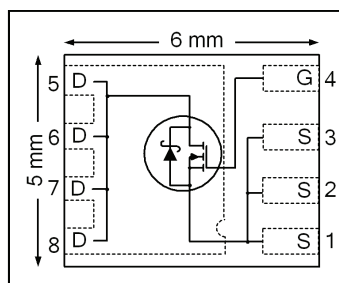


HEXFET® Power MOSFET

V_{DSS}	25	V
R_{DS(on)} max (@ V _{GS} = 10V)	1.10	mΩ
(@ V _{GS} = 4.5V)	1.35	
Qg (typical)	37.0	nC
I_D (@ T _{C (Bottom)} = 25°C)	100 ⑦	A



PQFN 5X6 mm

Applications

- Synchronous Rectifier MOSFET for Synchronous Buck Converters

Features

Low R _{DS(ON)} (<1.10 mΩ)
Schottky Intrinsic Diode with Low Forward Voltage
Low Thermal Resistance to PCB (<1.0°C/W)
Low Profile (<0.9 mm)
Industry-Standard Pinout
Compatible with Existing Surface Mount Techniques
RoHS Compliant, Halogen-Free
MSL1, Industrial Qualification

results in



Benefits

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

Base part number	Package Type	Standard Pack		Orderable Part Number
		Form	Quantity	
IRFH4210DPbF	PQFN 5mm x 6 mm	Tape and Reel	4000	IRFH4210DTRPbF

Absolute Maximum Ratings

	Parameter	Max.	Units
V _{GS}	Gate-to-Source Voltage	± 20	V
I _D @ T _A = 25°C	Continuous Drain Current, V _{GS} @ 10V	44	A
I _D @ T _{C(Bottom)} = 25°C	Continuous Drain Current, V _{GS} @ 10V	266⑥⑦	
I _D @ T _{C(Bottom)} = 100°C	Continuous Drain Current, V _{GS} @ 10V	168⑥⑦	
I _D @ T _{C(Bottom)} = 25°C	Continuous Drain Current, V _{GS} @ 10V (Source Bonding Technology Limited)	100⑦	
I _{DM}	Pulsed Drain Current ①	400	
P _D @ T _A = 25°C	Power Dissipation ⑤	3.5	W
P _D @ T _{C(Bottom)} = 25°C	Power Dissipation	125	
	Linear Derating Factor	0.028	W/°C
T _J T _{STG}	Operating Junction and Storage Temperature Range	-55 to + 150	°C

Notes ① through ⑦ are on page 9

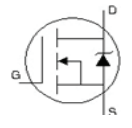
Static @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
BV_{DSS}	Drain-to-Source Breakdown Voltage	25	—	—	V	$V_{GS} = 0V, I_D = 1mA$
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	19	—	mV/ $^\circ\text{C}$	Reference to 25°C , $I_D = 10mA$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	0.85	1.10	m Ω	$V_{GS} = 10V, I_D = 50A$ ③
		—	1.10	1.35		$V_{GS} = 4.5V, I_D = 50A$ ③
$V_{GS(th)}$	Gate Threshold Voltage	1.1	1.6	2.1	V	$V_{DS} = V_{GS}, I_D = 100\mu A$
$\Delta V_{GS(th)}$	Gate Threshold Voltage Coefficient	—	-10	—	mV/ $^\circ\text{C}$	
I_{DSS}	Drain-to-Source Leakage Current	—	—	250	μA	$V_{DS} = 20V, V_{GS} = 0V$
I_{GSS}	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS} = 20V$
	Gate-to-Source Reverse Leakage	—	—	-100		$V_{GS} = -20V$
g_{fs}	Forward Transconductance	392	—	—	S	$V_{DS} = 13V, I_D = 50A$
Q_g	Total Gate Charge	—	77.0	—	nC	$V_{GS} = 10V, V_{DS} = 13V, I_D = 50A$
Q_g	Total Gate Charge	—	37.0	55.5	nC	$V_{DS} = 13V$ $V_{GS} = 4.5V$ $I_D = 50A$
Q_{gs1}	Pre-V _{th} Gate-to-Source Charge	—	7.6	—		
Q_{gs2}	Post-V _{th} Gate-to-Source Charge	—	6.4	—		
Q_{gd}	Gate-to-Drain Charge	—	13.2	—		
Q_{godr}	Gate Charge Overdrive	—	9.8	—		
Q_{sw}	Switch Charge ($Q_{gs2} + Q_{gd}$)	—	19.6	—		
Q_{oss}	Output Charge	—	37	—	nC	$V_{DS} = 16V, V_{GS} = 0V$
R_G	Gate Resistance	—	1.3	—	Ω	
$t_{d(on)}$	Turn-On Delay Time	—	19	—	ns	$V_{DD} = 13V, V_{GS} = 4.5V$ $I_D = 50A$ $R_G = 1.8\Omega$
t_r	Rise Time	—	45	—		
$t_{d(off)}$	Turn-Off Delay Time	—	24	—		
t_f	Fall Time	—	16	—		
C_{iss}	Input Capacitance	—	4812	—	pF	$V_{GS} = 0V$ $V_{DS} = 13V$ $f = 1.0MHz$
C_{oss}	Output Capacitance	—	1459	—		
C_{rss}	Reverse Transfer Capacitance	—	355	—		

Avalanche Characteristics

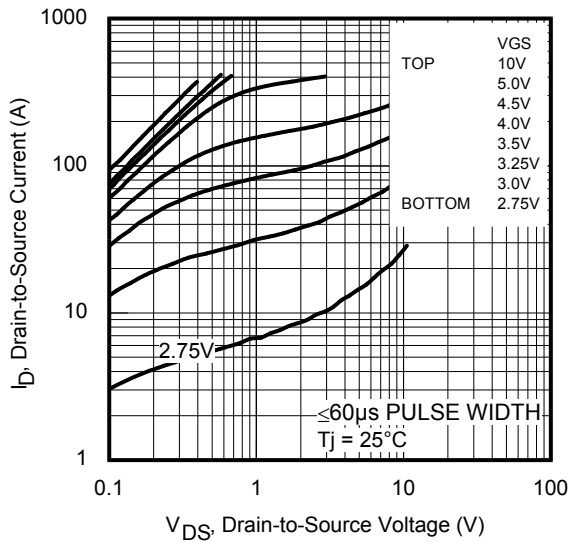
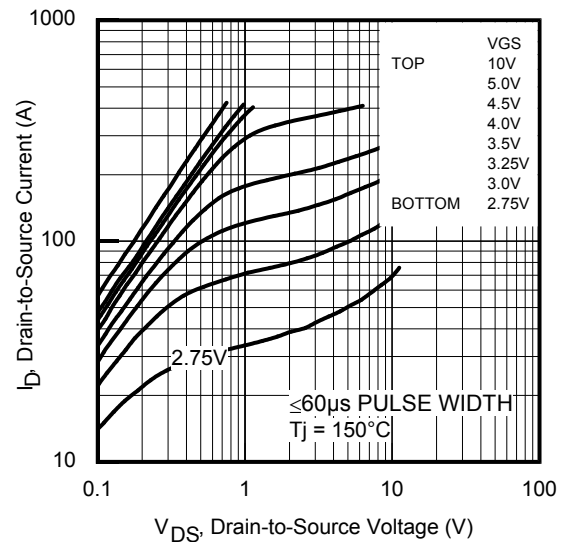
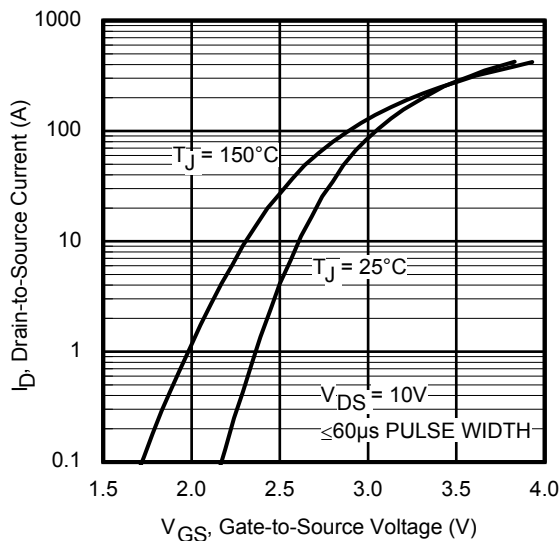
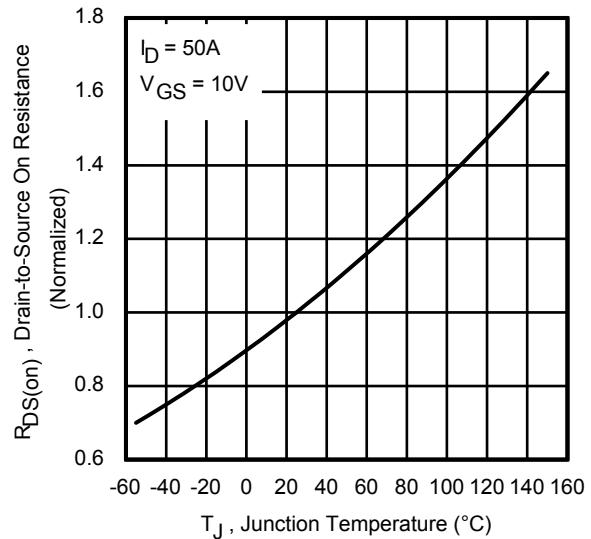
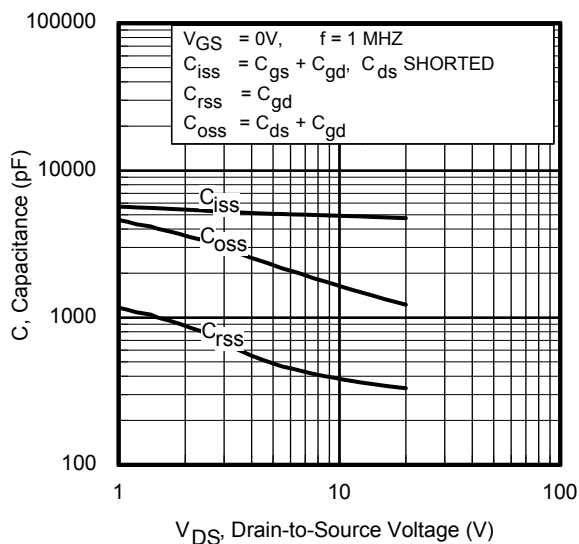
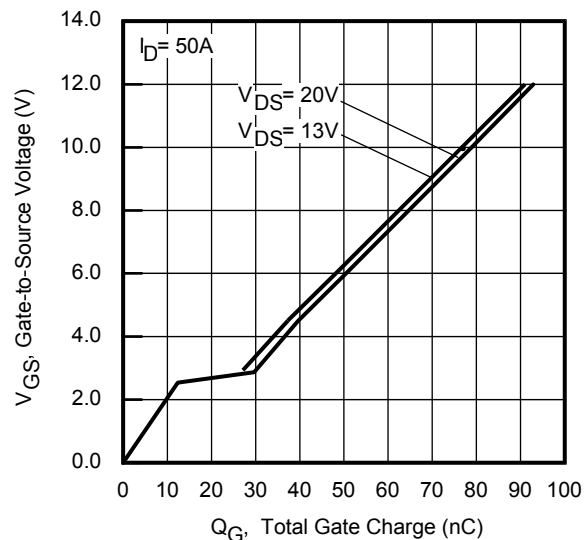
	Parameter	Typ.	Max.
E_{AS}	Single Pulse Avalanche Energy ②	—	247
I_{AR}	Avalanche Current ①	—	50

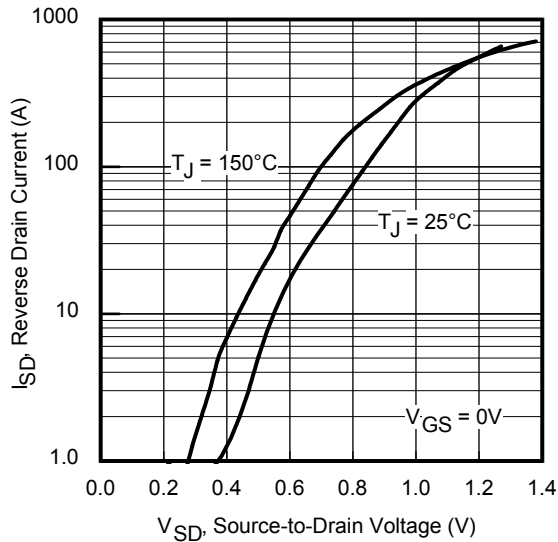
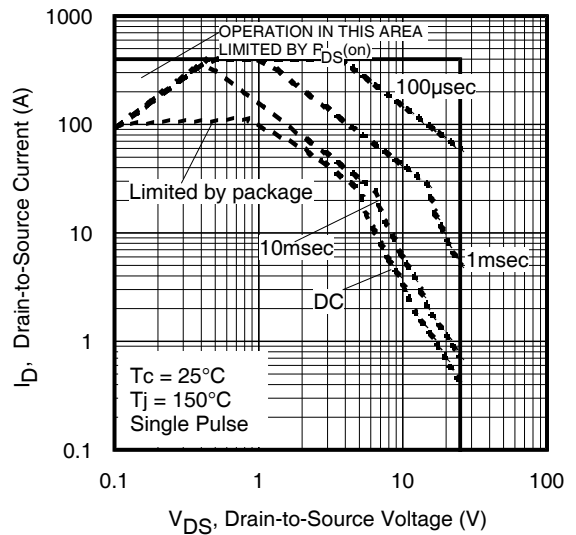
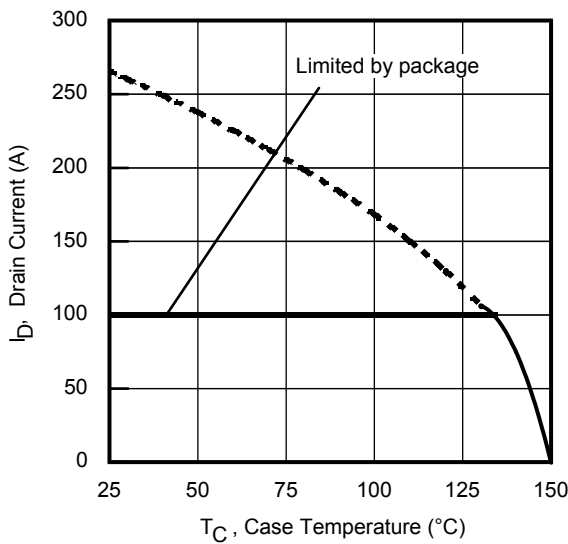
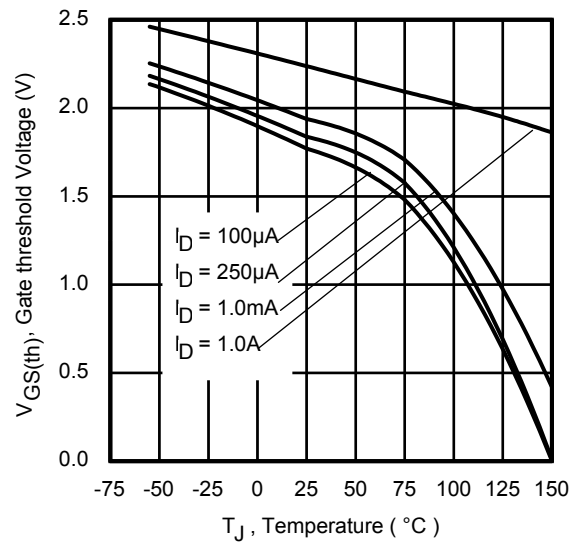
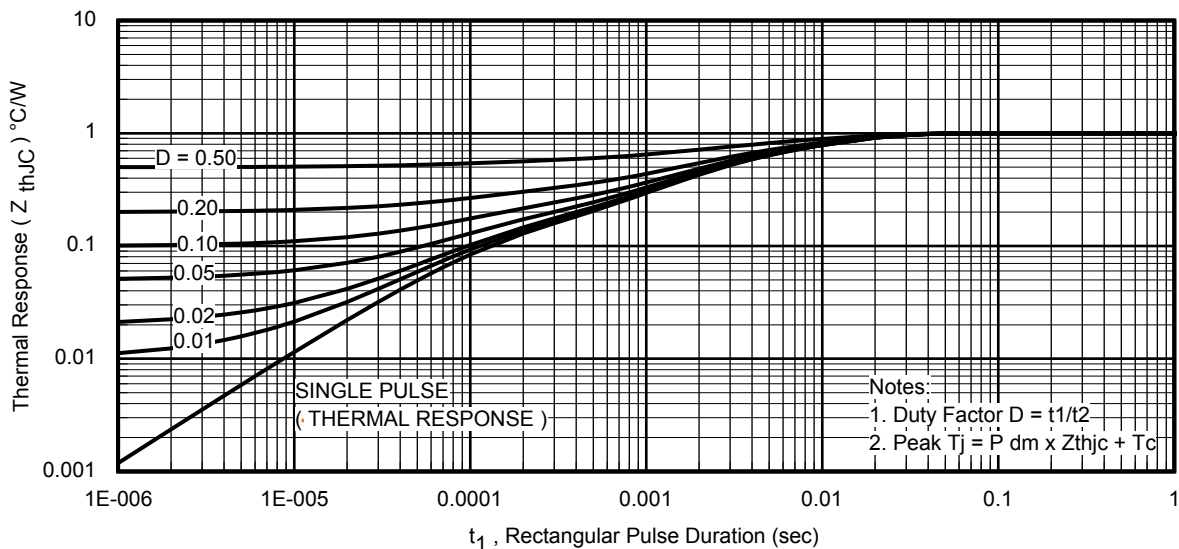
Diode Characteristics

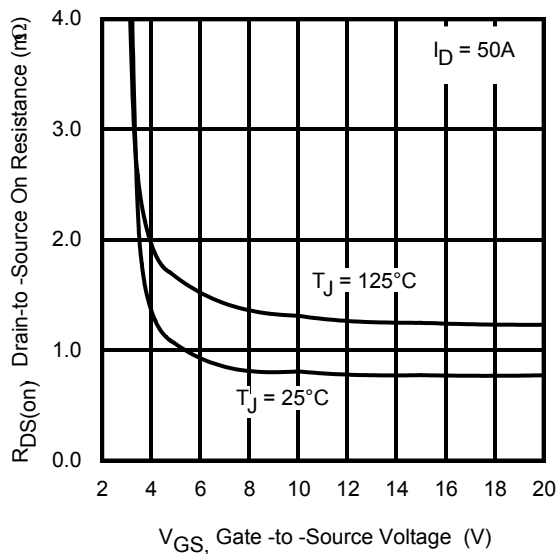
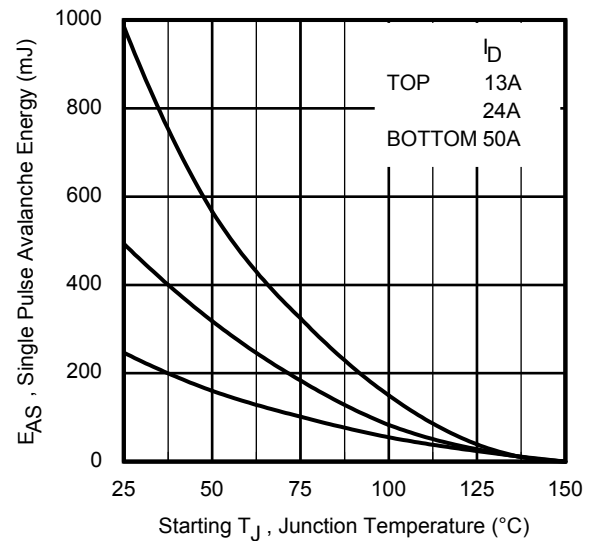
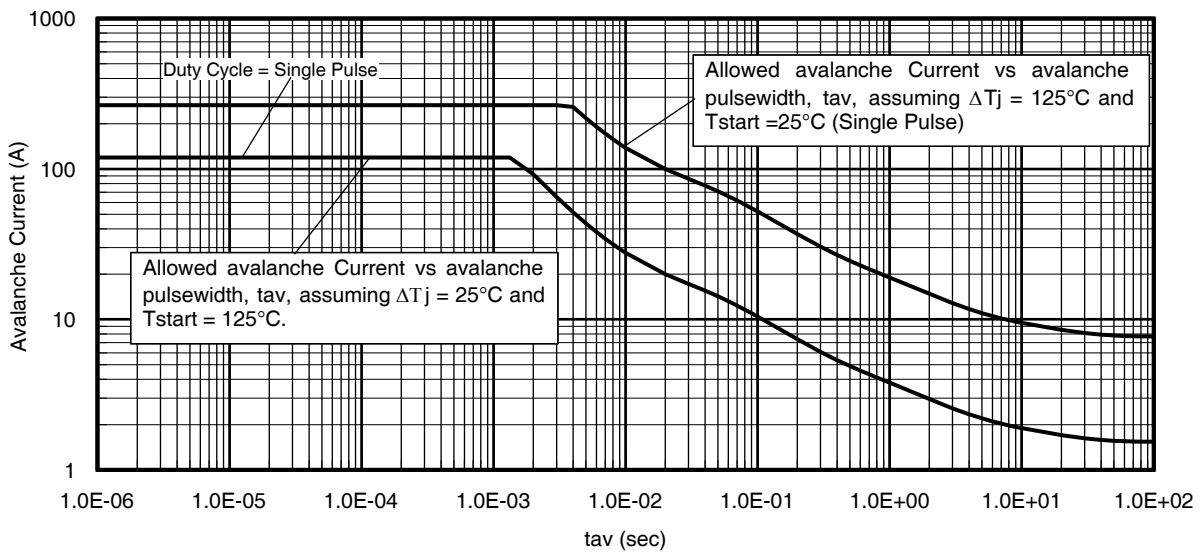
	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	100 ⑦	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode) ①	—	—	400		
V_{SD}	Diode Forward Voltage	—	—	0.75	V	$T_J = 25^\circ\text{C}, I_S = 50A, V_{GS} = 0V$ ③
t_{rr}	Reverse Recovery Time	—	27	41	ns	$T_J = 25^\circ\text{C}, I_F = 50A, V_{DD} = 13V$ $di/dt = 300A/\mu s$ ③
Q_{rr}	Reverse Recovery Charge	—	59	89	nC	

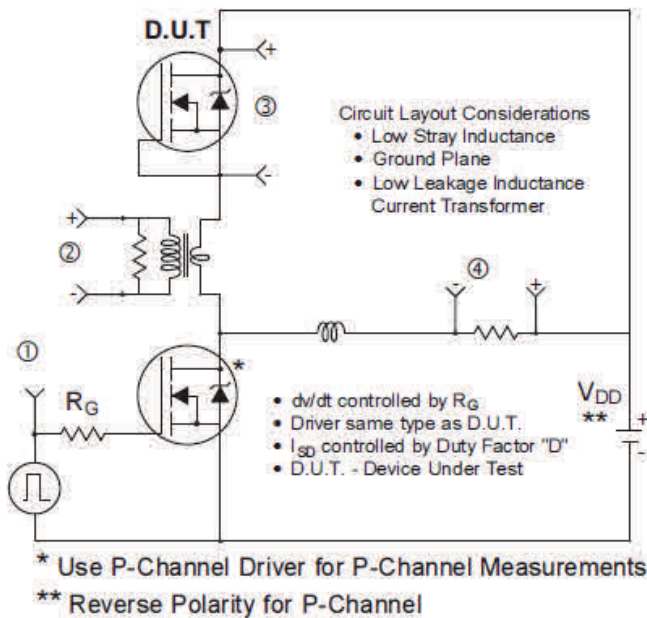
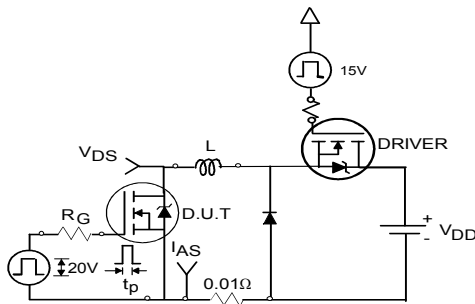
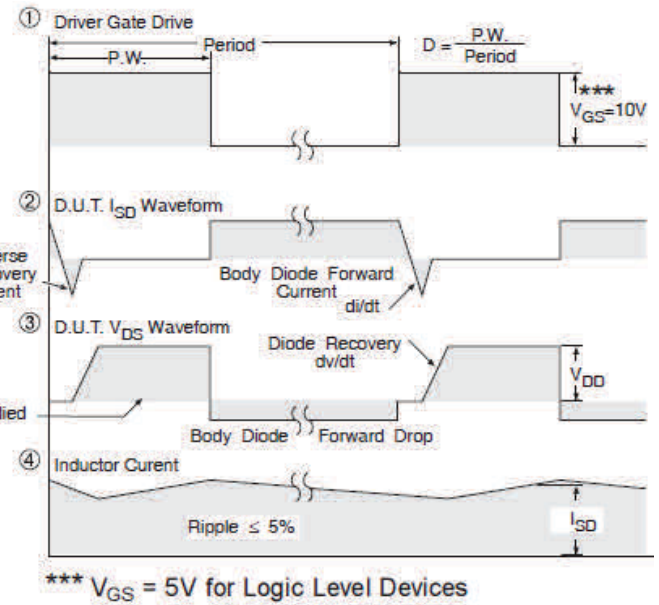
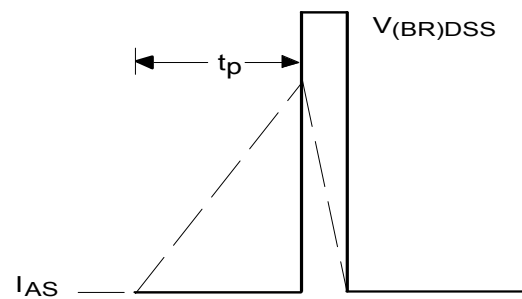
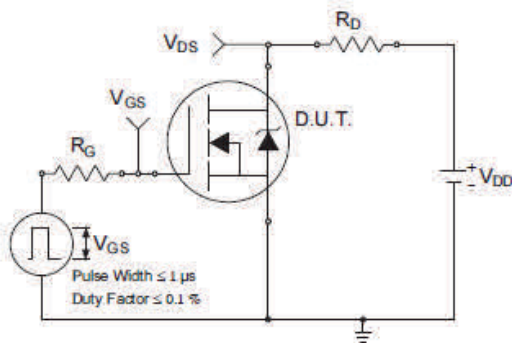
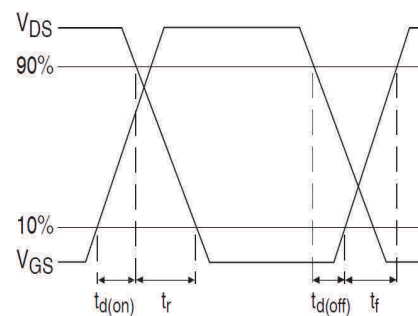
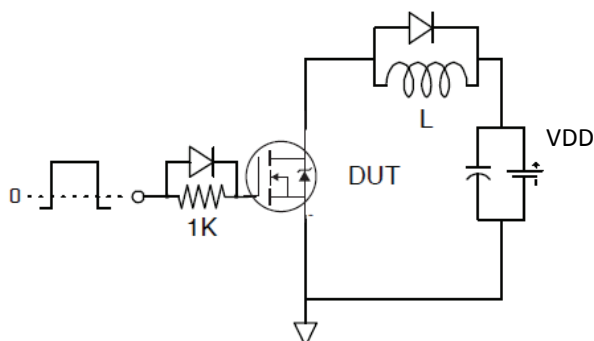
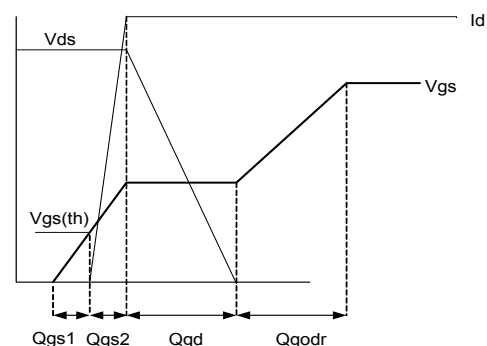
Thermal Resistance

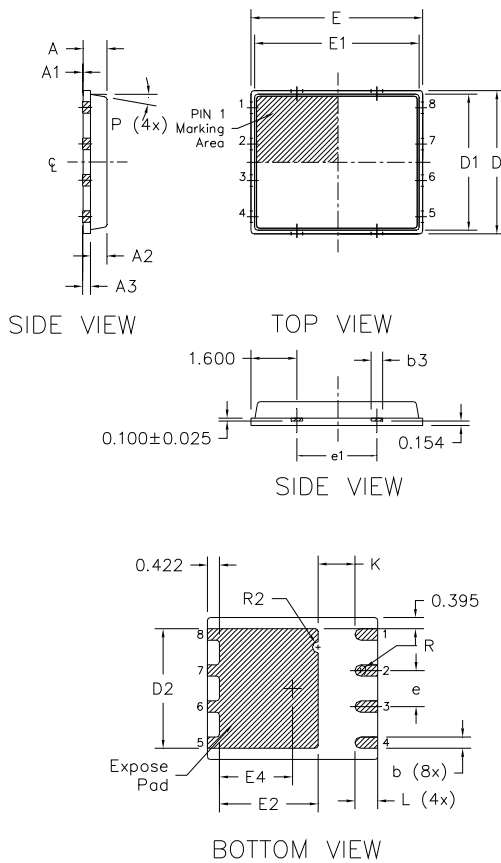
	Parameter	Typ.	Max.	Units
$R_{\theta JC}$ (Bottom)	Junction-to-Case ④	—	1.0	$^\circ\text{C/W}$
$R_{\theta JC}$ (Top)	Junction-to-Case ④	—	22	
$R_{\theta JA}$	Junction-to-Ambient ⑤	—	36	
$R_{\theta JA} (<10s)$	Junction-to-Ambient ⑤	—	21	


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 Temperature

Fig 10. Drain-to-Source Breakdown Voltage

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


Fig 12. On- Resistance vs. Gate Voltage

Fig 13. Maximum Avalanche Energy vs. Drain Current

Fig 14. Typical Avalanche Current vs. Pulsewidth


Fig 15. Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs

Fig 16a. Unclamped Inductive Test Circuit

Fig 16b. Unclamped Inductive Waveforms

Fig 17a. Switching Time Test Circuit

Fig 17b. Switching Time Waveforms

Fig 18. Gate Charge Test Circuit

Fig 19. Gate Charge Waveform

PQFN 5x6 Outline "B" Package Details


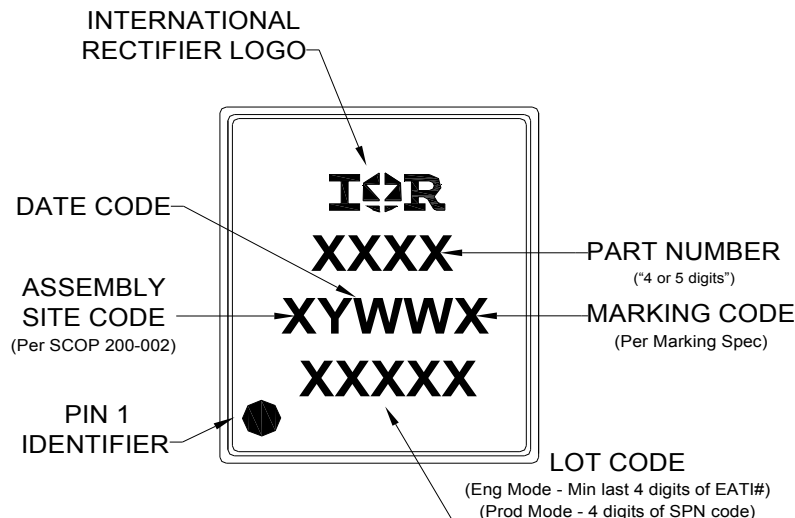
DIM SYMBOL	MILLIMETERS		INCH	
	MIN	MAX	MIN	MAX
A	0.800	0.900	0.0315	0.0543
A1	0.000	0.050	0.0000	0.0020
A3	0.200	REF	0.0079	REF
b	0.350	0.470	0.0138	0.0185
b1	0.025	0.125	0.0010	0.0049
b2	0.210	0.410	0.0083	0.0161
b3	0.150	0.450	0.0059	0.0177
D	5.000	BSC	0.1969	BSC
D1	4.750	BSC	0.1870	BSC
D2	4.100	4.300	0.1614	0.1693
E	6.000	BSC	0.2362	BSC
E1	5.750	BSC	0.2264	BSC
E2	3.380	3.780	0.1331	0.1488
e	1.270	REF	0.0500	REF
e1	2.800	REF	0.1102	REF
K	1.200	1.420	0.0472	0.0559
L	0.710	0.900	0.0280	0.0354
P	0°	12°	0°	12°
R	0.200	REF	0.0079	REF
R2	0.150	0.200	0.0059	0.0079

Note:

1. Dimensions and tolerancing conform to ASME Y14.5M-1994
2. Dimension L represents terminal full back from package edge up to 0.1mm is acceptable
3. Coplanarity applies to the expose Heat Slug as well as the terminal
4. Radius on terminal is Optional

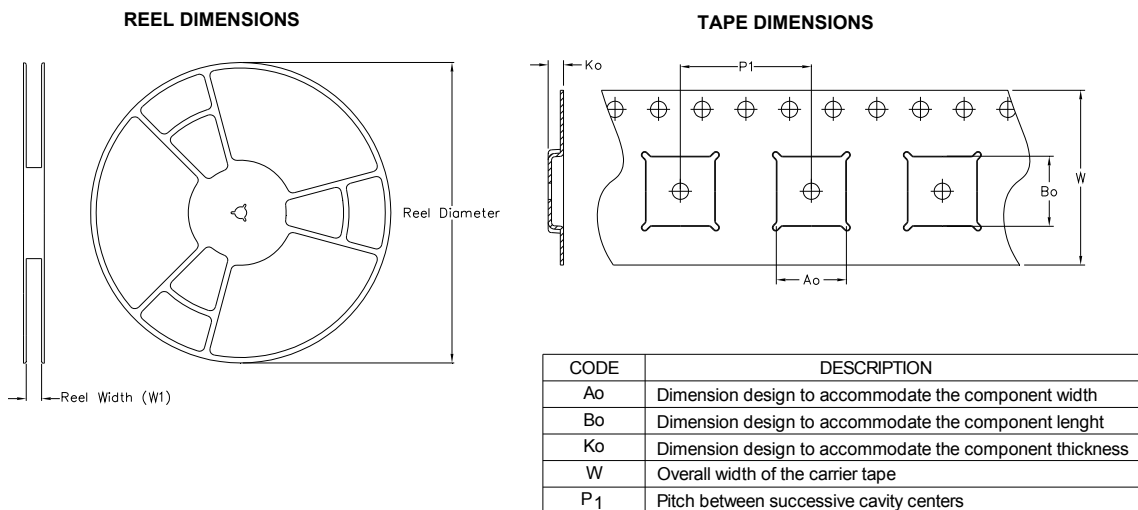
For more information on board mounting, including footprint and stencil recommendation, please refer to application note AN-1136: <http://www.irf.com/technical-info/appnotes/an-1136.pdf>

For more information on package inspection techniques, please refer to application note AN-1154: <http://www.irf.com/technical-info/appnotes/an-1154.pdf>

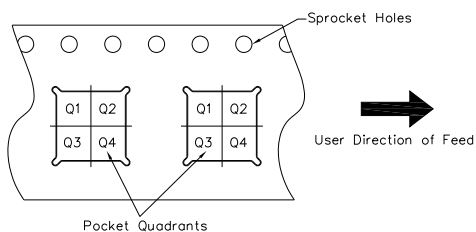
PQFN 5x6 Part Marking


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

PQFN 5x6 Tape and Reel



QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



Note: All dimension are nominal

Package Type	Reel Diameter (Inch)	QTY	Reel Width W1 (mm)	Ao (mm)	Bo (mm)	Ko (mm)	P1 (mm)	W (mm)	Pin 1 Quadrant
5 X 6 PQFN	13	4000	12.4	6.300	5.300	1.20	8.00	12	Q1

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

Qualification Information†

Qualification Level	Industrial (per JEDEC JESD47F†† guidelines)	
Moisture Sensitivity Level	PQFN 5mm x 6mm	MSL1 (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>

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

Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Starting $T_J = 25^{\circ}\text{C}$, $L = 0.20\text{mH}$, $R_G = 50\Omega$, $I_{AS} = 50\text{A}$.
- ③ Pulse width $\leq 400\text{ }\mu\text{s}$; duty cycle $\leq 2\%$.
- ④ R_{θ} is measured at T_J of approximately 90°C .
- ⑤ When mounted on 1 inch square PCB (FR-4). Please refer to AN-994 for more details:
<http://www.irf.com/technical-info/appnotes/an-994.pdf>
- ⑥ Calculated continuous current based on maximum allowable junction temperature.
- ⑦ Current is limited to 100A by source bonding technology.

Revision History

Date	Comments
4/30/2013	Release of final data sheet.
5/17/2013	- Updated package 3D drawing, on page 1. - Added Continuous Drain Current limited by source bonding technology, on page 1. - Divided note 6 into note 6 & 7, on page 8.
8/14/2013	Added "Fast/RFET™" above the part number, on page 1.
3/16/2015	Updated package outline and tape and reel on pages 7 and 8.

International
 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/>