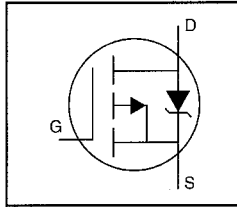


## HEXFET® Power MOSFET

- Dynamic dv/dt Rating
- Repetitive Avalanche Rated
- P-Channel
- Isolated Central Mounting Hole
- 175°C Operating Temperature
- Fast Switching
- Ease of Paralleling



$$V_{DSS} = -100V$$

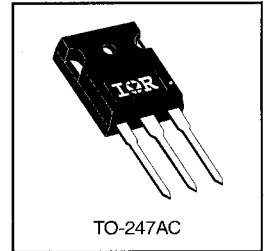
$$R_{DS(on)} = 0.20\Omega$$

$$I_D = -21A$$

### 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, $V_{GS} @ -10 V$          | -21                   | A     |
| $I_D$ @ $T_C = 100^\circ C$ | Continuous Drain Current, $V_{GS} @ -10 V$          | -15                   |       |
| $I_{DM}$                    | Pulsed Drain Current ①                              | -84                   |       |
| $P_D$ @ $T_C = 25^\circ C$  | Power Dissipation                                   | 180                   | W     |
|                             | Linear Derating Factor                              | 1.2                   | W/°C  |
| $V_{GS}$                    | Gate-to-Source Voltage                              | $\pm 20$              | V     |
| $E_{AS}$                    | Single Pulse Avalanche Energy ②                     | 960                   | mJ    |
| $I_{AR}$                    | Avalanche Current ①                                 | -21                   | A     |
| $E_{AR}$                    | Repetitive Avalanche Energy ①                       | 18                    | mJ    |
| dv/dt                       | Peak Diode Recovery dv/dt ③                         | -5.5                  | 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                    | —    | —    | 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)

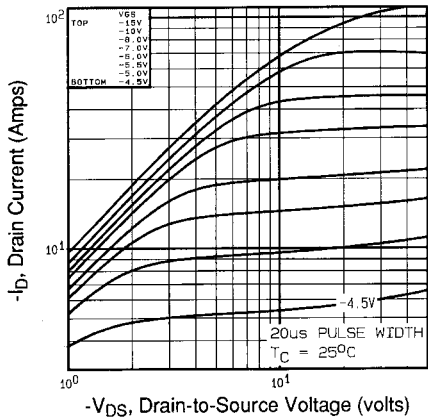
|                                 | Parameter                            | Min. | Typ.   | Max. | Units              | Test Conditions  |
|---------------------------------|--------------------------------------|------|--------|------|--------------------|--|
| $V_{(BR)DSS}$                   | Drain-to-Source Breakdown Voltage    | -100 | —      | —    | V                  | $V_{GS}=0V, I_D=-250\mu A$   |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient  | —    | -0.087 | —    | $V/^\circ\text{C}$ | Reference to $25^\circ\text{C}, I_D=-1mA$  |
| $R_{DS(on)}$                    | Static Drain-to-Source On-Resistance | —    | —      | 0.20 | $\Omega$           | $V_{GS}=-10V, I_D=-13A$ ④  |
| $V_{GS(th)}$                    | Gate Threshold Voltage               | -2.0 | —      | -4.0 | V                  | $V_{DS}=V_{GS}, I_D=-250\mu A$   |
| $g_{fs}$                        | Forward Transconductance             | 6.2  | —      | —    | S                  | $V_{DS}=-50V, I_D=-13A$ ④  |
| $I_{DSS}$                       | Drain-to-Source Leakage Current      | —    | —      | -100 | $\mu A$            | $V_{DS}=-100V, V_{GS}=0V$  |
|                                 |                                      | —    | —      | -500 |                    | $V_{DS}=-80V, V_{GS}=0V, T_J=150^\circ\text{C}$  |
| $I_{GSS}$                       | Gate-to-Source Forward Leakage       | —    | —      | -100 | nA                 | $V_{GS}=-20V$  |
|                                 | Gate-to-Source Reverse Leakage       | —    | —      | 100  |                    | $V_{GS}=20V$   |
| $Q_g$                           | Total Gate Charge                    | —    | —      | 61   | nC                 | $I_D=-19A$   |
| $Q_{gs}$                        | Gate-to-Source Charge                | —    | —      | 14   |                    | $V_{DS}=-80V$  |
| $Q_{gd}$                        | Gate-to-Drain ("Miller") Charge      | —    | —      | 29   |                    | $V_{GS}=-10V$ See Fig. 6 and 13 ④  |
| $t_{d(on)}$                     | Turn-On Delay Time                   | —    | 16     | —    | ns                 | $V_{DD}=-50V$  |
| $t_r$                           | Rise Time                            | —    | 73     | —    |                    | $I_D=-19A$   |
| $t_{d(off)}$                    | Turn-Off Delay Time                  | —    | 34     | —    |                    | $R_G=9.1\Omega$  |
| $t_f$                           | Fall Time                            | —    | 57     | —    |                    | $R_D=2.4\Omega$ 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                    | —    | 1400   | —    | pF                 | $V_{GS}=0V$  |
| $C_{oss}$                       | Output Capacitance                   | —    | 590    | —    |                    | $V_{DS}=25V$   |
| $C_{rss}$                       | Reverse Transfer Capacitance         | —    | 140    | —    |                    | $f=1.0MHz$ See Figure 5  |

## Source-Drain Ratings and Characteristics

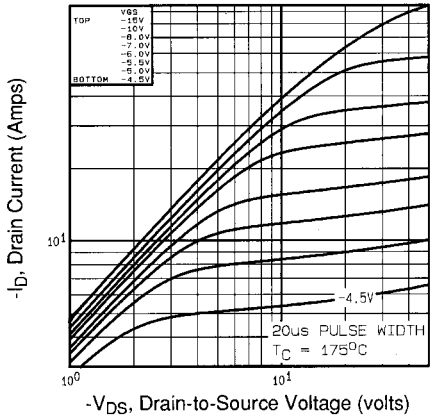
|          | Parameter                              | Min.  | Typ. | Max. | Units   | Test Conditions   |
|----------|--|---|------|------|---------|---|
| $I_S$    | Continuous Source Current (Body Diode) | —   | —    | -21  | A       | MOSFET symbol showing the integral reverse p-n junction diode.  |
| $I_{SM}$ | Pulsed Source Current (Body Diode) ①   | —   | —    | -84  |         |   |
| $V_{SD}$ | Diode Forward Voltage                  | —   | —    | -5.0 | V       | $T_J=25^\circ\text{C}, I_S=-21A, V_{GS}=0V$ ④   |
| $t_{rr}$ | Reverse Recovery Time                  | —   | 130  | 260  | ns      | $T_J=25^\circ\text{C}, I_F=-19A$  |
| $Q_{rr}$ | Reverse Recovery Charge                | —   | 0.35 | 0.70 | $\mu C$ | $di/dt=100A/\mu s$ ④  |
| $t_{on}$ | Forward Turn-On Time                   | Intrinsic turn-on time is negligible (turn-on is dominated by $L_S+L_D$ ) |      |      |         |   |

### Notes:

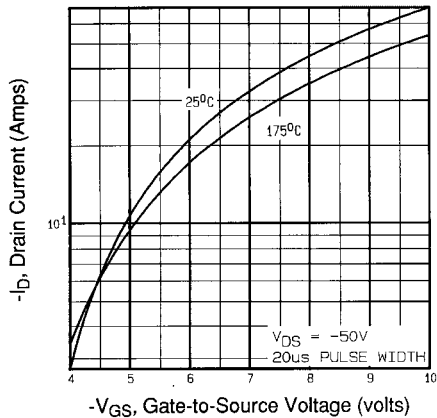
- ① Repetitive rating; pulse width limited by max. junction temperature (See Figure 11)
- ②  $V_{DD}=-25V$ , starting  $T_J=25^\circ\text{C}$ ,  $L=3.3mH$ ,  $R_G=25\Omega$ ,  $I_{AS}=-21A$  (See Figure 12)
- ③  $I_{SDS}\leq 21A$ ,  $di/dt\leq 200A/\mu s$ ,  $V_{DD}\leq V_{(BR)DSS}$ ,  $T_J\leq 175^\circ\text{C}$
- ④ Pulse width  $\leq 300\mu s$ ; duty cycle  $\leq 2\%$ .



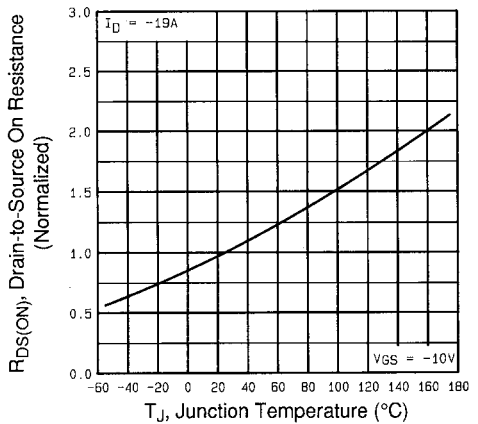
**Fig 1.** Typical Output Characteristics,  
 $T_C=25^\circ\text{C}$



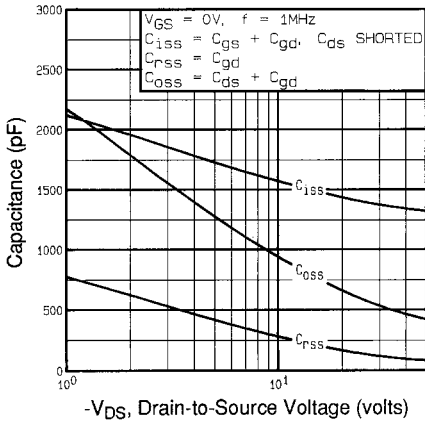
**Fig 2.** Typical Output Characteristics,  
 $T_C=175^\circ\text{C}$



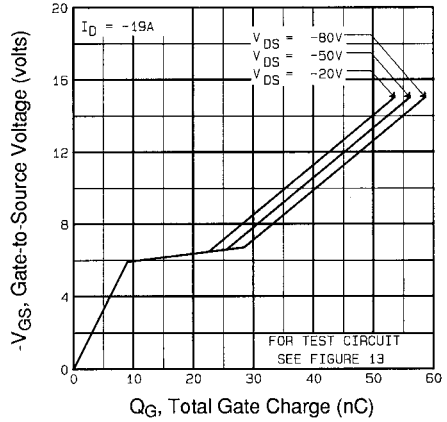
**Fig 3.** Typical Transfer Characteristics



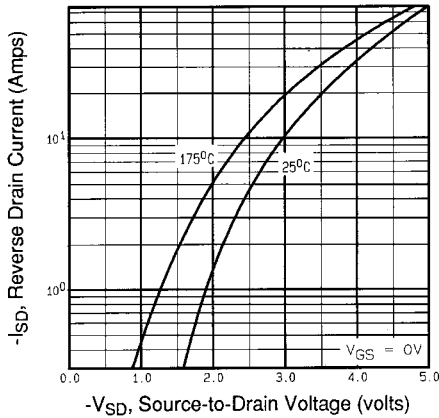
**Fig 4.** Normalized On-Resistance  
Vs. Temperature



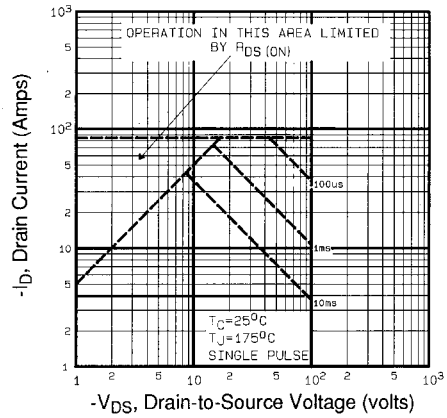
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



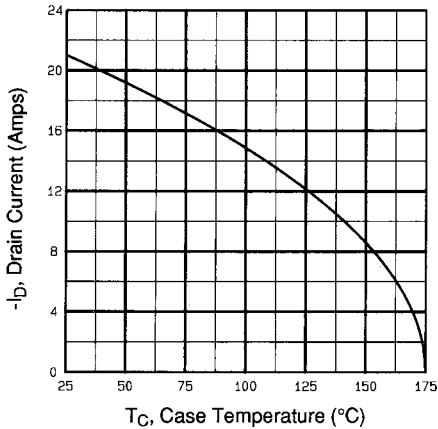
**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage



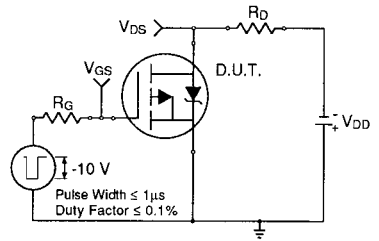
**Fig 7.** Typical Source-Drain Diode Forward Voltage



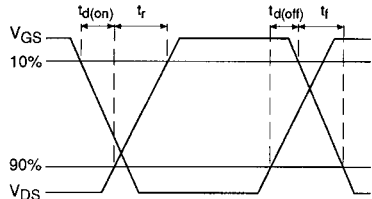
**Fig 8.** Maximum Safe Operating Area



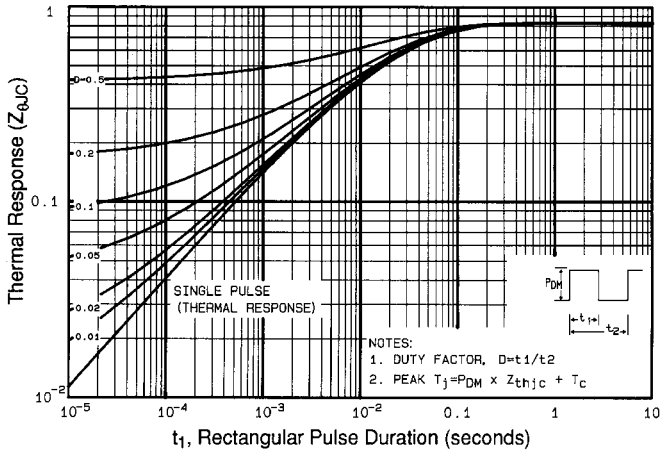
**Fig 9.** Maximum Drain Current Vs. Case Temperature



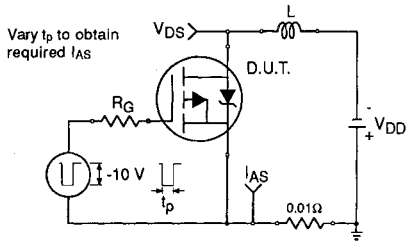
**Fig 10a.** Switching Time Test Circuit



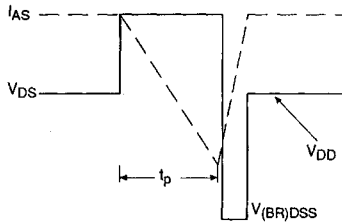
**Fig 10b.** Switching Time Waveforms



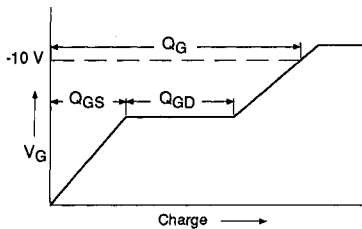
**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case



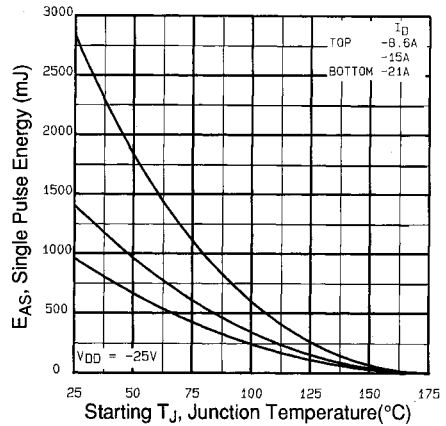
**Fig 12a.** Unclamped Inductive Test Circuit



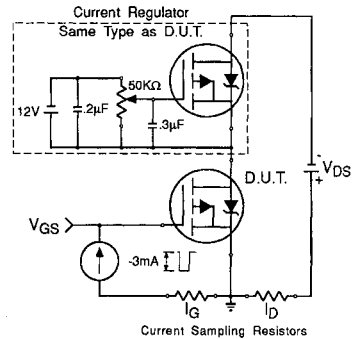
**Fig 12b.** Unclamped Inductive Waveforms



**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