Features:

- Coating meets UL 94V-0
- Designed for constant current to provide overload protection
- Consistent performance and reliability
- Cut and formed product is available on select sizes, contact Stackpole for details
- 100% RoHS compliant and lead free without exemption
- Halogen free
- REACH compliant

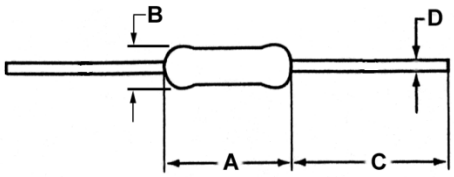


Electrical Specifications

Type / Code	Power Rating (W) @ 70ºC	Maximum Working Voltage (V) (1)	Maximum Overload Voltage (V)	TCR (ppm/ºC)	Ohmic Range (Ω) and Tolerance
					5%
FRN16	0.166	150	200	± 350	0.56 - 10K
FRN14	0.25	200	300	± 350	0.22 - 10K
FRN12	0.5	250	400	± 350	0.47 - 10K
FRN1	1	300	600	± 350	0.47 - 10K
FRN2	2	300	600	± 350	1 - 3K

(1) Lesser of $\sqrt{P*R}$ or maximum working voltage

Mechanical Specifications



Type / Code	A Body Length	B Body Diameter	C Lead Length (Bulk)	D Lead Diameter	Unit
FRN16	0.126 +0.008 / -0 3.20 +0.20 / -0	0.073 ± 0.006 1.85 ± 0.15	1.102 ± 0.118 28.00 ± 3.00	0.018 ± 0.002 0.45 ± 0.05	inches mm
FRN14	0.236 ± 0.020 6.00 ± 0.50	0.091 ± 0.008 2.30 ± 0.20	1.102 ± 0.118 28.00 ± 3.00	0.022 ± 0.002 0.55 ± 0.05	inches mm
FRN12	0.354 ± 0.039 9.00 ± 1.00	0.118 ± 0.020 3.00 ± 0.50	1.102 ± 0.118 28.00 ± 3.00	0.028 ± 0.002 0.70 ± 0.05	inches mm
FRN1	0.433 ± 0.039 11.00 ± 1.00	0.157 ± 0.020 4.00 ± 0.50	1.102 ± 0.118 28.00 ± 3.00	0.031 ± 0.002 0.80 ± 0.05	inches mm
FRN2	0.591 ± 0.039 15.00 ± 1.00	0.217 ± 0.039 5.50 ± 1.00	1.378 ± 0.118 35.00 ± 3.00	0.031 ± 0.002 0.80 ± 0.05	inches mm

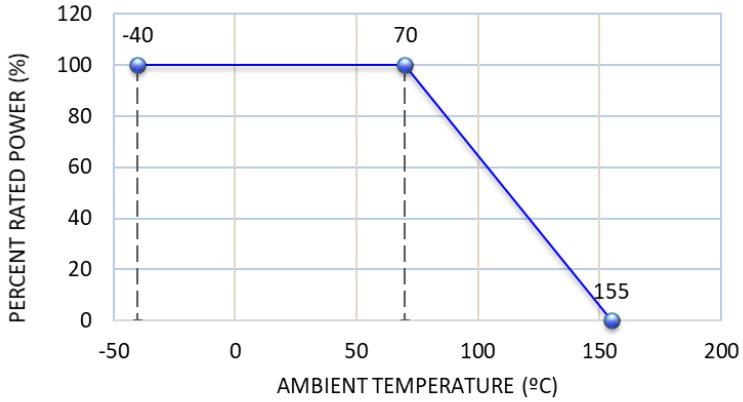
Performance Characteristics

Test	Test Result
Moisture Resistance	± 5%
Thermal Shock	± 1%
Load Life @ 70ºC - 1000 hours	± 5%
Resistance to Soldering Heat	± 1%
Short Time Overload	± 2%

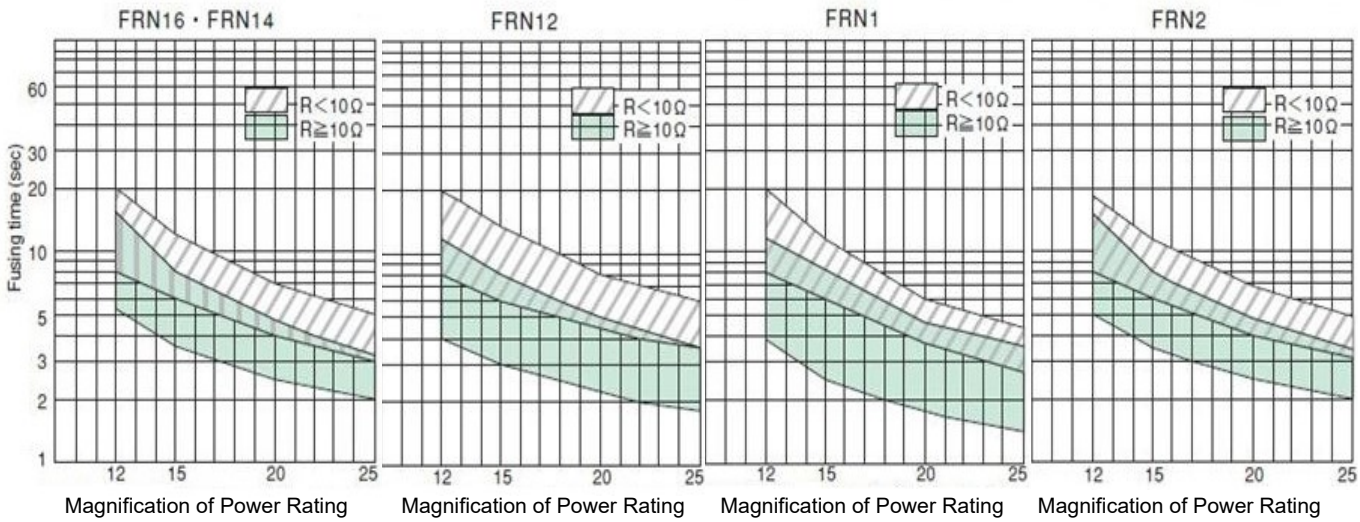
Operating temperature range is -40ºC to +155ºC

This specification may be changed at any time without prior notice.
Please confirm technical specifications before you order and/or use.

Power Derating Curve:



Fusing Curves



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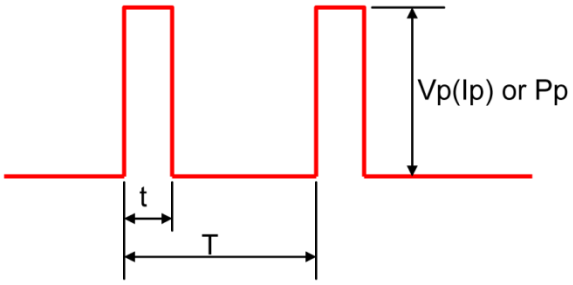
Repetitive Pulse Information

If repetitive pulses are applied to resistors, pulse wave form must be less than “Pulse limiting voltage”, “Pulse limiting current” or “Pulse limiting wattage” calculated by the formula below.

$$Vp = K\sqrt{P \times R \times T/t}$$

$$Ip = K\sqrt{P/R \times T/t}$$

$$Pp = K^2 \times P \times T/t$$



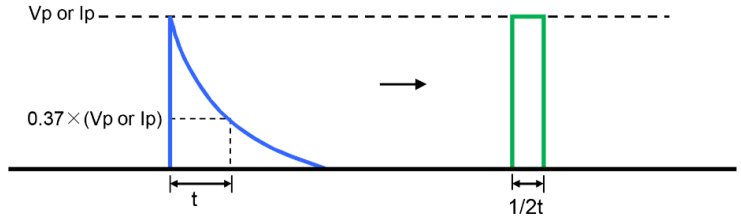
Where: Vp: Pulse limiting voltage (V)
Ip: Pulse limiting current (A)
Pp: Pulse limiting wattage (W)
P: Power rating (W)
R: Nominal resistance (ohm)
T: Repetitive period (sec)
t: Pulse duration (sec)
K: Coefficient: 0.6
[Vr: Rated Voltage (V), Ir: Rated Current (A)]

Note 1: If T > 10 → T = 10 (sec), T/t > 1000 → T/t = 1000.
Note 2: If T > 10 and T/t > 1000, “Pulse Limiting power (Single pulse) is applied.
Note 3: If Vp < Vr (Ip < Ir or Pp < P), Vr (Ir, P) is Vp (Ip, Pp).
Note 4: Pulse limiting voltage (Current, Wattage) is applied at less than rated ambient temperature. If ambient temperature is more than the rated temperature (70°C), please decrease power rating according to “Power Derating Curve”.
Note 5: Please assure sufficient margin for use period and conditions for “Pulse limiting voltage”.
Note 6: If the pulse waveform is not square wave, please judge after transform the waveform into square wave according to “Waveform Transformation to Square Wave” information.

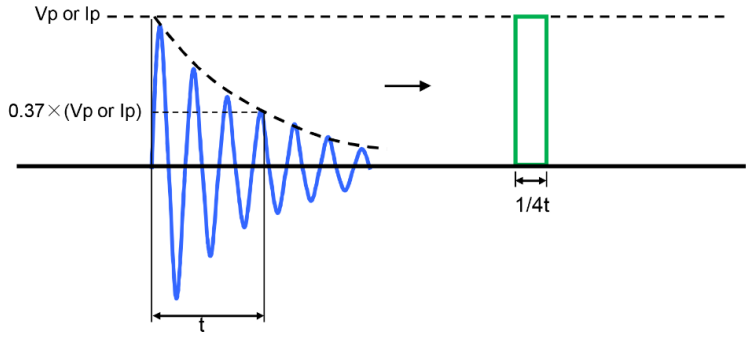
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Waveform Transformation to Square Wave

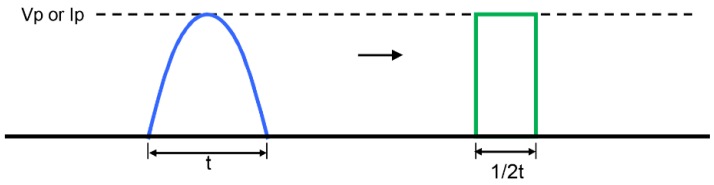
1. Discharge curve wave with time constant "t" → Square wave



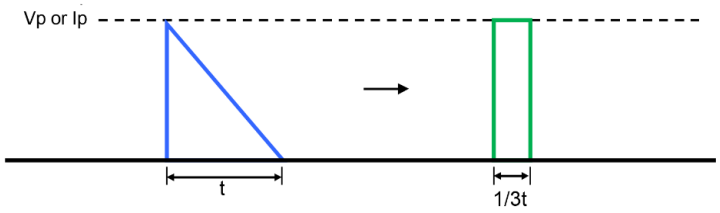
2. Damping oscillation wave with time constant of envelope "t" → Square wave



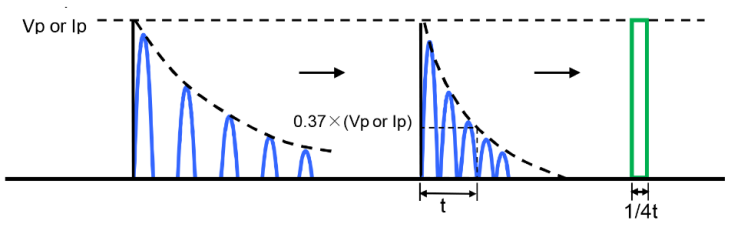
3. Half-wave rectification wave → Square wave



4. Triangular wave → Square wave



5. Special wave → Square wave



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Recommended Solder Profile

This information is intended as a reference for solder profiles for Stackpole resistive components. These profiles should be compatible with most soldering processes. These are only recommendations. Actual numbers will depend on board density, geometry, packages used, etc., especially those cells labeled with "*".

100% Matte Tin / RoHS Compliant Terminations

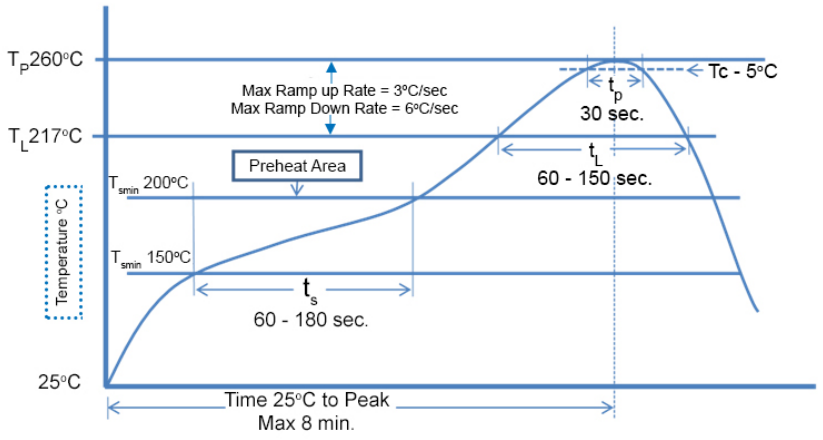
Soldering iron recommended temperatures: 330°C to 350°C with minimum duration.
Maximum number of reflow cycles: 3.

Wave Soldering			
Description	Maximum	Recommended	Minimum
Preheat Time	80 seconds	70 seconds	60 seconds
Temperature Diff.	140°C	120°C	100°C
Solder Temp.	260°C	250°C	240°C
Dwell Time at Max.	10 seconds	5 seconds	*
Ramp DN (°C/sec)	N/A	N/A	N/A

Temperature Diff. = Defference between final preheat stage and soldering stage.

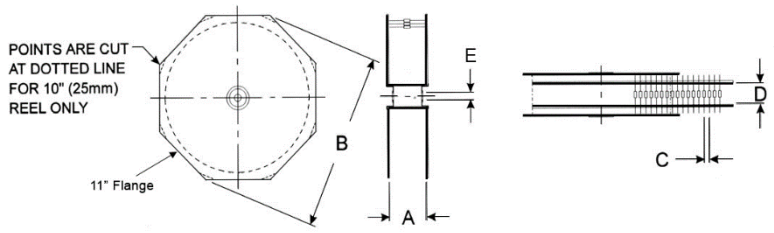
Convection IR Reflow			
Description	Maximum	Recommended	Minimum
Ramp Up (°C/sec)	3°C/sec	2°C/sec	*
Dwell Time > 217°C	150 seconds	90 seconds	60 seconds
Solder Temp.	260°C	245°C	*
Dwell Time at Max.	30 seconds	15 seconds	10 seconds
Ramp DN (°C/sec)	6°C/sec	3°C/sec	*

Recommended Lead Free Resistor Reflow Profile



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Packaging Specifications



Series	A max[1]	B max	C	D[2]	Tape	Unit
FRN16	2.618 66.50	13.504 343.00	0.197 ± 0.020 5.00 ± 0.50	2.063 ± 0.079 52.40 ± 2.00	0.250 6.35	inches mm
FRN14	2.508 63.70	13.504 343.00	0.197 ± 0.020 5.00 ± 0.50	2.063 ± 0.079 52.40 ± 2.00	0.250 6.35	inches mm
FRN12	2.618 66.50	13.504 343.00	0.197 ± 0.020 5.00 ± 0.50	2.063 ± 0.079 52.40 ± 2.00	0.250 6.35	inches mm
FRN1	2.421 61.50	13.504 343.00	0.197 ± 0.020 5.00 ± 0.50	2.063 ± 0.079 52.40 ± 2.00	0.250 6.35	inches mm
FRN2	3.917 99.50	13.504 343.00	0.394 ± 0.020 10.00 ± 0.50	2.500 ± 0.079 63.50 ± 2.00	0.250 6.35	inches mm

Dimension "E": This is a non-critical dimension that does not have a tolerance in the standard.
Range of diameters is from 0.547 inches (13.90 mm) to 1.500 inches (38.10 mm).

(1) Reference value only. The "A" dimension shall be governed by the overall length of the taped component.
The distance between flanges shall be 0.059 inches (1.50 mm) to 0.315 (8.00 mm) greater than the overall component.

(2) The given dimension "D" expresses the standard width spacing. A 26 mm narrow spacing is available as option "N" packaging code.

RoHS Compliance

Stackpole Electronics has joined the worldwide effort to reduce the amount of lead in electronic components and to meet the various regulatory requirements now prevalent, such as the European Union's directive regarding "Restrictions on Hazardous Substances" (RoHS 3). As part of this ongoing program, we periodically update this document with the status regarding the availability of our compliant components. All our standard part numbers are compliant to EU Directive 2011/65/EU of the European Parliament as amended by Directive (EU) 2015/863/EU as regards the list of restricted substances.

RoHS Compliance Status

Standard Product Series	Description	Package / Termination Type	Standard Series RoHS Compliant	Lead-Free Termination Composition	Lead-Free Mfg. Effective Date (Std Product Series)	Lead-Free Effective Date Code (YY/WW)
FRN	Axial Leaded Fusing Resistor	Axial	YES	99.3/0.7 Sn/Cu	Apr-05	05/14

"Conflict Metals" Commitment

We at Stackpole Electronics, Inc. are joined with our industry in opposing the use of metals mined in the "conflict region" of the eastern Democratic Republic of the Congo (DRC) in our products. Recognizing that the supply chain for metals used in the electronics industry is very complex, we work closely with our own suppliers to verify to the extent possible that the materials and products we supply do not contain metals sourced from this conflict region. As such, we are in compliance with the requirements of Dodd-Frank Act regarding Conflict Minerals.

This specification may be changed at any time without prior notice.
Please confirm technical specifications before you order and/or use.

Compliance to "REACH"

We certify that all passive components supplied by Stackpole Electronics, Inc. are SVHC (Substances of Very High Concern) free and compliant with the requirements of EU Directive 1907/2006/EC, "The Registration, Evaluation, Authorization and Restriction of Chemicals", otherwise referred to as REACH. Contact us for complete list of REACH Substance Candidate List.

Environmental Policy

It is the policy of Stackpole Electronics, Inc. (SEI) to protect the environment in all localities in which we operate. We continually strive to improve our effect on the environment. We observe all applicable laws and regulations regarding the protection of our environment and all requests related to the environment to which we have agreed. We are committed to the prevention of all forms of pollution.

How to Order

1	2	3	4	5	6	7	8	9	10	11
F	**R**	**N**	**1**	**2**	**J**	**T**	**4**	**R**	**7**	**0**

Product Series	
Code	Description
FRN	Fusing Metal Film

Power Rating	
Code	W
16	0.166
14	0.25
12	0.5
1	1
2	2

Tolerance		
Code	Tol	Value
J	5%	E24

Packaging			
Code	Description	Product Code	Quantity
T	Tape and Reel	FRN16, FRN14	5000
		FRN12, FRN1	2500
		FRN2	1000
A	Ammo	FRN16	5000
		FRN14, FRN12	2000
		FRN1	1000
		FRN2	500
B	Bulk	FRN16	2000
		FRN14, FRN12 FRN1, FRN2	1000

Resistance Value
Four characters with the multiplier used as the decimal holder.
0.47 ohm = R470 10 Kohm = 10K0

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