FDL100N50F
N-Channel UniFET™ FRFET® MOSFET
500 V, 100 A, 55 mΩ

Features
- $R_{DS(on)} = 43 \text{ mΩ (Typ.) } @ V_{GS} = 10 \text{ V, } I_D = 50 \text{ A}$
- Low Gate Charge (Typ. 238 nC)
- Low $C_{rss}$ (Typ. 64 pF)
- 100% Avalanche Tested
- Improved dv/dt Capability
- RoHS Compliant

Applications
- 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. The body diode’s reverse recovery performance of UniFET FRFET® MOSFET has been enhanced by lifetime control. Its $t_{rr}$ is less than 100nsec and the reverse $dv/dt$ immunity is 15V/ns while normal planar MOSFETs have over 200nsec and 4.5V/nsec respectively. Therefore, it can remove additional component and improve system reliability in certain applications in which the performance of MOSFET’s body diode is significant. 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.

MOSFET Maximum Ratings $T_J = 25^\circ C$ unless otherwise noted.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>FDL100N50F</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{DSS}$</td>
<td>Drain to Source Voltage</td>
<td>500</td>
<td>V</td>
</tr>
<tr>
<td>$V_{GSS}$</td>
<td>Gate to Source Voltage</td>
<td>±30</td>
<td>V</td>
</tr>
<tr>
<td>$I_D$</td>
<td>Drain Current</td>
<td>- Continuous ($T_J = 25^\circ C$)</td>
<td>100</td>
</tr>
<tr>
<td>$I_D$</td>
<td>Drain Current</td>
<td>- Continuous ($T_J = 100^\circ C$)</td>
<td>60</td>
</tr>
<tr>
<td>$I_{DM}$</td>
<td>Drain Current</td>
<td>- Pulsed (Note 1)</td>
<td>400</td>
</tr>
<tr>
<td>$E_{AS}$</td>
<td>Single Pulsed Avalanche Energy</td>
<td>(Note 2)</td>
<td>5000</td>
</tr>
<tr>
<td>$I_{AR}$</td>
<td>Avalanche Current (Note 1)</td>
<td>100</td>
<td>A</td>
</tr>
<tr>
<td>$E_{AR}$</td>
<td>Repetitive Avalanche Energy (Note 1)</td>
<td>73.5</td>
<td>mJ</td>
</tr>
<tr>
<td>$dv/dt$</td>
<td>Peak Diode Recovery $dv/dt$ (Note 3)</td>
<td>20</td>
<td>V/ns</td>
</tr>
<tr>
<td>$P_D$</td>
<td>Power Dissipation ($T_J = 25^\circ C$)</td>
<td>2500</td>
<td>W</td>
</tr>
<tr>
<td>$T_{J, TSTG}$</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&quot; from Case for 5 Seconds</td>
<td>300</td>
<td>°C</td>
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</table>

Thermal Characteristics

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>FDL100N50F</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_{JC}$</td>
<td>Thermal Resistance, Junction to Case, Max.</td>
<td>0.05</td>
<td>°C/W</td>
</tr>
<tr>
<td>$R_{JA}$</td>
<td>Thermal Resistance, Junction to Ambient, Max.</td>
<td>30</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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<tbody>
<tr>
<td>FDL100N50F</td>
<td>FDL100N50F</td>
<td>TO-264</td>
<td>Tube</td>
<td>N/A</td>
<td>N/A</td>
<td>25 units</td>
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</table>

### Electrical Characteristics \( T_C = 25^\circ C \) unless otherwise noted.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Test Conditions</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>( V_{DS(th)} )</td>
<td>Gate Threshold Voltage ( V_{GS} = V_{DS}, I_D = 250 \mu A )</td>
<td>3.0</td>
<td>-</td>
<td>5.0</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>( R_{DS(on)} )</td>
<td>Static Drain to Source On Resistance ( V_{GS} = 10 V, I_D = 50 A )</td>
<td>-</td>
<td>0.043</td>
<td>0.055</td>
<td>( \Omega )</td>
<td></td>
</tr>
<tr>
<td>( g_{FS} )</td>
<td>Forward Transconductance ( V_{DS} = 20 V, I_D = 50 A )</td>
<td>-</td>
<td>95</td>
<td>-</td>
<td>S</td>
<td></td>
</tr>
</tbody>
</table>

### Off Characteristics

- \( BVDSS \) : Drain to Source Breakdown Voltage \( I_D = 250 \mu A, V_{GS} = 0 V, T_C = 25^\circ C \) 500 - - V
- \( \Delta BVDSS / \Delta T_J \) : Breakdown Voltage Temperature Coefficient \( I_D = 250 \mu A, \) Referenced to 25°C - 0.5 - V/°C
- \( I_DSS \) : Zero Gate Voltage Drain Current \( V_{DS} = 500 V, V_{GS} = 0 V \) - - 10 \( \mu A \)
- \( I_GSS \) : Gate to Body Leakage Current \( V_{GS} = \pm 30 V, V_{DS} = 0 V \) - - ±100 nA

### On Characteristics

### Dynamic Characteristics

- \( C_{iss} \) : Input Capacitance \( V_{DS} = 25 V, V_{GS} = 0 V, f = 1 MHz \) - 12000 - pF
- \( C_{oss} \) : Output Capacitance \( V_{DS} = 20 V, I_D = 50 A \) - 1700 - pF
- \( C_{rss} \) : Reverse Transfer Capacitance - 64 - pF
- \( Q_{g(tot)} \) : Total Gate Charge at 10V \( V_{DD} = 400 V, I_D = 50 A, V_{GS} = 10 V \) - 238 - nC
- \( Q_{gs} \) : Gate to Source Gate Charge \( V_{DD} = 400 V, I_D = 50 A, V_{GS} = 10 V \) - 74 - nC
- \( Q_{gd} \) : Gate to Drain "Miller" Charge \( V_{DD} = 250 V, I_D = 50 A, V_{GS} = 10 V \) (Note 4) - 95 - nC

### Switching Characteristics

- \( t_{d(on)} \) : Turn-On Delay Time \( V_{DD} = 250 V, I_D = 50 A, V_{GS} = 10 V, R_G = 4.7 \Omega \) - 63 - ns
- \( \tau_r \) : Turn-On Rise Time \( V_{DD} = 250 V, I_D = 50 A, V_{GS} = 10 V, R_G = 4.7 \Omega \) - 186 - ns
- \( t_{d(off)} \) : Turn-Off Delay Time \( V_{DD} = 250 V, I_D = 50 A, V_{GS} = 10 V, R_G = 4.7 \Omega \) (Note 4) - 202 - ns
- \( \tau_f \) : Turn-Off Fall Time \( V_{DD} = 250 V, I_D = 50 A, V_{GS} = 10 V, R_G = 4.7 \Omega \) (Note 4) - 105 - ns

### Drain-Source Diode Characteristics

- \( I_{SDM} \) : Maximum Pulsed Drain to Source Diode Forward Current - - 100 A
- \( I_{SDM} \) : Maximum Pulsed Drain to Source Diode Forward Current - - 400 A
- \( V_{SD} \) : Drain to Source Diode Forward Voltage \( V_{GS} = 0 V, I_{SD} = 100 A \) - - 1.5 V
- \( t_{rr} \) : Reverse Recovery Time \( V_{GS} = 0 V, I_{SD} = 100 A \) - 250 - ns
- \( Q_{rr} \) : Reverse Recovery Charge \( \frac{dI}{dt} = 100 A/\mu s \) - 1.5 - \( \mu C \)

### Notes:

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. \( L = 1 \text{ in.}, I_{ASD} = 100 A, V_{GD} = 50 V, R_G = 25 \Omega, \text{ starting } T_J = 25^\circ C. \)
3. \( I_{SD} \leq 100 A, \text{ di/dt } \leq 200 A/\mu s, V_{GD} \leq BVDSS, \text{ starting } T_J = 25^\circ C. \)
4. Essentially independent of operating temperature typical characteristics.
Typical Performance Characteristics

Figure 1. On-Region Characteristics

- $V_{GS} = 15.0\, \text{V}$
- $10.0\, \text{V}$
- $8.0\, \text{V}$
- $6.0\, \text{V}$
- $7.0\, \text{V}$
- $6.5\, \text{V}$
- $6.0\, \text{V}$

*Notes:
1. 250μs Pulse Test
2. $T_C = 25^\circ\text{C}$

Figure 2. Transfer Characteristics

- $V_{GS} = 15.0\, \text{V}$

*Notes:
1. $V_{DS} = 20\, \text{V}$
2. 250μs Pulse Test

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

- $V_{GS} = 10\, \text{V}$
- $V_{GS} = 20\, \text{V}$

*Note: $T_C = 25^\circ\text{C}$

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

- $V_{SD} = 20\, \text{V}$

*Notes:
1. $V_{GS} = 0\, \text{V}$
2. 250μs Pulse Test

Figure 5. Capacitance Characteristics

- $C_{iss} = C_{gs} + C_{gd}$ ($C_{ds} = \text{shorted}$)
- $C_{oss} = C_{ds} + C_{gd}$
- $C_{rss} = C_{gd}$

*Note: $T_C = 25^\circ\text{C}$

Figure 6. Gate Charge Characteristics

- $V_{GS} = 100\, \text{V}$
- $V_{GS} = 250\, \text{V}$
- $V_{GS} = 400\, \text{V}$

*Note: $I_D = 50\, \text{A}$
Typical Performance Characteristics (Continued)

**Figure 7. Breakdown Voltage Variation vs. Temperature**

![Graph showing Breakdown Voltage Variation](image)

*Notes:
1. $V_{GS} = 0V$
2. $I_D = 1mA$

**Figure 8. On-Resistance Variation vs. Temperature**

![Graph showing On-Resistance Variation](image)

*Notes:
1. $V_{GS} = 10V$
2. $I_D = 50A$

**Figure 9. Maximum Safe Operating Area**

![Graph showing Maximum Safe Operating Area](image)

Operation in this Area is limited by $R_{DS(on)}$

*Notes:
1. $T_J = 25^\circ C$
2. $T_J = 150^\circ C$
3. Single Pulse

**Figure 10. Maximum Drain Current vs. Case Temperature**

![Graph showing Maximum Drain Current](image)

**Figure 11. Transient Thermal Response Curve**

![Graph showing Transient Thermal Response](image)

*Notes:
1. $Z_{\theta JC(t)} = 0.05^\circ C/W Max.$
2. Duty Factor, $D = t_1/t_2$
3. $T_JM - T_C = P_{DM} * Z_{\theta JC(t)}$
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. TO264, Molded, 3-Lead, Jede Variation AA

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