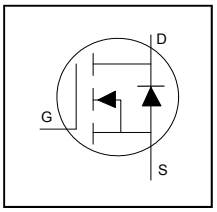
IRFB4137PbF

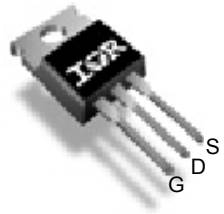
HEXFET® Power MOSFET

Application
- High Efficiency Synchronous Rectification in SMPS
- Uninterruptible Power Supply
- High Speed Power Switching
- Hard Switched and High Frequency Circuits



V_{DSS}	300V
$R_{DS(on)}$ typ.	56mΩ
max	69mΩ
I_D	38A

Benefits
- Improved Gate, Avalanche and Dynamic dV/dt Ruggedness
- Fully Characterized Capacitance and Avalanche SOA
- Enhanced body diode dV/dt and dI/dt Capability
- Lead-Free, RoHS Compliant



TO-220Pak

G	D	S
Gate	Drain	Source

Base part number	Package Type	Standard Pack		Orderable Part Number
		Form	Quantity	
IRFB4137PbF	TO-220Pak	Tube	50	IRFB4137PbF

	Parameter	Max.	Units
I_D @ T_C = 25°C	Continuous Drain Current, V_{GS} @ 10V	38	A
I_D @ T_C = 100°C	Continuous Drain Current, V_{GS} @ 10V	27	
I_{DM}	Pulsed Drain Current ①	152	
P_D @T_C = 25°C	Maximum Power Dissipation	341	W
	Linear Derating Factor	2.3	W/°C
V_{GS}	Gate-to-Source Voltage	± 20	V
dv/dt	Peak Diode Recovery dv/dt③	8.9	V/ns
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 175	°C
	Soldering Temperature, for 10 seconds (1.6mm from case)	300	
	Mounting Torque, 6-32 or M3 Screw	10 lbf·in (1.1 N·m)	

Avalanche Characteristics

$E_{AS\ (Thermally\ limited)}$	Single Pulse Avalanche Energy ②	414	mJ

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case ⑧	——	0.44	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat Greased Surface	0.50	——	
$R_{\theta JA}$	Junction-to-Ambient ⑦⑧	——	62	

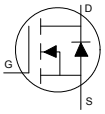
Static @ T_J = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	300	—	—	V	V_{GS} = 0V, I_D = 250µA
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.24	—	V/°C	Reference to 25°C, I_D = 3.5mA
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	56	69	mΩ	V_{GS} = 10V, I_D = 24A ④
$V_{GS(th)}$	Gate Threshold Voltage	3.0	—	5.0	V	V_{DS} = V_{GS}, I_D = 250µA
I_{DSS}	Drain-to-Source Leakage Current	—	—	20	µA	V_{DS} =300 V, V_{GS} = 0V
		—	—	250		V_{DS} =300V,V_{GS} = 0V,T_J =125°C
I_{GSS}	Gate-to-Source Forward Leakage	—	—	100	nA	V_{GS} = 20V
	Gate-to-Source Reverse Leakage	—	—	-100		V_{GS} = -20V
R_G	Gate Resistance	—	1.3	—	Ω	

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

gfs	Forward Transconductance	45	—	—	S	V_{DS} = 50V, I_D =24A
Q_g	Total Gate Charge	—	83	125	nC	I_D = 24A
Q_{gs}	Gate-to-Source Charge	—	28	42		V_{DS} = 150V
Q_{gd}	Gate-to-Drain Charge	—	26	39		V_{GS} = 10V
$t_{d(on)}$	Turn-On Delay Time	—	18	—	ns	V_{DD} = 195V
t_r	Rise Time	—	23	—		I_D = 24A
$t_{d(off)}$	Turn-Off Delay Time	—	34	—		R_G= 2.2Ω
t_f	Fall Time	—	20	—		V_{GS} = 10V
C_{iss}	Input Capacitance	—	5168	—	pF	V_{GS} = 0V
C_{oss}	Output Capacitance	—	300	—		V_{DS} = 50V
C_{rss}	Reverse Transfer Capacitance	—	77	—		f = 1.0MHz
$C_{oss\ eff.(ER)}$	Effective Output Capacitance (Energy Related)	—	196	—		V_{GS} = 0V, VDS = 0V to 240V⑥ See Fig.11
$C_{oss\ eff.(TR)}$	Output Capacitance (Time Related)	—	265	—		V_{GS} = 0V, VDS = 0V to 240V⑤

Diode Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)①	—	—	38	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode) ①	—	—	152		
V_{SD}	Diode Forward Voltage	—	—	1.3	V	T_J = 25°C,I_S = 24A,V_{GS} = 0V ④
t_{rr}	Reverse Recovery Time	—	302	—	ns	T_J = 25°C V_{DD} = 255V
		—	379	—		T_J = 125°C I_F = 24A,
Q_{rr}	Reverse Recovery Charge	—	1739	—	nC	T_J = 25°C di/dt = 100A/µs ④
		—	2497	—		T_J = 125°C
I_{RRM}	Reverse Recovery Current	—	13	—	A	T_J = 25°C

Notes:

① Repetitive rating; pulse width limited by max. junction temperature.

② Recommended max EAS limit, starting T_J = 25°C, L = 1.56mH, R_G = 50Ω, I_{AS} = 24A, V_{GS} =10V.

③ $I_{SD} \le$ 24A, di/dt ≤ 1771A/µs, $V_{DD} \le V_{(BR)DSS}$, $T_J \le$ 175°C.

④ Pulse width ≤ 400µs; duty cycle ≤ 2%.

⑤ C_{oss} eff. (TR) is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS}.

⑥ C_{oss} eff. (ER) is a fixed capacitance that gives the same energy as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS}.

⑦ When mounted on 1" square PCB (FR-4 or G-10 Material). For recommended footprint and soldering techniques refer to application note #AN-994

⑧ Rθ is measured at T_J approximately 90°C

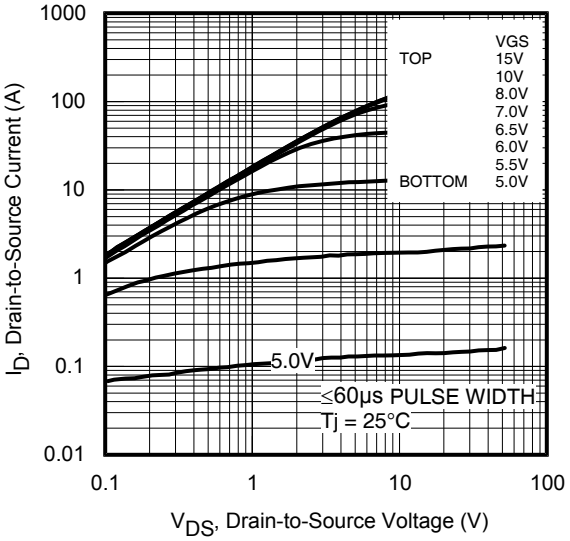


Fig 1. Typical Output Characteristics

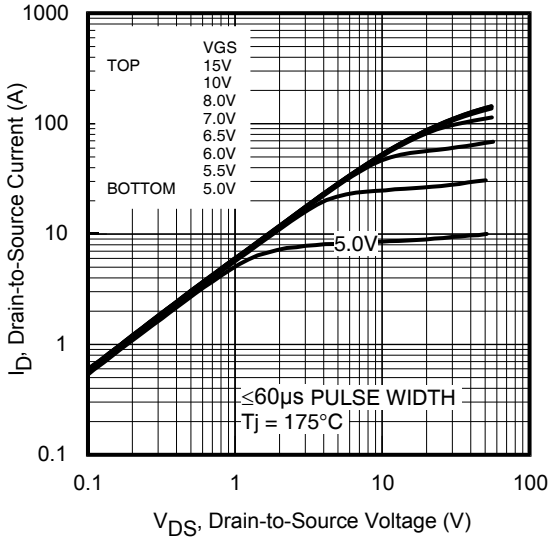


Fig 2. Typical Output Characteristics

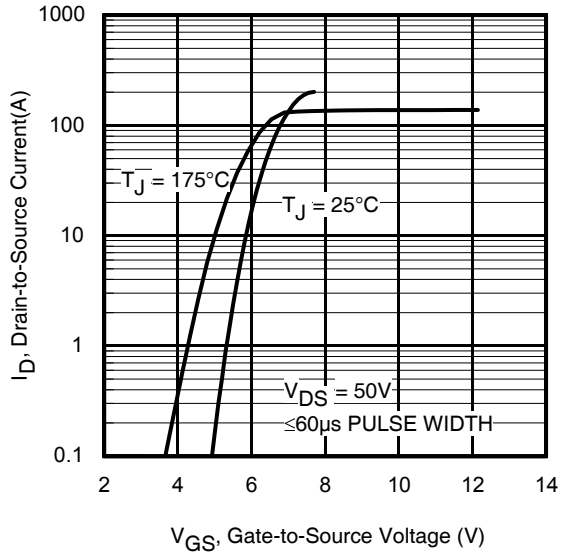


Fig 3. Typical Transfer Characteristics

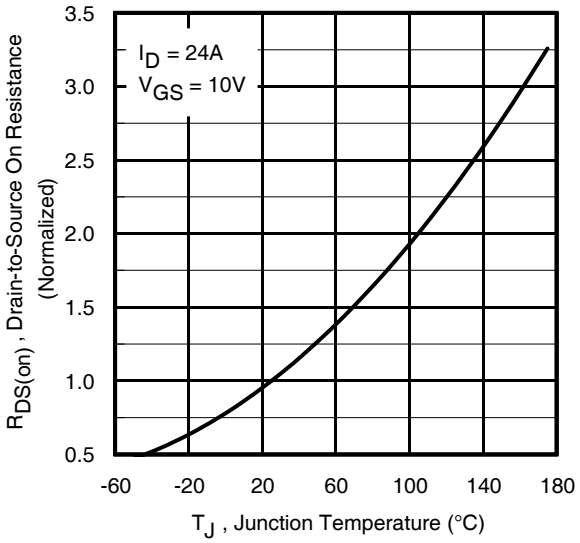


Fig 4. Normalized On-Resistance vs. Temperature

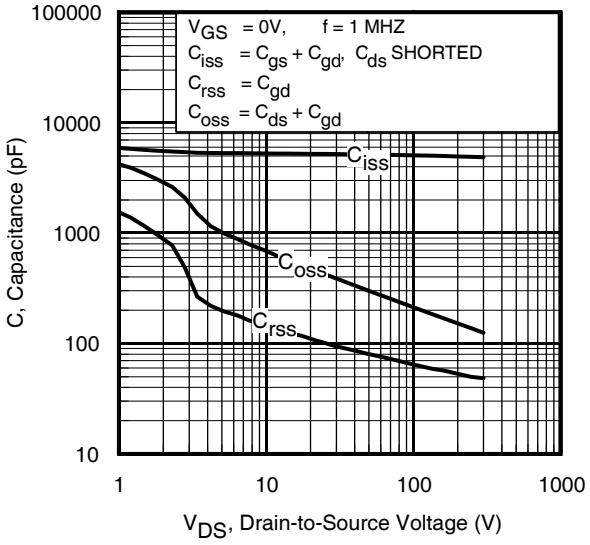


Fig 5. Typical Capacitance vs. Drain-to-Source Voltage

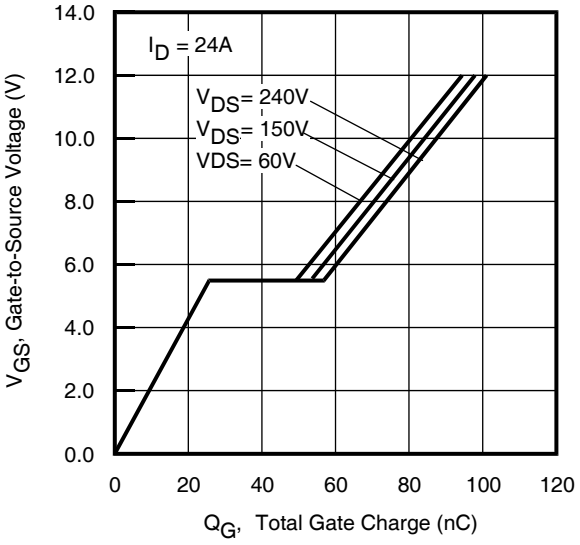


Fig 6. Typical Gate Charge vs. Gate-to-Source Voltage

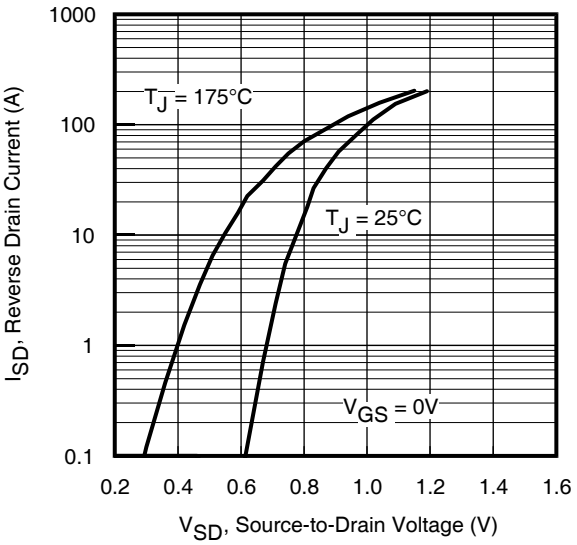


Fig 7. Typical Source-Drain Diode Forward Voltage

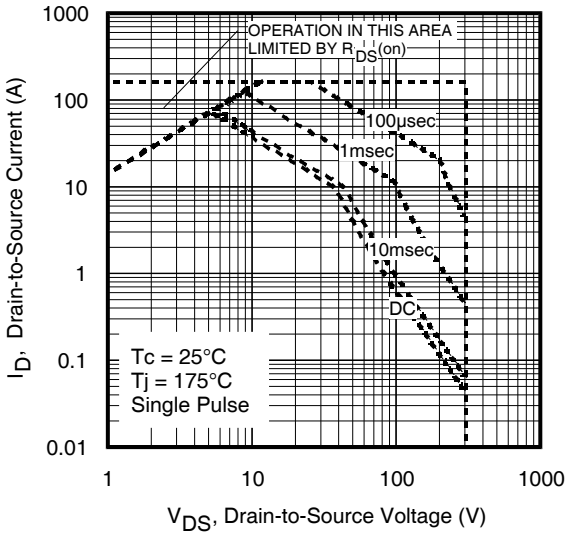


Fig 8. Maximum Safe Operating Area

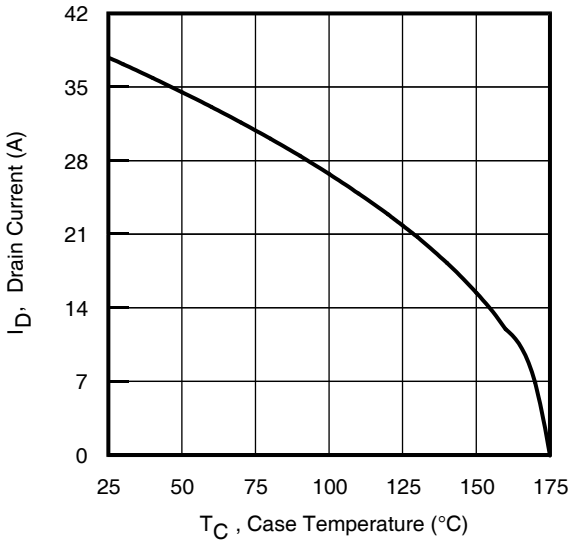


Fig 9. Maximum Drain Current vs. Case Temperature

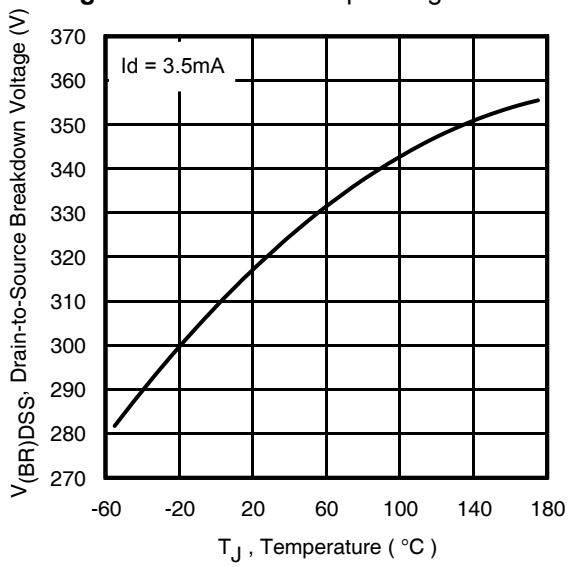


Fig 10. Drain-to–Source Breakdown Voltage

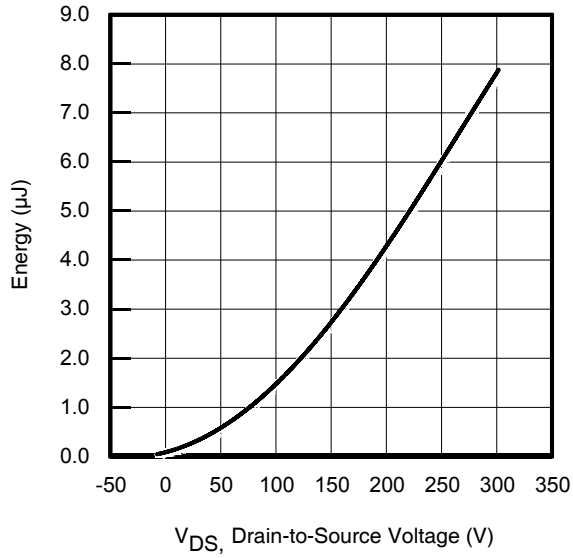


Fig 11. Typical C_{oss} Stored Energy

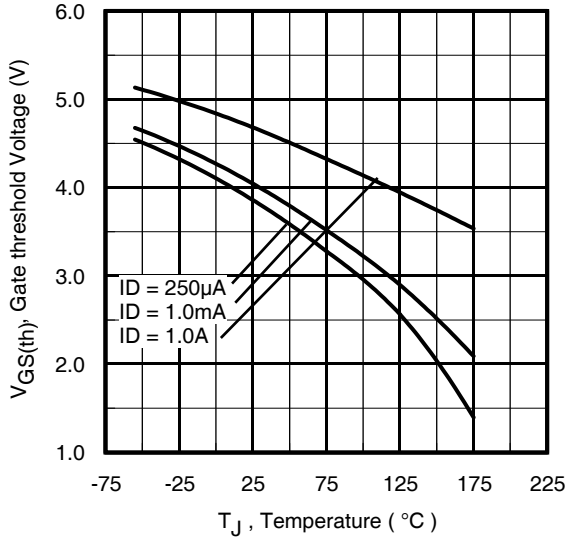


Fig 12. Threshold Voltage vs. Temperature

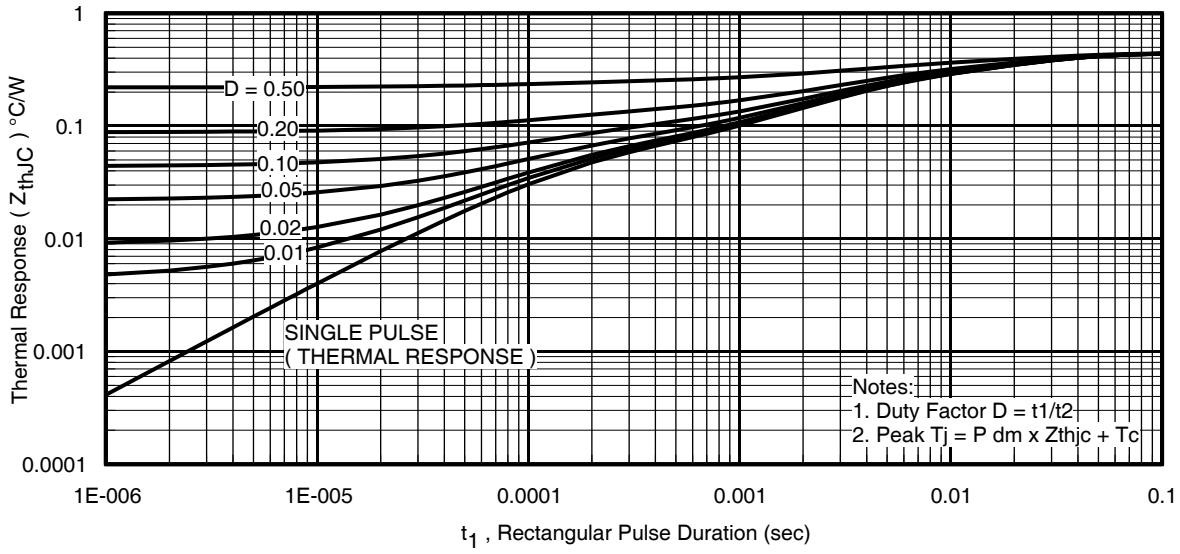


Fig 13. Maximum Effective Transient Thermal Impedance, Junction-to-Case

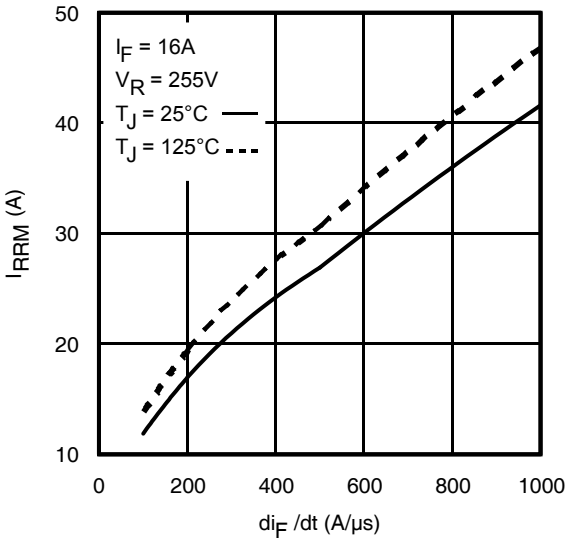


Fig 14. Typical Recovery Current vs. dif/dt

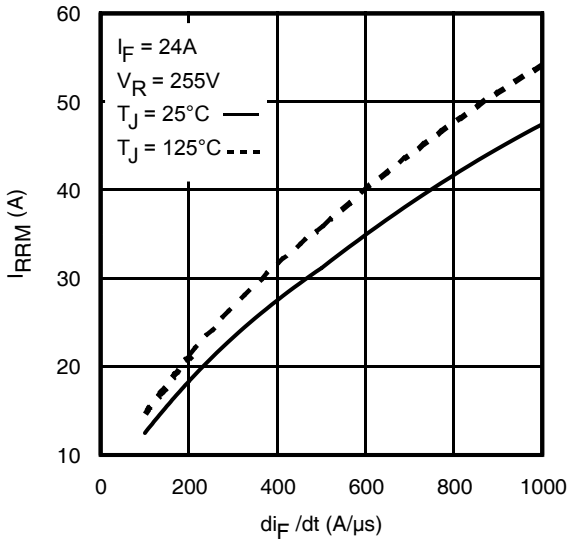


Fig 15. Typical Recovery Current vs. dif/dt

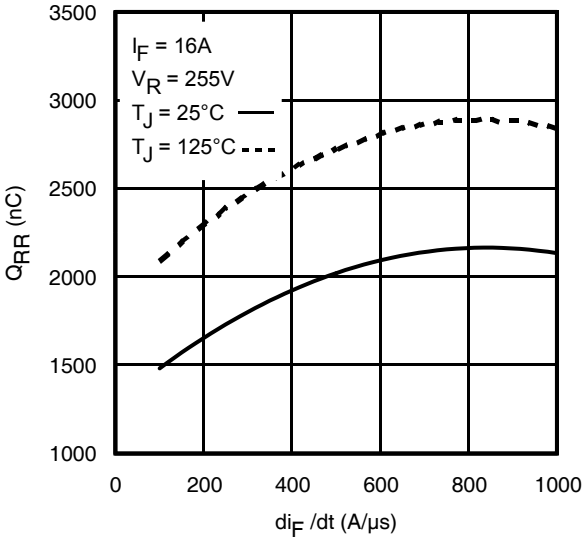


Fig 16. Typical Stored Charge vs. dif/dt

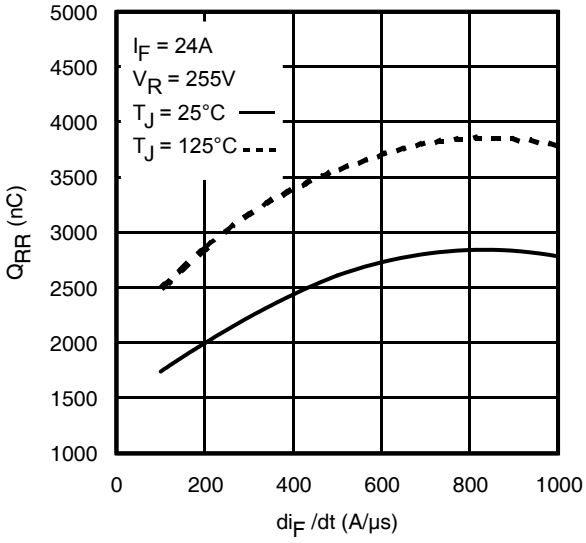


Fig 17. Typical Stored Charge vs. dif/dt

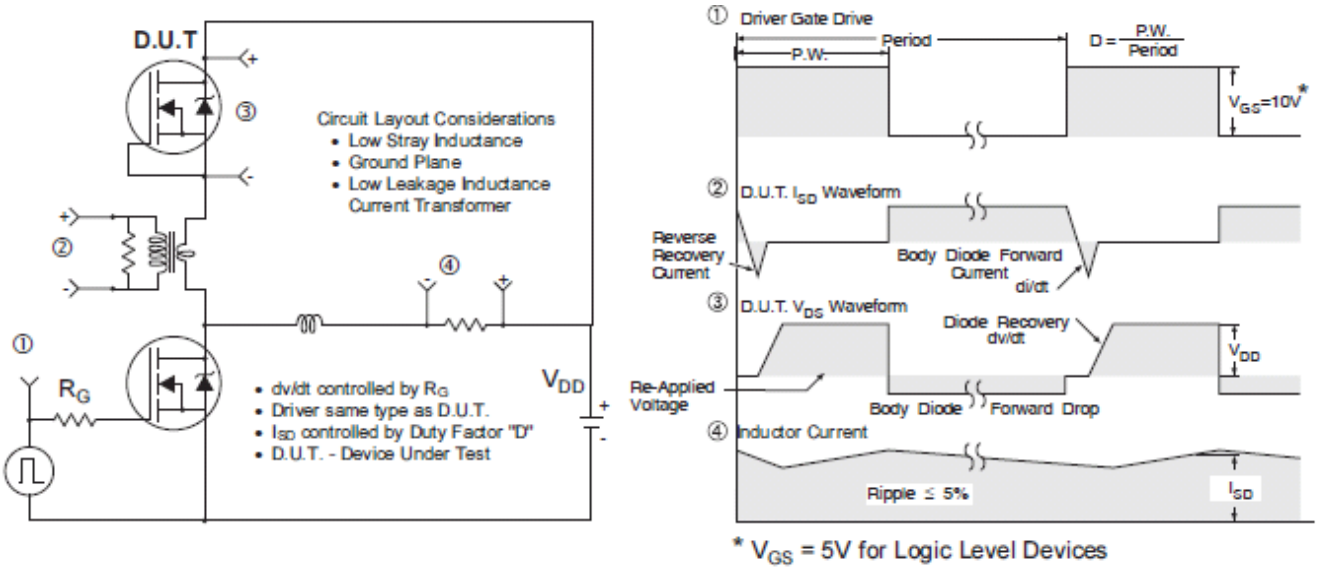


Fig 18. Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs

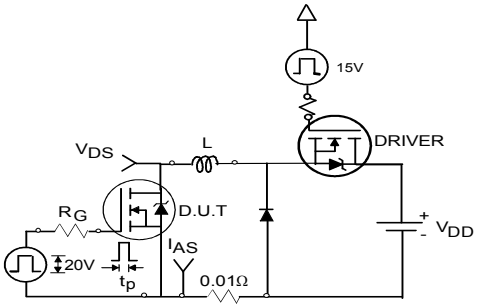


Fig 19a. Unclamped Inductive Test Circuit

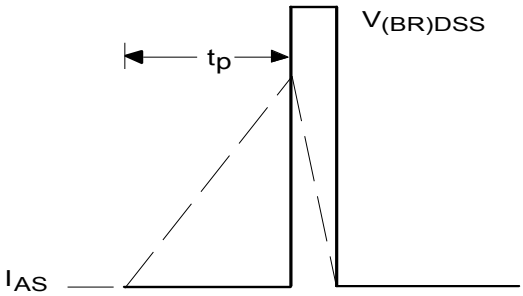


Fig 19b. Unclamped Inductive Waveforms

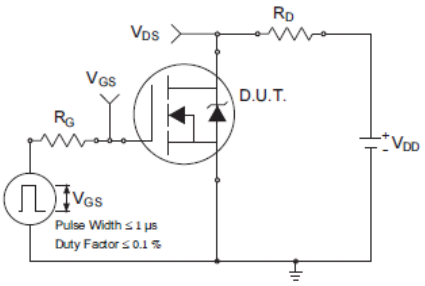


Fig 20a. Switching Time Test Circuit

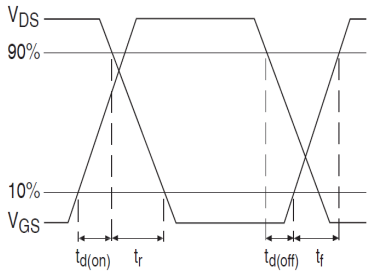


Fig 20b. Switching Time Waveforms

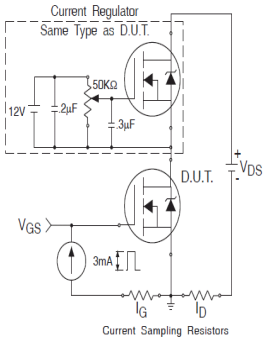


Fig 21a. Gate Charge Test Circuit

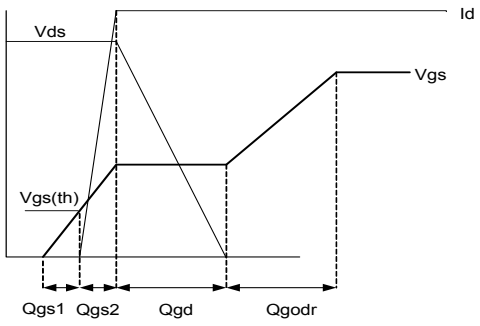
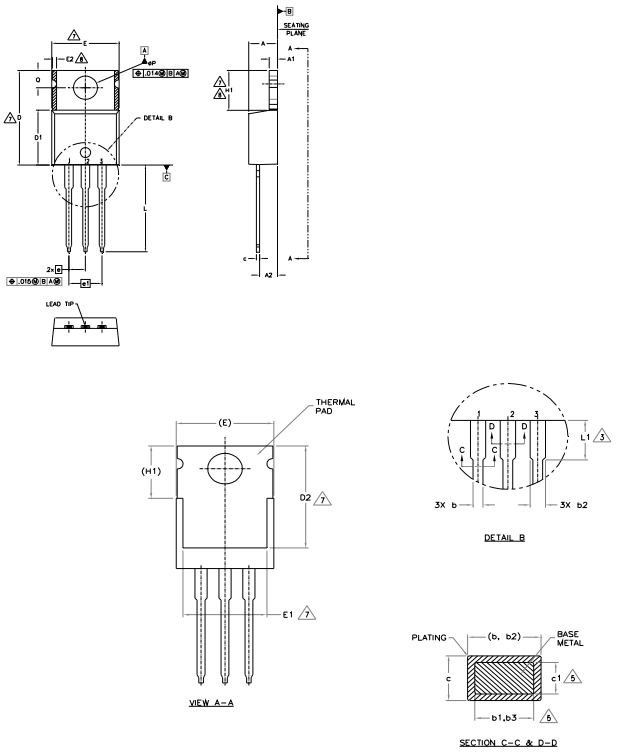


Fig 21b. Gate Charge Waveform

TO-220AB Package Outline (Dimensions are shown in millimeters (inches))



NOTES:

1.– DIMENSIONING AND TOLERANCING AS PER ASME Y14.5 M– 1994.
2.– DIMENSIONS ARE SHOWN IN INCHES [MILLIMETERS].
3.– LEAD DIMENSION AND FINISH UNCONTROLLED IN L1.
4.– DIMENSION D, D1 & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .005" (0.127) PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
5.– DIMENSION b1, b3 & c1 APPLY TO BASE METAL ONLY.
6.– CONTROLLING DIMENSION : INCHES.
7.– THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS E,H1,D2 & E1
8.– DIMENSION E2 X H1 DEFINE A ZONE WHERE STAMPING AND SINGULATION IRREGULARITIES ARE ALLOWED.
9.– OUTLINE CONFORMS TO JEDEC TO-220, EXCEPT A2 (max.) AND D2 (min.) WHERE DIMENSIONS ARE DERIVED FROM THE ACTUAL PACKAGE OUTLINE.

SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	3.56	4.83	.140	.190	
A1	0.51	1.40	.020	.055	
A2	2.03	2.92	.080	.115	
b	0.38	1.01	.015	.040	
b1	0.38	0.97	.015	.038	5
b2	1.14	1.78	.045	.070	
b3	1.14	1.73	.045	.068	5
c	0.36	0.61	.014	.024	
c1	0.36	0.56	.014	.022	5
D	14.22	16.51	.560	.650	4
D1	8.38	9.02	.330	.355	
D2	11.68	12.88	.460	.507	7
E	9.65	10.67	.380	.420	4,7
E1	6.86	8.89	.270	.350	7
E2	–	0.76	–	.030	8
e	2.54 BSC		.100 BSC		
e1	5.08 BSC		.200 BSC		
H1	5.84	6.86	.230	.270	7,8
L	12.70	14.73	.500	.580	
L1	3.56	4.06	.140	.160	3
øP	3.54	4.08	.139	.161	
Q	2.54	3.42	.100	.135	

LEAD ASSIGNMENTS

HEXFET
1.– GATE
2.– DRAIN
3.– SOURCE

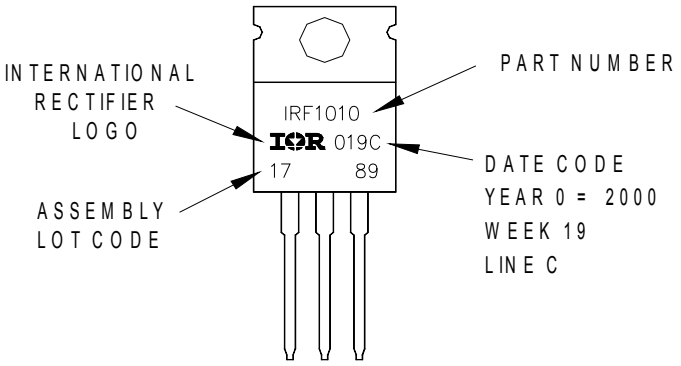
IGBTs, CoPACK
1.– GATE
2.– COLLECTOR
3.– EMITTER

DIODES
1.– ANODE
2.– CATHODE
3.– ANODE

TO-220AB Part Marking Information

EXAMPLE: THIS IS AN IRF1010
LOT CODE 1789
ASSEMBLED ON WW 19, 2000
IN THE ASSEMBLY LINE "C"

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



TO-220AB packages are not recommended for Surface Mount Application.

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

Qualification Information†

Qualification Level	Industrial (per JEDEC JESD47F) ††	
Moisture Sensitivity Level	TO-220	N/A
RoHS Compliant	Yes	

† Qualification standards can be found at International Rectifier's web site: http://www.irf.com/product-info/reliability/

†† Applicable version of JEDEC standard at the time of product release.

Data and specifications subject to change without notice.

International
IOR Rectifier

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