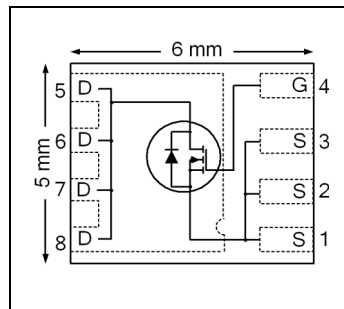


$V_{DSS}$	30	V
$R_{DS(on) max}$ (@ $V_{GS}=10V$ )	4.5	mΩ
$Q_g$ (typical)	16	nC
$I_D$ (@ $T_{c(Bottom)} = 25^\circ C$ )	79 <sup>Ⓞ</sup>	A



### Applications

- Control MOSFET for Buck Converters

### Features and Benefits

#### Features

Low charge (typical 16nC)
Low Thermal Resistance to PCB (<2.7°C/W)
100% Rg Tested
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
Increased Power Density
Increased Reliability
Increased Power Density
Multi-Vendor Compatibility
Easier Manufacturing
Environmentally Friendlier
Increased Reliability

Base part number	Package Type	Standard Pack		Orderable Part Number
		Form	Quantity	
IRFH5304PbF	PQFN 5 mm x 6 mm	Tape and Reel	4000	IRFH5304TRPbF

### 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, $V_{GS} @ 10V$	22	A
$I_D @ T_A = 70^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	17	
$I_D @ T_{c(Bottom)} = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	79 <sup>Ⓞ</sup>	
$I_D @ T_{c(Bottom)} = 100^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	50 <sup>Ⓞ</sup>	
$I_{DM}$	Pulsed Drain Current <sup>①</sup>	320	
$P_D @ T_A = 25^\circ C$	Power Dissipation <sup>Ⓞ</sup>	3.6	W
$P_D @ T_{c(Bottom)} = 25^\circ C$	Power Dissipation <sup>Ⓞ</sup>	46	
	Linear Derating Factor <sup>Ⓞ</sup>	0.029	W/°C
$T_J$ $T_{STG}$	Operating Junction and Storage Temperature Range	-55 to + 150	°C

Notes ① through ④ are on page 8

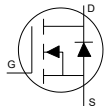
**Static @ T<sub>J</sub> = 25°C (unless otherwise specified)**

	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> = 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> = 1.0mA
R <sub>DS(on)</sub>	Static Drain-to-Source On-Resistance	—	3.8	4.5	mΩ	V <sub>GS</sub> = 10V, I <sub>D</sub> = 47A ②
		—	5.8	6.8		V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 47A ②
V <sub>GS(th)</sub>	Gate Threshold Voltage	1.35	1.8	2.35	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 50μA
ΔV <sub>GS(th)</sub>	Gate Threshold Voltage Coefficient	—	-6.6	—	mV/°C	
I <sub>DSS</sub>	Drain-to-Source Leakage Current	—	—	5.0	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	—	—	100	nA	V <sub>GS</sub> = 20 V
	Gate-to-Source Reverse Leakage	—	—	-100		V <sub>GS</sub> = -20 V
g <sub>fs</sub>	Forward Transconductance	88	—	—	S	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 47A
Q <sub>g</sub>	Total Gate Charge	—	41	—		V <sub>GS</sub> = 10V, V <sub>DS</sub> = 15V, I <sub>D</sub> = 49A
Q <sub>g</sub>	Total Gate Charge	—	16	56	nC	V <sub>DS</sub> = 15V I <sub>D</sub> = 47A V <sub>GS</sub> = 4.5V See Fig.17 & 18
Q <sub>gs1</sub>	Pre-V <sub>th</sub> Gate-to-Source Charge	—	3.6	—		
Q <sub>gs2</sub>	Post-V <sub>th</sub> Gate-to-Source Charge	—	2.7	—		
Q <sub>gd</sub>	Gate-to-Drain Charge	—	5.8	—		
Q <sub>godr</sub>	Gate Charge Overdrive	—	3.9	—		
Q <sub>sw</sub>	Switch Charge (Q <sub>gs2</sub> + Q <sub>gd</sub> )	—	8.5	—		
Q <sub>oss</sub>	Output Charge	—	9.8	—	nC	V <sub>DS</sub> = 16V, V <sub>GS</sub> = 0V
R <sub>G</sub>	Gate Resistance	—	1.2	—	Ω	
t <sub>d(on)</sub>	Turn-On Delay Time	—	13	—	ns	V <sub>DD</sub> = 15V, V <sub>GS</sub> = 4.5V I <sub>D</sub> = 47A R <sub>G</sub> = 1.8Ω See Fig.15
t <sub>r</sub>	Rise Time	—	25	—		
t <sub>d(off)</sub>	Turn-Off Delay Time	—	12	—		
t <sub>f</sub>	Fall Time	—	6.6	—		
C <sub>iss</sub>	Input Capacitance	—	2360	—	pF	V <sub>GS</sub> = 0V V <sub>DS</sub> = 10V f = 1.0MHz
C <sub>oss</sub>	Output Capacitance	—	510	—		
C <sub>rss</sub>	Reverse Transfer Capacitance	—	220	—		

**Avalanche Characteristics**

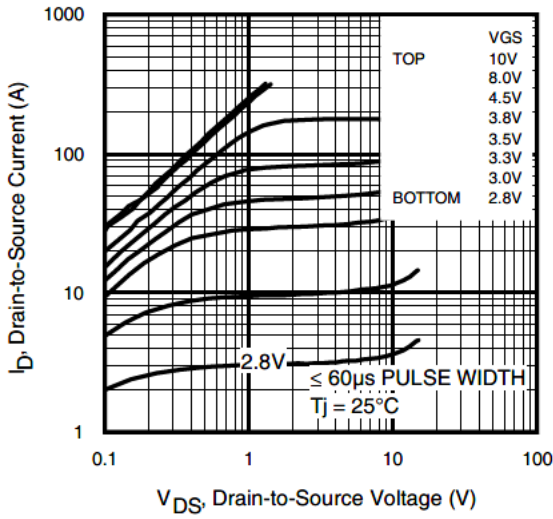
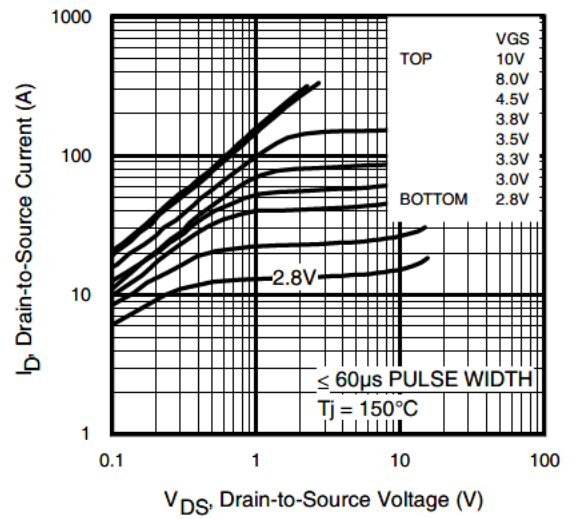
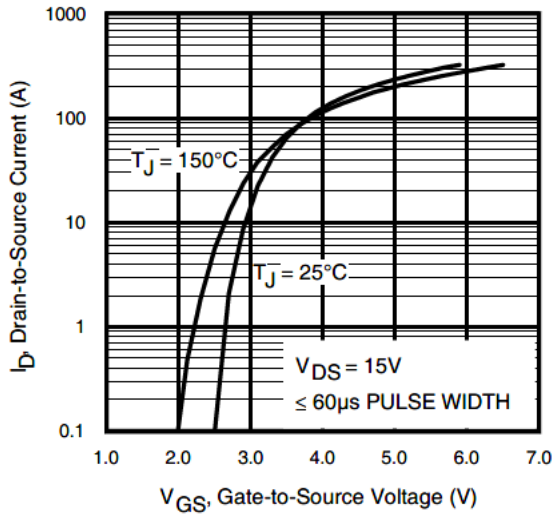
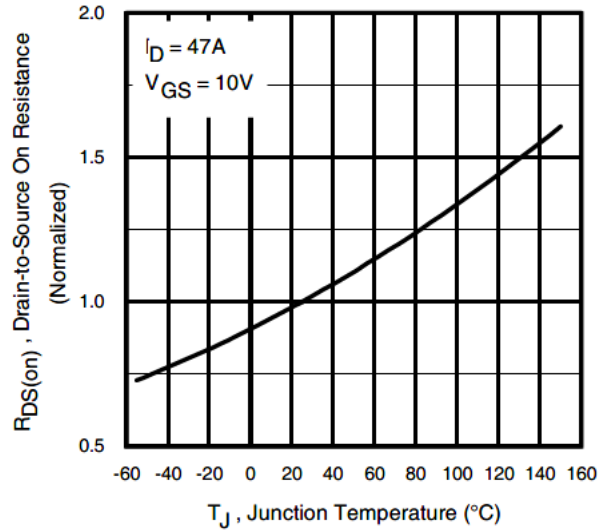
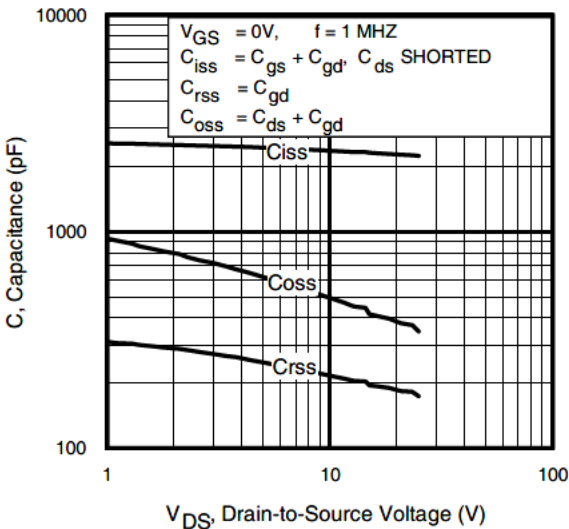
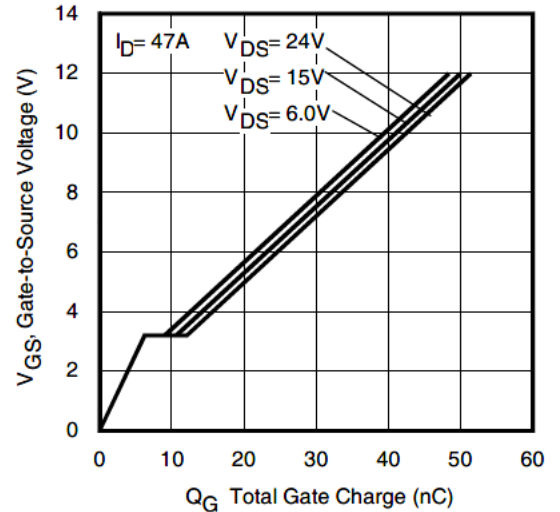
	Parameter	Typ.	Max.	Units
E <sub>AS</sub>	Single Pulse Avalanche Energy ②	—	46	mJ
I <sub>AR</sub>	Avalanche Current①	—	47	A

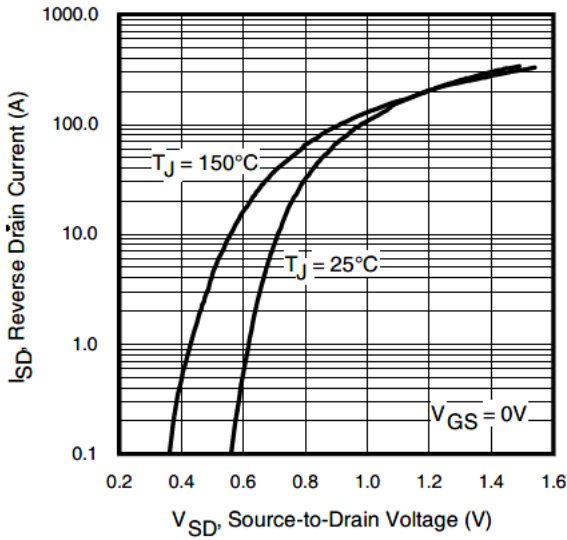
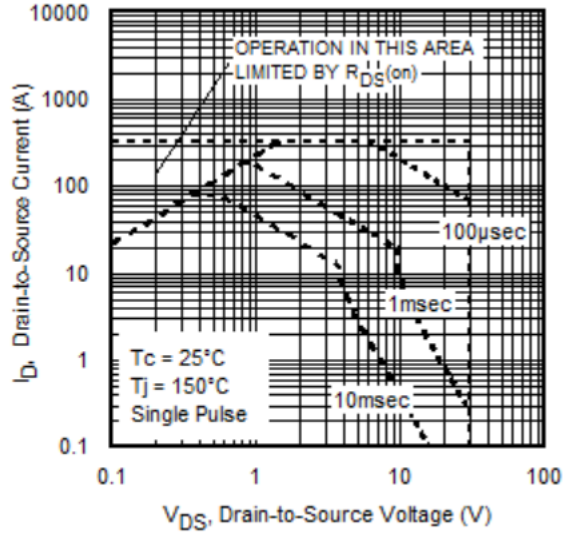
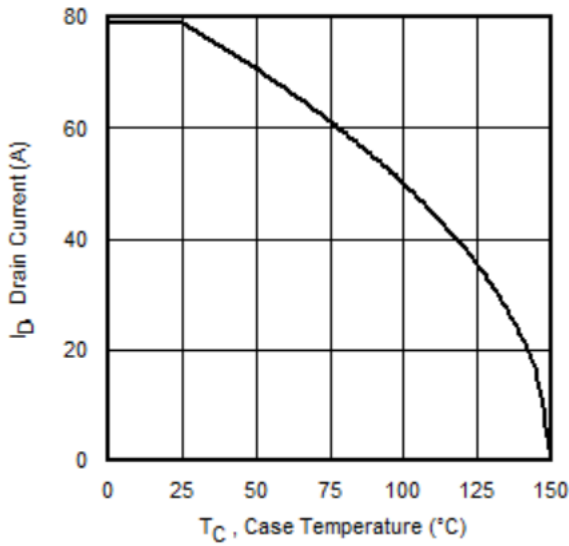
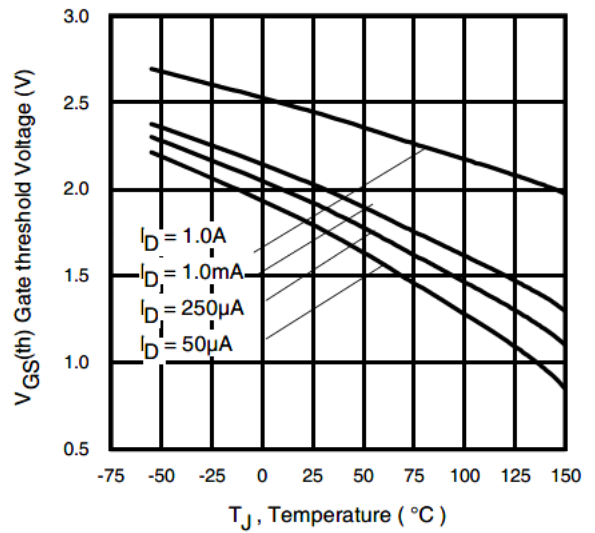
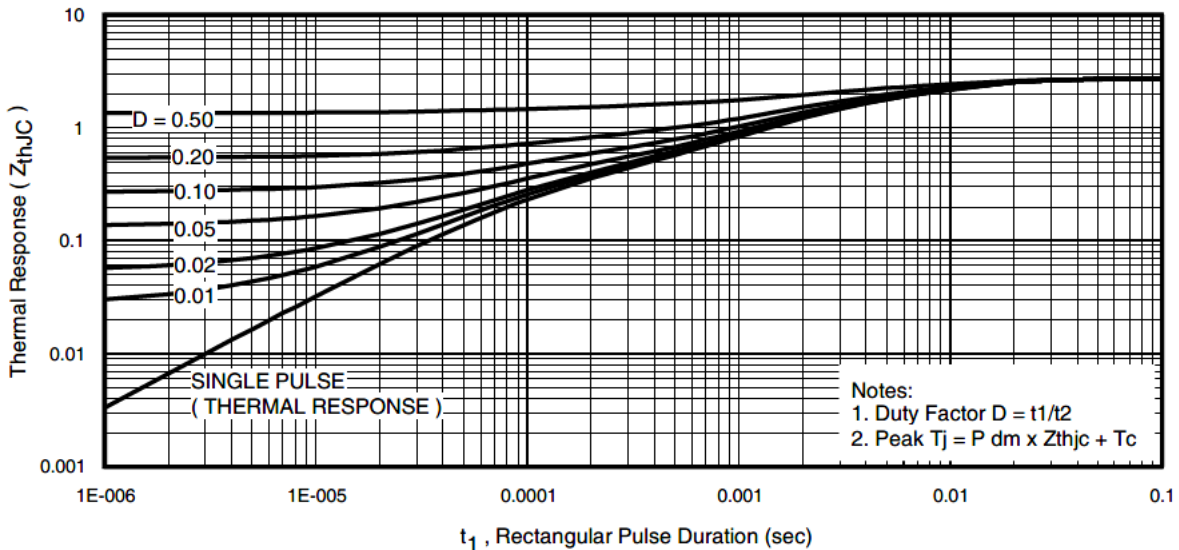
**Diode Characteristics**

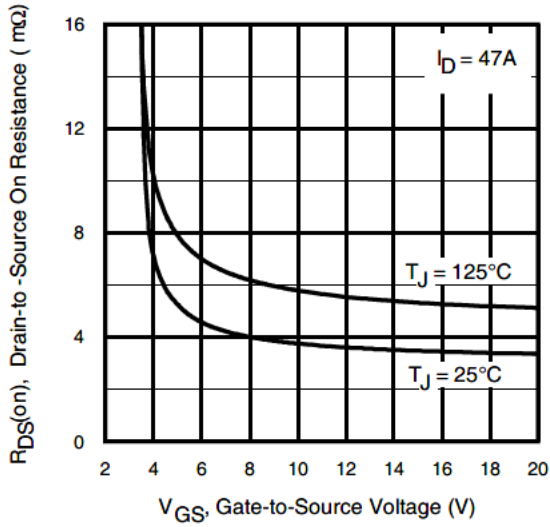
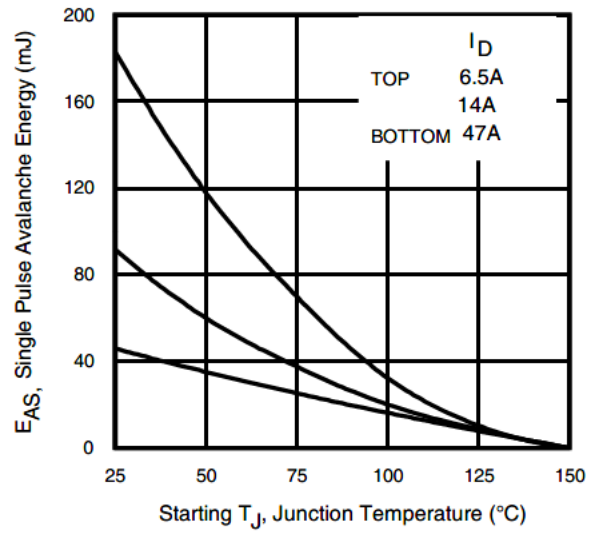
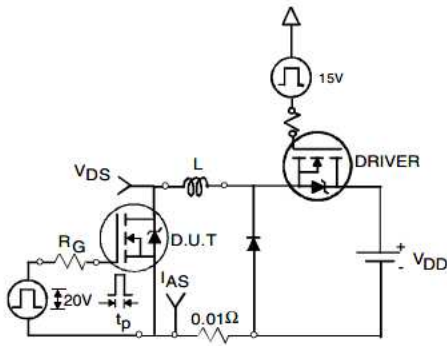
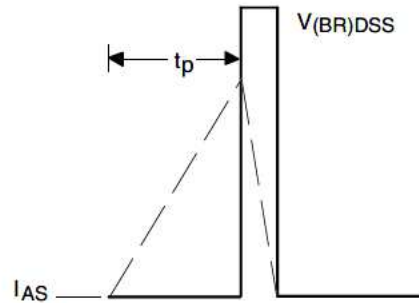
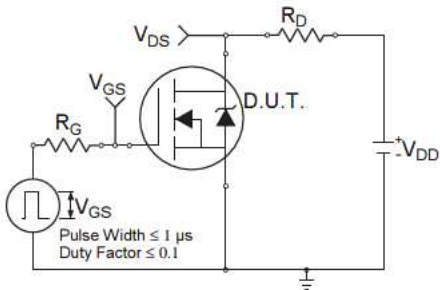
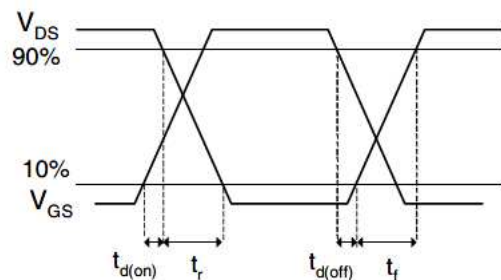
	Parameter	Min.	Typ.	Max.	Units	Conditions
I <sub>S</sub>	Continuous Source Current (Body Diode)	—	—	46	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I <sub>SM</sub>	Pulsed Source Current (Body Diode)	—	—	320①		
V <sub>SD</sub>	Diode Forward Voltage	—	0.71	—		T <sub>J</sub> = 25°C, I <sub>S</sub> = 5A, 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> = 47A, 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> = 47A, V <sub>DD</sub> = 15V di/dt = 300A/μs ③
Q <sub>rr</sub>	Reverse Recovery Charge	—	44	66	nC	
t <sub>on</sub>	Forward Turn-On Time	Time is dominated by parasitic Inductance				

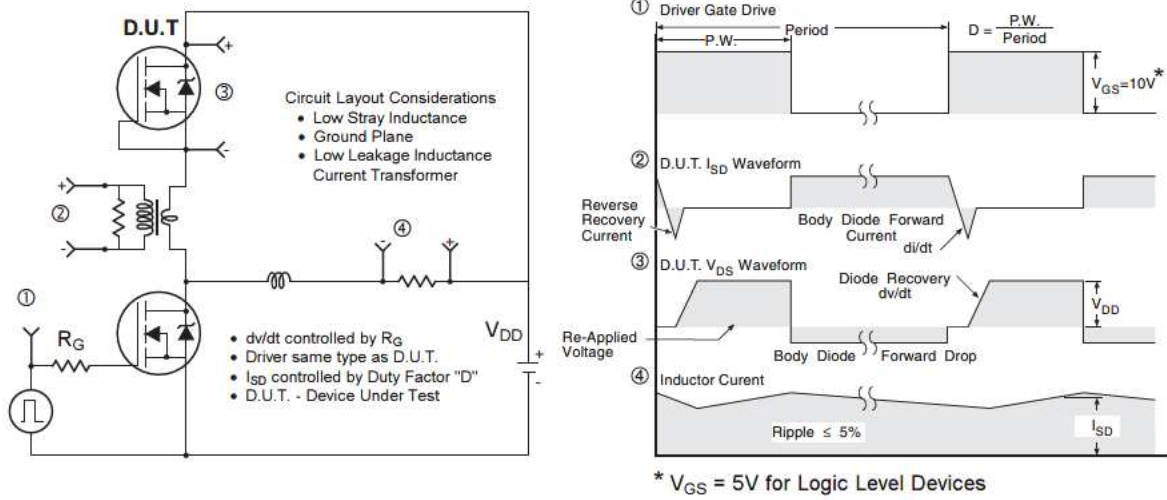
**Thermal Resistance**

	Parameter	Typ.	Max.	Units
R <sub>θJC</sub> (Bottom)	Junction-to-Mounting Base ④	—	2.7	°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	

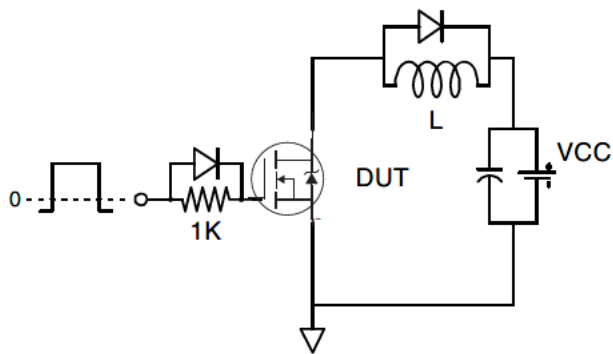

**Fig 1.** Typical Output Characteristics

**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 Temperature

**Fig 10.** Drain-to-Source Breakdown Voltage

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

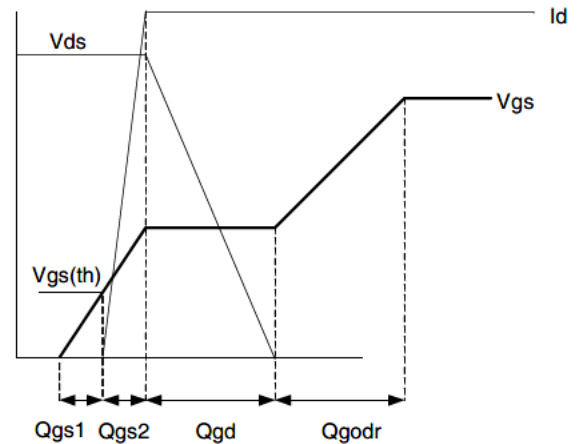

**Fig 12.** On-Resistance vs. Gate Voltage

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

**Fig 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**

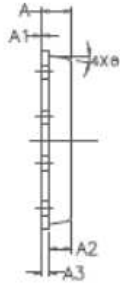


**Fig 17. Gate Charge Test Circuit**

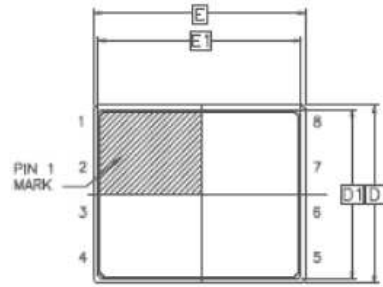


**Fig 18. Gate Charge Waveform**

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

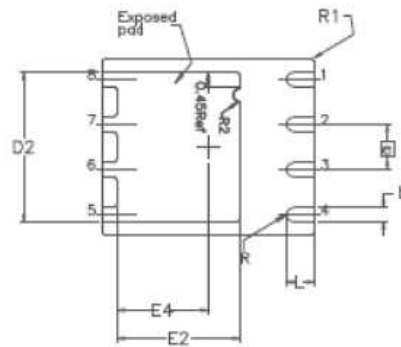


SIDE VIEW



TOP VIEW

SYMBOL	DIM	MIN	NOM	MAX
A		0.800	0.830	1.05
A1		0.000	0.020	0.050
A2		0.580	0.630	0.680
A3			0.254 REF	
Ø		0"	10"	12"
b		0.350	0.400	0.470
D		4.850	5.000	5.150
D1		4.675	4.750	5.000
D2		3.700	4.210	4.300
e			1.270 BSC	
E		5.850	6.000	6.150
E1		5.675	5.750	6.000
E2		3.380	3.480	3.760
F4		2.480	2.580	2.680
L		0.550	0.800	0.900
R			0.200 REF	
R1			0.100 REF	
R2		0.150	0.200	0.250

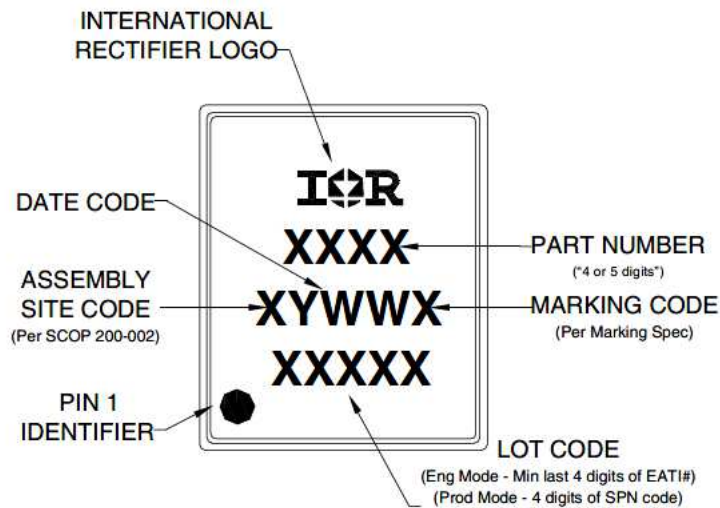


BOTTOM VIEW

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>

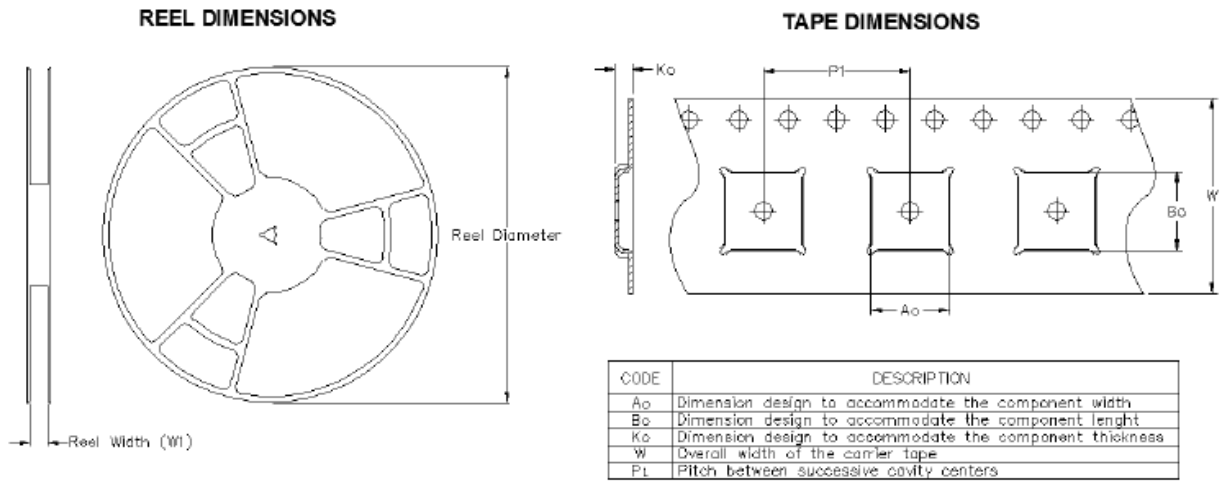
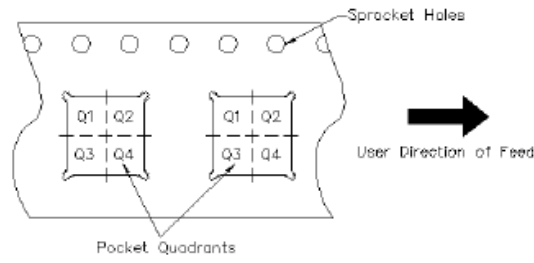
For more information on package inspection techniques, please refer to application note AN-1154: <http://www.irf.com/technical-info/appnotes/an-1154.pdf>

**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 in nominal*

Package Type	Reel Diameter (Inch)	QTY	Reel Width W 1 (mm)	A <sub>o</sub> (mm)	B <sub>o</sub> (mm)	K <sub>o</sub> (mm)	P <sub>1</sub> (mm)	W (mm)	Pin 1 Quadrant
5x6 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**

<b>Qualification Level</b>	Industrial (per JEDEC JESD47F <sup>†</sup> guidelines)	
<b>Moisture Sensitivity Level</b>	PQFN 5mm x 6mm	MSL1 (per JEDEC J-STD-020D <sup>†</sup> )
<b>RoHS Compliant</b>	Yes	

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

**Notes:**

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Starting  $T_J = 25^{\circ}\text{C}$ ,  $L = 0.041\text{mH}$ ,  $R_G = 50\Omega$ ,  $I_{AS} = 47\text{A}$ .
- 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 Rating refers to the product only with datasheet specified absolute maximum values, maintaining case temperature as specified. For other case temperatures please refer to Diagram 9. De-rating will be required based on the actual environmental conditions.

**Revision History**

Date	Rev.	Comments
5/14/2014	2.1	<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>• Update Package outline on page 7</li> <li>• Updated data sheet based on IR corporate template.</li> </ul>
03/19/2015	2.2	<ul style="list-style-type: none"> <li>• Updated package outline and tape and reel on pages 7 and 8</li> </ul>
03/19/2021	2.3	<ul style="list-style-type: none"> <li>• Updated datasheet based on IFX template.</li> <li>• Updated Datasheet based on new current rating and application note :App-AN_1912_PL51_2001_180356</li> </ul>

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