NL17SHT00

Single 2-Input NAND Gate/ CMOS Logic Level Shifter

LSTTL−Compatible Inputs

The NL17SHT00 is a single gate 2−input NAND fabricated with silicon gate CMOS technology.

The internal circuit is composed of multiple stages, including a buffer output which provides high noise immunity and stable output.

The device input is compatible with TTL−type input thresholds and the output has a full 5 V CMOS level output swing. The input protection circuitry on this device allows overvoltage tolerance on the input, allowing the device to be used as a logic−level translator from 3 V CMOS logic to 5 V CMOS Logic or from 1.8 V CMOS logic to 3 V CMOS Logic while operating at the high voltage power supply.

The NL17SHT00 input structure provides protection when voltages up to 7 V are applied, regardless of the supply voltage. This allows the NL17SHT00 to be used to interface 5 V circuits to 3 V circuits. The output structures also provide protection when $V_{CC} = 0$ V. These input and output structures help prevent device destruction caused by supply voltage − input/output voltage mismatch, battery backup, hot insertion, etc.

Features

- High Speed: $t_{PD} = 3.1$ ns (Typ) at $V_{CC} = 5$ V
- Low Power Dissipation: $I_{CC} = 1$ μA (Max) at $T_A = 25°C$
- TTL−Compatible Inputs: $V_{IL} = 0.8$ V; $V_{IH} = 2$ V
- CMOS−Compatible Outputs: $V_{OH} > 0.8\ V_{CC}$; $V_{OL} < 0.1\ V_{CC}$ @Load
- Power Down Protection Provided on Inputs and Outputs
- Balanced Propagation Delays
- Pin and Function Compatible with Other Standard Logic Families
- These are Pb−Free Devices

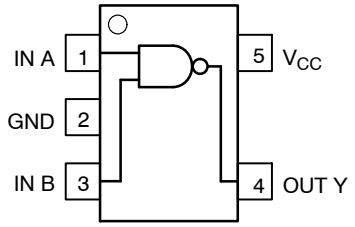

Figure 1. Pinout

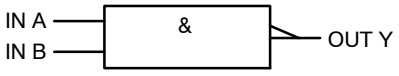

Figure 2. Logic Symbol

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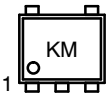
MARKING DIAGRAM

SOT−953
CASE 527AE



K = Specific Device Code
M = Month Code

PIN ASSIGNMENT	
1	IN A
2	GND
3	IN B
4	OUT Y
5	V_{CC}

FUNCTION TABLE

Inputs		Output
A	B	Y
L	L	H
L	H	H
H	L	H
H	H	L

ORDERING INFORMATION

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

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August, 2011 − Rev. 0

Publication Order Number:
NL17SHT00/D

MAXIMUM RATINGS

Symbol	Characteristics	Value	Unit
V_{CC}	DC Supply Voltage	−0.5 to +7.0	V
V_{IN}	DC Input Voltage	−0.5 to +7.0	V
V_{OUT}	DC Output Voltage V_{CC} = 0 High or Low State	−0.5 to 7.0 −0.5 to V_{CC} + 0.5	V
I_{IK}	Input Diode Current	−20	mA
I_{OK}	Output Diode Current V_{OUT} < GND; V_{OUT} > V_{CC}	±20	mA
I_{OUT}	DC Output Current	±25	mA
I_{CC}	DC Supply Current, V_{CC} and GND	50	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
P_D	Power Dissipation in Still Air at 85°C	50	mW
MSL	Moisture Sensitivity	Level 1	
F_R	Flammability Rating Oxygen Index: 28 to 34	UL 94 V−0 @ 0.125 in	
$I_{LATCHUP}$	Latchup Performance Above V_{CC} and Below GND at 125°C (Note 1)	±100	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. Tested to EIA/JESD78.

RECOMMENDED OPERATING CONDITIONS

Symbol	Characteristics	Min	Max	Unit
V_{CC}	DC Supply Voltage	3.0	5.5	V
V_{IN}	DC Input Voltage	0.0	5.5	V
V_{OUT}	DC Output Voltage V_{CC} = 0 High or Low State	0.0 0.0	5.5 V_{CC}	V
T_A	Operating Temperature Range	−55	+125	°C
t_r , t_f	Input Rise and Fall Time V_{CC} = 3.3 V ± 0.3 V V_{CC} = 5.0 V ± 0.5 V	0 0	100 20	ns/V

Device Junction Temperature versus Time to 0.1% Bond Failures

Junction Temperature °C	Time, Hours	Time, Years
80	1,032,200	117.8
90	419,300	47.9
100	178,700	20.4
110	79,600	9.4
120	37,000	4.2
130	17,800	2.0
140	8,900	1.0

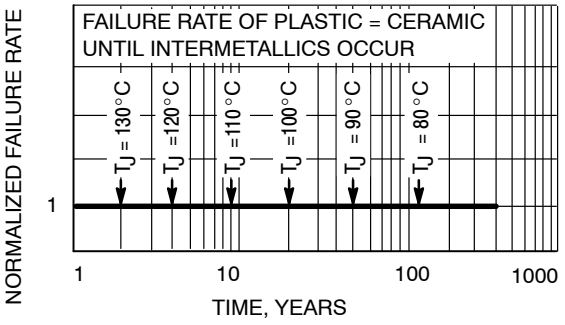


Figure 3. Failure Rate vs. Time Junction Temperature

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	V_{CC} (V)	T_A = 25°C			$T_A \le$ 85°C		−55 ≤ T_A ≤ 125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
V_{IH}	Minimum High−Level Input Voltage		3.0 4.5 5.5	1.4 2.0 2.0			1.4 2.0 2.0		1.4 2.0 2.0		V
V_{IL}	Maximum Low−Level Input Voltage		3.0 4.5 5.5			0.53 0.8 0.8		0.53 0.8 0.8		0.53 0.8 0.8	V
V_{OH}	Minimum High−Level Output Voltage $V_{IN} = V_{IH}$ or V_{IL}	$V_{IN} = V_{IH}$ or V_{IL} I_{OH} = −50 μA	3.0 4.5	2.9 4.4	3.0 4.5		2.9 4.4		2.9 4.4		V
		$V_{IN} = V_{IH}$ or V_{IL} I_{OH} = −4 mA I_{OH} = −8 mA	3.0 4.5	2.58 3.94			2.48 3.80		2.34 3.66		V
V_{OL}	Maximum Low−Level Output Voltage $V_{IN} = V_{IH}$ or V_{IL}	$V_{IN} = V_{IH}$ or V_{IL} I_{OL} = 50 μA	3.0 4.5		0.0 0.0	0.1 0.1		0.1 0.1		0.1 0.1	V
		$V_{IN} = V_{IH}$ or V_{IL} I_{OL} = 4 mA I_{OL} = 8 mA	3.0 4.5			0.36 0.36		0.44 0.44		0.52 0.52	V
I_{IN}	Maximum Input Leakage Current	V_{IN} = 5.5 V or GND	0 to 5.5			±0.1		±1.0		±1.0	μA
I_{CC}	Maximum Quiescent Supply Current	$V_{IN} = V_{CC}$ or GND	5.5			1.0		20		40	μA
I_{CCT}	Quiescent Supply Current	Input: V_{IN} = 3.4 V	5.5			1.35		1.50		1.65	mA
I_{OFF}	Power Off Output Leakage Current	V_{OUT} = 5.5 V	0.0			0.5		5.0		10	μA

AC ELECTRICAL CHARACTERISTICS Input $t_r = t_f$ = 3.0 ns

Symbol	Parameter	Test Conditions		T_A = 25°C			$T_A \le$ 85°C		−55 ≤ T_A ≤ 125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
t_{PLH}, t_{PHL}	Maximum Propagation Delay, Input A or B to Y	V_{CC} = 3.3 ± 0.3 V	C_L = 15 pF C_L = 50 pF		4.1 5.5	10.0 13.5		11.0 15.0		13.0 17.5	ns
		V_{CC} = 5.0 ± 0.5 V	C_L = 15 pF C_L = 50 pF		3.1 3.6	6.9 7.9		8.0 9.0		9.5 10.5	
C_{IN}	Maximum Input Capacitance				5.5	10		10		10	pF

		Typical @ 25°C, V_{CC} = 5.0 V	
C_{PD}	Power Dissipation Capacitance (Note 2)	11	pF

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

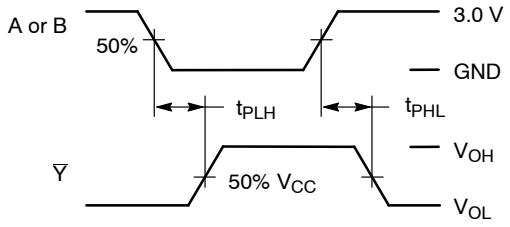
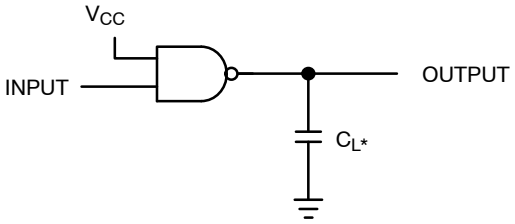


Figure 4. Switching Waveforms



*Includes all probe and jig capacitance.
A 1−MHz square input wave is recommended for propagation delay tests.

Figure 5. Test Circuit

ORDERING INFORMATION

Device	Package	Shipping†
NL17SHT00P5T5G	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.

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