

International

**IR** Rectifier

INSULATED GATE BIPOLAR TRANSISTOR WITH  
ULTRAFAST SOFT RECOVERY DIODE

PD - 95908

**IRG4PSH71UDPbF**

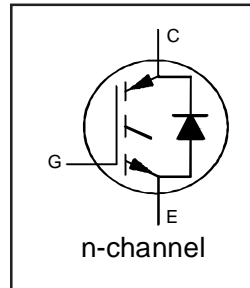
UltraFast Copack IGBT

**Features**

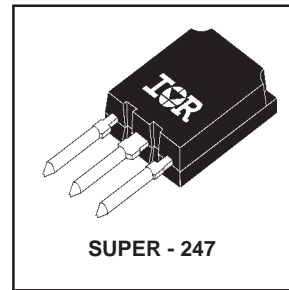
- UltraFast switching speed optimized for operating frequencies 8 to 40kHz in hard switching, 200kHz in resonant mode soft switching
- Generation 4 IGBT design provides tighter parameter distribution and higher efficiency (minimum switching and conduction losses) than prior generations
- Industry-benchmark 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 the TO-247, less space than TO-264
- IGBTs optimized for specific application conditions
- Cost and space saving in designs that require multiple, paralleled IGBTs
- HEXFRED™ antiparallel Diode minimizes switching losses and EMI



$V_{CES} = 1200V$   
 $V_{CE(on) typ.} = 2.52V$   
@  $V_{GE} = 15V, I_C = 50A$



**Absolute Maximum Ratings**

	Parameter	Max.	Units
$V_{CES}$	Collector-to-Emitter Voltage	1200	V
$I_C @ T_C = 25^\circ C$	Continuous Collector Current	99	A
$I_C @ T_C = 100^\circ C$	Continuous Collector Current	50	
$I_{CM}$	Pulse Collector Current <sup>Ⓢ</sup>	200	
$I_{LM}$	Clamped Inductive Load current <sup>Ⓢ</sup>	200	
$V_{GE}$	Gate-to-Emitter Voltage	±20	V
$I_F @ T_C = 100^\circ C$	Diode Continuous Forward Current	70	
$I_{FM}$	Diode Maximum Forward Current	200	
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	350	W
$P_D @ T_C = 100^\circ C$	Maximum Power Dissipation	140	
$T_J$	Operating Junction and	-55 to +150	
$T_{STG}$	Storage Temperature Range		°C
	Storage Temperature Range, for 10 sec.	300 (0.063 in. (1.6mm) from case)	

**Thermal / Mechanical Characteristics**

	Parameter	Min.	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case- IGBT	---	---	0.36	°C/W
$R_{\theta JC}$	Junction-to-Case- Diode	---	---	0.36	
$R_{\theta CS}$	Case-to-Sink, flat, greased surface	---	0.24	---	
$R_{\theta JA}$	Junction-to-Ambient, typical socket mount	---	---	38	
	Recommended Clip Force	20 (2.0)			N (kgf)
Wt	Weight	---	6 (0.21)	---	g (oz.)

www.irf.com

1  
09/20/04

# IRG4PSH71UDPbF

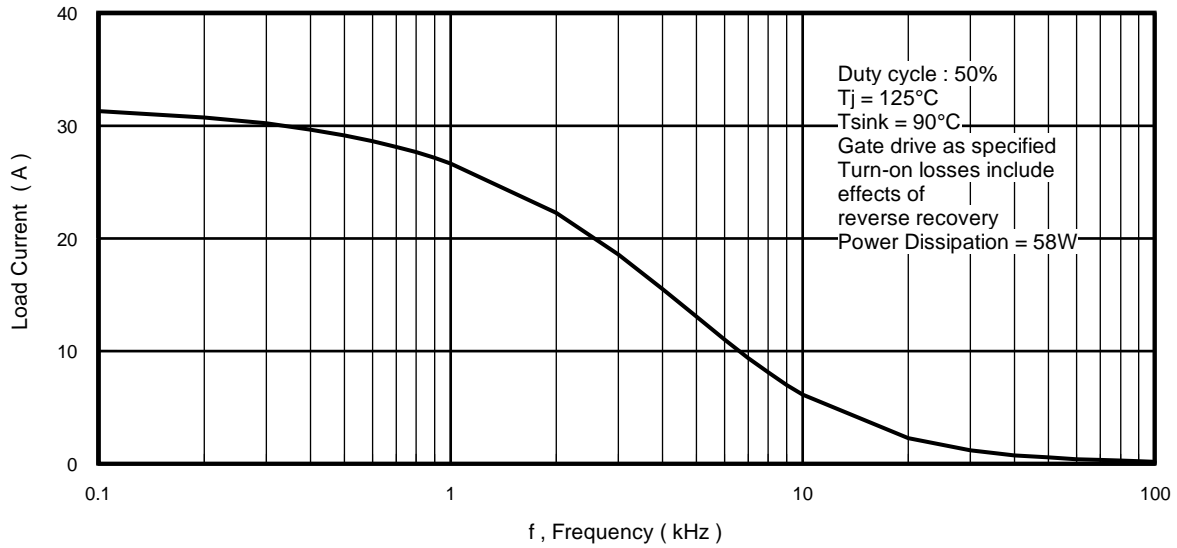
International  
IR Rectifier

## Electrical Characteristics @ T<sub>J</sub> = 25°C (unless otherwise specified)

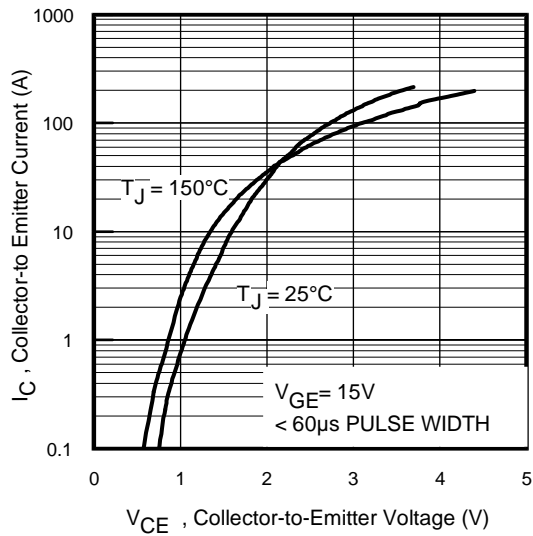
Parameter	Min.	Typ.	Max.	Units	Conditions	
V <sub>(BR)CES</sub>	1200	—	—	V	V <sub>GE</sub> = 0V, I <sub>C</sub> = 250μA	
V <sub>(BR)ECS</sub>	19	—	—	V	V <sub>GE</sub> = 0V, I <sub>C</sub> = 1.0A	
ΔV <sub>(BR)CES</sub> /ΔT <sub>J</sub>	—	0.78	—	V/°C	V <sub>GE</sub> = 0V, I <sub>C</sub> = 1mA	
V <sub>CE(on)</sub>	Collector-to-Emitter Saturation Voltage	—	2.52	2.70	V	I <sub>C</sub> = 70A I <sub>C</sub> = 140A I <sub>C</sub> = 70A, T <sub>J</sub> = 150°C V <sub>GE</sub> = 15V See Fig.2, 5
		—	3.17	—		
		—	2.68	—		
V <sub>GE(th)</sub>	3.0	—	6.0		V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 250μA	
ΔV <sub>GE(th)</sub> /ΔT <sub>J</sub>	—	-9.2	—	mV/°C	V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 1.0mA	
g <sub>fE</sub>	48	72	—	S	V <sub>CE</sub> = 100V, I <sub>C</sub> = 70A	
I <sub>CES</sub>	Zero Gate Voltage Collector Current	—	—	500	μA	V <sub>GE</sub> = 0V, V <sub>CE</sub> = 1200V V <sub>GE</sub> = 0V, V <sub>CE</sub> = 10V V <sub>GE</sub> = 0V, V <sub>CE</sub> = 1200V, T <sub>J</sub> = 150°C
		—	—	2.0		
		—	—	5000		
V <sub>FM</sub>	Diode Forward Voltage Drop	—	2.92	3.9	V	I <sub>F</sub> = 70A See Fig.13 I <sub>F</sub> = 70A, T <sub>J</sub> = 150°C
		—	2.88	3.7		
I <sub>GES</sub>	Gate-to-Emitter Leakage Current	—	—	±100	nA	V <sub>GE</sub> = ±20V

## Switching Characteristics @ T<sub>J</sub> = 25°C (unless otherwise specified)

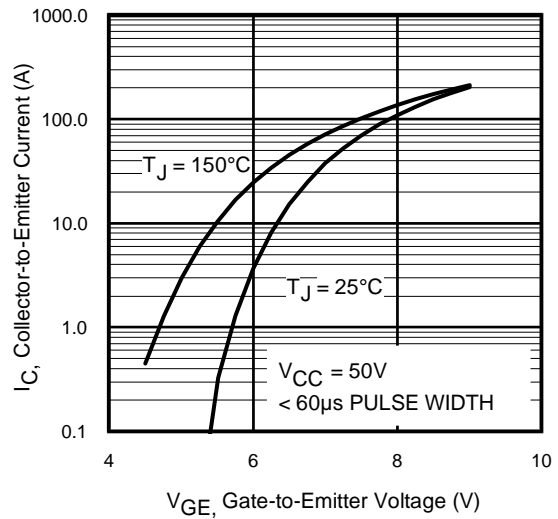
Parameter	Min.	Typ.	Max.	Units	Conditions	
Q <sub>g</sub>	—	380	570	nC	I <sub>C</sub> = 70A V <sub>CC</sub> = 400V See Fig.8 V <sub>GE</sub> = 15V	
Q <sub>ge</sub>	—	61	24			
Q <sub>gc</sub>	—	130	200			
t <sub>d(on)</sub>	—	46	—	ns	I <sub>C</sub> = 70A, V <sub>CC</sub> = 960V V <sub>GE</sub> = 15V, R <sub>G</sub> = 5.0Ω Energy losses include "tail" See Fig. 9, 10, 11, 14	
t <sub>r</sub>	—	77	—			
t <sub>d(off)</sub>	—	250	350			
t <sub>f</sub>	—	220	330			
E <sub>on</sub>	—	8.8	—			
E <sub>off</sub>	—	9.4	—			
E <sub>tot</sub>	—	18.2	19.7			
t <sub>d(on)</sub>	—	43	—	ns	T <sub>J</sub> = 150°C, See Fig. 9, 10, 11, 14 I <sub>C</sub> = 70A, V <sub>CC</sub> = 960V V <sub>GE</sub> = 15V, R <sub>G</sub> = 5.0Ω Energy losses include "tail"	
t <sub>r</sub>	—	78	—			
t <sub>d(off)</sub>	—	330	—			
t <sub>f</sub>	—	480	—			
E <sub>TS</sub>	—	26	—	mJ		
L <sub>E</sub>	Internal Emitter Inductance	—	13	—	nH	Measured 5mm from package
C <sub>ies</sub>	Input Capacitance	—	6640	—	pF	V <sub>GE</sub> = 0V V <sub>CC</sub> = 30V, See Fig.7 f = 1.0MHz
C <sub>oes</sub>	Output Capacitance	—	420	—		
C <sub>res</sub>	Reverse Transfer Capacitance	—	60	—		
t <sub>rr</sub>	Diode Reverse Recovery Time	—	110	170	ns	T <sub>J</sub> =25°C See Fig 14 T <sub>J</sub> =125°C
		—	180	270		
I <sub>rr</sub>	Diode Peak Reverse Recovery Current	—	6.0	9.0	A	T <sub>J</sub> =25°C See Fig 15 T <sub>J</sub> =125°C
		—	8.9	13		
Q <sub>rr</sub>	Diode Reverse Recovery Charge	—	350	530	nC	T <sub>J</sub> =25°C See Fig 16 T <sub>J</sub> =125°C
		—	870	1300		
di <sub>(rec)M</sub> /dt	Diode Peak Rate of Fall of Recovery During t <sub>b</sub>	—	150	230	A/μs	T <sub>J</sub> =25°C See Fig 17 T <sub>J</sub> =125°C
		—	130	200		



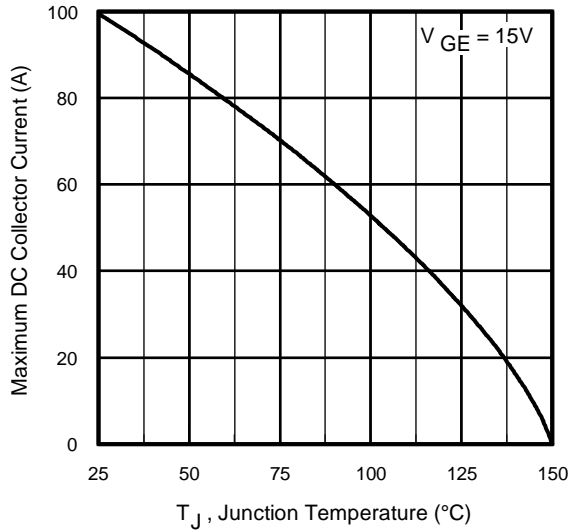
**Fig. 1 - Typical Load Current vs. Frequency**  
 (For square wave,  $I = I_{\text{RMS}}$  of fundamental; for triangular wave,  $I = I_{\text{PK}}$ )



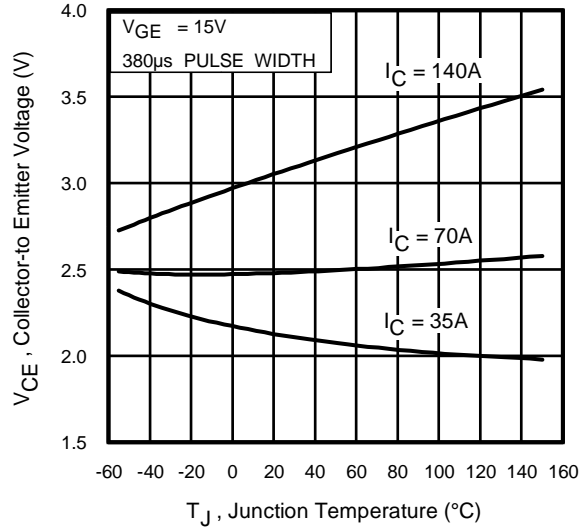
**Fig. 2 - Typical Output Characteristics**



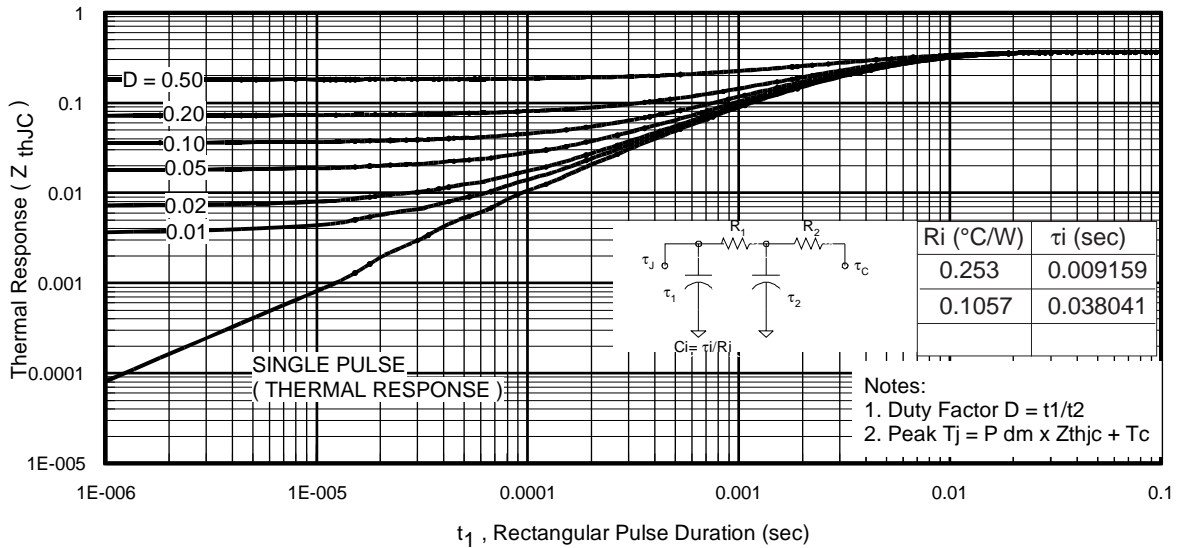
**Fig. 3 - Typical Transfer Characteristics**



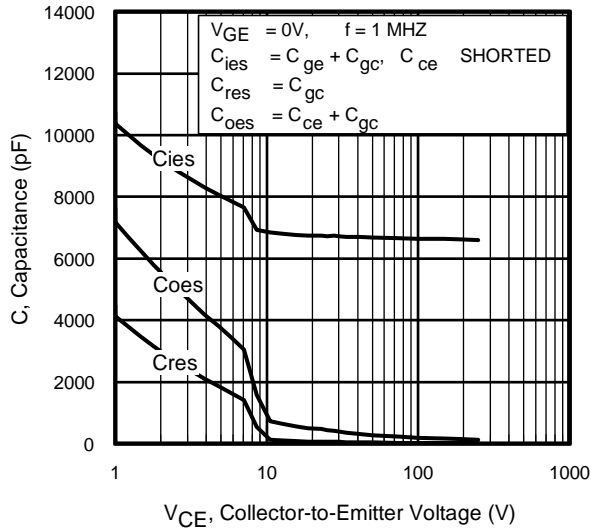
**Fig. 4** - Maximum Collector Current vs. Case Temperature



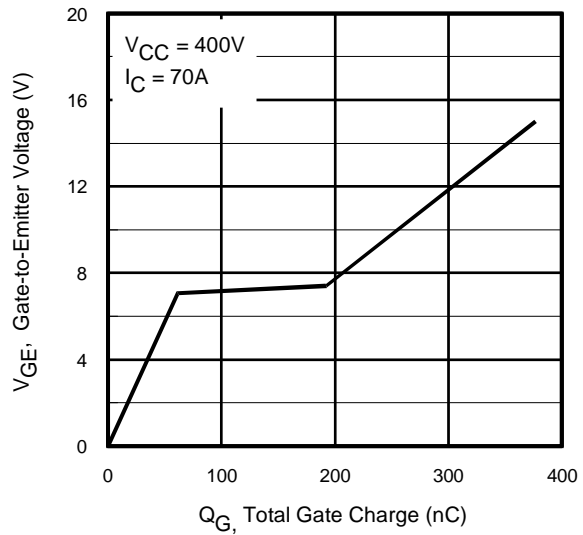
**Fig. 5** - Collector-to-Emitter Voltage vs. Junction Temperature



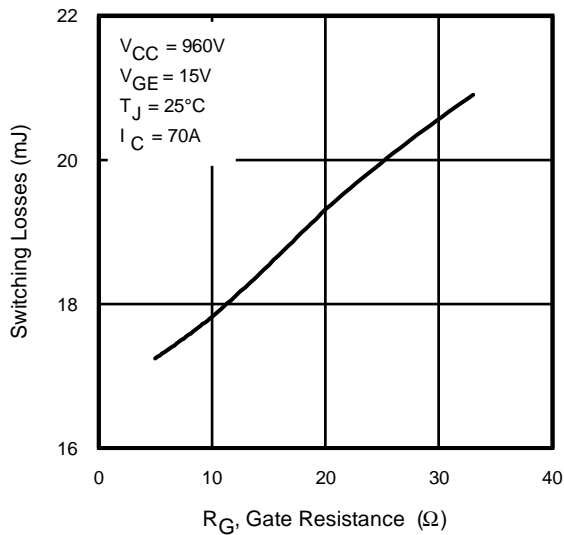
**Fig. 6** - Maximum Effective Transient Thermal Impedance, Junction-to-Case



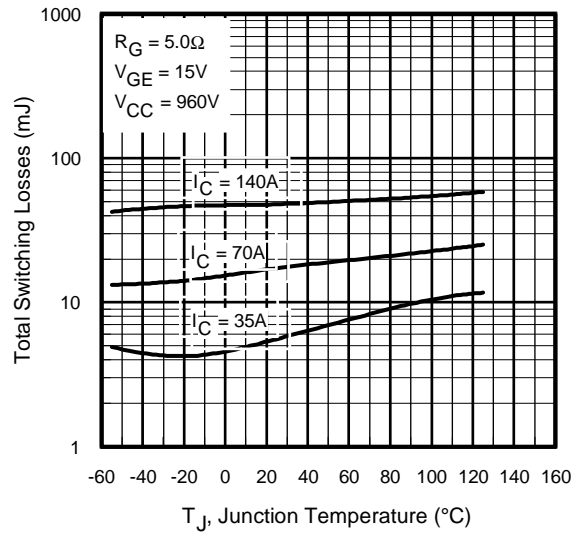
**Fig. 7** - Typical Capacitance vs. Collector-to-Emitter Voltage



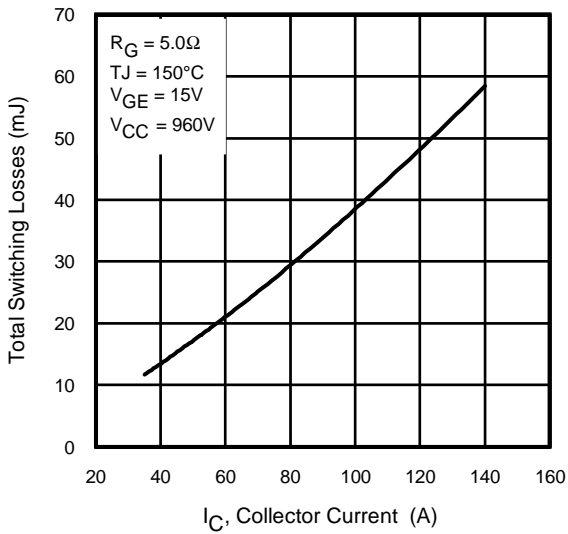
**Fig. 8** - Typical Gate Charge vs. Gate-to-Emitter Voltage



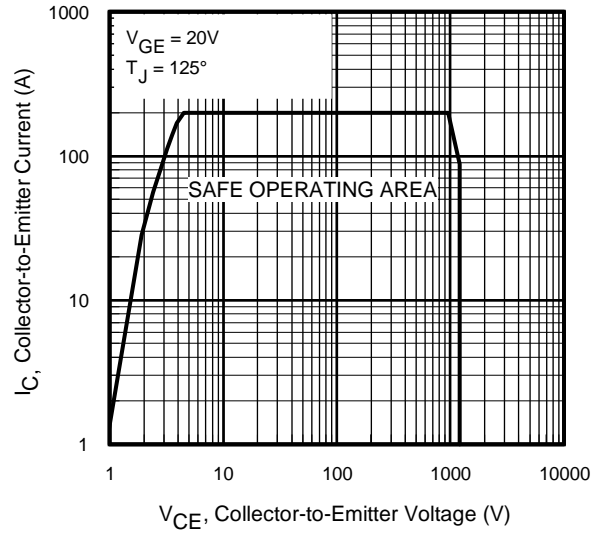
**Fig. 9** - Typical Switching Losses vs. Gate Resistance



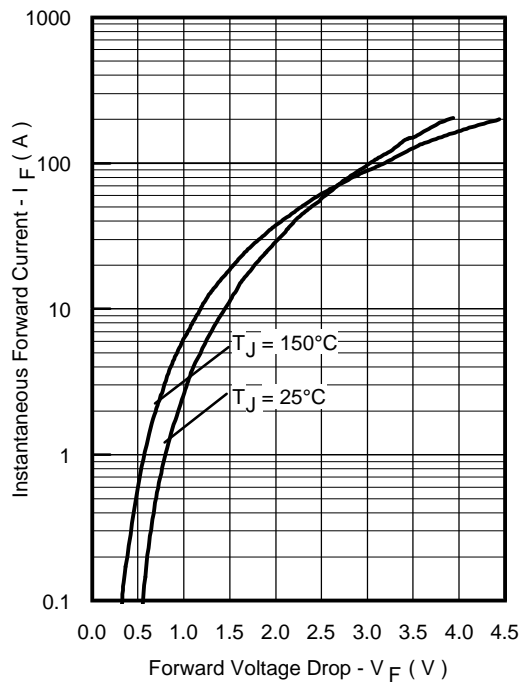
**Fig. 10** - Typical Switching Losses vs. Junction Temperature



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



**Fig. 12** - Turn-Off SOA



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

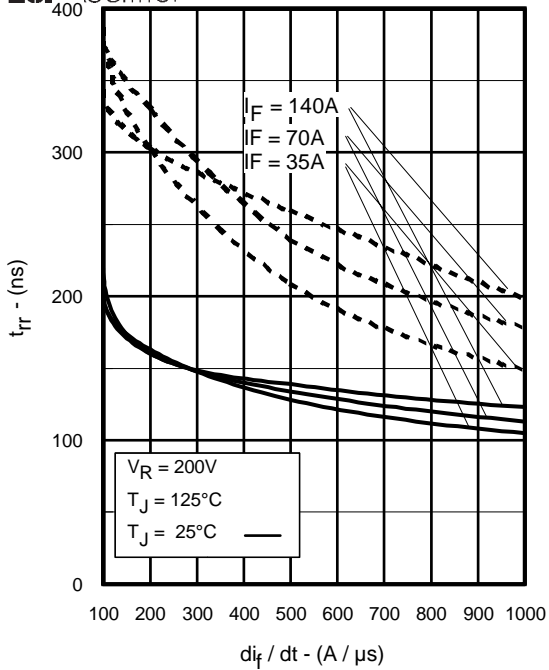


Fig. 14 - Typical Reverse Recovery vs.  $di_f/dt$

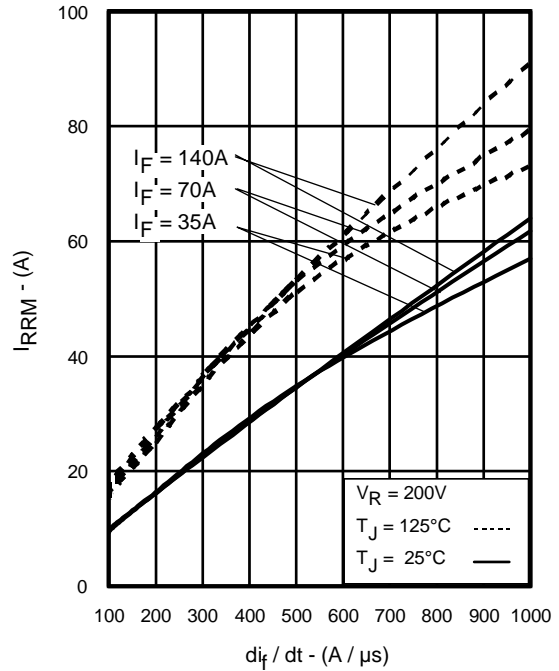


Fig. 15 - Typical Recovery Current vs.  $di_f/dt$

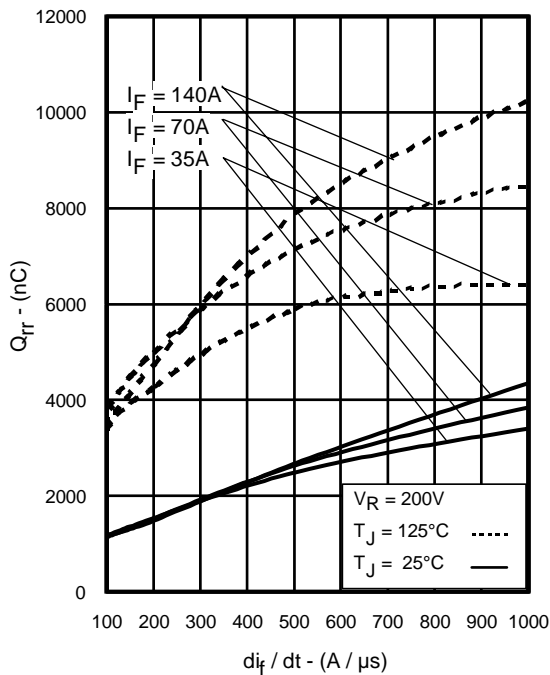


Fig. 16 - Typical Stored Charge vs.  $di_f/dt$   
www.irf.com

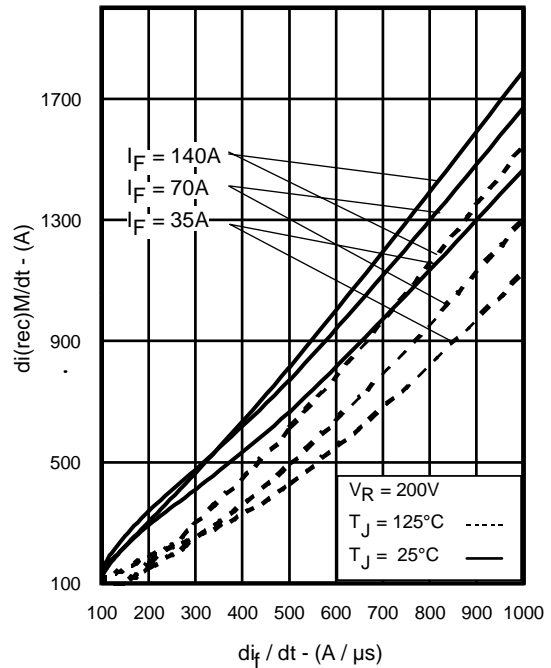
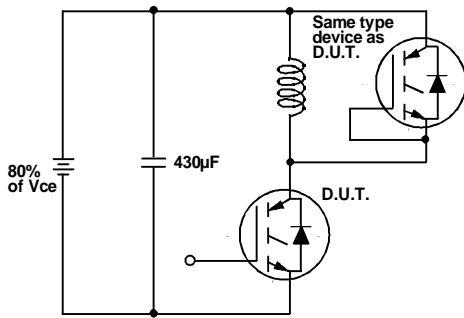
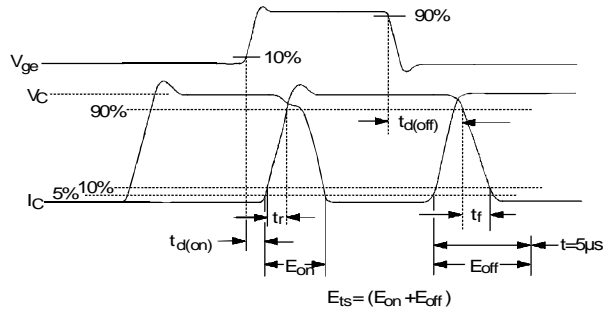


Fig. 17 - Typical  $di_{(rec)}M/dt$  vs.  $di_f/dt$

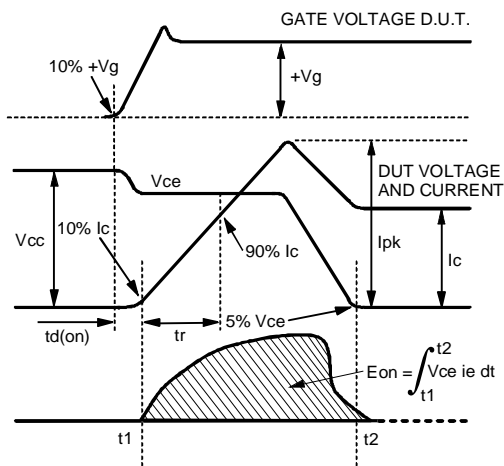
# IRG4PSH71UDPbF



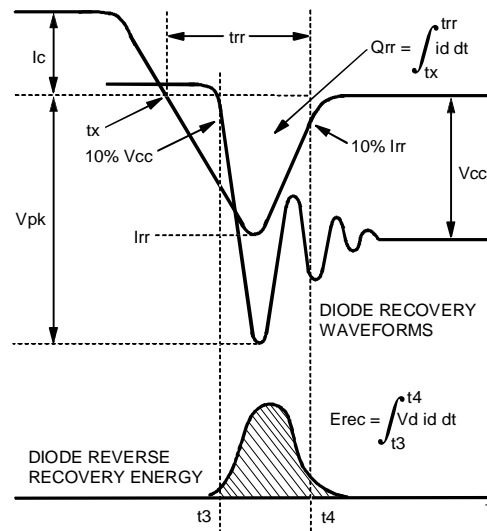
**Fig. 18a** - Test Circuit for Measurement of  $I_{LM}$ ,  $E_{on}$ ,  $E_{off}$ (diode),  $t_{rr}$ ,  $Q_{rr}$ ,  $I_{rr}$ ,  $t_{d(on)}$ ,  $t_r$ ,  $t_{d(off)}$ ,  $t_f$



**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  $E_{rec}$ ,  $t_{rr}$ ,  $Q_{rr}$ ,  $I_{rr}$



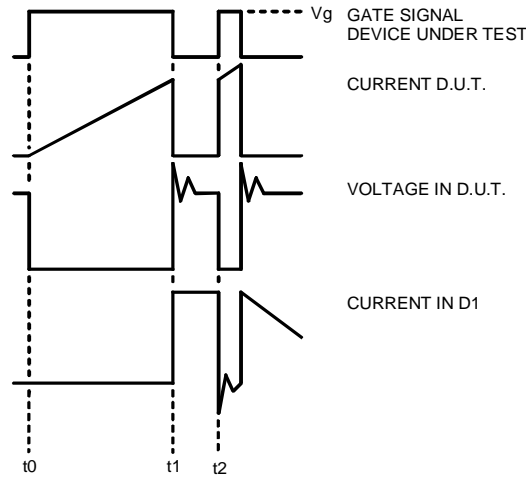


Figure 18e. Macro Waveforms for Figure 18a's Test Circuit

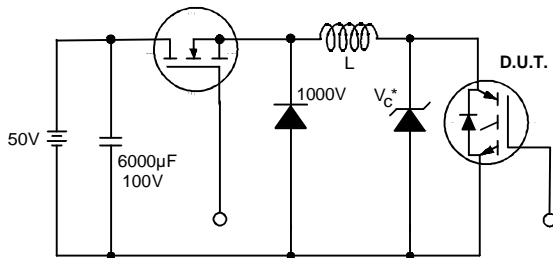


Figure 19. Clamped Inductive Load Test Circuit

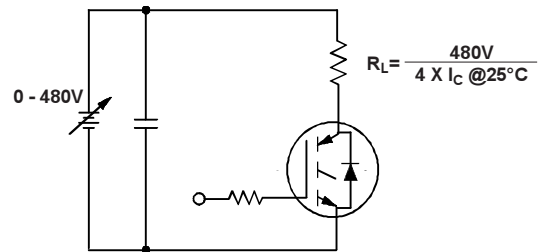
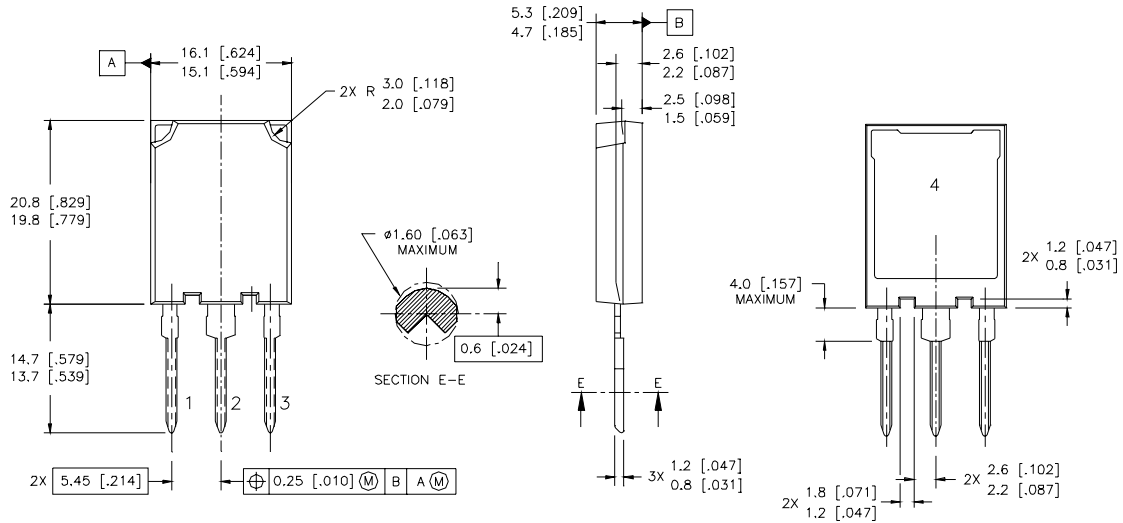


Figure 20. Pulsed Collector Current Test Circuit

# IRG4PSH71UDPbF

## Case Outline and Dimensions — Super-247



**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

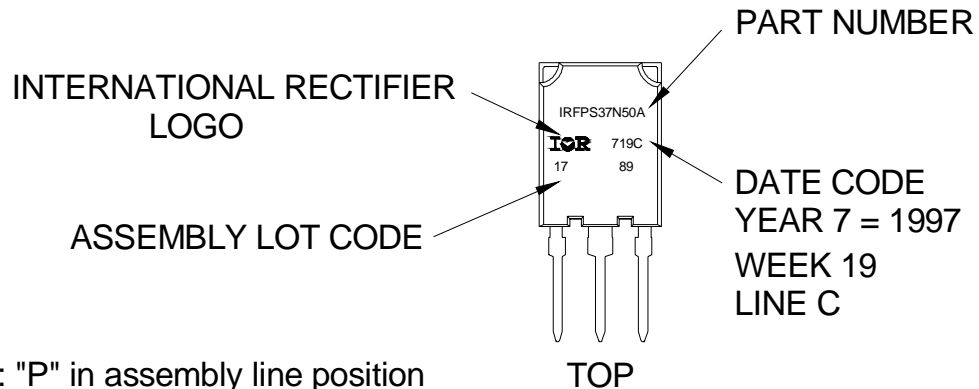
**Super TO-247™ package is not recommended for Surface Mount Application.**

**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 13a)
- ③ Pulse width  $\leq 80\mu s$ ; duty factor  $\leq 0.1\%$ .
- ④ Pulse width  $5.0\mu s$ , single shot.
- ⑤ Repetitive rating; pulse width limited by maximum junction temperature.

## 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"



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

Data and specifications subject to change without notice.  
This product has been designed and qualified for the Consumer market.  
Qualification Standards can be found on IR's Web site.

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](http://www.irf.com) for sales contact information.09/04

单击下面可查看定价，库存，交付和生命周期等信息

[>>Infineon Technologies\(英飞凌\)](#)