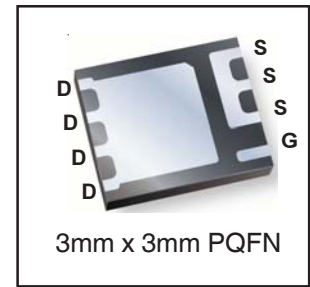
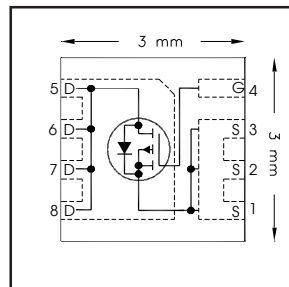




**THE DATASHEET OF  
IRFHM9331TRPBF**



$V_{DS}$	<b>-30</b>	<b>V</b>
$R_{DS(on) max}$ (@ $V_{GS} = -10V$ )	<b>14.6</b>	<b>mΩ</b>
$Q_g$ (typical)	<b>32</b>	<b>nC</b>
$I_D$ (@ $T_A = 25^\circ C$ )	<b>-11</b>	<b>A</b>



### Applications

- System/load switch

### Features and Benefits

#### Features

Low Thermal Resistance to PCB (<6.0°C/W)
Compatible with Existing Surface Mount Techniques
RoHS Compliant Containing no Lead, no Bromide and no Halogen
MSL1, Consumer Qualification

results in

⇒

#### Benefits

Enable better thermal dissipation
Easier Manufacturing
Environmentally Friendlier
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	
$I_D @ T_A = 25^\circ C$	Continuous Drain Current, $V_{GS} @ -10V$	-11	A
$I_D @ T_A = 70^\circ C$	Continuous Drain Current, $V_{GS} @ -10V$	-9	
$I_D @ T_C = 25^\circ C$	Continuous Drain Current, $V_{GS} @ -10V$	-24 <sup>⑦</sup>	
$I_D @ T_C = 70^\circ C$	Continuous Drain Current, $V_{GS} @ -10V$	-24	
$I_{DM}$	Pulsed Drain Current <sup>①</sup>	-90	
$P_D @ T_A = 25^\circ C$	Power Dissipation <sup>④</sup>	2.8	W
$P_D @ T_A = 70^\circ C$	Power Dissipation <sup>④</sup>	1.8	
	Linear Derating Factor	0.02	W/°C
$T_J$ $T_{STG}$	Operating Junction and Storage Temperature Range	-55 to + 150	°C

Notes <sup>①</sup> through <sup>⑦</sup> are on page 2

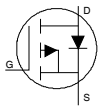
**Static @ T<sub>J</sub> = 25°C (unless otherwise specified)**

	Parameter	Min.	Typ.	Max.	Units	Conditions
BV <sub>DSS</sub>	Drain-to-Source Breakdown Voltage	-30	—	—	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = -250μA
ΔBV <sub>DSS</sub> /ΔT <sub>J</sub>	Breakdown Voltage Temp. Coefficient	—	0.02	—	V/°C	Reference to 25°C, I <sub>D</sub> = -1mA
R <sub>DS(on)</sub>	Static Drain-to-Source On-Resistance	—	10.0	—	mΩ	V <sub>GS</sub> = -20V, I <sub>D</sub> = -11A ③
		—	11.7	14.6		V <sub>GS</sub> = -10V, I <sub>D</sub> = -11A ③
V <sub>GS(th)</sub>	Gate Threshold Voltage	-1.3	-1.8	-2.4	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -25μA
ΔV <sub>GS(th)</sub>	Gate Threshold Voltage Coefficient	—	-5.1	—	mV/°C	
I <sub>DSS</sub>	Drain-to-Source Leakage Current	—	—	-1.0	μA	V <sub>DS</sub> = -24V, V <sub>GS</sub> = 0V
		—	—	-150		V <sub>DS</sub> = -24V, V <sub>GS</sub> = 0V, T <sub>J</sub> = 125°C
I <sub>GSS</sub>	Gate-to-Source Forward Leakage	—	—	-10	μA	V <sub>GS</sub> = -25V
	Gate-to-Source Reverse Leakage	—	—	10		V <sub>GS</sub> = 25V
g <sub>fs</sub>	Forward Transconductance	16	—	—	S	V <sub>DS</sub> = -10V, I <sub>D</sub> = -9.0A
Q <sub>g</sub>	Total Gate Charge ⑥	—	16	—	nC	V <sub>DS</sub> = -15V, V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -9.0A
Q <sub>g</sub>	Total Gate Charge ⑥	—	32	48	nC	V <sub>GS</sub> = -10V
Q <sub>gs</sub>	Gate-to-Source Charge ⑥	—	4.4	—		V <sub>DS</sub> = -15V
Q <sub>gd</sub>	Gate-to-Drain Charge ⑥	—	8	—		I <sub>D</sub> = -9.0A
R <sub>G</sub>	Gate Resistance ⑥	—	16	—	Ω	
t <sub>d(on)</sub>	Turn-On Delay Time	—	11	—	ns	V <sub>DD</sub> = -15V, V <sub>GS</sub> = -4.5V ③
t <sub>r</sub>	Rise Time	—	27	—		I <sub>D</sub> = -1.0A
t <sub>d(off)</sub>	Turn-Off Delay Time	—	72	—		R <sub>G</sub> = 6.8Ω
t <sub>f</sub>	Fall Time	—	60	—		See Figs. 19a & 19b
C <sub>iss</sub>	Input Capacitance	—	1543	—	pF	V <sub>GS</sub> = 0V
C <sub>oss</sub>	Output Capacitance	—	310	—		V <sub>DS</sub> = -25V
C <sub>rss</sub>	Reverse Transfer Capacitance	—	208	—		f = 1.0KHz

**Avalanche Characteristics**

	Parameter	Typ.	Max.	Units
E <sub>AS</sub>	Single Pulse Avalanche Energy ②	—	76	mJ
I <sub>AR</sub>	Avalanche Current ①	—	-9.0	A

**Diode Characteristics**

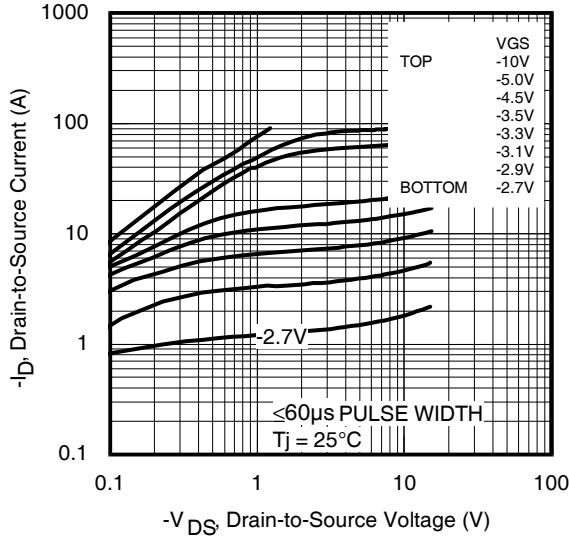
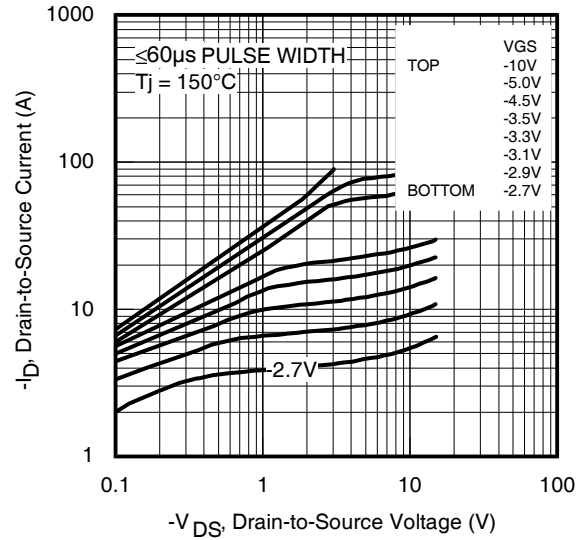
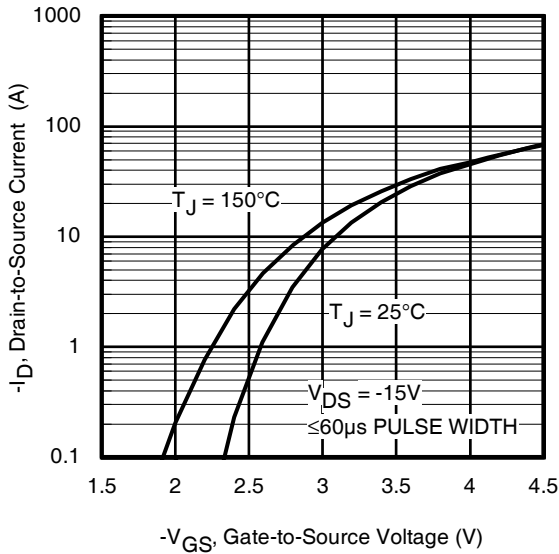
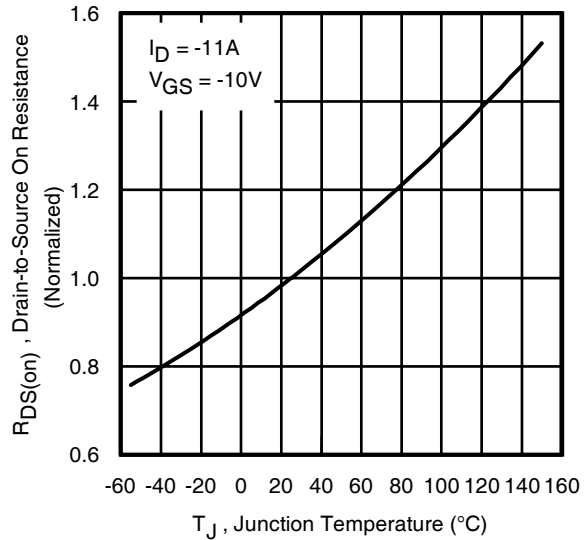
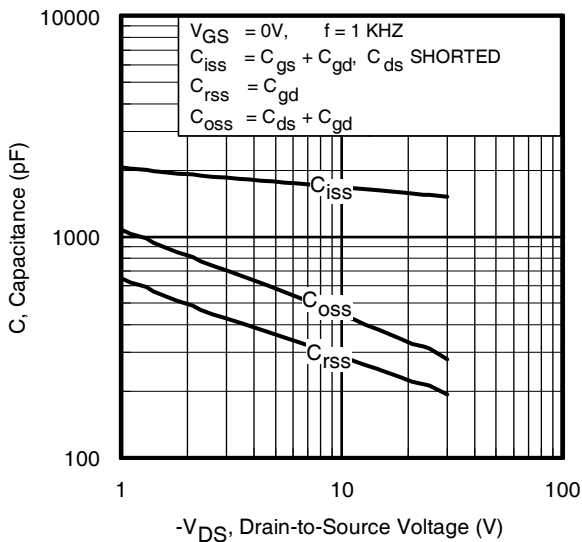
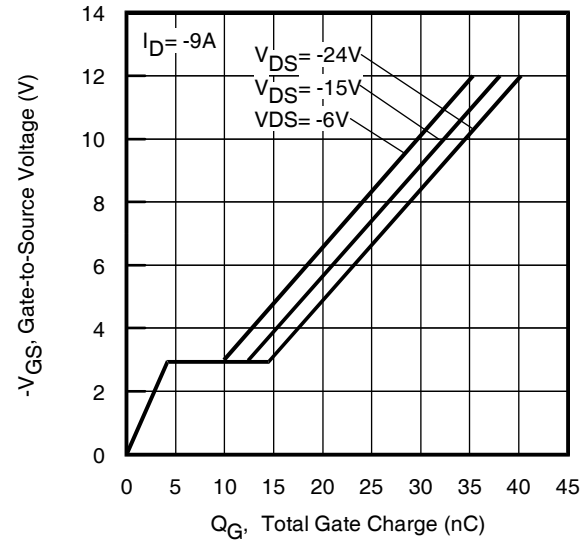
	Parameter	Min.	Typ.	Max.	Units	Conditions
I <sub>S</sub>	Continuous Source Current (Body Diode)	—	—	-2.8	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I <sub>SM</sub>	Pulsed Source Current (Body Diode) ①	—	—	-90		
V <sub>SD</sub>	Diode Forward Voltage	—	—	-1.2	V	T <sub>J</sub> = 25°C, I <sub>S</sub> = -2.8A, V <sub>GS</sub> = 0V ③
t <sub>rr</sub>	Reverse Recovery Time	—	64	96	ns	T <sub>J</sub> = 25°C, I <sub>F</sub> = -2.8A, V <sub>DD</sub> = -24V
Q <sub>rr</sub>	Reverse Recovery Charge	—	25	38	nC	di/dt = 100/μs ③

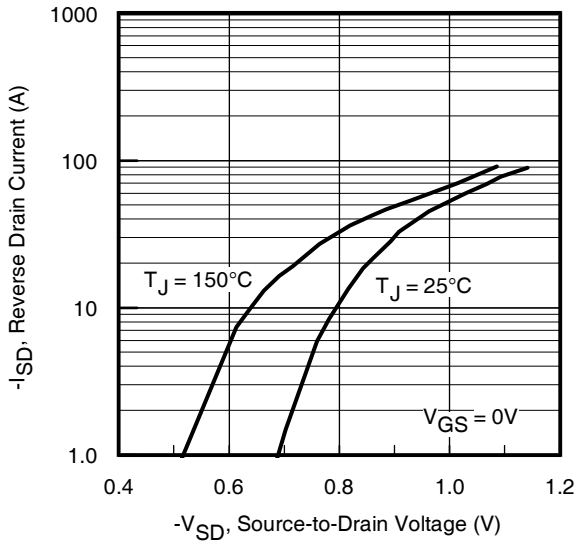
**Thermal Resistance**

	Parameter	Typ.	Max.	Units
R <sub>θJC</sub>	Junction-to-Case ⑤	—	6	°C/W
R <sub>θJA</sub>	Junction-to-Ambient ④	—	45	
R <sub>θJA</sub>	Junction-to-Ambient (t<10s) ④	—	30	

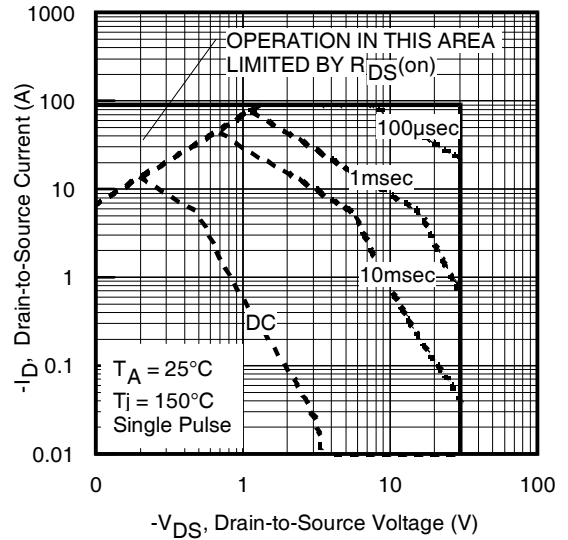
**Notes:**

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Starting T<sub>J</sub> = 25°C, L = 1.904mH, R<sub>G</sub> = 50Ω, I<sub>AS</sub> = -9A.
- ③ Pulse width ≤ 400μs; duty cycle ≤ 2%.
- ④ When mounted on 1 inch square copper board.
- ⑤ R<sub>θ</sub> is measured at T<sub>J</sub> of approximately 90°C.
- ⑥ For DESIGN AID ONLY, not subject to production testing.
- ⑦ Current limited by package.

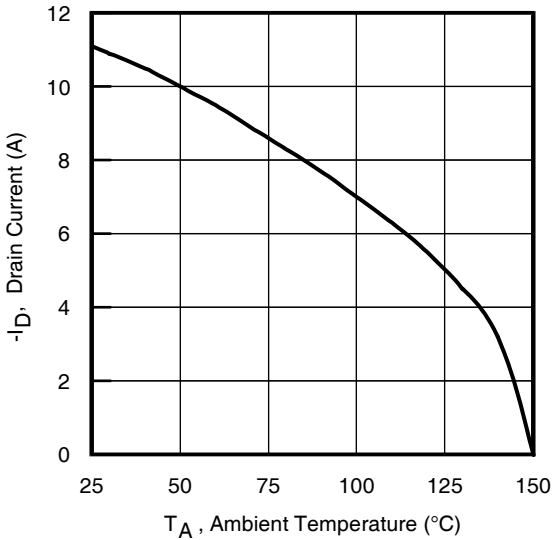

**Fig 1.** Typical Output Characteristics

**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



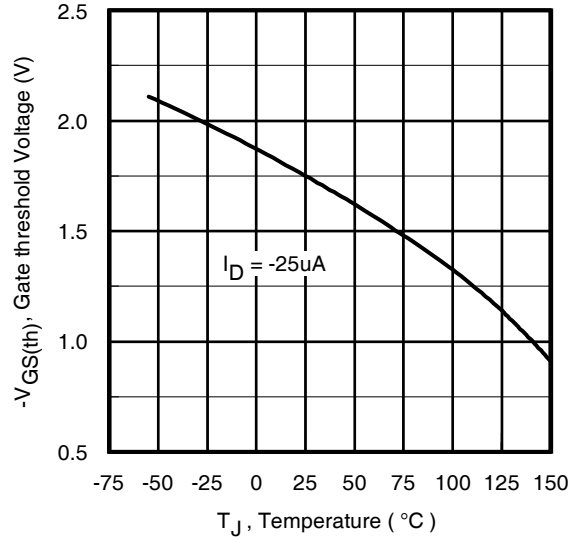
**Fig 7.** Typical Source-Drain Diode Forward Voltage



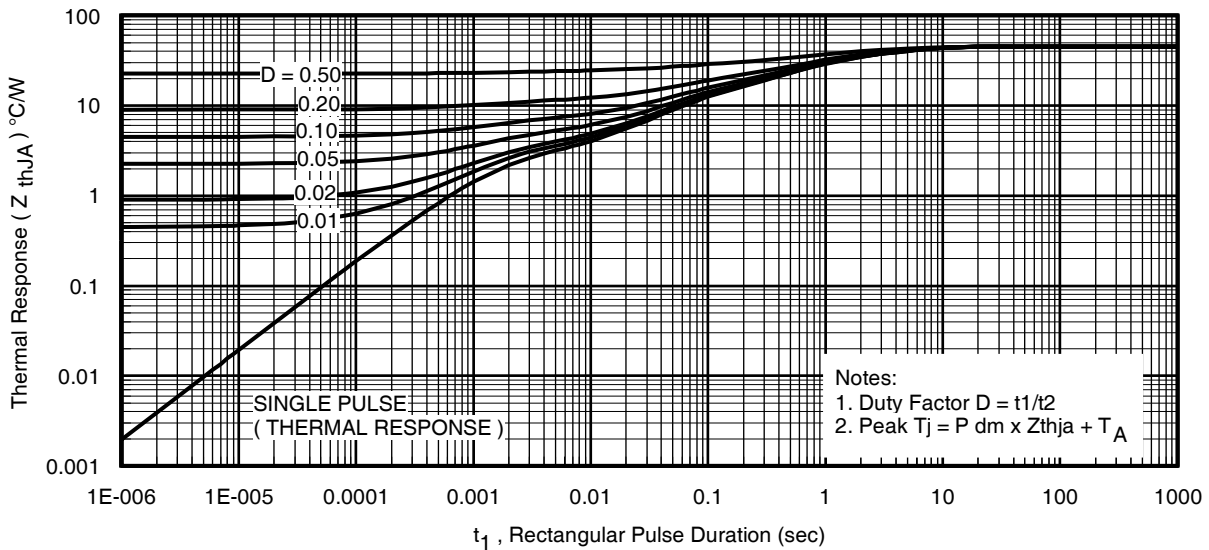
**Fig 8.** Maximum Safe Operating Area



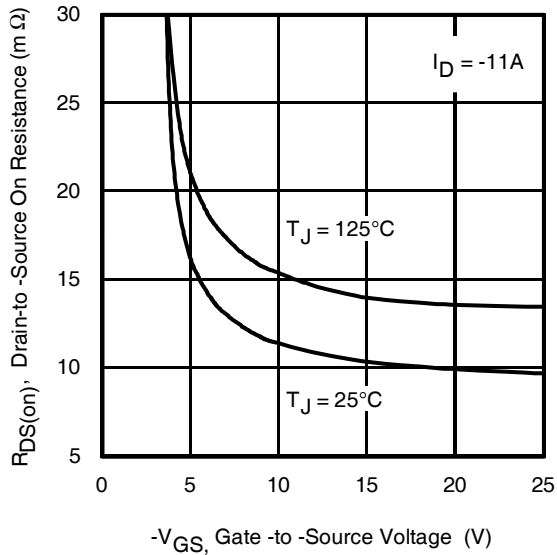
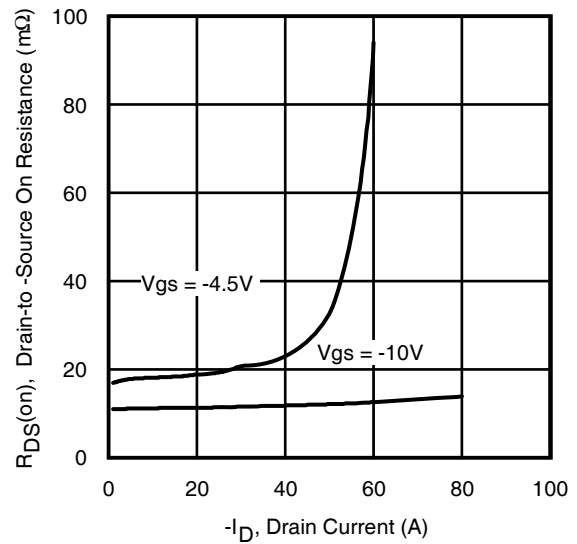
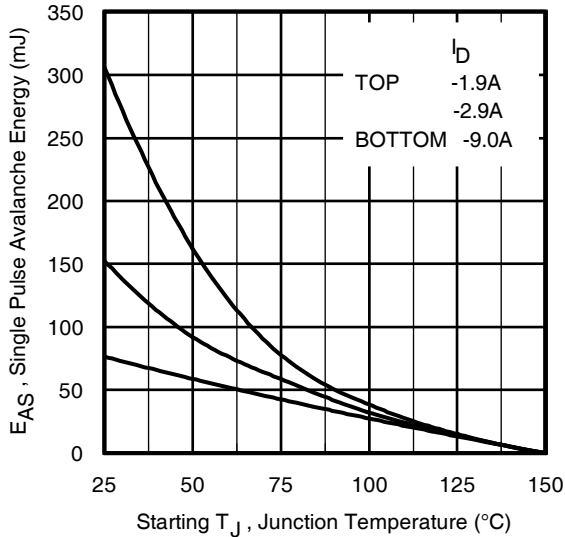
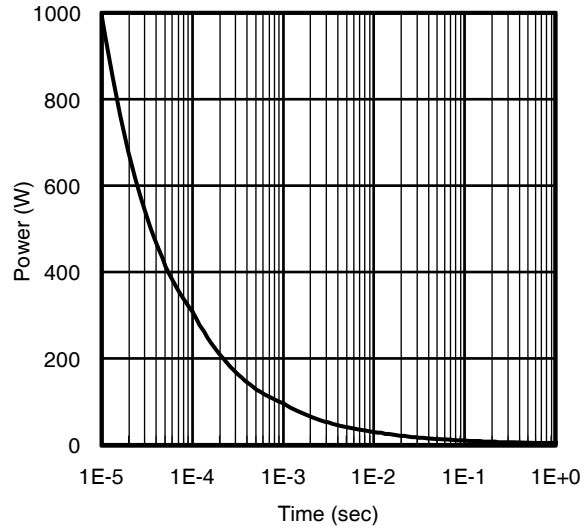
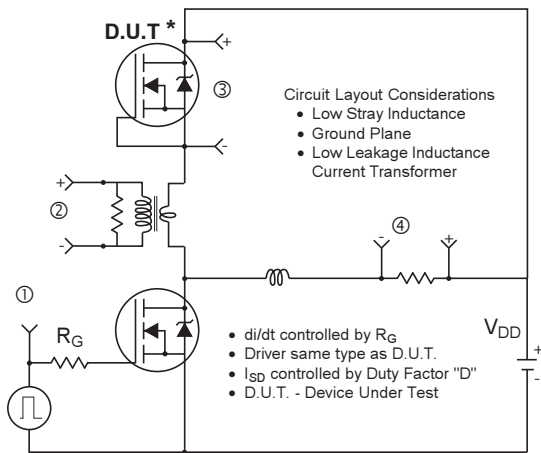
**Fig 9.** Maximum Drain Current vs. Ambient Temperature



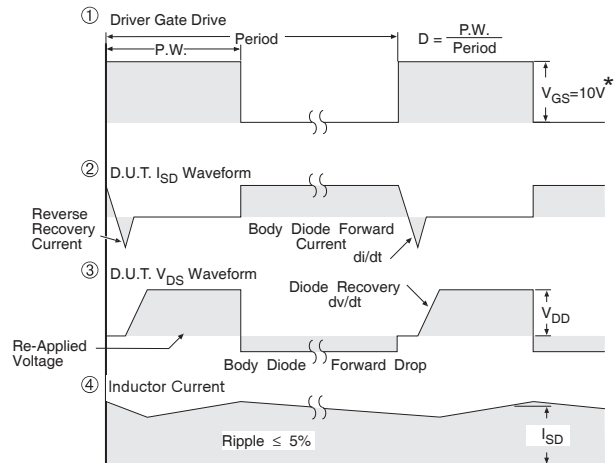
**Fig 10.** Threshold Voltage vs. Temperature



**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**

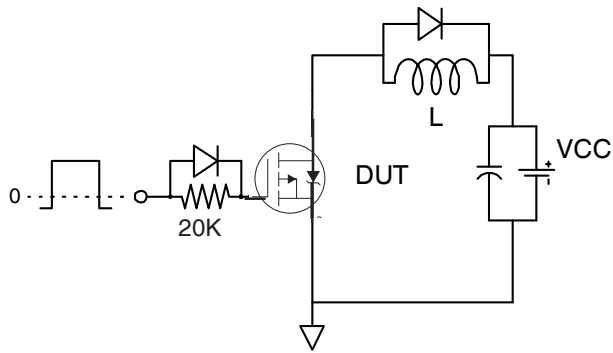


Fig 17a. Gate Charge Test Circuit

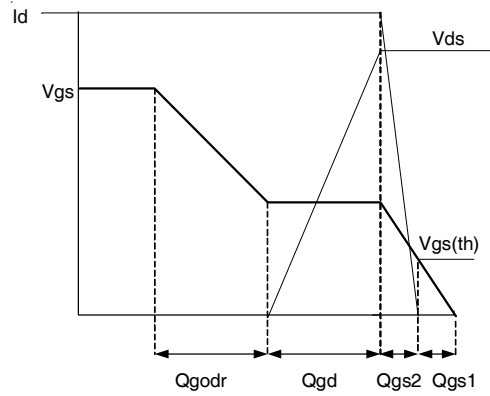


Fig 17b. Gate Charge Waveform

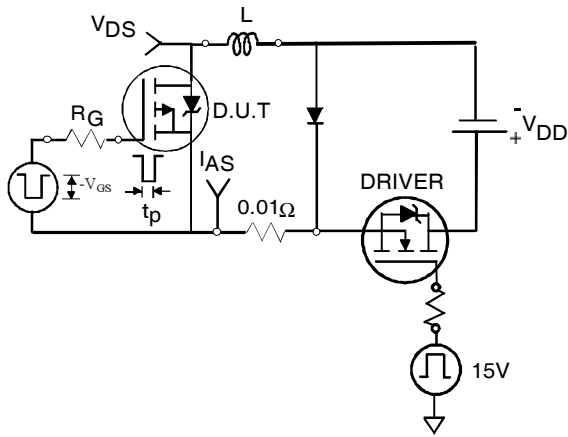


Fig 18a. Unclamped Inductive Test Circuit

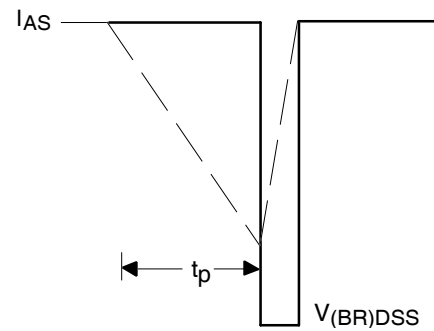


Fig 18b. Unclamped Inductive Waveforms

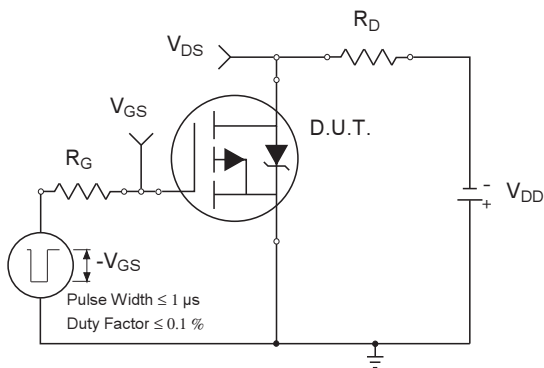


Fig 19a. Switching Time Test Circuit

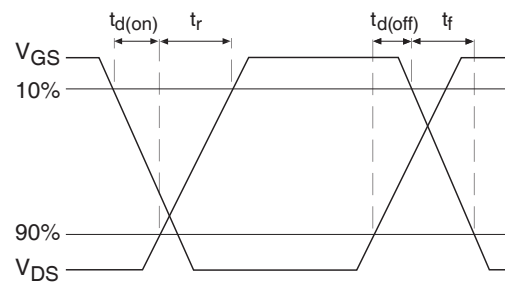
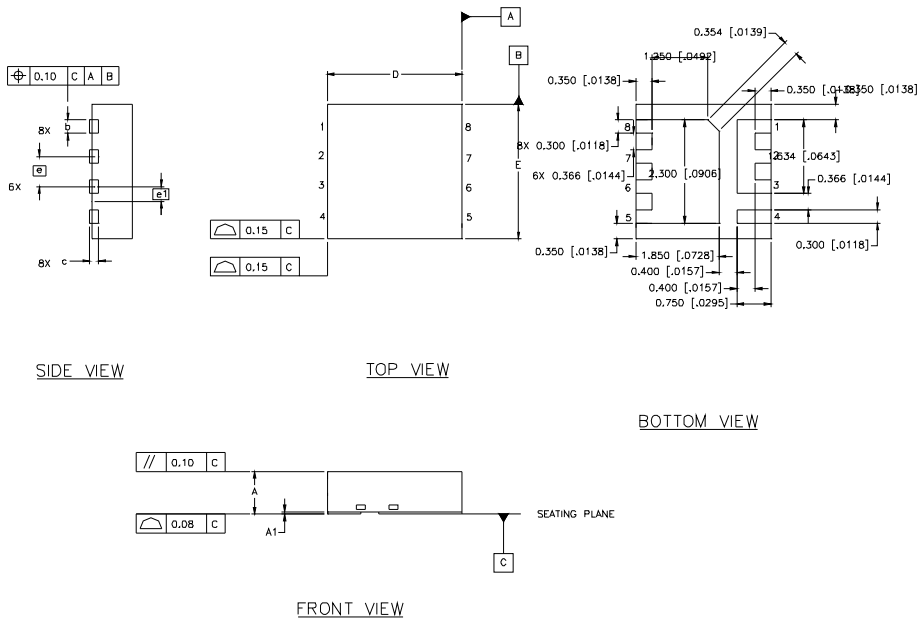


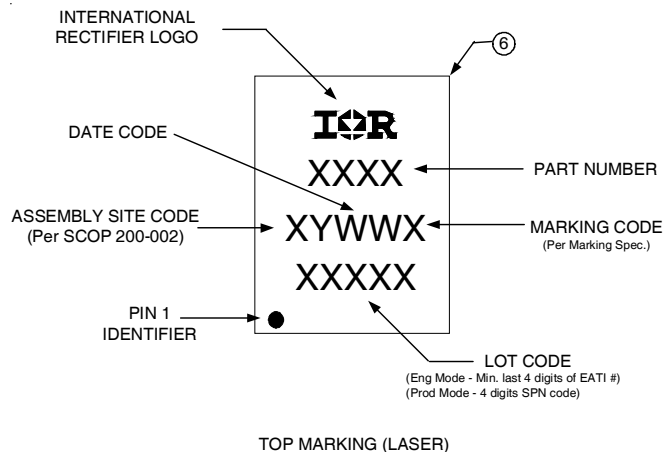
Fig 19b. Switching Time Waveforms

## PQFN Package Details



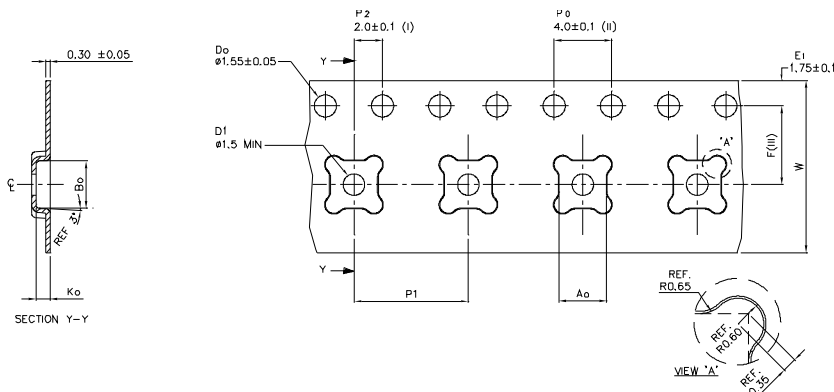
DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.0315	.0394	0.800	1.000
A1	.0000	.0020	0.000	0.050
b	.0098	.0138	0.250	0.350
c	.0080 REF.		0.203 REF.	
D	.1181 BASIC		3.000 BASIC	
E	.1181 BASIC		3.000 BASIC	
e	.0262 BASIC		0.666 BASIC	
e1	.0131 BASIC		0.333 BASIC	

## PQFN Part Marking



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
B0	3.30	+/- 0.1
K0	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  $\pm 0.20$ .  
 (III) Measured from centreline of sprocket hole to centreline of pocket.  
 (IV) Other material available.

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.

### Qualification information<sup>†</sup>

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

<sup>†</sup> Qualification standards can be found at International Rectifier's web site

<http://www.irf.com/product-info/reliability>

<sup>††</sup> 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/>

<sup>†††</sup> Applicable version of JEDEC standard at the time of product release.

### Revision History

Date	Comments
12/16/2013	<ul style="list-style-type: none"> <li>Updated ordering information to reflect the End-Of-life (EOL) of the mini-reel option (EOL notice #259)</li> <li>Updated data sheet with new IR corporate template</li> </ul>

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