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# FDN335N

## N-Channel 2.5V Specified PowerTrench™ MOSFET

### General Description

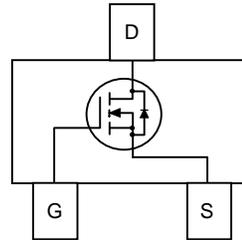
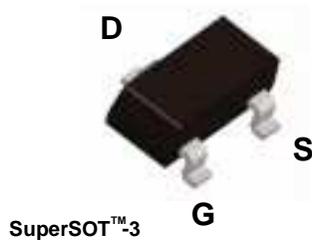
This N-Channel 2.5V specified MOSFET is produced using Fairchild Semiconductor's advanced PowerTrench process that has been especially tailored to minimize the on-state resistance and yet maintain low gate charge for superior switching performance.

### Applications

- DC/DC converter
- Load switch

### Features

- 1.7 A, 20 V.  $R_{DS(ON)} = 0.07 \Omega @ V_{GS} = 4.5 \text{ V}$   
 $R_{DS(ON)} = 0.100 \Omega @ V_{GS} = 2.5 \text{ V}$ .
- Low gate charge (3.5nC typical).
- High performance trench technology for extremely low  $R_{DS(ON)}$ .
- High power and current handling capability.



### Absolute Maximum Ratings T<sub>A</sub> = 25°C unless otherwise noted

| Symbol                            | Parameter  | Ratings     | Units |
|-----------------------------------|--|-------------|-------|
| V <sub>DSS</sub>                  | Drain-Source Voltage                             | 20          | V     |
| V <sub>GSS</sub>                  | Gate-Source Voltage                              | ±8          | V     |
| I <sub>D</sub>                    | Drain Current - Continuous (Note 1a)             | 1.7         | A     |
|                                   | - Pulsed   | 8           |       |
| P <sub>D</sub>                    | Power Dissipation for Single Operation (Note 1a) | 0.5         | W     |
|                                   | (Note 1b)  | 0.46        |       |
| T <sub>J</sub> , T <sub>stg</sub> | Operating and Storage Junction Temperature Range | -55 to +150 | °C    |

### Thermal Characteristics

|                  |   |     |      |
|------------------|---|-----|------|
| R <sub>θJA</sub> | Thermal Resistance, Junction-to-Ambient (Note 1a) | 250 | °C/W |
| R <sub>θJC</sub> | Thermal Resistance, Junction-to-Case (Note 1)     | 75  | °C/W |

### Package Outlines and Ordering Information

| Device Marking | Device  | Reel Size | Tape Width | Quantity   |
|----------------|---------|-----------|------------|------------|
| 335            | FDN335N | 7"        | 8mm        | 3000 units |

**Electrical Characteristics** $T_A = 25^\circ\text{C}$  unless otherwise noted

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|--------|-----------|-----------------|-----|-----|-----|-------|
|--------|-----------|-----------------|-----|-----|-----|-------|

**Off Characteristics**

|                                      |   |   |    |    |      |                      |
|--------------------------------------|---|---|----|----|------|----------------------|
| $BV_{DSS}$                           | Drain-Source Breakdown Voltage            | $V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$               | 20 |    |      | V                    |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$ |    | 14 |      | mV/ $^\circ\text{C}$ |
| $I_{DSS}$                            | Zero Gate Voltage Drain Current           | $V_{DS} = 16\text{ V}, V_{GS} = 0\text{ V}$                 |    |    | 1    | $\mu\text{A}$        |
| $I_{GSSF}$                           | Gate-Body Leakage Current, Forward        | $V_{GS} = 8\text{ V}, V_{DS} = 0\text{ V}$                  |    |    | 100  | nA                   |
| $I_{GSSR}$                           | Gate-Body Leakage Current, Reverse        | $V_{GS} = -8\text{ V}, V_{DS} = 0\text{ V}$                 |    |    | -100 | nA                   |

**On Characteristics** (Note 2)

|  |  |  |     |                         |                         |                      |
|--|--|--|-----|-------------------------|-------------------------|----------------------|
| $V_{GS(th)}$                           | Gate Threshold Voltage                         | $V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$  | 0.4 | 0.9                     | 1.5                     | V                    |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate Threshold Voltage Temperature Coefficient | $I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$  |     | -3                      |                         | mV/ $^\circ\text{C}$ |
| $R_{DS(on)}$                           | Static Drain-Source On-Resistance              | $V_{GS} = 4.5\text{ V}, I_D = 1.7\text{ A}$<br>$V_{GS} = 4.5\text{ V}, I_D = 1.7\text{ A}, T_J = 125^\circ\text{C}$<br>$V_{GS} = 2.5\text{ V}, I_D = 1.5\text{ A}$ |     | 0.055<br>0.079<br>0.078 | 0.070<br>0.120<br>0.100 | $\Omega$             |
| $I_{D(on)}$                            | On-State Drain Current                         | $V_{GS} = 4.5\text{ V}, V_{DS} = 5\text{ V}$   | 8   |                         |                         | A                    |
| $g_{FS}$                               | Forward Transconductance                       | $V_{DS} = 5\text{ V}, I_D = 1.5\text{ A}$  |     | 7                       |                         | S                    |

**Dynamic Characteristics**

|           |                              |  |  |     |  |    |
|-----------|------------------------------|--|--|-----|--|----|
| $C_{iss}$ | Input Capacitance            | $V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V},$<br>$f = 1.0\text{ MHz}$ |  | 310 |  | pF |
| $C_{oss}$ | Output Capacitance           |  |  | 80  |  | pF |
| $C_{rfs}$ | Reverse Transfer Capacitance |  |  | 40  |  | pF |

**Switching Characteristics** (Note 2)

|              |                     |   |  |      |    |    |
|--------------|---------------------|---|--|------|----|----|
| $t_{d(on)}$  | Turn-On Delay Time  | $V_{DD} = 10\text{ V}, I_D = 1\text{ A},$<br>$V_{GS} = 4.5\text{ V}, R_{GEN} = 6\ \Omega$ |  | 5    | 15 | ns |
| $t_r$        | Turn-On Rise Time   |   |  | 8.5  | 17 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time |   |  | 11   | 20 | ns |
| $t_f$        | Turn-Off Fall Time  |   |  | 3    | 10 | ns |
| $Q_g$        | Total Gate Charge   | $V_{DS} = 10\text{ V}, I_D = 1.7\text{ A},$<br>$V_{GS} = 4.5\text{ V},$                   |  | 3.5  | 5  | nC |
| $Q_{gs}$     | Gate-Source Charge  |   |  | 0.55 |    | nC |
| $Q_{gd}$     | Gate-Drain Charge   |   |  | 0.95 |    | nC |

**Drain-Source Diode Characteristics and Maximum Ratings**

|          |   |   |  |      |     |   |
|----------|---|---|--|------|-----|---|
| $I_S$    | Maximum Continuous Drain-Source Diode Forward Current |   |  | 0.42 |     | A |
| $V_{SD}$ | Drain-Source Diode Forward Voltage                    | $V_{GS} = 0\text{ V}, I_S = 0.42\text{ A}$ (Note 2) |  | 0.7  | 1.2 | V |

**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)  $250^\circ\text{C/W}$  when mounted on a  $0.02\text{ in}^2$  Pad of 2 oz. Cu.



b)  $270^\circ\text{C/W}$  when mounted on a minimum pad.

Scale 1 : 1 on letter size paper

2: Pulse Test: Pulse Width  $\leq 300\ \mu\text{s}$ , Duty Cycle  $\leq 2.0\%$

## Typical Characteristics

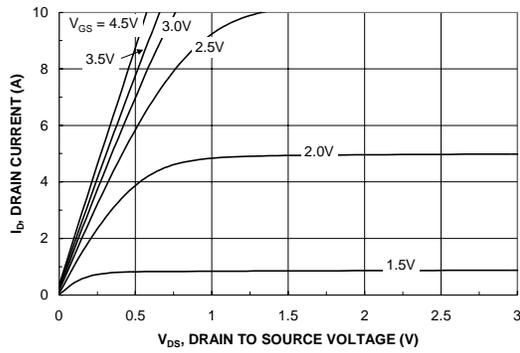


Figure 1. On-Region Characteristics.

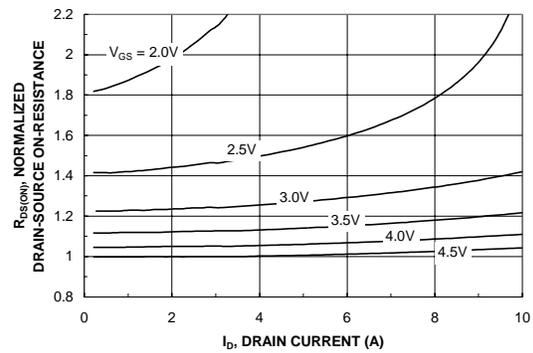


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

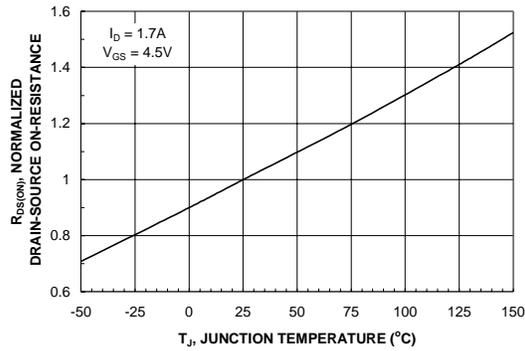


Figure 3. On-Resistance Variation with Temperature.

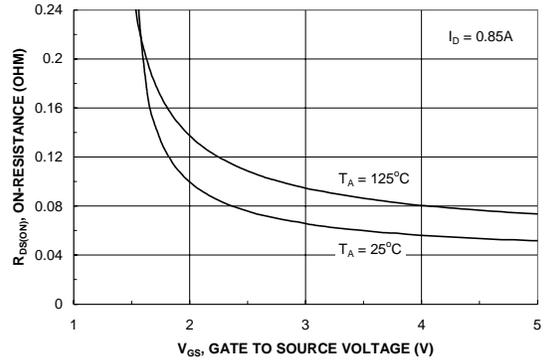


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

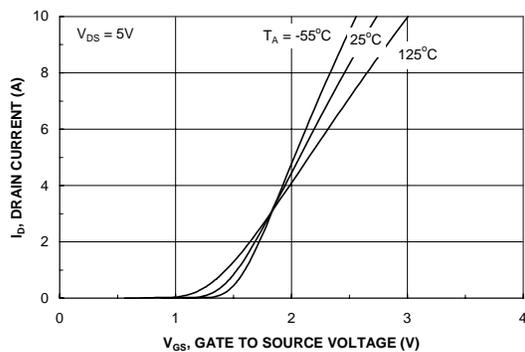


Figure 5. Transfer Characteristics.

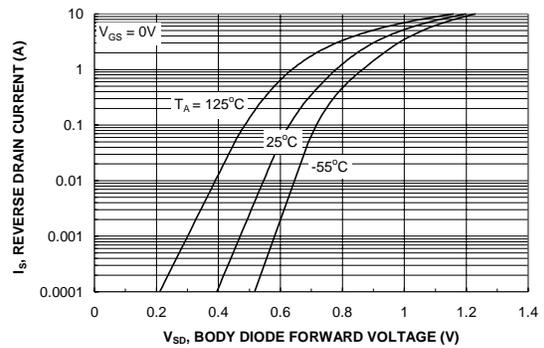
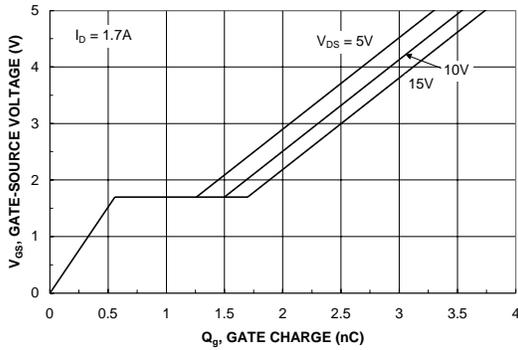
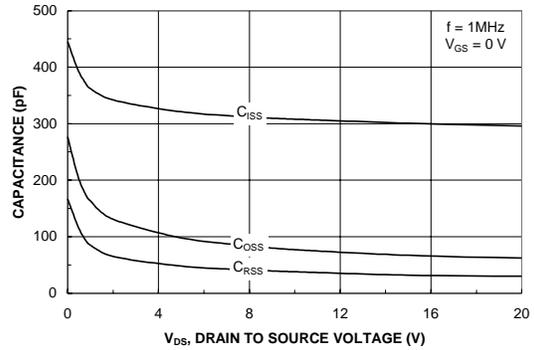


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

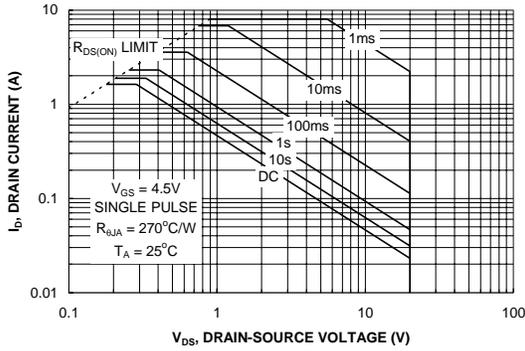
**Typical Characteristics** (continued)



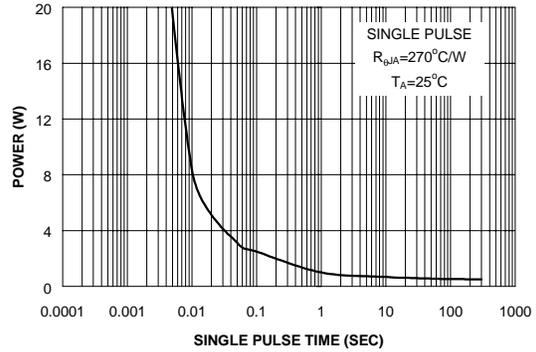
**Figure 7. Gate Charge Characteristics.**



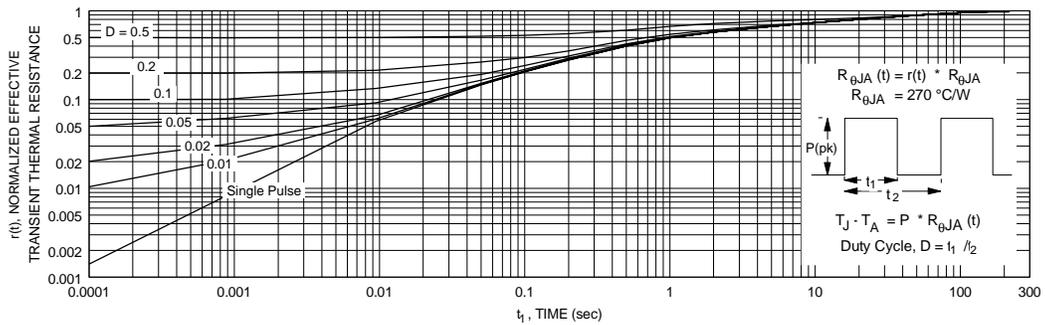
**Figure 8. Capacitance Characteristics.**



**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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