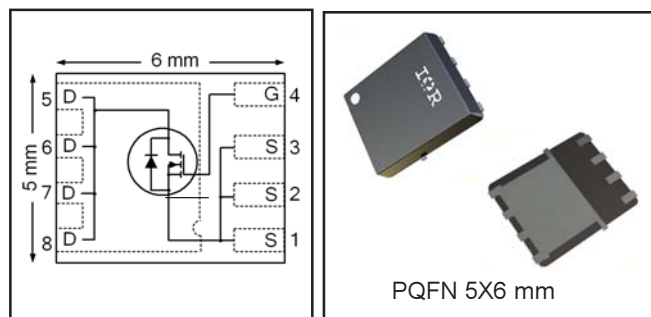


HEXFET® Power MOSFET

|                                            |             |           |
|--------------------------------------------|-------------|-----------|
| $V_{DS}$                                   | <b>30</b>   | <b>V</b>  |
| $V_{GS\ max}$                              | <b>± 20</b> | <b>V</b>  |
| $R_{DS(on)\ max}$<br>(@ $V_{GS} = 10V$ )   | <b>2.95</b> | <b>mΩ</b> |
| (@ $V_{GS} = 4.5V$ )                       | <b>4.30</b> |           |
| $Q_g\ typ$                                 | <b>30.0</b> | <b>nC</b> |
| $I_D$<br>(@ $T_{c(Bottom)} = 25^\circ C$ ) | <b>50</b> ⑦ | <b>A</b>  |



**Applications**

- Synchronous MOSFET for high frequency buck converters

**Features and Benefits**

**Features**

|                                                              |
|--------------------------------------------------------------|
| Low Thermal Resistance to PCB (< 1.7°C/W)                    |
| Low Profile (<1.2mm)                                         |
| Industry-Standard Pinout                                     |
| Compatible with Existing Surface Mount Techniques            |
| RoHS Compliant Containing no Lead, no Bromide and no Halogen |
| MSL1, Consumer Qualification                                 |

results in  
⇒

**Benefits**

|                                   |
|-----------------------------------|
| Enable better thermal dissipation |
| Increased Power Density           |
| Multi-Vendor Compatibility        |
| Easier Manufacturing              |
| Environmentally Friendlier        |
| Increased Reliability             |

| Orderable part number | Package Type   | Standard Pack |          | Note             |
|-----------------------|----------------|---------------|----------|------------------|
|                       |                | Form          | Quantity |                  |
| IRFH8316TRPBF         | PQFN 5mm x 6mm | Tape and Reel | 4000     |                  |
| IRFH8316TR2PBF        | PQFN 5mm x 6mm | Tape and Reel | 400      | EOL notice # 259 |

**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                   | 27           | A     |
| $I_D$ @ $T_A = 70^\circ C$            | Continuous Drain Current, $V_{GS}$ @ 10V                   | 21           |       |
| $I_D$ @ $T_{c(Bottom)} = 25^\circ C$  | Continuous Drain Current, $V_{GS}$ @ 10V                   | 120 ⑥ ⑦      |       |
| $I_D$ @ $T_{c(Bottom)} = 100^\circ C$ | Continuous Drain Current, $V_{GS}$ @ 10V                   | 78 ⑥ ⑦       |       |
| $I_D$ @ $T_C = 25^\circ C$            | Continuous Drain Current, $V_{GS}$ @ 10V (Package Limited) | 50 ⑦         |       |
| $I_{DM}$                              | Pulsed Drain Current ①                                     | 490          |       |
| $P_D$ @ $T_A = 25^\circ C$            | Power Dissipation ⑤                                        | 3.6          | W     |
| $P_D$ @ $T_{c(Bottom)} = 25^\circ C$  | Power Dissipation ⑤                                        | 59           |       |
|                                       | 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

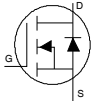
**Static @  $T_J = 25^\circ\text{C}$  (unless otherwise specified)**

|                              | 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        | —    | 21   | —    | mV/ $^\circ\text{C}$ | Reference to $25^\circ\text{C}$ , $I_D = 1.0\text{mA}$            |
| $R_{DS(on)}$                 | Static Drain-to-Source On-Resistance       | —    | 2.40 | 2.95 | m $\Omega$           | $V_{GS} = 10V, I_D = 20A$ ③                                       |
|                              |                                            | —    | 3.40 | 4.30 |                      | $V_{GS} = 4.5V, I_D = 16A$ ③                                      |
| $V_{GS(th)}$                 | Gate Threshold Voltage                     | 1.2  | 1.7  | 2.2  | V                    | $V_{DS} = V_{GS}, I_D = 50\mu A$                                  |
| $\Delta V_{GS(th)}$          | Gate Threshold Voltage Coefficient         | —    | -6.4 | —    | mV/ $^\circ\text{C}$ |                                                                   |
| $I_{DSS}$                    | Drain-to-Source Leakage Current            | —    | —    | 1    | $\mu A$              | $V_{DS} = 24V, V_{GS} = 0V$                                       |
|                              |                                            | —    | —    | 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                   | 69   | —    | —    | S                    | $V_{DS} = 10V, I_D = 20A$                                         |
| $Q_g$                        | Total Gate Charge                          | —    | 59   | —    | nC                   | $V_{GS} = 10V, V_{DS} = 15V, I_D = 20A$                           |
| $Q_g$                        | Total Gate Charge                          | —    | 30.0 | 45.0 | nC                   | $V_{DS} = 15V$<br>$V_{GS} = 4.5V$<br>$I_D = 20A$                  |
| $Q_{gs1}$                    | Pre-V <sub>th</sub> Gate-to-Source Charge  | —    | 7.0  | —    |                      |                                                                   |
| $Q_{gs2}$                    | Post-V <sub>th</sub> Gate-to-Source Charge | —    | 2.7  | —    |                      |                                                                   |
| $Q_{gd}$                     | Gate-to-Drain Charge                       | —    | 9.7  | —    |                      |                                                                   |
| $Q_{godr}$                   | Gate Charge Overdrive                      | —    | 10.6 | —    |                      |                                                                   |
| $Q_{sw}$                     | Switch Charge ( $Q_{gs2} + Q_{gd}$ )       | —    | 12.4 | —    |                      |                                                                   |
| $Q_{oss}$                    | Output Charge                              | —    | 18   | —    | nC                   | $V_{DS} = 16V, V_{GS} = 0V$                                       |
| $R_G$                        | Gate Resistance                            | —    | 1.1  | 1.7  | $\Omega$             |                                                                   |
| $t_{d(on)}$                  | Turn-On Delay Time                         | —    | 19   | —    | ns                   | $V_{DD} = 15V, V_{GS} = 4.5V$<br>$I_D = 20A$<br>$R_G = 1.8\Omega$ |
| $t_r$                        | Rise Time                                  | —    | 67   | —    |                      |                                                                   |
| $t_{d(off)}$                 | Turn-Off Delay Time                        | —    | 20   | —    |                      |                                                                   |
| $t_f$                        | Fall Time                                  | —    | 24   | —    |                      |                                                                   |
| $C_{iss}$                    | Input Capacitance                          | —    | 3610 | —    | pF                   | $V_{GS} = 0V$<br>$V_{DS} = 10V$<br>$f = 1.0\text{MHz}$            |
| $C_{oss}$                    | Output Capacitance                         | —    | 740  | —    |                      |                                                                   |
| $C_{rss}$                    | Reverse Transfer Capacitance               | —    | 390  | —    |                      |                                                                   |

**Avalanche Characteristics**

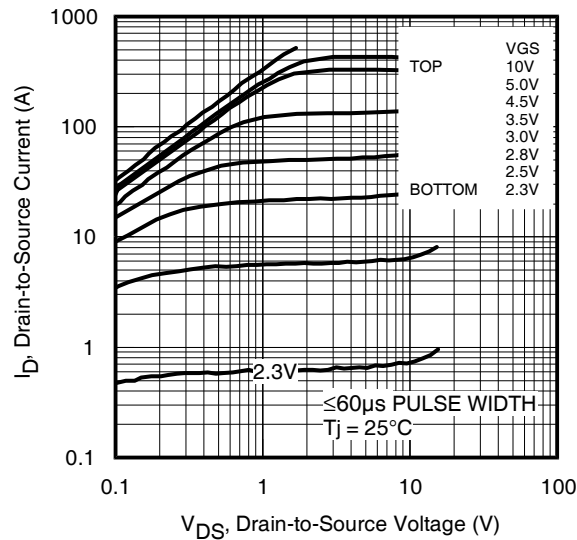
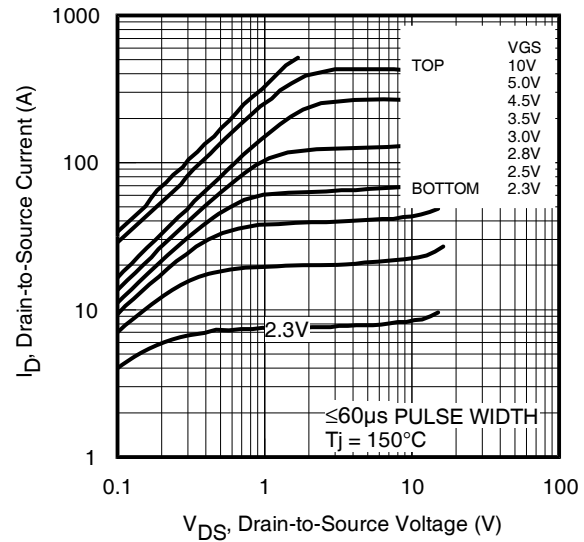
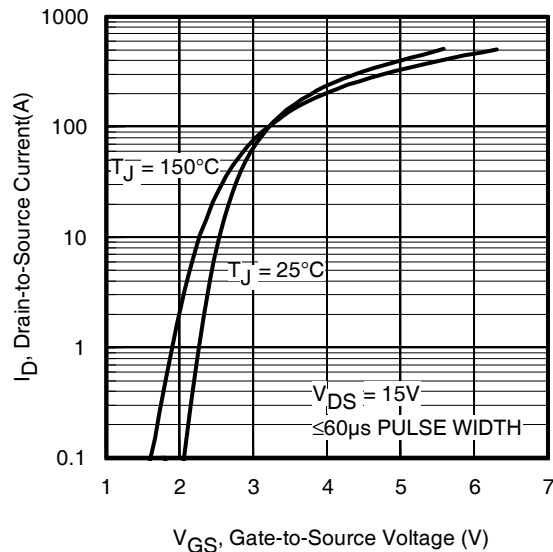
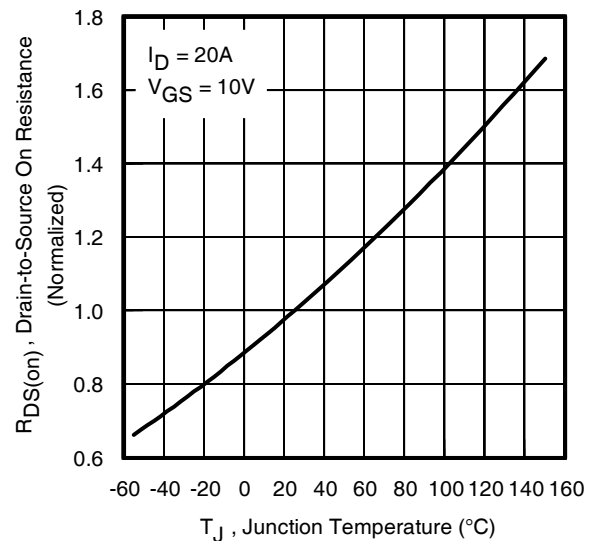
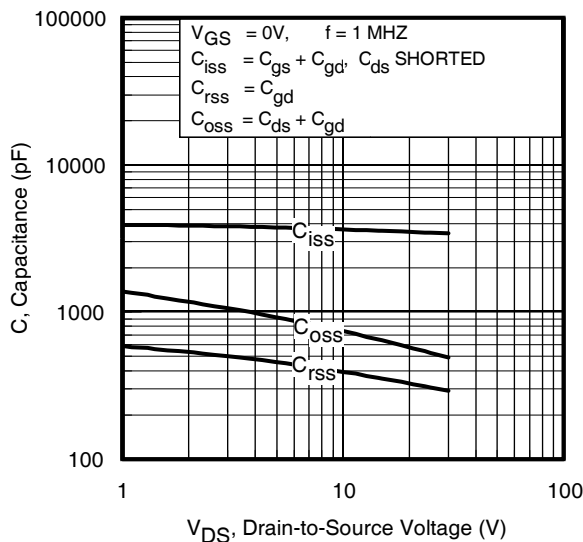
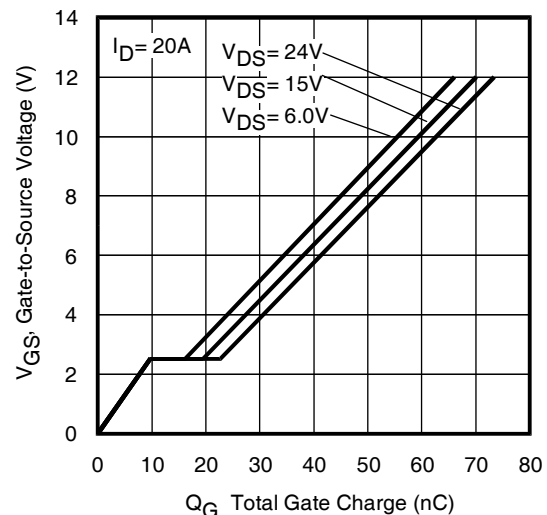
|          | Parameter                       | Typ. | Max. | Units |
|----------|---------------------------------|------|------|-------|
| $E_{AS}$ | Single Pulse Avalanche Energy ② | —    | 160  | mJ    |
| $I_{AR}$ | Avalanche Current ①             | —    | 20   | A     |

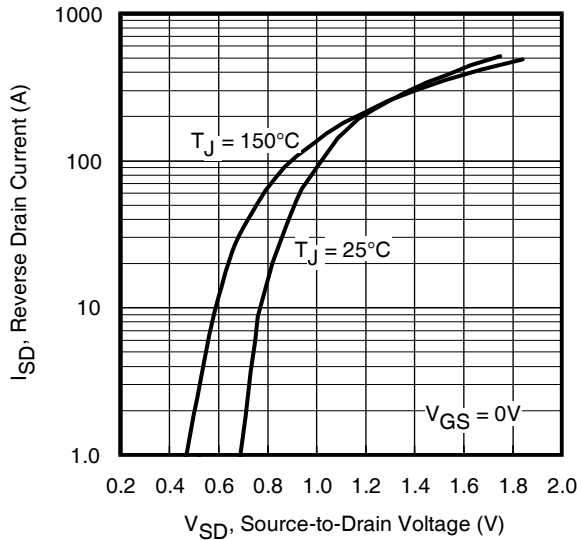
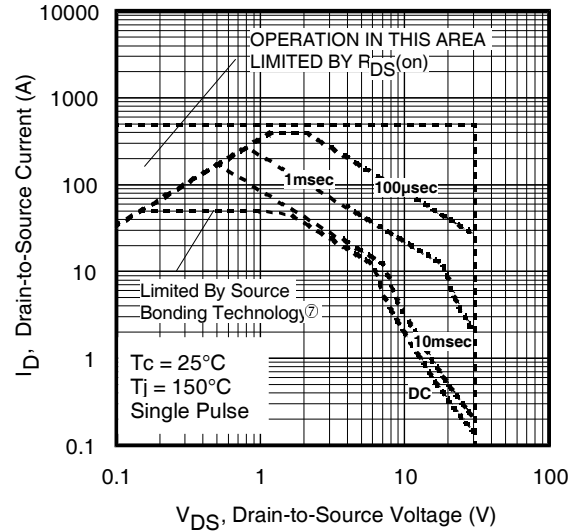
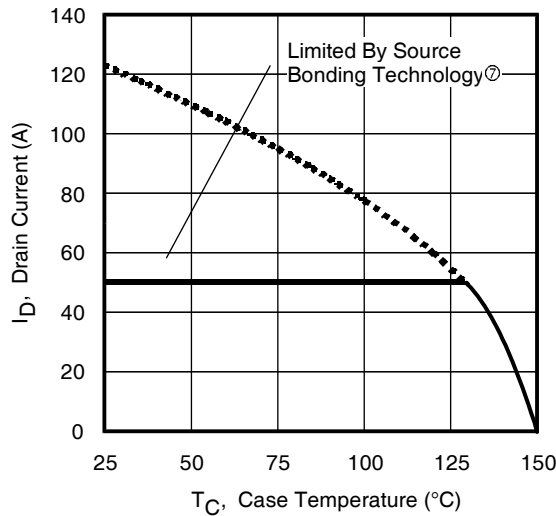
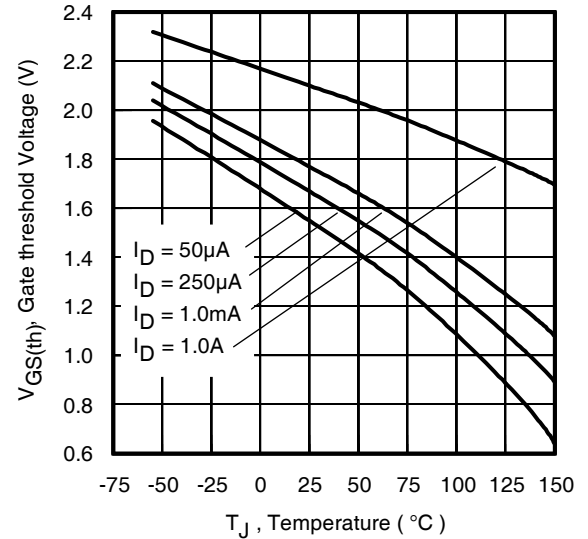
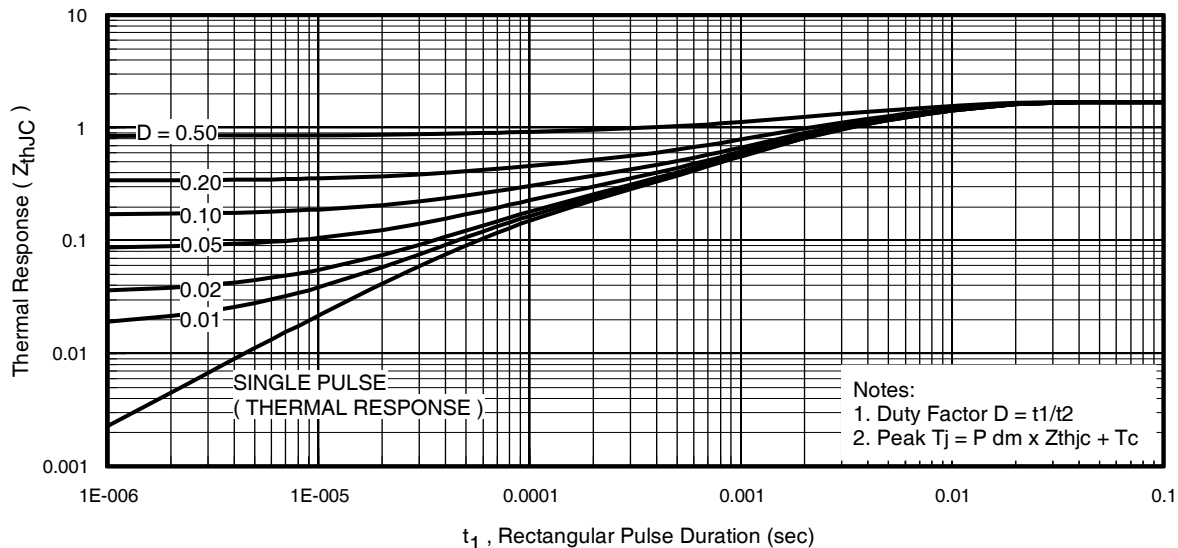
**Diode Characteristics**

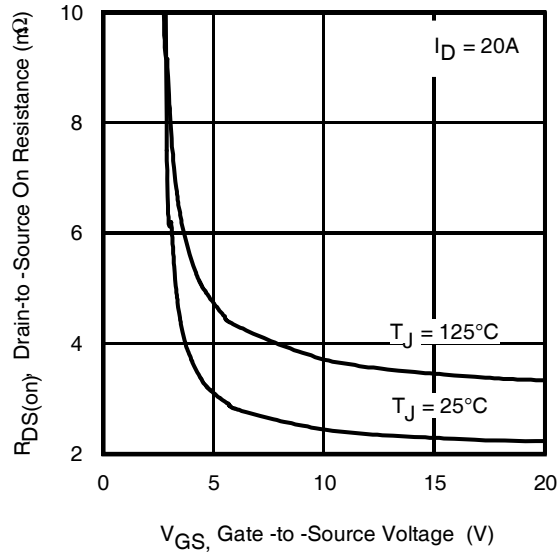
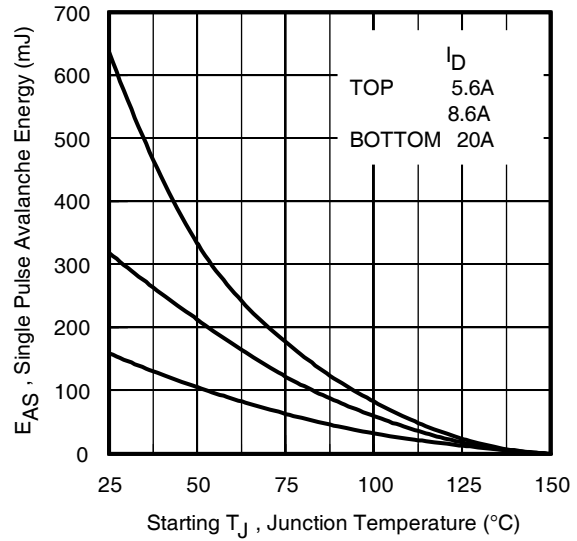
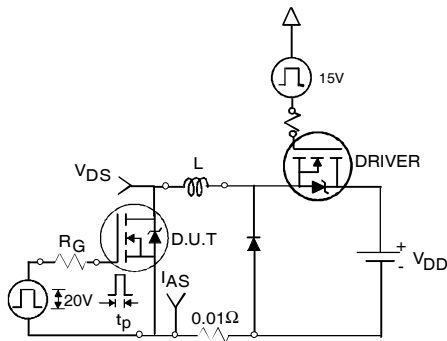
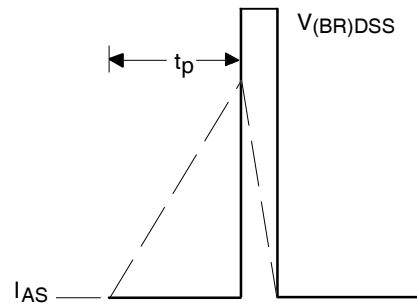
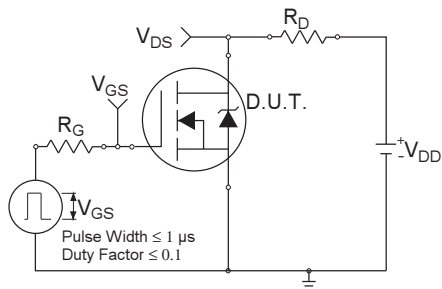
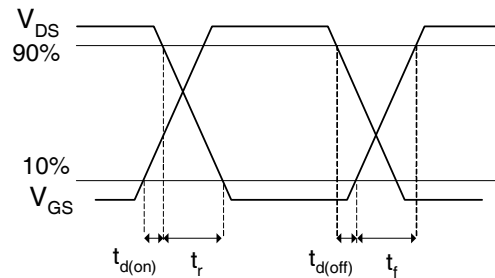
|          | Parameter                              | Min.                                      | Typ. | Max. | Units | Conditions                                                                                                                                           |
|----------|----------------------------------------|-------------------------------------------|------|------|-------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| $I_S$    | Continuous Source Current (Body Diode) | —                                         | —    | 50 ② | A     | MOSFET symbol showing the integral reverse p-n junction diode.  |
| $I_{SM}$ | Pulsed Source Current (Body Diode) ①   | —                                         | —    | 490  |       |                                                                                                                                                      |
| $V_{SD}$ | Diode Forward Voltage                  | —                                         | —    | 1.0  | V     | $T_J = 25^\circ\text{C}, I_S = 20A, V_{GS} = 0V$ ③                                                                                                   |
| $t_{rr}$ | Reverse Recovery Time                  | —                                         | 14   | 21   | ns    | $T_J = 25^\circ\text{C}, I_F = 20A, V_{DD} = 15V$                                                                                                    |
| $Q_{rr}$ | Reverse Recovery Charge                | —                                         | 18   | 27   | nC    | $di/dt = 380A/\mu s$ 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    | —    | 1.7  | $^\circ\text{C/W}$ |
| $R_{\theta JC}$ (Top)    | Junction-to-Case ④    | —    | 32   |                    |
| $R_{\theta JA}$          | Junction-to-Ambient ⑤ | —    | 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

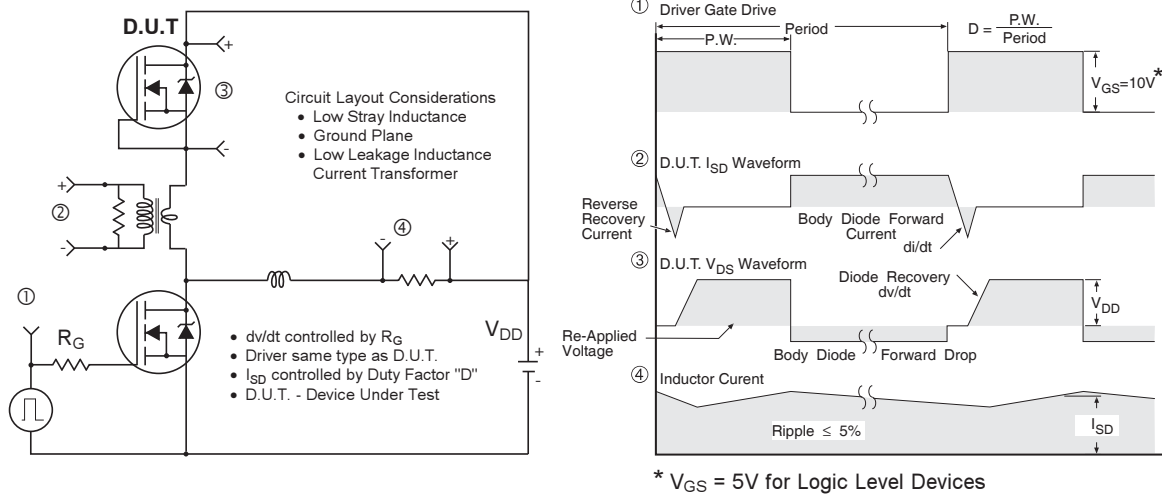


**Fig 16.** Peak Diode Recovery  $dv/dt$  Test Circuit for N-Channel HEXFET® Power MOSFETs

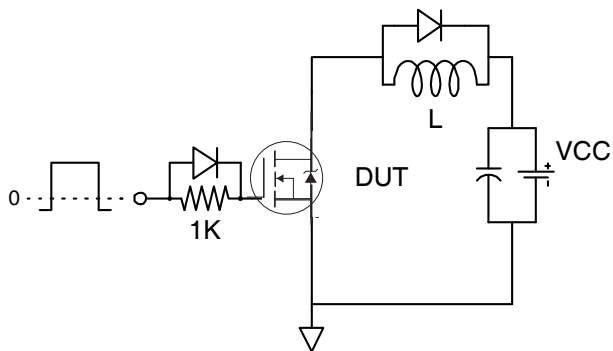


**Fig 17.** Gate Charge Test Circuit

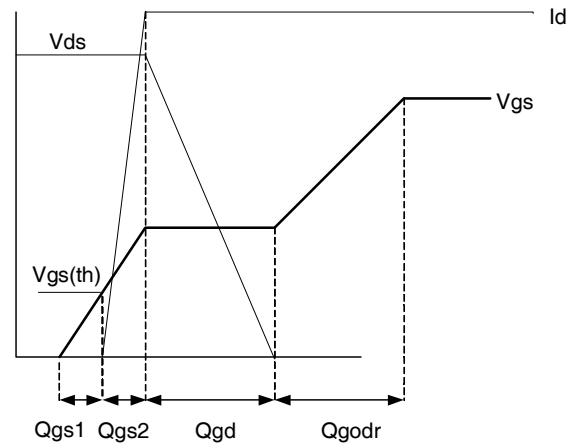
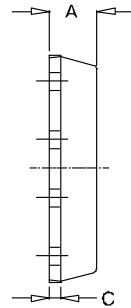
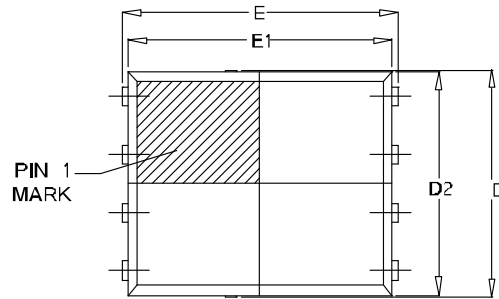


**Fig 18.** Gate Charge Waveform

## PQFN 5x6 Outline "E" Package Details

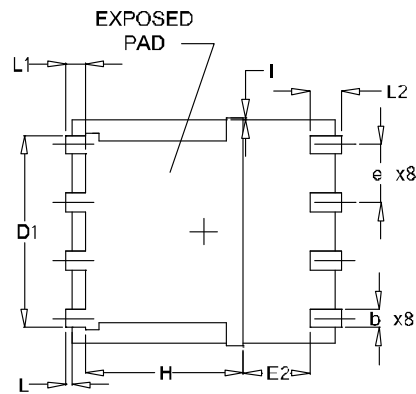


SIDEVIEW



TOP VIEW

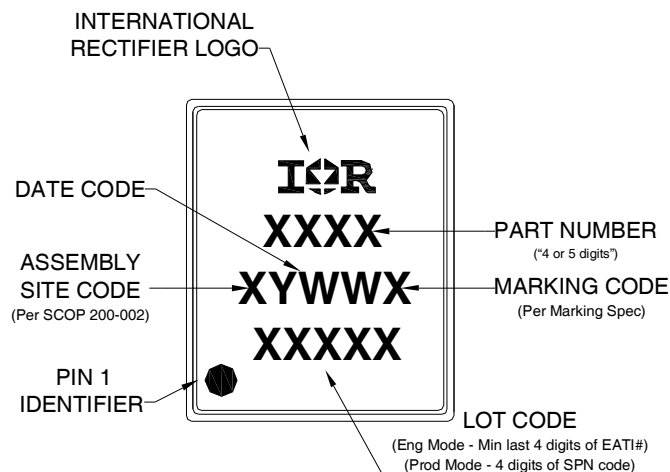
| SYMBOL | OUTLINE PQFN 5X6E |      |      |
|--------|-------------------|------|------|
|        | MIN.              | NOM  | MAX. |
| A      | 0.90              | 1.03 | 1.17 |
| b      | 0.33              | 0.41 | 0.48 |
| C      | 0.20              | 0.25 | 0.35 |
| D      | 4.80              | 4.98 | 5.15 |
| D1     | 3.91              | 4.11 | 4.31 |
| D2     | 4.80              | 4.90 | 5.00 |
| E      | 5.90              | 6.02 | 6.15 |
| E1     | 5.65              | 5.75 | 5.85 |
| E2     | 1.10              | —    | —    |
| e      | 1.27 BSC          |      |      |
| L      | 0.05              | 0.15 | 0.25 |
| L1     | 0.38              | 0.44 | 0.50 |
| L2     | 0.51              | 0.68 | 0.86 |
| H      | 3.32              | 3.45 | 3.58 |
| I      | —                 | —    | 0.18 |



BOTTOM VIEW

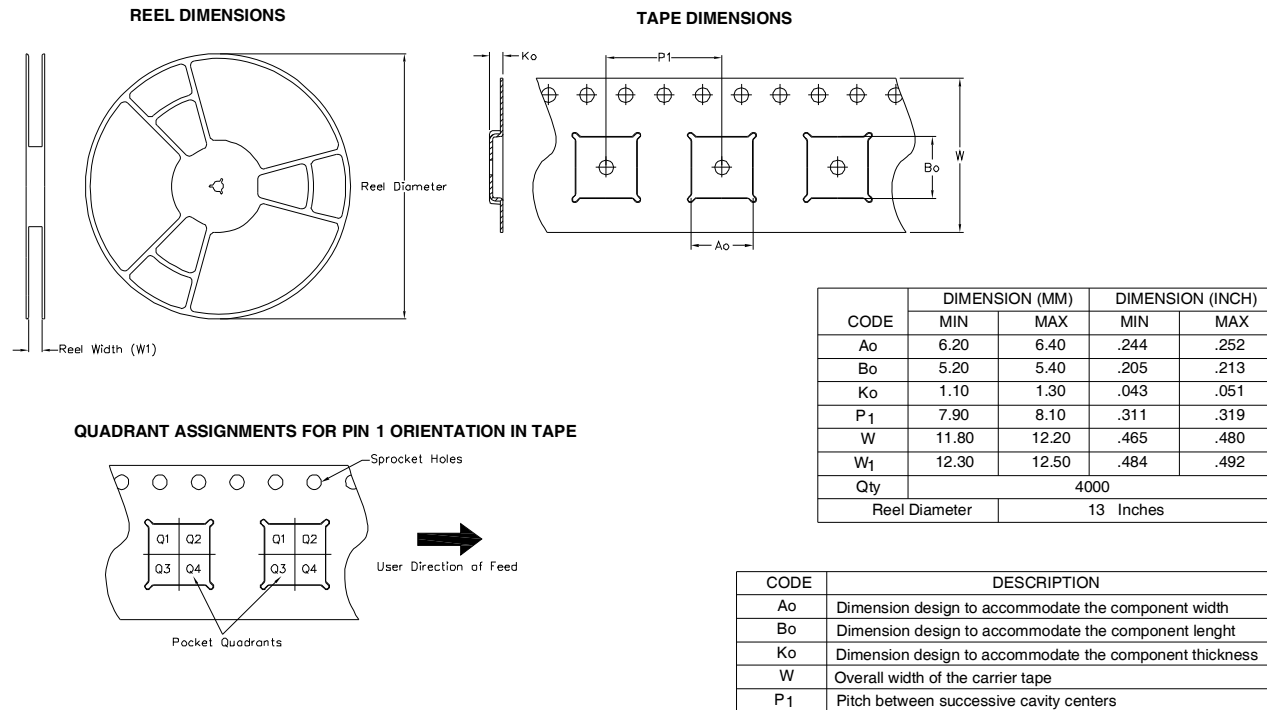
For footprint and stencil design recommendations, please refer to application note AN-1154 at <http://www.irf.com/technical-info/appnotes/an-1154.pdf>

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

**Qualification information<sup>†</sup>**

|                            |                                                                         |                                                |
|----------------------------|-------------------------------------------------------------------------|------------------------------------------------|
| Qualification level        | Consumer <sup>††</sup><br>(per JEDEC JESD47F <sup>†††</sup> guidelines) |                                                |
| Moisture Sensitivity Level | PQFN 5mm x 6mm                                                          | MSL1<br>(per JEDEC J-STD-020D <sup>†††</sup> ) |
| RoHS compliant             | Yes                                                                     |                                                |

<sup>†</sup> Qualification standards can be found at International Rectifier's web site

<http://www.irf.com/product-info/reliability>

<sup>††</sup> 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/>

<sup>†††</sup> Applicable version of JEDEC standard at the time of product release.

**Notes:**

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Starting  $T_J = 25^{\circ}\text{C}$ ,  $L = 0.796\text{mH}$ ,  $R_G = 50\Omega$ ,  $I_{AS} = 20\text{A}$ .
- ③ Pulse width  $\leq 400\mu\text{s}$ ; duty cycle  $\leq 2\%$ .
- ④  $R_{\theta}$  is measured at  $T_J$  of approximately  $90^{\circ}\text{C}$ .
- 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 Current is limited to 50A by source bonding technology.

**Revision History**

| Date      | Comment                                                                                                                                                                                                 |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5/13/2014 | <ul style="list-style-type: none"> <li>• Updated ordering information to reflect the End-Of-life (EOL) of the mini-reel option (EOL notice #259)</li> <li>• Updated Tape and Reel on page 8.</li> </ul> |

International  
 Rectifier

**IR WORLD HEADQUARTERS:** 101 N. Sepulveda Blvd., El Segundo, California 90245, USA  
 To contact International Rectifier, please visit <http://www.irf.com/whoto-call/>