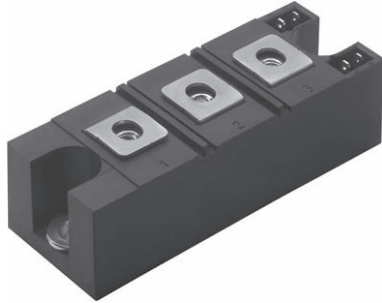



INT-A-PAK “Half Bridge” (Ultrafast Speed IGBT), 209 A


INT-A-PAK

| PRODUCT SUMMARY | |
|------------------------------|------------------------------------|
| V_{CES} | 600 V |
| I_C DC | 209 A |
| $V_{CE(on)}$ at 200 A, 25 °C | 2.6 V |
| Speed | 8 kHz to 30 kHz |
| Package | INT-A-PAK |
| Circuit | Half bridge with SMD gate resistor |

FEATURES

- Generation 5 Non Punch Through (NPT) technology
- Ultrafast: optimized for hard switching speed
- Low $V_{CE(on)}$
- 10 μ s short circuit capability
- Square RBSOA
- Positive $V_{CE(on)}$ temperature coefficient
- HEXFRED® antiparallel diode with ultrasoft reverse recovery characteristics
- Industry standard package
- Al_2O_3 DBC
- UL approved file E78996 
- Designed for industrial level
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912


**RoHS
COMPLIANT**

BENEFITS

- Benchmark efficiency for UPS and welding application
- Rugged transient performance
- Direct mounting on heatsink
- Very low junction to case thermal resistance

| ABSOLUTE MAXIMUM RATINGS | | | | |
|--------------------------------------|------------|--|-------------|-------|
| PARAMETER | SYMBOL | TEST CONDITIONS | MAX. | UNITS |
| Collector to emitter voltage | V_{CES} | | 600 | V |
| Continuous collector current | I_C | $T_C = 25\text{ °C}$ | 209 | A |
| | | $T_C = 80\text{ °C}$ | 142 | |
| Pulsed collector current | I_{CM} | | 400 | |
| Clamped inductive load current | I_{LM} | | 400 | |
| Diode continuous forward current | I_F | $T_C = 25\text{ °C}$ | 178 | |
| | | $T_C = 80\text{ °C}$ | 121 | |
| Gate to emitter voltage | V_{GE} | | ± 20 | V |
| Maximum power dissipation | P_D | $T_C = 25\text{ °C}$ | 781 | W |
| | | $T_C = 80\text{ °C}$ | 438 | |
| Isolation voltage | V_{ISOL} | Any terminal to case, $t = 1\text{ min}$ | 2500 | V |
| Operating junction temperature range | T_J | | -40 to +150 | °C |



| ELECTRICAL SPECIFICATIONS ($T_J = 25\text{ }^\circ\text{C}$ unless otherwise specified) | | | | | | |
|---|---------------|---|------|-------|-----------|-------|
| PARAMETER | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNITS |
| Collector to emitter breakdown voltage | $V_{BR(CES)}$ | $V_{GE} = 0\text{ V}, I_C = 500\text{ }\mu\text{A}$ | 600 | - | - | V |
| Collector to emitter voltage | $V_{CE(on)}$ | $V_{GE} = 15\text{ V}, I_C = 100\text{ A}$ | - | 1.95 | 2.1 | |
| | | $V_{GE} = 15\text{ V}, I_C = 200\text{ A}$ | - | 2.6 | 2.84 | |
| | | $V_{GE} = 15\text{ V}, I_C = 100\text{ A}, T_J = 125\text{ }^\circ\text{C}$ | - | 2.28 | 2.5 | |
| | | $V_{GE} = 15\text{ V}, I_C = 200\text{ A}, T_J = 125\text{ }^\circ\text{C}$ | - | 3.14 | 3.48 | |
| Gate threshold voltage | $V_{GE(th)}$ | $V_{CE} = V_{GE}, I_C = 500\text{ }\mu\text{A}$ | 3 | 4.2 | 6 | |
| Collector to emitter leakage current | I_{CES} | $V_{GE} = 0\text{ V}, V_{CE} = 600\text{ V}$ | - | 0.005 | 0.2 | mA |
| | | $V_{GE} = 0\text{ V}, V_{CE} = 600\text{ V}, T_J = 150\text{ }^\circ\text{C}$ | - | 0.01 | 15 | |
| Diode forward voltage drop | V_{FM} | $I_C = 100\text{ A}$ | - | 1.39 | 1.78 | V |
| | | $I_C = 200\text{ A}$ | - | 1.64 | 2.2 | |
| | | $I_C = 100\text{ A}, T_J = 125\text{ }^\circ\text{C}$ | - | 1.32 | 1.69 | |
| | | $I_C = 200\text{ A}, T_J = 125\text{ }^\circ\text{C}$ | - | 1.67 | 2.30 | |
| Gate to emitter leakage current | I_{GES} | $V_{GE} = \pm 20\text{ V}$ | - | - | ± 200 | nA |

| SWITCHING CHARACTERISTICS ($T_J = 25\text{ }^\circ\text{C}$ unless otherwise specified) | | | | | | |
|---|--------------|--|------------|-------|------|-------|
| PARAMETER | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNITS |
| Turn-on switching loss | E_{on} | $I_C = 200\text{ A}, V_{CC} = 360\text{ V}, V_{GE} = 15\text{ V}, R_g = 10\text{ }\Omega, L = 200\text{ }\mu\text{H}, T_J = 25\text{ }^\circ\text{C}$ | - | 3.65 | - | mJ |
| Turn-off switching loss | E_{off} | | - | 6.9 | - | |
| Total switching loss | E_{tot} | | - | 10.55 | - | |
| Turn-on switching loss | E_{on} | $I_C = 200\text{ A}, V_{CC} = 360\text{ V}, V_{GE} = 15\text{ V}, R_g = 10\text{ }\Omega, L = 200\text{ }\mu\text{H}, T_J = 125\text{ }^\circ\text{C}$ | - | 3.8 | - | |
| Turn-off switching loss | E_{off} | | - | 7.8 | - | |
| Total switching loss | E_{tot} | | - | 11.6 | - | |
| Turn-on delay time | $t_{d(on)}$ | | - | 507 | - | ns |
| Rise time | t_r | | - | 133 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 538 | - | |
| Fall time | t_f | - | 92 | - | | |
| Reverse bias safe operating area | RBSOA | $T_J = 150\text{ }^\circ\text{C}, I_C = 400\text{ A}, R_g = 27\text{ }\Omega, V_{GE} = 15\text{ V to }0$ | Fullsquare | | | |
| Short circuit safe operating area | SCSOA | $T_J = 150\text{ }^\circ\text{C}, V_{CC} = 400\text{ V}, V_P = 600\text{ V}, R_g = 27\text{ }\Omega, V_{GE} = 15\text{ V to }0$ | 10 | - | - | |
| Diode reverse recovery time | t_{rr} | $I_F = 50\text{ A}, dI_F/dt = 200\text{ A}/\mu\text{s}, V_{CC} = 400\text{ V}, T_J = 25\text{ }^\circ\text{C}$ | - | 226 | 260 | ns |
| Diode peak reverse current | I_{rr} | | - | 17 | 20 | A |
| Diode recovery charge | Q_{rr} | | - | 1900 | 2600 | nC |
| Diode reverse recovery time | t_{rr} | $I_F = 50\text{ A}, dI_F/dt = 200\text{ A}/\mu\text{s}, V_{CC} = 400\text{ V}, T_J = 125\text{ }^\circ\text{C}$ | - | 290 | 330 | ns |
| Diode peak reverse current | I_{rr} | | - | 25 | 30 | A |
| Diode recovery charge | Q_{rr} | | - | 3600 | 5000 | nC |



| THERMAL AND MECHANICAL SPECIFICATIONS | | | | | |
|--|--------------------------|------|------|------|-------|
| PARAMETER | SYMBOL | MIN. | TYP. | MAX. | UNITS |
| Operating junction and storage temperature range | T_J, T_{Stg} | -40 | - | 150 | °C |
| Junction to case per leg | IGBT | - | 0.13 | 0.16 | °C/W |
| | Diode | - | 0.19 | 0.32 | |
| Case to sink per module | R_{thCS} | - | 0.1 | - | |
| Mounting torque | case to heatsink | - | - | 4 | Nm |
| | case to terminal 1, 2, 3 | - | - | 3 | |
| Weight | | - | 185 | - | g |

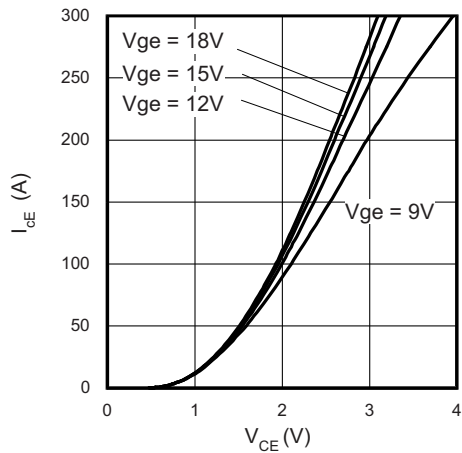


Fig. 1 - Typical IGBT Output Characteristics
 $T_J = 25\text{ }^\circ\text{C}$, $t_p = 500\text{ }\mu\text{s}$

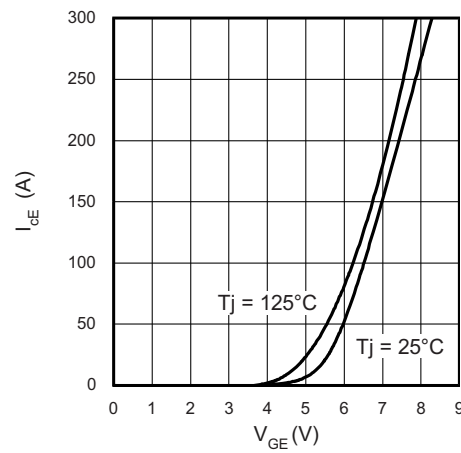


Fig. 3 - Typical Transfer Characteristics
 $V_{CE} = 20\text{ V}$, $t_p = 500\text{ }\mu\text{s}$

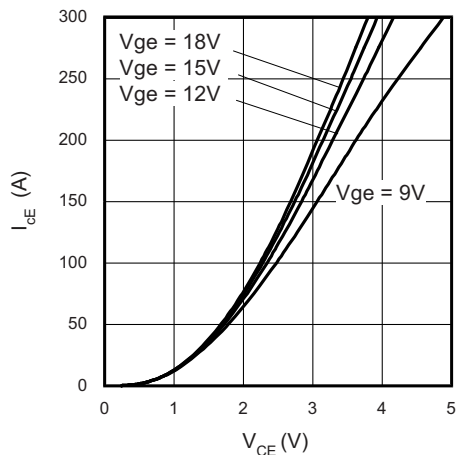


Fig. 2 - Typical IGBT Output Characteristics
 $T_J = 125\text{ }^\circ\text{C}$, $t_p = 500\text{ }\mu\text{s}$

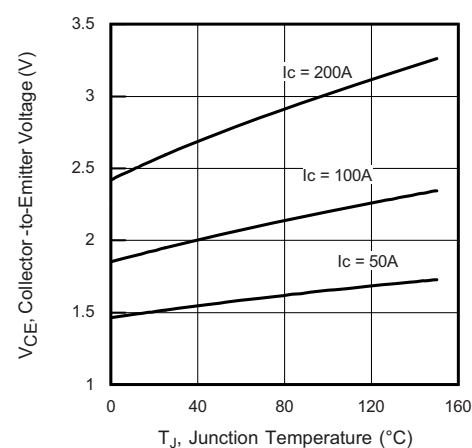


Fig. 4 - Typical Collector to Emitter Voltage vs. Junction Temperature

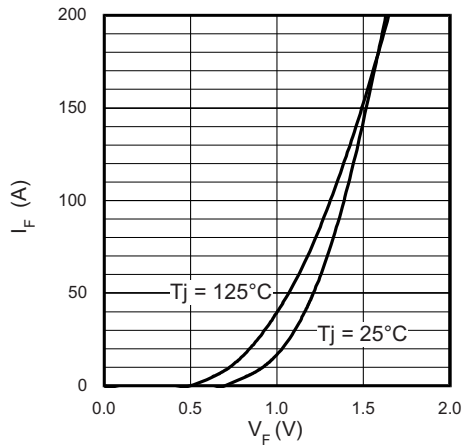


Fig. 5 - Diode Forward Characteristics, $t_p = 500 \mu s$

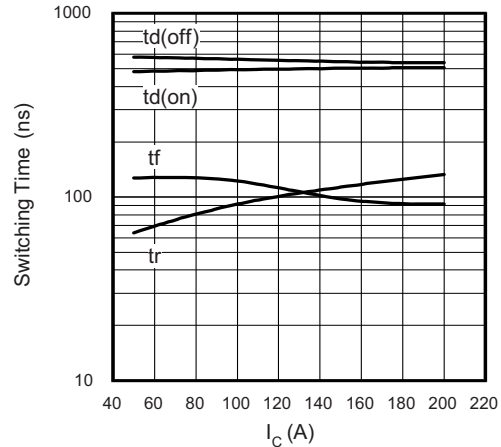


Fig. 8 - Typical Switching Time vs. I_C
 $T_J = 125^\circ C$, $L = 200 \mu H$, $V_{CC} = 360 V$,
 $R_g = 10 \Omega$, $V_{GE} = 15 V$

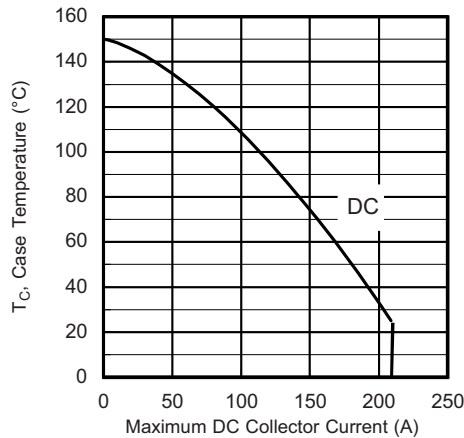


Fig. 6 - Maximum Collector Current vs. Case Temperature

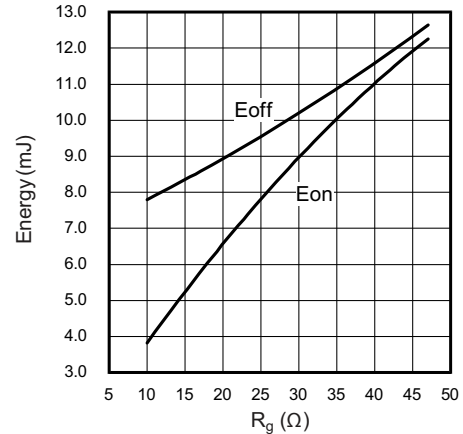


Fig. 9 - Typical Energy Loss vs. R_g
 $T_J = 125^\circ C$, $L = 200 \mu H$, $V_{CC} = 360 V$,
 $I_{CE} = 200 A$, $V_{GE} = 15 V$

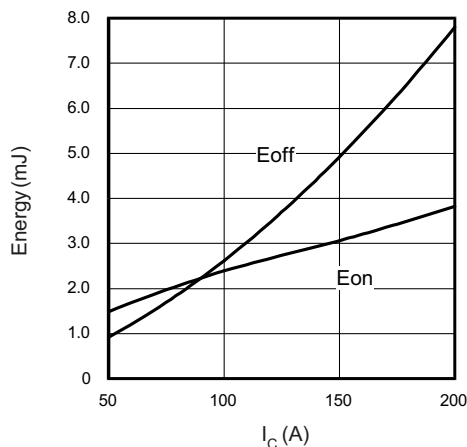


Fig. 7 - Typical Energy Loss vs. I_C
 $T_J = 125^\circ C$, $L = 200 \mu H$, $V_{CC} = 360 V$,
 $R_g = 10 \Omega$, $V_{GE} = 15 V$

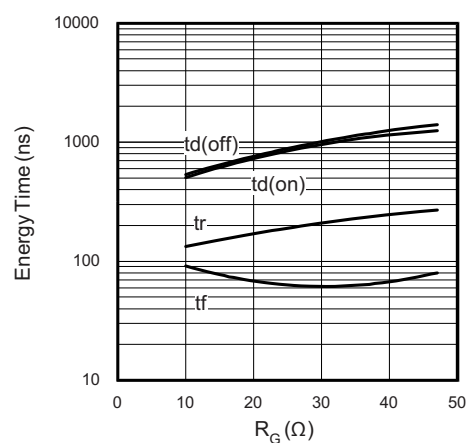


Fig. 10 - Typical Switching Time vs. R_g
 $T_J = 125^\circ C$, $L = 200 \mu H$, $V_{CC} = 360 V$,
 $I_{CE} = 200 A$, $V_{GE} = 15 V$

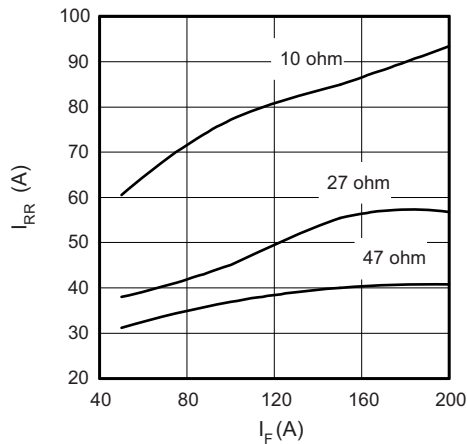


Fig. 11 - Typical Diode I_{rr} vs. I_F
 $T_J = 125^\circ\text{C}$

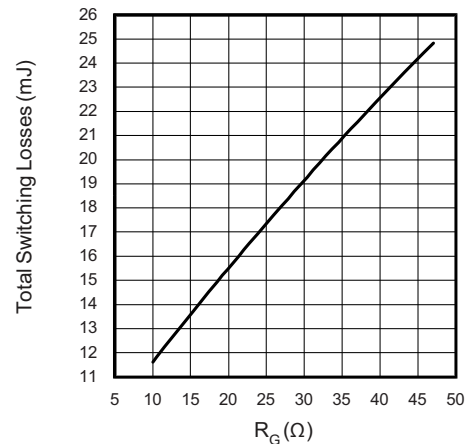


Fig. 14 - Typical Switching Losses vs. Gate Resistance
 $T_J = 125^\circ\text{C}$, $L = 200\ \mu\text{H}$, $R_g = 10\ \Omega$,
 $V_{CC} = 360\ \text{V}$, $V_{GE} = 15\ \text{V}$

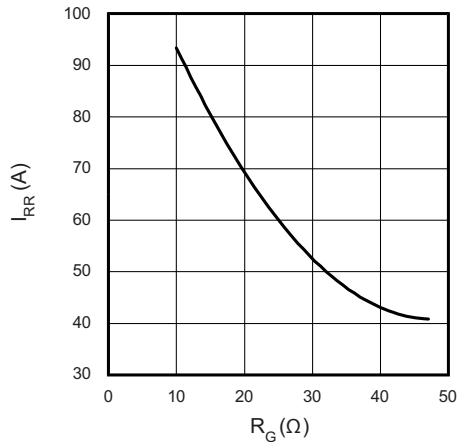


Fig. 12 - Typical Diode I_{rr} vs. R_g
 $T_J = 125^\circ\text{C}$, $I_F = 200\ \text{A}$

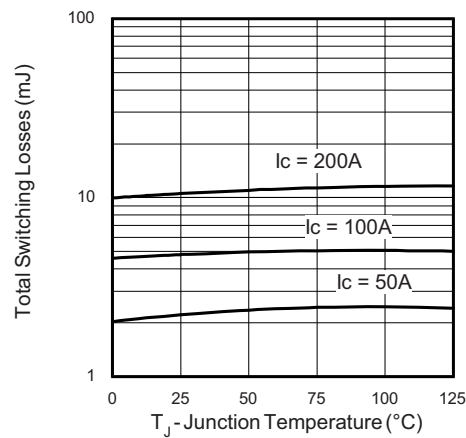


Fig. 15 - Typical Switching Losses vs. Junction Temperature;
 $L = 200\ \mu\text{H}$, $R_g = 10\ \Omega$, $V_{CC} = 360\ \text{V}$, $V_{GE} = 15\ \text{V}$

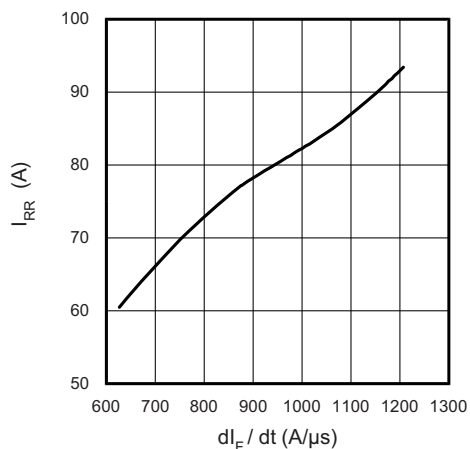


Fig. 13 - Typical Diode I_{rr} vs. di_F/dt
 $T_J = 125^\circ\text{C}$, $V_{CC} = 360\ \text{V}$, $I_F = 200\ \text{A}$, $V_{GE} = 15\ \text{V}$

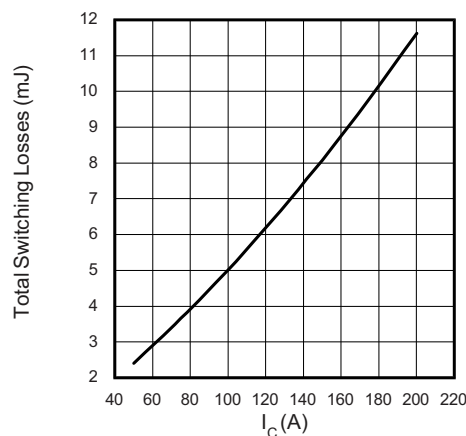


Fig. 16 - Typical Switching Losses vs. Collector to Emitter Current;
 $T_J = 125^\circ\text{C}$, $R_{g1} = 10\ \Omega$, $R_{g2} = 0\ \Omega$, $V_{CC} = 360\ \text{V}$, $V_{GE} = 15\ \text{V}$

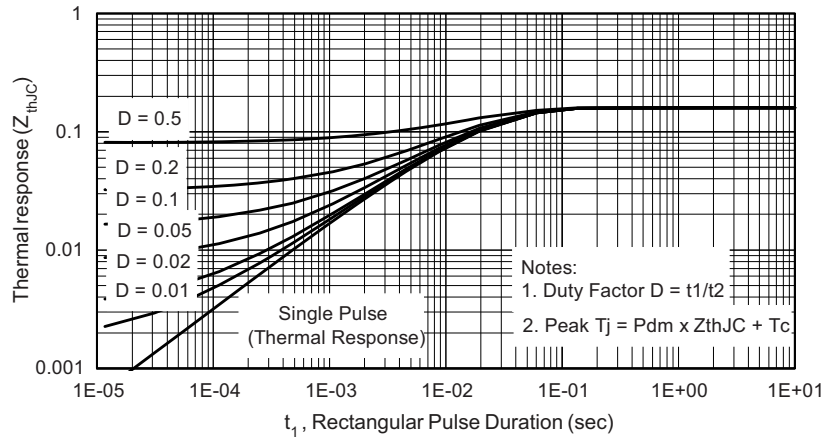


Fig. 17 - Maximum Transient Thermal Impedance, Junction to Case (IGBT)

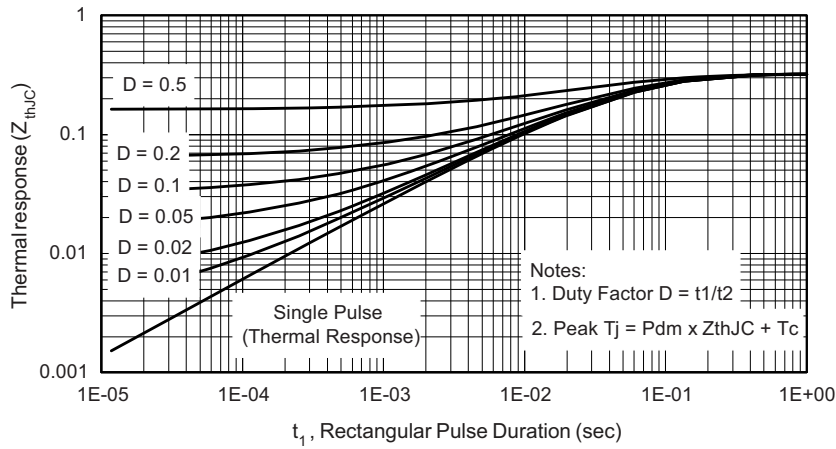
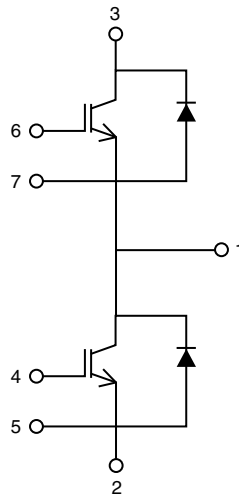


Fig. 18 - Maximum Transient Thermal Impedance, Junction to Case (HEXFRED®)

ORDERING INFORMATION TABLE

| | | | | | | | | | |
|-------------|------------|----------|----------|------------|----------|----------|-----------|----------|------------|
| Device code | VS- | G | B | 200 | T | S | 60 | N | PbF |
| | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | ⑧ | ⑨ |

- 1** - Vishay Semiconductors product
- 2** - Insulated Gate Bipolar Transistor (IGBT)
- 3** - B = IGBT Generation 5 NPT
- 4** - Current rating (200 = 200 A)
- 5** - Circuit configuration (T = Half-bridge)
- 6** - Package indicator (S = INT-A-PAK)
- 7** - Voltage rating (60 = 600 V)
- 8** - Speed/type (N = Ultrafast IGBT)
- 9** - Lead (Pb)-free

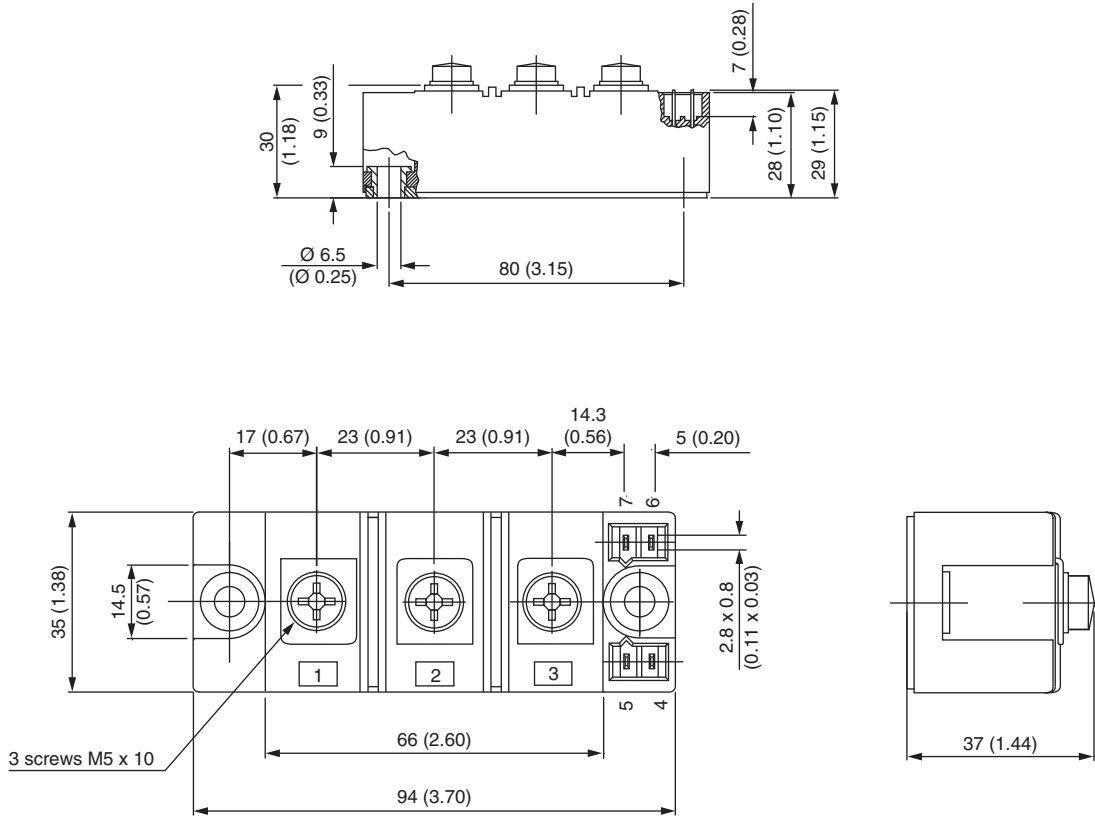
CIRCUIT CONFIGURATION

LINKS TO RELATED DOCUMENTS

| | |
|------------|--|
| Dimensions | www.vishay.com/doc?95543 |
|------------|--|



INT-A-PAK IGBT

DIMENSIONS in millimeters (inches)





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