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FAIRCHILD SEMICONDUCTOR®

July 2003

# FDS6912A

## Dual N-Channel Logic Level PowerTrench® MOSFET

### General Description

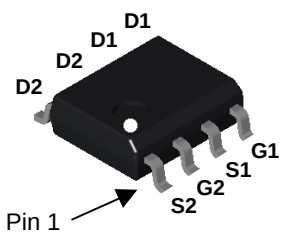
These N-Channel Logic Level MOSFETs are produced using Fairchild Semiconductor's advanced PowerTrench process that has been especially tailored to minimize the on-state resistance and yet maintain superior switching performance.

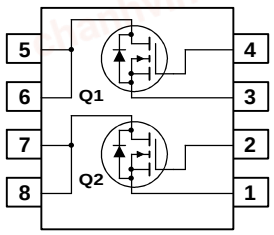
These devices are well suited for low voltage and battery powered applications where low in-line power loss and fast switching are required.

### Features

- 6 A, 30 V. $R_{DS(ON)}$ = 28 mΩ @ $V_{GS}$ = 10 V
  $R_{DS(ON)}$ = 35 mΩ @ $V_{GS}$ = 4.5 V
- Fast switching speed
- Low gate charge
- High performance trench technology for extremely low $R_{DS(ON)}$
- High power and current handling capability

SO-8




## Absolute Maximum Ratings

$T_A$=25°C unless otherwise noted

| Symbol | Parameter | | Ratings | Units |
|---|---|---|---|---|
| $V_{DSS}$ | Drain-Source Voltage | | 30 | V |
| $V_{GSS}$ | Gate-Source Voltage | | ± 20 | V |
| $I_D$ | Drain Current – Continuous | (Note 1a) | 6 | A |
| | – Pulsed | | 20 | |
| $P_D$ | Power Dissipation for Single Operation | (Note 1a) | 1.6 | W |
| | | (Note 1b) | 1.0 | |
| | | (Note 1c) | 0.9 | |
| $T_J$, $T_{STG}$ | Operating and Storage Junction Temperature Range | | –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 | Reel Size | Tape width | Quantity |
|---|---|---|---|---|
| FDS6912A | FDS6912A | 13'' | 12mm | 2500 units |

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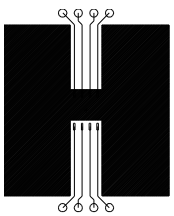
## Electrical Characteristics

$T_A$ = 25°C unless otherwise noted

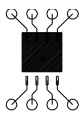
| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| $BV_{DSS}$ | Drain–Source Breakdown Voltage | $V_{GS}$ = 0 V, $I_D$ = 250 µA | 30 | | | V |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D$ = 250 µA, Referenced to 25°C | | 25 | | mV/°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = 24 V, $V_{GS}$ = 0 V<br>$V_{DS}$ = 24 V, $V_{GS}$ = 0 V, $T_J$ = 55°C | | | 1<br>10 | µA |
| $I_{GSS}$ | Gate–Source Leakage | $V_{GS}$ = ±20 V, $V_{DS}$ = 0 V | | | ±100 | nA |
| **On Characteristics** (Note 2) | | | | | | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$ = $V_{GS}$, $I_D$ = 250 µA | 1 | 1.9 | 3 | V |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate Threshold Voltage Temperature Coefficient | $I_D$ = 250 µA, Referenced to 25°C | | –4.5 | | mV/°C |
| $R_{DS(on)}$ | Static Drain–Source On–Resistance | $V_{GS}$ = 10 V, $I_D$ = 6 A<br>$V_{GS}$ = 4.5 V, $I_D$ = 5 A<br>$V_{GS}$ = 10 V, $I_D$ = 6 A,$T_J$ = 125°C | | 19<br>24<br>27 | 28<br>35<br>44 | mΩ |
| $I_{D(on)}$ | On–State Drain Current | $V_{GS}$ = 10 V, $V_{DS}$ = 5 V | 20 | | | A |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$ = 10 V, $I_D$ = 6 A | | 25 | | S |
| **Dynamic Characteristics** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = 15 V, $V_{GS}$ = 0 V, f = 1.0 MHz | | 575 | | pF |
| $C_{oss}$ | Output Capacitance | | | 145 | | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 65 | | pF |
| $R_G$ | Gate Resistance | $V_{GS}$ = 15 mV, f = 1.0 MHz | | 2.1 | | Ω |
| **Switching Characteristics** (Note 2) | | | | | | |
| $t_{d(on)}$ | Turn–On Delay Time | $V_{DD}$ = 15 V, $I_D$ = 1 A, $V_{GS}$ = 10 V, $R_{GEN}$ = 6 Ω | | 8 | 16 | ns |
| $t_r$ | Turn–On Rise Time | | | 5 | 10 | ns |
| $t_{d(off)}$ | Turn–Off Delay Time | | | 23 | 37 | ns |
| $t_f$ | Turn–Off Fall Time | | | 3 | 6 | ns |
| $Q_g$ | Total Gate Charge | $V_{DS}$ = 15 V, $I_D$ = 6 A, $V_{GS}$ = 5 V | | 5.8 | 8.1 | nC |
| $Q_{gs}$ | Gate–Source Charge | | | 1.7 | | nC |
| $Q_{gd}$ | Gate–Drain Charge | | | 2.1 | | nC |
| **Drain–Source Diode Characteristics and Maximum Ratings** | | | | | | |
| $I_S$ | Maximum Continuous Drain–Source Diode Forward Current | | | | 1.3 | A |
| $V_{SD}$ | Drain–Source Diode Forward Voltage | $V_{GS}$ = 0 V, $I_S$ = 1.3 A (Note 2) | | 0.75 | 1.2 | V |
| $t_{rr}$ | Diode Reverse Recovery Time | $I_F$ = 6 A, $d_{iF}/d_t$ = 100 A/µs | | 20 | | nS |
| $Q_{rr}$ | Diode Reverse Recovery Charge | | | 10 | | nC |

**Notes:**

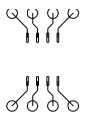
**1.** $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design.



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 2 oz copper



c) 135°C/W when mounted on a minimum mounting pad.

Scale 1 : 1 on letter size paper

Pulse Test: Pulse Width < 300µs, Duty Cycle < 2.0%

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## Typical Characteristics

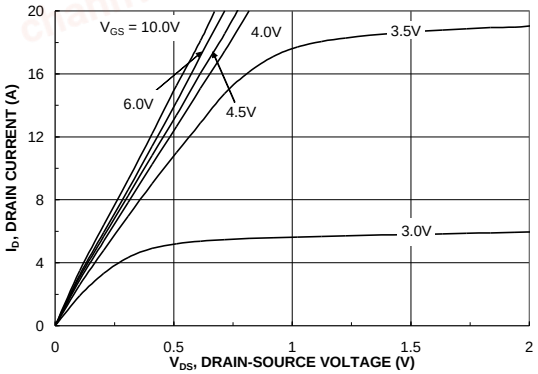



**Figure 1. On-Region Characteristics.**

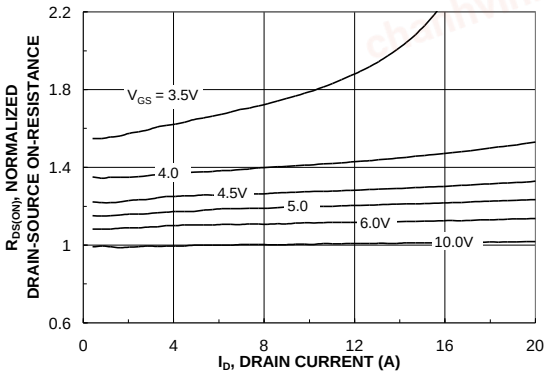



**Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.**

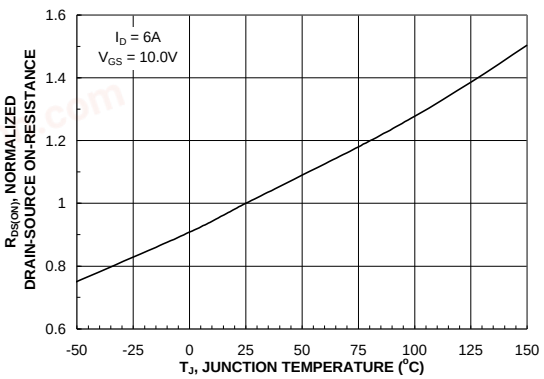



**Figure 3. On-Resistance Variation with Temperature.**

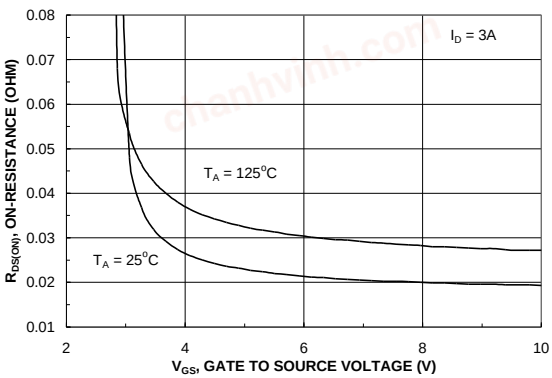



**Figure 4. On-Resistance Variation with Gate-to-Source Voltage.**

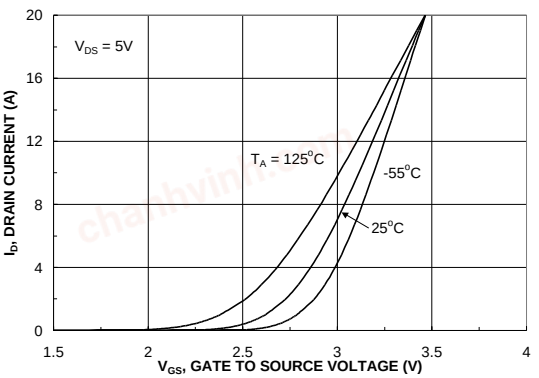



**Figure 5. Transfer Characteristics.**

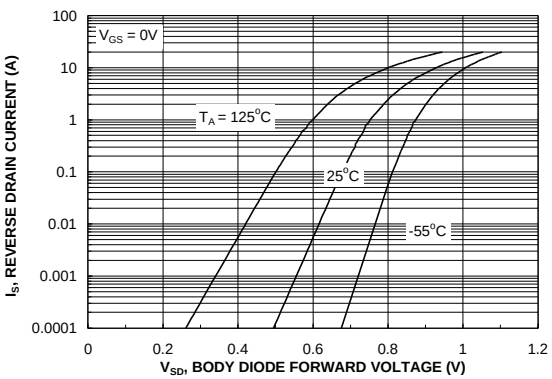



**Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.**

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## Typical Characteristics

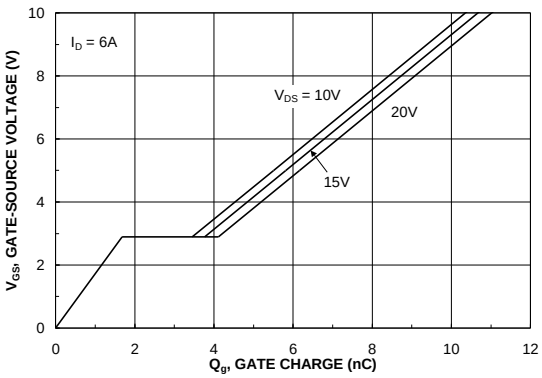



**Figure 7. Gate Charge Characteristics.**

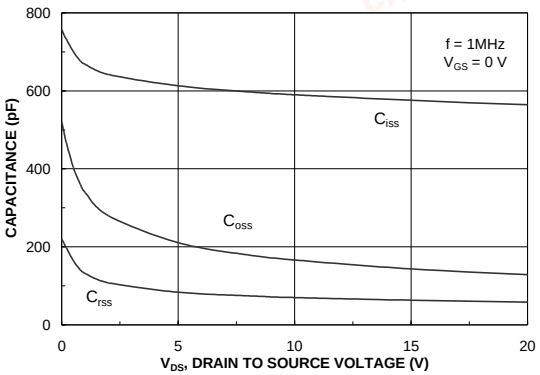



**Figure 8. Capacitance Characteristics.**

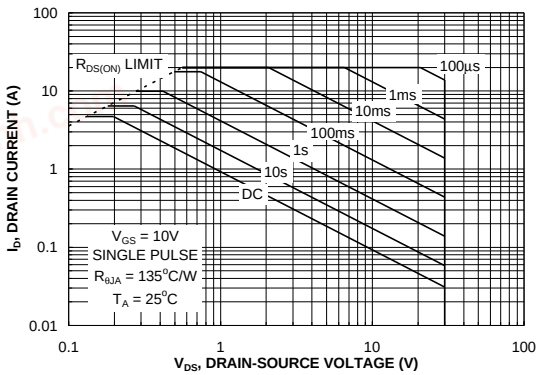



**Figure 9. Maximum Safe Operating Area.**

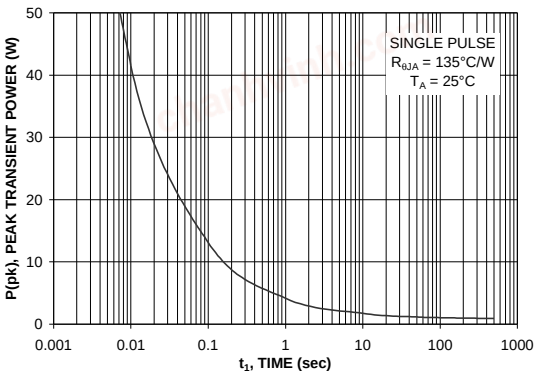



**Figure 10. Single Pulse Maximum Power Dissipation.**

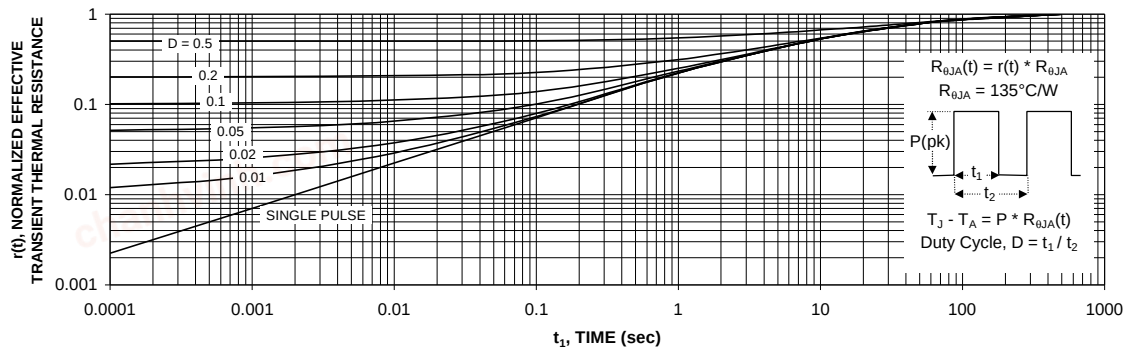



**Figure 11. Transient Thermal Response Curve.**

**Thermal characterization performed using the conditions described in Note 1c.**
**Transient thermal response will change depending on the circuit board design.**

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