

# NL17SG07E

## Buffer with Open Drain Output

The NL17SG07E MiniGate™ is an advanced high-speed CMOS Buffer with Open Drain Output in ultra-small footprint.

The NL17SG07E input and output structures provide protection when voltages up to 3.6 V are applied regardless of the supply voltage.

### Features

- Wide Operating  $V_{CC}$  Range: 0.9 V to 3.6 V
- High Speed:  $t_{PD} = 2.5$  ns (Typ) at  $V_{CC} = 3.0$  V,  $C_L = 15$  pF
- Low Power Dissipation:  $I_{CC} = 0.5$   $\mu$ A (Max) at  $T_A = 25^\circ$ C
- 3.6 V Overvoltage Tolerant (OVT) Input and Output Pins
- Ultra-Small Packages
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

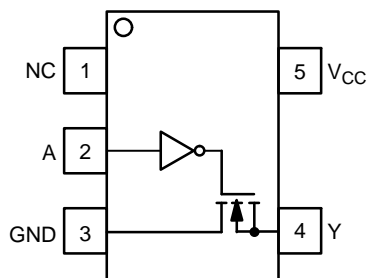


Figure 1. SC-88A  
(Top View)

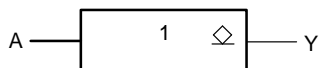


Figure 2. Logic Symbol



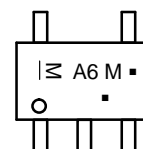
ON Semiconductor®

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SC-88A  
DF SUFFIX  
CASE 419A

### MARKING DIAGRAM



- M = Date Code\*
- = Pb-Free Package

(Note: Microdot may be in either location)

\*Date Code orientation and/or position may vary depending upon manufacturing location.

### PIN ASSIGNMENT

| PIN | NAME     |
|-----|----------|
| 1   | NC       |
| 2   | A        |
| 3   | GND      |
| 4   | Y        |
| 5   | $V_{CC}$ |

### FUNCTION TABLE

| Input A | Output Y |
|---------|----------|
| L       | L        |
| H       | Z        |

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

# NL17SG07E

## MAXIMUM RATINGS

| Symbol        | Parameter  | Value  | Unit |
|---------------|--|--|------|
| $V_{CC}$      | DC Supply Voltage  | -0.5 to +4.6   | V    |
| $V_{IN}$      | DC Input Voltage   | -0.5 to +4.6   | V    |
| $V_{OUT}$     | DC Output Voltage<br>Active Mode, LOW State<br>Tri-State Mode, Output at Hi-Z State<br>Power-Down Mode ( $V_{CC} = 0$ V) | -0.5 to $V_{CC} + 0.5$<br>-0.5 to +4.6<br>-0.5 to +4.6 | V    |
| $I_{IK}$      | DC Input Diode Current<br>$V_{IN} < GND$   | -20  | mA   |
| $I_{OK}$      | DC Output Diode Current<br>$V_{OUT} < GND$   | -20  | mA   |
| $I_{OUT}$     | DC Output Source/Sink Current  | $\pm 20$   | mA   |
| $I_{CC}$      | DC Supply Current per Supply Pin   | $\pm 20$   | mA   |
| $I_{GND}$     | DC Ground Current per Ground Pin   | $\pm 20$   | mA   |
| $T_{STG}$     | Storage Temperature Range  | -65 to +150  | °C   |
| $T_L$         | Lead Temperature, 1 mm from Case for 10 Seconds  | 260  | °C   |
| $T_J$         | Junction Temperature Under Bias  | +150   | °C   |
| MSL           | Moisture Sensitivity   | Level 1  |      |
| $F_R$         | Flammability Rating<br>Oxygen Index: 28 to 34  | UL 94 V-0 @ 0.125 in                                   |      |
| $V_{ESD}$     | ESD Withstand Voltage<br>Human Body Model (Note 2)   | >2000  | V    |
| $I_{LATCHUP}$ | Latch-up Performance above $V_{CC}$ and below GND at 125°C (Note 3)  | $\pm 75$   | 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. Measured with minimum pad spacing on an FR4 board, using 10 mm-by-1 inch, 2-ounce copper trace with no air flow.
2. Tested to EIA/JESD22-A114-A.
3. Tested to EIA/JESD78.

## RECOMMENDED OPERATING CONDITIONS

| Symbol                | Characteristics  | Min               | Max                    | Unit |
|-----------------------|--|-------------------|------------------------|------|
| $V_{CC}$              | Positive DC Supply Voltage   | 0.9               | 3.6                    | V    |
| $V_{IN}$              | Digital Input Voltage  | 0.0               | 3.6                    | V    |
| $V_{OUT}$             | Output Voltage<br>Output at Low State<br>Tri-State Mode, Output at Hi-Z State<br>Power-Down Mode ( $V_{CC} = 0$ V) | 0.0<br>0.0<br>0.0 | $V_{CC}$<br>3.6<br>3.6 | V    |
| $T_A$                 | Operating Temperature Range  | -55               | +125                   | °C   |
| $\Delta t / \Delta V$ | Input Transition Rise or Fall Rate<br>$V_{CC} = 3.3$ V $\pm$ 0.3 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.

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## DC ELECTRICAL CHARACTERISTICS

| Symbol           | Parameter                        | Condition  | V <sub>CC</sub> (V)      | T <sub>A</sub> = 25°C  |     |                        | -55°C ≤ T <sub>A</sub> ≤ 125°C |                        | Unit                   |   |
|------------------|----------------------------------|--|--------------------------|------------------------|-----|------------------------|--------------------------------|------------------------|------------------------|---|
|                  |                                  |  |                          | Min                    | Typ | Max                    | Min                            | Max                    |                        |   |
| V <sub>IH</sub>  | High-Level Input Voltage         |  | 0.9                      | V <sub>CC</sub>        |     |                        | V <sub>CC</sub>                |                        | V                      |   |
|                  |                                  |  | 1.1 to 1.3               | 0.70 x V <sub>CC</sub> |     |                        | 0.70 x V <sub>CC</sub>         |                        |                        |   |
|                  |                                  |  | 1.4 to 1.6               | 0.65 x V <sub>CC</sub> |     |                        | 0.65 x V <sub>CC</sub>         |                        |                        |   |
|                  |                                  |  | 1.65 to 1.95             | 0.65 x V <sub>CC</sub> |     |                        | 0.65 x V <sub>CC</sub>         |                        |                        |   |
|                  |                                  |  | 2.3 to 2.7               | 1.7                    |     |                        | 1.7                            |                        |                        |   |
|                  |                                  |  | 3.0 to 3.6               | 2.0                    |     |                        | 2.0                            |                        |                        |   |
| V <sub>IL</sub>  | Low-Level Input Voltage          |  | 0.9                      |                        |     | GND                    |                                | GND                    | V                      |   |
|                  |                                  |  | 1.1 to 1.3               |                        |     | 0.30 x V <sub>CC</sub> |                                | 0.30 x V <sub>CC</sub> |                        |   |
|                  |                                  |  | 1.4 to 1.6               |                        |     | 0.35 x V <sub>CC</sub> |                                | 0.35 x V <sub>CC</sub> |                        |   |
|                  |                                  |  | 1.65 to 1.95             |                        |     | 0.35 x V <sub>CC</sub> |                                | 0.35 x V <sub>CC</sub> |                        |   |
|                  |                                  |  | 2.3 to 2.7               |                        |     | 0.7                    |                                | 0.7                    |                        |   |
|                  |                                  |  | 3.0 to 3.6               |                        |     | 0.8                    |                                | 0.8                    |                        |   |
| V <sub>OL</sub>  | Low-Level Output Voltage         | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                 | I <sub>OL</sub> = 20 μA  | 0.9                    |     |                        | 0.1                            |                        | 0.1                    | V |
|                  |                                  |  | I <sub>OL</sub> = 0.3 mA | 1.1 to 1.3             |     |                        | 0.25 x V <sub>CC</sub>         |                        | 0.25 x V <sub>CC</sub> |   |
|                  |                                  |  | I <sub>OL</sub> = 1.7 mA | 1.4 to 1.6             |     |                        | 0.25 x V <sub>CC</sub>         |                        | 0.25 x V <sub>CC</sub> |   |
|                  |                                  |  | I <sub>OL</sub> = 3.0 mA | 1.65 to 1.95           |     |                        | 0.45                           |                        | 0.45                   |   |
|                  |                                  |  | I <sub>OL</sub> = 4.0 mA | 2.3 to 2.7             |     |                        | 0.4                            |                        | 0.4                    |   |
|                  |                                  |  | I <sub>OL</sub> = 8.0 mA | 3.0 to 3.6             |     |                        | 0.4                            |                        | 0.4                    |   |
| I <sub>IN</sub>  | Input Leakage Current            | V <sub>IN</sub> = 0 to 3.6 V   | 0.9 to 3.6               |                        |     | ±0.1                   |                                | ±1.0                   | μA                     |   |
| I <sub>CC</sub>  | Quiescent Supply Current         | V <sub>IN</sub> = V <sub>CC</sub> or GND   | 3.6                      |                        |     | 0.5                    |                                | 10                     | μA                     |   |
| I <sub>OZ</sub>  | Output Tri-State Leakage Current | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> , V <sub>OUT</sub> = 0 to 3.6 V | 0.9 to 3.6               |                        |     | 1.0                    |                                | 10                     | μA                     |   |
| I <sub>OFF</sub> | Power Off Leakage Current        | V <sub>IN</sub> = 0 to 3.6 V, V <sub>OUT</sub> = 0 to 3.6 V                          | 0                        |                        |     | 1.0                    |                                | 10                     | 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.

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## AC ELECTRICAL CHARACTERISTICS (Input $t_r = t_f = 3.0$ ns)

| Symbol                                    | Parameter                              | Test Condition                            | $V_{CC}$ (V)                            | $T_A = 25^\circ\text{C}$                  |            |  | $T_A = -55^\circ\text{C to } +125^\circ\text{C}$ |            | Unit |      |    |
|---|--|---|---|---|------------|--|--|------------|------|------|----|
|   |  |   |   | Min                                       | Typ        | Max                                    | Min  | Max        |      |      |    |
| $t_{PZL}$                                 | Propagation Delay, Enable Time, A to Y | $C_L = 10$ pF, $R_1 = R_L = 5$ k $\Omega$ | 0.9                                     | –   | 12         | –                                      | –  | –          | ns   |      |    |
|   |  |   | 1.1 to 1.3                              | –   | 5.5        | 7.9                                    | –  | 9.0        |      |      |    |
|   |  |   | 1.4 to 1.6                              | –   | 4.0        | 5.7                                    | –  | 7.3        |      |      |    |
|   |  |   | 1.65 to 1.95                            | –   | 3.3        | 3.9                                    | –  | 5.9        |      |      |    |
|   |  |   | 2.3 to 2.7                              | –   | 2.7        | 3.3                                    | –  | 4.5        |      |      |    |
|   |  |   | 3.0 to 3.6                              | –   | 2.4        | 2.9                                    | –  | 3.7        |      |      |    |
|   |  | $C_L = 15$ pF, $R_1 = R_L = 5$ k $\Omega$ | 0.9                                     | –   | 12.5       | –                                      | –  | –          | ns   |      |    |
|   |  |   | 1.1 to 1.3                              | –   | 5.8        | 8.1                                    | –  | 9.2        |      |      |    |
|   |  |   | 1.4 to 1.6                              | –   | 4.1        | 6.0                                    | –  | 7.4        |      |      |    |
|   |  |   | 1.65 to 1.95                            | –   | 3.4        | 4.0                                    | –  | 6.2        |      |      |    |
|   |  |   | 2.3 to 2.7                              | –   | 2.8        | 3.4                                    | –  | 4.6        |      |      |    |
|   |  | $C_L = 30$ pF, $R_1 = R_L = 5$ k $\Omega$ | 0.9                                     | –   | 13.2       | –                                      | –  | –          | ns   |      |    |
|   |  |   | 1.1 to 1.3                              | –   | 6.2        | 8.7                                    | –  | 9.8        |      |      |    |
|   |  |   | 1.4 to 1.6                              | –   | 4.5        | 6.2                                    | –  | 7.6        |      |      |    |
|   |  |   | 1.65 to 1.95                            | –   | 3.5        | 4.2                                    | –  | 6.4        |      |      |    |
|   |  |   | 2.3 to 2.7                              | –   | 3.0        | 3.6                                    | –  | 4.7        |      |      |    |
|   |  | $t_{PLZ}$                                 | Propagation Delay, Disable Time, A to Y | $C_L = 10$ pF, $R_1 = R_L = 5$ k $\Omega$ | 0.9        | –                                      | 8.0  | –          | –    | –    | ns |
|   |  |   |   |   | 1.1 to 1.3 | –                                      | 6.5  | 10.9       | –    | 11.5 |    |
| 1.4 to 1.6                                | –                                      |   |   |   | 5.2        | 8.9                                    | –  | 9.5        |      |      |    |
| 1.65 to 1.95                              | –                                      |   |   |   | 4.9        | 8.8                                    | –  | 9.4        |      |      |    |
| 2.3 to 2.7                                | –                                      |   |   |   | 3.8        | 8.4                                    | –  | 9.3        |      |      |    |
| $C_L = 15$ pF, $R_1 = R_L = 5$ k $\Omega$ | 0.9                                    |   |   | –   | 11.1       | –                                      | –  | –          | ns   |      |    |
|   | 1.1 to 1.3                             |   |   | –   | 9.0        | 13.4                                   | –  | 14         |      |      |    |
|   | 1.4 to 1.6                             |   |   | –   | 7.9        | 11.4                                   | –  | 12.0       |      |      |    |
|   | 1.65 to 1.95                           |   |   | –   | 7.6        | 11.3                                   | –  | 11.9       |      |      |    |
|   | 2.3 to 2.7                             |   |   | –   | 6.3        | 10.9                                   | –  | 11.8       |      |      |    |
| $C_L = 30$ pF, $R_1 = R_L = 5$ k $\Omega$ | 0.9                                    |   |   | –   | 16.2       | –                                      | –  | –          | ns   |      |    |
|   | 1.1 to 1.3                             |   |   | –   | 14         | 20.2                                   | –  | 20         |      |      |    |
|   | 1.4 to 1.6                             |   |   | –   | 13         | 18.9                                   | –  | 19.5       |      |      |    |
|   | 1.65 to 1.95                           |   |   | –   | 12.5       | 18.8                                   | –  | 19.4       |      |      |    |
|   | 2.3 to 2.7                             |   |   | –   | 11.2       | 18.4                                   | –  | 19.3       |      |      |    |
| $C_{IN}$                                  | Input Capacitance                      |   |   |   | 0 to 3.6   | –                                      | 3  | –          | –    | –    | pF |
|   |  |   |   |   | $C_{PD}$   | Power Dissipation Capacitance (Note 4) |  | 0.9 to 3.6 | –    | 4    |    |

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

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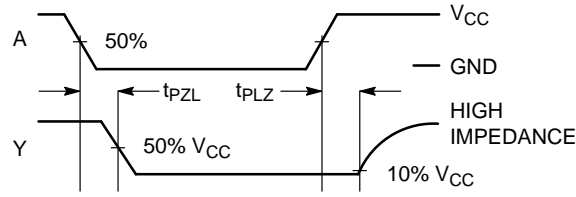
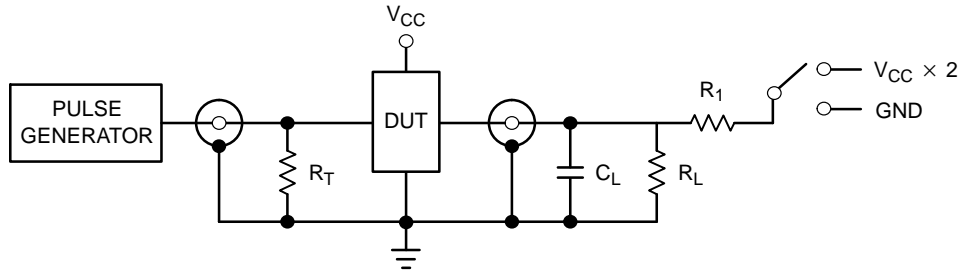


Figure 3. Switching Waveform



| Test             | Switch              |
|------------------|---------------------|
| t <sub>PZL</sub> | V <sub>CC</sub> x 2 |
| t <sub>PLZ</sub> | V <sub>CC</sub> x 2 |

Figure 4. Test Circuit

## ORDERING INFORMATION

| Device         | Package             | Shipping†          |
|----------------|---------------------|--------------------|
| NL17SG07EDFT2G | SC-88A<br>(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 Specifications Brochure, BRD8011/D.

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

ON Semiconductor®



SCALE 2:1

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

DATE 17 JAN 2013



### SOLDER FOOTPRINT

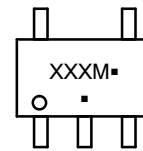


NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 419A-01 OBSOLETE. NEW STANDARD 419A-02.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

| DIM | INCHES    |       | MILLIMETERS |      |
|-----|-----------|-------|-------------|------|
|     | MIN       | MAX   | MIN         | MAX  |
| A   | 0.071     | 0.087 | 1.80        | 2.20 |
| B   | 0.045     | 0.053 | 1.15        | 1.35 |
| C   | 0.031     | 0.043 | 0.80        | 1.10 |
| D   | 0.004     | 0.012 | 0.10        | 0.30 |
| G   | 0.026 BSC |       | 0.65 BSC    |      |
| H   | ---       | 0.004 | ---         | 0.10 |
| J   | 0.004     | 0.010 | 0.10        | 0.25 |
| K   | 0.004     | 0.012 | 0.10        | 0.30 |
| N   | 0.008 REF |       | 0.20 REF    |      |
| S   | 0.079     | 0.087 | 2.00        | 2.20 |

### GENERIC MARKING DIAGRAM\*



- 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. Some products may not follow the Generic Marking.

- |  |  |  |  |  |
|--|--|--|--|--|
| <p>STYLE 1:<br/>PIN 1. BASE<br/>2. EMITTER<br/>3. BASE<br/>4. COLLECTOR<br/>5. COLLECTOR</p>                   | <p>STYLE 2:<br/>PIN 1. ANODE<br/>2. EMITTER<br/>3. BASE<br/>4. COLLECTOR<br/>5. CATHODE</p>  | <p>STYLE 3:<br/>PIN 1. ANODE 1<br/>2. N/C<br/>3. ANODE 2<br/>4. CATHODE 2<br/>5. CATHODE 1</p> | <p>STYLE 4:<br/>PIN 1. SOURCE 1<br/>2. DRAIN 1/2<br/>3. SOURCE 1<br/>4. GATE 1<br/>5. GATE 2</p> | <p>STYLE 5:<br/>PIN 1. CATHODE<br/>2. COMMON ANODE<br/>3. CATHODE 2<br/>4. CATHODE 3<br/>5. CATHODE 4</p>  |
| <p>STYLE 6:<br/>PIN 1. EMITTER 2<br/>2. BASE 2<br/>3. EMITTER 1<br/>4. COLLECTOR<br/>5. COLLECTOR 2/BASE 1</p> | <p>STYLE 7:<br/>PIN 1. BASE<br/>2. EMITTER<br/>3. BASE<br/>4. COLLECTOR<br/>5. COLLECTOR</p> | <p>STYLE 8:<br/>PIN 1. CATHODE<br/>2. COLLECTOR<br/>3. N/C<br/>4. BASE<br/>5. EMITTER</p>      | <p>STYLE 9:<br/>PIN 1. ANODE<br/>2. CATHODE<br/>3. ANODE<br/>4. ANODE<br/>5. ANODE</p>           | <p>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.</p> |

|                  |                          |  |
|------------------|--------------------------|--|
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| DESCRIPTION:     | SC-88A (SC-70-5/SOT-353) | PAGE 1 OF 1  |

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