

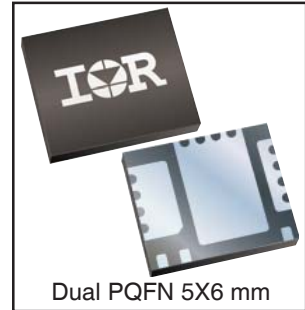
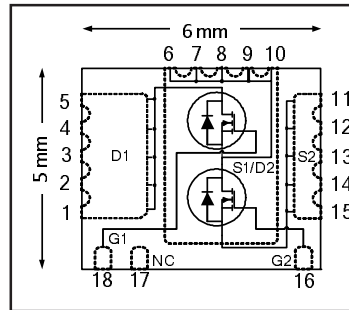


**THE DATASHEET OF
IRFH7911TRPBF**



HEXFET® Power MOSFET

| | | | |
|---|------------|------------|-----------|
| | Q1 | Q2 | |
| V_{DS} | 30 | 30 | V |
| $R_{DS(on) max}$ (@ $V_{GS} = 10V$) | 8.6 | 3.0 | mΩ |
| Q_g (typical) | 8.3 | 34 | nC |
| I_D (@ $T_A = 25^\circ C$) | 13 | 28 | A |



Applications

- Control and synchronous MOSFET for buck converters

Features and Benefits

Features

| |
|--|
| Control and synchronous FET in one package |
| Low charge control MOSFET (8.3 nC typical) |
| Low $R_{DS(on)}$ synchronous MOSFET (< 3.0 mΩ) |
| 100% Rg tested |
| Low Profile (≤ 0.9 mm) |
| Compatible with Existing Surface Mount Techniques |
| RoHS Compliant Containing no Lead, no Bromide and no Halogen |
| MSL2, Consumer Qualification |

results in
⇒

Benefits

| |
|--|
| Increased power density (50% vs two PQFN 5x6) |
| Lower switching losses |
| Lower conduction losses |
| Increased reliability |
| Increased power density |
| Easier manufacturing |
| Environmentally Friendlier |
| Increased reliability |

| Orderable part number | Package Type | Standard Pack | | Note |
|-----------------------|----------------|---------------|----------|------------------|
| | | Form | Quantity | |
| IRFH7911TRPbF | PQFN 5mm x 6mm | Tape and Reel | 4000 | |
| IRFH7911TR2PbF | PQFN 5mm x 6mm | Tape and Reel | 400 | EOL notice # 259 |

Absolute Maximum Ratings

| | Parameter | Q1 Max. | Q2 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, $V_{GS} @ 10V$ | 13 | 28 | A |
| $I_D @ T_A = 70^\circ C$ | Continuous Drain Current, $V_{GS} @ 10V$ | 10 | 23 | |
| I_{DM} | Pulsed Drain Current ① | 100 | 230 | |
| $P_D @ T_A = 25^\circ C$ | Power Dissipation | 2.4 | 3.4 | W |
| $P_D @ T_A = 70^\circ C$ | Power Dissipation | 1.5 | 2.2 | |
| | Linear Derating Factor ⑤ | 0.019 | 0.027 | W/°C |
| T_J T_{STG} | Operating Junction and Storage Temperature Range | -55 to + 150 | | °C |

Thermal Resistance

| | Parameter | Q1 Max. | Q2 Max. | Units |
|-----------------|-----------------------|---------|---------|-------|
| $R_{\theta JC}$ | Junction-to-Case ④ | 7.7 | 2.5 | °C/W |
| $R_{\theta JA}$ | Junction-to-Ambient ⑤ | 53 | 37 | |

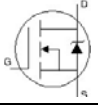
Static @ T_J = 25°C (unless otherwise specified)

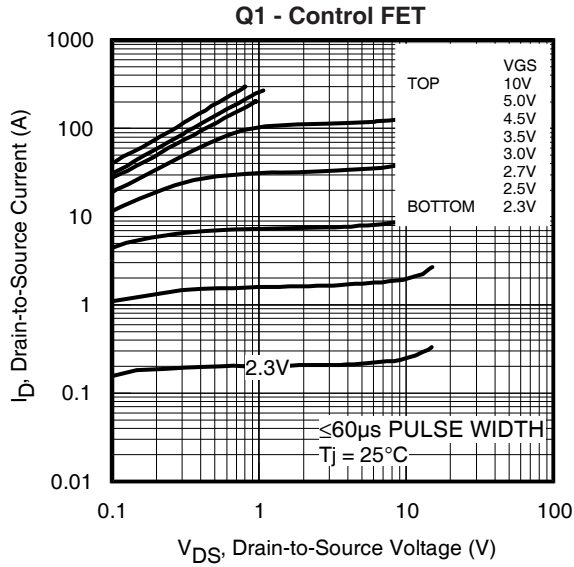
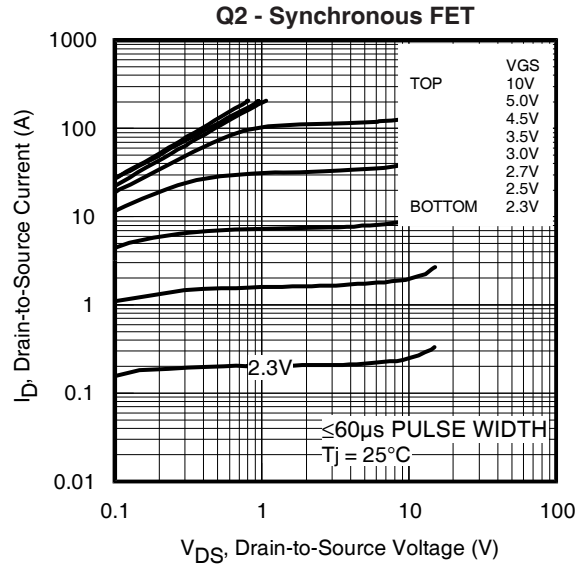
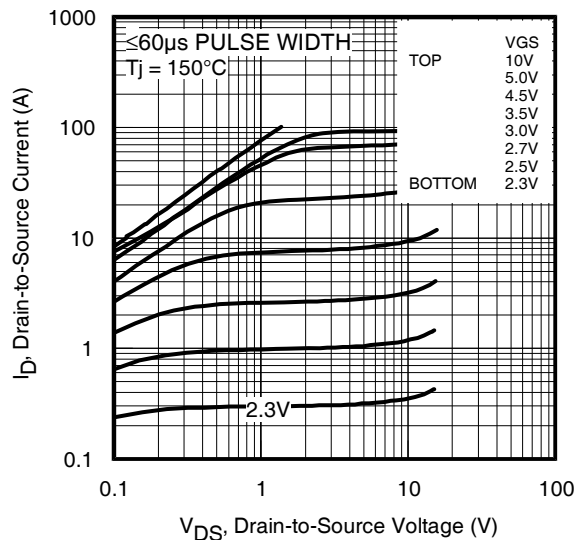
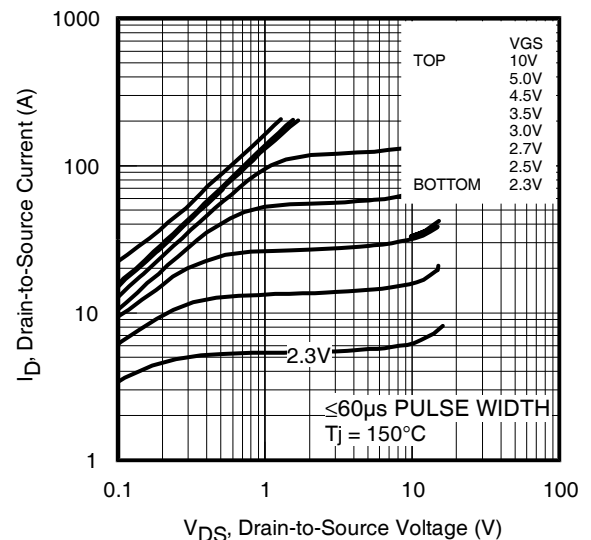
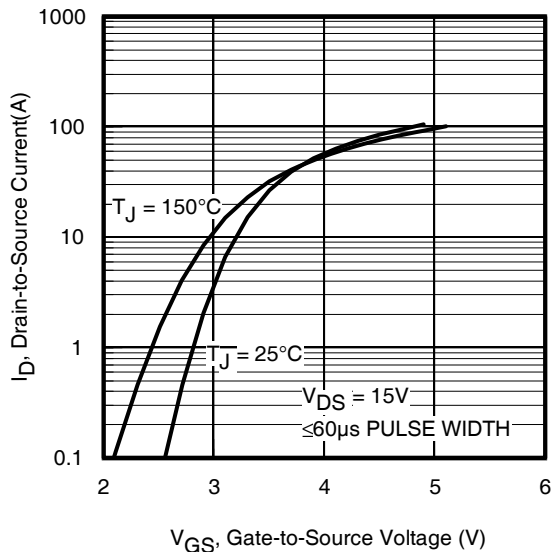
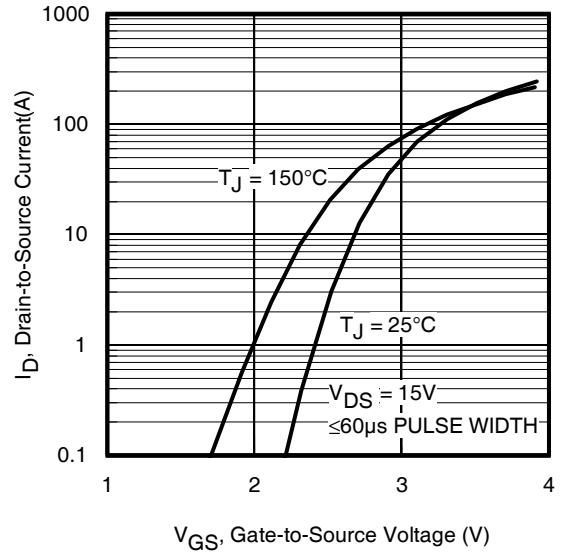
| | Parameter | | Min. | Typ. | Max. | Units | Conditions | | |
|--------------------------------|--|-------|------|-------|------|-------|--|----|-----------------------------|
| V_{DSS} | Drain-to-Source Breakdown Voltage | Q1&Q2 | 30 | — | — | V | $V_{GS} = 0V, I_D = 250\mu A$ | | |
| $\Delta BV_{DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient | Q1 | — | 0.021 | — | V/°C | Reference to 25°C, $I_D = 1mA$ | | |
| | | Q2 | — | 0.022 | — | | | | |
| $R_{DS(on)}$ | Static Drain-to-Source On-Resistance | Q1 | — | 7.2 | 8.6 | mΩ | $V_{GS} = 10V, I_D = 12A$ ③ | | |
| | | | — | 11.1 | 14.5 | | $V_{GS} = 4.5V, I_D = 10A$ ③ | | |
| | | Q2 | — | 2.4 | 3.0 | | $V_{GS} = 10V, I_D = 26A$ ③ | | |
| | | | — | 3.4 | 4.0 | | $V_{GS} = 4.5V, I_D = 21A$ ③ | | |
| $V_{GS(th)}$ | Gate Threshold Voltage | Q1&Q2 | 1.35 | — | 2.35 | V | Q1: $V_{DS} = V_{GS}, I_D = 25\mu A$ | | |
| $\Delta V_{GS(th)}/\Delta T_J$ | Gate Threshold Voltage Coefficient | Q1 | — | -6.8 | — | mV/°C | Q2: $V_{DS} = V_{GS}, I_D = 100\mu A$ | | |
| | | Q2 | — | -6.4 | — | | | | |
| I_{DSS} | Drain-to-Source Leakage Current | Q1&Q2 | — | — | 1.0 | μA | $V_{DS} = 24V, V_{GS} = 0V$ | | |
| | | Q1&Q2 | — | — | 150 | | $V_{DS} = 24V, V_{GS} = 0V, T_J = 125^\circ C$ | | |
| I_{GSS} | Gate-to-Source Forward Leakage | Q1&Q2 | — | — | 100 | nA | $V_{GS} = 20V$ | | |
| | Gate-to-Source Reverse Leakage | Q1&Q2 | — | — | -100 | | $V_{GS} = -20V$ | | |
| g_{fs} | Forward Transconductance | Q1 | 17 | — | — | S | $V_{DS} = 15V, I_D = 10A$ | | |
| | | Q2 | 106 | — | — | | $V_{DS} = 15V, I_D = 21A$ | | |
| Q_g | Total Gate Charge | Q1 | — | 8.3 | 12 | nC | Q1 $V_{DS} = 15V$ $V_{GS} = 4.5V, I_D = 10A$ Q2 $V_{DS} = 15V$ $V_{GS} = 4.5V, I_D = 21A$ | | |
| Q_{gs1} | Pre-V _{th} Gate-to-Source Charge | Q1 | — | 2.0 | — | | | | |
| | | Q2 | — | 7.9 | — | | | | |
| Q_{gs2} | Post-V _{th} Gate-to-Source Charge | Q1 | — | 1.0 | — | | | | |
| | | Q2 | — | 3.6 | — | | | | |
| Q_{gd} | Gate-to-Drain Charge | Q1 | — | 3.2 | — | | | | |
| | | Q2 | — | 11 | — | | | | |
| Q_{godr} | Gate Charge Overdrive | Q1 | — | 2.1 | — | | | | |
| | | Q2 | — | 12 | — | | | | |
| Q_{sw} | Switch Charge ($Q_{gs2} + Q_{gd}$) | Q1 | — | 4.2 | — | | | | |
| | | Q2 | — | 15 | — | | | | |
| Q_{oss} | Output Charge | Q1 | — | 5.0 | — | | | nC | $V_{DS} = 16V, V_{GS} = 0V$ |
| | | Q2 | — | 19 | — | | | | |
| R_G | Gate Resistance | Q1 | — | 1.8 | — | | | Ω | |
| | | Q2 | — | 0.7 | — | | | | |
| $t_{d(on)}$ | Turn-On Delay Time | Q1 | — | 12 | — | ns | Q1 $V_{DD} = 15V, V_{GS} = 4.5V$ $I_D = 10A$ $R_G = 1.8\Omega$ Q2 $V_{DD} = 15V, V_{GS} = 4.5V$ $I_D = 21A$ $R_G = 1.8\Omega$ | | |
| | | Q2 | — | 22 | — | | | | |
| t_r | Rise Time | Q1 | — | 15 | — | | | | |
| | | Q2 | — | 35 | — | | | | |
| $t_{d(off)}$ | Turn-Off Delay Time | Q1 | — | 12 | — | | | | |
| | | Q2 | — | 28 | — | | | | |
| t_f | Fall Time | Q1 | — | 5.9 | — | pF | $V_{GS} = 0V$ $V_{DS} = 15V$ $f = 1.0MHz$ | | |
| | | Q2 | — | 14 | — | | | | |
| C_{iss} | Input Capacitance | Q1 | — | 1060 | — | | | | |
| | | Q2 | — | 4450 | — | | | | |
| C_{oss} | Output Capacitance | Q1 | — | 230 | — | | | | |
| | | Q2 | — | 850 | — | | | | |
| C_{rss} | Reverse Transfer Capacitance | Q1 | — | 110 | — | | | | |
| | | Q2 | — | 440 | — | | | | |

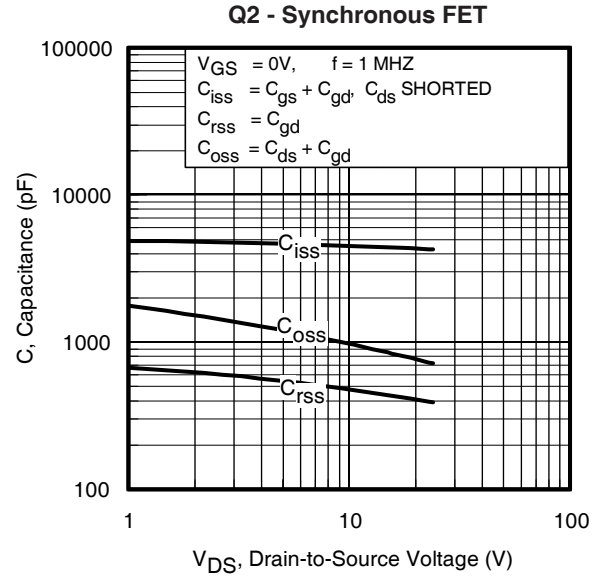
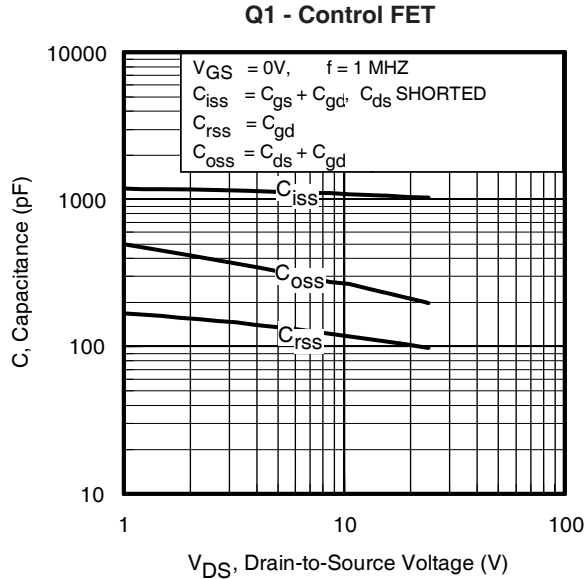
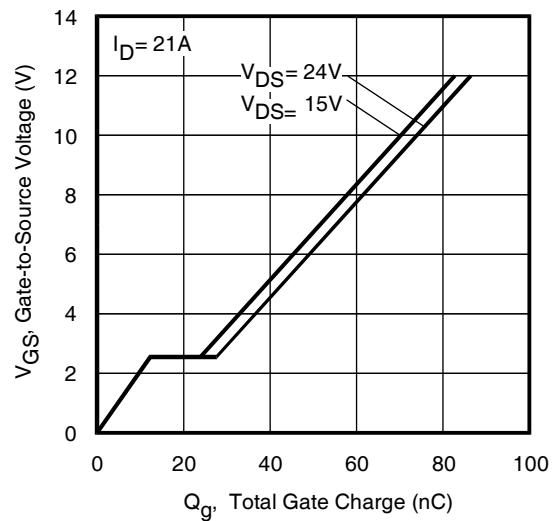
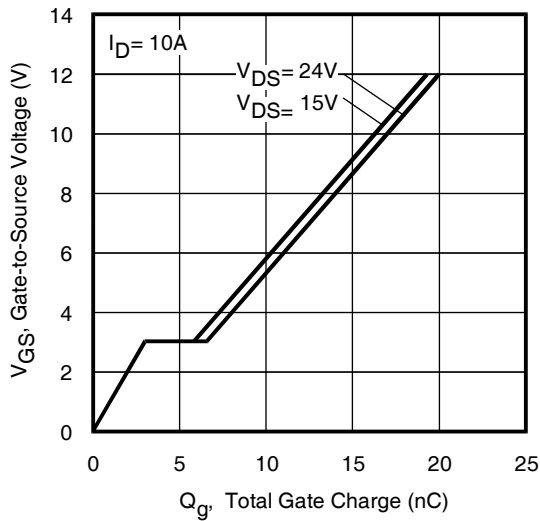
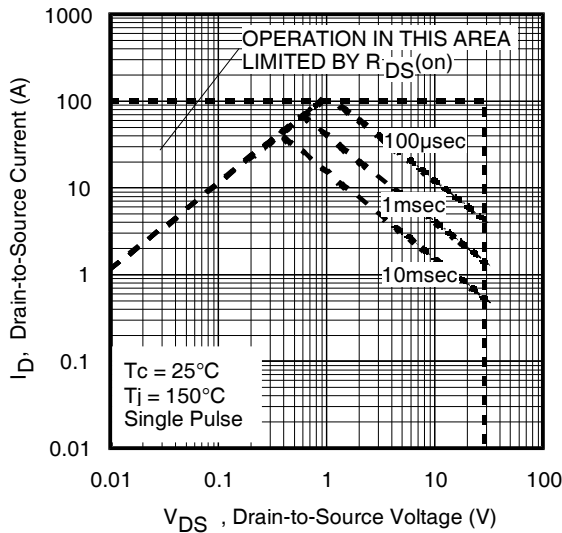
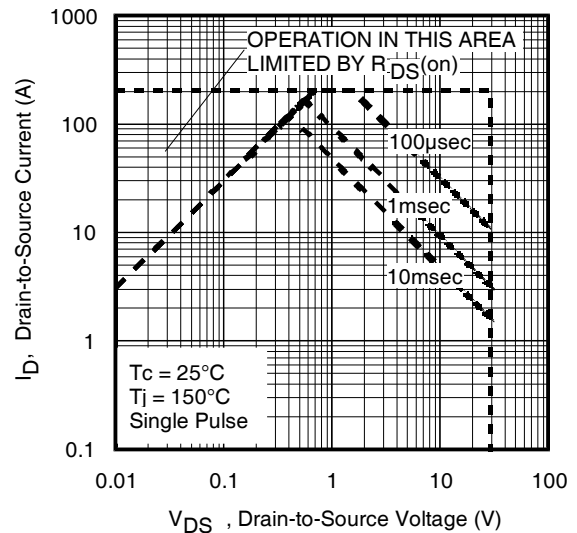
Avalanche Characteristics

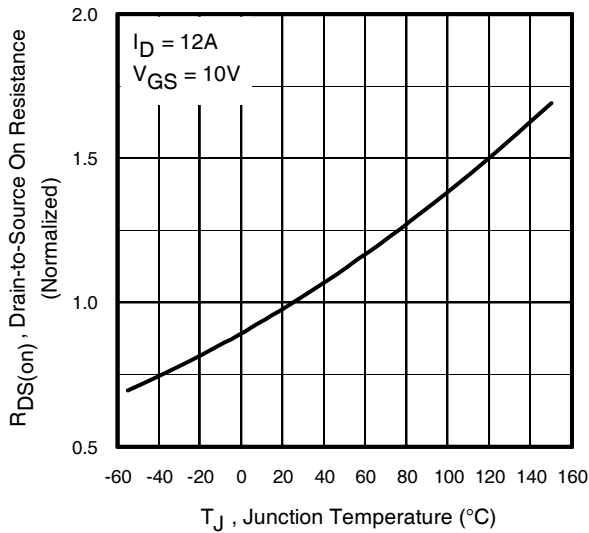
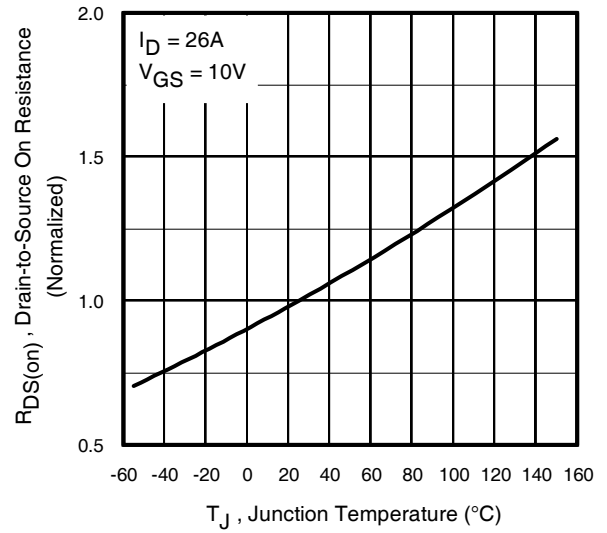
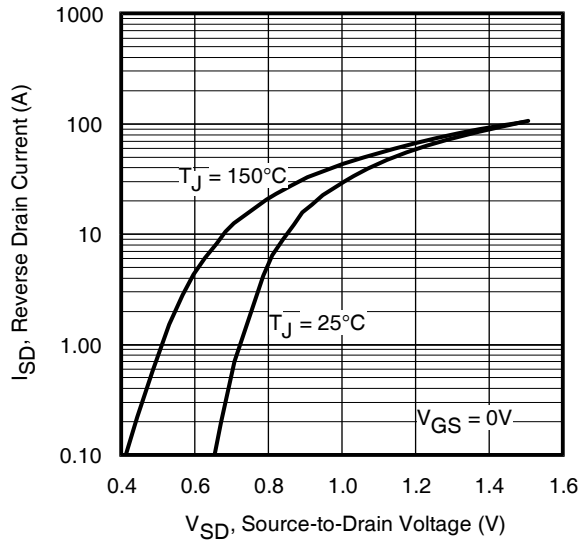
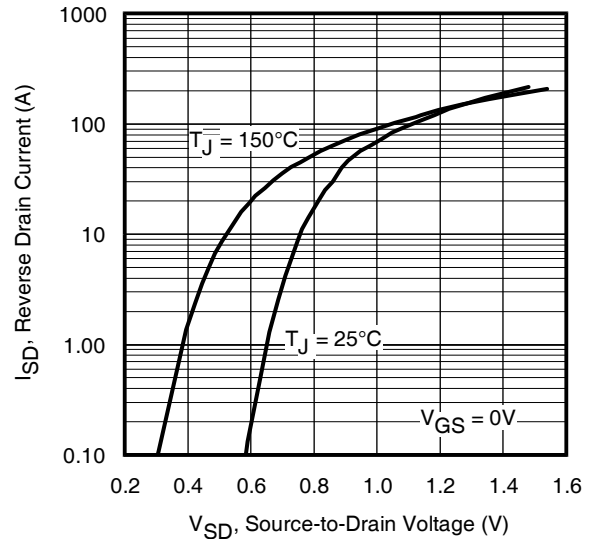
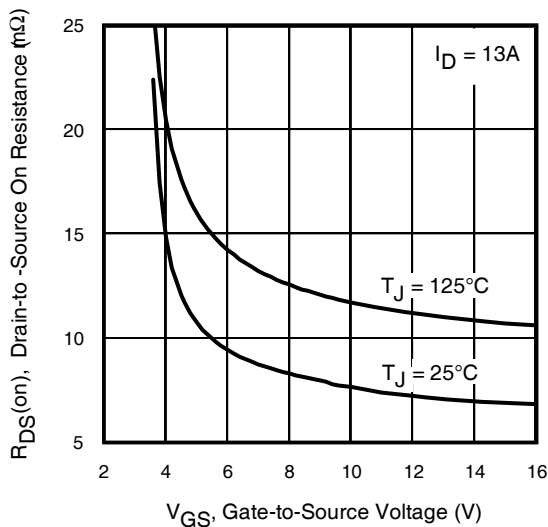
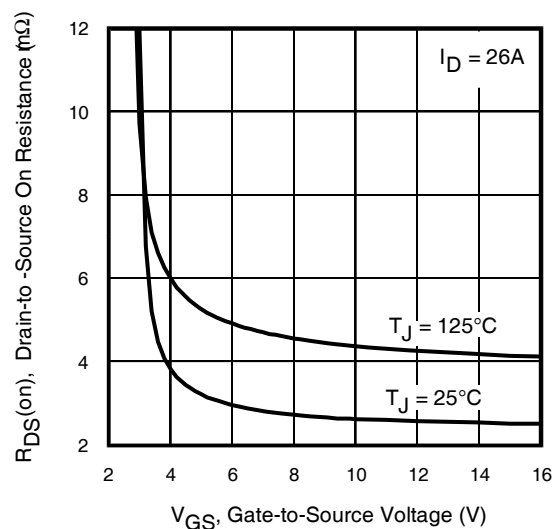
| | Parameter | Typ. | Q1 Max. | Q2 Max. | Units |
|----------|---------------------------------|------|---------|---------|-------|
| E_{AS} | Single Pulse Avalanche Energy ② | — | 12 | 32 | mJ |
| I_{AR} | Avalanche Current ① | — | 10 | 21 | A |

Diode Characteristics

| | Parameter | | Min. | Typ. | Max. | Units | Conditions |
|----------|--|----|------|------|------|-------|--|
| I_S | Continuous Source Current (Body Diode) | Q1 | — | — | 3.0 | A | MOSFET symbol showing the integral reverse p-n junction diode.  |
| | | Q2 | — | — | 3.0 | | |
| I_{SM} | Pulsed Source Current (Body Diode) ① | Q1 | — | — | 100 | A | |
| | | Q2 | — | — | 230 | | |
| V_{SD} | Diode Forward Voltage | Q1 | — | — | 1.0 | V | $T_J = 25^\circ C, I_S = 10A, V_{GS} = 0V$ ③ |
| | | Q2 | — | — | 1.0 | | $T_J = 25^\circ C, I_S = 21A, V_{GS} = 0V$ ③ |
| t_{rr} | Reverse Recovery Time | Q1 | — | 13 | 20 | ns | Q1 $T_J = 25^\circ C, I_F = 10A, V_{DD} = 15V, di/dt = 300A/\mu s$ ③ |
| | | Q2 | — | 20 | 29 | | |
| Q_{rr} | Reverse Recovery Charge | Q1 | — | 13 | 20 | nC | Q2 $T_J = 25^\circ C, I_F = 21A, V_{DD} = 15V, di/dt = 280A/\mu s$ ③ |
| | | Q2 | — | 24 | 36 | | |

Typical Characteristics

Fig 1. Typical Output Characteristics

Fig 2. Typical Output Characteristics

Fig 3. Typical Output Characteristics

Fig 4. Typical Output Characteristics

Fig 5. Typical Transfer Characteristics

Fig 6. Typical Transfer Characteristics

Typical Characteristics

Fig 7. Typical Capacitance vs. Drain-to-Source Voltage **Fig 8. Typical Capacitance vs. Drain-to-Source Voltage**

Fig 9. Typical Gate Charge vs. Gate-to-Source Voltage
Fig 10. Typical Gate Charge vs. Gate-to-Source Voltage

Fig 11. Maximum Safe Operating Area

Fig 12. Maximum Safe Operating Area

Typical Characteristics
Q1 - Control FET

Fig 13. Normalized On-Resistance vs. Temperature
Q2 - Synchronous FET

Fig 14. Normalized On-Resistance vs. Temperature

Fig 15. Typical Source-Drain Diode Forward Voltage

Fig 16. Typical Source-Drain Diode Forward Voltage

Fig 17. Typical On-Resistance vs. Gate Voltage

Fig 18. Typical On-Resistance vs. Gate Voltage

Typical Characteristics

Q1 - Control FET

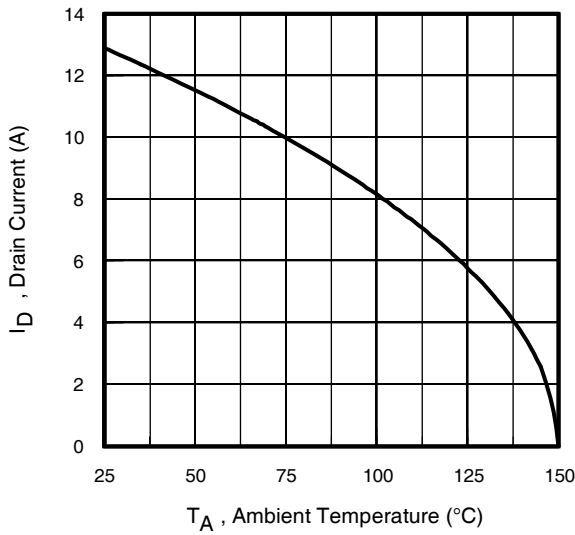


Fig 19. Maximum Drain Current vs. Ambient Temp.

Q2 - Synchronous FET

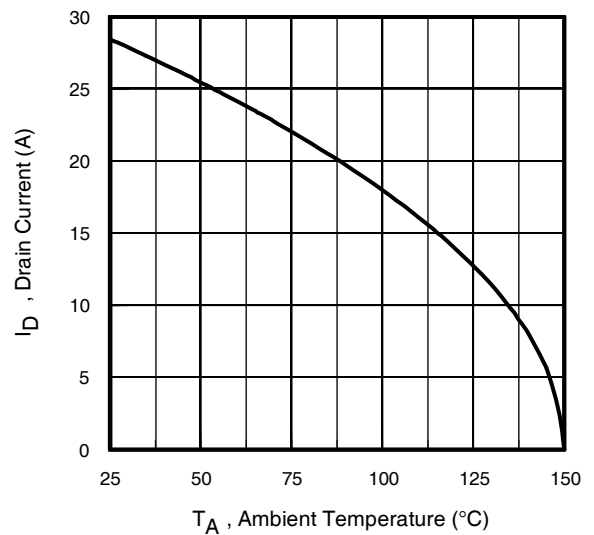


Fig 20. Maximum Drain Current vs. Ambient Temp.

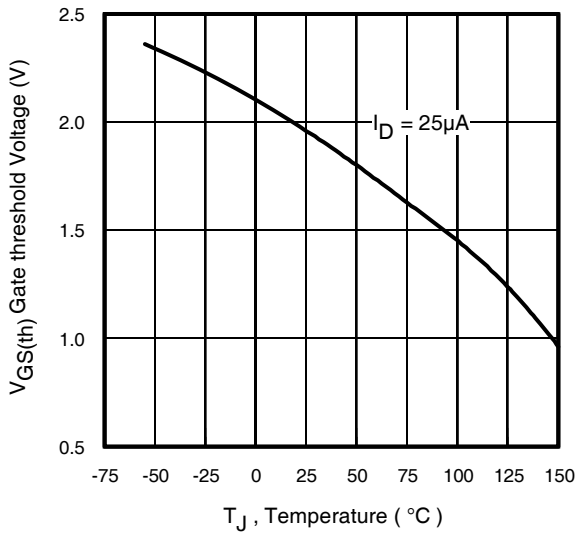


Fig 21. Threshold Voltage vs. Temperature

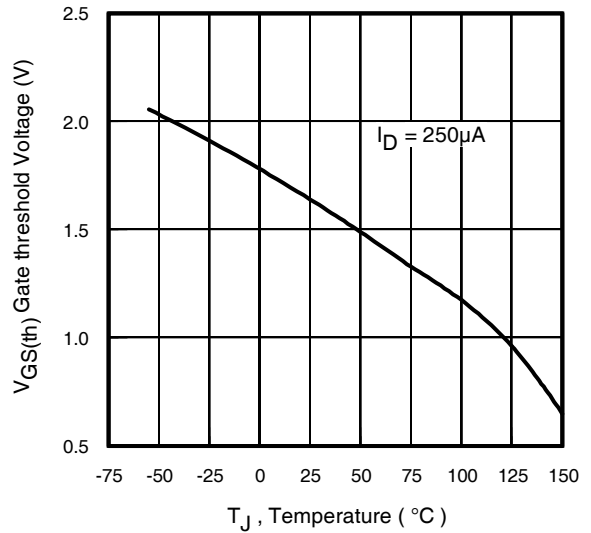


Fig 22. Threshold Voltage vs. Temperature

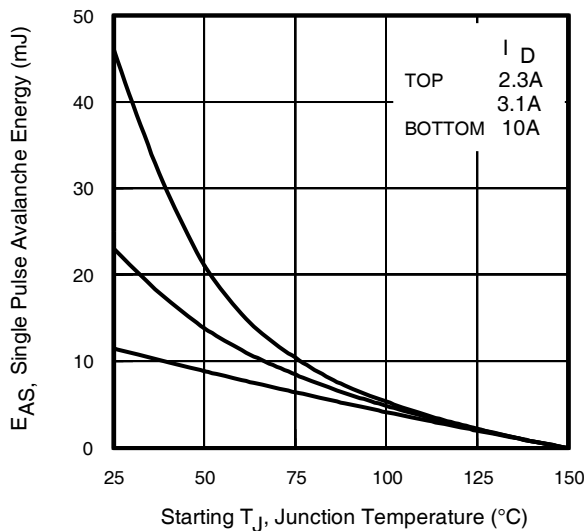


Fig 23. Maximum Avalanche Energy vs. Drain Current

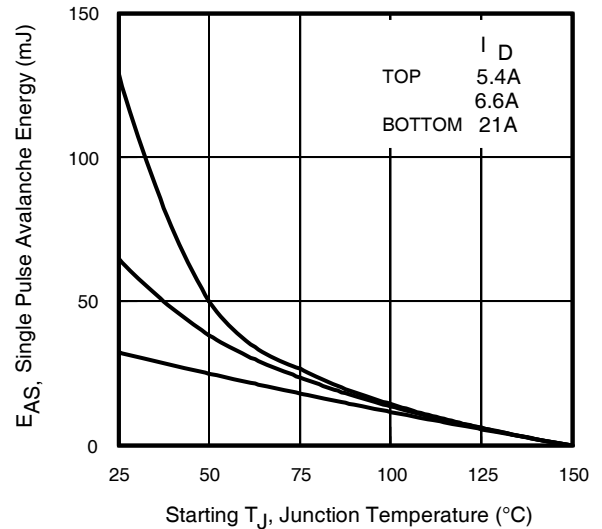


Fig 24. Maximum Avalanche Energy vs. Drain Current

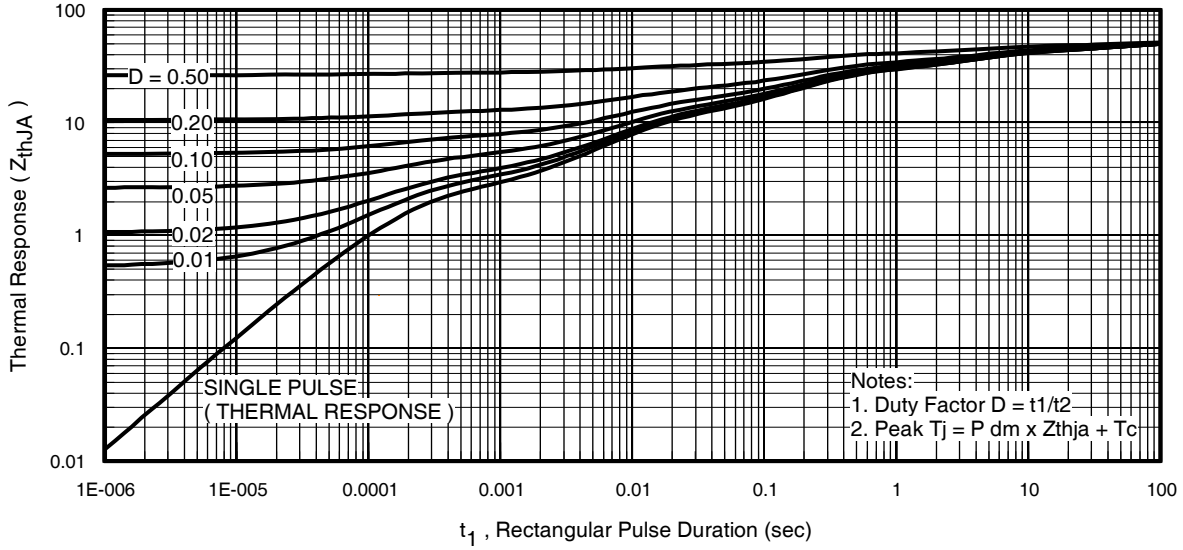


Fig 25. Maximum Effective Transient Thermal Impedance, Junction-to-Ambient (Q1)

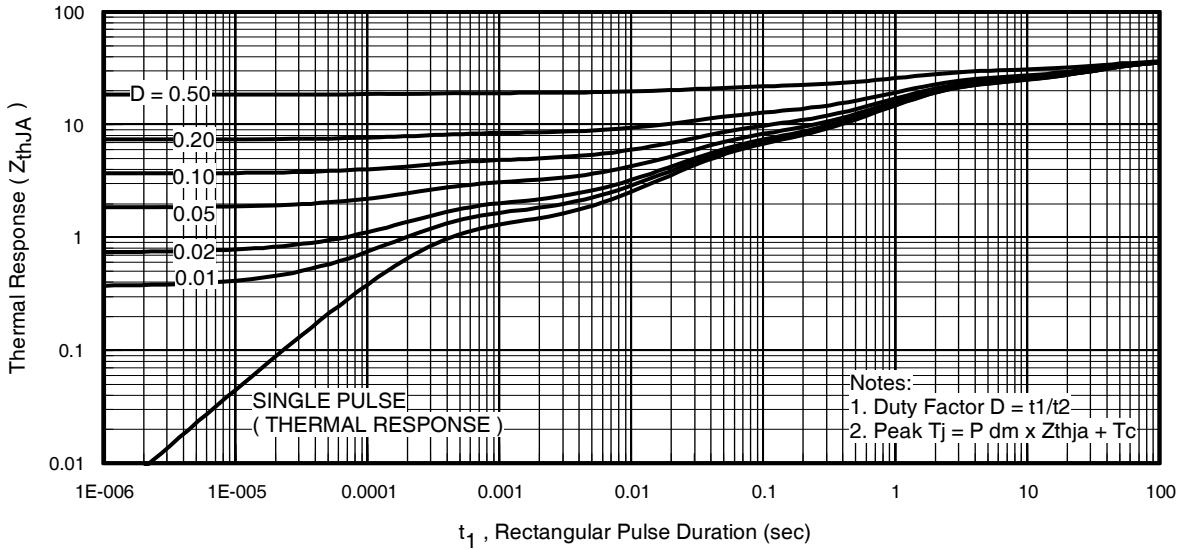
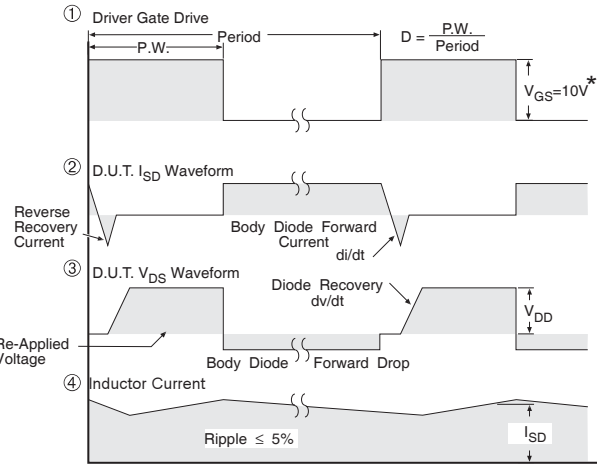
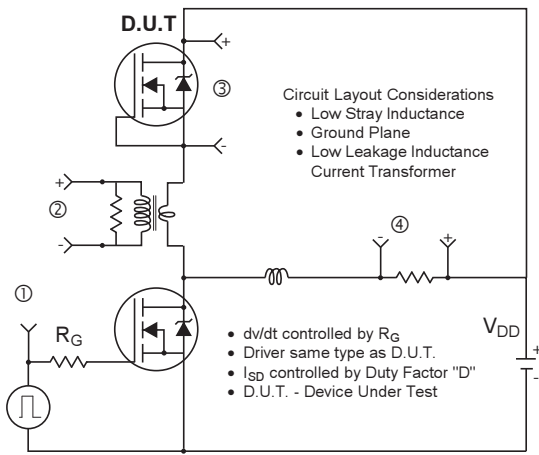


Fig 26. Maximum Effective Transient Thermal Impedance, Junction-to-Ambient (Q2)



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

Fig 28. Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs

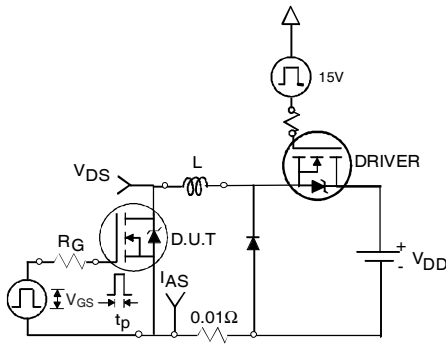


Fig 29a. Unclamped Inductive Test Circuit

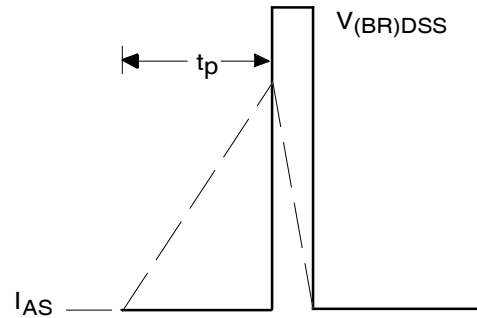


Fig 29b. Unclamped Inductive Waveforms

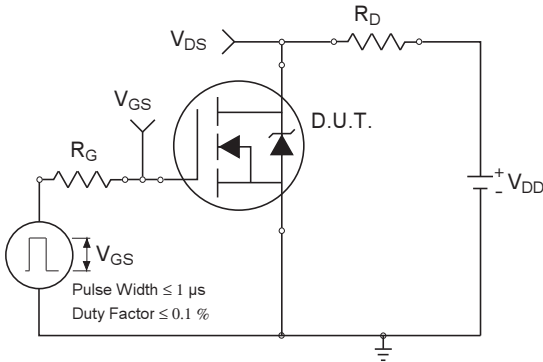


Fig 30a. Switching Time Test Circuit

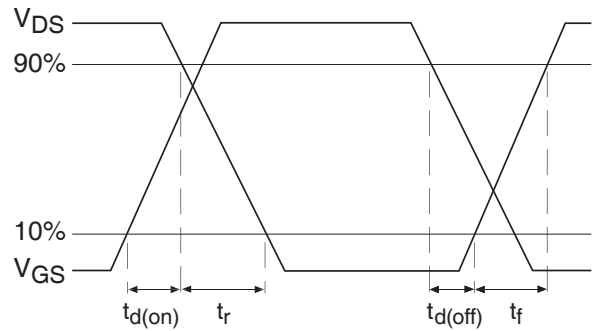


Fig 30b. Switching Time Waveforms

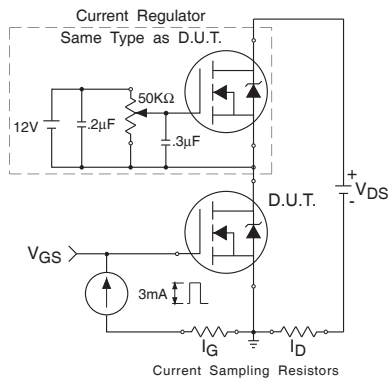


Fig 31a. Gate Charge Test Circuit

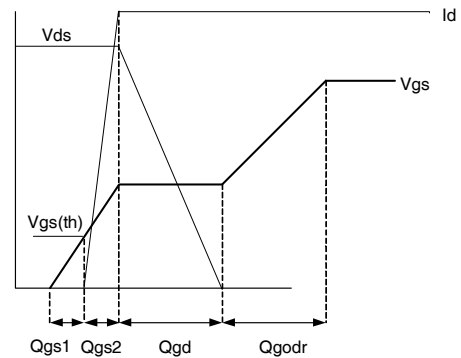
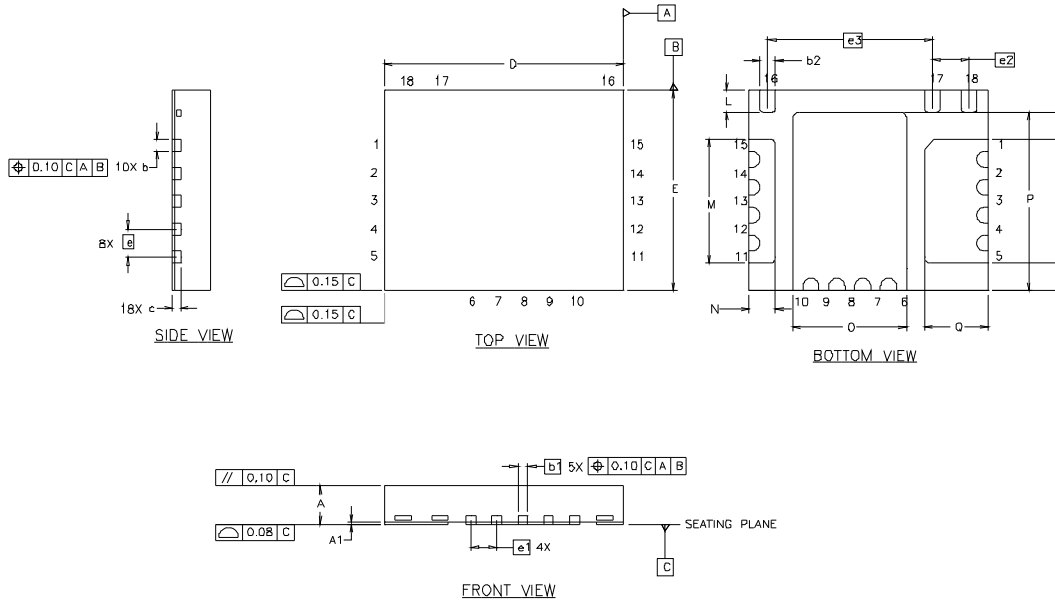


Fig 31b. Gate Charge Waveform

PQFN 5x6 Outline "C" Package Details

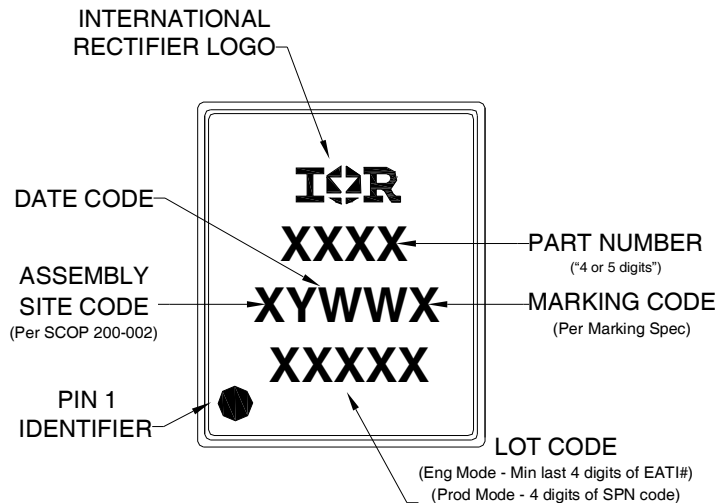


Outline PQFN 5X6 C

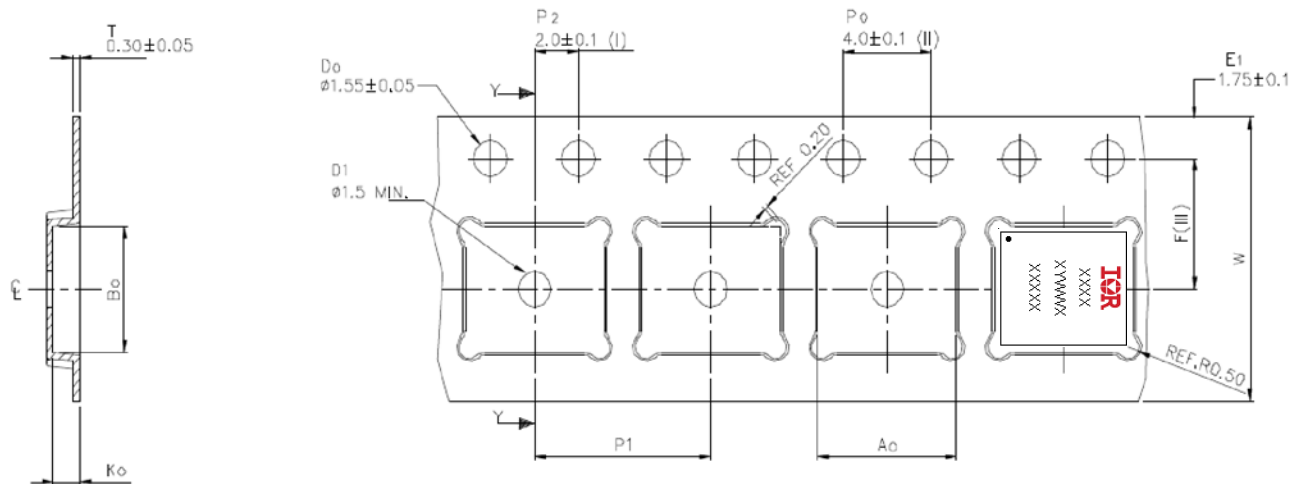
| DIM | INCHES | | MILLIMETERS | |
|-----|-------------|-------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | .0315 | .0394 | 0.800 | 1.000 |
| A1 | .0000 | .0020 | 0.000 | 0.050 |
| b | .0098 | .0158 | 0.250 | 0.350 |
| b1 | .0079 | 0.118 | 0.200 | 0.300 |
| b2 | .0138 | .0177 | 0.350 | 0.450 |
| e | .0080 REF. | | 0.203 REF. | |
| D | .2362 BASIC | | 6.000 BASIC | |
| E | .1969 BASIC | | 5.000 BASIC | |
| e | .0276 BASIC | | 0.700 BASIC | |
| e1 | .0256 BASIC | | 0.650 BASIC | |
| e2 | .0365 BASIC | | 0.926 BASIC | |
| e3 | .1630 BASIC | | 4.140 BASIC | |
| L | .0197 | .0236 | 0.500 | 0.600 |
| M | .1201 | 1.240 | 3.050 | 3.150 |
| N | .0243 | .0282 | .617 | .717 |
| O | .1102 | 1.142 | 2.800 | 2.900 |
| P | .1732 | .1772 | 4.400 | 4.500 |
| Q | .0607 | .0647 | 1.543 | 1.643 |
| R | .0266 REF. | | 0.675 REF. | |
| S | .0266 REF. | | 0.675 REF. | |

For footprint and stencil design recommendations, please refer to application note AN-1136 at <http://www.irf.com/technical-info/appnotes/an-1136.pdf>

PQFN 5x6 Outline "C" Part Marking



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

PQFN 5x6 Outline "C" Tape and Reel


SECTION Y-Y

| | |
|----------------|---------------|
| A ₀ | 6.30 +/− 0.1 |
| B ₀ | 5.30 +/− 0.1 |
| K ₀ | 1.20 +/− 0.1 |
| F | 5.50 +/− 0.1 |
| P ₁ | 8.00 +/− 0.1 |
| W | 12.00 +/− 0.3 |

- (I) Measured from centreline of sprocket hole to centreline of pocket.
- (II) Cumulative tolerance of 10 sprocket holes is ± 0.20 .
- (III) Measured from centreline of sprocket hole to centreline of pocket.
- (IV) Other material available.
- (V) Typical SR of form tape Max 10⁹ OHM/SQ

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.

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

Qualification information[†]

| | | |
|----------------------------|---|--|
| Qualification level | Consumer ^{††} (per JEDEC JESD47F ^{†††} guidelines) | |
| Moisture Sensitivity Level | PQFN 5mm x 6mm | MSL2 ^{††††} (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.

†††† Higher MSL ratings may be available for the specific package types listed here. Please contact your International Rectifier sales representative for further information:

<http://www.irf.com/whoto-call/salesrep/>

Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Starting $T_J = 25^\circ\text{C}$,
Q1: $L = 0.23\text{mH}$, $R_G = 25\Omega$, $I_{AS} = 10\text{A}$;
Q2: $L = 0.15\text{mH}$, $R_G = 25\Omega$, $I_{AS} = 21\text{A}$.
- ③ Pulse width $\leq 400\mu\text{s}$; duty cycle $\leq 2\%$.
- ④ When mounted on 1 inch square copper board.
- ⑤ R_θ is measured at T_J approximately 90°C .

Revision History

| Date | Comment |
|------------|--|
| 1/8/2010 | • Pin number on front page drawing has been corrected |
| 7/15/2010 | • MSL2 Consumer Qualification on page1 has been corrected |
| 10/25/2011 | • Link from AN-1152 to AN-1136 on page 9 has been corrected |
| 5/9/2014 | • 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. |

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