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[International Rectifier \(Infineon Technologies Americas Corp.\)
IRG4BC20KD-SPBF](#)

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PD -95677

IRG4BC20KD-SPbF

INSULATED GATE BIPOLAR TRANSISTOR WITH ULTRAFast SOFT RECOVERY DIODE

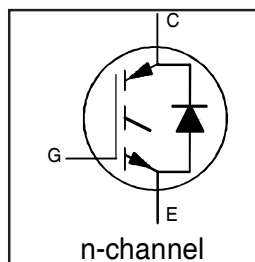
Short Circuit Rated UltraFast IGBT

Features

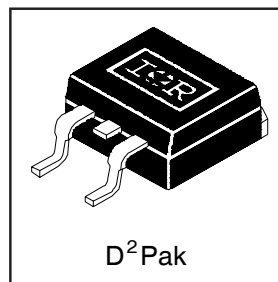
- Short Circuit Rated UltraFast: Optimized for high operating frequencies >5.0 kHz , and Short Circuit Rated to 10μs @ 125°C, V_{GE} = 15V
- Generation 4 IGBT design provides tighter parameter distribution and higher efficiency than previous generation
- IGBT co-packaged with HEXFRED™ ultrafast, ultra-soft-recovery anti-parallel diodes for use in bridge configurations
- Industry standard D²Pak package
- Lead-Free

Benefits

- Latest generation 4 IGBT's offer highest power density motor controls possible.
- HEXFRED™ diodes optimized for performance with IGBTs. Minimized recovery characteristics reduce noise, EMI and switching losses.
- This part replaces the IRGBC20KD2-S and IRGBC20MD2-S products.
- For hints see design tip 97003.



V _{CES} = 600V
V _{CE(on)} typ. = 2.27V
@V _{GE} = 15V, I _C = 9.0A



Absolute Maximum Ratings

	Parameter	Max.	Units
V _{CES}	Collector-to-Emitter Voltage	600	V
I _C @ T _C = 25°C	Continuous Collector Current	16	A
I _C @ T _C = 100°C	Continuous Collector Current	9.0	
I _{CM}	Pulsed Collector Current ①	32	
I _{LM}	Clamped Inductive Load Current ②	32	
I _F @ T _C = 100°C	Diode Continuous Forward Current	7.0	
I _{FM}	Diode Maximum Forward Current	32	
t _{sc}	Short Circuit Withstand Time	10	μs
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	Operating Junction and Storage Temperature Range	-55 to +150	°C
T _{STG}			
	Mounting Torque, 6-32 or M3 Screw.	10 lbf•in (1.1 N•m)	

Thermal Resistance

	Parameter	Typ.	Max.	Units
R _{θJC}	Junction-to-Case - IGBT	---	2.1	°C/W
R _{θJC}	Junction-to-Case - Diode	---	2.5	
R _{θCS}	Case-to-Sink, Flat, Greased Surface	0.5	---	
R _{θJA}	Junction-to-Ambient (PCB Mounted,steady-state)⑤	---	40	
Wt	Weight	1.44	---	g

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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	—	0.49	—	V/°C	V _{GE} = 0V, I _C = 1.0mA
V _{CE(on)}	Collector-to-Emitter Saturation Voltage	—	2.27	2.8	V	I _C = 9.0A V _{GE} = 15V
		—	3.01	—		I _C = 16A See Fig. 2, 5
		—	2.43	—		I _C = 9.0A, 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	2.9	4.3	—	S	V _{CE} = 100V, I _C = 9.0A
I _{CES}	Zero Gate Voltage Collector Current	—	—	250	μA	V _{GE} = 0V, V _{CE} = 600V
		—	—	1000		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)	—	34	51	nC	I _C = 9.0A
Q _{ge}	Gate - Emitter Charge (turn-on)	—	4.9	7.4		V _{CC} = 400V See Fig.8
Q _{gc}	Gate - Collector Charge (turn-on)	—	14	21		V _{GE} = 15V
t _{d(on)}	Turn-On Delay Time	—	54	—	ns	T _J = 25°C
t _r	Rise Time	—	34	—		I _C = 9.0A, V _{CC} = 480V
t _{d(off)}	Turn-Off Delay Time	—	180	270		V _{GE} = 15V, R _G = 50Ω
t _f	Fall Time	—	72	110		
E _{on}	Turn-On Switching Loss	—	0.34	—	mJ	Energy losses include "tail" and diode reverse recovery
E _{off}	Turn-Off Switching Loss	—	0.30	—		See Fig. 9,10,14
E _{ts}	Total Switching Loss	—	0.64	0.96		
t _{sc}	Short Circuit Withstand Time	10	—	—	μs	V _{CC} = 360V, T _J = 125°C V _{GE} = 15V, R _G = 50Ω, V _{CPK} < 500V
t _{d(on)}	Turn-On Delay Time	—	51	—	ns	T _J = 150°C, See Fig. 11,14
t _r	Rise Time	—	37	—		I _C = 9.0A, V _{CC} = 480V
t _{d(off)}	Turn-Off Delay Time	—	220	—		V _{GE} = 15V, R _G = 50Ω
t _f	Fall Time	—	160	—		Energy losses include "tail" and diode reverse recovery
E _{ts}	Total Switching Loss	—	0.85	—	mJ	
L _E	Internal Emitter Inductance	—	7.5	—	nH	Measured 5mm from package
C _{ies}	Input Capacitance	—	450	—	pF	V _{GE} = 0V
C _{oes}	Output Capacitance	—	61	—		V _{CC} = 30V See Fig. 7
C _{res}	Reverse Transfer Capacitance	—	14	—		f = 1.0MHz
t _{rr}	Diode Reverse Recovery Time	—	37	55	ns	T _J = 25°C See Fig. 14
		—	55	90		T _J = 125°C
I _{rr}	Diode Peak Reverse Recovery Current	—	3.5	5.0	A	T _J = 25°C See Fig. 15
		—	4.5	8.0		T _J = 125°C
Q _{rr}	Diode Reverse Recovery Charge	—	65	138	nC	T _J = 25°C See Fig. 16
		—	124	360		T _J = 125°C
di _(rec) M/dt	Diode Peak Rate of Fall of Recovery During t _b	—	240	—	A/μs	T _J = 25°C See Fig. 17
		—	210	—		T _J = 125°C

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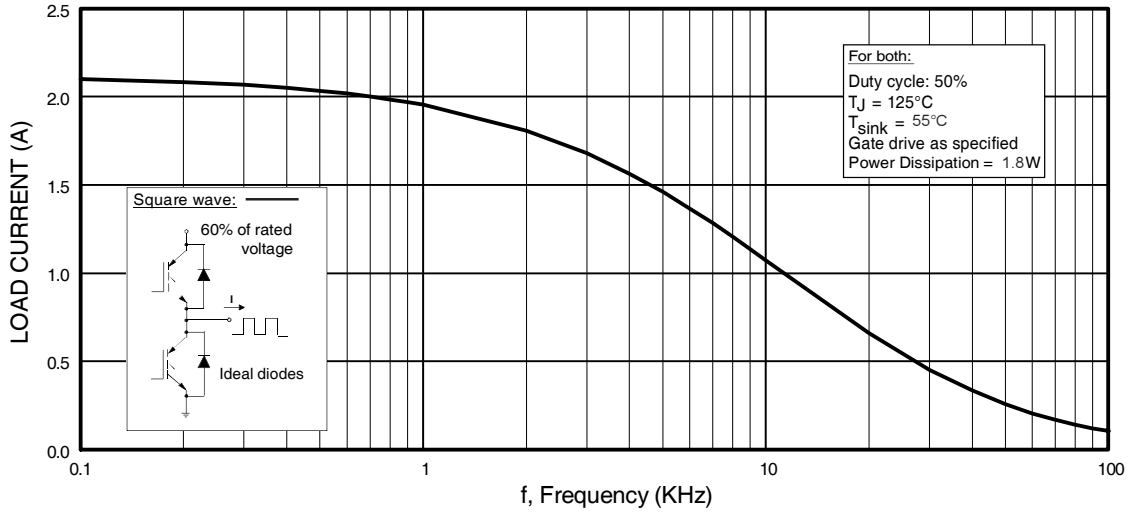


Fig. 1 - Typical Load Current vs. Frequency
 (Load Current = I_{RMS} of fundamental)

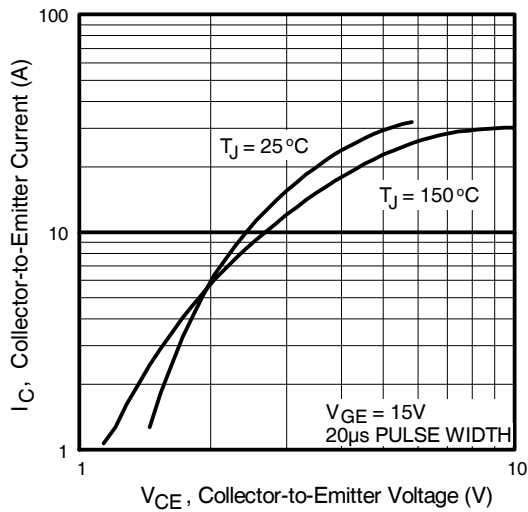


Fig. 2 - Typical Output Characteristics

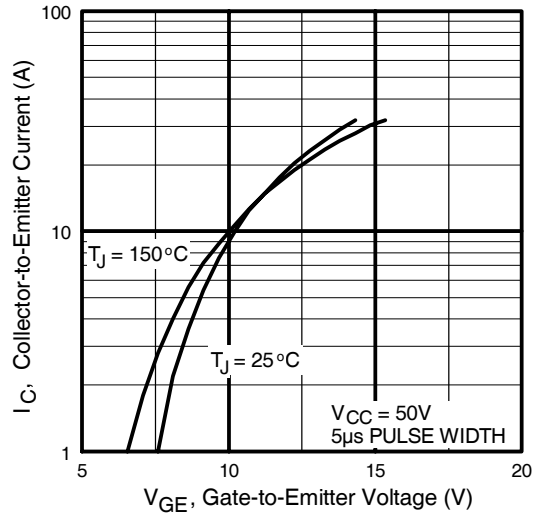


Fig. 3 - Typical Transfer Characteristics

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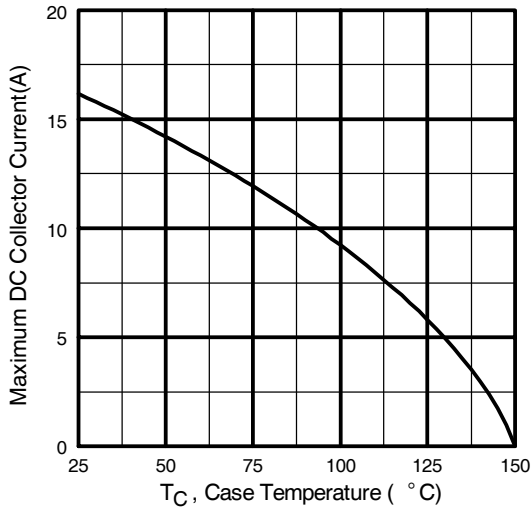


Fig. 4 - Maximum Collector Current vs. Case Temperature

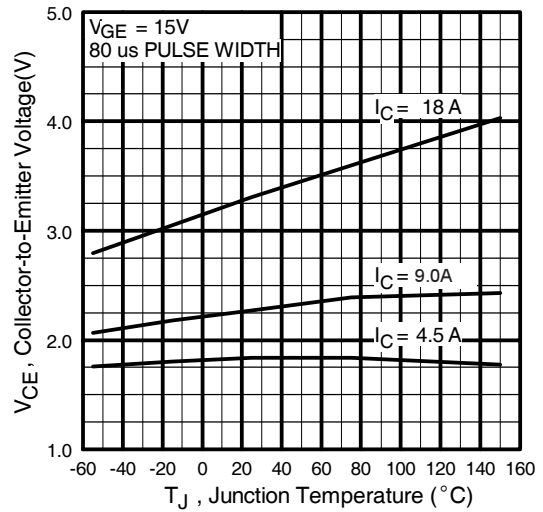


Fig. 5 - Typical Collector-to-Emitter Voltage vs. Junction Temperature

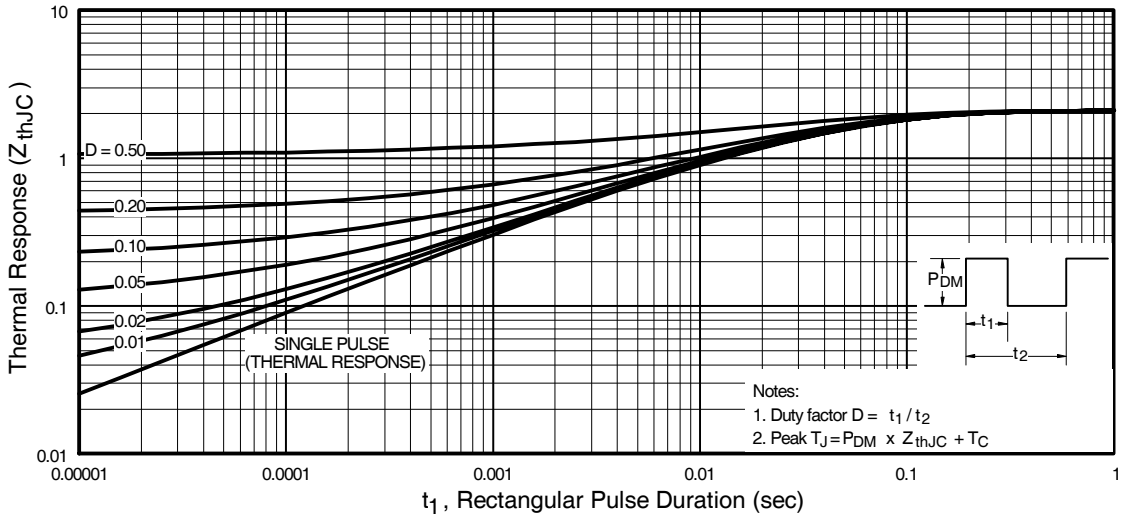


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

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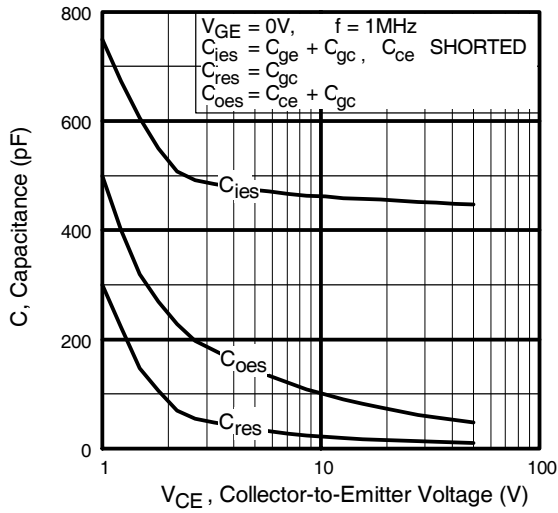


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

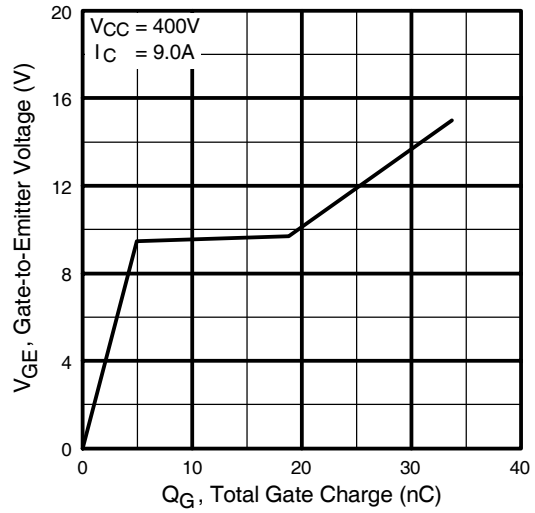


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

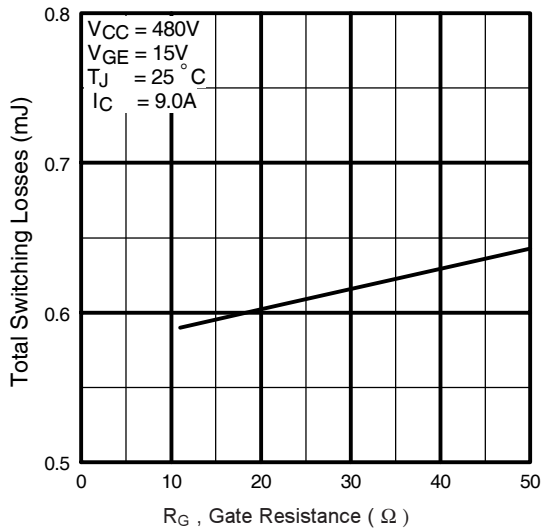


Fig. 9 - Typical Switching Losses vs. Gate Resistance

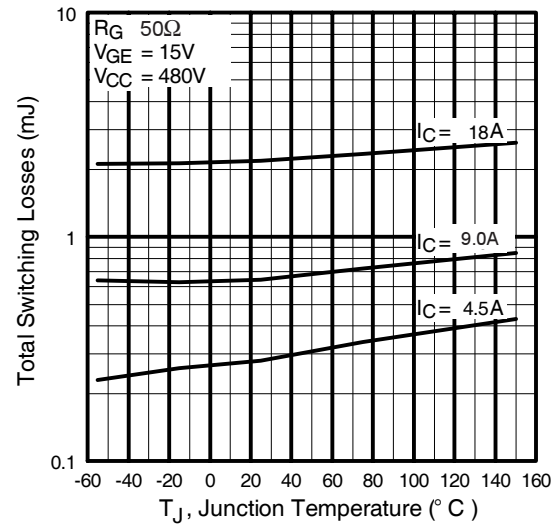


Fig. 10 - Typical Switching Losses vs. Junction Temperature

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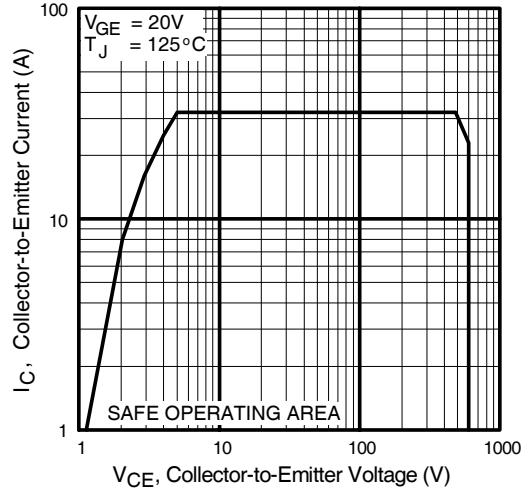
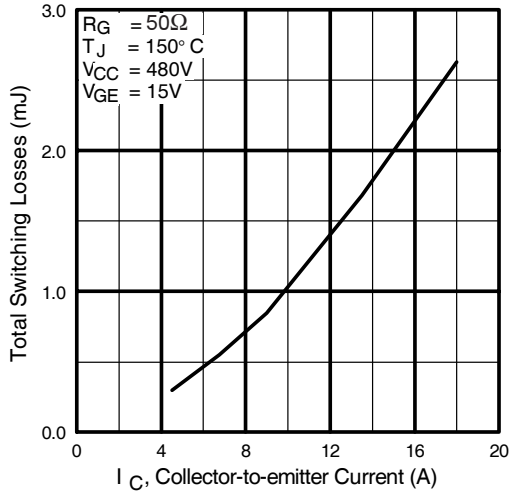


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

Fig. 12 - Turn-Off SOA

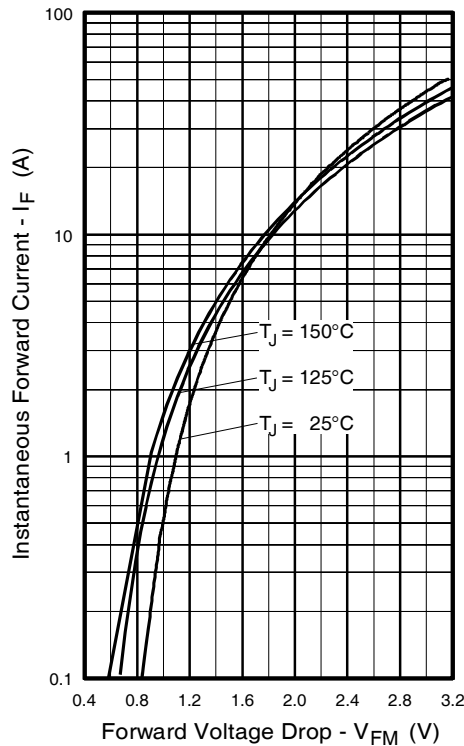


Fig. 13 - Maximum Forward Voltage Drop vs. Instantaneous Forward Current

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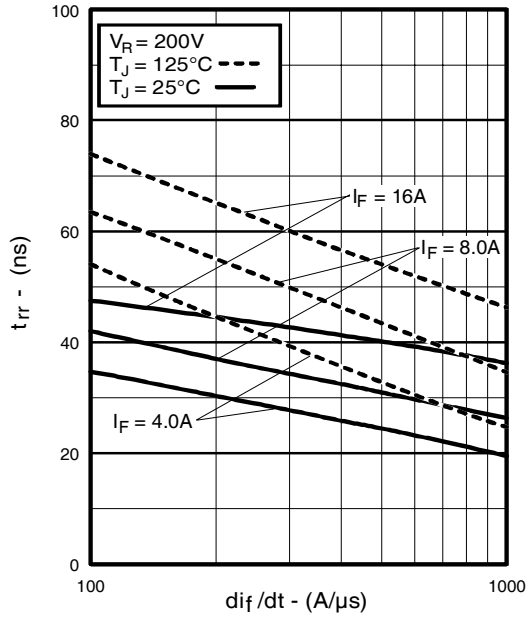


Fig. 14 - Typical Reverse Recovery vs. di_f/dt

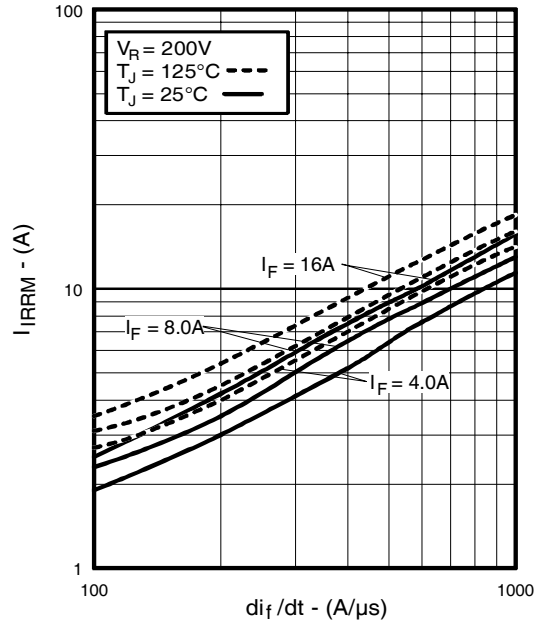


Fig. 15 - Typical Recovery Current vs. di_f/dt

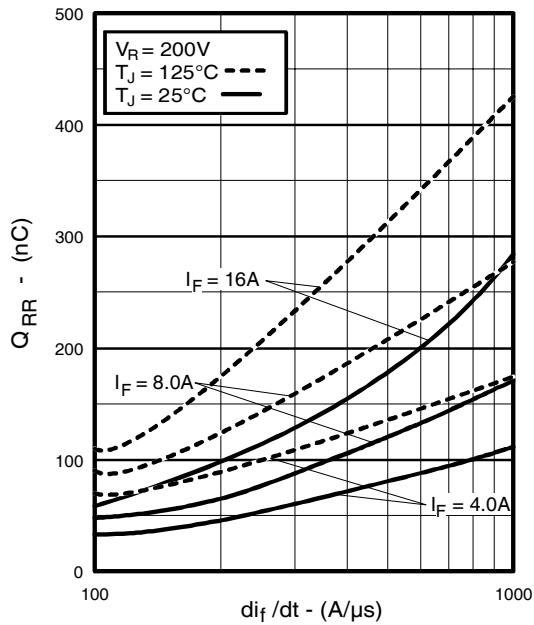


Fig. 16 - Typical Stored Charge vs. di_f/dt

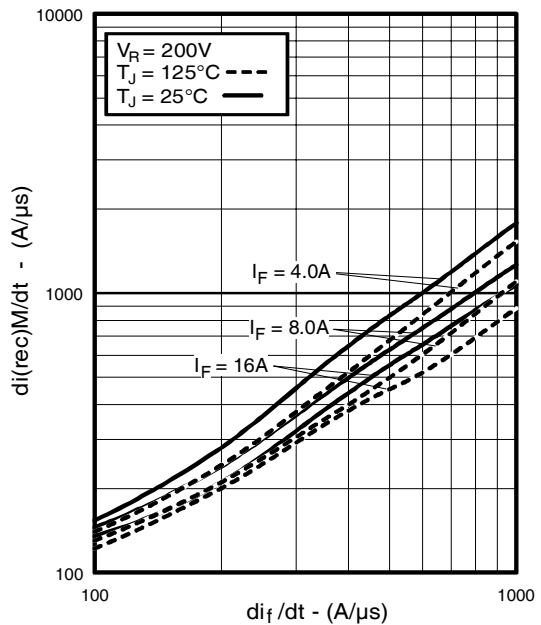


Fig. 17 - Typical $di_{(rec)M}/dt$ vs. di_f/dt

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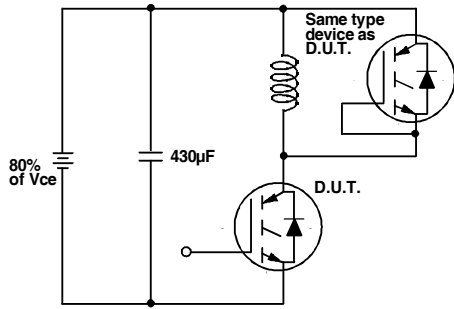


Fig. 18a - Test Circuit for Measurement of I_{LM} , E_{on} , $E_{off}(\text{diode})$, t_{rr} , Q_{rr} , I_{rr} , $t_{d(on)}$, t_r , $t_{d(off)}$, t_f

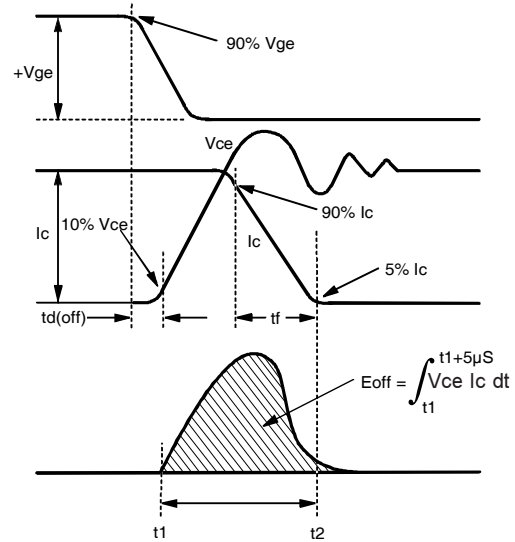


Fig. 18b - Test Waveforms for Circuit of Fig. 18a, Defining E_{off} , $t_{d(off)}$, t_f

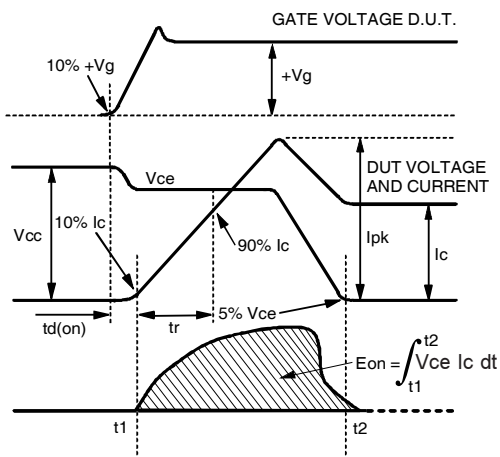


Fig. 18c - Test Waveforms for Circuit of Fig. 18a, Defining E_{on} , $t_{d(on)}$, t_r

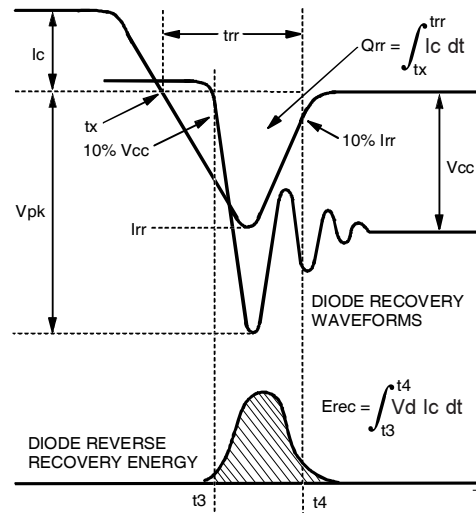


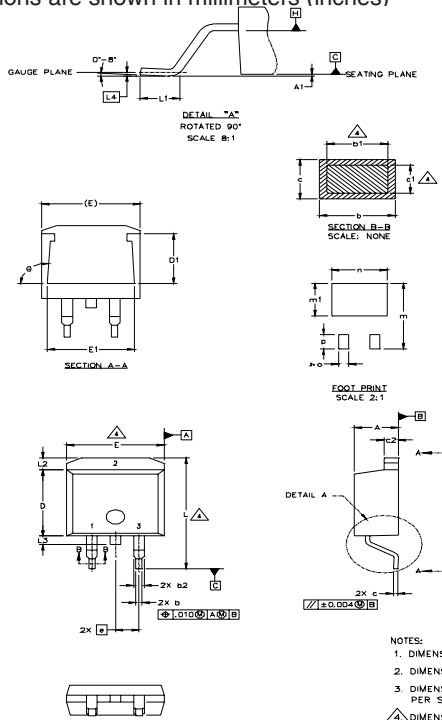
Fig. 18d - Test Waveforms for Circuit of Fig. 18a, Defining E_{rec} , t_{rr} , Q_{rr} , I_{rr}

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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	
A1		0.127		.005	
b	0.51	0.99	.020	.039	4
b1	0.51	0.89	.020	.035	
b2	1.14	1.40	.045	.055	
c	0.43	0.63	.017	.025	4
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		
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

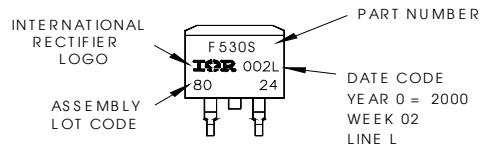
* PART DEPENDENT.

- 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 [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.

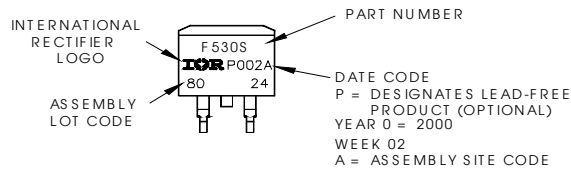
D²Pak Part Marking Information (Lead-Free)

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



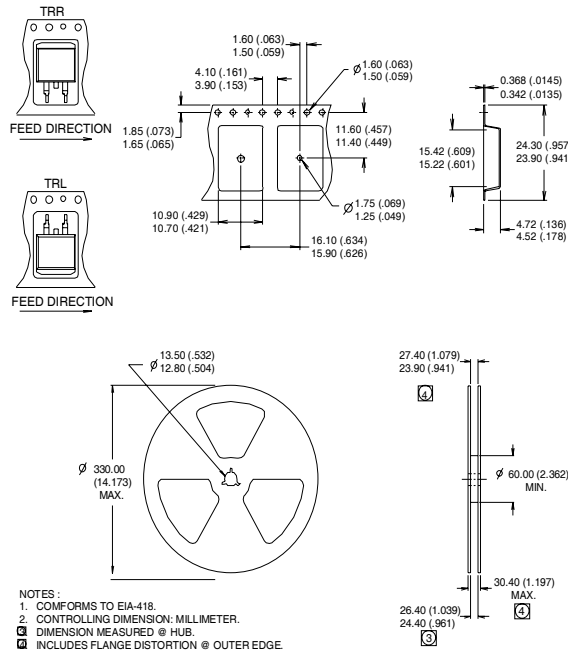
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Notes:

- ① Repetitive rating: $V_{GE}=20V$; pulse width limited by maximum junction temperature (figure 20)
- ② $V_{CC}=80\%(V_{CES})$, $V_{GE}=20V$, $L=10\mu H$, $R_G=50\Omega$ (figure 19)
- ③ Pulse width $\leq 80\mu s$; duty factor $\leq 0.1\%$.
- ④ Pulse width $5.0\mu s$, single shot.
- ⑤ When mounted on 1" square PCB (FR-4 or G-10 Material).
 For recommended footprint and soldering techniques refer to application note #AN-994.

D²Pak Tape & Reel Information



Data and specifications subject to change without notice.

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