FAIRCHILD SEMICONDUCTOR®

July 2007

# FDMS8680

## N-Channel PowerTrench® MOSFET

### 30V, 35A, 7.0mΩ

### Features

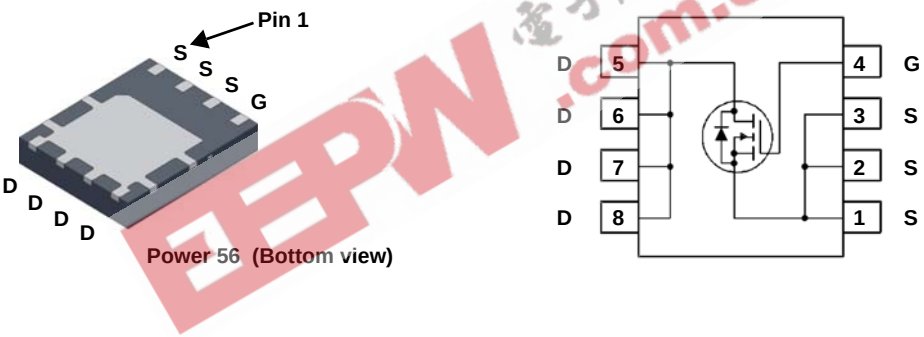
- Max $r_{DS(on)}$ = 7.0mΩ at $V_{GS}$ = 10V, $I_D$ = 14A
- Max $r_{DS(on)}$ = 11.0mΩ at $V_{GS}$ = 4.5V, $I_D$ = 11.5A
- Advanced Package and Silicon combination for low $r_{DS(on)}$ and high efficiency
- MSL1 robust package design
- RoHS Compliant

### General Description

The FDMS8680 has been designed to minimize losses in power conversion application. Advancements in both silicon and package technologies have been combined to offer the lowest $r_{DS(on)}$ while maintaining excellent switching performance.

### Applications

- High Side for Synchronous Buck to Power Core Processor
- Secondary Side Synchronous Rectifier
- High Side Switch in POL DC/DC Converter
- Oring FET/ Load Switch




## MOSFET Maximum Ratings $T_A$ = 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 | | 35 | A |
| | -Continuous (Silicon limited) | $T_C$ = 25°C | | 63 | |
| | -Continuous | $T_A$ = 25°C | (Note 1a) | 14 | |
| | -Pulsed | | | 100 | |
| $E_{AS}$ | Single Pulse Avalanche Energy | | (Note 3) | 216 | mJ |
| $P_D$ | Power Dissipation | $T_C$ = 25°C | | 50 | W |
| | Power Dissipation | $T_A$ = 25°C | (Note 1a) | 2.5 | |
| $T_J$, $T_{STG}$ | Operating and Storage Junction Temperature Range | | | -55 to +150 | °C |

### Thermal Characteristics

| | | | |
|---|---|---|---|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case | 2.5 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1a) | 50 | |

### Package Marking and Ordering Information

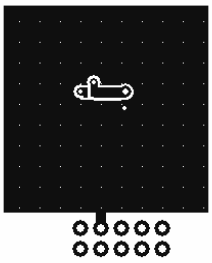
| Device Marking | Device | Package | Reel Size | Tape Width | Quantity |
|---|---|---|---|---|---|
| FDMS8680 | FDMS8680 | Power 56 | 13" | 12mm | 3000units |

## 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 | 30 | | | V |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D$ = 250μA, referenced to 25°C | | 24 | | mV/°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = 24V, $V_{GS}$ = 0V | | | 1 | μA |
| $I_{GSS}$ | Gate to Source Leakage Current | $V_{GS}$ = ±20V, $V_{DS}$ = 0V | | | ±100 | nA |
| **On Characteristics** | | | | | | |
| $V_{GS(th)}$ | Gate to Source Threshold Voltage | $V_{GS}$ = $V_{DS}$, $I_D$ = 250μA | 1.0 | 1.8 | 3.0 | V |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate to Source Threshold Voltage Temperature Coefficient | $I_D$ = 250μA, referenced to 25°C | | -5.7 | | mV/°C |
| $r_{DS(on)}$ | Static Drain to Source On Resistance | $V_{GS}$ = 10V, $I_D$ = 14A | | 5.5 | 7.0 | mΩ |
| | | $V_{GS}$ = 4.5V, $I_D$ = 11.5A | | 8.5 | 11.0 | |
| | | $V_{GS}$ = 10V, $I_D$ = 14A, $T_J$ = 125°C | | 8.2 | 10.5 | |
| $g_{FS}$ | Forward Transconductance | $V_{DD}$ = 10V, $I_D$ = 14A | | 72 | | S |
| **Dynamic Characteristics** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = 15V, $V_{GS}$ = 0V, f = 1MHz | | 1195 | 1590 | pF |
| $C_{oss}$ | Output Capacitance | | | 555 | 740 | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 95 | 145 | pF |
| $R_g$ | Gate Resistance | f = 1MHz | | 0.8 | 4.0 | Ω |
| **Switching Characteristics** | | | | | | |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD}$ = 15V, $I_D$ = 14A, $V_{GS}$ = 10V, $R_{GEN}$ = 6Ω | | 9 | 18 | ns |
| $t_r$ | Rise Time | | | 3 | 10 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | | 21 | 34 | ns |
| $t_f$ | Fall Time | | | 2 | 10 | ns |
| $Q_g$ | Total Gate Charge | $V_{GS}$ = 0V to 10V; $V_{DD}$ = 15V, $I_D$ = 14A | | 18 | 26 | nC |
| $Q_g$ | Total Gate Charge | $V_{GS}$ = 0V to 5V; $V_{DD}$ = 15V, $I_D$ = 14A | | 10 | 14 | nC |
| $Q_{gs}$ | Gate to Source Charge | $V_{DD}$ = 15V, $I_D$ = 14A | | 3.2 | | nC |
| $Q_{gd}$ | Gate to Drain “Miller” Charge | $V_{DD}$ = 15V, $I_D$ = 14A | | 2.7 | | nC |
| **Drain-Source Diode Characteristics** | | | | | | |
| $V_{SD}$ | Source to Drain Diode Forward Voltage | $V_{GS}$ = 0V, $I_S$ = 14A (Note 2) | | 0.8 | 1.2 | V |
| $t_{rr}$ | Reverse Recovery Time | $I_F$ = 14A, di/dt = 100A/μs | | 27 | 44 | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | | 15 | 27 | nC |

NOTES:

1. $R_{\theta JA}$ is determined with the device mounted on a 1in$^2$ pad 2 oz copper pad on a 1.5 x 1.5 in. board of FR-4 material. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design.



a. 50°C/W when mounted on a 1in$^2$ pad of 2 oz copper.

b. 125°C/W when mounted on a minimum pad of 2 oz copper.

2. Pulse Test: Pulse Width < 300μs, Duty cycle < 2.0%.
3. Starting $T_J$ = 25°C, L = 3mH, $I_{AS}$ = 12A, $V_{DD}$ = 30V, $V_{GS}$ = 10V.

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

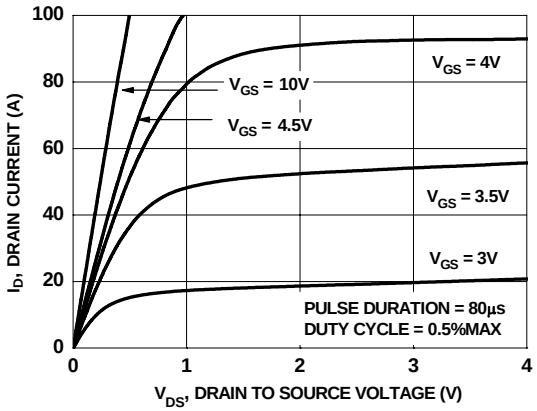



**Figure 1. On-Region Characteristics**

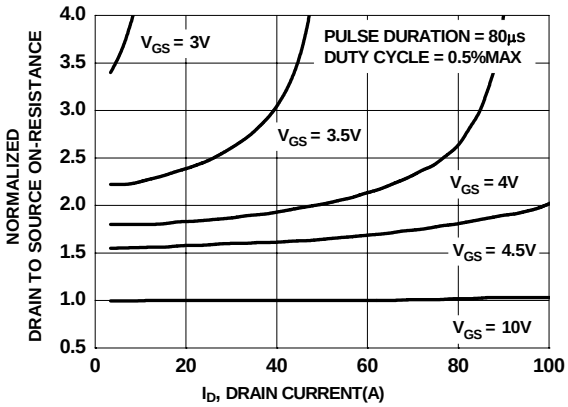



**Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage**

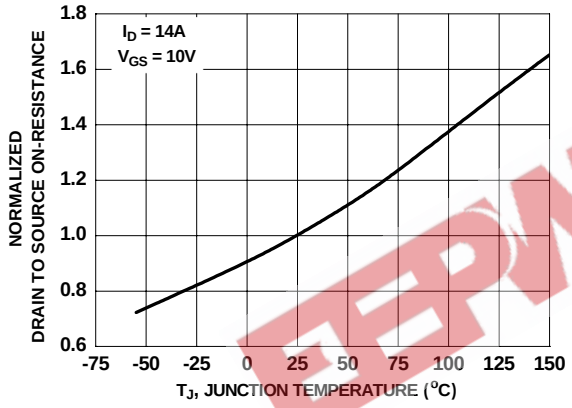



**Figure 3. Normalized On-Resistance vs Junction Temperature**

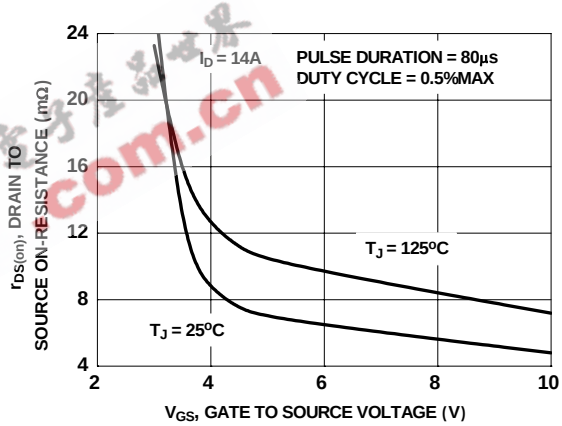



**Figure 4. On-Resistance vs Gate to Source Voltage**

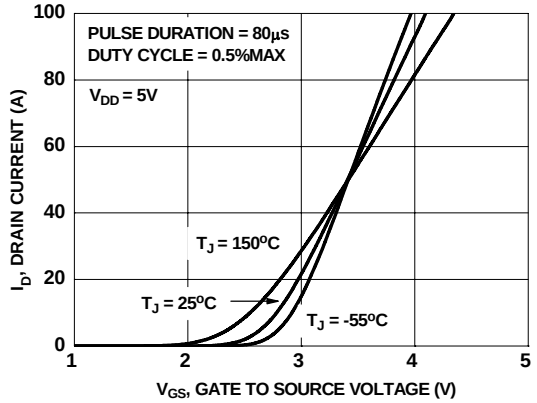



**Figure 5. Transfer Characteristics**

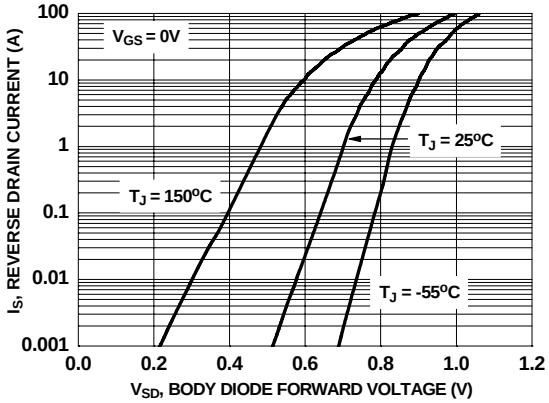



**Figure 6. Source to Drain Diode Forward Voltage vs Source Current**

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

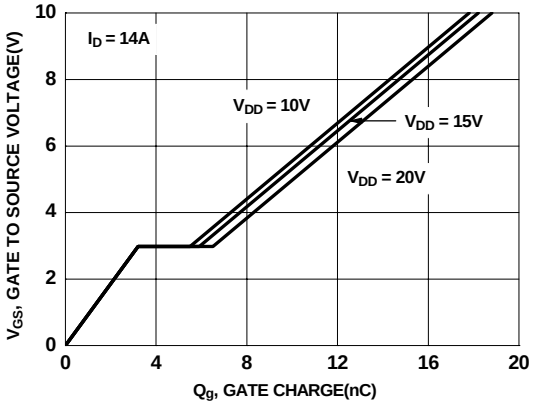



**Figure 7. Gate Charge Characteristics**

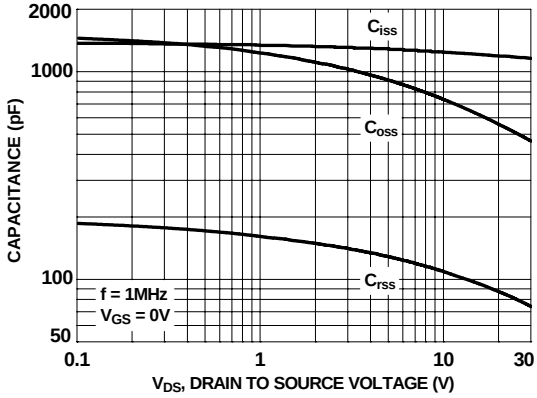



**Figure 8. Capacitance vs Drain to Source Voltage**

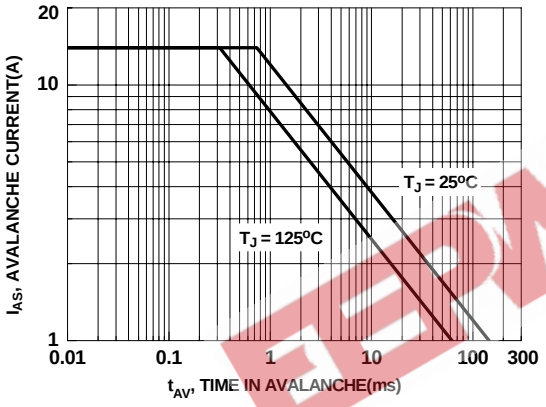



**Figure 9. Unclamped Inductive Switching Capability**

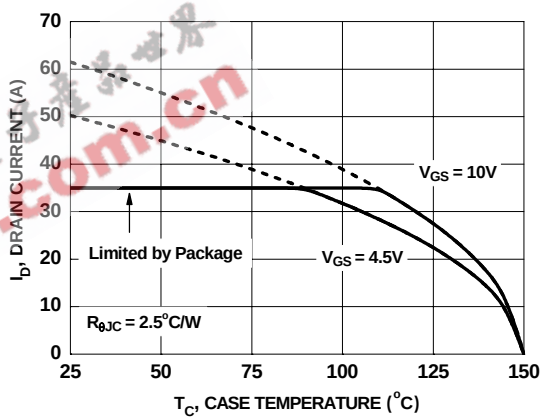



**Figure 10. Maximum Continuous Drain Current vs Case Temperature**

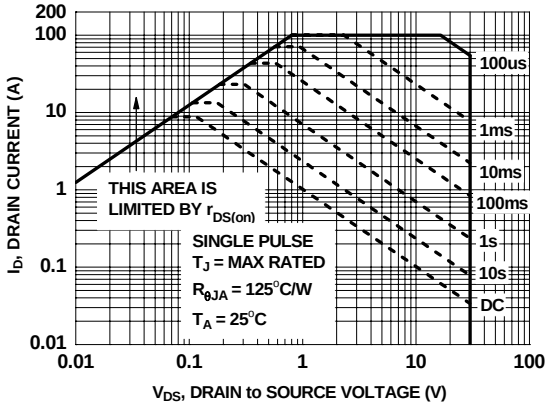



**Figure 11. Forward Bias Safe Operating Area**

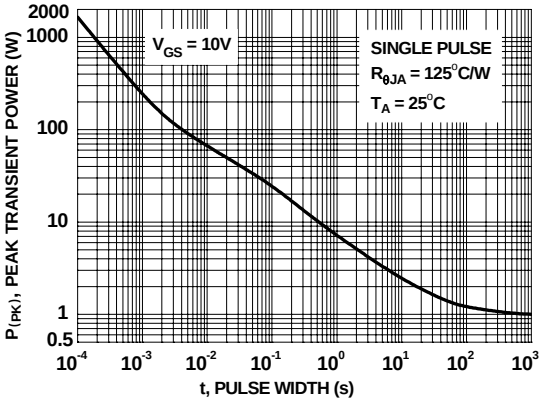



**Figure 12. Single Pulse Maximum Power Dissipation**

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

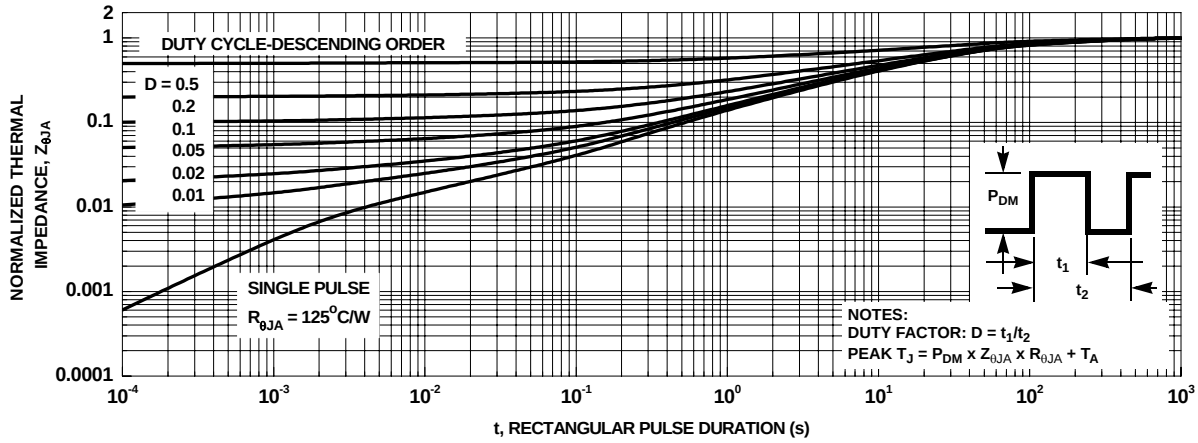



**Figure 13. Transient Thermal Response Curve**

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