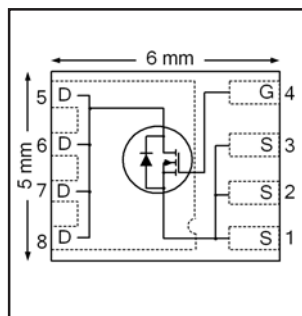


$V_{DS}$	30	V
$V_{GS\ max}$	$\pm 20$	V
$R_{DS(on)\ max}$ (@ $V_{GS} = 10V$ )	4.9	$m\Omega$
(@ $V_{GS} = 4.5V$ )	6.8	
$Q_g\ typ.$	19.4	nC
$I_D$ (@ $T_{C(Bottom)} = 25^\circ C$ )	25 ⑦	A

### HEXFET® Power MOSFET



### Applications

- Synchronous MOSFET for high frequency buck converters

### Features

Low Thermal Resistance to PCB (< 2.3°C/W)
Low Profile (<1.2mm)
Industry-Standard Pinout
Compatible with Existing Surface Mount Techniques
RoHS Compliant Containing no Lead, no Bromide and no Halogen
MSL1, Consumer Qualification

results in  
⇒

### Benefits

Enable better thermal dissipation
Increased Power Density
Multi-Vendor Compatibility
Easier Manufacturing
Environmentally Friendlier
Increased Reliability

Orderable part number	Package Type	Standard Pack		Note
		Form	Quantity	
IRFH8321TRPBF	PQFN 5mm x 6mm	Tape and Reel	4000	

### Absolute Maximum Ratings

	Parameter	Max.	Units
$V_{GS}$	Gate-to-Source Voltage	$\pm 20$	V
$I_D @ T_A = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	21	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, $V_{GS} @ 10V$	83 ⑥ ⑦	
$I_D @ T_{C(Bottom)} = 100^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	52 ⑥ ⑦	
$I_D @ T_C = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$ (Source Bonding Technology Limited)	25 ⑦	
$I_{DM}$	Pulsed Drain Current ①	332	W
$P_D @ T_A = 25^\circ C$	Power Dissipation ⑤	3.4	
$P_D @ T_{C(Bottom)} = 25^\circ C$	Power Dissipation ⑤	54	
	Linear Derating Factor ⑤	0.027	W/°C
$T_J$ $T_{STG}$	Operating Junction and Storage Temperature Range	-55 to + 150	°C

Notes ① through ⑦ are on page 9

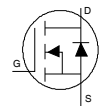
**Static @  $T_J = 25^\circ\text{C}$  (unless otherwise specified)**

	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	—	19.7	—	mV/ $^\circ\text{C}$	Reference to $25^\circ\text{C}$ , $I_D = 1.0\text{mA}$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	3.9	4.9	m $\Omega$	$V_{GS} = 10V, I_D = 20A$ ③
		—	5.4	6.8		$V_{GS} = 4.5V, I_D = 16A$ ③
$V_{GS(th)}$	Gate Threshold Voltage	1.2	1.7	2.2	V	$V_{DS} = V_{GS}, I_D = 50\mu A$
$\Delta V_{GS(th)}$	Gate Threshold Voltage Coefficient	—	-6.4	—	mV/ $^\circ\text{C}$	
$I_{DSS}$	Drain-to-Source Leakage Current	—	—	1.0	$\mu A$	$V_{DS} = 24V, V_{GS} = 0V$
		—	—	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	68	—	—	S	$V_{DS} = 10V, I_D = 20A$
$Q_g$	Total Gate Charge	—	39	59	nC	$V_{GS} = 10V, V_{DS} = 15V, I_D = 20A$
$Q_g$	Total Gate Charge	—	19.4	29.1	nC	$V_{DS} = 15V$ $V_{GS} = 4.5V$ $I_D = 20A$
$Q_{gs1}$	Pre-V <sub>th</sub> Gate-to-Source Charge	—	5.0	—		
$Q_{gs2}$	Post-V <sub>th</sub> Gate-to-Source Charge	—	1.9	—		
$Q_{gd}$	Gate-to-Drain Charge	—	6.7	—		
$Q_{godr}$	Gate Charge Overdrive	—	5.8	—		
$Q_{sw}$	Switch Charge ( $Q_{gs2} + Q_{gd}$ )	—	8.6	—	nC	$V_{DS} = 16V, V_{GS} = 0V$
$Q_{oss}$	Output Charge	—	16.7	—		
$R_G$	Gate Resistance	—	0.9	2.7	$\Omega$	
$t_{d(on)}$	Turn-On Delay Time	—	14	—	ns	$V_{DD} = 15V, V_{GS} = 4.5V$ $I_D = 20A$ $R_G = 1.8\Omega$
$t_r$	Rise Time	—	20	—		
$t_{d(off)}$	Turn-Off Delay Time	—	12	—		
$t_f$	Fall Time	—	6.8	—		
$C_{iss}$	Input Capacitance	—	2600	—	pF	$V_{GS} = 0V$ $V_{DS} = 10V$ $f = 1.0\text{MHz}$
$C_{oss}$	Output Capacitance	—	530	—		
$C_{rss}$	Reverse Transfer Capacitance	—	270	—		

**Avalanche Characteristics**

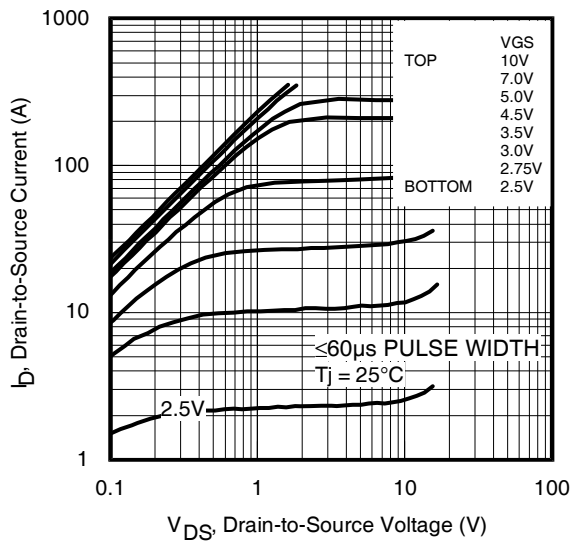
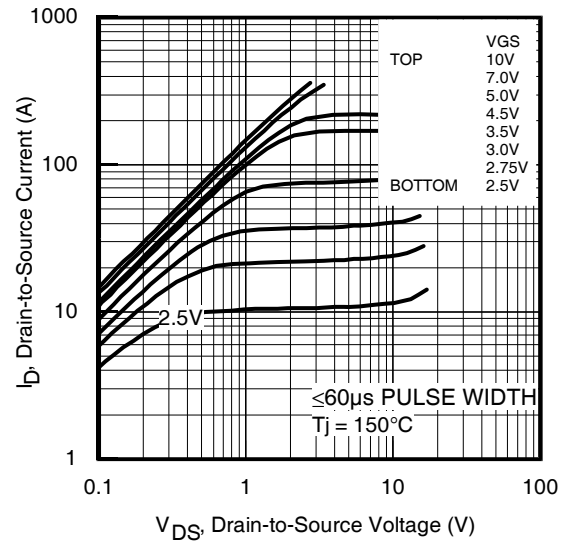
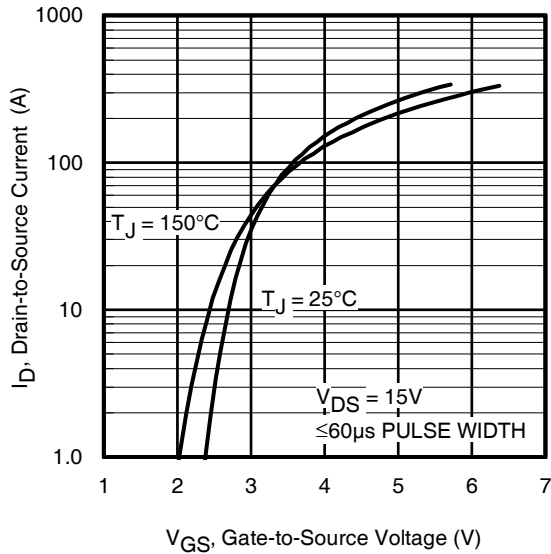
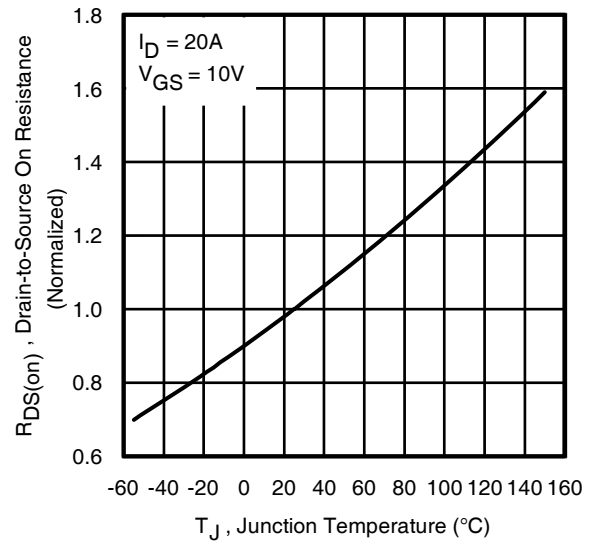
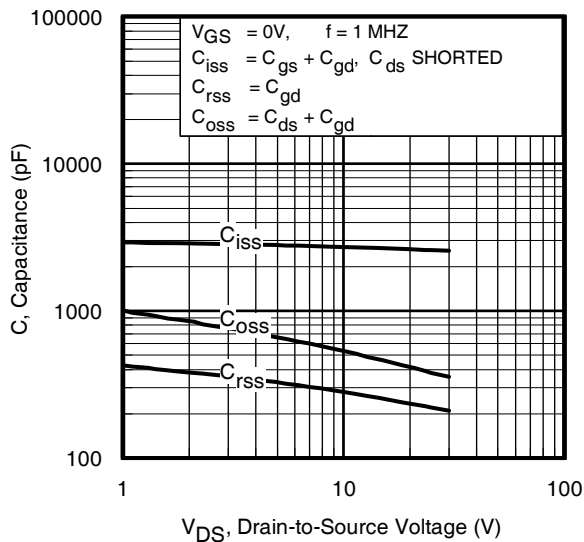
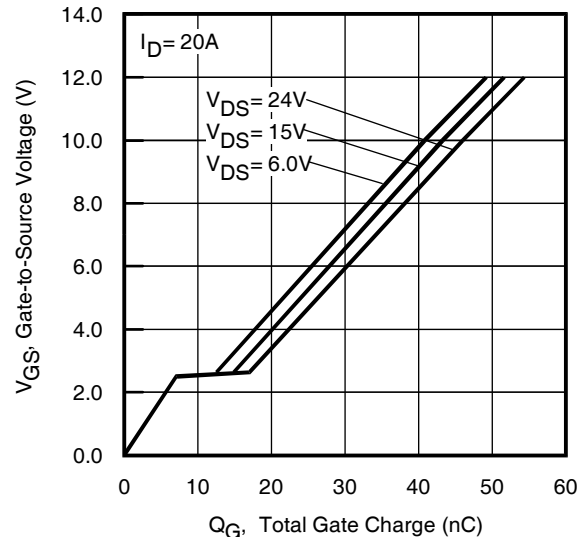
	Parameter	Typ.	Max.	Units
$E_{AS}$	Single Pulse Avalanche Energy ②	—	93	mJ
$I_{AR}$	Avalanche Current ①	—	20	A

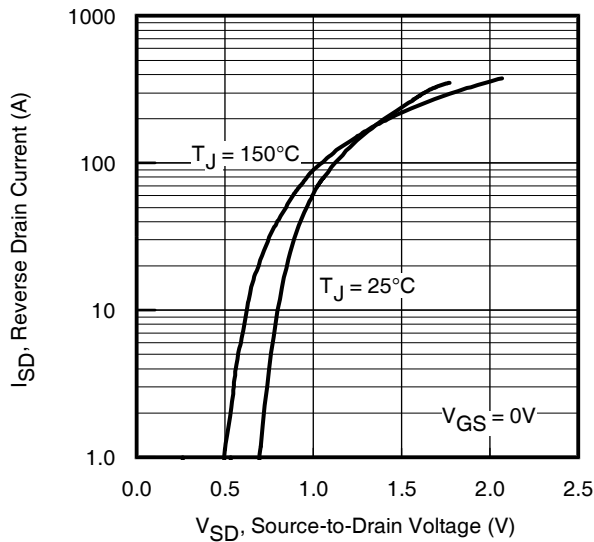
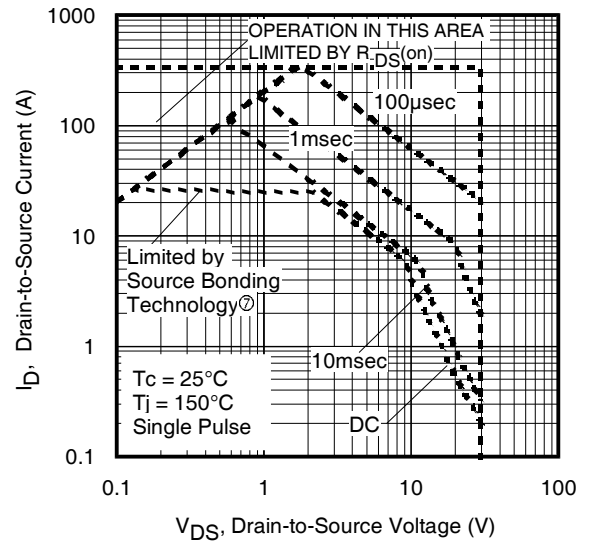
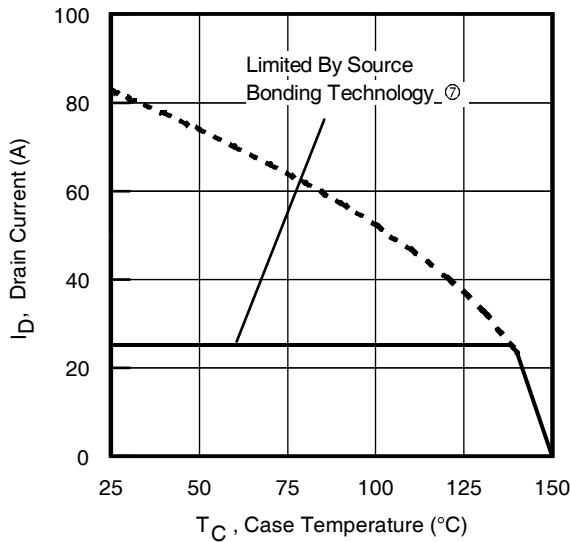
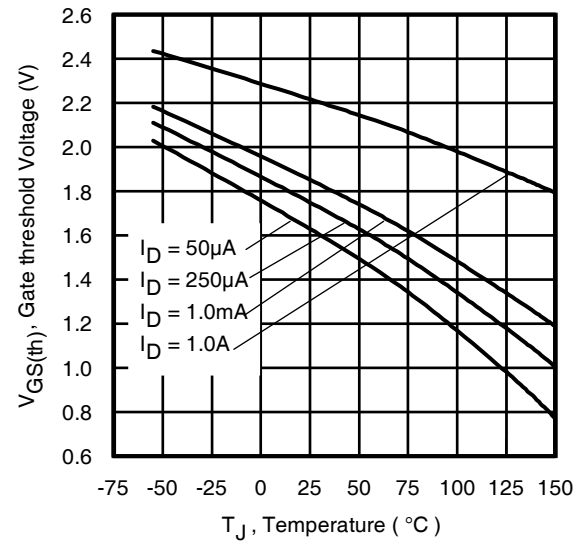
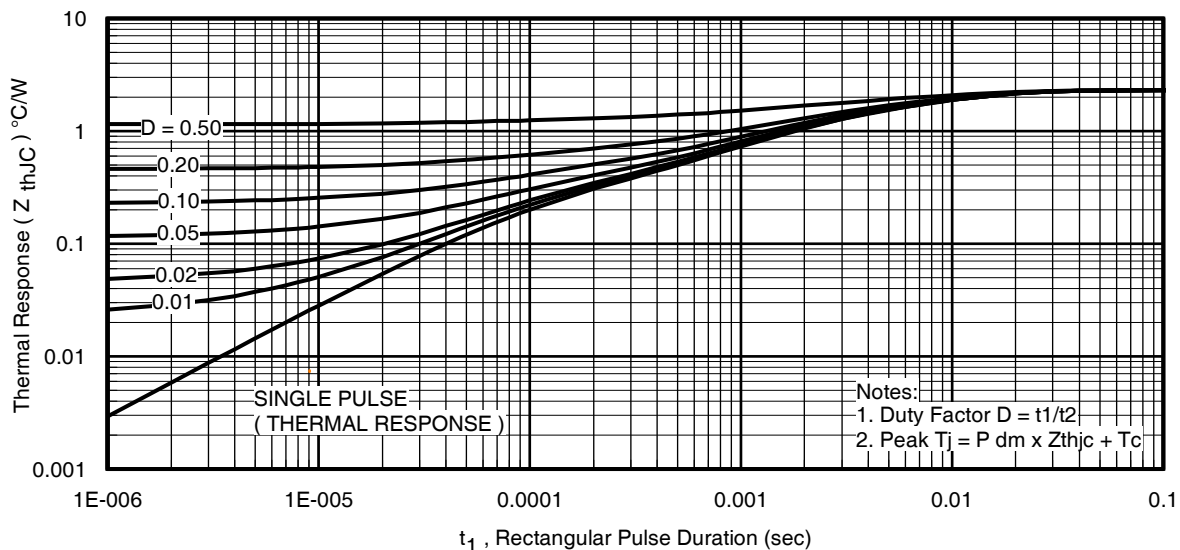
**Diode Characteristics**

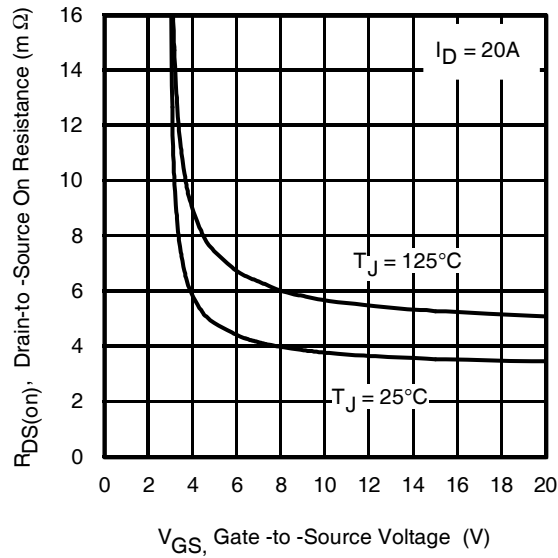
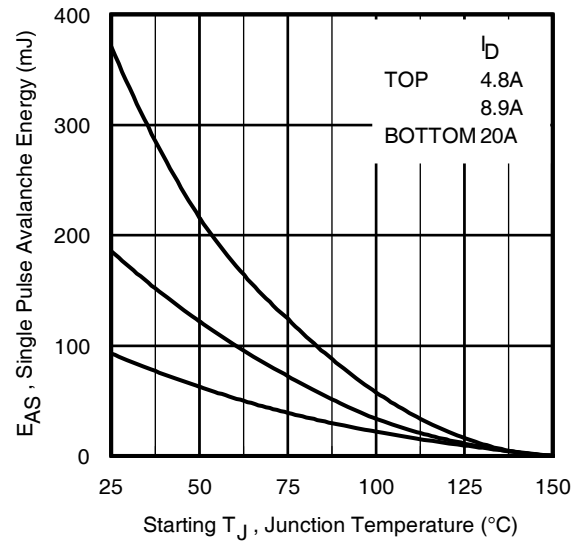
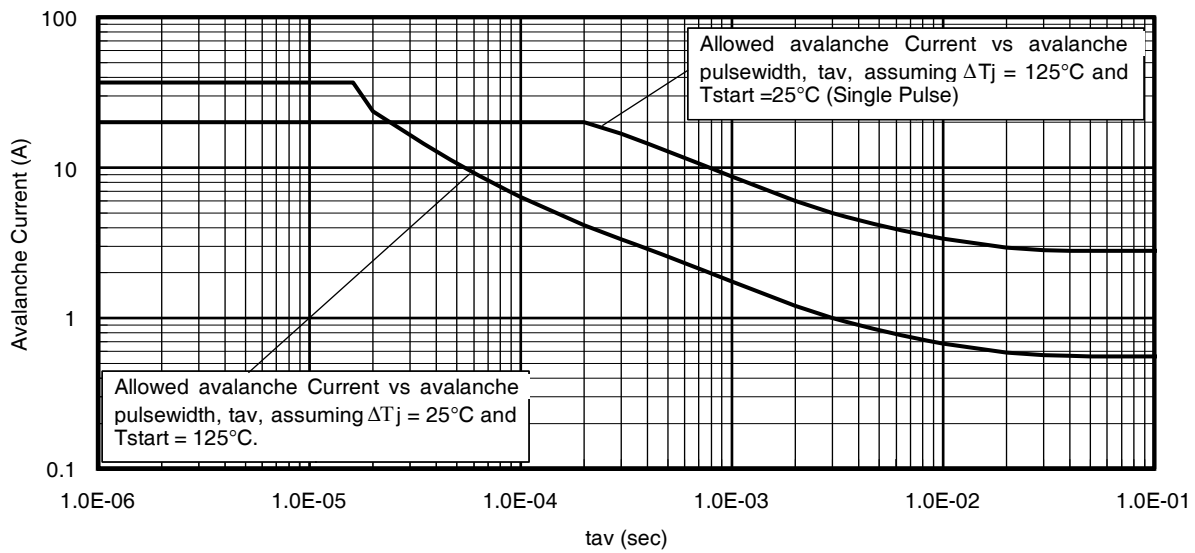
	Parameter	Min.	Typ.	Max.	Units	Conditions
I <sub>S</sub>	Continuous Source Current (Body Diode)	—	—	25⑦	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I <sub>SM</sub>	Pulsed Source Current (Body Diode) ①	—	—	332		
V <sub>SD</sub>	Diode Forward Voltage	—	—	1.0	V	T <sub>J</sub> = 25°C, I <sub>S</sub> = 20A, V <sub>GS</sub> = 0V ③
t <sub>rr</sub>	Reverse Recovery Time	—	12	18	ns	T <sub>J</sub> = 25°C, I <sub>F</sub> = 20A, V <sub>DD</sub> = 15V di/dt = 500 A/μs ③
Q <sub>rr</sub>	Reverse Recovery Charge	—	20	30	nC	
t <sub>on</sub>	Forward Turn-On Time	Time is dominated by parasitic Inductance				

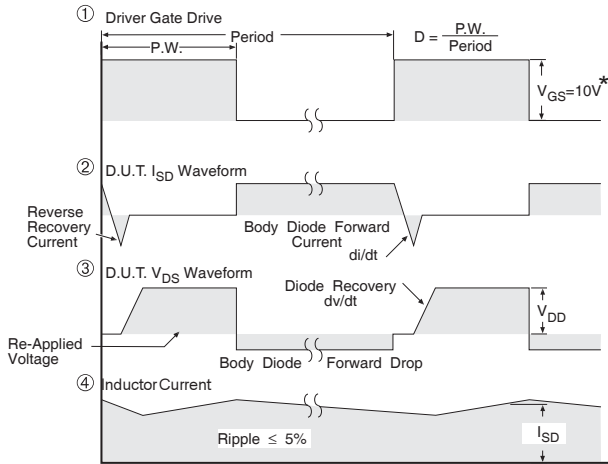
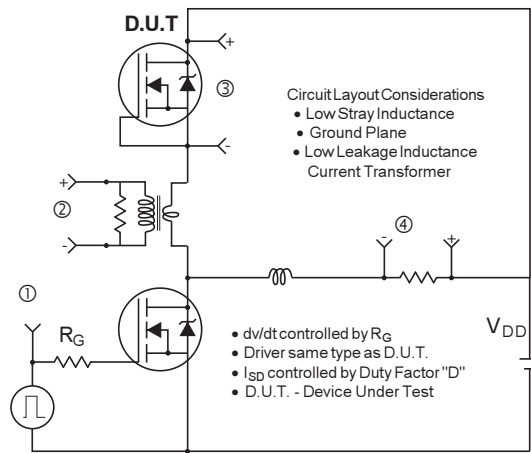
**Thermal Resistance**

	Parameter	Typ.	Max.	Units
$R_{qJC}$ (Bottom)	Junction-to-Case ④	—	2.3	$^\circ\text{C}/\text{W}$
$R_{qJC}$ (Top)	Junction-to-Case ④	—	31	
$R_{qJA}$	Junction-to-Ambient ⑤	—	37	
$R_{qJA} (<10s)$	Junction-to-Ambient ⑤	—	25	

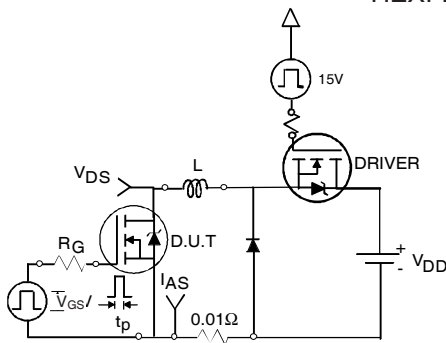

**Fig 1.** Typical Output Characteristics

**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 (Bottom) Temperature

**Fig 10.** Threshold Voltage vs. Temperature

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

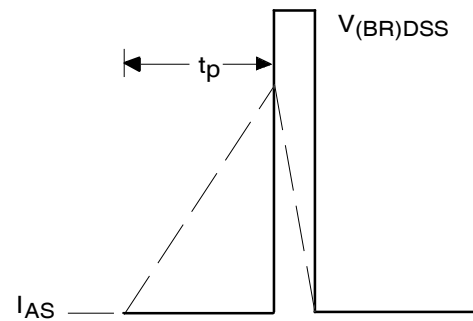

**Fig 12.** On-Resistance vs. Gate Voltage

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

**Fig 14.** Typical Avalanche Current vs. Pulsewidth



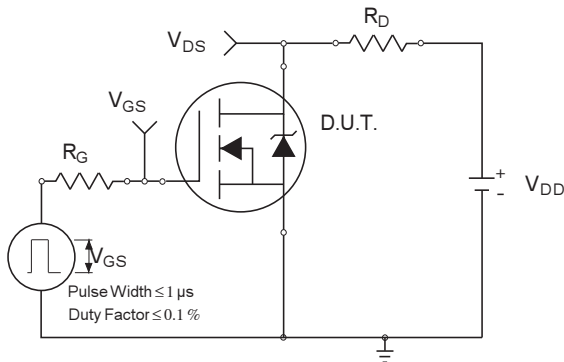
**Fig 15. Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs**



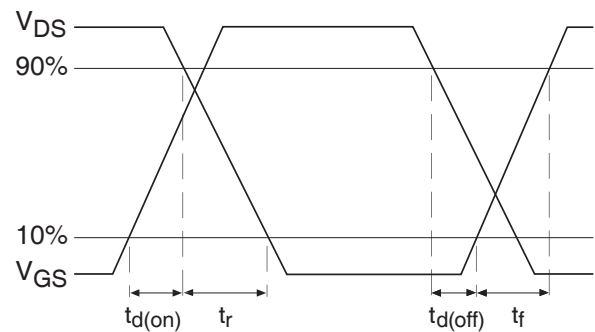
**Fig 16a. Unclamped Inductive Test Circuit**



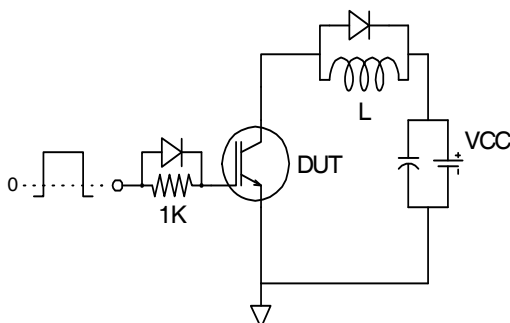
**Fig 16b. Unclamped Inductive Waveforms**



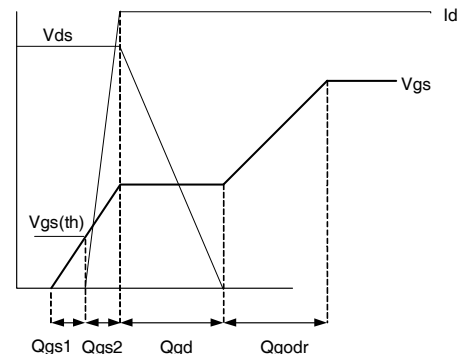
**Fig 17a. Switching Time Test Circuit**



**Fig 17b. Switching Time Waveforms**

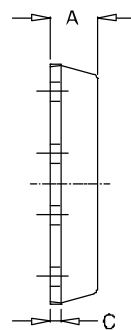


**Fig 18a. Gate Charge Test Circuit**

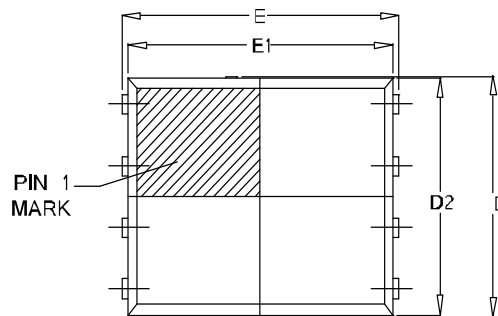


**Fig 18b. Gate Charge Waveform**

## PQFN 5x6 Outline "E" Package Details

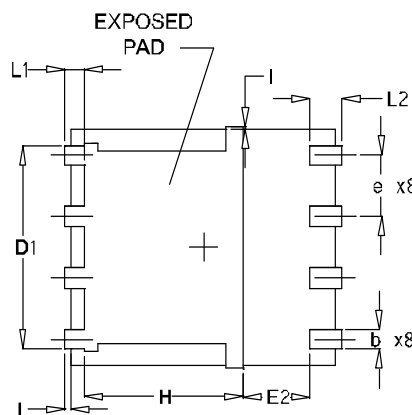


SIDEVIEW



TOP VIEW

SYMBOL	OUTLINE PQFN 5X6E		
	MIN.	NOM	MAX.
A	0.90	1.03	1.17
b	0.33	0.41	0.48
C	0.20	0.25	0.35
D	4.80	4.98	5.15
D1	3.91	4.11	4.31
D2	4.80	4.90	5.00
E	5.90	6.02	6.15
E1	5.65	5.75	5.85
E2	1.10	—	—
e	1.27 BSC		
L	0.05	0.15	0.25
L1	0.38	0.44	0.50
L2	0.51	0.68	0.86
H	3.32	3.45	3.58
I	—	—	0.18



BOTTOM VIEW

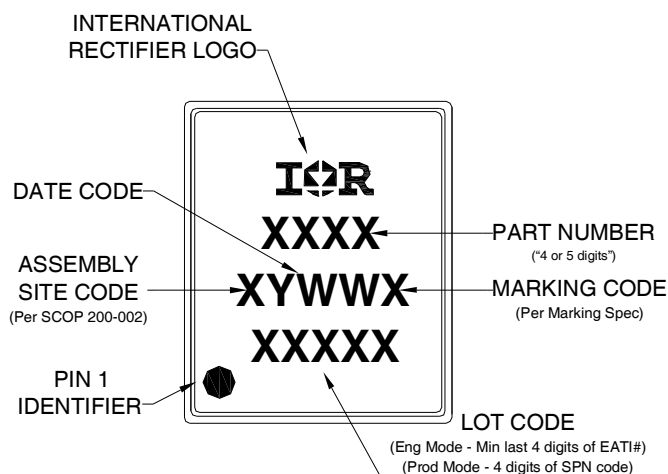
For footprint and stencil design recommendations, please refer to application note:

[AN-1136](#)

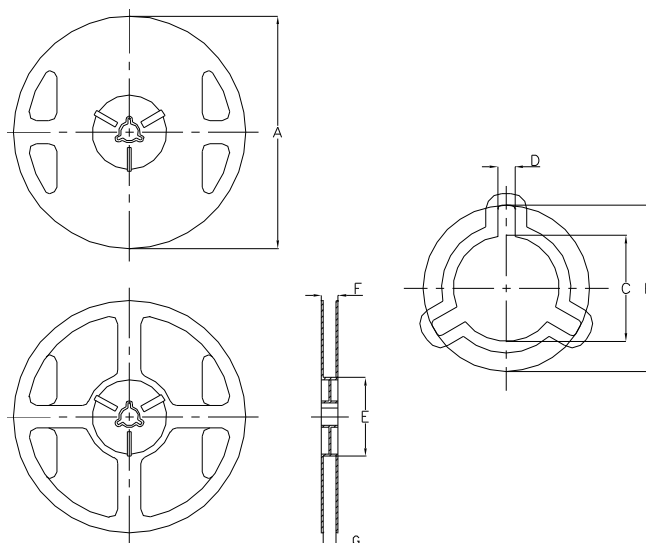
For PQFN inspection techniques, please refer to application note:

[AN-1154](#)

## PQFN 5x6 Outline "E" Part Marking

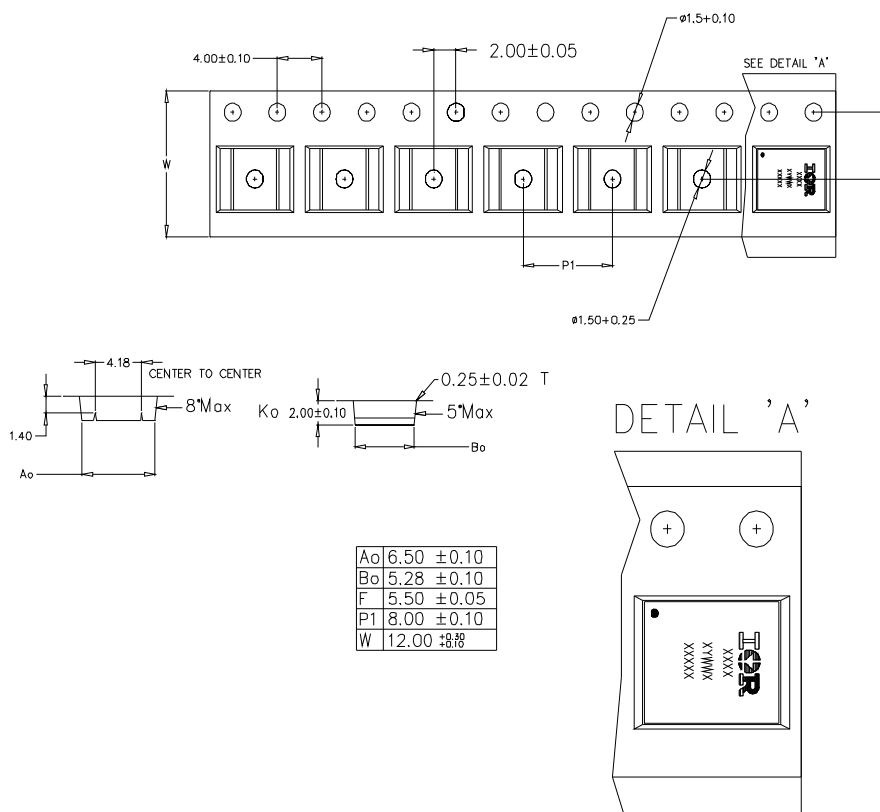

Note: For the most current drawing please refer to IR website at: <http://www.irf.com/package/>

# PQFN 5x6 Outline "E" Tape and Reel



NOTE: Controlling dimensions in mm Std reel quantity is 4000 parts.

REEL DIMENSIONS								
STANDARD OPTION (QTY 4000)					TR1 OPTION (QTY 400)			
	METRIC		IMPERIAL		METRIC		IMPERIAL	
CODE	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
A	329.5	330.5	12.972	13.011	177.5	178.5	6.988	7.028
B	20.9	21.5	0.823	0.846	20.9	21.5	0.823	0.846
C	12.8	13.5	0.504	0.532	13.2	13.8	0.520	0.543
D	1.7	2.3	0.067	0.091	1.9	2.3	0.075	0.091
E	97	99	3.819	3.898	65	66	2.350	2.598
F	Ref	17.4			Ref	12		
G	13	14.5	0.512	0.571	13	14.5	0.512	0.571





**Qualification information<sup>†</sup>**

Qualification level	Consumer <sup>††</sup> (per JEDEC JES D47F <sup>†††</sup> guidelines)	
Moisture Sensitivity Level	PQFN 5mm x 6mm	MSL1 (per JEDEC J-STD-020D <sup>†††</sup> )
RoHS compliant	Yes	

<sup>†</sup> Qualification standards can be found at International Rectifier's web site

<http://www.irf.com/product-info/reliability>

<sup>††</sup> 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/>

<sup>†††</sup> Applicable version of JEDEC standard at the time of product release.

**Notes:**

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Starting  $T_J = 25^{\circ}\text{C}$ ,  $L = 0.46\text{mH}$ ,  $R_G = 50\Omega$ ,  $I_{AS} = 20\text{A}$ .
- 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 Calculated continuous current based on maximum allowable junction temperature.
- ⑦ Current is limited to 25A by Source Bonding Technology.

Data and specifications subject to change without notice.

International  
 Rectifier

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