

# International IOR Rectifier

SINGLE SWITCH IGBT DUAL INT-A-PAK

PD - 50071C

## GA600GD25S

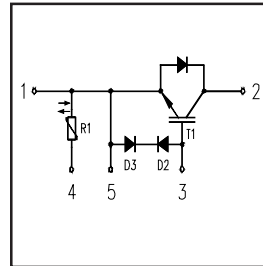
Standard™ Speed IGBT

### Features

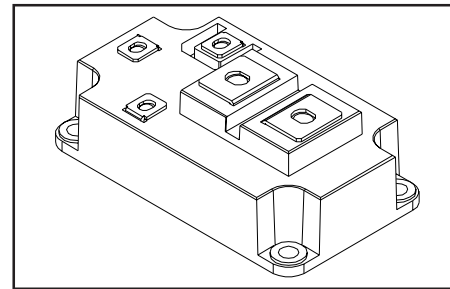
- Standard speed, optimized for battery powered application
- Very low conduction losses
- HEXFRED™ antiparallel diodes with ultra-soft recovery
- Industry standard package
- UL recognition pending
- Internal thermistor

### Benefits

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



$V_{CES} = 250V$   
 $V_{CE(on)} \text{ typ.} = 1.25V$   
 @  $V_{GE} = 15V, I_C = 600A$



### Absolute Maximum Ratings

	Parameter	Max.	Units
$V_{CES}$	Collector-to-Emitter Voltage	250	V
$I_C @ T_C = 25^\circ C$	Continuous Collector Current	600	A
$I_{CM}$	Pulsed Collector Current <sup>①</sup>	1200	
$I_{LM}$	Peak Switching Current <sup>②</sup>	1200	
$I_{FM}$	Peak Diode Forward Current	1200	
$V_{GE}$	Gate-to-Emitter Voltage	$\pm 17$	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	1920	W
$P_D @ T_C = 85^\circ C$	Maximum Power Dissipation	1000	
$T_J$	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	—	0.065	$^\circ C/W$
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case - Diode	—	0.20	
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink - Module	0.04	—	
	Mounting Torque, Case-to-Heatsink <sup>③</sup>	—	6.0	N·m
	Mounting Torque, Case-to-Terminal 1, 2 <sup>③</sup>	—	5.0	
	Mounting Torque, Case-to-Terminal 3,4,5,6	—	1.5	
	Weight of Module	365	—	g

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	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage	250	—	—	V	$V_{GE} = 0V, I_C = 1mA$
$V_{CE(on)}$	Collector-to-Emitter Voltage	—	1.25	1.4		$V_{GE} = 15V, I_C = 600A$
		—	1.25	—		$V_{GE} = 15V, I_C = 600A, T_J = 125^\circ\text{C}$
$V_{GE(th)}$	Gate Threshold Voltage	3.0	—	6.0		$I_C = 5.0mA, V_{CE} = 6.0V$
$\Delta V_{GE(th)}/\Delta T_J$	Temperature Coeff. of Threshold Voltage	—	-11	—	mV/ $^\circ\text{C}$	$V_{CE} = 6.0V, I_C = 5.0mA, T_C = 25/125^\circ\text{C}$
$g_{fe}$	Forward Transconductance $\text{\textcircled{C}}$	—	720	—	S	$V_{CE} = 25V, I_C = 600A$
$I_{CES}$	Collector-to-Emitter Leaking Current	—	—	2.0	mA	$V_{GE} = 0V, V_{CE} = 250V$
		—	—	20		$V_{GE} = 0V, V_{CE} = 250V, T_J = 125^\circ\text{C}$
$V_{FM}$	Diode Forward Voltage - Maximum	—	1.5	1.8	V	$I_F = 300A, V_{GE} = 0V$
		—	1.5	—		$I_F = 300A, V_{GE} = 0V, T_J = 125^\circ\text{C}$
$I_{GES}$	Gate-to-Emitter Leakage Current	—	—	1.0	$\mu\text{A}$	$V_{GE} = \pm 14V$ (18V zeners gate-emitter)
$\Delta T_{DP}$	Pulse Diode Temp Rise	—	—	80	$^\circ\text{C}$	$I_C = 300A, t = 150\text{msec}, T_c = 70^\circ\text{C}$
R-T <sub>25</sub>	Thermistor, Positive Temp Coefficient	738	820	902	$\Omega$	$I = 100mA, P = 2.5mW/^\circ\text{C}$ (see note 1)

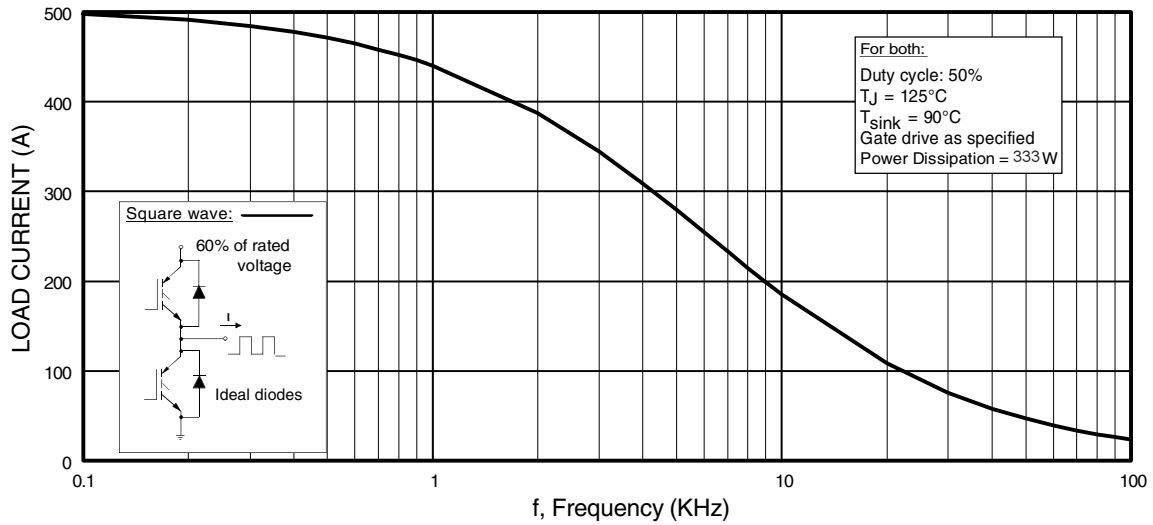
Dynamic Characteristics -  $T_J = 125^\circ\text{C}$  (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$Q_g$	Total Gate Charge (turn-on)	—	3825	5738	nC	$V_{CC} = 200V, V_{GE} = 15V$
$Q_{ge}$	Gate - Emitter Charge (turn-on)	—	555	832		$I_C = 600A$
$Q_{gc}$	Gate - Collector Charge (turn-on)	—	1262	1893		$T_J = 25^\circ\text{C}$
$t_{d(on)}$	Turn-On Delay Time	—	1060	—	ns	$R_{G1} = 15\Omega, R_{G2} = 0\Omega,$ $I_C = 600A$
$t_r$	Rise Time	—	950	—		Inductor load
$t_{d(off)}$	Turn-Off Delay Time	—	846	—		
$t_f$	Fall Time	—	934	—		$V_{GE} = \pm 15V$
$E_{on}$	Turn-On Switching Energy	—	17	—	mJ	See Fig. 17, 19
$E_{off(1)}$	Turn-Off Switching Energy	—	105	—		
$E_{ts(1)}$	Total Switching Energy	—	122	250		
$C_{ies}$	Input Capacitance	—	86063	—	pF	$V_{GE} = 0V$
$C_{oes}$	Output Capacitance	—	9754	—		$V_{CC} = 30V$
$C_{res}$	Reverse Transfer Capacitance	—	1913	—		$f = 1\text{MHz}$
$t_{rr}$	Diode Reverse Recovery Time	—	314	—	ns	$I_C = 600A$
$I_{rr}$	Diode Peak Reverse Current	—	80	—		$R_{G1} = 15\Omega$
$Q_{rr}$	Diode Recovery Charge	—	12513	—	$\mu\text{C}$	$R_{G2} = 0\Omega$
$di_{(rec)M}/dt$	Diode Peak Rate of Fall of Recovery During $t_b$	—	632	—	A/ $\mu\text{s}$	$V_{CC} = 150V$ $di/dt = 500A/\mu\text{s}$

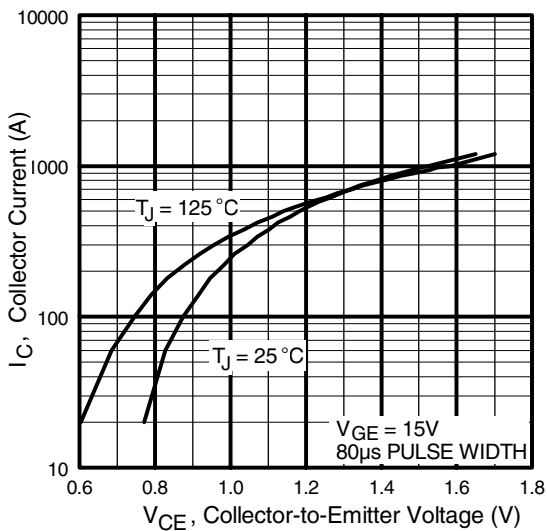
## Notes:

1. The thermistor has an average rate of change of  $7\Omega/^\circ\text{C}$  between  $20^\circ\text{C}$  and  $125^\circ\text{C}$ .

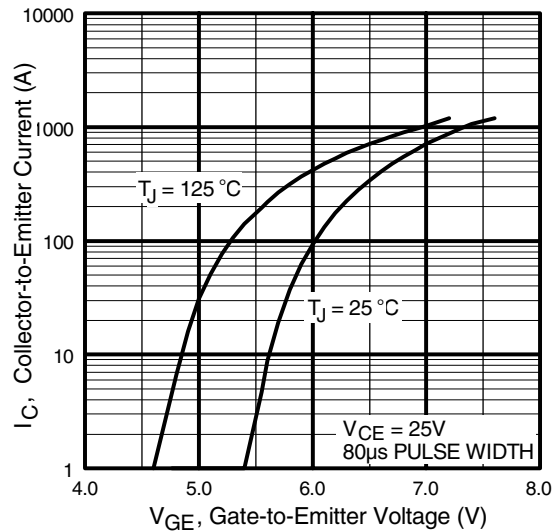
Consult U.S. Sensor data sheet for P821GS1K for details



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



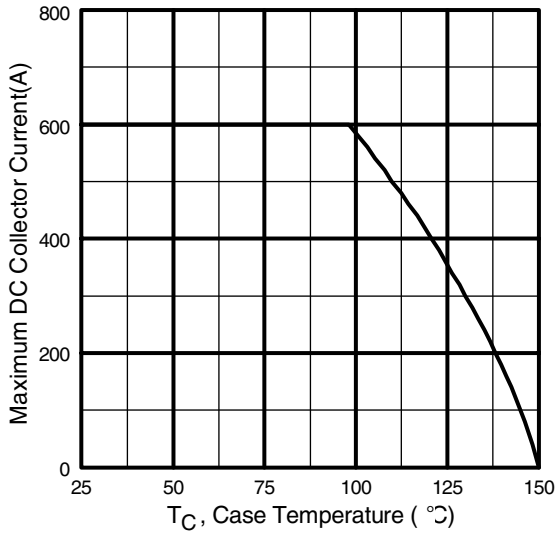
**Fig. 2** - Typical Output Characteristics



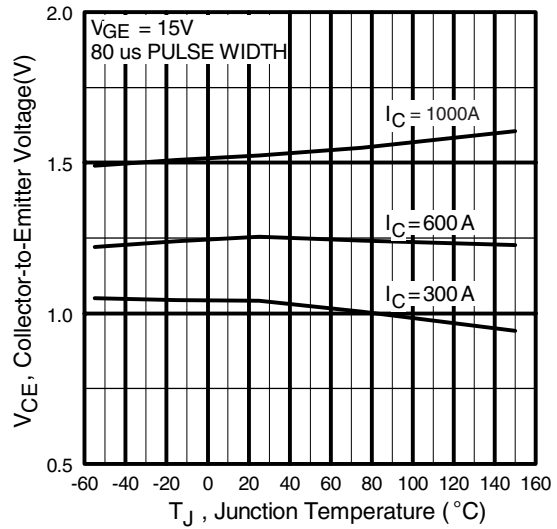
**Fig. 3** - Typical Transfer Characteristics

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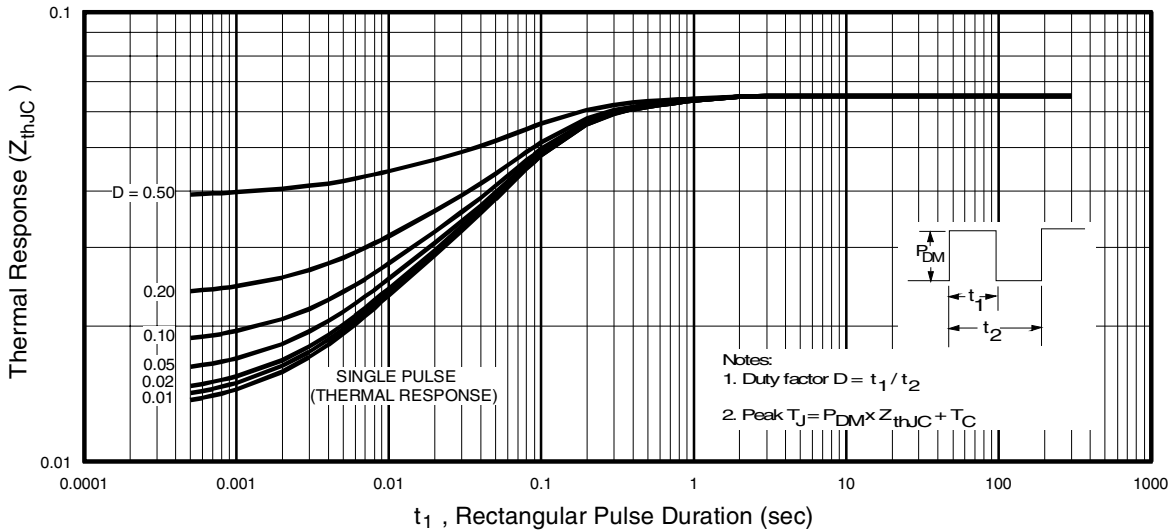
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**Fig. 4** - Maximum Collector Current vs. Case Temperature

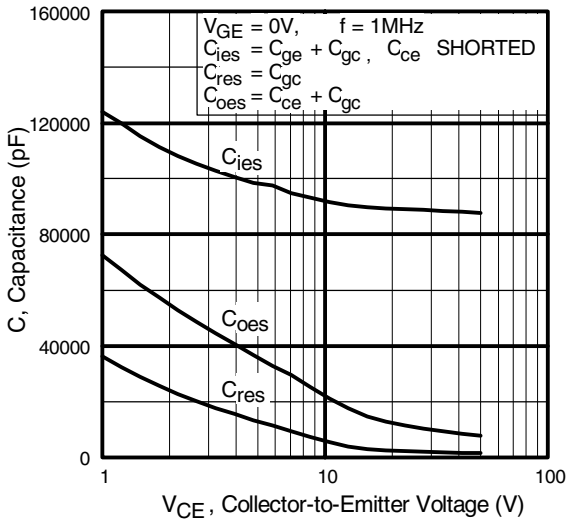


**Fig. 5** - Typical Collector-to-Emitter Voltage vs. Junction Temperature

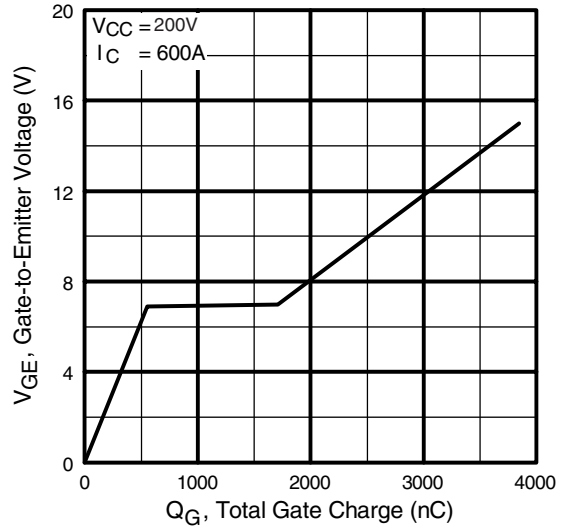


**Fig. 6** - Maximum Effective Transient Thermal Impedance, Junction-to-Case

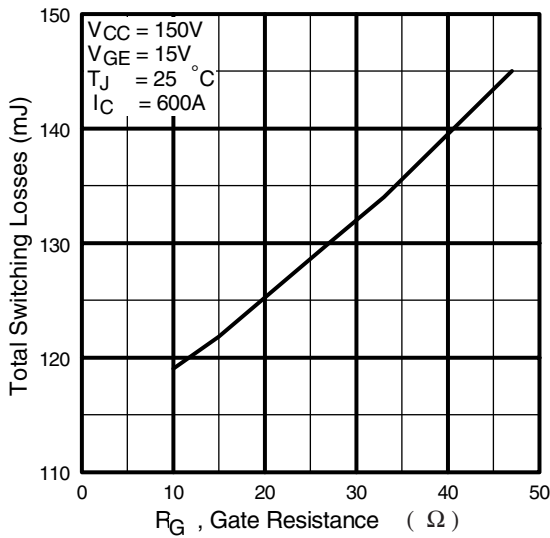
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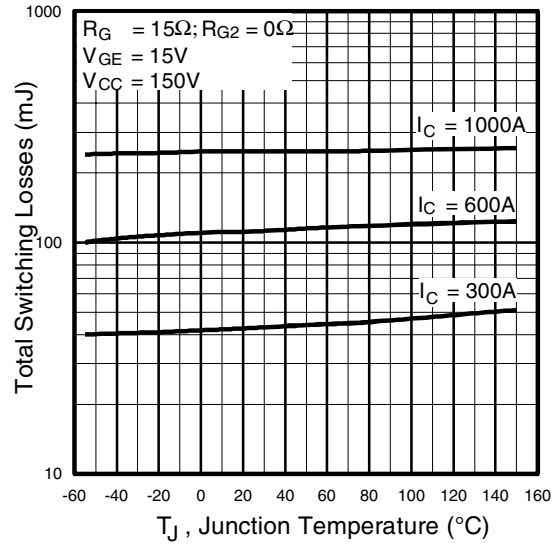
**Fig. 7** - Typical Capacitance vs. Collector-to-Emitter Voltage



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



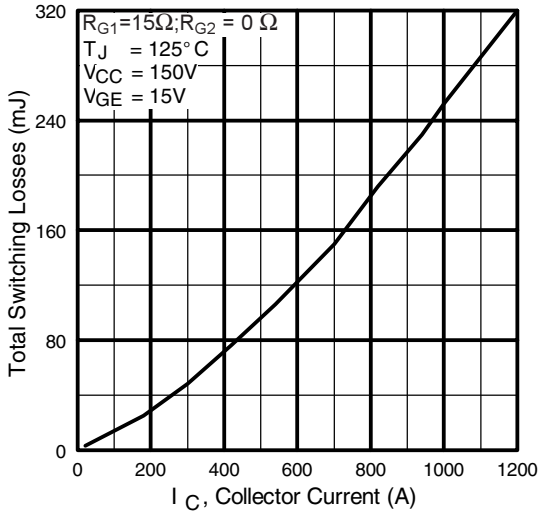
**Fig. 9** - Typical Switching Losses vs. Gate Resistance



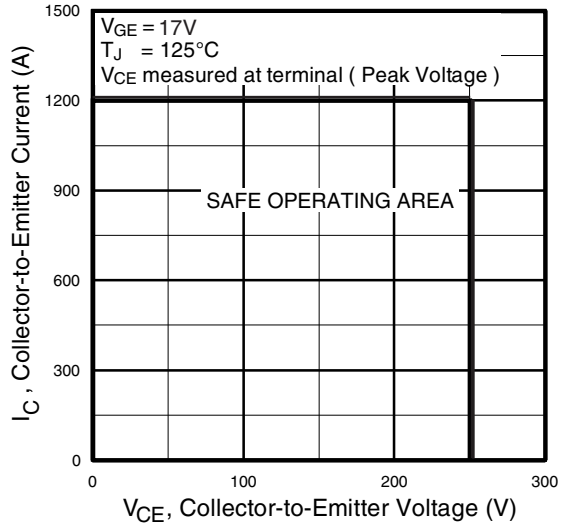
**Fig. 10** - Typical Switching Losses vs. Junction Temperature

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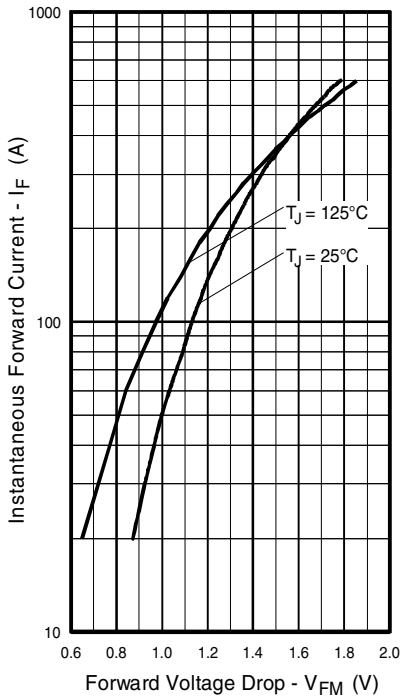
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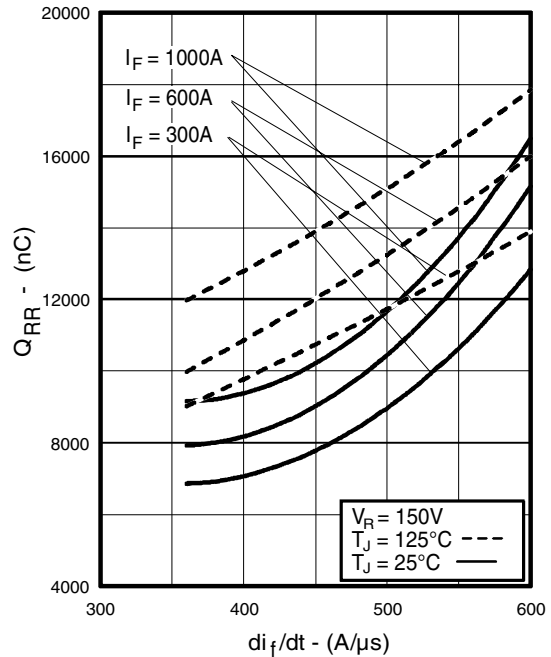
**Fig. 11** - Typical Switching Losses vs. Collector-to-Emitter Current



**Fig. 12** - Reverse Bias SOA



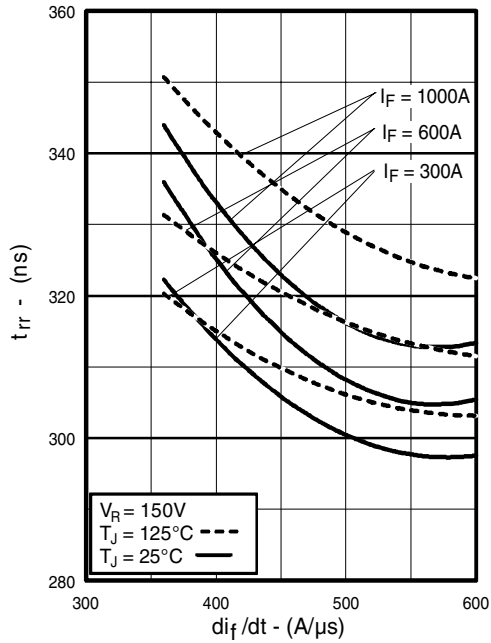
**Fig. 13** - Typical Forward Voltage Drop vs. Instantaneous Forward Current



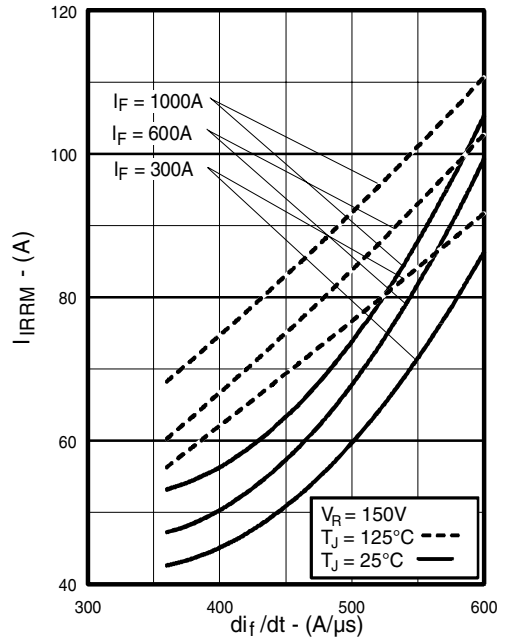
**Fig. 14** - Typical Stored Charge vs.  $di_f/dt$

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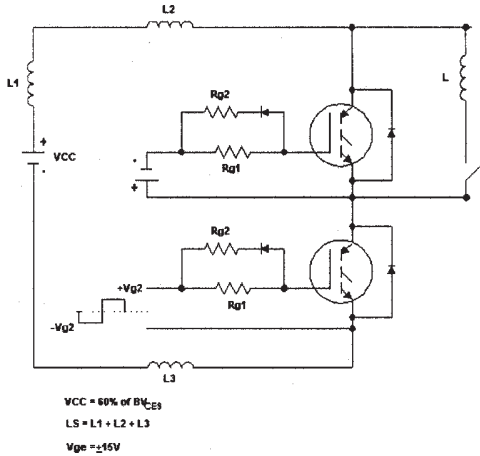
**Fig. 15** - Typical Reverse Recovery vs.  $dI_f/dt$



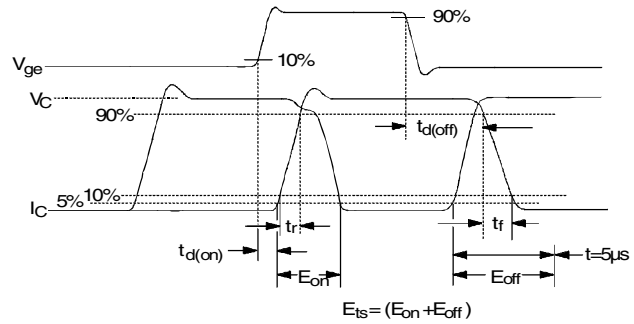
**Fig. 16** - Typical Recovery Current vs.  $dI_f/dt$

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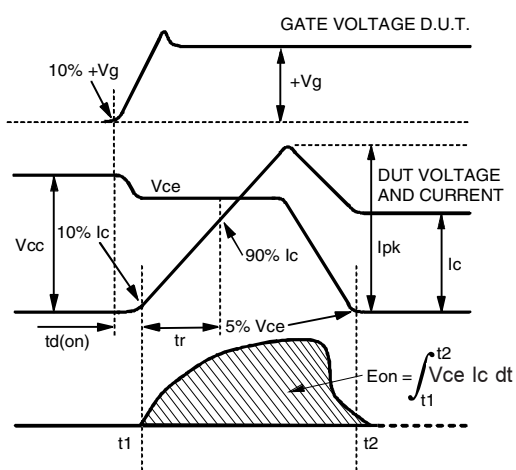
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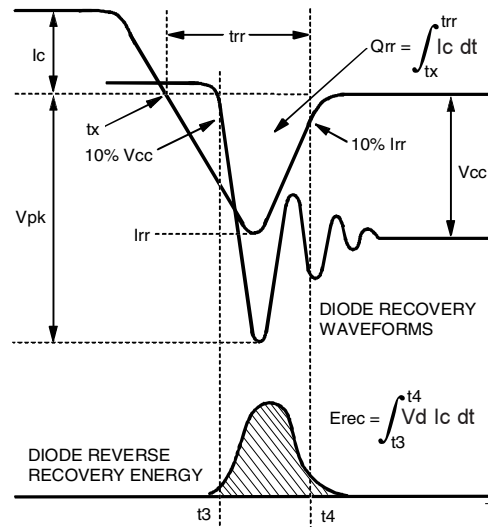
**Fig. 17a** - Test Circuit for Measurement of  $I_{LM}$ ,  $E_{on}$ ,  $E_{off}(\text{diode})$ ,  $t_{rr}$ ,  $Q_{rr}$ ,  $I_{rr}$ ,  $t_{d(on)}$ ,  $t_r$ ,  $t_{d(off)}$ ,  $t_f$



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



**Fig. 17c** - Test Waveforms for Circuit of Fig. 18a, Defining  $E_{on}$ ,  $t_{d(on)}$ ,  $t_r$



**Fig. 17d** - Test Waveforms for Circuit of Fig. 18a, Defining  $E_{rec}$ ,  $t_{rr}$ ,  $Q_{rr}$ ,  $I_{rr}$



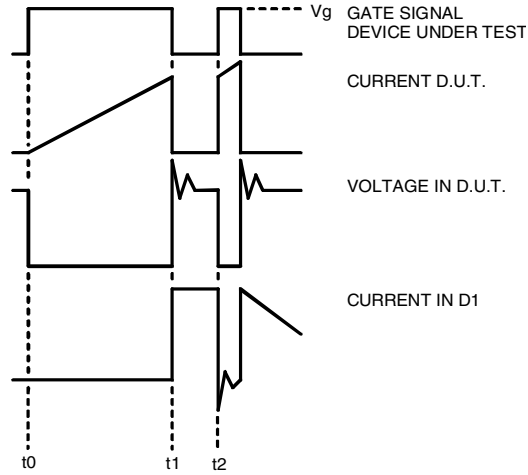


Figure 17e. Macro Waveforms for Figure 18a's Test Circuit

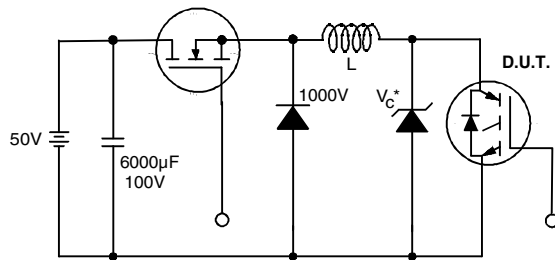


Figure 18. Clamped Inductive Load Test Circuit

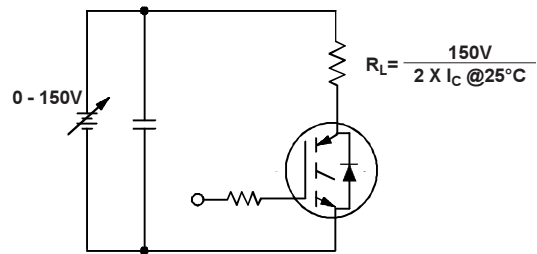


Figure 19. Pulsed Collector Current Test Circuit

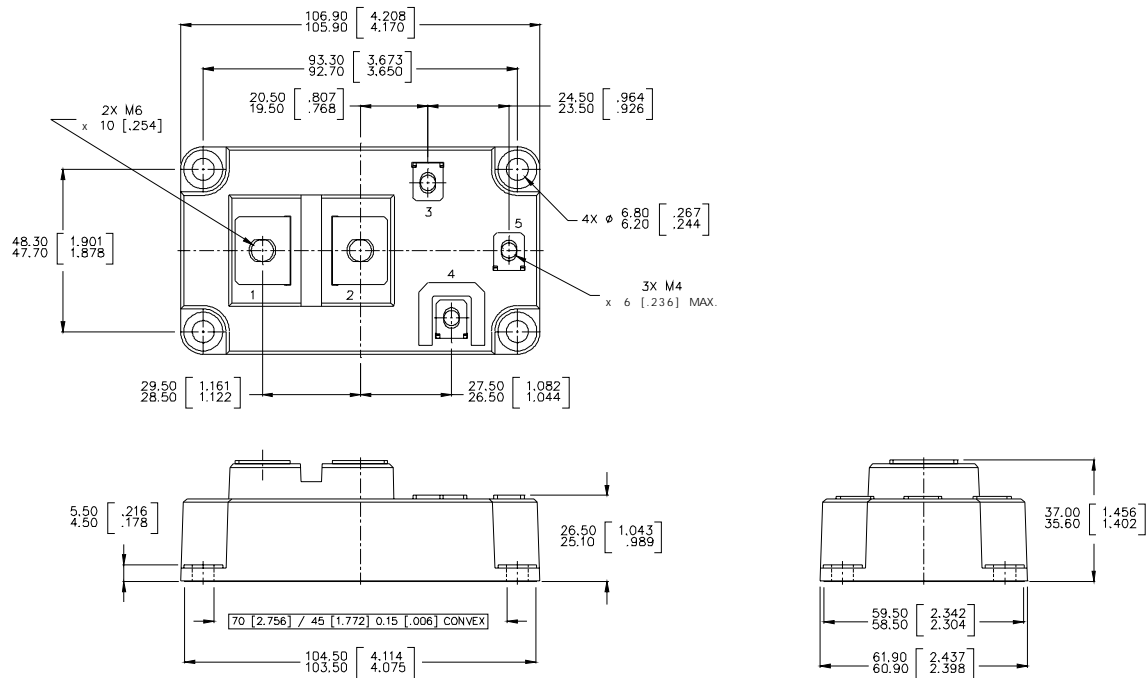
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**Notes:**

- ① Repetitive rating;  $V_{GE} = 17V$ , pulse width limited by max. junction temperature.
- ② See fig. 17
- ③ For screws M6.
- ④ Pulse width 50 $\mu$ s; single shot.

## Case Outline — DUAL INT-A-PAK



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.

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