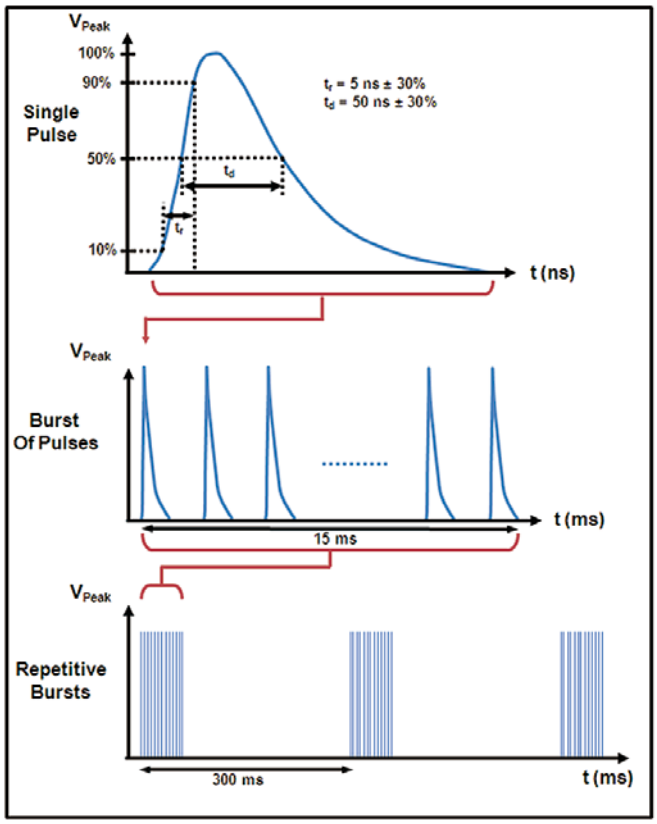


图2. IEC61000-4-4 EFT 50 负载波形

这些快速突发瞬变通过容性钳位器耦合到通信线路。EFT通过钳位器容性耦合到通信线路，而不是直接接触。这同样降低了EFT发生器的低输出阻抗所引起的负载。钳位器和电缆之间的耦合电容取决于电缆直径、屏蔽和绝缘。

电涌瞬变

电涌瞬变由开关或雷电瞬变产生的过压引起。开关瞬变的原因可以是电源系统切换、电源分配系统的负载变化或短路等各种系统故障。雷电瞬变的原因可以是附近的雷击将高电流和电压注入电路中。IEC61000-4-5定义了用于评估对这些破坏性电涌的抗扰度的波形、测试方法和测试级别。

波形定义为开路电压和短路电流下波形发生器的输出。标准描述了两种波形。10/700组合波形用于测试连接或对称通信线路所用的端口，例如电话交换线。1.2/50组合波形发生器用于所有其他情况，特别是短距离信号连接。RS-485端口主要使用1.2/50波形，本部分将予以说明。波形发生器的有效输出阻抗为2Ω，因此电涌瞬变相关的电流非常高。

图3显示1.2/50电涌瞬变波形。ESD和EFT具有相似的上升时间、脉冲宽度和能量水平，但电涌脉冲的上升时间为1.25us，脉冲宽度为50us。此外，电涌脉冲能量可以达到90J，比ESD或EFT脉冲的能量高出三到四个数量级。因此，电涌瞬变被认为是最严重的EMC瞬变。ESD与EFT相似，因此电路保护的设计可以相似，但电涌则不然，其能量非常高，因此必须以不同方式处理。这是开发保护措施以改善数据端口对所有三种瞬变的抗扰度，同时保持高性价比的过程中会遇到的主要问题之一。

电阻将电涌瞬变耦合到通信线路。图4显示半双工RS-485器件的耦合网络。电阻并联总和为40Ω。对于半双工器件，各电阻为80Ω。电涌测试期间，将5个正脉冲和5个负脉冲施加于数据端口，各脉冲间隔最长时间为1分钟。标准要求，器件在测试期间设置为正常工作状态。

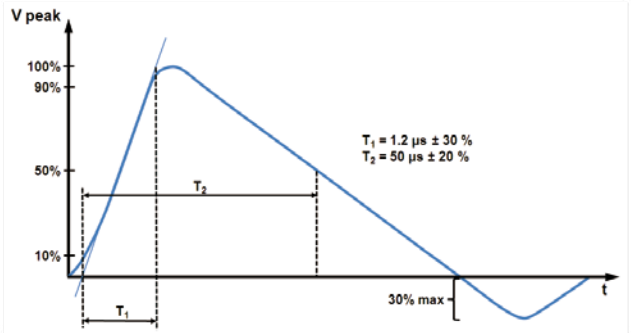


图3. IEC61000-4-5电涌1.2/50 波形

图3. IEC61000-4-5电涌1.2/50 波形

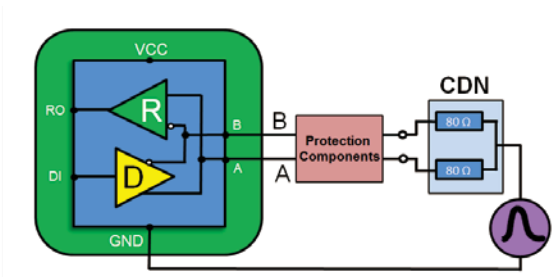


图4. 半双工RS-485器件的耦合/解耦网络

通过/失败标准

将瞬变施加于受测系统时，测试结果按照通过/失败标准分为四类。下面是通过/失败标准的列表，并举例说明各标准与RS-485收发器的关系。

- 正常工作；施加瞬变期间或之后不会发生位错误。
- 功能暂时丧失或性能暂时降低，不需要操作员干预；正常工工施加瞬变期间或之后的有限时间内可能发生位错误。
- 功能暂时丧失或性能暂时降低，需要操作员干预；可正常工工能发生闩锁事件，但上电复位后可消除，对器件性能正常工工无永久影响。
- 功能丧失，设备永久损坏；器件未通过测试。

标准A是最希望达到的，标准D是不可接受的。永久损坏会导致系统停机和维修/更换成本。对于任务关键型系统，标准B和标准C也是不可接受的，因为系统在瞬变事件期间必须能无错误运行。

瞬变保护

设计瞬变保护电路时，设计人员必须考虑以下主要事项：

1. 该电路必须防止或限制瞬变引起的损坏，并允许系统恢复正常工正常工作，性能影响极小。
2. 保护方案应当非常可靠，足以处理系统在实际应用经受到正常工的瞬变类型和电压水平。
3. 瞬变时长是一个重要因素。对于长时间瞬变，加热效应可正常工能会导致某些保护方案失效。
4. 正常条件下，保护电路不得干扰系统运行。
5. 如果保护电路因为过应力而失效，它应以保护系统的方式正常工失效。

图5显示一个典型保护方案，其特征是具有两重保护：主保护和次级保护。主保护可将大部分瞬变能量从系统转移开，通常位于系统和环境之间的接口。它旨在将瞬变分流至地，从而消除大部分能量。

次级保护的目的是保护系统各个部件，使其免受主保护允许通过的任何瞬态电压和电流的损坏。它经过优化，确保能够抵御残余瞬变影响，同时允许系统的敏感部分正常工作。主保护和次级保护的设计必须与系统I/O协同工作，从而最大程度地降低对保护电路的压力，这点很重要。主保护器件与次级保护器件之间一般有一个协调元件，如电阻或非线性过流保护器件等，用以确保二者协同应对瞬变。

用户确信它们在恶劣环境下也能正常工作。

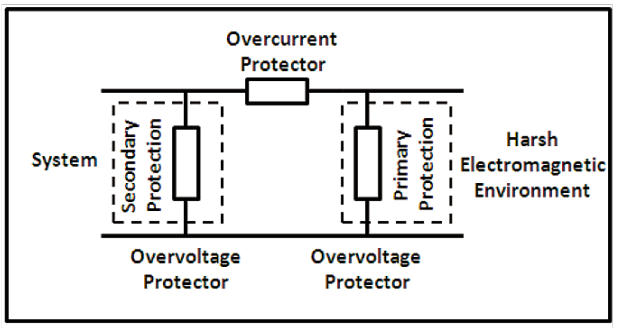


图5. 保护方案框图

RS-485瞬变抑制网络

就特性而言，EMC瞬态事件在时间上会有变化，因此保护元件必须具有动态性能，而且其动态特性需要与受保护器件的输入/输出极相匹配，这样才能实现成功的EMC设计。器件数据手册一般只包含直流数据，由于动态击穿和I/V特性可能与直流值存在很大差异，因此这些数据没有太多价值。必须进行精心设计并确定特性，了解受保护器件的输入/输出级的动态性能，并且使用保护元件，才能确保电路达到EMC标准。

图6所示电路显示了三种不同的完整特性EMC兼容解决方案。每个解决方案都经过独立外部EMC兼容性测试公司的认证，各方案使用精选的Bourns外部电路保护元件，针对ADI公司具有增强ESD保护性能的ADM3485E3.3 V RS-485收发器提供不同的成本/保护级别。所用的Bourns外部电路保护元件包括瞬态电压抑制器(CDSOT23-SM712)、瞬态闭锁单元(TBU-CA065-200-WH)、晶闸管电涌保护器(TISP4240M3BJR-S)和气体放电管(2038-15-SM-RPLF)。每种解决方案都经过特性测试，确保保护元件的动态I/V性能可以保护ADM3485E RS-485总线引脚的动态I/V特性，使得ADM3485E输入/输出级与外部保护元件协同防范瞬变事件。

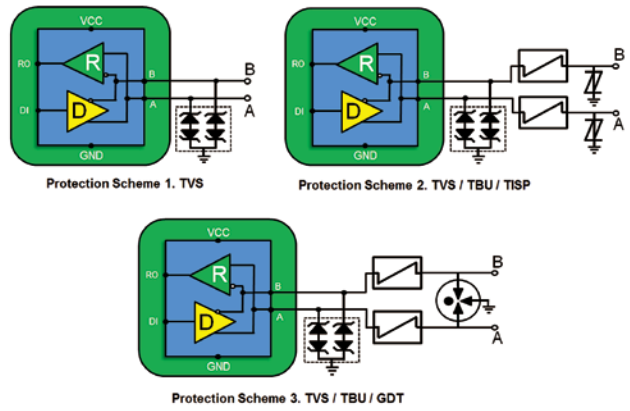


图6. 三个EMC兼容ADM3485E电路(原理示意图，未显示所有连接)

保护方案1

前面说过，EFT和ESD瞬变具有相似的能量水平，而电涌波形的能量水平则高出三到四个数量级。针对ESD和EFT的保护可通过相似方式实现，但针对高电涌级别的保护解决方案则更为复杂。第一个解决方案提供四级ESD和EFT保护及二级电涌保护。本文描述的所有电涌测试都使用1.2/50us波形。

此解决方案使用Bourns公司的CDSOT23-SM712瞬变电压抑制器(TVS)阵列，它包括两个双向TVS二极管，非常适合保护RS-485系统，过应力极小，同时支持RS-485收发器上的全范围RS-485信号和共模偏移(–7V至+12V)。表1显示针对ESD、EFT和电涌瞬变的电压保护级别。

	ESD (-4-2)		EFT (-4-4)		Surge (-4-5)	
级别	电压(接触/气隙)	级别	电压	级别	电压
4	8 kV/15 kV	4	2 kV	2	1 kV

表1. 解决方案1保护级别

TVS是基于硅的器件。在正常工作条件下，TVS具有很高的对地阻抗；理想情况下它是开路。保护方法是将瞬态导致的过压钳位到电压限值。这是通过PN结的低阻抗雪崩击穿实现的。当产生大于TVS的击穿电压的瞬态电压时，TVS会将瞬态钳位到小于保护器件的击穿电压的预定水平。瞬变立即受到钳位(< 1 ns)，瞬态电流从受保护器件转移至地。

重要的是要确保TVS的击穿电压在受保护引脚的正常工作范围之外。CDSOT23-SM712的独有特性是具有+13.3 V和–7.5 V的非对称击穿电压，与+12 V至–7 V的收发器共模范围相匹配，从而提供最佳保护，同时最大程度减小对ADM3485E RS-485收发器的过压应力。

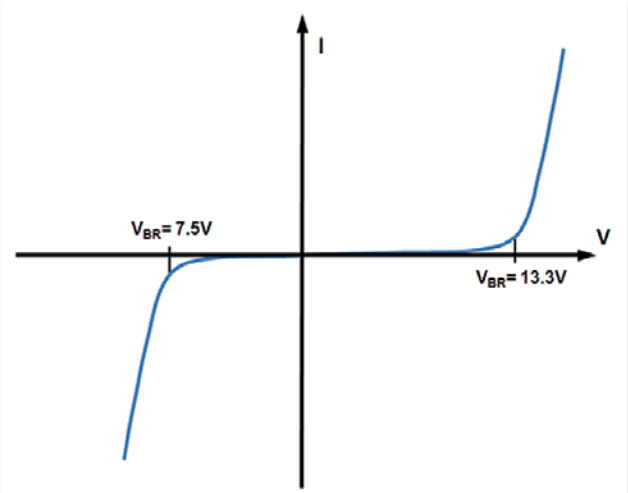


图7. CDSOT23-SM712 I/V特性

保护方案2

上一解决方案可提供最高四级ESD和EFT保护，但只能提供二级电涌保护。为了提高电涌保护级别，保护电路变得更加复杂。以下保护方案可以提供最高四级电涌保护。

CDSOT23-SM712专门针对RS-485数据端口设计。以下两个电路基于CDSOT23-SM712构建，提供更高级别的电路保护。CDSOT23-SM712提供次级保护，而TISP4240M3BJR-S提供主保护。主从保护器件与过流保护之间的协调通过TBU-CA065-200-WH完成。表2显示使用此保护电路的ESD、EFT和电涌瞬变保护电压级别。

	ESD (-4-2)	EFT (-4-4)		Surge (-4-5)	
级别	电压(接触/气隙)	级别	电压	级别	电压
4	8 kV/15 kV	4	2 kV	4	4 kV

表2. 解决方案2保护级别

当瞬变能量施加于保护电路时，TVS将会击穿，通过提供低阻抗的接地路径来保护器件。由于电压和电流较高，还必须通过限制通过的电流来保护TVS。这可采用瞬态闭锁单元(TBU)实现，它是一个主动高速过流保护元件。此解决方案中的TBU是Bourns TBU-CA065-200-WH。

TBU可阻挡电流，而不是将其分流至地。作为串联元件，它会对通过器件的电流做出反应，而不是对接口两端的电压做出反应。TBU是一个高速过流保护元件，具有预设电流限值和耐高压能力。

当发生过流，TVS由于瞬态事件击穿时，TBU中的电流将升至器件设置的限流水平。此时，TBU会在不足1us时间内将受保护电路与电涌断开。在瞬变的剩余时间内，TBU保持在受保护阻隔状态，只有极小的电流(<1mA)通过受保护电路。在正常工作条件下，TBU具有低阻抗，因此它对正常电路工作的影响很小。在阻隔模式下，它具有很高的阻抗以阻隔瞬变能量。在瞬态事件后，TBU自动复位至低阻抗状态，允许系统恢复正常工作。

与所有过流保护技术相同，TBU具有最大击穿电压，因此主保护器件必须钳位电压，并将瞬变能量重新引导至地。这通常使用气体放电管或固态晶闸管等技术实现，例如完全集成电涌保护器(TISP)。TISP充当主保护器件。当超过其预定义保护电压时，它提供瞬态开路低阻抗接地路径，从而将大部分瞬变能量从系统和其他保护器件转移开。

TISP的非线性电压-电流特性通过转移产生的电流来限制过压。作为晶闸管，TISP具有非连续电压-电流特性，它是由于高电压区和低电压区之间的切换动作而导致的。图9显示了器件的电压-电流特性。在TISP器件切换到低电压状态之前，它具有低阻抗接地路径以分流瞬变能量，雪崩击穿区域则导致了钳位动作。在限制过压的过程中，受保护电路短暂暴露在高压下，因而在切换到低压保护导通状态之前，TISP器件处在击穿区域。 TBU将保护下游电路，防止由于这种高电压导致的高电流造成损坏。当转移电流降低到临界值以下时，TISP器件自动复位，以便恢复正常系统运行。

如上所述，所有三个器件与系统I/O协同工作来保护系统免受高电压和电流瞬变影响。

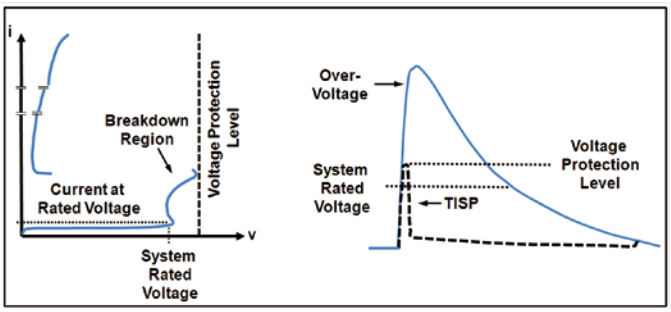


图9. TISP切换特性和电压限制波形

保护方案3

常常需要四级以上的电涌保护。此保护方案可保护RS-485端口免受最高6 kV电涌瞬变的影响。它的工作方式类似于保护解决方案2，但此电路采用气体放电管(GDT)取代TISP来保护TBU，进而保护次级保护器件TVS。GDT将针对高于前一种保护机制中所述TISP的过压和过流应力提供保护。此保护方案的GDT是Bourns公司的2038-15-SM-RPLF。TISP额定电流为220 A，而GDT每个导体的额定电流为5 kA。表3显示此设计提供的保护级别。

	ESD (-4-2)		EFT (-4-4)		Surge (-4-5)	
级别	电压(接触/气隙)	级别	电压	级别	电压
4	8 kV/15 kV	4	2 kV	X	6 kV

表3. 解决方案3保护级别

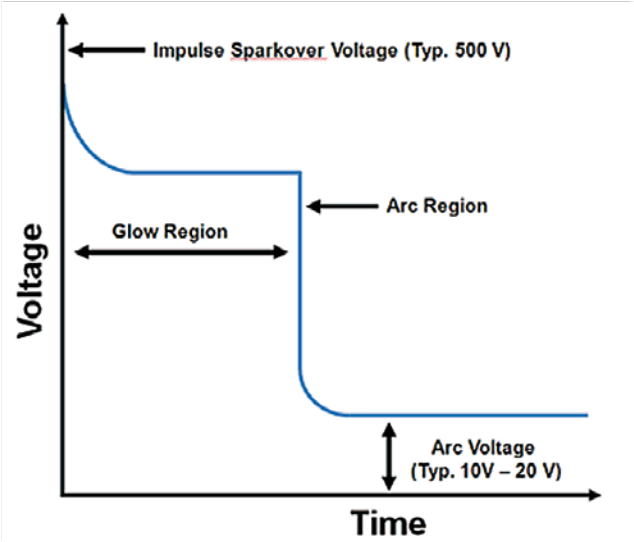


图10. GDT特性波形

GDT主要用作主保护器件，提供低阻抗接地路径以防止过压瞬变。当瞬态电压达到GDT火花放电电压时，GDT将从高阻抗关闭状态切换到电弧模式。在电弧模式下，GDT成为虚拟短路，提供瞬态开路电流接地路径，将瞬态电流从受保护器件上转移开。

图10显示GDT的典型特性。当GDT两端的电压增大时，放电管中的气体由于产生的电荷开始电离。这称为辉光区。在此区域中，增加的电流将产生雪崩效应，将GDT转换为虚拟短路，允许电流通过器件。在短路事件中，器件两端产生的电压称为弧电压。辉光区和电弧区之间的转换时间主要取决于器件的物理特性。

结论

本文说明了处理瞬变抗扰度的三种IEC标准。在实际工业应用中，RS-485通信端口遇到这些瞬变时可能遭到损坏。 EMC问题如果是在产品设计周期后期才发现，可能需要重新设计，导致计划延迟，代价巨大。因此，EMC问题应在设计周期开始时就予以考虑，否则可能后悔莫及，无法实现所需的EMC性能。

在设计面向RS-485网络的EMC兼容解决方案时，主要难题是让外部保护元件的动态性能与RS-485器件输入/输出结构的动态性能相匹配。

本文介绍了适用于RS-485通信端口的三种不同EMC兼容解决方案，设计人员可按照所需的保护级别选择保护方案。EVAL-CN0313-SDPZ是业界首个EMC兼容RS-485客户设计工具，针对ESD、EFT和电涌提供最高四级保护。表4总结了不同保护方案提供的保护级别。虽然这些设计工具不能取代所需的系统级严格评估和专业资质，但能够让设计人员在设计周期早期降低由于EMC问题导致的项目延误风险，从而缩短产品设计时间和上市时间。有关详情，请访问：www.analog.com/RS485emc。

	ESD (-4-2)		EFT (-4-4)		Surge (-4-5)	
保护方案	级别	电压 (接触 / 气隙)	级别	电压	级别	电压
TVS	4	8 kV/15 kV	4	2 kV	2	1 kV
TVS/TBU/TISP	4	8 kV/15 kV	4	2 kV	4	4 kV
TVS/TBU/GDT	4	8 kV/15 kV	4	2 kV	X	6 kV

表4. 三种ADM3485E EMC兼容解决方案

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