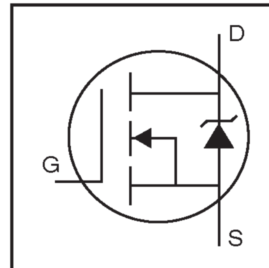
PD-94968

International
IOR Rectifier

IRF1404PbF

HEXFET® Power MOSFET

- Advanced Process Technology
- Ultra Low On-Resistance
- Dynamic dv/dt Rating
- 175°C Operating Temperature
- Fast Switching
- Fully Avalanche Rated
- Automotive Qualified (Q101)
- Lead-Free



V_{DSS} = 40V

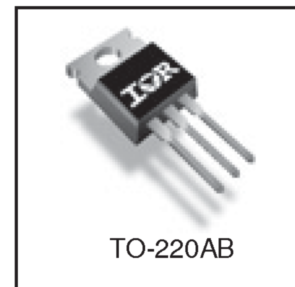
$R_{DS(on)}$ = 0.004Ω

I_D = 202A⑥

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 including automotive.

The TO-220 package is universally preferred for all automotive-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

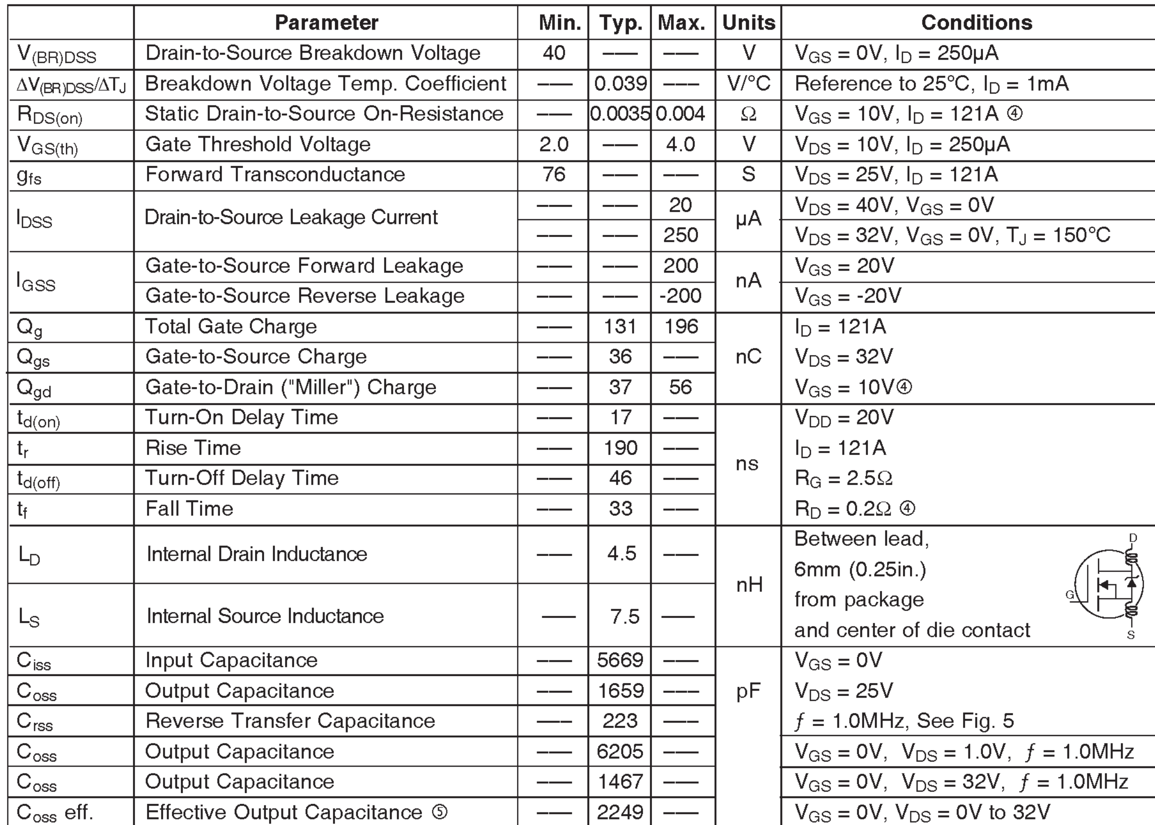
Absolute Maximum Ratings

	Parameter	Max.	Units
I_D @ T_C = 25°C	Continuous Drain Current, V_{GS} @ 10V	202⑥	A
I_D @ T_C = 100°C	Continuous Drain Current, V_{GS} @ 10V	143⑥	
I_{DM}	Pulsed Drain Current ①	808	
P_D @T_C = 25°C	Power Dissipation	333	W
	Linear Derating Factor	2.2	W/°C
V_{GS}	Gate-to-Source Voltage	± 20	V
E_{AS}	Single Pulse Avalanche Energy②	620	mJ
I_{AR}	Avalanche Current	See Fig.12a, 12b, 15, 16	A
E_{AR}	Repetitive Avalanche Energy⑦		mJ
dv/dt	Peak Diode Recovery dv/dt ③	1.5	V/ns
T_J	Operating Junction and	-55 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
$R_{θJC}$	Junction-to-Case	–––	0.45	°C/W
$R_{θCS}$	Case-to-Sink, Flat, Greased Surface	0.50	–––	
$R_{θJA}$	Junction-to-Ambient	–––	62	

Electrical Characteristics @ T_J = 25°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 = 250μA
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	–––	0.039	–––	V/°C	Reference to 25°C, I_D = 1mA
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	–––	0.0035	0.004	Ω	V_{GS} = 10V, I_D = 121A ④
$V_{GS(th)}$	Gate Threshold Voltage	2.0	–––	4.0	V	V_{DS} = 10V, I_D = 250μA
g_{fs}	Forward Transconductance	76	–––	–––	S	V_{DS} = 25V, I_D = 121A
I_{DSS}	Drain-to-Source Leakage Current	–––	–––	20	μA	V_{DS} = 40V, V_{GS} = 0V
		–––	–––	250		V_{DS} = 32V, V_{GS} = 0V, T_J = 150°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	–––	131	196	nC	I_D = 121A
Q_{gs}	Gate-to-Source Charge	–––	36	–––		V_{DS} = 32V
Q_{gd}	Gate-to-Drain ("Miller") Charge	–––	37	56		V_{GS} = 10V④
$t_{d(on)}$	Turn-On Delay Time	–––	17	–––	ns	V_{DD} = 20V
t_r	Rise Time	–––	190	–––		I_D = 121A
$t_{d(off)}$	Turn-Off Delay Time	–––	46	–––		R_G = 2.5Ω
t_f	Fall Time	–––	33	–––		R_D = 0.2Ω ④
L_D	Internal Drain Inductance	–––	4.5	–––	nH	Between lead, 6mm (0.25in.)
L_S	Internal Source Inductance	–––	7.5	–––		from package and center of die contact
C_{iss}	Input Capacitance	–––	5669	–––	pF	V_{GS} = 0V
C_{oss}	Output Capacitance	–––	1659	–––		V_{DS} = 25V
C_{rss}	Reverse Transfer Capacitance	–––	223	–––		ƒ = 1.0MHz, See Fig. 5
C_{oss}	Output Capacitance	–––	6205	–––		V_{GS} = 0V, V_{DS} = 1.0V, ƒ = 1.0MHz
C_{oss}	Output Capacitance	–––	1467	–––		V_{GS} = 0V, V_{DS} = 32V, ƒ = 1.0MHz
C_{oss} eff.	Effective Output Capacitance ⑤	–––	2249	–––		V_{GS} = 0V, V_{DS} = 0V to 32V

Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	–––	–––	202⑥	A	MOSFET symbol showing the
I_{SM}	Pulsed Source Current (Body Diode) ①	–––	–––	808		integral reverse p-n junction diode.
V_{SD}	Diode Forward Voltage	–––	–––	1.5	V	T_J = 25°C, I_S = 121A, V_{GS} = 0V ④
t_{rr}	Reverse Recovery Time	–––	78	117	ns	T_J = 25°C, I_F = 121A
Q_{rr}	Reverse RecoveryCharge	–––	163	245	nC	di/dt = 100A/μs 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°C, L = 85μH R_G = 25Ω, I_{AS} = 121A. (See Figure 12)

③ $I_{SD} \leq$ 121A, di/dt ≤ 130A/μs, $V_{DD} \leq V_{(BR)DSS}$, $T_J \leq$ 175°C

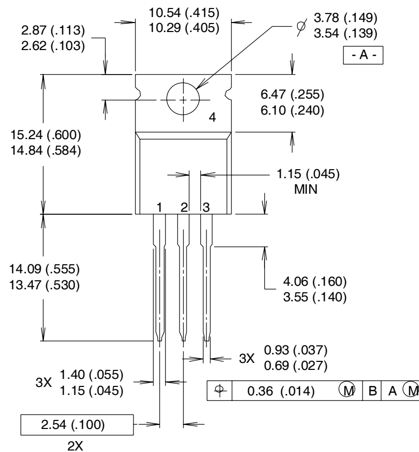
④ Pulse width ≤ 400μs; duty cycle ≤ 2%.

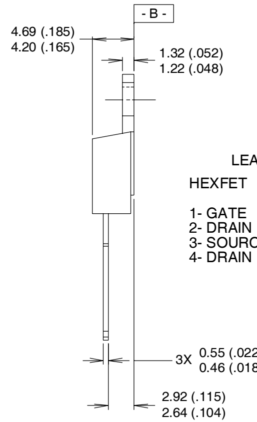
⑤ C_{oss} eff. is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS}

⑥ Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 75A.

TO-220AB Package Outline

Dimensions are shown in millimeters (inches)





LEAD ASSIGNMENTS

HEXFET	IGBTs, CoPACK
1- GATE	1- GATE
2- DRAIN	2- COLLECTOR
3- SOURCE	3- EMITTER
4- DRAIN	4- COLLECTOR

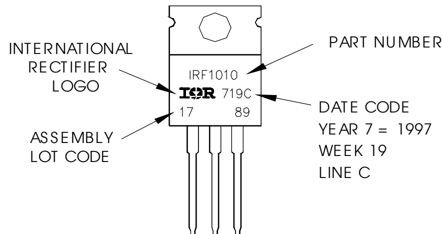
NOTES:

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

TO-220AB Part Marking Information

EXAMPLE: THIS IS AN IRF1010
LOT CODE 1789
ASSEMBLED ON WW 19, 1997
IN THE ASSEMBLY LINE "C"

Note: "P" in assembly line position indicates "Lead-Free"



TO-220AB package is not recommended for Surface Mount Application.

Data and specifications subject to change without notice.
This product has been designed and qualified for the automotive [Q101] market.

International
IOR Rectifier