

# **FDP5N50 / FDPF5N50**

## **N-Channel MOSFET**

**500V, 5A, 1.4Ω**

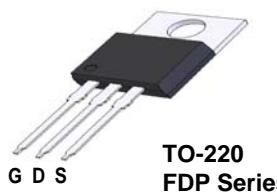
### **Features**

- $R_{DS(on)} = 1.15\Omega$  (Typ.) @  $V_{GS} = 10V$ ,  $I_D = 2.5A$
- Low gate charge (Typ. 11nC)
- Low  $C_{rss}$  (Typ. 5pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability
- RoHS compliant

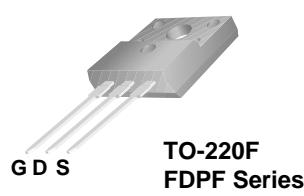
### **Description**

These N-Channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, planar stripe, DMOS technology.

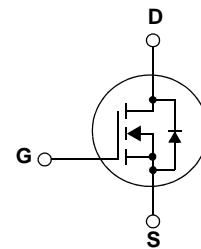
This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficient switched mode power supplies and active power factor correction.



**TO-220  
FDP Series**



**TO-220F  
FDPF Series**



### **MOSFET Maximum Ratings** $T_C = 25^\circ C$ unless otherwise noted\*

Symbol	Parameter		FDP5N50	FDPF5N50	Units
$V_{DSS}$	Drain to Source Voltage		500		V
$V_{GSS}$	Gate to Source Voltage		$\pm 30$		V
$I_D$	Drain Current	-Continuous ( $T_C = 25^\circ C$ )	5	5*	A
		-Continuous ( $T_C = 100^\circ C$ )	3	3*	
$I_{DM}$	Drain Current	- Pulsed (Note 1)	20	20*	A
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)		225		mJ
$I_{AR}$	Avalanche Current (Note 1)		5		A
$E_{AR}$	Repetitive Avalanche Energy (Note 1)		8.5		mJ
$dv/dt$	Peak Diode Recovery $dv/dt$ (Note 3)		4.5		V/ns
$P_D$	Power Dissipation ( $T_C = 25^\circ C$ )		85	28	W
		- Derate above $25^\circ C$	0.67	0.22	$W/^\circ C$
$T_J, T_{STG}$	Operating and Storage Temperature Range		$-55$ to $+150$		$^\circ C$
$T_L$	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds		300		$^\circ C$

\*Drain current limited by maximum junction temperature

### **Thermal Characteristics**

Symbol	Parameter	FDP5N50	FDPF5N50	Units
$R_{\theta JC}$	Thermal Resistance, Junction to Case	1.4	4.5	$^\circ C/W$
$R_{\theta CS}$	Thermal Resistance, Case to Sink Typ.	0.5	-	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	62.5	62.5	

## Package Marking and Ordering Information $T_C = 25^\circ\text{C}$ unless otherwise noted

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDP5N50	FDP5N50	TO-220	-	-	50
FDPF5N50	FDPF5N50	TO-220F	-	-	50

## Electrical Characteristics

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

$\text{BV}_{\text{DSS}}$	Drain to Source Breakdown Voltage	$I_D = 250\mu\text{A}, V_{GS} = 0\text{V}, T_J = 25^\circ\text{C}$	500	-	-	V
$\Delta \text{BV}_{\text{DSS}}/\Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\mu\text{A}, \text{Referenced to } 25^\circ\text{C}$	-	0.6	-	$^\circ\text{C}$
$I_{\text{DSS}}$	Zero Gate Voltage Drain Current	$V_{DS} = 500\text{V}, V_{GS} = 0\text{V}$	-	-	1	$\mu\text{A}$
		$V_{DS} = 400\text{V}, T_C = 125^\circ\text{C}$	-	-	10	
$I_{\text{GSS}}$	Gate to Body Leakage Current	$V_{GS} = \pm 30\text{V}, V_{DS} = 0\text{V}$	-	-	$\pm 100$	nA

### On Characteristics

$V_{GS(\text{th})}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250\mu\text{A}$	3.0	-	5.0	V
$R_{DS(\text{on})}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{V}, I_D = 2.5\text{A}$	-	1.15	1.4	$\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 20\text{V}, I_D = 2.5\text{A}$ (Note 4)	-	4.3	-	S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 25\text{V}, V_{GS} = 0\text{V}$ $f = 1\text{MHz}$	-	480	640	pF
$C_{oss}$	Output Capacitance		-	66	88	pF
$C_{rss}$	Reverse Transfer Capacitance		-	5	8	pF
$Q_{g(\text{tot})}$	Total Gate Charge at 10V	$V_{DS} = 400\text{V}, I_D = 5\text{A}$ $V_{GS} = 10\text{V}$ (Note 4, 5)	-	11	15	nC
$Q_{gs}$	Gate to Source Gate Charge		-	3	-	nC
$Q_{gd}$	Gate to Drain "Miller" Charge		-	5	-	nC

### Switching Characteristics

$t_{d(\text{on})}$	Turn-On Delay Time	$V_{DD} = 250\text{V}, I_D = 5\text{A}$ $R_G = 25\Omega$ (Note 4, 5)	-	13	36	ns
$t_r$	Turn-On Rise Time		-	22	54	ns
$t_{d(\text{off})}$	Turn-Off Delay Time		-	28	66	ns
$t_f$	Turn-Off Fall Time		-	20	50	ns

### Drain-Source Diode Characteristics

$I_S$	Maximum Continuous Drain to Source Diode Forward Current	-	-	5	A
$I_{SM}$	Maximum Pulsed Drain to Source Diode Forward Current	-	-	20	A
$V_{SD}$	Drain to Source Diode Forward Voltage	$V_{GS} = 0\text{V}, I_{SD} = 5\text{A}$	-	-	$1.4$
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0\text{V}, I_{SD} = 5\text{A}$	-	300	-
$Q_{rr}$	Reverse Recovery Charge	$dI_F/dt = 100\text{A}/\mu\text{s}$	(Note 4)	-	$1.8$

#### Notes:

1: Repetitive Rating: Pulse width limited by maximum junction temperature

2:  $L = 18\text{mH}, I_{AS} = 5\text{A}, V_{DD} = 50\text{V}, R_G = 25\Omega$ , Starting  $T_J = 25^\circ\text{C}$

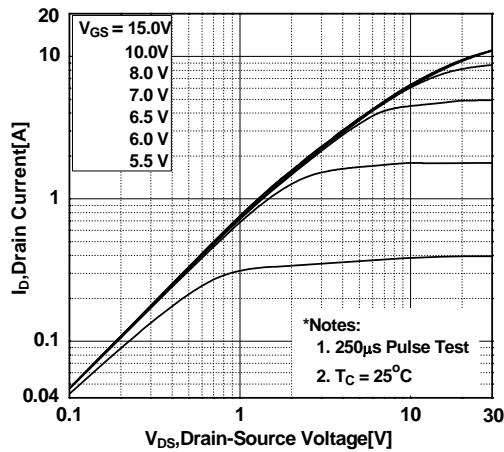
3:  $I_{SD} \leq 5\text{A}, dI/dt \leq 200\text{A}/\mu\text{s}, V_{DD} \leq \text{BV}_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$

4: Pulse Test: Pulse width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2\%$

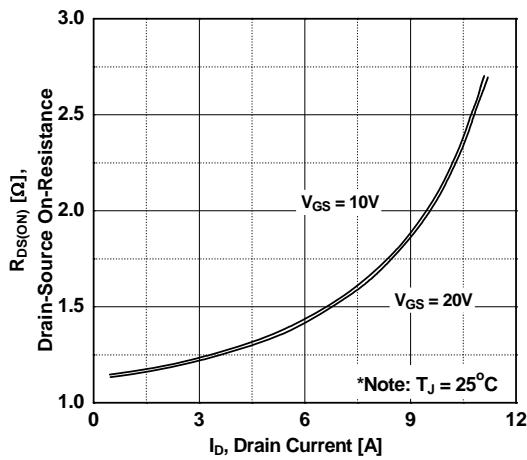
5: Essentially Independent of Operating Temperature Typical Characteristics

## Typical Performance Characteristics

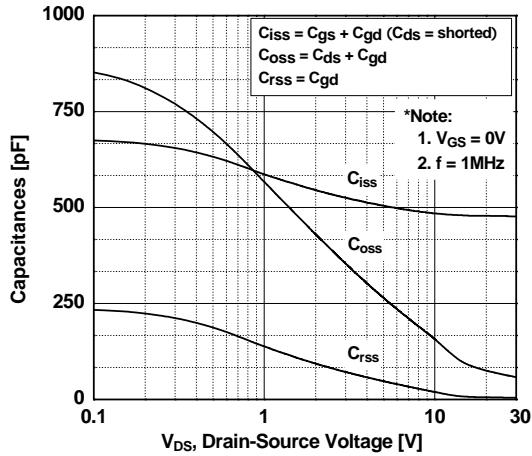
**Figure 1. On-Region Characteristics**



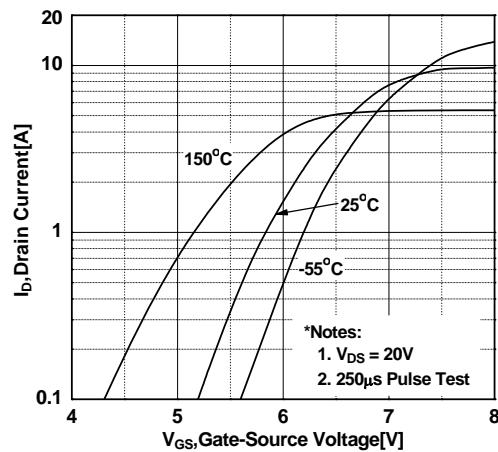
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



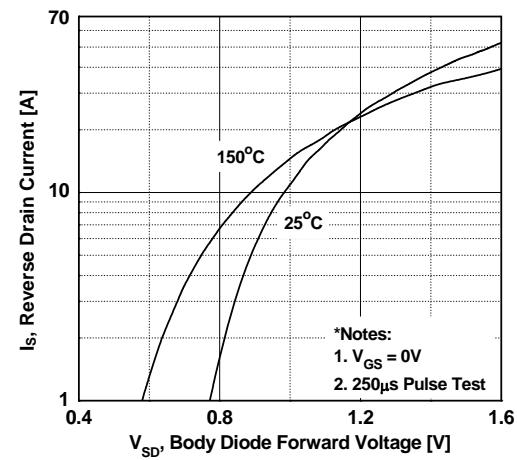
**Figure 5. Capacitance Characteristics**



**Figure 2. Transfer Characteristics**



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



**Figure 6. Gate Charge Characteristics**

