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Please note: As part of the Fairchild Semiconductor integration, some of the Fairchild orderable part numbers will need to change in order to meet ON Semiconductor’s system requirements. Since the ON Semiconductor product management systems do not have the ability to manage part nomenclature that utilizes an underscore (_), the underscore (_) in the Fairchild part numbers will be changed to a dash (-). This document may contain device numbers with an underscore (_). Please check the ON Semiconductor website to verify the updated device numbers. The most current and up-to-date ordering information can be found at www.onsemi.com. Please email any questions regarding the system integration to Fairchild_questions@onsemi.com.
FDB33N25
N-Channel UniFET™ MOSFET
250 V, 33 A, 94 mΩ

Features
- \( R_{DS(on)} = 94 \text{ mΩ (Max.)} @ V_{GS} = 10 \text{ V}, I_D = 16.5 \text{ A} \)
- Low Gate Charge (Typ. 36.8 nC)
- Low \( C_{rss} \) (Typ. 39 pF)
- 100% Avalanche Tested

Applications
- PDP TV
- Lighting
- Uninterrupable 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 \( T_C = 25^\circ \text{C} \) unless otherwise noted.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>FDB33N25</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 \text{C} ))</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Continuous (( T_C = 100^\circ \text{C} ))</td>
<td>20.4</td>
</tr>
<tr>
<td>( I_{DM} )</td>
<td>Drain Current</td>
<td>- Pulsed (Note 1)</td>
<td>132</td>
</tr>
<tr>
<td>( V_{GSS} )</td>
<td>Gate-Source voltage</td>
<td>( \pm 30 )</td>
<td>V</td>
</tr>
<tr>
<td>( E_{AS} )</td>
<td>Single Pulsed Avalanche Energy (Note 2)</td>
<td>918</td>
<td>mJ</td>
</tr>
<tr>
<td>( I_{AR} )</td>
<td>Avalanche Current (Note 1)</td>
<td>33</td>
<td>A</td>
</tr>
<tr>
<td>( E_{AR} )</td>
<td>Repetitive Avalanche Energy (Note 1)</td>
<td>23.5</td>
<td>mJ</td>
</tr>
<tr>
<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 \text{C} ))</td>
<td>235</td>
<td>W</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Derate Above 25°C</td>
<td>1.89</td>
</tr>
<tr>
<td>( T_J, T_{STG} )</td>
<td>Operating and Storage Temperature Range</td>
<td>-55 to +150</td>
<td>°C</td>
</tr>
<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>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>FDB33N25</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>( R_{JUC} )</td>
<td>Thermal Resistance, Junction-to-Case, Max.</td>
<td>0.53</td>
<td>°C/W</td>
</tr>
<tr>
<td>( R_{JUA} )</td>
<td>Thermal Resistance, Junction-to-Ambient (1 in² Pad of 2-oz Copper), Max.</td>
<td>40</td>
<td>°C/W</td>
</tr>
<tr>
<td>( R_{JUA} )</td>
<td>Thermal Resistance, Junction-to-Ambient (Minimum Pad of 2-oz Copper), Max.</td>
<td>62.5</td>
<td>°C/W</td>
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### Package Marking and Ordering Information

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Top Mark</th>
<th>Package</th>
<th>Packing Method</th>
<th>Reel Size</th>
<th>Tape Width</th>
<th>Quantity</th>
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</thead>
<tbody>
<tr>
<td>FDB33N25TM</td>
<td>FDB33N25</td>
<td>D²-PAK</td>
<td>Tape and Reel</td>
<td>330 mm</td>
<td>24 mm</td>
<td>800 units</td>
</tr>
</tbody>
</table>

### Electrical Characteristics

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

#### Symbol | Parameter | Conditions | Min. | Typ. | Max | Unit
--- | --- | --- | --- | --- | --- | ---

**Off Characteristics**

| Parameter | Conditions | Min. | Typ. | Max | Unit
--- | --- | --- | --- | --- | ---
| $BV_{DSS}$ | $V_{GS} = 0 V, I_D = 250 \mu A$ | 250 | -- | -- | V
| $\Delta BV_{DSS} / \Delta T_J$ | $I_D = 250 \mu A$, Referenced to 25°C | -- | 0.25 | -- | V/°C
| $IDSS$ | $V_{DS} = 250 V, V_{GS} = 0 V$ | -- | -- | 1 | μA
| | $V_{DS} = 200 V, T_C = 125^\circ C$ | -- | -- | 10 | μA
| $IGSSF$ | $V_{GS} = 30 V, V_{DS} = 0 V$ | -- | -- | 100 | nA
| $IGSSR$ | $V_{GS} = -30 V, V_{DS} = 0 V$ | -- | -- | -100 | nA

**On Characteristics**

| Symbol | Parameter | Conditions | Min. | Typ. | Max | Unit
--- | --- | --- | --- | --- | --- | ---
| $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = 250 \mu A$ | 3.0 | -- | 5.0 | V
| $R_{DS(on)}$ | $V_{GS} = 10 V, I_D = 16.5 A$ | -- | 0.77 | 0.094 | Ω
| $GFS$ | $V_{DS} = 40 V, I_D = 16.5 A$ | -- | 26.6 | -- | S

**Dynamic Characteristics**

| Symbol | Parameter | Conditions | Min. | Typ. | Max | Unit
--- | --- | --- | --- | --- | --- | ---
| $C_{iss}$ | Input Capacitance | $V_{DS} = 25 V, V_{GS} = 0 V$, $f = 1$ MHz | -- | 1640 | 2135 | pF
| $C_{oss}$ | Output Capacitance | -- | 330 | 430 | pF
| $C_{rss}$ | Reverse Transfer Capacitance | -- | 39 | 40 | pF

**Switching Characteristics**

| Symbol | Parameter | Conditions | Min. | Typ. | Max | Unit
--- | --- | --- | --- | --- | --- | ---
| $t_{(on)}$ | Turn-On Delay Time | $V_{DD} = 125 V, I_D = 33 A, V_{GS} = 10 V, R_G = 25 \Omega$ | -- | 35 | 80 | ns
| $t_{r}$ | Turn-On Rise Time | -- | 230 | 470 | ns
| $t_{(off)}$ | Turn-Off Delay Time | -- | 75 | 160 | ns
| $t_f$ | Turn-Off Fall Time | -- | 120 | 250 | ns
| $Q_g$ | Total Gate Charge | $V_{DS} = 200 V, I_D = 33 A, V_{GS} = 10 V$ | -- | 36.8 | 48 | nC
| $Q_{gs}$ | Gate-Source Charge | -- | 10 | -- | nC
| $Q_{gd}$ | Gate-Drain Charge | -- | 17 | -- | nC

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

| Symbol | Parameter | Conditions | Min. | Typ. | Max | Unit
--- | --- | --- | --- | --- | --- | ---
| $I_S$ | Maximum Continuous Drain-Source Diode Forward Current | -- | -- | 33 | A
| $I_{SM}$ | Maximum Pulsed Drain-Source Diode Forward Current | -- | -- | 132 | A
| $V_{SD}$ | Drain-Source Diode Forward Voltage | $V_{GS} = 0 V, I_S = 33 A$ | -- | -- | 1.4 | V
| $t_{rr}$ | Reverse Recovery Time | $V_{GS} = 0 V, I_S = 33 A$, $dI_{DS}/dt = 100 A/\mu s$ | -- | 220 | -- | ns
| $Q_{rr}$ | Reverse Recovery Charge | -- | 1.71 | -- | μC

**Notes:**

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. $L = 1.35 mH$, $I_{DS} = 33 A$, $V_{DD} = 50 V$, $R_G = 25 \Omega$, starting $T_J = 25^\circ C$.
3. $I_{DS} \leq 33 A$, $dI_{DS}/dt \leq 200 A/\mu s$, $V_{GS} \leq BV_{DSS}$, starting $T_J = 25^\circ C$.
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

Figure 8. On-Resistance Variation vs. Temperature

Figure 9. Maximum Safe Operating Area

Figure 10. Maximum Drain Current vs. Case Temperature

Figure 11. Transient Thermal Response Curve
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. TO263 (D²PAK), Molded, 2-Lead, Surface Mount

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<th>Product Status</th>
<th>Definition</th>
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<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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<td>First Production</td>
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<td>Full Production</td>
<td>Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.</td>
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<tr>
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<td>Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.</td>
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