

**AUTOMOTIVE MOSFET**

**IRF4104PbF**  
**IRF4104SPbF**  
**IRF4104LPbF**

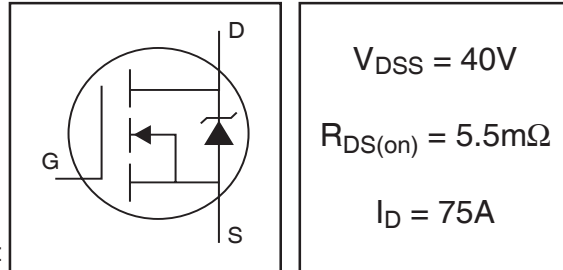
**Features**

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

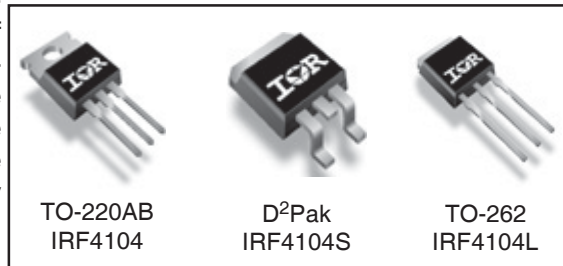
**Description**

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.

**HEXFET® Power MOSFET**



$V_{DSS} = 40V$   
 $R_{DS(on)} = 5.5m\Omega$   
 $I_D = 75A$



**Absolute Maximum Ratings**

	Parameter	Max.	Units
$I_D @ T_C = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$ (Silicon Limited)	120	A
$I_D @ T_C = 100^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	84	
$I_D @ T_C = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$ (Package limited)	75	
$I_{DM}$	Pulsed Drain Current ①	470	
$P_D @ T_C = 25^\circ C$	Power Dissipation	140	W
	Linear Derating Factor	0.95	W/°C
$V_{GS}$	Gate-to-Source Voltage	$\pm 20$	V
$E_{AS}$ (Thermally limited)	Single Pulse Avalanche Energy ②	120	mJ
$E_{AS}$ (Tested )	Single Pulse Avalanche Energy Tested Value ③	220	
$I_{AR}$	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 ⑦	10 lbf•in (1.1N•m)	

**Thermal Resistance**

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	1.05	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat Greased Surface ⑧	0.50	—	
$R_{\theta JA}$	Junction-to-Ambient ⑨	—	62	
$R_{\theta JA}$	Junction-to-Ambient (PCB Mount) ⑩	—	40	

# IRF4104S/LPbF

International  
IR Rectifier

## Electrical Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

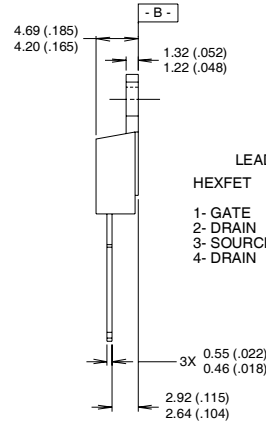
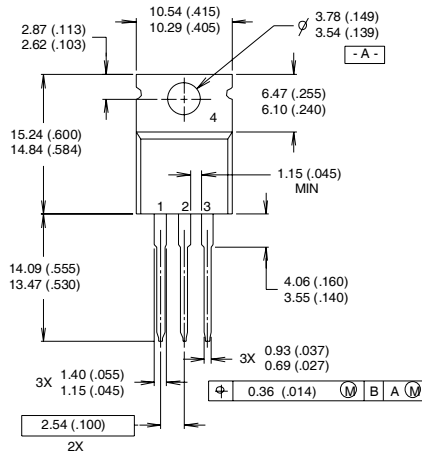
	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DS}$	Drain-to-Source Breakdown Voltage	40	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.032	—	V/°C	Reference to $25^\circ\text{C}$ , $I_D = 1\text{mA}$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	4.3	5.5	m $\Omega$	$V_{GS} = 10V, I_D = 75A$ ③
$V_{GS(th)}$	Gate Threshold Voltage	2.0	—	4.0	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
$g_{fs}$	Forward Transconductance	63	—	—	V	$V_{DS} = 10V, I_D = 75A$
$I_{DSS}$	Drain-to-Source Leakage Current	—	—	20	$\mu A$	$V_{DS} = 40V, V_{GS} = 0V$
		—	—	250		$V_{DS} = 40V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
$I_{GSS}$	Gate-to-Source Forward Leakage	—	—	200	nA	$V_{GS} = 20V$
	Gate-to-Source Reverse Leakage	—	—	-200		$V_{GS} = -20V$
$Q_g$	Total Gate Charge	—	68	100	nC	$I_D = 75A$ $V_{DS} = 32V$ $V_{GS} = 10V$ ③
$Q_{gs}$	Gate-to-Source Charge	—	21	—		
$Q_{gd}$	Gate-to-Drain ("Miller") Charge	—	27	—		
$t_{d(on)}$	Turn-On Delay Time	—	16	—	ns	$V_{DD} = 20V$ $I_D = 75A$ $R_G = 6.8\ \Omega$ $V_{GS} = 10V$ ③
$t_r$	Rise Time	—	130	—		
$t_{d(off)}$	Turn-Off Delay Time	—	38	—		
$t_f$	Fall Time	—	77	—		
$L_D$	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	—	3000	—	pF	$V_{GS} = 0V$ $V_{DS} = 25V$ $f = 1.0\text{MHz}$
$C_{oss}$	Output Capacitance	—	660	—		
$C_{riss}$	Reverse Transfer Capacitance	—	380	—		
$C_{oss}$	Output Capacitance	—	2160	—		
$C_{oss}$	Output Capacitance	—	560	—		
$C_{oss\ eff.}$	Effective Output Capacitance	—	850	—		

## Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
$I_S$	Continuous Source Current (Body Diode)	—	—	75	A	MOSFET symbol showing the integral reverse p-n junction diode.
$I_{SM}$	Pulsed Source Current (Body Diode) ①	—	—	470		
$V_{SD}$	Diode Forward Voltage	—	—	1.3	V	$T_J = 25^\circ\text{C}, I_S = 75A, V_{GS} = 0V$ ③
$t_{rr}$	Reverse Recovery Time	—	23	35	ns	$T_J = 25^\circ\text{C}, I_F = 75A, V_{DD} = 20V$
$Q_{rr}$	Reverse Recovery Charge	—	6.8	10	nC	$di/dt = 100A/\mu s$ ③
$t_{on}$	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by $L_S+L_D$ )				

## 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"

