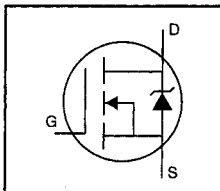


HEXFET® Power MOSFET

- Dynamic dv/dt Rating
- Repetitive Avalanche Rated
- Fast Switching
- Ease of Paralleling
- Simple Drive Requirements



$$V_{DSS} = 450V$$

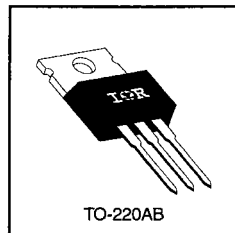
$$R_{DS(on)} = 1.2\Omega$$

$$I_D = 4.9A$$

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 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.



Absolute Maximum Ratings

	Parameter	Max.	Units
$I_D @ T_C = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10 V$	4.9	A
$I_D @ T_C = 100^\circ C$	Continuous Drain Current, $V_{GS} @ 10 V$	3.1	
I_{DM}	Pulsed Drain Current ①	20	
$P_D @ T_C = 25^\circ C$	Power Dissipation	74	W
	Linear Derating Factor	0.59	W/°C
V_{GS}	Gate-to-Source Voltage	± 20	V
E_{AS}	Single Pulse Avalanche Energy ②	330	mJ
I_{AR}	Avalanche Current ①	4.9	A
E_{AR}	Repetitive Avalanche Energy ①	7.4	mJ
dv/dt	Peak Diode Recovery dv/dt ③	4.0	V/ns
T_J	Operating Junction and	-55 to +150	°C
T_{STG}	Storage Temperature Range		
	Soldering Temperature, for 10 seconds		
	Mounting Torque, 6-32 or M3 screw	300 (1.6mm from case) 10 lbf·in (1.1 N·m)	

Thermal Resistance

	Parameter	Min.	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	—	1.7	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	—	0.50	—	
$R_{\theta JA}$	Junction-to-Ambient	—	—	62	

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	—	0.63	—	$V/^\circ\text{C}$	Reference to 25°C , $I_D=1\text{mA}$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	1.2	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_{fs}	Forward Transconductance	3.0	—	—	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	—	—	45	nC	$I_D=4.9A$
Q_{gs}	Gate-to-Source Charge	—	—	6.6		$V_{DS}=360V$
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	—	24		$V_{GS}=10V$ See Fig. 6 and 13 ④
$t_{d(on)}$	Turn-On Delay Time	—	5.9	—	ns	$V_{DD}=225V$
t_r	Rise Time	—	22	—		$I_D=4.9A$
$t_{d(off)}$	Turn-Off Delay Time	—	40	—		$R_G=12\Omega$
t_f	Fall Time	—	21	—		$R_D=45\Omega$ 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	—	680	—	pF	$V_{GS}=0V$
C_{oss}	Output Capacitance	—	190	—		$V_{DS}=25V$
C_{rss}	Reverse Transfer Capacitance	—	75	—		$f=1.0\text{MHz}$ See Figure 5



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	$T_J=25^\circ\text{C}$, $I_S=4.9A$, $V_{GS}=0V$ ④
t_{rr}	Reverse Recovery Time	—	460	690	ns	$T_J=25^\circ\text{C}$, $I_F=4.9A$
Q_{rr}	Reverse Recovery Charge	—	1.8	2.7	μC	$di/dt=100A/\mu s$ 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 Figure 11)
- ② $V_{DD}=50V$, starting $T_J=25^\circ\text{C}$, $L=24\text{mH}$, $R_G=25\Omega$, $I_{AS}=4.9A$ (See Figure 12)
- ③ $I_{SD}\leq 4.9A$, $di/dt\leq 80A/\mu s$, $V_{DD}\leq V_{(BR)DSS}$, $T_J\leq 150^\circ\text{C}$
- ④ Pulse width $\leq 300\mu s$; duty cycle $\leq 2\%$.

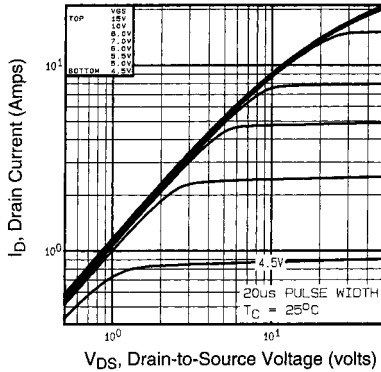


Fig 1. Typical Output Characteristics,
 $T_C=25^{\circ}\text{C}$

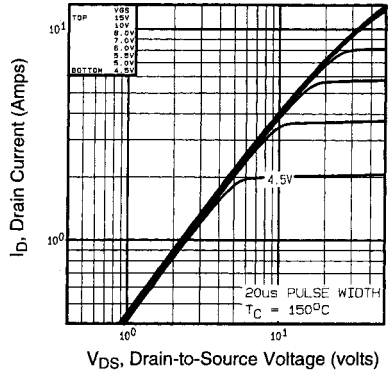


Fig 2. Typical Output Characteristics,
 $T_C=150^{\circ}\text{C}$

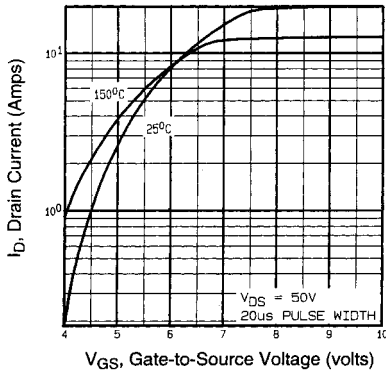


Fig 3. Typical Transfer Characteristics

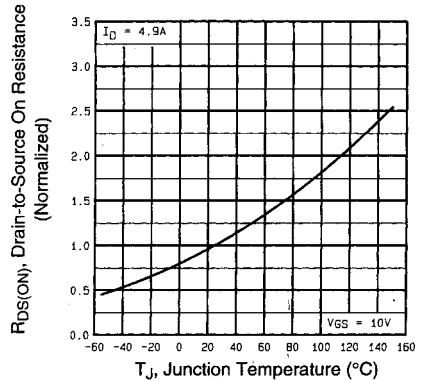


Fig 4. Normalized On-Resistance
Vs. Temperature

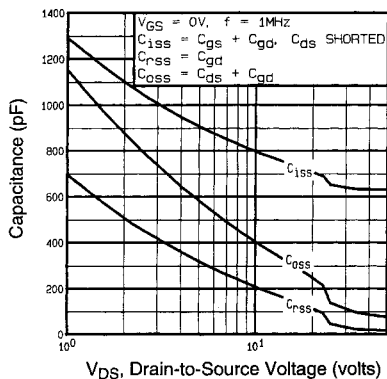


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

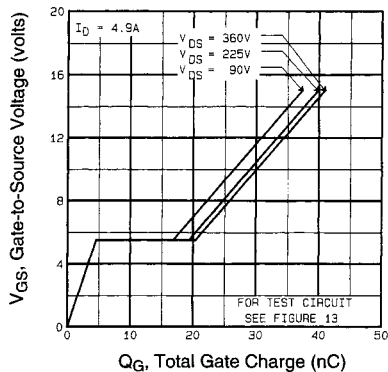


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

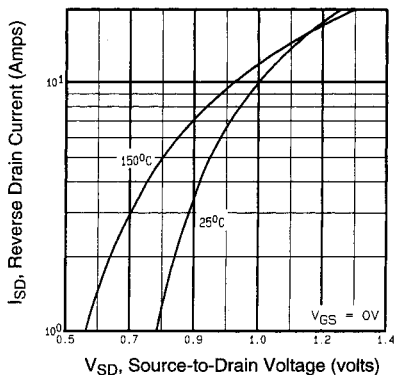


Fig 7. Typical Source-Drain Diode Forward Voltage

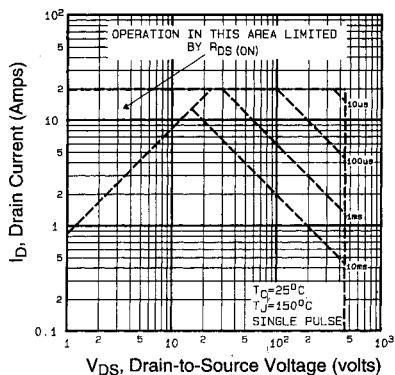


Fig 8. Maximum Safe Operating Area

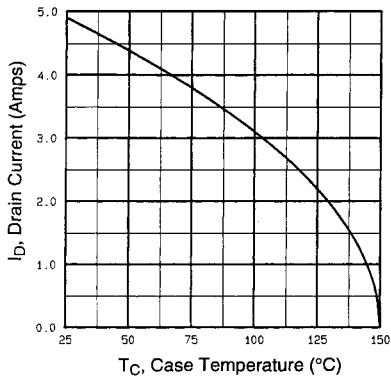


Fig. 9. Maximum Drain Current Vs. Case Temperature

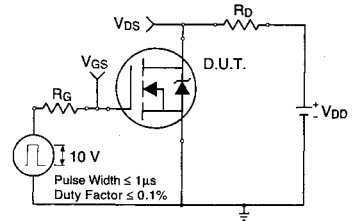


Fig 10a. Switching Time Test Circuit

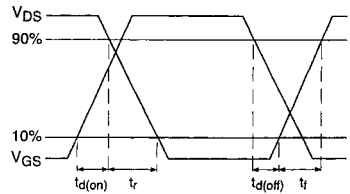


Fig 10b. Switching Time Waveforms

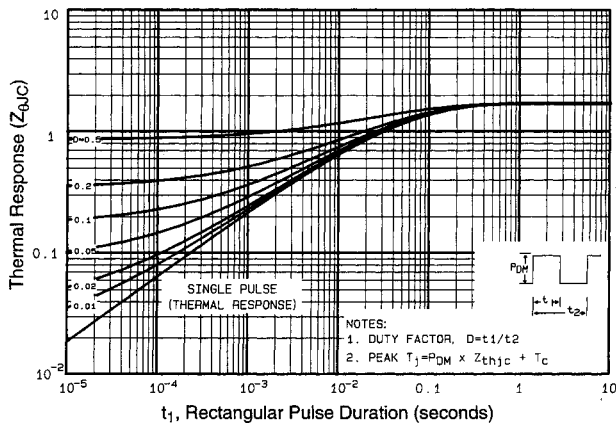


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

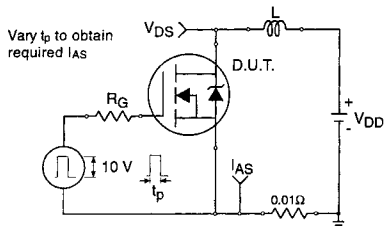


Fig 12a. Unclamped Inductive Test Circuit

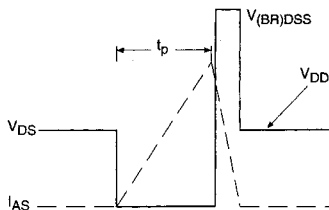


Fig 12b. Unclamped Inductive Waveforms

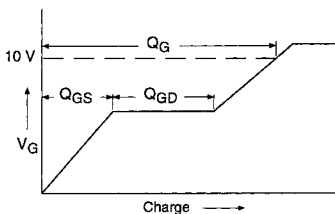


Fig 13a. Basic Gate Charge Waveform

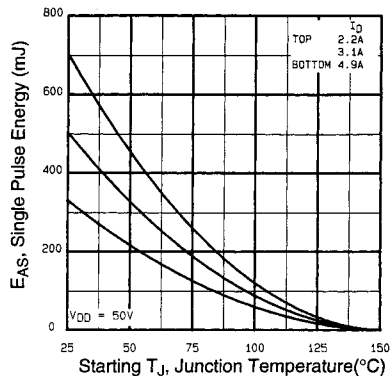


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

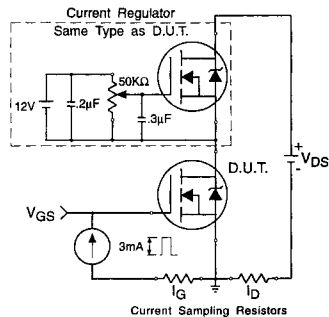


Fig 13b. Gate Charge Test Circuit

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

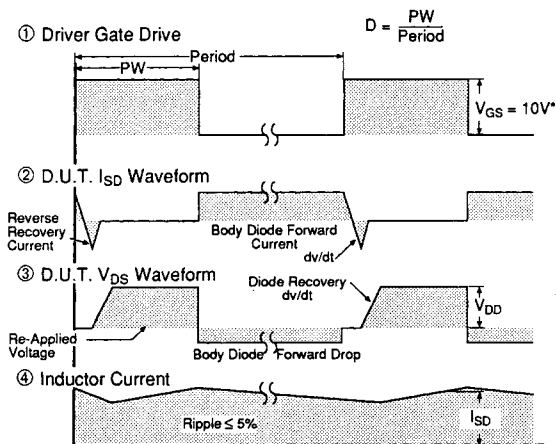
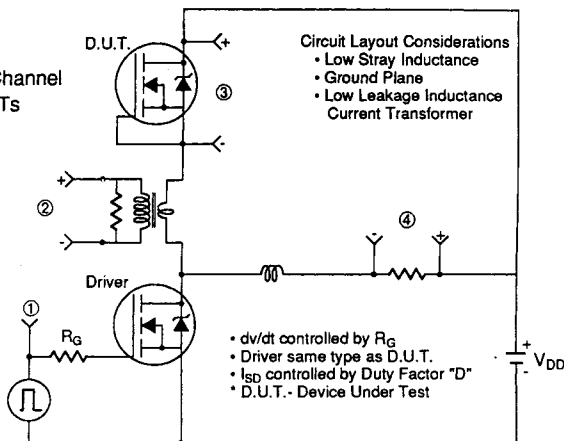
Appendix B: Package Outline Mechanical Drawing

Appendix C: Part Marking Information

Appendix A

Peak Diode Recovery dv/dt Test Circuit

Fig 14. For N-Channel HEXFETs



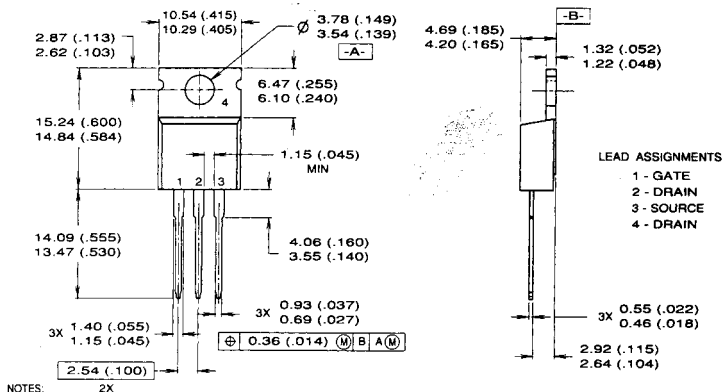
* $V_{GS} = 5V$ for Logic Level Devices

Package Outline

Appendix B

TO-220AB Outline

Dimensions are shown in millimeters (inches)



NOTES:

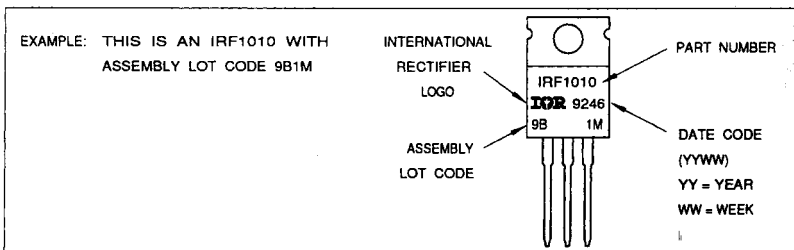
2X

- 1 DIMENSIONING & TOLERANCING PER ANSI Y14.5M, 1982.
- 2 CONTROLLING DIMENSION : INCH.
- 3 OUTLINE CONFORMS TO JEDEC OUTLINE TO-220-AB.
- 4 HEATSINK & LEAD MEASUREMENTS DO NOT INCLUDE BURRS.

Part Marking Information

Appendix C

TO-220AB



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, Twx: 4720403
EUROPEAN HEADQUARTERS: Hurst Green, Oxford, Surrey RH8 9BB England, Tel: (0883) 713215, Twx: 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 0841 **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.

PRINTED IN THE U.S.A. 11/93 10M

Date and specifications subject to change without notice. (1087)