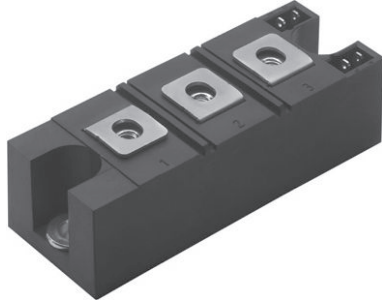





Thyristor/Thyristor, 160 A (INT-A-PAK Power Modules)



INT-A-PAK



FEATURES

- High voltage
- Electrically isolated by DBC ceramic (Al_2O_3)
- 3500 V_{RMS} isolating voltage
- Industrial standard package
- High surge capability
- Glass passivated chips
- Modules uses high voltage power thyristor/diodes in three basic configurations
- Simple mounting
- UL approved file E78996 
- Designed and qualified for multiple level
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

APPLICATIONS

- DC motor control and drives
- Battery charges
- Welders
- Power converters
- Lighting control
- Heat and temperature control

| PRIMARY CHARACTERISTICS | |
|-------------------------|-------------------------------|
| $I_{T(AV)}$ | 160 A |
| Type | Modules - thyristor, standard |
| Package | INT-A-PAK |

| MAJOR RATINGS AND CHARACTERISTICS | | | |
|-----------------------------------|-----------------|-------------|----------------------------|
| SYMBOL | CHARACTERISTICS | VALUES | UNITS |
| $I_{T(AV)}$ | 85 °C | 160 | A |
| $I_{T(RMS)}$ | | 355 | |
| I_{TSM} | 50 Hz | 4870 | |
| | 60 Hz | 5100 | |
| I^2t | 50 Hz | 119 | kA ² s |
| | 60 Hz | 108 | |
| $I^2\sqrt{t}$ | | 1190 | kA ² \sqrt{s} |
| V_{RRM} | Range | 1200, 1600 | V |
| T_J | Range | -40 to +125 | °C |

ELECTRICAL SPECIFICATIONS

| VOLTAGE RATINGS | | | | |
|-----------------|--------------|--|--|-----------------------------------|
| TYPE NUMBER | VOLTAGE CODE | V_{RRM}/V_{DRM} , MAXIMUM REPETITIVE PEAK REVERSE VOLTAGE V | V_{RSM}/V_{DSM} , MAXIMUM NON-REPETITIVE PEAK REVERSE VOLTAGE V | I_{RRM}/I_{DRM} AT 125 °C mA |
| VS-VSK.162 | 12 | 1200 | 1300 | 50 |
| | 16 | 1600 | 1700 | |



| ON-STATE CONDUCTION | | | | | |
|--|---------------|--|----------------------------|--------|--------------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | | VALUES | UNITS |
| Maximum average on-state current at case temperature | $I_{T(AV)}$ | 180° conduction, half sine wave | | 160 | A |
| | | | | 85 | °C |
| Maximum RMS on-state current | $I_{T(RMS)}$ | As AC switch | | 355 | |
| Maximum peak, one-cycle on-state, non-repetitive surge current | I_{TSM} | t = 10 ms | No voltage reappplied | 4870 | A |
| | | t = 8.3 ms | No voltage reappplied | 5100 | |
| | | t = 10 ms | 100 % V_{RRM} reappplied | 4100 | |
| | | t = 8.3 ms | 100 % V_{RRM} reappplied | 4300 | |
| Maximum I^2t for fusing | I^2t | t = 10 ms | No voltage reappplied | 119 | kA ² s |
| | | t = 8.3 ms | No voltage reappplied | 108 | |
| | | t = 10 ms | 100 % V_{RRM} reappplied | 84 | |
| | | t = 8.3 ms | 100 % V_{RRM} reappplied | 76.7 | |
| Maximum $I^2\sqrt{t}$ for fusing | $I^2\sqrt{t}$ | t = 0.1 ms to 10 ms, no voltage reappplied | | 1190 | kA ² √s |
| Low level value of threshold voltage | $V_{T(TO)1}$ | (16.7 % $\times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)}$, T_J maximum) | | 0.8 | V |
| High level value of threshold voltage | $V_{T(TO)2}$ | (I > $\pi \times I_{T(AV)}$, T_J maximum) | | 0.98 | |
| Low level value on-state slope resistance | r_{t1} | (16.7 % $\times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)}$, T_J maximum) | | 1.67 | mΩ |
| High level value on-state slope resistance | r_{t2} | (I > $\pi \times I_{T(AV)}$, T_J maximum) | | 1.38 | |
| Maximum on-state voltage drop | V_{TM} | $I_{TM} = \pi \times I_{T(AV)}$, $T_J = 25$ °C, 180° conduction | | 1.54 | V |
| Maximum forward voltage drop | V_{FM} | $I_{TM} = \pi \times I_{T(AV)}$, $T_J = 25$ °C, 180° conduction | | 1.54 | V |
| Maximum holding current | I_H | Anode supply = 6 V initial $I_T = 30$ A, $T_J = 25$ °C | | 200 | mA |
| Maximum latching current | I_L | Anode supply = 6 V resistive load = 1 Ω Gate pulse: 10 V, 100 μs, $T_J = 25$ °C | | 400 | |

| SWITCHING | | | | | |
|-----------------------|----------|--|--|-----------|-------|
| PARAMETER | SYMBOL | TEST CONDITIONS | | VALUES | UNITS |
| Typical delay time | t_{gd} | $T_J = 25$ °C | Gate current = 1 A, $dI_g/dt = 1$ A/μs $V_d = 0.67$ % V_{DRM} | 1 | μs |
| Typical rise time | t_{gr} | | | 2 | |
| Typical turn-off time | t_q | $I_{TM} = 300$ A, - $dI/dt = 15$ A/μs; $T_J = T_J$ maximum $V_R = 50$ V; $dV/dt = 20$ V/μs; gate 0 V, 100 Ω | | 50 to 200 | |

| BLOCKING | | | | | |
|--|--------------------------|--|--|--------|-------|
| PARAMETER | SYMBOL | TEST CONDITIONS | | VALUES | UNITS |
| Maximum peak reverse and off-state leakage current | I_{RRM} , I_{DRM} | $T_J = 125$ °C | | 50 | mA |
| RMS insulation voltage | V_{INS} | 50 Hz, circuit to base, all terminals shorted, t = 1 s | | 3500 | V |
| Critical rate of rise of off-state voltage | dV/dt | $T_J = T_J$ maximum, exponential to 67 % rated V_{DRM} | | 1000 | V/μs |



| TRIGGERING | | | | | |
|---|-------------|---|--|--------|------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | | VALUES | UNITS |
| Maximum peak gate power | P_{GM} | $t_p \leq 5$ ms, $T_J = T_J$ maximum | | 12 | W |
| Maximum average gate power | $P_{G(AV)}$ | $f = 50$ Hz, $T_J = T_J$ maximum | | 3 | |
| Maximum peak gate current | I_{GM} | $t_p \leq 5$ ms, $T_J = T_J$ maximum | | 3 | A |
| Maximum peak negative gate voltage | $-V_{GT}$ | | | 10 | V |
| Maximum required DC gate voltage to trigger | V_{GT} | $T_J = -40$ °C | Anode supply = 6 V, resistive load; $R_a = 1$ Ω | 4 | |
| | | $T_J = 25$ °C | | 2.5 | |
| | | $T_J = T_J$ maximum | | 1.7 | |
| Maximum required DC gate current to trigger | I_{GT} | $T_J = -40$ °C | | 270 | mA |
| | | $T_J = 25$ °C | | 150 | |
| | | $T_J = T_J$ maximum | | 80 | |
| Maximum gate voltage that will not trigger | V_{GD} | $T_J = T_J$ maximum, rated V_{DRM} applied | | 0.3 | V |
| Maximum gate current that will not trigger | I_{GD} | | | 10 | mA |
| Maximum rate of rise of turned-on current | di/dt | $T_J = T_J$ maximum, $I_{TM} = 400$ A rated V_{DRM} applied | | 300 | A/ μ s |

| THERMAL AND MECHANICAL SPECIFICATIONS | | | | | |
|---|-----------------------------------|--|--|-------------|-------|
| PARAMETER | SYMBOL | TEST CONDITIONS | | VALUES | UNITS |
| Maximum junction operating temperature range | T_J | | | -40 to +125 | °C |
| Maximum storage temperature range | T_{Stg} | | | -40 to +150 | |
| Maximum thermal resistance, junction to case per junction | R_{thJC} | DC operation | | 0.16 | K/W |
| Maximum thermal resistance, case to heat sink per module | R_{thCS} | Mounting surface, smooth, flat and greased | | 0.05 | |
| Mounting torque ± 10 % | IAP to heat sink busbar to IAP | A mounting compound is recommended and the torque should be rechecked after a period of 3 hours to allow for the spread of the compound. Lubricated threads. | | 4 to 6 | Nm |
| Approximate weight | | | | 200 | g |
| Case style | | | | 7.1 | oz. |
| | | | | INT-A-PAK | |

| ΔR CONDUCTION PER JUNCTION | | | | | | | | | | | |
|------------------------------------|--|--------|--------|--------|--------|---|--------|--------|--------|--------|-------|
| DEVICES | SINUSOIDAL CONDUCTION AT T_J MAXIMUM | | | | | RECTANGULAR CONDUCTION AT T_J MAXIMUM | | | | | UNITS |
| | 180° | 120° | 90° | 60° | 30° | 180° | 120° | 90° | 60° | 30° | |
| VS-VSK.162 | 0.0030 | 0.0031 | 0.0032 | 0.0033 | 0.0034 | 0.0029 | 0.0036 | 0.0039 | 0.0041 | 0.0040 | K/W |

Note

- Table shows the increment of thermal resistance R_{thJC} when devices operate at different conduction angles than DC

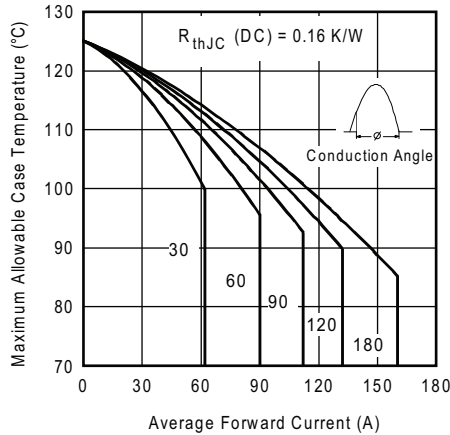


Fig. 1 - Current Ratings Characteristics

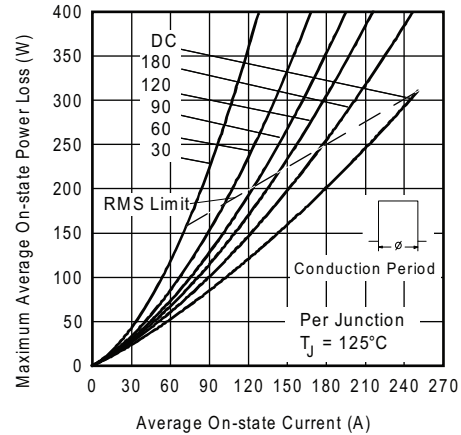


Fig. 4 - On-State Power Loss Characteristics

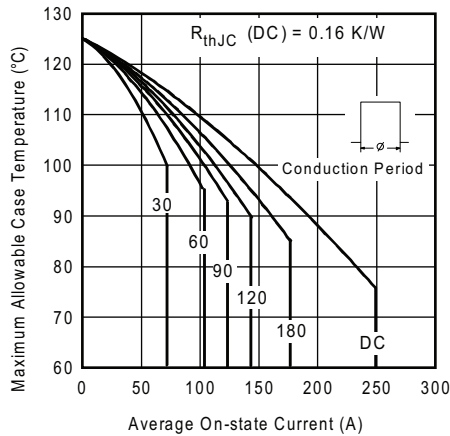


Fig. 2 - Current Ratings Characteristics

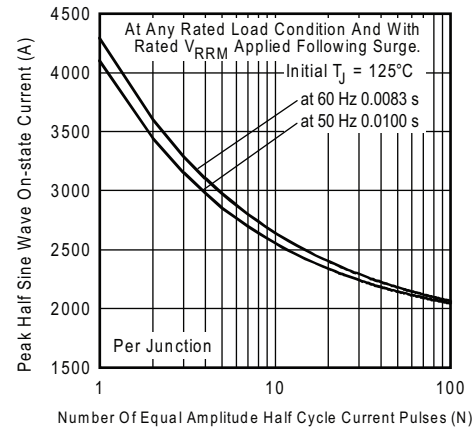


Fig. 5 - Maximum Non-Repetitive Surge Current

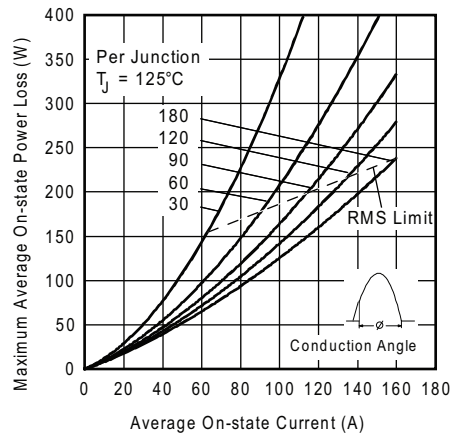


Fig. 3 - On-State Power Loss Characteristics

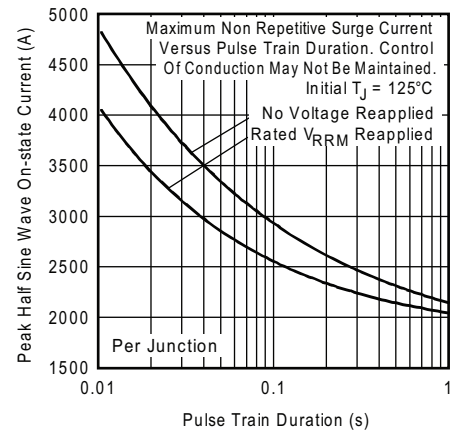


Fig. 6 - Maximum Non-Repetitive Surge Current

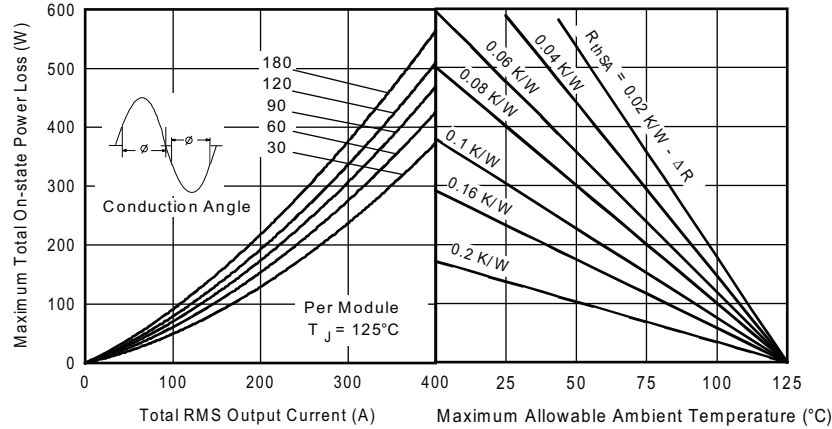


Fig. 7 - On-State Power Loss Characteristics

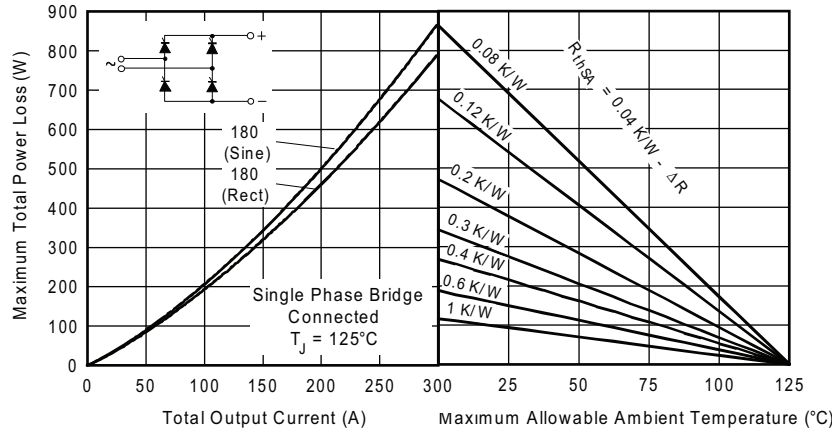


Fig. 8 - On-State Power Loss Characteristics

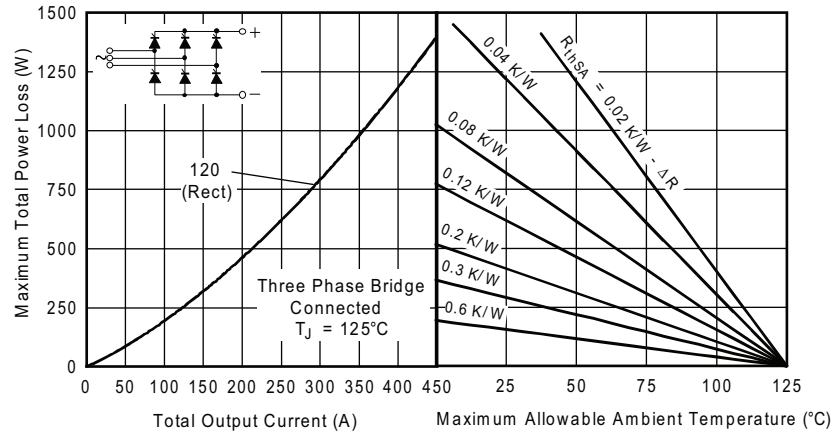


Fig. 9 - On-State Power Loss Characteristics

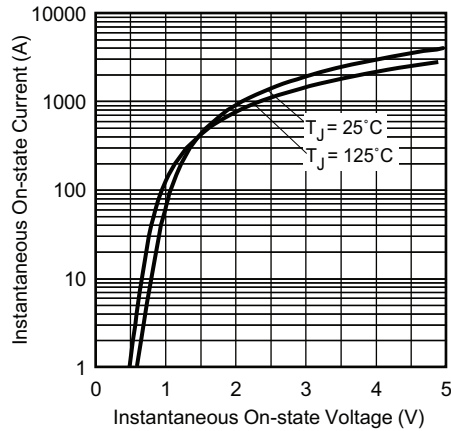


Fig. 10 - On-State Voltage Drop Characteristics

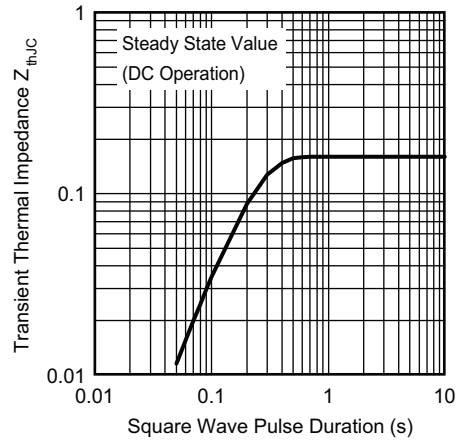


Fig. 11 - Thermal Impedance Z_{thJC} Characteristics

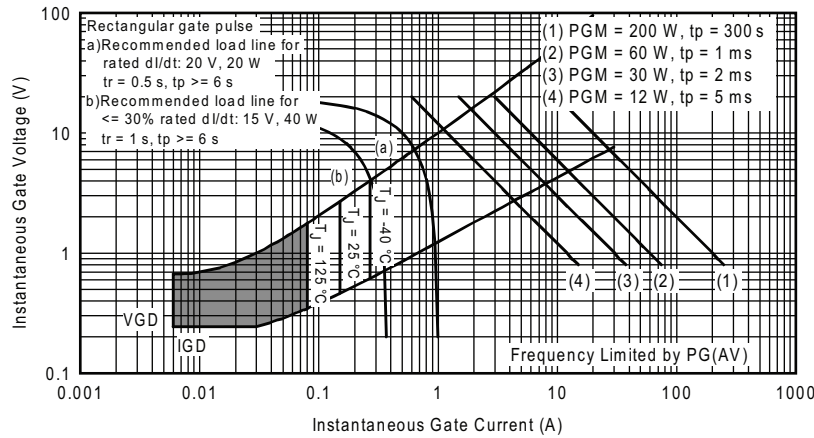


Fig. 12 - Gate Characteristics

ORDERING INFORMATION TABLE

| | | | | | |
|-------------|--------------|-----------|--------------------------------|-----------|------------|
| Device code | VS-VS | KU | 162 | 16 | PbF |
| | ① | ② | ③ | ④ | ⑤ |
| | 1 | - | Vishay Semiconductors product | | |
| | 2 | - | Circuit configuration | | |
| | 3 | - | Current rating: $I_{T(AV)}$ | | |
| | 4 | - | Voltage code x 100 = V_{RRM} | | |
| | 5 | - | PbF = Lead (Pb)-free | | |

Note

- To order the optional hardware go to www.vishay.com/doc?95172

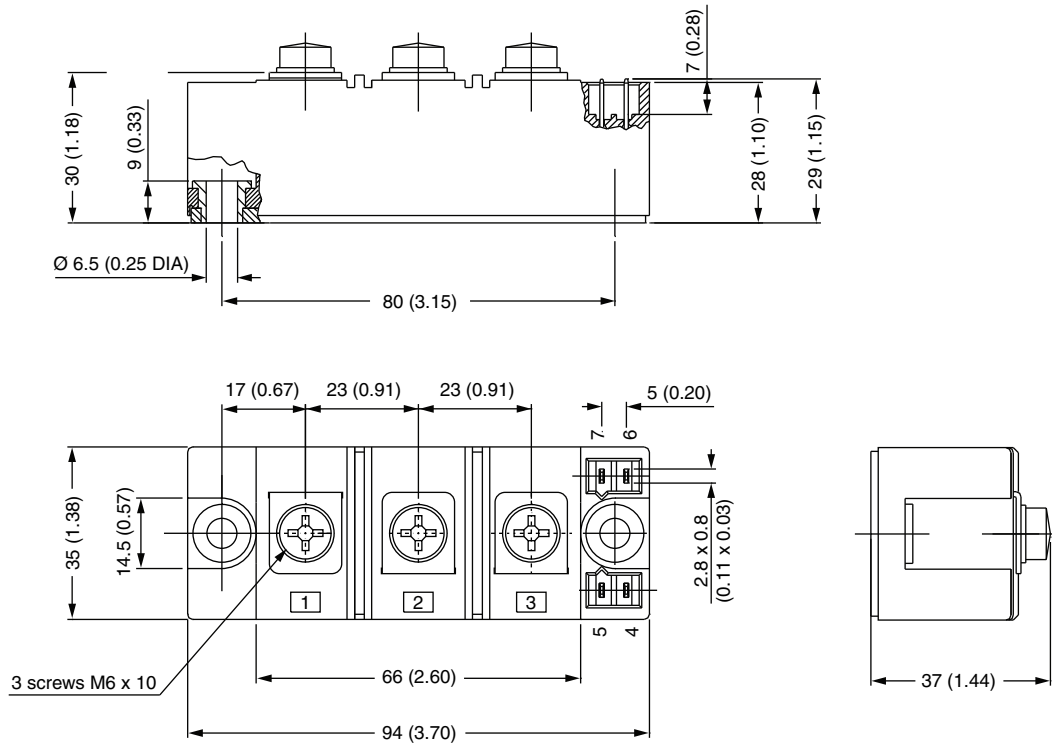


| CIRCUIT CONFIGURATION | | |
|--------------------------|----------------------------|--|
| CIRCUIT DESCRIPTION | CIRCUIT CONFIGURATION CODE | CIRCUIT DRAWING |
| Two SCRs common cathodes | U | <p>The drawing for VS-U shows a physical package with three SCRs. The top SCR has a cathode (-) on the left and an anode (+) on the right. The middle SCR has a cathode (-) on the left and an anode (+) on the right. The bottom SCR has a cathode (-) on the left and an anode (+) on the right. The electrical schematic shows a common cathode connection for both SCRs. Terminal (1) is the AC input. Terminal (2) is the common cathode. Terminal (3) is the common anode. Gate terminals are K1, K2 and G1, G2.</p> |
| Two SCRs common anodes | V | <p>The drawing for VS-V shows a physical package with three SCRs. The top SCR has a cathode (-) on the left and an anode (+) on the right. The middle SCR has a cathode (-) on the left and an anode (+) on the right. The bottom SCR has a cathode (-) on the left and an anode (+) on the right. The electrical schematic shows a common anode connection for both SCRs. Terminal (1) is the AC input. Terminal (2) is the common anode. Terminal (3) is the common cathode. Gate terminals are K1, K2 and G1, G2.</p> |

| LINKS TO RELATED DOCUMENTS | |
|----------------------------|--|
| Dimensions | www.vishay.com/doc?95067 |

INT-A-PAK IGBT/Thyristor

DIMENSIONS in millimeters (inches)





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