FCD900N60Z
N-Channel SuperFET® II MOSFET
600 V, 4.5 A, 900 mΩ

Features
• 650 V @ Tj = 150°C
• Typ. R(DS(on)) = 820 mΩ
• Ultra Low Gate Charge (Typ. Qg = 13 nC)
• Low Effective Output Capacitance (Typ. Coss(eff.) = 49 pF)
• 100% Avalanche Tested
• ESD Improved Capacity
• RoHS Compliant

Applications
• LCD / LED / PDP TV and Monitor Lighting
• Solar Inverter
• Charger

Description
SuperFET® II MOSFET is Fairchild Semiconductor’s brand-new high voltage super-junction (SJ) MOSFET family that is utilizing charge balance technology for outstanding low on-resistance and lower gate charge performance. This technology is tailored to minimize conduction loss, provide superior switching performance, dv/dt rate and higher avalanche energy. Consequently, SuperFET II MOSFET is very suitable for the switching power applications such as PFC, server/telecom power, FPD TV power, ATX power and industrial power applications.

Absolute Maximum Ratings

<table>
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<th>Parameter</th>
<th>FCD900N60Z</th>
<th>Unit</th>
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<tr>
<td>VDSS</td>
<td>Drain to Source Voltage</td>
<td>600</td>
<td>V</td>
</tr>
<tr>
<td>VGSS</td>
<td>Gate to Source Voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- DC</td>
<td>±20</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>- AC (f &gt; 1Hz)</td>
<td>±30</td>
<td>V</td>
</tr>
<tr>
<td>ID</td>
<td>Drain Current</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Continuous (Tc = 25°C)</td>
<td>4.5</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>- Continuous (Tc = 100°C)</td>
<td>3.5</td>
<td>A</td>
</tr>
<tr>
<td>IDM</td>
<td>Drain Current - Pulsed</td>
<td>13.5</td>
<td>A</td>
</tr>
<tr>
<td>EAS</td>
<td>Single Pulsed Avalanche Energy</td>
<td>47.5</td>
<td>mJ</td>
</tr>
<tr>
<td>EAR</td>
<td>Avalanche Current</td>
<td>1</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>(Note 1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Note 2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>dv/dt</td>
<td>MOSFET dv/dt</td>
<td>100</td>
<td>V/ns</td>
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<tr>
<td></td>
<td>Peak Diode Recovery dv/dt</td>
<td>20</td>
<td>V/ns</td>
</tr>
<tr>
<td>PD</td>
<td>Power Dissipation</td>
<td>52</td>
<td>W</td>
</tr>
<tr>
<td></td>
<td>(Tc = 25°C)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Derate Above 25°C</td>
<td>0.42</td>
<td>W/°C</td>
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<tr>
<td>TJ, TSTG</td>
<td>Operating and Storage Temperature Range</td>
<td>-55 to +150</td>
<td>°C</td>
</tr>
<tr>
<td>TL</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

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<td>R(UJC)</td>
<td>Thermal Resistance, Junction to Case, Max.</td>
<td>2.4</td>
<td>°C/W</td>
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<td>R(UJA)</td>
<td>Thermal Resistance, Junction to Ambient, Max.</td>
<td>100</td>
<td>°C/W</td>
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## Electrical Characteristics

### Off Characteristics

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<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
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<tr>
<td>BV_DSS</td>
<td>Drain to Source Breakdown Voltage</td>
<td>$V_{GS} = 0 , V, , I_D = 10 , mA, , T_J = 25^{\circ}C$</td>
<td>600</td>
<td>-</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>$\Delta BV_{DSS}$</td>
<td>Breakdown Voltage Temperature Coefficient</td>
<td>$I_D = 10 , mA$, Referenced to $25^{\circ}C$</td>
<td>-</td>
<td>0.67</td>
<td>-</td>
<td>V/°C</td>
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<tr>
<td>$BV_{DS}$</td>
<td>Drain to Source Avalanche Breakdown Voltage</td>
<td>$V_{GS} = 0 , V, , I_D = 4.5 , A$</td>
<td>700</td>
<td>-</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>IDSS</td>
<td>Zero Gate Voltage Drain Current</td>
<td>$V_{DS} = 480 , V, , V_{GS} = 0 , V$</td>
<td>-</td>
<td>-</td>
<td>5</td>
<td>μA</td>
</tr>
<tr>
<td>IGSSF</td>
<td>Gate-Body Leakage Current, Forward</td>
<td>$V_{GS} = 20 , V, , V_{DS} = 0 , V$</td>
<td>-</td>
<td>-</td>
<td>10</td>
<td>μA</td>
</tr>
<tr>
<td>IGSSR</td>
<td>Gate-Body Leakage Current, Reverse</td>
<td>$V_{GS} = -20 , V, , V_{DS} = 0 , V$</td>
<td>-</td>
<td>-</td>
<td>-10</td>
<td>μA</td>
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### On Characteristics

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<tr>
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<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
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</thead>
<tbody>
<tr>
<td>$V_{GS(th)}$</td>
<td>Gate Threshold Voltage</td>
<td>$V_{GS} = V_{DS}, , I_D = 250 , \mu A$</td>
<td>2.5</td>
<td>-</td>
<td>3.5</td>
<td>V</td>
</tr>
<tr>
<td>R_DS(on)</td>
<td>Static Drain to Source On Resistance</td>
<td>$V_{GS} = 10 , V, , I_D = 2.3 , A$</td>
<td>-</td>
<td>0.82</td>
<td>0.90</td>
<td>Ω</td>
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<tr>
<td>g_Rs</td>
<td>Forward Transconductance</td>
<td>$V_{DS} = 20 , V, , I_D = 2.3 , A$</td>
<td>-</td>
<td>4.6</td>
<td>-</td>
<td>S</td>
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### Dynamic Characteristics

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<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
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<tbody>
<tr>
<td>Ciss</td>
<td>Input Capacitance</td>
<td>$V_{DS} = 25 , V, , V_{GS} = 0 , V, , f = 1 , MHz$</td>
<td>-</td>
<td>543</td>
<td>720</td>
<td>pF</td>
</tr>
<tr>
<td>Coss</td>
<td>Output Capacitance</td>
<td>$V_{DS} = 380 , V, , V_{GS} = 0 , V, , f = 1 , MHz$</td>
<td>-</td>
<td>11</td>
<td>-</td>
<td>pF</td>
</tr>
<tr>
<td>Crss</td>
<td>Reverse Transfer Capacitance</td>
<td>$V_{DS} = 0 , V$ to $480 , V, , V_{GS} = 0 , V$</td>
<td>-</td>
<td>49</td>
<td>-</td>
<td>pF</td>
</tr>
<tr>
<td>Coss(ef.)</td>
<td>Effective Output Capacitance</td>
<td>$V_{DS} = 380 , V, , I_D = 2.3 , A, , V_{GS} = 10 , V$</td>
<td>-</td>
<td>13</td>
<td>17</td>
<td>nC</td>
</tr>
<tr>
<td>Q_GS</td>
<td>Total Gate Charge at 10V</td>
<td>$V_{DS} = 380 , V, , I_D = 2.3 , A, , V_{GS} = 10 , V$</td>
<td>-</td>
<td>-</td>
<td>2.3</td>
<td>nC</td>
</tr>
<tr>
<td>Q_LD</td>
<td>Gate to Drain &quot;Miller&quot; Charge</td>
<td>-</td>
<td>4.8</td>
<td>-</td>
<td>nC</td>
<td></td>
</tr>
<tr>
<td>ESR</td>
<td>Equivalent Series Resistance</td>
<td>$f = 1 , MHz$</td>
<td>-</td>
<td>2.4</td>
<td>-</td>
<td>Ω</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>
</tr>
</thead>
<tbody>
<tr>
<td>t_on</td>
<td>Turn-On Delay Time</td>
<td>$V_{DD} = 380 , V, , I_D = 2.3 , A, , V_{GS} = 10 , V, , R_G = 4.7 , \Omega$</td>
<td>-</td>
<td>10.9</td>
<td>32</td>
<td>ns</td>
</tr>
<tr>
<td>t_R</td>
<td>Turn-On Rise Time</td>
<td>-</td>
<td>5.3</td>
<td>21</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>t_off</td>
<td>Turn-Off Delay Time</td>
<td>-</td>
<td>33.6</td>
<td>77</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>t_f</td>
<td>Turn-Off Fall Time</td>
<td>-</td>
<td>11.9</td>
<td>34</td>
<td>ns</td>
<td></td>
</tr>
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### Drain-Source Diode Characteristics

<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>I_D</td>
<td>Maximum Continuous Drain to Source Diode Forward Current</td>
<td>-</td>
<td>-</td>
<td>4.5</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>I_SM</td>
<td>Maximum Pulsed Drain to Source Diode Forward Current</td>
<td>-</td>
<td>-</td>
<td>13.5</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>V_DS</td>
<td>Drain to Source Diode Forward Voltage</td>
<td>$V_{GS} = 0 , V, , I_{DS} = 2.3 , A$</td>
<td>-</td>
<td>-</td>
<td>1.2</td>
<td>V</td>
</tr>
<tr>
<td>t_R</td>
<td>Reverse Recovery Time</td>
<td>$V_{GS} = 0 , V, , I_{DS} = 2.3 , A$</td>
<td>-</td>
<td>156</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>Q_TR</td>
<td>Reverse Recovery Charge</td>
<td>$dI_{F}/dT = 100 , A/\mu s$</td>
<td>-</td>
<td>1.3</td>
<td>-</td>
<td>μC</td>
</tr>
</tbody>
</table>

**Notes:**

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. $I_{AS} = 1 \, A, \, V_{DD} = 50 \, V, \, R_G = 25 \, \Omega$, starting $T_J = 25^{\circ}C$.
3. $I_{DS} = 2.3 \, A, \, dI_{D}/dT \leq 200 \, A/\mu s$, $V_{DD} \leq BV_{DSS}$, 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

*Notes:
1. 250μs Pulse Test
2. TC = 25°C

*Note: TC = 25°C

*Notes:
1. VGS = 20V
2. 250μs Pulse Test

*Note: VGS = 0V

*Note: ID = 2.3A

*Note: VDS = 120V

*Note: VDS = 300V

*Note: VDS = 480V

*Note: IO = 2.3A
**Figure 7. Breakdown Voltage Variation**

Variation of Drain to Source Breakdown Voltage vs. Temperature

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

**Figure 8. On-Resistance Variation**

Variation of Drain to Source On-Resistance vs. Temperature

- Notes:
  1. $V_{GS} = 10V$
  2. $I_D = 2.3A$

**Figure 9. Maximum Safe Operating Area**

- Notes:
  1. $V_{GS} = 10V$
  2. $I_D = 2.3A$
  3. Single Pulse

**Figure 10. Maximum Drain Current**

Maximum Drain Current vs. Case Temperature

- Notes:
  1. $T_C = 25^oC$
  2. $T_J = 150^oC$

**Figure 11. Eoss vs. Drain to Source Voltage**

- Notes:
  1. $T_C = 25^oC$
  2. $T_J = 150^oC$
  3. Single Pulse
Typical Performance Characteristics (Continued)

Figure 12. Transient Thermal Response Curve

- Notes:
  1. $Z_{\theta JC}(t) = 2.4^oC/W$ Max.
  2. Duty Factor, $D = \frac{t_1}{t_2}$
  3. $T_{J, M} - T_C = P_{DM} \times Z_{\theta JC}(t)$
Figure 13. Gate Charge Test Circuit & Waveform

Figure 14. Resistive Switching Test Circuit & Waveforms

Figure 15. Unclamped Inductive Switching Test Circuit & Waveforms
Figure 16. Peak Diode Recovery dv/dt Test Circuit & Waveforms
Mechanical Dimensions

Figure 17. TO252 (D-PAK), Molded, 3-Lead, Option AA&AB

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<th>Definition</th>
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