

ON Semiconductor

Is Now

onsemi™

To learn more about onsemi™, please visit our website at
www.onsemi.com

onsemi and **onsemi** and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi** product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** 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 **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** 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. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** 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 **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** 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 **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner. Other names and brands may be claimed as the property of others.



ON Semiconductor®

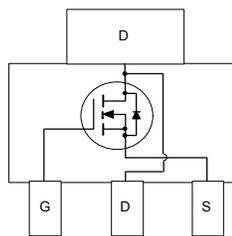
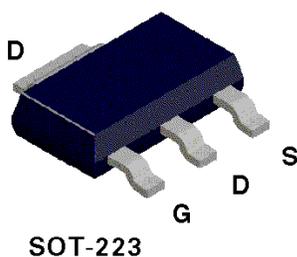
NDT451AN N-Channel Enhancement Mode Field Effect Transistor

General Description

Power SOT N-Channel enhancement mode power field effect transistors are produced using ON Semiconductor's proprietary, high cell density, DMOS technology. This very high density process is especially tailored to minimize on-state resistance and provide superior switching performance. These devices are particularly suited for low voltage applications such as DC motor control and DC/DC conversion where fast switching, low in-line power loss, and resistance to transients are needed.

Features

- 7.2A, 30V. $R_{DS(ON)} = 0.035\Omega @ V_{GS} = 10V$
 $R_{DS(ON)} = 0.05\Omega @ V_{GS} = 4.5V$.
- High density cell design for extremely low $R_{DS(ON)}$.
- High power and current handling capability in a widely used surface mount package.



Absolute Maximum Ratings $T_A = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	NDT451AN	Units	
V_{DSS}	Drain-Source Voltage	30	V	
V_{GSS}	Gate-Source Voltage	± 20	V	
I_D	Drain Current - Continuous (Note 1a)	± 7.2	A	
	- Pulsed	± 25		
P_D	Maximum Power Dissipation (Note 1a)	3	W	
		(Note 1b)		1.3
		(Note 1c)		1.1
T_J, T_{STG}	Operating and Storage Temperature Range	-65 to 150	$^\circ\text{C}$	

THERMAL CHARACTERISTICS

Symbol	Parameter	NDT451AN	Units
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1a)	42	$^\circ\text{C/W}$
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Note 1)	12	$^\circ\text{C/W}$

Electrical Characteristics ($T_A = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units	
OFF CHARACTERISTICS							
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	30			V	
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 24\text{ V}, V_{GS} = 0\text{ V}$			1	μA	
			$T_J = 55^\circ\text{C}$		10	μA	
I_{GSSF}	Gate - Body Leakage, Forward	$V_{GS} = 20\text{ V}, V_{DS} = 0\text{ V}$			100	nA	
I_{GSSR}	Gate - Body Leakage, Reverse	$V_{GS} = -20\text{ V}, V_{DS} = 0\text{ V}$			-100	nA	
ON CHARACTERISTICS (Note 2)							
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	1	1.6	3	V	
			$T_J = 125^\circ\text{C}$	0.7	1.2		2.2
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 7.2\text{ A}$		0.03	0.035	Ω	
			$T_J = 125^\circ\text{C}$		0.042		0.063
			$V_{GS} = 4.5\text{ V}, I_D = 6.0\text{ A}$		0.042		0.05
			$T_J = 125^\circ\text{C}$		0.058		0.09
$I_{D(on)}$	On-State Drain Current	$V_{GS} = 10\text{ V}, V_{DS} = 5\text{ V}$	25			A	
		$V_{GS} = 4.5\text{ V}, V_{DS} = 5\text{ V}$	15				
g_{FS}	Forward Transconductance	$V_{DS} = 10\text{ V}, I_D = 7.2\text{ A}$		11		S	
DYNAMIC CHARACTERISTICS							
C_{iss}	Input Capacitance	$V_{DS} = 15\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$		720		pF	
C_{oss}	Output Capacitance			370		pF	
C_{rss}	Reverse Transfer Capacitance			250		pF	
SWITCHING CHARACTERISTICS (Note 2)							
$t_{D(on)}$	Turn - On Delay Time	$V_{DD} = 10\text{ V}, I_D = 1\text{ A},$ $V_{GEN} = 10\text{ V}, R_{GEN} = 6\ \Omega$		12	20	ns	
t_r	Turn - On Rise Time			13	30	ns	
$t_{D(off)}$	Turn - Off Delay Time			29	50	ns	
t_f	Turn - Off Fall Time			10	20	ns	
Q_g	Total Gate Charge		$V_{DS} = 10\text{ V},$ $I_D = 7.2\text{ A}, V_{GS} = 10\text{ V}$		19	30	nC
Q_{gs}	Gate-Source Charge			2.3		nC	
Q_{gd}	Gate-Drain Charge			5.5		nC	

Electrical Characteristics (T_A = 25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS						
I _S	Maximum Continuous Drain-Source Diode Forward Current				2.3	A
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0 V, I _S = 7.2A (Note 2)		0.9	1.3	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0 V, I _F = 1.25 A, di _F /dt = 100 A/μs			100	ns

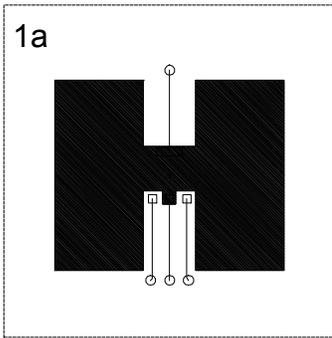
Notes:

- R_{θJA} is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. R_{θJC} is guaranteed by design while R_{θCA} is determined by the user's board design.

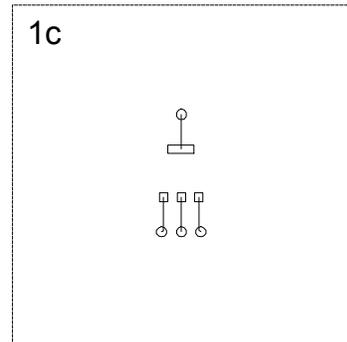
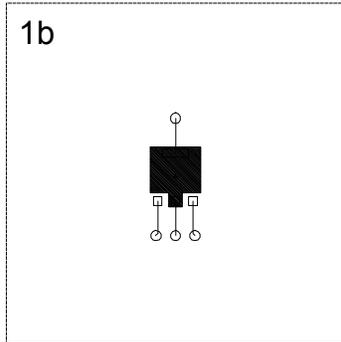
$$P_D(t) = \frac{T_J - T_A}{R_{\theta J A}(t)} = \frac{T_J - T_A}{R_{\theta J C} + R_{\theta C A}(t)} = I_D^2(t) \times R_{DS(on)} @ T_J$$

Typical R_{θJA} using the board layouts shown below on 4.5"x5" FR-4 PCB in a still air environment:

- 42°C/W when mounted on a 1 in² pad of 2oz copper.
- 95°C/W when mounted on a 0.066 in² pad of 2oz copper.
- 110°C/W when mounted on a 0.0123 in² pad of 2oz copper.



Scale 1 : 1 on letter size paper



- Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2.0%.

Typical Electrical Characteristics

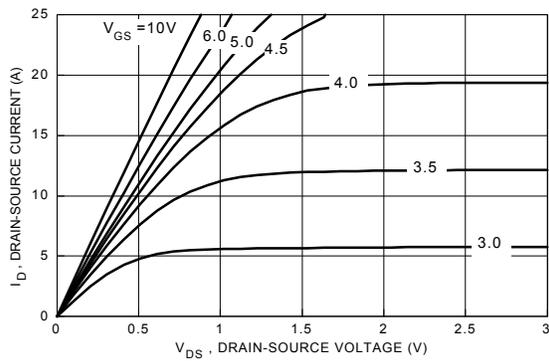


Figure 1. On-Region Characteristics.

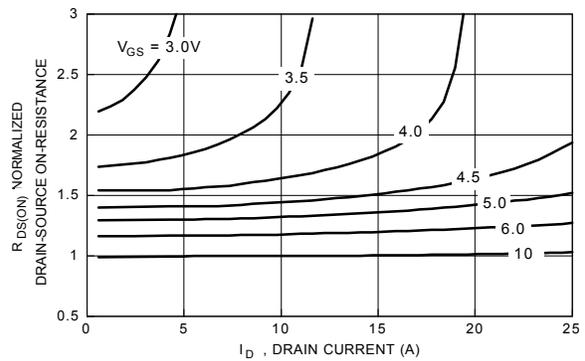


Figure 2. On-Resistance Variation with Gate Voltage and Drain Current.

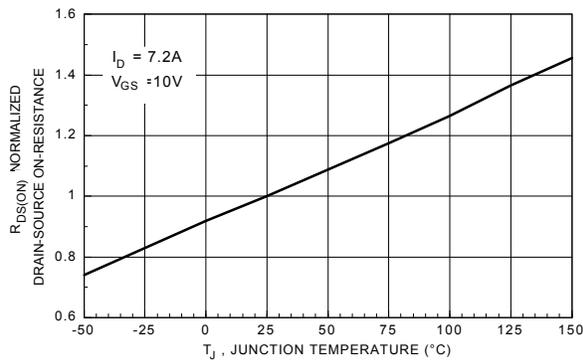


Figure 3. On-Resistance Variation with Temperature.

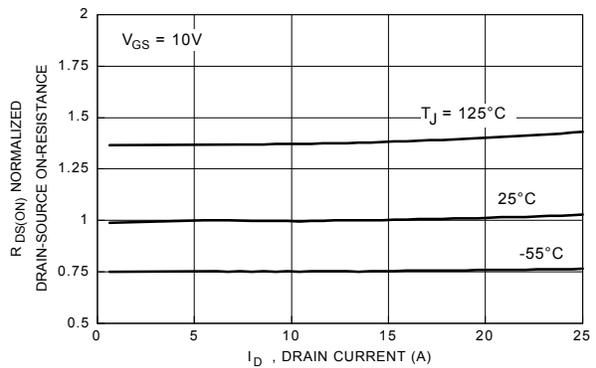


Figure 4. On-Resistance Variation with Drain Current and Temperature.

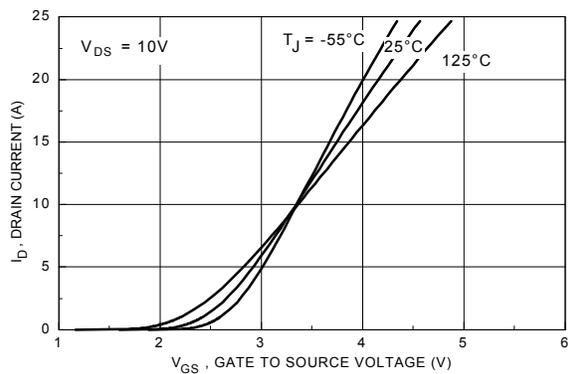


Figure 5. Transfer Characteristics.

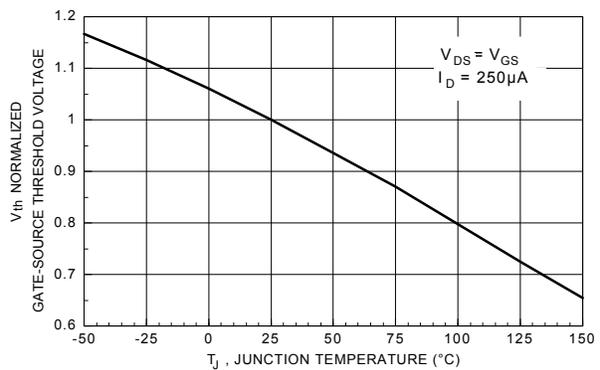


Figure 6. Gate Threshold Variation with Temperature.

Typical Electrical Characteristics

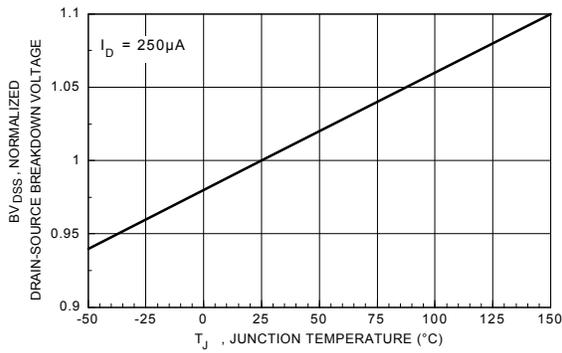


Figure 7. Breakdown Voltage Variation with Temperature.

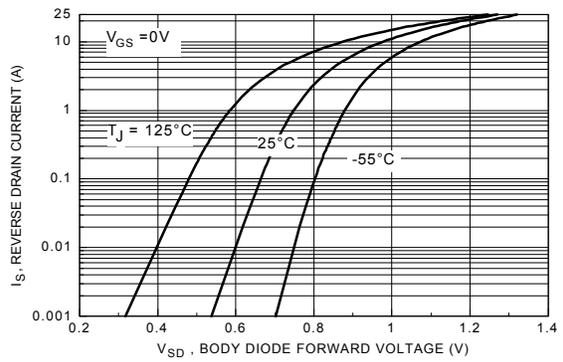


Figure 8. Body Diode Forward Voltage Variation with Current and Temperature.

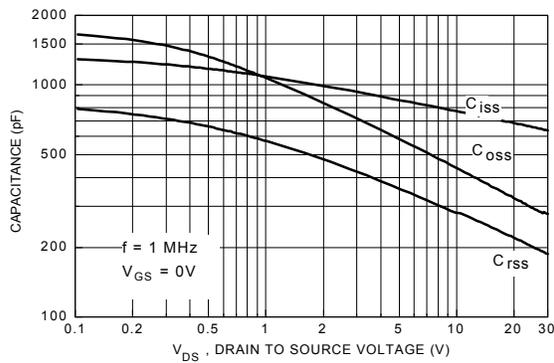


Figure 9. Capacitance Characteristics.

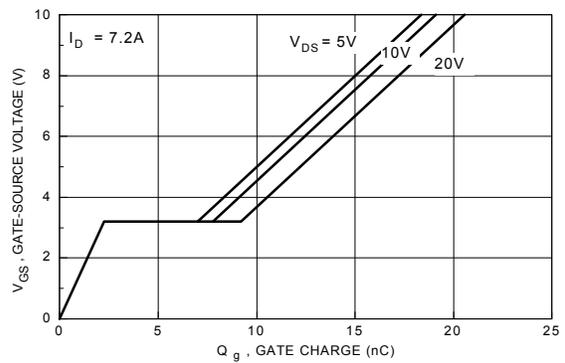


Figure 10. Gate Charge Characteristics.

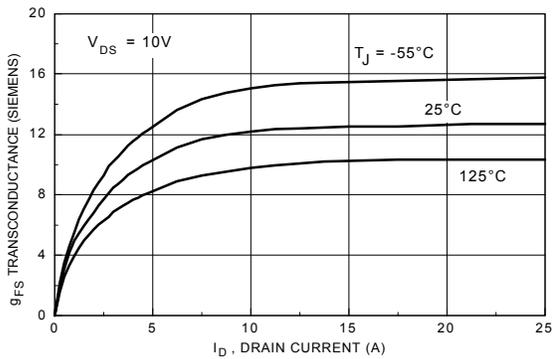


Figure 11. Transconductance Variation with Drain Current and Temperature.

Typical Thermal Characteristics

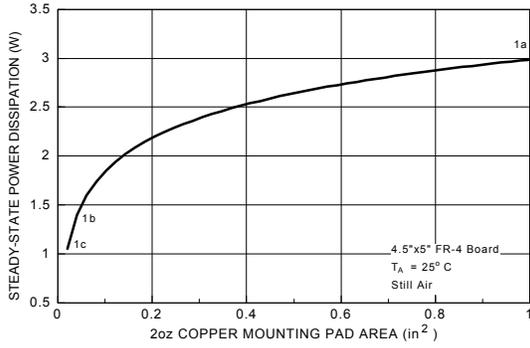


Figure 12. SOT-223 Maximum Steady-State Power Dissipation versus Copper Mounting Pad Area.

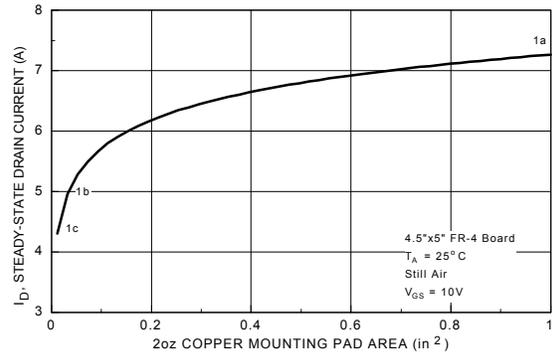


Figure 13. Maximum Steady-State Drain Current versus Copper Mounting Pad Area.

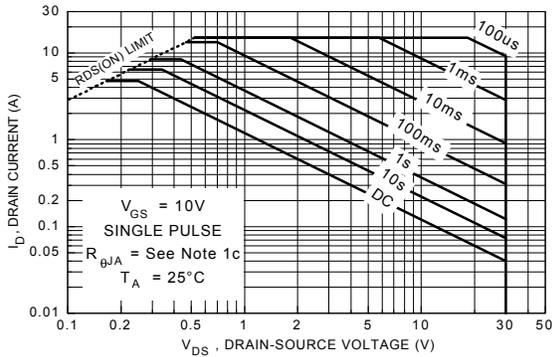


Figure 14. Maximum Safe Operating Area.

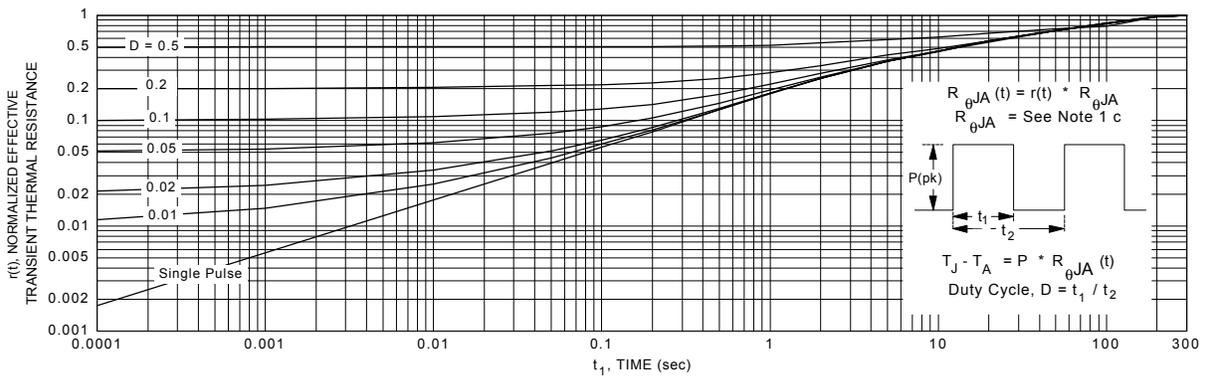


Figure 15. Transient Thermal Response Curve.

Note: Thermal characterization performed using the conditions described in note 1c. Transient thermal response will change depending on the circuit board design.

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. 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