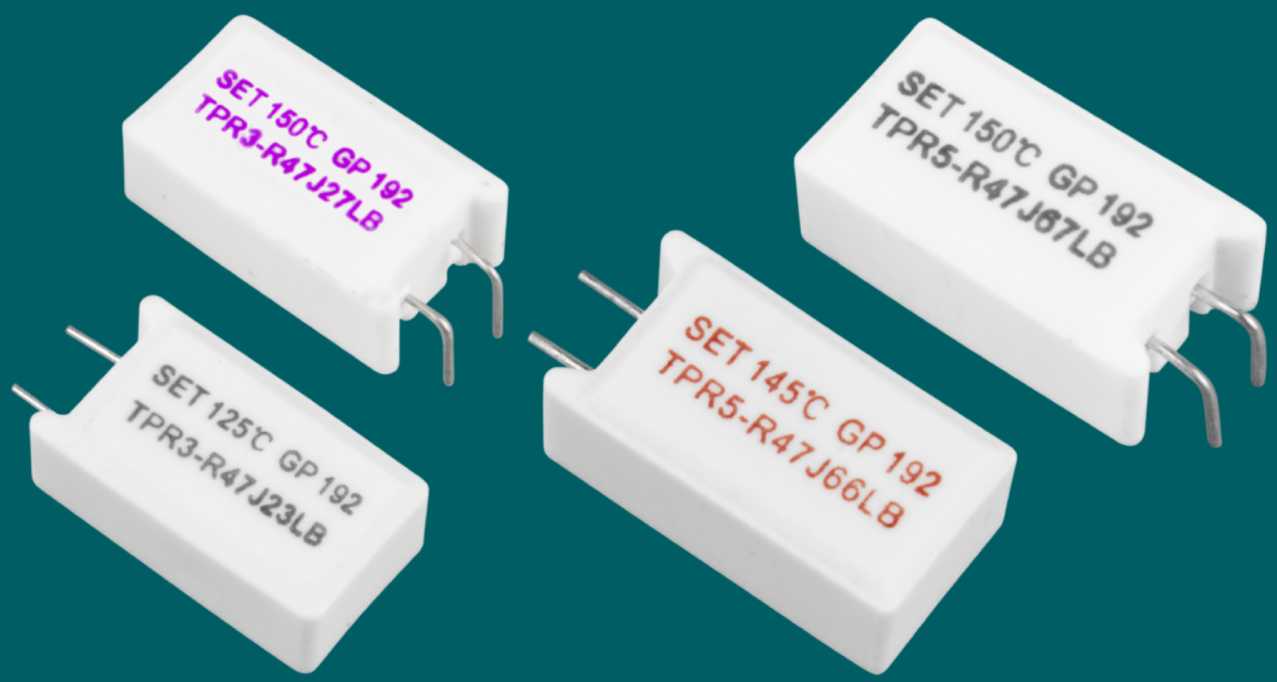
TPR

Thermally Protected Resistor

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

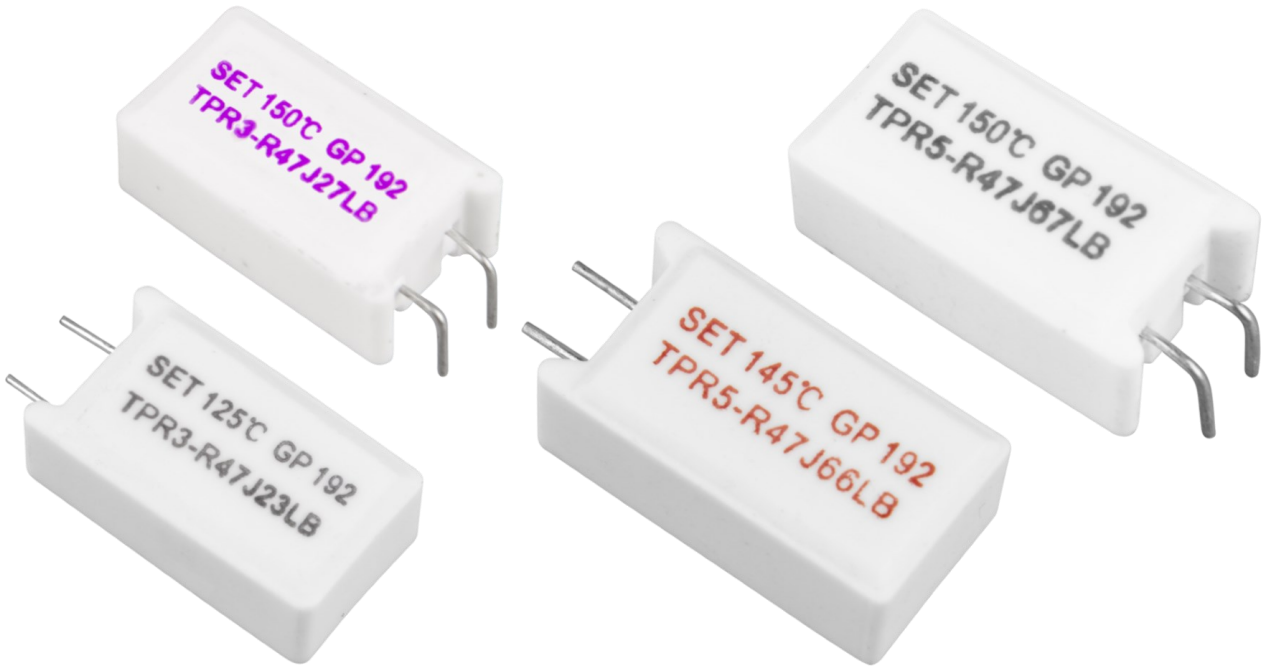


SET safe | SET fuse

Providing a Total Solution for High Standard Safety Circuit Protection

TPR

Thermally Protected Resistor



TPR

Features

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

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Thermally Protected Resistor (TPR) Features Overview

Page				
Shape				
Structure	Vertical	Horizontal	Vertical	Horizontal
R Resistance Range	0.27 Ω - 800 Ω		0.27 Ω - 1000 Ω	
P Power Type	3 W		5 W	
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	25.0 mm × 13.5 mm × 9.0 mm
T_f Rated Functioning Temp.	115 °C, 125 °C, 130 °C, 135 °C, 145 °C, 150 °C, 221 °C			

According to IEC60063-2015, resistance can be customized.

The forming modes and length of lead wires can be customized.

TPR

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TPR
Thermally Protected Resistor

Description

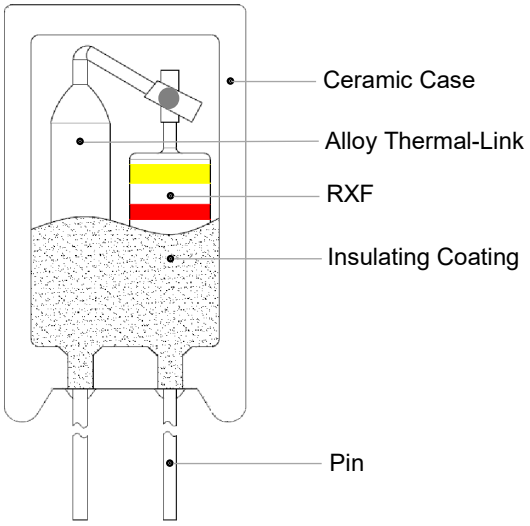
Thermally Protected Resistor (TPR) is an unique type of Power Resistor, with Over Temp. and Over Current Protections. Thermally Protected Resistor (TPR) is a type of power resistor, where Alloy Thermal-Link (ATCO) and Fusible Wirewound Resistor (RXF) are in series encapsulated in a ceramic case with 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.

Applications

- Power Supply
- Office Appliances
- Household Appliances

TPR

Structure



Note: The color of schematic diagram is for reference only

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Product Number System

TPR 3 - 4R7 J 30 L B

Shape

B : Square

Pin Type

L : Two Pins

ACTO Code

TPR3 Series			TPR5 Series		
Code	ATCO Model	T_f	Code	ATCO Model	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

Resistance Tolerance (%)

J : ± 5

K : ± 10

Rated Resistance (Ω)

R47 : 0.47

4R7 : 4.7

47R : 47

470R : 470

Power Type (W)

3 : 3

5 : 5

Product Category

TPR : Thermally Protected Resistor

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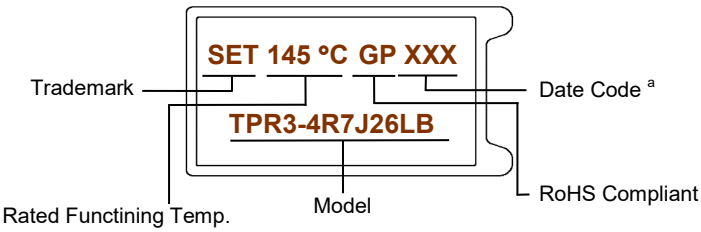
Marking



[a]: 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.

Note: The color of schematic diagram is for reference only

Glossary

Item	Description
RXF	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	**Alloy Thermal-Link** Alloy Type Thermal-Link, Alloy is the thermal element. — (GB/T 9816.3)
R	**Rated Resistance** Resistance value for which the resistor has been designed, and which is generally used for denomination of the resistor. — (IEC60115-1)
P_0	**Actual Power** The Max. power of TPR can be used within the allowable operating Temp. range. — (SETsafe | SETfuse Standards)
I_N	**Rated Current** $I_N = \sqrt{P_0 / R}$ — (SETsafe | SETfuse Standards)
U_N	**Rated Voltage** 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	**Rated Functioning Temp.** 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. Tolerance: T_f + 0 / -10 °C (GB 9816.1, EN 60691, K60691) Tolerance: T_f ± 7 °C (J60691) — (IEC 60691)
Fusing Temp.	**Fusing Temp.** 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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Operating Principle

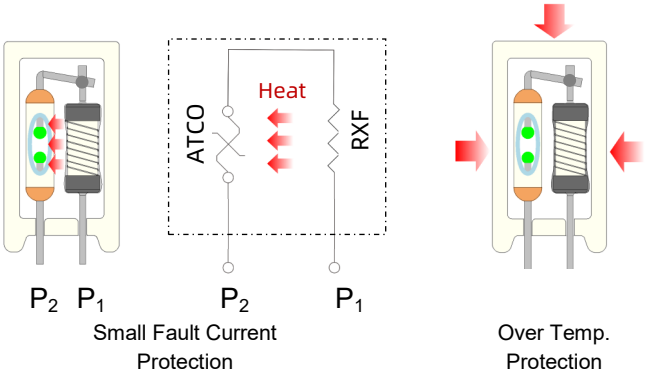
Instruction

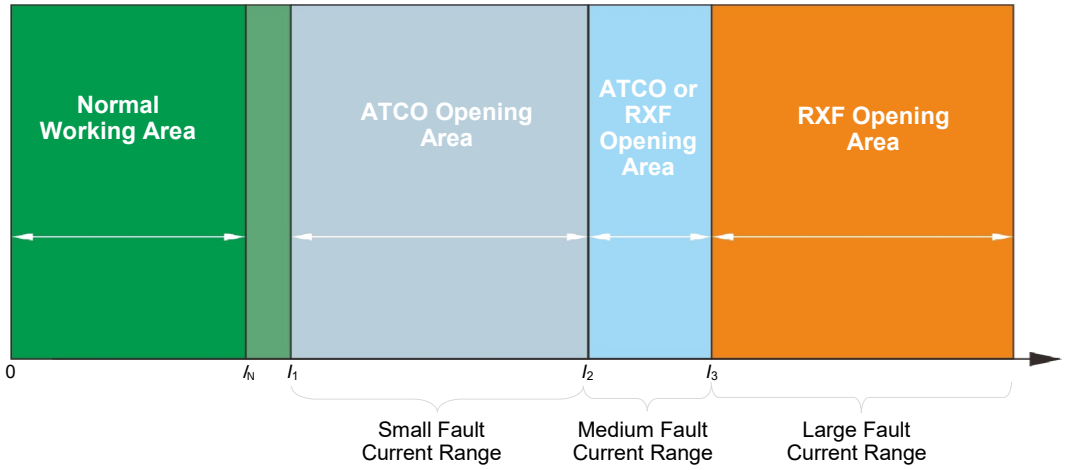
$R_{RXF} \geq 100R_{ATCO}$

- R_{RXF}: the resistance value of RXF
- R_{ATCO}: the resistance value of the Alloy Thermal-Link (ATCO)

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

- The Fusing Temp. of RXF (T_{RXF}): 1200 °C ~ 1500 °C
- The Fusing Temp. of ATCO (T_{ATCO}): 115 °C ~ 221 °C





I_N: Rated Current
I_1: Conventional Fusing Current

- **Small Fault Current Protection**

  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.

- **Medium Fault Current Protection**

  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.

- **Large Fault Current Protection (Short Circuit Protection)**

  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.

TPR

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Performance Test

Mechanical Performance Test

Item	Test Condition	Criterion
Tensile Test	A pin withstand 10 N × 60 s	No Visible Damage ΔR ≤ ± (1%R + 0.05 Ω)
Twist Test	A pin 2 mm away from body, bent 90°, twist 180° × 2 times.	No Visible Damage ΔR ≤ ± (1%R + 0.05 Ω)

Environmental Test

Item	Test Condition	Criterion
Temp. Cycle	1. - 55 °C × 30 minutes 2. Room Temp. × (10 to 15) minutes 3. 85 °C × 30 minutes 4. Room Temp. × (10 to 15) minutes 5. 5 Cycles from Step 1 to Step 4	ΔR ≤ ± (2%R + 0.05 Ω)

Electrical Performance Test

Item	Test Condition	Criterion
Short-Time Overload	$2.5U_N$ × 5 s	No Visible Damage ΔR ≤ ± (2%R + 0.05 Ω)
Insulation Resistance	Foil Method: Apply 500 VDC between both terminations of the resistor connected together as one pole and the metal foil as the other pole.	Insulation Resistance ≥ 1,000 MΩ
Voltage Proof	Foil Method: Apply 900 VAC × 1 minute between pin and the metal foil.	No Breakdown or Flashover
Surge Test	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.	Resistor shall not open after the test
Fusing Test	Apply specified test current to the resistor (constant current source)	Fusing Time ≤ 60 s

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Electrical Performance Test

Item	Test Condition	Criterion
Solderability	Solder Bath (non-activated flux) Scaling Powder: 25% Rosin Alcohol Bath Temp.: (255 ± 5) °C Depth of Immersion (From the seating plane or component body): (1.5 to 2.0) mm Time of Immersion: (2.5 ± 0.5) s	Soldering Area ≥ 95%
Fusing Temp.	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) 143 °C ~ 150 °C (T_f = 150 °C) 138 °C ~ 145 °C (T_f = 145 °C) 128 °C ~ 135 °C (T_f = 135 °C) 123 °C ~ 130 °C (T_f = 130 °C) 119 °C ~ 125 °C (T_f = 125 °C) 109 °C ~ 115 °C (T_f = 115 °C)

TPR

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ATTENTION

Cold Resistance Test

1. 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. Resistance Measurement (4-terminal test).

Replacement

As TPR is a non-resettable product, for safety sake, please use the same type of TPR for replacement.

Usage

1. Do not touch the resistor body or pins directly when power is on, to avoid burn or electric shock.
2. When air pressure is from 80 kPa to 106 kPa, the relative altitude shall be 2000 m to - 500 m.

Storage

1. Please store TPR with ambient temp. 10 °C to 30 °C and relative humidity 30% to 75%.
2. 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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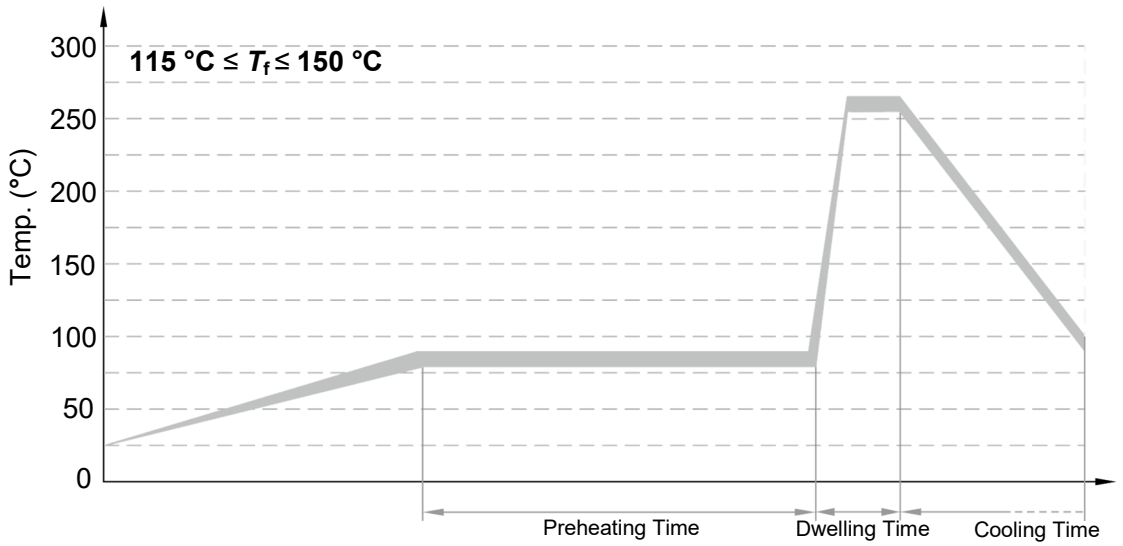
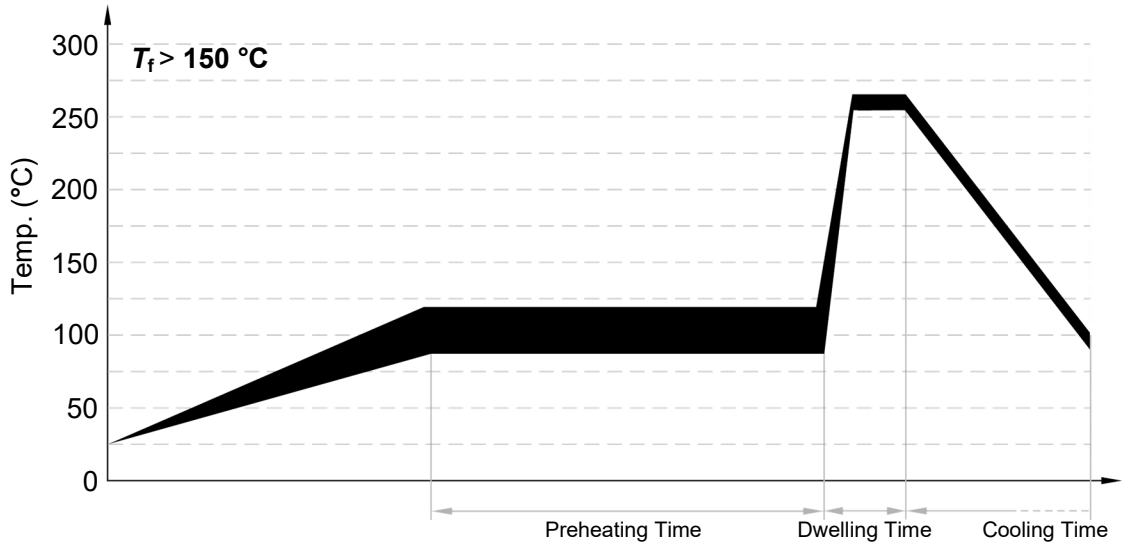
Soldering Parameters

Wave Soldering Parameters (For Reference Only)

The Wave Soldering Parameters are for reference only, before TPR is for practice usage, relative validation is recommended.





Item	Temp. (°C)		Time (s)
Preheating	115 °C ≤ T_f ≤ 150 °C	T_f > 150 °C	60 ~ 100
	80 to 90	90 to 120	
Dwelling	260 ± 5	260 ± 5	4 ~ 5

Recommended Hand-Soldering Parameters

Solder Iron Temp.: (350 ± 5) °C

Soldering Time: 3 s Max. (115 °C ≤ T_f ≤ 150 °C)

5 s Max. (T_f > 150 °C)

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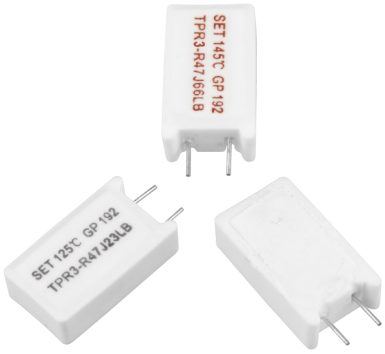
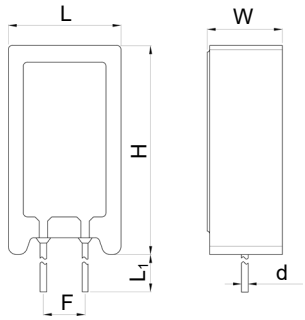
TPR

Vertical Installation

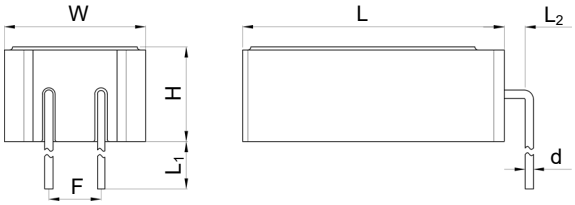


Dimensions (mm)



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

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 can be customized as required from 3.5 mm to 5.0 mm.

Electrical Characteristics

Item	Parameter
Power Type (***P***)	3 W
Rated Resistance (***R***)	0.27 Ω ~ 800 Ω
Resistance Tolerance	5% (E24)
Derating Factor (***f***)	See Rated Power Derating Curve
Actual Power(P_0)	$P_0 = P \times f$
Rated Current (I_N)	$I_N = \sqrt{P_0 / R}$
Rated Voltage (U_N)	$U_N = \sqrt{P_0 \times R}$
Rated Functioning Temp. (T_f)	115 °C, 125 °C, 130 °C, 135 °C, 145 °C, 150 °C, 221 °C
Fusing Time	25 W，(115 °C ≤ T_f ≤ 135 °C, less than 60 s)
	30 W，(145 °C ≤ T_f ≤ 150 °C, less than 60 s)
	35 W，(T_f = 221 °C, less than 60 s)
Fusing Temp.	See Specifications
Surge (For Reference Only)	2.0 kV (R > 10 Ω)
	1.0 kV (R ≤ 10 Ω)

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TPR

Specifications

Blue Font Is SETsafe | SETfuse Common Specifications.

Model	Power Type	Derating Factor (25 °C)	Rated Functioning Temp. (T_f)	Fusing Temp.	Resistance Range	Resistance Tolerance	Agency Approvals		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	○	○	●	●

○: On-going

Resistance Selection Table (According to IEC60063-2015 E24, blue font is SETsafe | SETfuse common resistance).

Rated Resistance	Code	Rated Resistance	Code	Rated Resistance	Code	Rated Resistance	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

TPR

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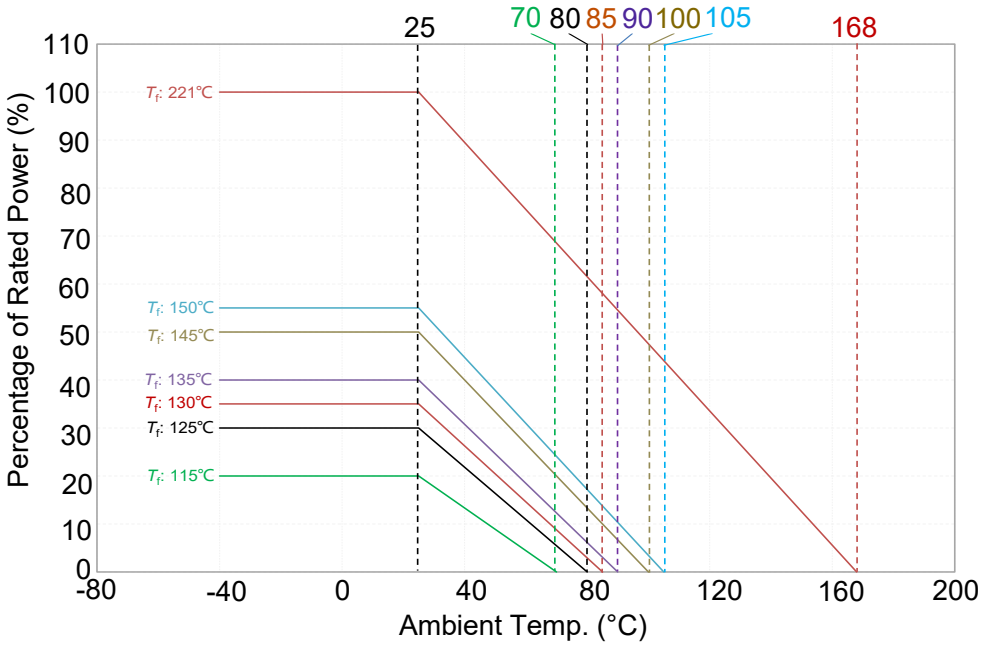
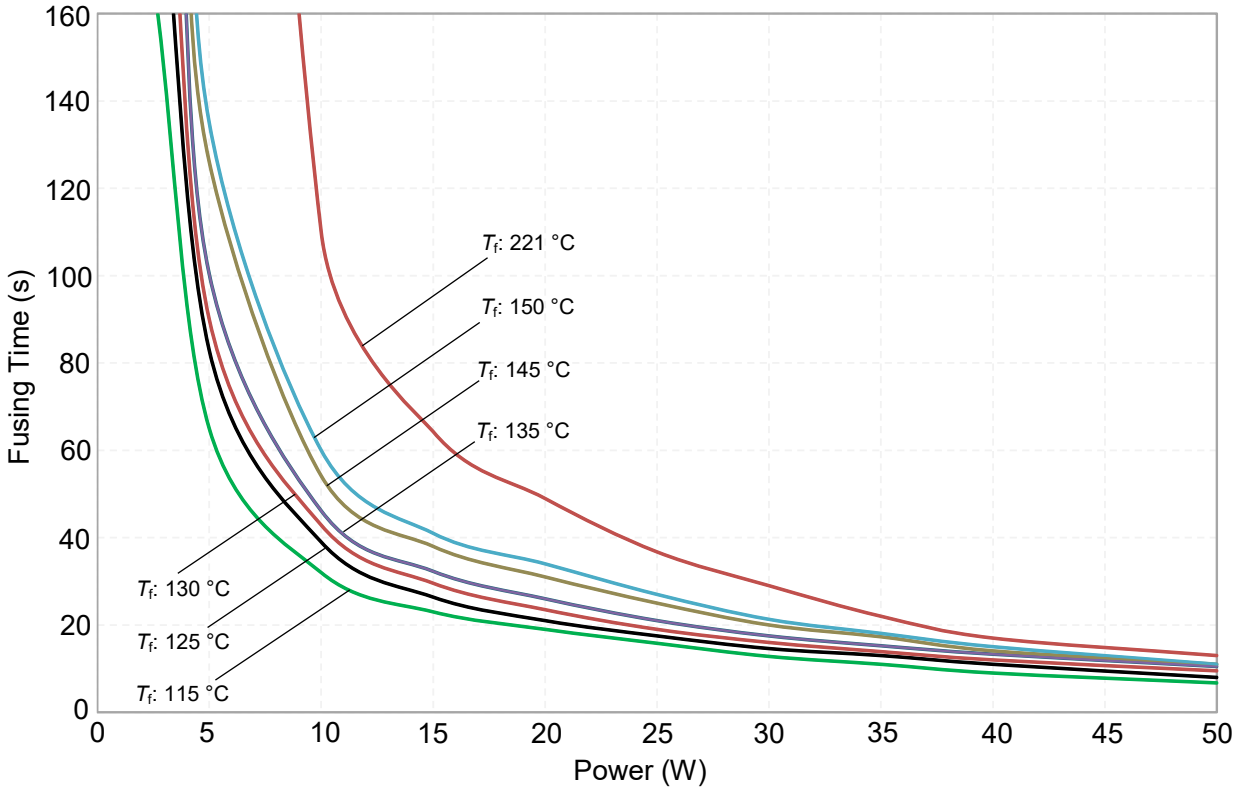
Rated Power Derating Curve (For Reference Only)

When the ambient temp. exceeds 25 ºC, the rated power value declines as the following curve.



Fusing Time Current (For Reference Only)

TPR can open effectively at lower power multiples to protect the circuit timely (ambient temp.: 25 °C ± 2°C).



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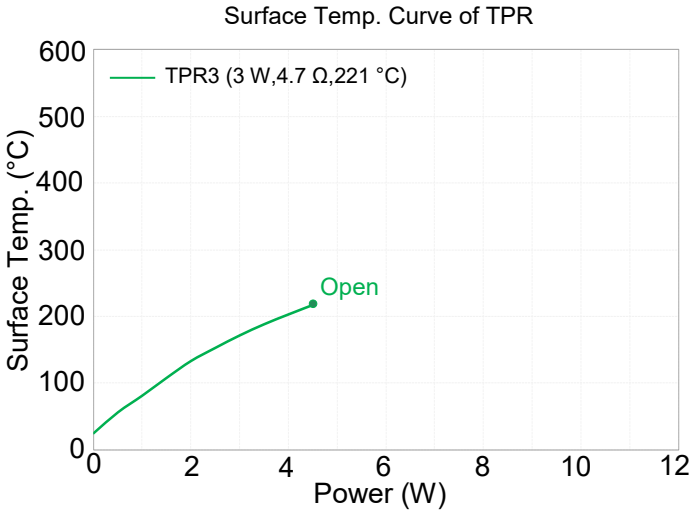
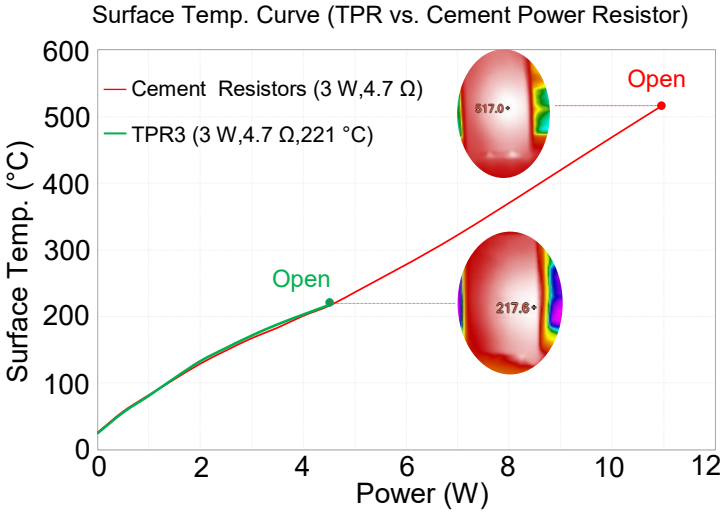
Surface Temp. Curve (For Reference Only)

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).





Agency Approvals of RXF (Built-in)

Rated Power	Resistance Range	Agency Approvals		
		cURus	VDE (REG E012)	CQC
(W)	(Ω)	cURus	VDE	CQC
1	0.47 to 51	●	●	●
	0.27 to 800	●	●	N/A

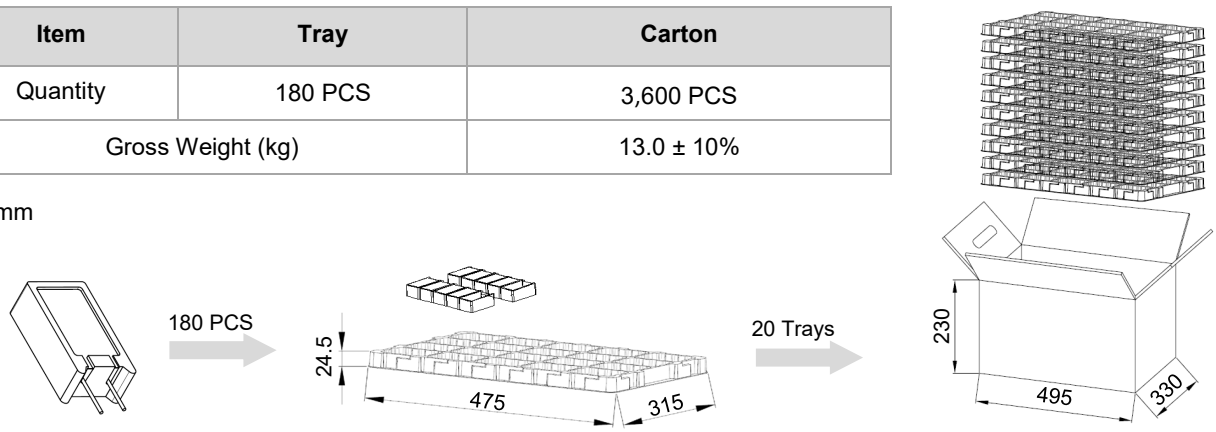
Agency Approvals of ATCO (Built-in)

Code	Model	Rated Functioning Temp.	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	●	●	●	●	●

Packaging Information (For Reference Only)

Item	Tray	Carton
Quantity	180 PCS	3,600 PCS
Gross Weight (kg)		13.0 ± 10%

Unit: mm



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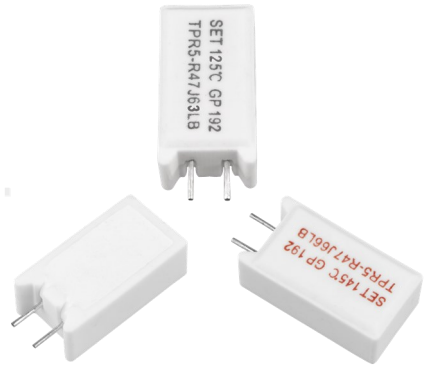
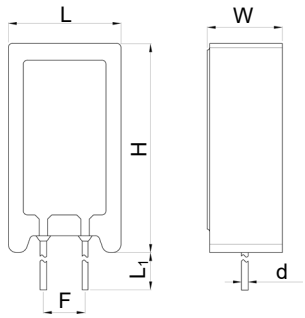
Vertical Installation

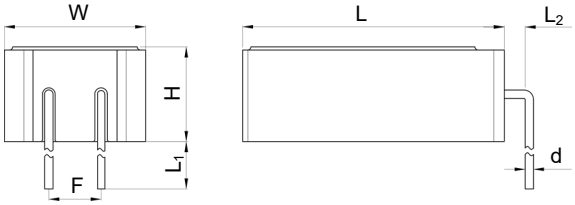


Dimensions (mm)



L	W	H	L_1[a]	F	d
13.5 ± 1.0	9.0 ± 1.0	25.0 ± 1.5	3.5 ± 0.5	5.0 ± 1.0	Φ0.75 ± 0.08

Horizontal Installation



L	W	H	L_1[a]	F	d	L_2
25.0 ± 1.5	13.5 ± 1.0	9.0 ± 1.0	3.5 ± 0.5	5.0 ± 1.0	Φ0.75 ± 0.08	1.5 Max.

[a]: L_1 can be customized as required from 3.5 mm to 5.0 mm.

Electrical Characteristics

Item	Parameter
Power Type (***P***)	5 W
Rated Resistance (***R***)	0.27 Ω ~ 1000 Ω
Resistance Tolerance	5% (E24)
Derating Factor (***f***)	See Rated Power Derating Curve
Actual Power(P_0)	$P_0 = P \times f$
Rated Current (I_N)	$I_N = \sqrt{P_0 / R}$
Rated Voltage (U_N)	$U_N = \sqrt{P_0 \times R}$
Rated Functioning Temp. (T_f)	115 °C, 125 °C, 130 °C, 135 °C, 145 °C, 150 °C, 221 °C
Fusing Time	35 W，(115 °C ≤ T_f ≤ 135 °C, less than 60 s)
	40 W，(145 °C ≤ T_f ≤ 150 °C, less than 60 s)
	50 W，(T_f = 221 °C, less than 60 s)
Fusing Temp.	See Specifications
Surge（For Reference Only）	2.0 kV (R > 10 Ω)
	1.0 kV (R ≤ 10 Ω)

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TPR

Specifications

Blue Font Is SETsafe | SETfuse Common Specifications.

Model	Power Type	Derating Factor (25 °C)	Rated Functioning Temp. (T_f)	Fusing Temp.	Resistance Range	Resistance Tolerance	Agency Approvals		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	○	○	●	●

○: On-going

Resistance Selection Table (According to IEC60063-2015 E24, blue font is SETsafe | SETfuse common resistance)

Rated Resistance	Code	Rated Resistance	Code	Rated Resistance	Code	Rated Resistance	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	820	820R
0.91	R91	9.1	9R1	91	91R	910	910R

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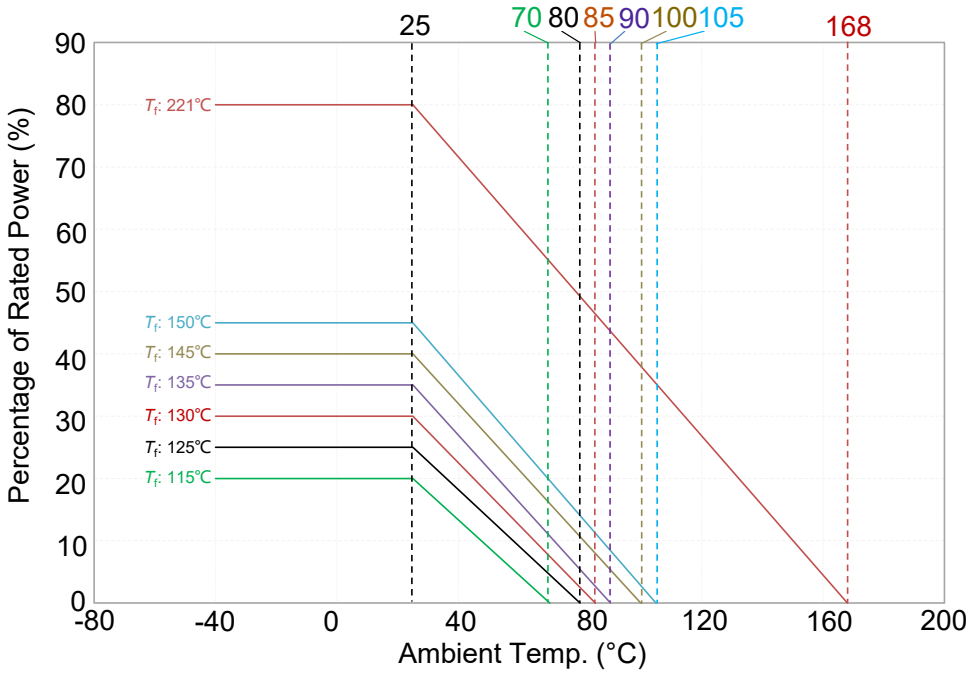
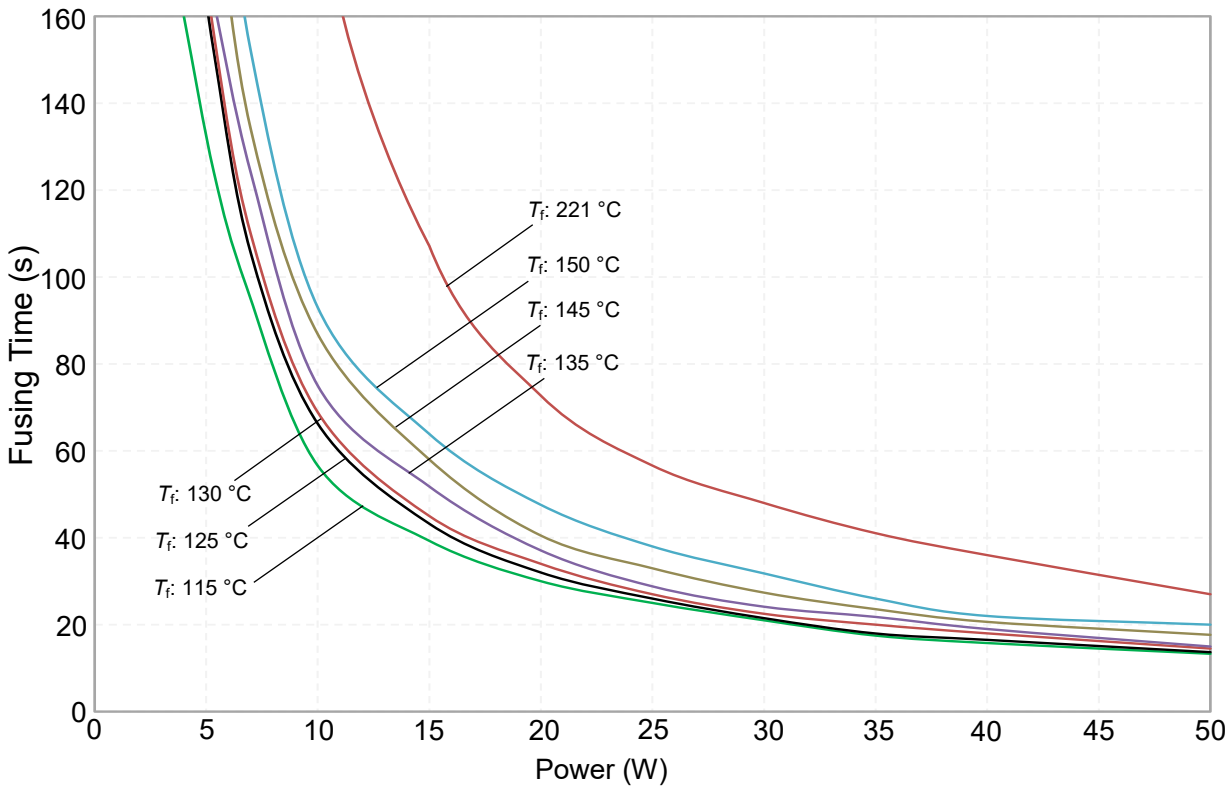
Rated Power Derating Curve (For Reference Only)

When the ambient temp. exceeds 25 ºC, the rated power value declines as the following curve.



Fusing Time Current (For Reference Only)

TPR can open effectively at lower power multiples to protect the circuit timely (ambient temp.: 25 °C ± 2°C).



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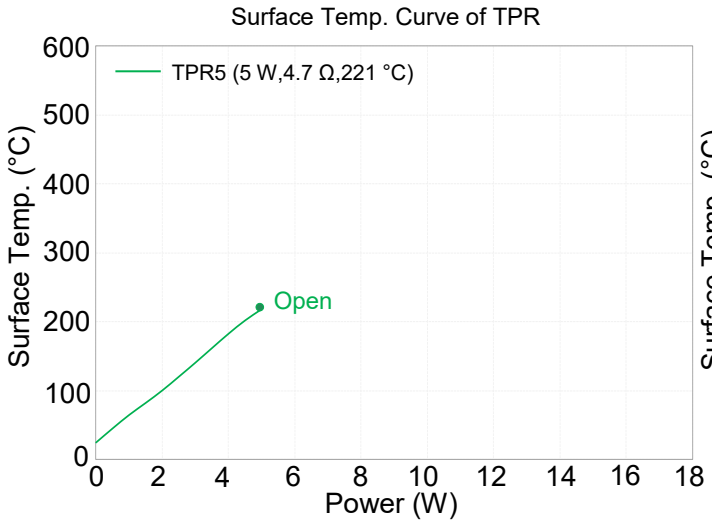
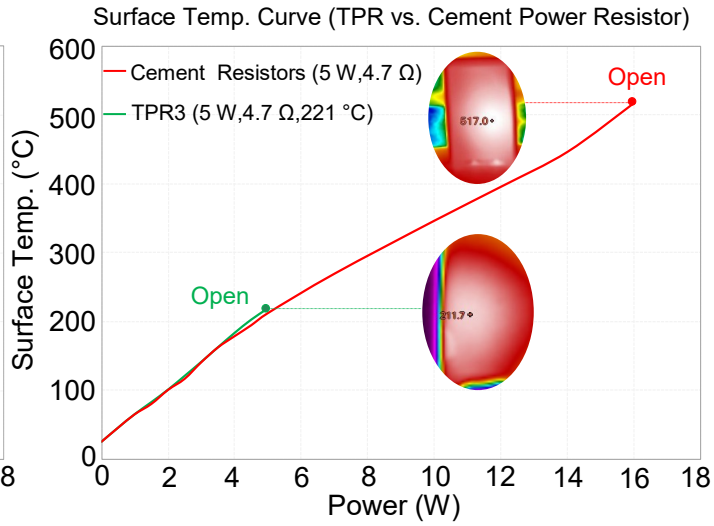
Surface Temp. Curve (For Reference Only)

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).





Agency Approvals of RXF (Built-in)

Rated Power	Resistance Range	Agency Approvals		
		cURus	VDE (REG E012)	CQC
(W)	(Ω)	cURus	VDE	CQC
2	3 ~ 68	●	●	●
	0.27 ~ 1,000	●	●	N/A

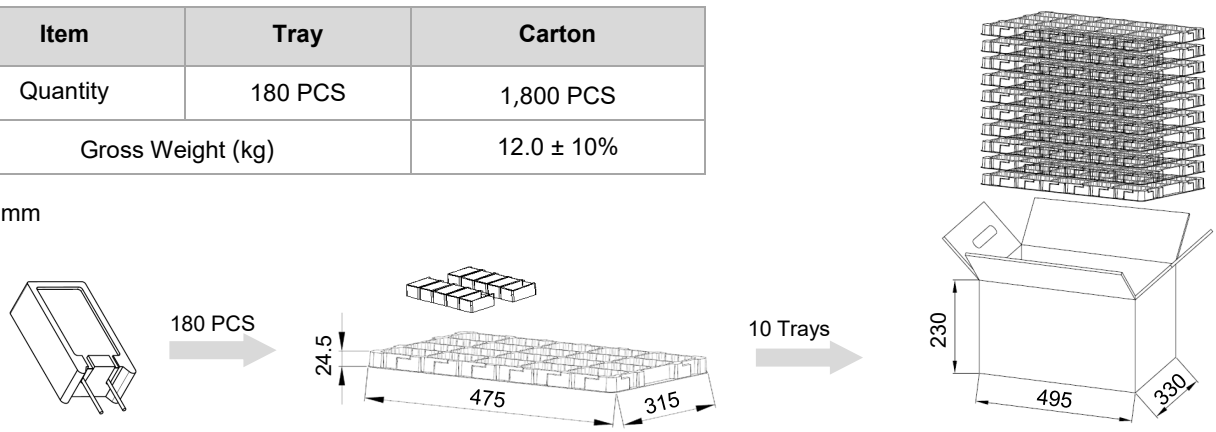
Agency Approvals of ATCO (Built-in)

Code	Model	Rated Functioning Temp.	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	●	●	●	●	●

Packaging Information (For Reference Only)

Item	Tray	Carton
Quantity	180 PCS	1,800 PCS
Gross Weight (kg)		12.0 ± 10%

Unit: mm



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