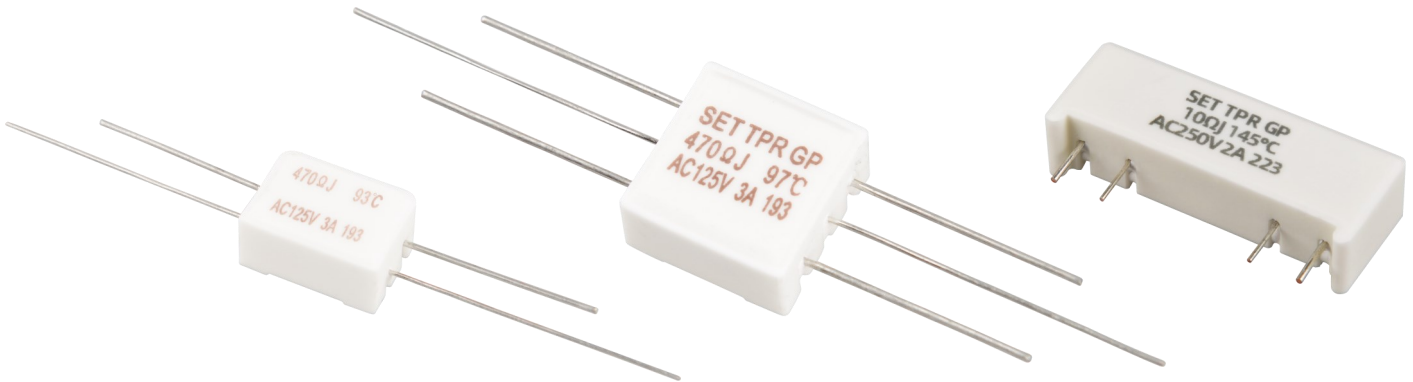


热保护型水泥电阻器 (主动控制)

Thermally Protected Resistor (Active Protection)



特征 Features

- 过流保护 Over Current Protection
- 过温保护 Over Temp. Protection
- 开机浪涌保护 Inrush Current Protection
- 环保型产品 RoHS & REACH Complaint

热保护型水泥电阻器 (主动控制)

Thermally Protected Resistor (Active Protection)

热保护型水泥电阻器（TPR主动控制）器特征概览

页码			
外形			
结构	4只脚 4 Pins	6只脚 6 Pins	4只脚 4 Pins
阻值 <i>R</i>	(0.27 ~ 1000) Ω	(0.27 ~ 800) Ω	(0.27 ~ 1000) Ω
	参照标准：IEC60063-2015，阻值可根据客户需求定制。 According to IEC60063-2015, resistance can be customized.		
功率类型 <i>P</i>	2 W	2 W	3 W
尺寸	16.5 mm × 12 mm × 7 mm	16.2 mm × 16.5 mm × 8.5 mm	38 mm × 9 mm × 14 mm
	引脚成型方式及尺寸可根据客户需求定制。 The forming modes and length of lead wires can be customized.		
<i>T_f</i> 额定动作温度	(102 ~ 150) °C	(102 ~ 135) °C	(115 ~ 150) °C

热保护型水泥电阻器 (主动控制)

Thermally Protected Resistor (Active Protection)

产品描述 Description

赛尔特公司的热保护型水泥电阻器（TPR）是一种同时具有过温过流保护功能的功率型电阻器。该产品是将合金型温度保险丝（ATCO）与线绕熔断电阻器（RXF）用硅树脂水泥封装在陶瓷壳内的功率型电阻器。它是一款既能利用温度保险丝的过温熔断特性实现过温保护功能，又能利用熔断电阻过流发热熔断温度保险丝的特性实现过流保护功能的独特的电路保护元件。

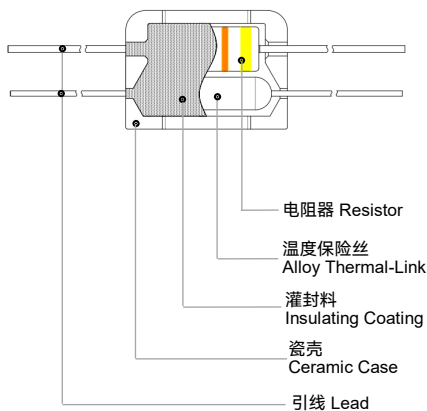
SETsafe | SETfuse Thermally Protected Resistor (TPR) is an unique type of Power Resistor, with Over Temp. and Over Current Protections. Thermally Protected Resistor (TPR) is a type of power resistor, where Alloy Thermal-Link (ATCO) and Fusible Wirewound Resistor (RXF) in a ceramic case with silicone cement. It is not only able to proceed over temp. protection by ATCO itself but also proceed over current protection by RXF transferring heat to ATCO to open the circuit.

应用 Applications

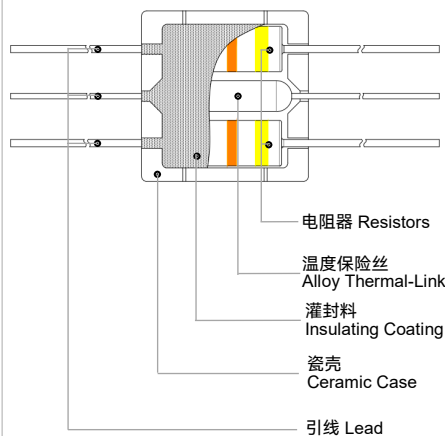
- LED驱动 LED Drivers
- 电热毯 Electric Blanket
- 工业设备 Industrial Equipment

结构图 Structure

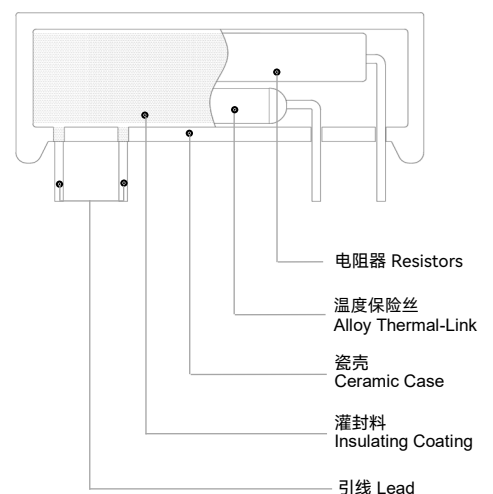
TPRC系列 Series



TPRC-2系列 Series



TPRD系列 Series



TPR

TPR

热保护型水泥电阻器 (主动控制)

Thermally Protected Resistor (Active Protection)

型号说明 Product Number System

● TPRC 系列 Series

TPR C - 4R7 J 41 F B H - 001

流水码 Other Options

安装方式 Installation Type

H: 卧式安装 Horizontal Installation

产品形状 Shape

B : 方形 Square

引出脚类型 Pin Type

F : 四只脚 Four Pins

温度保险丝代码 ACTO Code

代码 Code	ATCO型号 Model	额定动作温度 T_f
41	B1	102 °C
42	B2	115 °C
43	B3	125 °C
44	B4	130 °C
45	B5	135 °C
46	B6	145 °C
47	B7	150 °C

阻值公差 Resistance Tolerance (%)

J : ± 5

K : ± 10

标称阻值 Rated Resistance (Ω)

R47 : 0.47

4R7 : 4.7

47R : 47

470R : 470

功率类型 Power Type (W)

C : 2

产品类别 Product Category

TPR : 热保护型水泥电阻器
Thermally Protected Resistor

热保护型水泥电阻器 (主动控制)

Thermally Protected Resistor (Active Protection)

型号说明 Product Number System

● TPRC-2 系列 Series

TPR C - 2 - 4R7 J 41 G B H - 001

流水码 Other Options

安装方式 Installation Type

H: 卧式安装 Horizontal Installation

产品形状 Shape

B：方形 Square

引出脚类型 Pin Type

G：六只脚 Six Pins

温度保险丝代码 ACTO Code

代码 Code	ATCO型号 Model	额定动作温度 T_f
41	B1	102 °C
42	B2	115 °C
43	B3	125 °C
44	B4	130 °C
45	B5	135 °C

阻值公差 Resistance Tolerance (%)

J：±5

K：±10

标称阻值 Rated Resistance (Ω)

R47：0.47

4R7：4.7

47R：47

470R：470

电阻器数量 Number of Resistor

2：2

功率类型 Power Type (W)

C：2

产品类别 Product Category

TPR：热保护型水泥电阻器
Thermally Protected Resistor

热保护型水泥电阻器 (主动控制)

Thermally Protected Resistor (Active Protection)

型号说明 Product Number System

● TPRD 系列 Series

TPR D - 4R7 J 26 F B H - 001

流水码 Other Options

安装方式 Installation Type

H: 卧式安装 Horizontal Installation

产品形状 Shape

B: 方形 Square

引出脚类型 Pin Type

F: 四只脚 Four Pins

温度保险丝代码 ACTO Code

代码 Code	ATCO型号 Model	额定动作温度 T_f
22	H2	150 °C
23	H3	145 °C
24	H4	135 °C
25	H5	130 °C
26	H6	125 °C
27	H7	115 °C

阻值公差 Resistance Tolerance (%)

J: ± 5

K: ± 10

标称阻值 Rated Resistance (Ω)

R47: 0.47

4R7: 4.7

47R: 47

470R: 470

功率类型 Power Type (W)

D: 3

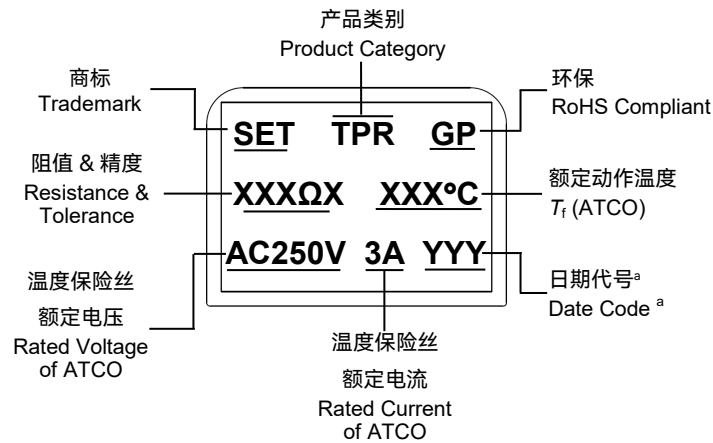
产品类别 Product Category

TPR: 热保护型水泥电阻器
Thermally Protected Resistor

热保护型水泥电阻器 (主动控制)

Thermally Protected Resistor (Active Protection)

产品标识 Marking



^a: 前两位数字代表生产年份代码, 最后一位数字代表生产季度代码。

举例: “211” 代表该产品为2021年第一季度生产。

The first XX means production year code, the last X means production quarter code.

eg: “211” means that the production time is the first quarter of Y2021.

术语 Glossary

项目 Item	描述 Description
RXF	线绕熔断电阻器 Fusible Wirewound Resistor 电阻丝绕在瓷基体上再经过绝缘封装处理而成的功率型电阻器。当通过电流超过预定值时, 能在预定的时间切断电流。线绕熔断电阻器为一次性熔断元件, 不可恢复。 A power resistor which is made by winding a resistive element on a ceramic core, and the core is coated by insulation coating. It intends to interrupt a current flow at a predetermined time when the current exceeds a predetermined value.
ATCO	合金型温度保险丝 Alloy Thermal-Link 合金型温度保险丝, 由易熔合金作为感温部件的热熔断体。 Alloy Type Thermal-Link, Alloy is the thermal element.
R	标称阻值 Rated Resistance 电阻器设计所确定的, 通常在电阻器上标出的阻值。 Resistance value for which the resistor has been designed, and which is generally used for denomination of the resistor.
U_N	额定电压 Rated Voltage 用标称阻值和额定功耗乘积的平方根计算出来的直流电压或交流电压有效值。 The d.c. or a.c. r.m.s. voltage calculated from the square root of the product of the rated resistance and the rated dissipation.
T_f	额定动作温度 Rated Functioning Temp. 在仅通以不超过10 mA的探测电流的条件下, 测得的使热熔断体导电状态改变的温度。 The temp. of the Alloy Thermal-Link which causes it to change the state of conductivity with a detection current up to 10 mA as the only load. 允许偏差 Tolerance: $T_f + 0 / -10\text{ }^{\circ}\text{C}$ (GB 9816.1, EN 60691, K60691) 允许偏差 Tolerance: $T_f \pm 7\text{ }^{\circ}\text{C}$ (J60691)
Fusing Temp.	实测熔断温度 Fusing Temp. 置于油池中, 通10 mA以下的负载电流, 每分钟升温 $0.5\text{ }^{\circ}\text{C} \sim 1\text{ }^{\circ}\text{C}$, 测断开温度。 The temp. of the Alloy Thermal-Link which causes it to change its state of conductivity is measured with silicone oil bath in which the temp. is increased at the rate of $0.5\text{ }^{\circ}\text{C}$ to $1\text{ }^{\circ}\text{C}$ / minute, with a detection current up to 10 mA as the only load.

热保护型水泥电阻器 (主动控制)

Thermally Protected Resistor (Active Protection)

工作原理 Operating Principle

● TPRC 系列 Series

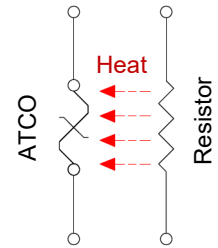
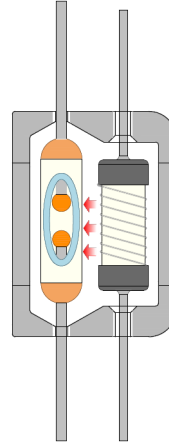
说明 Instruction

$$R_{RXF} \geq 100R_{ATCO}$$

- R_{RXF} : 线绕熔断电阻器的阻值
 R_{RXF} : the resistance value of RXF
- R_{ATCO} : 合金型温度保险丝的阻值
 R_{ATCO} : the resistance value of the Alloy Thermal-Link (ATCO)

$$T_{RXF} \geq 5T_{ATCO}$$

- 合金型温度保险丝断开温度 (T_{ATCO}) 为 102 °C ~ 150 °C
The Fusing Temp. of ATCO (T_{ATCO}): 102 °C ~ 150 °C



● TPRC-2 系列 Series

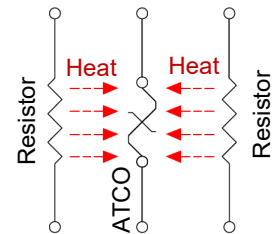
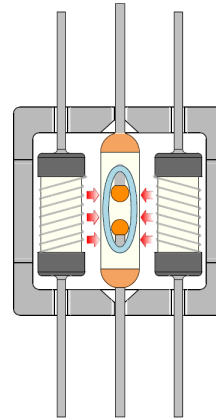
说明 Instruction

$$R_{RXF} \geq 100R_{ATCO}$$

- R_{RXF} : 线绕熔断电阻器的阻值
 R_{RXF} : the resistance value of RXF
- R_{ATCO} : 合金型温度保险丝的阻值
 R_{ATCO} : the resistance value of the Alloy Thermal-Link (ATCO)

$$T_{RXF} \geq 5T_{ATCO}$$

- 合金型温度保险丝断开温度 (T_{ATCO}) 为 102 °C ~ 135 °C
The Fusing Temp. of ATCO (T_{ATCO}): 102 °C ~ 135 °C



● TPRD 系列 Series

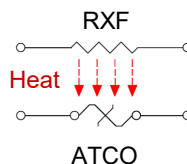
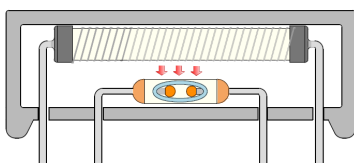
说明 Instruction

$$R_{RXF} \geq 100R_{ATCO}$$

- R_{RXF} : 线绕熔断电阻器的阻值
 R_{RXF} : the resistance value of RXF
- R_{ATCO} : 合金型温度保险丝的阻值
 R_{ATCO} : the resistance value of the Alloy Thermal-Link (ATCO)

$$T_{RXF} \geq 5T_{ATCO}$$

- 合金型温度保险丝断开温度 (T_{ATCO}) 为 115 °C ~ 150 °C
The Fusing Temp. of ATCO (T_{ATCO}): 115 °C ~ 150 °C



热保护型水泥电阻器 (主动控制)

Thermally Protected Resistor (Active Protection)

性能测试 Performance Test

机械性能测试 Mechanical Performance Test

项目 Item	试验条件 Test Condition	判定标准 Criterion
拉力测试 Tensile Test	对引线施加10 N的拉力，保持60 s。 A pin withstand 10 N × 60 s	无可见损伤 No Visible Damage $\Delta R \leq \pm (1\%R + 0.05 \Omega)$
扭转测试 Twist Test	引脚从根部折弯90°（折弯位置距本体2 mm），扭转180° × 2次。 A pin 2 mm away from body, bent 90°, twist 180° × 2 times.	无可见损伤 No Visible Damage $\Delta R \leq \pm (1\%R + 0.05 \Omega)$

环境测试 Environmental Test

项目 Item	试验条件 Test Condition	判定标准 Criterion
温度循环 Temp. Cycle	1. - 55 °C × 30 minutes 2. 室温 Room Temp. × (10 to 15) minutes 3. 85 °C × 30 minutes 4. 室温 Room Temp. × (10 to 15) minutes 5. 步骤1至4循环5次 5 Cycles from Step 1 to Step 4	$\Delta R \leq \pm (2\%R + 0.05 \Omega)$

电气特性测试 Electrical Performance Test

项目 Item	试验条件 Test Condition	判定标准 Criterion
短时间过载 Short-Time Overload	通2.5倍的额定电压，持续5 s。 $2.5U_N \times 5 \text{ s}$	无可见损伤 No Visible Damage $\Delta R \leq \pm (2\%R + 0.05 \Omega)$
绝缘电阻 Insulation Resistance	包箔法，在引线与金属膜之间施加500 VDC。 Foil Method: Apply 500 VDC between both terminations of the resistor connected together as one pole and the metal foil as the other pole.	绝缘电阻：≥1,000 MΩ Insulation Resistance ≥ 1,000 MΩ
耐电压 Voltage Proof	包箔法，引线与金属箔膜之间施加900 VAC，保持1 minute。 Foil Method: Apply 900 VAC × 1 minute between pin and the metal foil.	不得有弧光、击穿等现象发生 No Breakdown or Flashover
熔断测试 Fusing Test	对电阻器施加规定的测试电流（恒流源） Apply specified test current to the resistor (constant current source)	温度保险丝熔断时间≤ 60 s Fusing Time ≤ 60 s

热保护型水泥电阻器 (主动控制)

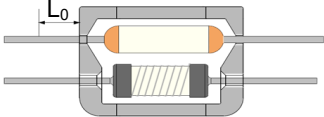
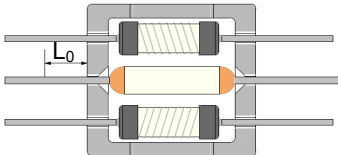
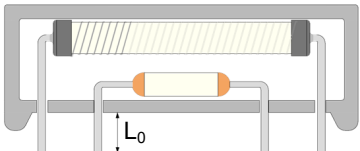
Thermally Protected Resistor (Active Protection)

电气特性测试 Electrical Performance Test

项目 Item	试验条件 Test Condition	判定标准 Criterion
可焊性 Solderability	槽焊法 (非活性松香) 助焊剂: 25%松香酒精 锡炉温度: $(255 \pm 5) ^\circ\text{C}$ 浸入深度 (距安装面或元件主体): $(1.5 \sim 2.0) \text{ mm}$ 浸入时间: $(2.5 \pm 0.5) \text{ s}$ Solder Bath (non-activated flux) Soldering Powder: 25% Rosin Alcohol Bath Temp.: $(255 \pm 5) ^\circ\text{C}$ Depth of Immersion (From the seating plane or component body): $(1.5 \text{ to } 2.0) \text{ mm}$ Time of Immersion: $(2.5 \pm 0.5) \text{ s}$	引线焊锡面积覆盖率 $\geq 95\%$ Soldering Area $\geq 95\%$
实测熔断温度 Fusing Temp.	产品置于油池, 通10 mA以下的负载电流, 每分钟升温 $0.3 ^\circ\text{C}$ 至 $0.5 ^\circ\text{C}$, 测断开温度。 Silicone oil bath: temp. rise rate is $0.3 ^\circ\text{C}/\text{minute}$ to $0.5 ^\circ\text{C}/\text{minute}$, detection current $\leq 10 \text{ mA}$.	$143 ^\circ\text{C} \sim 150 ^\circ\text{C}$ ($T_f = 150 ^\circ\text{C}$) $138 ^\circ\text{C} \sim 145 ^\circ\text{C}$ ($T_f = 145 ^\circ\text{C}$) $128 ^\circ\text{C} \sim 135 ^\circ\text{C}$ ($T_f = 135 ^\circ\text{C}$) $123 ^\circ\text{C} \sim 130 ^\circ\text{C}$ ($T_f = 130 ^\circ\text{C}$) $119 ^\circ\text{C} \sim 125 ^\circ\text{C}$ ($T_f = 125 ^\circ\text{C}$) $109 ^\circ\text{C} \sim 115 ^\circ\text{C}$ ($T_f = 115 ^\circ\text{C}$) $96 ^\circ\text{C} \sim 102 ^\circ\text{C}$ ($T_f = 102 ^\circ\text{C}$)

焊接参数 Soldering Parameters

推荐的手工焊参数 Recommended Hand-Soldering Parameters

系列 Series	最大容许焊接时间 Max. Allowable Soldering Time (s)			焊接温度 Soldering Temp. (°C)	图例 Legend
	距本体长度 Length of Lead Wire (L ₀)				
	10 mm	20 mm	30 mm		
TPRC	2	4	6	400	
TPRC-2	2	4	6	400	
系列 Series	距本体长度 Length of Lead Wire (L ₀)			焊接温度 Soldering Temp. (°C)	图例 Legend
	3.5 mm	4.5 mm	5.5 mm		
TPRD	3	4	6	400	

备注: 为防止温度保险丝被焊断, 焊接时视需要增加辅助散热装置。

Remark: Auxiliary heat sink fixture is required to avoid Thermal-Link cutting off unexpectedly.

热保护型水泥电阻器 (主动控制)

Thermally Protected Resistor (Active Protection)



注意

ATTENTION

冷电阻测试 Cold Resistance Test

1. 当产品电阻温度系数 ≥ 350 ($10^{-6}/^{\circ}\text{C}$), 对产品进行电阻测试时, 需要用电阻温度系数将阻值修正至基准温度 25°C 所对应的电阻值。
If product TCR is not less than 350 ($10^{-6}/^{\circ}\text{C}$), the measured resistance value shall be corrected as the relative resistance value under 25°C according to TCR formula.

2. 采用四端测试法。
Resistance Measurement (4-terminal test).

更换 Replacement

热保护型水泥电阻器是不可修复的产品, 基于安全原因, 替换时应使用同类别同型号的产品。
As TPR is a non-resettable product, for safety sake, please use the same type of TPR for replacement.

使用方法 Usage

1. 通电情况下请勿用人体直接触碰电阻器本体或引脚, 防止烫伤或触电。
Do not touch the resistor body or pins directly when power is on, to avoid burn or electric shock.
2. 气压在 80 kPa 到 106 kPa , 对应海拔为 2000 m 到 -500 m 。
When air pressure is from 80 kPa to 106 kPa , the relative altitude shall be 2000 m to -500 m .

贮存 Storage

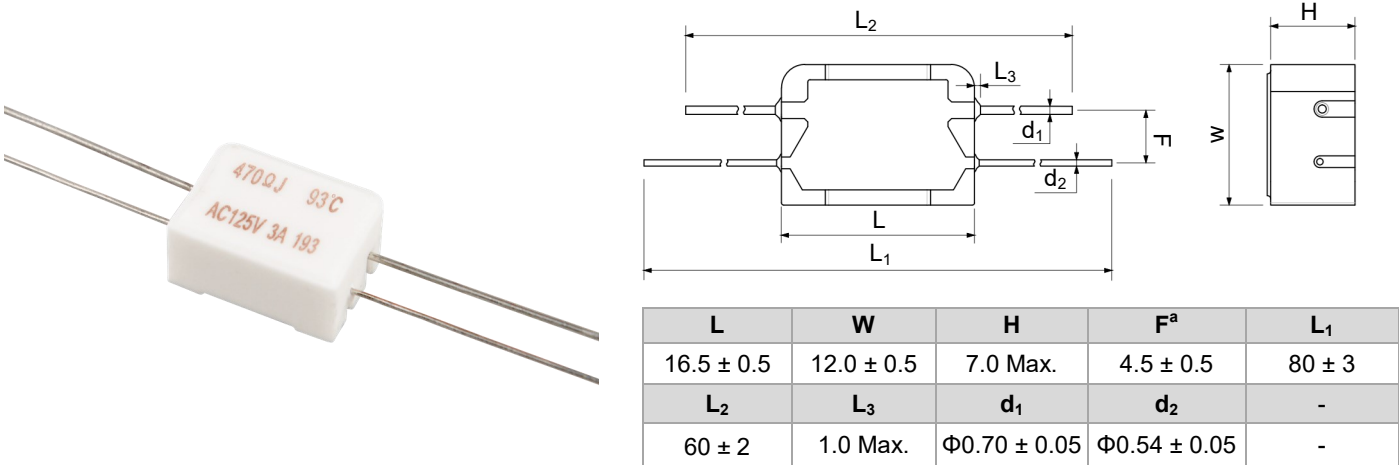
1. 将热保护型水泥电阻器放置在温度 10°C 至 30°C , 相对湿度 30% 至 75% 的条件下保存。
Please store TPR with ambient temp. 10°C to 30°C and relative humidity 30% to 75% .
2. 热保护型水泥电阻器的贮存应避免高温、高湿、日光直射及腐蚀性气体的场合, 避免影响引脚的可焊性, 产品购入后请于1年内使用完毕。
Do not store the TPR at the high temp., high humidity or corrosive gas environment, avoid influencing the solderability of the pins, please use them up within 1 year after receiving the goods.

热保护型水泥电阻器 (主动控制)

Thermally Protected Resistor (Active Protection)

TPRC 系列 Series

尺寸 Dimensions (mm)



^a: F 在离本体小于1 mm时满足(4.5±0.5) mm，成型方式及脚长可根据需求定制。
F can meet (4.5 ± 0.5) mm within 1 mm from the body. The forming modes and length of length of lead wires can be customized.

电性能参数 Electrical Characteristics

项目 Item	参数 Parameter
功率类型 Power Type (<i>P</i>)	2 W
标称阻值 Rated Resistance (<i>R</i>)	0.27 Ω ~ 1000 Ω
阻值公差 Resistance Tolerance	5% (E24) , 10% (E12)
额定电压 Rated Voltage (<i>U_N</i>)	$U_N = \sqrt{P \times R}$
温度保险丝额定电流 Rated Current of ATCO	3 A
温度保险丝额定电压 Rated Voltage of ATCO	125 VAC, 250 VAC
额定动作温度 Rated Functioning Temp. (<i>T_f</i>)	102 °C, 115 °C, 125 °C, 130 °C, 135 °C, 145 °C, 150 °C
熔断时间 Fusing Time	20 W, (102 °C , 小于60 s, less than 60 s)
	25 W, (115 °C ≤ <i>T_f</i> ≤ 135 °C , 小于60 s, less than 60 s)
	30 W, (145 °C ≤ <i>T_f</i> ≤ 150 °C , 小于60 s, less than 60 s)
最大熔断电流 Maximum Fusing Current	60 W对应电流 Current that Correspond to 60 W
实测熔断温度 Fusing Temp.	详见技术参数 See Specifications
浪涌（仅供参考） Surge (For Reference Only)	2.0 kV (<i>R</i> > 10 Ω)
	1.0 kV (<i>R</i> ≤ 10 Ω)

热保护型水泥电阻器 (主动控制)

Thermally Protected Resistor (Active Protection)

TPRC 系列 Series

技术参数 Specifications

型号 Model	功率 Power Type	额定动作温度 Rated Functioning Temp. (T _f)	实测熔断温度 Fusing Temp.	阻值范围 Resistance Range	阻值公差 Resistance Tolerance	安规认证 Agency Approvals		环保 Environmental Status	
								RoHS	REACH
	(W)	(°C)	(°C)	(Ω)	(%)	cURus	CQC		
TPRC-xxxx47FB	2	150	143 ~ 150	0.27 ~ 1000	±5, ±10	Pending	Pending	●	●
TPRC-xxxx46FB	2	145	138 ~ 145	0.27 ~ 1000	±5, ±10	Pending	Pending	●	●
TPRC-xxxx45LB	2	135	128 ~ 135	0.27 ~ 1000	±5, ±10	Pending	Pending	●	●
TPRC-xxxx44LB	2	130	123 ~ 130	0.27 ~ 1000	±5, ±10	Pending	Pending	●	●
TPRC-xxxx43LB	2	125	119 ~ 125	0.27 ~ 1000	±5, ±10	Pending	Pending	●	●
TPRC-xxxx42FB	2	115	109 ~ 115	0.27 ~ 1000	±5, ±10	Pending	Pending	●	●
TPRC-xxxx41FB	2	102	96 ~ 102	0.27 ~ 1000	±5, ±10	Pending	Pending	●	●

阻值选型表 (参照标准: IEC60063-2015, 蓝色字体为赛尔特常规阻值)
Resistance Selection Table (According to IEC60063-2015 E24, blue font is SETsafe | SETfuse common resistance).

标称阻值 Rated Resistance	代码 Code	标称阻值 Rated Resistance	代码 Code	标称阻值 Rated Resistance	代码 Code	标称阻值 Rated Resistance	代码 Code
(Ω)		(Ω)		(Ω)		(Ω)	
0.10	R10	1.0	1R0	10	10R	100	100R
0.11	R11	1.1	1R1	11	11R	110	110R
0.12	R12	1.2	1R2	12	12R	120	120R
0.13	R13	1.3	1R3	13	13R	130	130R
0.15	R15	1.5	1R5	15	15R	150	150R
0.16	R16	1.6	1R6	16	16R	160	160R
0.18	R18	1.8	1R8	18	18R	180	180R
0.20	R20	2.0	2R0	20	20R	200	200R
0.22	R22	2.2	2R2	22	22R	220	220R
0.24	R24	2.4	2R4	24	24R	240	240R
0.27	R27	2.7	2R7	27	27R	270	270R
0.30	R30	3.0	3R0	30	30R	300	300R
0.33	R33	3.3	3R3	33	33R	330	330R
0.36	R36	3.6	3R6	36	36R	360	360R
0.39	R39	3.9	3R9	39	39R	390	390R
0.43	R43	4.3	4R3	43	43R	430	430R
0.47	R47	4.7	4R7	47	47R	470	470R
0.51	R51	5.1	5R1	51	51R	510	510R
0.56	R56	5.6	5R6	56	56R	560	560R
0.62	R62	6.2	6R2	62	62R	620	620R
0.68	R68	6.8	6R8	68	68R	680	680R
0.75	R75	7.5	7R5	75	75R	750	750R
0.82	R82	8.2	8R2	82	82R	N/A	N/A
0.91	R91	9.1	9R1	91	91R	N/A	N/A

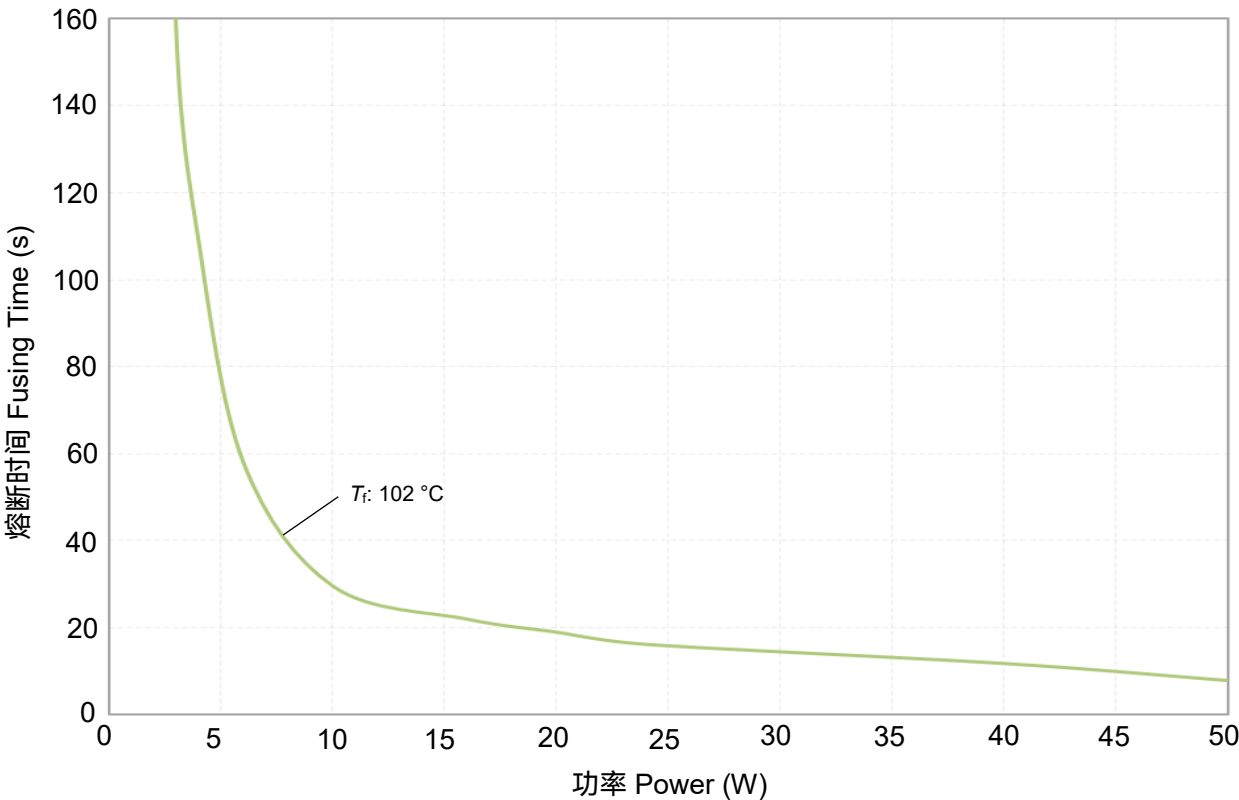
热保护型水泥电阻器 (主动控制)

Thermally Protected Resistor (Active Protection)

TPRC 系列 Series

熔断特性曲线 (仅供参考) Fusing Time Current (For Reference Only)

热保护型水泥电阻器能够在较低的功率倍数下即有效断开 (环境温度: 25 °C ± 2 °C) 。
TPR can open effectively at lower power multiples to protect the circuit timely (ambient temp.: 25 °C ± 2°C).



内置RXF认证 Agency Approvals of RXF (Built-in)

额定功率 Rated Power	阻值范围 Resistance Range	安规认证 Agency Approvals		
				
(W)	(Ω)	cURus	VDE	CQC
2	3 to 68	●	●	●
	0.27 to 1000	●	●	N/A

内置ATCO认证 Agency Approvals of ATCO (Built-in)

代号 Code	型号 Model	额定动作温度 Rated Functioning Temp. (°C)	安规认证 Agency Approvals				
							
			cURus	TUV	PSE	CCC	KC
47	B7	150	●	●	●	●	●
46	B6	145	●	●	●	●	●
45	B5	135	●	●	●	●	●
44	B4	130	●	●	●	●	●
43	B3	125	●	●	●	●	●
42	B2	115	●	●	●	●	●
41	B1	102	●	●	●	●	●

热保护型水泥电阻器 (主动控制)

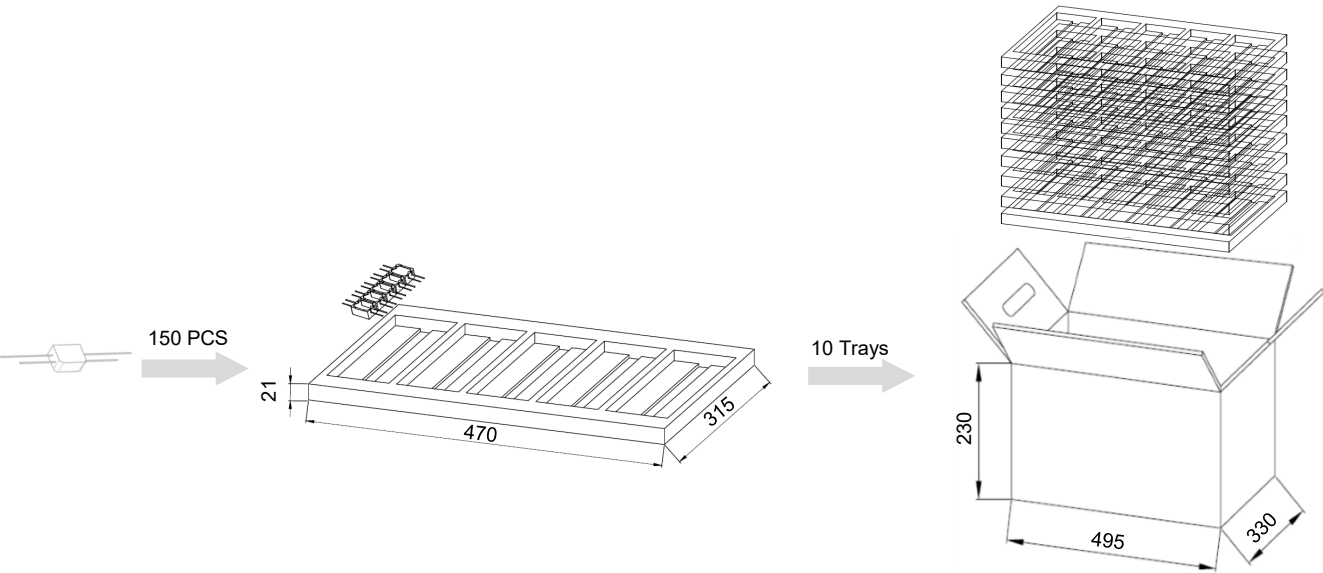
Thermally Protected Resistor (Active Protection)

TPRC 系列 Series

包装信息 (仅供参考) Packaging Information (For Reference Only)

项目 Item	吸塑盘 Tray	外包装箱 Carton
数量 Quantity	150 PCS	1500 PCS
毛重 Gross Weight (kg)		6.5 ± 10%

单位 Unit: mm



TPR

TPR