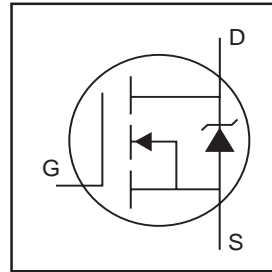


PROVISIONAL

# IRFBA1404

HEXFET® Power MOSFET

- Advanced Process Technology
- Ultra Low On-Resistance
- Dynamic dv/dt Rating
- 175°C Operating Temperature
- Fast Switching
- Fully Avalanche Rated
- Purchase IRFBA1404/P for Solder Plated Option

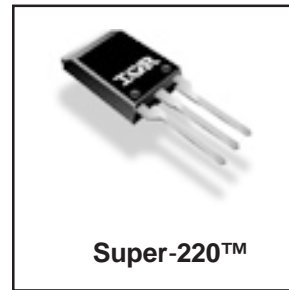


$V_{DS} = 40V$
$R_{DS(on)} = 0.0035\Omega$
$I_D = 212A\text{⑥}$

## 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 Super-220™ is a package that has been designed to have the same mechanical outline and pinout as the industry standard TO-220 but can house a considerably larger silicon die. It has increased current handling capability over both the TO-220 and the much larger TO-247 package. This makes it ideal to reduce component count in multiparallel TO-220 applications, reduce system power dissipation, upgrade existing designs or have TO-247 performance in a TO-220 outline.

This package has also been designed to meet automotive qualification standard Q101.



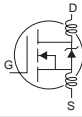
## Absolute Maximum Ratings

	Parameter	Max.	Units
$I_D @ T_C = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	212⑥	A
$I_D @ T_C = 100^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	150⑥	
$I_{DM}$	Pulsed Drain Current ①	650	
$P_D @ T_C = 25^\circ C$	Power Dissipation	300	W
	Linear Derating Factor	2.0	W/°C
$V_{GS}$	Gate-to-Source Voltage	$\pm 20$	V
$E_{AS}$	Single Pulse Avalanche Energy②	2000	mJ
$I_{AR}$	Avalanche Current①	95	A
$E_{AR}$	Repetitive Avalanche Energy①	30	mJ
dv/dt	Peak Diode Recovery dv/dt ③	4.0	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 )	
	Recommended clip force	20	
			N

## Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	0.50	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	0.5	—	
$R_{\theta JA}$	Junction-to-Ambient	—	58	

## 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	40	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.036	—	V/°C	Reference to $25^\circ\text{C}$ , $I_D = 1\text{mA}$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	0.0035	$\Omega$	$V_{GS} = 10V, I_D = 95A$ ④
$V_{GS(th)}$	Gate Threshold Voltage	2.0	—	4.0	V	$V_{DS} = 10V, I_D = 250\mu A$
$g_{fs}$	Forward Transconductance	106	—	—	S	$V_{DS} = 25V, I_D = 60A$
$I_{DSS}$	Drain-to-Source Leakage Current	—	—	10	$\mu A$	$V_{DS} = 40V, V_{GS} = 0V$
		—	—	250		$V_{DS} = 32V, V_{GS} = 0V, T_J = 150^\circ\text{C}$
$I_{GSS}$	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	200	nC	$I_D = 95A$
$Q_{gs}$	Gate-to-Source Charge	—	35	—		$V_{DS} = 32V$
$Q_{gd}$	Gate-to-Drain ("Miller") Charge	—	42	60		$V_{GS} = 10V$ ④
$t_{d(on)}$	Turn-On Delay Time	—	17	—	ns	$V_{DD} = 20V$
$t_r$	Rise Time	—	140	—		$I_D = 95A$
$t_{d(off)}$	Turn-Off Delay Time	—	72	—		$R_G = 2.5\Omega$
$t_f$	Fall Time	—	26	—		$R_D = 0.21\Omega$ ④
$L_D$	Internal Drain Inductance	—	2.0	—	nH	Between lead, 6mm (0.25in.) from package and center of die contact
$L_S$	Internal Source Inductance	—	5.0	—		
$C_{iss}$	Input Capacitance	—	7360	—	pF	$V_{GS} = 0V$
$C_{oss}$	Output Capacitance	—	1680	—		$V_{DS} = 25V$
$C_{rss}$	Reverse Transfer Capacitance	—	240	—		$f = 1.0\text{MHz}$ , See Fig. 5
$C_{oss}$	Output Capacitance	—	6630	—		$V_{GS} = 0V, V_{DS} = 1.0V, f = 1.0\text{MHz}$
$C_{oss}$	Output Capacitance	—	1490	—		$V_{GS} = 0V, V_{DS} = 32V, f = 1.0\text{MHz}$
$C_{oss\ eff.}$	Effective Output Capacitance ⑤	—	1540	—		$V_{GS} = 0V, V_{DS} = 0V \text{ to } 32V$

## Source-Drain Ratings and Characteristics

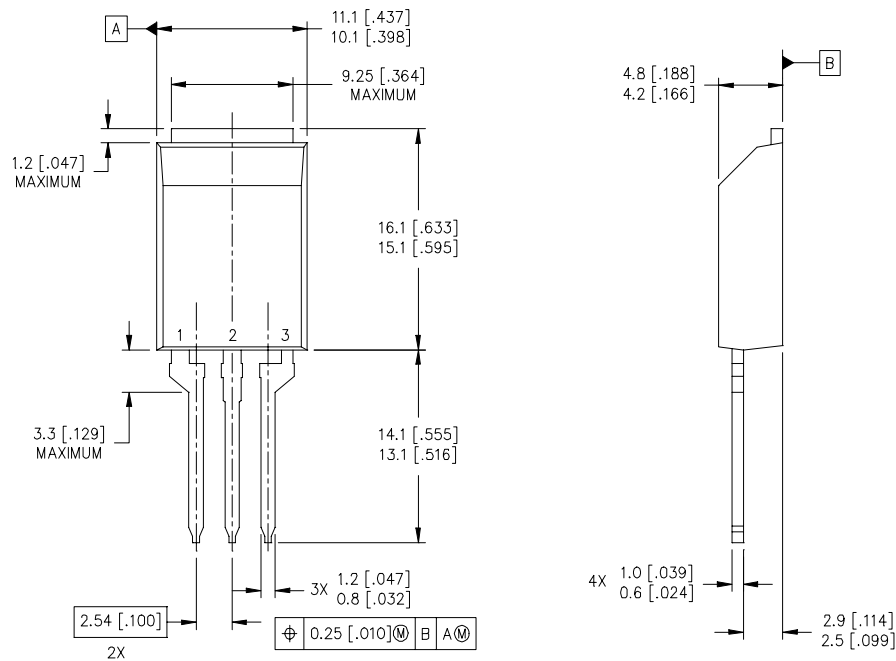
	Parameter	Min.	Typ.	Max.	Units	Conditions
$I_S$	Continuous Source Current (Body Diode)	—	—	212 ⑥	A	MOSFET symbol showing the integral reverse p-n junction diode.
$I_{SM}$	Pulsed Source Current (Body Diode) ①	—	—	650		
$V_{SD}$	Diode Forward Voltage	—	—	1.3	V	$T_J = 25^\circ\text{C}, I_S = 95A, V_{GS} = 0V$ ④
$t_{rr}$	Reverse Recovery Time	—	71	110	ns	$T_J = 25^\circ\text{C}, I_F = 95A$
$Q_{rr}$	Reverse Recovery Charge	—	180	270	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  $T_J = 25^\circ\text{C}$ ,  $L = 0.31\text{mH}$   
 $R_G = 25\Omega, I_{AS} = 95A$ .
- ③  $I_{SD} \leq 95A, di/dt \leq 150A/\mu s, V_{DD} \leq V_{(BR)DSS}, T_J \leq 175^\circ\text{C}$

- ④ Pulse width  $\leq 300\mu s$ ; duty cycle  $\leq 2\%$ .
- ⑤  $C_{oss\ eff.}$  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

Super-220™ Package Outline



NOTES:

1. DIMENSIONING & TOLERANCING PER ASME Y14.5M-1994.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
4. OUTLINE CONFORMS TO JEDEC OUTLINE TO-273AA.

LEAD ASSIGNMENTS

MOSFET	IGBT
1 - GATE	1 - GATE
2 - DRAIN	2 - COLLECTOR
3 - SOURCE	3 - EMITTER
4 - DRAIN	4 - COLLECTOR