International
**IOR** Rectifier

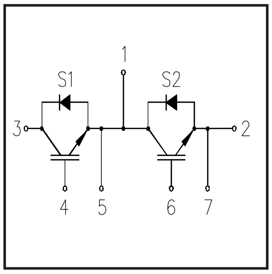
# GA300TD60U

"HALF-BRIDGE" IGBT DUAL INT-A-PAK

Ultra-Fast™ Speed IGBT

## Features

- Generation 4 IGBT technology
- UltraFast: Optimized for high operating frequencies 8-40 kHz in hard switching, >200 kHz in resonant mode
- Very low conduction and switching losses
- HEXFRED™ antiparallel diodes with ultra- soft recovery
- Industry standard package
- UL approved



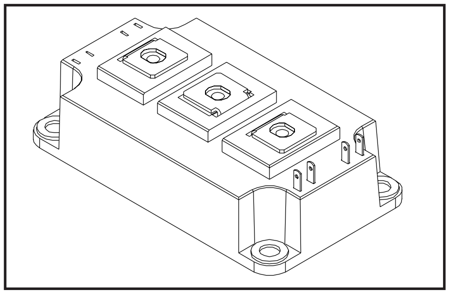
$V_{CES} = 600V$

$V_{CE(on)\ typ.} = 1.80V$

$@V_{GE} = 15V, I_C = 300A$

## Benefits

- Increased operating efficiency
- Direct mounting to heatsink
- Performance optimized for power conversion: UPS, SMPS, Welding
- Lower EMI, requires less snubbing



## Absolute Maximum Ratings

| | Parameter | Max. | Units |
|---|---|---|---|
| $V_{CES}$ | Collector-to-Emitter Voltage | 600 | V |
| $I_C$ @ $T_C$ = 25°C | Continuous Collector Current | 300 | A |
| $I_{CM}$ | Pulsed Collector Current• | 600 | |
| $I_{LM}$ | Peak Switching Current, | 600 | |
| $I_{FM}$ | Peak Diode Forward Current | 600 | |
| $V_{GE}$ | Gate-to-Emitter Voltage | ±20 | V |
| $V_{ISOL}$ | RMS Isolation Voltage, Any Terminal To Case, t = 1 min | 2500 | |
| $P_D$ @ $T_C$ = 25°C | Maximum Power Dissipation | 880 | W |
| $P_D$ @ $T_C$ = 85°C | Maximum Power Dissipation | 460 | |
| $T_J$ | Operating Junction Temperature Range | -40 to +150 | °C |
| $T_{STG}$ | Storage Temperature Range | -40 to +125 | |

## Thermal / Mechanical Characteristics

| | Parameter | Typ. | Max. | Units |
|---|---|---|---|---|
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case - IGBT | — | 0.14 | °C/W |
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case - Diode | — | 0.20 | |
| $R_{\theta CS}$ | Thermal Resistance, Case-to-Sink - Module | 0.1 | — | |
| | Mounting Torque, Case-to-Heatsink ③ | — | 6.0 | N·m |
| | Mounting Torque, Case-to-Terminal 1, 2 & 3③ | — | 5.0 | |
| | Weight of Module | 400 | — | g |

## Electrical Characteristics @ $T_J$ = 25°C (unless otherwise specified)

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $V_{(BR)CES}$ | Collector-to-Emitter Breakdown Voltage | 600 | — | — | V | $V_{GE}$ = 0V, $I_C$ = 1mA |
| $V_{CE(on)}$ | Collector-to-Emitter Voltage | — | 1.8 | 2.3 | | $V_{GE}$ = 15V, $I_C$ = 300A |
| | | — | 1.9 | — | | $V_{GE}$ = 15V, $I_C$ = 300A, $T_J$ = 125°C |
| $V_{GE(th)}$ | Gate Threshold Voltage | 3.0 | — | 6.0 | | $I_C$ = 1.75mA |
| $\Delta V_{GE(th)}/\Delta T_J$ | Temperature Coeff. of Threshold Voltage | — | -11 | — | mV/°C | $V_{CE} = V_{GE}$, $I_C$ = 1.75mA |
| $g_{fe}$ | Forward Transconductance „ | — | 269 | — | S | $V_{CE}$ = 25V, $I_C$ = 300A |
| $I_{CES}$ | Collector-to-Emitter Leaking Current | — | — | 1.0 | mA | $V_{GE}$ = 0V, $V_{CE}$ = 600V |
| | | — | — | 10 | | $V_{GE}$ = 0V, $V_{CE}$ = 600V, $T_J$ = 125°C |
| $V_{FM}$ | Diode Forward Voltage - Maximum | — | 3.3 | — | V | $I_F$ = 300A, $V_{GE}$ = 0V |
| | | — | 3.2 | — | | $I_F$ = 300A, $V_{GE}$ = 0V, $T_J$ = 125°C |
| $I_{GES}$ | Gate-to-Emitter Leakage Current | — | — | 400 | nA | $V_{GE}$ = ±20V |

## Dynamic Characteristics - $T_J$ = 125°C (unless otherwise specified)

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $Q_g$ | Total Gate Charge (turn-on) | — | 1249 | 1873 | nC | $V_{CC}$ = 400V |
| $Q_{ge}$ | Gate - Emitter Charge (turn-on) | — | 173 | 260 | | $I_C$ = 187A |
| $Q_{gc}$ | Gate - Collector Charge (turn-on) | — | 423 | 635 | | $T_J$ = 25°C |
| $t_{d(on)}$ | Turn-On Delay Time | — | 645 | — | ns | $R_{G1}$ = 27Ω, $R_{G2}$ = 0Ω, |
| $t_r$ | Rise Time | — | 282 | — | | $I_C$ = 300A |
| $t_{d(off)}$ | Turn-Off Delay Time | — | 418 | — | | $V_{CC}$ = 360V |
| $t_f$ | Fall Time | — | 220 | — | | $V_{GE}$ = ±15V |
| $E_{on}$ | Turn-On Switching Energy | — | 22 | — | mJ | See Fig.17 through Fig.19 |
| $E_{off}$ | Turn-Off Switching Energy | — | 25 | — | | |
| $E_{ts}$ | Total Switching Energy | — | 47 | 60 | | |
| $C_{ies}$ | Input Capacitance | — | 27755 | — | pF | $V_{GE}$ = 0V |
| $C_{oes}$ | Output Capacitance | — | 1735 | — | | $V_{CC}$ = 30V |
| $C_{res}$ | Reverse Transfer Capacitance | — | 361 | — | | $f$ = 1 MHz |
| $t_{rr}$ | Diode Reverse Recovery Time | — | 200 | — | ns | $I_C$ = 300A |
| $I_{rr}$ | Diode Peak ReverseCurrent | — | 128 | — | A | $R_{G1}$ = 27Ω |
| $Q_{rr}$ | Diode Recovery Charge | — | 12771 | — | nC | $R_{G2}$ = 0Ω |
| $di_{(rec)}M/dt$ | Diode Peak Rate of Fall of Recovery During $t_b$ | — | 1691 | — | A/µs | $V_{CC}$ = 360V<br>di/dt =1300A/µs |

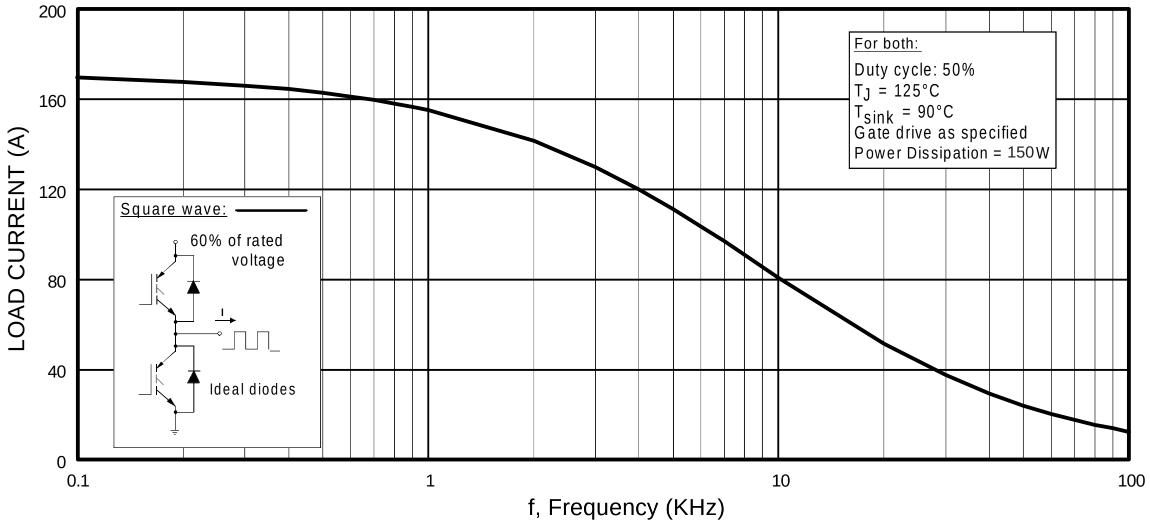


**Fig. 1** - Typical Load Current vs. Frequency
(Load Current = $I_{RMS}$ of fundamental)

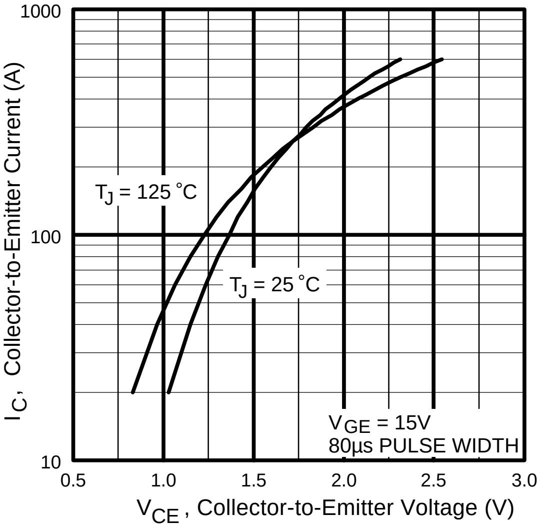


**Fig. 2** - Typical Output Characteristics

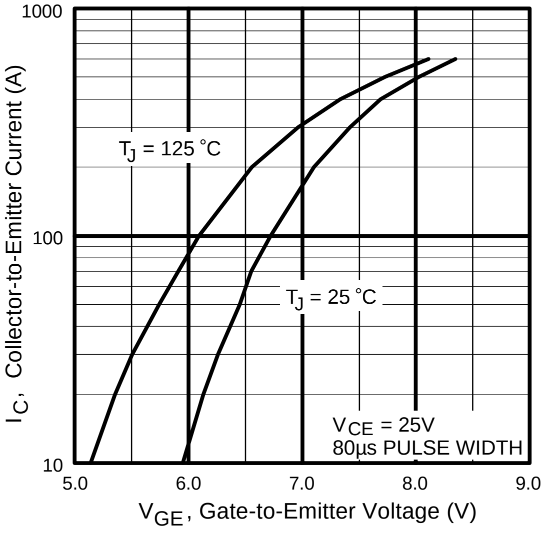
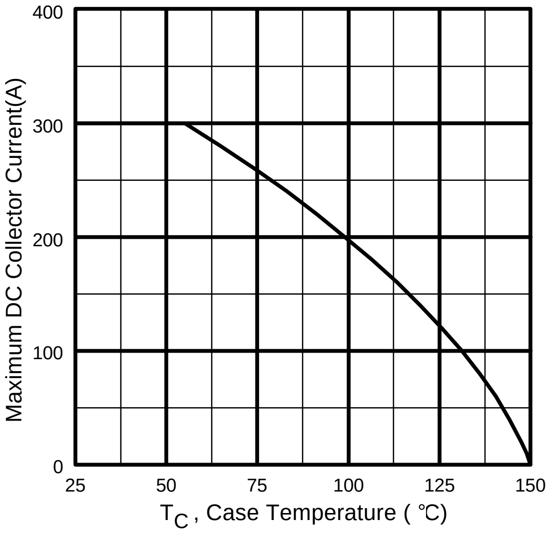


**Fig. 3** - Typical Transfer Characteristics



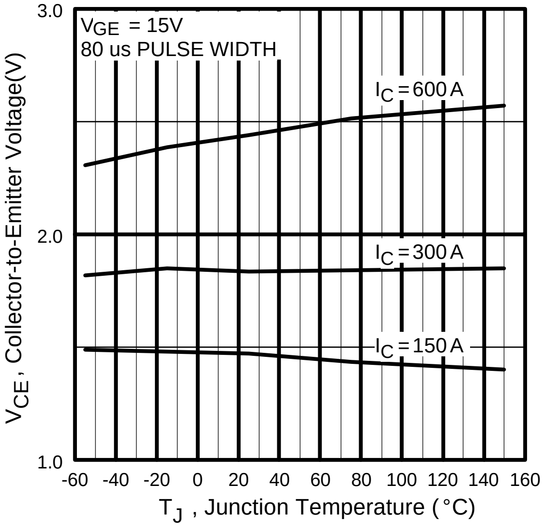


**Fig. 4** - Maximum Collector Current vs. Case Temperature

**Fig. 5** - Typical Collector-to-Emitter Voltage vs. Junction Temperature

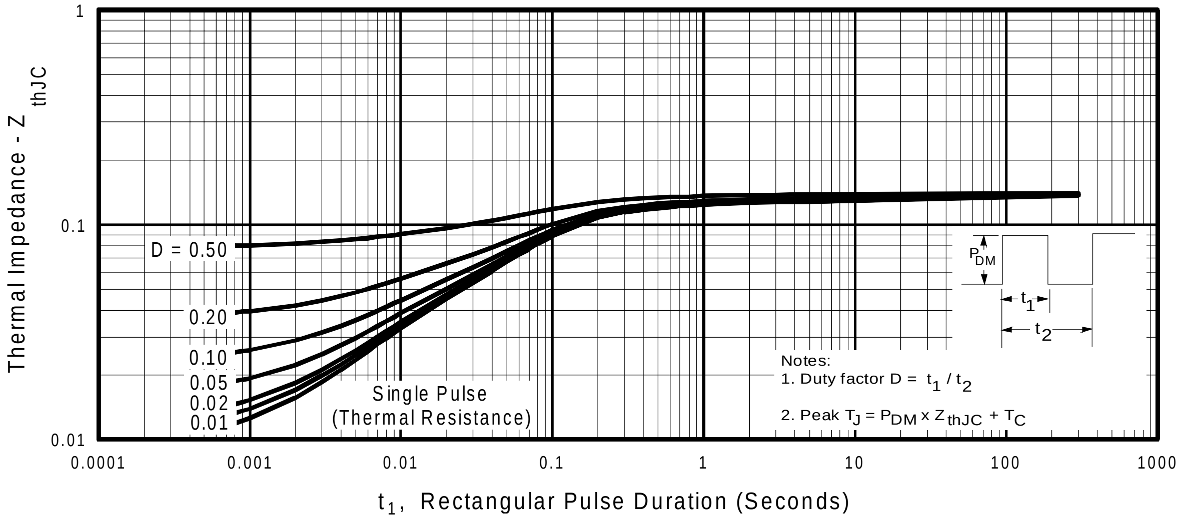
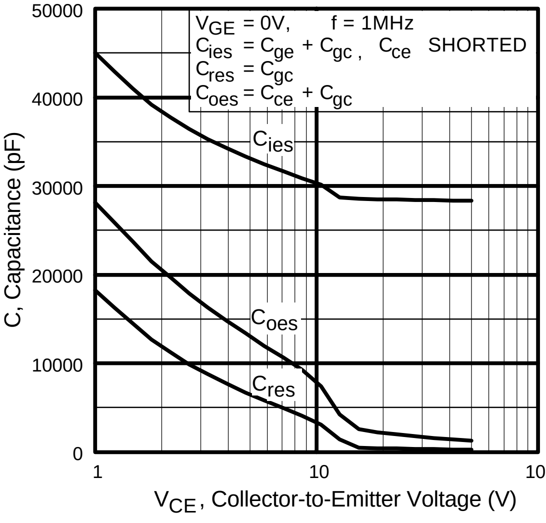


**Fig. 6** - Maximum Effective Transient Thermal Impedance, Junction-to-Case



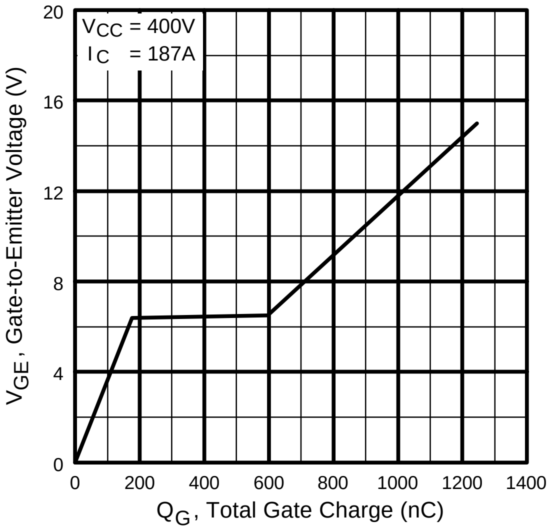
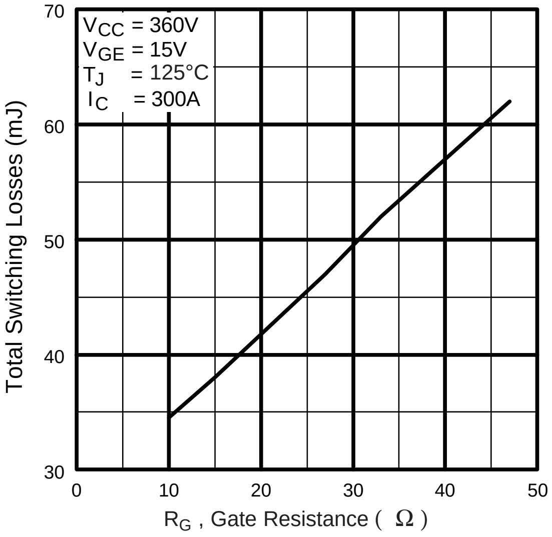


**Fig. 7 -** Typical Capacitance vs. Collector-to-Emitter Voltage

**Fig. 8** - Typical Gate Charge vs. Gate-to-Emitter Voltage



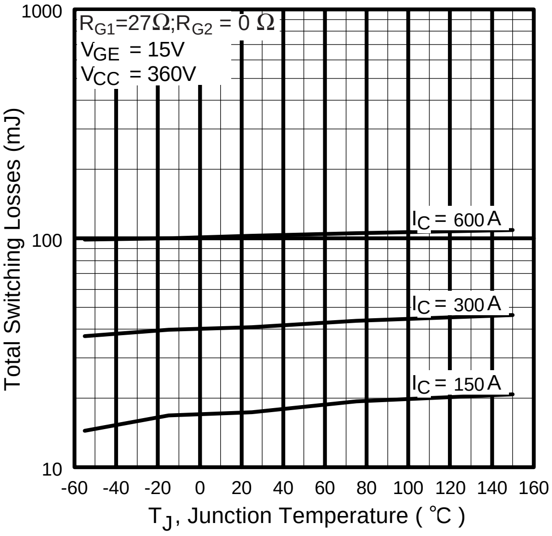


**Fig. 9** - Typical Switching Losses vs. Gate Resistance

**Fig. 10** - Typical Switching Losses vs. Junction Temperature

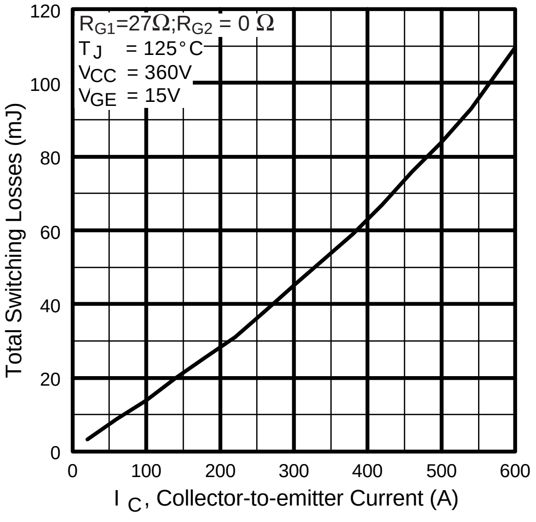


**Fig. 11 -** Typical Switching Losses vs. Collector-to-Emitter Current

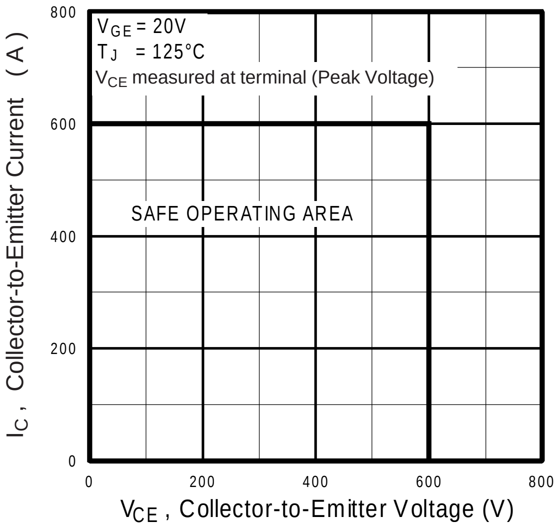


**Fig. 12** - Reverse Bias SOA

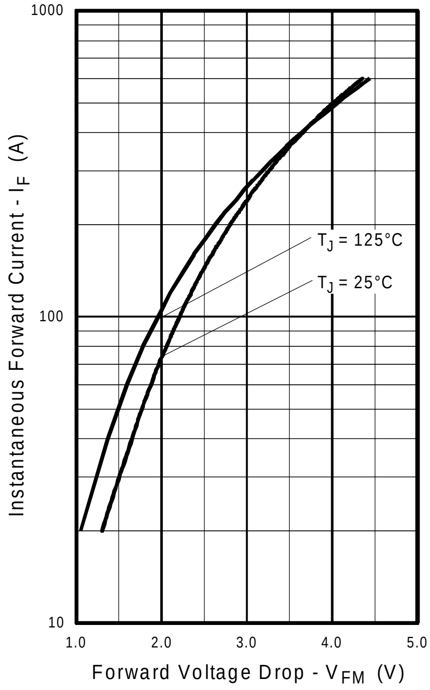


**Fig. 13** - Typical Forward Voltage Drop vs. Instantaneous Forward Current

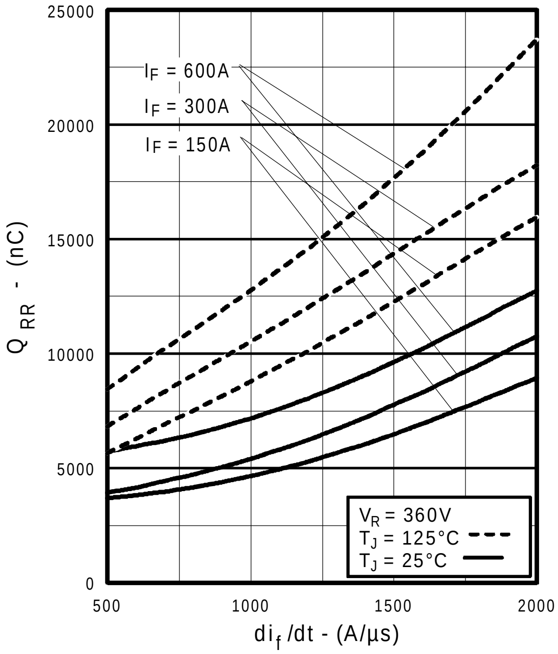


**Fig. 14 -** Typical Stored Charge vs. $di_f/dt$

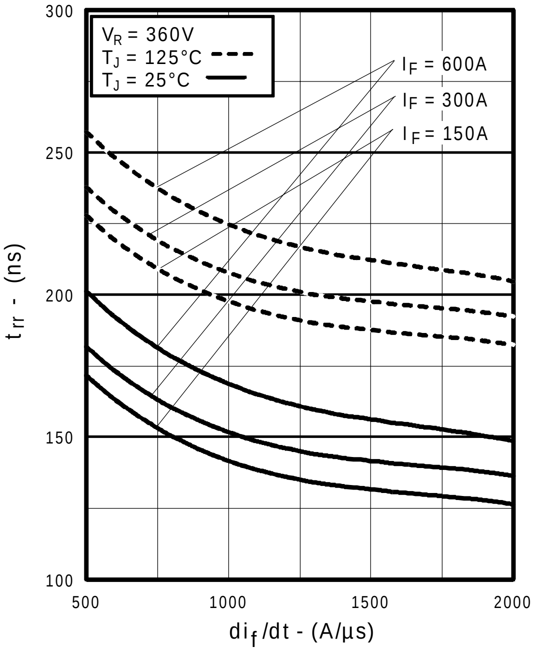


**Fig. 15** - Typical Reverse Recovery vs. $di_f/dt$

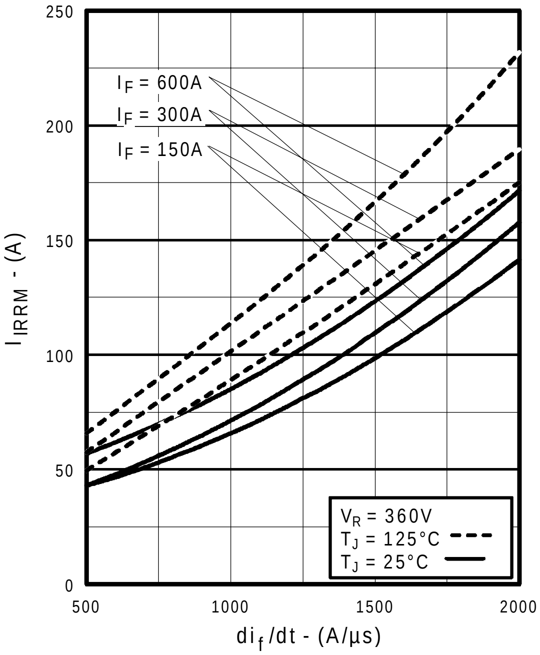


**Fig. 16** - Typical Recovery Current vs. $di_f/dt$

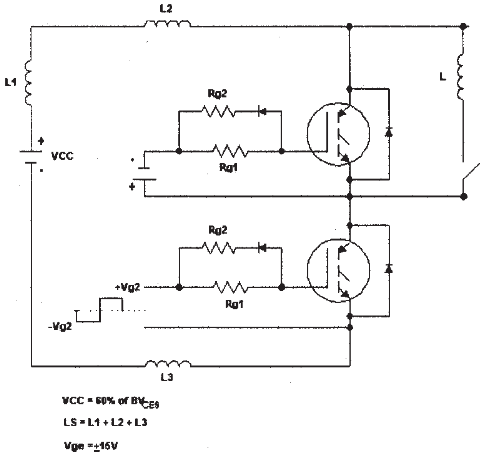


**Fig. 17a** - Test Circuit for Measurement of $I_{LM}$, $E_{on}$, $E_{off(diode)}$, $t_{rr}$, $Q_{rr}$, $I_{rr}$, $t_{d(on)}$, $t_r$, $t_{d(off)}$, $t_f$

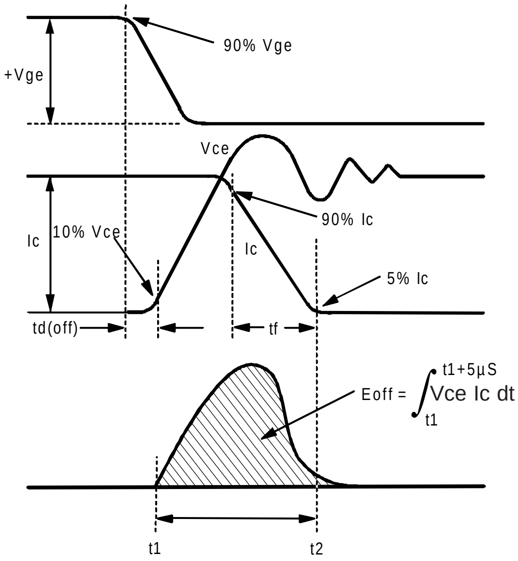


**Fig. 17b** - Test Waveforms for Circuit of Fig. 18a, Defining $E_{off}$, $t_{d(off)}$, $t_f$

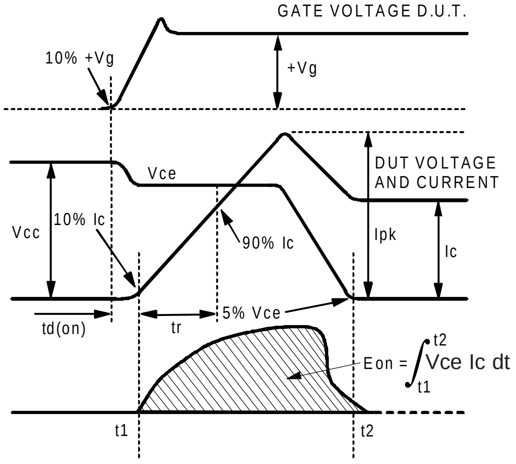


**Fig. 17c** - Test Waveforms for Circuit of Fig. 18a, Defining $E_{on}$, $t_{d(on)}$, $t_r$

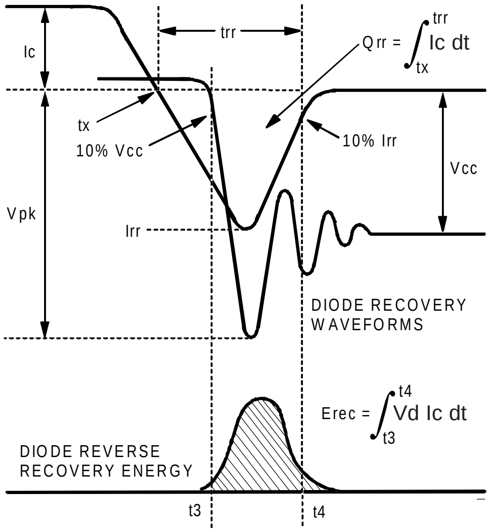


**Fig. 17d** - Test Waveforms for Circuit of Fig. 18a, Defining $E_{rec}$, $t_{rr}$, $Q_{rr}$, $I_{rr}$

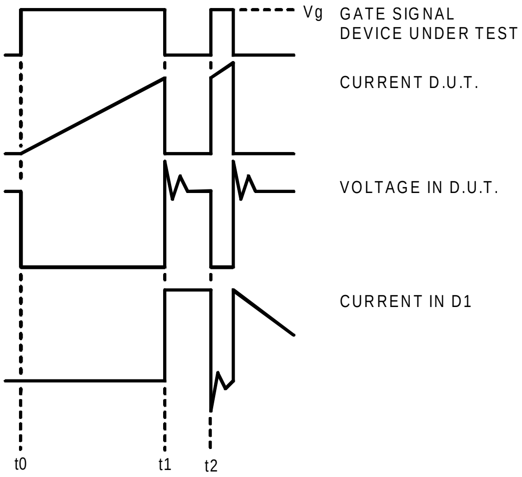


Figure 17e. Macro Waveforms for Figure 17a's Test Circuit

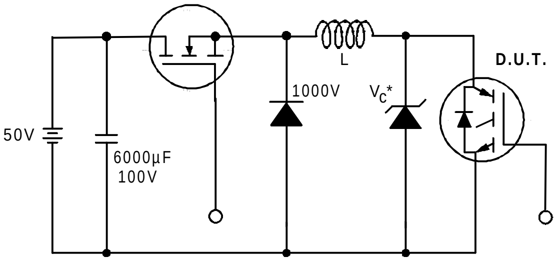


Figure 18. Clamped Inductive Load Test Circuit

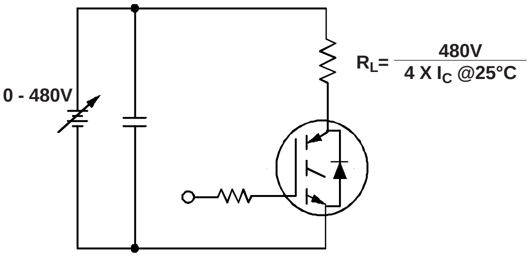


Figure 19. Pulsed Collector Current Test Circuit

**Notes:**

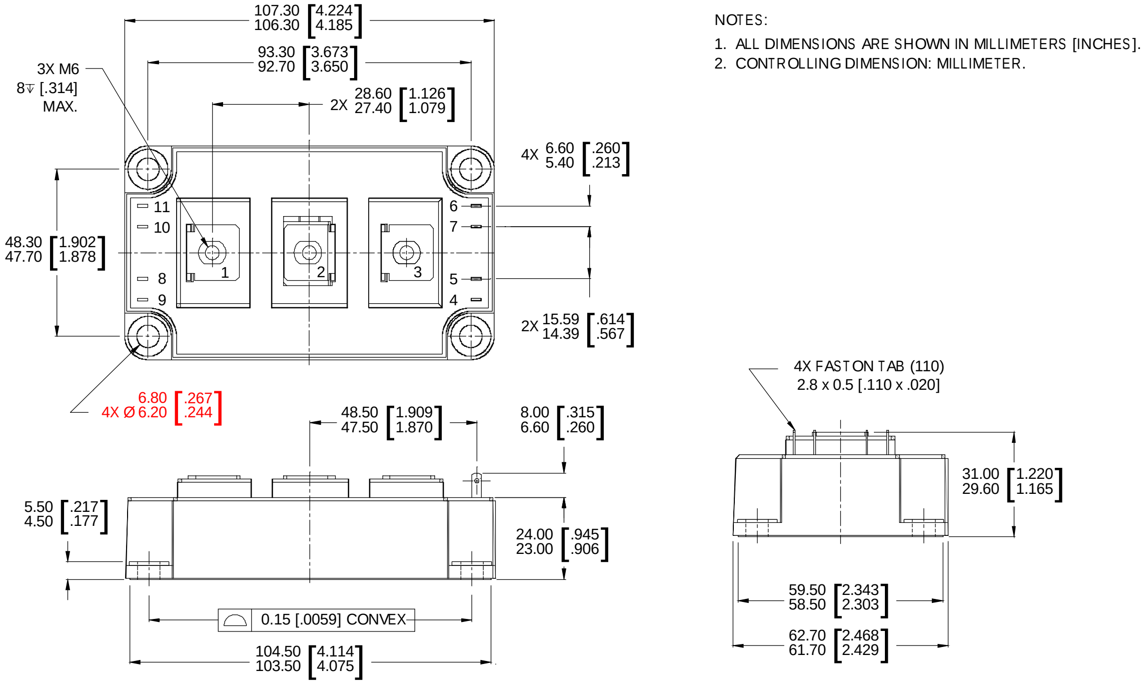
① Repetitive rating; $V_{GE}$ = 20V, pulse width limited by max. junction temperature.

② See fig. 17

③ For screws M6.

④ Pulse width  80µs; single shot.

## Case Outline — DUAL INT-A-PAK



NOTES:
1. ALL DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
2. CONTROLLING DIMENSION: MILLIMETER.

Data and specifications subject to change without notice.
This product has been designed and qualified for the Industrial market.
Qualification Standards can be found on IR's Web site.

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