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FDD6782A

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FAIRCHILD SEMICONDUCTOR®

January 2009

# FDD6782A

## N-Channel PowerTrench® MOSFET

### 25 V, 10.5 mΩ



## Features

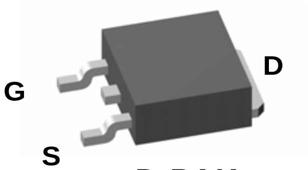
- Max $r_{DS(on)}$ = 10.5 mΩ at $V_{GS}$ = 10 V, $I_D$ = 14.9 A
- Max $r_{DS(on)}$ = 24.0 mΩ at $V_{GS}$ = 4.5 V, $I_D$ = 11.0 A
- 100% UIL test
- RoHS Compliant

## General Description

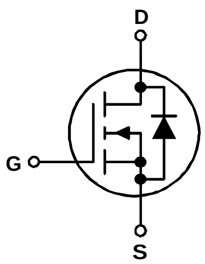
This N-Channel MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers. It has been optimized for low gate charge, low $r_{DS(on)}$ and fast switching speed.

## Applications

- Vcore DC-DC for Desktop Computers and Servers
- VRM for Intermediate Bus Architecture




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 | 20 | A |
| | -Continuous (Silicon limited) $T_C$ = 25 °C | 42 | |
| | -Continuous $T_A$ = 25 °C (Note 1a) | 20 | |
| | -Pulsed | 100 | |
| $E_{AS}$ | Single Pulse Avalanche Energy (Note 3) | 12 | mJ |
| $P_D$ | Power Dissipation $T_C$ = 25 °C | 31 | W |
| | Power Dissipation $T_A$ = 25 °C (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 | 4.8 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1a) | 40 | |

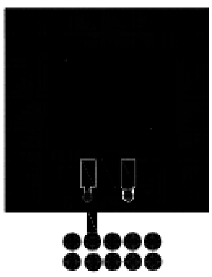
### Package Marking and Ordering Information

| Device Marking | Device | Package | Reel Size | Tape Width | Quantity |
|---|---|---|---|---|---|
| FDD6782A | FDD6782A | D-PAK (TO-252) | 13 ” | 12 mm | 2500 units |

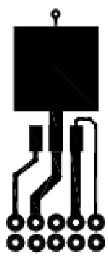
## Electrical Characteristics $T_J$ = 25 °C unless otherwise noted

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| $BV_{DSS}$ | Drain to Source Breakdown Voltage | $I_D$ = 250 μA, $V_{GS}$ = 0 V | 25 | | | V |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D$ = 250 μA, referenced to 25 °C | | 16 | | mV/°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = 20 V, $V_{GS}$ = 0 V | | | 1 | μA |
| $I_{GSS}$ | Gate to Source Leakage Current | $V_{GS}$ = ±20 V, $V_{DS}$ = 0 V | | | ±100 | nA |
| **On Characteristics** | | | | | | |
| $V_{GS(th)}$ | Gate to Source Threshold Voltage | $V_{GS}$ = $V_{DS}$, $I_D$ = 250 μA | 1.0 | 1.8 | 3.0 | V |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate to Source Threshold Voltage Temperature Coefficient | $I_D$ = 250 μA, referenced to 25 °C | | -6 | | mV/°C |
| $r_{DS(on)}$ | Static Drain to Source On Resistance | $V_{GS}$ = 10 V, $I_D$ = 14.9 A | | 8.3 | 10.5 | mΩ |
| | | $V_{GS}$ = 4.5 V, $I_D$ = 11.0 A | | 17.8 | 24.0 | |
| | | $V_{GS}$ = 10 V, $I_D$ = 14.9 A, $T_J$ = 150 °C | | 12.7 | 16.1 | |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$ = 5 V, $I_D$ = 14.9 A | | 60 | | S |
| **Dynamic Characteristics** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = 13 V, $V_{GS}$ = 0 V, f = 1MHz | | 800 | 1065 | pF |
| $C_{oss}$ | Output Capacitance | | | 162 | 220 | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 151 | 230 | pF |
| $R_g$ | Gate Resistance | f = 1MHz | | 1.0 | | Ω |
| **Switching Characteristics** | | | | | | |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD}$ = 13 V, $I_D$ = 14.9 A, $V_{GS}$ = 10 V, $R_{GEN}$ = 6 Ω | | 7 | 14 | ns |
| $t_r$ | Rise Time | | | 3 | 10 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | | 15 | 27 | ns |
| $t_f$ | Fall Time | | | 2 | 4 | ns |
| $Q_g$ | Total Gate Charge | $V_{GS}$ = 0 V to 10 V; $V_{DD}$ = 13 V, $I_D$ = 14.9 A | | 15 | 27 | nC |
| $Q_g$ | Total Gate Charge | $V_{GS}$ = 0 V to 5 V | | 8 | 16 | nC |
| $Q_{gs}$ | Gate to Source Charge | | | 2.5 | | nC |
| $Q_{gd}$ | Gate to Drain "Miller" Charge | | | 3.2 | | nC |
| **Drain-Source Diode Characteristics** | | | | | | |
| $V_{SD}$ | Source to Drain Diode Forward Voltage | $V_{GS}$ = 0 V, $I_S$ = 3.1 A (Note 2) | | 0.8 | 1.2 | V |
| | | $V_{GS}$ = 0 V, $I_S$ = 14.9 A (Note 2) | | 0.9 | 1.3 | |
| $t_{rr}$ | Reverse Recovery Time | $I_F$ = 14.9 A, di/dt = 100 A/μs | | 14 | 26 | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | | 4 | 10 | 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 < 300 μs, Duty cycle < 2.0%.
**3:** $E_{AS}$ of 12 mJ is based on starting $T_J$ = 25 °C, L = 1 mH, $I_{AS}$ = 5 A, $V_{DD}$ = 23 V, $V_{GS}$ = 10 V. 100% test at L = 0.1 mH, $I_{AS}$ = 12 A.

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

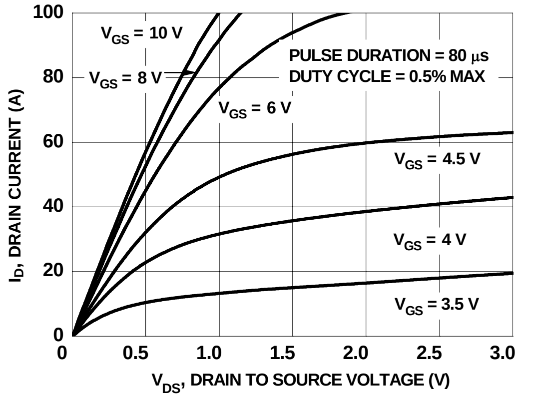



**Figure 1. On-Region Characteristics**

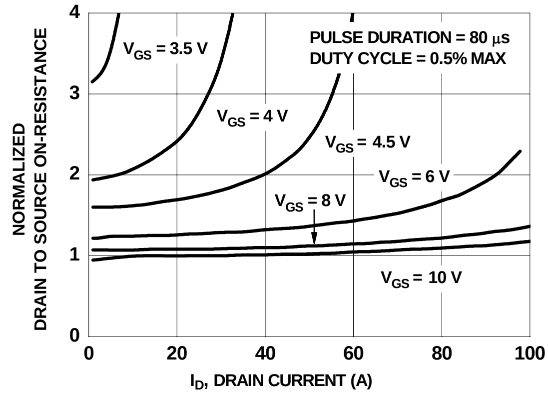



**Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage**

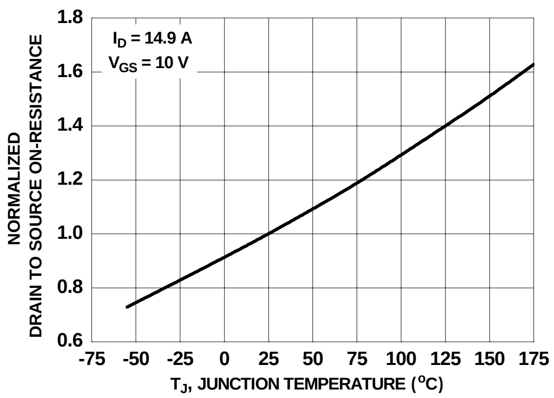



**Figure 3. Normalized On-Resistance vs Junction Temperature**

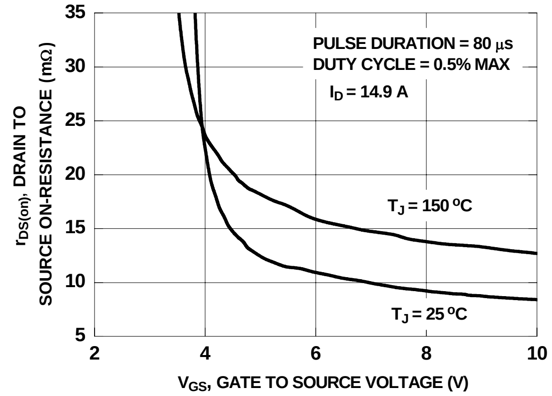



**Figure 4. On-Resistance vs Gate to Source Voltage**

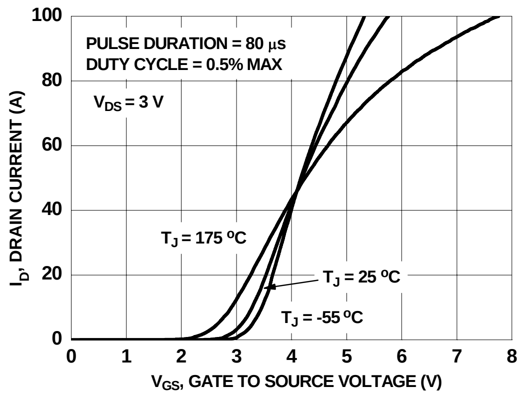



**Figure 5. Transfer Characteristics**

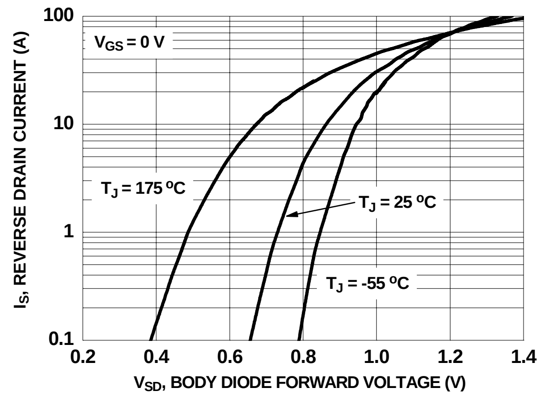



**Figure 6. Source to Drain Diode Forward Voltage vs Source Current**

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

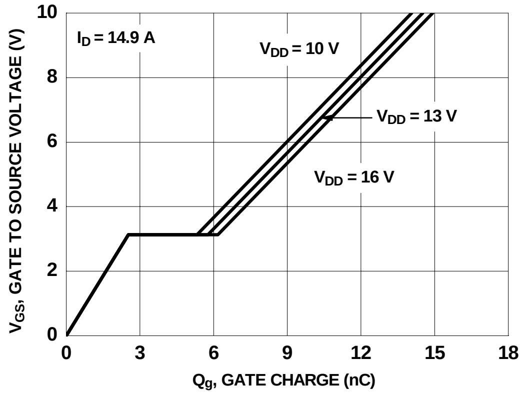



**Figure 7. Gate Charge Characteristics**

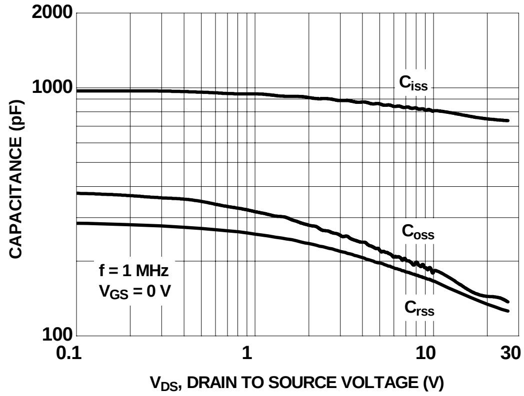



**Figure 8. Capacitance vs Drain to Source Voltage**

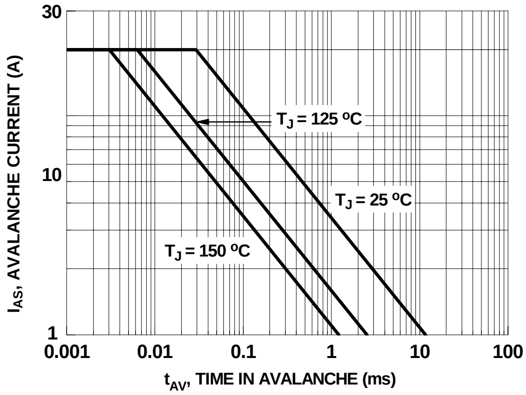



**Figure 9. Unclamped Inductive Switching Capability**

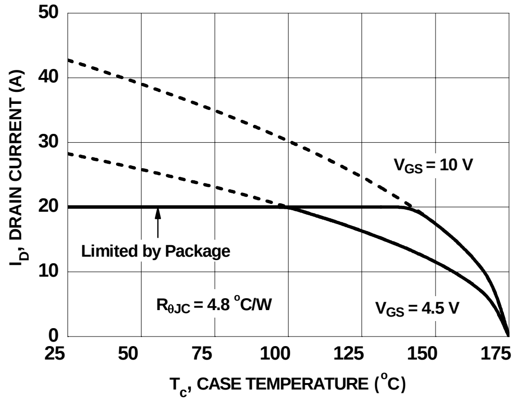



**Figure 10. Maximum Continuous Drain Current vs Case Temperature**

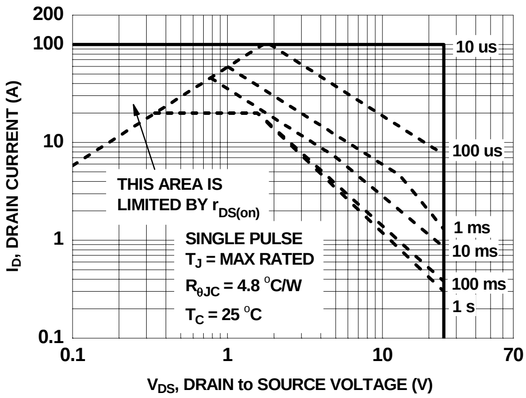



**Figure 11. Forward Bias Safe Operating Area**

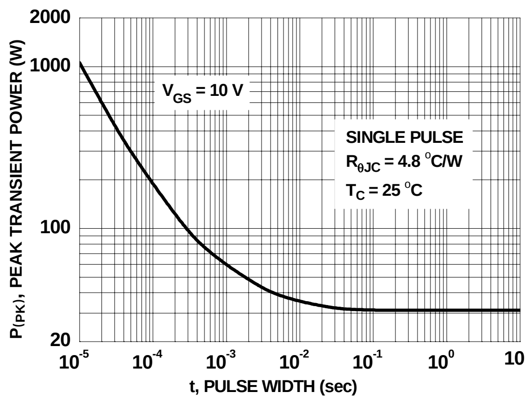



**Figure 12. Single Pulse Maximum Power Dissipation**

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

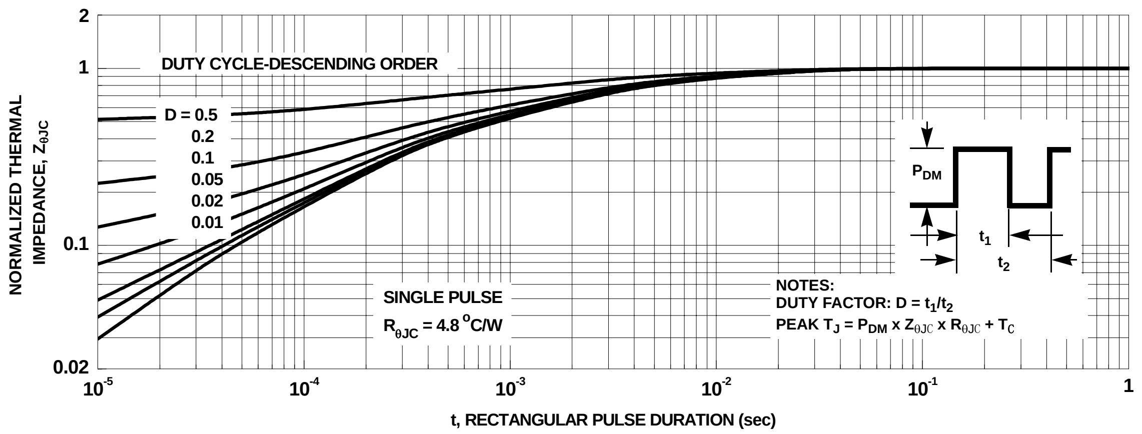



Figure 13. Transient Thermal Response Curve

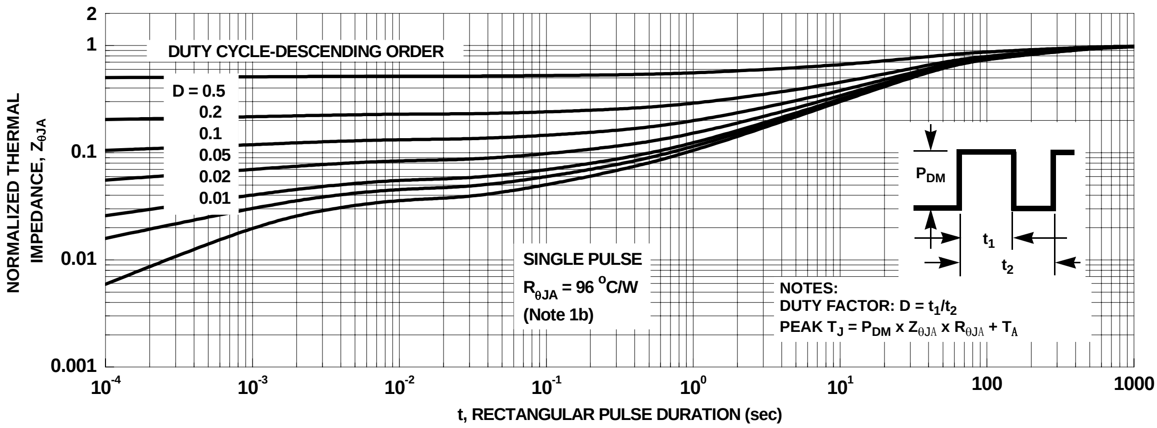



Figure 14. Transient Thermal Response Curve

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