

**FAIRCHILD**  
SEMICONDUCTOR®

September 2006

## FDP8441

### N-Channel PowerTrench® MOSFET 40V, 80A, 2.7mΩ

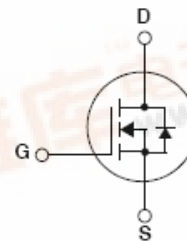
#### Features

- Typ  $r_{DS(on)}$  = 2.1mΩ at  $V_{GS} = 10V$ ,  $I_D = 80A$
- Typ  $Q_{g(10)}$  = 215nC at  $V_{GS} = 10V$
- Low Miller Charge
- Low  $Q_{rr}$  Body Diode
- UIS Capability (Single Pulse and Repetitive Pulse)
- Qualified to AEC Q101
- RoHS Compliant



#### Applications

- Automotive Engine Control
- Powertrain Management
- Solenoid and Motor Drivers
- Electronic Steering
- Integrated Starter / Alternator
- Distributed Power Architectures and VRMs
- Primary Switch for 12V Systems



FDP8441 N-Channel PowerTrench® MOSFET



## MOSFET Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted

| Symbol         | Parameter   | Ratings      | Units                     |
|----------------|---|--------------|---------------------------|
| $V_{DS}$       | Drain to Source Voltage   | 40           | V                         |
| $V_{GS}$       | Gate to Source Voltage  | $\pm 20$     | V                         |
| $I_D$          | Drain Current Continuous ( $T_C < 160^\circ\text{C}$ , $V_{GS} = 10\text{V}$ )                                  | 80           | A                         |
|                | Continuous ( $T_{amb} = 25^\circ\text{C}$ , $V_{GS} = 10\text{V}$ , with $R_{\theta JA} = 62^\circ\text{C/W}$ ) | 23           |                           |
|                | Pulsed  | See Figure 4 |                           |
| $E_{AS}$       | Single Pulse Avalanche Energy (Note 1)  | 947          | mJ                        |
| $P_D$          | Power dissipation   | 300          | W                         |
|                | Derate above $25^\circ\text{C}$   | 2            | $\text{W}/^\circ\text{C}$ |
| $T_J, T_{STG}$ | Operating and Storage Temperature   | -55 to 175   | $^\circ\text{C}$          |

## Thermal Characteristics

|                 |   |     |                           |
|-----------------|---|-----|---------------------------|
| $R_{\theta JC}$ | Thermal Resistance Junction to Case             | 0.5 | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JA}$ | Thermal Resistance Junction to Ambient (Note 2) | 62  | $^\circ\text{C}/\text{W}$ |

## Package Marking and Ordering Information

| Device Marking | Device  | Package  | Reel Size | Tape Width | Quantity |
|----------------|---------|----------|-----------|------------|----------|
| FDP8441        | FDP8441 | TO-220AB | Tube      | N/A        | 50 units |

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

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

### Off Characteristics

|               |                                   |  |    |   |           |               |
|---------------|-----------------------------------|--|----|---|-----------|---------------|
| $B_{V_{DSS}}$ | Drain to Source Breakdown Voltage | $I_D = 250\mu\text{A}$ , $V_{GS} = 0\text{V}$                              | 40 | - | -         | V             |
| $I_{DSS}$     | Zero Gate Voltage Drain Current   | $V_{DS} = 32\text{V}$<br>$V_{GS} = 0\text{V}$<br>$T_J = 150^\circ\text{C}$ | -  | - | 1         | $\mu\text{A}$ |
| $I_{GSS}$     | Gate to Source Leakage Current    | $V_{GS} = \pm 20\text{V}$  | -  | - | $\pm 100$ | nA            |

### On Characteristics

|              |                                  |   |   |     |     |            |
|--------------|----------------------------------|---|---|-----|-----|------------|
| $V_{GS(th)}$ | Gate to Source Threshold Voltage | $V_{DS} = V_{GS}$ , $I_D = 250\mu\text{A}$                                | 2 | 2.8 | 4   | V          |
| $r_{DS(on)}$ | Drain to Source On Resistance    | $I_D = 80\text{A}$ , $V_{GS} = 10\text{V}$                                | - | 2.1 | 2.7 | m $\Omega$ |
|              |                                  | $I_D = 80\text{A}$ , $V_{GS} = 10\text{V}$ ,<br>$T_J = 175^\circ\text{C}$ | - | 3.6 | 4.7 |            |

### Dynamic Characteristics

|              |                                  |   |   |       |     |          |    |
|--------------|----------------------------------|---|---|-------|-----|----------|----|
| $C_{iss}$    | Input Capacitance                | $V_{DS} = 25\text{V}$ , $V_{GS} = 0\text{V}$ ,<br>$f = 1\text{MHz}$ | -   | 15000 | -   | pF       |    |
| $C_{oss}$    | Output Capacitance               |   | -   | 1250  | -   | pF       |    |
| $C_{rss}$    | Reverse Transfer Capacitance     |   | -   | 685   | -   | pF       |    |
| $R_G$        | Gate Resistance                  | $V_{GS} = 0.5\text{V}$ , $f = 1\text{MHz}$                          | -   | 1.1   | -   | $\Omega$ |    |
| $Q_{g(TOT)}$ | Total Gate Charge at 10V         | $V_{GS} = 0$ to 10V   | $V_{DD} = 20\text{V}$<br>$I_D = 35\text{A}$<br>$I_g = 1\text{mA}$ | -     | 215 | 280      | nC |
| $Q_{g(TH)}$  | Threshold Gate Charge            | $V_{GS} = 0$ to 2V  |   | -     | 29  | 38       | nC |
| $Q_{gs}$     | Gate to Source Gate Charge       |   |   | -     | 60  | -        | nC |
| $Q_{gs2}$    | Gate Charge Threshold to Plateau |   |   | -     | 32  | -        | nC |
| $Q_{gd}$     | Gate to Drain "Miller" Charge    |   |   | -     | 49  | -        | nC |

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

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

**Switching Characteristics**

| Symbol       | Parameter           | Test Conditions  | Min | Typ  | Max | Units |
|--------------|---------------------|--|-----|------|-----|-------|
| $t_{(on)}$   | Turn-On Time        | $V_{DD} = 20\text{V}, I_D = 35\text{A}$<br>$V_{GS} = 10\text{V}, R_{GS} = 1.5\Omega$ | -   | -    | 77  | ns    |
| $t_{d(on)}$  | Turn-On Delay Time  |  | -   | 23   | -   | ns    |
| $t_r$        | Turn-On Rise Time   |  | -   | 24   | -   | ns    |
| $t_{d(off)}$ | Turn-Off Delay Time |  | -   | 75   | -   | ns    |
| $t_f$        | Turn-Off Fall Time  |  | -   | 17.9 | -   | ns    |
| $t_{off}$    | Turn-Off Time       |  | -   | -    | 147 | ns    |

**Drain-Source Diode Characteristics**

| Symbol   | Parameter                     | Test Conditions                                     | Min | Typ | Max  | Units |
|----------|-------------------------------|---|-----|-----|------|-------|
| $V_{SD}$ | Source to Drain Diode Voltage | $I_{SD} = 35\text{A}$                               | -   | 0.8 | 1.25 | V     |
|          |                               | $I_{SD} = 15\text{A}$                               | -   | 0.8 | 1.0  | V     |
| $t_{rr}$ | Reverse Recovery Time         | $I_F = 35\text{A}, di/dt = 100\text{A}/\mu\text{s}$ | -   | 52  | 68   | ns    |
| $Q_{rr}$ | Reverse Recovery Charge       | $I_F = 35\text{A}, di/dt = 100\text{A}/\mu\text{s}$ | -   | 76  | 99   | nC    |

**Notes:**

- 1: Starting  $T_J = 25^\circ\text{C}$ ,  $L = 0.46\text{mH}$ ,  $I_{AS} = 64\text{A}$ .
- 2: Pulse width = 100s.

This product has been designed to meet the extreme test conditions and environment demanded by the automotive industry. For a copy of the requirements, see AEC Q101 at: <http://www.aecouncil.com/>  
 All Fairchild Semiconductor products are manufactured, assembled and tested under ISO9000 and QS9000 quality systems certification.

### Typical Characteristics

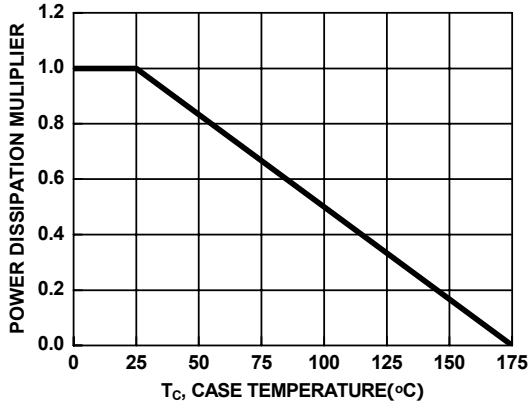


Figure 1. Normalized Power Dissipation vs Case Temperature

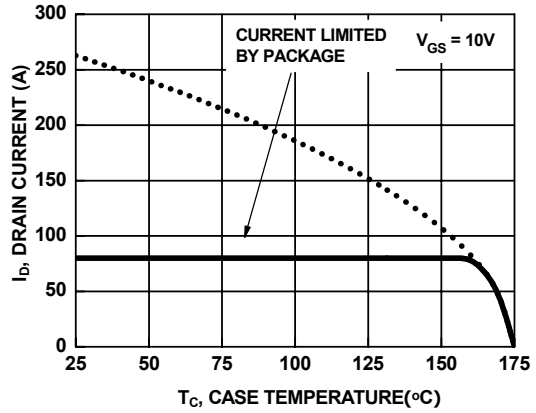


Figure 2. Maximum Continuous Drain Current vs Case Temperature

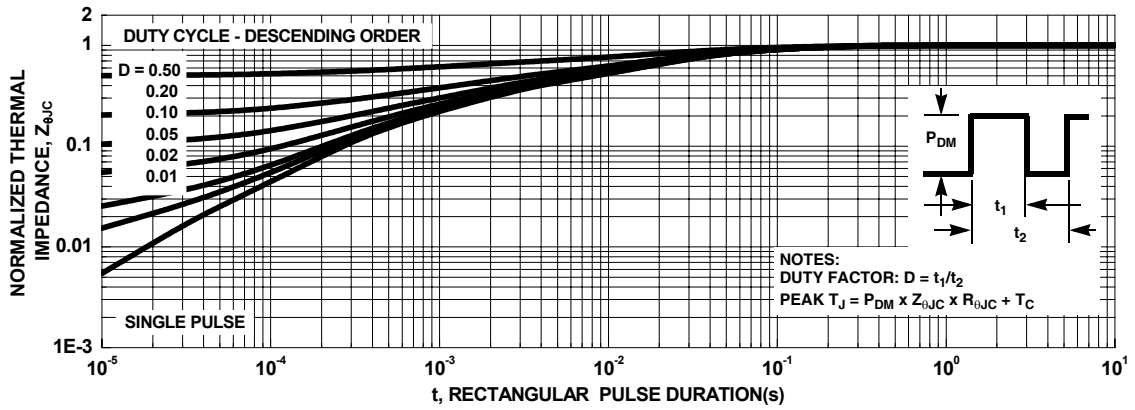


Figure 3. Normalized Maximum Transient Thermal Impedance

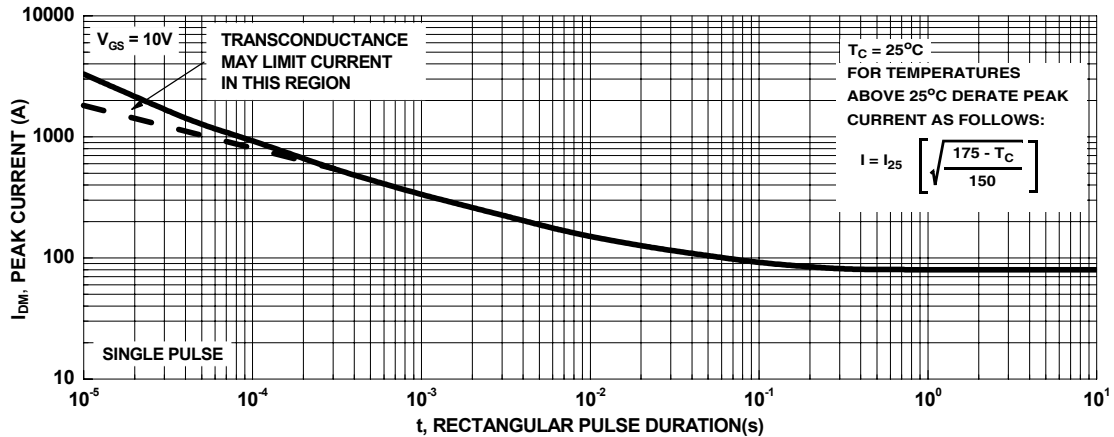


Figure 4. Peak Current Capability

## Typical Characteristics

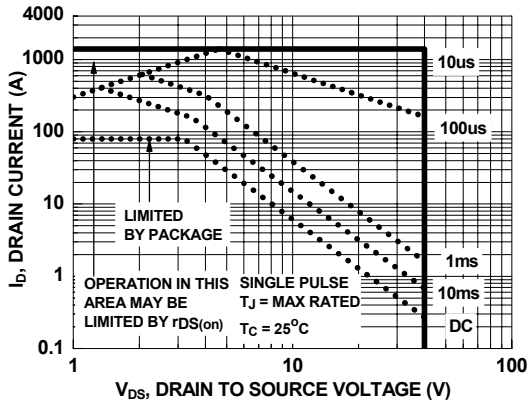
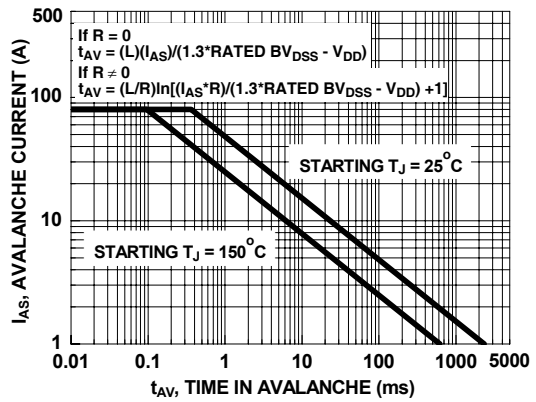


Figure 5. Forward Bias Safe Operating Area



NOTE: Refer to Fairchild Application Notes AN7514 and AN7515

Figure 6. Unclamped Inductive Switching Capability

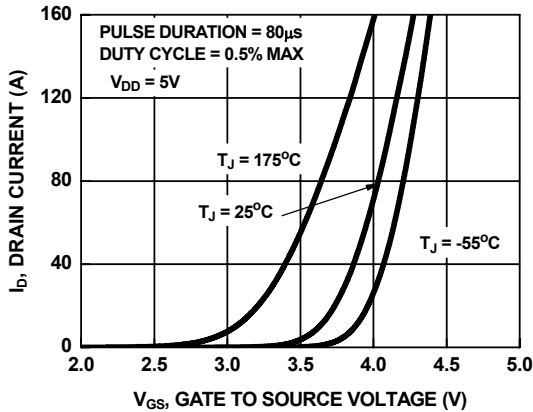


Figure 7. Transfer Characteristics

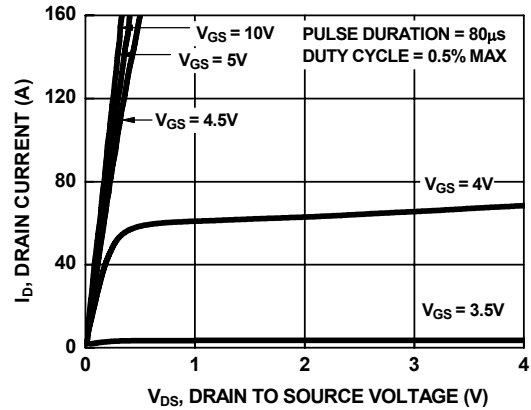


Figure 8. Saturation Characteristics

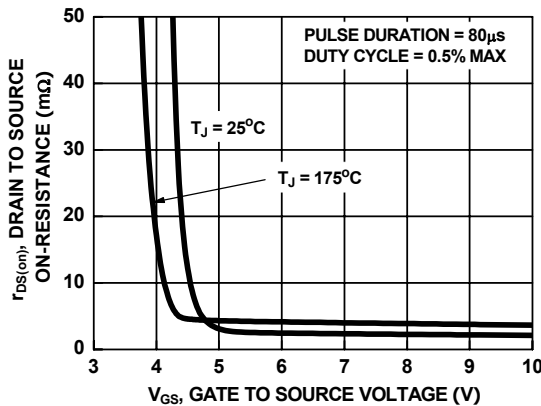


Figure 9. Drain to Source On-Resistance Variation vs Gate to Source Voltage

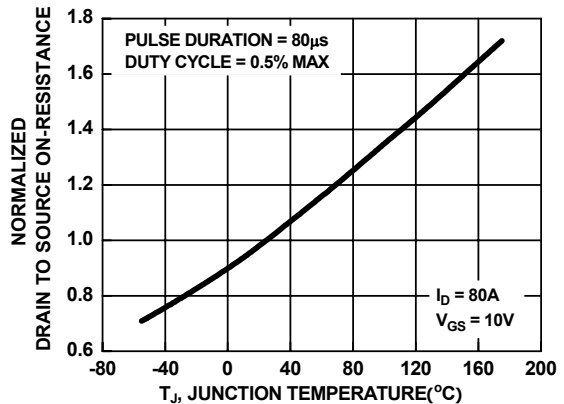


Figure 10. Normalized Drain to Source On-Resistance vs Junction Temperature

### Typical Characteristics

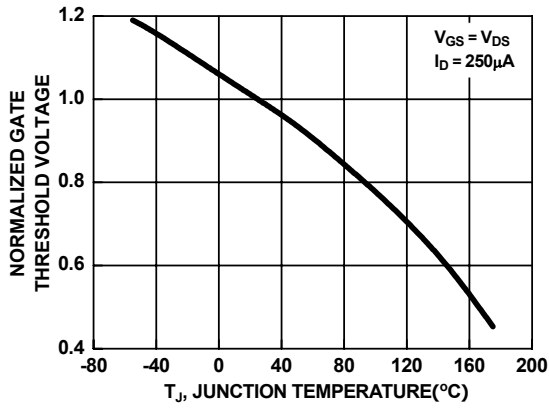


Figure 11. Normalized Gate Threshold Voltage vs Junction Temperature

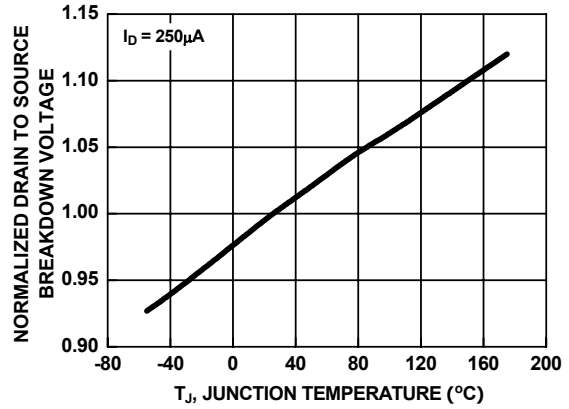


Figure 12. Normalized Drain to Source Breakdown Voltage vs Junction Temperature

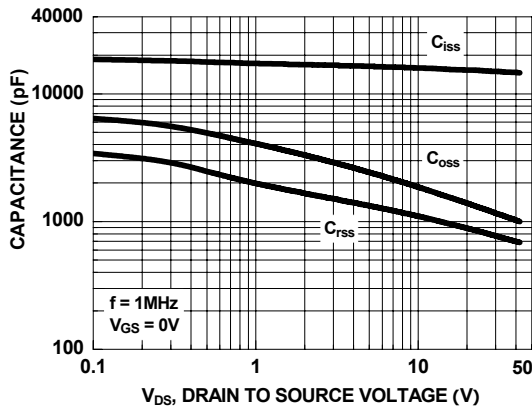


Figure 13. Capacitance vs Drain to Source Voltage

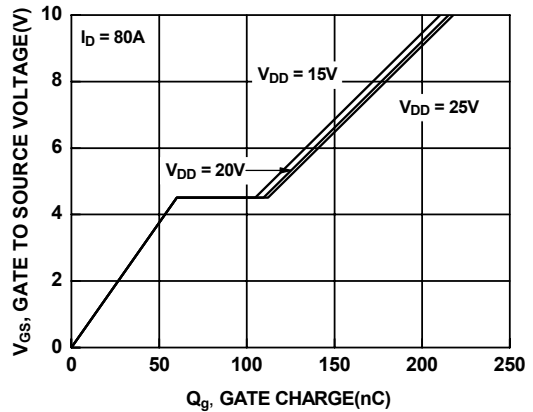


Figure 14. Gate Charge vs Gate to Source Voltage

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| Build it Now™                        | HiSeC™              | OPTOPLANAR™         | Stealth™         | Wire™     |
| CoolFET™                             | I <sup>2</sup> C™   | PACMAN™             | SuperFET™        |           |
| CROSSVOLT™                           | i-Lo™               | POP™                | SuperSOT™-3      |           |
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