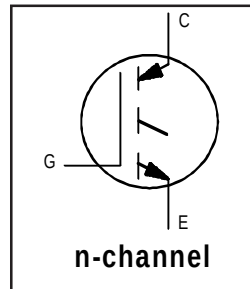


### Features

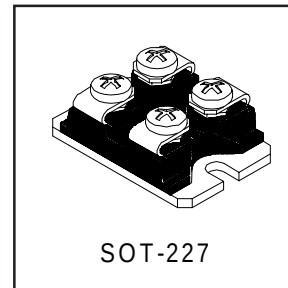
- Standard : Optimized for minimum saturation voltage and low operating frequencies up to 1kHz
- Lowest conduction losses available
- Fully isolated package ( 2,500 volt AC)
- Very low internal inductance ( 5 nH typ.)
- Industry standard outline



$V_{CES} = 600V$   
 $V_{CE(on)} \text{ typ.} = 1.10V$   
 @  $V_{GE} = 15V, I_C = 100A$

### Benefits

- Designed for increased operating efficiency in power conversion: UPS, SMPS, Welding, Induction heating
- Easy to assemble and parallel
- Direct mounting to heatsink
- Plug-in compatible with other SOT-227 packages



### Absolute Maximum Ratings

|                           | Parameter                                            | Max.               | Units      |
|---------------------------|------------------------------------------------------|--------------------|------------|
| $V_{CES}$                 | Collector-to-Emitter Breakdown Voltage               | 600                | V          |
| $I_C @ T_C = 25^\circ C$  | Continuous Collector Current                         | 200                | A          |
| $I_C @ T_C = 100^\circ C$ | Continuous Collector Current                         | 100                |            |
| $I_{CM}$                  | Pulsed Collector Current ①                           | 400                |            |
| $I_{LM}$                  | Clamped Inductive Load Current ②                     | 400                |            |
| $V_{GE}$                  | Gate-to-Emitter Voltage                              | $\pm 20$           | V          |
| $E_{ARV}$                 | Reverse Voltage Avalanche Energy ③                   | 155                | mJ         |
| $V_{ISOL}$                | RMS Isolation Voltage, Any Terminal to Case, t=1 min | 2500               | V          |
| $P_D @ T_C = 25^\circ C$  | Maximum Power Dissipation                            | 630                | W          |
| $P_D @ T_C = 100^\circ C$ | Maximum Power Dissipation                            | 250                |            |
| $T_J$                     | Operating Junction                                   | -55 to + 150       | $^\circ C$ |
| $T_{STG}$                 | 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                    | —    | 0.20 | $^\circ C/W$ |
| $R_{\theta CS}$ | Case-to-Sink, Flat, Greased Surface | 0.05 | —    |              |
| Wt              | Weight of Module                    | 30   | —    | gm           |

# GA200SA60S

International  
IOR Rectifier

## Electrical Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

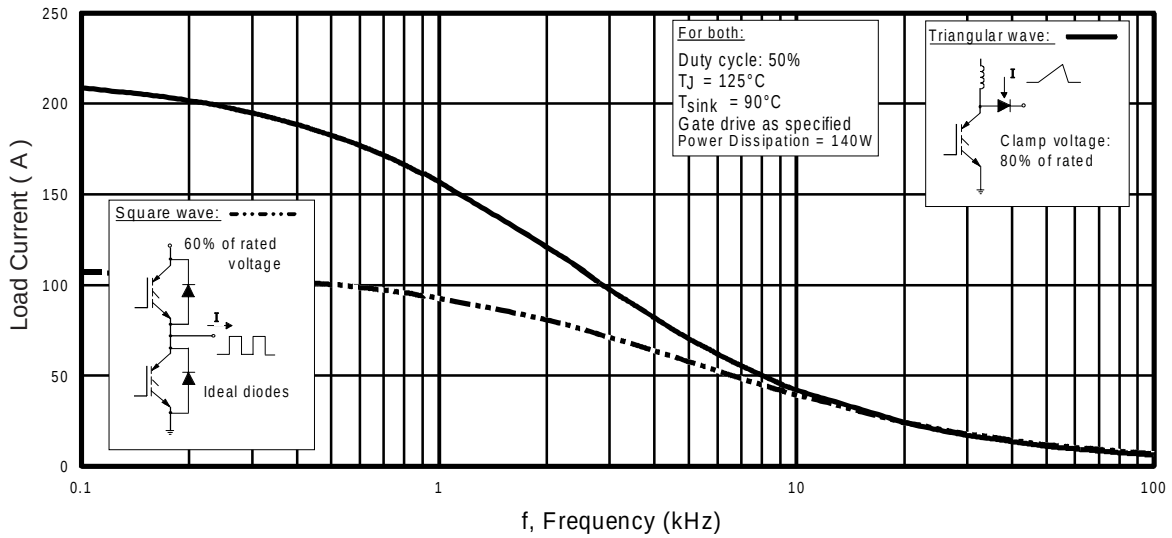
|                                 | Parameter                                | Min. | Typ. | Max.      | Units | Conditions                                           |
|---------------------------------|------------------------------------------|------|------|-----------|-------|------------------------------------------------------|
| $V_{(BR)CES}$                   | Collector-to-Emitter Breakdown Voltage   | 600  | —    | —         | V     | $V_{GE} = 0V, I_C = 250\mu A$                        |
| $V_{(BR)ECS}$                   | Emitter-to-Collector Breakdown Voltage ④ | 18   | —    | —         | V     | $V_{GE} = 0V, I_C = 1.0A$                            |
| $\Delta V_{(BR)CES}/\Delta T_J$ | Temperature Coeff. of Breakdown Voltage  | —    | 0.62 | —         | V/°C  | $V_{GE} = 0V, I_C = 1.0mA$                           |
| $V_{CE(ON)}$                    | Collector-to-Emitter Saturation Voltage  | —    | 1.10 | 1.3       | V     | $I_C = 100A$ $V_{GE} = 15V$                          |
|                                 |                                          | —    | 1.33 | —         |       | $I_C = 200A$ See Fig.2, 5                            |
|                                 |                                          | —    | 1.02 | —         |       | $I_C = 100A, T_J = 150^\circ\text{C}$                |
| $V_{GE(th)}$                    | Gate Threshold Voltage                   | 3.0  | —    | 6.0       |       | $V_{CE} = V_{GE}, I_C = 250\mu A$                    |
| $\Delta V_{GE(th)}/\Delta T_J$  | Temperature Coeff. of Threshold Voltage  | —    | -10  | —         | mV/°C | $V_{CE} = V_{GE}, I_C = 2mA$                         |
| $g_{fe}$                        | Forward Transconductance ⑤               | 90   | 150  | —         | S     | $V_{CE} = 100V, I_C = 100A$                          |
| $I_{CES}$                       | Zero Gate Voltage Collector Current      | —    | —    | 1.0       | mA    | $V_{GE} = 0V, V_{CE} = 600V$                         |
|                                 |                                          | —    | —    | 10        |       | $V_{GE} = 0V, V_{CE} = 10V, T_J = 150^\circ\text{C}$ |
| $I_{GES}$                       | Gate-to-Emitter Leakage Current          | —    | —    | $\pm 250$ | nA    | $V_{GE} = \pm 20V$                                   |

## Switching Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

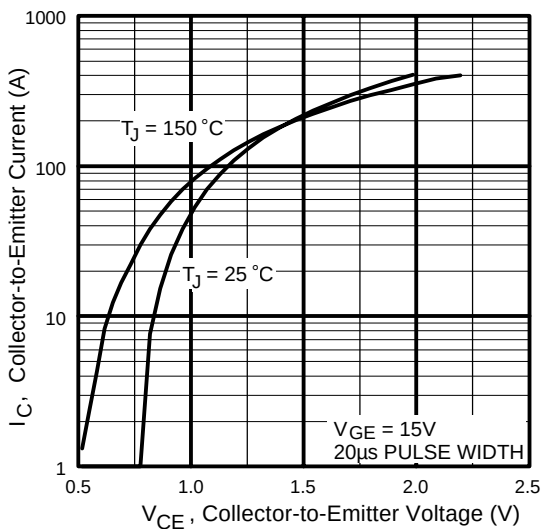
|              | Parameter                         | Min. | Typ.  | Max. | Units | Conditions                                                                                                                                          |
|--------------|-----------------------------------|------|-------|------|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| $Q_g$        | 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                | —    | 78    | —    | ns    | $T_J = 25^\circ\text{C}$<br>$I_C = 100A, V_{CC} = 480V$<br>$V_{GE} = 15V, R_G = 2.0\Omega$<br>Energy losses include "tail"<br>See Fig. 9, 10, 13    |
| $t_r$        | Rise Time                         | —    | 56    | —    |       |                                                                                                                                                     |
| $t_{d(off)}$ | Turn-Off Delay Time               | —    | 890   | 1300 |       |                                                                                                                                                     |
| $t_f$        | Fall Time                         | —    | 390   | 580  |       |                                                                                                                                                     |
| $E_{on}$     | Turn-On Switching Loss            | —    | 0.98  | —    | mJ    | See Fig. 10,11, 13                                                                                                                                  |
| $E_{off}$    | Turn-Off Switching Loss           | —    | 17.4  | —    |       |                                                                                                                                                     |
| $E_{ts}$     | Total Switching Loss              | —    | 18.4  | 25.5 |       |                                                                                                                                                     |
| $t_{d(on)}$  | Turn-On Delay Time                | —    | 72    | —    | ns    | $T_J = 150^\circ\text{C}$ ,<br>$I_C = 100A, V_{CC} = 480V$<br>$V_{GE} = 15V, R_G = 2.0\Omega$<br>Energy losses include "tail"<br>See Fig. 10,11, 13 |
| $t_r$        | Rise Time                         | —    | 60    | —    |       |                                                                                                                                                     |
| $t_{d(off)}$ | Turn-Off Delay Time               | —    | 1500  | —    |       |                                                                                                                                                     |
| $t_f$        | Fall Time                         | —    | 660   | —    |       |                                                                                                                                                     |
| $E_{ts}$     | Total Switching Loss              | —    | 35.7  | —    | mJ    |                                                                                                                                                     |
| $L_E$        | Internal Emitter Inductance       | —    | 5.0   | —    | nH    | Between lead,<br>and center of the die contact                                                                                                      |
| $C_{ies}$    | Input Capacitance                 | —    | 16250 | —    | pF    | $V_{GE} = 0V$                                                                                                                                       |
| $C_{oes}$    | Output Capacitance                | —    | 1040  | —    |       | $V_{CC} = 30V$ See Fig. 7                                                                                                                           |
| $C_{res}$    | Reverse Transfer Capacitance      | —    | 190   | —    |       | $f = 1.0MHz$                                                                                                                                        |

### Notes:

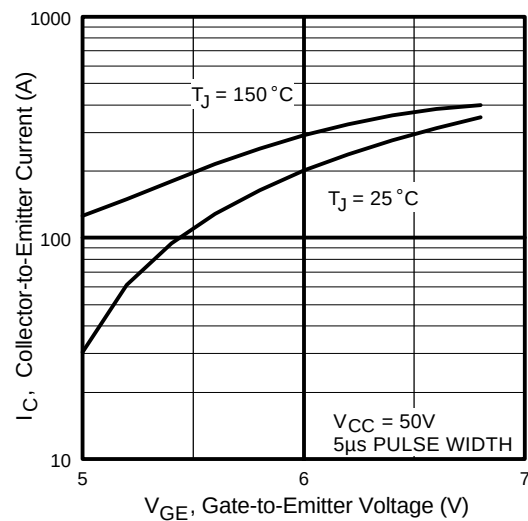
- ① Repetitive rating;  $V_{GE} = 20V$ , pulse width limited by max. junction temperature. ( See fig. 15 )
- ②  $V_{CC} = 80\%(V_{CES})$ ,  $V_{GE} = 20V$ ,  $L = 10\mu H$ ,  $R_G = 2.0\Omega$ , (See fig. 14)
- ③ Repetitive rating; pulse width limited by maximum junction temperature.
- ④ Pulse width  $\leq 80\mu s$ ; duty factor  $\leq 0.1\%$ .
- ⑤ Pulse width  $5.0\mu s$ , single shot.



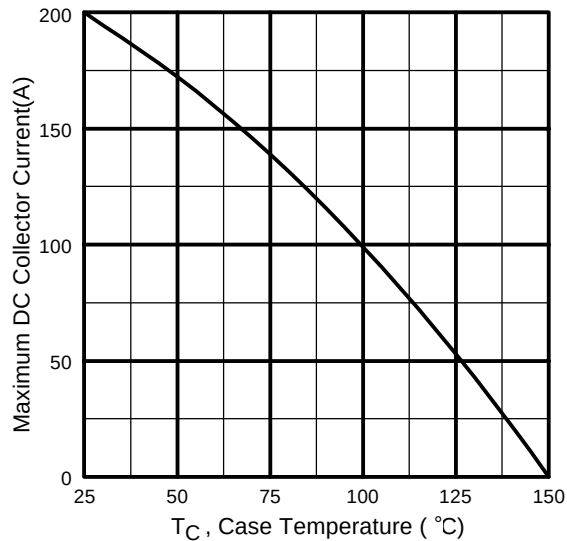
**Fig. 1** - Typical Load Current vs. Frequency  
 (Load Current =  $I_{\text{RMS}}$  of fundamental)



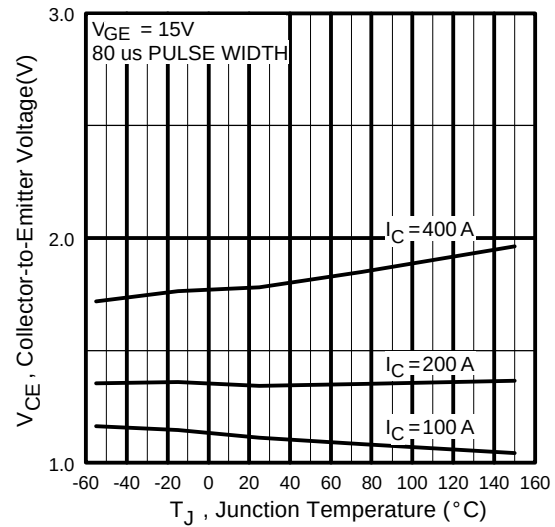
**Fig. 2** - Typical Output Characteristics



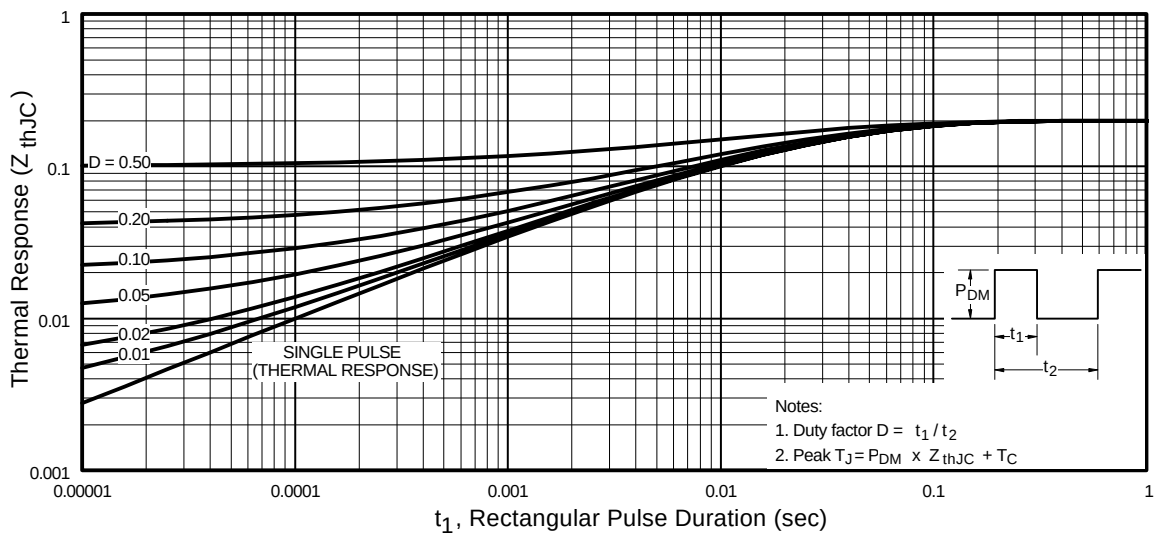
**Fig. 3** - Typical Transfer Characteristics



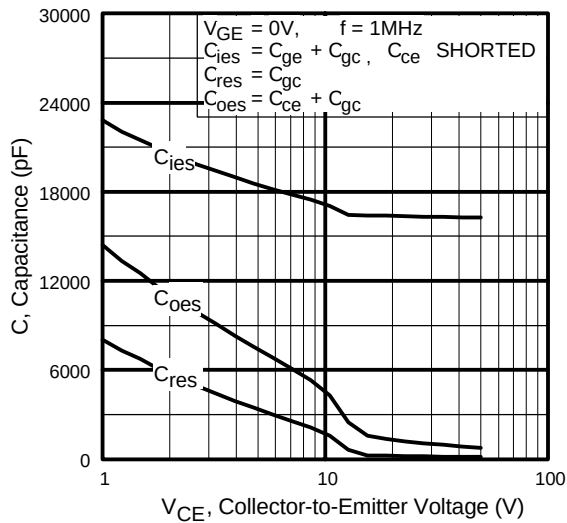
**Fig. 4** - Maximum Collector Current vs. Case Temperature



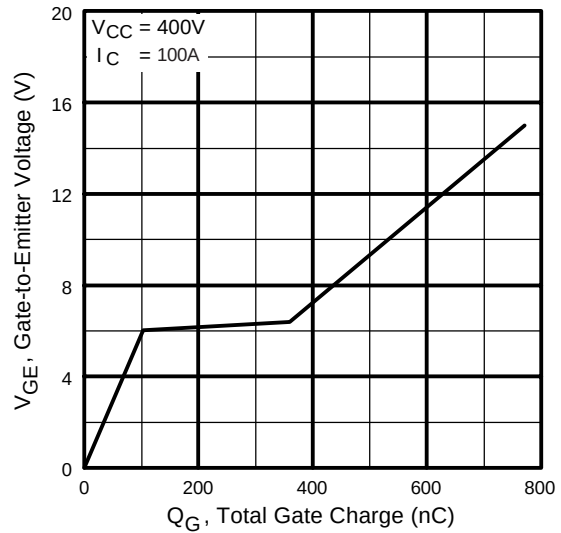
**Fig. 5** - Typical Collector-to-Emitter Voltage vs. Junction Temperature



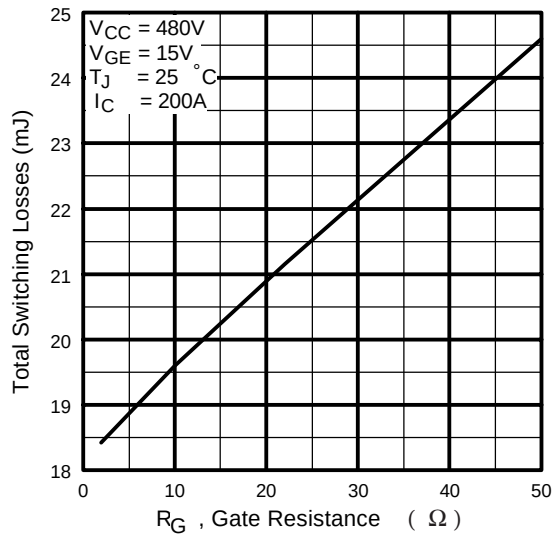
**Fig. 6** - Maximum Effective Transient Thermal Impedance, Junction-to-Case



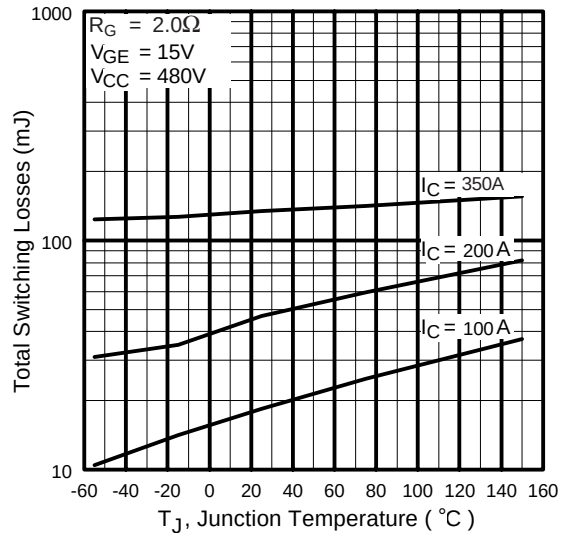
**Fig. 7** - Typical Capacitance vs.  
Collector-to-Emitter Voltage



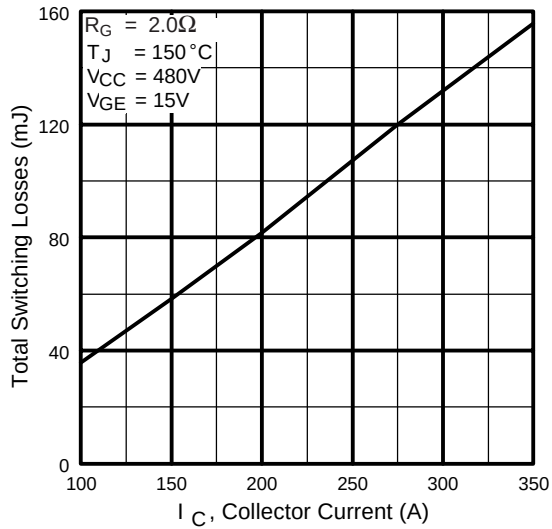
**Fig. 8** - Typical Gate Charge vs.  
Gate-to-Emitter Voltage



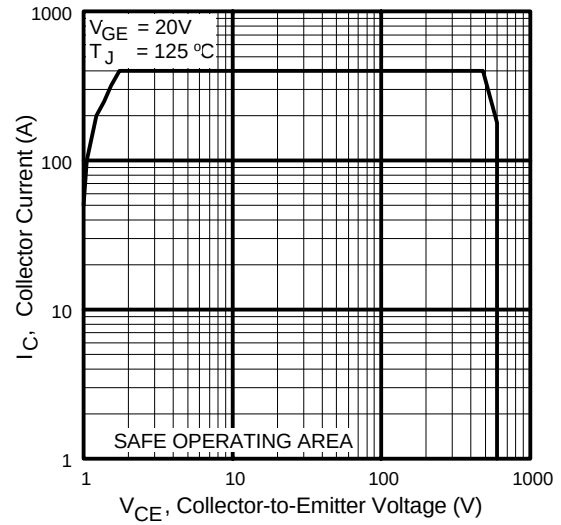
**Fig. 9** - Typical Switching Losses vs. Gate  
Resistance



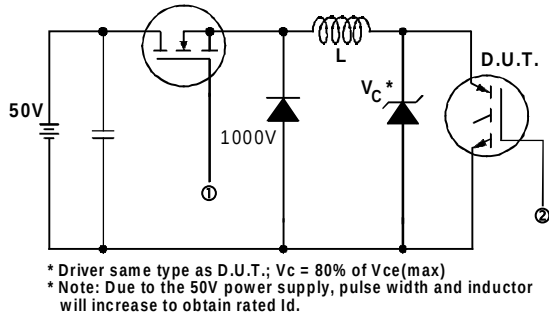
**Fig. 10** - Typical Switching Losses vs.  
Junction Temperature



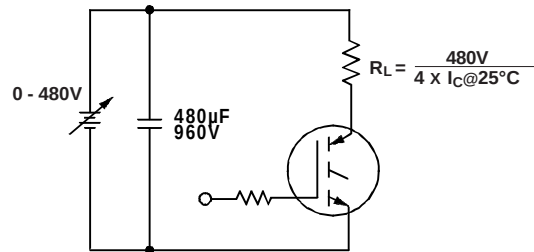
**Fig. 11** - Typical Switching Losses vs. Collector Current



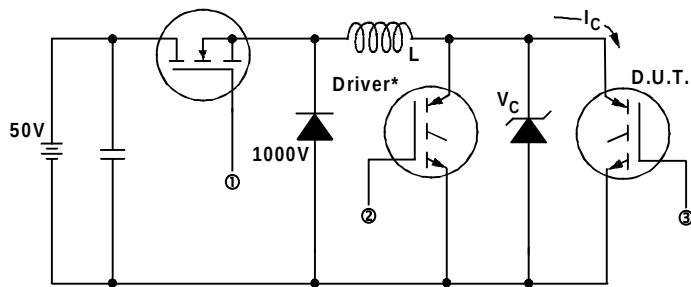
**Fig. 12** - Turn-Off SOA



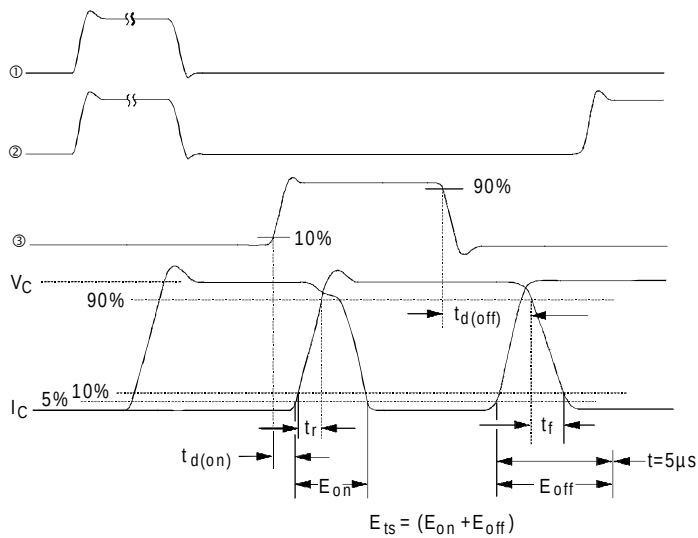
**Fig. 13a** - Clamped Inductive Load Test Circuit



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



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



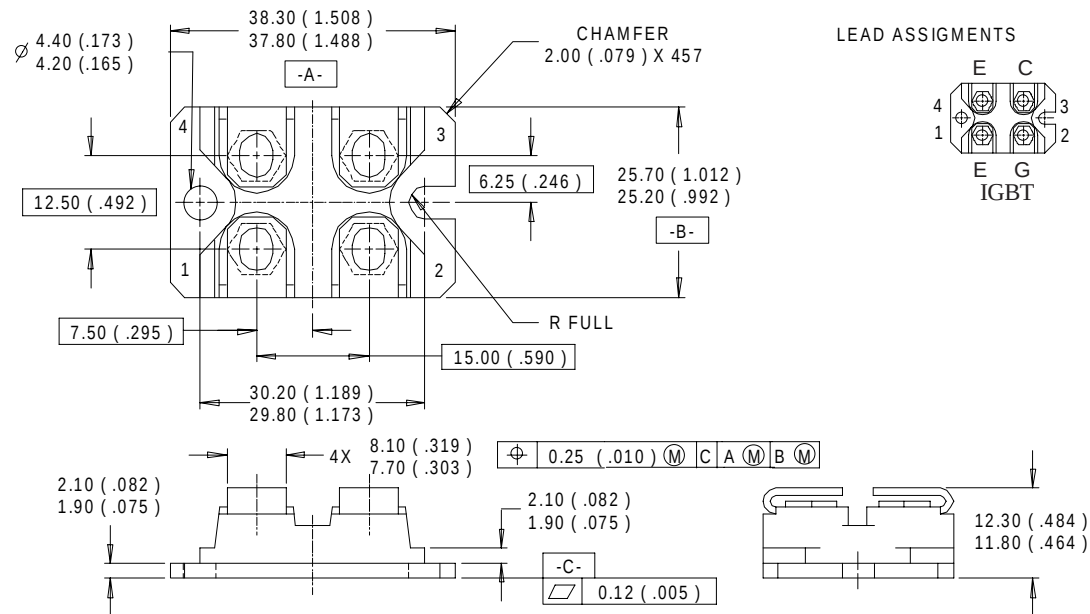
**Fig. 14b** - Switching Loss Waveforms

# GA200SA60S

International  
**IR** Rectifier

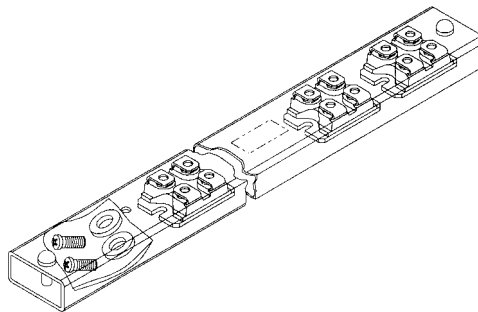
## SOT-227 Package Details

Dimensions are shown in millimeters ( inches )



## Tube

QUANTITIES PER TUBE IS 10  
M4 SREW AND WASHER INCLUDED



...International  
**IR** Rectifier

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**IR ITALY:** Via Liguria 49, 10071 Borgaro, Torino Tel: ++ 39 11 451 0111

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1/98