![International IOR Rectifier]

PD-96209

# Preliminary

# IRFH7928PbF

HEXFET® Power MOSFET

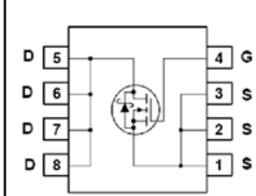
| $V_{DSS}$ | $R_{DS(on)}$ max | Qg |
|---|---|---|
| 30V | 2.9mΩ@$V_{GS}$ = 10V | 40nC |

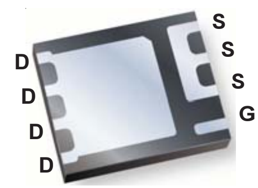
## Applications

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

## 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




PQFN

## 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°C | Continuous Drain Current, $V_{GS}$ @ 10V | 26 | A |
| $I_D$ @ $T_A$ = 70°C | Continuous Drain Current, $V_{GS}$ @ 10V | 21 | |
| $I_D$ @ $T_C$ = 25°C | Continuous Drain Current, $V_{GS}$ @ 10V | 124 | |
| $I_{DM}$ | Pulsed Drain Current ① | 208 | |
| $P_D$ @$T_A$ = 25°C | Power Dissipation ⑤ | 3.1 | W |
| $P_D$ @$T_A$ = 70°C | Power Dissipation ⑤ | 2.0 | |
| | Linear Derating Factor ⑤ | 0.025 | W/°C |
| $T_J$<br>$T_{STG}$ | Operating Junction and<br>Storage Temperature Range | -55 to + 150 | °C |

## Thermal Resistance

| | Parameter | Typ. | Max. | Units |
|---|---|---|---|---|
| $R_{θJC}$ | Junction-to-Case ④ | —— | 1.8 | °C/W |
| $R_{θJA}$ | 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

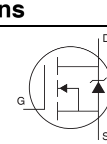
## Static @ $T_J$ = 25°C (unless otherwise specified)

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-to-Source Breakdown Voltage | 30 | — | — | V | $V_{GS}$ = 0V, $I_D$ = 250μA |
| $\Delta BV_{DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient | — | 0.02 | — | V/°C | Reference to 25°C, $I_D$ = 1mA |
| $R_{DS(on)}$ | Static Drain-to-Source On-Resistance | — | 2.4 | 2.9 | mΩ | $V_{GS}$ = 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 | $V_{DS}$ = $V_{GS}$, $I_D$ = 100μA |
| $\Delta V_{GS(th)}$ | Gate Threshold Voltage Coefficient | — | -6.4 | — | 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 |
| gfs | Forward Transconductance | 110 | — | — | S | $V_{DS}$ = 15V, $I_D$ = 21A |
| $Q_g$ | Total Gate Charge | — | 40 | 60 | nC | |
| $Q_{gs1}$ | Pre-Vth Gate-to-Source Charge | — | 10.2 | — | | $V_{DS}$ = 15V |
| $Q_{gs2}$ | Post-Vth Gate-to-Source Charge | — | 4.7 | — | | $V_{GS}$ = 4.5V |
| $Q_{gd}$ | Gate-to-Drain Charge | — | 13.5 | — | | $I_D$ = 21A |
| $Q_{godr}$ | Gate Charge Overdrive | — | 11.8 | — | | See Fig.17 & 18 |
| $Q_{sw}$ | 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 | Ω | |
| $t_{d(on)}$ | Turn-On Delay Time | — | 22.2 | — | ns | $V_{DD}$ = 15V, $V_{GS}$ = 4.5V |
| $t_r$ | Rise Time | — | 31.5 | — | | $I_D$ = 21A |
| $t_{d(off)}$ | Turn-Off Delay Time | — | 22.3 | — | | $R_G$=1.8Ω |
| $t_f$ | Fall Time | — | 14.2 | — | | See Fig.15 |
| $C_{iss}$ | Input Capacitance | — | 5657 | — | pF | $V_{GS}$ = 0V |
| $C_{oss}$ | Output Capacitance | — | 1005 | — | | $V_{DS}$ = 15V |
| $C_{rss}$ | Reverse Transfer Capacitance | — | 520 | — | | $f$ = 1.0MHz |

## 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°C, $I_S$ = 21A, $V_{GS}$ = 0V ③ |
| $t_{rr}$ | Reverse Recovery Time | — | 26 | 40 | ns | $T_J$ = 25°C, $I_F$ = 21A, $V_{DD}$ = 15V |
| $Q_{rr}$ | Reverse Recovery Charge | — | 31 | 47 | nC | di/dt = 200A/μs ③ |
| $t_{on}$ | Forward Turn-On Time | Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD) | | | | |

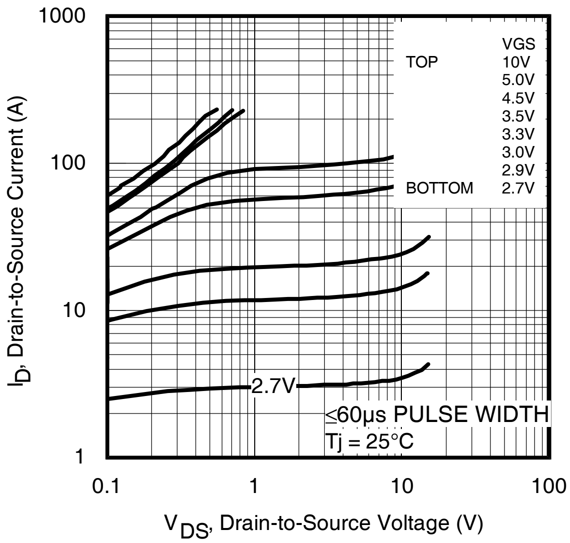



**Fig 1.** Typical Output Characteristics

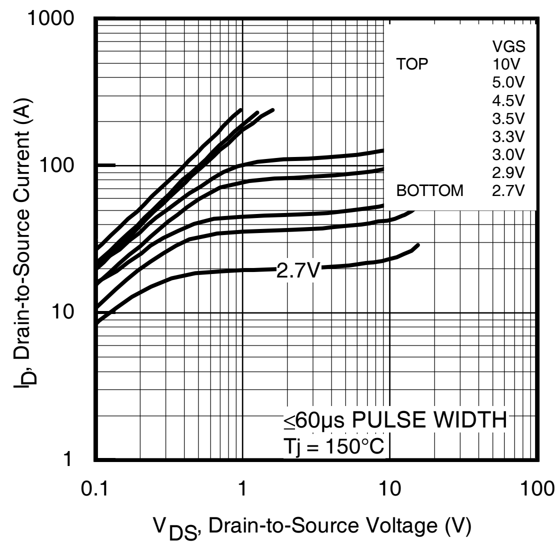



**Fig 2.** Typical Output Characteristics

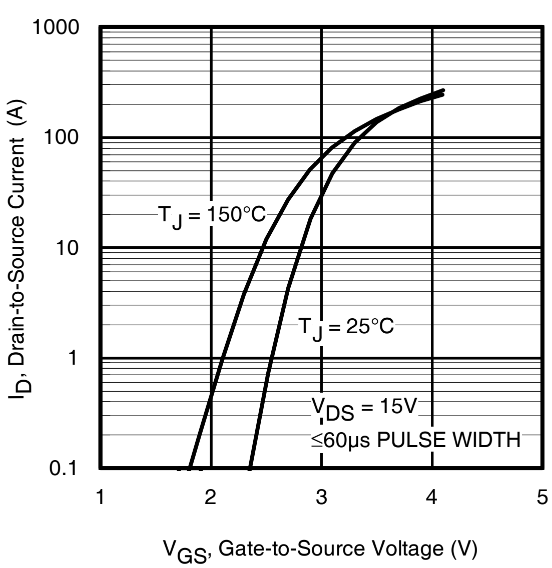



**Fig 3.** Typical Transfer Characteristics

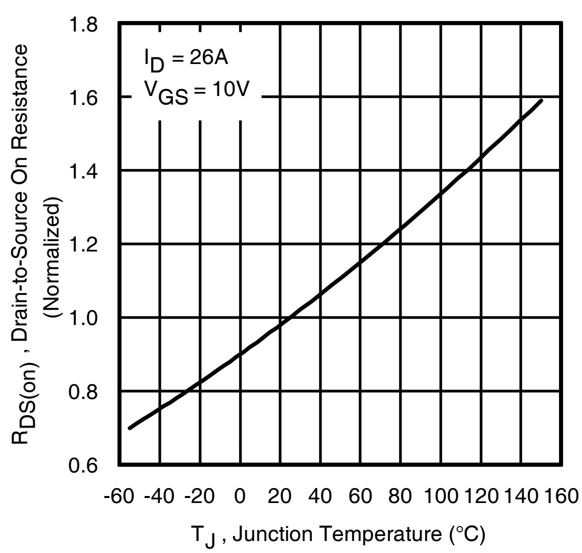



**Fig 4.** Normalized On-Resistance Vs. Temperature

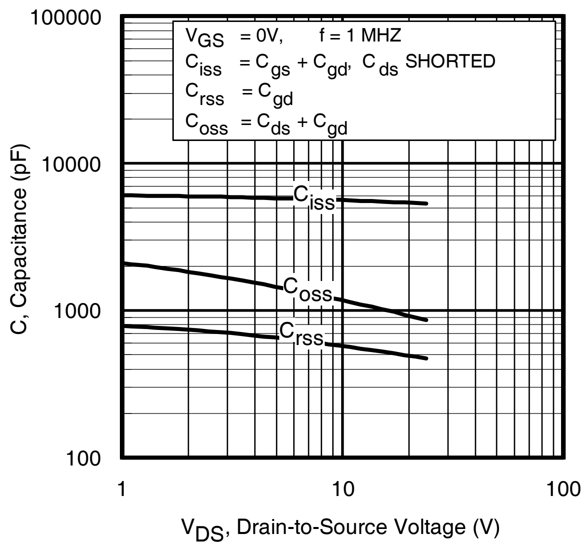



**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage

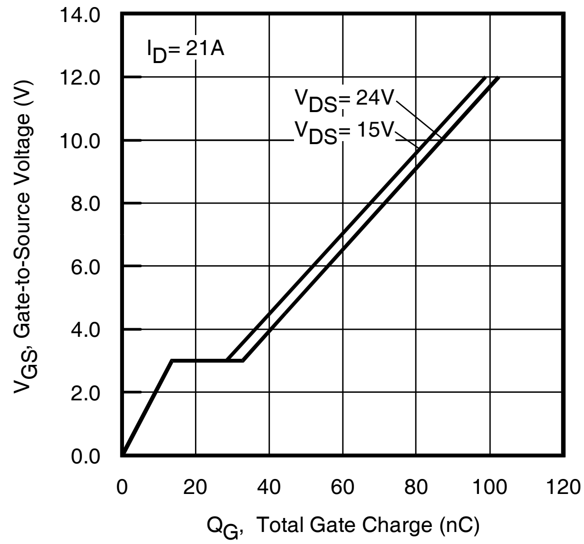



**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage

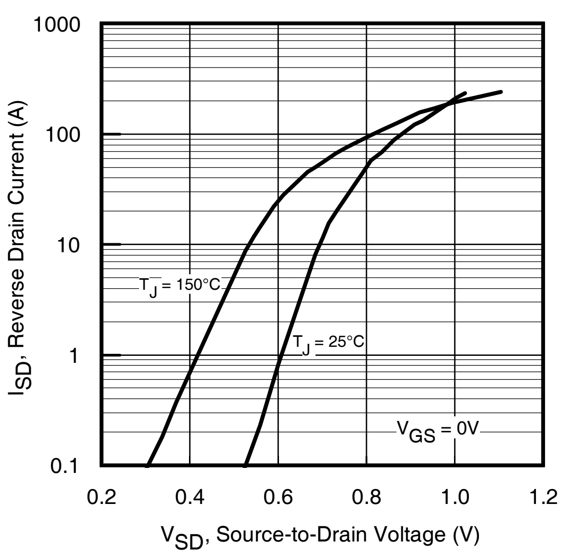



**Fig 7.** Typical Source-Drain Diode Forward Voltage

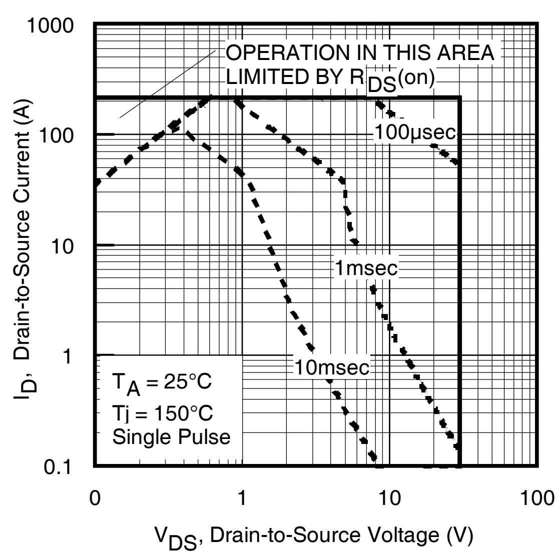



**Fig 8.** Maximum Safe Operating Area

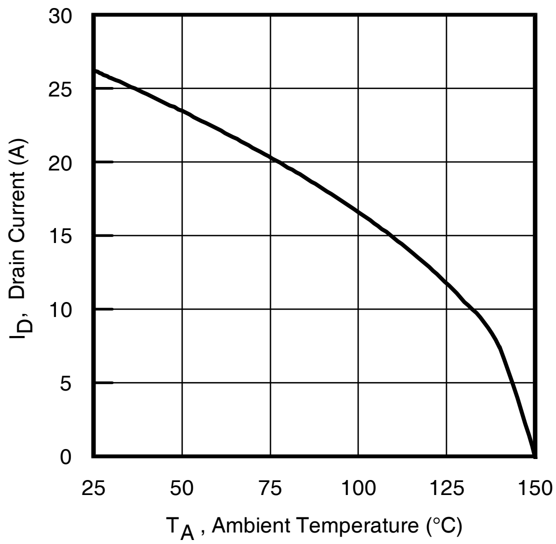



**Fig 9.** Maximum Drain Current Vs. Ambient Temperature

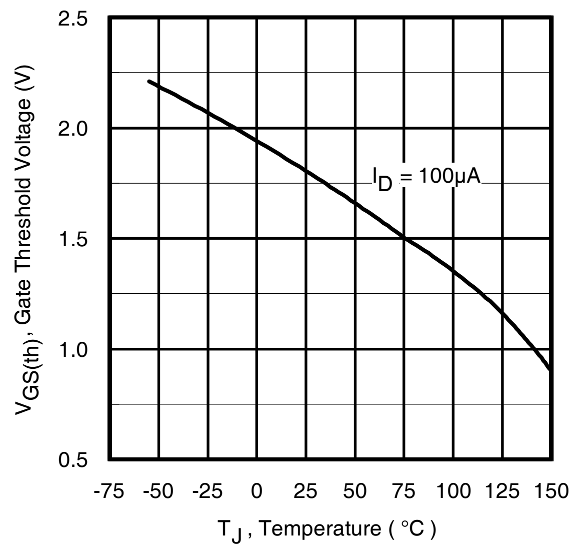



**Fig 10.** Threshold Voltage Vs. Temperature

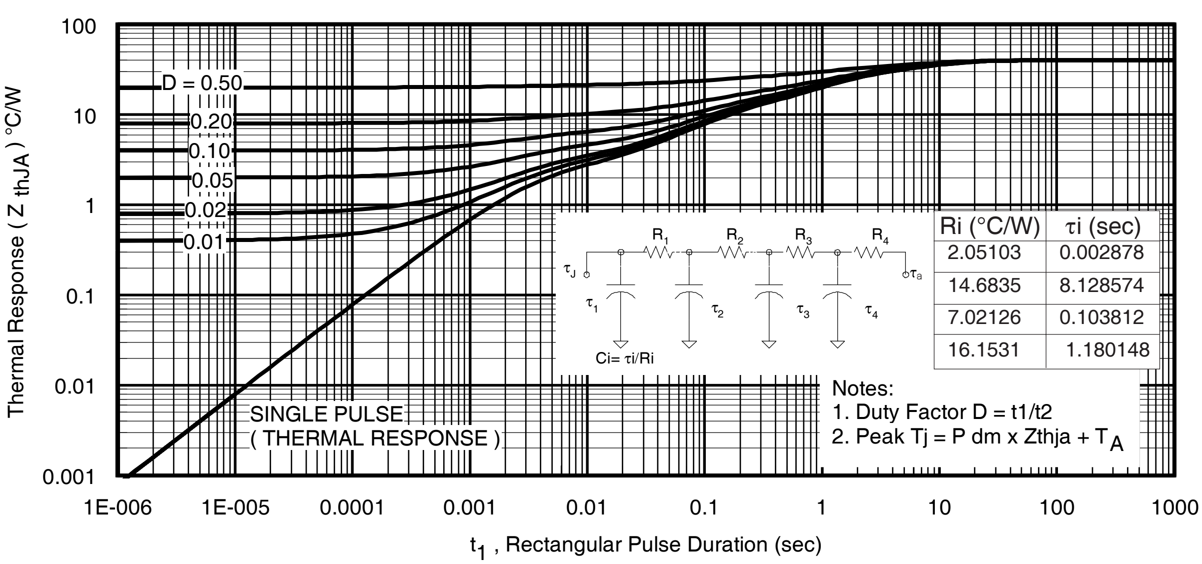



**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

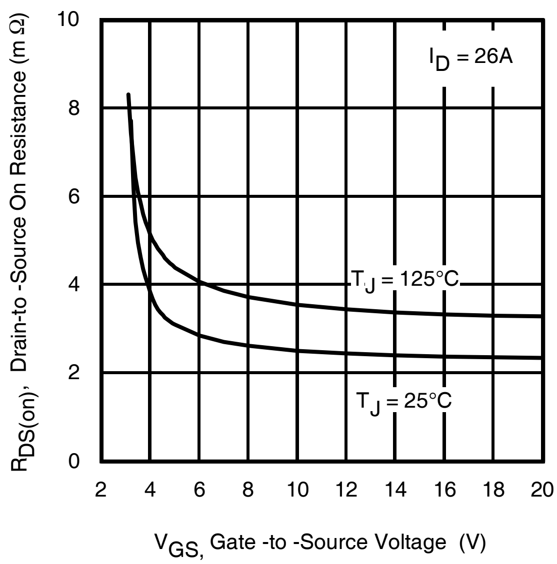



**Fig 12.** On-Resistance vs. Gate Voltage

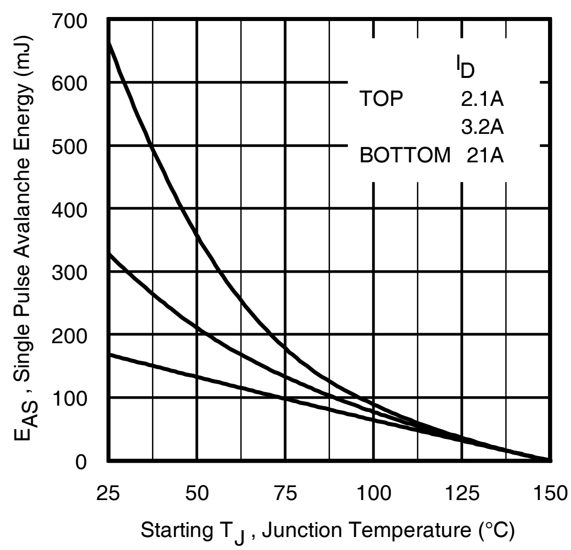



**Fig 13.** Maximum Avalanche Energy vs. Drain Current

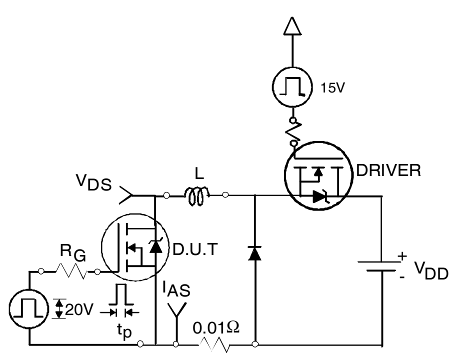



**Fig 14a.** Unclamped Inductive Test Circuit

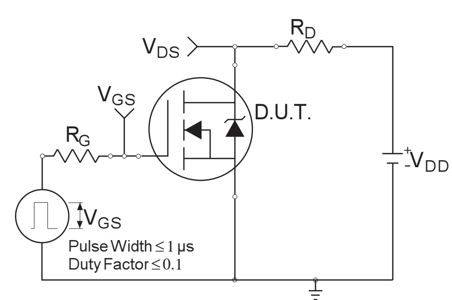



**Fig 15a.** Switching Time Test Circuit

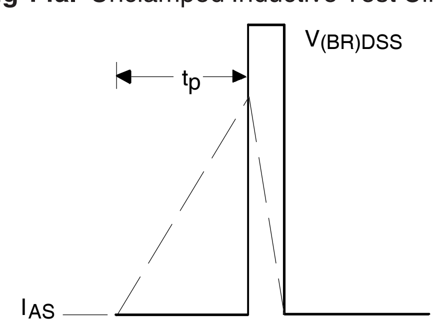



**Fig 14b.** Unclamped Inductive Waveforms

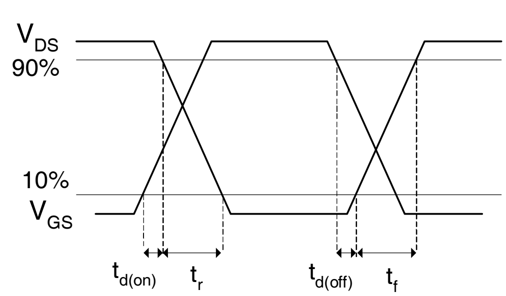



**Fig 15b.** Switching Time Waveforms

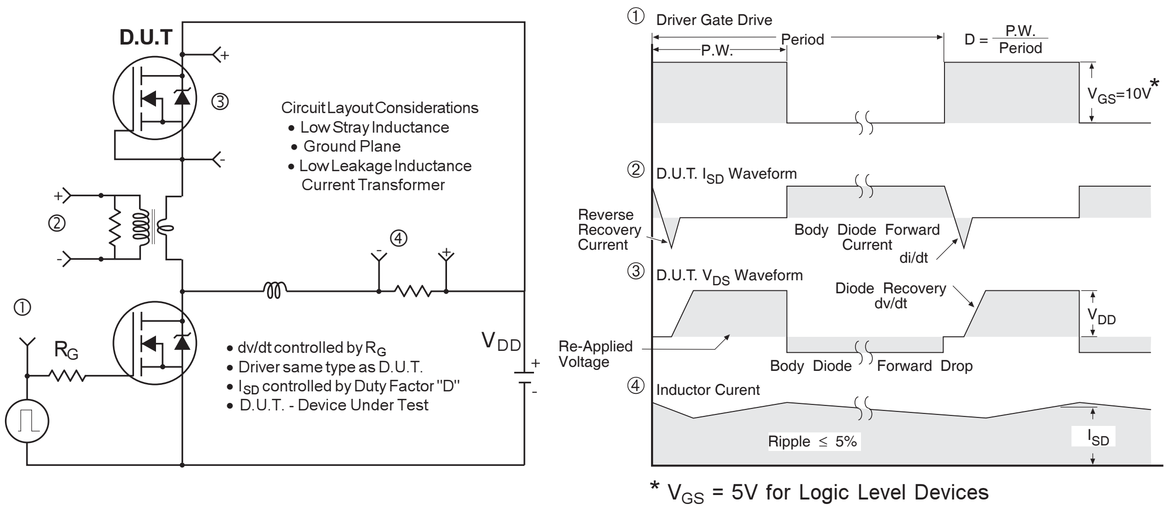



**Fig 16.** Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs

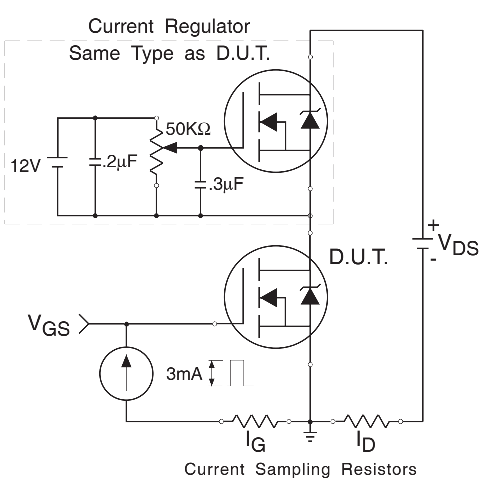



**Fig 17.** Gate Charge Test Circuit

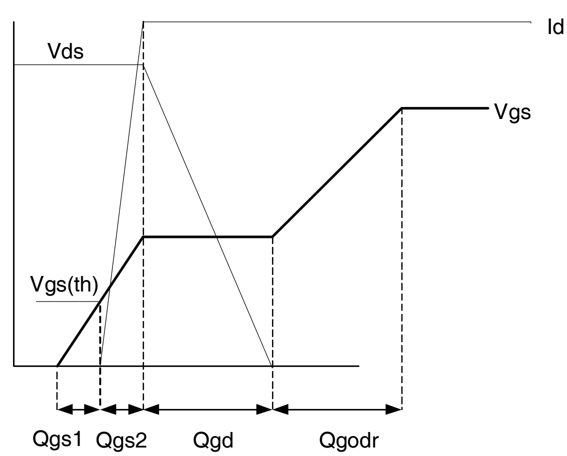
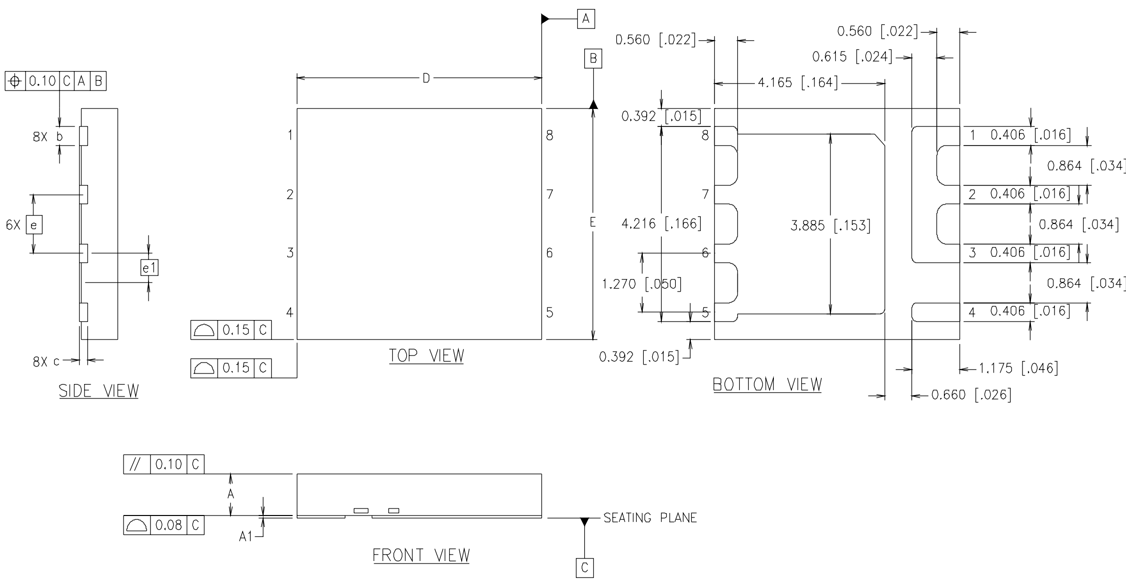



**Fig 18.** Gate Charge Waveform

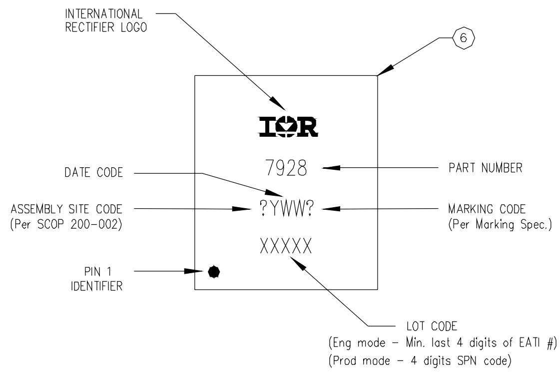
## PQFN Package Details




| 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 | |

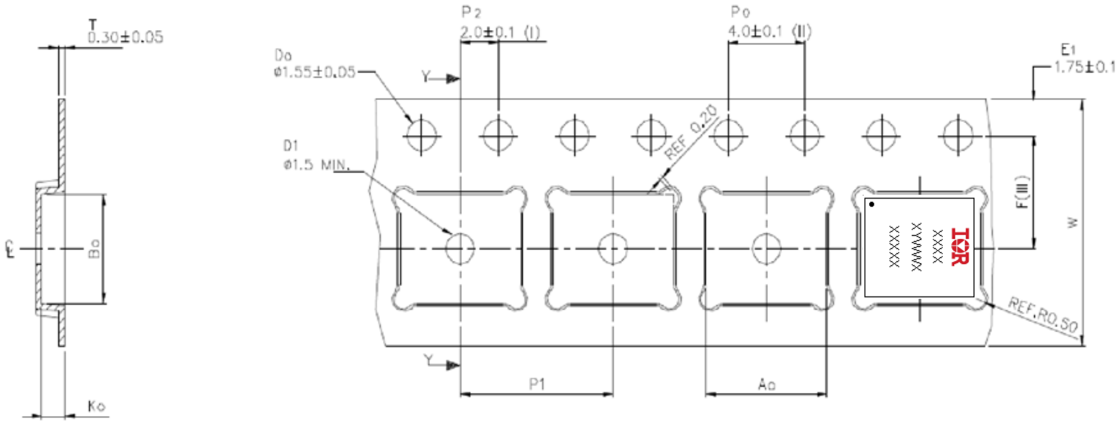
**Note: For the most current drawing please refer to IR website at: http://www.irf.com/package/**

## PQFN Part Marking




TOP MARKING (LASER)

## PQFN Tape and Reel




| | |
|---|---|
| Ao | 6.30 +/- 0.1 |
| Bo | 5.30 +/- 0.1 |
| Ko | 1.20 +/- 0.1 |
| F | 5.50 +/- 0.1 |
| $P_1$ | 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 $10^9$ 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/**

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

**Qualification information**†

| | | |
|---|---|---|
| Qualification level | Consumer†† (per JEDEC JESD47F ††† guidelines ) | |
| Moisture Sensitivity Level | PQFN 5mm x 6mm | MSL2†††† (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.

†††† 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°C, L = 0.089mH, $R_G$ = 25Ω, $I_{AS}$ = 21A.
③ Pulse width ≤ 400µs; duty cycle ≤ 2%.
④ Rthjc 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
IOR Rectifier

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