PD -95691A

International
IOR Rectifier

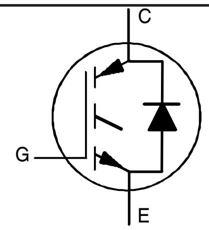
IRG4BC20SD-SPbF

INSULATED GATE BIPOLAR TRANSISTOR WITH ULTRAFAST SOFT RECOVERY DIODE

Standard Speed IGBT

Features

- Extremely low voltage drop 1.4Vtyp. @ 10A
- S-Series: Minimizes power dissipation at up to 3 KHz PWM frequency in inverter drives, up to 4 KHz in brushless DC drives.
- Very Tight Vce(on) distribution
- IGBT co-packaged with HEXFRED^{TM} ultrafast, ultra-soft-recovery anti-parallel diodes for use in bridge configurations
- Industry standard D^2Pak package
- Lead-Free



n-channel

V_{CES} = 600V

$V_{CE(on)\ typ.}$ = 1.4V

@V_{GE} = 15V, I_C = 10A

Benefits

- Generation 4 IGBT's offer highest efficiencies available
- IGBT's optimized for specific application conditions
- HEXFRED diodes optimized for performance with IGBT's . Minimized recovery characteristics require less/no snubbing
- Lower losses than MOSFET's conduction and Diode losses


D^2Pak

Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Voltage	600	V
I_C @ T_C = 25°C	Continuous Collector Current	19	A
I_C @ T_C = 100°C	Continuous Collector Current	10	
I_{CM}	Pulsed Collector Current ①	38	
I_{LM}	Clamped Inductive Load Current ②	38	
I_F @ T_C = 100°C	Diode Continuous Forward Current	7.0	
I_{FM}	Diode Maximum Forward Current	38	
V_{GE}	Gate-to-Emitter Voltage	± 20	V
P_D @ T_C = 25°C	Maximum Power Dissipation	60	W
P_D @ T_C = 100°C	Maximum Power Dissipation	24	
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to +150	°C

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case - IGBT	——	2.1	°C/W
$R_{\theta JC}$	Junction-to-Case - Diode	——	3.5	
$R_{\theta JA}$	Junction-to-Ambient (PCB Mounted,steady-state)*	——	80	
Wt	Weight	1.44	——	g (oz)

* When mounted on 1" square PCB (FR-4 or G-10 Material). For recommended footprint and soldering techniques refer to application note #AN-994.

01/21/10

Electrical Characteristics @ T_J = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions	
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage ƒ	600	—	—	V	V_{GE} = 0V, I_C = 250µA	
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	0.75	—	V/°C	V_{GE} = 0V, I_C = 1.0mA	
$V_{CE(on)}$	Collector-to-Emitter Saturation Voltage	—	1.40	1.6	V	I_C = 10A	V_{GE} = 15V
		—	1.85	—		I_C = 19A	See Fig. 2, 5
		—	1.44	—		I_C = 10A, T_J = 150°C	
$V_{GE(th)}$	Gate Threshold Voltage	3.0	—	6.0		$V_{CE} = V_{GE}$, I_C = 250µA	
$\Delta V_{GE(th)}/\Delta T_J$	Temperature Coeff. of Threshold Voltage	—	-11	—	mV/°C	$V_{CE} = V_{GE}$, I_C = 250µA	
g_{fe}	Forward Transconductance ④	2.0	5.8	—	S	V_{CE} = 100V, I_C = 10A	
I_{CES}	Zero Gate Voltage Collector Current	—	—	250	µA	V_{GE} = 0V, V_{CE} = 600V	
		—	—	1700		V_{GE} = 0V, V_{CE} = 600V, T_J = 150°C	
V_{FM}	Diode Forward Voltage Drop	—	1.4	1.7	V	I_C = 8.0A	See Fig. 13
		—	1.3	1.6		I_C = 8.0A, 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)	—	27	40	nC	I_C = 10A		
Qge	Gate - Emitter Charge (turn-on)	—	4.3	6.5		V_{CC} = 400V	See Fig. 8	
Q_{gc}	Gate - Collector Charge (turn-on)	—	10	15		V_{GE} = 15V		
$t_{d(on)}$	Turn-On Delay Time	—	62	—	ns	T_J = 25°C		
t_r	Rise Time	—	32	—		I_C = 10A, V_{CC} = 480V		
$t_{d(off)}$	Turn-Off Delay Time	—	690	1040		V_{GE} = 15V, R_G = 50Ω		
t_f	Fall Time	—	480	730		Energy losses include "tail" and		
E_{on}	Turn-On Switching Loss	—	0.32	—	mJ	diode reverse recovery.		
E_{off}	Turn-Off Switching Loss	—	2.58	—		See Fig. 9, 10, 11,18		
E_{ts}	Total Switching Loss	—	2.90	4.5				
$t_{d(on)}$	Turn-On Delay Time	—	64	—	ns	T_J = 150°C,	See Fig. 10,11, 18	
t_r	Rise Time	—	35	—		I_C = 10A, V_{CC} = 480V		
$t_{d(off)}$	Turn-Off Delay Time	—	980	—		V_{GE} = 15V, R_G = 50Ω		
t_f	Fall Time	—	800	—		Energy losses include "tail" and		
E_{ts}	Total Switching Loss	—	4.33	—	mJ	diode reverse recovery.		
L_E	Internal Emitter Inductance	—	7.5	—	nH	Measured 5mm from package		
C_{ies}	Input Capacitance	—	550	—	pF	V_{GE} = 0V		
C_{oes}	Output Capacitance	—	39	—		V_{CC} = 30V	See Fig. 7	
C_{res}	Reverse Transfer Capacitance	—	7.1	—		ƒ = 1.0MHz		
t_{rr}	Diode Reverse Recovery Time	—	37	55	ns	T_J = 25°C	See Fig.	
		—	55	90		T_J = 125°C	14	I_F = 8.0A
I_{rr}	Diode Peak Reverse Recovery Current	—	3.5	5.0	A	T_J = 25°C	See Fig.	
		—	4.5	8.0		T_J = 125°C	15	V_R = 200V
Q_{rr}	Diode Reverse Recovery Charge	—	65	138	nC	T_J = 25°C	See Fig.	
		—	124	360		T_J = 125°C	16	di/dt = 200Aµs
$di_{(rec)M}/dt$	Diode Peak Rate of Fall of Recovery	—	240	—	A/µs	T_J = 25°C	See Fig.	
	During t_b	—	210	—		T_J = 125°C	17	

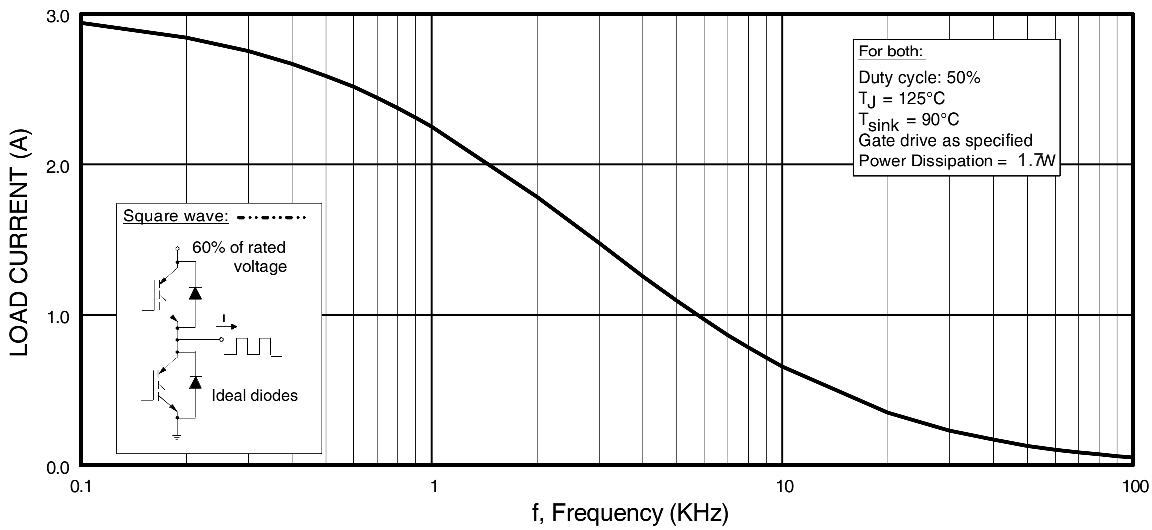


Fig. 1 - Typical Load Current vs. Frequency
(Load Current = I_{RMS} of fundamental)

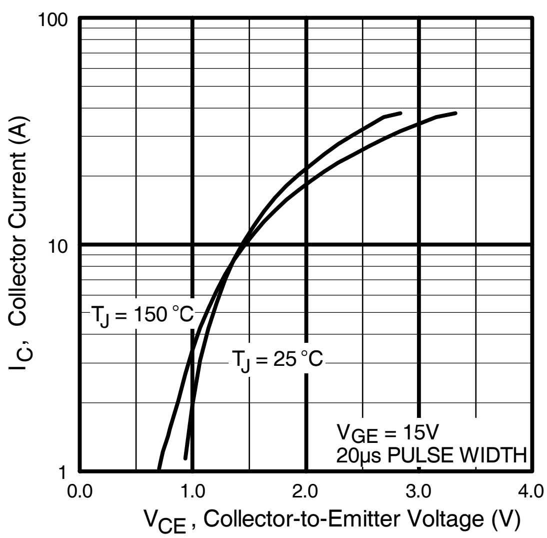


Fig. 2 - Typical Output Characteristics

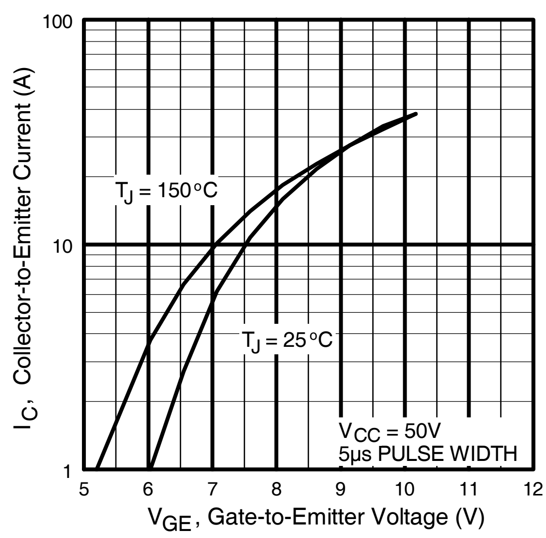


Fig. 3 - Typical Transfer Characteristics

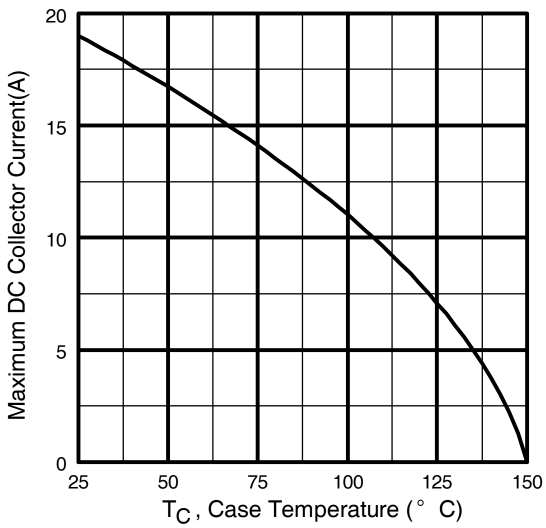


Fig. 4 - Maximum Collector Current vs. Case Temperature

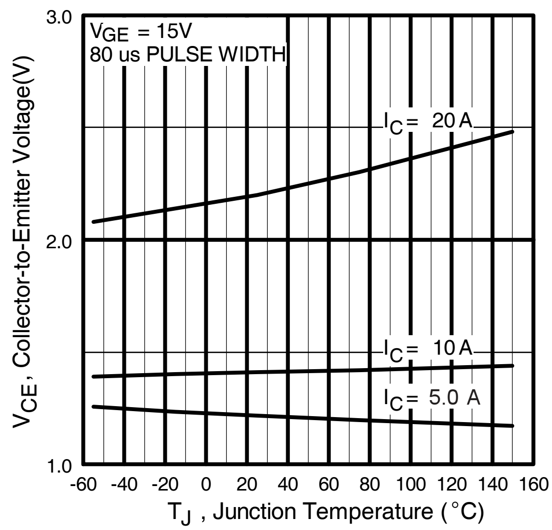


Fig. 5 - Typical Collector-to-Emitter Voltage vs. Junction Temperature

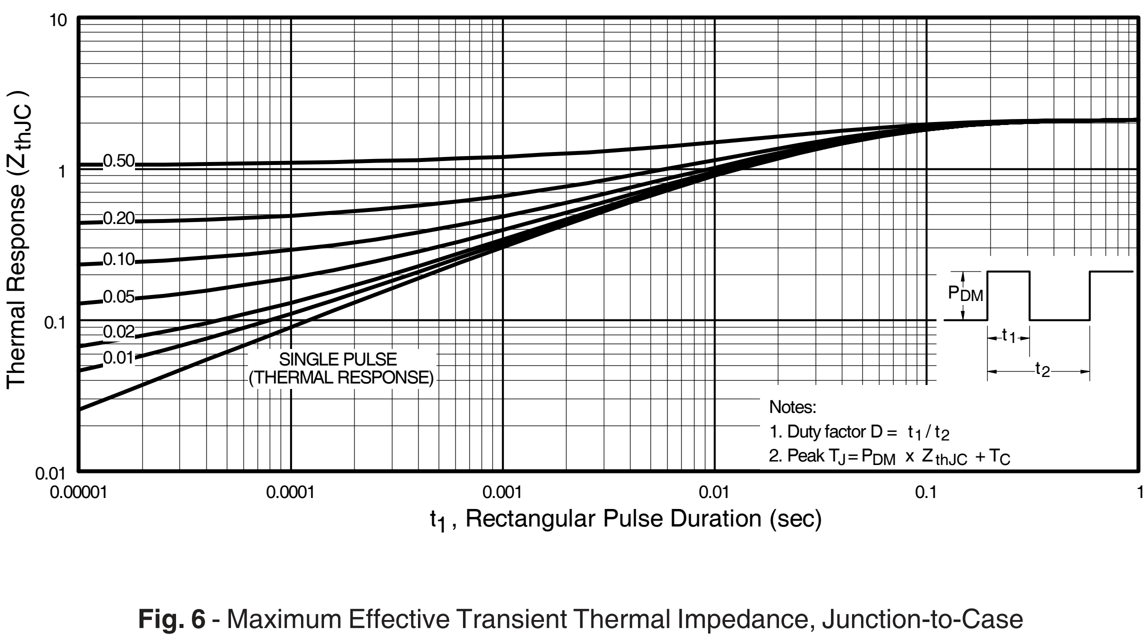


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

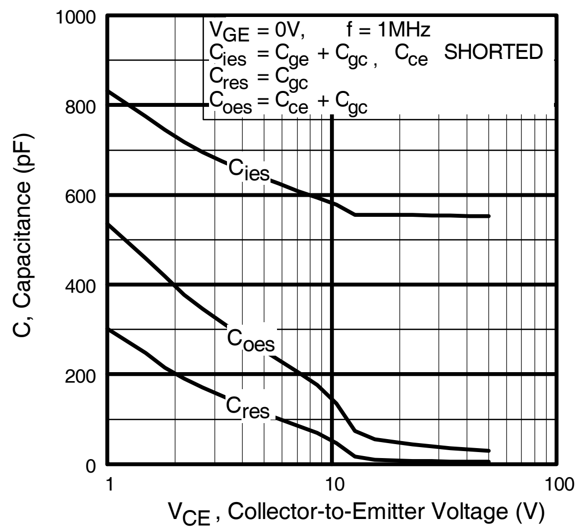


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

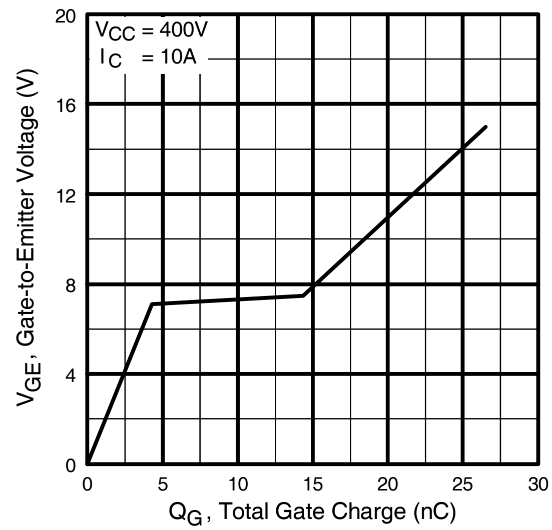


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

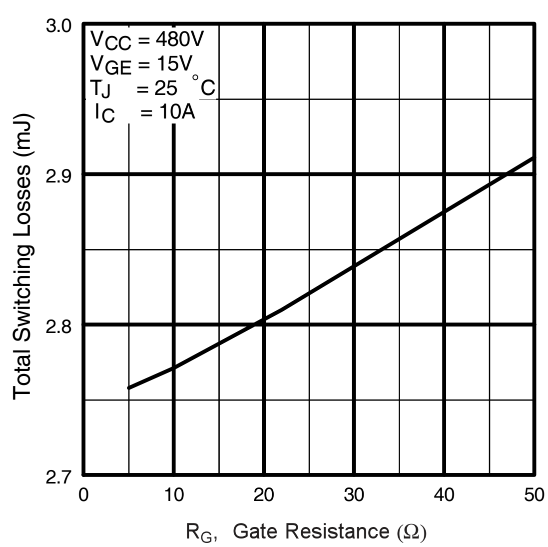


Fig. 9 - Typical Switching Losses vs. Gate Resistance

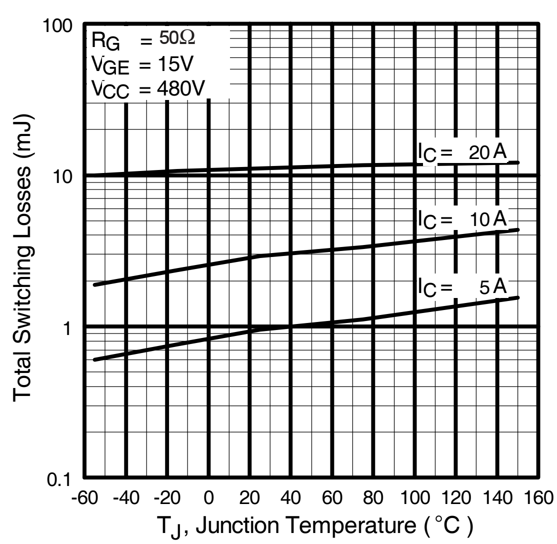


Fig. 10 - Typical Switching Losses vs. Junction Temperature

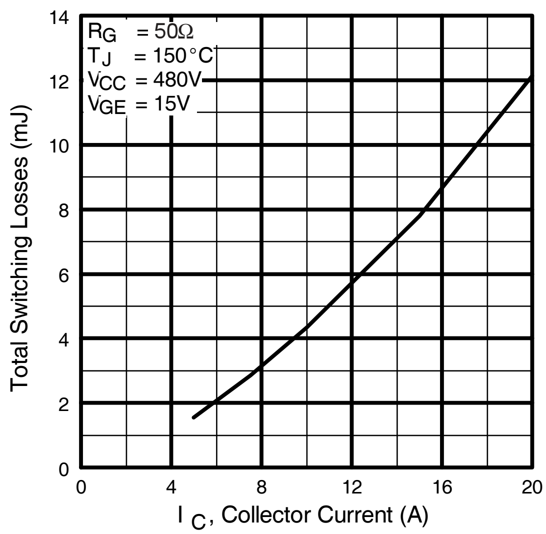


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

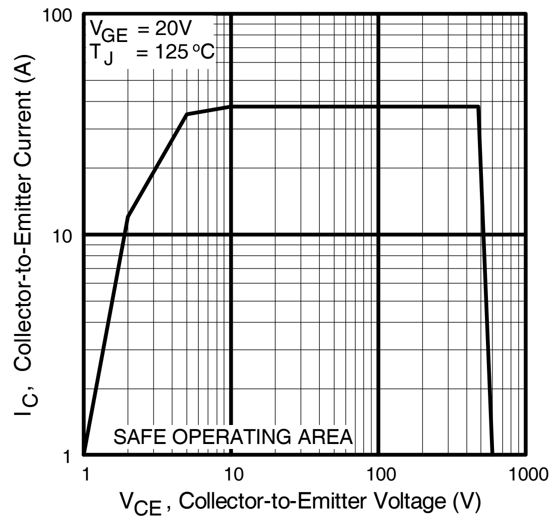


Fig. 12 - Turn-Off SOA

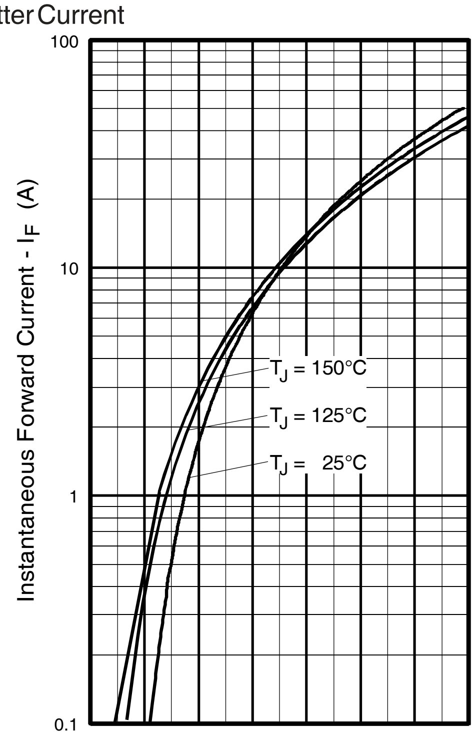


Fig. 13 - Maximum Forward Voltage Drop vs. Instantaneous Forward Current

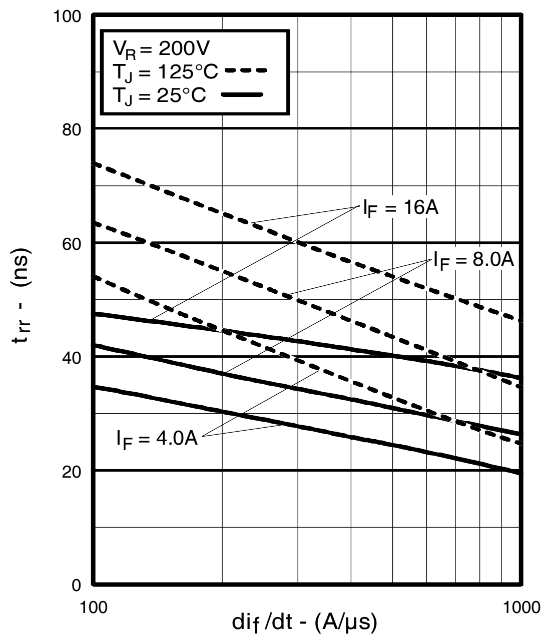


Fig. 14 - Typical Reverse Recovery vs. di_f/dt

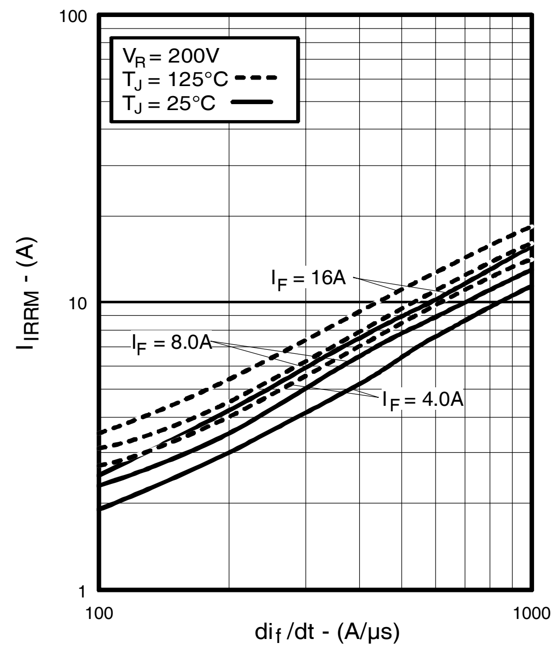


Fig. 15 - Typical Recovery Current vs. di_f/dt

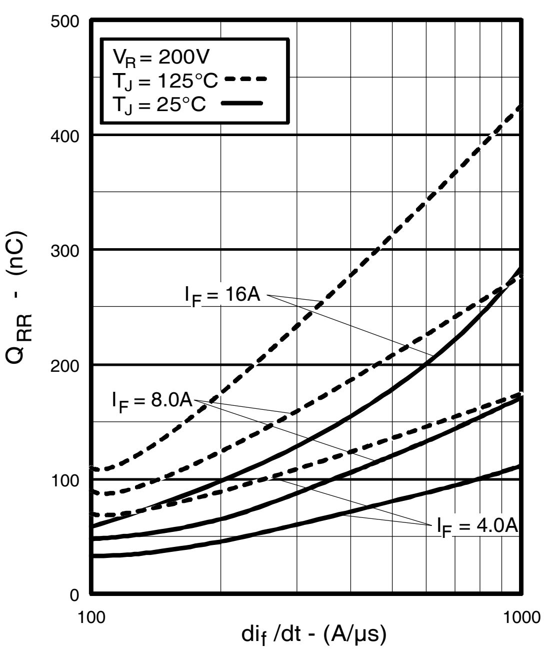


Fig. 16 - Typical Stored Charge vs. di_f/dt

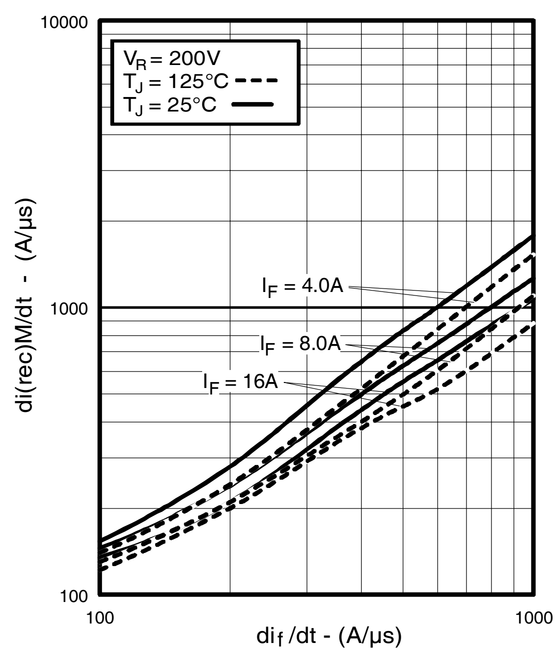


Fig. 17 - Typical $di_{(rec)M}/dt$ vs. di_f/dt

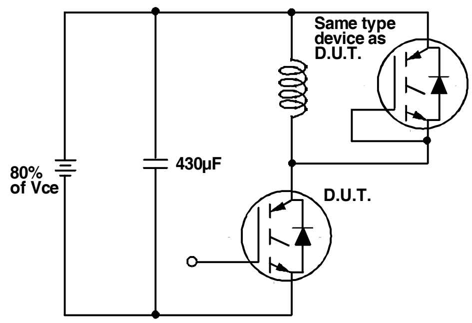


Fig. 18a - Test Circuit for Measurement of I_{LM}, E_{on}, $E_{off(diode)}$, t_{rr}, Q_{rr}, I_{rr}, $t_{d(on)}$, t_r, $t_{d(off)}$, t_f

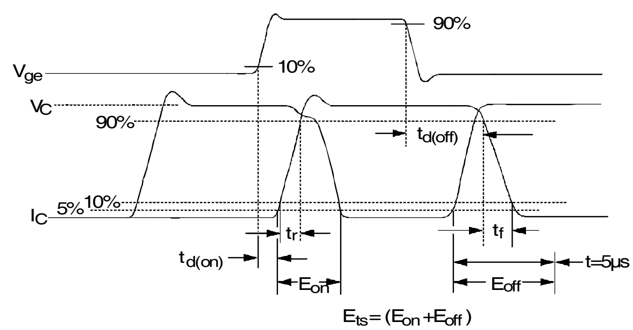


Fig. 18b - Test Waveforms for Circuit of Fig. 18a, Defining E_{off}, $t_{d(off)}$, t_f

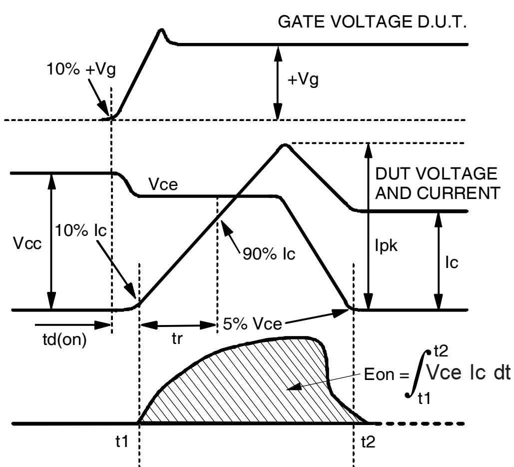


Fig. 18c - Test Waveforms for Circuit of Fig. 18a, Defining E_{on}, $t_{d(on)}$, t_r

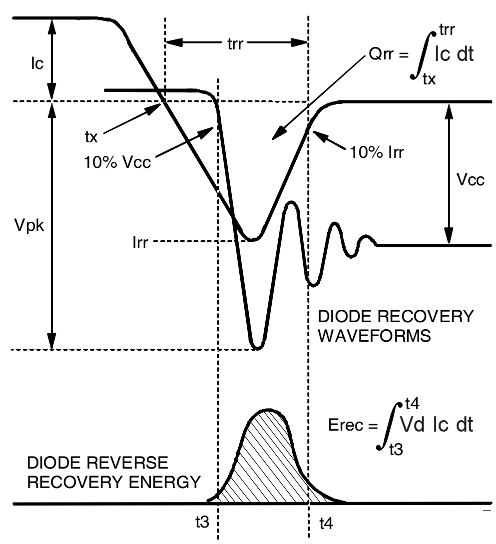


Fig. 18d - Test Waveforms for Circuit of Fig. 18a, Defining E_{rec}, t_{rr}, Q_{rr}, I_{rr}

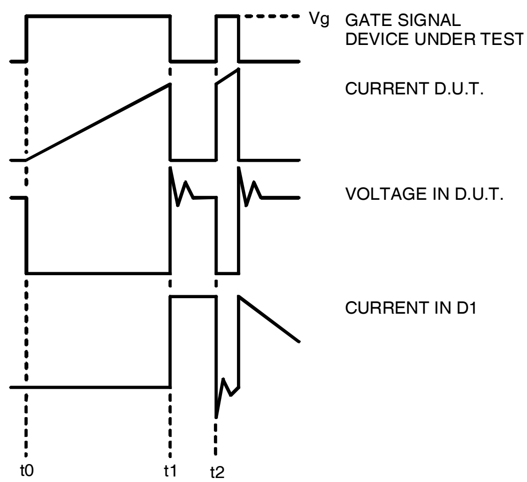


Figure 18e. Macro Waveforms for Figure 18a's Test Circuit

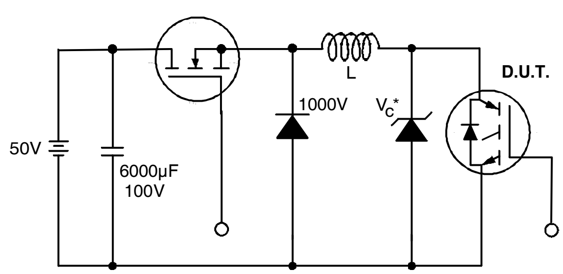
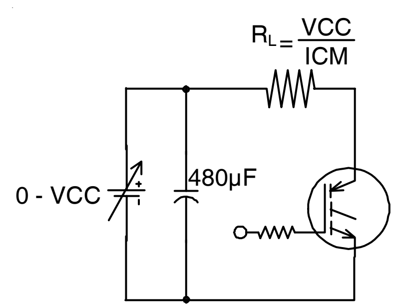


Figure 19. Clamped Inductive Load Test Circuit

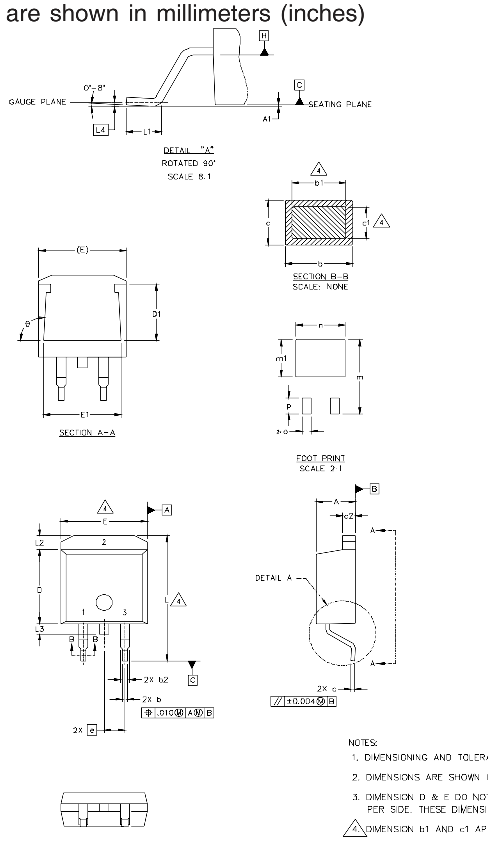


Pulsed Collector Current
Test Circuit

Figure 20. Pulsed Collector Current
Test Circuit

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	
A1		0.127		.005	
b	0.51	0.99	.020	.039	
b1	0.51	0.89	.020	.035	4
b2	1.14	1.40	.045	.055	
c	0.43	0.63	.017	.025	
c1	0.38	0.74	.015	.029	4
c2	1.14	1.40	.045	.055	
D	8.51	9.65	.335	.380	3
D1	5.33		.210		
E	9.65	10.67	.380	.420	3
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	IGBTs, CoPACK	DIODES
1.- GATE	1.- GATE	1.- ANODE *
2.- DRAIN	2.- COLLECTOR	2.- CATHODE
3.- SOURCE	3.- EMITTER	3.- ANODE

* PART DEPENDENT.

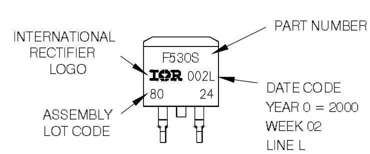
NOTES:

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 [.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.

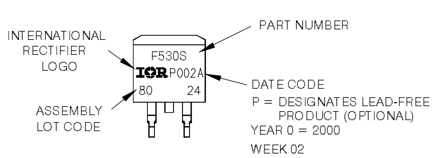
D²Pak Part Marking Information

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



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

Notes:

① Repetitive rating: V_{GE}=20V; pulse width limited by maximum junction temperature (figure 20)

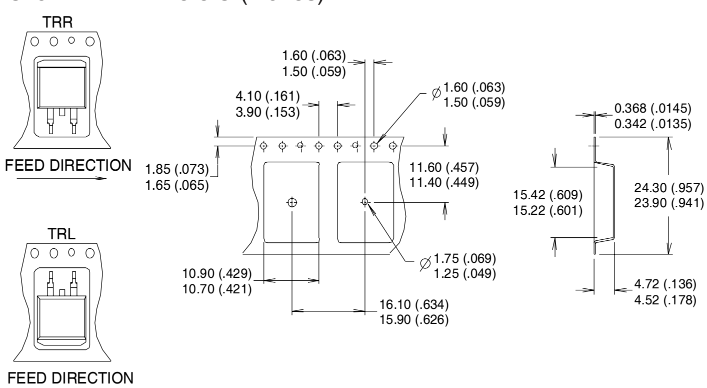
② V_{CC}=80%(V_{CES}), V_{GE}=20V, L=10µH, R_G = 50Ω (figure 19)

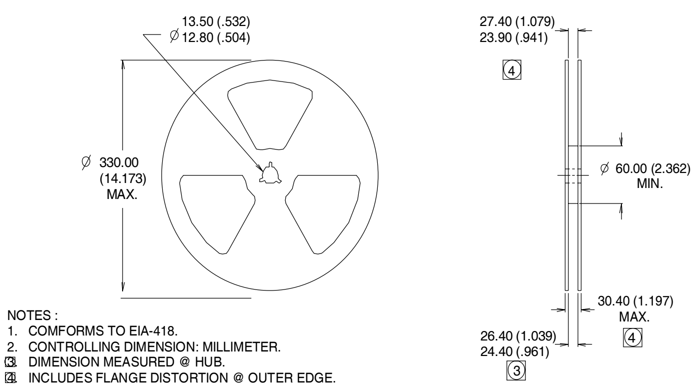
③ Pulse width ≤ 80µs; duty factor ≤ 0.1%.

④ Pulse width 5.0µs, single shot.

D^2Pak Tape & Reel Information

Dimensions are shown in millimeters (inches)





Data and specifications subject to change without notice.

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