ON Semiconductor®

# FDS8984
# N-Channel PowerTrench® MOSFET
### 30V, 7A, 23mΩ

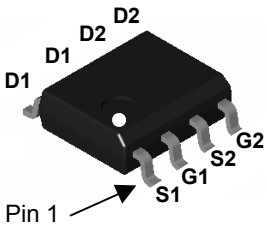
## General Description

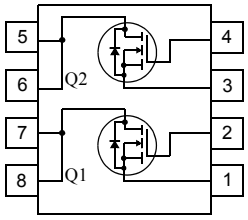
This N-Channel MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers. It has been optimized for low gate charge, low $r_{DS(ON)}$ and fast switching speed.

## Features

- Max $r_{DS(on)}$ = 23mΩ, $V_{GS}$ = 10V, $I_D$ = 7A
- Max $r_{DS(on)}$ = 30mΩ, $V_{GS}$ = 4.5V, $I_D$ = 6A
- Low gate charge
- 100% $R_G$ tested
- RoHS Compliant

SO-8




## 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 | (Note 1a) | 7 | A |
| | Pulsed | | 30 | A |
| $E_{AS}$ | Single Pulse Avalache Energy | (Note 2) | 32 | mJ |
| $P_D$ | Power Dissipation for Single Operation | | 1.6 | W |
| | Derate above 25°C | | 13 | mW/°C |
| $T_J$, $T_{STG}$ | Operating and Storage Temperature | | -55 to 150 | °C |

## Thermal Characteristics

| | | | | |
|---|---|---|---|---|
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | (Note 1a) | 78 | °C/W |
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case | (Note 1) | 40 | °C/W |

## Package Marking and Ordering Information

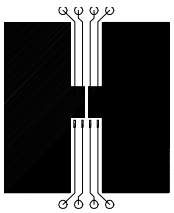
| Device Marking | Device | Package | Reel Size | Tape Width | Quantity |
|---|---|---|---|---|---|
| FDS8984 | FDS8984 | SO-8 | 330mm | 12mm | 2500 units |

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

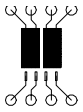
| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| $BV_{DSS}$ | Drain to Source Breakdown Voltage | $I_D$ = 250μA, $V_{GS}$ = 0V | 30 | | | V |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D$ = 250μA, referenced to 25°C | | 23 | | mV/°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = 24V, $V_{GS}$ = 0V | | | 1 | μA |
| | | $V_{DS}$ = 24V, $V_{GS}$ = 0V, $T_J$ = 125°C | | | 250 | μA |
| $I_{GSS}$ | Gate to Source Leakage Current | $V_{GS}$ = ±20V, $V_{DS}$ = 0V | | | ±100 | nA |
| **On Characteristics (Note 3)** | | | | | | |
| $V_{GS(th)}$ | Gate to Source Threshold Voltage | $V_{DS}$ = $V_{GS}$, $I_D$ = 250μA | 1.2 | 1.7 | 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 | | - 4.3 | | mV/°C |
| $r_{DS(on)}$ | Drain to Source On Resistance | $V_{GS}$ = 10V, $I_D$ = 7A | | 19 | 23 | mΩ |
| | | $V_{GS}$ = 4.5V, $I_D$ = 6A | | 24 | 30 | mΩ |
| | | $V_{GS}$ = 10V, $I_D$ = 7A, $T_J$ = 125°C | | 26 | 32 | mΩ |
| **Dynamic Characteristics** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = 15V, $V_{GS}$ = 0V, f = 1.0MHz | | 475 | 635 | pF |
| $C_{oss}$ | Output Capacitance | | | 100 | 135 | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 65 | 100 | pF |
| $R_G$ | Gate Resistance | f = 1MHz | | 0.9 | 1.6 | Ω |
| **Switching Characteristics (Note 3)** | | | | | | |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD}$ = 15V, $I_D$ = 7A, $V_{GS}$ = 10V, $R_{GS}$ = 33Ω | | 5 | 10 | ns |
| $t_r$ | Rise Time | | | 9 | 18 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | | 42 | 68 | ns |
| $t_f$ | Fall Time | | | 21 | 34 | ns |
| $Q_g$ | Total Gate Charge | $V_{DS}$ = 15V, $V_{GS}$ = 10V, $I_D$ = 7A | | 9.2 | 13 | nC |
| $Q_g$ | Total Gate Charge | $V_{DS}$ = 15V, $V_{GS}$ = 5V, $I_D$ = 7A | | 5.0 | 7 | nC |
| $Q_{gs}$ | Gate to Source Gate Charge | | | 1.5 | | nC |
| $Q_{gd}$ | Gate to Drain “Miller” Charge | | | 2.0 | | nC |
| **Drain-Source Diode Characteristics** | | | | | | |
| $V_{SD}$ | Source to Drain Diode Voltage | $I_{SD}$ = 7A | | 0.9 | 1.25 | V |
| | | $I_{SD}$ = 2.1A | | 0.8 | 1.0 | V |
| $t_{rr}$ | Diode Reverse Recovery Time | $I_F$ = 7A, di/dt = 100A/μs | | | 33 | ns |
| $Q_{rr}$ | Diode Reverse Recovery Charge | | | | 20 | nC |

**Notes:**

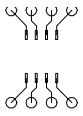
**1:** $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user’s board design.



a) 78°C/W when mounted on a 0.5in$^2$ pad of 2 oz copper



b) 125°C/W when mounted on a 0.02 in$^2$ pad of oz copper



c) 135°C/W when mounted on a minimun pad

Scale 1 : 1 on letter size paper

**2:** Starting $T_J$ = 25°C, L = 1mH, $I_{AS}$ = 8A, $V_{DD}$ = 27V, $V_{GS}$ = 10V.

**3:** Pulse Test:Pulse Width <300μS, Duty Cycle <2%.

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

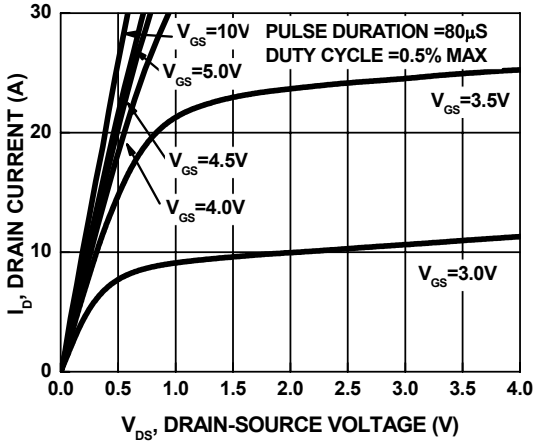



Figure 1. On Region Characteristics

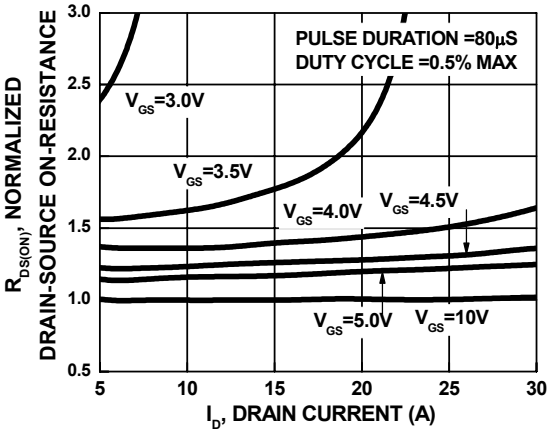



Figure 2. On-Resistance vs Drain Current and Gate Voltage

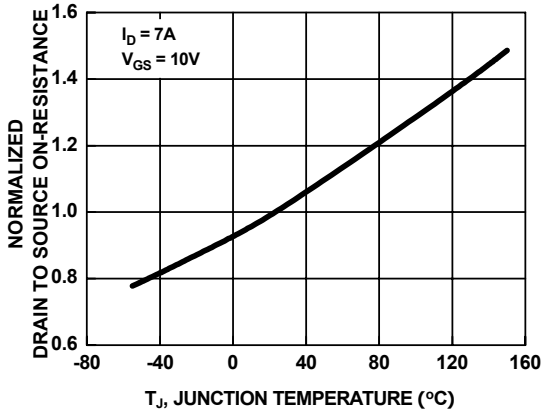



Figure 3. On Resistance vs Temperature

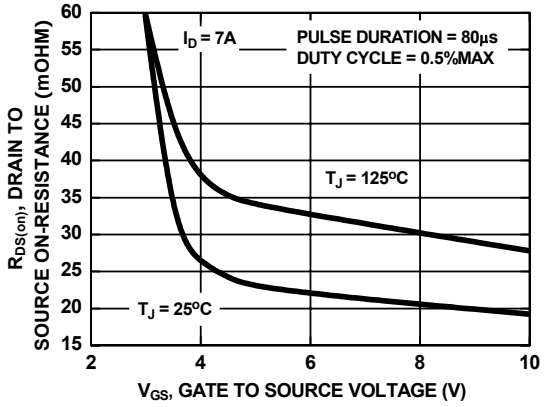



Figure 4. On-Resistance vs Gate to Source Votlage

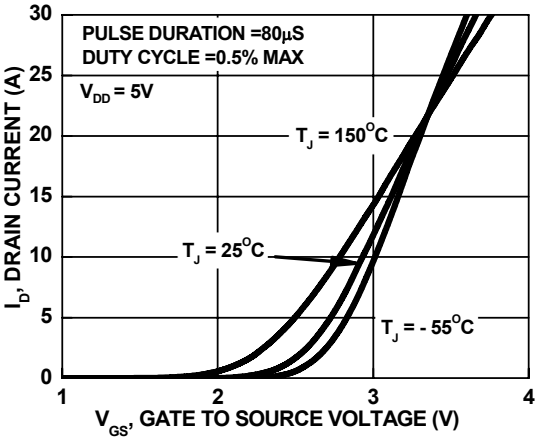



Figure 5. Transfer Characteristics

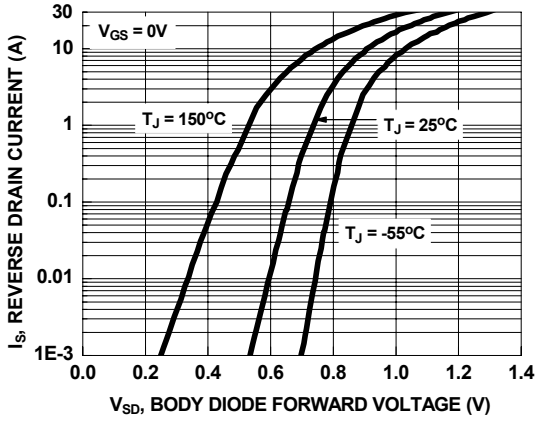



Figure 6. Source to Drain Diode Forward Voltage vs Source Current

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

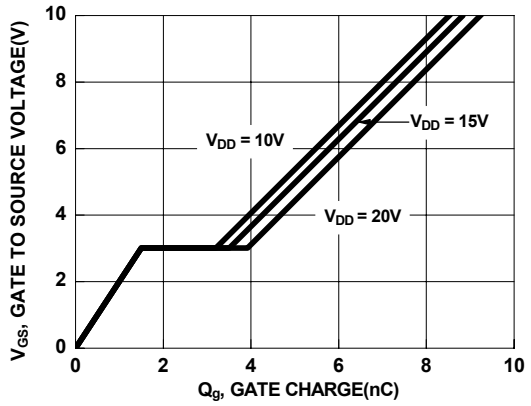



Figure 7. Gate Charge Characteristics

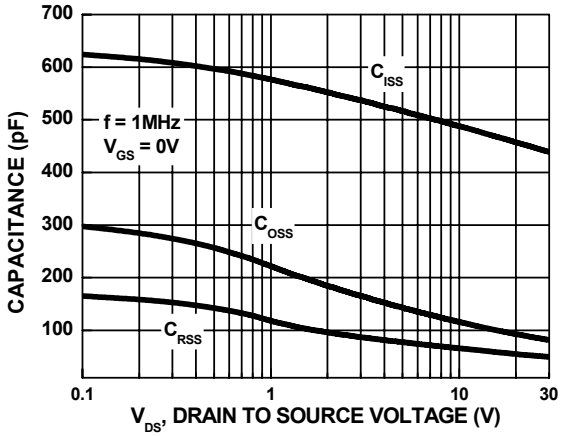



Figure 8. Capacitance vs Drain to Source Voltage

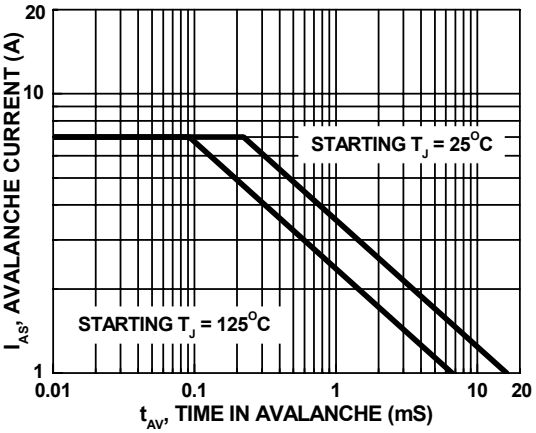



Figure 9. Unclamped Inductive Switching Capability

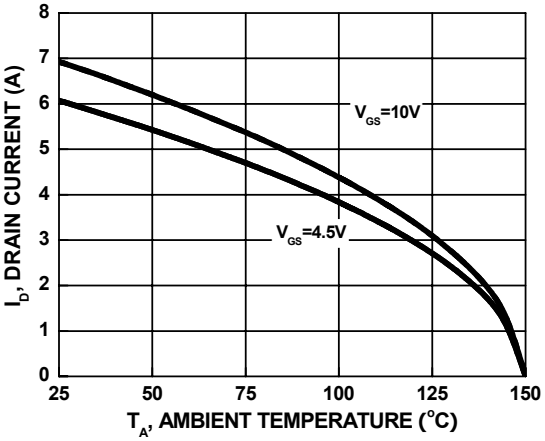



Figure 10. Maximum Continuous Drain Current vs Ambient Temperature

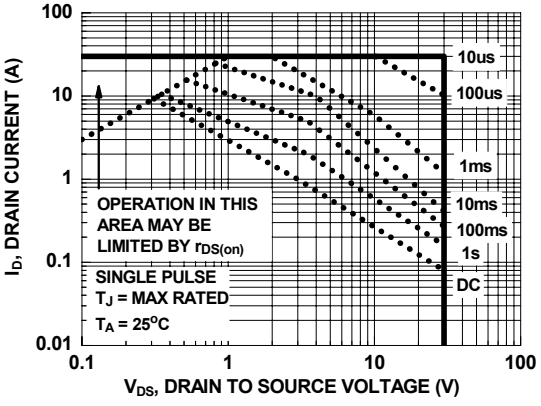



Figure 11. Forward Bias Safe Operating Area

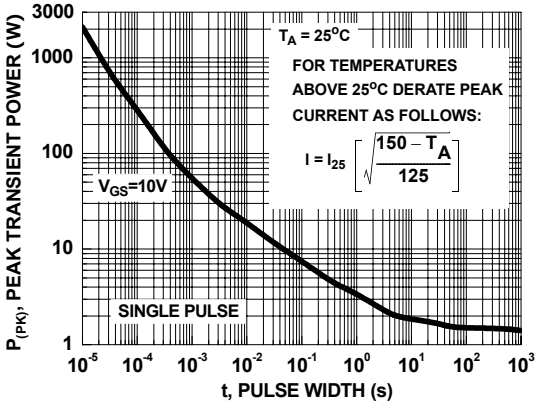



Figure 12. Single Pulse Maximum Power Dissipation

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

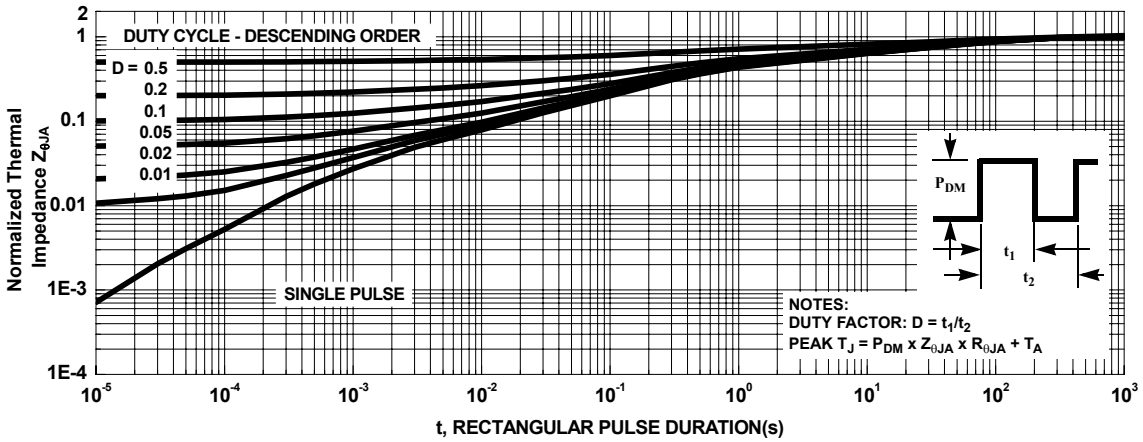



**Figure 13. Transient Thermal Response Curve**

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