

IRG4BC15UD-S/LPbF

International
IR Rectifier

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	—	0.63	—	V/°C	V _{GE} = 0V, I _C = 1.0mA
V _{CE(on)}	Collector-to-Emitter Saturation Voltage	—	2.02	2.4	V	I _C = 7.8A
		—	2.56	—		I _C = 14A
		—	2.21	—		I _C = 7.8A, 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	—	-10	—	mV/°C	V _{CE} = V _{GE} , I _C = 250μA
g _{fe}	Forward Transconductance ^④	4.1	6.2	—	S	V _{CE} = 100V, I _C = 7.8A
I _{CES}	Zero Gate Voltage Collector Current	—	—	250	μA	V _{GE} = 0V, V _{CE} = 600V
		—	—	1400		V _{GE} = 0V, V _{CE} = 600V, T _J = 150°C
V _{FM}	Diode Forward Voltage Drop	—	1.5	1.8	V	I _C = 4.0A
		—	1.4	1.7		I _C = 4.0A, 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)	—	23	35	nC	I _C = 7.8A
Q _{ge}	Gate - Emitter Charge (turn-on)	—	4.0	6.0		V _{CC} = 400V
Q _{gc}	Gate - Collector Charge (turn-on)	—	9.6	14		V _{GE} = 15V
t _{d(on)}	Turn-On Delay Time	—	17	—	ns	T _J = 25°C
t _r	Rise Time	—	20	—		I _C = 7.8A, V _{CC} = 480V
t _{d(off)}	Turn-Off Delay Time	—	160	240		V _{GE} = 15V, R _G = 75Ω
t _f	Fall Time	—	83	120		Energy losses include "tail" and diode reverse recovery.
E _{on}	Turn-On Switching Loss	—	0.24	—	mJ	T _J = 150°C, I _C = 7.8A, V _{CC} = 480V V _{GE} = 15V, R _G = 75Ω Energy losses include "tail" and diode reverse recovery.
E _{off}	Turn-Off Switching Loss	—	0.26	—		
E _{ts}	Total Switching Loss	—	0.50	0.63		
t _{d(on)}	Turn-On Delay Time	—	16	—	ns	T _J = 150°C, I _C = 7.8A, V _{CC} = 480V V _{GE} = 15V, R _G = 75Ω Energy losses include "tail" and diode reverse recovery.
t _r	Rise Time	—	21	—		
t _{d(off)}	Turn-Off Delay Time	—	180	—		
t _f	Fall Time	—	220	—		
E _{ts}	Total Switching Loss	—	0.76	—	mJ	
L _E	Internal Emitter Inductance	—	7.5	—	nH	Measured 5mm from package
C _{ies}	Input Capacitance	—	410	—	pF	V _{GE} = 0V
C _{oes}	Output Capacitance	—	37	—		V _{CC} = 30V
C _{res}	Reverse Transfer Capacitance	—	5.3	—		f = 1.0MHz
t _{rr}	Diode Reverse Recovery Time	—	28	42	ns	T _J = 25°C
		—	38	57		T _J = 125°C
I _{rr}	Diode Peak Reverse Recovery Current	—	2.9	5.2	A	T _J = 25°C
		—	3.7	6.7		T _J = 125°C
Q _{rr}	Diode Reverse Recovery Charge	—	40	60	nC	T _J = 25°C
		—	70	110		T _J = 125°C
di _{(rec)M} /dt	Diode Peak Rate of Fall of Recovery During t _b	—	280	—	A/μs	T _J = 25°C
		—	240	—		T _J = 125°C

I_F = 4.0A
V_R = 200V
di/dt 200A/μs

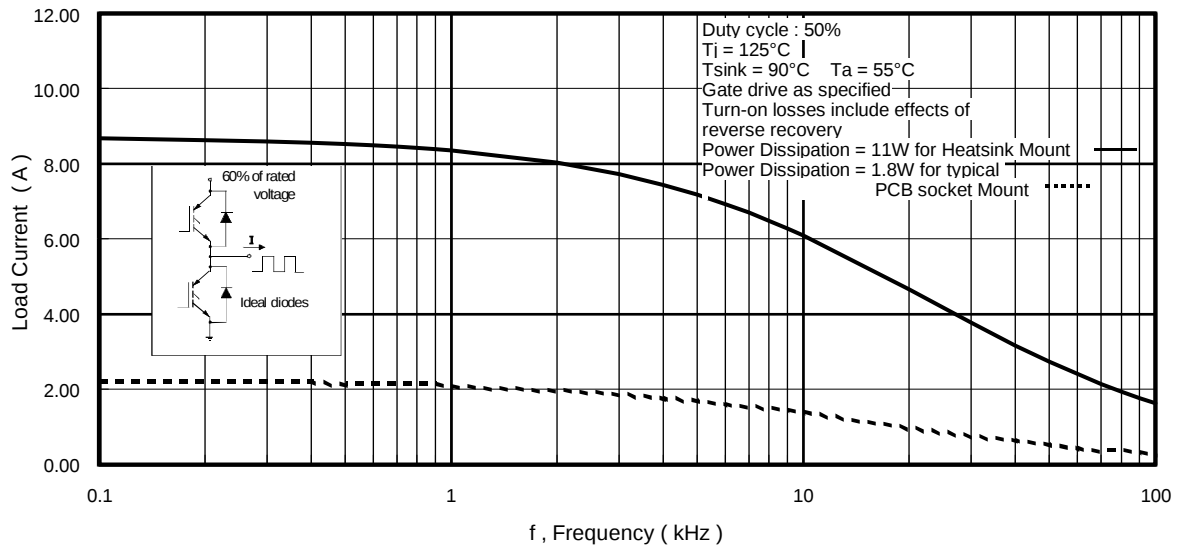


Fig. 1 - Typical Load Current vs. Frequency
 (Load Current = I_{RMS} of fundamental)

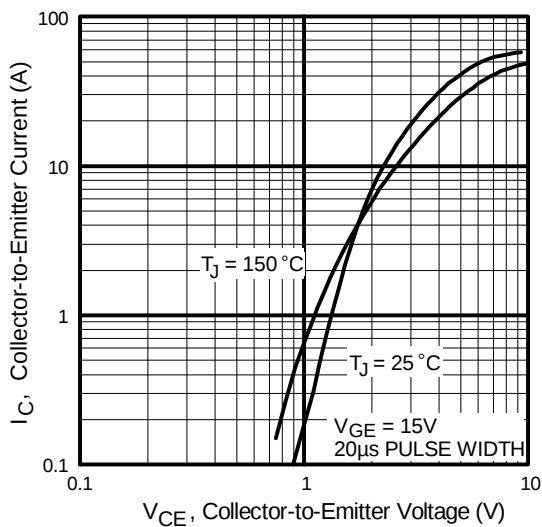


Fig. 2 - Typical Output Characteristics

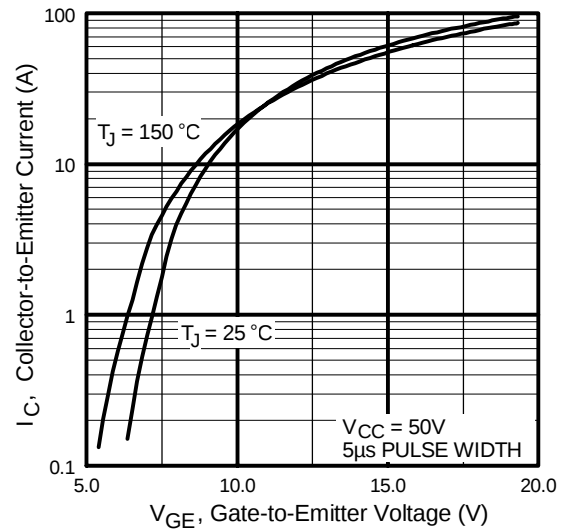


Fig. 3 - Typical Transfer Characteristics

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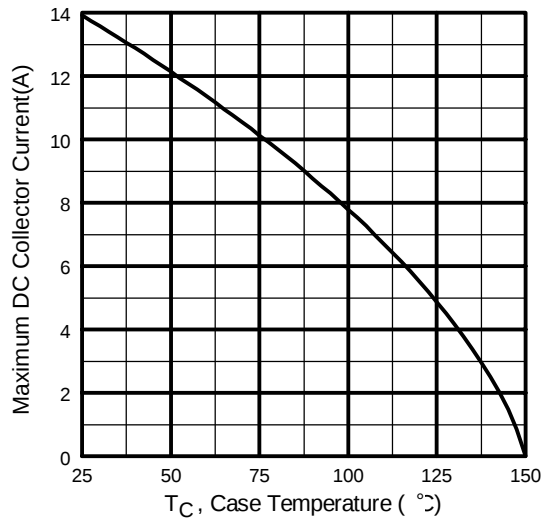


Fig. 4 - Maximum Collector Current vs. Case Temperature

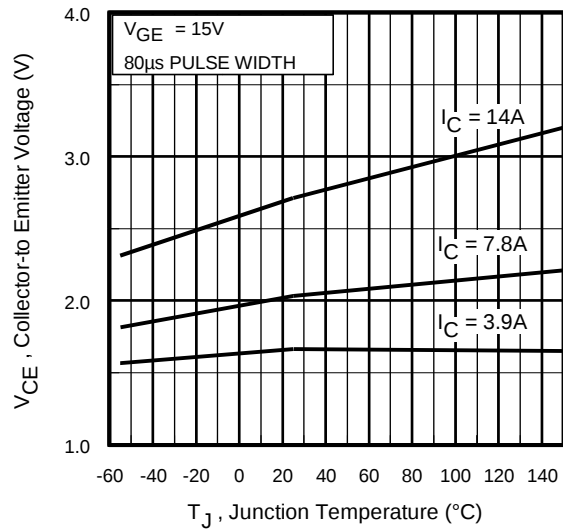


Fig. 5 - Typical Collector-to-Emitter Voltage vs. Junction Temperature

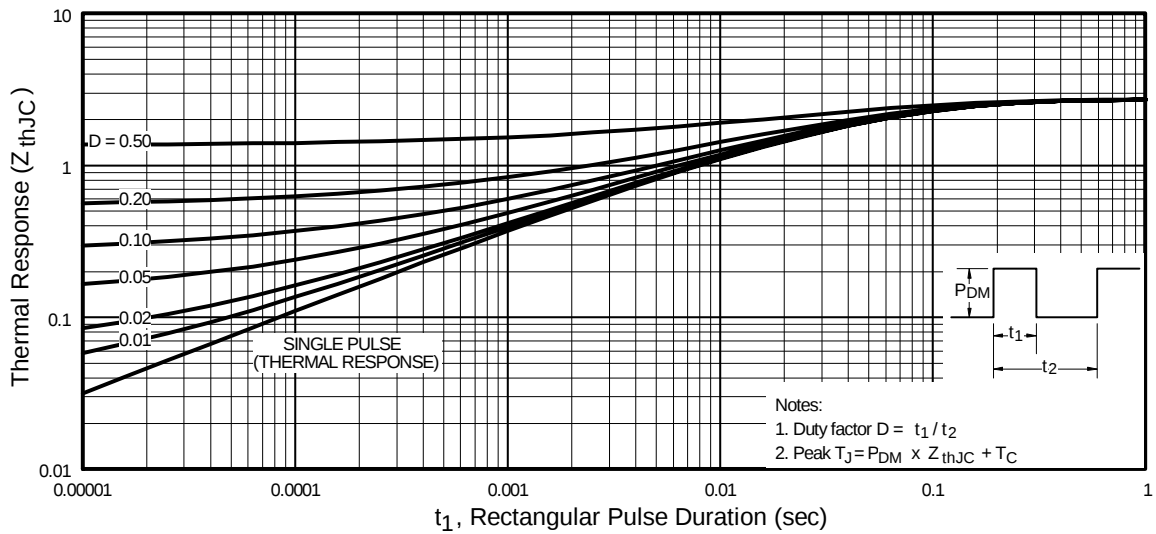


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

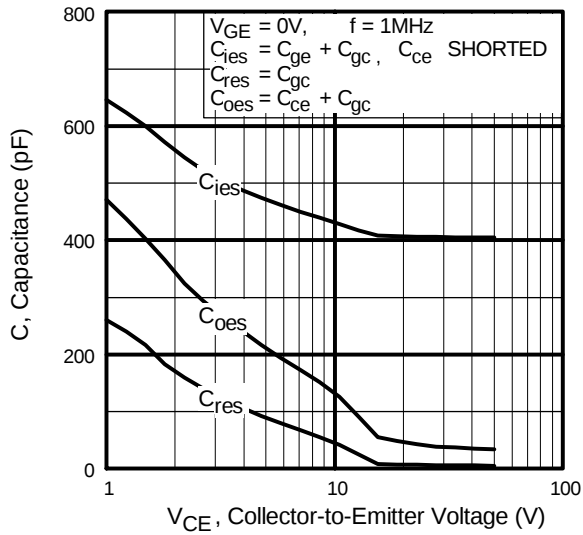


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

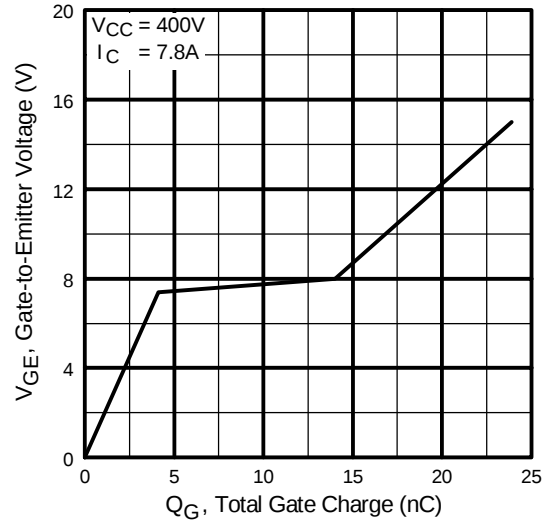


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

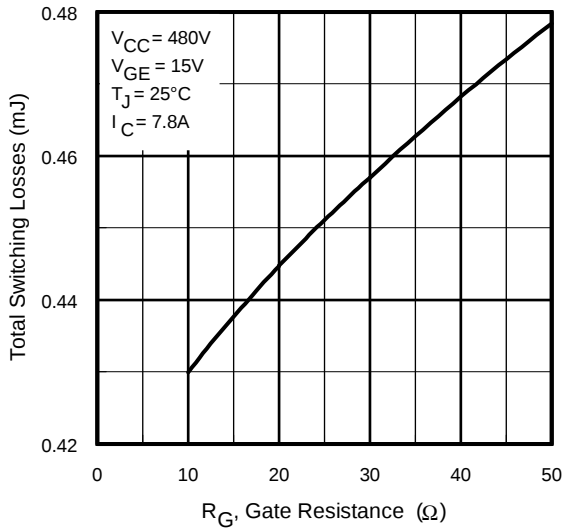


Fig. 9 - Typical Switching Losses vs. Gate Resistance

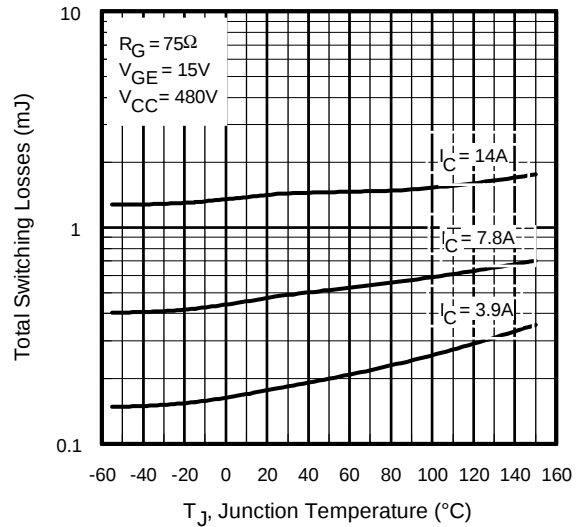


Fig. 10 - Typical Switching Losses vs. Junction Temperature

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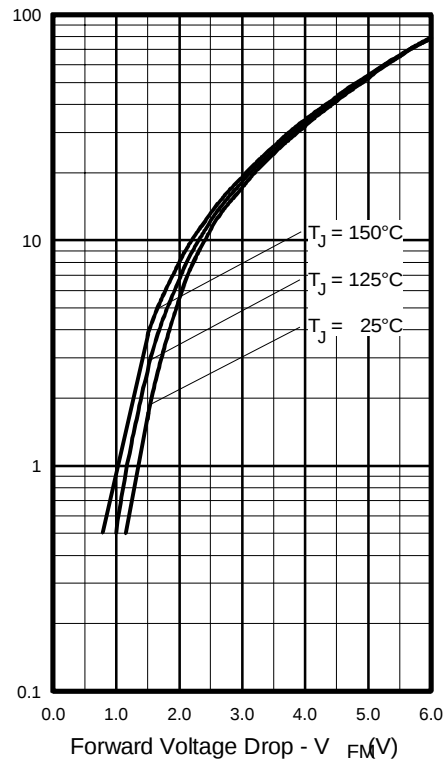
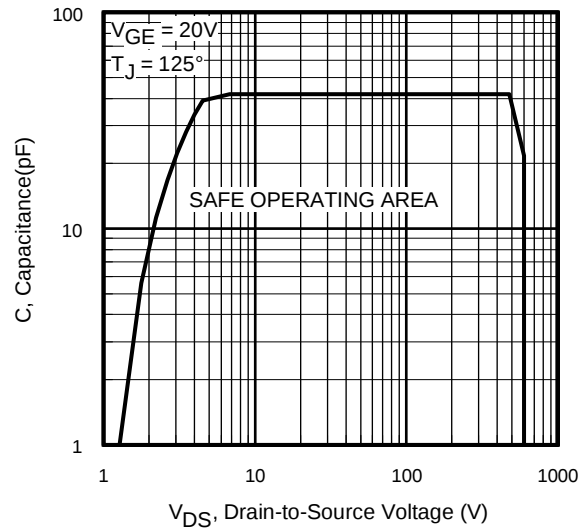
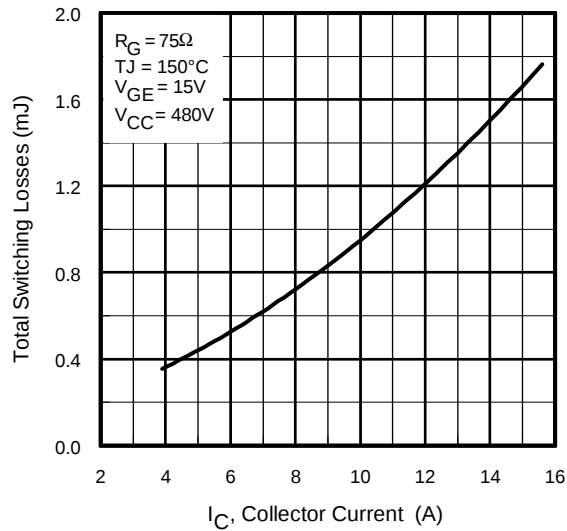


Fig. 13 - Maximum Forward Voltage Drop vs. Instantaneous Forward Current

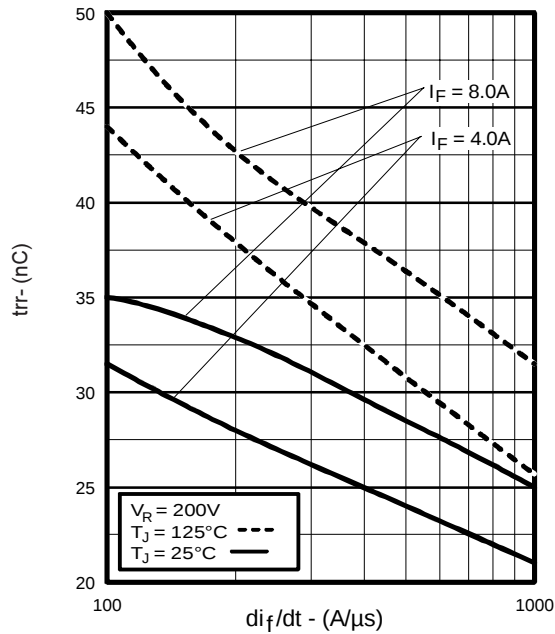


Fig. 14 - Typical Reverse Recovery vs. di_f/dt

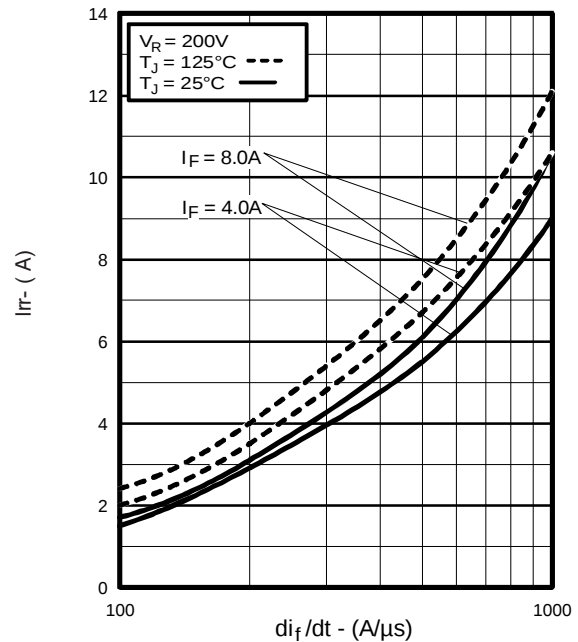


Fig. 15 - Typical Recovery Current vs. di_f/dt

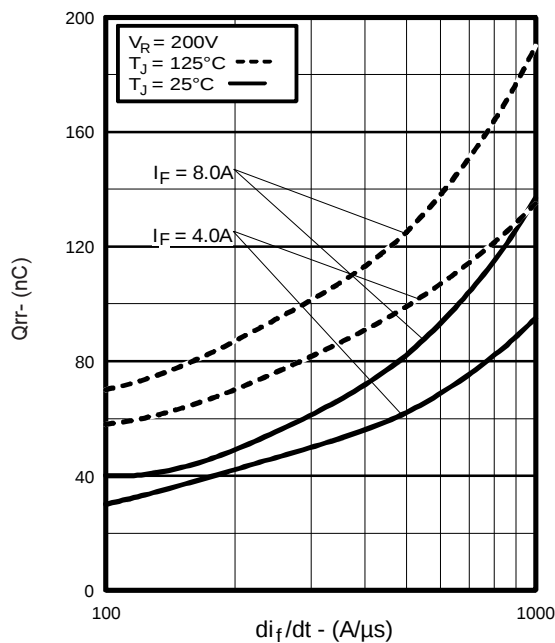


Fig. 16 - Typical Stored Charge vs. di_f/dt

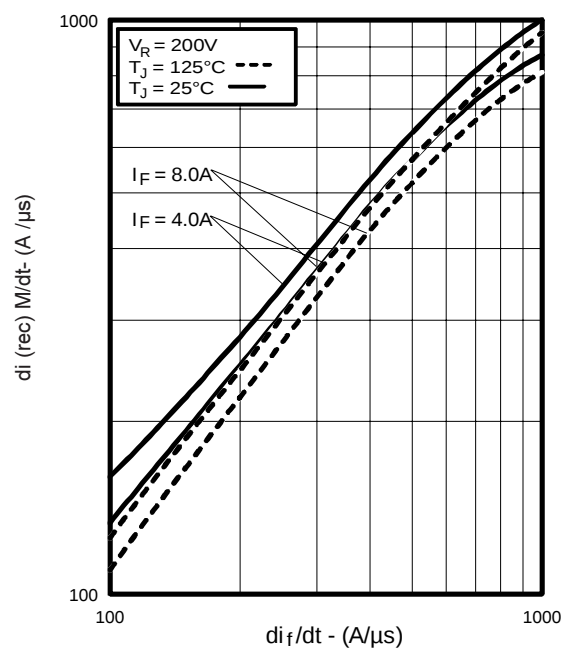


Fig. 17 - Typical $di_{(rec)M}/dt$ vs. di_f/dt

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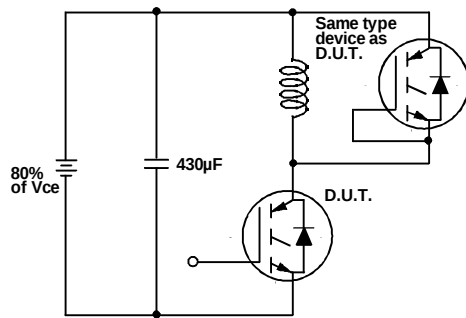


Fig. 18a - Test Circuit for Measurement of I_{LM} , E_{on} , $E_{off}(\text{diode})$, t_{rr} , Q_{rr} , I_{rr} , $t_{d(on)}$, t_r , $t_{d(off)}$, t_f

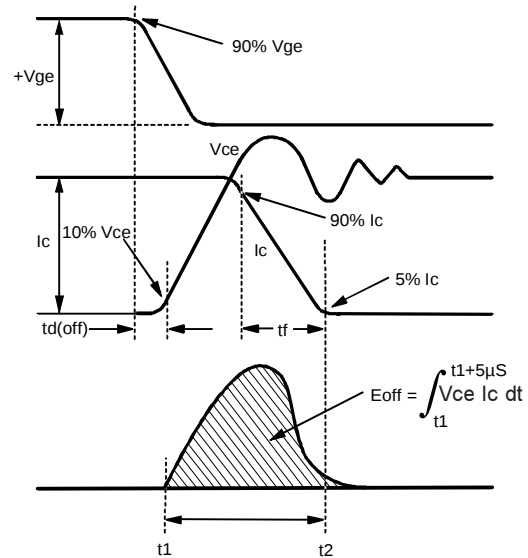


Fig. 18b - Test Waveforms for Circuit of Fig. 18a, Defining E_{off} , $t_{d(off)}$, t_f

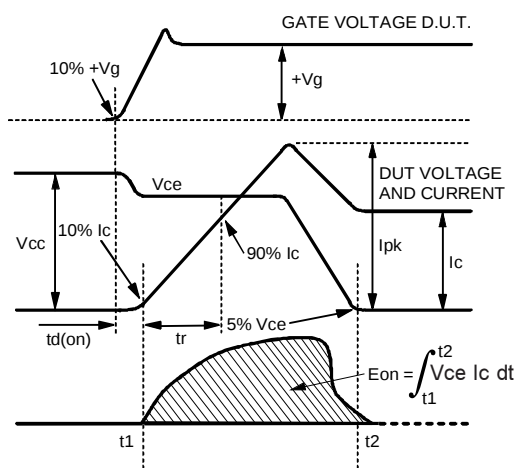


Fig. 18c - Test Waveforms for Circuit of Fig. 18a, Defining E_{on} , $t_{d(on)}$, t_r

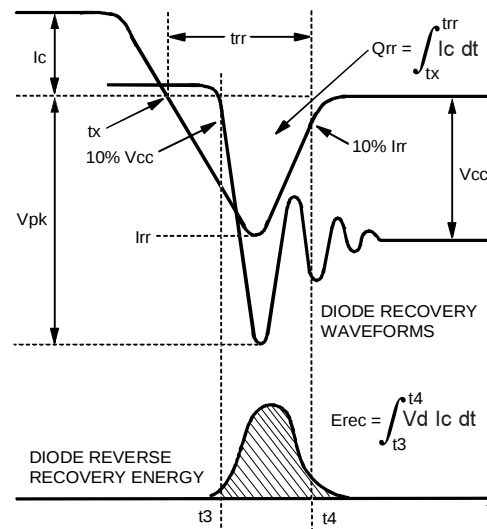


Fig. 18d - Test Waveforms for Circuit of Fig. 18a, Defining E_{rec} , t_{rr} , Q_{rr} , I_{rr}

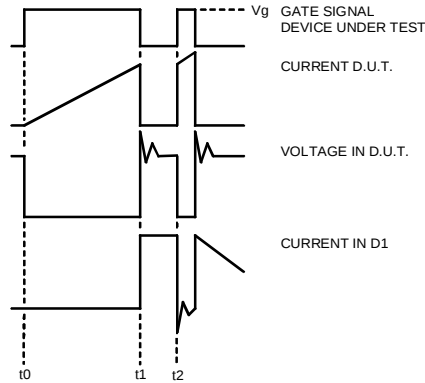


Figure 18e. Macro Waveforms for Figure 18a's Test Circuit

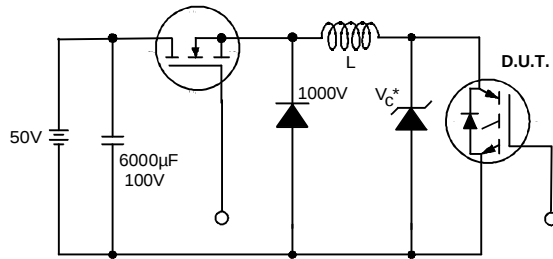


Figure 19. Clamped Inductive Load Test Circuit

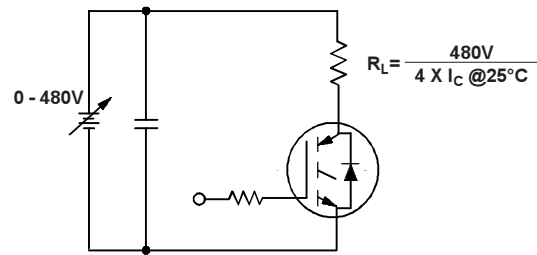


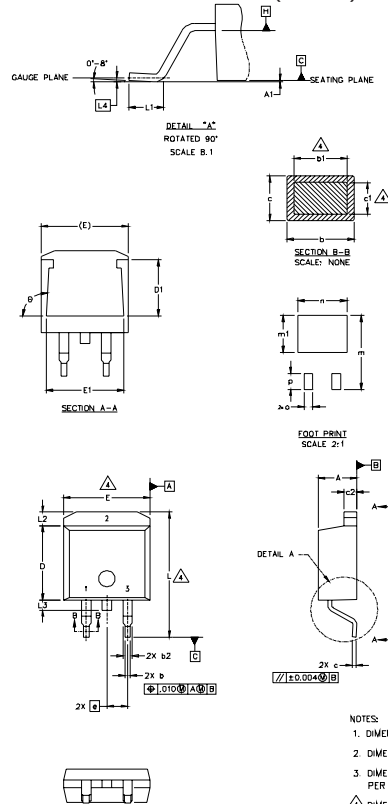
Figure 20. Pulsed Collector Current Test Circuit

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D²Pak Package Outline

Dimensions are shown in millimeters (inches)



SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	.160	.190	4
A1		0.127		.005	
b	0.51	0.99	.020	.039	
b1	0.51	0.89	.020	.035	
b2	1.14	1.40	.045	.055	4
c	0.43	0.63	.017	.025	
c1	0.38	0.74	.015	.029	
c2	1.14	1.40	.045	.055	
D	8.51	9.65	.335	.380	3
D1	5.33		.210		3
E	9.65	10.67	.380	.420	
E1	6.22		.245		
e	2.54	BSC	.100	BSC	
L	14.61	15.88	.575	.625	
L1	1.78	2.79	.070	.110	
L2		1.65		.065	
L3	1.27	1.78	.050	.070	
L4	0.25	BSC	.010	BSC	
m	17.78		.700		
m1	8.89		.350		
n	11.43		.450		
o	2.08		.082		
p	3.81		.150		
θ	90°	93°	90°	93°	

LEAD ASSIGNMENTS

HEXFET

1.- GATE
2.- DRAIN
3.- SOURCE

IGBTs, CoPACK

1.- GATE
2.- COLLECTOR
3.- EMITTER

DIODES

1.- ANODE *
2.- CATHODE
3.- ANODE

* PART DEPENDENT.

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994

2. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES]

3. DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.127 [0.005"] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY.

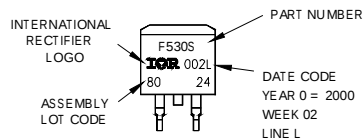
4. DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.

5. CONTROLLING DIMENSION: INCH.

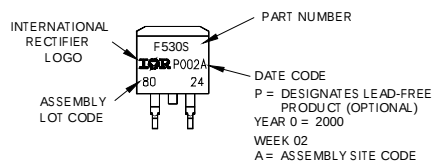
D²Pak Part Marking Information

EXAMPLE: THIS IS AN IRF530S WITH
LOT CODE 8024
ASSEMBLED ON WW 02, 2000
IN THE ASSEMBLY LINE "L"

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

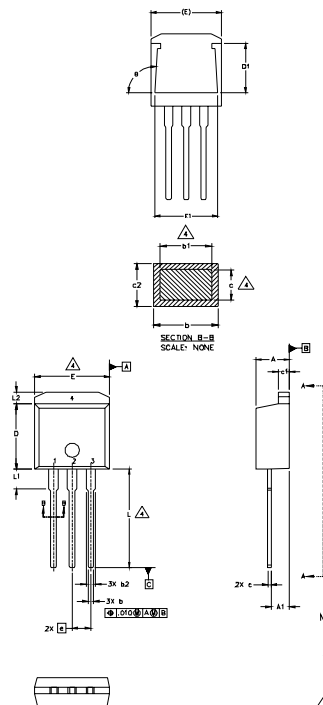


OR



TO-262 Package Outline

Dimensions are shown in millimeters (inches)



SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	.160	.190	4
A1	2.03	2.92	.080	.115	
b	0.51	0.99	.020	.039	
b1	0.51	0.89	.020	.035	
b2	1.14	1.40	.045	.055	
c	0.38	0.63	.015	.025	4
c1	1.14	1.40	.045	.055	
c2	0.43	.063	.017	.029	3
D	8.51	9.65	.335	.380	
D1	5.33		.210		
E	9.65	10.67	.380	.420	
E1	6.22		.245		
e	2.54 BSC		.100 BSC		
L	13.46	14.09	.530	.555	
L1	3.56	3.71	.140	.146	
L2		1.65		.065	

LEAD ASSIGNMENTS

HEXFET

- 1.- GATE
- 2.- DRAIN
- 3.- SOURCE
- 4.- DRAIN

IGBT

- 1 - GATE
- 2 - COLLECTOR
- 3 - EMITTER

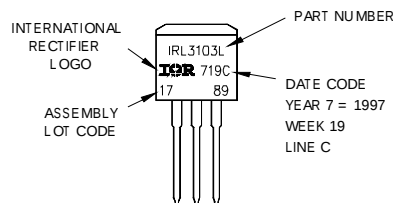
NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994
2. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES]
3. DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.127 [0.005"] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY.
4. DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.
5. CONTROLLING DIMENSION: INCH.

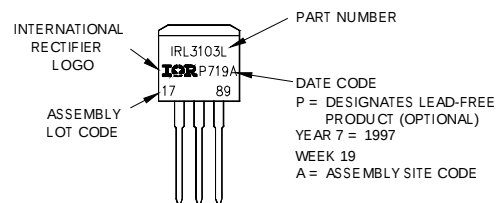
TO-262 Part Marking Information

EXAMPLE: THIS IS AN IRL3103L
LOT CODE 1789
ASSEMBLED ON WW 19, 1997
IN THE ASSEMBLY LINE "C"

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



OR

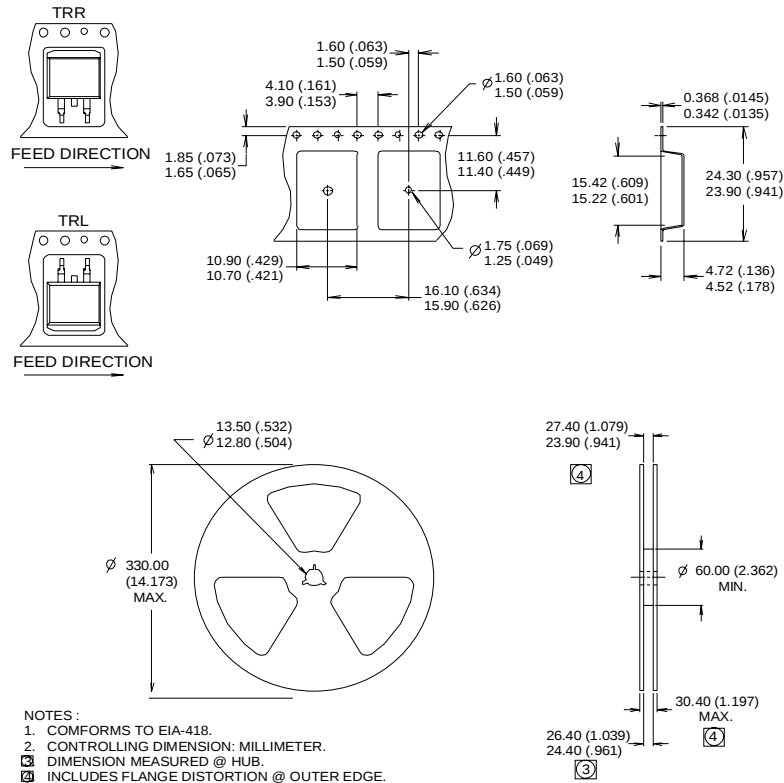


IRG4BC15UD-S/LPbF

D²Pak Tape & Reel Information

Dimensions are shown in millimeters (inches)

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IR Rectifier



Notes:

- ① Repetitive rating: $V_{GE}=20V$; pulse width limited by maximum junction temperature.
- ② $V_{CC}=80\%(V_{CES})$, $V_{GE}=20V$, $L=10\mu H$, $R_G = 75\Omega$
- ③ Pulse width $\leq 80\mu s$; duty factor $\leq 0.1\%$.
- ④ Pulse width $5.0\mu s$, single shot.
- ⑤ This only applies to TO-262 package.

⑥ This applies to D²Pak, when mounted on 1" square PCB (FR-4 or G-10 Material). For recommended footprint and soldering techniques refer to application note #AN-994.

Data and specifications subject to change without notice.
This product has been designed and qualified for the Industrial 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 for sales contact information.08/04

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