

IRFR320B / IRFU320B

400V N-Channel MOSFET

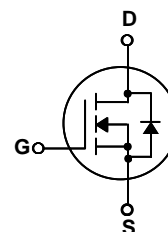
General Description

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 switch mode power supplies and electronic lamp ballasts based on half bridge.

Features

- 3.1A, 400V, $R_{DS(on)} = 1.75\Omega$ @ $V_{GS} = 10V$
- Low gate charge (typical 14 nC)
- Low C_{rss} (typical 11 pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability



Absolute Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	IRFR320B / IRFU320B	Units
V_{DSS}	Drain-Source Voltage	400	V
I_D	Drain Current - Continuous ($T_C = 25^\circ\text{C}$)	3.1	A
	- Continuous ($T_C = 100^\circ\text{C}$)	2.0	A
I_{DM}	Drain Current - Pulsed (Note 1)	12.4	A
V_{GSS}	Gate-Source Voltage	± 30	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	240	mJ
I_{AR}	Avalanche Current (Note 1)	3.1	A
E_{AR}	Repetitive Avalanche Energy (Note 1)	4.1	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.0	V/ns
P_D	Power Dissipation ($T_A = 25^\circ\text{C}$) *	2.5	W
	Power Dissipation ($T_C = 25^\circ\text{C}$)	41	W
	- Derate above 25°C	0.33	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 purposes, 1/8" from case for 5 seconds	300	$^\circ\text{C}$

Thermal Characteristics

Symbol	Parameter	Typ	Max	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	--	3.05	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient *	--	50	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	--	110	$^\circ\text{C/W}$

* When mounted on the minimum pad size recommended (PCB Mount)

Electrical Characteristics

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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Off Characteristics

BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	400	--	--	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$, Referenced to 25°C	--	0.4	--	V/ $^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 400\text{ V}, V_{GS} = 0\text{ V}$	--	--	10	μA
		$V_{DS} = 320\text{ V}, T_C = 125^\circ\text{C}$	--	--	100	μA
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	$V_{GS} = 10\text{ V}, I_D = 1.55\text{ A}$	--	1.4	1.75	Ω
g_{FS}	Forward Transconductance	$V_{DS} = 40\text{ V}, I_D = 1.55\text{ A}$ (Note 4)	--	2.7	--	S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	--	460	600	pF
C_{oss}	Output Capacitance		--	55	72	pF
C_{rss}	Reverse Transfer Capacitance		--	11	15	pF

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 200\text{ V}, I_D = 3.3\text{ A},$ $R_G = 25\text{ }\Omega$ (Note 4, 5)	--	10	30	ns
t_r	Turn-On Rise Time		--	35	80	ns
$t_{d(off)}$	Turn-Off Delay Time		--	35	80	ns
t_f	Turn-Off Fall Time		--	35	80	ns
Q_g	Total Gate Charge	$V_{DS} = 320\text{ V}, I_D = 3.3\text{ A},$ $V_{GS} = 10\text{ V}$ (Note 4, 5)	--	14	18	nC
Q_{gs}	Gate-Source Charge		--	2.7	--	nC
Q_{gd}	Gate-Drain Charge		--	5.6	--	nC

Drain-Source Diode Characteristics and Maximum Ratings

I _S	Maximum Continuous Drain-Source Diode Forward Current		--	--	3.1	A
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	12.4	A
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0 V, I _S = 3.1 A	--	--	1.5	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0 V, I _S = 3.3 A,	--	220	--	ns
Q _{rr}	Reverse Recovery Charge	dI _F / dt = 100 A/μs (Note 4)	--	1.36	--	μC

Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. $L = 43.7\text{ mH}$, $I_{AS} = 3.1\text{ A}$, $V_{DD} = 50\text{ V}$, $R_G = 25\text{ }\Omega$, Starting $T_J = 25^\circ\text{C}$
3. $I_{SD} \leq 3.3\text{ A}$, $dI/dt \leq 200\text{ A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ\text{C}$
4. Pulse Test : Pulse width $\leq 300\mu\text{s}$, Duty cycle $\leq 2\%$
5. Essentially independent of operating temperature

Typical Characteristics

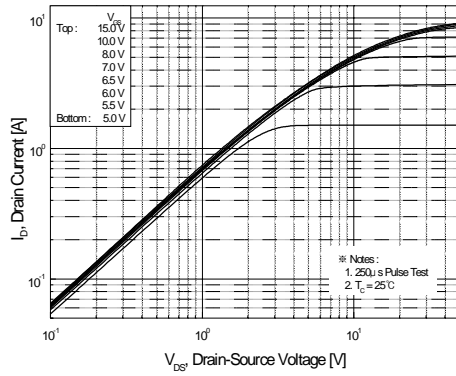


Figure 1. On-Region Characteristics

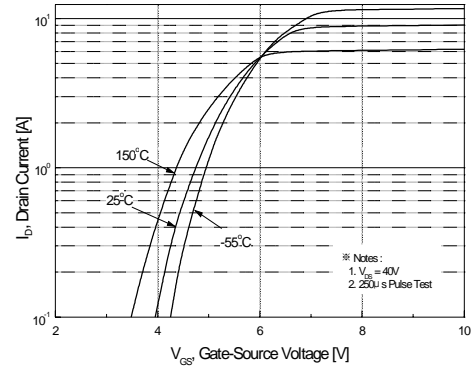


Figure 2. Transfer Characteristics

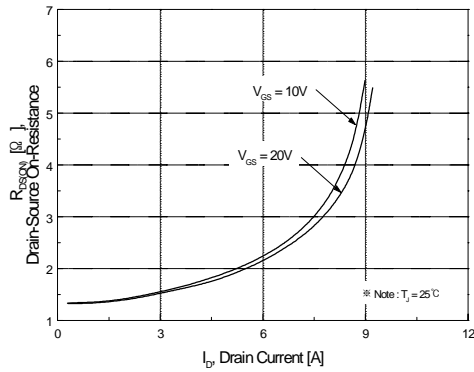


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

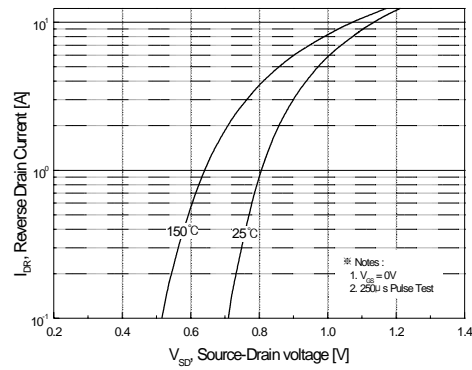


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

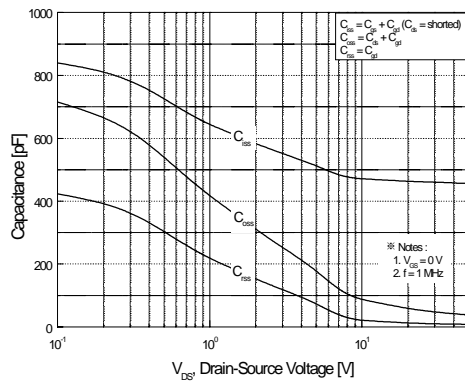


Figure 5. Capacitance Characteristics

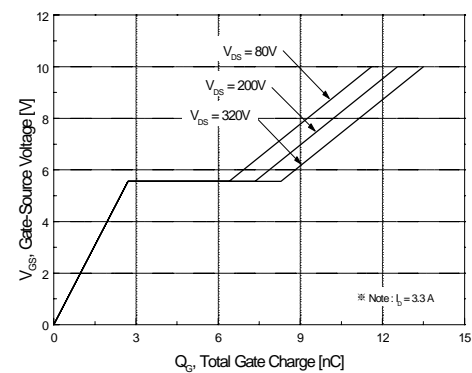


Figure 6. Gate Charge Characteristics

Typical Characteristics (Continued)

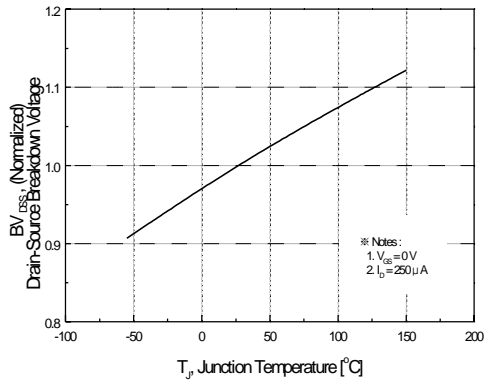


Figure 7. Breakdown Voltage Variation vs Temperature

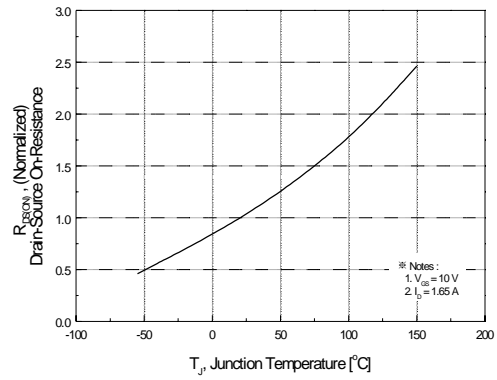


Figure 8. On-Resistance Variation vs Temperature

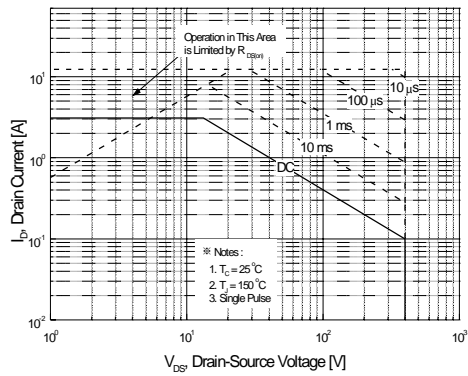


Figure 9. Maximum Safe Operating Area

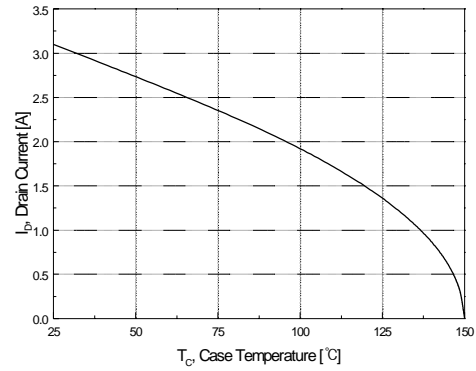


Figure 10. Maximum Drain Current vs Case Temperature

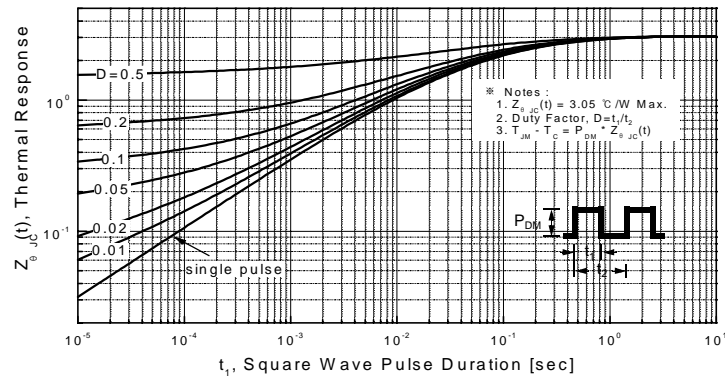
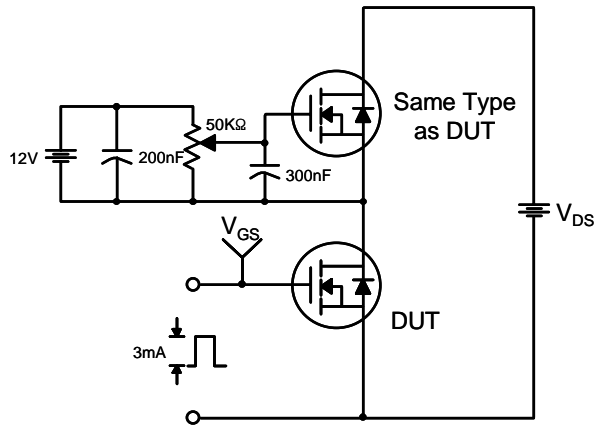
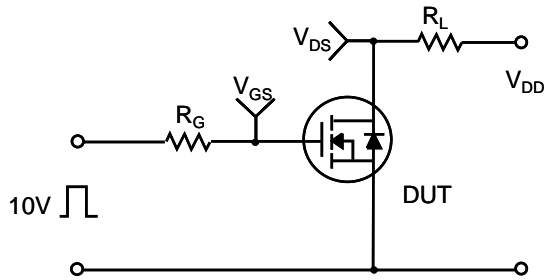


Figure 11. Transient Thermal Response Curve

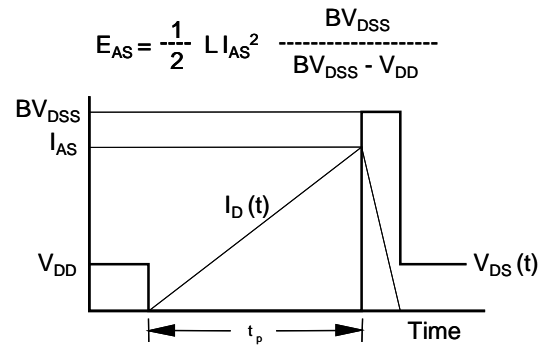
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms



Peak Diode Recovery dv/dt Test Circuit & Waveforms



IRFR320B / IRFU320B

Technical drawing of the 2000 Series 1000V Molded Case Circuit Breaker (MCCB) showing front, side, and top views with dimensions in millimeters.

Front View Dimensions:

- Overall Width: 6.60 ± 0.20
- Internal Width: 5.34 ± 0.30
- Flange Width (each side): (0.50)
- Top Flange Thickness: 0.70 ± 0.20
- Mounting Flange Thickness: 0.60 ± 0.20
- Terminal Mounting Flange Thickness: 0.80 ± 0.20
- Terminal Spacing (center-to-center): 2.30 TYP [2.30 ± 0.20]
- Terminal Width (each): 0.76 ± 0.10
- Terminal Mounting Flange Width (each): 0.89 ± 0.10
- Terminal Mounting Flange Thickness: 0.91 ± 0.10
- Terminal Mounting Flange Width (each): 0.50 ± 0.10
- Terminal Mounting Flange Thickness: 1.02 ± 0.20
- Terminal Mounting Flange Width (each): 2.30 ± 0.20
- Terminal Mounting Flange Thickness: 0.50 ± 0.10
- Terminal Mounting Flange Width (each): 0.89 ± 0.10
- Terminal Mounting Flange Thickness: 0.91 ± 0.10
- Terminal Mounting Flange Width (each): 0.50 ± 0.10
- Terminal Mounting Flange Thickness: 1.02 ± 0.20
- Terminal Mounting Flange Width (each): 2.30 ± 0.20
- Terminal Mounting Flange Thickness: 0.50 ± 0.10

Side View Dimensions:

- Overall Height: 9.50 ± 0.30
- Internal Height: 6.10 ± 0.20
- Terminal Mounting Flange Height: 2.70 ± 0.20
- Terminal Mounting Flange Width (each): 0.76 ± 0.10
- Terminal Mounting Flange Thickness: 0.89 ± 0.10
- Terminal Mounting Flange Width (each): 0.91 ± 0.10
- Terminal Mounting Flange Width (each): 0.50 ± 0.10
- Terminal Mounting Flange Thickness: 1.02 ± 0.20
- Terminal Mounting Flange Width (each): 2.30 ± 0.20
- Terminal Mounting Flange Thickness: 0.50 ± 0.10

Top View Dimensions:

- Overall Width: 6.60 ± 0.20
- Internal Width: (5.34)
- Internal Width: (5.04)
- Internal Width: (1.50)
- Internal Width: (0.70)
- Internal Width: (0.90)
- Internal Width: (1.00)
- Internal Width: (0.10)
- Internal Width: (3.05)
- Internal Width: $(2XR0.25)$
- Internal Width: (0.76 ± 0.10)

Technical drawing of a 3-pin connector. The drawing includes a top view, a side view, and a detail view of the pin profile.

Top View Dimensions:

- Overall width: 6.60 ± 0.20
- Distance between pin centers: 5.34 ± 0.20
- Pin width: 0.76 ± 0.10
- Pin thickness: 0.80 ± 0.10
- Pin length: 9.30 ± 0.30
- Pin tip radius: $R0.10$
- Pin spacing tolerance: $[2.30 \pm 0.20]$

Side View Dimensions:

- Overall height: 16.10 ± 0.30
- Top flange height: 0.60 ± 0.20
- Top flange width: 2.30 ± 0.20
- Top flange thickness: 0.50 ± 0.10
- Top flange depth: 0.50 ± 0.10

Detail View Dimensions:

- Pin tip radius: $R0.10$
- Pin thickness: 0.80 ± 0.10
- Pin width: 0.76 ± 0.10
- Pin length: 9.30 ± 0.30

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