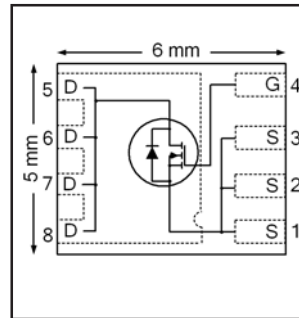


HEXFET® Power MOSFET

V_{DS}	60	V
$R_{DS(on) \text{ max}}$ (@ $V_{GS} = 10V$)	14.4	mΩ
Q_g (typical)	21	nC
R_G (typical)	1.1	Ω
I_D (@ $T_{C(Bottom)} = 25^\circ C$)	40	A



Applications

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

Features and Benefits

Features

Low $R_{DS(on)}$ (< 14.4 mΩ)
Low Thermal Resistance to PCB (< 2.7°C/W)
100% R_g tested
Low Profile (<0.9 mm)
Industry-Standard Pinout
Compatible with Existing Surface Mount Techniques
RoHS Compliant Containing no Lead, no Bromide and no Halogen
MSL1, Industrial Qualification

results in
⇒

Benefits

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

Orderable part number	Package Type	Standard Pack		Note
		Form	Quantity	
IRFH5406TRPbF	PQFN 5mm x 6mm	Tape and Reel	4000	
IRFH5406TR2PbF	PQFN 5mm x 6mm	Tape and Reel	400	EOL notice # 259

Absolute Maximum Ratings

	Parameter	Max.	Units
V_{DS}	Drain-to-Source Voltage	60	V
V_{GS}	Gate-to-Source Voltage	± 20	
I_D @ $T_A = 25^\circ C$	Continuous Drain Current, V_{GS} @ 10V	11	A
I_D @ $T_A = 70^\circ C$	Continuous Drain Current, V_{GS} @ 10V	9	
I_D @ $T_{C(Bottom)} = 25^\circ C$	Continuous Drain Current, V_{GS} @ 10V	40	
I_D @ $T_{C(Bottom)} = 100^\circ C$	Continuous Drain Current, V_{GS} @ 10V	25	
I_{DM}	Pulsed Drain Current ①	160	
P_D @ $T_A = 25^\circ C$	Power Dissipation ⑤	3.6	W
P_D @ $T_{C(Bottom)} = 25^\circ C$	Power Dissipation ⑤	46	
	Linear Derating Factor ⑤	0.029	W/°C
T_J	Operating Junction and	-55 to + 150	°C
T_{STG}	Storage Temperature Range		

Notes ① through ⑤ are on page 8

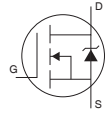
Static @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
BV_{DSS}	Drain-to-Source Breakdown Voltage	60	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.07	—	V/ $^\circ\text{C}$	Reference to 25°C , $I_D = 1.0\text{mA}$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	11.4	14.4	m Ω	$V_{GS} = 10V, I_D = 24A$ ③
$V_{GS(th)}$	Gate Threshold Voltage	2.0	—	4.0	V	$V_{DS} = V_{GS}, I_D = 50\mu A$
$\Delta V_{GS(th)}$	Gate Threshold Voltage Coefficient	—	-8.6	—	mV/ $^\circ\text{C}$	
I_{DSS}	Drain-to-Source Leakage Current	—	—	20	μA	$V_{DS} = 60V, V_{GS} = 0V$
		—	—	250		$V_{DS} = 60V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
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	27	—	—	S	$V_{DS} = 25V, I_D = 24A$
Q_g	Total Gate Charge	—	21	32	nC	$V_{DS} = 30V$ $V_{GS} = 10V$ $I_D = 24A$
Q_{gs1}	Pre-Vth Gate-to-Source Charge	—	3.6	—		
Q_{gs2}	Post-Vth Gate-to-Source Charge	—	1.9	—		
Q_{gd}	Gate-to-Drain Charge	—	6.5	—		
Q_{godr}	Gate Charge Overdrive	—	9	—		
Q_{sw}	Switch Charge ($Q_{gs2} + Q_{gd}$)	—	8.4	—		
Q_{oss}	Output Charge	—	7.4	—	nC	$V_{DS} = 16V, V_{GS} = 0V$
R_G	Gate Resistance	—	1.1	—	Ω	
$t_{d(on)}$	Turn-On Delay Time	—	5.4	—	ns	$V_{DD} = 30V, V_{GS} = 10V$ $I_D = 24A$ $R_G = 1.7\Omega$
t_r	Rise Time	—	8.7	—		
$t_{d(off)}$	Turn-Off Delay Time	—	12	—		
t_f	Fall Time	—	3.5	—		
C_{iss}	Input Capacitance	—	1256	—	pF	$V_{GS} = 0V$ $V_{DS} = 25V$ $f = 1.0\text{MHz}$
C_{oss}	Output Capacitance	—	206	—		
C_{rss}	Reverse Transfer Capacitance	—	92	—		

Avalanche Characteristics

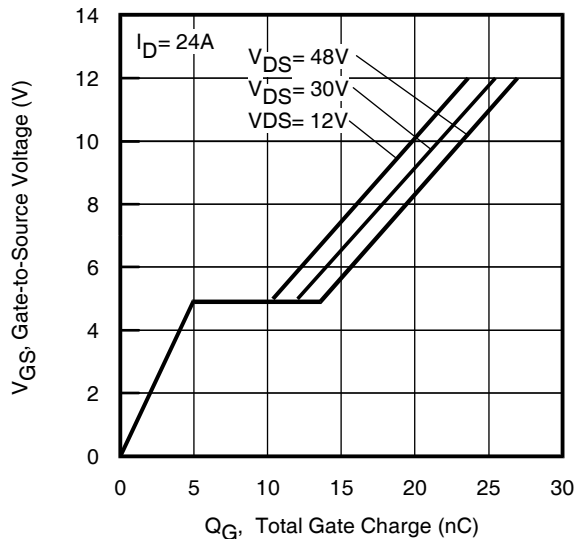
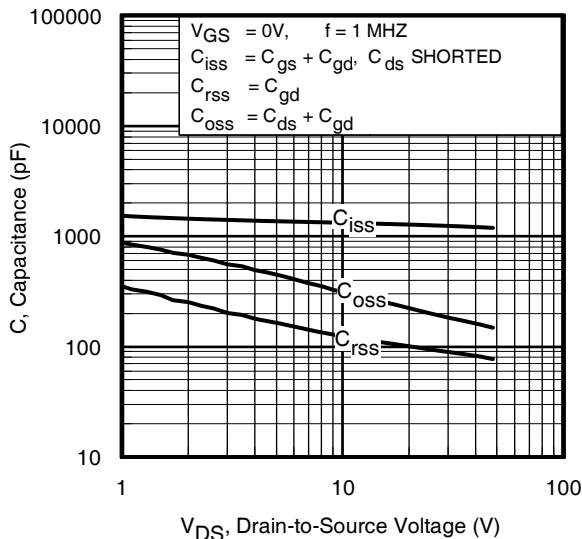
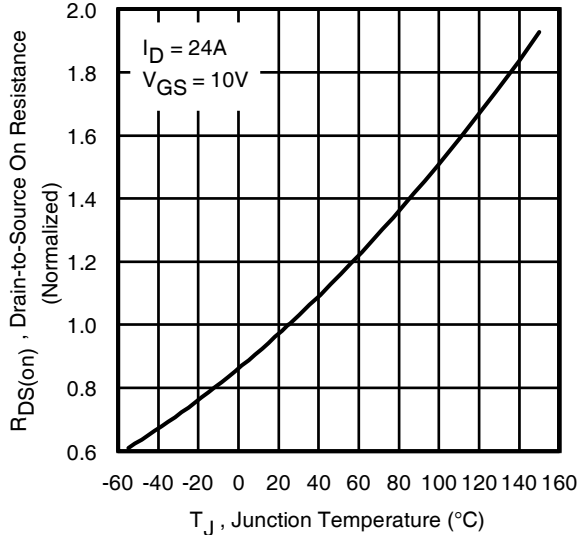
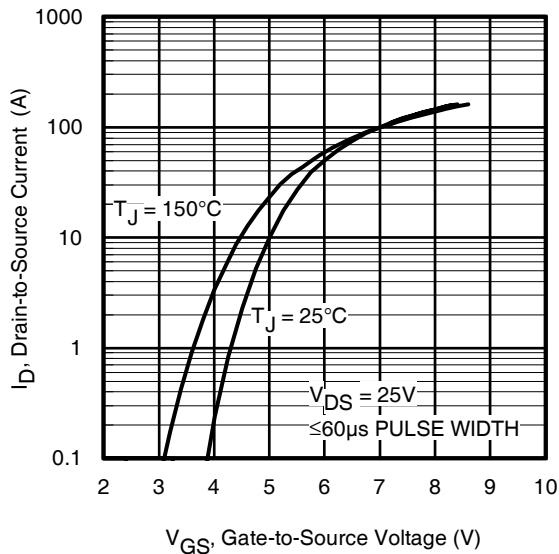
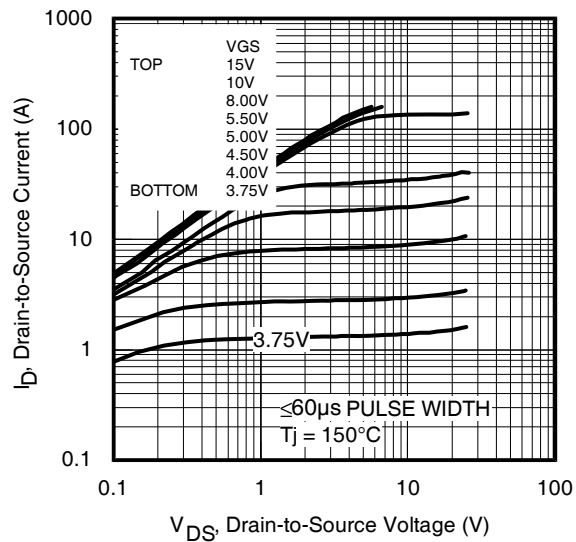
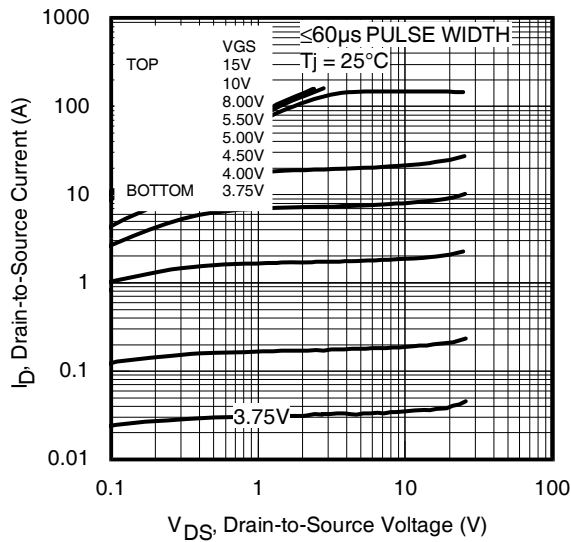
	Parameter	Typ.	Max.	Units
E_{AS}	Single Pulse Avalanche Energy ②	—	45	mJ
I_{AR}	Avalanche Current ①	—	24	A

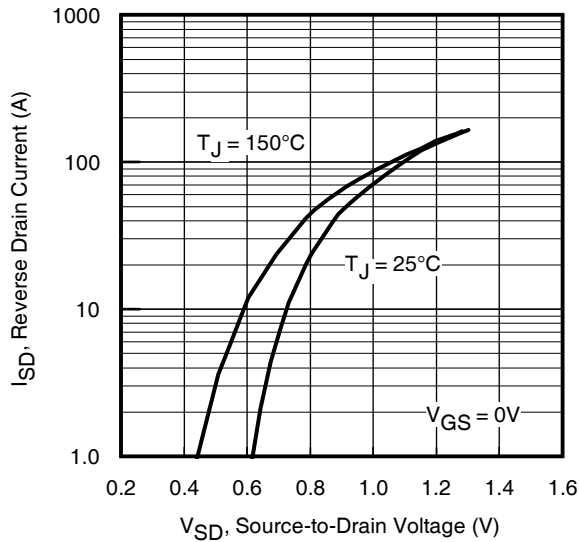
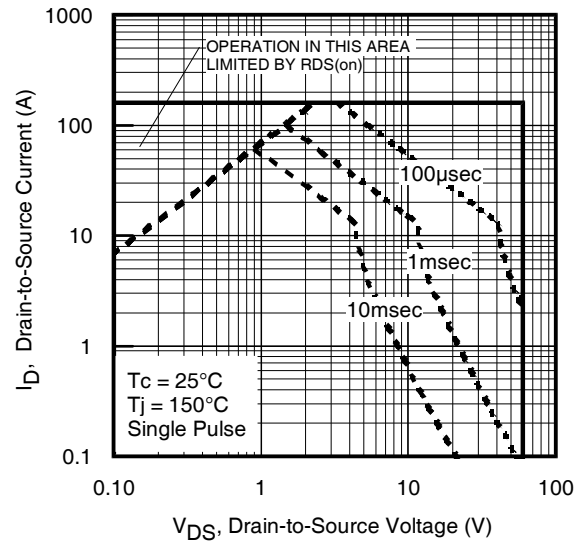
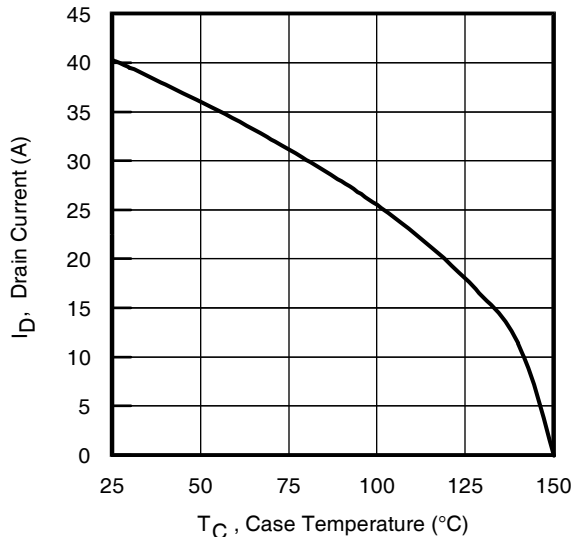
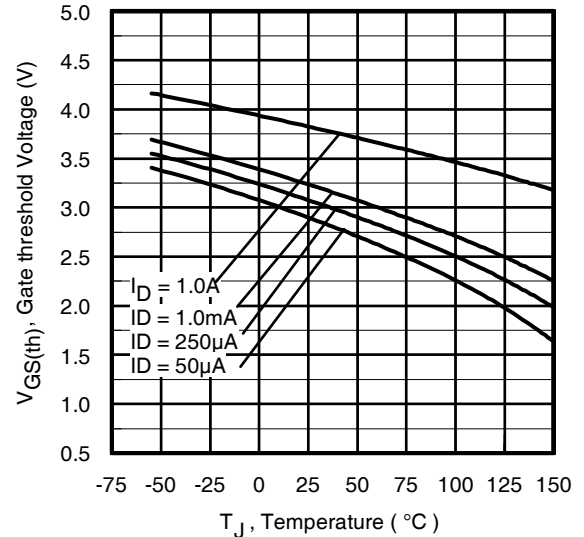
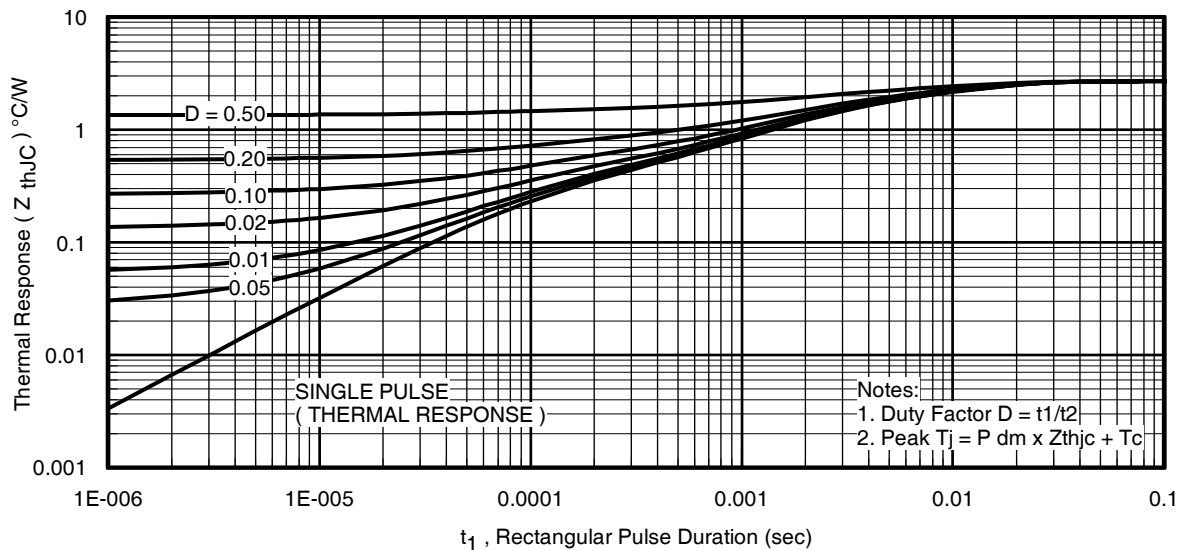
Diode Characteristics

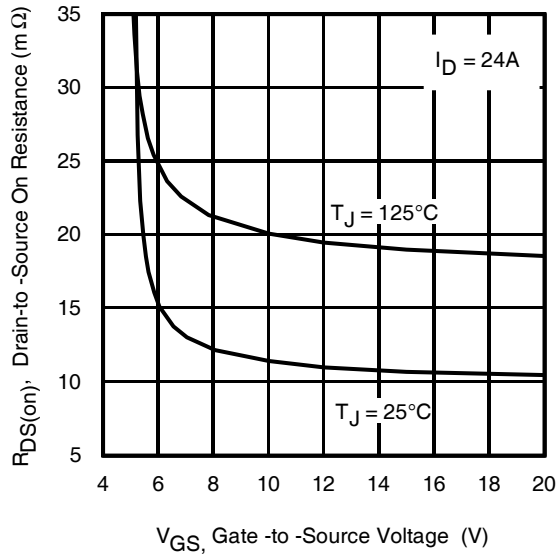
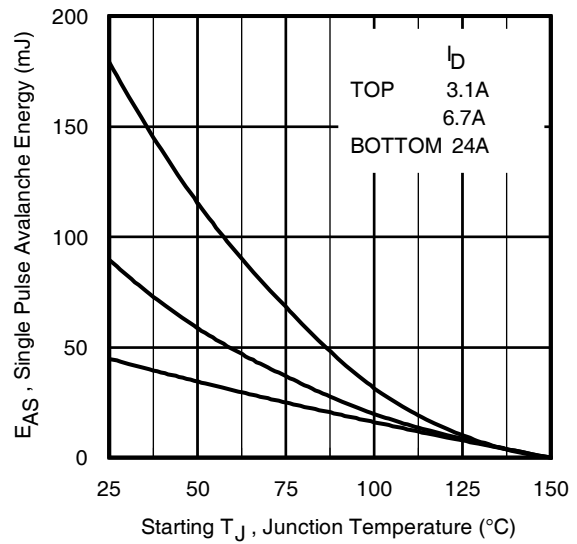
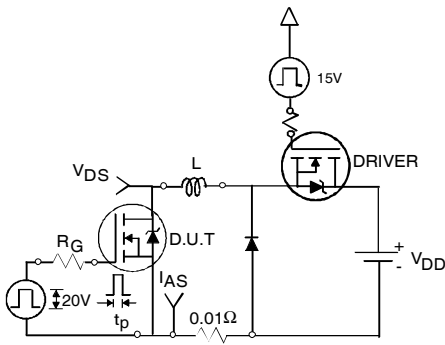
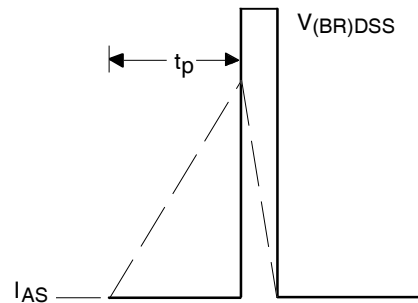
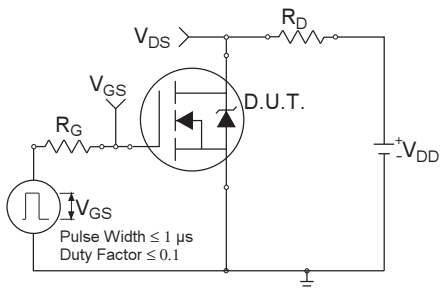
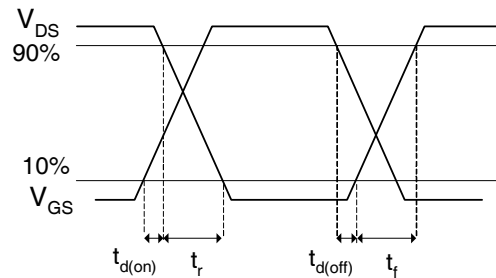
	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	40	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode) ①	—	—	160		
V_{SD}	Diode Forward Voltage	—	—	1.3	V	$T_J = 25^\circ\text{C}, I_S = 24A, V_{GS} = 0V$ ③
t_{rr}	Reverse Recovery Time	—	20	30	ns	$T_J = 25^\circ\text{C}, I_F = 24A, V_{DD} = 30V$
Q_{rr}	Reverse Recovery Charge	—	74	111	nC	$di/dt = 500A/\mu s$ 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-Case 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 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 (Bottom) Temperature

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

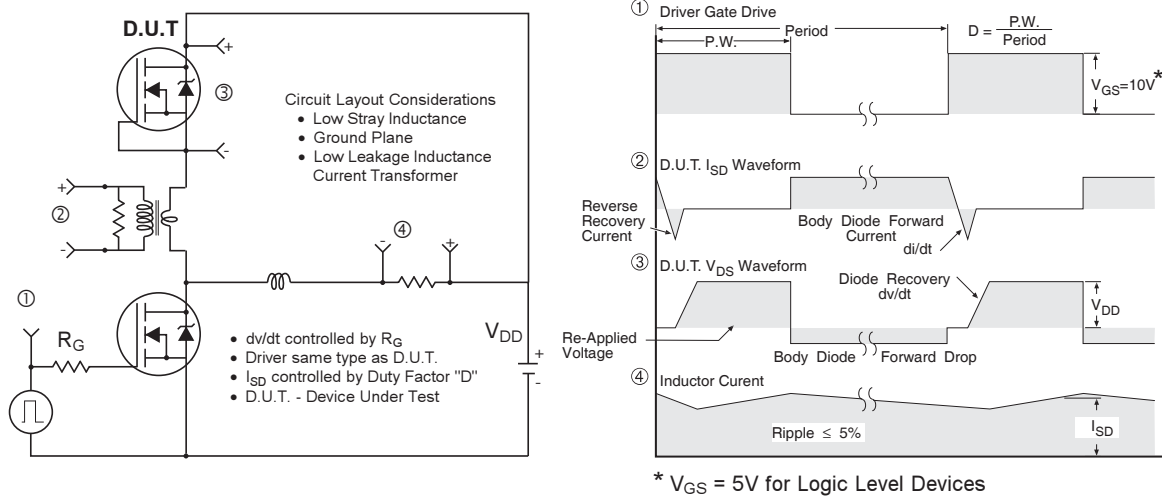


Fig 16. Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs

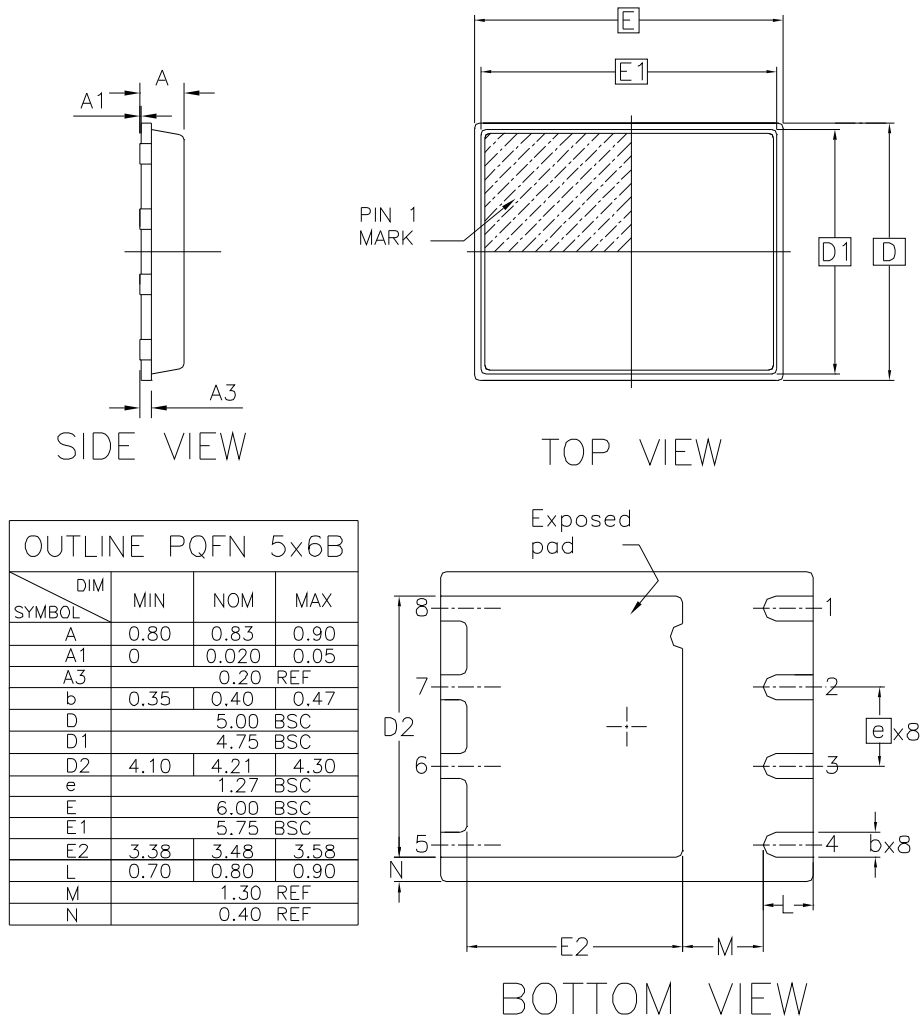


Fig 17. Gate Charge Test Circuit



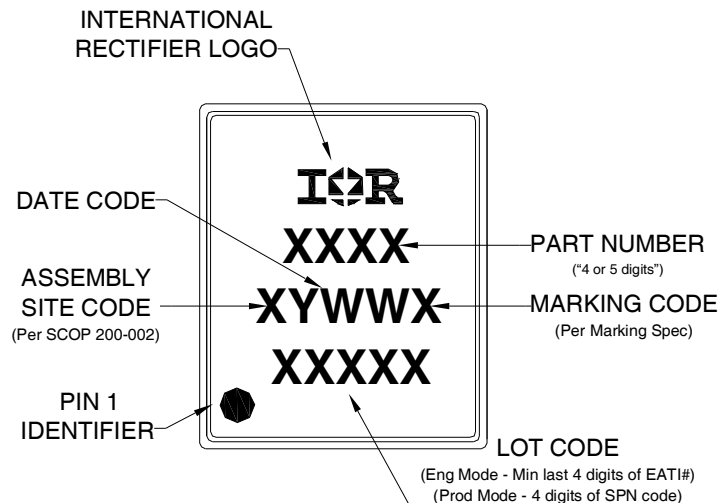
Fig 18. Gate Charge Waveform

PQFN 5x6 Outline "B" Package Details



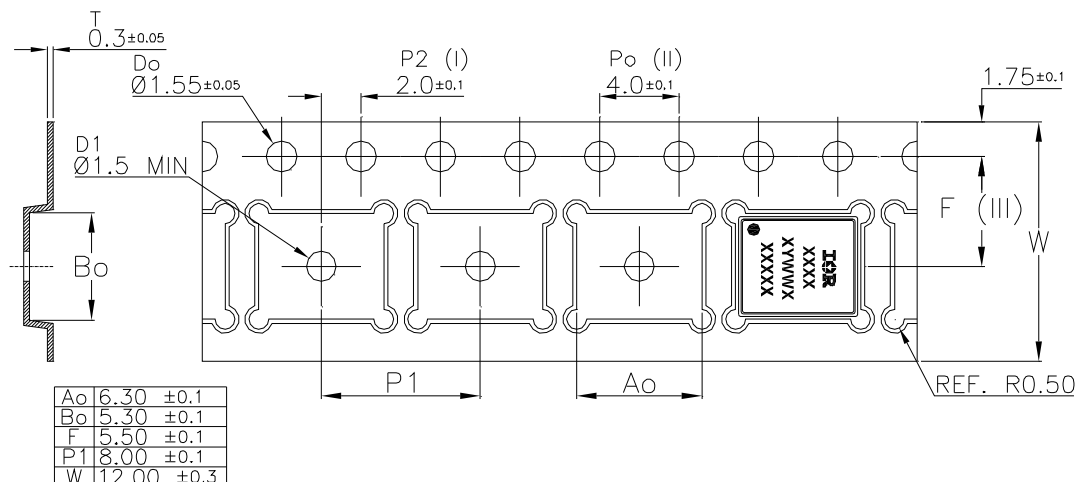
For footprint and stencil design recommendations, please refer to application note AN-1154 at <http://www.irf.com/technical-info/appnotes/an-1154.pdf>

PQFN 5x6 Outline "B" Part Marking



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

PQFN 5x6 Outline "B" Tape and Reel



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>

^{††} Higher qualification ratings may be available should the user have such requirements.

Please contact your International Rectifier sales representative for further information:

<http://www.irf.com/whoto-call/salesrep/>

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

Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Starting $T_J = 25^\circ\text{C}$, $L = 0.156\text{mH}$, $R_G = 50\Omega$, $I_{AS} = 24\text{A}$.
- 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.

Revision History

Date	Comments
12/16/2013	• Updated ordering information to reflect the End-Of-life (EOL) of the mini-reel option (EOL notice #259) • Updated data sheet with new IR corporate template

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

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