Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!

Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832
Email & Skype: info@chipsmall.com Web: www.chipsmall.com
Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China

International
IOR Rectifier

PD- 91777

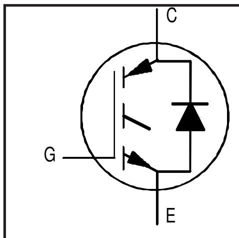
IRG4PH20KD

INSULATED GATE BIPOLAR TRANSISTOR WITH ULTRAFAST SOFT RECOVERY DIODE

Short Circuit Rated
UltraFast IGBT

Features

- High short circuit rating optimized for motor control, t_{sc} =10µs, V_{CC} = 720V , T_J = 125°C, V_{GE} = 15V
- Combines low conduction losses with high switching speed
- Tighter parameter distribution and higher efficiency than previous generations
- IGBT co-packaged with HEXFRED™ ultrafast, ultrasoft recovery antiparallel diodes



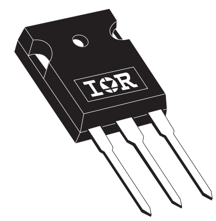
V_{CES} = 1200V

$V_{CE(on)\ typ.}$ = 3.17V

@V_{GE} = 15V, I_C = 5.0A

Benefits

- Latest generation 4 IGBT's offer highest power density motor controls possible
- HEXFRED™ diodes optimized for performance with IGBTs. Minimized recovery characteristics reduce noise, EMI and switching losses



TO-247AC

Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Voltage	1200	V
I_C @ T_C = 25°C	Continuous Collector Current	11	A
I_C @ T_C = 100°C	Continuous Collector Current	5.0	
I_{CM}	Pulsed Collector Current ①	22	
I_{LM}	Clamped Inductive Load Current ②	22	
I_F @ T_C = 100°C	Diode Continuous Forward Current	5.0	
I_{FM}	Diode Maximum Forward Current	22	
t_{sc}	Short Circuit Withstand Time	10	µs
V_{GE}	Gate-to-Emitter Voltage	± 20	V
P_D @ T_C = 25°C	Maximum Power Dissipation	60	W
P_D @ T_C = 100°C	Maximum Power Dissipation	24	
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to +150	°C
	Soldering Temperature, for 10 sec.	300 (0.063 in. (1.6mm) from case)	
	Mounting Torque, 6-32 or M3 Screw.	10 lbf•in (1.1 N•m)	

Thermal Resistance

	Parameter	Min.	Typ.	Max.	Units
$R_{θJC}$	Junction-to-Case - IGBT	——	——	2.1	°C/W
$R_{θJC}$	Junction-to-Case - Diode	——	——	3.5	
$R_{θCS}$	Case-to-Sink, flat, greased surface	——	0.24	——	
$R_{θJA}$	Junction-to-Ambient, typical socket mount	——	——	40	
Wt	Weight	——	6 (0.21)	——	g (oz)

6/25/98

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

	Parameter	Min.	Typ.	Max.	Units	Conditions	
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage③	1200	—	—	V	V_{GE} = 0V, I_C = 250µA	
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	1.13	—	V/°C	V_{GE} = 0V, I_C = 2.5mA	
$V_{CE(on)}$	Collector-to-Emitter Saturation Voltage	—	3.17	4.3	V	I_C = 5.0A	V_{GE} = 15V
		—	4.04	—		I_C = 11A	See Fig. 2, 5
		—	2.84	—		I_C = 5.0A, T_J = 150°C	
$V_{GE(th)}$	Gate Threshold Voltage	3.5	—	6.5		$V_{CE} = V_{GE}$, I_C = 250µA	
$\Delta V_{GE(th)}/\Delta T_J$	Temperature Coeff. of Threshold Voltage	—	-10	—	mV/°C	$V_{CE} = V_{GE}$, I_C = 1mA	
g_{fe}	Forward Transconductance ④	2.3	3.5	—	S	V_{CE} = 100V, I_C = 5.0A	
I_{CES}	Zero Gate Voltage Collector Current	—	—	250	µA	V_{GE} = 0V, V_{CE} = 1200V	
		—	—	1000		V_{GE} = 0V, V_{CE} = 1200V, T_J = 150°C	
V_{FM}	Diode Forward Voltage Drop	—	2.5	2.9	V	I_C = 5.0A	See Fig. 13
		—	2.2	2.6		I_C = 5.0A, T_J = 150°C	
I_{GES}	Gate-to-Emitter Leakage Current	—	—	±100	nA	V_{GE} = ±20V	

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

	Parameter	Min.	Typ.	Max.	Units	Conditions	
Q_g	Total Gate Charge (turn-on)	—	28	43	nC	I_C = 5.0A	
Q_{ge}	Gate - Emitter Charge (turn-on)	—	4.4	6.6		V_{CC} = 400V See Fig.8	
Q_{gc}	Gate - Collector Charge (turn-on)	—	12	18		V_{GE} = 15V	
$t_{d(on)}$	Turn-On Delay Time	—	50	—	ns		
t_r	Rise Time	—	30	—		T_J = 25°C	
$t_{d(off)}$	Turn-Off Delay Time	—	100	150		I_C = 5.0A, V_{CC} = 800V	
t_f	Fall Time	—	250	380		V_{GE} = 15V, R_G = 50Ω	
E_{on}	Turn-On Switching Loss	—	0.62	—	mJ	Energy losses include "tail"	
E_{off}	Turn-Off Switching Loss	—	0.30	—		and diode reverse recovery	
E_{ts}	Total Switching Loss	—	0.92	1.2		See Fig. 9,10,18	
t_{sc}	Short Circuit Withstand Time	10	—	—	µs	V_{CC} = 720V, T_J = 125°C V_{GE} = 15V, R_G = 50Ω	
$t_{d(on)}$	Turn-On Delay Time	—	50	—	ns	T_J = 150°C, See Fig. 10,11,18	
t_r	Rise Time	—	30	—		I_C = 5.0A, V_{CC} = 800V	
$t_{d(off)}$	Turn-Off Delay Time	—	110	—		V_{GE} = 15V, R_G = 50Ω,	
t_f	Fall Time	—	620	—		Energy losses include "tail"	
E_{ts}	Total Switching Loss	—	1.6	—	mJ	and diode reverse recovery	
L_E	Internal Emitter Inductance	—	13	—	nH	Measured 5mm from package	
C_{ies}	Input Capacitance	—	435	—	pF	V_{GE} = 0V	
C_{oes}	Output Capacitance	—	44	—		V_{CC} = 30V See Fig. 7	
C_{res}	Reverse Transfer Capacitance	—	8.3	—		ƒ = 1.0MHz	
t_{rr}	Diode Reverse Recovery Time	—	51	77	ns	T_J = 25°C See Fig.	
		—	68	102		T_J = 125°C 14	I_F = 5.0A
I_{rr}	Diode Peak Reverse Recovery Current	—	6.0	9.0	A	T_J = 25°C See Fig.	
		—	7.0	11		T_J = 125°C 15	V_R = 200V
Q_{rr}	Diode Reverse Recovery Charge	—	183	274	nC	T_J = 25°C See Fig.	
		—	285	427		T_J = 125°C 16	di/dt = 200A/µs
$di_{(rec)M}/dt$	Diode Peak Rate of Fall of Recovery	—	380	—	A/µs	T_J = 25°C See Fig.	
	During t_b	—	307	—		T_J = 125°C 17	

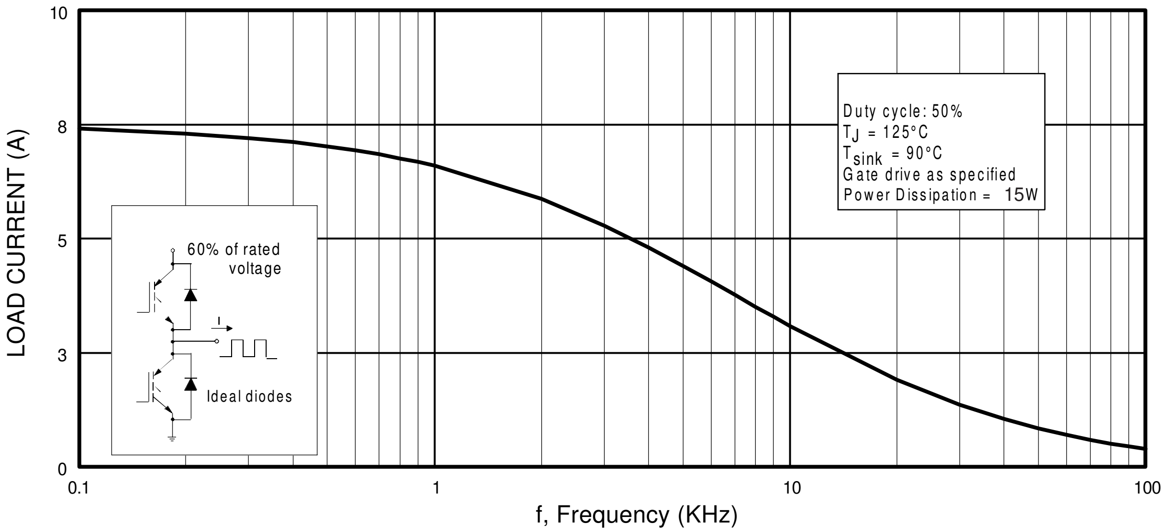


Fig. 1 - Typical Load Current vs. Frequency
(Load Current = I_{RMS} of fundamental)

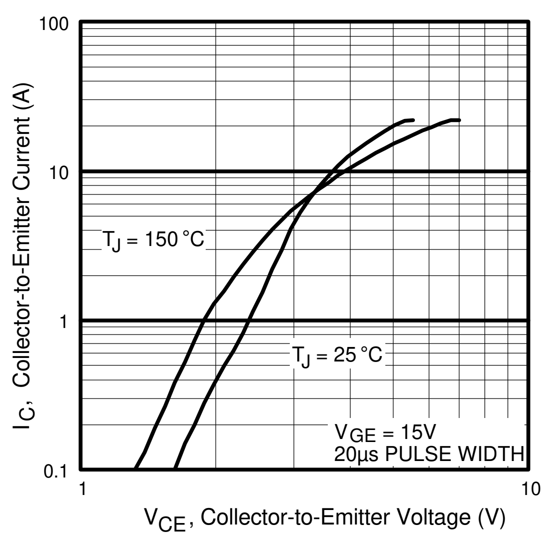


Fig. 2 - Typical Output Characteristics

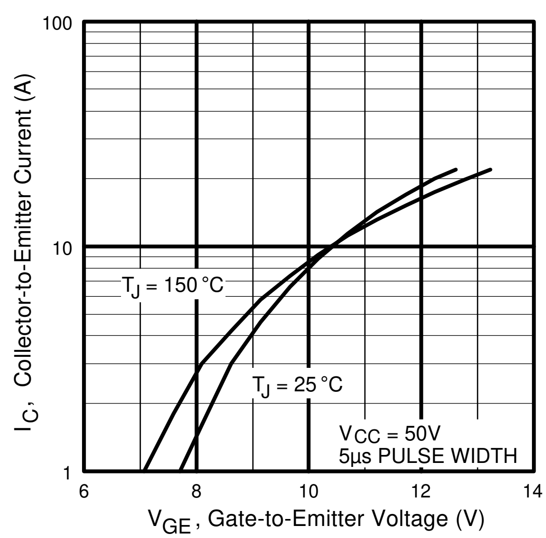


Fig. 3 - Typical Transfer Characteristics

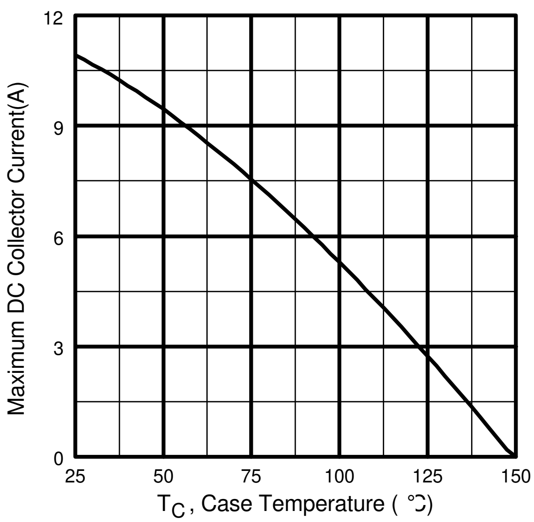


Fig. 4 - Maximum Collector Current vs. Case Temperature

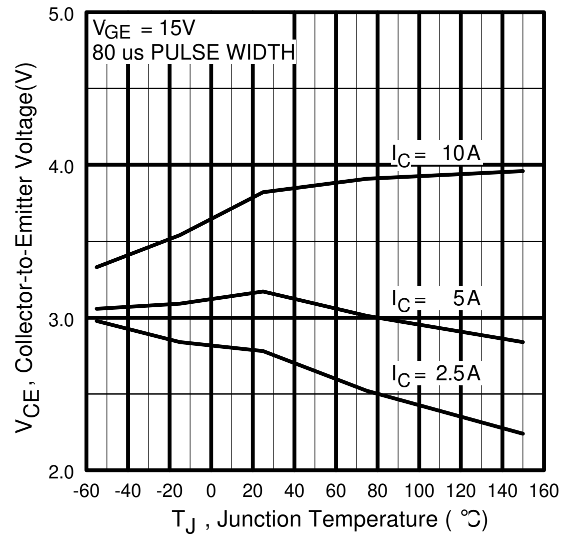


Fig. 5 - Typical Collector-to-Emitter Voltage vs. Junction Temperature

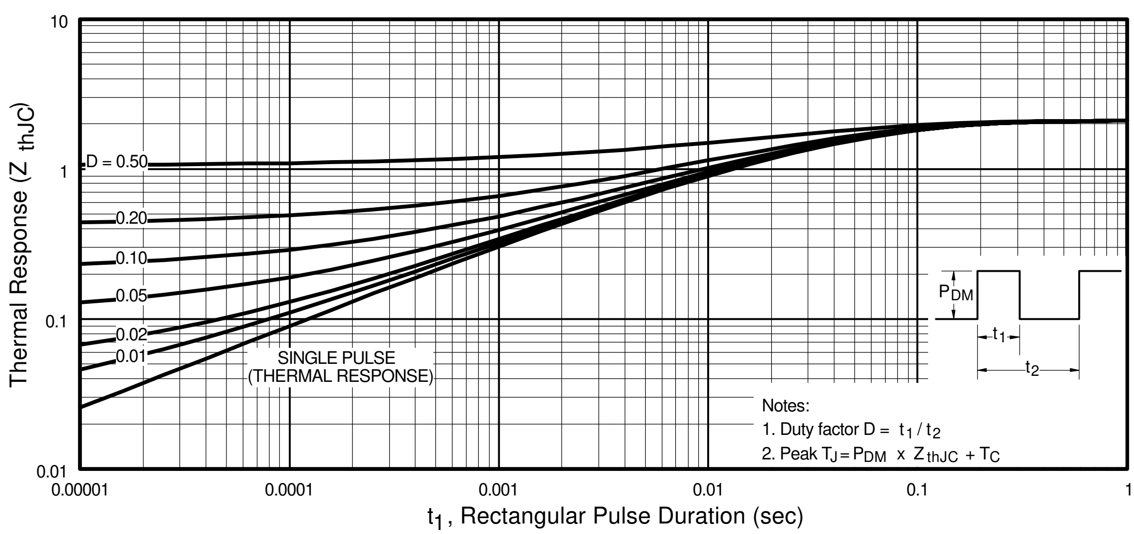


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

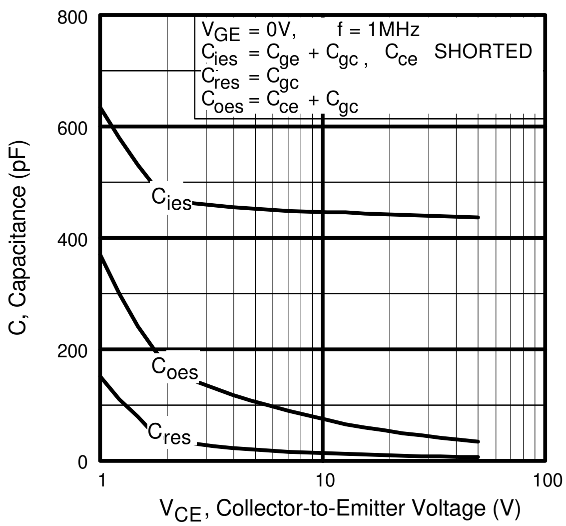


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

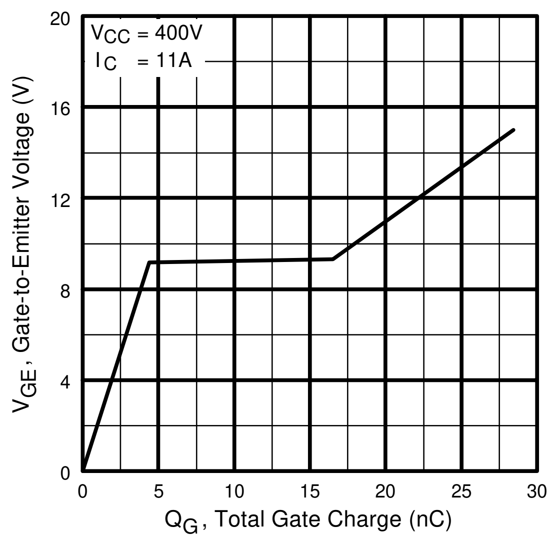


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

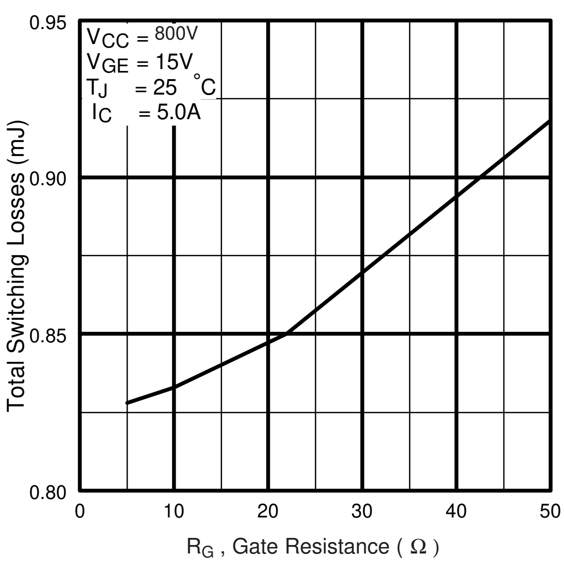


Fig. 9 - Typical Switching Losses vs. Gate Resistance

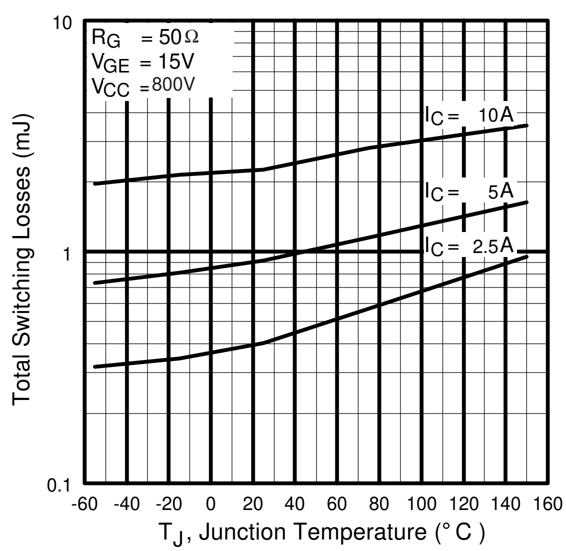


Fig. 10 - Typical Switching Losses vs. Junction Temperature

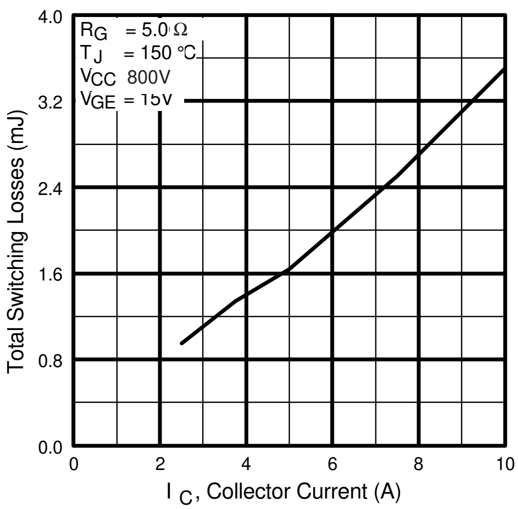


Fig. 11 - Typical Switching Losses vs. Collector Current

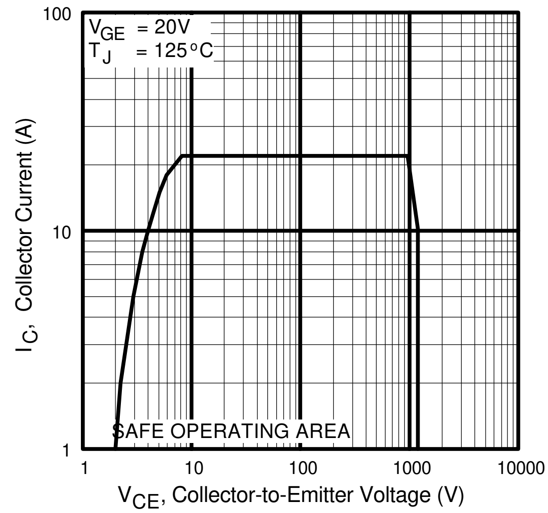


Fig. 12 - Turn-Off SOA

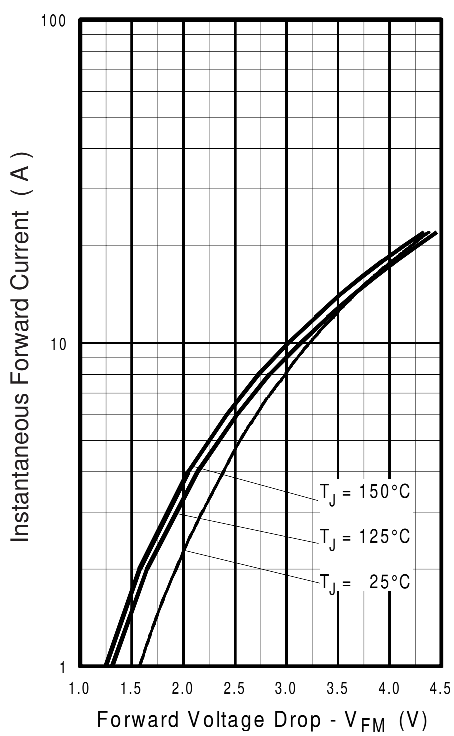


Fig. 13 - Typical Forward Voltage Drop vs. Instantaneous Forward Current

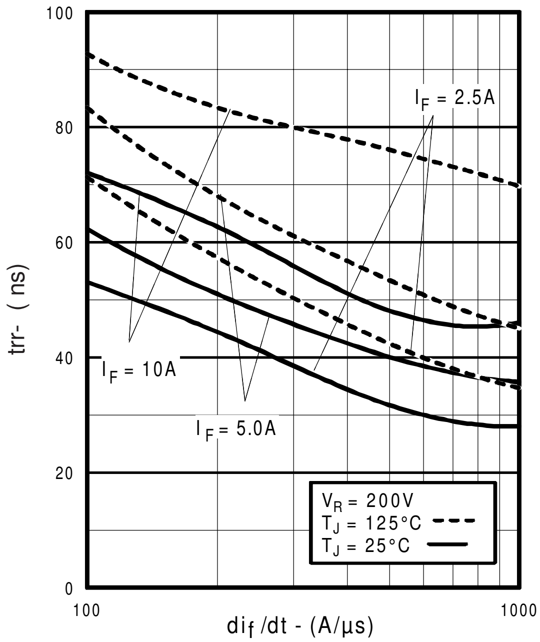


Fig. 14 - Typical Reverse Recovery vs. di_f/dt

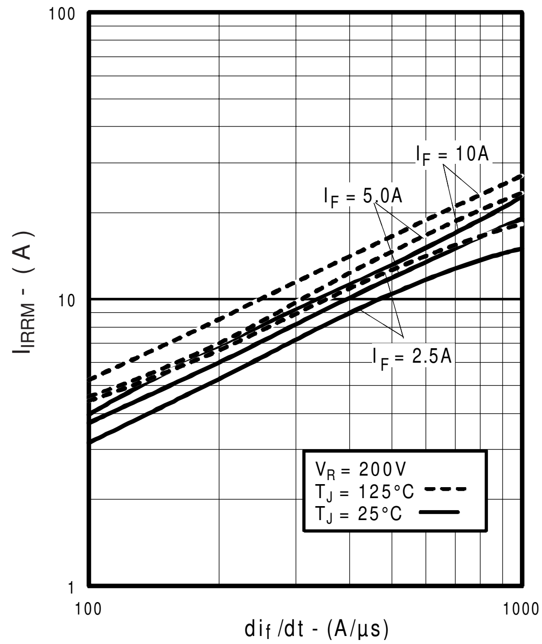


Fig. 15 - Typical Recovery Current vs. di_f/dt

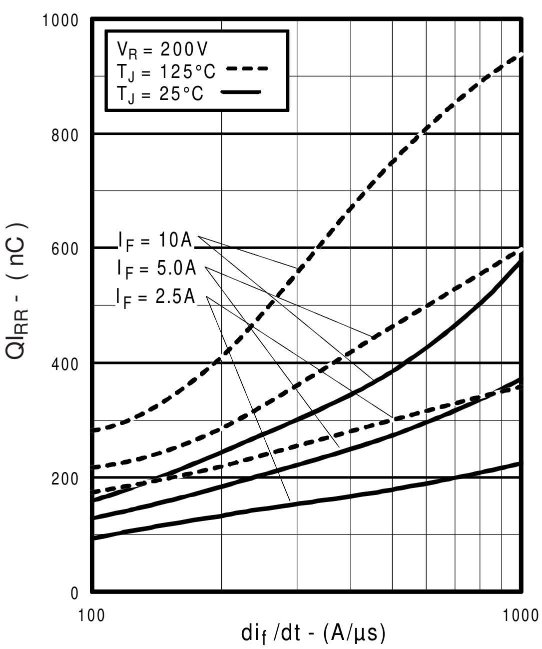


Fig. 16 - Typical Stored Charge vs. di_f/dt

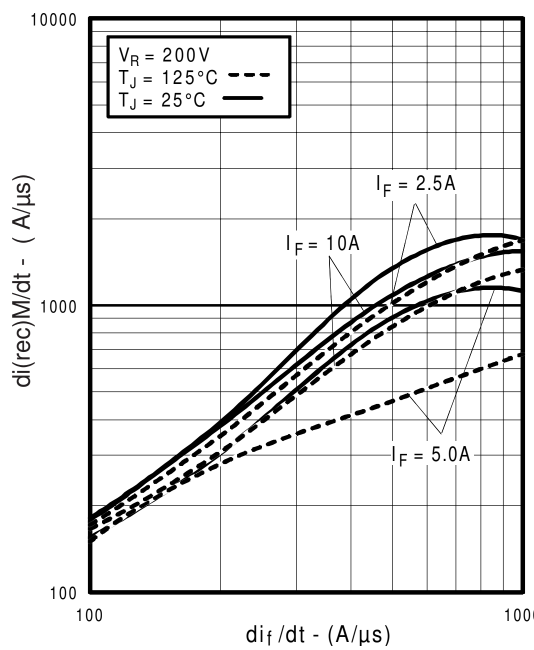


Fig. 17 - Typical $di_{(rec)M}/dt$ vs. di_f/dt

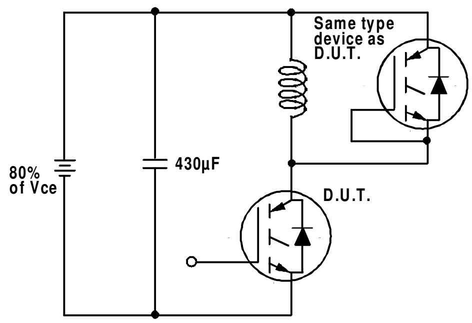


Fig. 18a - Test Circuit for Measurement of I_{LM}, E_{on}, $E_{off(diode)}$, t_{rr}, Q_{rr}, I_{rr}, $t_{d(on)}$, t_r, $t_{d(off)}$, t_f

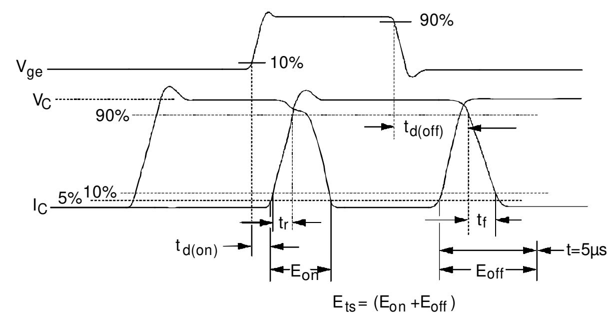


Fig. 18b - Test Waveforms for Circuit of Fig. 18a, Defining E_{off}, $t_{d(off)}$, t_f

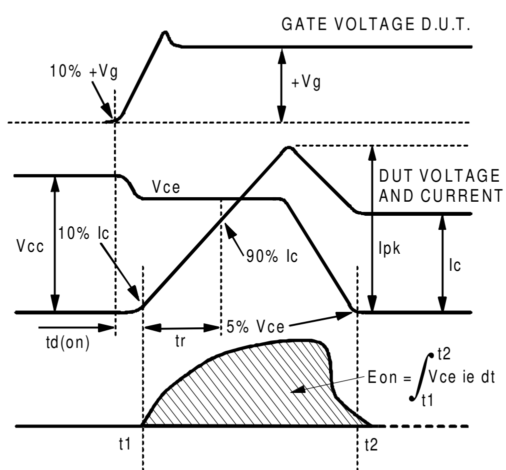


Fig. 18c - Test Waveforms for Circuit of Fig. 18a, Defining E_{on}, $t_{d(on)}$, t_r

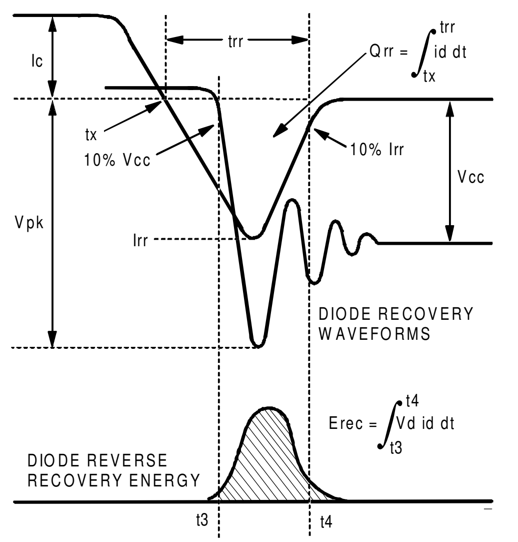


Fig. 18d - Test Waveforms for Circuit of Fig. 18a, Defining E_{rec}, t_{rr}, Q_{rr}, I_{rr}

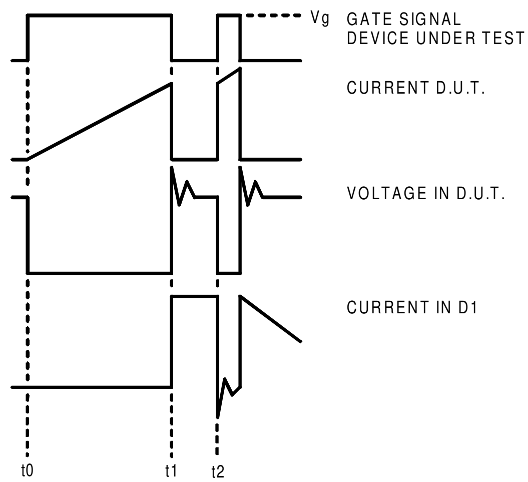


Figure 18e. Macro Waveforms for Figure 18a's Test Circuit

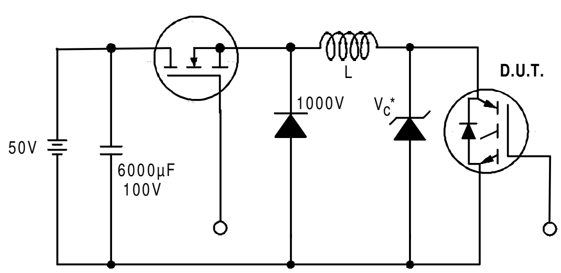


Figure 19. Clamped Inductive Load Test Circuit

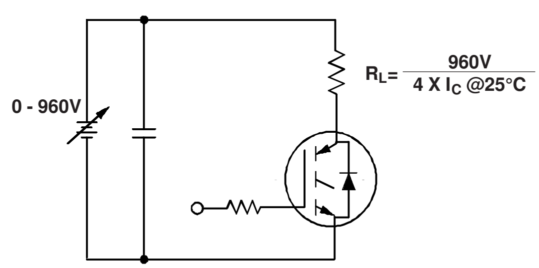


Figure 20. Pulsed Collector Current Test Circuit

Notes:

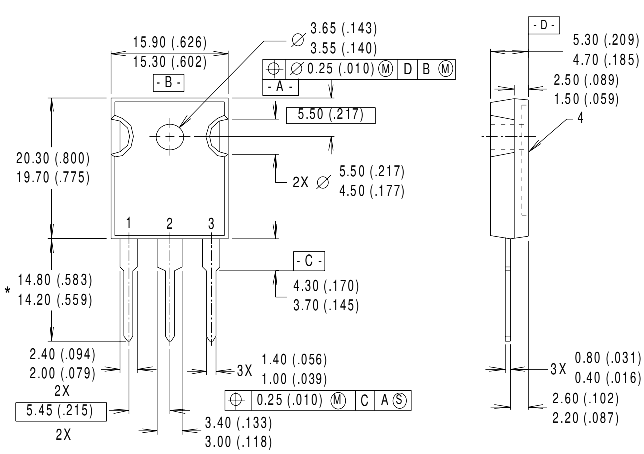
① Repetitive rating: V_{GE}=20V; pulse width limited by maximum junction temperature (figure 20)

② V_{CC}=80%(V_{CES}), V_{GE}=20V, L=10µH, R_G= 5.0Ω (figure 19)

③ Pulse width ≤ 80µs; duty factor ≤ 0.1%.

④ Pulse width 5.0µs, single shot.

Case Outline - TO-247AC



NOTES:
1 DIMENSIONS & TOLERANCING PER ANSI Y14.5M, 1982.
2 CONTROLLING DIMENSION : INCH.
3 DIMENSIONS ARE SHOWN MILLIMETERS (INCHES).
4 CONFORMS TO JEDEC OUTLINE TO-247AC.

LEAD ASSIGNMENTS
1 - GATE
2 - COLLECTOR
3 - EMITTER
4 - COLLECTOR

* LONGER LEADED (20mm) VERSION AVAILABLE (TO-247AD) TO ORDER ADD "-E" SUFFIX TO PART NUMBER

CONFORMS TO JEDEC OUTLINE TO-247AC (TO-3P)
Dimensions in Millimeters and (Inches)

International Rectifier

WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245, Tel: (310) 322 3331
EUROPEAN HEADQUARTERS: Hurst Green, Oxted, Surrey RH8 9BB, UK Tel: ++ 44 1883 732020
IR CANADA: 7321 Victoria Park Ave., Suite 201, Markham, Ontario L3R 2Z8, Tel: (905) 475 1897
IR GERMANY: Saalburgstrasse 157, 61350 Bad Homburg Tel: ++ 49 6172 96590
IR ITALY: Via Liguria 49, 10071 Borgaro, Torino Tel: ++ 39 11 451 0111
IR FAR EAST: K&H Bldg., 2F, 30-4 Nishi-Ikebukuro 3-Chome, Toshima-Ku, Tokyo Japan 171 Tel: 81 3 3983 0086
IR SOUTHEAST ASIA: 315 Outram Road, #10-02 Tan Boon Liat Building, Singapore 0316 Tel: 65 221 8371

Note: For the most current drawings please refer to the IR website at:
http://www.irf.com/package/