



August 2001

# FDFS2P102A

## Integrated P-Channel PowerTrench<sup>®</sup> MOSFET and Schottky Diode

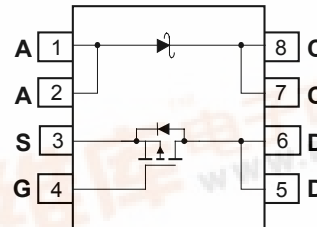
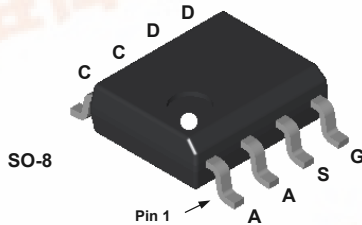
### General Description

The FDFS2P102A combines the exceptional performance of Fairchild's PowerTrench MOSFET technology with a very low forward voltage drop Schottky barrier rectifier in an SO-8 package.

This device is designed specifically as a single package solution for DC to DC converters. It features a fast switching, low gate charge MOSFET with very low on-state resistance. The independently connected Schottky diode allows its use in a variety of DC/DC converter topologies.

### Features

- -3.3 A, -20V  $R_{DS(ON)} = 125\text{ m}\Omega @ V_{GS} = -10\text{ V}$   
 $R_{DS(ON)} = 200\text{ m}\Omega @ V_{GS} = -4.5\text{ V}$
- $V_F < 0.39\text{ V @ } 1\text{ A } (T_J = 125^\circ\text{C})$   
 $V_F < 0.47\text{ V @ } 1\text{ A}$   
 $V_F < 0.58\text{ V @ } 2\text{ A}$
- Schottky and MOSFET incorporated into single power surface mount SO-8 package
- Electrically independent Schottky and MOSFET pinout for design flexibility



### Absolute Maximum Ratings T<sub>A</sub>=25°C unless otherwise noted

Symbol	Parameter	Ratings	Units
V <sub>DSS</sub>	MOSFET Drain-Source Voltage	-20	V
V <sub>GSS</sub>	MOSFET Gate-Source Voltage	±20	V
I <sub>D</sub>	Drain Current – Continuous (Note 1a)	-3.3	A
	– Pulsed	-10	
P <sub>D</sub>	Power Dissipation for Dual Operation	2	W
	Power Dissipation for Single Operation (Note 1a)	1.6	
	(Note 1b)	1	
	(Note 1c)	0.9	
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage Junction Temperature Range	-55 to +150	°C
V <sub>RRM</sub>	Schottky Repetitive Peak Reverse Voltage	20	V
I <sub>O</sub>	Schottky Average Forward Current (Note 1a)	1	A

### Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
FDFS2P102A	FDFS2P102A	13"	12mm	2500 units



### Electrical Characteristics

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

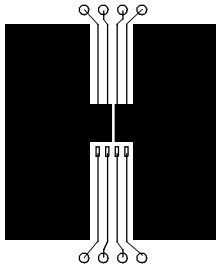
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
<b>Off Characteristics</b>						
$BV_{DSS}$	Drain–Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = -250\ \mu\text{A}$	-20			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = -250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$		-23		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = -16\text{ V}, V_{GS} = 0\text{ V}$			-1	$\mu\text{A}$
$I_{GSSF}$	Gate–Body Leakage, Forward	$V_{GS} = 20\text{ V}, V_{DS} = 0\text{ V}$			100	nA
$I_{GSSR}$	Gate–Body Leakage, Reverse	$V_{GS} = -20\text{ V}, V_{DS} = 0\text{ V}$			-100	nA
<b>On Characteristics (Note 2)</b>						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = -250\ \mu\text{A}$	-1	-1.8	-3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	$I_D = -250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$		4.4		mV/ $^\circ\text{C}$
$R_{DS(on)}$	Static Drain–Source On–Resistance	$V_{GS} = -10\text{ V}, I_D = -3.3\text{ A}$ $V_{GS} = -4.5\text{ V}, I_D = -2.5\text{ A}$ $V_{GS} = -10\text{ V}, I_D = -3.3\text{ A}, T_J = 125^\circ\text{C}$		96 152 137	125 200 190	m $\Omega$
$I_{D(on)}$	On–State Drain Current	$V_{GS} = -10\text{ V}, V_{DS} = -5\text{ V}$	-10			A
$g_{FS}$	Forward Transconductance	$V_{DS} = -5\text{ V}, I_D = -3.3\text{ A}$		4.6		S
<b>Dynamic Characteristics</b>						
$C_{iss}$	Input Capacitance	$V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V},$		182		pF
$C_{oss}$	Output Capacitance	$f = 1.0\text{ MHz}$		60		pF
$C_{rss}$	Reverse Transfer Capacitance			24		pF
<b>Switching Characteristics (Note 2)</b>						
$t_{d(on)}$	Turn–On Delay Time	$V_{DD} = -10\text{ V}, I_D = -1\text{ A},$		5	10	ns
$t_r$	Turn–On Rise Time	$V_{GS} = -10\text{ V}, R_{GEN} = 6\ \Omega$		14	52	ns
$t_{d(off)}$	Turn–Off Delay Time			11	20	ns
$t_f$	Turn–Off Fall Time			2	4	ns
$Q_g$	Total Gate Charge	$V_{DS} = -10\text{ V}, I_D = -3.3\text{ A},$		2.1	3.0	nC
$Q_{gs}$	Gate–Source Charge	$V_{GS} = -5\text{ V}$		1.0		nC
$Q_{gd}$	Gate–Drain Charge			0.6		nC
<b>Drain–Source Diode Characteristics and Maximum Ratings</b>						
$I_S$	Maximum Continuous Drain–Source Diode Forward Current				-1.3	A
$V_{SD}$	Drain–Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = -1.3\text{ A}$ (Note 2)		-0.8	-1.2	V
<b>Schottky Diode Characteristics</b>						
$I_R$	Reverse Leakage	$V_R = 20\text{ V}$	$T_J = 25^\circ\text{C}$		50	$\mu\text{A}$
			$T_J = 125^\circ\text{C}$		18	mA
$V_F$	Forward Voltage	$I_F = 1\text{ A}$	$T_J = 25^\circ\text{C}$		0.47	V
			$T_J = 125^\circ\text{C}$		0.39	
		$I_F = 2\text{ A}$	$T_J = 25^\circ\text{C}$		0.58	
			$T_J = 125^\circ\text{C}$		0.53	

## Thermal Characteristics

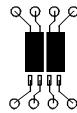
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1a)	78	$^{\circ}\text{C}/\text{W}$
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Note 1)	40	$^{\circ}\text{C}/\text{W}$

**Notes:**

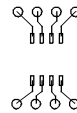
1.  $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.



a) 78 $^{\circ}\text{C}/\text{W}$  when mounted on a 0.5 in<sup>2</sup> pad of 2 oz copper



b) 125 $^{\circ}\text{C}/\text{W}$  when mounted on a 0.02 in<sup>2</sup> pad of 2 oz copper



c) 135 $^{\circ}\text{C}/\text{W}$  when mounted on a minimum pad.

Scale 1 : 1 on letter size paper

2. Pulse Test: Pulse Width < 300 $\mu\text{s}$ , Duty Cycle < 2.0%

## Typical Characteristics

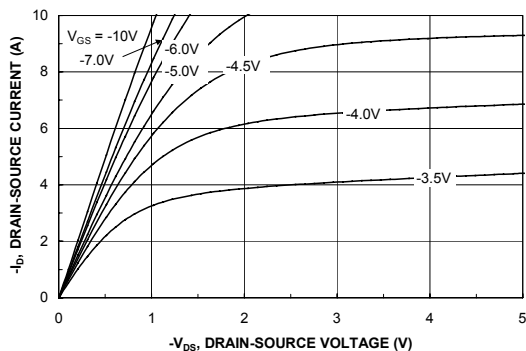


Figure 1. On-Region Characteristics.

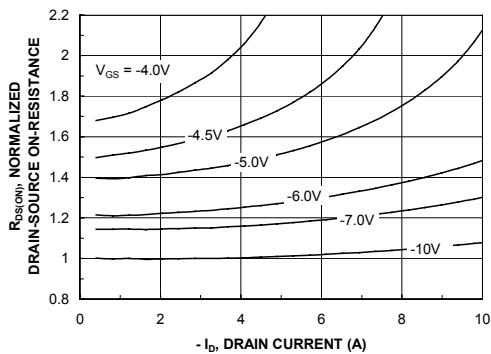


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

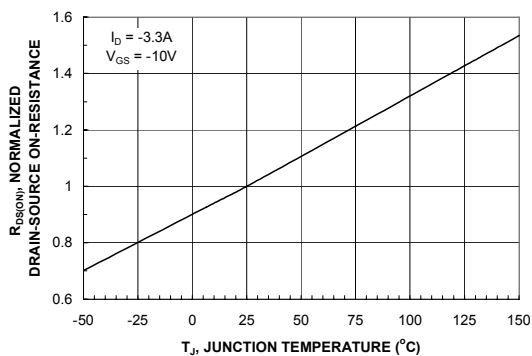


Figure 3. On-Resistance Variation with Temperature.

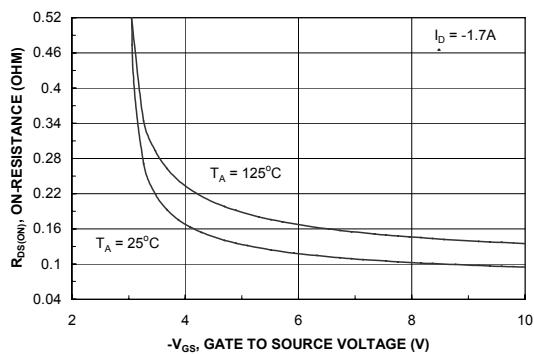


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

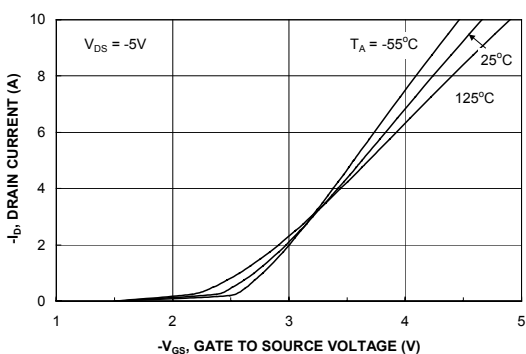


Figure 5. Transfer Characteristics.

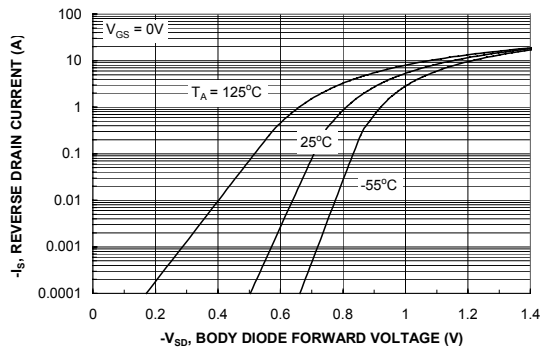
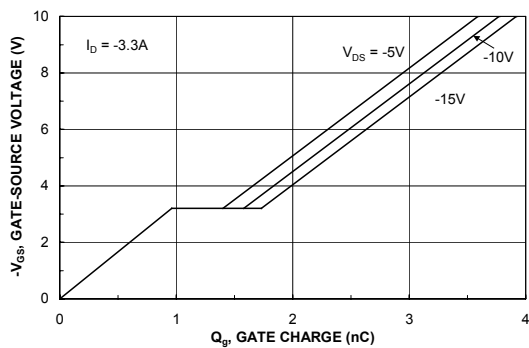
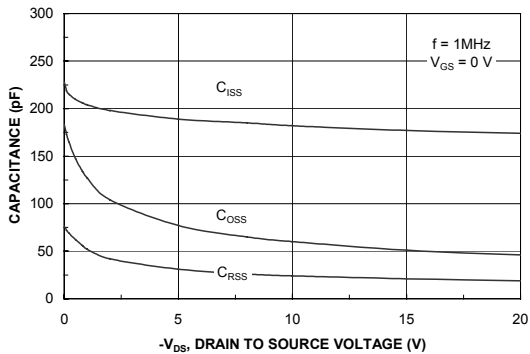


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

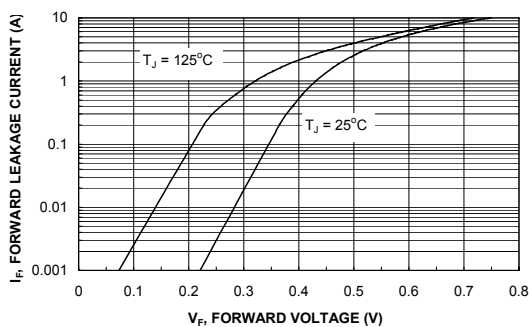
## Typical Characteristics



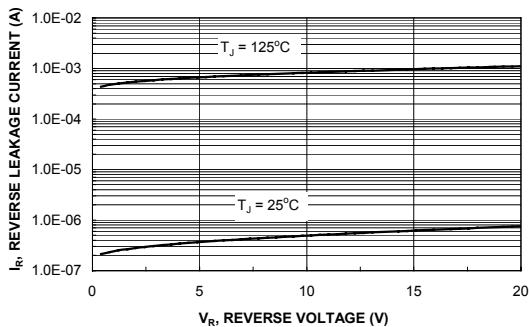
**Figure 7. Gate Charge Characteristics.**



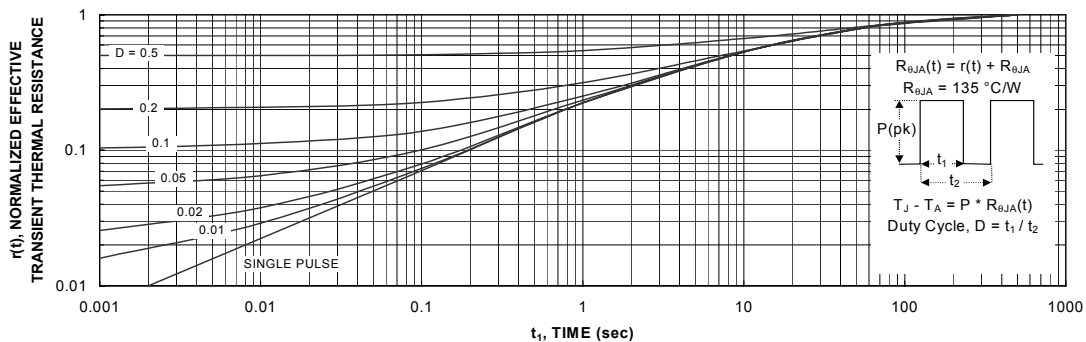
**Figure 8. Capacitance Characteristics.**



**Figure 9. Schottky Diode Forward Voltage.**



**Figure 10. Schottky Diode Reverse Current.**



**Figure 11. Transient Thermal Response Curve.**

Thermal characterization performed using the conditions described in Note 1c.  
Transient thermal response will change depending on the circuit board design.

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