

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 www.onsemi.com. Please email any questions regarding the system integration to Fairchild <a href="general-regarding-numbers-n

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



August 2008

FPF2116 IntelliMAX™ Advanced Load Management Products

Features

- 1.8 to 5.5V Input Voltage Range
- Controlled Turn-On
- 200mA Current Limit
- Undervoltage Lockout
- Thermal Shutdown
- <2µA Shutdown Current
- Auto Restart
- Fast Current limit Response Time
 - 3µs to Moderate Over Currents
 - 20ns to Hard Shorts
- Fault Blanking
- Reverse Current Blocking
- RoHS Compliant

Applications

- PDAs
- Cell Phones
- GPS Devices
- MP3 Players
- Digital Cameras
- Peripheral Ports
- Hot Swap Supplies

General Description

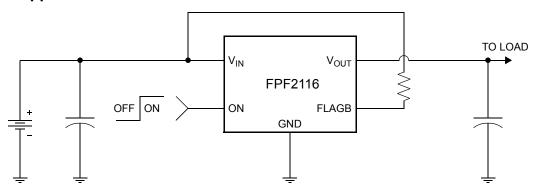
The FPF2116 is a load switch which provides full protection to systems and loads which may encounter large current conditions. This device contains a 0.125Ω current-limited P-channel MOSFET which can operate over an input voltage range of 1.8-5.5V. Internally, current is prevented from flowing when the MOSFET is off and the output voltage is higher than the input voltage. Switch control is by a logic input (ON) capable of interfacing directly with low voltage control signals. The part contains thermal shutdown protection which shuts off the switch to prevent damage to the part when a continuous over-current condition causes excessive heating.

When the switch current reaches the current limit, the part operates in a constant-current mode to prohibit excessive currents from causing damage. If the constant current condition still persists after 30ms, the part will shut off the switch and pull the fault signal pin (FLAGB) low. An auto-restart feature will turn the switch on again after 480ms if the ON pin is still active. The minimum current limit is 200mA.

The part is available in a space-saving 5 pin SOT23 package.



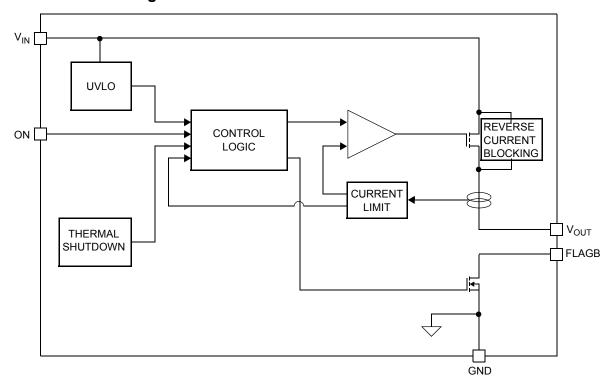
Typical Application Circuit



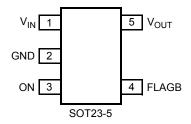
Ordering Information

Part	Current Limit [mA]	Current Limit Blanking Time [ms]	Auto-Restart Time [ms]	ON Pin Activity	Top Mark
FPF2116	200	30	480	Active HI	2116

Functional Block Diagram



Pin Configuration



Pin Description

Pin	Name	Function
1	V _{IN}	Supply Input: Input to the power switch and the supply voltage for the IC
2	GND	Ground
3	ON	ON Control Input
4	FLAGB	Fault Output: Active LO, open drain output which indicates an over current supply, under voltage or over temperature state.
5	V _{OUT}	Switch Output: Output of the power switch

Absolute Maximum Ratings

Parameter	Min	Max	Unit	
V _{IN} , V _{OUT} , ON, FLAGB to GND	-0.3	6	V	
Power Dissipation @ T _A = 25°C (note 1)		667	mW	
Operating Junction Temperature	-40	125	°C	
Storage Temperature	-65	150	°C	
Thermal Resistance, Junction to Ambient		150	°C/W	
Floatroctatic Discharge Protection	НВМ	4000		V
Electrostatic Discharge Protection	MM	400		V

Recommended Operating Range

Parameter	Min	Max	Unit
V_{IN}	1.8	5.5	V
Ambient Operating Temperature, T _A	-40	85	°C

Electrical Characteristics

 V_{IN} = 1.8 to 5.5V, T_A = -40 to +85°C unless otherwise noted. Typical values are at V_{IN} = 3.3V and T_A = 25°C.

Parameter	Symbol	Conditions		Min	Тур	Max	Units
Basic Operation	ľ	1			ı		
Operating Voltage	V _{IN}			1.8		5.5	V
Quiescent Current		I _{OUT} = 0mA	V _{IN} = 1.8 to 3.3V		95		μΑ
Quiescent Current	ΙQ	IOUT - UITA	V _{IN} = 3.3 to 5.5V		110	200	
V _{IN} Shutdown Current		$V_{ON} = 0V, V_{IN} = 5.5V,$	V _{OUT} short to GND			2	μA
V _{OUT} Shutdown Current		$V_{ON} = 0V, V_{OUT} = 5.5$	V, V _{IN} short to GND			2	μA
		V _{IN} = 3.3V, I _{OUT} = 50mA, T _A = 25°C			125	160	mΩ
On-Resistance	R _{ON}	V _{IN} = 3.3V, I _{OUT} = 50mA, T _A = 85°C			150	200	
		V _{IN} = 3.3V, I _{OUT} = 50mA, T _A = -40°C to +85°C		65		200	
ON Input Logic High Voltage (ON)	V	V _{IN} = 1.8V		0.75			V
ON Input Logic Flight Voltage (ON)	V _{IH}	V _{IN} = 5.5V		1.30			V
ON board Law Law Malkana	V _{IL}	V _{IN} = 1.8V				0.5	V
ON Input Logic Low Voltage		V _{IN} = 5.5V				1.0	
ON Input Leakage		V _{ON} = V _{IN} or GND				1	μA
Off Switch Leakage	I _{SWOFF}	V _{ON} = 0V, V _{OUT} = 0V				1	μA
FLAGB Output Logic Low Voltage		V _{IN} = 5V, I _{SINK} = 10mA			0.1	0.2	V
T LAGB Output Logic Low Voltage		V _{IN} = 1.8V, I _{SINK} = 10mA			0.15	0.3	
FLAGB Output High Leakage Current		V _{IN} = 5V, Switch on				1	μA
Protections							
Current Limit	I _{LIM}	V _{IN} = 3.3V, V _{OUT} = 3.0V		200	300	400	mA
		Shutdown Threshold			140		
Thermal Shutdown		Return from Shutdown			130		°C
		Hysteresis			10		
Under Voltage Shutdown	UVLO	V _{IN} Increasing		1.5	1.6	1.7	V
Under Voltage Shutdown Hysteresis					50		mV

3

Electrical Characteristics Cont.

 V_{IN} = 1.8 to 5.5V, T_A = -40 to +85°C unless otherwise noted. Typical values are at V_{IN} = 3.3V and T_A = 25°C.

Parameter	Symbol	Conditions	Min	Тур	Max	Units
Dynamic	'		•	,	,	•
Turn On Time	t _{ON}	$R_L = 500\Omega, C_L = 0.1\mu F$		25		μs
Turn Off Time	t _{OFF}	$R_L = 500\Omega, C_L = 0.1\mu F$		50		μs
V _{OUT} Rise Time	t _{RISE}	$R_L = 500\Omega, C_L = 0.1\mu F$		12		μs
V _{OUT} Fall Time	t _{FALL}	$R_L = 500\Omega, C_L = 0.1\mu F$		120		μs
Over Current Blanking Time	t _{BLANK}		15	30	60	ms
Auto-Restart Time	t _{RESTART}		240	480	960	ms
Short Circuit Response Time		V _{IN} = V _{ON} = 3.3V. Moderate Over-Current Condition.		3		μs
		V _{IN} = V _{ON} = 3.3V. Hard Short.		20		ns

Note 1: Package power dissipation on 1square inch pad, 2 oz copper board.

Typical Characteristics

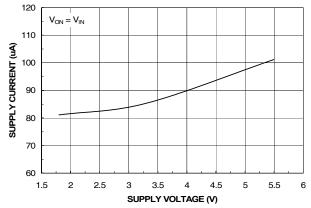


Figure 1. Quiescent Current vs. Input Voltage

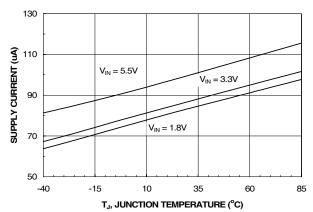


Figure 2. Quiescent Current vs. Temperature

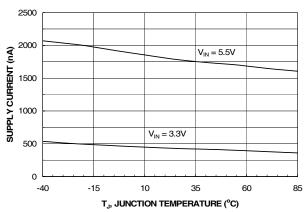


Figure 3. $I_{SHUTDOWN}$ Current vs. Temperature

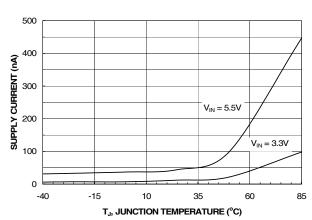


Figure 4. $I_{SWITCH-OFF}$ Current vs. Temperature

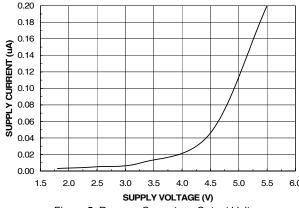


Figure 5. Reverse Current vs. Output Voltage

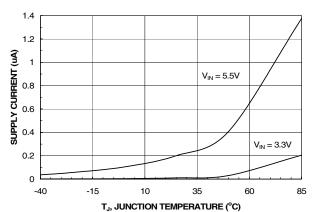


Figure 6. Reverse Current vs. Temperature

5

Typical Characteristics

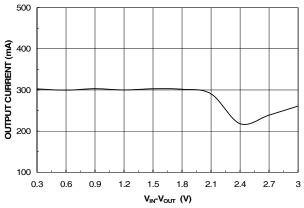


Figure 7. Current Limit vs. Output Voltage

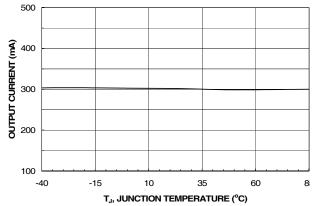


Figure 8. Current Limit vs. Temperature

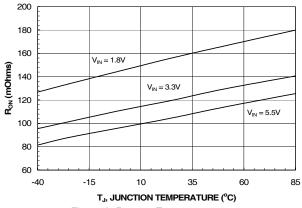


Figure 9. R_{ON} vs. Temperature

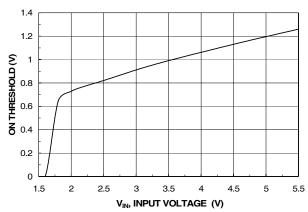


Figure 10. On Threshold vs. $V_{\rm IN}$

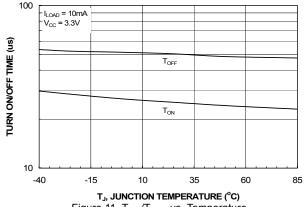


Figure 11. T_{ON}/T_{OFF} vs. Temperature

6

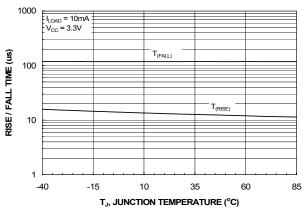
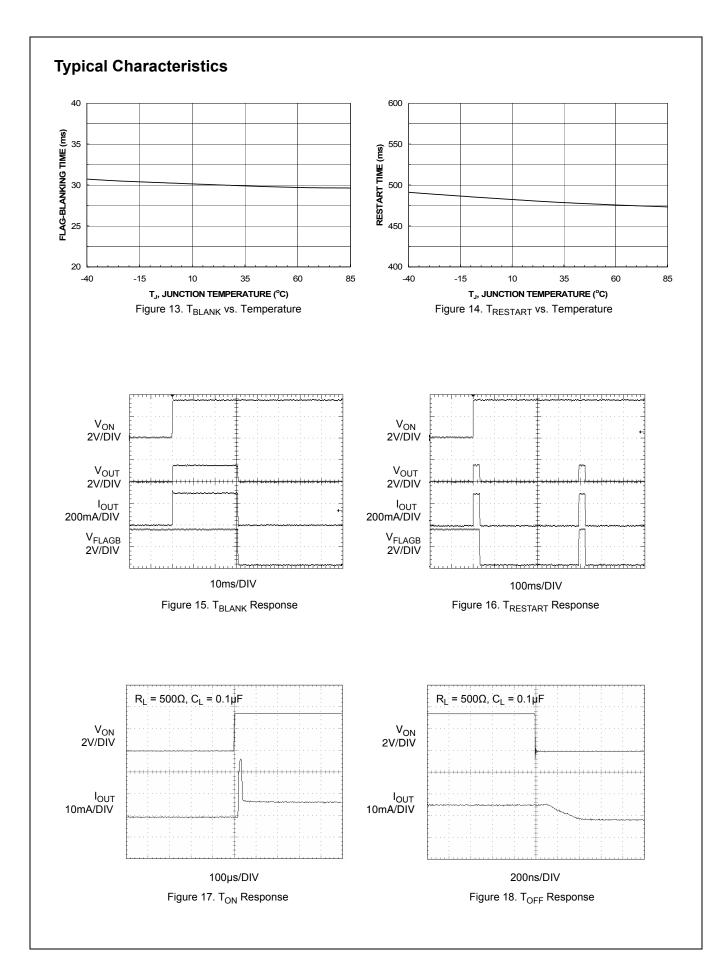


Figure 12. T_{RISE}/T_{FALL} vs. Temperature



Typical Characteristics

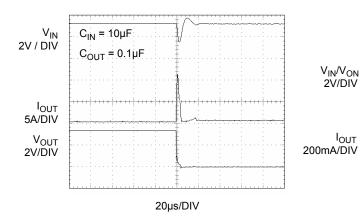


Figure 19. Short Circuit Response Time (Output Shorted to GND)

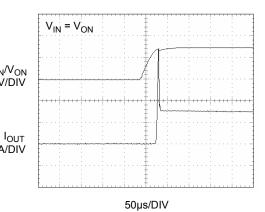


Figure 20. Current Limit Response (Switch power up to hard short)

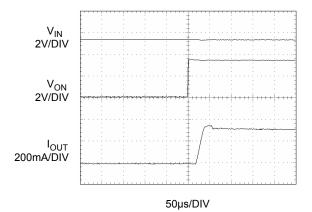


Figure 21. Current Limit Response Time (Output Shorted to GND by 10Ω , moderate short)

Description of Operation

The FPF2116 is a current limited switch that protects systems and loads which can be damaged or disrupted by the application of high currents. The core of the device is a 0.125Ω P-channel MOSFET and a controller capable of functioning over a wide input operating range of 1.8-5.5V. The controller protects against system malfunctions through current limiting, undervoltage lockout and thermal shutdown. The current limit is preset for 200mA.

On/Off Control

The ON pin controls the state of the switch. Activating ON continuously holds the switch in the on state so long as there is no fault. An under-voltage on $V_{\rm IN}$ or a junction temperature in excess of 150°C overrides the ON control to turn off the switch. In addition, excessive current will cause the switch to turn off. The part has an Auto-Restart feature which will automatically turn the switch on again after 480 ms. ON is active HI and has a low threshold making it capable of interfacing with low voltage signals. When the MOSFET is off, the body diode is disabled so no current can flow through it.

Fault Reporting

Upon the detection of an over-current, an input under-voltage, or an over-temperature condition, the FLAGB signals the fault mode by immediately activating LO. The FLAGB goes LO at the end of the blanking time. It will remain LO during the fault and immediately returns HI at the end of the fault condition. FLAGB is an open-drain MOSFET which requires a pull-up resistor between $V_{\rm IN}$ and FLAGB. During shutdown, the pull-down on FLAGB is disabled to reduce current draw from the supply.

Current Limiting

The current limit ensures that the current through the switch doesn't exceed 400mA while not limiting at less than 200mA. The part has a blanking time of 30 ms, nominally, during which the switch will act as a constant current source. At the end of the blanking time, the switch will be turned-off and the FLAGB pin will activate to indicate that current limiting has occurred.

Under-Voltage Lockout

The under-voltage lockout turns-off the switch if the input voltage drops below the under-voltage lockout threshold. With the ON pin active the input voltage rising above the under-voltage lockout threshold will cause a controlled turn-on of the switch which limits current over-shoots.

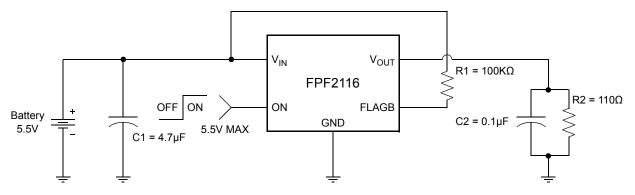
Thermal Shutdown

The thermal shutdown protects the part from internally or externally generated excessive temperatures. During an over-temperature condition the FLAGB is activated and the switch is turned-off. The switch automatically turns-on again if temperature of the die drops below the threshold temperature.

9 www.fairchildsemi.com

Application Information

Typical Application



Input Capacitor

To limit the voltage drop on the input supply caused by transient in-rush currents when the switch turns-on into a discharged load capacitor or a short-circuit, a capacitor needs to be placed between V_{IN} and GND. A 4.7µF ceramic capacitor, C_{IN} , must be placed close to the V_{IN} pin. A higher value of C_{IN} can be used to further reduce the voltage drop experienced as the switch is turned on into a large capacitive load.

Output Capacitor

A 0.1uF capacitor C_{OUT} , should be placed between V_{OUT} and GND. This capacitor will prevent parasitic board inductances from forcing V_{OUT} below GND when the switch turns-off. The total output capacitance needs to be kept below a maximum value, C_{OUT} (max), to prevent the part from registering an over-current condition and turning off the switch. The maximum output capacitance can be determined from the following formula

$$C_{OUT}(max) = \frac{I_{LIM}(min) \times t_{BLANK}(min)}{V_{IN}}$$
 (1)

Power Dissipation

During normal operation as a switch, the power dissipation is small and has little effect on the operating temperature of the part. The parts with the higher current limits will dissipate the most power and that will only be,

$$P = (I_{LIM})^2 \times R_{DS} = (0.4)^2 \times 0.125 = 20 \text{mW}$$
 (2)

When in current limit the maximum power dissipation will occur when the output is shorted to ground. The power dissipation will scale by the Auto-Restart Time, t_{RSTRT}, and the Over Current Blanking Time, t_{BLANK}, so that the maximum power dissipated is typically,

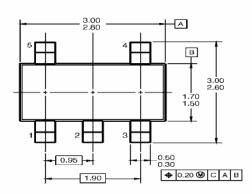
$$P(max) = \frac{t_{BLANK}}{t_{RETRY} + t_{BLANK}} \times V_{IN}(max) \times I_{LIM}(max)$$
$$= \frac{60}{60 + 960} \times 5.5 \times 0.4 = 130 \text{mW}$$
(3)

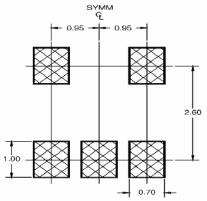
Board Layout

For best performance, all traces should be as short as possible. To be most effective, the input and output capacitors should be placed close to the device to minimize the effects that parasitic trace inductances may have on normal and short-circuit operation. Using wide traces for V_{IN} , V_{OUT} and GND will help minimize parasitic electrical effects along with minimizing the case to ambient thermal impedance.

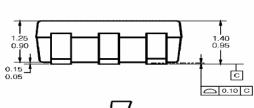
Dimensional Outline and Pad Layout

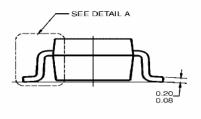
Package MA05B

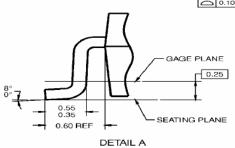




LAND PATTERN RECOMMENDATION







NOTES: UNLESS OTHERWISE SPECIFIED A) THIS PACKAGE CONFORMS TO JEDEC MO-178, ISSUE B, VARIATION AA, DATED JANUARY 1999.

B) ALL DIMENSIONS ARE IN MILLIMETERS.

MA05BRevC

5-Lead SOT23, JEDEC MO-178, 1.6mm





TRADEMARKS

The following includes registered and unregistered trademarks and service marks, owned by Fairchild Semiconductor and/or its global subsidianries, and is not intended to be an exhaustive list of all such trademarks.

Build it Now™ CorePLUS™ CorePOWER™ CROSSVOLT™ CTL™

Current Transfer Logic™ EcoSPARK[®]

EfficentMax™ EZSWITCH™

Fairchild®

Fairchild Semiconductor® FACT Quiet Series™ FACT®

 $\mathsf{FAST}^{\mathbb{R}}$ FastvCore™ FlashWriter® * F-PFS™ FRFET®

Global Power ResourceSM Green FPS™

Green FPS™ e-Series™ GTO™ IntelliMAX™ ISOPLANAR™ MegaBuck™ MICROCOUPLER™

MicroFET™ MicroPak™ MillerDrive™ MotionMax™ Motion-SPM™ OPTOLOGIC® OPTOPLANAR® PDP SPM™ Power-SPM™ PowerTrench®

Programmable Active Droop™

OFET QS™ Quiet Series™ RapidConfigure™

Saving our world, 1mW at a time™ SmartMax™

SMART START™ SPM[®] STEALTH™ SuperFET™ SuperSOT™-3 SuperSOT™-6 SuperSOT™-8 SupreMOS™

SyncFET™ SYSTEM ® The Power Franchise®

bwer franch TinyBoost™ TinyBuck™ TinyLogic[®] TINYOPTO™ TinvPower™ TinyPWM™ TinyWire™ uSerDes™

UHC® Ultra FRFET™ UniFET™

VCX™ VisualMax™

* EZSWITCH™ and FlashWriter® are trademarks of System General Corporation, used under license by Fairchild Semiconductor.

DISCLAIMER

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.

- 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. Farichild'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. Farichild strongly encourages customers to purchase Farichild 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. Farichild is committed to committed to combat this global problem and encourage our customers to do their part in stopping this practice by buying direct or from authorized

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. 135

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 www.onsemi.com/site/pdt/Patent-Marking.pdf. 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:

FPF2116



Компания «Океан Электроники» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Поставка оригинальных импортных электронных компонентов напрямую с производств Америки, Европы и Азии, а так же с крупнейших складов мира;
- Широкая линейка поставок активных и пассивных импортных электронных компонентов (более 30 млн. наименований);
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения «JONHON», а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов «FORSTAR».



«JONHON» (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

«**FORSTAR**» (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели, кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).



Телефон: 8 (812) 309-75-97 (многоканальный)

Факс: 8 (812) 320-03-32

Электронная почта: ocean@oceanchips.ru

Web: http://oceanchips.ru/

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А