

The content of this specification may change without notification 12/07/07

Custom solutions are available.

## HOW TO ORDER

### RHP-10A-100 F Y R

#### Packaging (50 pieces)

T = tube or R = tray (flanged type only)

#### TCR (ppm/°C)

Y =  $\pm 50$  Z =  $\pm 100$  N =  $\pm 250$

#### Tolerance

J =  $\pm 5\%$  F =  $\pm 1\%$

#### Resistance

R02 = 0.02  $\Omega$       100 = 10.0  $\Omega$   
 R10 = 0.10  $\Omega$       101 = 100  $\Omega$   
 1R0 = 1.00  $\Omega$       512 = 51.0K  $\Omega$

#### Size/Type (refer to spec)

10X    20B    50A    100A  
 10B    20C    50B  
 10C    20D    50C

#### Series

High Power Resistor

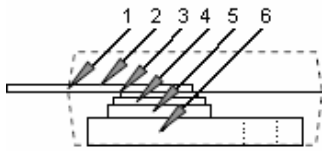
## FEATURES

- 20W, 35W, 50W, 100W, and 140W available
- TO126, TO220, TO263, TO247 packaging
- Surface Mount and Through Hole technology
- Resistance Tolerance from  $\pm 5\%$  to  $\pm 1\%$
- TCR (ppm/°C) from  $\pm 250$ ppm to  $\pm 50$ ppm
- Complete thermal flow design
- Non-Inductive impedance characteristic and heat venting through the insulated metal tab
- Durable design with complete thermal conduction, heat dissipation, and vibration

## APPLICATIONS

- RF circuit termination resistors
- CRT color video amplifiers
- Suits high-density compact installations
- High precision CRT and high speed pulse handling circuit
- High speed SW power supply
- Power unit of machines
- Motor control
- Drive circuits
- Automotive
- Measurements
- AC motor control
- RF linear amplifiers
- VHF amplifiers
- Industrial computers
- IPM, SW power supply
- Volt power sources
- Constant current sources
- Industrial RF power
- Precision voltage sources

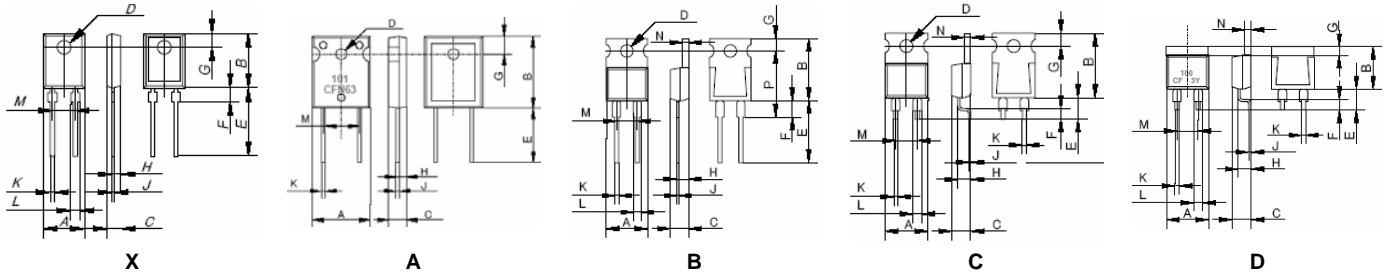
## CONSTRUCTION – shape X and A



there is insulation between the flange and the resistor

|   |           |               |
|---|-----------|---------------|
| 1 | Molding   | Epoxy         |
| 2 | Leads     | Tin plated Cu |
| 3 | Conductor | Copper        |
| 4 | Resistor  | Ni-Cr         |
| 5 | Substrate | Alumina       |
| 6 | Flange    | Ni plated Cu  |

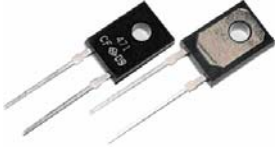

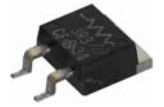
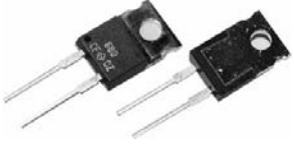


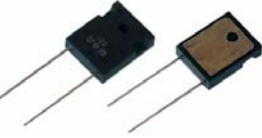



## SCHEMATIC



## DIMENSIONS (mm)

| Model | RHP-10X        | RHP-10B        | RHP-10C         | RHP-20B         | RHP-20C         | RHP-20D         | RHP-50A        | RHP-50B        | RHP-50C        | RHP-100E       |
|-------|----------------|----------------|-----------------|-----------------|-----------------|-----------------|----------------|----------------|----------------|----------------|
| Shape | X              | B              | C               | B               | C               | D               | A              | B              | C              | A              |
| A     | 8.5 $\pm$ 0.2  | 8.5 $\pm$ 0.2  | 10.1 $\pm$ 0.2  | 10.1 $\pm$ 0.2  | 10.1 $\pm$ 0.2  | 10.1 $\pm$ 0.2  | 16.0 $\pm$ 0.2 | 10.6 $\pm$ 0.2 | 10.6 $\pm$ 0.2 | 16.0 $\pm$ 0.2 |
| B     | 12.0 $\pm$ 0.2 | 12.0 $\pm$ 0.2 | 15.0 $\pm$ 0.2  | 15.0 $\pm$ 0.2  | 15.0 $\pm$ 0.2  | 10.3 $\pm$ 0.2  | 20.0 $\pm$ 0.5 | 15.0 $\pm$ 0.2 | 15.0 $\pm$ 0.2 | 20.0 $\pm$ 0.5 |
| C     | 3.1 $\pm$ 0.2  | 3.1 $\pm$ 0.2  | 4.5 $\pm$ 0.2   | 4.5 $\pm$ 0.2   | 4.5 $\pm$ 0.2   | 4.5 $\pm$ 0.2   | 4.8 $\pm$ 0.2  | 4.5 $\pm$ 0.2  | 4.5 $\pm$ 0.2  | 4.8 $\pm$ 0.2  |
| D     | 3.1 $\pm$ 0.1  | 3.1 $\pm$ 0.1  | 3.6 $\pm$ 0.1   | 3.6 $\pm$ 0.1   | 3.6 $\pm$ 0.1   | -               | 3.2 $\pm$ 0.1  | 1.5 $\pm$ 0.1  | 1.5 $\pm$ 0.1  | 3.2 $\pm$ 0.1  |
| E     | 17.0 $\pm$ 0.1 | 17.0 $\pm$ 0.1 | 5.0 $\pm$ 0.1   | 15.5 $\pm$ 0.1  | 5.0 $\pm$ 0.1   | 5.0 $\pm$ 0.1   | 14.5 $\pm$ 0.1 | 2.7 $\pm$ 0.1  | 2.7 $\pm$ 0.1  | 14.5 $\pm$ 0.5 |
| F     | 3.2 $\pm$ 0.5  | 3.2 $\pm$ 0.5  | 2.5 $\pm$ 0.5   | 4.0 $\pm$ 0.5   | 2.5 $\pm$ 0.5   | 2.5 $\pm$ 0.5   | -              | 5.08 $\pm$ 0.5 | 5.08 $\pm$ 0.5 | -              |
| G     | 3.8 $\pm$ 0.2  | 3.8 $\pm$ 0.2  | 3.0 $\pm$ 0.2   | 3.0 $\pm$ 0.2   | 3.0 $\pm$ 0.2   | 2.2 $\pm$ 0.2   | 5.1 $\pm$ 0.5  | 0.75 $\pm$ 0.2 | 0.75 $\pm$ 0.2 | 5.1 $\pm$ 0.5  |
| H     | 1.75 $\pm$ 0.1 | 1.75 $\pm$ 0.1 | 2.75 $\pm$ 0.1  | 2.75 $\pm$ 0.2  | 2.75 $\pm$ 0.2  | 2.75 $\pm$ 0.2  | 3.63 $\pm$ 0.2 | 0.5 $\pm$ 0.2  | 0.5 $\pm$ 0.2  | 3.63 $\pm$ 0.2 |
| J     | 0.5 $\pm$ 0.05 | 0.5 $\pm$ 0.05 | 0.5 $\pm$ 0.05  | 0.5 $\pm$ 0.05  | 0.5 $\pm$ 0.05  | 0.5 $\pm$ 0.05  | -              | 1.5 $\pm$ 0.05 | 1.5 $\pm$ 0.05 | -              |
| K     | 0.6 $\pm$ 0.05 | 0.6 $\pm$ 0.05 | 0.75 $\pm$ 0.05 | 0.75 $\pm$ 0.05 | 0.75 $\pm$ 0.05 | 0.75 $\pm$ 0.05 | 0.8 $\pm$ 0.05 | 19 $\pm$ 0.05  | 19 $\pm$ 0.05  | 0.8 $\pm$ 0.05 |
| L     | 1.4 $\pm$ 0.05 | 1.4 $\pm$ 0.05 | 1.5 $\pm$ 0.05  | 1.5 $\pm$ 0.05  | 1.5 $\pm$ 0.05  | 1.5 $\pm$ 0.05  | -              | 2.7 $\pm$ 0.05 | 2.7 $\pm$ 0.05 | -              |
| M     | 5.08 $\pm$ 0.1 | 5.08 $\pm$ 0.1 | 5.08 $\pm$ 0.1  | 5.08 $\pm$ 0.1  | 5.08 $\pm$ 0.1  | 5.08 $\pm$ 0.1  | 10.9 $\pm$ 0.1 | 3.6 $\pm$ 0.1  | 3.6 $\pm$ 0.1  | 10.9 $\pm$ 0.1 |
| N     | -              | -              | 1.5 $\pm$ 0.05  | 1.5 $\pm$ 0.05  | 1.5 $\pm$ 0.05  | 1.5 $\pm$ 0.05  | -              | 15 $\pm$ 0.05  | 2.0 $\pm$ 0.05 | -              |
| P     | -              | -              | -               | 16.0 $\pm$ 0.5  | -               | -               | -              | -              | -              | -              |

## OVERVIEW

| Model    | Physical (top & bottom view)  | Features  |
|----------|---|---|
| RHP-10X  |    | <ul style="list-style-type: none"> <li>TO126 Package</li> <li>20W high power resistor</li> <li>5.9 C/W heat resistance from hot spot to flange.</li> <li>0.10 ohm to 220 ohm resistance range</li> </ul>  |
| RPH-10B  |    | <ul style="list-style-type: none"> <li>TO220 Package</li> <li>Through hole RPH-10B 20W high power</li> <li>5.9 C/W heat resistance from hot spot to flange via thin film metallization technology</li> <li>0.10 ohm to 220 ohm resistance range</li> </ul>                  |
| RHP-10C  |    | <ul style="list-style-type: none"> <li>TO220 Package</li> <li>Surface mount RHP-10C 10W high power</li> <li>5.9 C/W heat resistance from hot spot to flange via thin film metallization technology</li> <li>0.10 ohm to 220 ohm resistance range</li> </ul>                 |
| RHP-20B  |    | <ul style="list-style-type: none"> <li>TO220 Package</li> <li>Through hole RHP-20B 35W high power</li> <li>3.3 C/W heat resistance from hot spot to flange via thin film metallization technology</li> <li>0.02 ohm to 220 ohm resistance range</li> </ul>                  |
| RHP-20C  |   | <ul style="list-style-type: none"> <li>TO220 Package</li> <li>Surface mount RHP-20C 20W</li> <li>3.3 C/W heat resistance from hot spot to flange via thin film metallization technology</li> <li>0.02 ohm to 220 ohm resistance range</li> </ul>                            |
| RHP-20D  |  | <ul style="list-style-type: none"> <li>TO263 (D2P) Package - Surface Mount Molded</li> <li>20W high power resistor</li> <li>3.3 C/W heat resistance from hot spot to flange via thin film metallization technology</li> <li>0.01 ohm to 51K ohm resistance range</li> </ul> |
| RHP-50A  |  | <ul style="list-style-type: none"> <li>TO247 Package</li> <li>100W high power resistor</li> <li>1.3 C/W heat resistance from hot spot to flange via thin film metallization technology</li> <li>0.01 ohm to 220 ohm resistance range</li> </ul>                             |
| RHP-50B  |  | <ul style="list-style-type: none"> <li>TO220 Package</li> <li>Through hole RHP-50B 50W high power</li> <li>2.3 C/W heat resistance from hot spot to flange via thin film metallization technology</li> <li>0.10 ohm to 220 ohm resistance range</li> </ul>                  |
| RHP-50C  |  | <ul style="list-style-type: none"> <li>TO220 Package</li> <li>Surface mount RHP-50C 50W high power</li> <li>2.3 C/W heat resistance from hot spot to flange via thin film metallization technology</li> <li>0.10 ohm to 220 ohm resistance range</li> </ul>                 |
| RHP-100A |  | <ul style="list-style-type: none"> <li>TO247 Package</li> <li>140W high power resistor</li> <li>0.9 C/W heat resistance from hot spot to flange or metal back plate. via thin film metallization technology</li> <li>0.02 ohm to 220 ohm resistance range</li> </ul>        |

## ELECTRICAL SPECIFICATIONS

| Model                  | RHP-10X  | RHP-10B                    | RHP-10C                    | RHP-20D                    | RHP-20B                    | RHP-20C                    |
|------------------------|----------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| Rated Power(heat sink) | 20W      | 20W                        | 20W                        | 20W                        | 35W                        | 20W                        |
| Rated Power            | 1W       | 1W                         | 1W                         | 2W                         | 1W                         | 1W                         |
| Heat Resistance        | 5.9 C/W  | 5.9 C/W                    | 5.9 C/W                    | 3.3 C/W                    | 3.3 C/W                    | 3.3 C/W                    |
| Withstanding Voltage   | 2000V AC | 2000V DC                   | 2000V DC                   | 2000V DC                   | 2200V DC (1500V AC)        | 2200V DC (1500V AC)        |
| Max. Operating Voltage | -        | 500V or $\sqrt{P \cdot R}$ | 500V or $\sqrt{P \cdot R}$ | 500V or $\sqrt{P \cdot R}$ | 500V or $\sqrt{P \cdot R}$ | 500V or $\sqrt{P \cdot R}$ |

|                    |                |            |          |
|--------------------|----------------|------------|----------|
| Resistance         | 0.01 ~ 0.091   | 0.10 ~ 9.1 | 10 ~ 220 |
| Nominal Resistance | E6             | E24        | E24      |
| TCR (ppm°C)        | ±250           | ±100       | ±50      |
| Tolerance          | ±5%            | ±5%, ±1%   | ±1%      |
| Operating Temp.    | -55°C ~ +155°C |            |          |

| Model                  | RHP-50A                              | RHP-50B & RHP-50C          | RHP-100A                             |
|------------------------|--------------------------------------|----------------------------|--------------------------------------|
| Rated Power(heat sink) | 100W                                 | 50W                        | 140W                                 |
| Rated Power            | 3W                                   | 1W                         | 3W                                   |
| Max. Applied Power     | 100W                                 | -                          | -                                    |
| Heat Resistance        | 1.3 C/W                              | 2.3 C/W                    | 0.9 C/W                              |
| Withstanding Voltage   | 2500V AC                             | 2000V DC                   | 2500V AC                             |
| Max. Operating Voltage | 700V or $\sqrt{P \cdot R}$ (applied) | 500V or $\sqrt{P \cdot R}$ | 700V or $\sqrt{P \cdot R}$ (applied) |

|                    |                |           |          |           |          |            |           |          |
|--------------------|----------------|-----------|----------|-----------|----------|------------|-----------|----------|
| Resistance         | 0.01~0.091     | 0.1 ~ 9.1 | 10 ~ 220 | 0.1 ~ 9.1 | 10 ~ 220 | 0.02~0.091 | 0.1 ~ 9.1 | 10 ~ 220 |
| Nominal Resistance | E6             | E12       | E24      | E24       | E24      | E6         | E12       | E24      |
| TCR (ppm°C)        | > ±250         | ±100      | ±50      | ±100      | ±50      | > ±250     | ±100      | ±50      |
| Tolerance          | ±5%            | ±5%, ±1%  | ±1%      | ±5%, ±1%  | ±1%      | ±5%        | ±5%, ±1%  | ±1%      |
| Operating Temp.    | -55°C ~ +155°C |           |          |           |          |            |           |          |

Resistance Range from 240 ohm to 51K ohm is available as a semi-custom solution for all of the RHP series.  
Values such as 2.0, 2.5, 4.0, and 5.0 are available upon special request.

## PERFORMANCE

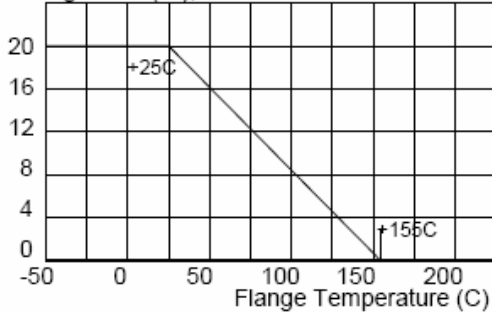
| Item                            | Performance                                   | Condition                               |
|---------------------------------|---|---|
| Rated Power                     | All other models                              | As specified                            |
|                                 | RHP-50A, 100A                                 | As specified                            |
| Rated Power (without heat sink) | All other models                              | Free Air                                |
|                                 | RHP-20D                                       | Attached on a simple footprint          |
| Withstanding Voltage            | As specified                                  | 60 seconds                              |
| Load Life                       | ± (1.0%+0.05Ω)                                | 25°C, 90 min on, 30 min. off, 1000 hrs. |
| Humidity                        | All other models                              | ± (1.0%+0.05Ω)                          |
|                                 | RHP-10X                                       | ± (1.0%+0.05Ω)                          |
| Temperature Cycle               | All other models; RHP-20B & 20C (0.10 ~ 220Ω) | ± (0.25%+0.05Ω)                         |
|                                 | RHP-20B & 20C (0.02 ~ 0.091Ω)                 | ± (1.0%+0.05Ω)                          |
| Soldering Heat                  | All other models; RHP-20B & 20C (0.10 ~ 220Ω) | ± (0.1%+0.05Ω)                          |
|                                 | RHP-50A, 100A                                 | ± (0.25%+0.05Ω)                         |
|                                 | RHP-20B & 20C (0.02 ~ 0.091Ω)                 | ± (0.5%+0.05Ω)                          |
| Solderability                   | All other models                              | > 95% of the surface                    |
|                                 | RHP-10X, RHP-50A, 100A                        | > 75% of round                          |
| Insulation Resistance           | > 1,000 Meg Ω                                 | Between terminals and metal back plate  |
| Vibration                       | ± (0.25%+0.05Ω)                               |   |

The performance data applies to all RHP models unless otherwise noted.

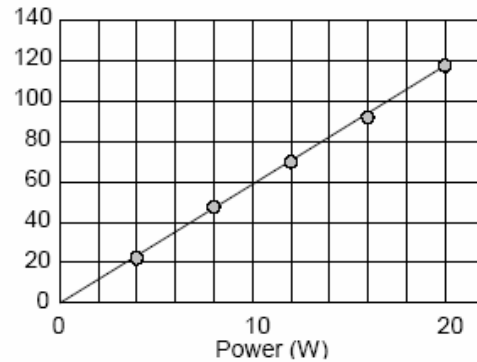
## RHP-10X

Derating Curve

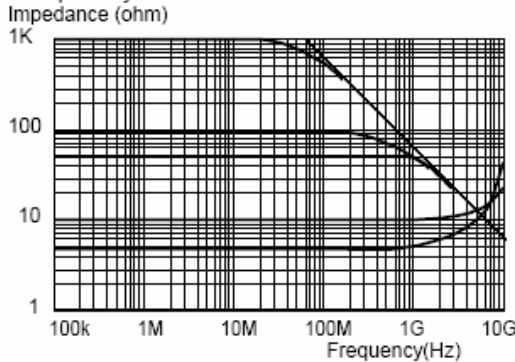
Rating Power(W), with 2.8K/W heat sink.



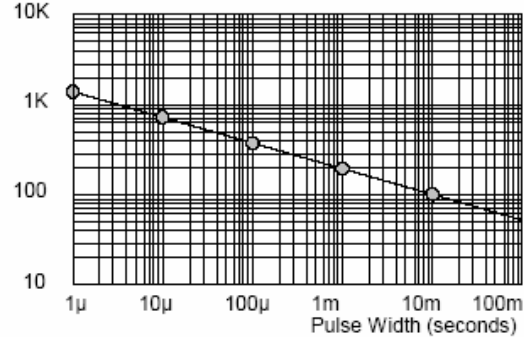
Temperature Rise at Flange Temperature(C)



Frequency Characteristics

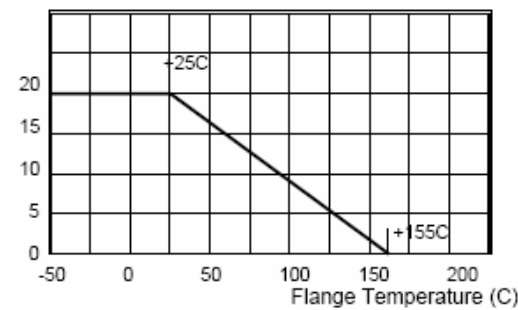


One time rectangular impulse Durability

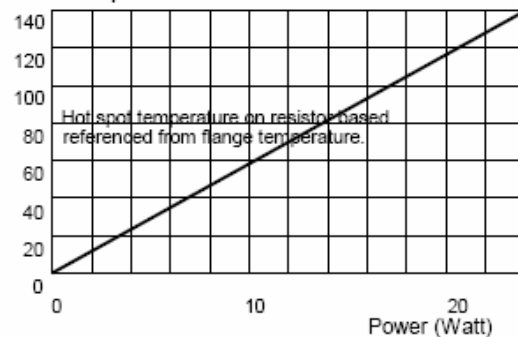


## RHP-10B, RHP-10C

Power(W) Derating

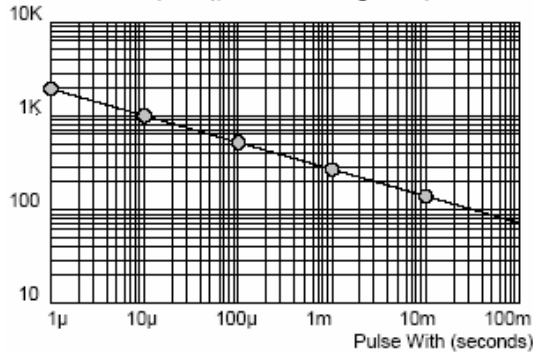


(C) Temperature Rise

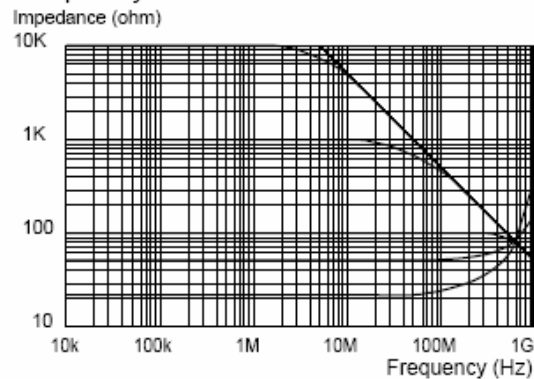


Pulse Energy Durability

Pulse Peak Watt (Watts), one time rectangular impulse.



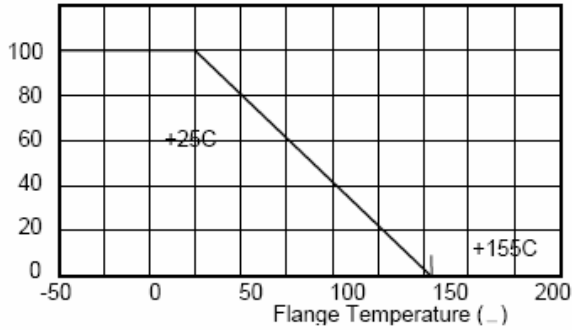
Frequency Characteristics



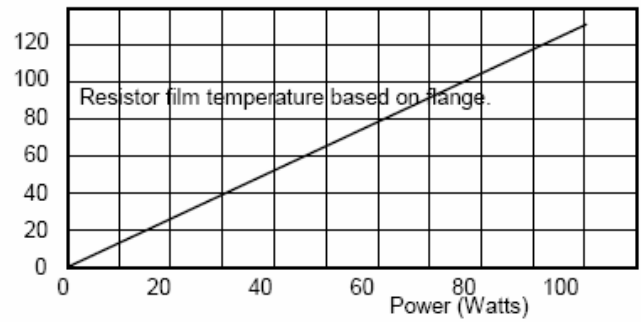


## RHP-50A

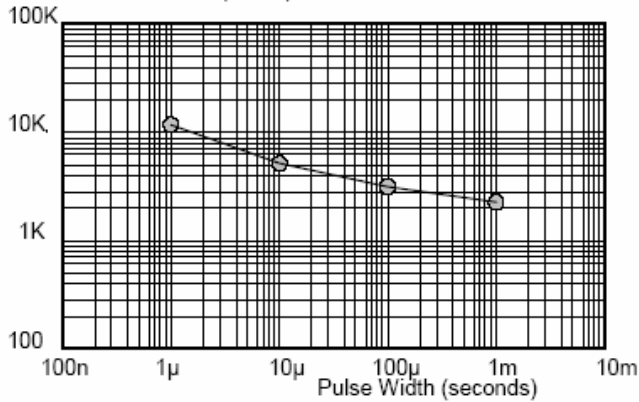
**Derating Curve**  
Rating Power(W)



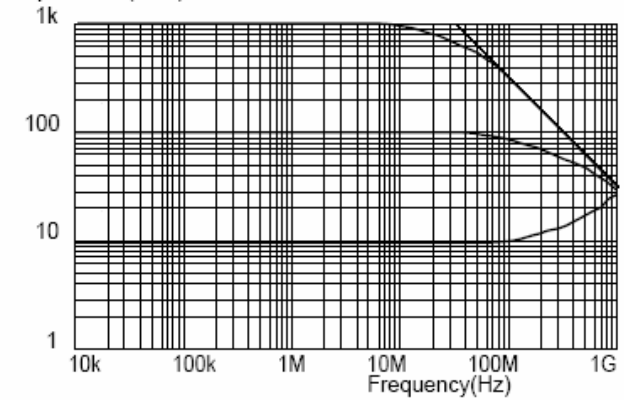
**Temperature Rise**  
Temperature Rise (C)



**Pulse Energy Durability**  
Pulse Peak Watt (Watts)

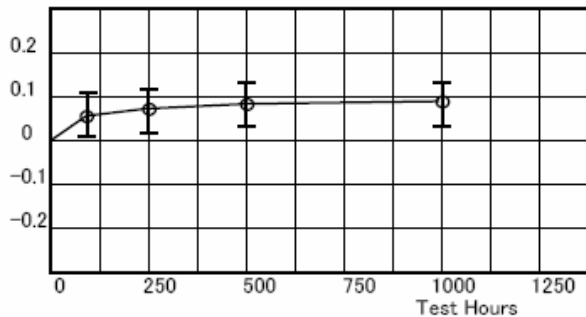


**Frequency Characteristics**  
Impedance (ohm)



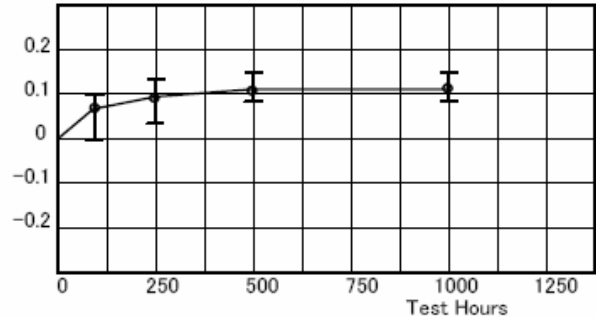
**Humidity (Typical)**

%R/R RHP-50A-1000FY with 0.71C/W heat sink



**Load Life (Typical)**

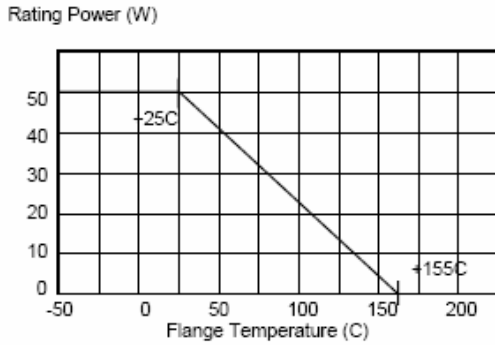
%R/R RHP-50A-1000FY with 0.71 C/W heat sink



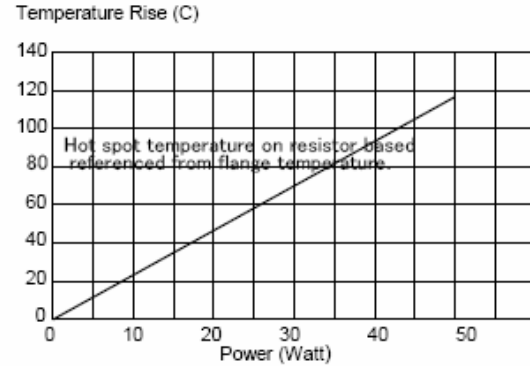


## RHP-50B, RHP-50C

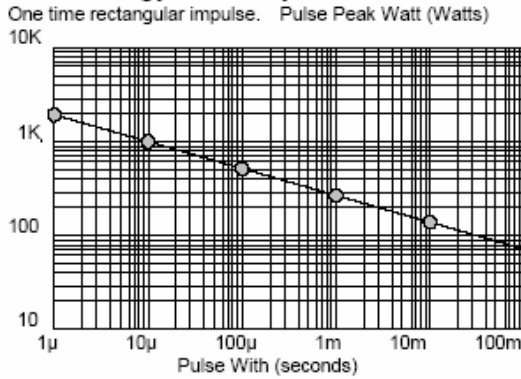
### Derating



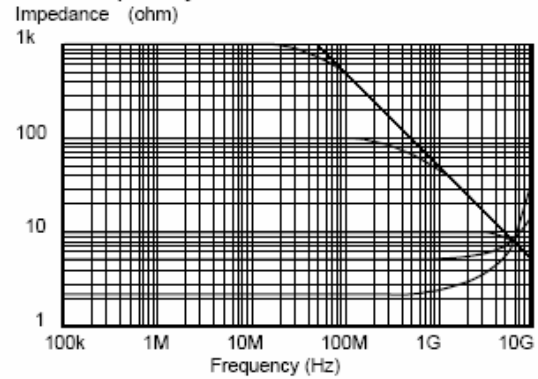
### Temperature Rise



### Pulse Energy Durability

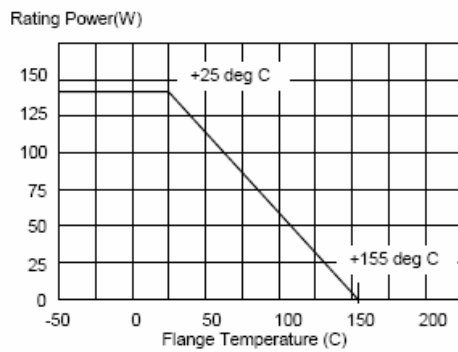


### Frequency Characteristics

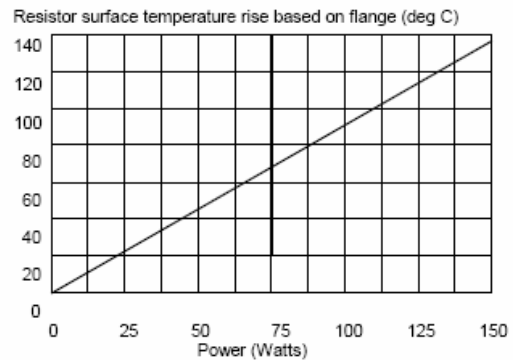


## RHP-100A

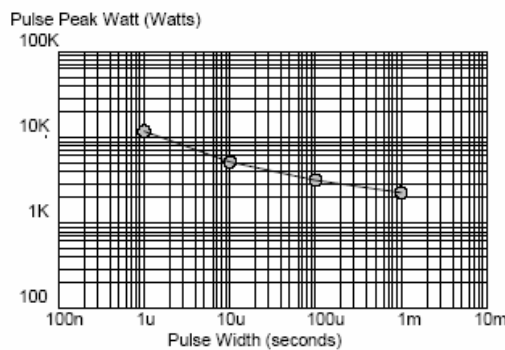
### Derating Curve



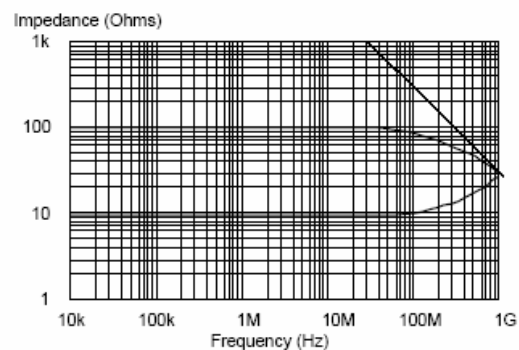
### Temperature Rise



### Pulse Energy Durability



### Frequency Characteristics



## NOTES

### GENERAL

- 0.1% tolerance resistors and resistance range from 240 ohm to 51K ohm are available as a semi-custom solution
- Use of heat conduction grease on surface of flange is recommended.
- Insulation material is unnecessary between flange and resistors; the flange and resistor are separated by alumina substrate.
- It surface mount soldering, temperature profile in the flange shall not exceed 220°C.
- Heat sink design will be performed when the resistor operating temperature is less than 155°C

### RHP-10X

- Heat resistance between resistor and flange is 3.6K/W
- For application to r-f circuit, Lead formed RHP-10X (smd) is prepared; RHP-10X are screw mount style.
- At resistance from 220 to 51kohms rating power shall be restricted in 10W.

### RHP-10B, RHP-10C

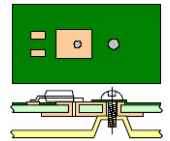
- Heat resistance between resistor and flange is 5.9 C/W.

### RHP-20B, RHP-20C

- Heat resistance between resistor and flange is 3.3 C/W
- At resistance from 220 to 51kohms rating power shall be restricted in 20W.
- The terminal material is Tin plated copper, but inside of resistor contains PbAg high melting solder that is exempted by RoHS directive 2002/95/EC.

### RHP-20D

- At flange soldering, temperature profile in flange shall not exceed 270°C for 30 minutes.
- Heat resistance between resistor and flange is 3.3C/W.
- This model shall be fit to Copper of printed wiring board with lower temperature solder than 220°C. Sn-Cu soldering will be done by soldering iron with 300°C -350°C tip temperature for less than 30 minutes.



### RHP-50A

- Using heat conduction grease on surface of flange is recommended.
- Heat resistance between resistor and flange is 1.3 K/W. Heat design will be done, as resistor temperature shall be under 155°C in operation.

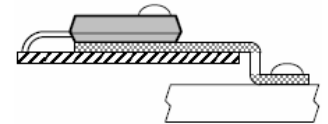
### RHP-50B, RHP-50-C

- Heat resistance between resistor and flange is 3.3 C/W.
- 5ppm TCR resistors are available as a semi-custom product
- At resistance from 220 to 51kohms rating power shall be restricted in 30W.
- Please note, terminal material is Tin plated copper, but inside of resistor contains PbAg high melting solder that is exempted by RoHS directive 2002/95/EC.

### RHP-100A

#### Recommendation

- Flat surface heat sink, thermal compound and sufficient mount screw torque will be necessary for good heat transfer.
- In a rush current protection application, such as charge current limitation resistor, sufficient power derating will be necessary.



Design for Heat Release

## TAPE DIMENSIONS (mm)

### Reel Dimensions

Outer Diameter: 300mm  
 Inner Diameter: 100mm  
 Width: 23.9mm min., 27.4mm max

Standard packaging is RoHS PS/PE tube packaging, which contains 50 pieces per tube. When ordering, note Tube (T) or Tray (R)

