High Pulse, Fusible, Non-Inductive, Flameproof, Metal Film Leaded Resistor



FEATURES

- UL 1412, Ed.5 US safety standard recognized; UL file no. E362452
- CAN/CSA C22.2 No.60065 Ed.2 Canadian safety standard recognized; UL file no. E362452
- Defined fusing characteristics
- Inherent non-inductive design
- Superior surge handling capability > 600 V (1.2 / 50 µs pulse)
- Meets active and passive flammability requirements as defined in IEC 60115-1 and UL 94 V-0
- Radial version is available
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

RoHS COMPLIANT

HALOGEN FREE

GREEN (5-2008)

DESCRIPTION

The specially developed product PR02-FS can be used for applications in which defined fusible characteristics and high voltage pulse handling is required. So this makes it easy for designers to meet safety requirements in their designs by selecting such products. Main applications are in lighting electronics.

APPLICATIONS

- All general purpose power applications
- Lighting ballast
- Lighting electronics
- Snubber resistor for inductive loads

TECHNICAL SPECIFICATIONS	
DESCRIPTION	**PR02-FS**
DIN size	0411
Resistance range	1 Ω to 100 Ω
Resistance tolerance	± 10 %; ± 20 %
Temperature coefficient	± 250 ppm/K
Operating Temperature	-55 °C to +200 °C
Rated dissipation, P_{70}	2 W
E-series	E12 (± 10 % and ± 20 %)
Generic specification	IEC 60115-1
Stability after:	
Endurance at 70 °C; 1000 h	ΔR max.: ± (5 % R + 0.1 Ω)
Damp heat, steady state (56 days)	ΔR max.: ± (3 % R + 0.1 Ω)
Resistance to soldering heat (10 s, 260 °C)	ΔR max.: ± (0.5 % R + 0.05 Ω)

For technical questions, contact: filmresistorsleaded@vishay.com

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PART NUMBER AND PRODUCT DESCRIPTION

Part Number: PR02FS0206809KA100

P	R	0	2	F	S	0	2	0	6	8	0	9	K	A	1	0	0

TYPE	VARIANT	WIRE TYPES	TCR / MATERIAL	RESISTANCE	TOLERANCE	PACKAGING	SPECIAL
PR02FS	**0** = neutral	**2** = Cu 0.78	**0** = standard	3 digit value 1 digit multiplier **Multiplier** **8** = $*10^{-2}$ **9** = $*10^{-1}$ **0** = $*10^{0}$	**K** = ± 10 % **M** = ± 20 %	**N3** **A1** **A7** **R5**	**00** = standard

Product Description: PR02-FS 10 % A1 68R

PR02-FS	10 %	A1	68R
TYPE	TOLERANCE	PACKAGING	RESISTANCE VALUE
PR02-FS	**10 %**	**N3** **A1** **A7** **R5**	**68R** = 68 Ω

PACKAGING

TYPE	CODE	QUANTITY	STYLE	DESCRIPTION	PITCH	WIDTH	PACKAGING DIMENSIONS
PR02-FS	N3	3000	Radial	Ammo pack acc. to IEC 60286-2	12.7 mm	-	45 mm x 262 mm x 330 mm
	A1	1000	Axial	Ammo pack acc. to IEC 60286-1	5 mm	52 mm	72 mm x 60 mm x 258 mm
	A7	1000	Axial	Ammo pack acc. to IEC 60286-1	5 mm	73 mm	95 mm x 74 mm x 260 mm
	R5	5000	Axial	Reel pack acc. to IEC 60286-1	5 mm	52 mm	100 mm x 375 mm x 375 mm

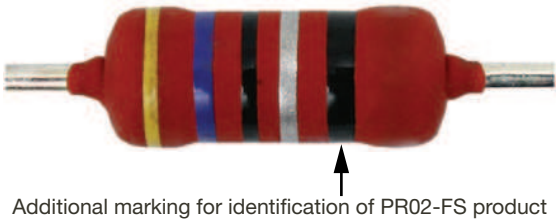
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DESCRIPTION

A homogeneous film of metal alloy is deposited on a high grade ceramic body. Tinned connecting wires of electrolytic copper are welded to the end-caps. The resistors are coated with a red, non-flammable lacquer conformal coating which provides electrical, mechanical and climatic protection. This coating is not resistant to aggressive fluxes and cleaning solvents. The encapsulation is resistant to all cleaning solvents in accordance with IEC 60068-2-45.

The nominal resistance and tolerance are marked on the resistor using colored bands in accordance with IEC 60062, marking codes for resistors and capacitors. An additional black color band is applied to differentiate the PR02-FS from standard PR02 product.



Additional marking for identification of PR02-FS product

MATERIALS

Vishay acknowledges the following systems for the regulation of hazardous substances:

- IEC 62474, Material Declaration for Products of and for the Electrotechnical Industry, with the list of declarable substances given therein (1)
- The Global Automotive Declarable Substance List (GADSL) (2)
- The REACH regulation (1907/2006/EC) and the related list of substances with very high concern (SVHC) (3) for its supply chain

The products do not contain any of the banned substances as per IEC 62474, GADSL, or the SVHC list, see www.vishay.com/how/leadfree.

Hence the products fully comply with the following directives:

- 2000/53/EC End-of-Life Vehicle Directive (ELV) and Annex II (ELV II)
- 2011/65/EU Restriction of the Use of Hazardous Substances Directive (RoHS) with amendment 2015/863/EU
- 2012/19/EU Waste Electrical and Electronic Equipment Directive (WEEE)

Vishay pursues the elimination of conflict minerals from its supply chain, see the Conflict Minerals Policy at www.vishay.com/doc?49037.

ASSEMBLY

The resistors are suitable for processing on automatic insertion equipment and cutting and bending machines. Excellent solderability is proven, even after extended storage. They are suitable for automatic soldering using wave or dipping.

The resistors are completely lead (Pb)-free, the pure tin plating provides compatibility with lead (Pb)-free and lead-containing soldering processes. The immunity of the plating against tin whisker growth, in compliance with IEC 60068-2-82, has been proven under extensive testing.

The encapsulant is resistant to cleaning solvent specified in IEC 60115-1. The suitability of conformal coatings, if applied, shall be qualified by appropriate means to ensure the long-term stability of the whole system.

APPROVALS

The PR02-FS series is specially designed to meet all safety requirements defined in UL1412. Essentially all tests are carried out in accordance with IEC 60115-1 specification, category -55 °C / +200 °C / 56 days (rated temperature range: lower category temperature, upper category temperature; damp heat, long term, 56 days). The tests are carried out in accordance with IEC 60068-2-xx. Test method under standard atmospheric conditions according to IEC 60068-1, 5.3.

RELATED PRODUCTS

For more information on products with higher wattage, higher pulse load capability and metal oxide film technology, please refer to the WK/WR datasheet at the link:

www.vishay.com/doc?20128

For products with higher rated dissipation with small body size, with metal film technology, please refer to the PR01, PR02, PR03 datasheet at the link:

www.vishay.com/doc?28729

Notes

(1) The IEC 62474 list of declarable substances is maintained in a dedicated database, which is available at http://std.iec.ch/iec62474

(2) The Global Automotive Declarable Substance List (GADSL) is maintained by the American Chemistry Council, and available at www.gadsl.org

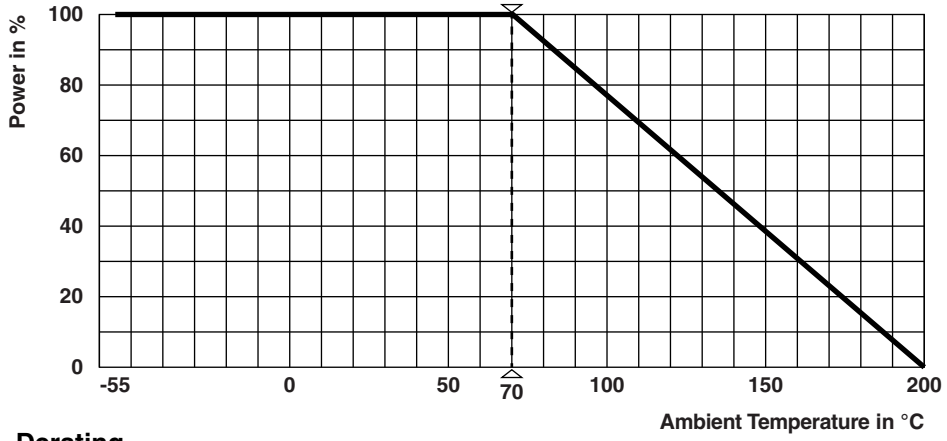
(3) The SVHC list is maintained by the European Chemical Agency (ECHA) and available at http://echa.europa.eu/candidate-list-table

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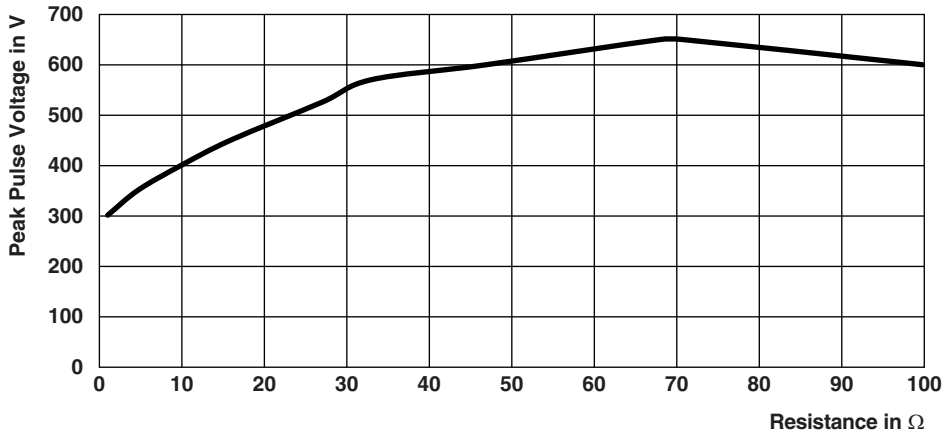
FUNCTIONAL PERFORMANCE

The power that the resistor can dissipate depends on the ambient temperature.

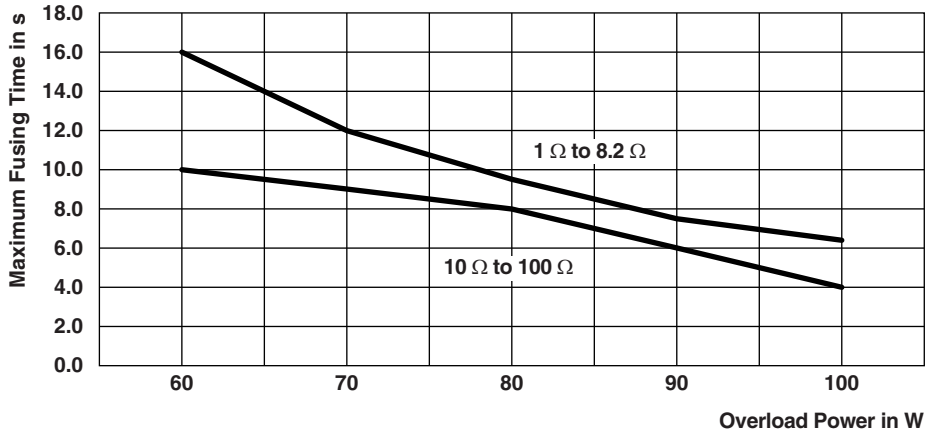


Derating

Maximum dissipation ($P_{max.}$) in percentage of rated power as a function of the ambient temperature (T_{amb})



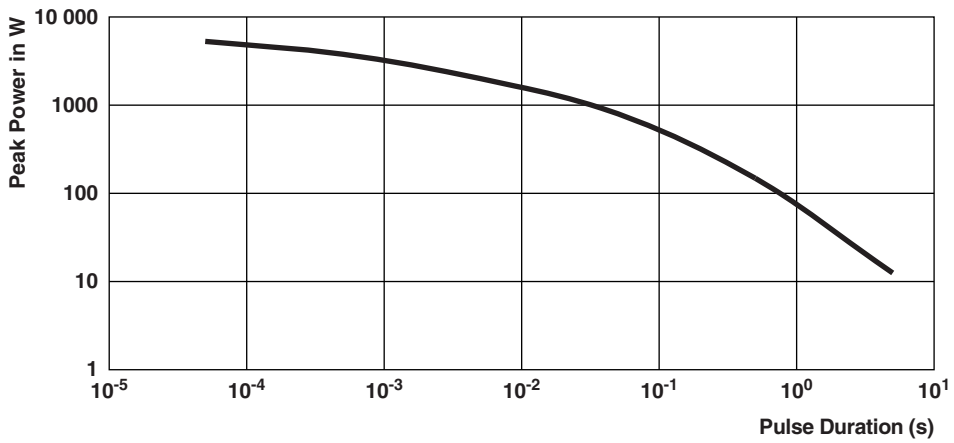
Pulse performance w.r.t. IEC 61000-4-5 after 10 pulses (5 positive and 5 negative with 30 s repetition time) of 1.2/50 µs are applied



Fusing performance in response to defined overload

Fusing means that the resistive value of the resistor increases at least 1000 times its initial value.

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Pulse performance after a rectangular pulse of defined duration is applied

TEST PROCEDURES AND REQUIREMENTS

All tests are carried out in accordance with the following specifications:

- IEC 60115-1, generic specification (includes tests)

The test and requirements table contains only the most important tests. For the full test schedule refer to the documents listed above.

The tests are carried out in accordance with IEC 60068-2-xx test method and under standard atmospheric conditions in accordance with IEC 60068-1, 4.3.

Climatic category LCT / UCT / 56 (rated temperature range: lower category temperature, upper category temperature; damp heat, steady state, test duration: 56 days) is valid.

Unless otherwise specified the following values apply:

- Temperature: 15 °C to 35 °C
- Relative humidity: 25 % to 75 %
- Air pressure: 86 kPa to 106 kPa (860 mbar to 1060 mbar)

For performing some of the tests, the components are mounted on a test board in accordance with IEC 60115-1, 4.31.

In test procedures and requirements table, only the tests and requirements are listed with reference to the relevant clauses of IEC 60115-1 and IEC 60068-2-xx test methods. A short description of the test procedure is also given.

TEST PROCEDURES AND REQUIREMENTS

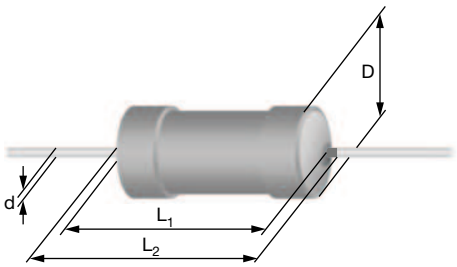
IEC 60115-1 CLAUSE	IEC 60068-2- TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE ($\delta R_{max.}$)
9.1	-	Visual examination		No holes; clean surface; no damage
9.2	-	Dimensions (outline)	Gauge (mm)	See Dimensions table
5.6	-	Resistance		± 10 % R ± 20 % R
12.1	-	Insulation resistance	500 V after 1 min; metal block method	$R_{ins\ min.}$: 10^4 MΩ
12.2	-	Voltage proof	U_{ins} = 500 V_{RMS}; 60 s	No breakdown or flashover
6.2	-	Temperature coefficient	At (20 / -55 / 20) °C and (20 / 155 / 20) °C	≤ ± 250 ppm/K
9.5	21 (Ua_1) 21 (Ub) 21 (Uc)	Robustness of terminations	Tensile, bending, and torsion	No damage $\Delta R_{max.}$: ± (0.5 % R + 0.05 Ω)

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TEST PROCEDURES AND REQUIREMENTS				
IEC 60115-1 CLAUSE	**IEC 60068-2-TEST METHOD**	**TEST**	**PROCEDURE**	**REQUIREMENTS PERMISSIBLE CHANGE ($\delta R_{max.}$)**
11.1	20 (Ta)	Solderability	+235 °C; 2 s; solder bath method; SnPb40	Good tinning (≥ 95 % covered, no visible damage)
			+245 °C; 3 s; solder bath method; SnAg3Cu0.5	Good tinning (≥ 95 % covered, no visible damage)
11.2	20 (Tb)	Resistance to soldering heat	Unmounted components (260 ± 5) °C; (10 ± 1) s	$\Delta R_{max.}$: ± (0.5 % R + 0.05 Ω)
10.1	14 (Na)	Rapid change of temperature	30 min at -55 °C and 30 min at +200 °C; 5 cycles	No visual damage $\Delta R_{max.}$: ± (1 % R + 0.05 Ω)
9.9	27 (Ea)	Bump	3 x 1500 bumps in three directions; 40 g	No damage $\Delta R_{max.}$: ± (0.5 % R + 0.05 Ω)
9.11	6 (Fc)	Vibration	10 sweep cycles per direction; 10 Hz to 2000 Hz; 1.5 mm or 200 m/s^2	No damage $\Delta R_{max.}$: ± (0.5 % R + 0.05 Ω)
10.3		Climatic sequence:		$R_{ins\ min.}$: 10^3 MΩ $\Delta R_{max.}$: ± (1.5 % R + 0.1 Ω)
10.3.4.2	2 (Bb)	Dry heat	200 °C; 16 h	
10.3.4.3	30 (Db)	Damp heat, cyclic	55 °C; 24 h; 90 % to 100 % RH; 1 cycle	
10.3.4.4	1 (Ab)	Cold	-55 °C; 2 h	
10.3.4.5	13 (M)	Low air pressure	1 h; (1 ± 0.1) kPa; 15 °C to 35 °C	
10.3.4.5	30 (Db)	Damp heat, cyclic	55 °C; 24 h; 95 % to 100 % RH; 5 cycles	
10.4	78 (Cab)	Damp heat (steady state)	(40 ± 2) °C; 56 days; (93 ± 3)% RH	$\Delta R_{max.}$: ± (3 % R + 0.1 Ω)
7.1	-	Endurance (at 70 °C)	$U = \sqrt{P_{70} \times R}$; 1.5 h on; 0.5 h off; 70 °C; 1000 h	$\Delta R_{max.}$: ± (5 % R + 0.1 Ω)
12.3	-	Active flammability	Accidental overload test	No damage, no flaming of gauze cylinder
11.3	45 (Xa)	Component solvent resistance	Isopropyl alcohol (used in industrial application) +23 °C; toothbrush method	Marking legible; no visible damage
12.4	-	Passive flammability	Needle flame test	No ignition of product, no ignition of under layer burning time is less than 30 s

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DIMENSIONS

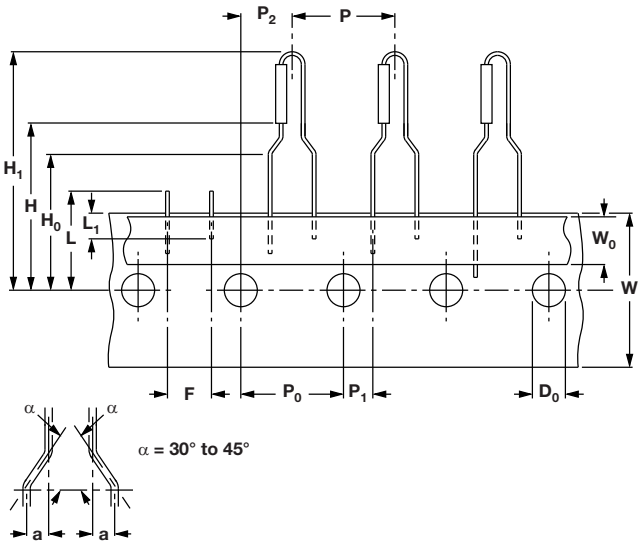


Type with straight leads

DIMENSIONS - Straight lead type and relevant physical dimensions; see straight leads outline					
TYPE	**Ø $D_{MAX.}$ (mm)**	**$L_{1\ MAX.}$ (mm)**	**$L_{2\ MAX.}$ (mm)**	**Ø d (mm)**	**MASS (mg)**
PR02-FS	3.9	10.0	12.0	0.78 ± 0.05	504

PR02-FS WITH RADIAL TAPING

Height for insertion (max.) = 29 mm



DIMENSIONS in millimeters		
Pitch of components	P	12.7 ± 1.0
Feed-hole pitch	P_0	12.7 ± 0.2
Feed-hole center to lead at topside at the tape	P_1	3.85 ± 0.5
Feed-hole center to body center	P_2	6.35 ± 1.0
Lead spacing	F	4.8 +0.7/-0
Width of carrier tape	W	18.0 ± 0.5
Minimum hold down tape width	W_0	5.5
Height for insertion (max.)	H1	29
Lead wire clinch height	H_0	16.5 ± 0.5
Body to hole center	H	19.5 ± 1
Feed-hole diameter	D_0	4.0 ± 0.2
Height for cutting (max.)	L	11.0
Minimum lead wire (tape portion) shortest lead	L_1	2.5

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