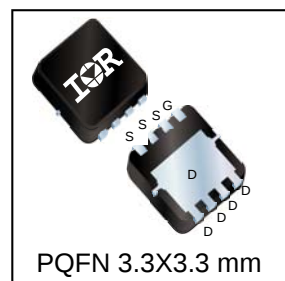
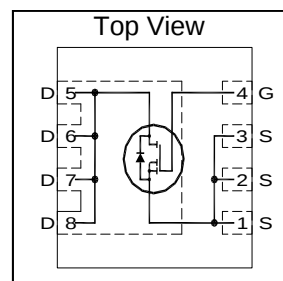


V_{DS}	30	V
V_{GS} max	±20	V
$R_{DS(on)}$ max (@ $V_{GS} = 10V$)	6.6	mΩ
(@ $V_{GS} = 4.5V$)	9.9	
Q_g (typical)	9.3	nC
I_D (@ $T_{C(Bottom)} = 25^\circ C$)	25⑤	A

HEXFET® Power MOSFET



Applications

- Charge and Discharge Switch for Notebook PC Battery Application
- System/Load Switch
- Control MOSFET for synchronous buck converter

Features

Low Thermal Resistance to PCB (<3.8°C/W)
Low Profile (<1.2mm)
Industry-Standard Pinout
Compatible with Existing Surface Mount Techniques
RoHS Compliant, Halogen-Free
MSL1, Consumer Qualification

results in



Benefits

Enable better Thermal Dissipation
Increased Power Density
Multi-Vendor Compatibility
Easier Manufacturing
Environmentally Friendlier
Increased Reliability

Base part number	Package Type	Standard Pack		Orderable Part Number
		Form	Quantity	
IRFHM8330PbF	PQFN 3.3 mm x 3.3 mm	Tape and Reel	4000	IRFHM8330TRPbF

Absolute Maximum Ratings

	Parameter	Max.	Units
V_{GS}	Gate-to-Source Voltage	± 20	V
I_D @ $T_A = 25^\circ C$	Continuous Drain Current, V_{GS} @ 10V	16	A
I_D @ $T_A = 70^\circ C$	Continuous Drain Current, V_{GS} @ 10V	13	
I_D @ $T_{C(Bottom)} = 25^\circ C$	Continuous Drain Current, V_{GS} @ 10V	55⑤⑥	
I_D @ $T_{C(Bottom)} = 100^\circ C$	Continuous Drain Current, V_{GS} @ 10V	35⑤⑥	
I_D @ $T_C = 25^\circ C$	Continuous Drain Current, V_{GS} @ 10V (Source Bonding Technology Limited)	25⑥	
I_{DM}	Pulsed Drain Current	210⑦	W
P_D @ $T_A = 25^\circ C$	Power Dissipation ④	2.7	
P_D @ $T_{C(Bottom)} = 25^\circ C$	Power Dissipation	33	
	Linear Derating Factor	0.021	W/°C
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 150	°C

Notes ① through ⑦ are on page 9

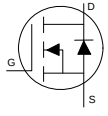
Static @ T_J = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
BV _{DSS}	Drain-to-Source Breakdown Voltage	30	—	—	V	V _{GS} = 0V, I _D = 250μA
ΔBV _{DSS} /ΔT _J	Breakdown Voltage Temp. Coefficient	—	23	—	mV/°C	Reference to 25°C, I _D = 1.0mA
R _{DS(on)}	Static Drain-to-Source On-Resistance	—	5.3	6.6	mΩ	V _{GS} = 10V, I _D = 20A ②
		—	7.7	9.9		V _{GS} = 4.5V, I _D = 16A ②
V _{GS(th)}	Gate Threshold Voltage	1.35	1.8	2.35	V	V _{DS} = V _{GS} , I _D = 25μA
ΔV _{GS(th)}	Gate Threshold Voltage Coefficient	—	-6.3	—	mV/°C	
I _{DSS}	Drain-to-Source Leakage Current	—	—	1.0	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} = 20V
	Gate-to-Source Reverse Leakage	—	—	-100		V _{GS} = -20V
g _{fs}	Forward Transconductance	61	—	—	S	V _{DS} = 10V, I _D = 20A
Q _g	Total Gate Charge	—	20	—	nC	V _{GS} = 10V, V _{DS} = 15V, I _D = 20A
Q _g	Total Gate Charge	—	9.3	14	nC	V _{DS} = 15V V _{GS} = 4.5V I _D = 20A
Q _{gs1}	Pre-V _{th} Gate-to-Source Charge	—	2.7	—		
Q _{gs2}	Post-V _{th} Gate-to-Source Charge	—	1.6	—		
Q _{gd}	Gate-to-Drain Charge	—	2.5	—		
Q _{godr}	Gate Charge Overdrive	—	2.5	—		
Q _{sw}	Switch Charge (Q _{gs2} + Q _{gd})	—	4.1	—		
Q _{oss}	Output Charge	—	7.1	—	nC	V _{DS} = 16V, V _{GS} = 0V
R _G	Gate Resistance	—	1.8	—	Ω	
t _{d(on)}	Turn-On Delay Time	—	9.2	—	ns	V _{DD} = 15V, V _{GS} = 4.5V I _D = 20A R _G = 1.8Ω
t _r	Rise Time	—	15	—		
t _{d(off)}	Turn-Off Delay Time	—	10	—		
t _f	Fall Time	—	5.7	—		
C _{iss}	Input Capacitance	—	1450	—	pF	V _{GS} = 0V V _{DS} = 25V f = 1.0MHz
C _{oss}	Output Capacitance	—	250	—		
C _{rss}	Reverse Transfer Capacitance	—	110	—		

Avalanche Characteristics

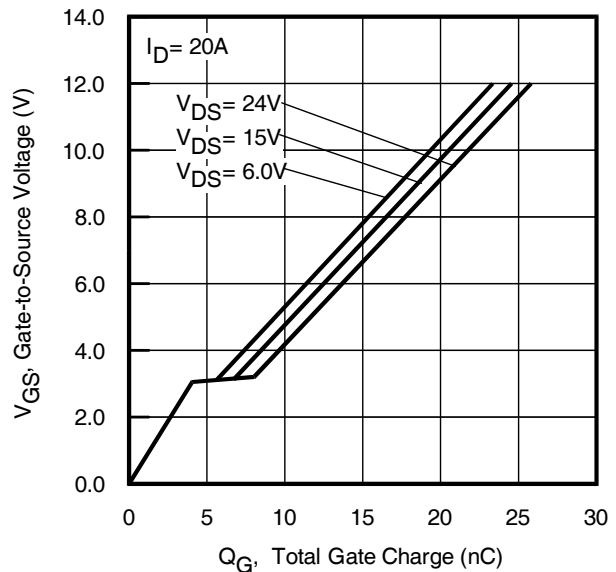
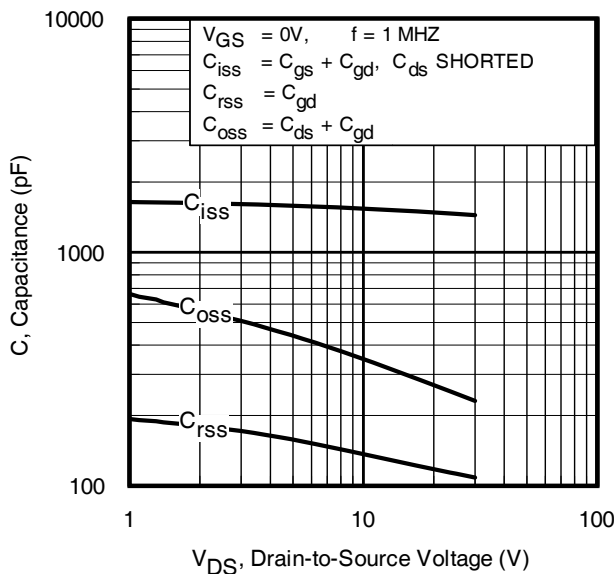
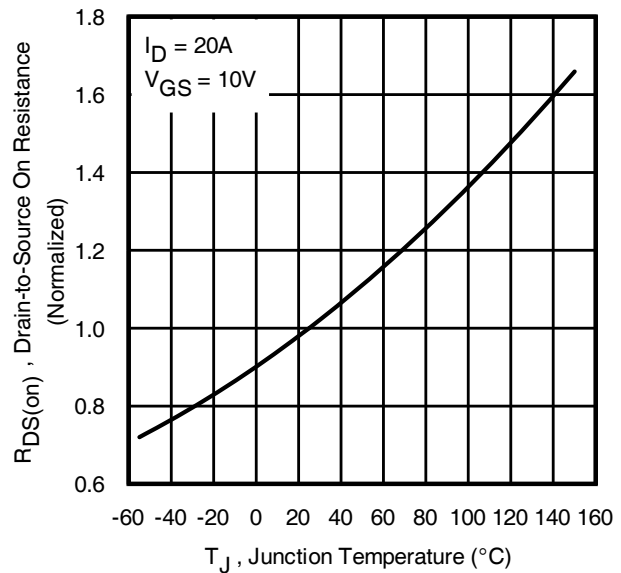
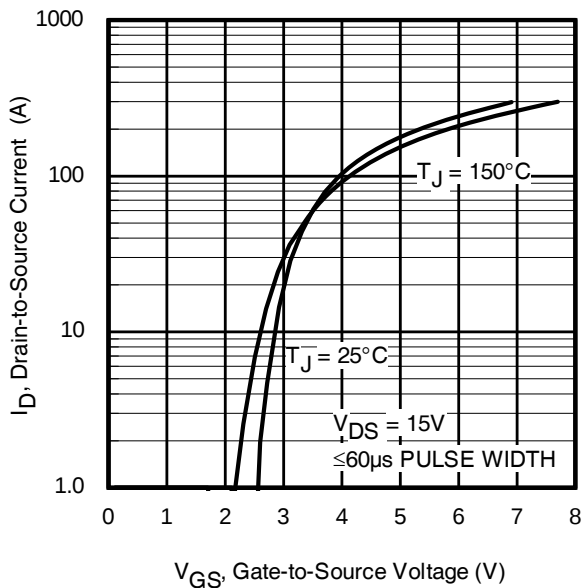
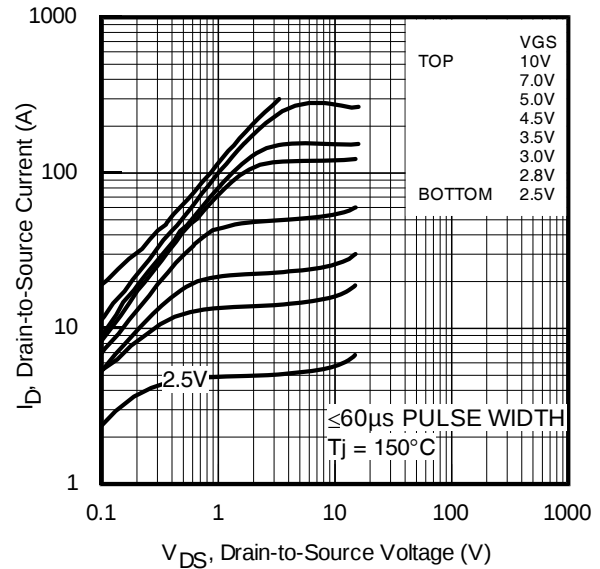
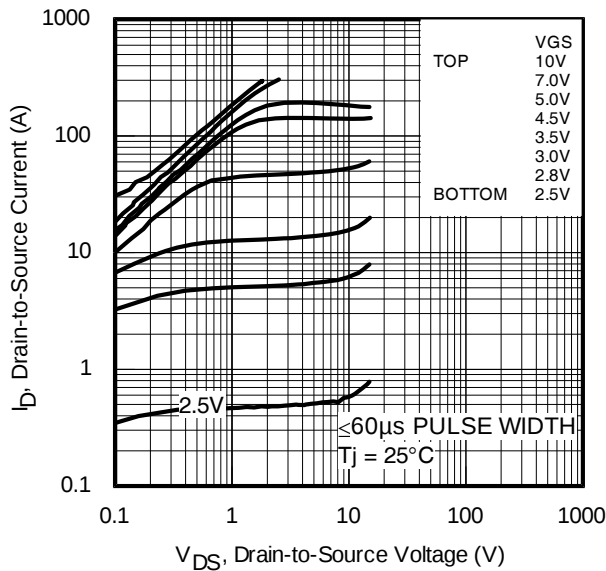
	Parameter	Typ.	Max.	Units
E _{AS}	Single Pulse Avalanche Energy ①	—	42	mJ

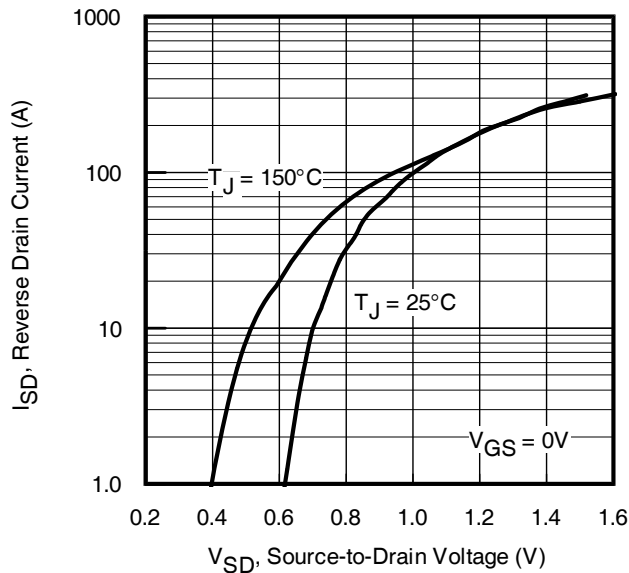
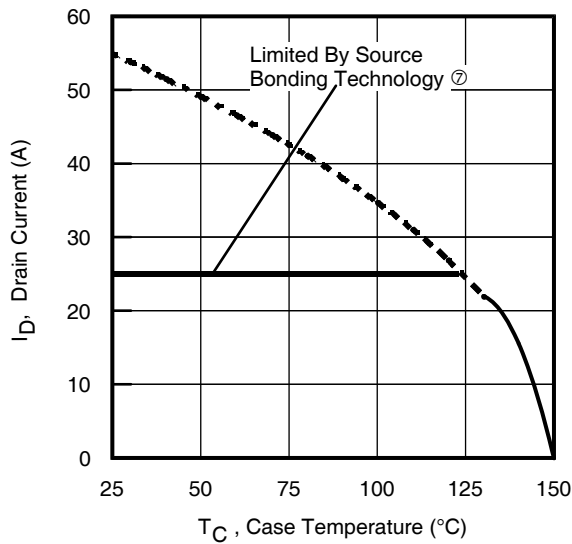
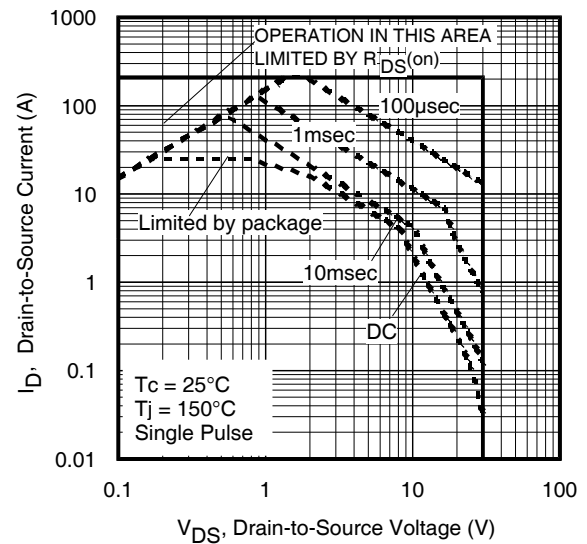
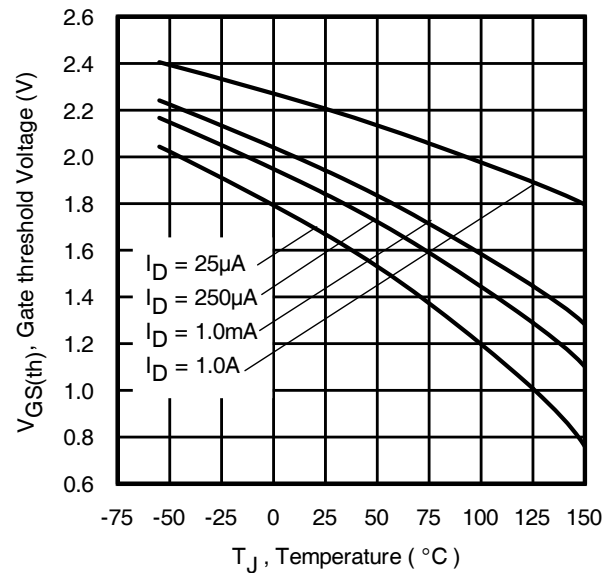
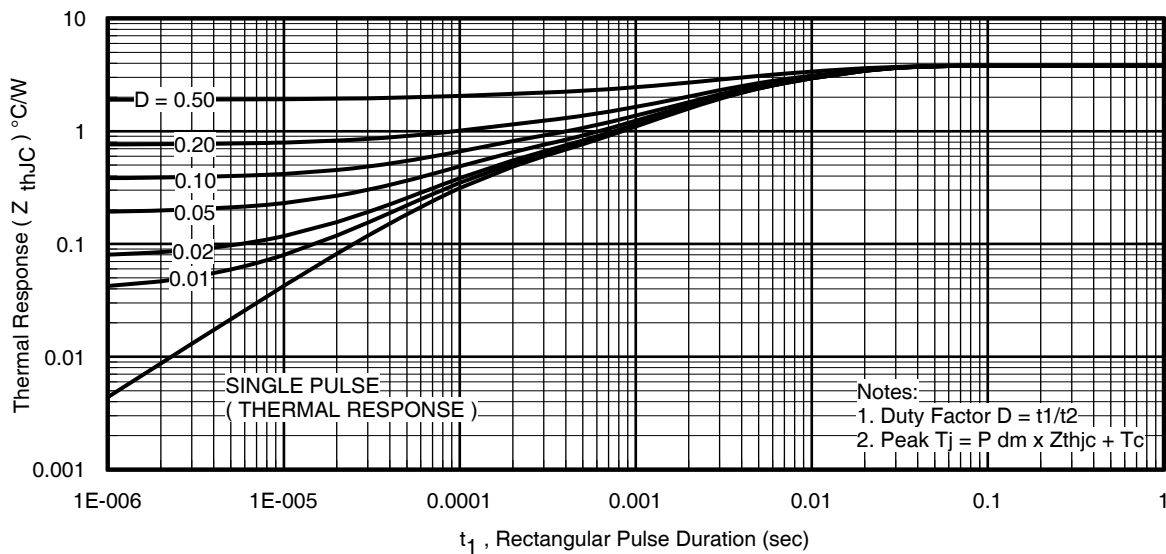
Diode Characteristics

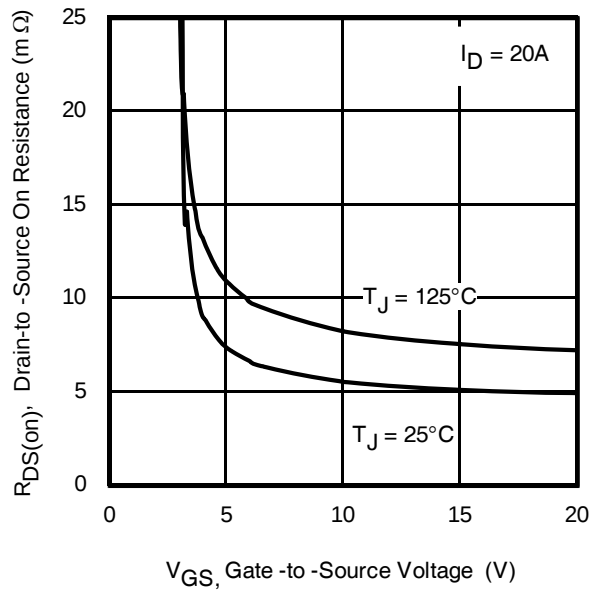
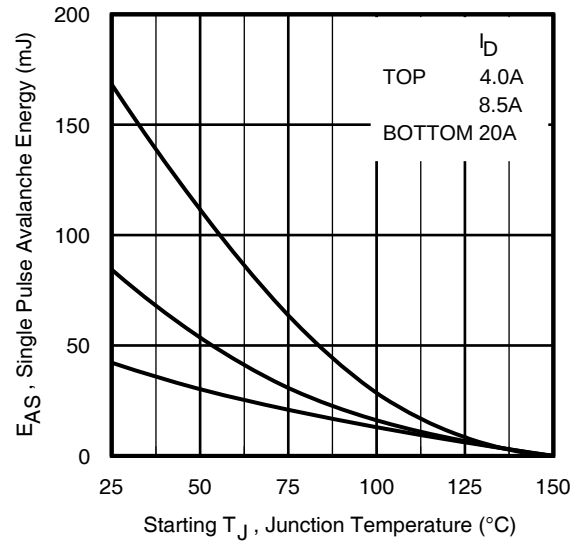
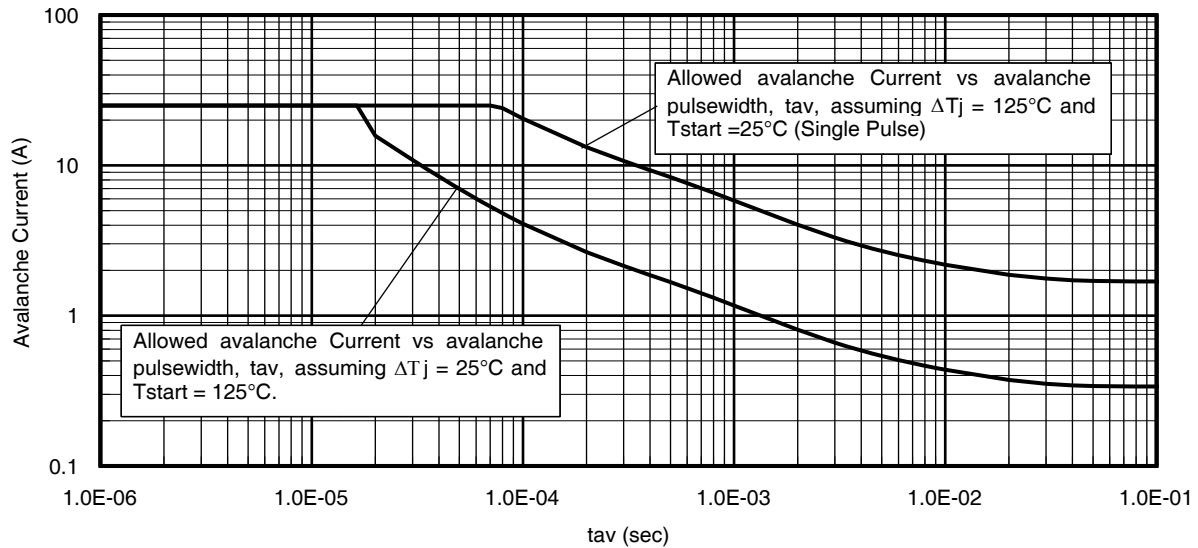
	Parameter	Min.	Typ.	Max.	Units	Conditions
I _S	Continuous Source Current (Body Diode)	—	—	25⑥	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I _{SM}	Pulsed Source Current (Body Diode) ①	—	—	210⑦		
V _{SD}	Diode Forward Voltage	—	—	1.0	V	T _J = 25°C, I _S = 20A, V _{GS} = 0V ②
t _{rr}	Reverse Recovery Time	—	14	21	ns	T _J = 25°C, I _F = 20A, V _{DD} = 15V
Q _{rr}	Reverse Recovery Charge	—	23	35	nC	di/dt = 390A/μs ②

Thermal Resistance

	Parameter	Typ.	Max.	Units
R _{θJC} (Bottom)	Junction-to-Case ③	—	3.8	°C/W
R _{θJC} (Top)	Junction-to-Case ③	—	42	
R _{θJA}	Junction-to-Ambient ④	—	47	
R _{θJA} (<10s)	Junction-to-Ambient ④	—	32	




Fig 7. Typical Source-Drain Diode Forward Voltage

Fig 9. Maximum Drain Current vs. Case Temperature

Fig 8. Maximum Safe Operating Area

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 14. Single Avalanche Event: Pulse Current vs. Pulse Width

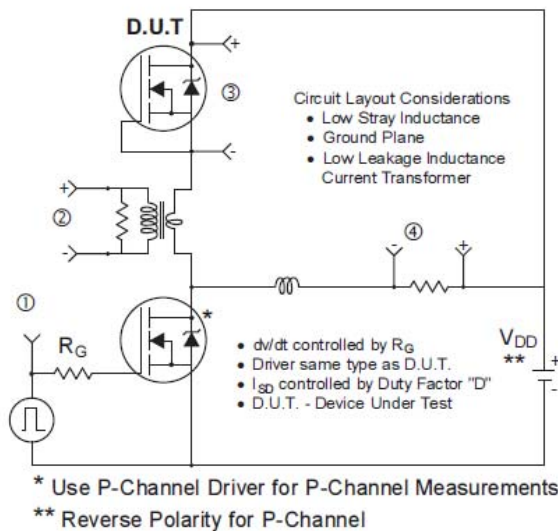


Fig 15. Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs

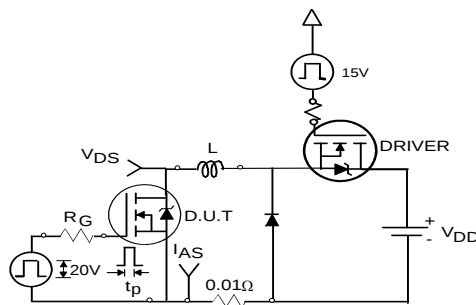


Fig 16a. Unclamped Inductive Test Circuit

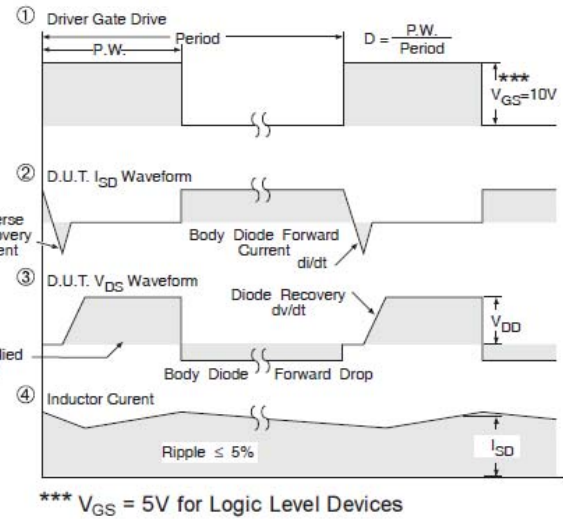


Fig 16b. Unclamped Inductive Waveforms

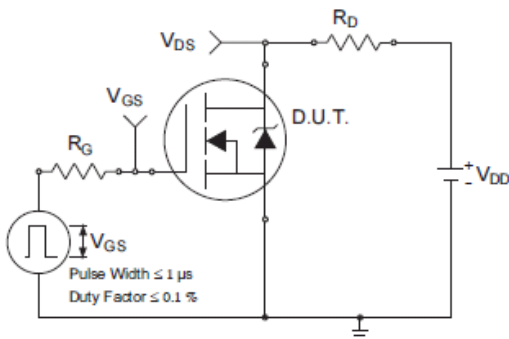


Fig 17a. Switching Time Test Circuit

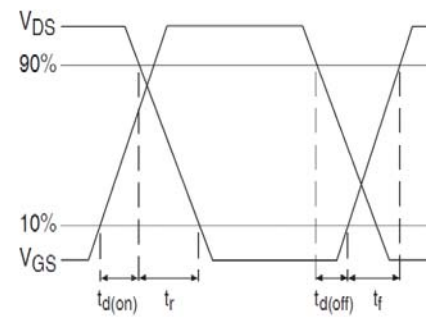


Fig 17b. Switching Time Waveforms

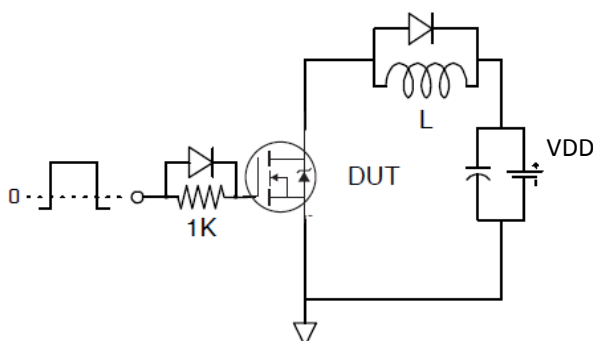


Fig 18a. Gate Charge Test Circuit

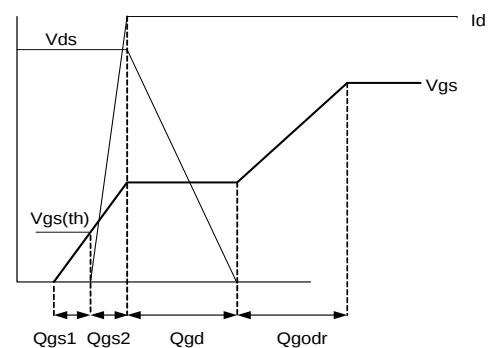


Fig 18b. Gate Charge Waveform

Placement and Layout Guidelines

The typical application topology for this product is the synchronous buck converter. These converters operate at high frequencies (typically around 400 kHz). During turn-on and turn-off switching cycles, the high di/dt currents circulating in the parasitic elements of the circuit induce high voltage ringing which may exceed the device rating and lead to undesirable effects. One of the major contributors to the increase in parasitics is the PCB power circuit inductance.

This section introduces a simple guideline that mitigates the effect of these parasitics on the performance of the circuit and provides reliable operation of the devices.

To reduce high frequency switching noise and the effects of Electromagnetic Interference (EMI) when the control MOSFET (Q1) is turned on, the layout shown in Figure 19 is recommended. The input bypass capacitors, control MOSFET and output capacitors are placed in a tight loop to minimize parasitic inductance which in turn lowers the amplitude of the switch node ringing, and minimizes exposure of the MOSFETs to repetitive avalanche conditions.

When the synchronous MOSFET (Q2) is turned on, high average DC current flows through the path indicated in Figure 19. Therefore, the Q2 turn-on path should be laid out with a tight loop and wide traces at both ends of the inductor to minimize loop resistance.

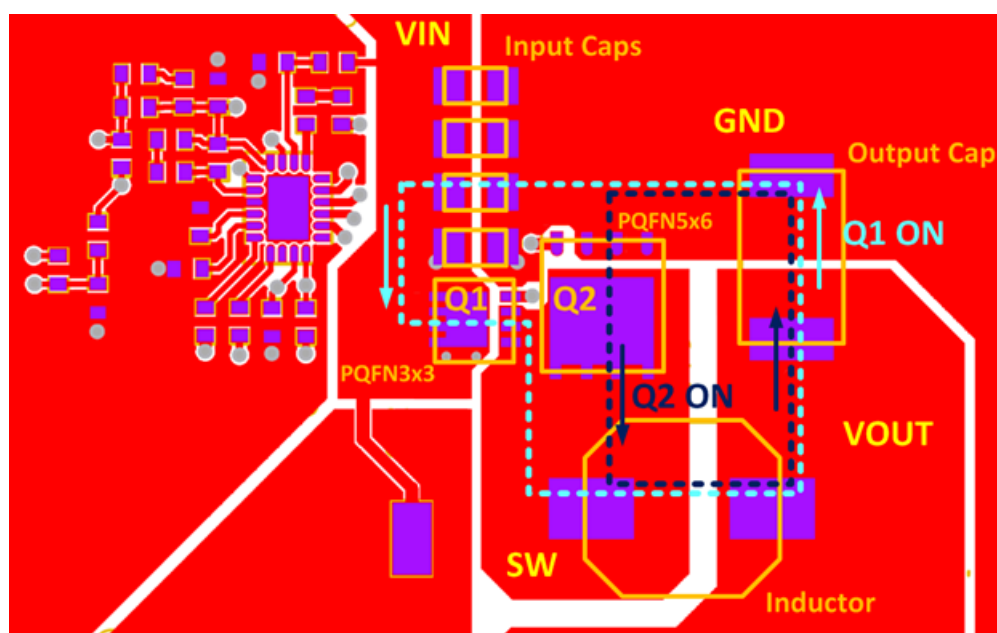
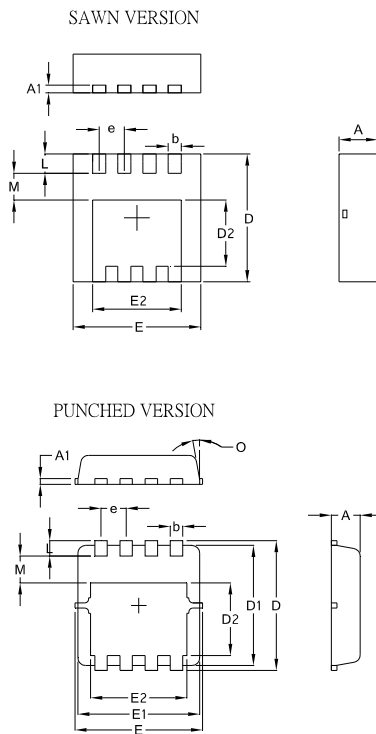


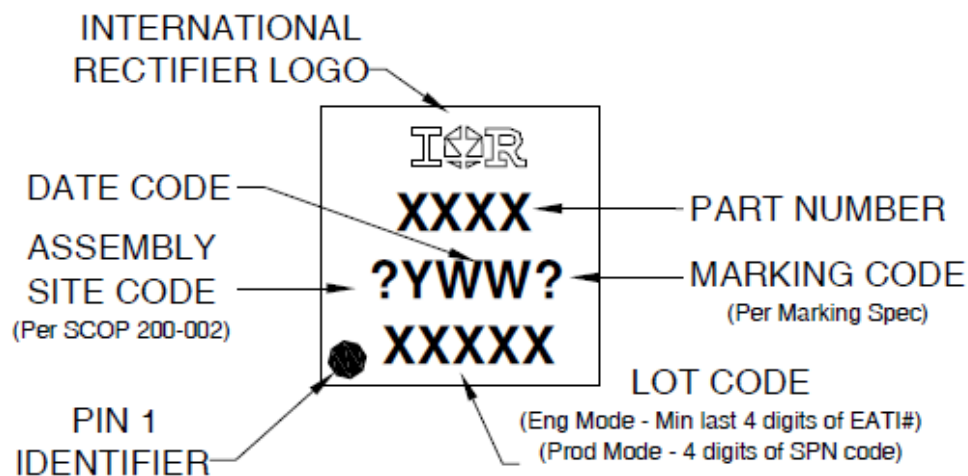
Fig 19. Placement and Layout Guidelines

PQFN 3.3mm x 3.3mm Outline Package Details


SYMBOL	COMMON			
	MM		INCH	
	MIN.	MAX.	MIN.	MAX.
A	0.70	1.05	0.0276	0.0413
A1	0.12	0.39	0.0047	0.0154
b	0.25	0.39	0.0098	0.0154
D	3.20	3.45	0.1260	0.1358
D1	3.00	3.20	0.1181	0.1417
D2	1.69	2.20	0.0665	0.0866
E	3.20	3.40	0.1260	0.1339
E1	3.00	3.20	0.1181	0.1417
E2	2.15	2.59	0.0846	0.1020
e	0.65 BSC		0.0256 BSC	
L	0.15	0.55	0.0059	0.0217
M	0.59	—	0.0232	—
O	9Deg	12Deg	9Deg	12Deg

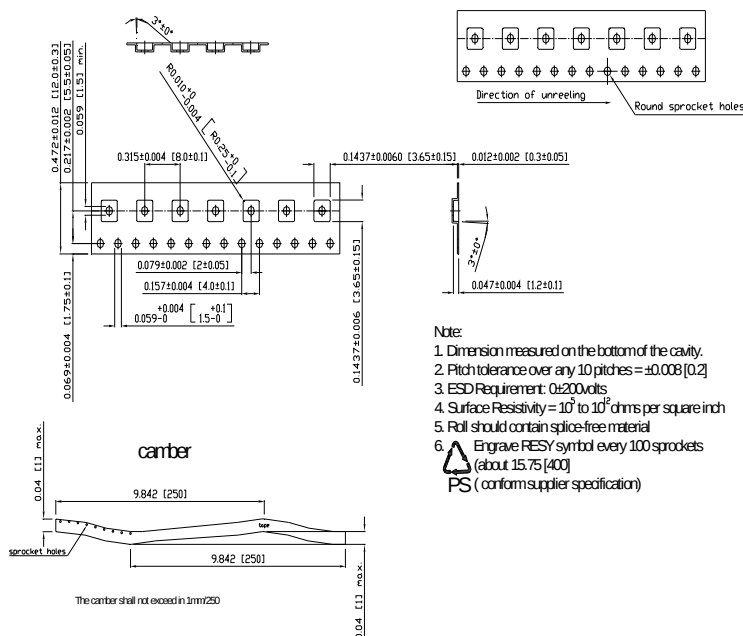
For more information on board mounting, including footprint and stencil recommendation, please refer to application note AN-1136: <http://www.irf.com/technical-info/appnotes/an-1136.pdf>

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 3.3mm x 3.3mm Outline Part Marking


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

PQFN 3.3mm x 3.3mm Outline Tape and Reel



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

Qualification Information[†]

Qualification Level	Consumer (per JEDEC JESD47F ^{††} guidelines)	
Moisture Sensitivity Level	PQFN 3.3mm x 3.3mm	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>

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

Notes:

- ① Starting $T_J = 25^{\circ}\text{C}$, $L = 0.21\text{mH}$, $R_G = 50\Omega$, $I_{AS} = 20\text{A}$.
- ② Pulse width $\leq 400\mu\text{s}$; duty cycle $\leq 2\%$.
- ③ R_{θ} is measured at T_J of approximately 90°C .
- ④ When mounted on 1 inch square PCB (FR-4). Please refer to AN-994 for more details:
<http://www.irf.com/technical-info/appnotes/an-994.pdf>
- ⑤ Calculated continuous current based on maximum allowable junction temperature.
- ⑥ Current is limited to 25A by source bonding technology.
- ⑦ Pulse drain current is limited by source bonding technology.

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