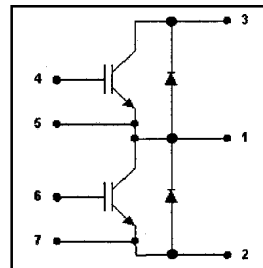


**Features**

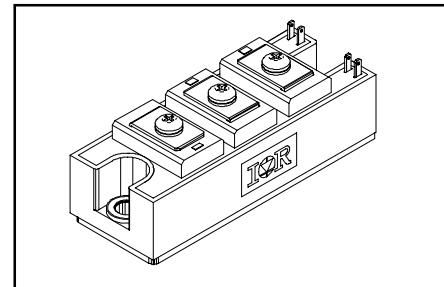
- Generation 4 IGBT technology
- UltraFast: Optimized for high operating frequencies 8-40 kHz in hard switching, >200 kHz in resonant mode
- Very low conduction and switching losses
- HEXFRED™ antiparallel diodes with ultra- soft recovery
- Industry standard package
- UL recognition pending

**Benefits**

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



$V_{CES} = 600V$
$V_{CE(on) \text{ typ.}} = 1.6V$
@ $V_{GE} = 15V, I_C = 100A$



**Absolute Maximum Ratings**

	Parameter	Max.	Units
$V_{CES}$	Collector-to-Emitter Voltage	600	V
$I_C @ T_C = 25^\circ C$	Continuous Collector Current	100	A
$I_{CM}$	Pulsed Collector Current*	200	
$I_{LM}$	Peak Switching Current,	200	
$I_{FM}$	Peak Diode Forward Current	200	
$V_{GE}$	Gate-to-Emitter Voltage	$\pm 20$	V
$V_{ISOL}$	RMS Isolation Voltage, Any Terminal To Case, $t = 1 \text{ min}$	2500	
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	320	W
$P_D @ T_C = 85^\circ C$	Maximum Power Dissipation	170	
$T_J$	Operating Junction Temperature Range	-40 to +150	$^\circ C$
$T_{STG}$	Storage Temperature Range	-40 to +125	

**Thermal / Mechanical Characteristics**

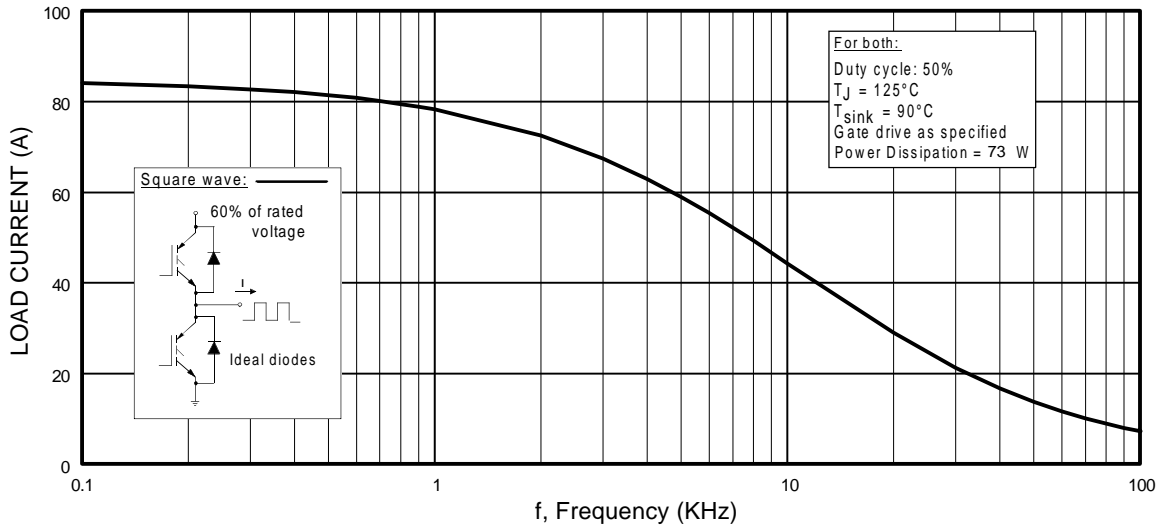
	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case - IGBT	—	0.38	$^\circ C/W$
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case - Diode	—	0.70	
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink - Module	0.1	—	N·m
	Mounting Torque, Case-to-Heatsink	—	4.0	
	Mounting Torque, Case-to-Terminal 1, 2 & 3③	—	3.0	
	Weight of Module	200	—	g

**Electrical Characteristics @ T<sub>J</sub> = 25°C (unless otherwise specified)**

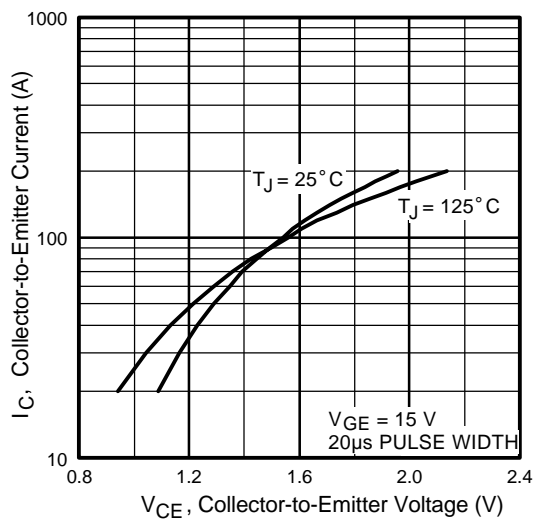
	Parameter	Min.	Typ.	Max.	Units	Conditions
V <sub>(BR)CES</sub>	Collector-to-Emitter Breakdown Voltage	600	—	—	V	V <sub>GE</sub> = 0V, I <sub>C</sub> = 1mA
V <sub>CE(on)</sub>	Collector-to-Emitter Voltage	—	1.6	2.1		V <sub>GE</sub> = 15V, I <sub>C</sub> = 100A
		—	1.6	—		V <sub>GE</sub> = 15V, I <sub>C</sub> = 100A, T <sub>J</sub> = 125°C
V <sub>GE(th)</sub>	Gate Threshold Voltage	3.0	—	6.0		I <sub>C</sub> = 500μA
ΔV <sub>GE(th)/ΔT<sub>J</sub></sub>	Temperature Coeff. of Threshold Voltage	—	-11	—	mV/°C	V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 500μA
g <sub>fe</sub>	Forward Transconductance „	—	107	—	S	V <sub>CE</sub> = 25V, I <sub>C</sub> = 100A
I <sub>CES</sub>	Collector-to-Emitter Leaking Current	—	—	1.0	mA	V <sub>GE</sub> = 0V, V <sub>CE</sub> = 600V
		—	—	10		V <sub>GE</sub> = 0V, V <sub>CE</sub> = 600V, T <sub>J</sub> = 125°C
V <sub>FM</sub>	Diode Forward Voltage - Maximum	—	3.6	—	V	I <sub>F</sub> = 100A, V <sub>GE</sub> = 0V
		—	3.5	—		I <sub>F</sub> = 100A, V <sub>GE</sub> = 0V, T <sub>J</sub> = 125°C
I <sub>GES</sub>	Gate-to-Emitter Leakage Current	—	—	100	nA	V <sub>GE</sub> = ±20V

**Dynamic Characteristics - T<sub>J</sub> = 125°C (unless otherwise specified)**

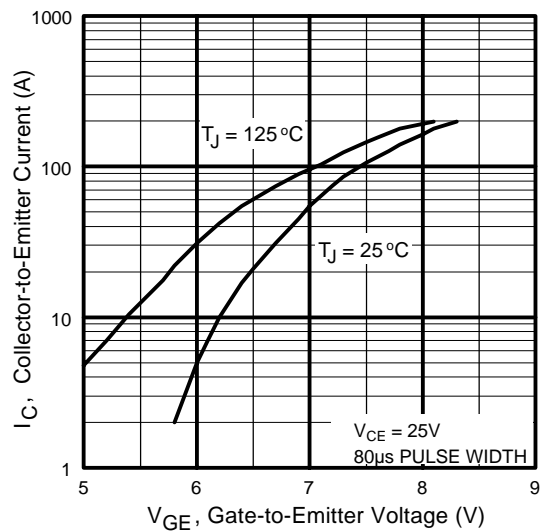
	Parameter	Min.	Typ.	Max.	Units	Conditions
Q <sub>g</sub>	Total Gate Charge (turn-on)	—	443	664	nC	V <sub>CC</sub> = 400V
Q <sub>ge</sub>	Gate - Emitter Charge (turn-on)	—	86	129		I <sub>C</sub> = 66A
Q <sub>gc</sub>	Gate - Collector Charge (turn-on)	—	150	225		T <sub>J</sub> = 25°C
t <sub>d(on)</sub>	Turn-On Delay Time	—	168	—	ns	R <sub>G1</sub> = 27Ω, R <sub>G2</sub> = 0Ω
t <sub>r</sub>	Rise Time	—	145	—		I <sub>C</sub> = 100A
t <sub>d(off)</sub>	Turn-Off Delay Time	—	320	—		V <sub>CC</sub> = 360V
t <sub>f</sub>	Fall Time	—	242	—		V <sub>GE</sub> = ±15V
E <sub>on</sub>	Turn-On Switching Energy	—	4.0	—	mJ	
E <sub>off (1)</sub>	Turn-Off Switching Energy	—	7.0	—		
E <sub>ts (1)</sub>	Total Switching Energy	—	11	17		
C <sub>ies</sub>	Input Capacitance	—	9837	—	pF	V <sub>GE</sub> = 0V
C <sub>oes</sub>	Output Capacitance	—	615	—		V <sub>CC</sub> = 30V
C <sub>res</sub>	Reverse Transfer Capacitance	—	128	—		f = 1 MHz
t <sub>rr</sub>	Diode Reverse Recovery Time	—	143	—	ns	I <sub>C</sub> = 100A
I <sub>rr</sub>	Diode Peak Reverse Current	—	95	—		A
Q <sub>rr</sub>	Diode Recovery Charge	—	6813	—	nC	R <sub>G2</sub> = 0Ω
di <sub>(rec)</sub> M <sub>/dt</sub>	Diode Peak Rate of Fall of Recovery During t <sub>b</sub>	—	1883	—		A/μs



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

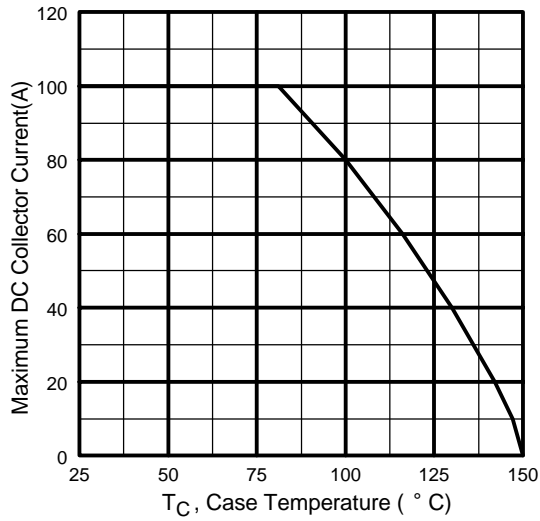


**Fig. 2** - Typical Output Characteristics

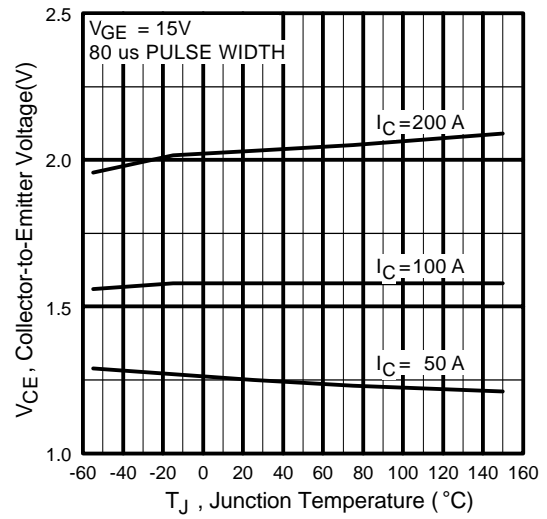


**Fig. 3** - Typical Transfer Characteristics

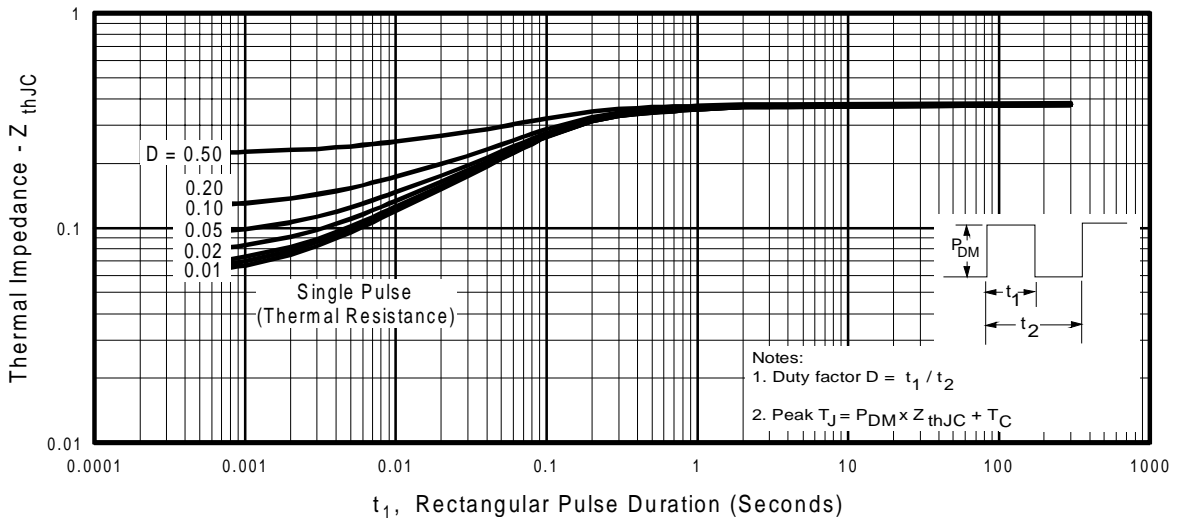
# GA100TS60U



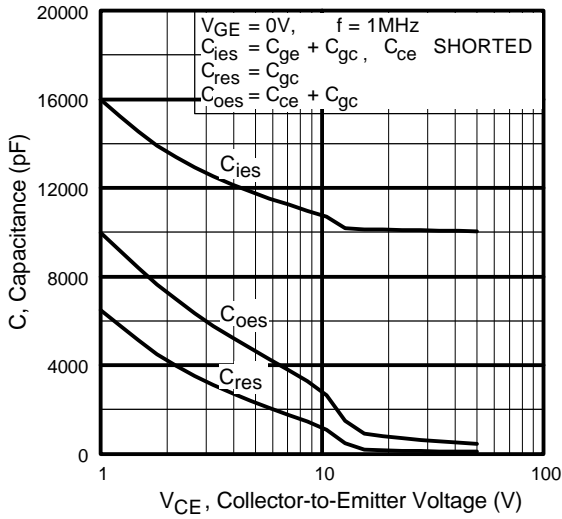
**Fig. 4** - Maximum Collector Current vs. Case Temperature



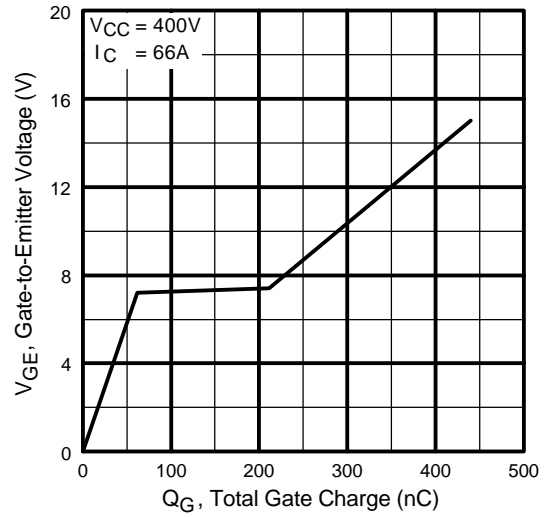
**Fig. 5** - Typical Collector-to-Emitter Voltage vs. Junction Temperature



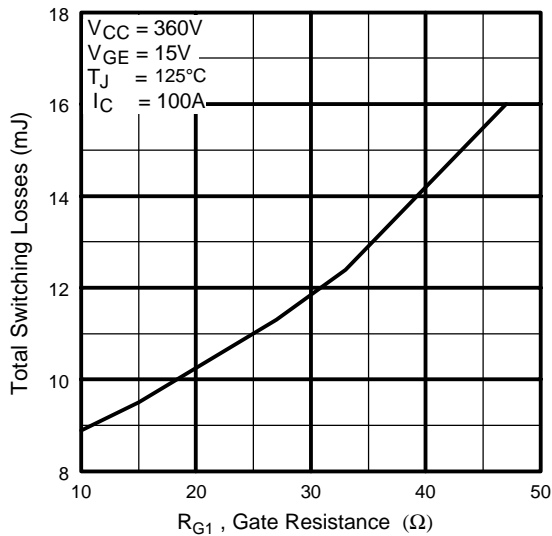
**Fig. 6** - Maximum Effective Transient Thermal Impedance, Junction-to-Case



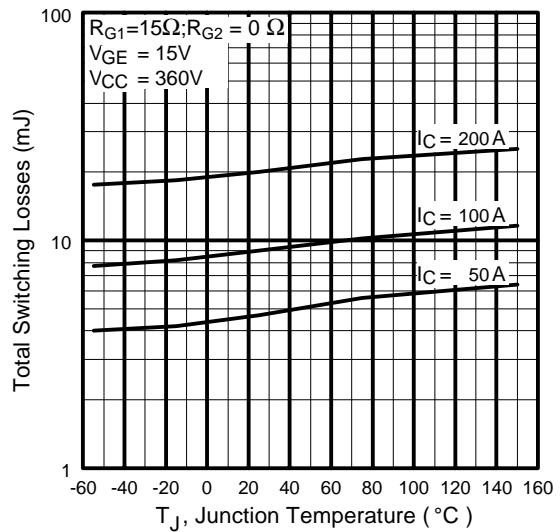
**Fig. 7** - Typical Capacitance vs. Collector-to-Emitter Voltage



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

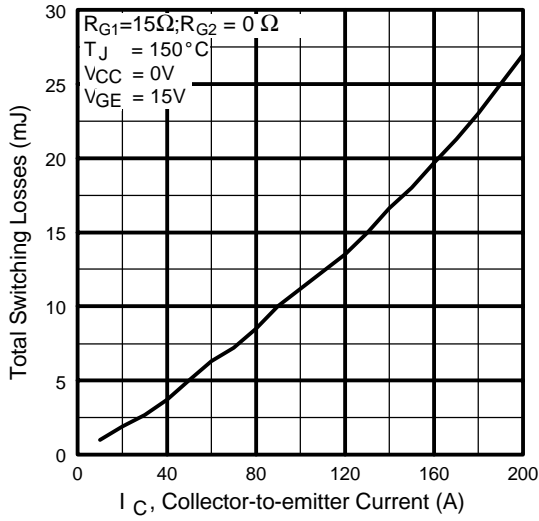


**Fig. 9** - Typical Switching Losses vs. Gate Resistance

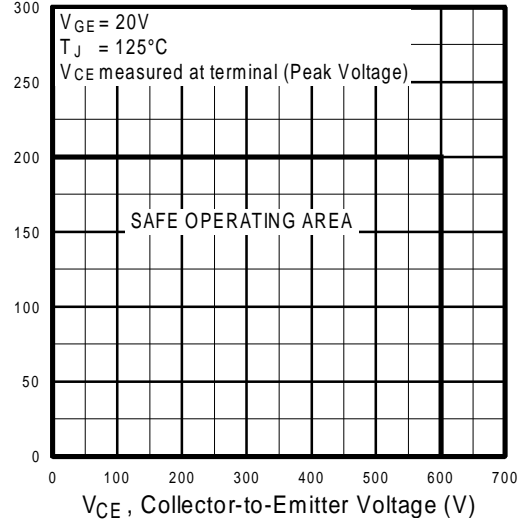


**Fig. 10** - Typical Switching Losses vs. Junction Temperature

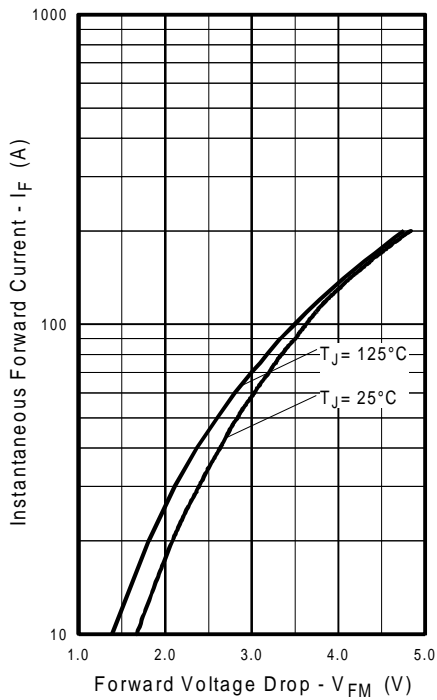
# GA100TS60U



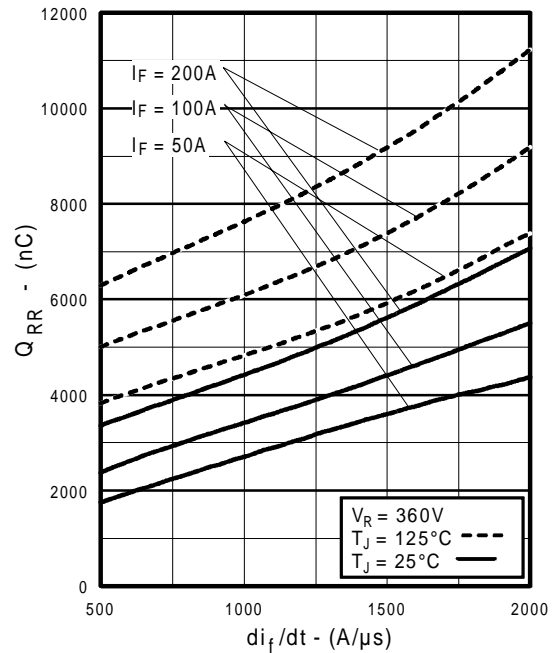
**Fig. 11** - Typical Switching Losses vs. Collector-to-Emitter Current



**Fig. 12** - Reverse Bias SOA



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



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

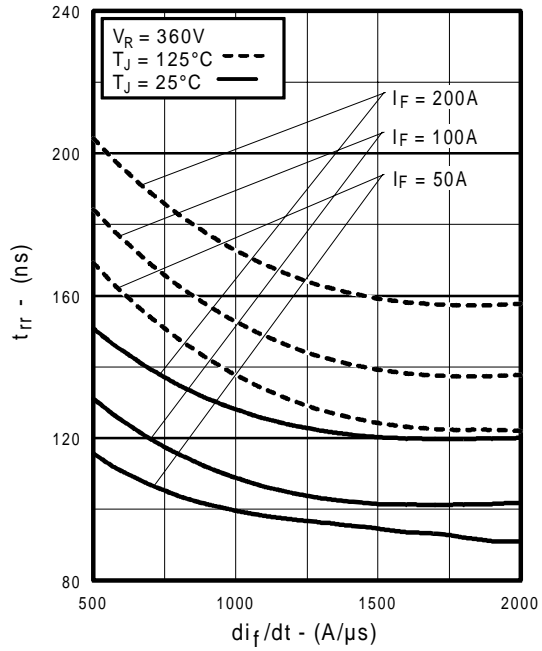


Fig. 15 - Typical Reverse Recovery vs.  $dI_f/dt$

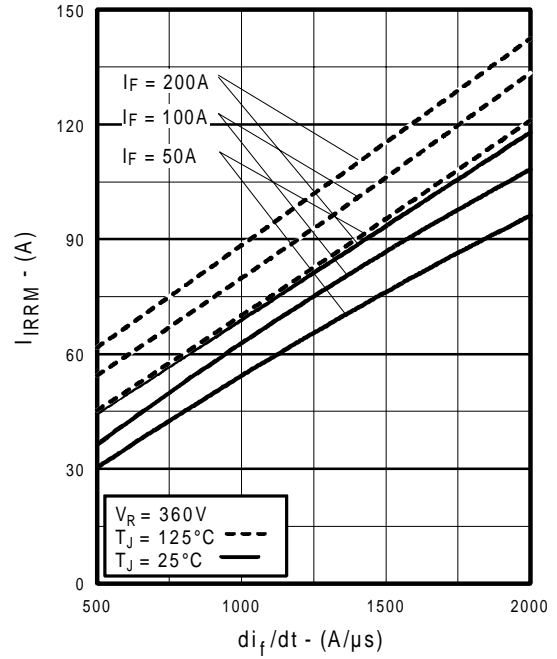
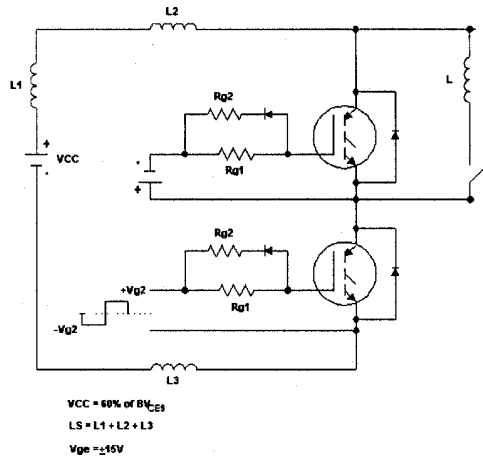
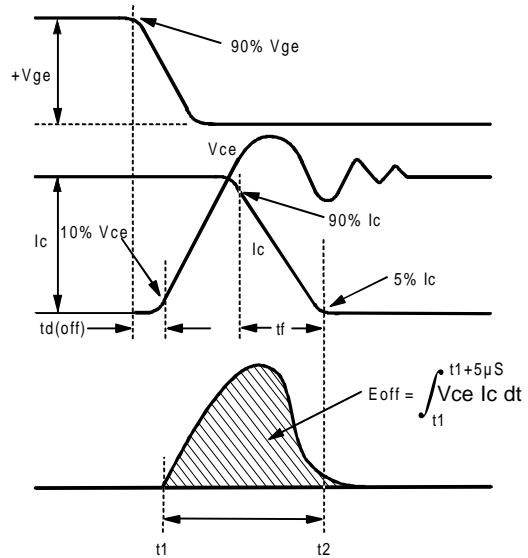


Fig. 16 - Typical Recovery Current vs.  $dI_f/dt$

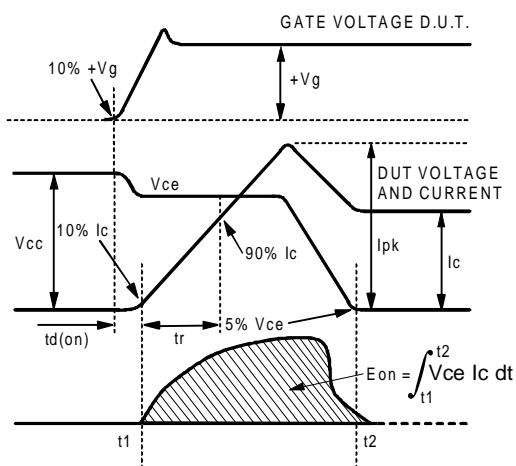
# GA100TS60U



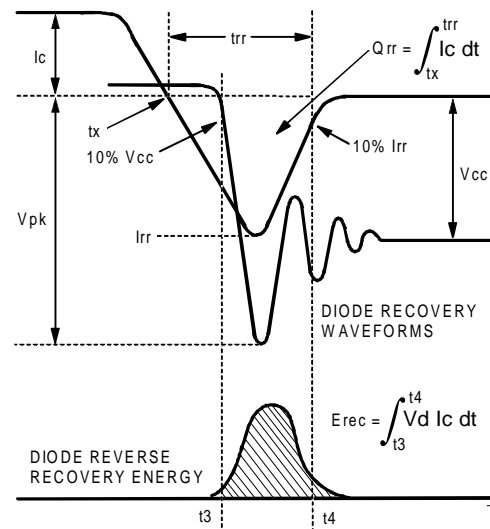
**Fig. 17** - Test Circuit for Measurement of  $I_{LM}$ ,  $E_{on}$ ,  $E_{off}(\text{diode})$ ,  $t_{rr}$ ,  $Q_{rr}$ ,  $I_{rr}$ ,  $t_{d(on)}$ ,  $t_r$ ,  $t_{d(off)}$ ,  $t_f$



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



**Fig. 19** - Test Waveforms for Circuit of Fig. 17, Defining  $E_{on}$ ,  $t_{d(on)}$ ,  $t_r$



**Fig. 20** - Test Waveforms for Circuit of Fig. 17, Defining  $E_{rec}$ ,  $t_{rr}$ ,  $Q_{rr}$ ,  $I_{rr}$



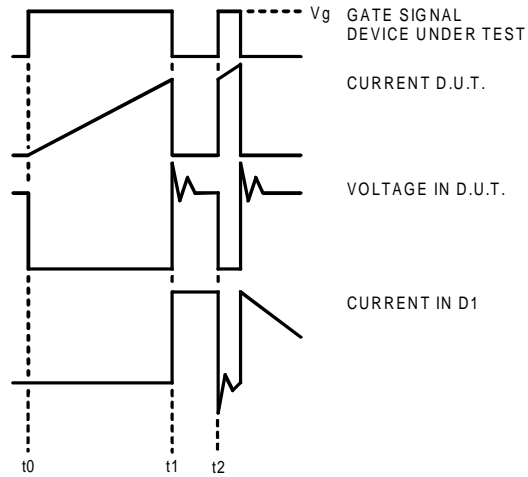


Figure 21. Macro Waveforms for Figure 17's Test Circuit

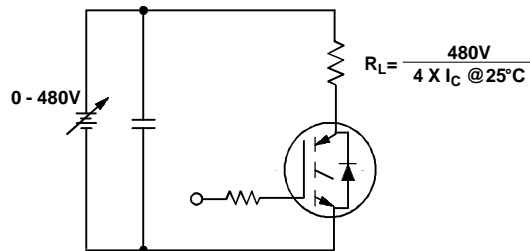


Figure 22. Pulsed Collector Current Test Circuit

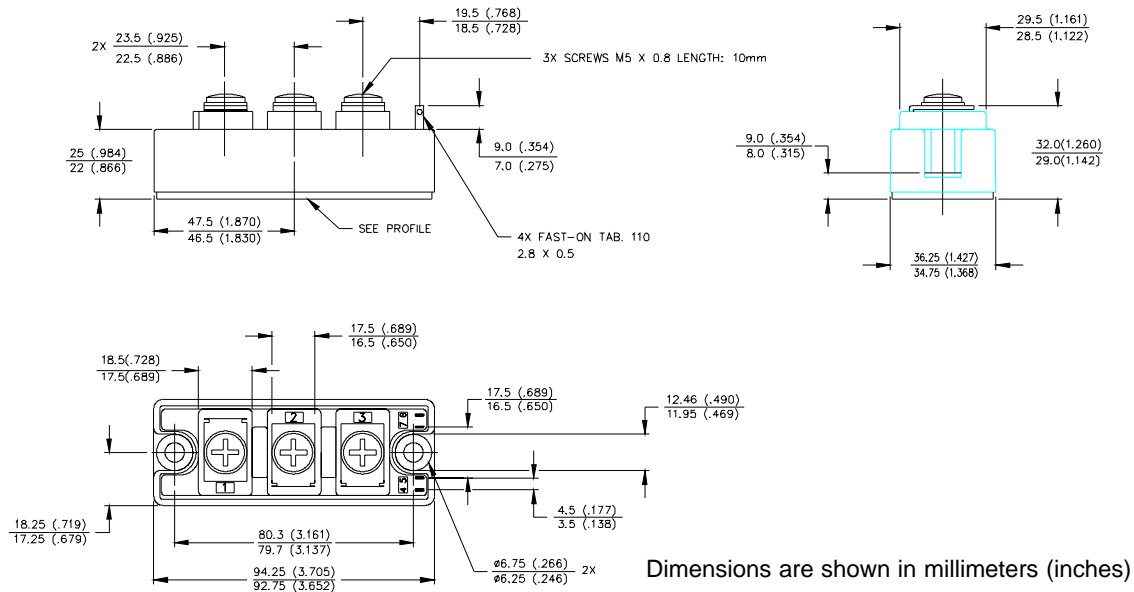
# GA100TS60U

International  
**IR** Rectifier

## Notes:

- ① Repetitive rating;  $V_{GE} = 20V$ , pulse width limited by max. junction temperature.
- ② See fig. 17
- ③ For screws M5x0.8
- ④ Pulse width 80 $\mu$ s; single shot.

## Case Outline — INT-A-PAK



Dimensions are shown in millimeters (inches)

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  
**IR JAPAN:** K&H Bldg., 2F, 30-4 Nishi-Ikebukuro 3-Chome, Toshima-Ku, Tokyo 171 Tel: 81 (0)3 3983 0086  
**IR SOUTHEAST ASIA:** 1 Kim Seng Promenade, Great World City West Tower, 13-11, Singapore 237994 Tel: ++ 65 (0)838 4630  
**IR TAIWAN:** 16 Fl. Suite D. 207, Sec. 2, Tun Haw South Road, Taipei, 10673 Tel: 886-(0)2 2377 9936

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