December 2003

# FDW2502P

## Dual P-Channel 2.5V Specified PowerTrench® MOSFET

### General Description

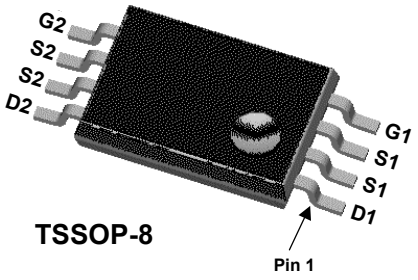
This P-Channel 2.5V specified MOSFET is a rugged gate version of Fairchild's Semiconductor's advanced PowerTrench process. It has been optimized for power management applications with a wide range of gate drive voltage (2.5V –12V).

### Applications

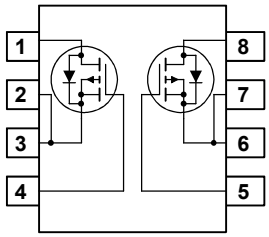
- Load switch
- Motor drive
- DC/DC conversion
- Power management

### Features

- –4.4 A, –20 V. $R_{DS(ON)}$ = 35 mΩ @ $V_{GS}$ = –4.5 V
  $R_{DS(ON)}$ = 57 mΩ @ $V_{GS}$ = –2.5 V.
- Extended $V_{GSS}$ range (±12V) for battery applications.
- High performance trench technology for extremely low $R_{DS(ON)}$ .
- Low profile TSSOP-8 package.




TSSOP-8




## Absolute Maximum Ratings $T_A$=25°C unless otherwise noted

| Symbol | Parameter | | Ratings | Units |
|---|---|---|---|---|
| $V_{DSS}$ | Drain-Source Voltage | | –20 | V |
| $V_{GSS}$ | Gate-Source Voltage | | ±12 | V |
| $I_D$ | Drain Current – Continuous | (Note 1a) | –4.4 | A |
| | – Pulsed | | –30 | |
| $P_D$ | Power Dissipation for Single Operation | (Note 1a) | 1.0 | W |
| | | (Note 1b) | 0.6 | |
| $T_J$, $T_{STG}$ | Operating and Storage Junction Temperature Range | | -55 to +150 | °C |

## Thermal Characteristics

| | | | | |
|---|---|---|---|---|
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | (Note 1a) | 125 | °C/W |
| | | (Note 1b) | 208 | |

## Package Marking and Ordering Information

| Device Marking | Device | Reel Size | Tape width | Quantity |
|---|---|---|---|---|
| 2502P | FDW2502P | 13'' | 12mm | 3000 units |

## Electrical Characteristics

$T_A$ = 25°C unless otherwise noted

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| $BV_{DSS}$ | Drain–Source Breakdown Voltage | $V_{GS}$ = 0 V, $I_D$ = –250 μA | –20 | | | V |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D$ = –250 μA, Referenced to 25°C | | –14 | | mV/°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = –16 V, $V_{GS}$ = 0 V | | | –1 | μA |
| $I_{GSS}$ | Gate–Body Leakage | $V_{GS}$ = ±12 V, $V_{DS}$ = 0 V | | | ±100 | nA |
| **On Characteristics** (Note 2) | | | | | | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$ = $V_{GS}$, $I_D$ = –250 μA | –0.4 | –0.9 | –1.5 | V |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate Threshold Voltage Temperature Coefficient | $I_D$ = –250 μA, Referenced to 25°C | | 3.2 | | mV/°C |
| $R_{DS(on)}$ | Static Drain–Source On–Resistance | $V_{GS}$ = –4.5 V, $I_D$ = –4.4 A<br>$V_{GS}$ = –4.5 V, $I_D$ = –4.4 , $T_J$=125°C<br>$V_{GS}$ = –2.5 V, $I_D$ = –3.3 A | | 27<br>35<br>38 | 35<br>56<br>57 | mΩ |
| $I_{D(on)}$ | On–State Drain Current | $V_{GS}$ = –4.5 V, $V_{DS}$ = –5 V | –30 | | | A |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$ = –5 V, $I_D$ = –4.4 A | | 18 | | S |
| **Dynamic Characteristics** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = –10 V, $V_{GS}$ = 0 V, f = 1.0 MHz | | 1465 | | pF |
| $C_{oss}$ | Output Capacitance | | | 310 | | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 155 | | pF |
| $R_G$ | Gate Resistance | $V_{GS}$ = 15 mV, f = 1.0 MHz | | 7.7 | | Ω |
| **Switching Characteristics** (Note 2) | | | | | | |
| $t_{d(on)}$ | Turn–On Delay Time | $V_{DD}$ = –10 V, $I_D$ = –1 A, $V_{GS}$ = –4.5 V, $R_{GEN}$ = 6 Ω | | 14 | 25 | ns |
| $t_r$ | Turn–On Rise Time | | | 8 | 16 | ns |
| $t_{d(off)}$ | Turn–Off Delay Time | | | 51 | 82 | ns |
| $t_f$ | Turn–Off Fall Time | | | 29 | 47 | ns |
| $Q_g$ | Total Gate Charge | $V_{DS}$ = –5 V, $I_D$ = –4.4 A, $V_{GS}$ = –5 V | | 15 | 21 | nC |
| $Q_{gs}$ | Gate–Source Charge | | | 2.9 | | nC |
| $Q_{gd}$ | Gate–Drain Charge | | | 3.5 | | nC |
| **Drain–Source Diode Characteristics and Maximum Ratings** | | | | | | |
| $t_{rr}$ | Diode Reverse Recovery Time | $I_F$ = –4.4 A, $d_{iF}/d_t$ = 100 A/μs | | 21 | | ns |
| $Q_{rr}$ | Diode Reverse Recovery Charge | | | 8.1 | | nC |
| $I_S$ | Maximum Continuous Drain–Source Diode Forward Current | | | | –0.83 | A |
| $V_{SD}$ | Drain–Source Diode Forward Voltage | $V_{GS}$ = 0 V, $I_S$ = –0.83 A (Note 2) | | –0.7 | –1.2 | V |

**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) $R_{\theta JA}$ is 125°C/W (steady state) when mounted on a 1 inch² copper pad on FR-4.

b) $R_{\theta JA}$ is 208°C/W (steady state) when mounted on a minimum copper pad on FR-4.

**2.** Pulse Test: Pulse Width < 300μs, Duty Cycle < 2.0%

## Typical Characteristics

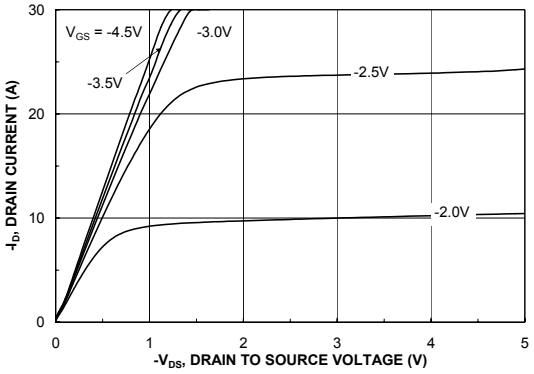



**Figure 1. On-Region Characteristics.**

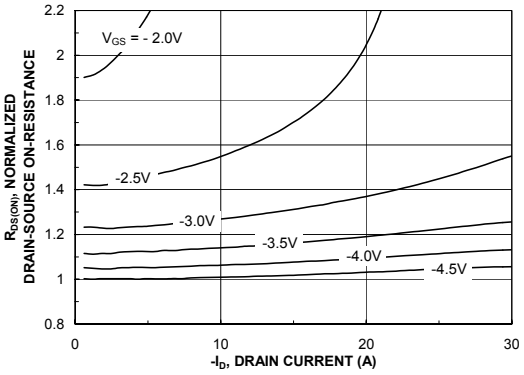



**Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.**

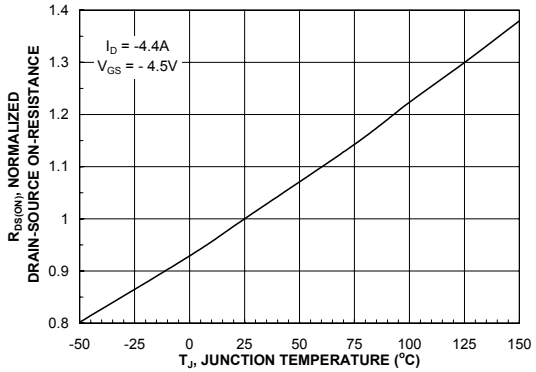



**Figure 3. On-Resistance Variation with Temperature.**

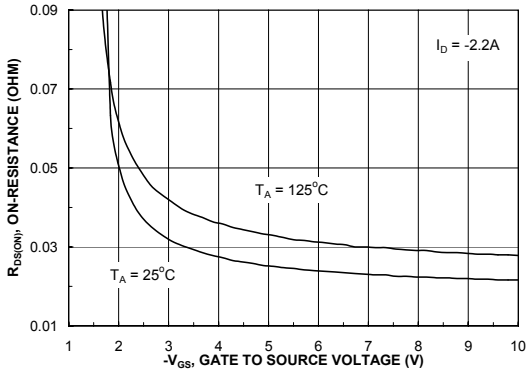



**Figure 4. On-Resistance Variation with Gate-to-Source Voltage.**

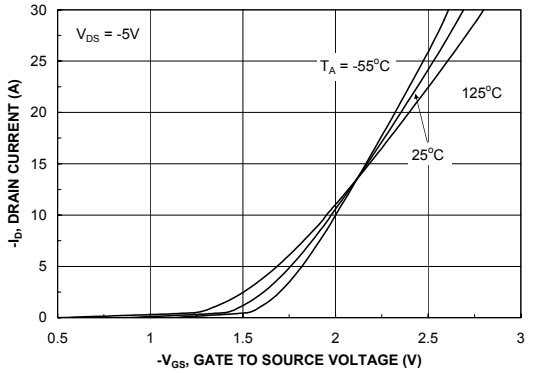



**Figure 5. Transfer Characteristics.**

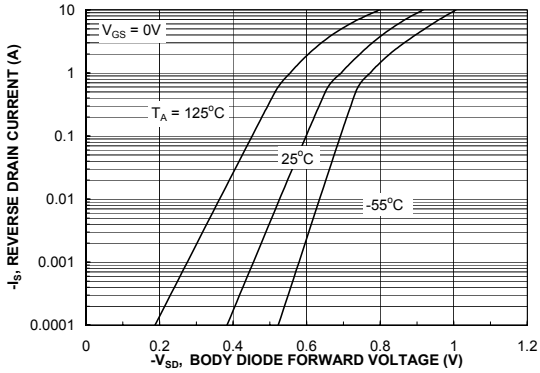



**Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.**

## Typical Characteristics

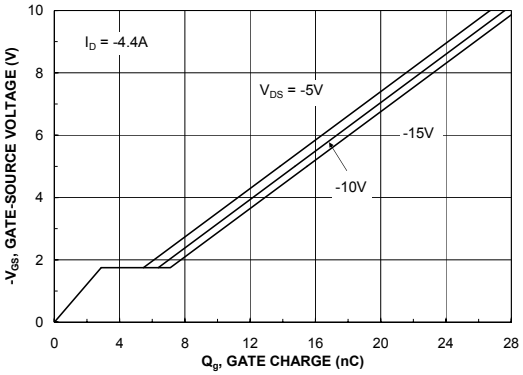



**Figure 7. Gate Charge Characteristics.**

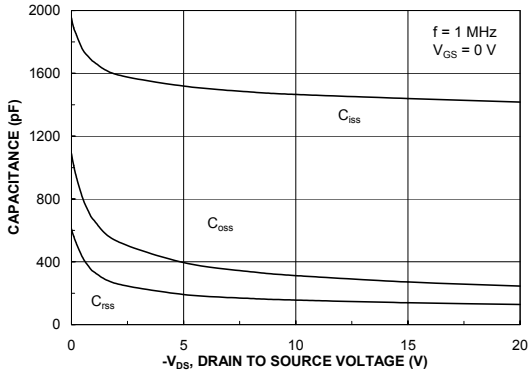



**Figure 8. Capacitance Characteristics.**

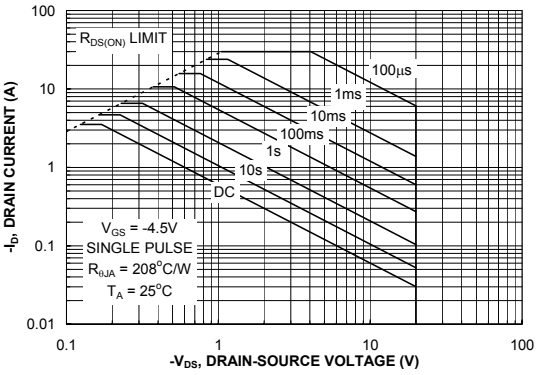



**Figure 9. Maximum Safe Operating Area.**

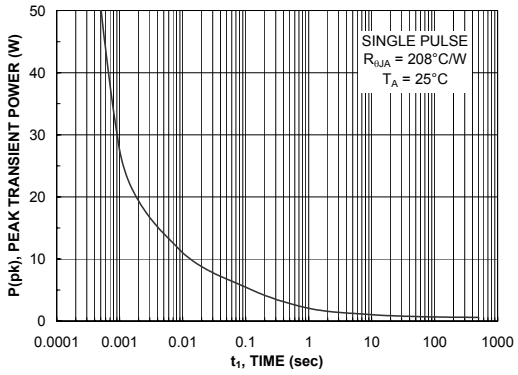



**Figure 10. Single Pulse Maximum Power Dissipation.**

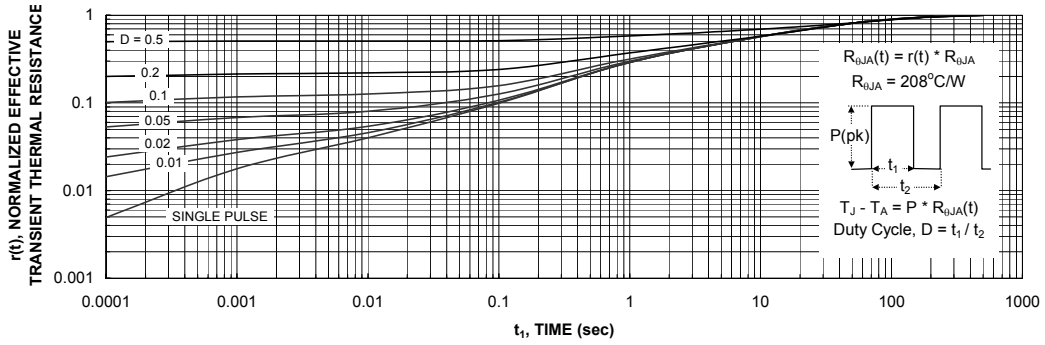



**Figure 11. Transient Thermal Response Curve.**

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

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