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FQP50N06L

N-Channel QFET® MOSFET
60 V, 52.4 A, 21 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
• 52.4 A, 60 V, $R_{DS(on)} = 21$ mΩ (Max.) @ $V_{GS} = 10$ V, $I_D = 26.2$ A
• Low Gate Charge (Typ. 24.5 nC)
• Low Crss (Typ. 90 pF)
• 100% Avalanche Tested
• 175°C Maximum Junction Temperature Rating

Absolute Maximum Ratings

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<th>Parameter</th>
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<th>Unit</th>
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<tbody>
<tr>
<td>$V_{DSS}$</td>
<td>Drain-Source Voltage</td>
<td>60</td>
<td>V</td>
</tr>
<tr>
<td>$I_D$</td>
<td>Drain Current</td>
<td>52.4</td>
<td>A</td>
</tr>
<tr>
<td>$I_{DM}$</td>
<td>Drain Current</td>
<td>37.1</td>
<td>A</td>
</tr>
<tr>
<td>$V_{GS}$</td>
<td>Gate-Source Voltage</td>
<td>± 20</td>
<td>V</td>
</tr>
<tr>
<td>$E_{AS}$</td>
<td>Single Pulsed Avalanche Energy</td>
<td>990</td>
<td>mJ</td>
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<tr>
<td>$I_{AR}$</td>
<td>Avalanche Current</td>
<td>52.4</td>
<td>A</td>
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<tr>
<td>$E_{AR}$</td>
<td>Repetitive Avalanche Energy</td>
<td>12.1</td>
<td>mJ</td>
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<tr>
<td>$dV/dt$</td>
<td>Peak Diode Recovery $dV/dt$</td>
<td>7.0</td>
<td>V/ns</td>
</tr>
<tr>
<td>$P_D$</td>
<td>Power Dissipation ($T_J = 25$°C)</td>
<td>121</td>
<td>W</td>
</tr>
<tr>
<td></td>
<td>- Derate above 25°C</td>
<td>0.81</td>
<td>W/°C</td>
</tr>
<tr>
<td>$T_J, T_{STG}$</td>
<td>Operating and Storage Temperature Range</td>
<td>-55 to +175</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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Thermal Characteristics

<table>
<thead>
<tr>
<th>Symbol</th>
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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>1.24</td>
<td>°C/W</td>
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<td>$R_{JUA}$</td>
<td>Thermal Resistance, Junction-to-Ambient, Max.</td>
<td>62.5</td>
<td>°C/W</td>
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### Package Marking and Ordering Information

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<th>Reel Size</th>
<th>Tape Width</th>
<th>Quantity</th>
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<td>FQP50N06L</td>
<td>TO-220</td>
<td>Tube</td>
<td>N/A</td>
<td>N/A</td>
<td>50 units</td>
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</tbody>
</table>

### Electrical Characteristics

**Symbol** | **Parameter** | **Test Conditions** | **Min** | **Typ** | **Max** | **Unit**
--- | --- | --- | --- | --- | --- | ---

#### Off Characteristics
- **$B_{VDSS}$** (Drain-Source Breakdown Voltage)  
  $V_{GS} = 0$ V, $I_D = 250$ μA  
  60 -- -- V
- **$\Delta B_{VDSS}$** (Breakdown Voltage Temperature Coefficient)  
  $I_D = 250$ μA, Referenced to 25°C  
  -- 0.06 -- V/°C
- **$I_{DSS}$** (Zero Gate Voltage Drain Current)  
  $V_{DS} = 60$ V, $V_{GS} = 0$ V  
  -- -- 1 μA
  $V_{DS} = 48$ V, $T_J = 150°C$  
  -- -- 10 μA
- **$I_{GSSF}$** (Gate-Body Leakage Current, Forward)  
  $V_{GS} = 20$ V, $V_{DS} = 0$ V  
  -- -- 100 nA
- **$I_{GSSR}$** (Gate-Body Leakage Current, Reverse)  
  $V_{GS} = -20$ V, $V_{DS} = 0$ V  
  -- -- -100 nA

#### On Characteristics
- **$V_{GS(th)}$** (Gate Threshold Voltage)  
  $V_{DS} = V_{GS}, I_D = 250$ μA  
  1.0 -- 2.5 V
- **$R_{DS(on)}$** (Static Drain-Source On-Resistance)  
  $V_{GS} = 10$ V, $I_D = 26.2$ A  
  -- 0.017 0.021 Ω  
  $V_{GS} = 5$ V, $I_D = 26.2$ A  
  -- 0.020 0.025 Ω
- **$g_{FS}$** (Forward Transconductance)  
  $V_{DS} = 25$ V, $I_D = 26.2$ A  
  -- 40 -- S

### Dynamic Characteristics
- **$C_{iss}$** (Input Capacitance)  
  $V_{DS} = 25$ V, $V_{GS} = 0$ V,  
  $f = 1.0$ MHz  
  -- 1250 1630 pF
- **$C_{oss}$** (Output Capacitance)  
  $V_{DS} = 48$ V, $I_D = 52.4$ A,  
  $V_{GS} = 5$ V  
  -- 445 580 pF
- **$C_{rss}$** (Reverse Transfer Capacitance)  
  -- 90 120 pF

### Switching Characteristics
- **$t_{(on)}$** (Turn-On Delay Time)  
  $V_{DD} = 30$ V, $I_D = 26.2$ A,  
  $R_G = 25$ Ω  
  -- 20 50 ns
- **$t_r$** (Turn-On Rise Time)  
  -- 380 770 ns
- **$t_{(off)}$** (Turn-Off Delay Time)  
  -- 80 170 ns
- **$t_f$** (Turn-Off Fall Time)  
  -- 145 300 ns
- **$Q_g$** (Total Gate Charge)  
  $V_{DS} = 48$ V, $I_D = 52.4$ A,  
  $V_{GS} = 5$ V  
  -- 24.5 32 nC
- **$Q_{gs}$** (Gate-Source Charge)  
  -- 6 -- nC
- **$Q_{gd}$** (Gate-Drain Charge)  
  -- 14.5 -- nC

### Drain-Source Diode Characteristics and Maximum Ratings
- **$I_S$** (Maximum Continuous Drain-Source Diode Forward Current)  
  -- -- 52.4 A
- **$I_{SM}$** (Maximum Pulsed Drain-Source Diode Forward Current)  
  -- -- 210 A
- **$V_{SD}$** (Drain-Source Diode Forward Voltage)  
  $V_{GS} = 0$ V, $I_S = 52.4$ A  
  -- 1.5 V
- **$t_{rr}$** (Reverse Recovery Time)  
  $V_{GS} = 0$ V, $I_S = 52.4$ A  
  -- 65 -- ns
- **$Q_{rr}$** (Reverse Recovery Charge)  
  $dI_{F} / dt = 100$ A/μs  
  -- 125 -- nC

### Notes:
1. Repetitive Rating : Pulse width limited by maximum junction temperature.
2. $L = 300$ μH, $I_{DS} = 52.4$ A, $V_{DD} = 25$ V, $R_G = 25$ Ω, starting $T_J = 25°C$.
3. $I_{OD} = 52.4$ A, $dI_{D} / dt = 300$ A/μs, $V_{DD} = B_{VDSS}$, starting $T_J = 25°C$.
4. Essentially independent of operating temperature.
Typical Characteristics

![Graph 1: On-Region Characteristics](image1)
![Graph 2: Transfer Characteristics](image2)
![Graph 3: On-Resistance Variation vs. Drain Current and Gate Voltage](image3)
![Graph 4: Body Diode Forward Voltage Variation vs. Source Current and Temperature](image4)
![Graph 5: Capacitance Characteristics](image5)
![Graph 6: Gate Charge Characteristics](image6)
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
Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms
Mechanical Dimensions

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

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