

# FDMC7570S

## MOSFET – N-Channel, POWERTRENCH<sup>®</sup>, SyncFET<sup>™</sup>

25 V, 40 A, 2 mΩ

### General Description

The FDMC7570S has been designed to minimize losses in power conversion application. Advancements in both silicon and package technologies have been combined to offer the lowest  $R_{DS(on)}$  while maintaining excellent switching performance. This device has the added benefit of an efficient monolithic Schottky body diode.

### Features

- Max  $R_{DS(on)}$  = 2 mΩ at  $V_{GS} = 10$  V,  $I_D = 27$  A
- Max  $R_{DS(on)}$  = 2.9 mΩ at  $V_{GS} = 4.5$  V,  $I_D = 21.5$  A
- Advanced Package and Combination for Low  $R_{DS(on)}$  and High Efficiency
- SyncFET Schottky Body Diode
- 100% UIL Tested
- These Devices are Pb-Free and are RoHS Compliant

### Applications

- Synchronous Rectifier for DC/DC Converters
- Notebook Vcore/GPU Low Side Switch
- Networking Point of Load Low Side Switch
- Telecom Secondary Side Rectification

### MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

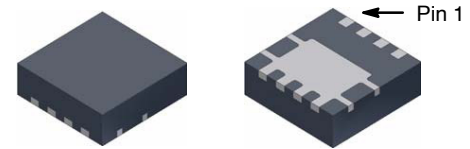
Parameter	Symbol	Rating	Unit
Drain to Source Voltage	$V_{DS}$	25	V
Gate to Source Voltage (Note 4)	$V_{GS}$	±20	V
Drain Current	$I_D$	40 132 27 120	A
– Continuous (Package limited) $T_C = 25^\circ\text{C}$			
– Continuous (Silicon limited) $T_C = 25^\circ\text{C}$			
– Continuous $T_A = 25^\circ\text{C}$ (Note 1a)			
– Pulsed			
Single Pulse Avalanche Energy (Note 3)	$E_{AS}$	144	mJ
Power Dissipation $T_C = 25^\circ\text{C}$	$P_D$	59	W
Power Dissipation $T_A = 25^\circ\text{C}$ (Note 1a)		2.3	
Operating and Storage Junction Temperature Range	$T_J, T_{STG}$	–55 to +150	$^\circ\text{C}$

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.



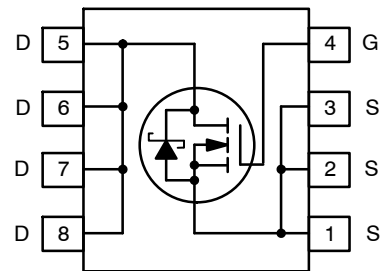
ON Semiconductor<sup>®</sup>

[www.onsemi.com](http://www.onsemi.com)

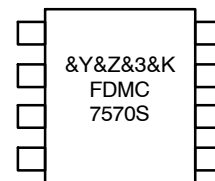


Power 33  
PQFN8  
CASE 483AK

### PIN ASSIGNMENT



### MARKING DIAGRAM



&Y = ON Semiconductor Logo  
 &Z = Assembly Plant Code  
 &3 = 3-Digit Data Code  
 &K = 2-Digit Lot Traceability Code  
 FDMC7570S = Specific Device Code

### ORDERING INFORMATION

Device	Package	Shipping <sup>†</sup>
FDMC7570S	PGFN8 (Pb-Free)	3,000 / Tape & Reel

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

# FDMC7570S

## THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	2.1	$^{\circ}C/W$
Thermal Resistance, Junction to Ambient (Note 1a)	$R_{\theta JA}$	53	

## ELECTRICAL CHARACTERISTICS ( $T_J = 25^{\circ}C$ unless otherwise specified)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
<b>OFF CHARACTERISTIC</b>						
Drain to Source Breakdown Voltage	$I_D = 1 \text{ mA}, V_{GS} = 0 \text{ V}$	$BV_{DSS}$	25			V
Breakdown Voltage Temperature / Coefficient	$I_D = 10 \text{ mA}$ , referenced to $25^{\circ}C$	$\Delta BV_{DSS} / \Delta T_J$		21		$mV/^{\circ}C$
Zero Gate Voltage Drain Current	$V_{DS} = 20 \text{ V}, V_{GS} = 0 \text{ V}$	$I_{DSS}$			500	$\mu A$
Gate to Source Leakage Current, Forward	$V_{GS} = 20 \text{ V}, V_{DS} = 0 \text{ V}$	$I_{GSS}$			100	nA

### ON CHARACTERISTICS

Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = 1 \text{ mA}$	$V_{GS(th)}$	1.2	1.7	3	V
Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 10 \text{ mA}$ , referenced to $25^{\circ}C$	$\Delta V_{GS(th)} / \Delta T_J$		-4		$mV/^{\circ}C$
Static Drain to Source On Resistance	$V_{GS} = 10 \text{ V}, I_D = 27 \text{ A}$	$R_{DS(on)}$		1.6	2	m $\Omega$
	$V_{GS} = 4.5 \text{ V}, I_D = 21.5 \text{ A}$			2.4	2.9	
	$V_{GS} = 10 \text{ V}, I_D = 27 \text{ A}, T_J = 125^{\circ}C$			2.2	2.8	
Forward Transconductance	$V_{DS} = 5 \text{ V}, I_D = 27 \text{ A}$	$g_{FS}$		154		S

### DYNAMIC CHARACTERISTICS

Input Capacitance	$V_{DS} = 13 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	$C_{iss}$		3315	4410	pF
Output Capacitance		$C_{oss}$		1010	1345	pF
Reverse Transfer Capacitance		$C_{rss}$		168	255	pF
Gate Resistance		$R_g$		1.2	2.1	$\Omega$

### SWITCHING CHARACTERISTICS

Turn-On Delay Time	$V_{DD} = 13 \text{ V}, I_D = 27 \text{ A}, V_{GS} = 10 \text{ V}, R_{GEN} = 6 \Omega$	$t_{d(on)}$		14	26	ns
Rise Time		$t_r$		6.8	14	ns
Turn-Off Delay Time		$t_{d(off)}$		34	55	ns
Fall Time		$t_f$		4.5	10	ns
Total Gate Charge	$V_{GS} = 0 \text{ V to } 10 \text{ V}, V_{DD} = 13 \text{ V}$	$Q_g$		49	68	nC
Total Gate Charge	$V_{GS} = 0 \text{ V to } 4.5 \text{ V}, V_{DD} = 13 \text{ V}$	$Q_g$		22	31	nC
Gate to Source Gate Charge	$I_D = 27 \text{ A}$	$Q_{gs}$		10.8		nC
Gate to Drain "Miller" Charge		$Q_{gd}$		5.5		nC

### DRAIN-SOURCE DIODE CHARACTERISTICS

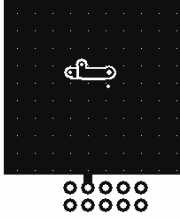
Source to Drain Diode Forward Voltage	$V_{GS} = 0 \text{ V}, I_S = 27 \text{ A}$ (Note 2)	$V_{SD}$		0.78	1.2	V
	$V_{GS} = 0 \text{ V}, I_S = 2 \text{ A}$ (Note 2)			0.43	0.8	
Reverse Recovery Time	$I_F = 27 \text{ A}, di/dt = 300 \text{ A}/\mu s$	$t_{rr}$		30	48	ns
Reverse Recovery Charge		$Q_{rr}$		29	46	nC

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

# FDMC7570S

## NOTES:

1.  $R_{\theta JA}$  is determined with the device mounted on a 1 in<sup>2</sup> pad 2 oz copper pad on a 1.5 × 1.5 in. board of FR-4 material.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.



a) 53°C/W when mounted on a 1 in<sup>2</sup> pad of 2 oz copper.



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

2. Pulse Test: Pulse Width < 300 μs, Duty cycle < 2.0%.
3.  $E_{AS}$  of 144 mJ is based on starting  $T_J = 25^\circ\text{C}$ ,  $L = 1$  mH,  $I_{AS} = 17$  A,  $V_{DD} = 23$  V,  $V_{GS} = 10$  V. 100% test at  $L = 0.3$  mH,  $I_{AS} = 25$  A.
4. As an N-ch device, the negative  $V_{GS}$  rating is for lower duty cycle pulse occurrence only. No continuous rating is implied.

TYPICAL CHARACTERISTICS

( $T_J = 25^\circ\text{C}$  unless otherwise noted)

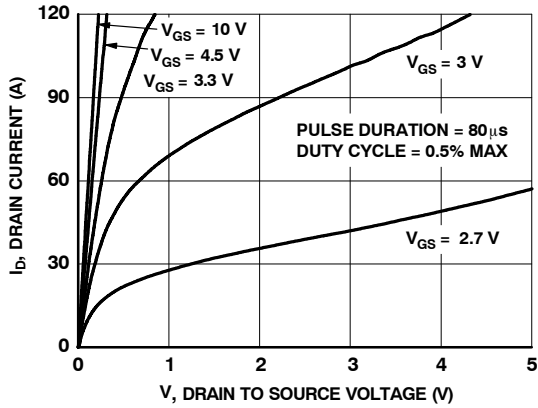


Figure 1. On-Region Characteristics

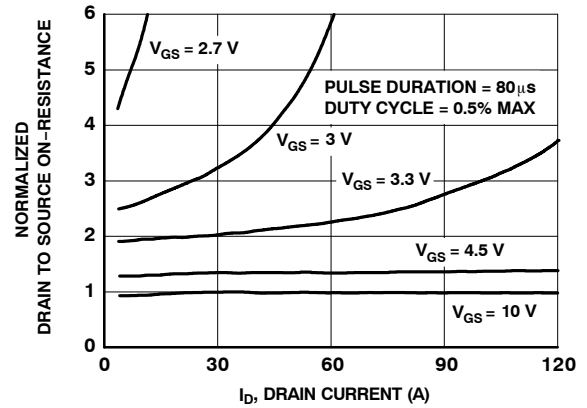


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

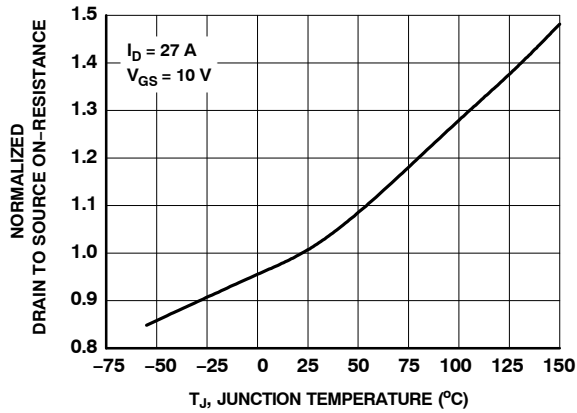


Figure 3. Normalized On-Resistance vs. Junction Temperature

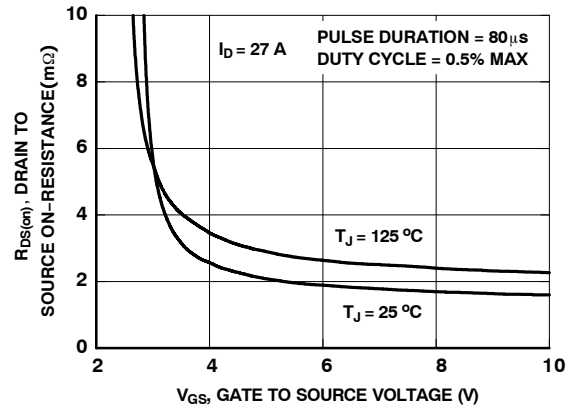


Figure 4. On-Resistance vs. Gate to Source Voltage

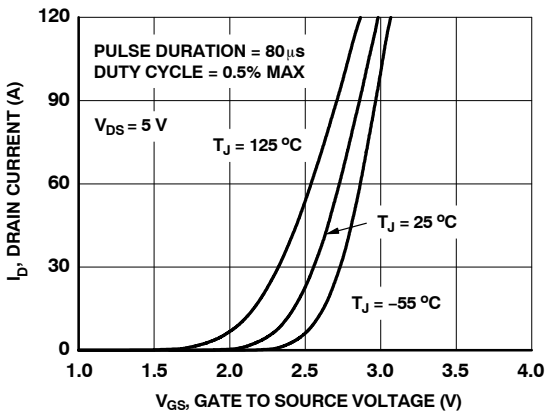


Figure 5. Transfer Characteristics

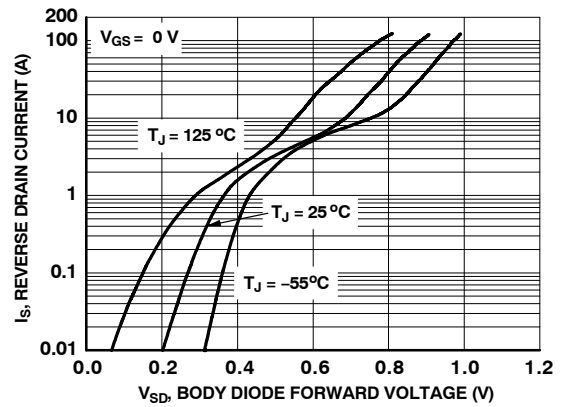


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

# FDMC7570S

## TYPICAL CHARACTERISTICS (continued)

( $T_J = 25^\circ\text{C}$  unless otherwise noted)

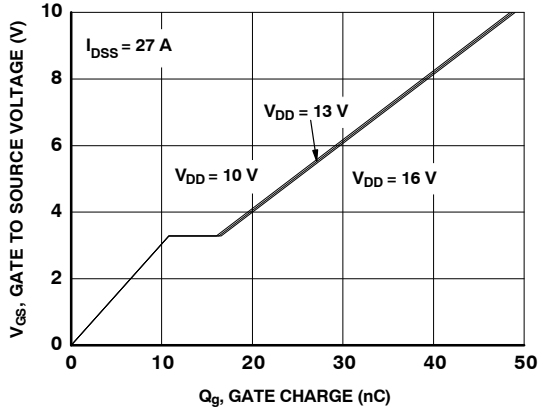


Figure 7. Gate Charge Characteristics

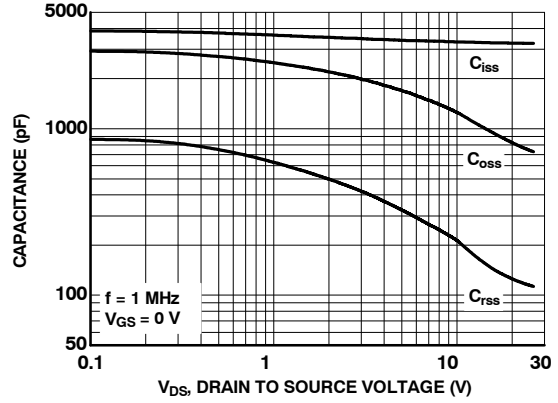


Figure 8. Capacitance vs Drain to Source Voltage

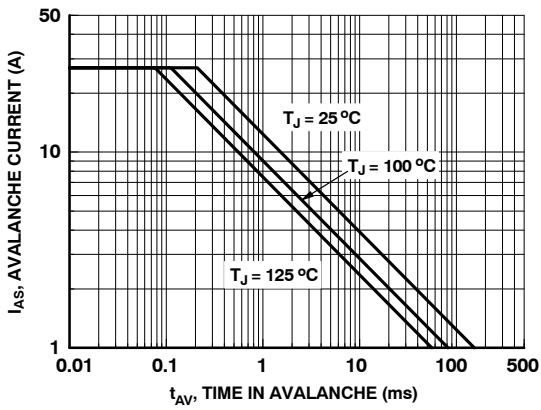


Figure 9. Unclamped Inductive Switching Capability

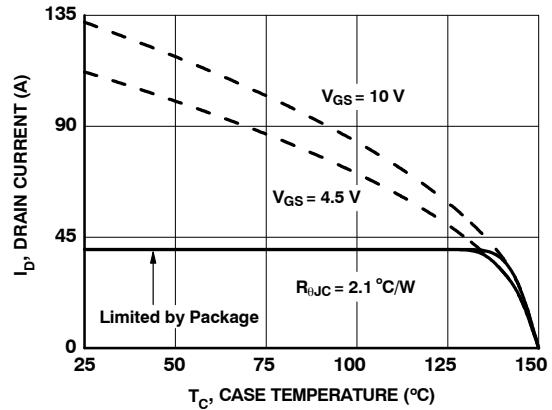


Figure 10. Maximum Continuous Drain Current vs Case Temperature

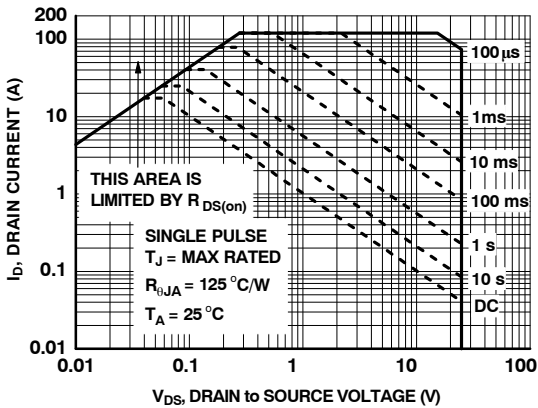


Figure 11. Forward Bias Safe Operating Area

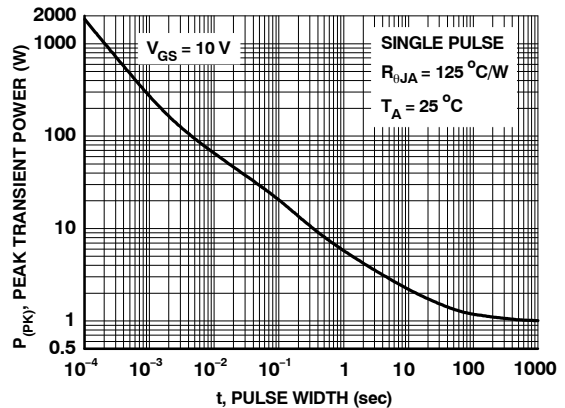


Figure 12. Single Pulse Maximum Power Dissipation

# FDMC7570S

## TYPICAL CHARACTERISTICS (continued)

( $T_J = 25^\circ\text{C}$  unless otherwise noted)

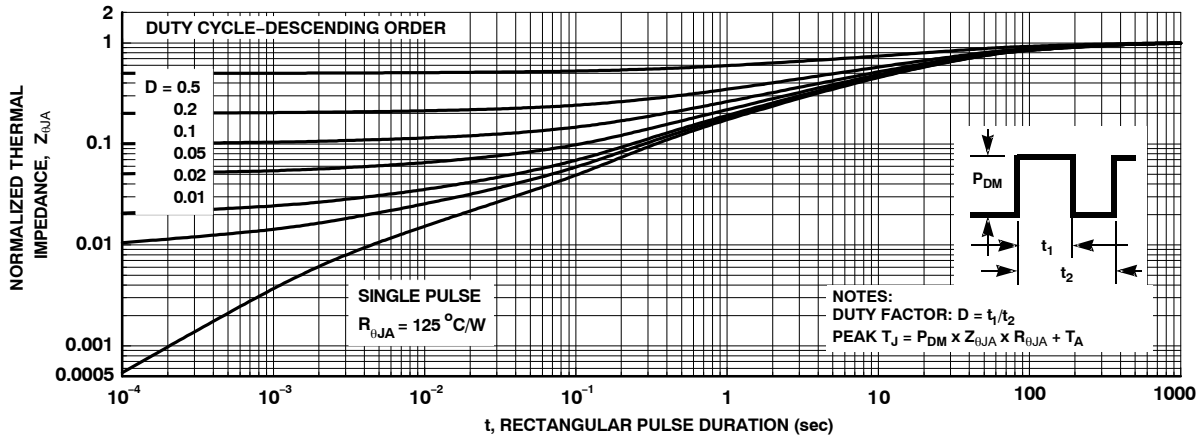


Figure 13. Junction-to-Ambient Transient Thermal Response Curve

### SyncFET SCHOTTKY BODY DIODE CHARACTERISTICS

ON Semiconductor'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 14 shows the reverse recovery characteristic of the FDMC7570S.

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

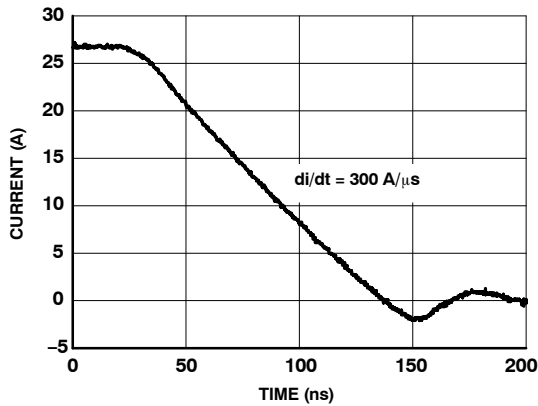


Figure 14. FDMC7570S SyncFET Body Diode Reverse Recovery Characteristic

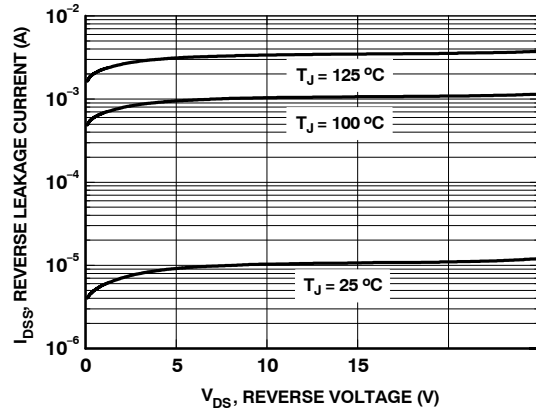


Figure 15. SyncFET Body Diode Reverse Leakage vs. Drain-Source Voltage

POWERTRENCH is a registered trademark and SyncFET is a trademark of Semiconductor Components Industries, LLC (SCILLC) or its subsidiaries in the United States and/or other countries.







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 [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://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 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](mailto: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

**ON Semiconductor Website:** [www.onsemi.com](http://www.onsemi.com)

**Order Literature:** <http://www.onsemi.com/orderlit>

For additional information, please contact your local  
Sales Representative