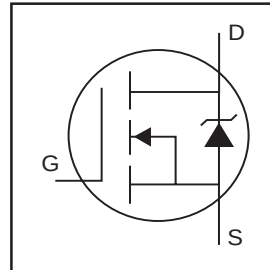


- Advanced Process Technology
- Ultra Low On-Resistance
- Dynamic dv/dt Rating
- 175°C Operating Temperature
- Fast Switching
- Fully Avalanche Rated

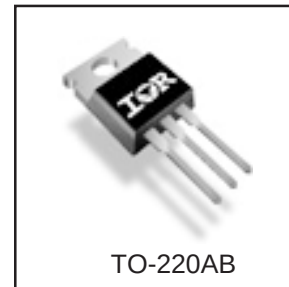
Description

Seventh Generation HEXFET® power MOSFETs from International Rectifier utilize advanced processing techniques to achieve extremely low 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 and reliable device for use in a wide variety of applications.

The TO-220AB 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.



$V_{DS} = 55V$
 $R_{DS(on)} = 0.005\Omega$
 $I_D = 133A\text{⑥}$



TO-220AB

Absolute Maximum Ratings

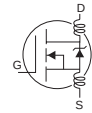
	Parameter	Max.	Units
I_D @ $T_C = 25^\circ C$	Continuous Drain Current, V_{GS} @ 10V	133⑥	A
I_D @ $T_C = 100^\circ C$	Continuous Drain Current, V_{GS} @ 10V	94⑥	
I_{DM}	Pulsed Drain Current ①	530	
P_D @ $T_C = 25^\circ C$	Power Dissipation	200	W
	Linear Derating Factor	1.3	W/°C
V_{GS}	Gate-to-Source Voltage	± 20	V
E_{AS}	Single Pulse Avalanche Energy②	1200	mJ
I_{AR}	Avalanche Current①	80	A
E_{AR}	Repetitive Avalanche Energy①	20	mJ
dv/dt	Peak Diode Recovery dv/dt ③	1.2	V/ns
T_J	Operating Junction and	-40 to + 175	°C
T_{STG}	Storage Temperature Range	-55 to + 175	
	Soldering Temperature, for 10 seconds	300 (1.6mm from case)	
	Mounting Torque, 6-32 or M3 Screw	10 lbf•in (1.1N•m)	

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	0.75	°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	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	55	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.056	—	V/°C	Reference to 25°C , $I_D = 1mA$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	0.005	Ω	$V_{GS} = 10V, I_D = 80A$ ④
$V_{GS(th)}$	Gate Threshold Voltage	2.0	—	4.0	V	$V_{DS} = 10V, I_D = 250\mu A$
g_{fs}	Forward Transconductance	96	—	—	S	$V_{DS} = 25V, I_D = 89A$
I_{DSS}	Drain-to-Source Leakage Current	—	—	20	μA	$V_{DS} = 55V, V_{GS} = 0V$
		—	—	250		$V_{DS} = 44V, V_{GS} = 0V, T_J = 150^\circ\text{C}$
I_{GSS}	Gate-to-Source Forward Leakage	—	—	200	nA	$V_{GS} = 20V$
	Gate-to-Source Reverse Leakage	—	—	-200		$V_{GS} = -20V$
Q_g	Total Gate Charge	—	180	—	nC	$I_D = 89A$
Q_{gs}	Gate-to-Source Charge	—	34	—		$V_{DS} = 44V$
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	49	—		$V_{GS} = 10V$ ④
$t_{d(on)}$	Turn-On Delay Time	—	18	—	ns	$V_{DD} = 28V$
t_r	Rise Time	—	140	—		$I_D = 89A$
$t_{d(off)}$	Turn-Off Delay Time	—	75	—		$R_G = 2.5\Omega$
t_f	Fall Time	—	130	—		$R_D = 0.37\Omega$ 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	—	6650	—	pF	$V_{GS} = 0V$
C_{oss}	Output Capacitance	—	1210	—		$V_{DS} = 25V$
C_{rss}	Reverse Transfer Capacitance	—	240	—		$f = 1.0MHz$, See Fig. 5
C_{oss}	Output Capacitance	—	5230	—		$V_{GS} = 0V, V_{DS} = 1.0V, f = 1.0MHz$
C_{oss}	Output Capacitance	—	920	—		$V_{GS} = 0V, V_{DS} = 44V, f = 1.0MHz$
$C_{oss \text{ eff.}}$	Effective Output Capacitance ⑤	—	950	—		$V_{GS} = 0V, V_{DS} = 0V \text{ to } 44V$



Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	133	A	MOSFET symbol showing the integral reverse p-n junction diode.
I_{SM}	Pulsed Source Current (Body Diode) ①	—	—	530		
V_{SD}	Diode Forward Voltage	—	—	1.3	V	$T_J = 25^\circ\text{C}, I_S = 89A, V_{GS} = 0V$ ④
t_{rr}	Reverse Recovery Time	—	85	—	ns	$T_J = 25^\circ\text{C}, I_F = 89A$
Q_{rr}	Reverse Recovery Charge	—	280	—	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.
- ② Starting $T_J = 25^\circ\text{C}$, $L = 0.37mH$
 $R_G = 25\Omega$, $I_{AS} = 80A$.
- ③ $I_{SD} \leq 90A$, $di/dt \leq 190A/\mu s$, $V_{DD} \leq V_{(BR)DSS}$,
 $T_J \leq 175^\circ\text{C}$

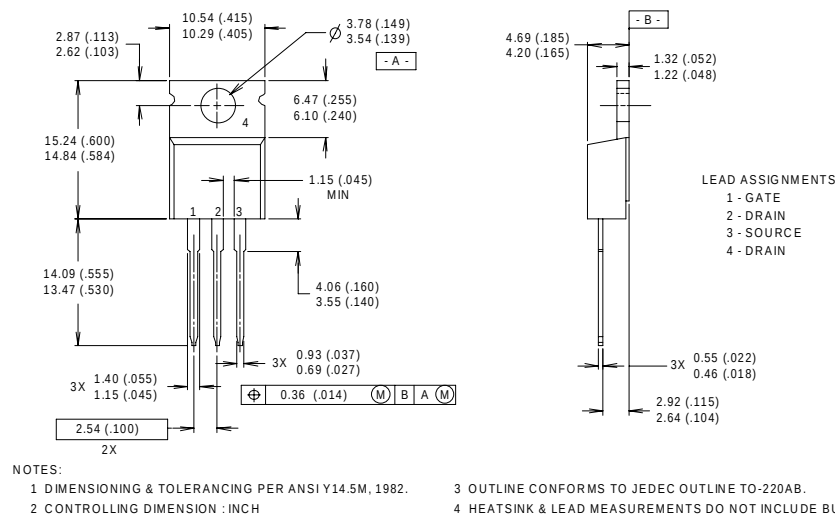
- ④ Pulse width $\leq 300\mu s$; duty cycle $\leq 2\%$.
- ⑤ $C_{oss \text{ eff.}}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS}
- ⑥ Calculated continuous current based on maximum allowable junction temperature; for recommended current-handling of the package refer to Design Tip # 93-4

TO-220AB Package Outline

Dimensions are shown in millimeters (inches)

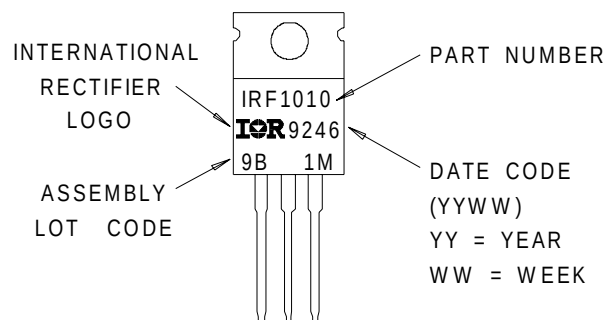
PROVISIONAL

IRF1405



TO-220AB Part Marking Information

EXAMPLE : THIS IS AN IRF1010
WITH ASSEMBLY
LOT CODE 9B1M



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IR Rectifier

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Data and specifications subject to change without notice. 11/99