



October 2000

FDFS2P102

Integrated P-Channel MOSFET and Schottky Diode

General Description

The FDFS2P102 combines the exceptional performance of Fairchild's high cell density MOSFET with a very low forward voltage drop Schottky barrier rectifier in an SO-8 package.

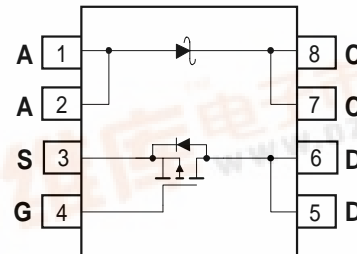
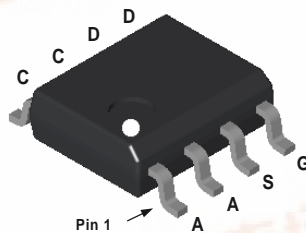
This device is designed specifically as a single package solution for DC to DC converters. It features a fast switching, low gate charge MOSFET with very low on-state resistance. The independently connected Schottky diode allows its use in a variety of DC/DC converter topologies.

Applications

- DC/DC converters
- Load Switch
- Motor Drives

Features

- -3.3 A , -20 V . $R_{DS(ON)} = 0.125\ \Omega$ @ $V_{GS} = -10\text{ V}$
 $R_{DS(ON)} = 0.200\ \Omega$ @ $V_{GS} = -4.5\text{ V}$.
- $V_F < 0.39\text{ V}$ @ 1 A ($T_J = 125\text{ }^\circ\text{C}$).
 $V_F < 0.47\text{ V}$ @ 1 A .
 $V_F < 0.58\text{ V}$ @ 2 A .
- Schottky and MOSFET incorporated into single power surface mount SO-8 package.
- Electrically independent Schottky and MOSFET pinout for design flexibility.



MOSFET Maximum Ratings

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

Symbol	Parameter	Ratings	Units
V_{DSS}	Drain-Source Voltage	-20	V
V_{GSS}	Gate-Source Voltage	± 20	V
I_D	Drain Current - Continuous (Note 1a)	-3.3	A
	- Pulsed	-20	
P_D	Power Dissipation for Dual Operation	2	W
	Power Dissipation for Single Operation (Note 1a)	1.6	
	(Note 1b)	1	
	(Note 1c)	0.9	
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150	$^\circ\text{C}$

Schottky Diode Maximum Ratings

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

V_{RRM}	Repetitive Peak Reverse Voltage	20	V
I_O	Average Forward Current (Note 1a)	1	A

Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape Width	Quantity
FDFS2P102	FDFS2P102	13	12mm	2500 units



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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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Off Characteristics

BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = -250\text{ }\mu\text{A}$	-20			V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = -16\text{ V},$ $V_{GS} = 0\text{ V}$			-1	μA
		$T_J = 55^\circ\text{C}$			-10	
I_{GSSF}	Gate-Body Forward Leakage	$V_{GS} = 20\text{ V}, V_{DS} = 0\text{ V}$			100	nA
I_{GSSR}	Gate-Body Reverse Leakage	$V_{GS} = -20\text{ V}, V_{DS} = 0\text{ V}$			-100	nA

On Characteristics (Note 2)

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = -250\text{ }\mu\text{A}$	-1	-1.4	-2	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = -10\text{ V}, I_D = -3.3\text{ A}$ $V_{GS} = -4.5\text{ V}, I_D = -2.5\text{ A}$		0.100 0.167	0.125 0.2	Ω
$I_{D(on)}$	On-State Drain Current	$V_{GS} = -10\text{ V}, V_{DS} = -5\text{ V}$	-10			A
g_{FS}	Forward Transconductance	$V_{DS} = -10\text{ V}, I_D = -3.3\text{ A}$		5		S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$		270		pF
C_{oss}	Output Capacitance			150		pF
C_{rss}	Reverse Transfer Capacitance			45		pF

Switching Characteristics (Note 2)

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = -15\text{ V}, I_D = -1\text{ A},$ $V_{GS} = -10\text{ V}, R_{GEN} = 6\text{ }\Omega$		8	16	ns
t_r	Turn-On Rise Time			7	14	ns
$t_{d(off)}$	Turn-Off Delay Time			17	27	ns
t_f	Turn-Off Fall Time			10	1.8	ns
Q_g	Total Gate Charge	$V_{DS} = -5\text{ V}, I_D = -3.3\text{ A},$ $V_{GS} = -10\text{ V},$		7	10	nC

Drain-Source Diode Characteristics and Maximum Ratings

I _S	Maximum Continuous Drain-Source Diode Forward Current				-1.3	A
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0 V, I _S = -1.3 A (Note 2)		-0.8	-1.2	V

Schottky Diode Characteristics

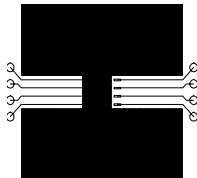
I_R	Reverse Leakage	$V_R = 20\text{ V}$	$T_J = 25^\circ\text{C}$		250	μA
			$T_J = 125^\circ\text{C}$		18	mA
V_F	Forward Voltage	$I_F = 1\text{ A}$	$T_J = 25^\circ\text{C}$		0.47	V
			$T_J = 125^\circ\text{C}$		0.39	
		$I_F = 2\text{ A}$	$T_J = 25^\circ\text{C}$		0.58	
			$T_J = 125^\circ\text{C}$		0.53	

Thermal Characteristics

R_{JA}	Thermal Resistance, Junction-to-Ambient	(Note 1a)	78	
R_{JC}	Thermal Resistance, Junction-to-Case	(Note 1)	40	

Notes:

- 1: $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient 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) 50°C/W when mounted on a 1 in^2 pad of 2 oz. copper.



b) 105°C/W when mounted on a 0.04 in^2 pad of 2 oz. copper.



c) 125°C/W when mounted on a minimum pad.

Scale 1 : 1 on letter size paper

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

Typical Characteristics

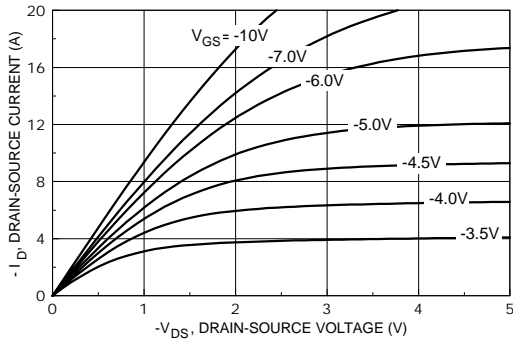


Figure 1. On-Region Characteristics.

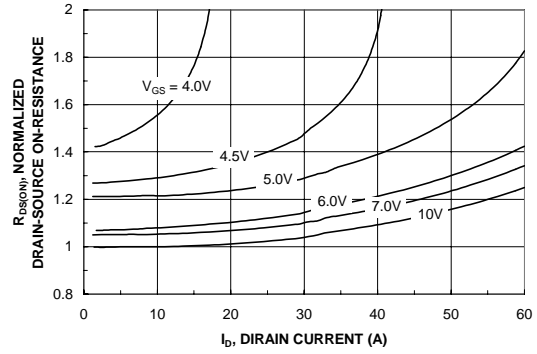


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

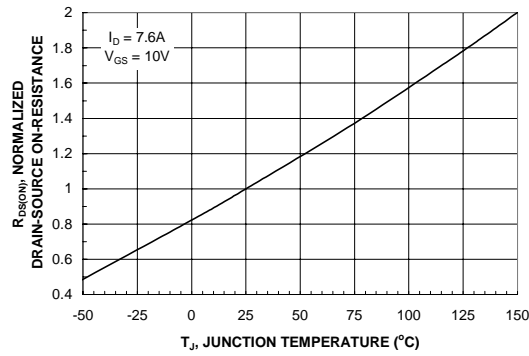


Figure 3. On-Resistance Variation with Temperature.

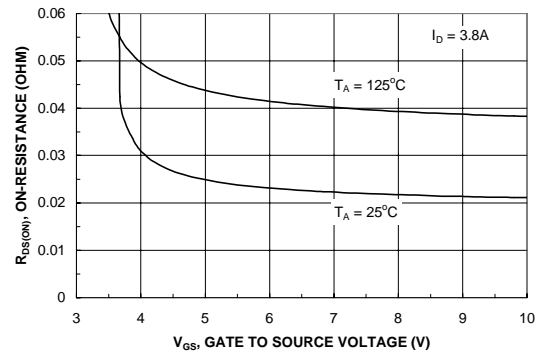


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

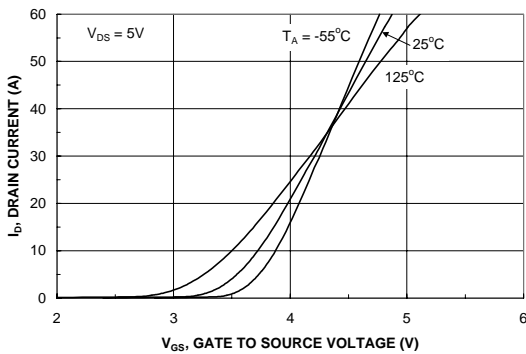


Figure 5. Transfer Characteristics.

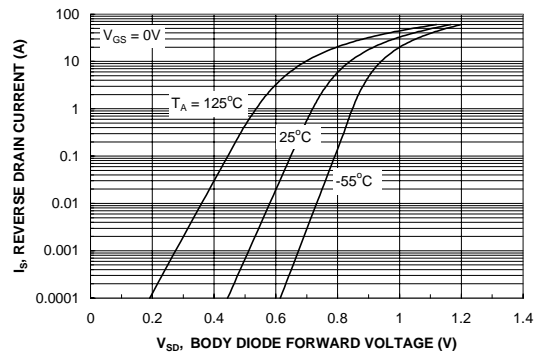


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics (continued)

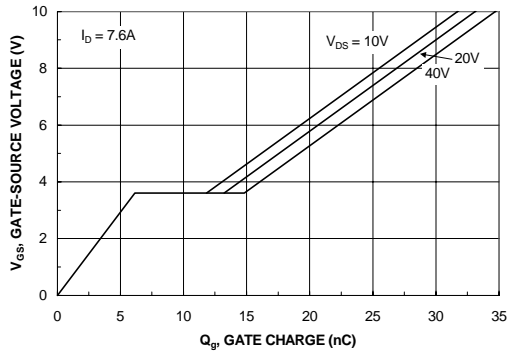


Figure 7. Gate-Charge Characteristics.

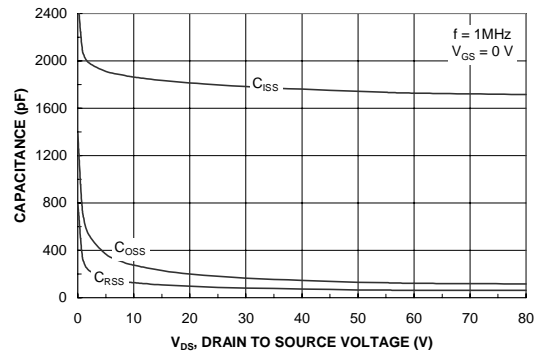


Figure 8. Capacitance Characteristics.

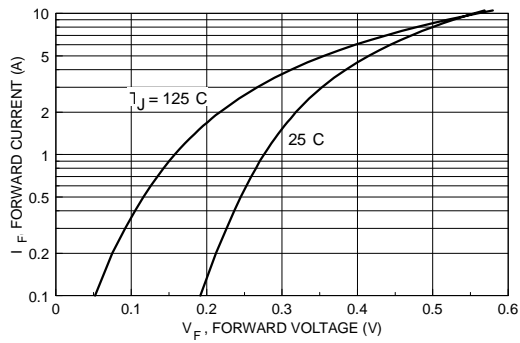


Figure 9. Schottky Diode Forward Voltage.

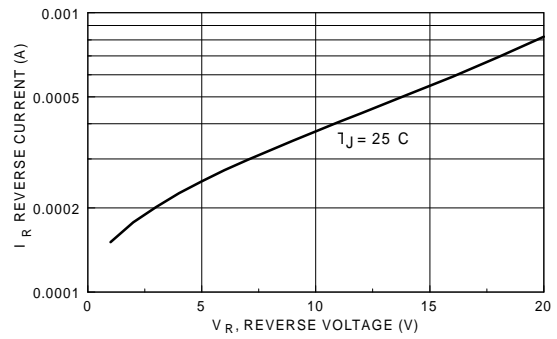


Figure 10. Schottky Diode Reverse Current.

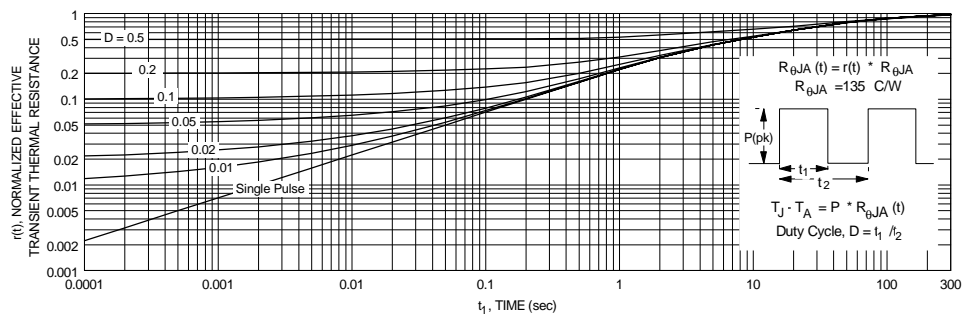


Figure 11. Transient Thermal Response Curve.

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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