

December 2013

### FQP8N80C / FQPF8N80C / FQPF8N80CYDTU

### N-Channel QFET® MOSFET

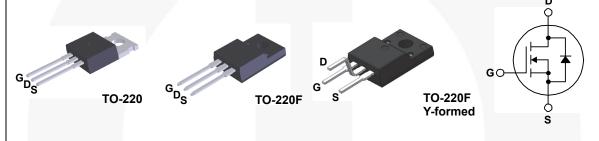
800 V, 8.0 A, 1.55 Ω

### **Description**

This N-Channel enhancement mode power MOSFET is • 8.0 A, 800 V,  $R_{DS(on)}$  = 1.55  $\Omega$  (Max.) @  $V_{GS}$  = 10 V, produced using Fairchild Semiconductor's proprietary planar stripe and DMOS technology. This advanced MOSFET technology has been especially tailored to reduce on-state • Low Gate Charge (Typ. 35 nC) resistance, and to provide superior switching performance • Low Crss (Typ. 13 pF) and high avalanche energy strength. These devices are suitable for switched mode power supplies, active power • 100% Avalanche Tested factor correction (PFC), and electronic lamp ballasts.

### **Features**

- $I_D = 4.0 A$



### Absolute Maximum Ratings T<sub>C</sub> = 25°C unless otherwise noted.

Symbol	Parameter		FQP8N80C	FQPF8N80C	Unit
V <sub>DSS</sub>	Drain-Source Voltage		8	00	V
I <sub>D</sub>	Drain Current - Continuous (T <sub>C</sub> = 25°C)		8	8 *	Α
	- Continuous (T <sub>C</sub> = 100°C)		5.1	5.1 *	Α
I <sub>DM</sub>	Drain Current - Pulsed (Not	te 1)	32	32 *	Α
V <sub>GSS</sub>	Gate-Source Voltage		± 30		V
E <sub>AS</sub>	Single Pulsed Avalanche Energy (Note 2)		850		mJ
I <sub>AR</sub>	Avalanche Current (Note 1)		8		Α
E <sub>AR</sub>	Repetitive Avalanche Energy (Note 1)		17.8		mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)		4.5		V/ns
P <sub>D</sub>	Power Dissipation (T <sub>C</sub> = 25°C)		178	59	W
	- Derate above 25°C		1.43	0.48	W/°C
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage Temperature Range		-55 to +150		°C
T <sub>L</sub>	Maximum lead temperature for soldering, 1/8" from case for 5 seconds	300		°C	

<sup>\*</sup> Drain current limited by maximum junction temperature.

### **Thermal Characteristics**

Symbol	Parameter	FQP8N80C	FQPF8N80C	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	0.89	2.66	°C/W
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink Typ, Max.	0.5		°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	62.5	62.5	°C/W

### **Package Marking and Ordering Information**

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FQP8N80C	FQP8N80C	TO-220	Tube	N/A	N/A	50 units
FQPF8N80C	FQPF8N80C	TO-220F	Tube	N/A	N/A	50 units
FQPF8N80CYDTU	FQPF8N80C	TO-220F (Y-formed)	Tube	N/A	N/A	50 units

### **Electrical Characteristics**

T<sub>C</sub> = 25°C unless otherwise noted.

Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit
Off Cha	aracteristics					
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	$V_{GS} = 0 \text{ V}, I_D = 250 \mu\text{A}$	800			V
ΔBV <sub>DSS</sub> / ΔT <sub>J</sub>	Breakdown Voltage Temperature Coefficient	$I_D$ = 250 μA, Referenced to 25°C	1	0.5		V/°(
I <sub>DSS</sub> Zero Gate Voltage Drain Current	Zero Coto Valtoro Dueio Cumont	V <sub>DS</sub> = 800 V, V <sub>GS</sub> = 0 V	-		10	μΑ
	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 640 V, T <sub>C</sub> = 125°C	1		100	μΑ
I <sub>GSSF</sub>	Gate-Body Leakage Current, Forward	V <sub>GS</sub> = 30 V, V <sub>DS</sub> = 0 V	-		100	nA
I <sub>GSSR</sub>	Gate-Body Leakage Current, Reverse	V <sub>GS</sub> = -30 V, V <sub>DS</sub> = 0 V	-		-100	nA
On Cha	racteristics					
V <sub>GS(th)</sub>	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_{D} = 250 \mu\text{A}$	3.0		5.0	V
	Static Drain-Source	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 4 A	-	1.29	1.55	Ω
' DS(on)	On-Resistance	55 5				
R <sub>DS(on)</sub>	On-Resistance Forward Transconductance	$V_{DS} = 50 \text{ V}, I_D = 4 \text{ A}$ (Note 4)		5.6		S
g <sub>FS</sub>	Forward Transconductance ic Characteristics	50				
9FS <b>Dynam</b> C <sub>iss</sub>	ic Characteristics Input Capacitance	V <sub>DS</sub> = 25 V, V <sub>GS</sub> = 0 V,		1580	2050	pF
9FS  Dynam  C <sub>iss</sub> C <sub>oss</sub>	ic Characteristics Input Capacitance Output Capacitance	50		1580 135	2050 175	pF pF
9FS  Dynam  C <sub>iss</sub> C <sub>oss</sub> C <sub>rss</sub>	ic Characteristics Input Capacitance	V <sub>DS</sub> = 25 V, V <sub>GS</sub> = 0 V,		1580	2050	pF
9FS  Dynam  C <sub>iss</sub> C <sub>oss</sub> C <sub>rss</sub> Switchi	ic Characteristics Input Capacitance Output Capacitance Reverse Transfer Capacitance	V <sub>DS</sub> = 25 V, V <sub>GS</sub> = 0 V, f = 1.0 MHz		1580 135	2050 175	pF pF
9FS  Dynam  C <sub>iss</sub> C <sub>oss</sub> C <sub>rss</sub>	ic Characteristics Input Capacitance Output Capacitance Reverse Transfer Capacitance ing Characteristics	$V_{DS} = 25 \text{ V}, V_{GS} = 0 \text{ V},$ $f = 1.0 \text{ MHz}$ $V_{DD} = 400 \text{ V}, I_D = 8 \text{ A},$		1580 135 13	2050 175 17	pF pF
g <sub>FS</sub> Dynam  C <sub>iss</sub> C <sub>oss</sub> C <sub>rss</sub> Switchi  t <sub>d(on)</sub>	ic Characteristics Input Capacitance Output Capacitance Reverse Transfer Capacitance ing Characteristics Turn-On Delay Time	$V_{DS} = 25 \text{ V}, V_{GS} = 0 \text{ V},$ $f = 1.0 \text{ MHz}$ $V_{DD} = 400 \text{ V}, I_{D} = 8 \text{ A},$ $R_{G} = 25 \Omega$		1580 135 13	2050 175 17	pF pF pF
9FS  Dynam  Ciss Coss Crss  Switchi  td(on) tr  td(off)	ic Characteristics Input Capacitance Output Capacitance Reverse Transfer Capacitance ing Characteristics Turn-On Delay Time Turn-On Rise Time	$V_{DS} = 25 \text{ V}, V_{GS} = 0 \text{ V},$ $f = 1.0 \text{ MHz}$ $V_{DD} = 400 \text{ V}, I_D = 8 \text{ A},$		1580 135 13 40 110	2050 175 17 90 230	pF pF pF
$\begin{array}{c} \textbf{g}_{\text{FS}} \\ \textbf{Dynam} \\ \textbf{C}_{\text{iss}} \\ \textbf{C}_{\text{oss}} \\ \textbf{C}_{\text{rss}} \\ \\ \textbf{Switchi} \\ \textbf{t}_{\text{d}(\text{on})} \\ \textbf{t}_{r} \\ \\ \textbf{t}_{\text{d}(\text{off})} \\ \textbf{t}_{\text{f}} \end{array}$	ic Characteristics Input Capacitance Output Capacitance Reverse Transfer Capacitance ing Characteristics Turn-On Delay Time Turn-On Rise Time Turn-Off Delay Time	$V_{DS} = 25 \text{ V}, V_{GS} = 0 \text{ V},$ f = 1.0 MHz $V_{DD} = 400 \text{ V}, I_{D} = 8 \text{ A},$ $R_{G} = 25 \Omega$ (Note 4, 5)		1580 135 13 40 110 65	2050 175 17 90 230 140	pF pF pF
g <sub>FS</sub> Dynam  C <sub>iss</sub> C <sub>oss</sub> C <sub>rss</sub> Switchi  t <sub>d(on)</sub> t <sub>r</sub>	Forward Transconductance  ic Characteristics  Input Capacitance Output Capacitance Reverse Transfer Capacitance  ing Characteristics Turn-On Delay Time Turn-On Rise Time Turn-Off Delay Time Turn-Off Fall Time	$V_{DS} = 25 \text{ V}, V_{GS} = 0 \text{ V},$ $f = 1.0 \text{ MHz}$ $V_{DD} = 400 \text{ V}, I_{D} = 8 \text{ A},$ $R_{G} = 25 \Omega$		1580 135 13 40 110 65 70	2050 175 17 90 230 140 150	pF pF pF

## $Q_{rr}$

 $I_{SM}$ 

 $V_{\text{SD}}$ 

 $t_{rr}$ 

Notes: 1. Repetitive rating : pulse-width limited by maximum junction temperature. 2. L = 25 mH, I<sub>AS</sub> = 8 A, V<sub>DD</sub> = 50 V, R<sub>G</sub> = 25  $\Omega$ , starting T<sub>J</sub> = 25°C. 3. I<sub>SD</sub>  $\leq$  8 A, di/dt  $\leq$  200 A/ $\mu$ s, V<sub>DD</sub>  $\leq$  BV<sub>DSS</sub>, starting T<sub>J</sub> = 25°C. 4. Pulse test : pulse-width  $\leq$  300  $\mu$ s, duty cycle  $\leq$  2%. 5. Essentially independent of operating temperature.

Drain-Source Diode Forward Voltage

Maximum Continuous Drain-Source Diode Forward Current

Maximum Pulsed Drain-Source Diode Forward Current

Reverse Recovery Charge

Reverse Recovery Time

8

32

1.4

690

8.2

(Note 4)

Α

Α

V

ns

μС

 $V_{GS}$  = 0 V,  $I_{S}$  = 8 A

 $V_{GS} = 0 V, I_{S} = 8 A,$ 

 $dI_F / dt = 100 A/\mu s$ 

# **Typical Characteristics** I<sub>D</sub>, Drain Qurent [A] V<sub>DS</sub> Drain-Source Voltage [V] Figure 1. On-Region Characteristics 2.5 R<sub>DSON</sub> [9, ], Drain-Source On-Resistance V<sub>cs</sub> = 10V I<sub>D</sub>, Drain Current [A]

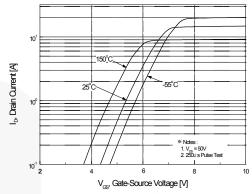


Figure 2. Transfer Characteristics

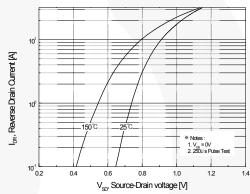


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

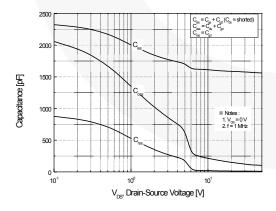


Figure 5. Capacitance Characteristics

Figure 6. Gate Charge Characteristics

150

# Pigure 7. Breakdown Voltage Variation vs Temperature

Typical Characteristics (Continued)

re 7. Breakdown Voltage Variation Figure 8. On-Resistance Variation vs Temperature vs Temperature

-100

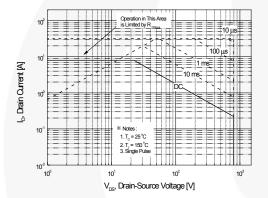
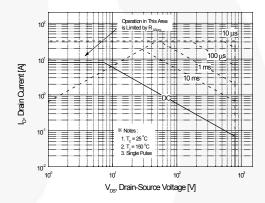


Figure 9-1. Maximum Safe Operating Area for FQP8N80C Figure 9-2. Maximum Safe Operating Area for FQPF8N80C



Figure 10. Maximum Drain Current vs Case Temperature

T<sub>c</sub>, Case Temperature [°C]



T<sub>J</sub>, Junction Temperature [°C]

### Typical Characteristics (Continued)

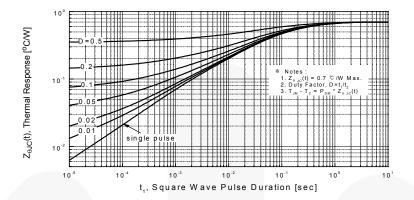


Figure 11-1. Transient Thermal Response Curve for FQP8N80C

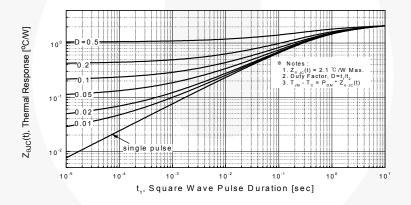


Figure 11-2. Transient Thermal Response Curve for FQPF8N80C

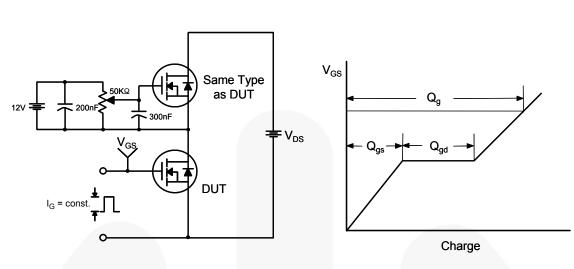


Figure 12. Gate Charge Test Circuit & Waveform

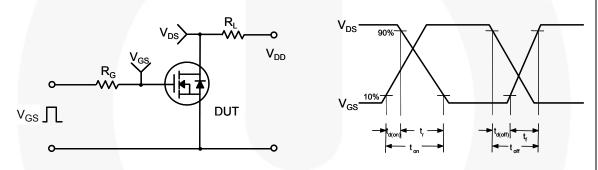


Figure 13. Resistive Switching Test Circuit & Waveforms

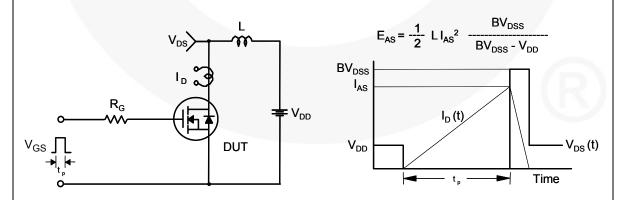
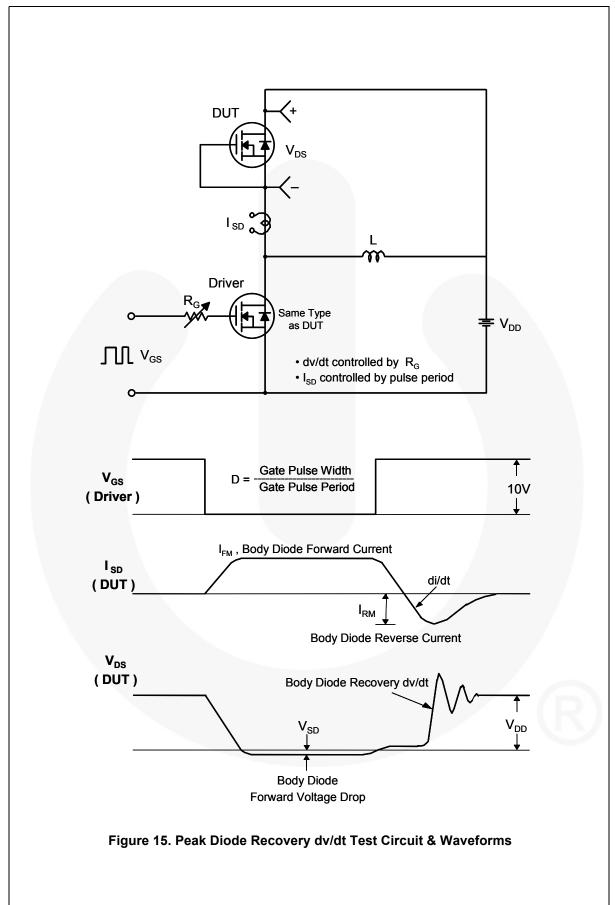


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms



### **Mechanical Dimensions**

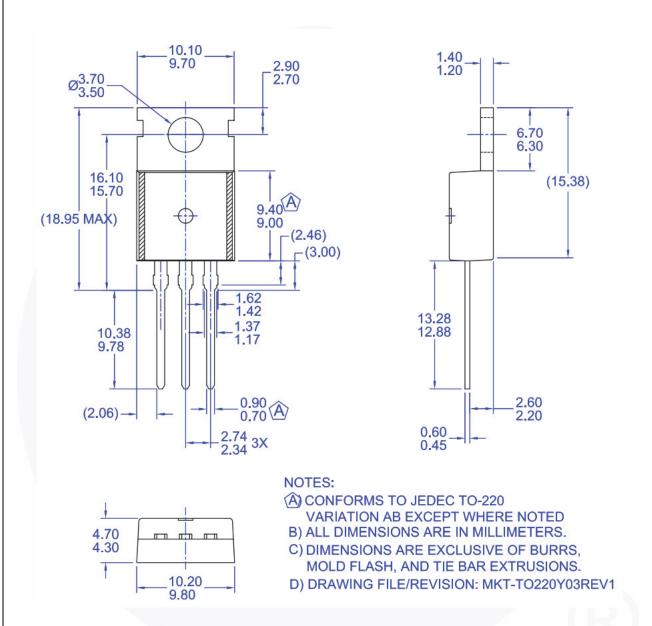


Figure 16. TO220, Molded, 3-Lead, Jedec Variation AB

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 TO220-003

### **Mechanical Dimensions**

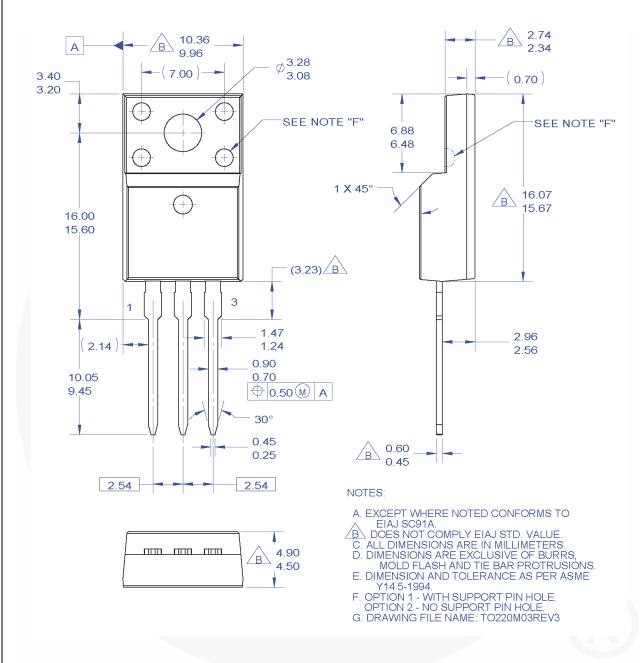


Figure 17. TO220, Molded, 3-Lead, Full Pack, EIAJ SC91, Straight Lead

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\_TF220-003

### **Mechanical Dimensions**

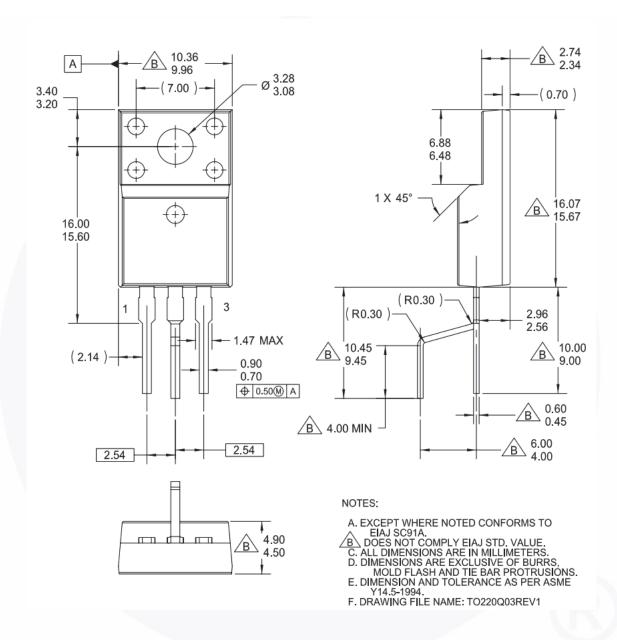


Figure 18. TO220, Molded, 3-Lead, Full Pack, EIAJ SC91, Y-Formed

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 TF220-FA3





### **TRADEMARKS**

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™  $CROSSVOLT^{\text{TM}}$ 

CTI ™ Current Transfer Logic™ DEUXPEED® Dual Cool™

EcoSPARK® EfficentMax™ ESBC™

Fairchild<sup>®</sup> Fairchild Semiconductor® FACT Quiet Series™

FACT® FAST® FastvCore™ FETBench™ FPS™

F-PFS™ FRFET®

Global Power Resource<sup>SM</sup> GreenBridge™ Green FPS™

Green FPS™ e-Series™

G*max*™ GTO™ IntelliMAX™ ISOPLANAR™

Marking Small Speakers Sound Louder

and Better™ MegaBuck™ MICROCOUPLER™ MicroFET™

MicroPak™ MicroPak2™ MillerDrive™ MotionMax™ mWSaver® OptoHiT™ OPTOLOGIC® OPTOPLANAR® PowerTrench® PowerXS™

Programmable Active Droop™

**QFET** QS™ Quiet Series™ RapidConfigure™

Saving our world, 1mW/W/kW at a time™ SignalWise™

SmartMax™ SMART START™

Solutions for Your Success™

STEALTH™ SuperFET® SuperSOT™-3 SuperSOT™-6 SuperSOT™-8

SupreMOS® SvncFET™

Sync-Lock™ SYSTEM®\* TinyBoost<sup>®</sup> TinyBuck<sup>®</sup> TinyCalc™ TinyLogic<sup>®</sup> TINYOPTO™ TinvPower™ TinyPWM™ TinyWire™ TranSiC™ TriFault Detect™ TRUECURRENT®\* μSerDes™

UHC® Ultra FRFET™ UniFFT™ VCX™ VisualMax™ VoltagePlus™ XSTM

\*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. THESE SPECIFICATIONS DO NOT EXPAND THE TERMS OF FAIRCHILD'S WORLDWIDE TERMS AND CONDITIONS, SPECIFICALLY THE WARRANTY THEREIN, WHICH COVERS THESE PRODUCTS.

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:

- 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.
- 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.

### ANTI-COUNTERFEITING POLICY

Fairchild Semiconductor Corporation's Anti-Counterfeiting Policy. Fairchild's Anti-Counterfeiting Policy is also stated on our external website, www.Fairchildsemi.com, under Sales Support.

Counterfeiting of semiconductor parts is a growing problem in the industry. All manufactures of semiconductor products are experiencing counterfeiting of their parts. 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 handing 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 warranty 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

Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	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.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

Rev. 166

ON Semiconductor and III) are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at <a href="www.onsemi.com/site/pdf/Patent-Marking.pdf">www.onsemi.com/site/pdf/Patent-Marking.pdf</a>. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages.

Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

### **PUBLICATION ORDERING INFORMATION**

### LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor 19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada Email: orderlit@onsemi.com

N. American Technical Support: 800-282-9855 Toll Free Europe, Middle East and Africa Technical Support:

Phone: 421 33 790 2910 Japan Customer Focus Center Phone: 81-3-5817-1050

ON Semiconductor Website: www.onsemi.com

Order Literature: http://www.onsemi.com/orderlit

For additional information, please contact your local Sales Representative

© Semiconductor Components Industries, LLC

www.onsemi.com