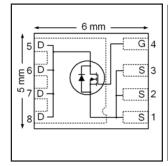


# HEXFET® Power MOSFET

V <sub>DS</sub>	150	V
<b>R</b> <sub>DS(on) max</sub> (@V <sub>GS</sub> = 10V)	58	$\mathbf{m}\Omega$
Q <sub>g (typical)</sub>	21	nC
R <sub>G (typical)</sub>	2.3	Ω
<b>I</b> <sub>D</sub> (@T <sub>c(Bottom)</sub> = 25°C)	27	Α





## **Applications**

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

## **Features and Benefits**

## **Features**

Low RDSon (< $58 \text{ m}\Omega$ )	1
,	1
Low Thermal Resistance to PCB (<1.2°C/W)	
100% Rg tested	
Low Profile (<0.9 mm)	results in
Industry-Standard Pinout	$\Rightarrow$
Compatible with Existing Surface Mount Techniques	
RoHS Compliant Containing no Lead, no Bromide and no Halogen	
MSL1, Industrial Qualification	
	•

## **Benefits**

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

Orderable part number	Package Type	Standard Pack		Note
		Form	Quantity	
IRFH5215TRPBF	PQFN 5mm x 6mm	Tape and Reel	4000	
IRFH5215TR2PBF	PQFN 5mm x 6mm	Tape and Reel	400	EOL notice #259

# **Absolute Maximum Ratings**

	Parameter	Max.	Units	
V <sub>DS</sub>	Drain-to-Source Voltage	150	V	
V <sub>GS</sub>	Gate-to-Source Voltage	± 20		
I <sub>D</sub> @ T <sub>A</sub> = 25°C	Continuous Drain Current, V <sub>GS</sub> @ 10V	5.0		
I <sub>D</sub> @ T <sub>A</sub> = 70°C	Continuous Drain Current, V <sub>GS</sub> @ 10V	4.0		
I <sub>D</sub> @ T <sub>C(Bottom)</sub> = 25°C	Continuous Drain Current, V <sub>GS</sub> @ 10V	27	Α	
I <sub>D</sub> @ T <sub>C(Bottom)</sub> = 100°C	Continuous Drain Current, V <sub>GS</sub> @ 10V	17	1	
I <sub>DM</sub>	Pulsed Drain Current ①	108	7	
P <sub>D</sub> @T <sub>A</sub> = 25°C	Power Dissipation ®	3.6	10/	
P <sub>D</sub> @ T <sub>C(Bottom)</sub> = 25°C	Power Dissipation ®	104	<del> </del>	
	Linear Derating Factor ®	0.029	W/°C	
T <sub>J</sub>	Operating Junction and	-55 to + 150	00	
T <sub>STG</sub>	Storage Temperature Range		°C	

Notes ① through ⑤ are on page 9



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

	Parameter	Min.	Тур.	Max.	Units	Conditions
BV <sub>DSS</sub>	Drain-to-Source Breakdown Voltage	150			V	$V_{GS} = 0V, I_D = 250uA$
$\Delta BV_{DSS}/\Delta T_{J}$	Breakdown Voltage Temp. Coefficient		0.19		V/°C	Reference to 25°C, I <sub>D</sub> = 1.0mA
R <sub>DS(on)</sub>	Static Drain-to-Source On-Resistance		45.5	58	mΩ	V <sub>GS</sub> = 10V, I <sub>D</sub> = 16A ③
$V_{GS(th)}$	Gate Threshold Voltage	3.0		5.0	V	V - V I - 100uA
$\Delta V_{GS(th)}$	Gate Threshold Voltage Coefficient		-12		mV/°C	$V_{DS} = V_{GS}$ , $I_D = 100 \mu A$
I <sub>DSS</sub>	Drain-to-Source Leakage Current			20		$V_{DS} = 150V, V_{GS} = 0V$
				250	μA	$V_{DS} = 150V, V_{GS} = 0V, T_{J} = 125^{\circ}C$
I <sub>GSS</sub>	Gate-to-Source Forward Leakage			100	nA	$V_{GS} = 20V$
	Gate-to-Source Reverse Leakage			-100	I IIA	V <sub>GS</sub> = -20V
gfs	Forward Transconductance	21			S	$V_{DS} = 50V, I_{D} = 16A$
$Q_g$	Total Gate Charge		21	32		
Q <sub>gs1</sub>	Pre-Vth Gate-to-Source Charge		7.2			$V_{DS} = 75V$
$Q_{gs2}$	Post-Vth Gate-to-Source Charge		2.2		nC	$V_{GS} = 10V$
$Q_gd$	Gate-to-Drain Charge		6.7		nc	I <sub>D</sub> = 16A
$Q_{godr}$	Gate Charge Overdrive		4.9			
Q <sub>sw</sub>	Switch Charge (Q <sub>gs2</sub> + Q <sub>gd</sub> )		8.9			
Q <sub>oss</sub>	Output Charge		10		nC	$V_{DS} = 16V, V_{GS} = 0V$
$R_G$	Gate Resistance		2.3		Ω	
t <sub>d(on)</sub>	Turn-On Delay Time		6.7			$V_{DD} = 75V, V_{GS} = 10V$
t <sub>r</sub>	Rise Time		6.3		]	I <sub>D</sub> = 16A
t <sub>d(off)</sub>	Turn-Off Delay Time		11		ns	$R_G=1.3\Omega$
t <sub>f</sub>	Fall Time		2.9			
C <sub>iss</sub>	Input Capacitance		1350			$V_{GS} = 0V$
C <sub>oss</sub>	Output Capacitance		120		pF	$V_{DS} = 50V$
C <sub>rss</sub>	Reverse Transfer Capacitance		30			f = 1.0MHz

# **Avalanche Characteristics**

	Parameter	Тур.	Max.	Units
E <sub>AS</sub>	Single Pulse Avalanche Energy ②		96	mJ
I <sub>AR</sub>	Avalanche Current ①		16	Α

## **Diode Characteristics**

	Parameter	Min.	Тур.	Max.	Units	Conditions
I <sub>S</sub>	Continuous Source Current (Body Diode)			27		MOSFET symbol showing the
I <sub>SM</sub>	Pulsed Source Current (Body Diode) ①			108		integral reverse p-n junction diode.
$V_{SD}$	Diode Forward Voltage			1.3	V	$T_J = 25^{\circ}C$ , $I_S = 16A$ , $V_{GS} = 0V$ ③
t <sub>rr</sub>	Reverse Recovery Time		40	60	ns	$T_J = 25^{\circ}C$ , $I_F = 16A$ , $V_{DD} = 75V$
Q <sub>rr</sub>	Reverse Recovery Charge		370	555	nC	di/dt = 500A/µs ③
t <sub>on</sub>	Forward Turn-On Time	Time is	Time is dominated by parasitic Inductance			

# **Thermal Resistance**

	Parameter	Тур.	Max.	Units
R <sub>θJC</sub> (Bottom)	Junction-to-Case @		1.2	
R <sub>θJC</sub> (Top)	Junction-to-Case @		15	°C/W
$R_{\theta JA}$	Junction-to-Ambient ®		35	1
R <sub>θJA</sub> (<10s)	Junction-to-Ambient ®		22	



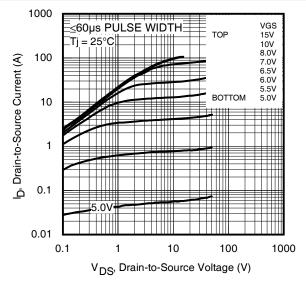


Fig 1. Typical Output Characteristics

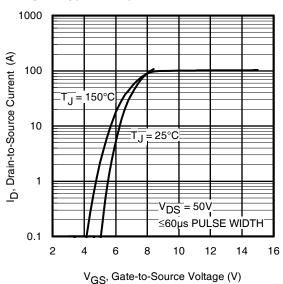


Fig 3. Typical Transfer Characteristics

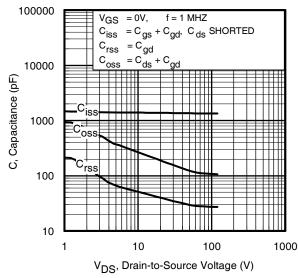


Fig 5. Typical Capacitance vs.Drain-to-Source Voltage

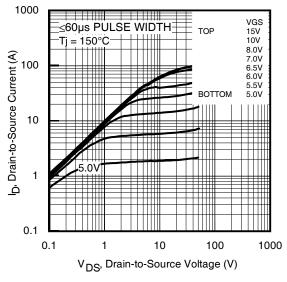


Fig 2. Typical Output Characteristics

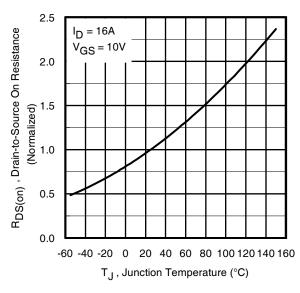


Fig 4. Normalized On-Resistance vs. Temperature

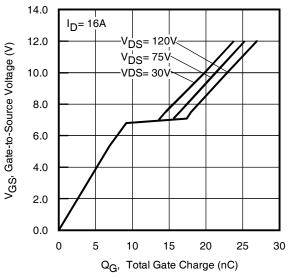


Fig 6. Typical Gate Charge vs. Gate-to-Source Voltage

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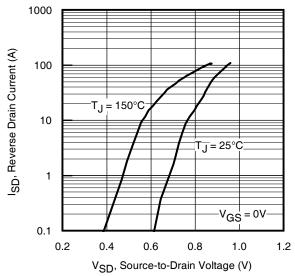
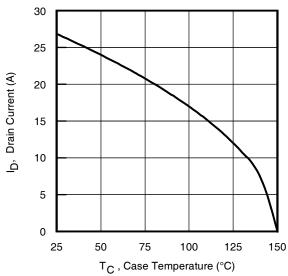


Fig 7. Typical Source-Drain Diode Forward Voltage



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

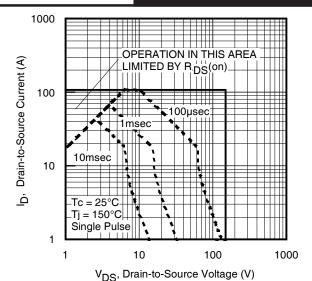


Fig 8. Maximum Safe Operating Area

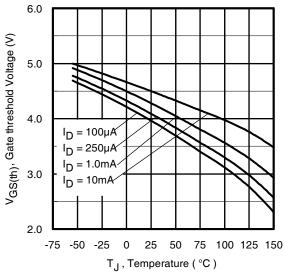


Fig 10. Threshold Voltage vs. Temperature

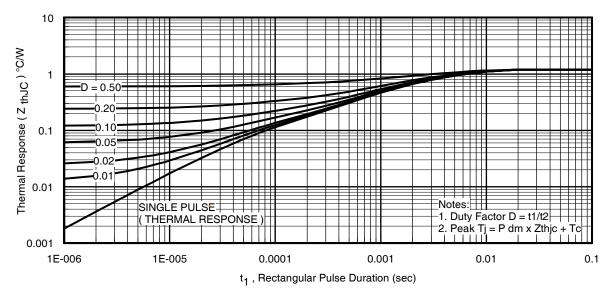


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case (Bottom)



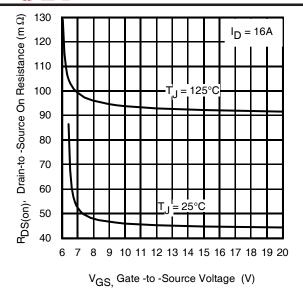


Fig 12. On-Resistance vs. Gate Voltage

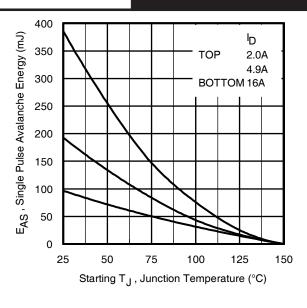


Fig 13. Maximum Avalanche Energy vs. Drain Current

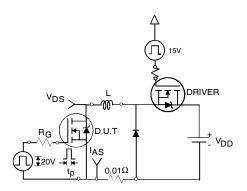


Fig 14a. Unclamped Inductive Test Circuit

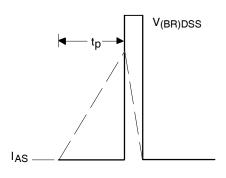


Fig 14b. Unclamped Inductive Waveforms

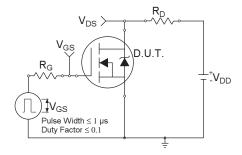


Fig 15a. Switching Time Test Circuit

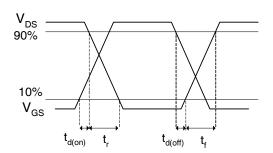


Fig 15b. Switching Time Waveforms



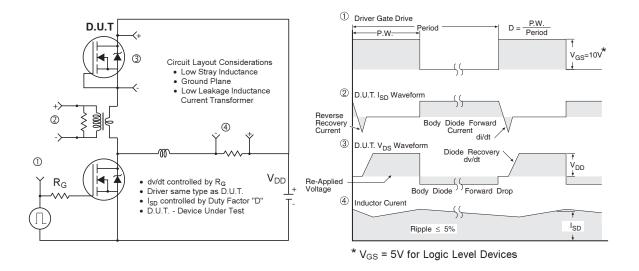


Fig 16. Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs

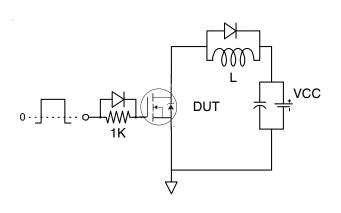


Fig 17. Gate Charge Test Circuit

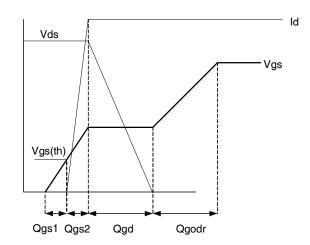
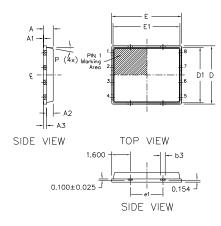


Fig 18. Gate Charge Waveform



# PQFN 5x6 Outline "B" Package Details



DIM	MILLIMITERS		INCH	
SYMBOL	MIN MAX		MIN	MAX
А	0.800	0.900	0.0315	0.0543
Α1	0.000	0.050	0.0000	0.0020
А3	0.20	0 REF	0.007	9 REF
Ь	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	5.00	O BSC	0.1969 BSC	
D1	4.75	O BSC	0.1870 BSC	
D2	4.100	4.300	0.1614	0.1693
E	6.00	0 BSC	0.2362 BSC	
E1	5.75	0 BSC	0.2264 BSC	
E2	3.380	3,780	0.1331	0.1488
е	1.27	70 REF	0.050	OO REF
e1	2.80	00 REF	0.1102 REF	
K	1.200	1.420	0.0472	0.0559
L	0.710	0.900	0.0280	0.0354
Р	0°	12°	0°	12°
R	0.200	) REF	0.007	9 REF
R2	0.150	0.200	0.0059	0.0079

#### Note:

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

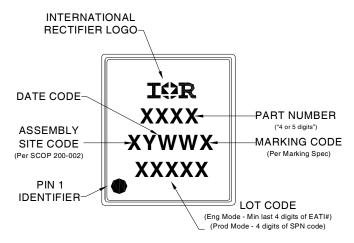
0.422 - K
R2 — F 0.395
R
D2 e e
5
Expose
BOTTOM VIEW

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

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**

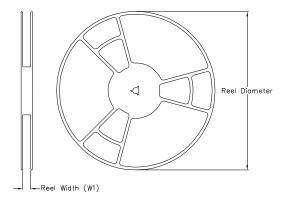


Note: For the most current drawing please refer to IR website at: http://www.irf.com/package/

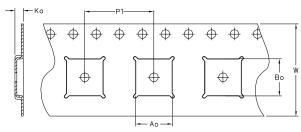


# PQFN 5x6 Tape and Reel

## REEL DIMENSIONS

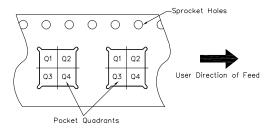


## **TAPE DIMENSIONS**



CODE	DESCRIPTION
Ao	Dimension design to accommodate the component width
Во	Dimension design to accommodate the component lenght
Ко	Dimension design to accommodate the component thickness
W	Overall wiath of the carrier tape
РΊ	Pitch between successive covity centers

### **QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**



Note: All dimension are nominal

Package Type	Reel Diameter (Inch)	QTY	Reel Wiath 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	Ql

Note: For the most current drawing please refer to IR website at:  $\underline{\text{http://www.irf.com/package/}}$ 



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

Qualification level	Industrial <sup>††</sup> (per JEDEC JES D47F <sup>†††</sup> quidelines )				
Moisture Sensitivity Level	PQFN 5mm x 6mm	MSL1 (per JEDEC J-STD-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:

  <a href="http://www.irf.com/whoto-call/salesrep/">http://www.irf.com/whoto-call/salesrep/</a>
- ††† Applicable version of JEDEC standard at the time of product release.

### Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature.
- $\ensuremath{\text{@}} \ensuremath{\text{Starting T}_J} = 25^\circ C, \ L = 0.75 \text{mH}, \ R_G = 50 \Omega, \ I_{AS} = 16 A.$
- ③ Pulse width  $\leq$  400 $\mu$ s; duty cycle  $\leq$  2%.
- 4 R<sub> $\theta$ </sub> is measured at T<sub>J</sub> of approximately 90°C.
- When mounted on 1 inch square 2 oz copper pad on 1.5x1.5 in. board of FR-4 material.

**Revision History** 

Date	Comment			
1/13/2014	<ul> <li>Updated ordering information to reflect the End-Of-Life (EOL) of the mini-reel option (EOL notice #259).</li> </ul>			
1/13/2014	Updated data sheet with the new IR corporate template.			
3/16/2015	3/16/2015 • Updated package outline and tape and reel on pages 7 and 8.			



IR WORLD HEADQUARTERS: 101 N. Sepulveda Blvd., El Segundo, California 90245, USA

To contact International Rectifier, please visit <a href="http://www.irf.com/whoto-call/">http://www.irf.com/whoto-call/</a>

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