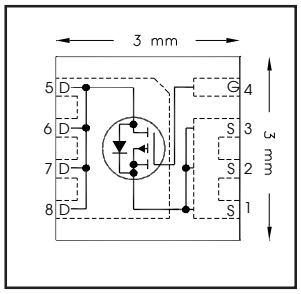
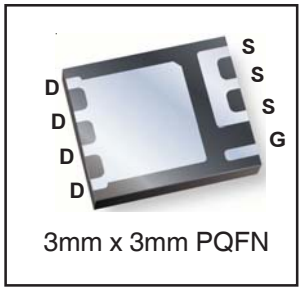
IRFHM9331PbF

HEXFET® Power MOSFET

V_{DS}	-30	V
$R_{DS(on)\ max}$ (@V_{GS} = -10V)	14.6	mΩ
$Q_{g\ (typical)}$	32	nC
I_D (@T_A = 25°C)	-11	A





3mm x 3mm PQFN

Applications

- System/load switch

Features and Benefits

Features		Benefits
Low Thermal Resistance to PCB (<6.0°C/W)		Enable better thermal dissipation
Compatible with Existing Surface Mount Techniques	results in	Easier Manufacturing
RoHS Compliant Containing no Lead, no Bromide and no Halogen	⇒	Environmentally Friendlier
MSL1, Consumer Qualification		Increased Reliability

Orderable part number	Package Type	Standard Pack		Note
		Form	Quantity	
IRFHM9331TRPbF	PQFN 3mm x 3mm	Tape and Reel	4000	
~~IRFHM9331TR2PbF~~	~~PQFN 3mm x 3mm~~	~~Tape and Reel~~	~~400~~	EOL notice # 259

Absolute Maximum Ratings

	Parameter	Max.	Units
V_{DS}	Drain-to-Source Voltage	-30	V
V_{GS}	Gate-to-Source Voltage	± 25	
I_D @ T_A = 25°C	Continuous Drain Current, V_{GS} @ -10V	-11	A
I_D @ T_A = 70°C	Continuous Drain Current, V_{GS} @ -10V	-9	
I_D @ T_C = 25°C	Continuous Drain Current, V_{GS} @ -10V	-24⑦	
I_D @ T_C = 70°C	Continuous Drain Current, V_{GS} @ -10V	-24	
I_{DM}	Pulsed Drain Current ①	-90	
P_D @T_A = 25°C	Power Dissipation ④	2.8	W
P_D @ T_A = 70°C	Power Dissipation ④	1.8	
	Linear Derating Factor	0.02	W/°C
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 150	°C

Notes ① through ⑦ are on page 2

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
BV_{DSS}	Drain-to-Source Breakdown Voltage	-30	—	—	V	V_{GS} = 0V, I_D = -250µA
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.02	—	V/°C	Reference to 25°C, I_D = -1mA
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	10.0	—	mΩ	V_{GS} = -20V, I_D = -11A ③
		—	11.7	14.6		V_{GS} = -10V, I_D = -11A ③
$V_{GS(th)}$	Gate Threshold Voltage	-1.3	-1.8	-2.4	V	V_{DS} = V_{GS}, I_D = -25µA
$\Delta V_{GS(th)}$	Gate Threshold Voltage Coefficient	—	-5.1	—	mV/°C	
I_{DSS}	Drain-to-Source Leakage Current	—	—	-1.0	µA	V_{DS} = -24V, V_{GS} = 0V
		—	—	-150		V_{DS} = -24V, V_{GS} = 0V, T_J = 125°C
I_{GSS}	Gate-to-Source Forward Leakage	—	—	-10	µA	V_{GS} = -25V
	Gate-to-Source Reverse Leakage	—	—	10		V_{GS} = 25V
gfs	Forward Transconductance	16	—	—	S	V_{DS} = -10V, I_D = -9.0A
Q_g	Total Gate Charge ⑥	—	16	—	nC	V_{DS} = -15V,V_{GS} = -4.5V,I_D = - 9.0A
Q_g	Total Gate Charge ⑥	—	32	48	nC	V_{GS} = -10V
Q_{gs}	Gate-to-Source Charge ⑥	—	4.4	—		V_{DS} = -15V
Q_{gd}	Gate-to-Drain Charge ⑥	—	8	—		I_D = -9.0A
R_G	Gate Resistance ⑥	—	16	—	Ω	
$t_{d(on)}$	Turn-On Delay Time	—	11	—	ns	V_{DD} = -15V, V_{GS} = -4.5V ③
t_r	Rise Time	—	27	—		I_D = -1.0A
$t_{d(off)}$	Turn-Off Delay Time	—	72	—		R_G = 6.8Ω
t_f	Fall Time	—	60	—		See Figs. 19a & 19b
C_{iss}	Input Capacitance	—	1543	—	pF	V_{GS} = 0V
C_{oss}	Output Capacitance	—	310	—		V_{DS} = -25V
C_{rss}	Reverse Transfer Capacitance	—	208	—		f = 1.0KHz

Avalanche Characteristics

	Parameter	Typ.	Max.	Units
E_{AS}	Single Pulse Avalanche Energy ②	—	76	mJ
I_{AR}	Avalanche Current ①	—	-9.0	A

Diode Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	-2.8	A	MOSFET symbol showing the integral reverse p-n junction diode.
I_{SM}	Pulsed Source Current (Body Diode) ①	—	—	-90		
V_{SD}	Diode Forward Voltage	—	—	-1.2	V	T_J = 25°C, I_S = -2.8A, V_{GS} = 0V ③
t_{rr}	Reverse Recovery Time	—	64	96	ns	T_J = 25°C, I_F = -2.8A, V_{DD} = -24V
Q_{rr}	Reverse Recovery Charge	—	25	38	nC	di/dt = 100/µs ③

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case ⑤	—	6	°C/W
$R_{\theta JA}$	Junction-to-Ambient ④		45	
$R_{\theta JA}$	Junction-to-Ambient (t<10s) ④	—	30	

Notes:

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

② Starting T_J = 25°C, L = 1.904mH, R_G = 50Ω, I_{AS} = -9A.

③ Pulse width ≤ 400µs; duty cycle ≤ 2%.

④ When mounted on 1 inch square copper board.

⑤ R_θ is measured at T_J of approximately 90°C.

⑥ For DESIGN AID ONLY, not subject to production testing.

⑦ Current limited by package.

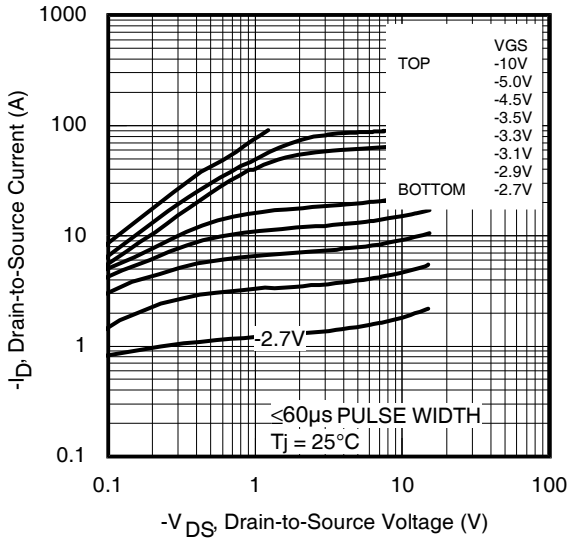


Fig 1. Typical Output Characteristics

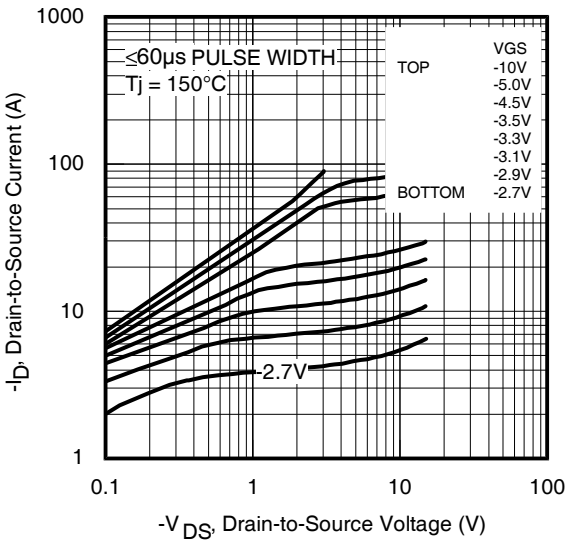


Fig 2. Typical Output Characteristics

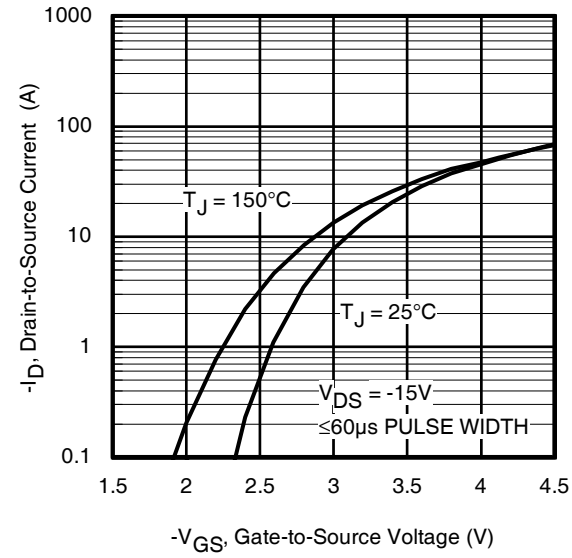


Fig 3. Typical Transfer Characteristics

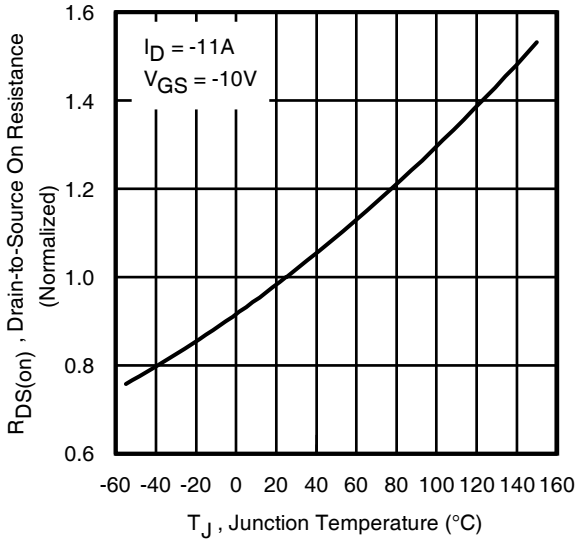


Fig 4. Normalized On-Resistance vs. Temperature

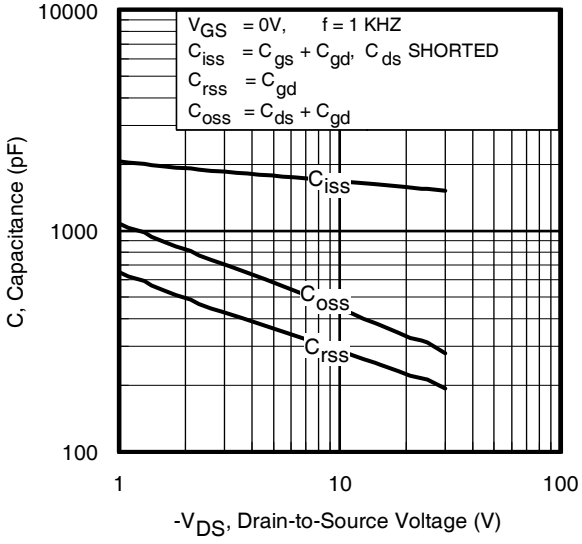


Fig 5. Typical Capacitance vs.Drain-to-Source Voltage

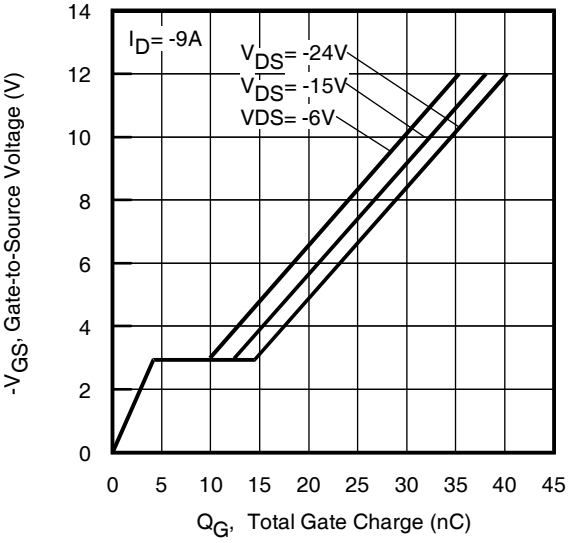


Fig 6. Typical Gate Charge vs.Gate-to-Source Voltage

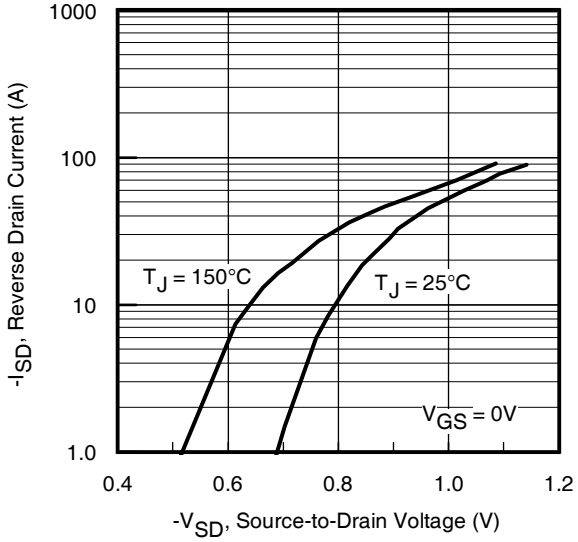


Fig 7. Typical Source-Drain Diode Forward Voltage

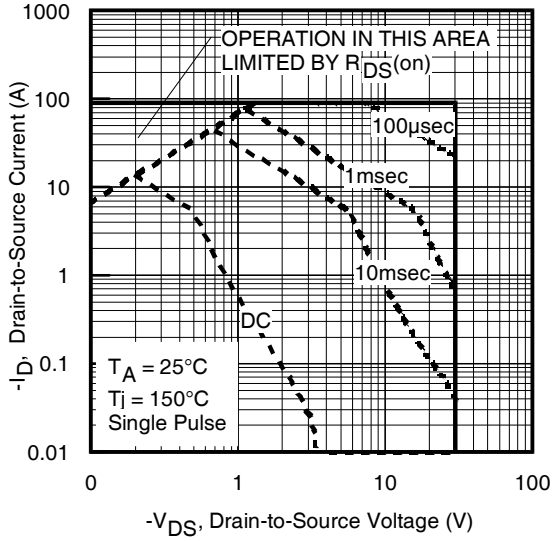


Fig 8. Maximum Safe Operating Area

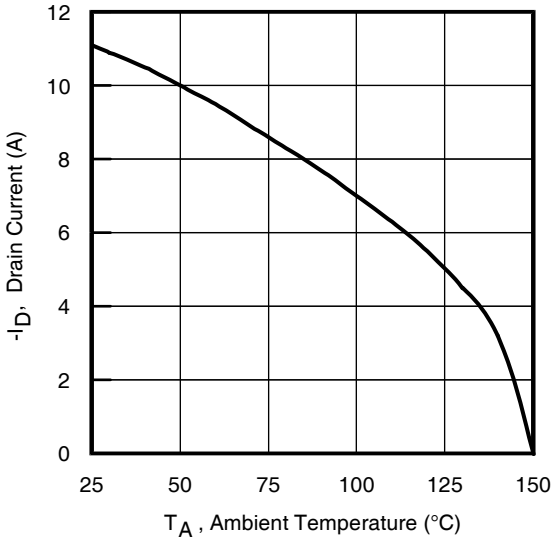


Fig 9. Maximum Drain Current vs. Ambient Temperature

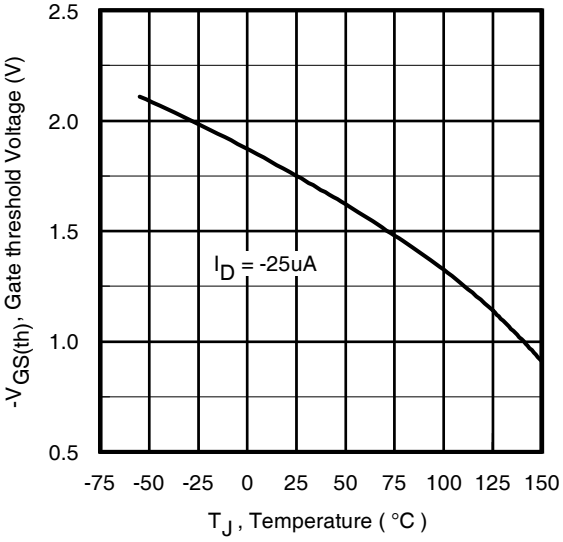


Fig 10. Threshold Voltage vs. Temperature

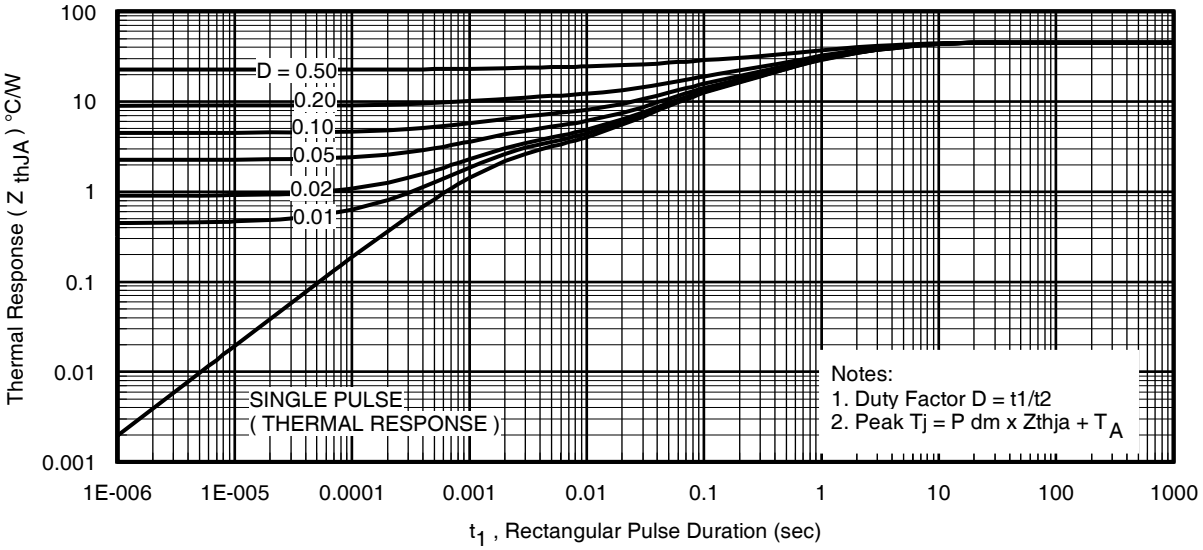


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

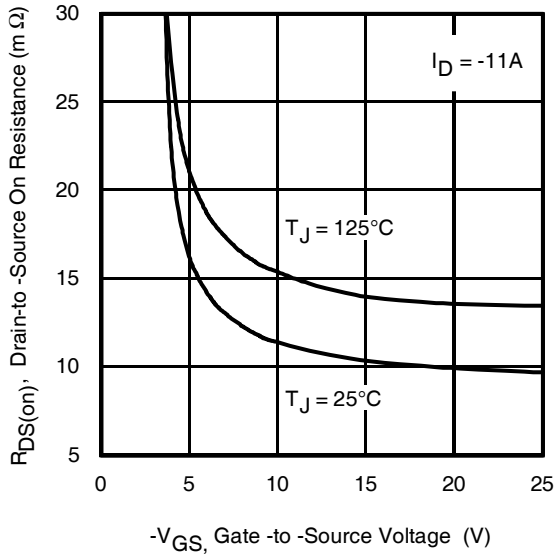


Fig 12. On-Resistance vs. Gate Voltage

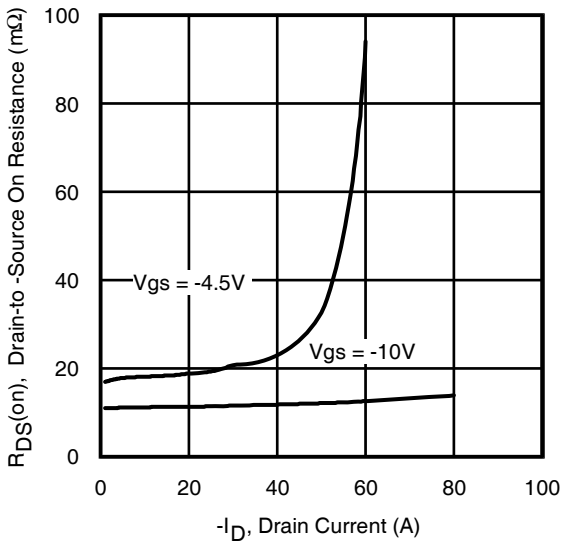


Fig 13. Typical On-Resistance vs. Drain Current

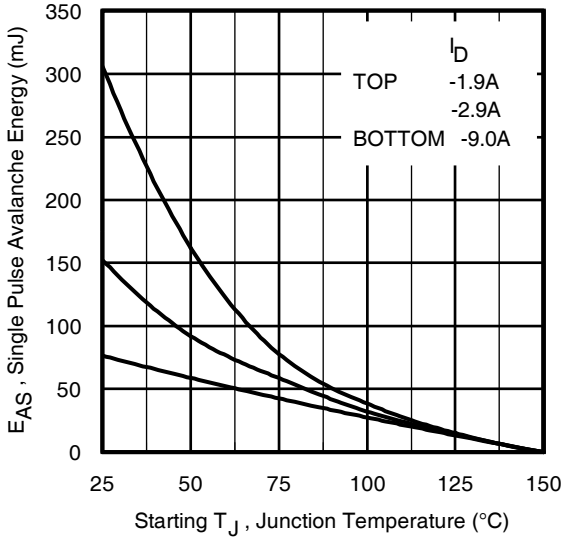


Fig 14. Maximum Avalanche Energy vs. Drain Current

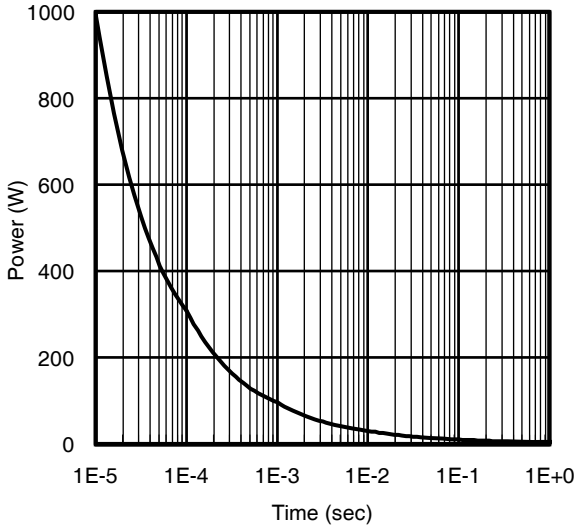
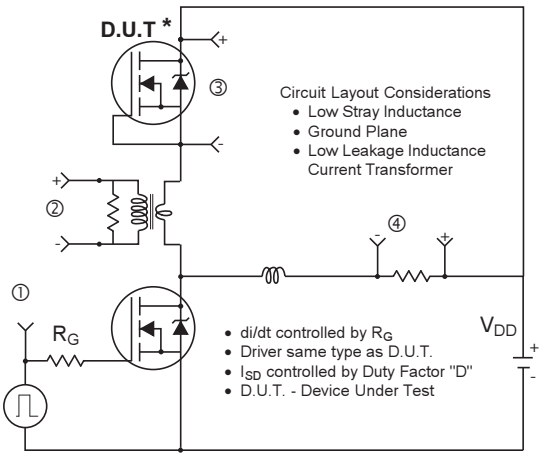
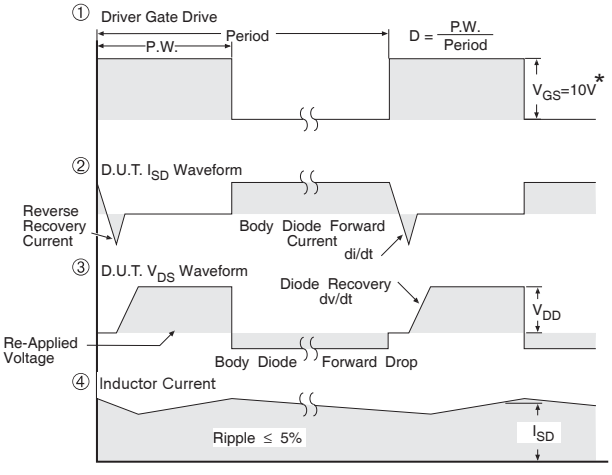


Fig 15. Typical Power vs. Time



* Reverse Polarity of D.U.T for P-Channel



* V_{GS} = 5V for Logic Level Devices

Fig 16. Diode Reverse Recovery Test Circuit for P-Channel HEXFET® Power MOSFETs

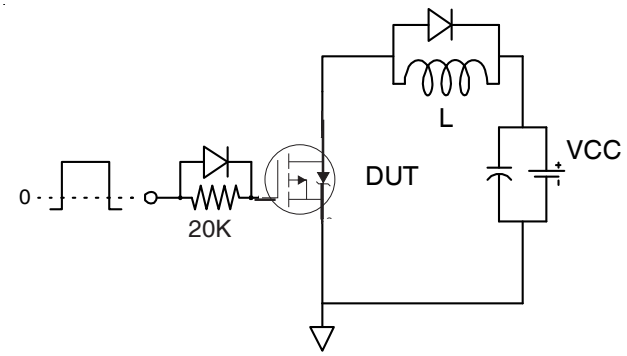


Fig 17a. Gate Charge Test Circuit

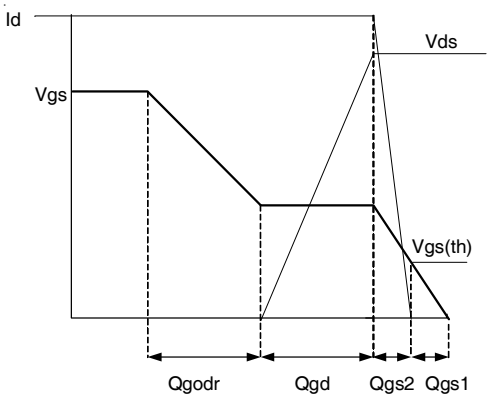


Fig 17b. Gate Charge Waveform

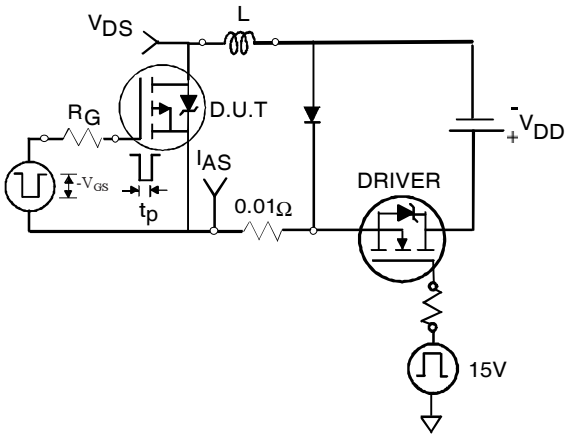


Fig 18a. Unclamped Inductive Test Circuit

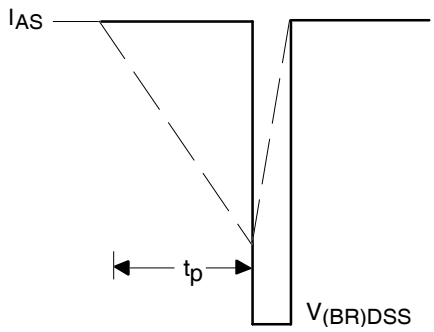


Fig 18b. Unclamped Inductive Waveforms

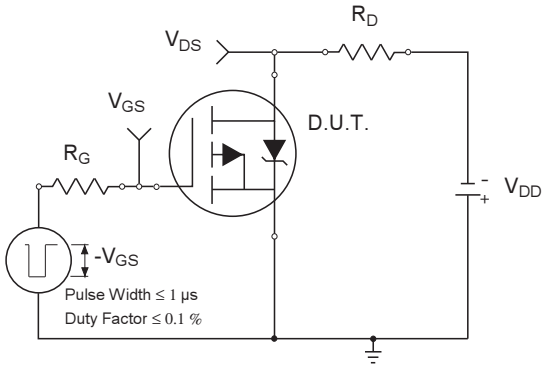


Fig 19a. Switching Time Test Circuit

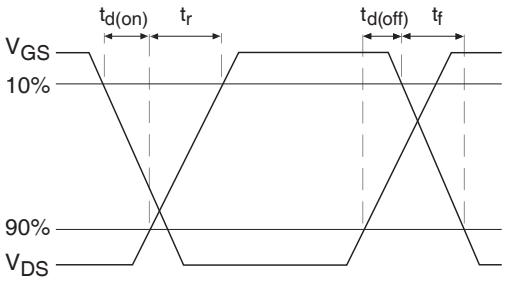
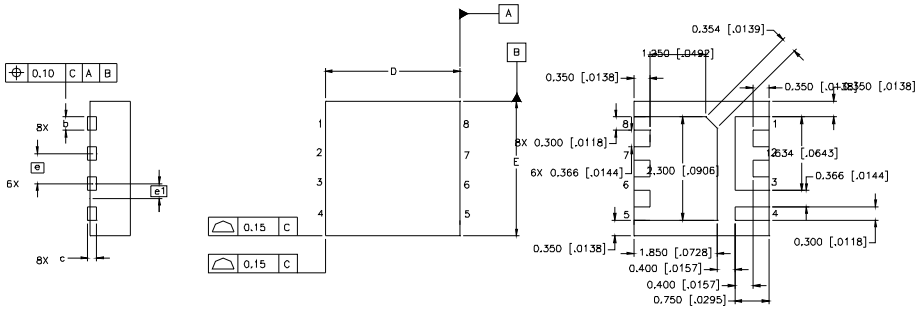


Fig 19b. Switching Time Waveforms

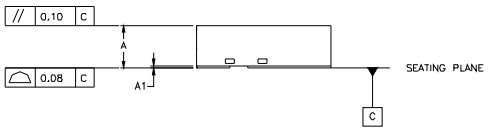
PQFN Package Details



SIDE VIEW

TOP VIEW

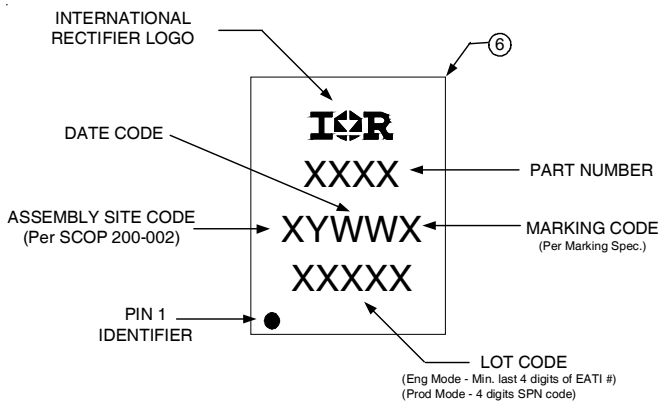
BOTTOM VIEW



FRONT VIEW

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.0315	.0394	0.800	1.000
A1	.0000	.0020	0.000	0.050
b	.0098	.0138	0.250	0.350
c	.0080 REF.		0.203 REF.	
D	.1181 BASIC		3.000 BASIC	
E	.1181 BASIC		3.000 BASIC	
e	.0262 BASIC		0.666 BASIC	
e1	.0131 BASIC		0.333 BASIC	

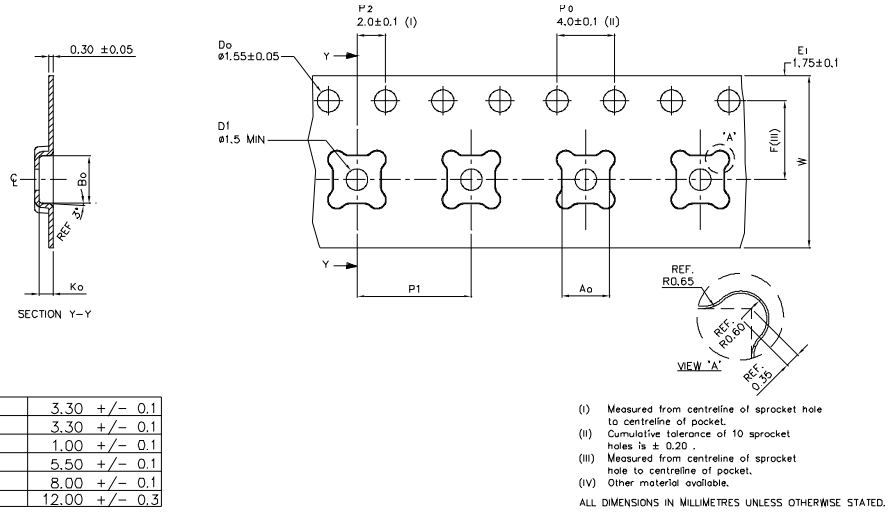
PQFN Part Marking



TOP MARKING (LASER)

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

PQFN Tape and Reel



Ao	3.30 +/- 0.1
Bo	3.30 +/- 0.1
Ko	1.00 +/- 0.1
F	5.50 +/- 0.1
P1	8.00 +/- 0.1
W	12.00 +/- 0.3

(I) Measured from centreline of sprocket hole to centreline of pocket.
(II) Cumulative tolerance of 10 sprocket holes is ± 0.20 .
(III) Measured from centreline of sprocket hole to centreline of pocket.
(IV) Other material available.

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.

Qualification information†

Qualification level	Consumer†† (per JEDEC JESD47F ††† guidelines)	
Moisture Sensitivity Level	PQFN 3mm x 3mm	MSL1 (per IPC/JEDEC J-STD-020D†††)
RoHS compliant	Yes	

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

†† Higher qualification ratings may be available should the user have such requirements. Please contact your International Rectifier sales representative for further information: http://www.irf.com/whoto-call/salesrep/

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

Revision History

Date	Comments
12/16/2013	• Updated ordering information to reflect the End-Of-life (EOL) of the mini-reel option (EOL notice #259) • Updated data sheet with new IR corporate template

International IOR Rectifier

IR WORLD HEADQUARTERS: 101 N. Sepulveda Blvd., El Segundo, California 90245, USA
To contact International Rectifier, please visit http://www.irf.com/whoto-call/

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