FAIRCHILD SEMICONDUCTOR®

August 2008

# FDG327NZ

## 20V N-Channel PowerTrench® MOSFET

### General Description

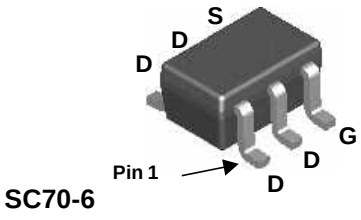
This N-Channel MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers. It has been optimized use in small switching regulators, providing an extremely low $R_{DS(ON)}$ and gate charge ($Q_G$) in a small package.

### Applications

- DC/DC converter
- Power management
- Load switch

### Features

- 1.5 A, 20 V. $R_{DS(ON)}$ = 90 mΩ @ $V_{GS}$ = 4.5 V.
  $R_{DS(ON)}$ = 100 mΩ @ $V_{GS}$ = 2.5 V
  $R_{DS(ON)}$ = 140 mΩ @ $V_{GS}$ = 1.8 V
- Fast switching speed
- Low gate charge
- High performance trench technology for extremely low $R_{DS(ON)}$
- High power and current handling capability.

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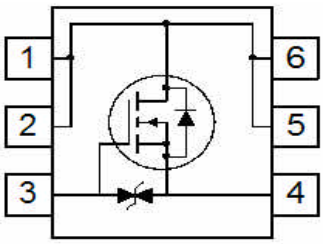



## Absolute Maximum Ratings

$T_A$=25°C unless otherwise noted

| Symbol | Parameter | | Ratings | Units |
|---|---|---|---|---|
| $V_{DSS}$ | Drain-Source Voltage | | 20 | V |
| $V_{GSS}$ | Gate-Source Voltage | | ± 8 | |
| $I_D$ | Drain Current – Continuous | (Note 1a) | 1.5 | A |
| | – Pulsed | | 6 | |
| $P_D$ | Power Dissipation for Single Operation | (Note 1a) | 0.42 | W |
| | | (Note 1b) | 0.38 | |
| $T_J$, $T_{STG}$ | Operating and Storage Junction Temperature Range | | –55 to +150 | °C |

## Thermal Characteristics

| | | | | |
|---|---|---|---|---|
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | (Note 1a) | 300 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | (Note 1b) | 333 | |

## Package Marking and Ordering Information

| Device Marking | Device | Reel Size | Tape width | Quantity |
|---|---|---|---|---|
| .37 | FDG327NZ | 7'' | 8mm | 3000 units |

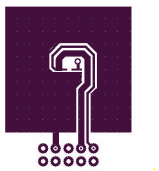
## Electrical Characteristics

$T_A$ = 25°C unless otherwise noted

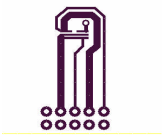
| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| $BV_{DSS}$ | Drain–Source Breakdown Voltage | $V_{GS}$ = 0 V, $I_D$ = 250 µA | 20 | | | V |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D$ = 250 µA, Referenced to 25°C | | 11 | | mV/°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = 16 V, $V_{GS}$ = 0 V | | | 1 | µA |
| $I_{GSS}$ | Gate–Body Leakage | $V_{GS}$ = ± 8 V, $V_{DS}$ = 0 V | | | ±10 | µA |
| **On Characteristics** (Note 2) | | | | | | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$ = $V_{GS}$, $I_D$ = 250 µA | 0.4 | 0.7 | 1.5 | V |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate Threshold Voltage Temperature Coefficient | ID = 250 µA, Referenced to 25°C | | –2 | | mV/°C |
| $R_{DS(on)}$ | Static Drain–Source On–Resistance | $V_{GS}$ = 4.5 V, $I_D$ = 1.5 A<br>$V_{GS}$ = 2.5 V, $I_D$ = 1.4 A<br>$V_{GS}$ = 1.8 V, $I_D$ = 1.2 A<br>$V_{GS}$ = 4.5 V, $I_D$ = 1.5 A, $T_J$ =125°C | | 68<br>77<br>90<br>86 | 90<br>100<br>140<br>123 | mΩ |
| $I_{D(on)}$ | On–State Drain Current | $V_{GS}$ = 4.5V, $V_{DS}$ = 5 V | 3 | | | A |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$ = 10 V, $I_D$ = 1.5 A | | 2.2 | | S |
| **Dynamic Characteristics** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = 10 V, $V_{GS}$ = 0 V<br>f = 1.0 MHz | | 412 | | pF |
| $C_{oss}$ | Output Capacitance | | | 81 | | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 44 | | pF |
| $R_G$ | Gate Resistance | $V_{GS}$ = 15 mV, f = 1.0 MHz | | 1.9 | | Ω |
| **Switching Characteristics** (Note 2) | | | | | | |
| $t_{d(on)}$ | Turn–On Delay Time | $V_{DD}$ = 10 V, $I_D$ = 1 A,<br>$V_{GS}$ = 4.5 V, $R_{GEN}$ = 6 Ω | | 6.2 | 13 | ns |
| $t_r$ | Turn–On Rise Time | | | 2.3 | 10 | ns |
| $t_{d(off)}$ | Turn–Off Delay Time | | | 18 | 33 | ns |
| $t_f$ | Turn–Off Fall Time | | | 2.9 | 10 | ns |
| $Q_g$ | Total Gate Charge | $V_{DS}$ = 10 V, $I_D$ = 1.5 A,<br>$V_{GS}$ = 4.5 V | | 4.2 | 6 | nC |
| $Q_{gs}$ | Gate–Source Charge | | | 0.4 | | nC |
| $Q_{gd}$ | Gate–Drain Charge | | | 1 | | nC |
| **Drain–Source Diode Characteristics and Maximum Ratings** | | | | | | |
| $V_{SD}$ | Drain–Source Diode Forward Voltage | $V_{GS}$ = 0 V, $I_S$ = 0.32 A (Note 2) | | 0.6 | 1.2 | V |
| $t_{rr}$ | Diode Reverse Recovery Time | $I_F$ = 1.5 A, $d_{iF}/d_t$ = 100 A/µs | | 4 | | nS |
| $Q_{rr}$ | Diode Reverse Recovery Charge | | | 2 | | 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) 300°C/W when mounted on a 1in$^2$ pad of 2 oz copper.



b) 333°C/W when mounted on a minimum pad of 2 oz copper.

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

## Typical Characteristics

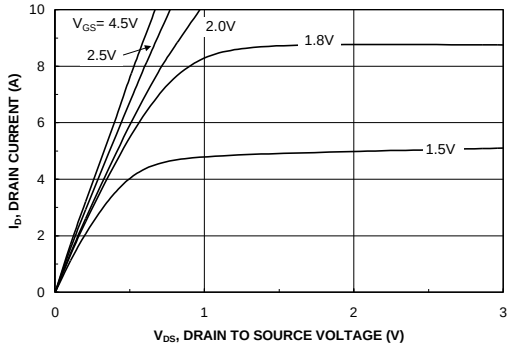



**Figure 1. On-Region Characteristics.**

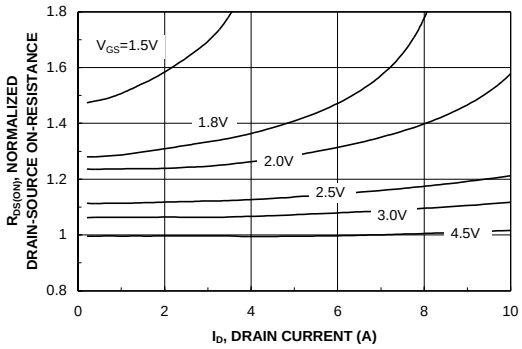



**Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.**

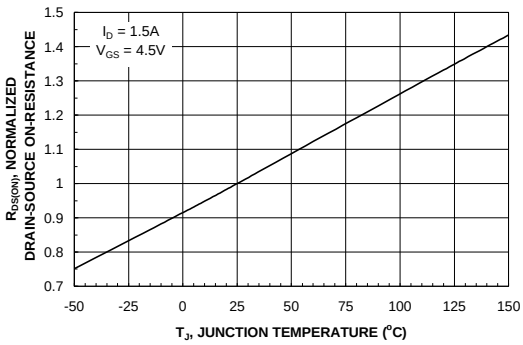



**Figure 3. On-Resistance Variation withTemperature.**

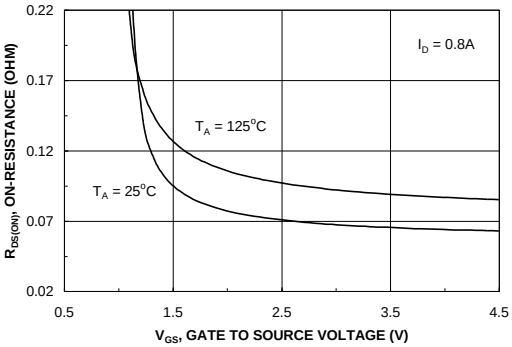



**Figure 4. On-Resistance Variation with Gate-to-Source Voltage.**

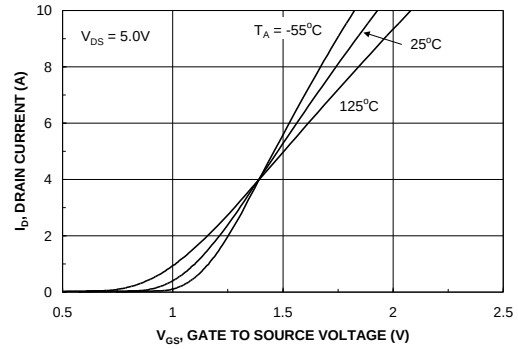



**Figure 5. Transfer Characteristics.**

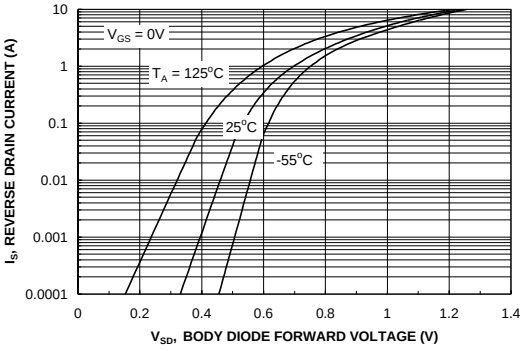



**Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.**

## Typical Characteristics

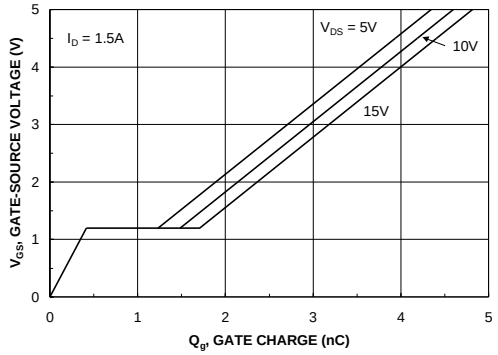



**Figure 7. Gate Charge Characteristics.**

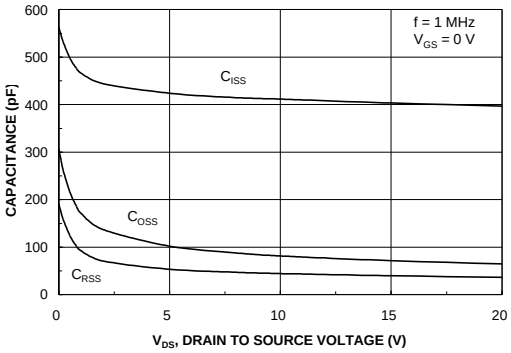



**Figure 8. Capacitance Characteristics.**

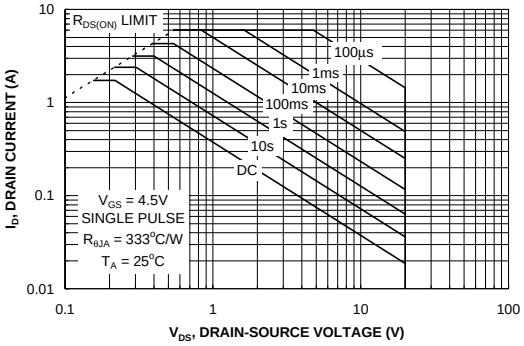



**Figure 9. Maximum Safe Operating Area.**

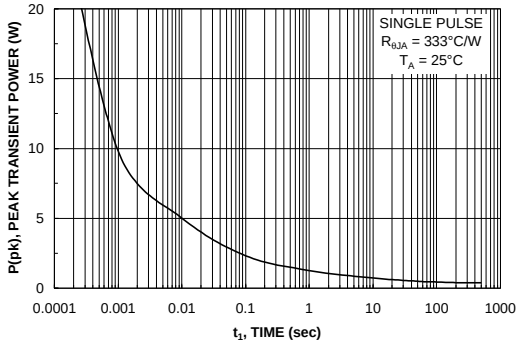



**Figure 10. Single Pulse Maximum Power Dissipation.**

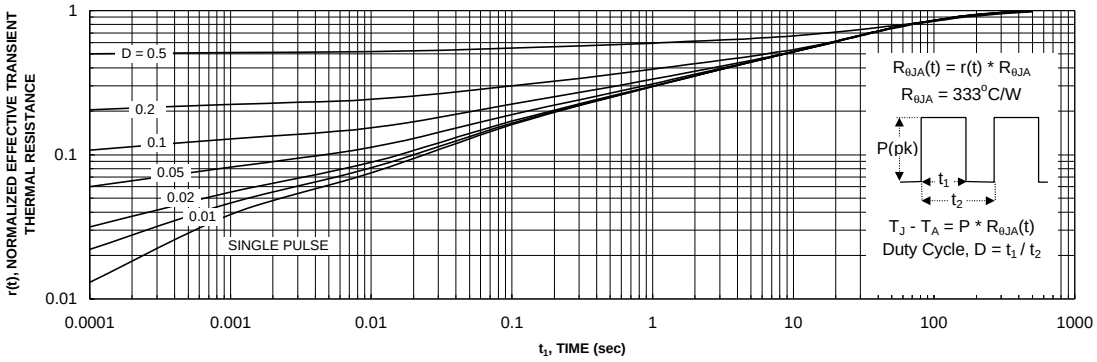



**Figure 11. Transient Thermal Response Curve.**

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

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