Features:

- General purpose resistor ideal for commercial/industrial applications
- Flame retardant coatings standard
- Flameproof version available as CFF
- Panasert available on selected sizes - contact Stackpole
- Auto sequencing/insertion compatible
- CFM (mini) ideal choice when size constraints apply
- Cut and formed product is available on select sizes - contact Stackpole
- Standard lead wire for CF / CFM is copper plated steel, with 100% tin over plate
- 100% tin plate on copper wire is available as type CFQ / CFQM
- RoHS compliant, lead free and halogen free

Electrical Specifications - CF

Type / Code	Power Rating (W) @ 70ºC	Maximum Working Voltage (V) (1)	Maximum Overload Voltage (V)	Dielectric Withstanding Voltage (V)	TCR (ppm/ºC) per Ohmic Range	Ohmic Range (Ω) and Tolerance	
						2%	5%
CF18	0.125	250	500	350	< 10 Ω = ±400 ppm/ºC	10 - 1M	1 - 22M
CF14	0.25	350	600	350	10 Ω to 9.99K Ω = 0 ~ -400 ppm/ºC	1 - 1M	1 - 22M
CF12	0.5	350	700	600	10 K Ω to 99K Ω = 0 ~ -500 ppm/ºC	10 - 1M	1 - 22M
CF1	1	500	1000	600	100 K Ω to 999K Ω = 0 ~ -850 ppm/ºC	1 - 1M	1 - 10M
CF2	2	500	1000	600	1M Ω and above = 0 ~ -1500 ppm/ºC	1 - 1M	1 - 10M

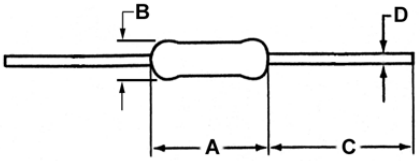
(1) Lesser of $\sqrt{P*R}$ or maximum working voltage.

Electrical Specifications - CFM

Type / Code	Power Rating (W) @ 70ºC	Maximum Working Voltage (V) (1)	Maximum Overload Voltage (V)	Dielectric Withstanding Voltage (V)	TCR (ppm/ºC) per Ohmic Range	Ohmic Range (Ω) and Tolerance	
						2%	5%
CFM14	0.25	250	500	350	< 10 Ω = ±400 ppm/ºC 10 Ω to 9.99K Ω = 0 ~ -400 ppm/ºC	1 - 1M	1 - 10M
CFM12	0.5	350	600	350	10 K Ω to 99K Ω = 0 ~ -500 ppm/ºC	1 - 1M	1 - 10M
CFM1	1	600	1000	600	100 K Ω to 999K Ω = 0 ~ -850 ppm/ºC 1M Ω and above = 0 ~ -1500 ppm/ºC	1 - 1M	1 - 10M

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

Mechanical Specifications – CF / CFQ



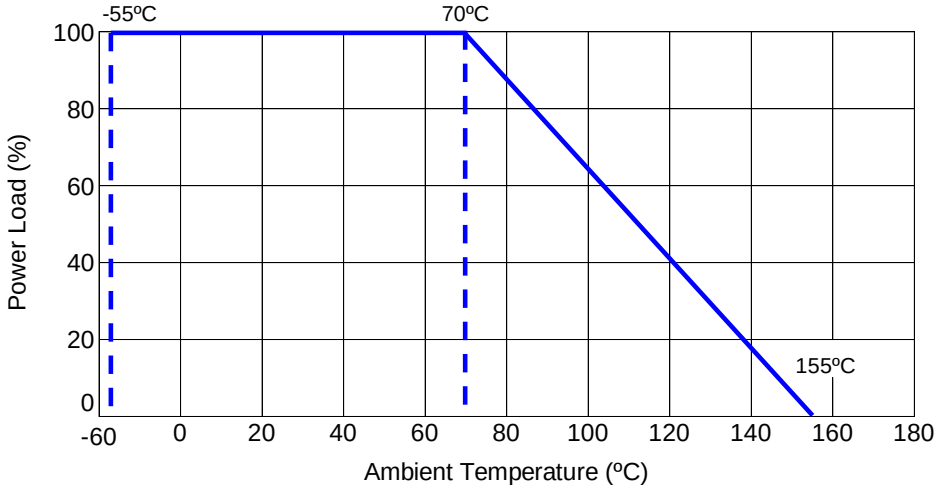
Type / Code	A Body Length	B Body Diameter	C Lead Length (Bulk)	D - Lead Diameter CF / CFM	D - Lead Diameter CFQ / CFQM	Unit
CF18 / CFQ18	0.130 ± 0.012 3.30 ± 0.30	0.067 ± 0.012 1.70 ± 0.30	1.102 ± 0.118 28.00 ± 3.00	0.016 ± 0.003 0.40 ± 0.08	0.018 ± 0.003 0.45 ± 0.08	inches mm
CF14 / CFQ14	0.236 ± 0.012 6.00 ± 0.30	0.091 ± 0.012 2.30 ± 0.30	1.102 ± 0.118 28.00 ± 3.00	0.022 ± 0.003 0.55 ± 0.08	0.022 ± 0.003 0.55 ± 0.08	inches mm
CF12 / CFQ12	0.335 ± 0.039 8.50 ± 1.00	0.106 ± 0.020 2.70 ± 0.50	1.102 ± 0.118 28.00 ± 3.00	0.022 ± 0.003 0.55 ± 0.08	0.028 ± 0.004 0.70 ± 0.10	inches mm
CF1 / CFQ1	0.433 ± 0.039 11.00 ± 1.00	0.177 ± 0.020 4.50 ± 0.50	1.181 ± 0.118 30.00 ± 3.00	0.031 ± 0.004 0.80 ± 0.10	0.031 ± 0.004 0.80 ± 0.10	inches mm
CF2 / CFQ2	0.591 ± 0.039 15.00 ± 1.00	0.197 ± 0.020 5.00 ± 0.50	1.339 ± 0.157 34.00 ± 4.00	0.031 ± 0.004 0.80 ± 0.10	0.031 ± 0.004 0.80 ± 0.10	inches mm

Mechanical Specifications – CFM / CFQM						
Type / Code	A Body Length	B Body Diameter	C Lead Length (Bulk)	D - Lead Diameter CF / CFM	D - Lead Diameter CFQ / CFQM	Unit
CFM14 / CFQM14	0.130 ± 0.012 3.30 ± 0.30	0.067 ± 0.012 1.70 ± 0.30	1.102 ± 0.118 28.00 ± 3.00	0.016 ± 0.003 0.40 ± 0.08	0.018 ± 0.003 0.45 ± 0.08	inches mm
CFM12 / CFQM12	0.236 ± 0.012 6.00 ± 0.30	0.091 ± 0.012 2.30 ± 0.30	1.102 ± 0.118 28.00 ± 3.00	0.022 ± 0.003 0.55 ± 0.08	0.022 ± 0.003 0.55 ± 0.08	inches mm
CFM1 / CFQM1	0.354 ± 0.020 9.00 ± 0.50	0.138 ± 0.020 3.50 ± 0.50	1.102 ± 0.118 28.00 ± 3.00	0.028 ± 0.002 0.70 ± 0.05	0.028 ± 0.002 0.70 ± 0.05	inches mm

Performance Characteristics								
Test	Test Method	Typical Result			Test Limit			
Current Noise	MIL-STD 202, Method 308	1 Ω ~ 91K Ω	100K Ω ~ 910K Ω	1M Ω ~ 22M Ω	1 Ω ~ 91K Ω	100K Ω ~ 910K Ω	1M Ω ~ 22M Ω	
		0.15µ V/V	0.32µ V/V	0.54µ V/V	0.2µ V/V	0.4µ V/V	0.6µ V/V	
Short Time Overload	JIS C5201-1, IEC60115-1, 4.13	< ± 0.25%			≤ ± (0.75% + 0.05 Ω)			
Resistance to Solder Heat	JIS C5201-1, IEC60115-1, 4.18	< ± 0.3%			≤ ± (0.50% + 0.05 Ω)			
Rapid Change of Temperature	JIS C5201-1, IEC60115-1, 4.19	< ± 0.3%			≤ ± (1.00% + 0.05 Ω)			
Endurance at 70°C	JIS C5201-1, IEC60115-1, 4.25.1	< ± 1%			R < 100K Ω: ≤ ± (2.0% + 0.05 Ω)			
Terminal Strength	MIL-STD 202, Method 211	< ± 0.2%			≤ ± (0.50% + 0.05 Ω)			
Damp Heat (Steady state)	JIS C5201-1, IEC60115-1, 4.24	< ± 1.5%			R < 100K Ω: ≤ ± (3.0% + 0.05 Ω)			

Operating temperature range is -55°C to +155°C

Power Derating Curve:



Recommended Solder Profiles

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

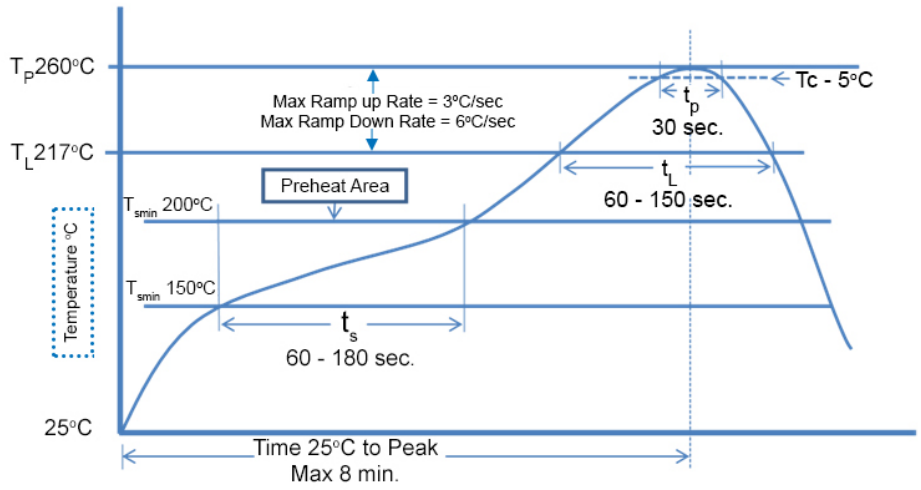
Soldering iron recommended temperatures: 330°C to 350°C with minimum duration.
Maximum number of reflow cycles: 3.

Wave Soldering – 100% Matte Tin / RoHS Compliant Terminations			
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

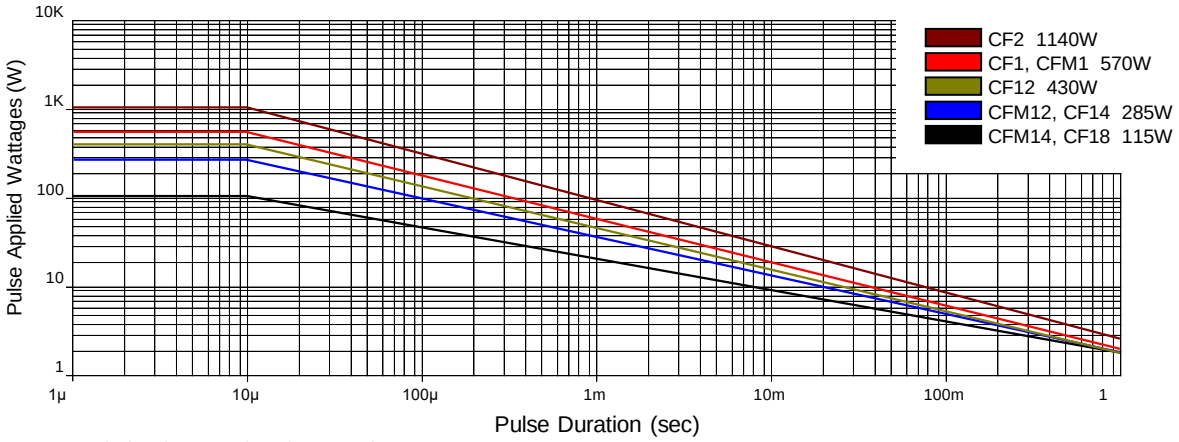
Temperature Diff. = Defference between final preheat stage and soldering stage.

Convection IR Reflow – 100% Matte Tin / RoHS Compliant Terminations			
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



Single Pulse Power:

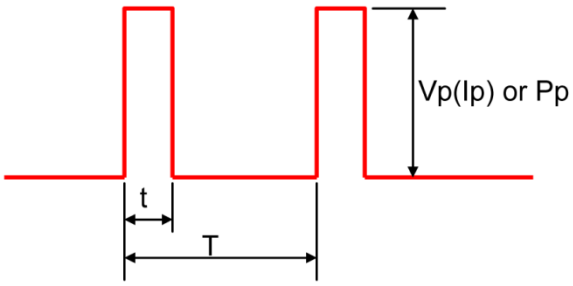


Typical performance for reference only.

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.

$$Vp = K\sqrt{P \times R \times T/t}$$
$$Ip = K\sqrt{P/R \times T/t}$$
$$Pp = K^2 \times P \times T/t$$

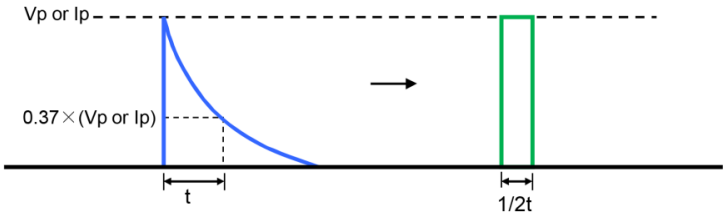


Where: Vp: Pulse limiting voltage (V)
Ip: Pulse limiting current (A)
Pp: Pulse limiting wattage (W)
P: Power rating (W)
R: Nominal resistance (ohm)
T: Repetitive period (sec.)
t: Pulse duration (sec.)
K: Coefficient: 0.8
[Vr: Rated Voltage (V), Ir: Rated Current (A)]

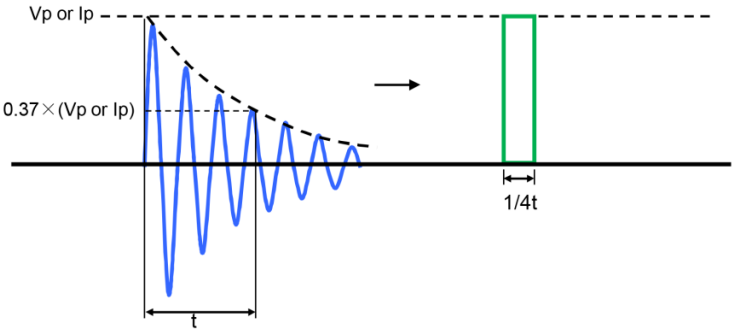
Note 1: If T > 10 → T = 10 (sec.), T / t > 1000 → T / t = 1000.
Note 2: If T > 10 and T / t > 1000, "Pulse Limiting power (single pulse) is applied.
Note 3: If Vp < Vr (Ip < Ir or Pp < P), Vr (Ir, P) is Vp (Ip, Pp).
Note 4: Pulse limiting voltage (Current, Wattage) is applied at less than rated ambient 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 the "Waveform Transformation to Square Wave".

Waveform Transformation to Square Wave

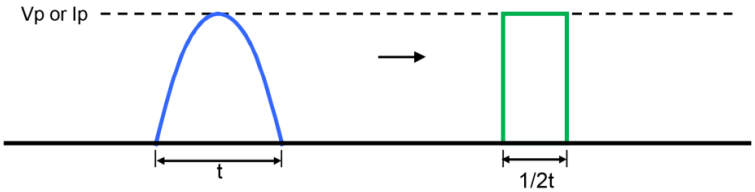
1. Discharge curve wave with time constant “t” → Square wave



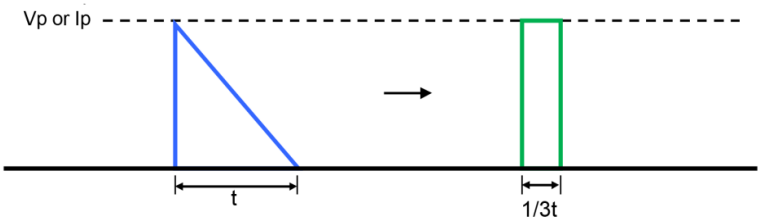
2. Damping oscillation wave with time constant of envelope “t” → Square wave



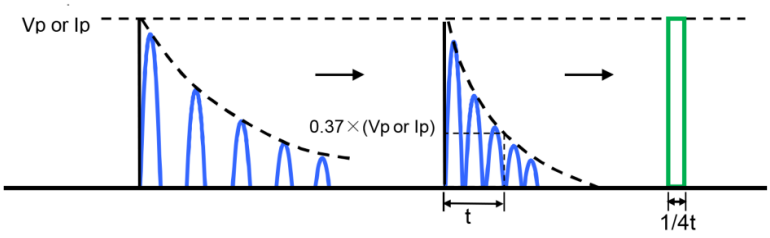
3. Half-wave rectification wave → Square wave



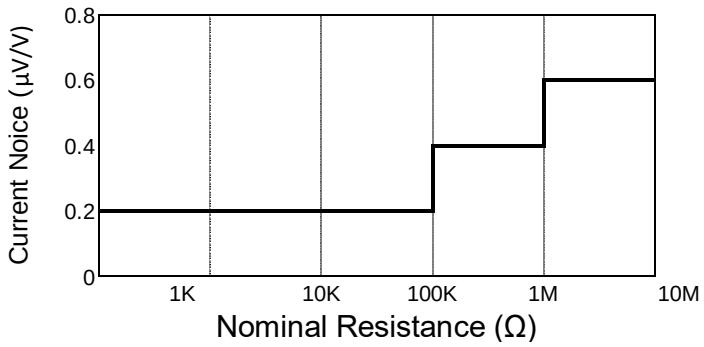
4. Triangular wave → Square wave



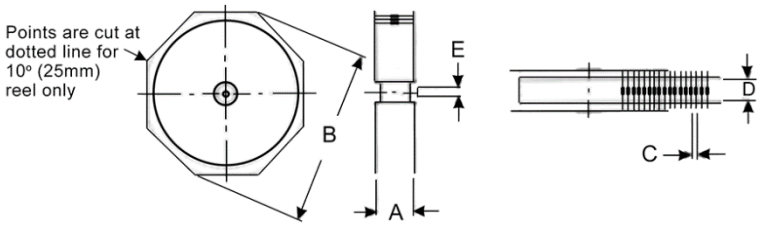
5. Special wave → Square wave



Current Noise:



Packaging Specifications



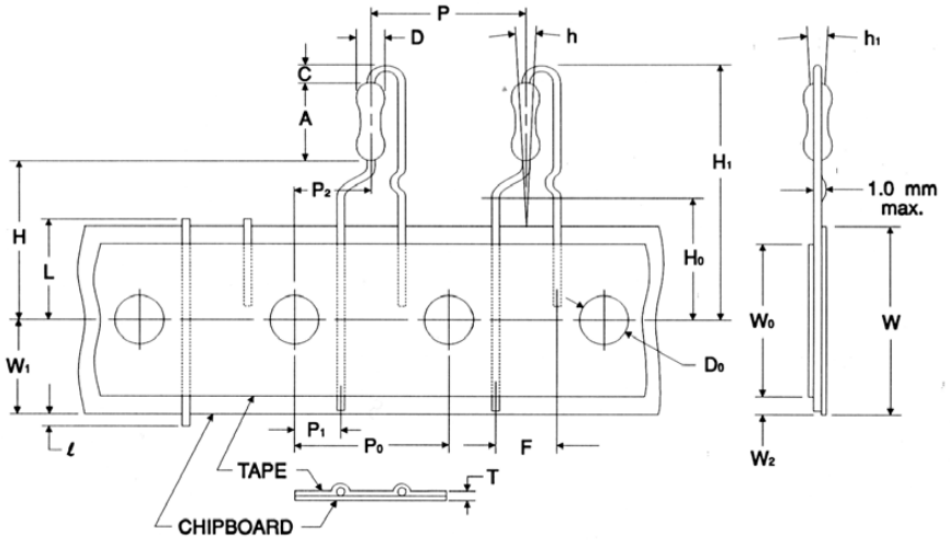
Type / Code	Class	Tape	A Max (1).	B Max	C	D (2)	Unit
CF18 / CFQ18	I	0.250 6.35	2.508 63.70	13.504 343.00	0.197 ± 0.020 5.00 ± 0.50	2.063 ± 0.079 52.40 ± 2.00	inches mm
CF14 / CFQ14	I	0.250 6.35	2.638 67.00	13.504 343.00	0.197 ± 0.020 5.00 ± 0.50	2.063 ± 0.079 52.40 ± 2.00	inches mm
CF12 / CFQ12	I	0.250 6.35	2.736 69.50	13.504 343.00	0.197 ± 0.020 5.00 ± 0.50	2.063 ± 0.079 52.40 ± 2.00	inches mm
CF1 / CFQ1	I	0.250 6.35	2.972 75.50	13.504 343.00	0.197 ± 0.020 5.00 ± 0.50	2.063 ± 0.079 52.40 ± 2.00	inches mm
CF2 / CFQ2	I	0.250 6.35	3.130 79.50	13.504 343.00	0.394 ± 0.020 10.00 ± 0.50	2.063 ± 0.079 52.40 ± 2.00	inches mm
CFM14 / CFQM14	I	0.250 6.35	2.508 63.70	13.504 343.00	0.197 ± 0.020 5.00 ± 0.50	2.063 ± 0.079 52.40 ± 2.00	inches mm
CFM12 / CFQM12	I	0.250 6.35	2.638 67.00	13.504 343.00	0.197 ± 0.020 5.00 ± 0.50	2.063 ± 0.079 52.40 ± 2.00	inches mm
CFM1 / CFQM1	I	0.250 6.35	2.736 69.50	13.504 343.00	0.197 ± 0.020 5.00 ± 0.50	2.063 ± 0.079 52.40 ± 2.00	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.
Contact Stackpole for more details.

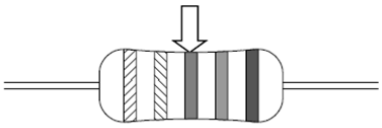
Radial Lead Taping Specifications (Pana-Sert PCF14)

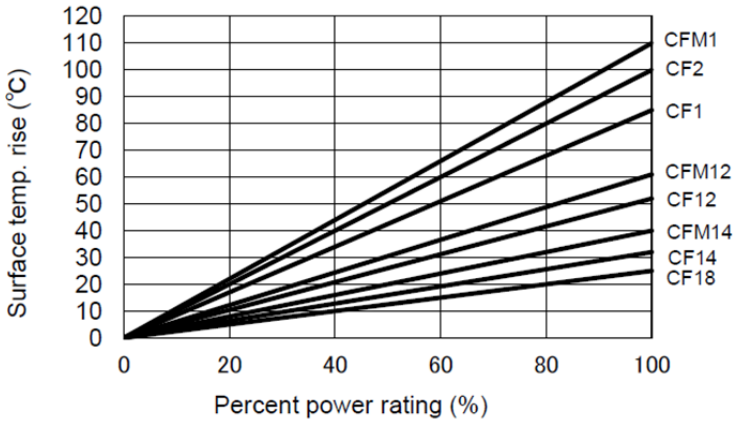


Symbol	Description	PANA-SERT	Unit	Symbol	Description	PANA-SERT	Unit
A	Resistor body length	0.256 ± 0.020 6.50 ± 0.50	inches mm	L	Cutout Length (1)	0.433 max. 11.00 max.	inches mm
C	Height of bending	0.098 ± 0.020 2.50 ± 0.50	inches mm	P	Resitor pitch (1)	0.500 ± 0.039 12.70 ± 1.00	inches mm
D	Resistor body diameter	0.091 ± 0.008 2.30 ± 0.20	inches mm	P_0	Sprocket-hole pitch (1)	0.500 ± 0.012 12.70 ± 0.30	inches mm
D_0	Sprocket-hole diameter	0.157 ± 0.012 4.00 ± 0.30	inches mm	P_1	Sprocket-hole center to lead center	0.152 ± 0.028 3.85 ± 0.70	inches mm
F	Resistor lead spacing	0.197 ± 0.039 5.00 ± 1.00	inches mm	P_2	Sprocket-hole center to resistor center (1)	0.250 ± 0.051 6.35 ± 1.30	inches mm
H	Height to bottom of resistor	0.748 ± 0.039 19.00 ± 1.00	inches mm	T	Thickness (chipboard and tape)	0.028 ± 0.008 0.70 ± 0.20	inches mm
H_0	Height to lead clinch	0.630 ± 0.020 16.00 ± 0.50	inches mm	W	Chipboard width (1)	0.709 + 0.039 / -0.020 18.00 + 1.00 / -0.50	inches mm
H_1	Height of resistor	1.122 max. 28.50 max.	inches mm	W_0	Hold-down tape width	0.49 min. 12.50 min.	inches mm
h	Resistor alignment	0 ± 0.079 (0 ± 5º) 0 ± 2.00 (0 ± 5º)	inches mm	W_1	Sprocket-hole position	0.354 + 0.030 / -0.020 9.00 + 0.75 / -0.50	inches mm
h_1	Resistor alignment	0 ± 0.079 (0 ± 5º) 0 ± 2.00 (0 ± 5º)	inches mm	W_2	Hold-down tape position	0.118 max. 3.00 max.	inches mm
I	Lead protrusion	0.079 max. 2.00 max.	inches mm				

Surface Temperature Rise

Measurement Point





Standard Color Codes

PRECISION - Have three significant-figure bands, a multiplier band and a tolerance band. Tolerances 1% or less.

GENERAL PURPOSE - Have two significant-figure bands, a multiplier band and a tolerance band. Tolerances 2% or greater.

Color Band Description		
Band	Precision	General Purpose
1st Band	Nominal	Nominal
2nd Band	Nominal	Nominal
3rd Band	Nominal	Multiplier
4th Band	Multiplier	Tolerance
5th Band	Tolerance	-

	Nominal	Multiplier	Tolerance (%)
Black	0	1	-
Brown	1	10	1
Red	2	100	2
Orange	3	1 K	-
Yellow	4	10 K	-
Green	5	100 K	0.5
Blue	6	1000 K	0.25
Violet	7	-	0.1
Gray	8	-	-
White	9	0.001	-
Silver	-	0.01	10
Gold	-	0.1	5

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)
CF	Carbon Film Leaded Resistor	Axial	YES	100% Matte Sn	Jan-04 (Taiwan, China)	04/01
CFM	Mini-Carbon Film Leaded Resistor	Axial	YES	100% Matte Sn	Jan-04 (Taiwan, China)	04/01

"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.

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
C	**F**	**1**	**2**	**J**	**T**	**1**	**0**	**0**	**K**

Product Series

Code	Description
CF	Standard
CFF	Flameproof
CFM	Mini
PCF	Panasert CF14
PCFM	Panasert CF12
CFQ	Tin plating on copper wire
CFQM	Tin plating (mini)
PCFQ	Tin plating on copper wire Panasert

Power Rating

Code	W
18	0.125
14	0.25
12	0.5
1	1
2	2

Tolerance

Code	Tol
G	2%
J	5%

Packaging

Code	Description	Product Code	Quantity
T	Tape and Reel	CF18, CFQ18, CFM14, CFQM14, CF14, CFQ14, CFM12, CFQM12, CF12, CFQ12, PCF14, PCFM12	5000
		CFM1/CFQM1	2500
		CF1/CFQ1	2000
		CF2/CFQ2	1000
A	Ammo	CF18, CFQ18, CFM14, CFQM14, CF14, CFQ14, CFM12, CFQM12	5000
		CF12, CFQ12, CFM1, CFQM1, PCF14, PCFM12, CF1, CFQ1	2000
		CF2	1000
B(*)	Bulk	All Sizes	1000

Resistance Value

Four characters with the multiplier used as the decimal holder.

10 ohm = 10R0
10.2 Kohm = 10K2
1 Mohm = 1M00

(*) Bulk packaging may be subject to 25Kpc MOQ