

IRF1407PbF

Typical Applications

- Integrated Starter Alternator
- 42 Volts Automotive Electrical Systems
- Lead-Free

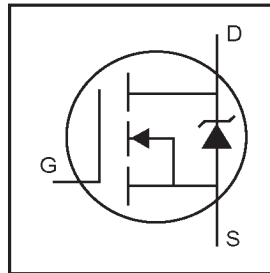
Benefits

- Advanced Process Technology
- Ultra Low On-Resistance
- Dynamic dv/dt Rating
- 175°C Operating Temperature
- Fast Switching
- Repetitive Avalanche Allowed up to Tjmax

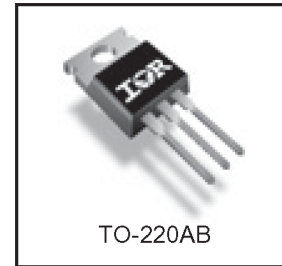
Description

Specifically designed for Automotive applications, this Stripe Planar design of HEXFET® Power MOSFETs utilizes the latest processing techniques to achieve extremely low on-resistance per silicon area. Additional features of this HEXFET power MOSFET are a 175°C junction operating temperature, fast switching speed and improved repetitive avalanche rating. These benefits combine to make this design an extremely efficient and reliable device for use in Automotive applications and a wide variety of other applications.

HEXFET® Power MOSFET



$V_{DSS} = 75V$
$R_{DS(on)} = 0.0078\Omega$
$I_D = 130A\text{Ⓞ}$



Absolute Maximum Ratings

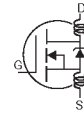
	Parameter	Max.	Units
$I_D @ T_C = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	130Ⓞ	A
$I_D @ T_C = 100^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	92Ⓞ	
I_{DM}	Pulsed Drain Current Ⓞ	520	
$P_D @ T_C = 25^\circ C$	Power Dissipation	330	W
	Linear Derating Factor	2.2	W/°C
V_{GS}	Gate-to-Source Voltage	± 20	V
E_{AS}	Single Pulse Avalanche EnergyⓄ	390	mJ
I_{AR}	Avalanche CurrentⓄ	See Fig.12a, 12b, 15, 16	A
E_{AR}	Repetitive Avalanche EnergyⓄ		mJ
dv/dt	Peak Diode Recovery dv/dt Ⓞ	4.6	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)	
	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	—	0.45	°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	75	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.09	—	$V/^\circ\text{C}$	Reference to $25^\circ\text{C}, I_D = 1\text{mA}$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	0.0078	Ω	$V_{GS} = 10V, I_D = 78A$ ④
$V_{GS(th)}$	Gate Threshold Voltage	2.0	—	4.0	V	$V_{DS} = 10V, I_D = 250\mu A$
g_{fs}	Forward Transconductance	74	—	—	S	$V_{DS} = 25V, I_D = 78A$
I_{DSS}	Drain-to-Source Leakage Current	—	—	20	μA	$V_{DS} = 75V, V_{GS} = 0V$
		—	—	250		$V_{DS} = 60V, V_{GS} = 0V, T_J = 150^\circ\text{C}$
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	—	160	250	nC	$I_D = 78A$
Q_{gs}	Gate-to-Source Charge	—	35	52		$V_{DS} = 60V$
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	54	81		$V_{GS} = 10V$ ④
$t_{d(on)}$	Turn-On Delay Time	—	11	—	ns	$V_{DD} = 38V$
t_r	Rise Time	—	150	—		$I_D = 78A$
$t_{d(off)}$	Turn-Off Delay Time	—	150	—		$R_G = 2.5\Omega$
t_f	Fall Time	—	140	—		$V_{GS} = 10V$ 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	—	5600	—	pF	$V_{GS} = 0V$
C_{oss}	Output Capacitance	—	890	—		$V_{DS} = 25V$
C_{rss}	Reverse Transfer Capacitance	—	190	—		$f = 1.0\text{KHz}$, See Fig. 5
C_{oss}	Output Capacitance	—	5800	—		$V_{GS} = 0V, V_{DS} = 1.0V, f = 1.0\text{KHz}$
C_{oss}	Output Capacitance	—	560	—		$V_{GS} = 0V, V_{DS} = 60V, f = 1.0\text{KHz}$
$C_{oss \text{ eff.}}$	Effective Output Capacitance ⑤	—	1100	—		$V_{GS} = 0V, V_{DS} = 0V \text{ to } 60V$



Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	130	A	MOSFET symbol showing the integral reverse p-n junction diode.
I_{SM}	Pulsed Source Current (Body Diode) ①	—	—	520		
V_{SD}	Diode Forward Voltage	—	—	1.3	V	$T_J = 25^\circ\text{C}, I_S = 78A, V_{GS} = 0V$ ④
t_{rr}	Reverse Recovery Time	—	110	170	ns	$T_J = 25^\circ\text{C}, I_F = 78A$
Q_{rr}	Reverse Recovery Charge	—	390	590	nC	$di/dt = 100A/\mu s$ ④
t_{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by $L_S + L_D$)				

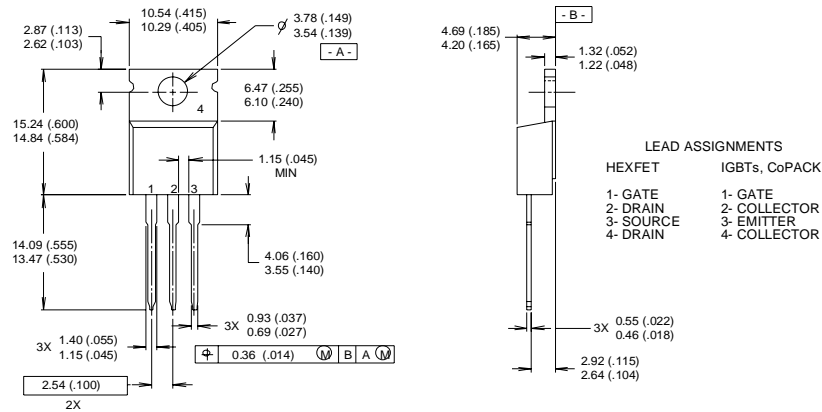
Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature. (See fig. 11).
- ② Starting $T_J = 25^\circ\text{C}$, $L = 0.13\text{mH}$, $R_G = 25\Omega$, $I_{AS} = 78A$. (See Figure 12).
- ③ $I_{SD} \leq 78A$, $di/dt \leq 320A/\mu s$, $V_{DD} \leq V_{(BR)DSS}$, $T_J \leq 175^\circ\text{C}$
- ④ Pulse width $\leq 400\mu s$; 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. Package limitation current is 75A.
- ⑦ Limited by T_{Jmax} , see Fig.12a, 12b, 15, 16 for typical repetitive avalanche performance.

TO-220AB Package Outline

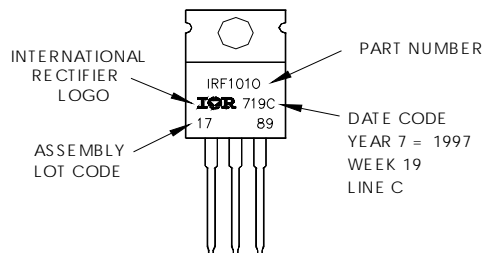
Dimensions are shown in millimeters (inches)



- 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"



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