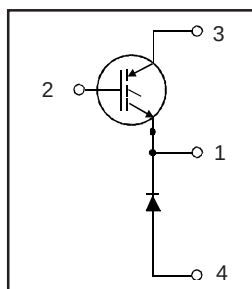


Features

- 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 isolated package (2,500 Volt AC/RMS)
- Very low internal inductance (≤ 5 nH typ.)
- Industry standard outline



$V_{CES} = 600V$
$V_{CE(on)} \text{ typ.} = 1.49V$
@ $V_{GE} = 15V, I_C = 50A$

Benefits

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



Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Breakdown Voltage	600	V
$I_C @ T_C = 25^\circ\text{C}$	Continuous Collector Current	100	A
$I_C @ T_C = 100^\circ\text{C}$	Continuous Collector Current	50	
I_{CM}	Pulsed Collector Current	200	
I_{LM}	Clamped Inductive Load Current②	200	
V_{GE}	Gate-to-Emitter Voltage	± 20	V
V_{ISOL}	RMS Isolation Voltage, Any Terminal to Case, $t=1$ min	2500	
$P_D @ T_C = 25^\circ\text{C}$	Maximum Power Dissipation	250	W
$P_D @ T_C = 100^\circ\text{C}$	Maximum Power Dissipation	100	
T_J	Operating Junction	-55 to + 150	$^\circ\text{C}$
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, IGBT	—	0.50	$^\circ\text{C/W}$
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case , Diode	—	1.0	
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	0.05	—	
Wt	Weight of Module	30	—	gm

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 ^③	600	—	—	V	$V_{GE} = 0V, I_C = 250\mu A$
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	0.36	—	V/ $^\circ\text{C}$	$V_{GE} = 0V, I_C = 1.0mA$
$V_{CE(on)}$	Collector-to-Emitter Saturation Voltage	—	1.49	2.1	V	$I_C = 50A$ $V_{GE} = 15V$
		—	1.80	—		$I_C = 100A$ See Fig. 1, 4
		—	1.47	—		$I_C = 50A, T_J = 150^\circ\text{C}$
$V_{GE(th)}$	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	—	-7.6	—	mV/ $^\circ\text{C}$	$V_{CE} = V_{GE}, I_C = 250\mu A$
g_{fe}	Forward Transconductance ^④	34	52	—	S	$V_{CE} = 100V, I_C = 50A$
I_{CES}	Zero Gate Voltage Collector Current	—	—	250	μA	$V_{GE} = 0V, V_{CE} = 600V$
		—	—	1.3	mA	$V_{GE} = 0V, V_{CE} = 600V, T_J = 150^\circ\text{C}$
V_{FM}	Diode Forward Voltage Drop	—	1.3	1.6	V	$I_C = 50A$ See Fig. 12
		—	1.16	1.3		$I_C = 50A, T_J = 150^\circ\text{C}$
I_{GES}	Gate-to-Emitter Leakage Current	—	—	± 100	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)	—	430	640	nC	$I_C = 50A$ $V_{CC} = 400V$ See Fig. 7 $V_{GE} = 15V$
Q_{ge}	Gate - Emitter Charge (turn-on)	—	48	72		
Q_{gc}	Gate - Collector Charge (turn-on)	—	130	190		
$t_{d(on)}$	Turn-On Delay Time	—	57	—	ns	$T_J = 25^\circ\text{C}$ $I_C = 60A, V_{CC} = 480V$ $V_{GE} = 15V, R_G = 5.0\Omega$ Energy losses include "tail" and diode reverse recovery.
t_r	Rise Time	—	80	—		
$t_{d(off)}$	Turn-Off Delay Time	—	240	—		
t_f	Fall Time	—	120	—		
E_{on}	Turn-On Switching Loss	—	0.41	—	mJ	$T_J = 150^\circ\text{C},$ $I_C = 60A, V_{CC} = 480V$ $V_{GE} = 15V, R_G = 5.0\Omega$ Energy losses include "tail" and diode reverse recovery.
E_{off}	Turn-Off Switching Loss	—	2.51	—		
E_{ts}	Total Switching Loss	—	2.92	4.4		
$t_{d(on)}$	Turn-On Delay Time	—	57	—	ns	$T_J = 150^\circ\text{C},$ $I_C = 60A, V_{CC} = 480V$ $V_{GE} = 15V, R_G = 5.0\Omega$ Energy losses include "tail" and diode reverse recovery.
t_r	Rise Time	—	80	—		
$t_{d(off)}$	Turn-Off Delay Time	—	380	—		
t_f	Fall Time	—	170	—		
E_{ts}	Total Switching Loss	—	4.78	—	mJ	
L_E	Internal Emitter Inductance	—	2.0	—	nH	
C_{ies}	Input Capacitance	—	7400	—	pF	$V_{GE} = 0V$ $V_{CC} = 30V$ See Fig. 6 $f = 1.0MHz$
C_{oes}	Output Capacitance	—	730	—		
C_{res}	Reverse Transfer Capacitance	—	90	—		
t_{rr}	Diode Reverse Recovery Time	—	90	140	ns	$T_J = 25^\circ\text{C}$ See Fig. 13
		—	120	180		$T_J = 125^\circ\text{C}$
I_{rr}	Diode Peak Reverse Recovery Current	—	7.3	11	A	$T_J = 25^\circ\text{C}$ See Fig. 14
		—	11	16		$T_J = 125^\circ\text{C}$
Q_{rr}	Diode Reverse Recovery Charge	—	360	550	nC	$T_J = 25^\circ\text{C}$ See Fig. 15
		—	780	1200		$T_J = 125^\circ\text{C}$
$di_{(rec)M}/dt$	Diode Peak Rate of Fall of Recovery During t_b	—	370	—	A/ μs	$T_J = 25^\circ\text{C}$ See Fig. 16
		—	220	—		$T_J = 125^\circ\text{C}$

Details of note ① through ④ are on the page 7

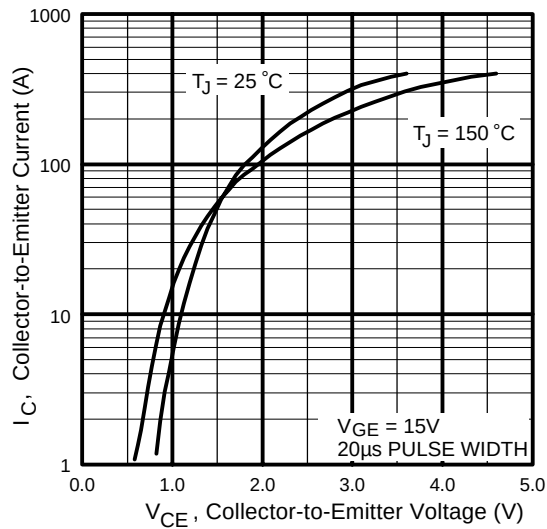


Fig. 1 - Typical Output Characteristics

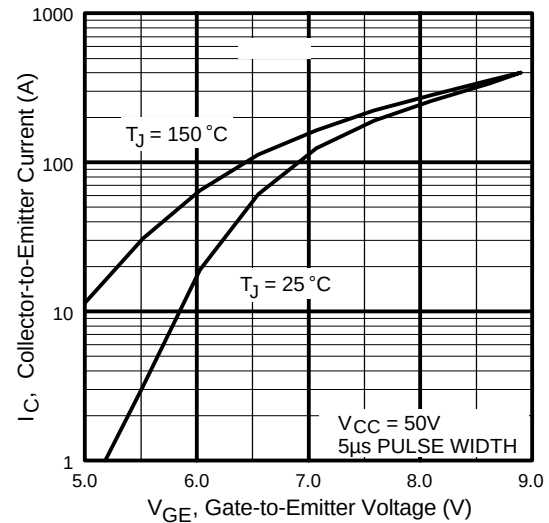


Fig. 2 - Typical Transfer Characteristics

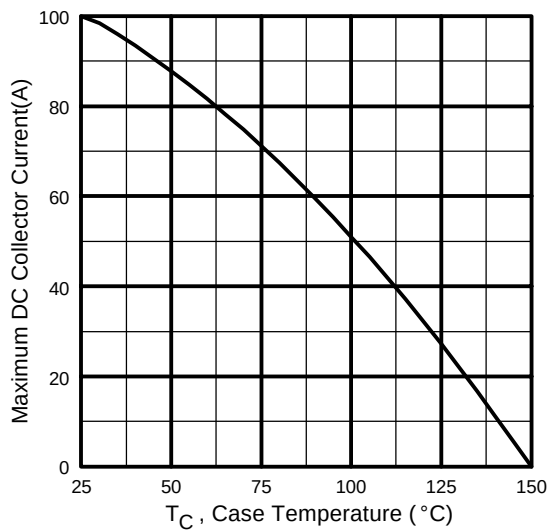


Fig. 3 - Maximum Collector Current vs. Case Temperature

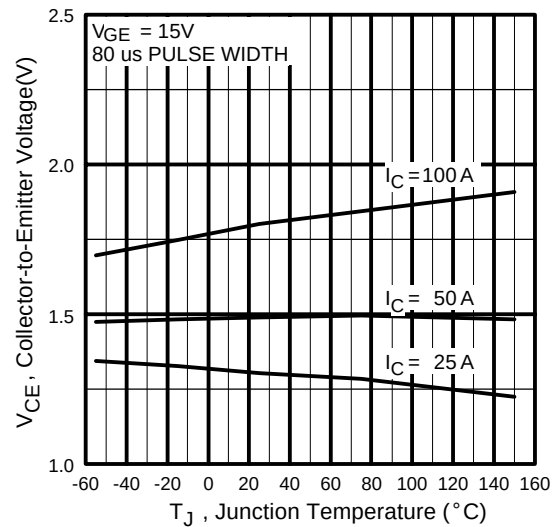


Fig. 4 - Typical Collector-to-Emitter Voltage vs. Junction Temperature

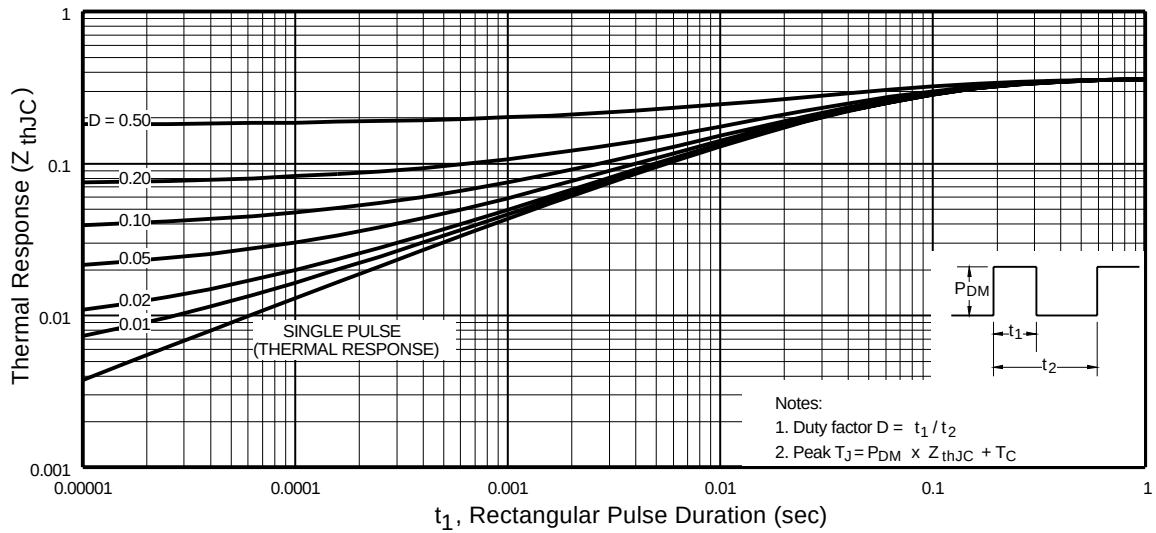
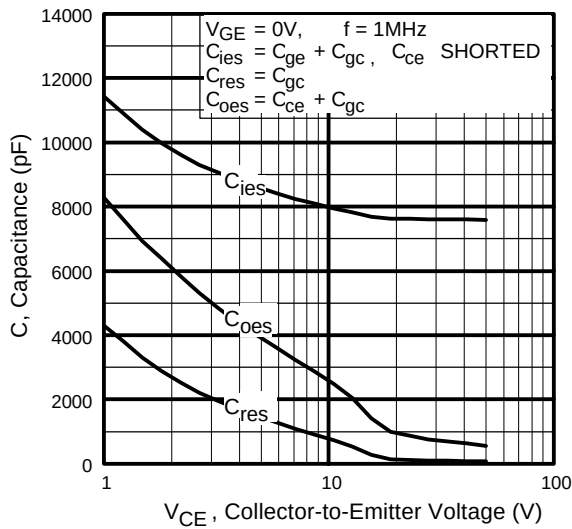
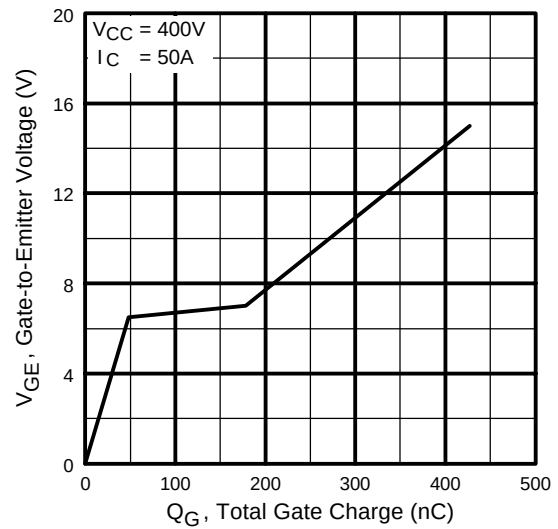


Fig. 5 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

Fig. 6 - Typical Capacitance vs.
Collector-to-Emitter VoltageFig. 7 - Typical Gate Charge vs.
Gate-to-Emitter Voltage

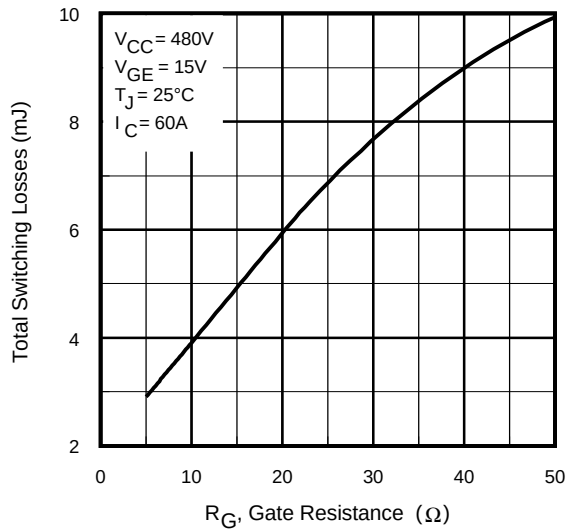


Fig. 8 - Typical Switching Losses vs. Gate Resistance

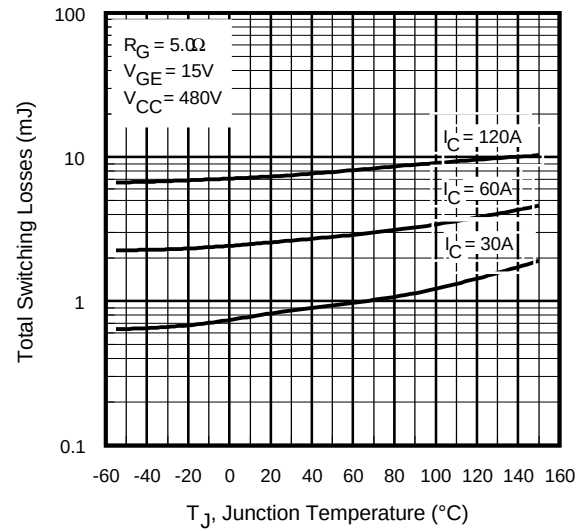


Fig. 9 - Typical Switching Losses vs. Junction Temperature

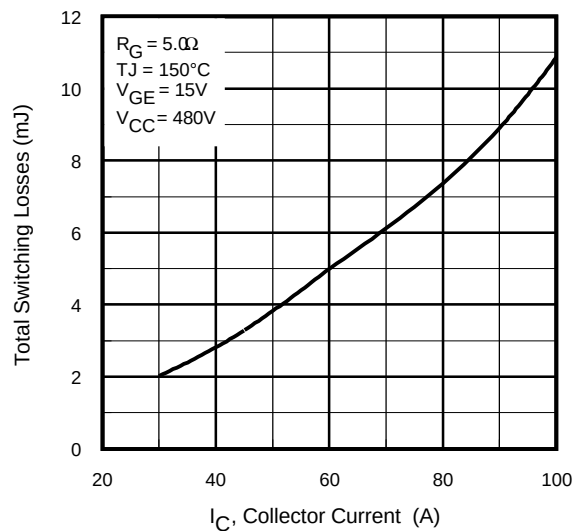


Fig. 10 - Typical Switching Losses vs. Collector-to-Emitter Current

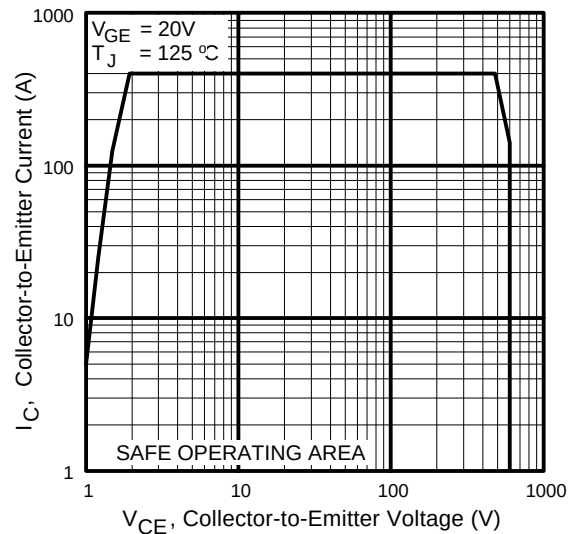


Fig. 11 - Turn-Off SOA

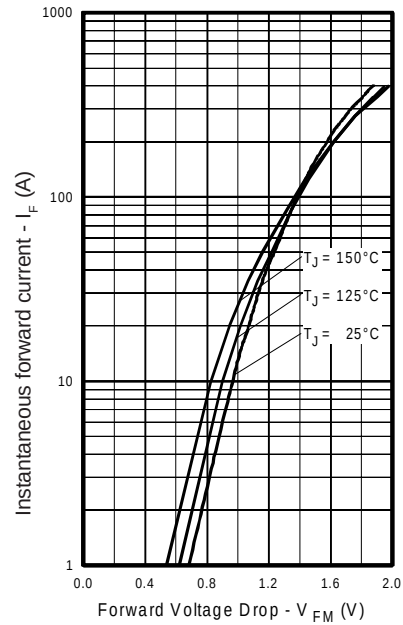
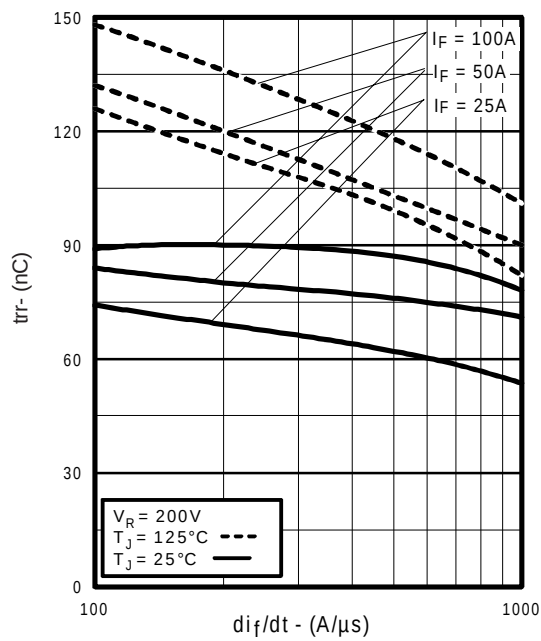
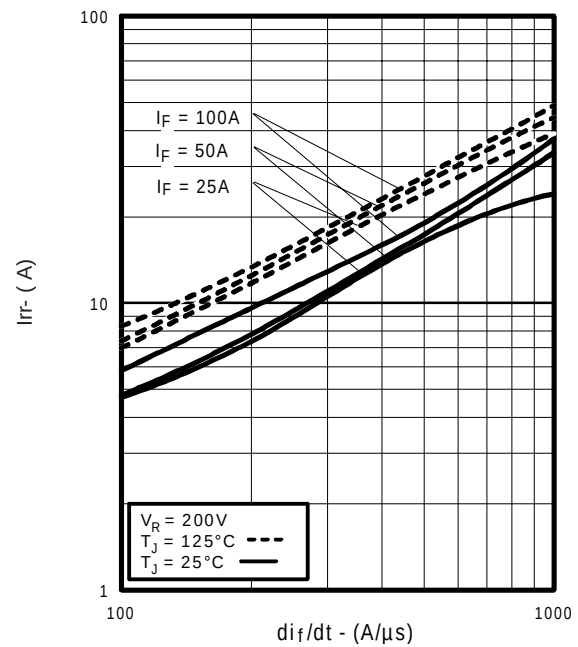


Fig. 12 - Typical Forward Voltage Drop vs. Instantaneous Forward Current

Fig. 13 - Typical Reverse Recovery vs. di_f/dt
6Fig. 14 - Typical Recovery Current vs. di_f/dt
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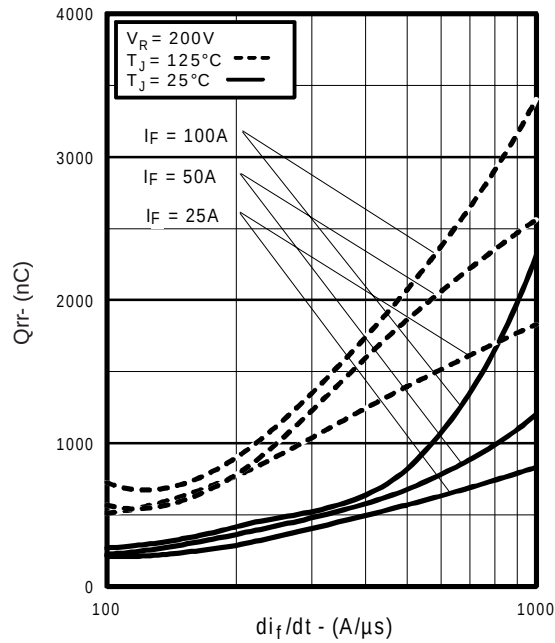


Fig. 15 - Typical Stored Charge vs. di_f/dt

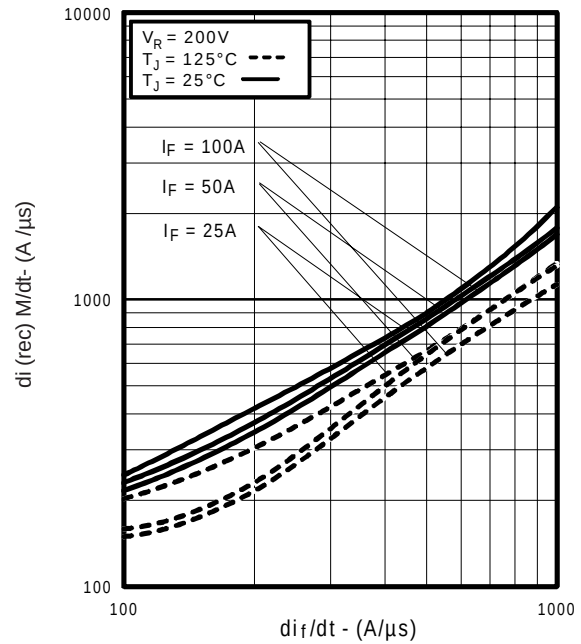


Fig. 16 - Typical $di_{(rec)M}/dt$ vs. di_f/dt

Notes:

- ① Repetitive rating: $V_{GE}=20V$; pulse width limited by maximum junction temperature (figure 20)
- ② $V_{CC}=80\%(V_{CES})$, $V_{GE}=20V$, $L=10\mu H$, $R_G=5.0\Omega$ (figure 19)
- ③ Pulse width $\leq 80\mu s$; duty factor $\leq 0.1\%$.
- ④ Pulse width $5.0\mu s$, single shot.

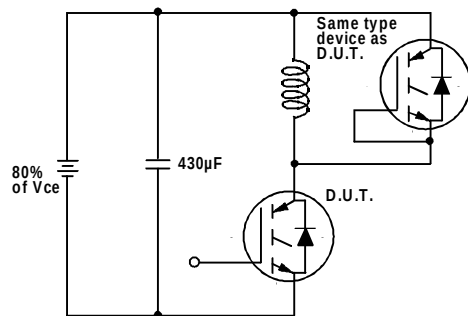


Fig. 17a - Test Circuit for Measurement of I_{LM} , E_{on} , $E_{off(diode)}$, t_{rr} , Q_{rr} , I_{rr} , $t_{d(on)}$, t_r , $t_{d(off)}$, t_f

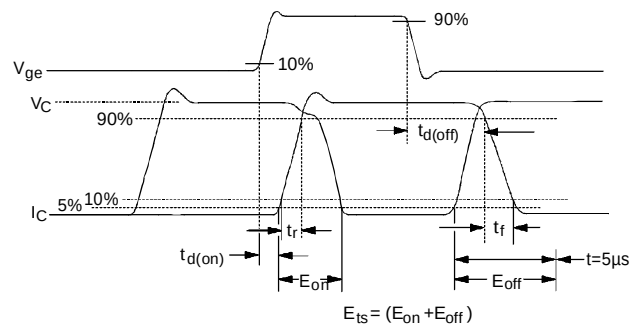


Fig. 17b - Test Waveforms for Circuit of Fig. 17a, Defining E_{off} , $t_{d(off)}$, t_r

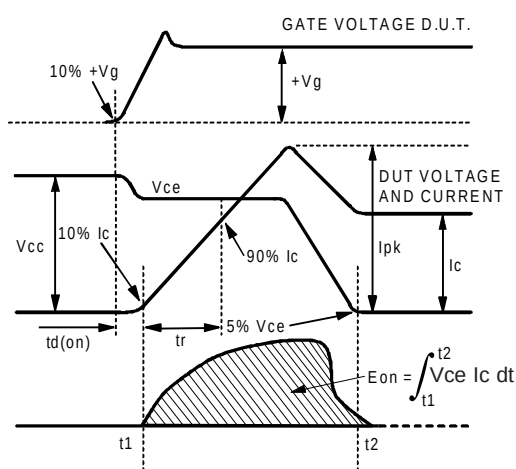


Fig. 17c - Test Waveforms for Circuit of Fig. 17a, Defining E_{on} , $t_{d(on)}$, t_r

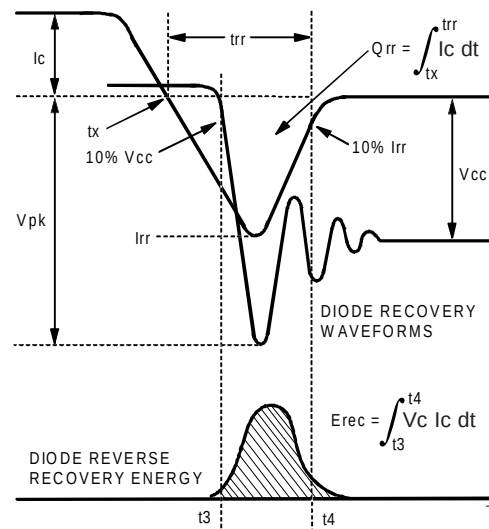


Fig. 17d - Test Waveforms for Circuit of Fig. 17a, Defining E_{rec} , t_{rr} , Q_{rr} , I_{rr}

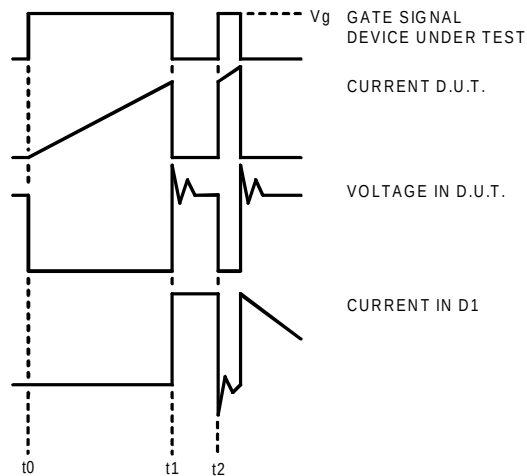


Figure 17e. Macro Waveforms for Figure 17a's Test Circuit

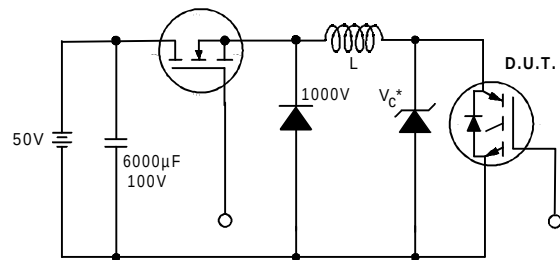


Figure 18. Clamped Inductive Load Test Circuit

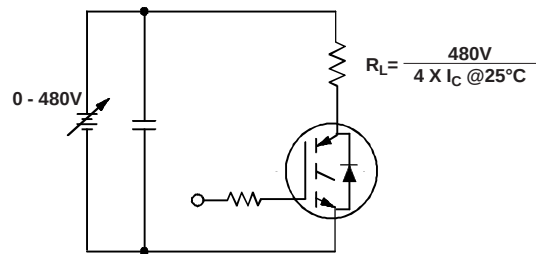


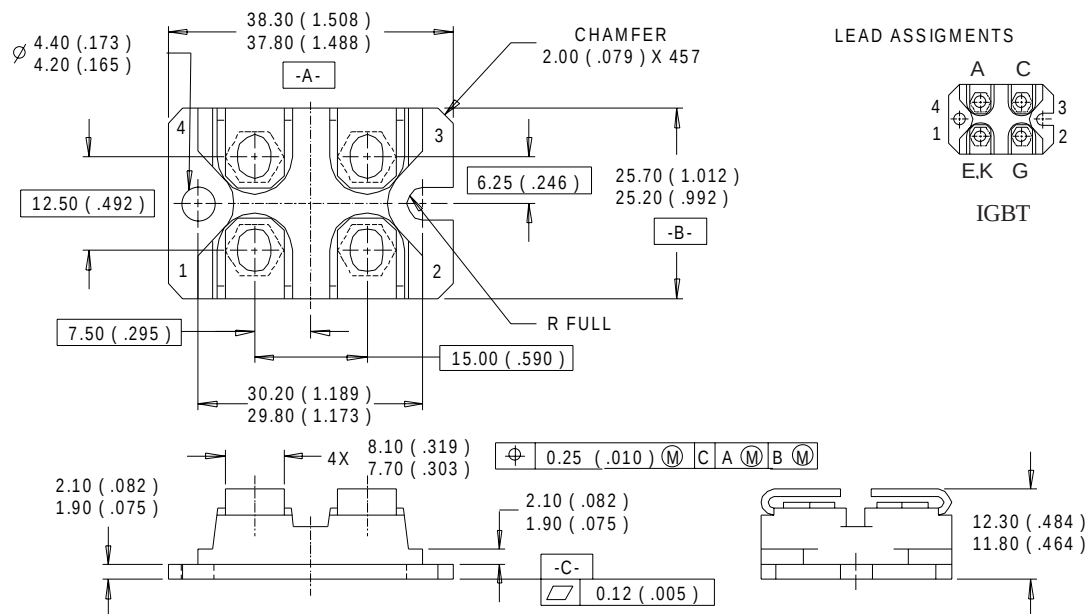
Figure 19. Pulsed Collector Current Test Circuit

GA100NA60U

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IR Rectifier

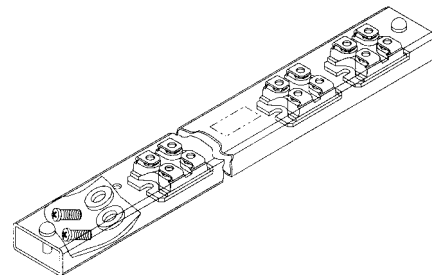
SOT-227 Package Details

Dimensions are shown in millimeters (inches)



Tube

QUANTITIES PER TUBE IS 10
M4 SCREW AND WASHER INCLUDED



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.

International
IR Rectifier

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