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FQP47P06

P-Channel QFET® MOSFET
- 60 V, - 47 A, 26 mΩ

Description
This P-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
- 47 A, - 60 V, R_{DS(on)} = 26 mΩ @ V_{GS} = - 10 V, I_{D} = - 23.5 A
- Low Gate Charge (Typ. 84 nC)
- Low Crss (yp. 320 pF)
- 100% Avalanche Tested
- 175°C Maximum Junction Temperature Rating.

Absolute Maximum Ratings  \( T_{C} = 25°C \) unless otherwise noted

<table>
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<th>Symbol</th>
<th>Parameter</th>
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<th>Unit</th>
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<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 - Continuous (( T_{C} = 25°C ))</td>
<td>-47</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>- Continuous (( T_{C} = 100°C ))</td>
<td>-33.2</td>
<td>A</td>
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<td>I_{DM}</td>
<td>Drain Current - Pulsed (Note 1)</td>
<td>-188</td>
<td>A</td>
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<tr>
<td>V_{GSS}</td>
<td>Gate-Source Voltage</td>
<td>±25</td>
<td>V</td>
</tr>
<tr>
<td>E_{AS}</td>
<td>Single Pulsed Avalanche Energy (Note 2)</td>
<td>820</td>
<td>mJ</td>
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<tr>
<td>I_{AR}</td>
<td>Avalanche Current (Note 1)</td>
<td>-47</td>
<td>A</td>
</tr>
<tr>
<td>E_{AR}</td>
<td>Repetitive Avalanche Energy (Note 1)</td>
<td>16</td>
<td>mJ</td>
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<tr>
<td>dV/dt</td>
<td>Peak Diode Recovery dV/dt (Note 3)</td>
<td>-7.0</td>
<td>V/ns</td>
</tr>
<tr>
<td>P_{D}</td>
<td>Power Dissipation (( T_{C} = 25°C ))</td>
<td>160</td>
<td>W</td>
</tr>
<tr>
<td></td>
<td>- Derate above 25°C</td>
<td>1.06</td>
<td>W/°C</td>
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<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 purposes, 1/8&quot; from case for 5 seconds</td>
<td>300</td>
<td>°C</td>
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Thermal Characteristics

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<th>Unit</th>
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<td>R_{JUC}</td>
<td>Thermal Resistance, Junction-to-Case, Max.</td>
<td>0.94</td>
<td>°C/W</td>
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<tr>
<td>R_{ICS}</td>
<td>Thermal Resistance, Case-to-Sink, Typ.</td>
<td>0.5</td>
<td>°C/W</td>
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<tr>
<td>R_{JUA}</td>
<td>Thermal Resistance, Junction-to-Ambient, Max.</td>
<td>62.5</td>
<td>°C/W</td>
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### Electrical Characteristics

TC = 25°C unless otherwise noted

#### Off Characteristics

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<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
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<tr>
<td>BV\text{DSS}</td>
<td>Drain-Source Breakdown Voltage</td>
<td>$V_{GS} = 0 \text{ V}, I_D = -250 \mu\text{A}$</td>
<td>-60</td>
<td>--</td>
<td>--</td>
<td>V</td>
</tr>
<tr>
<td>$\Delta BVDSS / \Delta T_J$</td>
<td>Breakdown Voltage Temperature Coefficient</td>
<td>$I_D = -250 \mu\text{A}$, 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>$V_{DS} = -60 \text{ V}, V_{GS} = 0 \text{ V}$</td>
<td>--</td>
<td>--</td>
<td>-1</td>
<td>$\mu\text{A}$</td>
</tr>
<tr>
<td>$I_{GSSF}$</td>
<td>Gate-Body Leakage Current, Forward</td>
<td>$V_{GS} = -25 \text{ V}, V_{DS} = 0 \text{ V}$</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>$V_{GS} = 25 \text{ V}, V_{DS} = 0 \text{ V}$</td>
<td>--</td>
<td>--</td>
<td>100</td>
<td>nA</td>
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#### On Characteristics

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<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
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<tr>
<td>$V_{GS(th)}$</td>
<td>Gate Threshold Voltage</td>
<td>$V_{DS} = V_{GS}, I_D = -250 \mu\text{A}$</td>
<td>-2.0</td>
<td>--</td>
<td>-4.0</td>
<td>V</td>
</tr>
<tr>
<td>$R_{DS(on)}$</td>
<td>Static Drain-Source On-Resistance</td>
<td>$V_{GS} = -10 \text{ V}, I_D = -23.5 \text{ A}$</td>
<td>--</td>
<td>0.021</td>
<td>0.026</td>
<td>$\Omega$</td>
</tr>
<tr>
<td>$g_{FS}$</td>
<td>Forward Transconductance</td>
<td>$V_{DS} = -30 \text{ V}, I_D = -23.5 \text{ A}$ (Note 4)</td>
<td>--</td>
<td>21</td>
<td>--</td>
<td>S</td>
</tr>
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#### Dynamic Characteristics

<table>
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<tr>
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<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C_{iss}$</td>
<td>Input Capacitance</td>
<td>$V_{DS} = -25 \text{ V}, V_{GS} = 0 \text{ V}$, $f = 1.0 \text{ MHz}$</td>
<td>--</td>
<td>2800</td>
<td>3600</td>
<td>pF</td>
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<tr>
<td>$C_{oss}$</td>
<td>Output Capacitance</td>
<td></td>
<td>--</td>
<td>1300</td>
<td>1700</td>
<td>pF</td>
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<tr>
<td>$C_{rss}$</td>
<td>Reverse Transfer Capacitance</td>
<td></td>
<td>--</td>
<td>320</td>
<td>420</td>
<td>pF</td>
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#### Switching Characteristics

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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>$t_{on}$</td>
<td>Turn-On Delay Time</td>
<td>$V_{DD} = -30 \text{ V}, I_D = -23.5 \text{ A}$, $R_G = 25 \Omega$</td>
<td>--</td>
<td>50</td>
<td>110</td>
<td>ns</td>
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<tr>
<td>$t_r$</td>
<td>Turn-On Rise Time</td>
<td></td>
<td>--</td>
<td>450</td>
<td>910</td>
<td>ns</td>
</tr>
<tr>
<td>$t_{off}$</td>
<td>Turn-Off Delay Time</td>
<td></td>
<td>--</td>
<td>100</td>
<td>210</td>
<td>ns</td>
</tr>
<tr>
<td>$t_f$</td>
<td>Turn-Off Fall Time</td>
<td></td>
<td>--</td>
<td>195</td>
<td>400</td>
<td>ns</td>
</tr>
<tr>
<td>$Q_g$</td>
<td>Total Gate Charge</td>
<td>$V_{DS} = -48 \text{ V}, I_D = -47 \text{ A}$, $V_{GS} = -10 \text{ V}$</td>
<td>--</td>
<td>84</td>
<td>110</td>
<td>nC</td>
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<tr>
<td>$Q_{gs}$</td>
<td>Gate-Source Charge</td>
<td></td>
<td>--</td>
<td>18</td>
<td>--</td>
<td>nC</td>
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<tr>
<td>$Q_{gd}$</td>
<td>Gate-Drain Charge</td>
<td></td>
<td>--</td>
<td>44</td>
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<td>nC</td>
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#### 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>
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<tr>
<td>$I_S$</td>
<td>Maximum Continuous Drain-Source Diode Forward Current</td>
<td></td>
<td>--</td>
<td>--</td>
<td>-47</td>
<td>A</td>
</tr>
<tr>
<td>$I_{SM}$</td>
<td>Maximum Pulsed Drain-Source Diode Forward Current</td>
<td></td>
<td>--</td>
<td>--</td>
<td>-188</td>
<td>A</td>
</tr>
<tr>
<td>$V_{SD}$</td>
<td>Drain-Source Diode Forward Voltage</td>
<td></td>
<td>--</td>
<td>--</td>
<td>-4.0</td>
<td>V</td>
</tr>
<tr>
<td>$t_{rr}$</td>
<td>Reverse Recovery Time</td>
<td></td>
<td>--</td>
<td>130</td>
<td>--</td>
<td>ns</td>
</tr>
<tr>
<td>$Q_{tr}$</td>
<td>Reverse Recovery Charge</td>
<td>$dI_F / dt = 100 \text{ A/µs}$ (Note 4)</td>
<td></td>
<td>--</td>
<td>0.55</td>
<td>--</td>
</tr>
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### Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. $L = 0.43\text{mH}$, $I_{DS} = -47\text{A}$, $V_{DD} = -25\text{V}$, $R_G = 25 \Omega$, Starting $T_J = 25\text{°C}$
3. $I_{GSS} \leq -47\text{A}$, $dI/dt \leq 300\text{A/µs}$, $V_{DS} \leq BVDSS$, Starting $T_J = 25\text{°C}$
4. Pulse Test : Pulse width $\leq 300\text{µs}$, Duty cycle $\leq 2%$
5. Essentially independent of operating temperature

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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
Peak Diode Recovery $dv/dt$ Test Circuit & Waveforms

- **DUT**
- **VDS**
- **Driver**
- **RG**
- Compliment of DUT (N-Channel)

- $dv/dt$ controlled by $R_G$
- $I_{SD}$ controlled by pulse period

$V_{DD}$

- $I_{SD}$
- 10V

$V_{GS}$ (Driver)

- D = Gate Pulse Width
- Gate Pulse Period

$V_{DS}$ (DUT)

- $I_{RM}$, Body Diode Reverse Current
- Body Diode Forward Current

$V_{DD}$

- Body Diode Forward Voltage Drop
- Body Diode Recovery $dv/dt$
Mechanical Dimensions

TO-220B03

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
   ANSI Y14.5M-1994
D) LOCATION OF THE PIN HOLE MAY VARY
   (LOWER LEFT CORNER, LOWER CENTER
   AND CENTER OF THE PACKAGE)
E) DOES NOT COMPLY JEDEC STANDARD VALUE,
F) "A1" DIMENSIONS REPRESENT LIKE BELOW:
   SINGLE GAUGE = 0.51 - 0.61
   DUAL GAUGE = 1.14 - 1.46
G) DRAWING FILE NAME: TO220B03REV6

Dimensions in Millimeters
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2. A critical component in any component of a life support device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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<th>Product Status</th>
<th>Definition</th>
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<tr>
<td>Advance Information</td>
<td>Formative / In Design</td>
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