

TinyLogic ULP-A Dual 2-Input NAND Gate



ON Semiconductor®

www.onsemi.com

NC7WP00

The NC7WP00 is a dual 2-input NAND gate in tiny footprint packages. The device is designed to operate for $V_{CC} = 0.9\text{ V}$ to 3.6 V .

Features

- Designed for 0.9 V to 3.6 V V_{CC} Operation
- 2.1 ns t_{PD} at 3.3 V (Typ)
- Inputs/Outputs Over-Voltage Tolerant up to 3.6 V
- I_{OFF} Supports Partial Power Down Protection
- Source/Sink 2.6 mA at 3.3 V
- Available in US8 and MicroPak™ Packages
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

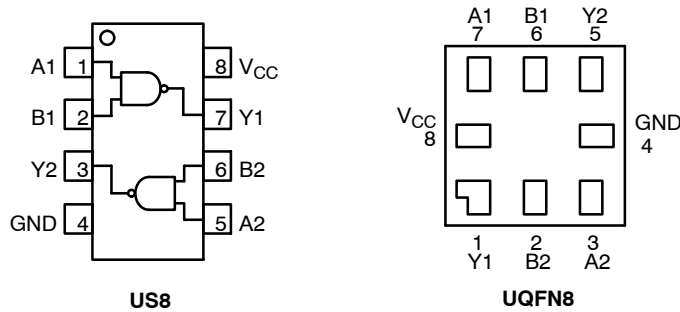


Figure 1. Pinout Diagrams (Top Views)

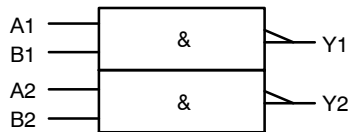


Figure 2. Logic Symbol

PIN ASSIGNMENT

| Pin | US8 | UQFN8 |
|-----|----------|----------|
| 1 | A1 | Y1 |
| 2 | B1 | B2 |
| 3 | Y2 | A2 |
| 4 | GND | GND |
| 5 | A2 | Y2 |
| 6 | B2 | B1 |
| 7 | Y1 | A1 |
| 8 | V_{CC} | V_{CC} |

FUNCTION TABLE ($Y = \overline{AB}$)

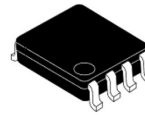
| Inputs | | Output |
|--------|---|--------|
| A | B | Y |
| L | L | H |
| L | H | H |
| H | L | H |
| H | H | L |

NOTE: H = HIGH Logic Level
L = LOW Logic Level

MARKING DIAGRAMS



UQFN8
1.6X1.6, 0.5P
CASE 523AY



US8
CASE 846AN



CC, XXXX = Specific Device Code
KK = 2-Digit Lot Run Traceability Code
XY = 2-Digit Date Code Format
Z = Assembly Plant Code
A = Assembly Site
L = Wafer Lot Number
YW = Assembly Start Week

ORDERING INFORMATION

See detailed ordering, marking and shipping information on page 6 of this data sheet.

NC7WP00

MAXIMUM RATINGS

| Symbol | Characteristics | Value | Unit |
|-----------------------|--|--|-----------------------------|
| V_{CC} | DC Supply Voltage | -0.5 to +4.3 | V |
| V_{IN} | DC Input Voltage | -0.5 to +4.3 | V |
| V_{OUT} | DC Output Voltage Active-Mode (High or Low State) Tri-State Mode (Note 1) Power-Down Mode ($V_{CC} = 0\text{ V}$) | -0.5 to $V_{CC} + 0.5$ -0.5 to +4.3 -0.5 to +4.3 | V |
| I_{IK} | DC Input Diode Current $V_{IN} < \text{GND}$ | -50 | mA |
| I_{OK} | DC Output Diode Current $V_{OUT} < \text{GND}$ | -50 | mA |
| I_{OUT} | DC Output Source/Sink Current | ± 50 | mA |
| I_{CC} or I_{GND} | DC Supply Current per Supply Pin or Ground Pin | ± 50 | mA |
| T_{STG} | Storage Temperature Range | -65 to +150 | $^{\circ}\text{C}$ |
| T_L | Lead Temperature, 1 mm from Case for 10 Seconds | 260 | $^{\circ}\text{C}$ |
| T_J | Junction Temperature Under Bias | +150 | $^{\circ}\text{C}$ |
| θ_{JA} | Thermal Resistance (Note 2) US8 MicroPak | 250 210 | $^{\circ}\text{C}/\text{W}$ |
| P_D | Power Dissipation in Still Air US8 MicroPak | 500 595 | mW |
| MSL | Moisture Sensitivity | Level 1 | - |
| F_R | Flammability Rating Oxygen Index: 28 to 34 | UL 94 V-0 @ 0.125 in | - |
| V_{ESD} | ESD Withstand Voltage (Note 3) Human Body Model Charged Device Model | 2000 1000 | V |
| $I_{Latchup}$ | Latchup Performance (Note 4) | ± 100 | mA |

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.

1. Applicable to devices with outputs that may be tri-stated.
2. Measured with minimum pad spacing on an FR4 board, using 10 mm-by-1 inch, 2 ounce copper trace no air flow per JESD51-7.
3. HBM tested to EIA / JESD22-A114-A. CDM tested to JESD22-C101-A. JEDEC recommends that ESD qualification to EIA/JESD22-A115A (Machine Model) be discontinued.
4. Tested to EIA/JESD78 Class II.

RECOMMENDED OPERATING CONDITIONS

| Symbol | Parameter | Min | Max | Unit |
|------------|--|-------------|------------------------|--------------------|
| V_{CC} | Positive DC Supply Voltage | 0.9 | 3.6 | V |
| V_{IN} | DC Input Voltage | 0 | 3.6 | V |
| V_{OUT} | DC Output Voltage Active-Mode (High or Low State) Tri-State Mode (Note 1) Power-Down Mode ($V_{CC} = 0\text{ V}$) | 0 0 0 | V_{CC} 3.6 3.6 | V |
| T_A | Operating Temperature Range | -40 | +85 | $^{\circ}\text{C}$ |
| t_r, t_f | Input Transition Rise and Fall Time $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$ | 0 | 10 | ns/V |

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

NC7WP00

DC ELECTRICAL CHARACTERISTICS

| Symbol | Parameter | Condition | V _{CC} (V) | T _A = 25°C | | | T _A = -40°C to +85°C | | Unit |
|---------------------------|---------------------------|---|---------------------|------------------------|-----------------------|------------------------|---------------------------------|------------------------|------|
| | | | | Min | Typ | Max | Min | Max | |
| V _{IH} | High-Level Input Voltage | | 0.9 | - | 0.5 | - | - | - | V |
| | | | 1.1 to 1.3 | 0.65 x V _{CC} | - | - | 0.65 x V _{CC} | - | |
| | | | 1.4 to 1.6 | 0.65 x V _{CC} | - | - | 0.65 x V _{CC} | - | |
| | | | 1.65 to 1.95 | 0.65 x V _{CC} | - | - | 0.65 x V _{CC} | - | |
| | | | 2.3 to 2.7 | 1.6 | - | - | 1.6 | - | |
| 3.0 to 3.6 | 2.1 | - | - | 2.1 | - | | | | |
| V _{IL} | Low-Level Input Voltage | | 0.9 | - | 0.5 | - | - | - | V |
| | | | 1.1 to 1.3 | - | - | 0.35 x V _{CC} | - | 0.35 x V _{CC} | |
| | | | 1.4 to 1.6 | - | - | 0.35 x V _{CC} | - | 0.35 x V _{CC} | |
| | | | 1.65 to 1.95 | - | - | 0.35 x V _{CC} | - | 0.35 x V _{CC} | |
| | | | 2.3 to 2.7 | - | - | 0.7 | - | 0.7 | |
| 3.0 to 3.6 | - | - | 0.9 | - | 0.9 | | | | |
| V _{OH} | High-Level Output Voltage | V _{IN} = V _{IH} or V _{IL} | | | | | | | V |
| | | I _{OH} = -20 μA | 0.9 | - | V _{CC} - 0.1 | - | - | - | |
| | | | 1.1 to 1.3 | V _{CC} - 0.1 | - | - | V _{CC} - 0.1 | - | |
| | | | 1.4 to 1.6 | V _{CC} - 0.1 | - | - | V _{CC} - 0.1 | - | |
| | | | 1.65 to 1.95 | V _{CC} - 0.1 | - | - | V _{CC} - 0.1 | - | |
| | | | 2.3 to 2.7 | V _{CC} - 0.1 | - | - | V _{CC} - 0.1 | - | |
| | | | 3.0 to 3.6 | V _{CC} - 0.1 | - | - | V _{CC} - 0.1 | - | |
| | | I _{OH} = -0.5 mA | 1.1 to 1.3 | 0.75 x V _{CC} | - | - | 0.70 x V _{CC} | - | |
| | | I _{OH} = -1 mA | 1.4 to 1.6 | 1.07 | - | - | 0.99 | - | |
| | | I _{OH} = -1.5 mA | 1.65 to 1.95 | 1.24 | - | - | 1.22 | - | |
| I _{OH} = -2.1 mA | 2.3 to 2.7 | 1.95 | - | - | 1.87 | - | | | |
| I _{OH} = -2.6 mA | 3.0 to 3.6 | 2.61 | - | - | 2.55 | - | | | |
| V _{OL} | Low-Level Output Voltage | V _{IN} = V _{IH} or V _{IL} | | | | | | | V |
| | | I _{OL} = 20 μA | 0.9 | - | 0.1 | - | - | - | |
| | | | 1.1 to 1.3 | - | - | 0.1 | - | 0.1 | |
| | | | 1.4 to 1.6 | - | - | 0.1 | - | 0.1 | |
| | | | 1.65 to 1.95 | - | - | 0.1 | - | 0.1 | |
| | | | 2.3 to 2.7 | - | - | 0.1 | - | 0.1 | |
| | | | 3.0 to 3.6 | - | - | 0.1 | - | 0.1 | |
| | | I _{OL} = 0.5 mA | 1.1 to 1.3 | - | - | 0.3 x V _{CC} | - | 0.3 x V _{CC} | |
| | | I _{OL} = 1 mA | 1.4 to 1.6 | - | - | 0.31 | - | 0.37 | |
| | | I _{OL} = 1.5 mA | 1.65 to 1.95 | - | - | 0.31 | - | 0.35 | |
| I _{OL} = 2.1 mA | 2.3 to 2.7 | - | - | 0.31 | - | 0.33 | | | |
| I _{OL} = 2.6 mA | 3.0 to 3.6 | - | - | 0.31 | - | 0.33 | | | |
| I _{IN} | Input Leakage Current | V _{IN} = 0 V to 3.6 V | 0.9 to 3.6 | - | - | ±0.1 | - | ±0.5 | μA |
| I _{OFF} | Power Off Leakage Current | V _{IN} = 0 V to 3.6 V or V _{OUT} = 0 V to 3.6 V | 0 | - | - | 0.5 | - | 0.5 | μA |
| I _{CC} | Quiescent Supply Current | V _{IN} = V _{CC} or GND | 0.9 to 3.6 | - | - | 0.9 | - | 0.9 | μA |

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.

NC7WP00

AC ELECTRICAL CHARACTERISTICS

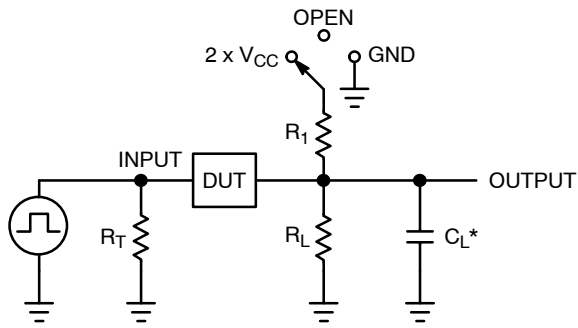
| Symbol | Parameter | Condition | V _{CC} (V) | T _A = 25°C | | | T _A = -40°C to +85°C | | Unit |
|-------------------------------------|--|---|---------------------|-----------------------|------|------|---------------------------------|------|------|
| | | | | Min | Typ | Max | Min | Max | |
| t _{PLH} , t _{PHL} | Propagation Delay, (A or B) to Y (Figures 3 and 4) | R _L = 1 MΩ, C _L = 10 pF | 0.9 | - | 40.7 | - | - | - | ns |
| | | | 1.10 to 1.30 | - | 10.9 | 23.5 | - | 31.0 | |
| | | | 1.40 to 1.60 | - | 5.6 | 12.0 | - | 14.0 | |
| | | | 1.65 to 1.95 | - | 3.7 | 10.0 | - | 12.0 | |
| | | | 2.3 to 2.7 | - | 2.7 | 7.0 | - | 8.0 | |
| | | | 3.0 to 3.6 | - | 2.1 | 6.0 | - | 7.0 | |
| t _{PLH} , t _{PHL} | Propagation Delay, (A or B) to Y (Figures 3 and 4) | R _L = 1 MΩ, C _L = 15 pF | 0.9 | - | 42.2 | - | - | - | ns |
| | | | 1.10 to 1.30 | - | 11.4 | 24.9 | - | 34.0 | |
| | | | 1.40 to 1.60 | - | 6.0 | 13.0 | - | 16.0 | |
| | | | 1.65 to 1.95 | - | 4.0 | 10.0 | - | 12.0 | |
| | | | 2.3 to 2.7 | - | 3.0 | 7.0 | - | 8.0 | |
| | | | 3.0 to 3.6 | - | 2.3 | 6.0 | - | 7.0 | |
| t _{PLH} , t _{PHL} | Propagation Delay, (A or B) to Y (Figures 3 and 4) | R _L = 1 MΩ, C _L = 30 pF | 0.9 | - | 46.4 | - | - | - | ns |
| | | | 1.10 to 1.30 | - | 13.0 | 28.9 | - | 43.0 | |
| | | | 1.40 to 1.60 | - | 7.3 | 16.0 | - | 18.0 | |
| | | | 1.65 to 1.95 | - | 5.1 | 12.0 | - | 14.0 | |
| | | | 2.3 to 2.7 | - | 3.7 | 9.0 | - | 10.0 | |
| | | | 3.0 to 3.6 | - | 2.9 | 7.0 | - | 9.0 | |

CAPACITIVE CHARACTERISTICS

| Symbol | Parameter | Test Condition | Typical (T _A = 25°C) | Unit |
|------------------|--|--|---------------------------------|------|
| C _{IN} | Input Capacitance | V _{CC} = 0 V | 2.0 | pF |
| C _{OUT} | Output Capacitance | V _{CC} = 0 V | 4.0 | pF |
| C _{PD} | Power Dissipation Capacitance (Note 5) | f = 10 MHz, V _{CC} = 0.9 to 3.6 V, V _{IN} = 0 V or V _{CC} | 6.0 | pF |

5. C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation I_{CC(OPR)} = C_{PD} • V_{CC} • f_{in} + I_{CC}. C_{PD} is used to determine the no-load dynamic power consumption: P_D = C_{PD} • V_{CC}² • f_{in} + I_{CC} • V_{CC}.

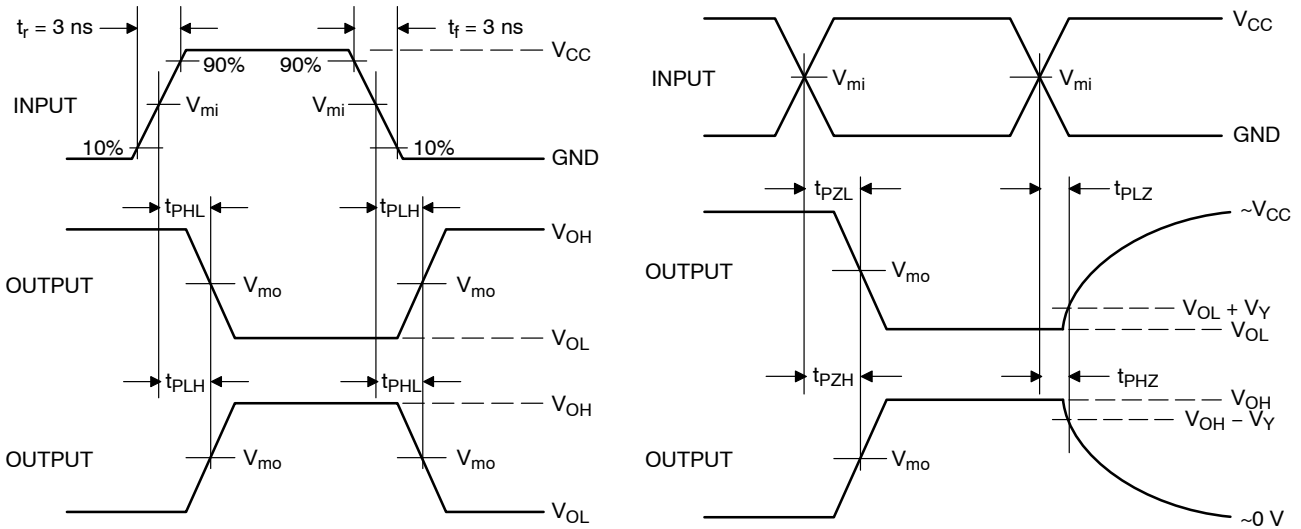
NC7WP00



C_L includes probe and jig capacitance
 R_T is Z_{OUT} of pulse generator (typically 50 Ω)
 $f = 1$ MHz

| Test | Switch Position |
|---------------------|-------------------|
| t_{PLH} / t_{PHL} | Open |
| t_{PLZ} / t_{PZL} | $2 \times V_{CC}$ |
| t_{PHZ} / t_{PZH} | GND |

Figure 3. Test Circuit



| V_{CC}, V | V_{mi}, V | V_{mo}, V | V_Y, V |
|--------------|--------------|--------------|----------|
| 0.9 | $V_{CC} / 2$ | $V_{CC} / 2$ | 0.1 |
| 1.1 to 1.3 | $V_{CC} / 2$ | $V_{CC} / 2$ | 0.1 |
| 1.4 to 1.6 | $V_{CC} / 2$ | $V_{CC} / 2$ | 0.1 |
| 1.65 to 1.95 | $V_{CC} / 2$ | $V_{CC} / 2$ | 0.15 |
| 2.3 to 2.7 | $V_{CC} / 2$ | $V_{CC} / 2$ | 0.15 |
| 3.0 to 3.6 | 1.5 | 1.5 | 0.3 |

Figure 4. Switching Waveforms

NC7WP00

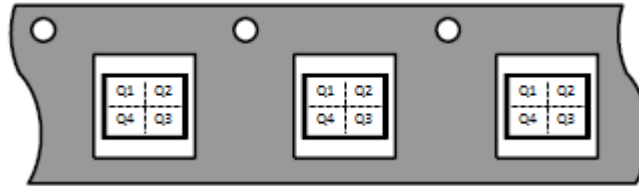
ORDERING INFORMATION

| Device | Package | Marking | Pin 1 Orientation (See below) | Shipping [†] |
|------------|-----------------|---------|----------------------------------|-----------------------|
| NC7WP00K8X | US8 | WP00 | Q4 | 3000 / Tape & Reel |
| NC7WP00L8X | MicroPak, UQFN8 | Y3 | Q4 | 5000 / Tape & Reel |

[†]For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

Pin 1 Orientation in Tape and Reel

Direction of Feed



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

UQFN8 1.6X1.6, 0.5P
CASE 523AY
ISSUE O

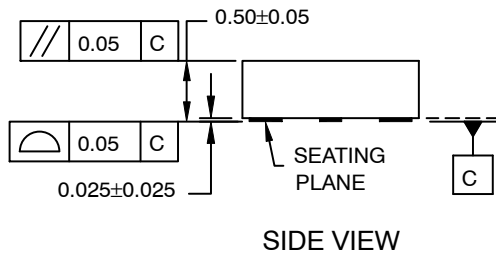
DATE 31 AUG 2016



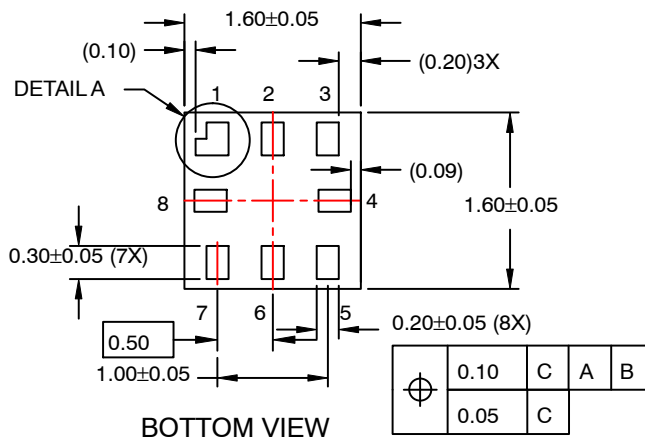
**RECOMMENDED
LAND PATTERN**

NOTES:

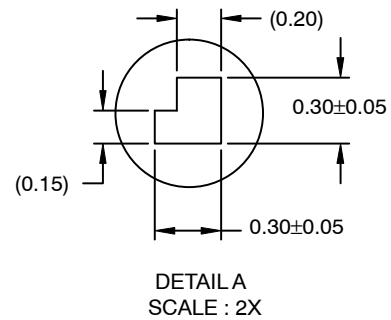
- A. PACKAGE CONFORMS TO JEDEC MO-255 VARIATION UAAD.
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 2009.
- D. LAND PATTERN RECOMMENDATION IS EXISTING INDUSTRY LAND PATTERN.



SIDE VIEW



BOTTOM VIEW



**DETAIL A
SCALE : 2X**

| | | |
|-------------------------|----------------------------|--|
| DOCUMENT NUMBER: | 98AON13591G | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red. |
| DESCRIPTION: | UQFN8 1.6X1.6, 0.5P | PAGE 1 OF 1 |

ON Semiconductor and **ON** are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. 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. ON Semiconductor does not convey any license under its patent rights nor the rights of others.



US8
CASE 846AN
ISSUE O

DATE 31 DEC 2016



NOTES:

- A. CONFORMS TO JEDEC REGISTRATION MO-187
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- D. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M, 1994.



| | | |
|-------------------------|-------------|--|
| DOCUMENT NUMBER: | 98AON13778G | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red. |
| DESCRIPTION: | US8 | PAGE 1 OF 1 |

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 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. ON Semiconductor 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.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:

Email Requests to: orderlit@onsemi.com

onsemi Website: www.onsemi.com

TECHNICAL SUPPORT

North American Technical Support:

Voice Mail: 1 800-282-9855 Toll Free USA/Canada

Phone: 011 421 33 790 2910

Europe, Middle East and Africa Technical Support:

Phone: 00421 33 790 2910

For additional information, please contact your local Sales Representative