

NL17SZ86

Single 2-Input Exclusive-OR Gate

The NL17SZ86 is a high performance single 2-input Exclusive-OR Gate operating from a 2.3 V to 5.5 V supply.

Features

- Extremely High Speed: t_{PD} 2.4 ns (typical) at $V_{CC} = 5.0$ V
- Designed for 1.65 V to 5.5 V V_{CC} Operation
- Over Voltage Tolerant Inputs
- V_{TTL} Compatible – Interface Capability with 5.0 V TTL Logic with $V_{CC} = 3$ V
- LVCMOS Compatible
- 24 mA Balanced Output Sink and Source Capability
- Near Zero Static Supply Current Substantially Reduces System Power Requirements
- Replacement for NC7SZ86
- NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable
- These Devices are Pb-Free and are RoHS Compliant

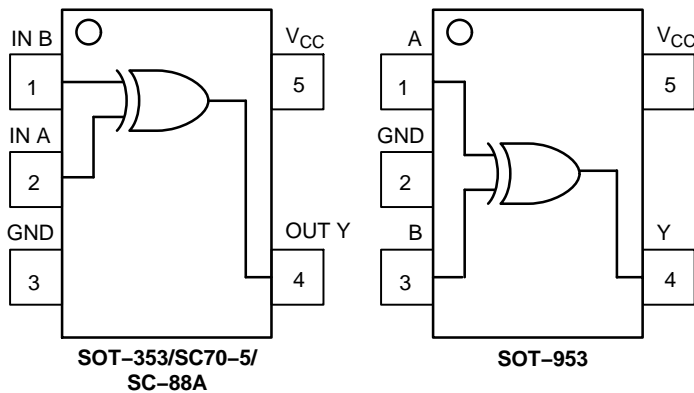


Figure 1. Pinout (Top View)

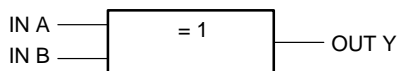


Figure 2. Logic Symbol



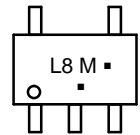
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SC-88A / SOT-353 / SC-70
DF SUFFIX
CASE 419A

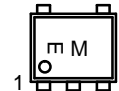
MARKING DIAGRAMS



M = Date Code
A = Assembly Location
Y = Year
W = Work Week
▪ = Pb-Free Package
(Note: Microdot may be in either location)



SOT-953
CASE 527AE



E = Specific Device Code
(E with 90 degree clockwise rotation)
M = Month Code

ORDERING INFORMATION

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

NL17SZ86

PIN ASSIGNMENT (SOT-353/SC70-5/SC-88A)

| Pin | Function |
|-----|-----------------|
| 1 | IN B |
| 2 | IN A |
| 3 | GND |
| 4 | OUT Y |
| 5 | V _{CC} |

PIN ASSIGNMENT (SOT-953)

| Pin | Function |
|-----|-----------------|
| 1 | IN A |
| 2 | GND |
| 3 | IN B |
| 4 | OUT Y |
| 5 | V _{CC} |

FUNCTION TABLE

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

MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|----------------------|---|----------------------------------|------|
| V _{CC} | DC Supply Voltage | -0.5 to +7.0 | V |
| V _I | DC Input Voltage | -0.5 V ≤ V _I ≤ +7.0 V | V |
| V _O | DC Output Voltage (SOT-353/SC70-5/SC-88A Packages) Output in High or Low State (Note 1) Power-Down Mode | -0.5 V to +7.0 | V |
| V _O | DC Output Voltage (SOT-953 Package) | -0.5 to V _{CC} + 0.5 | V |
| I _{IK} | DC Input Diode Current V _I < GND | -50 | mA |
| I _{OK} | DC Output Diode Current (SOT-953 Package) V _{OUT} < GND, V _{OUT} > V _{CC} | ±50 | mA |
| I _{OK} | DC Output Diode Current (SOT-353/SC70-5/SC-88A Packages) V _{OUT} < GND | -50 | mA |
| I _O | DC Output Sink Current | ±50 | mA |
| I _{CC} | DC Supply Current per Supply Pin | ±100 | mA |
| I _{GND} | DC Ground Current per Ground Pin | ±100 | 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 |
| θ _{JA} | Thermal Resistance (Note 2) | 350 | °C/W |
| P _D | Power Dissipation in Still Air at 85°C | 150 | mW |
| MSL | Moisture Sensitivity | Level 1 | |
| F _R | Flammability Rating Oxygen Index: 28 to 34 | UL 94 V-0 @ 0.125 in | |
| ESD | ESD Classification Human Body Model (Note 4) Machine Model (Note 5) Charge Device Model (Note 6) | Class 1B Class B N/A | |
| I _{LATCHUP} | Latchup Performance Above V _{CC} and Below GND at 85°C (Note 3) | ±500 | 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. I_O absolute maximum rating must be observed.
2. Measured with minimum pad spacing on an FR4 board, using 10 mm-by-1 inch, 2-ounce copper trace with no air flow.
3. Tested to EIA/JESD78
4. Tested to EIA/JESD22-A114-A, rated to EIA/JESD22-A114-B.
5. Tested to EIA/JESD22-A115-A, rated to EIA/JESD22-A115-B.
6. Tested to JESD22-C101-A.

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RECOMMENDED OPERATING CONDITIONS

| Symbol | Parameter | Min | Max | Unit |
|-----------------|---|-------------|-----------------|------|
| V _{CC} | Supply Voltage Operating Data Retention Only | 1.65 1.5 | 5.5 5.5 | V |
| V _I | Input Voltage (Note 7) | 0 | 5.5 | V |
| V _O | Output Voltage (SOT-353/SC70-5/SC-88A Packages) (HIGH or LOW State) | 0 | 5.5 | V |
| V _O | Output Voltage (SOT-953 Package) (HIGH or LOW State) | 0 | V _{CC} | V |
| T _A | Operating Free-Air Temperature | -55 | +125 | °C |
| Δt/ΔV | Input Transition Rise or Fall Rate V _{CC} = 2.5 V ± 0.2 V V _{CC} = 3.0 V ± 0.3 V V _{CC} = 5.0 V ± 0.5 V | 0 0 0 | 20 10 5 | 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.

7. Unused inputs may not be left open. All inputs must be tied to a high- or low-logic input voltage level.

DC ELECTRICAL CHARACTERISTICS

| Symbol | Parameter | Condition | V _{CC} (V) | T _A = 25°C | | | -55°C ≤ T _A ≤ 125°C | | Unit |
|------------------|---|---|--|--|---|--|--|--|------|
| | | | | Min | Typ | Max | Min | Max | |
| V _{IH} | High-Level Input Voltage | | 1.65 to 1.95 2.3 to 5.5 | 0.75 V _{CC} 0.7 V _{CC} | | | 0.75 V _{CC} 0.7 V _{CC} | | V |
| V _{IL} | Low-Level Input Voltage | | 1.65 to 1.95 2.3 to 5.5 | | | 0.25 V _{CC} 0.3 V _{CC} | | 0.25 V _{CC} 0.3 V _{CC} | V |
| V _{OH} | High-Level Output Voltage V _{IN} = V _{IL} or V _{IL} | I _{OH} = -100 μA I _{OH} = -3 mA I _{OH} = -8 mA I _{OH} = -12 mA I _{OH} = -16 mA I _{OH} = -24 mA I _{OH} = -32 mA | 1.65 to 5.5 1.65 2.3 2.7 3.0 3.0 4.5 | V _{CC} - 0.1 1.29 1.9 2.2 2.4 2.3 3.8 | V _{CC} 1.8 2.1 2.4 2.7 2.5 4.0 | | V _{CC} - 0.1 1.29 1.9 2.2 2.4 2.3 3.8 | | V |
| V _{OL} | Low-Level Output Voltage V _{IN} = V _{IH} | I _{OL} = 100 μA I _{OL} = 3 mA I _{OL} = 8 mA I _{OL} = 12 mA I _{OL} = 16 mA I _{OL} = 24 mA I _{OL} = 32 mA | 1.65 to 5.5 1.65 2.3 2.7 3.0 3.0 4.5 | | 0.08 0.20 0.22 0.28 0.38 0.42 | 0.1 0.24 0.3 0.4 0.4 0.55 0.55 | | 0.1 0.24 0.3 0.4 0.4 0.55 0.55 | V |
| I _{IN} | Input Leakage Current | V _{IN} = 5.5 V or GND | 0 to 5.5 | | | ±0.1 | | ±1.0 | μA |
| I _{OFF} | Power Off Leakage Current (SOT-353/SC70-5/SC-88A Packages) | V _{IN} = 5.5 V or V _{OUT} = 5.5 V | 0 | | | 1 | | 10 | μA |
| I _{CC} | Quiescent Supply Current | V _{IN} = 5.5 V or GND | 5.5 | | | 1 | | 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.

AC ELECTRICAL CHARACTERISTICS t_R = t_F = 3.0 ns

| Symbol | Parameter | Condition | V _{CC} (V) | T _A = 25°C | | | -55°C ≤ T _A ≤ 125°C | | Unit |
|--------------------------------------|---------------------------------------|---|------------------------|-----------------------|------------|------------|--------------------------------|------------|------|
| | | | | Min | Typ | Max | Min | Max | |
| t _{PLH} t _{PHL} | Propagation Delay (Figure 3 and 4) | R _L = 1 MΩ, C _L = 15 pF | 1.65 | 2.0 | 6.9 | 13.8 | 2.0 | 14.5 | ns |
| | | R _L = 1 MΩ, C _L = 15 pF | 1.8 | 2.0 | 5.7 | 11.5 | 2.0 | 12 | |
| | | R _L = 1 MΩ, C _L = 15 pF | 2.5 ± 0.2 | 1.2 | 4.1 | 7.0 | 1.2 | 7.5 | |
| | | R _L = 1 MΩ, C _L = 15 pF R _L = 500 Ω, C _L = 50 pF | 3.3 ± 0.3 | 0.8 1.2 | 3.0 3.8 | 4.8 5.4 | 0.8 1.2 | 5.2 5.9 | |
| | | R _L = 1 MΩ, C _L = 15 pF R _L = 500 Ω, C _L = 50 pF | 5.0 ± 0.5 | 0.5 0.8 | 2.2 2.9 | 3.5 4.2 | 0.5 1.0 | 3.8 4.6 | |

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CAPACITIVE CHARACTERISTICS

| Symbol | Parameter | Condition | Typical | Unit |
|----------|---|--|---------|------|
| C_{IN} | Input Capacitance | $V_{CC} = 5.5\text{ V}, V_I = 0\text{ V or } V_{CC}$ | 7.0 | pF |
| C_{PD} | Power Dissipation Capacitance (Note 8) | 10 MHz, $V_{CC} = 3.3\text{ V}, V_I = 0\text{ V or } V_{CC}$ 10 MHz, $V_{CC} = 5.5\text{ V}, V_I = 0\text{ V or } V_{CC}$ | 9 11 | pF |

8. 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: $I_{CC(OPR)} = C_{PD} \cdot V_{CC} \cdot f_{in} + I_{CC}$. C_{PD} is used to determine the no-load dynamic power consumption; $P_D = C_{PD} \cdot V_{CC}^2 \cdot f_{in} + I_{CC} \cdot V_{CC}$.

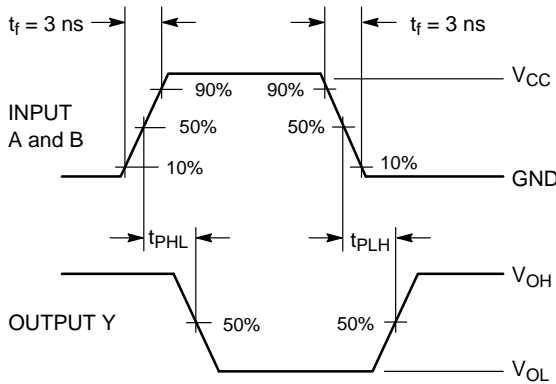
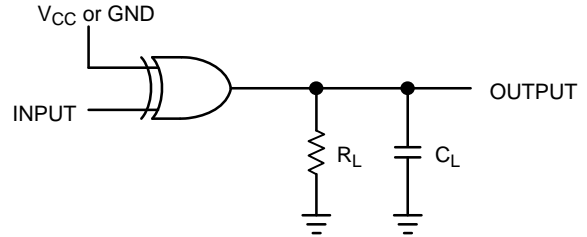


Figure 3. Switching Waveform



A 1-MHz square input wave is recommended for propagation delay tests.

Figure 4. Test Circuit

DEVICE ORDERING INFORMATION

| Device | Package | Shipping [†] |
|-----------------|------------------------------------|-----------------------|
| NL17SZ86DFT2G | SC70-5/SC-88A/SOT-353 (Pb-Free) | 3000 / Tape & Reel |
| NLV17SZ86DFT2G* | SC70-5/SC-88A/SOT-353 (Pb-Free) | 3000 / Tape & Reel |
| NL17SZ86P5T5G | SOT-953 (Pb-Free) | 8000 / Tape & Reel |

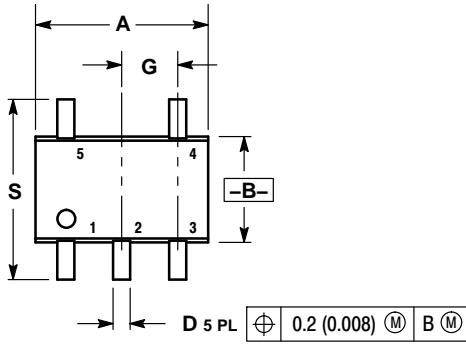
[†]For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

*NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable.

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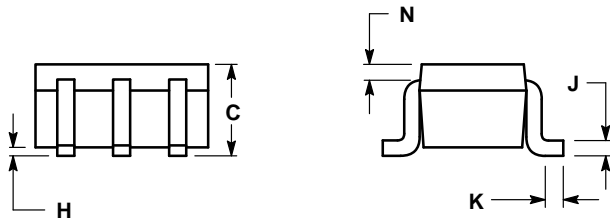
PACKAGE DIMENSIONS

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

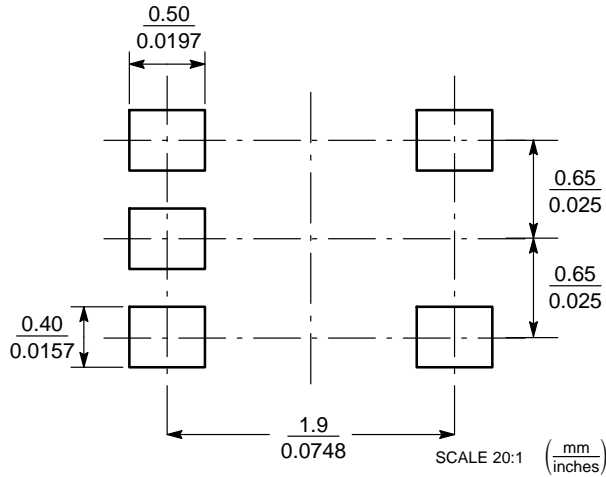


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH.
 3. 419A-01 OBSOLETE. NEW STANDARD 419A-02.
 4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

| 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 |



SOLDER FOOTPRINT*

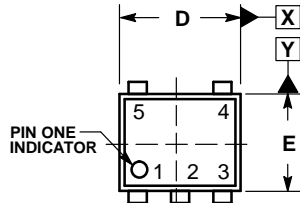


*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

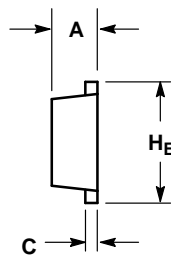
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PACKAGE DIMENSIONS

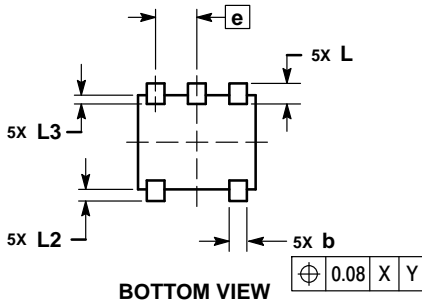
SOT-953
CASE 527AE
ISSUE E



TOP VIEW



SIDE VIEW



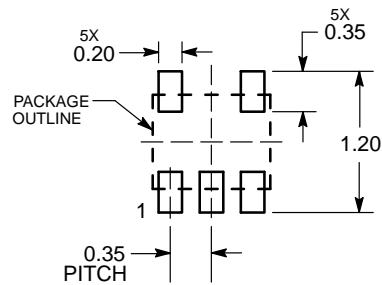
BOTTOM VIEW

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

| DIM | MILLIMETERS | | |
|-----|-------------|------|------|
| | MIN | NOM | MAX |
| A | 0.34 | 0.37 | 0.40 |
| b | 0.10 | 0.15 | 0.20 |
| C | 0.07 | 0.12 | 0.17 |
| D | 0.95 | 1.00 | 1.05 |
| E | 0.75 | 0.80 | 0.85 |
| e | 0.35 BSC | | |
| HE | 0.95 | 1.00 | 1.05 |
| L | 0.175 REF | | |
| L2 | 0.05 | 0.10 | 0.15 |
| L3 | --- | --- | 0.15 |

SOLDERING FOOTPRINT*



DIMENSIONS: MILLIMETERS

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

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