

# Resistor Embedded Protector

## 4.0x3.0 / 12A



Rev.: C, 20221028



### Description 描述

ASTM's ATF Serie fuse is a three terminals surface mountable battery protector designed to against both overcurrent and overvoltage, element can not only cut off the circuit when overcurrent issue happens, but also the heater can generate heat to blow the fuse once overvoltage detected by IC or FET. ASTM ATF 系列熔断器作为三端表面贴装式电池过流过压保护产品, 不但能在过流发生时切断电路, 并且当 IC 或 FET 检测到过压时, 内置的加热电阻会产生热量熔断保险丝以切断电路.

### Feature 特点

- Protect Li-ion battery from overcurrent and overcharge 锂电池过流过压保护
- Substrate embedded Resistor 基板嵌入式电阻
- Surface mounted fuse 表面贴装熔断器
- RoHS compliance 符合 RoHS
- Halogen free / Sb free 无卤/无铋
- Fast response time 响应快速

### Application 应用

- Power bank 移动电源
- Electronic cigarettes 电子烟
- Electric curtain 电动窗帘
- Tablets 平板电脑
- Laptops 笔记本电脑
- Power tools 电动工具
- Wireless Bluetooth headsets 无线蓝牙耳机
- Mobile phone 手机

### Specifications 规格

Ordering P/N 订购料号	Applicable cells in series 电池芯串联数	Rated Current 额定电流 (A)	Rated Voltage 额定电压 (Vdc)	Breaking Capacity 分断能力 (A)	Fuse Resistance 保险丝阻值 (mΩ)	Operating Voltage 加热电阻 动作电压范围 (V)	Heater Resistance 加热电阻阻值 (Ω)
ATF403004V12A	1 cell	12	36	50	2.0 ~ 4.0	3.0~4.5	0.5~1.5
ATF403008V12A	2 cells					4.0~9.0	2.0~2.7
ATF403012V12A	3 cells					7.4~13.8	4.8~9.1
ATF403014V12A	4 cells					10.5~19.6	9.6~18.4
ATF403024V12A	5~6 cells					14.4~28.0	19.6~34.5
ATF403032V12A	7~8 cells					24.5~36.0	32.4~85.7
ATF403050V12A	9~14 cells	12	62	50	2.0 ~ 4.0	31.5~62.0	96.1~141.7

### Electrical Characteristics 电气特性

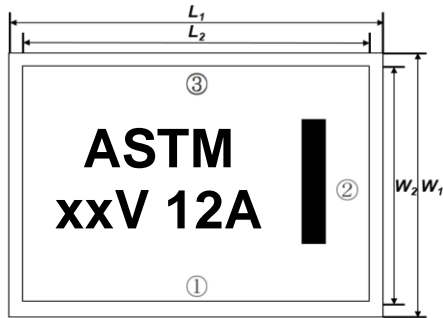
Items 项目	Conditions 施加条件	Requirements / Result 要求 / 结果
Current carrying capacity 电流负载能力	Apply 100% of its rated current. 施加 100% 额定电流	No melting. 不熔断
Fusing time 熔断时间	Apply 200% of its rated current. 施加 200% 额定电流	The fuse shall be melt within 1min. 熔断器在 1 分钟内熔断
	The minimum value of the operating voltage range of each model shall be applied to heater. 在每个型号加热电阻两端施加的电压应为其对应动作电压的最小值	
Operating temperature range 运行温度范围	The following examinations are executed respectively within the range from -10 to 65°C. 在 -10 到 65°C 温度下分别进行以下测试 • Fusing time test 熔断时间测试 • Current carrying capacity test 电流负载能力测试	The fuse shall be passed each test. 熔断器能够通过每项测试

\*Electrical characteristics are influenced by thermal capacity of PCB, parts, pattern width, etc. Therefore you should check them on your PCB. 电气特性会受到 PCB 热容量, 元器件本身和线路尺寸等影响, 客户在使用前应在实际的 PCB 板上对产品的电气特性进行评测.

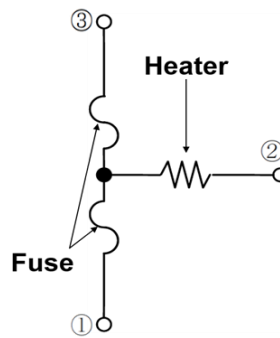
# Resistor Embedded Protector 4.0x3.0 / 12A

## Dimension 尺寸

Top View 俯视图



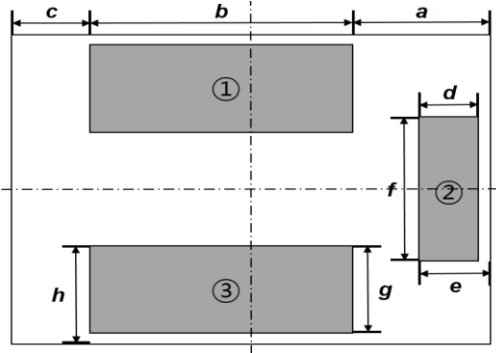
Equivalent Circuit 等效电路图



Dimension & Weight  
尺寸 & 单重

Code 编号	Spec. 规格 (mm)
$L_1$	$4.0 \pm 0.2$
$L_2$	$3.7 \pm 0.1$
$W_1$	$3.0 \pm 0.2$
$W_2$	$2.7 \pm 0.1$
$T$	$0.95 \pm 0.1$
$T_1$	0.5
$T_2$	0.45
$a$	1.15
$b$	2.2
$c$	0.65
$d$	0.5
$e$	0.6
$f$	1.4
$g$	0.85
$h$	0.95
* Without extra notification the tolerance is $\pm 0.10$ mm 除非特殊注明, 否则默认公差为 $\pm 0.10$ mm	
* Weight 单重: $0.027 \pm 5\%$ g/pc	

Bottom View 背面图

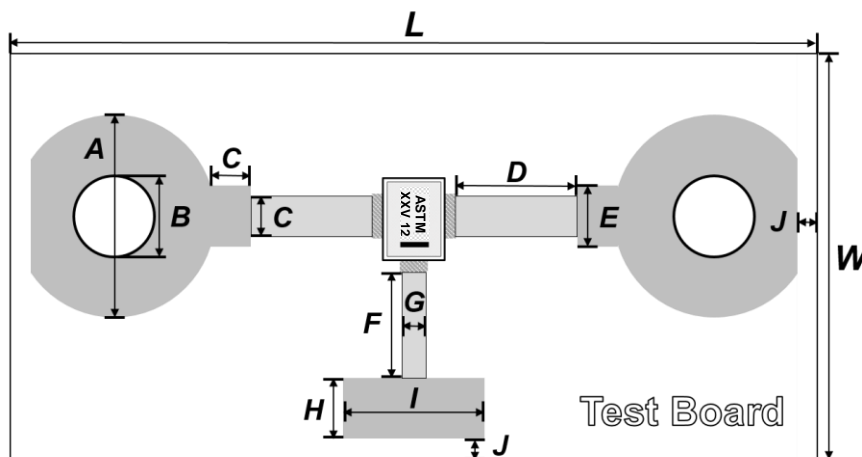


Side View 侧面图



## Measurement 测试

Test Circuit Board Drawing 1  
测试板图 1



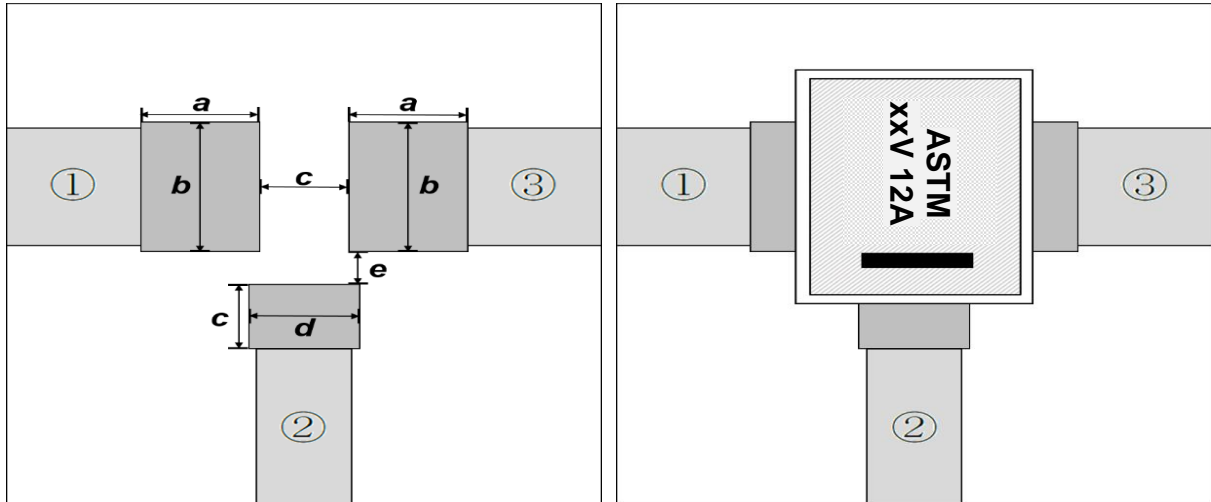
Dimension  
尺寸

Code 编号	Spec. 规格 (mm)
$L$	$40.0 \pm 0.2$
$W$	$20.0 \pm 0.2$
$A$	$10.0 \pm 0.1$
$B$	$4.0 \pm 0.1$
$C$	$2.0 \pm 0.1$
$D$	$6.0 \pm 0.1$
$E$	$3.0 \pm 0.1$
$F$	$5.0 \pm 0.1$
$G$	$1.2 \pm 0.1$
$H$	$3.0 \pm 0.1$
$I$	$7.0 \pm 0.1$
$J$	$1.0 \pm 0.1$

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## 4.0x3.0 / 12A

Test Circuit Board Drawing 2  
测试板图 2



\* Terminal ①↔③ for current fusing time& carrying capacity.

端子①↔③:过流熔断时间&电流负载能力

\* Terminal ②↔③(or ②↔①) for voltage fusing time.

端子②↔③(or ②↔①):过压熔断时间

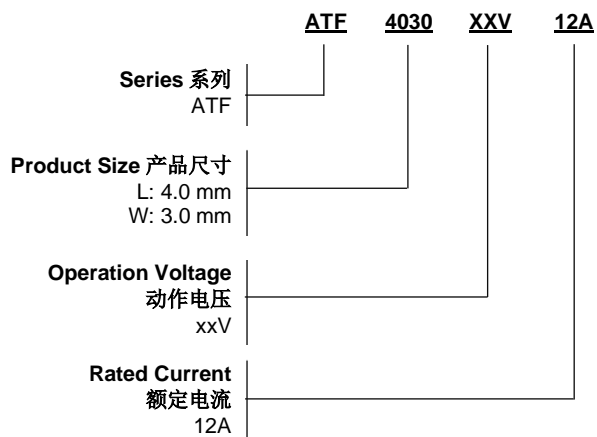
\* Board thickness 测试板厚度: 0.60 mm

\* Copper thickness 铜厚: 0.07 mm (2.0 oz)

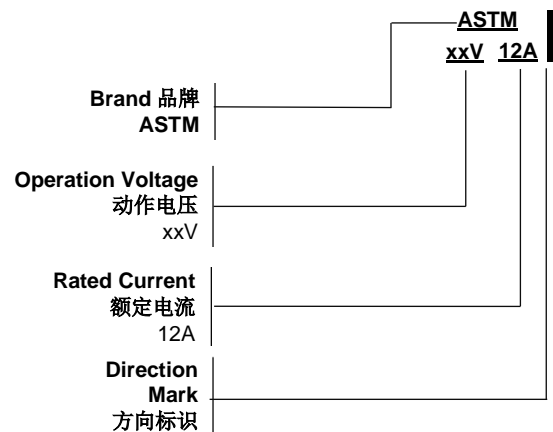
Code 编号	Spec. 规格 (mm)
a	1.5 ± 0.1
b	2.2 ± 0.1
c	1.1 ± 0.1
d	1.4 ± 0.1
e	0.55 ± 0.05

### Part Number and Marking System 品名&标识

#### Part Numbering 品名



#### Part Marking 标识



# Resistor Embedded Protector

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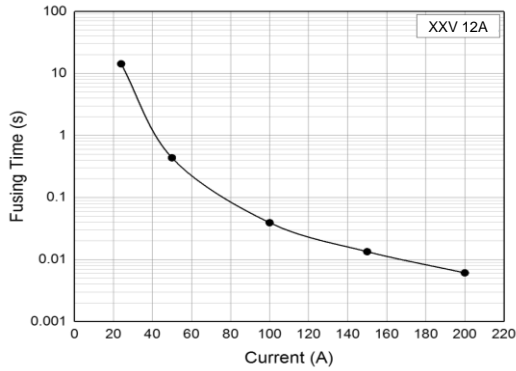


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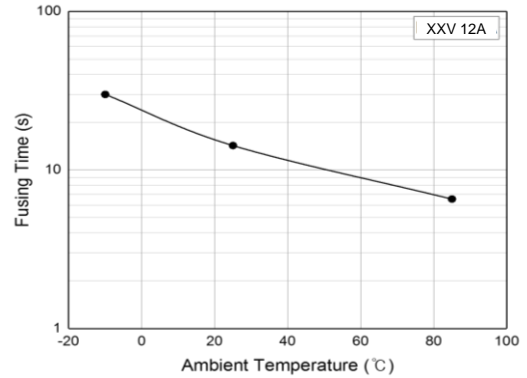


### Typical Performance Data 性能曲线 (Ambient Temperature: 25°C)

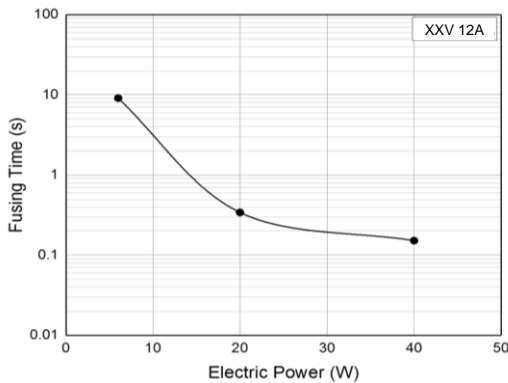
Fusing Time by Current  
熔断时间-电流曲线



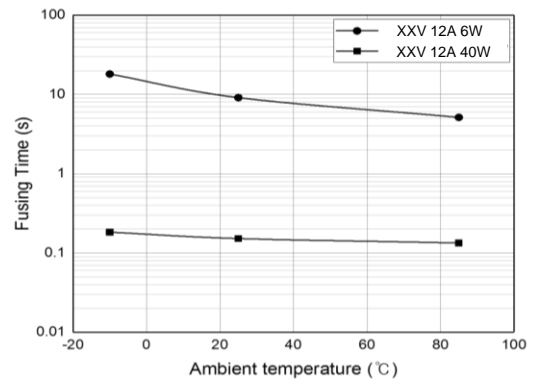
Fusing Time by 2xRated-Current vs Ambient Temperature  
2 倍额定电流下熔断时间 VS 环境温度曲线



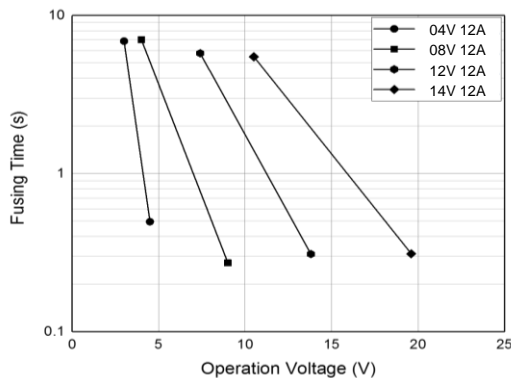
Fusing Time by Heater (Wattage)  
熔断时间-加热功率(瓦特)曲线



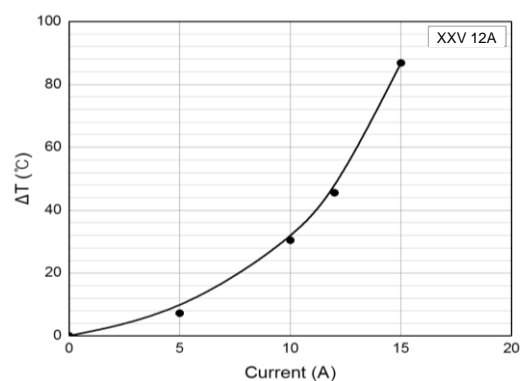
Fusing Time vs Ambient Temperature  
熔断时间 VS 环境温度曲线



Fusing Time by Heater (Voltage)  
熔断时间-动作电压(V)曲线



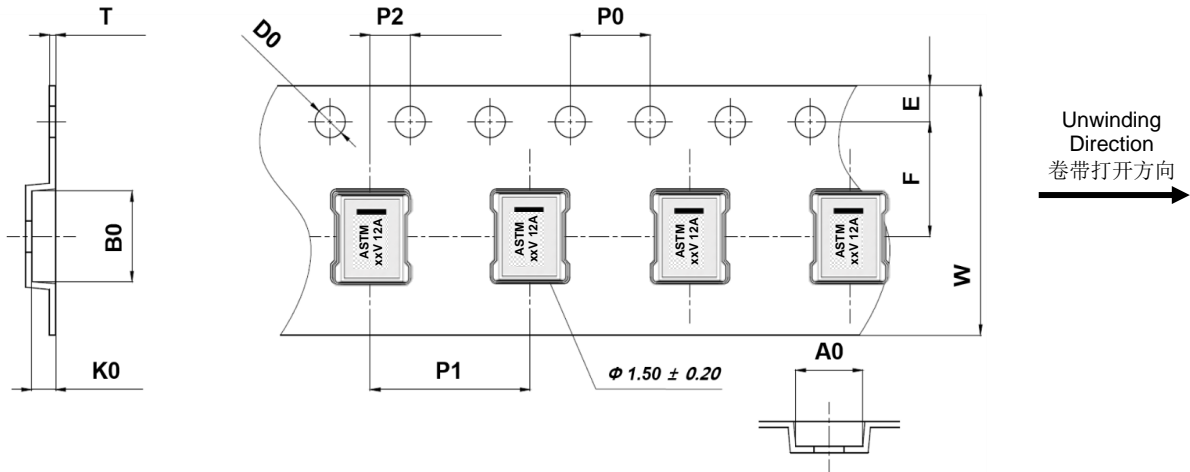
Temperature Rise by Current  
温升-电流曲线



# Resistor Embedded Protector 4.0x3.0 / 12A

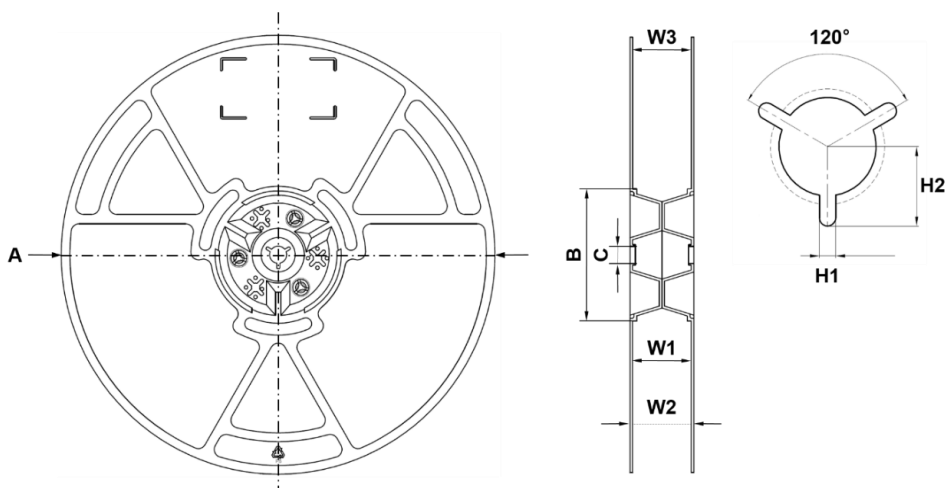
## Package 包装

Dimension of Taping 编带尺寸(mm)



Code 编号	Dimension 尺寸规格	Code 编号	Dimension 尺寸规格	Code 编号	Dimension 尺寸规格
A0	$3.35 \pm 0.10$	E	$1.75 \pm 0.10$	P0	$4.00 \pm 0.10$
B0	$4.35 \pm 0.10$	F	$5.50 \pm 0.05$	P1	$8.00 \pm 0.10$
K0	$1.20 \pm 0.10$	T	$0.30 \pm 0.05$	P2	$2.00 \pm 0.10$
D0	$1.50 \pm 0.10$	W	$12.00 \pm 0.30$		

Dimension of Reels 卷盘尺寸(mm)



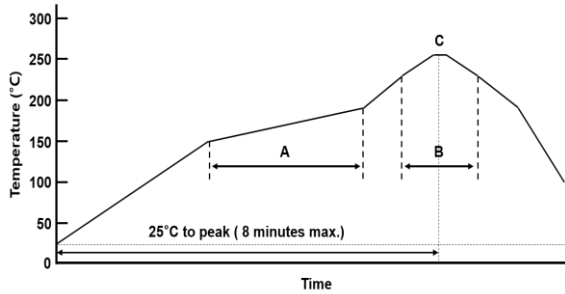
Code 编号	Dimension 尺寸规格
A	$330.0 \pm 2.0$
W1	$12.4 \pm 1.5$
H1	$2.0 \pm 0.5$
B	$100.0 \pm 1.0$
W2	$16.4 \pm 2.0$
H2	$10.5 \pm 1.0$
C	$13.0 \pm 0.2$
W3	$13.65 \pm 1.5$

Packaging Quantity: 5,000 Pcs. / Reel  
包装数量: 5,000 Pcs. / 卷盘

# Resistor Embedded Protector 4.0x3.0 / 12A

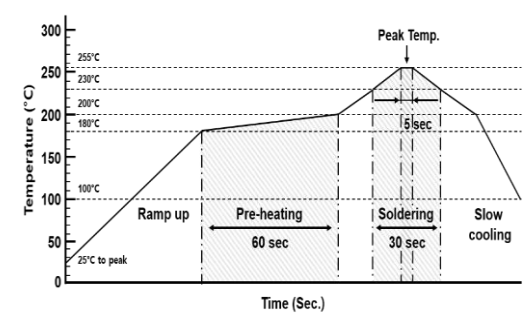
## Mounting Parameters 装配参数

Reflow Profile 推荐的回流焊曲线



Code 编号	Temperature 温度 (°C)	Time 时间 (s)
A (Pre-Heating) (预热)	150~190	90 ± 30
B	Over 230	25 ± 5
C (Peak 峰值)	255 ± 5	Max. 5

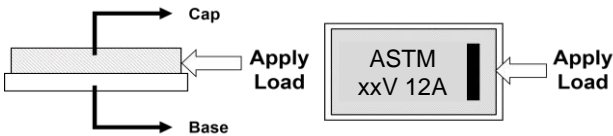
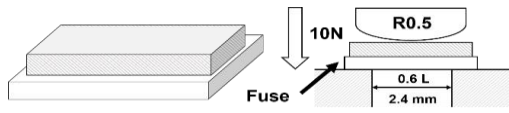
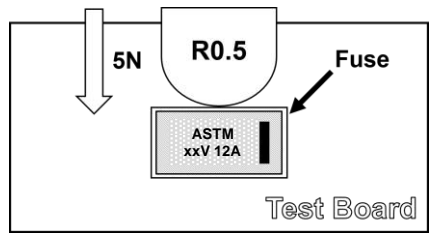
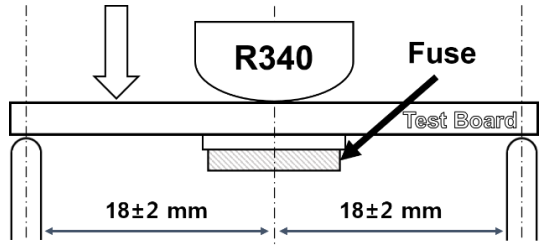
## Mounting Characteristics 装配特性

Items 项目	Conditions 实验条件	Requirements / Result 要求 / 结果
Resistance To Soldering Heat 耐焊接热	 <p>① Reflow soldering method 回流焊工艺                      • Peak temp 峰值: 255 ± 5°C, 5 sec; 230 ± 5°C, 30 sec                      At electrode temperature of the specimen. (Solder temperature) 温度为样品端子温度(焊接温度)                      The specimen shall be passed through the reflow furnace with the condition shown in the above profile for 2 times. 样品需要通过上述条件回流焊两次。                      The specimen shall be stored at standard atmospheric conditions for 24hrs after which the measurement shall be made. 样品需要在室温条件下放置 24 小时后才能进行测量</p> <p>② Soldering iron method 烙铁焊接工艺                      • Bit temperature 烙铁头温度: 300 ± 5°C                      • Application of soldering iron 焊接时间: 3 ± 1sec.                      Apply the soldering iron to the electrode. 进行焊接                      The specimen shall be stored at standard atmospheric condition for 24hrs, after which the measurements shall be made.                      样品需要在室温条件下放置 24 小时后才能进行测量</p>	Without deformation of case or excessive looseness of caps. 盖子无变形和松动  Electrical characteristics shall be satisfied. 电气特性在规格内
	• Solder 焊锡: Pb-free (Sn 96.5 / Ag 3.0 / Cu 0.5[%]) • Flux 助焊剂: 25wt% Rosin Ethanol solution 松香酒精溶液 • Dipping depth 浸渍深度: 2 ~ 2.5 mm • Temperature 温度: 245 ± 5°C • Dipping time 浸渍时间: 3 ± 0.5sec • Dipping and drawing speed 浸渍及拉高速度: 25 ± 2.5mm/sec	
Solderability 可焊性		A new uniform coating of solder shall cover a minimum of 95% of the surface being immersed. 锡涂层需覆盖浸渍面积 95%以上

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### Mechanical Characteristics 机械特性

Items 项目	Conditions 实验条件	Requirements / Result 要求 / 结果
Adhesion Strength between ceramic base and cap 盖子附着强度	<p>The ceramic base shall be sustained, and the cap is sheared. 本体固定，对盖子施加负载</p> 	<p>Destruction strength shall be 6N or more. 破坏强度在 6N 或以上</p>
Core body Strength 主体强度	<p>A static load of 10N using a R0.5 pressure rod shall be applied to the center of body, in the arrow direction and held for 10sec. 按箭头方向使用 R0.5 加压杆、10N 静负载于产品中部并保持 10 秒</p> 	<p>Without mechanical damage such as breaks. 无变形破损等机械损伤</p> <p>Electrical characteristics shall be satisfied. 满足电气特性</p>
Adhesion 端子附着力	<p>A static load of 5N using a R0.5 pressure rod shall be applied to the side of surface mounted ceramic base, in the arrow direction and held for 10sec. 按箭头方向使用 R0.5 加压杆、5N 静负载于产品基板中心部位并保持 10 秒</p> 	<p>Without electrode peeling. 无端子剥离</p> <p>Electrical characteristics shall be satisfied. 满足电气特性</p>
Board bending test 基板耐弯曲测试	<p>A dynamic load shall be applied in the direction of the arrow until bent width reaches 0.5mm and held for 30sec. 按箭头方向施加压力直至弯曲宽度达到 0.5mm 并保持 30 秒</p> 	<p>Without mechanical damage such as breaks. 无变形破损等机械损伤</p> <p>Electrical characteristics shall be satisfied 满足电气特性</p>

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### Endurance Characteristics 耐久特性

Items 项目	Conditions 实验条件	Requirements / Result 要求 / 结果
Dry Heat 高温存储	The fuse shall be stored at a temperature of $125 \pm 5^{\circ}\text{C}$ for 96hrs. And then it shall be subjected to standard atmospheric conditions for 1hr, after which electrical characteristics shall be measured. 熔断器在温度为 $120 \pm 5^{\circ}\text{C}$ 的环境中存储 96 小时, 再在室温条件下放置 24 小时后进行测试	Without deformation of case or excessive looseness of caps. 盖子无变形和松动  Electrical characteristics shall be satisfied. 电气特性在规格内
Cold 低温存储	The fuse shall be stored at a temperature of $-55 \pm 3^{\circ}\text{C}$ for 96hrs. And then it shall be subjected to standard atmospheric conditions for 1hr, after which electrical characteristics shall be measured. 熔断器在温度为 $-55 \pm 5^{\circ}\text{C}$ 的环境中存储 96 小时, 再在室温条件下放置 1 小时后进行测试	
Damp Heat 高温高湿存储	The fuse shall be stored at a temperature of $60 \pm 2^{\circ}\text{C}$ with relative humidity of 90~95% RH for 250hrs. And then it shall be subjected to standard atmospheric conditions for 1hr, after which electrical characteristics shall be measured. 熔断器在温度为 $60 \pm 2^{\circ}\text{C}$ , 湿度为 90~95%RH 的环境中存储 250 小时, 再在室温条件下放置 1 小时后进行测试	
Thermal Shock 热冲击	Exposing the fuse to alternating low and high temperatures cycles as bellows. 将熔断器按照以下的温度, 时间和次数循环后进行测试 <ul style="list-style-type: none"> <li>• Low temperature test 低温, 时间: <math>-55 \pm 3^{\circ}\text{C}</math>, 15min</li> <li>• High temperature test 高温, 时间: <math>125 \pm 2^{\circ}\text{C}</math>, 15min</li> <li>• Cycle times 循环次数: 100 cycles</li> </ul>	
Endurance Test 耐用性能	Current of 80A shall be carried during 0.01 sec, and then switched off during 9.99 sec. This cycle is repeated 500 times. 将熔断器按照 80A 通电 0.01 秒, 间歇 9.99 秒的条件循环 500 次后进行测试	
		Without damage such as deformation or disconnection of fuse element. 元器件外观无损坏, 如变形, 断开等 Resistance changing rate under 10% before test. 阻值变化率低于 10%



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### Handling Instructions 使用说明

- Please confirm the latest product information before a design 请在选用产品前确认所选型号产品的最新信息
- Storage Condition 存储条件
  - This product should be stored in a cool (Room temperature under 40°C) and dry condition less than 60% relative humidity and kept out of solvent fumes circumstances.  
建议的产品存储条件为: 温度低于 40°C, 相对湿度小于 60%, 环境无腐蚀有害气体
  - Under stable storage conditions the preservation period is 1 year after shipping.  
保质期为出货后的 1 年(储存条件等于或优于建议的产品存储条件)
- Fuse complies with environmental regulation. 产品符合所有的环境法律法规要求
  - Fuse complies with RoHS  
产品符合最新的 RoHS 要求
  - Fuse complies with general requirement for Halogen Free.  
产品符合最新的无卤要求
- Performance data is typical value 规格书上的数值为名义值
  - These data is not a guaranteed value.  
规格书上的数值不是保证值
  - These data is measured with our company's standard PCB.  
规格书上的数值是用制造厂家的标准测试板测试得到的
  - The characteristics are influenced by thermal capacity of PCB.  
这些特性值会受到测试板热容量的影响
  - Generally, when thermal capacity of PCB increases, current-carrying capacity will be increase and fusing time will be long  
一般情况下, PCB 的热容量增加会导致载流能力变大和熔断时间变长。
- Precautions regarding handling 使用注意事项
  - Make sure that the terminals of this product are connected on the lands of the circuit board referring to section "Measurement".  
确保产品端子和 PCB 上的焊盘连接完好 焊盘尺寸参考本规格书中测试部分
  - Ultrasonic-cleaning of immersion-cleaning and so on must not be done to Fuse before and after mounted.  
在贴装前后请不要用超声波或浸泡的方式来清洗产品
  - When cleaning is done, flux on element would flow, and it would not be satisfied its specification. Moreover, a similar influence happens when the product comes in contact with cleaning-solution. These products after cleaning will not be guaranteed.  
如果进行清洗(超声波或者浸泡清洗), 保险丝表面的助焊剂可能会流失, 从而出现无法满足规格的情况。如果本产品接触到清洁剂, 也有可能发生同样的情况。因此, 请避免对本产品进行清洗, 清洗后的产品品质得不到保证
  - Please avoid contacting Self Control Protector and resin-mold. The resin might infiltrate into the product, and it doesn't meet the specification when the resin-mold is done to this product. These products after resin-mold will not be guaranteed.  
如果对本产品进行树脂封装, 树脂可能会流到产品内部而导致不能满足规格, 所以请避免树脂封装。进行了树脂封装的产品, 品质将得不到保证
  - Prevent corrosive gas (Cl<sub>2</sub>, NH<sub>3</sub>, SOX, NOX, etc.) from contacting the products.  
请不要让产品暴露在含有腐蚀性气体(Cl<sub>2</sub>, NH<sub>3</sub>, SOX, NOX, etc.)的环境中
  - Please do not re-use of the Fuse removed by solder correction.  
从 PCBA 上通过加热熔锡取下的产品, 请不要再使用
  - Excessive stress or shock may make products broken or cracked due to the nature of ceramics structure.  
本产品为陶瓷基板结构产品, 过度的应力或者冲击可导致产品结构受损
- SMD Re-work 表面贴装返工
  - Please, Do Not Reuse the Fuse removed or detached by PCB re-work.  
请不要再使用经过 PCB 返工后的产品
  - After PCB Re-work, Re-mounting of NEW Fuse should be done as follow step.  
PCB 返工后, 应按照下面的条件补焊新产品到 PCB 上
    - Iron 手工烙铁焊接: Temperature 温度 of 300 ± 5°C for 3sec.
    - Hot Plate 通过加热盘焊接: Temperature 温度 of 220 ± 5°C for 3sec.