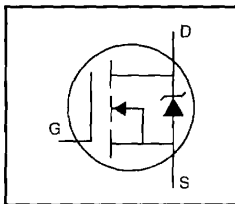


HEXFET® Power MOSFET

- Isolated Package
- High Voltage Isolation= 2.5KV RMS ⑤
- Sink to Lead Creepage Dist.= 4.8mm
- Dynamic dv/dt Rating
- Low Thermal Resistance



$$V_{DSS} = 450V$$

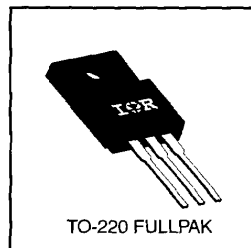
$$R_{DS(on)} = 0.63\Omega$$

$$I_D = 4.9A$$

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 Fullpak eliminates the need for additional insulating hardware in commercial-industrial applications. The moulding compound used provides a high isolation capability and a low thermal resistance between the tab and external heatsink. This isolation is equivalent to using a 100 micron mica barrier with standard TO-220 product. The Fullpak is mounted to a heatsink using a single clip or by a single screw fixing.


Absolute Maximum Ratings

| | Parameter | Max. | Units |
|---------------------------|--|-----------------------|-------|
| $I_D @ T_C = 25^\circ C$ | Continuous Drain Current, $V_{GS} @ 10 V$ | 4.9 | |
| $I_D @ T_C = 100^\circ C$ | Continuous Drain Current, $V_{GS} @ 10 V$ | 3.1 | A |
| I_{DM} | Pulsed Drain Current ① | 20 | |
| $P_D @ T_C = 25^\circ C$ | Power Dissipation | 40 | W |
| | Linear Derating Factor | 0.32 | W/°C |
| V_{GS} | Gate-to-Source Voltage | ±20 | V |
| E_{AS} | Single Pulse Avalanche Energy ② | 130 | mJ |
| I_{AR} | Avalanche Current ① | 4.9 | A |
| E_{AR} | Repetitive Avalanche Energy ① | 4.0 | mJ |
| dv/dt | Peak Diode Recovery dv/dt ③ | 3.5 | V/ns |
| T_J | Operating Junction and Storage Temperature Range | -55 to +150 | |
| T_{STG} | Soldering Temperature, for 10 seconds | 300 (1.6mm from case) | °C |
| | 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 | — | — | 3.1 | °C/W |
| $R_{\theta JA}$ | Junction-to-Ambient | — | — | 65 | |

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 | 450 | — | — | 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°C , $I_D=1\text{mA}$ |
| $R_{DS(on)}$ | Static Drain-to-Source On-Resistance | — | — | 0.63 | Ω | $V_{GS}=10V, I_D=2.9A$ ④ |
| $V_{GS(th)}$ | Gate Threshold Voltage | 2.0 | — | 4.0 | V | $V_{DS}=V_{GS}, I_D=250\mu A$ |
| g'_s | Forward Transconductance | 3.3 | — | — | S | $V_{DS}=50V, I_D=2.9A$ ④ |
| I_{DSS} | Drain-to-Source Leakage Current | — | — | 25 | μA | $V_{DS}=450V, V_{GS}=0V$ |
| | | — | — | 250 | | $V_{DS}=360V, V_{GS}=0V, T_J=125^\circ\text{C}$ |
| 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 | — | — | 80 | nC | $I_D=8.8A$ |
| Q_{gs} | Gate-to-Source Charge | — | — | 12 | | $V_{DS}=360V$ |
| Q_{gd} | Gate-to-Drain ("Miller") Charge | — | — | 41 | | $V_{GS}=10V$ See Fig. 6 and 13 ④ |
| $t_{d(on)}$ | Turn-On Delay Time | — | 8.7 | — | ns | $V_{DD}=225V$ |
| t_r | Rise Time | — | 28 | — | | $I_D=8.8A$ |
| $t_{d(off)}$ | Turn-Off Delay Time | — | 58 | — | | $R_G=9.1\Omega$ |
| t_f | Fall Time | — | 27 | — | | $R_D=25\Omega$ See Figure 10 ④ |
| 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 | — | 1400 | — | pF | $V_{GS}=0V$ |
| C_{oss} | Output Capacitance | — | 370 | — | | $V_{DS}=25V$ |
| C_{rss} | Reverse Transfer Capacitance | — | 140 | — | | $f=1.0\text{MHz}$ See Figure 5 |
| C | Drain to Sink Capacitance | — | 12 | — | | $f=1.0\text{MHz}$ |


Source-Drain Ratings and Characteristics

| | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|----------|--|---|------|------|---------------|--|
| I_S | Continuous Source Current (Body Diode) | — | — | 4.9 | A | MOSFET symbol showing the integral reverse p-n junction diode. |
| I_{SM} | Pulsed Source Current (Body Diode) ① | — | — | 20 | | |
| V_{SD} | Diode Forward Voltage | — | — | 2.0 | V | $T_J=25^\circ\text{C}, I_S=8.8A, V_{GS}=0V$ ④ |
| t_{rr} | Reverse Recovery Time | — | 490 | 740 | ns | $T_J=25^\circ\text{C}, I_F=8.8A$ |
| Q_{rr} | Reverse Recovery Charge | — | 3.2 | 4.8 | μC | $di/dt=100A/\mu\text{s}$ 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)

③ $I_{SD} \leq 8.8A$, $di/dt \leq 200A/\mu\text{s}$, $V_{DD} \leq V_{(BR)DSS}$, $T_J \leq 150^\circ\text{C}$ ⑤ $t=60\text{s}$, $f=60\text{Hz}$ ② $V_{DD}=50V$, starting $T_J=25^\circ\text{C}$, $L=9.6\text{mH}$, $R_G=25\Omega$, $I_{AS}=4.9A$ (See Figure 12)④ Pulse width $\leq 300\mu\text{s}$; duty cycle $\leq 2\%$.

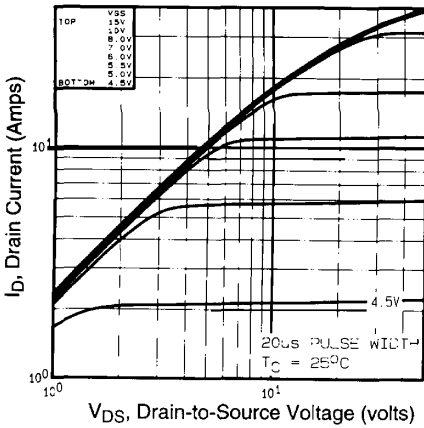


Fig 1. Typical Output Characteristics,
 $T_C=25^\circ\text{C}$

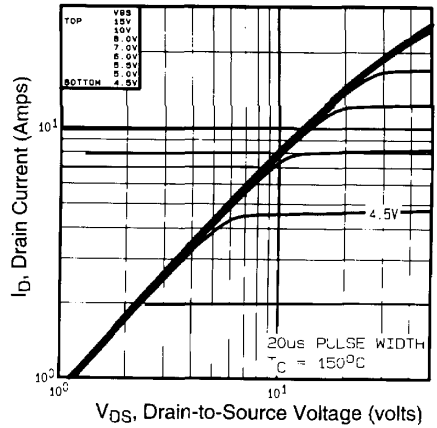


Fig 2. Typical Output Characteristics,
 $T_C=150^\circ\text{C}$

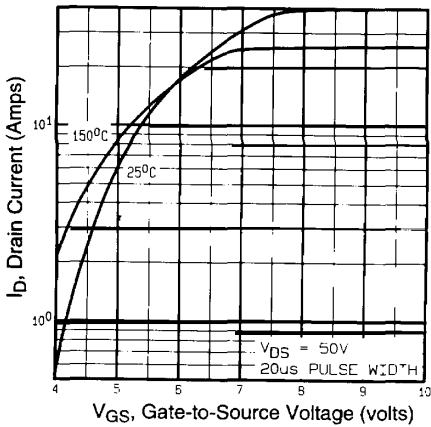


Fig 3. Typical Transfer Characteristics

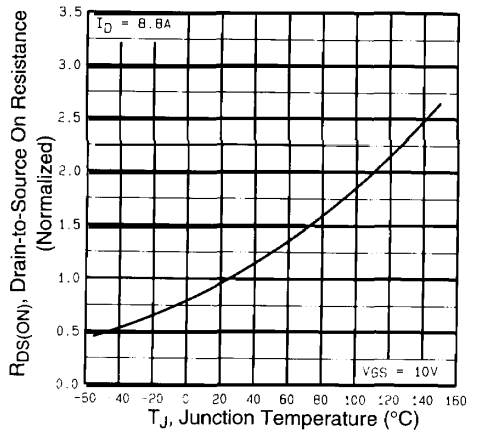


Fig 4. Normalized On-Resistance
Vs. Temperature

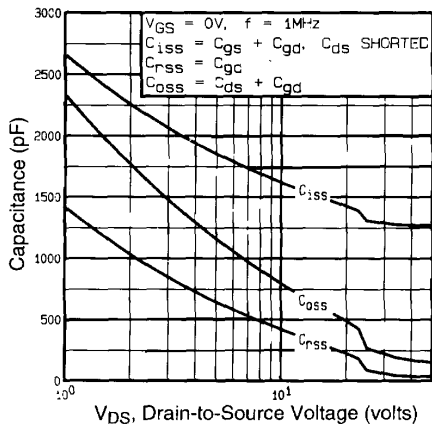


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

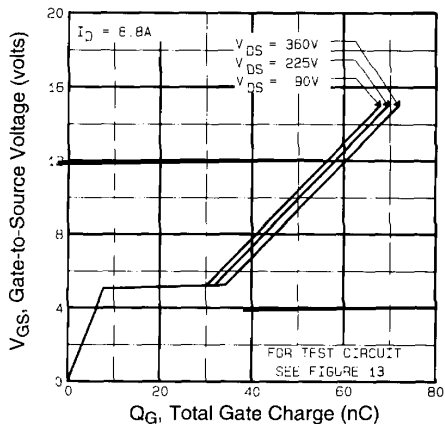


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

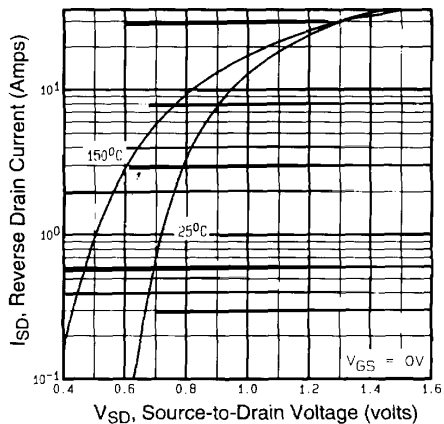


Fig 7. Typical Source-Drain Diode Forward Voltage

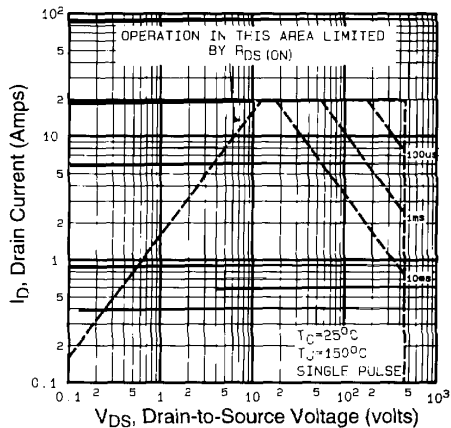


Fig 8. Maximum Safe Operating Area

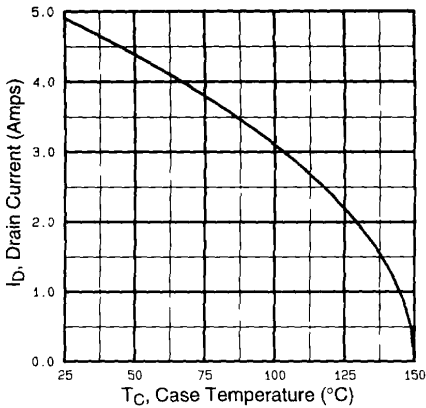


Fig 9. Maximum Drain Current Vs. Case Temperature

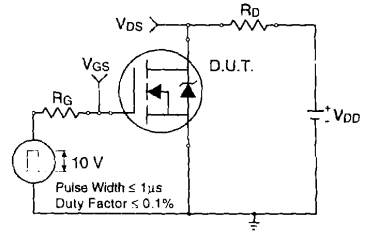


Fig 10a. Switching Time Test Circuit

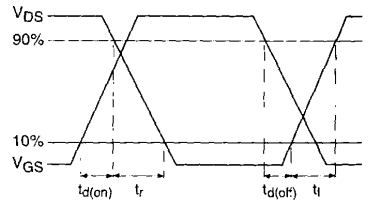


Fig 10b. Switching Time Waveforms

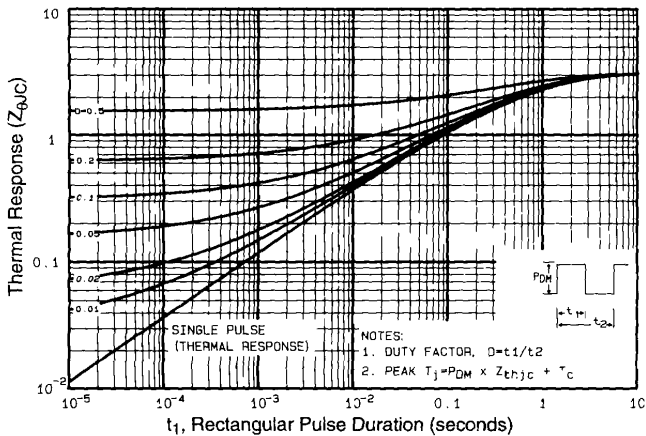


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

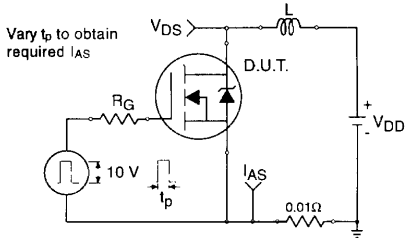


Fig 12a. Unclamped Inductive Test Circuit

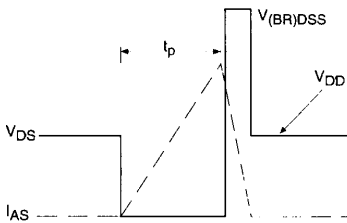


Fig 12b. Unclamped Inductive Waveforms

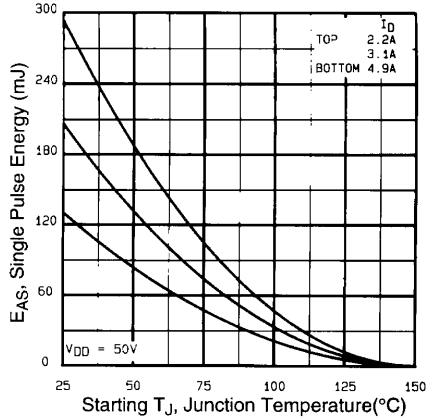


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

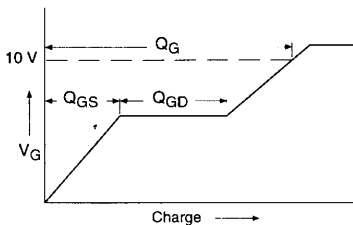


Fig 13a. Basic Gate Charge Waveform

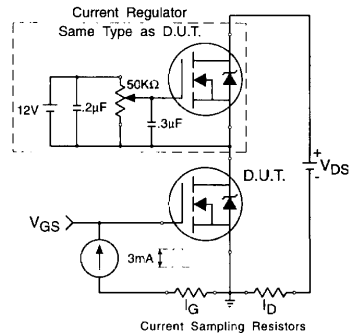


Fig 13b. Gate Charge Test Circuit

Appendix A: Figure 14, Peak Diode Recovery dv/dt Test Circuit

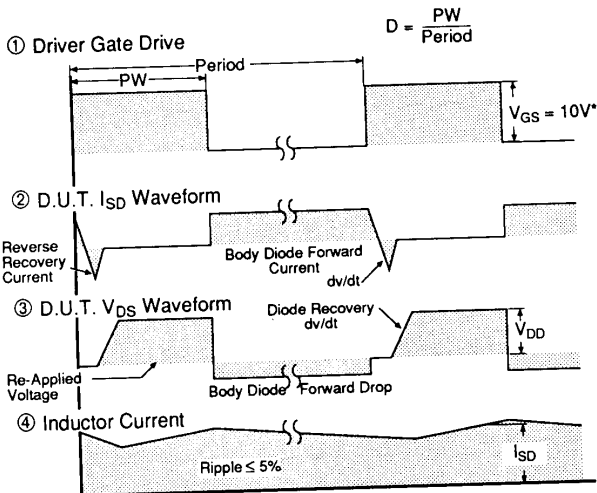
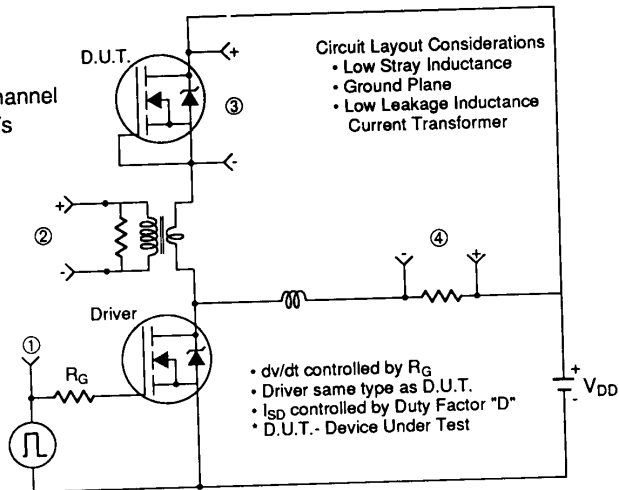
Appendix B: Package Outline Mechanical Drawing

Appendix C: Part Marking Information

Appendix A

Peak Diode Recovery dv/dt Test Circuit

Fig 14. For N-Channel HEXFETs



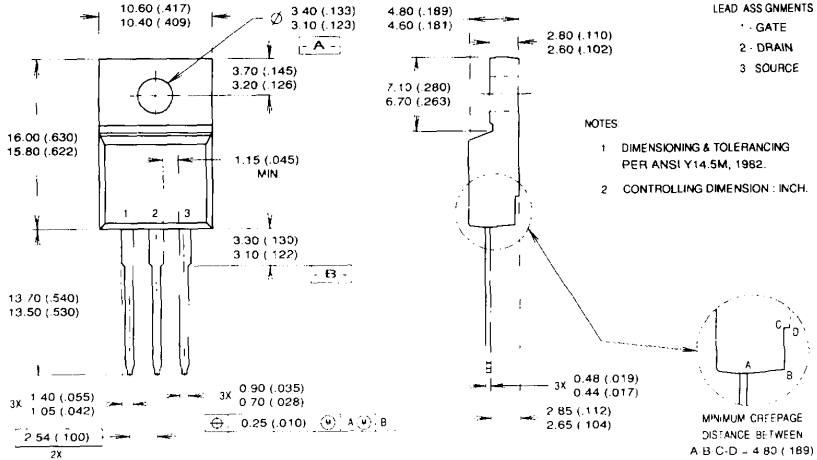
* $V_{GS} = 5V$ for Logic Level Devices

Package Outline

Appendix B

TO-220 FullPak Outline

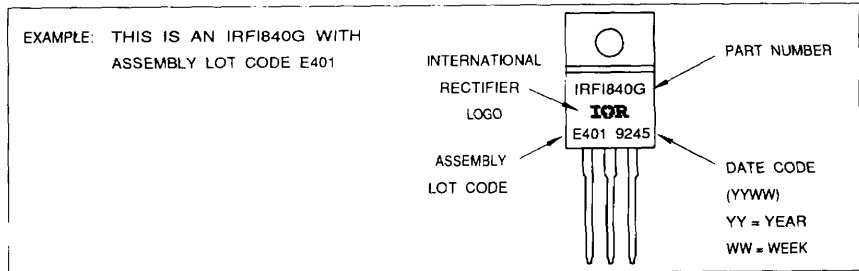
Dimensions are shown in millimeters (inches)



Part Marking Information

Appendix C

TO-220 FULL-PAK



Printed on Signet recycled offset:
made from 50% recycled waste paper, including
10% de-inked, post-consumer waste.



International Rectifier

WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245, Tel: (310) 322-3331, Tlx: 4720403
EUROPEAN HEADQUARTERS: Hurst Green, Oxsted, Surrey RH9 9BB England, Te: (0883) 713215, Tlx: 95219

IR CANADA: 101 Bentley St., Markham, Ontario L3R 3L1, Tel: (416) 475-1897. **IR GERMANY:** Saalburgstrasse 157, D-6380 Bad Homburg, Tel: 6172-37066. **IR ITALY:** Via Liguria 49 10071 Borgaro, Torino, Tel: (011) 470 1484. **IR FAR EAST:** K&H Building, 30-4 Nishikebukuro 3-Chome, Toshima-ku, Tokyo 171 Japan, Tel: (03) 983 0641. **IR SOUTHEAST ASIA:** 190 Middle Road, HEX 10-01 Fortune Centre, Singapore 0718, Tel: (65) 336 3922.

Sales Offices, Agents and Distributors in Major Cities Throughout the World.