

# NL7SZ97

## Configurable Multifunction Gate

The NL7SZ97 is an advanced high-speed CMOS multifunction gate. The device allows the user to choose logic functions MUX, AND, OR, NAND, NOR, INVERT and BUFFER. The device has Schmitt-trigger inputs, thereby enhancing noise immunity.

The NL7SZ97 input and output structures provide protection when voltages up to 7.0 V are applied, regardless of the supply voltage.

### Features

- High Speed:  $t_{PD} = 3.3 \text{ ns (Typ) @ } V_{CC} = 5.0 \text{ V}$
- Low Power Dissipation:  $I_{CC} = 1 \mu\text{A (Maximum) at } T_A = 25^\circ\text{C}$
- Power Down Protection Provided on inputs
- Balanced Propagation Delays
- Overvoltage Tolerant (OVT) Input and Output Pins
- Ultra-Small Package
- This is a Pb-Free Device



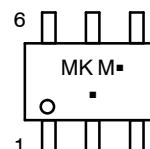
**ON Semiconductor®**

<http://onsemi.com>



**SC-88 (SOT-363)  
CASE 419B**

### MARKING DIAGRAM



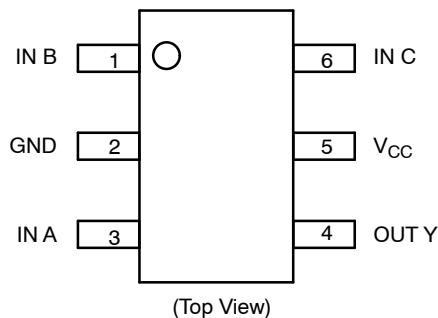
MK = Specific Device Code

M = Date Code

▪ = Pb-Free Package

(Note: Microdot may be in either location)

### PIN ASSIGNMENTS



(Top View)

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 7 of this data sheet.

NL7SZ97

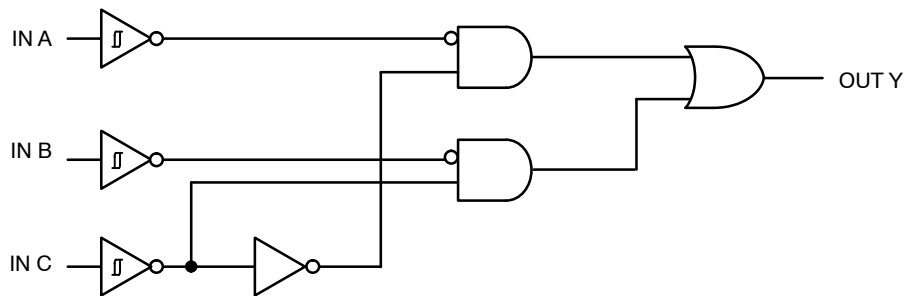


Figure 1. Function Diagram

PIN ASSIGNMENT

|   |                 |
|---|-----------------|
| 1 | IN B            |
| 2 | GND             |
| 3 | IN A            |
| 4 | OUT Y           |
| 5 | V <sub>CC</sub> |
| 6 | IN C            |

FUNCTION TABLE\*

| Input |   |   | Output |
|-------|---|---|--------|
| A     | B | C | Y      |
| L     | L | L | L      |
| L     | L | H | L      |
| L     | H | L | H      |
| L     | H | H | L      |
| H     | L | L | L      |
| H     | L | H | H      |
| H     | H | L | H      |
| H     | H | H | H      |

\*To select a logic function, please refer to “Logic Configurations section”.

LOGIC CONFIGURATIONS

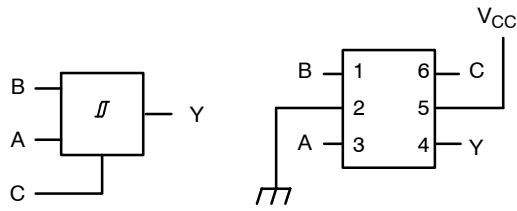


Figure 2. 2-Input MUX

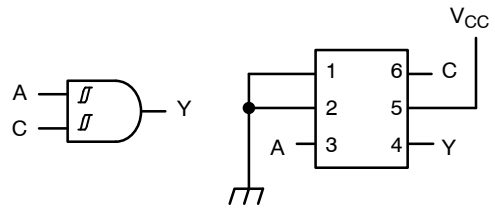


Figure 3. 2-Input AND (When B = "L")

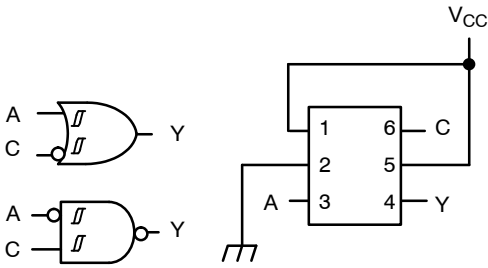


Figure 4. 2-Input OR with Input C Inverted (When B = "H")

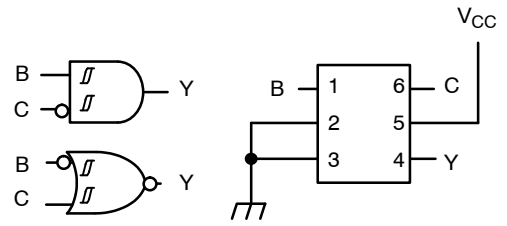


Figure 5. 2-Input AND with Input C Inverted (When A = "L")

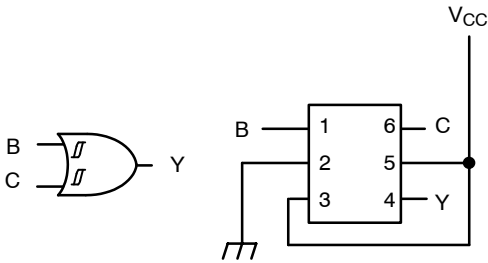


Figure 6. 2-Input OR (When A = "H")

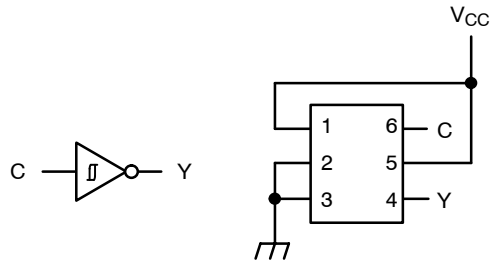


Figure 7. Inverter (When A = "L" and B = "H")

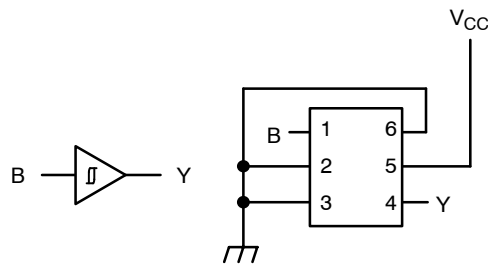


Figure 8. Buffer (When A = C = "L")

## MAXIMUM RATINGS

| Symbol               | Parameter                                                                                                    | Value                | Unit |
|----------------------|--------------------------------------------------------------------------------------------------------------|----------------------|------|
| V <sub>CC</sub>      | DC Supply Voltage                                                                                            | −0.5 to +7.0         | V    |
| V <sub>IN</sub>      | DC Input Voltage                                                                                             | −0.5 to +7.0         | V    |
| V <sub>OUT</sub>     | DC Output Voltage                                                                                            | −0.5 to +7.0         | V    |
| I <sub>IK</sub>      | DC Input Diode Current<br>V <sub>IN</sub> < GND                                                              | −50                  | mA   |
| I <sub>OK</sub>      | DC Output Diode Current<br>V <sub>OUT</sub> < GND                                                            | −50                  | mA   |
| I <sub>O</sub>       | DC Output Source/Sink Current                                                                                | ± 50                 | mA   |
| I <sub>CC</sub>      | DC Supply Current Per Supply Pin                                                                             | ± 100                | mA   |
| I <sub>GND</sub>     | DC Ground Current per Ground Pin                                                                             | ± 100                | mA   |
| T <sub>STG</sub>     | Storage Temperature Range                                                                                    | −65 to +150          | °C   |
| T <sub>L</sub>       | Lead Temperature, 1 mm from Case for 10 Seconds                                                              | 260                  | °C   |
| T <sub>J</sub>       | Junction Temperature Under Bias                                                                              | +150                 | °C   |
| θ <sub>JA</sub>      | Thermal Resistance (Note 1)<br>SC−88                                                                         | 350                  | °C/W |
| P <sub>D</sub>       | Power Dissipation in Still Air at 85°C<br>SC−88                                                              | 200                  | mW   |
| MSL                  | Moisture Sensitivity                                                                                         | Level 1              |      |
| F <sub>R</sub>       | Flammability Rating Oxygen<br>Index: 28 to 34                                                                | UL 94 V−0 @ 0.125 in |      |
| V <sub>ESD</sub>     | ESD Withstand Voltage<br>Human Body Mode (Note 2)<br>Machine Model (Note 3)<br>Charged Device Model (Note 4) | >2000<br>>200<br>N/A | V    |
| I <sub>LATCHUP</sub> | Latchup Performance Above V <sub>CC</sub> and Below GND at 125°C (Note 5)                                    | ± 500                | mA   |

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.

1. Measured with minimum pad spacing on an FR4 board, using 10 mm<sup>2</sup> by 1 inch, 2 ounce copper trace no air flow.
2. Tested to EIA/JESD22−A114−A.
3. Tested to EIA/JESD22−A115−A.
4. Tested to JESD22−C101−A.
5. Tested to EIA/JESD78.

## RECOMMENDED OPERATING CONDITIONS

| Symbol           | Parameter                                                                                                                                   | Min         | Max                              | Unit |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------|-------------|----------------------------------|------|
| V <sub>CC</sub>  | Positive DC Supply Voltage                                                                                                                  | 1.65        | 5.5                              | V    |
| V <sub>IN</sub>  | Digital Input Voltage                                                                                                                       | 0           | 5.5                              | V    |
| V <sub>OUT</sub> | Output Voltage                                                                                                                              | 0           | 5.5                              | V    |
| T <sub>A</sub>   | Operating Free−Air Temperature (Note 6)                                                                                                     | −55         | +125                             | °C   |
| Δt/ΔV            | Input Transition Rise or Fall Rate<br>V <sub>CC</sub> = 2.5 V ± 0.2 V<br>V <sub>CC</sub> = 3.3 V ± 0.3 V<br>V <sub>CC</sub> = 5.0 V ± 0.5 V | 0<br>0<br>0 | No Limit<br>No Limit<br>No Limit | nS/V |

6. The NL7SZ97 will not have degradation in its electrical specifications or Mean−Time−Between−Failure (MTBF) when exposed to a temperature cycle test of 140°C for 21 hours, 135°C for 750 hours and of 130°C for 175 hours.

DC ELECTRICAL CHARACTERISTICS

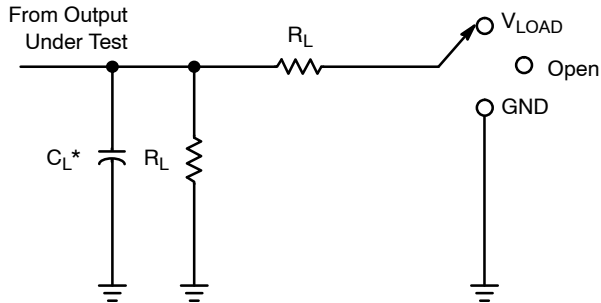
| Symbol          | Parameter                         | Conditions                                                       | V <sub>CC</sub><br>(V) | T <sub>A</sub> = 25°C |     |      | T <sub>A</sub> ≤ +85°C |      | T <sub>A</sub> = -55°C to +125°C |      | Unit |
|-----------------|-----------------------------------|------------------------------------------------------------------|------------------------|-----------------------|-----|------|------------------------|------|----------------------------------|------|------|
|                 |                                   |                                                                  |                        | Min                   | Typ | Max  | Min                    | Max  | Min                              | Max  |      |
| V <sub>T+</sub> | Positive Threshold Voltage        |                                                                  | 1.65                   | 0.79                  |     | 1.16 |                        | 1.16 |                                  | 1.16 | V    |
|                 |                                   |                                                                  | 2.3                    | 1.11                  |     | 1.56 |                        | 1.56 |                                  | 1.56 |      |
|                 |                                   |                                                                  | 3.0                    | 1.5                   |     | 1.87 |                        | 1.87 |                                  | 1.87 |      |
|                 |                                   |                                                                  | 4.5                    | 2.16                  |     | 2.74 |                        | 2.74 |                                  | 2.74 |      |
|                 |                                   |                                                                  | 5.5                    | 2.61                  |     | 3.33 |                        | 3.33 |                                  | 3.33 |      |
| V <sub>T-</sub> | Negative Threshold Voltage        |                                                                  | 1.65                   | 0.35                  |     | 0.62 | 0.35                   |      | 0.35                             |      | V    |
|                 |                                   |                                                                  | 2.3                    | 0.58                  |     | 0.87 | 0.58                   |      | 0.58                             |      |      |
|                 |                                   |                                                                  | 3.0                    | 0.84                  |     | 1.19 | 0.84                   |      | 0.84                             |      |      |
|                 |                                   |                                                                  | 4.5                    | 1.41                  |     | 1.9  | 1.41                   |      | 1.41                             |      |      |
|                 |                                   |                                                                  | 5.5                    | 1.78                  |     | 2.29 | 1.78                   |      | 1.78                             |      |      |
| V <sub>H</sub>  | Hysteresis Voltage                |                                                                  | 1.65                   | 0.30                  |     | 0.62 | 0.30                   | 0.62 | 0.30                             | 0.62 | V    |
|                 |                                   |                                                                  | 2.3                    | 0.40                  |     | 0.8  | 0.40                   | 0.8  | 0.40                             | 0.8  |      |
|                 |                                   |                                                                  | 3.0                    | 0.53                  |     | 0.87 | 0.53                   | 0.87 | 0.53                             | 0.87 |      |
|                 |                                   |                                                                  | 4.5                    | 0.71                  |     | 1.04 | 0.71                   | 1.04 | 0.71                             | 1.04 |      |
|                 |                                   |                                                                  | 5.5                    | 0.8                   |     | 1.2  | 0.8                    | 1.2  | 0.8                              | 1.2  |      |
| V <sub>OH</sub> | Minimum High-Level Output Voltage | V <sub>IN</sub> ≤ V <sub>T-MIN</sub><br>I <sub>OH</sub> = -50 μA | 1.65 – 5.5             | V <sub>CC</sub> – 0.1 |     |      | V <sub>CC</sub> – 0.1  |      | V <sub>CC</sub> – 0.1            |      | V    |
|                 |                                   | V <sub>IN</sub> ≤ V <sub>T-MIN</sub>                             |                        |                       |     |      |                        |      |                                  |      |      |
|                 |                                   | I <sub>OH</sub> = -4 mA                                          | 1.65                   | 1.2                   |     |      | 1.2                    |      | 1.2                              |      |      |
|                 |                                   | I <sub>OH</sub> = -8 mA                                          | 2.3                    | 1.9                   |     |      | 1.9                    |      | 1.9                              |      |      |
|                 |                                   | I <sub>OH</sub> = -16 mA                                         | 3.0                    | 2.4                   |     |      | 2.4                    |      | 2.4                              |      |      |
|                 |                                   | I <sub>OH</sub> = -24 mA                                         | 3.0                    | 2.3                   |     |      | 2.3                    |      | 2.3                              |      |      |
|                 |                                   | I <sub>OH</sub> = -32 mA                                         | 4.5                    | 3.8                   |     |      | 3.8                    |      | 3.8                              |      |      |
| V <sub>OL</sub> | Maximum Low-Level Output Voltage  | V <sub>IN</sub> ≥ V <sub>T+MAX</sub><br>I <sub>OL</sub> = 50 μA  | 1.65 – 5.5             |                       |     | 0.1  |                        | 0.1  |                                  | 0.1  | V    |
|                 |                                   | V <sub>IN</sub> ≥ V <sub>T+MAX</sub>                             |                        |                       |     |      |                        |      |                                  |      |      |
|                 |                                   | I <sub>OL</sub> = 4 mA                                           | 1.65                   |                       |     | 0.45 |                        | 0.45 |                                  | 0.45 |      |
|                 |                                   | I <sub>OL</sub> = 8 mA                                           | 2.3                    |                       |     | 0.3  |                        | 0.3  |                                  | 0.3  |      |
|                 |                                   | I <sub>OL</sub> = 16 mA                                          | 3.0                    |                       |     | 0.4  |                        | 0.4  |                                  | 0.4  |      |
|                 |                                   | I <sub>OL</sub> = 24 mA                                          | 3.0                    |                       |     | 0.55 |                        | 0.55 |                                  | 0.55 |      |
|                 |                                   | I <sub>OL</sub> = 32 mA                                          | 4.5                    |                       |     | 0.55 |                        | 0.55 |                                  | 0.55 |      |
| I <sub>IN</sub> | Input Leakage Current             | 0 ≤ V <sub>IN</sub> ≤ 5.5 V                                      | 0 to 5.5               |                       |     | ±0.1 |                        | ±1.0 |                                  | ±1.0 | μA   |
| I <sub>CC</sub> | Quiescent Supply Current          | 0 ≤ V <sub>IN</sub> ≤ V <sub>CC</sub>                            | 5.5                    |                       |     | 1.0  |                        | 10   |                                  | 10   | μA   |

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

| Symbol                   | Parameter                                                         | $V_{CC}$ (V) | Test Condition | $T_A = 25^\circ\text{C}$ |     |      | $T_A \leq +85^\circ\text{C}$ |      | $T_A = -55^\circ\text{C}$<br>to $+125^\circ\text{C}$ |      | Unit |
|--------------------------|-------------------------------------------------------------------|--------------|----------------|--------------------------|-----|------|------------------------------|------|------------------------------------------------------|------|------|
|                          |                                                                   |              |                | Min                      | Typ | Max  | Min                          | Max  | Min                                                  | Max  |      |
| $t_{PLH}$ ,<br>$t_{PHL}$ | Propagation Delay,<br>Any Input to Output<br>Y (See Test Circuit) | 1.65 – 1.95  |                | 3.2                      | 8.6 | 14.4 | 3.2                          | 14.4 | 3.2                                                  | 14.4 | ns   |
|                          |                                                                   | 2.3 – 2.7    |                | 2.0                      | 5.1 | 8.3  | 2.0                          | 8.3  | 2.0                                                  | 8.3  |      |
|                          |                                                                   | 3.0 – 3.6    |                | 1.5                      | 3.9 | 6.3  | 1.5                          | 6.3  | 1.5                                                  | 6.3  |      |
|                          |                                                                   | 4.5 – 5.5    |                | 1.1                      | 3.3 | 5.1  | 1.1                          | 5.1  | 1.1                                                  | 5.1  |      |
| $C_{IN}$                 | Input Capacitance                                                 |              |                |                          | 3.5 |      |                              |      |                                                      |      | pF   |
| $C_{PD}$                 | Power Dissipation<br>Capacitance<br>(Note 7)                      | 5.0          | $f = 10$ MHz   |                          | 22  |      |                              |      |                                                      |      | pF   |

7.  $C_{PD}$  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:  $P_D = C_{PD} \cdot V_{CC}^2 \cdot f_{in} + I_{CC} \cdot V_{CC}$ .

**TEST CIRCUIT AND VOLTAGE WAVEFORMS**



| Test              | S1         |
|-------------------|------------|
| $t_{PLH}/t_{PHL}$ | Open       |
| $t_{PLZ}/t_{PZL}$ | $V_{LOAD}$ |
| $t_{PHZ}/t_{PZH}$ | GND        |

\* $C_L$  includes probes and jig capacitance.

**Figure 9. Load Circuit**

| $V_{CC}$                         | Inputs   |                      | $V_M$      | $V_{LOAD}$        | $C_L$ | $R_L$        | $V_A$  |
|----------------------------------|----------|----------------------|------------|-------------------|-------|--------------|--------|
|                                  | $V_I$    | $t_r/t_f$            |            |                   |       |              |        |
| $1.8\text{ V} \pm 0.15\text{ V}$ | $V_{CC}$ | $\leq 2\text{ ns}$   | $V_{CC}/2$ | $2 \times V_{CC}$ | 30 pF | 1 k $\Omega$ | 0.15 V |
| $2.5\text{ V} \pm 0.2\text{ V}$  | $V_{CC}$ | $\leq 2\text{ ns}$   | $V_{CC}/2$ | $2 \times V_{CC}$ | 30 pF | 500 $\Omega$ | 0.15 V |
| $3.3\text{ V} \pm 0.3\text{ V}$  | 3 V      | $\leq 2.5\text{ ns}$ | 1.5 V      | 6 V               | 50 pF | 500 $\Omega$ | 0.3 V  |
| $5.5\text{ V} \pm 0.5\text{ V}$  | $V_{CC}$ | $\leq 2.5\text{ ns}$ | $V_{CC}/2$ | $2 \times V_{CC}$ | 50 pF | 500 $\Omega$ | 0.3 V  |

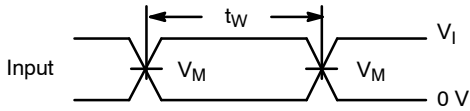


Figure 10. Voltage Waveforms Pulse Duration

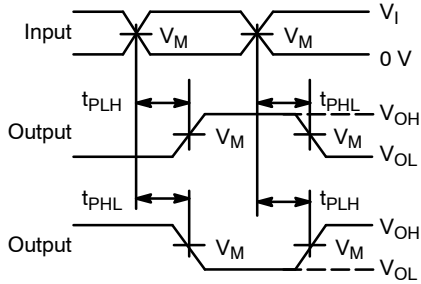


Figure 12. Voltage Waveforms Propagation Delay Times Inverting and Noninverting Outputs

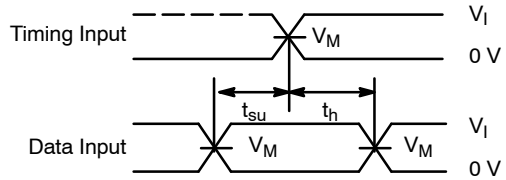


Figure 11. Voltage Waveforms Setup and Hold Times

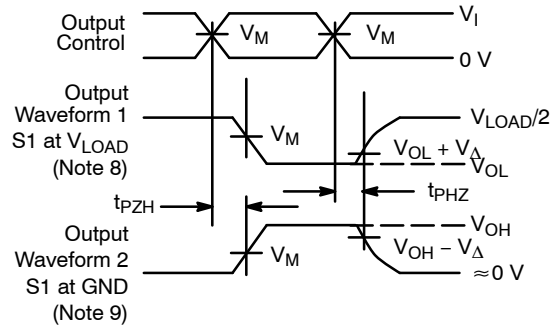


Figure 13. Voltage Waveforms Enable and Disable Times Low- and High-Level Enabling

8. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control.
9. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control
10. All input pulses are supplied by generators having the following characteristics:  $PRR \leq 10 \text{ MHz}$ ,  $Z_O = 50 \Omega$ .
11. The outputs are measured one at a time, with one transition per measurement.
12. All parameters are waveforms are not applicable to all devices.

## ORDERING INFORMATION

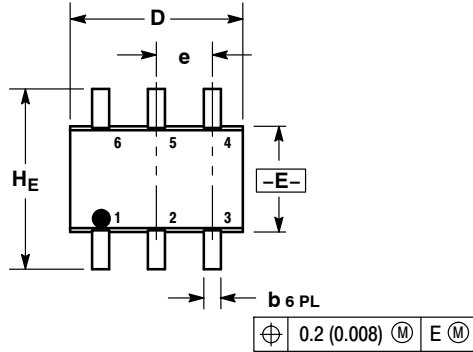
| Device       | Package            | Shipping <sup>†</sup> |
|--------------|--------------------|-----------------------|
| NL7SZ97DFT2G | SC-88<br>(Pb-Free) | 3000 / Tape & Reel    |

<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.

# NL7SZ97

## PACKAGE DIMENSIONS

SC-88/SC70-6/SOT-363  
CASE 419B-02  
ISSUE W

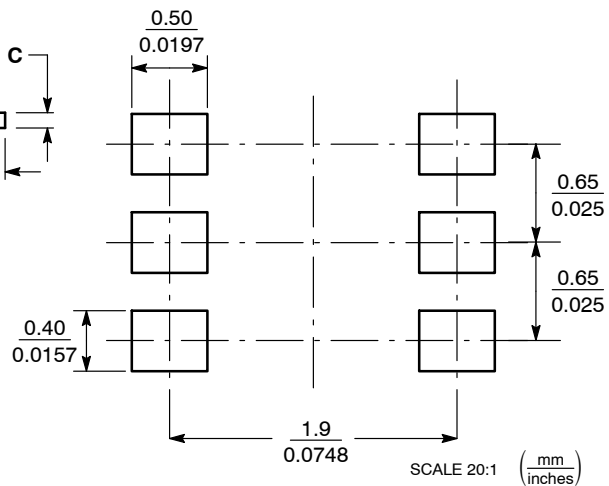


### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 419B-01 OBSOLETE, NEW STANDARD 419B-02.

| DIM | MILLIMETERS |      |      | INCHES    |       |       |
|-----|-------------|------|------|-----------|-------|-------|
|     | MIN         | NOM  | MAX  | MIN       | NOM   | MAX   |
| A   | 0.80        | 0.95 | 1.10 | 0.031     | 0.037 | 0.043 |
| A1  | 0.00        | 0.05 | 0.10 | 0.000     | 0.002 | 0.004 |
| A3  | 0.20 REF    |      |      | 0.008 REF |       |       |
| b   | 0.10        | 0.21 | 0.30 | 0.004     | 0.008 | 0.012 |
| C   | 0.10        | 0.14 | 0.25 | 0.004     | 0.005 | 0.010 |
| D   | 1.80        | 2.00 | 2.20 | 0.070     | 0.078 | 0.086 |
| E   | 1.15        | 1.25 | 1.35 | 0.045     | 0.049 | 0.053 |
| e   | 0.65 BSC    |      |      | 0.026 BSC |       |       |
| L   | 0.10        | 0.20 | 0.30 | 0.004     | 0.008 | 0.012 |
| H_E | 2.00        | 2.10 | 2.20 | 0.078     | 0.082 | 0.086 |

### SOLDERING 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.

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- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



#### Как с нами связаться

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