

IRG4PSC71UDPbF

INSULATED GATE BIPOLAR TRANSISTOR WITH
ULTRAFAST SOFT RECOVERY DIODE

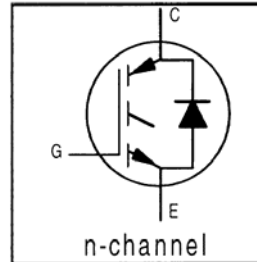
UltraFast CoPack IGBT

Features

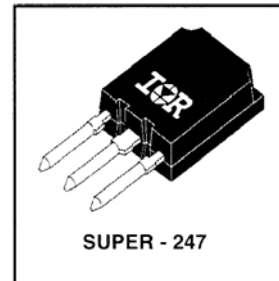
- Generation 4 IGBT design provides tighter parameter distribution and higher efficiency (minimum switching and conduction losses) than prior generations
- IGBT co-packaged with HEXFRED ultrafast, ultrasoft recovery anti-parallel diodes for use in bridge configurations
- Industry-benchmark Super-247 package with higher power handling capability compared to same footprint TO-247
- Creepage distance increased to 5.35mm
- Lead-Free

Benefits

- Generation 4 IGBT's offer highest efficiencies available
- Maximum power density, twice the power handling of TO-247, less space than TO-264
- IGBTs optimized for specific application conditions
- HEXFRED diodes optimized for performance with IGBTs
- Cost and space saving in designs that require multiple, paralleled IGBTs



$V_{CES} = 600V$
$V_{CE(ON)} \text{ typ.} = 1.67V$
@ $V_{GE} = 15V, I_C = 60A$



Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Voltage	600	V
$I_C @ T_C = 25^\circ C$	Continuous Collector Current	85 ^⑤	A
$I_C @ T_C = 100^\circ C$	Continuous Collector Current	60	
I_{CM}	Pulsed Collector Current ^①	200	
I_{LM}	Clamped Inductive Load Current ^②	200	
$I_F @ T_C = 100^\circ C$	Diode Continuous Forward Current	60	
I_{FM}	Diode Maximum Forward Current	350	
V_{GE}	Gate-to-Emitter Voltage	± 20	V
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	350	W
$P_D @ T_C = 100^\circ C$	Maximum Power Dissipation	140	
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)	

Thermal Resistance\ Mechanical

	Parameter	Min.	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case - IGBT	—	—	0.36	$^\circ C/W$
$R_{\theta JC}$	Junction-to-Case - Diode	—	—	0.69	
$R_{\theta CS}$	Case-to-Sink, flat, greased surface	—	0.24	—	
$R_{\theta JA}$	Junction-to-Ambient, typical socket mount	—	—	38	
	Recommended Clip Force	20.0(2.0)	—	—	N (kgf)
	Weight	—	6 (0.21)	—	g (oz)

IRG4PSC71UDPbF

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 Voltage ^③	600	—	—	V	$V_{GE} = 0V, I_C = 250\mu A$
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	0.39	—	V/°C	$V_{GE} = 0V, I_C = 10mA$
$V_{CE(on)}$	Collector-to-Emitter Saturation Voltage	—	1.67	2.0	V	$I_C = 60A, V_{GE} = 15V$ See Fig. 2, 5
		—	1.95	—		
		—	1.71	—		
$V_{GE(th)}$	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	—	-13	—	mV/°C	$V_{CE} = V_{GE}, I_C = 1.5mA$
g_{fe}	Forward Transconductance ^②	47	70	—	S	$V_{CE} = 50V, I_C = 60A$
I_{CES}	Zero Gate Voltage Collector Current	—	—	500	μA	$V_{GE} = 0V, V_{CE} = 600V$
		—	—	13	mA	$V_{GE} = 0V, V_{CE} = 600V, T_J = 150^\circ C$
V_{FM}	Diode Forward Voltage Drop	—	1.4	1.7	V	$I_C = 60A$ See Fig. 13
		—	1.3	—		
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)	—	340	520	nC	$I_C = 60A$ $V_{CC} = 400V$ $V_{GE} = 15V$ See Fig. 8
Q_{ge}	Gate - Emitter Charge (turn-on)	—	44	66		
Q_{gc}	Gate - Collector Charge (turn-on)	—	160	240		
$t_{d(on)}$	Turn-On Delay Time	—	90	—	ns	$T_J = 25^\circ C$ $I_C = 60A, V_{CC} = 480V$ $V_{GE} = 15V, R_G = 5.0\Omega$ Energy losses include "tail" and diode reverse recovery. See Fig. 9, 10, 11, 18
t_r	Rise Time	—	94	—		
$t_{d(off)}$	Turn-Off Delay Time	—	245	368		
t_f	Fall Time	—	110	167		
E_{on}	Turn-On Switching Loss	—	3.26	—	mJ	See Fig. 9, 10, 11, 18
E_{off}	Turn-Off Switching Loss	—	2.27	—		
E_{ts}	Total Switching Loss	—	5.53	7.2		
$t_{d(on)}$	Turn-On Delay Time	—	91	—	ns	$T_J = 150^\circ C$, See Fig. 9, 10, 11, 18 $I_C = 60A, V_{CC} = 480V$ $V_{GE} = 15V, R_G = 5.0\Omega$ Energy losses include "tail" and diode reverse recovery.
t_r	Rise Time	—	88	—		
$t_{d(off)}$	Turn-Off Delay Time	—	353	—		
t_f	Fall Time	—	150	—		
E_{ts}	Total Switching Loss	—	7.1	—	mJ	
L_E	Internal Emitter Inductance	—	13	—	nH	Measured 5mm from package
C_{ies}	Input Capacitance	—	7500	—	pF	$V_{GE} = 0V$ $V_{CC} = 30V$ $f = 1.0MHz$ See Fig. 7
C_{oes}	Output Capacitance	—	720	—		
C_{res}	Reverse Transfer Capacitance	—	93	—		
t_{rr}	Diode Reverse Recovery Time	—	82	120	ns	$T_J = 25^\circ C$ See Fig. 14 $T_J = 125^\circ C$
		—	140	210		
I_{rr}	Diode Peak Reverse Recovery Current	—	8.2	12	A	$T_J = 25^\circ C$ See Fig. 15 $T_J = 125^\circ C$
		—	13	20		
Q_{rr}	Diode Reverse Recovery Charge	—	364	546	nC	$T_J = 25^\circ C$ See Fig. 16 $T_J = 125^\circ C$
		—	1084	1625		
$di_{(rec)M}/dt$ During t_b	Diode Peak Rate of Fall of Recovery	—	328	—	A/ μs	$T_J = 25^\circ C$ See Fig. 17 $T_J = 125^\circ C$
		—	266	—		

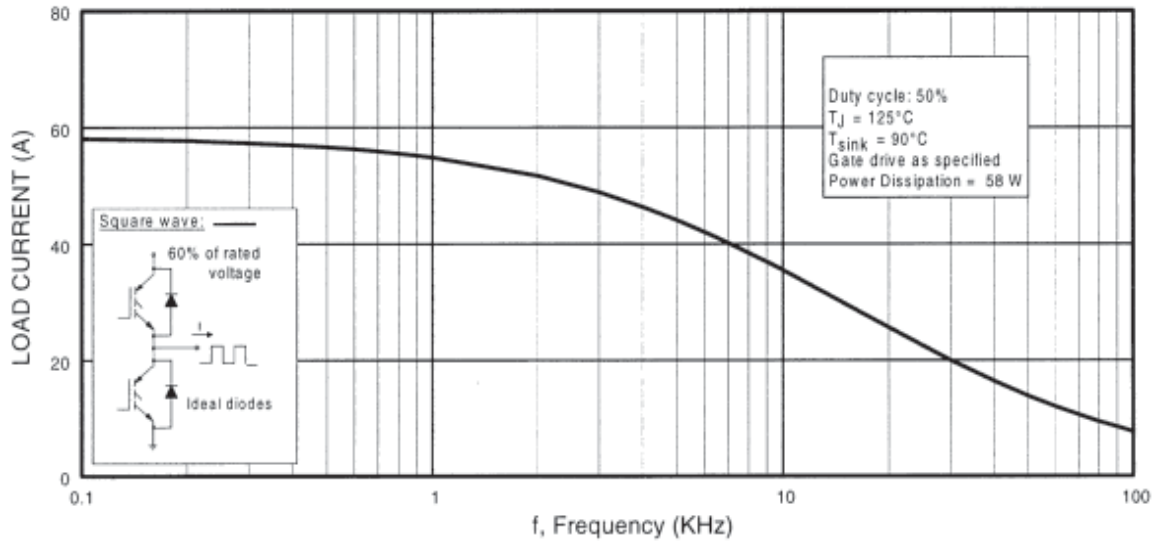


Fig. 1 - Typical Load Current vs. Frequency
 (Load Current = I_{RMS} of fundamental)

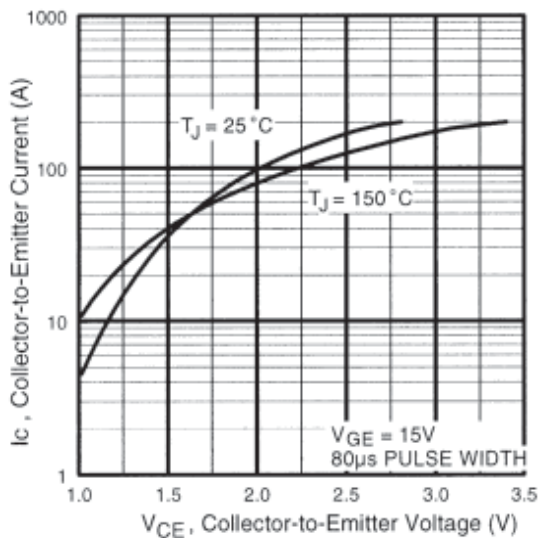


Fig. 2 - Typical Output Characteristics
www.irf.com

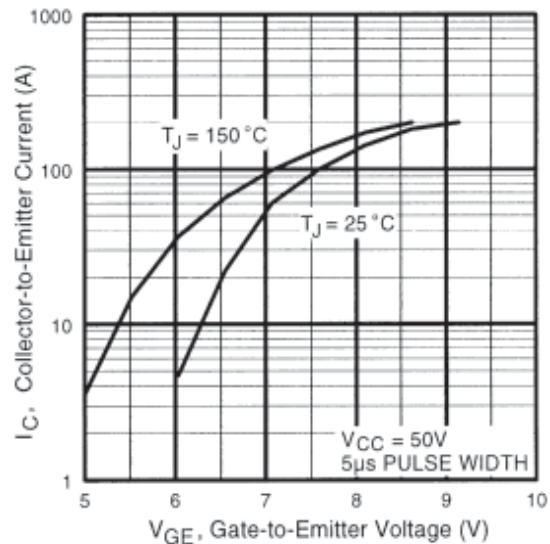


Fig. 3 - Typical Transfer Characteristics

IRG4PSC71UDPbF

International
IR Rectifier

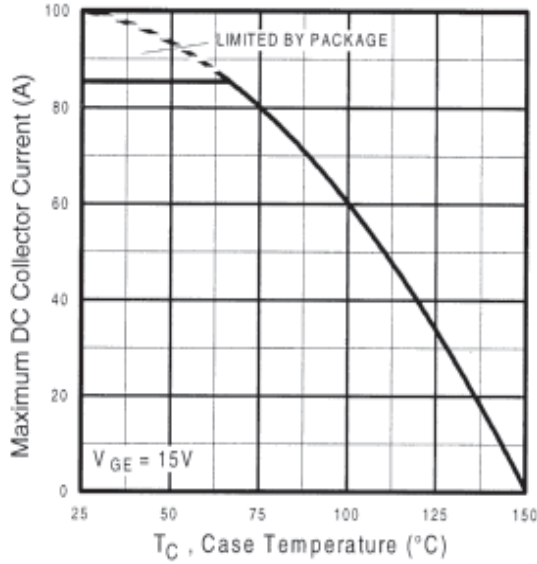


Fig. 4 - Maximum Collector Current vs. Case Temperature

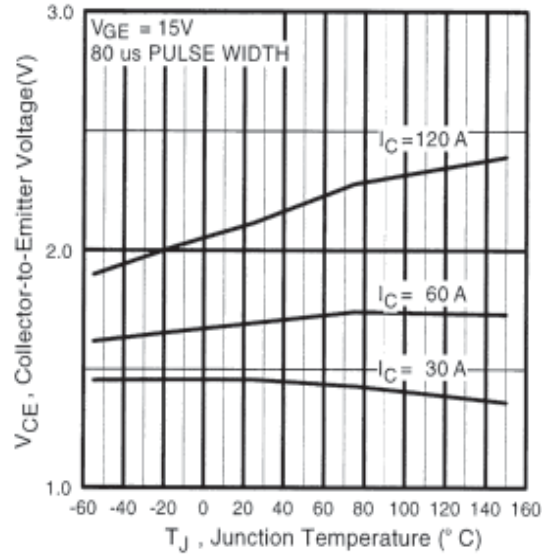


Fig. 5 - Typical Collector-to-Emitter Voltage vs. Junction Temperature

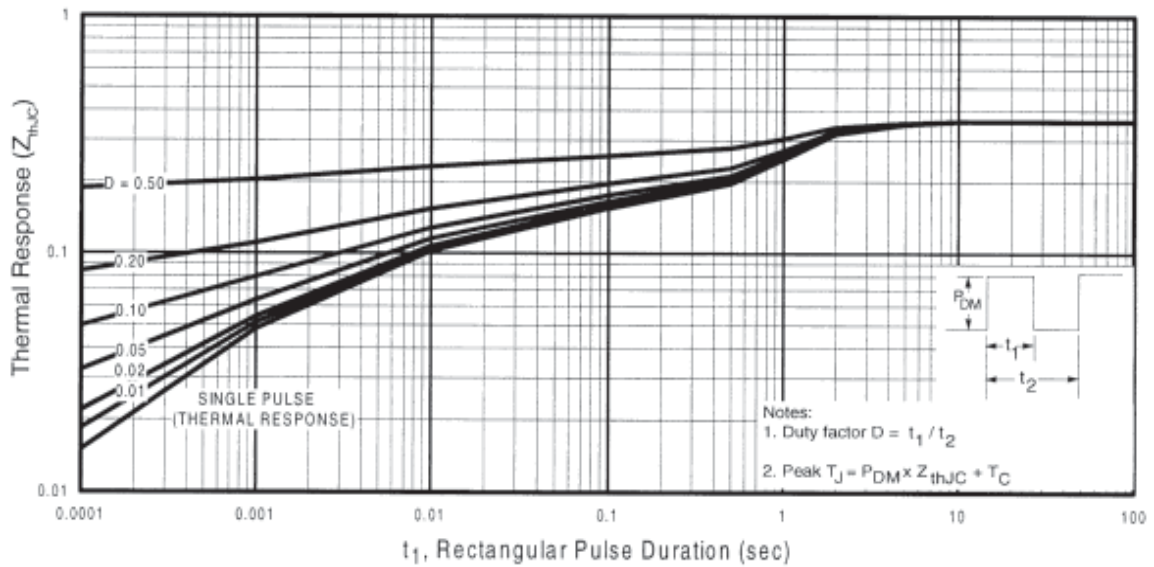


Fig. 6 - Maximum IGBT Effective Transient Thermal Impedance, Junction-to-Case

IRG4PSC71UDPbF

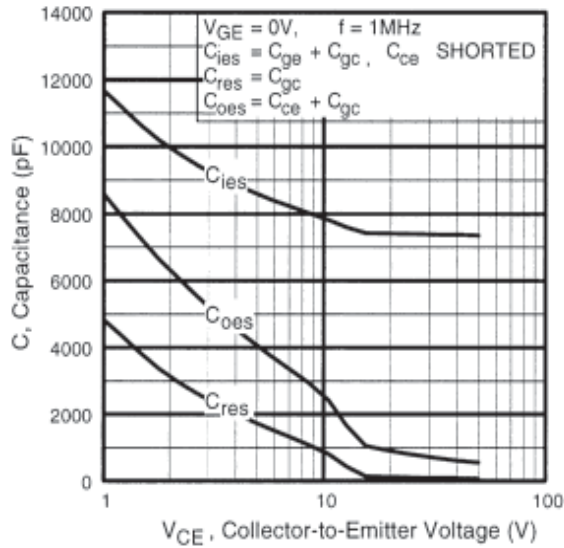


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

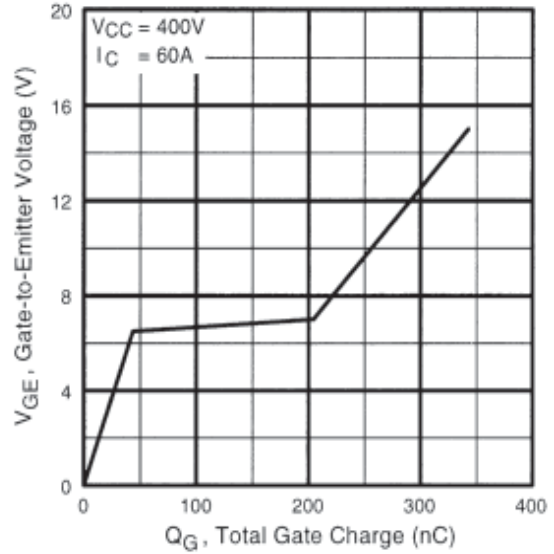


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

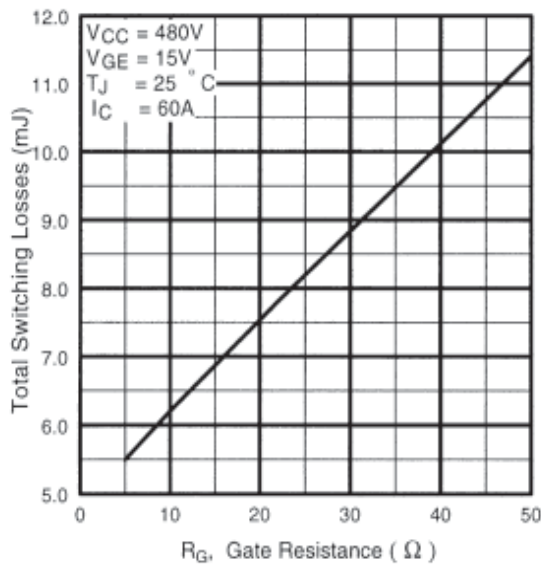


Fig. 9 - Typical Switching Losses vs. Gate Resistance

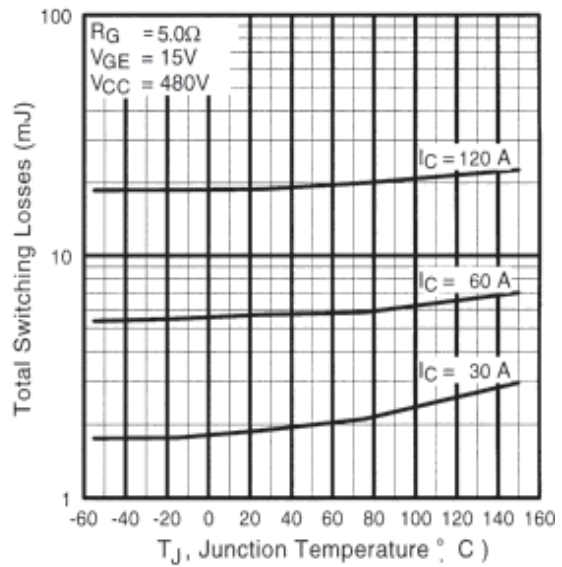


Fig. 10 - Typical Switching Losses vs. Junction Temperature

IRG4PSC71UDPbF

International
IR Rectifier

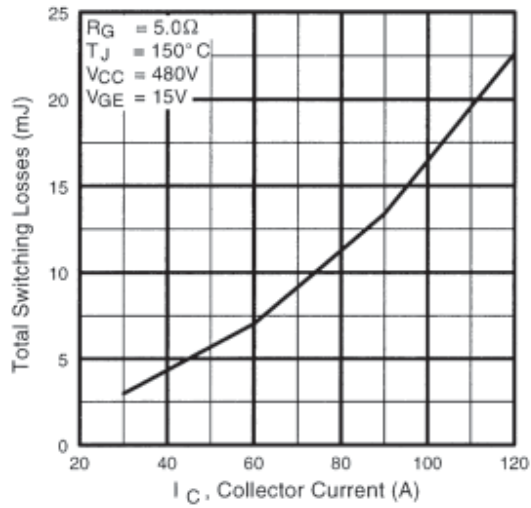


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

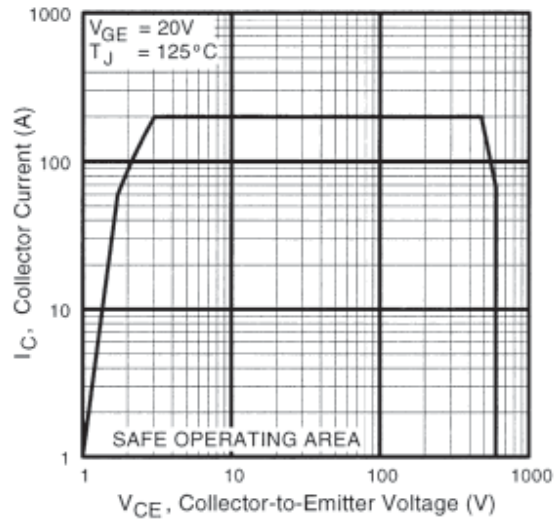


Fig. 12 - Turn-Off SOA

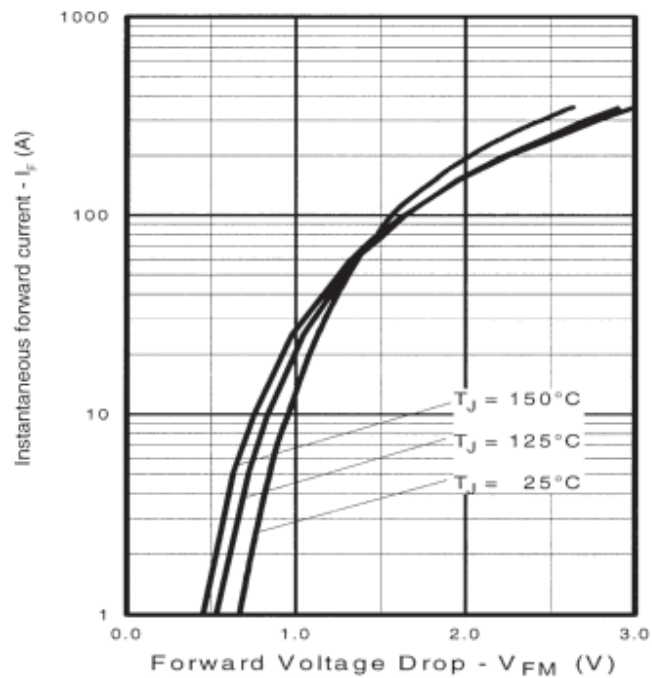


Fig. 13 - Maximum Forward Voltage Drop vs. Instantaneous Forward Current

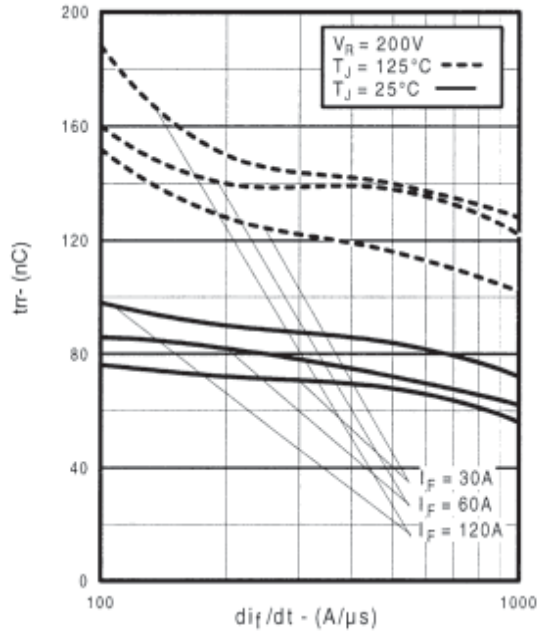


Fig. 14 - Typical Reverse Recovery vs. di_f/dt

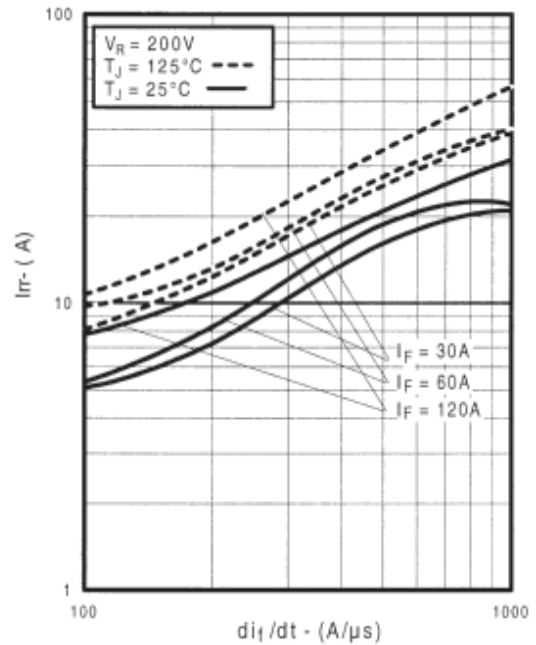


Fig. 15 - Typical Recovery Current vs. di_f/dt

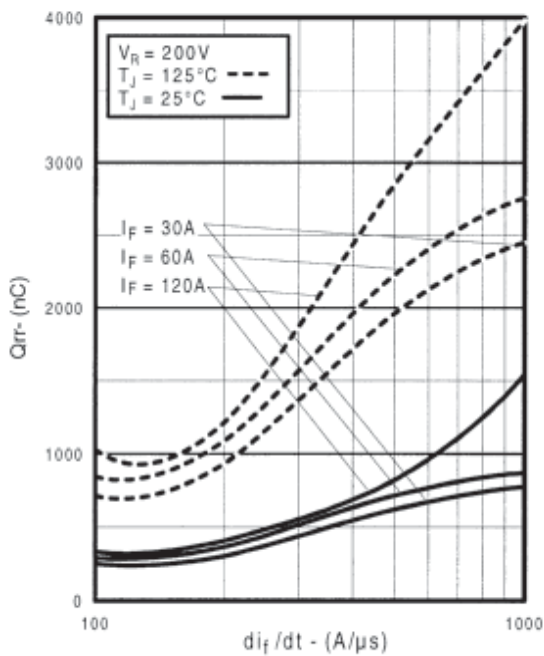


Fig. 16 - Typical Stored Charge vs. di_f/dt
www.irf.com

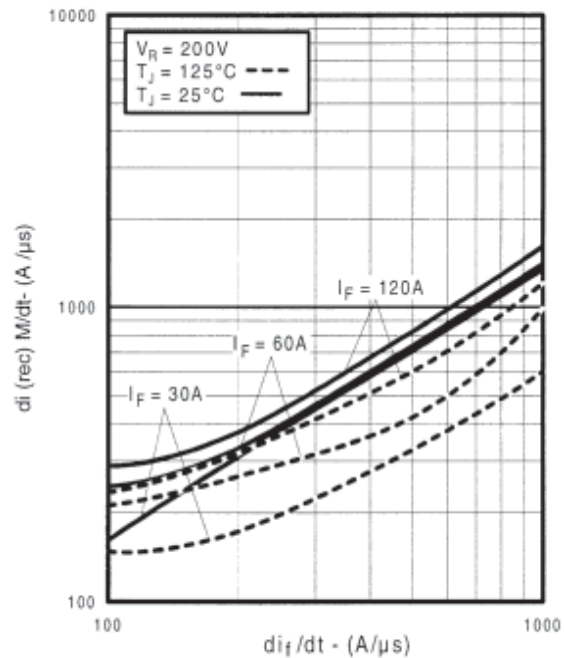


Fig. 17 - Typical $di_{(rec)M}/dt$ vs. di_f/dt

IRG4PSC71UDPbF

International
IR Rectifier

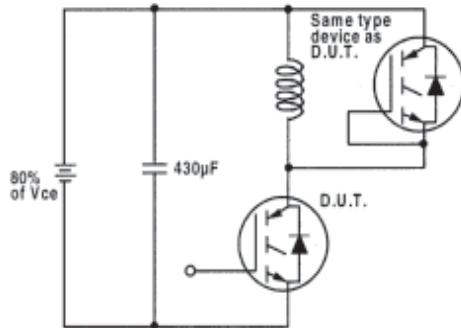


Fig. 18a - Test Circuit for Measurement of I_{LM} , E_{on} , $E_{off}(\text{diode})$, t_{rr} , Q_{rr} , I_{rr} , $t_{d(on)}$, t_r , $t_{d(off)}$, t_f

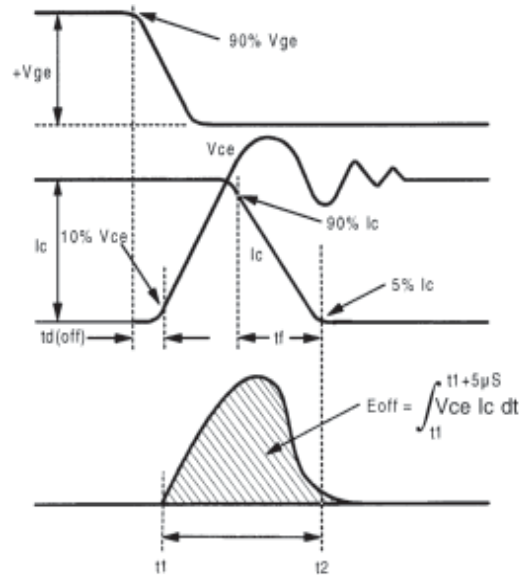


Fig. 18b - Test Waveforms for Circuit of Fig. 18a, Defining E_{off} , $t_{d(off)}$, t_f

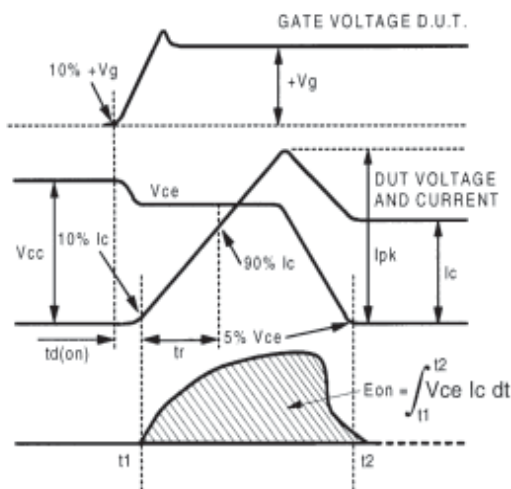


Fig. 18c - Test Waveforms for Circuit of Fig. 18a, Defining E_{on} , $t_{d(on)}$, t_r

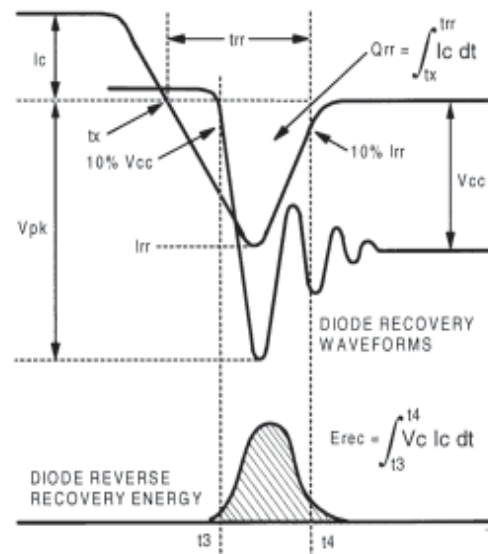


Fig. 18d - Test Waveforms for Circuit of Fig. 18a, Defining E_{rec} , t_{tr} , Q_{rr} , I_{rr}

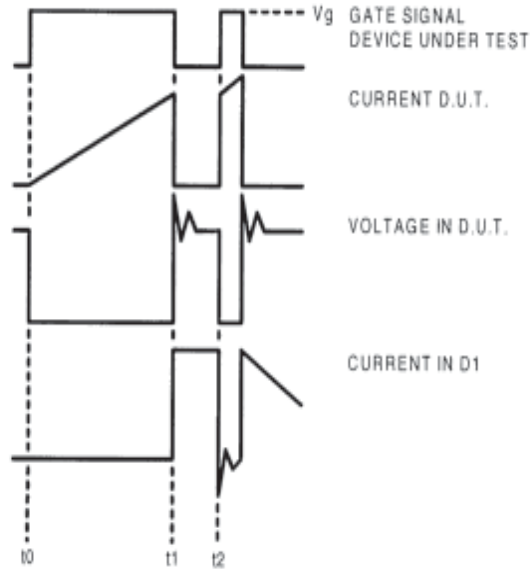


Figure 18e. Macro Waveforms for Figure 18a's Test Circuit

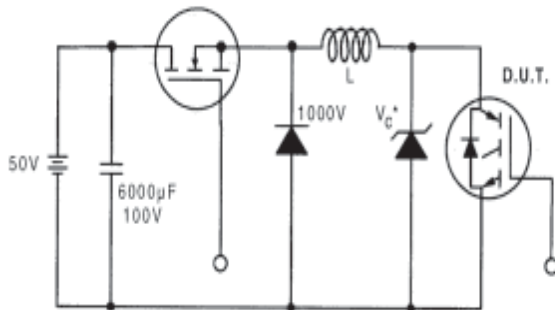


Figure 19. Clamped Inductive Load Test Circuit

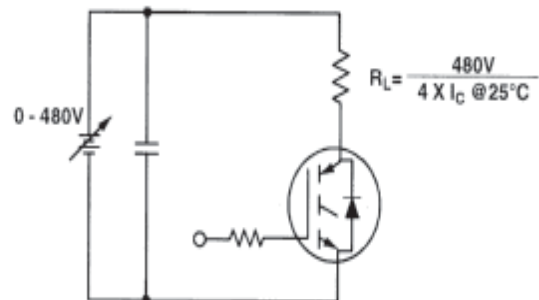


Figure 20. Pulsed Collector Current Test Circuit

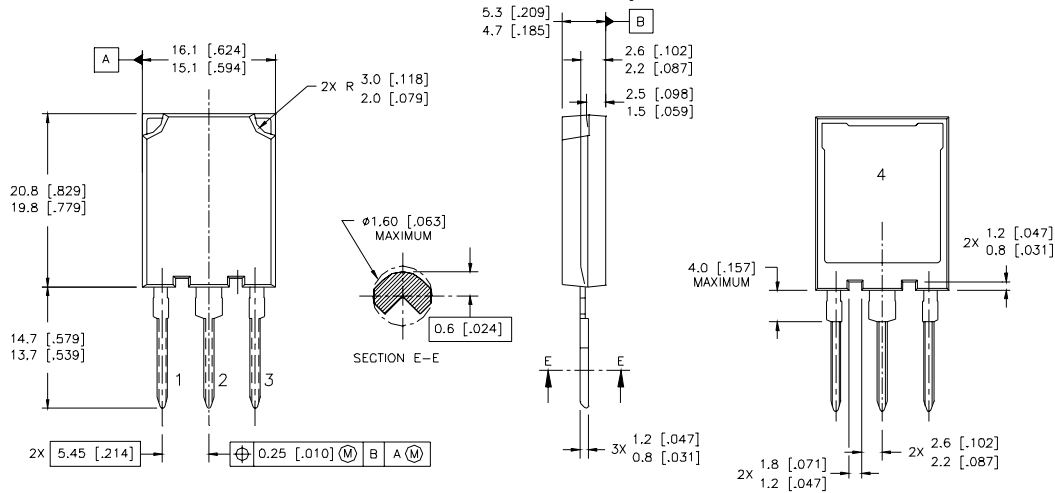
Notes:

- ① Repetitive rating: $V_{GE}=20V$; pulse width limited by maximum junction temperature (figure 20)
- ② $V_{CC}=80\%(V_{CES})$, $V_{GE}=20V$, $L=10\mu H$, $R_G= 5.0\Omega$ (figure 19)
- ③ Pulse width $\leq 80\mu s$; duty factor $\leq 0.1\%$
- ④ Pulse width $5.0\mu s$, single shot
- ⑤ Current limited by the package, (Die current = 100A)

IRG4PSC71UDPbF

Case Outline and Dimensions — Super-247

International
IR Rectifier



NOTES:

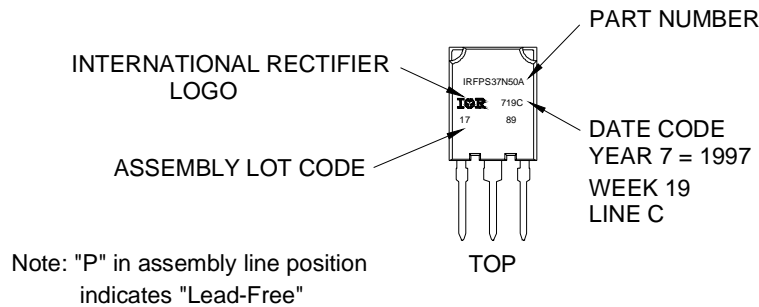
1. DIMENSIONS & TOLERANCING PER ASME Y14.5M-1994
2. CONTROLLING DIMENSION: MILLIMETER
3. DIMENSIONS ARE SHOWN IN MILLIMETRES [INCHES]

LEAD ASSIGNMENTS

MOSFET	IGBT
1 - GATE	1 - GATE
2 - DRAIN	2 - COLLECTOR
3 - SOURCE	3 - EMITTER
4 - DRAIN	4 - COLLECTOR

Super-247 (TO-274AA) Part Marking Information

EXAMPLE: THIS IS AN IRFPS37N50A WITH
ASSEMBLY LOT CODE 1789
ASSEMBLED ON WW 19, 1997
IN THE ASSEMBLY LINE "C"



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. 09/04

www.irf.com