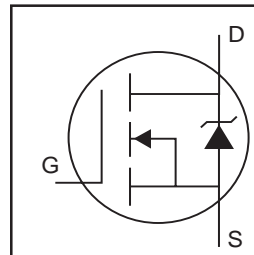


# IRLBA1304

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.

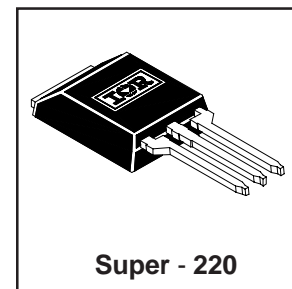


$V_{DSS} = 40V$
$R_{DS(on)} = 0.004\Omega$
$I_D = 185A$ Ⓢ

## 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	$\pm 16$	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	300 (1.6mm from case )	
	Recommended clip force	20	N

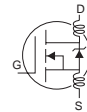
## Thermal Resistance

	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.  
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## 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 $25^\circ\text{C}$ , $I_D = 1\text{mA}$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	0.0040	$\Omega$	$V_{GS} = 10V, I_D = 110A$ 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	$\mu A$	$V_{DS} = 40V, V_{GS} = 0V$
		—	—	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  $\leq 2\%$ .

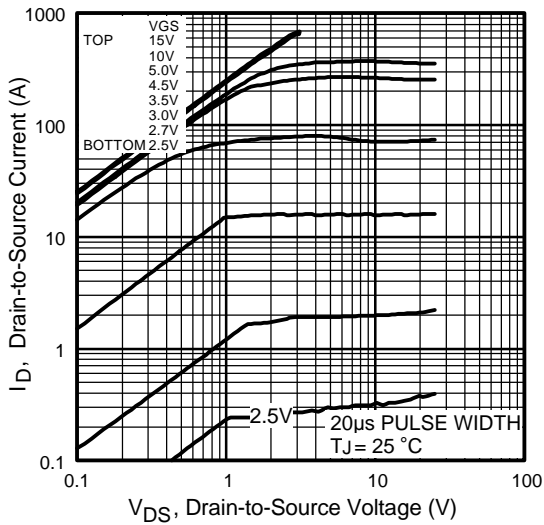


Fig 1. Typical Output Characteristics

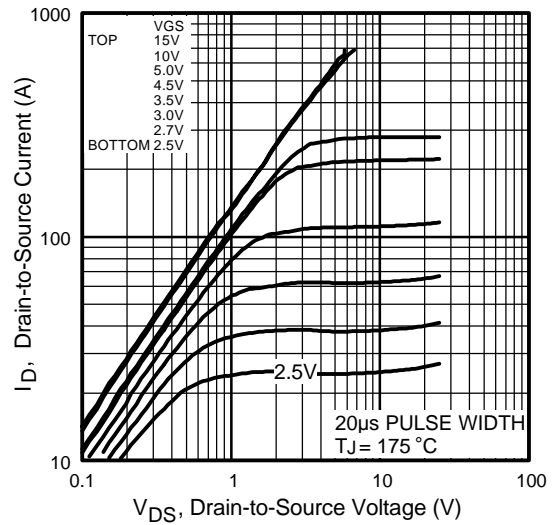


Fig 2. Typical Output Characteristics

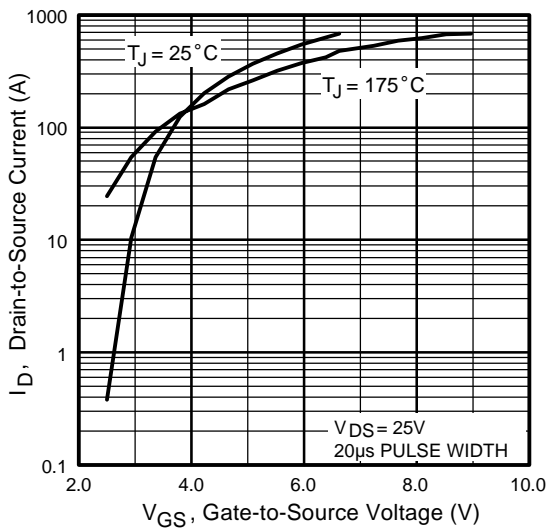


Fig 3. Typical Transfer Characteristics

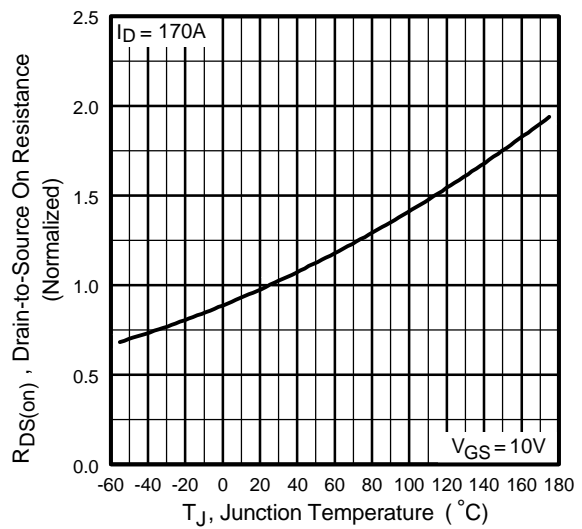
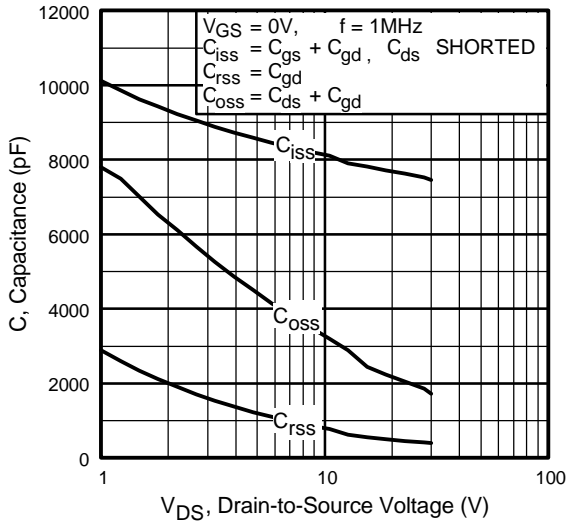
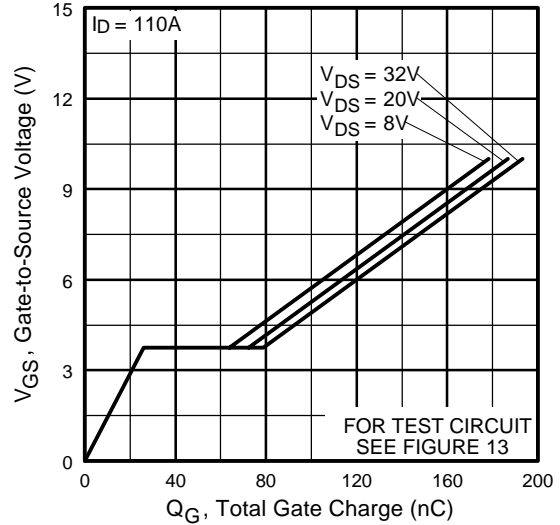


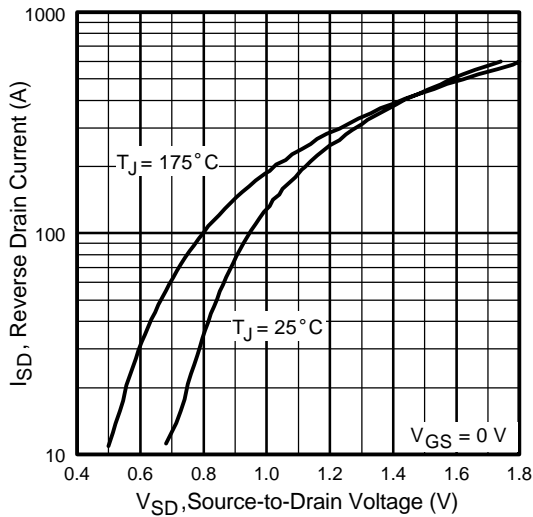
Fig 4. Normalized On-Resistance Vs. Temperature



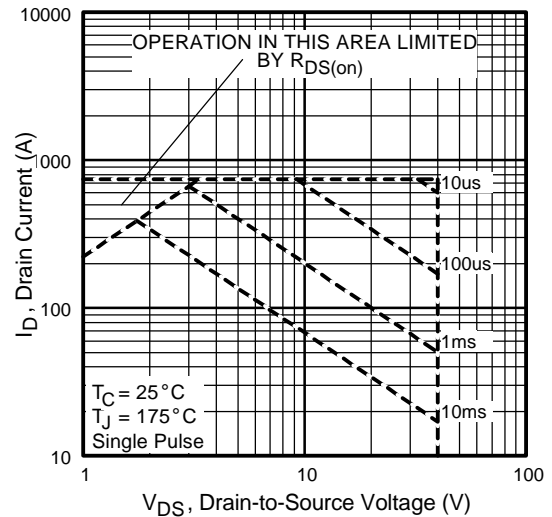
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



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



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



**Fig 8.** Maximum Safe Operating Area

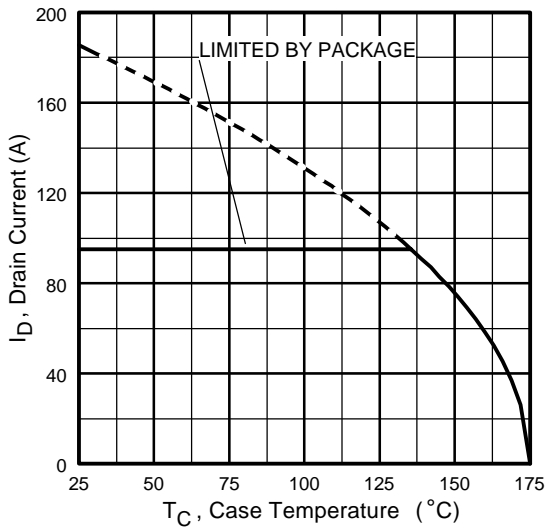


Fig 9. Maximum Drain Current Vs. Case Temperature

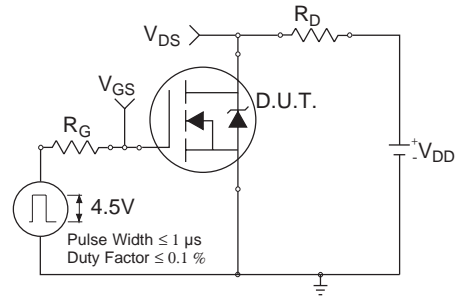


Fig 10a. Switching Time Test Circuit



Fig 10b. Switching Time Waveforms

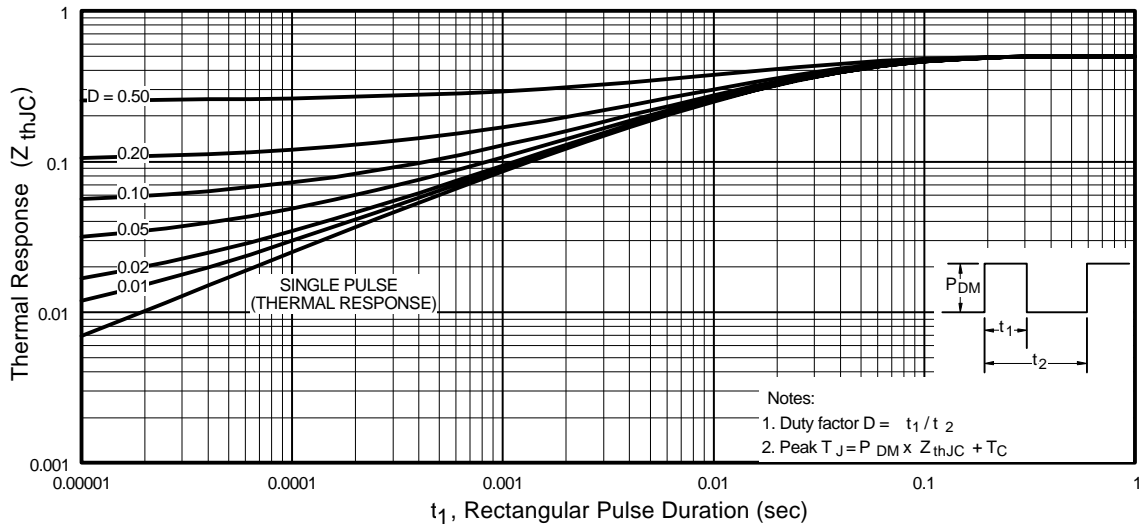
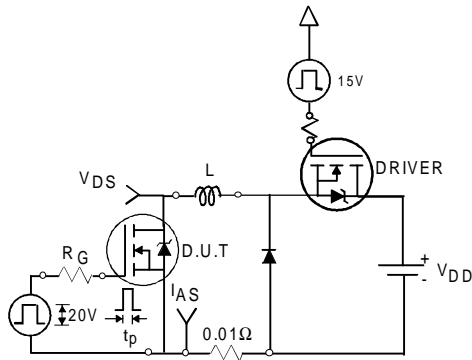
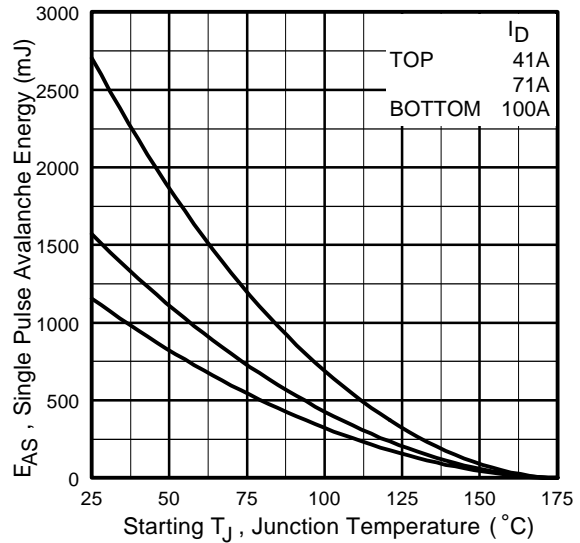


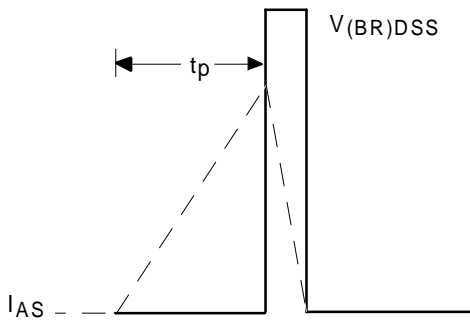
Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case



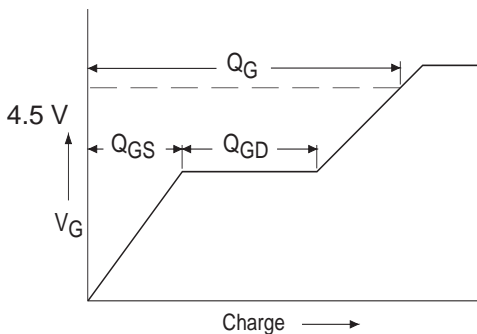
**Fig 12a.** Unclamped Inductive Test Circuit



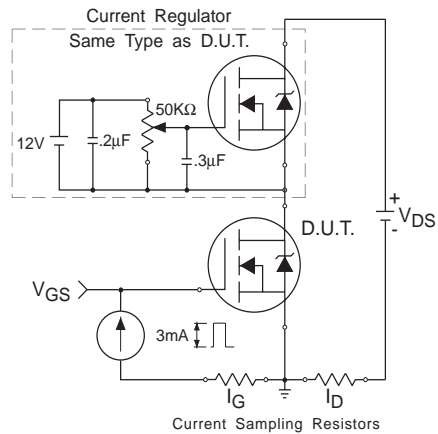
**Fig 12c.** Maximum Avalanche Energy Vs. Drain Current



**Fig 12b.** Unclamped Inductive Waveforms

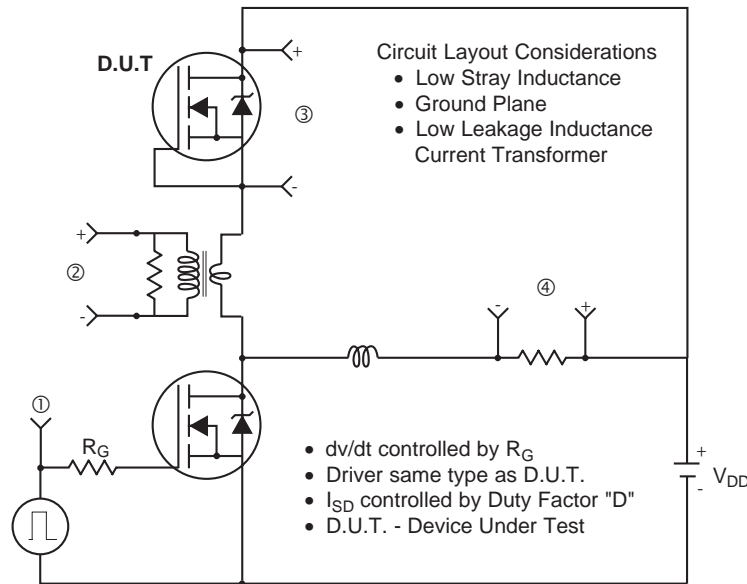


**Fig 13a.** Basic Gate Charge Waveform



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

**Peak Diode Recovery dv/dt Test Circuit**



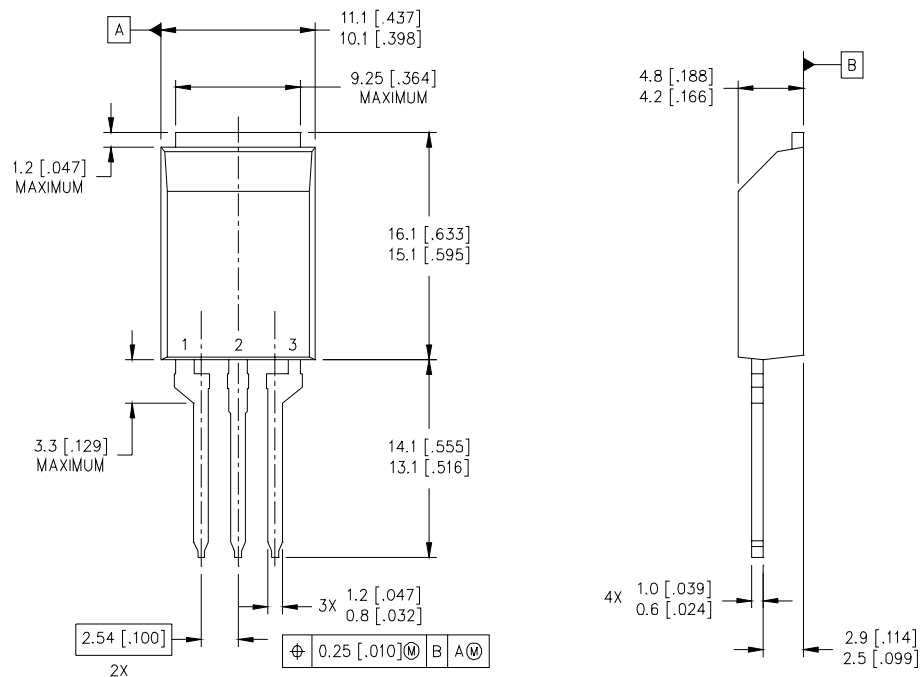
\*  $V_{GS} = 5V$  for Logic Level Devices

**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

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**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

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

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