

NTGS3446

Power MOSFET 20 V, 5.1 A Single N-Channel, TSOP6

Features

- Ultra Low $R_{DS(on)}$
- Higher Efficiency Extending Battery Life
- Logic Level Gate Drive
- Diode Exhibits High Speed, Soft Recovery
- Avalanche Energy Specified
- I_{DSS} Specified at Elevated Temperature
- Pb-Free Package is Available

Applications

- Power Management in portable and battery-powered products, i.e. computers, printers, PCMCIA cards, cellular and cordless
- Lithium Ion Battery Applications
- Notebook PC

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

Rating	Symbol	Value	Unit
Drain-to-Source Voltage	V_{DSS}	20	V
Gate-to-Source Voltage	V_{GS}	± 12	V
Thermal Resistance Junction-to-Ambient (Note 1) Total Power Dissipation @ $T_A = 25^\circ\text{C}$	$R_{\theta JA}$ P_d	244 0.5	$^\circ\text{C/W}$ W
Drain Current - Continuous @ $T_A = 25^\circ\text{C}$ - Pulsed Drain Current ($t_p < 10 \mu\text{s}$)	I_D I_{DM}	2.5 10	A A
Thermal Resistance Junction-to-Ambient (Note 2) Total Power Dissipation @ $T_A = 25^\circ\text{C}$	$R_{\theta JA}$ P_d	128 1.0	$^\circ\text{C/W}$ W
Drain Current - Continuous @ $T_A = 25^\circ\text{C}$ - Pulsed Drain Current ($t_p < 10 \mu\text{s}$)	I_D I_{DM}	3.6 14	A A
Thermal Resistance Junction-to-Ambient (Note 3) Total Power Dissipation @ $T_A = 25^\circ\text{C}$	$R_{\theta JA}$ P_d	62.5 2.0	$^\circ\text{C/W}$ W
Drain Current - Continuous @ $T_A = 25^\circ\text{C}$ - Pulsed Drain Current ($t_p < 10 \mu\text{s}$)	I_D I_{DM}	5.1 20	A A
Source Current (Body Diode)	I_S	5.1	A
Operating and Storage Temperature Range	T_J, T_{stg}	-55 to 150	$^\circ\text{C}$
Maximum Lead Temperature for Soldering Purposes for 10 seconds	T_L	260	$^\circ\text{C}$

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

1. Minimum FR-4 or G-10PCB, operating to steady state.
2. Mounted onto a 2" square FR-4 board (1" sq. 2 oz. cu. 0.06" thick single-sided), operating to steady state.
3. Mounted onto a 2" square FR-4 board (1" sq. 2 oz. cu. 0.06" thick single-sided), $t < 5.0$ seconds.

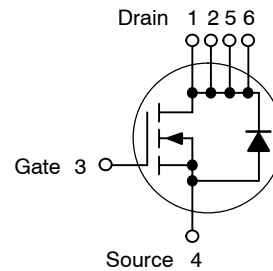


ON Semiconductor®

<http://onsemi.com>

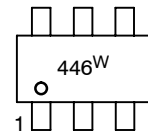
$V_{(BR)DSS}$	$R_{DS(on)}$ TYP	I_D MAX
20 V	36 m Ω @ 4.5 V	5.1 A

N-Channel



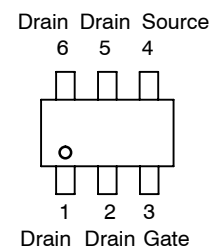
TSOP-6
CASE 318G
STYLE 1

MARKING DIAGRAM



446 = Device Code
W = Work Week

PIN ASSIGNMENT



ORDERING INFORMATION

Device	Package	Shipping†
NTGS3446T1	TSOP-6	3000/Tape & Reel
NTGS3446T1G	TSOP-6 (Pb-Free)	3000/Tape & Reel

†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.

NTGS3446

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Drain-to-Source Breakdown Voltage (V _{GS} = 0 Vdc, I _D = 0.25 mA) Temperature Coefficient (Positive)	V _{(BR)DSS}	20 -	- 22	- -	Vdc mV/°C
Zero Gate Voltage Collector Current (V _{DS} = 20 Vdc, V _{GS} = 0 Vdc) (V _{DS} = 20 Vdc, V _{GS} = 0 Vdc, T _J = 85°C)	I _{DSS}	- -	- -	1.0 25	μAdc
Gate-Body Leakage Current (V _{GS} = ±12 Vdc, V _{DS} = 0)	I _{GSS(f)} I _{GSS(r)}	- -	- -	100 -100	nAdc

ON CHARACTERISTICS (Note 4)

Gate Threshold Voltage I _D = 0.25 mA, V _{DS} = V _{GS} Temperature Coefficient (Negative)	V _{GS(th)}	0.6 -	0.85 -2.5	1.2 -	Vdc mV/°C
Static Drain-to-Source On-Resistance (V _{GS} = 4.5 Vdc, I _D = 5.1 Adc) (V _{GS} = 2.5 Vdc, I _D = 4.4 Adc)	R _{DS(on)}	- -	36 44	45 55	mΩ
Forward Transconductance (V _{DS} = 10 Vdc, I _D = 5.1 Adc)	g _{FS}	-	12	-	mhos

DYNAMIC CHARACTERISTICS

Input Capacitance	(V _{DS} = 10 Vdc, V _{GS} = 0 Vdc, f = 1.0 MHz)	C _{ISS}	-	510	750	pF
Output Capacitance		C _{OSS}	-	200	350	
Transfer Capacitance		C _{RSS}	-	60	100	

SWITCHING CHARACTERISTICS (Note 5)

Turn-On Delay Time	(V _{DD} = 10 Vdc, I _D = 1.0 Adc, V _{GS} = 4.5 Vdc, R _G = 6.0 Ω)	t _{d(on)}	-	9.0	16	ns
Rise Time		t _r	-	12	20	
Turn-Off Delay Time		t _{d(off)}	-	35	60	
Fall Time		t _f	-	20	35	
Gate Charge	(V _{DS} = 10 Vdc, I _D = 5.1 Adc, V _{GS} = 4.5 Vdc)	Q _T	-	8.0	15	nC
		Q _{gs}	-	2.0	-	
		Q _{gd}	-	2.0	-	

SOURCE-DRAIN DIODE CHARACTERISTICS

Forward On-Voltage (Note 4)	(I _S = 1.7 Adc, V _{GS} = 0 Vdc) (I _S = 1.7 Adc, V _{GS} = 0 Vdc, T _J = 85°C)	V _{SD}	- -	0.74 0.66	1.1 -	Vdc
Reverse Recovery Time	(I _S = 1.7 Adc, V _{GS} = 0 Vdc, di _S /dt = 100 A/μs)	t _{rr}	-	20	-	ns
		t _a	-	11	-	
		t _b	-	9.0	-	
Reverse Recovery Stored Charge		Q _{RR}	-	0.01	-	μC

4. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.
5. Switching characteristics are independent of operating junction temperature.

NTGS3446

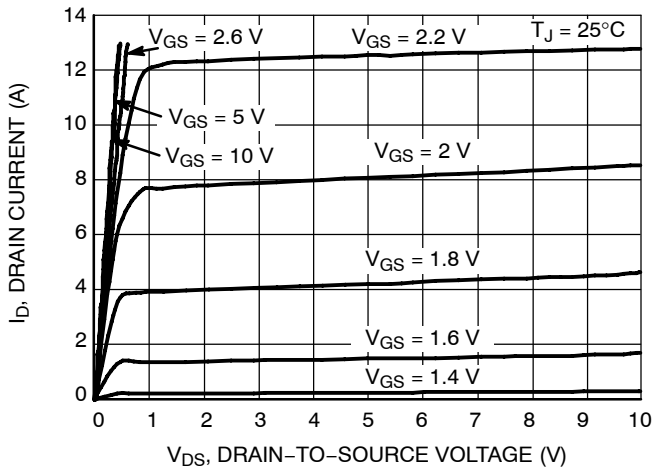


Figure 1. On-Region Characteristics

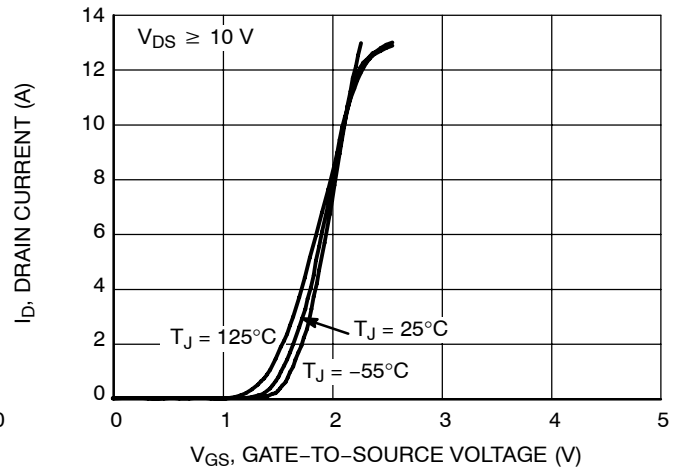


Figure 2. Transfer Characteristics

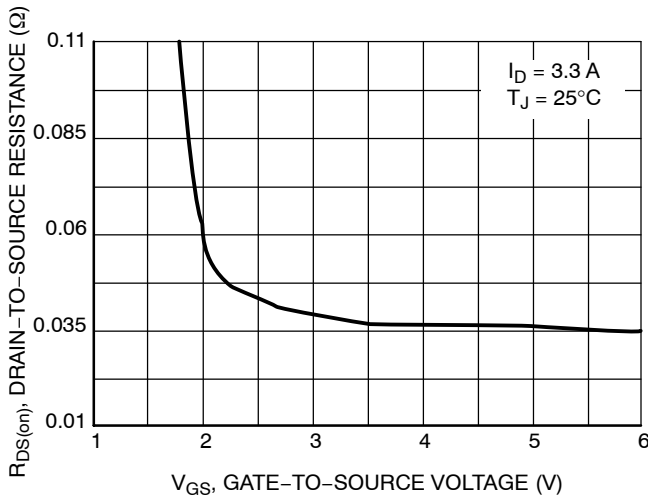


Figure 3. On-Resistance versus Gate-to-Source Voltage

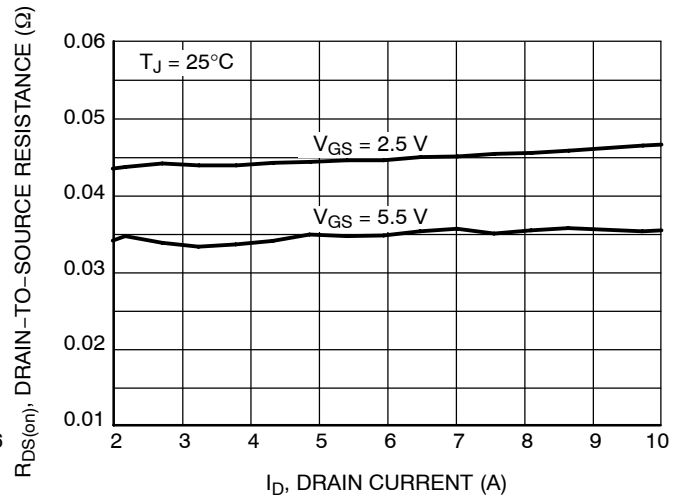


Figure 4. On-Resistance versus Drain Current and Gate Voltage

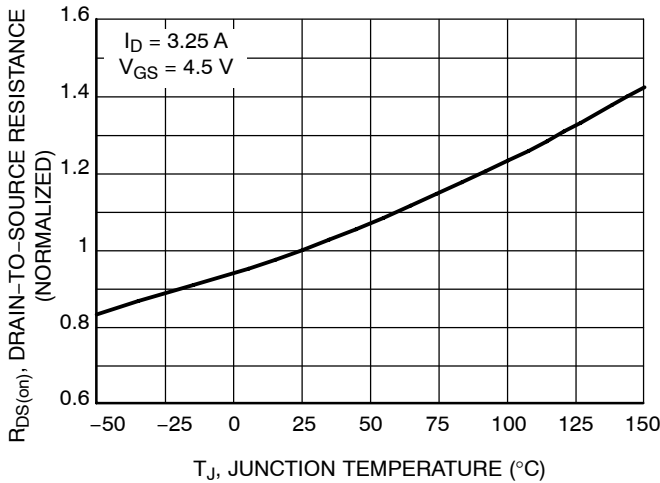


Figure 5. On-Resistance Variation with Temperature

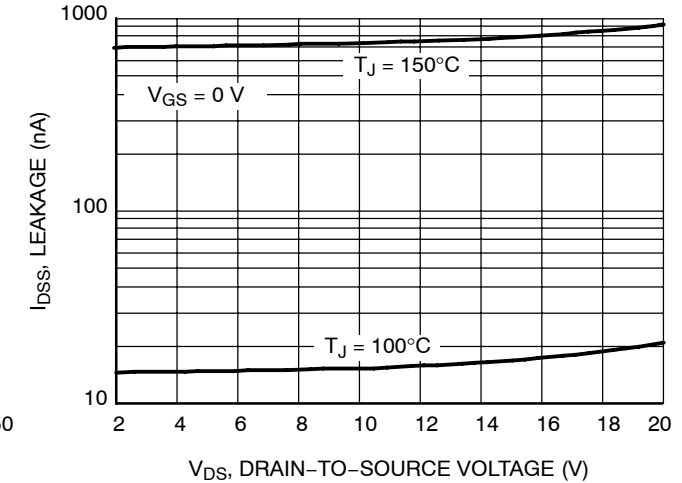
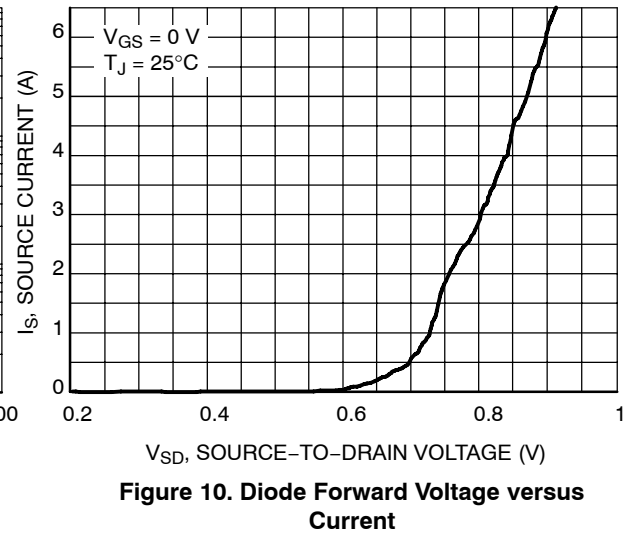
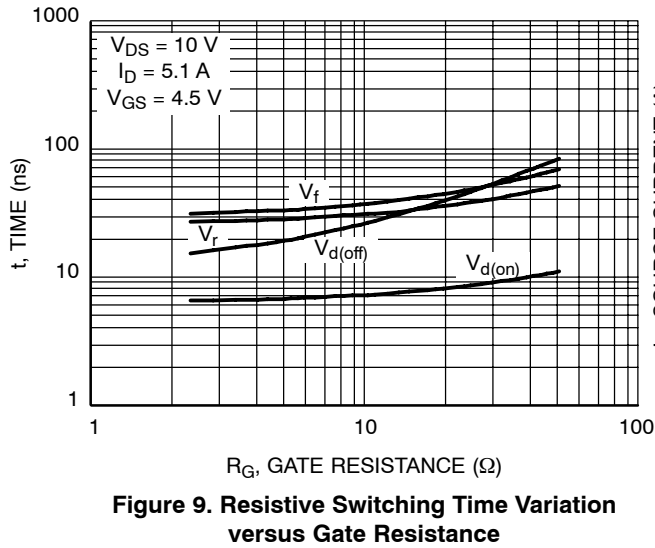
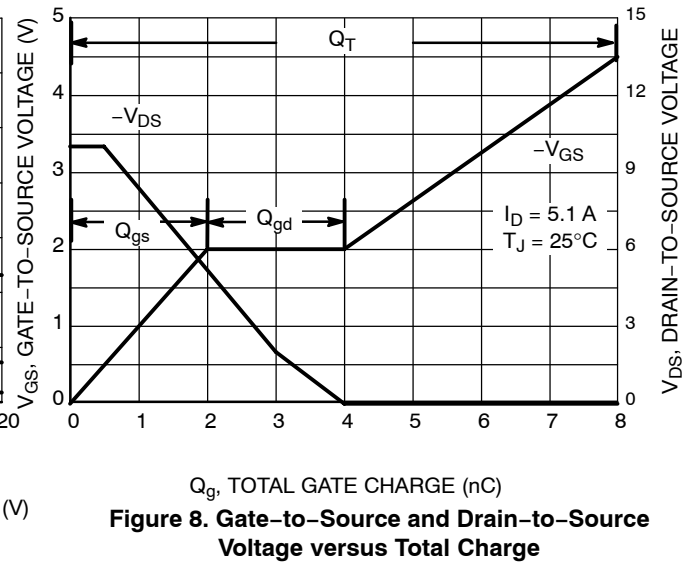
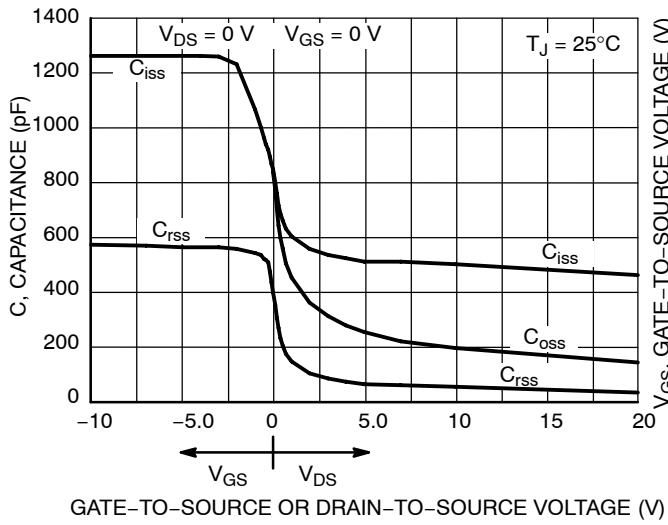


Figure 6. Drain-to-Source Leakage Current versus Voltage



MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



SCALE 2:1

TSOP-6 CASE 318G-02 ISSUE V

DATE 12 JUN 2012



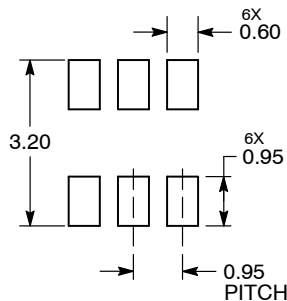
NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.15 PER SIDE. DIMENSIONS D AND E1 ARE DETERMINED AT DATUM H.
5. PIN ONE INDICATOR MUST BE LOCATED IN THE INDICATED ZONE.

DIM	MILLIMETERS		
	MIN	NOM	MAX
A	0.90	1.00	1.10
A1	0.01	0.06	0.10
b	0.25	0.38	0.50
c	0.10	0.18	0.26
D	2.90	3.00	3.10
E	2.50	2.75	3.00
E1	1.30	1.50	1.70
e	0.85	0.95	1.05
L	0.20	0.40	0.60
L2	0.25 BSC		
M	0°	-	10°

- | | | | | | |
|--|--|---|---|---|--|
| STYLE 1:
PIN 1. DRAIN
2. DRAIN
3. GATE
4. SOURCE
5. DRAIN
6. DRAIN | STYLE 2:
PIN 1. EMITTER 2
2. BASE 1
3. COLLECTOR 1
4. EMITTER 1
5. BASE 2
6. COLLECTOR 2 | STYLE 3:
PIN 1. ENABLE
2. N/C
3. R BOOST
4. Vz
5. V in
6. V out | STYLE 4:
PIN 1. N/C
2. V in
3. NOT USED
4. GROUND
5. ENABLE
6. LOAD | STYLE 5:
PIN 1. EMITTER 2
2. BASE 2
3. COLLECTOR 1
4. EMITTER 1
5. BASE 1
6. COLLECTOR 2 | STYLE 6:
PIN 1. COLLECTOR
2. COLLECTOR
3. BASE
4. EMITTER
5. COLLECTOR
6. COLLECTOR |
| STYLE 7:
PIN 1. COLLECTOR
2. COLLECTOR
3. BASE
4. N/C
5. COLLECTOR
6. EMITTER | STYLE 8:
PIN 1. Vbus
2. D(in)
3. D(in)+
4. D(out)+
5. D(out)
6. GND | STYLE 9:
PIN 1. LOW VOLTAGE GATE
2. DRAIN
3. SOURCE
4. DRAIN
5. DRAIN
6. HIGH VOLTAGE GATE | STYLE 10:
PIN 1. D(OUT)+
2. GND
3. D(OUT)-
4. D(IN)-
5. VBUS
6. D(IN)+ | STYLE 11:
PIN 1. SOURCE 1
2. DRAIN 2
3. DRAIN 2
4. SOURCE 2
5. GATE 1
6. DRAIN 1/GATE 2 | STYLE 12:
PIN 1. I/O
2. GROUND
3. I/O
4. I/O
5. VCC
6. I/O |
| STYLE 13:
PIN 1. GATE 1
2. SOURCE 2
3. GATE 2
4. DRAIN 2
5. SOURCE 1
6. DRAIN 1 | STYLE 14:
PIN 1. ANODE
2. SOURCE
3. GATE
4. CATHODE/DRAIN
5. CATHODE/DRAIN
6. CATHODE/DRAIN | STYLE 15:
PIN 1. ANODE
2. SOURCE
3. GATE
4. DRAIN
5. N/C
6. CATHODE | STYLE 16:
PIN 1. ANODE/CATHODE
2. BASE
3. EMITTER
4. COLLECTOR
5. ANODE
6. CATHODE | STYLE 17:
PIN 1. EMITTER
2. BASE
3. ANODE/CATHODE
4. ANODE
5. CATHODE
6. COLLECTOR | |

RECOMMENDED SOLDERING FOOTPRINT*



DIMENSIONS: MILLIMETERS

*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

GENERIC MARKING DIAGRAM*



IC

STANDARD

- | | |
|----------------------------|----------------------------|
| XXX = Specific Device Code | XXX = Specific Device Code |
| A = Assembly Location | M = Date Code |
| Y = Year | ▪ = Pb-Free Package |
| W = Work Week | |
| ▪ = Pb-Free Package | |

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

DOCUMENT NUMBER:	98ASB14888C	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	TSOP-6	PAGE 1 OF 1

onsemi and onsemi are trademarks of Semiconductor Components Industries, LLC dba onsemi or its subsidiaries in the United States and/or other countries. onsemi reserves the right to make changes without further notice to any products herein. onsemi makes no warranty, representation or guarantee regarding the 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. onsemi does not convey any license under its patent rights nor the rights of others.

onsemi, **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**'s 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.

ADDITIONAL INFORMATION

TECHNICAL PUBLICATIONS:

Technical Library: www.onsemi.com/design/resources/technical-documentation
onsemi Website: www.onsemi.com

ONLINE SUPPORT: www.onsemi.com/support

For additional information, please contact your local Sales Representative at www.onsemi.com/support/sales

