

# FPR 2-T218

Precision Shunt Resistors

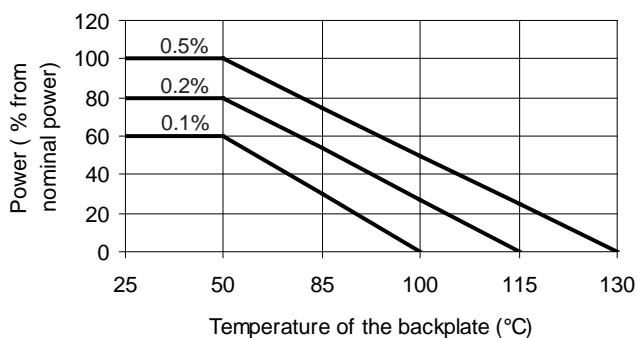


- Resistances from 0.002Ohm to 50Ohms
- Power Rating to 30Watt
- Resistance Tolerances to  $\pm 0.25\%$
- TCR to  $\pm 15\text{ppm/K}$
- Load Stability to 0.1%
- TO-218 (TO-247) Housing

## SPECIFICATIONS

Type	FPR 2-T218
Resistance Range	0.002 to 50 Ohms
Power rating free air 70°C with heatsink	2 W 30 W
Thermal Resistance Rthj-c	2.5 K/W
Tolerances from 0.002 Ohms from 0.01 Ohms from 0.02 Ohms	1% / 2% / 5% 0.5% / 1% / 2% / 5% 0.25% / 0.5% / 1% / 2% / 5%
Stability	0.1% / 0.2% / 0.5% (depends on stress)
Temperature Coefficient	R > 0.2 Ohms $\pm 15\text{ppm/K}$ (20 to 60°C) R $\leq$ 0.2 Ohms TCR see table A next page
Voltage Proof	300 VDC
Thermal EMF	< 0.1 $\mu\text{V/K}$
Operating Temperature Range	-40 to 130°C
Resistor Material	CuNiMn-Foil
Substrate	anodized aluminium
Housing	PPS
Connector Material	Cu tinned
Terminals	2
Max. Torque	1 Nm

## Derating



### Power Rating Notes -

The FPR Series Resistors must be attached to a suitable heat-sink. The maximum internal resistor temperature is 130°C.

To specify an appropriate heatsink use the following formula :

$$R_{0H} = \frac{T_{MAX} - (P \times R_{0R}) - T_A}{P}$$

Where:  $R_{0H}$  = Thermal Resistance of Heatsink ( K/W )  
 $R_{0R}$  = Thermal Resistance of Resistor ( K/W )  
 $T_{MAX}$  = Maximum Temperature of Resistor  
 $T_A$  = Ambient Temperature of Heatsink ( °C )  
 $P$  = Power Through Resistor ( W )

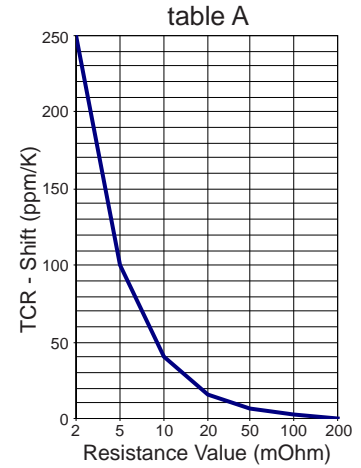
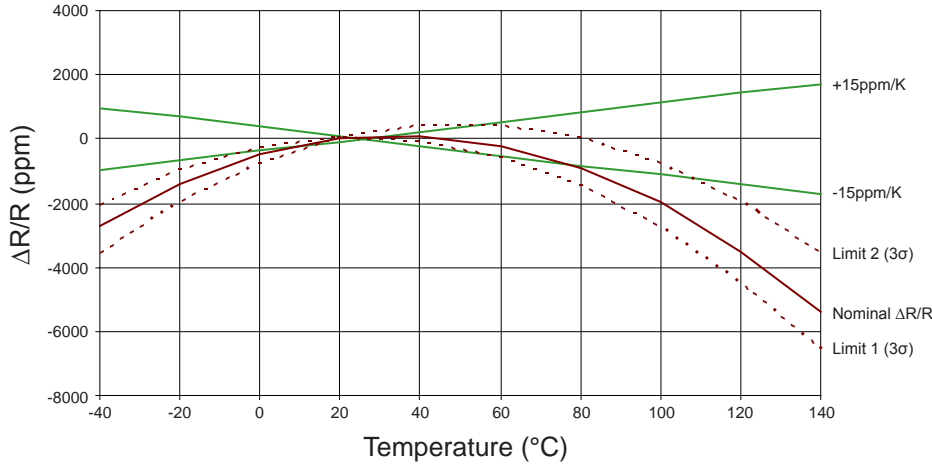
## Ordering Information

Part Number - Resistance - Contact - Tolerance

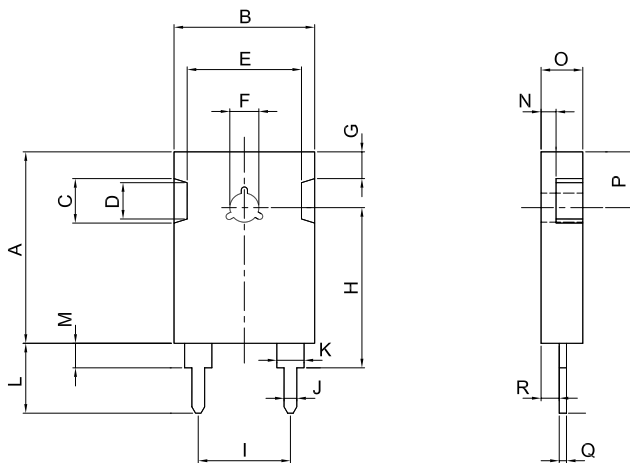
FPR 2-T218 0.068 Ohms A 0.5%

**SPECIFICATIONS** (continued)

**Temperature Coefficient**



**Dimensions**



Dimension	mm	tol. (±mm)	inches	tol. (±inches)
A	21.10	0.2	0.83	0.008
B	15.50	0.2	0.61	0.008
C	4.90	0.1	0.19	0.004
D	4.00	0.1	0.16	0.004
E	12.60	0.2	0.50	0.008
F	∅3.2	0.1	∅0.13	0.004
G	2.95	0.1	0.12	0.004
H (A-Contact)	17.65	0.2	0.69	0.008
H (B-Contact)	16.85	0.2	0.66	0.008
H (C-Contact)	17.75	0.2	0.70	0.008
I	10.16	0.2	0.40	0.008
J	1.40	0.1	0.06	0.004
K	3.00	0.1	0.12	0.004
L (A-Contact)	7.70	0.2	0.30	0.008
L (B-Contact)	5.00	0.2	0.20	0.008
L (C-Contact)	14.50	0.2	0.57	0.008
M (A-Contact)	2.70	0.1	0.11	0.004
M (B-Contact)	1.90	0.1	0.07	0.004
M (C-Contact)	2.80	0.1	0.11	0.004
N	1.65	0.1	0.06	0.004
O	4.60	0.1	0.18	0.004
P	6.15	0.2	0.24	0.008
Q	0.80	0.1	0.03	0.004
R	2.00	0.1	0.08	0.004



- Resistances from 0.001 Ohm to 500 Ohms
- Power Rating to 2500 Watt
- Resistance Tolerances to  $\pm 0.1\%$
- TCR to  $\pm 15\text{ppm/K}$
- Load Stability to 0.1%
- Very Low Inductance ( $< 50\text{nH}$ )

### SPECIFICATIONS

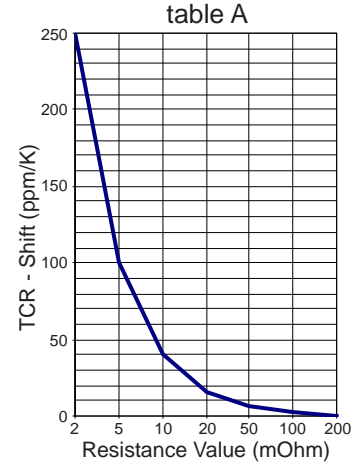
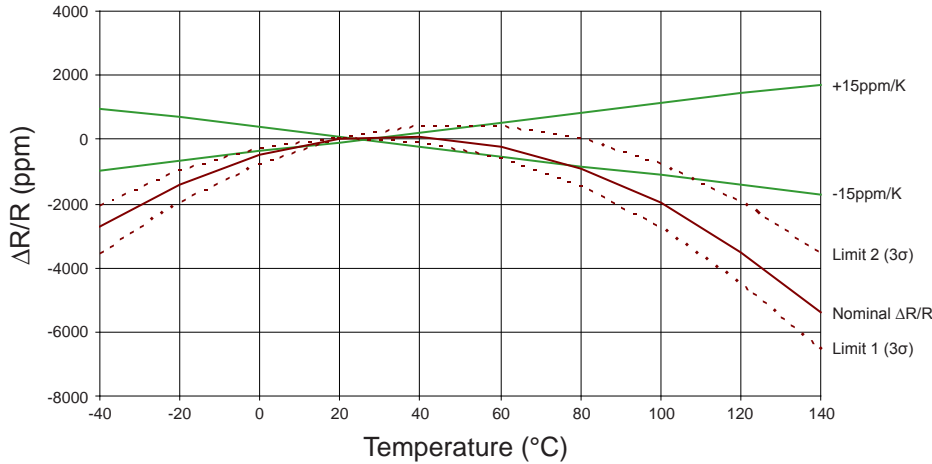
Type	8065	80110	80216	80320	80370
Resistance Range	0.001 to 400 Ohms	0.001 to 500 Ohms			
Power rating free air 25°C with heatsink	24 W 350 W	32 W 600 W	60 W 1200 W	80 W 2000 W	90 W 2500 W
Thermal Resistance Rthj-c	0.16 K/W	0.09 K/W	0.04 K/W	0.026 K/W	0.022 K/W
Tolerances (4 terminal version) from 0.001 Ohms from 0.01 Ohms from 0.02 Ohms	0.5% / 1% / 2% / 5% 0.25% / 0.5% / 1% / 2% / 5% 0.1% / 0.25% / 0.5% / 1% / 2% / 5%				
Tolerances (2 terminal version)	0.5% / 1% / 2% / 5%				
Stability	0.1% / 0.2% / 0.5% (depends on stress)				
Temperature Coefficient (4 terminal version)	$\pm 15\text{ppm/K}$ (20 to 60°C) from $R \leq 0.02$ Ohms $\pm 20\text{ppm/K}$ (20 to 60°C) from $R \leq 0.01$ Ohms $\pm 30\text{ppm/K}$ (20 to 60°C)				
Temperature Coefficient (2 terminal version)	$\pm 15\text{ppm/K}$ (20 to 60°C) $\pm 50\text{ppm/K}$ (-40 to 130°C) $R \leq 0.2$ Ohms TCR see table A next page				
Max. Current	60 A upon request special cable up to 250 A				
Inductivity	$< 50$ nH				
Capacity against housing	500 pF	850 pF	1.7 nF	2.5 nF	2.9 nF
Insulation Strength	1.5 kVDV (higher upon request)				
Thermal EMF	$< 0.1\mu\text{V/K}$				
Operating Temperature Range	-40 to 130°C				
Resistor Material	CuNiMn-Foil				
Substrate	anodized aluminium				
Housing	anodized aluminium				
Connector Material	Cu-Cable / 4mm <sup>2</sup> / 500mm length (other upon request / AWG possible)				
Terminals	2 or 4				

### Ordering Information

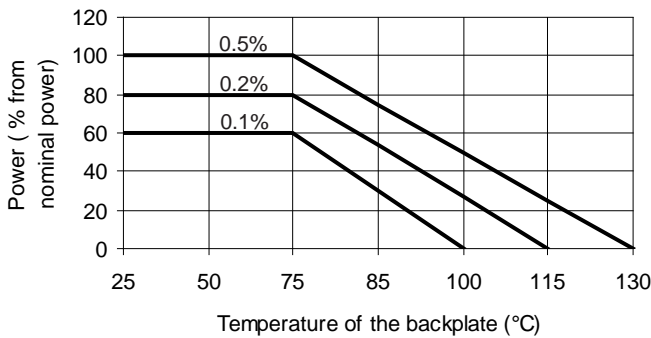
Part Number - Resistance - Contact - Tolerance  
FHR 4-80216 1.0 Ohms D 1%

**SPECIFICATIONS** (continued)

**Temperature Coefficient**



**Derating**



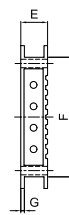
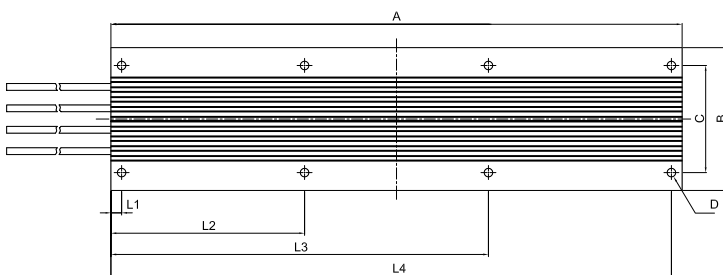
**Power Rating Notes -**

The FHR Series Resistors must be attached to a suitable heat-sink. The maximum internal resistor temperature is 130°C. To specify an appropriate heatsink use the following formula :

$$R_{0H} = \frac{T_{MAX} - (P \times R_{0R}) - T_A}{P}$$

Where:  $R_{0H}$  = Thermal Resistance of Heatsink ( K/W )  
 $R_{0R}$  = Thermal Resistance of Resistor ( K/W )  
 $T_{MAX}$  = Maximum Temperature of Resistor  
 $T_A$  = Ambient Temperature of Heatsink ( °C )  
 $P$  = Power Through Resistor ( W )

**Dimensions**



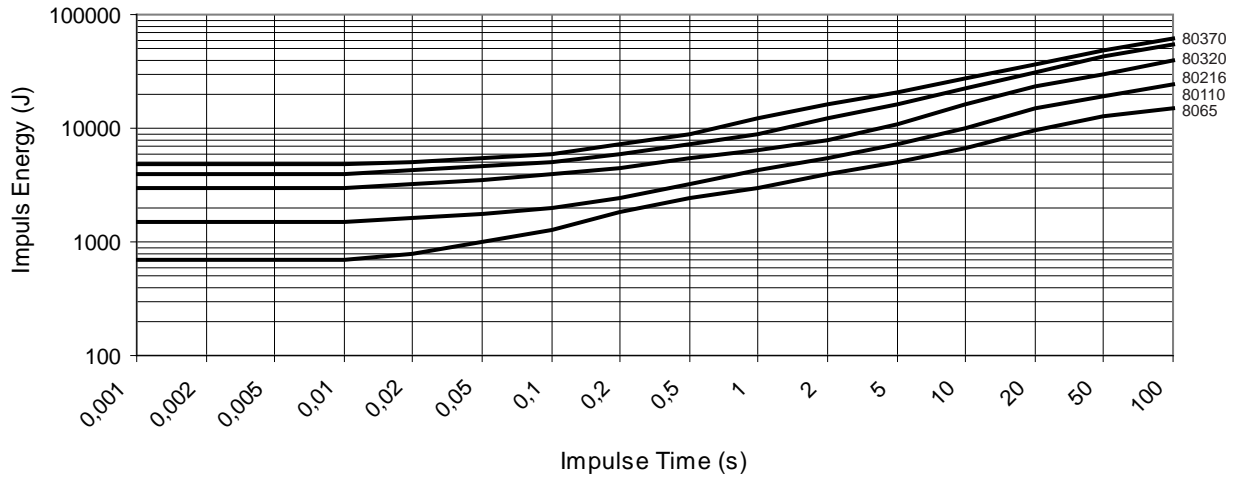
Dimension	mm	tol. (±mm)	inches	tol. (±inches)
B	80.00	0.3	3.15	0.012
C	60.00	0.3	2.36	0.012
D	Ø4.75	0.2	Ø0.19	0.008
E	15.00	0.2	0.59	0.008
F	67.00	0.3	2.64	0.012
G	2.00	0.1	0.08	0.004

Dimension	8065 mm	80110 mm	80216 mm	80320 mm	80370 mm	tol. (±mm)	8065 inches	80110 inches	80216 inches	80320 inches	80370 inches	tol. (±inches)
A	65.00	110.00	216.00	320.00	370.00	0.3	2.56	4.33	8.50	12.60	14.57	0.012
L1	6.00	6.00	6.00	6.00	6.00	0.3	0.24	0.24	0.24	0.24	0.24	0.012
L2	59.00	104.00	108.00	108.50	125.50	0.3	2.32	4.09	4.25	4.27	4.94	0.012
L3			210.00	211.50	244.50	0.3			8.27	8.33	9.63	0.012
L4				314.00	364.00	0.3				12.36	14.33	0.012

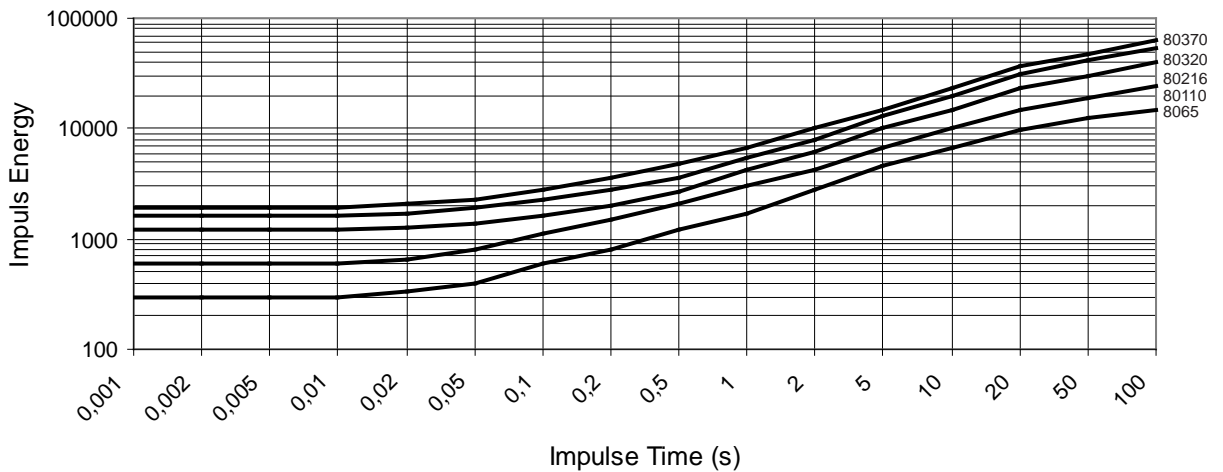
**SPECIFICATIONS** (continued)

**Stability against Impulses**  
Reference values without heatsink

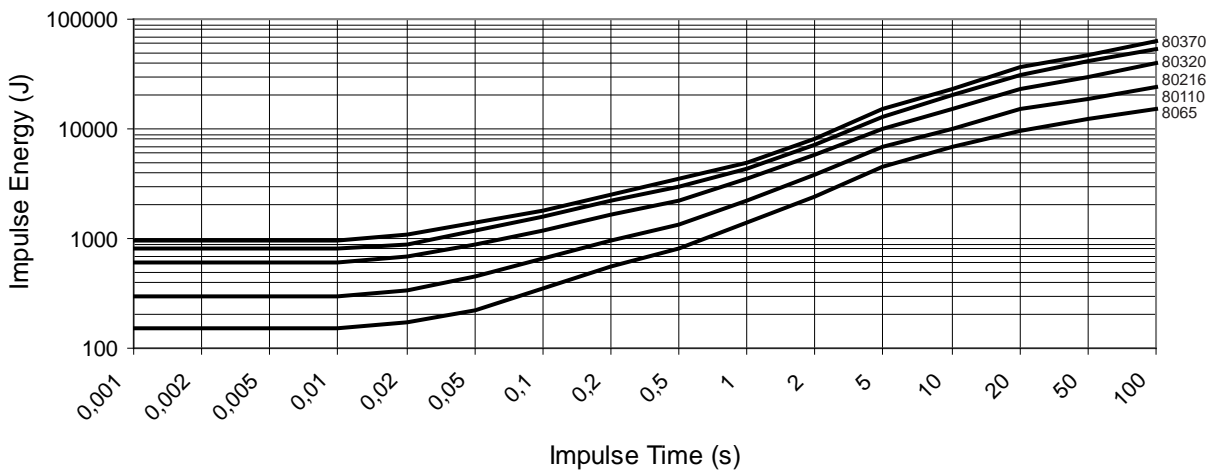
Resistance value R001 to R002



Resistance value R002 to R005



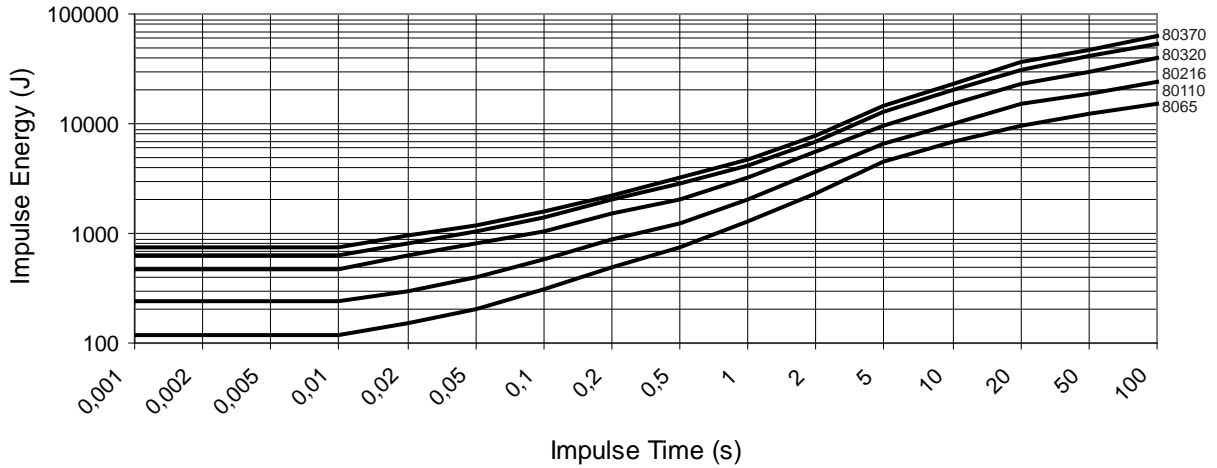
Resistance value R005 to R01



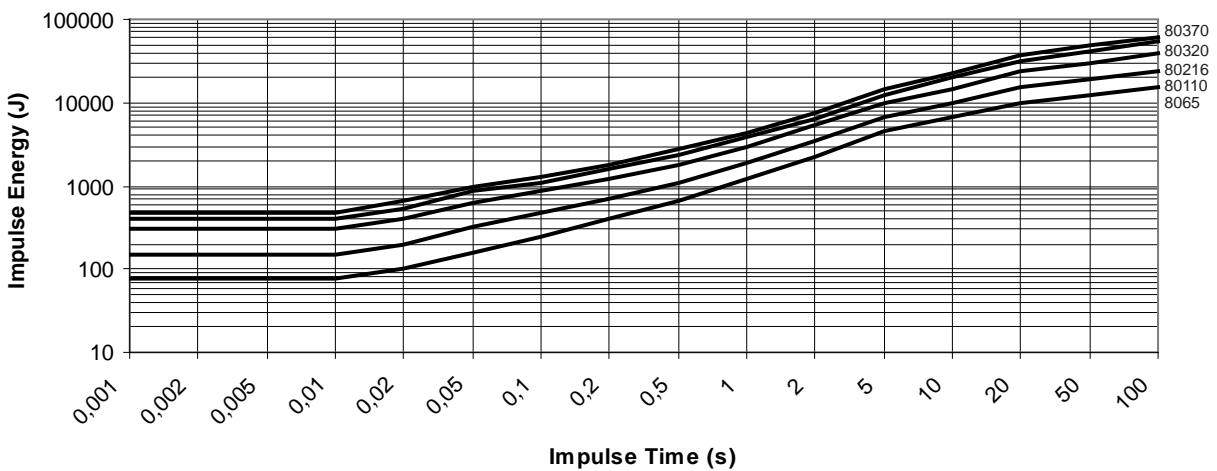
**SPECIFICATIONS** (continued)

**Stability against Impulses**  
Reference values without heatsink

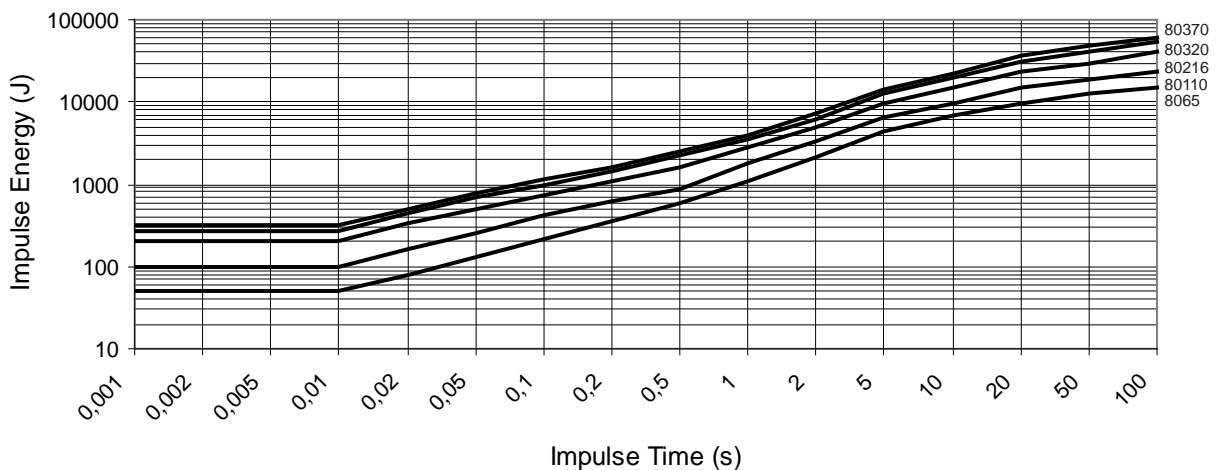
Resistance value R01 to R1



Resistance value R1 to 1R



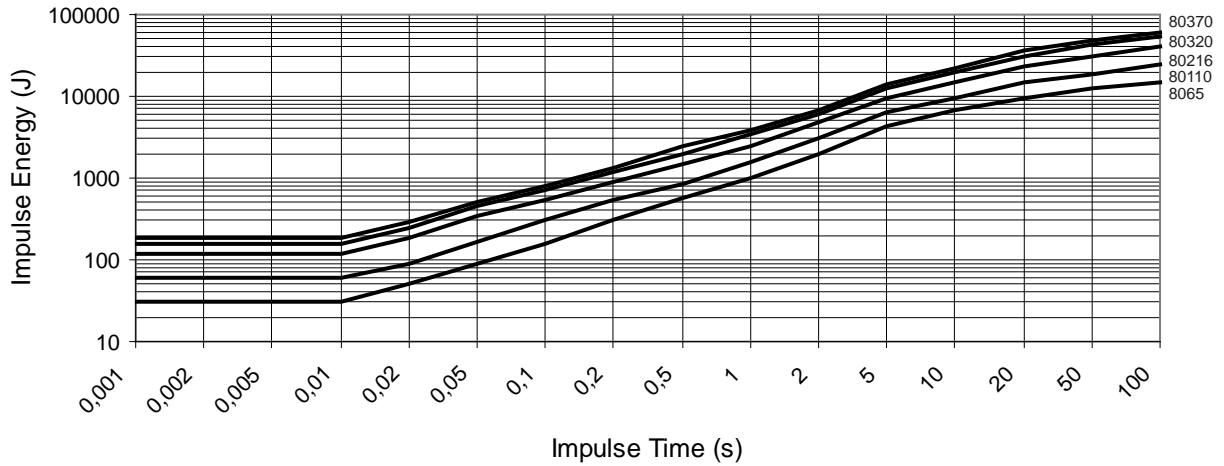
Resistance value 1R to 10R



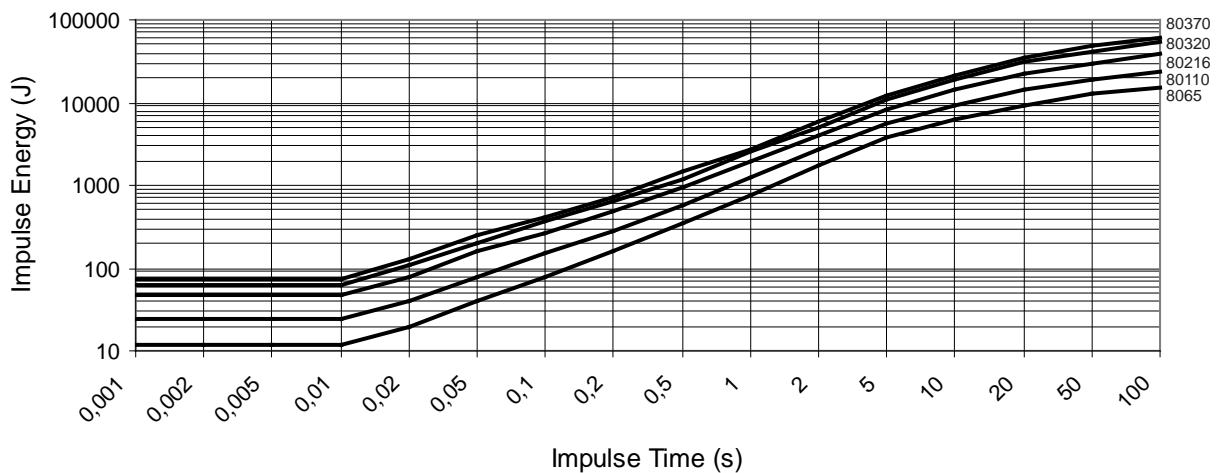
**SPECIFICATIONS** (continued)

**Stability against Impulses**  
Reference values without heatsink

Resistance value 10R to 100R



Resistance value 100R to 500R

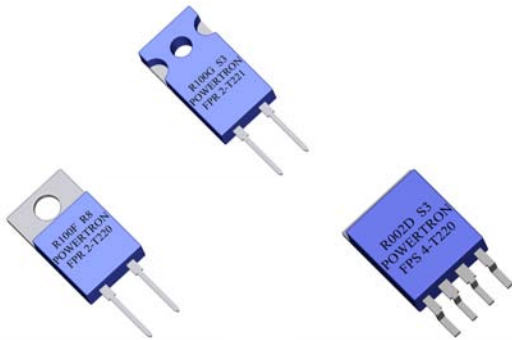


**Lead Variations**

<b>Standard:</b>	Lead D	from to 60 A	isolated round cable (Cu / tinned)
<b>optional:</b>	Lead H1	from to 70 A	isolated Cu - flat cable
	Lead H2	from to 85 A	isolated Cu - flat cable
	Lead H3	from to 100 A	isolated Cu - flat cable
	Lead H4	from to 120 A	isolated Cu - flat cable
	Lead H5	from to 150 A	isolated Cu - flat cable
	Lead H6	from to 250 A	isolated Cu - flat cable

# FPR FPS 2/4-T220 T221

Precision Power Shunt Resistors



- Resistances from 0.002Ohm to 50Ohms
- Power Rating to 15Watt
- Resistance Tolerances to  $\pm 0.1\%$
- TCR to  $\pm 15\text{ppm/K}$
- Load Stability to 0.1%
- TO-220 Housing
- Convenient SMD D2Pak Available

## SPECIFICATIONS

Type	FPR 2-T220 T221	FPS 2-T220	FPR 4-T220 T221	FPS 4-T220
Resistance Range	0.002 to 50 Ohms			
Power rating free air 70°C with heatsink	1.5 W 15 W			
Thermal Resistance Rthj-c	4.8 K/W			
Tolerances from 0.002 Ohms from 0.01 Ohms from 0.1 Ohms	2% / 5% 1% / 2% / 5% 0.5% / 1% / 2% / 5%		1% / 2% / 5% 0.1% / 0.25% / 0.5% / 1% / 2% / 5% 0.1% / 0.25% / 0.5% / 1% / 2% / 5%	
Stability	0.1% / 0.2% / 0.5% (depends on stress)			
Temperature Coefficient	$\pm 15\text{ppm/K}$ (20 to 60°C) $\pm 50\text{ppm/K}$ (-40 to 130°C) $R \leq 0.2$ Ohms TCR see table A next page		$\pm 15\text{ppm/K}$ (20 to 60°C) $\pm 50\text{ppm/K}$ (-40 to 130°C)	
Max. Current	50 A			
Voltage Proof	300 VDC			
Thermal EMF	< 0.1 $\mu\text{V/K}$			
Operating Temperature Range	-40 to 130°C			
Resistor Material	CuNiMn-Foil			
Substrate	$\text{Al}_2\text{O}_3$ or anodized aluminium			
Housing	Epoxy or PPS			
Connector Material	Cu tinned			
Terminals	2		4	
Max. torque	1 Nm / T221: 0.8 Nm		1 Nm / T221: 0.8 Nm	

## Ordering Information

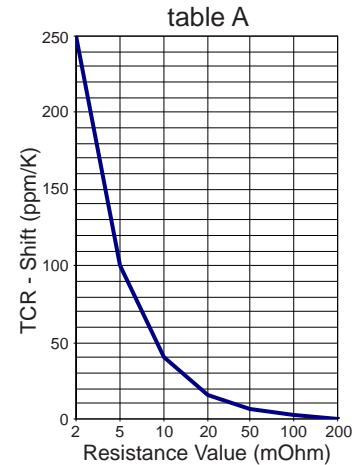
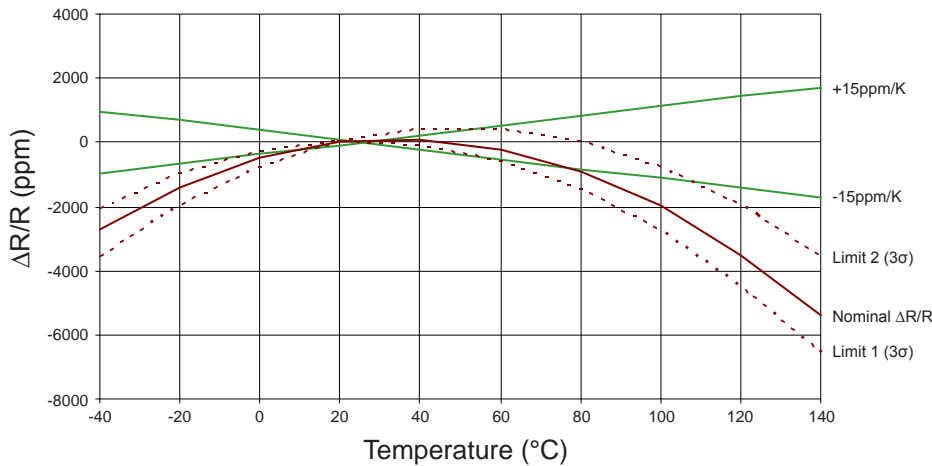
Part Number - Resistance - Contact - Tolerance

FPS 4-T220 0.01 Ohms C 0.1%

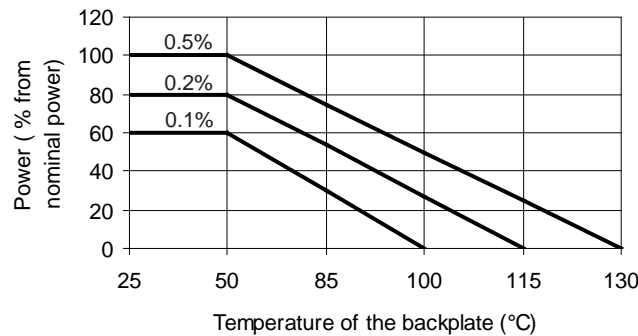


**SPECIFICATIONS** (continued)

**Temperature Coefficient**



**Derating**



**Power Rating Notes -**

The FPR Series Resistors must be attached to a suitable heat-sink. The maximum internal resistor temperature is 130°C. To specify an appropriate heatsink use the following formula :

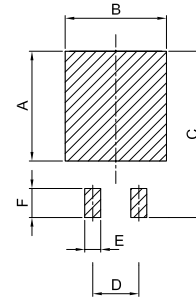
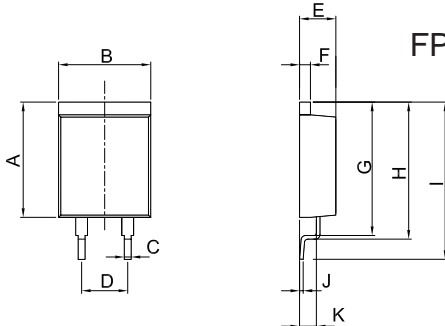
$$R_{0H} = \frac{T_{MAX} - (P \times R_{0R}) - T_A}{P}$$

Where:  $R_{0H}$  = Thermal Resistance of Heatsink ( K/W )  
 $R_{0R}$  = Thermal Resistance of Resistor ( K/W )  
 $T_{MAX}$  = Maximum Temperature of Resistor  
 $T_A$  = Ambient Temperature of Heatsink ( °C )  
 $P$  = Power Through Resistor ( W )

**SPECIFICATIONS** (continued)

**Dimensions**

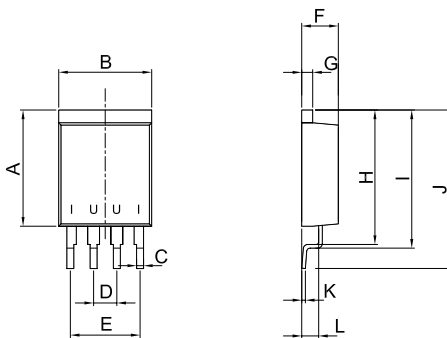
**FPS 2-T220**



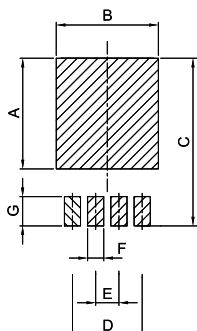
Dimension	mm	tol. (±mm)	inches	tol. (±inches)
A	12.70	0.2	0.50	0.008
B	10.16	0.2	0.40	0.008
C	0.76	0.1	0.03	0.004
D	5.08	0.1	0.20	0.004
E	4.00	0.1	0.16	0.004
F	1.20	0.1	0.05	0.004
G	14.60	0.2	0.57	0.008
H	15.00	0.2	0.59	0.008
I	17.33	0.2	0.68	0.008
J	0.40	0.1	0.02	0.004
K	1.85	0.1	0.07	0.004

Dimension	mm	inches
A	12.10	0.476
B	11.16	0.439
C	18.33	0.722
D	5.08	0.200
E	1.76	0.069
F	3.20	0.126

**FPS 4-T220**



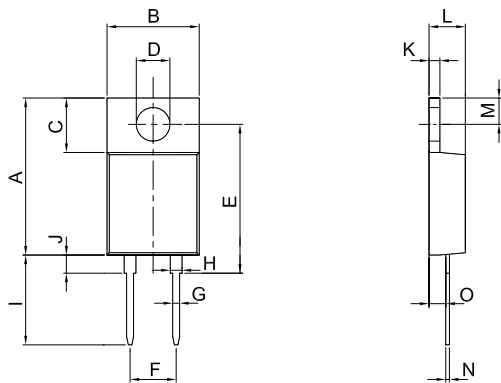
Dimension	mm	tol. (±mm)	inches	tol. (±inches)
A	12.70	0.2	0.50	0.008
B	10.16	0.2	0.40	0.008
C	0.76	0.1	0.03	0.004
D	2.54	0.1	0.10	0.004
E	7.62	0.1	0.30	0.004
F	4.00	0.1	0.16	0.004
G	1.20	0.1	0.05	0.004
H	14.60	0.2	0.57	0.008
I	15.00	0.2	0.59	0.008
J	17.33	0.2	0.68	0.008
K	0.40	0.1	0.02	0.004
L	1.85	0.1	0.07	0.004



Dimension	mm	inches
A	12.10	0.476
B	11.16	0.439
C	18.33	0.722
D	7.62	0.300
E	2.54	0.100
F	1.76	0.069
G	3.20	0.126

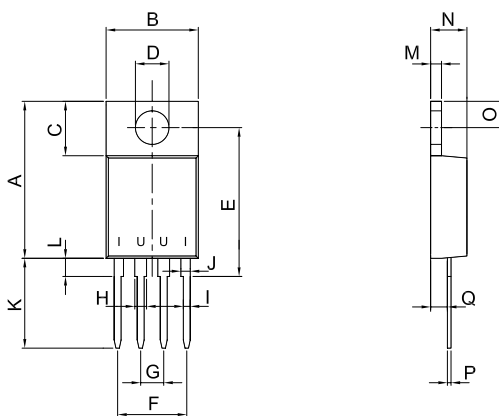
**SPECIFICATIONS** (continued)

FPR 2-T220



Dimension	mm	tol. (±mm)	inches	tol. (±inches)
A	17.30	0.2	0.68	0.008
B	10.16	0.2	0.40	0.008
C	6.00	0.1	0.24	0.004
D	Ø3.7	0.1	Ø0.146	0.004
E	16.40	0.2	0.65	0.008
F	5.08	0.1	0.20	0.004
G	0.76	0.1	0.03	0.004
H	1.30	0.1	0.05	0.004
I	10.00	0.2	0.39	0.008
I (C-Contact)	13.80	0.2	0.54	0.008
J	2.00	0.1	0.08	0.004
K	1.20	0.1	0.05	0.004
L	4.00	0.1	0.16	0.004
M	2.90	0.1	0.11	0.004
N	0.40	0.1	0.02	0.004
O	1.85	0.1	0.07	0.004

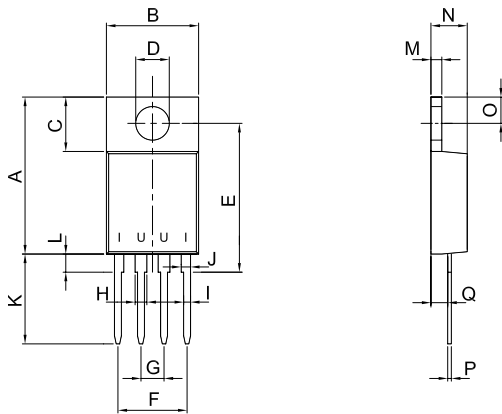
FPR 4-T220



Dimension	mm	tol. (±mm)	inches	tol. (±inches)
A	17.30	0.2	0.68	0.008
B	10.16	0.2	0.40	0.008
C	6.00	0.1	0.24	0.004
D	Ø3.7	0.1	Ø0.146	0.004
E	16.40	0.2	0.65	0.008
F	7.62	0.2	0.30	0.008
G	2.54	0.1	0.10	0.004
H	1.30	0.1	0.05	0.004
I	0.76	0.1	0.03	0.004
J	1.03	0.1	0.04	0.004
K	10.00	0.2	0.39	0.008
K (C-Contact)	13.80	0.2	0.54	0.008
L	2.00	0.1	0.08	0.004
M	1.20	0.1	0.05	0.004
N	4.00	0.1	0.16	0.004
O	2.90	0.1	0.11	0.004
P	0.40	0.1	0.02	0.004
Q	1.85	0.1	0.07	0.004

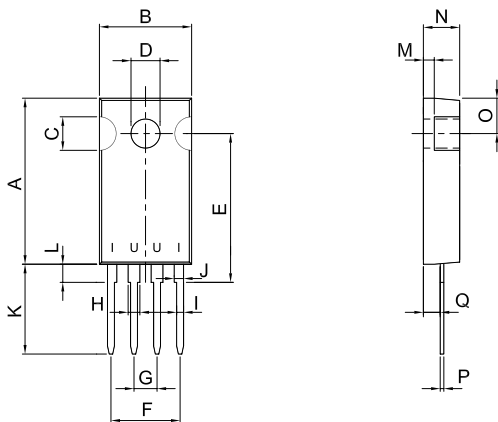
**SPECIFICATIONS** (continued)

FPR 2-T221



Dimension	mm	tol. (±mm)	inches	tol. (±inches)
A	18.30	0.2	0.72	0.008
B	10.16	0.2	0.40	0.008
C	3.70	0.1	0.15	0.004
D	∅3.2	0.1	∅0.126	0.004
E	16.40	0.2	0.65	0.008
F	5.08	0.1	0.20	0.004
G	0.76	0.1	0.03	0.004
H	1.30	0.1	0.05	0.004
I	10.00	0.2	0.39	0.008
I (C-Contact)	13.80	0.2	0.54	0.008
J	2.00	0.1	0.08	0.004
K	1.20	0.1	0.05	0.004
L	4.00	0.1	0.16	0.004
M	3.90	0.1	0.15	0.004
N	0.40	0.1	0.02	0.004
O	1.85	0.1	0.07	0.004

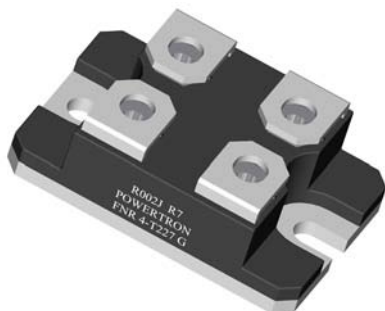
FPR 4-T221



Dimension	mm	tol. (±mm)	inches	tol. (±inches)
A	18.30	0.2	0.72	0.008
B	10.16	0.2	0.40	0.008
C	3.70	0.1	0.15	0.004
D	∅3.2	0.1	∅0.126	0.004
E	16.40	0.2	0.65	0.008
F	7.62	0.2	0.30	0.008
G	2.54	0.1	0.10	0.004
H	1.30	0.1	0.05	0.004
I	0.76	0.1	0.03	0.004
J	1.03	0.1	0.04	0.004
K	10.00	0.2	0.39	0.008
K (C-Contact)	13.80	0.2	0.54	0.008
L	2.00	0.1	0.08	0.004
M	1.20	0.1	0.05	0.004
N	4.00	0.1	0.16	0.004
O	3.90	0.1	0.15	0.004
P	0.40	0.1	0.02	0.004
Q	1.85	0.1	0.07	0.004

# FPR FNR 2-T227 4-T227

Foil Power Resistors



- Resistances from 0.001Ohm to 100Ohms
- Power Rating to 80Watt
- Resistance Tolerances to  $\pm 0.1\%$
- TCR to  $\pm 15\text{ppm/K}$
- Load Stability to 0.1%

## SPECIFICATIONS

Type	FPR 2-T227	FPR 4-T227	FNR 2-T227	FNR 4-T227
Terminals	2	4 (kelvin connection)	2	4 (kelvin connection)
Resistance Range	0.01 to 100 Ohms	0.001 to 100 Ohms	0.01 to 100 Ohms	0.001 to 100 Ohms
Power Rating (with heatsink)	60W		80W	
Thermal Resistance Rthj-c	1.3 K/W		1.0 K/W	
Tolerances	0.1% / 1% / 2% / 5% (others upon request)			
Stability	0.1% / 0.2% / 0.5% (depends on stress)			
Temperature Coefficient	$\pm 15\text{ ppm/K}$ (20 to 60°C) from $R < 0.02\text{ Ohms}$ $\pm 20\text{ ppm/K}$ (20 to 60°C) FPR 2-T227 / FNR 2-T227 TK Shift depends from resistance value (see graph next page)			
Voltage Proof	2.5 kV DC			
Thermal EMF	$< 1\ \mu\text{V/K}$			
Max. Current	50A (higher upon request)			
Operating Temperature	$-40^\circ\text{C}$ to $130^\circ\text{C}$			
Resistor Material	Metalfoil CuNiMn (DIN 17471)			
Substrate	$\text{Al}_2\text{O}_3$		AlN	
Housing	Epoxy			
Connector Material	Cu / tinned or nickel plated			
Max. Torque	backplate: 1.5Nm terminals: 1.3 Nm			

## Ordering Information

Part Number - Resistance - Tolerance  
FPR 2-T227 1.1 Ohms 1%

**SPECIFICATIONS** (continued)

**Temperature Coefficient**

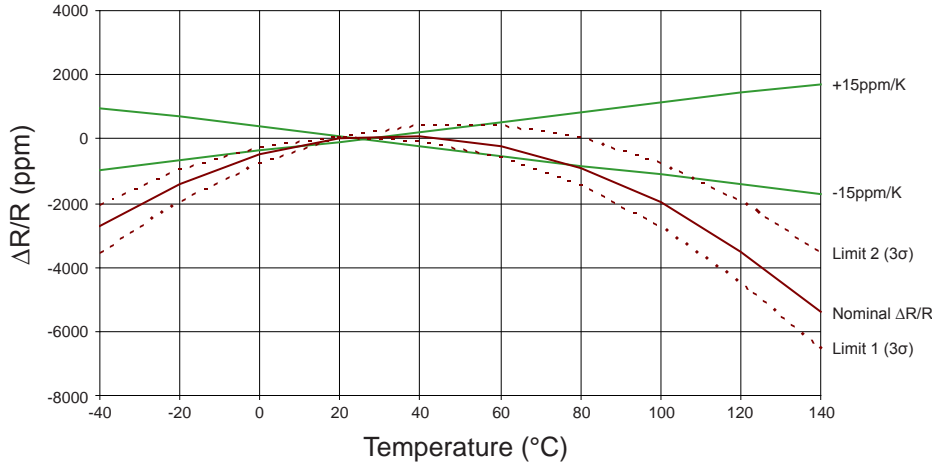
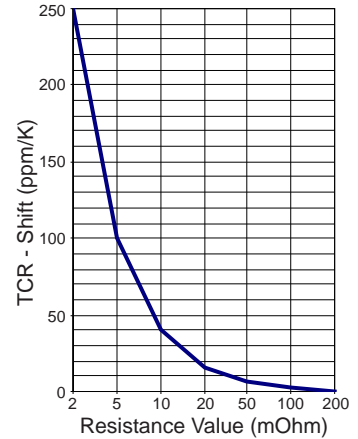
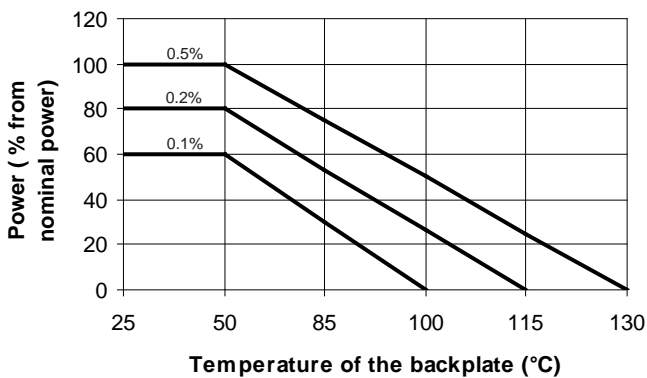


table A



**Derating and Stability**



Power Rating Notes -

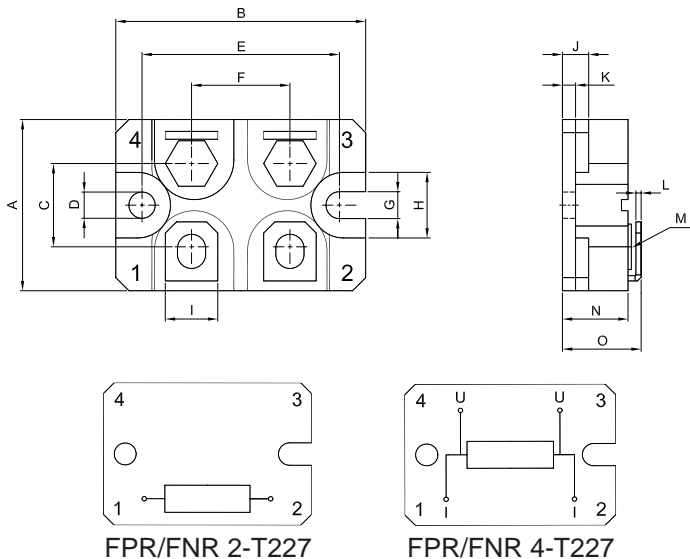
The FPR/FNR Series Foil Resistors must be attached to a suitable heatsink. The maximum internal resistor temperature is 130°C for a 0.5% stability part.

To specify an appropriate heatsink use the following formula :

$$R_{\theta H} = \frac{T_{MAX} - (P \times R_{\theta R}) - T_A}{P}$$

Where:  $R_{\theta H}$  = Thermal Resistance of Heatsink ( K/W )  
 $R_{\theta R}$  = Thermal Resistance of Resistor ( K/W )  
 $T_{MAX}$  = Maximum Temperature of Resistor  
 $T_A$  = Ambient Temperature of Heatsink ( °C )  
 $P$  = Power Through Resistor ( W )

**Dimensions and Attachment Variations**

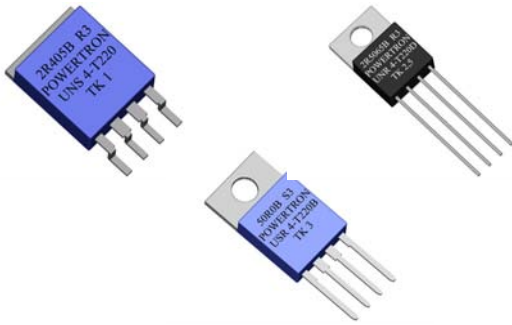


Dimension	mm	tol. (±mm)	inches	tol. (±inches)
A	26	0.5	1.02	0.020
B	38	0.5	1.50	0.020
C	12.7	0.2	0.50	0.008
D	4	0.2	0.16	0.008
E	30	0.2	1.18	0.008
F	15	0.2	0.59	0.008
G	4.1	0.2	0.16	0.008
H	10	0.2	0.39	0.008
I	8	0.2	0.31	0.008
J	4	0.2	0.16	0.008
K	2	0.2	0.08	0.008
L	0.8	0.1	0.03	0.004
M	M4		M4	
N	10	0.2	0.39	0.008
O	11.9	0.2	0.47	0.008

# USR UNR 4-T220 / T220B

# USS UNS 4-T220

Precision Shunt Resistors



- Resistances from 0.2Ohm to 80Ohms
- Power Rating to 15Watt
- Resistance Tolerances to  $\pm 0.01\%$
- TCR to  $\pm 1\text{ppm/K}$
- Load Stability to 0.01%

## SPECIFICATIONS

Type	USR / USS	UNR / UNS
Resistance Range	0.2 to 80 Ohms	
Power rating free air 70°C with heatsink	1.5W 10W	1.5W 15W
Thermal Resistance Rthj-c	10.8 K/W	6.8 K/W
Tolerances from 0.5 Ohms from 10.0 Ohms from 50.0 Ohms	0.1% / 0.25% / 0.5% / 1% 0.05% / 0.1% / 0.25% / 0.5% / 1% 0.01% / 0.02% / 0.05% / 0.1% / 0.25% / 0.5% / 1%	
Stability	0.01%	
Shelf Life Stability	25ppm / $\Delta R$ after 1 year 50ppm / $\Delta R$ after 3 year	
Temperature Coefficient	max. $\pm 5\text{ppm/K}$ (-55 to 155°C) typ. $\pm 3\text{ppm/K}$ (-55 to 125°C) upon request $\pm 1\text{ppm/K}$ (0 to 60°C)	
Voltage Proof	1 kVDC	
Thermal EMF	< 0.1 $\mu\text{V/K}$	
Operating Temperature Range	-55 to 155°C	
Resistor Material	NiCr-Foil	
Substrate	Al <sub>2</sub> O <sub>3</sub>	AlN
Housing	Epoxy + Cu heatsink nickel plated	
Connector Material	Cu tinned	
Terminals	4	
Max. Torque	1.0 Nm	
Notes	Specially designed for applications with fast changing electrical load	

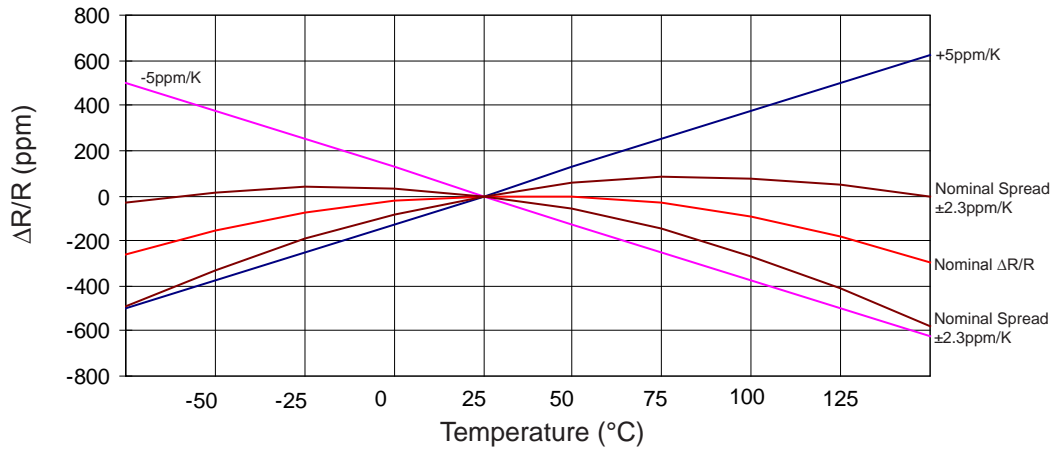
## Ordering Information

Part Number - Resistance - Contact - Tolerance - TCR

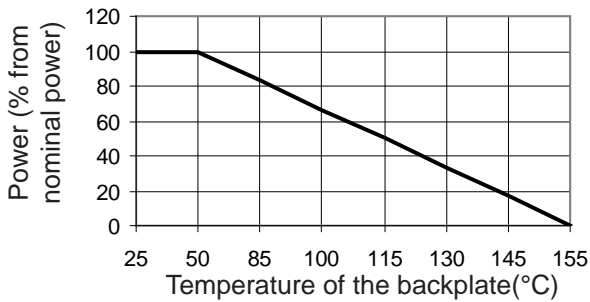
UNR 2-T220B 5.7kOhms C 0.5% 3ppm

**SPECIFICATIONS** (continued)

**Temperature Coefficient**



**Derating**



**Power Rating Notes -**

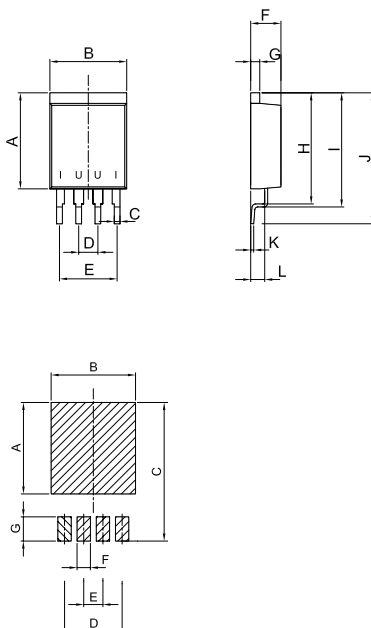
The U-Series Resistors must be attached to a suitable heatsink. The maximum internal resistor temperature is 155°C. To specify an appropriate heatsink use the following formula :

$$R_{0H} = \frac{T_{MAX} - (P \times R_{0R}) - T_A}{P}$$

Where:  $R_{0H}$  = Thermal Resistance of Heatsink ( K/W )  
 $R_{0R}$  = Thermal Resistance of Resistor ( K/W )  
 $T_{MAX}$  = Maximum Temperature of Resistor  
 $T_A$  = Ambient Temperature of Heatsink ( °C )  
 $P$  = Power Through Resistor ( W )

**Dimensions**

USS 4-T220 / UNS 4-T220



Dimension	mm	tol. (±mm)	inches	tol. (±inches)
A	12.70	0.2	0.50	0.008
B	10.16	0.2	0.40	0.008
C	0.76	0.1	0.03	0.004
D	2.54	0.1	0.10	0.004
E	7.62	0.1	0.30	0.004
F	4.00	0.1	0.16	0.004
G	1.20	0.1	0.05	0.004
H	14.60	0.2	0.57	0.008
I	15.00	0.2	0.59	0.008
J	17.33	0.2	0.68	0.008
K	0.40	0.1	0.02	0.004
L	1.85	0.1	0.07	0.004

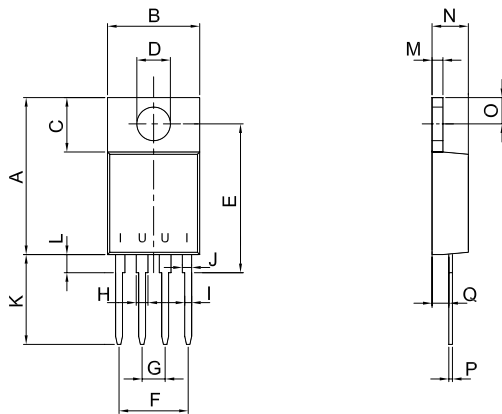
Dimension	mm	inches
A	12.10	0.476
B	11.16	0.439
C	18.33	0.722
D	7.62	0.300
E	2.54	0.100
F	1.76	0.069
G	3.20	0.126



**SPECIFICATIONS** (continued)

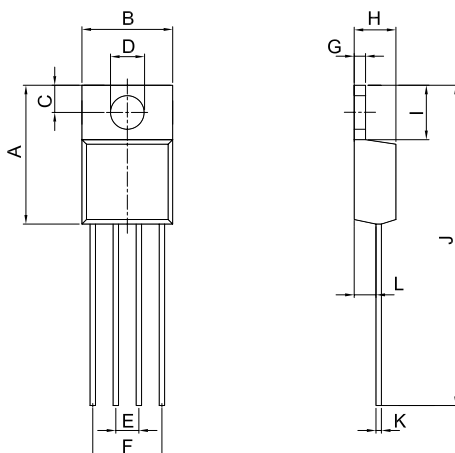
Dimensions

USR 4-T220B / UNR 4-T220B

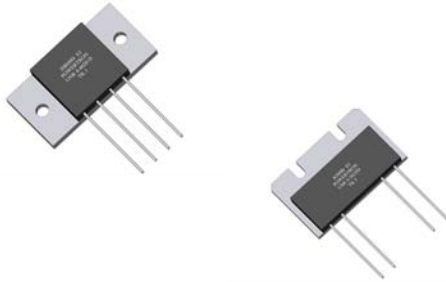


Dimension	mm	tol. (±mm)	inches	tol. (±inches)
A	17.30	0.2	0.68	0.008
B	10.16	0.2	0.40	0.008
C	6.00	0.1	0.24	0.004
D	∅3.7	0.1	∅0.146	0.004
E	16.40	0.2	0.65	0.008
F	7.62	0.2	0.30	0.008
G	2.54	0.1	0.10	0.004
H	1.30	0.1	0.05	0.004
I	0.76	0.1	0.03	0.004
J	1.03	0.1	0.04	0.004
K	10.00	0.2	0.39	0.008
K (C-Contact)	13.80	0.2	0.54	0.008
L	2.00	0.1	0.08	0.004
M	1.20	0.1	0.05	0.004
N	4.00	0.1	0.16	0.004
O	2.90	0.1	0.11	0.004
P	0.40	0.1	0.02	0.004
Q	1.85	0.1	0.07	0.004

USR 4-T220 / UNR 4-T220



Dimension	mm	tol. (±mm)	inches	tol. (±inches)
A	15.30	0.2	0.60	0.008
B	10.00	0.2	0.39	0.008
C	2.80	0.1	0.11	0.004
D	∅3.7	0.1	∅0.146	0.004
E	2.54	0.1	0.10	0.004
F	7.62	0.1	0.30	0.004
G	1.27	0.1	0.05	0.004
H	4.60	0.1	0.18	0.004
I	6.00	0.2	0.24	0.008
J	35.30	2.0	1.39	0.079
K	∅0.6	0.1	∅0.02	0.004
L	2.41	0.1	0.09	0.004



- Resistances from 0.05Ohm to 500Ohms
- Power Rating to 50Watt
- Resistance Tolerances to  $\pm 0.01\%$
- TCR to  $\pm 1\text{ppm/K}$
- Load Stability to 0.01%

### SPECIFICATIONS

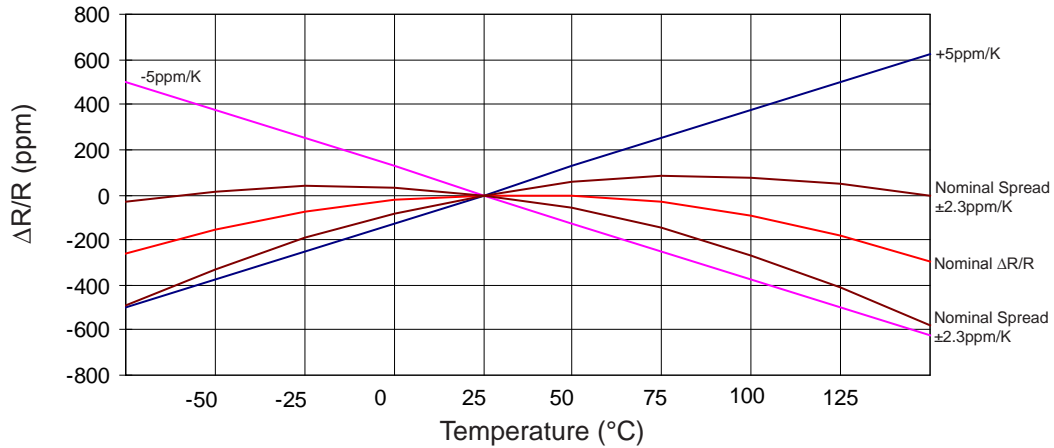
Type	USR 4-3425 3825	USR 4-4020	UNR 4-3425 3825	UNR 4-4020
Resistance Range	0.05 to 500 Ohms other resistance values upon request / power rating depending on resistance value			0.05 to 400 Ohms
Power rating free air 70°C for 3825H with heatsink	3 W 5 W 30 W	2.5 W 30 W	3 W 5 W 50 W	2.5 W 50 W
Thermal Resistance Rthj-c	3.5 K/W	3.6 K/W	2.1 K/W	2.2 K/W
Tolerances from 0.05 Ohms from 10.0 Ohms from 50.0 Ohms	0.1% / 0.25% / 0.5% / 1% 0.05% / 0.1% / 0.25% / 0.5% / 1% 0.01% / 0.02% / 0.05% / 0.1% / 0.25% / 0.5% / 1%			
Stability	0.01%			
Shelf Life Stability	25ppm / $\Delta R$ after 1 year 50ppm / $\Delta R$ after 3 year			
Temperature Coefficient	max. $\pm 5\text{ppm/K}$ (-55 to 155°C) typ. $\pm 3\text{ppm/K}$ (-55 to 125°C) upon request $\pm 1\text{ppm/K}$ (0 to 60°C)			
Voltage Proof	750 VDC			
max. Current	15 A			
Thermal EMF	< 0.1 $\mu\text{V/K}$			
Operating Temperature Range	-55 to 155°C			
Resistor Material	NiCr-Foil			
Substrate	Al <sub>2</sub> O <sub>3</sub>		AlN	
Housing	Epoxy + Al-heatsink			
Connector Material	Cu tinned			
Terminals	4			
Max. Torque	1.0 Nm			
Notes	Specially designed for applications with fast changing electrical load			

### Ordering Information

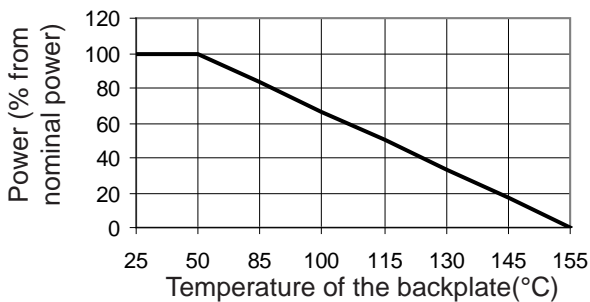
Part Number - Resistance - Contact - Tolerance - TCR  
 USR 4-3825H 10Ohms D 0.5% 3ppm

**SPECIFICATIONS** (continued)

**Temperature Coefficient**



**Derating**



**Power Rating Notes -**

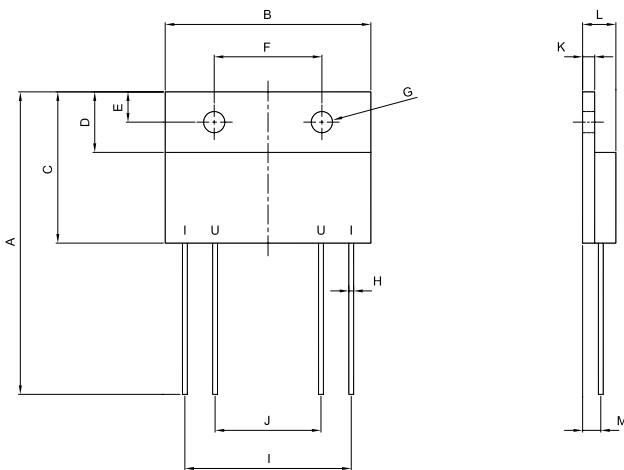
The U-Series Resistors must be attached to a suitable heatsink. The maximum internal resistor temperature is 155°C. To specify an appropriate heatsink use the following formula :

$$R_{0H} = \frac{T_{MAX} - (P \times R_{0R}) - T_A}{P}$$

Where:  $R_{0H}$  = Thermal Resistance of Heatsink ( K/W )  
 $R_{0R}$  = Thermal Resistance of Resistor ( K/W )  
 $T_{MAX}$  = Maximum Temperature of Resistor  
 $T_A$  = Ambient Temperature of Heatsink ( °C )  
 $P$  = Power Through Resistor ( W )

**Dimensions**

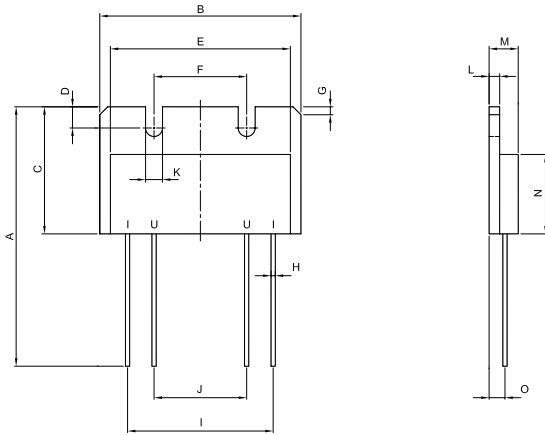
USR 4-3425 / UNR 4-3425



Dimension	mm	tol. (±mm)	inches	tol. (±inches)
A	50.00	2.0	1.97	0.079
B	34.00	0.3	1.34	0.012
C	25.00	0.2	0.98	0.008
D	10.00	0.2	0.39	0.008
E	5.00	0.1	0.20	0.004
F	17.80	0.2	0.70	0.008
G	∅3.50	0.1	∅0.14	0.004
H	∅0.8	0.1	∅0.031	0.004
I	27.50	0.2	1.08	0.008
J	17.50	0.2	0.69	0.008
K	2.00	0.1	0.08	0.004
L	5.50	0.1	0.22	0.004
M	3.00	0.2	0.12	0.008

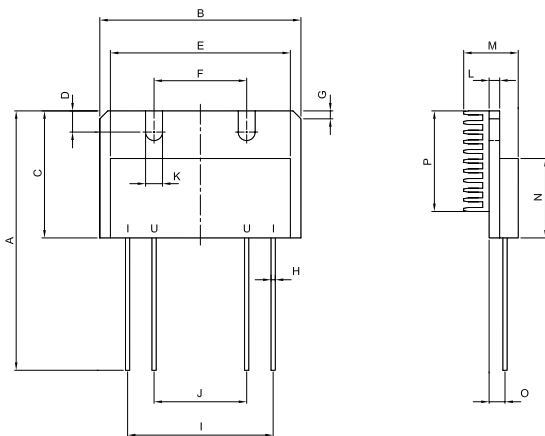
**SPECIFICATIONS** (continued)

USR 4-3825 / UNR 4-3825



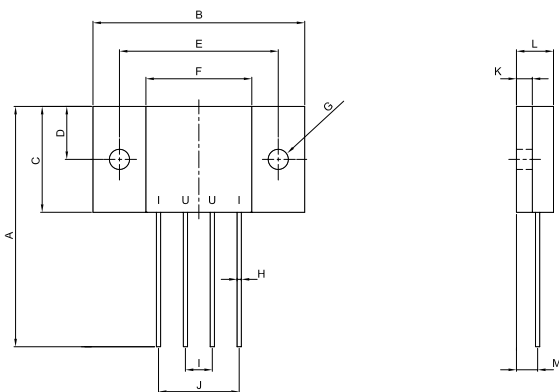
Dimension	mm	tol. (±mm)	inches	tol. (±inches)
A	49.00	2.0	1.93	0.079
B	38.00	0.3	1.50	0.012
C	24.00	0.2	0.94	0.008
D	4.00	0.1	0.16	0.004
E	34.00	0.3	1.34	0.012
F	17.50	0.2	0.69	0.008
G	1.5x45°	0.1	0.6x45°	0.004
H	∅0.8	0.1	∅0.031	0.004
I	27.50	0.2	1.08	0.008
J	17.50	0.2	0.69	0.008
K	∅3.2	0.1	∅0.126	0.004
L	2.00	0.1	0.08	0.004
M	5.50	0.1	0.22	0.004
N	15.00	0.2	0.59	0.008
O	3.00	0.2	0.12	0.008

USR 4-3825H / UNR 4-3825H



Dimension	mm	tol. (±mm)	inches	tol. (±inches)
A	49.00	2.0	1.93	0.079
B	38.00	0.3	1.50	0.012
C	24.00	0.2	0.94	0.008
D	4.00	0.1	0.16	0.004
E	34.00	0.3	1.34	0.012
F	17.50	0.2	0.69	0.008
G	1.5x45°	0.1	0.6x45°	0.004
H	∅0.8	0.1	∅0.031	0.004
I	27.50	0.2	1.08	0.008
J	17.50	0.2	0.69	0.008
K	∅3.2	0.1	∅0.126	0.004
L	2.00	0.1	0.08	0.004
M	max.10.3	0.2	max.0.4	0.008
N	15.00	0.2	0.59	0.008
O	3.00	0.2	0.12	0.008
P	19.00	0.2	0.75	0.008

USR 4-4020 / UNR 4-4020



Dimension	mm	tol. (±mm)	inches	tol. (±inches)
A	45.40	2.0	1.79	0.079
B	40.00	0.3	1.57	0.012
C	20.00	0.2	0.79	0.008
D	10.00	0.2	0.39	0.008
E	30.00	0.2	1.18	0.008
F	20.00	0.2	0.79	0.008
G	∅3.80	0.1	∅0.15	0.004
H	∅0.8	0.1	∅0.031	0.004
I	5.08	0.1	0.20	0.004
J	15.24	0.2	0.60	0.008
K	3.00	0.1	0.12	0.004
L	7.00	0.1	0.28	0.004
M	4.00	0.1	0.16	0.004

# UHN 2-3825D

Precision Shunt Resistors



- Resistances from 50Ohm
- Power Rating to 30Watt
- Resistance Tolerances to  $\pm 1\%$
- TCR to  $\pm 5\text{ppm/K}$
- Load Stability to 0.01%
- Customized Resistance Values
- Twin Resistor Construction

## SPECIFICATIONS

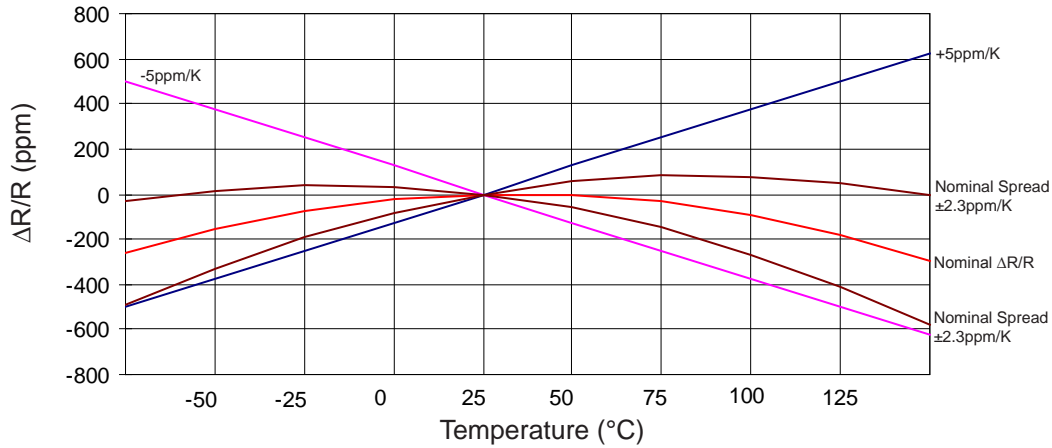
Type	UHN 2-3825D
Resistance Range	50 Ohms (2x) Other values upon request
Power rating free air 70°C with heatsink	3 W 30 W
Thermal Resistance Rthj-c	3.5 K/W
Tolerances	1% (0.1% difference between the two resistances) Other tolerances upon request
Stability	0.01%
Temperature Coefficient	max. $\pm 5\text{ppm/K}$ (-55 to 155°C)
Voltage Proof	500 VDC
max. Current	15 A
Thermal EMF	$< 0.1\mu\text{V/K}$
Operating Temperature Range	-55 to 155°C
Resistor Material	NiCr-Foil
Substrate	$\text{Al}_2\text{O}_3$
Housing	Epoxy + Al-heatsink
Connector Material	Cu tinned
Terminals	3
Max. Torque	1.0 Nm

## Ordering Information

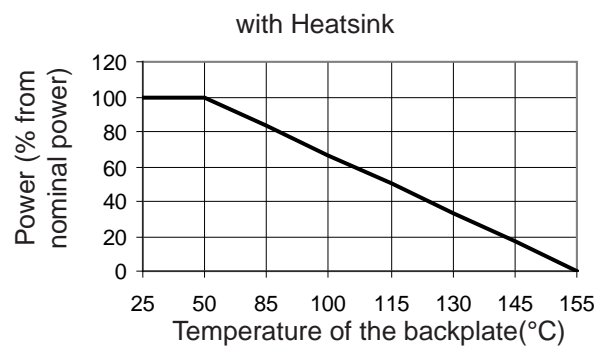
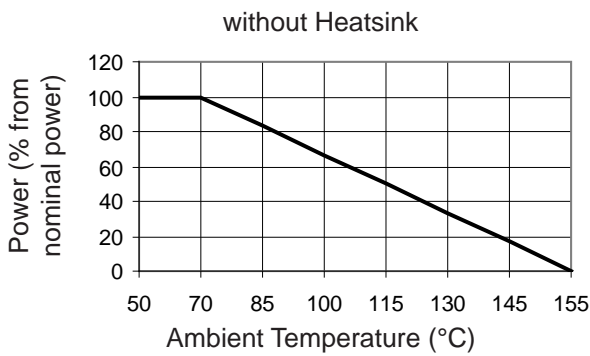
Part Number - Resistance - Tolerance  
UHN 2-3825D 50Ohms-50Ohms 0.5%

**SPECIFICATIONS** (continued)

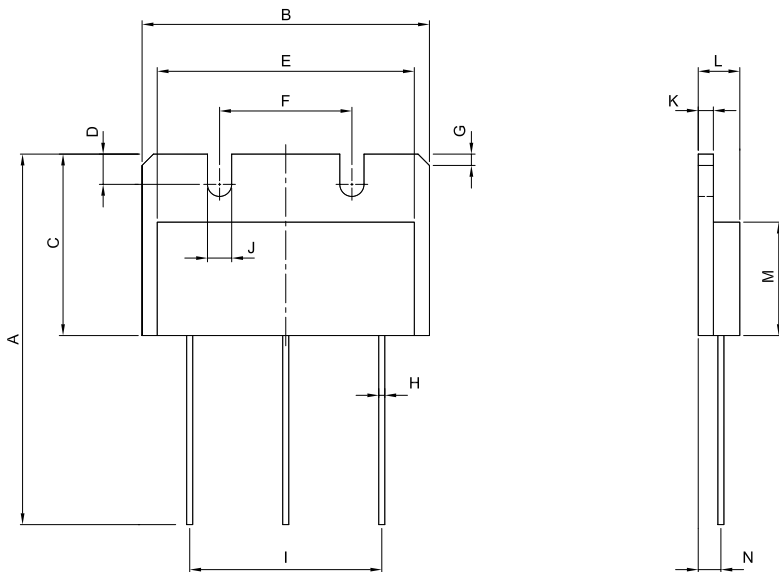
**Temperature Coefficient**



**Derating**



**Dimensions**



Dimension	mm	tol. (±mm)	inches	tol. (±inches)
A	49.00	2.0	1.93	0.079
B	38.00	0.3	1.50	0.012
C	24.00	0.2	0.94	0.008
D	4.00	0.1	0.16	0.004
E	34.00	0.3	1.34	0.012
F	17.50	0.2	0.69	0.008
G	1.5x45°	0.1	0.6x45°	0.004
H	∅0.8	0.1	∅0.031	0.004
I	25.40	0.2	1.00	0.008
J	∅3.2	0.1	∅0.126	0.004
K	2.00	0.1	0.08	0.004
L	5.50	0.1	0.22	0.004
M	15.00	0.2	0.59	0.008
N	3.00	0.2	0.12	0.008

# USR UNR 2-T220 / T220B / T221

## USS UNS 2-T220

Precision Foil Resistors



- Resistances from 0.5Ohm to 150kOhms
- Power Rating to 10Watt
- Resistance Tolerances to  $\pm 0.01\%$
- TCR to  $\pm 3\text{ppm/K}$
- Load Stability to 0.01%
- TO-220 Housing
- Convenient SMD D2Pak Available



### SPECIFICATIONS

Type	USR / USS	UNR / UNS
Resistance Range	0.5 Ohms to 150 kOhms	0.5 Ohms to 5 kOhms
Power rating free air 70°C (R<50R0) free air 70°C (R>50R0) with heatsink (R<50R0) with heatsink (R>50R0)	1.5W 1.0W 10W 6W	1.5W 1.0W 15W 10W
Thermal Resistance Rthj-c R<50R0 R>50R0	10.8 K/W 18.8 K/W	6.8 K/W 10.8 K/W
Tolerances from 0.5 Ohms from 10.0 Ohms from 25.0 Ohms from 50.0 Ohms	0.1% / 0.25% / 0.5% / 1% 0.05% / 0.1% / 0.25% / 0.5% / 1% 0.02% / 0.05% / 0.1% / 0.25% / 0.5% / 1% 0.01% / 0.02% / 0.05% / 0.1% / 0.25% / 0.5% / 1%	
Stability	0.01%	
Shelf Life Stability	25ppm / $\Delta R$ after 1 year 50ppm / $\Delta R$ after 3 year	
Temperature Coefficient	max. $\pm 5\text{ppm/K}$ (-55 to 155°C) typ. $\pm 3\text{ppm/K}$ (-55 to 125°C)	
Voltage Proof	1 kVDC	
Thermal EMF	< 0.1 $\mu\text{V/K}$	
Operating Temperature Range	-55 to 155°C	
Resistor Material	NiCr-Foil	
Substrate	Al <sub>2</sub> O <sub>3</sub>	AlN
Housing	Epoxy + Cu heatsink nickel plated	
Connector Material	Cu tinned	
Terminals	2	
Max. Torque	1.0 Nm	
Notes	Specially designed for applications with fast changing electrical load	

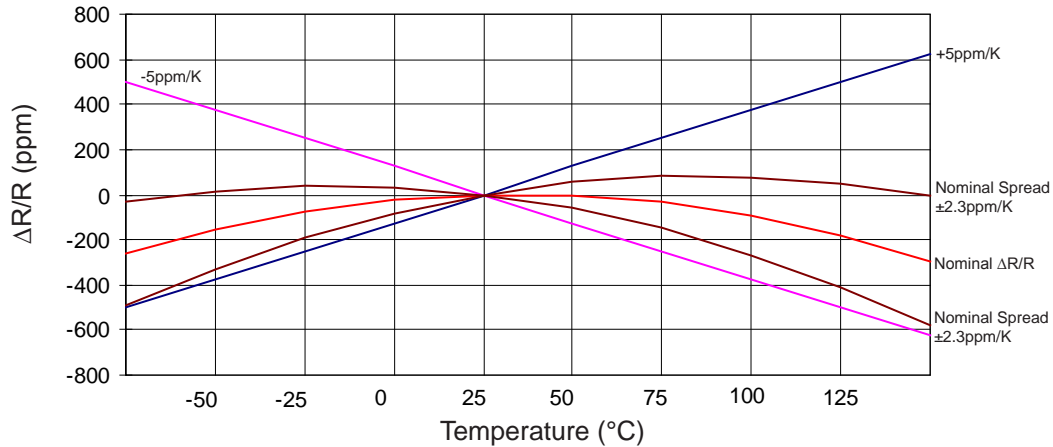
### Ordering Information

Part Number - Resistance - Contact - Tolerance - TCR

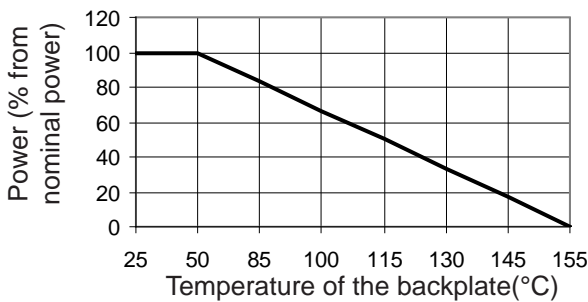
UNR 2-T220B 5.7kOhms C 0.5% 3ppm

**SPECIFICATIONS** (continued)

**Temperature Coefficient**



**Derating**



**Power Rating Notes -**

The U-Series Resistors must be attached to a suitable heatsink. The maximum internal resistor temperature is 155°C.

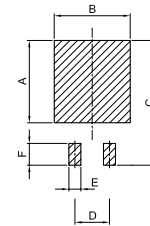
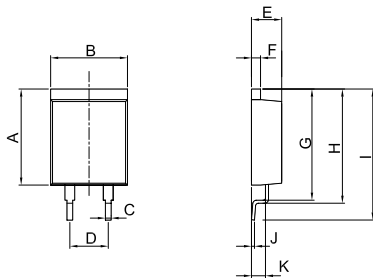
To specify an appropriate heatsink use the following formula :

$$R_{0H} = \frac{T_{MAX} - (P \times R_{0R}) - T_A}{P}$$

Where:  $R_{0H}$  = Thermal Resistance of Heatsink ( K/W )  
 $R_{0R}$  = Thermal Resistance of Resistor ( K/W )  
 $T_{MAX}$  = Maximum Temperature of Resistor  
 $T_A$  = Ambient Temperature of Heatsink ( °C )  
 $P$  = Power Through Resistor ( W )

**Dimensions**

**USS 2-T220 / UNS 2-T220**



Dimension	mm	tol. (±mm)	inches	tol. (±inches)
A	12.70	0.2	0.50	0.008
B	10.16	0.2	0.40	0.008
C	0.76	0.1	0.03	0.004
D	5.08	0.1	0.20	0.004
E	4.00	0.1	0.16	0.004
F	1.20	0.1	0.05	0.004
G	14.60	0.2	0.57	0.008
H	15.00	0.2	0.59	0.008
I	17.33	0.2	0.68	0.008
J	0.40	0.1	0.02	0.004
K	1.85	0.1	0.07	0.004

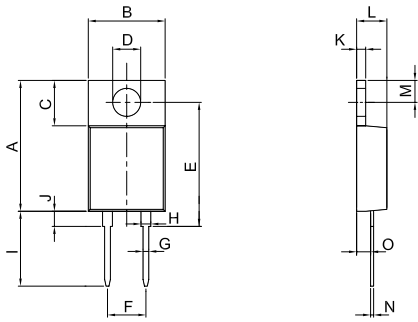
Dimension	mm	inches
A	12.10	0.476
B	11.16	0.439
C	18.33	0.722
D	5.08	0.200
E	1.76	0.069
F	3.20	0.126



**SPECIFICATIONS** (continued)

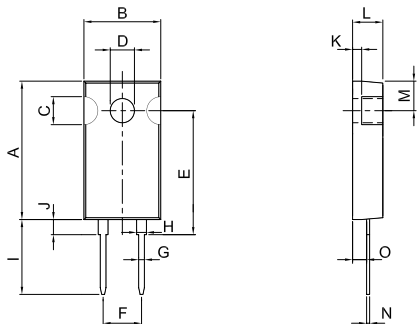
**Dimensions**

USR 2-T220B / UNR 2-T220B



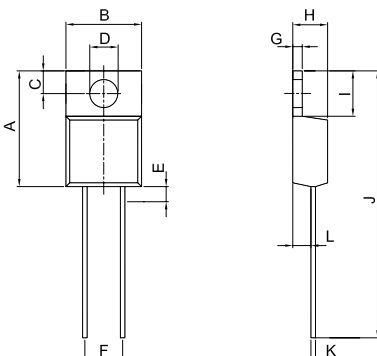
Dimension	mm	tol. (±mm)	inches	tol. (±inches)
A	17.30	0.2	0.68	0.008
B	10.16	0.2	0.40	0.008
C	6.00	0.1	0.24	0.004
D	Ø3.7	0.1	Ø0.146	0.004
E	16.40	0.2	0.65	0.008
F	5.08	0.1	0.20	0.004
G	0.76	0.1	0.03	0.004
H	1.30	0.1	0.05	0.004
I	10.00	0.2	0.39	0.008
I (C-Contact)	13.80	0.2	0.54	0.008
J	2.00	0.1	0.08	0.004
K	1.20	0.1	0.05	0.004
L	4.00	0.1	0.16	0.004
M	2.90	0.1	0.11	0.004
N	0.40	0.1	0.02	0.004
O	1.85	0.1	0.07	0.004

USR 2-T221 / UNR 2-T221



Dimension	mm	tol. (±mm)	inches	tol. (±inches)
A	18.30	0.2	0.72	0.008
B	10.16	0.2	0.40	0.008
C	3.70	0.1	0.15	0.004
D	Ø3.2	0.1	Ø0.126	0.004
E	16.40	0.2	0.65	0.008
F	5.08	0.1	0.20	0.004
G	0.76	0.1	0.03	0.004
H	1.30	0.1	0.05	0.004
I	10.00	0.2	0.39	0.008
I (C-Contact)	13.80	0.2	0.54	0.008
J	2.00	0.1	0.08	0.004
K	1.20	0.1	0.05	0.004
L	4.00	0.1	0.16	0.004
M	3.90	0.1	0.15	0.004
N	0.40	0.1	0.02	0.004
O	1.85	0.1	0.07	0.004

USR 2-T220 / UNR 2-T220



Dimension	mm	tol. (±mm)	inches	tol. (±inches)
A	15.30	0.2	0.60	0.008
B	10.00	0.2	0.39	0.008
C	2.80	0.1	0.11	0.004
D	Ø3.7	0.1	Ø0.146	0.004
E	2.00	0.1	0.08	0.004
F	5.08	0.1	0.20	0.004
G	1.27	0.1	0.05	0.004
H	4.60	0.1	0.18	0.004
I	6.00	0.2	0.24	0.008
J	35.30	2.0	1.39	0.079
K	Ø0.6	0.1	Ø0.02	0.004
L	2.41	0.1	0.09	0.004

# USR 4-1414

Precision Shunt Resistors



- Resistances from 0.50Ohm to 100Ohms
- Power Rating to 25Watt
- Resistance Tolerances to  $\pm 0.01\%$
- TCR to  $\pm 1\text{ppm/K}$
- Load Stability to 0.01%

## SPECIFICATIONS

Type	USR 4-1414
Resistance Range	0.5 to 100 Ohms
Power rating free air 70°C with heatsink	0.8 W 25 W
Thermal Resistance Rthj-c	< 4.2 K/W
Tolerances from 0.5 Ohms from 1.0 Ohms	0.1% / 0.25% / 0.5% / 1% 0.01% / 0.02% / 0.05% / 0.1% / 0.25% / 0.5% / 1%
Stability	0.01%
Temperature Coefficient	max. $\pm 5\text{ppm/K}$ (-55 to 155°C) typ. $\pm 3\text{ppm/K}$ (-55 to 125°C) upon request $\pm 1\text{ppm/K}$ (0 to 60°C)
Voltage Proof	1.5 kVDC
Thermal EMF	< 0.1 $\mu\text{V/K}$
Operating Temperature Range	-55 to 155°C
Resistor Material	NiCr-Foil
Substrate	Al <sub>2</sub> O <sub>3</sub> upon request: AlN
Housing	Plastic / Epoxy
Connector Material	Cu tinned
Terminals	4

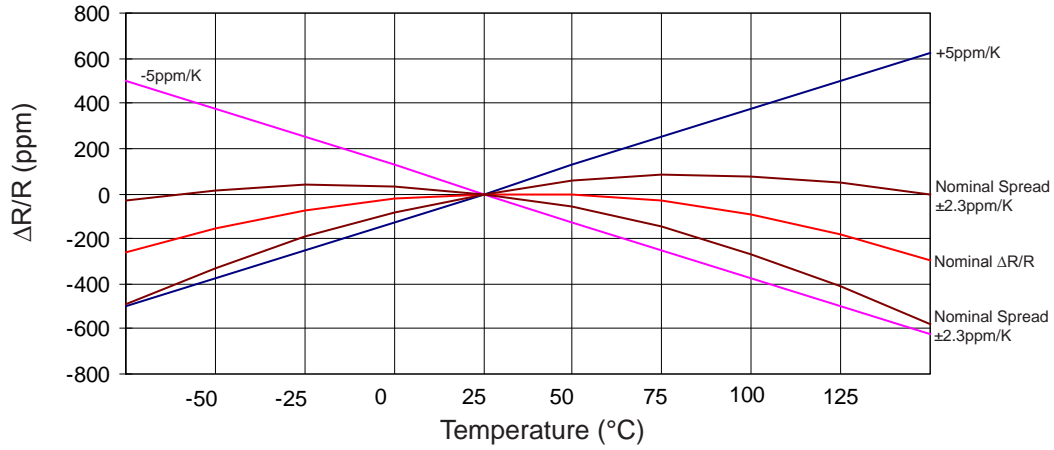
## Ordering Information

Part Number - Resistance - Tolerance - TCR

USR 4-1414 0.50Ohms 0.5% 1ppm

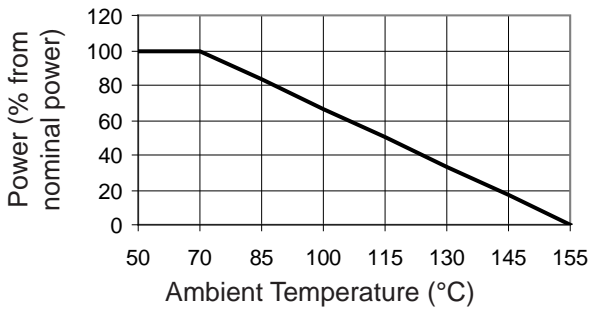
**SPECIFICATIONS** (continued)

**Temperature Coefficient**

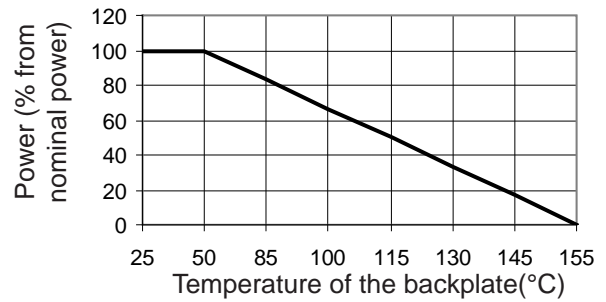


**Derating**

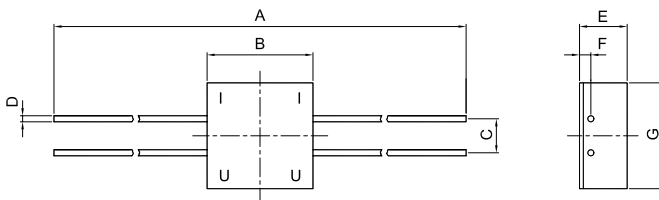
without Heatsink



with Heatsink



**Dimensions**



Dimension	mm	tol. (±mm)	inches	tol. (±inches)
A	94.00	0.5	3.70	0.020
B	14.00	0.2	0.55	0.008
C	4.50	0.1	0.18	0.004
D	∅0.80	0.1	∅0.03	0.004
E	6.30	0.2	0.25	0.008
F	1.50	0.2	0.06	0.008
G	14.00	0.2	0.55	0.008

# KPR KPN 2/4-T227 KHR KHN 2/4-T227

Power Resistors



- Resistances from 0.05Ohm to 5MOhms
- Power Rating to 200Watt
- Resistance Tolerances to  $\pm 1\%$
- TCR to  $\pm 50\text{ppm/K}$
- TO-227 (TO-238) Housing

## SPECIFICATIONS

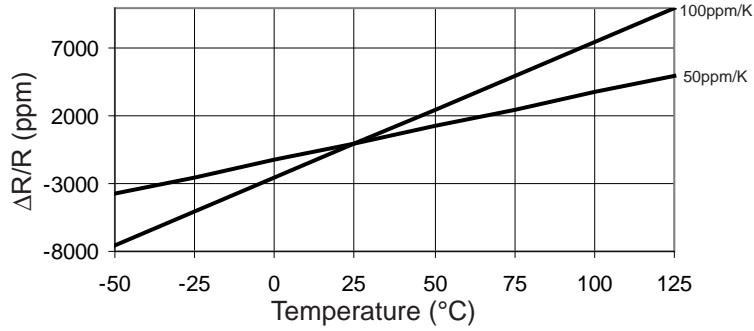
Type	KPR 2/4-T227 KPN 2-T227	KHR 2/4-T227 KHN 2-T227
Resistance Range	0.05 Ohms to 5 MOhms	
Power rating with heatsink	100 W	200 W
Thermal Resistance Rthj-c	0.7 K/W	0.35 K/W
Tolerances from 0.05 Ohms from 0.1 Ohms	2% / 5% / 10% 1% / 2% / 5% / 10%	
Stability	1%	
Temperature Coefficient 0.05 to 0.099 Ohms 0.1 to 5 MOhms	$\pm 300\text{ ppm/K}$ $\pm 100\text{ ppm/K}$ upon request $\pm 50\text{ ppm/K}$	
Voltage Proof	2.5 kVDC	
Inductivity	$\leq 50\text{ nH}$	
Capacity	$\leq 35\text{ pF}$	
Max. Voltage depending on resistance value		
Operating Temperature Range	-55 to 155°C	
Resistor Material	Thick Film	
Substrate	Al <sub>2</sub> O <sub>3</sub>	
Housing	Epoxy or Plastic	
Connector Material	Cu tinned	
Terminals	2 or 4	
Max. Torque backplate terminals	1.5 Nm 1.3 Nm	

## Ordering Information

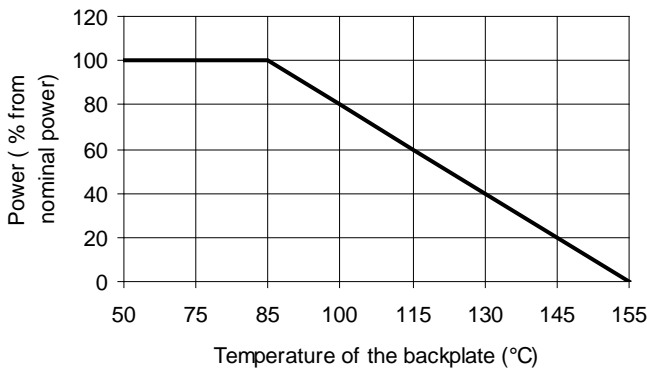
Part Number - Resistance - Tolerance  
KHR 2-T227 10 Ohms 5%

**SPECIFICATIONS** (continued)

**Temperature Coefficient**



**Derating**

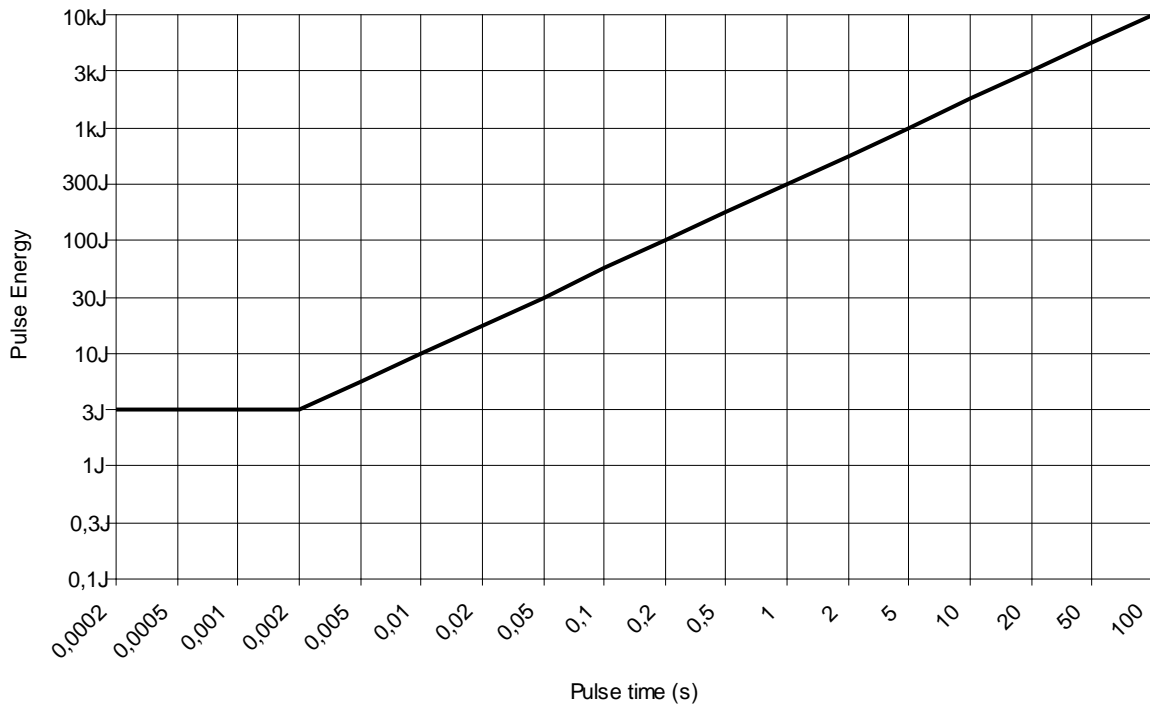


**Power Rating Notes -**  
 The KPR / KPN / KHR / KHN Series Resistors must be attached to a suitable heatsink. The maximum internal resistor temperature is 155°C.  
 To specify an appropriate heatsink use the following formula :

$$R_{0H} = \frac{T_{MAX} - (P \times R_{0R}) - T_A}{P}$$

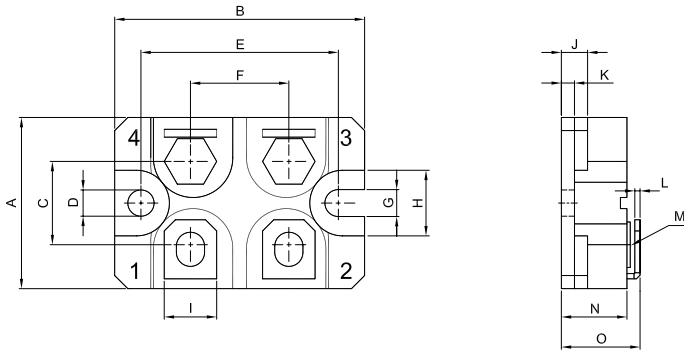
Where:  $R_{0H}$  = Thermal Resistance of Heatsink ( K/W )  
 $R_{0R}$  = Thermal Resistance of Resistor ( K/W )  
 $T_{MAX}$  = Maximum Temperature of Resistor  
 $T_A$  = Ambient Temperature of Heatsink ( °C )  
 $P$  = Power Through Resistor ( W )

**Pulse Stability**

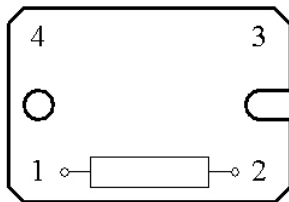


**SPECIFICATIONS** (continued)

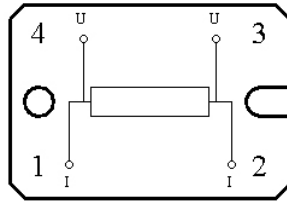
Dimensions and Attachment Variations



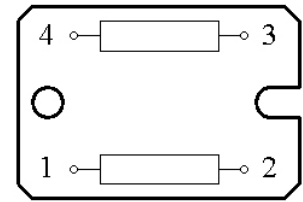
Dimension	mm	tol. (±mm)	inches	tol. (±inches)
A	26	0.5	1.02	0.020
B	38	0.5	1.50	0.020
C	12.7	0.2	0.50	0.008
D	4	0.2	0.16	0.008
E	30	0.2	1.18	0.008
F	15	0.2	0.59	0.008
G	4.1	0.2	0.16	0.008
H	10	0.2	0.39	0.008
I	8	0.2	0.31	0.008
J	4	0.2	0.16	0.008
K	2	0.2	0.08	0.008
L	0.8	0.1	0.03	0.004
M	M4		M4	
N	10	0.2	0.39	0.008
O	11.9	0.2	0.47	0.008



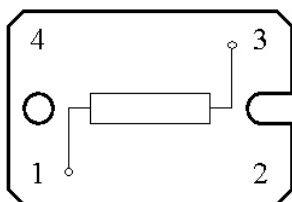
KPR/KHR 2-T227



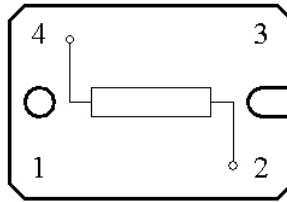
KPR/KHR 4-T227



KPN/KHN 2-T227



KPR/KHR 2-T227 dia1



KPR/KHR 2-T227 dia2

# KPR KPN 2/4-T227 KHR KHN 2/4-T227

Power Resistors



- Resistances from 0.05Ohm to 5MOhms
- Power Rating to 200Watt
- Resistance Tolerances to  $\pm 1\%$
- TCR to  $\pm 50\text{ppm/K}$
- TO-227 (TO-238) Housing

## SPECIFICATIONS

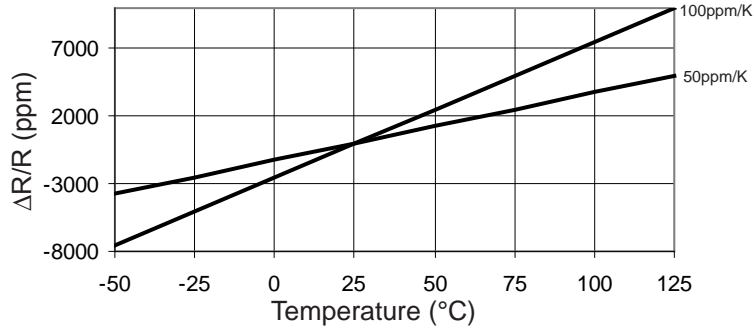
Type	KPR 2/4-T227 KPN 2-T227	KHR 2/4-T227 KHN 2-T227
Resistance Range	0.05 Ohms to 5 MOhms	
Power rating with heatsink	100 W	200 W
Thermal Resistance Rthj-c	0.7 K/W	0.35 K/W
Tolerances from 0.05 Ohms from 0.1 Ohms	2% / 5% / 10% 1% / 2% / 5% / 10%	
Stability	1%	
Temperature Coefficient 0.05 to 0.099 Ohms 0.1 to 5 MOhms	$\pm 300\text{ ppm/K}$ $\pm 100\text{ ppm/K}$ upon request $\pm 50\text{ ppm/K}$	
Voltage Proof	2.5 kVDC	
Inductivity	$\leq 50\text{ nH}$	
Capacity	$\leq 35\text{ pF}$	
Max. Voltage depending on resistance value		
Operating Temperature Range	-55 to 155°C	
Resistor Material	Thick Film	
Substrate	Al <sub>2</sub> O <sub>3</sub>	
Housing	Epoxy or Plastic	
Connector Material	Cu tinned	
Terminals	2 or 4	
Max. Torque backplate terminals	1.5 Nm 1.3 Nm	

## Ordering Information

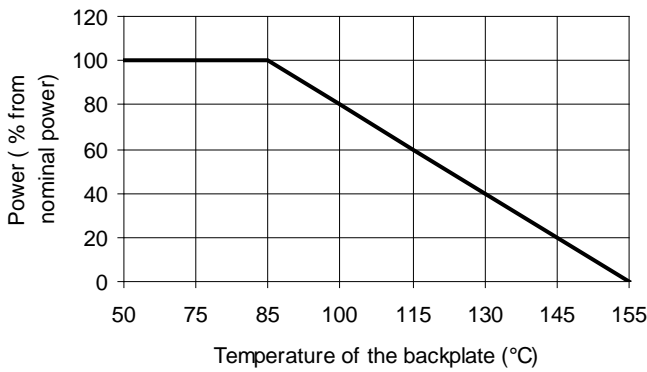
Part Number - Resistance - Tolerance  
KHR 2-T227 10 Ohms 5%

**SPECIFICATIONS** (continued)

**Temperature Coefficient**



**Derating**

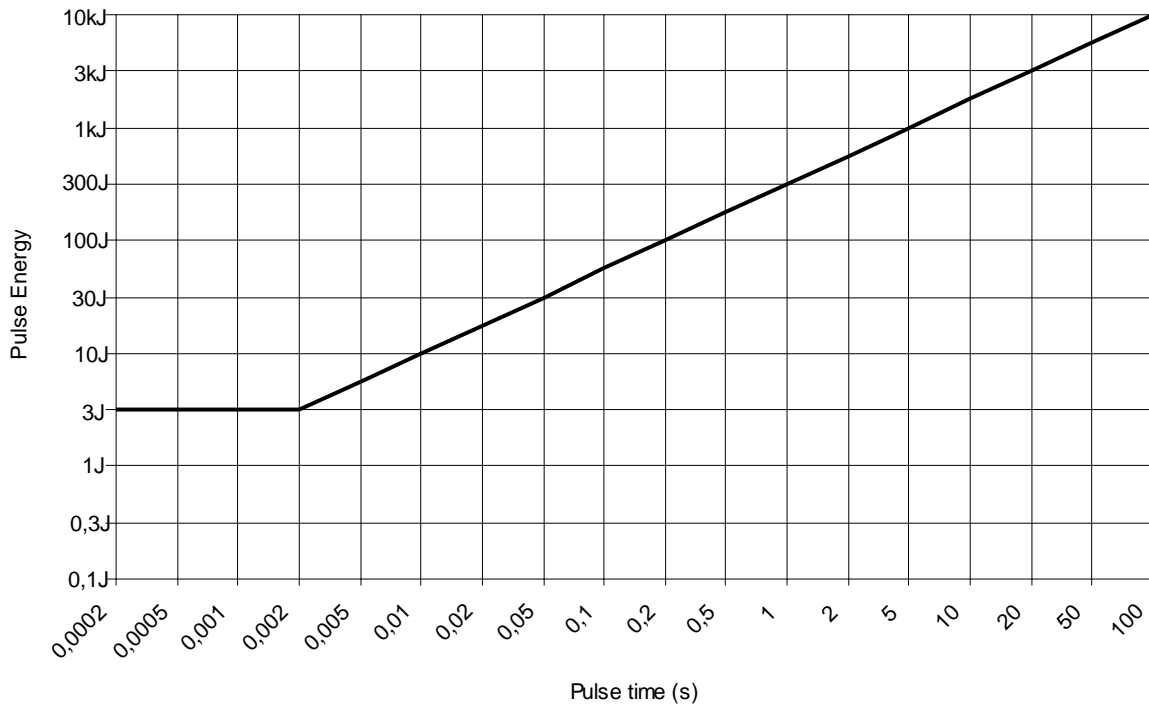


**Power Rating Notes -**  
 The KPR / KPN / KHR / KHN Series Resistors must be attached to a suitable heatsink. The maximum internal resistor temperature is 155°C.  
 To specify an appropriate heatsink use the following formula :

$$R_{0H} = \frac{T_{MAX} - (P \times R_{0R}) - T_A}{P}$$

Where:  $R_{0H}$  = Thermal Resistance of Heatsink ( K/W )  
 $R_{0R}$  = Thermal Resistance of Resistor ( K/W )  
 $T_{MAX}$  = Maximum Temperature of Resistor  
 $T_A$  = Ambient Temperature of Heatsink ( °C )  
 $P$  = Power Through Resistor ( W )

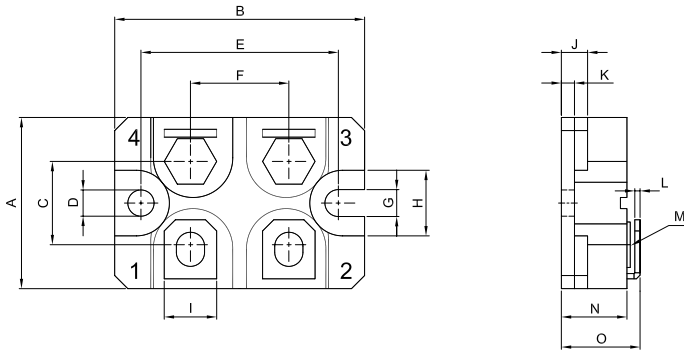
**Pulse Stability**



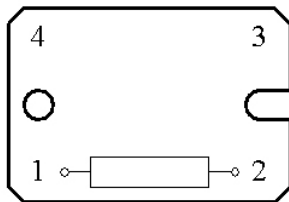


**SPECIFICATIONS** (continued)

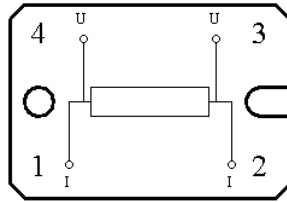
Dimensions and Attachment Variations



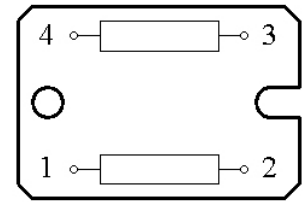
Dimension	mm	tol. (±mm)	inches	tol. (±inches)
A	26	0.5	1.02	0.020
B	38	0.5	1.50	0.020
C	12.7	0.2	0.50	0.008
D	4	0.2	0.16	0.008
E	30	0.2	1.18	0.008
F	15	0.2	0.59	0.008
G	4.1	0.2	0.16	0.008
H	10	0.2	0.39	0.008
I	8	0.2	0.31	0.008
J	4	0.2	0.16	0.008
K	2	0.2	0.08	0.008
L	0.8	0.1	0.03	0.004
M	M4		M4	
N	10	0.2	0.39	0.008
O	11.9	0.2	0.47	0.008



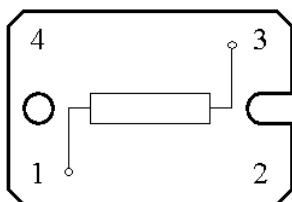
KPR/KHR 2-T227



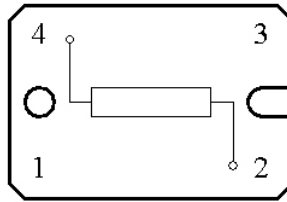
KPR/KHR 4-T227



KPN/KHN 2-T227



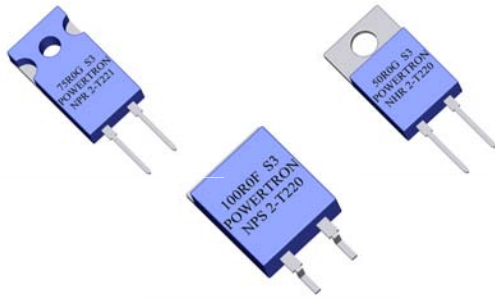
KPR/KHR 2-T227 dia1



KPR/KHR 2-T227 dia2

# NPR NPS 2-T220 T221 NHR NHS 2-T220 T221

Power Resistors



- Resistances from 0.02Ohm to 100kOhms
- Power Rating to 50Watt
- Resistance Tolerances to  $\pm 1\%$
- TCR to  $\pm 50\text{ppm/K}$
- Load Stability to 0.5%
- TO-220 Housing
- Convenient SMD D2Pak Available



## SPECIFICATIONS

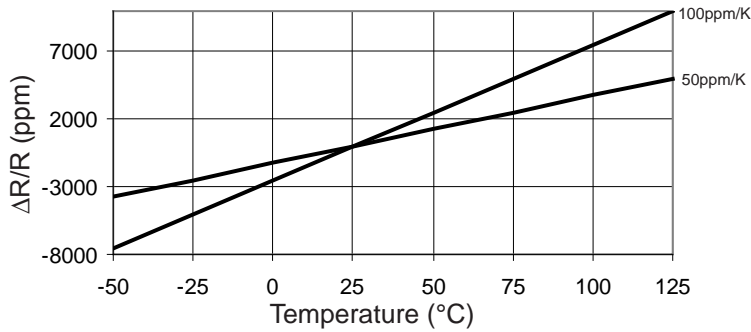
Type	NPR / NPS	NHR / NHS
Resistance Range	0.02 Ohms to 100kOhms	0.02 Ohms to 15kOhms
Power rating free air 70°C with heatsink	1.5 W 30 W	1.5 W 50 W
Thermal Resistance Rthj-c	3.5 K/W	2.1 K/W
Tolerances from 0.02 Ohms from 1.0 Ohms	2% / 5% 1% / 2% / 5%	
Stability	0.5%	
Temperature Coefficient 0.02 to 0.049 Ohms 0.05 to 0.099 Ohms 0.1 Ohms to 100 kOhms	$\pm 600\text{ ppm/K}$ $\pm 300\text{ ppm/K}$ $\pm 100\text{ ppm/K}$ upon request $\pm 50\text{ ppm/K}$	
Voltage Proof	2.0 kVDC	1.5 kVDC
Max. Voltage depending on resistance value		
Operating Temperature Range	-40 to 155°C	
Resistor Material	Thick Film	
Substrate	$\text{Al}_2\text{O}_3$	
Housing	Epoxy or PPS	
Connector Material	Cu tinned	
Terminals	2	
Max. Torque	T220: 1 Nm T221: 0.8 Nm	

## Ordering Information

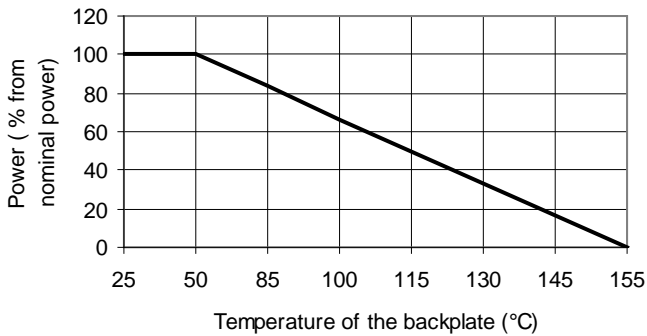
Part Number - Resistance - Contact - Tolerance  
NHR 2-T221 C 1.1 kOhms 1%

**SPECIFICATIONS** (continued)

**Temperature Coefficient**



**Derating**



**Power Rating Notes -**

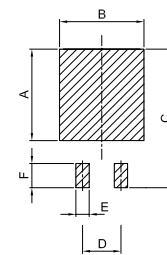
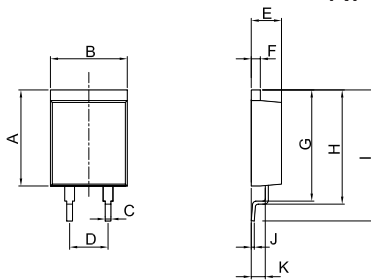
The NPR / NHR Series Resistors must be attached to a suitable heatsink. The maximum internal resistor temperature is 155°C. To specify an appropriate heatsink use the following formula :

$$R_{0H} = \frac{T_{MAX} - (P \times R_{0R}) - T_A}{P}$$

Where:  $R_{0H}$  = Thermal Resistance of Heatsink ( K/W )  
 $R_{0R}$  = Thermal Resistance of Resistor ( K/W )  
 $T_{MAX}$  = Maximum Temperature of Resistor  
 $T_A$  = Ambient Temperature of Heatsink ( °C )  
 $P$  = Power Through Resistor ( W )

**Dimensions**

**NPS / NHS 2-T220**

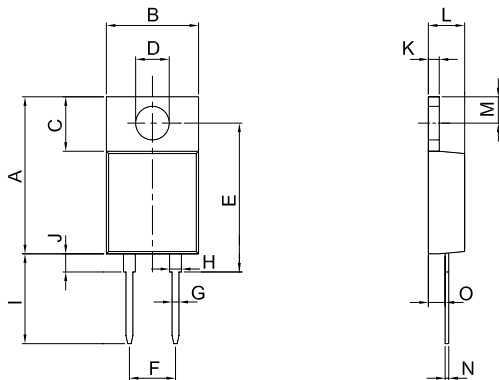


Dimension	mm	tol. (±mm)	inches	tol. (±inches)
A	12.70	0.2	0.50	0.008
B	10.16	0.2	0.40	0.008
C	0.76	0.1	0.03	0.004
D	5.08	0.1	0.20	0.004
E	4.00	0.1	0.16	0.004
F	1.20	0.1	0.05	0.004
G	14.60	0.2	0.57	0.008
H	15.00	0.2	0.59	0.008
I	17.33	0.2	0.68	0.008
J	0.40	0.1	0.02	0.004
K	1.85	0.1	0.07	0.004

Dimension	mm	inches
A	12.10	0.476
B	11.16	0.439
C	18.33	0.722
D	5.08	0.200
E	1.76	0.069
F	3.20	0.126

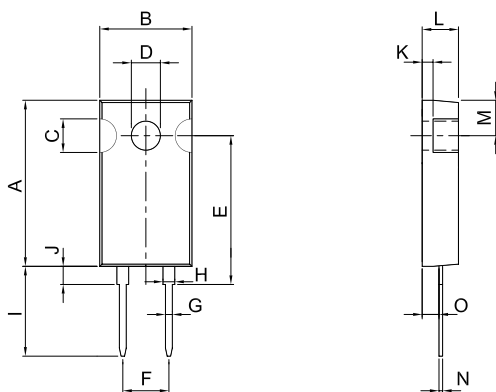
**SPECIFICATIONS** (continued)

NPR / NHR 2-T220



Dimension	mm	tol. (±mm)	inches	tol. (±inches)
A	17.30	0.2	0.68	0.008
B	10.16	0.2	0.40	0.008
C	6.00	0.1	0.24	0.004
D	Ø3.7	0.1	Ø0.146	0.004
E	16.40	0.2	0.65	0.008
F	5.08	0.1	0.20	0.004
G	0.76	0.1	0.03	0.004
H	1.30	0.1	0.05	0.004
I	10.00	0.2	0.39	0.008
I (C-Contact)	13.80	0.2	0.54	0.008
J	2.00	0.1	0.08	0.004
K	1.20	0.1	0.05	0.004
L	4.00	0.1	0.16	0.004
M	2.90	0.1	0.11	0.004
N	0.40	0.1	0.02	0.004
O	1.85	0.1	0.07	0.004

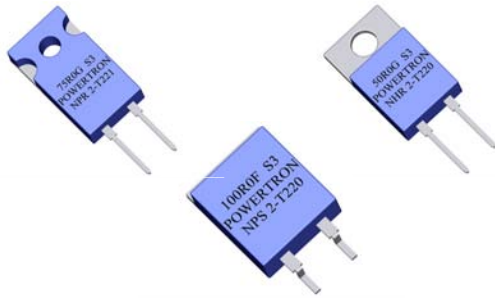
NPR / NHR 2-T221



Dimension	mm	tol. (±mm)	inches	tol. (±inches)
A	18.30	0.2	0.72	0.008
B	10.16	0.2	0.40	0.008
C	3.70	0.1	0.15	0.004
D	Ø3.2	0.1	Ø0.126	0.004
E	16.40	0.2	0.65	0.008
F	5.08	0.1	0.20	0.004
G	0.76	0.1	0.03	0.004
H	1.30	0.1	0.05	0.004
I	10.00	0.2	0.39	0.008
I (C-Contact)	13.80	0.2	0.54	0.008
J	2.00	0.1	0.08	0.004
K	1.20	0.1	0.05	0.004
L	4.00	0.1	0.16	0.004
M	3.90	0.1	0.15	0.004
N	0.40	0.1	0.02	0.004
O	1.85	0.1	0.07	0.004

# NPR NPS 2-T220 T221 NHR NHS 2-T220 T221

Power Resistors



- Resistances from 0.02Ohm to 100kOhms
- Power Rating to 50Watt
- Resistance Tolerances to  $\pm 1\%$
- TCR to  $\pm 50\text{ppm/K}$
- Load Stability to 0.5%
- TO-220 Housing
- Convenient SMD D2Pak Available



## SPECIFICATIONS

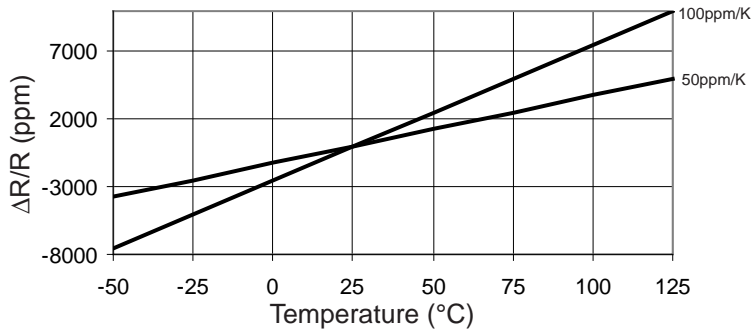
Type	NPR / NPS	NHR / NHS
Resistance Range	0.02 Ohms to 100kOhms	0.02 Ohms to 15kOhms
Power rating free air 70°C with heatsink	1.5 W 30 W	1.5 W 50 W
Thermal Resistance Rthj-c	3.5 K/W	2.1 K/W
Tolerances from 0.02 Ohms from 1.0 Ohms	2% / 5% 1% / 2% / 5%	
Stability	0.5%	
Temperature Coefficient 0.02 to 0.049 Ohms 0.05 to 0.099 Ohms 0.1 Ohms to 100 kOhms	$\pm 600\text{ ppm/K}$ $\pm 300\text{ ppm/K}$ $\pm 100\text{ ppm/K}$ upon request $\pm 50\text{ ppm/K}$	
Voltage Proof	2.0 kVDC	1.5 kVDC
Max. Voltage depending on resistance value		
Operating Temperature Range	-40 to 155°C	
Resistor Material	Thick Film	
Substrate	$\text{Al}_2\text{O}_3$	
Housing	Epoxy or PPS	
Connector Material	Cu tinned	
Terminals	2	
Max. Torque	T220: 1 Nm T221: 0.8 Nm	

## Ordering Information

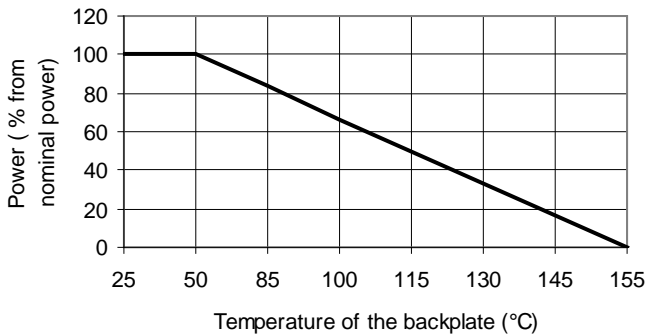
Part Number - Resistance - Contact - Tolerance  
NHR 2-T221 C 1.1 kOhms 1%

**SPECIFICATIONS** (continued)

**Temperature Coefficient**



**Derating**



**Power Rating Notes -**

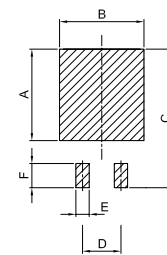
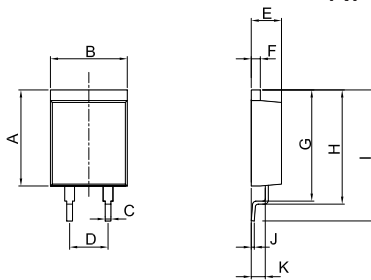
The NPR / NHR Series Resistors must be attached to a suitable heatsink. The maximum internal resistor temperature is 155°C. To specify an appropriate heatsink use the following formula :

$$R_{0H} = \frac{T_{MAX} - (P \times R_{0R}) - T_A}{P}$$

Where:  $R_{0H}$  = Thermal Resistance of Heatsink ( K/W )  
 $R_{0R}$  = Thermal Resistance of Resistor ( K/W )  
 $T_{MAX}$  = Maximum Temperature of Resistor  
 $T_A$  = Ambient Temperature of Heatsink ( °C )  
 $P$  = Power Through Resistor ( W )

**Dimensions**

**NPS / NHS 2-T220**

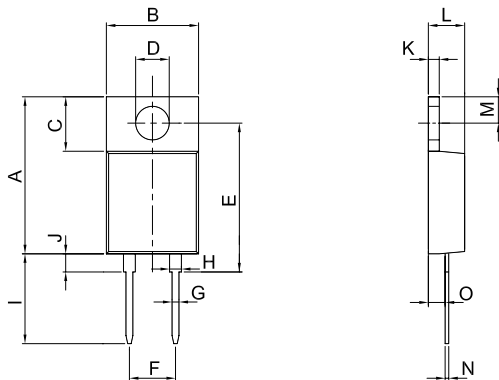


Dimension	mm	tol. (±mm)	inches	tol. (±inches)
A	12.70	0.2	0.50	0.008
B	10.16	0.2	0.40	0.008
C	0.76	0.1	0.03	0.004
D	5.08	0.1	0.20	0.004
E	4.00	0.1	0.16	0.004
F	1.20	0.1	0.05	0.004
G	14.60	0.2	0.57	0.008
H	15.00	0.2	0.59	0.008
I	17.33	0.2	0.68	0.008
J	0.40	0.1	0.02	0.004
K	1.85	0.1	0.07	0.004

Dimension	mm	inches
A	12.10	0.476
B	11.16	0.439
C	18.33	0.722
D	5.08	0.200
E	1.76	0.069
F	3.20	0.126

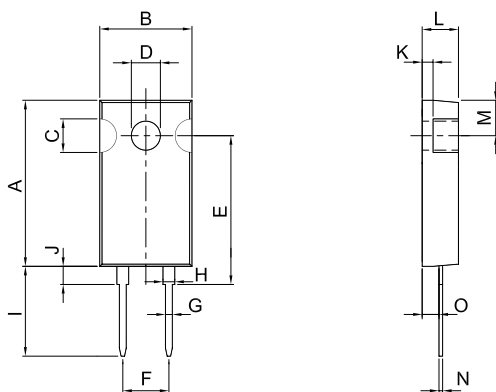
**SPECIFICATIONS** (continued)

NPR / NHR 2-T220



Dimension	mm	tol. (±mm)	inches	tol. (±inches)
A	17.30	0.2	0.68	0.008
B	10.16	0.2	0.40	0.008
C	6.00	0.1	0.24	0.004
D	Ø3.7	0.1	Ø0.146	0.004
E	16.40	0.2	0.65	0.008
F	5.08	0.1	0.20	0.004
G	0.76	0.1	0.03	0.004
H	1.30	0.1	0.05	0.004
I	10.00	0.2	0.39	0.008
I (C-Contact)	13.80	0.2	0.54	0.008
J	2.00	0.1	0.08	0.004
K	1.20	0.1	0.05	0.004
L	4.00	0.1	0.16	0.004
M	2.90	0.1	0.11	0.004
N	0.40	0.1	0.02	0.004
O	1.85	0.1	0.07	0.004

NPR / NHR 2-T221



Dimension	mm	tol. (±mm)	inches	tol. (±inches)
A	18.30	0.2	0.72	0.008
B	10.16	0.2	0.40	0.008
C	3.70	0.1	0.15	0.004
D	Ø3.2	0.1	Ø0.126	0.004
E	16.40	0.2	0.65	0.008
F	5.08	0.1	0.20	0.004
G	0.76	0.1	0.03	0.004
H	1.30	0.1	0.05	0.004
I	10.00	0.2	0.39	0.008
I (C-Contact)	13.80	0.2	0.54	0.008
J	2.00	0.1	0.08	0.004
K	1.20	0.1	0.05	0.004
L	4.00	0.1	0.16	0.004
M	3.90	0.1	0.15	0.004
N	0.40	0.1	0.02	0.004
O	1.85	0.1	0.07	0.004

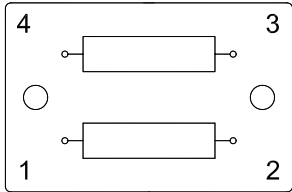
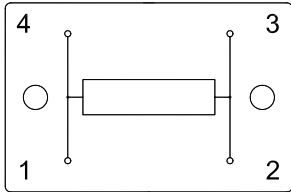
# KHR 4-T600 T900

Power Resistors



- Resistances from 100Ohm to 1kOhms
- Power Rating to 900Watt
- Resistance Tolerances to  $\pm 10\%$
- TCR to  $\pm 100\text{ppm/K}$
- TO-227 (TO-238) Housing

## SPECIFICATIONS

Type	KHR 4-T600	KHR 4-T900
Resistance Range	100 Ohms to 1kOhm	
Number of Resistors	double 	single 
Power Rating with Heatsink	600 W	900 W
Thermal Resistance Rthj-c	0.22 K/W	0.15 K/W
Tolerances	$\pm 10\%$ other Tolerances upon request	
Load Life	1%	
Short Time Overload	Rated Power x 2.5 (2.5 seconds monted on heatsink)	
Temperature Coefficient	$\pm 100\text{ppm/K}$	
Max. Voltage	$E = \sqrt{P \times R}$	
Voltage Proof	2.5kVAC	
Operating Temperature Range	-55 to 155°C	
Resistor Material	Thinfilm	
Substrate	AlN	
Housing	PCB	
Connector Material	Cu nickel plated	
Terminals	4	

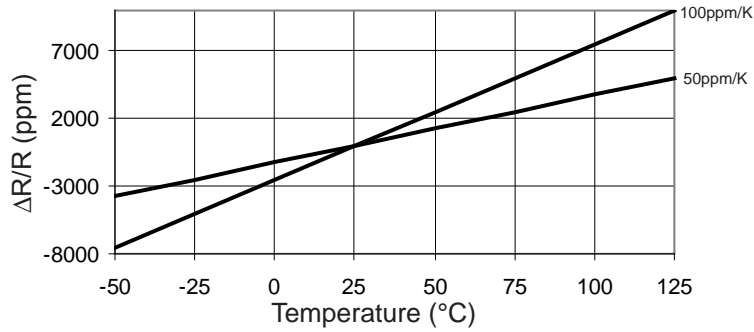
## Ordering Information

Part Number - Resistance - Tolerance  
 KHR 4-T900 10.5 kOhms 10%

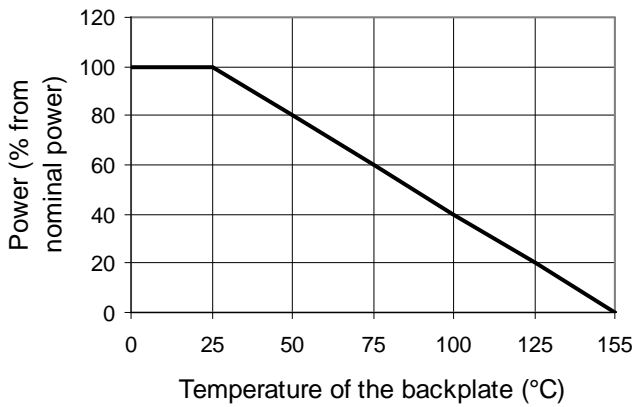


**SPECIFICATIONS** (continued)

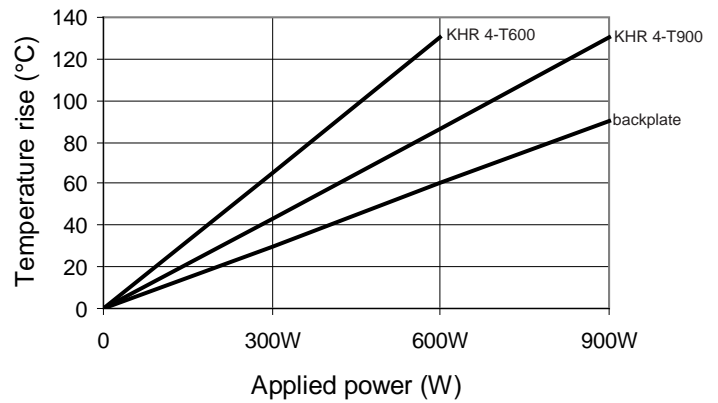
**Temperature Coefficient**



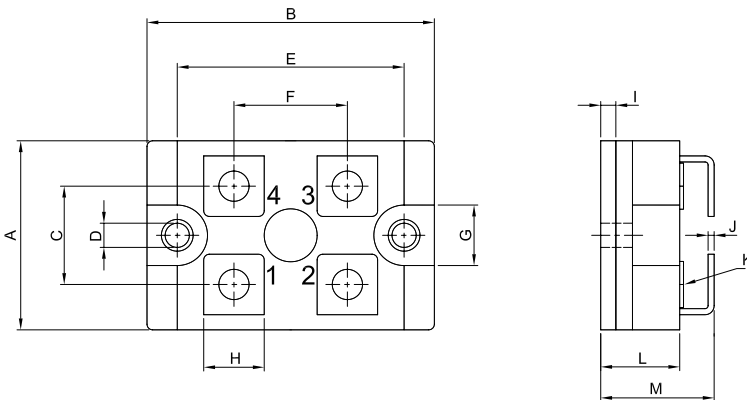
**Derating**



**Temperature Rise**



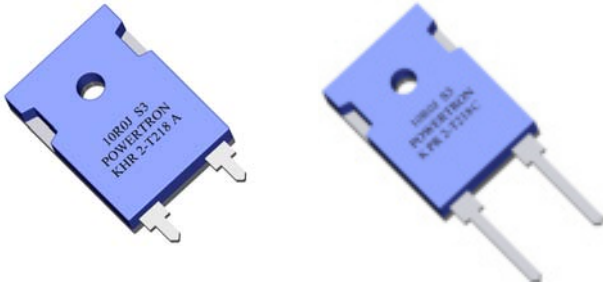
**Dimensions**



Dimension	mm	tol. (±mm)	inches	tol. (±inches)
A	25.00	0.5	0.98	0.020
B	38.00	0.5	1.50	0.020
C	13.00	0.5	0.51	0.020
D	3.20	0.1	0.13	0.004
E	30.00	0.2	1.18	0.008
F	15.00	0.5	0.59	0.020
G	8.00	0.2	0.31	0.008
H	8.00	0.2	0.31	0.008
I	2.00	0.2	0.08	0.008
J	0.80	0.1	0.03	0.004
K	M4		M4	
L	10.45	0.2	0.41	0.008
M	15.00	1.0	0.59	0.020

# KPR KHR 2-T218

Power Resistors



- Resistances from 0.05Ohm to 100kOhms
- Power Rating to 100Watt
- Resistance Tolerances to  $\pm 1\%$
- TCR to  $\pm 100\text{ppm/K}$
- Load Stability to 1%
- TO-218 (TO-247) Housing

## SPECIFICATIONS

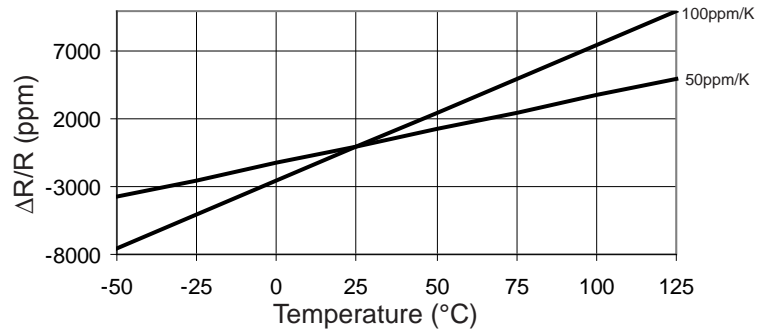
Type	KPR 2-T218	KHR 2-T218
Resistance Range	0.050 Ohms to 100 kOhms	
Power rating free air 70°C with heatsink	2 W 50 W	2 W 100 W
Thermal Resistance Rthj-c	2.1 K/W	0.8 K/W
Tolerances from 0.1 Ohms from 1.0 Ohms from 5.0 Ohms	5% 2% / 5% 1% / 2% / 5%	
Stability	1%	
Temperature Coefficient 0.05 to 0.099 Ohms 0.1 to 100 kOhms	$\pm 300\text{ ppm/K}$ $\pm 100\text{ ppm/K}$ upon request $\pm 50\text{ ppm/K}$	
Voltage Proof	2.5 kVDC	1.5 kVDC
Max. Voltage depending on resistance value		
Operating Temperature Range	-55 to 155°C	
Resistor Material	Thick Film	
Substrate	Al <sub>2</sub> O <sub>3</sub> upon request: AlN	
Housing	PPS	
Connector Material	Cu tinned	
Terminals	2	
Max. Torque	1 Nm	

## Ordering Information

Part Number - Resistance - Contact - Tolerance  
KHR 2-T218 15 kOhms A 5%

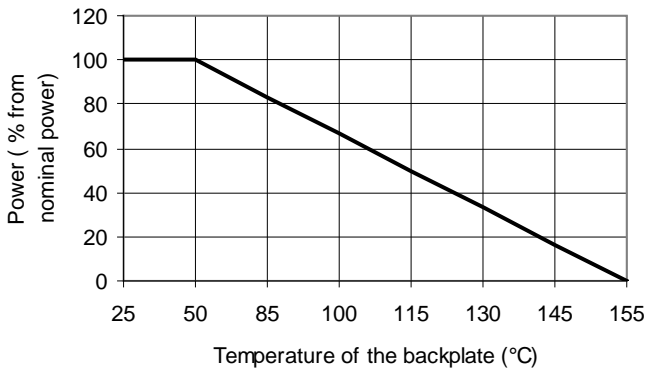
**SPECIFICATIONS** (continued)

Temperature Coefficient

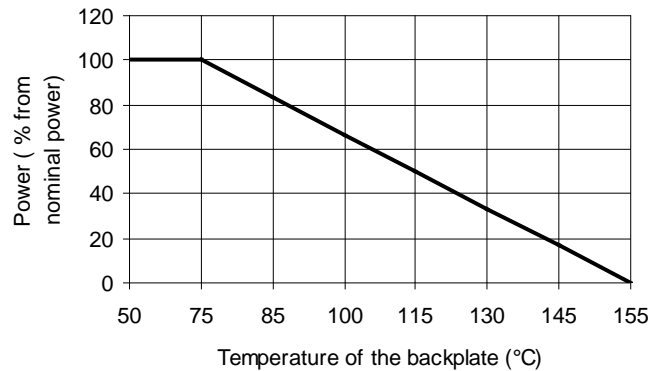


Derating

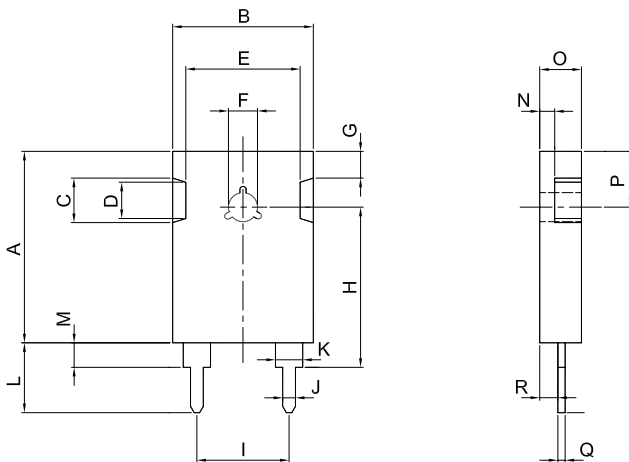
KPR 2-T218



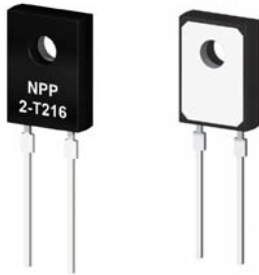
KHR 2-T218



Dimensions



Dimension	mm	tol. (±mm)	inches	tol. (±inches)
A	21.10	0.2	0.83	0.008
B	15.50	0.2	0.61	0.008
C	4.90	0.1	0.19	0.004
D	4.00	0.1	0.16	0.004
E	12.60	0.2	0.50	0.008
F	∅3.2	0.1	∅0.13	0.004
G	2.95	0.1	0.12	0.004
H (A-Contact)	17.65	0.2	0.69	0.008
H (B-Contact)	16.85	0.2	0.66	0.008
H (C-Contact)	17.75	0.2	0.70	0.008
I	10.16	0.2	0.40	0.008
J	1.40	0.1	0.06	0.004
K	3.00	0.1	0.12	0.004
L (A-Contact)	7.70	0.2	0.30	0.008
L (B-Contact)	5.00	0.2	0.20	0.008
L (C-Contact)	14.50	0.2	0.57	0.008
M (A-Contact)	2.70	0.1	0.11	0.004
M (B-Contact)	1.90	0.1	0.07	0.004
M (C-Contact)	2.80	0.1	0.11	0.004
N	1.65	0.1	0.06	0.004
O	4.60	0.1	0.18	0.004
P	6.15	0.2	0.24	0.008
Q	0.80	0.1	0.03	0.004
R	2.00	0.1	0.08	0.004



- Resistances from 0.01 to 51K Ohms
- Power Rating to 20Watt
- Resistance Tolerances to  $\pm 0.05\%$
- TCR to  $\pm 5\text{ppm/K}$
- TO-126 Housing
- Convenient SMD DPak Available
- Low Inductance (  $< 50\text{nH}$  )



### SPECIFICATIONS

Type	Power Rating		Thermal Resistance	Resistance Range <sup>3</sup>		Tolerances	Temperature Coefficients
	Heatsink <sup>1</sup>	Free Air <sup>2</sup>		Min	Max		
<b>NPR 2-T126</b>	20W	1W	5.9K/W	0.01 $\Omega$	51K $\Omega$	$\pm 1\%$ ( R>0.1 $\Omega$ ) $\pm 5\%$	$\pm 50\text{ppm/K}$ ( R>10 $\Omega$ ) $\pm 100\text{ppm/K}$ ( R>0.1 $\Omega$ ) $\pm 250\text{ppm/K}$
<b>NPP 2-T126</b>	5W	0.5W	6.0K/W	0.1 $\Omega$	51K $\Omega$	$\pm 0.05\%$ / $\pm 0.1\%$ / $\pm 0.25\%$ ( R>5 $\Omega$ ) $\pm 0.5\%$ ( R>1 $\Omega$ ) / $\pm 1\%$ ( R>0.1 $\Omega$ ) $\pm 2\%$ / $\pm 5\%$	$\pm 5$ / $\pm 10\text{ppm/K}$ ( R>1 $\Omega$ ) $\pm 25\text{ppm/K}$ ( R>0.1 $\Omega$ ) $\pm 100\text{ppm/K}$

<sup>1</sup> Power rating based on 25°C Flange Temperature

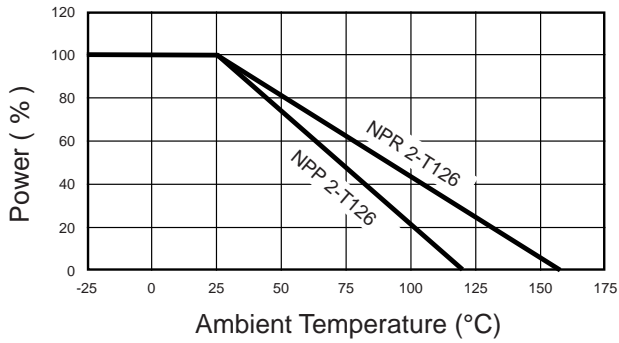
<sup>2</sup> Power rating based on 25°C Ambient Temperature

<sup>3</sup> Consult Factory for Higher or Lower Values

Specification	Value	
Maximum Current	25A	
Temperature Range	-55°C to +155°C : NPP 2T126 -55°C to +120°C : NPR 2-T126	
Dielectric Strength	2000 VAC	
Max. Operating Voltage	500 V	
Insulation Resistance	>1000 Meg-Ohm	
Environmental Performance	$\Delta R$	Test Conditions
Load Life	$\pm 1\%$	25°C / 90 min ON / 30 min OFF / 1000 hr
Humidity Resistance	$\pm 1\%$	40°C / 90-95% RH / DC 0.1W / 1000 hr
Temperature Cycle	$\pm 0.25\%$	-55°C for 30 min / +155°C for 30 min / 1000 hr
Solder Heat	$\pm 0.1\%$	+350°C / 3s
Vibration	$\pm 0.25\%$	

### SPECIFICATIONS (continued)

Power Derating Curve



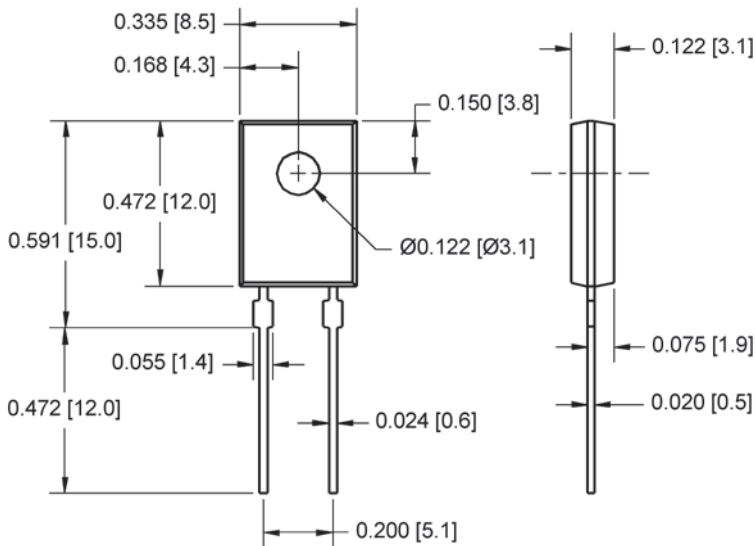
#### Power Rating Notes -

The NPR 2-T126 Series Foil Resistors must be attached to a suitable heatsink. The maximum internal resistor temperature is 155°C (120°C for the NPP 2-T126).

To specify an appropriate heatsink use the following formula :

$$R_{\theta H} = \frac{T_{MAX} - (P \times R_{\theta R}) - T_A}{P}$$

Where:  $R_{\theta H}$  = Thermal Resistance of Heatsink ( K/W )  
 $R_{\theta R}$  = Thermal Resistance of Resistor ( K/W )  
 $T_{MAX}$  = Maximum Temperature of Resistor  
 $T_A$  = Ambient Temperature of Heatsink ( °C )  
 $P$  = Power Through Resistor ( W )



#### Mounting Notes -

The NPR 2-T126 Series Film Resistors must be attached to a suitable heatsink. Mount resistor using thermal grease to a clean / flat surface. Use a compression washer to provide 150 to 300 pounds ( 665 to 1330N ) of mounting force. Torque mounting screw to 8 in-lbs ( 0.9 Nm ).

### Ordering Information

Part Number - Resistance - Tolerance - TCR

Example: NPR 2-T126 0.5 Ohm 1% 100ppm

# UAL Series

Aluminum Housed Wirewound Resistors



- Power Rating 5 to 300Watts
- All Welded Construction
- Resistances from 0.005 to 250kOhms
- Tolerance to  $\pm 0.01\%$
- High Overload and Pulse Handling
- Low TCR:  $\pm 20\text{ppm/K}$  Standard
- Four Terminal Versions Available

## SPECIFICATIONS

Type	MIL-R-39009 MIL-R-18546 Style	Power Rating ( W @ 25°C )			Resistance Range <sup>1</sup>
		Commercial	MIL	Free Air	
UAL-5	RER-60 / RE-60	7.5 <sup>a</sup>	5 <sup>a</sup>	4.5	0.01 to 22K
UAL-10	RER-65 / RE-65	12.5 <sup>a</sup>	10 <sup>a</sup>	7.5	0.01 to 47K
UAL-25	RER-70 / RE-70	25 <sup>b</sup>	20 <sup>b</sup>	12	0.01 to 90K
UAL-50	RER-75 / RE-75	50 <sup>c</sup>	30 <sup>c</sup>	20	0.01 to 250K
UAL-100	RER-77 / RE-77	100 <sup>d</sup>	75 <sup>d</sup>	40	0.01 to 50K
UAL-180	-	180 <sup>d</sup>	-	-	0.01 to 50K
UAL-250	RER-80 / RE-80	250 <sup>d</sup>	120 <sup>d</sup>	100	0.01 to 50K
UAL-300	-	300 <sup>e</sup>	-	75	0.005 to 100K

<sup>1</sup> For non-inductive windings, divide maximum resistance by 2

<sup>a</sup> Heatsink Required : 0.040 [1.0] Alum. Plate, 129 in<sup>2</sup> [832 cm<sup>2</sup>] or equiv.

<sup>b</sup> Heatsink Required : 0.040 [1.0] Alum. Plate, 167 in<sup>2</sup> [1077 cm<sup>2</sup>] or equiv.

<sup>c</sup> Heatsink Required : 0.059 [1.5] Alum. Plate, 291 in<sup>2</sup> [1877 cm<sup>2</sup>] or equiv.

<sup>d</sup> Heatsink Required : 0.125 [3.2] Alum. Plate, 294 in<sup>2</sup> [1896 cm<sup>2</sup>] or equiv.

<sup>e</sup> Heatsink Required : 0.125 [3.2] Alum. Plate, 895 in<sup>2</sup> [5780 cm<sup>2</sup>] or equiv.

## Ordering Information

For Non-Inductive Windings / insert the letter "N" ( i.e. UALN-25 )

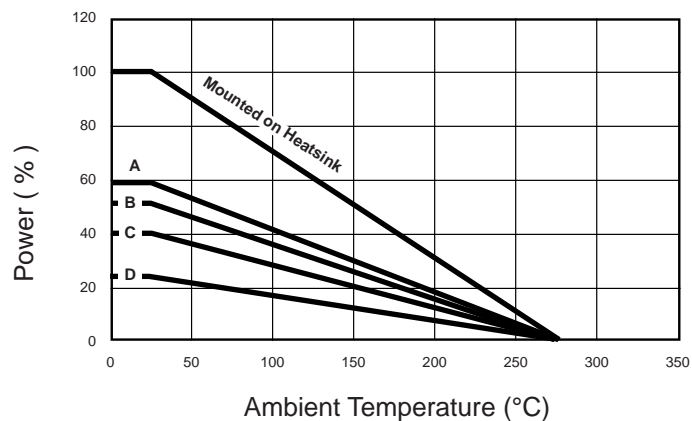
Part Number - Resistance - Tolerance - TCR ( If not standard )

Example: UAL-25 10 Ohm 1%

### SPECIFICATIONS (continued)

Specification	Value
Tolerances	±0.01% to ±10% ( 1% Standard )
Temperature Coefficient	>10Ω : ±20ppm/K 1Ω to10Ω : ±50ppm/K <1Ω : Call Factory
Temperature Range	-55°C to +275°C
Dielectric Strength	1500 VAC
Constuction	Centerless ground ceramic core Tinned copper or copperweld leads High-temperature epoxy molding Compound Anodized aluminum housing All welded terminations
Environmental Performance (MIL-STD 202)	ΔR
Dielectric	±0.2% + 0.05Ω
Load Life	±1% + 0.05Ω
Storage	±0.2% + 0.05Ω
Moisture Resistance	±0.2% + 0.05Ω
Thermal Shock	±0.2% + 0.05Ω
5X Overload ( 5s )	±0.2% + 0.05Ω
Shock	±0.1% + 0.05Ω
Vibration	±0.1% + 0.05Ω

Power Derating Curve



**Free-air Derating**

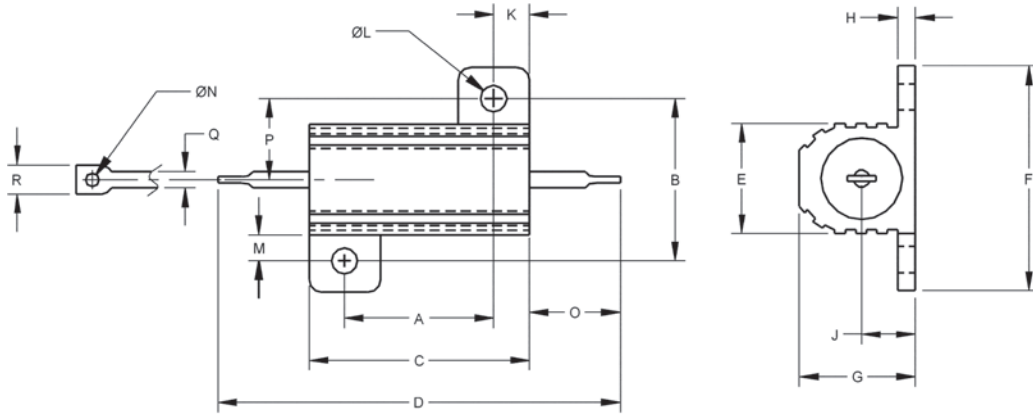
A : UAL-5, UAL-10

B : UAL-25

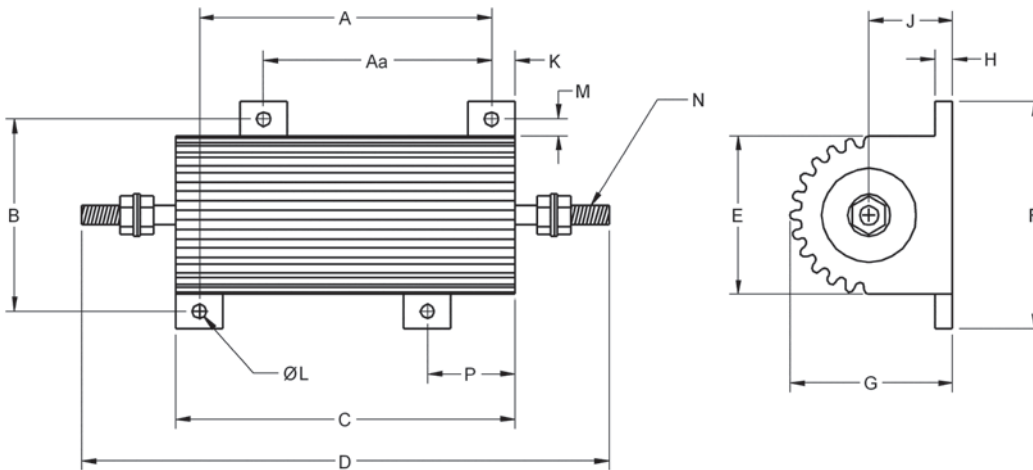
C : UAL-50, UAL-100, UAL-250

D : UAL-300

### Dimensions



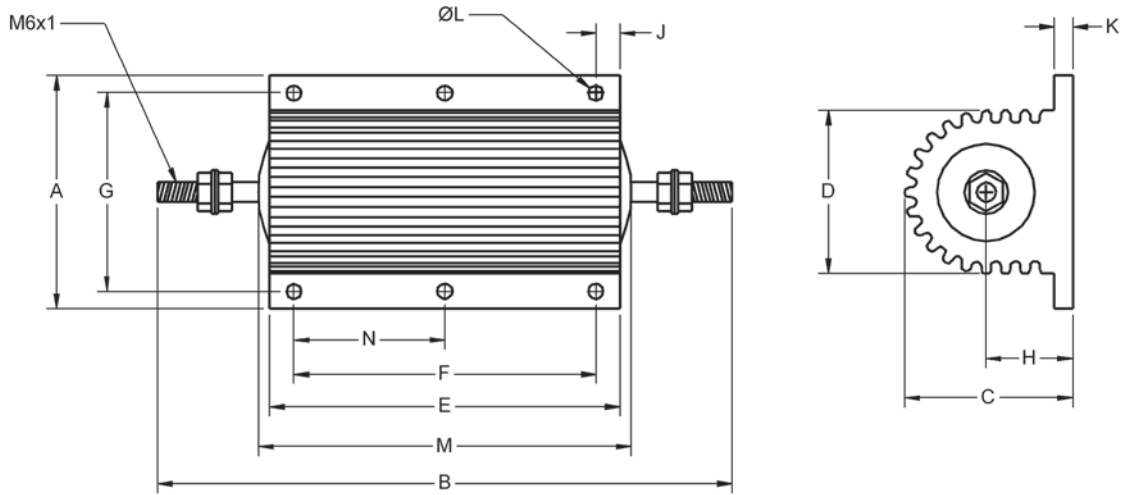
Type	A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	Q	R
	±0.005 [±0.13]	±0.005 [±0.13]	±0.031 [±0.8]	±0.062 [±1.6]	±0.015 [±0.4]	±0.015 [±0.4]	±0.015 [±0.4]	±0.010 [±0.25]	±0.010 [±0.25]	±0.010 [±0.25]	±0.005 [±0.13]	±0.015 [±0.4]	±0.005 [±0.13]	±0.062 [±1.6]	±0.031 [±0.8]	±0.002 [±0.05]	±0.031 [±0.8]
UAL-5	0.444 [11.3]	0.490 [12.4]	0.600 [15.2]	1.125 [28.5]	0.334 [8.5]	0.646 [16.4]	0.320 [8.1]	0.065 [1.7]	0.140 [3.6]	0.078 [2.0]	0.093 [2.4]	0.078 [2.0]	0.050 [1.3]	0.266 [6.8]	0.245 [6.2]	0.051 [1.30]	0.085 [2.2]
UAL-10	0.562 [14.3]	0.625 [15.9]	0.750 [19.1]	1.375 [35.0]	0.430 [10.9]	0.800 [20.3]	0.400 [10.2]	0.075 [1.9]	0.190 [4.8]	0.093 [2.4]	0.093 [2.4]	0.102 [2.6]	0.086 [2.2]	0.312 [7.9]	0.312 [7.9]	0.081 [2.06]	0.140 [3.6]
UAL-25	0.719 [18.3]	0.781 [19.8]	1.062 [27.0]	1.938 [49.2]	0.530 [13.5]	1.080 [27.4]	0.560 [14.2]	0.085 [2.2]	0.260 [6.6]	0.172 [4.4]	0.125 [3.2]	0.125 [3.2]	0.086 [2.2]	0.438 [11.1]	0.391 [9.9]	0.081 [2.06]	0.140 [3.6]
UAL-50	1.563 [39.7]	0.844 [21.4]	1.968 [50.0]	2.781 [70.6]	0.615 [15.6]	1.140 [29.0]	0.615 [15.6]	0.085 [2.2]	0.300 [7.6]	0.196 [5.0]	0.125 [3.2]	0.125 [3.2]	0.086 [2.2]	0.438 [11.1]	0.422 [10.7]	0.081 [2.06]	0.140 [3.6]



Type	A	Aa	B	C	D	E	F	G	H	J	K	L	M	N	P	Mtg. Screw
	±0.005 [±0.13]	±0.005 [±0.13]	±0.005 [±0.13]	±0.031 [±0.8]	±0.062 [±1.6]	±0.015 [±0.4]	±0.015 [±0.4]	±0.015 [±0.4]	±0.010 [±0.25]	±0.015 [±0.4]	±0.015 [±0.4]	±0.005 [±0.13]	±0.015 [±0.4]	N	±0.015 [±0.4]	
UAL-100	2.750 [69.9]	-	2.250 [57.2]	3.500 [88.9]	5.480 [139]	1.800 [45.7]	2.810 [71.4]	1.750 [44.5]	0.188 [4.8]	0.800 [20.3]	0.375 [9.5]	0.188 [4.8]	0.225 [5.7]	12-24	-	(2) #8
UAL-180	2.750 [69.9]	-	2.500 [63.5]	3.500 [88.9]	5.480 [139]	2.100 [53.3]	3.000 [76.2]	2.190 [55.6]	0.250 [6.4]	0.950 [24.1]	0.375 [9.5]	0.188 [4.8]	0.200 [5.1]	12-24	-	(2) #8
UAL-250	3.875 [98.4]	3.000 [76.2]	1.062 [27.0]	4.500 [114]	7.000 [178]	2.100 [53.3]	3.000 [76.2]	2.190 [55.6]	0.250 [6.4]	1.000 [25.4]	0.312 [7.9]	0.188 [4.8]	0.200 [5.1]	1/4-20	1.188 [30.7]	(4) #8



### Dimensions (continued)



Type	A MAX	B MAX	C MAX	D MAX	E MAX	F ±0.010 [±0.3]	G ±0.010 [±0.3]	H MAX	J MAX	K MAX	L ±0.010 [±0.3]	M MAX	N ±0.010 [±0.3]
<b>UAL-300</b>	2.854 [72.5]	7.260 [184.4]	1.646 [41.8]	1.791 [45.5]	5.028 [127.7]	4.094 [104.0]	2.323 [59.0]	0.807 [20.5]	0.488 [12.4]	0.217 [5.5]	0.260 [6.6]	5.567 [141.4]	2.047 [52.0]