

# Preliminary IRFH7928PbF

HEXFET® Power MOSFET

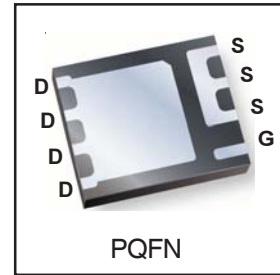
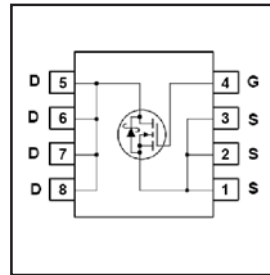
## Applications

- Synchronous MOSFET for Notebook Processor Power
- Synchronous Rectifier MOSFET for Isolated DC-DC Converters in Networking Systems

$V_{DS}$	$R_{DS(on)}$ max	Qg
30V	2.9mΩ @ $V_{GS} = 10V$	40nC

## Benefits

- Very low  $R_{DS(ON)}$  at 4.5V  $V_{GS}$
- 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	30	V
$V_{GS}$	Gate-to-Source Voltage	± 20	
$I_D @ T_A = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	26	A
$I_D @ T_A = 70^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	21	
$I_D @ T_C = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	124	
$I_{DM}$	Pulsed Drain Current ①	208	
$P_D @ T_A = 25^\circ C$	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	—	1.8	°C/W
$R_{\theta JA}$	Junction-to-Ambient ⑤	—	40	

### ORDERING INFORMATION:

See detailed ordering and shipping information on the last page of this data sheet.

Notes ① through ⑤ are on page 10

www.irf.com

# IRFH7928PbF

PRELIMINARY

International  
IR Rectifier

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

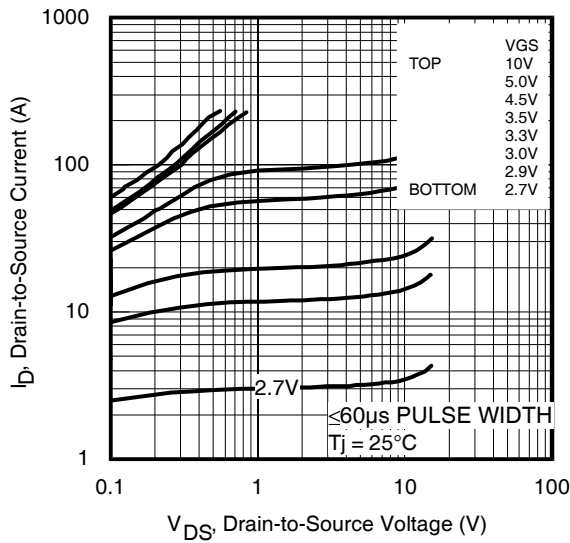
	Parameter	Min.	Typ.	Max.	Units	Conditions
$BV_{DSS}$	Drain-to-Source Breakdown Voltage	30	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.02	—	V/ $^\circ\text{C}$	Reference to $25^\circ\text{C}, I_D = 1\text{mA}$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	2.4	2.9	m $\Omega$	$V_{GS} = 10V, I_D = 26A$ ③
		—	3.0	3.8		$V_{GS} = 4.5V, I_D = 21A$ ③
$V_{GS(th)}$	Gate Threshold Voltage	1.35	1.8	2.35	V	$V_{DS} = V_{GS}, I_D = 100\mu A$
$\Delta V_{GS(th)}$	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	110	—	—	S	$V_{DS} = 15V, I_D = 21A$
$Q_g$	Total Gate Charge	—	40	60	nC	$V_{DS} = 15V$ $V_{GS} = 4.5V$ $I_D = 21A$ See Fig.17 & 18
$Q_{gs1}$	Pre-V <sub>th</sub> Gate-to-Source Charge	—	10.2	—		
$Q_{gs2}$	Post-V <sub>th</sub> Gate-to-Source Charge	—	4.7	—		
$Q_{gd}$	Gate-to-Drain Charge	—	13.5	—		
$Q_{godr}$	Gate Charge Overdrive	—	11.8	—		
$Q_{sw}$	Switch Charge ( $Q_{gs2} + Q_{gd}$ )	—	18.2	—		
$Q_{oss}$	Output Charge	—	22.5	—	nC	$V_{DS} = 16V, V_{GS} = 0V$
$R_G$	Gate Resistance	—	0.57	0.7	$\Omega$	
$t_{d(on)}$	Turn-On Delay Time	—	22.2	—	ns	$V_{DD} = 15V, V_{GS} = 4.5V$ $I_D = 21A$ $R_G = 1.8\Omega$ See Fig.15
$t_r$	Rise Time	—	31.5	—		
$t_{d(off)}$	Turn-Off Delay Time	—	22.3	—		
$t_f$	Fall Time	—	14.2	—		
$C_{iss}$	Input Capacitance	—	5657	—	pF	$V_{GS} = 0V$ $V_{DS} = 15V$ $f = 1.0\text{MHz}$
$C_{oss}$	Output Capacitance	—	1005	—		
$C_{riss}$	Reverse Transfer Capacitance	—	520	—		

## Avalanche Characteristics

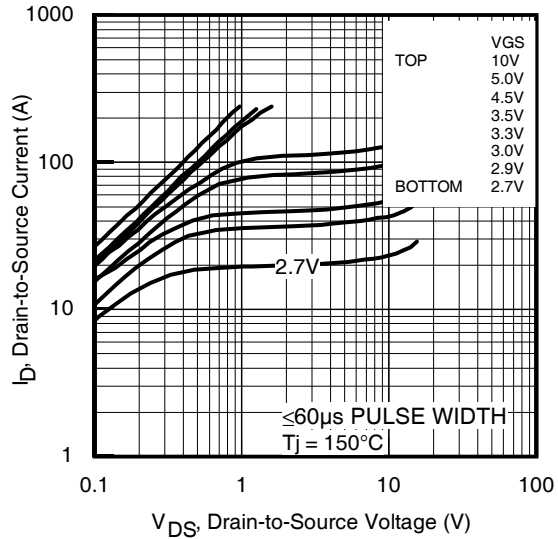
	Parameter	Typ.	Max.	Units
$E_{AS}$	Single Pulse Avalanche Energy ②	—	168	mJ
$I_{AR}$	Avalanche Current ①	—	21	A

## Diode Characteristics

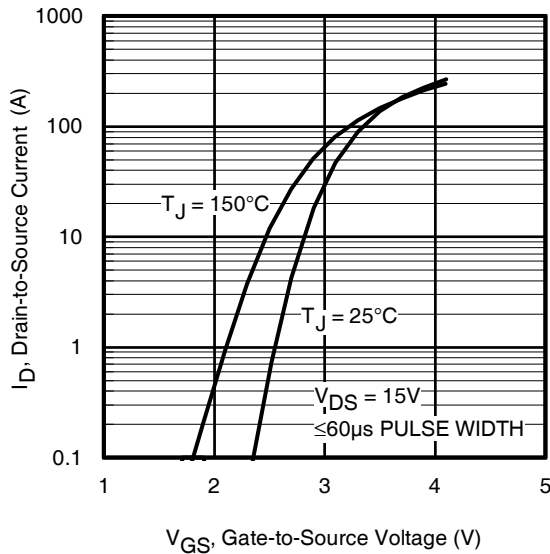
	Parameter	Min.	Typ.	Max.	Units	Conditions
$I_S$	Continuous Source Current (Body Diode)	—	—	3.9	A	MOSFET symbol showing the integral reverse p-n junction diode.
$I_{SM}$	Pulsed Source Current (Body Diode) ①	—	—	208		
$V_{SD}$	Diode Forward Voltage	—	—	1.0	V	$T_J = 25^\circ\text{C}, I_S = 21A, V_{GS} = 0V$ ③
$t_{rr}$	Reverse Recovery Time	—	26	40	ns	$T_J = 25^\circ\text{C}, I_F = 21A, V_{DD} = 15V$
$Q_{rr}$	Reverse Recovery Charge	—	31	47	nC	$di/dt = 200A/\mu s$ ③
$t_{on}$	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				



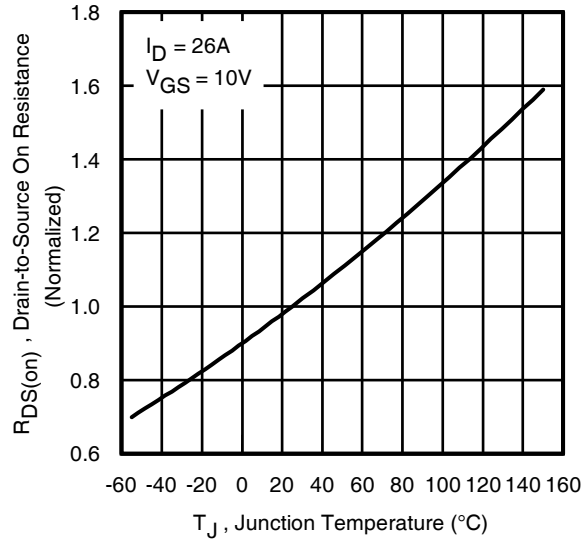
**Fig 1.** Typical Output Characteristics



**Fig 2.** Typical Output Characteristics



**Fig 3.** Typical Transfer Characteristics



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

# IRFH7928PbF

PRELIMINARY

International  
IR Rectifier

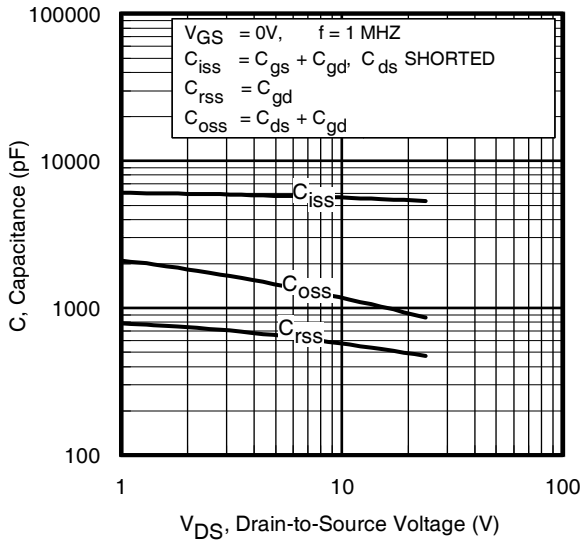


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

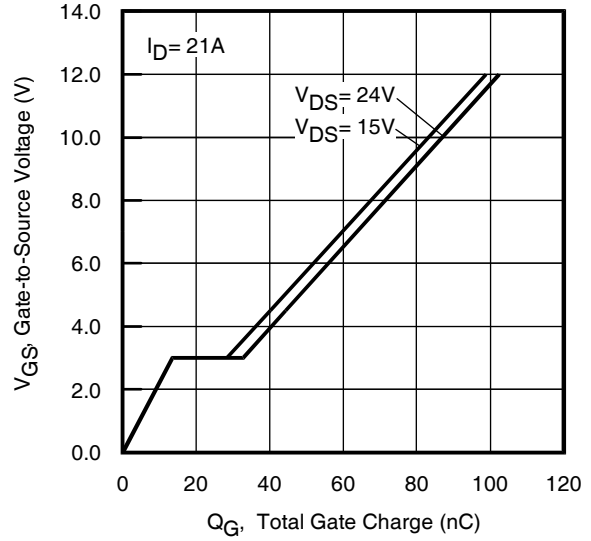


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

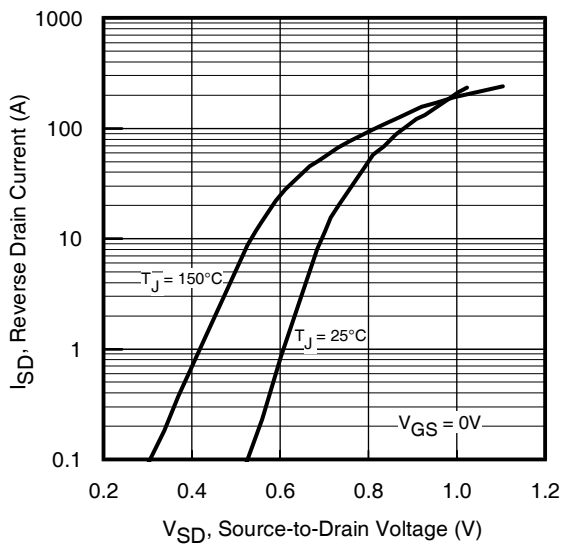


Fig 7. Typical Source-Drain Diode Forward Voltage

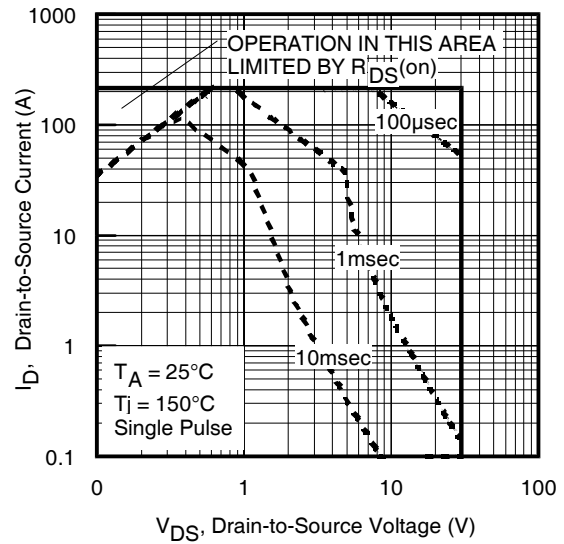


Fig 8. Maximum Safe Operating Area

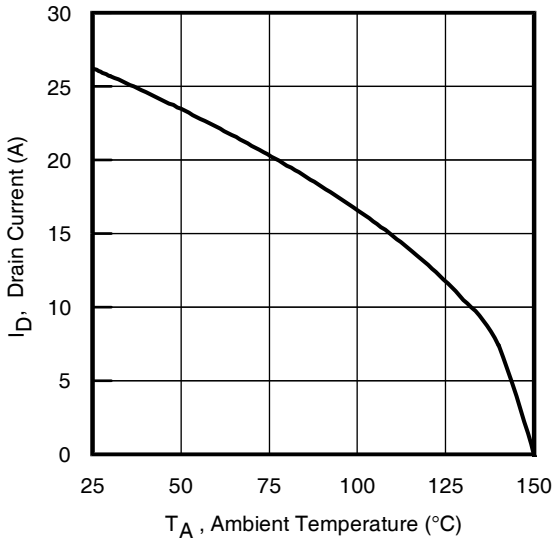


Fig 9. Maximum Drain Current Vs. Ambient Temperature

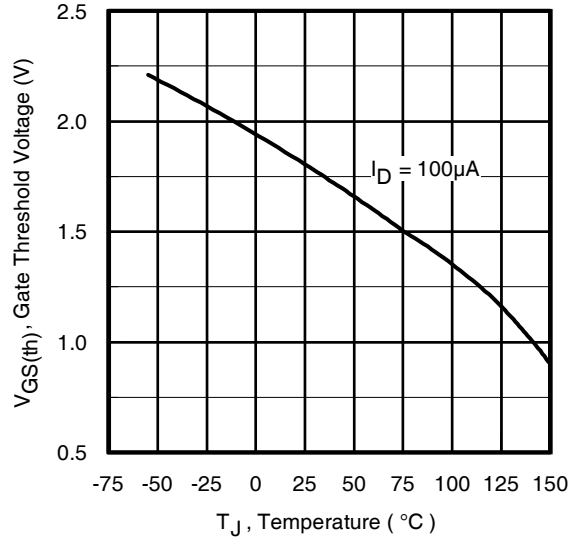


Fig 10. Threshold Voltage Vs. Temperature

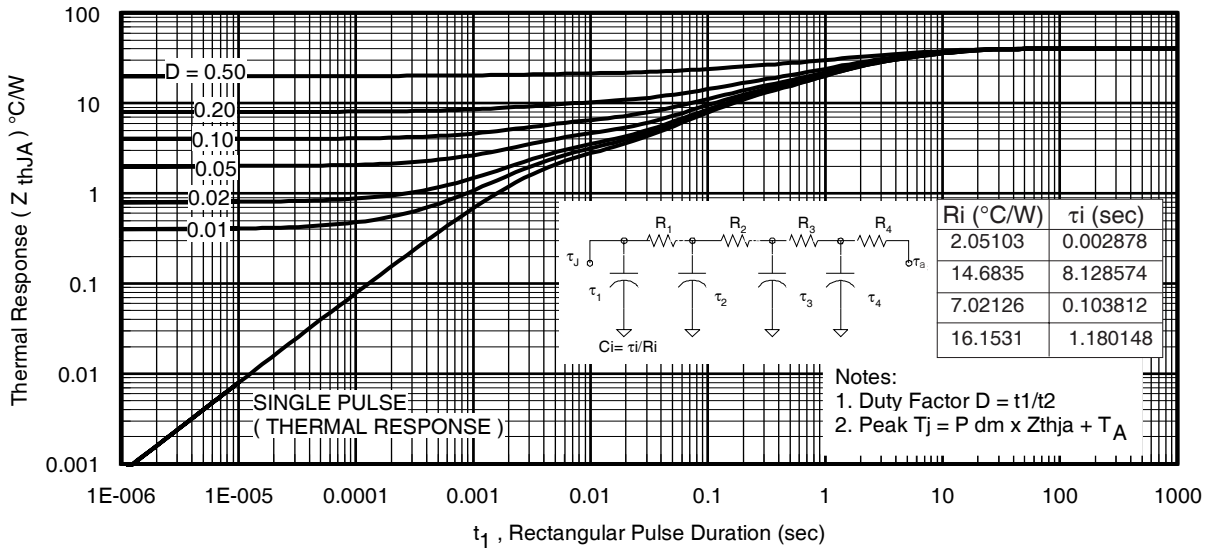
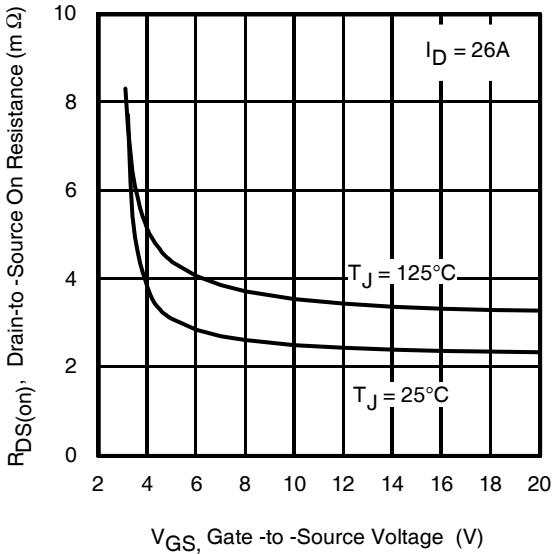


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

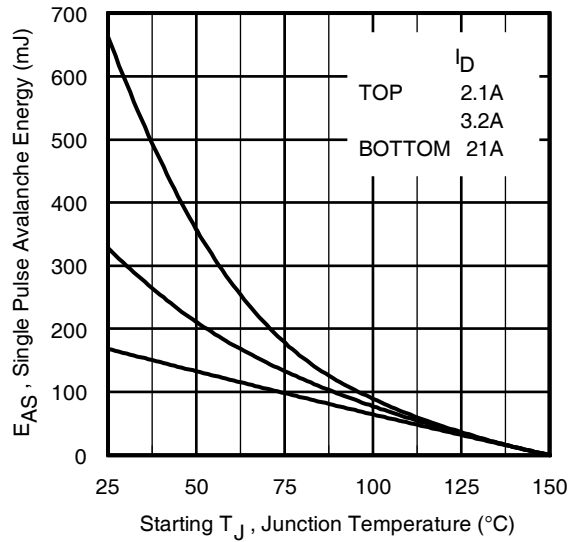
# IRFH7928PbF

PRELIMINARY

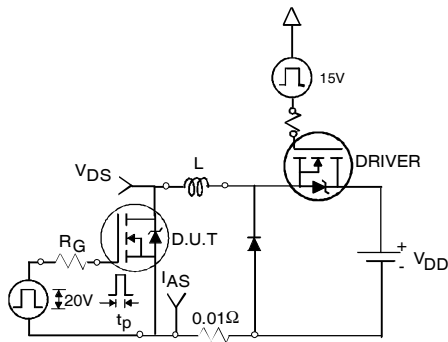
International  
**IR** Rectifier



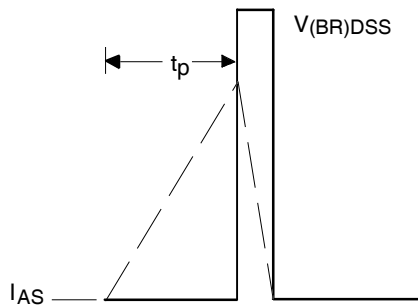
**Fig 12.** On-Resistance vs. Gate Voltage



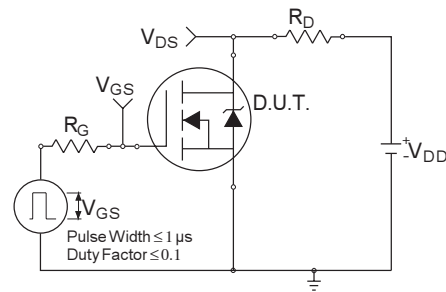
**Fig 13.** Maximum Avalanche Energy vs. Drain Current



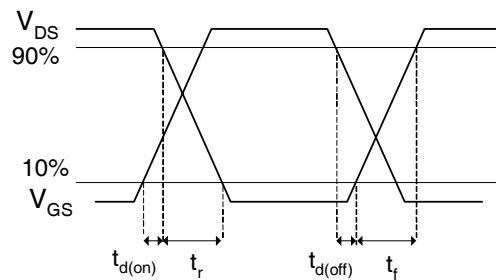
**Fig 14a.** Unclamped Inductive Test Circuit



**Fig 14b.** Unclamped Inductive Waveforms



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



**Fig 15b.** Switching Time Waveforms

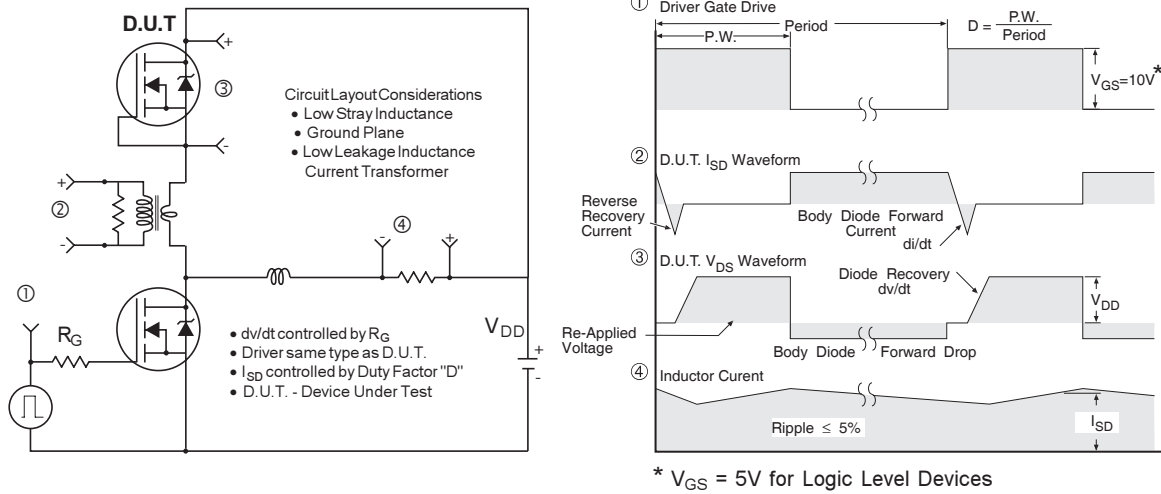


Fig 16. Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs

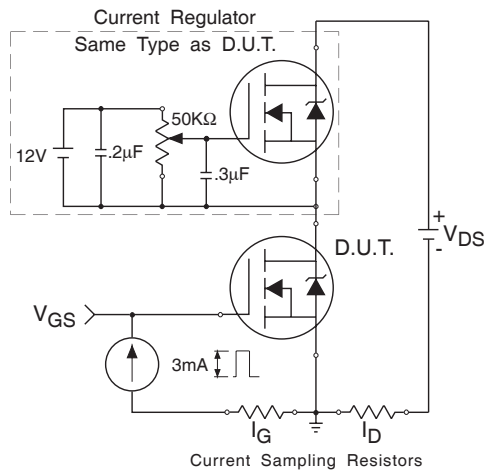


Fig 17. Gate Charge Test Circuit

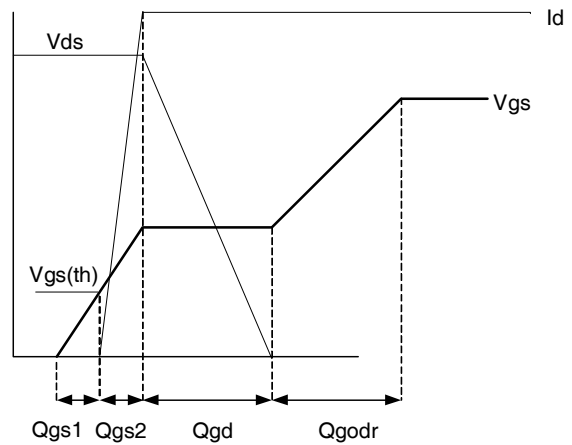
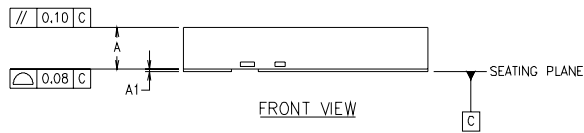
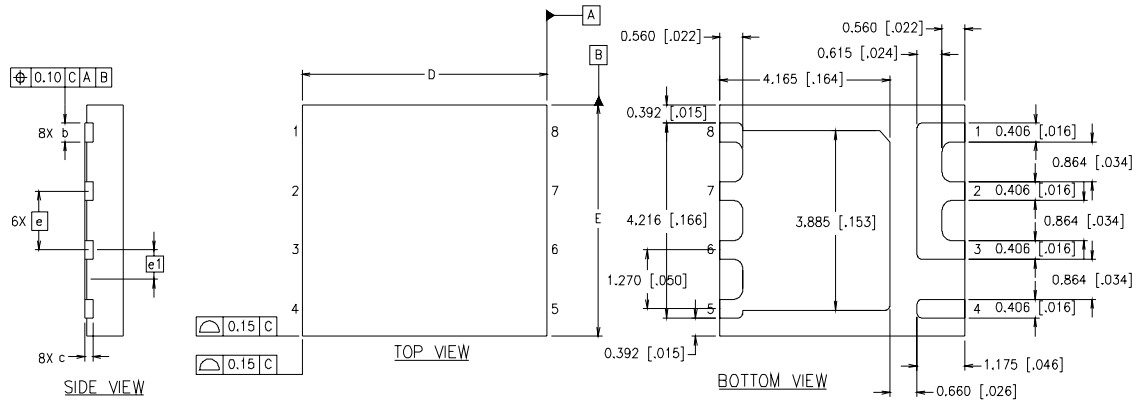


Fig 18. Gate Charge Waveform

# IRFH7928PbF

## PQFN Package Details

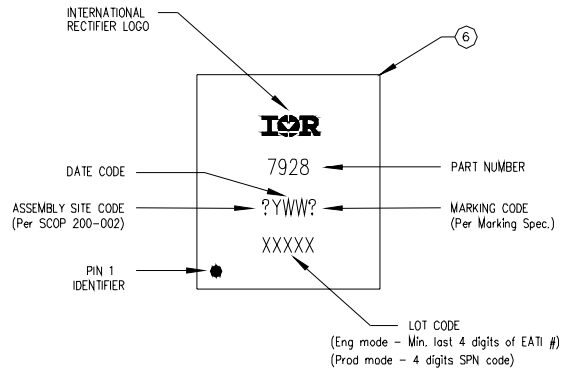


DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.0315	.0394	0.800	1.000
A1	.0000	.0020	0.000	0.050
b	.0140	.0180	0.356	0.456
c	.0080 REF.		0.203 REF.	
D	.2362 BASIC		6.0 BASIC	
E	.1969 BASIC		5.0 BASIC	
e	.0500 BASIC		1.270 BASIC	
e1	.0250 BASIC		0.635 BASIC	

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

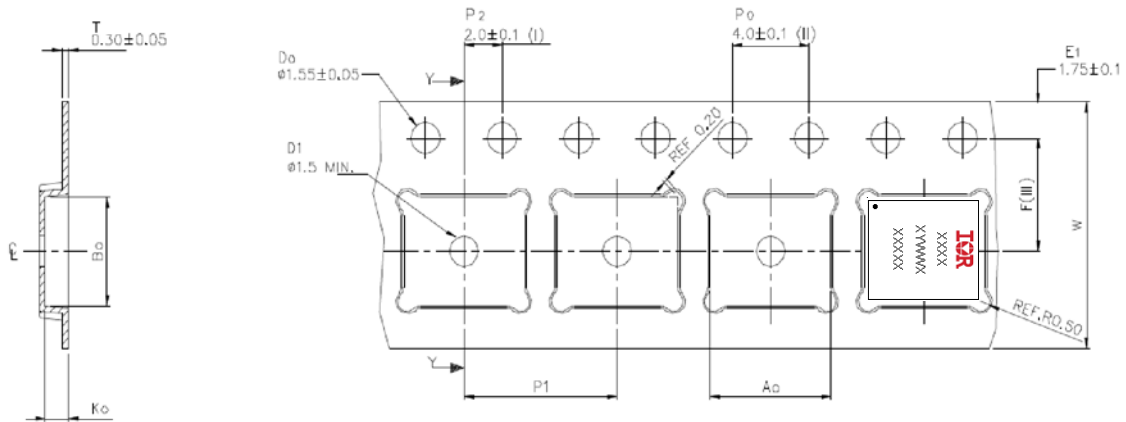


## PQFN Part Marking



TOP MARKING (LASER)

## 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/>  
www.irf.com

# IRFH7928PbF

International  
**IR** Rectifier

Orderable part number	Package Type	Standard Pack		Note
		Form	Quantity	
IRFH7928TRPBF	PQFN 5mm x 6mm	Tape and Reel	4000	

## Qualification information<sup>†</sup>

Qualification level	Consumer <sup>††</sup> (per JEDEC JESD47F <sup>†††</sup> guidelines)		
Moisture Sensitivity Level	PQFN 5mm x 6mm	MSL2 <sup>††††</sup> (per JEDEC J-STD-020D <sup>†††</sup> )	
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.
- †††† Higher MSL ratings may be available for the specific package types listed here.  
Please contact your International Rectifier sales representative for further information:  
<http://www.irf.com/whoto-call/salesrep/>

## Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Starting  $T_J = 25^\circ\text{C}$ ,  $L = 0.089\text{mH}$ ,  $R_G = 25\Omega$ ,  $I_{AS} = 21\text{A}$ .
- ③ Pulse width  $\leq 400\mu\text{s}$ ; duty cycle  $\leq 2\%$ .
- ④  $R_{thjc}$  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.

International  
**IR** Rectifier

**IR WORLD HEADQUARTERS:** 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105  
TAC Fax: (310) 252-7903

Visit us at [www.irf.com](http://www.irf.com) for sales contact information.12/2008