



FDP39N20 / FDPF39N20

200V N-Channel MOSFET

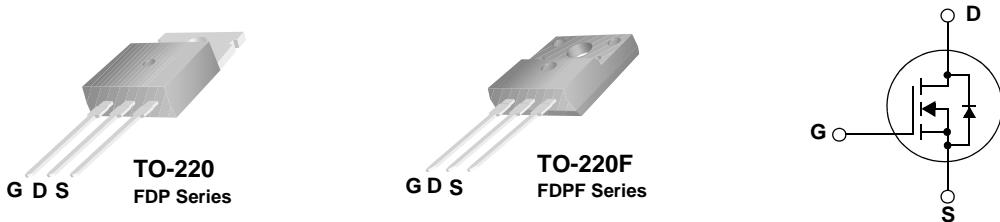
Features

- 39A, 200V, $R_{DS(on)} = 0.066\Omega$ @ $V_{GS} = 10\text{ V}$
- Low gate charge (typical 38 nC)
- Low C_{rss} (typical 57 pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability

Description

These N-Channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, planar stripe, 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 efficient switched mode power supplies and active power factor correction.



Absolute Maximum Ratings

Symbol	Parameter	FDP39N20	FDPF39N20	Unit
V_{DSS}	Drain-Source Voltage	200		V
I_D	Drain Current - Continuous ($T_C = 25^\circ\text{C}$) - Continuous ($T_C = 100^\circ\text{C}$)	39 23.4	39 * 23.4 *	A
I_{DM}	Drain Current - Pulsed	(Note 1)	156	A
V_{GSS}	Gate-Source voltage		±30	V
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	860	mJ
I_{AR}	Avalanche Current	(Note 1)	39	A
E_{AR}	Repetitive Avalanche Energy	(Note 1)	25.1	mJ
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	4.5	V/ns
P_D	Power Dissipation $(T_C = 25^\circ\text{C})$ - Derate above 25°C	251 2.0	59 0.48	W 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 Purpose, 1/8" from Case for 5 Seconds		300	$^\circ\text{C}$

* Drain current limited by maximum junction temperature

Thermal Characteristics

Symbol	Parameter	FDP39N20	FDPF39N20	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	0.5	2.1	$^\circ\text{C}/\text{W}$
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink Typ.	0.5	-	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62.5	62.5	$^\circ\text{C}/\text{W}$

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDP39N20	FDP39N20	TO-220	-	-	50
FDPF39N20	FDPF39N20	TO-220F	-	-	50

Electrical Characteristics

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

Symbol	Parameter	Conditions	Min.	Typ.	Max	Units
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{\text{GS}} = 0\text{V}, I_D = 250\mu\text{A}$	200	--	--	V
$\Delta \text{BV}_{\text{DSS}} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\mu\text{A}$, Referenced to 25°C	--	0.2	--	$\text{V}/^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{\text{DS}} = 200\text{V}, V_{\text{GS}} = 0\text{V}$ $V_{\text{DS}} = 160\text{V}, T_C = 125^\circ\text{C}$	--	--	1 10	μA μA
I_{GSSF}	Gate-Body Leakage Current, Forward	$V_{\text{GS}} = 30\text{V}, V_{\text{DS}} = 0\text{V}$	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	$V_{\text{GS}} = -30\text{V}, V_{\text{DS}} = 0\text{V}$	--	--	-100	nA
On Characteristics						
$V_{\text{GS(th)}}$	Gate Threshold Voltage	$V_{\text{DS}} = V_{\text{GS}}, I_D = 250\mu\text{A}$	3.0	--	5.0	V
$R_{\text{DS(on)}}$	Static Drain-Source On-Resistance	$V_{\text{GS}} = 10\text{V}, I_D = 19.5\text{A}$	--	0.056	0.066	Ω
g_{FS}	Forward Transconductance	$V_{\text{DS}} = 40\text{V}, I_D = 19.5\text{A}$	(Note 4)	--	28.5	--
Dynamic Characteristics						
C_{iss}	Input Capacitance	$V_{\text{DS}} = 25\text{V}, V_{\text{GS}} = 0\text{V}, f = 1.0\text{MHz}$	--	1640	2130	pF
C_{oss}	Output Capacitance		--	400	520	pF
C_{rss}	Reverse Transfer Capacitance		--	57	85	pF
Switching Characteristics						
$t_{\text{d(on)}}$	Turn-On Delay Time	$V_{\text{DD}} = 100\text{V}, I_D = 39\text{A}$ $R_G = 25\Omega$	--	30	70	ns
t_r	Turn-On Rise Time		--	160	330	ns
$t_{\text{d(off)}}$	Turn-Off Delay Time		--	150	310	ns
t_f	Turn-Off Fall Time		--	150	310	ns
Q_g	Total Gate Charge	$V_{\text{DS}} = 160\text{V}, I_D = 39\text{A}$ $V_{\text{GS}} = 10\text{V}$	--	38	49	nC
Q_{gs}	Gate-Source Charge		--	11	--	nC
Q_{gd}	Gate-Drain Charge		--	16.5	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current	--	--	39	--	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current	--	--	156	--	A
V_{SD}	Drain-Source Diode Forward Voltage	$V_{\text{GS}} = 0\text{V}, I_S = 39\text{A}$	--	--	1.4	V
t_{rr}	Reverse Recovery Time	$V_{\text{GS}} = 0\text{V}, I_S = 39\text{A}$ $dI_F/dt = 100\text{A}/\mu\text{s}$	--	152	--	ns
Q_{rr}	Reverse Recovery Charge		--	1.1	--	μC

NOTES:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. $L = 0.85\text{mH}$, $I_{AS} = 39\text{A}$, $V_{DD} = 50\text{V}$, $R_G = 25\Omega$, Starting $T_J = 25^\circ\text{C}$
3. $I_{SD} \leq 39\text{A}$, $dI/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, 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

Typical Performance Characteristics

Figure 1. On-Region Characteristics

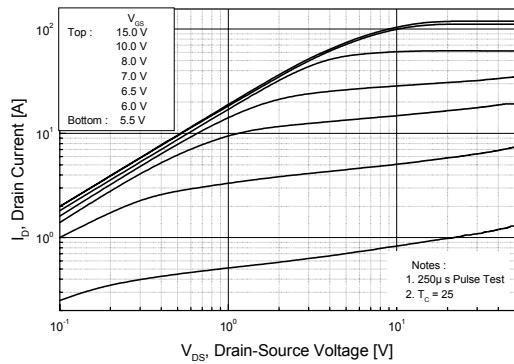


Figure 2. Transfer Characteristics

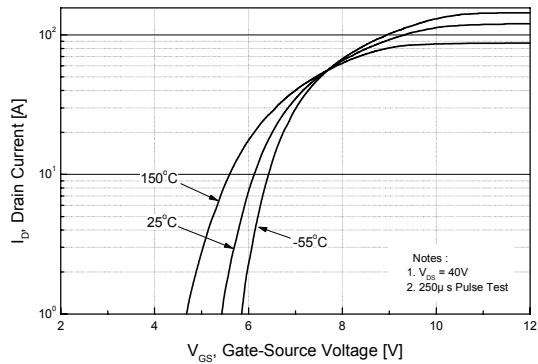


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

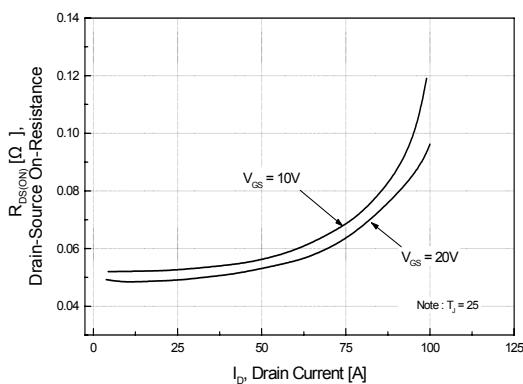


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

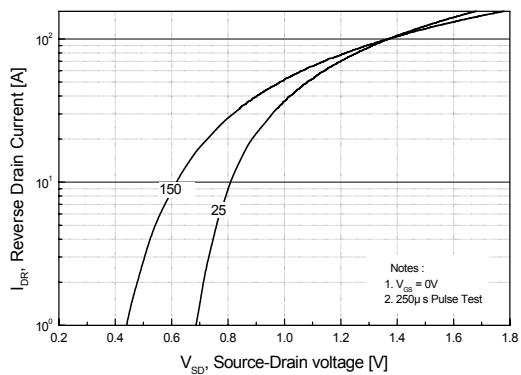


Figure 5. Capacitance Characteristics

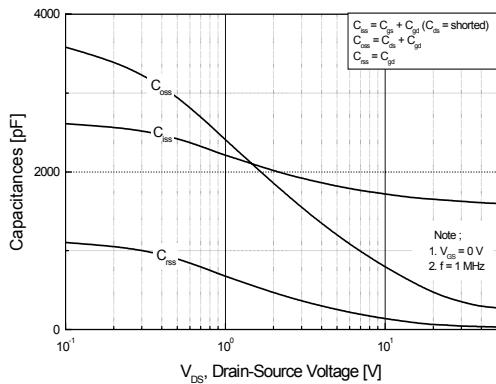


Figure 6. Gate Charge Characteristics

