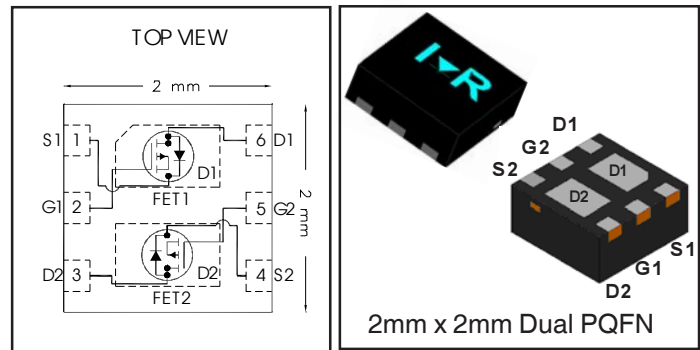


| | | |
|---|---------------|-----------|
| V_{DS} | -30 | V |
| $V_{GS\ max}$ | ±20 | V |
| $R_{DS(on)\ max}$ (@ $V_{GS} = -10V$) | 170 | mΩ |
| I_D (@ $T_C = 25^\circ C$) | -3.4 ② | A |



Applications

- Charge and Discharge Switch for Battery Application
- System/load switch

Features and Benefits

Features

| |
|--|
| Low $R_{DS(on)}$ ($\leq 170m\Omega$) |
| Low Thermal Resistance to PCB ($\leq 19^\circ C/W$) |
| Low Profile ($\leq 1.0\ mm$) |
| Compatible with Existing Surface Mount Techniques |
| RoHS Compliant Containing no Lead, no Bromide and no Halogen |
| MSL1, Industrial Qualification |

results in

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 | |
| IRFHS9351TRPBF | PQFN 2mm x 2mm | Tape and Reel | 4000 | |
| IRFHS9351TR2PBF | PQFN 2mm x 2mm | Tape and Reel | 400 | EOL notice # 259 |

Absolute Maximum Ratings

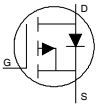
| | Parameter | Max. | Units |
|--------------------------|--|--------------|-------|
| V_{DS} | Drain-to-Source Voltage | -30 | V |
| V_{GS} | Gate-to-Source Voltage | ± 20 | |
| $I_D @ T_A = 25^\circ C$ | Continuous Drain Current, $V_{GS} @ -10V$ | -2.3 | A |
| $I_D @ T_A = 70^\circ C$ | Continuous Drain Current, $V_{GS} @ -10V$ | -1.5 | |
| $I_D @ T_C = 25^\circ C$ | Continuous Drain Current, $V_{GS} @ -10V$ | -5.1 ② | |
| $I_D @ T_C = 70^\circ C$ | Continuous Drain Current, $V_{GS} @ -10V$ | -4.1 ② | |
| $I_D @ T_C = 25^\circ C$ | Continuous Drain Current, $V_{GS} @ 10V$ (Package Limited) | -3.4 ② | |
| I_{DM} | Pulsed Drain Current ① | -20 | |
| $P_D @ T_A = 25^\circ C$ | Power Dissipation ④ | 1.4 | W |
| $P_D @ T_A = 70^\circ C$ | Power Dissipation ④ | 0.9 | |
| | Linear Derating Factor | 0.01 | W/°C |
| T_J T_{STG} | Operating Junction and Storage Temperature Range | -55 to + 150 | °C |

Notes ① through ⑥ are on page 2

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 |
| V _{DSS} / 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 | — | 135 | 170 | m | V _{GS} = -10V, I _D = -3.1A ③ |
| | | — | 235 | 290 | | V _{GS} = -4.5V, I _D = -2.5A ③ |
| V _{GS(th)} | Gate Threshold Voltage | -1.3 | -1.8 | -2.4 | V | V _{DS} = V _{GS} , I _D = -10μA |
| V _{GS(th)} | Gate Threshold Voltage Coefficient | — | -4.6 | — | 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 |
| g _{fs} | Forward Transconductance | 2.4 | — | — | S | V _{DS} = -10V, I _D = -3.1A |
| Q _g | Total Gate Charge ⑥ | — | 1.9 | — | nC | V _{DS} = -15V, V _{GS} = -4.5V, I _D = -3.1A |
| Q _g | Total Gate Charge ⑥ | — | 3.7 | — | nC | V _{GS} = -10V |
| Q _{gs} | Gate-to-Source Charge ⑥ | — | 0.6 | — | | V _{DS} = -15V |
| Q _{gd} | Gate-to-Drain Charge ⑥ | — | 1.1 | — | | I _D = -3.1A |
| R _G | Gate Resistance ⑥ | — | 17 | — | | |
| t _{d(on)} | Turn-On Delay Time | — | 8.3 | — | ns | V _{DD} = -15V, V _{GS} = -4.5V ③ |
| t _r | Rise Time | — | 30 | — | | I _D = -3.1A |
| t _{d(off)} | Turn-Off Delay Time | — | 6.3 | — | | R _G = 1.8 |
| t _f | Fall Time | — | 7.9 | — | | See Figs. 19a & 19b |
| C _{iss} | Input Capacitance | — | 160 | — | pF | V _{GS} = 0V |
| C _{oss} | Output Capacitance | — | 39 | — | | V _{DS} = -25V |
| C _{rss} | Reverse Transfer Capacitance | — | 26 | — | | f = 1.0KHz |

Diode Characteristics

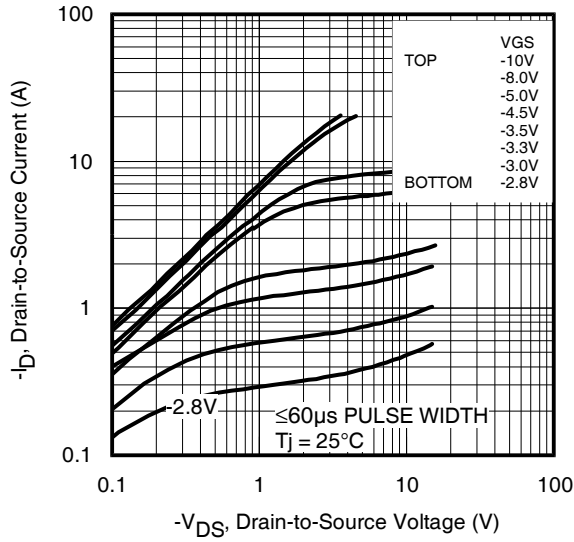
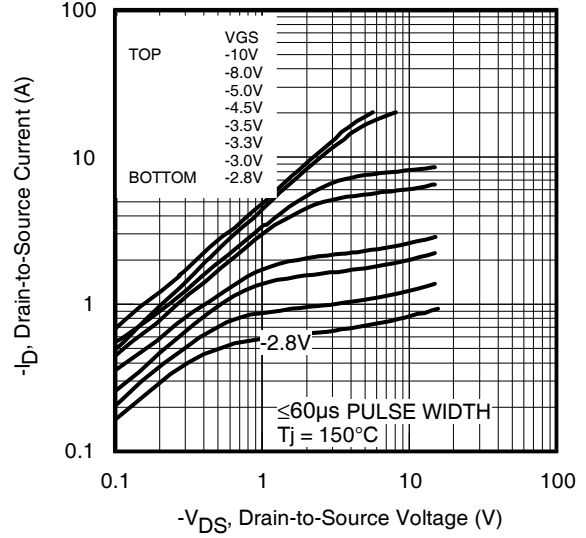
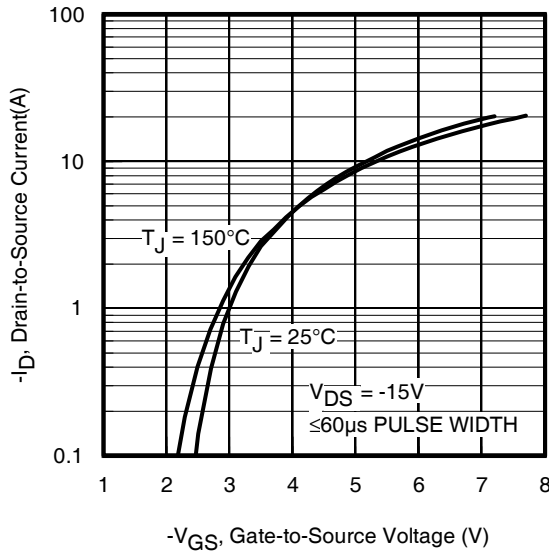
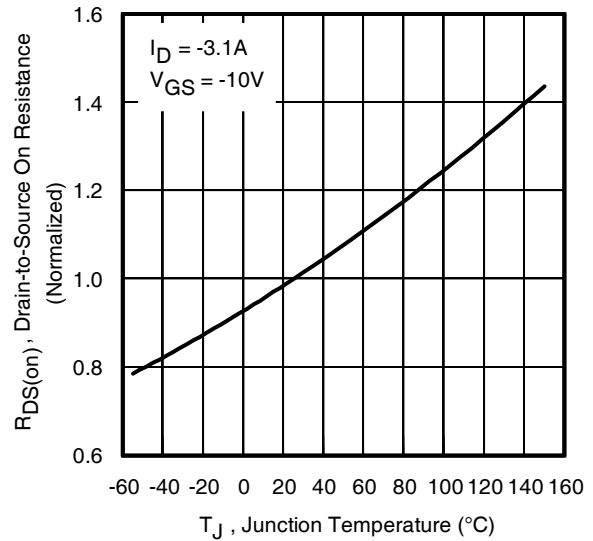
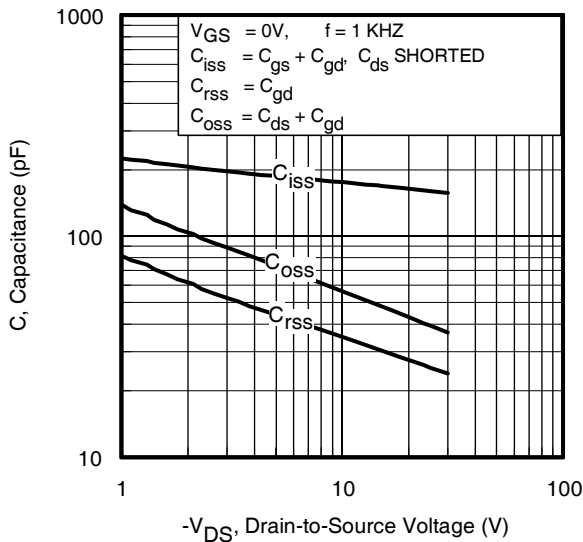
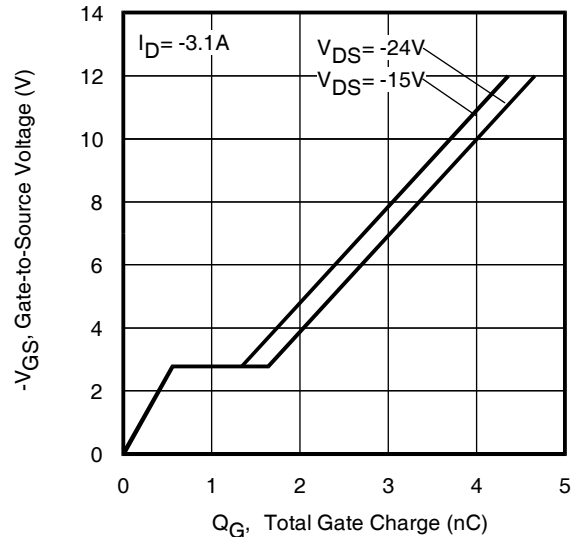
| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|-----------------|--|------|------|------|-------|--|
| I _S | Continuous Source Current (Body Diode) | — | — | -5.1 | A | MOSFET symbol showing the integral reverse p-n junction diode.  |
| I _{SM} | Pulsed Source Current (Body Diode) ① | — | — | -20 | | |
| V _{SD} | Diode Forward Voltage | — | — | -1.2 | V | T _J = 25°C, I _S = -3.1A, V _{GS} = 0V ③ |
| t _{rr} | Reverse Recovery Time | — | 20 | 30 | ns | T _J = 25°C, I _F = -3.1A, V _{DD} = -15V |
| Q _{rr} | Reverse Recovery Charge | — | 42 | 63 | nC | di/dt = 370/μs ③ |

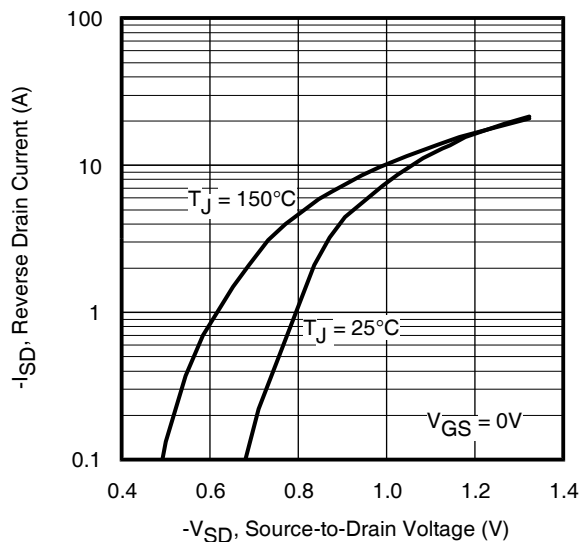
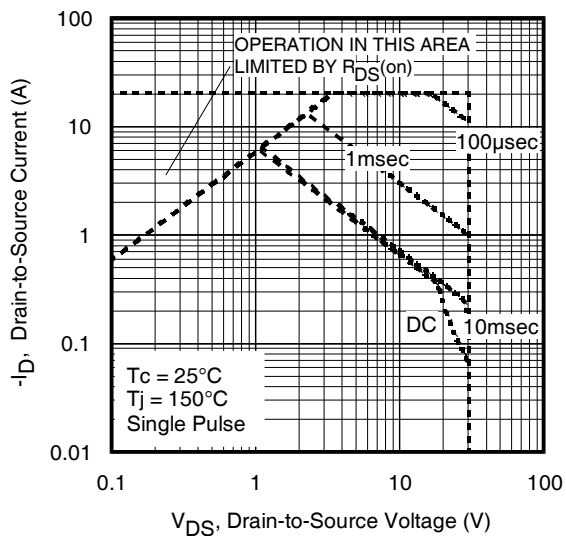
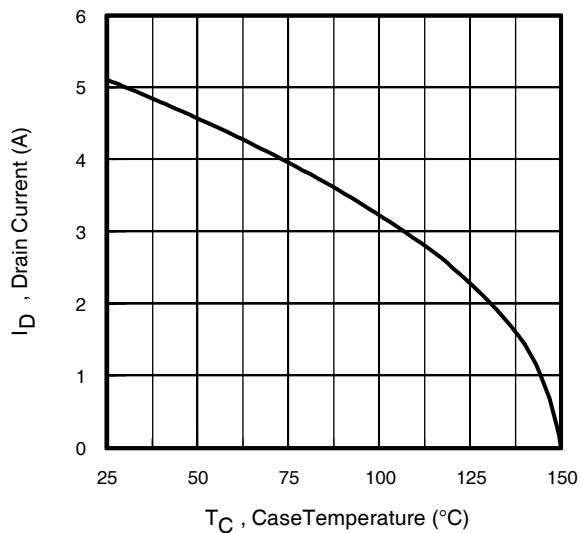
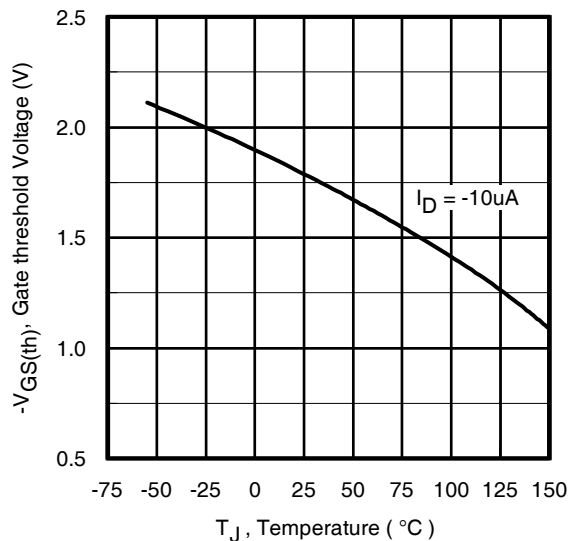
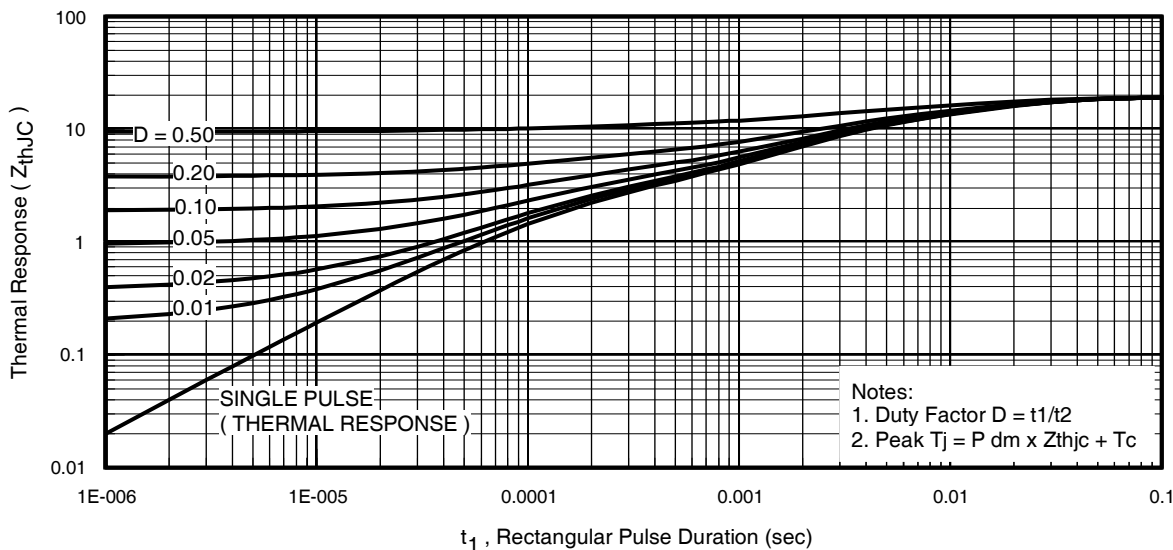
Thermal Resistance

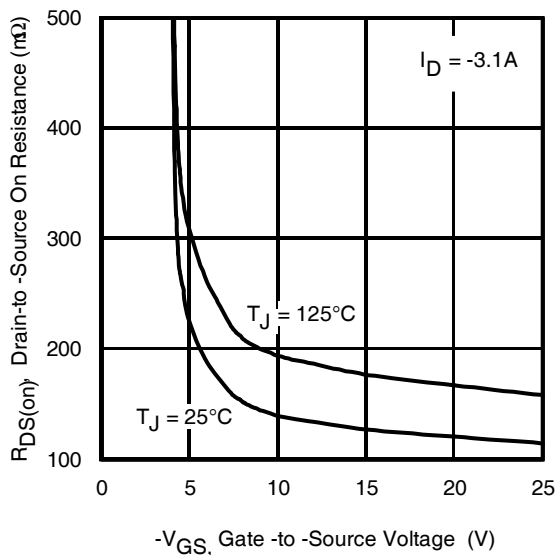
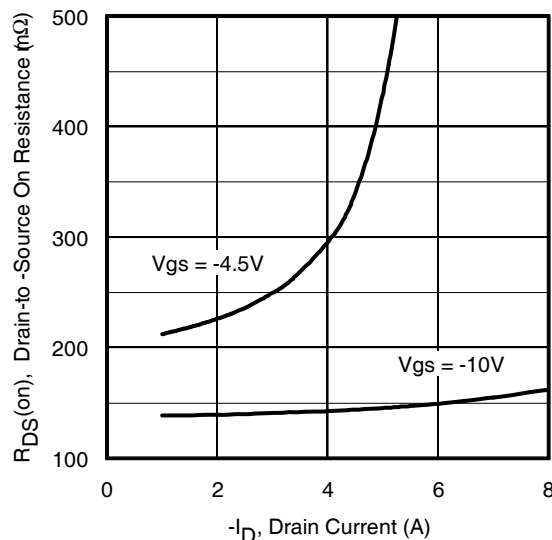
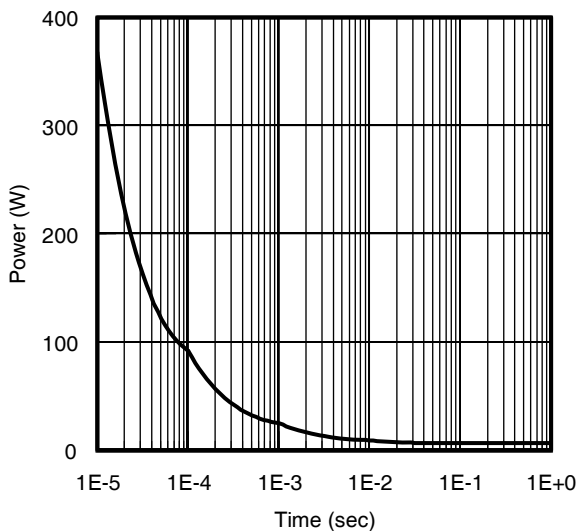
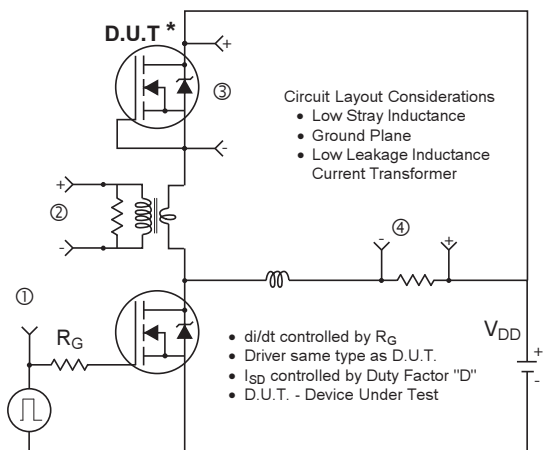
| | Parameter | Typ. | Max. | Units |
|--------------------------|-------------------------------|------|------|-------|
| R _{JC} (Bottom) | Junction-to-Case ② | — | 19 | °C/W |
| R _{JC} (Top) | Junction-to-Case ② | — | 170 | |
| R _{JA} | Junction-to-Ambient ④ | — | 90 | |
| R _{JA} | Junction-to-Ambient (t<10s) ④ | — | 75 | |

Notes:

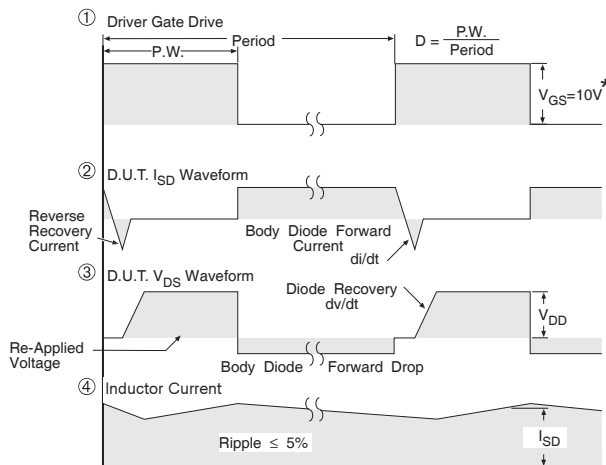
- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Current limited by package. .
- ③ Pulse width ≤ 400μs; duty cycle ≤ 2%.
- ④ When mounted on 1 inch square copper board.
- ⑤ R_θ is measured at T_J of approximately 90°C.
- ⑥ For DESIGN AID ONLY, not subject to production testing.


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 Temperature

Fig 10. Threshold Voltage vs. Temperature

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


Fig 12. On-Resistance vs. Gate Voltage

Fig 13. Typical On-Resistance vs. Drain Current

Fig 14. Typical Power vs. Time


* Reverse Polarity of D.U.T. for P-Channel



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

Fig 15. Diode Reverse Recovery Test Circuit for P-Channel HEXFET[®] Power MOSFETs

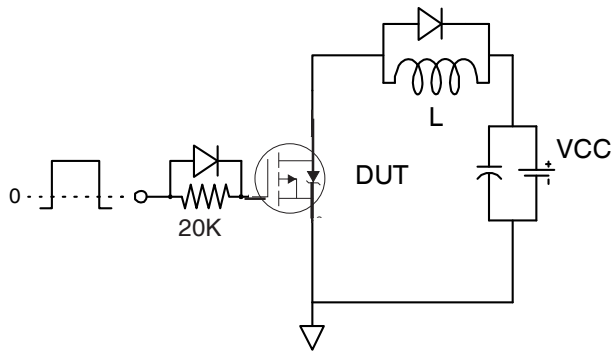
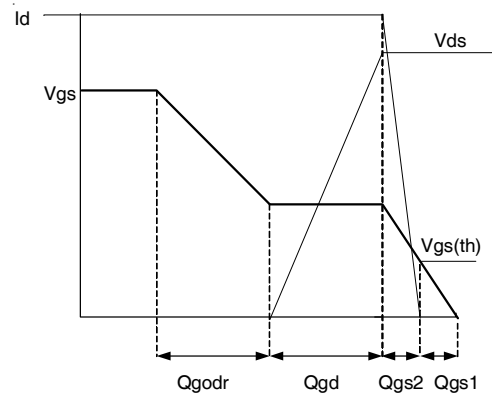
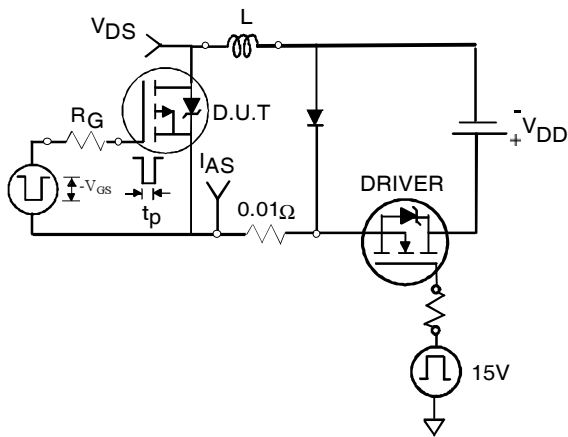
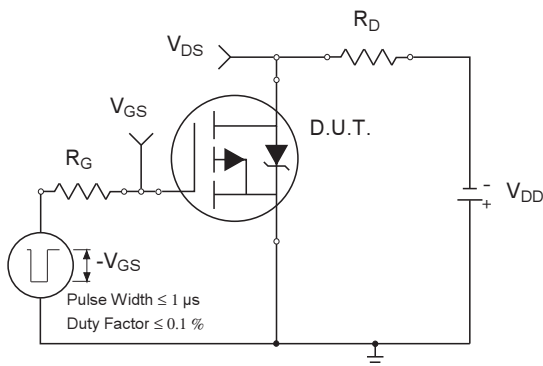
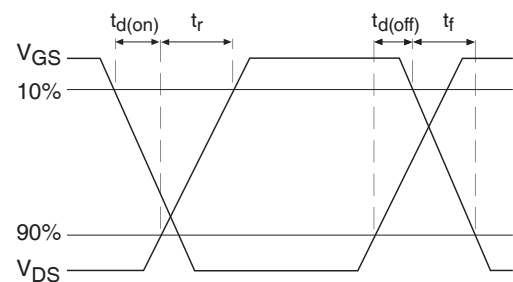
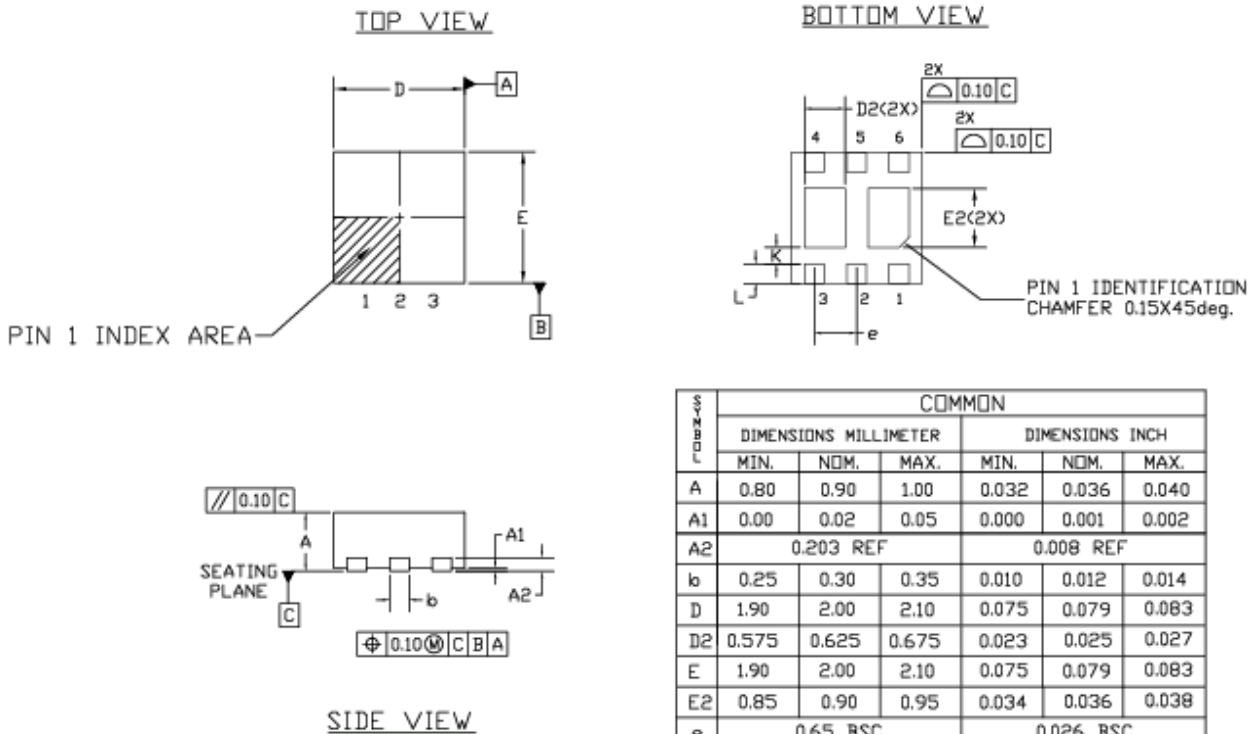

Fig 16a. Gate Charge Test Circuit

Fig 16b. Gate Charge Waveform

Fig 17a. Unclamped Inductive Test Circuit

Fig 17b. Unclamped Inductive Waveforms

Fig 18a. Switching Time Test Circuit

Fig 18b. Switching Time Waveforms

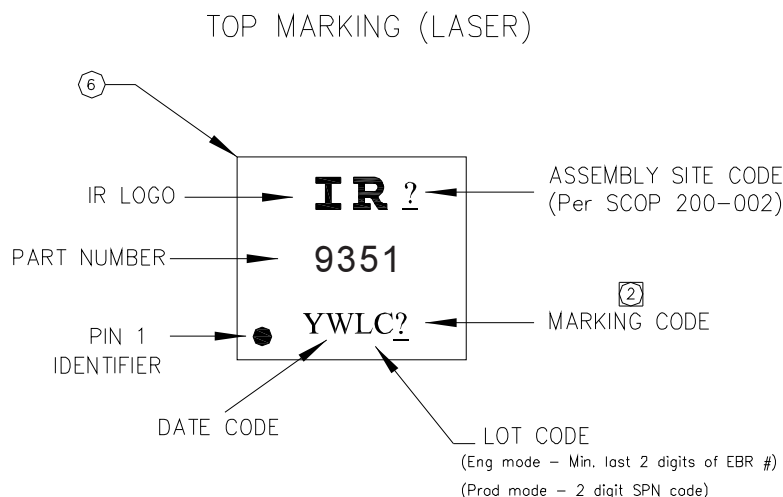
PQFN Package Details



NOTES :

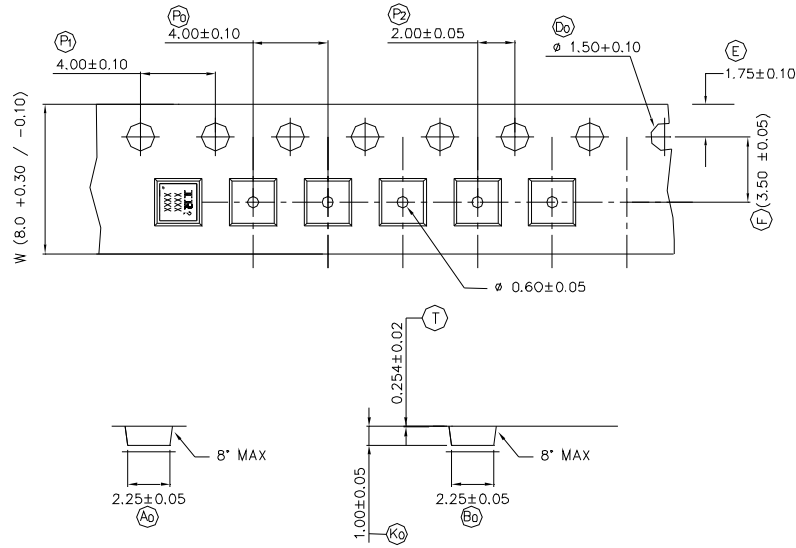
1. DIMENSION AND TOLERANCING CONFORM TO ASME Y14.5M-1994.
2. CONTROLLING DIMENSIONS : MILLIMETER. CONVERTED INCH DIMENSION ARE NOT NECESSARILY EXACT.

PQFN Part Marking

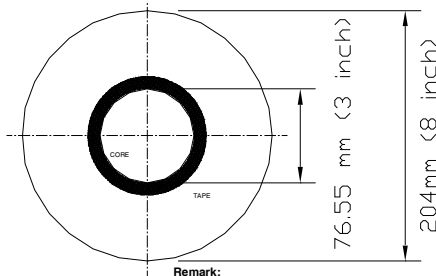
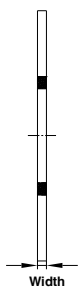


Note: For the most current drawing please refer to IR website at: <http://www.irf.com/package/>

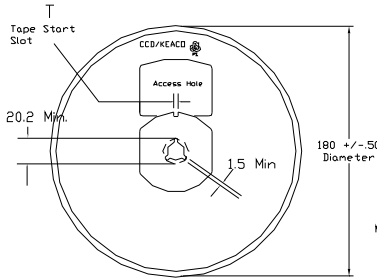
PQFN Tape and Reel



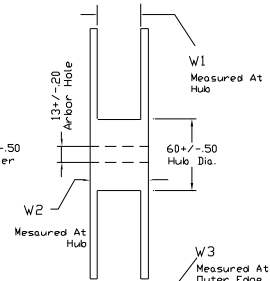
NOTE: The Surface Resistivity is $10^4 - 10^8$ OHM/SQ



Remark:
 - Dimension above are typical dimensions.
 - Cover tape thickness is 0.043mm +/- 0.005mm.
 - Surface resistivity $10E5 < R_s < 10E8$.



FRONT VIEW



SIDE VIEW

| COVER TAPE (WIDTH) | TOLERANCE |
|--------------------|------------|
| 5.4 mm | +/- 0.1 mm |
| 9.5 mm | +/- 0.1 mm |

| TAPE WIDTH | T | W1 | W2 | W3 | PART NO |
|------------|----------|--------------------------------------|----------|----------------------|---------|
| 8 MM | 3 ± 0.50 | 8.4 ^{+1.5} _{-0.0} | 14.4 Max | 7.90 Min 10.9 Max | 91586-1 |
| 12 MM | 3 ± 0.50 | 12.4 ^{+2.0} _{-0.0} | 18.4 Max | 11.9 Min 15.4 Max | 91586-2 |

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

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

Qualification information[†]

| | | |
|----------------------------|--|--|
| Qualification level | Industrial ^{††} (per JEDEC JESD47F ^{†††} guidelines) | |
| Moisture Sensitivity Level | PQFN 2mm x 2mm | MSL1 (per IPC/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.

Revision History

| Date | Comment |
|-----------|--|
| 5/13/2014 | <ul style="list-style-type: none"> • Updated ordering information to reflect the End-Of-life (EOL) of the mini-reel option (EOL notice #259) • Updated data sheet based on corporate template. |
| 5/21/2014 | <ul style="list-style-type: none"> • Updated qual level from "Consumer" to "Industrial" on page 1 & 9. |

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/>