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[International Rectifier \(Infineon Technologies Americas Corp.\)](#)
[IRG4BC10SD-SPBF](#)

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International IR Rectifier

INSULATED GATE BIPOLAR TRANSISTOR WITH
ULTRAFAST SOFT RECOVERY DIODE

PD - 95780

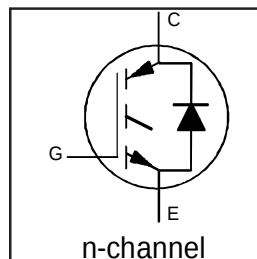
IRG4BC10SD-SPbF

IRG4BC10SD-LPbF

Standard Speed
CoPack IGBT

Features

- Extremely low voltage drop 1.1Vtyp. @ 2A
- 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™ ultrafast, ultra-soft-recovery anti-parallel diodes for use in bridge configurations
- Industry standard D²Pak & TO-262 packages
- Lead-Free



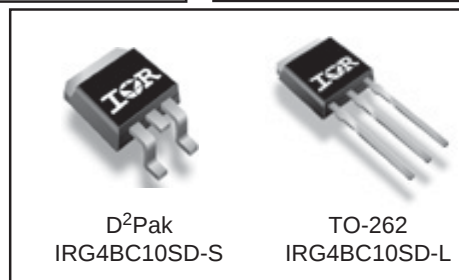
$$V_{CES} = 600V$$

$$V_{CE(on)} \text{ typ.} = 1.10V$$

$$@V_{GE} = 15V, I_C = 2.0A$$

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



Absolute Maximum Ratings

	Parameter	Max.	Units
V _{CES}	Collector-to-Emitter Voltage	600	V
I _C @ T _C = 25°C	Continuous Collector Current	14	A
I _C @ T _C = 100°C	Continuous Collector Current	8.0	
I _{CM}	Pulsed Collector Current ①	18	
I _{LM}	Clamped Inductive Load Current ②	18	
I _F @ T _C = 100°C	Diode Continuous Forward Current	4.0	
I _{FM}	Diode Maximum Forward Current	18	V
V _{GE}	Gate-to-Emitter Voltage	± 20	
P _D @ T _C = 25°C	Maximum Power Dissipation	38	W
P _D @ T _C = 100°C	Maximum Power Dissipation	15	
T _J	Operating Junction and	-55 to +150	°C
T _{STG}	Storage Temperature Range		
	Soldering Temperature, for 10 sec.	300 (0.063 in. (1.6mm) from case)	

Thermal Resistance

	Parameter	Min.	Typ.	Max.	Units
R _{θJC}	Junction-to-Case - IGBT	—	—	3.3	°C/W
R _{θJC}	Junction-to-Case - Diode	—	—	7.0	
R _{θCS}	Case-to-Sink, flat, greased surface	—	0.50	—	
R _{θJA}	Junction-to-Ambient, typical socket mount ⑤	—	—	80	
R _{θJA}	Junction-to-Ambient (PCB Mount, steady state)⑥	—	—	40	
Wt	Weight	—	2.0(0.07)	—	g (oz)

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08/27/04

IRG4BC10SD-S/LPbF

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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 Voltage③	600	—	—	V	V _{GE} = 0V, I _C = 250μA
ΔV _{(BR)CES} /ΔT _J	Temperature Coeff. of Breakdown Voltage	—	0.64	—	V/°C	V _{GE} = 0V, I _C = 1.0mA
V _{CE(on)}	Collector-to-Emitter Saturation Voltage	—	1.58	1.8	V	I _C = 8.0A V _{GE} = 15V
		—	2.05	—		I _C = 14.0A See Fig. 2, 5
		—	1.68	—		I _C = 8.0A, 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	—	-9.5	—	mV/°C	V _{CE} = V _{GE} , I _C = 250μA
g _{fe}	Forward Transconductance④	3.65	5.48	—	S	V _{CE} = 100V, I _C = 8.0A
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	—	1.5	1.8	V	I _C = 4.0A See Fig. 13
		—	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)	—	15	22	nC	I _C = 8.0A
Q _{ge}	Gate - Emitter Charge (turn-on)	—	2.42	3.6		V _{CC} = 400V See Fig. 8
Q _{gc}	Gate - Collector Charge (turn-on)	—	6.53	9.8		V _{GE} = 15V
t _{d(on)}	Turn-On Delay Time	—	76	—	ns	T _J = 25°C
t _r	Rise Time	—	32	—		I _C = 8.0A, V _{CC} = 480V
t _{d(off)}	Turn-Off Delay Time	—	815	1200		V _{GE} = 15V, R _G = 100Ω
t _f	Fall Time	—	720	1080		Energy losses include "tail" and diode reverse recovery.
E _{on}	Turn-On Switching Loss	—	0.31	—		See Fig. 9, 10, 18
E _{off}	Turn-Off Switching Loss	—	3.28	—	mJ	
E _{ts}	Total Switching Loss	—	3.60	10.9	mJ	
E _{ts}	Total Switching Loss	—	1.46	2.6		I _C = 5.0A
t _{d(on)}	Turn-On Delay Time	—	70	—	ns	T _J = 150°C, See Fig. 10,11, 18
t _r	Rise Time	—	36	—		I _C = 8.0A, V _{CC} = 480V
t _{d(off)}	Turn-Off Delay Time	—	890	—		V _{GE} = 15V, R _G = 100Ω
t _f	Fall Time	—	890	—		Energy losses include "tail" and diode reverse recovery.
E _{ts}	Total Switching Loss	—	3.83	—	mJ	
L _E	Internal Emitter Inductance	—	7.5	—	nH	Measured 5mm from package
C _{ies}	Input Capacitance	—	280	—	pF	V _{GE} = 0V
C _{oes}	Output Capacitance	—	30	—		V _{CC} = 30V See Fig. 7
C _{res}	Reverse Transfer Capacitance	—	4.0	—		f = 1.0MHz
t _{rr}	Diode Reverse Recovery Time	—	28	42	ns	T _J = 25°C See Fig. 14
		—	38	57		T _J = 125°C
I _{rr}	Diode Peak Reverse Recovery Current	—	2.9	5.2	A	T _J = 25°C See Fig. 15
		—	3.7	6.7		T _J = 125°C
Q _{rr}	Diode Reverse Recovery Charge	—	40	60	nC	T _J = 25°C See Fig. 16
		—	70	105		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 See Fig. 17
		—	235	—		T _J = 125°C

Details of note ① through ④ are on the last page

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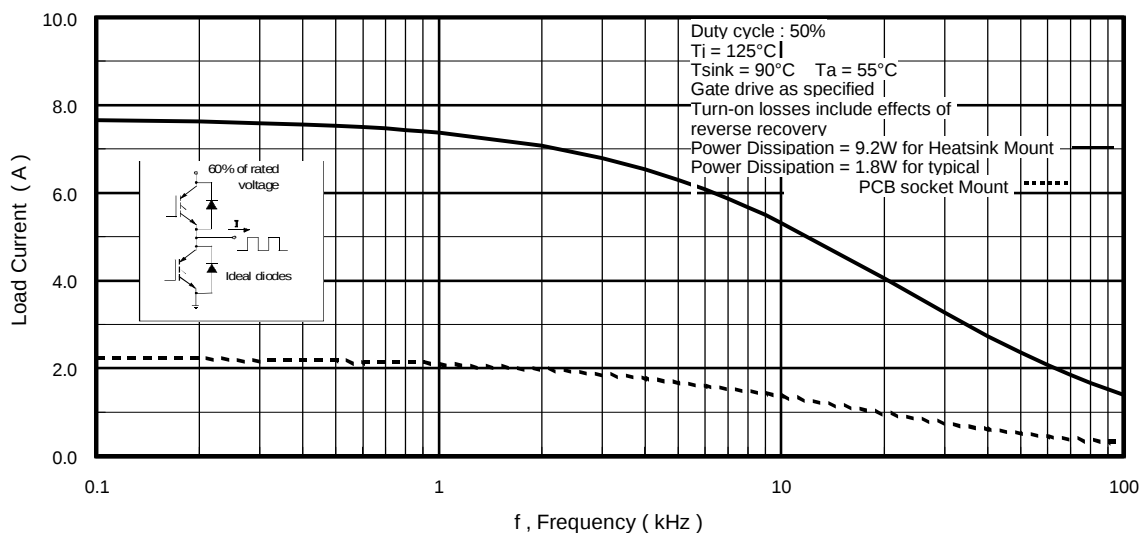


Fig. 1 - Typical Load Current vs. Frequency
(Load Current = I_{RMS} of fundamental)

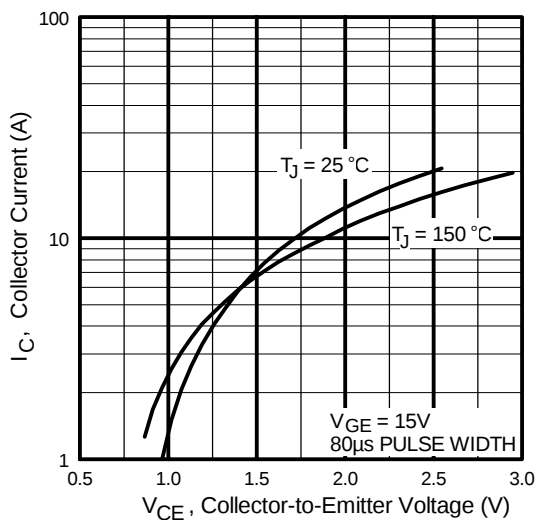


Fig. 2 - Typical Output Characteristics

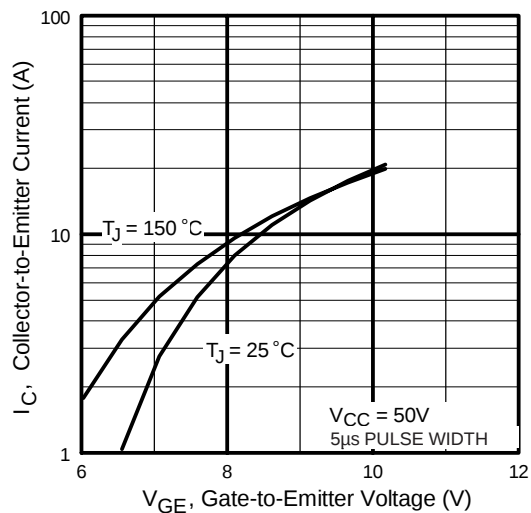


Fig. 3 - Typical Transfer Characteristics

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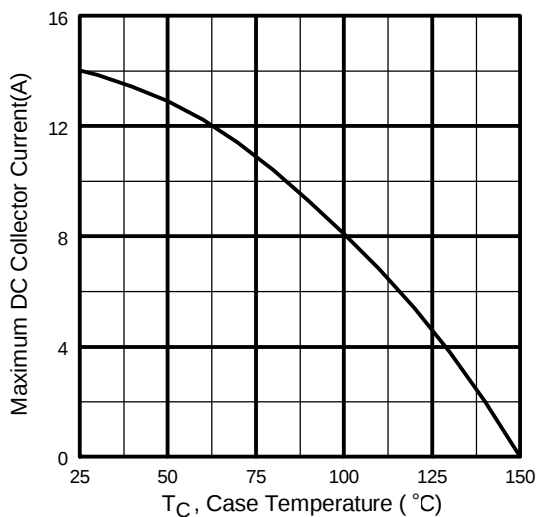


Fig. 4 - Maximum Collector Current vs. Case Temperature

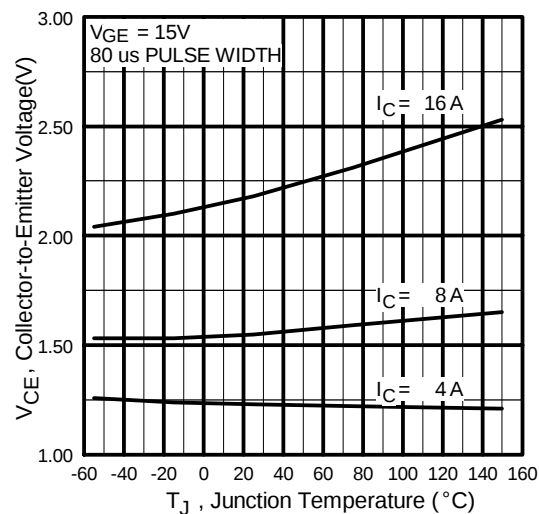


Fig. 5 - Typical Collector-to-Emitter Voltage vs. Junction Temperature

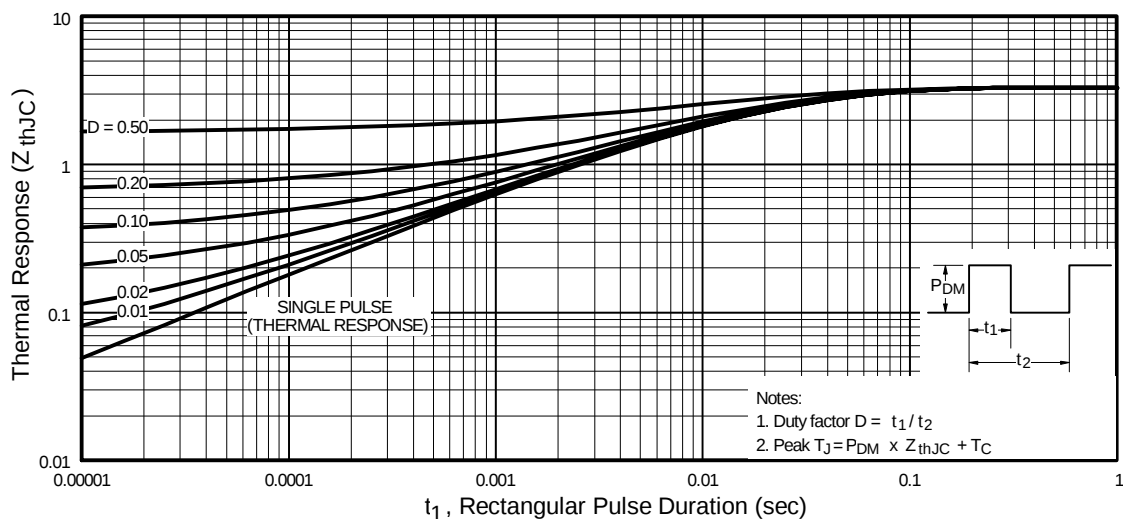


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

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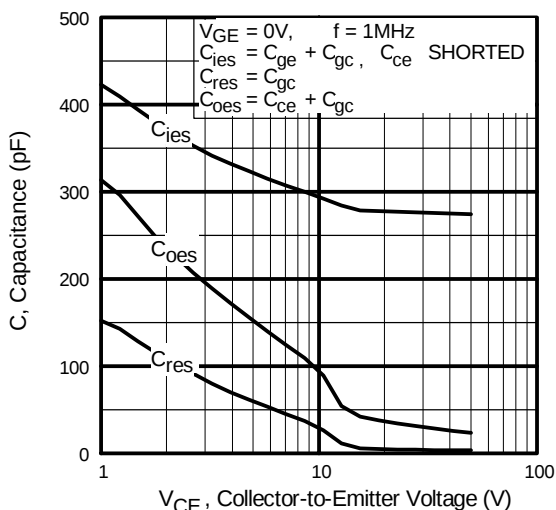


Fig. 7 - Typical Capacitance vs.
Collector-to-Emitter Voltage

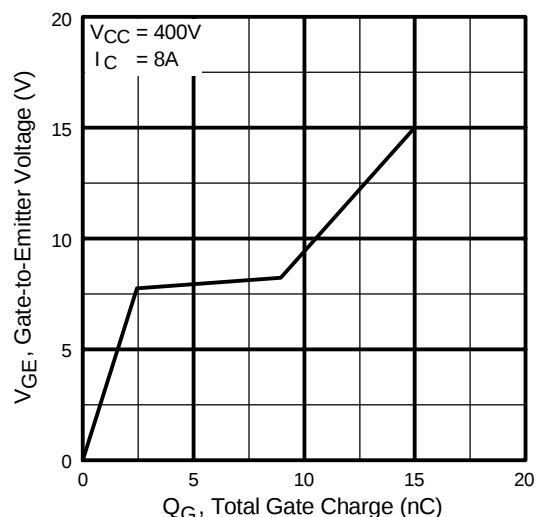


Fig. 8 - Typical Gate Charge vs.
Gate-to-Emitter Voltage

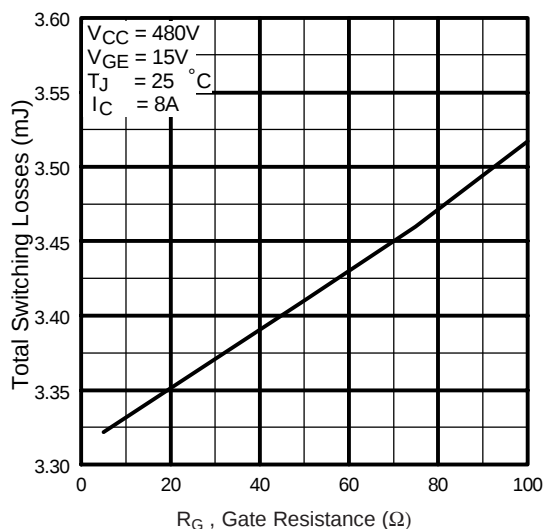


Fig. 9 - Typical Switching Losses vs. Gate
Resistance

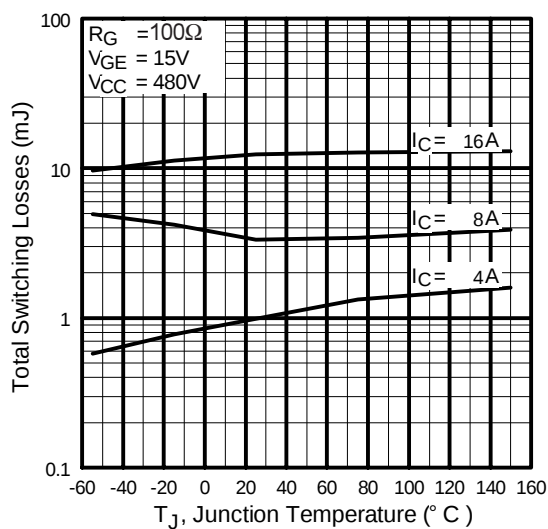


Fig. 10 - Typical Switching Losses vs.
Junction Temperature

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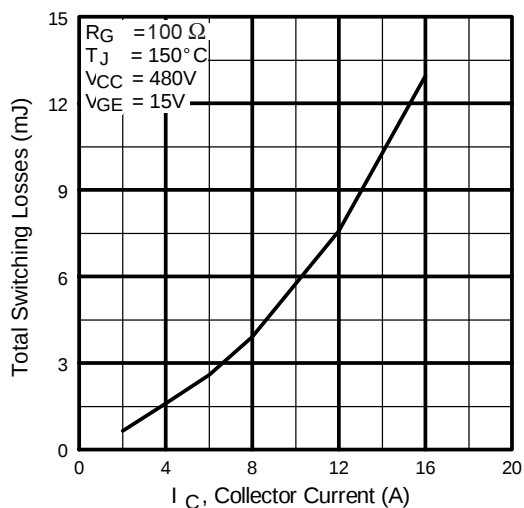


Fig. 11 - Typical Switching Losses vs. Collector Current

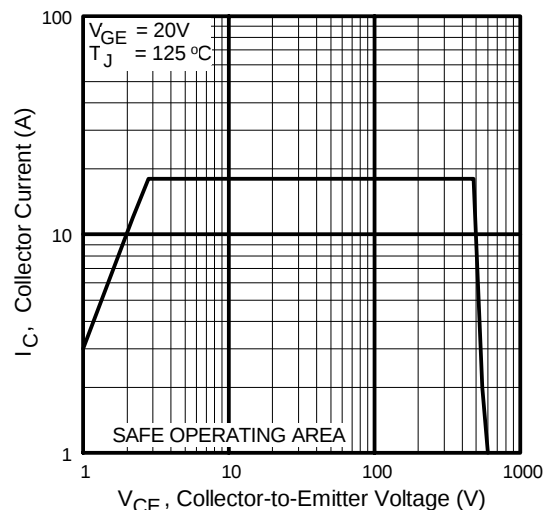


Fig. 12 - Turn-Off SOA

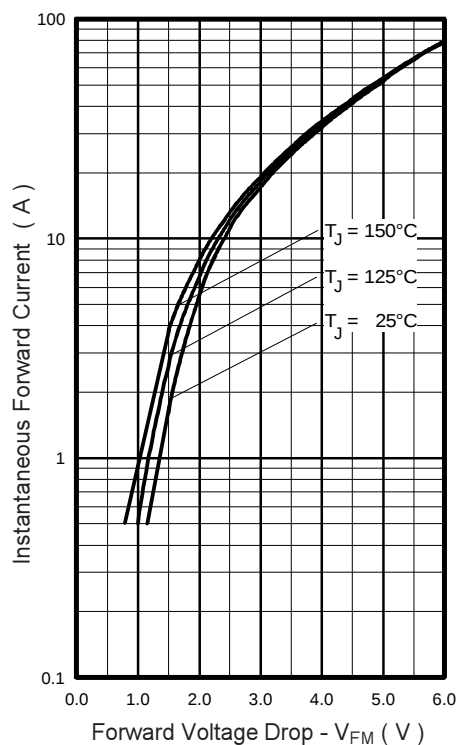


Fig. 13 - Maximum Forward Voltage Drop vs. Instantaneous Forward Current

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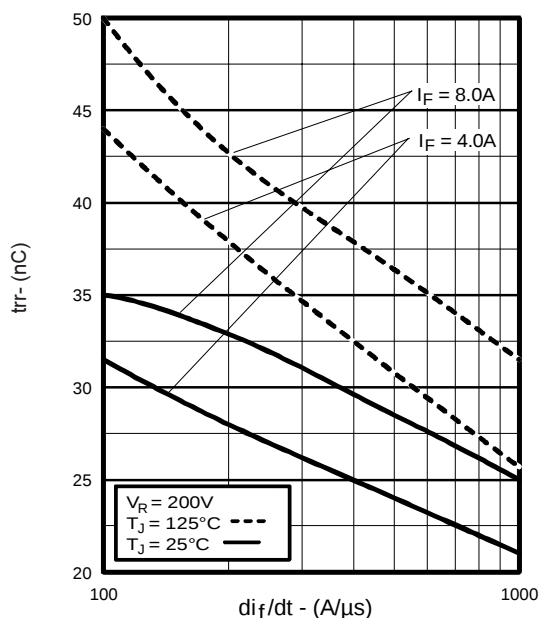


Fig. 14 - Typical Reverse Recovery vs. di_f/dt

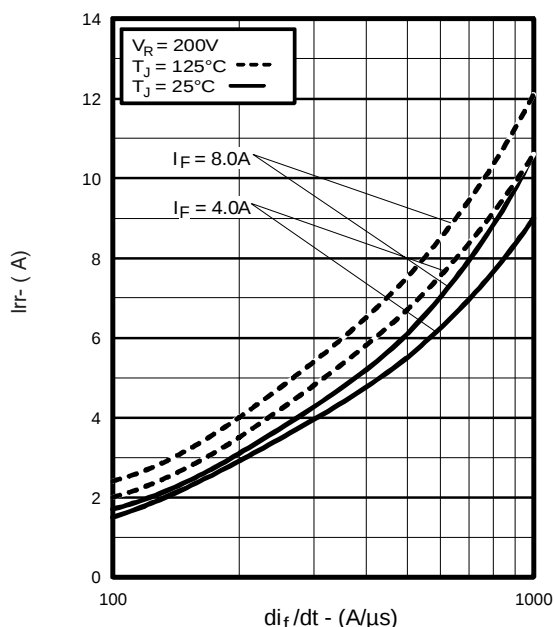


Fig. 15 - Typical Recovery Current vs. di_f/dt

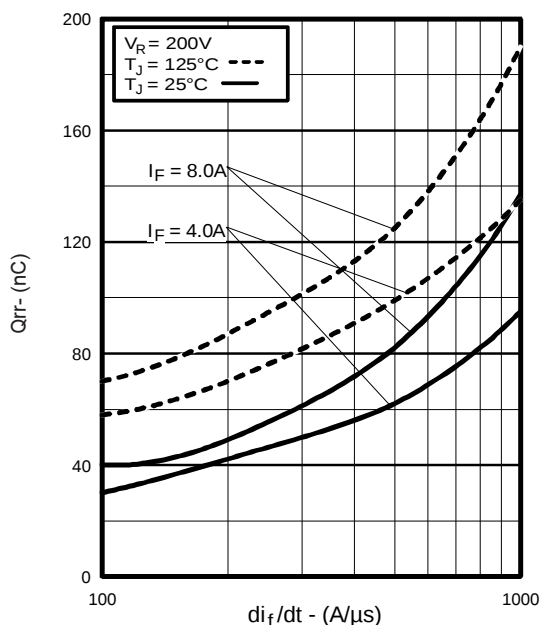


Fig. 16 - Typical Stored Charge vs. di_f/dt

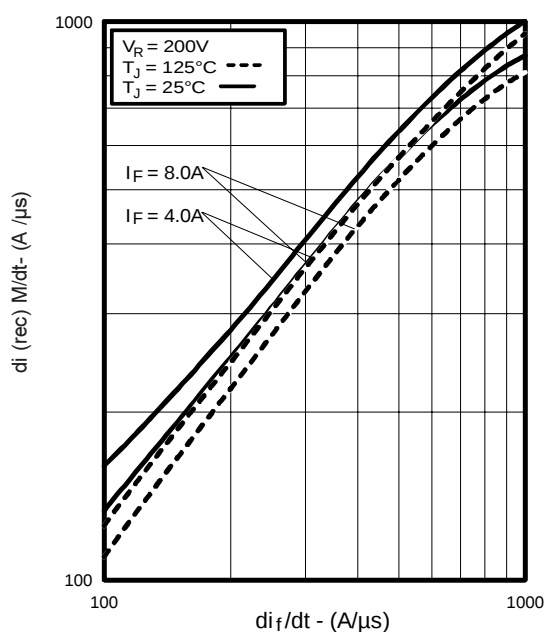


Fig. 17 - Typical $di_{(rec)M}/dt$ vs. di_f/dt

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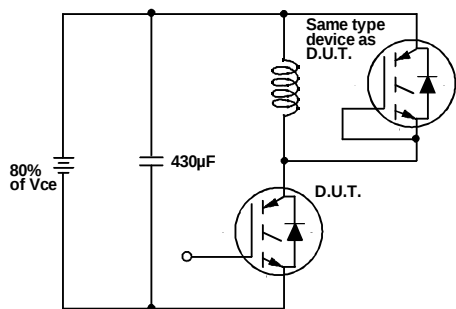


Fig. 18a - Test Circuit for Measurement of I_{LM} , E_{on} , $E_{off}(\text{diode})$, t_{rr} , Q_{rr} , I_{rr} , $t_{d(on)}$, t_r , $t_{d(off)}$, t_f

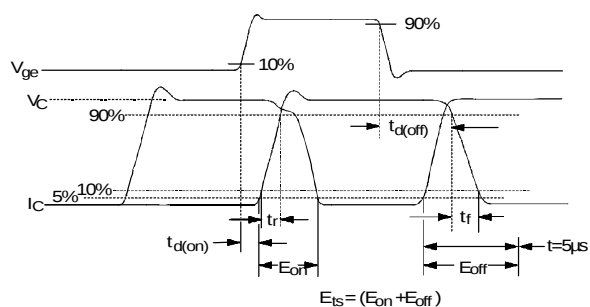


Fig. 18b - Test Waveforms for Circuit of Fig. 18a, Defining E_{off} , $t_{d(off)}$, t_f

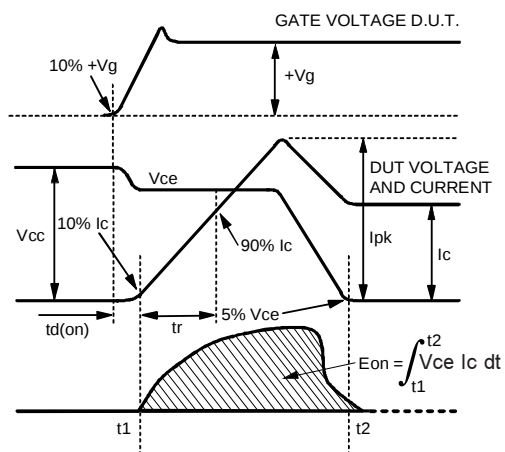


Fig. 18c - Test Waveforms for Circuit of Fig. 18a, Defining E_{on} , $t_{d(on)}$, t_r

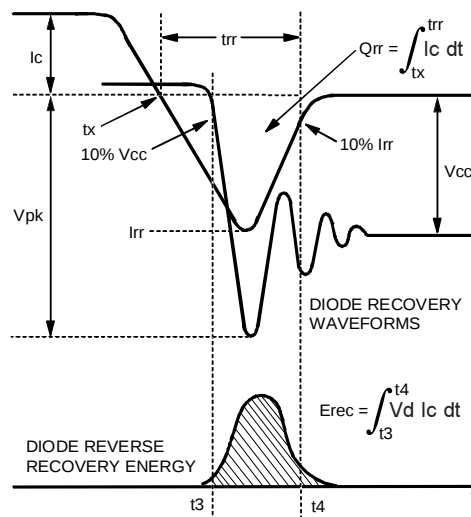


Fig. 18d - Test Waveforms for Circuit of Fig. 18a, Defining E_{rec} , t_{rr} , Q_{rr} , I_{rr}

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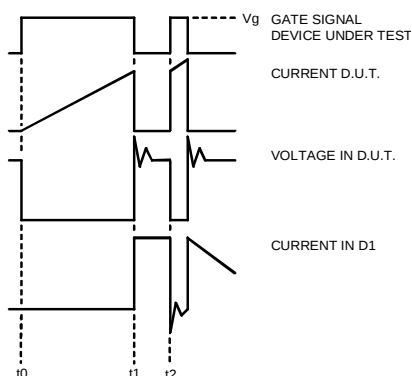


Figure 18e. Macro Waveforms for Figure 18a's Test Circuit

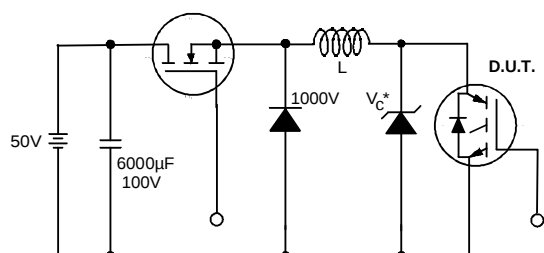


Figure 19. Clamped Inductive Load Test Circuit

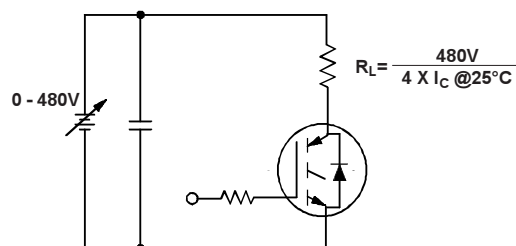


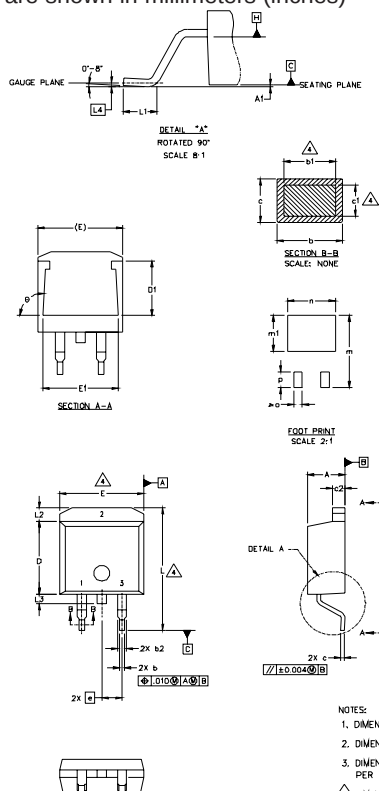
Figure 20. Pulsed Collector Current Test Circuit

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D²Pak Package Outline

Dimensions are shown in millimeters (inches)



S Y M B O L	DIMENSIONS				N O T E S
	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	1
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		
ø	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:

- 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 d1 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 WW02, 2000
IN THE ASSEMBLY LINE "1"

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

Diagram of a 2-pin rectifier component with the following markings and labels:

- INTERNATIONAL RECTIFIER LOGO**: Points to the stylized 'IR' logo on the component.
- ASSEMBLY LOT CODE**: Points to the numbers '80' and '24' on the component.
- PART NUMBER**: Points to the text 'F530S' on the component.
- DATE CODE**: Points to the text '002L' on the component.
- YEAR 0 = 2000**: Explains the meaning of the first digit of the date code.
- WEEK 02**: Explains the meaning of the second digit of the date code.
- LINE L**: Explains the meaning of the letter of the date code.

OR

INTERNATIONAL RECTIFIER LOGO

PART NUMBER

DATE CODE

ASSEMBLY LOT CODE

P = DESIGNATES LEAD-FREE PRODUCT (OPTIONAL)

YEAR 0 = 2000

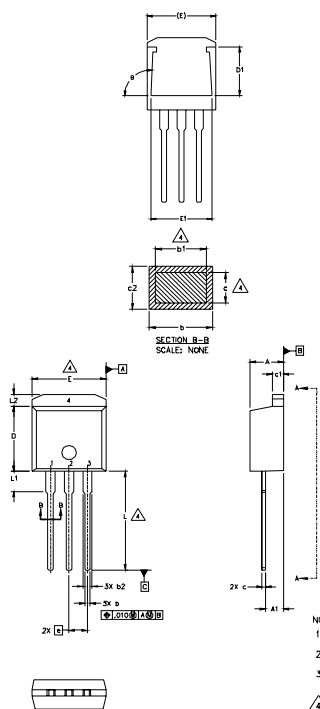
WEEK 02

A = ASSEMBLY SITE CODE

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TO-262 Package Outline

Dimensions are shown in millimeters (inches)



IRG4BC10SD-S/LPbF

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	4
b2	1.14	1.40	.045	.055	
c	0.38	0.63	.015	.025	
c1	1.14	1.40	.045	.055	3
c2	0.43	.063	.017	.029	
D	8.51	9.65	.335	.380	
D1	5.33		.210		3
E	9.65	10.67	.380	.420	
E	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

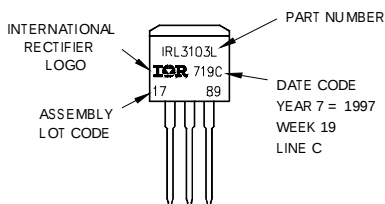
IGBT

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

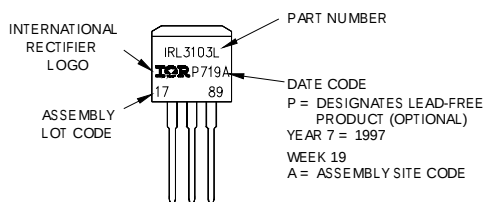
- NOTES:
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 2. DIMENSIONS ARE SHOWN IN MILLIMETERS (INCHES).
 3. DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.127 (.005") PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY.
 4. DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.
 5. CONTROLLING DIMENSION: INCH.

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

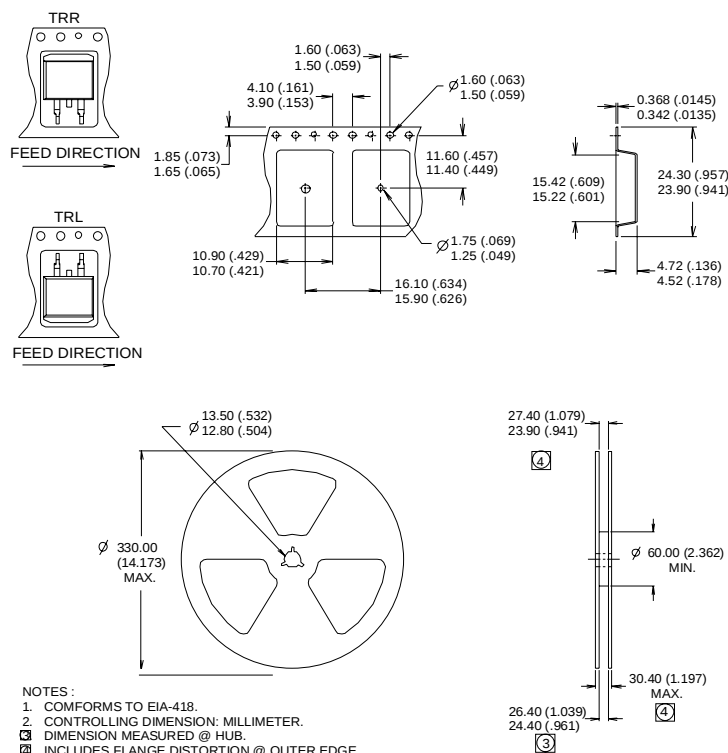


IRG4BC10SD-S/LPbF

D²Pak Tape & Reel Information

Dimensions are shown in millimeters (inches)

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Notes:

- ① Repetitive rating: $V_{GE}=20V$; pulse width limited by maximum junction temperature (figure 20)
- ② $V_{CC}=80\%(V_{CES})$, $V_{GE}=20V$, $L=10\mu H$, $R_G = 100W$ (figure 19)
- 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.

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TAC Fax: (310) 252-7903

Visit us at www.irf.com for sales contact information.08/04

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Note: For the most current drawings please refer to the IR website at:

<http://www.irf.com/package/>