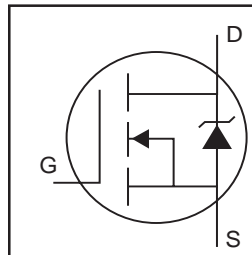


IRLBA1304

HEXFET® Power MOSFET

- Logic-Level Gate Drive
- Ultra Low On-Resistance
- Same outline as TO-220
- 50% greater current in typ. application conditions vs. TO-220
- Fully Avalanche Rated
- Purchase IRLBA1304/P for solder plated option.

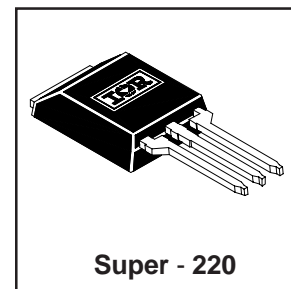


| |
|----------------------------|
| $V_{DSS} = 40V$ |
| $R_{DS(on)} = 0.004\Omega$ |
| $I_D = 185A$ Ⓢ |

Description

The HEXFET® is the most popular power MOSFET in the world.

This particular HEXFET® is in the Super220™ and has the same outline and pinout as the industry standard TO-220. It has increased current handling capability over both the TO-220 and the much larger TO-247 package. This makes it ideal to reduce component count in multiparalleled TO-220 applications, reduce system power dissipation, upgrade existing designs or have TO-247 performance in a TO-220 outline. This package has also been designed to meet automotive qualification standard Q101.



Absolute Maximum Ratings

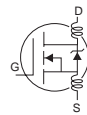
| | Parameter | Max. | Units |
|---------------------------|--|--------------------------|-------|
| $I_D @ T_C = 25^\circ C$ | Continuous Drain Current, $V_{GS} @ 10V$ | 185, pkg limited to 95A* | A |
| $I_D @ T_C = 100^\circ C$ | Continuous Drain Current, $V_{GS} @ 10V$ | 130, pkg limited to 95A* | |
| I_{DM} | Pulsed Drain Current ① | 740 | |
| $P_D @ T_C = 25^\circ C$ | Power Dissipation | 300 | W |
| | Linear Derating Factor | 2.0 | W/°C |
| V_{GS} | Gate-to-Source Voltage | ± 16 | V |
| E_{AS} | Single Pulse Avalanche Energy② | 1160 | mJ |
| I_{AR} | Avalanche Current① | 100 | A |
| E_{AR} | Repetitive Avalanche Energy① | 30 | mJ |
| dv/dt | Peak Diode Recovery dv/dt ③ | 5.0 | V/ns |
| T_J | Operating Junction and | -55 to + 175 | °C |
| T_{STG} | Storage Temperature Range | | |
| | Soldering Temperature, for 10 seconds | | |
| | Recommended clip force | 20 | N |

Thermal Resistance

| | Parameter | Typ. | Max. | Units |
|-----------------|-------------------------------------|------|------|-------|
| $R_{\theta JC}$ | Junction-to-Case | — | 0.5 | °C/W |
| $R_{\theta CS}$ | Case-to-Sink, Flat, Greased Surface | 0.5 | — | |
| $R_{\theta JA}$ | Junction-to-Ambient | — | 58 | |

* Current capability in normal application, see Fig.9.

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

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---------------------------------|--------------------------------------|------|-------|--------|---------------------|--|
| $V_{(BR)DSS}$ | Drain-to-Source Breakdown Voltage | 40 | — | — | V | $V_{GS} = 0V, I_D = 250\mu A$ |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient | — | 0.043 | — | V/ $^\circ\text{C}$ | Reference to 25°C , $I_D = 1\text{mA}$ |
| $R_{DS(on)}$ | Static Drain-to-Source On-Resistance | — | — | 0.0040 | Ω | $V_{GS} = 10V, I_D = 110A$ ④ |
| | | — | — | 0.0065 | | $V_{GS} = 4.5V, I_D = 93$ ④ |
| $V_{GS(th)}$ | Gate Threshold Voltage | 1.0 | — | — | V | $V_{DS} = V_{GS}, I_D = 250\mu A$ |
| g_{fs} | Forward Transconductance | 120 | — | — | S | $V_{DS} = 25V, I_D = 110A$ |
| I_{DSS} | Drain-to-Source Leakage Current | — | — | 25 | μA | $V_{DS} = 40V, V_{GS} = 0V$ |
| | | — | — | 250 | | $V_{DS} = 32V, V_{GS} = 0V, T_J = 150^\circ\text{C}$ |
| I_{GSS} | Gate-to-Source Forward Leakage | — | — | 100 | nA | $V_{GS} = 16V$ |
| | Gate-to-Source Reverse Leakage | — | — | -100 | | $V_{GS} = -16V$ |
| Q_g | Total Gate Charge | — | — | 140 | nC | $I_D = 110A$ |
| Q_{gs} | Gate-to-Source Charge | — | — | 39 | | $V_{DS} = 32V$ |
| Q_{gd} | Gate-to-Drain ("Miller") Charge | — | — | 79 | | $V_{GS} = 4.5V$, See Fig. 6 and 13 ④ |
| $t_{d(on)}$ | Turn-On Delay Time | — | 21 | — | | $V_{DD} = 20V$ |
| t_r | Rise Time | — | 350 | — | | $I_D = 110A$ |
| $t_{d(off)}$ | Turn-Off Delay Time | — | 45 | — | | $R_G = 0.9\Omega$ |
| t_f | Fall Time | — | 103 | — | | $R_D = 0.18\Omega$, See Fig. 10 ④ |
| L_D | Internal Drain Inductance | — | 2.0 | — | nH | Between lead, 6mm (0.25in.) from package and center of die contact |
| L_S | Internal Source Inductance | — | 5.0 | — | |  |
| C_{iss} | Input Capacitance | — | 7660 | — | pF | $V_{GS} = 0V$ |
| C_{oss} | Output Capacitance | — | 2150 | — | | $V_{DS} = 25V$ |
| C_{rss} | Reverse Transfer Capacitance | — | 460 | — | | $f = 1.0\text{MHz}$, See Fig. 5 |

Source-Drain Ratings and Characteristics

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|----------|---|---|------|------|-------|---|
| I_S | Continuous Source Current (Body Diode) | — | — | 185* | A | MOSFET symbol showing the integral reverse p-n junction diode. |
| I_{SM} | Pulsed Source Current (Body Diode) ① | — | — | 740 | | |
| V_{SD} | Diode Forward Voltage | — | — | 1.3 | V | $T_J = 25^\circ\text{C}, I_S = 110A, V_{GS} = 0V$ ④ |
| t_{rr} | Reverse Recovery Time | — | 100 | 150 | ns | $T_J = 25^\circ\text{C}, I_F = 110A$ |
| Q_{rr} | Reverse Recovery Charge | — | 250 | 380 | nC | $di/dt = 100A/\mu s$ 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 fig. 11)
- ② Starting $T_J = 25^\circ\text{C}$, $L = 230\mu H$
 $R_G = 25\Omega, I_{AS} = 100A$. (See Figure 12)

- ③ $I_{SD} \leq 110A, di/dt \leq 170A/\mu s, V_{DD} \leq V_{(BR)DSS}, T_J \leq 175^\circ\text{C}$
- ④ Pulse width $\leq 300\mu s$; duty cycle $\leq 2\%$.

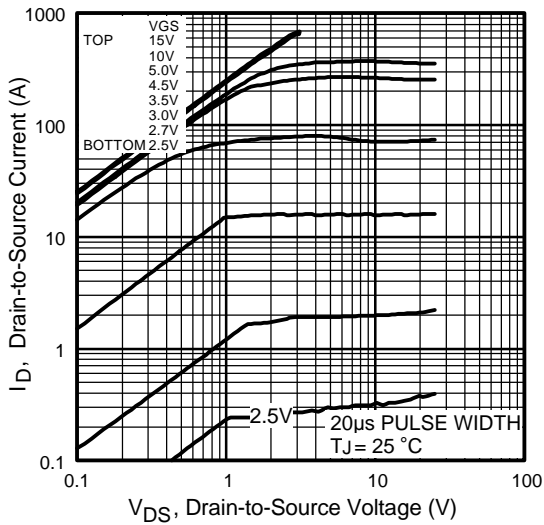


Fig 1. Typical Output Characteristics

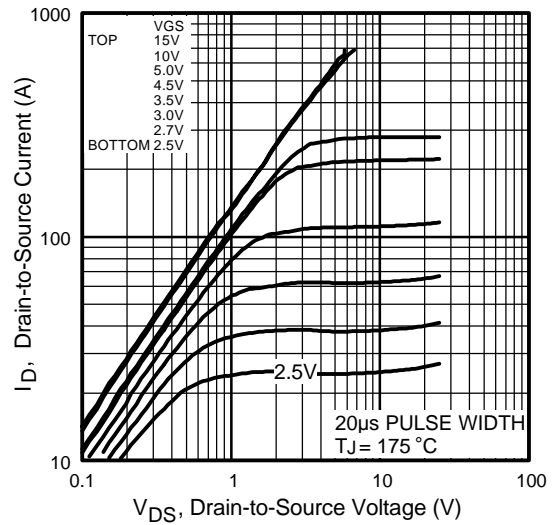


Fig 2. Typical Output Characteristics

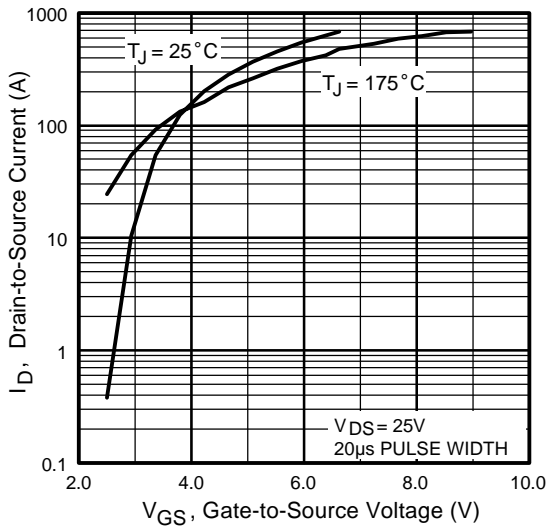


Fig 3. Typical Transfer Characteristics

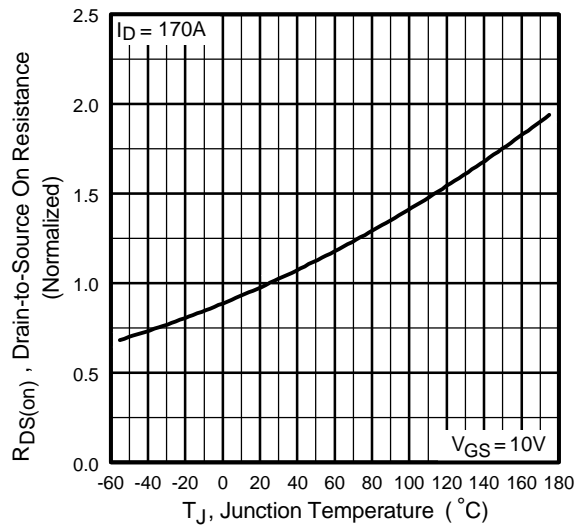


Fig 4. Normalized On-Resistance Vs. Temperature

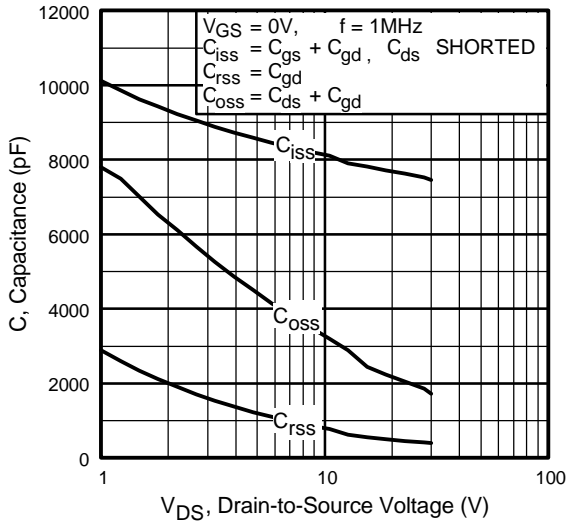


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

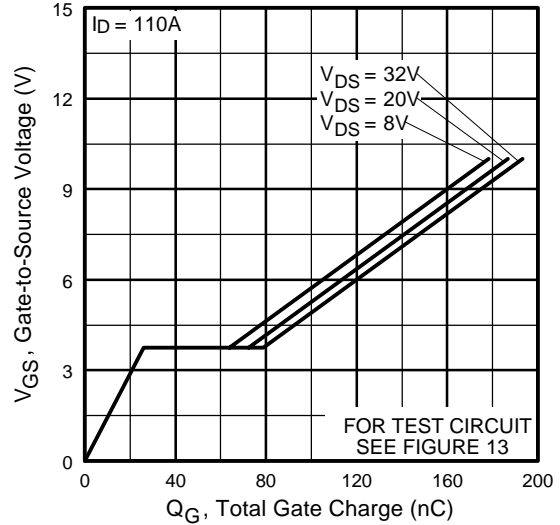


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

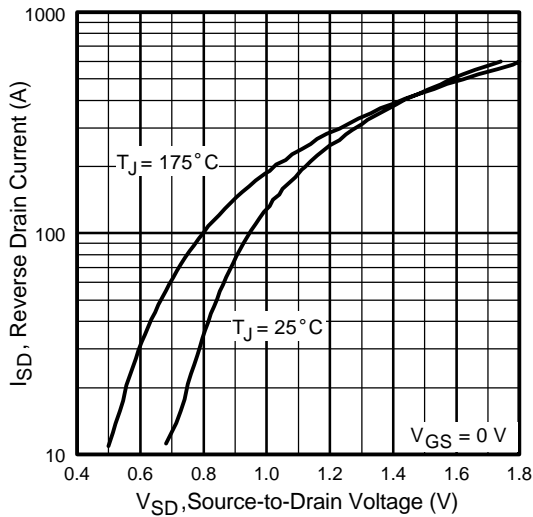


Fig 7. Typical Source-Drain Diode Forward Voltage

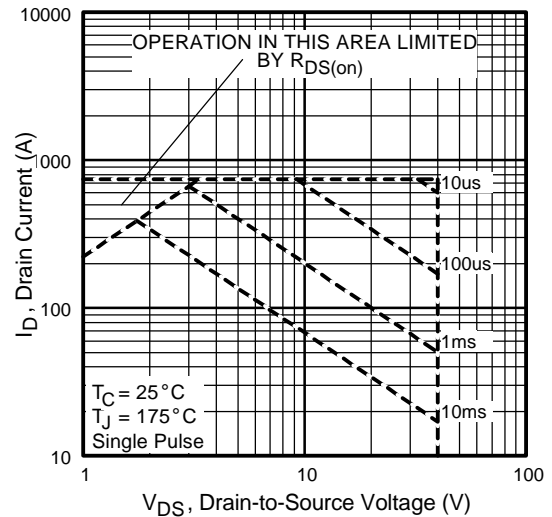


Fig 8. Maximum Safe Operating Area

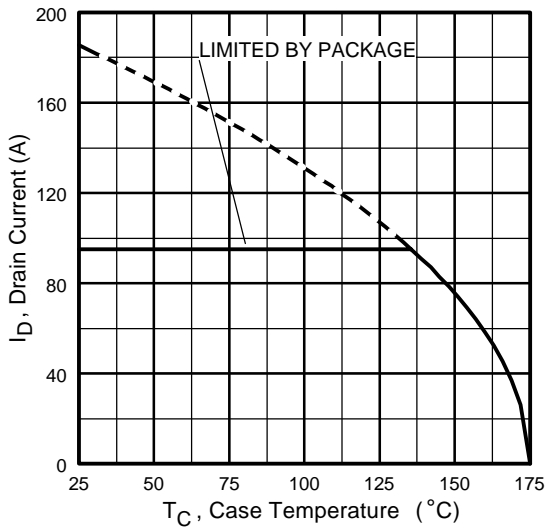


Fig 9. Maximum Drain Current Vs. Case Temperature

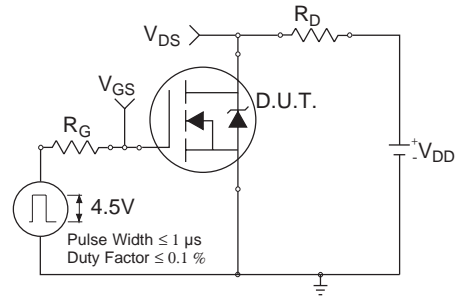


Fig 10a. Switching Time Test Circuit



Fig 10b. Switching Time Waveforms

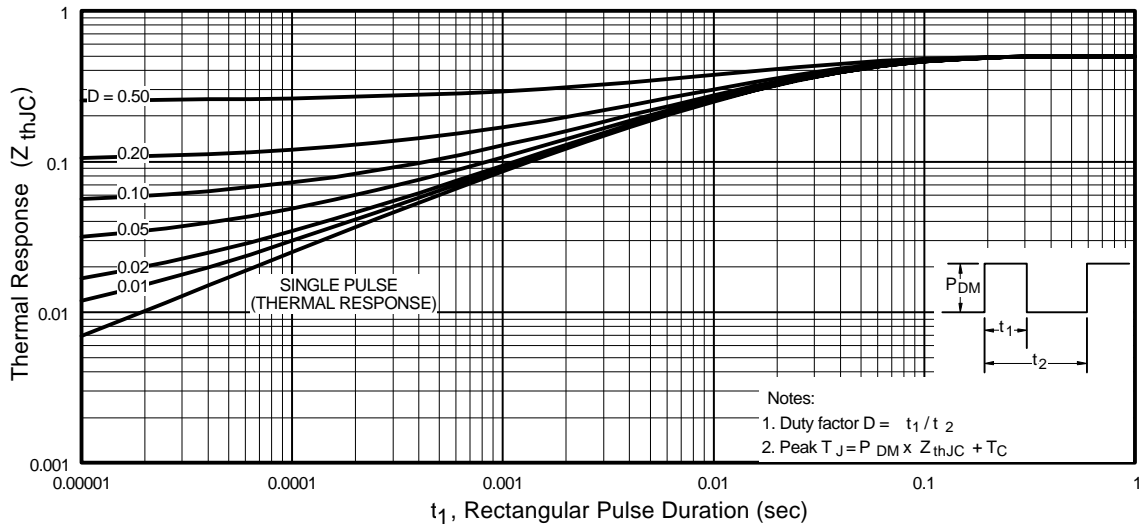


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

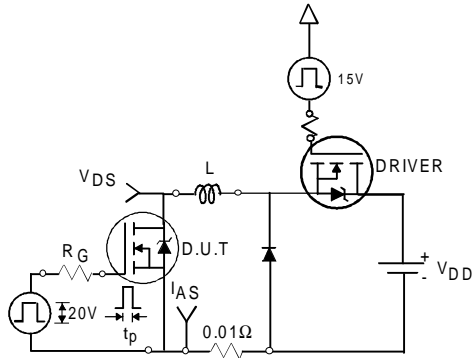


Fig 12a. Unclamped Inductive Test Circuit

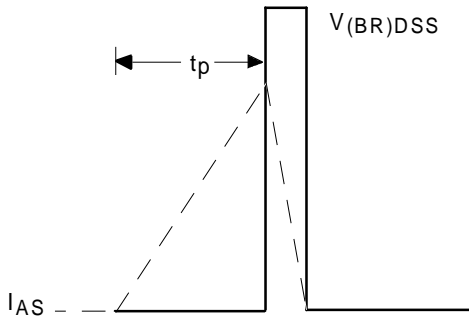


Fig 12b. Unclamped Inductive Waveforms

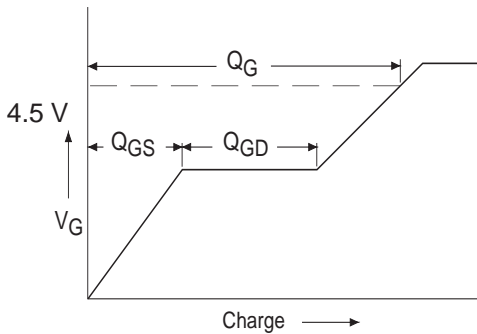


Fig 13a. Basic Gate Charge Waveform

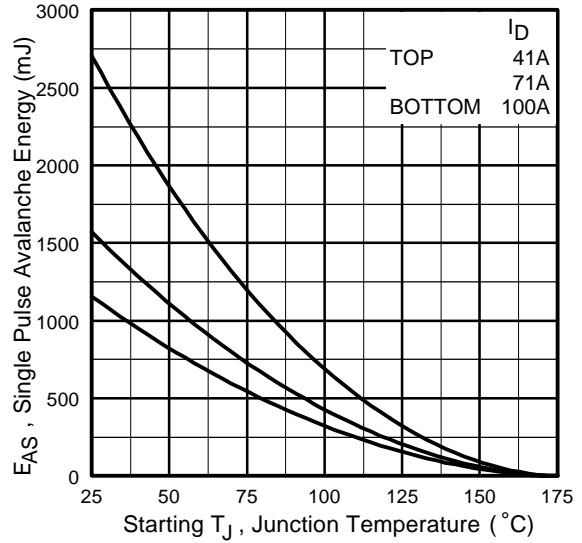


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

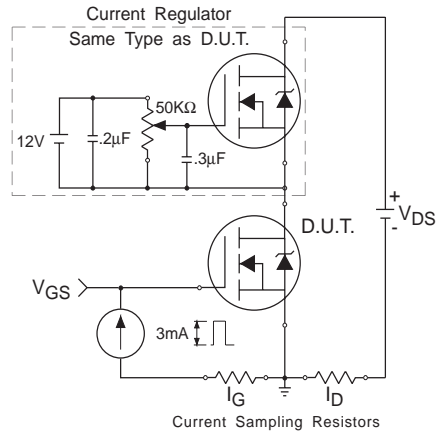
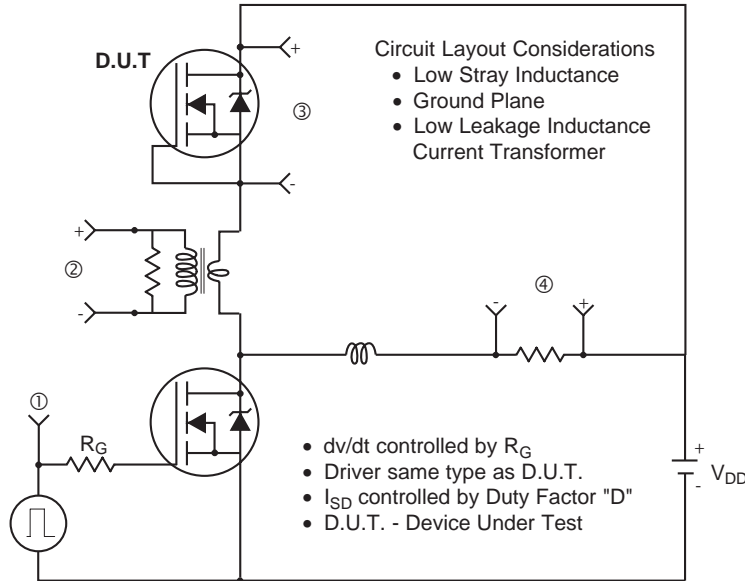


Fig 13b. Gate Charge Test Circuit

Peak Diode Recovery dv/dt Test Circuit



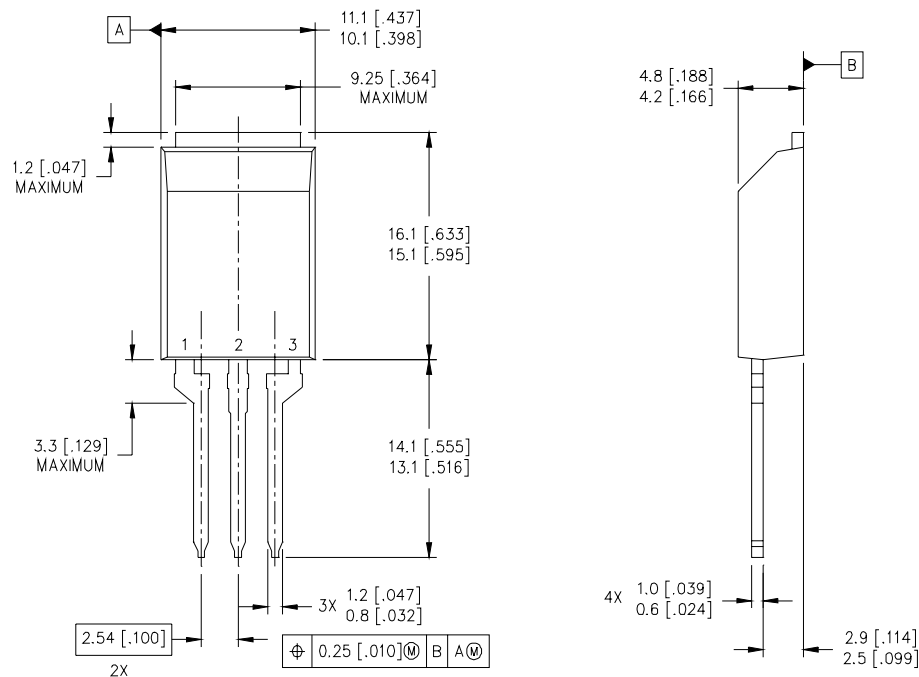
* $V_{GS} = 5V$ for Logic Level Devices

Fig 14. For N-Channel HEXFETS

IRLBA1304

International
IR Rectifier

Super-220 Package Outline



NOTES:

1. DIMENSIONING & TOLERANCING PER ASME Y14.5M-1994.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
4. OUTLINE CONFORMS TO JEDEC OUTLINE TO-273AA.

LEAD ASSIGNMENTS

| HEXFET | IGBT |
|------------|---------------|
| 1 - GATE | 1 - GATE |
| 2 - DRAIN | 2 - COLLECTOR |
| 3 - SOURCE | 3 - EMITTER |
| 4 - DRAIN | 4 - COLLECTOR |

International
IR Rectifier

WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245, Tel: (310) 322 3331

IR GREAT BRITAIN: Hurst Green, Oxted, Surrey RH8 9BB, UK Tel: ++ 44 1883 732020

IR CANADA: 15 Lincoln Court, Brampton, Ontario L6T3Z2, Tel: (905) 453 2200

IR GERMANY: Saalburgstrasse 157, 61350 Bad Homburg Tel: ++ 49 6172 96590

IR ITALY: Via Liguria 49, 10071 Borgaro, Torino Tel: ++ 39 11 451 0111

IR FAR EAST: K&H Bldg., 2F, 30-4 Nishi-Ikebukuro 3-Chome, Toshima-Ku, Tokyo Japan 171 Tel: 81 3 3983 0086

IR SOUTHEAST ASIA: 1 Kim Seng Promenade, Great World City West Tower, 13-11, Singapore 237994 Tel: ++ 65 838 4630

IR TAIWAN: 16 Fl. Suite D. 207, Sec. 2, Tun Haw South Road, Taipei, 10673, Taiwan Tel: 886-2-2377-9936

<http://www.irf.com/> Data and specifications subject to change without notice. 9/99