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# IRF644B

## N-Channel BFET MOSFET

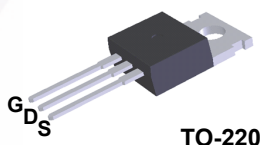
250 V, 14 A, 280 mΩ

### Description

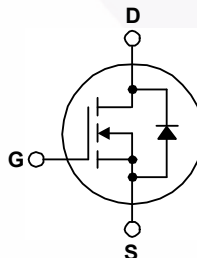
These N-Channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, planar, DMOS technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency switching DC/DC converters and switch mode power supplies.

### Features

- 14 A, 250 V,  $R_{DS(on)} = 280 \text{ m}\Omega$  @  $V_{GS} = 10 \text{ V}$
- Low gate charge (Typ. 47 nC)
- Low  $C_{rss}$  (Typ. 30 pF)
- Fast Switching
- 100% Avalanche Tested
- Improved dv/dt Capability



TO-220



### Absolute Maximum Ratings

$T_C = 25^\circ\text{C}$  unless otherwise noted.

Symbol	Parameter	IRF644B_FP001	Unit
$V_{DSS}$	Drain-Source Voltage	250	V
$I_D$	Drain Current - Continuous ( $T_C = 25^\circ\text{C}$ )	14	A
	- Continuous ( $T_C = 100^\circ\text{C}$ )	8.9	A
$I_{DM}$	Drain Current - Pulsed (Note 1)	56	A
$V_{GSS}$	Gate-Source Voltage	$\pm 30$	V
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	480	mJ
$I_{AR}$	Avalanche Current (Note 1)	14	A
$E_{AR}$	Repetitive Avalanche Energy (Note 1)	13.9	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.8	V/ns
$P_D$	Power Dissipation ( $T_C = 25^\circ\text{C}$ )	139	W
	- Derate Above $25^\circ\text{C}$	1.11	W/ $^\circ\text{C}$
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to +150	$^\circ\text{C}$
$T_L$	Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds	300	$^\circ\text{C}$

### Thermal Characteristics

Symbol	Parameter	IRF644B_FP001	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	0.9	$^\circ\text{C/W}$
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink	0.5	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62.5	$^\circ\text{C/W}$

## Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
IRF644B_FP001	IRF644B	TO-220	Tube	N/A	N/A	50 units

## Electrical Characteristics

 $T_C = 25^\circ\text{C}$  unless otherwise noted.

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
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### Off Characteristics

$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	250	--	--	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$ , Referenced to $25^\circ\text{C}$	--	0.24	--	$V/^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 250\text{ V}, V_{GS} = 0\text{ V}$	--	--	10	$\mu\text{A}$
		$V_{DS} = 200\text{ V}, T_C = 125^\circ\text{C}$	--	--	100	$\mu\text{A}$
$I_{GSSF}$	Gate-Body Leakage Current, Forward	$V_{GS} = 30\text{ V}, V_{DS} = 0\text{ V}$	--	--	100	nA
$I_{GSSR}$	Gate-Body Leakage Current, Reverse	$V_{GS} = -30\text{ V}, V_{DS} = 0\text{ V}$	--	--	-100	nA

### On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	2.0	--	4.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 7.0\text{ A}$	--	0.22	0.28	$\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 40\text{ V}, I_D = 7.0\text{ A}$	--	11.7	--	S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	--	1250	1600	pF
$C_{oss}$	Output Capacitance		--	150	195	pF
$C_{rss}$	Reverse Transfer Capacitance		--	30	40	pF

### Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 125\text{ V}, I_D = 14\text{ A},$ $R_G = 25\text{ }\Omega$ (Note 4)	--	20	50	ns
$t_r$	Turn-On Rise Time		--	115	240	ns
$t_{d(off)}$	Turn-Off Delay Time		--	150	310	ns
$t_f$	Turn-Off Fall Time		--	95	200	ns
$Q_g$	Total Gate Charge	$V_{DS} = 200\text{ V}, I_D = 14\text{ A},$ $V_{GS} = 10\text{ V}$ (Note 4)	--	47	60	nC
$Q_{gs}$	Gate-Source Charge		--	6.2	--	nC
$Q_{gd}$	Gate-Drain Charge		--	23	--	nC

### Drain-Source Diode Characteristics and Maximum Ratings

I <sub>S</sub>	Maximum Continuous Drain-Source Diode Forward Current		--	--	14	A
I <sub>SM</sub>	Maximum Pulsed Drain-Source Diode Forward Current		--	--	56	A
V <sub>SD</sub>	Drain-Source Diode Forward Voltage	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 14 A	--	--	1.5	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 14 A,	--	240	--	ns
Q <sub>rr</sub>	Reverse Recovery Charge	dI <sub>F</sub> / dt = 100 A/μs	--	1.96	--	μC

#### Notes:

1. Repetitive rating : pulse-width limited by maximum junction temperature.
2.  $L = 3.9\text{ mH}, I_{AS} = 14\text{ A}, V_{DD} = 50\text{ V}, R_G = 25\text{ }\Omega$ , starting  $T_J = 25^\circ\text{C}$ .
3.  $I_{SD} \leq 14\text{ A}, di/dt \leq 300\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , starting  $T_J = 25^\circ\text{C}$ .
4. Essentially independent of operating temperature.

## Typical Characteristics

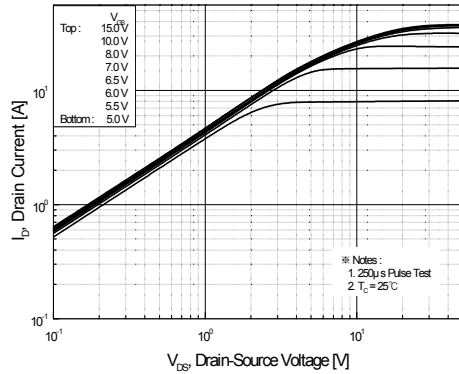


Figure 1. On-Region Characteristics

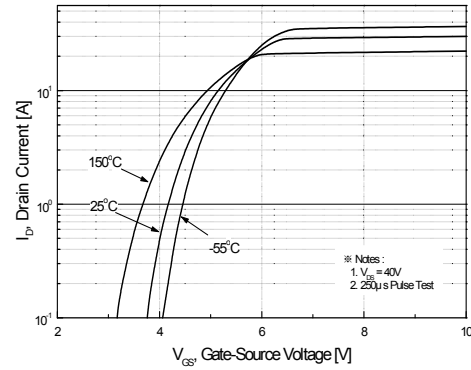


Figure 2. Transfer Characteristics

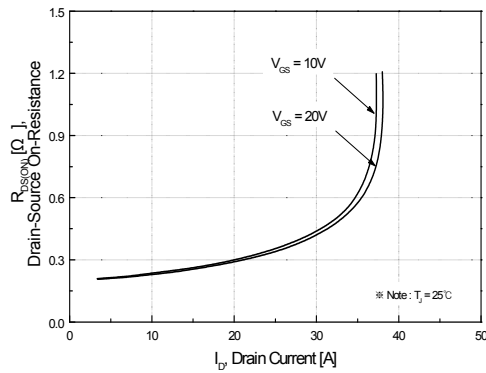


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

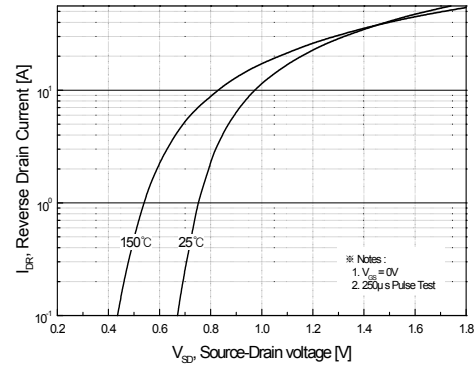


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

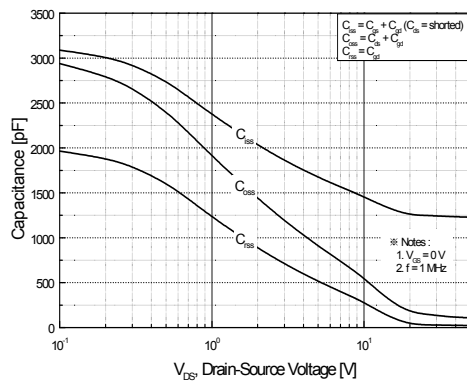


Figure 5. Capacitance Characteristics

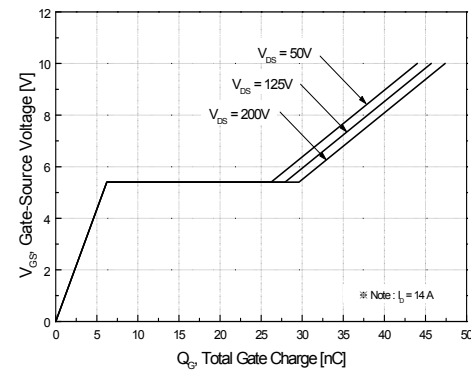


Figure 6. Gate Charge Characteristics

## Typical Characteristics (Continued)

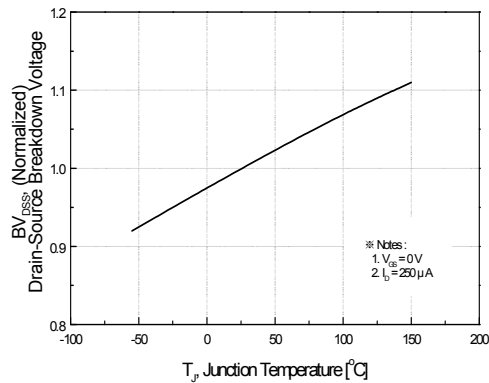


Figure 7. Breakdown Voltage Variation vs Temperature

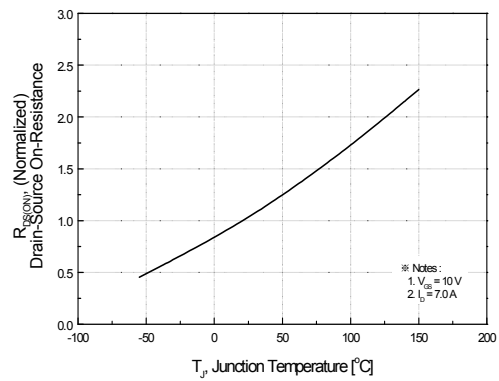


Figure 8. On-Resistance Variation vs Temperature

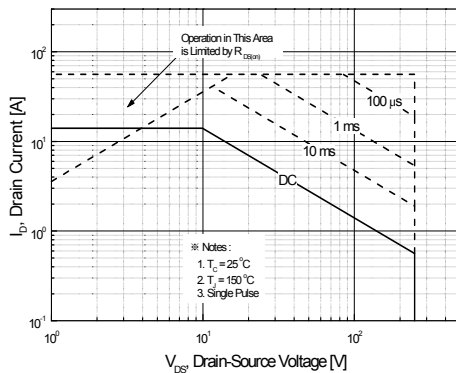


Figure 9. Maximum Safe Operating Area

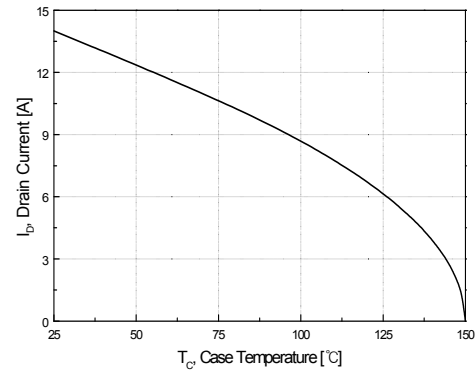


Figure 10. Maximum Drain Current vs Case Temperature

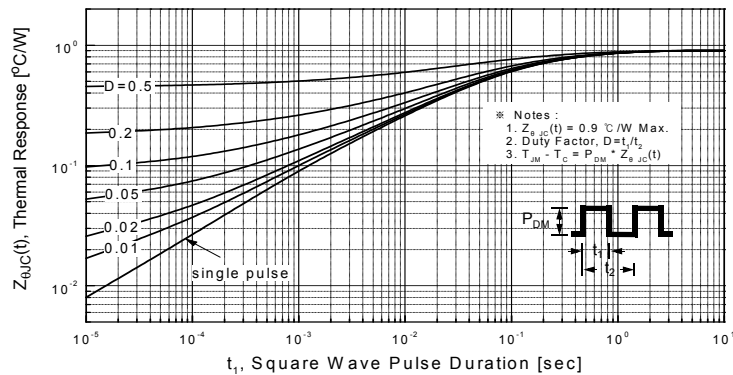


Figure 11. Transient Thermal Response Curve

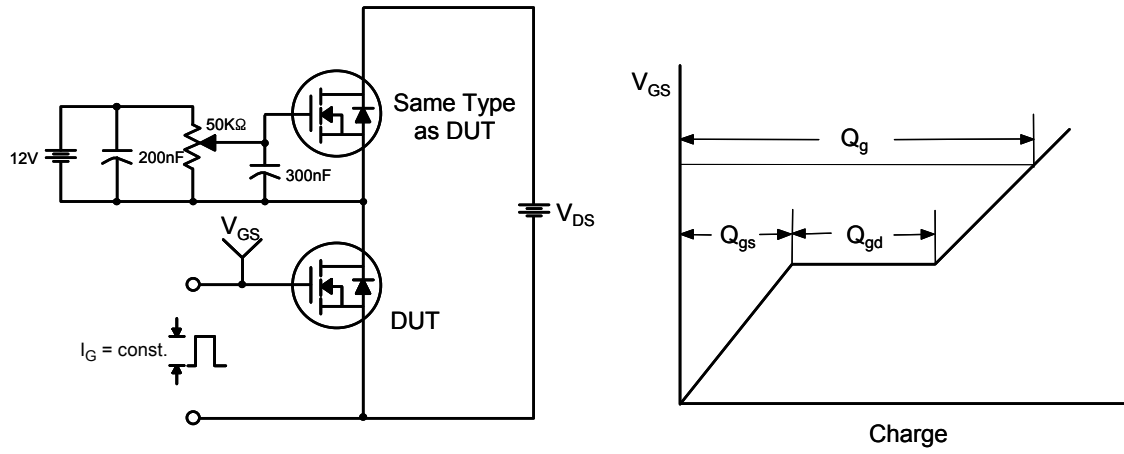


Figure 12. Gate Charge Test Circuit & Waveform

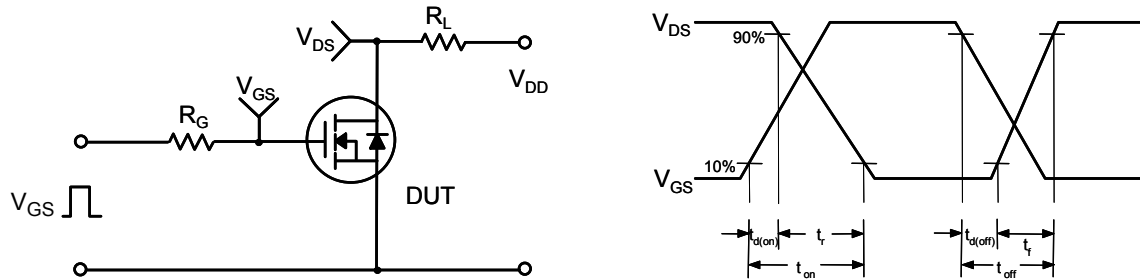


Figure 13. Resistive Switching Test Circuit & Waveforms

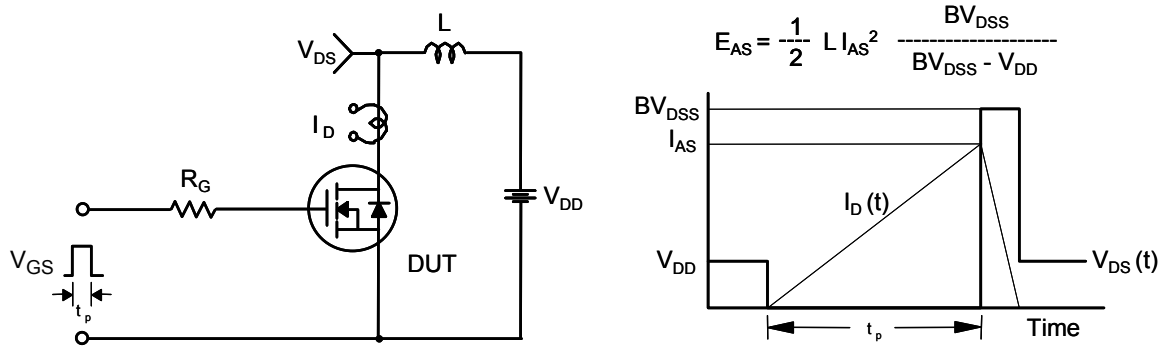
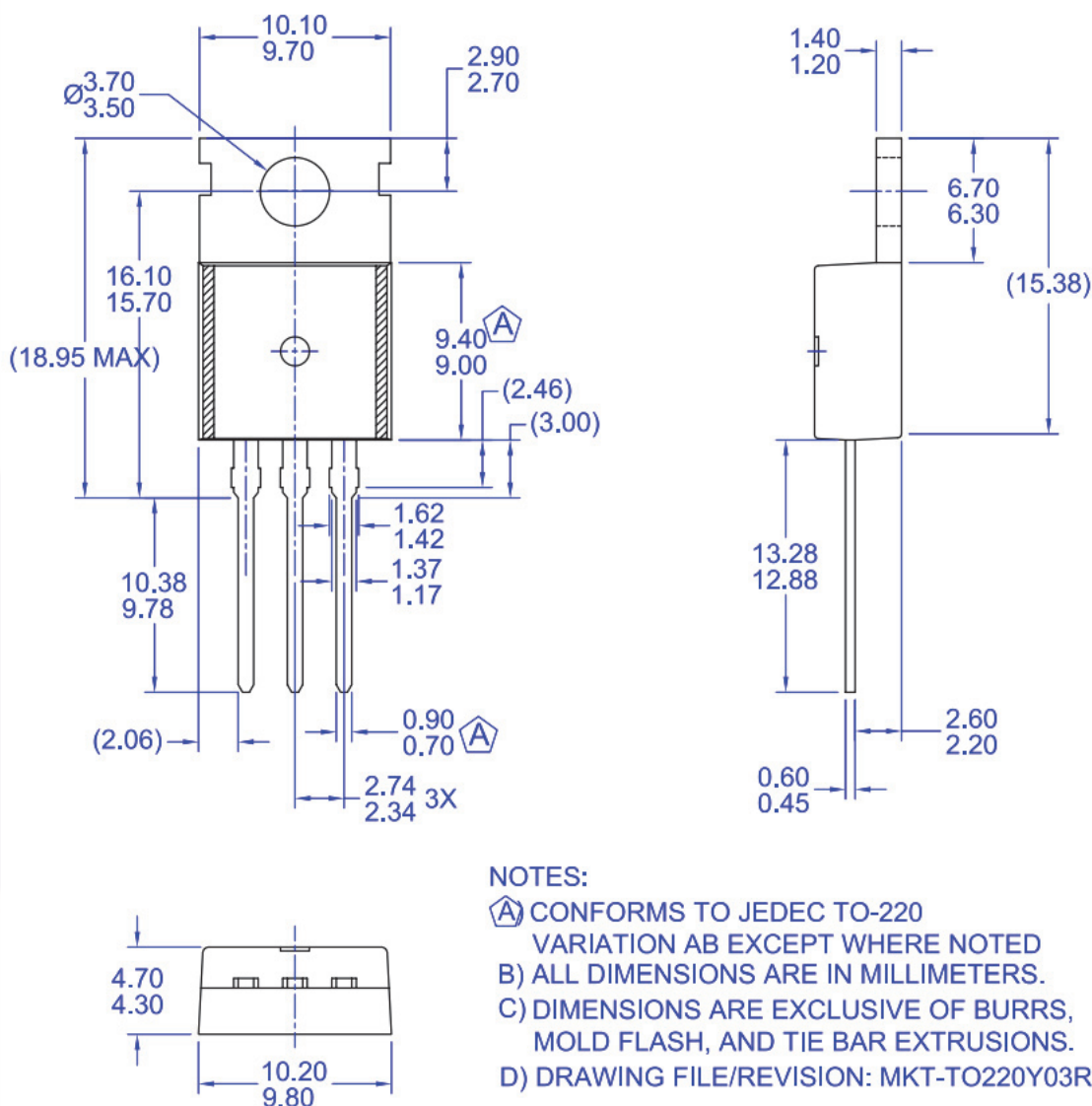


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms



Figure 15. Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms

# Mechanical Dimensions



**Figure 16. TO220, Molded, 3-Lead, Jedec Variation AB**

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