**FAIRCHILD**
SEMICONDUCTOR®

April 2008

# FDS5351

## N-Channel PowerTrench® MOSFET
### 60V, 6.1A, 35mΩ

### Features

- Max $r_{DS(on)}$ = 35mΩ at $V_{GS}$ = 10V, $I_D$ = 6.1A

- Max $r_{DS(on)}$ = 42mΩ at $V_{GS}$ = 4.5V, $I_D$ = 5.5A

- High performance trench technology for extremely low $r_{DS(on)}$

- 100% UIL Tested

- RoHS Compliant

### General Description

This N-Channel MOSFET is produced using Fairchild Semiconductor's advanced Power Trench® process that has been especially tailored to minimize the on-state resistance and yet maintain superior switching performance.

### Application

- Inverter Switch

- Synchronous Rectifier

- Load Switch

SO-8

Pin 1

| D | 5 | | 4 | G |
| D | 6 | | 3 | S |
| D | 7 | | 2 | S |
| D | 8 | | 1 | S |
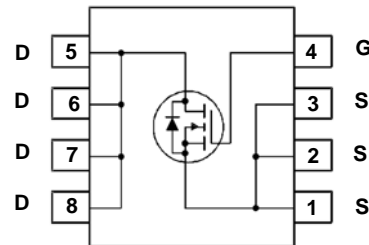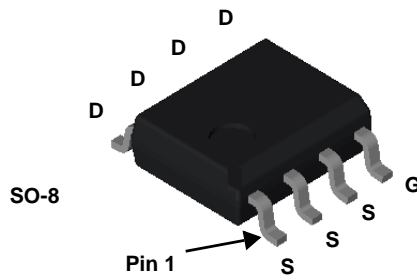
## MOSFET Maximum Ratings $T_A$ = 25°C unless otherwise noted

| Symbol | Parameter | | Ratings | Units |
|---|---|---|---|---|
| $V_{DS}$ | Drain to Source Voltage | | 60 | V |
| $V_{GS}$ | Gate to Source Voltage | | ±20 | V |
| $I_D$ | Drain Current   -Continuous | | 6.1 | A |
| | -Pulsed | | 30 | |
| $E_{AS}$ | Single Pulse Avalanche Energy | (Note 3) | 73 | mJ |
| $P_D$ | Power Dissipation          $T_A$ = 25°C | (Note 1a) | 5 | W |
| | Power Dissipation          $T_A$ = 25°C | (Note 1b) | 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 | (Note 1) | 25 | °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 |
|---|---|---|---|---|---|
| FDS5351 | FDS5351 | SO-8 | 13'' | 12mm | 2500units |

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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 | $I_D = 250\mu A$, $V_{GS} = 0V$ | 60 | | | V |
| $\dfrac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D = 250\mu A$, referenced to 25°C | | 55 | | mV/°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS} = 48V$, $V_{GS} = 0V$ | | | 1 | $\mu A$ |
| $I_{GSS}$ | Gate to Source Leakage Current | $V_{GS} = \pm 20V$, $V_{DS} = 0V$ | | | ±100 | nA |
| **On Characteristics** | | | | | | |
| $V_{GS(th)}$ | Gate to Source Threshold Voltage | $V_{GS} = V_{DS}$, $I_D = 250\mu A$ | 1.0 | 2.0 | 3.0 | V |
| $\dfrac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate to Source Threshold Voltage Temperature Coefficient | $I_D = 250\mu A$, referenced to 25°C | | -6.2 | | mV/°C |
| $r_{DS(on)}$ | Static Drain to Source On Resistance | $V_{GS} = 10V$, $I_D = 6.1A$ | | 26.5 | 35.0 | m$\Omega$ |
| | | $V_{GS} = 4.5V$, $I_D = 5.5A$ | | 32.4 | 42.0 | |
| | | $V_{GS} = 10V$, $I_D = 6.1A$, $T_J = 125°C$ | | 44.5 | 58.8 | |
| $g_{FS}$ | Forward Transconductance | $V_{DD} = 5V$, $I_D = 6.1A$ | | 24 | | S |
| **Dynamic Characteristics** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{DS} = 30V$, $V_{GS} = 0V$, f = 1MHz | | 985 | 1310 | pF |
| $C_{oss}$ | Output Capacitance | | | 90 | 120 | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 50 | 75 | pF |
| $R_g$ | Gate Resistance | f = 1MHz | | 1.7 | | $\Omega$ |
| **Switching Characteristics** | | | | | | |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD} = 30V$, $I_D = 6.1A$, $V_{GS} = 10V$, $R_{GEN} = 6\Omega$ | | 8 | 16 | 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 | | 19 | 27 | nC |
| $Q_g$ | Total Gate Charge | $V_{GS} = 0V$ to 4.5V, $V_{DD} = 30V$, $I_D = 6.1A$ | | 9 | 13 | nC |
| $Q_{gs}$ | Gate to Source Charge | | | 3 | | nC |
| $Q_{gd}$ | Gate to Drain "Miller" Charge | | | 3.5 | | nC |
| **Drain-Source Diode Characteristics** | | | | | | |
| $V_{SD}$ | Source to Drain Diode Forward Voltage | $V_{GS} = 0V$, $I_S = 6.1A$ (Note 2) | | 0.82 | 1.3 | V |
| | | $V_{GS} = 0V$, $I_S = 2.1A$ (Note 2) | | 0.76 | 1.2 | |
| $t_{rr}$ | Reverse Recovery Time | $I_F = 6.1A$, di/dt = 100A/$\mu s$ | | 24 | 38 | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | | 15 | 27 | nC |

NOTES:

1. $R_{\theta JA}$ is determined with the device mounted on a 1in² 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.
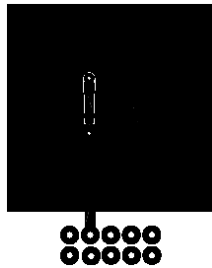


a) 50°C/W when mounted on a 1in² pad of 2 oz copper.
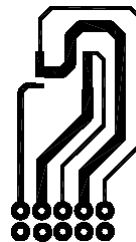


b) 125°C/W when mounted on a minimum pad.

2. Pulse Test: Pulse Width < 300$\mu s$, Duty cycle < 2.0%.

3. UIL condition: Starting $T_J = 25°C$, L = 3mH, $I_{AS} = 7A$, $V_{DD} = 60V$, $V_{GS} = 10V$.

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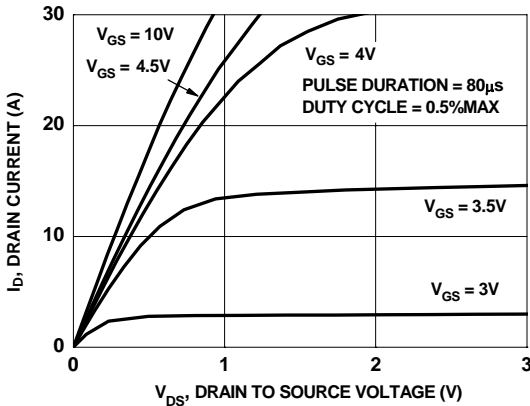## Typical Characteristics $T_J = 25°C$ unless otherwise noted



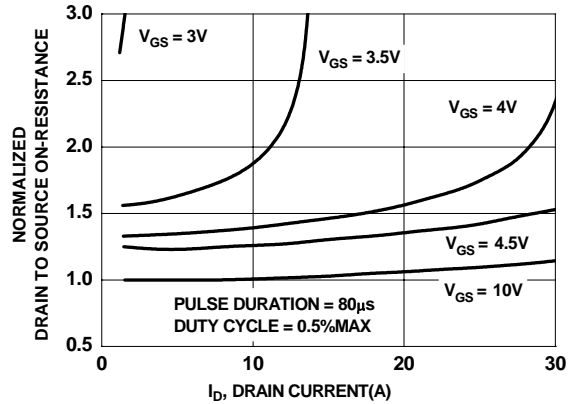**Figure 1. On-Region Characteristics**



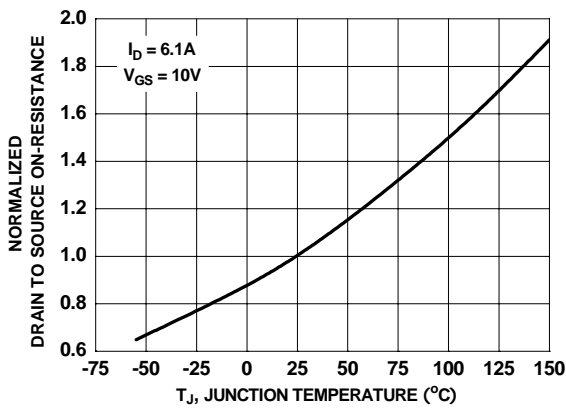**Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage**



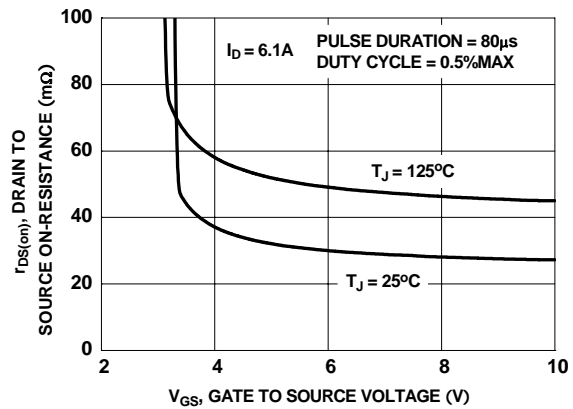**Figure 3. Normalized On-Resistance vs Junction Temperature**



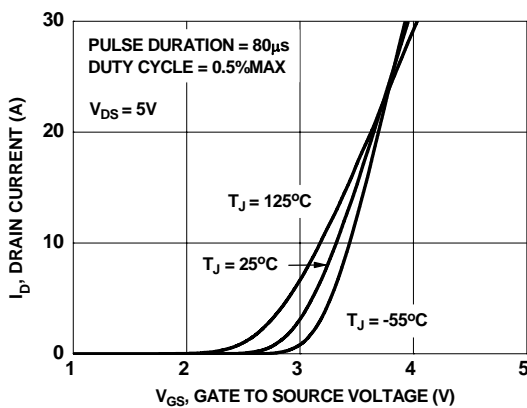**Figure 4. On-Resistance vs Gate to Source Voltage**
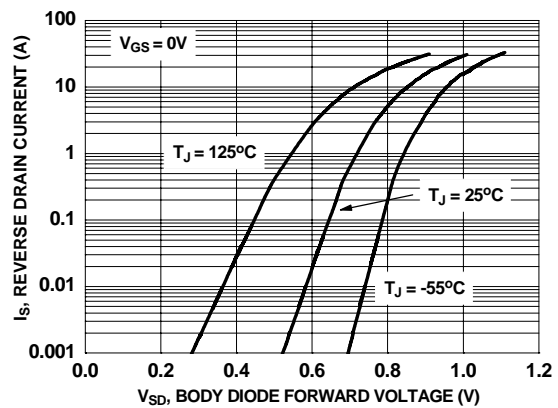


**Figure 5. Transfer Characteristics**



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

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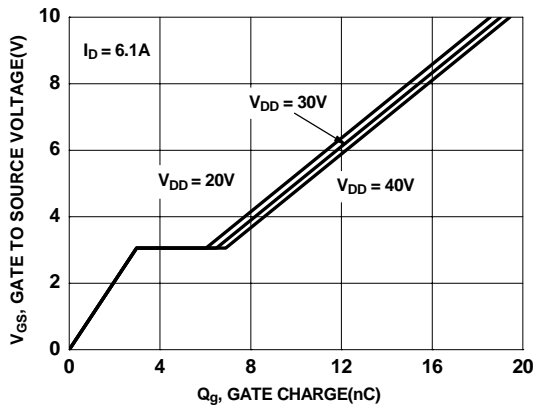## Typical Characteristics $T_J = 25°C$ unless otherwise noted



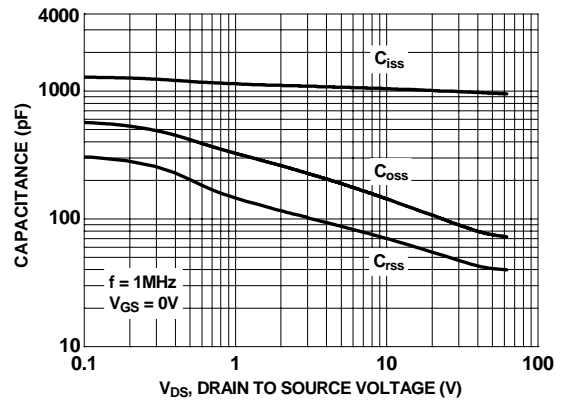**Figure 7. Gate Charge Characteristics**



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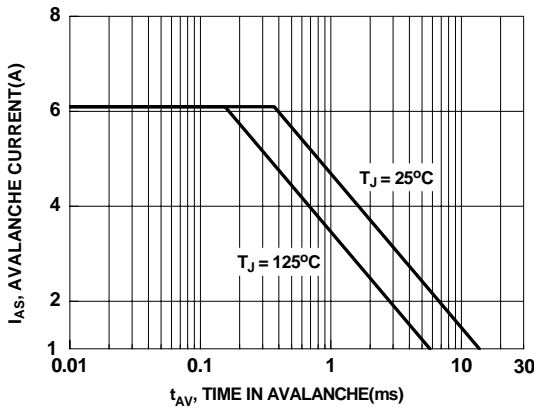


**Figure 9. Unclamped Inductive Switching Capability**
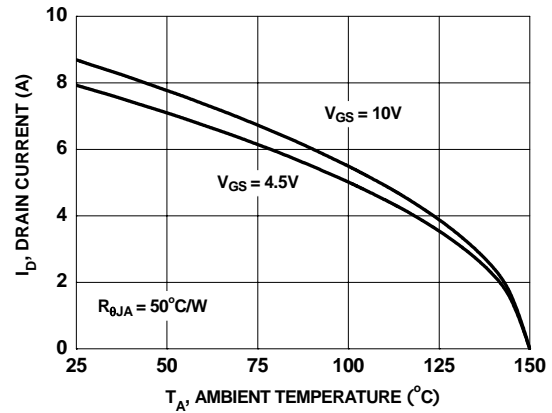


**Figure 10. Maximum Continuous Drain Current vs Ambient Temperature**
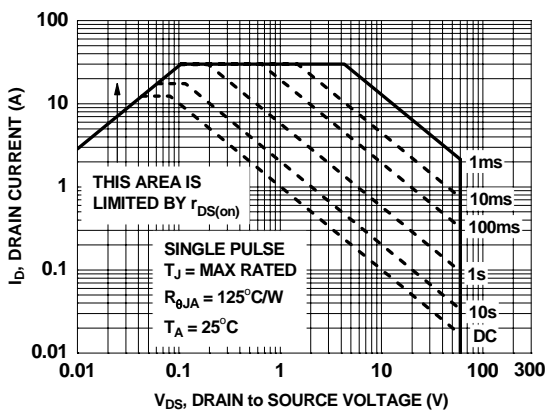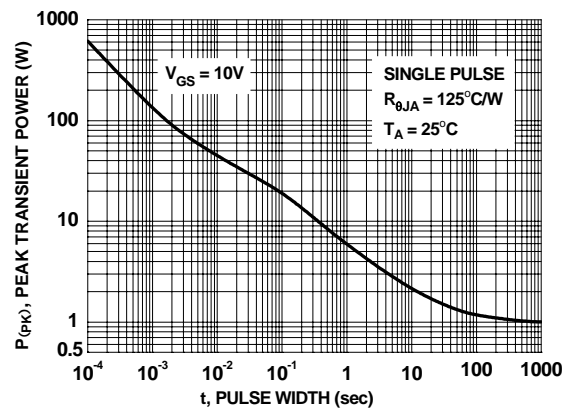


**Figure 11. Forward Bias Safe Operating Area**



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

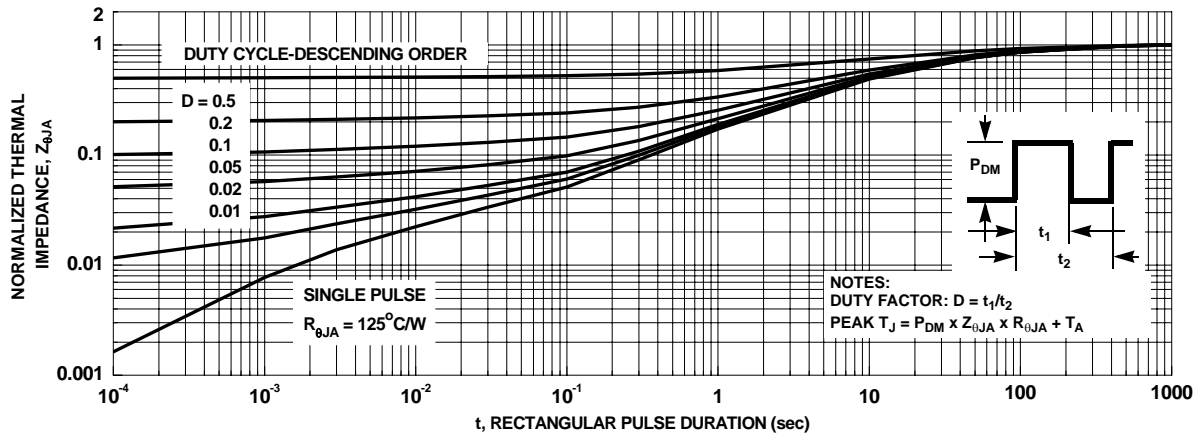**Typical Characteristics** $T_J = 25°C$ unless otherwise noted



**Figure 13. Transient Thermal Response Curve**

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