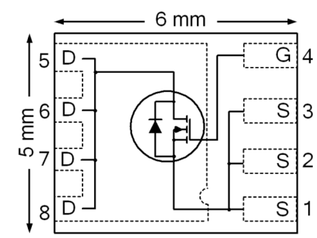
StrongIRFET™
IRFH5304PbF

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



PQFN 5 x 6 mm

Applications

- Control MOSFET for Buck Converters

Features and Benefits

Features		Benefits
Low charge (typical 16nC)		Lower Conduction Losses
Low Thermal Resistance to PCB (<2.7°C/W)		Increased Power Density
100% Rg Tested		Increased Reliability
Low Profile (≤ 0.9 mm)	results in	Increased Power Density
Industry-Standard Pinout	⇒	Multi-Vendor Compatibility
Compatible with Existing Surface Mount Techniques		Easier Manufacturing
RoHS Compliant, Halogen-Free		Environmentally Friendlier
MSL1, Industrial Qualification		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°C	Continuous Drain Current, V_{GS} @ 10V	22	A
I_D @ T_A = 70°C	Continuous Drain Current, V_{GS} @ 10V	17	
I_D @ $T_{c(Bottom)}$ = 25°C	Continuous Drain Current, V_{GS} @ 10V	79⑥	
I_D @ $T_{c(Bottom)}$ = 100°C	Continuous Drain Current, V_{GS} @ 10V	50⑥	
I_{DM}	Pulsed Drain Current①	320	
P_D @T_A = 25°C	Power Dissipation⑤	3.6	W
P_D @$T_{c(Bottom)}$ = 25°C	Power Dissipation⑤	46	
	Linear Derating Factor⑤	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

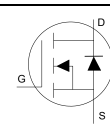
Static @ T_J = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
BV_{DSS}	Drain-to-Source Breakdown Voltage	30	——	——	V	V_{GS} = 0V, I_D = 250μA
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	——	0.02	——	V/°C	Reference to 25°C, I_D = 1.0mA
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	——	3.8	4.5	mΩ	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 = 50μA
$\Delta V_{GS(th)}$	Gate Threshold Voltage Coefficient	——	-6.6	——	mV/°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°C
I_{GSS}	Gate-to-Source Forward Leakage	——	——	100	nA	V_{GS} = 20 V
	Gate-to-Source Reverse Leakage	——	——	-100		V_{GS} = -20 V
gfs	Forward Transconductance	88	——	——	S	V_{DS} = 15 V, 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
Q_{gs1}	Pre-Vth Gate-to-Source Charge	——	3.6	——		I_D = 47A
Q_{gs2}	Post-Vth Gate-to-Source Charge	——	2.7	——		V_{GS} = 4.5V
Q_{gd}	Gate-to-Drain Charge	——	5.8	——		See Fig.17 & 18
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
t_r	Rise Time	——	25	——		I_D = 47A
$t_{d(off)}$	Turn-Off Delay Time	——	12	——		R_G = 1.8Ω
t_f	Fall Time	——	6.6	——		See Fig.15
C_{iss}	Input Capacitance	——	2360	——	pF	V_{GS} = 0V
C_{oss}	Output Capacitance	——	510	——		V_{DS} = 10V
C_{rss}	Reverse Transfer Capacitance	——	220	——		f = 1.0MHz

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
Q_{rr}	Reverse Recovery Charge	——	44	66	nC	di/dt = 300A/μs ③
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	°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	

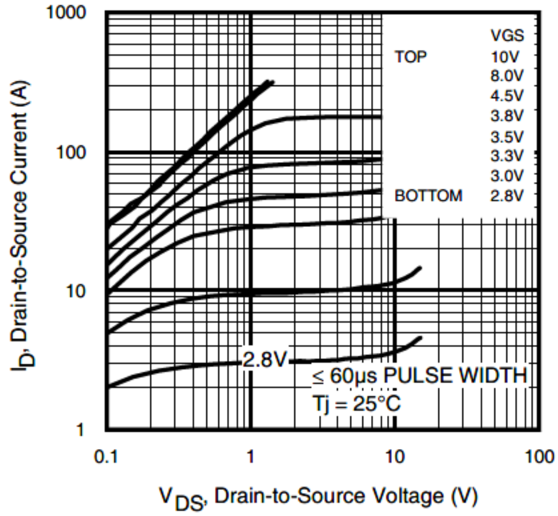


Fig 1. Typical Output Characteristics

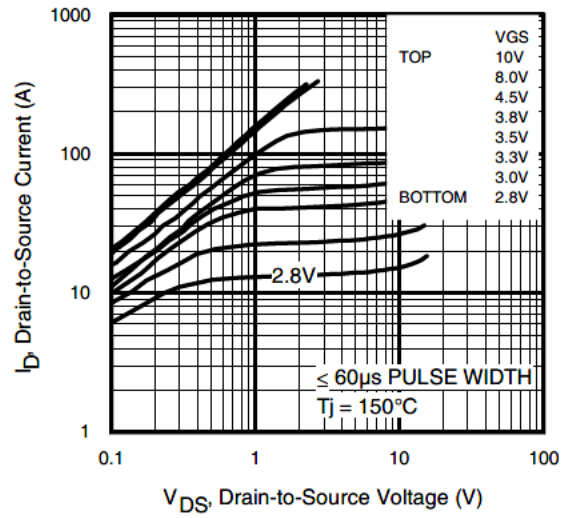


Fig 2. Typical Output Characteristics

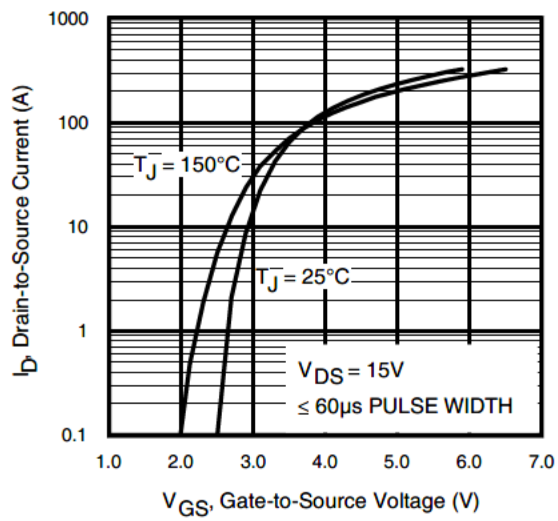


Fig 3. Typical Transfer Characteristics

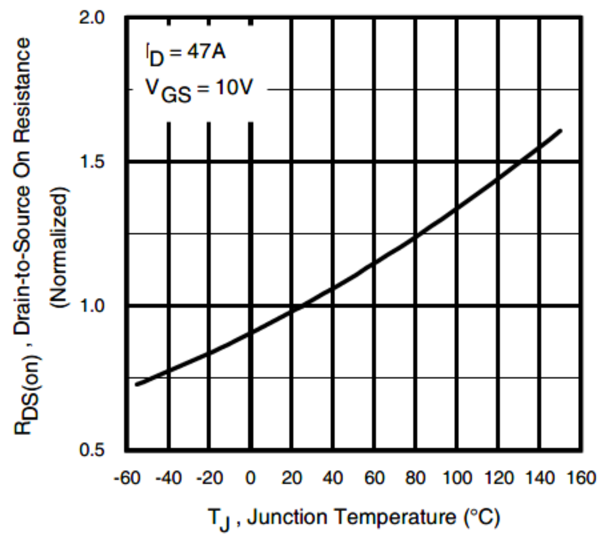


Fig 4. Normalized On-Resistance vs. Temperature

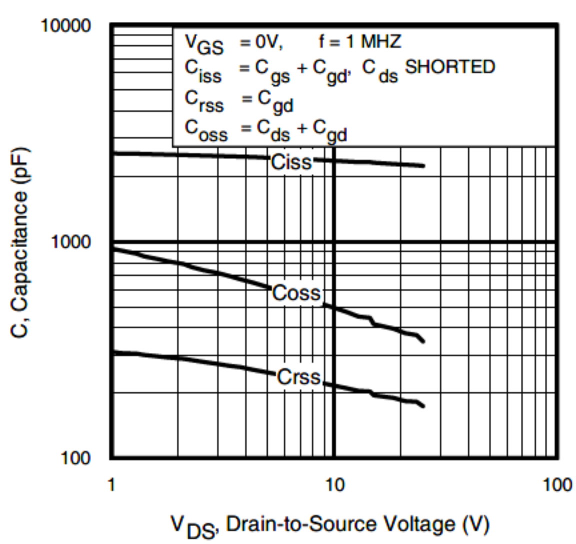


Fig 5. Typical Capacitance vs. Drain-to-Source Voltage

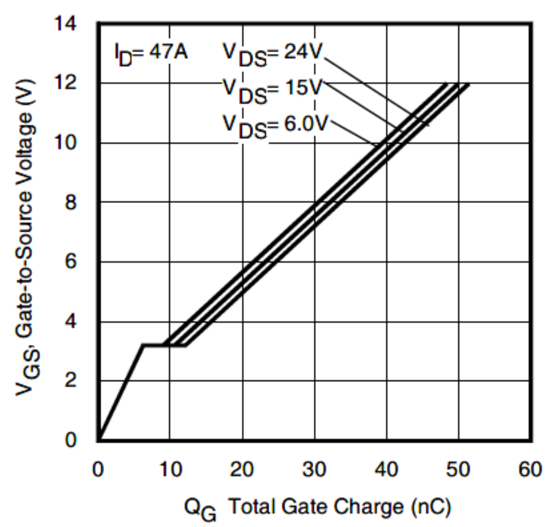


Fig 6. Typical Gate Charge vs. Gate-to-Source Voltage

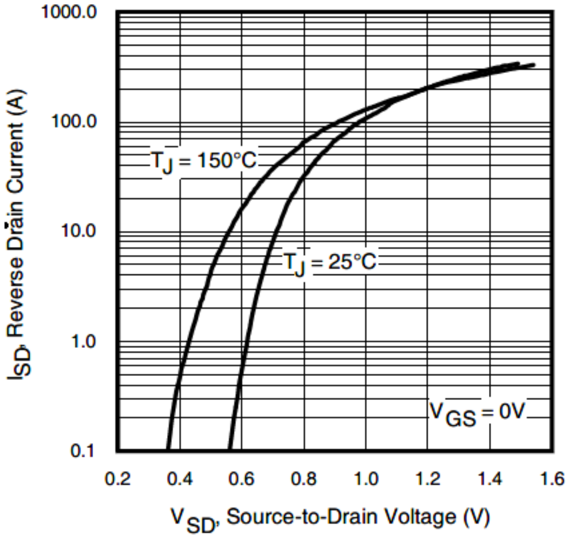


Fig 7. Typical Source-Drain Diode Forward Voltage

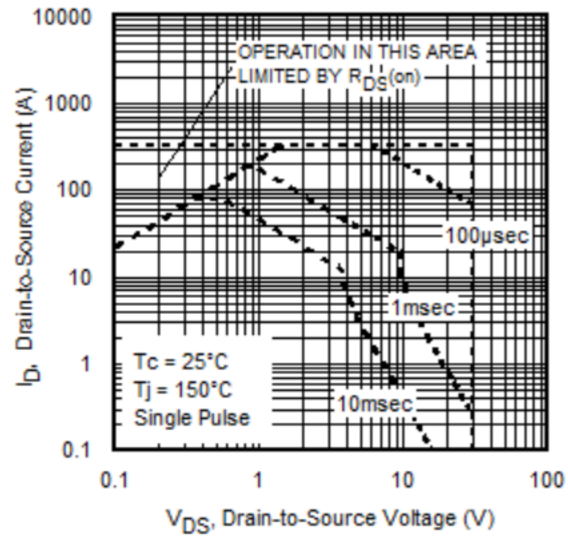


Fig 8. Maximum Safe Operating Area

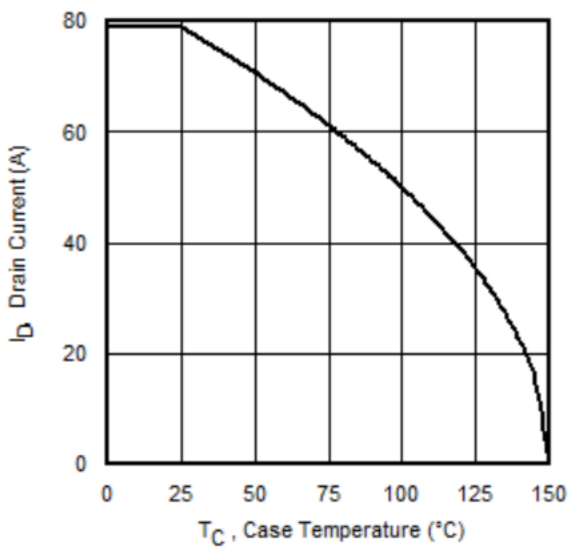


Fig 9. Maximum Drain Current vs. Case Temperature

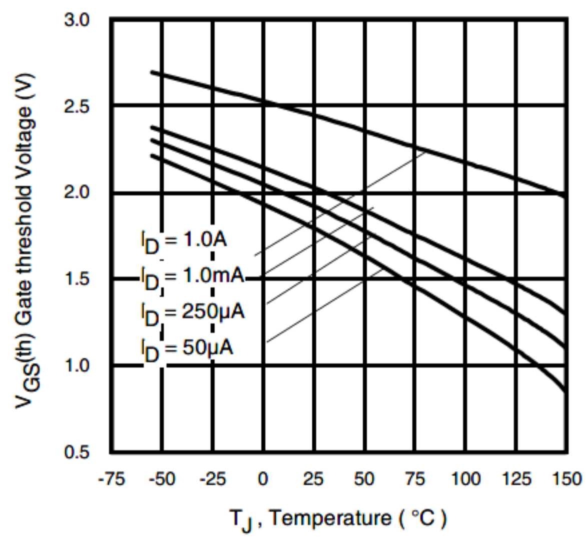


Fig 10. Drain-to-Source Breakdown Voltage

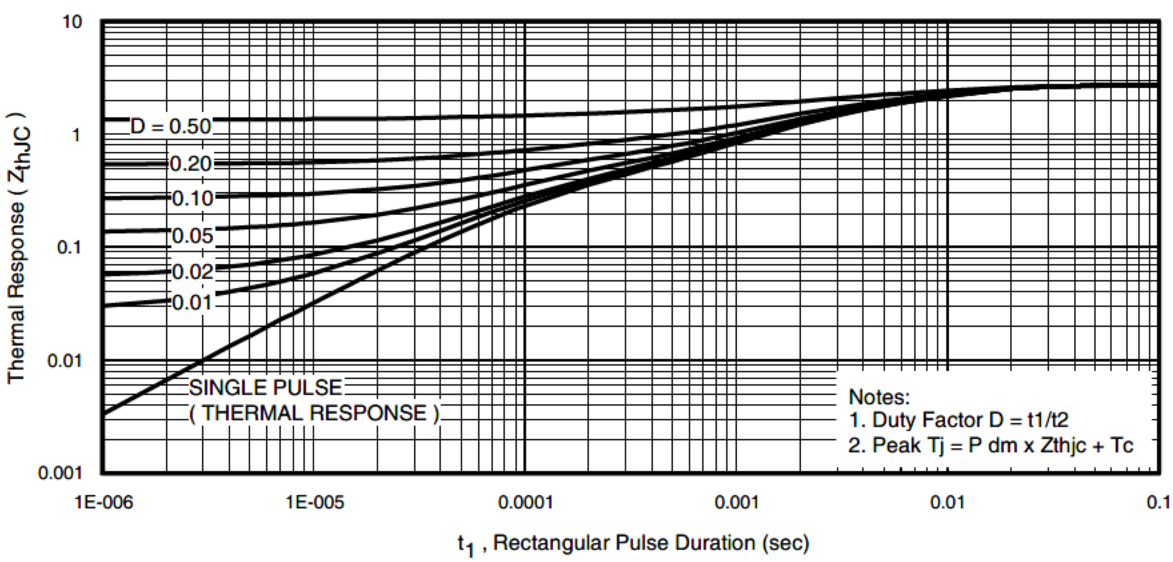


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

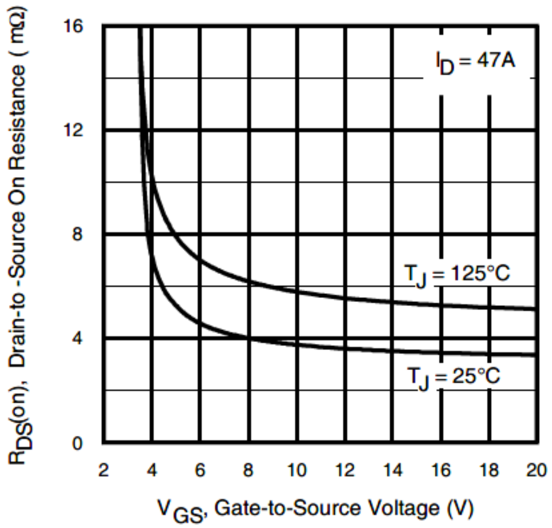


Fig 12. On-Resistance vs. Gate Voltage

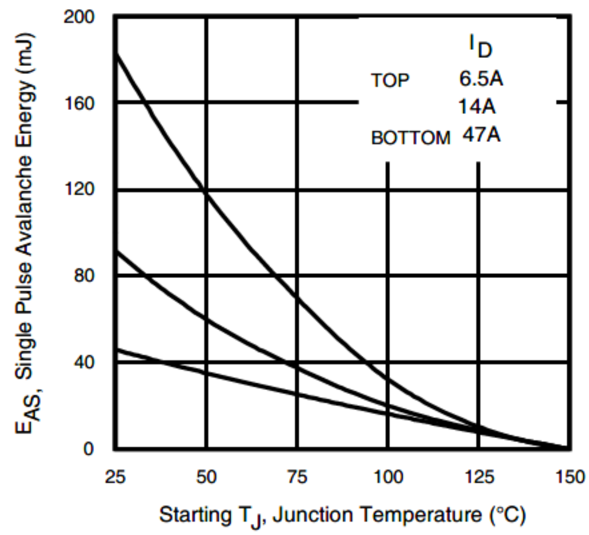


Fig 13. Maximum Avalanche Energy vs. Drain Current

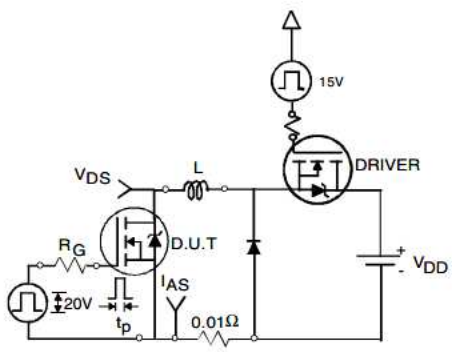


Fig 14a. Unclamped Inductive Test Circuit

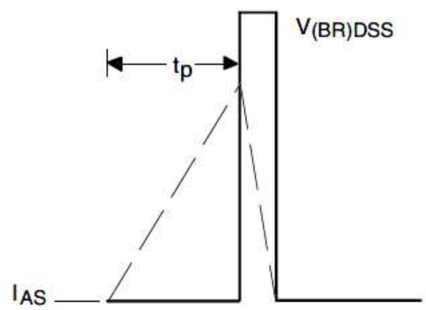


Fig 14b. Unclamped Inductive Waveforms

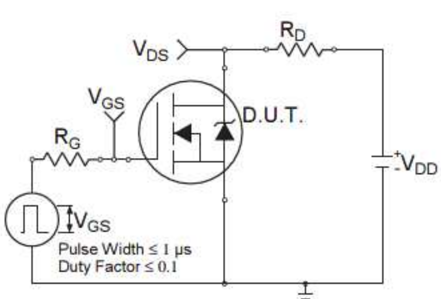


Fig 15a. Switching Time Test Circuit

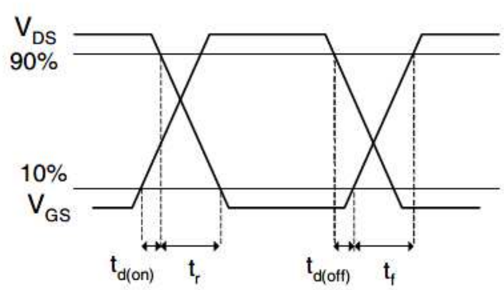


Fig 15b. Switching Time Waveforms

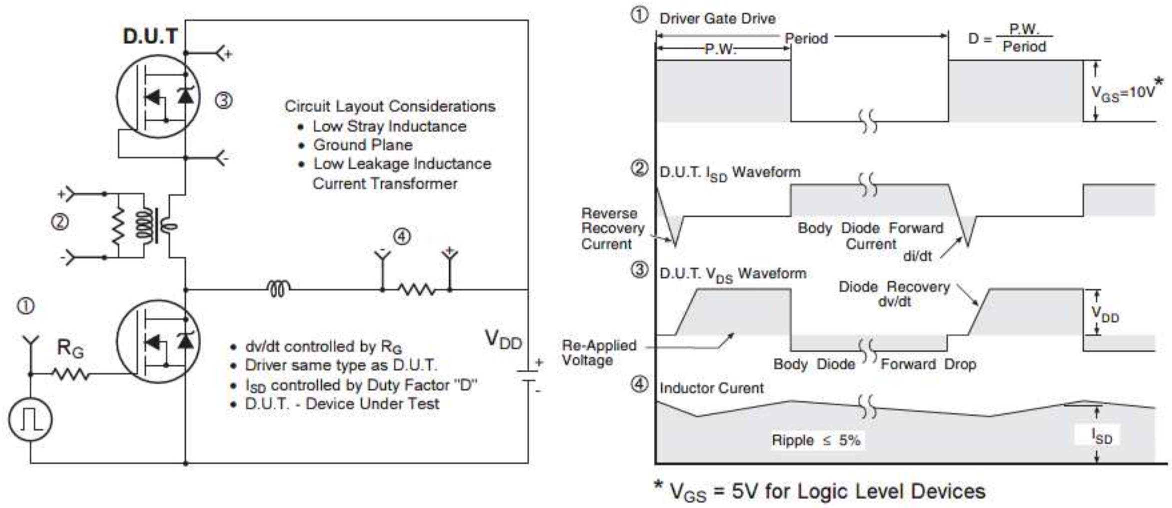


Fig 16. Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs

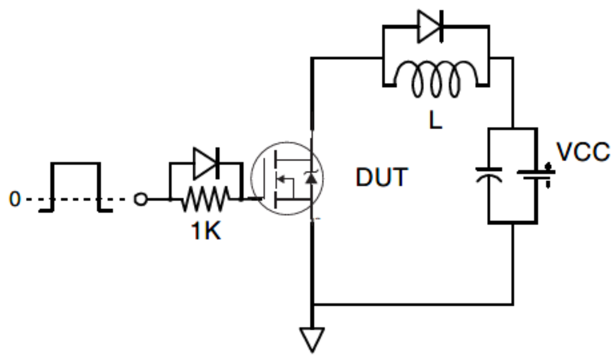


Fig 17. Gate Charge Test Circuit

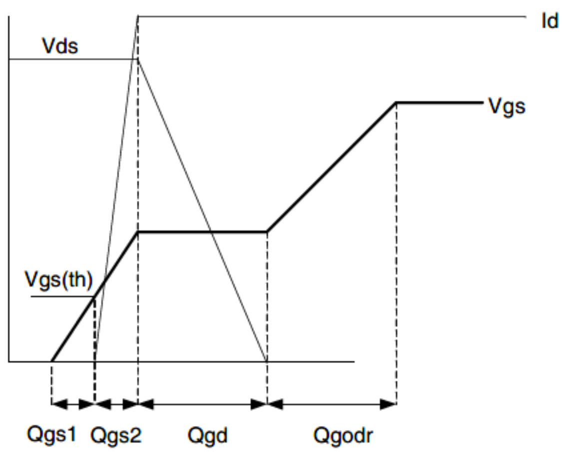
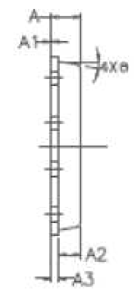
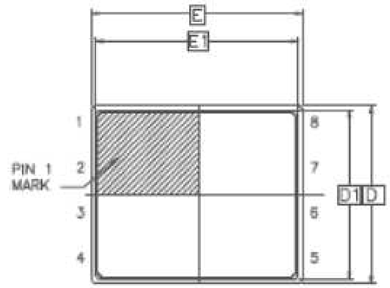


Fig 18. Gate Charge Waveform

PQFN 5x6 Outline "B" Package Details

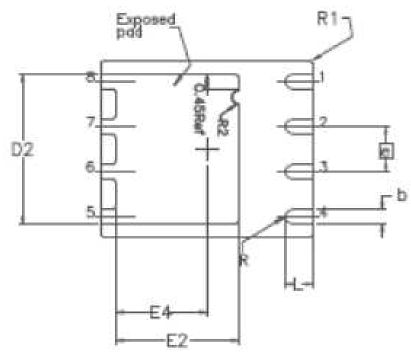


SIDE VIEW



TOP VIEW

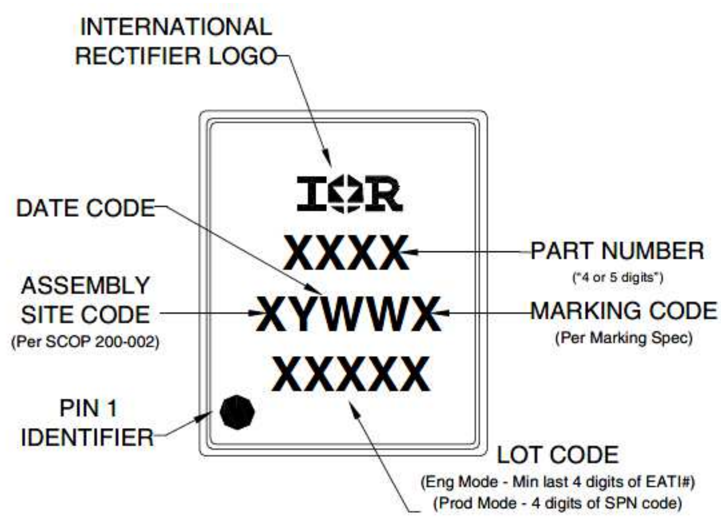
DIM / SYMBOL	MIN	NOM	MAX
A	0.800	0.830	1.05
A1	0.000	0.020	0.050
A2	0.580	0.630	0.680
A3	0.254 REF		
Θ	0°	10°	12°
b	0.350	0.400	0.470
D	4.850	5.000	5.150
D1	4.675	4.750	5.000
D2	3.700	4.210	4.300
e	1.270 BSC		
E	5.850	6.000	6.150
E1	5.675	5.750	6.000
E2	3.380	3.480	3.760
E4	2.480	2.580	2.680
L	0.550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

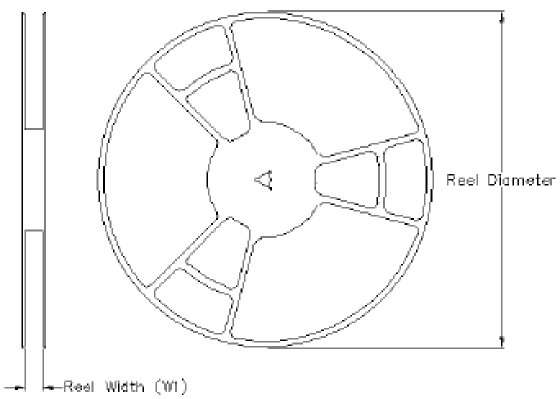
PQFN 5x6 Part Marking



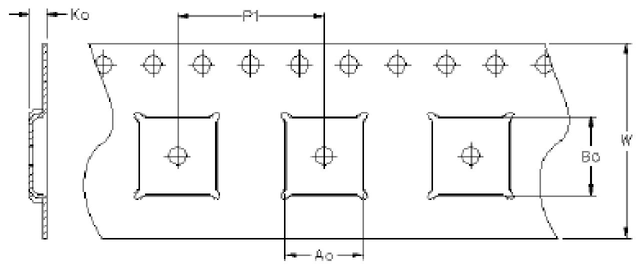
Note: For the most current drawing please refer to IR website at http://www.irf.com/package/

PQFN 5x6 Tape and Reel

REEL DIMENSIONS

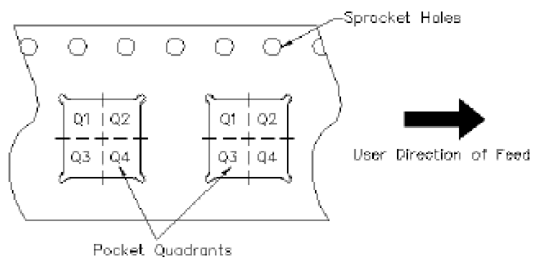


TAPE DIMENSIONS



CODE	DESCRIPTION
Ao	Dimension design to accommodate the component width
Bo	Dimension design to accommodate the component lenght
Ko	Dimension design to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

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°C, L = 0.041mH, R_G = 50Ω, I_{AS} = 47A.
③ Pulse width ≤ 400µs; duty cycle ≤ 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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Edition 2016-04-19
Published by
Infineon Technologies AG
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