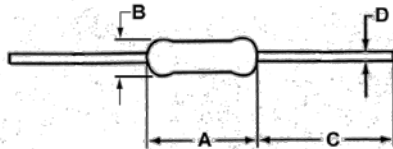


- Features:
- General purpose resistor ideal for commercial/industrial applications
 - Flame retardant coatings standard
 - Flameproof version available as CFF
 - Panasert available on selected sizes; contact factory
 - Auto sequencing/insertion compatible
 - CFM (mini) ideal choice when size constraints apply
 - Cut and formed product is available on select sizes; contact factory
 - 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



Electrical Specifications							
Type / Code	Power Rating (Watts) @ 70°C	Maximum Working Voltage (1)	Maximum Overload Voltage	Dielectric Withstanding Voltage	Resistance Temperature Coefficient per Ohmic Range	Ohmic Range (Ω) and Tolerance	
						2%	5%
CF18	0.125W	250V	500V	350V	<10Ω = ±400ppm/°C 10Ω to 9.99KΩ = 0 ~ -400ppm/°C 10KΩ to 99KΩ = 0 ~ -500ppm/°C 100KΩ to 999KΩ = 0 ~ -850ppm/°C 1MΩ and above = 0 ~ -1500ppm/°C	10 - 1M	1 - 22M
CF14	0.25W	350V	600V	350V		1 - 1M	
CF12	0.5W	350V	700V	600V		10 - 1M	
CF1	1W	500V	1,000V	600V		1 - 1M	1 - 10M
CF2	2W	500V	1,000V	600V			
CFM14	0.25W	250V	500V	350V			
CFM12	0.5W	350V	600V	350V			
CFM1	1W	600V	1,000V	600V			

(1) Lesser of $\sqrt{\text{PR}}$ or maximum working voltage.

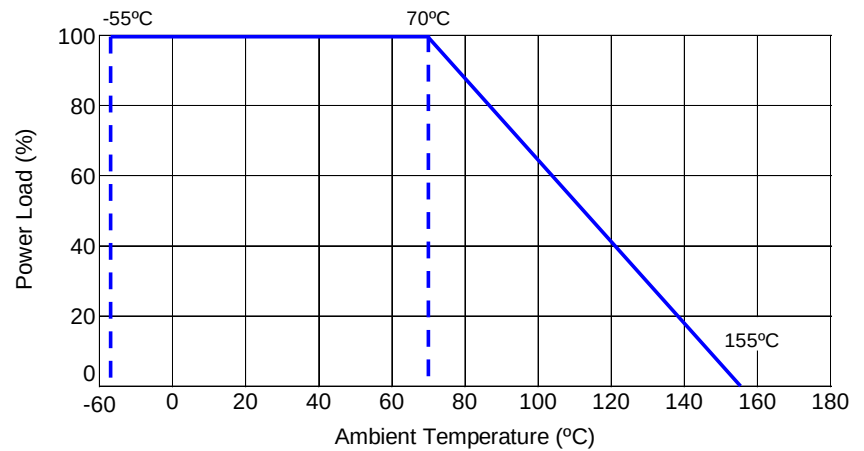


Mechanical Specifications					
Type / Code	A Body Length	B Body Diameter	C Lead Length(Bulk)	D Lead Diameter	Unit
CF18	0.130 ± 0.012	0.067 ± 0.012	1.102 ± 0.118	0.018 ± 0.003	inches
	3.30 ± 0.30	1.70 ± 0.30	28.00 ± 3.00	0.45 ± 0.08	mm
CF14	0.236 ± 0.012	0.091 ± 0.012	1.102 ± 0.118	0.022 ± 0.003	inches
	6.00 ± 0.30	2.30 ± 0.30	28.00 ± 3.00	0.55 ± 0.08	mm
CF12	0.335 ± 0.039	0.106 ± 0.020	1.102 ± 0.118	0.028 ± 0.002	inches
	8.50 ± 1.00	2.70 ± 0.50	28.00 ± 3.00	0.70 ± 0.05	mm
CF1	0.433 ± 0.039	0.177 ± 0.020	1.181 ± 0.118	0.028 ± 0.002	inches
	11.00 ± 1.00	4.50 ± 0.50	30.00 ± 3.00	0.70 ± 0.05	mm
CF2	0.591 ± 0.039	0.197 ± 0.020	1.339 ± 0.157	0.028 ± 0.002	inches
	15.00 ± 1.00	5.00 ± 0.50	34.00 ± 4.00	0.70 ± 0.05	mm
CFM14	0.130 ± 0.012	0.067 ± 0.012	1.102 ± 0.118	0.018 ± 0.003	inches
	3.30 ± 0.30	1.70 ± 0.30	28.00 ± 3.00	0.45 ± 0.08	mm
CFM12	0.236 ± 0.012	0.091 ± 0.012	1.102 ± 0.118	0.022 ± 0.003	inches
	6.00 ± 0.30	2.30 ± 0.30	28.00 ± 3.00	0.55 ± 0.08	mm
CFM1	0.354 ± 0.020	0.138 ± 0.020	1.102 ± 0.118	0.028 ± 0.002	inches
	9.00 ± 0.50	3.50 ± 0.50	28.00 ± 3.00	0.70 ± 0.05	mm

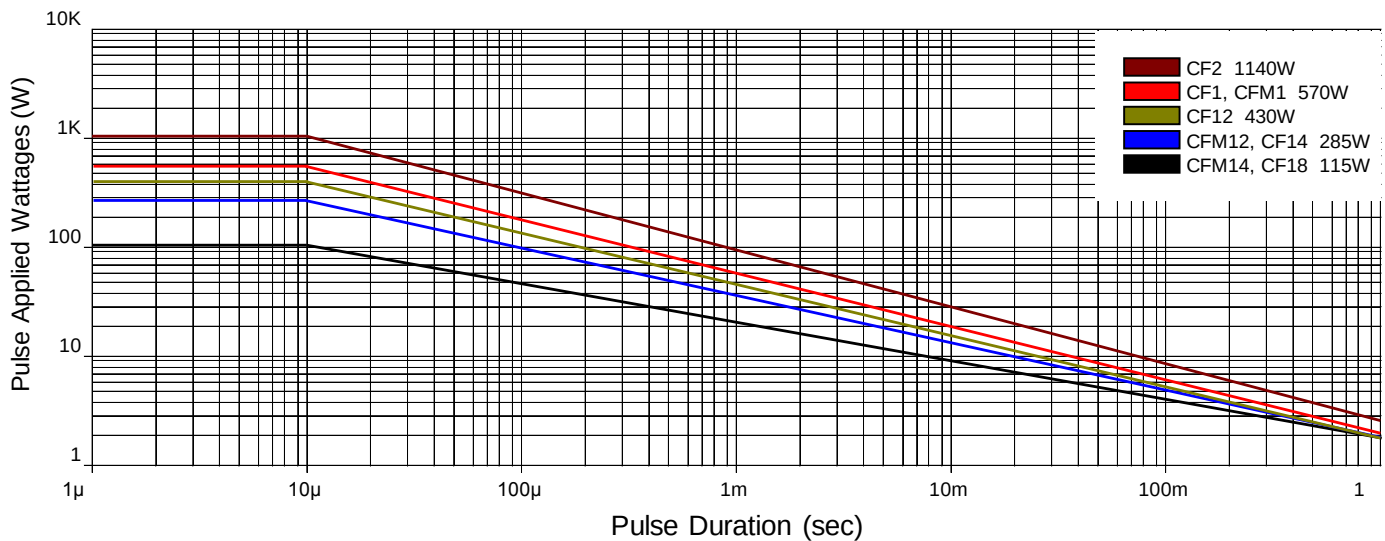
Performance Characteristics							
Test	Standard / Method	Typical Results			Test Limits		
Current Noise	MIL-STD 202, Method 308	1 Ω ~ 91K Ω	100K Ω ~ 910K Ω	1M Ω ~ 22M Ω	1 Ω ~ 91K Ω	100K Ω ~ 910K Ω	1M Ω ~ 22M Ω
		0.15 μ V/V	0.32 μ V/V	0.54 μ V/V	0.2 μ V/V	0.4 μ V/V	0.6 μ V/V
Short Time Overload	JIS C5201-1, IEC60115-1, 4.13	< $\pm$ 0.25%			$\leq \pm$ (0.75% + 0.05 Ω)		
Resistance to Solder Heat	JIS C5201-1, IEC60115-1, 4.18	< $\pm$ 0.3%			$\leq \pm$ (0.50% + 0.05 Ω)		
Rapid Change of Temperature	JIS C5201-1, IEC60115-1, 4.19	< $\pm$ 0.3%			$\leq \pm$ (1.00% + 0.05 Ω)		
Endurance at 70°C	JIS C5201-1, IEC60115-1, 4.25.1	< $\pm$ 1.0%			R<100K Ω : $\leq \pm$ (2.0% + 0.05 Ω) R $\geq$ 100K Ω : $\leq \pm$ (3.0% + 0.05 Ω)		
Terminal Strength	MIL-STD 202, Method 211	< $\pm$ 0.20%			$\leq \pm$ (0.50% + 0.05 Ω)		
Damp Heat (Steady state)	JIS C5201-1, IEC60115-1, 4.24	< $\pm$ 1.5%			R<100K Ω : $\leq \pm$ (3.0% + 0.05 Ω) R $\geq$ 100K Ω : $\leq \pm$ (5.0% + 0.05 Ω)		

Operating Temperature Range: -55°C to +155°C

Power Derating Curve:



Single Pulse Power:



Typical performance for reference only.

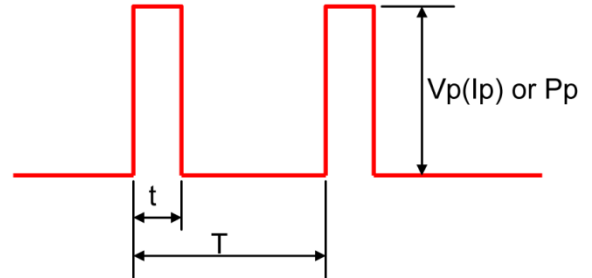
Repetitive Pulse Data:

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.

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

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

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



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 by resistors type (refer to below matrix)
- [Vr: Rated Voltage (V), Ir: Rated Current (A)]

Note 1: If $T > 10 \rightarrow T = 10$ (sec), $T/t > 1000 \rightarrow T/t = 1000$

Note 2: If $T > 10$ and $T/t > 1000$, “Pulse Limiting power (Single pulse) is applied

Note 3: If $V_p < V_r$ ($I_p < I_r$ or $P_p < P$), V_r (I_r , P) is V_p (I_p , P_p)

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°), please decrease power rating according to “Power Derating Curve”

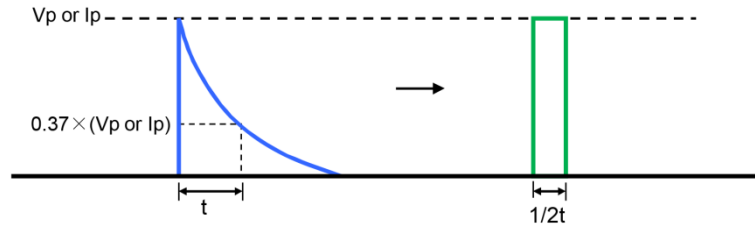
Note 5: Please assure sufficient margin for use period and conditions for “Pulse limiting voltage”

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”.

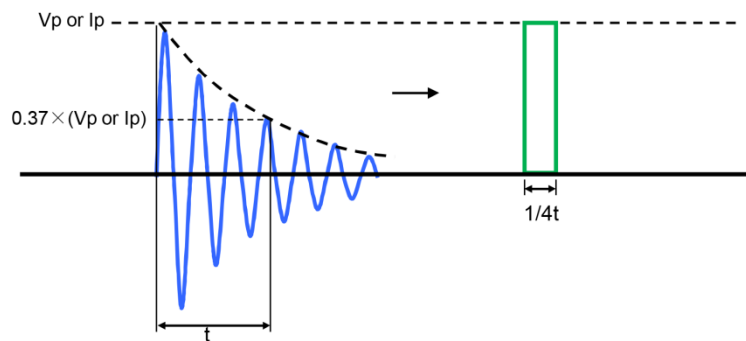
Coefficient (K) Matrix	
Resistor Type	K
RNF, RNMF	0.7
CF, CFM, HDM	0.8
ASR, SPR, ASRM, SPRM	1.0
RSPF, RSPL	0.9
RSF, RSMF	0.8
FRN	0.6

Waveform Transformation to Square Wave

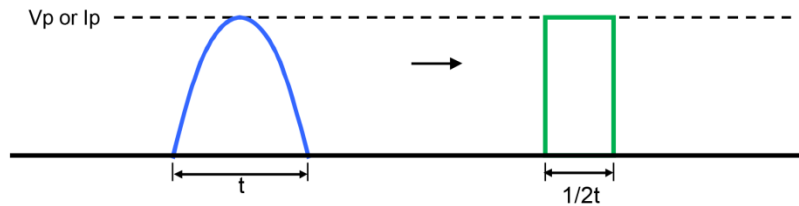
1. Discharge curve wave with time constant "t" → Square wave



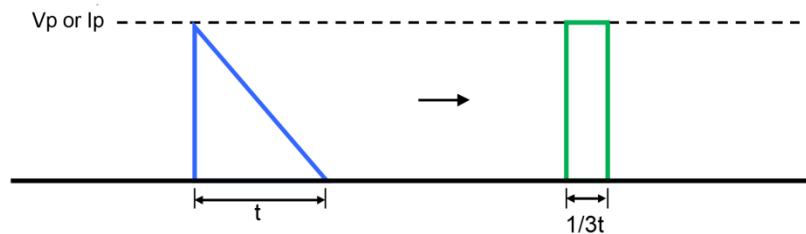
2. Damping oscillation wave with time constant of envelope "t" → Square wave



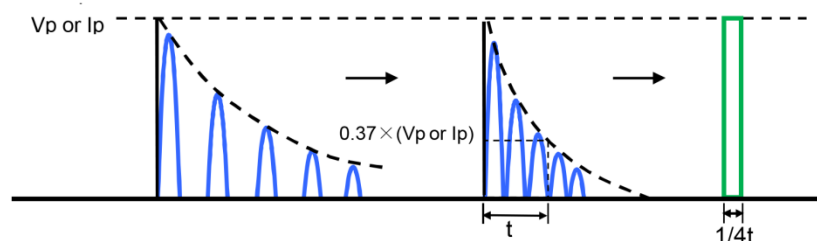
3. Half-wave rectification wave → Square wave



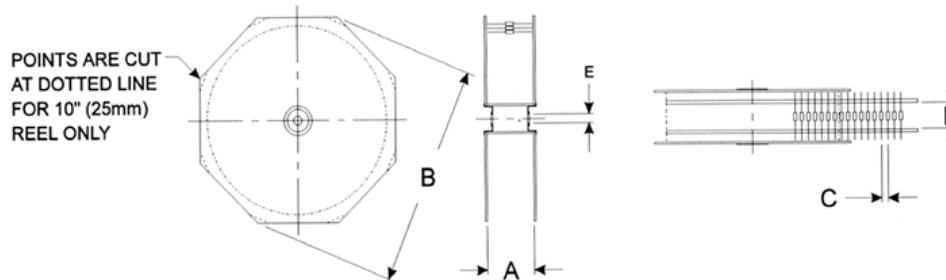
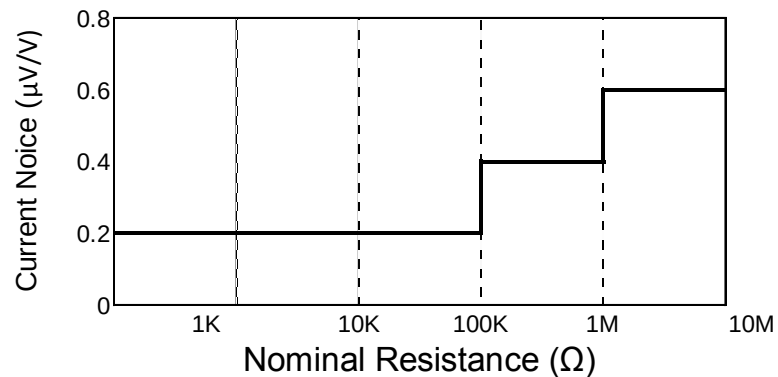
4. Triangular wave → Square wave



5. Special wave → Square wave



Current Noise:



Lead-Tape Specifications: Reeled in accordance with EIA-296-F

Type / Code	Qty per Reel	A max.(1)		B max		C		D(2)		Tape		Class
		inches	mm	inches	mm	inches	mm	inches	mm	inches	mm	
CF18, CFM14	5,000	2.508	63.70	13.504	343.00	0.197 ± 0.020	5.00 ± 0.50	2.063 + 0.079 / -0.039	52.40 + 2.00 / -1.00	0.250	6.35	I
CF14, CFM12	5,000	2.638	67.00	13.504	343.00	0.197 ± 0.020	5.00 ± 0.50	2.063 + 0.079 / -0.039	52.40 + 2.00 / -1.00	0.250	6.35	I
CF12, CFM1	5,000	2.736	69.50	13.504	343.00	0.197 ± 0.020	5.00 ± 0.50	2.063 + 0.079 / -0.039	52.40 + 2.00 / -1.00	0.250	6.35	I
CF1	2,000	2.972	75.50	13.504	343.00	0.197 ± 0.020	5.00 ± 0.50	2.063 + 0.079 / -0.039	52.40 + 2.00 / -1.00	0.250	6.35	I
CF2	1,000	3.130	79.50	13.504	343.00	0.394 ± 0.020	10.00 ± 0.50	2.063 + 0.079 / -0.039	52.40 + 2.00 / -1.00	0.250	6.35	I

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)

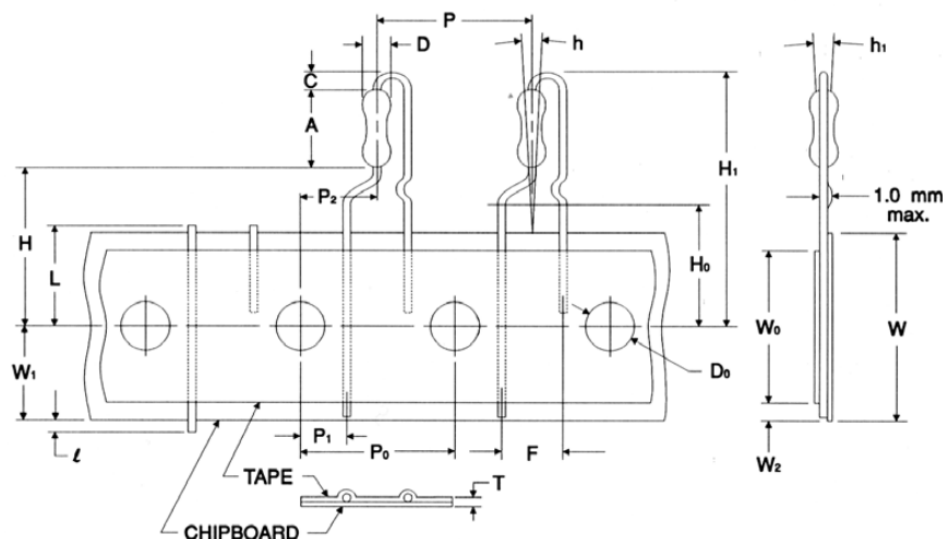
(1) Reference value only. The "A" dimension shall be governed by the overall length of the taped component.

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 26mm narrow spacing is available as option "N" packaging code.

Contact factory for more details.

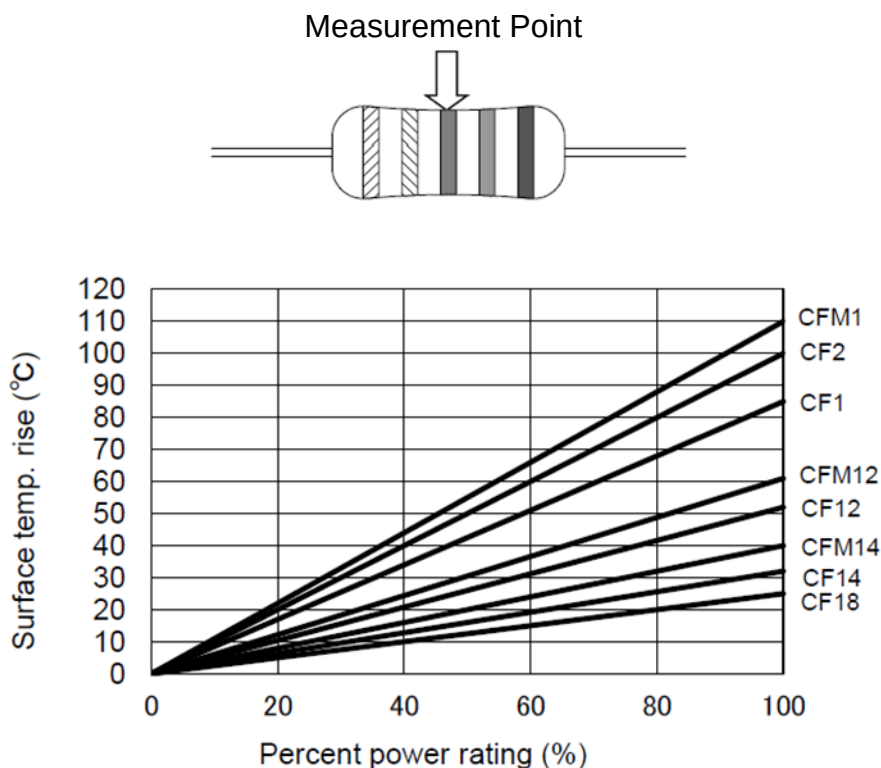
Radial Lead Taping Specification – Pana-Sert (PCF14)



Symbol	Description	PANA-SERT	Unit
A	Resistor body length	0.256 ± 0.020 6.50 ± 0.50	inches mm
C	Height of bending	0.098 ± 0.020 2.50 ± 0.50	inches mm
D	Resistor body diameter	0.091 ± 0.008 2.30 ± 0.20	inches mm
D ₀	Sprocket-hole diameter	0.157 ± 0.012 4.00 ± 0.30	inches mm
F	Resistor lead spacing	0.197 ± 0.039 5.00 ± 1.00	inches mm
H	Height to bottom of resistor	0.748 ± 0.039 19.00 ± 1.00	inches mm
H ₀	Height to lead clinch	0.630 ± 0.020 16.00 ± 0.50	inches mm
H ₁	Height of resistor	1.122 max. 28.50 max.	inches mm
h	Resistor alignment	0 ± 0.079 (0±5°) 0 ± 2.00 (0±5°)	inches mm
h ₁	Resistor alignment	0 ± 0.079 (0±5°) 0 ± 2.00 (0±5°)	inches mm
l	Lead protrusion	0.079 max. 2.00 max.	inches mm

Symbol	Description	PANA-SERT	Unit
L	Cutout Length(1)	0.433 max. 11.00 max.	inches mm
P	Resistor pitch(1)	0.500 ± 0.039 12.70 ± 1.00	inches mm
P ₀	Sprocket-hole pitch(1)	0.500 ± 0.012 12.70 ± 0.30	inches mm
P ₁	Sprocket-hole center to lead center	0.152 ± 0.028 3.85 ± 0.70	inches mm
P ₂	Sprocket-hole center to resistor center(1)	0.250 ± 0.051 6.35 ± 1.30	inches mm
T	Thickness (chipboard and tape)	0.028 ± 0.008 0.70 ± 0.20	inches mm
W	Chipboard width(1)	0.709 + 0.039 / -0.020 18.00 + 1.00 / -0.50	inches mm
W ₀	Hold-down tape width	0.49 min. 12.50 min.	inches mm
W ₁	Sprocket-hole position	0.354 + 0.030 / -0.020 9.00 + 0.75 / -0.50	inches mm
W ₂	Hold-down tape position	0.118 max. 3.00 max.	inches mm

Surface Temperature Rise:



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	Size	Power Rating	Tolerance	Code	Description	Size	Quantity	Resistance Value
CF	Standard	18 0.125W	Code Tol	B	Bulk	CF18, CFM14, CF14, CFM12 CF12, CFM1, CF1, CF2	1,000	Four characters with the multiplier used as the decimal holder.
CFF	Flameproof	14 0.25W	G 2%					
CFM	Mini	12 0.5W	J 5%					
PCF	Panasert CF14	1 1W		T	Tape and Reel	CF18, CFM14, CF14, CFM12, CF12, PCF14, PCFM12	5,000	
PCFM	Panasert CF12	2 2W				CFM1	2,500	10 ohm = 10R0
CFQ	Tin plating on copper wire					CF1	2,000	10.2 Kohm = 10K2
CFQM	Tin plating (mini)					CF2	1,000	1 Mohm = 1M00
PCFQ	Tin plating on copper wire Panasert			A	Ammo	CF18, CFM14, CF14, CFM12 CF12, CFM1, PCF14, PCFM12	5,000 2,000	
						CF1, CF2	1,000	