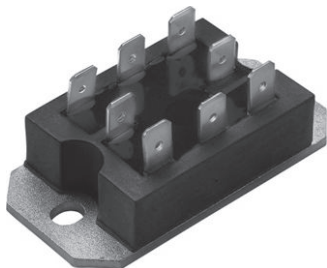


## Power Modules, Passivated Assembled Circuit Elements, 25 A


**PACE-PAK (D-19)**

### FEATURES

- Glass passivated junctions for greater reliability
- Electrically isolated base plate
- Available up to 1200  $V_{RRM}/V_{DRM}$
- High dynamic characteristics
- Wide choice of circuit configurations
- Simplified mechanical design and assembly
- UL E78996 approved 
- Material categorization: For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
COMPLIANT

### DESCRIPTION

The VS-P100 series of integrated power circuits consists of power thyristors and power diodes configured in a single package. With its isolating base plate, mechanical designs are greatly simplified giving advantages of cost reduction and reduced size.

Applications include power supplies, control circuits and battery chargers.

| PRODUCT SUMMARY |                                                                                                                                |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------|
| $I_O$           | 25 A                                                                                                                           |
| Type            | Modules - Thyristor, Standard                                                                                                  |
| Package         | PACE-PAK (D-19)                                                                                                                |
| Circuit         | Single phase, hybrid bridge common cathode,<br>Single phase, hybrid bridge doubler connection,<br>Single phase, all SCR bridge |

| MAJOR RATINGS AND CHARACTERISTICS |                 |             |                   |
|-----------------------------------|-----------------|-------------|-------------------|
| SYMBOL                            | CHARACTERISTICS | VALUES      | UNITS             |
| $I_O$                             | 85 °C           | 25          | A                 |
| $I_{TSM}$                         | 50 Hz           | 357         | A                 |
|                                   | 60 Hz           | 375         |                   |
| $I^2t$                            | 50 Hz           | 637         | A <sup>2</sup> s  |
|                                   | 60 Hz           | 580         |                   |
| $I^2\sqrt{t}$                     |                 | 6365        | A <sup>2</sup> √s |
| $V_{DRM}, V_{RRM}$                |                 | 400 to 1200 | V                 |
| $V_{ISOL}$                        |                 | 2500        | V                 |
| $T_J$                             | Range           | -40 to 125  | °C                |
| $T_{Stg}$                         |                 | -40 to 125  | °C                |

### ELECTRICAL SPECIFICATIONS

| VOLTAGE RATINGS           |                                                                                           |                                                                    |                                             |
|---------------------------|-------------------------------------------------------------------------------------------|--------------------------------------------------------------------|---------------------------------------------|
| TYPE NUMBER               | $V_{RRM}/V_{DRM}$ , MAXIMUM<br>REPETITIVE PEAK REVERSE AND<br>PEAK OFF-STATE VOLTAGE<br>V | $V_{RSM}$ , MAXIMUM<br>NON-REPETITIVE PEAK<br>REVERSE VOLTAGE<br>V | $I_{RRM}$ MAXIMUM<br>AT $T_J$ MAXIMUM<br>mA |
| VS-P101, VS-P121, VS-P131 | 400                                                                                       | 500                                                                | 10                                          |
| VS-P102, VS-P122, VS-P132 | 600                                                                                       | 700                                                                |                                             |
| VS-P103, VS-P123, VS-P133 | 800                                                                                       | 900                                                                |                                             |
| VS-P103, VS-P124, VS-P134 | 1000                                                                                      | 1100                                                               |                                             |
| VS-P105, VS-P125, VS-P135 | 1200                                                                                      | 1300                                                               |                                             |



| ON-STATE CONDUCTION                                                |                                     |                                                                                                                                                                          |                                  |                                                                       |        |                   |
|--------------------------------------------------------------------|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-----------------------------------------------------------------------|--------|-------------------|
| PARAMETER                                                          | SYMBOL                              | TEST CONDITIONS                                                                                                                                                          |                                  |                                                                       | VALUES | UNITS             |
| Maximum DC output current at case temperature                      | I <sub>O</sub>                      | Full bridge                                                                                                                                                              |                                  |                                                                       | 25     | A                 |
|                                                                    |                                     |                                                                                                                                                                          |                                  |                                                                       | 85     | °C                |
| Maximum peak, one-cycle non-repetitive on-state or forward current | I <sub>TSM</sub> , I <sub>FSM</sub> | t = 10 ms                                                                                                                                                                | No voltage reapplied             | Sinusoidal half wave, initial T <sub>J</sub> = T <sub>J</sub> maximum | 357    | A                 |
|                                                                    |                                     | t = 8.3 ms                                                                                                                                                               |                                  |                                                                       | 375    |                   |
|                                                                    |                                     | t = 10 ms                                                                                                                                                                | 100 % V <sub>RRM</sub> reapplied |                                                                       | 300    |                   |
|                                                                    |                                     | t = 8.3 ms                                                                                                                                                               |                                  |                                                                       | 315    |                   |
| Maximum I <sup>2</sup> t for fusing                                | I <sup>2</sup> t                    | t = 10 ms                                                                                                                                                                | No voltage reapplied             |                                                                       | 637    | A <sup>2</sup> s  |
|                                                                    |                                     | t = 8.3 ms                                                                                                                                                               |                                  |                                                                       | 580    |                   |
|                                                                    |                                     | t = 10 ms                                                                                                                                                                | 100 % V <sub>RRM</sub> reapplied |                                                                       | 450    |                   |
|                                                                    |                                     | t = 8.3 ms                                                                                                                                                               |                                  |                                                                       | 410    |                   |
| Maximum I <sup>2</sup> √t for fusing                               | I <sup>2</sup> √t                   | t = 0.1 ms to 10 ms, no voltage reapplied<br>I <sup>2</sup> t for time tx = I <sup>2</sup> √t · √tx                                                                      |                                  |                                                                       | 6365   | A <sup>2</sup> √s |
| Maximum value of threshold voltage                                 | V <sub>T(TO)</sub>                  | T <sub>J</sub> = 125 °C                                                                                                                                                  |                                  |                                                                       | 0.82   | V                 |
| Maximum level value of on-state slope resistance                   | r <sub>t1</sub>                     | T <sub>J</sub> = 125 °C, average power = V <sub>T(TO)</sub> × I <sub>T(AV)</sub> + r <sub>t</sub> + (I <sub>T(RMS)</sub> ) <sup>2</sup>                                  |                                  |                                                                       | 12     | mΩ                |
| Maximum on-state voltage drop                                      | V <sub>TM</sub>                     | I <sub>TM</sub> = π × I <sub>T(AV)</sub>                                                                                                                                 |                                  | T <sub>J</sub> = 25 °C                                                | 1.35   | V                 |
| Maximum forward voltage drop                                       | V <sub>FM</sub>                     | I <sub>FM</sub> = π × I <sub>F(AV)</sub>                                                                                                                                 |                                  | T <sub>J</sub> = 25 °C                                                | 1.35   | V                 |
| Maximum non-repetitive rate of rise of turned-on current           | di/dt                               | T <sub>J</sub> = 125 °C from 0.67 V <sub>DRM</sub><br>I <sub>TM</sub> = π × I <sub>T(AV)</sub> , I <sub>g</sub> = 500 mA, t <sub>r</sub> < 0.5 μs, t <sub>p</sub> > 6 μs |                                  |                                                                       | 200    | A/μs              |
| Maximum holding current                                            | I <sub>H</sub>                      | T <sub>J</sub> = 25 °C anode supply = 6 V, resistive load, gate open                                                                                                     |                                  |                                                                       | 130    | mA                |
| Maximum latching current                                           | I <sub>L</sub>                      | T <sub>J</sub> = 25 °C anode supply = 6 V, resistive load                                                                                                                |                                  |                                                                       | 250    |                   |

| BLOCKING                                                                                  |                                     |                                                                                |        |       |
|-------------------------------------------------------------------------------------------|-------------------------------------|--------------------------------------------------------------------------------|--------|-------|
| PARAMETER                                                                                 | SYMBOL                              | TEST CONDITIONS                                                                | VALUES | UNITS |
| Maximum critical rate of rise of off-state voltage                                        | dV/dt                               | T <sub>J</sub> = 125 °C, exponential to 0.67 V <sub>DRM</sub> gate open        | 200    | V/μs  |
| Maximum peak reverse and off-state leakage current at V <sub>RRM</sub> , V <sub>DRM</sub> | I <sub>RRM</sub> , I <sub>DRM</sub> | T <sub>J</sub> = 125 °C, gate open circuit                                     | 10     | mA    |
| Maximum peak reverse leakage current                                                      | I <sub>RRM</sub>                    | T <sub>J</sub> = 25 °C                                                         | 100    | μA    |
| RMS isolation voltage                                                                     | V <sub>ISOL</sub>                   | 50 Hz, circuit to base, all terminals shorted, T <sub>J</sub> = 25 °C, t = 1 s | 2500   | V     |

| TRIGGERING                                 |                    |                                                         |                                      |        |       |  |
|--------------------------------------------|--------------------|---------------------------------------------------------|--------------------------------------|--------|-------|--|
| PARAMETER                                  | SYMBOL             | TEST CONDITIONS                                         |                                      | VALUES | UNITS |  |
| Maximum peak gate power                    | P <sub>GM</sub>    |                                                         |                                      | 8      | W     |  |
| Maximum average gate power                 | P <sub>G(AV)</sub> |                                                         |                                      | 2      |       |  |
| Maximum peak gate current                  | I <sub>GM</sub>    |                                                         |                                      | 2      | A     |  |
| Maximum peak negative gate voltage         | -V <sub>GM</sub>   |                                                         |                                      | 10     | V     |  |
| Maximum gate voltage required to trigger   | V <sub>GT</sub>    | T <sub>J</sub> = - 40 °C                                | Anode supply =<br>6 V resistive load | 3      | V     |  |
|                                            |                    | T <sub>J</sub> = 25 °C                                  |                                      | 2      |       |  |
|                                            |                    | T <sub>J</sub> = 125 °C                                 |                                      | 1      |       |  |
| Maximum gate current required to trigger   | I <sub>GT</sub>    | T <sub>J</sub> = - 40 °C                                |                                      | 90     | mA    |  |
|                                            |                    | T <sub>J</sub> = 25 °C                                  |                                      | 60     |       |  |
|                                            |                    | T <sub>J</sub> = 125 °C                                 |                                      | 35     |       |  |
| Maximum gate voltage that will not trigger | V <sub>GD</sub>    | T <sub>J</sub> = 125 °C, rated V <sub>DRM</sub> applied |                                      | 0.2    | V     |  |
| Maximum gate current that will not trigger | I <sub>GD</sub>    |                                                         |                                      | 2      | mA    |  |

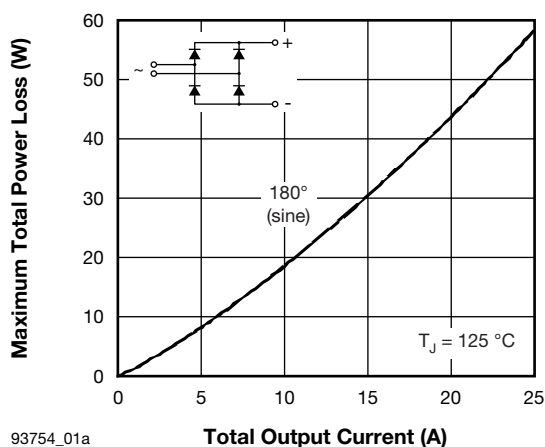


## THERMAL AND MECHANICAL SPECIFICATIONS

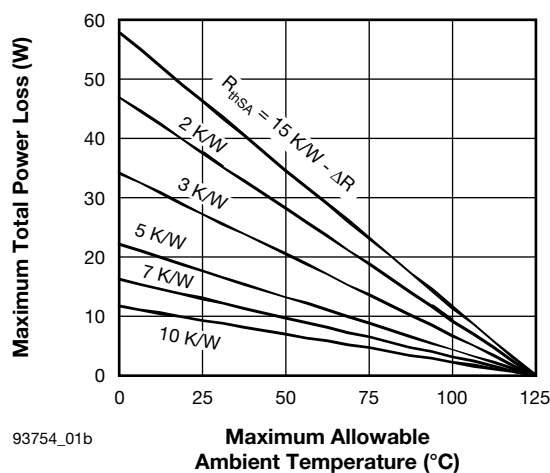
| PARAMETER                                                 | SYMBOL         | TEST CONDITIONS                      | VALUES          | UNITS |
|-----------------------------------------------------------|----------------|--------------------------------------|-----------------|-------|
| Maximum junction operating and storage temperature range  | $T_J, T_{Stg}$ |                                      | -40 to 125      | °C    |
| Maximum thermal resistance, junction to case per junction | $R_{thJC}$     | DC operation                         | 2.24            | K/W   |
| Maximum thermal resistance, case to heatsink              | $R_{thCS}$     | Mounting surface, smooth and greased | 0.10            |       |
| Mounting torque, base to heatsink <sup>(1)</sup>          |                |                                      | 4               | Nm    |
| Approximate weight                                        |                |                                      | 58              | g     |
|                                                           |                |                                      | 2.0             | oz.   |
| Case style                                                |                |                                      | PACE-PAK (D-19) |       |

### Note

(1) A mounting compound is recommended and the torque should be checked after a period of 3 hours to allow for the spread of the compound

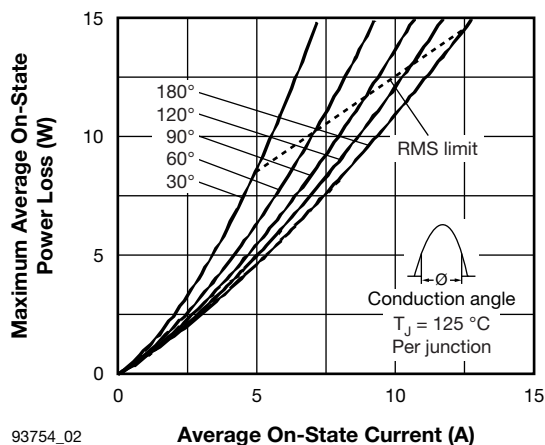


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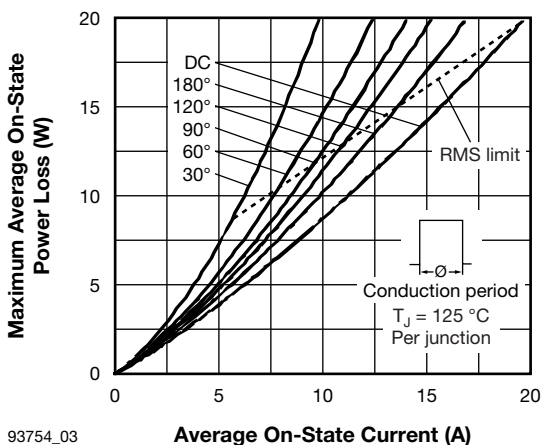
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Fig. 1 - Current Ratings Nomogram (1 Module Per Heatsink)



93754\_02

Fig. 2 - On-State Power Loss Characteristics



93754\_03

Fig. 3 - On-State Power Loss Characteristics

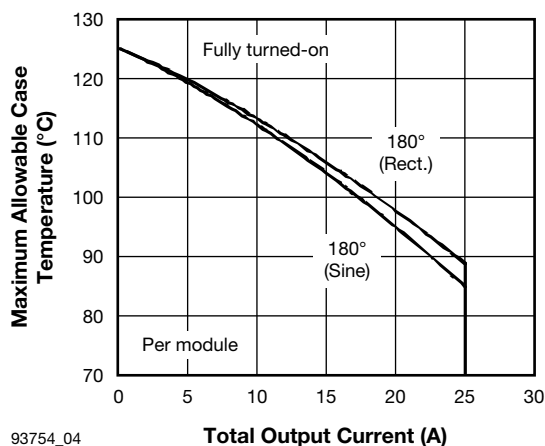


Fig. 4 - Current Ratings Characteristics

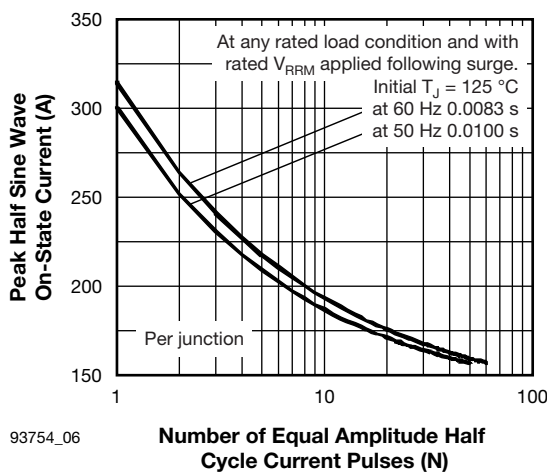


Fig. 6 - Maximum Non-Repetitive Surge Current

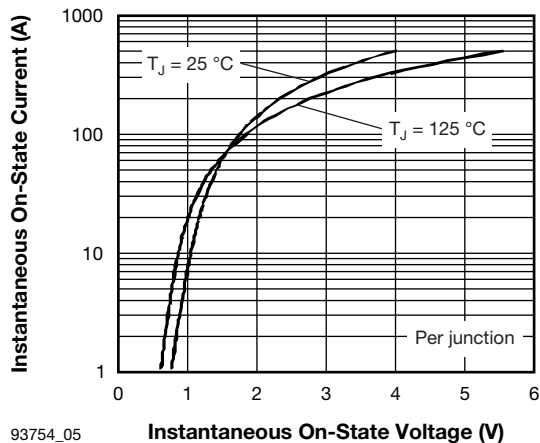


Fig. 5 - On-State Voltage Drop Characteristics

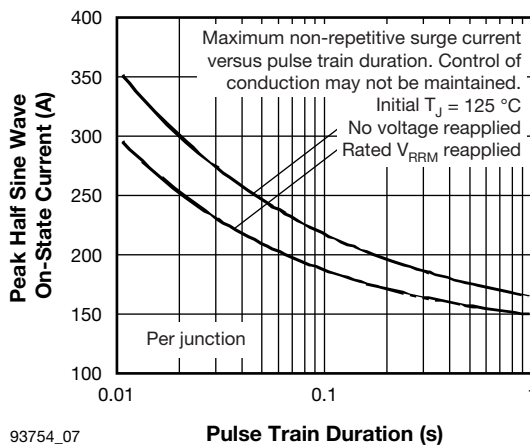


Fig. 7 - Maximum Non-Repetitive Surge Current

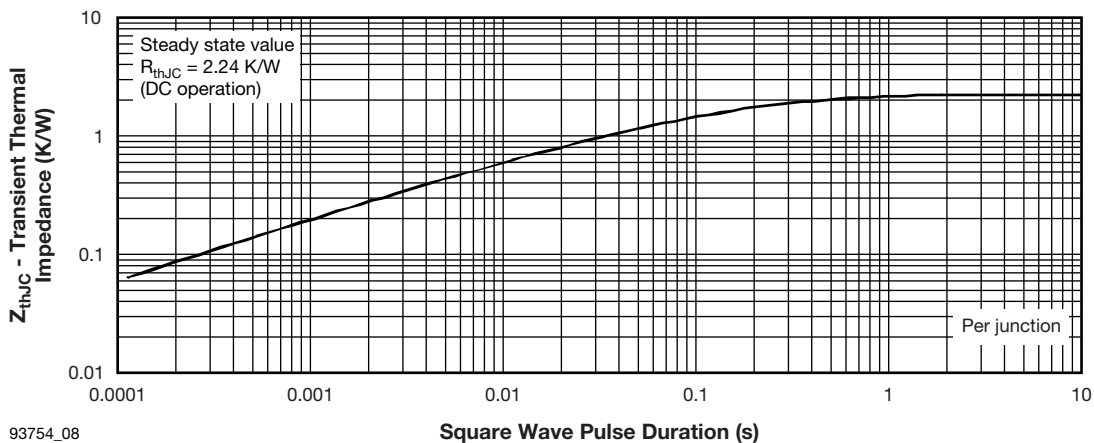


Fig. 8 - Thermal Impedance  $Z_{thJC}$  Characteristics

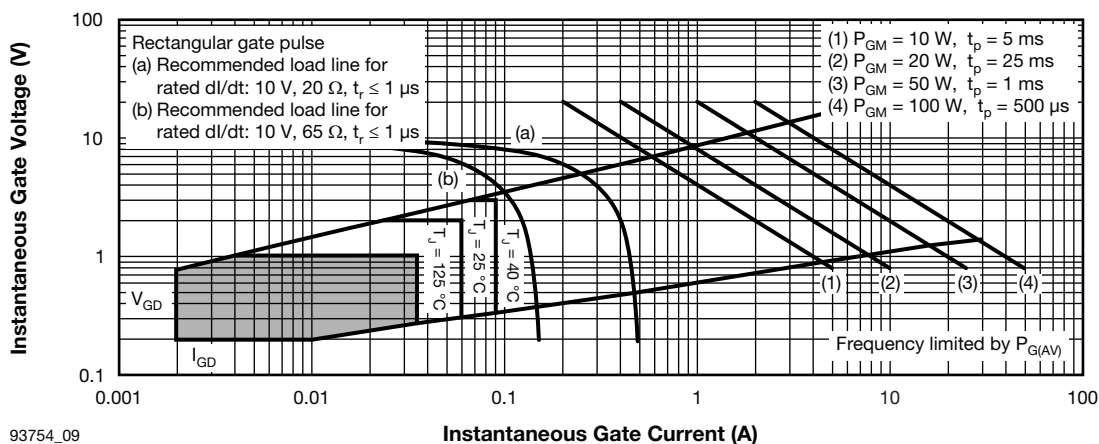


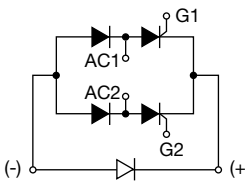
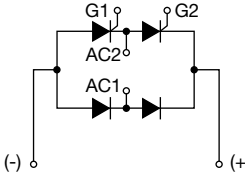
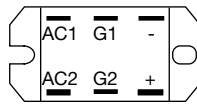
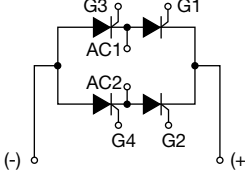
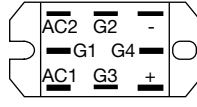
Fig. 9 - Gate Characteristics

## ORDERING INFORMATION TABLE

Device code

|     |   |   |   |   |   |   |
|-----|---|---|---|---|---|---|
| VS- | P | 1 | 0 | 2 | K | W |
| ①   | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |

- 1** - Vishay Semiconductors product
- 2** - Module type
- 3** - Current rating  
1 = 25 A DC (P100 Series)  
4 = 40 A DC (P400 Series)
- 4** - Circuit configuration  
0 = Single Phase, Hybrid Bridge Common Cathode  
2 = Single Phase, Hybrid Bridge Doubler Connection  
3 = Single Phase, all SCR Bridge
- 5** - Voltage code  
1 = 400 V  
2 = 600 V  
3 = 800 V  
4 = 1000 V  
5 = 1200 V
- 6** - K = Optional Voltage Suppression
- 7** - W = Optional Freewheeling Diode

| CIRCUIT CONFIGURATION                          |                            |                                                                                   |                                                                                     |
|------------------------------------------------|----------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| CIRCUIT DESCRIPTION                            | CIRCUIT CONFIGURATION CODE | SCHEMATIC DIAGRAM                                                                 | TERMINAL POSITIONS                                                                  |
| Single phase, hybrid bridge common cathode     | 0                          |  |  |
| Single phase, hybrid bridge doubler connection | 2                          |  |  |
| Single phase, all SCR bridge                   | 3                          |  |  |

| CODING (1)                                     |                            |              |                          |                         |                                                      |
|------------------------------------------------|----------------------------|--------------|--------------------------|-------------------------|------------------------------------------------------|
| CIRCUIT DESCRIPTION                            | CIRCUIT CONFIGURATION CODE | BASIC SERIES | WITH VOLTAGE SUPPRESSION | WITH FREEWHEELING DIODE | WITH BOTH VOLTAGE SUPPRESSION AND FREEWHEELING DIODE |
| Single phase, hybrid bridge common cathode     | 0                          | P10.         | P10.K                    | P10.W                   | P10.KW                                               |
| Single phase, hybrid bridge doubler connection | 2                          | P12.         | P12.K                    | -                       | -                                                    |
| Single phase, all SCR bridge                   | 3                          | P13.         | P13.K                    | -                       | -                                                    |

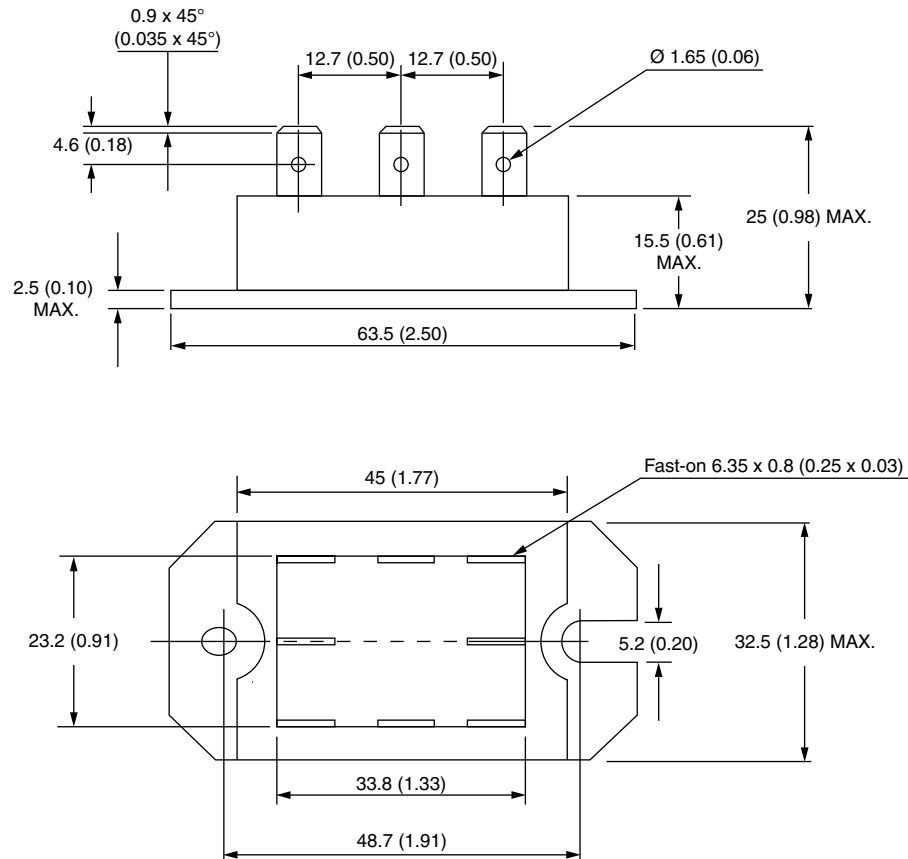
#### Note

(1) To complete code refer to Voltage Ratings table, i.e.: For 600 V P10.W complete code is P102W

| LINKS TO RELATED DOCUMENTS |                                                                        |
|----------------------------|------------------------------------------------------------------------|
| Dimensions                 | <a href="http://www.vishay.com/doc?95335">www.vishay.com/doc?95335</a> |

## D-19 PACE-PAK

**DIMENSIONS** in millimeters (inches)





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