

# Is Now Part of



# ON Semiconductor®

# To learn more about ON Semiconductor, please visit our website at www.onsemi.com

Please note: As part of the Fairchild Semiconductor integration, some of the Fairchild orderable part numbers will need to change in order to meet ON Semiconductor's system requirements. Since the ON Semiconductor product management systems do not have the ability to manage part nomenclature that utilizes an underscore (\_), the underscore (\_) in the Fairchild part numbers will be changed to a dash (-). This document may contain device numbers with an underscore (\_). Please check the ON Semiconductor website to verify the updated device numbers. The most current and up-to-date ordering information can be found at <a href="www.onsemi.com">www.onsemi.com</a>. Please email any questions regarding the system integration to Fairchild <a href="guestions@onsemi.com">guestions@onsemi.com</a>.

ON Semiconductor and the ON Semiconductor logo 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 www.onsemi.com/site/pdf/Patent-Marking.pdf. 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 EDA 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 officer



November 2013

# FCPF11N60F

# N-Channel SuperFET<sup>®</sup> FRFET<sup>®</sup> MOSFET 600 V, 11 A, 380 m $\Omega$

### **Features**

- 600 V @ T<sub>J</sub> = 150°C
- Typ.  $R_{DS(on)}$  = 320 m $\Omega$
- Fast Recovery Type (t<sub>rr</sub> = 120 ns)
- Ultra Low Gate Charge (Typ. Q<sub>g</sub> = 40 nC)
- Low Effective Output Capacitance (Typ. C<sub>oss(eff.)</sub> = 95 pF)
- · 100% Avalanche Tested
- · RoHS compliant

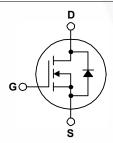
# **Applications**

- LCD/LED/PDP TV
- · Solar Inverter
- Lighting
- · AC-DC Power Supply

# Description

SuperFET® MOSFET is Fairchild Semiconductor's first generation of high voltage super-junction (SJ) MOSFET family that is utilizing charge balance technology for outstanding low onresistance and lower gate charge performance. This technology is tailored to minimize conduction loss, provide superior switching performance, dv/dt rate and higher avalanche energy. Consequently, SuperFET MOSFET is very suitable for the switching power applications such as PFC, server/telecom power, FPD TV power, ATX power and industrial power applications. SuperFET FRFET® MOSFET's optimized body diode reverse recovery performance can remove additional component and improve system reliability.





# **MOSFET Maximum Ratings** $T_C = 25^{\circ}C$ unless otherwise noted.

Symbol		Parameter		FCPF11N60F	Unit		
V <sub>DSS</sub>	Drain to Source Voltage		Drain to Source Voltage			600	V
	Dunin Courset	- Continuous (T <sub>C</sub> = 25°C)		11*			
ID	Drain Current	- Continuous (T <sub>C</sub> = 100°C)		7*	Α		
I <sub>DM</sub>	Drain Current	- Pulsed	(Note 1)	33*	Α		
V <sub>GSS</sub>	Gate to Source Voltage			±30	V		
E <sub>AS</sub>	Single Pulsed Avalanche Energy (Note 2)		(Note 2)	340	mJ		
I <sub>AR</sub>	Avalanche Current (Not		(Note 1)	11	Α		
E <sub>AR</sub>	Repetitive Avalanche Energy (Note 1		(Note 1)	12.5	mJ		
dv/dt	Peak Diode Recovery d	iv/dt	(Note 3)	4.5	V/ns		
n	Dower Dissinction	(T <sub>C</sub> = 25°C)		36	W		
$P_{D}$	Power Dissipation - Derate Above 25°C		- De	- Derate Above 25°C		0.29	W/°C
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage	perating and Storage Temperature Range		-55 to +150	οС		
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 termperature.

#### Thermal Characteristics

Symbol	Parameter	FCPF11N60F	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	3.5	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	62.5	°C/W

# **Package Marking and Ordering Information**

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FCPF11N60F	FCPF11N60F	TO-220F	-	-	50

# **Electrical Characteristics** $T_C = 25^{\circ}C$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit
Off Charac	cteristics					
D\/	Drain to Source Preakdown Voltage	$V_{GS} = 0 \text{ V}, I_D = 250 \mu\text{A}, T_C = 25^{\circ}\text{C}$	600	-	-	V
BV <sub>DSS</sub> Drain to Source Breakdown Voltage		$V_{GS} = 0 \text{ V}, I_D = 250 \mu\text{A}, T_C = 150^{\circ}\text{C}$	-	650	-	V
ΔBV <sub>DSS</sub> / ΔT <sub>J</sub>	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = 250 μA, Referenced to 25°C	-	0.6	-	V/°C
BV <sub>DS</sub>	Drain-Source Avalanche Breakdown Voltage	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 11 A	-	700	-	V
	Zoro Cata Valtaga Prain Current	V <sub>DS</sub> = 600 V, V <sub>GS</sub> = 0 V	-	-	1	
IDSS	Zero Gate Voltage Drain Current	$V_{DS} = 480 \text{ V}, T_{C} = 125^{\circ}\text{C}$	-	-	10	μΑ
I <sub>GSS</sub>	Gate to Body Leakage Current	V <sub>GS</sub> = ±30 V, V <sub>DS</sub> = 0 V	-	-	±100	nA

## **On Characteristics**

V <sub>GS(th)</sub>	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250 \mu A$	3.0	-	5.0	V
R <sub>DS(on)</sub>	Static Drain to Source On Resistance	$V_{GS} = 10 \text{ V}, I_D = 5.5 \text{ A}$	-	0.32	0.38	Ω
9 <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 40 V, I <sub>D</sub> = 5.5 A	_	6	-	S

# **Dynamic Characteristics**

C <sub>iss</sub>	Input Capacitance	V 05.V.V 0.V	- \	1148	1490	pF
C <sub>oss</sub>	Output Capacitance	citance $V_{DS} = 25 \text{ V}, V_{GS} = 0 \text{ V},$ $f = 1.0 \text{ MHz}$		671	870	pF
C <sub>rss</sub>	Reverse Transfer Capacitance	1 - 1.0 WH 12	-	63	82	pF
C <sub>oss</sub>	Output Capacitance	$V_{DS} = 480 \text{ V}, V_{GS} = 0 \text{ V}, f = 1.0 \text{ MHz}$	-	35	-	pF
C <sub>oss(eff.)</sub>	Effective Output Capacitance	$V_{DS} = 0 \text{ V to } 400 \text{ V}, V_{GS} = 0 \text{ V}$	-	95	-	pF
Q <sub>g(tot)</sub>	Total Gate Charge at 10V	V <sub>DS</sub> = 480 V, I <sub>D</sub> = 11 A,	-	40	52	nC
$Q_{gs}$	Gate to Source Gate Charge	V <sub>GS</sub> = 10 V	-	7.2	-	nC
$Q_{gd}$	Gate to Drain "Miller" Charge	(Note 4)	-	21	-	nC

# **Switching Characteristics**

t <sub>d(on)</sub>	Turn-On Delay Time		-	34	80	ns
t <sub>r</sub>	Turn-On Rise Time	$V_{DD} = 300 \text{ V}, I_D = 11 \text{ A},$	/-	98	205	ns
t <sub>d(off)</sub>	Turn-Off Delay Time	$R_G = 25 \Omega$	-	119	250	ns
t <sub>f</sub>	Turn-Off Fall Time	(Note 4)	-	56	120	ns

#### **Drain-Source Diode Characteristics**

I <sub>S</sub>	Maximum Continuous Drain to Source Diode	Maximum Continuous Drain to Source Diode Forward Current		-	11	Α
I <sub>SM</sub>	Maximum Pulsed Drain to Source Diode Forward Current		-	-	33	Α
$V_{SD}$	Drain to Source Diode Forward Voltage V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 11 A		-	-	1.4	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 11 A,	-	120	//-	ns
Q <sub>rr</sub>	Reverse Recovery Charge	$V_{GS} = 0 \text{ V, } I_{SD} = 11 \text{ A,}$ $dI_F/dt = 100 \text{ A/}\mu\text{s}$	-	0.8	-	μC

#### Notes

- 1. Repetitive rating: pulse-width limited by maximum junction temperature.
- 2. I<sub>AS</sub> = 5.5 A, V<sub>DD</sub> = 50 V, R<sub>G</sub> = 25  $\Omega$ , starting T<sub>J</sub> = 25°C.
- 3.  $I_{SD} \le$  11 A, di/dt  $\le$  200 A/ $\mu$ s,  $V_{DD} \le$  BV $_{DSS,}$  starting  $T_J$  = 25°C.
- 4. Essentially independent of operating temperature.

# **Typical Performance Characteristics**

Figure 1. On-Region Characteristics

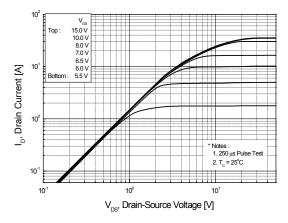


Figure 3. On-Resistance Variation vs.

Drain Current and Gate Voltage

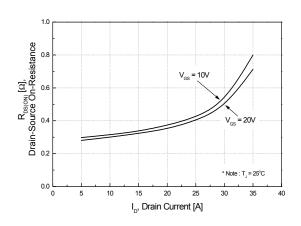


Figure 5. Capacitance Characteristics

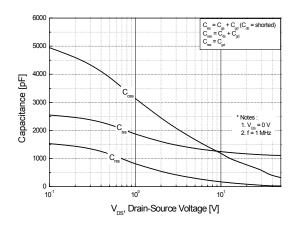


Figure 2. Transfer Characteristics

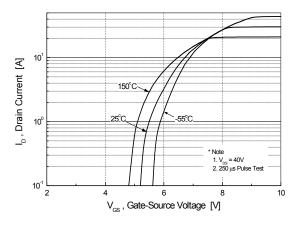


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperatue

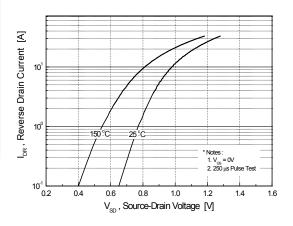
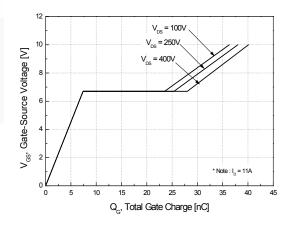


Figure 6. Gate Charge Characteristics



# **Typical Performance Characteristics** (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

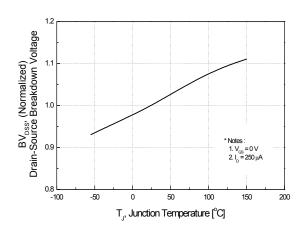


Figure 8. On-Resistance Variation vs. Temperature

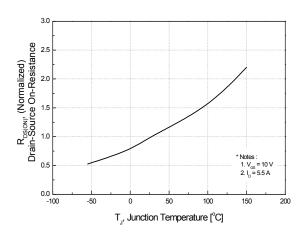
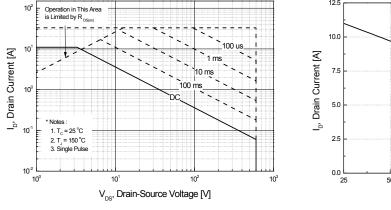


Figure 9. Safe Operating Area

Figure 10. Maximum Drain Current vs. Case Temperature



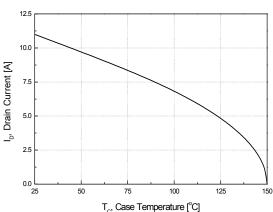
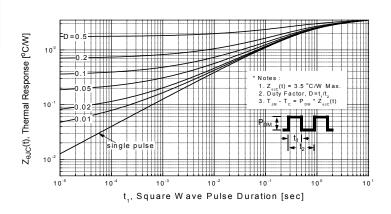


Figure 11. Transient Thermal Response Curve



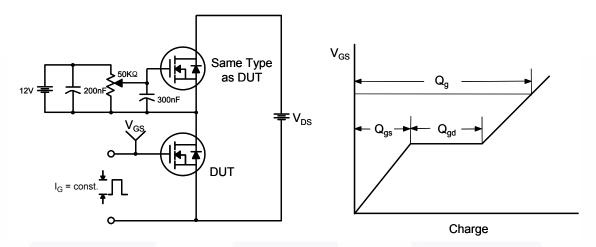


Figure 12. Gate Charge Test Circuit & Waveform

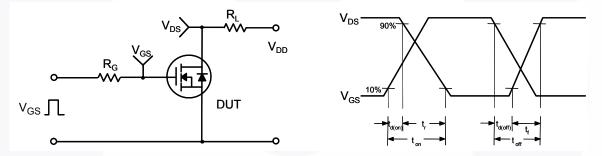


Figure 13. Resistive Switching Test Circuit & Waveforms

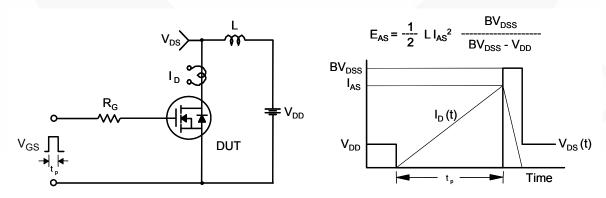


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

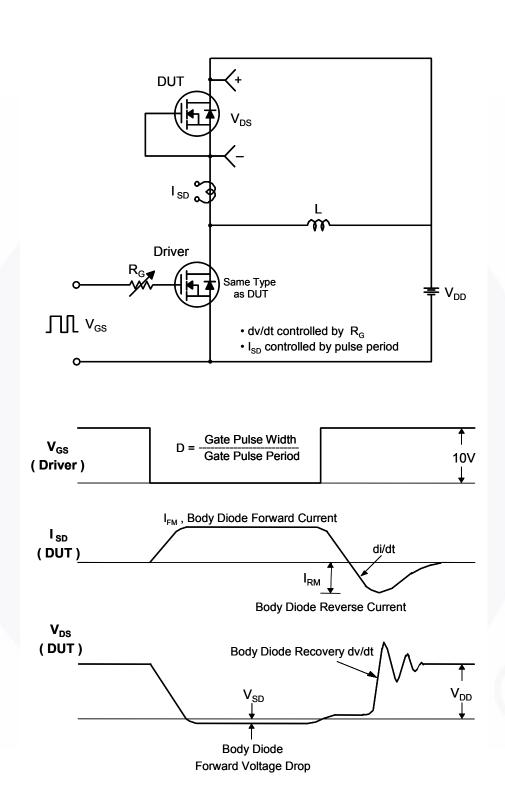


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

# **Mechanical Dimensions**

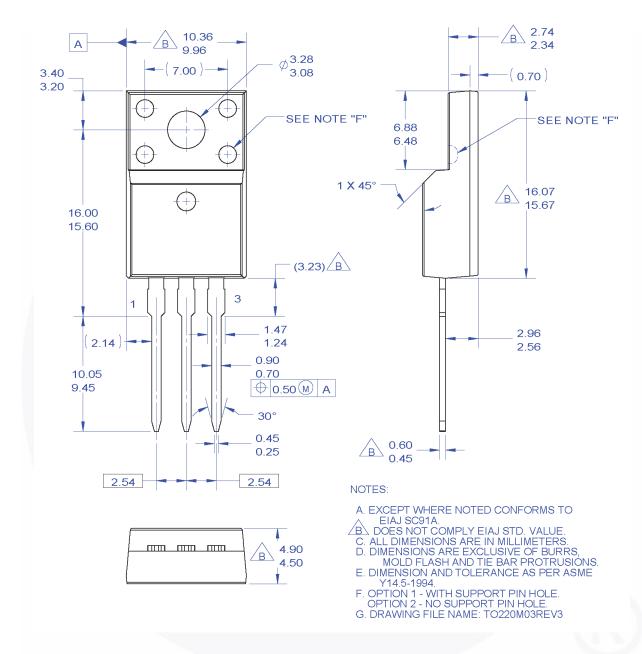


Figure 16. TO220, Molded, 3-Lead, Full Pack, EIAJ SC91, Straight Lead

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





#### **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®\*

UHC<sup>®</sup> Ultra FRFET™ UniFFT™ VCX™ VisualMax™

uSerDes™

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 in 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/pdt/Patent-Marking.pdf">www.onsemi.com/site/pdt/Patent-Marking.pdf</a>. ON Semiconductor reserves the right to make changes without further notice to any products herein. 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 exp

### **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 USA/Canada
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

# **Mouser Electronics**

**Authorized Distributor** 

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

**ON Semiconductor:** 

FCPF11N60F

# **ПОСТАВКА** ЭЛЕКТРОННЫХ КОМПОНЕНТОВ

многоканальный

Общество с ограниченной ответственностью «МосЧип» ИНН 7719860671 / КПП 771901001 Адрес: 105318, г.Москва, ул.Щербаковская д.3, офис 1107

# Данный компонент на территории Российской Федерации Вы можете приобрести в компании MosChip.

Для оперативного оформления запроса Вам необходимо перейти по данной ссылке:

# http://moschip.ru/get-element

Вы можете разместить у нас заказ для любого Вашего проекта, будь то серийное производство или разработка единичного прибора.

В нашем ассортименте представлены ведущие мировые производители активных и пассивных электронных компонентов.

Нашей специализацией является поставка электронной компонентной базы двойного назначения, продукции таких производителей как XILINX, Intel (ex.ALTERA), Vicor, Microchip, Texas Instruments, Analog Devices, Mini-Circuits, Amphenol, Glenair.

Сотрудничество с глобальными дистрибьюторами электронных компонентов, предоставляет возможность заказывать и получать с международных складов практически любой перечень компонентов в оптимальные для Вас сроки.

На всех этапах разработки и производства наши партнеры могут получить квалифицированную поддержку опытных инженеров.

Система менеджмента качества компании отвечает требованиям в соответствии с ГОСТ Р ИСО 9001, ГОСТ РВ 0015-002 и ЭС РД 009

# Офис по работе с юридическими лицами:

105318, г. Москва, ул. Щербаковская д. 3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: info@moschip.ru

Skype отдела продаж:

moschip.ru moschip.ru\_6 moschip.ru\_4 moschip.ru\_9