FQA140N10

N-Channel QFET® MOSFET

100 V, 140 A, 10 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

- 140 A, 100 V, \( R_{DS(on)} = 10 \text{ mΩ} \) (Max.) @ \( V_{GS} = 10 \text{ V}, I_D = 70 \text{ A} \)
- Low Gate Charge (Typ. 220 nC)
- Low Crss (Typ. 470 pF)
- 100% Avalanche Tested
- 175°C Maximum Junction Temperature Rating

Absolute Maximum Ratings \( T_C = 25°C \) unless otherwise noted.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>FQA140N10</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>( V_{DSS} )</td>
<td>Drain-Source Voltage</td>
<td>100</td>
<td>V</td>
</tr>
<tr>
<td>( I_D )</td>
<td>Drain Current</td>
<td>140</td>
<td>A</td>
</tr>
<tr>
<td>( I_{DM} )</td>
<td>Drain Current (Note 1)</td>
<td>99</td>
<td>A</td>
</tr>
<tr>
<td>( I_{DMP} )</td>
<td>Drain Current - Pulsed (Note 1)</td>
<td>560</td>
<td>A</td>
</tr>
<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>1500</td>
<td>mJ</td>
</tr>
<tr>
<td>( I_{AR} )</td>
<td>Avalanche Current (Note 1)</td>
<td>140</td>
<td>A</td>
</tr>
<tr>
<td>( E_{AR} )</td>
<td>Repetitive Avalanche Energy (Note 1)</td>
<td>37.5</td>
<td>mJ</td>
</tr>
<tr>
<td>( dv/dt )</td>
<td>Peak Diode Recovery ( dv/dt ) (Note 3)</td>
<td>6.5</td>
<td>V/ns</td>
</tr>
<tr>
<td>( P_D )</td>
<td>Power Dissipation (( T_C = 25°C ))</td>
<td>375</td>
<td>W</td>
</tr>
<tr>
<td>( T_J, T_STG )</td>
<td>Operating and Storage Temperature Range</td>
<td>-55 to +175</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>°C</td>
</tr>
</tbody>
</table>

Thermal Characteristics

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>FQA140N10</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>( R_{JUC} )</td>
<td>Thermal Resistance, Junction-to-Case, Max.</td>
<td>0.4</td>
<td>°C/W</td>
</tr>
<tr>
<td>( R_{JUA} )</td>
<td>Thermal Resistance, Junction-to-Ambient, Max.</td>
<td>40</td>
<td>°C/W</td>
</tr>
</tbody>
</table>
## Package Marking and Ordering Information

<table>
<thead>
<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>FQA140N10</td>
<td>FQA140N10</td>
<td>TO-3PN</td>
<td>Tube</td>
<td>N/A</td>
<td>N/A</td>
<td>30 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_{GS(th)} )</td>
<td>Gate Threshold Voltage</td>
<td>$V_{DS} = V_{GS}, I_D = 250, \mu A$</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>$V_{GS} = 10, V, I_D = 70, A$</td>
<td>--</td>
<td>0.008</td>
<td>0.01</td>
<td>Ω</td>
</tr>
<tr>
<td>( g_{FS} )</td>
<td>Forward Transconductance</td>
<td>$V_{DS} = 30, V, I_D = 70, A$</td>
<td>--</td>
<td>80</td>
<td>--</td>
<td>S</td>
</tr>
<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>6100</td>
<td>7900</td>
<td>pF</td>
</tr>
<tr>
<td>( C_{oss} )</td>
<td>Output Capacitance</td>
<td></td>
<td></td>
<td>--</td>
<td>2000</td>
<td>2600</td>
</tr>
<tr>
<td>( C_{rss} )</td>
<td>Reverse Transfer Capacitance</td>
<td></td>
<td></td>
<td>--</td>
<td>420</td>
<td>550</td>
</tr>
<tr>
<td>( t_{d(on)} )</td>
<td>Turn-On Delay Time</td>
<td>$V_{DD} = 40, V, I_D = 140, A$, $R_G = 25, \Omega$</td>
<td>--</td>
<td>75</td>
<td>160</td>
<td>ns</td>
</tr>
<tr>
<td>( t_r )</td>
<td>Turn-On Rise Time</td>
<td></td>
<td></td>
<td>--</td>
<td>940</td>
<td>1890</td>
</tr>
<tr>
<td>( t_{d(off)} )</td>
<td>Turn-Off Delay Time</td>
<td></td>
<td></td>
<td>--</td>
<td>350</td>
<td>710</td>
</tr>
<tr>
<td>( t_f )</td>
<td>Turn-Off Fall Time</td>
<td></td>
<td></td>
<td>--</td>
<td>360</td>
<td>730</td>
</tr>
<tr>
<td>( Q_g )</td>
<td>Total Gate Charge</td>
<td>$V_{DS} = 64, V, I_D = 140, A$</td>
<td>--</td>
<td>220</td>
<td>285</td>
<td>nC</td>
</tr>
<tr>
<td>( Q_{gs} )</td>
<td>Gate-Source Charge</td>
<td>$V_{GS} = 10, V$</td>
<td>--</td>
<td>39</td>
<td>--</td>
<td>nC</td>
</tr>
<tr>
<td>( Q_{gd} )</td>
<td>Gate-Drain Charge</td>
<td></td>
<td></td>
<td>--</td>
<td>114</td>
<td>--</td>
</tr>
</tbody>
</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>$V_{GS} = 0, V, I_S = 140, A$</td>
<td>--</td>
<td>--</td>
<td>140</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>560</td>
<td>A</td>
</tr>
<tr>
<td>( V_{SD} )</td>
<td>Drain-Source Diode Forward Voltage</td>
<td>$V_{GS} = 0, V, I_S = 140, A$</td>
<td>--</td>
<td>--</td>
<td>1.5</td>
<td>V</td>
</tr>
<tr>
<td>( t_{rr} )</td>
<td>Reverse Recovery Time</td>
<td>$V_{GS} = 0, V, I_S = 140, A$, $dI_F / dt = 100, \text{A/μs}$</td>
<td>--</td>
<td>140</td>
<td>--</td>
<td>ns</td>
</tr>
<tr>
<td>( Q_{rr} )</td>
<td>Reverse Recovery Charge</td>
<td></td>
<td></td>
<td>--</td>
<td>730</td>
<td>--</td>
</tr>
</tbody>
</table>

### Notes:
1. Repetitive rating : pulse-width limited by maximum junction temperature.
2. $L_L = 0.115\, \text{mH}, I_{DS(on)} = 140\, \text{A}, V_{DD} = 25\, \text{V}, R_G = 25\, \Omega$, starting $T_J = 25\, ^\circ C$.
3. $I_{DS} \leq 140\, \text{A}, dI_D / dt \leq 300\, \text{A/μs}, V_{DD} \leq V_{DSS}$, starting $T_J = 25\, ^\circ C$.
4. Essentially independent of operating temperature.
5. Continuous drain current calculated by maximum junction temperature : limited by package.
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

- D = Gate Pulse Width
- Gate Pulse Period
- $V_{DD}$
- $V_{GS}$ (Driver)
- $I_{SD}$ (DUT)
- $V_{DS}$ (DUT)
- $I_{RM}$, Body Diode Reverse Current
- $I_{FM}$, Body Diode Forward Current
- $dV_{SD}/dt$, Body Diode Forward Voltage Drop
- $dV_{DS}/dt$, Body Diode Recovery dv/dt
Figure 16. TO3PN, 3-Lead, Plastic, EIAJ SC-65

Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.

Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:

http://www.fairchildsemi.com/package/packageDetails.html?id=PN_TT3PN-003
TRADMARKS
The following includes registered and unregistered trademarks and service marks, owned by Fairchild Semiconductor and/or its global subsidiaries, and is not intended to be an exhaustive list of all such trademarks.

AccuPower™
AX-CAP®
BitSiC™
Build it Now™
CorePLUS™
CorePOWER™
CROSSVOLT™
CTL™
Current Transfer Logic™
DEUXP®
Dual Cool™
EcoSPARK®
EfficientMax™
ESBC™
Fairchild®
Fairchild Semiconductor®
FACT Quiet Series™
FACT®
FAST®
FastCore™
FETBench™
FPS™
F-FPBS™
FRFET®
Global Power Resource™
GreenBridge™
Green FPS™
Green FPS™-e-Series™
Gmax™
GTO™
IntelliMAX™
ISOPLANAR™
Marking Small Speakers Sound Louder and Better™
MegaBuck™
MICROCOUPLER™
MicroFET™
MicroPak™
MillerDrive™
MotionMax™
mWSaver®
OptoHT™
OPTOLOGIC®
OPTOPLANAR®
PowerTrench®
PowerX®
Programmable Active Droop™
QFET®
QS™
Quiet Series™
RapidConfigure™
Saving our world, 1mW/kW at a time™
SignalWise™
SmartMax™
SMART START™
Solutions for Your Success™
SPM®
STEALTH™
SuperFET®
SuperSOT™-3
SuperSOT™-8
SupreSOT™-8
SupreMOS®
SyncFET™
Sync-Lock™

*Trademarks of System General Corporation, used under license by Fairchild Semiconductor.

DISCLAIMER
FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION, OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS.

LIFE SUPPORT POLICY
FAIRCHILD’S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF FAIRCHILD SEMICONDUCTOR CORPORATION.

As used here in:
1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury of the user.
2. A critical component in any component of a life support device or system, or to affect its safety or effectiveness.

ANTI-COUNTERFEITING POLICY
Fairchild Semiconductor Corporation’s Anti-Counterfeiting Policy. Fairchild's Anti-Counterfeiting Policy is also stated on our external website, www.fairchilddemi.com, under Sales Support.

Counterfeit parts is a growing problem in the industry. All manufacturers of semiconductor products are experiencing counterfeiters of their products. Customers who inadvertently purchase counterfeit parts experience many problems such as loss of brand reputation, substandard performance, failed application, and increased cost of production and manufacturing delays. Fairchild is taking strong measures to protect ourselves and our customers from the proliferation of counterfeit parts. Fairchild strongly encourages customers to purchase Fairchild parts either directly from Fairchild or from Authorized Fairchild Distributors who are listed by country on our web page cited above. Products customers buy either from Fairchild directly or from Authorized Fairchild Distributors are genuine parts, have full traceability, meet Fairchild’s quality standards for handling and storage and provide access to Fairchild’s full range of up-to-date technical and product information. Fairchild and our Authorized Distributors will stand behind all warranties and will appropriately address and resolve any issues that may arise. Fairchild will not provide any warranty coverage or other assistance for parts bought from Unauthorized Sources. Fairchild is committed to combat this global problem and encourage our customers to do their part in stopping this practice by buying direct or from authorized distributors.

PRODUCT STATUS DEFINITIONS
Definition of Terms

<table>
<thead>
<tr>
<th>Datasheet Identification</th>
<th>Product Status</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<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>
</tr>
<tr>
<td>Preliminary</td>
<td>First Production</td>
<td>Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.</td>
</tr>
<tr>
<td>No Identification Needed</td>
<td>Full Production</td>
<td>Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.</td>
</tr>
<tr>
<td>Obsolete</td>
<td>Not In Production</td>
<td>Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.</td>
</tr>
</tbody>
</table>