

IRG4PSH71UDPbF

INSULATED GATE BIPOLAR TRANSISTOR WITH
ULTRAFAST SOFT RECOVERY DIODE

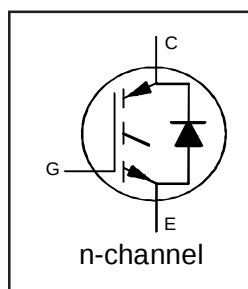
UltraFast Copack IGBT

Features

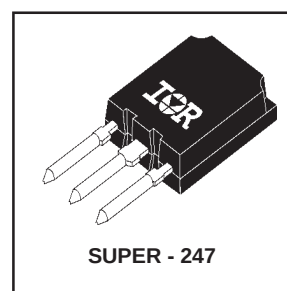
- UltraFast switching speed optimized for operating frequencies 8 to 40kHz in hard switching, 200kHz in resonant mode soft switching
- Generation 4 IGBT design provides tighter parameter distribution and higher efficiency (minimum switching and conduction losses) than prior generations
- Industry-benchmark 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



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



Absolute Maximum Ratings

	Parameter	Max.	Units
V _{CES}	Collector-to-Emitter Voltage	1200	V
I _C @ T _C = 25°C	Continuous Collector Current	99	A
I _C @ T _C = 100°C	Continuous Collector Current	50	
I _{CM}	Pulse Collector Current ①	200	
I _{LM}	Clamped Inductive Load current ②	200	
V _{GE}	Gate-to-Emitter Voltage	±20	V
I _F @ T _c = 100°C	Diode Continuous Forward Current	70	W
I _{FM}	Diode Maximum Forward Current	200	
P _D @ T _C = 25°C	Maximum Power Dissipation	350	
P _D @ T _C = 100°C	Maximum Power Dissipation	140	
T _J	Operating Junction and	-55 to +150	°C
T _{STG}	Storage Temperature Range		
	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	$^\circ C/W$
$R_{\theta JC}$	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.)

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

Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)CES}$	1200	—	—	V	$V_{GE} = 0V, I_C = 250\mu A$
$V_{(BR)ECS}$	19	—	—	V	$V_{GE} = 0V, I_C = 1.0A$
$\Delta V_{(BR)CES}/\Delta T_J$	—	0.78	—	$V/^\circ\text{C}$	$V_{GE} = 0V, I_C = 1mA$
$V_{CE(on)}$	Collector-to-Emitter Saturation Voltage	—	2.52	V	$I_C = 70A, V_{GE} = 15V$
		—	3.17		$I_C = 140A$ See Fig.2, 5
		—	2.68		$I_C = 70A, T_J = 150^\circ\text{C}$
$V_{GE(th)}$	Gate Threshold Voltage	3.0	—	6.0	$V_{CE} = V_{GE}, I_C = 250\mu A$
$\Delta V_{GE(th)}/\Delta T_J$	Threshold Voltage temp. coefficient	—	-9.2	—	$mV/^\circ\text{C}, V_{CE} = V_{GE}, I_C = 1.0mA$
g_{fe}	Forward Transconductance ④	48	72	—	$S, V_{CE} = 100V, I_C = 70A$
I_{CES}	Zero Gate Voltage Collector Current	—	—	500	$\mu A, V_{GE} = 0V, V_{CE} = 1200V$
		—	—	2.0	$\mu A, V_{GE} = 0V, V_{CE} = 10V$
		—	—	5000	$\mu A, V_{GE} = 0V, V_{CE} = 1200V, T_J = 150^\circ\text{C}$
V_{FM}	Diode Forward Voltage Drop	—	2.92	3.9	$V, I_F = 70A$ See Fig.13
		—	2.88	3.7	$V, I_F = 70A, T_J = 150^\circ\text{C}$
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	—	380	570	nC	$I_C = 70A$
Q_{ge}	—	61	24		$V_{CC} = 400V$ See Fig.8
Q_{gc}	—	130	200		$V_{GE} = 15V$
$t_{d(on)}$	—	46	—	ns	$I_C = 70A, V_{CC} = 960V$
t_r	—	77	—		$V_{GE} = 15V, R_G = 5.0\Omega$
$t_{d(off)}$	—	250	350		Energy losses include "tail"
t_f	—	220	330		See Fig. 9, 10, 11, 14
E_{on}	—	8.8	—	mJ	$T_J = 150^\circ\text{C},$ See Fig. 9, 10, 11, 14
E_{off}	—	9.4	—		
E_{tot}	—	18.2	19.7		
$t_{d(on)}$	—	43	—	ns	$I_C = 70A, V_{CC} = 960V$
t_r	—	78	—		$V_{GE} = 15V, R_G = 5.0\Omega$
$t_{d(off)}$	—	330	—		Energy losses include "tail"
t_f	—	480	—		
E_{TS}	—	26	—	mJ	
L_E	—	13	—	nH	Measured 5mm from package
C_{ies}	—	6640	—	pF	$V_{GE} = 0V$
C_{oes}	—	420	—		$V_{CC} = 30V,$ See Fig.7
C_{res}	—	60	—		$f = 1.0MHz$
t_{rr}	Diode Reverse Recovery Time	—	110	170	$T_J = 25^\circ\text{C}$ See Fig
		—	180	270	$T_J = 125^\circ\text{C}$ 14
I_{rr}	Diode Peak Reverse Recovery Current	—	6.0	9.0	$T_J = 25^\circ\text{C}$ See Fig
		—	8.9	13	$T_J = 125^\circ\text{C}$ 15
Q_{rr}	Diode Reverse Recovery Charge	—	350	530	$T_J = 25^\circ\text{C}$ See Fig
		—	870	1300	$T_J = 125^\circ\text{C}$ 16
$di_{(rec)M}/dt$	Diode Peak Rate of Fall of Recovery During t_b	—	150	230	$T_J = 25^\circ\text{C}$ See Fig
		—	130	200	$T_J = 125^\circ\text{C}$ 17

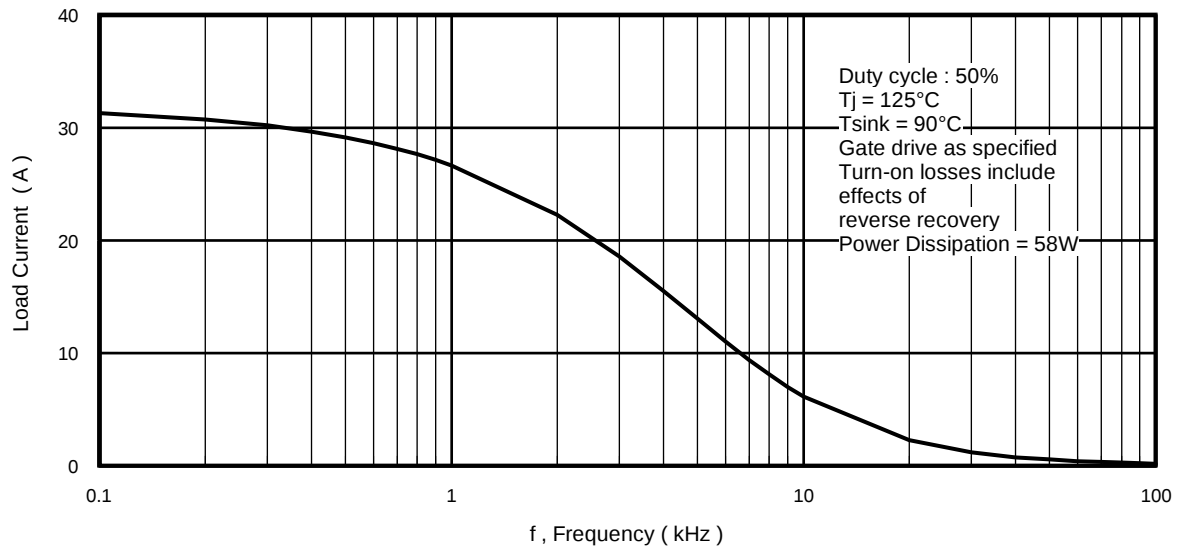


Fig. 1 - Typical Load Current vs. Frequency
 (For square wave, $I = I_{\text{RMS}}$ of fundamental; for triangular wave, $I = I_{\text{PK}}$)

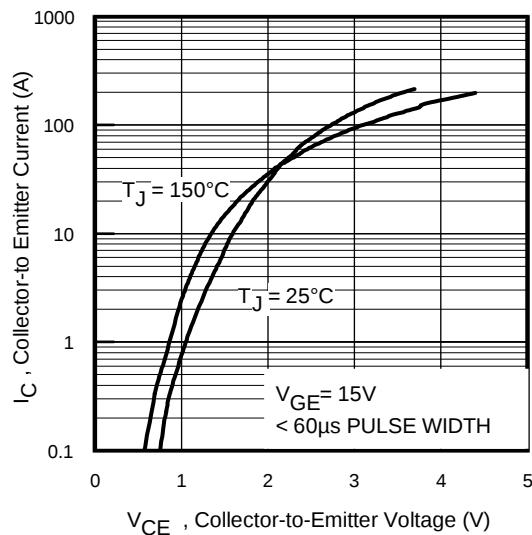


Fig. 2 - Typical Output Characteristics

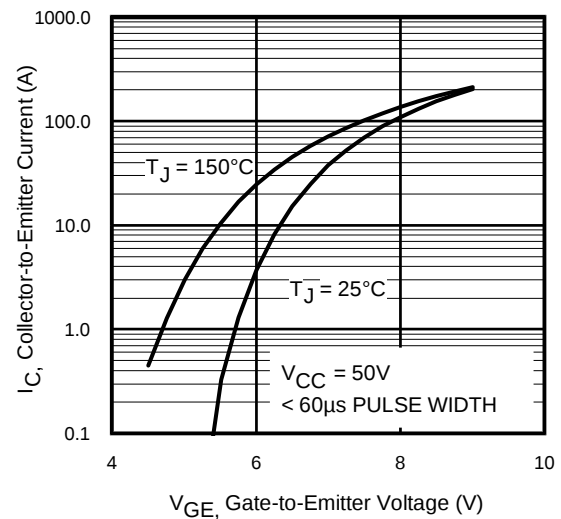


Fig. 3 - Typical Transfer Characteristics

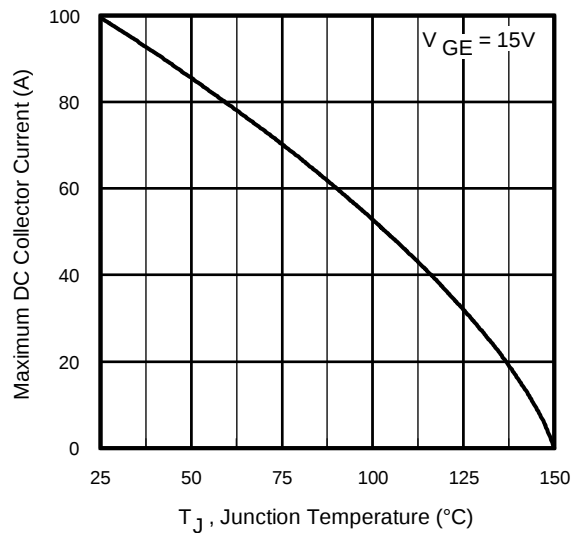


Fig. 4 - Maximum Collector Current vs. Case Temperature

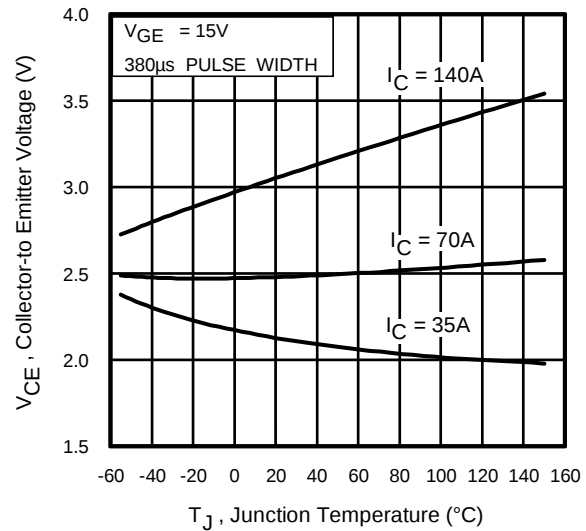


Fig. 5 - Collector-to-Emitter Voltage vs. Junction Temperature

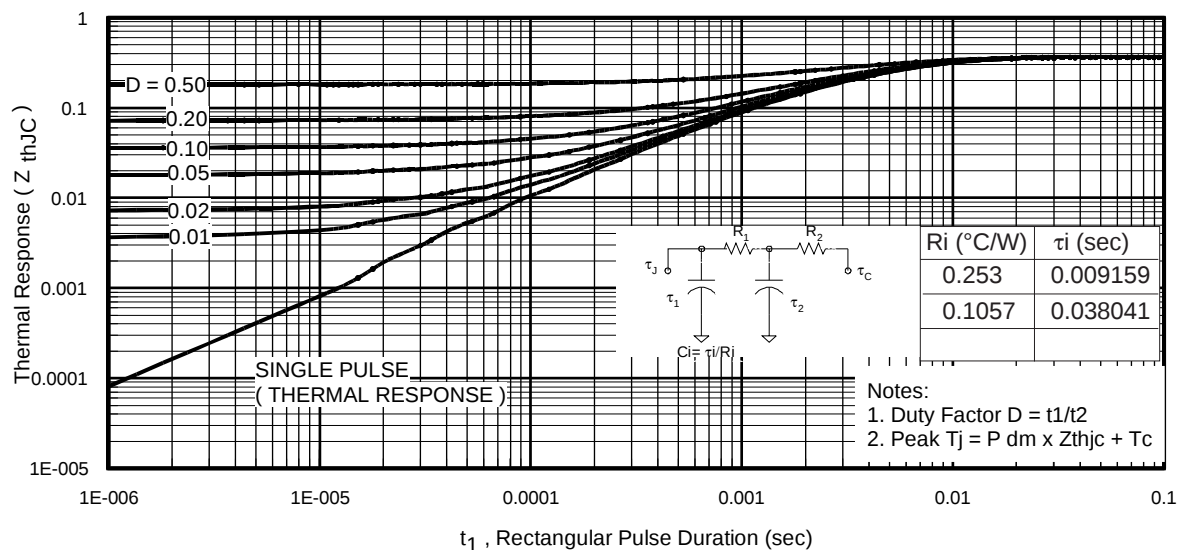


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

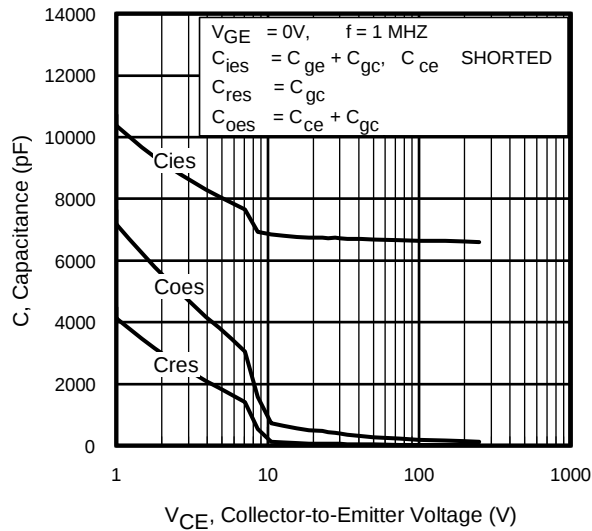


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

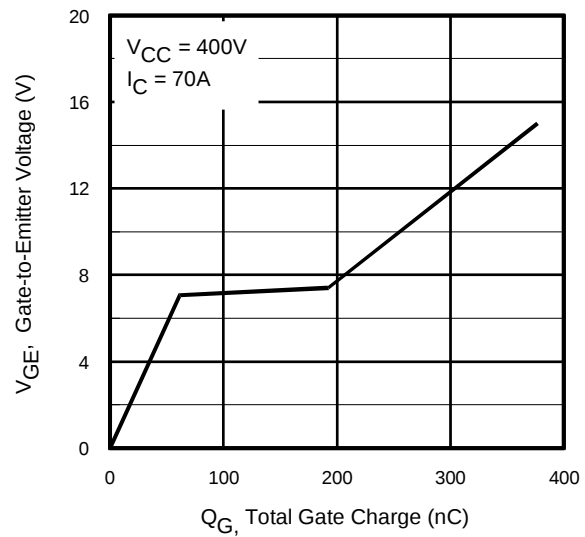


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

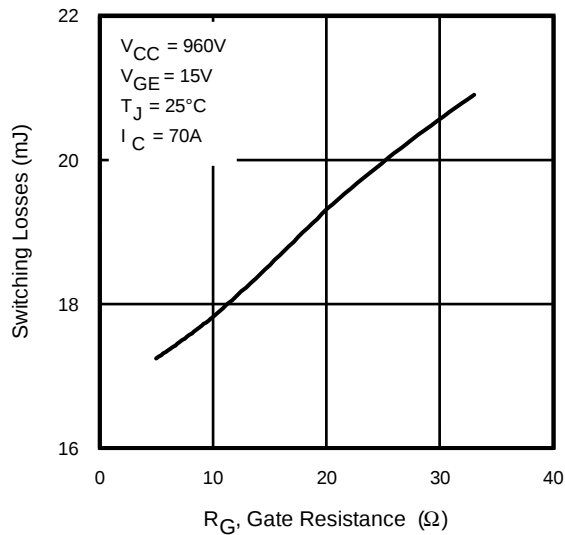


Fig. 9 - Typical Switching Losses vs. Gate Resistance

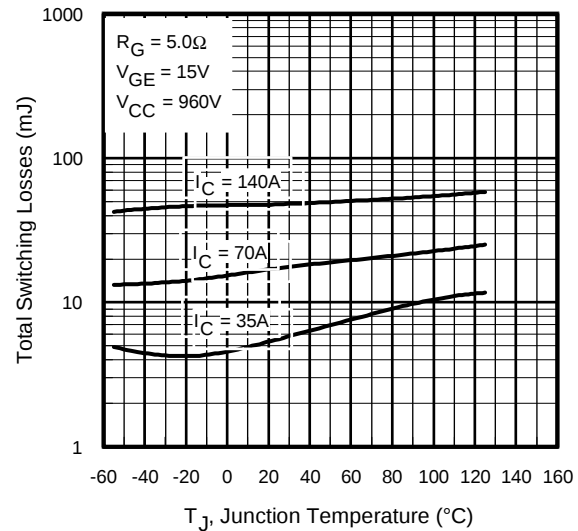


Fig. 10 - Typical Switching Losses vs. Junction Temperature

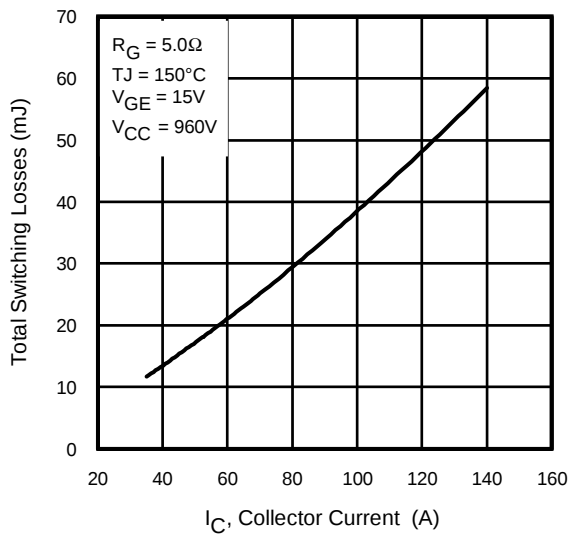


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

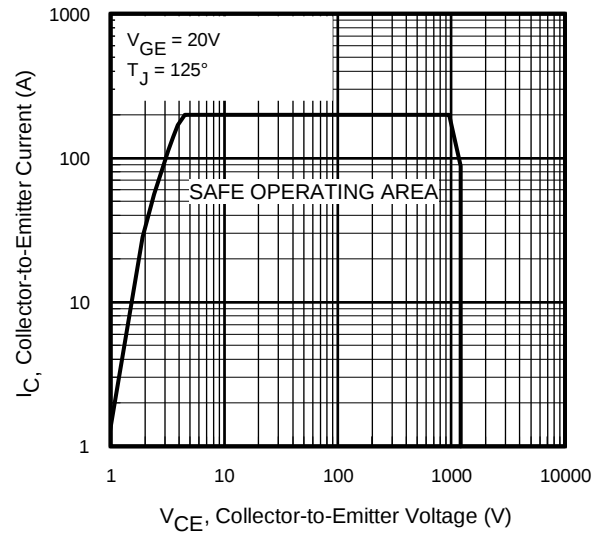


Fig. 12 - Turn-Off SOA

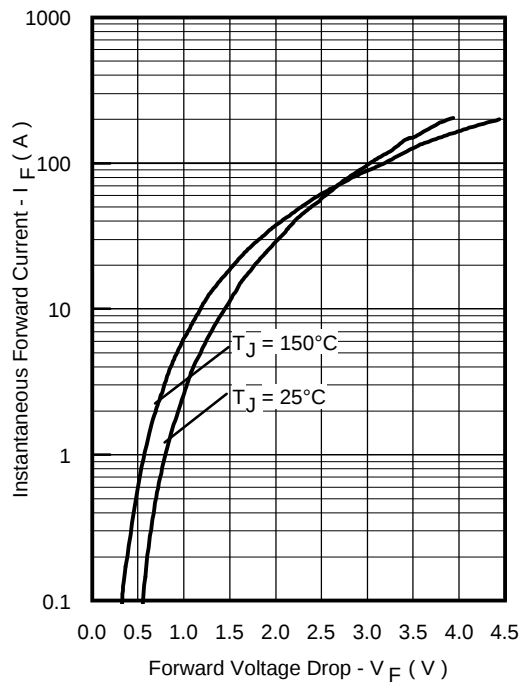


Fig. 13 - Maximum Forward Voltage Drop vs. Instantaneous Forward Current

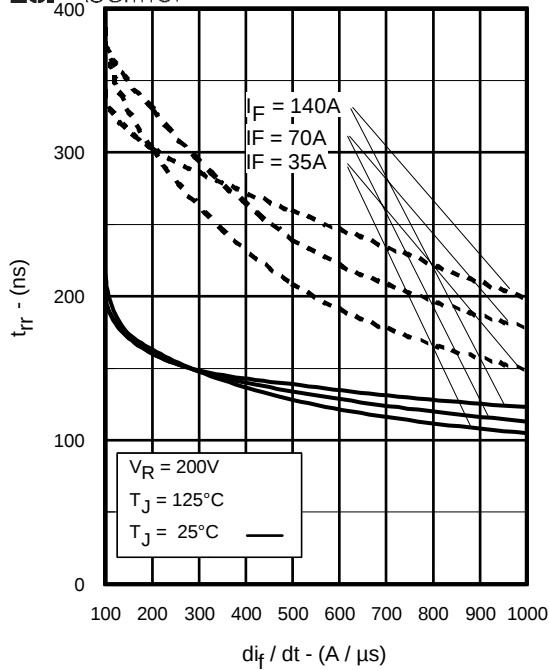


Fig. 14 - Typical Reverse Recovery vs. di_f/dt

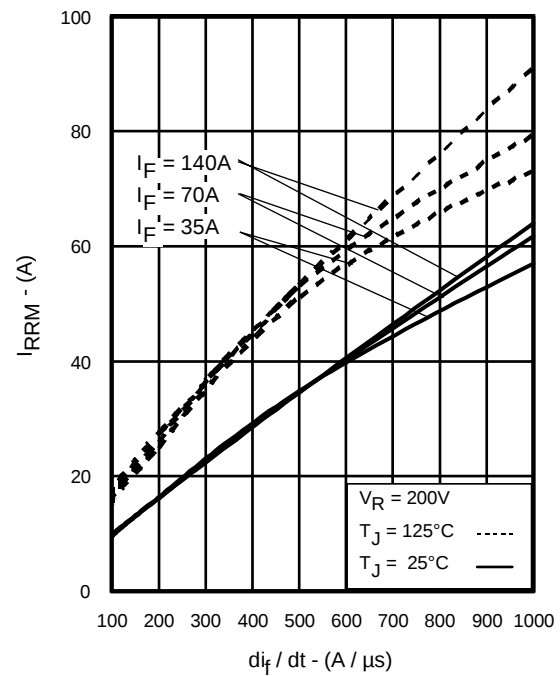


Fig. 15 - Typical Recovery Current vs. di_f/dt

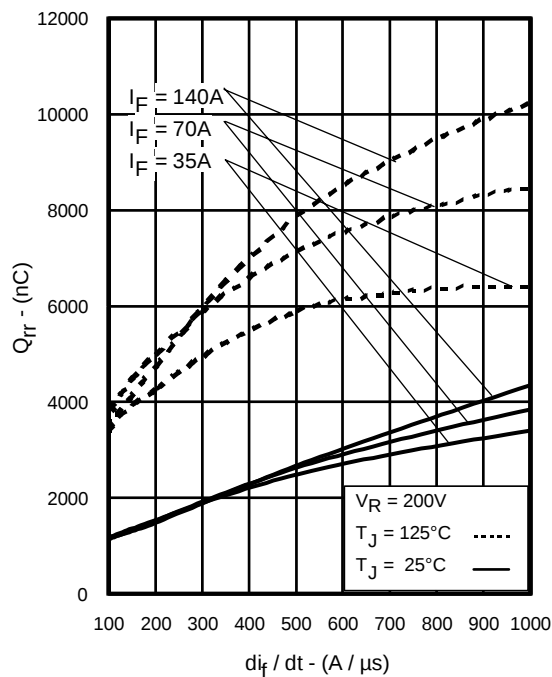


Fig. 16 - Typical Stored Charge vs. di_f/dt
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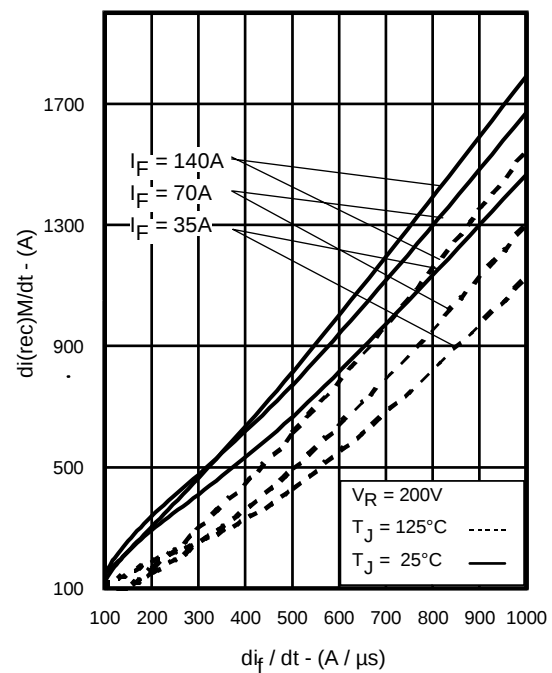


Fig. 17 - Typical $di_{(rec)}M/dt$ vs. di_f/dt

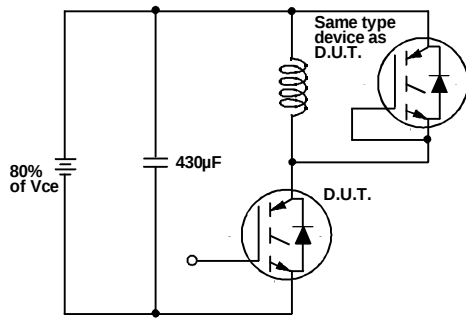


Fig. 18a - Test Circuit for Measurement of I_{LM} , E_{on} , $E_{off}(\text{diode})$, t_{rr} , Q_{rr} , I_{rr} , $t_{d(on)}$, t_r , $t_{d(off)}$, t_f

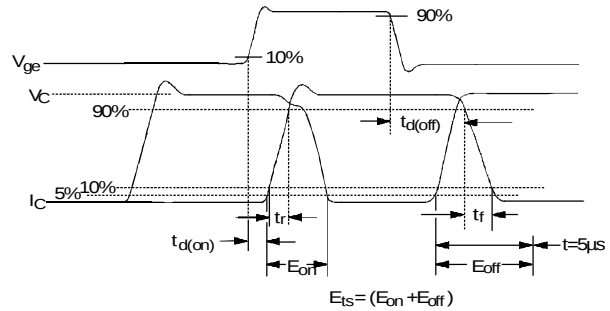


Fig. 18b - Test Waveforms for Circuit of Fig. 18a, Defining E_{off} , $t_{d(off)}$, t_f

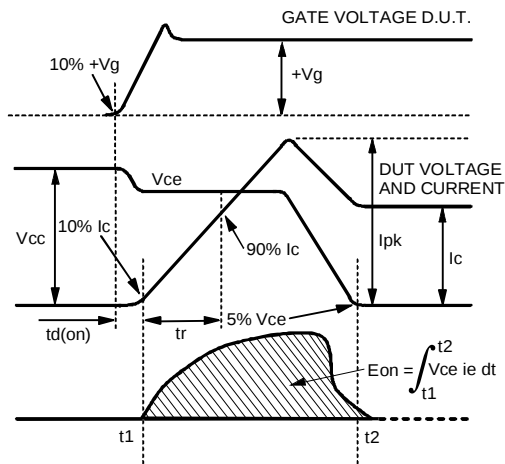


Fig. 18c - Test Waveforms for Circuit of Fig. 18a, Defining E_{on} , $t_{d(on)}$, t_r

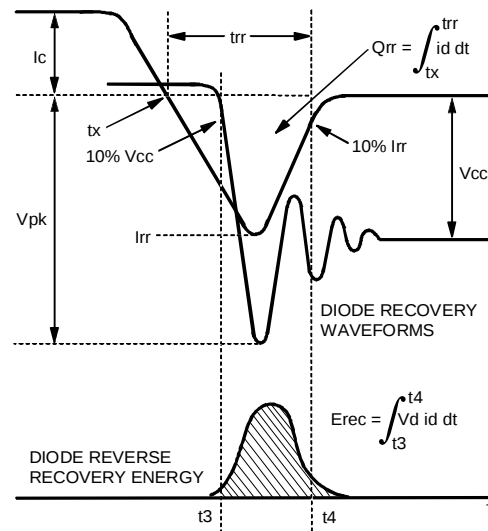
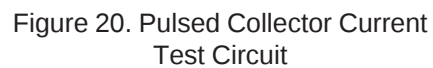
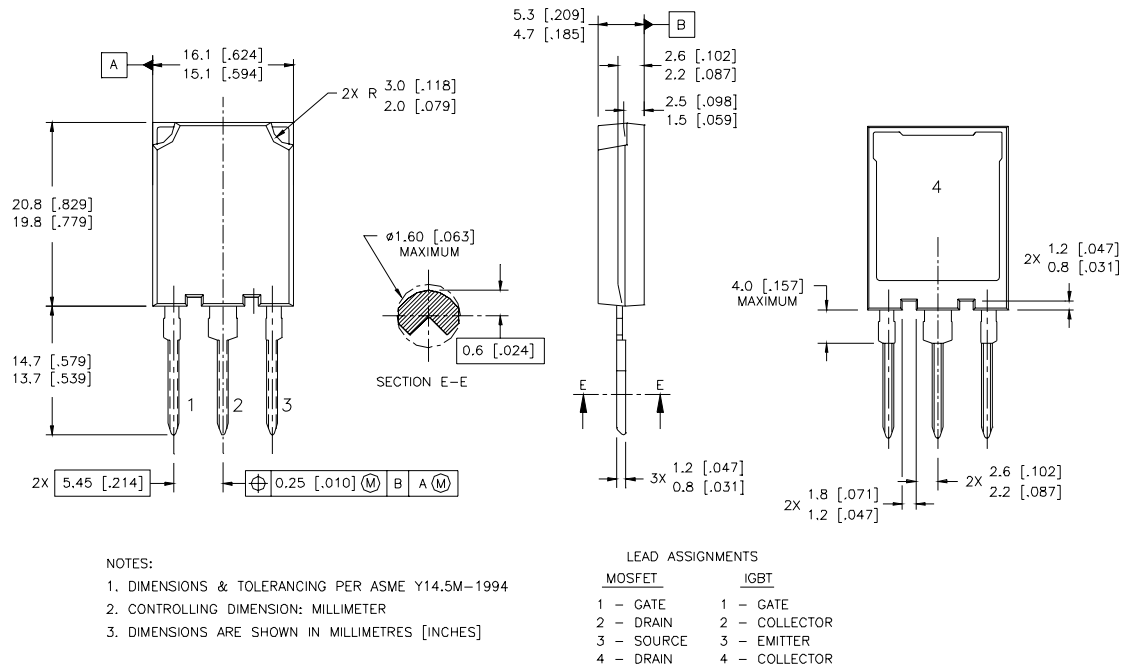


Fig. 18d - Test Waveforms for Circuit of Fig. 18a, Defining E_{rec} , t_{rr} , Q_{rr} , I_{rr}



Case Outline and Dimensions — Super-247



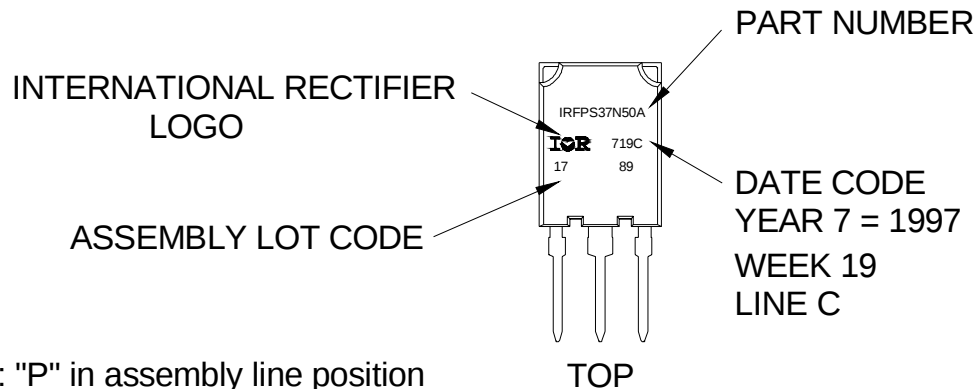
Super TO-247™ package is not recommended for Surface Mount Application.

Notes:

- Repetitive rating: $V_{GE}=20V$; pulse width limited by maximum junction temperature (figure 20)
- $V_{CC}=80\%(V_{CES})$, $V_{GE}=20V$, $L=10\mu H$, $R_G=5.0\ \Omega$ (figure 13a)
- Pulse width $\leq 80\mu s$; duty factor $\leq 0.1\%$.
- Pulse width $5.0\mu s$, single shot.
- 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

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