

SMPS MOSFET

IRF820A

HEXFET® Power MOSFET

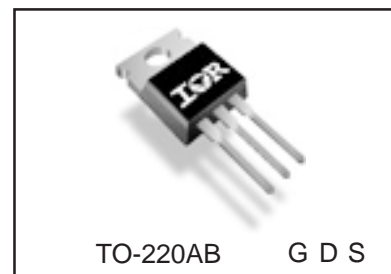
Applications

- Switch Mode Power Supply (SMPS)
- Uninterruptable Power Supply
- High speed power switching

| | | |
|------------------------|-------------------------------|----------------------|
| V_{DSS} | R_{DS(on)} max | I_D |
| 500V | 3.0Ω | 2.5A |

Benefits

- Low Gate Charge Q_g results in Simple Drive Requirement
- Improved Gate, Avalanche and dynamic dv/dt Ruggedness
- Fully Characterized Capacitance and Avalanche Voltage and Current
- Effective C_{OSS} specified (See AN 1001)



Absolute Maximum Ratings

| | Parameter | Max. | Units |
|---|---|------------------------|--------------|
| I _D @ T _C = 25°C | Continuous Drain Current, V _{GS} @ 10V | 2.5 | A |
| I _D @ T _C = 100°C | Continuous Drain Current, V _{GS} @ 10V | 1.6 | |
| I _{DM} | Pulsed Drain Current ① | 10 | |
| P _D @ T _C = 25°C | Power Dissipation | 50 | W |
| | Linear Derating Factor | 0.4 | W/°C |
| V _{GS} | Gate-to-Source Voltage | ± 30 | V |
| dv/dt | Peak Diode Recovery dv/dt ③ | 3.4 | V/ns |
| T _J | Operating Junction and | -55 to + 150 | °C |
| T _{STG} | Storage Temperature Range | | |
| | Soldering Temperature, for 10 seconds | 300 (1.6mm from case) | |
| | Mounting torque, 6-32 or M3 screw | 10 lbf•in (1.1N•m) | |

Typical SMPS Topologies:

- Two transistor Forward
- Half Bridge and Full Bridge

Notes ① through ⑤ are on page 8
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Static @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---------------------------------|--------------------------------------|------|------|------|----------|---|
| $V_{(BR)DSS}$ | Drain-to-Source Breakdown Voltage | 500 | — | — | V | $V_{GS} = 0V, I_D = 250\mu A$ |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient | — | 0.60 | — | V/°C | Reference to $25^\circ\text{C}, I_D = 1\text{mA}$ |
| $R_{DS(on)}$ | Static Drain-to-Source On-Resistance | — | — | 3.0 | Ω | $V_{GS} = 10V, I_D = 1.5A$ ④ |
| $V_{GS(th)}$ | Gate Threshold Voltage | 2.0 | — | 4.5 | V | $V_{DS} = V_{GS}, I_D = 250\mu A$ |
| I_{DSS} | Drain-to-Source Leakage Current | — | — | 25 | μA | $V_{DS} = 500V, V_{GS} = 0V$ |
| | | — | — | 250 | | $V_{DS} = 400V, V_{GS} = 0V, T_J = 125^\circ\text{C}$ |
| I_{GSS} | Gate-to-Source Forward Leakage | — | — | 100 | nA | $V_{GS} = 30V$ |
| | Gate-to-Source Reverse Leakage | — | — | -100 | | $V_{GS} = -30V$ |

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

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|-----------------|---------------------------------|------|------|------|-------|---|
| g_{fs} | Forward Transconductance | 1.4 | — | — | S | $V_{DS} = 50V, I_D = 1.5A$ |
| Q_g | Total Gate Charge | — | — | 17 | nC | $I_D = 2.5A$ |
| Q_{gs} | Gate-to-Source Charge | — | — | 4.3 | | $V_{DS} = 400V$ |
| Q_{gd} | Gate-to-Drain ("Miller") Charge | — | — | 8.5 | | $V_{GS} = 10V$, See Fig. 6 and 13 ④ |
| $t_{d(on)}$ | Turn-On Delay Time | — | 8.1 | — | ns | $V_{DD} = 250V$ |
| t_r | Rise Time | — | 12 | — | | $I_D = 2.5A$ |
| $t_{d(off)}$ | Turn-Off Delay Time | — | 16 | — | | $R_G = 21\Omega$ |
| t_f | Fall Time | — | 13 | — | | $R_D = 97\Omega$, See Fig. 10 ④ |
| C_{iss} | Input Capacitance | — | 340 | — | pF | $V_{GS} = 0V$ |
| C_{oss} | Output Capacitance | — | 53 | — | | $V_{DS} = 25V$ |
| C_{riss} | Reverse Transfer Capacitance | — | 2.7 | — | | $f = 1.0\text{MHz}$, See Fig. 5 |
| C_{oss} | Output Capacitance | — | 490 | — | | $V_{GS} = 0V, V_{DS} = 1.0V, f = 1.0\text{MHz}$ |
| C_{oss} | Output Capacitance | — | 15 | — | | $V_{GS} = 0V, V_{DS} = 400V, f = 1.0\text{MHz}$ |
| $C_{oss\ eff.}$ | Effective Output Capacitance | — | 28 | — | | $V_{GS} = 0V, V_{DS} = 0V$ to $400V$ ⑤ |

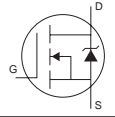
Avalanche Characteristics

| | Parameter | Typ. | Max. | Units |
|----------|--------------------------------|------|------|-------|
| E_{AS} | Single Pulse Avalanche Energy② | — | 140 | mJ |
| I_{AR} | Avalanche Current① | — | 2.5 | A |
| E_{AR} | Repetitive Avalanche Energy① | — | 5.0 | mJ |

Thermal Resistance

| | Parameter | Typ. | Max. | Units |
|-----------------|-------------------------------------|------|------|-------|
| $R_{\theta JC}$ | Junction-to-Case | — | 2.5 | °C/W |
| $R_{\theta CS}$ | Case-to-Sink, Flat, Greased Surface | 0.50 | — | |
| $R_{\theta JA}$ | Junction-to-Ambient | — | 62 | |

Diode Characteristics

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|----------|--|---|------|------|-------|--|
| I_S | Continuous Source Current (Body Diode) | — | — | 2.5 | A | MOSFET symbol showing the integral reverse p-n junction diode.  |
| I_{SM} | Pulsed Source Current (Body Diode) ① | — | — | 10 | | |
| V_{SD} | Diode Forward Voltage | — | — | 1.6 | V | $T_J = 25^\circ\text{C}, I_S = 2.5A, V_{GS} = 0V$ ④ |
| t_{rr} | Reverse Recovery Time | — | 330 | 500 | ns | $T_J = 25^\circ\text{C}, I_F = 2.5A$ |
| Q_{rr} | Reverse Recovery Charge | — | 760 | 1140 | nC | $di/dt = 100A/\mu s$ ④ |
| t_{on} | Forward Turn-On Time | Intrinsic turn-on time is negligible (turn-on is dominated by L_S+L_D) | | | | |

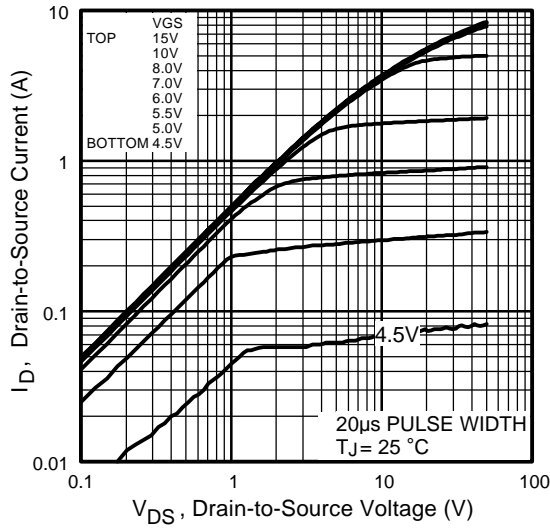


Fig 1. Typical Output Characteristics

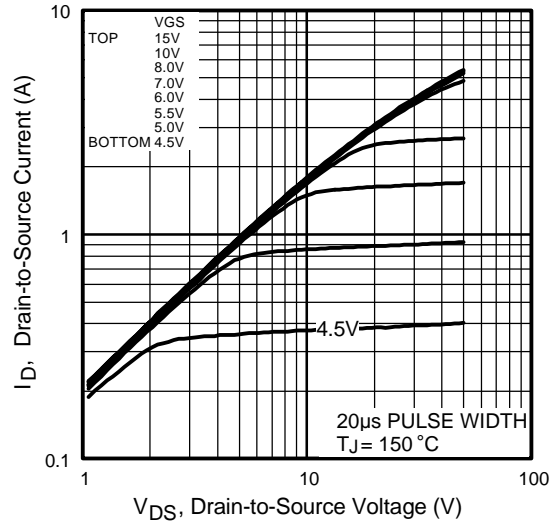


Fig 2. Typical Output Characteristics

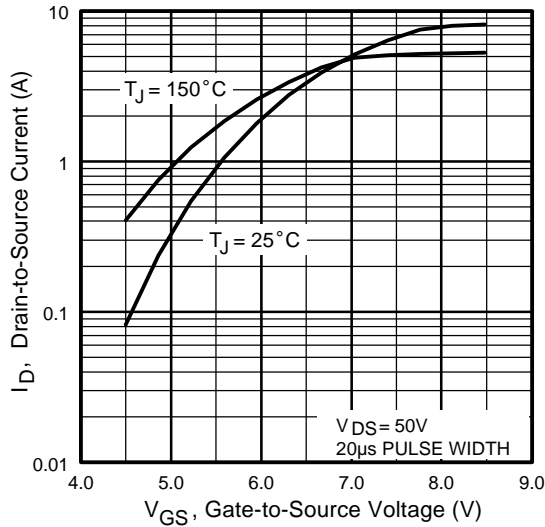


Fig 3. Typical Transfer Characteristics

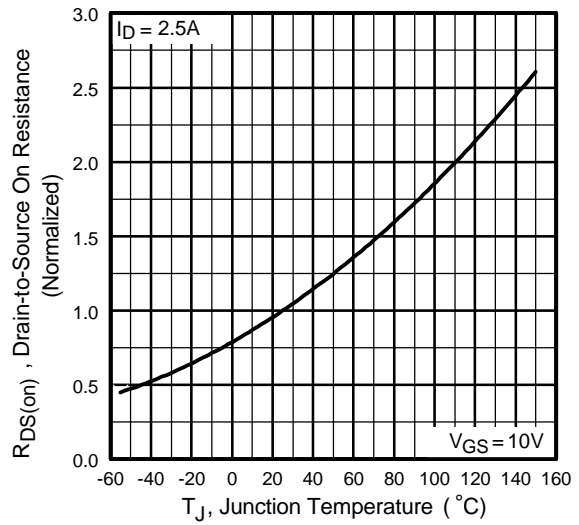


Fig 4. Normalized On-Resistance Vs. Temperature

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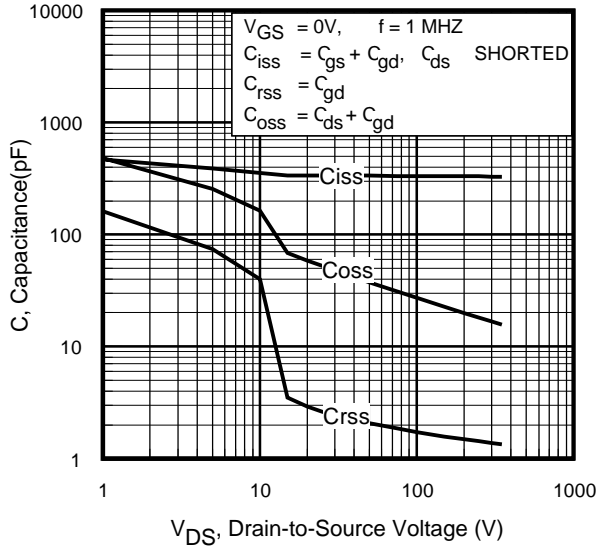


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

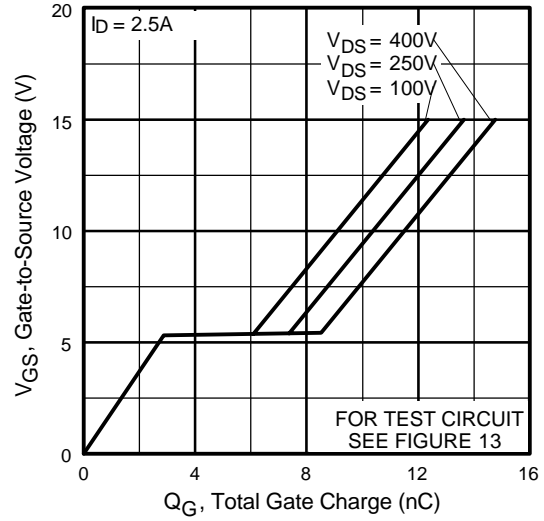


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

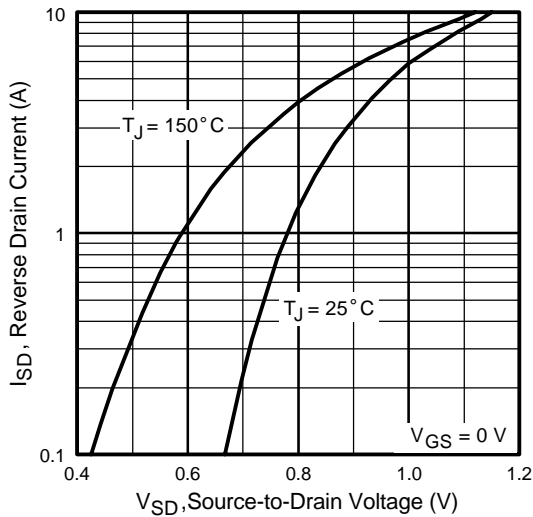


Fig 7. Typical Source-Drain Diode Forward Voltage

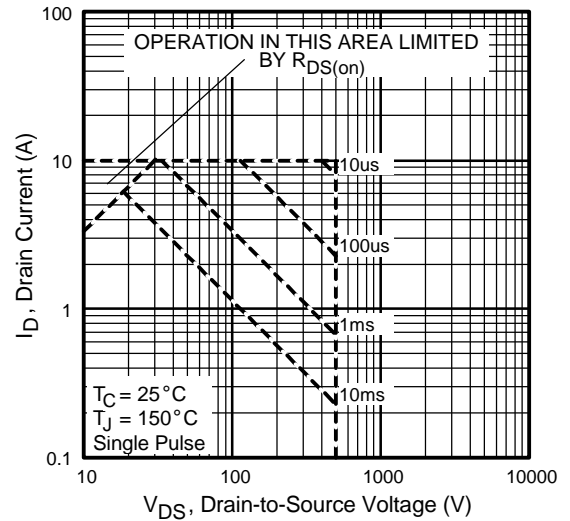


Fig 8. Maximum Safe Operating Area

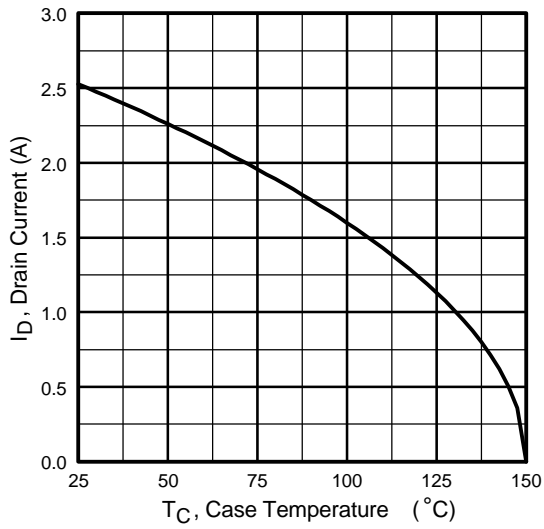


Fig 9. Maximum Drain Current Vs. Case Temperature



Fig 10a. Switching Time Test Circuit



Fig 10b. Switching Time Waveforms

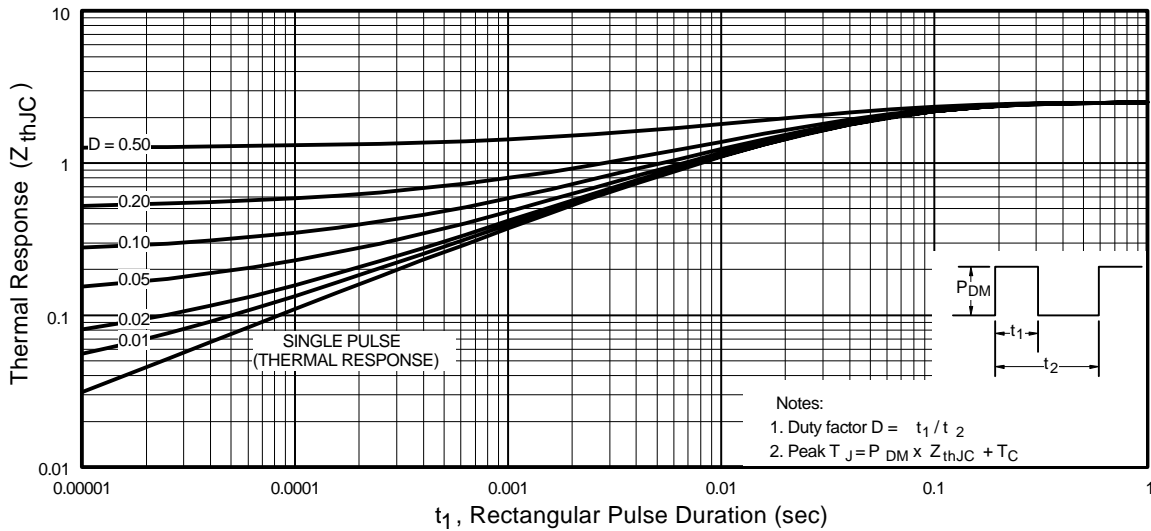


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

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Fig 12a. Unclamped Inductive Test Circuit



Fig 12b. Unclamped Inductive Waveforms



Fig 13a. Basic Gate Charge Waveform



Fig 13b. Gate Charge Test Circuit

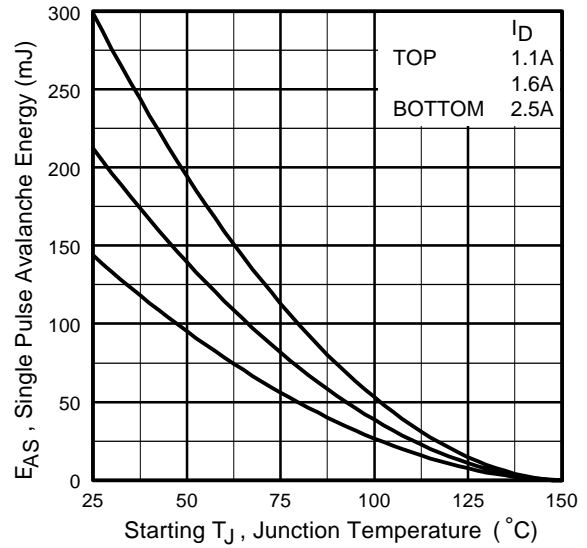


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

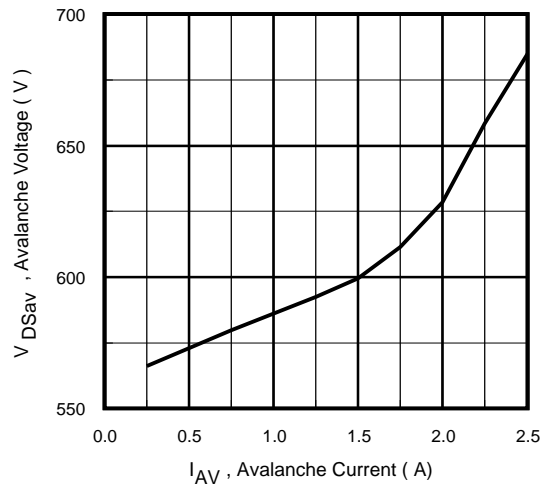


Fig 12d. Typical Drain-to-Source Voltage Vs. Avalanche Current

Peak Diode Recovery dv/dt Test Circuit



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

Fig 14. For N-Channel HEXFET® Power MOSFETs

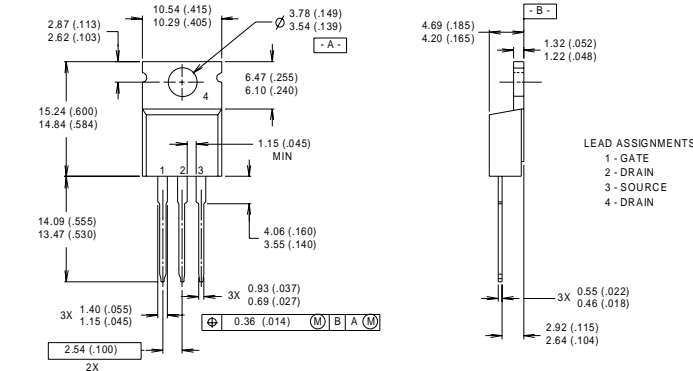
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Package Outline

TO-220AB

Dimensions are shown in millimeters (inches)

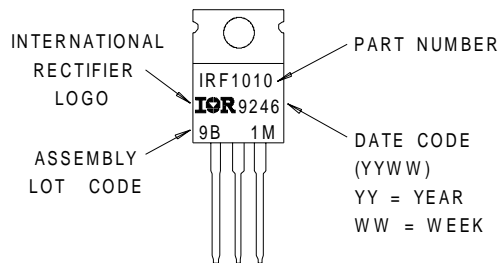


- NOTES:
- 1 DIMENSIONING & TOLERANCING PER ANSI Y14.5M, 1982.
 - 2 CONTROLLING DIMENSION : INCH
 - 3 OUTLINE CONFORMS TO JEDEC OUTLINE TO-220AB.
 - 4 HEATSINK & LEAD MEASUREMENTS DO NOT INCLUDE BURRS.

Part Marking Information

TO-220AB

EXAMPLE : THIS IS AN IRF1010
WITH ASSEMBLY
LOT CODE 9B1M



Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature. (See fig. 11)
- ② Starting $T_J = 25^\circ\text{C}$, $L = 45\text{mH}$
 $R_G = 25\Omega$, $I_{AS} = 2.5\text{A}$. (See Figure 12)
- ③ $I_{SD} \leq 2.5\text{A}$, $di/dt \leq 270\text{A}/\mu\text{s}$, $V_{DD} \leq V_{(BR)DSS}$,
 $T_J \leq 150^\circ\text{C}$
- ④ Pulse width $\leq 300\mu\text{s}$; duty cycle $\leq 2\%$.
- ⑤ C_{OSS} eff. is a fixed capacitance that gives the same charging time as C_{OSS} while V_{DS} is rising from 0 to 80% V_{DSS}

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Data and specifications subject to change without notice. 5/00