

# FDFC2P100

## Integrated P-Channel PowerTrench® MOSFET and Schottky Diode

-20V, -3A, 150mΩ

### Features

- Max  $r_{DS(on)}$  = 150mΩ at  $V_{GS} = -4.5V$ ,  $I_D = -3.0A$
- Max  $r_{DS(on)}$  = 200mΩ at  $V_{GS} = -2.5V$ ,  $I_D = -2.2A$
- Low Gate Charge (3.4nC typ)
- Compact industry standard SuperSOT™-6 package

### Schottky:

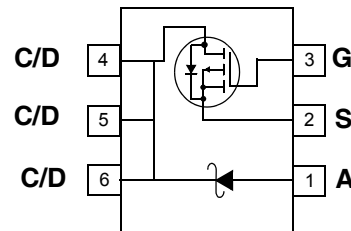
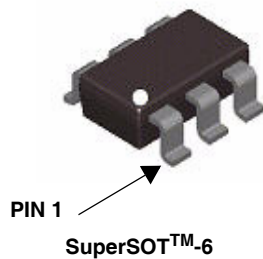
- $V_F < 0.45V$  at  $I_F = 1A$
- RoHS Compliant



### General Description

The FDFC2P100 combine the exceptional performance of Fairchild's PowerTrench MOSFET technology with a very low forward voltage drop Schottky barrier rectifier in an SSOT-6 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. Significant improvement of Thermal Characteristics and Power Dissipation via replacement of independently connected Schottky with internal connection of Schottky Diode Cathode pn to P-Channel PowerTrench MosFET Drain pin.



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

| Symbol         | Parameter  | Ratings     | Units      |
|----------------|--|-------------|------------|
| $V_{DS}$       | Drain to Source Voltage                          | -20         | V          |
| $V_{GS}$       | Gate to Source Voltage                           | $\pm 12$    | V          |
| $I_D$          | Drain Current -Continuous (Note 1a)              | -3          | A          |
|                | -Pulsed  | -6          |            |
| $P_D$          | Power Dissipation (Note 1a)<br>(Note 1b)         | 1.5         | W          |
|                |  | 0.8         |            |
| $V_{RRM}$      | Schotty Repetitive Peak Reverse Voltage          | 20          | V          |
| $I_O$          | Schotty Average Forward Current (Note 1a)        | 1           | A          |
| $T_J, T_{STG}$ | Operating and Storage Junction Temperature Range | -55 to +150 | $^\circ C$ |

### Thermal Characteristics

|                 |   |     |              |
|-----------------|---|-----|--------------|
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1a) | 87  | $^\circ C/W$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1b) | 166 |              |

### Package Marking and Ordering Information

| Device Marking | Device    | Package | Reel Size | Tape Width | Quantity  |
|----------------|-----------|---------|-----------|------------|-----------|
| .100           | FDFC2P100 | SSOT-6  | 7"        | 8mm        | 3000units |

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

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|--------|-----------|-----------------|-----|-----|-----|-------|
|--------|-----------|-----------------|-----|-----|-----|-------|

#### Off Characteristics

|                                      |   |  |     |     |           |               |
|--------------------------------------|---|--|-----|-----|-----------|---------------|
| $BV_{DSS}$                           | Drain to Source Breakdown Voltage         | $I_D = -250\mu\text{A}, V_{GS} = 0\text{V}$                | -20 |     |           | V             |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D = -250\mu\text{A}$ , referenced to $25^\circ\text{C}$ |     | -12 |           | mV/°C         |
| $I_{DSS}$                            | Zero Gate Voltage Drain Current           | $V_{GS} = 0\text{V}, V_{DS} = -16\text{V}$                 |     |     | -1        | $\mu\text{A}$ |
| $I_{GSS}$                            | Gate to Source Leakage Current            | $V_{GS} = \pm 12\text{V}, V_{DS} = 0\text{V}$              |     |     | $\pm 100$ | $\mu\text{A}$ |

#### On Characteristics

|  |  |  |      |      |      |            |
|--|--|--|------|------|------|------------|
| $V_{GS(th)}$                           | Gate to Source Threshold Voltage                         | $V_{GS} = V_{DS}, I_D = -250\mu\text{A}$                             | -0.6 | -0.9 | -1.5 | V          |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate to Source Threshold Voltage Temperature Coefficient | $I_D = -250\mu\text{A}$ , referenced to $25^\circ\text{C}$           |      | 3    |      | mV/°C      |
| $r_{DS(on)}$                           | Drain to Source On-Resistance                            | $V_{GS} = -4.5\text{V}, I_D = -3.0\text{A}$                          |      | 95   | 150  | m $\Omega$ |
|  |  | $V_{GS} = -2.5\text{V}, I_D = -2.2\text{A}$                          |      | 150  | 200  |            |
|  |  | $V_{GS} = -4.5\text{V}, I_D = -3.0\text{A}, T_J = 125^\circ\text{C}$ |      | 130  | 252  |            |
| $g_{FS}$                               | Forward Transconductance                                 | $V_{DS} = -5\text{V}, I_D = -3.0\text{A}$                            |      | 5.4  |      | S          |

#### Dynamic Characteristics

|           |                              |  |                   |     |     |    |
|-----------|------------------------------|--|-------------------|-----|-----|----|
| $C_{iss}$ | Input Capacitance            | $V_{DS} = -10\text{V}, V_{GS} = 0\text{V},$<br>$f = 1\text{MHz}$ |                   | 335 | 445 | pF |
| $C_{oss}$ | Output Capacitance           |  |                   | 80  | 105 | pF |
| $C_{rss}$ | Reverse Transfer Capacitance |  |                   | 40  | 60  | pF |
| $R_g$     | Gate Resistance              |  | $f = 1\text{MHz}$ |     | 6   |    |

#### Switching Characteristics

|              |                               |  |                                      |                         |     |     |
|--------------|-------------------------------|--|--------------------------------------|-------------------------|-----|-----|
| $t_{d(on)}$  | Turn-On Delay Time            | $V_{DD} = -10\text{V}, I_D = -3.0\text{A}$<br>$V_{GS} = -4.5\text{V}, R_{GEN} = 6\Omega$ |                                      | 9                       | 16  | ns  |
| $t_r$        | Rise Time                     |  |                                      | 11                      | 20  | ns  |
| $t_{d(off)}$ | Turn-Off Delay Time           |  |                                      | 12                      | 22  | ns  |
| $t_f$        | Fall Time                     |  |                                      | 4                       | 8   | ns  |
| $Q_{g(TOT)}$ | Total Gate Charge at -10V     |  | $V_{GS} = 0\text{V to } -10\text{V}$ | $V_{DD} = -4.5\text{V}$ | 3.4 | 4.7 |
| $Q_{gs}$     | Gate to Source Gate Charge    |  | $I_D = -3.0\text{A}$                 | 0.9                     |     | nC  |
| $Q_{gd}$     | Gate to Drain "Miller" Charge |  |                                      | 1.0                     |     | nC  |

#### Drain-Source Diode Characteristics

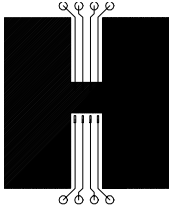
|          |  |   |  |      |      |    |
|----------|--|---|--|------|------|----|
| $I_S$    | Maximum Continuous Drain to Source Diode forward Current |   |  |      | -1.2 | A  |
| $V_{SD}$ | Source to Drain Diode Forward Voltage                    | $V_{GS} = 0\text{V}, I_S = -1.2\text{A}$ (Note 2)     |  | -0.8 | -1.2 | V  |
| $t_{rr}$ | Reverse Recovery Time                                    | $I_F = -3.0\text{A}, di/dt = 100\text{A}/\mu\text{s}$ |  | 17   |      | ns |
| $Q_{rr}$ | Reverse Recovery Charge                                  |   |  | 5    |      | nC |

#### Schottky Diode Characteristics

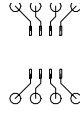
|       |                 |                      |                           |  |      |      |               |
|-------|-----------------|----------------------|---------------------------|--|------|------|---------------|
| $I_R$ | Reverse Leakage | $V_R = 20\text{V}$   | $T_J = 25^\circ\text{C}$  |  | 26   | 400  | $\mu\text{A}$ |
|       |                 |                      | $T_J = 100^\circ\text{C}$ |  | 2.7  | 20   | mA            |
|       |                 | $V_R = 10\text{V}$   | $T_J = 25^\circ\text{C}$  |  | 23   | 200  | $\mu\text{A}$ |
|       |                 |                      | $T_J = 100^\circ\text{C}$ |  | 2.5  | 10   | mA            |
| $V_F$ | Forward Voltage | $I_F = 500\text{mA}$ | $T_J = 25^\circ\text{C}$  |  | 0.31 | 0.4  | V             |
|       |                 |                      | $T_J = 100^\circ\text{C}$ |  | 0.24 | 0.35 |               |
|       |                 | $I_F = 1\text{A}$    | $T_J = 25^\circ\text{C}$  |  | 0.37 | 0.45 |               |
|       |                 |                      | $T_J = 100^\circ\text{C}$ |  | 0.3  | 0.42 |               |

**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.



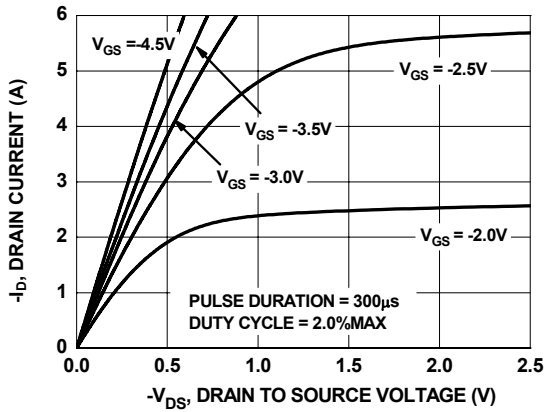
a) 87°C/W when mounted on a 1in<sup>2</sup> pad of 2 oz copper



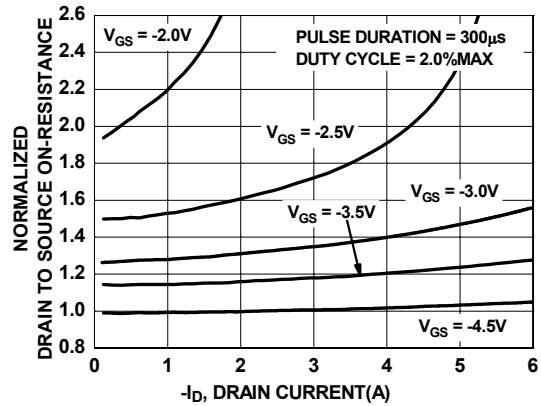
b) 166°C/W when mounted on a minimum pad

2: Pulse Test: Pulse Width  $\leq$ 300 ms, Duty Cycle < 2.0%

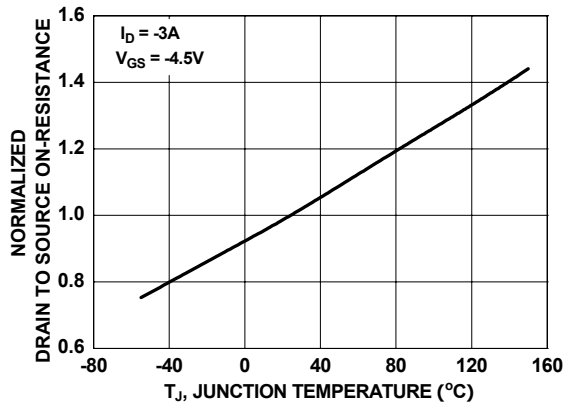
**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted



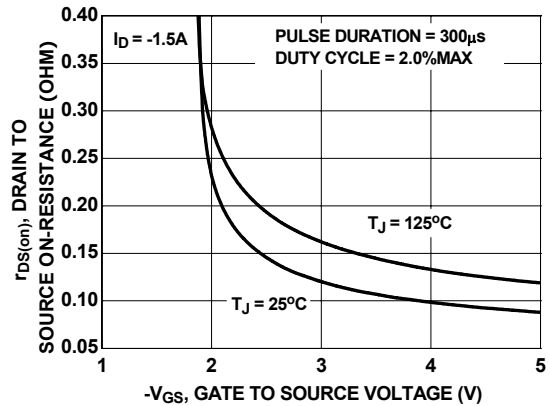
**Figure 1. On Region Characteristics**



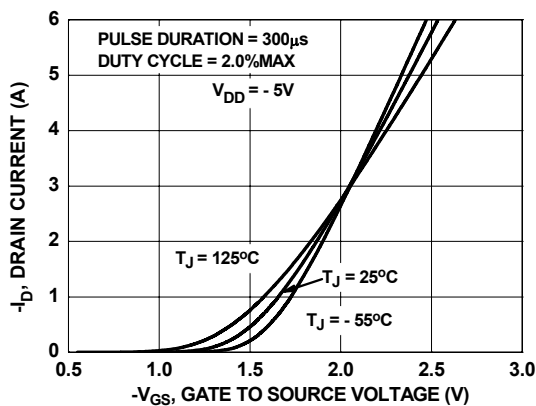
**Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage**



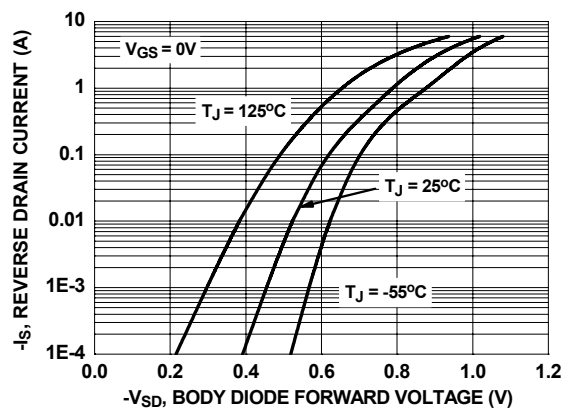
**Figure 3. Normalized On-Resistance vs Junction Temperature**



**Figure 4. On-Resistance vs Gate to Source Voltage**



**Figure 5. Transfer Characteristics**



**Figure 6. Source to Drain Diode Forward Voltage vs Source Current**

**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted

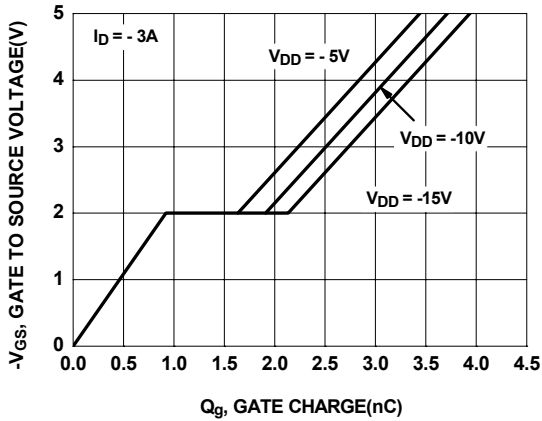


Figure 7. Gate Charge Characteristics

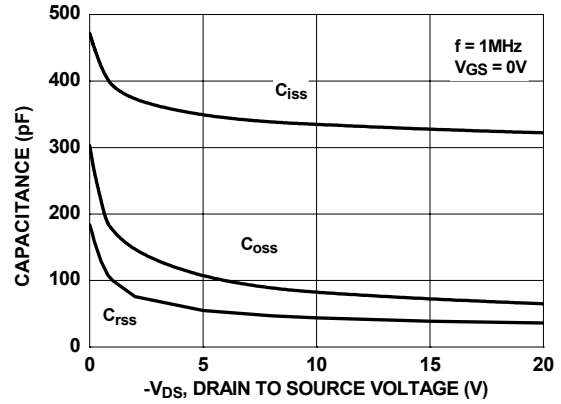


Figure 8. Capacitance vs Drain to Source Voltage

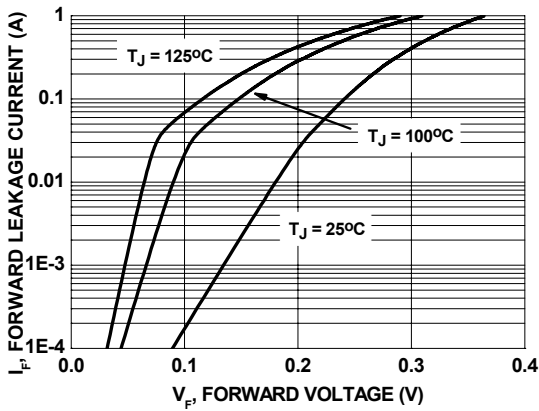


Figure 9. Schottky Diode Forward Voltage

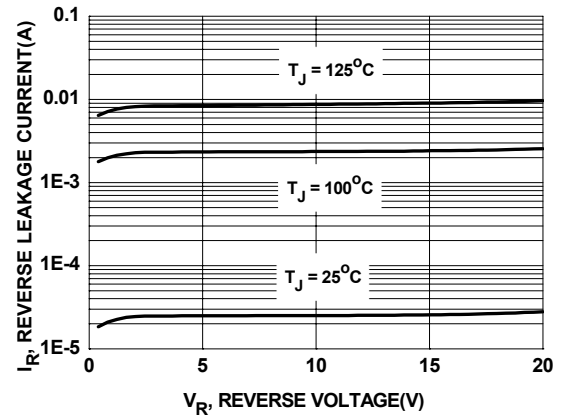


Figure 10. Schottky Diode Reverse Current

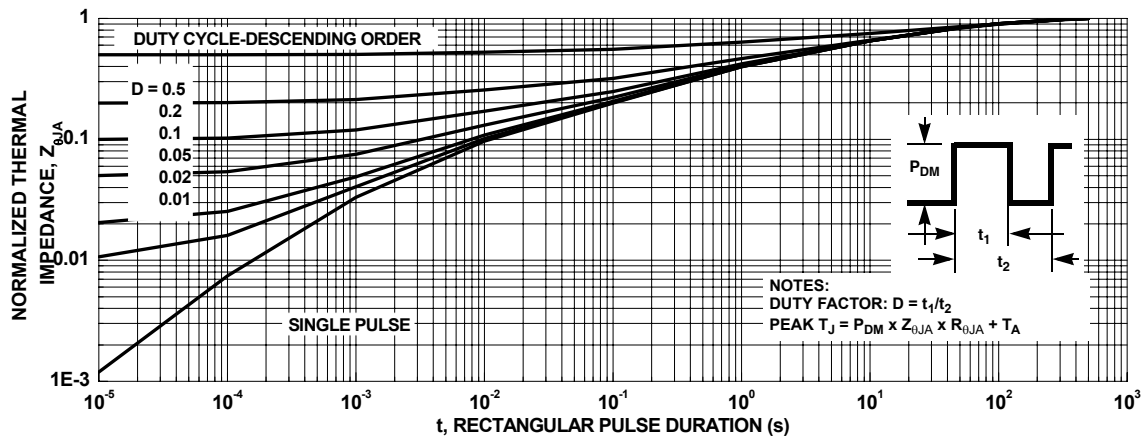


Figure 11. Transient Thermal Response Curve

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| DOMET™                               | ImpliedDisconnect™  | Power247™           | SuperSOT™-6      |           |
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| FRFET™                               | MSX™                | RapidConfigure™     | TinyLogic®       |           |
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