FDV301N
Digital FET, N-Channel

General Description
This N-Channel logic level enhancement mode field effect transistor is produced using Fairchild's proprietary, high cell density, DMOS technology. This very high density process is especially tailored to minimize on-state resistance. This device has been designed especially for low voltage applications as a replacement for digital transistors. Since bias resistors are not required, this one N-channel FET can replace several different digital transistors, with different bias resistor values.

Features
- 25 V, 0.22 A continuous, 0.5 A Peak.
  \( R_{DS(ON)} = 5 \, \Omega \) @ \( V_{GS} = 2.7 \, V \)
  \( R_{DS(ON)} = 4 \, \Omega \) @ \( V_{GS} = 4.5 \, V \).
- Very low level gate drive requirements allowing direct operation in 3V circuits. \( V_{GSMH} \leq 1.06 \, V \).
- Gate-Source Zener for ESD ruggedness.
  >6kV Human Body Model
- Replace multiple NPN digital transistors with one DMOS FET.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>FDV301N</th>
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</thead>
<tbody>
<tr>
<td>( V_{DSS}, V_{CC} )</td>
<td>Drain-Source Voltage, Power Supply Voltage</td>
<td>25</td>
</tr>
<tr>
<td>( V_{GSS}, V_{i} )</td>
<td>Gate-Source Voltage, ( V_{IN} )</td>
<td>8</td>
</tr>
<tr>
<td>( I_{D}, I_{O} )</td>
<td>Drain/Output Current - Continuous</td>
<td>0.22</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.5</td>
</tr>
<tr>
<td>( P_{D} )</td>
<td>Maximum Power Dissipation</td>
<td>0.35</td>
</tr>
<tr>
<td>( T_{J}, T_{STG} )</td>
<td>Operating and Storage Temperature Range</td>
<td>-55 to 150</td>
</tr>
<tr>
<td>ESD</td>
<td>Electrostatic Discharge Rating MIL-STD-883D Human Body Model (100pf / 1500 Ohm)</td>
<td>6.0</td>
</tr>
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**THERMAL CHARACTERISTICS**

\( R_{JA} \) | Thermal Resistance, Junction-to-Ambient | 357 |

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June 2009

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### Inverter Electrical Characteristics (T<sub>A</sub> = 25°C unless otherwise noted)

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<tr>
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<th>Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Units</th>
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<tbody>
<tr>
<td>IO(off)</td>
<td>Zero Input Voltage Output Current</td>
<td>V&lt;sub&gt;CC&lt;/sub&gt; = 20 V, V&lt;sub&gt;I&lt;/sub&gt; = 0 V</td>
<td>1 µA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V&lt;sub&gt;I&lt;/sub&gt;</td>
<td>Input Voltage</td>
<td>V&lt;sub&gt;GS&lt;/sub&gt; = 5 V, I&lt;sub&gt;O&lt;/sub&gt; = 10 µA</td>
<td>0.5</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V&lt;sub&gt;MIN&lt;/sub&gt;</td>
<td>Output to Ground Resistance</td>
<td>V&lt;sub&gt;CC&lt;/sub&gt; = 0.3 V, I&lt;sub&gt;O&lt;/sub&gt; = 0.005 A</td>
<td>1</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RO(on)</td>
<td></td>
<td></td>
<td>4</td>
<td>5</td>
<td></td>
<td>Ω</td>
</tr>
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### Electrical Characteristics (T<sub>A</sub> = 25°C unless otherwise noted)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>BV&lt;sub&gt;DS&lt;/sub&gt;</td>
<td>Drain-Source Breakdown Voltage</td>
<td>V&lt;sub&gt;GS&lt;/sub&gt; = 0 V, I&lt;sub&gt;D&lt;/sub&gt; = 250 µA</td>
<td>25</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>ΔBV&lt;sub&gt;DS&lt;/sub&gt;/ΔT&lt;sub&gt;J&lt;/sub&gt;</td>
<td>Breakdown Voltage Temp. Coefficient</td>
<td>I&lt;sub&gt;D&lt;/sub&gt; = 250 µA, Referenced to 25 °C</td>
<td>25</td>
<td>mV / °C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IOSS</td>
<td>Zero Gate Voltage Drain Current</td>
<td>V&lt;sub&gt;GS&lt;/sub&gt; = 20 V, V&lt;sub&gt;DD&lt;/sub&gt; = 0 V</td>
<td>10</td>
<td>µA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IGSS</td>
<td>Gate - Body Leakage Current</td>
<td>V&lt;sub&gt;GS&lt;/sub&gt; = 8 V, V&lt;sub&gt;DD&lt;/sub&gt; = 0 V</td>
<td>100</td>
<td>nA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V&lt;sub&gt;GS&lt;/sub&gt;(th)</td>
<td>Gate Threshold Voltage</td>
<td>V&lt;sub&gt;DS&lt;/sub&gt; = 2.7 V, I&lt;sub&gt;D&lt;/sub&gt; = 0.2 A</td>
<td>-2.1</td>
<td>mV / °C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V&lt;sub&gt;DS&lt;/sub&gt;(on)</td>
<td>Static Drain-Source On-Resistance</td>
<td>V&lt;sub&gt;GS&lt;/sub&gt; = 2.7 V, I&lt;sub&gt;D&lt;/sub&gt; = 0.2 A</td>
<td>3.8</td>
<td>Ω</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V&lt;sub&gt;GS&lt;/sub&gt;(on)</td>
<td>Total Gate Charge</td>
<td>V&lt;sub&gt;DS&lt;/sub&gt; = 5 V, I&lt;sub&gt;D&lt;/sub&gt; = 0.2 A, V&lt;sub&gt;GS&lt;/sub&gt; = 4.5 V</td>
<td>0.49</td>
<td>nC</td>
<td></td>
<td></td>
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<tr>
<td>V&lt;sub&gt;GS&lt;/sub&gt;</td>
<td>Forward Transconductance</td>
<td>V&lt;sub&gt;DS&lt;/sub&gt; = 5 V, I&lt;sub&gt;D&lt;/sub&gt; = 0.4 A</td>
<td>0.2</td>
<td>A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>g&lt;sub&gt;F&lt;/sub&gt;</td>
<td>Forward Transconductance</td>
<td></td>
<td>0.2</td>
<td>S</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C&lt;sub&gt;iss&lt;/sub&gt;</td>
<td>Input Capacitance</td>
<td>V&lt;sub&gt;DS&lt;/sub&gt; = 10 V, V&lt;sub&gt;GS&lt;/sub&gt; = 0 V, f = 1 MHz</td>
<td>9.5</td>
<td>pF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C&lt;sub&gt;oss&lt;/sub&gt;</td>
<td>Output Capacitance</td>
<td></td>
<td>6</td>
<td>pF</td>
<td></td>
<td></td>
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<tr>
<td>C&lt;sub&gt;rss&lt;/sub&gt;</td>
<td>Reverse Transfer Capacitance</td>
<td></td>
<td>1.3</td>
<td>pF</td>
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### Switching Characteristics (Note)

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<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Units</th>
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<tbody>
<tr>
<td>IOH</td>
<td>Turn - On Delay Time</td>
<td>V&lt;sub&gt;DD&lt;/sub&gt; = 6 V, I&lt;sub&gt;D&lt;/sub&gt; = 0.5 A</td>
<td>3.2</td>
<td>8</td>
<td>ns</td>
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<tr>
<td>I&lt;sub&gt;H&lt;/sub&gt;</td>
<td>Turn - On Rise Time</td>
<td>V&lt;sub&gt;DD&lt;/sub&gt; = 4.5 V, R&lt;sub&gt;MIN&lt;/sub&gt; = 50 Ω</td>
<td>6</td>
<td>15</td>
<td>ns</td>
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<tr>
<td>IOFF</td>
<td>Turn - Off Delay Time</td>
<td></td>
<td>3.5</td>
<td>8</td>
<td>ns</td>
<td></td>
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<tr>
<td>I&lt;sub&gt;F&lt;/sub&gt;</td>
<td>Turn - Off Fall Time</td>
<td></td>
<td>3.5</td>
<td>8</td>
<td>ns</td>
<td></td>
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<tr>
<td>Qg</td>
<td>Total Gate Charge</td>
<td>V&lt;sub&gt;DS&lt;/sub&gt; = 5 V, I&lt;sub&gt;D&lt;/sub&gt; = 0.2 A, V&lt;sub&gt;GS&lt;/sub&gt; = 4.5 V</td>
<td>0.49</td>
<td>0.7</td>
<td>nC</td>
<td></td>
</tr>
<tr>
<td>Qgs</td>
<td>Gate-Source Charge</td>
<td></td>
<td>0.22</td>
<td>nC</td>
<td></td>
<td></td>
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<tr>
<td>Qgd</td>
<td>Gate-Drain Charge</td>
<td></td>
<td>0.07</td>
<td>nC</td>
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### Drain-Source Diode Characteristics and Maximum Ratings

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<th>Symbol</th>
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<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Units</th>
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<tr>
<td>ISD</td>
<td>Maximum Continuous Drain-Source Diode Forward Current</td>
<td></td>
<td>0.29</td>
<td>A</td>
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<td></td>
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<tr>
<td>V&lt;sub&gt;SD&lt;/sub&gt;</td>
<td>Drain-Source Diode Forward Voltage</td>
<td>V&lt;sub&gt;GS&lt;/sub&gt; = 0 V, I&lt;sub&gt;D&lt;/sub&gt; = 0.29 A</td>
<td>0.8</td>
<td>1.2</td>
<td>V</td>
<td></td>
</tr>
</tbody>
</table>
Typical Electrical 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.
**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.**
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<th>Definition</th>
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