

# IRFH5053PbF

## Applications

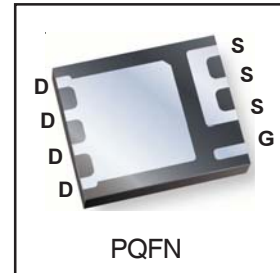
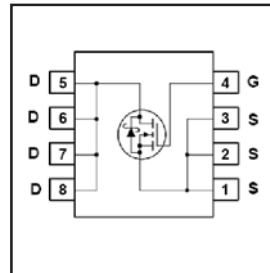
- 3 Phase Boost Converter Applications
- Secondary Side Synchronous Rectification

HEXFET® Power MOSFET

$V_{DS}$	$R_{DS(on)}$ max	Qg
100V	18mΩ @ $V_{GS} = 10V$	24nC

## Benefits

- Very low  $R_{DS(ON)}$  at 10V  $V_{GS}$
- Low Gate Charge
- Fully Characterized Avalanche Voltage and Current
- 100% Tested for  $R_G$
- Lead-Free (Qualified up to 260°C Reflow)
- RoHS compliant (Halogen Free)
- Low Thermal Resistance
- Large Source Lead for more reliable Soldering



## Absolute Maximum Ratings

	Parameter	Max.	Units
$V_{DS}$	Drain-to-Source Voltage	100	V
$V_{GS}$	Gate-to-Source Voltage	± 20	
$I_D @ T_A = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	9.3	A
$I_D @ T_A = 70^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	7.4	
$I_D @ T_C = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	46	
$I_{DM}$	Pulsed Drain Current ①	75	
$P_D @ T_A = 25^\circ C$	Power Dissipation ⑤	3.1	W
$P_D @ T_A = 70^\circ C$	Power Dissipation ⑤	2.0	
	Linear Derating Factor ⑤	0.025	W/°C
$T_J$	Operating Junction and	-55 to + 150	°C
$T_{STG}$	Storage Temperature Range		

## Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case ④	—	1.6	°C/W
$R_{\theta JA}$	Junction-to-Ambient ⑤	—	40	

Notes ① through ⑤ are on page 9

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International  
**IR** Rectifier

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

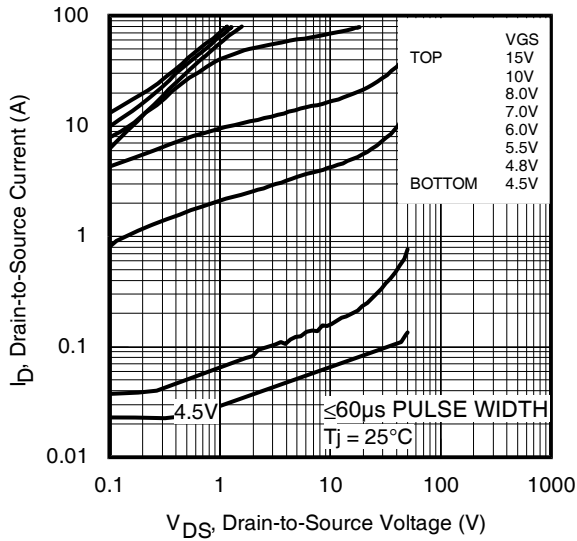
	Parameter	Min.	Typ.	Max.	Units	Conditions
$BV_{DSS}$	Drain-to-Source Breakdown Voltage	100	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.11	—	V/°C	Reference to $25^\circ\text{C}, I_D = 1mA$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	14.4	18	mΩ	$V_{GS} = 10V, I_D = 9.3A$ ③
$V_{GS(th)}$	Gate Threshold Voltage	3.0	3.7	4.9	V	$V_{DS} = V_{GS}, I_D = 100\mu A$
$\Delta V_{GS(th)}$	Gate Threshold Voltage Coefficient	—	-11	—	mV/°C	
$I_{DSS}$	Drain-to-Source Leakage Current	—	—	20	μA	$V_{DS} = 80V, V_{GS} = 0V$
		—	—	250		$V_{DS} = 80V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
$I_{GSS}$	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS} = 20V$
	Gate-to-Source Reverse Leakage	—	—	-100		$V_{GS} = -20V$
$g_{fs}$	Forward Transconductance	19	—	—	S	$V_{DS} = 50V, I_D = 7.4A$
$Q_g$	Total Gate Charge	—	24	36	nC	$V_{DS} = 50V$ $V_{GS} = 10V$ $I_D = 7.4A$ See Fig.17 & 18
$Q_{gs1}$	Pre-Vth Gate-to-Source Charge	—	5.2	—		
$Q_{gs2}$	Post-Vth Gate-to-Source Charge	—	1.5	—		
$Q_{gd}$	Gate-to-Drain Charge	—	8.6	—		
$Q_{godr}$	Gate Charge Overdrive	—	8.7	—		
$Q_{sw}$	Switch Charge ( $Q_{gs2} + Q_{gd}$ )	—	10.1	—		
$Q_{oss}$	Output Charge	—	12	—	nC	$V_{DS} = 16V, V_{GS} = 0V$
$R_G$	Gate Resistance	—	0.8	—	Ω	
$t_{d(on)}$	Turn-On Delay Time	—	12	—	ns	$V_{DD} = 50V, V_{GS} = 10V$ $I_D = 7.4A$ $R_G = 1.8\Omega$ See Fig.15
$t_r$	Rise Time	—	7.5	—		
$t_{d(off)}$	Turn-Off Delay Time	—	18	—		
$t_f$	Fall Time	—	4.1	—		
$C_{iss}$	Input Capacitance	—	1510	—	pF	$V_{GS} = 0V$ $V_{DS} = 50V$ $f = 1.0MHz$
$C_{oss}$	Output Capacitance	—	230	—		
$C_{riss}$	Reverse Transfer Capacitance	—	59	—		

## Avalanche Characteristics

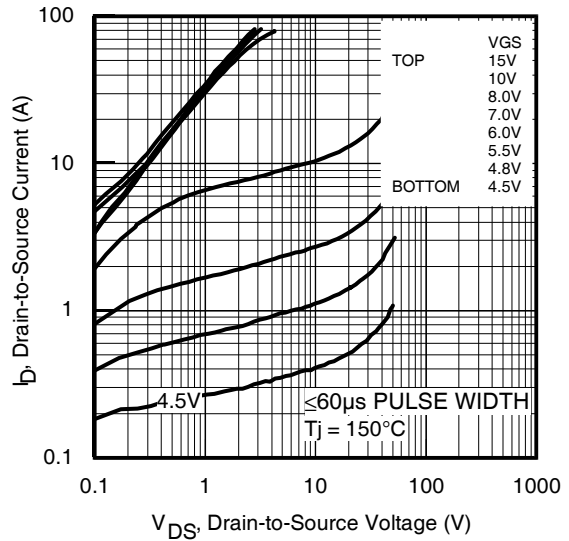
	Parameter	Typ.	Max.	Units
$E_{AS}$	Single Pulse Avalanche Energy ②	—	21	mJ
$I_{AR}$	Avalanche Current ①	—	7.4	A

## Diode Characteristics

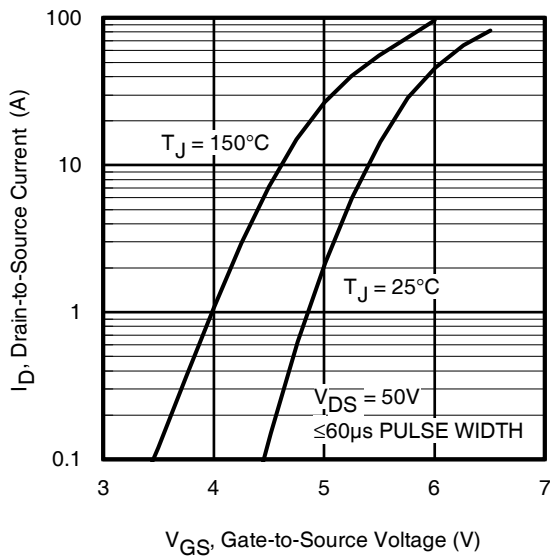
	Parameter	Min.	Typ.	Max.	Units	Conditions
$I_S$	Continuous Source Current (Body Diode)	—	—	2.8	A	MOSFET symbol showing the integral reverse p-n junction diode.
$I_{SM}$	Pulsed Source Current (Body Diode) ①	—	—	75		
$V_{SD}$	Diode Forward Voltage	—	—	1.3	V	$T_J = 25^\circ\text{C}, I_S = 7.4A, V_{GS} = 0V$ ③
$t_{rr}$	Reverse Recovery Time	—	31	47	ns	$T_J = 25^\circ\text{C}, I_F = 7.4A, V_{DD} = 50V$
$Q_{rr}$	Reverse Recovery Charge	—	210	320	nC	$di/dt = 800A/\mu s$ ③ See Fig.16
$t_{on}$	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				



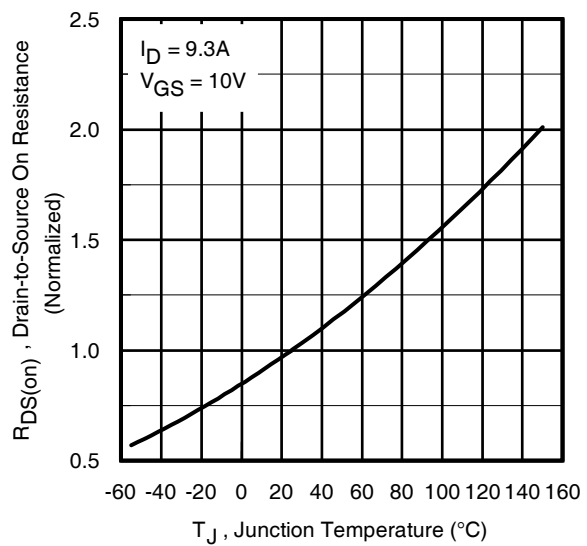
**Fig 1.** Typical Output Characteristics



**Fig 2.** Typical Output Characteristics

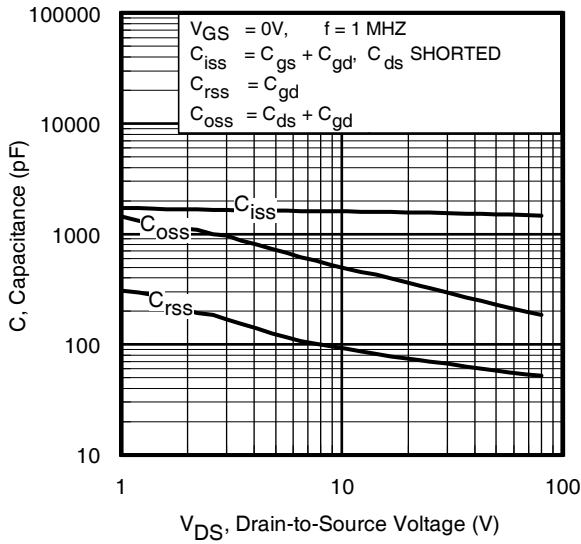


**Fig 3.** Typical Transfer Characteristics

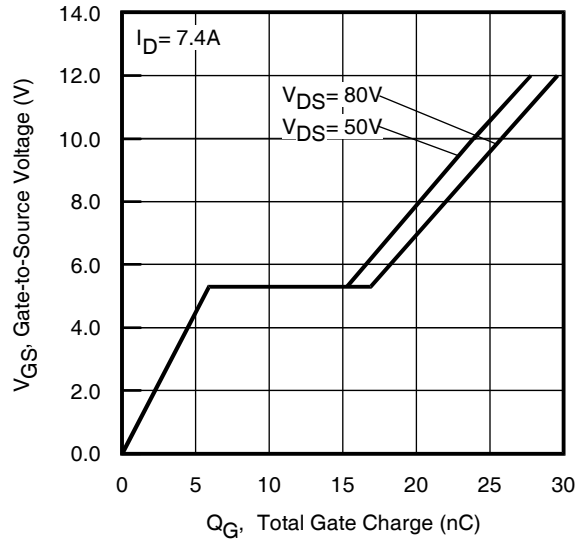


**Fig 4.** Normalized On-Resistance vs. Temperature

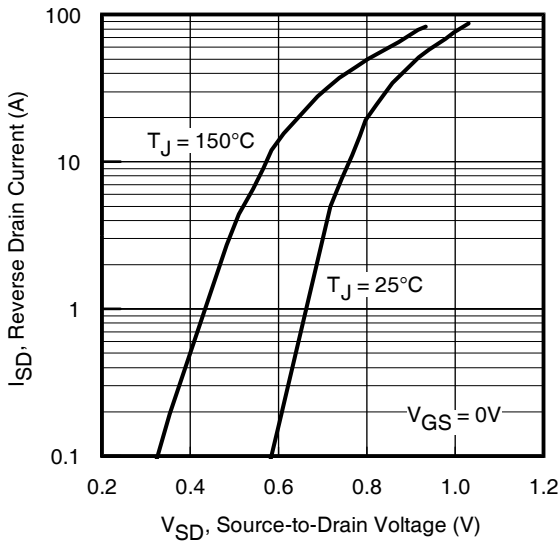
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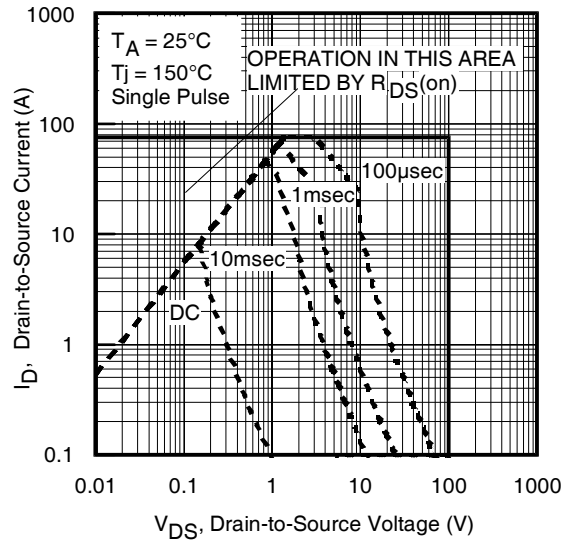
**Fig 5.** Typical Capacitance vs. Drain-to-Source Voltage



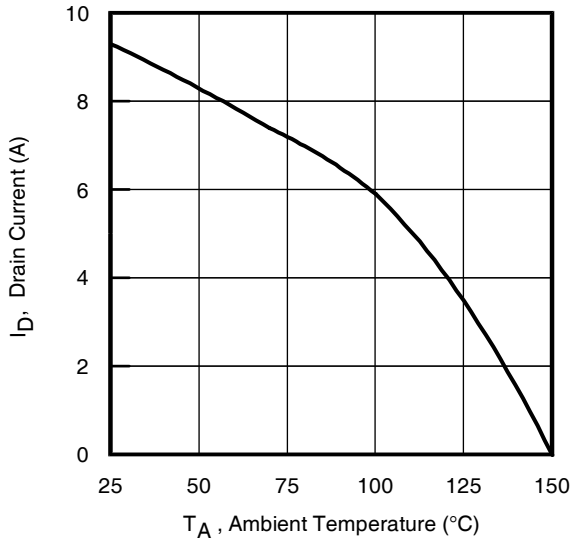
**Fig 6.** Typical Gate Charge vs. Gate-to-Source Voltage



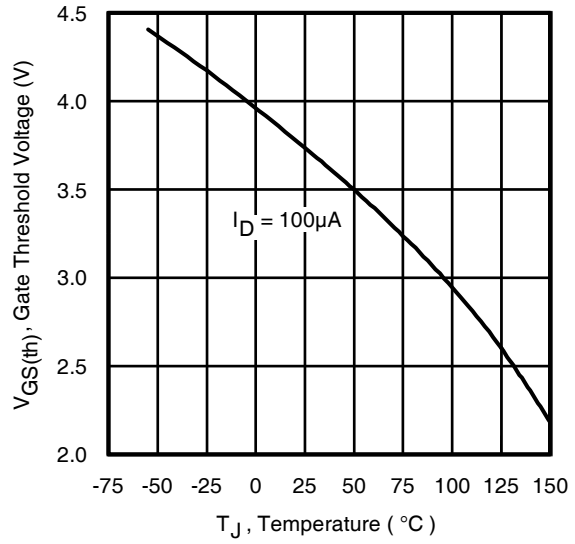
**Fig 7.** Typical Source-Drain Diode Forward Voltage



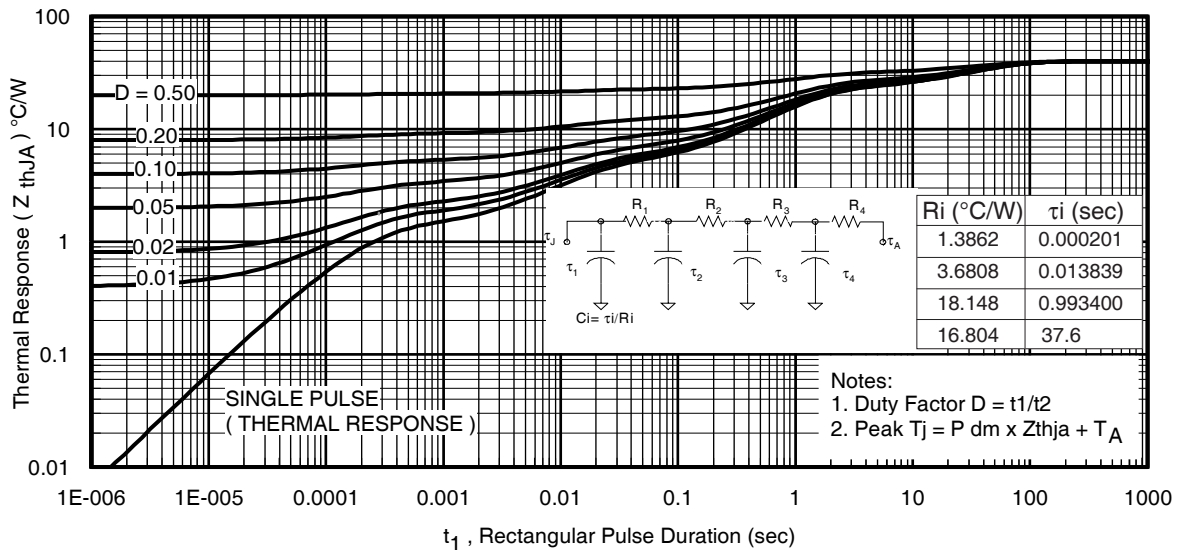
**Fig 8.** Maximum Safe Operating Area



**Fig 9.** Maximum Drain Current vs. Ambient Temperature



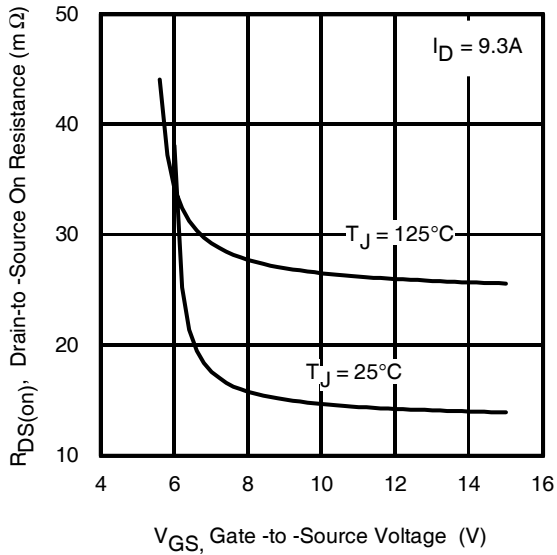
**Fig 10.** Threshold Voltage vs. Temperature



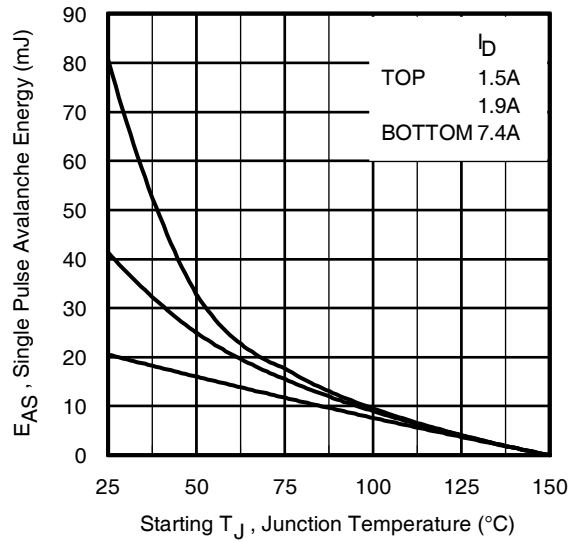
**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

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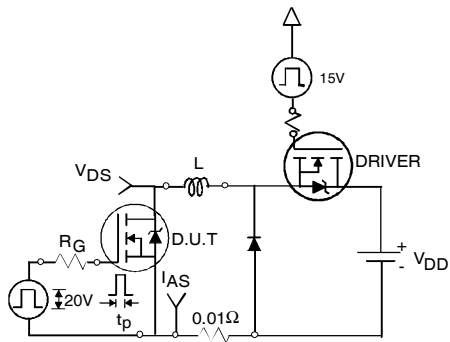
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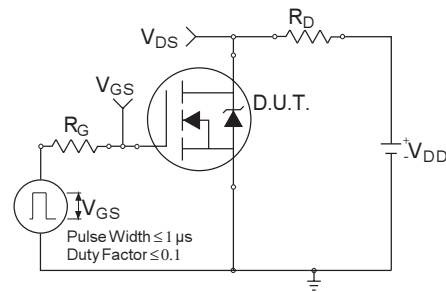
**Fig 12.** On-Resistance vs. Gate Voltage



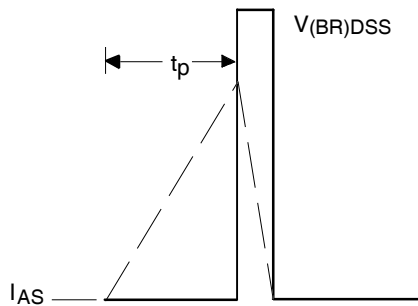
**Fig 13.** Maximum Avalanche Energy vs. Drain Current



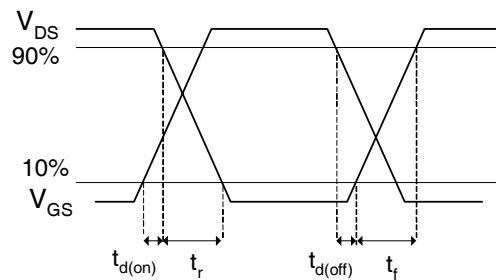
**Fig 14a.** Unclamped Inductive Test Circuit



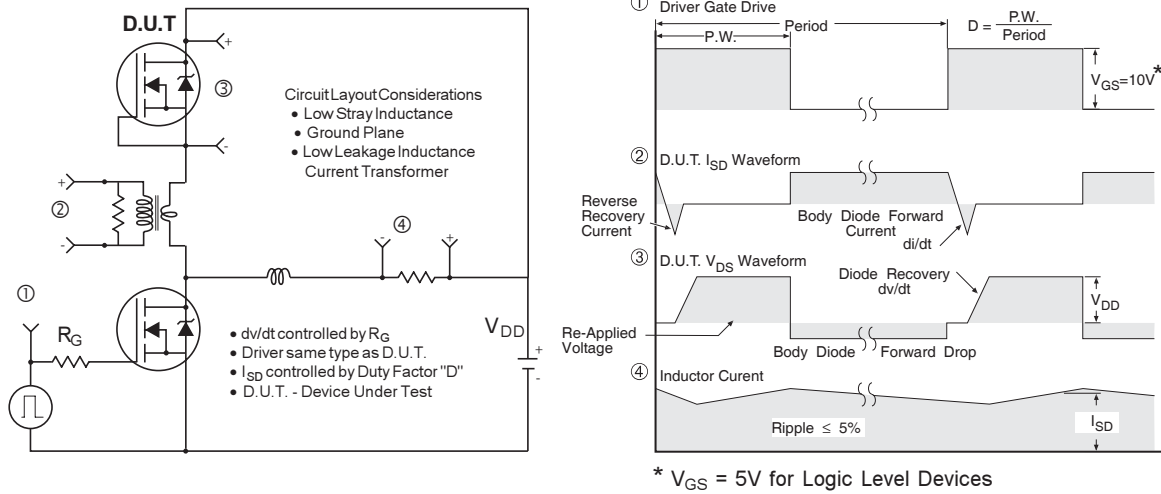
**Fig 15a.** Switching Time Test Circuit



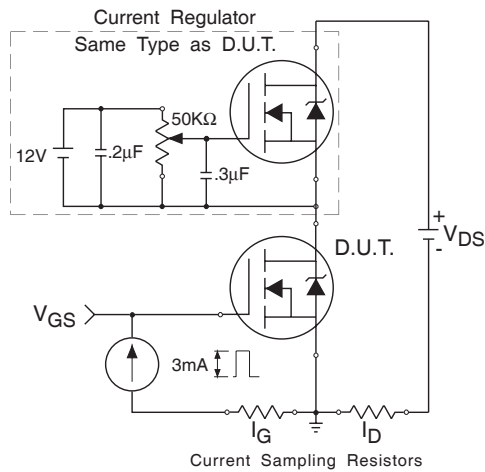
**Fig 14b.** Unclamped Inductive Waveforms



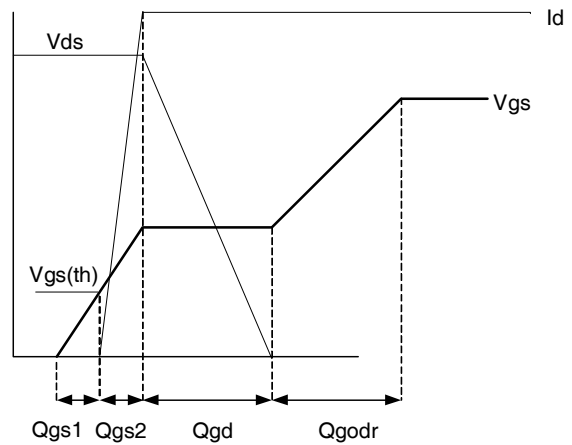
**Fig 15b.** Switching Time Waveforms



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



**Fig 17. Gate Charge Test Circuit**

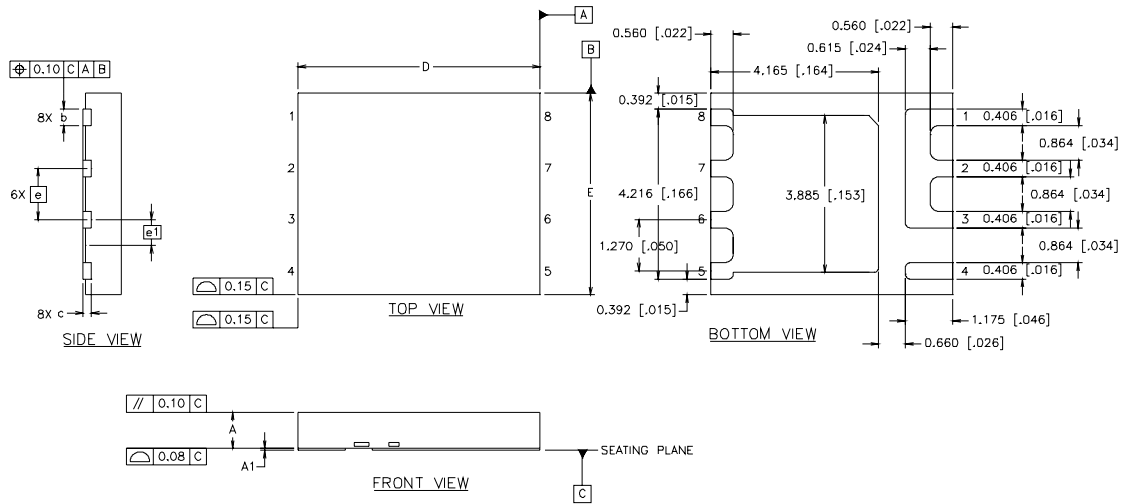


**Fig 18. Gate Charge Waveform**

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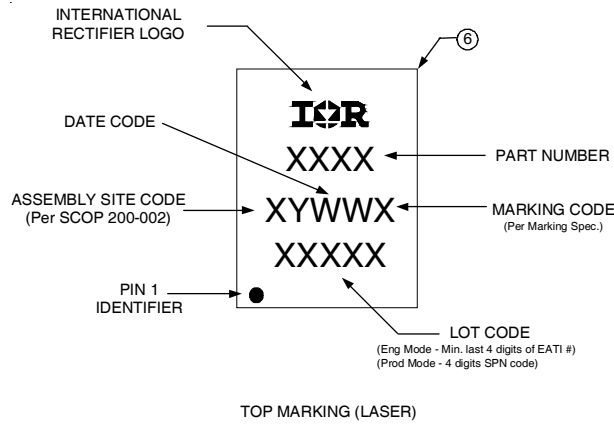
## PQFN Package Details

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DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.0315	.0394	0.800	1.000
A1	.0000	.0020	0.000	0.050
b	.0140	.0180	0.356	0.456
c	.0080 REF.		0.203 REF.	
D	.2362 BASIC		6.0 BASIC	
E	.1969 BASIC		5.0 BASIC	
e	.0500 BASIC		1.270 BASIC	
e1	.0250 BASIC		0.635 BASIC	

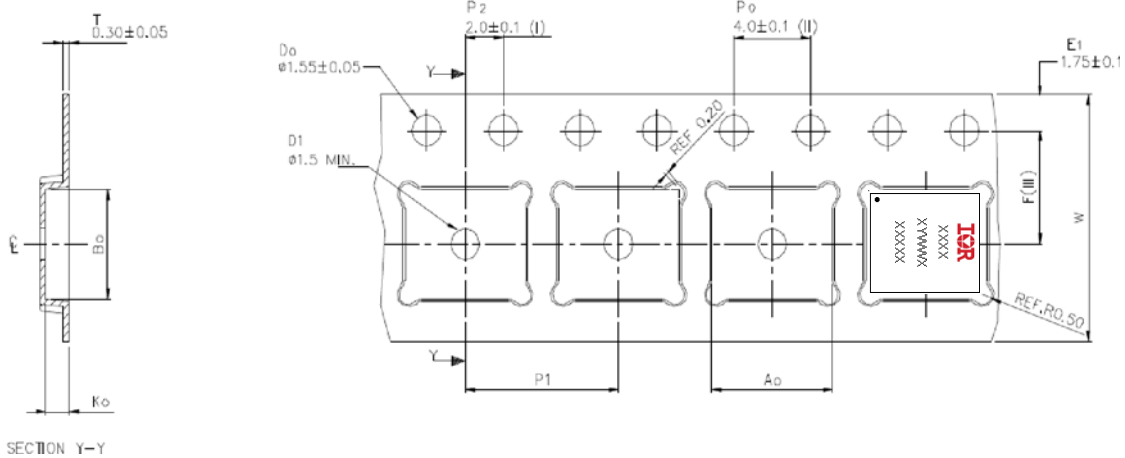
## PQFN Part Marking



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



## PQFN Tape and Reel



A <sub>0</sub>	6.30 +/− 0.1
B <sub>0</sub>	5.30 +/− 0.1
K <sub>0</sub>	1.20 +/− 0.1
F	5.50 +/− 0.1
P <sub>1</sub>	8.00 +/− 0.1
W	12.00 +/− 0.3

- (I) Measured from centreline of sprocket hole to centreline of pocket.
- (II) Cumulative tolerance of 10 sprocket holes is ± 0.20 .
- (III) Measured from centreline of sprocket hole to centreline of pocket.
- (IV) Other material available.
- (V) Typical SR of form tape Max 10<sup>9</sup> OHM/SQ

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED

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

### Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Starting T<sub>J</sub> = 25°C, L = 0.75mH, R<sub>G</sub> = 25Ω, I<sub>AS</sub> = 7.4A.
- ③ Pulse width ≤ 400μs; duty cycle ≤ 2%.
- ④ R<sub>thjc</sub> is guaranteed by design
- ⑤ When mounted on 1 inch square 2 oz copper pad on 1.5x1.5 in. board of FR-4 material.

Data and specifications subject to change without notice.  
 This product has been designed and qualified for the Consumer market.  
 Qualification Standards can be found on IR's Web site.

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**IR** Rectifier

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