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.
FQP30N06L

N-Channel QFET® MOSFET
60 V, 32 A, 35 mΩ

Description
This N-Channel enhancement mode power MOSFET is produced using Fairchild Semiconductor’s proprietary planar stripe and DMOS technology. This advanced MOSFET technology has been especially tailored to reduce on-state resistance, and to provide superior switching performance and high avalanche energy strength. These devices are suitable for switched mode power supplies, audio amplifier, DC motor control, and variable switching power applications.

Features
- 32 A, 60 V, $R_{DS(on)} = 35$ mΩ (Max.) @ $V_{GS} = 10$ V, $I_D = 16$ A
- Low Gate Charge (Typ. 15 nC)
- Low Crss (Typ. 50 pF)
- 100% Avalanche Tested
- 175°C Maximum Junction Temperature Rating

Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>FQP30N06L</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{DSS}$</td>
<td>Drain-Source Voltage</td>
<td>60 V</td>
</tr>
<tr>
<td>$I_D$</td>
<td>Drain Current</td>
<td>32 A</td>
</tr>
<tr>
<td>$I_{DM}$</td>
<td>Drain Current</td>
<td>22.6 A</td>
</tr>
<tr>
<td>$V_{GSS}$</td>
<td>Gate-Source Voltage</td>
<td>± 20 V</td>
</tr>
<tr>
<td>$E_{AS}$</td>
<td>Single Pulsed Avalanche Energy</td>
<td>350 mJ</td>
</tr>
<tr>
<td>$I_{AR}$</td>
<td>Avalanche Current</td>
<td>32 A</td>
</tr>
<tr>
<td>$E_{AR}$</td>
<td>Repetitive Avalanche Energy</td>
<td>7.9 mJ</td>
</tr>
<tr>
<td>$dV/dt$</td>
<td>Peak Diode Recovery $dV/dt$</td>
<td>7.0 V/ns</td>
</tr>
<tr>
<td>$P_D$</td>
<td>Power Dissipation ($T_J = 25°C$)</td>
<td>79 W</td>
</tr>
<tr>
<td></td>
<td>- Derate above 25°C</td>
<td>0.53 W/°C</td>
</tr>
<tr>
<td>$T_J, T_{STG}$</td>
<td>Operating and Storage Temperature Range</td>
<td>-55 to +175 °C</td>
</tr>
<tr>
<td>$T_L$</td>
<td>Maximum Lead Temperature for Soldering, 1/8” from Case for 5 seconds</td>
<td>300 °C</td>
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Thermal Characteristics

<table>
<thead>
<tr>
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<tr>
<td>$R_{JUC}$</td>
<td>Thermal Resistance, Junction-to-Case, Max.</td>
<td>1.90 °C/W</td>
</tr>
<tr>
<td>$R_{JUA}$</td>
<td>Thermal Resistance, Junction-to-Ambient, Max.</td>
<td>62.5 °C/W</td>
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### Package Marking and Ordering Information

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<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>FQP30N06L</td>
<td>FQP30N06L</td>
<td>TO-220</td>
<td>Tube</td>
<td>N/A</td>
<td>N/A</td>
<td>50 units</td>
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### Electrical Characteristics

**Off Characteristics**

<table>
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<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_{BVDSS})</td>
<td>Drain-Source Breakdown Voltage</td>
<td>(V_{GS} = 0) V, (I_D = 250) (\mu)A</td>
<td>60</td>
<td>--</td>
<td>--</td>
<td>V</td>
</tr>
<tr>
<td>(\Delta V_{BVDSS} / \Delta T_J)</td>
<td>Breakdown Voltage Temperature Coefficient</td>
<td>(I_D = 250) (\mu)A, Referenced to 25°C</td>
<td>--</td>
<td>0.06</td>
<td>--</td>
<td>V/°C</td>
</tr>
<tr>
<td>(I_{DSS})</td>
<td>Zero Gate Voltage Drain Current</td>
<td>(V_{DS} = 60) V, (V_{GS} = 0) V</td>
<td>--</td>
<td>--</td>
<td>1</td>
<td>(\mu)A</td>
</tr>
<tr>
<td>(I_{GSSF})</td>
<td>Gate-Body Leakage Current, Forward</td>
<td>(V_{GS} = 20) V, (V_{DS} = 0) 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} = -20) V, (V_{DS} = 0) V</td>
<td>--</td>
<td>--</td>
<td>-100</td>
<td>nA</td>
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**On Characteristics**

<table>
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<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_{GS(th)})</td>
<td>Gate Threshold Voltage</td>
<td>(V_{DS} = V_{GS}, I_D = 250) (\mu)A</td>
<td>1.0</td>
<td>--</td>
<td>2.5</td>
<td>V</td>
</tr>
<tr>
<td>(R_{DS(on)})</td>
<td>Static Drain-Source On-Resistance</td>
<td>(V_{GS} = 10) V, (I_D = 16) A</td>
<td>--</td>
<td>0.027</td>
<td>0.035</td>
<td>Ω</td>
</tr>
<tr>
<td>(R_{DS(on)})</td>
<td>Static Drain-Source On-Resistance</td>
<td>(V_{GS} = 5) V, (I_D = 16) A</td>
<td>--</td>
<td>0.035</td>
<td>0.045</td>
<td>Ω</td>
</tr>
<tr>
<td>(g_{FS})</td>
<td>Forward Transconductance</td>
<td>(V_{DS} = 25) V, (I_D = 16) A</td>
<td>--</td>
<td>24</td>
<td>--</td>
<td>S</td>
</tr>
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</table>

**Dynamic 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>(C_{iss})</td>
<td>Input Capacitance</td>
<td>(V_{DS} = 25) V, (V_{GS} = 0) V, (f = 1.0) MHz</td>
<td>--</td>
<td>800</td>
<td>1040</td>
<td>pF</td>
</tr>
<tr>
<td>(C_{oss})</td>
<td>Output Capacitance</td>
<td></td>
<td>--</td>
<td>270</td>
<td>350</td>
<td>pF</td>
</tr>
<tr>
<td>(C_{rss})</td>
<td>Reverse Transfer Capacitance</td>
<td></td>
<td>--</td>
<td>50</td>
<td>65</td>
<td>pF</td>
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</table>

**Switching 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>(t_{d(on)})</td>
<td>Turn-On Delay Time</td>
<td>(V_{DD} = 30) V, (I_D = 16) A, (R_G = 25) Ω</td>
<td>--</td>
<td>15</td>
<td>40</td>
<td>ns</td>
</tr>
<tr>
<td>(t_r)</td>
<td>Turn-On Rise Time</td>
<td></td>
<td>--</td>
<td>210</td>
<td>430</td>
<td>ns</td>
</tr>
<tr>
<td>(t_{d(off)})</td>
<td>Turn-Off Delay Time</td>
<td>(V_{DD} = 48) V, (I_D = 32) A, (V_{GS} = 5) V</td>
<td>--</td>
<td>15</td>
<td>20</td>
<td>nC</td>
</tr>
<tr>
<td>(Q_g)</td>
<td>Total Gate Charge</td>
<td></td>
<td>--</td>
<td>3.5</td>
<td>--</td>
<td>nC</td>
</tr>
<tr>
<td>(Q_{gd})</td>
<td>Gate-Drain Charge</td>
<td></td>
<td>--</td>
<td>8.5</td>
<td>--</td>
<td>nC</td>
</tr>
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</table>

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

<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_S)</td>
<td>Maximum Continuous Drain-Source Diode Forward Current</td>
<td></td>
<td>--</td>
<td>32</td>
<td>--</td>
<td>A</td>
</tr>
<tr>
<td>(I_{SM})</td>
<td>Maximum Pulsed Drain-Source Diode Forward Current</td>
<td></td>
<td>--</td>
<td>128</td>
<td>--</td>
<td>A</td>
</tr>
<tr>
<td>(V_{SD})</td>
<td>Drain-Source Diode Forward Voltage</td>
<td>(V_{GS} = 0) V, (I_S = 32) A</td>
<td>--</td>
<td>--</td>
<td>1.5</td>
<td>V</td>
</tr>
<tr>
<td>(t_{tr})</td>
<td>Reverse Recovery Time</td>
<td>(V_{GS} = 0) V, (I_D = 32) A</td>
<td>--</td>
<td>--</td>
<td>60</td>
<td>ns</td>
</tr>
<tr>
<td>(Q_{tr})</td>
<td>Reverse Recovery Charge</td>
<td>(dI_F / dt = 100) A/μs</td>
<td>--</td>
<td>90</td>
<td>--</td>
<td>nC</td>
</tr>
</tbody>
</table>

**Notes:**

1. Repetitive Rating : Pulse width limited by maximum junction temperature.
2. \(L = 400\) \(\mu\)H, \(I_{DS} = 32\) A, \(V_{DD} = 25\) V, \(R_G = 25\) Ω, starting \(T_J = 25°C\).
3. \(I_{DS} \leq 32\) A, \(di/dt \leq 300\) A/μs, \(V_{DD} \leq V_{BVDSS}\), starting \(T_J = 25°C\).
4. Essentially independent of operating temperature.
Typical 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 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

E_{AS} = \frac{1}{2} L I_{AS}^2 \quad \frac{B_{V_{DSS}}}{B_{V_{DSS}} - V_{DD}}

E_{AS} = \frac{1}{2} L I_{AS}^2 \quad \frac{B_{V_{DSS}}}{B_{V_{DSS}} - V_{DD}}
Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms
Mechanical Dimensions

Figure 16. TO220, Molded, 3-Lead, Jedec Variation AB

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- XS™

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Definition of Terms

<table>
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<tr>
<th>Datasheet Identification</th>
<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>
<td>Preliminary</td>
<td>First Production</td>
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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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