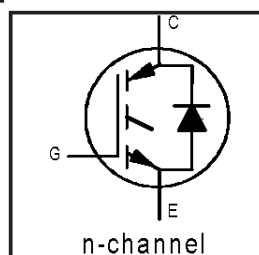


**INSULATED GATE BIPOLAR TRANSISTOR WITH
ULTRAFAST SOFT RECOVERY DIODE**

Fast CoPack IGBT

Features

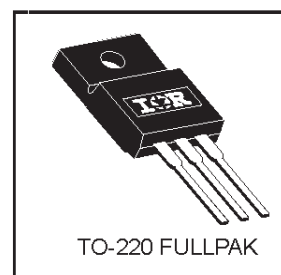
- Very Low 1.59V votage drop
- 2.5kV, 60s insulation voltage ⑤
- 4.8 mm creepage distance to heatsink
- Fast: Optimized for medium operating frequencies (1-5 kHz in hard switching, >20 kHz in resonant mode).
- IGBT co-packaged with HEXFRED™ ultrafast, ultrasoft recovery antiparallel diodes
- Tighter parameter distribution
- Industry standard Isolated TO-220 Fullpak™ outline



$V_{CES} = 600V$
$V_{CE(on) typ.} = 1.59V$
@ $V_{GE} = 15V, I_C = 17A$

Benefits

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



Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Voltage	600	V
$I_C @ T_C = 25^{\circ}C$	Continuous Collector Current	20.3	A
$I_C @ T_C = 100^{\circ}C$	Continuous Collector Current	11	
I_{CM}	Pulsed Collector Current ①	120	
I_{LM}	Clamped Inductive Load Current ②	120	
$I_F @ T_C = 100^{\circ}C$	Diode Continuous Forward Current	8.5	
I_{FM}	Diode Maximum Forward Current	120	
V_{isol}	RMS Isolation Voltage, Terminal to Case⑤	2500	V
V_{GE}	Gate-to-Emitter Voltage	± 20	
$P_D @ T_C = 25^{\circ}C$	Maximum Power Dissipation	45	W
$P_D @ T_C = 100^{\circ}C$	Maximum Power Dissipation	18	
T_J	Operating Junction and	-55 to +150	$^{\circ}C$
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	—	2.8	$^{\circ}C/W$
$R_{\theta JC}$	Junction-to-Case - Diode	—	4.1	
$R_{\theta JA}$	Junction-to-Ambient, typical socket mount	—	65	
Wt	Weight	2.0 (0.07)	—	g (oz)

IRG4IBC30FDPbF

International
IR Rectifier

Electrical Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage③	600	—	—	V	$V_{GE} = 0V, I_C = 250\mu A$
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	0.69	—	$V/^\circ C$	$V_{GE} = 0V, I_C = 1.0mA$
$V_{CE(on)}$	Collector-to-Emitter Saturation Voltage	—	1.59	1.8	V	$I_C = 17A, V_{GE} = 15V$
		—	1.99	—		$I_C = 31A, V_{GE} = 15V$
		—	1.70	—		$I_C = 17A, T_J = 150^\circ C$
$V_{GE(th)}$	Gate Threshold Voltage	3.0	—	6.0		$V_{CE} = V_{GE}, I_C = 250\mu A$
$\Delta V_{GE(th)}/\Delta T_J$	Temperature Coeff. of Threshold Voltage	—	-11	—	$mV/^\circ C$	$V_{CE} = V_{GE}, I_C = 250\mu A$
g_{fe}	Forward Transconductance ④	6.1	10	—	S	$V_{CE} = 100V, I_C = 17A$
I_{CES}	Zero Gate Voltage Collector Current	—	—	250	μA	$V_{GE} = 0V, V_{CE} = 600V$
		—	—	2500		$V_{GE} = 0V, V_{CE} = 600V, T_J = 150^\circ C$
V_{FM}	Diode Forward Voltage Drop	—	1.4	1.7	V	$I_C = 12A$ See Fig. 13
		—	1.3	1.6		$I_C = 12A, T_J = 150^\circ C$
I_{GES}	Gate-to-Emitter Leakage Current	—	—	± 100	nA	$V_{GE} = \pm 20V$

Switching Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
Q_g	Total Gate Charge (turn-on)	—	51	77	nC	$I_C = 17A$
Q_{ge}	Gate - Emitter Charge (turn-on)	—	7.9	12		$V_{CC} = 400V$ See Fig. 8
Q_{gc}	Gate - Collector Charge (turn-on)	—	19	28		$V_{GE} = 15V$
$t_{d(on)}$	Turn-On Delay Time	—	42	—	ns	$T_J = 25^\circ C$
t_r	Rise Time	—	26	—		$I_C = 17A, V_{CC} = 480V$
$t_{d(off)}$	Turn-Off Delay Time	—	230	350		$V_{GE} = 15V, R_G = 23\Omega$
t_f	Fall Time	—	160	230	mJ	Energy losses include "tail" and diode reverse recovery.
E_{on}	Turn-On Switching Loss	—	0.63	—		See Fig. 9, 10, 11, 18
E_{off}	Turn-Off Switching Loss	—	1.39	—		
E_{ts}	Total Switching Loss	—	2.02	3.9		
$t_{d(on)}$	Turn-On Delay Time	—	42	—	ns	$T_J = 150^\circ C$ See Fig. 9, 10, 11, 18
t_r	Rise Time	—	27	—		$I_C = 17A, V_{CC} = 480V$
$t_{d(off)}$	Turn-Off Delay Time	—	310	—		$V_{GE} = 15V, R_G = 23\Omega$
t_f	Fall Time	—	310	—	mJ	Energy losses include "tail" and diode reverse recovery.
E_{ts}	Total Switching Loss	—	3.2	—		
L_E	Internal Emitter Inductance	—	7.5	—	nH	Measured 5mm from package
C_{ies}	Input Capacitance	—	1100	—	pF	$V_{GE} = 0V$
C_{oes}	Output Capacitance	—	74	—		$V_{CC} = 30V$ See Fig. 7
C_{res}	Reverse Transfer Capacitance	—	14	—		$f = 1.0MHz$
t_{rr}	Diode Reverse Recovery Time	—	42	60	ns	$T_J = 25^\circ C$ See Fig. 14
		—	80	120		$T_J = 125^\circ C$
I_{rr}	Diode Peak Reverse Recovery Current	—	3.5	6.0	A	$T_J = 25^\circ C$ See Fig. 15
		—	5.6	10		$T_J = 125^\circ C$
Q_{rr}	Diode Reverse Recovery Charge	—	80	180	nC	$T_J = 25^\circ C$ See Fig. 16
		—	220	600		$T_J = 125^\circ C$
$di_{(rec)M}/dt$	Diode Peak Rate of Fall of Recovery During t_b	—	180	—	A/ μs	$T_J = 25^\circ C$ See Fig. 17
		—	120	—		$T_J = 125^\circ C$

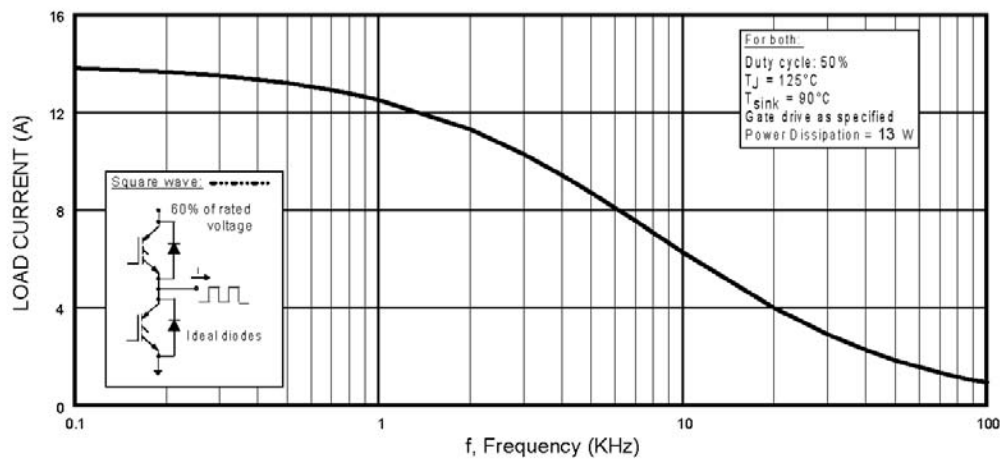


Fig. 1 - Typical Load Current vs. Frequency
(Load Current = I_{RMS} of fundamental)

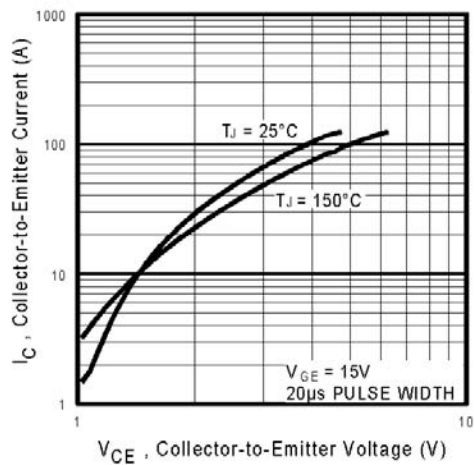


Fig. 2 - Typical Output Characteristics

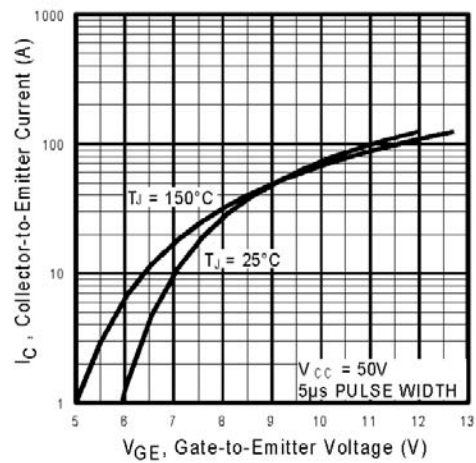


Fig. 3 - Typical Transfer Characteristics

IRG4IBC30FDPbF

International
IR Rectifier

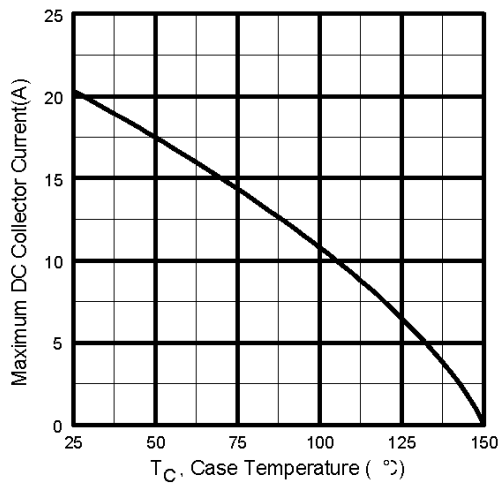


Fig. 4 - Maximum Collector Current vs. Case Temperature

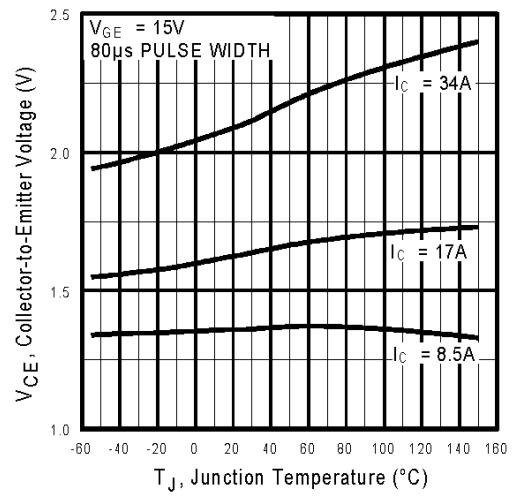


Fig. 5 - Typical Collector-to-Emitter Voltage vs. Junction Temperature

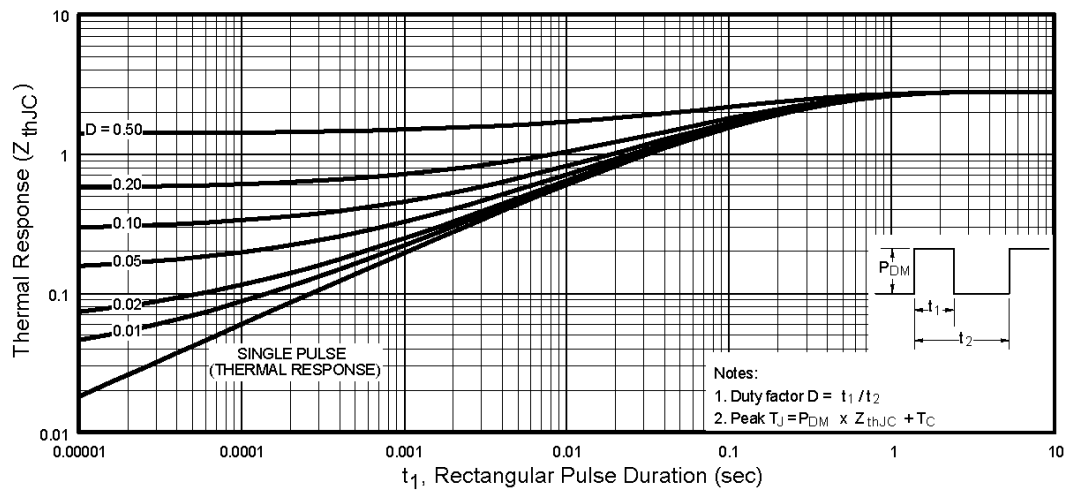


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

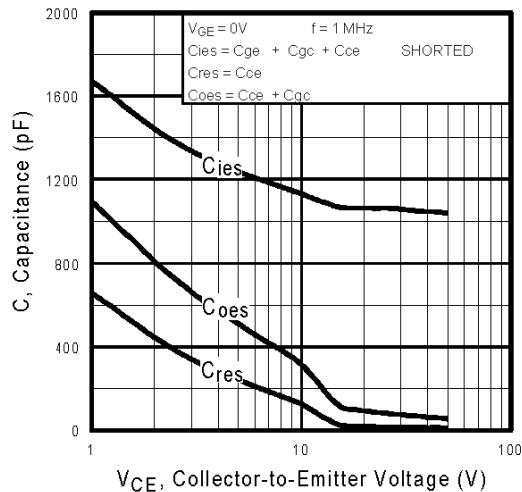


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

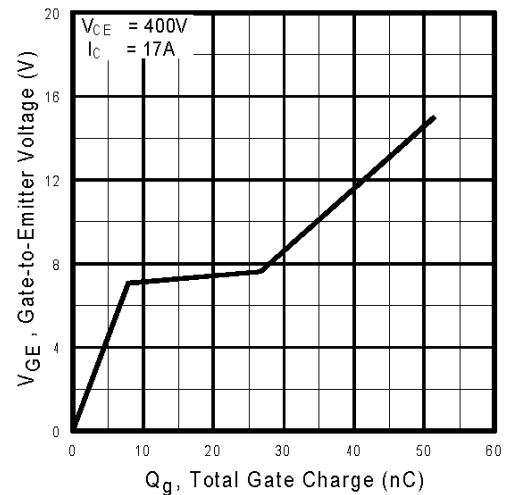


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

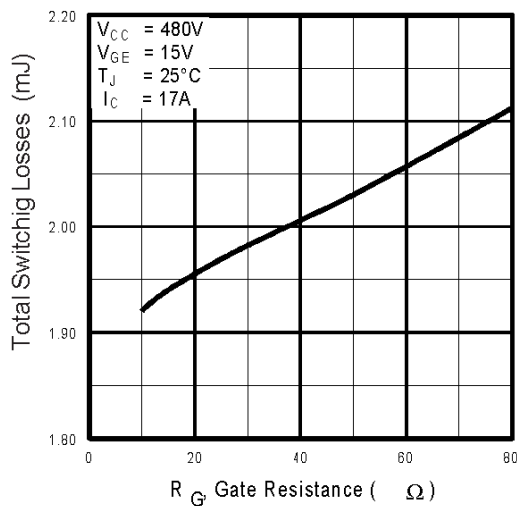


Fig. 9 - Typical Switching Losses vs. Gate Resistance

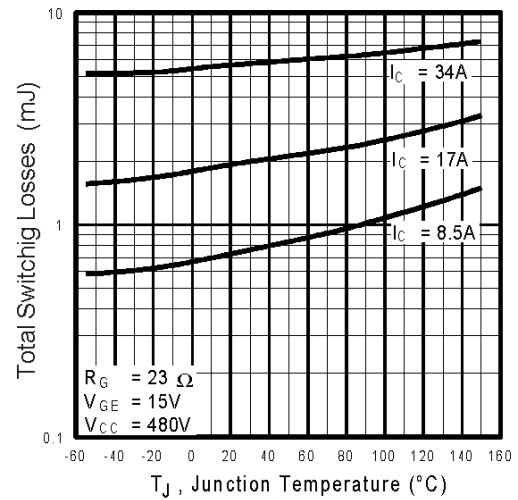
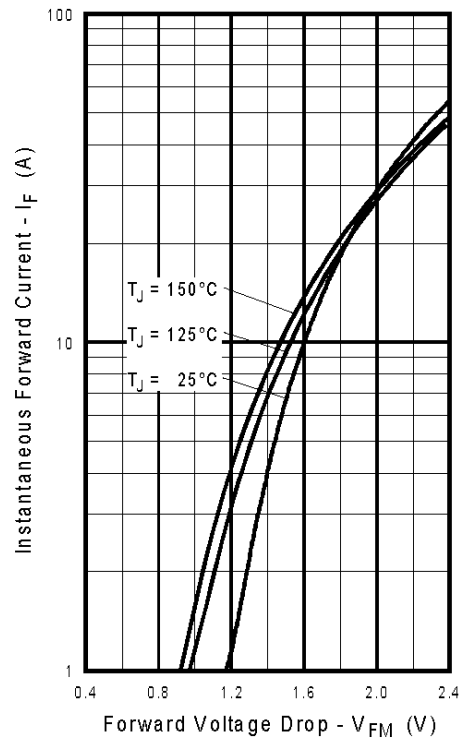
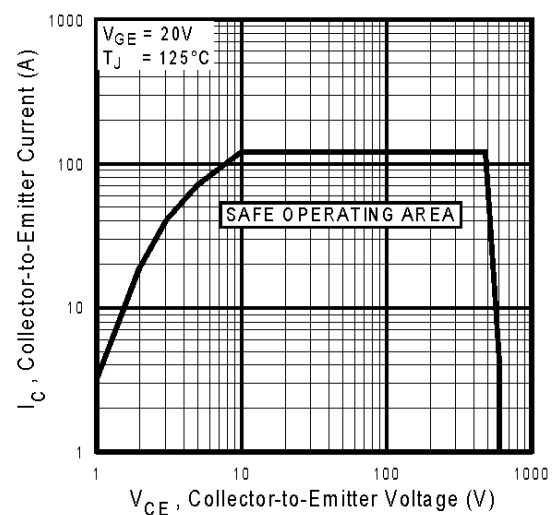
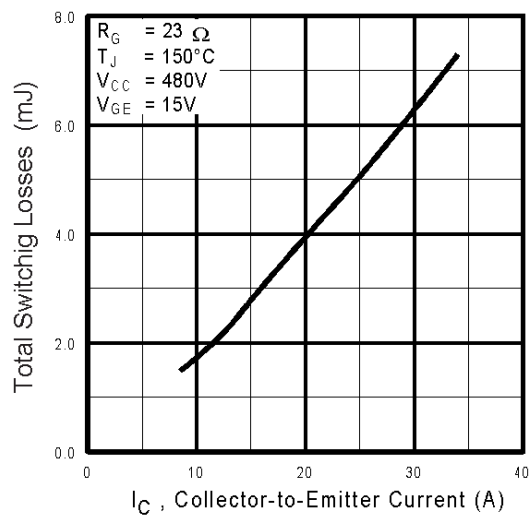


Fig. 10 - Typical Switching Losses vs. Junction Temperature

IRG4IBC30FDPbF

International
IR Rectifier



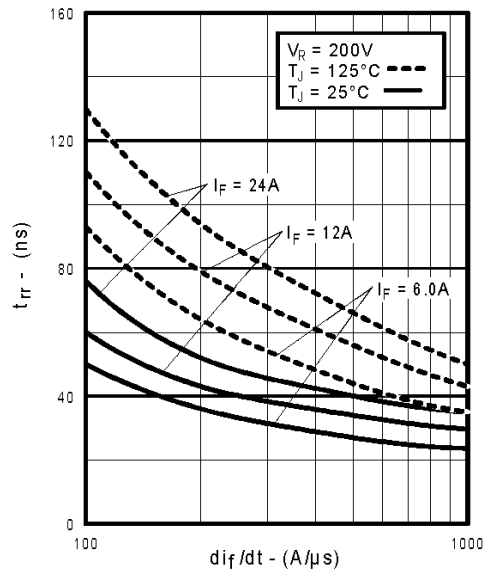


Fig. 14 - Typical Reverse Recovery vs. di_f/dt

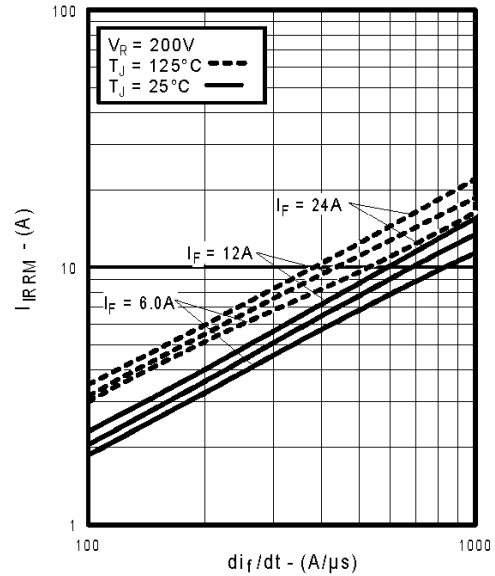


Fig. 15 - Typical Recovery Current vs. di_f/dt

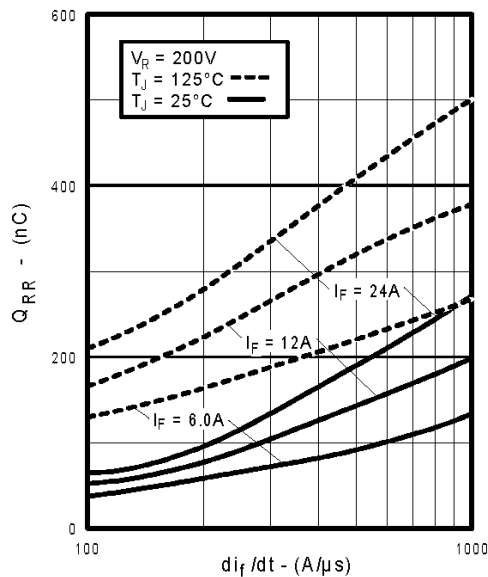


Fig. 16 - Typical Stored Charge vs. di_f/dt

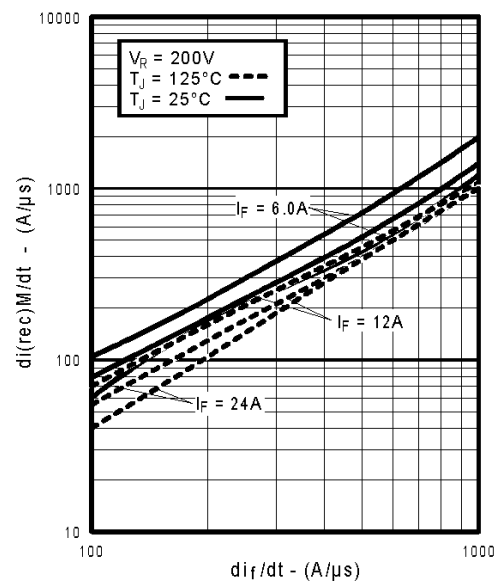


Fig. 17 - Typical $di_{(rec)}/dt$ vs. di_f/dt

IRG4IBC30FDPbF

International
IR Rectifier

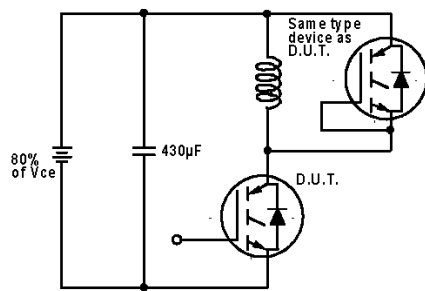


Fig. 18a - Test Circuit for Measurement of I_{LM} , E_{on} , $E_{off}(\text{diode})$, t_{rr} , Q_{rr} , I_{rr} , $t_{d(on)}$, t_r , $t_{d(off)}$, t_f

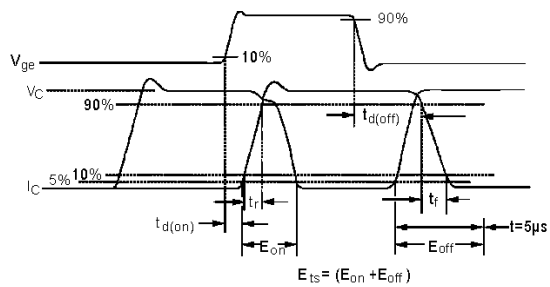


Fig. 18b - Test Waveforms for Circuit of Fig. 18a, Defining E_{off} , $t_{d(off)}$, t_f

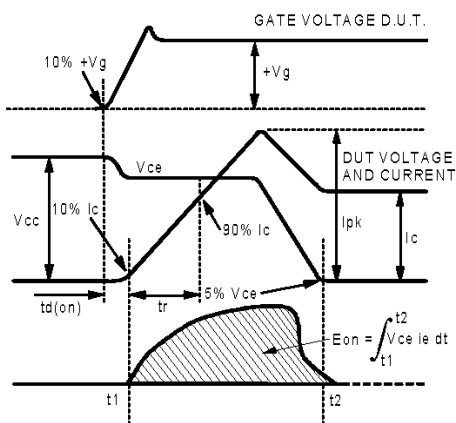


Fig. 18c - Test Waveforms for Circuit of Fig. 18a, Defining E_{on} , $t_{d(on)}$, t_r

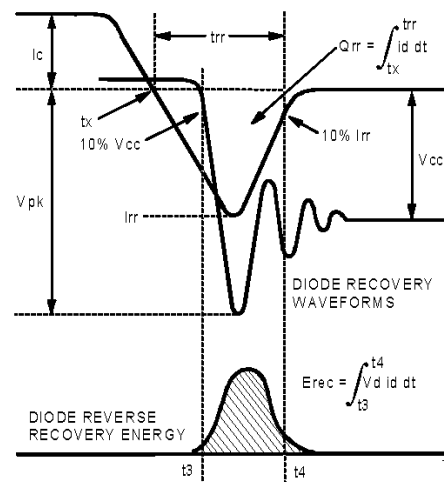


Fig. 18d - Test Waveforms for Circuit of Fig. 18a, Defining E_{rec} , t_{rr} , Q_{rr} , I_{rr}

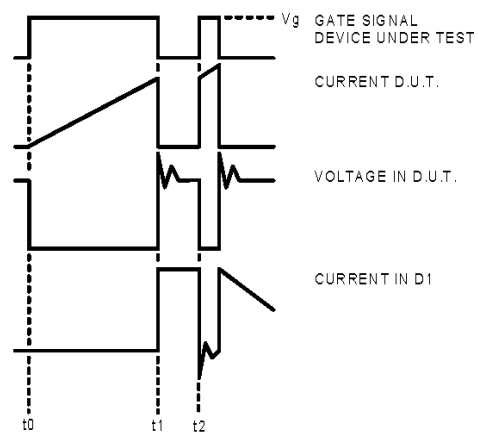


Figure 18e. Macro Waveforms for Figure 18a's Test Circuit

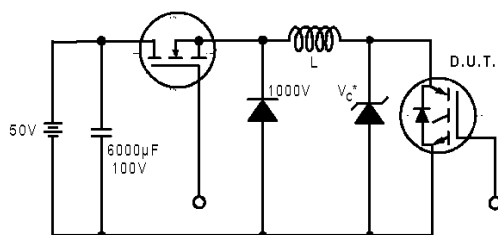


Figure 19. Clamped Inductive Load Test Circuit

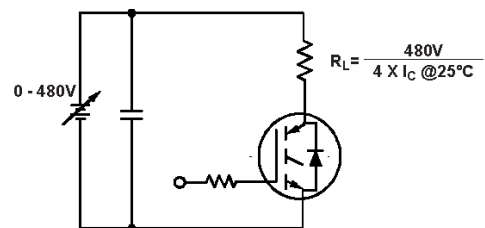


Figure 20. Pulsed Collector Current Test Circuit

IRG4IBC30FDPbF

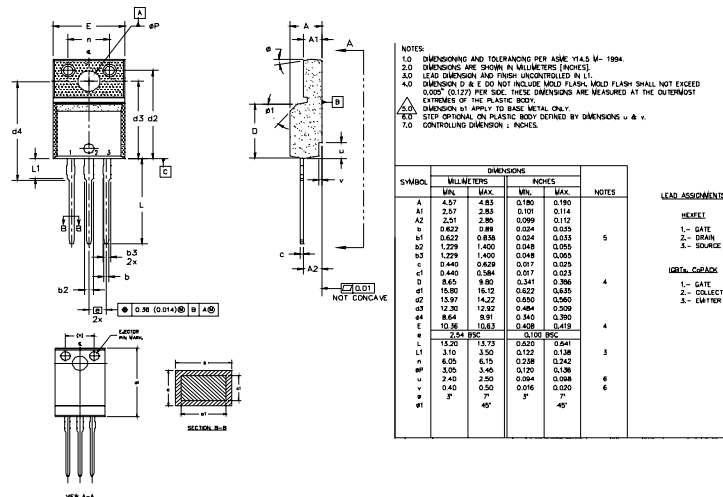
International
Rectifier

Notes:

- ① Repetitive rating: $V_{GE}=20V$; pulse width limited by maximum junction temperature (figure 20)
- ② $V_{CC}=80\%(V_{CES})$, $V_{GE}=20V$, $L=10\mu H$, $R_G = 23\Omega$ (figure 19)
- ③ Pulse width $\leq 80\mu s$; duty factor $\leq 0.1\%$.
- ④ Pulse width $5.0\mu s$, single shot.
- ⑤ $t = 60s$, $f = 60Hz$

TO-220 Full-Pak Package Outline

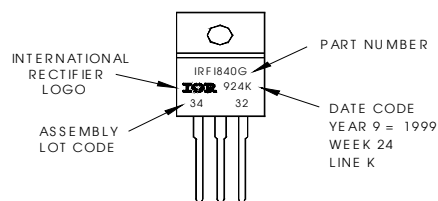
Dimensions are shown in millimeters (inches)



TO-220 Full-Pak Part Marking Information

EXAMPLE: THIS IS AN IRF1840G
WITH ASSEMBLY
LOT CODE 3432
ASSEMBLED ON WW 24 1999
IN THE ASSEMBLY LINE "K"

Note: "P" in assembly line position indicates "Lead-Free"



Data and specifications subject to change without notice.

International
IR 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.07/04

www.irf.com

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