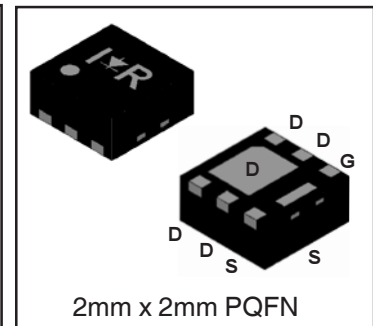
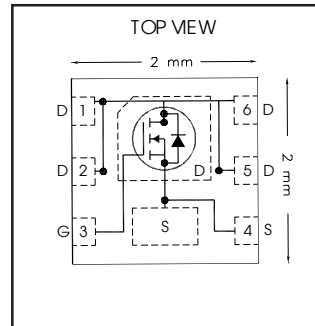


|  |             |           |
|--|-------------|-----------|
| $V_{DS}$                                 | <b>30</b>   | <b>V</b>  |
| $V_{GS}$                                 | <b>±12</b>  | <b>V</b>  |
| $R_{DS(on) max}$<br>(@ $V_{GS} = 4.5V$ ) | <b>15.5</b> | <b>mΩ</b> |
| $Q_g$ (typical)                          | <b>11</b>   | <b>nC</b> |
| $I_D$<br>(@ $T_{C(Bottom)} = 25°C$ )     | <b>12</b> Ⓣ | <b>A</b>  |



### Applications

- Charge and discharge switch for battery application
- System/Load Switch

### Features and Benefits

#### Features

|  |
|--|
| Low $R_{DS(on)}$ ( $\leq 15.5m\Omega$ )                      |
| Low Thermal Resistance to PCB ( $\leq 13°C/W$ )              |
| Low Profile ( $\leq 0.9$ mm)                                 |
| Compatible with Existing Surface Mount Techniques            |
| RoHS Compliant Containing no Lead, no Bromide and no Halogen |
| MSL1, Industrial Qualification                               |

results in

#### Resulting Benefits

|                                   |
|-----------------------------------|
| Lower Conduction Losses           |
| Enable better thermal dissipation |
| Increased Power Density           |
| Easier Manufacturing              |
| Environmentally Friendlier        |
| Increased Reliability             |

| Orderable part number | Package Type   | Standard Pack |          | Note             |
|-----------------------|----------------|---------------|----------|------------------|
|                       |                | Form          | Quantity |                  |
| IRLHS6342TRPbF        | PQFN 2mm x 2mm | Tape and Reel | 4000     |                  |
| IRLHS6342TR2PbF       | PQFN 2mm x 2mm | 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                                      | ±12          |       |
| $I_D @ T_A = 25°C$           | Continuous Drain Current, $V_{GS} @ 10V$                    | 8.7          | A     |
| $I_D @ T_A = 70°C$           | Continuous Drain Current, $V_{GS} @ 10V$                    | 6.9          |       |
| $I_D @ T_{C(Bottom)} = 25°C$ | Continuous Drain Current, $V_{GS} @ 10V$                    | 19Ⓣ          |       |
| $I_D @ T_{C(Bottom)} = 70°C$ | Continuous Drain Current, $V_{GS} @ 10V$                    | 15Ⓣ          |       |
| $I_D @ T_{C(Bottom)} = 25°C$ | Continuous Drain Current, $V_{GS} @ 10V$ (Wirebond Limited) | 12Ⓣ          |       |
| $I_{DM}$                     | Pulsed Drain Current ①                                      | 76           |       |
| $P_D @ T_A = 25°C$           | Power Dissipation ⑤   | 2.1          | W     |
| $P_D @ T_A = 70°C$           | Power Dissipation ⑤   | 1.3          |       |
|                              | Linear Derating Factor ⑤                                    | 0.02         | W/°C  |
| $T_J$<br>$T_{STG}$           | Operating Junction and<br>Storage Temperature Range         | -55 to + 150 | °C    |

Notes ① through ⑤ are on page 2

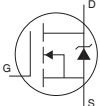
**Static @ T<sub>J</sub> = 25°C (unless otherwise specified)**

|                                     | Parameter                            | Min. | Typ. | Max. | Units | Conditions  |
|-------------------------------------|--------------------------------------|------|------|------|-------|---|
| BV <sub>DSS</sub>                   | Drain-to-Source Breakdown Voltage    | 30   | —    | —    | V     | V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA                        |
| ΔBV <sub>DSS</sub> /ΔT <sub>J</sub> | Breakdown Voltage Temp. Coefficient  | —    | 22   | —    | mV/°C | Reference to 25°C, I <sub>D</sub> = 1mA                             |
| R <sub>DS(on)</sub>                 | Static Drain-to-Source On-Resistance | —    | 12.0 | 15.5 | mΩ    | V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 8.5A ③                     |
|                                     |                                      | —    | 15.0 | 19.5 |       | V <sub>GS</sub> = 2.5V, I <sub>D</sub> = 8.5A ③                     |
| V <sub>GS(th)</sub>                 | Gate Threshold Voltage               | 0.5  | —    | 1.1  | V     | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 10μA           |
| ΔV <sub>GS(th)</sub>                | Gate Threshold Voltage Coefficient   | —    | -4.2 | —    | mV/°C |   |
| I <sub>DSS</sub>                    | Drain-to-Source Leakage Current      | —    | —    | 1.0  | μA    | V <sub>DS</sub> = 24V, V <sub>GS</sub> = 0V                         |
|                                     |                                      | —    | —    | 150  |       | V <sub>DS</sub> = 24V, V <sub>GS</sub> = 0V, T <sub>J</sub> = 125°C |
| I <sub>GSS</sub>                    | Gate-to-Source Forward Leakage       | —    | —    | 100  | nA    | V <sub>GS</sub> = 12V   |
|                                     | Gate-to-Source Reverse Leakage       | —    | —    | -100 |       | V <sub>GS</sub> = -12V  |
| g <sub>fs</sub>                     | Forward Transconductance             | 39   | —    | —    | S     | V <sub>DS</sub> = 10V, I <sub>D</sub> = 8.5A                        |
| Q <sub>g</sub>                      | Total Gate Charge                    | —    | 11   | —    | nC    | V <sub>DS</sub> = 15V   |
| Q <sub>gs</sub>                     | Gate-to-Source Charge                | —    | 0.5  | —    |       | V <sub>GS</sub> = 4.5V  |
| Q <sub>gd</sub>                     | Gate-to-Drain Charge                 | —    | 4.6  | —    |       | I <sub>D</sub> = 8.5A (See Fig. 6 & 17)                             |
| R <sub>G</sub>                      | Gate Resistance                      | —    | 2.1  | —    | Ω     |   |
| t <sub>d(on)</sub>                  | Turn-On Delay Time                   | —    | 4.9  | —    | ns    | V <sub>DD</sub> = 15V, V <sub>GS</sub> = 4.5V                       |
| t <sub>r</sub>                      | Rise Time                            | —    | 13   | —    |       | I <sub>D</sub> = 8.5A   |
| t <sub>d(off)</sub>                 | Turn-Off Delay Time                  | —    | 19   | —    |       | R <sub>G</sub> = 1.8Ω   |
| t <sub>f</sub>                      | Fall Time                            | —    | 13   | —    |       | See Fig. 18   |
| C <sub>iss</sub>                    | Input Capacitance                    | —    | 1019 | —    | pF    | V <sub>GS</sub> = 0V  |
| C <sub>oss</sub>                    | Output Capacitance                   | —    | 97   | —    |       | V <sub>DS</sub> = 25V   |
| C <sub>rss</sub>                    | Reverse Transfer Capacitance         | —    | 70   | —    |       | f = 1.0MHz  |

**Avalanche Characteristics**

|                 | Parameter                       | Typ. | Max. | Units |
|-----------------|---------------------------------|------|------|-------|
| E <sub>AS</sub> | Single Pulse Avalanche Energy ② | —    | 14   | mJ    |
| I <sub>AR</sub> | Avalanche Current ①             | —    | 8.5  | A     |

**Diode Characteristics**

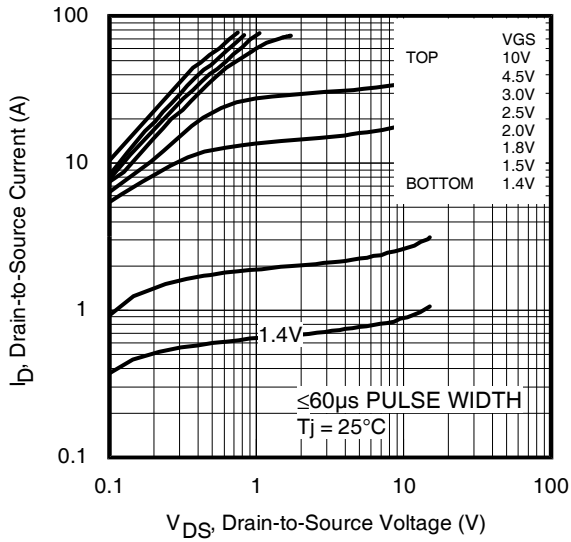
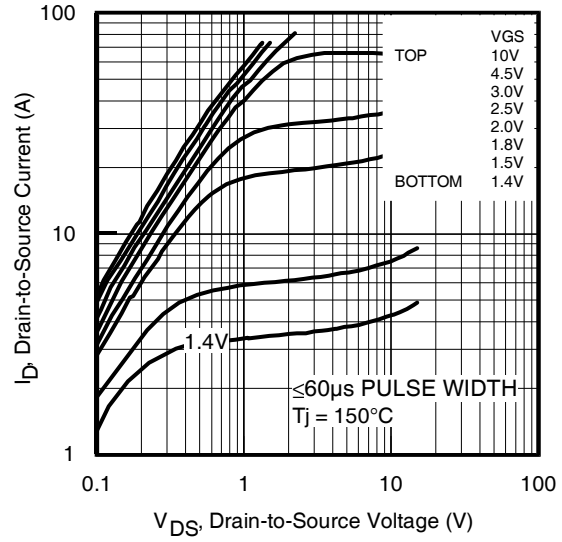
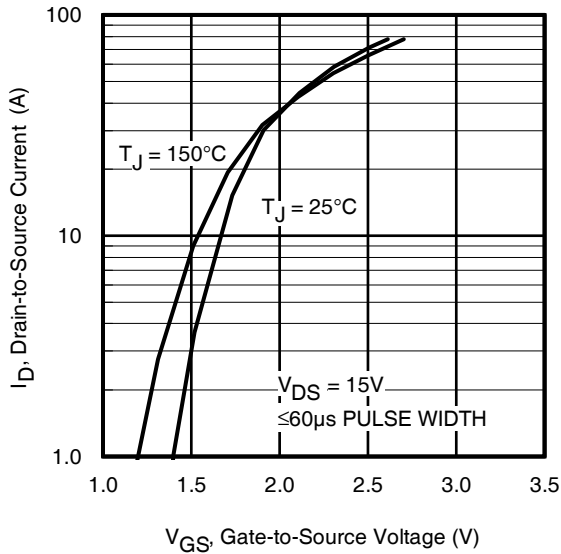
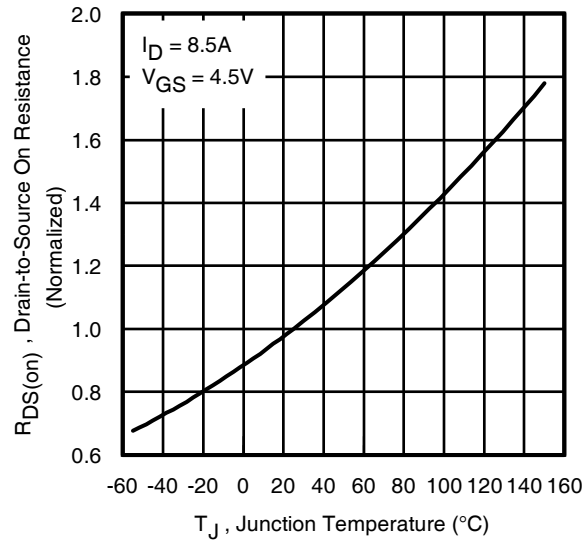
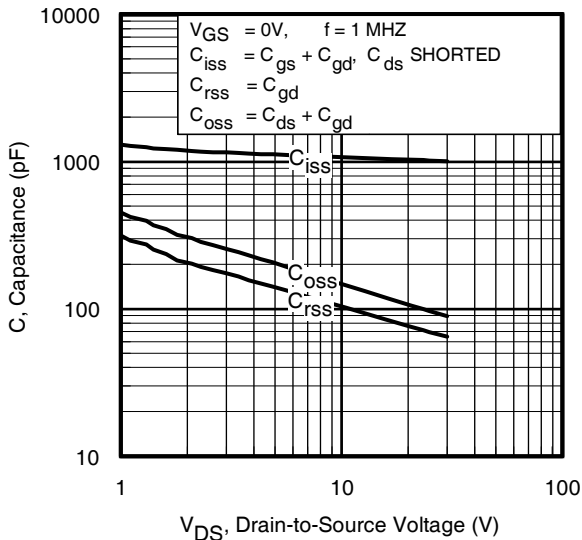
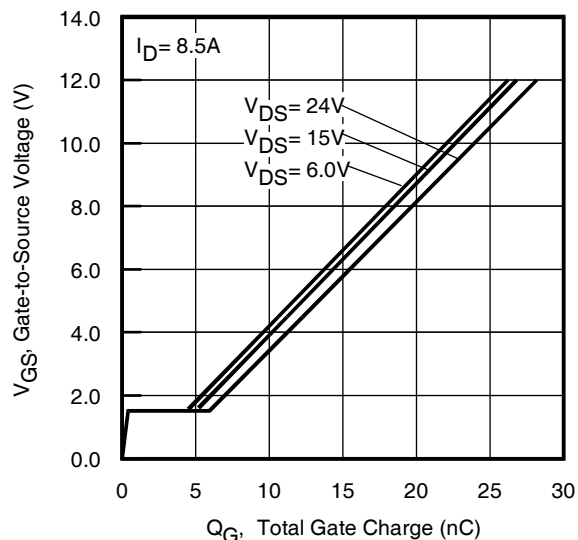
|                 | Parameter                                 | Min.                                      | Typ. | Max.            | Units | Conditions   |
|-----------------|---|---|------|-----------------|-------|--|
| I <sub>S</sub>  | Continuous Source Current<br>(Body Diode) | —   | —    | 12 <sup>⑦</sup> | A     | MOSFET symbol showing the integral reverse p-n junction diode.  |
| I <sub>SM</sub> | Pulsed Source Current<br>(Body Diode) ①   | —   | —    | 76              |       |  |
| V <sub>SD</sub> | Diode Forward Voltage                     | —   | —    | 1.2             | V     | T <sub>J</sub> = 25°C, I <sub>S</sub> = 8.5A, V <sub>GS</sub> = 0V ③   |
| t <sub>rr</sub> | Reverse Recovery Time                     | —   | 11   | 17              | ns    | T <sub>J</sub> = 25°C, I <sub>F</sub> = 8.5A, V <sub>DD</sub> = 15V  |
| Q <sub>rr</sub> | Reverse Recovery Charge                   | —   | 13   | 20              | nC    | di/dt = 300 A/μs ③   |
| t <sub>on</sub> | Forward Turn-On Time                      | Time is dominated by parasitic Inductance |      |                 |       |  |

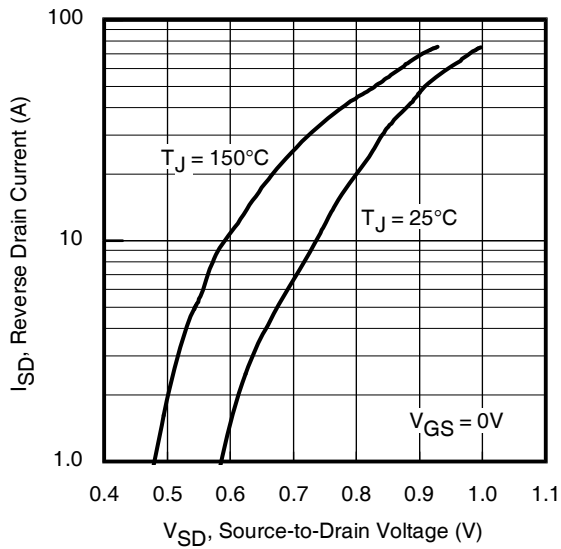
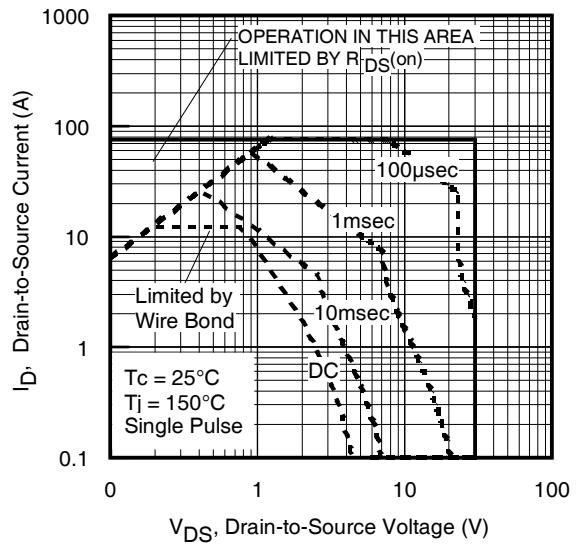
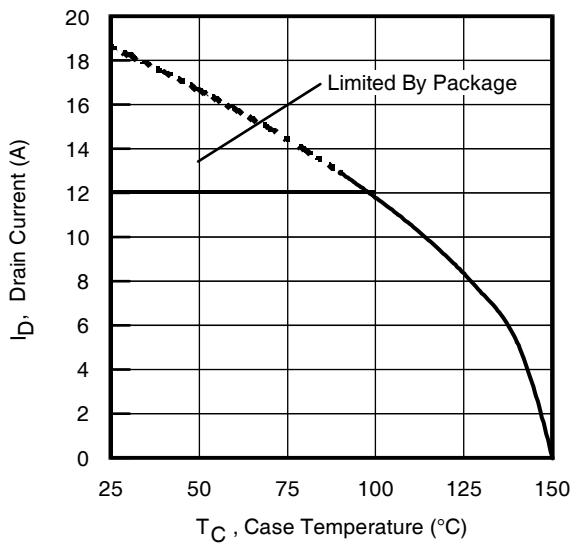
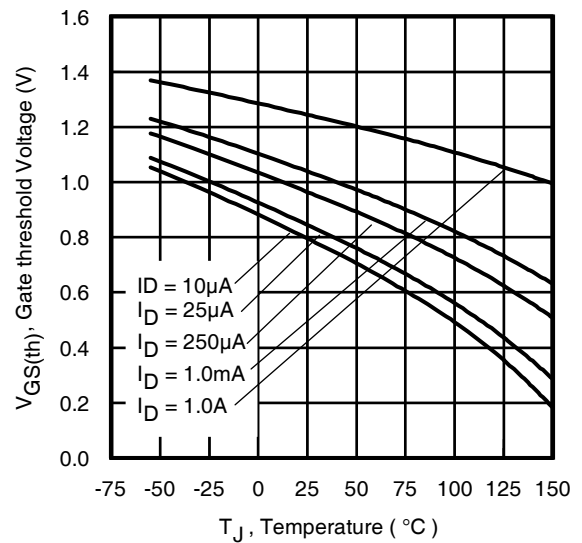
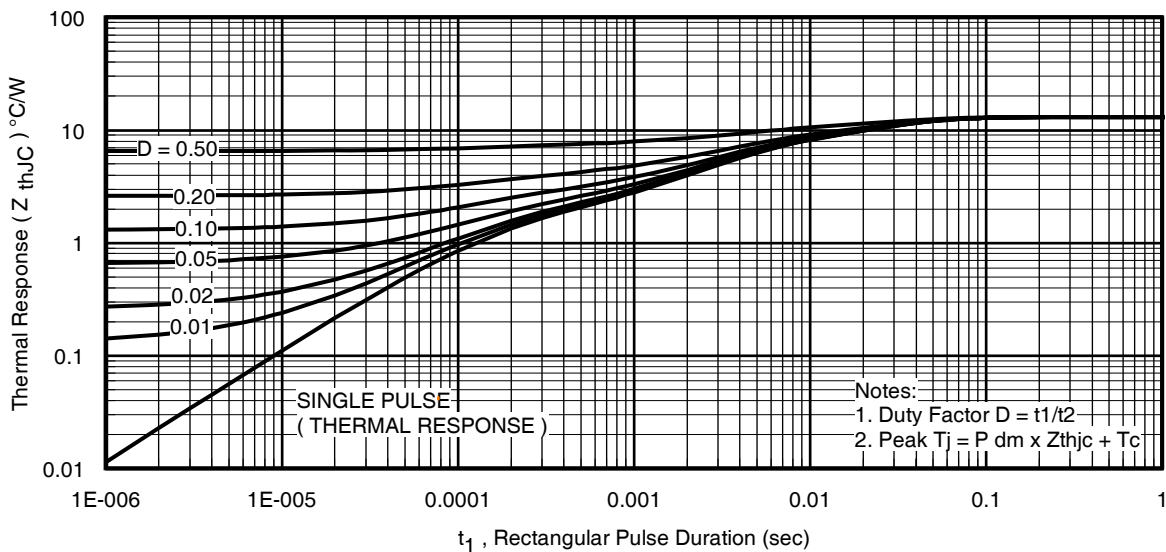
**Thermal Resistance**

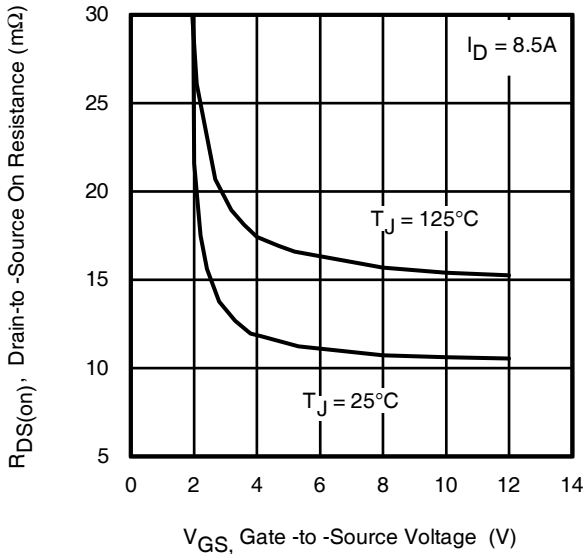
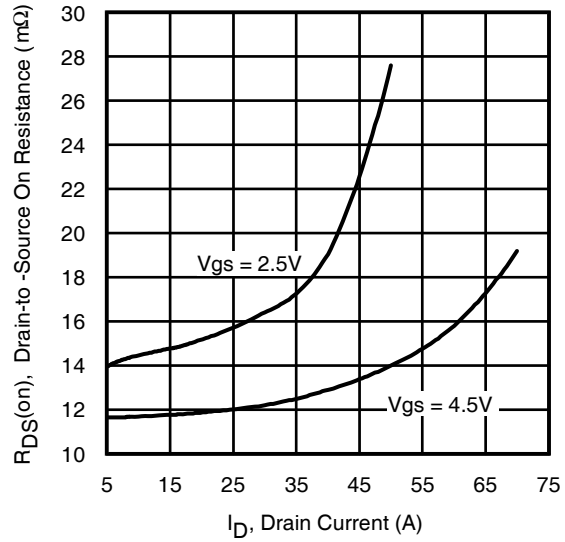
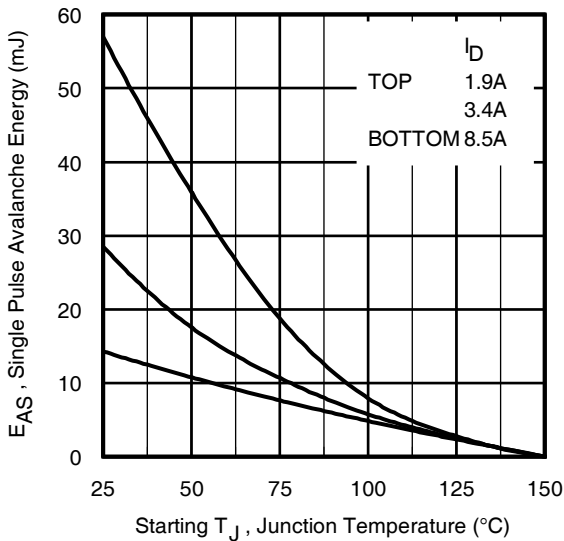
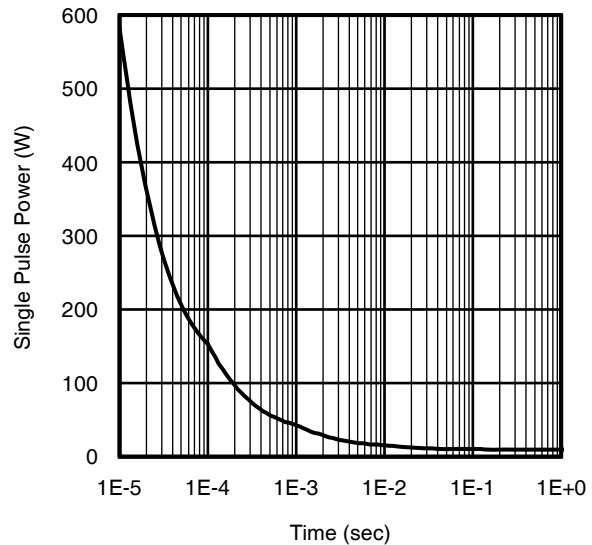
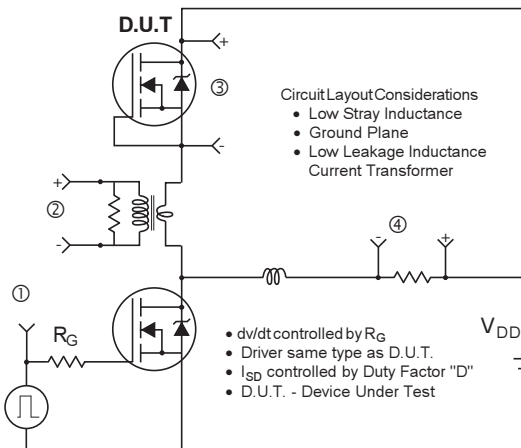
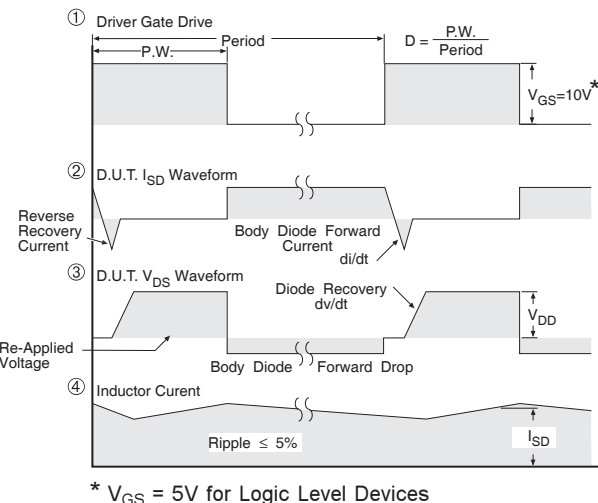
|                           | Parameter                    | Typ. | Max. | Units |
|---------------------------|------------------------------|------|------|-------|
| R <sub>θJC</sub> (Bottom) | Junction-to-Case ⑤           | —    | 13   | °C/W  |
| R <sub>θJC</sub> (Top)    | Junction-to-Case ⑤           | —    | 90   |       |
| R <sub>θJA</sub>          | Junction-to-Ambient ④        | —    | 60   |       |
| R <sub>θJA</sub>          | Junction-to-Ambient (<10s) ④ | —    | 42   |       |

**Notes:**

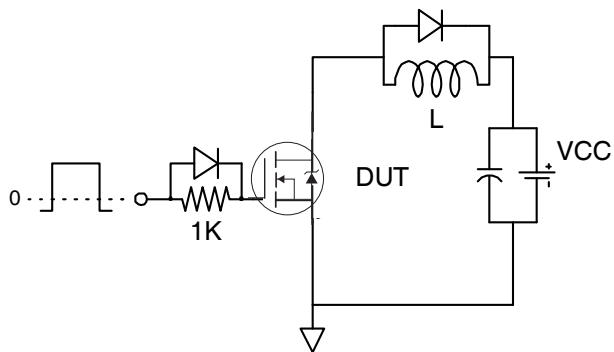
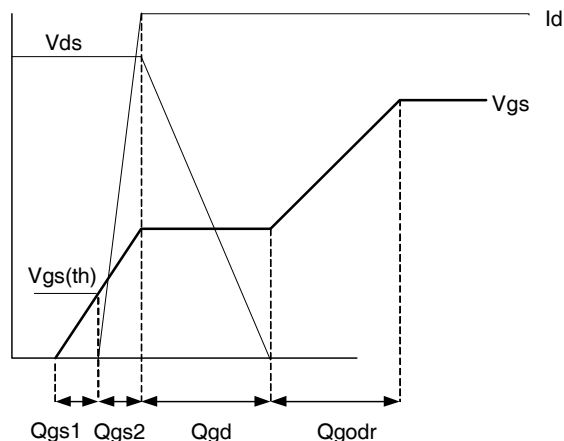
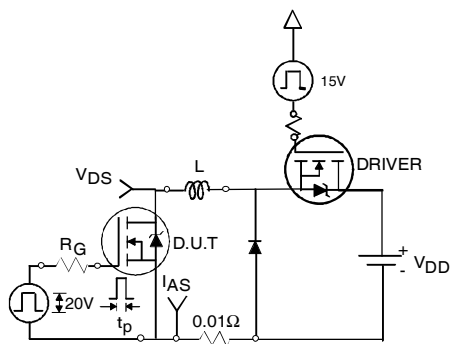
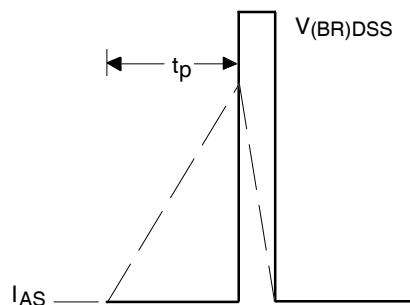
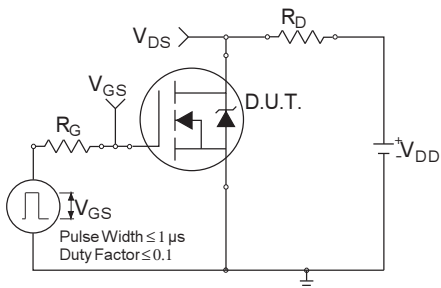
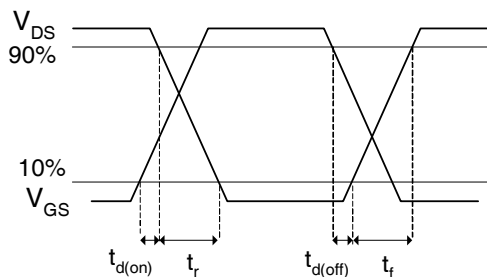
- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Starting T<sub>J</sub> = 25°C, L = 0.39mH, R<sub>G</sub> = 50Ω, I<sub>AS</sub> = 8.5A.
- ③ Pulse width ≤ 400μs; duty cycle ≤ 2%.
- ④ R<sub>θ</sub> is measured at T<sub>J</sub> of approximately 90°C.
- ⑤ When mounted on 1 inch 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 12A by die-source to lead-frame bonding technology


**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**

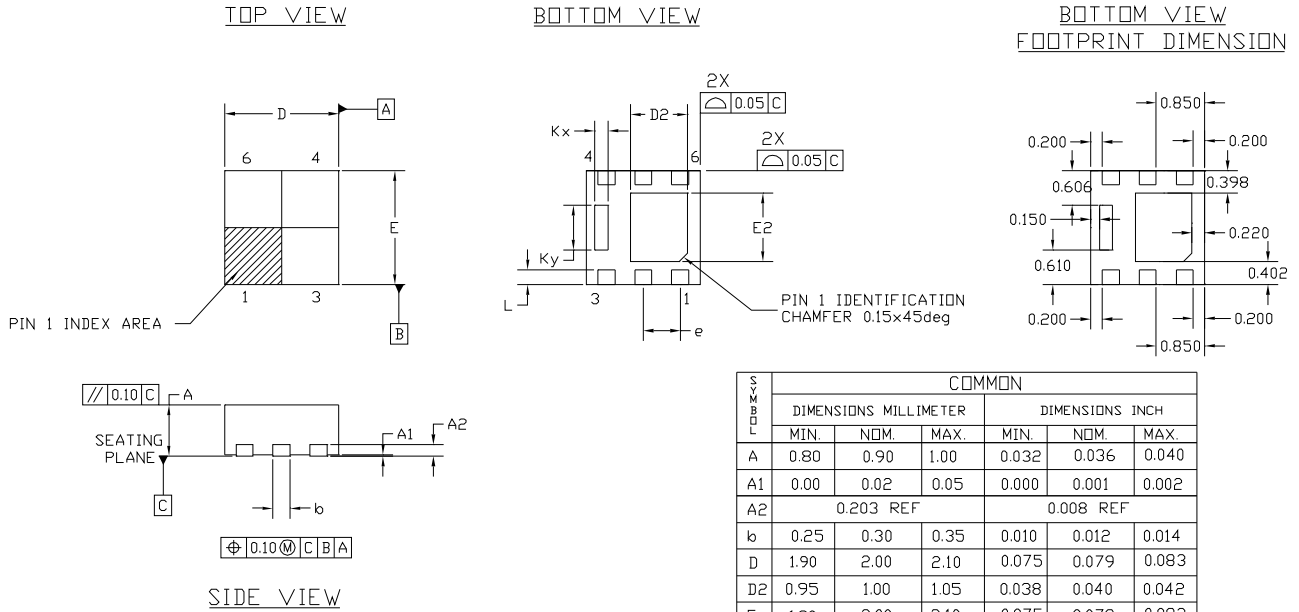

**Fig 7.** Typical Source-Drain Diode Forward Voltage

**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. Typical On-Resistance vs. Drain Current**

**Fig 14. Maximum Avalanche Energy vs. Drain Current**

**Fig 15. Typical Power vs. Time**

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


\*  $V_{GS} = 5V$  for Logic Level Devices


**Fig 17a. Gate Charge Test Circuit**

**Fig 17b. Gate Charge Waveform**

**Fig 18a. Unclamped Inductive Test Circuit**

**Fig 18b. Unclamped Inductive Waveforms**

**Fig 19a. Switching Time Test Circuit**

**Fig 19b. Switching Time Waveforms**

# PQFN 2x2 Outline Package Details



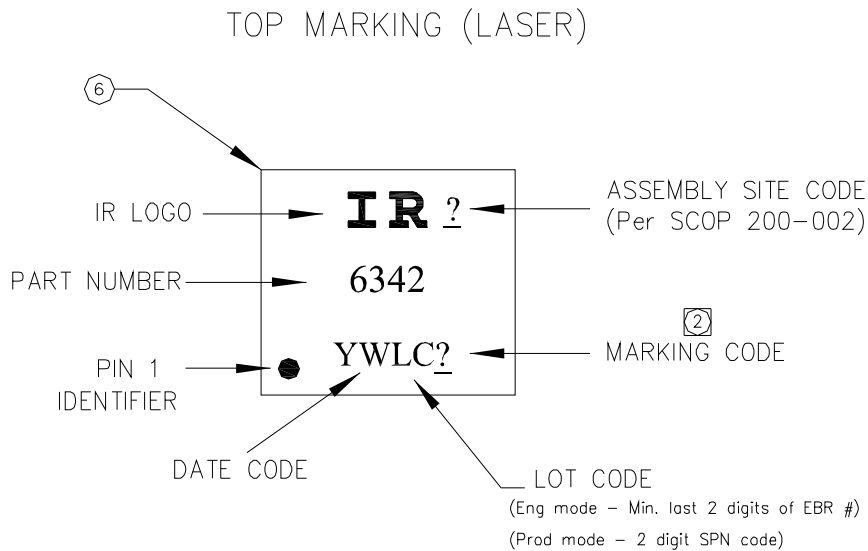
| SYMBOL | COMMON                |      |      |                 |       |       |
|--------|-----------------------|------|------|-----------------|-------|-------|
|        | DIMENSIONS MILLIMETER |      |      | DIMENSIONS INCH |       |       |
|        | MIN.                  | NOM. | MAX. | MIN.            | NOM.  | MAX.  |
| A      | 0.80                  | 0.90 | 1.00 | 0.032           | 0.036 | 0.040 |
| A1     | 0.00                  | 0.02 | 0.05 | 0.000           | 0.001 | 0.002 |
| A2     | 0.203 REF             |      |      | 0.008 REF       |       |       |
| b      | 0.25                  | 0.30 | 0.35 | 0.010           | 0.012 | 0.014 |
| D      | 1.90                  | 2.00 | 2.10 | 0.075           | 0.079 | 0.083 |
| D2     | 0.95                  | 1.00 | 1.05 | 0.038           | 0.040 | 0.042 |
| E      | 1.90                  | 2.00 | 2.10 | 0.075           | 0.079 | 0.083 |
| E2     | 1.15                  | 1.20 | 1.25 | 0.046           | 0.048 | 0.050 |
| e      | 0.65 BSC              |      |      | 0.026 BSC       |       |       |
| L      | 0.20                  | 0.25 | 0.30 | 0.008           | 0.010 | 0.012 |
| Kx     | 0.23 REF              |      |      | 0.010 REF       |       |       |
| Ky     | 0.785 REF             |      |      | 0.031 REF       |       |       |

NOTES :

1. DIMENSION AND TOLERANCING CONFORM TO ASME Y14.5M-1994.
2. CONTROLLING DIMENSIONS : MILLIMETER
3. DIMENSION *b* APPLIES TO METALLIZED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 mm. FROM TERMINAL TIP.

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 2x2 Outline Part Marking



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

# PQFN 2x2 Outline Tape and Reel

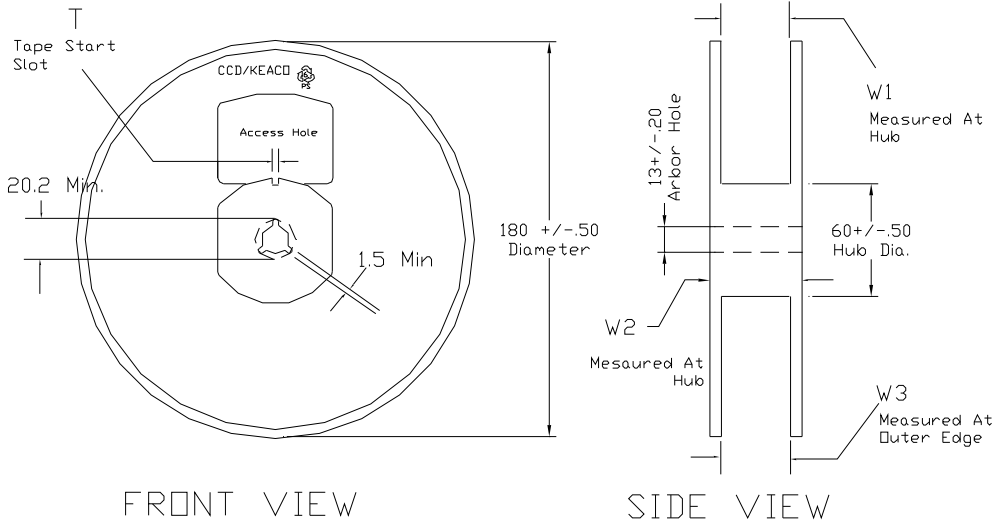
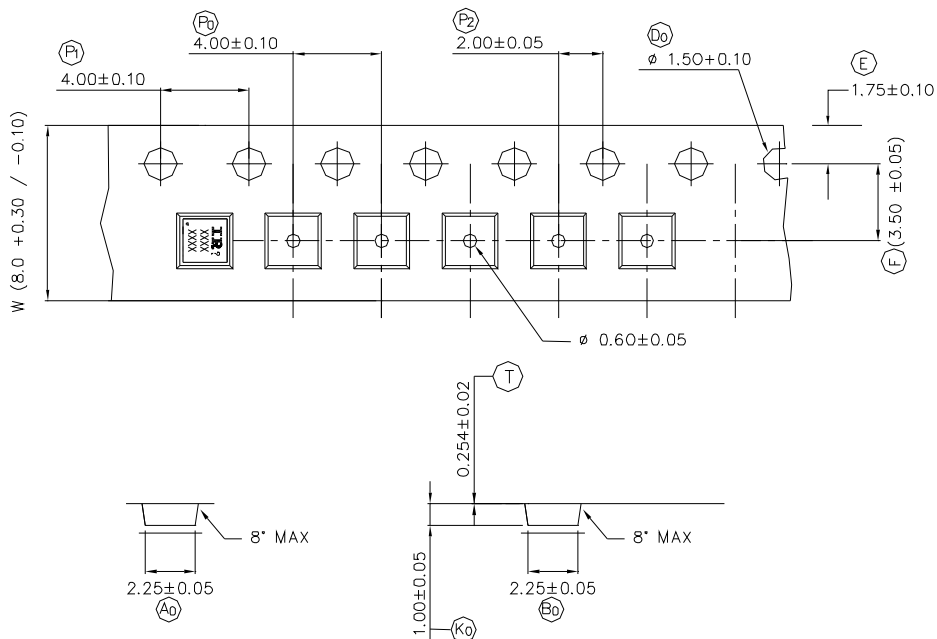


TABLE 1: REEL DETAILS

| TAPE WIDTH | T        | W1                                   | W2       | W3                   | PART NO |
|------------|----------|--------------------------------------|----------|----------------------|---------|
| 8 MM       | 3 ± 0.50 | 8.4 <sup>+1.5</sup> <sub>-0.0</sub>  | 14.4 Max | 7.90 Min<br>10.9 Max | 91586-1 |
| 12 MM      | 5 ± 0.50 | 12.4 <sup>+2.0</sup> <sub>-0.0</sub> | 18.4 Max | 11.9 Min<br>15.4 Max | 91586-2 |

Note: Surface resistivity is  $\geq 1 \times 10^5$  but  $< 1 \times 10^{12}$  ohm/sq.



NOTE: The Surface Resistivity is  $10^4 - 10^8$  OHM/SQ

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



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

|                            |   |   |
|----------------------------|---|---|
| Qualification level        | Industrial <sup>†</sup><br>(per JEDEC JESD47F <sup>††</sup> guidelines) |   |
| Moisture Sensitivity Level | PQFN 2mm x 2mm  | MSL1<br>(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>

†† Applicable version of JEDEC standard at the time of product release.

**Revision History**

| Date       | Comments  |
|------------|---|
| 12/17/2013 | <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 Qual level from "Consumer" to "Industrial" on page 1, 9</li> <li>Updated data sheet with new IR corporate template</li> </ul> |

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[8877003PA](#) [NTE6400](#) [SQJ402EP-T1-GE3](#) [2SK2614\(TE16L1,Q\)](#) [2N7002KW-FAI](#) [DMN1017UCP3-7](#) [EFC2J004NUZTDG](#) [ECH8691-TL-W](#)  
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[SSM6P69NU,LF](#) [DMP22D4UFO-7B](#) [DMN1006UCA6-7](#)