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# 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

Pin 1
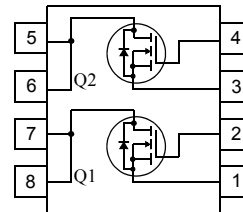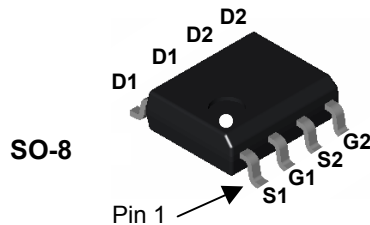


## MOSFET Maximum Ratings  $T_A$ = 25°C unless otherwise noted

| 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 |

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## 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 |
| $\dfrac{\Delta BV_{DSS}}{\Delta T_J}$ | 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 |
| | | $T_J$ = 125°C | | | 250 | |
| $I_{GSS}$ | 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 |
| $\dfrac{\Delta V_{GS(th)}}{\Delta T_J}$ | 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 | |
| | | $V_{GS}$ = 10V, $I_D$ = 7A, $T_J$ = 125°C | | 26 | 32 | |
| **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.
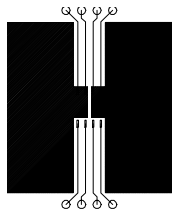


a) 78°C/W when mounted on a 0.5in² pad of 2 oz copper
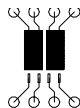
b) 125°C/W when mounted on a 0.02 in² pad of oz copper
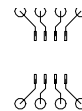
c) 135°C/W when mounted on a minimun pad

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%.

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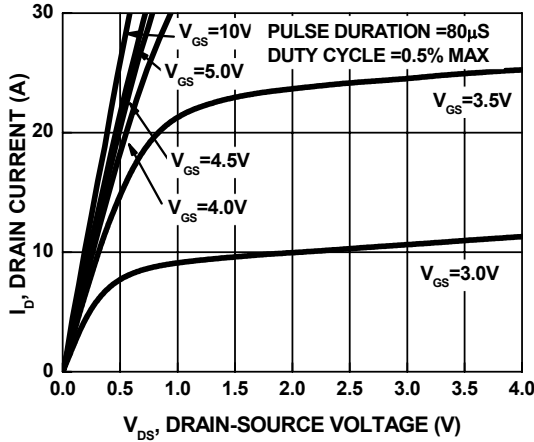


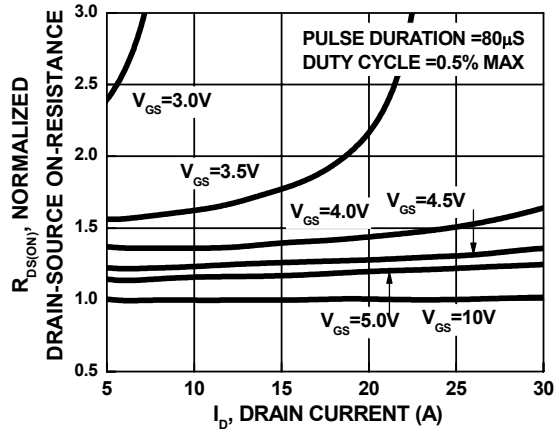Figure 1.  On Region Characteristics



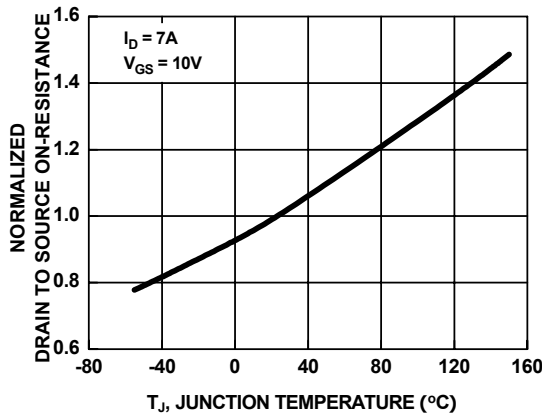Figure 2.  On-Resistance vs Drain Current and Gate Voltage
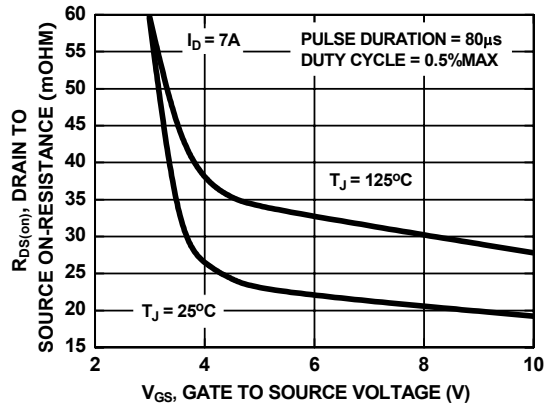


Figure 3.  On Resistance vs Temperature



Figure 4.  On-Resistance vs Gate to Source Votlage
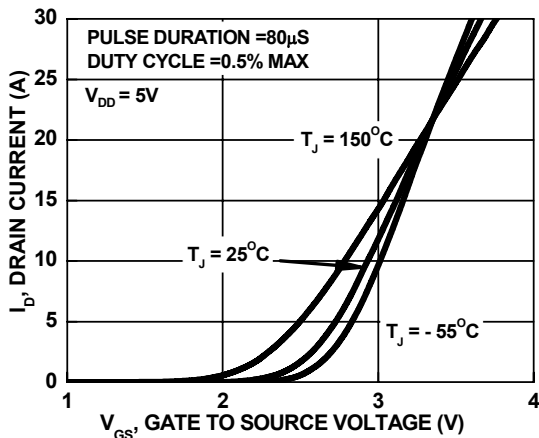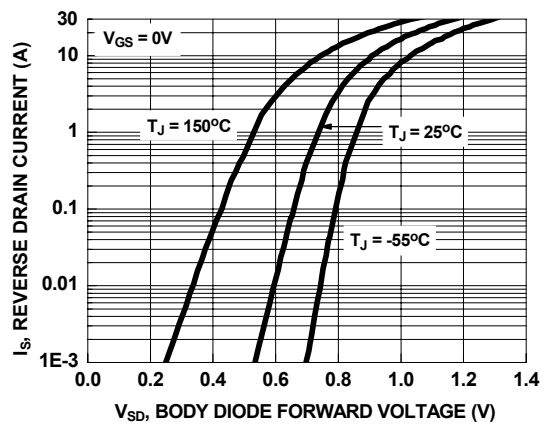


Figure 5.  Transfer Characteristics



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

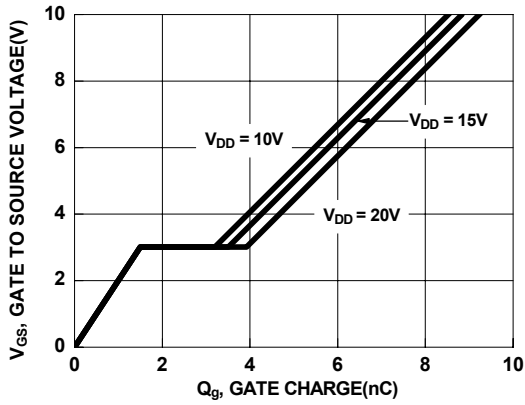## Typical Characteristics $T_J$ = 25°C unless otherwise noted



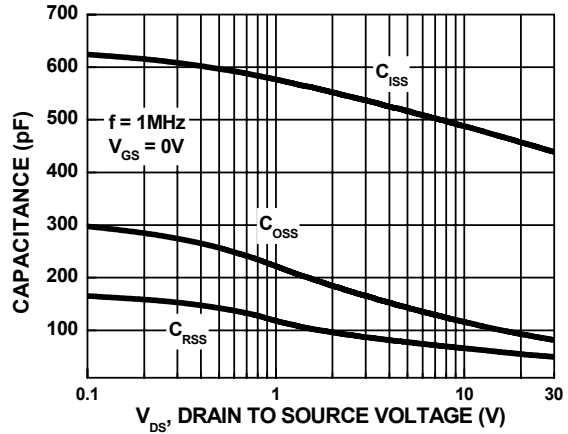**Figure 7. Gate Charge Characteristics**



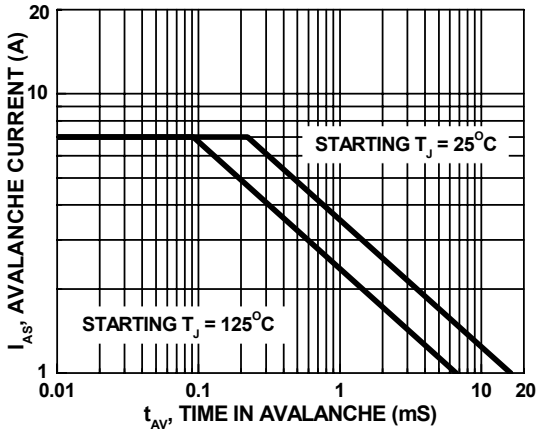**Figure 8. Capacitance vs Drain to Source Voltage**



**Figure 9. Unclamped Inductive Switching Capability**
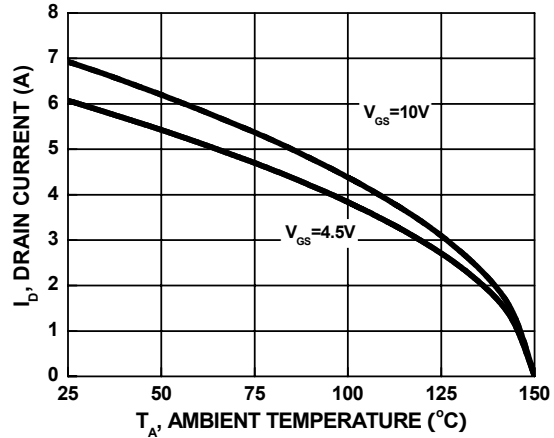


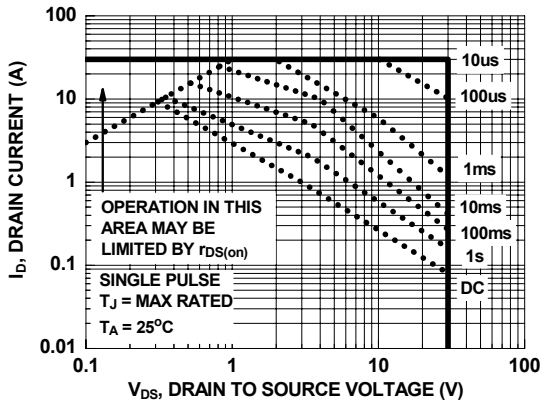**Figure 10. Maximum Continuous Drain Current vs Ambient Temperature**
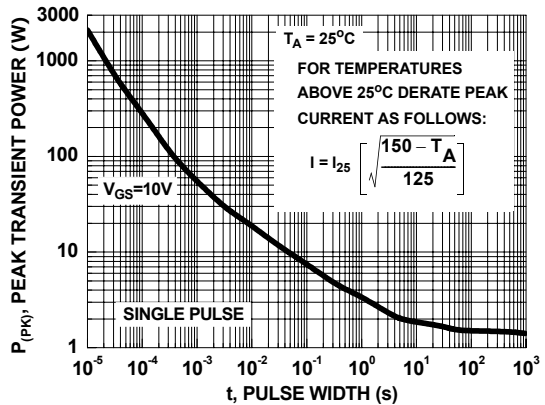


**Figure 11. Forward Bias Safe Operating Area**



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

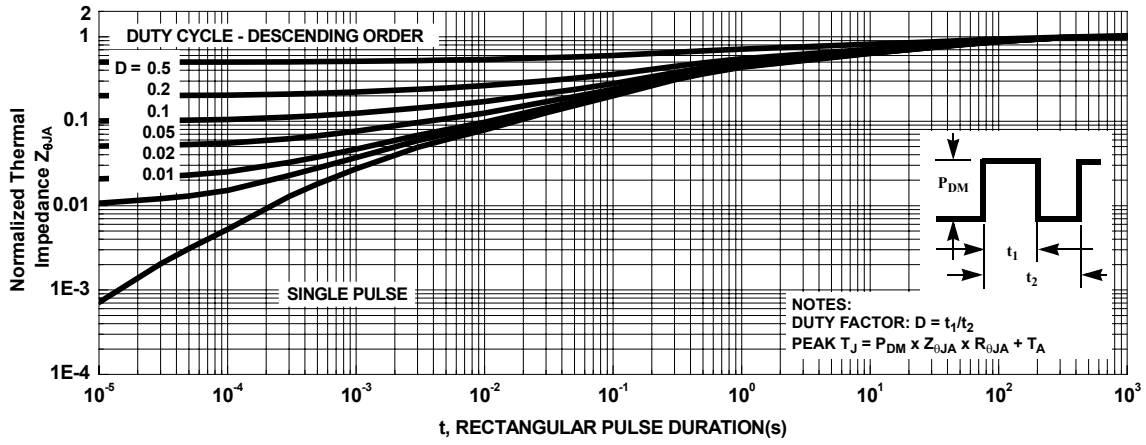**Typical Characteristics** $T_J$ = 25°C unless otherwise noted



**Figure 13.  Transient Thermal Response Curve**

NOTES:
DUTY FACTOR: D = $t_1/t_2$
PEAK $T_J$ = $P_{DM}$ x $Z_{\theta JA}$ x $R_{\theta JA}$ + $T_A$

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