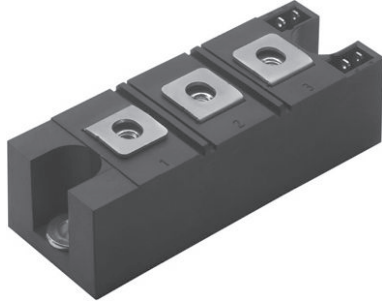





Thyristor/Thyristor, 160 A (INT-A-PAK Power Modules)



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 | | 5100 | |
| | | t = 10 ms | 100 % V_{RRM} reappplied | 4100 | |
| | | t = 8.3 ms | | 4300 | |
| Maximum I^2t for fusing | I^2t | t = 10 ms | No voltage reappplied | 119 | kA ² s |
| | | t = 8.3 ms | | 108 | |
| | | t = 10 ms | 100 % V_{RRM} reappplied | 84 | |
| | | t = 8.3 ms | | 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} | $t_p \leq 5 \text{ ms}$, $T_J = T_J \text{ maximum}$ | | 12 | W |
| Maximum average gate power | $P_{G(AV)}$ | $f = 50 \text{ Hz}$, $T_J = T_J \text{ maximum}$ | | 3 | |
| Maximum peak gate current | I_{GM} | $t_p \leq 5 \text{ ms}$, $T_J = T_J \text{ maximum}$ | | 3 | A |
| Maximum peak negative gate voltage | $-V_{GT}$ | | | 10 | V |
| Maximum required DC gate voltage to trigger | V_{GT} | $T_J = -40 \text{ }^\circ\text{C}$ | Anode supply = 6 V, resistive load; $R_a = 1 \text{ } \Omega$ | 4 | |
| | | $T_J = 25 \text{ }^\circ\text{C}$ | | 2.5 | |
| | | $T_J = T_J \text{ maximum}$ | | 1.7 | |
| Maximum required DC gate current to trigger | I_{GT} | $T_J = -40 \text{ }^\circ\text{C}$ | | 270 | mA |
| | | $T_J = 25 \text{ }^\circ\text{C}$ | | 150 | |
| | | $T_J = T_J \text{ maximum}$ | | 80 | |
| Maximum gate voltage that will not trigger | V_{GD} | $T_J = T_J \text{ maximum}$, 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 | $T_J = T_J \text{ maximum}$, $I_{TM} = 400 \text{ A}$ rated V_{DRM} applied | | 300 | A/ μs |

| THERMAL AND MECHANICAL SPECIFICATIONS | | | | | |
|---|-----------------------------------|--|--|-------------|------------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | | VALUES | UNITS |
| Maximum junction operating temperature range | T_J | | | -40 to +125 | $^\circ\text{C}$ |
| 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 $\pm 10 \%$ | 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

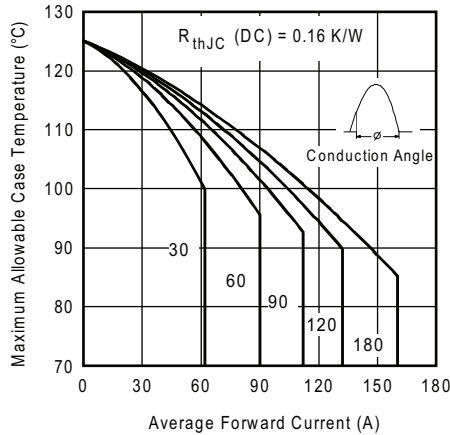


Fig. 1 - Current Ratings Characteristics

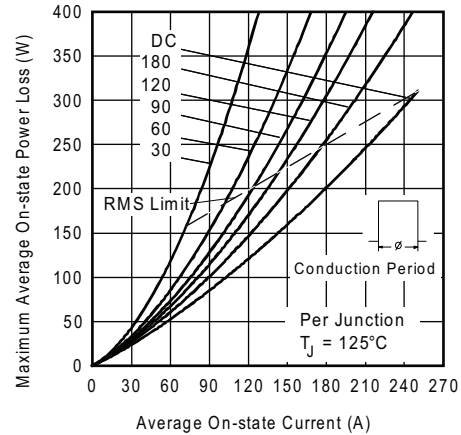


Fig. 4 - On-State Power Loss Characteristics

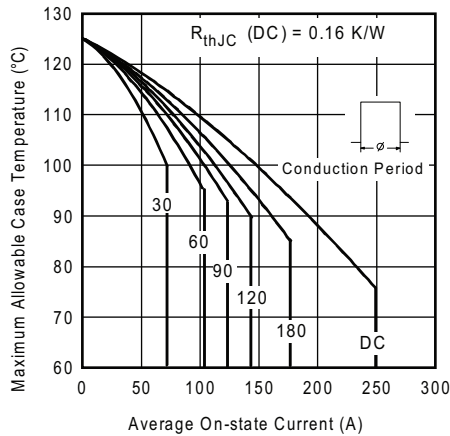


Fig. 2 - Current Ratings Characteristics

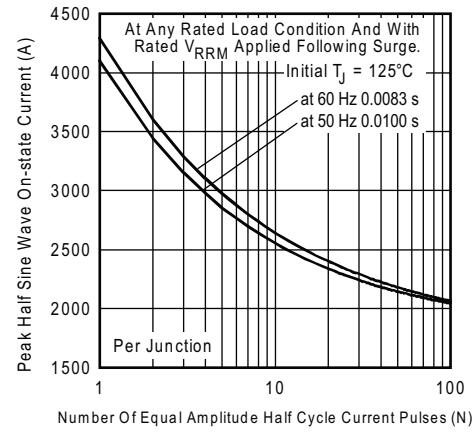


Fig. 5 - Maximum Non-Repetitive Surge Current

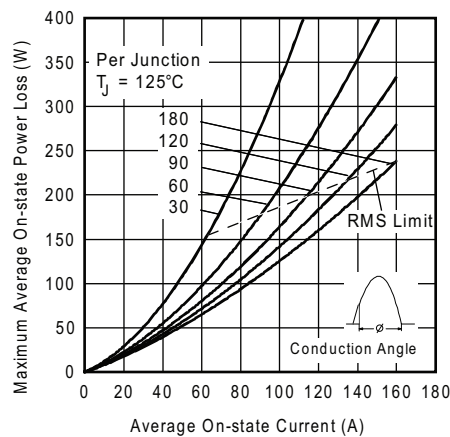


Fig. 3 - On-State Power Loss Characteristics

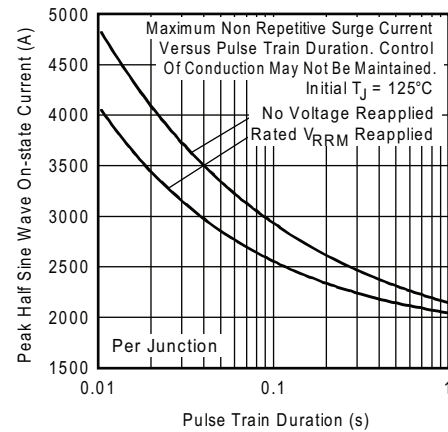


Fig. 6 - Maximum Non-Repetitive Surge Current

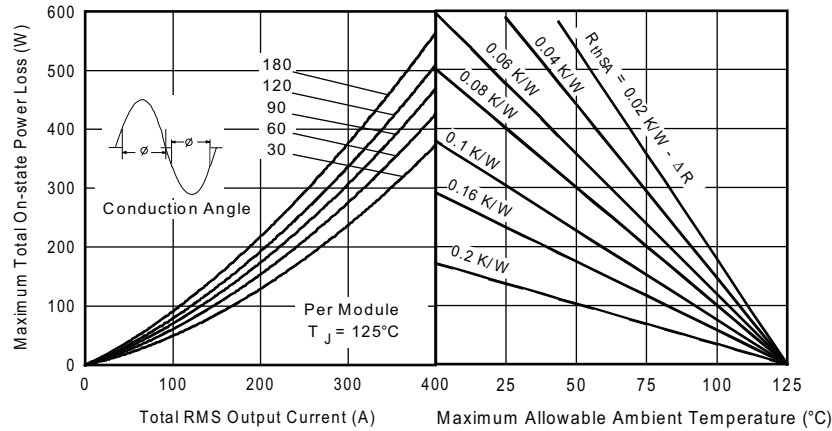


Fig. 7 - On-State Power Loss Characteristics

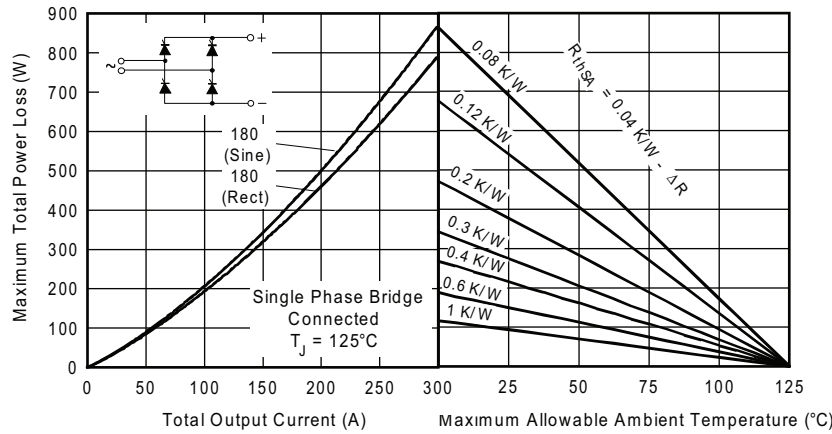


Fig. 8 - On-State Power Loss Characteristics

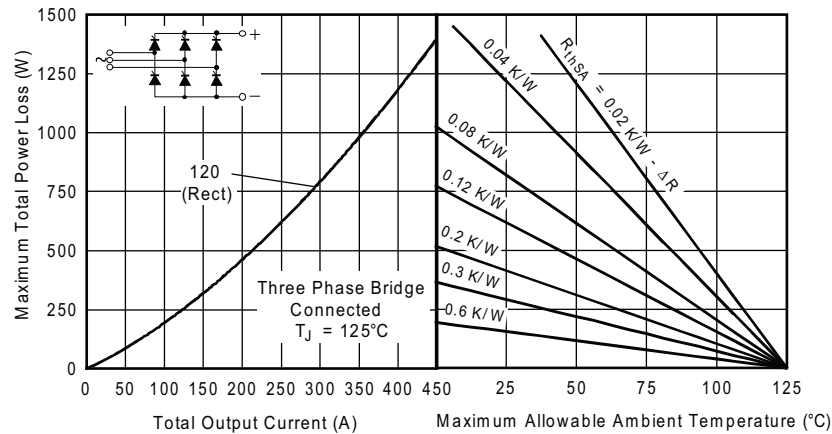


Fig. 9 - On-State Power Loss Characteristics

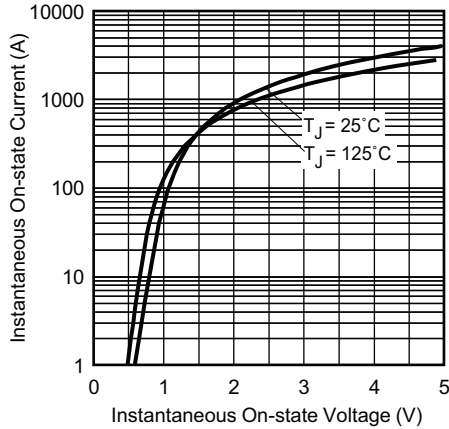


Fig. 10 - On-State Voltage Drop Characteristics

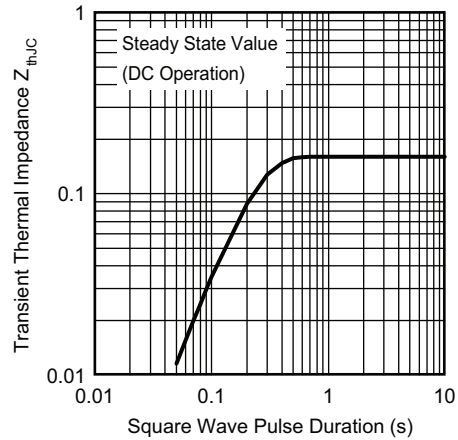


Fig. 11 - Thermal Impedance Z_{thJC} Characteristics

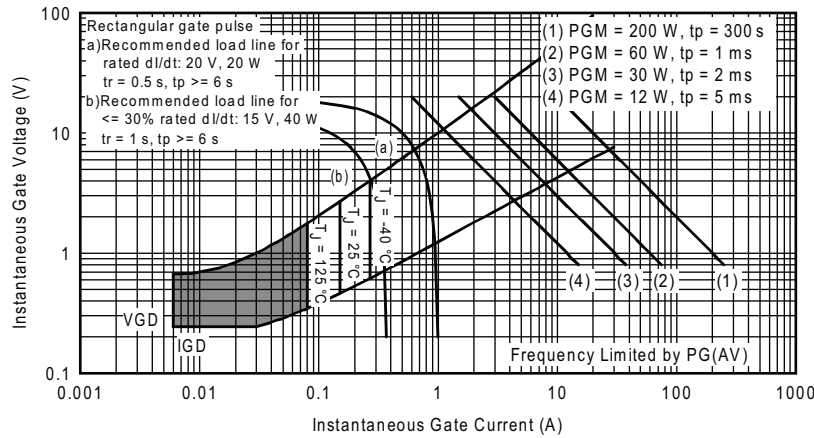


Fig. 12 - Gate Characteristics

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

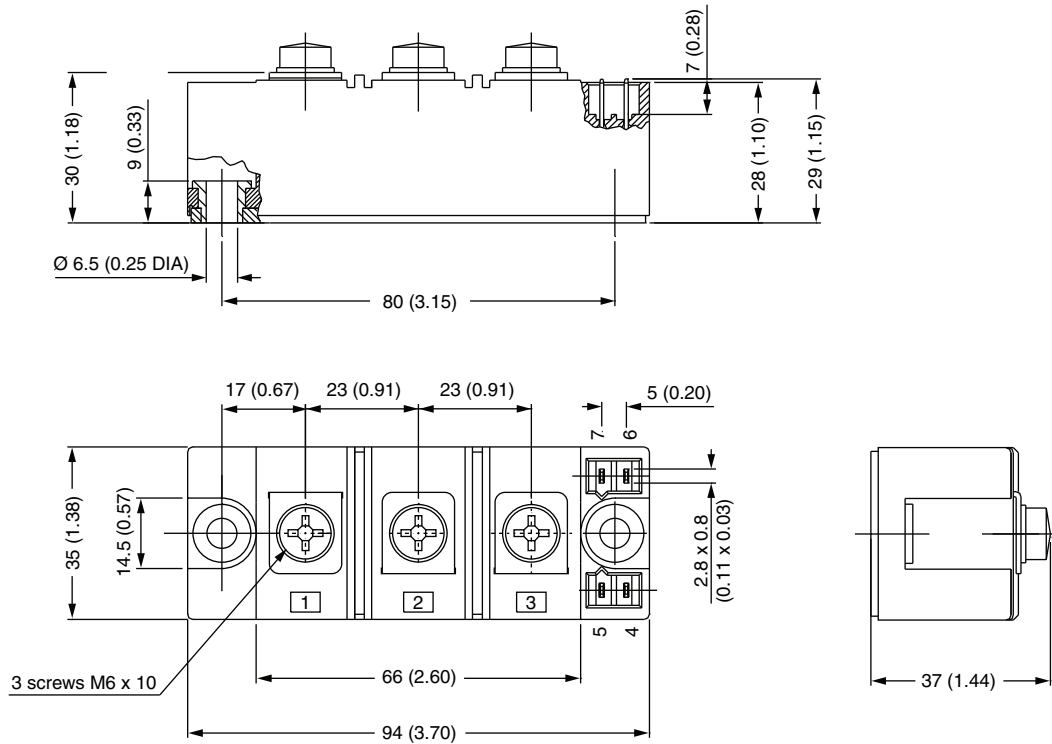


| CIRCUIT CONFIGURATION | | |
|--------------------------|----------------------------|-----------------|
| CIRCUIT DESCRIPTION | CIRCUIT CONFIGURATION CODE | CIRCUIT DRAWING |
| Two SCRs common cathodes | U | |
| Two SCRs common anodes | V | |

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

INT-A-PAK IGBT/Thyristor

DIMENSIONS in millimeters (inches)





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