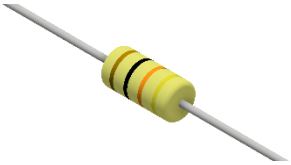


Features:

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

Electrical Specifications - CF, CFQ, PCF

Type/Code	Size	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%
CF, CFQ	18	0.125	250	500	350	< 10Ω = ± 400 ppm/ºC 10Ω to 9.99KΩ = 0 ~ -400 ppm/ºC 10KΩ to 99KΩ = 0 ~ -500 ppm/ºC 100KΩ to 999KΩ = 0 ~ -850 ppm/ºC 1MΩ and above = 0 ~ -1500 ppm/ºC	10 - 1M	1 - 22M
CF, CFQ, PCF	14	0.25	350	600	350		1 - 1M	1 - 22M
CF, CFQ	12	0.5	350	700	600		10 - 1M	1 - 22M
CF, CFQ	1	1	500	1000	600		1 - 1M	1 - 10M
CF, CFQ	2	2	500	1000	600		1 - 1M	1 - 10M

(1) Lesser of √(P*R) or maximum working voltage.

Electrical Specifications - CFM, CFQM, PCFM

Type/Code	Size	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%
CFM, CFQM	14	0.25	250	500	350	< 10Ω = ± 400 ppm/ºC 10Ω to 9.99KΩ = 0 ~ -400 ppm/ºC 10KΩ to 99KΩ = 0 ~ -500 ppm/ºC 100KΩ to 999KΩ = 0 ~ -850 ppm/ºC 1MΩ and above = 0 ~ -1500 ppm/ºC	1 - 1M	1 - 10M
CFM, CFQM PCFM	12	0.5	350	600	350		1 - 1M	1 - 10M
CFM, CFQM	1	1	600	1000	600		1 - 1M	1 - 10M

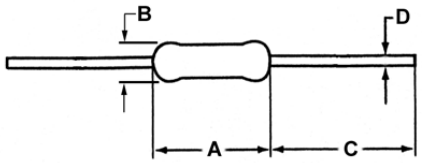
(1) Lesser of √(P*R) or maximum working voltage.

Electrical Specifications - CFF, CFFM

Type/Code	Size	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%
CFF	18	0.166	200	400	300	< 10Ω = ± 400 ppm/ºC 10Ω to 9.99KΩ = 0 ~ -400 ppm/ºC 10KΩ to 99KΩ = 0 ~ -500 ppm/ºC 100KΩ to 999KΩ = 0 ~ -850 ppm/ºC 1MΩ and above = 0 ~ -1500 ppm/ºC	1 - 2.2M
	14	0.25	300	600	500		1 - 5.1M
	12	0.5	350	700	500		1 - 5.1M
CFFM	14	0.25	250	500	300		1 - 2.2M
	12	0.5	300	600	500		1 - 2.2M

(1) Lesser of √(P*R) or maximum working voltage.

Mechanical Specifications



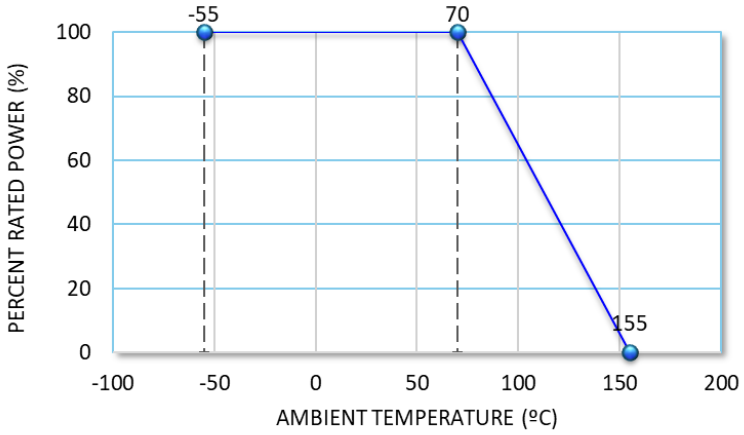
Type/Code	Size	A Body Length	B Body Diameter	C Lead Length (ref.)	D - Lead Diameter	Unit
CF	18	0.130 ± 0.012 3.30 ± 0.30	0.067 ± 0.012 1.70 ± 0.30	1.102 ± 0.118 28.00 ± 3.00	0.016 ± 0.003 0.40 ± 0.08	inches mm
CFQ	18	0.130 ± 0.012 3.30 ± 0.30	0.067 ± 0.012 1.70 ± 0.30	1.102 ± 0.118 28.00 ± 3.00	0.018 ± 0.003 0.45 ± 0.08	inches mm
CFF	18	0.126 ± 0.008 3.20 ± 0.20	0.073 ± 0.008 1.85 ± 0.20	1.102 ± 0.118 28.00 ± 3.00	0.018 ± 0.002 0.45 ± 0.05	inches mm
CF, CFF, CFQ, PCF	14	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	inches mm
CFFM	14	0.126 ± 0.008 3.20 ± 0.20	0.073 ± 0.008 1.85 ± 0.20	1.102 ± 0.118 28.00 ± 3.00	0.018 ± 0.002 0.45 ± 0.05	inches mm
CFM	14	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	inches mm
CFQM	14	0.130 ± 0.012 3.30 ± 0.30	0.067 ± 0.012 1.70 ± 0.30	1.102 ± 0.118 28.00 ± 3.00	0.018 ± 0.003 0.45 ± 0.08	inches mm
CF	12	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	inches mm
CFF, CFQ	12	0.335 ± 0.039 8.50 ± 1.00	0.106 ± 0.020 2.70 ± 0.50	1.102 ± 0.118 28.00 ± 3.00	0.028 ± 0.004 0.70 ± 0.10	inches mm
CFM, CFQM, CFFM	12	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	inches mm
CF, CFQ	1	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	inches mm
CFM, CFQM	1	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	inches mm
CF, CFQ	2	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	inches mm

Performance Characteristics

Test	Test Method	Typical Result			Test Limit		
Current Noise	MIL-STD 202, Method 308	1Ω ~ 91KΩ	100KΩ ~ 910KΩ	1MΩ ~ 22MΩ	1Ω ~ 91KΩ	100KΩ ~ 910KΩ	1MΩ ~ 22MΩ
		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% + 0.05Ω)		
Resistance to Soldering Heat	JIS C5201-1, IEC60115-1, 4.18	< ±0.3%			≤ ±(0.5% + 0.05Ω)		
Rapid Change of Temperature	JIS C5201-1, IEC60115-1, 4.19	< ±0.3%			≤ ±(1% + 0.05Ω)		
Endurance at 70°C	JIS C5201-1, IEC60115-1, 4.25.1	< ±1%			R < 100KΩ: ≤ ±(2% + 0.05Ω) R ≥ 100KΩ: ≤ ±(3% + 0.05Ω)		
Terminal Strength	MIL-STD 202, Method 211	< ±0.2%			≤ ±(0.5% + 0.05Ω)		
Damp Heat (Steady state)	JIS C5201-1, IEC60115-1, 4.24	< ±1.5%			R < 100KΩ: ≤ ±(3% + 0.05Ω) R ≥ 100KΩ: ≤ ±(5% + 0.05Ω)		

Operating temperature range is -55 to +155°C

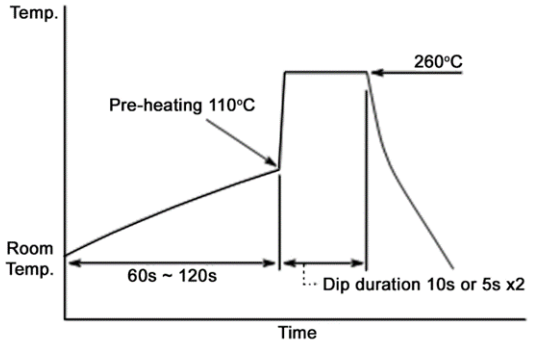
Power Derating Curve:



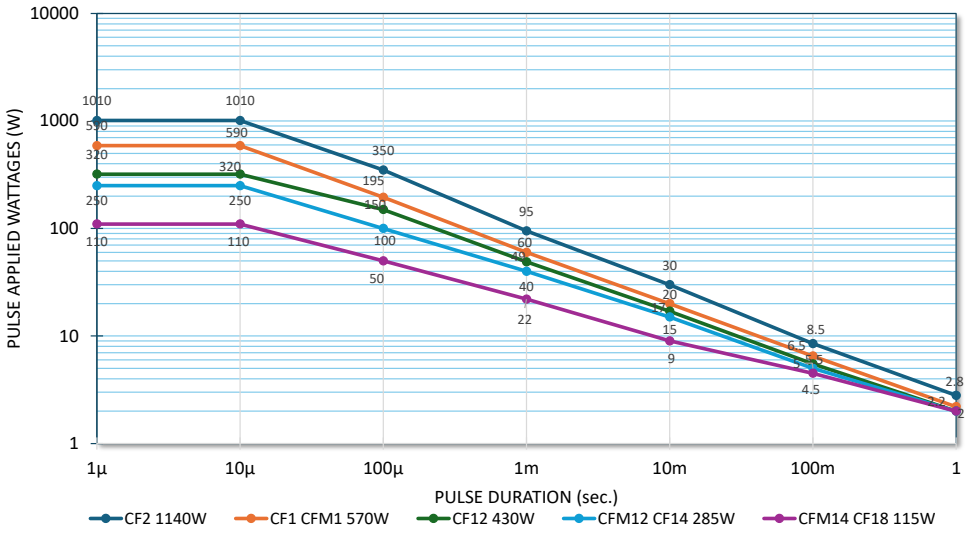
Recommended Soldering Condition

Flow Soldering:
- Pre-heating: 110°C MAX
- Peak temperature/duration: 260°C within 10 seconds (1st, 2nd wave total)
- Temperature profile (see chart on the right)

Iron Soldering:
- 380°C, 5 seconds, once/terminal



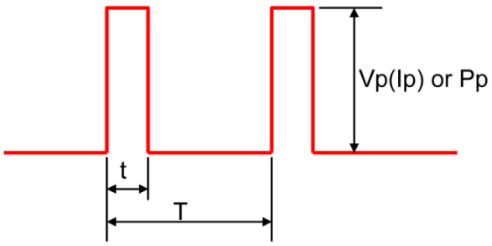
Single Pulse Power



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.

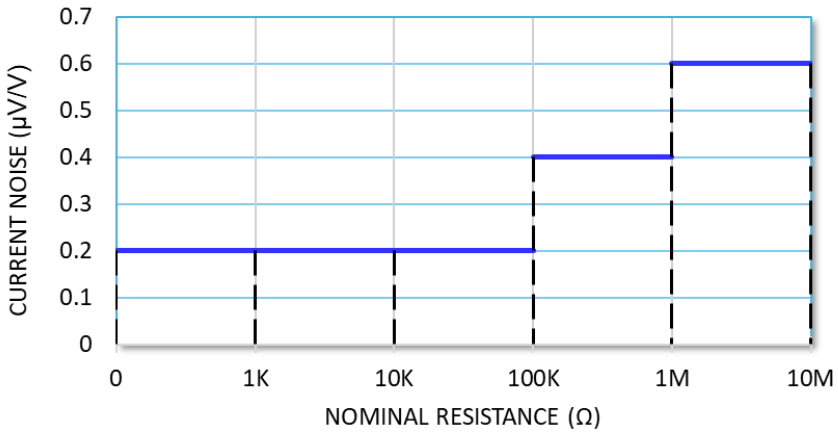
$$Vp = K\sqrt{P \times R \times T/t}$$
$$Ip = K\sqrt{P/R \times T/t}$$
$$Pp = K^2 \times P \times T/t$$



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)]

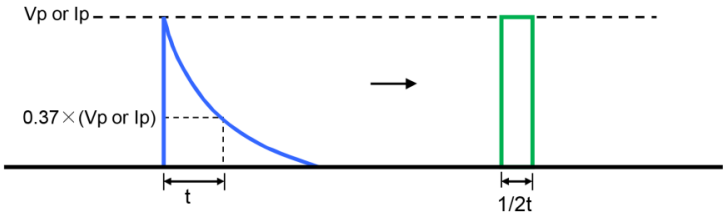
Note 1: If T > 10 → T = 10 (sec.), T / t > 1000 → T / t = 1000.
Note 2: If T > 10 and T / t > 1000, “Pulse Limiting power (single pulse) is applied.
Note 3: If Vp < Vr (Ip < Ir or Pp < P), Vr (Ir, P) is Vp (Ip, Pp).
Note 4: Pulse limiting voltage (Current, Wattage) is applied at less than rated ambient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

Current Noise

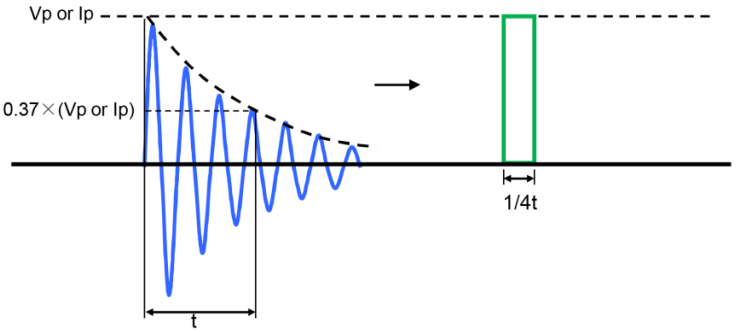


Waveform Transformation to Square Wave

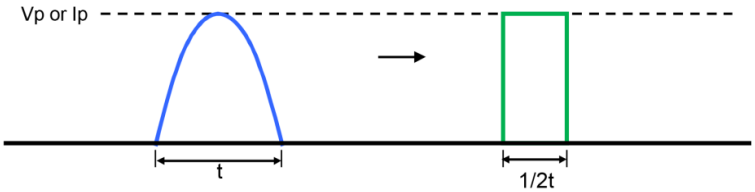
1. Discharge curve wave with time constant “t” → Square wave



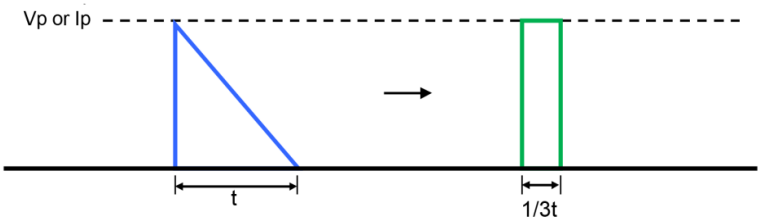
2. Damping oscillation wave with time constant of envelope “t” → Square wave



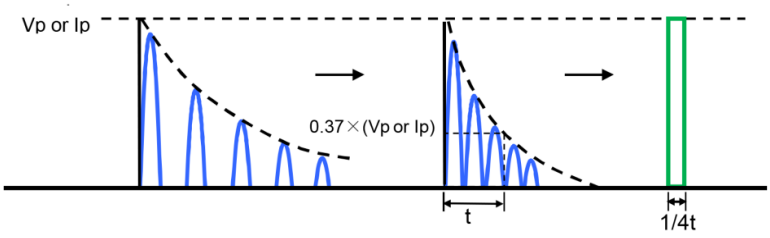
3. Half-wave rectification wave → Square wave



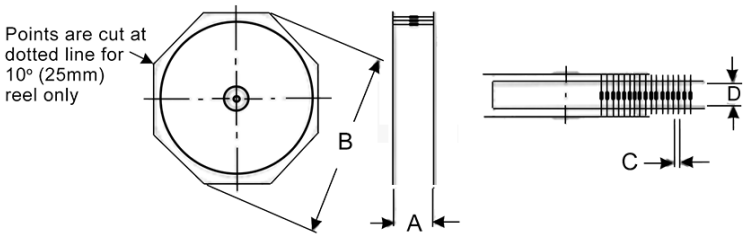
4. Triangular wave → Square wave



5. Special wave → Square wave



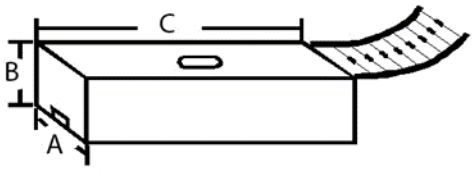
Reel Specifications



Type/Code	Size	Class	Tape	A Max (1).	B Max	C	D	Unit
CF, CFQ	18	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
CFF	18	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
CF, CFQ, CFF	14	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
CF, CFQ, CFF	12	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
CF, CFQ	1	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
CF, CFQ	2	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
CFM, CFQM, CFFM	14	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
CFM, CFQM, CFFM	12	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
CFM, CFQM	1	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

Packaging is per EIA-296.

Ammo Packaging Specifications

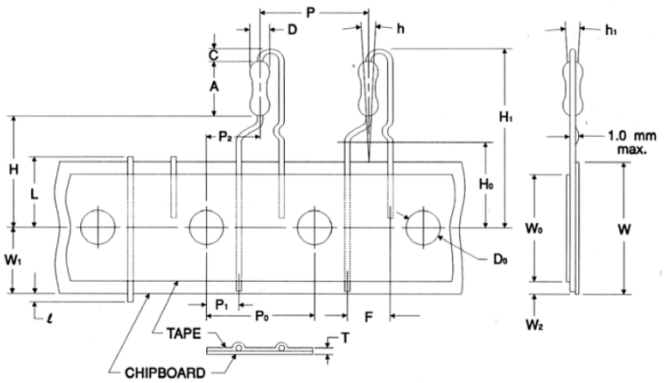


Type/Code	Size	A	B	C	Unit
CF, CFQ	16	2.953 ± 0.079 75.00 ± 2.00	2.756 ± 0.118 70.00 ± 3.00	10.039 ± 0.197 255.00 ± 5.00	inches mm
CF, CFQ	14	2.953 ± 0.079 75.00 ± 2.00	3.937 ± 0.118 100.00 ± 3.00	10.039 ± 0.197 255.00 ± 5.00	inches mm
CF, CFQ	12	2.953 ± 0.079 75.00 ± 2.00	2.756 ± 0.118 70.00 ± 3.00	10.039 ± 0.197 255.00 ± 5.00	inches mm
CFQ	2	2.953 ± 0.079 75.00 ± 2.00	3.543 ± 0.118 90.00 ± 3.00	10.039 ± 0.197 255.00 ± 5.00	inches mm

Ammo Packaging Specifications (cont.)

Type/Code	Size	A	B	C	Unit
CFM, CFQM	14	2.953 ± 0.079 75.00 ± 2.00	2.756 ± 0.118 70.00 ± 3.00	10.039 ± 0.197 255.00 ± 5.00	inches mm
CFM, CFQM	12	2.953 ± 0.079 75.00 ± 2.00	3.937 ± 0.118 100.00 ± 3.00	10.039 ± 0.197 255.00 ± 5.00	inches mm
CFQ, CFQM	1	2.953 ± 0.079 75.00 ± 2.00	2.953 ± 0.118 75.00 ± 3.00	10.039 ± 0.197 255.00 ± 5.00	inches mm

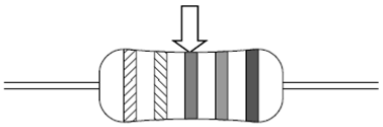
Radial Lead Taping Specifications (Pana-Sert PCF14)

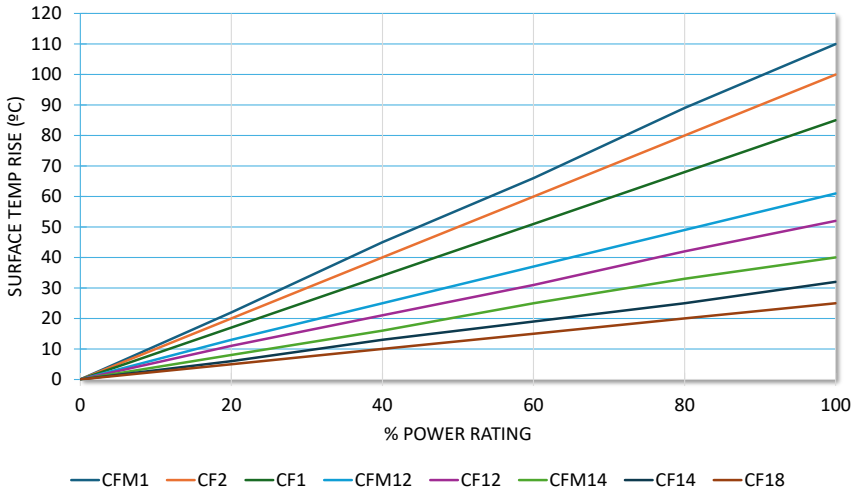


Symbol	Description	PANA-SERT	Unit	Symbol	Description	PANA-SERT	Unit
A	Resistor body length	0.256 ± 0.020 6.50 ± 0.50	inches mm	L	Cutout Length	0.433 max. 11.00 max.	inches mm
C	Height of bending	0.098 ± 0.020 2.50 ± 0.50	inches mm	P	Resistor pitch	0.500 ± 0.039 12.70 ± 1.00	inches mm
D	Resistor body diameter	0.091 ± 0.008 2.30 ± 0.20	inches mm	P_0	Sprocket-hole pitch	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	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	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				

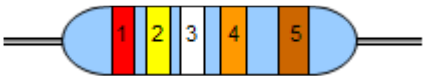
Surface Temperature Rise

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

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	-

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	Carbon Film Resistor (Mini)	Axial	YES	100% Matte Sn	Jan-04 (Taiwan, China)	04/01
CFF	Carbon Film Resistor (Flameproof)	Axial	YES	100% Matte Sn	Jan-04 (Taiwan, China)	04/01
CFFM	Carbon Film Resistor (Flameproof - mini)	Axial	YES	100% Matte Sn	Jan-04 (Taiwan, China)	04/01
PCF	Carbon Film Resistor (Panasert CF14)	Axial	YES	100% Matte Sn	Jan-04 (Taiwan, China)	04/01
PCFM	Carbon Film Resistor (Panasert CFM12)	Axial	YES	100% Matte Sn	Jan-04 (Taiwan, China)	04/01
CFQ	Carbon Film Resistor (Tin Plating on Copper Wire)	Axial	YES	100% Matte Sn	Jan-04 (Taiwan, China)	04/01
CFQM	Carbon Film Resistor (Tin Plating Mini on Copper Wire)	Axial	YES	100% Matte Sn	Jan-04 (Taiwan, China)	04/01
PCFQ	Carbon Film Resistor (Tin Plating on Copper Wire - Panasert)	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

C	F	1	2	J	T	1	0	0	K

Product Series	
Code	Description
CF	Standard
CFM	Mini
CFF	Flameproof
CFFM	Flameproof (mini)
PCF	Panasert CF14
PCFM	Panasert CFM12
CFQ	Tin plating on copper wire
CFQM	Tin plating (mini)
PCFQ	Tin plating on copper wire Panasert

Power Rating	
Code	W
18	0.125
CFF18	0.166
14	0.25
12	0.5
1	1
2	2

Tolerance	
Code	Tol
G	2%
J	5%

Packaging			
Code	Description	Product Code	Qty(*)
T	Tape and Reel	CF18, CFQ18, CFF18 CF14, CFM14, CFF14, CFFM14 CFQ14, CFQM14 CF12, CFM12, CFF12, CFFM12 CFQ12, CFQM12	5000
		CFM1, CFQM1, PCF14, PCFM12	2500
		CF1, CFQ1	2000
		CF2, CFQ2	1000
A	Ammo	CF18, CFQ18, CFF18 CF14, CFF14, CFFM14, CFM14 CFQ14, CFQM14 CFM12, CFFM12, CFQM12	5000
		CF12, CFF12, CFQ12, PCFM12 CF1, CFM1, CFQ1, CFQM1 PCF14	2000
		CF2	1000

(*) Unpopular values may be subject to MOQ higher than SPQ.

Resistance Value
Four characters with the multiplier used as the decimal holder.
10 ohm = 10R0 10.2 Kohm = 10K2 1 Mohm = 1M00