

# NS5B1G385

## Analog Switch, Single SPST, (NO) Normally Open

The NS5B1G385 is Single Pole Single Throw (SPST) high-speed TTL-compatible switch. The low resistance and capacitance characteristics of this switch make it ideal for low-distortion audio, video, and data routing applications. The switch has a normally open logic configuration meaning the switch is on (NO connected to COM) when IN is high. These switches are available in 5-pin SC-70 and 5-pin TSOP-5 (SOT23-5) packages for operation over the industrial (-40°C to +85°C) temperature range.

### Features

- $V_{CC}$  Operating Range: 2.0 V to 5.5 V
- Low On Resistance :  $R_{ON}$ : 4.0  $\Omega$  Typical @  $V_{CC} = 4.5$  V
- Minimal Propagation Delay :  $t_{pd} < 0.5$  ns
- Control Input Compatible with TTL Levels
- ESD Performance: Human Body Model  $> \pm 2$  kV
- 5-Pin SC-70 or 5-Pin TSOP-5 Packages Available
- These are Pb-Free Devices

### Typical Applications

- Audio, Video, and High-Speed Data Switching
- Mobile Phones
- Portable Devices
- Desktop & Notebook Computing



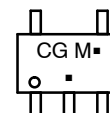
ON Semiconductor®

<http://onsemi.com>

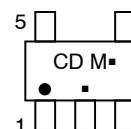
### MARKING DIAGRAMS



SC-70  
CASE 419A



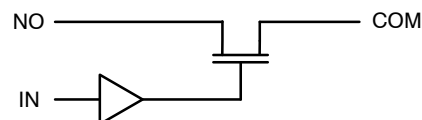
TSOP-5  
(SOT23-5)  
CASE 483



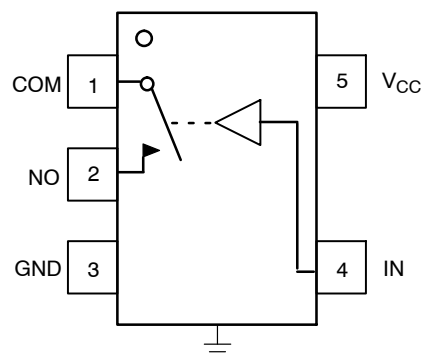
CG = For SC-70  
CD = For TSOP-5  
M = Date Code  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

### LOGIC DIAGRAM



### PIN ASSIGNMENTS



### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 4 of this data sheet.

# NS5B1G385

## PIN DESCRIPTION

| PIN # | Name            | Direction | Description               |
|-------|-----------------|-----------|---------------------------|
| 1     | COM             | I/O       | Common Signal Line        |
| 2     | NO              | I/O       | Normally Open Signal Line |
| 3     | GND             | Input     | Ground                    |
| 4     | IN              | Input     | Control Signal Line       |
| 5     | V <sub>CC</sub> | Input     | Voltage Supply            |

## TRUTH TABLE

| IN Control Input | Function                 |
|------------------|--------------------------|
| L                | NO Disconnected from COM |
| H                | NO Connected to COM      |

## MAXIMUM RATINGS

| Symbol              | Pins            | Rating                           | Value                         | Condition      | Unit |
|---------------------|-----------------|----------------------------------|-------------------------------|----------------|------|
| V <sub>CC</sub>     | V <sub>CC</sub> | Positive DC Supply Voltage       | -0.5 to +7.0                  |                | V    |
| V <sub>IS</sub>     | NO or COM       | Analog Signal Voltage            | -0.5 to V <sub>CC</sub> + 0.5 |                | V    |
| V <sub>IN</sub>     | IN              | Control Input Voltage            | -0.5 to +7.0                  |                | V    |
| I <sub>IS_CON</sub> | NO or COM       | Analog Signal Continuous Current | ± 300                         | Closed Switch  | mA   |
| I <sub>IS_PK</sub>  | NO or COM       | Analog Signal Peak Current       | ± 500                         | 10% Duty Cycle | mA   |
| I <sub>IN</sub>     | IN              | Control Input Current            | ± 20                          |                | mA   |
| T <sub>STG</sub>    |                 | Storage Temperature Range        | -65 to 150                    |                | °C   |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

## RECOMMENDED OPERATING CONDITIONS

| Symbol                          | Pins            | Parameter                   | Value                  | Condition               | Unit |
|---------------------------------|-----------------|-----------------------------|------------------------|-------------------------|------|
| V <sub>CC</sub>                 | V <sub>CC</sub> | Positive DC Supply Voltage  | 2.0 to 5.5             |                         | V    |
| V <sub>IS</sub>                 | NO or COM       | Analog Signal Voltage       | GND to V <sub>CC</sub> |                         | V    |
| V <sub>IN</sub>                 | IN              | Control Input Voltage       | GND to 5.5             |                         | V    |
| T <sub>A</sub>                  |                 | Operating Temperature Range | -40 to +85             |                         | °C   |
| t <sub>r</sub> , t <sub>f</sub> |                 | Input Rise or Fall Time     | 20                     | V <sub>CC</sub> = 3.3 V | ns/V |
|                                 |                 |                             | 10                     | V <sub>CC</sub> = 5.0 V |      |

Minimum and maximum values are guaranteed through test or design across the **Recommended Operating Conditions**, where applicable. Typical values are listed for guidance only and are based on the particular conditions listed for each section, where applicable. These conditions are valid for all values found in the characteristics tables unless otherwise specified in the test conditions.

## ESD PROTECTION

| Pins     | Description      | Minimum Voltage |
|----------|------------------|-----------------|
| All Pins | Human Body Model | 2 kV            |

# NS5B1G385

## DC ELECTRICAL CHARACTERISTICS

### CONTROL INPUT (Typical: T = 25°C)

| Symbol          | Pins | Parameter             | Test Conditions                       | V <sub>CC</sub><br>(V) | -40°C to +85°C |      |      | Unit |
|-----------------|------|-----------------------|---------------------------------------|------------------------|----------------|------|------|------|
|                 |      |                       |                                       |                        | Min            | Typ  | Max  |      |
| V <sub>IH</sub> | IN   | Control Input High    |                                       | 4.5 – 5.5              | 2.0            |      |      | V    |
| V <sub>IL</sub> | IN   | Control Input Low     |                                       | 4.5 – 5.5              |                |      | 0.8  | V    |
| I <sub>IN</sub> | IN   | Control Input Leakage | 0 ≤ V <sub>IN</sub> ≤ V <sub>CC</sub> | 5.0                    |                | ±0.1 | ±0.5 | μA   |

### SUPPLY CURRENT AND LEAKAGE (Typical: T = 25°C)

| Symbol                    | Pins            | Parameter         | Test Conditions   | V <sub>CC</sub><br>(V) | -40°C to +85°C |      |      | Unit |
|---------------------------|-----------------|-------------------|---|------------------------|----------------|------|------|------|
|                           |                 |                   |   |                        | Min            | Typ  | Max  |      |
| I <sub>NO</sub><br>(OFF)  | NO              | OFF State Leakage | V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub><br>V <sub>NO</sub> = 1.0 V<br>V <sub>COM</sub> = 4.5 V | 5.5                    |                | ±10  | ±100 | nA   |
| I <sub>COM</sub><br>(OFF) | COM             | OFF State Leakage | V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub><br>V <sub>NO</sub> = 4.5 V<br>V <sub>COM</sub> = 1.0 V | 5.5                    |                | ±10  | ±100 | nA   |
| I <sub>CC</sub>           | V <sub>CC</sub> | Quiescent Supply  | V <sub>IN</sub> and V <sub>IS</sub> = V <sub>CC</sub> or GND<br>I <sub>D</sub> = 0 A                        | 2.0 – 5.5              |                | ±0.1 | ±1.0 | μA   |
| I <sub>OFF</sub>          | IN              | Power Off Leakage | V <sub>IN</sub> = 5.5 V or GND  | 0                      |                | ±0.5 | ±1.0 | μA   |

### ON RESISTANCE (Typical: T = 25°C)

| Symbol          | Pins    | Parameter     | Test Conditions  | V <sub>CC</sub><br>(V) | -40°C to +85°C |                    |                  | Unit |
|-----------------|---------|---------------|--|------------------------|----------------|--------------------|------------------|------|
|                 |         |               |  |                        | Min            | Typ                | Max              |      |
| R <sub>ON</sub> | NO, COM | ON Resistance | V <sub>IS</sub> = 0 V, I <sub>ON</sub> = 30 mA<br>V <sub>IS</sub> = 0 V, I <sub>ON</sub> = 64 mA<br>V <sub>IS</sub> = 2.4 V, I <sub>ON</sub> = 15 mA | 4.5<br>4.5<br>4.5      |                | 4.0<br>4.0<br>11.5 | 7.0<br>7.0<br>15 | Ω    |

# NS5B1G385

## AC ELECTRICAL CHARACTERISTICS

**TIMING/FREQUENCY** (Typical: T = 25°C, R<sub>L</sub> = 50 Ω, C<sub>L</sub> = 35 pF, f = 1 MHz)

| Symbol           | Pins      | Parameter         | Test Conditions                        | V <sub>CC</sub> (V) | -40°C to +85°C |     |     | Unit |
|------------------|-----------|-------------------|--|---------------------|----------------|-----|-----|------|
|                  |           |                   |  |                     | Min            | Typ | Max |      |
| t <sub>ON</sub>  | IN to NO  | Turn On Time      | As Above, Figures 1 and 2              | 4.5                 |                |     | 6.0 | ns   |
| t <sub>OFF</sub> | IN to NO  | Turn Off Time     | As Above, Figures 1 and 2              | 4.5                 |                |     | 2.0 | ns   |
| t <sub>PD</sub>  | NO to COM | Propagation Delay | As Above                               | 4.5                 |                |     | 0.5 | ns   |
| BW               |           | -3dB Bandwidth    | C <sub>L</sub> = 5 pF, Figures 3 and 4 | 4.5                 |                | 330 |     | MHz  |

**CAPACITANCE** (Typical: T = 25°C, R<sub>L</sub> = 50 Ω, C<sub>L</sub> = 5 pF, f = 1 MHz)

| Symbol           | Pins      | Parameter       | Test Conditions                                  | V <sub>CC</sub> (V) | -40°C to +85°C |     |     | Unit |
|------------------|-----------|-----------------|--|---------------------|----------------|-----|-----|------|
|                  |           |                 |  |                     | Min            | Typ | Max |      |
| C <sub>IN</sub>  | IN        | Control Input   |  | 0 V                 |                | 2.2 |     | pF   |
| C <sub>ON</sub>  | NO to COM | Through Switch  | V <sub>IN</sub> = 0V                             | 4.5 V               |                | 12  |     | pF   |
| C <sub>OFF</sub> | NO        | Unselected Port | V <sub>IS</sub> = 4.5 V, V <sub>IN</sub> = 4.5 V | 4.5 V               |                | 4.1 |     | pF   |

## DEVICE ORDERING INFORMATION

| Device Order Number | Package Type        | Tape & Reel Size <sup>†</sup> |
|---------------------|---------------------|-------------------------------|
| NS5B1G385DFT2G      | SC-70<br>(Pb-Free)  | 3000 / Tape & Reel            |
| NS5B1G385DTT1G      | TSOP-5<br>(Pb-Free) | 3000 / 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 Specifications Brochure, BRD8011/D.

# NS5B1G385

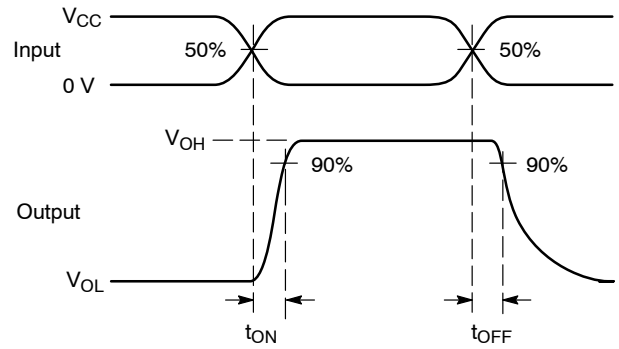
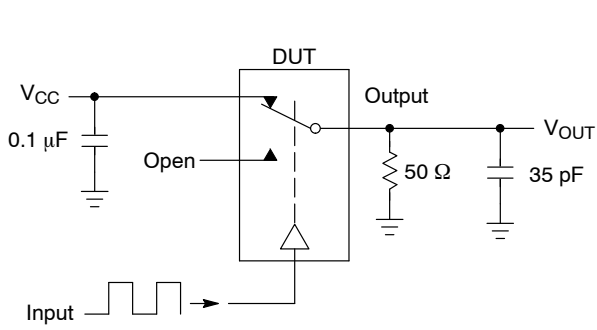


Figure 1.  $t_{ON}/t_{OFF}$

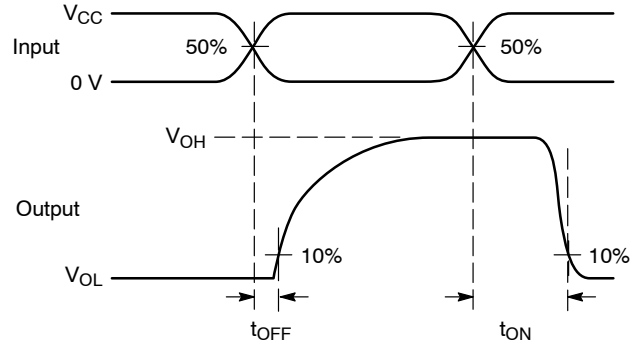
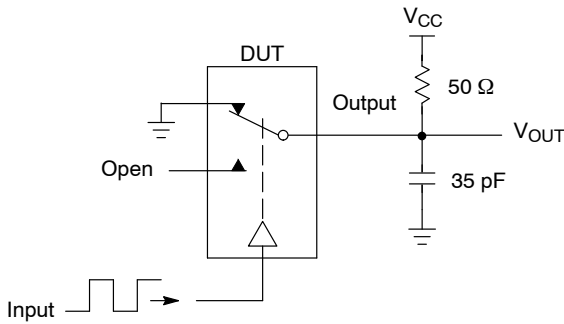
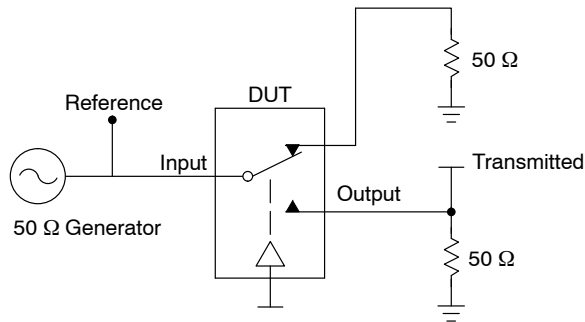


Figure 2.  $t_{ON}/t_{OFF}$



Channel switch control/s test socket is normalized. Off isolation is measured across an off channel. On loss is the bandwidth of an On switch.  $V_{ISO}$ , Bandwidth and  $V_{ONL}$  are independent of the input signal direction.

$$V_{ISO} = \text{Off Channel Isolation} = 20 \text{ Log} \left( \frac{V_{OUT}}{V_{IN}} \right) \text{ for } V_{IN} \text{ at } 100 \text{ kHz}$$

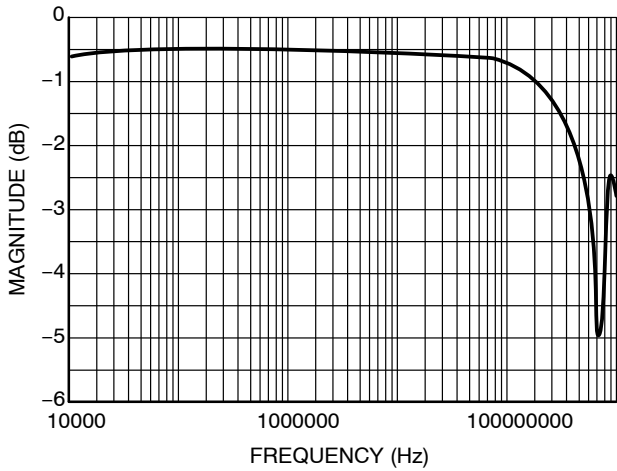
$$V_{ONL} = \text{On Channel Loss} = 20 \text{ Log} \left( \frac{V_{OUT}}{V_{IN}} \right) \text{ for } V_{IN} \text{ at } 100 \text{ kHz to } 50 \text{ MHz}$$

Bandwidth (BW) = the frequency 3 dB below  $V_{ONL}$

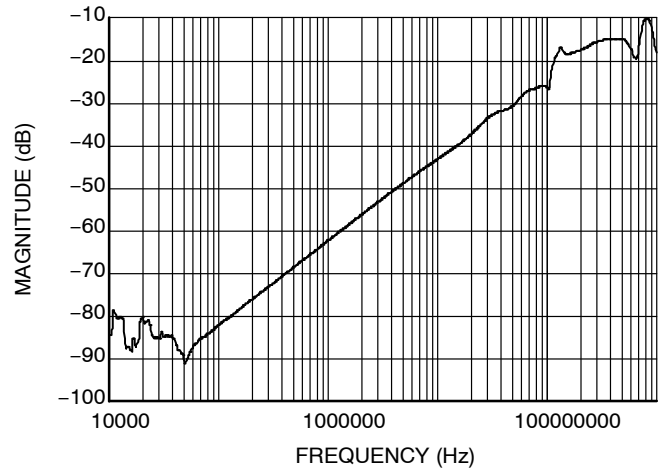
$V_{CT}$  = Use  $V_{ISO}$  setup and test to all other switch analog input/outputs terminated with 50 Ω

Figure 3. Off Channel Isolation/On Channel Loss (BW)/Crosstalk (On Channel to Off Channel)/ $V_{ONL}$

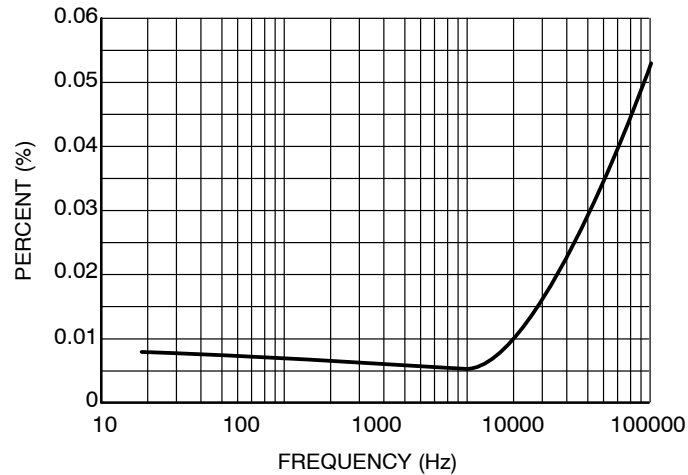
# NS5B1G385



**Figure 4. Typical Bandwidth @  $V_{CC} = 5.5$  V,  $25^{\circ}\text{C}$**



**Figure 5. Off-Channel Isolation @  $V_{CC} = 5.5$  V,  $25^{\circ}\text{C}$**



**Figure 6. Typical Total Harmonic Distortion @  $V_{CC} = 4.5$  V**

# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



SCALE 2:1

## SC-88A (SC-70-5/SOT-353) CASE 419A-02 ISSUE M

DATE 11 APR 2023



RECOMMENDED  
MOUNTING FOOTPRINT

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

### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETERS
3. 419A-01 OBSOLETE. NEW STANDARD 419A-02
4. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.1016MM PER SIDE.

| DIM | MILLIMETERS |      |      |
|-----|-------------|------|------|
|     | MIN.        | NOM. | MAX. |
| A   | 0.80        | 0.95 | 1.10 |
| A1  | ---         | ---  | 0.10 |
| A3  | 0.20 REF    |      |      |
| b   | 0.10        | 0.20 | 0.30 |
| c   | 0.10        | ---  | 0.25 |
| D   | 1.80        | 2.00 | 2.20 |
| E   | 2.00        | 2.10 | 2.20 |
| E1  | 1.15        | 1.25 | 1.35 |
| e   | 0.65 BSC    |      |      |
| L   | 0.10        | 0.15 | 0.30 |

### GENERIC MARKING DIAGRAM\*



\*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.

XXX = Specific Device Code

M = Date Code

▪ = Pb-Free Package

(Note: Microdot may be in either location)

#### STYLE 1:

1. BASE
2. EMITTER
3. BASE
4. COLLECTOR
5. COLLECTOR

#### STYLE 2:

1. ANODE
2. EMITTER
3. BASE
4. COLLECTOR
5. CATHODE

#### STYLE 3:

1. ANODE 1
2. N/C
3. ANODE 2
4. CATHODE 2
5. CATHODE 1

#### STYLE 4:

1. SOURCE 1
2. DRAIN 1/2
3. SOURCE 1
4. GATE 1
5. GATE 2

#### STYLE 5:

1. CATHODE
2. COMMON ANODE
3. CATHODE 2
4. CATHODE 3
5. CATHODE 4

#### STYLE 6:

1. EMITTER 2
2. BASE 2
3. EMITTER 1
4. COLLECTOR
5. COLLECTOR 2/BASE 1

#### STYLE 7:

1. BASE
2. EMITTER
3. BASE
4. COLLECTOR
5. COLLECTOR

#### STYLE 8:

1. CATHODE
2. COLLECTOR
3. N/C
4. BASE
5. EMITTER

#### STYLE 9:

1. ANODE
2. CATHODE
3. ANODE
4. ANODE
5. ANODE

Note: Please refer to datasheet for style callout. If style type is not called out in the datasheet refer to the device datasheet pinout or pin assignment.

|                         |                                 |   |
|-------------------------|---------------------------------|---|
| <b>DOCUMENT NUMBER:</b> | <b>98ASB42984B</b>              | Electronic versions are uncontrolled except when accessed directly from the Document Repository.<br>Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red. |
| <b>DESCRIPTION:</b>     | <b>SC-88A (SC-70-5/SOT-353)</b> | <b>PAGE 1 OF 1</b>  |

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.

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

ON Semiconductor®



SCALE 2:1

### TSOP-5 CASE 483 ISSUE N

DATE 12 AUG 2020



NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.15 PER SIDE. DIMENSION A.
5. OPTIONAL CONSTRUCTION: AN ADDITIONAL TRIMMED LEAD IS ALLOWED IN THIS LOCATION. TRIMMED LEAD NOT TO EXTEND MORE THAN 0.2 FROM BODY.

| DIM | MILLIMETERS |      |
|-----|-------------|------|
|     | MIN         | MAX  |
| A   | 2.85        | 3.15 |
| B   | 1.35        | 1.65 |
| C   | 0.90        | 1.10 |
| D   | 0.25        | 0.50 |
| G   | 0.95 BSC    |      |
| H   | 0.01        | 0.10 |
| J   | 0.10        | 0.26 |
| K   | 0.20        | 0.60 |
| M   | 0°          | 10°  |
| S   | 2.50        | 3.00 |

#### SOLDERING FOOTPRINT\*



\*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\*



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

(Note: Microdot may be in either location)

\*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.

|                  |             |  |
|------------------|-------------|--|
| DOCUMENT NUMBER: | 98ARB18753C | 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-5      | 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](http://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](mailto:orderlit@onsemi.com)

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