

# IRL3402PbF

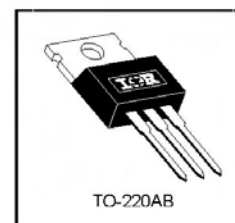
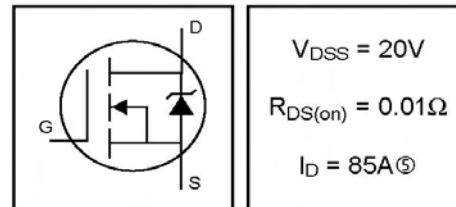
HEXFET® Power MOSFET

- Advanced Process Technology
- Optimized for 4.5V-7.0V Gate Drive
- Ideal for CPU Core DC-DC Converters
- Fast Switching
- Lead-Free

## Description

These HEXFET Power MOSFETs were designed specifically to meet the demands of CPU core DC-DC converters. Advanced processing techniques combined with an optimized gate oxide design results in a die sized specifically to offer maximum efficiency at minimum cost.

The TO-220 package is universally preferred for all 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.



## Absolute Maximum Ratings

	Parameter	Max.	Units
$I_D @ T_C = 25^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 5.0\text{V}$	85 <sup>①</sup>	A
$I_D @ T_C = 100^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 5.0\text{V}$	54	
$I_{DM}$	Pulsed Drain Current <sup>①</sup>	340	
$P_D @ T_C = 25^\circ\text{C}$	Power Dissipation	110	W
	Linear Derating Factor	0.91	W/°C
$V_{GS}$	Gate-to-Source Voltage	$\pm 10$	V
$V_{GSM}$	Gate-to-Source Voltage (Start Up Transient, $t_p = 100\mu\text{s}$ )	14	V
$E_{AS}$	Single Pulse Avalanche Energy <sup>②</sup>	290	mJ
$I_{AR}$	Avalanche Current <sup>①</sup>	51	A
$E_{AR}$	Repetitive Avalanche Energy <sup>①</sup>	11	mJ
$dv/dt$	Peak Diode Recovery $dv/dt$ <sup>③</sup>	5.0	V/ns
$T_J$	Operating Junction and Storage Temperature Range	-55 to + 150	°C
$T_{STG}$			
	Mounting torque, 6-32 or M3 screw	10 lbf•in (1.1N•m)	

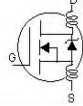
## Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	1.1	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	0.50	—	
$R_{\theta JA}$	Junction-to-Ambient	—	62	

# IRL3402PbF

International  
IR Rectifier

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

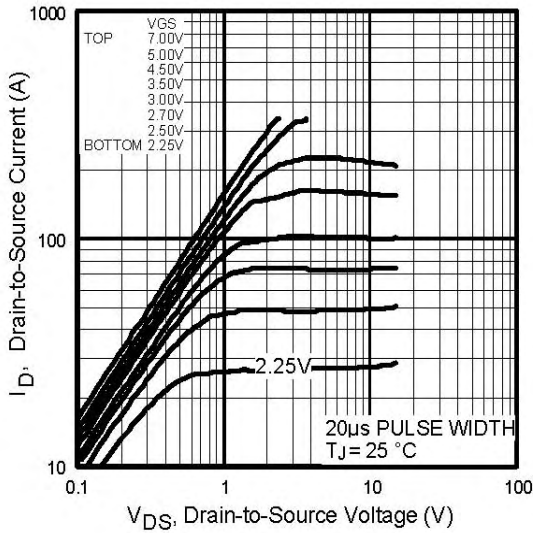
	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	20	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.02	—	V/°C	Reference to $25^\circ\text{C}$ , $I_D = 1mA$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	0.010	$\Omega$	$V_{GS} = 4.5V, I_D = 51A$ ④
		—	—	0.008		$V_{GS} = 7.0V, I_D = 51A$ ④
$V_{GS(th)}$	Gate Threshold Voltage	0.70	—	—	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
$g_{fs}$	Forward Transconductance	65	—	—	S	$V_{DS} = 10V, I_D = 51A$
$I_{DSS}$	Drain-to-Source Leakage Current	—	—	25	$\mu A$	$V_{DS} = 20V, V_{GS} = 0V$
		—	—	250		$V_{DS} = 16V, V_{GS} = 0V, T_J = 150^\circ\text{C}$
$I_{GSS}$	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS} = 10V$
	Gate-to-Source Reverse Leakage	—	—	-100		$V_{GS} = -10V$
$Q_g$	Total Gate Charge	—	—	78	nC	$I_D = 51A$
$Q_{gs}$	Gate-to-Source Charge	—	—	18		$V_{DS} = 10V$
$Q_{gd}$	Gate-to-Drain ("Miller") Charge	—	—	30		$V_{GS} = 4.5V$ , See Fig. 6 ④
$t_{d(on)}$	Turn-On Delay Time	—	10	—	ns	$V_{DD} = 10V$
$t_r$	Rise Time	—	140	—		$I_D = 51A$
$t_{d(off)}$	Turn-Off Delay Time	—	80	—		$R_G = 5.0\Omega, V_{GS} = 4.5V$
$t_f$	Fall Time	—	120	—		$R_D = 0.19\Omega$ , 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	—	3300	—	pF	$V_{GS} = 0V$
$C_{oss}$	Output Capacitance	—	1400	—		$V_{DS} = 15V$
$C_{rss}$	Reverse Transfer Capacitance	—	510	—		$f = 1.0MHz$ , See Fig. 5

## Source-Drain Ratings and Characteristics

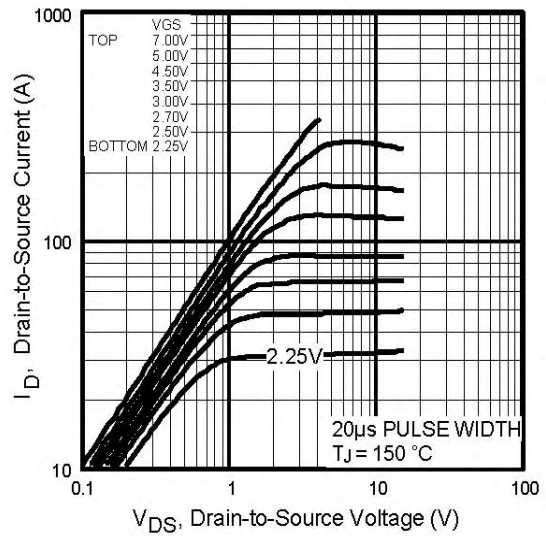
	Parameter	Min.	Typ.	Max.	Units	Conditions
$I_S$	Continuous Source Current (Body Diode)	—	—	85	A	MOSFET symbol showing the integral reverse p-n junction diode.
$I_{SM}$	Pulsed Source Current (Body Diode) ①	—	—	340		
$V_{SD}$	Diode Forward Voltage	—	—	1.3	V	$T_J = 25^\circ\text{C}, I_S = 51A, V_{GS} = 0V$ ④
$t_{rr}$	Reverse Recovery Time	—	72	110	ns	$T_J = 25^\circ\text{C}, I_F = 51A$
$Q_{rr}$	Reverse Recovery Charge	—	160	240	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:

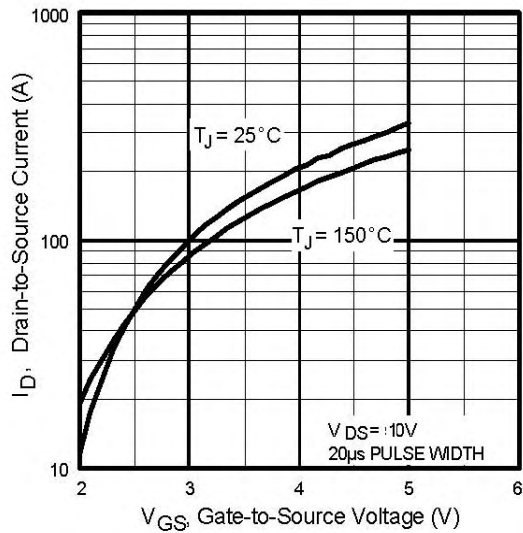
- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Starting  $T_J = 25^\circ\text{C}$ ,  $L = 220\mu H$   
 $R_G = 25\Omega$ ,  $I_{AS} = 51A$ .
- ③  $I_{SD} \leq 51A$ ,  $di/dt \leq 82A/\mu s$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  
 $T_J \leq 150^\circ\text{C}$
- ④ Pulse width  $\leq 300\mu s$ ; duty cycle  $\leq 2\%$ .
- ⑤ Calculated continuous current based on maximum allowable junction temperature; for recommended current-handling of the package refer to Design Tip # 93-4



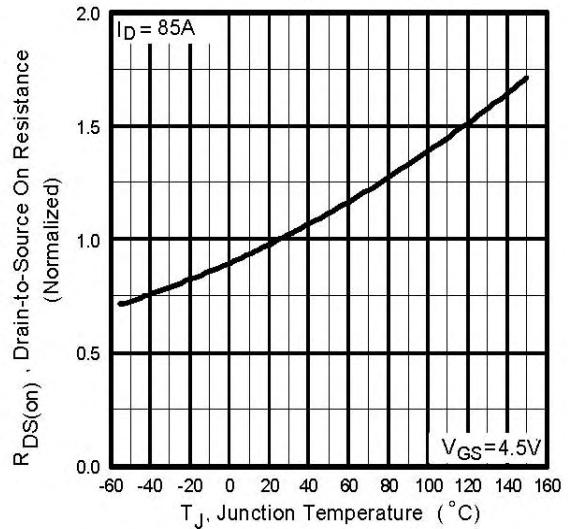
**Fig 1.** Typical Output Characteristics



**Fig 2.** Typical Output Characteristics



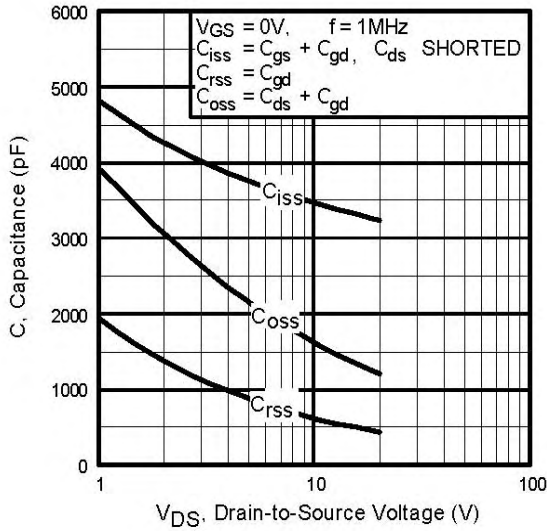
**Fig 3.** Typical Transfer Characteristics



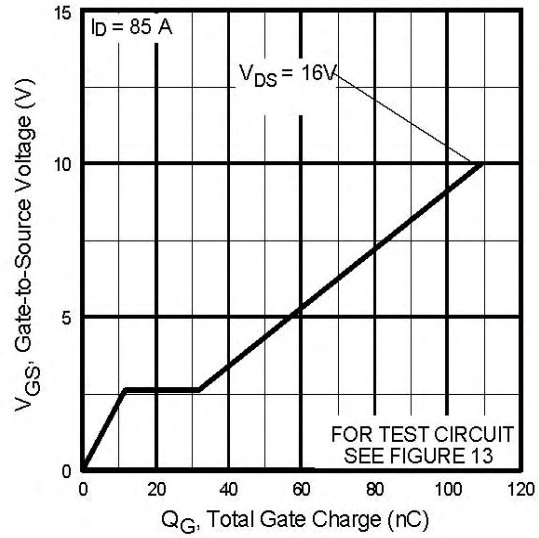
**Fig 4.** Normalized On-Resistance Vs. Temperature

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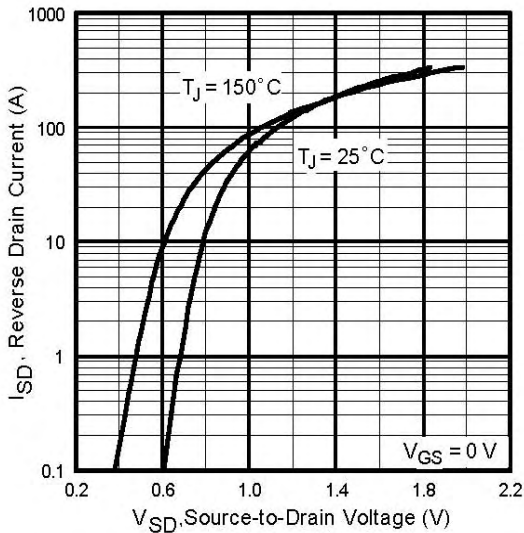
International  
**IR** Rectifier



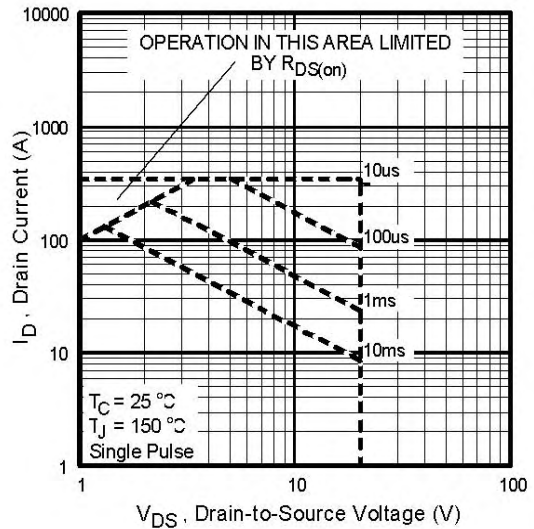
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



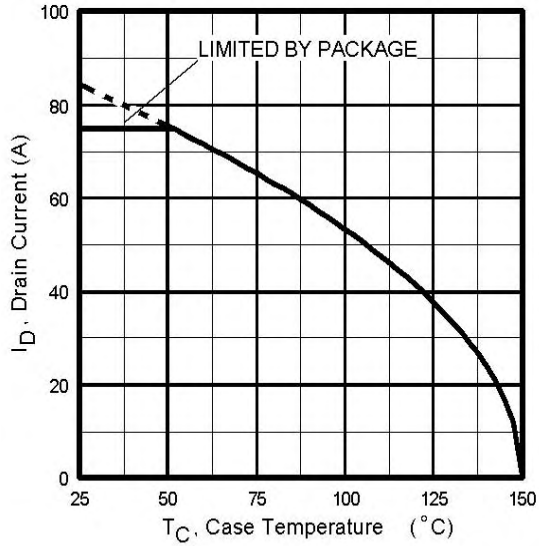
**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage



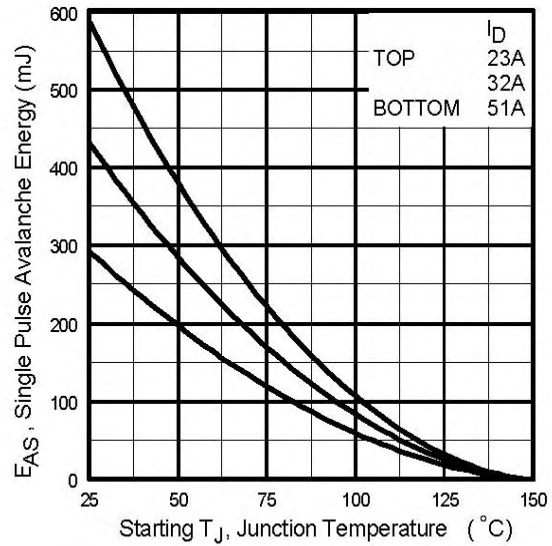
**Fig 7.** Typical Source-Drain Diode Forward Voltage



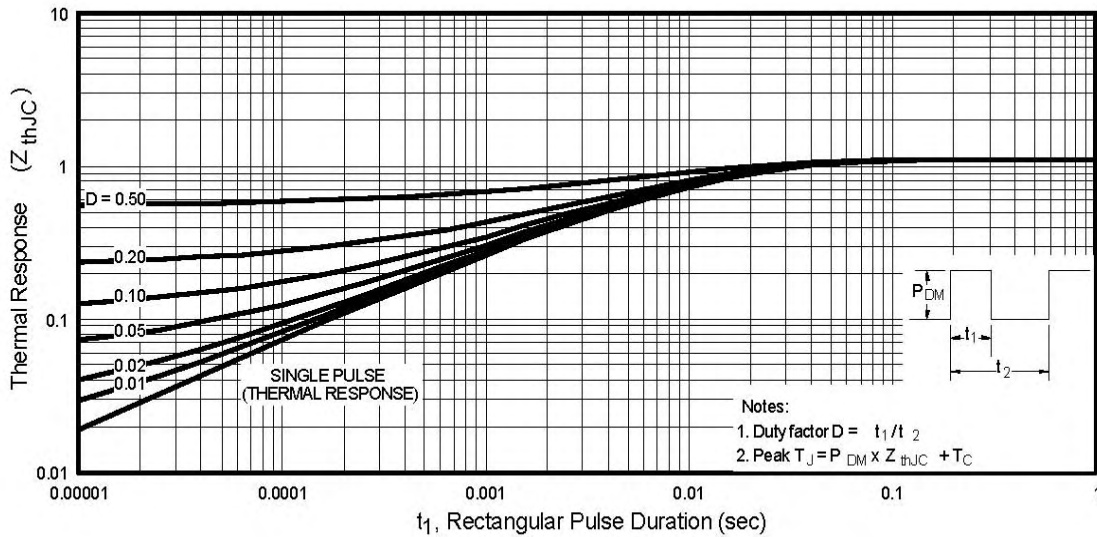
**Fig 8.** Maximum Safe Operating Area



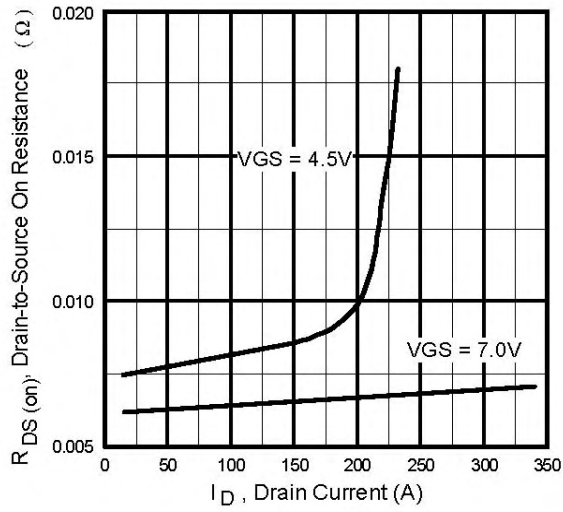
**Fig 9.** Maximum Drain Current Vs. Case Temperature



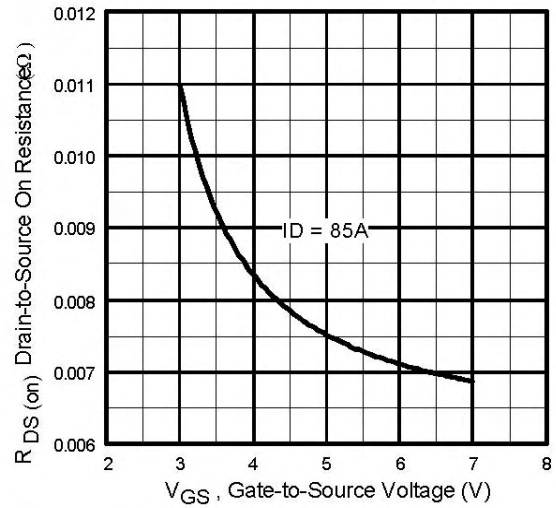
**Fig 10.** Maximum Avalanche Energy Vs. Drain Current



**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case



**Fig 12.** On-Resistance Vs. Drain Current

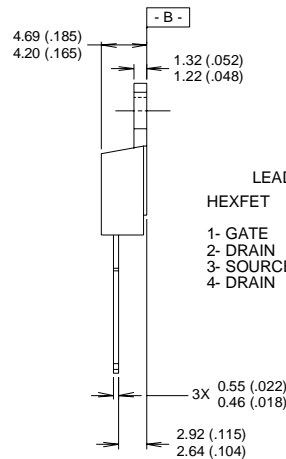
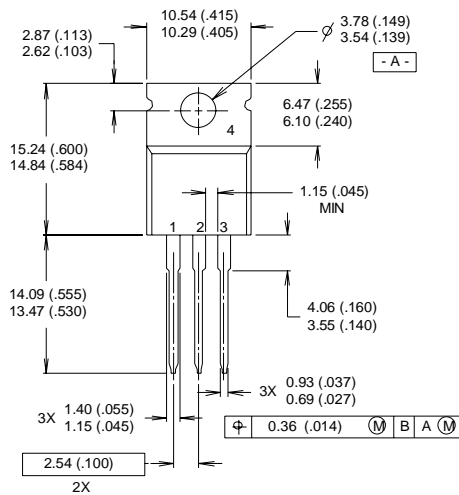


**Fig 13.** On-Resistance Vs. Gate Voltage

## TO-220AB Package Outline

Dimensions are shown in millimeters (inches)

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### 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.

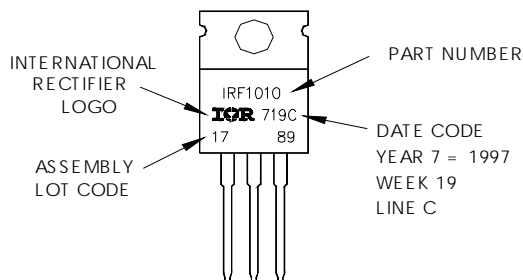
## TO-220AB Part Marking Information

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"



Data and specifications subject to change without notice.