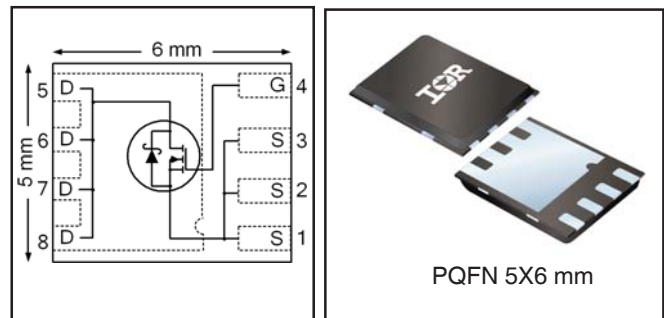


# IRFH5302DPbF

HEXFET® Power MOSFET

$V_{DS}$	<b>30</b>	<b>V</b>
$R_{DS(on) max}$ (@ $V_{GS} = 10V$ )	<b>2.5</b>	<b>mΩ</b>
$V_{SD max}$ (@ $I_S = 5.0A$ )	<b>0.65</b>	<b>V</b>
$t_{rr}$ (typical)	<b>19</b>	<b>ns</b>
$I_D$ (@ $T_{c(Bottom)} = 25^\circ C$ )	<b>100</b> Ⓣ	<b>A</b>



## Applications

- Synchronous MOSFET for high frequency buck converters

## Features and Benefits

### Features

Low $R_{DS(on)}$ (<2.5mΩ)
Schottky Intrinsic Diode with Low Forward Voltage
Low Thermal Resistance to PCB (<1.2°C/W)
100% Rg tested
Low Profile (<0.9 mm)
Industry-Standard Pinout
Compatible with Existing Surface Mount Techniques
RoHS Compliant Containing no Lead, no Bromide and no Halogen
MSL1, Industrial Qualification

results in  
⇒

### Benefits

Lower Conduction Losses
Lower Switching Losses
Increased Power Density
Increased Reliability
Increased Power Density
Multi-Vendor Compatibility
Easier Manufacturing
Environmentally Friendlier
Increased Reliability

Orderable part number	Package Type	Standard Pack		Note
		Form	Quantity	
IRFH5302DTRPBF	PQFN 5mm x 6mm	Tape and Reel	4000	
IRFH5302DTR2PBF	PQFN 5mm x 6mm	Tape and Reel	400	

## Absolute Maximum Ratings

	Parameter	Max.	Units
$V_{DS}$	Drain-to-Source Voltage	30	V
$V_{GS}$	Gate-to-Source Voltage	± 20	
$I_D$ @ $T_A = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	29	A
$I_D$ @ $T_A = 70^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	23	
$I_D$ @ $T_{c(Bottom)} = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$ Ⓣ	100	
$I_D$ @ $T_{c(Bottom)} = 100^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$ Ⓣ	100	
$I_{DM}$	Pulsed Drain Current ①	400	
$P_D$ @ $T_A = 25^\circ C$	Power Dissipation ②	3.6	W
$P_D$ @ $T_{c(Bottom)} = 25^\circ C$	Power Dissipation ②	104	
	Linear Derating Factor ③	0.83	W/°C
$T_J$	Operating Junction and	-55 to + 150	°C
$T_{STG}$	Storage Temperature Range		

Notes ① through ⑥ are on page 8

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

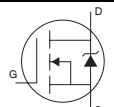
	Parameter	Min.	Typ.	Max.	Units	Conditions
BV <sub>DSS</sub>	Drain-to-Source Breakdown Voltage	30	—	—	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = 500μA
ΔBV <sub>DSS</sub> /ΔT <sub>J</sub>	Breakdown Voltage Temp. Coefficient	—	-0.25	—	V/°C	Reference to 25°C, I <sub>D</sub> = 1.0mA
R <sub>DS(on)</sub>	Static Drain-to-Source On-Resistance	—	2.0	2.5	mΩ	V <sub>GS</sub> = 10V, I <sub>D</sub> = 50A ③
		—	3.1	3.7		V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 50A ③
V <sub>GS(th)</sub>	Gate Threshold Voltage	1.35	1.80	2.35	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 100μA
ΔV <sub>GS(th)</sub>	Gate Threshold Voltage Coefficient	—	-10	—	mV/°C	
I <sub>DSS</sub>	Drain-to-Source Leakage Current	—	—	500	μA	V <sub>DS</sub> = 24V, V <sub>GS</sub> = 0V
		—	—	5.0	mA	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	—	—	100	nA	V <sub>GS</sub> = 20V
	Gate-to-Source Reverse Leakage	—	—	-100		V <sub>GS</sub> = -20V
g <sub>fs</sub>	Forward Transconductance	110	—	—	S	V <sub>DS</sub> = 15V, I <sub>D</sub> = 50A
Q <sub>g</sub>	Total Gate Charge	—	55	—	nC	V <sub>GS</sub> = 10V, V <sub>DS</sub> = 15V, I <sub>D</sub> = 50A
Q <sub>g</sub>	Total Gate Charge	—	26	39	nC	V <sub>DS</sub> = 15V V <sub>GS</sub> = 4.5V I <sub>D</sub> = 50A
Q <sub>gs1</sub>	Pre-V <sub>th</sub> Gate-to-Source Charge	—	6.2	—		
Q <sub>gs2</sub>	Post-V <sub>th</sub> Gate-to-Source Charge	—	4.0	—		
Q <sub>gd</sub>	Gate-to-Drain Charge	—	7.9	—		
Q <sub>godr</sub>	Gate Charge Overdrive	—	7.9	—		
Q <sub>sw</sub>	Switch Charge (Q <sub>gs2</sub> + Q <sub>gd</sub> )	—	11.9	—		
Q <sub>oss</sub>	Output Charge	—	19	—	nC	V <sub>DS</sub> = 16V, V <sub>GS</sub> = 0V
R <sub>G</sub>	Gate Resistance	—	1.9	—	Ω	
t <sub>d(on)</sub>	Turn-On Delay Time	—	16	—	ns	V <sub>DD</sub> = 15V, V <sub>GS</sub> = 4.5V I <sub>D</sub> = 50A R <sub>G</sub> = 1.8Ω
t <sub>r</sub>	Rise Time	—	30	—		
t <sub>d(off)</sub>	Turn-Off Delay Time	—	20	—		
t <sub>f</sub>	Fall Time	—	12	—		
C <sub>iss</sub>	Input Capacitance	—	3635	—	pF	V <sub>GS</sub> = 0V V <sub>DS</sub> = 25V f = 1.0MHz
C <sub>oss</sub>	Output Capacitance	—	680	—		
C <sub>rss</sub>	Reverse Transfer Capacitance	—	260	—		

## Avalanche Characteristics

	Parameter	Typ.	Max.	Units
E <sub>AS</sub>	Single Pulse Avalanche Energy ②	—	130	mJ
I <sub>AR</sub>	Avalanche Current ①	—	50	A

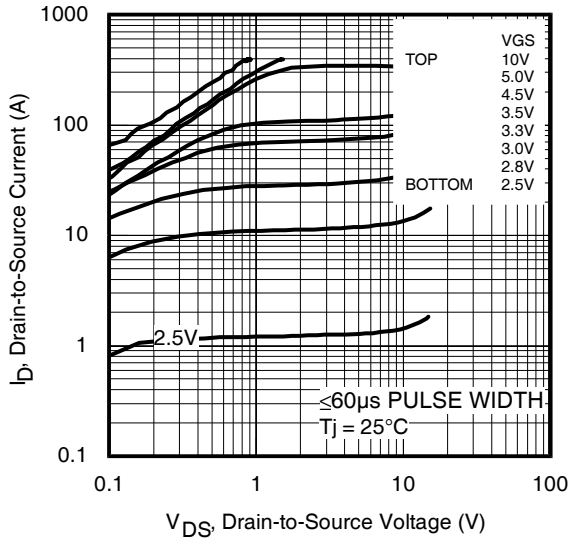
## Diode Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I <sub>S</sub>	Continuous Source Current (Body Diode)	—	—	100	A	MOSFET symbol showing the integral reverse p-n junction diode.
I <sub>SM</sub>	Pulsed Source Current (Body Diode) ①	—	—	400		
V <sub>SD</sub>	Diode Forward Voltage	—	—	0.65	V	T <sub>J</sub> = 25°C, I <sub>S</sub> = 5.0A, V <sub>GS</sub> = 0V ③
V <sub>SD</sub>	Diode Forward Voltage	—	—	1.0	V	T <sub>J</sub> = 25°C, I <sub>S</sub> = 50A, V <sub>GS</sub> = 0V ③
t <sub>rr</sub>	Reverse Recovery Time	—	19	29	ns	T <sub>J</sub> = 25°C, I <sub>F</sub> = 50A, V <sub>DD</sub> = 15V
Q <sub>rr</sub>	Reverse Recovery Charge	—	28	42	nC	di/dt = 300A/μs ③
t <sub>on</sub>	Forward Turn-On Time	Time is dominated by parasitic Inductance				

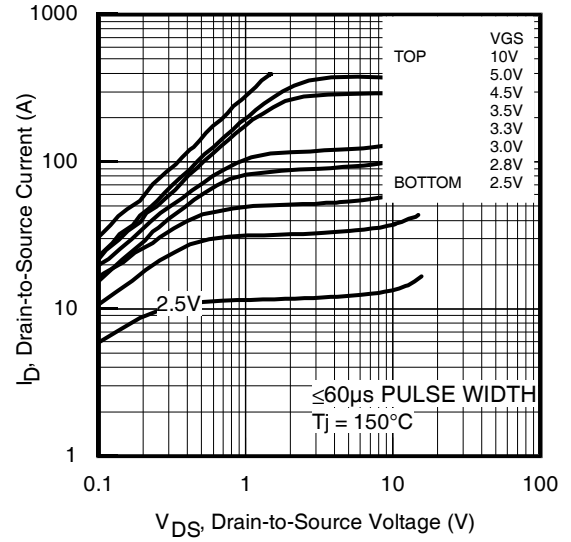


## Thermal Resistance

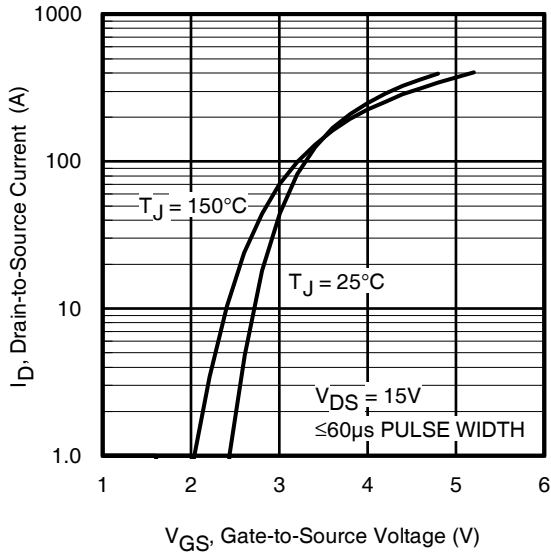
	Parameter	Typ.	Max.	Units
R <sub>θJC</sub> (Bottom)	Junction-to-Case ④	—	1.2	°C/W
R <sub>θJC</sub> (Top)	Junction-to-Case ④	—	15	
R <sub>θJA</sub>	Junction-to-Ambient ⑤	—	35	
R <sub>θJA</sub> (<10s)	Junction-to-Ambient ⑤	—	22	



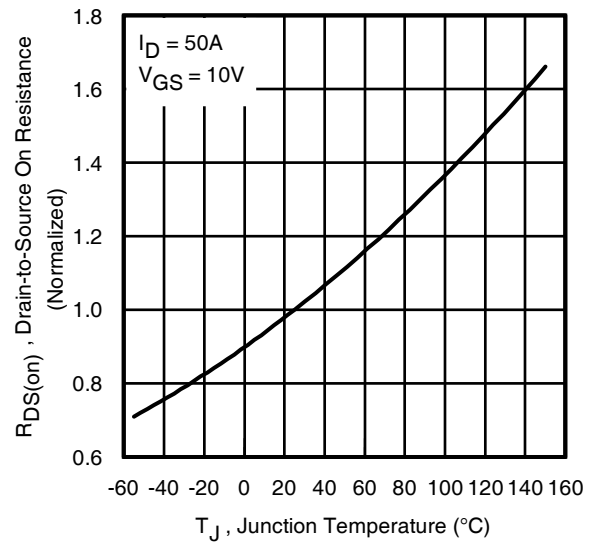
**Fig 1.** Typical Output Characteristics



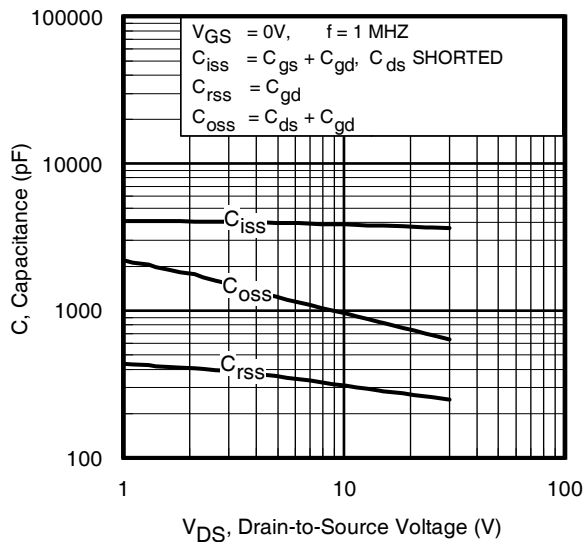
**Fig 2.** Typical Output Characteristics



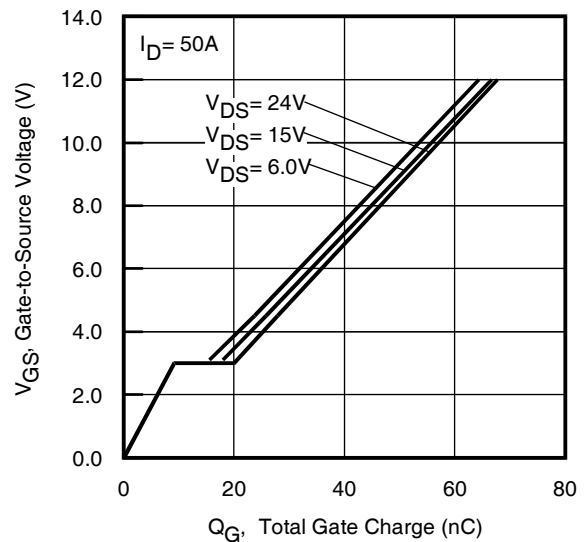
**Fig 3.** Typical Transfer Characteristics



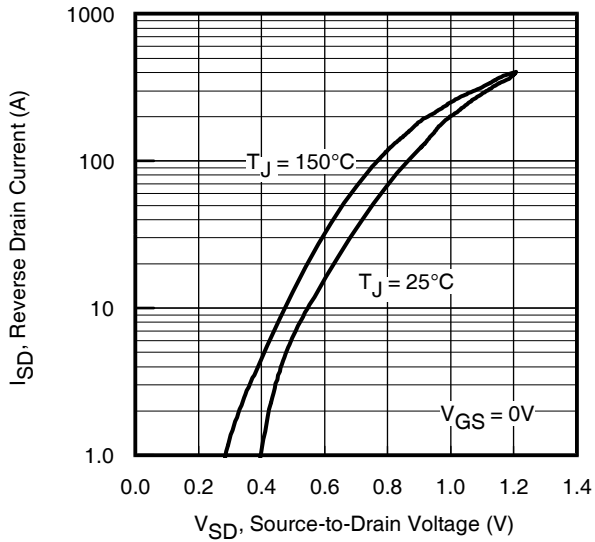
**Fig 4.** Normalized On-Resistance vs. Temperature



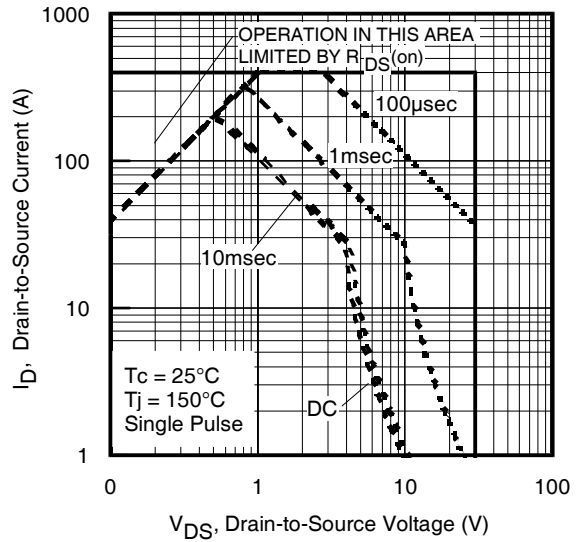
**Fig 5.** Typical Capacitance vs. Drain-to-Source Voltage  
[www.irf.com](http://www.irf.com)



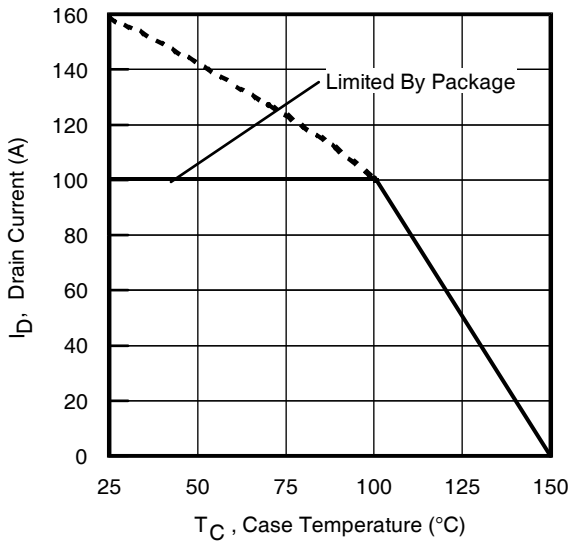
**Fig 6.** Typical Gate Charge vs. Gate-to-Source Voltage



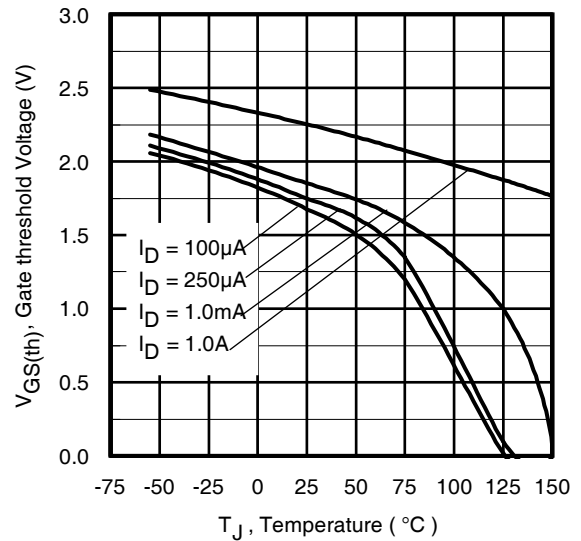
**Fig 7.** Typical Source-Drain Diode Forward Voltage



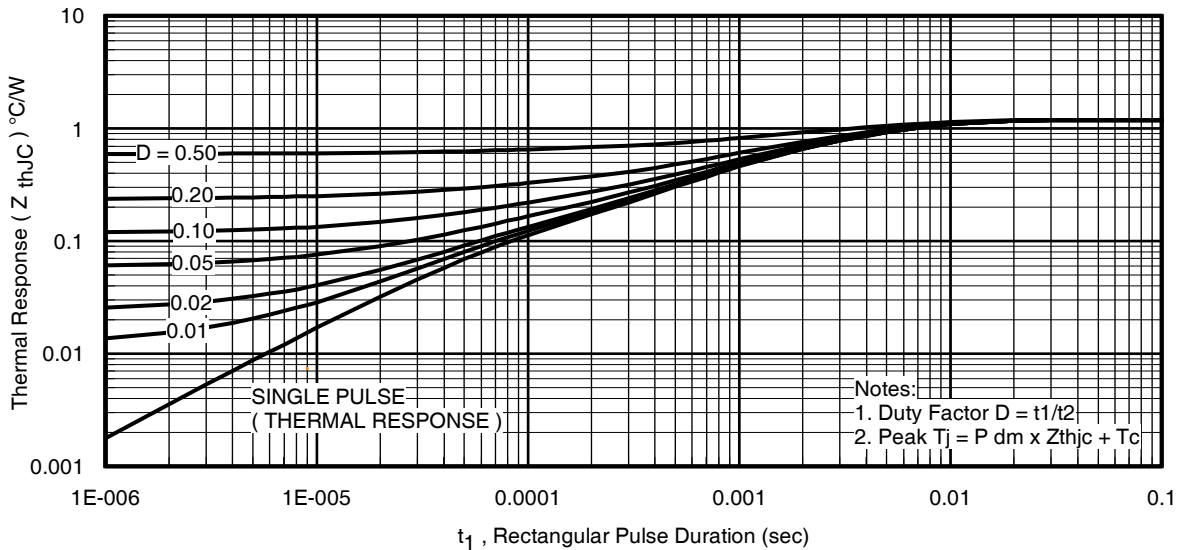
**Fig 8.** Maximum Safe Operating Area



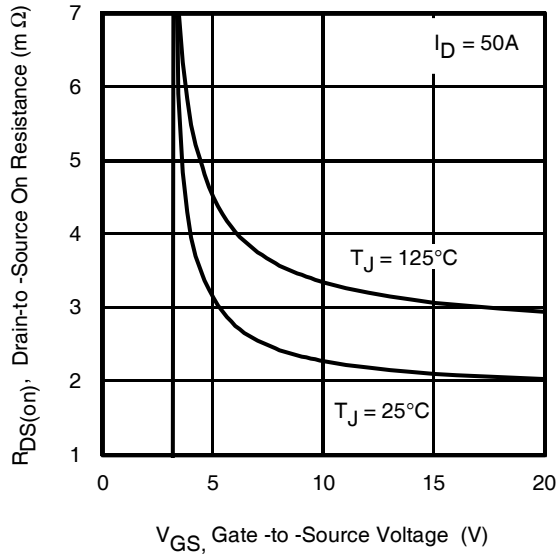
**Fig 9.** Maximum Drain Current vs. Case (Bottom) Temperature



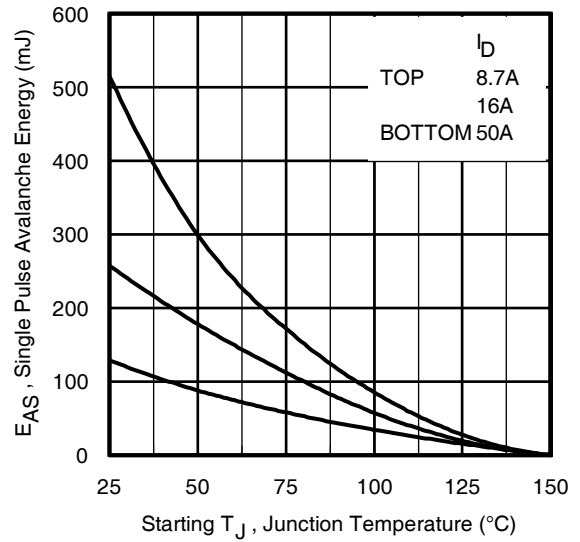
**Fig 10.** Threshold Voltage vs. Temperature



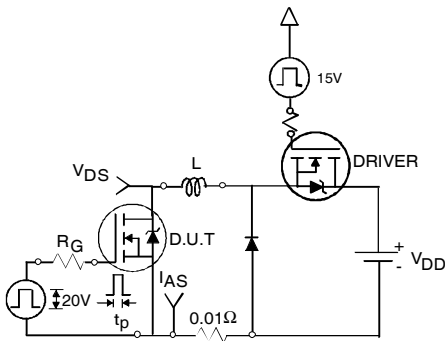
**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case (Bottom)



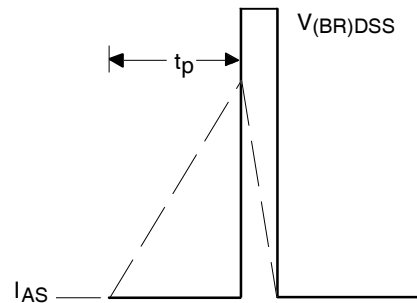
**Fig 12.** On-Resistance vs. Gate Voltage



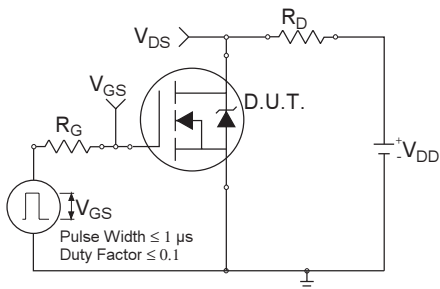
**Fig 13.** Maximum Avalanche Energy vs. Drain Current



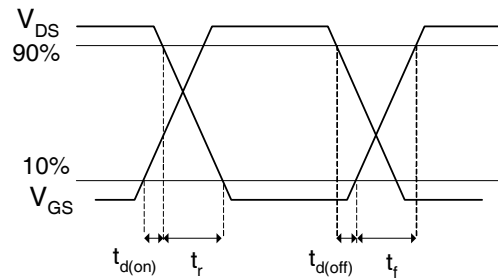
**Fig 14a.** Unclamped Inductive Test Circuit



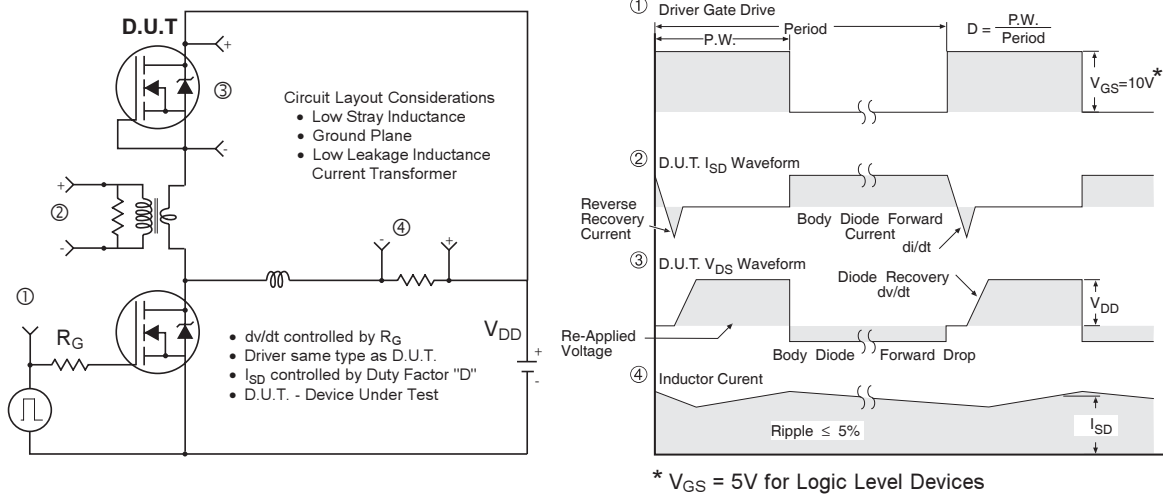
**Fig 14b.** Unclamped Inductive Waveforms



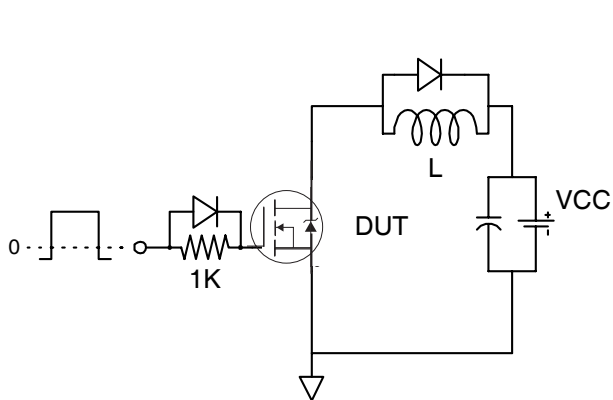
**Fig 15a.** Switching Time Test Circuit



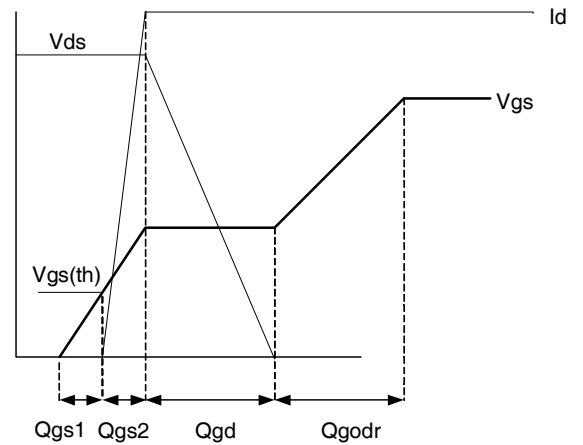
**Fig 15b.** Switching Time Waveforms



**Fig 16.** Peak Diode Recovery  $dv/dt$  Test Circuit for N-Channel HEXFET<sup>®</sup> Power MOSFETs

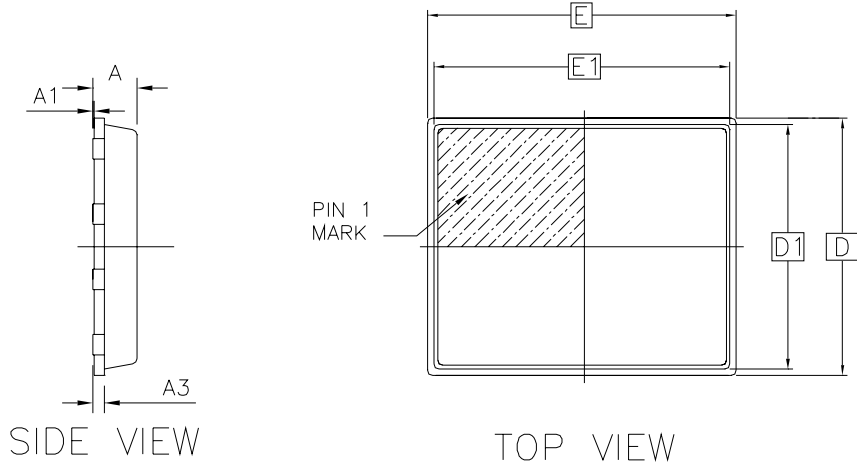


**Fig 17.** Gate Charge Test Circuit

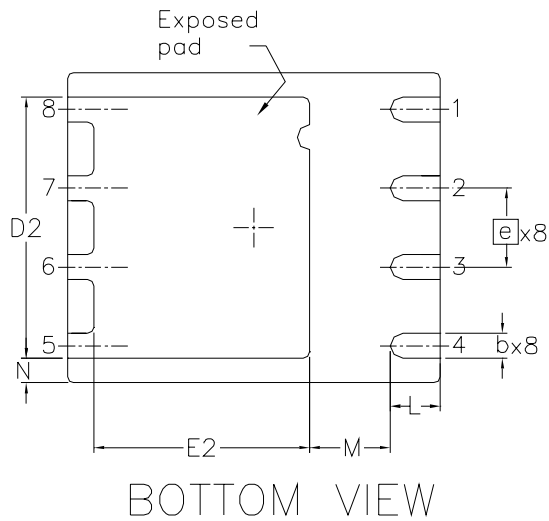


**Fig 18.** Gate Charge Waveform

### PQFN 5x6 Outline "B" Package Details

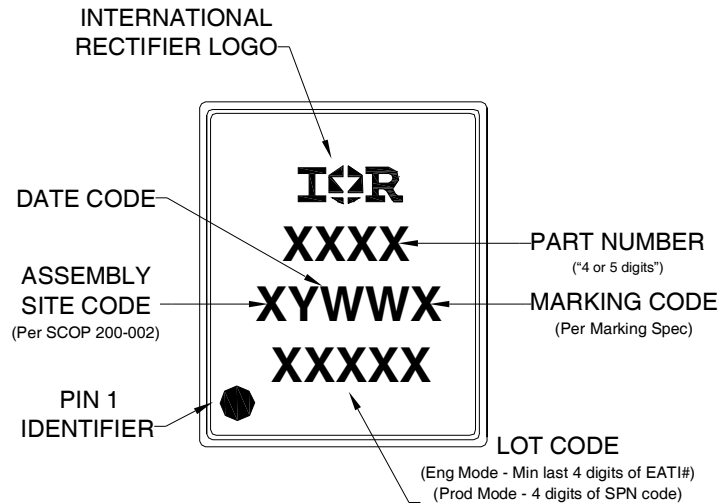


OUTLINE PQFN 5x6B			
DIM SYMBOL	MIN	NOM	MAX
A	0.80	0.83	0.90
A1	0	0.020	0.05
A3		0.20	REF
b	0.35	0.40	0.47
D		5.00	BSC
D1		4.75	BSC
D2	4.10	4.21	4.30
e		1.27	BSC
E		6.00	BSC
E1		5.75	BSC
E2	3.38	3.48	3.58
L	0.70	0.80	0.90
M		1.30	REF
N		0.40	REF



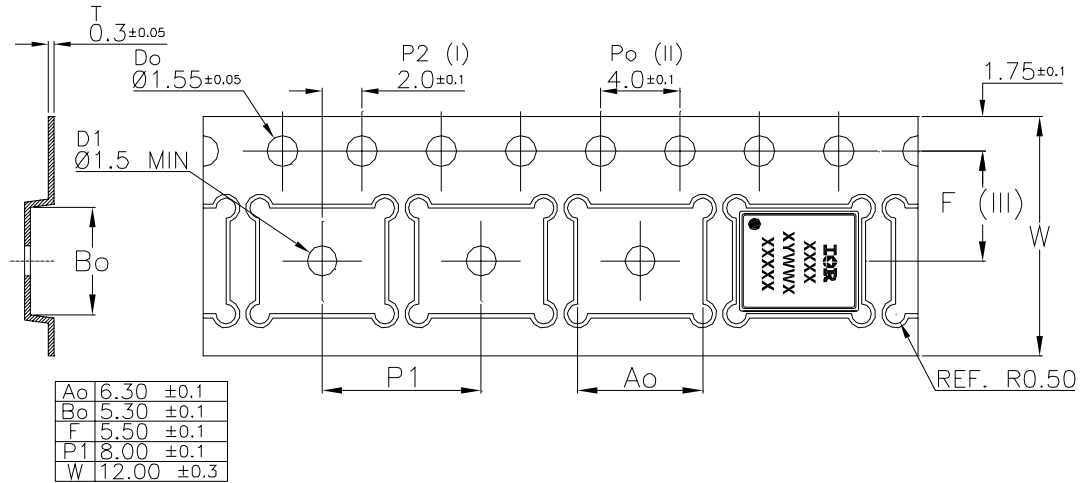
For footprint and stencil design recommendations, please refer to application note AN-1154 at <http://www.irf.com/technical-info/appnotes/an-1154.pdf>

### PQFN 5x6 Outline "B" Part Marking



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

## PQFN 5x6 Outline "B" Tape and Reel



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

Qualification level	Industrial <sup>††</sup> (per JEDEC JESD47F <sup>†††</sup> guidelines)	
Moisture Sensitivity Level	PQFN 5mm x 6mm	MSL1 (per JEDEC J-ST D-020D <sup>†††</sup> )
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.

### Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Starting  $T_J = 25^\circ\text{C}$ ,  $L = 0.14\text{mH}$ ,  $R_G = 25\Omega$ ,  $I_{AS} = 50\text{A}$ .
- ③ Pulse width  $\leq 400\mu\text{s}$ ; duty cycle  $\leq 2\%$ .
- ④  $R_\theta$  is measured at  $T_J$  of approximately  $90^\circ\text{C}$ .
- ⑤ When mounted on 1 inch square 2 oz copper pad on 1.5x1.5 in. board of FR-4 material.
- ⑥ Calculated continuous current based on maximum allowable junction temperature. Package is limited to 100A by production test capability.

### Revision History

Date	Comment
3/31/2010	Idss limits at $T_J 25^\circ\text{C}$ is changed to 500 $\mu\text{A}$ max, $V_{ds} = 24\text{V}$ and at $T_J 125^\circ\text{C}$ it is changed to 5.0mA max, $V_{ds} = 24\text{V}$ . All other parameters remain unchanged.

Data and specifications subject to change without notice.

International  
**IR** Rectifier

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