January 2004

# FDFC3N108

## N-Channel 1.8V Specified PowerTrench® MOSFET with Schottky Diode

### General Description

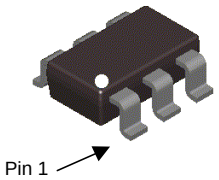
This N-Channel 1.8V specified MOSFET uses Fairchild's advanced low voltage PowerTrench process. It is combined with a low forward drop Schottky that is isolated from the MOSFET, providing a compact power solution for battery power management and DC/DC converter applications.

### Applications

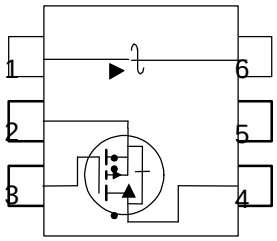
- Battery management/Charger Application
- DC/DC Conversion

### Features

- 3 A, 20 V $R_{DS(ON)}$ = 70 mΩ @ $V_{GS}$ = 4.5 V
  $R_{DS(ON)}$ = 95 mΩ @ $V_{GS}$ = 2.5 V
- Low gate charge
- High performance trench technology for extremely low $R_{DS(ON)}$




**SuperSOT™-6**




## MOSFET 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 | | ±12 | V |
| $I_D$ | Drain Current – Continuous | (Note 1a) | 3 | A |
| | – Pulsed | | 12 | |
| $P_D$ | Maximum Power Dissipation | (Note 1a) | 0.96 | W |
| | | (Note 1b) | 0.90 | |
| | | (Note 1c) | 0.70 | |
| $T_J$, $T_{stg}$ | Operating and Storage Junction Temperature Range | | –55 to +150 | °C |

## Schottky Diode Maximum Ratings

| | | | |
|---|---|---|---|
| $V_{RRM}$ | Repetitive Peak reverse voltage | 20 | V |
| $I_O$ | Average Forward Current | 2.0 | A |

## Thermal Characteristics

| | | | | |
|---|---|---|---|---|
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | (Note 1a) | 130 | °C/W |
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case | (Note 1) | 60 | |

## Package Marking and Ordering Information

| Device Marking | Device | Reel Size | Tape width | Quantity |
|---|---|---|---|---|
| .108 | FDFC3N108 | 7'' | 8mm | 3000 units |

## Electrical Characteristics

$T_A$ = 25°C unless otherwise noted

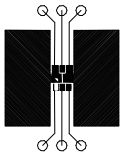
| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| $BV_{DSS}$ | Drain–Source Breakdown Voltage | $V_{GS}$ = 0 V, $I_D$ = 250 µA | 20 | | | V |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D$ = 250 µA, Referenced to 25°C | | 12 | | mV/°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = 16 V, $V_{GS}$ = 0 V | | | 1 | µA |
| $I_{GSS}$ | Gate–Body Leakage | $V_{GS}$ = ±12 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 | 0.5 | 0.9 | 1.5 | V |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate Threshold Voltage Temperature Coefficient | $I_D$ = 250 µA, Referenced to 25°C | | –3 | | mV/°C |
| $R_{DS(on)}$ | Static Drain–Source On–Resistance | $V_{GS}$ = 4.5 V, $I_D$ = 3 A<br>$V_{GS}$ = 2.5 V, $I_D$ = 2.5 A<br>$V_{GS}$ = 4.5 V, $I_D$ = 3 A, $T_J$=125°C | | 56<br>73<br>78 | 70<br>95<br>106 | mΩ |
| $I_{D(on)}$ | On–State Drain Current | $V_{GS}$ = 4.5 V, $V_{DS}$ = 5 V | 12 | | | A |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$ = 5 V, $I_D$ = 3 A | | 10 | | S |
| **Dynamic Characteristics** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = 10 V, $V_{GS}$ = 0 V, f = 1.0 MHz | | 355 | | pF |
| $C_{oss}$ | Output Capacitance | | | 85 | | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 45 | | pF |
| $R_G$ | Gate Resistance | $V_{GS}$ = 15 mV, f = 1.0 MHz | | 2.0 | | Ω |
| **Switching Characteristics** (Note 2) | | | | | | |
| $t_{d(on)}$ | Turn–On Delay Time | $V_{DD}$ = 10 V, $I_D$ = 1 A, $V_{GS}$ = 4.5 V, $R_{GEN}$ = 6 Ω | | 6 | 12 | ns |
| $t_r$ | Turn–On Rise Time | | | 7 | 14 | ns |
| $t_{d(off)}$ | Turn–Off Delay Time | | | 20 | 36 | ns |
| $t_f$ | Turn–Off Fall Time | | | 1 | 2 | ns |
| $Q_g$ | Total Gate Charge | $V_{DS}$ = 10V, $I_D$ = 3 A, $V_{GS}$ = 4.5 V | | 3.5 | 4.9 | nC |
| $Q_{gs}$ | Gate–Source Charge | | | 0.7 | | nC |
| $Q_{gd}$ | Gate–Drain Charge | | | 1.0 | | nC |
| **Drain–Source Diode Characteristics and Maximum Ratings** | | | | | | |
| $I_S$ | Maximum Continuous Drain–Source Diode Forward Current | | | | 0.8 | A |
| $V_{SD}$ | Drain–Source Diode Forward Voltage | $V_{GS}$ = 0 V, $I_S$ = 0.8 A (Note 2) | | | 1.2 | V |
| $t_{rr}$ | Diode Reverse Recovery Time | $I_F$ = 3 A, $d_{iF}/d_t$ = 100 A/µs | | 12 | | nS |
| $Q_{rr}$ | Diode Reverse Recovery Charge | | | 3 | | nC |
| **Schottky Diode Characteristic** | | | | | | |
| $I_R$ | Reverse Leakage | $V_R$ = 20V, $T_J$ = 25 °C | | | 250 | µA |
| | | $V_R$ = 20V, $T_J$ = 100 °C | | | 10 | mA |
| $V_F$ | Forward Voltage | $I_F$ = 1A | | 363 | 425 | mV |
| | | $I_F$ = 2A | | 449 | 550 | |

## Electrical Characteristics

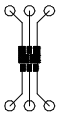
$T_A$ = 25°C unless otherwise noted

**Notes:**

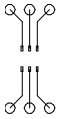
**1.** $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design.



a) 130 °C/W when mounted on a 0.125 $in^2$ pad of 2 oz. copper.



b) 140 °C/W when mounted on a .004 $in^2$ pad of 2 oz copper

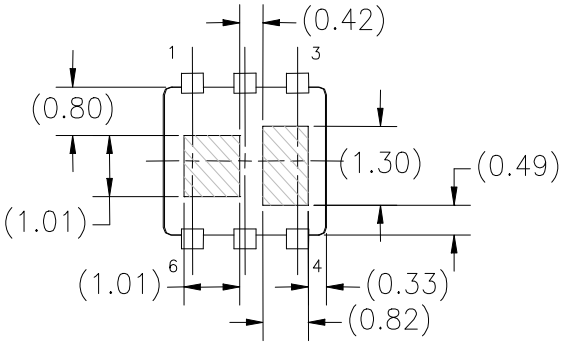


c) 180 C°/W when mounted on a minimum pad.

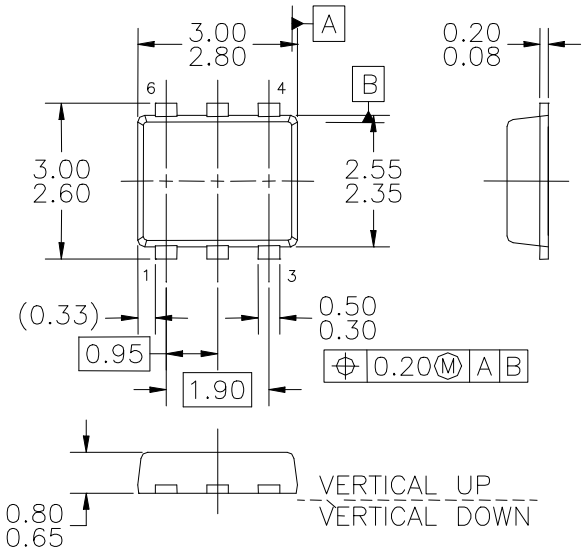
Scale 1 : 1 on letter size paper

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

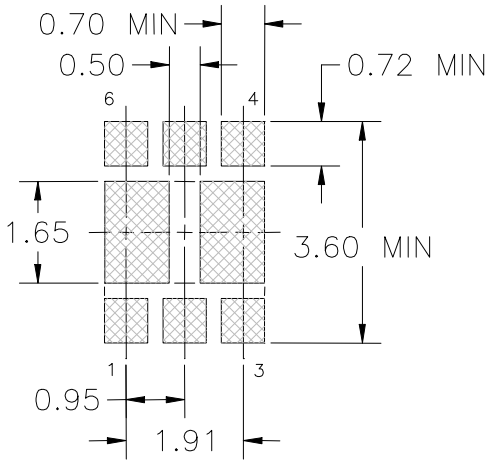
## Dimensional Outline and Pad Layout




**Bottom View**




**Top View**




**Recommended Landing Pattern**

NOTES: UNLESS OTHERWISE SPECIFIED

ALL DIMENSIONS ARE IN MILLIMETERS.

## Typical Characteristics

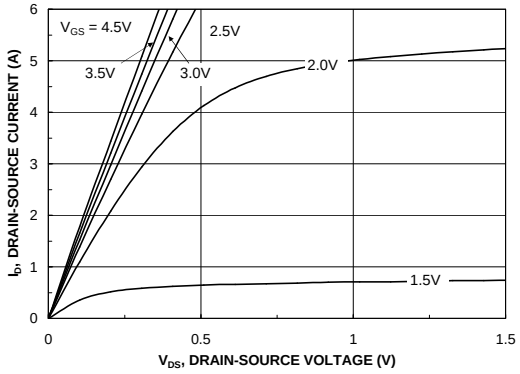



**Figure 1. On-Region Characteristics.**

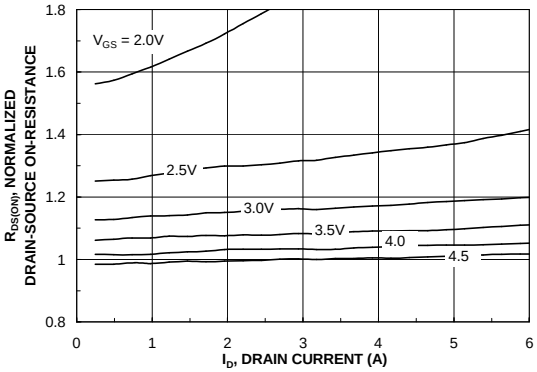



**Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.**

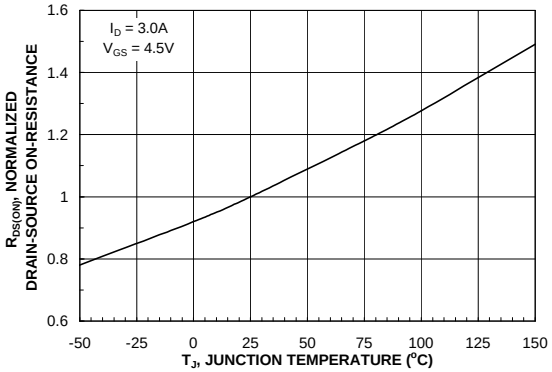



**Figure 3. On-Resistance Variation with Temperature.**

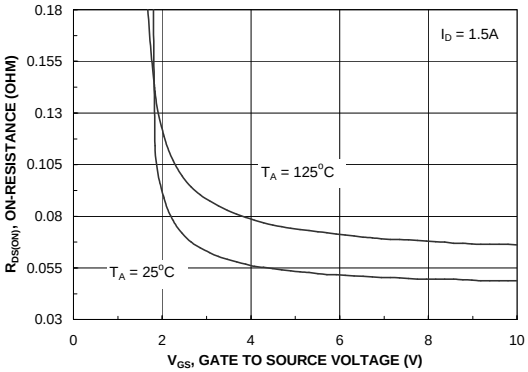



**Figure 4. On-Resistance Variation with Gate-to-Source Voltage.**

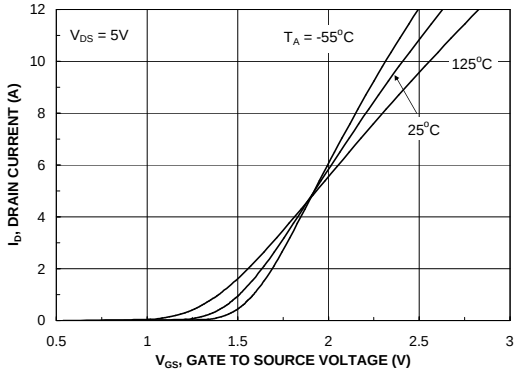



**Figure 5. Transfer Characteristics.**

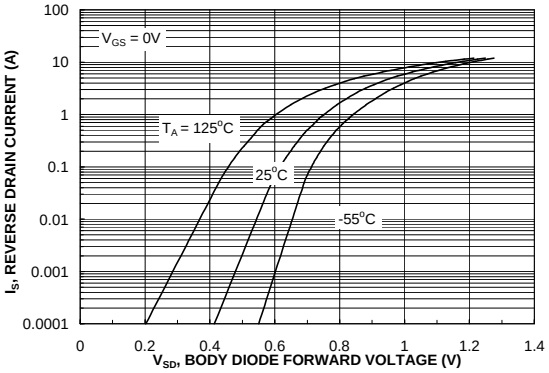



**Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.**

## Typical Characteristics

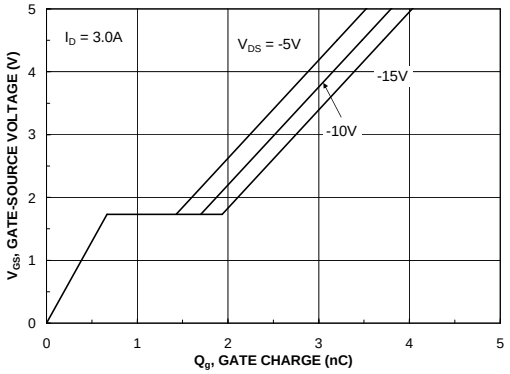



**Figure 7. Gate Charge Characteristics.**

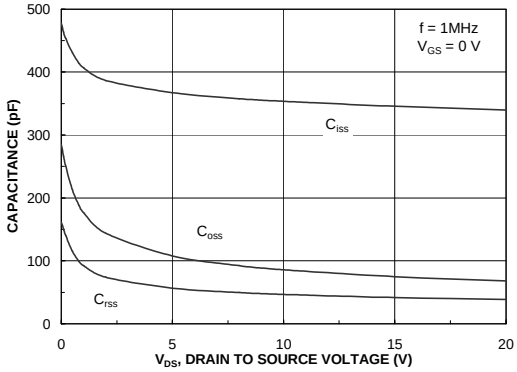



**Figure 8. Capacitance Characteristics.**

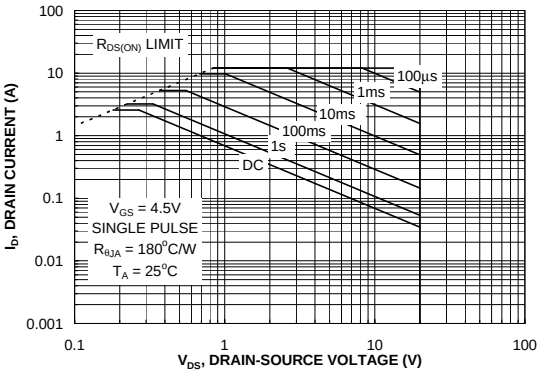



**Figure 9. Schottky Diode Forward Voltage.**

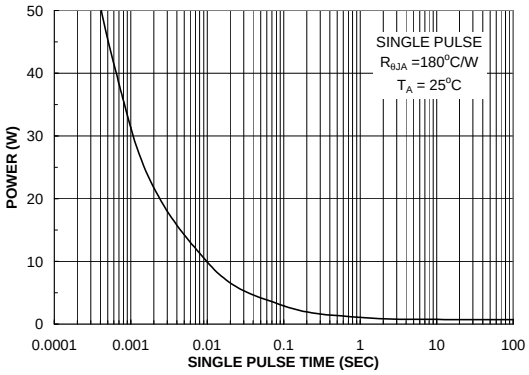



**Figure 10. Schottky Diode Reverse Current.**

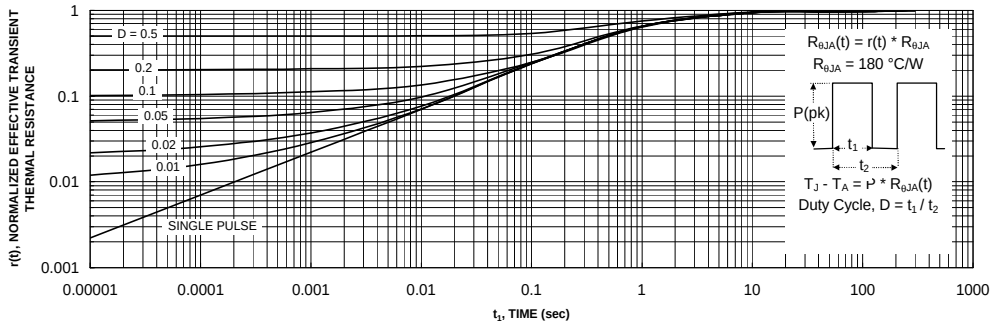



**Figure 11. Transient Thermal Response Curve.**

**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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