FDD6N25
N-Channel UniFET™ MOSFET
250 V, 4.4 A, 1.1 Ω

Features
• $R_{DS(on)} = 1.1 \, \Omega\text{ (Max.) at } V_{GS} = 10\, V, I_D = 2.2\, A$
• Low Gate Charge (Typ. 4.5 nC)
• Low $C_{rss}$ (Typ. 5 pF)
• 100% Avalanche Tested

Applications
• LCD/LED/PDP TV
• Consumer Appliances
• Lighting
• Uninterruptible Power Supply
• AC-DC Power Supply

Description
UniFET™ MOSFET is Fairchild Semiconductor’s high voltage MOSFET family based on planar stripe and DMOS technology. This MOSFET is tailored to reduce on-state resistance, and to provide better switching performance and higher avalanche energy strength. This device family is suitable for switching power converter applications such as power factor correction (PFC), flat panel display (FPD) TV power, ATX and electronic lamp ballasts.

Absolute Maximum Ratings $T_C = 25^\circ C$ unless otherwise noted.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>FDD6N25TM</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{DSS}$</td>
<td>Drain-Source Voltage</td>
<td>250</td>
<td>V</td>
</tr>
<tr>
<td>$I_D$</td>
<td>Drain Current</td>
<td>- Continuous ($T_C = 25^\circ C$)</td>
<td>4.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Continuous ($T_C = 100^\circ C$)</td>
<td>2.6</td>
</tr>
<tr>
<td>$I_{DM}$</td>
<td>Drain Current</td>
<td>- Pulsed (Note 1)</td>
<td>18</td>
</tr>
<tr>
<td>$V_{GSS}$</td>
<td>Gate-Source voltage</td>
<td>$\pm30$</td>
<td>V</td>
</tr>
<tr>
<td>$E_{AS}$</td>
<td>Single Pulsed Avalanche Energy (Note 2)</td>
<td>45</td>
<td>mJ</td>
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<tr>
<td>$I_{AR}$</td>
<td>Avalanche Current (Note 1)</td>
<td>4.4</td>
<td>A</td>
</tr>
<tr>
<td>$E_{AR}$</td>
<td>Repetitive Avalanche Energy (Note 1)</td>
<td>5</td>
<td>mJ</td>
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<td>$dv/dt$</td>
<td>Peak Diode Recovery dv/dt (Note 3)</td>
<td>4.5</td>
<td>V/ns</td>
</tr>
<tr>
<td>$P_D$</td>
<td>Power Dissipation ($T_C = 25^\circ C$)</td>
<td>50</td>
<td>W</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Derate Above 25°C</td>
<td>0.4</td>
</tr>
<tr>
<td>$T_J, T_{STG}$</td>
<td>Operating and Storage Temperature Range</td>
<td>-55 to +150</td>
<td>°C</td>
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<tr>
<td>$T_L$</td>
<td>Maximum Lead Temperature for Soldering, 1/8” from Case for 5 Seconds</td>
<td>300</td>
<td>°C</td>
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Thermal Characteristics

<table>
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<th>Unit</th>
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<tr>
<td>$R_{JUC}$</td>
<td>Thermal Resistance, Junction-to-Case, Max.</td>
<td>2.5</td>
<td>°C/W</td>
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<tr>
<td>$R_{JUA}$</td>
<td>Thermal Resistance, Junction-to-Ambient, Max.</td>
<td>110</td>
<td>°C/W</td>
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## Package Marking and Ordering Information

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<th>Part Number</th>
<th>Top Mark</th>
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<th>Packing Method</th>
<th>Reel Size</th>
<th>Tape Width</th>
<th>Quantity</th>
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<td>FDD6N25TM</td>
<td>FDD6N25</td>
<td>DPAK</td>
<td>Tape and Reel</td>
<td>330 mm</td>
<td>16 mm</td>
<td>2500 units</td>
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## Electrical Characteristics  \( T_C = 25^\circ\text{C} \) 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>Unit</th>
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<tr>
<td>( BV_{DSS} )</td>
<td>Drain-Source Breakdown Voltage</td>
<td>( V_GS = 0 \text{ V}, I_D = 250 \mu\text{A} )</td>
<td>250</td>
<td>--</td>
<td>--</td>
<td>V</td>
</tr>
<tr>
<td>( \Delta BV_{DSS} / \Delta T_J )</td>
<td>Breakdown Voltage Temperature Coefficient</td>
<td>( I_D = 250 \mu\text{A}, \text{Referenced to } 25^\circ\text{C} )</td>
<td>--</td>
<td>0.25</td>
<td>--</td>
<td>V/°C</td>
</tr>
<tr>
<td>( I_{DS} )</td>
<td>Zero Gate Voltage Drain Current</td>
<td>( V_{DS} = 250 \text{ V}, V_{GS} = 0 \text{ V} )</td>
<td>--</td>
<td>--</td>
<td>10</td>
<td>μA</td>
</tr>
<tr>
<td>( I_{GSF} )</td>
<td>Gate-Body Leakage Current, Forward</td>
<td>( V_GS = 30 \text{ V}, V_{DS} = 0 \text{ V} )</td>
<td>--</td>
<td>--</td>
<td>100</td>
<td>nA</td>
</tr>
<tr>
<td>( I_{GSSR} )</td>
<td>Gate-Body Leakage Current, Reverse</td>
<td>( V_GS = -30 \text{ V}, V_{DS} = 0 \text{ V} )</td>
<td>--</td>
<td>--</td>
<td>-100</td>
<td>nA</td>
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### Off Characteristics

**On Characteristics**

<table>
<thead>
<tr>
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<th>Min.</th>
<th>Typ.</th>
<th>Max</th>
<th>Unit</th>
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<tbody>
<tr>
<td>( V_{GS(th)} )</td>
<td>Gate Threshold Voltage</td>
<td>( V_{DS} = V_{GS}, I_D = 250 \mu\text{A} )</td>
<td>3.0</td>
<td>--</td>
<td>5.0</td>
<td>V</td>
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<tr>
<td>( R_{DS(on)} )</td>
<td>Static Drain-Source On-Resistance</td>
<td>( V_GS = 10 \text{ V}, I_D = 2.2 \text{ A} )</td>
<td>--</td>
<td>0.9</td>
<td>1.1</td>
<td>Ω</td>
</tr>
<tr>
<td>( g_{FS} )</td>
<td>Forward Transconductance</td>
<td>( V_{DS} = 40 \text{ V}, I_D = 2.2 \text{ A} )</td>
<td>--</td>
<td>5.5</td>
<td>--</td>
<td>S</td>
</tr>
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### Dynamic Characteristics

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<tr>
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<th>Min.</th>
<th>Typ.</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>( C_{iss} )</td>
<td>Input Capacitance</td>
<td>( V_{DS} = 25 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz} )</td>
<td>--</td>
<td>194</td>
<td>250</td>
<td>pF</td>
</tr>
<tr>
<td>( C_{oss} )</td>
<td>Output Capacitance</td>
<td></td>
<td>--</td>
<td>38</td>
<td>50</td>
<td>pF</td>
</tr>
<tr>
<td>( C_{rss} )</td>
<td>Reverse Transfer Capacitance</td>
<td></td>
<td>--</td>
<td>5</td>
<td>8</td>
<td>pF</td>
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### Switching Characteristics

<table>
<thead>
<tr>
<th>Symbol</th>
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<th>Min.</th>
<th>Typ.</th>
<th>Max</th>
<th>Unit</th>
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</thead>
<tbody>
<tr>
<td>( t_{d(on)} )</td>
<td>Turn-On Delay Time</td>
<td>( V_{DD} = 125 \text{ V}, I_D = 6 \text{ A}, V_{GS} = 10 \text{ V}, R_G = 25 \text{ Ω} )</td>
<td>--</td>
<td>10</td>
<td>30</td>
<td>ns</td>
</tr>
<tr>
<td>( t_r )</td>
<td>Turn-On Rise Time</td>
<td></td>
<td>--</td>
<td>25</td>
<td>60</td>
<td>ns</td>
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<tr>
<td>( t_{d(off)} )</td>
<td>Turn-Off Delay Time</td>
<td></td>
<td>--</td>
<td>7</td>
<td>24</td>
<td>ns</td>
</tr>
<tr>
<td>( t_f )</td>
<td>Turn-Off Fall Time</td>
<td></td>
<td>--</td>
<td>12</td>
<td>34</td>
<td>ns</td>
</tr>
<tr>
<td>( Q_g )</td>
<td>Total Gate Charge</td>
<td>( V_{DS} = 200 \text{ V}, I_D = 6 \text{ A}, V_{GS} = 10 \text{ V} )</td>
<td>--</td>
<td>4.5</td>
<td>6</td>
<td>nC</td>
</tr>
<tr>
<td>( Q_{gs} )</td>
<td>Gate-Source Charge</td>
<td></td>
<td>--</td>
<td>1.5</td>
<td>--</td>
<td>nC</td>
</tr>
<tr>
<td>( Q_{gd} )</td>
<td>Gate-Drain Charge</td>
<td></td>
<td>--</td>
<td>1.8</td>
<td>--</td>
<td>nC</td>
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### Drain-Source Diode Characteristics and Maximum Ratings

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max</th>
<th>Unit</th>
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</thead>
<tbody>
<tr>
<td>( I_S )</td>
<td>Maximum Continuous Drain-Source Diode Forward Current</td>
<td></td>
<td>--</td>
<td>--</td>
<td>4.4</td>
<td>A</td>
</tr>
<tr>
<td>( I_{SM} )</td>
<td>Maximum Pulsed Drain-Source Diode Forward Current</td>
<td></td>
<td>--</td>
<td>--</td>
<td>18</td>
<td>A</td>
</tr>
<tr>
<td>( V_{SD} )</td>
<td>Drain-Source Diode Forward Voltage</td>
<td>( V_GS = 0 \text{ V}, I_S = 4.4 \text{ A} )</td>
<td>--</td>
<td>--</td>
<td>1.4</td>
<td>V</td>
</tr>
<tr>
<td>( t_{rr} )</td>
<td>Reverse Recovery Time</td>
<td>( V_GS = 0 \text{ V}, I_S = 6 \text{ A},  \text{di/dt} = 100 \text{ A/μs} )</td>
<td>--</td>
<td>145</td>
<td>--</td>
<td>ns</td>
</tr>
<tr>
<td>( Q_{rr} )</td>
<td>Reverse Recovery Charge</td>
<td></td>
<td>--</td>
<td>0.55</td>
<td>--</td>
<td>μC</td>
</tr>
</tbody>
</table>

### Notes:
1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. \( L = 3.7 \text{ mH}, I_{DS} = 4.4 \text{ A}, V_{DD} = 50 \text{ V}, R_G = 25 \text{ Ω} \), starting \( T_J = 25^\circ\text{C} \).
3. \( I_{DS} \leq 4.4 \text{ A}, \text{di/dt} \leq 200 \text{ A/μs}, V_{DD} \leq BV_{DSS}, \) starting \( T_J = 25^\circ\text{C} \).
4. Essentially independent of operating temperature typical characteristics.
Typical Performance Characteristics

Figure 1. On-Region Characteristics

Figure 2. Transfer Characteristics

Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

Figure 5. Capacitance Characteristics

Figure 6. Gate Charge Characteristics
Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

![Breakdown Voltage Variation](image)

Figure 8. On-Resistance Variation vs. Temperature

![On-Resistance Variation](image)

Figure 9. Maximum Safe Operating Area

![Maximum Safe Operating Area](image)

Figure 10. Maximum Drain Current vs. Case Temperature

![Maximum Drain Current](image)

Figure 11. Transient Thermal Response Curve

![Transient Thermal Response Curve](image)
**Figure 12. Gate Charge Test Circuit & Waveform**

**Figure 13. Resistive Switching Test Circuit & Waveforms**

**Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms**
Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms
Mechanical Dimensions

Figure 16. TO252 (D-PAK), Molded, 3-Lead, Option AA&AB

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<th>Product Status</th>
<th>Definition</th>
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<tr>
<td>Advance Information</td>
<td>Formative / In Design</td>
<td>Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.</td>
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<tr>
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