September 2006

# FDP8860
# N-Channel PowerTrench® MOSFET

**30V, 80A, 2.5mΩ**

## Features

- Max $r_{DS(on)}$ = 2.5mΩ at $V_{GS}$ = 10V, $I_D$ = 80A
- Max $r_{DS(on)}$ = 2.9mΩ at $V_{GS}$ = 4.5V, $I_D$ = 80A
- Low Miller Charge
- Low $Q_{rr}$ Body Diode
- UIL Capability (Single Pulse and Repetitive Pulse)
- RoHS Compliant

## General Description

This N-Channel MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers. It has been optimized for low gate charge, low $r_{DS(on)}$ and fast switching speed.

## Application

- DC - DC Conversion
- Start / Alternator Sytems

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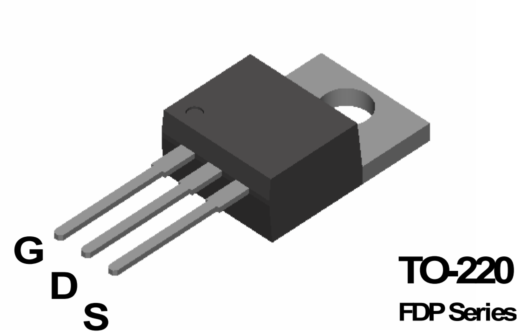

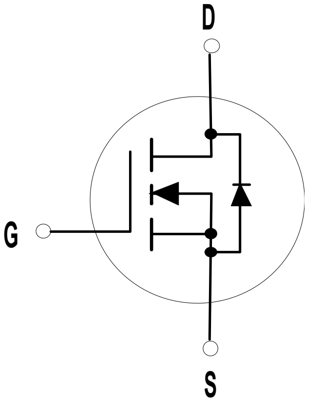

## MOSFET Maximum Ratings $T_C$ = 25°C unless otherwise noted

| Symbol | Parameter | Ratings | Units |
|---|---|---|---|
| $V_{DS}$ | Drain to Source Voltage | 30 | V |
| $V_{GS}$ | Gate to Source Voltage | ±20 | V |
| $I_D$ | Drain Current -Continuous (Package limited) $T_C$ = 25°C | 80 | A |
|  | -Continuous (Silicon limited) $T_C$ = 25°C | 219 |  |
|  | -Pulsed (Note 1) | 556 |  |
| $E_{AS}$ | Single Pulse Avalanche Energy (Note 2) | 673 | mJ |
| $P_D$ | Power Dissipation | 254 | W |
| $T_J$, $T_{STG}$ | Operating and Storage Temperature | -55 to +175 | °C |

### Thermal Characteristics

|  |  |  |  |
|---|---|---|---|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case TO220 | 0.59 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient TO220 | 62 |  |

### Package Marking and Ordering Information

| Device Marking | Device | Package | Reel Size | Tape Width | Quantity |
|---|---|---|---|---|---|
| FDP8860 | FDP8860 | TO220AB | Tube | N/A | 50 units |

## Electrical Characteristics $T_J = 25°C$ unless otherwise noted

### Off Characteristics

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain to Source Breakdown Voltage | $I_D = 1mA$, $V_{GS} = 0V$ | 30 | | | V |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D = 1mA$, referenced to 25°C | | 22 | | mV/°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS} = 24V$, $V_{GS} = 0V$ | | | 1 | μA |
| | | $T_J = 150°C$ | | | 250 | |
| $I_{GSS}$ | Gate to Source Leakage Current | $V_{GS} = \pm 20V$ | | | ±100 | nA |

### On Characteristics

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| $V_{GS(th)}$ | Gate to Source Threshold Voltage | $V_{GS} = V_{DS}$, $I_D = 250\mu A$ | 1 | 1.6 | 2.5 | V |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate to Source Threshold Voltage Temperature Coefficient | $I_D = 250\mu A$, referenced to 25°C | | -9.6 | | mV/°C |
| $r_{DS(on)}$ | Drain to Source On Resistance | $V_{GS} = 10V$, $I_D = 80A$ | | 1.9 | 2.5 | mΩ |
| | | $V_{GS} = 5V$, $I_D = 80A$ | | 2.0 | 2.8 | |
| | | $V_{GS} = 4.5V$, $I_D = 80A$ | | 2.1 | 2.9 | |
| | | $V_{GS} = 10V$, $I_D = 80A$, $T_J = 150°C$ | | 2.9 | 3.8 | |
| $g_{FS}$ | Forward Transconductance | $V_{DS} = 10V$, $I_D = 80A$ | | 3.4 | | S |

### Dynamic Characteristics

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| $C_{iss}$ | Input Capacitance | $V_{DS} = 15V$, $V_{GS} = 0V$, f = 1MHz | | 9200 | 12240 | pF |
| $C_{oss}$ | Output Capacitance | | | 1700 | 2260 | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 1060 | 1590 | pF |
| $R_g$ | Gate Resistance | f = 1MHz | | 1.7 | | Ω |

### Switching Characteristics

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD} = 15V$, $I_D = 80A$<br>$V_{GS} = 5V$, $R_{GEN} = 3\Omega$ | | 35 | 56 | ns |
| $t_r$ | Rise Time | | | 135 | 216 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | | 64 | 103 | ns |
| $t_f$ | Fall Time | | | 59 | 95 | ns |
| $Q_{g(TOT)}$ | Total Gate Charge at 10V | $V_{GS} = 0V$ to $10V$; $V_{DD} = 15V$, $I_D = 80A$ | | 158 | 222 | nC |
| $Q_{g(5)}$ | Total Gate Charge at 5V | $V_{GS} = 0V$ to $5V$ | | 81 | 114 | nC |
| $Q_{gs}$ | Gate to Source Gate Charge | | | 27 | | nC |
| $Q_{gd}$ | Gate to Drain “Miller” Charge | | | 33 | | nC |

### Drain-Source Diode Characteristics

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| $V_{SD}$ | Source to Drain Diode Forward Voltage | $V_{GS} = 0V$, $I_S = 80A$ | | 0.88 | 1.25 | V |
| | | $V_{GS} = 0V$, $I_S = 40A$ | | 0.81 | 1.2 | |
| $t_{rr}$ | Reverse Recovery Time | $I_F = 80A$, $di/dt = 100A/\mu s$ | | 60 | 90 | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | | 74 | 111 | nC |

**Notes:**

**1:** Pulse Test: Pulse Width < 80μs, Duty cycle < 0.5%.

**2:** Starting $T_J = 25^oC$, L= 0.3mH, $I_{AS} = 67A$, $V_{DD} = 27V$, $V_{GS} = 10V$.

## Typical Characteristics $T_J$ = 25°C unless otherwise noted

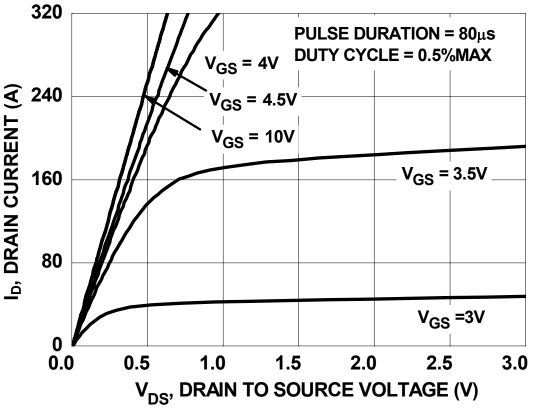

Figure 1. On Region Characteristics

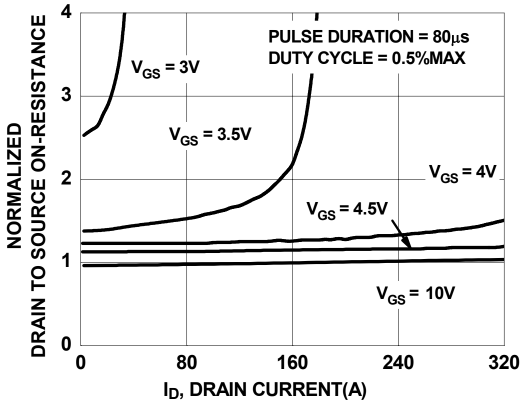

Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

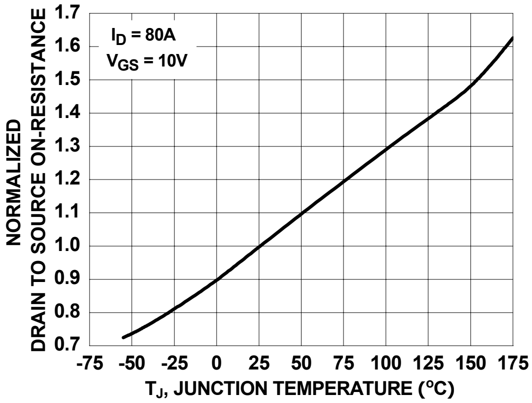

Figure 3. Normalized On Resistance vs Junction Temperature

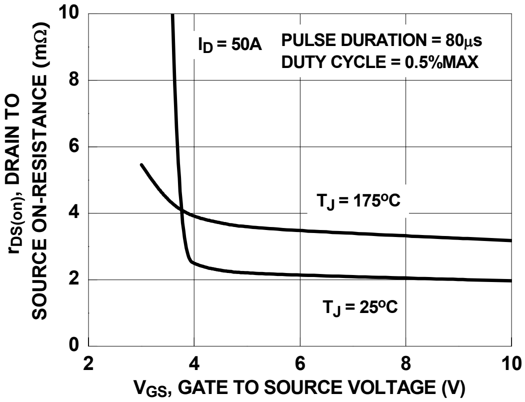

Figure 4. On-Resistance vs Gate to Source Voltage

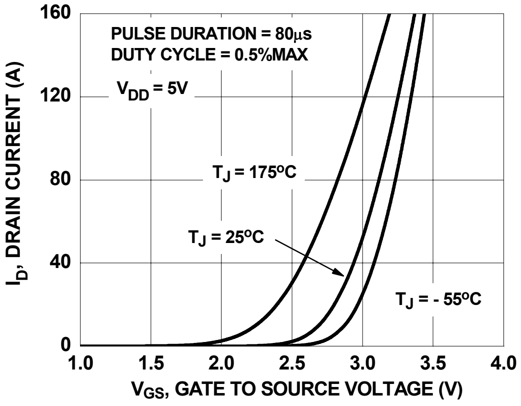

Figure 5. Transfer Characteristics

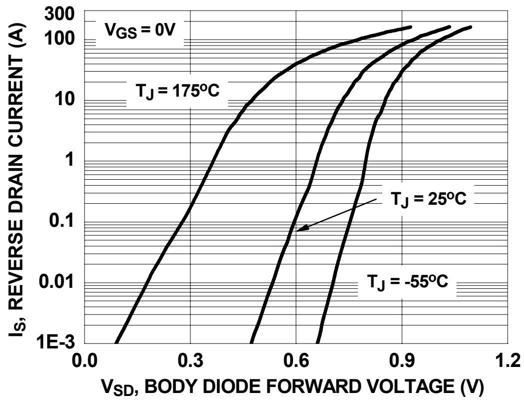

Figure 6. Source to Drain Diode Forward Voltage vs Source Current

## Typical Characteristics $T_J$ = 25°C unless otherwise noted

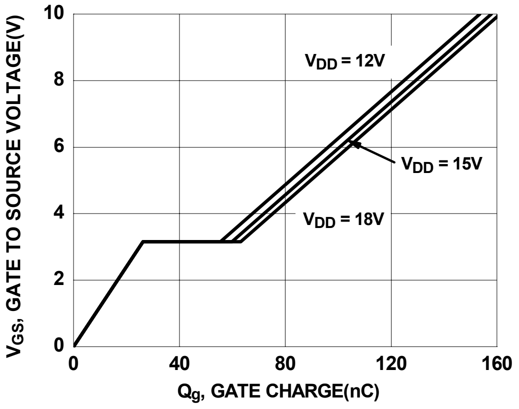

Figure 7. Gate Charge Characteristics

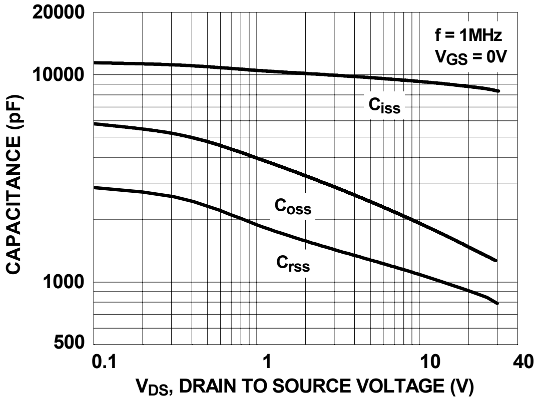

Figure 8. Capacitance vs Drain to Source Voltage

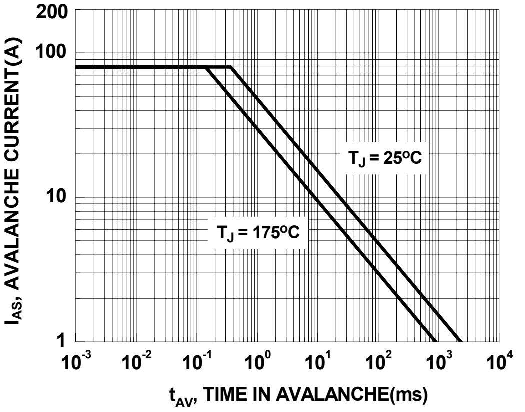

Figure 9. Unclamped Inductive Switching Capability

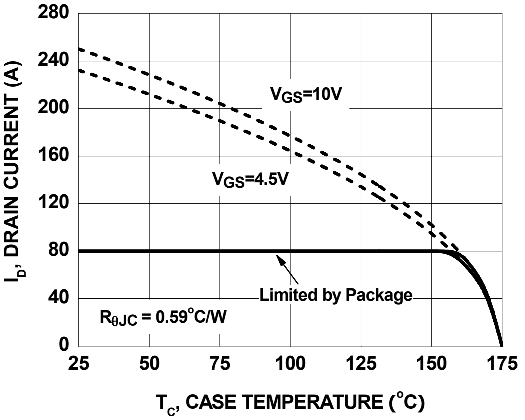

Figure 10. Maximum Continuous Drain Current vs Case Temperature

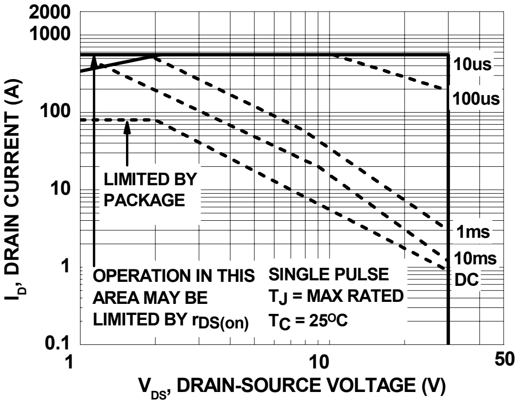

Figure 11. Forward Bias Safe Operating Area

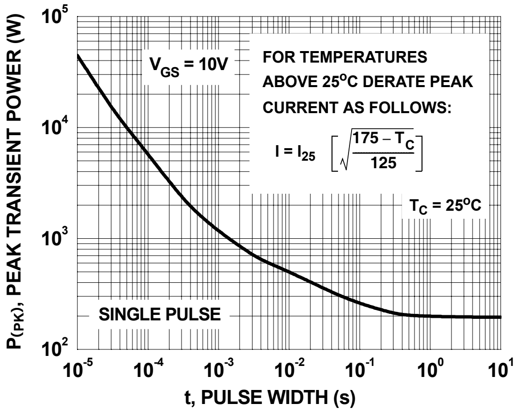

Figure 12. Single Pulse Maximum Power Dissipation

## Typical Characteristics $T_J$ = 25°C unless otherwise noted

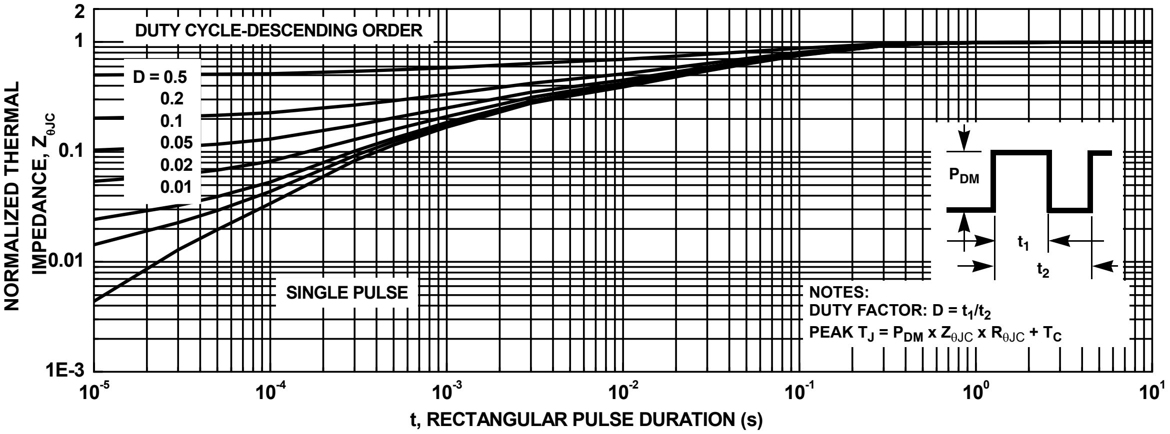

Figure 13. Transient Thermal Response Curve

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