FAIRCHILD SEMICONDUCTOR®

December 2006

# FDD8750
# N-Channel PowerTrench® MOSFET
## 25V, 2.7A, 40mΩ

## Features

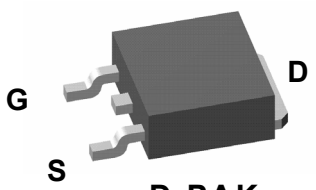
- Max $r_{DS(on)}$ = 40mΩ at $V_{GS}$ = 10V, $I_D$ = 2.7A
- Max $r_{DS(on)}$ = 60mΩ at $V_{GS}$ = 4.5V, $I_D$ = 2.7A
- Low gate charge: $Q_{g(10)}$ = 6nC(Typ)
- Low gate resistance
- Avalanche rated and 100% tested
- RoHS Compliant

## General Description

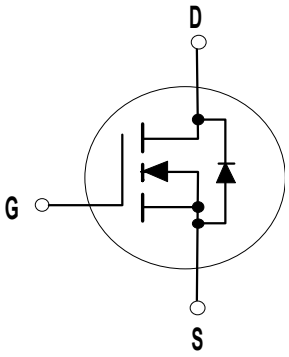
This N-Channel MOSFET has been designed specifically to improve the overall effciency of DC/DC converters using either synchronous or conventional switching PWM controllers.It has been optimized for low gate charge, low $r_{DS(on)}$ and fast switching speed.

## Application

- Low current DC-DC switching
- Linear regulation




D-PAK
(TO-252)




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

| Symbol | Parameter | | | Ratings | Units |
|---|---|---|---|---|---|
| $V_{DS}$ | Drain to Source Voltage | | | 25 | V |
| $V_{GS}$ | Gate to Source Voltage | | | ±20 | V |
| $I_D$ | Drain Current -Continuous(Package Limited) | $T_C$= 25°C | | 2.7 | A |
| | -Continuous(Silicon Limited) | $T_C$= 25°C | (Note 1) | 16 | |
| | -Continuous | $T_A$= 25°C | (Note 1a) | 6.5 | |
| | -Pulsed | | | 14 | |
| $E_{AS}$ | Drain-Source Avalanche Energy | | (Note 3) | 19 | mJ |
| $P_D$ | Power Dissipation | $T_C$= 25°C | | 18 | W |
| | Power Dissipation | | (Note 1a) | 3.7 | |
| $T_J$, $T_{STG}$ | Operating and Storage Junction Temperature Range | | | –55 to +175 | °C |

### Thermal Characteristics

| | | | |
|---|---|---|---|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case | 8 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1a) | 40 | |

### Package Marking and Ordering Information

| Device Marking | Device | Package | Reel Size | Tape Width | Quantity |
|---|---|---|---|---|---|
| FDD8750 | FDD8750 | D-PAK(TO-252) | 13” | 12mm | 2500 units |

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

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| $BV_{DSS}$ | Drain to Source Breakdown Voltage | $I_D$ = 250μA, $V_{GS}$ = 0V | 25 | | | V |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D$ = 250μA, referenced to 25°C | | 18 | | mV/°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ =20V, $V_{GS}$ = 0V | | | 1 | μA |
| | | $T_J$=150°C | | | 250 | |
| $I_{GSS}$ | Gate to Source Leakage Current | $V_{GS}$ = ±20V, $V_{GS}$ = 0V | | | ±100 | nA |
| **On Characteristics (Note 2)** | | | | | | |
| $V_{GS(th)}$ | Gate to Source Threshold Voltage | $V_{GS}$ = $V_{DS}$, $I_D$ = 250μA | 1.2 | 2.0 | 2.5 | V |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate to Source Threshold Voltage Temperature Coefficient | $I_D$ = 250μA, referenced to 25°C | | -5 | | mV/°C |
| $r_{DS(on)}$ | Static Drain to Source On Resistance | $V_{GS}$ = 10V, $I_D$ = 2.7A | | 28 | 40 | mΩ |
| | | $V_{GS}$ = 4.5V, $I_D$ = 2.7A | | 39 | 60 | |
| | | $V_{GS}$ = 10V, $I_D$ = 2.7A, $T_J$=150°C | | 44 | 63 | |
| **Dynamic Characteristics** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = 13V, $V_{GS}$ = 0V, f = 1MHz | | 320 | 425 | pF |
| $C_{oss}$ | Output Capacitance | | | 80 | 110 | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 50 | 75 | pF |
| $R_g$ | Gate Resistance | f = 1MHz | | 1.8 | | Ω |
| **Switching Characteristics** | | | | | | |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD}$ = 13V, $I_D$ = 2.7A, $V_{GS}$ = 10V, $R_{GEN}$ = 6Ω | | 3 | 10 | ns |
| $t_r$ | Rise Time | | | 12 | 22 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | | 8 | 16 | ns |
| $t_f$ | Fall Time | | | 5 | 10 | ns |
| $Q_g$ | Total Gate Charge | $V_{GS}$ = 0V to 10V, $V_{DD}$ =13V, $I_D$ = 2.7A | | 6 | 9 | nC |
| $Q_{g(5)}$ | Total Gate Charge | $V_{GS}$ = 0V to 5V, $V_{DD}$ =13V, $I_D$ = 2.7A | | 3.4 | 5 | nC |
| $Q_{gs}$ | Gate to Source Gate Charge | $V_{DD}$ =13V, $I_D$ = 2.7A | | 1.1 | | nC |
| $Q_{gd}$ | Gate to Drain “Miller” Charge | $V_{DD}$ =13V, $I_D$ = 2.7A | | 1.2 | | nC |
| **Drain-Source Diode Characteristics** | | | | | | |
| $V_{SD}$ | Source to Drain Diode Forward Voltage | $V_{GS}$ = 0V, $I_S$ = 2.7A (Note 2) | | 0.8 | 1.6 | V |
| $t_{rr}$ | Reverse Recovery Time | $I_F$ = 2.7A, di/dt = 100A/μs | | 16 | 24 | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | | 7 | 11 | nC |

**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 $R_{\theta JA}$ is determined by the user's board design.

a. 40°C/W when mounted on a 1 $in^2$ pad of 2 oz copper;
b. 96°C/W when mounted on a minimum pad.

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

**3:** Starting $T_J$ = 25°C, L = 3mH, $I_{AS}$ = 3.6A, $V_{DD}$ = 25V, $V_{GS}$ = 10V.

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

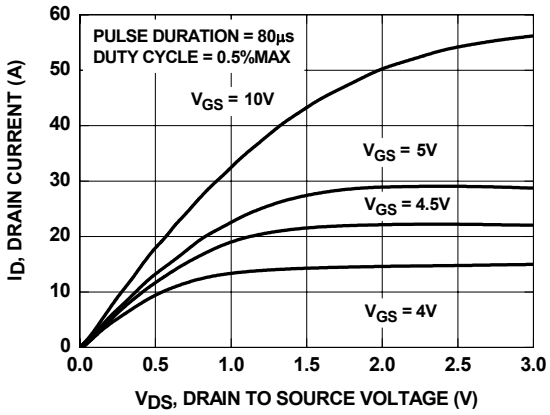



**Figure 1. On Region Characteristics**

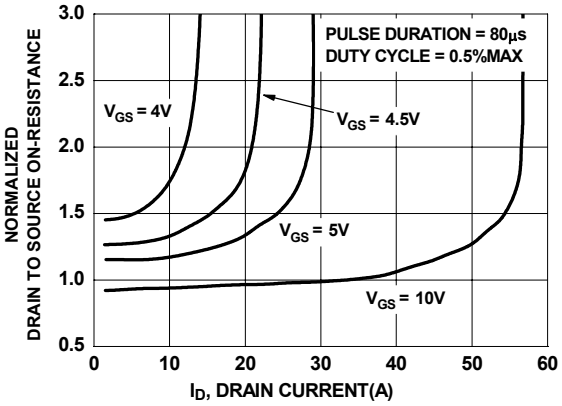



**Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage**

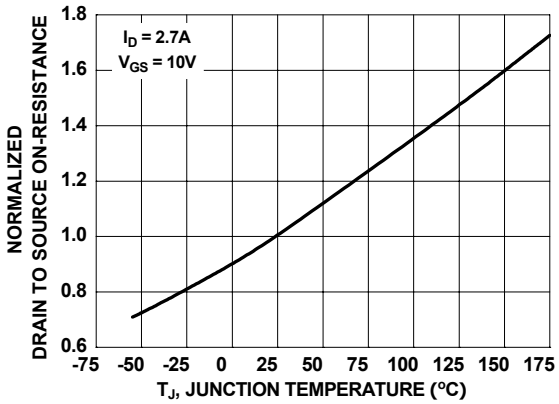



**Figure 3. Normalized On Resistance vs Junction Temperature**

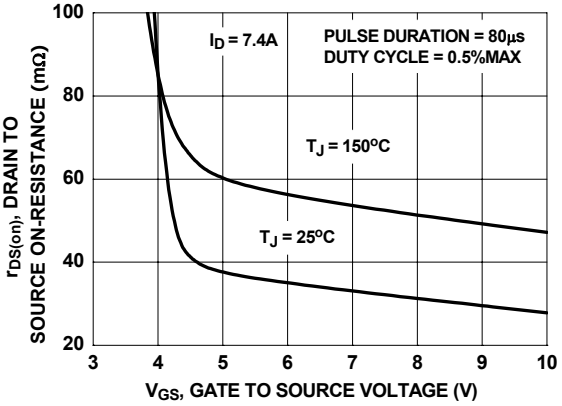



**Figure 4. On-Resistance vs Gate to Source Voltage**

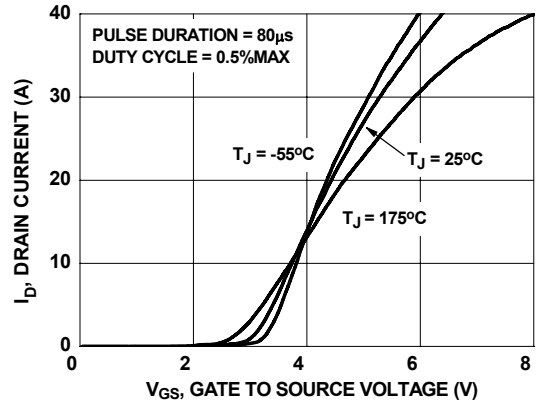



**Figure 5. Transfer Characteristics**

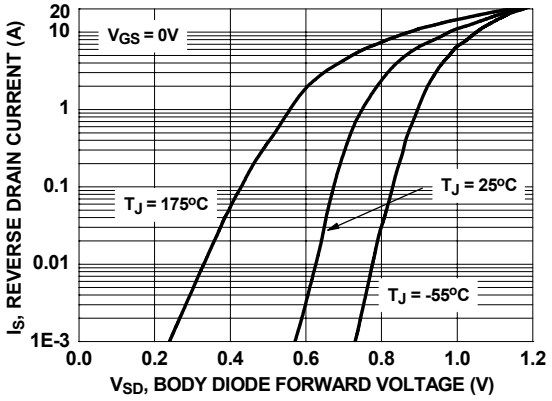



**Figure 6. Source to Drain Diode Forward Voltage vs Source Current**

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

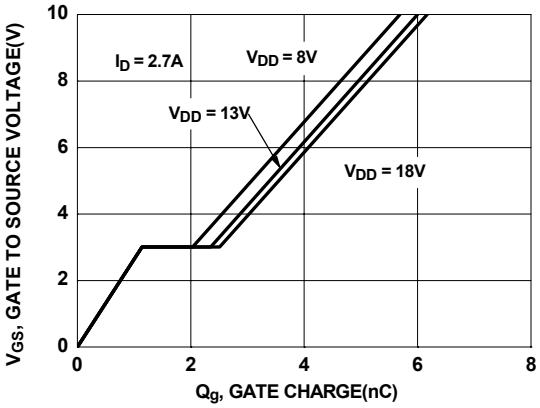



**Figure 7. Gate Charge Characteristics**

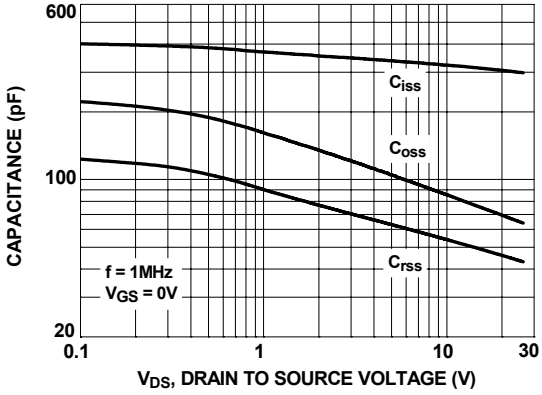



**Figure 8. Capacitance vs Drain to Source Voltage**

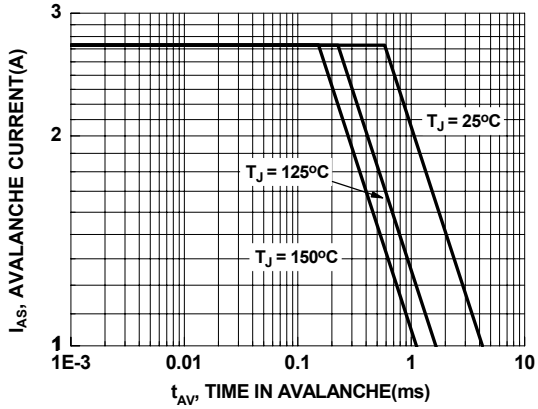



**Figure 9. Unclamped Inductive Switching Capability**

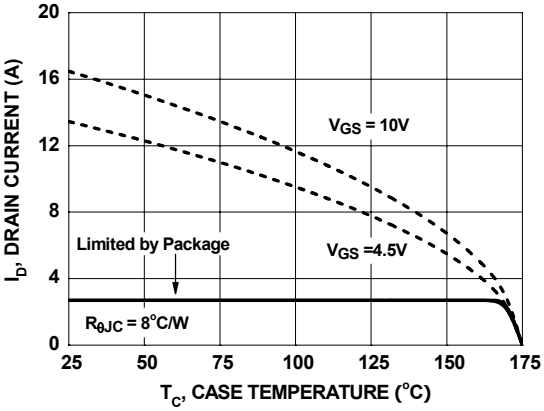



**Figure 10. Maximum Continuous Drain Current vs Case Temperature**

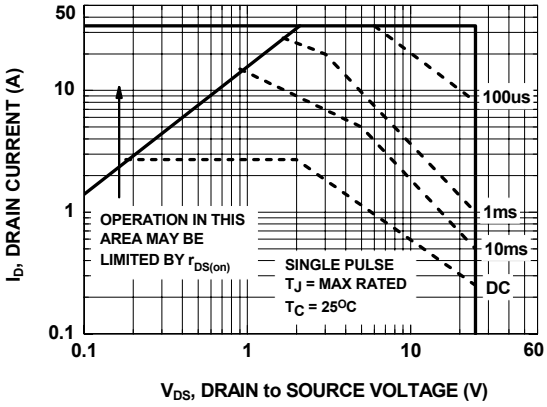



**Figure 11. Forward Bias Safe Operating Area**

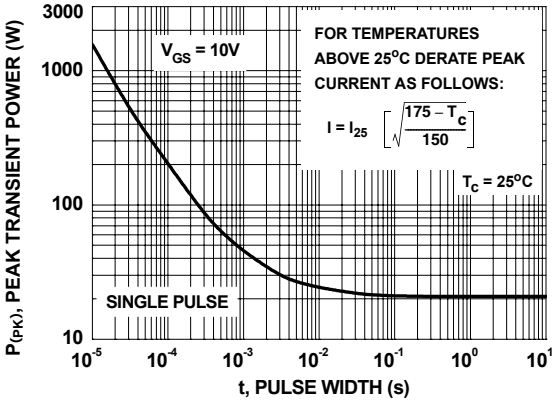



**Figure 12. Single Pulse Maximum Power Dissipation**

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

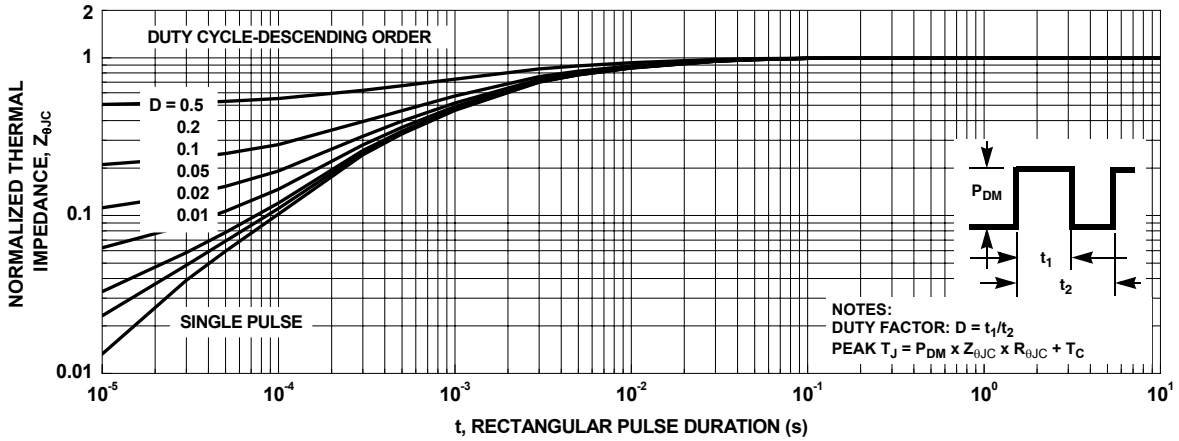



**Figure 13. Transient Thermal Response Curve**

## TRADEMARKS

The following are registered and unregistered trademarks Fairchild Semiconductor owns or is authorized to use and is not intended to be an exhaustive list of all such trademarks.

| | | | | |
|---|---|---|---|---|
| ACEx™ | FACT Quiet Series™ | OCX™ | SILENT SWITCHER® | UniFET™ |
| ActiveArray™ | GlobalOptoisolator™ | OCXPro™ | SMART START™ | VCX™ |
| Bottomless™ | GTO™ | OPTOLOGIC® | SPM™ | Wire™ |
| Build it Now™ | HiSeC™ | OPTOPLANAR™ | Stealth™ | |
| CoolFET™ | $I^2C$™ | PACMAN™ | SuperFET™ | |
| *CROSSVOLT*™ | *i-Lo*™ | POP™ | SuperSOT™-3 | |
| DOME™ | ImpliedDisconnect™ | Power247™ | SuperSOT™-6 | |
| EcoSPARK™ | IntelliMAX™ | PowerEdge™ | SuperSOT™-8 | |
| $E^2CMOS$™ | ISOPLANAR™ | PowerSaver™ | SyncFET™ | |
| EnSigna™ | LittleFET™ | PowerTrench® | TCM™ | |
| FACT® | MICROCOUPLER™ | QFET® | TinyBoost™ | |
| FAST® | MicroFET™ | QS™ | TinyBuck™ | |
| FASTr™ | MicroPak™ | QT Optoelectronics™ | TinyPWM™ | |
| FPS™ | MICROWIRE™ | Quiet Series™ | TinyPower™ | |
| FRFET™ | MSX™ | RapidConfigure™ | TinyLogic® | |
| | MSXPro™ | RapidConnect™ | TINYOPTO™ | |
| Across the board. Around the world.™ | | µSerDes™ | TruTranslation™ | |
| The Power Franchise® | | ScalarPump™ | UHC® | |
| Programmable Active Droop™ | | | | |



**PRODUCT STATUS DEFINITIONS**
**Definition of Terms**

| Datasheet Identification | Product Status | Definition |
|---|---|---|
| Advance Information | Formative or In Design | This datasheet contains the design specifications for product development. Specifications may change in any manner without notice. |
| Preliminary | First Production | This datasheet contains preliminary data, and supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design. |
| No Identification Needed | Full Production | This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design. |
| Obsolete | Not In Production | This datasheet contains specifications on a product that has been discontinued by Fairchild semiconductor. The datasheet is printed for reference information only. |

Rev. I22