

# **IRF720B/IRFS720B**

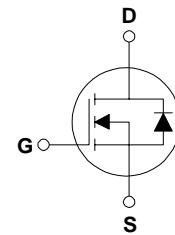
## **400V N-Channel MOSFET**

### **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**

- 3.3A, 400V,  $R_{DS(on)} = 1.75\Omega$  @  $V_{GS} = 10$  V
- 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	IRF720B	IRFS720B	Units
$V_{DSS}$	Drain-Source Voltage	400		V
$I_D$	Drain Current - Continuous ( $T_C = 25^\circ\text{C}$ )	3.3	3.3 *	A
	- Continuous ( $T_C = 100^\circ\text{C}$ )	2.1	2.1 *	A
$I_{DM}$	Drain Current - Pulsed	(Note 1)	13.2	13.2 *
$V_{GSS}$	Gate-Source Voltage		$\pm 30$	V
$E_{AS}$	Single Pulsed Avalanche Energy	(Note 2)	240	mJ
$I_{AR}$	Avalanche Current	(Note 1)	3.3	A
$E_{AR}$	Repetitive Avalanche Energy	(Note 1)	4.9	mJ
$dv/dt$	Peak Diode Recovery $dv/dt$	(Note 3)	5.5	V/ns
$P_D$	Power Dissipation ( $T_C = 25^\circ\text{C}$ )	49	33	W
	- Derate above $25^\circ\text{C}$	0.39	0.27	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	$^\circ\text{C}$

\* Drain current limited by maximum junction temperature

### **Thermal Characteristics**

Symbol	Parameter	IRF720B	IRFS720B	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case Max.	2.57	3.74	$^\circ\text{C}/\text{W}$
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink Typ.	0.5	--	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient Max.	62.5	62.5	$^\circ\text{C}/\text{W}$

## Electrical Characteristics

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
<b>Off Characteristics</b>						
$\text{BV}_{\text{DSS}}$	Drain-Source Breakdown Voltage	$V_{\text{GS}} = 0 \text{ V}$ , $I_D = 250 \mu\text{A}$	400	--	--	V
$\Delta \text{BV}_{\text{DSS}} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}$ , Referenced to $25^\circ\text{C}$	--	0.4	--	$\text{V}/^\circ\text{C}$
$I_{\text{DSS}}$	Zero Gate Voltage Drain Current	$V_{\text{DS}} = 400 \text{ V}$ , $V_{\text{GS}} = 0 \text{ V}$	--	--	10	$\mu\text{A}$
		$V_{\text{DS}} = 320 \text{ V}$ , $T_C = 125^\circ\text{C}$	--	--	100	$\mu\text{A}$
$I_{\text{GSSF}}$	Gate-Body Leakage Current, Forward	$V_{\text{GS}} = 30 \text{ V}$ , $V_{\text{DS}} = 0 \text{ V}$	--	--	100	nA
$I_{\text{GSSR}}$	Gate-Body Leakage Current, Reverse	$V_{\text{GS}} = -30 \text{ V}$ , $V_{\text{DS}} = 0 \text{ V}$	--	--	-100	nA

## On Characteristics

$V_{\text{GS}(\text{th})}$	Gate Threshold Voltage	$V_{\text{DS}} = V_{\text{GS}}$ , $I_D = 250 \mu\text{A}$	2.0	--	4.0	V
$R_{\text{DS}(\text{on})}$	Static Drain-Source On-Resistance	$V_{\text{GS}} = 10 \text{ V}$ , $I_D = 1.65 \text{ A}$	--	1.4	1.75	$\Omega$
$g_{\text{FS}}$	Forward Transconductance	$V_{\text{DS}} = 40 \text{ V}$ , $I_D = 1.65 \text{ A}$ (Note 4)	--	2.8	--	S

## Dynamic Characteristics

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

## Switching Characteristics

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

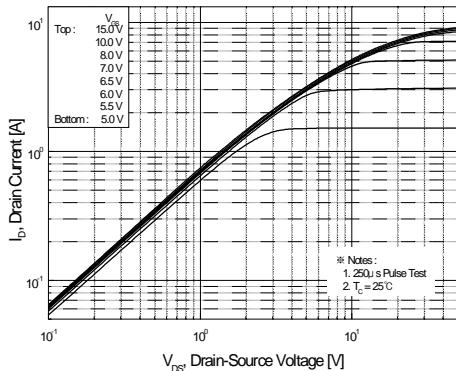
## Drain-Source Diode Characteristics and Maximum Ratings

$I_S$	Maximum Continuous Drain-Source Diode Forward Current	--	--	3.3	A	
$I_{\text{SM}}$	Maximum Pulsed Drain-Source Diode Forward Current	--	--	13.2	A	
$V_{\text{SD}}$	Drain-Source Diode Forward Voltage	$V_{\text{GS}} = 0 \text{ V}$ , $I_S = 3.3 \text{ A}$	--	--	1.5	V
$t_{\text{rr}}$	Reverse Recovery Time	$V_{\text{GS}} = 0 \text{ V}$ , $I_S = 3.3 \text{ A}$ , $dI_F / dt = 100 \text{ A}/\mu\text{s}$	--	220	--	ns
$Q_{\text{rr}}$	Reverse Recovery Charge		--	1.36	--	$\mu\text{C}$

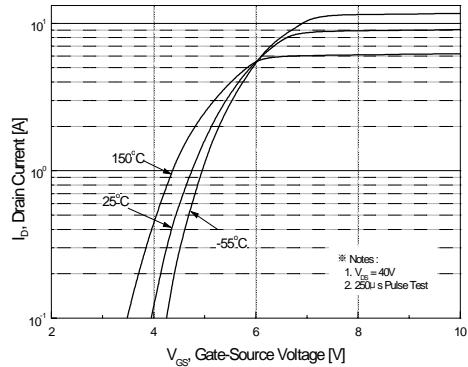
### Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2.  $L = 39\text{mH}$ ,  $I_{AS} = 3.3\text{A}$ ,  $V_{DD} = 50\text{V}$ ,  $R_G = 25 \Omega$ , Starting  $T_J = 25^\circ\text{C}$
3.  $I_{SD} \leq 3.3\text{A}$ ,  $dI/dt \leq 300\text{A}/\mu\text{s}$ ,  $V_{DD} \leq \text{BV}_{\text{DSS}}$ , 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

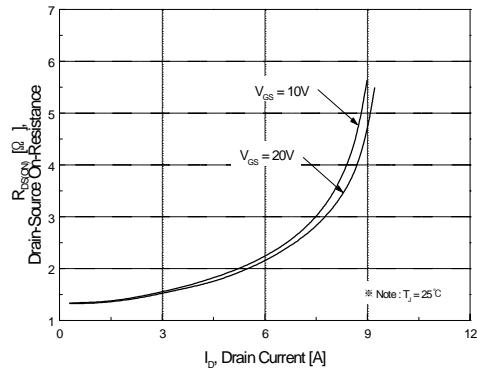
## Typical Characteristics



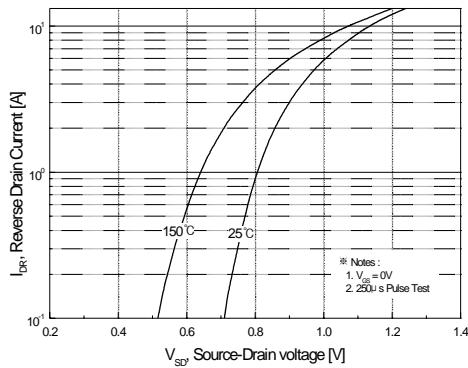
**Figure 1. On-Region Characteristics**



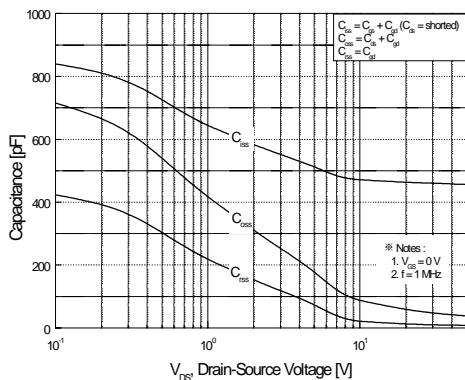
**Figure 2. Transfer Characteristics**



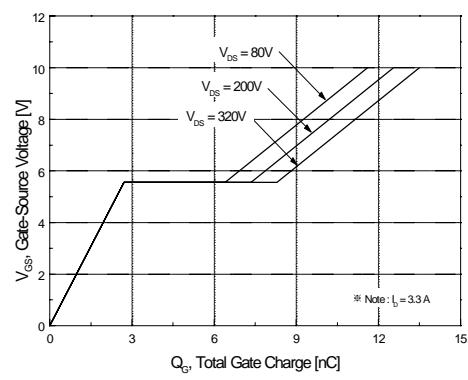
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



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



**Figure 5. Capacitance Characteristics**



**Figure 6. Gate Charge Characteristics**