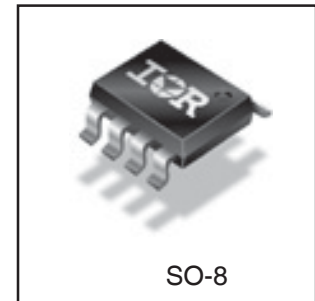
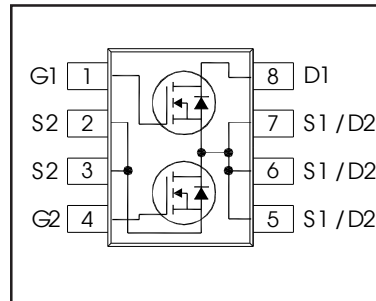


| | | |
|--|------|------------|
| V_{DS} | 30 | V |
| $R_{DS(on) \text{ max Q1}}$ (@ $V_{GS} = 10V$) | 16.2 | m Ω |
| $R_{DS(on) \text{ max Q2}}$ (@ $V_{GS} = 10V$) | 10.8 | |
| Q_g (typical) Q1 | 7.5 | nC |
| Q_g (typical) Q2 | 14 | |
| I_D (@ $T_A = 25^\circ C$) Q1 | 7.6 | A |
| I_D (@ $T_A = 25^\circ C$) Q2 | 11 | |



Applications

- Dual SO-8 MOSFET for POL Converters in Notebook Computers, Servers, Graphics Cards, Game Consoles and Set-Top Box

Features

| |
|---|
| Industry-standard pinout SO-8 Package |
| Compatible with Existing Surface Mount Techniques |
| RoHS Compliant, Halogen-Free |
| MSL1, Industrial qualification |

Benefits

| |
|------------------------------|
| ⇒ Multi-Vendor Compatibility |
| Easier Manufacturing |
| Environmentally Friendlier |
| Increased Reliability |

| Base Part Number | Package Type | Standard Pack | | Orderable Part Number |
|------------------|--------------|---------------|----------|-----------------------|
| | | Form | Quantity | |
| IRF7904PbF-1 | SO-8 | Tube/Bulk | 95 | IRF7904PbF-1 |
| | | Tape and Reel | 4000 | IRF7904TRPbF-1 |

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 | 7.6 | 11 | A |
| I_D @ $T_A = 70^\circ C$ | Continuous Drain Current, V_{GS} @ 10V | 6.1 | 8.9 | |
| I_{DM} | Pulsed Drain Current ① | 61 | 89 | |
| P_D @ $T_A = 25^\circ C$ | Power Dissipation | 1.4 | 2.0 | W |
| P_D @ $T_A = 70^\circ C$ | Power Dissipation | 0.9 | 1.3 | |
| | Linear Derating Factor | 0.011 | 0.016 | W/ $^\circ C$ |
| T_J | Operating Junction and | -55 to + 150 | | $^\circ C$ |
| T_{STG} | Storage Temperature Range | | | |

Thermal Resistance

| | Parameter | Q1 Max. | Q2 Max. | Units |
|-----------------|--------------------------|---------|---------|--------------|
| $R_{\theta JL}$ | Junction-to-Drain Lead ⑤ | 20 | 20 | $^\circ C/W$ |
| $R_{\theta JA}$ | Junction-to-Ambient ④⑤ | 90 | 62.5 | |

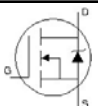
Static @ T_J = 25°C (unless otherwise specified)

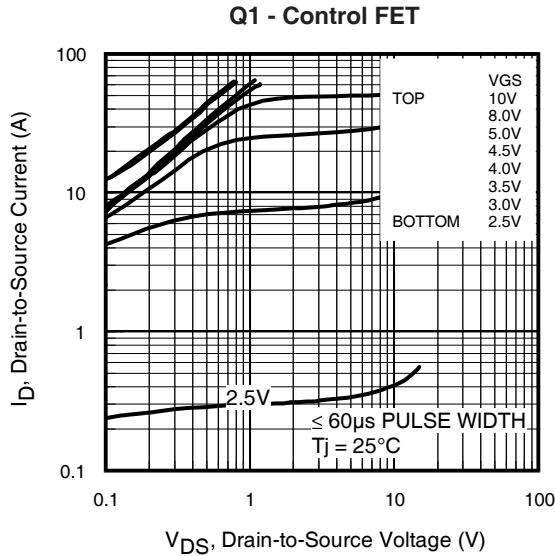
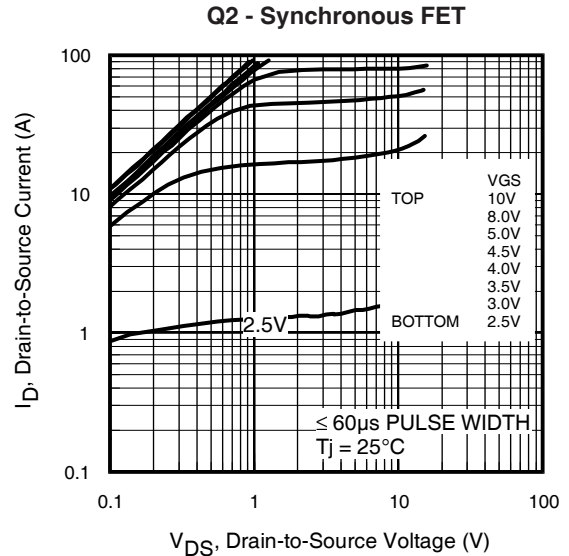
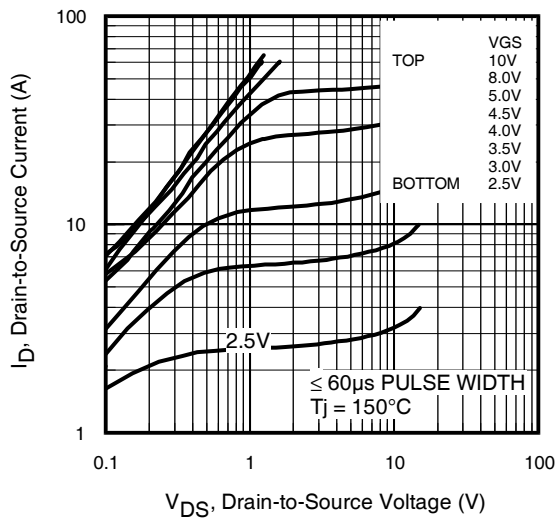
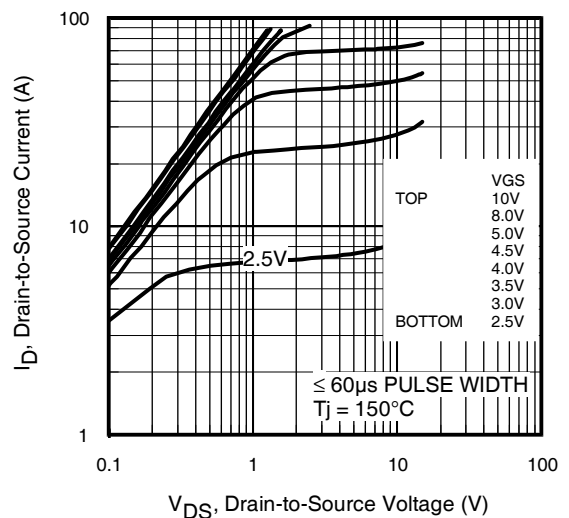
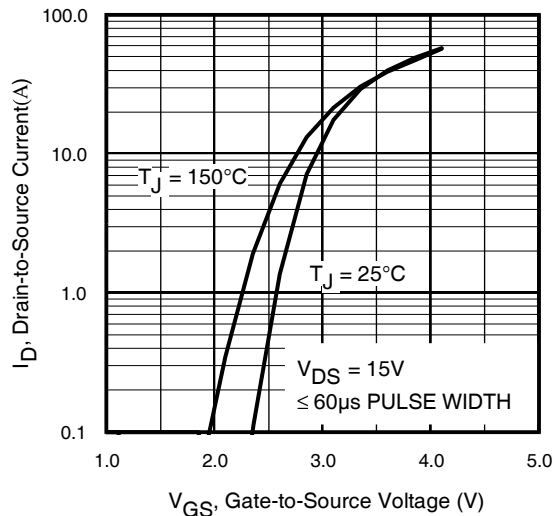
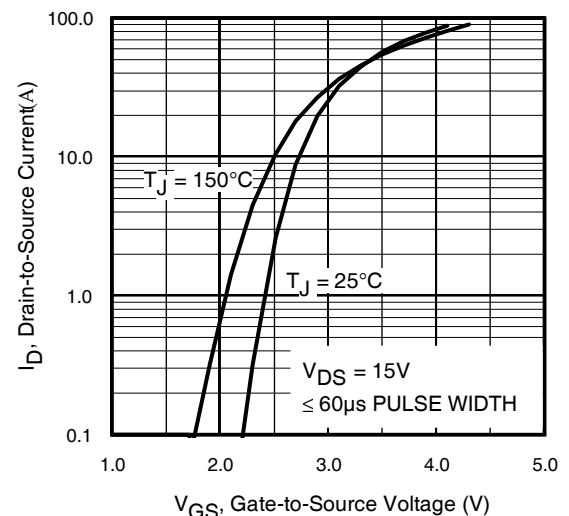
| | Parameter | | Min. | Typ. | Max. | Units | Conditions |
|---------------------------------------|---|-------|------|-------|------|-------|--|
| BV _{DSS} | Drain-to-Source Breakdown Voltage | Q1&Q2 | 30 | — | — | V | V _{GS} = 0V, I _D = 250μA |
| ΔBV _{DSS} /ΔT _J | Breakdown Voltage Temp. Coefficient | Q1 | — | 0.024 | — | V/°C | Reference to 25°C, I _D = 1mA |
| | | Q2 | — | 0.024 | — | | |
| R _{DS(on)} | Static Drain-to-Source On-Resistance | Q1 | — | 11.4 | 16.2 | mΩ | V _{GS} = 10V, I _D = 7.6A ③ |
| | | | — | 14.5 | 20.5 | | V _{GS} = 4.5V, I _D = 6.1A ③ |
| | | Q2 | — | 8.6 | 10.8 | | V _{GS} = 10V, I _D = 11A ③ |
| | | | — | 10 | 13 | | V _{GS} = 4.5V, I _D = 8.8A ③ |
| V _{GS(th)} | Gate Threshold Voltage | Q1&Q2 | 1.35 | — | 2.25 | V | Q1: V _{DS} = V _{GS} , I _D = 25μA |
| ΔV _{GS(th)} /ΔT _J | Gate Threshold Voltage Coefficient | Q1 | — | -5.0 | — | mV/°C | Q2: V _{DS} = V _{GS} , I _D = 50μA |
| | | Q2 | — | -5.0 | — | | |
| 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°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 = 6.1A |
| | | Q2 | 23 | — | — | | V _{DS} = 15V, I _D = 8.8A |
| Q _g | Total Gate Charge | Q1 | — | 7.5 | 11 | nC | Q1 V _{DS} = 15V V _{GS} = 4.5V, I _D = 6.1A Q2 V _{DS} = 15V V _{GS} = 4.5V, I _D = 8.8A |
| Q _{gs1} | Pre-V _{th} Gate-to-Source Charge | Q1 | — | 2.2 | — | | |
| | | Q2 | — | 3.7 | — | | |
| Q _{gs2} | Post-V _{th} Gate-to-Source Charge | Q1 | — | 0.6 | — | | |
| | | Q2 | — | 1.1 | — | | |
| Q _{gd} | Gate-to-Drain Charge | Q1 | — | 2.5 | — | | |
| | | Q2 | — | 4.8 | — | | |
| Q _{godr} | Gate Charge Overdrive | Q1 | — | 2.2 | — | | |
| | | Q2 | — | 4.4 | — | | |
| Q _{sw} | Switch Charge (Q _{gs2} + Q _{gd}) | Q1 | — | 3.1 | — | | |
| | | Q2 | — | 5.9 | — | | |
| Q _{oss} | Output Charge | Q1 | — | 4.5 | — | nC | V _{DS} = 16V, V _{GS} = 0V |
| | | Q2 | — | 9.1 | — | | |
| R _G | Gate Resistance | Q1 | — | 3.2 | 4.8 | Ω | |
| | | Q2 | — | 2.9 | 4.4 | | |
| t _{d(on)} | Turn-On Delay Time | Q1 | — | 6.9 | — | ns | Q1 V _{DD} = 15V, V _{GS} = 4.5V I _D = 6.1A |
| | | Q2 | — | 7.8 | — | | |
| t _r | Rise Time | Q1 | — | 7.3 | — | ns | Q2 V _{DD} = 15V, V _{GS} = 4.5V I _D = 8.8A Clamped Inductive Load |
| | | Q2 | — | 10 | — | | |
| t _{d(off)} | Turn-Off Delay Time | Q1 | — | 10 | — | ns | Q2 V _{DD} = 15V, V _{GS} = 4.5V I _D = 8.8A Clamped Inductive Load |
| | | Q2 | — | 15 | — | | |
| t _f | Fall Time | Q1 | — | 3.2 | — | ns | Q2 V _{DD} = 15V, V _{GS} = 4.5V I _D = 8.8A Clamped Inductive Load |
| | | Q2 | — | 4.6 | — | | |
| C _{iss} | Input Capacitance | Q1 | — | 910 | — | pF | V _{GS} = 0V V _{DS} = 15V f = 1.0MHz |
| | | Q2 | — | 1780 | — | | |
| C _{oss} | Output Capacitance | Q1 | — | 190 | — | pF | V _{GS} = 0V V _{DS} = 15V f = 1.0MHz |
| | | Q2 | — | 390 | — | | |
| C _{rss} | Reverse Transfer Capacitance | Q1 | — | 94 | — | pF | V _{GS} = 0V V _{DS} = 15V f = 1.0MHz |
| | | Q2 | — | 180 | — | | |

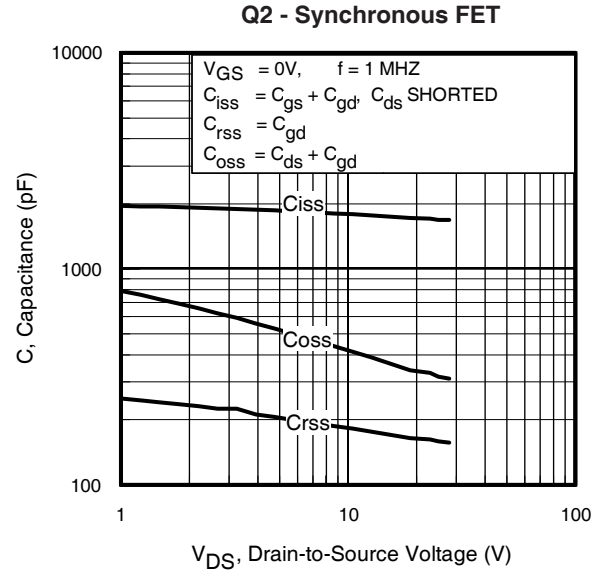
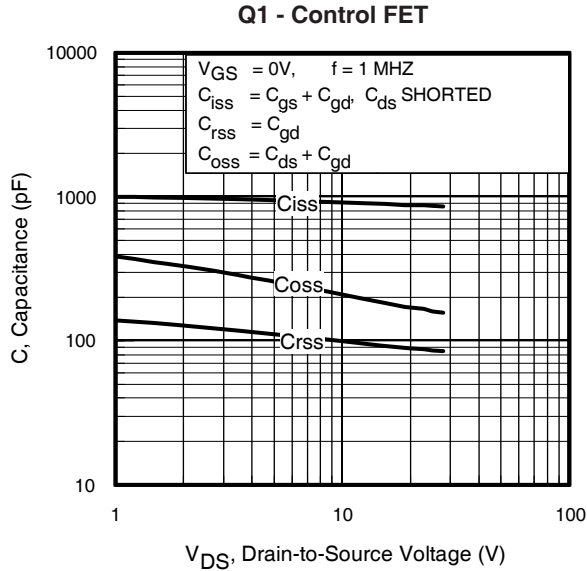
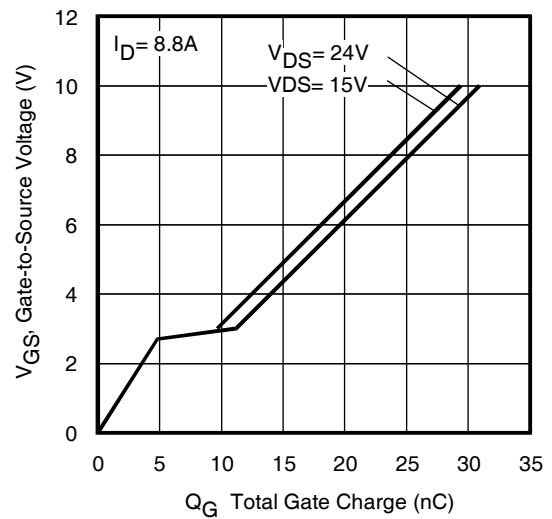
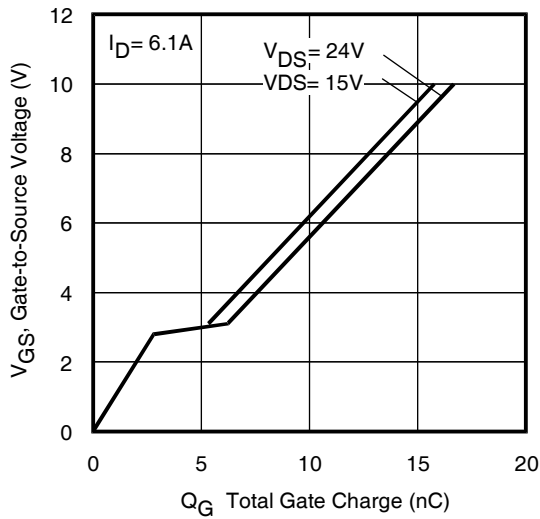
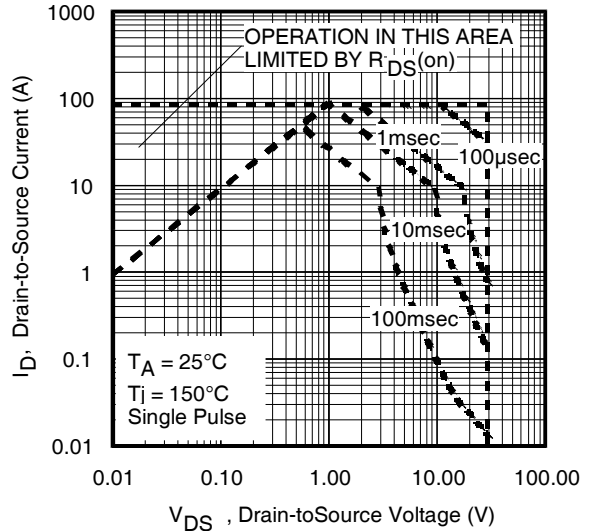
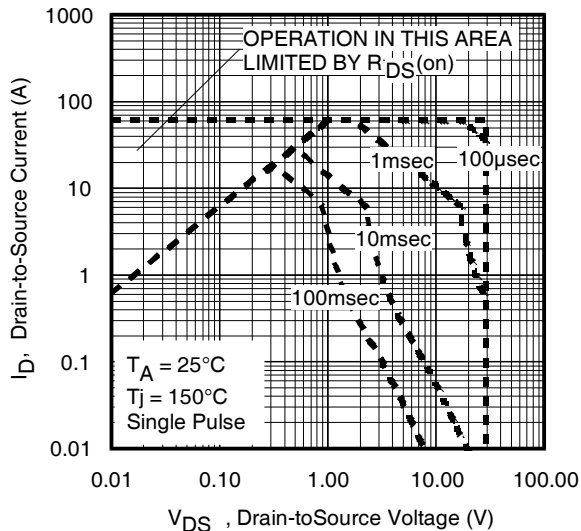
Avalanche Characteristics

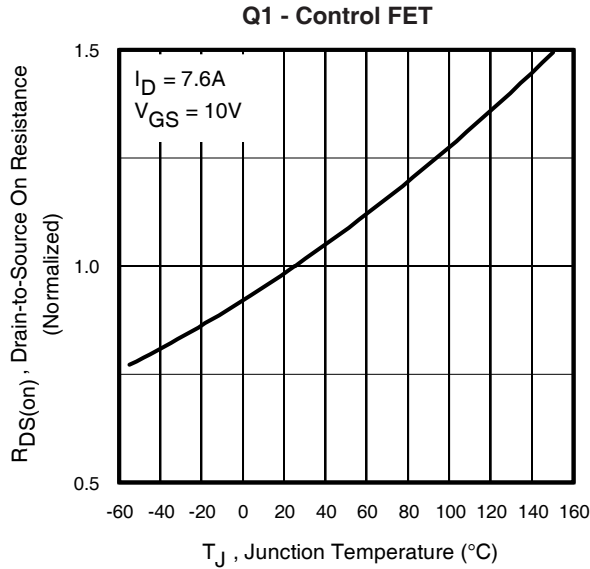
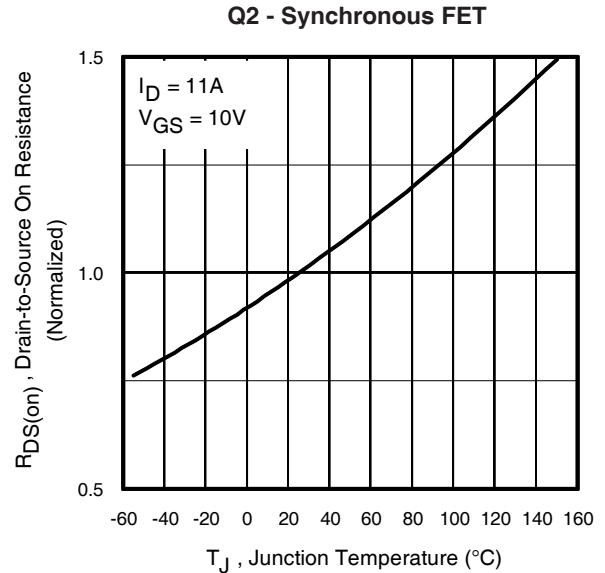
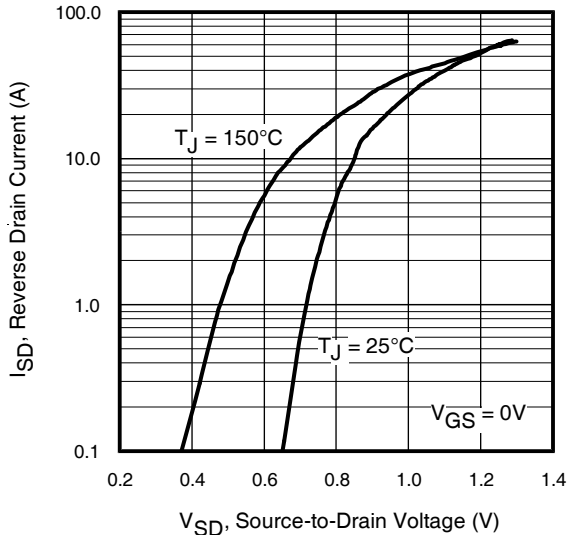
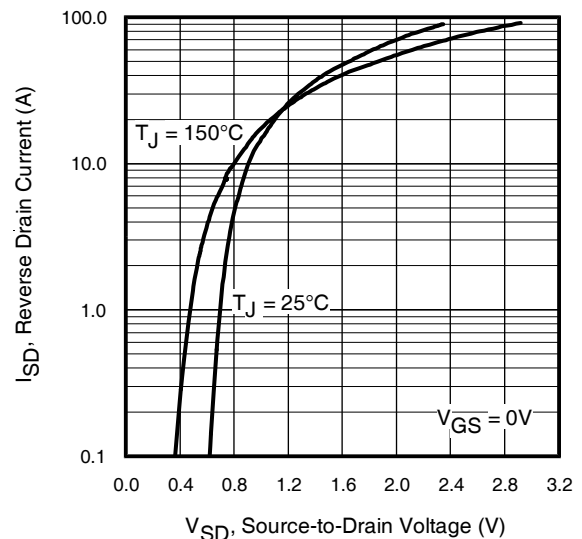
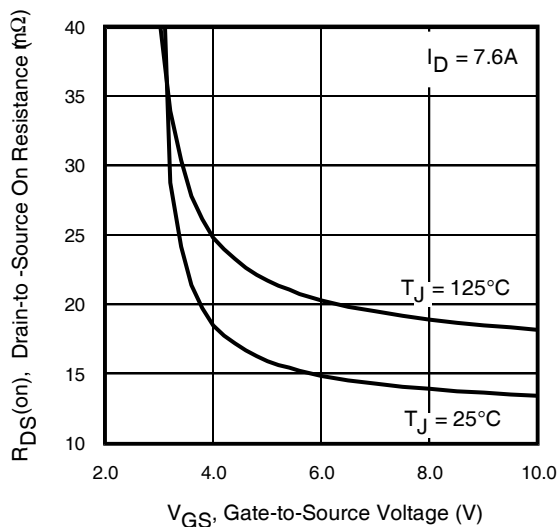
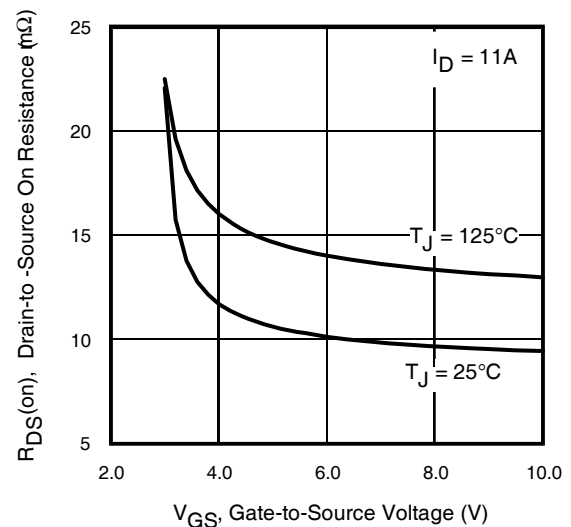
| | Parameter | Typ. | Q1 Max. | Q2 Max. | Units |
|-----------------|---------------------------------|------|---------|---------|-------|
| E _{AS} | Single Pulse Avalanche Energy ② | — | 140 | 250 | mJ |
| I _{AR} | Avalanche Current ① | — | 6.1 | 8.8 | A |

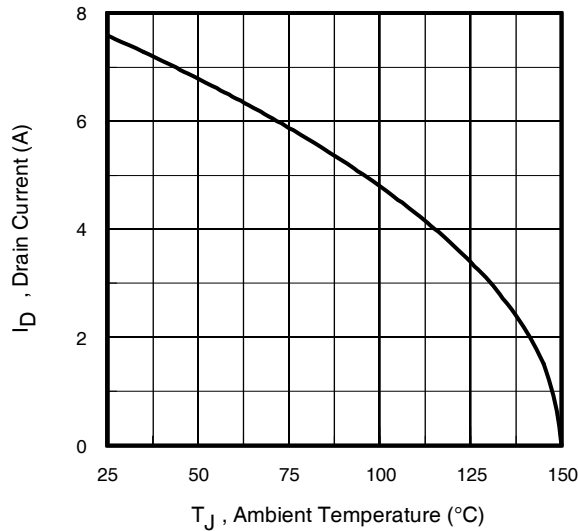
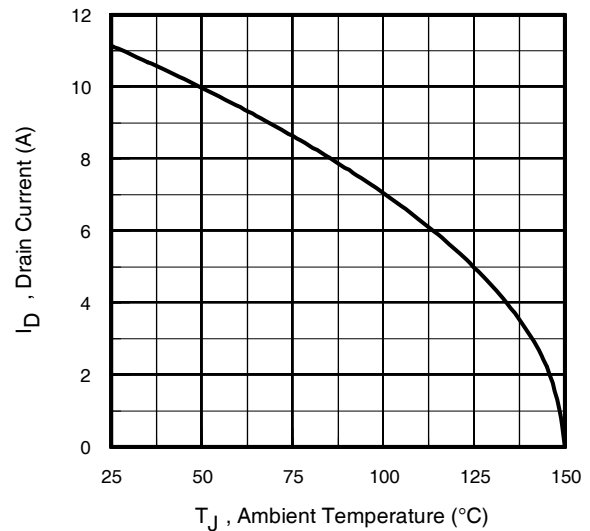
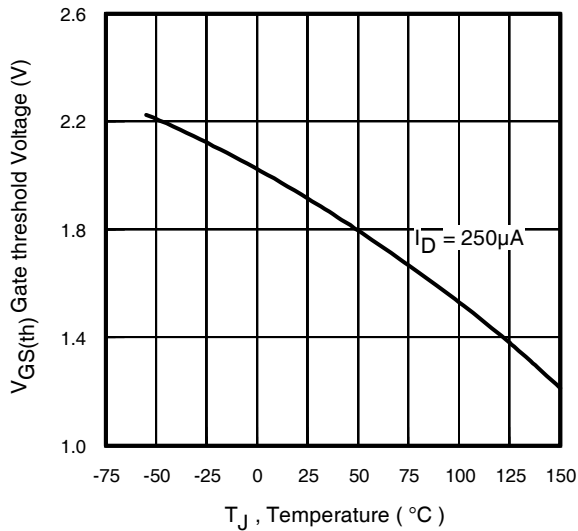
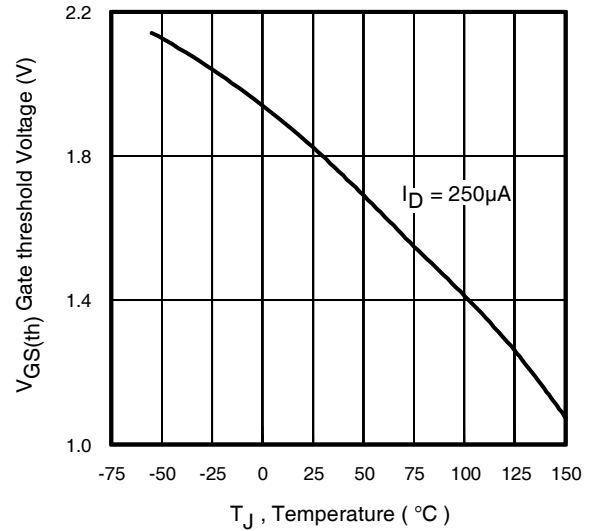
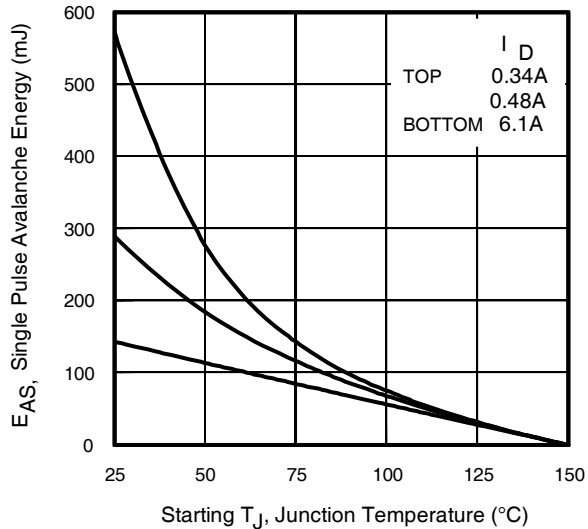
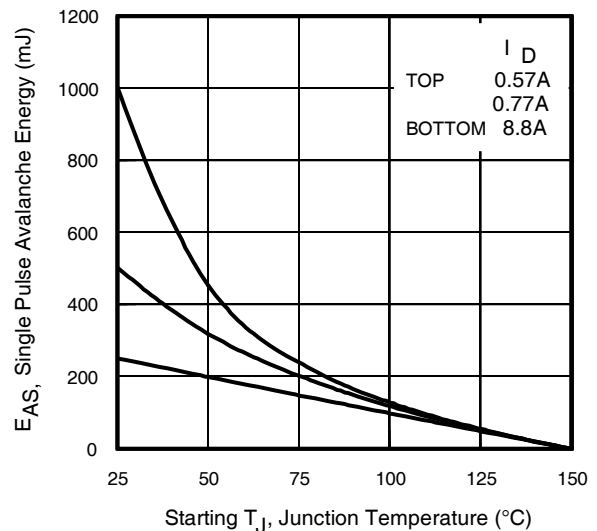
Diode Characteristics

| | Parameter | | Min. | Typ. | Max. | Units | Conditions |
|-----------------|--|----|------|------|------|-------|--|
| I _S | Continuous Source Current (Body Diode) | Q1 | — | — | 1.8 | A | MOSFET symbol showing the integral reverse p-n junction diode.  |
| | | Q2 | — | — | 2.5 | | |
| I _{SM} | Pulsed Source Current (Body Diode) ① | Q1 | — | — | 61 | A | |
| | | Q2 | — | — | 88 | | |
| V _{SD} | Diode Forward Voltage | Q1 | — | — | 1.0 | V | T _J = 25°C, I _S = 6.1A, V _{GS} = 0V ③ |
| | | Q2 | — | — | 1.0 | | T _J = 25°C, I _S = 8.8A, V _{GS} = 0V ③ |
| t _{rr} | Reverse Recovery Time | Q1 | — | 11 | 17 | ns | Q1 T _J = 25°C, I _F = 6.1A, V _{DD} = 15V, di/dt = 100A/μs ③ |
| | | Q2 | — | 16 | 24 | | |
| Q _{rr} | Reverse Recovery Charge | Q1 | — | 2.6 | 3.9 | nC | Q2 T _J = 25°C, I _F = 8.8A, V _{DD} = 15V, di/dt = 100A/μs ③ |
| | | Q2 | — | 6.9 | 10 | | |

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

Fig 13. Normalized On-Resistance vs. Temperature

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

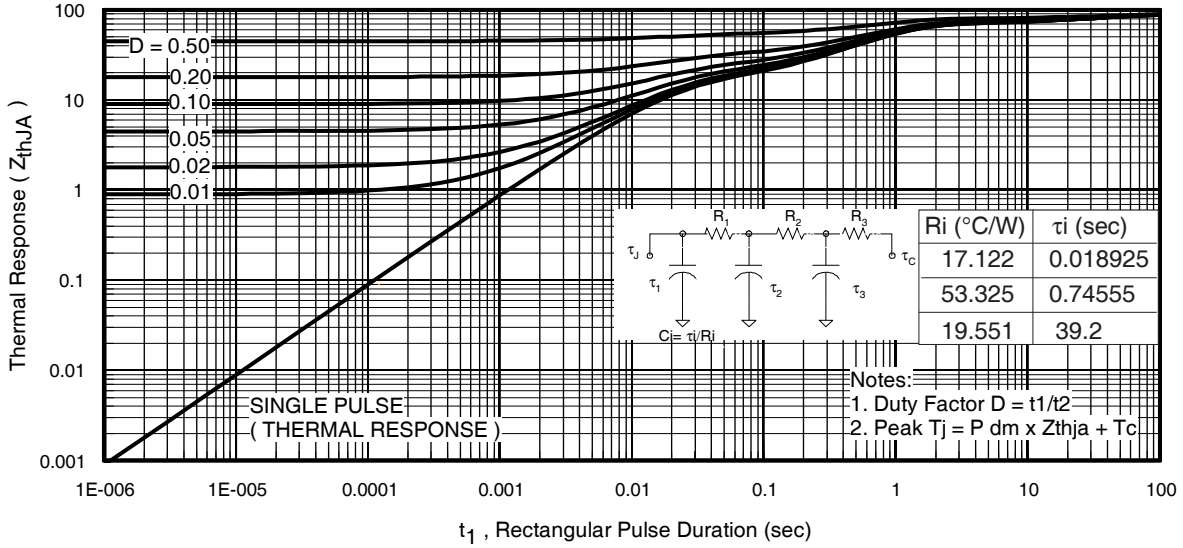


Fig 25. Maximum Effective Transient Thermal Impedance, Junction-to-Ambient (Q1)

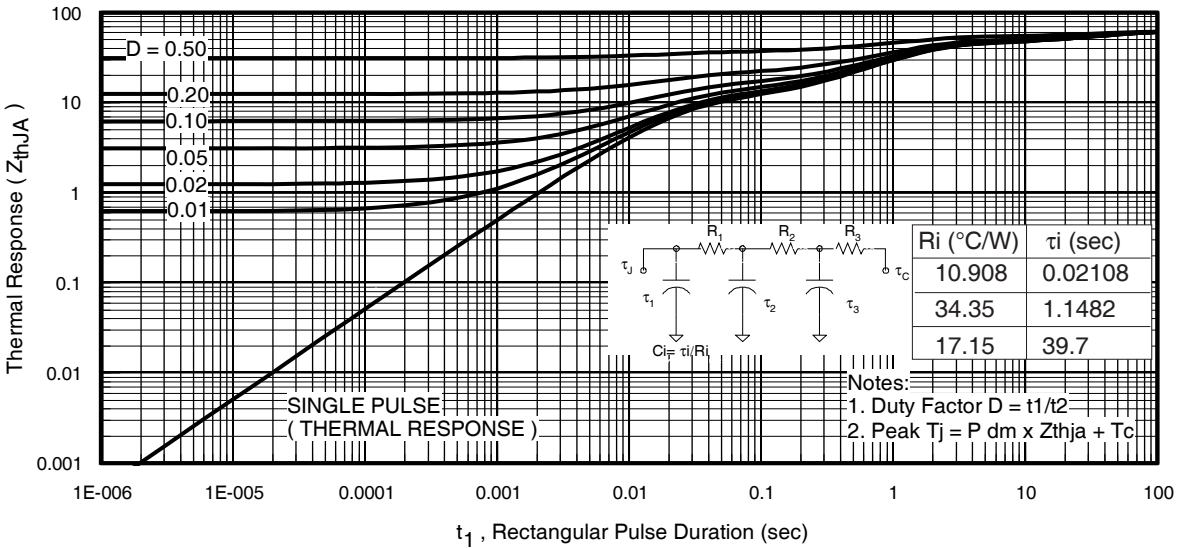


Fig 26. Maximum Effective Transient Thermal Impedance, Junction-to-Ambient (Q2)

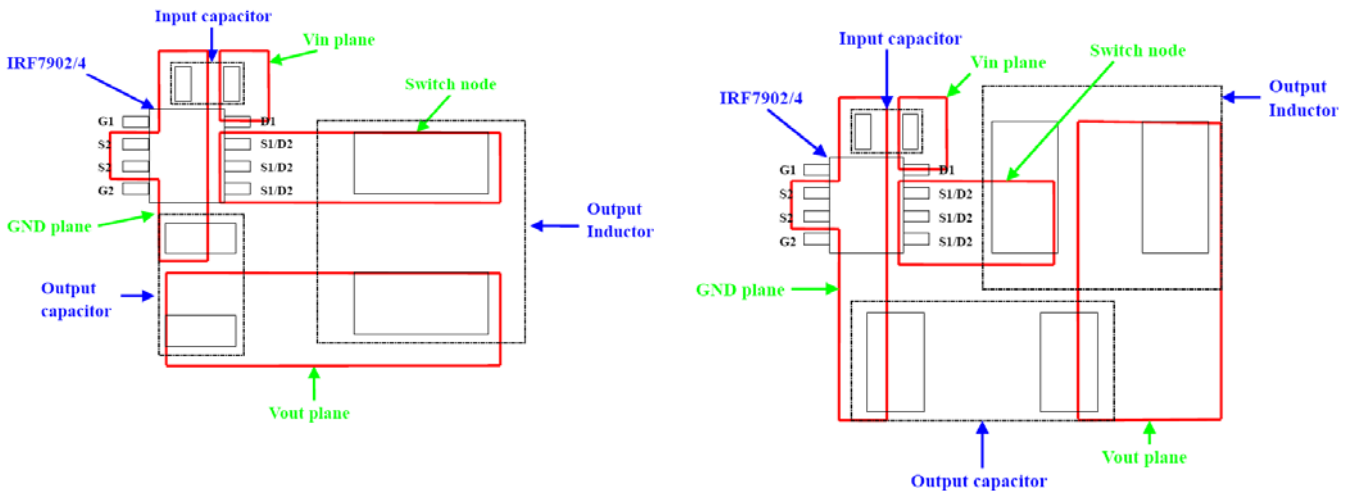
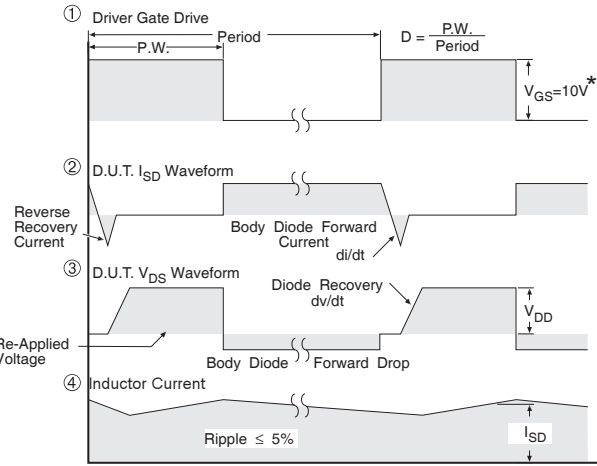
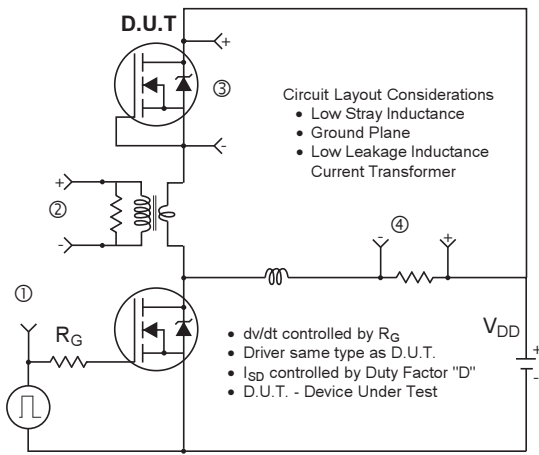


Fig 27. Layout Diagram



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

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

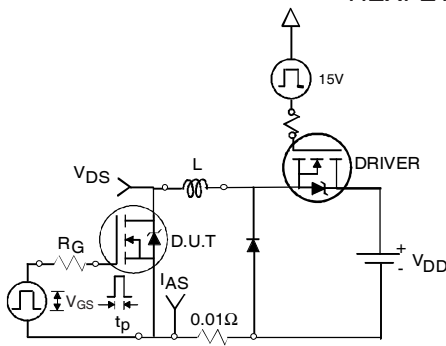


Fig 29a. Unclamped Inductive Test Circuit

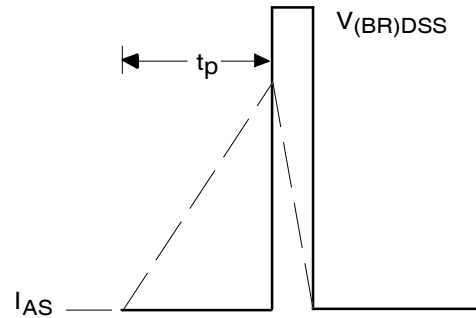


Fig 29b. Unclamped Inductive Waveforms

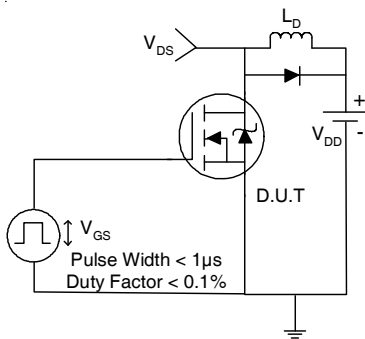


Fig 30a. Switching Time Test Circuit

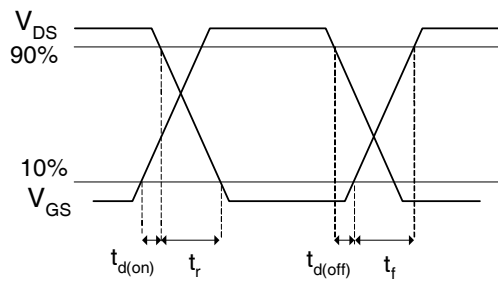


Fig 30b. Switching Time Waveforms

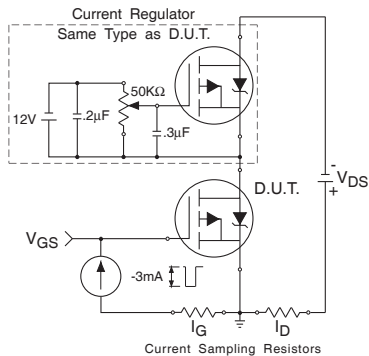


Fig 31a. Gate Charge Test Circuit

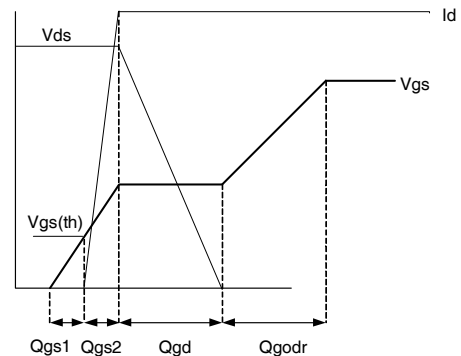
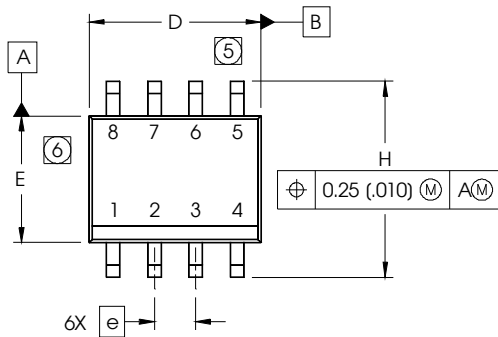


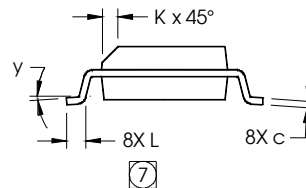
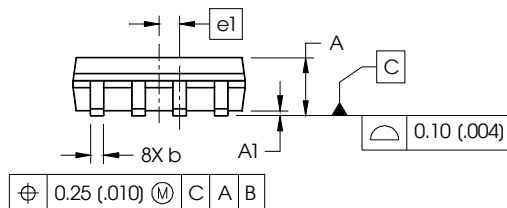
Fig 31b. Gate Charge Waveform

SO-8 Package Outline

Dimensions are shown in millimeters (inches)



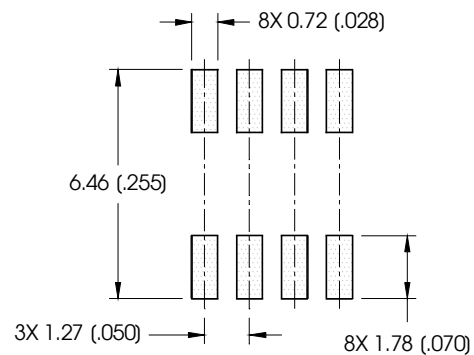
| DIM | INCHES | | MILLIMETERS | |
|-----|------------|-------|-------------|------|
| | MIN | MAX | MIN | MAX |
| A | .0532 | .0688 | 1.35 | 1.75 |
| A1 | .0040 | .0098 | 0.10 | 0.25 |
| b | .013 | .020 | 0.33 | 0.51 |
| c | .0075 | .0098 | 0.19 | 0.25 |
| D | .189 | .1968 | 4.80 | 5.00 |
| E | .1497 | .1574 | 3.80 | 4.00 |
| e | .050 BASIC | | 1.27 BASIC | |
| e1 | .025 BASIC | | 0.635 BASIC | |
| H | .2284 | .2440 | 5.80 | 6.20 |
| K | .0099 | .0196 | 0.25 | 0.50 |
| L | .016 | .050 | 0.40 | 1.27 |
| y | 0° | 8° | 0° | 8° |



NOTES:

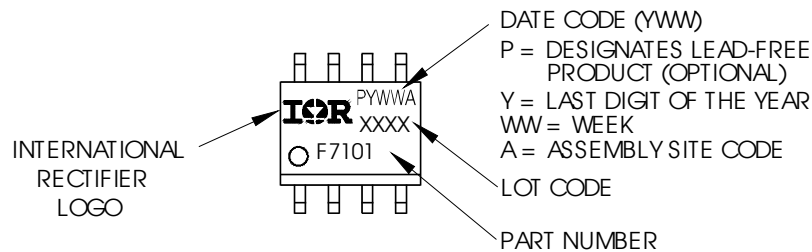
1. DIMENSIONING & TOLERANCING PER ASME Y14.5M-1994.
2. CONTROLLING DIMENSION: MILLIMETER
3. DIMENSIONS ARE SHOWN IN MILLIMETERS (INCHES).
4. OUTLINE CONFORMS TO JEDEC OUTLINE MS-012AA.
- ⑤ DIMENSION DOES NOT INCLUDE MOLD PROTRUSIONS. MOLD PROTRUSIONS NOT TO EXCEED 0.15 (.006).
- ⑥ DIMENSION DOES NOT INCLUDE MOLD PROTRUSIONS. MOLD PROTRUSIONS NOT TO EXCEED 0.25 (.010).
- ⑦ DIMENSION IS THE LENGTH OF LEAD FOR SOLDERING TO A SUBSTRATE.

FOOTPRINT

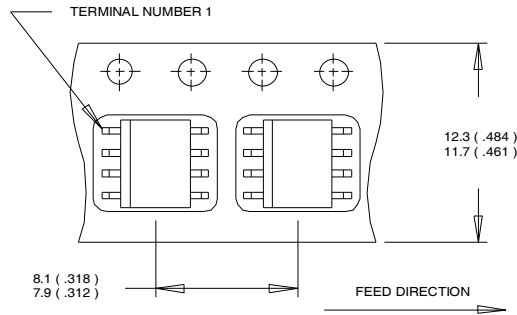


SO-8 Part Marking

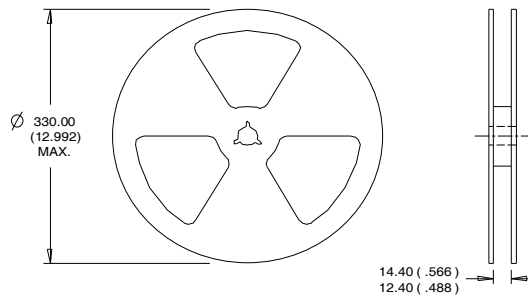
EXAMPLE: THIS IS AN IRF7101 (MOSFET)



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

SO-8 Tape and Reel (Dimensions are shown in millimeters (inches))


- NOTES:
1. CONTROLLING DIMENSION : MILLIMETER.
 2. ALL DIMENSIONS ARE SHOWN IN MILLIMETERS(INCHES).
 3. OUTLINE CONFORMS TO EIA-481 & EIA-541.



- NOTES :
1. CONTROLLING DIMENSION : MILLIMETER.
 2. OUTLINE CONFORMS TO EIA-481 & EIA-541.

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

Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Starting $T_J = 25^\circ\text{C}$, Q1: $L = 7.7\text{mH}$, $R_G = 25\Omega$, $I_{AS} = 6.1\text{A}$; Q2: $L = 6.5\text{mH}$, $R_G = 25\Omega$, $I_{AS} = 8.8\text{A}$.
- 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 .

Qualification information[†]

| | | |
|----------------------------|--|---|
| Qualification level | Industrial (per JEDEC JESD47F ^{††} guidelines) | |
| Moisture Sensitivity Level | SO-8 | 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>

^{††} Applicable version of JEDEC standard at the time of product release