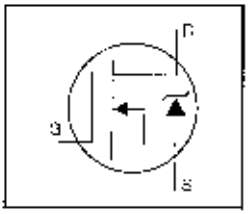
# International IOR Rectifier

# IRFZ14

HEXFET® Power MOSFET

- Dynamic dv/dt Rating
- 175°C Operating Temperature
- Fast Switching
- Ease of Paralleling
- Simple Drive Requirements




$V_{DSS}$ = 60V

$R_{DS(on)}$ = 0.20Ω

$I_D$ = 10A

## Description

Third Generation HEXFETs from International Rectifier provide the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost effectiveness.

The TO-220 package is universally preferred for all commercial-industrial applications at power dissipation levels to approximately 50 watts. The low thermal resistance and low package cost of the TO-220 contribute to its wide acceptance throughout the industry.

TO-220AB

DATA SHEETS

## Absolute Maximum Ratings

| | Parameter | Max. | Units |
|---|---|---|---|
| $I_D$ @ $T_C$ = 25°C | Continuous Drain Current, $V_{GS}$ @ 10 V | 10 | A |
| $I_D$ @ $T_C$ = 100°C | Continuous Drain Current, $V_{GS}$ @ 10 V | 7.2 | |
| $I_{DM}$ | Pulsed Drain Current ① | 40 | |
| $P_D$ @ $T_C$ = 25°C | Power Dissipation | 43 | W |
| | Linear Derating Factor | 0.29 | W/°C |
| $V_{GS}$ | Gate-to-Source Voltage | ±20 | V |
| $E_{AS}$ | Single Pulse Avalanche Energy ② | 47 | mJ |
| dv/dt | Peak Diode Recovery dv/dt ③ | 4.5 | V/ns |
| $T_J$<br>$T_{STG}$ | Operating Junction and<br>Storage Temperature Range | -55 to +175 | °C |
| | Soldering Temperature, for 10 seconds | 300 (1.6mm from case) | |
| | Mounting Torque, 6-32 or M3 screw | 10 lbf-in (1.1 N·m) | |

## Thermal Resistance

| | Parameter | Min. | Typ | Max. | Units |
|---|---|---|---|---|---|
| $R_{\theta JC}$ | Junction-to-Case | — | — | 3.5 | °C/W |
| $R_{\theta CS}$ | Case-to-Sink, Flat, Greased Surface | — | 0.50 | — | |
| $R_{\theta JA}$ | Junction-to-Ambient | — | — | 62 | |

## Electrical Characteristics @ $T_J$ = 25°C (unless otherwise specified)

| | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Drain-to-Source Breakdown Voltage | 60 | — | — | V | $V_{GS}$=0V, $I_D$= 250μA |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient | — | 0.060 | — | V/°C | Reference to 25°C, $I_D$= 1mA |
| $R_{DS(on)}$ | Static Drain-to-Source On-Resistance | — | — | 0.20 | Ω | $V_{GS}$=10V, $I_D$=6.0A ③ |
| $V_{GS(th)}$ | Gate Threshold Voltage | 2.0 | — | 4.0 | V | $V_{DS}$=$V_{GS}$, $I_D$=250μA |
| $g_{fs}$ | Forward Transconductance | 2.4 | — | — | S | $V_{DS}$=25V, $I_D$=6.0A ③ |
| $I_{DSS}$ | Drain-to-Source Leakage Current | | | 25 | μA | $V_{DS}$=60V, $V_{GS}$=0V |
| | | — | — | 250 | | $V_{DS}$=48V, $V_{GS}$=0V, $T_J$=150°C |
| $I_{GSS}$ | Gate-to-Source Forward Leakage | — | | 100 | nA | $V_{GS}$=20V |
| | Gate-to-Source Reverse Leakage | — | — | -100 | | $V_{GS}$=-20V |
| $Q_g$ | Total Gate Charge | — | — | 11 | nC | $I_D$=10A |
| $Q_{gs}$ | Gate-to-Source Charge | — | | 3.7 | | $V_{DS}$=48V |
| $Q_{gd}$ | Gate-to-Drain ("Miller") Charge | — | — | 5.8 | | $V_{GS}$=10V See Fig. 6 and 13 ③ |
| $t_{d(on)}$ | Turn-On Delay Time | — | 10 | | ns | $V_{DD}$=30V |
| $t_r$ | Rise Time | — | 50 | — | | $I_D$=10A |
| $t_{d(off)}$ | Turn-Off Delay Time | — | 13 | — | | $R_G$=24Ω |
| $t_f$ | Fall Time | — | 19 | — | | $R_D$=2.7Ω See Figure 10 ③ |
| $L_D$ | Internal Drain Inductance | | 4.5 | | nH | Between lead, 6 mm (0.25in.) from package and center of die contact |
| $L_S$ | Internal Source Inductance | | 7.5 | | | |
| $C_{iss}$ | Input Capacitance | — | 300 | — | pF | $V_{GS}$=0V |
| $C_{oss}$ | Output Capacitance | — | 180 | — | | $V_{DS}$=25V |
| $C_{rss}$ | Reverse Transfer Capacitance | — | 29 | — | | f=1.0MHz See Figure 5 |

## Source-Drain Ratings and Characteristics

| | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current (Body Diode) | — | — | 10 | A | MOSFET symbol showing the |
| $I_{SM}$ | Pulsed Source Current (Body Diode) ① | — | — | 40 | | integral reverse p-n junction diode. |
| $V_{SD}$ | Diode Forward Voltage | — | — | 1.6 | V | $T_J$=25°C, $I_S$=10A, $V_{GS}$=0V ③ |
| $t_{rr}$ | Reverse Recovery Time | — | 70 | 140 | ns | $T_J$=25°C, $I_F$=10A |
| $Q_{rr}$ | Reverse Recovery Charge | | 0.20 | 0.40 | μC | di/dt =100A/μs ③ |
| $t_{on}$ | Forward Turn-On Time | Intrinsic turn-on time is negligible. Turn-on is dominated by $L_S$ and $L_D$ | | | | |

Notes:

① Repetitive rating; pulse width limited by max. junction temperature (See Figure 11)

② $V_{DD}$=25V, starting $T_J$=25°C, L=548μH $R_G$=25Ω, $I_{AS}$=10A (See Figure 12)

③ $I_{SD}$≤10A, di/dt≤90A/μs, $V_{DD}$≤$V_{(BR)DSS}$, $T_J$≤175°C

④ Pulse width ≤ 300 μs; duty cycle ≤2%.

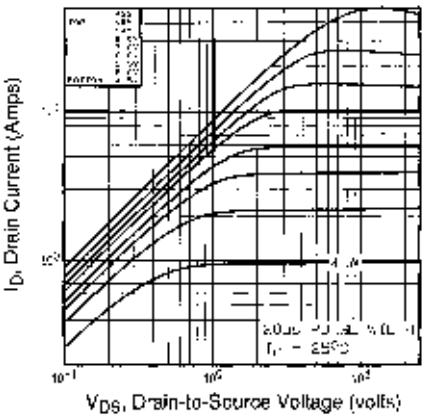



**Fig 1.** Typical Output Characteristics, $T_C$=25°C

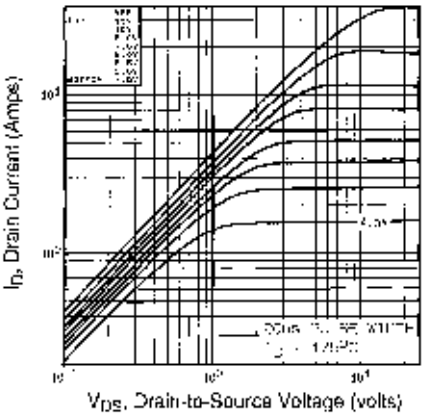



**Fig 2.** Typical Output Characteristics, $T_C$=175°C

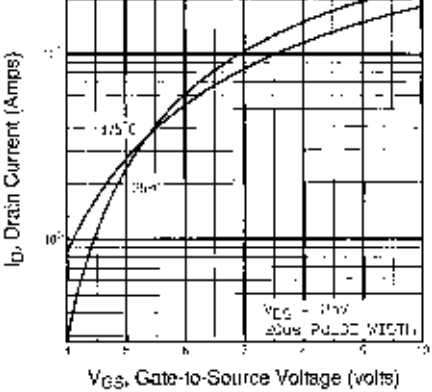



**Fig 3.** Typical Transfer Characteristics

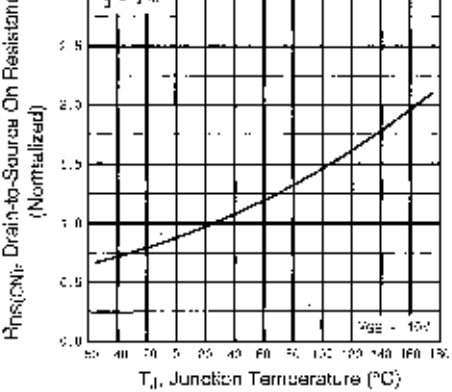



**Fig 4.** Normalized On-Resistance Vs. Temperature

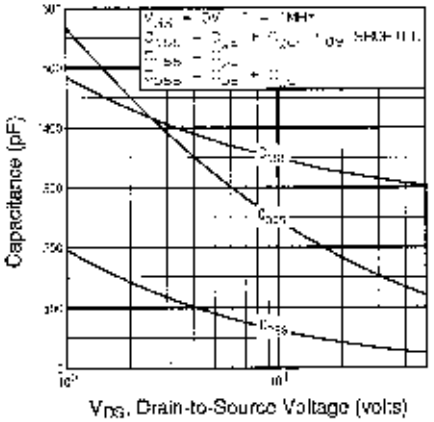



Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

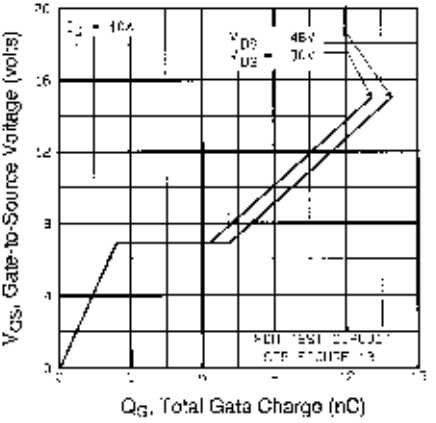



Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

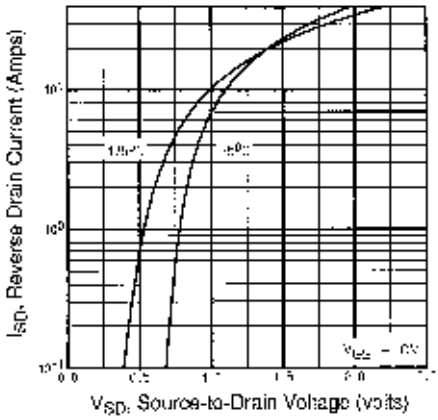



Fig 7. Typical Source-Drain Diode Forward Voltage

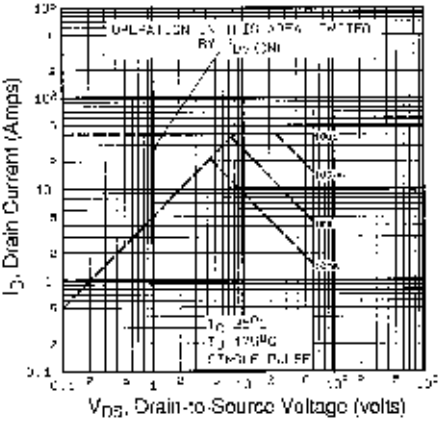



Fig 8. Maximum Safe Operating Area

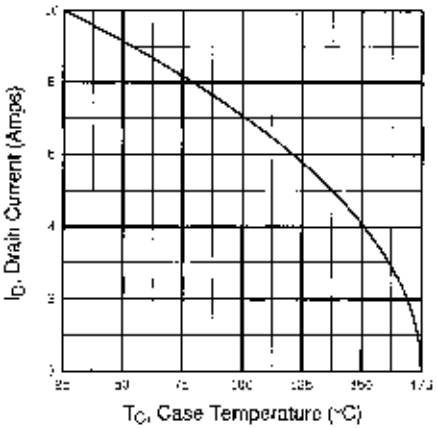



**Fig 9.** Maximum Drain Current Vs. Case Temperature

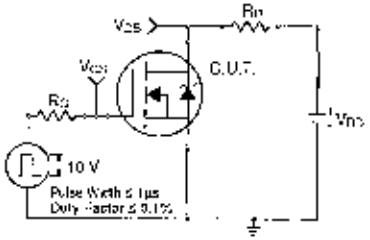



**Fig 10a.** Switching Time Test Circuit

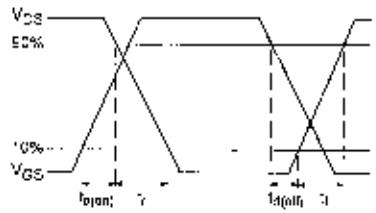



**Fig 10b.** Switching Time Waveforms

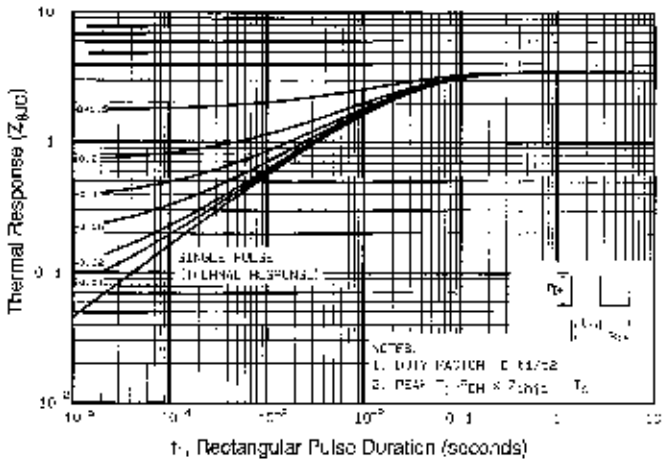



**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case

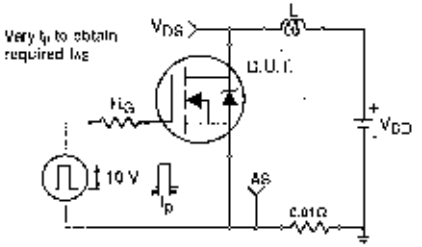



Fig 12a. Unclamped Inductive Test Circuit

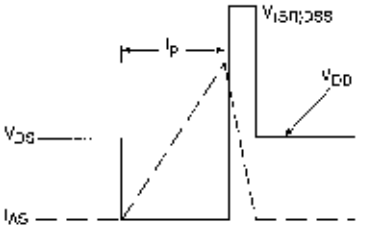



Fig 12b. Unclamped Inductive Waveforms

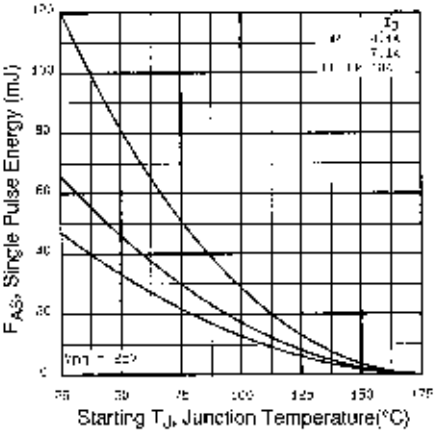



Fig 12c. Maximum Avalanche Energy Vs. Drain Current

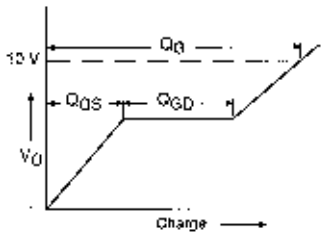



Fig 13a. Basic Gate Charge Waveform

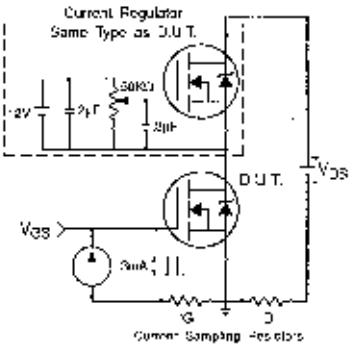



Fig 13b. Gate Charge Test Circuit



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