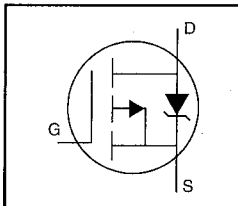


## HEXFET® Power MOSFET

- Dynamic  $dv/dt$  Rating
- Repetitive Avalanche Rated
- P-Channel
- Isolated Central Mounting Hole
- Fast Switching
- Ease of Paralleling
- Simple Drive Requirements



$$V_{DSS} = -200V$$

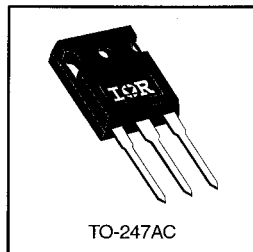
$$R_{DS(on)} = 0.50\Omega$$

$$I_D = -12A$$

## 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-247 package is preferred for commercial-industrial applications where higher power levels preclude the use of TO-220 devices. The TO-247 is similar but superior to the earlier TO-218 package because of its isolated mounting hole. It also provides greater creepage distance between pins to meet the requirements of most safety specifications.



DATA  
SHEETS

## Absolute Maximum Ratings

|                             | Parameter                                           | Max.                  | Units |
|-----------------------------|-----------------------------------------------------|-----------------------|-------|
| $I_D$ @ $T_C = 25^\circ C$  | Continuous Drain Current, $V_{GS} @ -10V$           | -12                   | A     |
| $I_D$ @ $T_C = 100^\circ C$ | Continuous Drain Current, $V_{GS} @ -10V$           | -7.5                  |       |
| $I_{DM}$                    | Pulsed Drain Current ①                              | -48                   |       |
| $P_D$ @ $T_C = 25^\circ C$  | Power Dissipation                                   | 150                   | W     |
|                             | Linear Derating Factor                              | 1.2                   | W/°C  |
| $V_{GS}$                    | Gate-to-Source Voltage                              | $\pm 20$              | V     |
| $E_{AS}$                    | Single Pulse Avalanche Energy ②                     | 790                   | mJ    |
| $I_{AR}$                    | Avalanche Current ①                                 | -12                   | A     |
| $E_{AR}$                    | Repetitive Avalanche Energy ①                       | 15                    | mJ    |
| $dv/dt$                     | Peak Diode Recovery $dv/dt$ ③                       | -5.0                  | V/ns  |
| $T_J$<br>$T_{STG}$          | Operating Junction and<br>Storage Temperature Range | -55 to +150           | °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                    | —    | —    | 0.83 | °C/W  |
| $R_{\theta CS}$ | Case-to-Sink, Flat, Greased Surface | —    | 0.24 | —    |       |
| $R_{\theta JA}$ | Junction-to-Ambient                 | —    | —    | 40   |       |

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

|                                 | Parameter                            | Min. | Typ.  | Max. | Units                     | Test Conditions                                                      |
|---------------------------------|--------------------------------------|------|-------|------|---------------------------|----------------------------------------------------------------------|
| $V_{(BR)DSS}$                   | Drain-to-Source Breakdown Voltage    | -200 | —     | —    | V                         | $V_{GS}=0\text{V}$ , $I_D=-250\mu\text{A}$                           |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient  | —    | -0.20 | —    | $\text{V}/^\circ\text{C}$ | Reference to $25^\circ\text{C}$ , $I_D=-1\text{mA}$                  |
| $R_{DS(on)}$                    | Static Drain-to-Source On-Resistance | —    | —     | 0.50 | $\Omega$                  | $V_{DS}=-10\text{V}$ , $I_D=-7.2\text{A}$ ④                          |
| $V_{GS(th)}$                    | Gate Threshold Voltage               | -2.0 | —     | -4.0 | V                         | $V_{DS}=V_{GS}$ , $I_D=-250\mu\text{A}$                              |
| $g_{fs}$                        | Forward Transconductance             | 4.2  | —     | —    | S                         | $V_{DS}=-50\text{V}$ , $I_D=-7.2\text{A}$ ④                          |
| $I_{DSS}$                       | Drain-to-Source Leakage Current      | —    | —     | -100 | $\mu\text{A}$             | $V_{DS}=-200\text{V}$ , $V_{GS}=0\text{V}$                           |
|                                 |                                      | —    | —     | -500 |                           | $V_{DS}=-160\text{V}$ , $V_{GS}=0\text{V}$ , $T_J=125^\circ\text{C}$ |
| $I_{GSS}$                       | Gate-to-Source Forward Leakage       | —    | —     | -100 | nA                        | $V_{GS}=-20\text{V}$                                                 |
|                                 | Gate-to-Source Reverse Leakage       | —    | —     | 100  |                           | $V_{GS}=20\text{V}$                                                  |
| $Q_g$                           | Total Gate Charge                    | —    | —     | 44   | nC                        | $I_D=-11\text{A}$                                                    |
| $Q_{gs}$                        | Gate-to-Source Charge                | —    | —     | 7.1  |                           | $V_{DS}=-160\text{V}$                                                |
| $Q_{gd}$                        | Gate-to-Drain ("Miller") Charge      | —    | —     | 27   |                           | $V_{GS}=-10\text{V}$ See Fig. 6 and 13 ④                             |
| $t_{d(on)}$                     | Turn-On Delay Time                   | —    | 14    | —    | ns                        | $V_{DD}=-100\text{V}$                                                |
| $t_r$                           | Rise Time                            | —    | 43    | —    |                           | $I_D=-11\text{A}$                                                    |
| $t_{d(off)}$                    | Turn-Off Delay Time                  | —    | 39    | —    |                           | $R_G=9.1\Omega$                                                      |
| $t_f$                           | Fall Time                            | —    | 38    | —    |                           | $R_D=8.6\Omega$ See Figure 10 ④                                      |
| $L_D$                           | Internal Drain Inductance            | —    | 5.0   | —    | nH                        | Between lead, 6 mm (0.25in.) from package and center of die contact  |
| $L_S$                           | Internal Source Inductance           | —    | 13    | —    |                           |                                                                      |
| $C_{iss}$                       | Input Capacitance                    | —    | 1200  | —    | pF                        | $V_{GS}=0\text{V}$                                                   |
| $C_{oss}$                       | Output Capacitance                   | —    | 370   | —    |                           | $V_{DS}=-25\text{V}$                                                 |
| $C_{rss}$                       | Reverse Transfer Capacitance         | —    | 81    | —    |                           | $f=1.0\text{MHz}$ See Figure 5                                       |

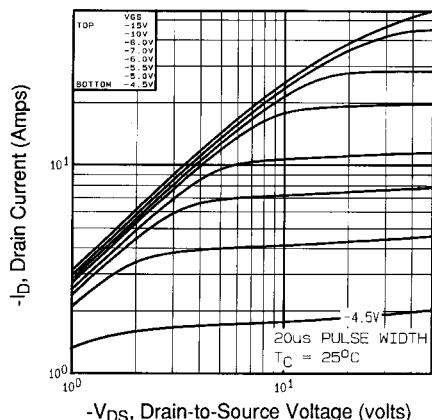


## Source-Drain Ratings and Characteristics

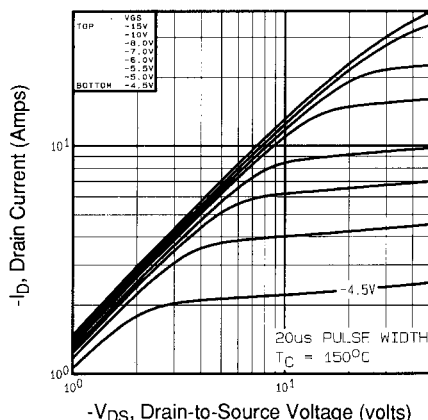
|          | Parameter                              | Min.                                                                      | Typ. | Max. | Units         | Test Conditions                                                                                                                                   |
|----------|----------------------------------------|---------------------------------------------------------------------------|------|------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| $I_S$    | Continuous Source Current (Body Diode) | —                                                                         | —    | -12  | A             | MOSFET symbol showing the integral reverse p-n junction diode.  |
| $I_{SM}$ | Pulsed Source Current (Body Diode) ①   | —                                                                         | —    | -48  |               |                                                                                                                                                   |
| $V_{SD}$ | Diode Forward Voltage                  | —                                                                         | —    | -5.0 | V             | $T_J=25^\circ\text{C}$ , $I_S=-12\text{A}$ , $V_{GS}=0\text{V}$ ④                                                                                 |
| $t_{rr}$ | Reverse Recovery Time                  | —                                                                         | 250  | 300  | ns            | $T_J=25^\circ\text{C}$ , $I_F=-11\text{A}$                                                                                                        |
| $Q_{rr}$ | Reverse Recovery Charge                | —                                                                         | 2.9  | 3.6  | $\mu\text{C}$ | $di/dt=100\text{A}/\mu\text{s}$ ④                                                                                                                 |
| $t_{on}$ | Forward Turn-On Time                   | Intrinsic turn-on time is negligible (turn-on is dominated by $L_S+L_D$ ) |      |      |               |                                                                                                                                                   |

### Notes:

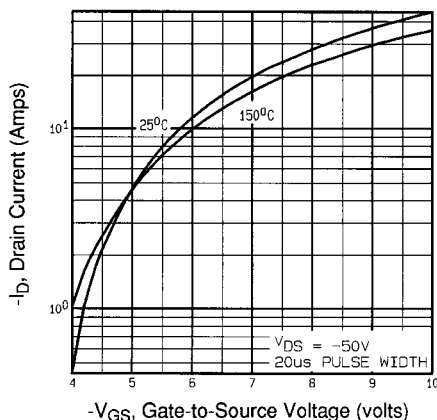
- ① Repetitive rating; pulse width limited by max. junction temperature (See Figure 11)
- ②  $V_{DD}=-50\text{V}$ , starting  $T_J=25^\circ\text{C}$ ,  $L=8.2\text{mH}$ ,  $R_G=25\Omega$ ,  $I_{AS}=-12\text{A}$  (See Figure 12)
- ③  $I_{SD}\leq 12\text{A}$ ,  $di/dt\leq 150\text{A}/\mu\text{s}$ ,  $V_{DD}\leq V_{(BR)DSS}$ ,  $T_J\leq 150^\circ\text{C}$
- ④ Pulse width  $\leq 300\mu\text{s}$ ; duty cycle  $\leq 2\%$ .



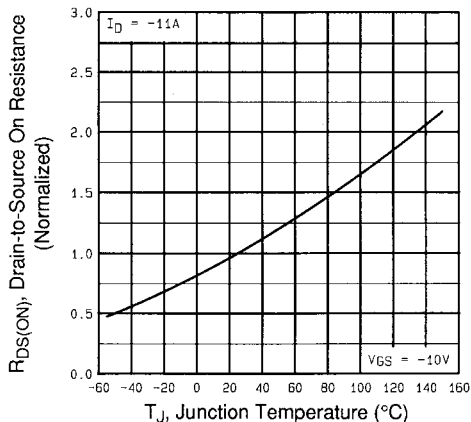
**Fig 1.** Typical Output Characteristics,  
 $T_C = 25^\circ\text{C}$



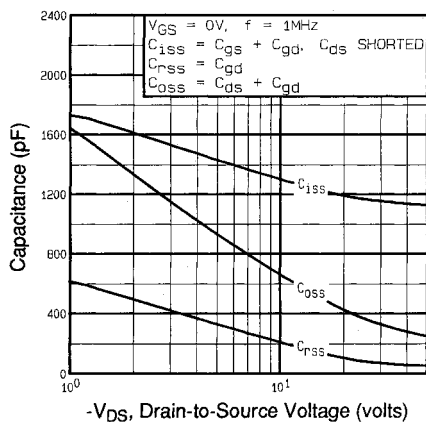
**Fig 2.** Typical Output Characteristics,  
 $T_C = 150^\circ\text{C}$



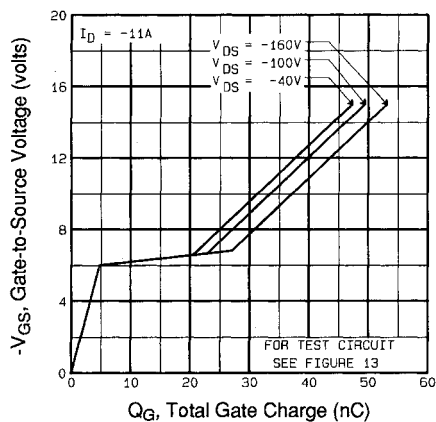
**Fig 3.** Typical Transfer Characteristics



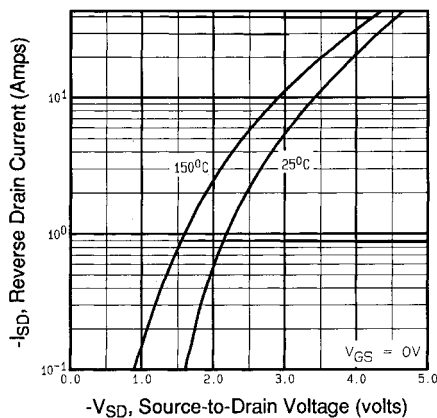
**Fig 4.** Normalized On-Resistance  
Vs. Temperature



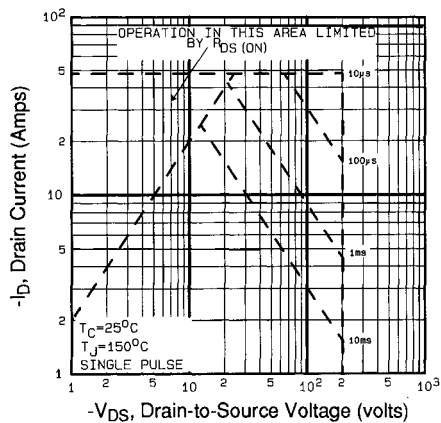
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



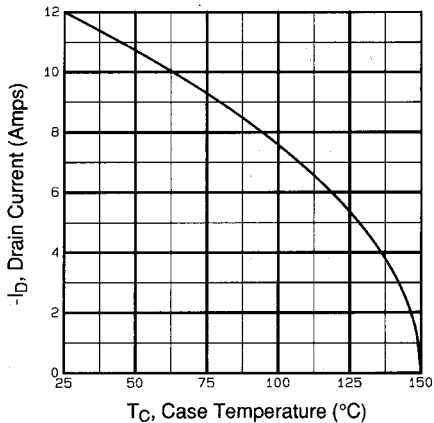
**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage



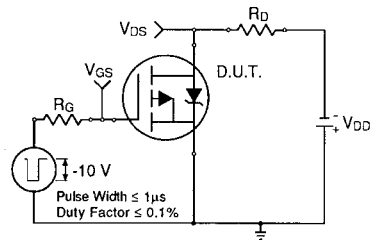
**Fig 7.** Typical Source-Drain Diode Forward Voltage



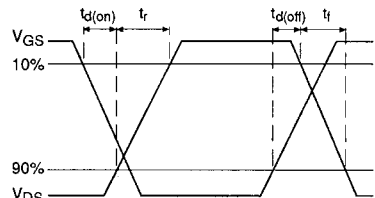
**Fig 8.** Maximum Safe Operating Area



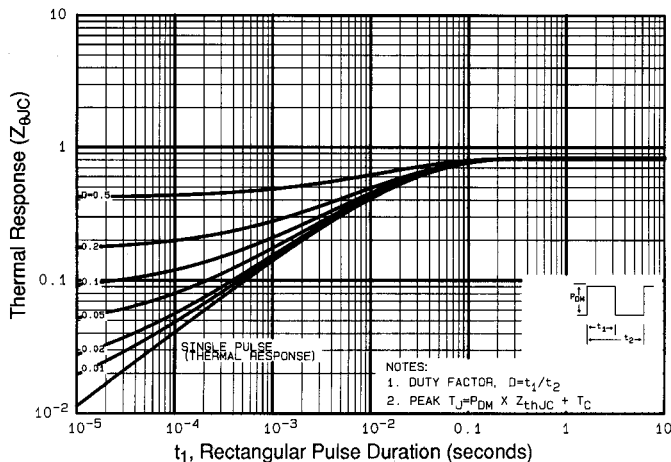
**Fig 9.** Maximum Drain Current Vs. Case Temperature



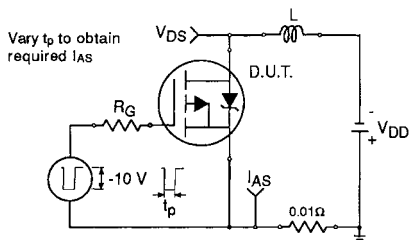
**Fig 10a.** Switching Time Test Circuit



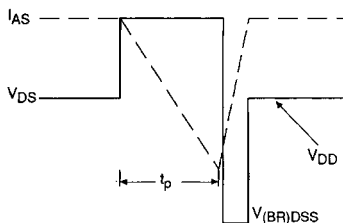
**Fig 10b.** Switching Time Waveforms



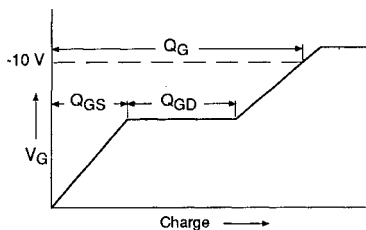
**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case



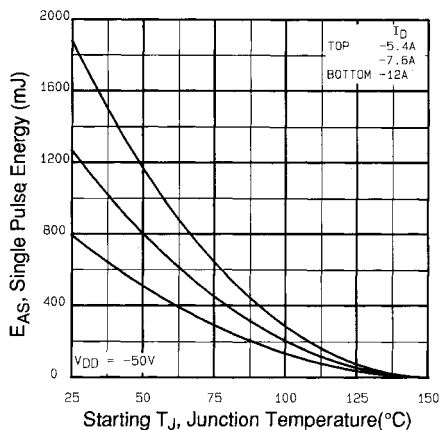
**Fig 12a.** Unclamped Inductive Test Circuit



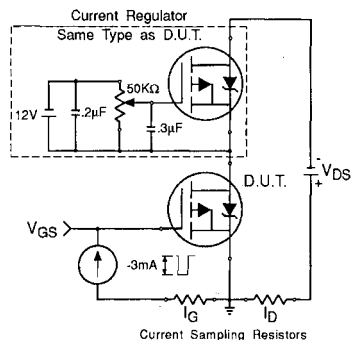
**Fig 12b.** Unclamped Inductive Waveforms



**Fig 13a.** Basic Gate Charge Waveform



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



**Fig 13b.** Gate Charge Test Circuit

**Appendix A:** Figure 14, Peak Diode Recovery  $dv/dt$  Test Circuit – See page 1506

**Appendix B:** Package Outline Mechanical Drawing – See page 1511

**Appendix C:** Part Marking Information – See page 1517

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