

# 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.

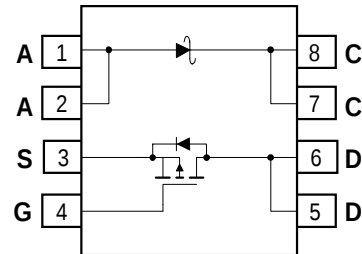
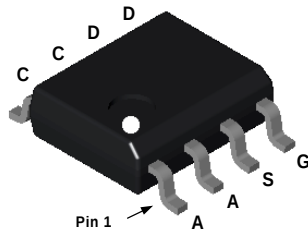
This device is designed specifically as a single package solution for DC to DC converters. It features a fast switching, low gate charge MOSFET with very low on-state resistance. The independently connected Schottky diode allows its use in a variety of DC/DC converter topologies.

### Applications

- DC/DC converters
- Load Switch
- Motor Drives

### Features

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



### 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                                                                                                | $\pm 20$             | V                |
| $I_D$          | Drain Current - Continuous (Note 1a)<br>- Pulsed                                                                   | -3.3<br>-20          | A                |
| $P_D$          | Power Dissipation for Dual Operation<br>Power Dissipation for Single Operation (Note 1a)<br>(Note 1b)<br>(Note 1c) | 2<br>1.6<br>1<br>0.9 | W                |
| $T_J, T_{STG}$ | 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 |
|--------|-----------|-----------------|-----|-----|-----|-------|
|--------|-----------|-----------------|-----|-----|-----|-------|

**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 | $V_{DS} = -16\text{ V},$<br>$V_{GS} = 0\text{ V}$    |     |  | -1   | $\mu\text{A}$ |
|            |                                 | $T_1 = 55^\circ\text{C}$                             |     |  | -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 | $V_{GS} = -10\text{ V}, I_D = -3.3\text{ A}$     |     | 0.100 | 0.125 | $\Omega$ |
|              |                                   | $V_{GS} = -4.5\text{ V}, I_D = -2.5\text{ A}$    |     | 0.167 | 0.2   |          |
| $I_{D(on)}$  | 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            | $V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V},$<br>$f = 1.0\text{ MHz}$ |  | 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  | $V_{DD} = -15\text{ V}, I_D = -1\text{ A},$<br>$V_{GS} = -10\text{ V}, R_{GEN} = 6\text{ }\Omega$ |  | 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   | $V_{DS} = -5\text{ V}, I_D = -3.3\text{ A},$<br>$V_{GS} = -10\text{ V},$                          |  | 7  | 10  | nC |

**Drain-Source Diode Characteristics and Maximum Ratings**

|                 |                                                       |                                                |          |  |  |      |      |   |
|-----------------|-------------------------------------------------------|------------------------------------------------|----------|--|--|------|------|---|
| I <sub>S</sub>  | Maximum Continuous Drain-Source Diode Forward Current |                                                |          |  |  | -1.3 | A    |   |
| V <sub>SD</sub> | Drain-Source Diode Forward Voltage                    | V <sub>GS</sub> = 0 V, I <sub>S</sub> = -1.3 A | (Note 2) |  |  | -0.8 | -1.2 | V |

**Schottky Diode Characteristics**

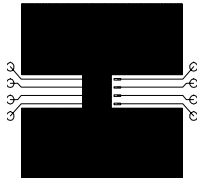
|       |                 |                     |                           |  |      |               |
|-------|-----------------|---------------------|---------------------------|--|------|---------------|
| $I_R$ | Reverse Leakage | $V_R = 20\text{ V}$ | $T_1 = 25^\circ\text{C}$  |  | 250  | $\mu\text{A}$ |
|       |                 |                     | $T_1 = 125^\circ\text{C}$ |  | 18   | mA            |
| $V_F$ | Forward Voltage | $I_F = 1\text{ A}$  | $T_1 = 25^\circ\text{C}$  |  | 0.47 | V             |
|       |                 |                     | $T_1 = 125^\circ\text{C}$ |  | 0.39 |               |
|       |                 | $I_F = 2\text{ A}$  | $T_1 = 25^\circ\text{C}$  |  | 0.58 |               |
|       |                 |                     | $T_1 = 125^\circ\text{C}$ |  | 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)  $50^\circ\text{C/W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz. copper.



b)  $105^\circ\text{C/W}$  when mounted on a 0.04 in<sup>2</sup> pad of 2 oz. copper.



c)  $125^\circ\text{C/W}$  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

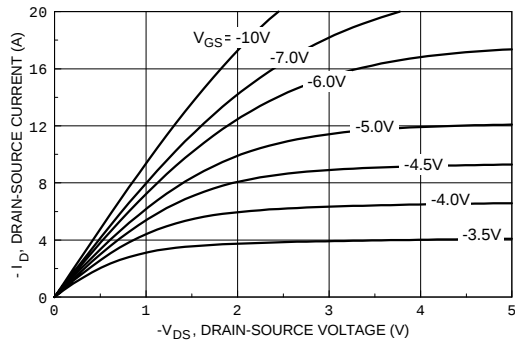


Figure 1. On-Region Characteristics.

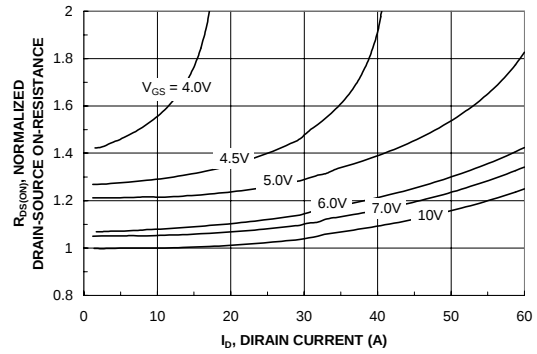


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

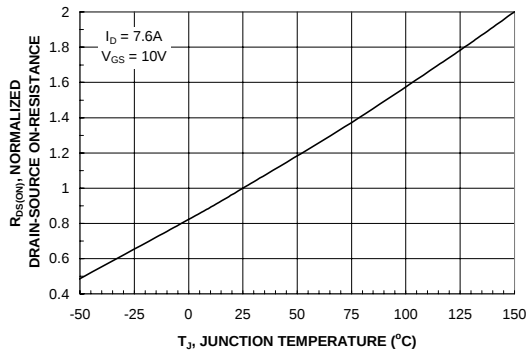


Figure 3. On-Resistance Variation with Temperature.

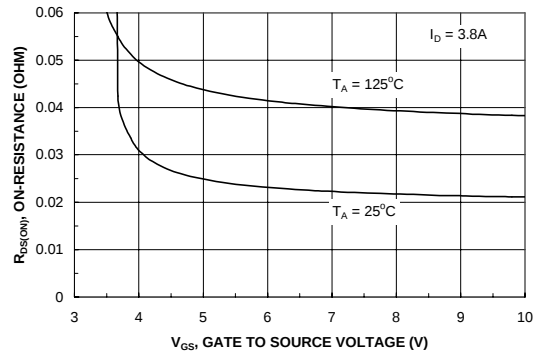


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

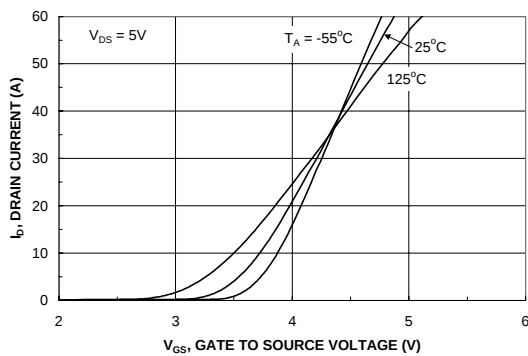


Figure 5. Transfer Characteristics.

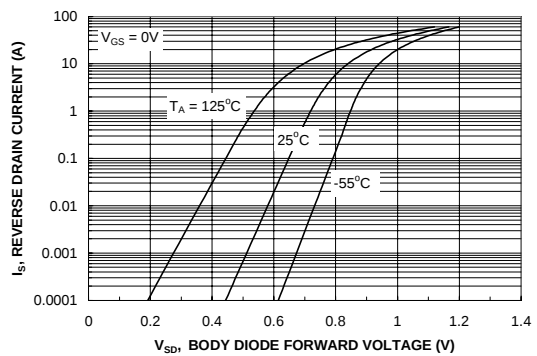


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

## Typical Characteristics (continued)

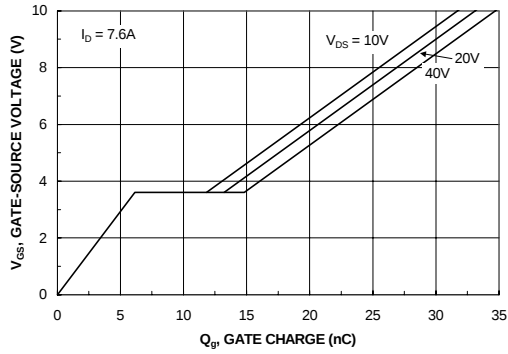


Figure 7. Gate-Charge Characteristics.

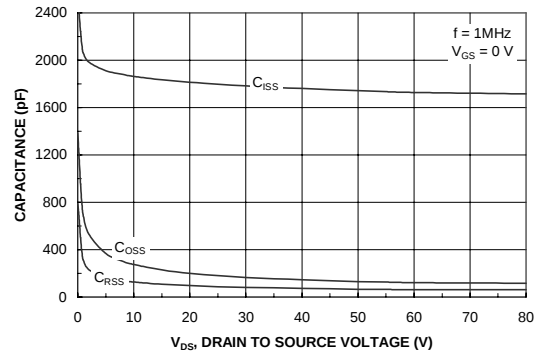


Figure 8. Capacitance Characteristics.

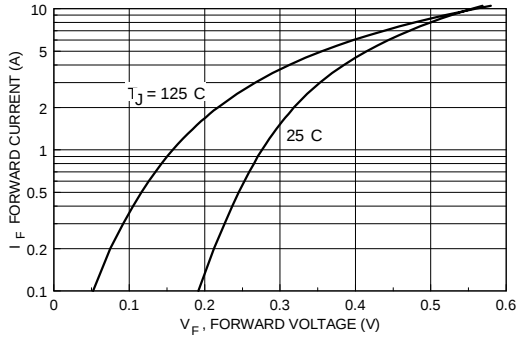


Figure 9. Schottky Diode Forward Voltage.

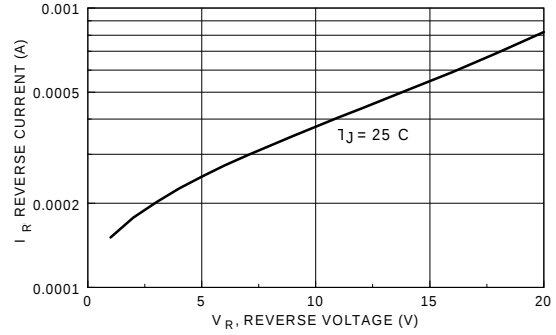


Figure 10. Schottky Diode Reverse Current.

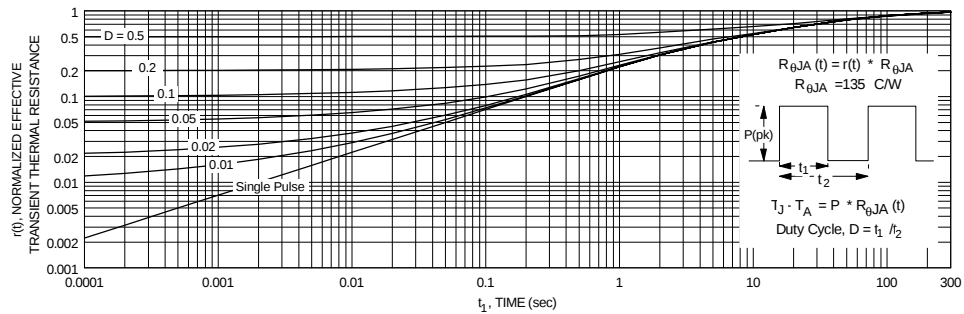


Figure 11. Transient Thermal Response Curve.

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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| FACT™                | OPTOPLANAR™         | SyncFET™            |      |
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