FQD1N80 / FQU1N80
N-Channel QFET® MOSFET

800 V, 1.0 A, 20 Ω

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.

Features
- 1.0 A, 800 V, $R_{DS(on)} = 20 \, \Omega$ (Max.) @ $V_{GS} = 10 \, V$, $I_D = 0.5 \, A$
- Low Gate Charge (Typ. 5.5 nC)
- Low Crss (Typ. 2.7 pF)
- 100% Avalanche Tested

Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>FQD1N80TM / FQU1N80TU</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{DSS}$</td>
<td>Drain-Source Voltage</td>
<td>800</td>
<td>V</td>
</tr>
<tr>
<td>$I_D$</td>
<td>Drain Current</td>
<td>1.0</td>
<td>A</td>
</tr>
<tr>
<td>$I_{DM}$</td>
<td>Drain Current - Pulsed</td>
<td>4.0</td>
<td>A</td>
</tr>
<tr>
<td>$V_{GSS}$</td>
<td>Gate-Source Voltage</td>
<td>±30</td>
<td>V</td>
</tr>
<tr>
<td>$E_{AS}$</td>
<td>Single Pulsed Avalanche Energy</td>
<td>90</td>
<td>mJ</td>
</tr>
<tr>
<td>$I_{AR}$</td>
<td>Avalanche Current (Note 1)</td>
<td>1.0</td>
<td>A</td>
</tr>
<tr>
<td>$E_{AR}$</td>
<td>Repetitive Avalanche Energy (Note 1)</td>
<td>4.5</td>
<td>mJ</td>
</tr>
<tr>
<td>$dV/dt$</td>
<td>Peak Diode Recovery $dV/dt$ (Note 3)</td>
<td>4.0</td>
<td>V/ns</td>
</tr>
<tr>
<td>$P_D$</td>
<td>Power Dissipation ($T_A = 25^\circ C$)</td>
<td>2.5</td>
<td>W</td>
</tr>
<tr>
<td></td>
<td>Power Dissipation ($T_C = 25^\circ C$)</td>
<td>45</td>
<td>W</td>
</tr>
<tr>
<td></td>
<td>- Derate above 25°C</td>
<td>0.36</td>
<td>W/°C</td>
</tr>
<tr>
<td>$T_J$, $T_{STG}$</td>
<td>Operating and Storage Temperature Rang</td>
<td>-55 to +150</td>
<td>°C</td>
</tr>
<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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</table>

Thermal Characteristics

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>FQD1N80TM / FQU1N80TU</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_{JC}$</td>
<td>Thermal Resistance, Junction to Case, Max.</td>
<td>2.78</td>
<td>°C/W</td>
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<tr>
<td>$R_{JA}$</td>
<td>Thermal Resistance, Junction to Ambient (Minimum Pad of 2-oz Copper), Max.</td>
<td>110</td>
<td>°C/W</td>
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<tr>
<td></td>
<td>Thermal Resistance, Junction to Ambient (*1 in² Pad of 2-oz Copper), Max.</td>
<td>50</td>
<td>°C/W</td>
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Package Marking and Ordering Information

<table>
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<tr>
<th>Part Number</th>
<th>Top Mark</th>
<th>Package</th>
<th>Packing Method</th>
<th>Reel Size</th>
<th>Tape Width</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>FQD1N80TM</td>
<td>FQD1N80</td>
<td>D-PAK</td>
<td>Tape and Reel</td>
<td>330 mm</td>
<td>16 mm</td>
<td>2500 units</td>
</tr>
<tr>
<td>FQU1N80TU</td>
<td>FQU1N80</td>
<td>I-PAK</td>
<td>Tube</td>
<td>N/A</td>
<td>N/A</td>
<td>70 units</td>
</tr>
</tbody>
</table>

Electrical Characteristics

\[ T_C = 25^\circ C \] unless otherwise noted.

<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>( V_{DSS} )</td>
<td>Drain-Source Breakdown Voltage ( V_{GS} = 0 ), ( I_D = 250 , \mu A )</td>
<td>800</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>V</td>
</tr>
<tr>
<td>( \Delta V_{DSS} / \Delta T_J )</td>
<td>Breakdown Voltage Temperature Coefficient ( I_D = 250 , \mu A, ) Referenced to ( 25^\circ C )</td>
<td>--</td>
<td>1.0</td>
<td>--</td>
<td>V/°C</td>
<td></td>
</tr>
<tr>
<td>( I_{SS} )</td>
<td>Zero Gate Voltage Drain Current ( V_{DS} = 800 , V, ) ( V_{GS} = 0 )</td>
<td>--</td>
<td>10</td>
<td>--</td>
<td>( \mu A )</td>
<td></td>
</tr>
<tr>
<td>( I_{GS} )</td>
<td>Gate-Body Leakage Current, Forward ( V_{GS} = 30 , V, V_{DS} = 0 )</td>
<td>--</td>
<td>100</td>
<td>--</td>
<td>nA</td>
<td></td>
</tr>
<tr>
<td>( I_{GS} )</td>
<td>Gate-Body Leakage Current, Reverse ( V_{GS} = -30 , V, V_{DS} = 0 )</td>
<td>--</td>
<td>-100</td>
<td>--</td>
<td>nA</td>
<td></td>
</tr>
</tbody>
</table>

On Characteristics

\[ V_{GS(th)} \] | Gate Threshold Voltage \( V_{DS} = V_{GS}, \) \( I_D = 250 \, \mu A \) | 3.0 | -- | 5.0 | V    |

\( R_{DS(on)} \) | Static Drain-Source On-Resistance \( V_{GS} = 10 \, V, I_D = 0.5 \, A \) | -- | 15.5 | 20 | Ω    |

\( g_{FS} \) | Forward Transconductance \( V_{DS} = 50 \, V, I_D = 0.5 \, A \) | -- | 0.75 | -- | S    |

Dynamic Characteristics

\( C_{iss} \) | Input Capacitance \( V_{DS} = 25 \, V, V_{GS} = 0 \) \( V \), \( f = 1.0 \, \text{MHz} \) | -- | 150 | 195 | pF   |

\( C_{oss} \) | Output Capacitance \( f = 1.0 \, \text{MHz} \) | -- | 20 | 26 | pF   |

\( C_{rss} \) | Reverse Transfer Capacitance | -- | 2.7 | 3.5 | pF   |

Switching Characteristics

\( t_{(on)} \) | Turn-On Delay Time \( V_{DD} = 400 \, V, I_D = 1.0 \, A, R_G = 25 \, \Omega \) | -- | 10 | 30 | ns   |

\( t_r \) | Turn-On Rise Time | -- | 25 | 60 | ns   |

\( t_{(off)} \) | Turn-Off Delay Time | -- | 15 | 40 | ns   |

\( t_f \) | Turn-Off Fall Time | -- | 25 | 60 | ns   |

\( Q_g \) | Total Gate Charge \( V_{DS} = 640 \, V, I_D = 1.0 \, A \) | -- | 5.5 | 7.2 | nC   |

\( Q_{gs} \) | Gate-Source Charge \( V_{GS} = 10 \, V \) | -- | 1.1 | -- | nC   |

\( Q_{gd} \) | Gate-Drain Charge | -- | 3.3 | -- | nC   |

Drain-Source Diode Characteristics and Maximum Ratings

\( I_S \) | Maximum Continuous Drain-Source Diode Forward Current | -- | -- | 1.0 | A    |

\( I_{SM} \) | Maximum Pulsed Drain-Source Diode Forward Current | -- | -- | 4.0 | A    |

\( V_{SD} \) | Drain-Source Diode Forward Voltage \( V_{GS} = 0 \, V, I_S = 1.0 \, A \) | -- | -- | 1.4 | V    |

\( t_{rr} \) | Reverse Recovery Time \( V_{GS} = 0 \, V, I_S = 1.0 \, A \) | -- | 300 | -- | ns   |

\( Q_{rr} \) | Reverse Recovery Charge \( dI_F / dt = 100 \, \text{A/μs} \) | -- | 0.6 | -- | μC   |

Notes:
1. Repetitive rating : pulse-width limited by maximum junction temperature.
2. \( L = 170 \, \text{mH}, I_{AS} = 1.0 \, A, V_{DD} = 50 \, V, R_G = 25 \, \Omega \), starting \( T_J = 25^\circ C \).
3. \( I_{AS} = 1.0 \, A, dI/dt < 200 \, \text{A/μs}, V_{DD} < BVDSS, \) starting \( T_J = 25^\circ C \).
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
Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms
Figure 16. TO252 (D-PAK), Molded, 3-Lead, Option AA&AB

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Figure 17. TO251 (I-PAK), Molded, 3-Lead

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