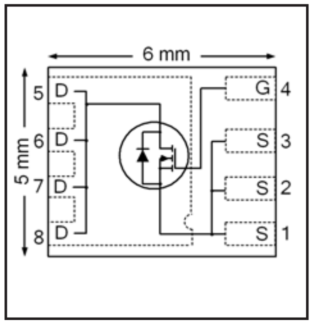
PD-97789

# IRFH7110PbF

HEXFET® Power MOSFET

| | | |
|---|---|---|
| $V_{DS}$ | 100 | V |
| $V_{gs}$ max | ± 20 | V |
| $R_{DS(on)}$ max<br>(@$V_{GS}$ = 10V) | 13.5 | mΩ |
| $Q_G$ (typical) | 58 | nC |
| $R_G$ (typical) | 0.6 | Ω |
| $I_D$<br>(@$T_{c(Bottom)}$ = 25°C) | 50⑦ | A |




PQFN 5X6 mm

## Applications

- Secondary Side Synchronous Rectification
- Inverters for DC Motors
- DC-DC Brick Applications
- Boost Converters

### Features and Benefits

| Features | | Benefits |
|---|---|---|
| Low RDSon (< 13.5mW) | | Lower Conduction Losses |
| Low Thermal Resistance to PCB (< 1.2°C/W) | | Enables better thermal dissipation |
| Low Profile (<0.9 mm) | results in | Increased Power Density |
| Industry-Standard Pinout | ⇒ | Multi-Vendor Compatibility |
| Compatible with Existing Surface Mount Techniques | | Easier Manufacturing |
| RoHS Compliant Containing no Lead, no Bromide and no Halogen | | Environmentally Friendlier |
| MSL1, Industrial Qualification | | Increased Reliability |

| Orderable part number | Package Type | Standard Pack | | Note |
|---|---|---|---|---|
| | | Form | Quantity | |
| IRFH7110TRPBF | PQFN 5mm x 6mm | Tape and Reel | 4000 | |
| IRFH7110TR2PBF | PQFN 5mm x 6mm | Tape and Reel | 400 | |

## 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°C | Continuous Drain Current, $V_{GS}$ @ 10V | 11 | A |
| $I_D$ @ $T_A$ = 70°C | Continuous Drain Current, $V_{GS}$ @ 10V | 8.6 | |
| $I_D$ @ $T_{C(Bottom)}$ = 25°C | Continuous Drain Current, $V_{GS}$ @ 10V | 58⑥⑦ | |
| $I_D$ @ $T_{C(Bottom)}$ = 100°C | Continuous Drain Current, $V_{GS}$ @ 10V | 37⑥ | |
| $I_D$ @ $T_C$ = 25°C | Continuous Drain Current, $V_{GS}$ @ 10V (Package Limited) | 50⑦ | |
| $I_{DM}$ | Pulsed Drain Current ① | 240 | |
| $P_D$ @$T_A$ = 25°C | Power Dissipation ⑤ | 3.6 | W |
| $P_D$ @$T_{C(Bottom)}$ = 25°C | Power Dissipation ⑤ | 104 | |
| | Linear Derating Factor ⑤ | 0.029 | W/°C |
| $T_J$<br>$T_{STG}$ | Operating Junction and<br>Storage Temperature Range | -55 to + 150 | °C |

Notes ① through ⑦ are on page 9



5/15/12

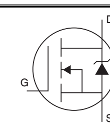
## Static @ $T_J$ = 25°C (unless otherwise specified)

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-to-Source Breakdown Voltage | 100 | ––– | ––– | V | $V_{GS}$ = 0V, $I_D$ = 250μA |
| $\Delta BV_{DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient | ––– | 0.09 | ––– | V/°C | Reference to 25°C, $I_D$ = 1.0mA |
| $R_{DS(on)}$ | Static Drain-to-Source On-Resistance | ––– | 10.6 | 13.5 | mΩ | $V_{GS}$ = 10V, $I_D$ = 35A ③ |
| $V_{GS(th)}$ | Gate Threshold Voltage | 2.0 | 3.0 | 4.0 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = 100μA |
| $\Delta V_{GS(th)}$ | Gate Threshold Voltage Coefficient | ––– | -9.0 | ––– | mV/°C | |
| $I_{DSS}$ | Drain-to-Source Leakage Current | ––– | ––– | 20 | μA | $V_{DS}$ = 100V, $V_{GS}$ = 0V |
| | | ––– | ––– | 250 | | $V_{DS}$ = 100V, $V_{GS}$ = 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 | 74 | ––– | ––– | S | $V_{DS}$ = 25V, $I_D$ = 35A |
| $Q_g$ | Total Gate Charge | ––– | 58 | 87 | nC | $V_{DS}$ = 50V<br>$V_{GS}$ = 10V<br>$I_D$ = 35A |
| $Q_{gs1}$ | Pre-Vth Gate-to-Source Charge | ––– | 11 | ––– | | |
| $Q_{gs2}$ | Post-Vth Gate-to-Source Charge | ––– | 3.6 | ––– | | |
| $Q_{gd}$ | Gate-to-Drain Charge | ––– | 16 | ––– | | |
| $Q_{godr}$ | Gate Charge Overdrive | ––– | 27.4 | ––– | | |
| $Q_{sw}$ | Switch Charge ($Q_{gs2}$ + $Q_{gd}$) | ––– | 19.6 | ––– | | |
| $Q_{oss}$ | Output Charge | ––– | 17 | ––– | nC | $V_{DS}$ = 16V, $V_{GS}$ = 0V |
| $R_G$ | Gate Resistance | ––– | 0.6 | ––– | Ω | |
| $t_{d(on)}$ | Turn-On Delay Time | ––– | 11 | ––– | ns | $V_{DD}$ = 50V, $V_{GS}$ = 10V<br>$I_D$ = 35A<br>$R_G$=1.8Ω |
| $t_r$ | Rise Time | ––– | 23 | ––– | | |
| $t_{d(off)}$ | Turn-Off Delay Time | ––– | 22 | ––– | | |
| $t_f$ | Fall Time | ––– | 18 | ––– | | |
| $C_{iss}$ | Input Capacitance | ––– | 3240 | ––– | pF | $V_{GS}$ = 0V<br>$V_{DS}$ = 25V<br>ƒ = 1.0MHz |
| $C_{oss}$ | Output Capacitance | ––– | 300 | ––– | | |
| $C_{rss}$ | Reverse Transfer Capacitance | ––– | 140 | ––– | | |

## Avalanche Characteristics

| | Parameter | Typ. | Max. | Units |
|---|---|---|---|---|
| $E_{AS}$ | Single Pulse Avalanche Energy ② | ––– | 110 | mJ |
| $I_{AR}$ | Avalanche Current ① | ––– | 35 | A |

## Diode Characteristics

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current (Body Diode) | ––– | ––– | 50⑦ | A | MOSFET symbol showing the integral reverse p-n junction diode.  |
| $I_{SM}$ | Pulsed Source Current (Body Diode) ① | ––– | ––– | 240 | | |
| $V_{SD}$ | Diode Forward Voltage | ––– | ––– | 1.3 | V | $T_J$ = 25°C, $I_S$ = 35A, $V_{GS}$ = 0V ③ |
| $t_{rr}$ | Reverse Recovery Time | ––– | 27 | 41 | ns | $T_J$ = 25°C, $I_F$ = 35A, $V_{DD}$ = 50V<br>di/dt = 500A/μs ③ |
| $Q_{rr}$ | Reverse Recovery Charge | ––– | 140 | 210 | nC | |
| $t_{on}$ | Forward Turn-On Time | Time is dominated by parasitic Inductance | | | | |

## Thermal Resistance

| | Parameter | Typ. | Max. | Units |
|---|---|---|---|---|
| $R_{\theta JC}$ (Bottom) | Junction-to-Case ④ | ––– | 1.2 | °C/W |
| $R_{\theta JC}$ (Top) | Junction-to-Case ④ | ––– | 32 | |
| $R_{\theta JA}$ | Junction-to-Ambient ④⑤ | ––– | 35 | |
| $R_{\theta JA}$ (<10s) | Junction-to-Ambient ⑤ | ––– | 22 | |

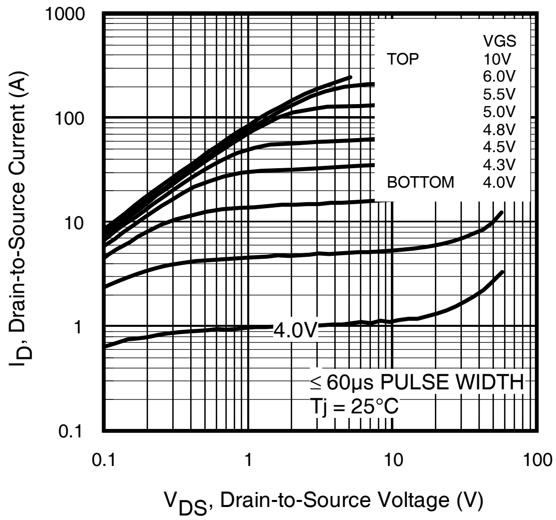



**Fig 1.** Typical Output Characteristics

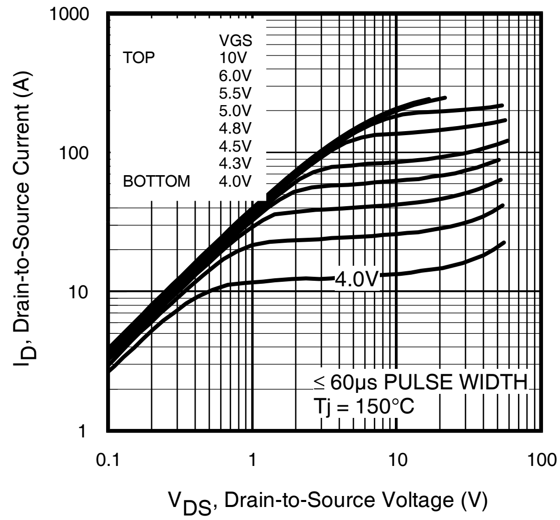



**Fig 2.** Typical Output Characteristics

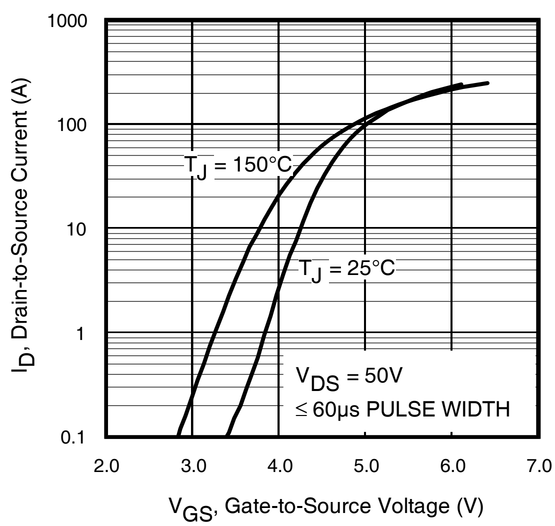



**Fig 3.** Typical Transfer Characteristics

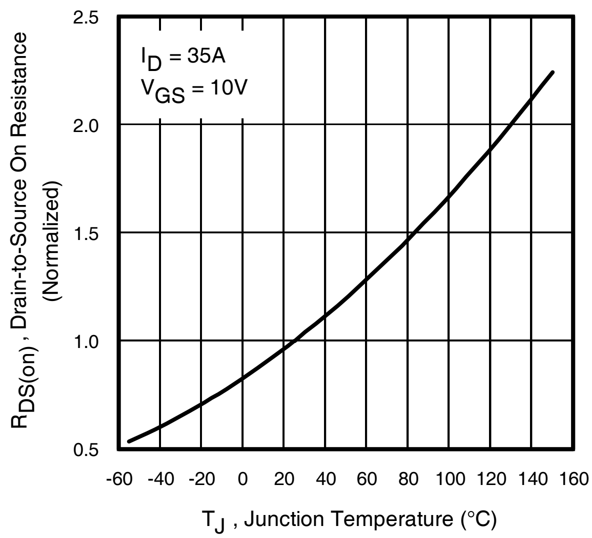



**Fig 4.** Normalized On-Resistance vs. Temperature

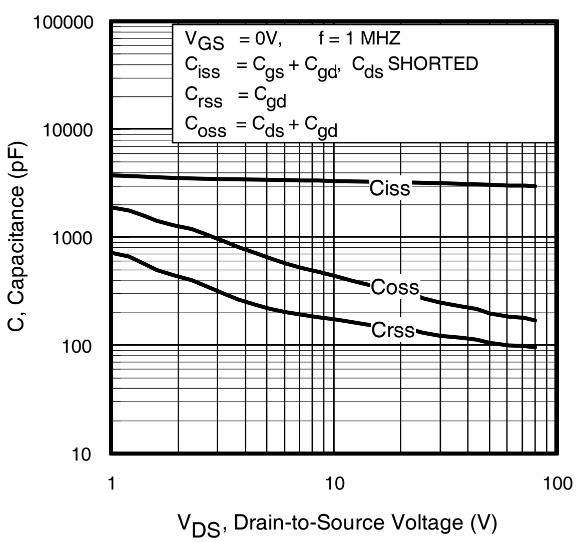



**Fig 5.** Typical Capacitance vs. Drain-to-Source Voltage

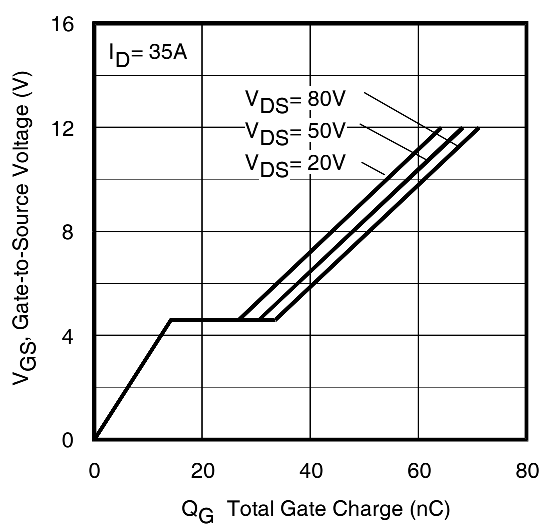



**Fig 6.** Typical Gate Charge vs. Gate-to-Source Voltage

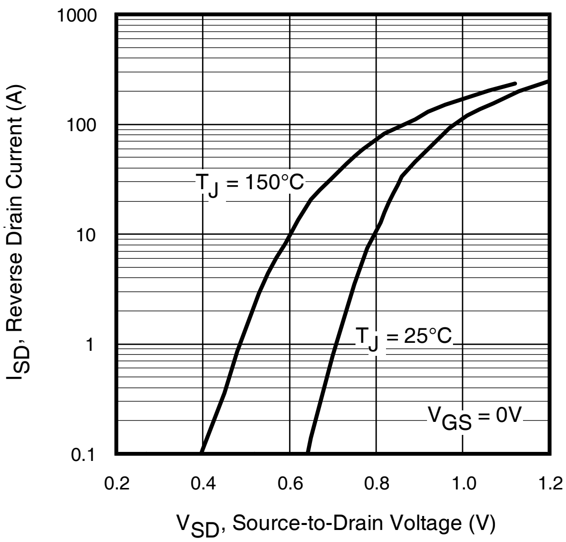



**Fig 7.** Typical Source-Drain Diode Forward Voltage

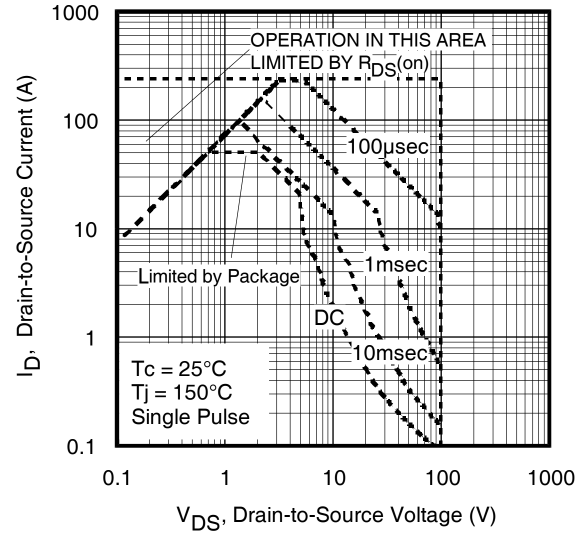



**Fig 8.** Maximum Safe Operating Area

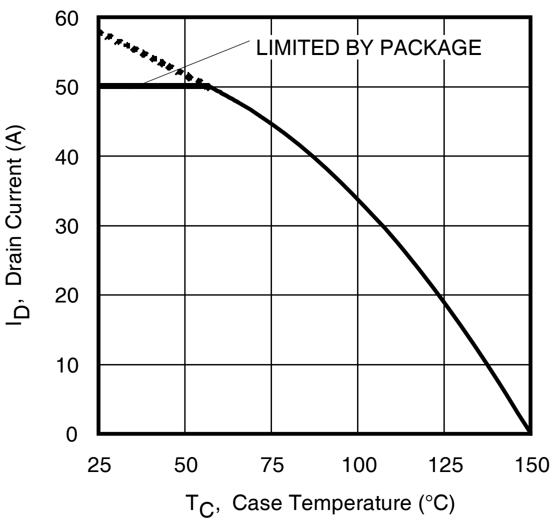



**Fig 9.** Maximum Drain Current vs. Case (Bottom) Temperature

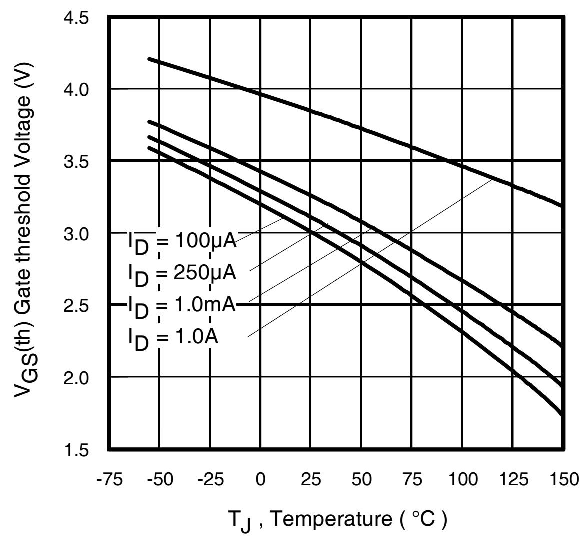



**Fig 10.** Threshold Voltage vs. Temperature

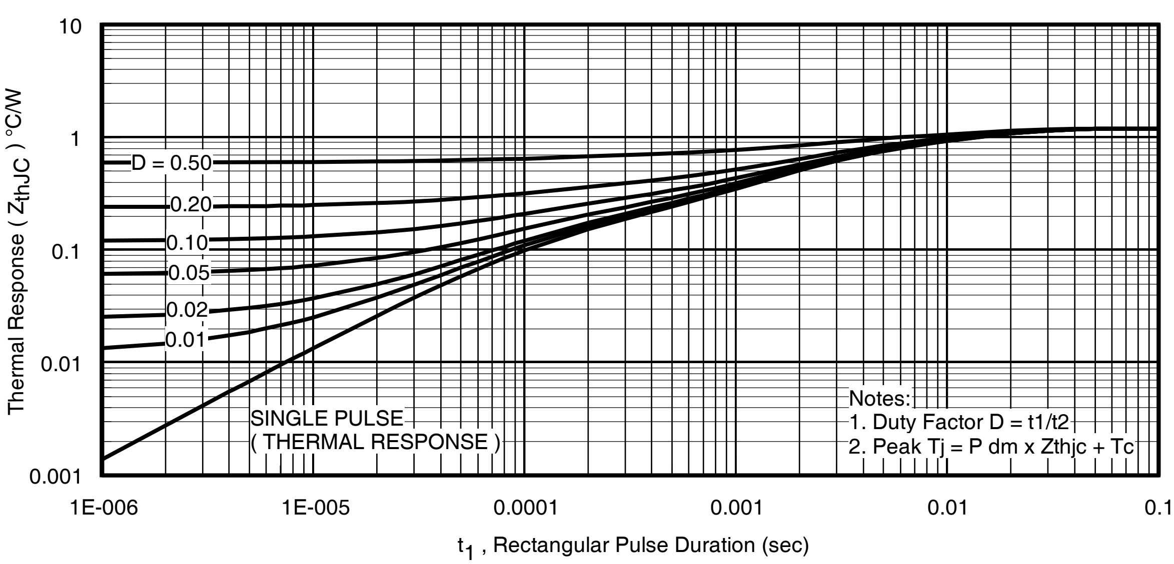



**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case (Bottom)

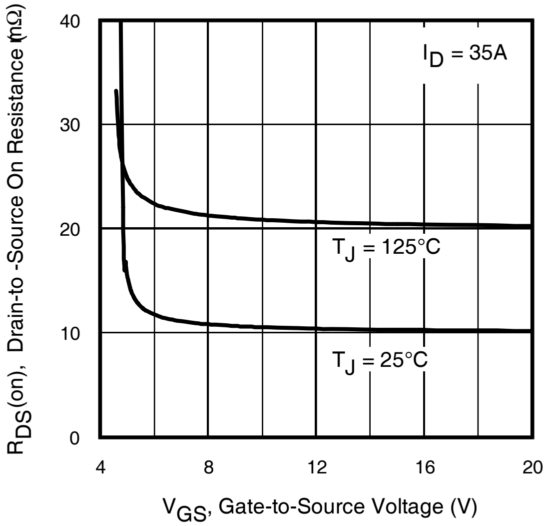



**Fig 12.** On-Resistance vs. Gate Voltage

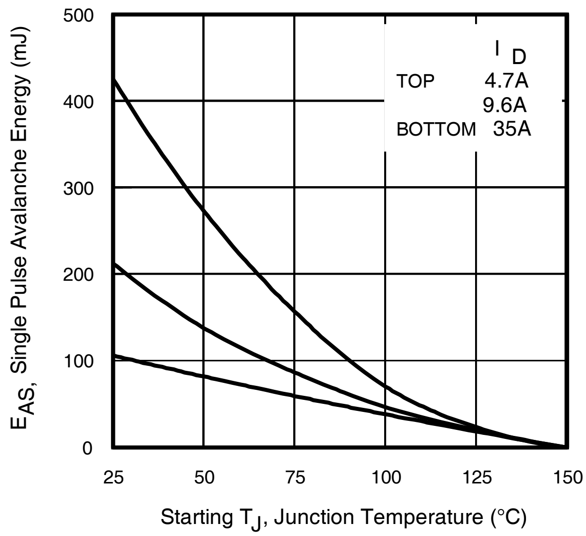



**Fig 13.** Maximum Avalanche Energy vs. Drain Current

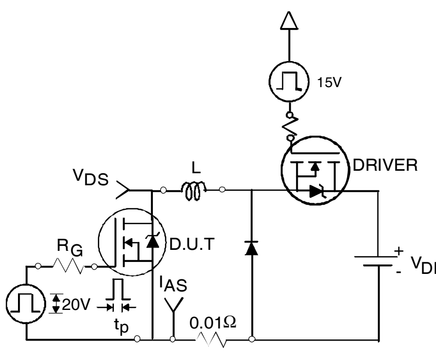



**Fig 14a.** Unclamped Inductive Test Circuit

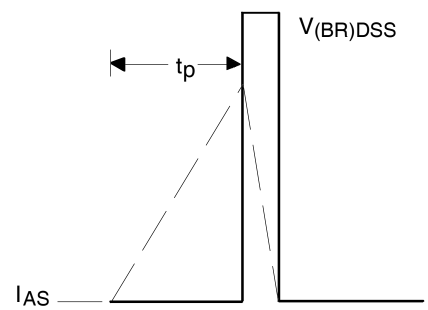



**Fig 14b.** Unclamped Inductive Waveforms

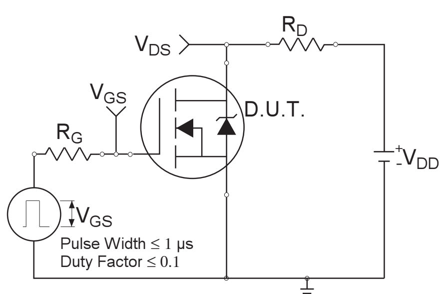



**Fig 15a.** Switching Time Test Circuit

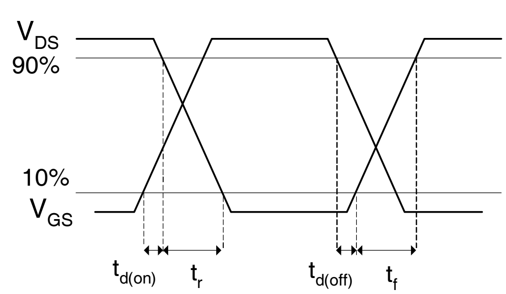



**Fig 15b.** Switching Time Waveforms

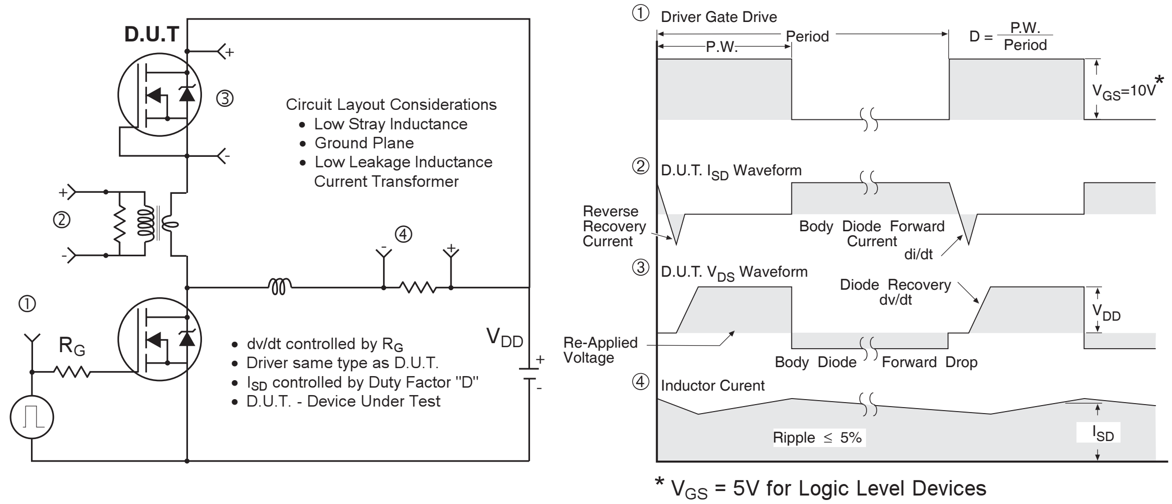



**Fig 16.** Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs

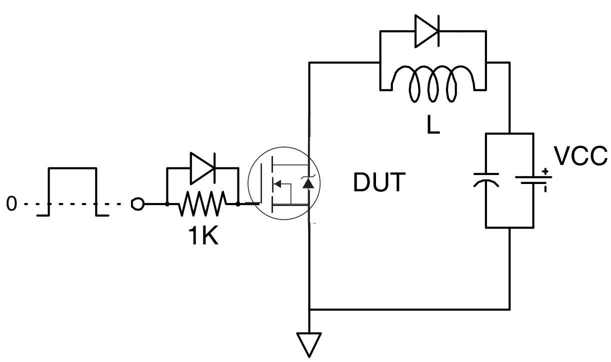



**Fig 17.** Gate Charge Test Circuit

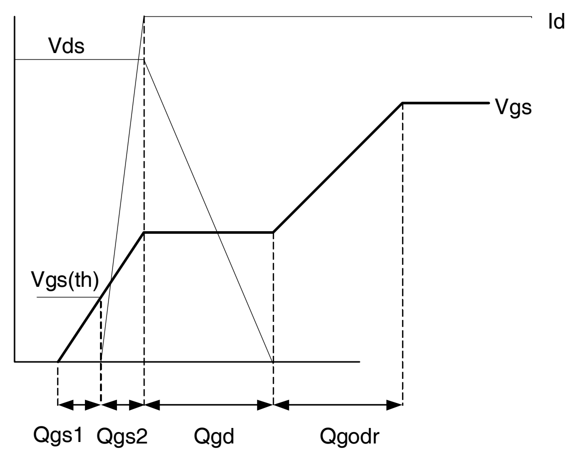
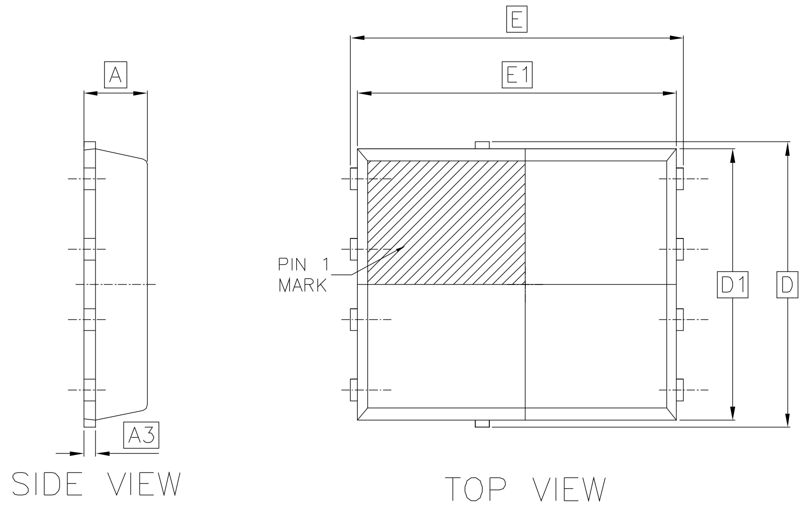
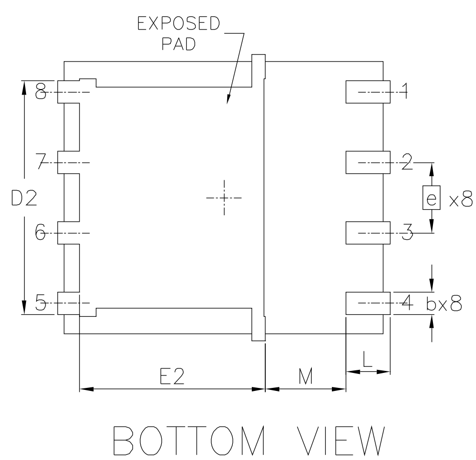



**Fig 18.** Gate Charge Waveform

# PQFN 5x6 Outline "E" Package Details

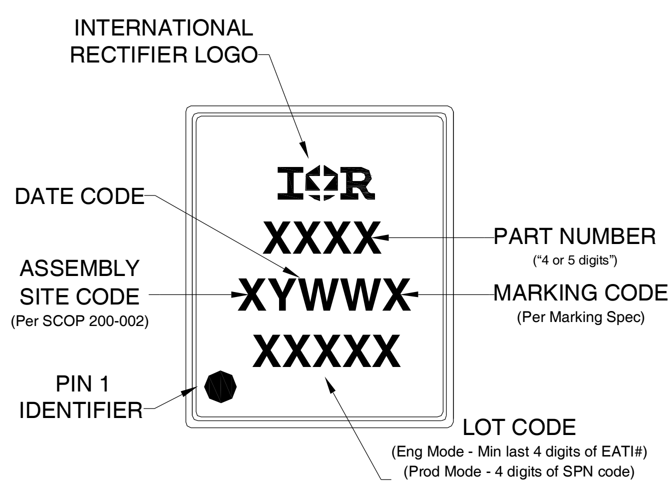



| OUTLINE PQFN 5x6E | | | |
|---|---|---|---|
| SYMBOL \ DIM | MIN | NOM | MAX |
| A | 1.03 | 1.10 | 1.17 |
| A3 | | 0.212 REF | |
| b | 0.34 | 0.40 | 0.48 |
| D | | 5.26 BSC | |
| D1 | | 4.90 BSC | |
| D2 | 4.11 | 4.21 | 4.31 |
| e | | 1.27 BSC | |
| E | | 6.05 BSC | |
| E1 | | 5.75 BSC | |
| E2 | 3.27 | 3.37 | 3.47 |
| L | 0.74 | 0.80 | 0.86 |
| M | | 1.51 REF | |
| N | | 0.525 REF | |



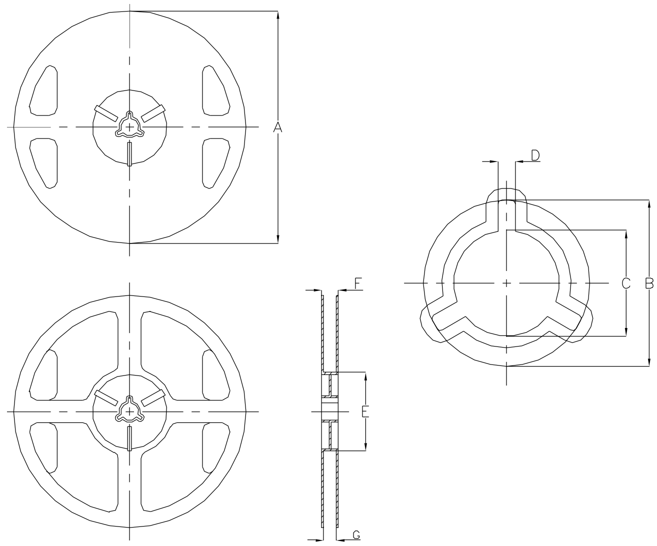

**For footprint and stencil design recommendations, please refer to application note AN-1154 at** http://www.irf.com/technical-info/appnotes/an-1154.pdf

# PQFN 5x6 Outline "E" Part Marking



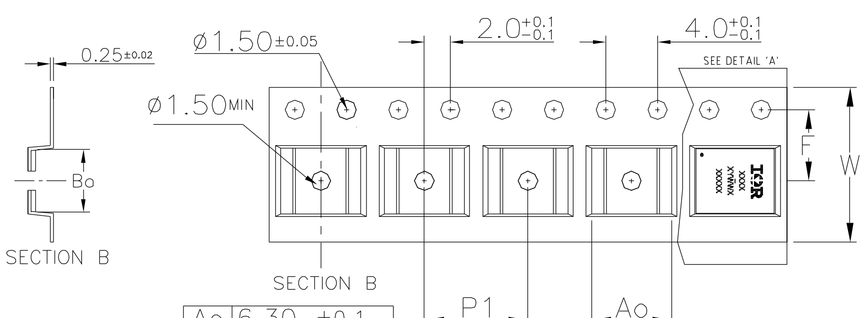

**Note: For the most current drawing please refer to IR website at:** http://www.irf.com/package/

## PQFN 5x6 Outline "E" Tape and Reel



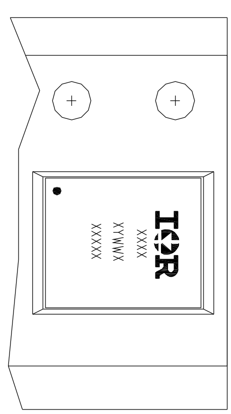

NOTE: Controlling dimensions in mm Std reel quantity is 4000 parts.

| 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 |




| | | |
|---|---|---|
| Ao | 6.30 | ±0.1 |
| Bo | 5.20 | ±0.1 |
| F | 5.50 | ±0.05 |
| P1 | 8.00 | ±0.1 |
| W | 12.00 | +0.3 -0.1 |

DETAIL 'A'



**Qualification information**†

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

†† 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.

**Notes:**

① Repetitive rating; pulse width limited by max. junction temperature.
② Starting $T_J$ = 25°C, L = 0.174mH, $R_G$ = 50Ω, $I_{AS}$ = 35A.
③ Pulse width ≤ 400µs; duty cycle ≤ 2%.
④ $R_\theta$ is measured at $T_J$ of approximately 90°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 Package is limited to 50A by die-source to lead-frame bonding technology

Data and specifications subject to change without notice.

International
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