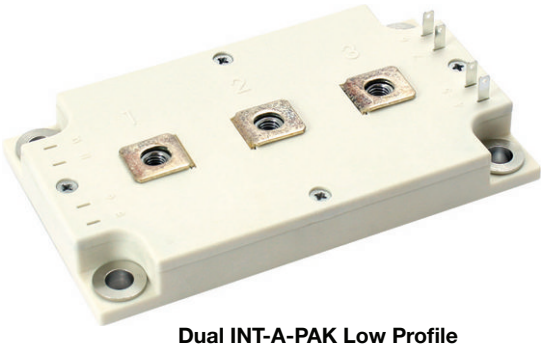
# Dual INT-A-PAK Low Profile “Half Bridge” (Standard Speed IGBT), 300 A



Dual INT-A-PAK Low Profile

## FEATURES

- TrenchStop IGBT technology
- Standard: optimized for hard switching speed
- Low $V_{CE(on)}$
- Square RBSOA
- Gen 4 FRED Pt® dices technology
- 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

Pb-free

RoHS COMPLIANT

## BENEFITS

- Increased operating efficiency
- Performance optimized as output inverter stage for TIG welding machines
- Direct mounting on heatsink
- Very low junction to case thermal resistance

| PRIMARY CHARACTERISTICS | |
|---|---|
| $V_{CES}$ | 600 V |
| $I_C$ DC at $T_C$ = 100 °C | 300 A |
| $V_{CE(on)}$ (typical) at 300 A, 25 °C | 1.15 V |
| Speed | DC to 1 kHz |
| Package | Dual INT-A-PAK low profile |
| Circuit configuration | Half bridge |

| ABSOLUTE MAXIMUM RATINGS | | | | |
|---|---|---|---|---|
| PARAMETER | SYMBOL | TEST CONDITIONS | MAX. | UNITS |
| Collector to emitter voltage | $V_{CES}$ | | 600 | V |
| Continuous collector current | $I_C$ (1) | $T_C$ = 25 °C | 466 | A |
| | | $T_C$ = 80 °C | 349 | |
| Pulsed collector current | $I_{CM}$ | $T_C$ = 175 °C, $t_p$ = 6 ms, $V_{GE}$ = 15 V | 1500 | |
| Clamped inductive load current | $I_{LM}$ | | 700 | |
| Diode continuous forward current | $I_F$ | $T_C$ = 25 °C | 260 | |
| | | $T_C$ = 80 °C | 192 | |
| Gate to emitter voltage | $V_{GE}$ | | ± 20 | V |
| Maximum power dissipation (IGBT) | $P_D$ | $T_C$ = 25 °C | 882 | W |
| | | $T_C$ = 80 °C | 559 | |
| Maximum power dissipation (diode) | $P_D$ | $T_C$ = 25 °C | 441 | W |
| | | $T_C$ = 80 °C | 279 | |
| RMS isolation voltage | $V_{ISOL}$ | Any terminal to case ($V_{RMS}$ t = 1 s, $T_J$ = 25 °C) | 3500 | V |

**Note**

(1) Maximum continuous collector current must be limited to 500 A to do not exceed the maximum temperature of terminals



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| ELECTRICAL SPECIFICATIONS ($T_J$ = 25 °C unless otherwise specified) | | | | | | |
|---|---|---|---|---|---|---|
| **PARAMETER** | **SYMBOL** | **TEST CONDITIONS** | **MIN.** | **TYP.** | **MAX.** | **UNITS** |
| Collector to emitter breakdown voltage | $V_{BR(CES)}$ | $V_{GE}$ = 0 V, $I_C$ = 800 µA | 600 | - | - | V |
| Collector to emitter voltage | $V_{CE(on)}$ | $V_{GE}$ = 15 V, $I_C$ = 300 A | - | 1.15 | 1.47 | |
| | | $V_{GE}$ = 15 V, $I_C$ = 300 A, $T_J$ = 125 °C | - | 1.16 | - | |
| Gate threshold voltage | $V_{GE(th)}$ | $V_{CE}$ = $V_{GE}$, $I_C$ = 4 mA | 3.8 | 5.0 | 6.3 | |
| Collector to emitter leakage current | $I_{CES}$ | $V_{GE}$ = 0 V, $V_{CE}$ = 600 V | - | 1.2 | 200 | µA |
| | | $V_{GE}$ = 0 V, $V_{CE}$ = 600 V, $T_J$ = 125 °C | - | 380 | - | |
| Diode forward voltage drop | $V_{FM}$ | $I_{FM}$ = 300 A | - | 1.56 | 2.02 | V |
| | | $I_{FM}$ = 300 A, $T_J$ = 125 °C | - | 1.45 | - | |
| Gate to emitter leakage current | $I_{GES}$ | $V_{GE}$ = ± 20 V | - | - | ± 200 | nA |

| SWITCHING CHARACTERISTICS ($T_J$ = 25 °C unless otherwise specified) | | | | | | |
|---|---|---|---|---|---|---|
| **PARAMETER** | **SYMBOL** | **TEST CONDITIONS** | **MIN.** | **TYP.** | **MAX.** | **UNITS** |
| Total gate charge (turn-on) | $Q_g$ | $I_C$ = 75 A, $V_{CC}$ = 520 V, $V_{GE}$ = 15 V | - | 1863 | - | nC |
| Gate-to-emitter charge (turn-on) | $Q_{ge}$ | | - | 296 | - | |
| Gate-to-collector charge (turn-on) | $Q_{gc}$ | | - | 540 | - | |
| Turn-on switching loss | $E_{on}$ | $I_C$ = 300 A, $V_{CC}$ = 300 V, $V_{GE}$ = 15 V, $R_g$ = 1.5 Ω, L = 500 µH, $T_J$ = 25 °C | - | 2.1 | - | mJ |
| Turn-off switching loss | $E_{off}$ | | - | 13.9 | - | |
| Total switching loss | $E_{tot}$ | | - | 16 | - | |
| Turn-on switching loss | $E_{on}$ | $I_C$ = 300 A, $V_{CC}$ = 300 V, $V_{GE}$ = 15 V, $R_g$ = 1.5 Ω, L = 500 µH, $T_J$ = 125 °C | - | 2 | - | |
| Turn-off switching loss | $E_{off}$ | | - | 20 | - | |
| Total switching loss | $E_{tot}$ | | - | 22 | - | |
| Turn-on delay time | $t_{d(on)}$ | | - | 19 | - | ns |
| Rise time | $t_r$ | | - | 75 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 419 | - | |
| Fall time | $t_f$ | | - | 194 | - | |
| Reverse bias safe operating area | RBSOA | $T_J$ = 175 °C, $I_C$ = 700 A, $R_g$ = 1.5 Ω, $V_{GE}$ = +15 V/0 V, $V_{CC}$ = 300 V, $V_p$ = 600 V | Fullsquare | | | |
| Diode reverse recovery time | $t_{rr}$ | $I_F$ = 50 A, $dI_F/dt$ = 500 A/µs, $V_{CC}$ = 200 V, $T_J$ = 25 °C | - | 152 | - | ns |
| Diode peak reverse current | $I_{rr}$ | | - | 24 | - | A |
| Diode recovery charge | $Q_{rr}$ | | - | 1.81 | - | µC |
| Diode reverse recovery time | $t_{rr}$ | $I_F$ = 50 A, $dI_F/dt$ = 500 A/µs, $V_{CC}$ = 200 V, $T_J$ = 125 °C | - | 201 | - | ns |
| Diode peak reverse current | $I_{rr}$ | | - | 39 | - | A |
| Diode recovery charge | $Q_{rr}$ | | - | 3.94 | - | µC |

| THERMAL AND MECHANICAL SPECIFICATIONS | | | | | | |
|---|---|---|---|---|---|---|
| **PARAMETER** | | **SYMBOL** | **MIN.** | **TYP.** | **MAX.** | **UNITS** |
| Operating junction and storage temperature range | | $T_J$, $T_{Stg}$ | -40 | - | 175 | °C |
| Junction to case per leg | IGBT | $R_{thJC}$ | - | - | 0.17 | °C/W |
| | Diode | | - | - | 0.34 | |
| Case to sink per module | | $R_{thCS}$ | - | 0.05 | - | |
| Mounting torque | case to heatsink: M6 screw | | 4 | - | 6 | Nm |
| | case to terminal 1, 2, 3: M5 screw | | 2 | - | 5 | |
| Weight | | | - | 270 | - | g |


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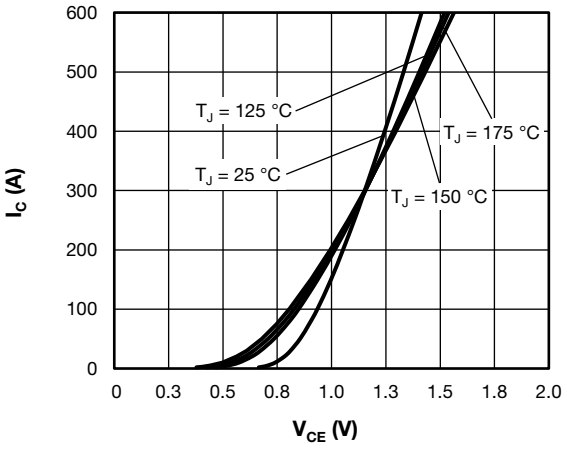



Fig. 1 - Typical Trench IGBT Output Characteristics, $V_{GE}$ = 15 V

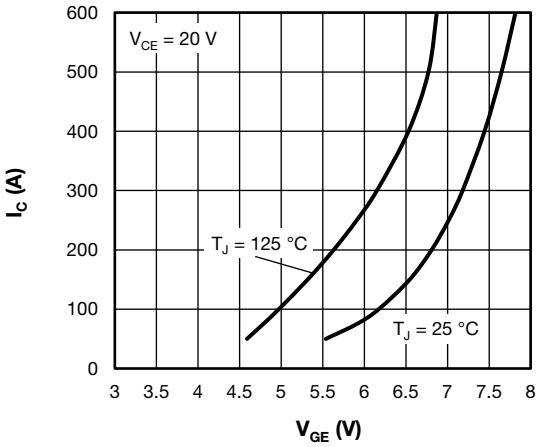



Fig. 4 - Typical Trench IGBT Transfer Characteristics

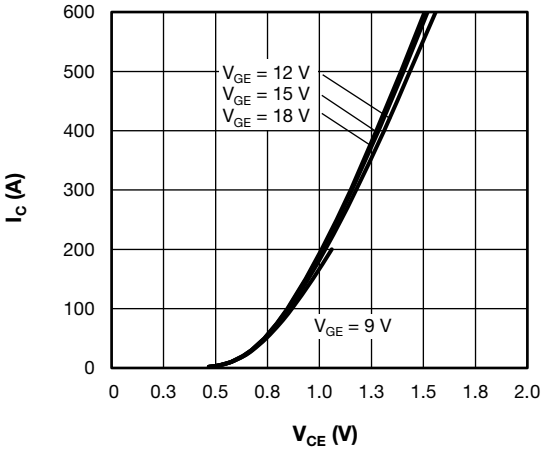



Fig. 2 - Typical Trench IGBT Output Characteristics, $T_J$ = 125 °C

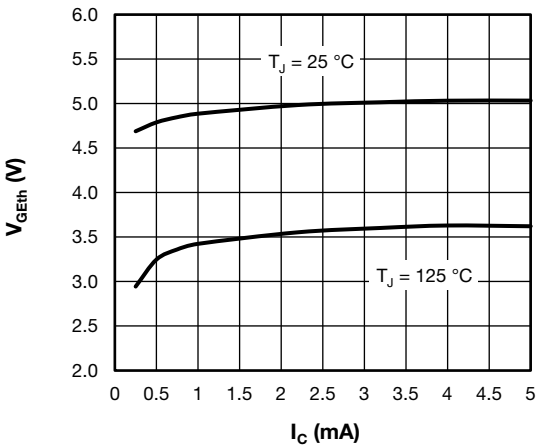



Fig. 5 - Typical Trench IGBT Gate Threshold Voltage

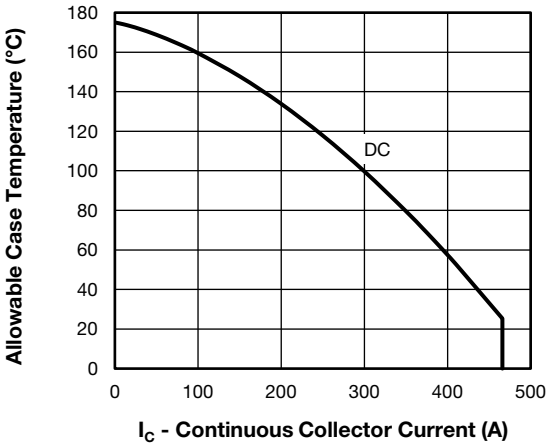



Fig. 3 - Maximum Trench IGBT Continuous Collector Current vs. Case Temperature

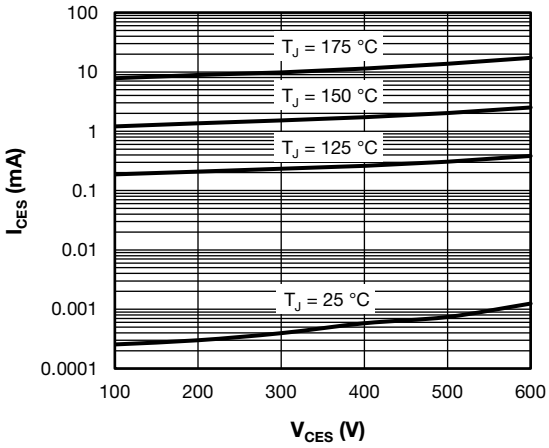



Fig. 6 - Typical trench IGBT Zero Gate Voltage Collector Current


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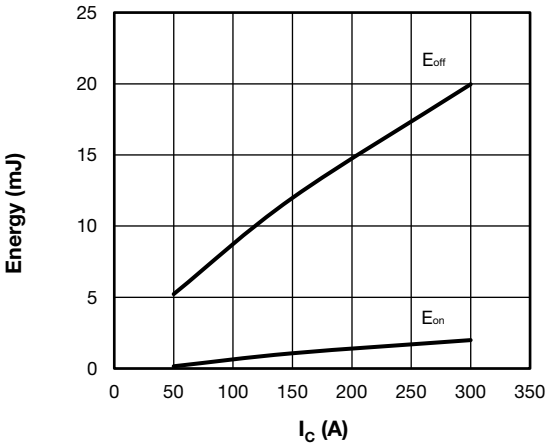



Fig. 7 - Typical Trench IGBT Energy Loss vs. $I_{C)}$,
(with Antiparallel Diode), $T_J$ = 125 °C, $V_{CC}$ = 300 V, $R_g$ = 1.5 Ω,
$V_{GE}$ = +15 V/-15 V, L = 500 µH

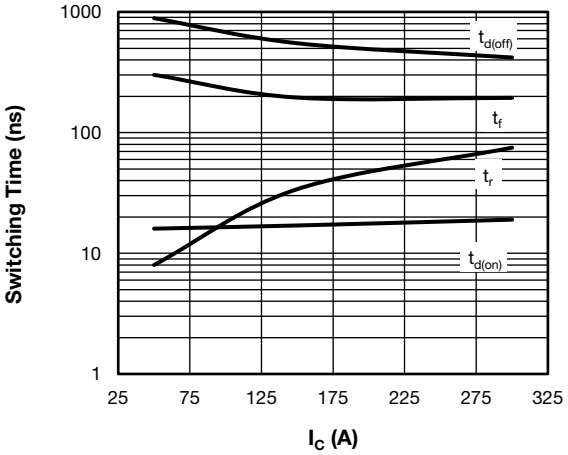



Fig. 8 - Typical Trench IGBT Switching Time vs. $I_{C,}$
(with Antiparallel Diode), $T_J$ = 125 °C, $V_{CC}$ = 300 V, $R_g$ = 1.5 Ω,
$V_{GE}$ = +15 V/-15 V, L = 500 µH

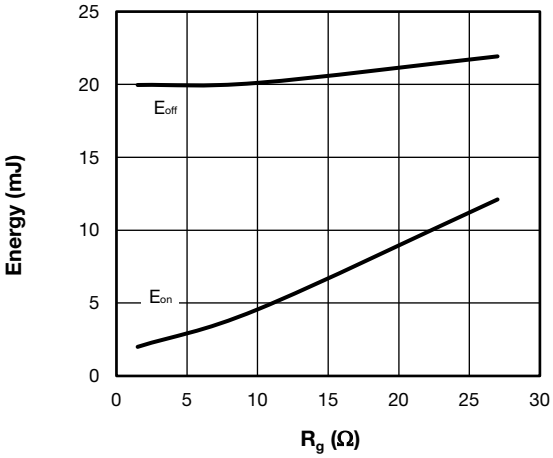



Fig. 9 - Typical Trench IGBT Energy Loss vs. $R_g$
(with Antiparallel Diode), $T_J$ = 125 °C, $V_{CC}$ = 300 V, $I_C$ = 300 A,
$V_{GE}$ = +15 V/-15 V, L = 500 µH

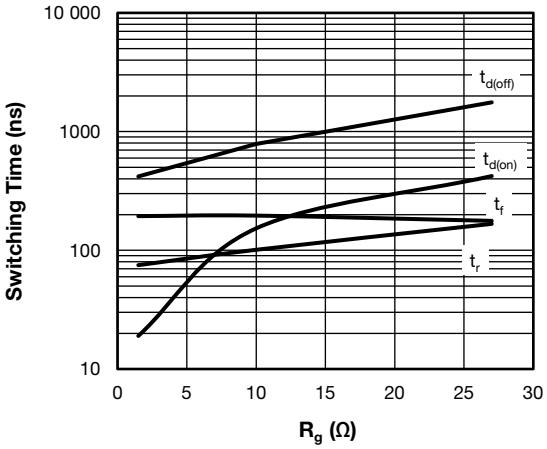



Fig. 10 - Typical Trench IGBT Switching Time vs. $R_g$
(with Antiparallel Diode), $T_J$ = 125 °C, $V_{CC}$ = 300 V, $I_C$ = 300 A,
$V_{GE}$ = +15 V/-15 V, L = 500 µH

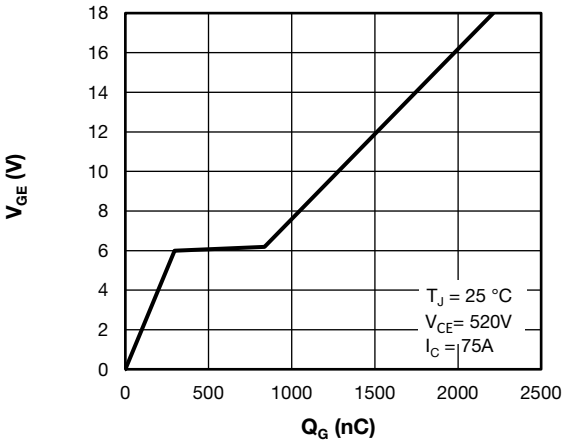



Fig. 11 - Typical Trench IGBT Gate Charge vs.
Gate to Emitter Voltage

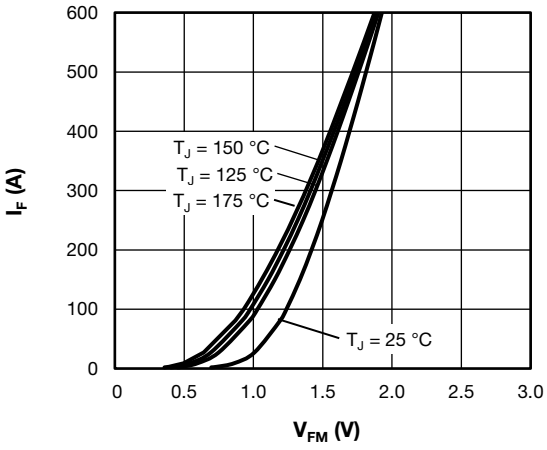



Fig. 12 - Typical Antiparallel Diode Forward Characteristics


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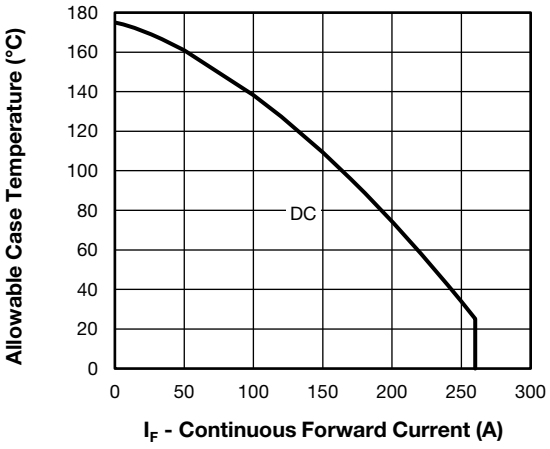



Fig. 13 - Maximum Antiparallel Diode Continuous Forward Current vs. Case Temperature

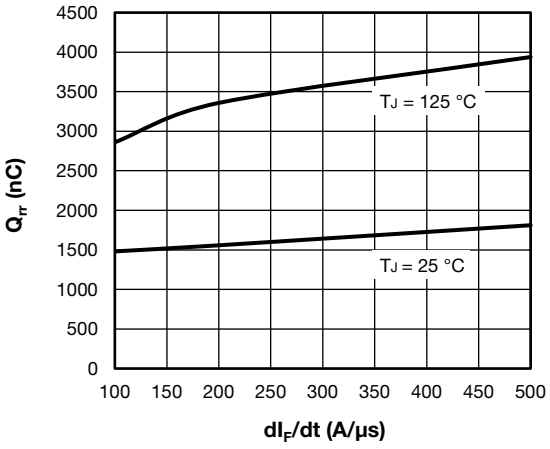



Fig. 16 - Typical Antiparallel Diode Reverse Recovery Charge vs. $dI_F/dt$, $I_F$ = 50 A, $V_{CC}$ = 200 V

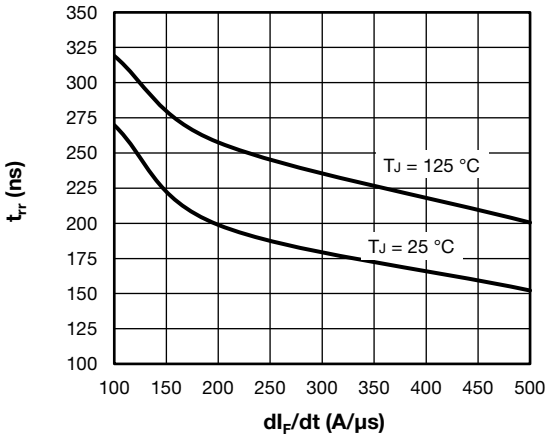



Fig. 14 - Typical Antiparallel Diode Reverse Recovery Time vs. $dI_F/dt$, $I_F$ = 50 A, $V_{CC}$ = 200 V

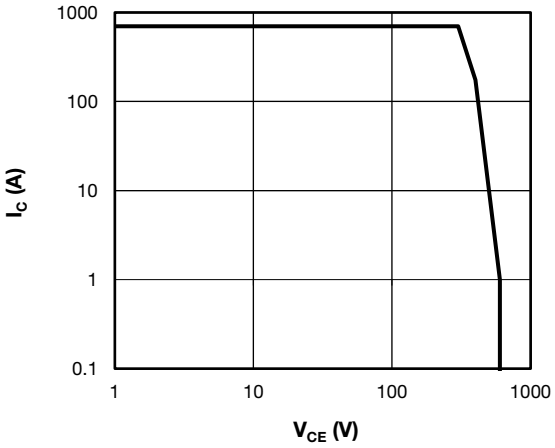



Fig. 17 - Trench IGBT Reverse BIAS SOA
$T_J$ = 175 °C, $I_C$ = 700 A, $R_g$ = 1.5 Ω, $V_{GE}$ = +15 V/0 V, $V_{CC}$ = 300 V, $V_p$ = 600 V

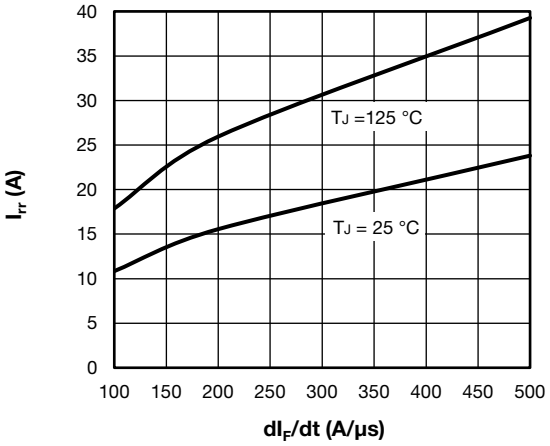



Fig. 15 - Typical Antiparallel Diode Reverse Recovery Current vs. $dI_F/dt$, $I_F$ = 50 A, $V_{CC}$ = 200 V

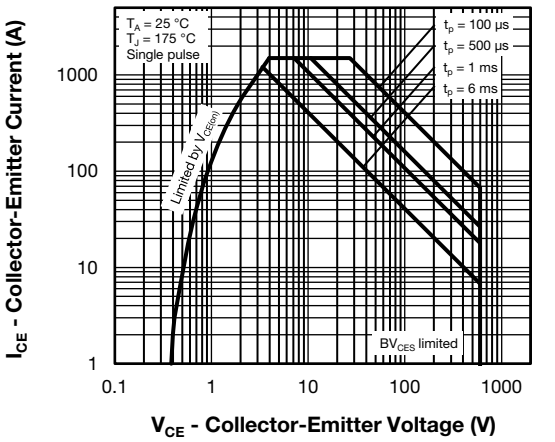



Fig. 18 - Trench IGBT Safe Operating Area


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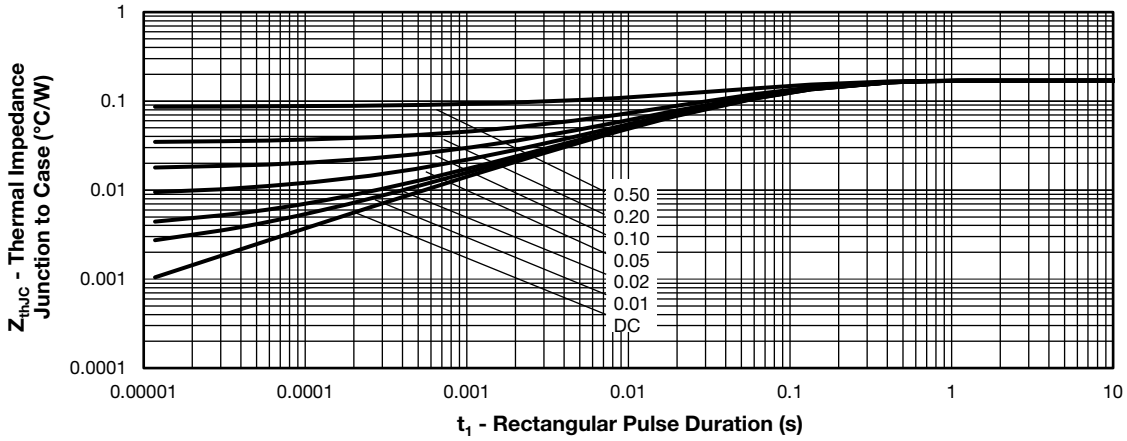



Fig. 19 - Maximum Trench IGBT Thermal Impedance $Z_{thJC}$ Characteristics (IGBT)

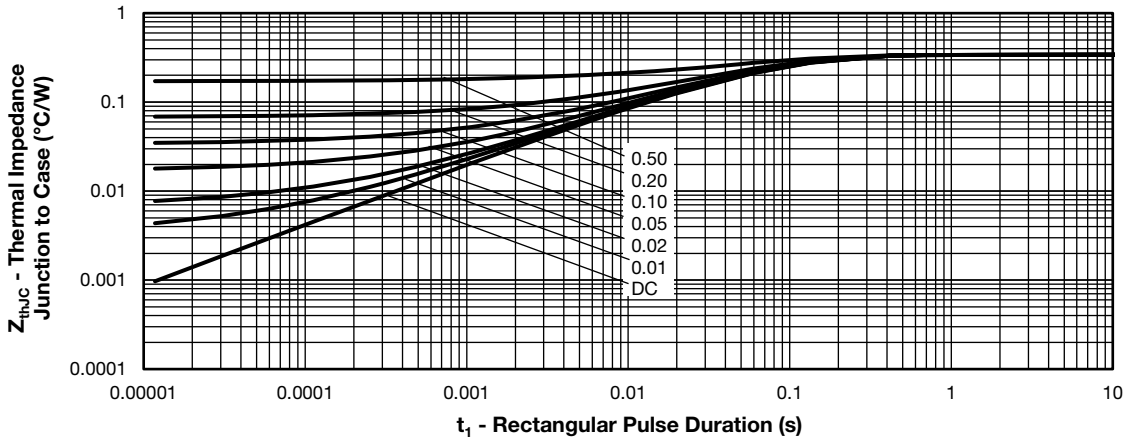



Fig. 20 - Maximum Antiparallel Diode Thermal Impedance $Z_{thJC}$ Characteristics

## ORDERING INFORMATION TABLE

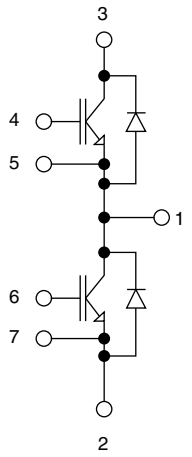
**Device code**

| G | T | 300 | T | D | 60 | S |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

- 1 - Insulated gate bipolar transistor (IGBT)
- 2 - T = Trench IGBT technology
- 3 - Current rating (300 = 300 A)
- 4 - Circuit configuration (T = half bridge)
- 5 - Package indicator (D = dual INT-A-PAK low profile)
- 6 - Voltage rating (60 = 600 V)
- 7 - Speed / type (S = standard speed IGBT)


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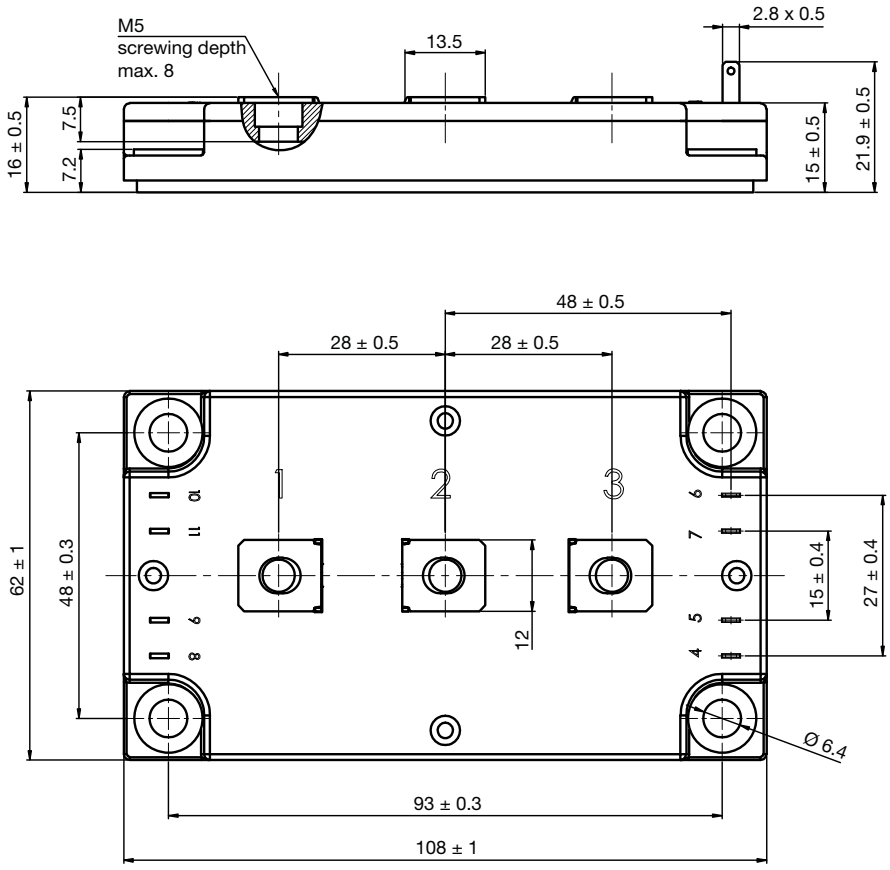



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**DIMENSIONS** in millimeters






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