

Powerex, Inc., Hillis Street, Youngwood, Pennsylvania 15697 (724) 925-7272

**POW-R-BLOK™**  
**Dual SCR Isolated Module**  
**600 Amperes / Up to 2400 Volts**



**Description:**

Powerex Dual SCR Modules are designed for use in applications requiring phase control and isolated packaging. The modules are isolated for easy mounting with other components on a common heatsink.

**Features:**

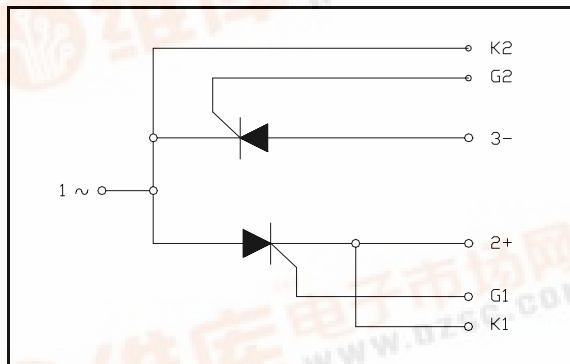
- Electrically Isolated Heatsinking
- Compression Bonded Elements
- Metal Baseplate
- Low Thermal Impedance for Improved Current Capability

**Benefits:**

- No Additional Insulation Components Required
- Easy Installation
- No Clamping Components Required
- Reduce Engineering Time

**Applications:**

- Bridge Circuits
- AC & DC Motor Drives
- Motor Soft Starters
- Battery Supplies
- Power Supplies
- Large IGBT Circuit Front Ends



**Ordering Information:**

Select the complete eight-digit module part number from the table below.

Example: PD432406 is a 2400 Volt, 600A Average Dual SCR Isolated POW-R-BLOK™ Module

| Type | Voltage<br>Volts (x100) | Current<br>Amperes<br>(x100) |
|------|-------------------------|------------------------------|
| PD43 | 20                      | 06                           |
|      | 22                      |                              |
|      | 24                      |                              |



PRELIMINARY

PD43\_\_06

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**Absolute Maximum Ratings**

| Characteristics                                                                      | Conditions                                          | Symbol                | Units                                 |
|--------------------------------------------------------------------------------------|-----------------------------------------------------|-----------------------|---------------------------------------|
| Repetitive Peak Forward and Reverse Blocking Voltage                                 |                                                     | $V_{DRM}$ & $V_{RRM}$ | Up to 2400 V                          |
| Non-Repetitive Peak Blocking Voltage<br>( $t < 5$ msec)                              |                                                     | $V_{RSM}$             | $V_{RRM} + 100V$ V                    |
| RMS Current AC Switch Configuration<br>(180° Conduction)                             | 180° Conduction, $T_C=66^\circ C$                   | $I_{T(RMS)}$          | 1665 A                                |
|                                                                                      | 180° Conduction, $T_C=71^\circ C$                   | $I_{T(RMS)}$          | 1550 A                                |
|                                                                                      | 180° Conduction, $T_C=76^\circ C$                   | $I_{T(RMS)}$          | 1440 A                                |
|                                                                                      | <b>180° Conduction, <math>T_C=81^\circ C</math></b> | $I_{T(RMS)}$          | <b>1330</b> A                         |
|                                                                                      | 180° Conduction, $T_C=86^\circ C$                   | $I_{T(RMS)}$          | 1220 A                                |
|                                                                                      | 180° Conduction, $T_C=90^\circ C$                   | $I_{T(RMS)}$          | 1110 A                                |
| RMS Current Per SCR<br>(180° Conduction)                                             | 180° Conduction, $T_C=66^\circ C$                   | $I_{T(RMS)}$          | 1178 A                                |
|                                                                                      | 180° Conduction, $T_C=71^\circ C$                   | $I_{T(RMS)}$          | 1100 A                                |
|                                                                                      | 180° Conduction, $T_C=76^\circ C$                   | $I_{T(RMS)}$          | 1020 A                                |
|                                                                                      | <b>180° Conduction, <math>T_C=81^\circ C</math></b> | $I_{T(RMS)}$          | <b>942</b> A                          |
|                                                                                      | 180° Conduction, $T_C=86^\circ C$                   | $I_{T(RMS)}$          | 864 A                                 |
|                                                                                      | 180° Conduction, $T_C=90^\circ C$                   | $I_{T(RMS)}$          | 785 A                                 |
| Average Forward Current Per SCR<br>(180° Conduction)                                 | 180° Conduction, $T_C=66^\circ C$                   | $I_{T(AV)}$           | 750 A                                 |
|                                                                                      | 180° Conduction, $T_C=71^\circ C$                   | $I_{T(AV)}$           | 700 A                                 |
|                                                                                      | 180° Conduction, $T_C=76^\circ C$                   | $I_{T(AV)}$           | 650 A                                 |
|                                                                                      | <b>180° Conduction, <math>T_C=81^\circ C</math></b> | $I_{T(AV)}$           | <b>600</b> A                          |
|                                                                                      | 180° Conduction, $T_C=86^\circ C$                   | $I_{T(AV)}$           | 550 A                                 |
|                                                                                      | 180° Conduction, $T_C=90^\circ C$                   | $I_{T(AV)}$           | 500 A                                 |
| Peak One Cycle Surge Current, Non-Repetitive<br>$T_J = 25C, V_r = 0$                 | 60 Hz                                               | $I_{TSM}$             | 50,890 A                              |
|                                                                                      | 50 Hz                                               | $I_{TSM}$             | 46,400 A                              |
| Peak One Cycle Surge Current, Non-Repetitive<br>$T_J = 25C, V_r = V_{rrm}$           | 60 Hz                                               | $I_{TSM}$             | 33,925 A                              |
|                                                                                      | 50 Hz                                               | $I_{TSM}$             | 30,935 A                              |
| Peak One Cycle Surge Current, Non-Repetitive<br>$T_J = 125C, V_r = 0$                | 60 Hz                                               | $I_{TSM}$             | 44,250 A                              |
|                                                                                      | 50 Hz                                               | $I_{TSM}$             | 40,350 A                              |
| Peak One Cycle Surge Current, Non-Repetitive<br>$T_J = 125C, V_r = V_{rrm}$          | 60 Hz                                               | $I_{TSM}$             | 29,500 A                              |
|                                                                                      | 50 Hz                                               | $I_{TSM}$             | 26,900 A                              |
| Peak Three Cycle Surge Current, Non-Repetitive<br>60 Hz, $T_J = 125C, V_r = V_{rrm}$ |                                                     | $I_{TSM}$             | 23,690 A                              |
| Peak Ten Cycle Surge Current, Non-Repetitive<br>60 Hz, $T_J = 125C, V_r = V_{rrm}$   |                                                     | $I_{TSM}$             | 18,615 A                              |
| $I^2t$ for Fusing for One Cycle<br>$T_J = 125C, V_r = V_{rrm}$                       | 8.3 milliseconds                                    | $I^2t$                | $3.63 \times 10^6$ A <sup>2</sup> sec |
|                                                                                      | 10 milliseconds                                     | $I^2t$                | $3.62 \times 10^6$ A <sup>2</sup> sec |
| Maximum Rate-of-Rise of On-State Current,<br>(Non-Repetitive)                        | Per JEDEC Standard 397 5.2.2.6                      | $di/dt$               | 400 A/ $\mu$ s                        |
| Maximum Rate-of-Rise of On-State Current,<br>(Repetitive)                            | Per JEDEC Standard 397 5.2.2.6                      | $di/dt$               | 150 A/ $\mu$ s                        |
| Operating Temperature                                                                |                                                     | $T_J$                 | -40 to +125 °C                        |
| Storage Temperature                                                                  |                                                     | $T_{stg}$             | -40 to +150 °C                        |
| Max. Mounting Torque, M6 Mounting Screw                                              |                                                     |                       | 132 in. – Lb.                         |
|                                                                                      |                                                     |                       | 15 Nm                                 |
| Max. Mounting Torque, M10 Terminal Screw                                             |                                                     |                       | 106 in. – Lb.                         |
|                                                                                      |                                                     |                       | 12 Nm                                 |
| Module Weight, Typical                                                               |                                                     |                       | 455 g                                 |
|                                                                                      |                                                     |                       | 11.75 lb                              |
| V Isolation @ 25C                                                                    |                                                     | $V_{rms}$             | 3000 V                                |

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### Electrical Characteristics, T<sub>J</sub>=25° C unless otherwise specified

| Characteristics                          | Symbol                | Test Conditions                                                                            | Min.                     | Max.                                            | Units |
|------------------------------------------|-----------------------|--------------------------------------------------------------------------------------------|--------------------------|-------------------------------------------------|-------|
| Repetitive Peak Forward Leakage Current  | I <sub>DRM</sub>      | Up to 2400V, T <sub>J</sub> =125° C                                                        |                          | 100                                             | mA    |
| Repetitive Peak Reverse Leakage Current  | I <sub>RRM</sub>      | Up to 2400V, T <sub>J</sub> =125° C                                                        |                          | 100                                             | mA    |
| Peak On-State Voltage                    | V <sub>TM</sub>       | I <sub>TM</sub> =3000A, T <sub>J</sub> =125° C                                             |                          | 1.75                                            | V     |
| Threshold Voltage, Low-level             | V <sub>(TO)1</sub>    | T <sub>J</sub> = 125° C, I = 15%I <sub>T(AV)</sub> to πI <sub>T(AV)</sub>                  |                          | 0.869                                           | V     |
| Slope Resistance, Low-level              | r <sub>T1</sub>       |                                                                                            |                          | 0.237                                           | mΩ    |
| Threshold Voltage, High-level            | V <sub>(TO)2</sub>    | T <sub>J</sub> = 125° C, I = πI <sub>T(AV)</sub> to I <sub>TSM</sub>                       |                          | 1.055                                           | V     |
| Slope Resistance, High-level             | r <sub>T2</sub>       |                                                                                            |                          | 0.175                                           | mΩ    |
| V <sub>TM</sub> Coefficients, Full Range |                       | T <sub>J</sub> = 125° C, I = 50A to 6kA<br><br>V <sub>TM</sub> = A+ B Ln I +C I + D Sqrt I | A =<br>B =<br>C =<br>D = | 0.93159<br>-4.51 E-02<br>9.95 E-05<br>1.29 E-02 |       |
| Minimum dV/dt                            | dV/dt                 | Exponential to 0.67V <sub>DRM</sub><br>T <sub>J</sub> =125° C, Gate Open                   | 600                      |                                                 | V/μs  |
| Gate Trigger Current                     | I <sub>GT</sub>       | T <sub>J</sub> =25° C, V <sub>D</sub> =12V                                                 |                          | 200                                             | mA    |
| Gate Trigger Voltage                     | V <sub>GT</sub>       | T <sub>J</sub> =25° C, V <sub>D</sub> =12V                                                 |                          | 3.0                                             | Volts |
| Non-Triggering Gate Voltage              | V <sub>GDM</sub>      | T <sub>J</sub> =125° C, V <sub>D</sub> = ½ V <sub>DRM</sub>                                |                          | 0.15                                            | Volts |
| Holding Current                          | I <sub>H</sub>        |                                                                                            |                          | 300                                             | mA    |
| Peak Forward Gate Current                | I <sub>GTM</sub>      |                                                                                            |                          | 4.0                                             | Amp   |
| Peak Reverse Gate Voltage                | V <sub>GRM</sub>      |                                                                                            |                          | 5                                               | Volts |
| Maximum Average Gate Power Dissipation   | P <sub>GM (AVE)</sub> |                                                                                            |                          | 16                                              | Watts |

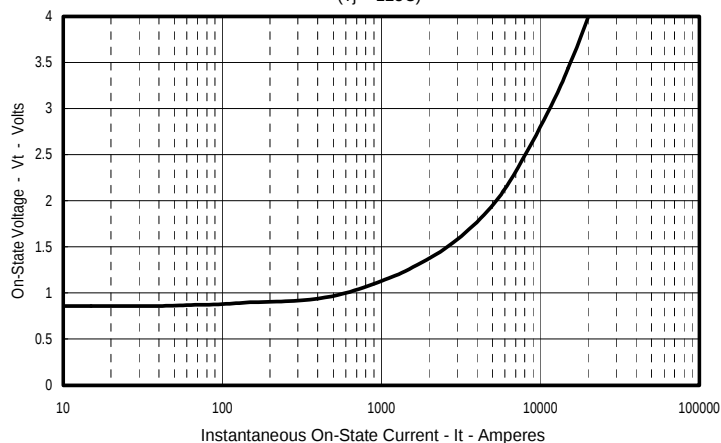
### Thermal Characteristics

| Characteristics                             | Symbol            |                                                                                                                                                                                                                | Max.                                                                                                                | Units                                                                                                        |
|---------------------------------------------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| Thermal Resistance, Junction to Case        | R <sub>ΘJ-C</sub> | Per Module, both conducting<br>Per Junction, both conducting                                                                                                                                                   | 0.029<br>0.058                                                                                                      | °C/W<br>°C/W                                                                                                 |
| Thermal Impedance Coefficients              | Z <sub>ΘJ-C</sub> | Z <sub>ΘJ-C</sub> = K <sub>1</sub> (1-exp(-t/t <sub>1</sub> ))<br>+ K <sub>2</sub> (1-exp(-t/t <sub>2</sub> ))<br>+ K <sub>3</sub> (1-exp(-t/t <sub>3</sub> ))<br>+ K <sub>4</sub> (1-exp(-t/t <sub>4</sub> )) | K <sub>1</sub> = 5.04 E-04<br>K <sub>2</sub> = 2.31 E-03<br>K <sub>3</sub> = 2.83 E-03<br>K <sub>4</sub> =5.24 E-02 | t <sub>1</sub> = 2.47 E-03<br>t <sub>2</sub> = 4.42 E-02<br>t <sub>3</sub> = 1.370<br>t <sub>4</sub> = 9.668 |
| Thermal Resistance, Case to Sink Lubricated | R <sub>ΘC-S</sub> | Per Module                                                                                                                                                                                                     | 0.009                                                                                                               | °C/W                                                                                                         |

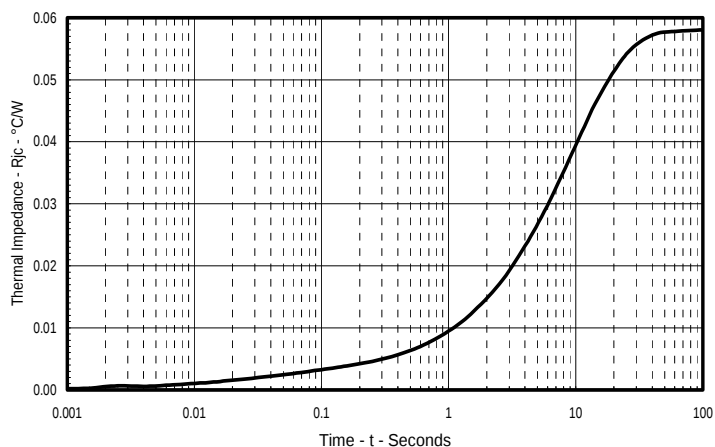
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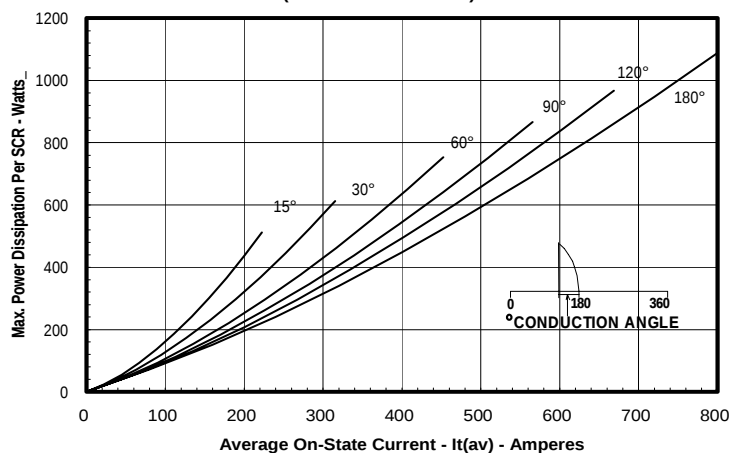
Typical On-State Forward Voltage Drop  
( $T_j = 125^\circ\text{C}$ )



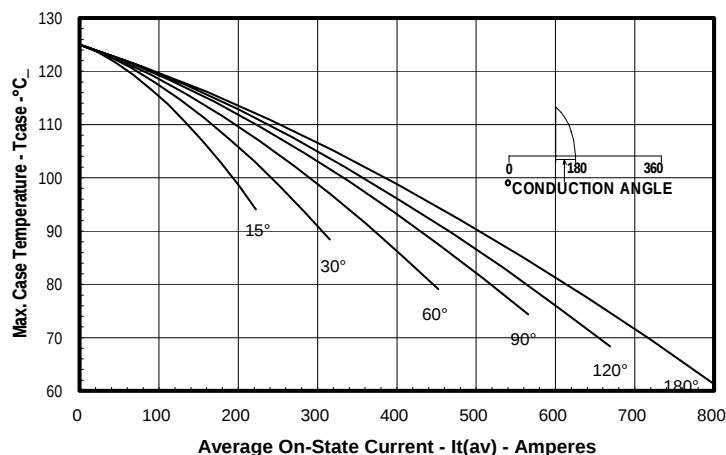
Maximum Transient Thermal Impedance  
(Junction To Case)



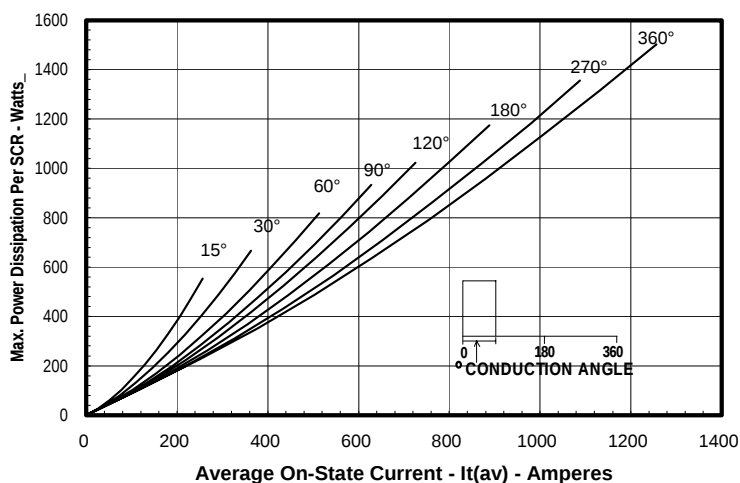
Maximum On-State Power Dissipation  
(Sinusoidal Waveform)



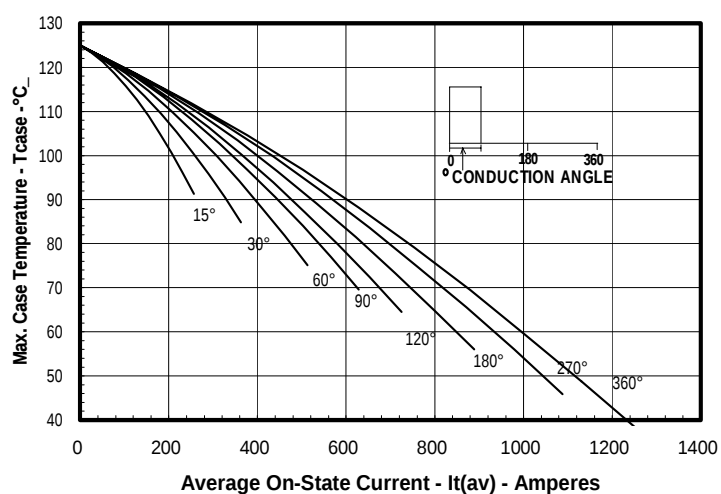
Maximum Allowable Case Temperature  
(Sinusoidal Waveform)



Maximum On-State Power Dissipation  
(Rectangular Waveform)



Maximum Allowable Case Temperature  
(Rectangular Waveform)



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| DIM. | INCHES | MILLIMETERS |
|------|--------|-------------|
| A    | 7.80   | 198.1       |
| B    | 4.00   | 101.6       |
| C    | 2.68   | 68.1        |
| D    | 6.44   | 163.6       |
| E    | 3.44   | 87.4        |
| F    | .28    | 7.1         |
| G    | 7.31   | 185.7       |
| H    | 7.00   | 177.8       |
| J    | 1.65   | 42          |
| K    | .21    | 5.3         |
| L    | .28    | 7.1         |
| M    | .281   | 7.1         |
| N    | .45    | 11.4        |
| P    | .54    | 13.7        |
| Q    | 5.93   | 150.6       |
| R    | .19    | 4.8         |
| S    | .11    | 2.8         |
| T    | .48    | 12.2        |
| U    | 2.28   | 58          |
| V    | 2.54   | 64.5        |
| W    | 4.93   | 125.2       |
| X    | 3.81   | 96.8        |
| Y    | .03    | .8          |
| Z    | 2.00   | 50.8        |
| AA   | 1.00   | 25.4        |
| BB   | .50    | 12.7        |
| CC   | 1.00   | 25.4        |
| DD   | .406   | 10.3        |
| EE   | 2.87   | 72.9        |
| FF   | .66    | 16.8        |

