**FQP9N25C / FQPF9N25C**  
N-Channel QFET® MOSFET  
250 V, 8.8 A, 430 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, active power factor correction (PFC), and electronic lamp ballasts.

### Absolute Maximum Ratings

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<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>FQP9N25C</th>
<th>FQPF9N25C</th>
<th>Unit</th>
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<tbody>
<tr>
<td>( V_{DSS} )</td>
<td>Drain-Source Voltage</td>
<td>250</td>
<td>250</td>
<td>V</td>
</tr>
<tr>
<td>( I_D )</td>
<td>Drain Current - Continuous (( T_C = 25°C ))</td>
<td>8.8</td>
<td>8.8 *</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>- Continuous (( T_C = 100°C ))</td>
<td>5.6</td>
<td>5.6 *</td>
<td>A</td>
</tr>
<tr>
<td>( I_{DM} )</td>
<td>Drain Current - Pulsed (Note 1)</td>
<td>35.2</td>
<td>35.2 *</td>
<td>A</td>
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<tr>
<td>( V_{GSS} )</td>
<td>Gate-Source Voltage</td>
<td>±30</td>
<td>±30</td>
<td>V</td>
</tr>
<tr>
<td>( E_{AS} )</td>
<td>Single Pulsed Avalanche Energy (Note 2)</td>
<td>285</td>
<td>285</td>
<td>mJ</td>
</tr>
<tr>
<td>( I_{AR} )</td>
<td>Avalanche Current (Note 1)</td>
<td>8.8</td>
<td>8.8</td>
<td>A</td>
</tr>
<tr>
<td>( E_{AR} )</td>
<td>Repetitive Avalanche Energy (Note 1)</td>
<td>7.4</td>
<td>7.4</td>
<td>mJ</td>
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<tr>
<td>( dv/dt )</td>
<td>Peak Diode Recovery ( dv/dt )</td>
<td>(Note 3)</td>
<td>5.5</td>
<td>V/ns</td>
</tr>
<tr>
<td>( P_D )</td>
<td>Power Dissipation (( T_C = 25°C ))</td>
<td>74</td>
<td>38</td>
<td>W</td>
</tr>
<tr>
<td></td>
<td>- Derate above 25°C</td>
<td>0.59</td>
<td>0.3</td>
<td>W/°C</td>
</tr>
<tr>
<td>( T_J, T_{STG} )</td>
<td>Operating and Storage Temperature Range</td>
<td>-55 to +150</td>
<td>-55 to +150</td>
<td>°C</td>
</tr>
<tr>
<td>( T_L )</td>
<td>Maximum lead temperature for soldering purposes, 1/8” from case for 5 seconds</td>
<td>300</td>
<td>300</td>
<td>°C</td>
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* Drain current limited by maximum junction temperature.

### Thermal Characteristics

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<th>FQPF9N25C</th>
<th>Unit</th>
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<tbody>
<tr>
<td>( R_{JUC} )</td>
<td>Thermal Resistance, Junction-to-Case</td>
<td>1.69</td>
<td>3.29</td>
<td>°C/W</td>
</tr>
<tr>
<td>( R_{JUS} )</td>
<td>Thermal Resistance, Case-to-Sink Typ.</td>
<td>0.5</td>
<td>--</td>
<td>°C/W</td>
</tr>
<tr>
<td>( R_{JUA} )</td>
<td>Thermal Resistance, Junction-to-Ambient</td>
<td>62.5</td>
<td>62.5</td>
<td>°C/W</td>
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### Electrical Characteristics

<table>
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<tr>
<th>Symbol</th>
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<th>Test Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
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</thead>
<tbody>
<tr>
<td>BVDSS</td>
<td>Drain-Source Breakdown Voltage</td>
<td>VGS = 0 V, ID = 250 µA</td>
<td>250</td>
<td>--</td>
<td>--</td>
<td>V</td>
</tr>
<tr>
<td>ΔBVDSS / ΔTJ</td>
<td>Breakdown Voltage Temperature Coefficient</td>
<td>ID = 250 µA, Referenced to 25°C</td>
<td>--</td>
<td>0.30</td>
<td>--</td>
<td>V/°C</td>
</tr>
<tr>
<td>IDSS</td>
<td>Zero Gate Voltage Drain Current</td>
<td>VDS = 250 V, VGS = 0 V</td>
<td>--</td>
<td>10</td>
<td>--</td>
<td>µA</td>
</tr>
<tr>
<td>IGSF</td>
<td>Gate-Body Leakage Current, Forward</td>
<td>VGS = 30 V, VDS = 0 V</td>
<td>--</td>
<td>100</td>
<td>--</td>
<td>nA</td>
</tr>
<tr>
<td>IGSSR</td>
<td>Gate-Body Leakage Current, Reverse</td>
<td>VGS = -30 V, VDS = 0 V</td>
<td>--</td>
<td>-100</td>
<td>--</td>
<td>nA</td>
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### Off Characteristics

<table>
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<tr>
<th>Symbol</th>
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<th>Typ</th>
<th>Max</th>
<th>Unit</th>
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<tbody>
<tr>
<td>BVDS</td>
<td>Drain-Source Breakdown Voltage</td>
<td>VGS = 0 V, ID = 250 µA</td>
<td>250</td>
<td>--</td>
<td>--</td>
<td>V</td>
</tr>
<tr>
<td>RBDS(on)</td>
<td>Static Drain-Source On-Resistance</td>
<td>VGS = 10 V, ID = 4.4 A</td>
<td>--</td>
<td>0.35</td>
<td>0.43</td>
<td>Ω</td>
</tr>
<tr>
<td>gFS</td>
<td>Forward Transconductance</td>
<td>VDS = 40 V, ID = 4.4 A (Note 4)</td>
<td>--</td>
<td>7.0</td>
<td>--</td>
<td>S</td>
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### Dynamic Characteristics

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<tr>
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<th>Max</th>
<th>Unit</th>
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</thead>
<tbody>
<tr>
<td>Ciss</td>
<td>Input Capacitance</td>
<td>VDS = 25 V, VGS = 0 V, f = 1.0 MHz</td>
<td>--</td>
<td>545</td>
<td>710</td>
<td>pF</td>
</tr>
<tr>
<td>Coss</td>
<td>Output Capacitance</td>
<td>--</td>
<td>115</td>
<td>150</td>
<td>pF</td>
<td></td>
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<tr>
<td>Crss</td>
<td>Reverse Transfer Capacitance</td>
<td>--</td>
<td>45.5</td>
<td>60</td>
<td>pF</td>
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### Switching Characteristics

<table>
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<tr>
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<th>Typ</th>
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<th>Unit</th>
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<tbody>
<tr>
<td>t(on)</td>
<td>Turn-On Delay Time</td>
<td>VDD = 125 V, ID = 8.8 A, RG = 25 Ω</td>
<td>--</td>
<td>15</td>
<td>40</td>
<td>ns</td>
</tr>
<tr>
<td>tr</td>
<td>Turn-On Rise Time</td>
<td></td>
<td>--</td>
<td>85</td>
<td>180</td>
<td>ns</td>
</tr>
<tr>
<td>t(off)</td>
<td>Turn-Off Delay Time</td>
<td></td>
<td>--</td>
<td>90</td>
<td>190</td>
<td>ns</td>
</tr>
<tr>
<td>tf</td>
<td>Turn-Off Fall Time</td>
<td></td>
<td>--</td>
<td>65</td>
<td>140</td>
<td>ns</td>
</tr>
<tr>
<td>Qg</td>
<td>Total Gate Charge</td>
<td>VDS = 200 V, ID = 8.8 A, VGS = 10 V</td>
<td>--</td>
<td>26.5</td>
<td>35</td>
<td>nC</td>
</tr>
<tr>
<td>Qgs</td>
<td>Gate-Source Charge</td>
<td></td>
<td>--</td>
<td>3.5</td>
<td>--</td>
<td>nC</td>
</tr>
<tr>
<td>Qgd</td>
<td>Gate-Drain Charge</td>
<td></td>
<td>--</td>
<td>13.5</td>
<td>--</td>
<td>nC</td>
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### Drain-Source Diode Characteristics and Maximum Ratings

<table>
<thead>
<tr>
<th>Symbol</th>
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<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
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</thead>
<tbody>
<tr>
<td>IS</td>
<td>Maximum Continuous Drain-Source Diode Forward Current</td>
<td>--</td>
<td>--</td>
<td>8.8</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>ISM</td>
<td>Maximum Pulsed Drain-Source Diode Forward Current</td>
<td>--</td>
<td>--</td>
<td>35.2</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>VSD</td>
<td>Drain-Source Diode Forward Voltage</td>
<td>VGS = 0 V, IS = 8.8 A</td>
<td>--</td>
<td>--</td>
<td>1.5</td>
<td>V</td>
</tr>
<tr>
<td>tr</td>
<td>Reverse Recovery Time</td>
<td>VGS = 0 V, IS = 8.8 A, dIF / dt = 100 A/µs (Note 4)</td>
<td>--</td>
<td>218</td>
<td>--</td>
<td>ns</td>
</tr>
<tr>
<td>Qr</td>
<td>Reverse Recovery Charge</td>
<td></td>
<td>--</td>
<td>1.58</td>
<td>--</td>
<td>µC</td>
</tr>
</tbody>
</table>

### Notes
1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. L = 5.9mH, ISD = 8.8A, VDD = 50V, RG = 25 Ω, Starting TJ = 25°C
3. ISD ≤ 8.8A, dI/dt = 300A/µs, VDD ≤ BVDS, Starting TJ = 25°C
4. Pulse Test : Pulse width ≤ 300µs, Duty cycle ≤ 2%
5. 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 with 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 9-1. Maximum Safe Operating Area for FQP9N25C

Figure 9-2. Maximum Safe Operating Area for FQPF9N25C

Figure 10. Maximum Drain Current vs Case Temperature
Typical Characteristics (Continued)

Figure 11-1. Transient Thermal Response Curve for FQP9N25C

Figure 11-2. Transient Thermal Response Curve for FQPF9N25C
Peak Diode Recovery dv/dt Test Circuit & Waveforms

- **DUT**
- **V_{DS}**
- **I_{SD}**
- **Driver**
- **RG**
- **Same Type as DUT**

- **V_GS** • dv/dt controlled by RG
- **I_{SD}** controlled by pulse period

**V_{DD}**

**Body Diode**
- **Forward Voltage Drop**
- **IFM**, Body Diode Forward Current
- **IRM**, Body Diode Reverse Current

**Body Diode Recovery dv/dt**
- **dI/dt**
- **D = Gate Pulse Width**
- **Gate Pulse Period**

**V_{GS}** (Driver)

| D = \frac{D}{Gate Pulse Width} | Gate Pulse Period | 10V |

**V_{DS}** (DUT)

- **I_{FM}**, Body Diode Forward Current
- **I_{RM}**, Body Diode Reverse Current

**Body Diode Forward Voltage Drop**

- **V_{SD}**
- **V_{DD}**
**Mechanical Dimensions**

**TO-220**

**NOTES: UNLESS OTHERWISE SPECIFIED**
A) REFERENCE JEDEC, TO-220, ISSUE K, VARIATION AB, DATED APRIL, 2002.
B) ALL DIMENSIONS ARE IN MILLIMETERS.
C) DIMENSIONING AND TOLERANCING PER
ANS Y14.5-1973
D) LOCATION OF THE PIN HOLES MAY VARY
(LOWER LEFT CORNER, LOWER CENTER
AND CENTER OF THE PACKAGE)
△ DOES NOT COMPLY JEDEC STANDARD VALUE.
F) "A1" DIMENSIONS REPRESENT LIKE BELOW:
SINGLE GAUGE = 0.51 - 0.61
DUAL GAUGE = 0.14 - 0.40
G) DRAWING FILE NAME: TO220B03REV6

Dimensions in Millimeters
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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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