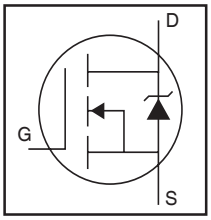
International
IOR Rectifier

IRFB4115PbF

HEXFET® Power MOSFET

Applications

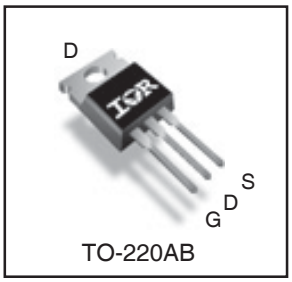
- High Efficiency Synchronous Rectification in SMPS
- Uninterruptible Power Supply
- High Speed Power Switching
- Hard Switched and High Frequency Circuits



V_{DSS}	150V
$R_{DS(on)}$ typ.	9.3mΩ
max.	11mΩ
I_D (Silicon Limited)	104A

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, Halogen-Free



TO-220AB

G	D	S
Gate	Drain	Source

Base Part Number	Package Type	Standard Pack		Orderable Part Number
		Form	Quantity	
IRFB4115PbF	TO-220	Tube	50	IRFB4115PbF

Absolute Maximum Ratings

Symbol	Parameter	Max.	Units
I_D @ T_C = 25°C	Continuous Drain Current, V_{GS} @ 10V	104	A
I_D @ T_C = 100°C	Continuous Drain Current, V_{GS} @ 10V	74	
I_{DM}	Pulsed Drain Current ①	420	
P_D @T_C = 25°C	Maximum Power Dissipation	380	W
	Linear Derating Factor	2.5	W/°C
V_{GS}	Gate-to-Source Voltage	± 20	V
dv/dt	Peak Diode Recovery ③	18	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	10lb·in (1.1N·m)	

Avalanche Characteristics

$E_{AS\ (Thermally\ limited)}$	Single Pulse Avalanche Energy ②	830	mJ

Thermal Resistance

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case ⑧	—	0.40	°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)

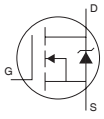
Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	150	—	—	V	V_{GS} = 0V, I_D = 250µA
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.18	—	V/°C	Reference to 25°C, I_D = 3.5mA①
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	9.3	11	mΩ	V_{GS} = 10V, I_D = 62A 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} = 150V, V_{GS} = 0V
		—	—	250		V_{DS} = 150V, 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	Internal Gate Resistance	—	2.3	—	Ω	

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

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
gfs	Forward Transconductance	97	—	—	S	V_{DS} = 50V, I_D = 62A
Q_g	Total Gate Charge	—	77	120	nC	I_D = 62A
Q_{gs}	Gate-to-Source Charge	—	28	—		V_{DS} = 75V
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	26	—		V_{GS} = 10V ④
Q_{sync}	Total Gate Charge Sync. (Q_g - Q_{gd})	—	51	—		I_D = 62A, V_{DS} =0V, V_{GS} = 10V
$t_{d(on)}$	Turn-On Delay Time	—	18	—	ns	V_{DD} = 98V
t_r	Rise Time	—	73	—		I_D = 62A
$t_{d(off)}$	Turn-Off Delay Time	—	41	—		R_G = 2.2Ω
t_f	Fall Time	—	39	—		V_{GS} = 10V ④
C_{iss}	Input Capacitance	—	5270	—	pF	V_{GS} = 0V
C_{oss}	Output Capacitance	—	490	—		V_{DS} = 50V
C_{rss}	Reverse Transfer Capacitance	—	105	—		f = 1.0 MHz, See Fig. 5
C_{oss} eff. (ER)	Effective Output Capacitance (Energy Related)	—	460	—		V_{GS} = 0V, V_{DS} = 0V to 120V ⑥, See Fig. 11
C_{oss} eff. (TR)	Effective Output Capacitance (Time Related)	—	530	—		V_{GS} = 0V, V_{DS} = 0V to 120V ⑤

Diode Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	104	A	MOSFET symbol showing the integral reverse p-n junction diode.
I_{SM}	Pulsed Source Current (Body Diode) ②	—	—	420	A	
V_{SD}	Diode Forward Voltage	—	—	1.3	V	T_J = 25°C, I_S = 62A, V_{GS} = 0V ④
t_{rr}	Reverse Recovery Time	—	86	—	ns	T_J = 25°C V_R = 130V,
		—	110	—		T_J = 125°C I_F = 62A
Q_{rr}	Reverse Recovery Charge	—	300	—	nC	T_J = 25°C di/dt = 100A/µs ④
		—	450	—		T_J = 125°C
I_{RRM}	Reverse Recovery Current	—	6.5	—	A	T_J = 25°C
t_{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				



Notes:

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

② Recommended max EAS limit, starting T_J = 25°C, L = 0.17mH, R_G = 25Ω, I_{AS} = 100A, V_{GS} =15V.

③ I_{SD} ≤ 62A, di/dt ≤ 1040A/µs, V_{DD} ≤ $V_{(BR)DSS}$, T_J ≤ 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 R_θ is measured at T_J approximately 90°C.

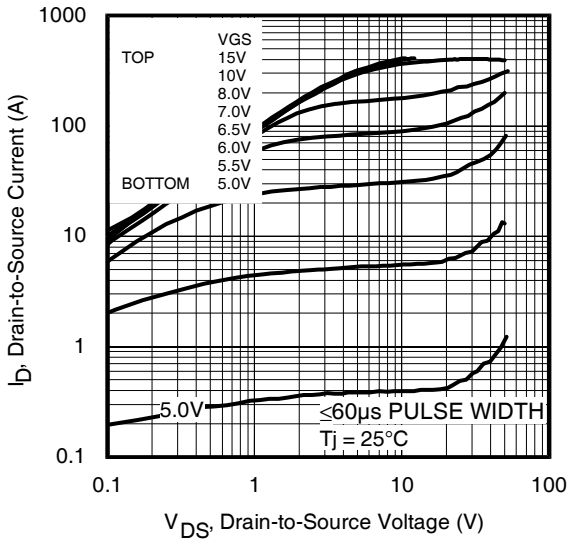


Fig 1. Typical Output Characteristics

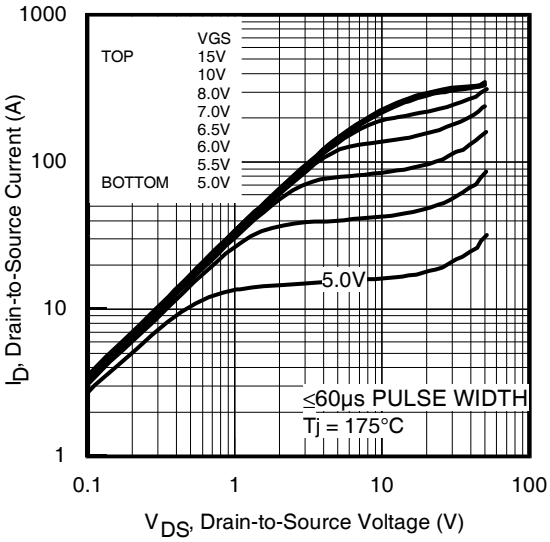


Fig 2. Typical Output Characteristics

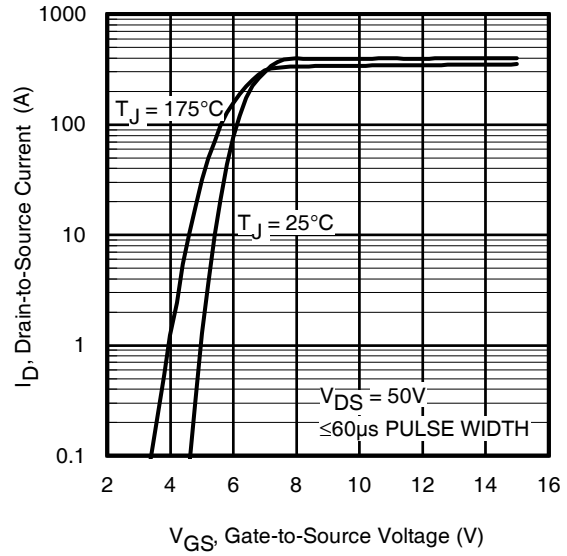


Fig 3. Typical Transfer Characteristics

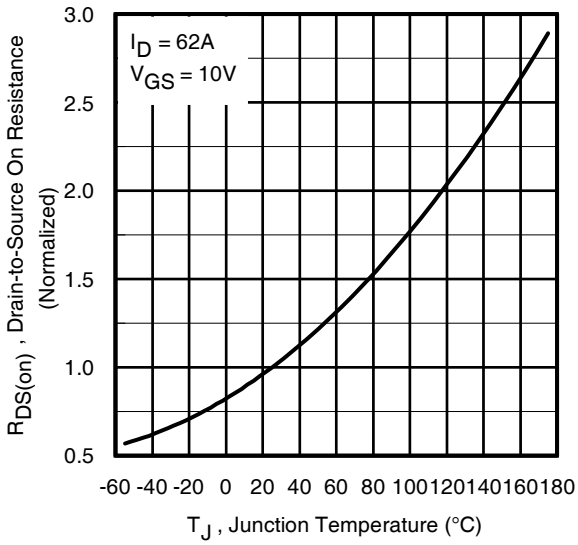


Fig 4. Normalized On-Resistance vs. Temperature

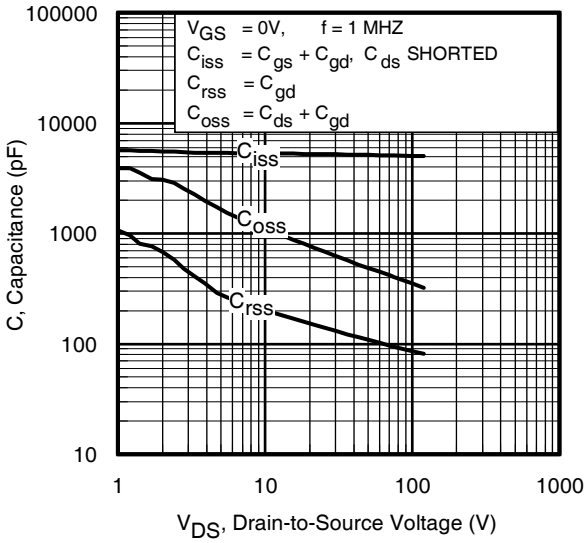


Fig 5. Typical Capacitance vs. Drain-to-Source Voltage

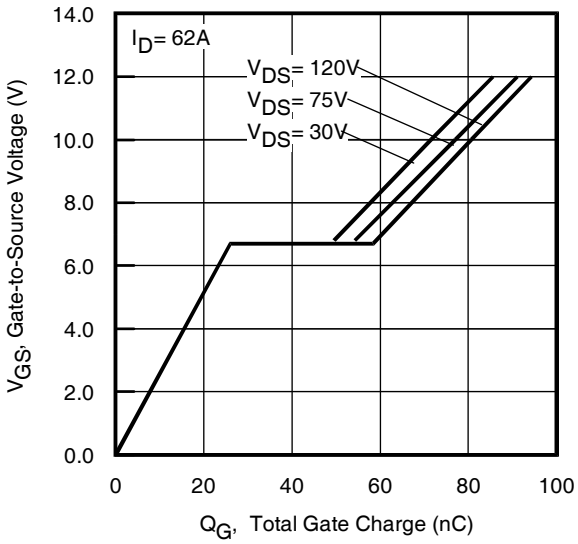


Fig 6. Typical Gate Charge vs. Gate-to-Source Voltage

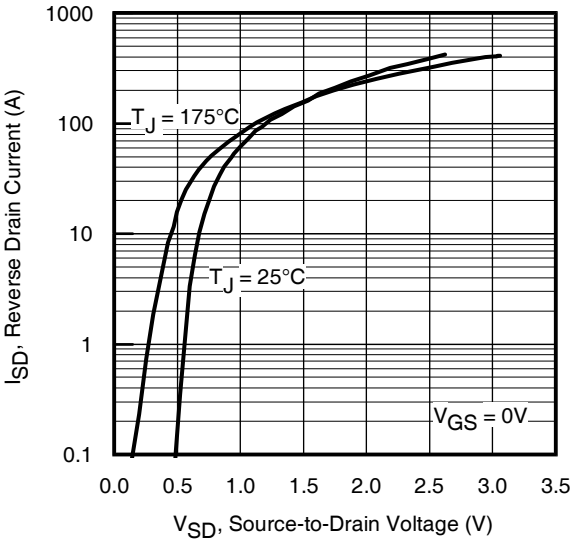


Fig 7. Typical Source-Drain Diode Forward Voltage

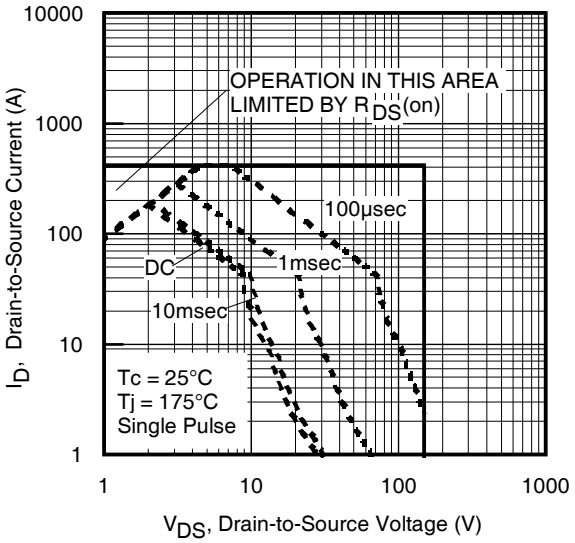


Fig 8. Maximum Safe Operating Area

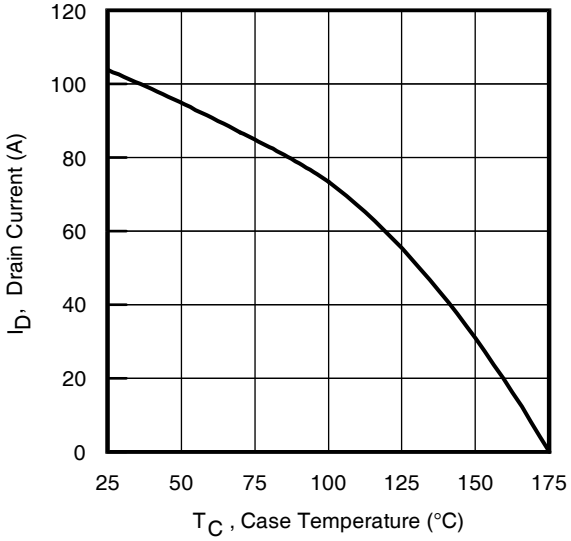


Fig 9. Maximum Drain Current vs. Case Temperature

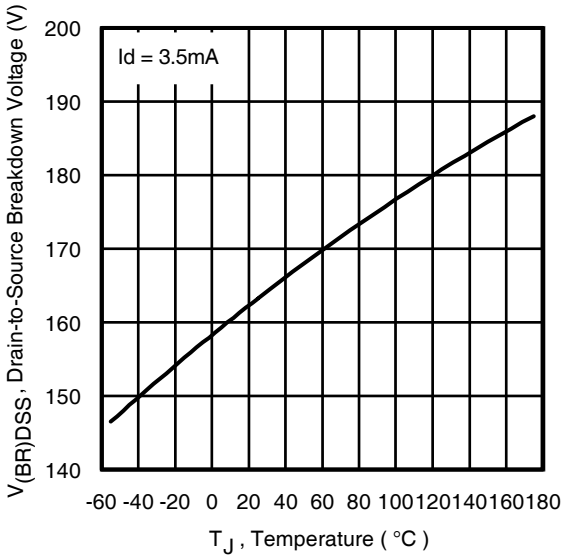


Fig 10. Drain-to-Source Breakdown Voltage

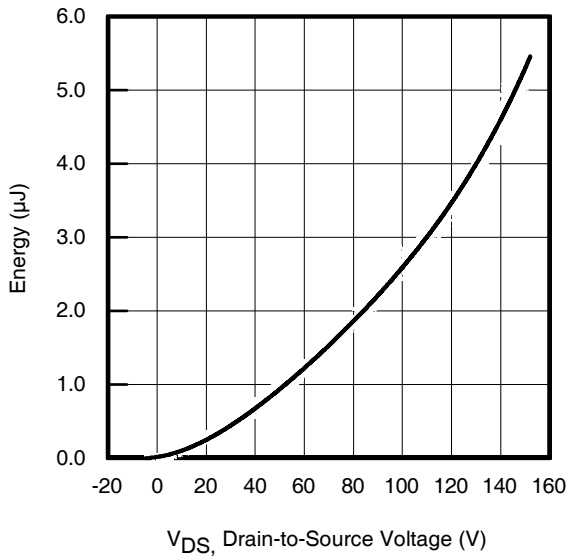


Fig 11. Typical C_{OSS} Stored Energy

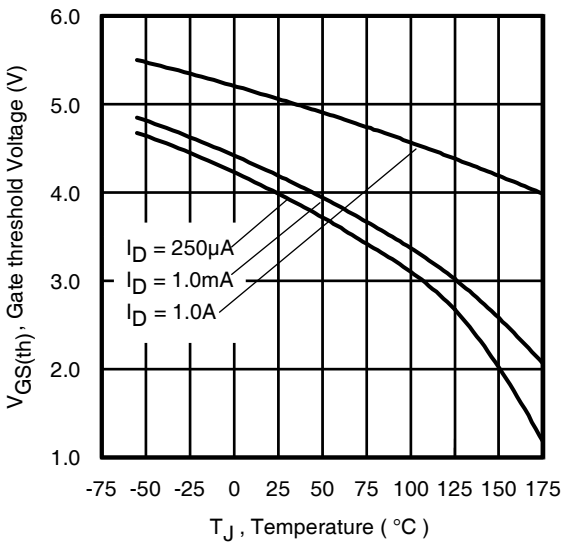


Fig 12. Threshold Voltage vs. Temperature

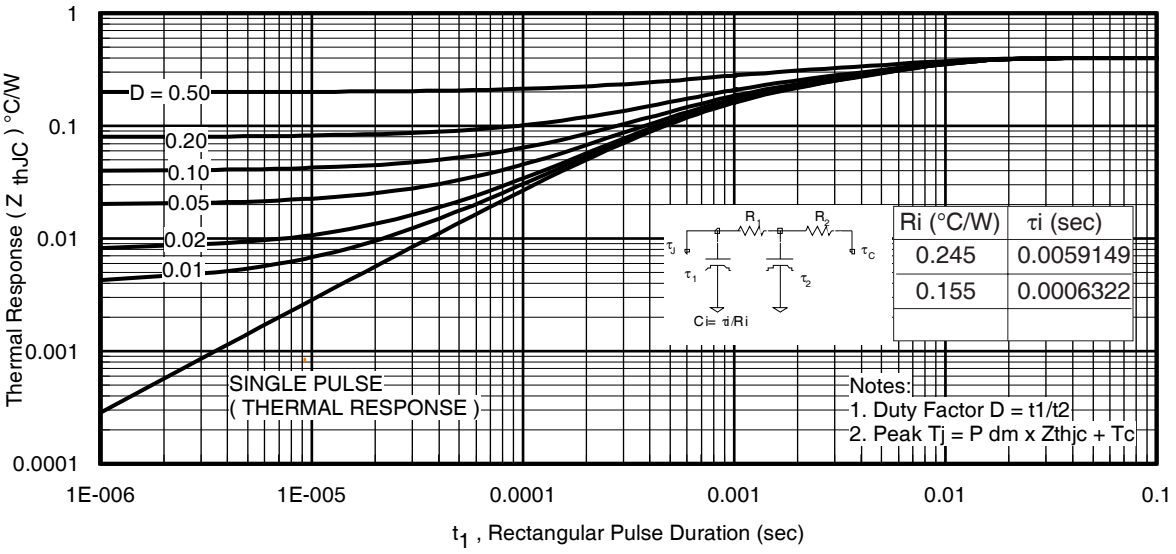


Fig 13. Maximum Effective Transient Thermal Impedance, Junction-to-Case

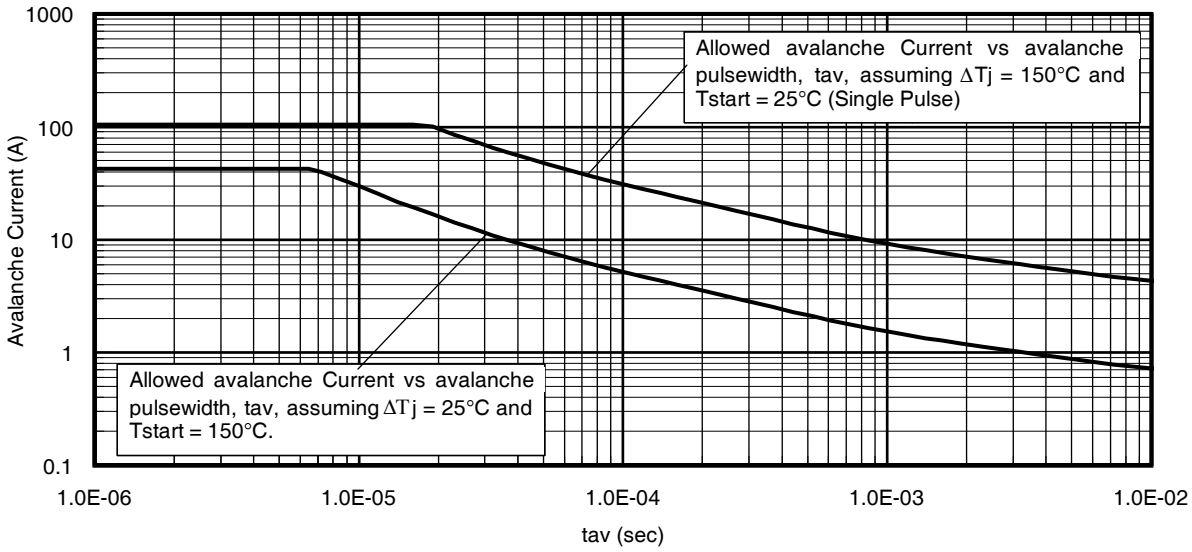


Fig 14. Typical Avalanche Current vs.Pulsewidth

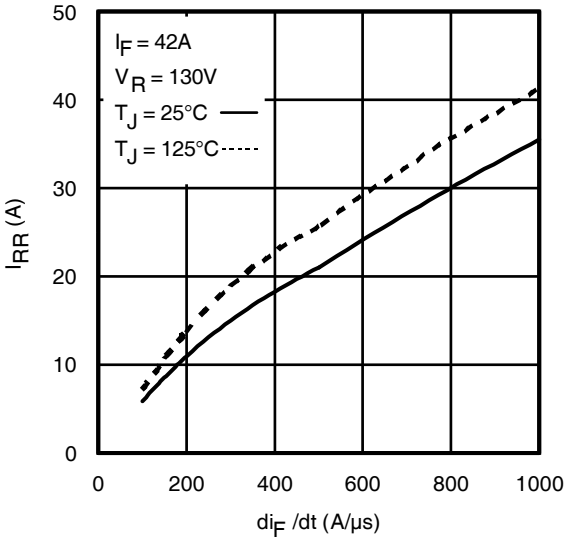


Fig 15. - Typical Recovery Current vs. di_f/dt

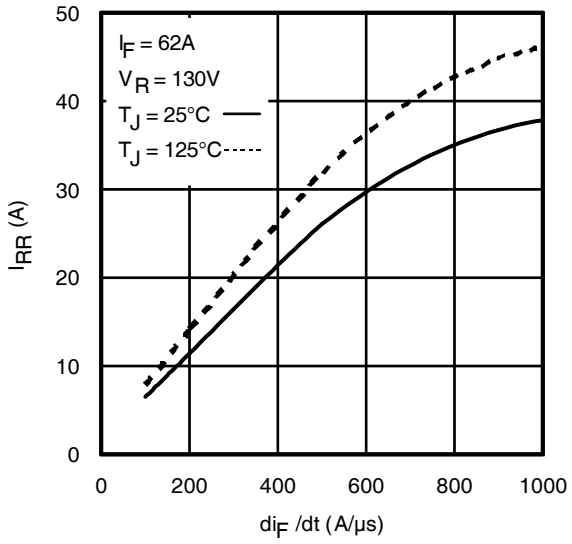


Fig 16. - Typical Recovery Current vs. di_f/dt

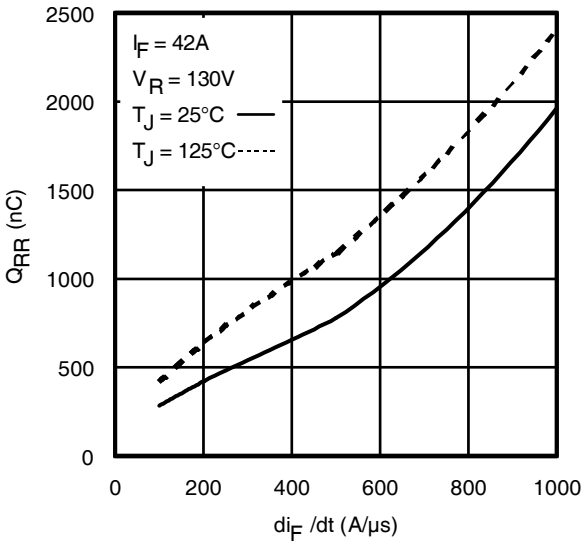


Fig 17. - Typical Stored Charge vs. di_f/dt

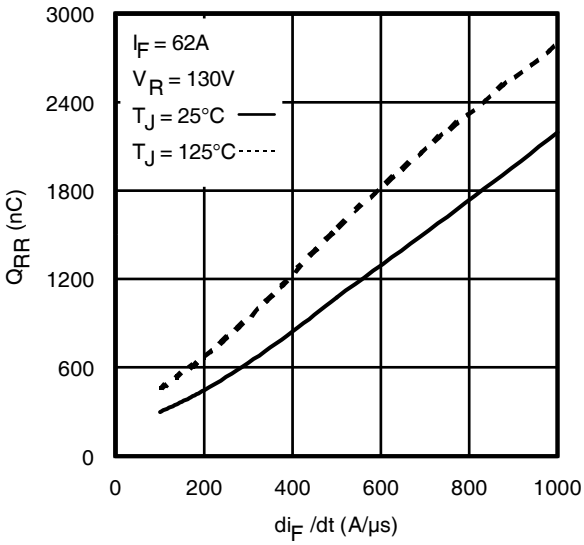


Fig 18. - Typical Stored Charge vs. di_f/dt

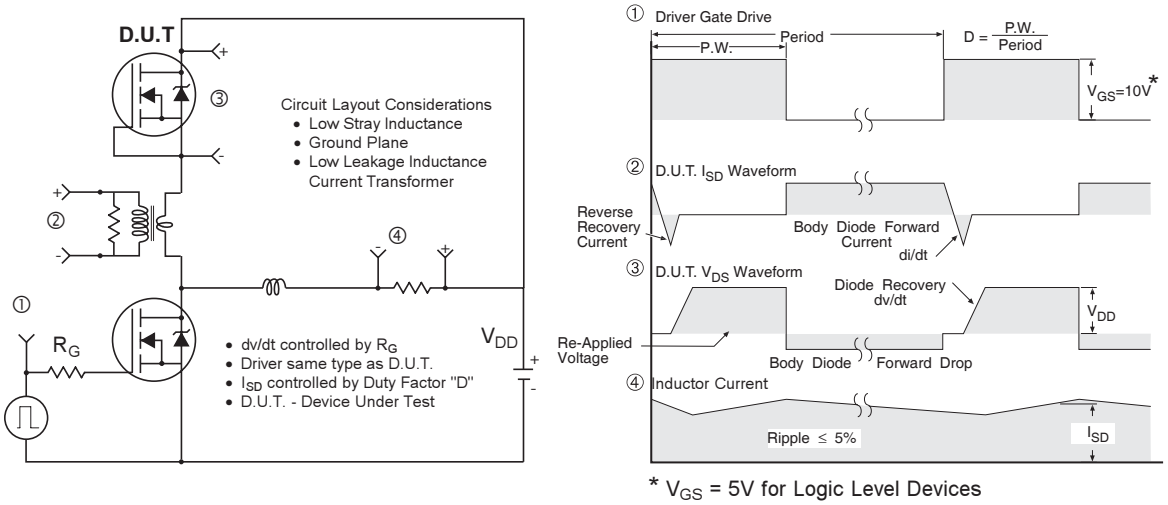


Fig 19. Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs

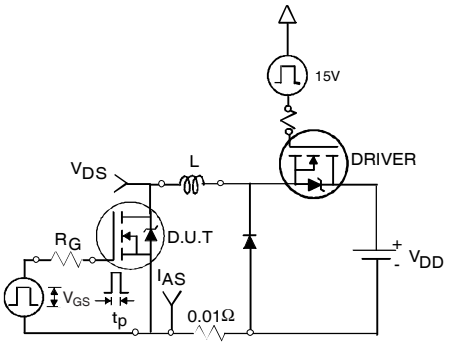


Fig 20a. Unclamped Inductive Test Circuit

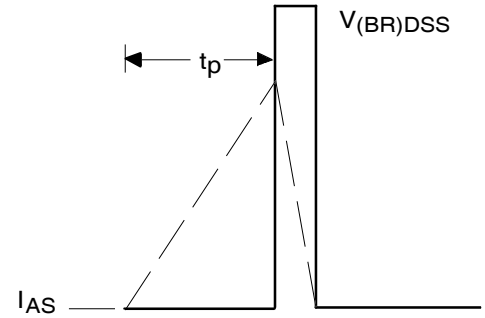


Fig 20b. Unclamped Inductive Waveforms

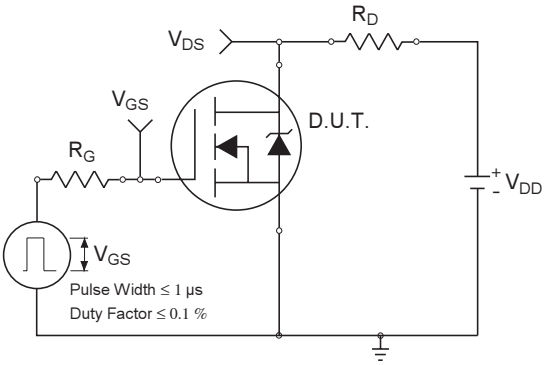


Fig 21a. Switching Time Test Circuit

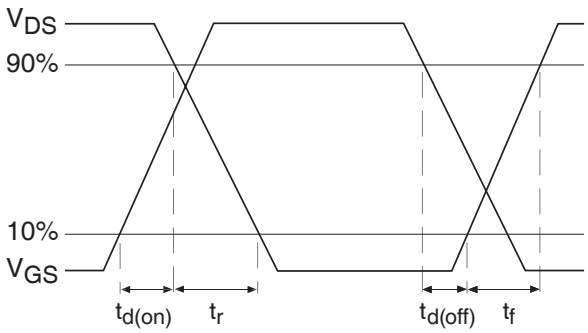


Fig 21b. Switching Time Waveforms

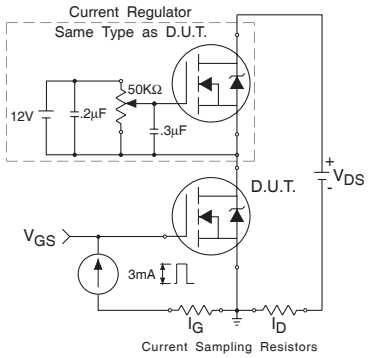


Fig 22a. Gate Charge Test Circuit

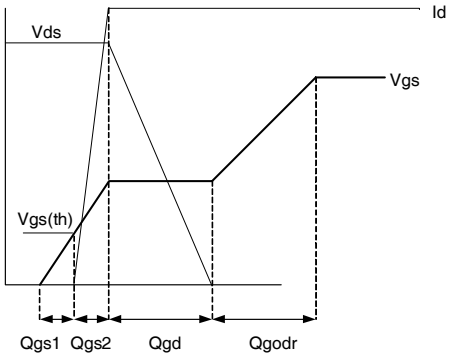
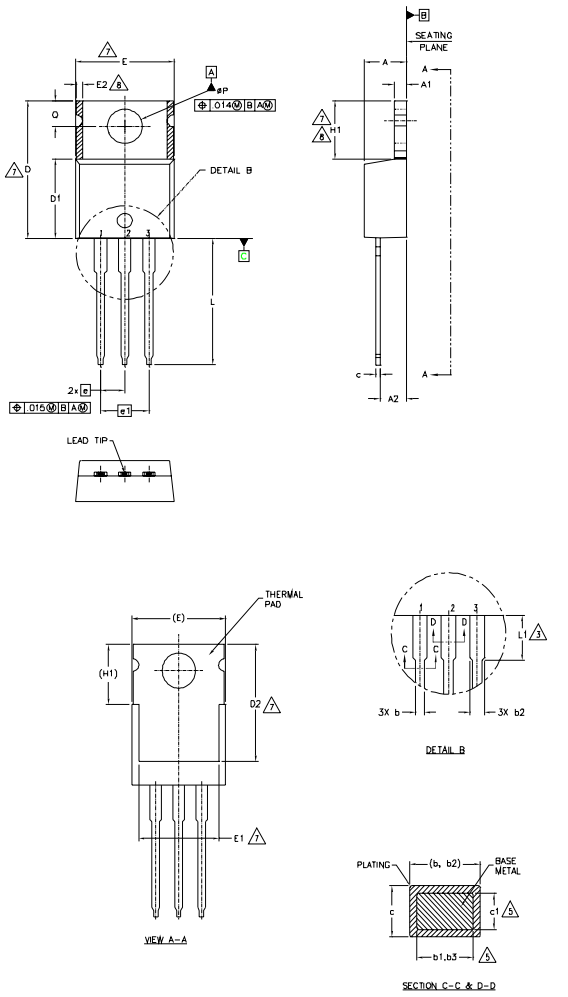


Fig 22b. Gate Charge Waveform

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	1.14	1.40	.045	.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	

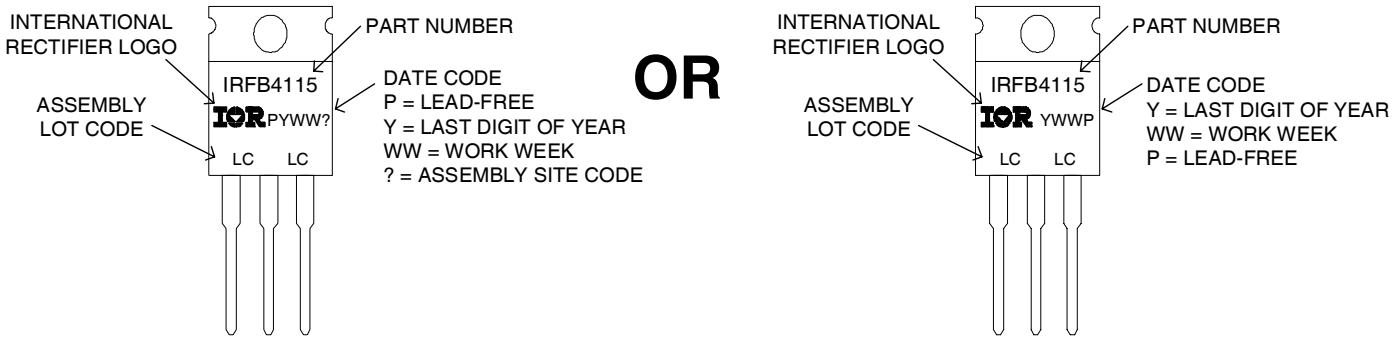
LEAD ASSIGNMENTS

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



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†† guidelines)	
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.

Revision History

Date	Comment
4/28/2014	• Updated data sheet with new IR corporate template. • Updated package outline & part marking on page 7. • Added bullet point in the Benefits "RoHS Compliant, Halogen -Free" on page 1. • Updated typo on the Fig.16 and Fig.17, unit of Y-axis from "A" to "nC" on page 5.
11/6/2014	• Added Fig 14 - Typical Avalanche Current vs Pulsewidth on page 5.

International
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