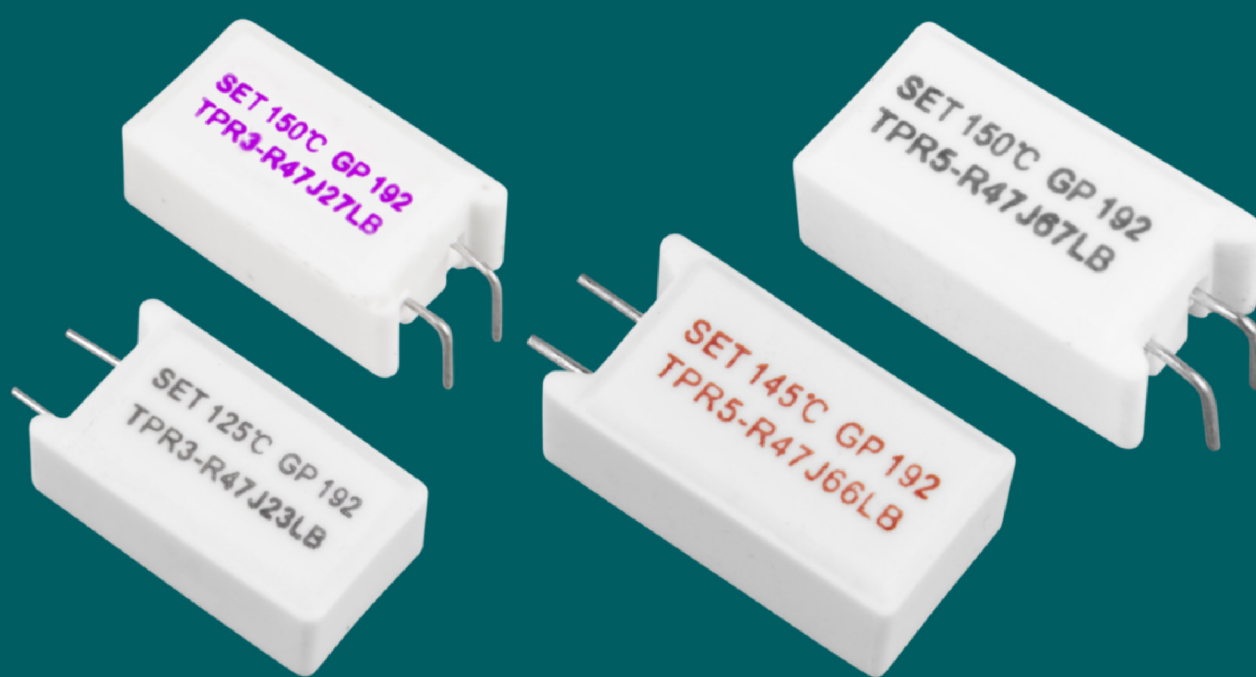
# TPR

## 热保护型水泥电阻器
## Thermally Protected Resistor

- 过流保护
- 过温保护
- 开机浪涌保护
- 小故障电流保护
- 短路保护
- 环保型产品

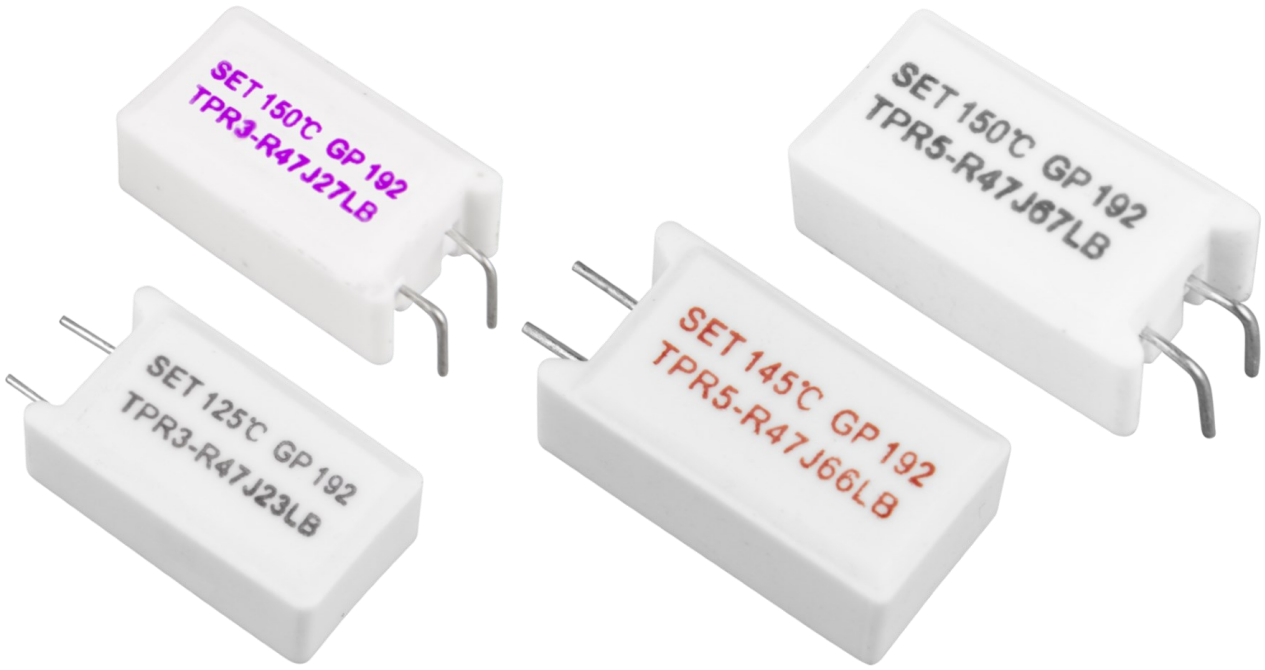
· Over Current Protection
· Over Temp. Protection
· Inrush Current Protection
· Small Fault Current Protection
· Short Circuit Protection
· RoHS & REACH Complaint




SET safe | SET fuse
赛尔特

制造电路控制及安全保护元器件 提供电路安全解决方案
Providing a Total Solution for High Standard Safety Circuit Protection

# 热保护型水泥电阻器
## Thermally Protected Resistor (TPR)






## 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
- 小故障电流保护 Small Fault Current Protection
- 短路保护 Short Circuit Protection
- 环保型产品 RoHS & REACH Complaint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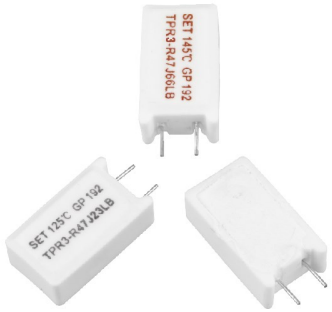
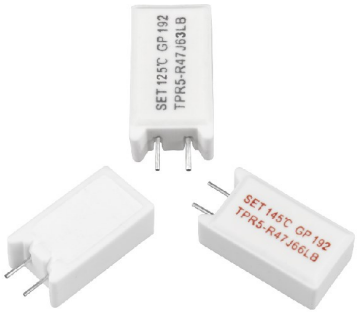
# 热保护型水泥电阻器
## Thermally Protected Resistor (TPR)

### 热保护型水泥电阻器特征概览
### Thermally Protected Resistor ( TPR ) Features Overview

| 页码 Page | P11 | P11 | P15 | P15 |
|---|---|---|---|---|
| 外形 Shape |  | |  | |
| 结构 Structure | 立式 Vertical | 卧式 Horizontal | 立式 Vertical | 卧式 Horizontal |
| ***R*** 阻值 Resistance Range | 0.27 Ω - 800 Ω | | 0.27 Ω - 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. | | | |
| ***P*** 功率类型 Power Type | 3 W | | 5 W | |
| 尺寸 Dimensions | 11.5 mm × 7.0 mm × 20.5 mm | 20.5 mm × 11.5 mm × 7.0 mm | 13.5 mm × 9.0 mm × 25.0 mm | 27.0 mm × 14.0 mm × 9.5 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. | | | |
| $T_f$ 额定动作温度 Rated Functioning Temp. | 115 °C, 125 °C, 130 °C, 135 °C, 145 °C, 150 °C, 221 °C | | | |

+86 592-571-5838 www.SETsafe.com www.SETfuse.com E-mail : sales@SETfuse.com



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# 热保护型水泥电阻器
Thermally Protected Resistor (TPR)

## 产品描述 Description

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）串联连接后用硅树脂水泥封装在陶瓷壳内的功率型电阻器。赛尔特热保护型水泥电阻不仅具有与普通水泥电阻器相同的尺寸和大故障电流保护功能，还可有效解决普通线绕熔断电阻器在小故障电流下所产生异常持续高温的安全隐患。

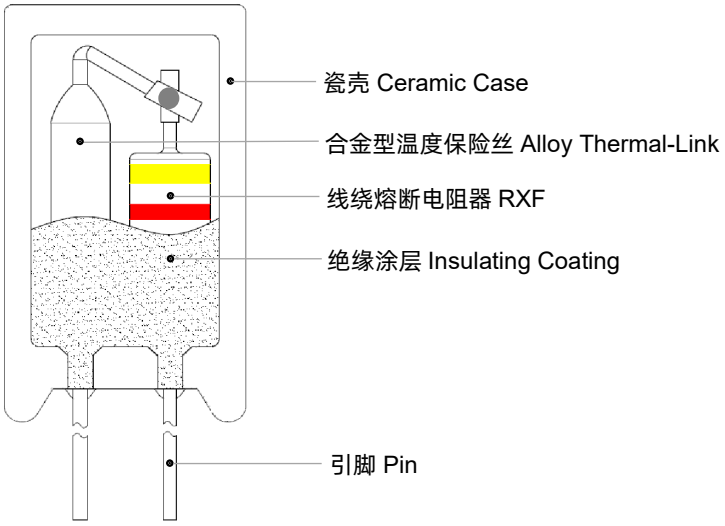
Thermally Protected Resistor (TPR) is an unique type of Power Resistor, with Over Temp. and Over Current Protections. Thermally Protected Resistor (TPR) is a type of power resistor, where Alloy Thermal-Link (ATCO) and Fusible Wirewound Resistor (RXF) are in series encapsulated in a ceramic case with silicone cement. SETsafe | SETfuse TPR has the same physical size as ordinary ceramic resistor while additionally providing fault current protection. TPR can also effectively protect against the damages to devices & equipment, caused by continuous heat dissipations by ceramic resistors due to fault currents.

## 应用 Applications

- 电源 Power Supply
- 办公设备 Office Appliances
- 家电 Household Appliances



## 结构图 Structure




备注：示意图颜色仅供参考
Note: The color of schematic diagram is for reference only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## 型号说明 Product Number System

TPR 3 - 4R7 J 30 L B

**产品形状 Shape**

B： 方形 Square

**引出脚类型 Pin Type**

L： 二只脚 Two Pins

**温度保险丝代码 ACTO Code**

| TPR3 系列 Series | | | TPR5 系列 Series | | |
|---|---|---|---|---|---|
| 代码 Code | ATCO 型号 Model | 额定动作温度 $T_f$ | 代码 Code | ATCO 型号 Model | 额定动作温度 $T_f$ |
| 22 | H2 | 115 °C | 62 | C2 | 115 °C |
| 23 | H3 | 125 °C | 63 | C3 | 125 °C |
| 24 | H4 | 130 °C | 64 | C4 | 130 °C |
| 25 | H5 | 135 °C | 65 | C5 | 135 °C |
| 26 | H6 | 145 °C | 66 | C6 | 145 °C |
| 27 | H7 | 150 °C | 67 | C7 | 150 °C |
| 30 | H31 | 221°C | 70 | C31 | 221°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)**

3： 3

5： 5

**产品类别 Product Category**

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





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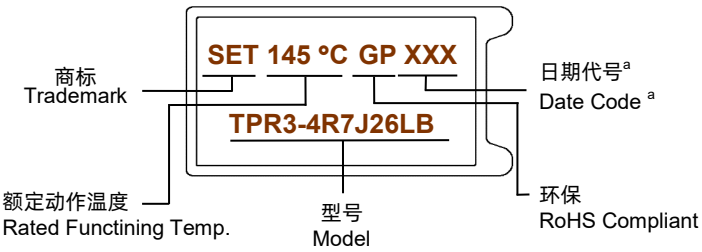
# 热保护型水泥电阻器
Thermally Protected Resistor (TPR)

## 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.

备注：示意图颜色仅供参考
Note: The color of schematic diagram is for reference only

## 术语 Glossary

| 项目<br>Item | 描述<br>Description |
|---|---|
| **RXF** | **线绕熔断电阻器 Fusible Wirewound Resistor**<br>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。 — (SETsafe \| SETfuse 企业标准)<br>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. — (SETsafe \| SETfuse Standards) |
| **ATCO** | **合金型温度保险丝 Alloy Thermal-Link**<br>合金型温度保险丝，由易熔合金作为感温部件的热熔断体。 — (GB/T 9816.3)<br>Alloy Type Thermal-Link, Alloy is the thermal element. |
| ***R*** | **标称阻值 Rated Resistance**<br>电阻器设计所确定的，通常在电阻器上标出的阻值。 — (GB/T 5729)<br>Resistance value for which the resistor has been designed, and which is generally used for denomination of the resistor. — (IEC60115-1) |
| $P_0$ | **实际功率 Actual Power**<br>在允许的工作温度范围内，TPR可使用的最大功率 。 — (SETsafe \| SETfuse 企业标准)<br>The Max. power of TPR can be used within the allowable operating Temp. range. — (SETsafe \| SETfuse Standards) |
| $I_N$ | **额定电流 Rated Current**<br>$I_N = \sqrt{P_0 / R}$ — (SETsafe \| SETfuse Standards) |
| $U_N$ | **额定电压 Rated Voltage**<br>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。 — (GB/T 5729)<br>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. — (IEC60115-1) |
| $T_f$ | **额定动作温度 Rated Functioning Temp.**<br>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。 — (GB 9816.1)<br>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. — (IEC 60691)<br>允许偏差 Tolerance: $T_f$ + 0 / -10 °C (GB 9816.1, EN 60691, K60691)<br>允许偏差 Tolerance: $T_f$ ± 7 °C (J60691) |
| **Fusing Temp.** | **实测熔断温度 Fusing Temp.**<br>置于油池中，通10 mA以下的负载电流，每分钟升温0.5 °C ~ 1 °C，测断开温度。 — (GB 9816.1)<br>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 °C to 1 °C / minute, with a detection current up to 10 mA as the only load. — (IEC 60691) |


TPR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# 热保护型水泥电阻器
Thermally Protected Resistor (TPR)

## 工作原理 Operating Principle

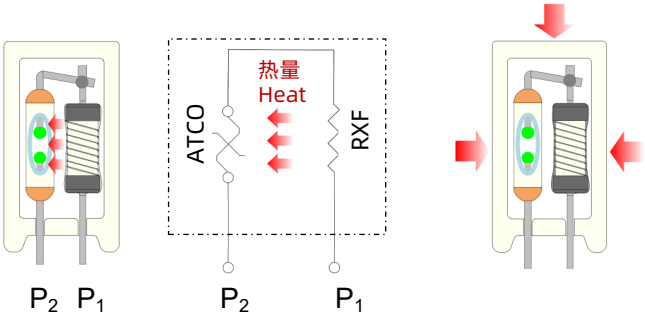
### 说明 Instruction

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

- $R_{RXF}$: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)

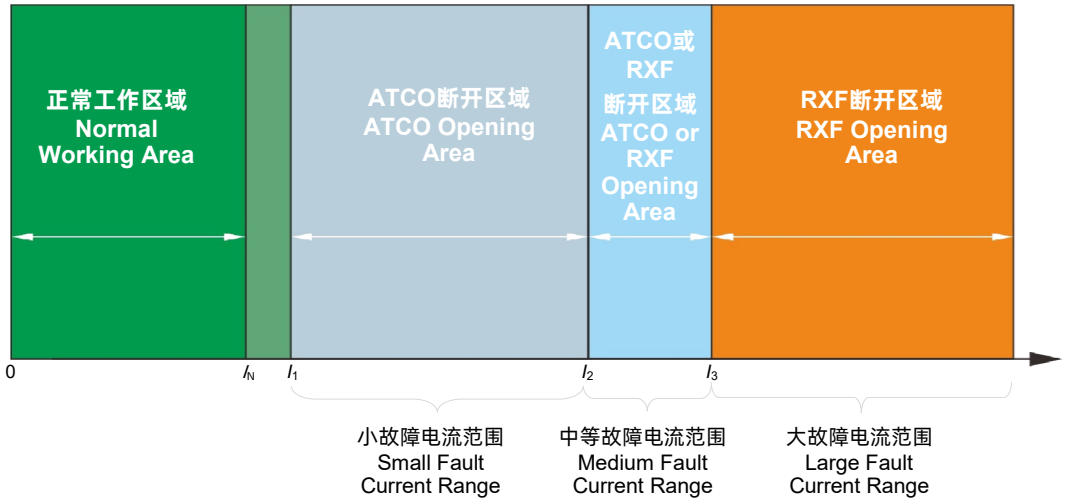
$T_{RXF} \geq 5T_{ATCO}$

- 电阻丝断开温度（$T_{RXF}$）为1200 °C ~ 1500 °C
  The Fusing Temp. of RXF ($T_{RXF}$): 1200 °C ~ 1500 °C
- 合金型温度保险丝断开温度（$T_{ATCO}$）为115 °C ~ 221 °C
  The Fusing Temp. of ATCO ($T_{ATCO}$): 115 °C ~ 221 °C




小故障电流保护
Small Fault Current Protection

过温保护
Over Temp. Protection




$I_N$：额定电流 Rated Current
$I_1$：临界熔断电流 Conventional Fusing Current

- **小故障电流保护原理 Small Fault Current Protection**

  小故障电流下，即 $I_1<I<I_2$ 时，RXF发热并将热量传递给ATCO，当达到ATCO的熔断温度时，ATCO断开，从而起到保护电路的作用。即在小故障电流下，RXF未断开，ATCO断开。
  Under small fault current, $I_1 < I < I_2$, ATCO senses the heat that generated by RXF. When the ATCO reaches the fusing temp., ATCO opens the circuit quickly. In this case, RXF keeps intact and ATCO opens.

- **中等故障电流保护原理 Medium Fault Current Protection**

  中等故障电流下，即$I_2<I<I_3$ 时，因发热功率大，RXF在较短时间内发生熔断，其断开过程产生的余热使得ATCO熔断。即在中等故障电流下，RXF & ATCO 均断开。
  Under medium fault current, $I_2 < I < I_3$, RXF opens in a short time due to the large heat generated, meanwhile, RXF conducts its residual heat to ATCO. In this case, both RXF and ATCO open.

- **大故障电流保护原理 Large Fault Current Protection (Short Circuit Protection)**

  大故障电流下，即 $I>I_3$ 时，如出现电路短路，RXF瞬间断开。因断开时间极短，其产生的热量不足以将ATCO熔断。即在大故障电流下，RXF断开，ATCO未断开。
  Under large fault current, $I > I_3$, such as short circuit, RXF opens instantly, but ATCO keeps intact because the fusing time of RXF is too short to generate enough heat. In this case, RXF opens and ATCO keeps intact.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# 性能测试 Performance Test

### 机械性能测试 Mechanical Performance Test

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

### 环境测试 Environmental Test

| 项目<br>Item | 试验条件<br>Test Condition | 判定标准<br>Criterion |
|---|---|---|
| 温度循环<br>Temp. Cycle | 1. - 55 °C × 30 minutes<br>2. 室温 Room Temp. × (10 to 15) minutes<br>3. 85 °C × 30 minutes<br>4. 室温 Room Temp. × (10 to 15) minutes<br>5. 步骤1至4循环5次 5 Cycles from Step 1 to Step 4 | ΔR ≤ ± (2%R + 0.05 Ω) |

### 电气特性测试 Electrical Performance Test

| 项目<br>Item | 试验条件<br>Test Condition | 判定标准<br>Criterion |
|---|---|---|
| 短时间过载<br>Short-Time Overload | 通2.5倍的额定电压，持续5 s。<br>2.5$U_N$ × 5 s | 无可见损伤<br>No Visible Damage<br>ΔR ≤ ± (2%R + 0.05 Ω) |
| 绝缘电阻<br>Insulation Resistance | 包箔法，在引线与金属膜之间施加500 VDC。<br>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<br>Insulation Resistance ≥ 1,000 MΩ |
| 耐电压<br>Voltage Proof | 包箔法，引线与金属箔膜之间施加900 VAC，保持1 minute。<br>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<br>No Breakdown or Flashover |
| 雷击浪涌测试<br>Surge Test | 使用组合波发生器 (1.2/50 μs, 8/20 μs, 2 Ω)对电阻器施加开路电压1.0 kV (R ≤ 10 Ω) 或 2.0 kV (R > 10 Ω)，冲击10次，间隔1 minute。<br>Combination Wave Generator (1.2/50 μs, 8/20 μs, 2 Ω), apply open-circuit voltage 1.0 kV (R ≤ 10 Ω) or 2.0 kV (R > 10 Ω) to the resistor, 10 pulses test at 1 minute Interval. | 试验后电阻器无开路<br>Resistor shall not open after the test |
| 熔断测试<br>Fusing Test | 对电阻器施加规定的测试电流（恒流源）<br>Apply specified test current to the resistor (constant current source) | 温度保险丝熔断时间≤ 60 s<br>Fusing Time ≤ 60 s |


TPR


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**电气特性测试 Electrical Performance Test**

| 项目<br>Item | 试验条件<br>Test Condition | 判定标准<br>Criterion |
|---|---|---|
| 可焊性<br>Solderability | 槽焊法（非活性松香）<br>助焊剂：25%松香酒精<br>锡炉温度：(255 ± 5) °C<br>浸入深度（距安装面或元件主体）：(1.5 ~ 2.0) mm<br>浸入时间：(2.5 ± 0.5) s<br>Solder Bath (non-activated flux)<br>Scaling Powder: 25% Rosin Alcohol<br>Bath Temp.: (255 ± 5) °C<br>Depth of Immersion (From the seating plane or component body): (1.5 to 2.0) mm<br>Time of Immersion: (2.5 ± 0.5) s | 引线焊锡面积覆盖率≥95%<br>Soldering Area ≥ 95% |
| 实测熔断温度<br>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 °C至0.5 °C，测断开温度。<br>Silicone oil bath: temp. rise rate is 0.3 °C/minute to 0.5 °C/minute, detection current ≤ 10 mA. | 216 °C ~ 221 °C（$T_f$ = 221 °C）<br>143 °C ~ 150 °C（$T_f$ = 150 °C）<br>138 °C ~ 145 °C（$T_f$ = 145 °C）<br>128 °C ~ 135 °C（$T_f$ = 135 °C）<br>123 °C ~ 130 °C（$T_f$ = 130 °C）<br>119 °C ~ 125 °C（$T_f$ = 125 °C）<br>109 °C ~ 115 °C（$T_f$ = 115 °C） |


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# 注意
# ATTENTION



## 冷电阻测试 Cold Resistance Test

1. 当产品电阻温度系数≥350 ($10^{-6}$/°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 ($10^{-6}$/°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.


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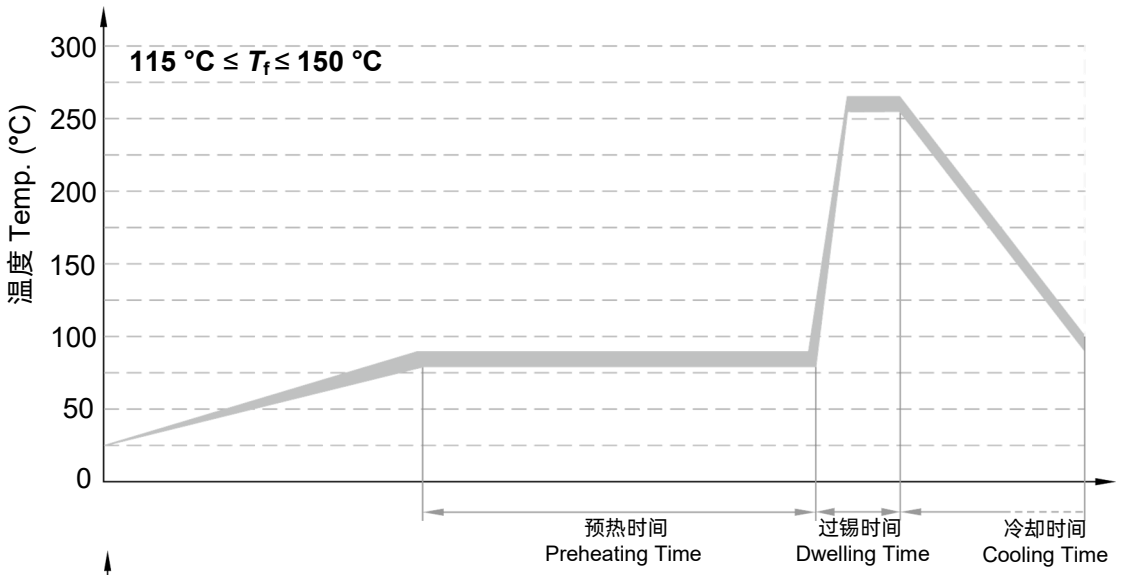
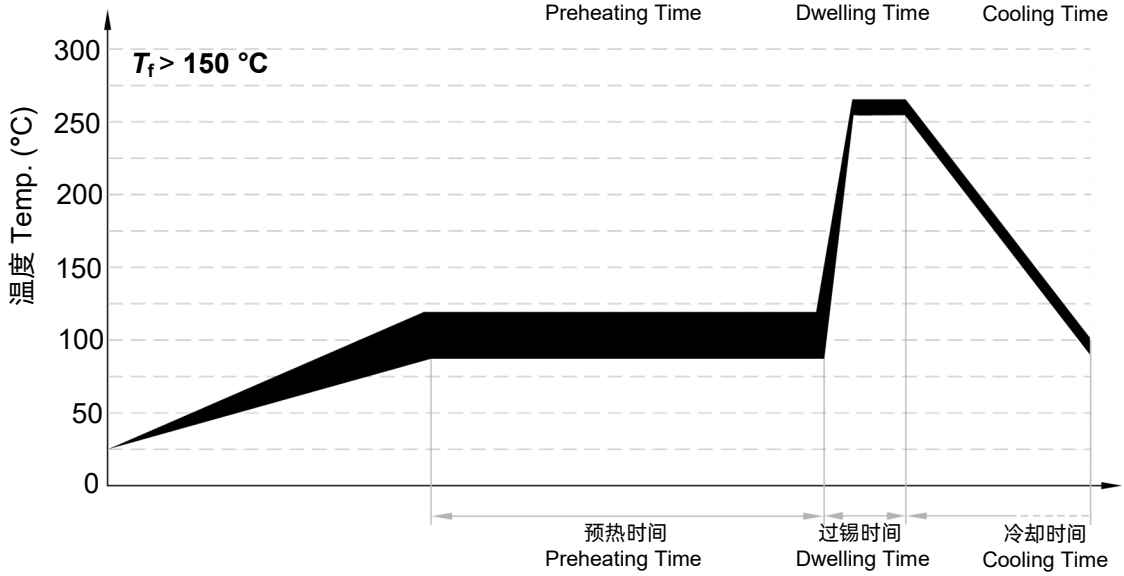
## 焊接参数 Soldering Parameters

**波峰焊参数（仅供参考）Wave Soldering Parameters (For Reference Only)**

波峰焊参数仅供参考，在TPR实际应用前，推荐进行相关验证。
The Wave Soldering Parameters are for reference only, before TPR is for practice usage, relative validation is recommended.




| 项目 Item | 温度 Temp. (°C) | | 时间 Time (s) |
|---|---|---|---|
| 预热 Preheating | 115 °C ≤ $T_f$ ≤ 150°C | $T_f$ > 150°C | 60 ~ 100 |
| | 80 to 90 | 90 to 120 | |
| 过锡 Dwelling | 260 ± 5 | 260 ± 5 | 4 ~ 5 |

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

烙铁温度 Solder Iron Temp.: (350 ± 5) °C

焊接时间 Soldering Time: 3 s Max. (115 °C ≤ $T_f$ ≤ 150 °C)

5 s Max. ($T_f$ > 150 °C)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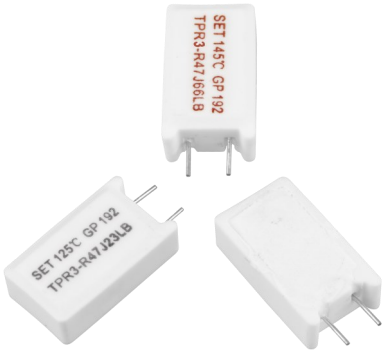
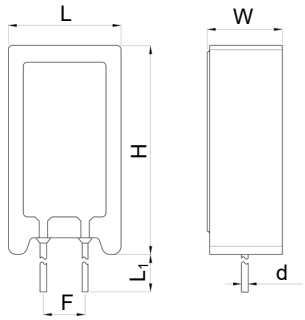
## 立式 Vertical Installation

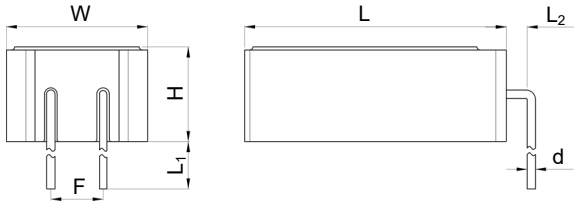



## 尺寸 Dimensions (mm)




| L | W | H | $L_1$[a] | F | d |
|---|---|---|---|---|---|
| 11.5 ± 1.0 | 7.0 ± 1.0 | 20.5 ± 1.5 | 3.5 ± 0.5 | 5.0 ± 1.0 | Φ0.55 ± 0.08 |

## 卧式 Horizontal Installation




| L | W | H | $L_1$[a] | F | d | $L_2$ |
|---|---|---|---|---|---|---|
| 20.5 ± 1.5 | 11.5 ± 1.0 | 7.0 ± 1.0 | 3.5 ± 0.5 | 5.0 ± 1.0 | Φ0.55 ± 0.08 | 1.5 Max. |

[a]: $L_1$可根据需求定制，尺寸范围在3.5 mm ~ 5.0 mm。$L_1$ can be customized as required from 3.5 mm to 5.0 mm.

## 电性能参数 Electrical Characteristics

| 项目 Item | 参数 Parameter |
|---|---|
| 功率类型 Power Type ( ***P*** ) | 3 W |
| 标称阻值 Rated Resistance ( ***R*** ) | 0.27 Ω ~ 800 Ω |
| 阻值公差 Resistance Tolerance | 5% ( E24 ) |
| 降额系数 Derating Factor (***f*** ) | 详见降额曲线 See Rated Power Derating Curve |
| 实际功率 Actual Power( $P_0$ ) | $P_0 = P \times f$ |
| 额定电流 Rated Current ( $I_N$) | $I_N = \sqrt{P_0 / R}$ |
| 额定电压 Rated Voltage ( $U_N$) | $U_N = \sqrt{P_0 \times R}$ |
| 额定动作温度 Rated Functioning Temp. ($T_f$) | 115 °C, 125 °C, 130 °C, 135 °C, 145 °C, 150 °C, 221 °C |
| 熔断时间 Fusing Time | 25 W，(115 °C ≤ $T_f$ ≤ 135 °C，小于60 s, less than 60 s) |
| | 30 W，(145 °C ≤ $T_f$ ≤ 150 °C，小于60 s, less than 60 s) |
| | 35 W，($T_f$ = 221 °C，小于60 s, less than 60 s) |
| 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 (R > 10 Ω) |
| | 1.0 kV (R ≤ 10 Ω) |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## 技术参数 Specifications

蓝色字体为赛尔特常规规格。 Blue Font Is SETsafe | SETfuse Common Specifications.

| 型号 Model | 功率 Power Type | 降额系数 Derating Factor (25 °C) | 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 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | cURus | CQC | RoHS | REACH |
| | (W) | (%) | (°C) | (°C) | (Ω) | (%) | | | | |
| TPR3-xxxx30LB | 3 | 100 | 221 | 216 ~ 221 | 0.27 ` 800 | ± 5 | ○ | ○ | ● | ● |
| TPR3-xxxx27LB | 3 | 55 | 150 | 143 ~ 150 | 0.27 ~ 800 | ± 5 | ○ | ○ | ● | ● |
| TPR3-xxxx26LB | 3 | 50 | 145 | 138 ~ 145 | 0.27 ~ 800 | ± 5 | ○ | ○ | ● | ● |
| TPR3-xxxx25LB | 3 | 40 | 135 | 128 ~ 135 | 0.27 ~ 800 | ± 5 | ○ | ○ | ● | ● |
| TPR3-xxxx24LB | 3 | 35 | 130 | 123 ~ 130 | 0.27 ~ 800 | ± 5 | ○ | ○ | ● | ● |
| TPR3-xxxx23LB | 3 | 30 | 125 | 119 ~ 125 | 0.27 ~ 800 | ± 5 | ○ | ○ | ● | ● |
| TPR3-xxxx22LB | 3 | 20 | 115 | 109 ~ 115 | 0.27 ~ 800 | ± 5 | ○ | ○ | ● | ● |

○: 认证申请中 On-going

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 (Ω) | 代码 Code | 标称阻值 Rated Resistance (Ω) | 代码 Code | 标称阻值 Rated Resistance (Ω) | 代码 Code | 标称阻值 Rated Resistance (Ω) | 代码 Code |
|---|---|---|---|---|---|---|---|
| 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 |


TPR


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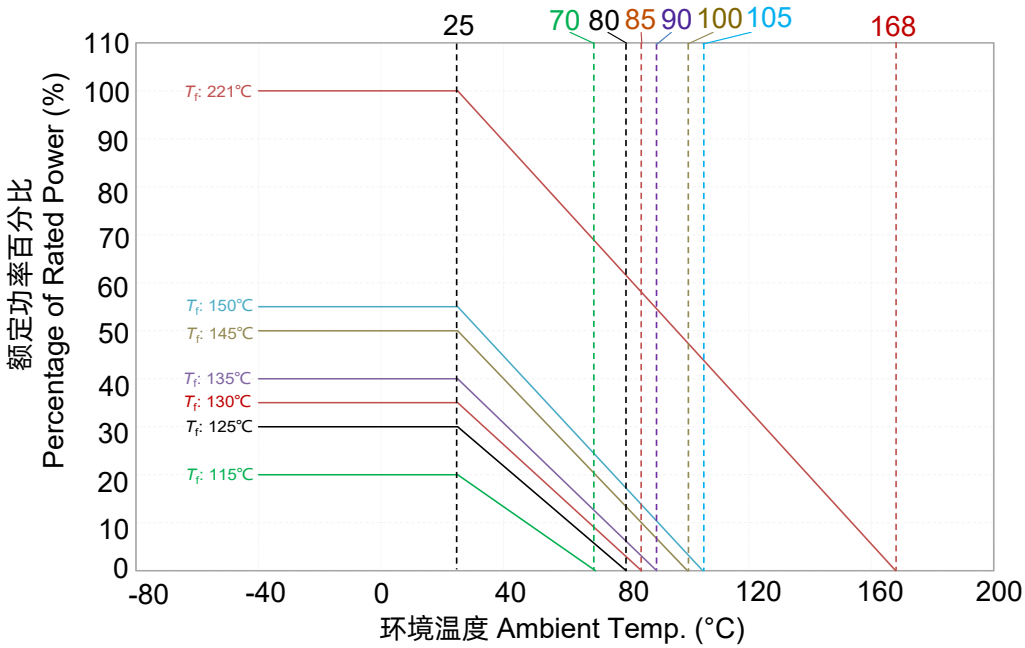
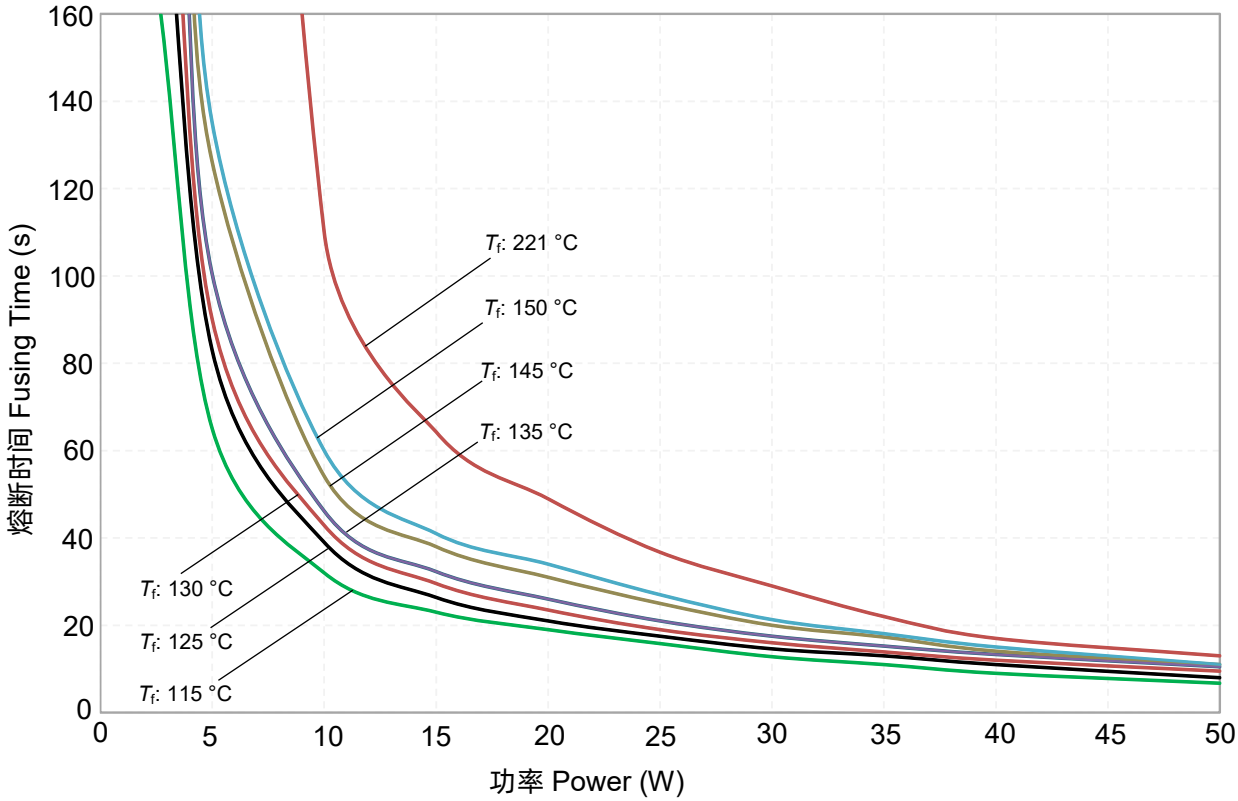
## 降额曲线（仅供参考） Rated Power Derating Curve (For Reference Only)

当元器件周围的环境温度超过25 ºC时，额定功率随着环境温度的上升而下降情况如下图所示。
When the ambient temp. exceeds 25 ºC, the rated power value declines as the following curve.




## 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).





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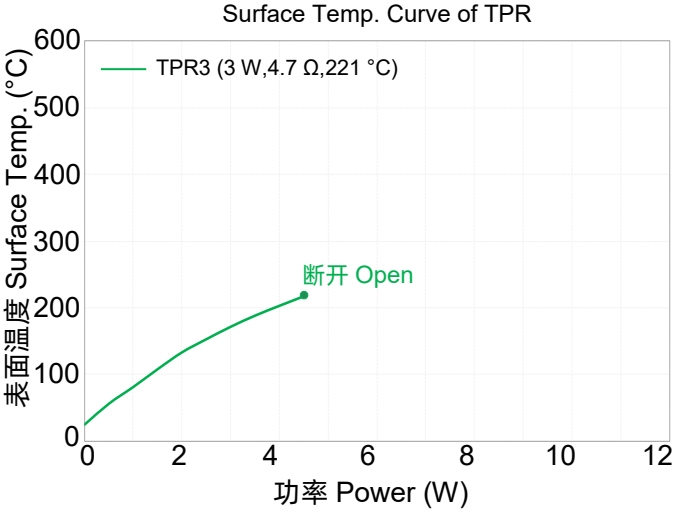
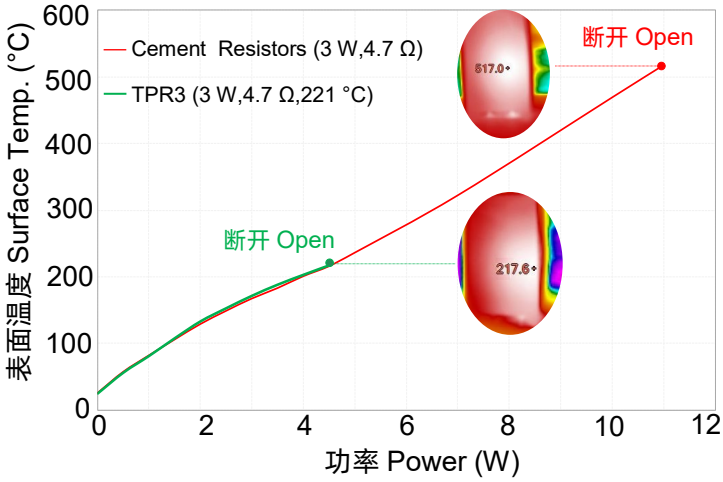
## 表面温度曲线（仅供参考） Surface Temp. Curve (For Reference Only)

热保护型水泥电阻器在熔断之前，其表面温度均处于较低水平，可确保整机出现故障时，热保护型水泥电阻器及时切断电路而不产生附加损伤（环境温度：25 °C ± 2 °C）。
The surface temp. of TPR is always at a lower level, when small fault current happens to the device, TPR is able to open the circuit timely without additional damage (ambient temp.: 25 °C ± 2 °C).

TPR表面温度
Surface Temp. Curve of TPR




表面温度（TPR vs. 功率型水泥电阻器）
Surface Temp. Curve (TPR vs. Cement Power Resistor)




**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 | | |
|---|---|---|---|---|
| | | cURus | VDE REG E012 | CQC |
| (W) | (Ω) | cURus | VDE | CQC |
| 1 | 0.47 to 51 | ● | ● | ● |
| | 0.27 to 800 | ● | ● | N/A |

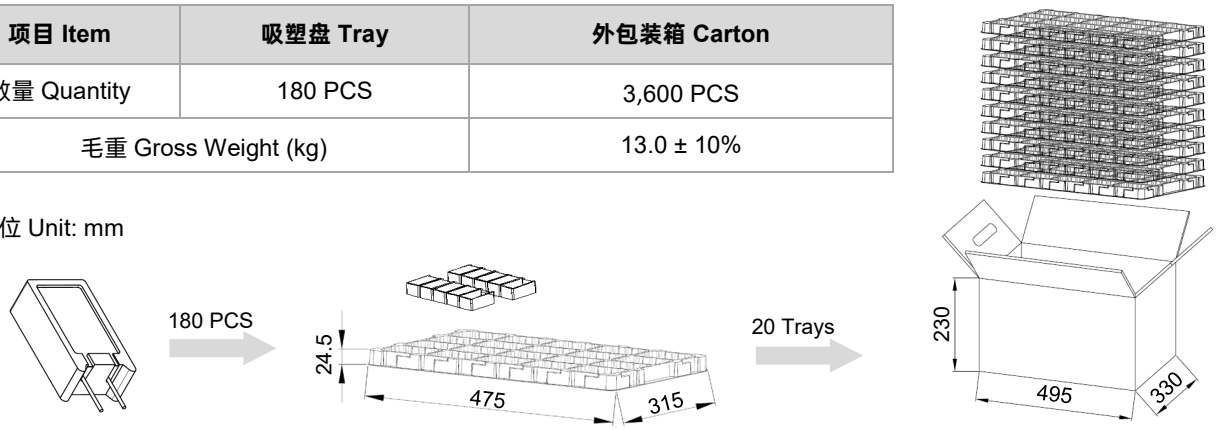
**内置ATCO认证 Agency Approvals of ATCO (Built-in)**

| 代号 Code | 型号 Model | 额定动作温度 Rated Functioning Temp. | 安规认证 Agency Approvals | | | | |
|---|---|---|---|---|---|---|---|
| | | | cURus | TUV | PSE | CCC | KC |
| | | (°C) | cURus | TUV | PSE | CCC | KC |
| 30 | H31 | 221 | ● | ● | N/A | ● | N/A |
| 27 | H7 | 150 | ● | ● | ● | ● | ● |
| 26 | H6 | 145 | ● | ● | ● | ● | ● |
| 25 | H5 | 135 | ● | ● | ● | ● | ● |
| 24 | H4 | 130 | ● | ● | ● | ● | ● |
| 23 | H3 | 125 | ● | ● | ● | ● | ● |
| 22 | H2 | 115 | ● | ● | ● | ● | ● |

## 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 | 180 PCS | 3,600 PCS |
| 毛重 Gross Weight (kg) | | 13.0 ± 10% |

单位 Unit: mm





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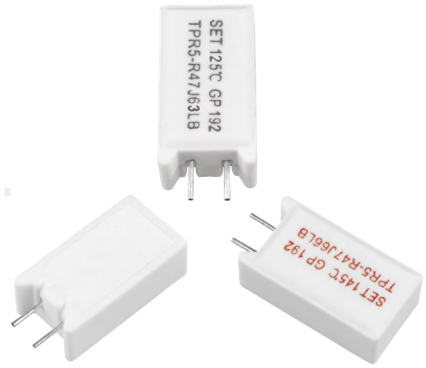
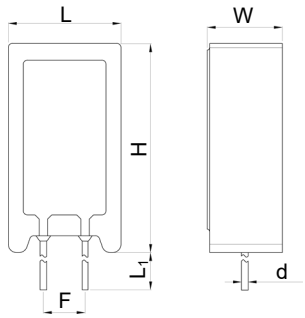
# 热保护型水泥电阻器
Thermally Protected Resistor (TPR)



## 立式 Vertical Installation

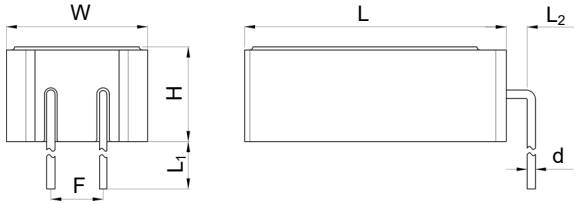



## 尺寸 Dimensions (mm)




| L | W | H | $L_1$[a] | F | d |
|---|---|---|---|---|---|
| 14.0 ± 1.0 | 9.5 ± 1.0 | 27.0 ± 1.5 | 3.5 ± 0.5 | 5.0 ± 1.0 | Φ0.75 ± 0.08 |

## 卧式 Horizontal Installation




| L | W | H | $L_1$[a] | F | d | $L_2$ |
|---|---|---|---|---|---|---|
| 27.0 ± 1.5 | 14.0 ± 1.0 | 9.5 ± 1.0 | 3.5 ± 0.5 | 5.0 ± 1.0 | Φ0.75 ± 0.08 | 1.5 Max. |

[a]: $L_1$可根据需求定制，尺寸范围在3.5 mm ~ 5.0 mm。$L_1$ can be customized as required from 3.5 mm to 5.0 mm.

## 电性能参数 Electrical Characteristics

| 项目 Item | 参数 Parameter |
|---|---|
| 功率类型 Power Type ( ***P*** ) | 5 W |
| 标称阻值 Rated Resistance ( ***R*** ) | 0.27 Ω ~ 1000 Ω |
| 阻值公差 Resistance Tolerance | 5% ( E24 ) |
| 降额系数 Derating Factor (***f***) | 详见降额曲线 See Rated Power Derating Curve |
| 实际功率 Actual Power( $P_0$ ) | $P_0 = P \times f$ |
| 额定电流 Rated Current ( $I_N$) | $I_N = \sqrt{P_0 / R}$ |
| 额定电压 Rated Voltage ( $U_N$) | $U_N = \sqrt{P_0 \times R}$ |
| 额定动作温度 Rated Functioning Temp. ($T_f$) | 115 °C, 125 °C, 130 °C, 135 °C, 145 °C, 150 °C, 221 °C |
| 熔断时间 Fusing Time | 35 W，(115 °C ≤ $T_f$ ≤ 135 °C，小于60 s, less than 60 s) |
| | 40 W，(145 °C ≤ $T_f$ ≤ 150 °C，小于60 s, less than 60 s) |
| | 50 W，($T_f$ = 221 °C，小于60 s, less than 60 s) |
| 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 (R > 10 Ω) |
| | 1.0 kV (R ≤ 10 Ω) |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TPR

## 技术参数 Specifications

蓝色字体为赛尔特常规规格。 Blue Font Is SETsafe | SETfuse Common Specifications.

| 型号 Model | 功率 Power Type | 降额系数 Derating Factor (25 °C) | 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 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | cURus | CQC | RoHS | REACH |
| | (W) | (%) | (°C) | (°C) | (Ω) | (%) | | | | |
| TPR5-xxxx70LB | 5 | 80 | 221 | 216 ~ 221 | 0.27 ~ 1000 | ± 5 | ○ | ○ | ● | ● |
| TPR5-xxxx67LB | 5 | 45 | 150 | 143 ~ 150 | 0.27 ~ 1000 | ± 5 | ○ | ○ | ● | ● |
| TPR5-xxxx66LB | 5 | 40 | 145 | 138 ~ 145 | 0.27 ~ 1000 | ± 5 | ○ | ○ | ● | ● |
| TPR5-xxxx65LB | 5 | 35 | 135 | 128 ~ 135 | 0.27 ~ 1000 | ± 5 | ○ | ○ | ● | ● |
| TPR5-xxxx64LB | 5 | 30 | 130 | 123 ~ 130 | 0.27 ~ 1000 | ± 5 | ○ | ○ | ● | ● |
| TPR5-xxxx63LB | 5 | 25 | 125 | 119 ~ 125 | 0.27 ~ 1000 | ± 5 | ○ | ○ | ● | ● |
| TPR5-xxxx62LB | 5 | 20 | 115 | 109 ~ 115 | 0.27 ~ 1000 | ± 5 | ○ | ○ | ● | ● |

○: 认证申请中 On-going

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 (Ω) | 代码 Code | 标称阻值 Rated Resistance (Ω) | 代码 Code | 标称阻值 Rated Resistance (Ω) | 代码 Code | 标称阻值 Rated Resistance (Ω) | 代码 Code |
|---|---|---|---|---|---|---|---|
| 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 | 820 | 820R |
| 0.91 | R91 | 9.1 | 9R1 | 91 | 91R | 910 | 910R |


TPR


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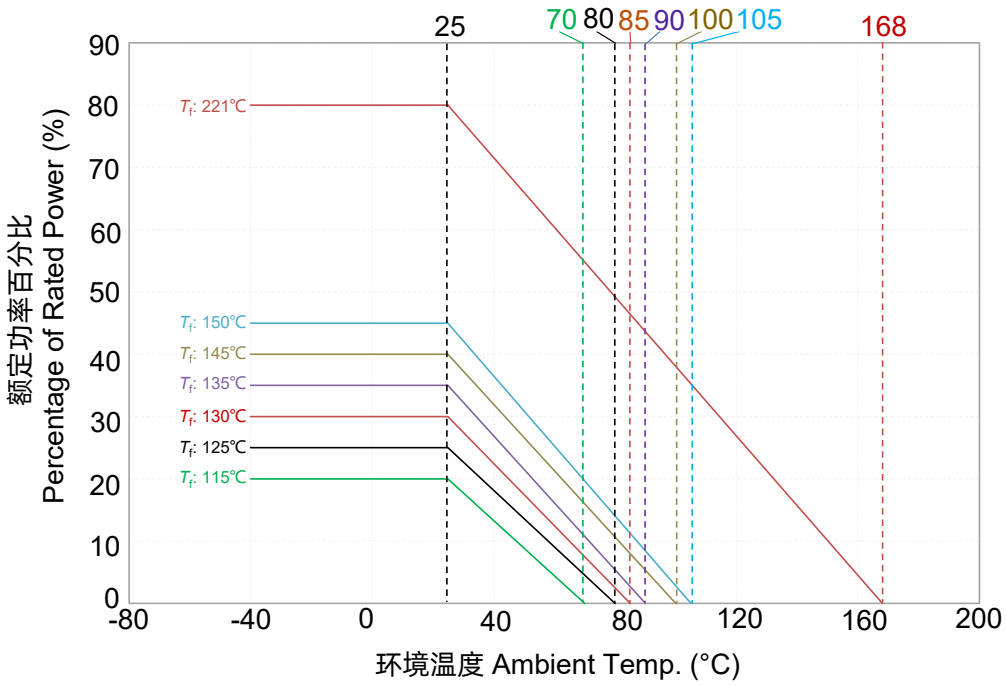
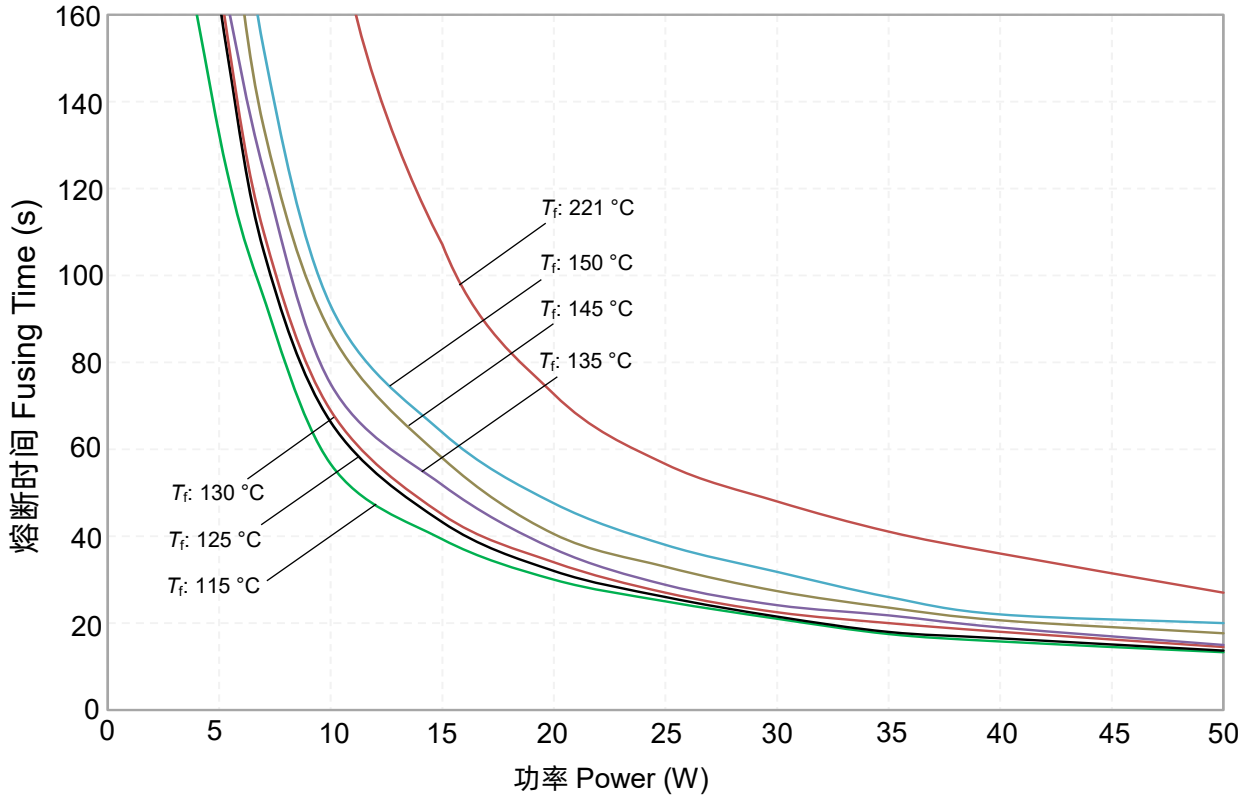
## 降额曲线（仅供参考） Rated Power Derating Curve (For Reference Only)

当元器件周围的环境温度超过25 ºC时，额定功率随着环境温度的上升而下降情况如下图所示。
When the ambient temp. exceeds 25 ºC, the rated power value declines as the following curve.




## 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).





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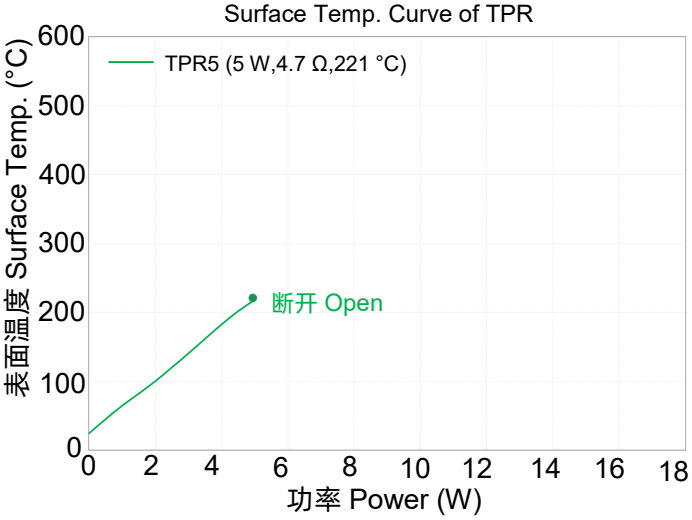
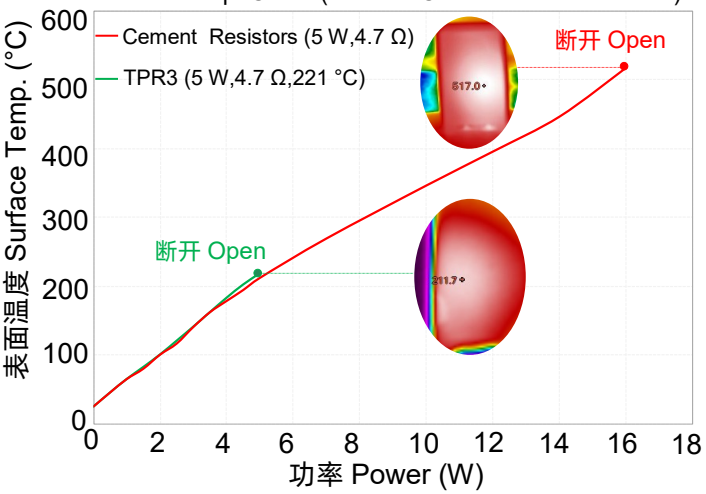
## 表面温度曲线（仅供参考） Surface Temp. Curve (For Reference Only)

热保护型水泥电阻器在熔断之前，其表面温度均处于较低水平，可确保整机出现故障时，热保护型水泥电阻器及时切断电路而不产生附加损伤（环境温度：25 °C ± 2 °C）。
The surface temp. of TPR is always at a lower level, when small fault current happens to the device, TPR is able to open the circuit timely without additional damage (ambient temp. 25 °C ± 2°C).

TPR表面温度
Surface Temp. Curve of TPR




表面温度（TPR vs. 功率型水泥电阻器）
Surface Temp. Curve (TPR vs. Cement Power Resistor)




**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 | | |
|---|---|---|---|---|
| | | cURus | VDE REG E012 | CQC |
| (W) | (Ω) | cURus | VDE | CQC |
| 2 | 3 ~ 68 | ● | ● | ● |
| | 0.27 ~ 1,000 | ● | ● | N/A |

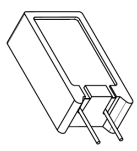
**内置ATCO认证 Agency Approvals of ATCO (Built-in)**

| 代号 Code | 型号 Model | 额定动作温度 Rated Functioning Temp. | 安规认证 Agency Approvals | | | | |
|---|---|---|---|---|---|---|---|
| | | | cURus | TUV | PSE | CCC | KC |
| | | (°C) | cURus | TUV | PSE | CCC | KC |
| 70 | C31 | 221 | ● | ● | N/A | ● | N/A |
| 67 | C7 | 150 | ● | ● | ● | ● | ● |
| 66 | C6 | 145 | ● | ● | ● | ● | ● |
| 65 | C5 | 135 | ● | ● | ● | ● | ● |
| 64 | C4 | 130 | ● | ● | ● | ● | ● |
| 63 | C3 | 125 | ● | ● | ● | ● | ● |
| 62 | C2 | 115 | ● | ● | ● | ● | ● |

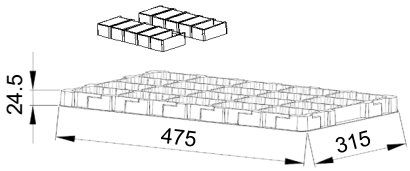
## 包装信息（仅供参考） Packaging Information (For Reference Only)

| 项目 Item | 吸塑盘 Tray | 外包装箱 Carton |
|---|---|---|
| 数量 Quantity | 180 PCS | 1,800 PCS |
| 毛重 Gross Weight (kg) | | 12.0 ± 10% |

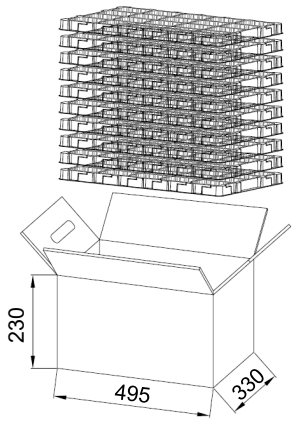
单位 Unit: mm



180 PCS




10 Trays





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www.SETsafe.com www.SETfuse.com
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