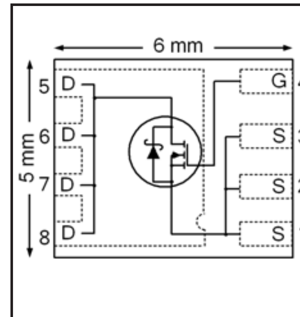
International
IOR Rectifier

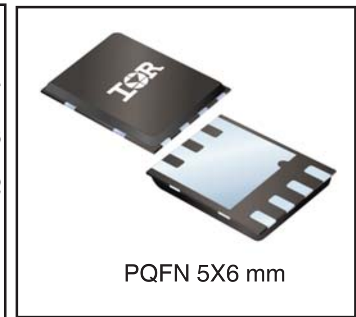


# IRFH5250DPbF

HEXFET® Power MOSFET

| | | |
|---|---|---|
| $V_{DS}$ | 25 | V |
| $R_{DS(on)}$ max (@$V_{GS}$ = 10V) | 1.4 | mΩ |
| $V_{SD}$ max (@$I_S$ = 5.0A) | 0.6 | V |
| $t_{rr}$ (typical) | 27 | ns |
| $I_D$ (@$T_{c(Bottom)}$ = 25°C) | 100 ⑥ | A |



PQFN 5X6 mm

## Applications

- Synchronous MOSFET for high frequency buck converters

### Features and Benefits

| Features | | Benefits |
|---|---|---|
| Low RDSon (<1.4mΩ) | | Lower Conduction Losses |
| Schottky Intrinsic Diode with Low Forward Voltage | | Lower Switching Losses |
| Low Thermal Resistance to PCB (<0.5°C/W) | | Enable better thermal dissipation |
| 100% Rg tested | | Increased Reliability |
| 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 | |
| IRFH5250DTRPBF | PQFN 5mm x 6mm | Tape and Reel | 4000 | |
| IRFH5250DTR2PBF | PQFN 5mm x 6mm | Tape and Reel | 400 | |

## Absolute Maximum Ratings

| | Parameter | Max. | Units |
|---|---|---|---|
| $V_{DS}$ | Drain-to-Source Voltage | 25 | V |
| $V_{GS}$ | Gate-to-Source Voltage | ± 20 | |
| $I_D$ @ $T_A$ = 25°C | Continuous Drain Current, $V_{GS}$ @ 10V | 40 | A |
| $I_D$ @ $T_A$ = 70°C | Continuous Drain Current, $V_{GS}$ @ 10V | 32 | |
| $I_D$ @ $T_{C(Bottom)}$ = 25°C | Continuous Drain Current, $V_{GS}$ @ 10V ⑥ | 100 | |
| $I_D$ @ $T_{C(Bottom)}$ = 100°C | Continuous Drain Current, $V_{GS}$ @ 10V ⑥ | 100 | |
| $I_{DM}$ | Pulsed Drain Current ① | 400 | |
| $P_D$ @$T_A$ = 25°C | Power Dissipation ⑤ | 3.6 | W |
| $P_D$ @$T_{C(Bottom)}$ = 25°C | Power Dissipation ⑤ | 250 | |
| | 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 ⑥ are on page 8





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

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-to-Source Breakdown Voltage | 25 | —— | —— | V | $V_{GS}$ = 0V, $I_D$ = 1.0mA |
| $\Delta BV_{DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient | —— | -8.0 | —— | mV/°C | Reference to 25°C, $I_D$ = 10mA |
| $R_{DS(on)}$ | Static Drain-to-Source On-Resistance | —— | 1.0 | 1.4 | mΩ | $V_{GS}$ = 10V, $I_D$ = 50A ③ |
| | | —— | 1.7 | 2.2 | | $V_{GS}$ = 4.5V, $I_D$ = 50A ③ |
| $V_{GS(th)}$ | Gate Threshold Voltage | 1.35 | 1.80 | 2.35 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = 150μA |
| $\Delta V_{GS(th)}$ | Gate Threshold Voltage Coefficient | —— | -11 | —— | mV/°C | |
| $I_{DSS}$ | Drain-to-Source Leakage Current | —— | —— | 500 | μA | $V_{DS}$ = 20V, $V_{GS}$ = 0V |
| | | —— | —— | 5.0 | mA | $V_{DS}$ = 20V, $V_{GS}$ = 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 | 120 | —— | —— | S | $V_{DS}$ = 13V, $I_D$ = 50A |
| $Q_g$ | Total Gate Charge | —— | 83 | —— | nC | $V_{GS}$ = 10V, $V_{DS}$ = 13V, $I_D$ = 50A |
| $Q_g$ | Total Gate Charge | —— | 39 | 59 | nC | |
| $Q_{gs1}$ | Pre-Vth Gate-to-Source Charge | —— | 11 | —— | | $V_{DS}$ = 13V |
| $Q_{gs2}$ | Post-Vth Gate-to-Source Charge | —— | 6.1 | —— | | $V_{GS}$ = 4.5V |
| $Q_{gd}$ | Gate-to-Drain Charge | —— | 12 | —— | | $I_D$ = 50A |
| $Q_{godr}$ | Gate Charge Overdrive | —— | 9.9 | —— | | |
| $Q_{sw}$ | Switch Charge ($Q_{gs2}$ + $Q_{gd}$) | —— | 18.1 | —— | | |
| $Q_{oss}$ | Output Charge | —— | 36 | —— | nC | $V_{DS}$ = 16V, $V_{GS}$ = 0V |
| $R_G$ | Gate Resistance | —— | 1.4 | —— | Ω | |
| $t_{d(on)}$ | Turn-On Delay Time | —— | 23 | —— | ns | $V_{DD}$ = 13V, $V_{GS}$ = 4.5V |
| $t_r$ | Rise Time | —— | 72 | —— | | $I_D$ = 50A |
| $t_{d(off)}$ | Turn-Off Delay Time | —— | 23 | —— | | $R_G$=1.8Ω |
| $t_f$ | Fall Time | —— | 24 | —— | | |
| $C_{iss}$ | Input Capacitance | —— | 6115 | —— | pF | $V_{GS}$ = 0V |
| $C_{oss}$ | Output Capacitance | —— | 1730 | —— | | $V_{DS}$ = 13V |
| $C_{rss}$ | Reverse Transfer Capacitance | —— | 610 | —— | | $f$ = 1.0MHz |

## Avalanche Characteristics

| | Parameter | Typ. | Max. | Units |
|---|---|---|---|---|
| $E_{AS}$ | Single Pulse Avalanche Energy ② | —— | 470 | mJ |
| $I_{AR}$ | Avalanche Current ① | —— | 50 | A |

## Diode Characteristics

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current (Body Diode) | —— | —— | 100 | A | MOSFET symbol showing the integral reverse p-n junction diode. |
| $I_{SM}$ | Pulsed Source Current (Body Diode) ① | —— | —— | 400 | | |
| $V_{SD}$ | Diode Forward Voltage | —— | —— | 0.6 | V | $T_J$ = 25°C, $I_S$ = 5.0A, $V_{GS}$ = 0V ③ |
| $V_{SD}$ | Diode Forward Voltage | —— | —— | 1.0 | V | $T_J$ = 25°C, $I_S$ = 50A, $V_{GS}$ = 0V ③ |
| $t_{rr}$ | Reverse Recovery Time | —— | 27 | 41 | ns | $T_J$ = 25°C, $I_F$ = 50A, $V_{DD}$ = 13V |
| $Q_{rr}$ | Reverse Recovery Charge | —— | 51 | 77 | nC | di/dt = 335A/μs ③ |
| $t_{on}$ | Forward Turn-On Time | Time is dominated by parasitic Inductance | | | | |

## Thermal Resistance

| | Parameter | Typ. | Max. | Units |
|---|---|---|---|---|
| $R_{\theta JC}$ (Bottom) | Junction-to-Case ④ | —— | 0.5 | °C/W |
| $R_{\theta JC}$ (Top) | Junction-to-Case ④ | —— | 15 | |
| $R_{\theta JA}$ | Junction-to-Ambient ⑤ | —— | 35 | |
| $R_{\theta JA}$ (<10s) | Junction-to-Ambient ⑤ | —— | 22 | |



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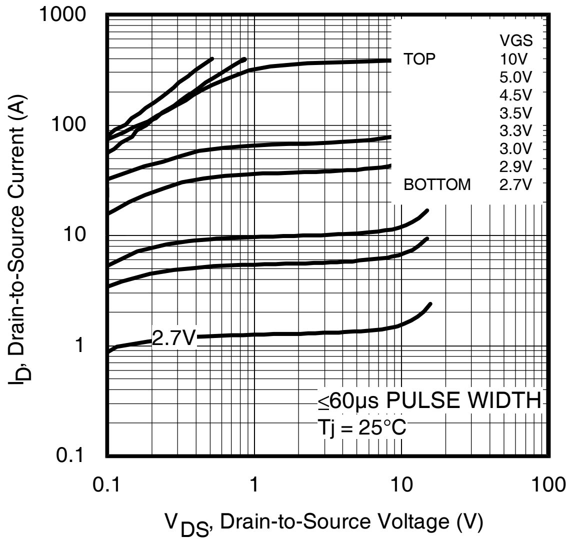


**Fig 1.** Typical Output Characteristics

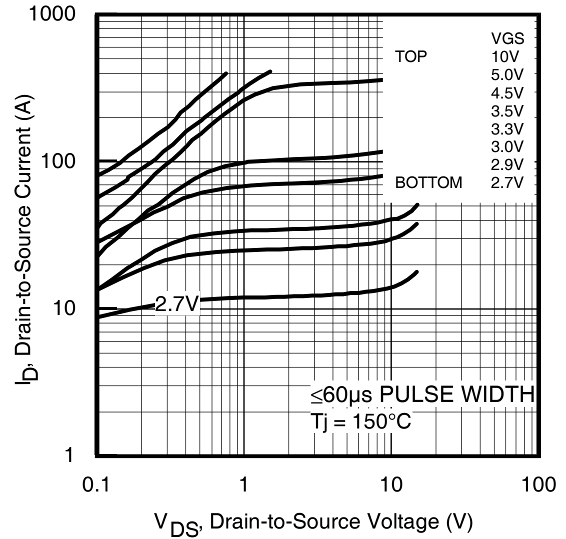


**Fig 2.** Typical Output Characteristics

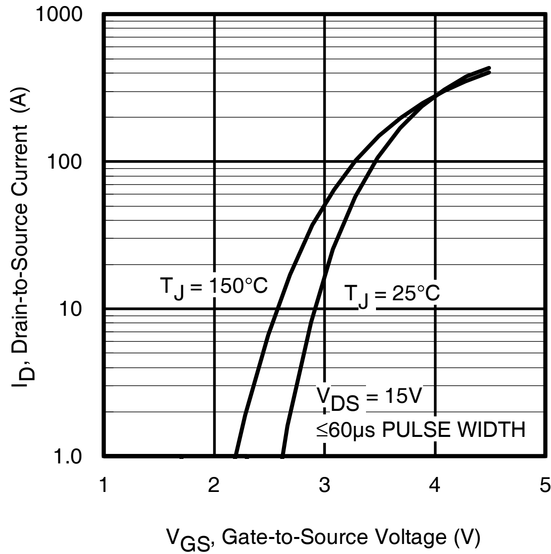


**Fig 3.** Typical Transfer Characteristics

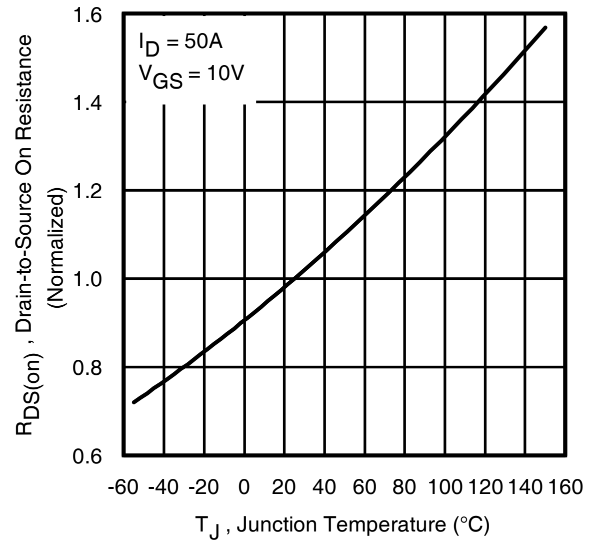


**Fig 4.** Normalized On-Resistance vs. Temperature

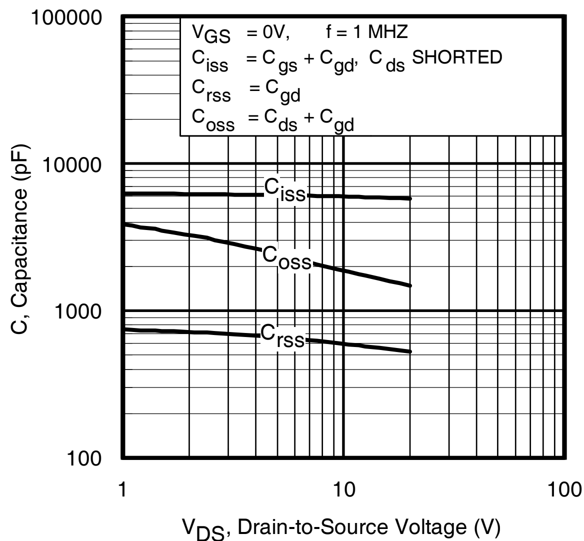


**Fig 5.** Typical Capacitance vs.Drain-to-Source Voltage

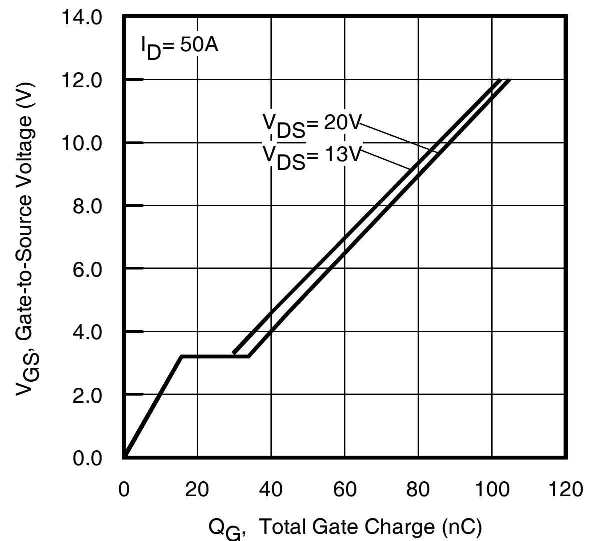


**Fig 6.** Typical Gate Charge vs.Gate-to-Source Voltage



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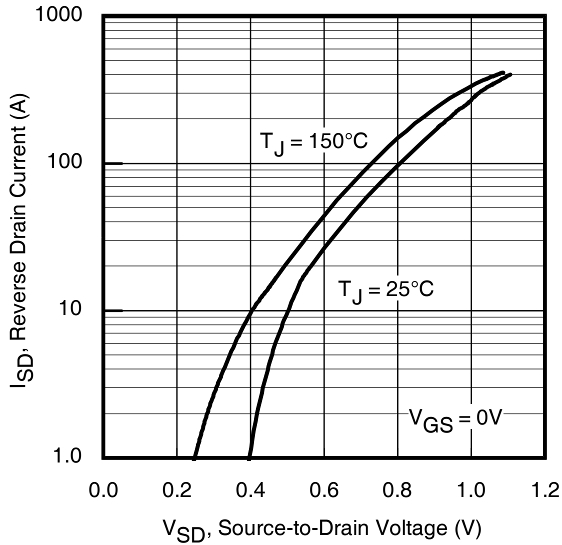


**Fig 7.** Typical Source-Drain Diode Forward Voltage

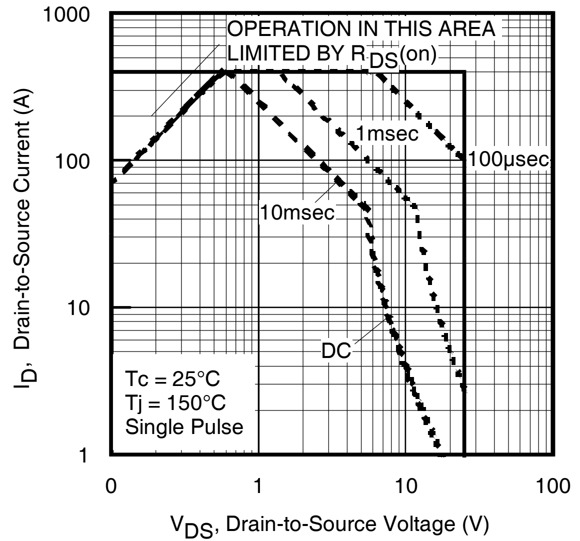


**Fig 8.** Maximum Safe Operating Area

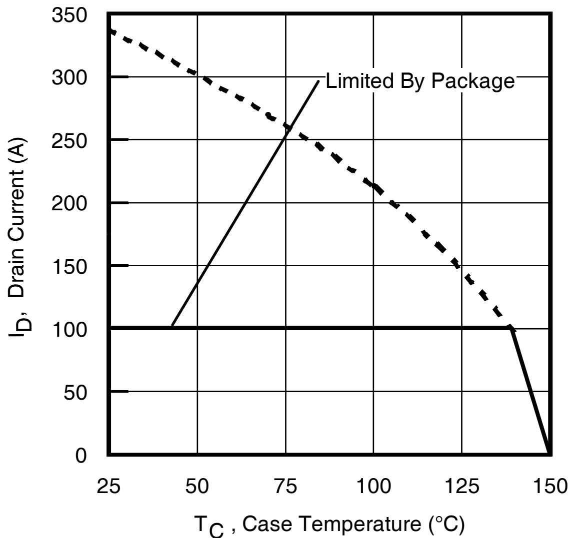


**Fig 9.** Maximum Drain Current vs. Case (Bottom) Temperature

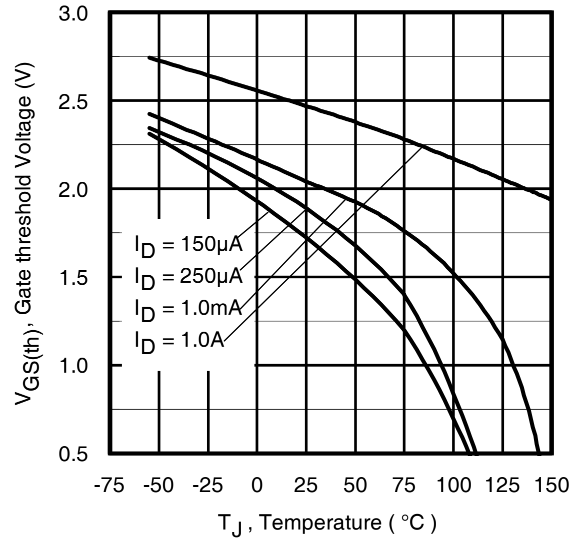


**Fig 10.** Threshold Voltage vs. Temperature

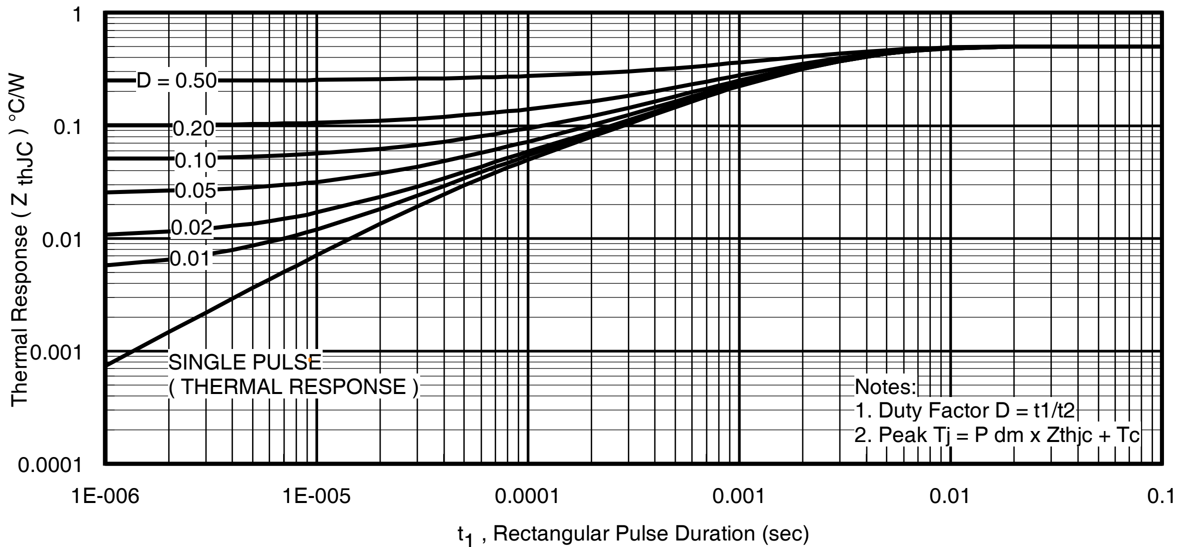


**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case (Bottom)



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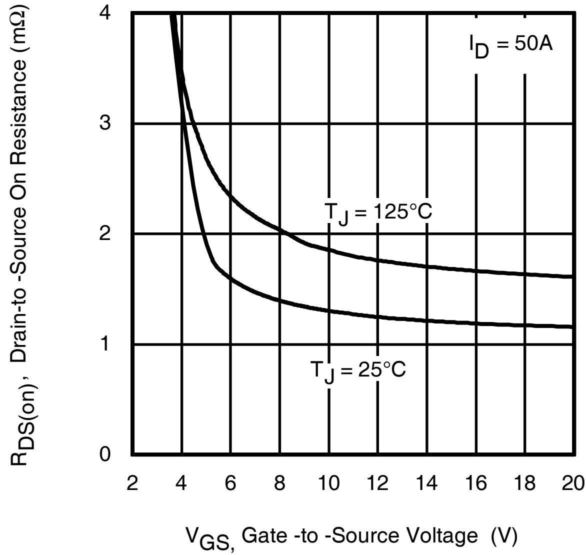


**Fig 12.** On-Resistance vs. Gate Voltage

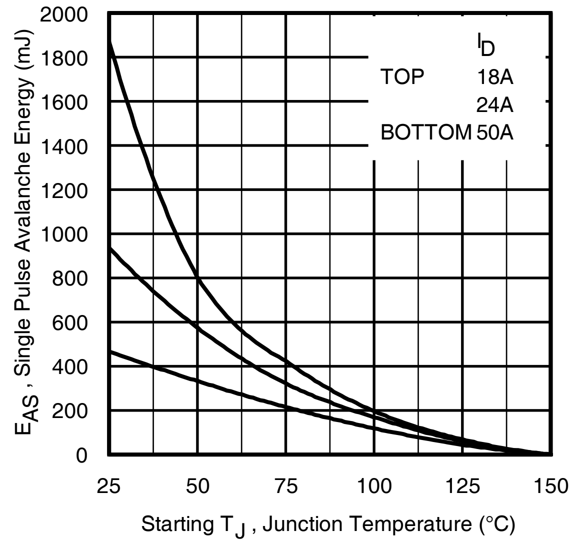


**Fig 13.** Maximum Avalanche Energy vs. Drain Current

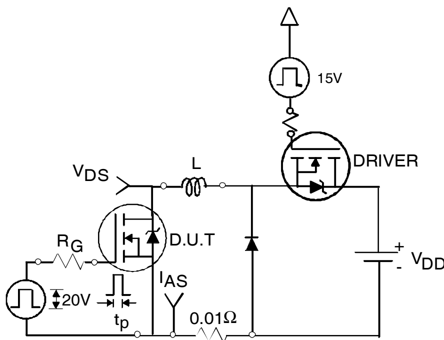


**Fig 14a.** Unclamped Inductive Test Circuit

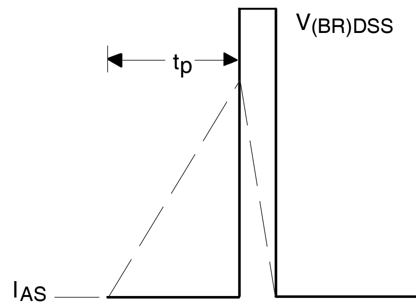


**Fig 14b.** Unclamped Inductive Waveforms

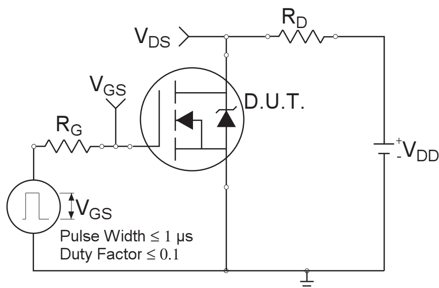


**Fig 15a.** Switching Time Test Circuit

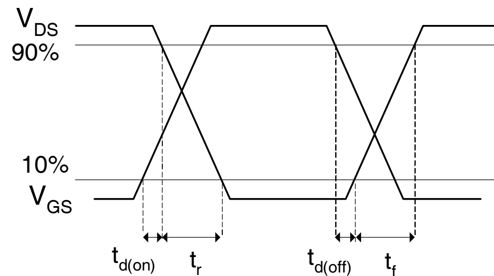


**Fig 15b.** Switching Time Waveforms



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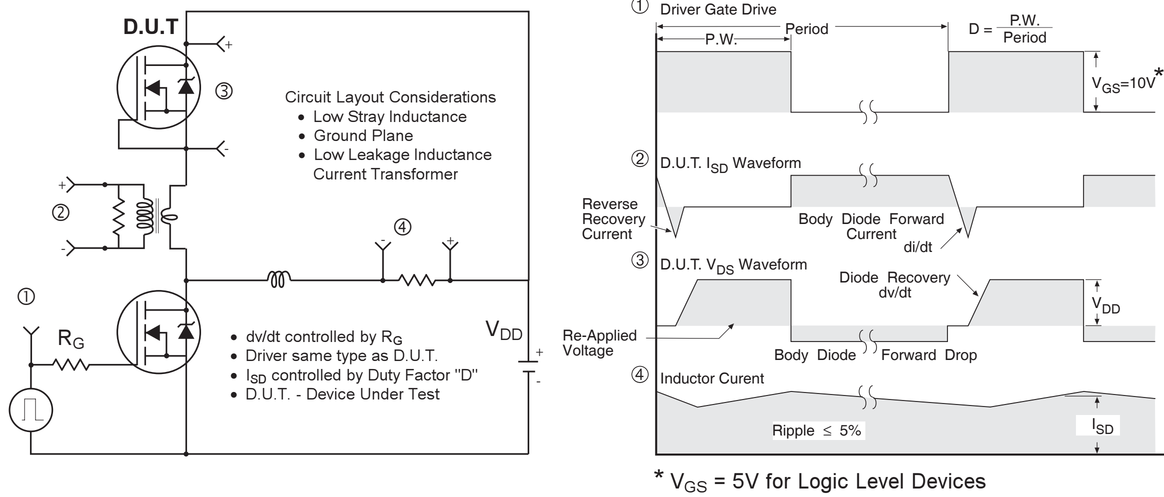


**Fig 16.** Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs

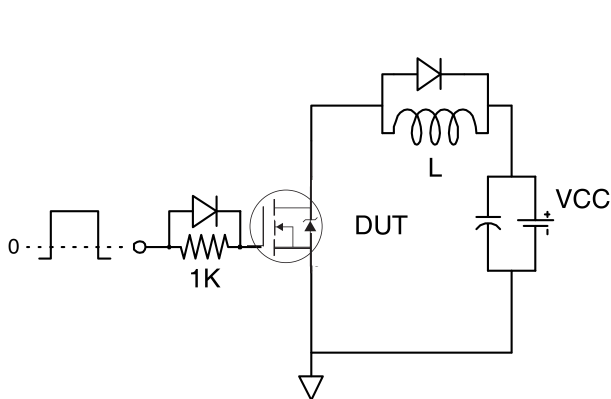


**Fig 17.** Gate Charge Test Circuit

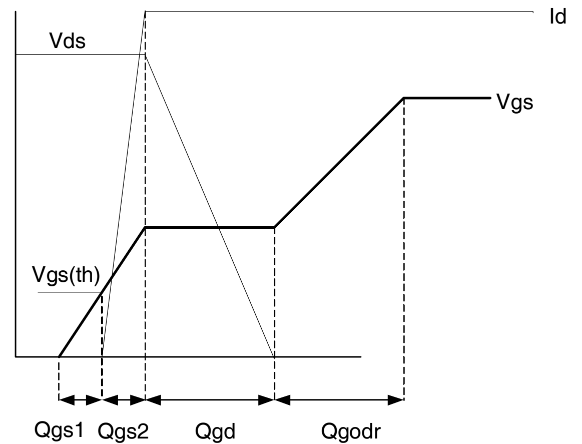


**Fig 18.** Gate Charge Waveform



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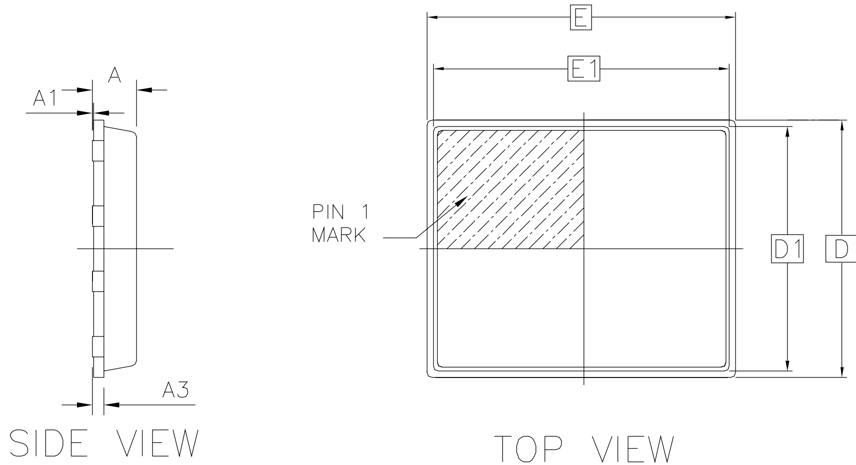
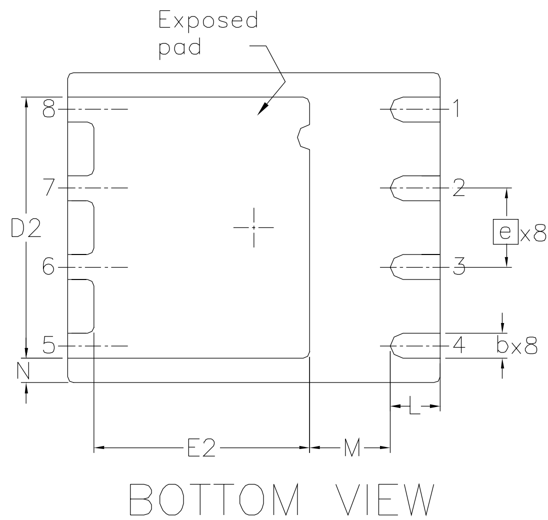
## PQFN 5x6 Outline "B" Package Details

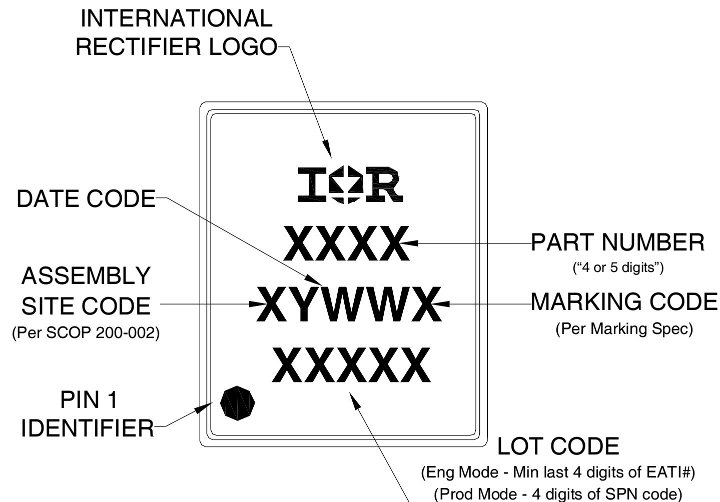



| OUTLINE PQFN 5x6B | | | |
|---|---|---|---|
| SYMBOL / DIM | MIN | NOM | MAX |
| A | 0.80 | 0.83 | 0.90 |
| A1 | 0 | 0.020 | 0.05 |
| A3 | | 0.20 REF | |
| b | 0.35 | 0.40 | 0.47 |
| D | | 5.00 BSC | |
| D1 | | 4.75 BSC | |
| D2 | 4.10 | 4.21 | 4.30 |
| e | | 1.27 BSC | |
| E | | 6.00 BSC | |
| E1 | | 5.75 BSC | |
| E2 | 3.38 | 3.48 | 3.58 |
| L | 0.70 | 0.80 | 0.90 |
| M | | 1.30 REF | |
| N | | 0.40 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 "B" Part Marking




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



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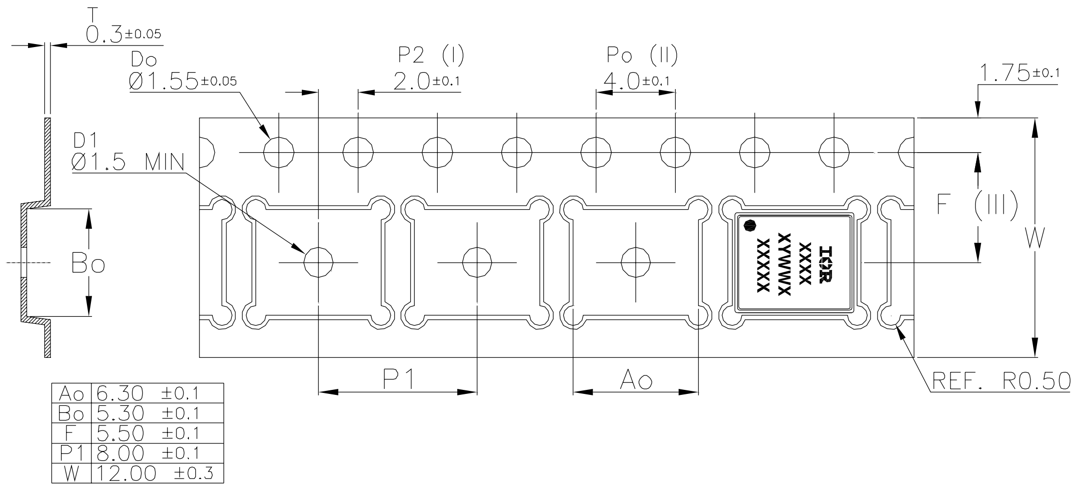
## PQFN 5x6 Outline "B" Tape and Reel




### 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 = 0.37mH, $R_G$ = 25Ω, $I_{AS}$ = 50A.
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. Package is limited to 100A by production test capability.

### Revision History

| Date | Comment |
|---|---|
| 3/26/2010 | Idss limits at Tj 25°C is changed to 500µA max and at Tj 125°C it is changed to 5.0mA max. All other parameters remain unchanged. |
| | |

Data and specifications subject to change without notice.

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