International
IOR Rectifier

PD -50051D

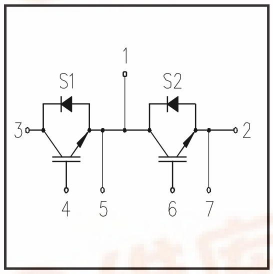
GA400TD25S

"HALF-BRIDGE" IGBT DUAL INT-A-PAK

Standard Speed IGBT

Features

- Generation 4 IGBT technology
- Standard: Optimized for minimum saturation voltage and operating frequencies up to 10kHz
- Very low conduction and switching losses
- HEXFRED™ antiparallel diodes with ultra- soft recovery
- Industry standard package
- UL approved



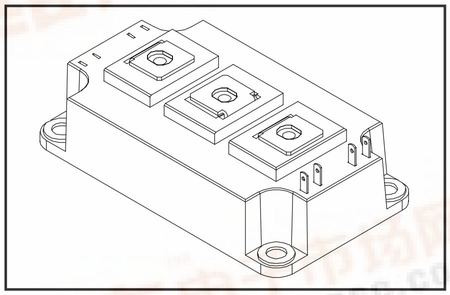
V_{CES} = 250V

$V_{CE(on)\ typ.}$ = 1.3V

@V_{GE} = 15V, I_C = 400A

Benefits

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



Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Voltage	250	V
I_C @ T_C = 25°C	Continuous Collector Current	400	A
I_{CM}	Pulsed Collector Current①	800	
I_{LM}	Peak Switching Current②	800	
I_{FM}	Peak Diode Forward Current	800	
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°C	Maximum Power Dissipation	1350	W
P_D @ T_C = 85°C	Maximum Power Dissipation	700	
T_J	Operating Junction Temperature Range	-40 to +150	°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	—	0.09	°C/W
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case - Diode	—	0.20	
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink - Module	0.1	—	
	Mounting Torque, Case-to-Heatsink ③	—	6.0	N·m
	Mounting Torque, Case-to-Terminal 1, 2 & 3③	—	5.0	
	Weight of Module	400	—	g

05/15/02

Electrical Characteristics @ T_J = 25°C (unless otherwise specified)

	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	—	1.3	1.6		V_{GE} = 15V, I_C = 400A
		—	1.3	—		V_{GE} = 15V, I_C = 400A, T_J = 125°C
$V_{GE(th)}$	Gate Threshold Voltage	3.0	—	6.0		I_C = 3.0mA
$\Delta V_{GE(th)}/\Delta T_J$	Temperature Coeff. of Threshold Voltage	—	-11	—	mV/°C	V_{CE} = V_{GE}, I_C = 2.5mA
g_{fe}	Forward Transconductance④	—	371	—	S	V_{CE} = 25V, I_C = 400A
I_{CES}	Collector-to-Emitter Leaking Current	—	—	0.50	mA	V_{GE} = 0V, V_{CE} = 250V
		—	—	20		V_{GE} = 0V, V_{CE} = 250V, T_J = 125°C
V_{FM}	Diode Forward Voltage - Maximum	—	1.7	2.2	V	I_F = 500A, V_{GE} = 0V
		—	1.7	—		I_F = 500A, V_{GE} = 0V, T_J = 125°C
I_{GES}	Gate-to-Emitter Leakage Current	—	—	500	nA	V_{GE} = ±20V

Dynamic Characteristics - T_J = 125°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
Q_g	Total Gate Charge (turn-on)	—	1600	2400		V_{CC} = 200V
Q_{ge}	Gate - Emitter Charge (turn-on)	—	232	348	nC	I_C = 440A
Q_{gc}	Gate - Collector Charge (turn-on)	—	528	792		T_J = 25°C
$t_{d(on)}$	Turn-On Delay Time	—	1250	—		R_{G1} = 15Ω, R_{G2} = 0Ω,
t_r	Rise Time	—	365	—	ns	I_C = 400A
$t_{d(off)}$	Turn-Off Delay Time	—	841	—		V_{CC} = 150V
t_f	Fall Time	—	792	—		V_{GE} = ±15V
E_{on}	Turn-On Switching Energy	—	6.0	—	mJ	See Fig.17 through Fig.21
E_{off}	Turn-Off Switching Energy	—	38	—		
E_{ts}	Total Switching Energy	—	45	52		
C_{ies}	Input Capacitance	—	36000	—		V_{GE} = 0V
C_{oes}	Output Capacitance	—	4080	—	pF	V_{CC} = 30V
C_{res}	Reverse Transfer Capacitance	—	800	—		f = 1 MHz
t_{rr}	Diode Reverse Recovery Time	—	229	—	ns	I_C = 400A
I_{rr}	Diode Peak ReverseCurrent	—	71	—	A	R_{G1} = 15Ω
Q_{rr}	Diode Recovery Charge	—	8154	—	nC	R_{G2} = 0Ω
$di_{(rec)}M/_{dt}$	Diode Peak Rate of Fall of Recovery During t_b	—	911	—	A/µs	V_{CC} = 150V di/dt»1400A/µs

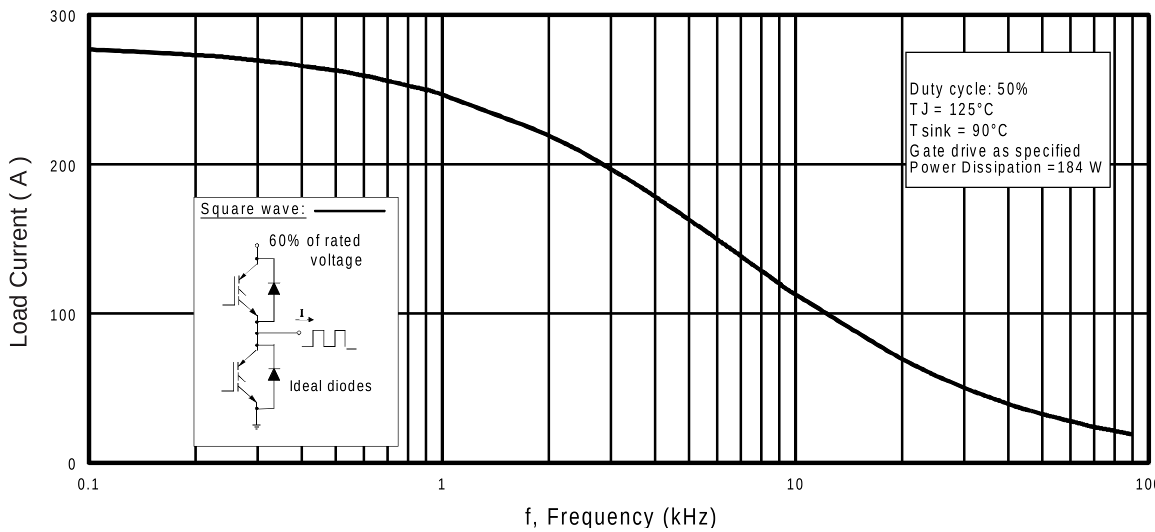


Fig. 1 - Typical Load Current vs. Frequency
(Load Current = I_{RMS} of fundamental)

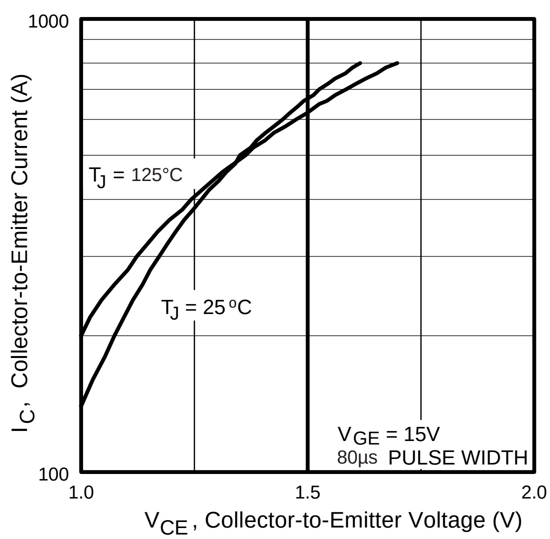


Fig. 2 - Typical Output Characteristics

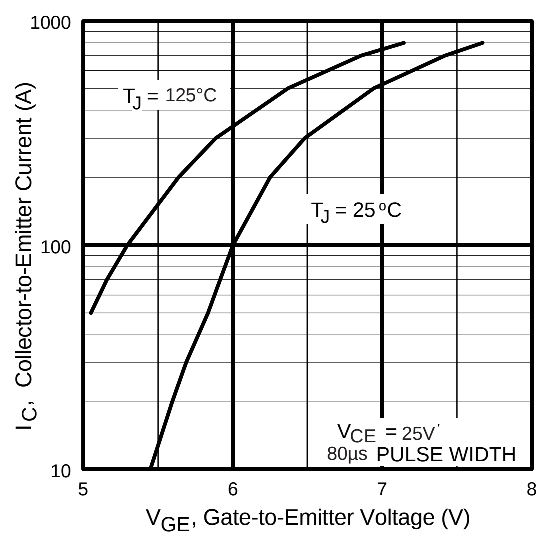


Fig. 3 - Typical Transfer Characteristics

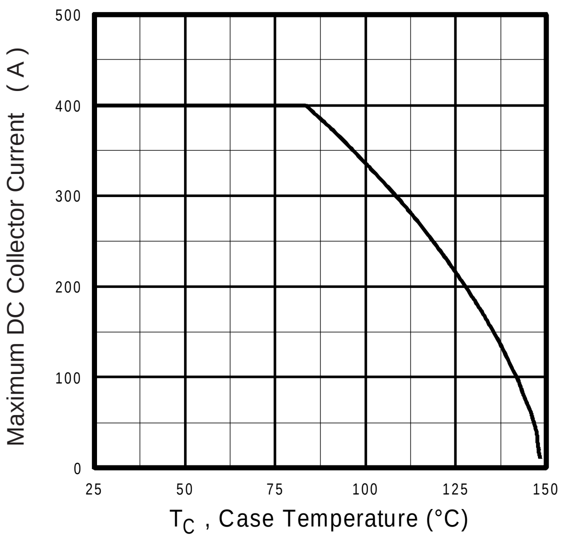


Fig. 4 - Maximum Collector Current vs. Case Temperature

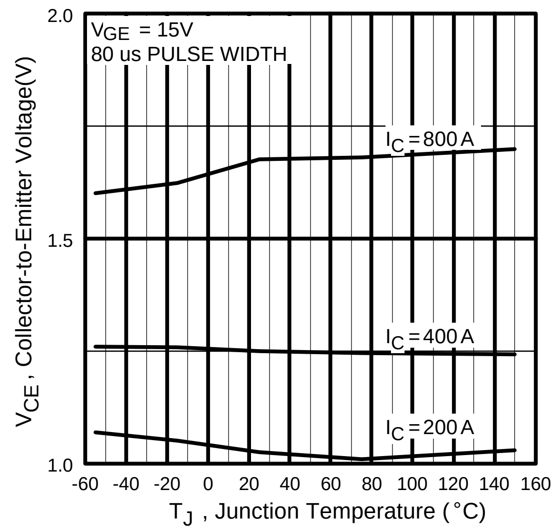


Fig. 5 - Typical Collector-to-Emitter Voltage vs. Junction Temperature

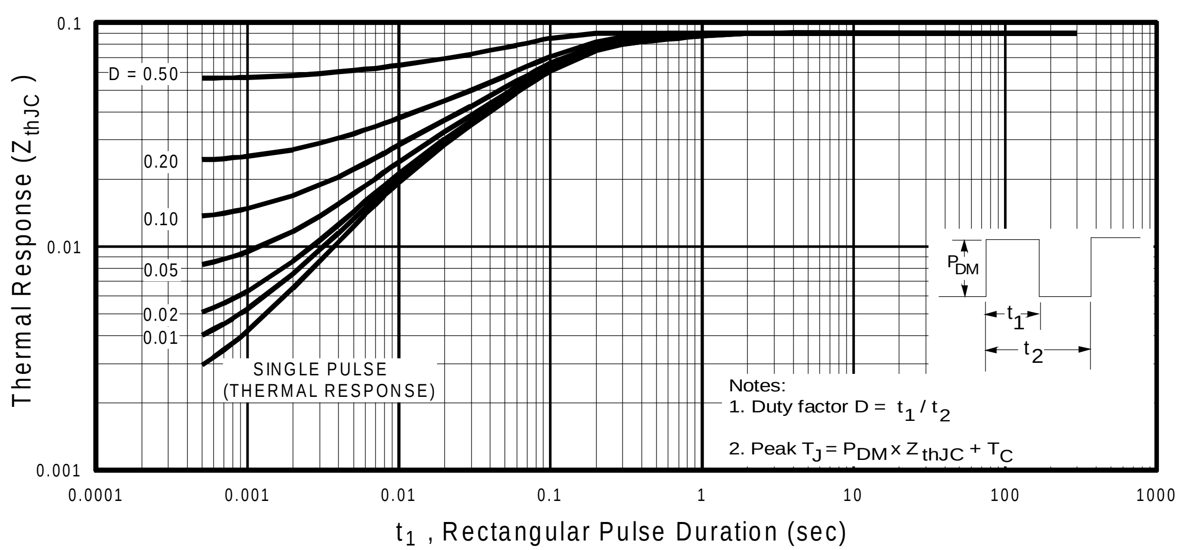


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

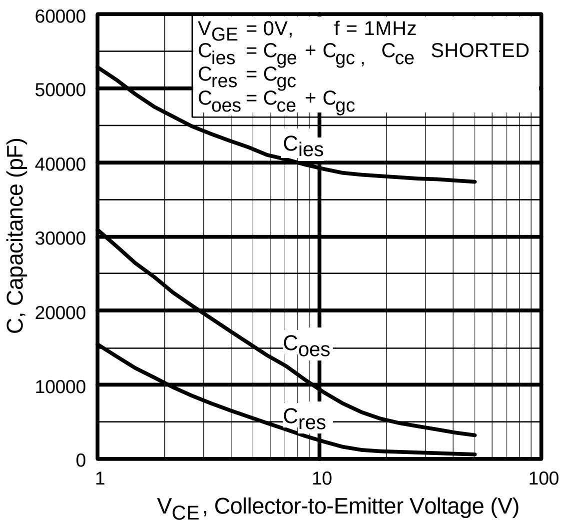


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

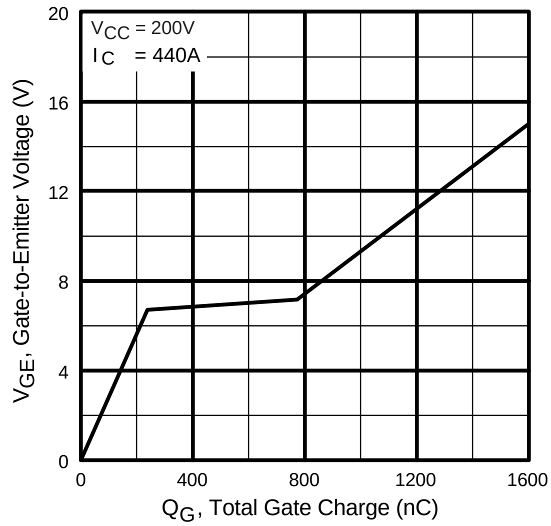


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

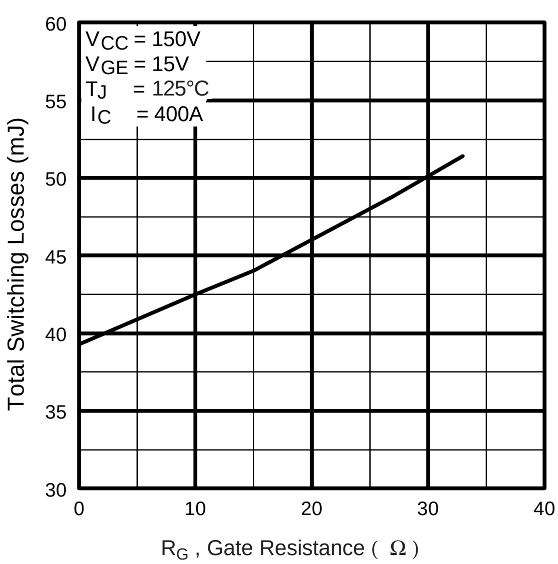


Fig. 9 - Typical Switching Losses vs. Gate Resistance

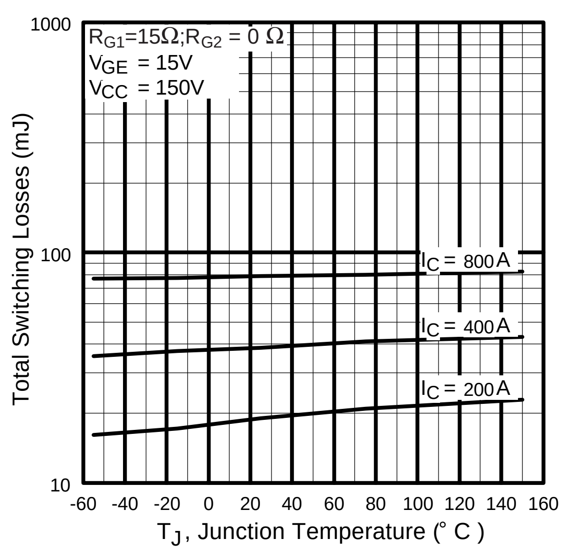


Fig. 10 - Typical Switching Losses vs. Junction Temperature

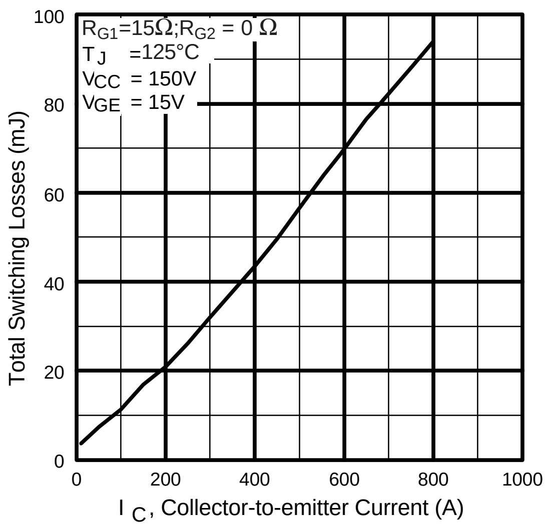


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

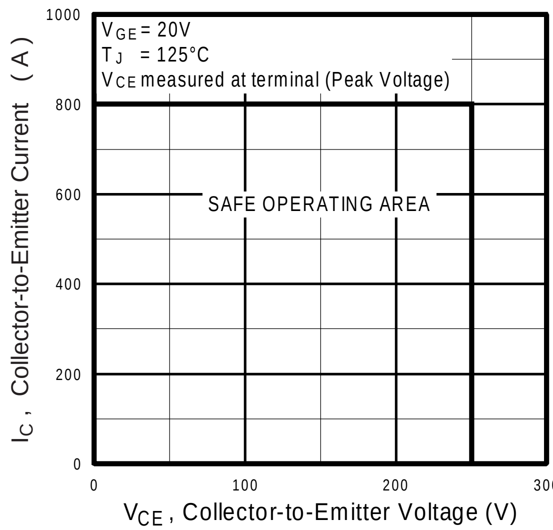


Fig. 12 - Reverse Bias SOA

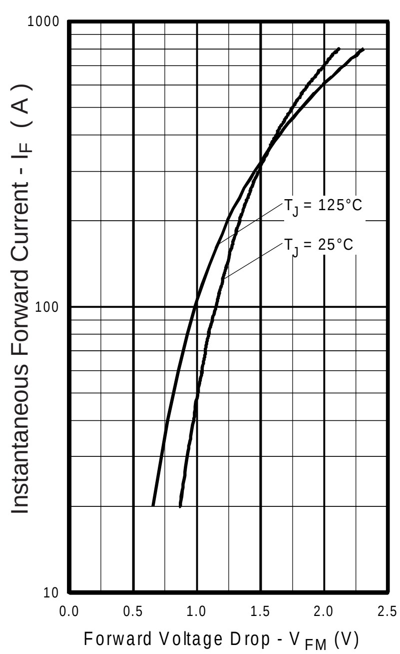


Fig. 13 - Typical Forward Voltage Drop vs. Instantaneous Forward Current

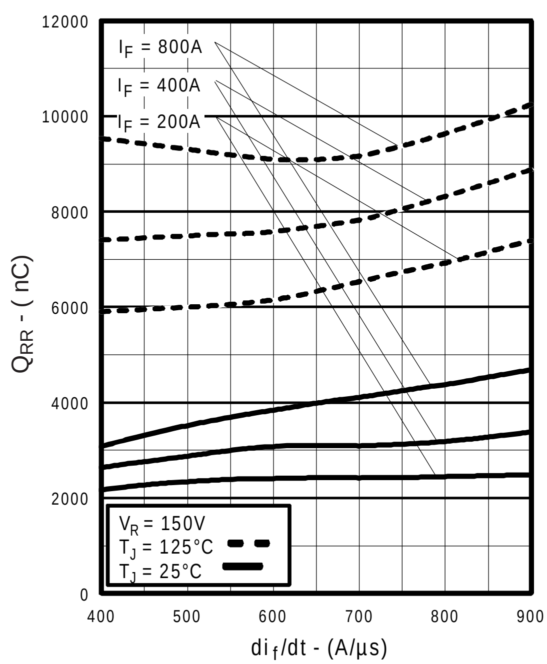


Fig. 14 - Typical Stored Charge vs. di_f/dt

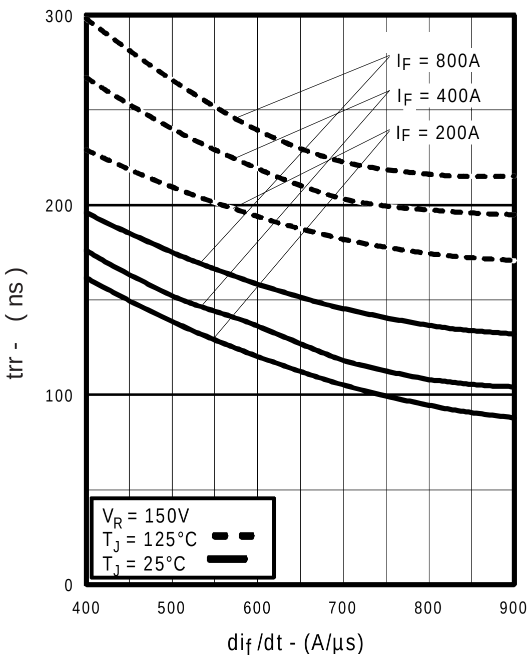


Fig. 15 - Typical Reverse Recovery vs. di_f/dt

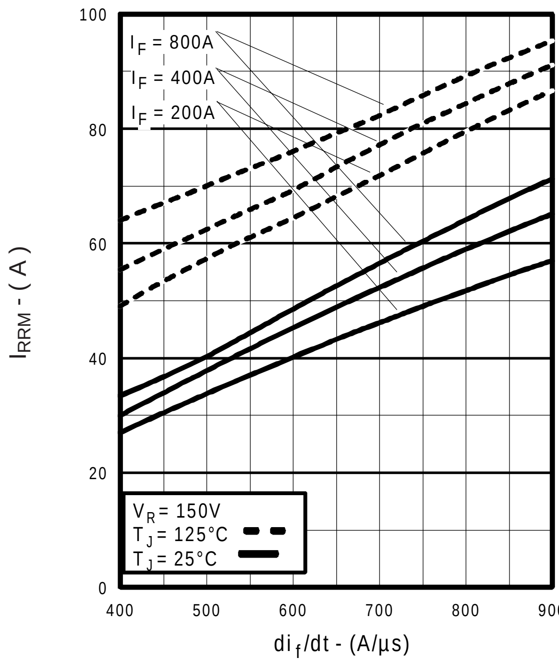


Fig. 16 - Typical Recovery Current vs. di_f/dt

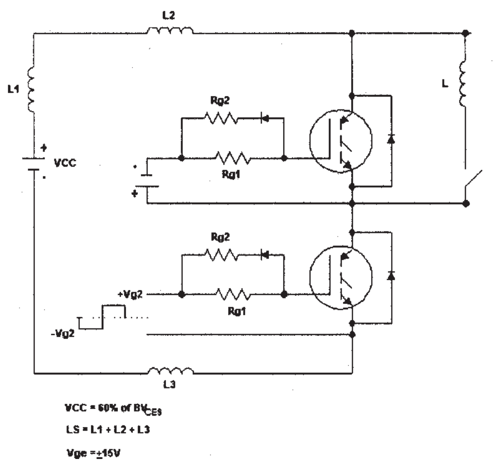


Fig. 17 - Test Circuit for Measurement of I_{LM}, E_{on}, $E_{off(diode)}$, t_{rr}, Q_{rr}, I_{rr}, $t_{d(on)}$, t_r, $t_{d(off)}$, t_f

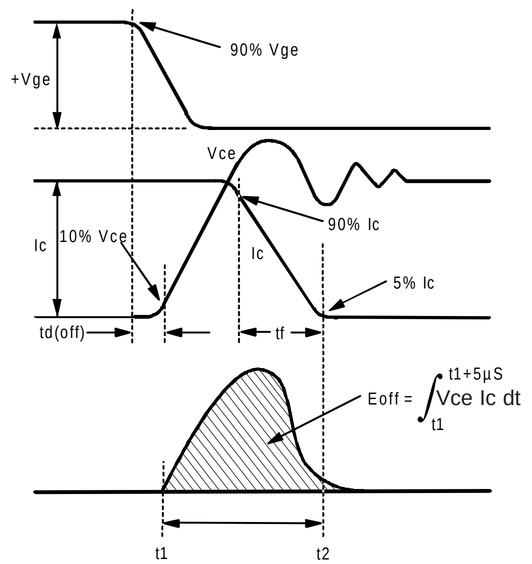


Fig. 18 - Test Waveforms for Circuit of Fig. 17, Defining E_{off}, $t_{d(off)}$, t_f

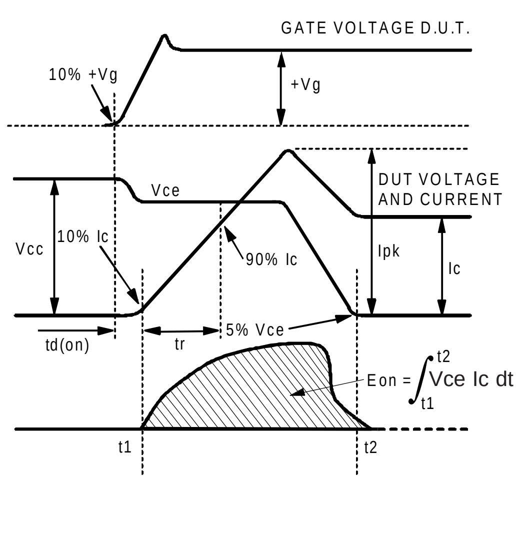


Fig. 19 - Test Waveforms for Circuit of Fig. 17, Defining E_{on}, $t_{d(on)}$, t_r

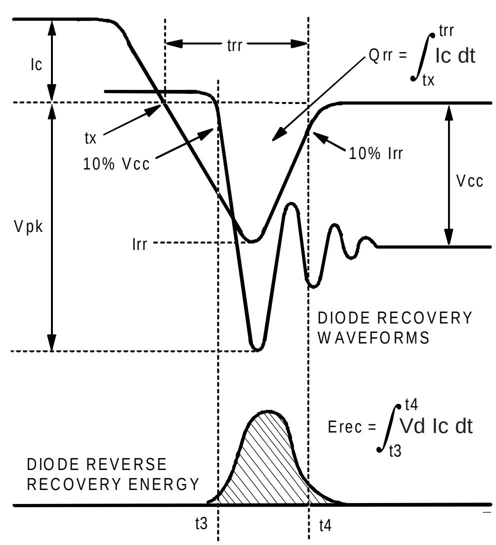


Fig. 20 - Test Waveforms for Circuit of Fig. 17, Defining E_{rec}, t_{rr}, Q_{rr}, I_{rr}

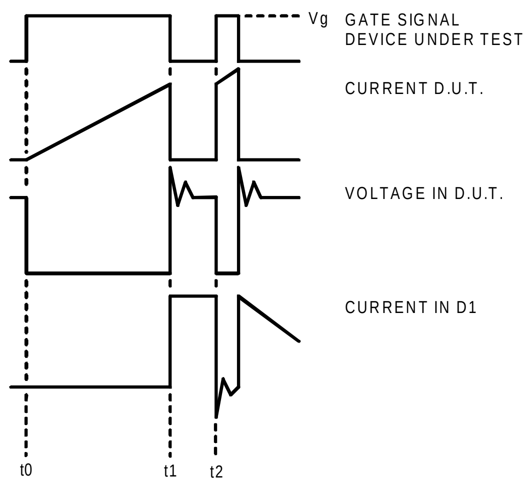


Figure 21. Macro Waveforms for Figure 17's Test Circuit

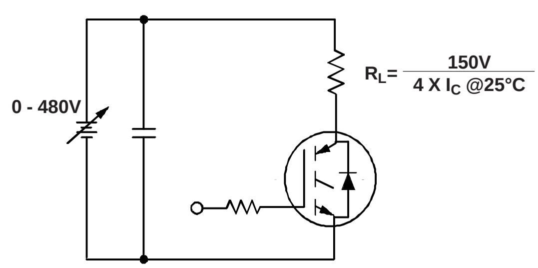


Figure 22. Pulsed Collector Current Test Circuit

Notes:

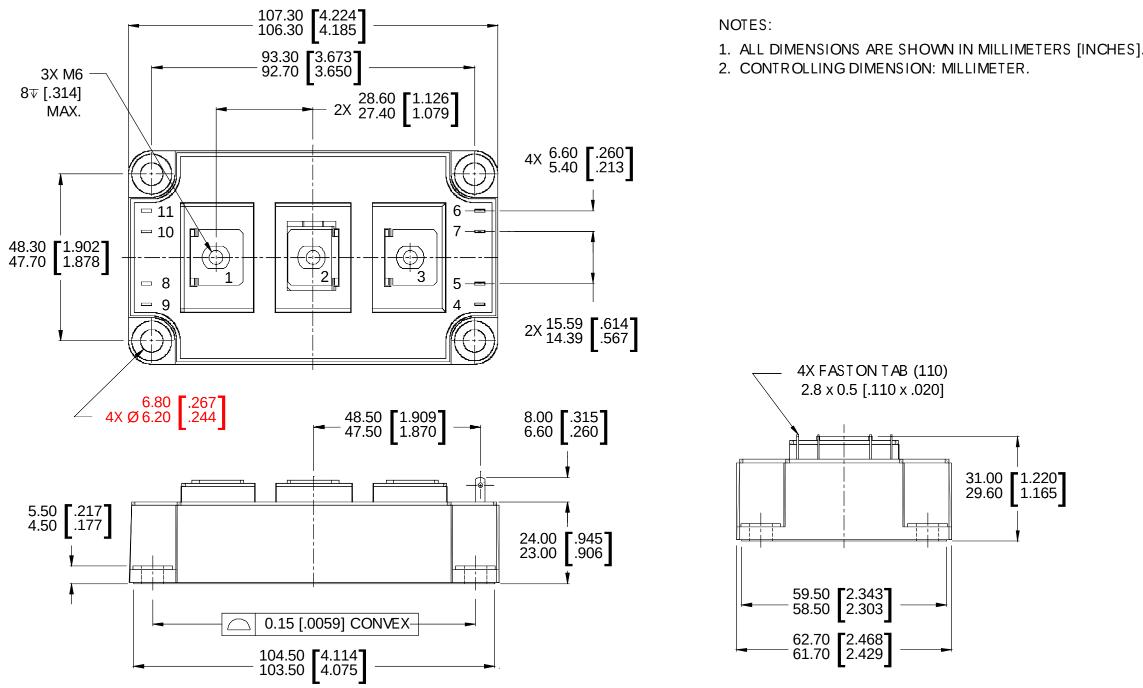
① Repetitive rating; V_{GE} = 20V, pulse width limited by max. junction temperature.

② See fig. 17

③ For screws M6.

④ Pulse width 80µs; 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.

International
IOR Rectifier

IR WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105
TAC Fax: (310) 252-7903
Visit us at www.irf.com for sales contact information.05/02