

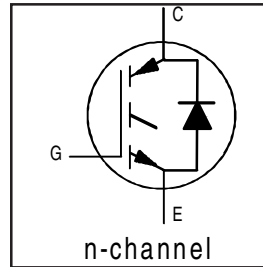
IRG4IBC20FD

INSULATED GATE BIPOLAR TRANSISTOR WITH
ULTRAFAST SOFT RECOVERY DIODE

Fast CoPack IGBT

Features

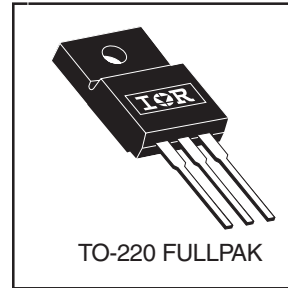
- Very Low 1.66V voltage drop
- 2.5kV, 60s insulation voltage ^⑤
- 4.8 mm creepage distance to heatsink
- Fast: Optimized for medium operating frequencies (1-5 kHz in hard switching, >20 kHz in resonant mode).
- IGBT co-packaged with HEXFRED™ ultrafast, ultrasoft recovery antiparallel diodes
- Tighter parameter distribution
- Industry standard Isolated TO-220 Fullpak™ outline



$V_{CES} = 600V$
$V_{CE(on) typ.} = 1.66V$
@ $V_{GE} = 15V, I_C = 9.0A$

Benefits

- Simplified assembly
- Highest efficiency and power density
- HEXFRED™ antiparallel Diode minimizes switching losses and EMI



Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Voltage	600	V
$I_C @ T_C = 25^\circ C$	Continuous Collector Current	14.3	A
$I_C @ T_C = 100^\circ C$	Continuous Collector Current	7.7	
I_{CM}	Pulsed Collector Current ^①	64	
I_{LM}	Clamped Inductive Load Current ^②	64	
$I_F @ T_C = 100^\circ C$	Diode Continuous Forward Current	6.5	
I_{FM}	Diode Maximum Forward Current	64	
Visol	RMS Isolation Voltage, Terminal to Case ^⑤	2500	V
V_{GE}	Gate-to-Emitter Voltage	± 20	
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	34	W
$P_D @ T_C = 100^\circ C$	Maximum Power Dissipation	14	
T_J	Operating Junction and	-55 to +150	°C
T_{STG}	Storage Temperature Range		
	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	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case - IGBT	—	3.7	°C/W
$R_{\theta JC}$	Junction-to-Case - Diode	—	5.1	
$R_{\theta JA}$	Junction-to-Ambient, typical socket mount	—	65	
Wt	Weight	2.0 (0.07)	—	g (oz)

Electrical Characteristics @ T_J = 25°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 = 250μA
ΔV _{(BR)CES/ΔT_J}	Temperature Coeff. of Breakdown Voltage	—	0.72	—	V/°C	V _{GE} = 0V, I _C = 1.0mA
V _{CE(on)}	Collector-to-Emitter Saturation Voltage	—	1.66	2.0	V	I _C = 9.0A
		—	2.06	—		I _C = 16A
		—	1.76	—		I _C = 9.0A, T _J = 150°C
V _{GE(th)}	Gate Threshold Voltage	3.0	—	6.0		V _{CE} = V _{GE} , I _C = 250μA
ΔV _{GE(th)/ΔT_J}	Temperature Coeff. of Threshold Voltage	—	-11	—	mV/°C	V _{CE} = V _{GE} , I _C = 250μA
g _{fe}	Forward Transconductance ^④	2.9	5.1	—	S	V _{CE} = 100V, I _C = 9.0A
I _{CES}	Zero Gate Voltage Collector Current	—	—	250	μA	V _{GE} = 0V, V _{CE} = 600V
		—	—	1700		V _{GE} = 0V, V _{CE} = 600V, T _J = 150°C
V _{FM}	Diode Forward Voltage Drop	—	1.4	1.7	V	I _C = 8.0A
		—	1.3	1.6		I _C = 8.0A, 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)	—	27	40	nC	I _C = 9.0A	
Q _{ge}	Gate - Emitter Charge (turn-on)	—	4.2	6.2		V _{CC} = 400V	
Q _{gc}	Gate - Collector Charge (turn-on)	—	9.9	15		V _{GE} = 15V	
t _{d(on)}	Turn-On Delay Time	—	43	—	ns	T _J = 25°C	
t _r	Rise Time	—	20	—		I _C = 9.0A, V _{CC} = 480V	
t _{d(off)}	Turn-Off Delay Time	—	240	360		V _{GE} = 15V, R _G = 50Ω	
t _f	Fall Time	—	150	220		Energy losses include "tail" and diode reverse recovery.	
E _{on}	Turn-On Switching Loss	—	0.25	—		mJ	See Fig. 9, 10, 18
E _{off}	Turn-Off Switching Loss	—	0.64	—			
E _{ts}	Total Switching Loss	—	0.89	1.3			
t _{d(on)}	Turn-On Delay Time	—	41	—	ns	T _J = 150°C, See Fig. 11, 18	
t _r	Rise Time	—	22	—		I _C = 9.0A, V _{CC} = 480V	
t _{d(off)}	Turn-Off Delay Time	—	320	—		V _{GE} = 15V, R _G = 50Ω	
t _f	Fall Time	—	290	—		Energy losses include "tail" and diode reverse recovery.	
E _{ts}	Total Switching Loss	—	1.35	—		mJ	
L _E	Internal Emitter Inductance	—	7.5	—	nH	Measured 5mm from package	
C _{ies}	Input Capacitance	—	540	—	pF	V _{GE} = 0V	
C _{oes}	Output Capacitance	—	37	—		V _{CC} = 30V	
C _{res}	Reverse Transfer Capacitance	—	7.0	—		f = 1.0MHz	
t _{rr}	Diode Reverse Recovery Time	—	37	55	ns	T _J = 25°C See Fig. 14	
		—	55	90		T _J = 125°C	
I _{rr}	Diode Peak Reverse Recovery Current	—	3.5	5.0	A	T _J = 25°C See Fig. 15	
		—	4.5	8.0		T _J = 125°C	
Q _{rr}	Diode Reverse Recovery Charge	—	65	138	nC	T _J = 25°C See Fig. 16	
		—	124	360		T _J = 125°C	
di _{(rec)M/dt}	Diode Peak Rate of Fall of Recovery During t _b	—	240	—	A/μs	T _J = 25°C See Fig. 17	
		—	210	—		T _J = 125°C	

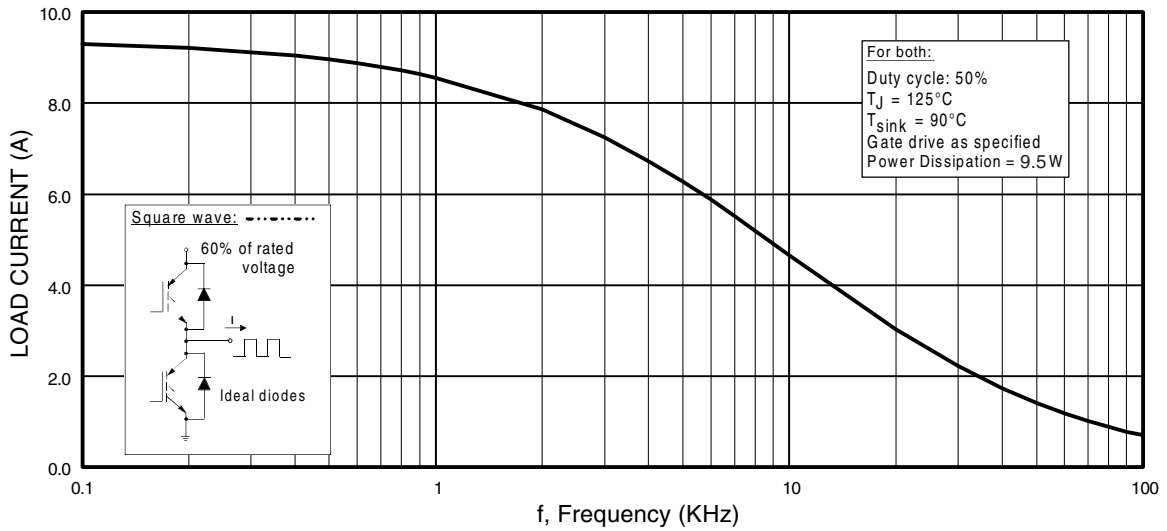


Fig. 1 - Typical Load Current vs. Frequency
 (Load Current = I_{RMS} of fundamental)

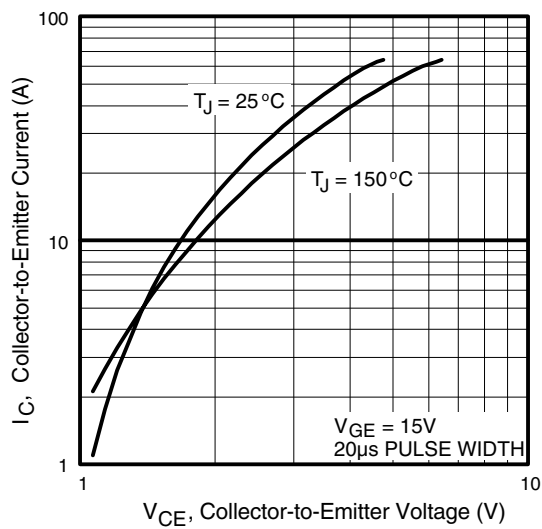


Fig. 2 - Typical Output Characteristics
www.irf.com

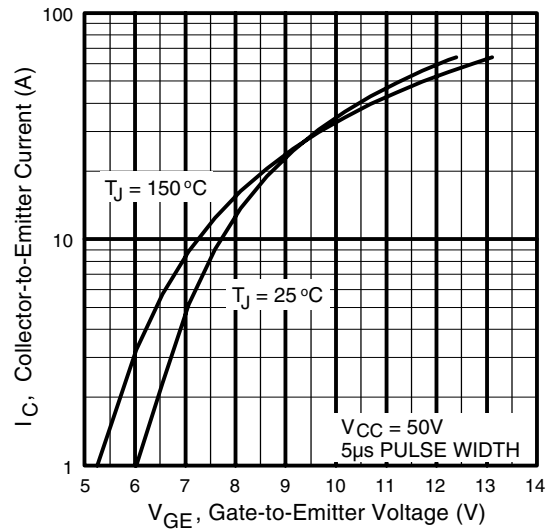


Fig. 3 - Typical Transfer Characteristics

IRG4IBC20FD

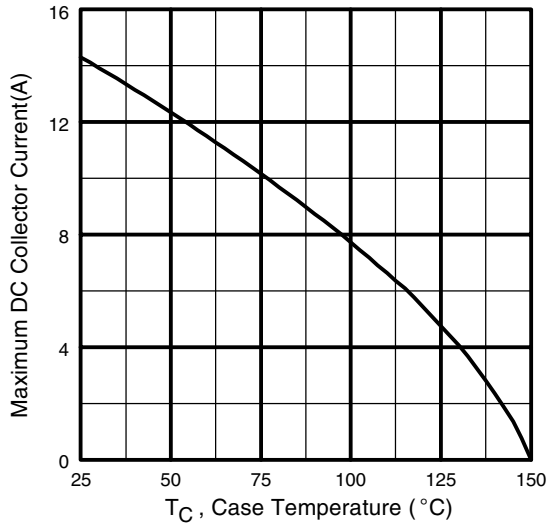


Fig. 4 - Maximum Collector Current vs. Case Temperature

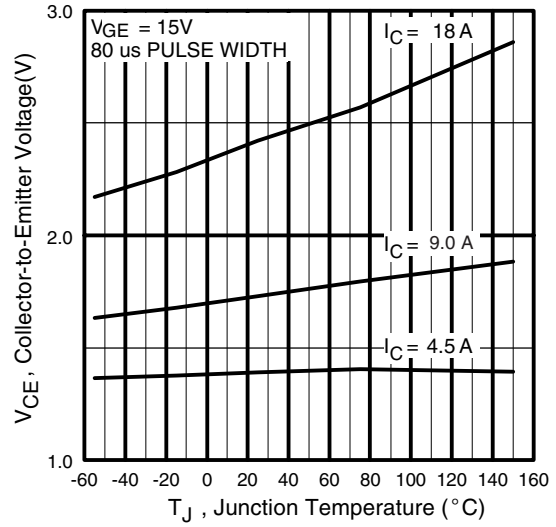


Fig. 5 - Typical Collector-to-Emitter Voltage vs. Junction Temperature

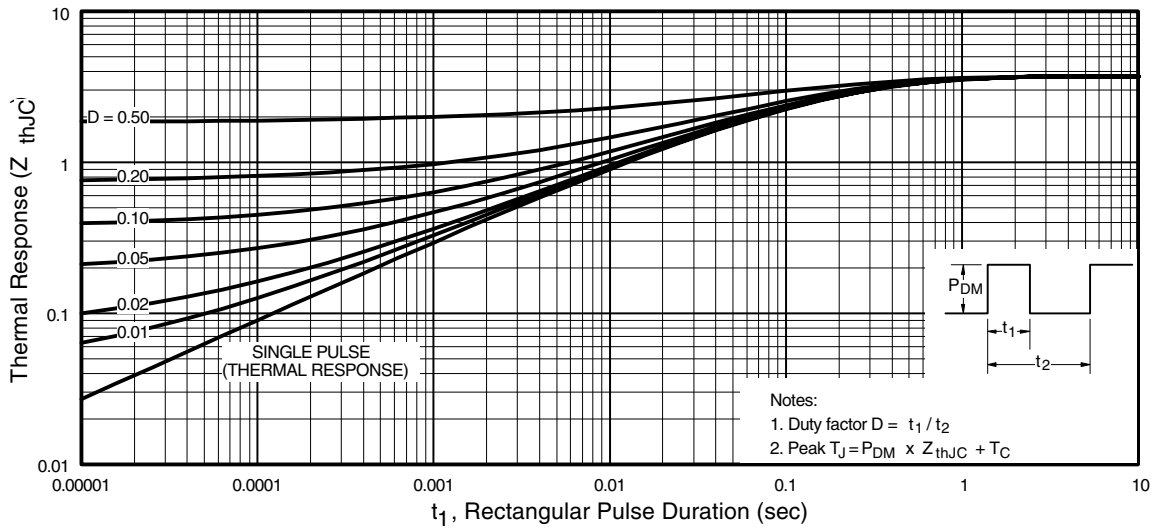


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

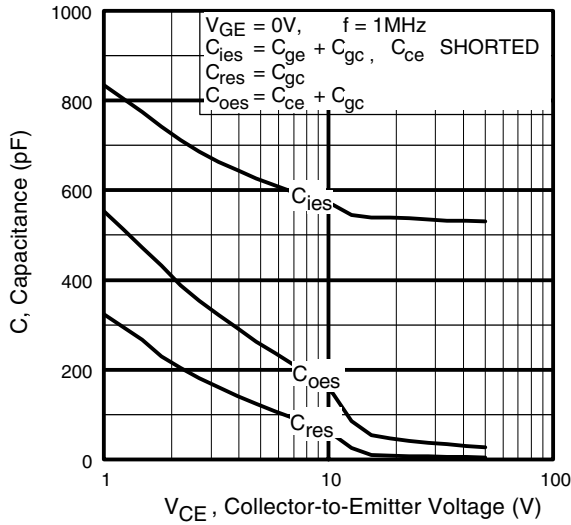


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

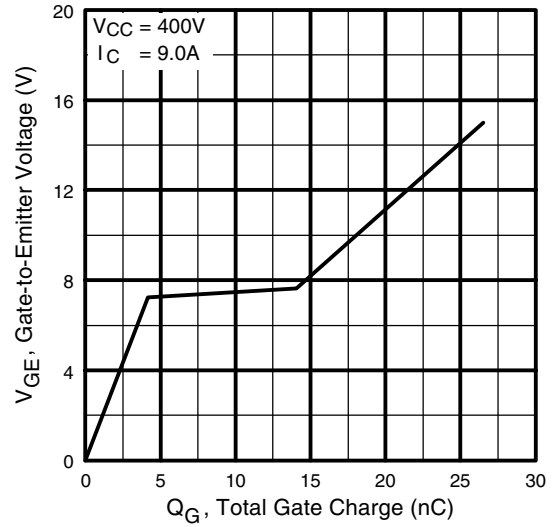


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

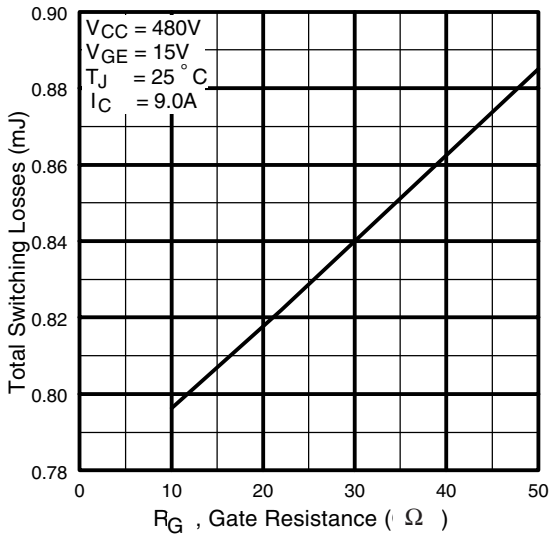


Fig. 9 - Typical Switching Losses vs. Gate Resistance

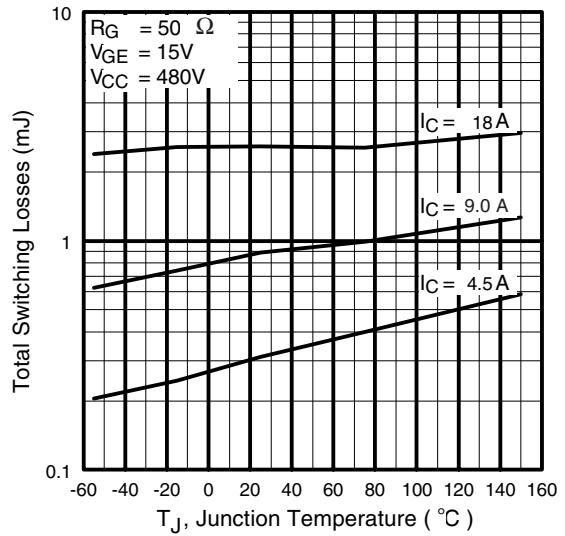


Fig. 10 - Typical Switching Losses vs. Junction Temperature

IRG4IBC20FD

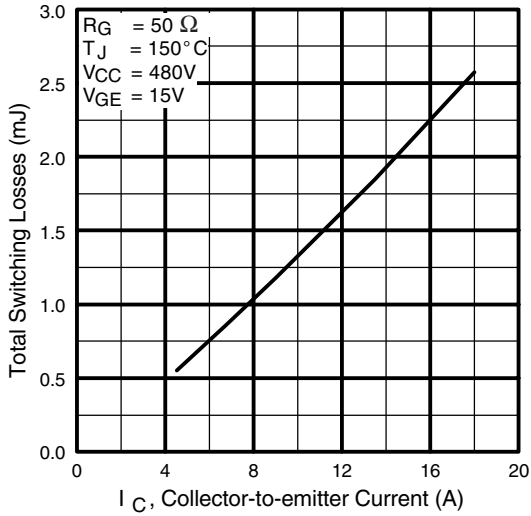


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

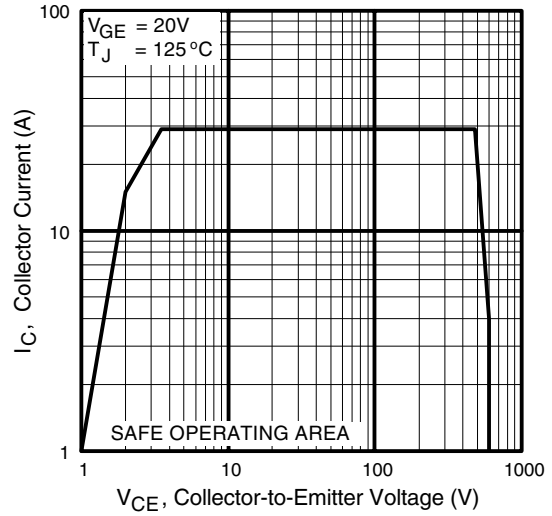


Fig. 12 - Turn-Off SOA

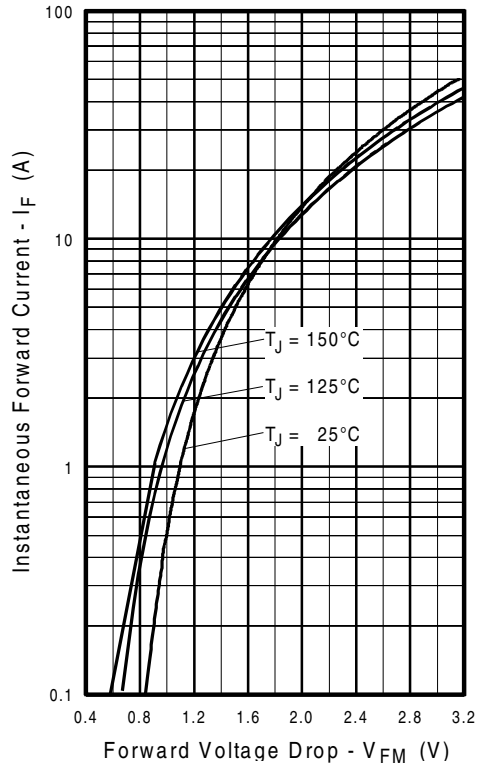


Fig. 13 - Maximum Forward Voltage Drop vs. Instantaneous Forward Current

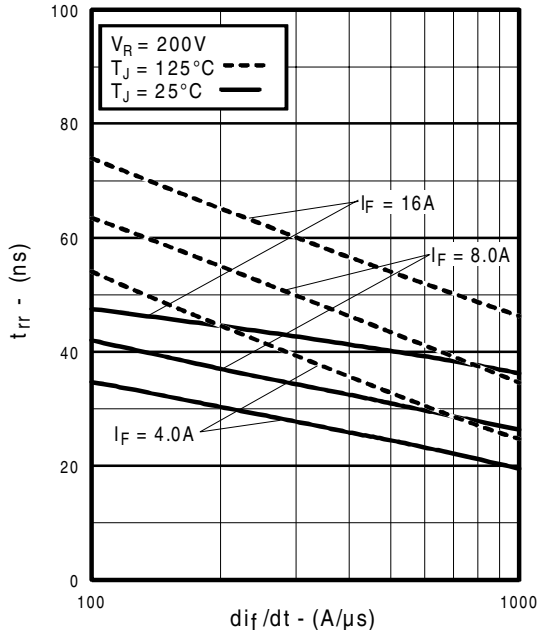


Fig. 14 - Typical Reverse Recovery vs. di_f/dt

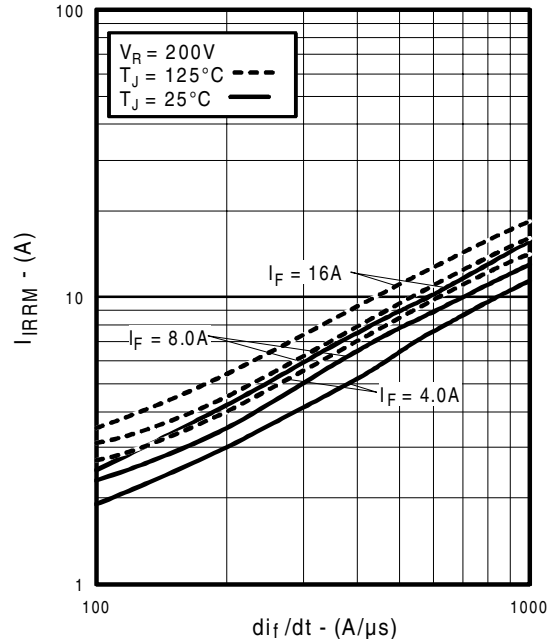


Fig. 15 - Typical Recovery Current vs. di_f/dt

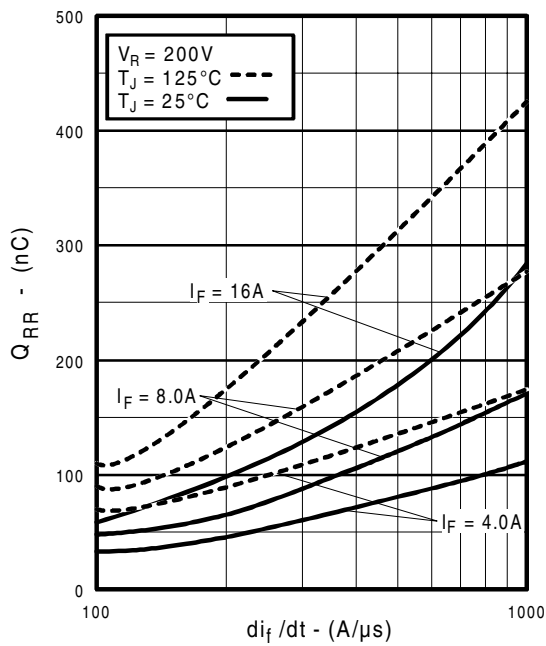


Fig. 16 - Typical Stored Charge vs. di_f/dt

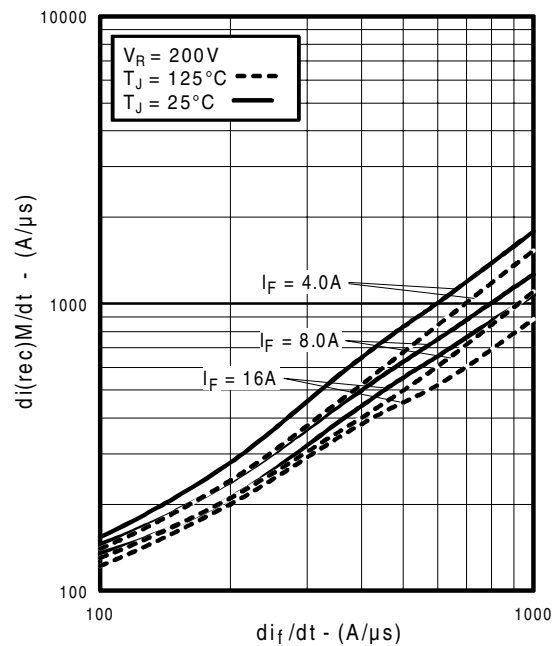


Fig. 17 - Typical $di_{(rec)M}/dt$ vs. di_f/dt

IRG4IBC20FD

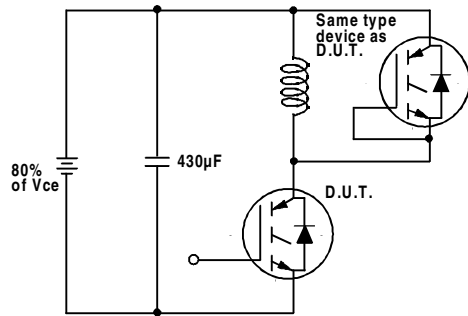


Fig. 18a - Test Circuit for Measurement of I_{LM} , E_{on} , $E_{off}(\text{diode})$, t_{rr} , Q_{rr} , I_{rr} , $t_{d(on)}$, t_r , $t_{d(off)}$, t_f

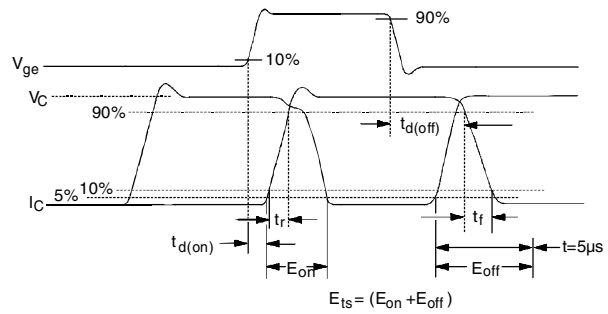


Fig. 18b - Test Waveforms for Circuit of Fig. 18a, Defining E_{off} , $t_{d(off)}$, t_f

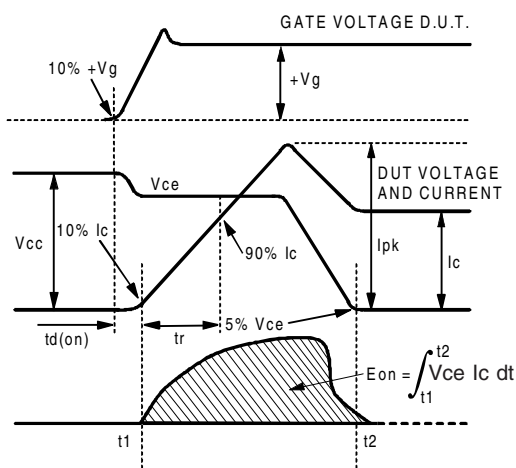


Fig. 18c - Test Waveforms for Circuit of Fig. 18a, Defining E_{on} , $t_{d(on)}$, t_r

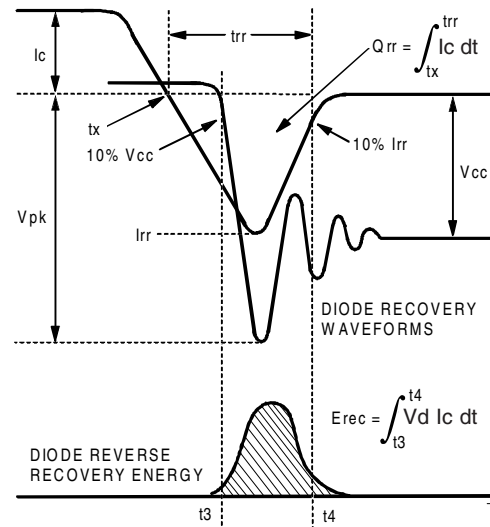


Fig. 18d - Test Waveforms for Circuit of Fig. 18a, Defining E_{rec} , t_{rr} , Q_{rr} , I_{rr}

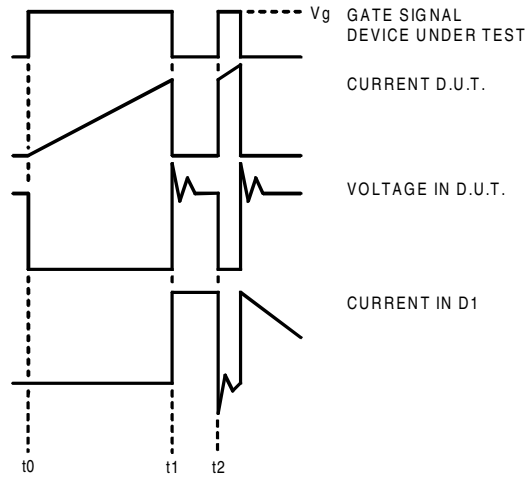


Figure 18e. Macro Waveforms for Figure 18a's Test Circuit

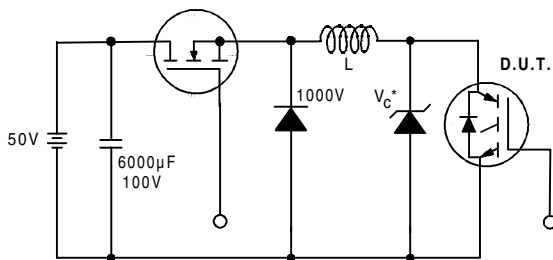


Figure 19. Clamped Inductive Load Test Circuit

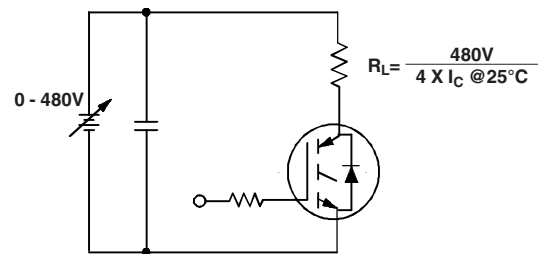


Figure 20. Pulsed Collector Current Test Circuit

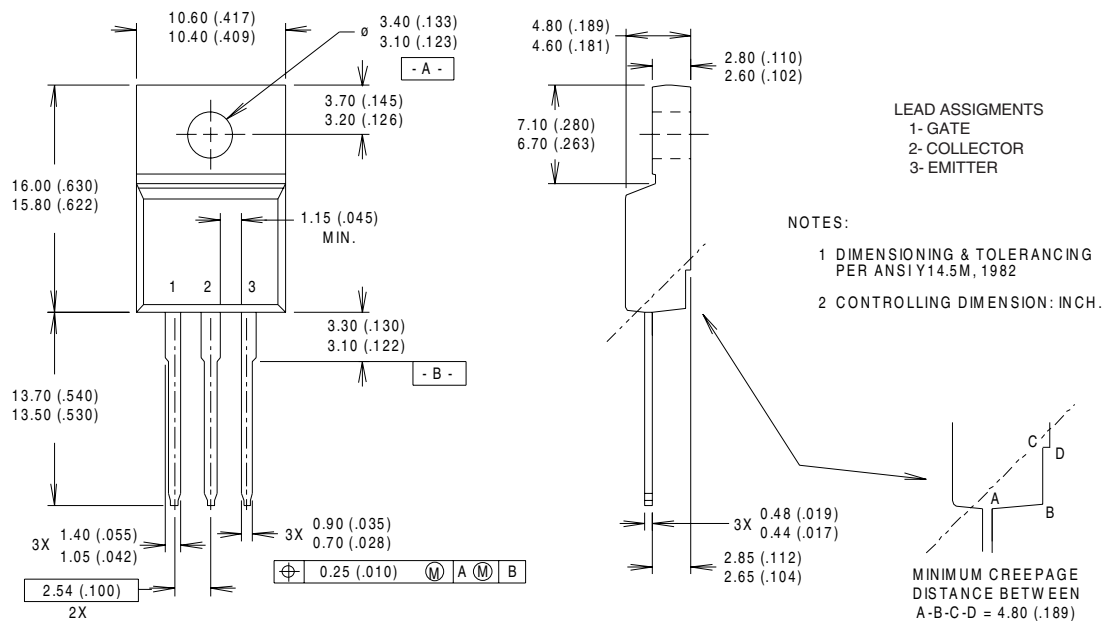
IRG4IBC20FD

International
IR Rectifier

Notes:

- ① Repetitive rating: $V_{GE}=20V$; pulse width limited by maximum junction temperature (figure 20)
- ② $V_{CC}=80\%(V_{CES})$, $V_{GE}=20V$, $L=10\mu H$, $R_G = 50\Omega$ (figure 19)
- ③ Pulse width $\leq 80\mu s$; duty factor $\leq 0.1\%$.
- ④ Pulse width $5.0\mu s$, single shot.
- ⑤ $t = 60s$, $f = 60Hz$

Case Outline — TO-220 FULLPAK



International
IR Rectifier

IR WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105
IR EUROPEAN REGIONAL CENTRE: 439/445 Godstone Rd, Whyteleafe, Surrey CR3 0BL, UK Tel: ++ 44 (0)20 8645 8000
IR CANADA: 15 Lincoln Court, Brampton, Ontario L6T3Z2, Tel: (905) 453 2200
IR GERMANY: Saalburgstrasse 157, 61350 Bad Homburg Tel: ++ 49 (0) 6172 96590
IR ITALY: Via Liguria 49, 10071 Borgaro, Torino Tel: ++ 39 011 451 0111
IR JAPAN: K&H Bldg., 2F, 30-4 Nishi-Ikebukuro 3-Chome, Toshima-Ku, Tokyo 171 Tel: 81 (0)3 3983 0086
IR SOUTHEAST ASIA: 1 Kim Seng Promenade, Great World City West Tower, 13-11, Singapore 237994 Tel: ++ 65 (0)838 4630
IR TAIWAN: 16 Fl. Suite D. 207, Sec. 2, Tun Haw South Road, Taipei, 10673 Tel: 886-(0)2 2377 9936
Data and specifications subject to change without notice. 4/00



LittleDiode supplies new, hard to find or obsolete electronic components and semiconductors all over the world.

With over two million different components listed you are sure to find the part you need.

Feel free to visit us today at our online store:

LittleDiode.com

Looking forward to providing you with the best possible service.