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# FDN371N

## 20V N-Channel PowerTrench® MOSFET

### General Description

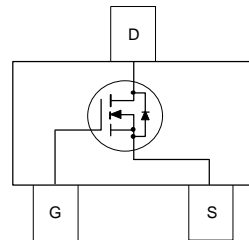
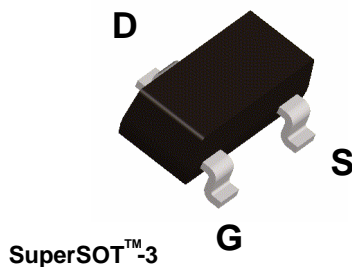
This 20V N-Channel MOSFET uses Fairchild's high voltage PowerTrench process. It has been optimized for power management applications.

### Applications

- Load switch
- Battery protection
- Power management

### Features

- 2.5 A, 20 V.  $R_{DS(ON)} = 50 \text{ m}\Omega @ V_{GS} = 4.5 \text{ V}$   
 $R_{DS(ON)} = 60 \text{ m}\Omega @ V_{GS} = 2.5 \text{ V}$
- Low gate charge (7.6 nC typical)
- Fast switching speed
- High performance trench technology for extremely low  $R_{DS(ON)}$



### 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   | ± 12        | V     |
| I <sub>D</sub>                    | Drain Current – Continuous (Note 1a)                          | 2.5         | A     |
|                                   | – Pulsed  | 10          |       |
| P <sub>D</sub>                    | Power Dissipation for Single Operation (Note 1a)<br>(Note 1b) | 0.5         | W     |
|                                   |   | 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 Marking and Ordering Information

| Device Marking | Device  | Reel Size | Tape width | Quantity   |
|----------------|---------|-----------|------------|------------|
| 371            | FDN371N | 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 $25^\circ\text{C}$ |    | 13 |      | 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, Forward                | $V_{GS} = 12\text{ V}, V_{DS} = 0\text{ V}$                 |    |    | 100  | nA                   |
| $I_{GSSR}$                           | Gate–Body Leakage, Reverse                | $V_{GS} = -12\text{ V}, V_{DS} = 0\text{ V}$                |    |    | -100 | nA                   |

**On Characteristics (Note 2)**

|  |  |  |     |                |                |                      |
|--|--|--|-----|----------------|----------------|----------------------|
| $V_{GS(th)}$                           | Gate Threshold Voltage                         | $V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$  | 0.5 | 1.0            | 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              | $V_{GS} = 4.5\text{ V}, I_D = 2.5\text{ A}$<br>$V_{GS} = 2.5\text{ V}, I_D = 2.3\text{ A}$<br>$V_{GS} = 4.5\text{ V}, I_D = 2.5\text{ A}, T_J = 125^\circ\text{C}$ |     | 22<br>29<br>31 | 50<br>60<br>75 | m $\Omega$           |
| $I_{D(on)}$                            | On–State Drain Current                         | $V_{GS} = 4.5\text{ V}, V_{DS} = 5\text{ V}$   | 5   |                |                | A                    |
| $g_{FS}$                               | Forward Transconductance                       | $V_{DS} = 5\text{ V}, I_D = 2.5\text{ A}$  |     | 16             |                | S                    |

**Dynamic Characteristics**

|           |                              |  |  |     |  |    |
|-----------|------------------------------|--|--|-----|--|----|
| $C_{iss}$ | Input Capacitance            | $V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V},$<br>$f = 1.0\text{ MHz}$ |  | 815 |  | pF |
| $C_{oss}$ | Output Capacitance           |  |  | 197 |  | pF |
| $C_{rss}$ | Reverse Transfer Capacitance |  |  | 106 |  | pF |

**Switching Characteristics (Note 2)**

|              |                     |   |  |     |      |    |
|--------------|---------------------|---|--|-----|------|----|
| $t_{d(on)}$  | Turn–On Delay Time  | $V_{DD} = 10\text{ V}, I_D = 1\text{ A},$<br>$V_{GS} = 4.5\text{ V}, R_{GEN} = 6\ \Omega$ |  | 7   | 14   | ns |
| $t_r$        | Turn–On Rise Time   |   |  | 9   | 18   | ns |
| $t_{d(off)}$ | Turn–Off Delay Time |   |  | 17  | 31   | ns |
| $t_f$        | Turn–Off Fall Time  |   |  | 5.5 | 11   | ns |
| $Q_g$        | Total Gate Charge   | $V_{DS} = 10\text{ V}, I_D = 2.5\text{ A},$<br>$V_{GS} = 4.5\text{ V}$                    |  | 7.6 | 10.7 | nC |
| $Q_{gs}$     | Gate–Source Charge  |   |  | 1.5 |      | nC |
| $Q_{gd}$     | Gate–Drain Charge   |   |  | 2   |      | 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) |  | 0.6  | 1.2 | V |

**Notes:**

- $R_{\theta JA}$  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. copper.



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

Scale 1 : 1 on letter size paper

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

## Typical Characteristics

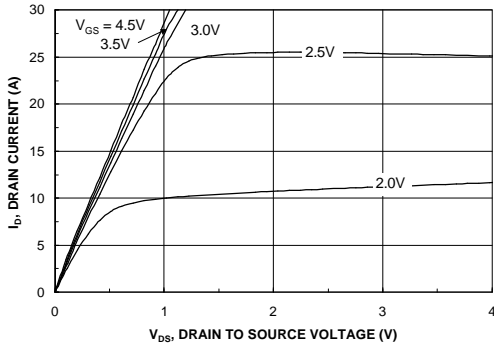


Figure 1. On-Region Characteristics.

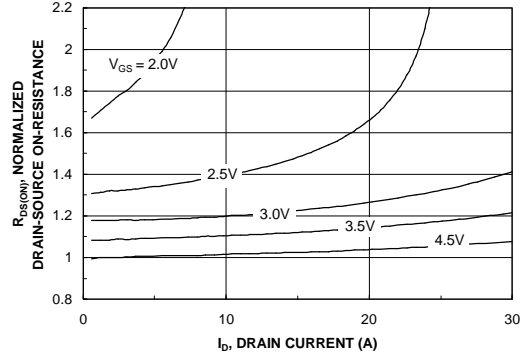


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

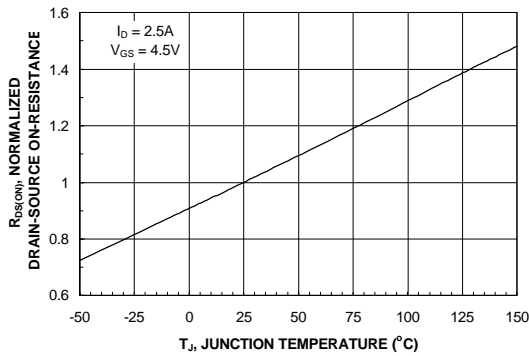


Figure 3. On-Resistance Variation with Temperature.

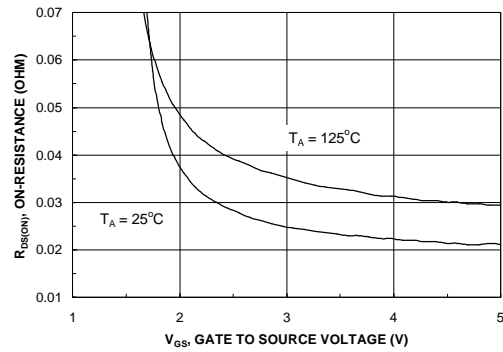


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

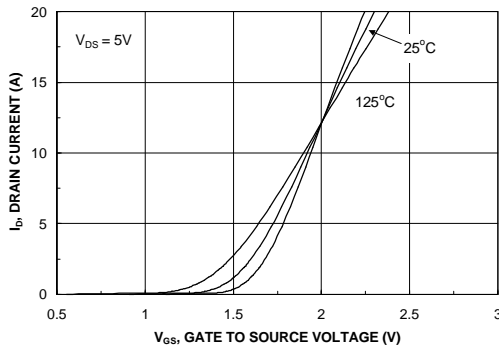


Figure 5. Transfer Characteristics.

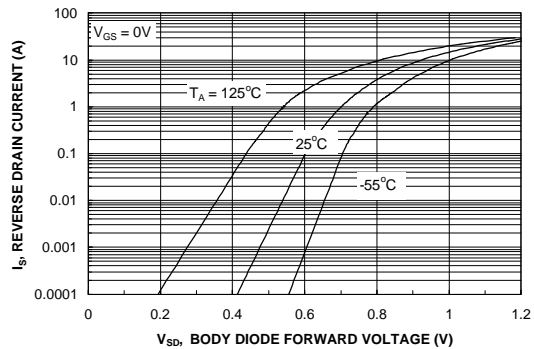
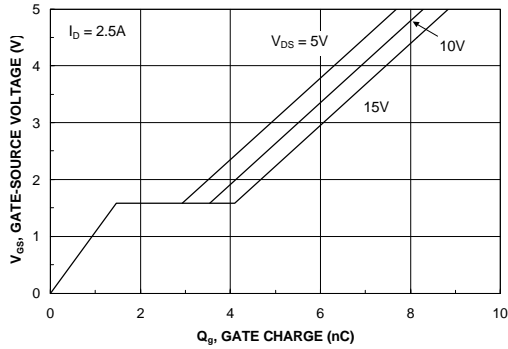
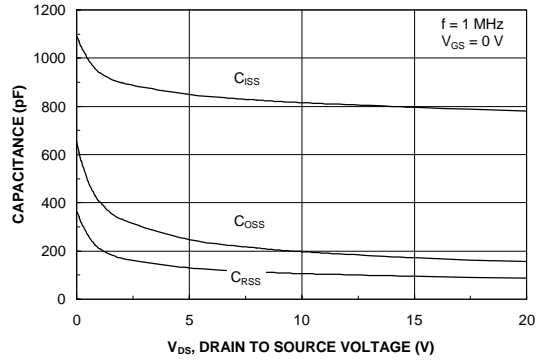


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

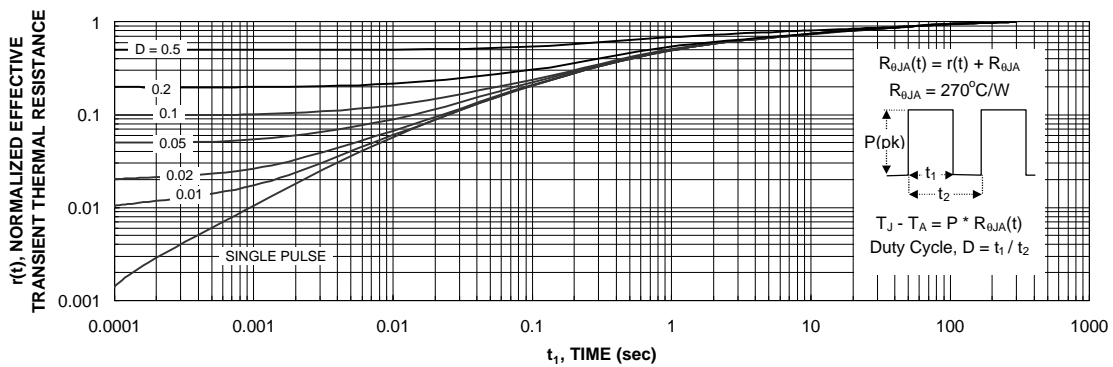
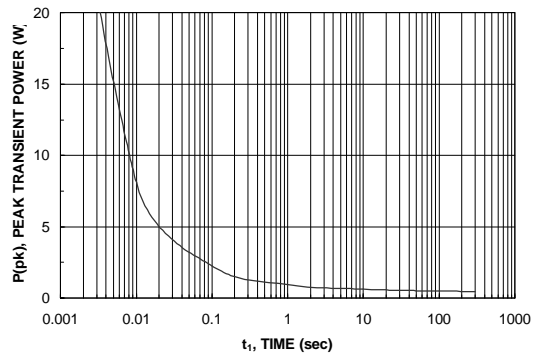
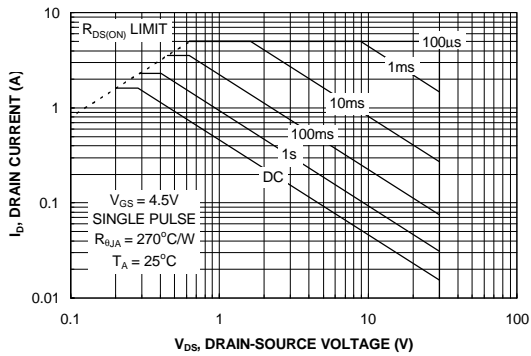
## Typical Characteristics



**Figure 7. Gate Charge Characteristics.**



**Figure 8. Capacitance Characteristics.**



**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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