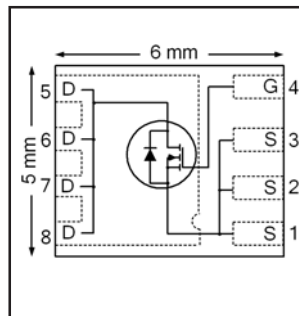


HEXFET® Power MOSFET

$V_{DS}$	<b>40</b>	<b>V</b>
$R_{DS(on) max}$ (@ $V_{GS} = 10V$ )	<b>4.3</b>	<b>mΩ</b>
$Q_g$ (typical)	<b>43</b>	<b>nC</b>
$R_G$ (typical)	<b>1.7</b>	<b>Ω</b>
$I_D$ (@ $T_{c(Bottom)} = 25°C$ )	<b>100</b> Ⓞ	<b>A</b>



### Applications

- Secondary Side Synchronous Rectification
- Inverters for DC Motors
- DC-DC Brick Applications
- Boost Converters

### Features and Benefits

#### Features

Low $R_{DS(on)}$ (< 4.3 mΩ)
Low Thermal Resistance to PCB (< 1.2°C/W)
100% $R_g$ 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
Enables better thermal dissipation
Increased Reliability
Increased Power Density
Multi-Vendor Compatibility
Easier Manufacturing
Environmentally Friendlier
Increased Reliability

Orderable part number	Package Type	Standard Pack		Note
		Form	Quantity	
IRFH5204TRPbF	PQFN 5mm x 6mm	Tape and Reel	4000	
IRFH5204TR2PbF	PQFN 5mm x 6mm	Tape and Reel	400	EOL notice # 259

### Absolute Maximum Ratings

	Parameter	Max.	Units
$V_{DS}$	Drain-to-Source Voltage	40	V
$V_{GS}$	Gate-to-Source Voltage	± 20	
$I_D @ T_A = 25°C$	Continuous Drain Current, $V_{GS} @ 10V$	22	A
$I_D @ T_A = 70°C$	Continuous Drain Current, $V_{GS} @ 10V$	18	
$I_D @ T_{C(Bottom)} = 25°C$	Continuous Drain Current, $V_{GS} @ 10V$	100	
$I_D @ T_{C(Bottom)} = 100°C$	Continuous Drain Current, $V_{GS} @ 10V$	100	
$I_{DM}$	Pulsed Drain Current ①	400	
$P_D @ T_A = 25°C$	Power Dissipation ⑤	3.6	W
$P_D @ T_{C(Bottom)} = 25°C$	Power Dissipation ⑤	105	
	Linear Derating Factor ⑤	0.029	W/°C
$T_J$ $T_{STG}$	Operating Junction and Storage Temperature Range	-55 to + 150	°C

Notes ① through ⑥ are on page 8

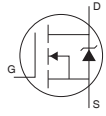
**Static @ T<sub>J</sub> = 25°C (unless otherwise specified)**

	Parameter	Min.	Typ.	Max.	Units	Conditions
BV <sub>DSS</sub>	Drain-to-Source Breakdown Voltage	40	—	—	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA
ΔBV <sub>DSS</sub> /ΔT <sub>J</sub>	Breakdown Voltage Temp. Coefficient	—	0.05	—	V/°C	Reference to 25°C, I <sub>D</sub> = 1.0mA
R <sub>DS(on)</sub>	Static Drain-to-Source On-Resistance	—	3.6	4.3	mΩ	V <sub>GS</sub> = 10V, I <sub>D</sub> = 50A ③
V <sub>GS(th)</sub>	Gate Threshold Voltage	2.0	—	4.0	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 100μA
ΔV <sub>GS(th)</sub>	Gate Threshold Voltage Coefficient	—	-9.3	—	mV/°C	
I <sub>DSS</sub>	Drain-to-Source Leakage Current	—	—	20	μA	V <sub>DS</sub> = 40V, V <sub>GS</sub> = 0V
		—	—	250		V <sub>DS</sub> = 40V, 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	96	—	—	S	V <sub>DS</sub> = 15V, I <sub>D</sub> = 50A
Q <sub>g</sub>	Total Gate Charge	—	43	65	nC	V <sub>DS</sub> = 20V V <sub>GS</sub> = 10V I <sub>D</sub> = 50A
Q <sub>gs1</sub>	Pre-V <sub>th</sub> Gate-to-Source Charge	—	9.1	—		
Q <sub>gs2</sub>	Post-V <sub>th</sub> Gate-to-Source Charge	—	4.0	—		
Q <sub>gd</sub>	Gate-to-Drain Charge	—	14	—		
Q <sub>godr</sub>	Gate Charge Overdrive	—	16	—		
Q <sub>sw</sub>	Switch Charge (Q <sub>gs2</sub> + Q <sub>gd</sub> )	—	18	—		
Q <sub>oss</sub>	Output Charge	—	18	—	nC	V <sub>DS</sub> = 16V, V <sub>GS</sub> = 0V
R <sub>G</sub>	Gate Resistance	—	1.7	—	Ω	
t <sub>d(on)</sub>	Turn-On Delay Time	—	8.4	—	ns	V <sub>DD</sub> = 20V, V <sub>GS</sub> = 10V I <sub>D</sub> = 50A R <sub>G</sub> = 1.8Ω
t <sub>r</sub>	Rise Time	—	14	—		
t <sub>d(off)</sub>	Turn-Off Delay Time	—	18	—		
t <sub>f</sub>	Fall Time	—	8.3	—		
C <sub>iss</sub>	Input Capacitance	—	2460	—	pF	V <sub>GS</sub> = 0V V <sub>DS</sub> = 25V f = 1.0MHz
C <sub>oss</sub>	Output Capacitance	—	515	—		
C <sub>rss</sub>	Reverse Transfer Capacitance	—	250	—		

**Avalanche Characteristics**

	Parameter	Typ.	Max.	Units
E <sub>AS</sub>	Single Pulse Avalanche Energy ②	—	102	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)	—	—	100⑥	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	—	—	1.3	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	—	30	45	ns	T <sub>J</sub> = 25°C, I <sub>F</sub> = 50A, V <sub>DD</sub> = 20V
Q <sub>rr</sub>	Reverse Recovery Charge	—	128	192	nC	di/dt = 500A/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	

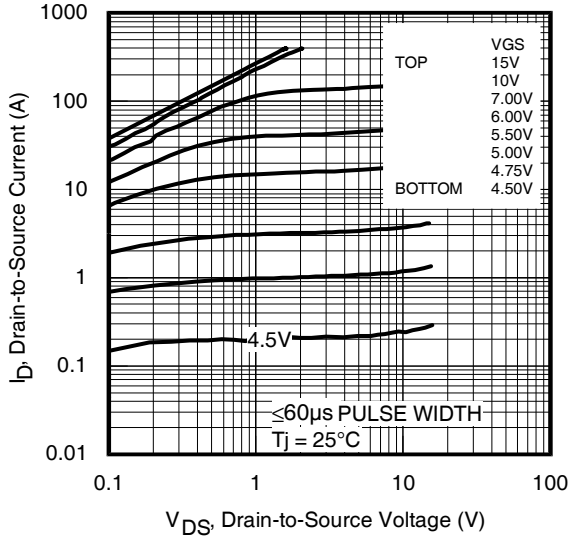


Fig 1. Typical Output Characteristics

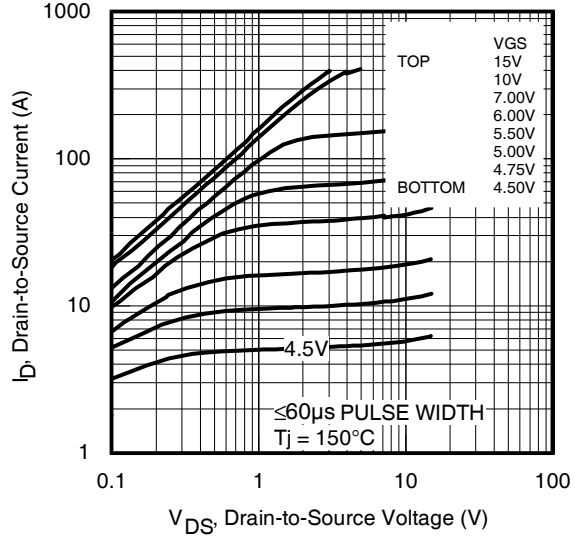


Fig 2. Typical Output Characteristics

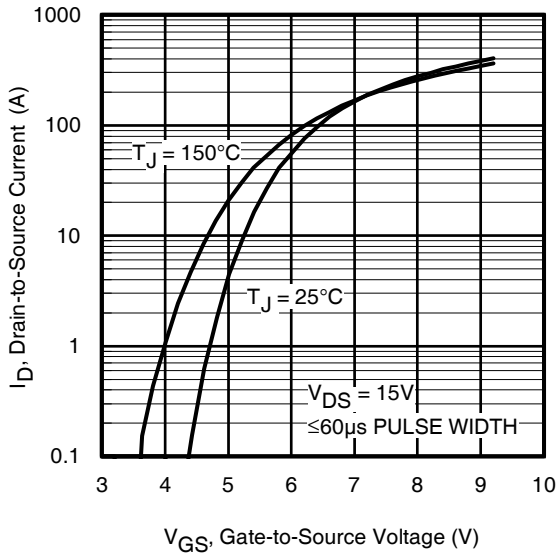


Fig 3. Typical Transfer Characteristics

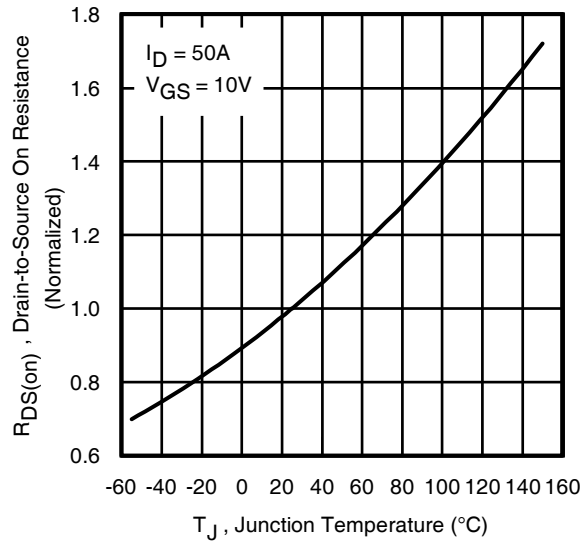


Fig 4. Normalized On-Resistance Vs. Temperature

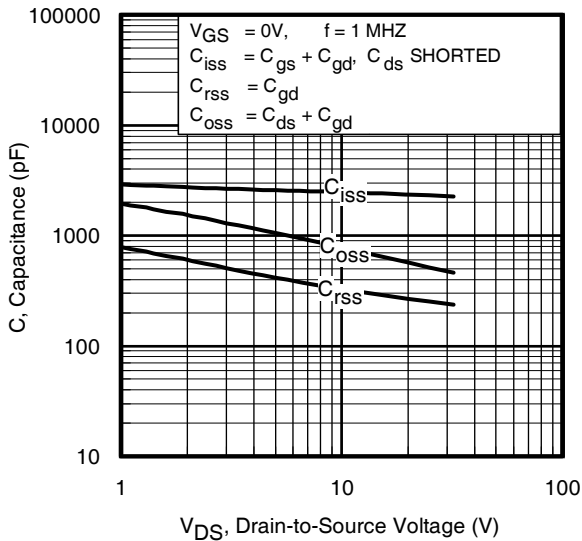


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

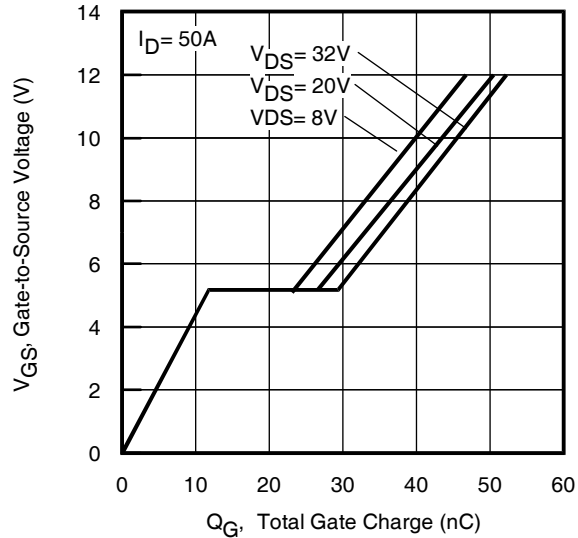
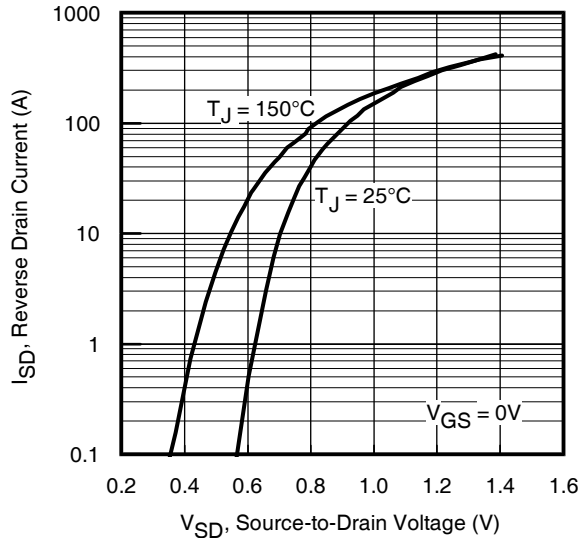
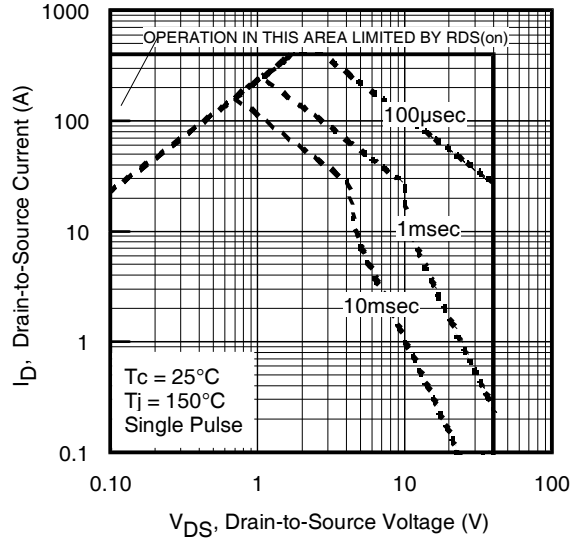
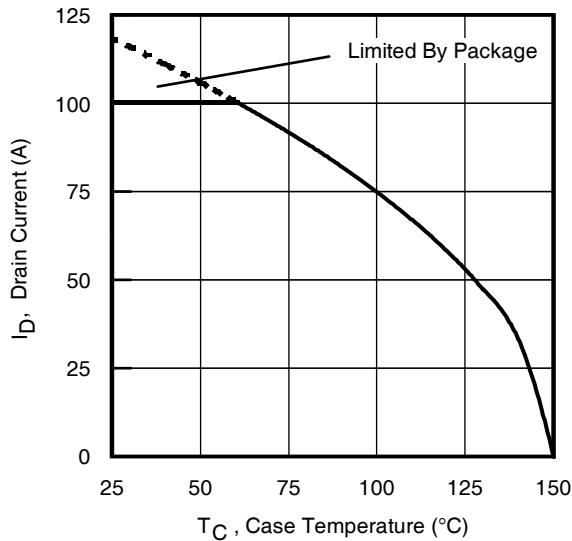
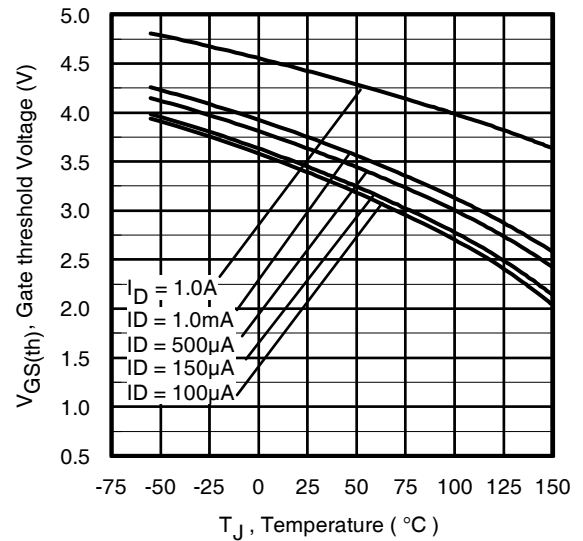
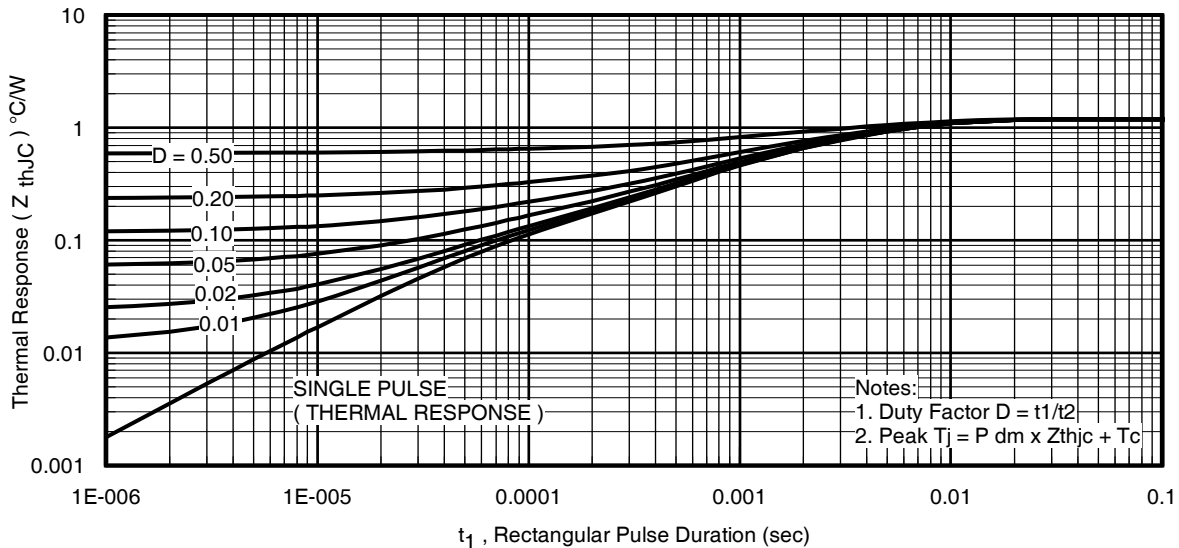


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage


**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)

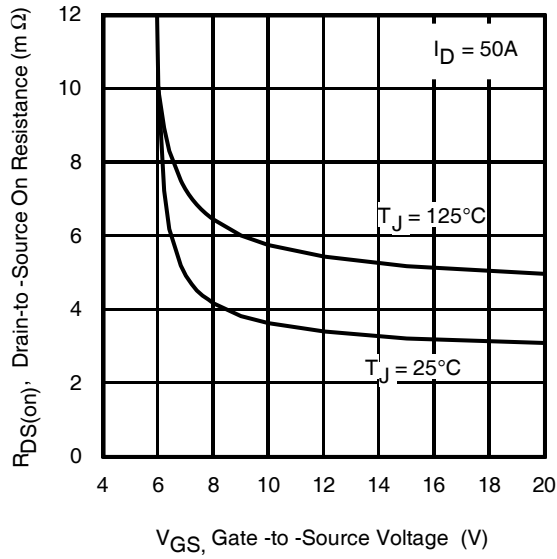


Fig 12. On-Resistance vs. Gate Voltage

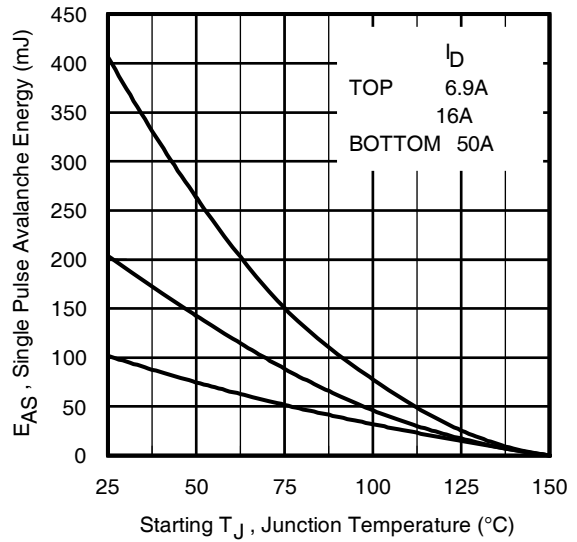


Fig 13. Maximum Avalanche Energy vs. Drain Current

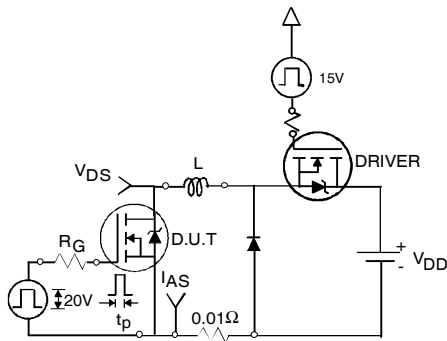


Fig 14a. Unclamped Inductive Test Circuit



Fig 14b. Unclamped Inductive Waveforms

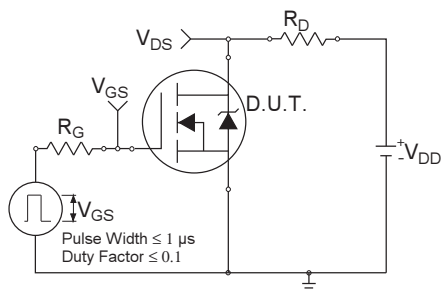


Fig 15a. Switching Time Test Circuit

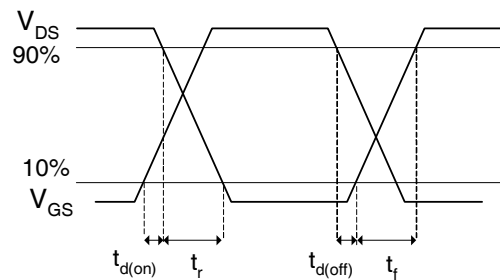
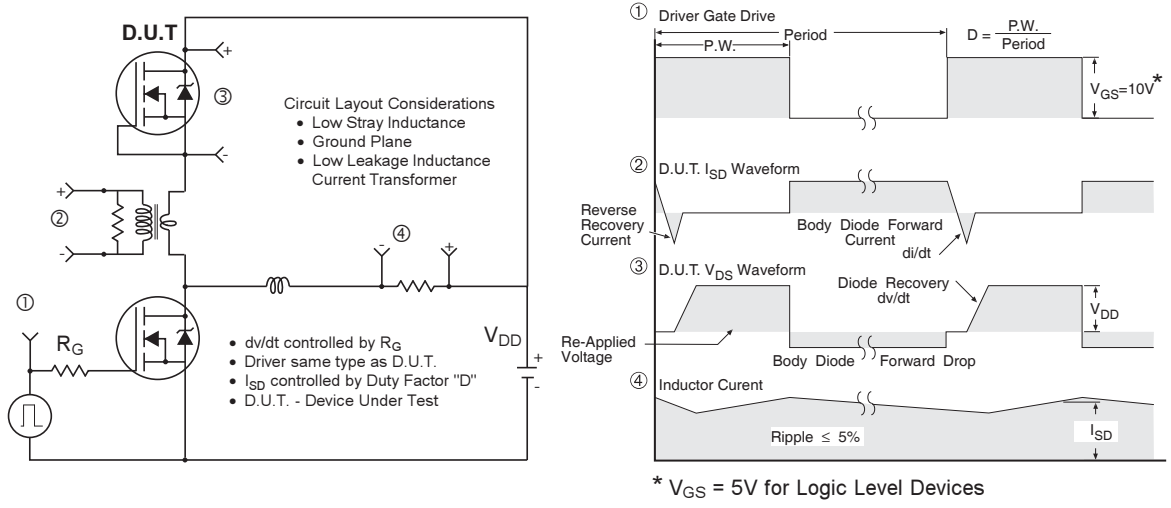
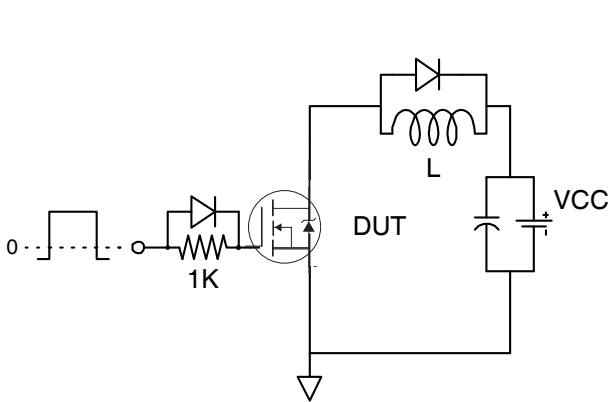


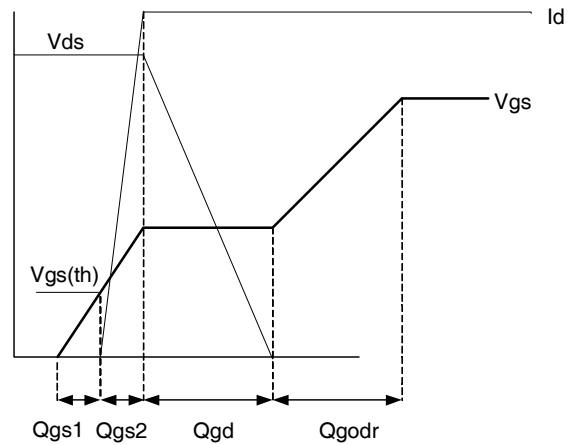
Fig 15b. Switching Time Waveforms



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

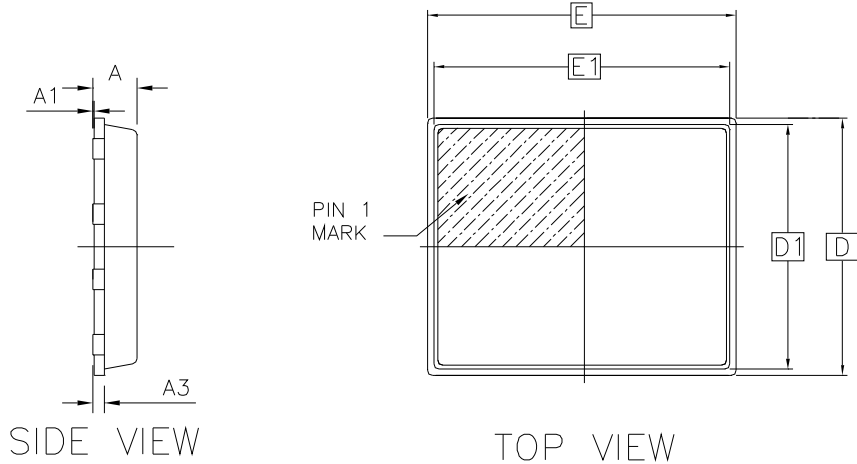


**Fig 17. Gate Charge Test Circuit**

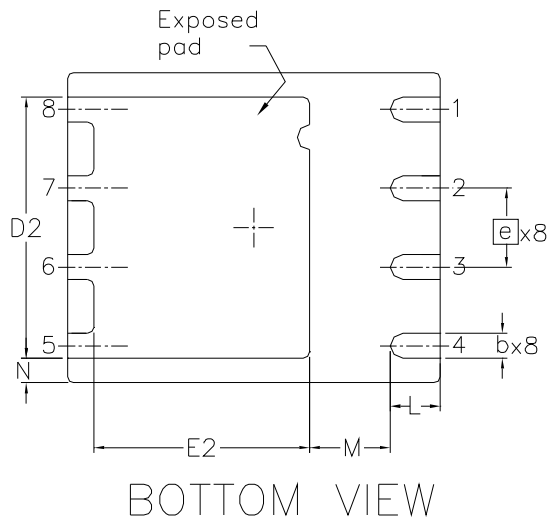


**Fig 18. Gate Charge Waveform**

## PQFN 5x6 Outline "B" Package Details

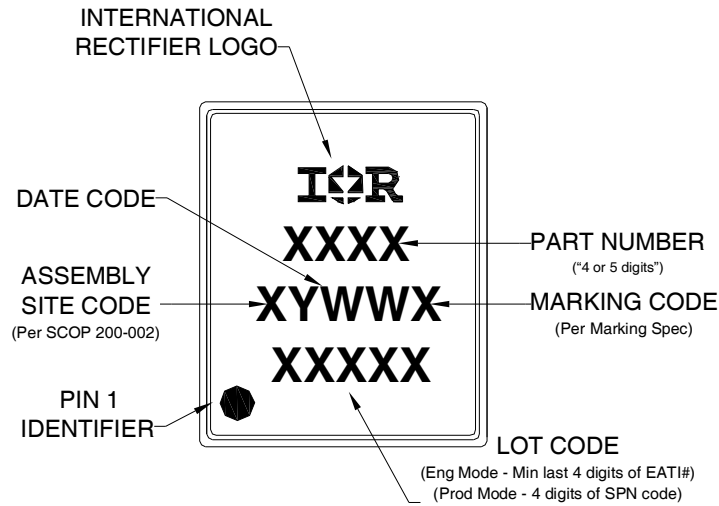


OUTLINE PQFN 5x6B			
DIM SYMBOL	MIN	NOM	MAX
A	0.80	0.83	0.90
A1	0	0.020	0.05
A3		0.20	REF
b	0.35	0.40	0.47
D		5.00	BSC
D1		4.75	BSC
D2	4.10	4.21	4.30
e		1.27	BSC
E		6.00	BSC
E1		5.75	BSC
E2	3.38	3.48	3.58
L	0.70	0.80	0.90
M		1.30	REF
N		0.40	REF



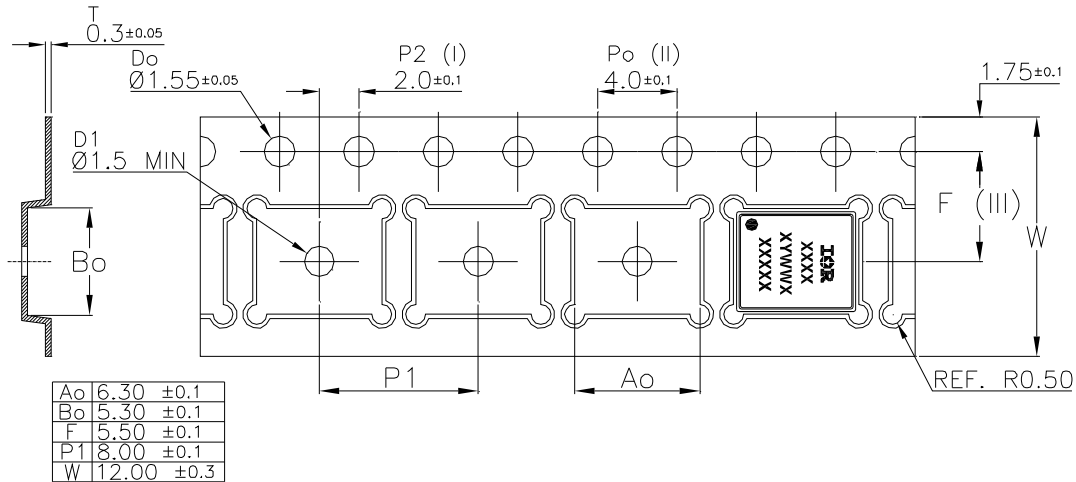
For footprint and stencil design recommendations, please refer to application note AN-1154 at <http://www.irf.com/technical-info/appnotes/an-1154.pdf>

## 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 JES D47F <sup>†††</sup> guidelines)	
Moisture Sensitivity Level	PQFN 5mm x 6mm	MSL1 (per JEDEC J-STD-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.

### Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Starting  $T_J = 25^\circ\text{C}$ ,  $L = 0.081\text{mH}$ ,  $R_G = 50\Omega$ ,  $I_{AS} = 50\text{A}$ .
- 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	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>