

AUTOMOTIVE MOSFET

IRL1404ZPbF
IRL1404ZSPbF
IRL1404ZLPbF

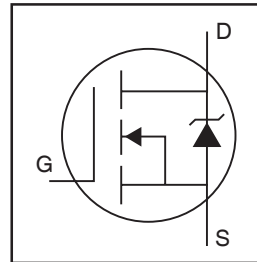
HEXFET® Power MOSFET

Features

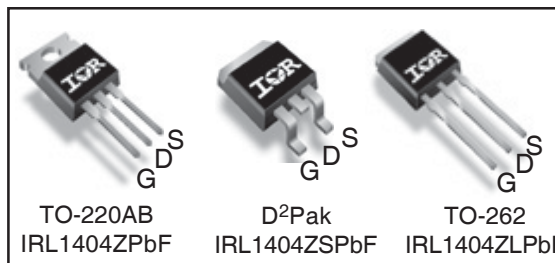
- Logic Level
- Advanced Process Technology
- Ultra Low On-Resistance
- 175°C Operating Temperature
- Fast Switching
- Repetitive Avalanche Allowed up to T_{jmax}
- Lead-Free

Description

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



$V_{DSS} = 40V$
$R_{DS(on)} = 3.1m\Omega$
$I_D = 75A$



G	D	S
Gate	Drain	Source

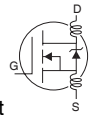
Absolute Maximum Ratings

	Parameter	Max.	Units
$I_D @ T_C = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$ (Silicon Limited)	180	A
$I_D @ T_C = 100^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	130	
$I_D @ T_C = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$ (Package Limited)	75	
I_{DM}	Pulsed Drain Current ①	790	
$P_D @ T_C = 25^\circ C$	Power Dissipation	200	W
	Linear Derating Factor	1.3	W/°C
V_{GS}	Gate-to-Source Voltage	± 16	V
E_{AS} (Thermally limited)	Single Pulse Avalanche Energy ②	190	mJ
E_{AS} (Tested)	Single Pulse Avalanche Energy Tested Value ③	490	
I_{AR}	Avalanche Current ④	See Fig.12a, 12b, 15, 16	A
E_{AR}	Repetitive Avalanche Energy ⑤		mJ
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)	

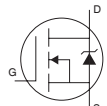
Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	0.75 ⑥	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface ⑦	0.50	—	
$R_{\theta JA}$	Junction-to-Ambient ⑧	—	62	
$R_{\theta JA}$	Junction-to-Ambient (PCB Mount) ⑨	—	40	

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
ΔV _{(BR)DSS} /ΔT _J	Breakdown Voltage Temp. Coefficient	—	0.034	—	V/°C	Reference to 25°C, I _D = 1mA
R _{DS(on)}	Static Drain-to-Source On-Resistance	—	2.5	3.1	mΩ	V _{GS} = 10V, I _D = 75A ③
		—	—	4.7		V _{GS} = 5.0V, I _D = 40A ③
		—	—	5.9		V _{GS} = 4.5V, I _D = 40A ③
V _{GS(th)}	Gate Threshold Voltage	1.4	—	2.7	V	V _{DS} = V _{GS} , I _D = 250μA
g _{fs}	Forward Transconductance	120	—	—	S	V _{DS} = 10V, I _D = 75A
I _{DSS}	Drain-to-Source Leakage Current	—	—	20	μA	V _{DS} = 40V, V _{GS} = 0V
I _{GSS}	Gate-to-Source Forward Leakage	—	—	200	nA	V _{GS} = 16V
	Gate-to-Source Reverse Leakage	—	—	-200	nA	V _{GS} = -16V
Q _g	Total Gate Charge	—	75	110	nC	I _D = 75A
Q _{gs}	Gate-to-Source Charge	—	28	—		V _{DS} = 32V
Q _{gd}	Gate-to-Drain ("Miller") Charge	—	40	—		V _{GS} = 5.0V ③
t _{d(on)}	Turn-On Delay Time	—	19	—	ns	V _{DD} = 20V
t _r	Rise Time	—	180	—		I _D = 75A
t _{d(off)}	Turn-Off Delay Time	—	30	—		R _G = 4.0Ω
t _f	Fall Time	—	49	—		V _{GS} = 5.0V ③
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	—	5080	—	pF	V _{GS} = 0V
C _{oss}	Output Capacitance	—	970	—		V _{DS} = 25V
C _{rss}	Reverse Transfer Capacitance	—	570	—		f = 1.0MHz
C _{oss}	Output Capacitance	—	3310	—		V _{GS} = 0V, V _{DS} = 1.0V, f = 1.0MHz
C _{oss}	Output Capacitance	—	870	—		V _{GS} = 0V, V _{DS} = 32V, f = 1.0MHz
C _{oss eff.}	Effective Output Capacitance	—	1280	—		V _{GS} = 0V, V _{DS} = 0V to 32V ④

Source-Drain Ratings and Characteristics

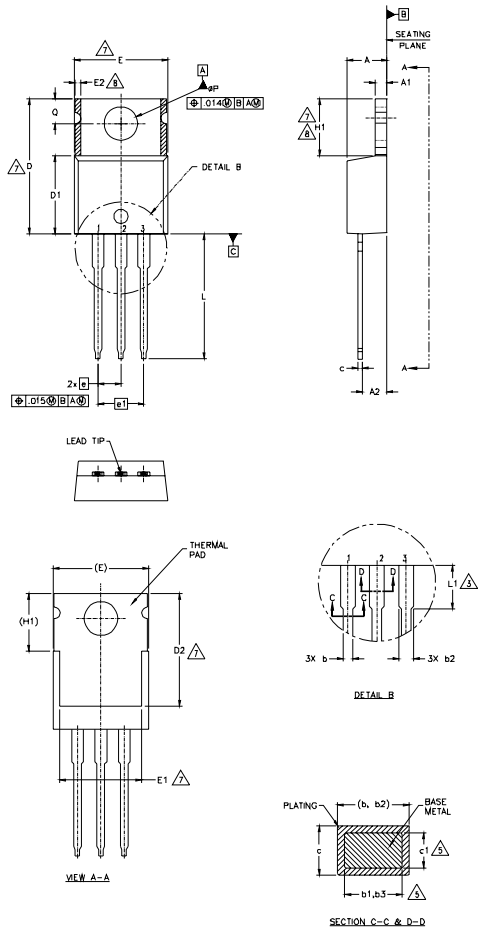
	Parameter	Min.	Typ.	Max.	Units	Conditions
I _S	Continuous Source Current (Body Diode)	—	—	180	A	MOSFET symbol showing the integral reverse p-n junction diode.
I _{SM}	Pulsed Source Current (Body Diode) ①	—	—	720		
V _{SD}	Diode Forward Voltage	—	—	1.3	V	T _J = 25°C, I _S = 75A, V _{GS} = 0V ③
t _{rr}	Reverse Recovery Time	—	26	39	ns	T _J = 25°C, I _F = 75A, V _{DD} = 20V
Q _{rr}	Reverse Recovery Charge	—	18	27	nC	di/dt = 100A/μs ③
t _{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				

Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature. (See fig. 11).
- ② Limited by T_{Jmax}, starting T_J = 25°C, L = 0.066mH, R_G = 25Ω, I_{AS} = 75A, V_{GS} = 10V. Part not recommended for use above this value.
- ③ Pulse width ≤ 1.0ms; duty cycle ≤ 2%.
- ④ 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}.
- ⑤ Limited by T_{Jmax}, see Fig.12a, 12b, 15, 16 for typical repetitive avalanche performance.
- ⑥ This value determined from sample failure population. 100% tested to this value in production.
- ⑦ This is only applied to TO-220AB package.
- ⑧ When mounted on 1" square PCB (FR-4 or G-10 Material). For recommended footprint and soldering techniques refer to application note #AN-994.
- ⑨ TO-220 device will have an R_{th} value of 0.65°C/W.

TO-220AB Package Outline

Dimensions are shown in millimeters (inches)



- NOTES:
- 1.- DIMENSIONING AND TOLERANCING AS PER ASME Y14.5 M- 1994.
 - 2.- DIMENSIONS ARE SHOWN IN INCHES [MILLIMETERS]
 - 3.- LEAD DIMENSION AND FINISH UNCONTROLLED IN L1.
 - 4.- DIMENSION D, D1 & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .005" (0.127) PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
 - 5.- DIMENSION b1, b3 & c1 APPLY TO BASE METAL ONLY.
 - 6.- CONTROLLING DIMENSION : INCHES.
 - 7.- THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS E,H1,D2 & E1
 - 8.- DIMENSION E2 X H1 DEFINE A ZONE WHERE STAMPING AND SINGULATION IRREGULARITIES ARE ALLOWED.
 - 9.- OUTLINE CONFORMS TO JEDEC TO-220, EXCEPT A2 (max.) AND D2 (min.) WHERE DIMENSIONS ARE DERIVED FROM THE ACTUAL PACKAGE OUTLINE.

SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	3.56	4.83	.140	.190	
A1	0.51	1.40	.020	.055	
A2	2.03	2.92	.080	.115	
b	0.38	1.01	.015	.040	
b1	0.38	0.97	.015	.038	5
b2	1.14	1.78	.045	.070	
b3	1.14	1.73	.045	.068	5
c	0.36	0.61	.014	.024	
c1	0.36	0.56	.014	.022	5
D	14.22	16.51	.560	.650	4
D1	8.38	9.02	.330	.355	
D2	11.68	12.88	.460	.507	7
E	9.65	10.67	.380	.420	4,7
E1	6.86	8.89	.270	.350	7
E2	-	0.76	-	.030	8
e	2.54 BSC		.100 BSC		
e1	5.08 BSC		.200 BSC		
H1	5.84	6.86	.230	.270	7,8
L	12.70	14.73	.500	.580	
L1	-	6.35	-	.250	3
ØP	3.54	4.08	.139	.161	
Q	2.54	3.42	.100	.135	

LEAD ASSIGNMENTS

HERFEL

- 1.- GATE
- 2.- DRAIN
- 3.- SOURCE

IGBTs, CoPACK

- 1.- GATE
- 2.- COLLECTOR
- 3.- EMITTER

DIODES

- 1.- ANODE/OPEN
- 2.- CATHODE
- 3.- ANODE

TO-220AB Part Marking Information

EXAMPLE: THIS IS AN IRF1010
LOT CODE 1789
ASSEMBLED ON WW 19, 2000
IN THE ASSEMBLY LINE "C"

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

