International Rectifier

PD - 50048D

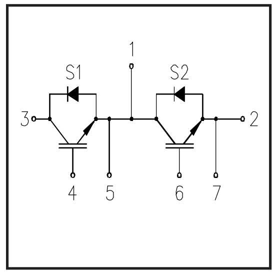
GA500TD60U

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

Ultra-Fast™ Speed IGBT

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 approved



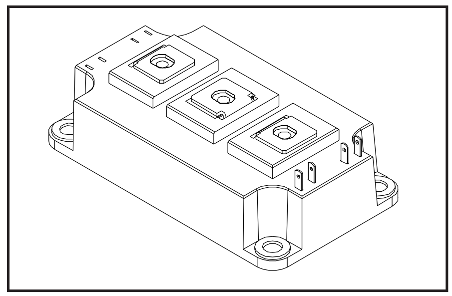
V_{CES} = 600V

$V_{CE(on)\ typ.}$ = 1.9V

@V_{GE} = 15V, I_C = 500A

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	600	V
I_C @ T_C = 25°C	Continuous Collector Current	500	A
I_{CM}	Pulsed Collector Current①	1000	
I_{LM}	Peak Switching Current②	1000	
I_{FM}	Peak Diode Forward Current	500	
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	1550	W
P_D @ T_C = 85°C	Maximum Power Dissipation	800	
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	—	0.08	°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 & 3 ③	—	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	600	—	—	V	V_{GE} = 0V, I_C = 1mA
$V_{CE(on)}$	Collector-to-Emitter Voltage	—	1.9	2.4		V_{GE} = 15V, I_C = 500A
		—	2.0	—		V_{GE} = 15V, I_C = 500A, 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 = 3.0mA
g_{fe}	Forward Transconductance ④	—	244	—	S	V_{CE} = 25V, I_C = 500A
I_{CES}	Collector-to-Emitter Leaking Current	—	—	2.0	mA	V_{GE} = 0V, V_{CE} = 600V
		—	—	20		V_{GE} = 0V, V_{CE} = 600V, T_J = 125°C
V_{FM}	Diode Forward Voltage - Maximum	—	4.0	—	V	I_F = 500A, V_{GE} = 0V
		—	4.1	—		I_F = 500A, V_{GE} = 0V, T_J = 125°C
I_{GES}	Gate-to-Emitter Leakage Current	—	—	250	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)	—	2100	3200	nC	V_{CC} = 400V
Q_{ge}	Gate - Emitter Charge (turn-on)	—	292	440		I_C = 500A
Q_{gc}	Gate - Collector Charge (turn-on)	—	1050	1580		T_J = 25°C
$t_{d(on)}$	Turn-On Delay Time	—	1900	—	ns	R_{G1} = 15Ω, R_{G2} = 0Ω,
t_r	Rise Time	—	430	—		I_C = 500A
$t_{d(off)}$	Turn-Off Delay Time	—	800	—		V_{CC} = 360V
t_f	Fall Time	—	190	—		V_{GE} = ±15V
E_{on}	Turn-On Switching Energy	—	41	—	mJ	See Fig.17 through Fig.21
E_{off}	Turn-Off Switching Energy	—	56	—		
E_{ts}	Total Switching Energy	—	97	110		
C_{ies}	Input Capacitance	—	46800	—	pF	V_{GE} = 0V
C_{oes}	Output Capacitance	—	2920	—		V_{CC} = 30V
C_{res}	Reverse Transfer Capacitance	—	600	—		f = 1 MHz
t_{rr}	Diode Reverse Recovery Time	—	246	—	ns	I_C = 500A
I_{rr}	Diode Peak ReverseCurrent	—	144	—	A	R_{G1} = 15Ω
Q_{rr}	Diode Recovery Charge	—	17655	—	µC	R_{G2} = 0Ω
$di_{(rec)}M/dt$	Diode Peak Rate of Fall of Recovery During t_b	—	1386	—	A/µs	V_{CC} = 360V di/dt=1300A/µs

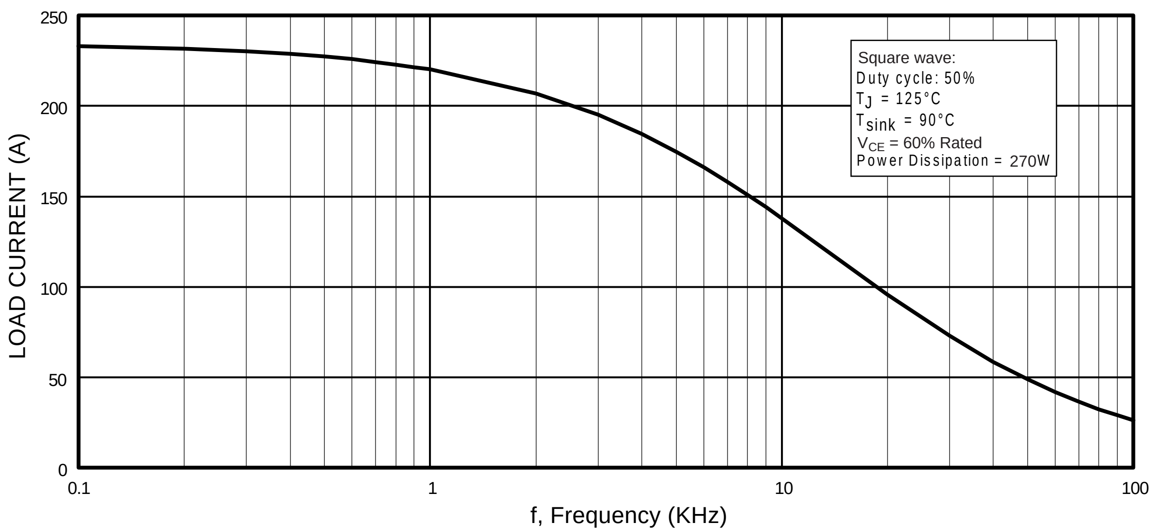


Fig. 1 - Typical Load Current vs. Frequency
(Load Current = I_{RMS} of fundamental)

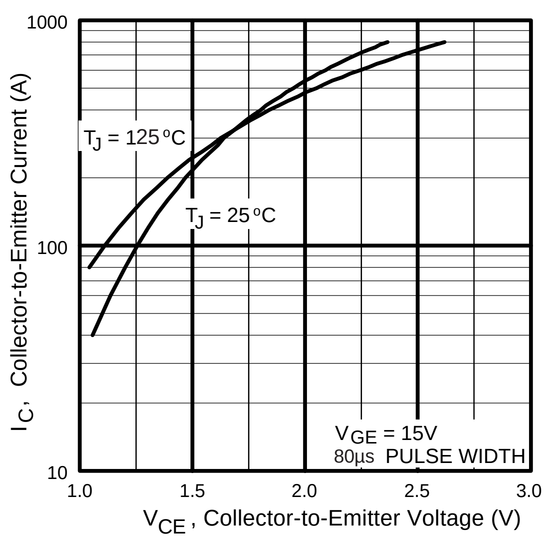


Fig. 2 - Typical Output Characteristics

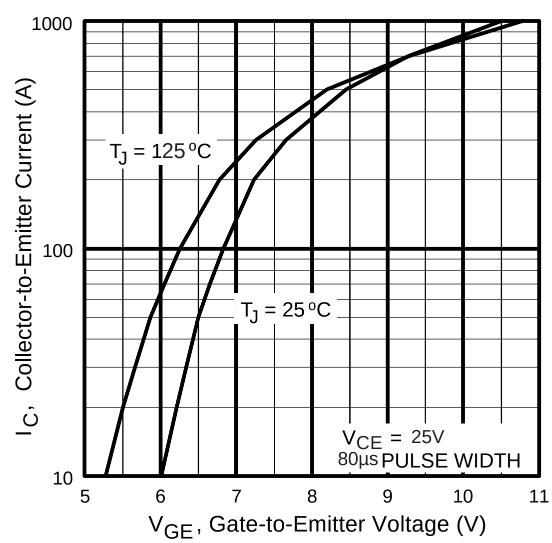


Fig. 3 - Typical Transfer Characteristics

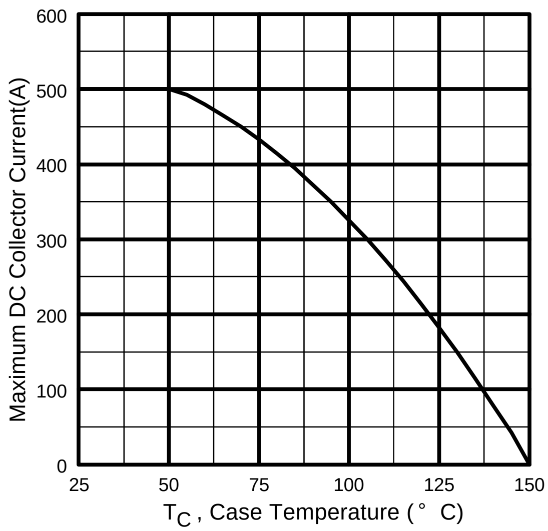


Fig. 4 - Maximum Collector Current vs. Case Temperature

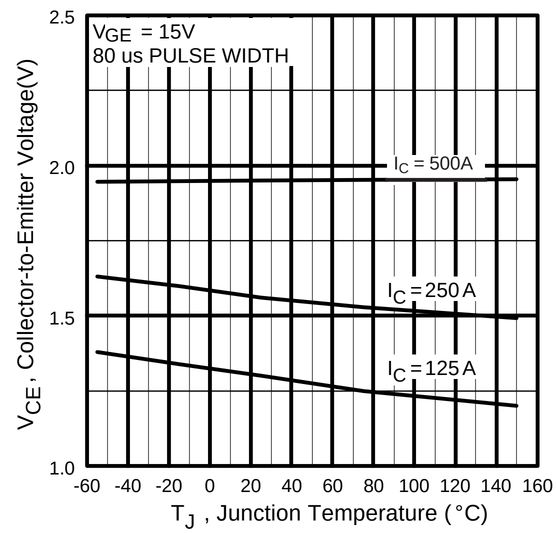


Fig. 5 - Typical Collector-to-Emitter Voltage vs. Junction Temperature

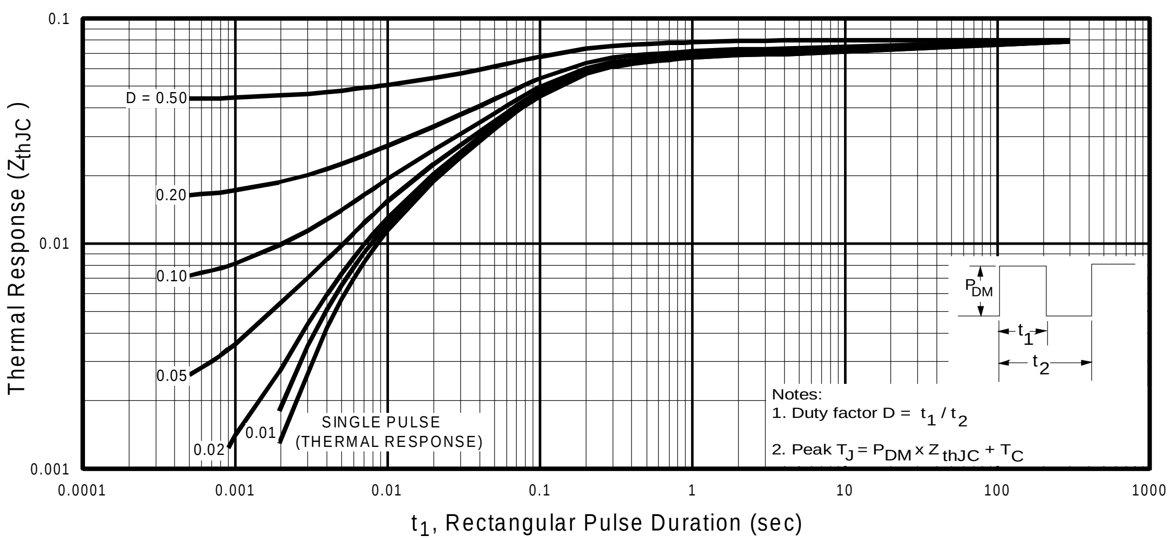


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

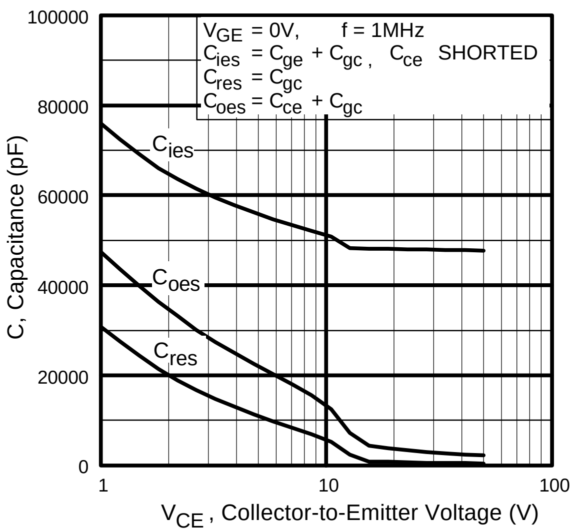


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

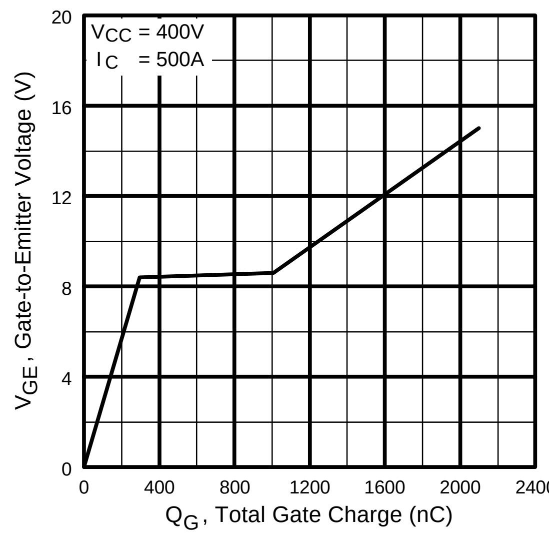


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

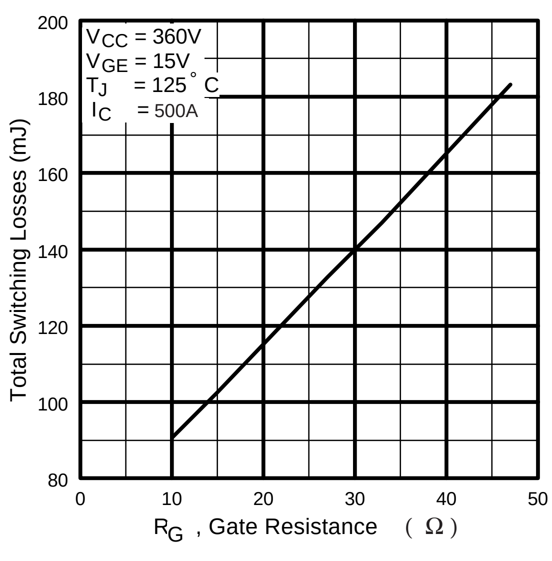


Fig. 9 - Typical Switching Losses vs. Gate Resistance

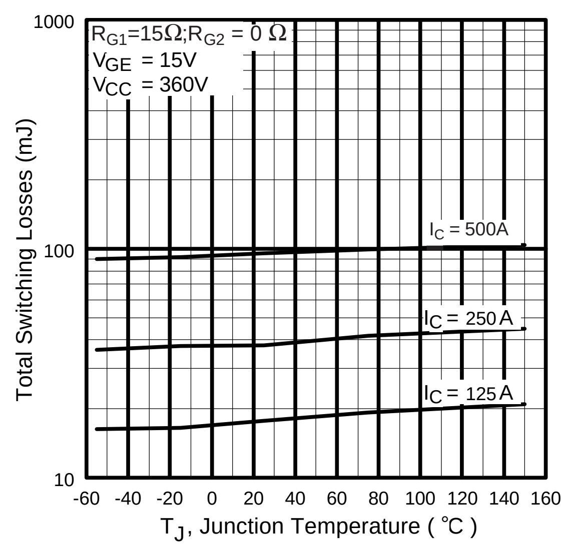


Fig. 10 - Typical Switching Losses vs. Junction Temperature

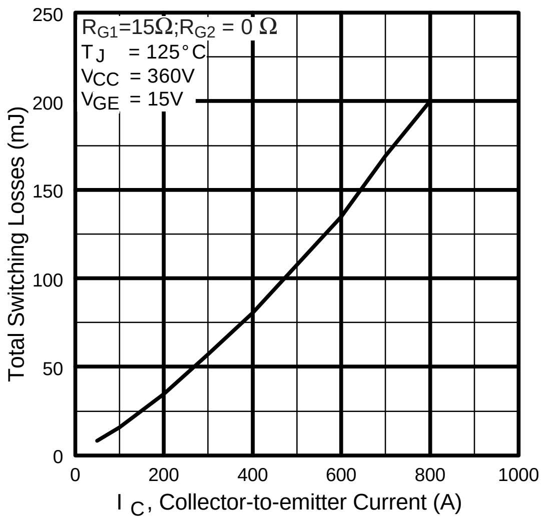


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

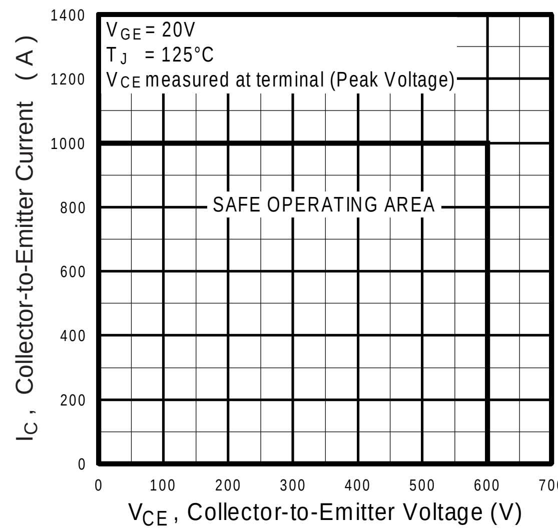


Fig. 12 - Reverse Bias SOA

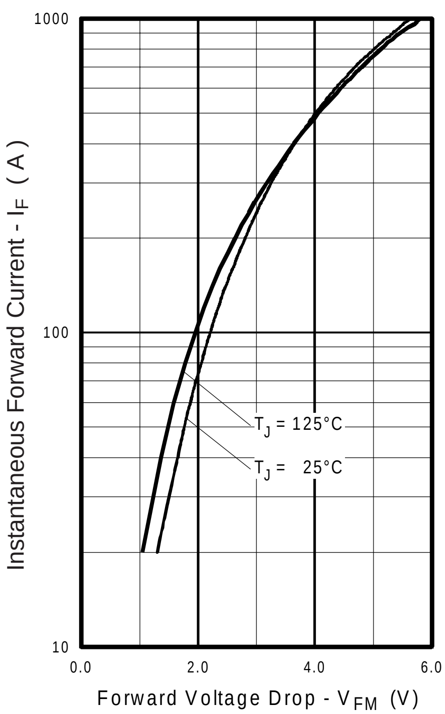


Fig. 13 - Typical Forward Voltage Drop vs. Instantaneous Forward Current

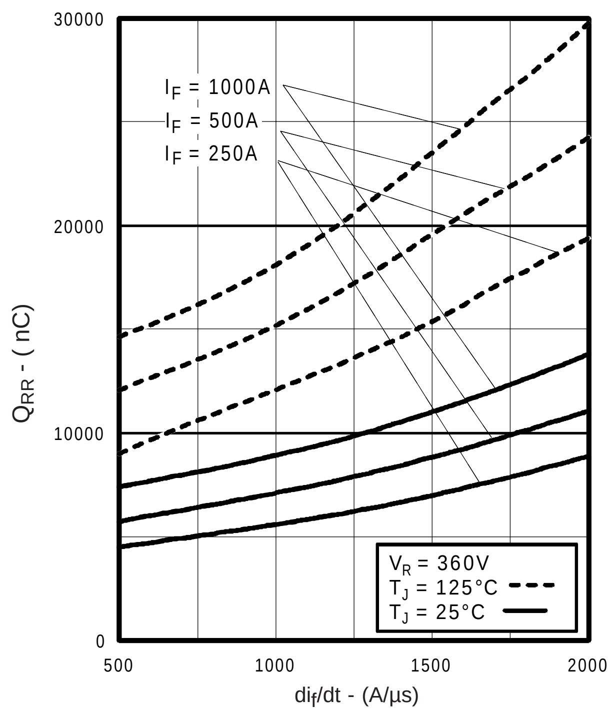


Fig. 14 - Typical Stored Charge vs. di_f/dt

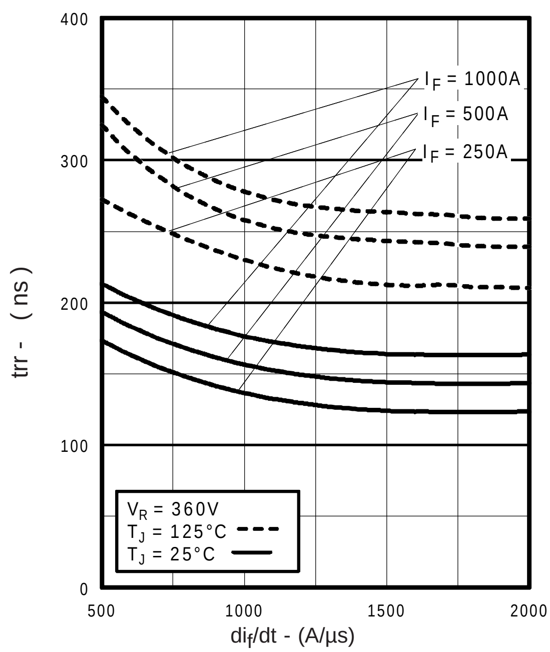


Fig. 15 - Typical Reverse Recovery vs. di_f/dt

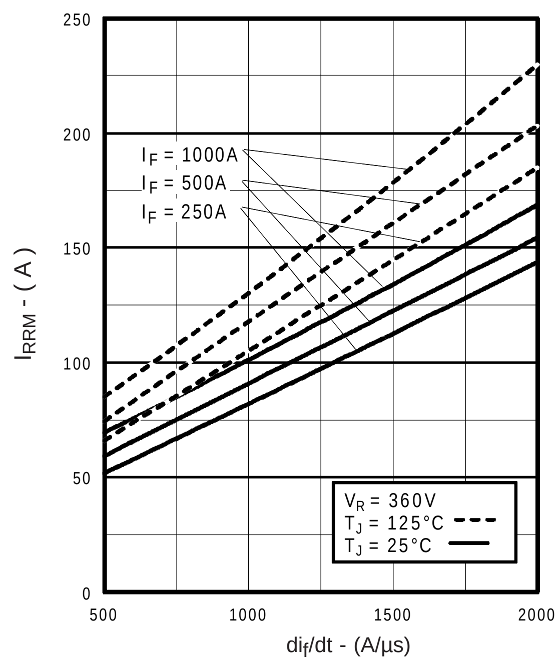


Fig. 16 - Typical Recovery Current vs. di_f/dt

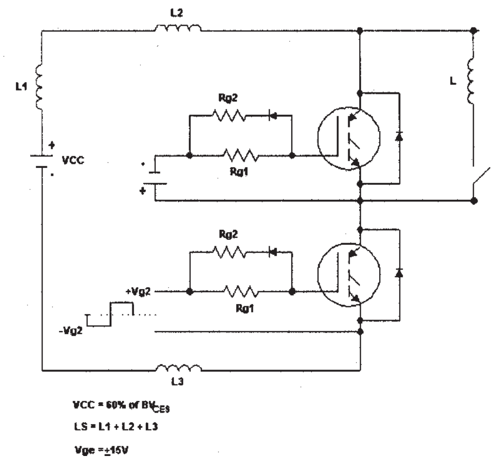


Fig. 17 - Test Circuit for Measurement of I_{LM}, E_{on}, $E_{off(diode)}$, t_{rr}, Q_{rr}, I_{rr}, $t_{d(on)}$, t_r, $t_{d(off)}$, t_f

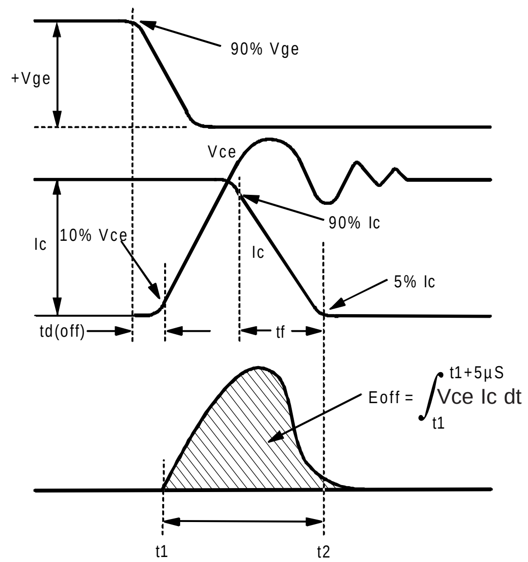


Fig. 18 - Test Waveforms for Circuit of Fig. 17, Defining E_{off}, $t_{d(off)}$, t_f

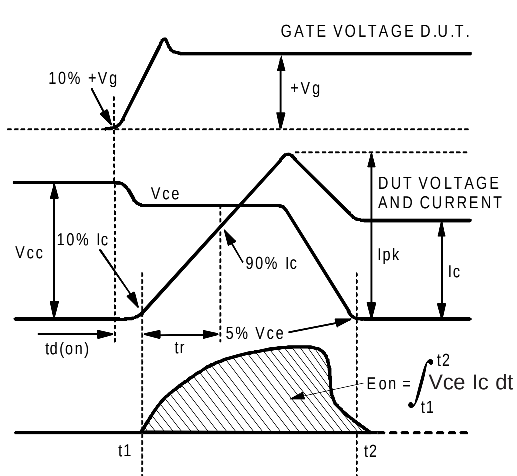


Fig. 19 - Test Waveforms for Circuit of Fig. 17, Defining E_{on}, $t_{d(on)}$, t_r

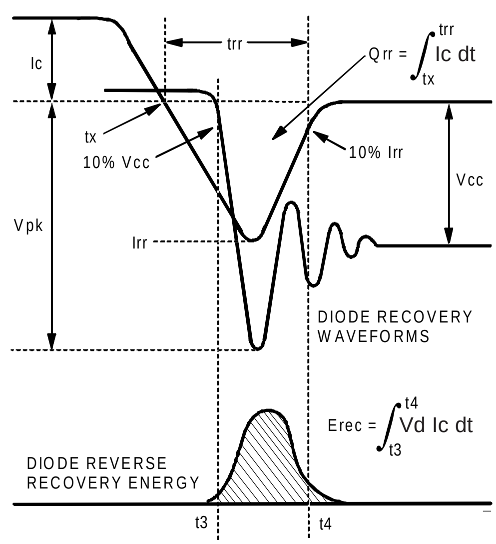


Fig. 20 - Test Waveforms for Circuit of Fig. 17, Defining E_{rec}, t_{rr}, Q_{rr}, I_{rr}

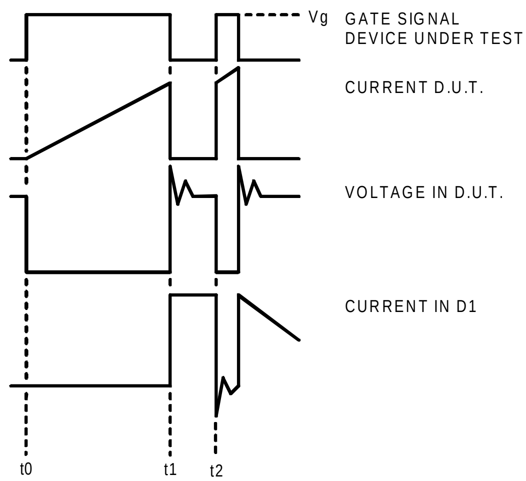


Figure 21. Macro Waveforms for Figure 17's Test Circuit

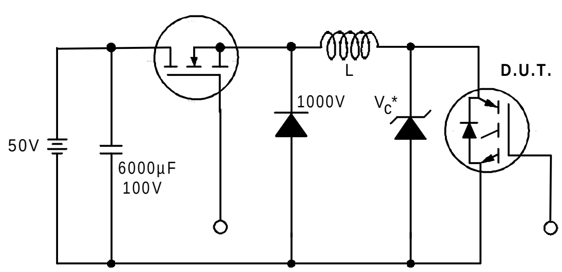


Figure 22. Clamped Inductive Load Test Circuit

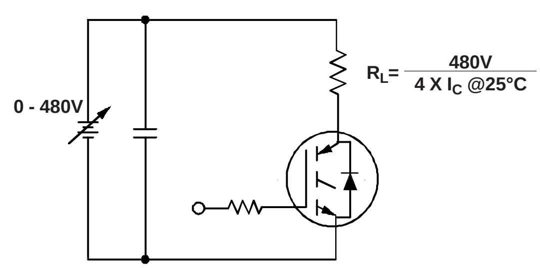


Figure 23. Pulsed Collector Current Test Circuit

Notes:

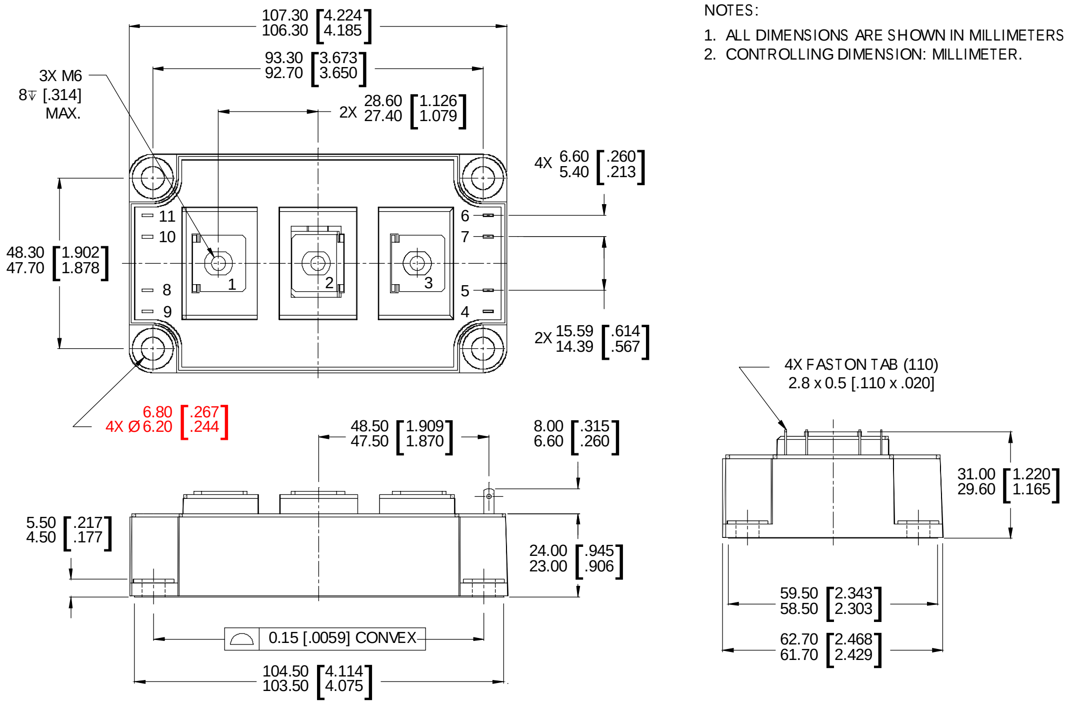
① Repetitive rating; V_{GE} = 20V, pulse width limited by max. junction temperature.

② See fig. 17

③ For screws M6.

④ Pulse width 80µs; single shot.

Case Outline — DUAL INT-A-PAK



NOTES:
1. ALL DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
2. CONTROLLING DIMENSION: MILLIMETER.

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