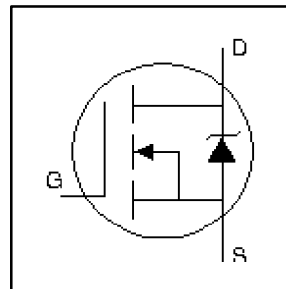


HEXFET® Power MOSFET

- Logic-Level Gate Drive
- Advanced Process Technology
- Dynamic dv/dt Rating
- 175°C Operating Temperature
- Fast Switching
- Fully Avalanche Rated



$$V_{DS} = 55V$$

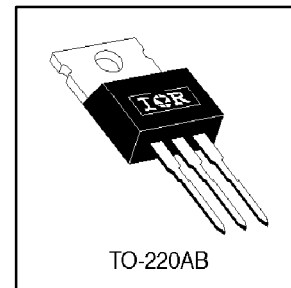
$$R_{DS(on)} = 0.035\Omega$$

$$I_D = 27A$$

Description

Fifth Generation HEXFETs from International Rectifier utilize advanced processing techniques to achieve the lowest possible on-resistance per silicon area. This benefit, combined with the fast switching speed and ruggedized device design that HEXFET Power MOSFETs are well known for, provides the designer with an extremely efficient device for use in a wide variety of applications.

The TO-220 package is universally preferred for all commercial-industrial applications at power dissipation levels to approximately 50 watts. The low thermal resistance and low package cost of the TO-220 contribute to its wide acceptance throughout the industry.



TO-220AB

Absolute Maximum Ratings

	Parameter	Max.	Units
$I_D @ T_C = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	27	A
$I_D @ T_C = 100^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	19	
I_{DM}	Pulsed Drain Current ①	110	
$P_D @ T_C = 25^\circ C$	Power Dissipation	56	W
	Linear Derating Factor	0.37	W/°C
V_{GS}	Gate-to-Source Voltage	± 20	V
E_{AS}	Single Pulse Avalanche Energy ②	110	mJ
I_{AR}	Avalanche Current ①	16	A
E_{AR}	Repetitive Avalanche Energy ①	5.6	mJ
dv/dt	Peak Diode Recovery dv/dt ③	10	V/ns
T_J	Operating Junction and	-55 to + 175	°C
T_{STG}	Storage Temperature Range		
	Soldering Temperature, for 10 seconds		
	Mounting torque, 6-32 or M3 screw.	10 lbf•in (1.1N•m)	

Thermal Resistance

	Parameter	Min.	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	—	2.7	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	—	0.50	—	
$R_{\theta JA}$	Junction-to-Ambient	—	—	62	

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
V _{(BR)DSS}	Drain-to-Source Breakdown Voltage	55	—	—	V	V _{GS} = 0V, I _D = 250μA
ΔV _{(BR)DSS} /ΔT _J	Breakdown Voltage Temp. Coefficient	—	0.065	—	V/°C	Reference to 25°C, I _D = 1mA
R _{DS(on)}	Static Drain-to-Source On-Resistance	—	—	0.035	Ω	V _{GS} = 10V, I _D = 16A ④
		—	—	0.046		V _{GS} = 5.0V, I _D = 16A ④
		—	—	0.060		V _{GS} = 4.0V, I _D = 14A ④
V _{GS(th)}	Gate Threshold Voltage	1.0	—	2.0	V	V _{DS} = V _{GS} , I _D = 250μA
g _{fs}	Forward Transconductance	11	—	—	S	V _{DS} = 25V, I _D = 16A
I _{DSS}	Drain-to-Source Leakage Current	—	—	25	μA	V _{DS} = 55V, V _{GS} = 0V
		—	—	250		V _{DS} = 44V, V _{GS} = 0V, T _J = 150°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	—	—	25	nC	I _D = 16A
Q _{gs}	Gate-to-Source Charge	—	—	5.2		V _{DS} = 44V
Q _{gd}	Gate-to-Drain ("Miller") Charge	—	—	14		V _{GS} = 5.0V, See Fig. 6 and 13 ④
t _{d(on)}	Turn-On Delay Time	—	8.9	—	ns	V _{DD} = 28V
t _r	Rise Time	—	100	—		I _D = 16A
t _{d(off)}	Turn-Off Delay Time	—	21	—		R _G = 6.5Ω, V _{GS} = 5.0V
t _f	Fall Time	—	29	—		R _D = 1.8Ω, See Fig. 10 ④
L _D	Internal Drain Inductance	—	4.5	—	nH	Between lead, 6mm (0.25in.) from package and center of die contact
L _S	Internal Source Inductance	—	7.5	—		
C _{iss}	Input Capacitance	—	880	—	pF	V _{GS} = 0V
C _{oss}	Output Capacitance	—	220	—		V _{DS} = 25V
C _{rss}	Reverse Transfer Capacitance	—	94	—		f = 1.0MHz, See Fig. 5



Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I _S	Continuous Source Current (Body Diode)	—	—	27	A	MOSFET symbol showing the integral reverse p-n junction diode.
I _{SM}	Pulsed Source Current (Body Diode) ①	—	—	110		
V _{SD}	Diode Forward Voltage	—	—	1.3	V	T _J = 25°C, I _S = 16A, V _{GS} = 0V ④
t _{rr}	Reverse Recovery Time	—	76	110	ns	T _J = 25°C, I _F = 16A
Q _{rr}	Reverse Recovery Charge	—	190	290	nC	di/dt = 100A/μs ④

Notes:

① Repetitive rating; pulse width limited by max. junction temperature. (See fig. 11)

③ I_{SD} ≤ 16A, di/dt ≤ 270A/μs, V_{DD} ≤ V_{(BR)DSS}, T_J ≤ 175°C

② V_{DD} = 25V, starting T_J = 25°C, L = 610μH
R_G = 25Ω, I_{AS} = 16A. (See Figure 12)

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

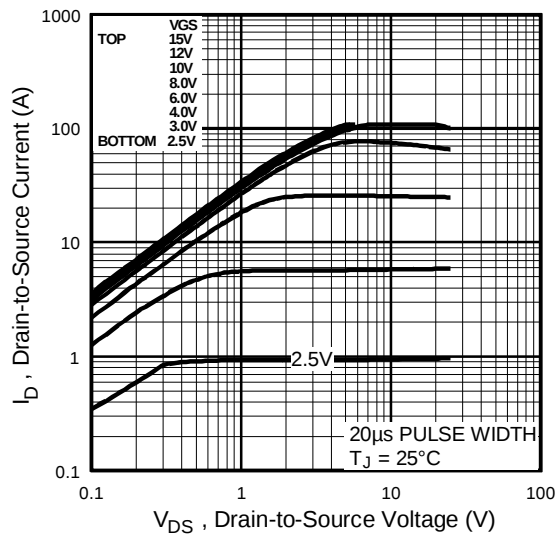


Fig 1. Typical Output Characteristics,
 $T_J = 25^\circ\text{C}$

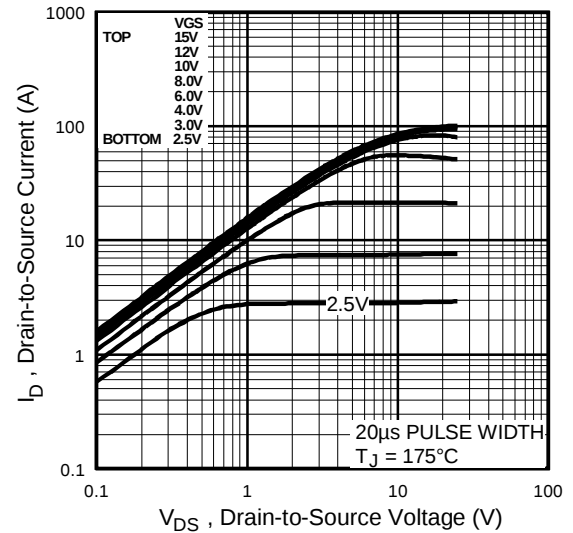


Fig 2. Typical Output Characteristics,
 $T_J = 175^\circ\text{C}$

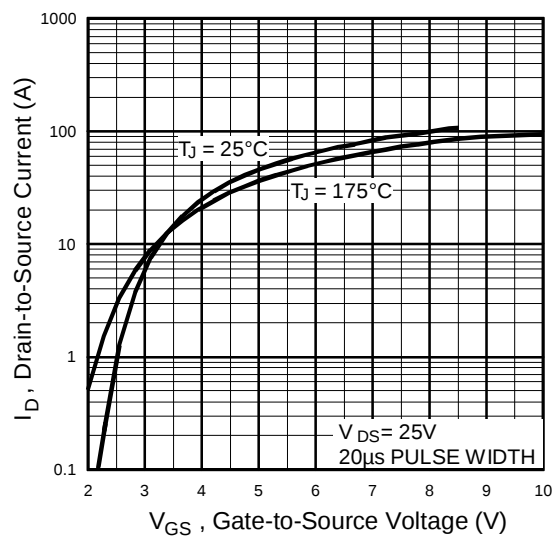


Fig 3. Typical Transfer Characteristics

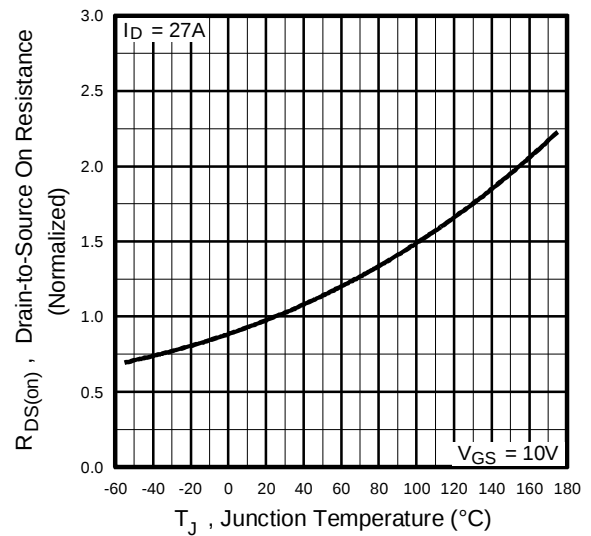


Fig 4. Normalized On-Resistance
Vs. Temperature

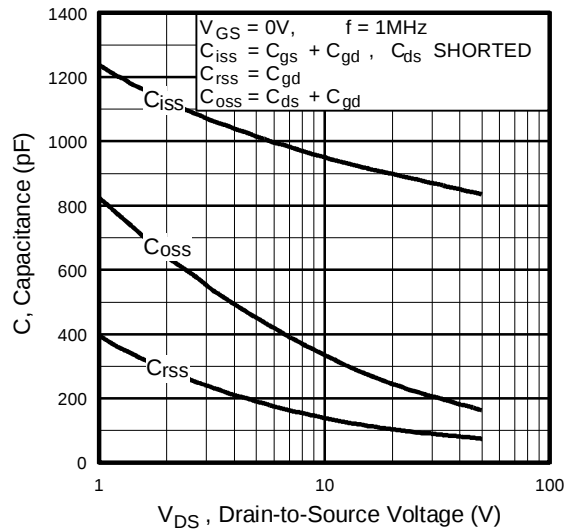


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

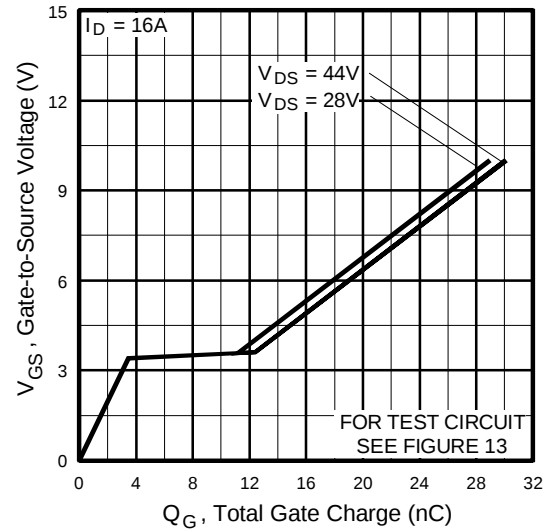


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

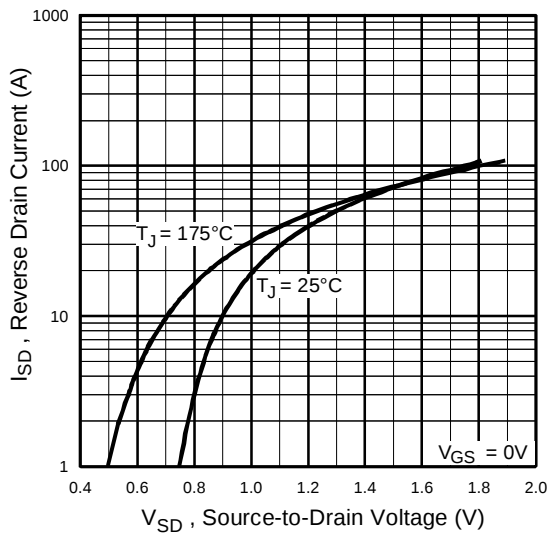


Fig 7. Typical Source-Drain Diode Forward Voltage

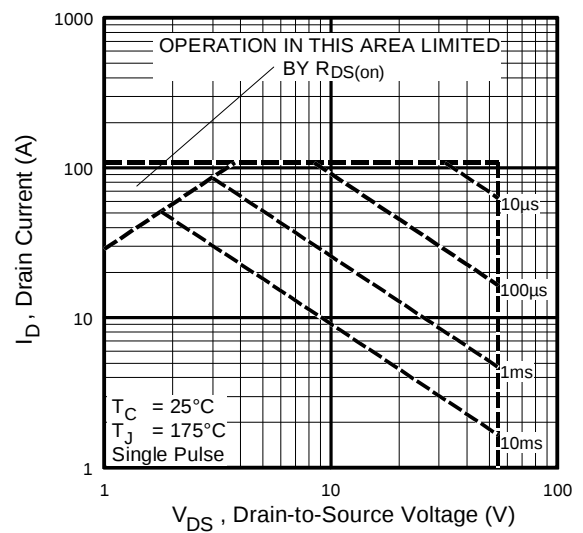


Fig 8. Maximum Safe Operating Area

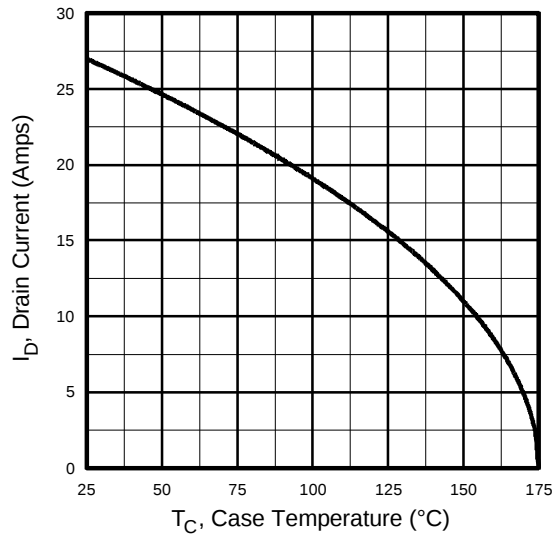


Fig 9. Maximum Drain Current Vs. Case Temperature

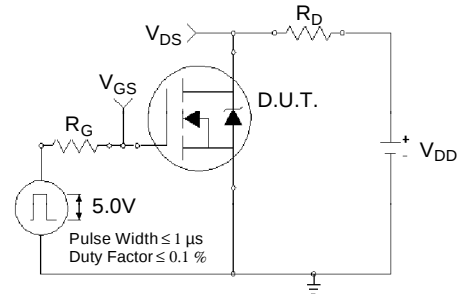


Fig 10a. Switching Time Test Circuit

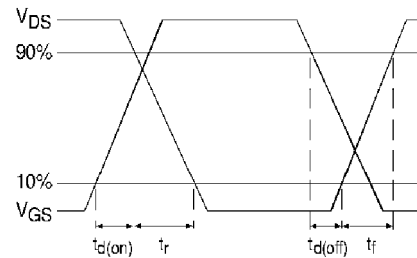


Fig 10b. Switching Time Waveforms

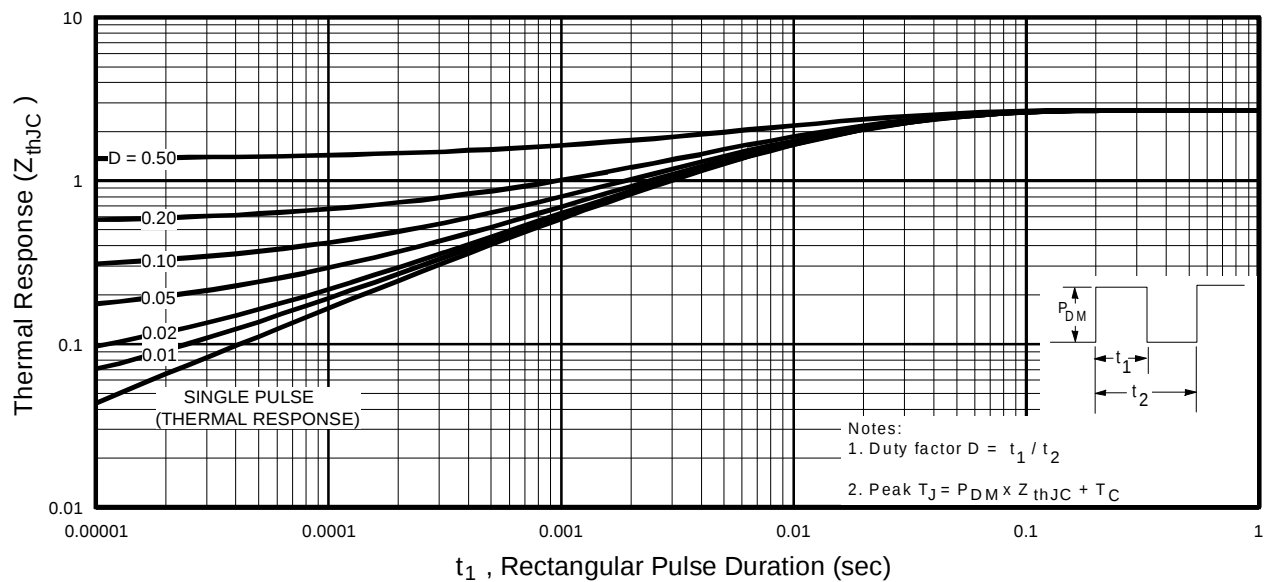


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

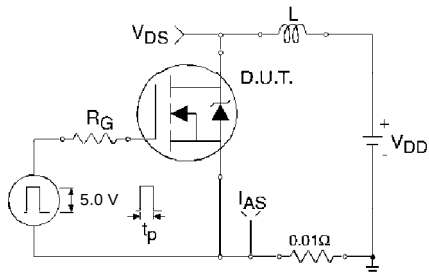


Fig 12a. Unclamped Inductive Test Circuit

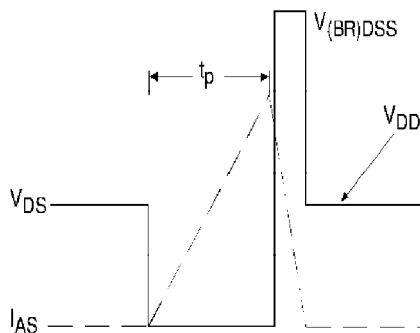


Fig 12b. Unclamped Inductive Waveforms

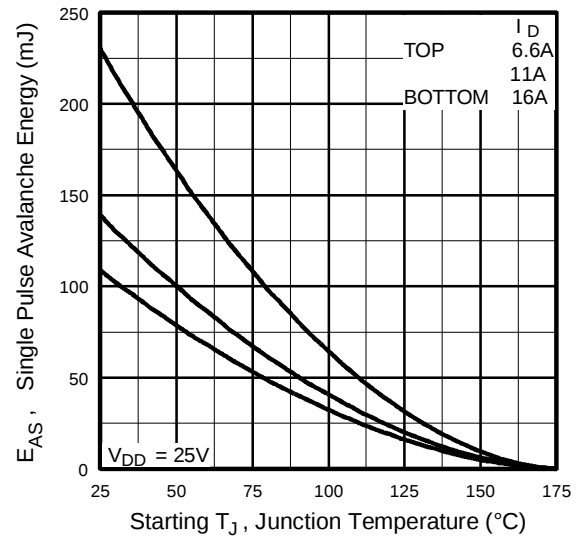


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

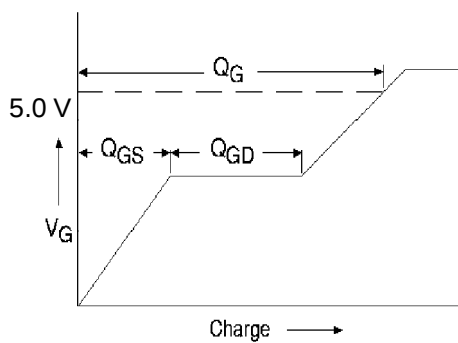


Fig 13a. Basic Gate Charge Waveform

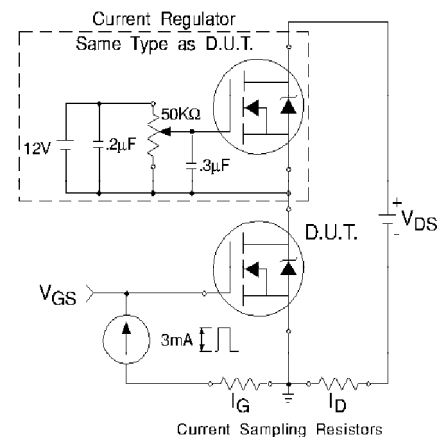


Fig 13b. Gate Charge Test Circuit

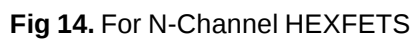
The diagram shows a switching circuit for a Device Under Test (D.U.T.). A square-wave voltage source (1) is connected to the gate of a driver MOSFET through a gate resistor R_G . The driver MOSFET's source is grounded, and its drain is connected to the gate of the D.U.T. MOSFET. The D.U.T. MOSFET's source is also grounded, and its drain is connected to a load resistor, which is then connected to a V_{DD} supply. A current transformer (2) is placed in the drain line of the driver MOSFET. A current probe (3) is placed on the gate line of the D.U.T. MOSFET. A second current probe (4) is placed on the drain line of the D.U.T. MOSFET, after the load resistor.

Circuit Layout Considerations

- Low Stray Inductance
- Ground Plane
- Low Leakage Inductance

Current Transformer

- dv/dt controlled by R_G
- Driver same type as D.U.T.
- I_{SD} controlled by Duty Factor "D"
- D.U.T. - Device Under Test



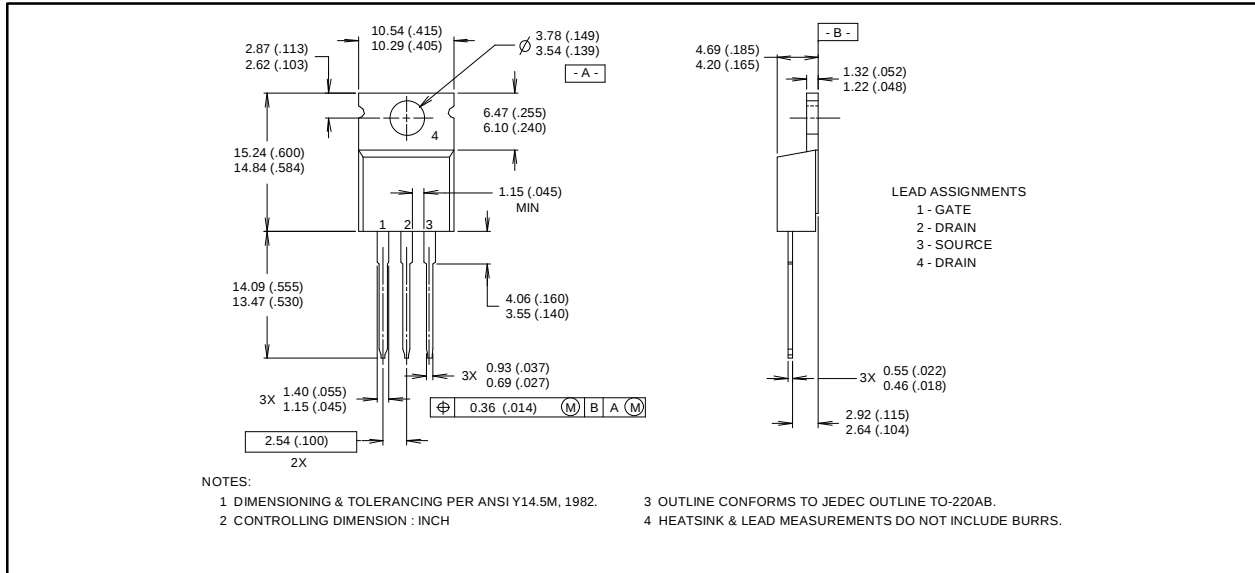
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Package Outline

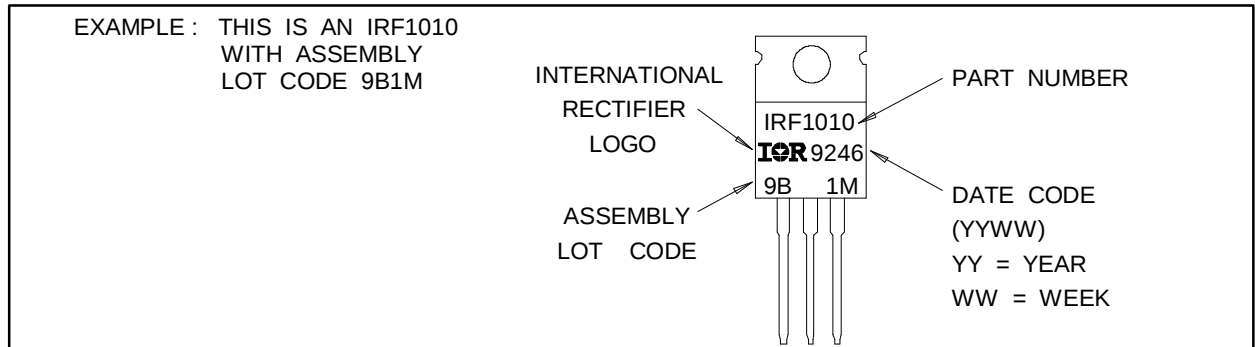
TO-220AB Outline

Dimensions are shown in millimeters (inches)



Part Marking Information

TO-220AB



International Rectifier

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

EUROPEAN HEADQUARTERS: Hurst Green, Oxted, Surrey RH8 9BB, UK Tel: (44) 0883 713215

IR CANADA: 7321 Victoria Park Ave., Suite 201, Markham, Ontario L3R 3L1, Tel: (905) 475 1897 **IR GERMANY:** Saalburgstrasse 157, 61350 Bad Homburg Tel: 6172 37066 **IR ITALY:** Via Liguria 49, 10071 Borgaro, Torino Tel: (39) 1145 10111 **IR FAR EAST:** K&H Bldg., 2F, 3-30-4 Nishi-Ikeburo 3-Chome, Toshima-Ki, Tokyo 171 Tel: (03)3983 0641 **IR SOUTHEAST ASIA:** 315 Outram Road, #10-02 Tan Boon Liat Building, 0316 Tel: 65 221 8371

Data and specifications subject to change without notice.