# INT-A-PAK, Half Bridge - Trench IGBT, 200 A



INT-A-PAK

## FEATURES

- Trench IGBT
- Very low $V_{CE(on)}$
- Positive $V_{CE(on)}$ temperature coefficient
- FRED Pt® anti-parallel diode low $Q_{rr}$ and low switching energy
- Industry and standard package
- $T_J$ = 175 °C
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

RoHS COMPLIANT

## BENEFITS

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

| PRIMARY CHARACTERISTICS | |
|---|---|
| $V_{CES}$ | 650 V |
| $I_C$ (DC) at $T_C$ = 59°C | 150 A |
| $V_{CE(on)}$ (typical) at $I_C$ = 200 A, $T_J$ = 25 °C | 1.90 V |
| Speed | 8 kHz to 30 kHz |
| Package | INT-A-PAK |
| Circuit configuration | Half bridge |

| ABSOLUTE MAXIMUM RATINGS | | | | | |
|---|---|---|---|---|---|
| PARAMETER | | SYMBOL | TEST CONDITIONS | MAX. | UNITS |
| Collector to emitter voltage | | $V_{CES}$ | | 650 | V |
| Continuous collector current | | $I_C$ | $T_C$ = 25 °C | 177 | A |
| | | | $T_C$ = 80 °C | 132 | |
| Pulsed collector current | | $I_{CM}$ | $T_J$ = 175 °C, $t_p$ = 6 ms, $V_{GE}$ = 15 V | 570 | |
| Clamped inductive load current | | $I_{LM}$ | | 600 | |
| Diode continuous forward current | | $I_F$ | $T_C$ = 25 °C | 138 | |
| | | | $T_C$ = 80 °C | 103 | |
| Maximum non-repetitive peak current | | $I_{FSM}$ | 10 ms sine or 6 ms rectangular pulse, $T_J$ = 25 °C | 700 | |
| Gate to emitter voltage | | $V_{GE}$ | | ± 20 | V |
| Maximum power dissipation | IGBT | $P_D$ | $T_C$ = 25 °C | 429 | W |
| | | | $T_C$ = 80 °C | 271 | |
| | Diode | | $T_C$ = 25 °C | 288 | |
| | | | $T_C$ = 80 °C | 183 | |
| RMS isolation voltage | | $V_{ISOL}$ | $T_J$ = 25 °C, f = 50 Hz, t = 1 s | 3500 | V |
| Operating junction temperature range | | $T_J$ | | -40 to +175 | °C |



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| ELECTRICAL SPECIFICATIONS ($T_J$ = 25 °C unless otherwise noted) | | | | | | |
|---|---|---|---|---|---|---|
| **PARAMETER** | **SYMBOL** | **TEST CONDITIONS** | **MIN.** | **TYP.** | **MAX.** | **UNITS** |
| Collector to emitter breakdown voltage | $V_{(BR)CES}$ | $V_{GE}$ = 0 V, $I_C$ = 400 µA | 650 | - | - | V |
| Collector to emitter voltage | $V_{CE(on)}$ | $V_{GE}$ = 15 V, $I_C$ = 100 A | - | 1.49 | - | |
| | | $V_{GE}$ = 15 V, $I_C$ = 200 A | - | 1.90 | 2.12 | |
| | | $V_{GE}$ = 15 V, $I_C$ = 100 A, $T_J$ = 125 °C | - | 1.62 | - | |
| | | $V_{GE}$ = 15 V, $I_C$ = 200 A, $T_J$ = 125 °C | - | 2.20 | - | |
| Gate threshold voltage | $V_{GE(th)}$ | $V_{CE}$ = $V_{GE}$, $I_C$ = 2.0 mA | 2.9 | 4.0 | 5.3 | |
| Temperature coefficient of threshold voltage | $\Delta V_{GE(th)}/\Delta T_J$ | $V_{CE}$ = $V_{GE}$, $I_C$ = 2.0 mA (25 °C to 125 °C) | - | -10 | - | mV/°C |
| Forward transconductance | $g_{fe}$ | $V_{CE}$ = 20 V, $I_C$ = 200 A | - | 200 | - | S |
| Transfer characteristics | $V_{GE}$ | $V_{CE}$ = 20 V, $I_C$ = 200 A | - | 6.6 | - | V |
| Collector to emitter leakage current | $I_{CES}$ | $V_{GE}$ = 0 V, $V_{CE}$ = 650 V | - | 0.3 | 200 | µA |
| | | $V_{GE}$ = 0 V, $V_{CE}$ = 650 V, $T_J$ = 125 °C | - | 0.1 | - | mA |
| Diode forward voltage drop | $V_{FM}$ | $I_{FM}$ = 100 A | - | 1.75 | - | V |
| | | $I_{FM}$ = 200 A | - | 2.08 | 3.04 | |
| | | $I_{FM}$ = 100 A, $T_J$ = 125 °C | - | 1.41 | - | |
| | | $I_{FM}$ = 200 A, $T_J$ = 125 °C | - | 1.80 | - | |
| Gate to emitter leakage current | $I_{GES}$ | $V_{GE}$ = ± 20 V | - | - | 200 | nA |

| SWITCHING CHARACTERISTICS | | | | | | |
|---|---|---|---|---|---|---|
| **PARAMETER** | **SYMBOL** | **TEST CONDITIONS** | **MIN.** | **TYP.** | **MAX.** | **UNITS** |
| Total gate charge (turn-on) | $Q_g$ | $I_C$ = 200 A | - | 476 | - | nC |
| Gate to emitter charge (turn-on) | $Q_{ge}$ | $V_{CC}$ = 520 V | - | 61 | - | |
| Gate to collector (turn-on) | $Q_{gc}$ | $V_{GE}$ = 15 V | - | 128 | - | |
| Turn-on switching loss | $E_{on}$ | $V_{CC}$ = 325 V, $I_C$ = 200 A, $R_g$ = 4.7 Ω, L = 500 µH, $V_{GE}$ = 15 V | - | 2.34 | - | mJ |
| Turn-off switching loss | $E_{off}$ | | - | 3.77 | - | |
| Total switching loss | $E_{tot}$ | | - | 6.11 | - | |
| Turn-on switching loss | $E_{on}$ | $V_{CC}$ = 325 V, $I_C$ = 200 A, $R_g$ = 4.7 Ω, L = 500 µH, $V_{GE}$ = 15 V, $T_J$ = 125 °C | - | 2.82 | - | mJ |
| Turn-off switching loss | $E_{off}$ | | - | 3.86 | - | |
| Total switching loss | $E_{tot}$ | | - | 6.68 | - | |
| Turn-on delay time | $t_{d(on)}$ | | - | 79 | - | ns |
| Rise time | $t_r$ | | - | 82 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 306 | - | |
| Fall time | $t_f$ | | - | 34 | - | |
| Reverse bias safe operating area | RBSOA | $I_C$ = 600 A, $R_g$ = 27 Ω, $V_{CC}$ = 400 V, $V_p$ = 650 V, $V_{GE}$ = 15 V to 0 V, $T_J$ = 175 °C | | | | |
| **ANTI-PARALLEL DIODE** | | | | | | |
| Diode reverse recovery time | $t_{rr}$ | $I_F$ = 50 A, $dI_F/dt$ = 500 A/µs, $V_{rr}$ = 200 V, $T_J$ = 25 °C | - | 73 | - | ns |
| Diode peak reverse current | $I_{rr}$ | | - | 13 | - | A |
| Diode recovery charge | $Q_{rr}$ | | - | 465 | - | nC |
| Diode reverse recovery time | $t_{rr}$ | $I_F$ = 50 A, $dI_F/dt$ = 500 A/µs, $V_{rr}$ = 200 V, $T_J$ = 125 °C | - | 146 | - | ns |
| Diode peak reverse current | $I_{rr}$ | | - | 28 | - | A |
| Diode recovery charge | $Q_{rr}$ | | - | 2064 | - | nC |


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| THERMAL AND MECHANICAL SPECIFICATIONS | | | | | | | |
|---|---|---|---|---|---|---|---|
| PARAMETER | | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNITS |
| Operating junction temperature range | | $T_J$ | | -40 | - | 175 | °C |
| Storage temperature range | | $T_{Stg}$ | | -40 | - | 125 | |
| Junction to case per leg | IGBT | $R_{thJC}$ | | - | - | 0.35 | °C/W |
| | Diode | | | - | - | 0.52 | |
| Case to sink per module (conductive grease applied) | | $R_{thCS}$ | | - | 0.05 | - | |
| Mounting torque | Power terminal screw: M5 | | | 2.5 | - | 5.0 | Nm |
| | Mounting screw: M6 | | | 3.0 | - | 5.0 | |
| Weight | | | | - | 150 | - | g |

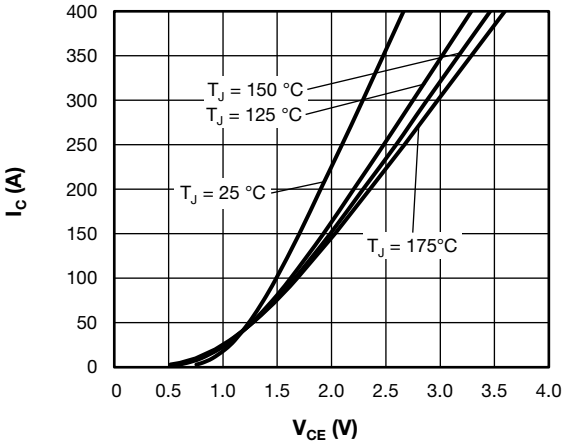



Fig. 1 - Typical IGBT Output Characteristics, $V_{GE}$ = 15 V

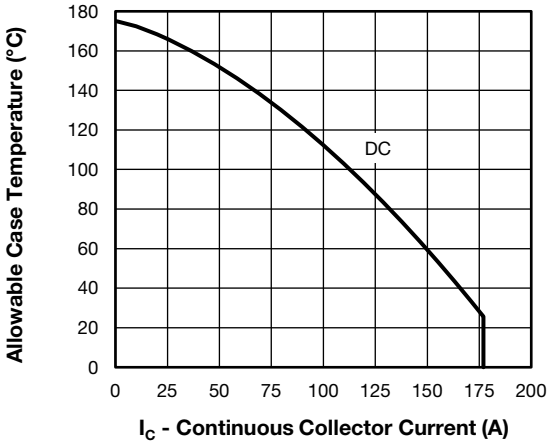



Fig. 3 - Maximum IGBT Continuous Collector Current vs. Case Temperature

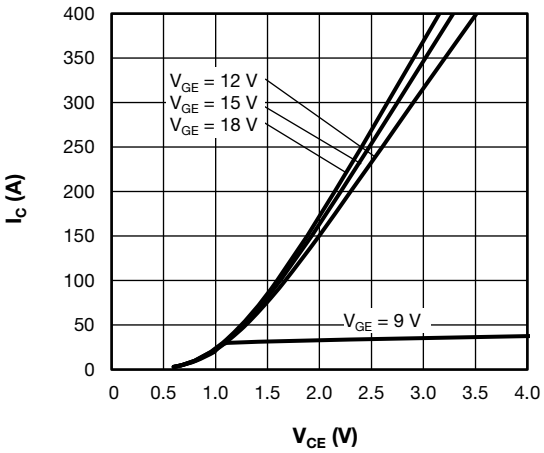



Fig. 2 - Typical IGBT Output Characteristics, $T_J$ = 125 °C

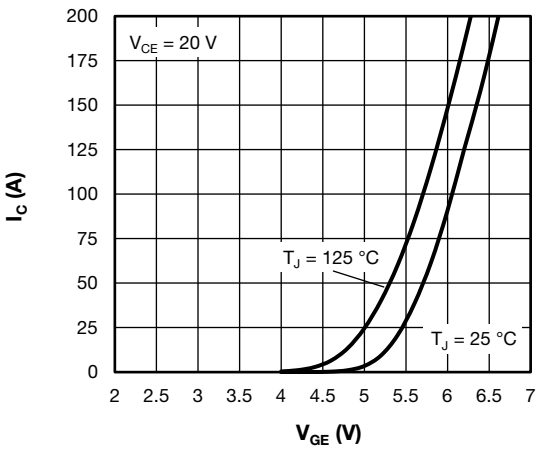



Fig. 4 - Typical IGBT Transfer Characteristics


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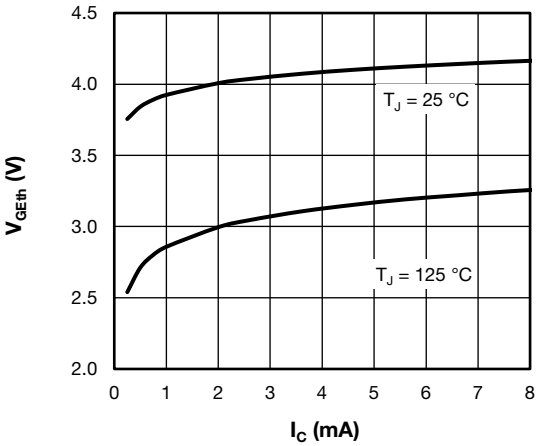



Fig. 5 - Typical IGBT Threshold Voltage

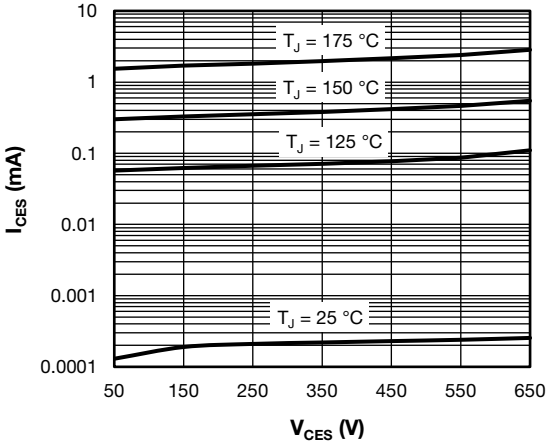



Fig. 6 - Typical IGBT Zero Gate Voltage Collector Current

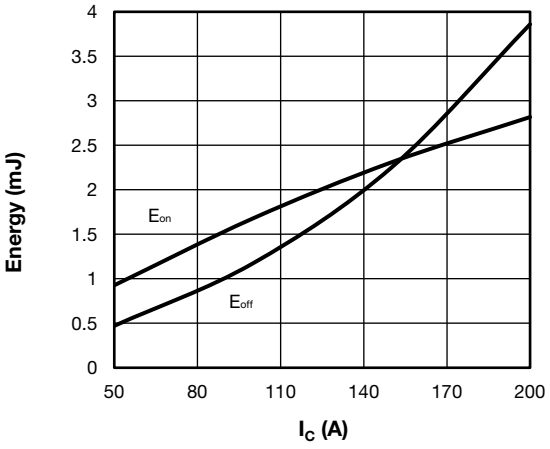



Fig. 7 - Typical Trench IGBT Energy Loss vs. $I_C$
(with Antiparallel Diode)
$T_J$ = 125 °C, $V_{CC}$ = 300 V, $R_g$ = 4.7 Ω, $V_{GE}$ = +15 V / -15 V, L = 500 µH

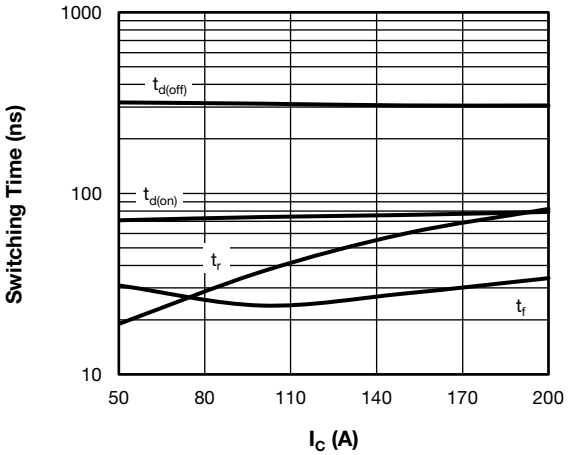



Fig. 8 - Typical Trench IGBT Switching Time vs. $I_C$
(with Antiparallel Diode)
$T_J$ = 125 °C, $V_{CC}$ = 300 V, $R_g$ = 4.7 Ω, $V_{GE}$ = +15 V / -15 V, L = 500 µH

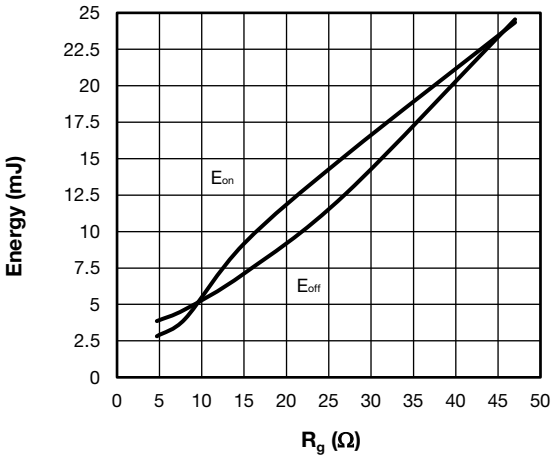



Fig. 9 - Typical Trench IGBT Energy Loss vs. $R_g$
(with Antiparallel Diode)
$T_J$ = 125 °C, $V_{CC}$ = 300 V, $I_C$ = 200 A, $V_{GE}$ = +15 V / -15 V, L = 500 µH

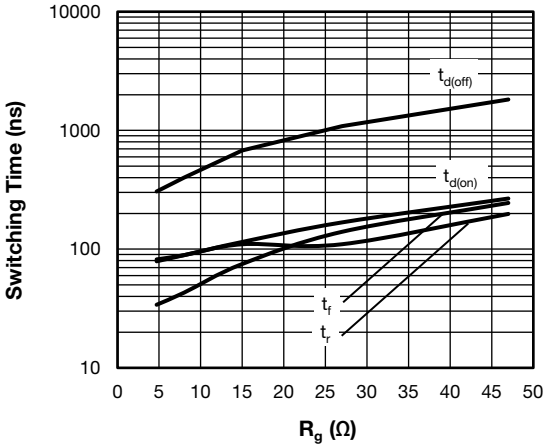



Fig. 10 - Typical Trench IGBT Switching Time vs. $R_g$
(with Antiparallel Diode)
$T_J$ = 125 °C, $V_{CC}$ = 300 V, $I_C$ = 200 A, $V_{GE}$ = +15 V / -15 V,
L = 500 µH


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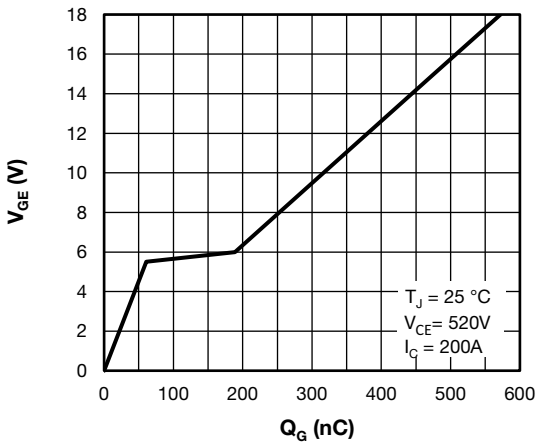



Fig. 11 - Typical Trench IGBT Gate Charge vs. Gate to Emitter Voltage

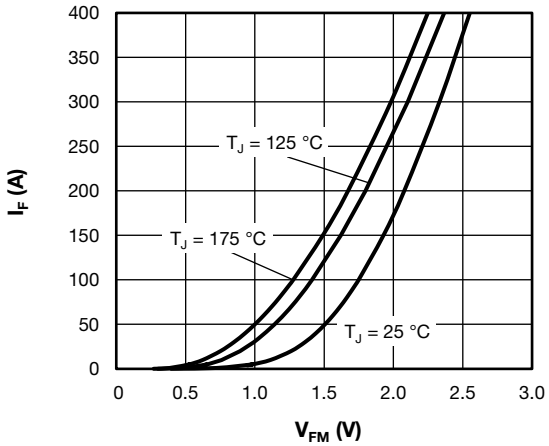



Fig. 12 - Typical IGBT Switching Time vs. $I_C$

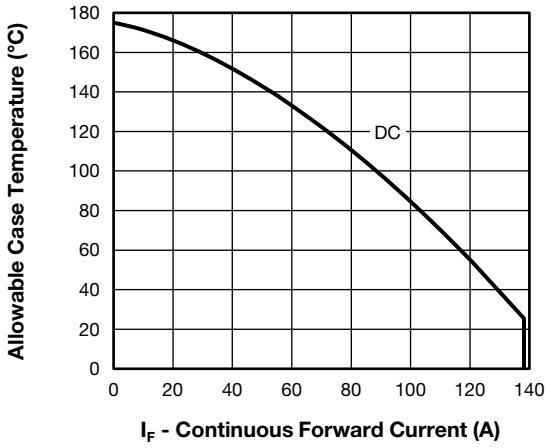



Fig. 13 - Maximum Diode Continuous Forward Current vs. Case Temperature

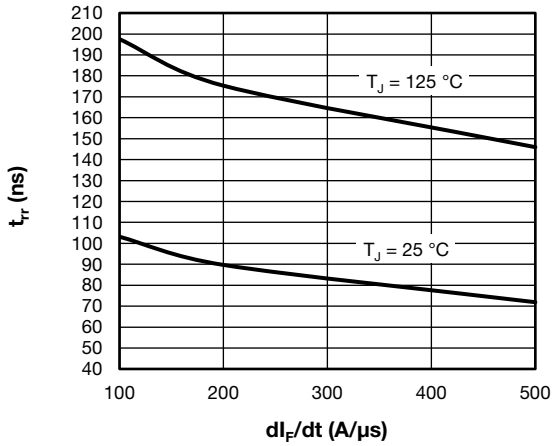



Fig. 14 - Typical Diode Reverse Recovery Time vs. $dI_F/dt$
$V_{rr}$ = 200 V, $I_F$ = 50 A

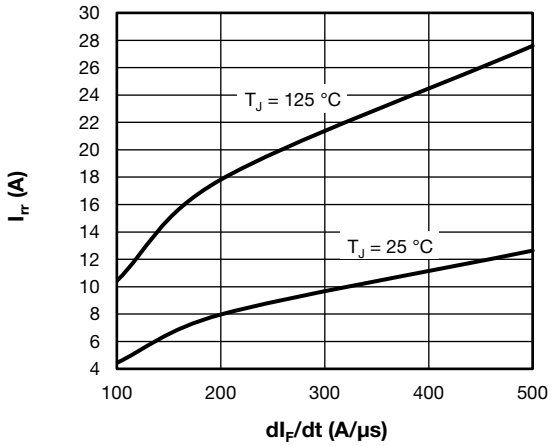



Fig. 15 - Typical Diode Reverse Recovery Current vs. $dI_F/dt$
$V_{rr}$ = 200 V, $I_F$ = 50 A

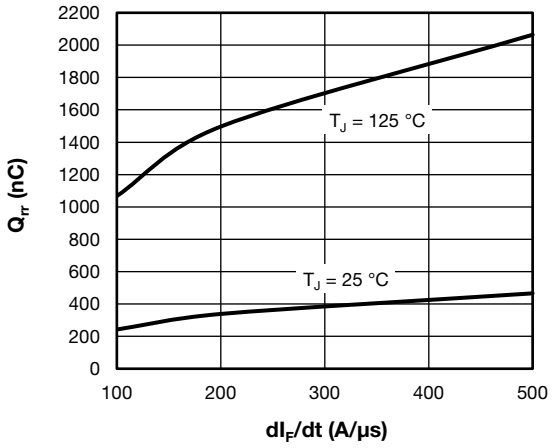



Fig. 16 - Typical Diode Reverse Recovery Current vs. $dI_F/dt$
$V_{rr}$ = 200 V, $I_F$ = 50 A



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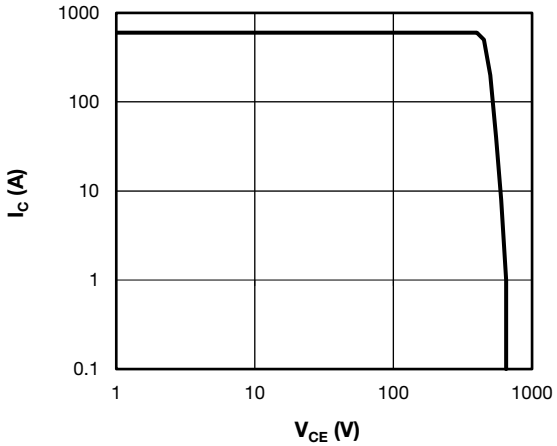



Fig. 17 - Typical Trench IGBT Reverse BIAS SOA
$T_J$ = 175 °C, $I_C$ = 600 A, $R_g$ = 27 Ω, $V_{GE}$ = +15 V / 0 V, $V_{CC}$ = 400 V, $V_p$ = 650 V

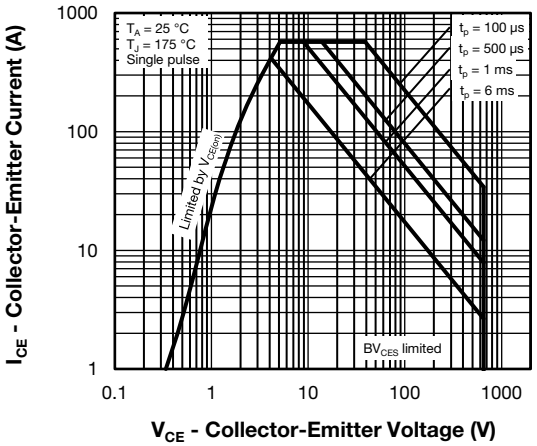



Fig. 18 - Trench IGBT safe Operating Area

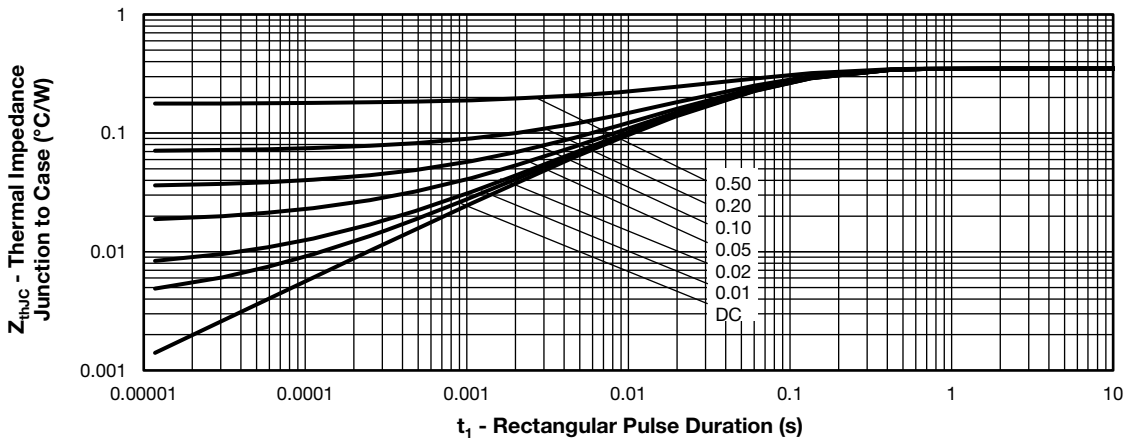



Fig. 19 - Maximum Trench IGBT Thermal Impedance $Z_{thJC}$ Characteristics

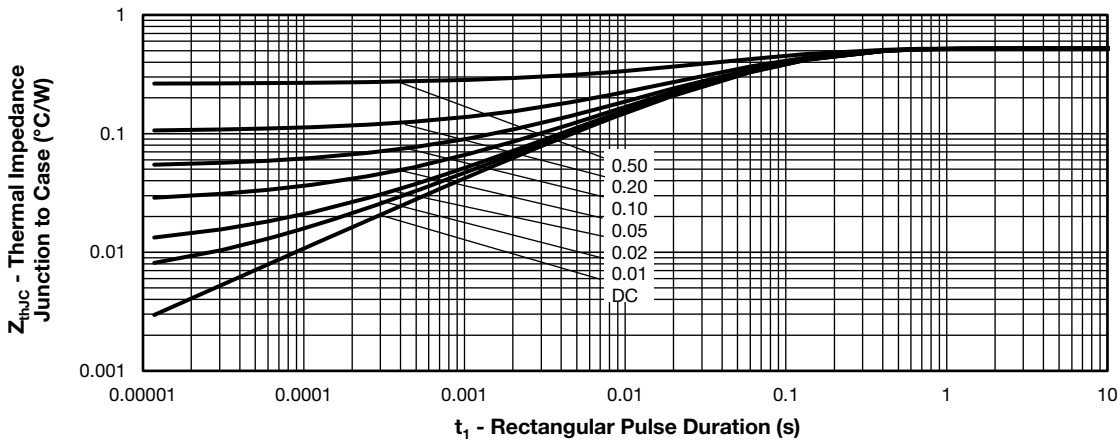


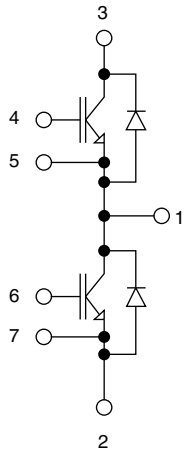

Fig. 20 - Maximum Diode Thermal Impedance $Z_{thJC}$ Characteristics



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## CIRCUIT CONFIGURATION



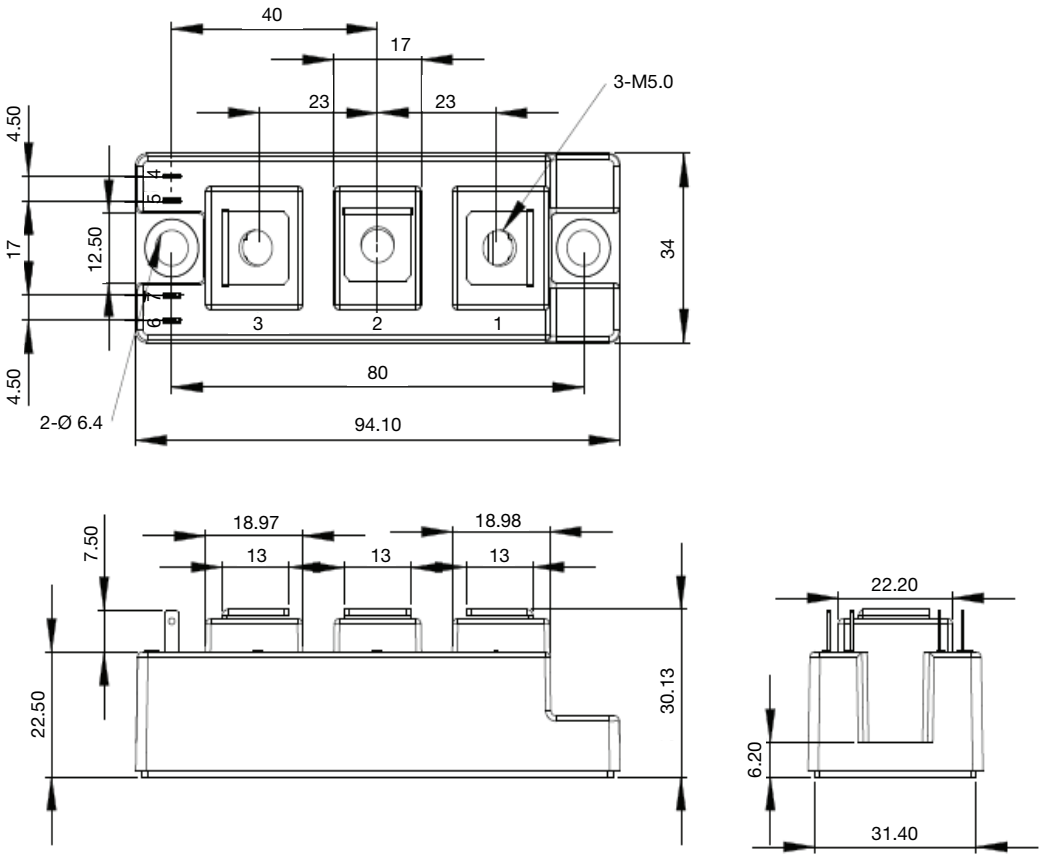

## ORDERING INFORMATION TABLE

| Device code | VS- | G | T | 200 | T | P | 065 | U |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |

| | | |
|---|---|---|
| 1 | - | Vishay Semiconductors product |
| 2 | - | Insulated gate bipolar transistor (IGBT) |
| 3 | - | T = trench IGBT |
| 4 | - | Current rating (200 = 200 A) |
| 5 | - | Circuit configuration (T = half bridge) |
| 6 | - | Package indicator (P = INT-A-PAK IGBT) |
| 7 | - | Voltage rating (065 = 650 V) |
| 8 | - | Speed/type (U = ultrafast) |


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**DIMENSIONS** in millimeters



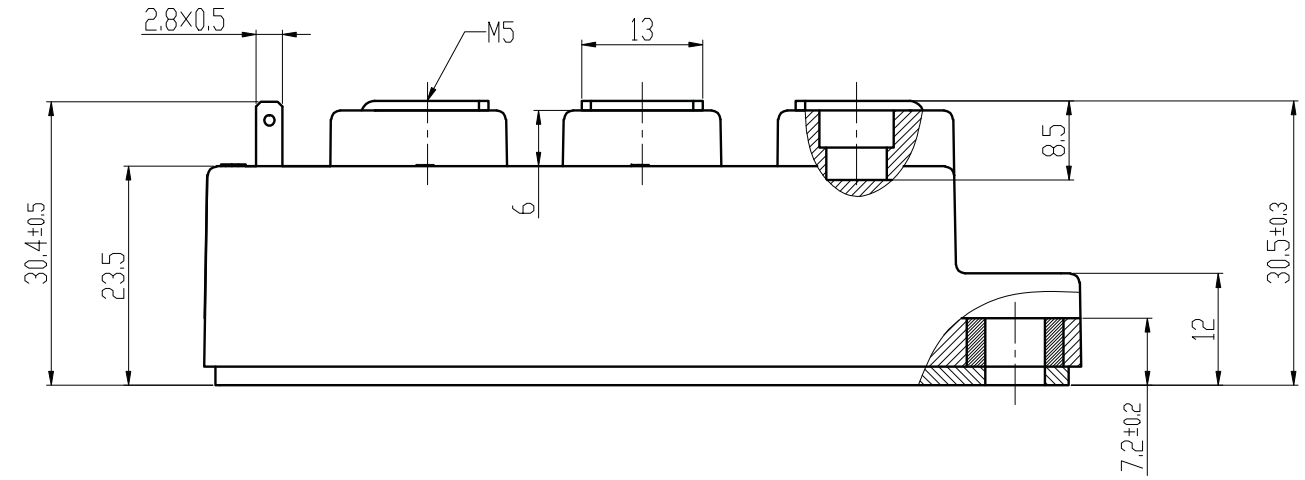


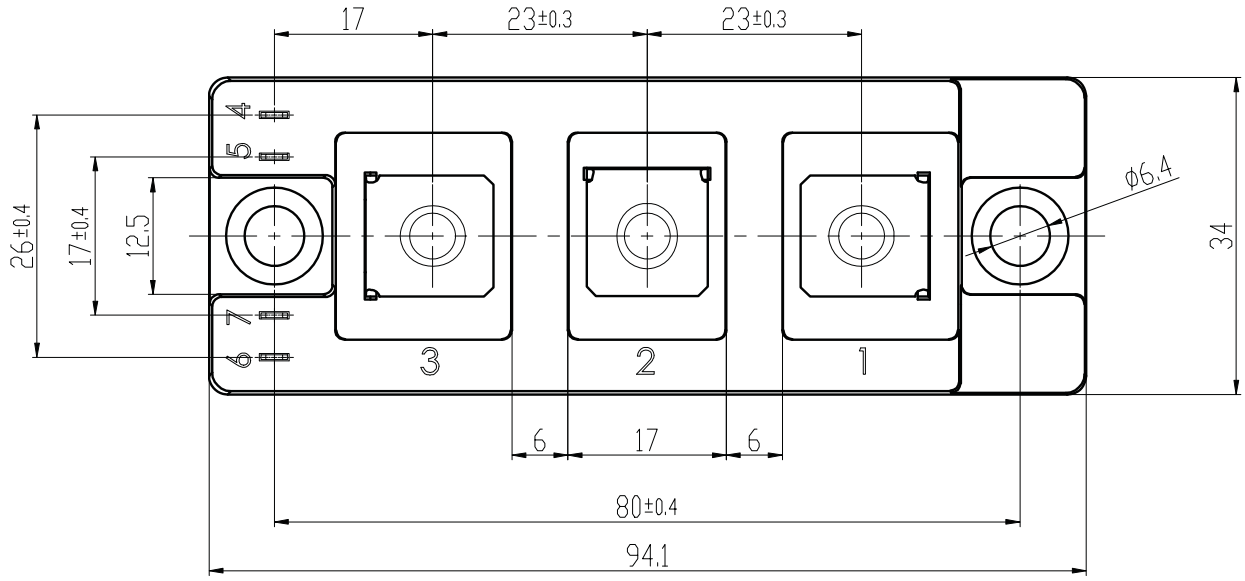

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# INT-A-PAK

**DIMENSIONS** in millimeters (inches)






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ENTEGRECİ

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# Elektronik komponent tedarikinde Entegreci

Entegreci, Eskişehir merkezli, Türkiye geneline satış yapan bir elektronik komponent mağazasıdır. Entegreler (IC), mikrodenetleyiciler, transistörler, diyotlar, pasif elemanlar, konnektörler, modüller ve geliştirme kartları tek adetten seri üretim adetlerine kadar satılır. Ürün sayfalarında güncel stok durumunu, fiyatı ve datasheet bağlantısını bulabilirsiniz.

### Parça koduyla arama

Üretici parça numarasını yazın; stok ve fiyatı hemen görün.

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### Ürün kategorileri

Entegreden kapasitöre tüm elektronik komponent kategorileri.

**Kategorilere göz atın**

### Üreticiler

Aradığınız üreticinin ürünlerini tek sayfada inceleyin.

**Üreticileri görün**

### Toplu alım ve teklif

Listede olmayan ya da yüksek adetli parçalar için teklif isteyin.

**Teklif isteyin**

**www.entegreci.com** | **destek@entegreci.com** | **0850 305 90 34**

Entegreci is an online electronic components store based in Türkiye. Search by manufacturer part number to see stock, prices and datasheets for integrated circuits, microcontrollers, transistors, passive components and connectors, or request a quote for parts that are not listed.

Bu sayfa Entegreci tarafından eklenmiştir. Belgenin önceki sayfaları asıl yayıncısına aittir ve içeriği değiştirilmemiştir; en güncel sürüm için belgenin yayıncısına başvurun.