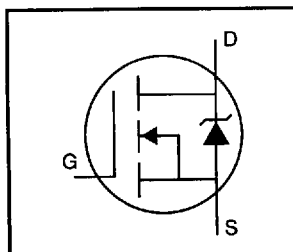


- Isolated Package
- DC Package Isolation= 4.0KVDC ⑤
- AC Package Isolation= 2.0KVRMS ⑥
- Lead to Lead Creepage Dist.= 7.5mm
- Sink to Lead Creepage Dist.= 6.0mm
- Dynamic dv/dt Rating
- Repetitive Avalanche Rated



$$V_{DSS} = 500V$$

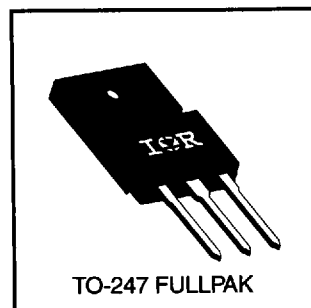
$$R_{DS(on)} = 0.85\Omega$$

$$I_D = 6.4A$$

### 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 Fullpak eliminates the need for additional insulating hardware in commercial-industrial applications. The package has been carefully designed to meet the creepage distance requirements of UL 1012. For further information request application note AN972, "Thermal and Mechanical Considerations for FullPak Applications".


DATA  
SHEETS

### Absolute Maximum Ratings

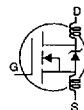
|                             | Parameter                                           | Max.                  | Units |
|-----------------------------|-----------------------------------------------------|-----------------------|-------|
| $I_D$ @ $T_C = 25^\circ C$  | Continuous Drain Current, $V_{GS}$ @ 10 V           | 6.4                   | A     |
| $I_D$ @ $T_C = 100^\circ C$ | Continuous Drain Current, $V_{GS}$ @ 10 V           | 4.0                   |       |
| $I_{DM}$                    | Pulsed Drain Current ①                              | 26                    |       |
| $P_D$ @ $T_C = 25^\circ C$  | Power Dissipation                                   | 83                    | W     |
|                             | Linear Derating Factor                              | 0.67                  | W/°C  |
| $V_{GS}$                    | Gate-to-Source Voltage                              | ±20                   | V     |
| $E_{AS}$                    | Single Pulse Avalanche Energy ②                     | 280                   | mJ    |
| $I_{AR}$                    | Avalanche Current ①                                 | 6.4                   | A     |
| $E_{AR}$                    | Repetitive Avalanche Energy ①                       | 8.3                   | mJ    |
| dv/dt                       | Peak Diode Recovery dv/dt ③                         | 3.5                   | 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    | —    | —    | 1.5  | °C/W  |
| $R_{\theta JA}$ | 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    | 500  | —    | —    | V                   | $V_{GS}=0V, I_D=250\mu A$                                           |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient  | —    | 0.59 | —    | V/ $^\circ\text{C}$ | Reference to $25^\circ\text{C}$ , $I_D=1mA$                         |
| $R_{DS(on)}$                    | Static Drain-to-Source On-Resistance | —    | —    | 0.85 | $\Omega$            | $V_{GS}=10V, I_D=3.8A$ 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             | 4.7  | —    | —    | S                   | $V_{DS}=50V, I_D=3.8A$ ④                                            |
| $I_{DSS}$                       | Drain-to-Source Leakage Current      | —    | —    | 25   | $\mu A$             | $V_{DS}=500V, V_{GS}=0V$                                            |
|                                 |                                      | —    | —    | 250  |                     | $V_{DS}=400V, V_{GS}=0V, T_J=125^\circ\text{C}$                     |
| $I_{GSS}$                       | Gate-to-Source Forward Leakage       | —    | —    | 100  | nA                  | $V_{GS}=20V$                                                        |
|                                 | Gate-to-Source Reverse Leakage       | —    | —    | -100 |                     | $V_{GS}=-20V$                                                       |
| $Q_g$                           | Total Gate Charge                    | —    | —    | 67   | nC                  | $I_D=8.0A$                                                          |
| $Q_{gs}$                        | Gate-to-Source Charge                | —    | —    | 10   |                     | $V_{DS}=400V$                                                       |
| $Q_{gd}$                        | Gate-to-Drain ("Miller") Charge      | —    | —    | 34   |                     | $V_{GS}=10V$ See Fig. 6 and 13 ④                                    |
| $t_{d(on)}$                     | Turn-On Delay Time                   | —    | 14   | —    | ns                  | $V_{DD}=250V$                                                       |
| $t_r$                           | Rise Time                            | —    | 22   | —    |                     | $I_D=8.0A$                                                          |
| $t_{d(off)}$                    | Turn-Off Delay Time                  | —    | 55   | —    |                     | $R_G=9.1\Omega$                                                     |
| $t_f$                           | Fall Time                            | —    | 21   | —    |                     | $R_D=31\Omega$ 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                    | —    | 1300 | —    | pF                  | $V_{GS}=0V$                                                         |
| $C_{oss}$                       | Output Capacitance                   | —    | 200  | —    |                     | $V_{DS}=25V$                                                        |
| $C_{rss}$                       | Reverse Transfer Capacitance         | —    | 39   | —    |                     | $f=1.0MHz$ See Figure 5                                             |
| $C$                             | Drain to Sink Capacitance            | —    | 26   | —    | pF                  | $f=1.0MHz$                                                          |



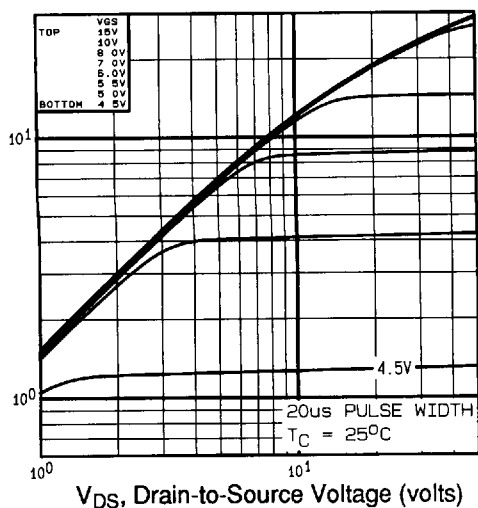
## Source-Drain Ratings and Characteristics

|          | Parameter                              | Min.                                                                      | Typ. | Max. | Units   | Test Conditions                                                |
|----------|----------------------------------------|---------------------------------------------------------------------------|------|------|---------|----------------------------------------------------------------|
| $I_S$    | Continuous Source Current (Body Diode) | —                                                                         | —    | 6.4  | A       | MOSFET symbol showing the integral reverse p-n junction diode. |
| $I_{SM}$ | Pulsed Source Current (Body Diode) ①   | —                                                                         | —    | 26   |         |                                                                |
| $V_{SD}$ | Diode Forward Voltage                  | —                                                                         | —    | 1.8  | V       | $T_J=25^\circ\text{C}, I_S=6.4A, V_{GS}=0V$ ④                  |
| $t_{rr}$ | Reverse Recovery Time                  | —                                                                         | 410  | 850  | ns      | $T_J=25^\circ\text{C}, I_F=8.0A$                               |
| $Q_{rr}$ | Reverse Recovery Charge                | —                                                                         | 2.8  | 5.6  | $\mu C$ | $di/dt=100A/\mu s$ ④                                           |
| $t_{on}$ | Forward Turn-On Time                   | Intrinsic turn-on time is negligible (turn-on is dominated by $L_S+L_D$ ) |      |      |         |                                                                |

### Notes:

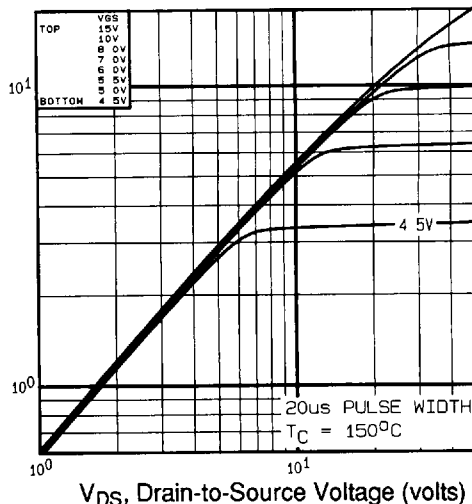
- ① Repetitive rating; pulse width limited by max. junction temperature (See Figure 11)
- ②  $V_{DD}=50V$ , starting  $T_J=25^\circ\text{C}$ ,  $L=12mH$ ,  $R_G=25\Omega$ ,  $I_{AS}=6.4A$  (See Figure 12)
- ③  $I_{SD}\leq 8.0A$ ,  $di/dt\leq 100A/\mu s$ ,  $V_{DD}\leq V_{(BR)DSS}$ ,  $T_J\leq 150^\circ\text{C}$
- ④ Pulse width  $\leq 300\mu s$ ; duty cycle  $\leq 2\%$ .
- ⑤  $t=60s$
- ⑥  $t=60s$ ,  $f=60Hz$

ID, Drain Current (Amps)



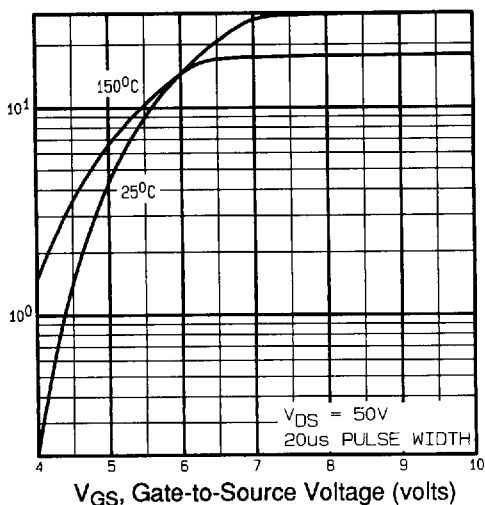
**Fig 1.** Typical Output Characteristics,  
 $T_C=25^\circ\text{C}$

ID, Drain Current (Amps)

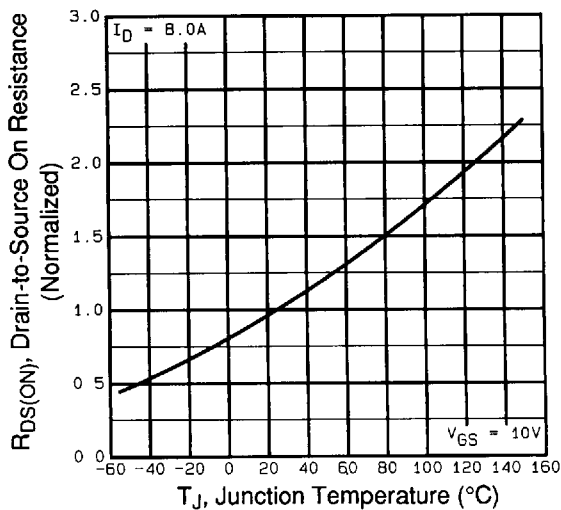


**Fig 2.** Typical Output Characteristics,  
 $T_C=150^\circ\text{C}$

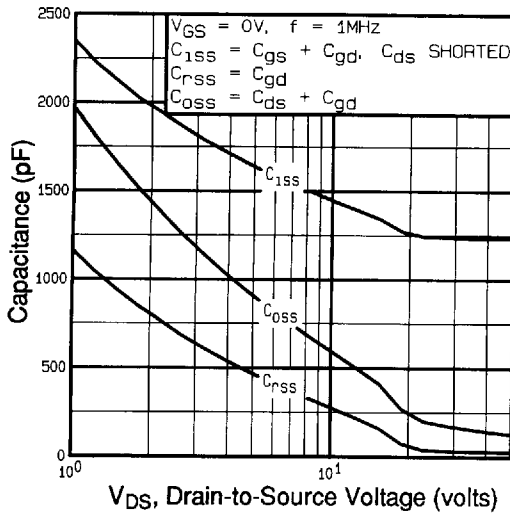
ID, Drain Current (Amps)



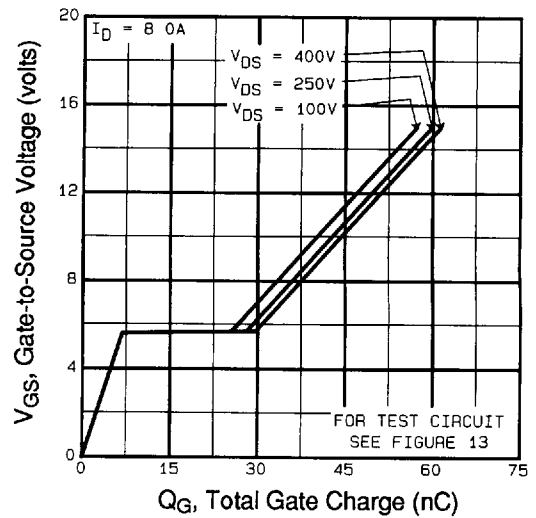
**Fig 3.** Typical Transfer Characteristics



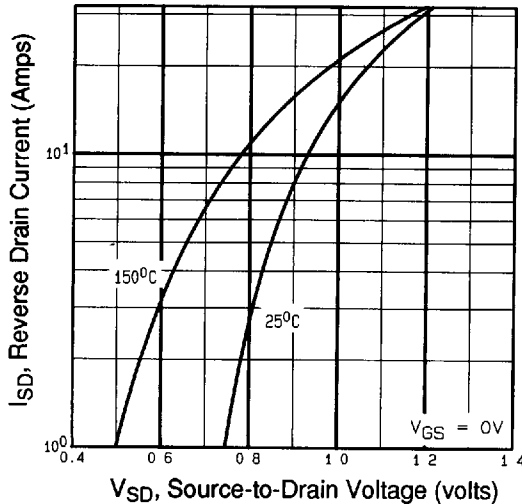
**Fig 4.** Normalized On-Resistance  
Vs. Temperature



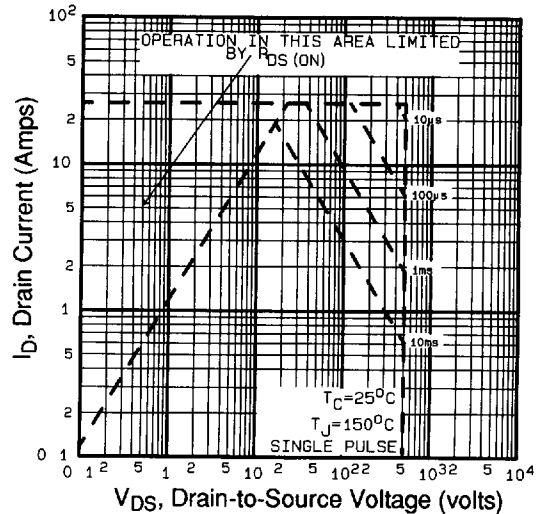
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



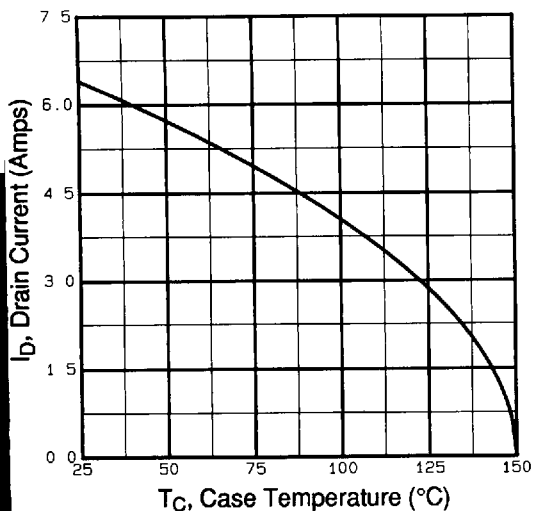
**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage



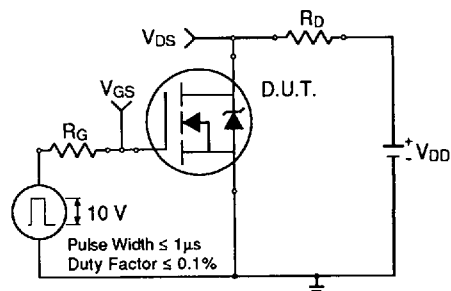
**Fig 7.** Typical Source-Drain Diode Forward Voltage



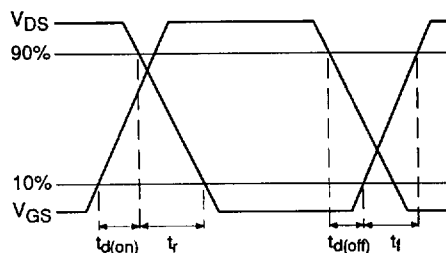
**Fig 8.** Maximum Safe Operating Area



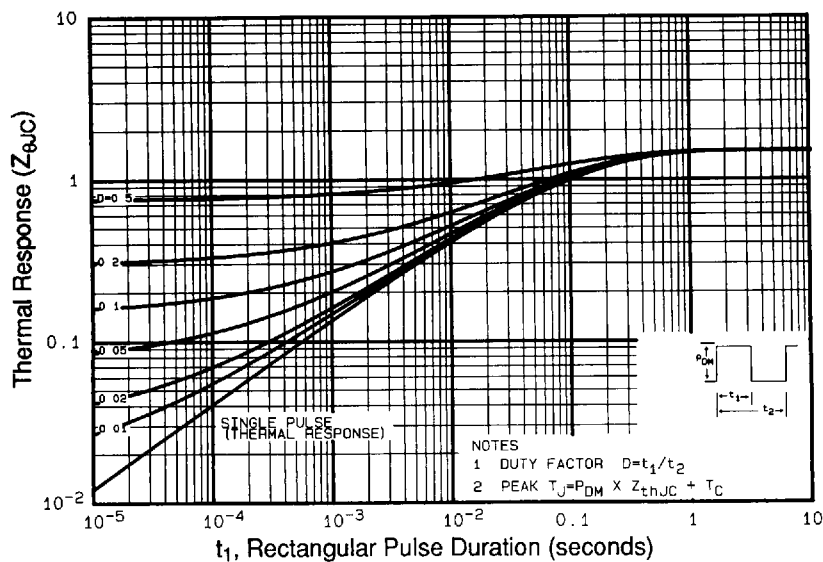
**Fig 9.** Maximum Drain Current Vs. Case Temperature



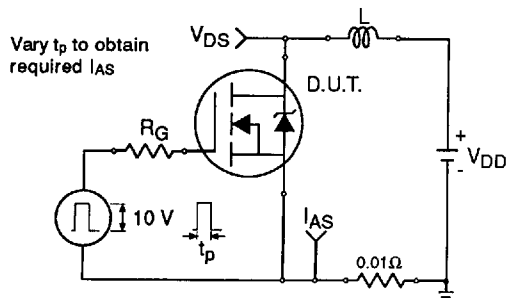
**Fig 10a.** Switching Time Test Circuit



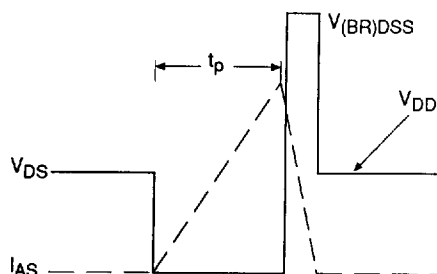
**Fig 10b.** Switching Time Waveforms



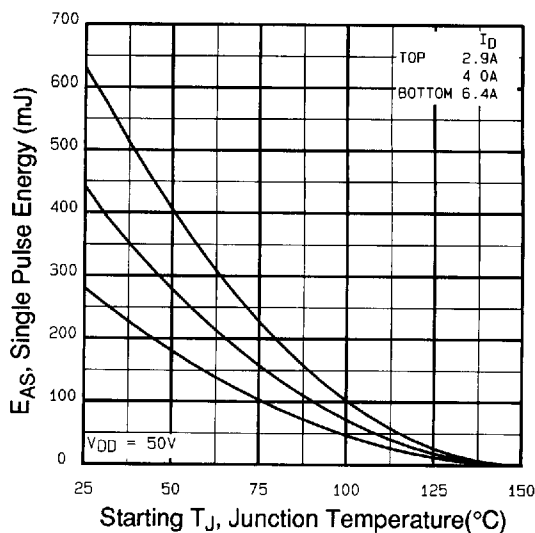
**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case



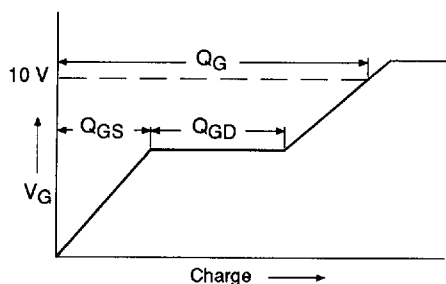
**Fig 12a.** Unclamped Inductive Test Circuit



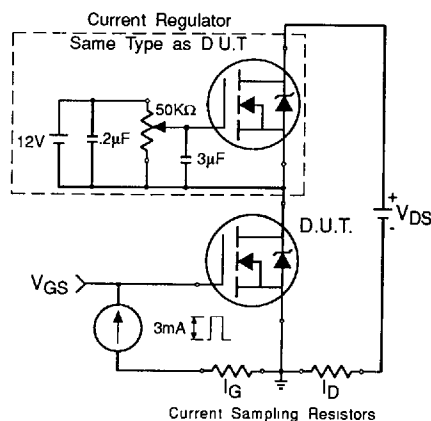
**Fig 12b.** Unclamped Inductive Waveforms



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



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



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

**Appendix A:** Figure 14, Peak Diode Recovery  $dv/dt$  Test Circuit – See page 1505

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

**Appendix C:** Part Marking Information – See page 1518

**International Rectifier**