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

Dual INT-A-PAK Low Profile

## FEATURES

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

- 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 $T_C$ = 25 °C | 530 A |
| $V_{CE(on)}$ (typical) at 300 A, 25 °C | 1.24 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 | 530 | A |
| | | $T_C$ = 80 °C | 376 | |
| Pulsed collector current | $I_{CM}$ | | 800 | |
| Clamped inductive load current | $I_{LM}$ | | 800 | |
| Diode continuous forward current | $I_F$ | $T_C$ = 25 °C | 219 | |
| | | $T_C$ = 80 °C | 145 | |
| Gate to emitter voltage | $V_{GE}$ | | ± 20 | V |
| Maximum power dissipation (IGBT) | $P_D$ | $T_C$ = 25 °C | 1136 | W |
| | | $T_C$ = 80 °C | 636 | |
| 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, $I_C$ = 500 µA | 600 | - | - | V |
| Collector to emitter voltage | $V_{CE(on)}$ | $V_{GE}$ = 15 V, $I_C$ = 150 A | - | 1.04 | 1.15 | V |
| | | $V_{GE}$ = 15 V, $I_C$ = 300 A | - | 1.24 | 1.45 | |
| | | $V_{GE}$ = 15 V, $I_C$ = 150 A, $T_J$ = 125 °C | - | 0.96 | 1.06 | |
| | | $V_{GE}$ = 15 V, $I_C$ = 300 A, $T_J$ = 125 °C | - | 1.22 | 1.42 | |
| Gate threshold voltage | $V_{GE(th)}$ | $V_{CE}$ = $V_{GE}$, $I_C$ = 250 µA | 2.9 | 4.8 | 6.3 | |
| Collector to emitter leakage current | $I_{CES}$ | $V_{GE}$ = 0 V, $V_{CE}$ = 600 V | - | 0.02 | 0.75 | mA |
| | | $V_{GE}$ = 0 V, $V_{CE}$ = 600 V, $T_J$ = 125 °C | - | 1.5 | 10 | |
| Diode forward voltage drop | $V_{FM}$ | $I_{FM}$ = 150 A | - | 1.23 | 1.39 | V |
| | | $I_{FM}$ = 300 A | - | 1.48 | 1.75 | |
| | | $I_{FM}$ = 150 A, $T_J$ = 125 °C | - | 1.17 | 1.33 | |
| | | $I_{FM}$ = 300 A, $T_J$ = 125 °C | - | 1.50 | 1.77 | |
| 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 |
| Turn-on switching loss | $E_{on}$ | $I_C$ = 300 A, $V_{CC}$ = 360 V, $V_{GE}$ = 15 V, $R_g$ = 1.5 Ω, L = 500 µH, $T_J$ = 25 °C | - | 9 | - | mJ |
| Turn-off switching loss | $E_{off}$ | | - | 90 | - | |
| Total switching loss | $E_{tot}$ | | - | 99 | - | |
| Turn-on switching loss | $E_{on}$ | $I_C$ = 300 A, $V_{CC}$ = 360 V, $V_{GE}$ = 15 V, $R_g$ = 1.5 Ω, L = 500 µH, $T_J$ = 125 °C | - | 23 | - | |
| Turn-off switching loss | $E_{off}$ | | - | 133 | - | |
| Total switching loss | $E_{tot}$ | | - | 156 | - | |
| Turn-on delay time | $t_{d(on)}$ | | - | 442 | - | ns |
| Rise time | $t_r$ | | - | 301 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 406 | - | |
| Fall time | $t_f$ | | - | 1570 | - | |
| Reverse bias safe operating area | RBSOA | $T_J$ = 150 °C, $I_C$ = 800 A, $V_{CC}$ = 400 V, $V_P$ = 600 V, $R_g$ = 22 Ω, $V_{GE}$ = 15 V to 0 V, L = 500 µH | Fullsquare | | | |
| Diode reverse recovery time | $t_{rr}$ | $I_F$ = 300 A, $dI_F/dt$ = 500 A/µs, $V_{CC}$ = 400 V, $T_J$ = 25 °C | - | 150 | 179 | ns |
| Diode peak reverse current | $I_{rr}$ | | - | 43 | 59 | A |
| Diode recovery charge | $Q_{rr}$ | | - | 3.9 | 6.3 | µC |
| Diode reverse recovery time | $t_{rr}$ | $I_F$ = 300 A, $dI_F/dt$ = 500 A/µs, $V_{CC}$ = 400 V, $T_J$ = 125 °C | - | 236 | 265 | ns |
| Diode peak reverse current | $I_{rr}$ | | - | 64 | 80 | A |
| Diode recovery charge | $Q_{rr}$ | | - | 8.6 | 11.1 | µC |

| 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 | $R_{thJC}$ | - | - | 0.11 | °C/W |
| | Diode | | - | - | 0.4 | |
| 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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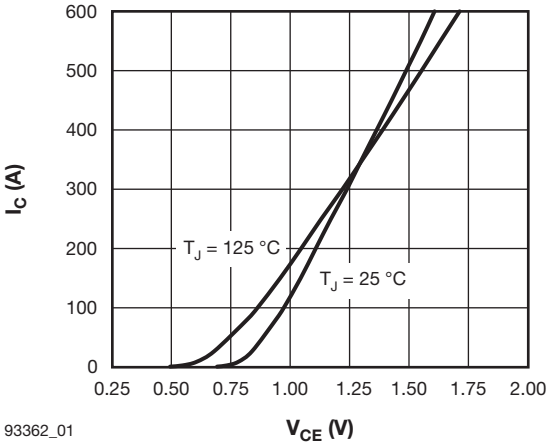


Fig. 1 - Typical Output Characteristics,
$T_J$ = 25 °C, $V_{GE}$ = 15 V

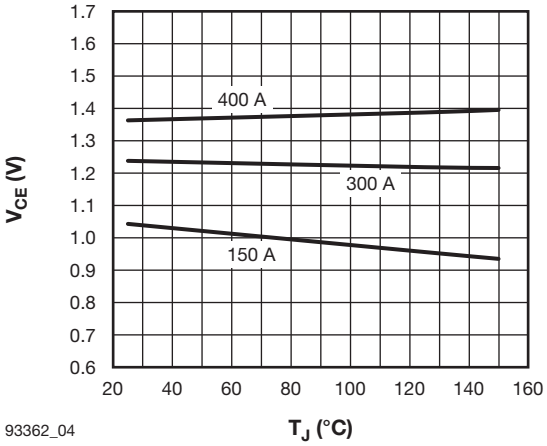


Fig. 4 - Typical IGBT Collector to Emitter Voltage vs.
Junction Temperature,
$V_{GE}$ = 15 V

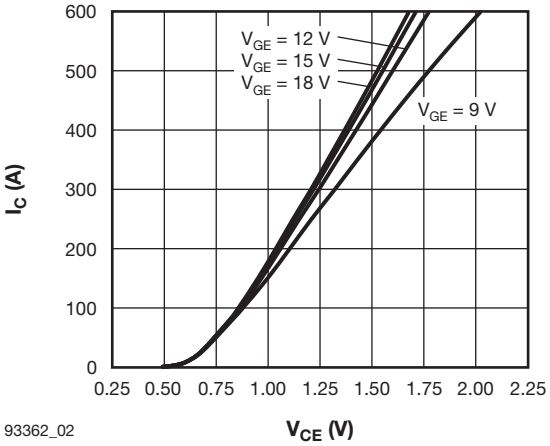


Fig. 2 - Typical Output Characteristics,
$T_J$ = 125 °C

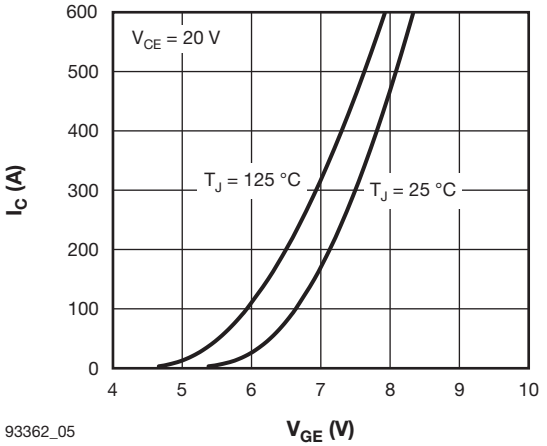


Fig. 5 - Typical IGBT Transfer Characteristics

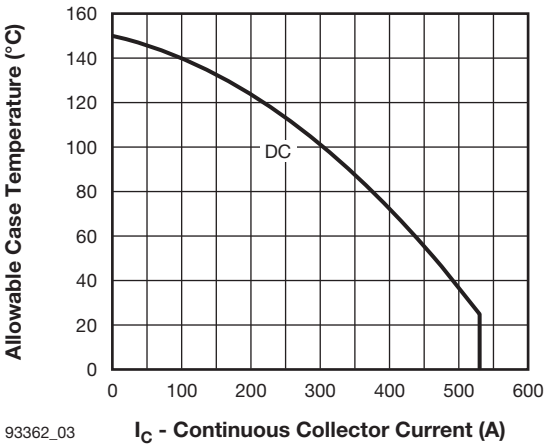


Fig. 3 - Maximum DC IGBT Collector Current vs.
Case Temperature

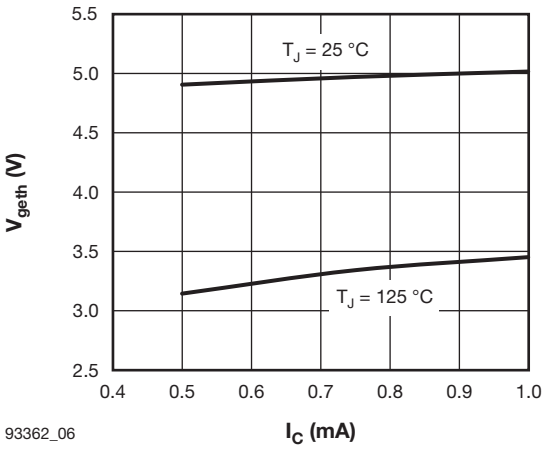


Fig. 6 - Typical IGBT Gate Threshold Voltage


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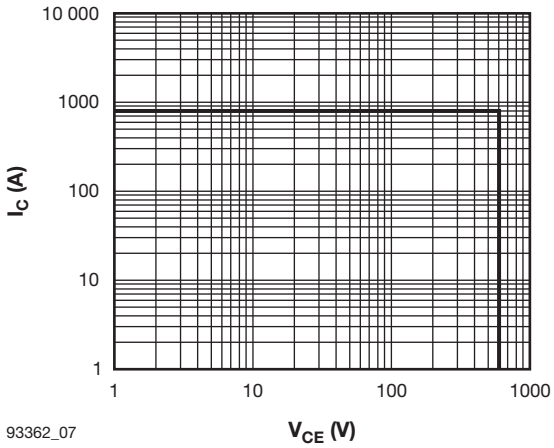


Fig. 7 - IGBT Reverse Bias SOA,
$T_J$ = 150 °C, $V_{GE}$ = 15 V, $R_g$ = 22 Ω

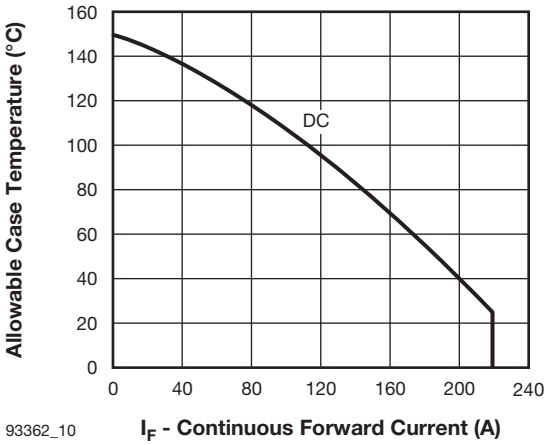


Fig. 10 - Maximum DC Forward Current vs. Case Temperature

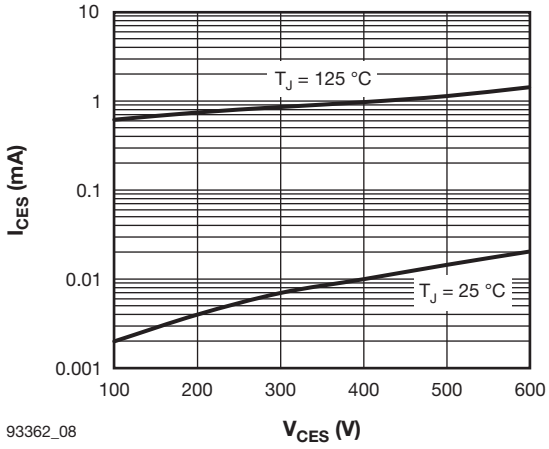


Fig. 8 - Typical IGBT Zero Gate Voltage Collector Current

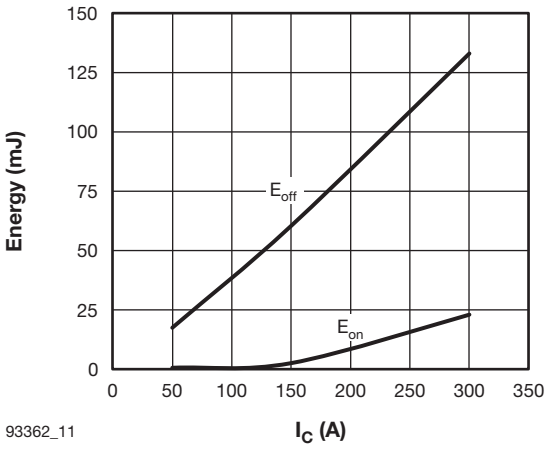


Fig. 11 - Typical IGBT Energy Loss vs. $I_C$,
$T_J$ = 125 °C, $V_{CC}$ = 360 V, $R_g$ = 1.5 Ω,
$V_{GE}$ = 15 V, L = 500 µH

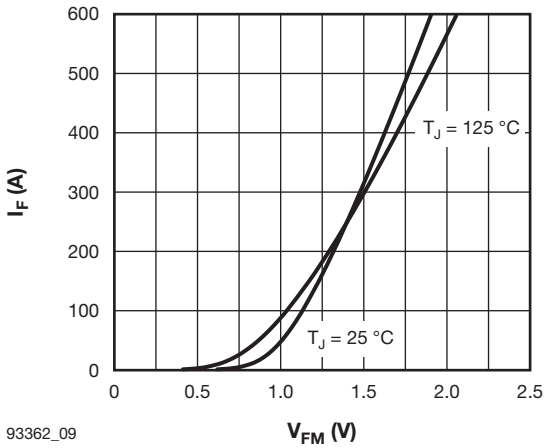


Fig. 9 - Typical Diode Forward Characteristics

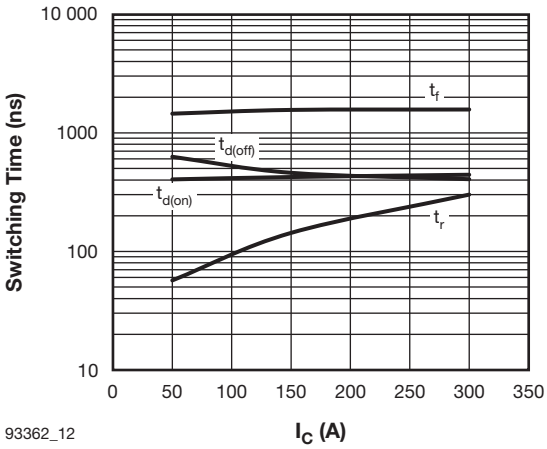


Fig. 12 - Typical IGBT Switching Time vs. $I_C$,
$T_J$ = 125 °C, $V_{CC}$ = 360 V, $R_g$ = 1.5 Ω,
$V_{GE}$ = 15 V, L = 500 µH


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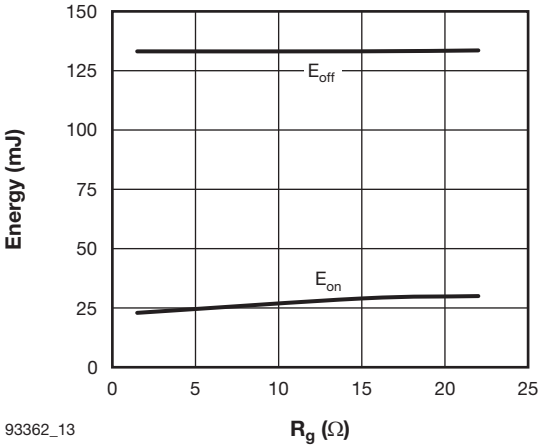


Fig. 13 - Typical IGBT Energy Loss vs. $R_g$,
$T_J$ = 125 °C, $I_C$ = 300 A, $V_{CC}$ = 360 V,
$V_{GE}$ = 15 V, L = 500 µH

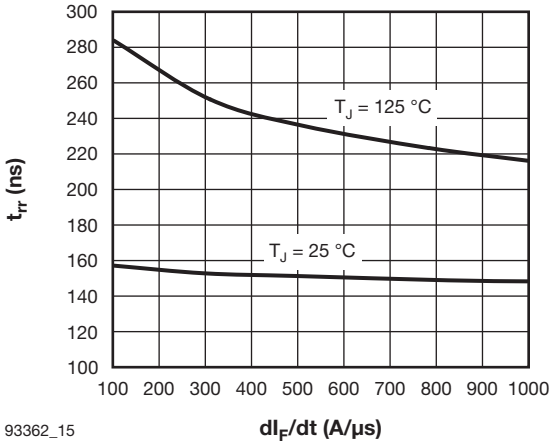


Fig. 15 - Typical Reverse Recovery Time vs. $dI_F/dt$,
$V_{CC}$ = 400 V, $I_F$ = 300 A

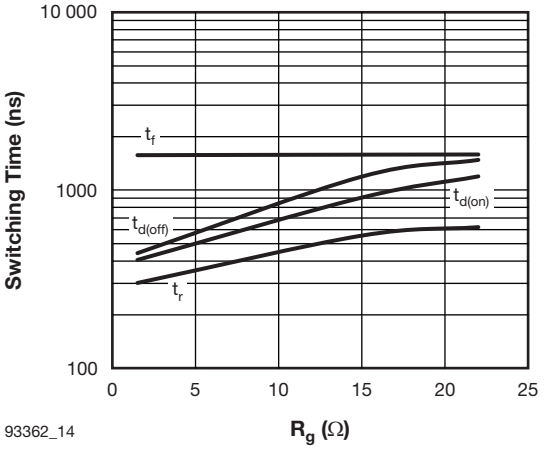


Fig. 14 - Typical IGBT Switching Time vs. $R_g$,
$T_J$ = 125 °C, $I_C$ = 300 A, $V_{CC}$ = 360 V,
$V_{GE}$ = 15 V, L = 500 µH

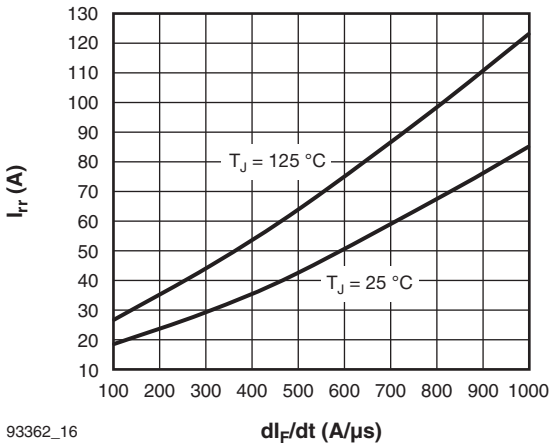


Fig. 16 - Typical Reverse Recovery Current vs. $dI_F/dt$,
$V_{CC}$ = 400 V, $I_F$ = 300 A

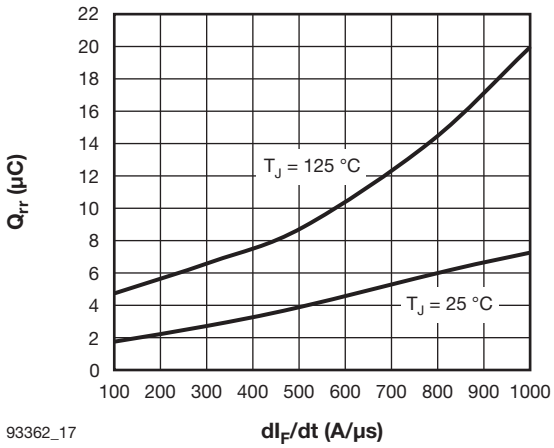


Fig. 17 - Typical Reverse Recovery Charge vs. $dI_F/dt$,
$V_{CC}$ = 400 V, $I_F$ = 300 A


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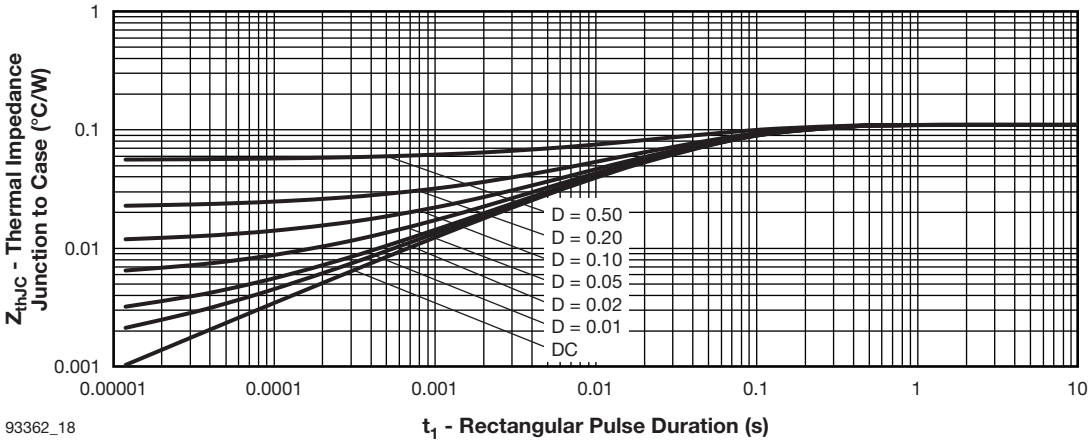


Fig. 18 - Maximum Thermal Impedance $Z_{thJC}$ Characteristics (IGBT)

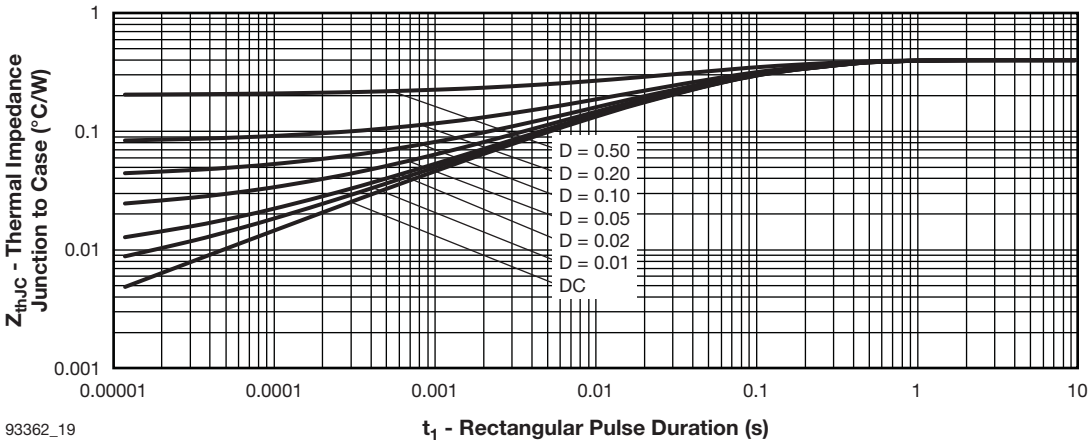


Fig. 19 - Maximum Thermal Impedance $Z_{thJC}$ Characteristics (Diode)

## ORDERING INFORMATION TABLE

**Device code**

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

| | | |
|---|---|---|
| 1 | - | Insulated gate bipolar transistor (IGBT) |
| 2 | - | A = Gen 4 IGBT |
| 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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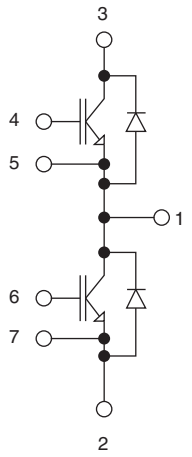
## CIRCUIT CONFIGURATION

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