Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

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Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China

International
IOR Rectifier

PD -50066A

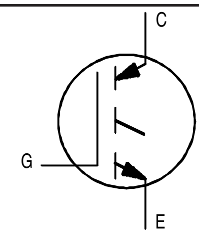
# GA200SA60U

INSULATED GATE BIPOLAR TRANSISTOR

Ultra-Fast™ Speed IGBT

## Features

- UltraFast: Optimized for minimum saturation voltage and operating frequencies up to 40 kHz in hard switching, > 200 kHz in resonant mode
- Very low conduction and switching losses
- Fully isolate package ( 2,500 Volt AC/RMS)
- Very low internal inductance ( ≤ 5 nH typ.)
- Industry standard outline




n-channel

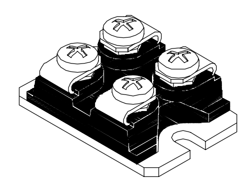
$V_{CES} = 600V$

$V_{CE(on)}$ typ. = 1.60V

@ $V_{GE}$ = 15V, $I_C$ = 100A

## Benefits

- Designed for increased operating efficiency in power conversion: UPS, SMPS, Welding, Induction heating
- Lower overall losses available at frequencies ≥ 20kHz
- Easy to assemble and parallel
- Direct mounting to heatsink
- Lower EMI, requires less snubbing
- Plug-in compatible with other SOT-227 packages



SOT-227

## Absolute Maximum Ratings

| | Parameter | Max. | Units |
|---|---|---|---|
| $V_{CES}$ | Collector-to-Emitter Breakdown Voltage | 600 | V |
| $I_C$ @ $T_C$ = 25°C | Continuous Collector Current | 200 | A |
| $I_C$ @ $T_C$ = 100°C | Continuous Collector Current | 100 | |
| $I_{CM}$ | Pulsed Collector Current | 400 | |
| $I_{LM}$ | Clamped Inductive Load Current② | 400 | |
| $V_{GE}$ | Gate-to-Emitter Voltage | ± 20 | V |
| $E_{ARV}$ | Reverse Voltage Avalanche Energy ③ | 160 | mJ |
| $V_{ISOL}$ | RMS Isolation Voltage, Any Terminal to Case, t=1 min | 2500 | V |
| $P_D$ @ $T_C$ = 25°C | Maximum Power Dissipation | 500 | W |
| $P_D$ @ $T_C$ = 100°C | Maximum Power Dissipation | 200 | |
| $T_J$ | Operating Junction | -55 to + 150 | °C |
| $T_{STG}$ | Storage Temperature Range | -55 to + 150 | |
| | Mounting Torque, 6-32 or M3 Screw | 12 lbf •in(1.3N•m) | |

## Thermal Resistance

| | Parameter | Typ. | Max. | Units |
|---|---|---|---|---|
| $R_{\theta JC}$ | Junction-to-Case | —— | 0.25 | °C/W |
| $R_{\theta CS}$ | Case-to-Sink, Flat, Greased Surface | 0.05 | —— | |
| Wt | Weight of Module | 30 | —— | gm |



4/24/2000

## 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, $I_C$ = 250µA | |
| $V_{(BR)ECS}$ | Emitter-to-Collector Breakdown Voltage ④ | 18 | — | — | V | $V_{GE}$ = 0V, $I_C$ = 1.0A | |
| $DV_{(BR)CES}/DT_J$ | Temperature Coeff. of Breakdown Voltage | — | 0.38 | — | V/°C | $V_{GE}$ = 0V, $I_C$ = 10 mA | |
| $V_{CE(ON)}$ | Collector-to-Emitter Saturation Voltage | — | 1.60 | 1.9 | V | $I_C$ = 100A | $V_{GE}$ = 15V |
| | | — | 1.92 | — | | $I_C$ = 200A | See Fig.2, 5 |
| | | — | 1.54 | — | | $I_C$ = 100A , $T_J$ = 150°C | |
| $V_{GE(th)}$ | Gate Threshold Voltage | 3.0 | — | 6.0 | | $V_{CE} = V_{GE}$, $I_C$ = 250µA | |
| $\Delta V_{GE(th)}/\Delta T_J$ | Temperature Coeff. of Threshold Voltage | — | -11 | — | mV/°C | $V_{CE} = V_{GE}$, $I_C$ = 2.0 mA | |
| $g_{fe}$ | Forward Transconductance ⑤ | 79 | | — | S | $V_{CE}$ = 100V, $I_C$ = 100A | |
| $I_{CES}$ | Zero Gate Voltage Collector Current | — | — | 1.0 | mA | $V_{GE}$ = 0V, $V_{CE}$ = 600V | |
| | | — | — | 10 | | $V_{GE}$ = 0V, $V_{CE}$ = 600V, $T_J$ = 150°C | |
| $I_{GES}$ | Gate-to-Emitter Leakage Current | — | — | ±250 | nA | $V_{GE}$ = ±20V | |

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

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $Q_g$ | Total Gate Charge (turn-on) | — | 770 | 1200 | nC | $I_C$ = 100A |
| $Q_{ge}$ | Gate - Emitter Charge (turn-on) | — | 100 | 150 | | $V_{CC}$ = 400V See Fig. 8 |
| $Q_{gc}$ | Gate - Collector Charge (turn-on) | — | 260 | 380 | | $V_{GE}$ = 15V |
| $t_{d(on)}$ | Turn-On Delay Time | — | 54 | — | ns | |
| $t_r$ | Rise Time | — | 79 | — | | $T_J$ = 25°C |
| $t_{d(off)}$ | Turn-Off Delay Time | — | 130 | 200 | | $I_C$ = 100A, $V_{CC}$ = 480V |
| $t_f$ | Fall Time | — | 300 | 450 | | $V_{GE}$ = 15V, $R_G$ = 2.0Ω |
| $E_{on}$ | Turn-On Switching Loss | — | 0.98 | — | mJ | Energy losses include "tail" |
| $E_{off}$ | Turn-Off Switching Loss | — | 3.48 | — | | See Fig. 9, 10, 14 |
| $E_{ts}$ | Total Switching Loss | — | 4.46 | 7.6 | | |
| $t_{d(on)}$ | Turn-On Delay Time | — | 56 | — | ns | $T_J$ = 150°C, |
| $t_r$ | Rise Time | — | 75 | — | | $I_C$ = 100A, $V_{CC}$ = 480V |
| $t_{d(off)}$ | Turn-Off Delay Time | — | 160 | — | | $V_{GE}$ = 15V, $R_G$ = 2.0Ω |
| $t_f$ | Fall Time | — | 460 | — | | Energy losses include "tail" |
| $E_{ts}$ | Total Switching Loss | — | 7.24 | — | mJ | See Fig. 10, 11, 14 |
| $L_E$ | Internal Emitter Inductance | — | 5.0 | — | nH | Measured 5mm from package |
| $C_{ies}$ | Input Capacitance | — | 16500 | — | pF | $V_{GE}$ = 0V |
| $C_{oes}$ | Output Capacitance | — | 1000 | — | | $V_{CC}$ = 30V See Fig. 7 |
| $C_{res}$ | Reverse Transfer Capacitance | — | 200 | — | | $f$ = 1.0MHz |

**Notes:**

① Repetitive rating; $V_{GE}$ = 20V, pulse width limited by max. junction temperature. ( See fig. 13b )

② $V_{CC}$ = 80%($V_{CES}$), $V_{GE}$ = 20V, L = 10µH, $R_G$ = 2.0Ω, (See fig. 13a)

③ Repetitive rating; pulse width limited by maximum junction temperature.

④ Pulse width ≤ 80µs; duty factor ≤ 0.1%.

⑤ Pulse width 5.0µs, single shot.

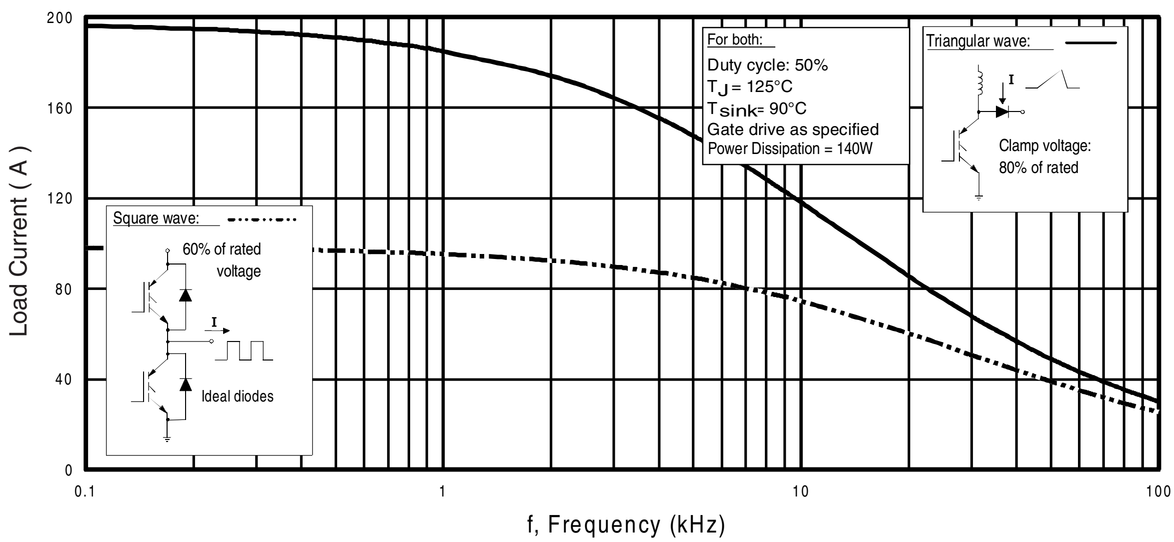



**Fig. 1** - Typical Load Current vs. Frequency
(Load Current = $I_{RMS}$ of fundamental)

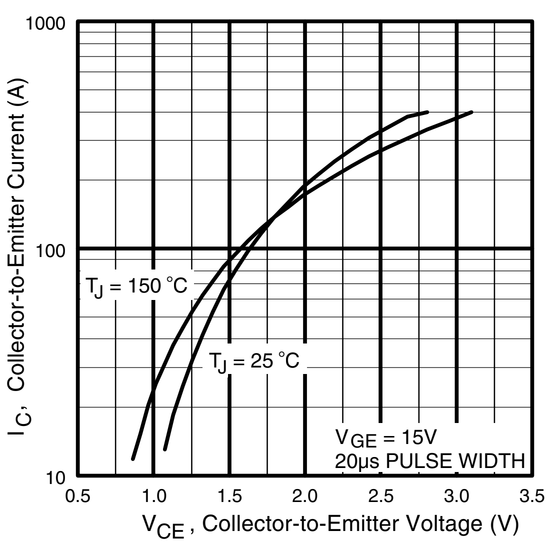



**Fig. 2** - Typical Output Characteristics

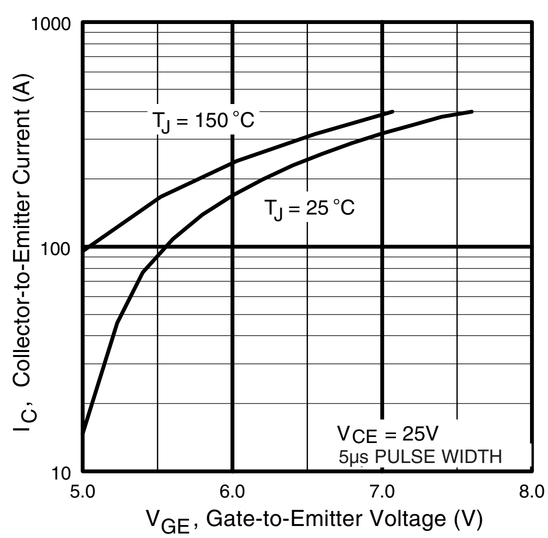



**Fig. 3** - Typical Transfer Characteristics

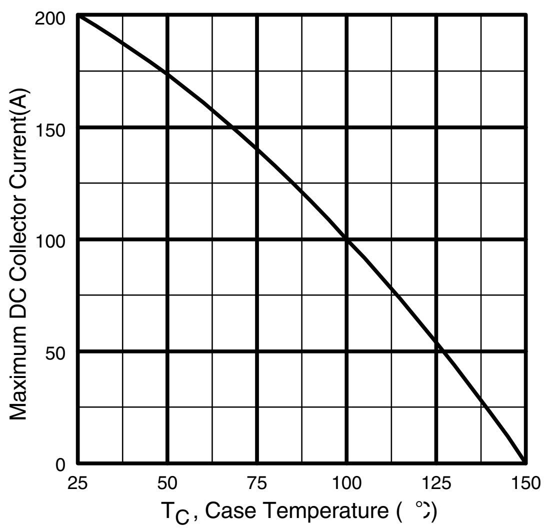



**Fig. 4** - Maximum Collector Current vs. Case Temperature

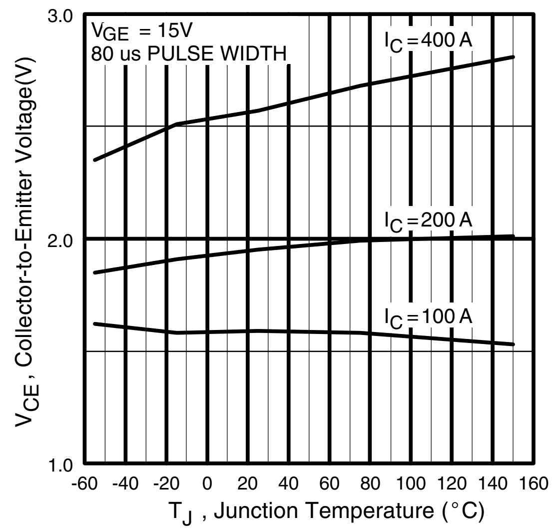



**Fig. 5** - Typical Collector-to-Emitter Voltage vs. Junction Temperature

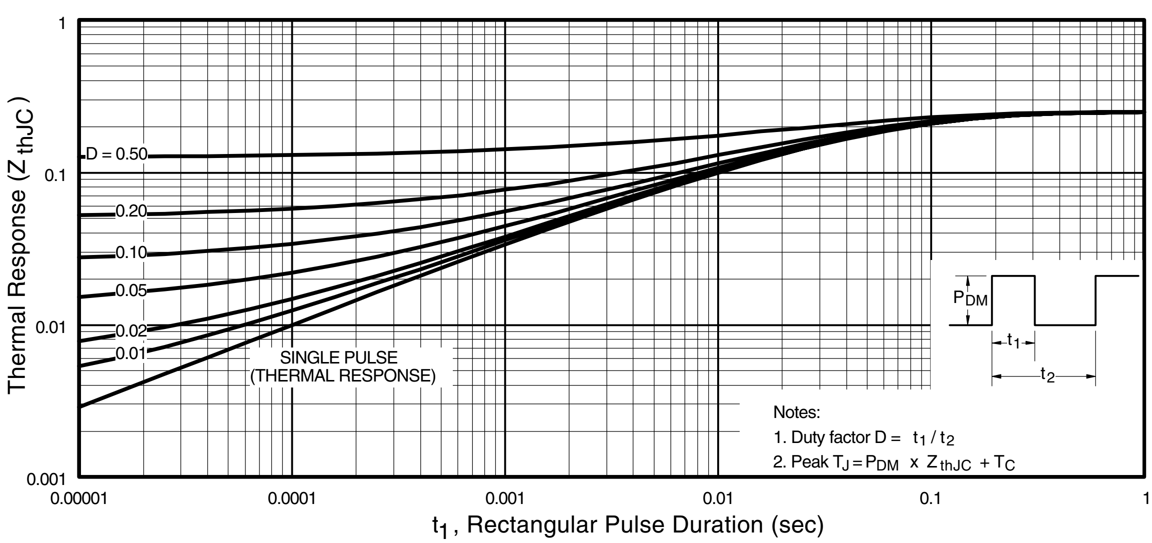



**Fig. 6** - Maximum Effective Transient Thermal Impedance, Junction-to-Case

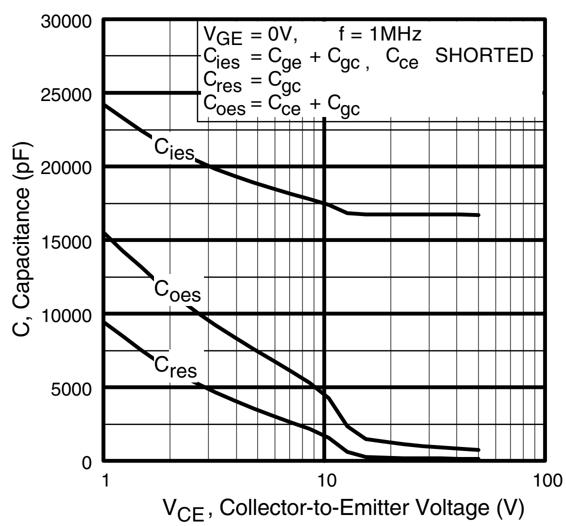



**Fig. 7 -** Typical Capacitance vs. Collector-to-Emitter Voltage

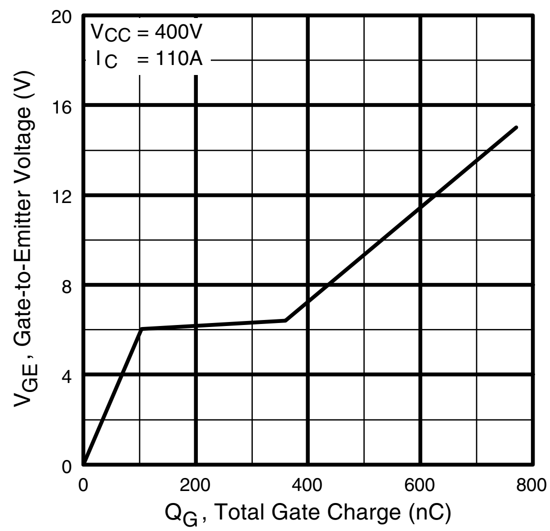



**Fig. 8** - Typical Gate Charge vs. Gate-to-Emitter Voltage

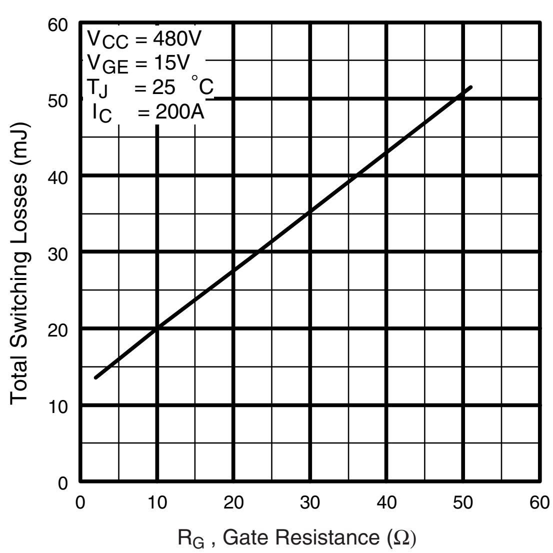



**Fig. 9** - Typical Switching Losses vs. Gate Resistance

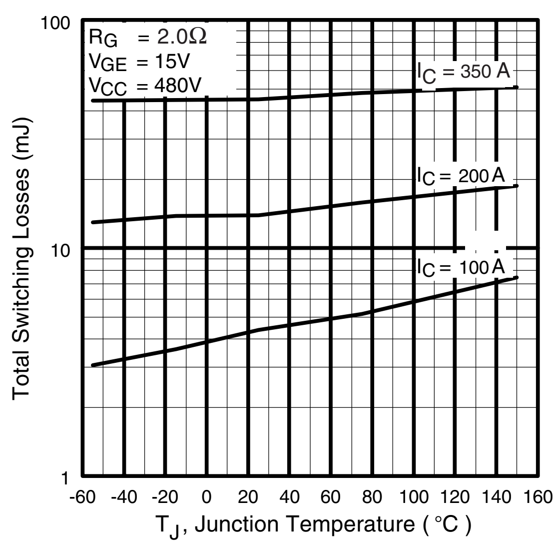



**Fig. 10** - Typical Switching Losses vs. Junction Temperature

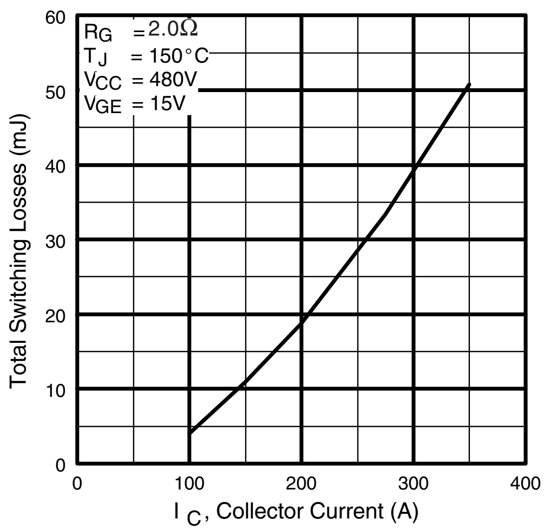



**Fig. 11 -** Typical Switching Losses vs. Collector Current

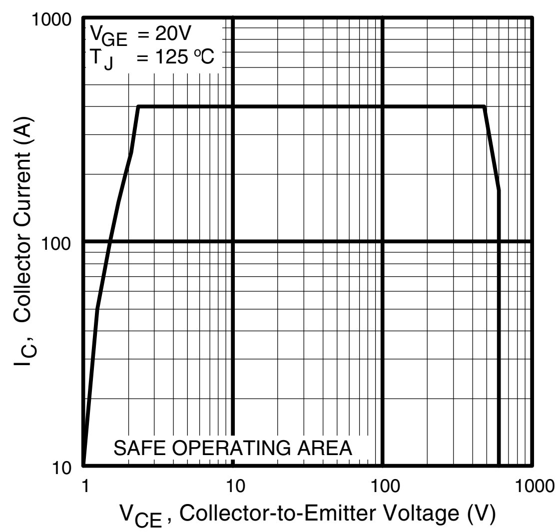



**Fig. 12** - Turn-Off SOA

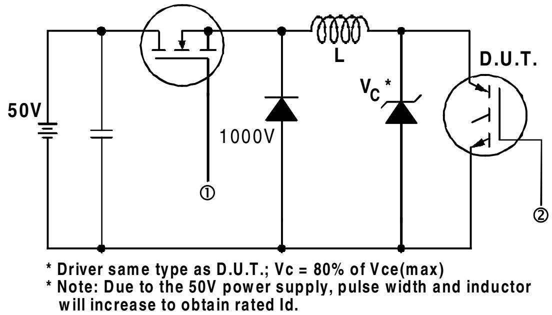



**Fig. 13a** - Clamped Inductive Load Test Circuit

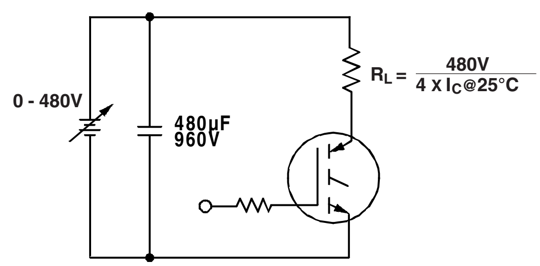



**Fig. 13b** - Pulsed Collector Current Test Circuit

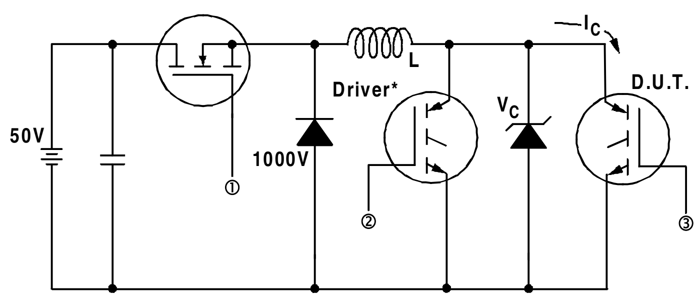



**Fig. 14a** - Switching Loss Test Circuit

* Driver same type as D.U.T., VC = 480V

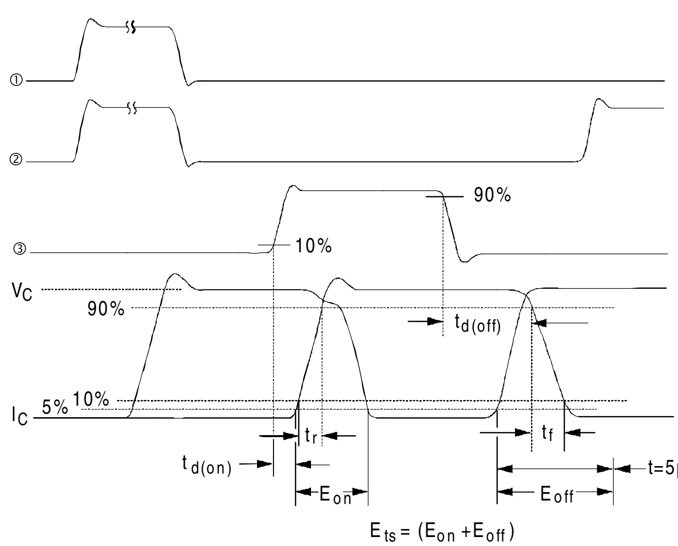
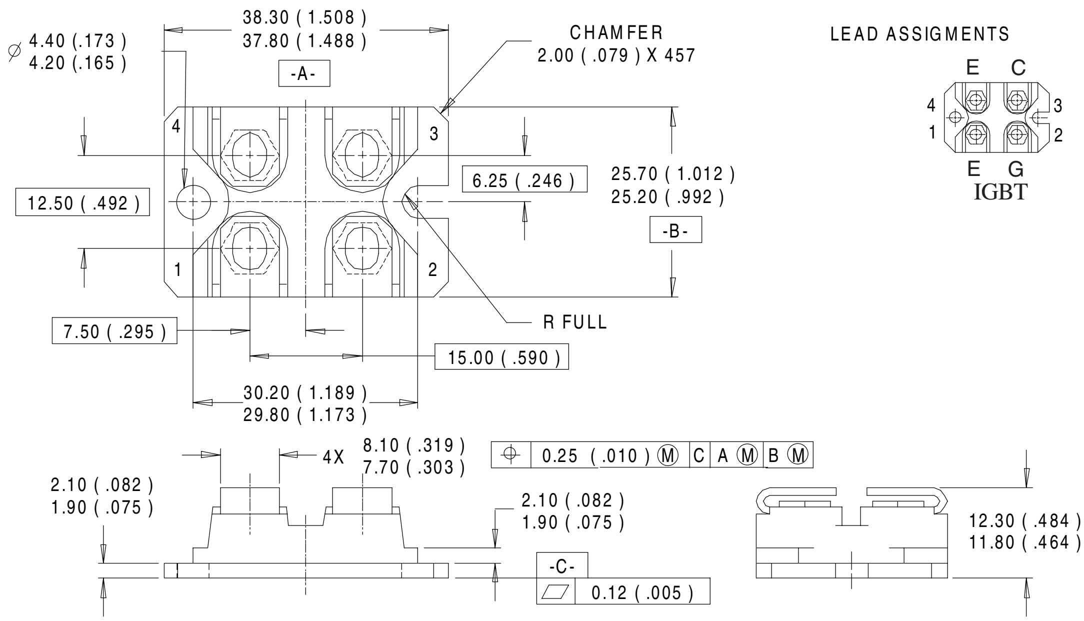



**Fig. 14b** - Switching Loss Waveforms

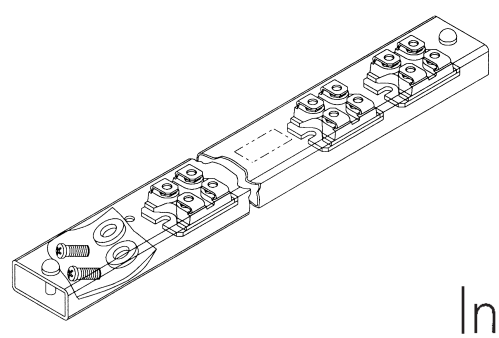
## SOT-227 Package Details

Dimensions are shown in millimeters ( inches )




## Tube

QUANTITIES PER TUBE IS 10
M4 SREW AND WASHER INCLUDED



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*Data and specifications subject to change without notice. 4/00*