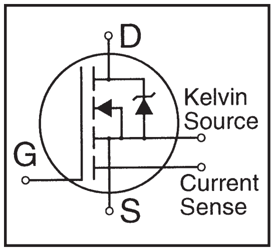
International
IOR Rectifier

PD - 9.529B

# IRCZ44

HEXFET® Power MOSFET

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




$V_{DSS}$ = 60V

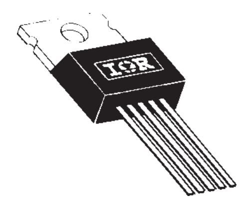
$R_{DS(on)}$ = 0.028Ω

$I_D$ = 50*A

## Description

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

The HEXSense device provides an accurate fraction of the drain current through the additional two leads to be used for control or protection of the device. These devices exhibit similar electrical and thermal characteristics as their IRF-series equivalent part numbers. The provision of a kelvin source connection effectively eliminates problems of common source inductance when the HEXSence is used as a fast, high-current switch in non current-sensing applications.



TO-220 HexSense

## Absolute Maximum Ratings

| | Parameter | Max. | Units |
|---|---|---|---|
| $I_D$ @ $T_C$ = 25°C | Continuous Drain Current, $V_{GS}$ @ 10V | 50* | A |
| $I_D$ @ $T_C$ = 100°C | Continuous Drain Current, $V_{GS}$ @ 10V | 37 | |
| $I_{DM}$ | Pulsed Drain Current ① | 210 | |
| $P_D$ @$T_C$ = 25°C | Power Dissipation | 150 | W |
| | Linear Derating Factor | 1.0 | W/°C |
| $V_{GS}$ | Gate-to-Source Voltage | ±20 | V |
| $E_{AS}$ | Single Pulse Avalanche Energy ② | 30 | 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) | |

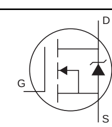
## Thermal Resistance

| | Parameter | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| $R_{\theta JC}$ | Junction-to-Case | — | — | 1.0 | °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 | 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 | —— | —— | 0.028 | Ω | $V_{GS}$ = 10V, $I_D$ = 31A ④ |
| $V_{GS(th)}$ | Gate Threshold Voltage | 2.0 | —— | 4.0 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = 250µA |
| $g_{fs}$ | Forward Transconductance | 18 | —— | —— | S | $V_{DS}$ = 25V, $I_D$ = 31A |
| $I_{DSS}$ | Drain-to-Source Leakage Current | —— | —— | 25 | | $V_{DS}$ = 60V, $V_{GS}$ = 0V |
| | | —— | —— | 250 | | $V_{DS}$ = 48V, $V_{GS}$ = 0V, $T_J$ = 150°C |
| $I_{GSS}$ | Gate-to-Source Forward Leakage | —— | —— | 100 | | $V_{GS}$ = 20V |
| | Gate-to-Source Reverse Leakage | —— | —— | -100 | | $V_{GS}$ = -20V |
| $Q_g$ | Total Gate Charge | —— | —— | 95 | | $I_D$ = 52A |
| $Q_{gs}$ | Gate-to-Source Charge | —— | —— | 27 | nC | $V_{DS}$ = 48V |
| $Q_{gd}$ | Gate-to-Drain ("Miller") Charge | —— | —— | 46 | | $V_{GS}$ = 10V, See Fig. 6 and 13 ④ |
| $t_{d(on)}$ | Turn-On Delay Time | —— | 19 | —— | | $V_{DD}$ = 30V |
| $t_r$ | Rise Time | —— | 120 | —— | | $I_D$ = 52A |
| $t_{d(off)}$ | Turn-Off Delay Time | —— | 55 | —— | | $R_G$ = 9.1Ω |
| $t_f$ | Fall Time | —— | 86 | —— | | $R_D$ = 0.54Ω, See Fig. 10 ④ |
| $L_D$ | Internal Drain Inductance | —— | 4.5 | —— | nH | Between lead, 6 mm (0.25in.) from package and center of die contact |
| $L_C$ | Internal Source Inductance | —— | 7.5 | —— | | |
| $C_{iss}$ | Input Capacitance | —— | 2500 | —— | | $V_{GS}$ = 0V |
| $C_{oss}$ | Output Capacitance | —— | 1200 | —— | pF | $V_{DS}$ = 25V |
| $C_{rss}$ | Reverse Transfer Capacitance | —— | 200 | —— | | $f$ = 1.0MHz, See Fig. 5 |
| r | Current Sensing Ratio | 2460 | —— | 2720 | —— | $I_D$ = 52A, $V_{GS}$ = 10V |
| $C_{oss}$ | Output Capacitance of Sensing Cells | —— | 9.0 | —— | pF | $V_{GS}$ = 0V, $V_{DS}$ = 25V, $f$ = 1.0MHz |

## Source-Drain Ratings and Characteristics

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current (Body Diode) | —— | —— | 50* | A | MOSFET symbol showing the integral reverse p-n junction diode.   |
| $I_{SM}$ | Pulsed Source Current (Body Diode) ① | —— | —— | 210 | | |
| $V_{SD}$ | Diode Forward Voltage | —— | —— | 2.5 | V | $T_J$ = 25°C, $I_S$ = 52A, $V_{GS}$ = 0V ④ |
| $t_{rr}$ | Reverse Recovery Time | —— | 140 | 300 | ns | $T_J$ = 25°C, $I_F$ = 52A |
| $Q_{rr}$ | Reverse Recovery Charge | —— | 1.2 | 2.8 | nC | di/dt = 100A/µs ④ |
| $t_{on}$ | Forward Turn-On Time | Intrinsic turn-on time is negligible (turn-on is dominated by $L_S$+$L_D$) | | | | |

**Notes:**

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

② $V_{DD}$ = 25V, starting $T_J$ = 25°C, L = 0.013mH $R_G$ = 25Ω, $I_{AS}$ = 52A. (See Figure 12)

③ $I_{SD} \leq$ 52A, di/dt ≤ 250A/µs, $V_{DD} \leq V_{(BR)DSS}$, $T_J \leq$ 175°C

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

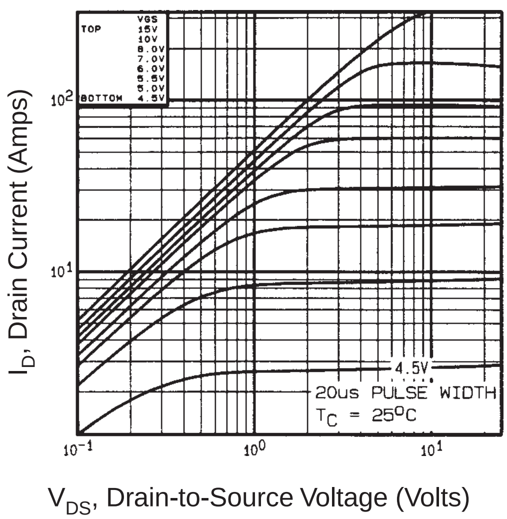



**Fig. 1 Typical Output Characteristics, $T_C$=25°C**

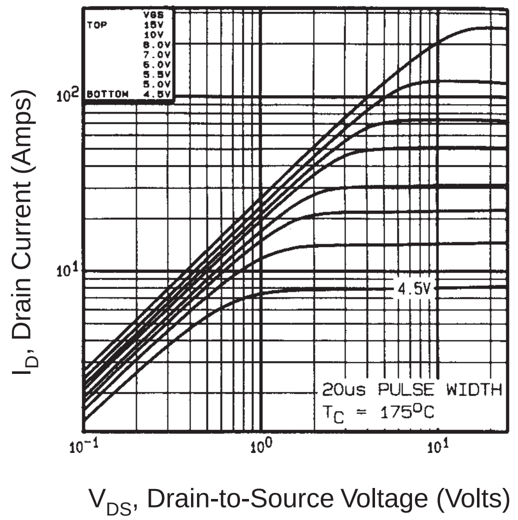



**Fig. 2 Typical Output Characteristics, $T_C$=175°C**

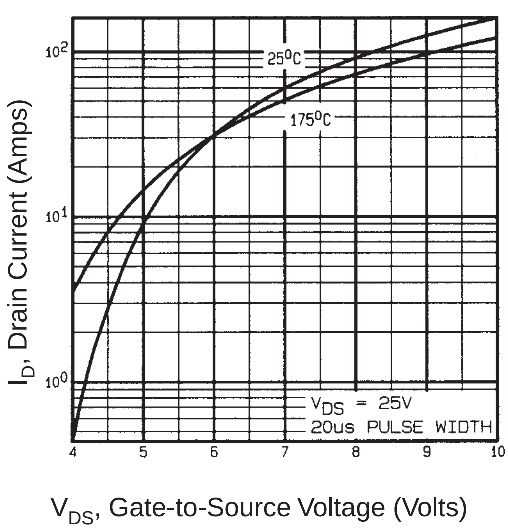



**Fig. 3 Typical Transfer Characteristics**

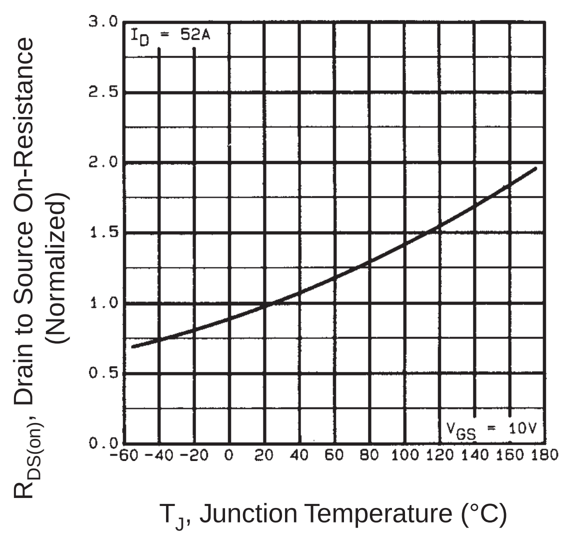



**Fig. 4 Normalized On-Resistance vs. Temperature**

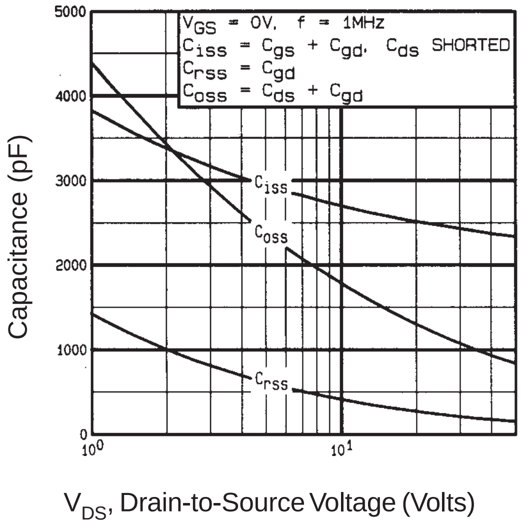



**Fig. 5 Typical Capacitance vs. Drain-to-Source Voltage**

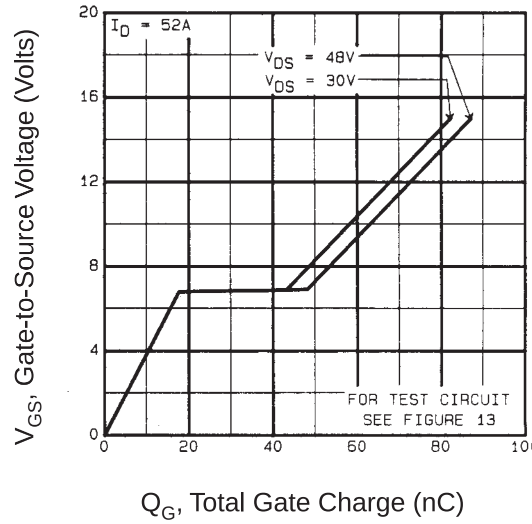



**Fig. 6 Typical Gate Charge vs. Gate-to-Source Voltage**

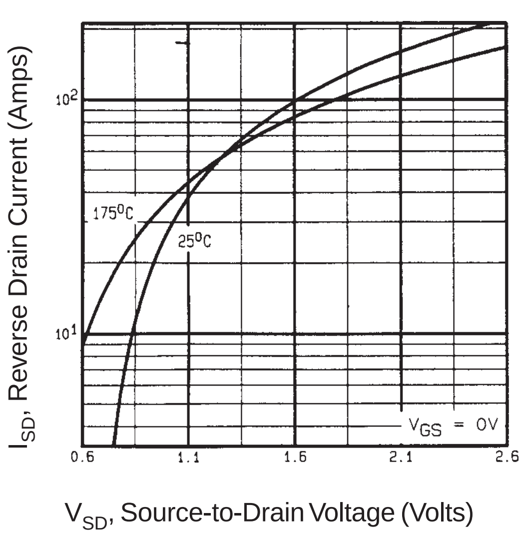



**Fig. 7 Typical Source-Drain Diode Forward Voltage**

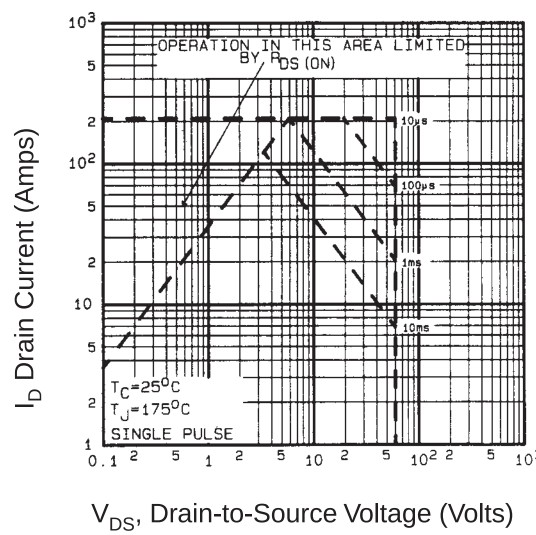



**Fig. 8 Maximum Safe Operating Area**

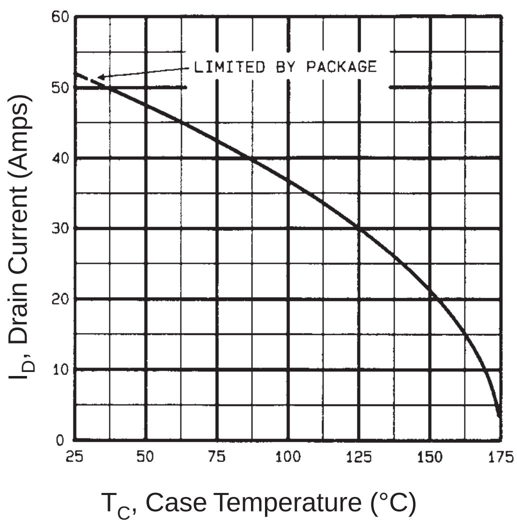



**Fig. 9 Maximum Drain Current vs. Case Temperature**

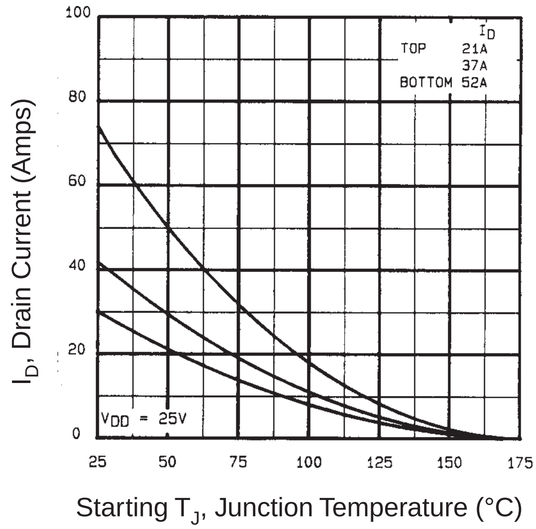



**Fig. 12c Maximum Avalanche Energy vs. Drain Current**

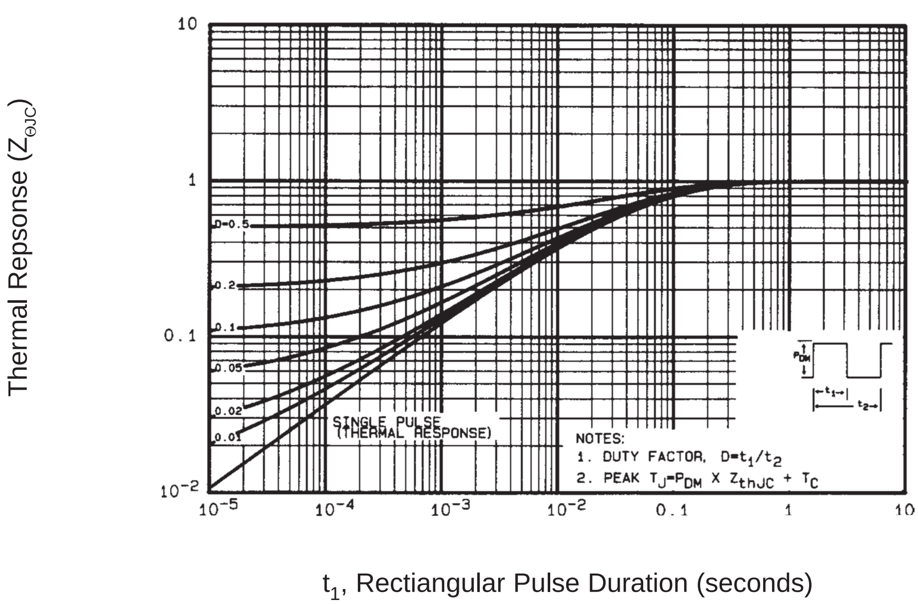



**Fig. 11 Maximum Effective Transient Thermal Impedance, Junction-to-Case**

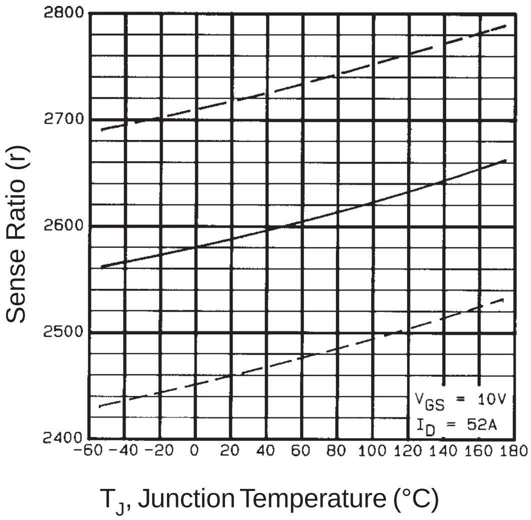



**Fig. 15 Typical HEXSense Ratio vs. Junction Temperature**

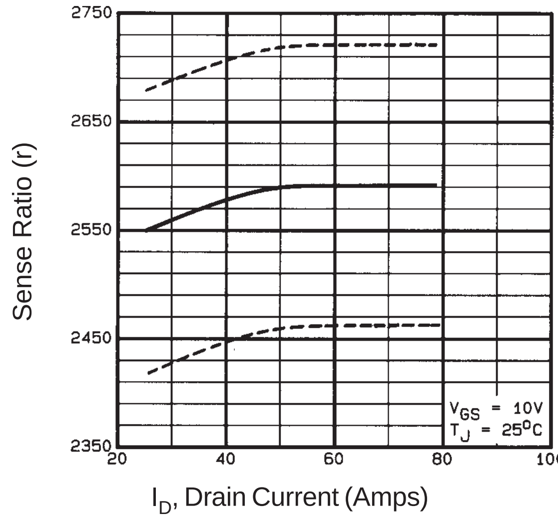



**Fig. 16 Typical HEXSense Ratio vs. Drain Current**

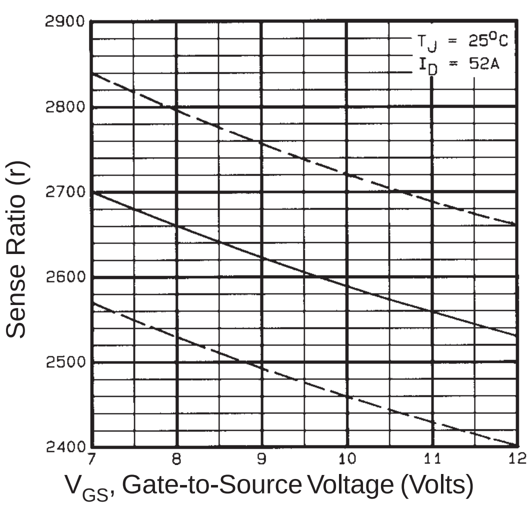



**Fig. 17 Typical HEXSense Ratio vs. Gate Voltage**

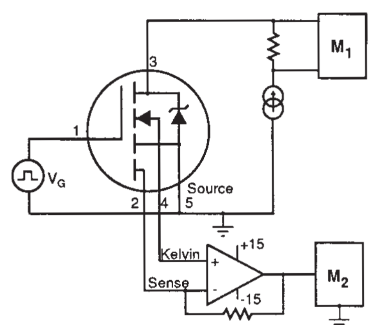



**Fig. 18 HEXSense Ratio Test Circuit**

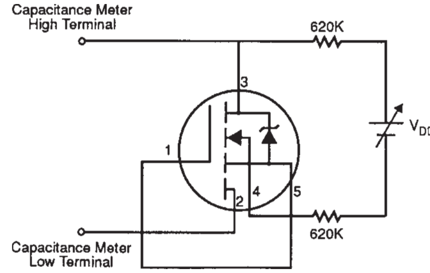



**Fig. 19 HEXSense Sensing Cell Output Capacitance Test Circuit**

**Mechanical drawings, Appendix A**
**Part marking information, Appendix B**
**Test Circuit diagrams, Appendix C**