

IRF8721GPbF

HEXFET® Power MOSFET

Applications

- Control MOSFET of Sync-Buck Converters used for Notebook Processor Power
- Control MOSFET for Isolated DC-DC Converters in Networking Systems

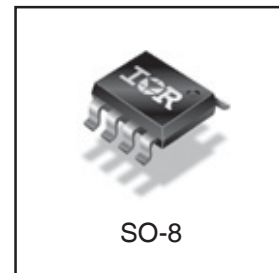
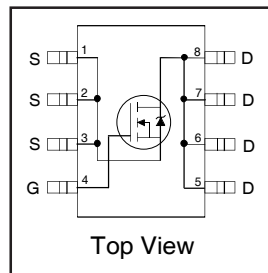
Benefits

- Very Low Gate Charge
- Low $R_{DS(on)}$ at 4.5V V_{GS}
- Low Gate Impedance
- Fully Characterized Avalanche Voltage and Current
- 20V V_{GS} Max. Gate Rating
- Lead-Free
- Halogen-Free

Description

The IRF8721GPbF incorporates the latest HEXFET Power MOSFET Silicon Technology into the industry standard SO-8 package. The IRF8721GPbF has been optimized for parameters that are critical in synchronous buck operation including $R_{ds(on)}$ and gate charge to reduce both conduction and switching losses. The reduced total losses make this product ideal for high efficiency DC-DC converters that power the latest generation of processors for Notebook and Netcom applications.

| | | |
|-----------|--------------------------------|-------|
| V_{DSS} | $R_{DS(on)}$ max | Qg |
| 30V | 8.5m Ω @ $V_{GS} = 10V$ | 8.3nC |



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, $V_{GS} @ 10V$ | 14 | A |
| $I_D @ T_A = 70^\circ C$ | Continuous Drain Current, $V_{GS} @ 10V$ | 11 | |
| I_{DM} | Pulsed Drain Current ① | 110 | |
| $P_D @ T_A = 25^\circ C$ | Power Dissipation | 2.5 | W |
| $P_D @ T_A = 70^\circ C$ | Power Dissipation | 1.6 | |
| | Linear Derating Factor | 0.02 | W/ $^\circ C$ |
| T_J | Operating Junction and | -55 to + 150 | $^\circ C$ |
| T_{STG} | Storage Temperature Range | | |

Thermal Resistance

| | Parameter | Typ. | Max. | Units |
|-----------------|--------------------------|------|------|--------------|
| $R_{\theta JL}$ | Junction-to-Drain Lead ⑤ | — | 20 | $^\circ C/W$ |
| $R_{\theta JA}$ | Junction-to-Ambient ⑥ | — | 50 | |

Notes ① through ⑥ are on page 9

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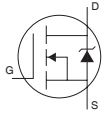
Static @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

| | 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 | — | 0.021 | — | $V/^\circ\text{C}$ | Reference to $25^\circ\text{C}, I_D = 1\text{mA}$ |
| $R_{DS(on)}$ | Static Drain-to-Source On-Resistance | — | 6.9 | 8.5 | $\text{m}\Omega$ | $V_{GS} = 10V, I_D = 14A$ ③ |
| | | — | 10.6 | 12.5 | | $V_{GS} = 4.5V, I_D = 11A$ ③ |
| $V_{GS(th)}$ | Gate Threshold Voltage | 1.35 | — | 2.35 | V | $V_{DS} = V_{GS}, I_D = 25\mu A$ |
| $\Delta V_{GS(th)}$ | Gate Threshold Voltage Coefficient | — | -6.2 | — | $\text{mV}/^\circ\text{C}$ | |
| I_{DSS} | Drain-to-Source Leakage Current | — | — | 1.0 | μA | $V_{DS} = 24V, V_{GS} = 0V$ |
| | | — | — | 150 | | $V_{DS} = 24V, V_{GS} = 0V, T_J = 125^\circ\text{C}$ |
| 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 | 27 | — | — | S | $V_{DS} = 15V, I_D = 11A$ |
| Q_g | Total Gate Charge | — | 8.3 | 12 | nC | $V_{DS} = 15V$ $V_{GS} = 4.5V$ $I_D = 11A$ See Fig. 16a and 16b |
| Q_{gs1} | Pre-V _{th} Gate-to-Source Charge | — | 2.0 | — | | |
| Q_{gs2} | Post-V _{th} Gate-to-Source Charge | — | 1.0 | — | | |
| Q_{gd} | Gate-to-Drain Charge | — | 3.2 | — | | |
| Q_{godr} | Gate Charge Overdrive | — | 2.0 | — | | |
| Q_{sw} | Switch Charge ($Q_{gs2} + Q_{gd}$) | — | 4.2 | — | | |
| Q_{oss} | Output Charge | — | 5.0 | — | nC | $V_{DS} = 16V, V_{GS} = 0V$ |
| R_G | Gate Resistance | — | 1.8 | 3.0 | Ω | |
| $t_{d(on)}$ | Turn-On Delay Time | — | 8.2 | — | ns | $V_{DD} = 15V, V_{GS} = 4.5V$ $I_D = 11A$ $R_G = 1.8\Omega$ See Fig. 15a |
| t_r | Rise Time | — | 11 | — | | |
| $t_{d(off)}$ | Turn-Off Delay Time | — | 8.1 | — | | |
| t_f | Fall Time | — | 7.0 | — | | |
| C_{iss} | Input Capacitance | — | 1040 | — | pF | $V_{GS} = 0V$ $V_{DS} = 15V$ $f = 1.0\text{MHz}$ |
| C_{oss} | Output Capacitance | — | 229 | — | | |
| C_{riss} | Reverse Transfer Capacitance | — | 114 | — | | |

Avalanche Characteristics

| | Parameter | Typ. | Max. | Units |
|----------|---------------------------------|------|------|-------|
| E_{AS} | Single Pulse Avalanche Energy ② | — | 68 | mJ |
| I_{AR} | Avalanche Current ① | — | 11 | A |

Diode Characteristics

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|----------|---|--|------|------|-------|--|
| I_S | Continuous Source Current (Body Diode) | — | — | 3.1 | A | MOSFET symbol showing the integral reverse p-n junction diode.  |
| I_{SM} | Pulsed Source Current (Body Diode) ① | — | — | 112 | | |
| V_{SD} | Diode Forward Voltage | — | — | 1.0 | V | $T_J = 25^\circ\text{C}, I_S = 11A, V_{GS} = 0V$ ③ |
| t_{rr} | Reverse Recovery Time | — | 14 | 21 | ns | $T_J = 25^\circ\text{C}, I_F = 11A, V_{DD} = 15V$ |
| Q_{rr} | Reverse Recovery Charge | — | 15 | 23 | nC | $di/dt = 300A/\mu s$ ③ |
| t_{on} | Forward Turn-On Time | Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD) | | | | |

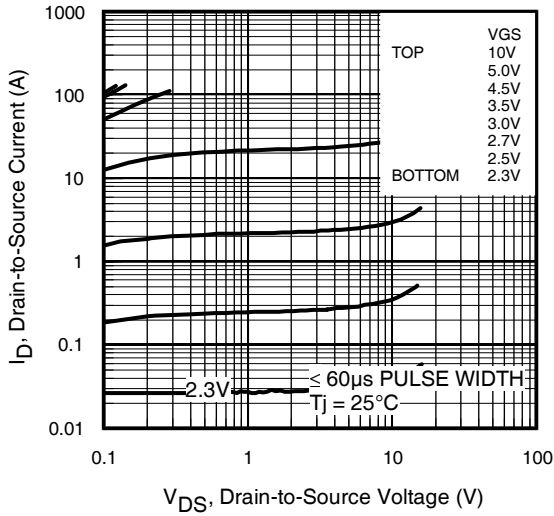


Fig 1. Typical Output Characteristics

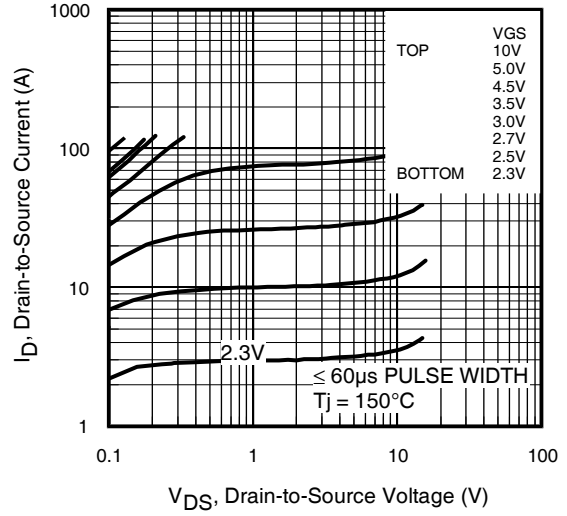


Fig 2. Typical Output Characteristics

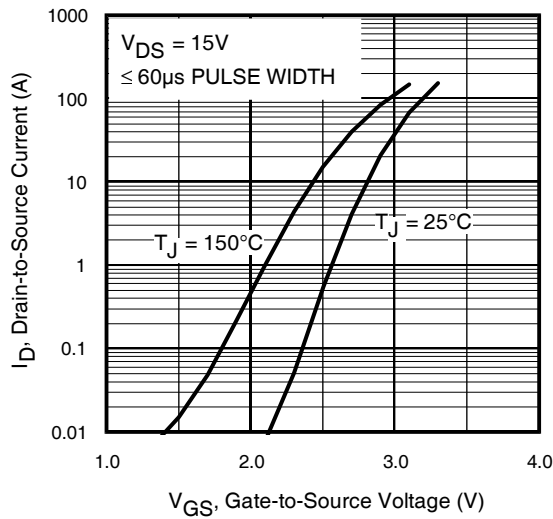


Fig 3. Typical Transfer Characteristics

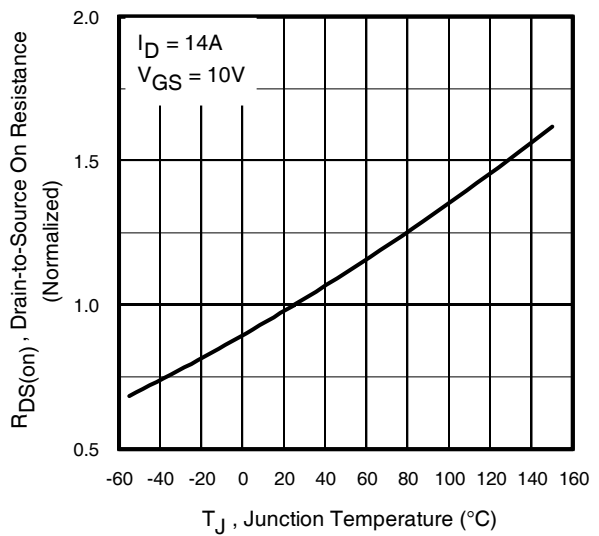


Fig 4. Normalized On-Resistance Vs. Temperature

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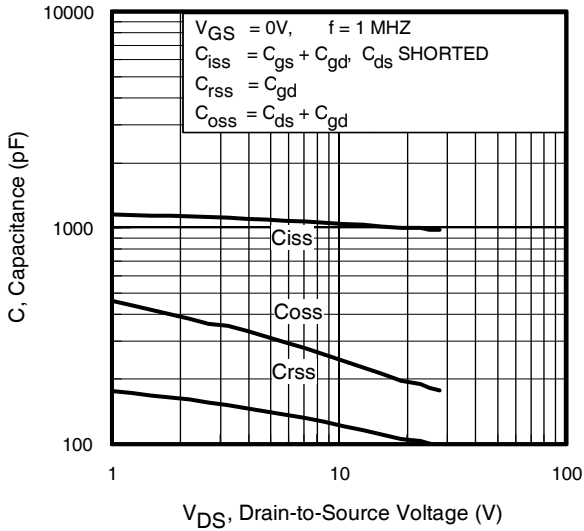


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

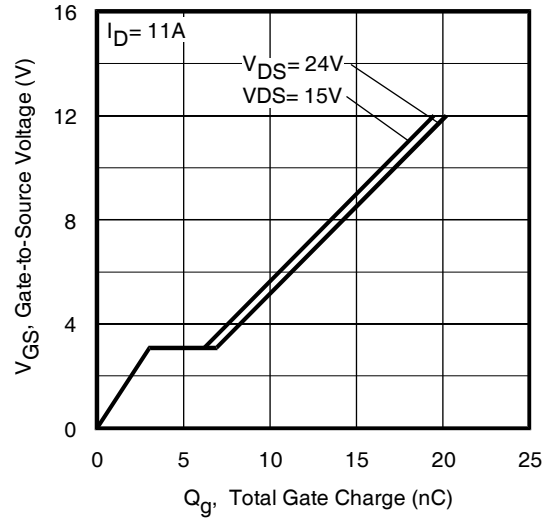


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

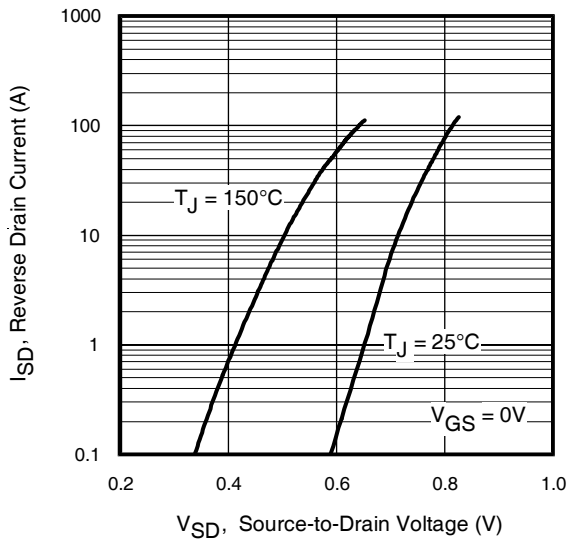


Fig 7. Typical Source-Drain Diode Forward Voltage

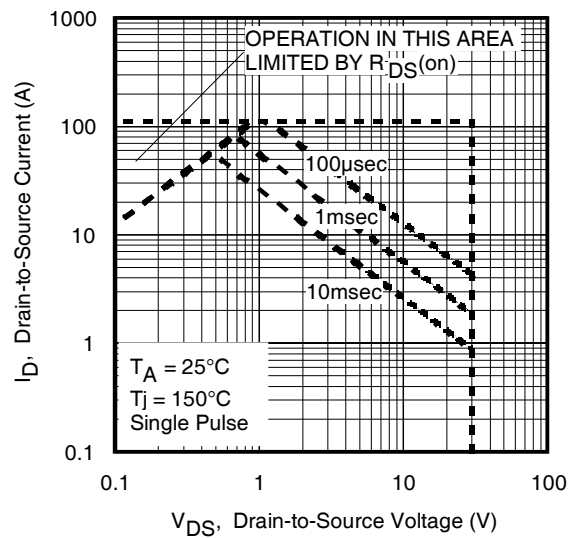


Fig 8. Maximum Safe Operating Area

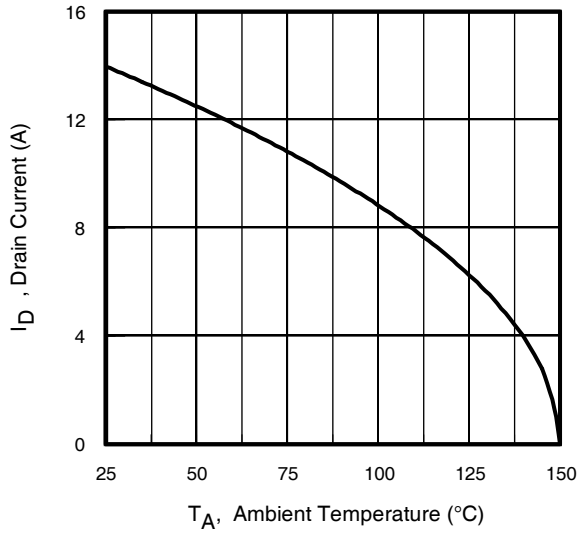


Fig 9. Maximum Drain Current Vs. Case Temperature

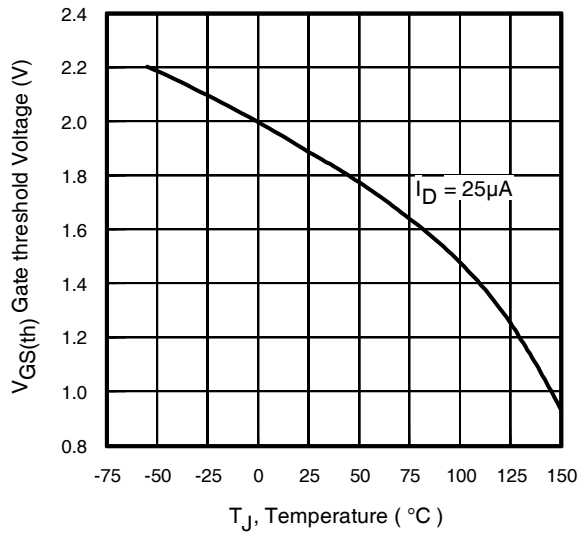


Fig 10. Threshold Voltage Vs. Temperature

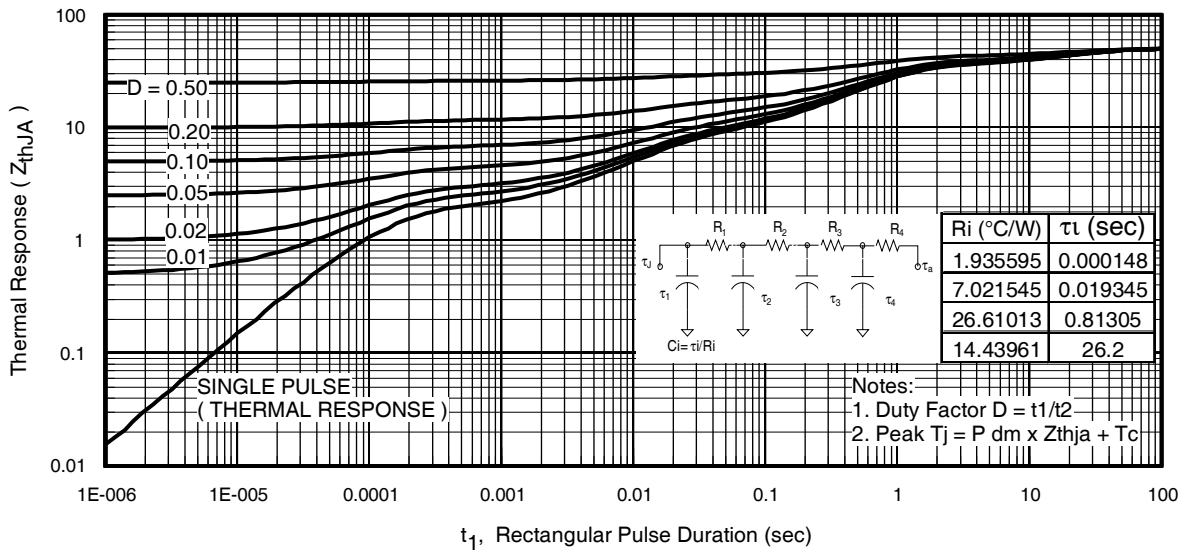


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

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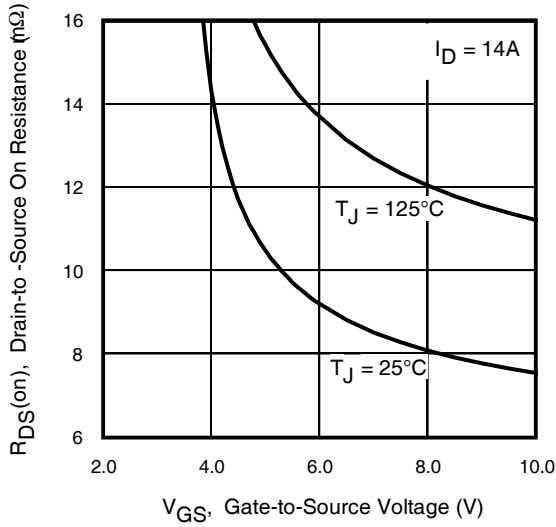


Fig 12. On-Resistance vs. Gate Voltage

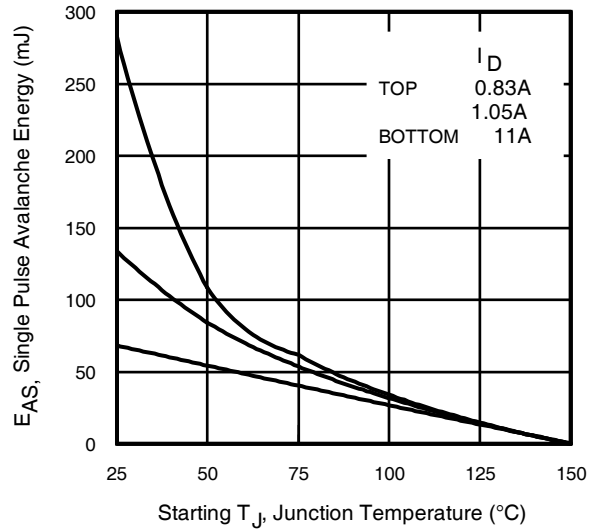


Fig 13. Maximum Avalanche Energy vs. Drain Current

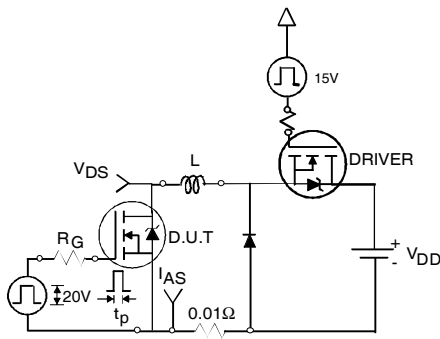


Fig 14a. Unclamped Inductive Test Circuit

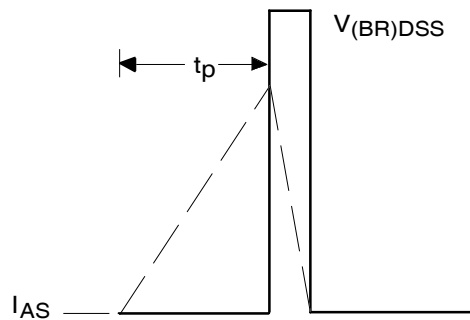


Fig 14b. Unclamped Inductive Waveforms

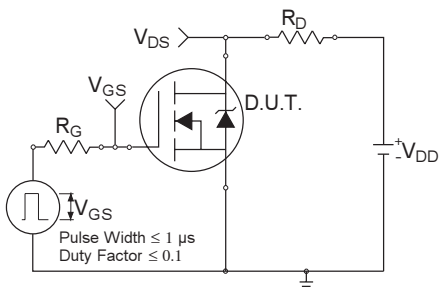


Fig 15a. Switching Time Test Circuit

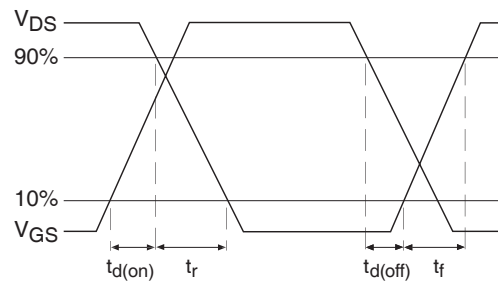


Fig 15b. Switching Time Waveforms

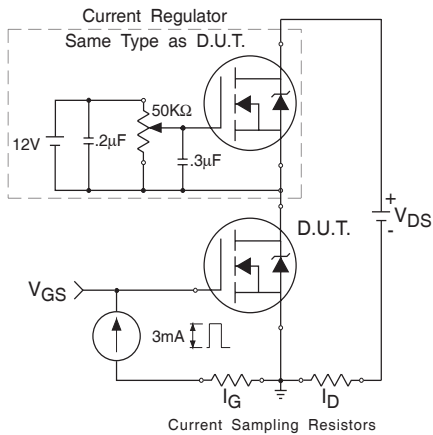


Fig 16a. Gate Charge Test Circuit

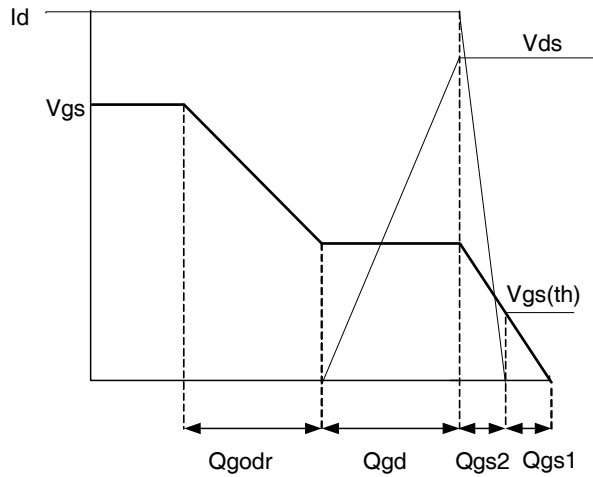
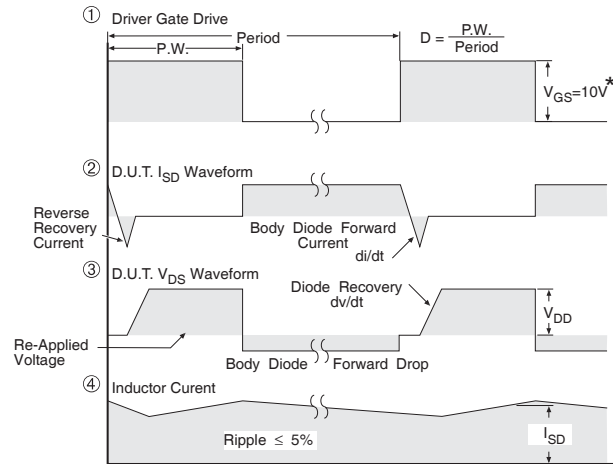
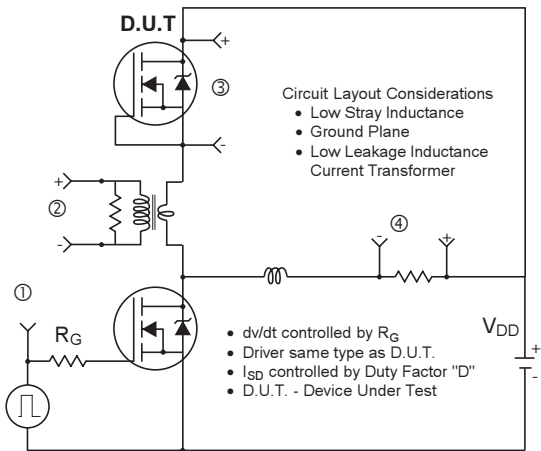


Fig 16b. Gate Charge Waveform



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

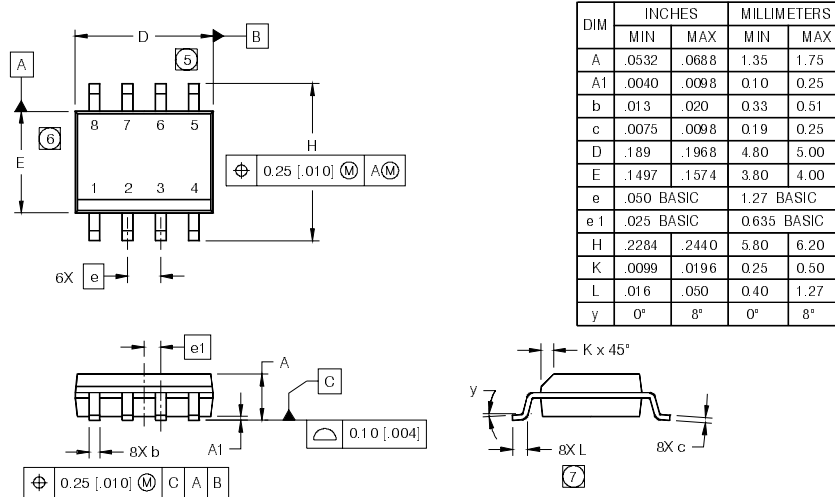
Fig 17. Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs

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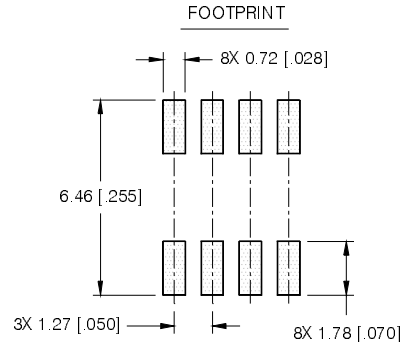
SO-8 Package Outline (MOSFET & Fetky)

Dimensions are shown in millimeters (inches)



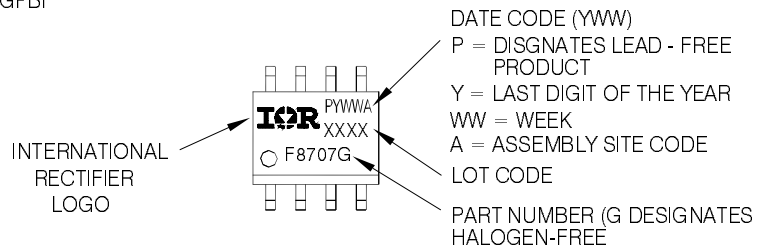
NOTES:

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 [0.006].
6. DIMENSION DOES NOT INCLUDE MOLD PROTRUSIONS. MOLD PROTRUSIONS NOT TO EXCEED 0.25 [0.010].
7. DIMENSION IS THE LENGTH OF LEAD FOR SOLDERING TO A SUBSTRATE.



SO-8 Part Marking Information

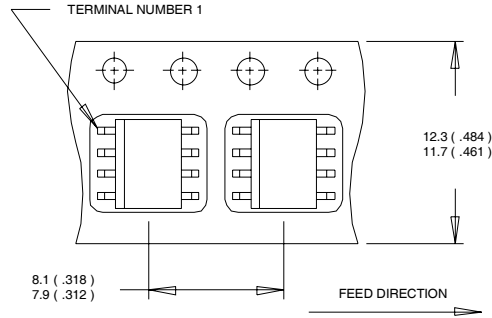
EXAMPLE: THIS IS AN IRF8707GPBF



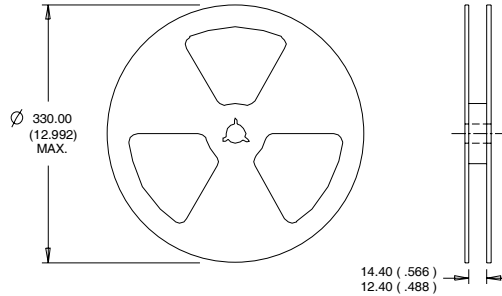
Note: For the most current drawing please refer to IR website at <http://www.irf.com/package/>

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 $T_J = 25^\circ\text{C}$, $L = 1.09\text{mH}$, $R_G = 25\Omega$, $I_{AS} = 11\text{A}$.
- 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 of approximately 90°C .

Data and specifications subject to change without notice.

This product has been designed and qualified for the Consumer market.

Qualification Standards can be found on IR's Web site.