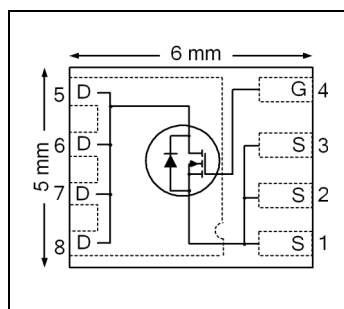


V_{DS}	30	V
$R_{DS(on) \max}$ (@ $V_{GS}=10V$)	4.5	mΩ
Q_g (typical)	16	nC
I_D (@ $T_{c(Bottom)} = 25^\circ C$)	79⑥	A



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	79⑥	
I_D @ $T_{c(Bottom)} = 100^\circ C$	Continuous Drain Current, V_{GS} @ 10V	50⑥	
I_{DM}	Pulsed Drain Current①	320	
P_D @ $T_A = 25^\circ C$	Power Dissipation⑤	3.6	W
P_D @ $T_{c(Bottom)} = 25^\circ C$	Power Dissipation⑤	46	
	Linear Derating Factor⑤	0.029	W/°C
T_J	Operating Junction and	-55 to + 150	°C
T_{STG}	Storage Temperature Range		

Notes ① through ⑥ are on page 8

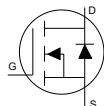
Static @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
BV_{DSS}	Drain-to-Source Breakdown Voltage	30	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.02	—	$V/^\circ\text{C}$	Reference to $25^\circ\text{C}, I_D = 1.0mA$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	3.8	4.5	$m\Omega$	$V_{GS} = 10V, I_D = 47A$ ②
		—	5.8	6.8		$V_{GS} = 4.5V, I_D = 47A$ ②
$V_{GS(th)}$	Gate Threshold Voltage	1.35	1.8	2.35	V	$V_{DS} = V_{GS}, I_D = 50\mu A$
$\Delta V_{GS(th)}$	Gate Threshold Voltage Coefficient	—	-6.6	—	$mV/^\circ\text{C}$	
I_{DSS}	Drain-to-Source Leakage Current	—	—	5.0	μA	$V_{DS} = 24V, V_{GS} = 0V$
		—	—	150		$V_{DS} = 24V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
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	88	—	—	S	$V_{DS} = 15V, I_D = 47A$
Q_g	Total Gate Charge	—	41	—		$V_{GS} = 10V, V_{DS} = 15V, I_D = 49A$
Q_g	Total Gate Charge	—	16	56	nC	$V_{DS} = 15V$ $I_D = 47A$ $V_{GS} = 4.5V$ See Fig.17 & 18
Q_{gs1}	Pre-V _{th} Gate-to-Source Charge	—	3.6	—		
Q_{gs2}	Post-V _{th} Gate-to-Source Charge	—	2.7	—		
Q_{gd}	Gate-to-Drain Charge	—	5.8	—		
Q_{godr}	Gate Charge Overdrive	—	3.9	—		
Q_{sw}	Switch Charge ($Q_{gs2} + Q_{gd}$)	—	8.5	—		
Q_{oss}	Output Charge	—	9.8	—	nC	$V_{DS} = 16V, V_{GS} = 0V$
R_G	Gate Resistance	—	1.2	—	Ω	
$t_{d(on)}$	Turn-On Delay Time	—	13	—	ns	$V_{DD} = 15V, V_{GS} = 4.5V$ $I_D = 47A$ $R_G = 1.8\Omega$ See Fig.15
t_r	Rise Time	—	25	—		
$t_{d(off)}$	Turn-Off Delay Time	—	12	—		
t_f	Fall Time	—	6.6	—		
C_{iss}	Input Capacitance	—	2360	—	pF	$V_{GS} = 0V$ $V_{DS} = 10V$ $f = 1.0MHz$
C_{oss}	Output Capacitance	—	510	—		
C_{rss}	Reverse Transfer Capacitance	—	220	—		

Avalanche Characteristics

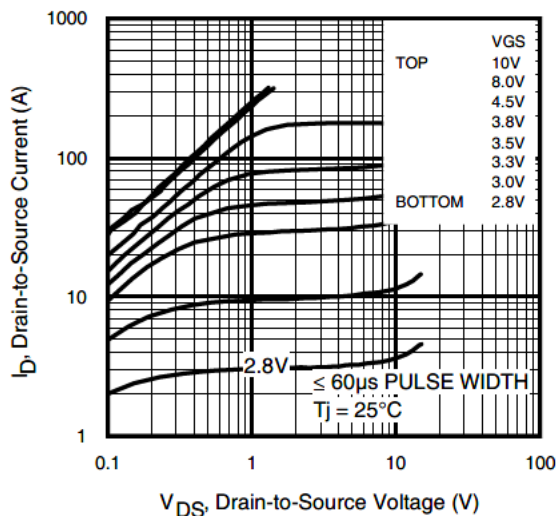
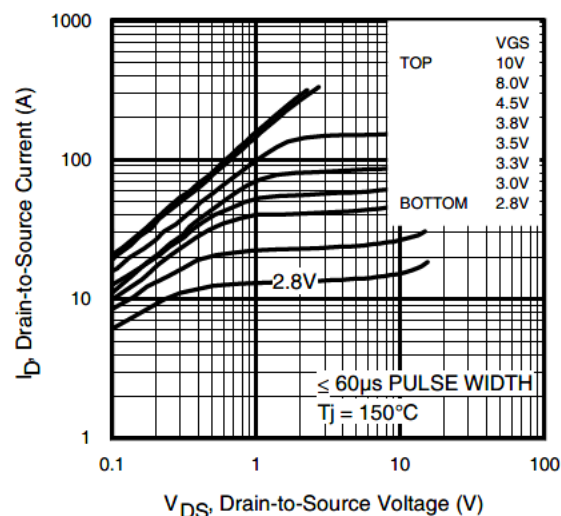
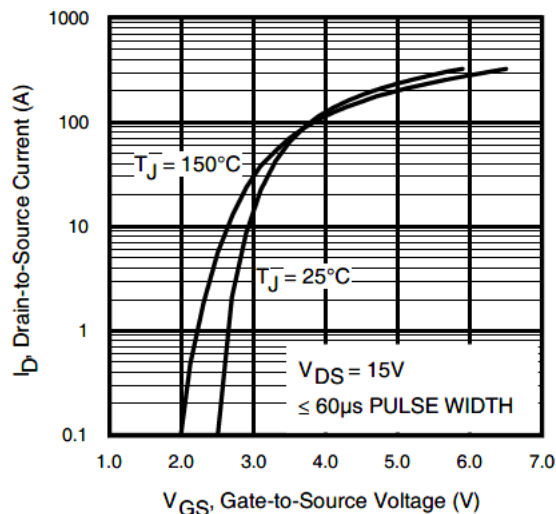
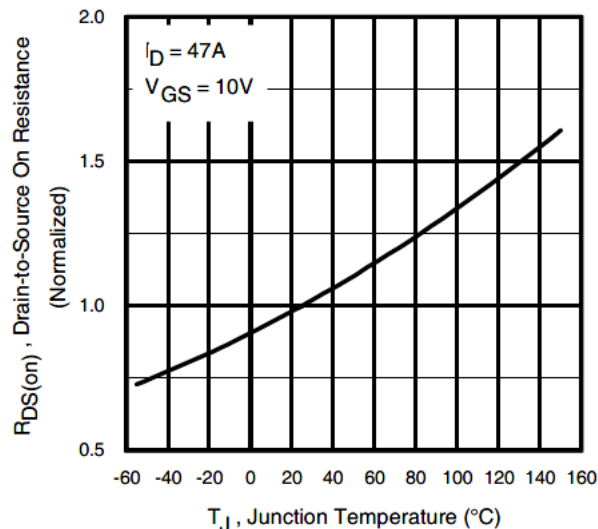
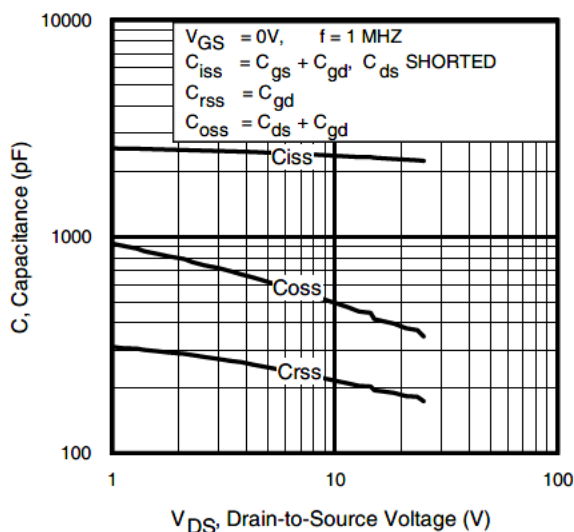
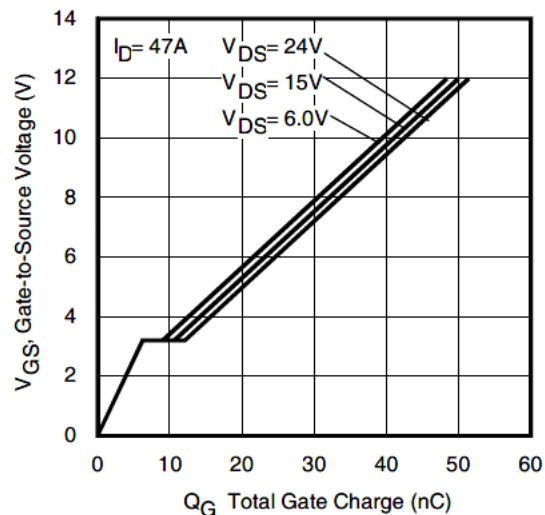
	Parameter	Typ.	Max.	Units
E_{AS}	Single Pulse Avalanche Energy ②	—	46	mJ
I_{AR}	Avalanche Current①		47	A

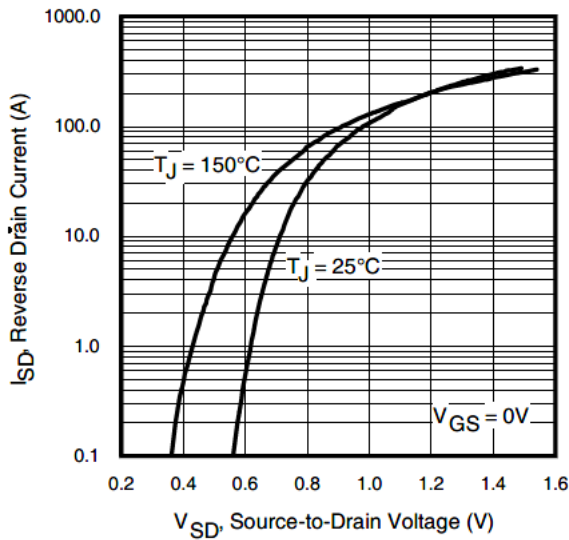
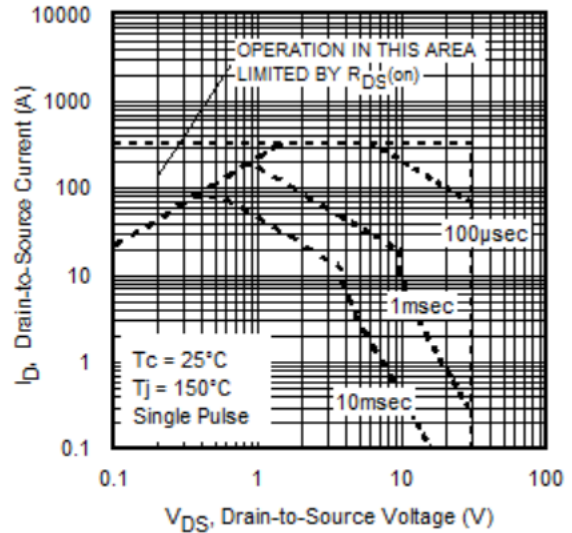
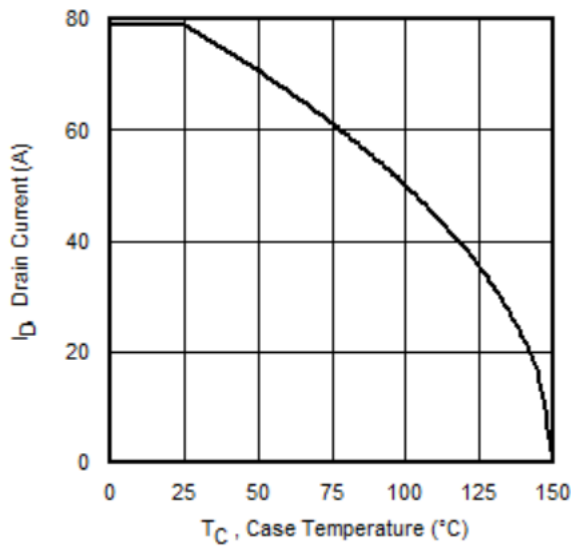
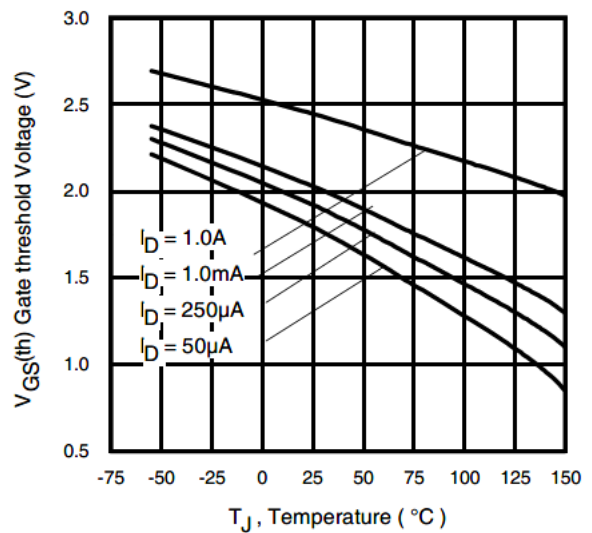
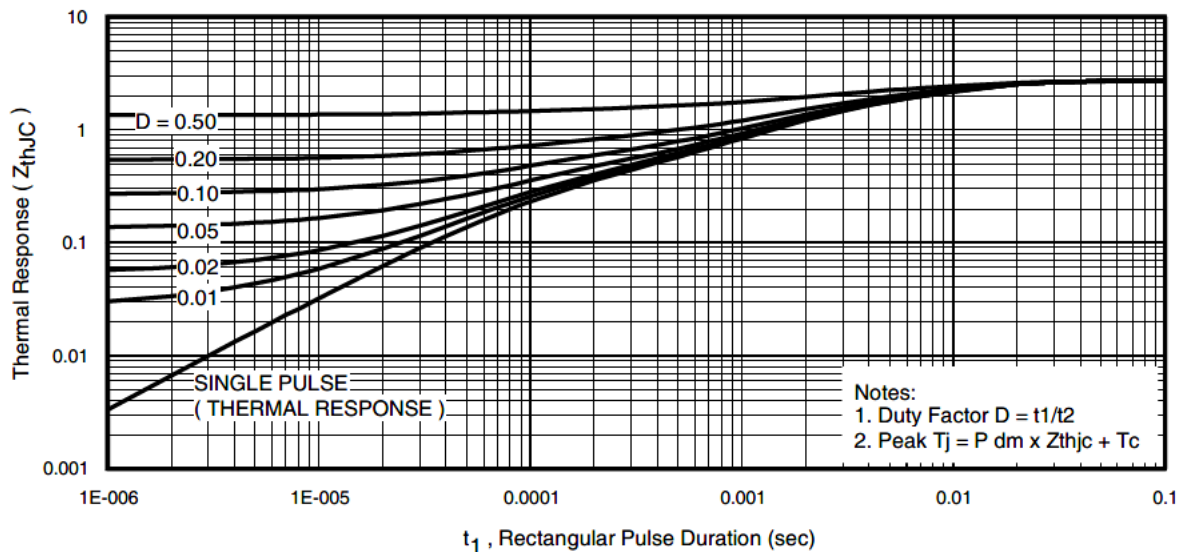
Diode Characteristics

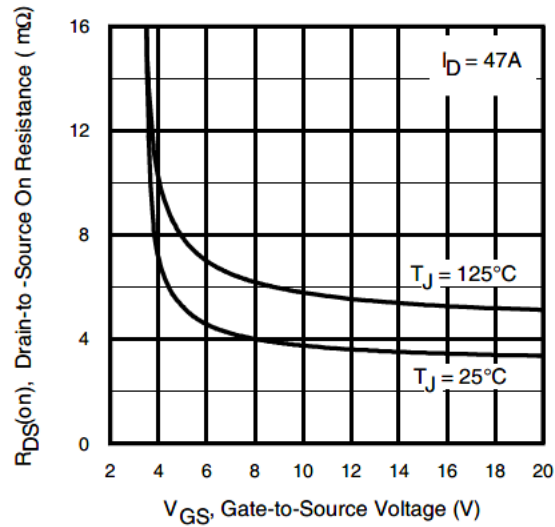
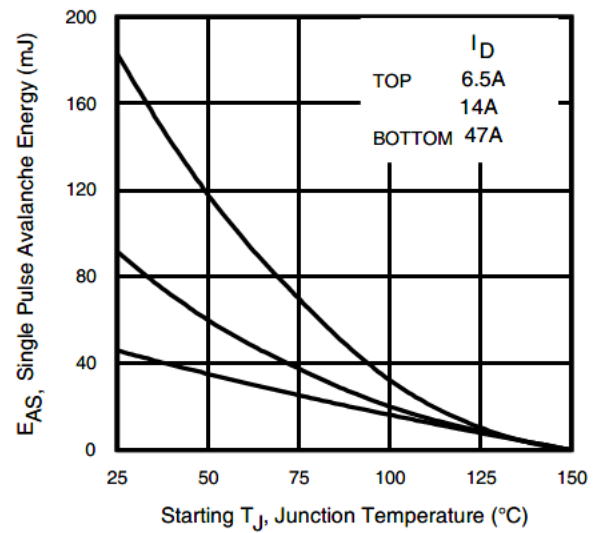
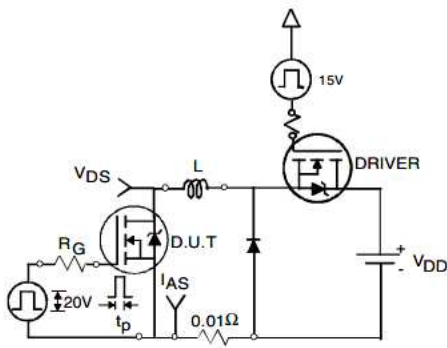
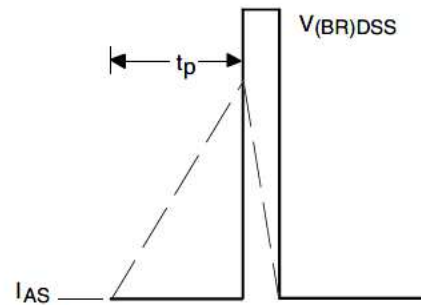
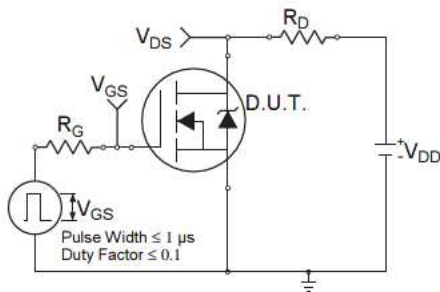
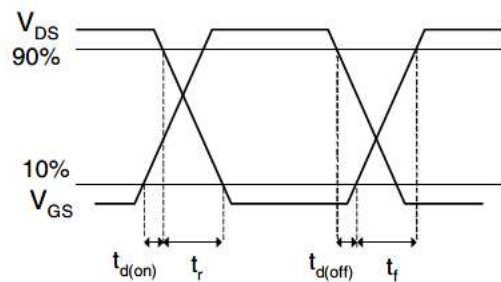
	Parameter	Min.	Typ.	Max.	Units	Conditions
I _S	Continuous Source Current (Body Diode)	—	—	46	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I _{SM}	Pulsed Source Current (Body Diode)	—	—	320①		
V _{SD}	Diode Forward Voltage	—	0.71	—		T _J = 25°C, I _S =5A, V _{GS} =0V ③
V _{SD}	Diode Forward Voltage	—	—	1.0	V	T _J = 25°C, I _S =47A, V _{GS} =0V ③
t _{rr}	Reverse Recovery Time	—	19	29	ns	T _J = 25°C, I _F = 47A, V _{DD} = 15V di/dt = 300A/μs ③
Q _{rr}	Reverse Recovery Charge	—	44	66	nC	
t _{on}	Forward Turn-On Time	Time is dominated by parasitic Inductance				

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$ (Bottom)	Junction-to-Mounting Base ④	—	2.7	$^\circ\text{C/W}$
$R_{\theta JC}$ (Top)	Junction-to-Case ④	—	15	
$R_{\theta JA}$	Junction-to-Ambient ⑤	—	35	
$R_{\theta JA} (<10s)$	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

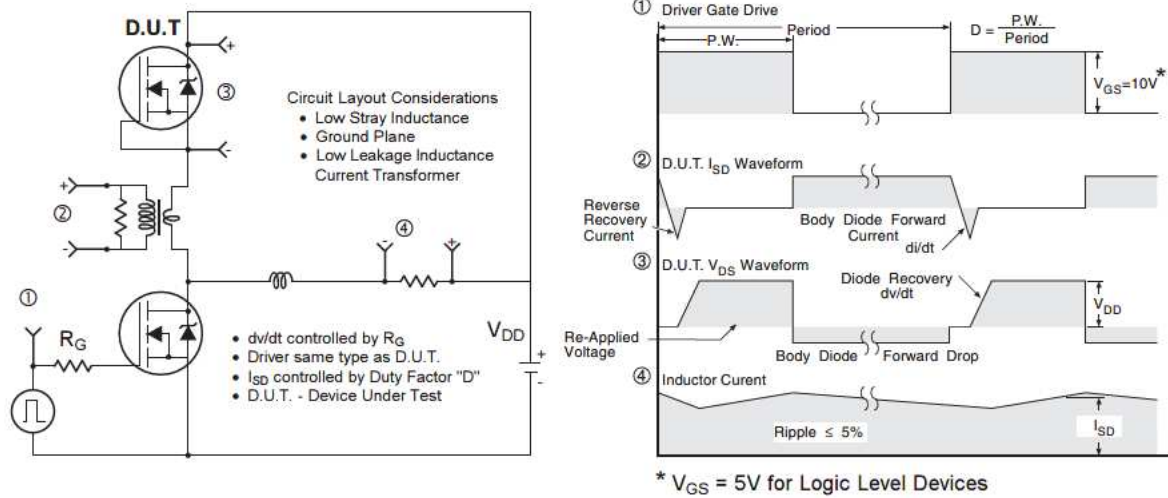


Fig 16. Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs

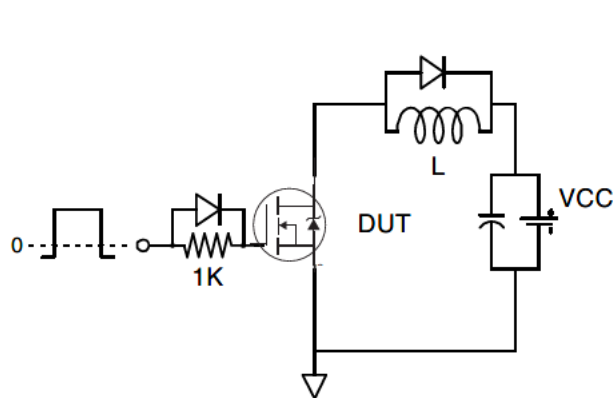


Fig 17. Gate Charge Test Circuit

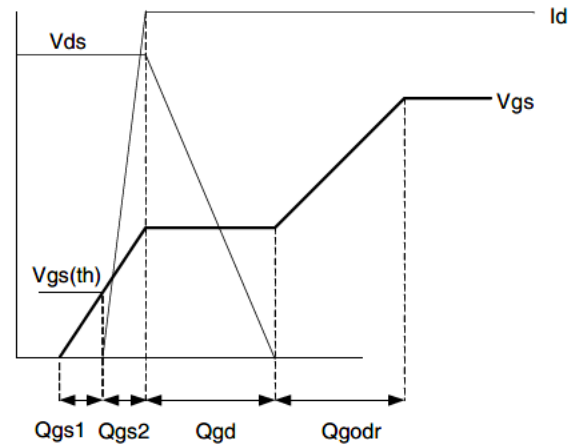
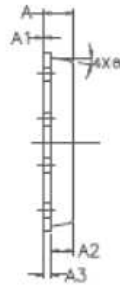
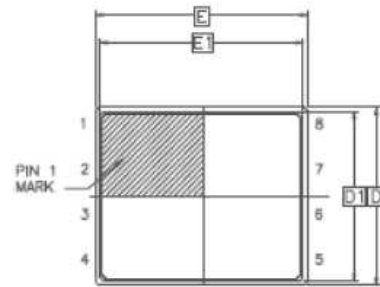


Fig 18. Gate Charge Waveform

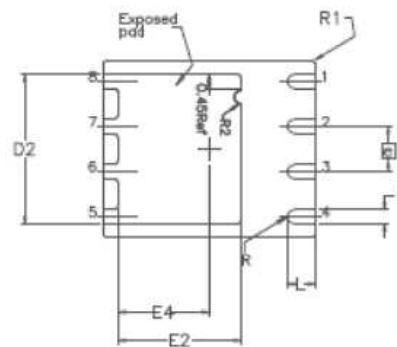
PQFN 5x6 Outline "B" Package Details


SIDE VIEW



TOP VIEW

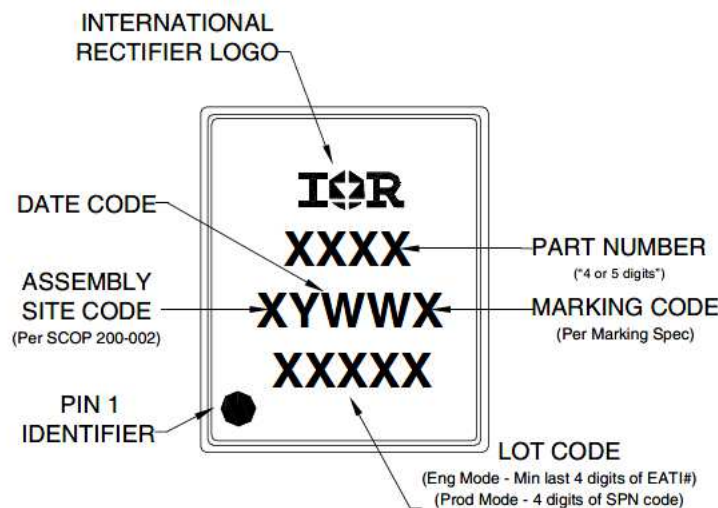
DIM SYMBOL	MIN	NOM	MAX
A	0.800	0.830	1.05
A1	0.000	0.020	0.050
A2	0.580	0.630	0.680
A3		0.254 REF	
Ø	0"	10"	12"
b	0.350	0.400	0.470
D	4.850	5.000	5.150
D1	4.675	4.750	5.000
D2	3.700	4.210	4.300
e		1.270 BSC	
E	5.850	6.000	6.150
E1	5.675	5.750	6.000
E2	3.380	3.480	3.760
E4	2.480	2.580	2.680
L	0.550	0.800	0.900
R		0.200 REF	
R1		0.100 REF	
R2	0.150	0.200	0.250



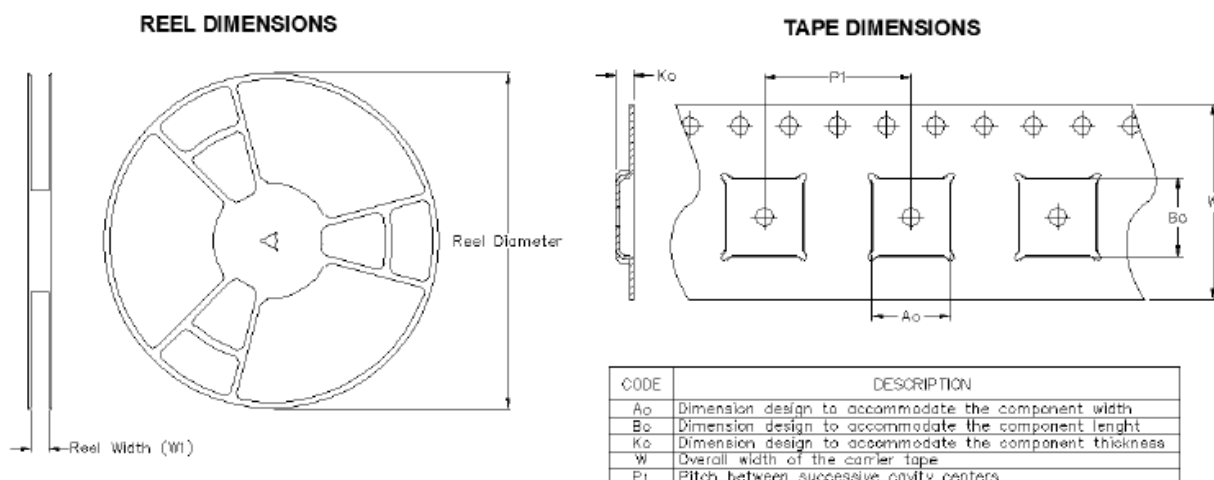
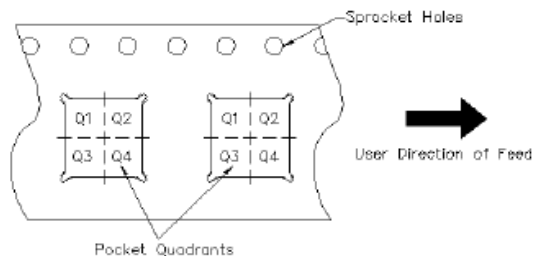
BOTTOM VIEW

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)	Ao (mm)	Bo (mm)	Ko (mm)	P1 (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

Qualification Level	Industrial (per JEDEC JESD47F [†] guidelines)	
Moisture Sensitivity Level	PQFN 5mm x 6mm	MSL1 (per JEDEC J-STD-020D [†])
RoHS Compliant	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_{θ} is measured at T_J of approximately 90°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	- Updated ordering information to reflect the End-of-Life (EOL) of the mini-reel option (EOL notice #259) - Update Package outline on page 7 - Updated data sheet based on IR corporate template.
03/19/2015	2.2	Updated package outline and tape and reel on pages 7 and 8
03/19/2021	2.3	- Updated datasheet based on IFX template. - Updated Datasheet based on new current rating and application note :App-AN_1912_PL51_2001_180356

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