

Is Now Part of



# **ON Semiconductor**®

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

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="https://www.onsemi.com">www.onsemi.com</a>. Please email any questions regarding the system integration to <a href="https://www.onsemi.com">Fairchild\_questions@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 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 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 applications, 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 equif prese

# FAIRCHILD

SEMICONDUCTOR

# FDMC7660S N-Channel Power Trench<sup>®</sup> SyncFET<sup>™</sup> **30 V, 20 A, 2.2 m**Ω

### Features

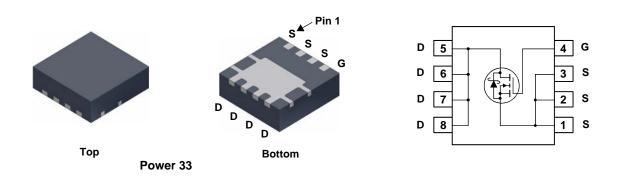
- Max  $r_{DS(on)} = 2.2 \text{ m}\Omega$  at  $V_{GS} = 10 \text{ V}$ ,  $I_D = 20 \text{ A}$
- Max  $r_{DS(on)}$  = 2.95 m $\Omega$  at V<sub>GS</sub> = 4.5 V, I<sub>D</sub> = 18 A
- High performance technology for extremely low r<sub>DS(on)</sub>
- Termination is Lead-free and RoHS Compliant

# **General Description**

The FDMC7660S has been designed to minimize losses in power conversion applications. Advancements in both silicon and package technologies have been combined to offer the lowest  $r_{\text{DS}(\text{on})}$  while maintaining excellent switching performance. This device has the added benefit of an efficient monolithic Schottky body diode.

## **Applications**

- Synchronous Rectifier for DC/DC Converters
- Notebook Vcore/GPU low side switch
- Networking Point of Load low side switch
- Telecom secondary side rectification



# **MOSFET Maximum Ratings** $T_A = 25 \degree C$ unless otherwise noted

Symbol	Parameter			Ratings	Units	
V <sub>DS</sub>	Drain to Source Voltage			30	V	
V <sub>GS</sub>	Gate to Source Voltage		(Note 4)	±20	V	
ID	Drain Current -Continuous (Package limited)	T <sub>C</sub> = 25 °C		40		
	-Continuous (Silicon limited) $T_C = 25 \text{ °C}$			100	_	
	-Continuous	T <sub>A</sub> = 25 °C	(Note 1a)	20	Α	
	-Pulsed			200		
E <sub>AS</sub>	Single Pulse Avalanche Energy		(Note 3)	128	mJ	
	Power Dissipation			41		
P <sub>D</sub>	Power Dissipation (Note 1a)			2.3		
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage Junction Temperature Ra	ange		-55 to +150	°C	

$R_{\theta JC}$	Thermal Resistance, Junction to Case		3	°C/W
$R_{ ext{ heta}JA}$	Thermal Resistance, Junction to Ambient (Note	e 1a)	53	C/VV

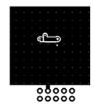
# **Package Marking and Ordering Information**

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDMC7660S	FDMC7660S	Power 33	13 "	12 mm	3000 units

January 2014

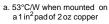
Symbol	Parameter	Test Conditions	Min	Тур	Max	Units	
Off Chara	acteristics						
BV <sub>DSS</sub>	Drain to Source Breakdown Voltage	I <sub>D</sub> = 1 mA, V <sub>GS</sub> = 0 V	30			V	
ΔBV <sub>DSS</sub> ΔT <sub>J</sub>	Breakdown Voltage Temperature Coefficient	$I_D = 1$ mA, referenced to 25 °C		13		mV/°C	
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 24 V, V <sub>GS</sub> = 0 V			500	μΑ	
I <sub>GSS</sub>	Gate to Source Leakage Current	$V_{GS} = 20 \text{ V}, \text{ V}_{DS} = 0 \text{ V}$			100	nA	
On Chara	octeristics						
V <sub>GS(th)</sub>	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = 1 \text{ mA}$	1.2	1.6	2.5	V	
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 1$ mA, referenced to 25 °C		-3		mV/°C	
		V <sub>GS</sub> = 10 V, I <sub>D</sub> = 20 A		1.7	2.2		
r <sub>DS(on)</sub>	Static Drain to Source On Resistance	V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 18 A		2.5	2.95	mΩ	
		$V_{GS} = 10 \text{ V}, \ \text{I}_{D} = 20 \text{ A}, \ \text{T}_{J} = 125 \ ^{\circ}\text{C}$		2.2	3.1		
9 <sub>FS</sub>	Forward Transconductance	$V_{DD} = 5 V, I_D = 20 A$		129		S	
•	Characteristics			0050	1005		
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 15 V, V <sub>GS</sub> = 0 V,		3250	4325	pF	
C <sub>oss</sub>	Output Capacitance	f = 1 MHz		1260	1680	pF	
C <sub>rss</sub>	Reverse Transfer Capacitance		0.4	105	160	pF Ω	
R <sub>g</sub>	Gate Resistance		0.1	0.8	1.6	Ω	
Switching	g Characteristics						
t <sub>d(on)</sub>	Turn-On Delay Time			14	25	ns	
t <sub>r</sub>	Rise Time	V <sub>DD</sub> = 15 V, I <sub>D</sub> = 20 A,		5	10	ns	
t <sub>d(off)</sub>	Turn-Off Delay Time	$V_{GS}$ = 10 V, $R_{GEN}$ = 6 $\Omega$		34	54	ns	
t <sub>f</sub>	Fall Time			3.9	10	ns	
0	Total Gate Charge	$V_{GS} = 0 V \text{ to } 10 V$		47	66	nC	
Q <sub>g(TOT)</sub>	Total Gate Charge	$V_{GS} = 0 \text{ V to } 4.5 \text{ V}$ $V_{DD} = 15 \text{ V}$		21	29	nC	
Q <sub>gs</sub>	Total Gate Charge	I <sub>D</sub> = 20 A		9.5		nC	
Q <sub>gd</sub>	Gate to Drain "Miller" Charge			5		nC	
Drain-Sou	urce Diode Characteristics						
V	Source to Drain Diode Forward Voltage $\frac{V_{GS} = 0 \text{ V}, \text{ I}_{S} = 20 \text{ A}}{V_{GS} = 0 \text{ V}, \text{ I}_{S} = 1.9 \text{ A}}$	$V_{GS} = 0 V, I_S = 20 A$ (Note 2)		0.8	1.2	V	
V <sub>SD</sub>		$V_{GS} = 0 V, I_S = 1.9 A$ (Note 2)		0.4	0.7	v	
t <sub>rr</sub>	Reverse Recovery Time	- I <sub>F</sub> = 20 A, di/dt = 300 A/μs		31	50	ns	
		$\mu_{\rm E} = 20$ A, $\mu_{\rm U} = 300$ A/ $\mu_{\rm S}$		39	62	nC	

1. R<sub>0,A</sub> is determined with the device mounted on a 1in<sup>2</sup> pad 2 oz copper pad on a 1.5 x 1.5 in. board of FR-4 material. R<sub>0,JC</sub> is guaranteed by design while R<sub>0CA</sub> is determined by the user's board design.



2. Pulse Test: Pulse Width < 300  $\mu s,$  Duty cycle < 2.0 %.

3. Starting  $T_J = 25^{\circ}C$ ; N-ch: L = 1 mH,  $I_{AS} = 16$  A,  $V_{DD} = 27$  V,  $V_{GS} = 10$  V.

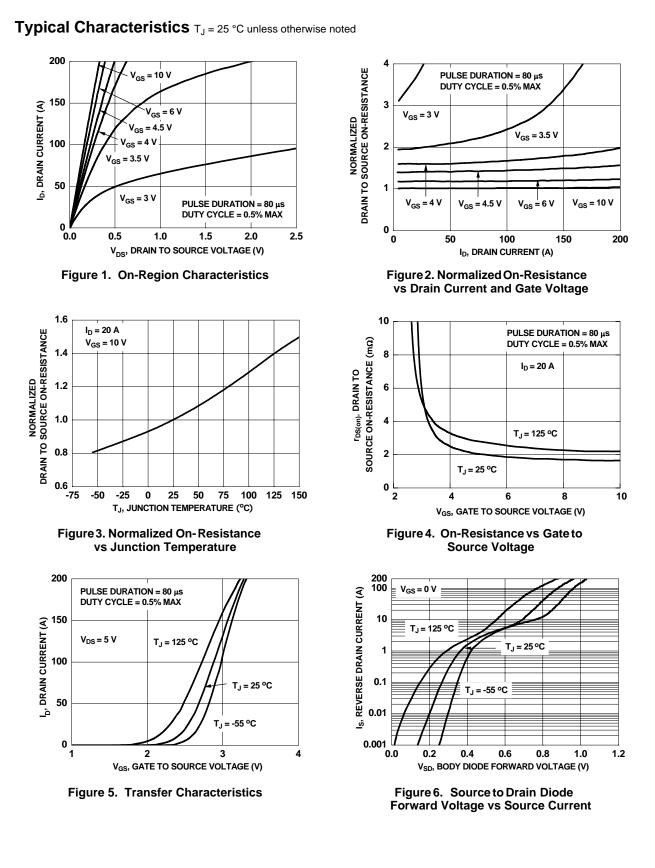


4. As an N-ch device, the negative Vgs rating is for low duty cycle pulse ocurrence only. No continuous rating is implied.

b. 125°C/W when mounted on a minimum pad of 2 oz copper

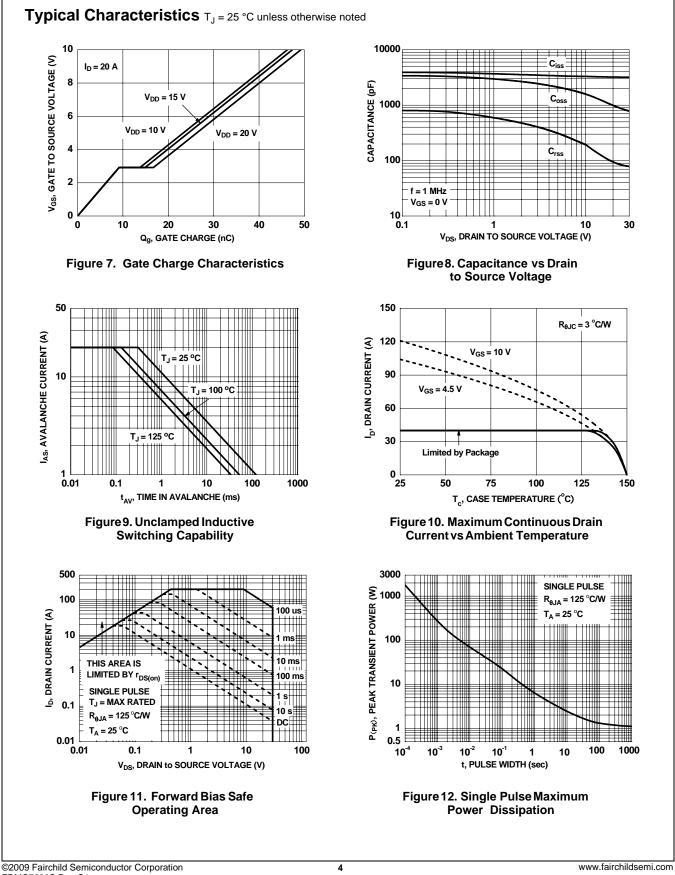
©2009 Fairchild Semiconductor Corporation FDMC7660S Rev.C1

00000



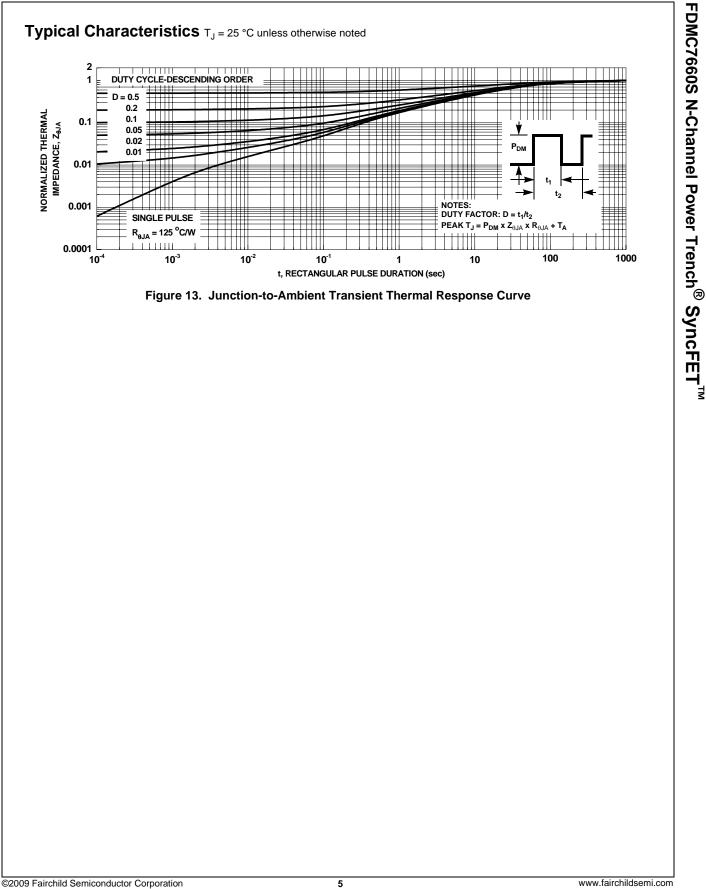
©2009 Fairchild Semiconductor Corporation FDMC7660S Rev.C1

www.fairchildsemi.com



FDMC7660S Rev.C1

FDMC7660S N-Channel Power Trench<sup>®</sup> SyncFET<sup>™</sup>



5

# FDMC7660S N-Channel Power Trench<sup>®</sup> SyncFET<sup>™</sup>

# Typical Characteristics (continued)

### SyncFET Schottky body diode Characteristics

Fairchild's SyncFET process embeds a Schottky diode in parallel with PowerTrench MOSFET. This diode exhibits similar characteristics to a discrete external Schottky diode in parallel with a MOSFET. Figure 27 shows the reverse recovery characteristic of the FDMC7660S.

Schottky barrier diodes exhibit significant leakage at high temperature and high reverse voltage. This will increase the power in the device.

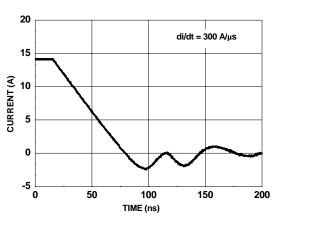


Figure 14. FDMC7660S SyncFET body diode reverse recovery characteristic

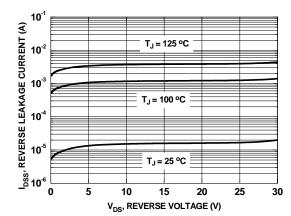
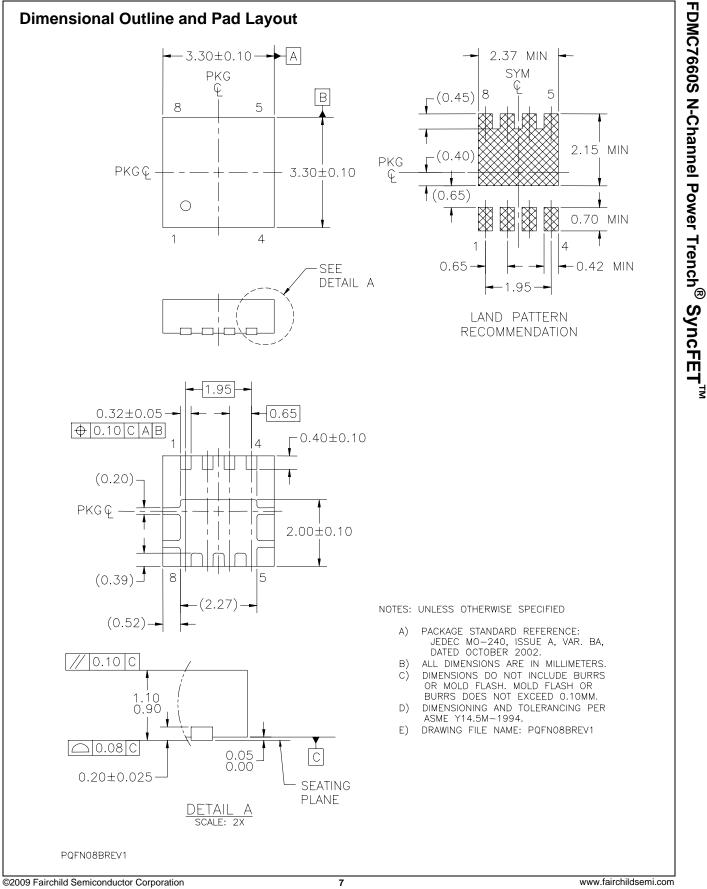


Figure 15. SyncFET body diode reverse leakage versus drain-source voltage



FDMC7660S Rev.C1





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™	F-PFS™	-215	Sync-Lock™
AX-CAP <sup>®</sup> *	FRFET®	®	SYSTEM ®*
BitSiC™	Global Power Resource <sup>SM</sup>	PowerTrench <sup>®</sup>	CENEDAL
Build it Now™	GreenBridge™	PowerXS™	Lageneral TinyBoost <sup>®</sup>
CorePLUS™	Green FPS™	Programmable Active Droop <sup>™</sup>	TinyBuck <sup>®</sup>
CorePOWER™	Green FPS™ e-Series™	QFET®	TinyCalc™
CROSSVOLT™	G <i>max</i> ™	QS™	TinyLogic®
CTL™	GTO™	Quiet Series <sup>™</sup>	TINYOPTO™
Current Transfer Logic™	IntelliMAX™	RapidConfigure™	TinyPower™
DEUXPEED®	ISOPLANAR™	TM TM	TinyPWM™
Dual Cool™	Marking Small Speakers Sound Louder		TinyWire™
EcoSPARK <sup>®</sup>	and Better™	Saving our world, 1mW/W/kW at a time™	TranSiC™
EfficentMax™	MegaBuck™	SignalWise™	TriFault Detect™
ESBC™	MICROCOUPLER™	SmartMax™	TRUECURRENT®*
R	MicroFET™	SMART START™	μSerDes™
+	MicroPak™	Solutions for Your Success™	μοστροσ
Fairchild®	MicroPak2™	SPM®	$\mathcal{M}$
Fairchild Semiconductor <sup>®</sup>	MillerDrive™	STEALTH™	/ Ser <mark>Des<sup>*</sup></mark> UHC <sup>®</sup>
FACT Quiet Series™	MotionMax™	SuperFET <sup>®</sup>	
FACT®	mWSaver®	SuperSOT™-3	Ultra FRFET™ UniFET™
FAST <sup>®</sup>	OptoHiT™	SuperSOT™-6	VCX™
FastvCore™	OPTOLOGIC®	SuperSOT™-8	
FETBench™	OPTOPLANAR®	SupreMOS®	VisualMax™ VoltagePlus™
FPS™		SyncFET™	XS™
			7.0

\*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.

As used here in:

- Life support devices or systems are devices or systems which, (a) are 1. 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 2. 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.		

ON Semiconductor and 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 <u>www.onsemi.com/site/pdf/Patent-Marking.pdf</u>. 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 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 haves against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly ori indirectly, any claim of personal injury or death

### 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

© Semiconductor Components Industries, LLC

# **Mouser Electronics**

Authorized Distributor

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

ON Semiconductor: FDMC7660S



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

Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



### Как с нами связаться

**Телефон:** 8 (812) 309 58 32 (многоканальный) **Факс:** 8 (812) 320-02-42 **Электронная почта:** <u>org@eplast1.ru</u> **Адрес:** 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.