

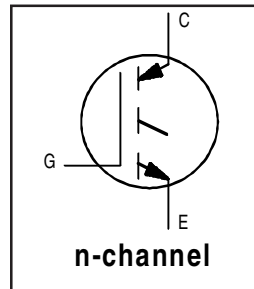
# GA200SA60S

INSULATED GATE BIPOLAR TRANSISTOR

Standard Speed IGBT

## Features

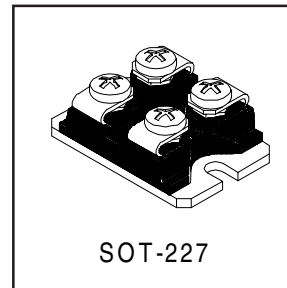
- Standard : Optimized for minimum saturation voltage and low operating frequencies up to 1kHz
- Lowest conduction losses available
- Fully isolated package ( 2,500 volt AC)
- Very low internal inductance ( 5 nH typ.)
- Industry standard outline



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

## 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

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

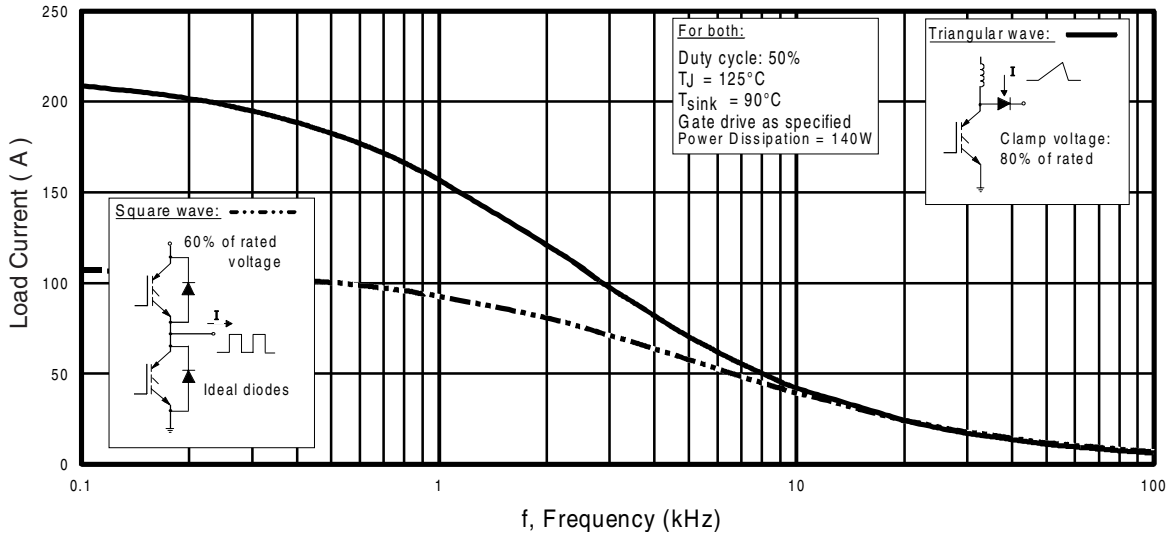
	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage	600	—	—	V	$V_{GE} = 0V, I_C = 250\mu A$
$V_{(BR)ECS}$	Emitter-to-Collector Breakdown Voltage ④	18	—	—	V	$V_{GE} = 0V, I_C = 1.0A$
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	0.62	—	V/°C	$V_{GE} = 0V, I_C = 1.0mA$
$V_{CE(ON)}$	Collector-to-Emitter Saturation Voltage	—	1.10	1.3	V	$I_C = 100A$ $I_C = 200A$ $I_C = 100A, T_J = 150^\circ\text{C}$ $V_{GE} = 15V$ See Fig.2, 5
		—	1.33	—		
		—	1.02	—		
$V_{GE(th)}$	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	$V_{CE} = V_{GE}, I_C = 2\text{ mA}$
$g_{fe}$	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)

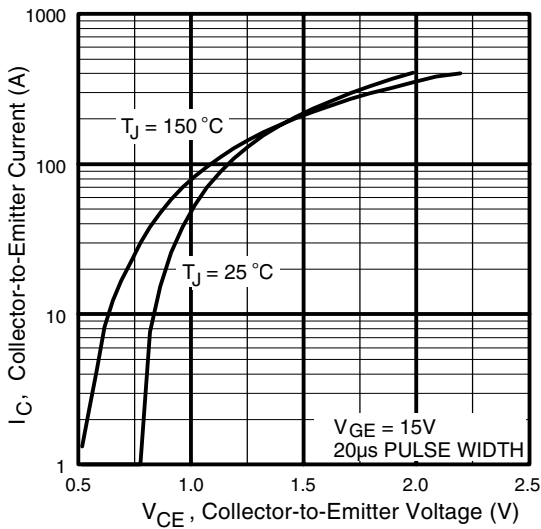
	Parameter	Min.	Typ.	Max.	Units	Conditions
$Q_g$	Total Gate Charge (turn-on)	—	770	1200	nC	$I_C = 100A$ $V_{CC} = 400V$ $V_{GE} = 15V$ See Fig. 8
$Q_{ge}$	Gate - Emitter Charge (turn-on)	—	100	150		
$Q_{gc}$	Gate - Collector Charge (turn-on)	—	260	380		
$t_{d(on)}$	Turn-On Delay Time	—	78	—	ns	$T_J = 25^\circ\text{C}$ $I_C = 100A, V_{CC} = 480V$ $V_{GE} = 15V, R_G = 2.0\Omega$ Energy losses include "tail" 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. 9, 10, 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	$T_J = 150^\circ\text{C}$ , $I_C = 100A, V_{CC} = 480V$ $V_{GE} = 15V, R_G = 2.0\Omega$ Energy losses include "tail" 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, and center of the die contact
$C_{ies}$	Input Capacitance	—	16250	—	pF	$V_{GE} = 0V$ $V_{CC} = 30V$ $f = 1.0MHz$ See Fig. 7
$C_{oes}$	Output Capacitance	—	1040	—		
$C_{res}$	Reverse Transfer Capacitance	—	190	—		

### Notes:

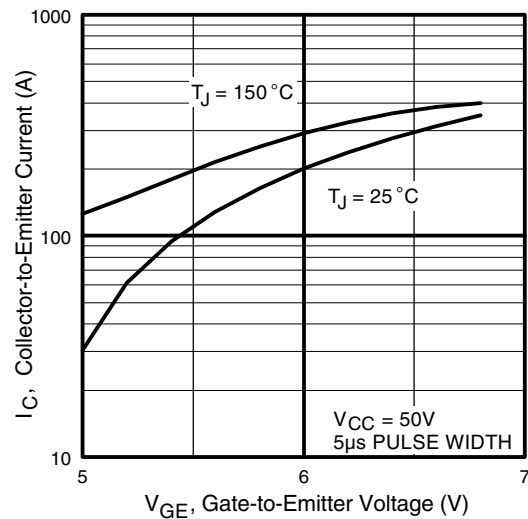
- ① Repetitive rating;  $V_{GE} = 20V$ , pulse width limited by max. junction temperature. ( See fig. 15 )
- ②  $V_{CC} = 80\%(V_{CES})$ ,  $V_{GE} = 20V$ ,  $L = 10\mu H$ ,  $R_G = 2.0\Omega$ , (See fig. 14)
- ③ Repetitive rating; pulse width limited by maximum junction temperature.
- ④ Pulse width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



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

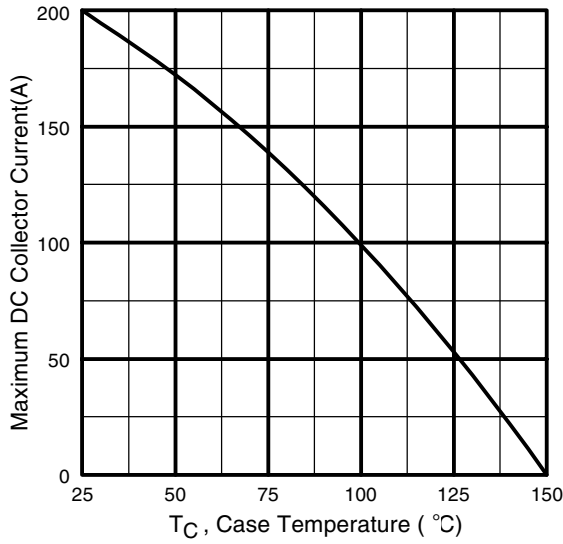


**Fig. 2 - Typical Output Characteristics**

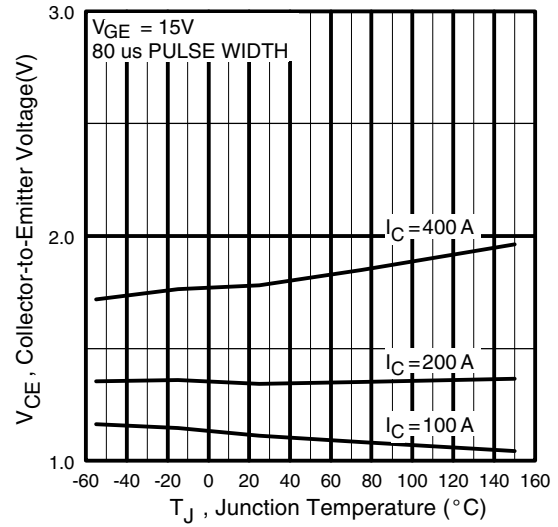


**Fig. 3 - Typical Transfer Characteristics**

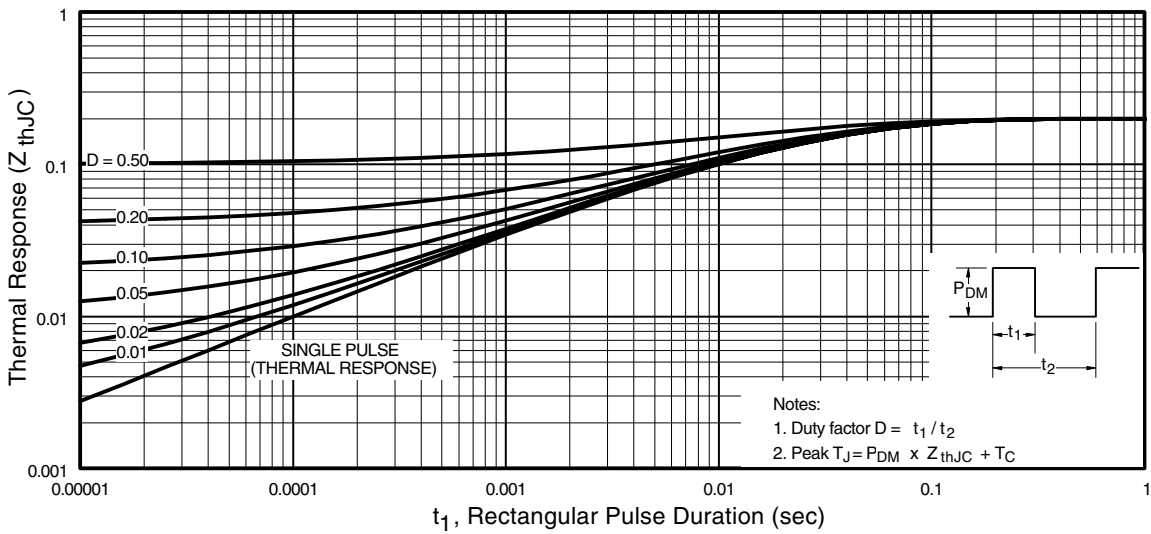
# GA200SA60S



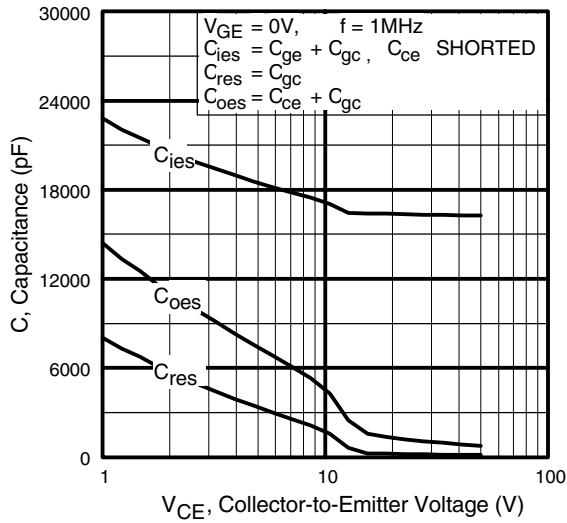
**Fig. 4** - Maximum Collector Current vs. Case Temperature



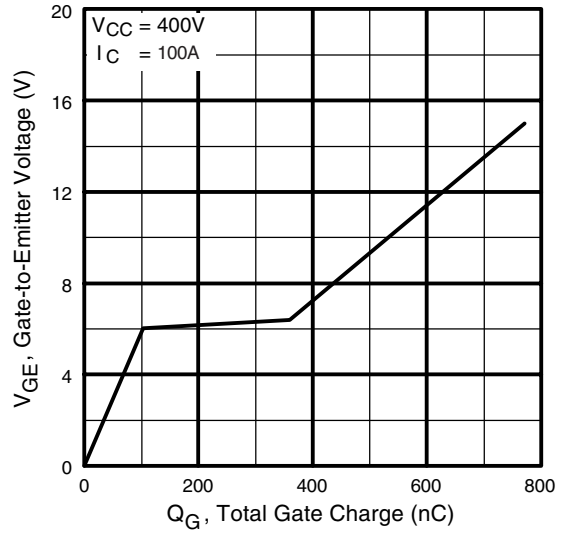
**Fig. 5** - Typical Collector-to-Emitter Voltage vs. Junction Temperature



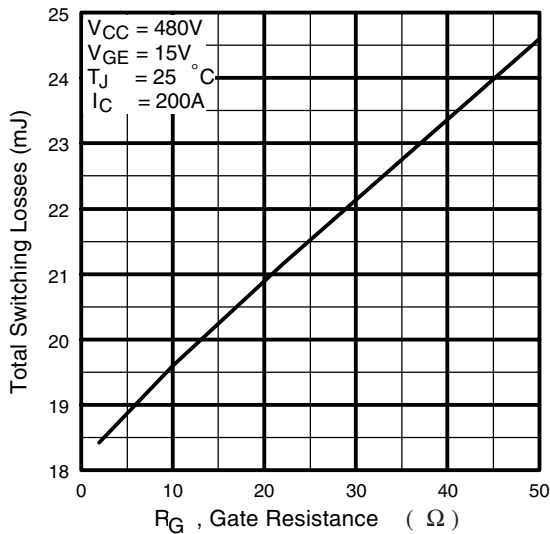
**Fig. 6** - Maximum Effective Transient Thermal Impedance, Junction-to-Case



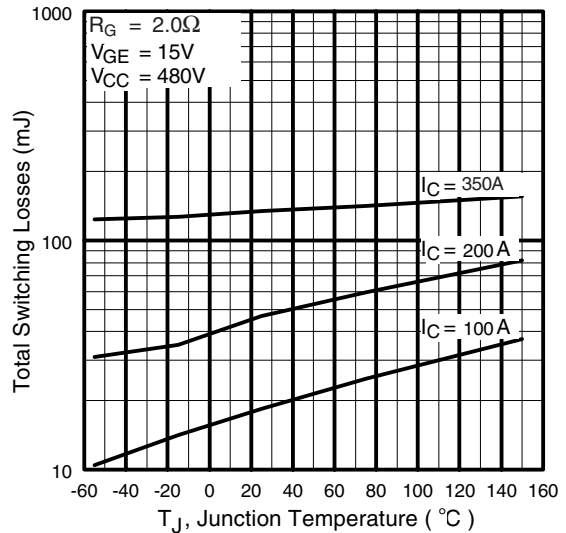
**Fig. 7** - Typical Capacitance vs. Collector-to-Emitter Voltage



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

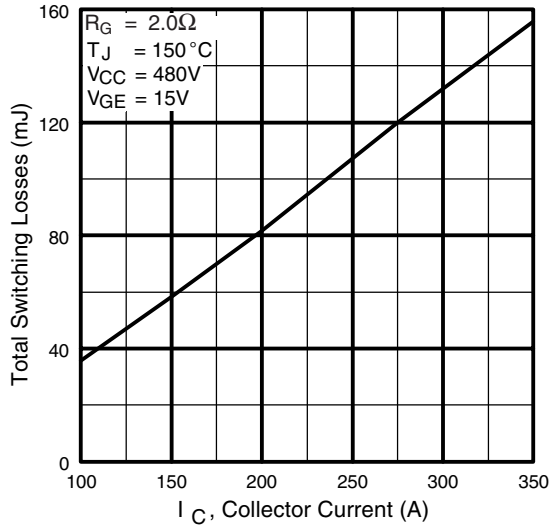


**Fig. 9** - Typical Switching Losses vs. Gate Resistance

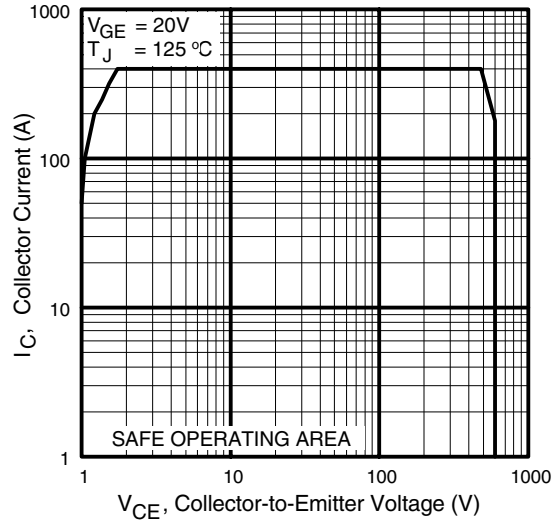


**Fig. 10** - Typical Switching Losses vs. Junction Temperature

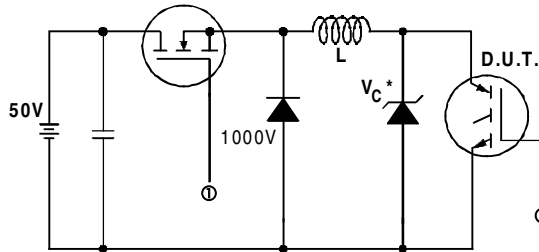
# GA200SA60S



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

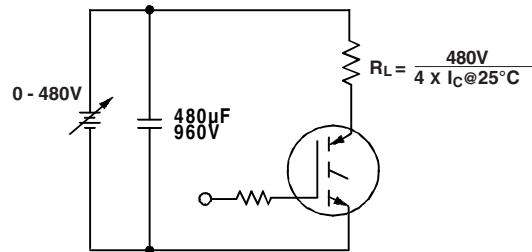


**Fig. 12** - Turn-Off SOA

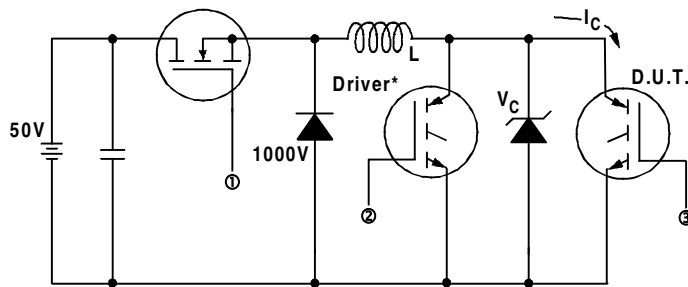


\* Driver same type as D.U.T.;  $V_c = 80\%$  of  $V_{ce(max)}$   
 \* Note: Due to the 50V power supply, pulse width and inductor will increase to obtain rated  $I_d$ .

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

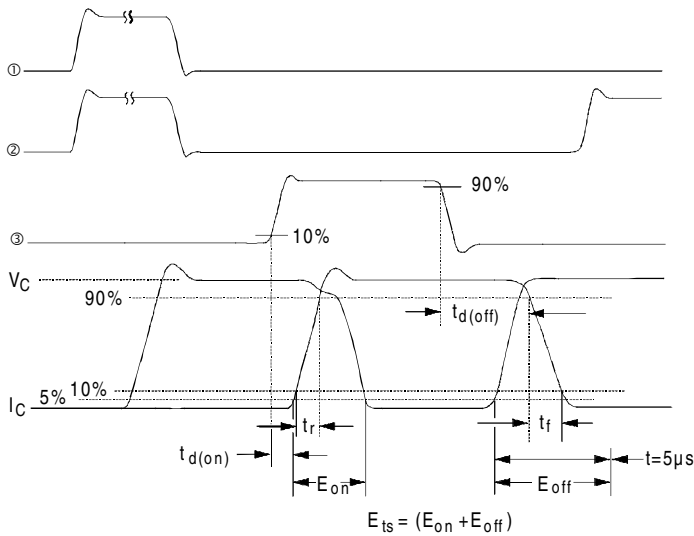


**Fig. 13b** - Pulsed Collector Current Test Circuit



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

\* Driver same type as D.U.T.,  $V_C = 480V$



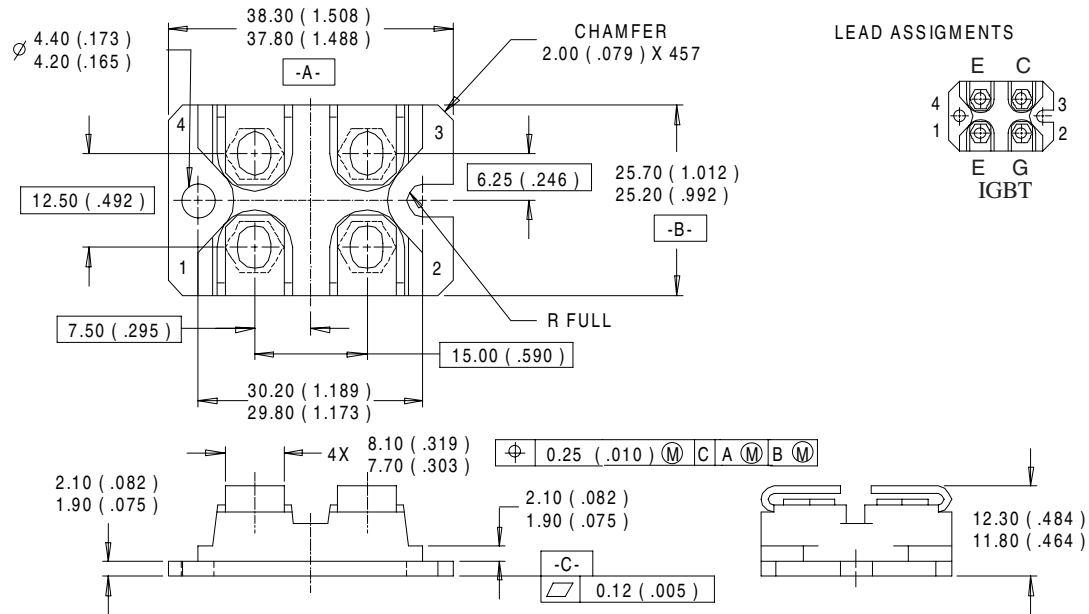
**Fig. 14b** - Switching Loss Waveforms

# GA200SA60S

International  
**IR** Rectifier

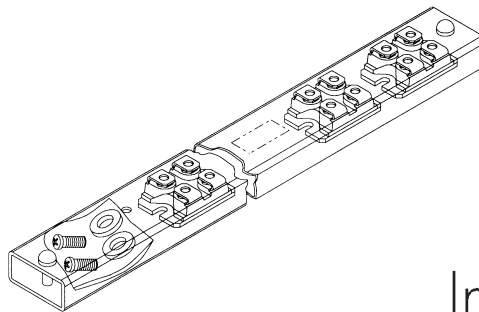
## SOT-227 Package Details

Dimensions are shown in millimeters ( inches )



## Tube

QUANTITIES PER TUBE IS 10  
M4 SREW AND WASHER INCLUDED



International  
**IR** Rectifier

**IR WORLD HEADQUARTERS:** 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105  
**IR EUROPEAN REGIONAL CENTRE:** 439/445 Godstone Rd, Whyteleafe, Surrey CR3 OBL, UK Tel: ++ 44 (0)20 8645 8000  
**IR CANADA:** 15 Lincoln Court, Brampton, Ontario L6T3Z2, Tel: (905) 453 2200  
**IR GERMANY:** Saalburgstrasse 157, 61350 Bad Homburg Tel: ++ 49 (0) 6172 96590  
**IR ITALY:** Via Liguria 49, 10071 Borgaro, Torino Tel: ++ 39 011 451 0111  
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