

Power Modules, Passivated Assembled Circuit Elements, 40 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


RoHS
COMPLIANT

| PRIMARY CHARACTERISTICS | |
|-------------------------|-------------------------------|
| I_o | 40 A |
| Type | Modules - thyristor, standard |
| Package | PACE-PAK (D-19) |

DESCRIPTION

The VS-P400 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.

| MAJOR RATINGS AND CHARACTERISTICS | | | |
|-----------------------------------|-----------------|-------------|-------------------|
| SYMBOL | CHARACTERISTICS | VALUES | UNITS |
| I_o | 80 °C | 40 | A |
| I_{TSM} , I_{FSM} | 50 Hz | 385 | A |
| | 60 Hz | 400 | |
| I^2t | 50 Hz | 745 | A ² s |
| | 60 Hz | 680 | |
| $I^2\sqrt{t}$ | | 7450 | A ² √s |
| V_{RRM} | Range | 400 to 1200 | V |
| V_{ISOL} | | 2500 | V |
| T_J | | -40 to +125 | °C |
| T_{Stg} | | | |

ELECTRICAL SPECIFICATIONS

| VOLTAGE RATINGS | | | |
|---------------------------|---|--|--|
| TYPE NUMBER | V_{RRM}/V_{DRM} , MAXIMUM REPETITIVE PEAK REVERSE AND PEAK OFF-STATE VOLTAGE V | V_{RSM} , MAXIMUM NON-REPETITIVE PEAK REVERSE VOLTAGE V | I_{RRM} MAXIMUM AT T_J MAXIMUM mA |
| VS-P401, VS-P421, VS-P431 | 400 | 500 | 10 |
| VS-P402, VS-P422, VS-P432 | 600 | 700 | |
| VS-P403, VS-P423, VS-P433 | 800 | 900 | |
| VS-P404, VS-P424, VS-P434 | 1000 | 1100 | |
| VS-P405, VS-P425, VS-P435 | 1200 | 1300 | |



| ON-STATE CONDUCTION | | | | | |
|--|-------------------------------------|--|----------------------------------|--------|-------------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | | VALUES | UNITS |
| Maximum DC output current at case temperature | I _O | Full bridge circuits | | 40 | A |
| | | | | 80 | °C |
| Maximum peak, one-cycle non-repetitive on-state or forward current | I _{TSM} , I _{FSM} | t = 10 ms | No voltage reapplied | 385 | A |
| | | t = 8.3 ms | | | |
| | | t = 10 ms | 100 % V _{RRM} reapplied | 325 | |
| | | t = 8.3 ms | | | |
| Maximum I ² t for fusing | I ² t | t = 10 ms | No voltage reapplied | 745 | A ² s |
| | | t = 8.3 ms | | | |
| | | t = 10 ms | 100 % V _{RRM} reapplied | 530 | |
| | | t = 8.3 ms | | | |
| Maximum I ² √t for fusing | I ² √t | t = 0.1 ms to 10 ms, no voltage reapplied I ² t for time tx = I ² √t · √tx | | 7450 | A ² √s |
| Low level value of threshold voltage | V _{T(TO)1} | (16.7 % × π × I _{T(AV)} < I < π × I _{T(AV)}), T _J = T _J maximum | | 0.83 | V |
| High level value of threshold voltage | V _{T(TO)2} | (I > π × I _{T(AV)}), T _J = T _J maximum | | 1.03 | |
| Low level value of on-state slope resistance | r _{t1} | (16.7 % × π × I _{T(AV)} < I < π × I _{T(AV)}), T _J = T _J maximum | | 9.61 | mΩ |
| High level value of on-state slope resistance | r _{t2} | (I > π × I _{T(AV)}), T _J = T _J maximum | | 7.01 | |
| Maximum on-state voltage drop | V _{TM} | I _{TM} = π × I _{T(AV)} | T _J = 25 °C | 1.4 | V |
| Maximum forward voltage drop | V _{FM} | I _{FM} = π × I _{F(AV)} | T _J = 25 °C | 1.4 | V |
| Maximum non-repetitive rate of rise of turned-on current | di/dt | T _J = 125 °C from 0.67 V _{DRM} I _{TM} = π × I _{T(AV)} , I _g = 500 mA, t _r < 0.5 μs, t _p > 6 μs | | 200 | A/μs |
| Maximum holding current | I _H | T _J = 25 °C anode supply = 6 V, resistive load | | 130 | mA |
| Maximum latching current | I _L | | | 250 | |

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

| TRIGGERING | | | | | |
|--|--------------------|---|--|--------|-------|
| PARAMETER | SYMBOL | TEST CONDITIONS | | VALUES | UNITS |
| Maximum peak gate power | P _{GM} | | | 8 | W |
| Maximum average gate power | P _{G(AV)} | | | 2 | |
| Maximum peak gate current | I _{GM} | | | 2 | A |
| Maximum peak negative gate voltage | -V _{GM} | | | 10 | V |
| Maximum gate voltage required to trigger | V _{GT} | T _J = - 40 °C | | 3 | V |
| | | T _J = 25 °C | | 2 | |
| | | T _J = 125 °C | | 1 | |
| Maximum gate current required to trigger | I _{GT} | T _J = - 40 °C | | 90 | mA |
| | | T _J = 25 °C | | 60 | |
| | | T _J = 125 °C | | 35 | |
| Maximum gate voltage that will not trigger | V _{GD} | T _J = 125 °C, rated V _{DRM} applied | | 0.2 | V |
| Maximum gate current that will not trigger | I _{GD} | | | 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 | 1.05 | K/W |
| Maximum thermal resistance, case to heatsink | R_{thCS} | Mounting surface, smooth and greased | 0.10 | |
| Mounting torque, base to heatsink ⁽¹⁾ | | | 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

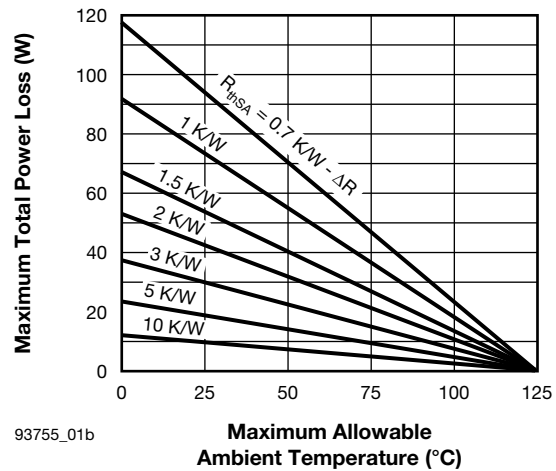


Fig. 1 - Current Ratings Nomogram (1 Module Per Heatsink)

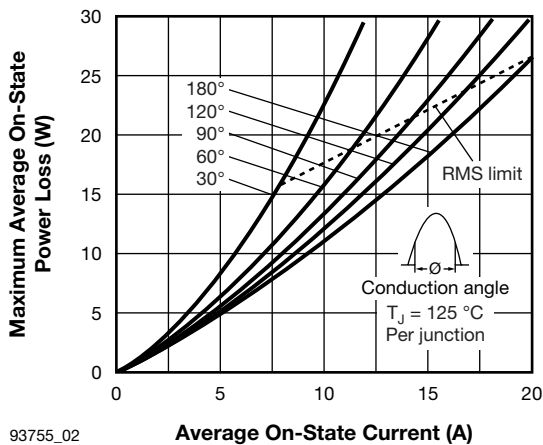


Fig. 2 - On-State Power Loss Characteristics

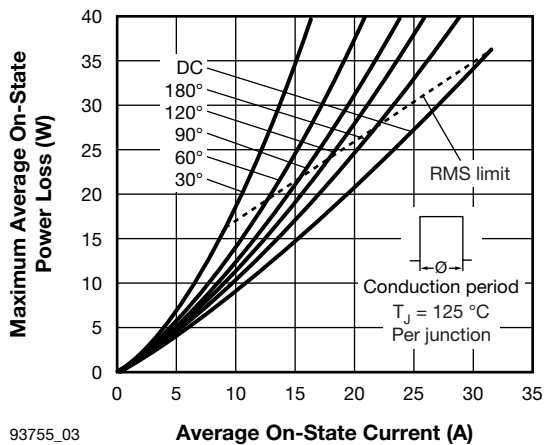
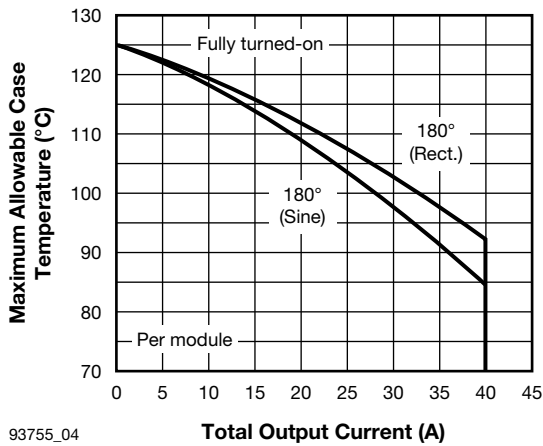
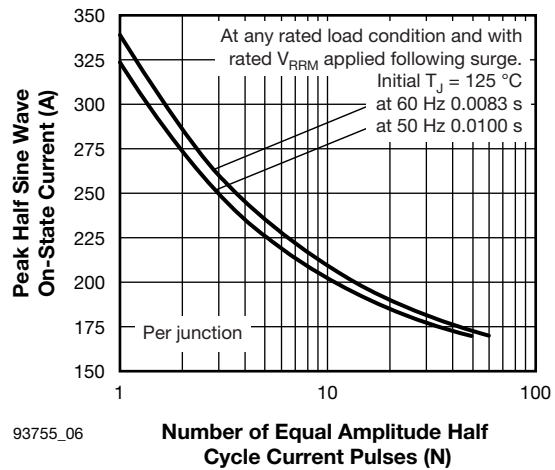


Fig. 3 - On-State Power Loss Characteristics



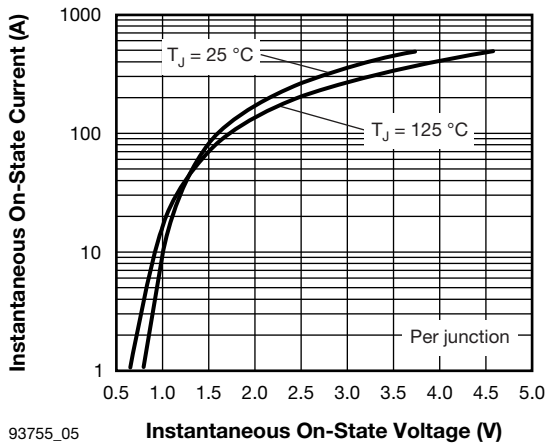
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Fig. 4 - Current Ratings Characteristics



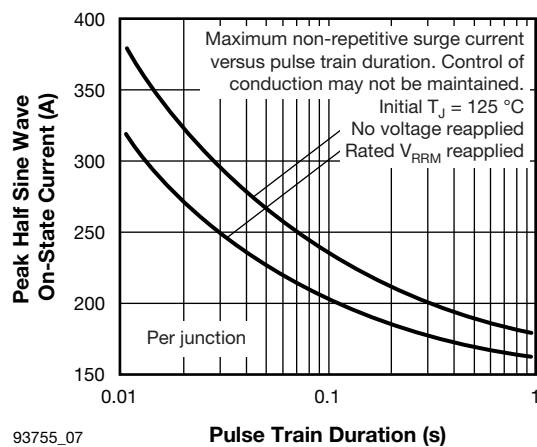
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Fig. 6 - Maximum Non-Repetitive Surge Current



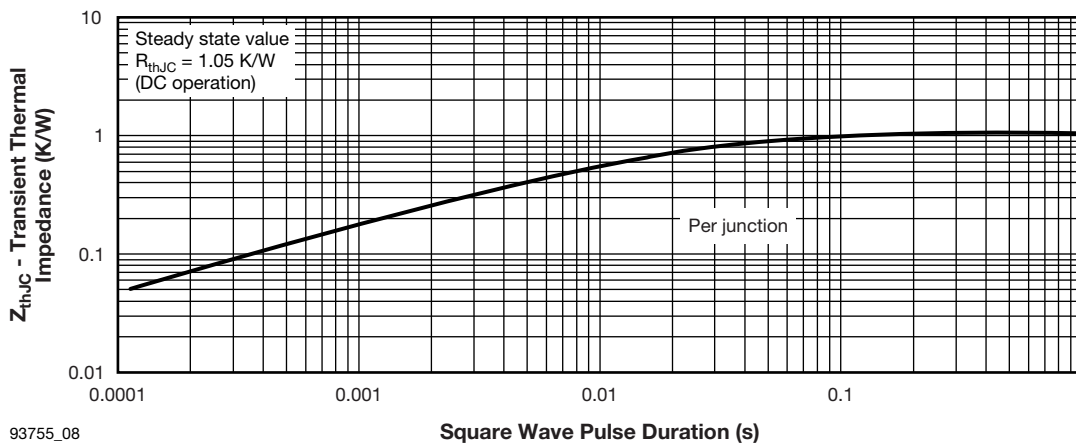
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Fig. 5 - On-State Voltage Drop Characteristics



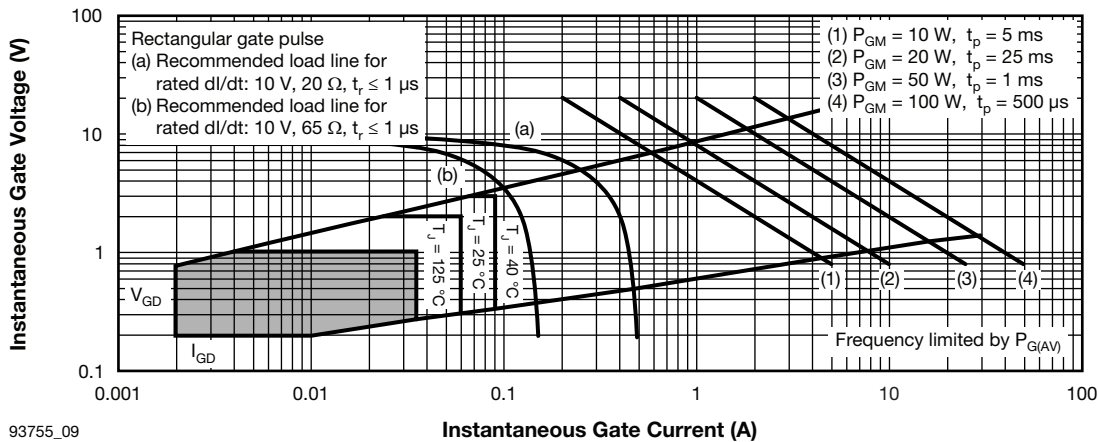
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Fig. 7 - Maximum Non-Repetitive Surge Current



93755_08

Fig. 8 - Thermal Impedance Z_{thJC} Characteristics



93755_09

Fig. 9 - Gate Characteristics

ORDERING INFORMATION TABLE

| | | | | | | | |
|-------------|------------|----------|----------|----------|----------|----------|----------|
| Device code | VS- | P | 4 | 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 | P40. | P40.K | P40.W | P40.KW |
| Single phase, hybrid bridge doubler connection | 2 | P42. | P42.K | - | - |
| Single phase, all SCR bridge | 3 | P43. | P43.K | - | - |

Note

(1) To complete code refer to Voltage Ratings table, i.e.: for 600 V P40.W complete code is P402W

| LINKS TO RELATED DOCUMENTS | |
|----------------------------|--|
| Dimensions | www.vishay.com/doc?95335 |

D-19 PACE-PAK

DIMENSIONS in millimeters (inches)





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