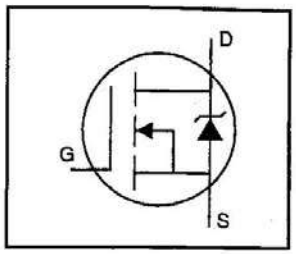
International
IOR Rectifier

# IRFI840GLCPbF

HEXFET® Power MOSFET

- Ultra Low Gate Charge
- Reduced Gate Drive Requirement
- Enhanced 30V $V_{GS}$ Rating
- Isolated Package
- High Voltage Isolation= 2.5KVRMS ⑤
- Sink to Lead Creepage Dist.= 4.8mm
- Repetitive Avalanche Rated
- Lead-Free




$V_{DSS}$ = 500V

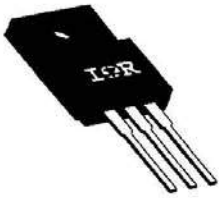
$R_{DS(on)}$ = 0.85Ω

$I_D$ = 4.5A

## Description

This new series of Low Charge HEXFETs achieve significantly lower gate charge over conventional MOSFETs. Utilizing advanced HEXFET technology, the device improvements allow for reduced gate drive requirements, faster switching speeds and increased total system savings.These device improvements combined with the proven ruggedness and reliability that are characteristic of HEXFETs offer the designer a new standard in power transistors for switching applications.

The TO-220 Fullpak eliminates the need for additional insulating hardware. The moulding compound used provides a high isolation capability and low thermal resistance between the tab and external heatsink.



TO-220 FULLPAK

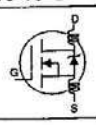
## Absolute Maximum Ratings

| | Parameter | Max. | Units |
|---|---|---|---|
| $I_D$ @ $T_C$ = 25°C | Continuous Drain Current, $V_{GS}$ @ 10 V | 4.5 | A |
| $I_D$ @ $T_C$ = 100°C | Continuous Drain Current, $V_{GS}$ @ 10 V | 2.9 | |
| $I_{DM}$ | Pulsed Drain Current ① | 18 | |
| $P_D$ @ $T_C$ = 25°C | Power Dissipation | 40 | W |
| | Linear Derating Factor | 0.32 | W/°C |
| $V_{GS}$ | Gate-to-Source Voltage | ±30 | V |
| $E_{AS}$ | Single Pulse Avalanche Energy ② | 300 | mJ |
| $I_{AR}$ | Avalanche Current ① | 4.5 | A |
| $E_{AR}$ | Repetitive Avalanche Energy ① | 4.0 | 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) | |

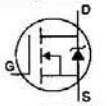
## Thermal Resistance

| | Parameter | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| $R_{\theta JC}$ | Junction-to-Case | — | — | 3.1 | °C/W |
| $R_{\theta JA}$ | Junction-to-Ambient | — | — | 65 | |

## Electrical Characteristics @ $T_J$ = 25°C (unless otherwise specified)

| | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Drain-to-Source Breakdown Voltage | 500 | — | — | V | $V_{GS}$=0V, $I_D$= 250µA |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient | — | 0.63 | — | V/°C | Reference to 25°C, $I_D$= 1mA |
| $R_{DS(on)}$ | Static Drain-to-Source On-Resistance | — | — | 0.85 | Ω | $V_{GS}$=10V, $I_D$=2.7A ④ |
| $V_{GS(th)}$ | Gate Threshold Voltage | 2.0 | — | 4.0 | V | $V_{DS}$=$V_{GS}$, $I_D$= 250µA |
| $g_{fs}$ | Forward Transconductance | 4.0 | — | — | S | $V_{DS}$=50V, $I_D$=4.8A ④ |
| $I_{DSS}$ | Drain-to-Source Leakage Current | — | — | 25 | µA | $V_{DS}$=500V, $V_{GS}$=0V |
| | | — | — | 250 | | $V_{DS}$=400V, $V_{GS}$=0V, $T_J$=125°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 | — | — | 39 | nC | $I_D$=8.0A |
| $Q_{gs}$ | Gate-to-Source Charge | — | — | 10 | | $V_{DS}$=400V |
| $Q_{gd}$ | Gate-to-Drain ("Miller") Charge | — | — | 19 | | $V_{GS}$=10V See Fig. 6 and 13 ④ |
| $t_{d(on)}$ | Turn-On Delay Time | — | 12 | — | ns | $V_{DD}$=250V |
| $t_r$ | Rise Time | — | 25 | — | | $I_D$=8.0A |
| $t_{d(off)}$ | Turn-Off Delay Time | — | 27 | — | | $R_G$=9.1Ω |
| $t_f$ | Fall Time | — | 19 | — | | $R_D$=30Ω 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 | — | 1100 | — | pF | $V_{GS}$=0V |
| $C_{oss}$ | Output Capacitance | — | 170 | — | | $V_{DS}$= 25V |
| $C_{rss}$ | Reverse Transfer Capacitance | — | 18 | — | | $f$=1.0MHz See Figure 5 |
| C | Drain to Sink Capacitance | — | 12 | — | pF | $f$=1.0MHz |

## Source-Drain Ratings and Characteristics

| | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current (Body Diode) | — | — | 4.5 | A | MOSFET symbol showing the integral reverse p-n junction diode.  |
| $I_{SM}$ | Pulsed Source Current (Body Diode) ① | — | — | 18 | | |
| $V_{SD}$ | Diode Forward Voltage | — | — | 2.0 | V | $T_J$=25°C, $I_S$=4.5A, $V_{GS}$=0V ④ |
| $t_{rr}$ | Reverse Recovery Time | — | 490 | 740 | ns | $T_J$=25°C, $I_F$=8.0A |
| $Q_{rr}$ | Reverse Recovery Charge | — | 3.0 | 4.5 | µC | di/dt=100A/µs ④ |
| $t_{on}$ | Forward Turn-On Time | Intrinsic turn-on time is neglegible (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°C, L=26mH $R_G$=25Ω, $I_{AS}$=4.5A (See Figure 12)

③ $I_{SD}$≤8.0A, di/dt≤100A/µs, $V_{DD}$≤$V_{(BR)DSS}$, $T_J$≤150°C

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

⑤ t=60s, $f$=60Hz

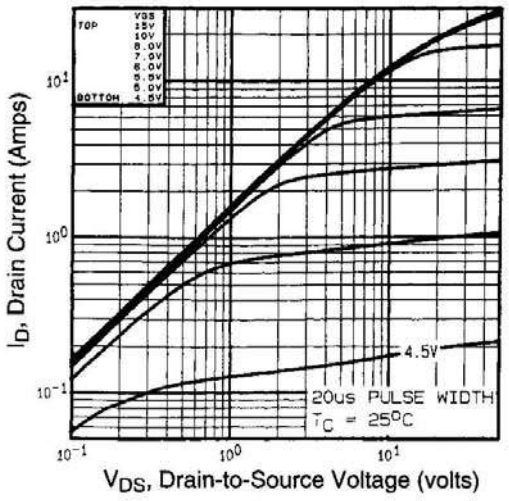



**Fig 1.** Typical Output Characteristics, $T_C$=25°C

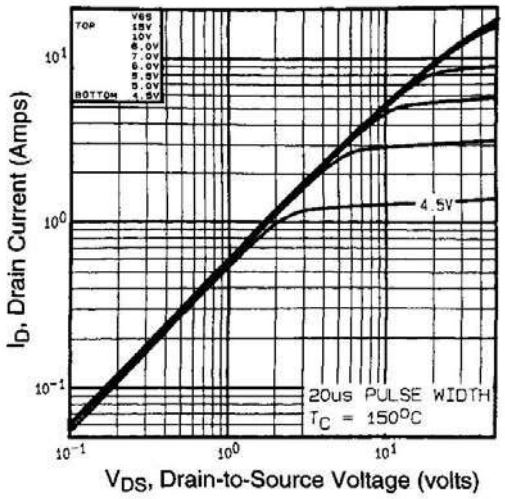



**Fig 2.** Typical Output Characteristics, $T_C$=150°C

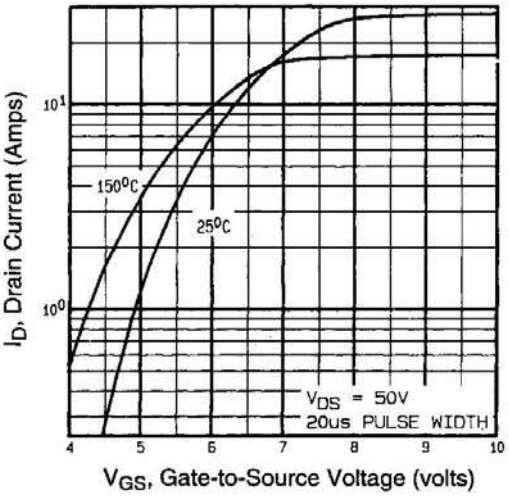



**Fig 3.** Typical Transfer Characteristics

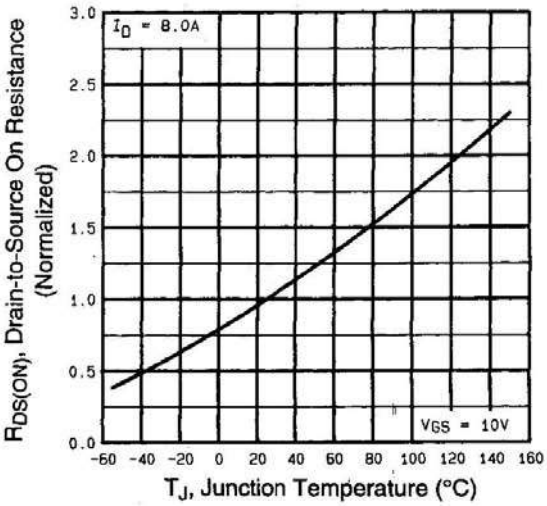



**Fig 4.** Normalized On-Resistance Vs. Temperature

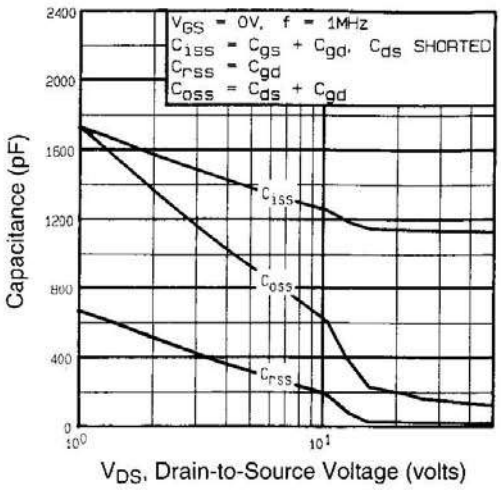



**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage

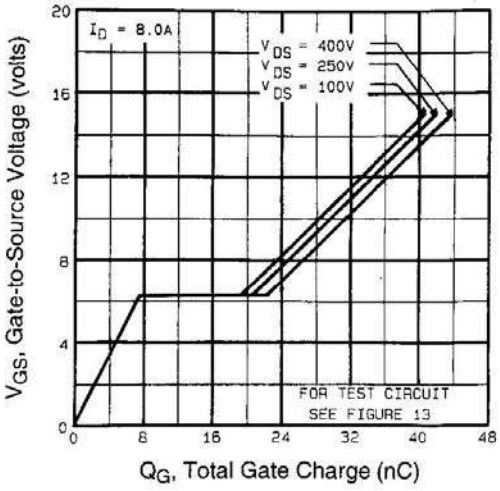



**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage

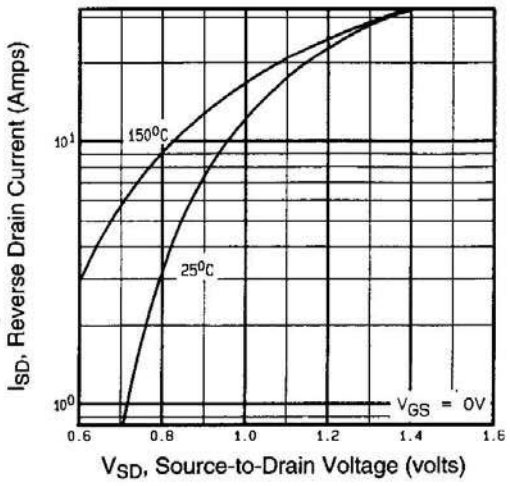



**Fig 7.** Typical Source-Drain Diode Forward Voltage

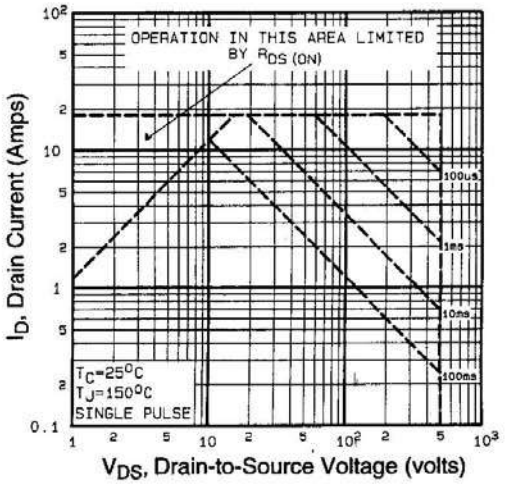



**Fig 8.** Maximum Safe Operating Area

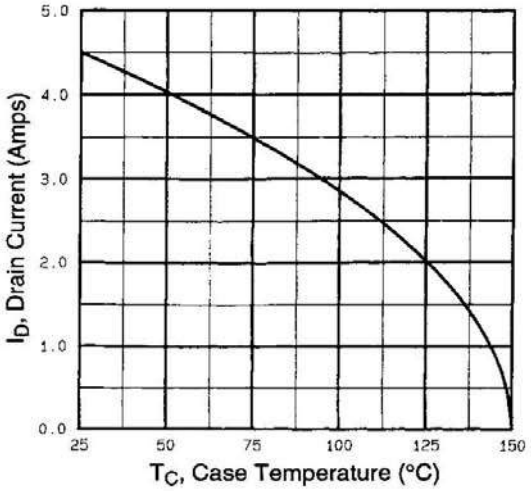



**Fig 9.** Maximum Drain Current Vs. Case Temperature

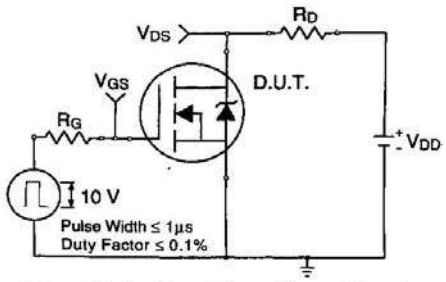



**Fig 10a.** Switching Time Test Circuit

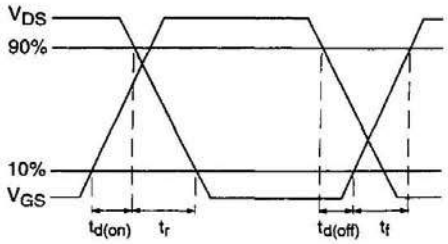



**Fig 10b.** Switching Time Waveforms

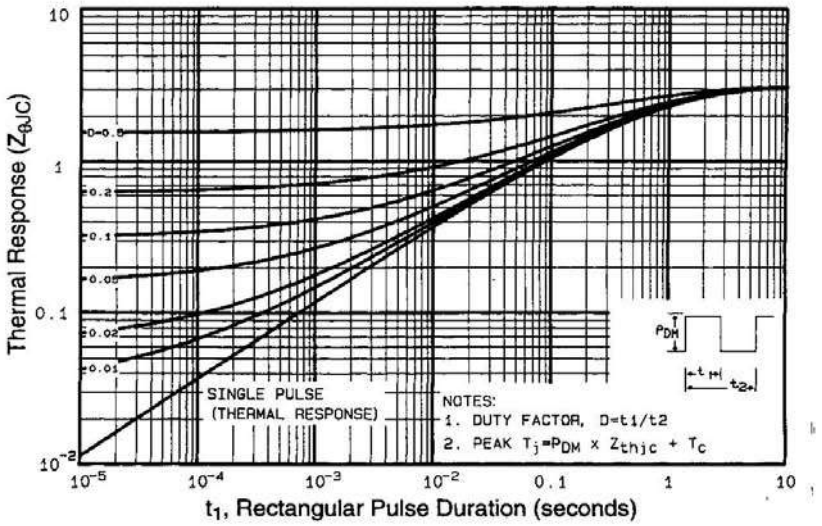



**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case

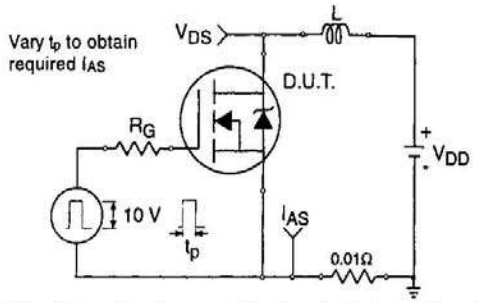



**Fig 12a.** Unclamped Inductive Test Circuit

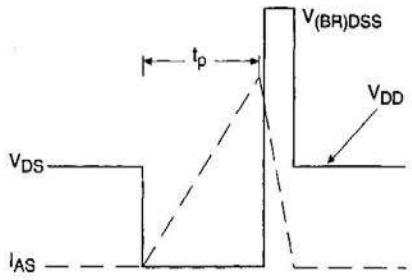



**Fig 12b.** Unclamped Inductive Waveforms

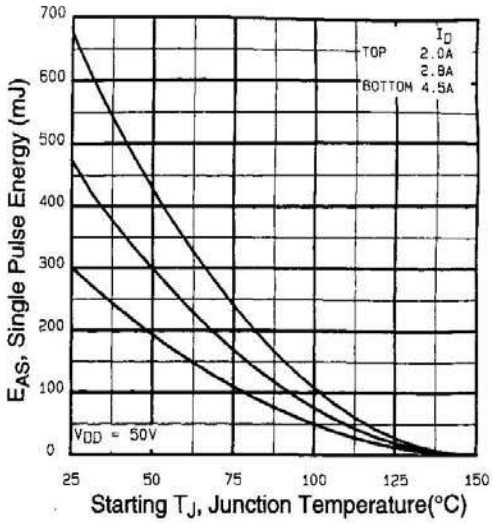



**Fig 12c.** Maximum Avalanche Energy Vs. Drain Current

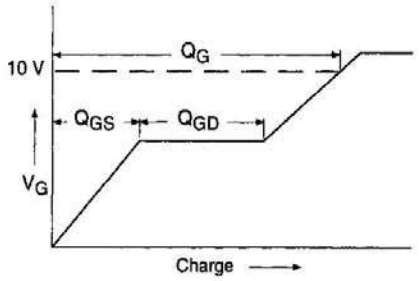



**Fig 13a.** Basic Gate Charge Waveform

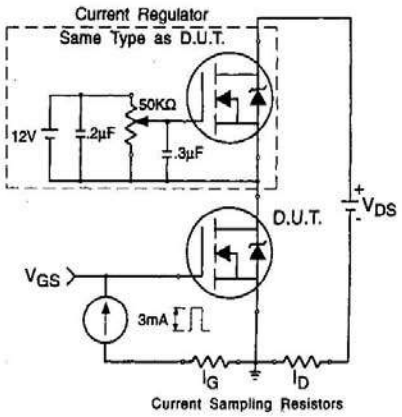



**Fig 13b.** Gate Charge Test Circuit

# Appendix A

## Peak Diode Recovery dv/dt Test Circuit

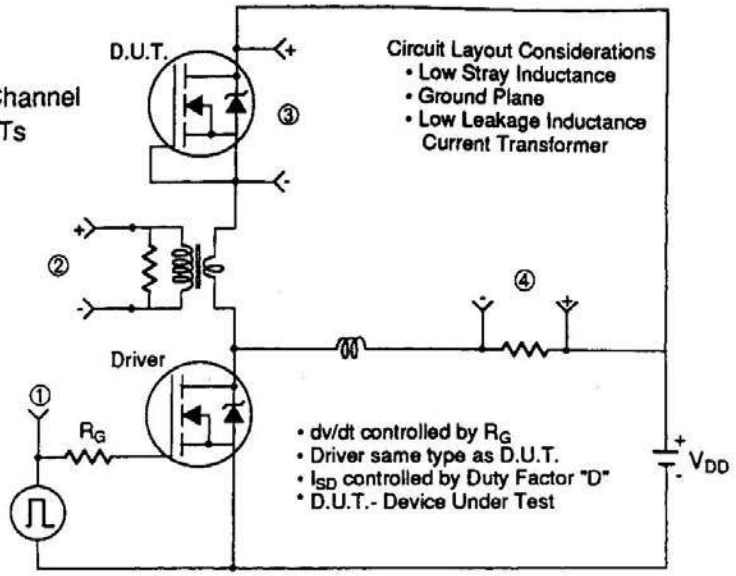
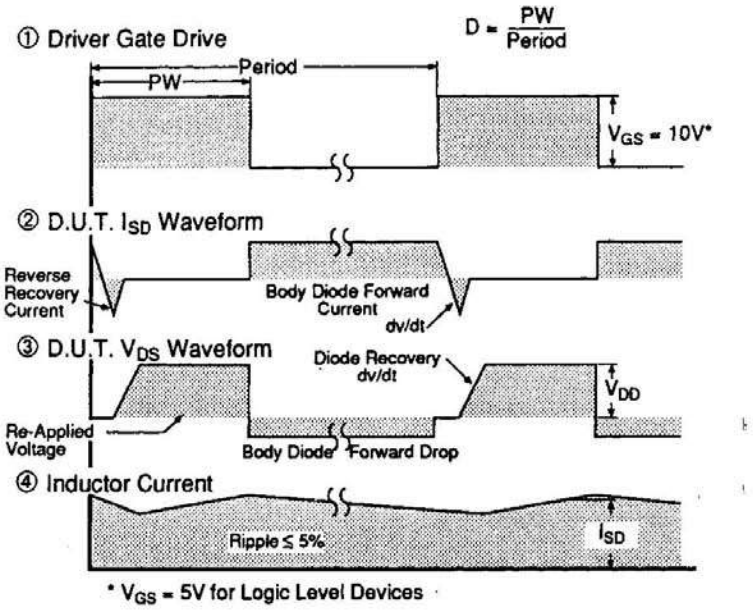
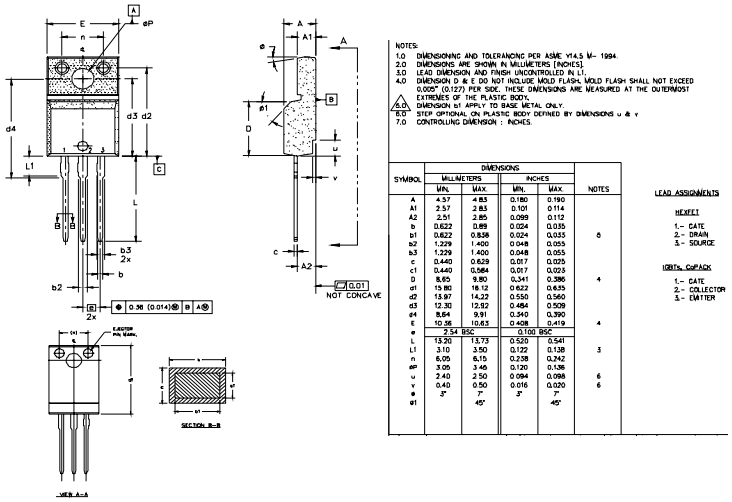



**Fig 14.** For N-Channel HEXFETs



## TO-220 Full-Pak Package Outline

Dimensions are shown in millimeters (inches)

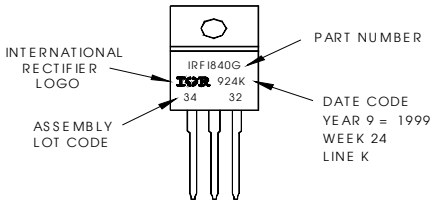



| SYMBOL | DIMENSIONS | | | | NOTES |
|---|---|---|---|---|---|
| | MILLIMETERS | | INCHES | | |
| | MIN. | MAX. | MIN. | MAX. | |
| A | 4.57 | 4.83 | 0.180 | 0.190 | |
| A1 | 2.57 | 2.83 | 0.101 | 0.114 | |
| A2 | 2.51 | 2.85 | 0.099 | 0.112 | |
| b | 0.622 | 0.89 | 0.024 | 0.035 | |
| b1 | 0.622 | 0.838 | 0.024 | 0.033 | 5 |
| b2 | 1.229 | 1.400 | 0.048 | 0.055 | |
| b3 | 1.229 | 1.400 | 0.048 | 0.055 | |
| c | 0.440 | 0.629 | 0.017 | 0.025 | |
| c1 | 0.440 | 0.584 | 0.017 | 0.023 | |
| D | 8.65 | 9.80 | 0.341 | 0.386 | 4 |
| d1 | 15.80 | 16.12 | 0.622 | 0.635 | |
| d2 | 13.97 | 14.22 | 0.550 | 0.560 | |
| d3 | 12.30 | 12.92 | 0.484 | 0.509 | |
| d4 | 8.64 | 9.91 | 0.340 | 0.390 | |
| E | 10.36 | 10.63 | 0.408 | 0.419 | 4 |
| e | 2.54 BSC | | 0.100 BSC | | |
| L | 13.20 | 13.73 | 0.520 | 0.541 | |
| L1 | 3.10 | 3.50 | 0.122 | 0.138 | 3 |
| n | 6.05 | 6.15 | 0.238 | 0.242 | |
| øP | 3.05 | 3.45 | 0.120 | 0.136 | |
| u | 2.40 | 2.50 | 0.094 | 0.098 | 6 |
| v | 0.40 | 0.50 | 0.016 | 0.020 | 6 |
| ø | 3° | 7° | 3° | 7° | |
| ø1 | | 45° | | 45° | |

## TO-220 Full-Pak Part Marking Information

EXAMPLE: THIS IS AN IRFI840G
WITH ASSEMBLY
LOT CODE 3432
ASSEMBLED ON WW 24 1999
IN THE ASSEMBLY LINE "K"

**Note:** "P" in assembly line position indicates "Lead-Free"




Data and specifications subject to change without notice.

International
IOR Rectifier

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12/03

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