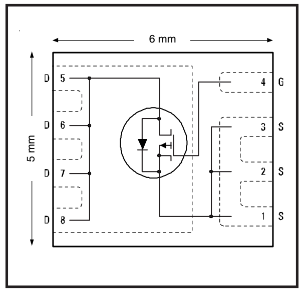
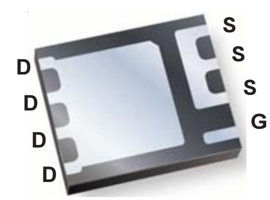
International
IOR Rectifier

IRFH9310PbF

HEXFET® Power MOSFET

V_{DS}	-30	V
$R_{DS(on)}$ max (@V_{GS} = 10V)	4.6	mΩ
Q_g (typical)	110	nC
R_G (typical)	2.8	Ω
I_D (@T_A = 25°C)	-21	A





PQFN
5mm x 6mm

Applications

- Charge and Discharge Switch for Notebook PC Battery Application

Features and Benefits

Features		Resulting Benefits
Low R_{DSon} (≤ 4.6mΩ)	results in ⇒	Lower Conduction Losses
Industry-Standard PQFN Package		Multi-Vendor Compatibility
RoHS Compliant Containing no Lead, no Bromide and no Halogen		Environmentally Friendlier

Orderable part number	Package Type	Standard Pack		Note
		Form	Quantity	
IRFH9310TRPBF	PQFN 5mm x 6mm	Tape and Reel	4000	

Absolute Maximum Ratings

	Parameter	Max.	Units
V_{DS}	Drain-to-Source Voltage	-30	V
V_{GS}	Gate-to-Source Voltage	± 20	V
I_D @ T_A = 25°C	Continuous Drain Current, V_{GS} @ -10V	-21	A
I_D @ T_A = 70°C	Continuous Drain Current, V_{GS} @ -10V	-17	A
I_D @ T_C = 25°C	Continuous Drain Current, V_{GS} @ -10V (Silicon Limited)	-107	A
I_D @ T_C = 70°C	Continuous Drain Current, V_{GS} @ -10V (Silicon Limited)	- 86	A
I_D @ T_C = 25°C	Continuous Drain Current, V_{GS} @ -10V (Package Limited)	-40	A
I_{DM}	Pulsed Drain Current ①	-170	A
P_D @T_A = 25°C	Power Dissipation ④	3.1	W
P_D @ T_A = 70°C	Power Dissipation ④	2.0	W
	Linear Derating Factor	0.025	W/°C
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 150	°C

Notes ① through ⑥ are on page 2

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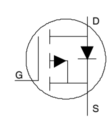
Static @ T_J = 25°C (unless otherwise specified)

	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	——	0.020	——	V/°C	Reference to 25°C, I_D = -1mA
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	——	3.7	4.6	mΩ	V_{GS} = -10V, I_D = -21A ③
		——	5.7	7.1		V_{GS} = -4.5V, I_D = -17A ③
$V_{GS(th)}$	Gate Threshold Voltage	-1.3	-1.9	-2.4	V	V_{DS} = V_{GS}, I_D = -100μA
$\Delta V_{GS(th)}$	Gate Threshold Voltage Coefficient	——	-5.8	——	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	——	——	-100	nA	V_{GS} = -20V
	Gate-to-Source Reverse Leakage	——	——	100		V_{GS} = 20V
gfs	Forward Transconductance	39	——	——	S	V_{DS} = -10V, I_D = -17A
Q_g	Total Gate Charge ⑥	——	58	——	nC	V_{DS} = -15V,V_{GS} = -4.5V,I_D = - 17A
Q_g	Total Gate Charge ⑥	——	110	165	nC	V_{GS} = -10V
Q_{gs}	Gate-to-Source Charge ⑥	——	17	——		V_{DS} = -15V
Q_{gd}	Gate-to-Drain Charge ⑥	——	28	——		I_D = -17A
R_G	Gate Resistance ⑥	——	2.8	——	Ω	
$t_{d(on)}$	Turn-On Delay Time	——	25	——	ns	V_{DD} = -15V, V_{GS} = -4.5V ③
t_r	Rise Time	——	47	——		I_D = -1.0A
$t_{d(off)}$	Turn-Off Delay Time	——	65	——		R_G = 1.8Ω
t_f	Fall Time	——	70	——		See Figs. 19a & 19b
C_{iss}	Input Capacitance	——	5250	——	pF	V_{GS} = 0V
C_{oss}	Output Capacitance	——	1300	——		V_{DS} = -15V
C_{rss}	Reverse Transfer Capacitance	——	880	——		f = 1.0MHz

Avalanche Characteristics

	Parameter	Typ.	Max.	Units
E_{AS}	Single Pulse Avalanche Energy ②	——	170	mJ
I_{AR}	Avalanche Current ①	——	-17	A

Diode Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	——	——	-3.1	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode) ①	——	——	-170		
V_{SD}	Diode Forward Voltage	——	——	-1.2	V	T_J = 25°C, I_S = -3.1A, V_{GS} = 0V ③
t_{rr}	Reverse Recovery Time	——	42	63	ns	T_J = 25°C, I_F = -3.1A, V_{DD} = -24V
Q_{rr}	Reverse Recovery Charge	——	42	63	nC	di/dt = 100/μs ③

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case ⑤	——	1.6	°C/W
$R_{\theta JA}$	Junction-to-Ambient ④	——	40	
$R_{\theta JA}$	Junction-to-Ambient (t<10s) ④	——	35	

Notes:

① Repetitive rating; pulse width limited by max. junction temperature.
② Starting T_J = 25°C, L = 1.1mH, R_G = 50Ω, I_{AS} = -17A.
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.

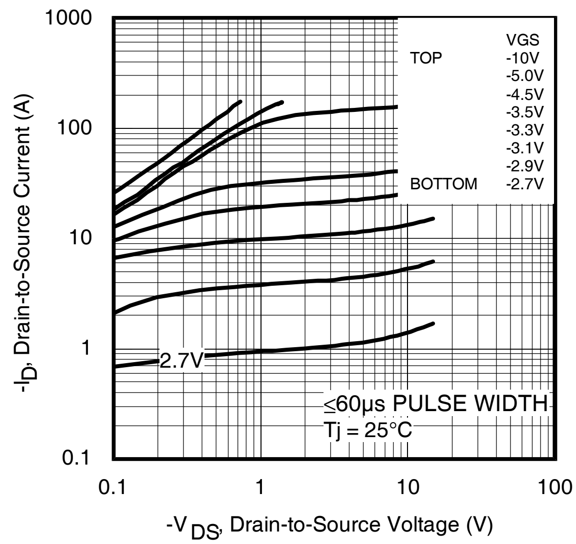


Fig 1. Typical Output Characteristics

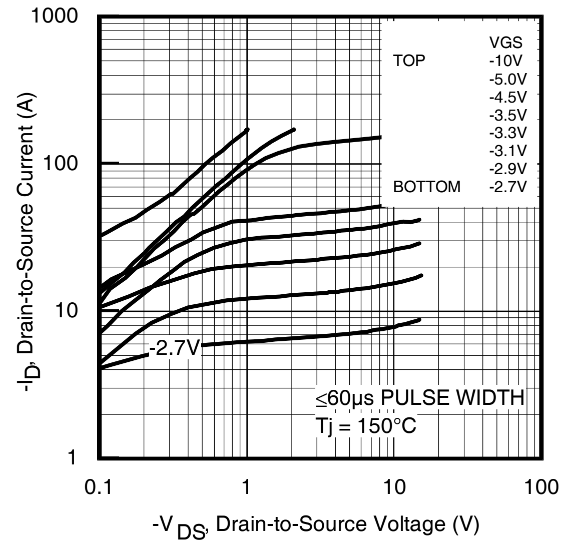


Fig 2. Typical Output Characteristics

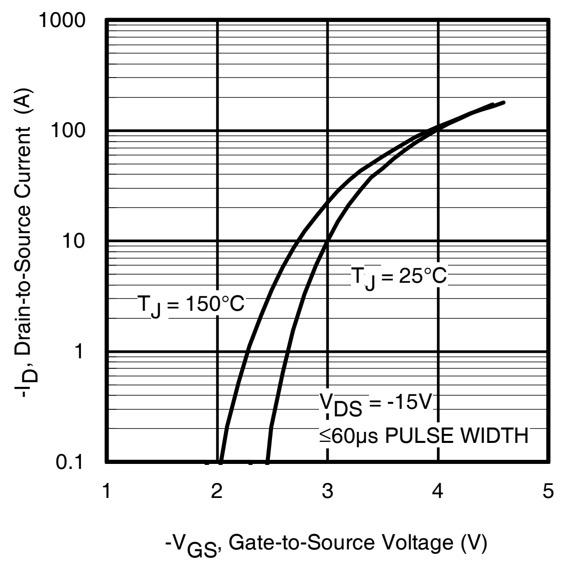


Fig 3. Typical Transfer Characteristics

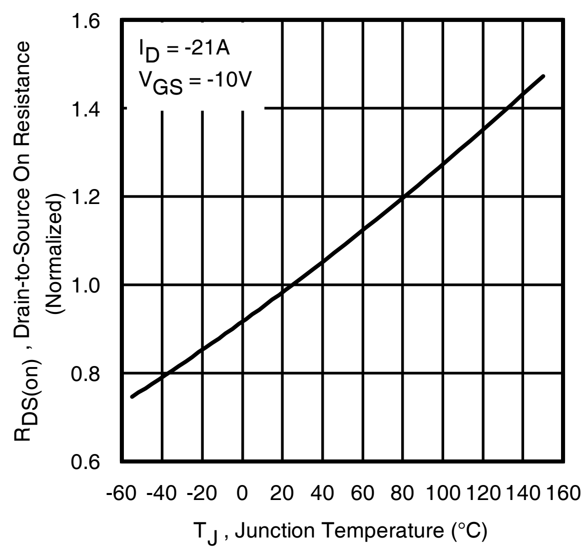


Fig 4. Normalized On-Resistance vs. Temperature

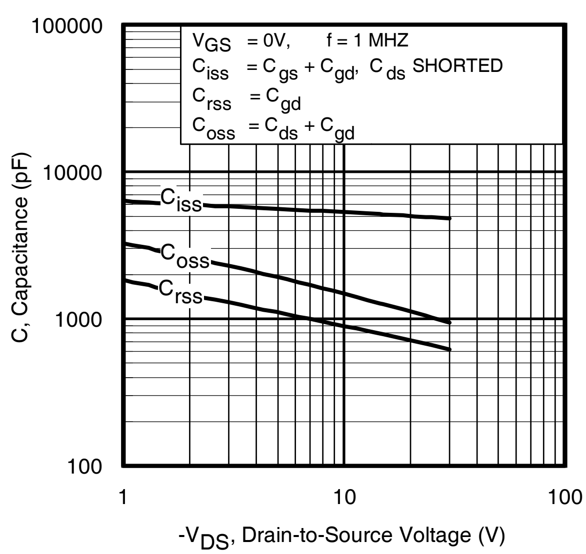


Fig 5. Typical Capacitance vs.Drain-to-Source Voltage

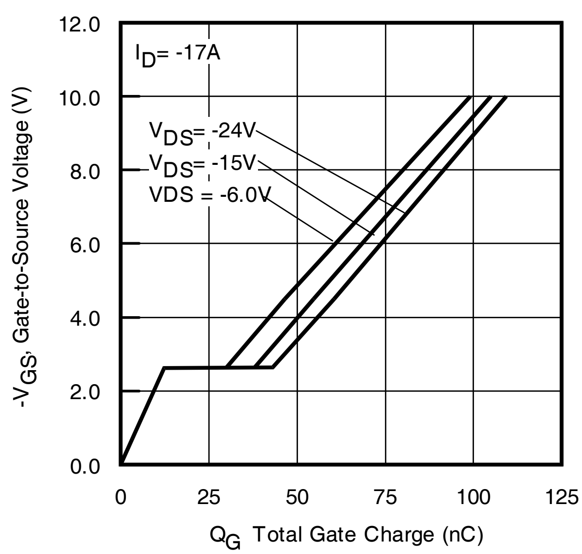


Fig 6. Typical Gate Charge vs.Gate-to-Source Voltage

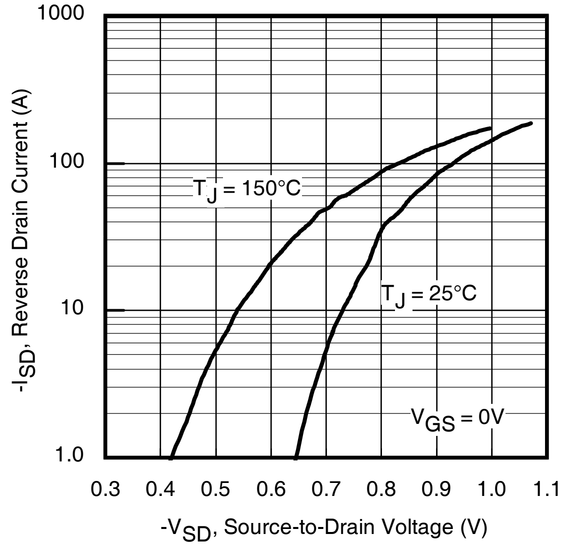


Fig 7. Typical Source-Drain Diode Forward Voltage

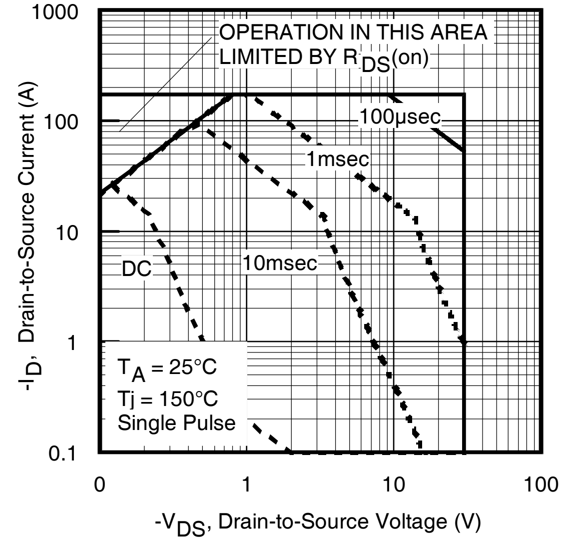


Fig 8. Maximum Safe Operating Area

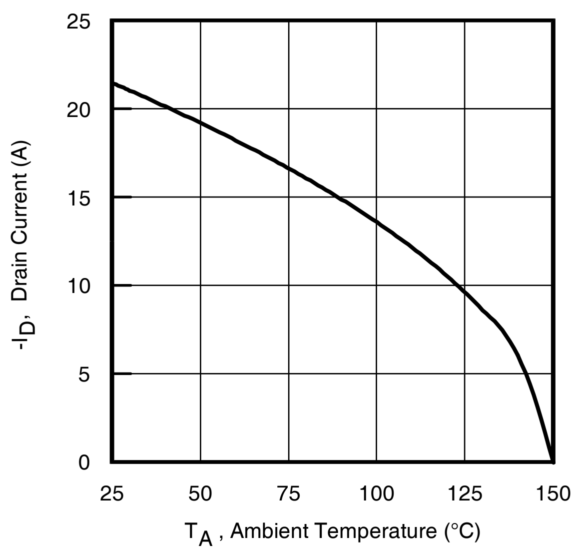


Fig 9. Maximum Drain Current vs. Ambient Temperature

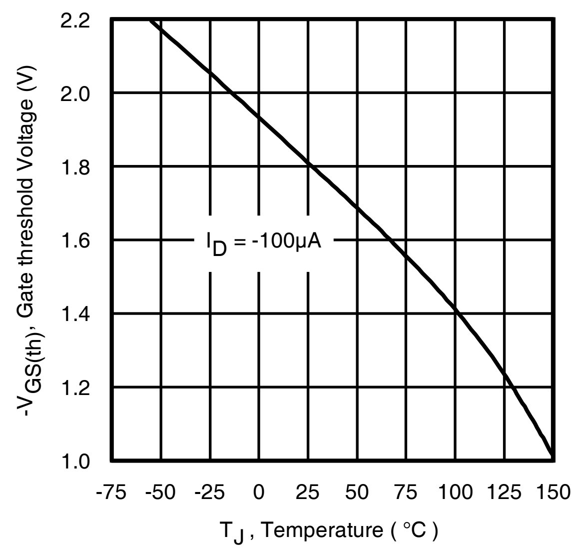


Fig 10. Threshold Voltage vs. Temperature

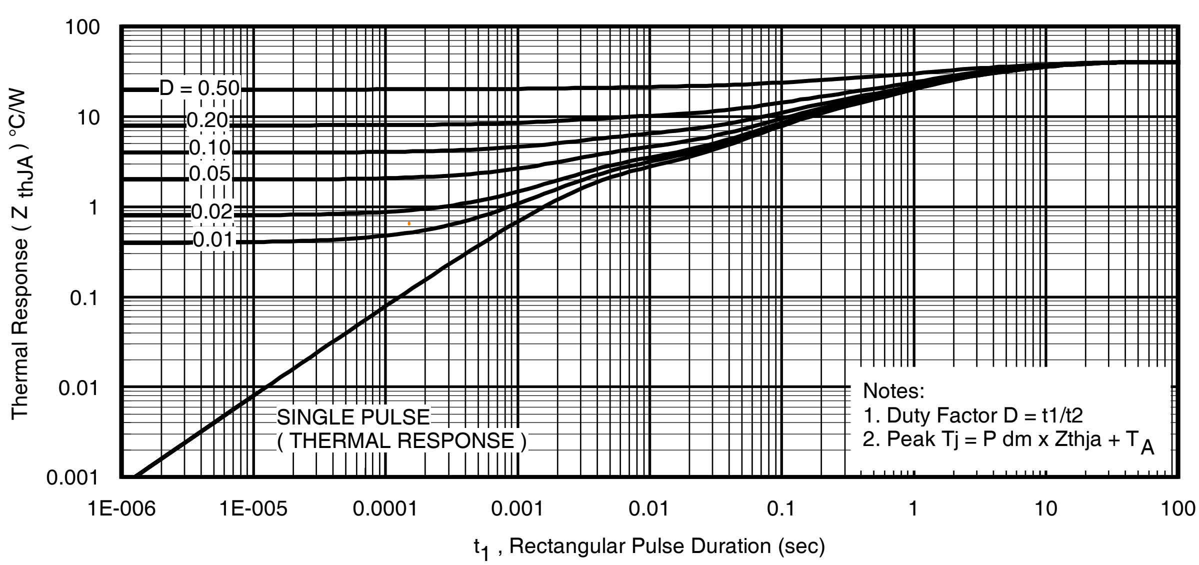


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

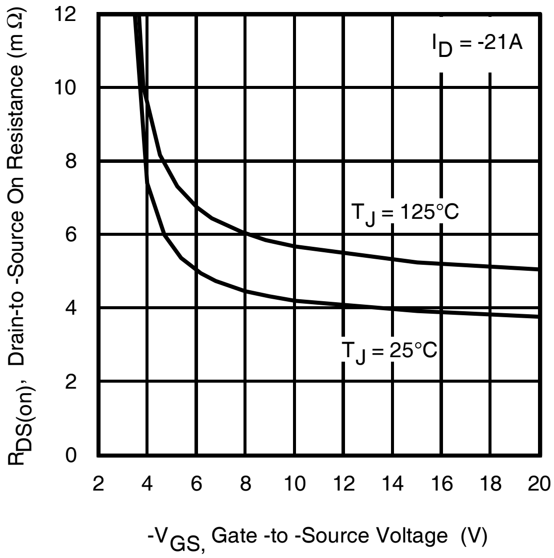


Fig 12. On-Resistance vs. Gate Voltage

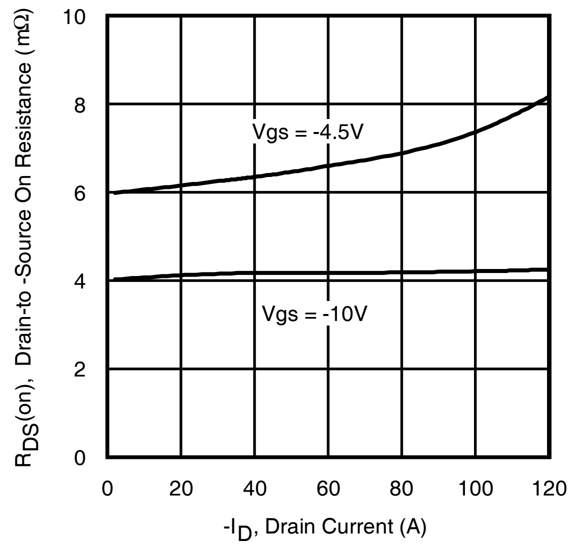


Fig 13. Typical On-Resistance vs. Drain Current

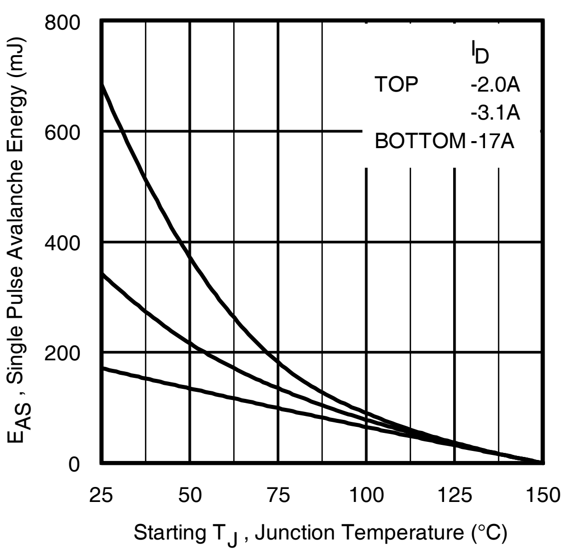


Fig 14. Maximum Avalanche Energy vs. Drain Current

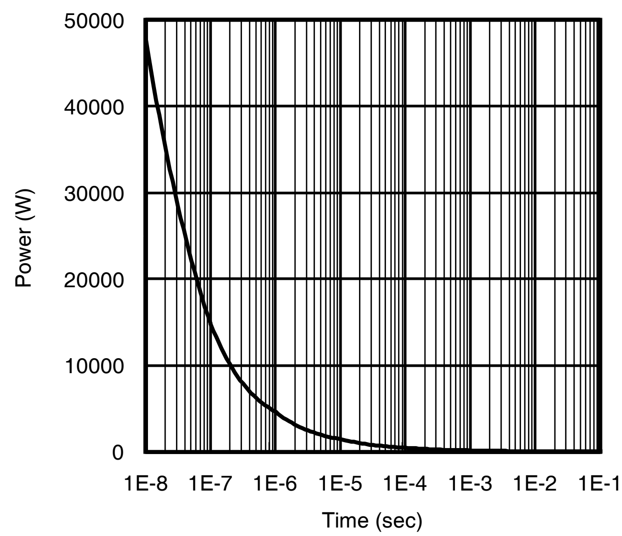
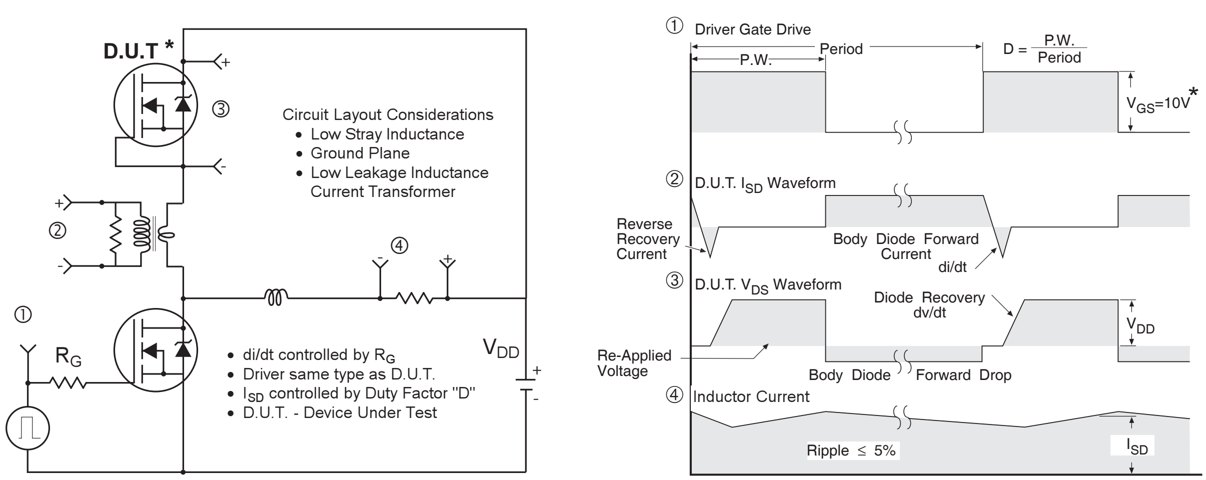


Fig 15. Typical Power vs. Time



* 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

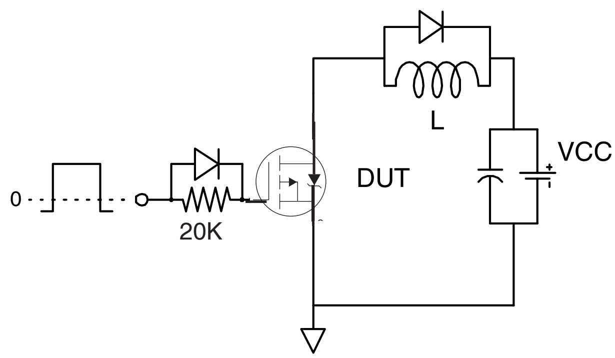


Fig 17a. Gate Charge Test Circuit

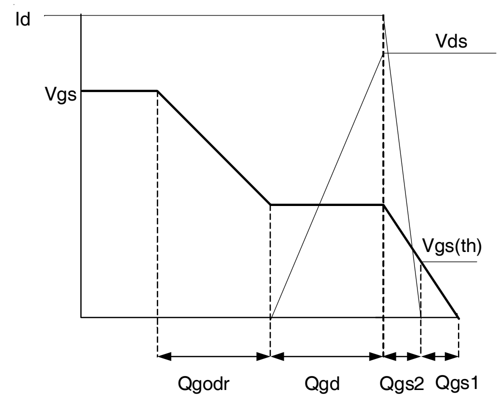


Fig 17b. Gate Charge Waveform

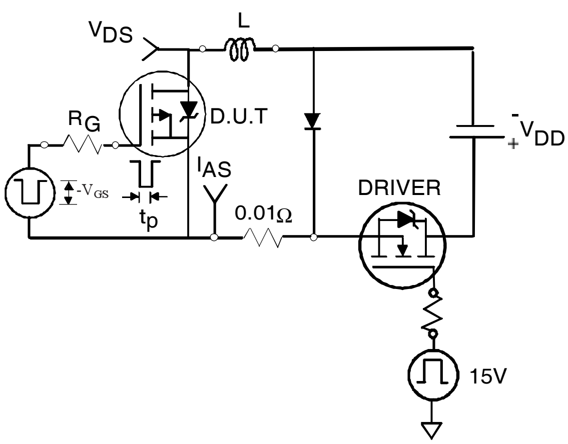


Fig 18a. Unclamped Inductive Test Circuit

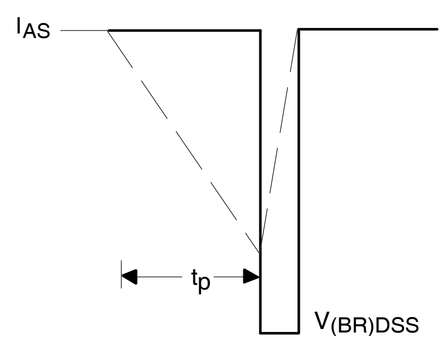


Fig 18b. Unclamped Inductive Waveforms

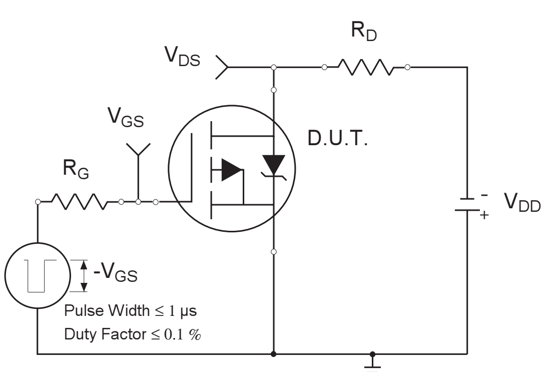


Fig 19a. Switching Time Test Circuit

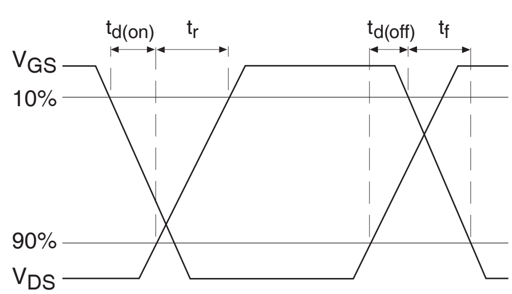
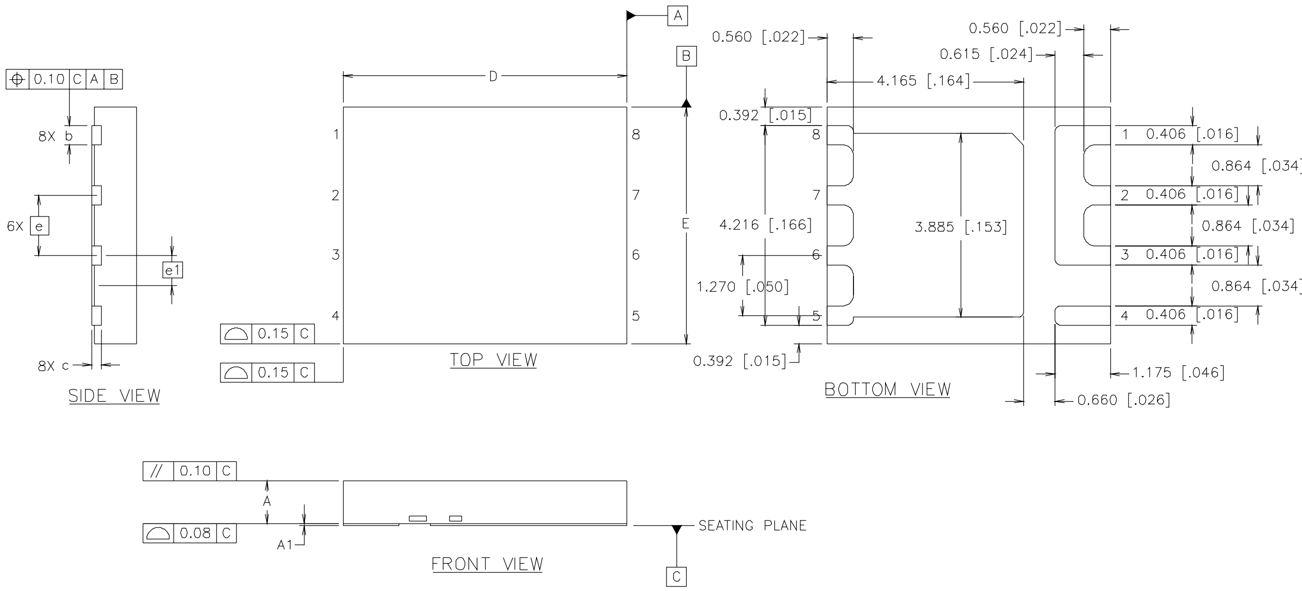


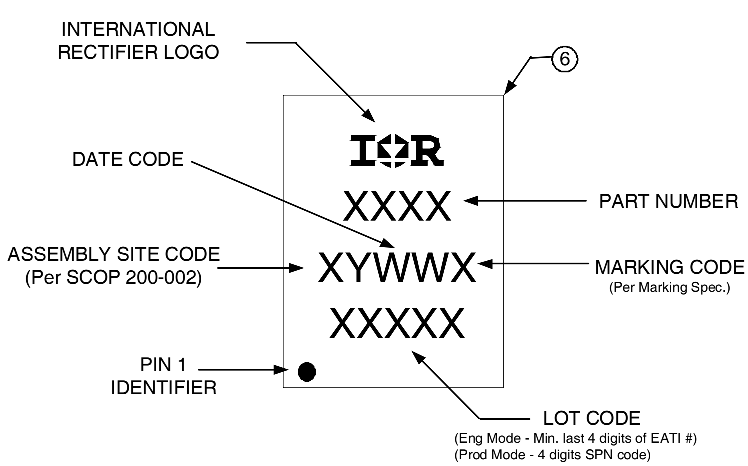
Fig 19b. Switching Time Waveforms

PQFN Package Details



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.0315	.0394	0.800	1.000
A1	.0000	.0020	0.000	0.050
b	.0140	.0180	0.356	0.456
c	.0080 REF.		0.203 REF.	
D	.2362 BASIC		6.0 BASIC	
E	.1969 BASIC		5.0 BASIC	
e	.0500 BASIC		1.270 BASIC	
e1	.0250 BASIC		0.635 BASIC	

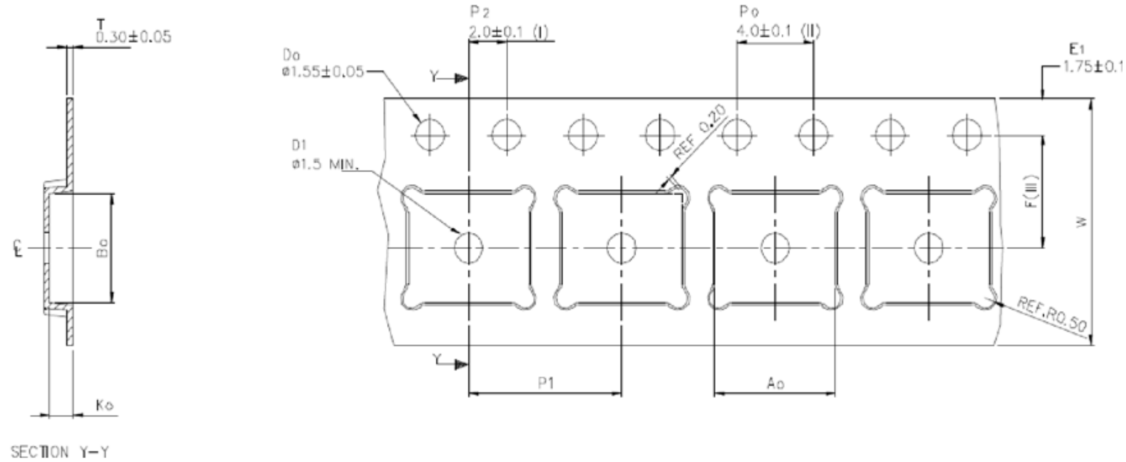
PQFN Part Marking



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	6.30 +/− 0.1
Bo	5.30 +/− 0.1
Ko	1.20 +/− 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.
(V) Typical SR of form tape Max 10^9 OHM/SQ

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.

Qualification Information†

Qualification level	Consumer ††	
	(per JEDEC JESD47F††† guidelines)	
Moisture Sensitivity Level	PQFN 5mm x 6mm	MSL2 (per 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.

†††† Higher MSL ratings may be available for the specific package types listed here. Please contact your International Rectifier sales representative for further information: http://www.irf.com/whoto-call/salesrep/

Data and specifications subject to change without notice.

International
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IR WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105
TAC Fax: (310) 252-7903
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