





JN Semiconductor®

To kara more about Old Semiconductor, please visit our website at

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 questions@onsemi.com.

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



December 2013

FQN1N50C

N-Channel QFET® MOSFET

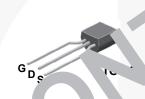
500 V, 0.38 A, 6 Ω

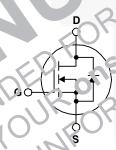
Description

This N-Channel enhancement mode power MOSFET is produced using Fairchild Semiconductor's proprietary planar stripe and DMOS technology. This advanced MOSFET technology has been especially tailored to reduce on-state resistance, and to provide superior switching performance and high avalanche energy strength. These devices are suitable for switched mode power supplies, active power factor correction (PFC), and electronic lamp ballasts.

Features

- 0.38 A, 500 V, $R_{DS(on)} = 6 \Omega$ (Max.) @ $V_{GS} = 10 \text{ V}$, $I_D = 0.19 \text{ A}$
- Low Gate Charge (Typ. 4.9 nC)
- · Low Crss (Typ. 4.1 pF)
- 100% Avalanche Tested





Absolute Maxim m Ratings To = 25 Curles otherwis and

Symbol	Paramete.	FQN1N50CTA	Unit
V _{DSS}	Dram-Souri Voltage	500	V
l _P	air. ent - Continuous (1°C = 25°C)	0.38	A
	- Continuous (১৫ = 100° ১)	0.24	A
DM	Drain Chrent - Fulse 1 (Note	1) 3.04	A
V _{GSS}	Gate-Source Vollage	± 30	V
=AS	Single Pulsed Avalancin) Energy (Note	2) 44.4	mJ
AR	Avalanche Current (Note	1) 0.38	A
ΕΔΓ	Repetitive Avaianche Energy (Note	1) 0.21	mJ
dv/dt	Peak Diode Recovery dv/dt (Note	3) 4.5	V/ns
P _D	Power Dissipation (T _A = 25°C)	0.89	W
	Power Dissipation (T _L = 25°C)	2.08	W
	- Derate above 25°C	0.017	W/°C
T _J , T _{STG}	Operating and Storage Temperature Range	-55 to +150	°C
T _L	Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds.	300	°C

Thermal Characteristics

Symbol	Parameter	FQN1N50CTA	Unit		
$R_{\theta JL}$	Thermal Resistance, Junction-to-Lead, Max.	(Note 5a)	60	°C/W	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	(Note 5b)	140		

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FQN1N50CTA	1N50C	TO-92	AMMO	N/A	N/A	2000 units

Electrical Characteristics T_C = 25°C unless otherwise noted.

Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit
Off Characte	eristics					
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} = 0 V, I _D = 250 μA	500			V
ΔBV _{DSS} / ΔT _J	Breakdown Voltage Temperature Coefficient	I_D = 250 μ A, Referenced to 25°C		0.5		V/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 500 V, V _{GS} = 0 V			.0	μА
		V_{DS} = 400 V, T_{C} = 125°C			2)	μΛ
I _{GSSF}	Gate-Body Leakage Current, Forward	$V_{GS} = 30 \text{ V}, V_{DS} = 0 \text{ V}$			٥٥،	пA
I _{GSSR}	Gate-Body Leakage Current, Reverse	V _{GS} = -30 V, V _{DS} = 0 V	<u>_</u>		-100	nA
On Characte	eristics		7 7		5/1/	
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} , I _D = ~~uA	2.0	2	4.0	V
R _{DS(on)}	Static Drain-Source On-Resistance	V _{GS} = 10 V, = 0. A	CQ	4.6	6.0	Ω
9 _{FS}	Forward Transconductance	V = V, I _D = '9A		CO.S	110	S
Dynamic Ch	naracteristics	JOE -	, 01	1/2	7/	
C _{iss}	Input Capacitance	25 V, V _{\gamma\sigma} = 0 \/,		150	195	pF
C _{oss}	Output Capacitance	☐ f = 1.0 MHz		28	40	pF
C _{rss}	Reverse Transfor Capa ance	Opi, < 1 12	7/-	4.1		pF
Switching C	Characteristics	COR COR	•			
t _{d(on)}	7 .n-On Dela, "me	V _{DD} = 200 V, I _D = 1 C A,		10	30	ns
t _r	Time	$\vec{R}_3 = 25 \Omega$		10	30	ns
t _{d(c'}	Turn Off " lay Time	1		20	50	ns
	n-Off Fall Time	(Note 4)	/	15	40	ns
Q	Total Cate Charge	$V_{DS} = 400 \text{ V}, I_D = 1.0 \text{ A},$		4.9	6.4	nC
Q _{gs}	Gate-Source Chargo	V _{GS} = 10 V		0.66	/	nC
Q _{gd}	Gate-Drain Charge	(Note 4)		2.9		nC
5rain-95urd	ce Diode Characteristics and Maximum Ra	atings				
ls	Maximun Cantinuous Drain-Source Dioc	de Forward Current			0.38	Α
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current				3.04	Α
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0 V, I _S = 0.38 A			1.4	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0 V, I _S = 1.0 A,		188		ns
Q _{rr}	Reverse Recovery Charge	dI _F / dt = 100 A/μs		0.55	-	μС

- 1. Repetitive rating : pulse-width limited by maximum junction temperature.
- 2. L = 80 mH, I_{AS} = 1.0 A, V_{DD} = 50 V, R_{G} = 25 Ω , starting T_{J} = 25°C.
- $3.~\text{I}_{SD} \leq 0.38~\text{A, di/dt} \leq 200~\text{A/}\mu\text{s, V}_{DD} \leq \text{BV}_{DSS,}~\text{starting}~~\text{T}_{J} = 25^{\circ}\text{C}.$
- 4. Essentially independent of operating temperature.

- 5. a) Reference point of the R_{B,IL} is the drain lead.
 b) When mounted on 3"x4.5" FR-4 PCB without any pad copper in a still air environment (R_{B,IA} is the sum of the junction-to-case and case-to-ambient thermal resistance. R_{BCA} is determined by the user's board design)

Typical Performance Characteristics

Figure 1. On-Region Characteristics

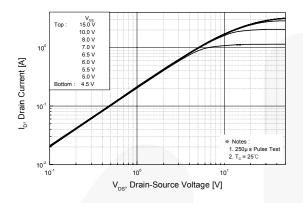


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

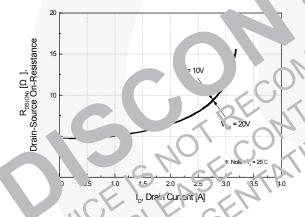


Figure 5. Capacitan :e Characteristics

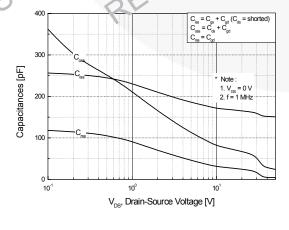
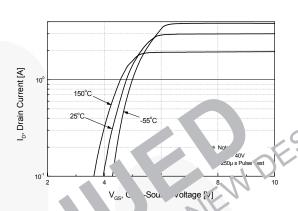


Figure 2. Transfer Characteristics



Body Diona Forward Voltage Va. ation vs. Source Curent and Temperative

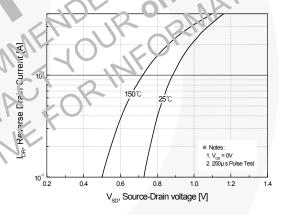
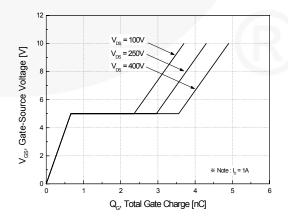


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

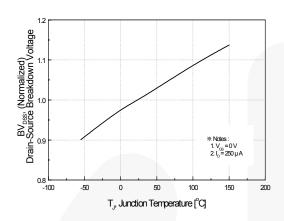


Figure 8. On-Resistance Variation vs. Temperature

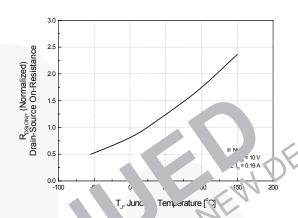
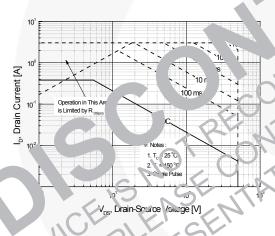


Figure 9. Maximum Safe Operating Area



Maximum Drain Current vs. Case Temperature

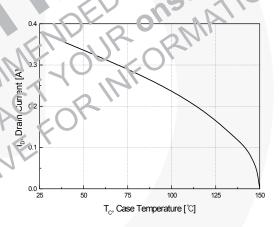
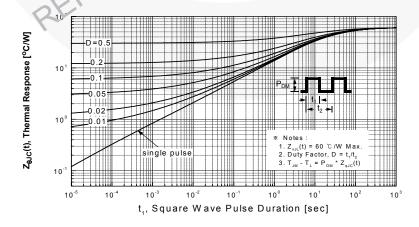


Figure 11. Transient Thermal Response Curve



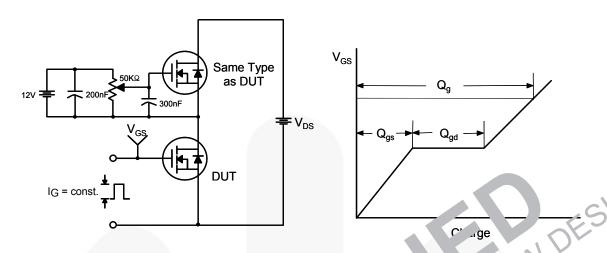


Figure 12. Gate Charge Test Circuit & Vave. m

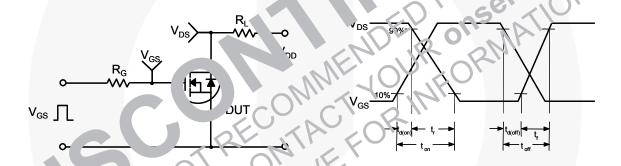


Figure 13. Resistive Switching Test Circuit & Waveforms

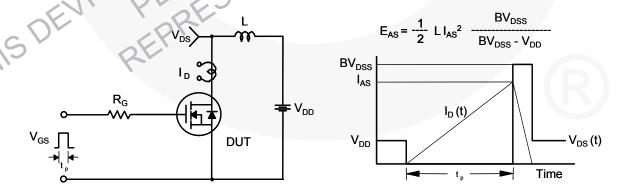


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

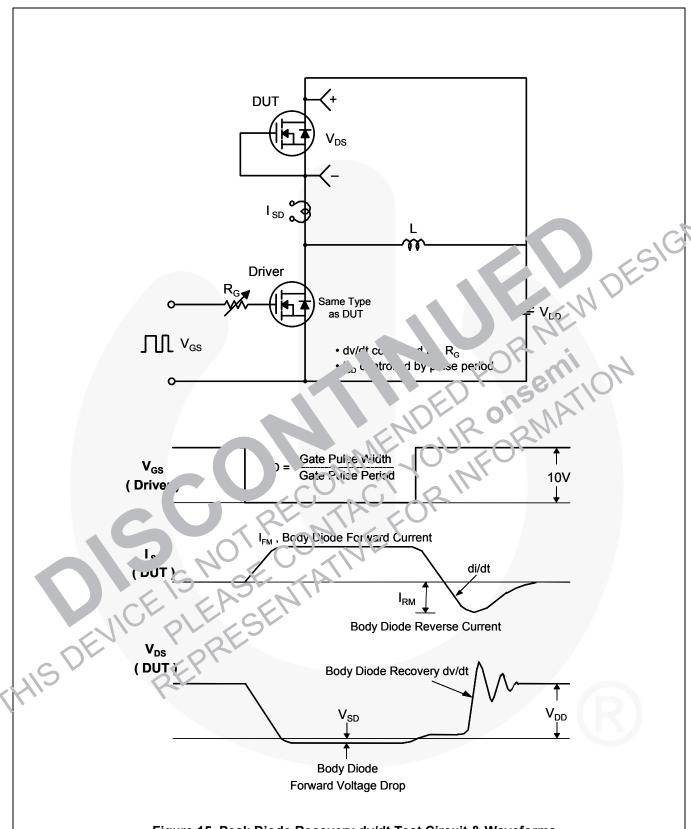


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

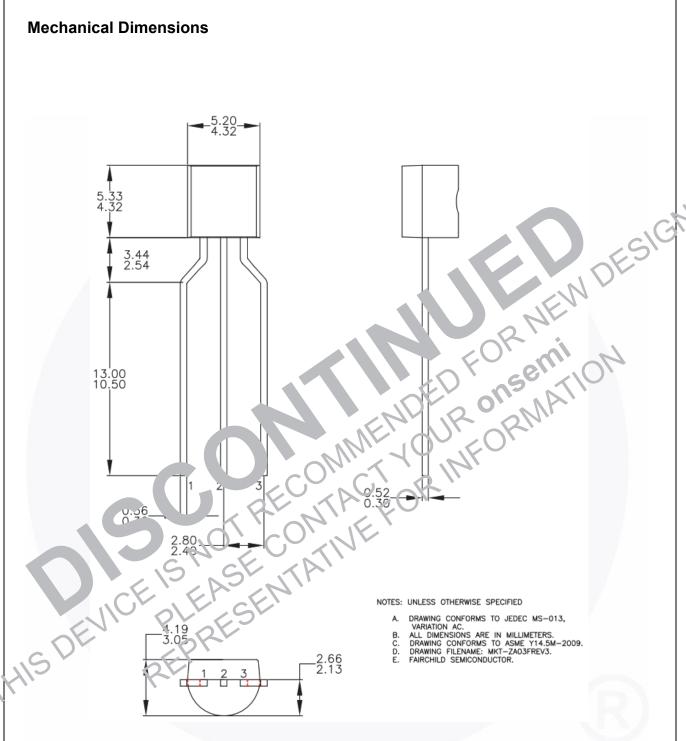


Figure 16. TO92, Molded, 3-Lead, 0.200 In Line Spacing LD Form (J61Z Option)

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 TO92-F03





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™ F-PFSTM AX-CAP® BitSiC™ Build it Now™ CorePLUS™ CorePOWER™ $CROSSVOLT^{\text{TM}}$ CTI ™

Current Transfer Logic™ DEUXPEED® Dual Cool™ EcoSPARK®

EfficentMax™ ESBC™

Fairchild[®] Fairchild Semiconductor® FACT Quiet Series™ FACT[®] FAST® FastvCore™ FETBench™ FPS™

FRFET® Global Power ResourceSM 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 * SignalWise™ SmartMax™

SMART START™ Solutions for Your Soccess™

STEALTH™ SuperFFT® SuperS St rSC 3ul 301 Supre 756 SvncFL

Sync-Lock™ SYSTEM ®* TinyBoost[®] TinyBuck[®] TinyCalc™ TinyLogic[®] TINY COWE √PWM™ Ti. Vire™ Tra. C™

TriFa.

, Des™ DITC Ulti a FRFET™ UniFFT™ VCX™ Mxe' /II' uaiV \ oragePlus?

TRUECURRENT

,ect™

*Trademarks of System General Corporation, used under irchild Sumicond

DISCLAIMER

O N 'E CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE FAIRCHILD SEMICONDUCTOR RESERVES ≟ RIGh S.N., ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY DESIT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS. RELIABILITY, FUNCTION, OR DESIGN. FA CHILD D PRODUCT OR CIRCUIT DESCRIBE BEIN 'EITHER THESE SPECIFICATIONS DO NO EXPAND THEREIN, WHICH COVERS THE E PRODUCTS. TED JOF FAIRCHILD'S WORLDWIDE TERMS AND CONDITIONS, SPECIFICALLY THE WARRANTY

FAIRCHILD'S PROL CTS NO LEXPRESS WE TEN LOV. OF LORIZED FOR USE AS CRITE TAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE .JV. OF FAIRCHILD SEMICONDUCTUR CORPORTION.

As used here in:

- su, rt o res stems are devices or systems which, (a) are ntended sur, all implant in or the body or (a) support or sustain life, d (c) where failure to perform when properly used in accordance with in juction for use provided in the landing, can be masonably ex, + .o 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-COUNTER SITING POLIC!

Fairchild Se riconductor Corporation's Anti-Counterfeiting Policy. Fairchild's Anti-Counterfeiting Policy is also stated on our external website, www.Fa childs-nil.com, under Sales Syppio.

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

palts. Customers who inadvertently curchase 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. Tairchild 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. Specification 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 me 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 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 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