# Triple Schmitt-Trigger Inverter

The NL37WZ14 is a high performance triple inverter with Schmitt-Trigger inputs operating from a 1.65 to 5.5 V supply.

Pin configuration and function are the same as the NL37WZ04, but the inputs have hysteresis, and with its Schmitt trigger function, the NL37WZ14 can be used as a line receiver which will receive slow input signals. The NL37WZ14 is capable of transforming slowly changing input signals into sharply defined, jitter–free output signals. In addition, it has a greater noise margin than conventional inverters. The NL37WZ14 has hysteresis between the positive–going and the negative–going input thresholds (typically 1.0 V) which is determined internally by transistor ratios and is essentially insensitive to temperature and supply voltage variations.

#### **Features**

- Designed for 1.65 V to 5.5 V V<sub>CC</sub> Operation
- Over Voltage Tolerant Inputs and Outputs
- LVTTL Compatible Interface Capability with 5 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
- Current Drive Capability is 24 mA at the Outputs
- Chip Complexity: FET = 94
- These Devices are Pb-Free and are RoHS Compliant
- NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable

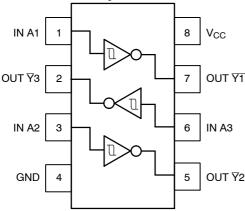


Figure 1. Pinout (Top View)

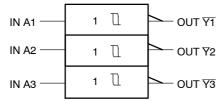


Figure 2. Logic Symbol



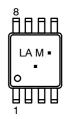
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MARKING DIAGRAM



US8 US SUFFIX CASE 493



LA = Device Code

M = Date Code\*

Pb-Free Package

(Note: Microdot may be in either location)
\*Date Code orientation may vary depending upon manufacturing location.

#### **PIN ASSIGNMENT**

1	IN A1
2	OUT \overline{Y3}
3	IN A2
4	GND
5	OUT Y2
6	IN A3
7	OUT Y1
8	V <sub>CC</sub>

#### **FUNCTION TABLE**

A Input	<b>▼</b> Output
L	Н
Н	L

#### **ORDERING INFORMATION**

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

#### **MAXIMUM RATINGS**

Symbol	Parameter		Value	Unit
V <sub>CC</sub>	DC Supply Voltage		-0.5 to +7.0	V
VI	DC Input Voltage		-0.5 to +7.0	V
Vo	DC Output Voltage		-0.5 to +7.0	V
I <sub>IK</sub>	DC Input Diode Current	V <sub>I</sub> < GND	-50	mA
lok	DC Output Diode Current	V <sub>O</sub> < GND	-50	mA
I <sub>O</sub>	DC Output 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
TL	Lead Temperature, 1 mm from Case for 10 Seconds		260	°C
TJ	Junction Temperature under Bias		+ 150	°C
$\theta_{\sf JA}$	Thermal Resistance (Note 1)		250	°C/W
$P_{D}$	Power Dissipation in Still Air at 85°C		250	mW
MSL	Moisture Sensitivity		Level 1	
F <sub>R</sub>	Flammability Rating	Oxygen Index: 28 to 34	UL 94 V-0 @ 0.125 in	
V <sub>ESD</sub>		Human Body Model (Note 2)  Machine Model (Note 3)  arged Device Model (Note 4)	> 2000 > 200 N/A	V

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-by-1 inch, 2-ounce copper trace with no air flow.
- 2. Tested to EIA/JESD22-A114-A.
- 3. Tested to EIA/JESD22-A115-A.
- 4. Tested to JESD22-C101-A.

#### **RECOMMENDED OPERATING CONDITIONS**

Symbol	Parameter			Max	Unit
V <sub>CC</sub>	Supply Voltage	Operating ata Retention Only	2.3 1.5	5.5 5.5	V
V <sub>I</sub>	Input Voltage	(Note 5)	0	5.5	V
Vo	Output Voltage (HI	GH or LOW State)	0	5.5	V
T <sub>A</sub>	Operating Free-Air Temperature		- 55	+ 125	°C
Δt/ΔV	V <sub>0</sub>	$_{CC}$ = 2.5 V ± 0.2 V $_{CC}$ = 3.0 V ± 0.3 V $_{CC}$ = 5.0 V ± 0.5 V	0 0 0	No Limit No Limit No Limit	ns/V

<sup>5.</sup> Unused inputs may not be left open. All inputs must be tied to a high- or low-logic input voltage level.

#### **DEVICE ORDERING INFORMATION**

Device Order Number	Package	Shipping <sup>†</sup>
NL37WZ14USG	US8 (Pb-Free)	3000 / Tape & Reel
NLV37WZ14USG*	US8 (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.

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

#### **DC CHARACTERISTICS**

			V <sub>CC</sub>	T <sub>A</sub> = 25°C		-55°C≤1	A≤125°C		
Symbol	Parameter	Condition	(V)	Min	Тур	Max	Min	Max	Unit
V <sub>T</sub> +	Positive Input Threshold		2.3	1.0	1.5	1.8	1.0	1.8	V
	Voltage		2.7	1.2	1.7	2.0	1.2	2.0	
			3.0	1.3	1.9	2.2	1.3	2.2	
			4.5	1.9	2.7	3.1	1.9	3.1	
			5.5	2.2	3.3	3.6	2.2	3.6	
$V_T-$	Negative Input Threshold		2.3	0.4	0.75	1.15	0.4	1.15	V
	Voltage		2.7	0.5	0.87	1.4	0.5	1.4	
			3.0	0.6	1.0	1.5	0.6	1.5	
			4.5	1.0	1.5	2.0	1.0	2.0	
			5.5	1.2	1.9	2.3	1.2	2.3	
$V_{H}$	Input Hysteresis Voltage		2.3	0.25	0.75	1.1	1.25	1.1	V
			2.7	0.3	0.83	1.15	0.3	1.15	
			3.0	0.4	0.93	1.2	0.4	1.2	
			4.5	0.6	1.2	1.5	0.6	1.5	
			5.5	0.7	1.4	1.7	0.7	1.7	
V <sub>OH</sub>	High-Level Output Voltage	I <sub>OH</sub> = -100 μA	1.65 to 5.5	V <sub>CC</sub> -0.1	V <sub>CC</sub>		V <sub>CC</sub> -0.1		V
	$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OH} = -3 \text{ mA}$	1.65	1.29	1.52		1.29		
		$I_{OH} = -8 \text{ mA}$	2.3	1.9	2.1		1.9		
		$I_{OH} = -12 \text{ mA}$	2.7	2.2	2.4		2.2		
		$I_{OH} = -16 \text{ mA}$	3.0	2.4	2.7		2.4		
		$I_{OH} = -24 \text{ mA}$	3.0	2.3	2.5		2.3		
		$I_{OH} = -32 \text{ mA}$	4.5	3.8	4.0		3.8		
V <sub>OL</sub>	Low-Level Output Voltage	I <sub>OL</sub> = 100 μA	1.65 to 5.5			0.1		0.1	V
	$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OL} = 4 \text{ mA}$	1.65		0.08	0.24		0.24	
		$I_{OL} = 8 \text{ mA}$	2.3		0.2	0.3		0.3	
		$I_{OL}$ = 12 mA	2.7		0.22	0.4		0.4	
		$I_{OL} = 16 \text{ mA}$	3.0		0.28	0.4		0.4	
		$I_{OL} = 24 \text{ mA}$	3.0		0.38	0.55		0.55	
		$I_{OL} = 32 \text{ mA}$	4.5		0.42	0.55		0.55	
I <sub>IN</sub>	Input Leakage Current	V <sub>IN</sub> = 5.5 V or GND	0 to 5.5			±0.1		±1.0	μΑ
I <sub>OFF</sub>	Power Off Leakage Current	V <sub>IN</sub> = 5.5 V or V <sub>OUT</sub> = 5.5 V	0			1		10	μΑ
I <sub>CC</sub>	Quiescent Supply Current	V <sub>IN</sub> = 5.5 V or GND	5.5			1		10	μΑ

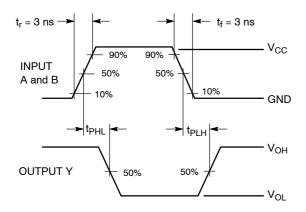
#### AC ELECTRICAL CHARACTERISTICS (Input $t_r = t_f = 3.0 \text{ ns}$ )

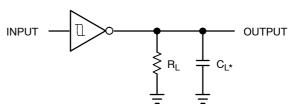
			V <sub>CC</sub>	T <sub>A</sub> = 25°C		T <sub>A</sub> = 25°C		$-55^{\circ}C \le T_{A} \le 125^{\circ}C$		
Symbol	Parameter	Condition	(V)	Min	Тур	Max	Min	Max	Unit	
t <sub>PLH</sub>	Propagation Delay	$R_L = 1 M\Omega$ , $C_L = 15 pF$	2.5 ± 0.2	1.8	4.3	7.4	1.8	8.1	ns	
t <sub>PHL</sub>	Input A to Y (Figure 3 and 4)	$R_L = 1 M\Omega$ , $C_L = 15 pF$	$3.3 \pm 0.3$	1.5	3.3	5.0	1.5	5.5		
	,	$R_L$ = 500 $\Omega$ , $C_L$ = 50 pF		1.8	4.0	6.0	1.8	6.6		
		$R_L = 1 M\Omega$ , $C_L = 15 pF$	5.0 ± 0.5	1.0	2.7	4.1	1.0	4.5		
		$R_L = 500 \Omega, C_L = 50 pF$		1.2	3.2	4.9	1.2	5.4		

#### **CAPACITIVE CHARACTERISTICS**

Symbol	Parameter	Condition	Typical	Unit
C <sub>IN</sub>	Input Capacitance	$V_{CC}$ = 5.5 V, $V_I$ = 0 V or $V_{CC}$	2.5	pF
C <sub>PD</sub>	Power Dissipation Capacitance	10 MHz, $V_{CC}$ = 3.3 V, $V_I$ = 0 V or $V_{CC}$	11	pF
	(Note 6)	10 MHz, $V_{CC} = 5.0 \text{ V}$ , $V_{I} = 0 \text{ V}$ or $V_{CC}$	12.5	

<sup>6.</sup> C<sub>PD</sub> 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;  $P_D = C_{PD} \bullet V_{CC}^2 \bullet f_{in} + I_{CC} \bullet V_{CC}$ .





 ${}^{\star}C_L$  includes all probe and jig capacitances.

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

Figure 3. Switching Waveforms

Figure 4. Test Circuit

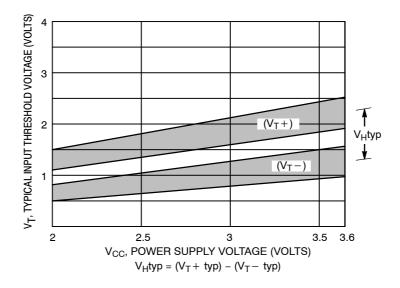
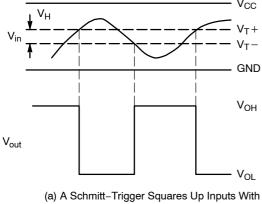
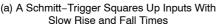
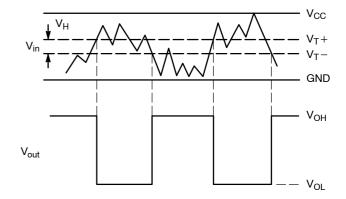


Figure 5. Typical Input Threshold,  $V_T +$ ,  $V_T -$  versus Power Supply Voltage







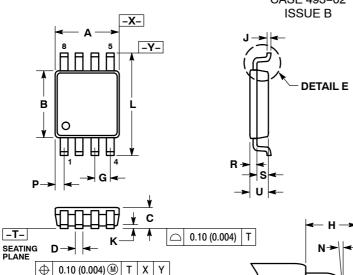
(b) A Schmitt-Trigger Offers Maximum Noise Immunity

Figure 6. Typical Schmitt-Trigger Applications

#### PACKAGE DIMENSIONS

# US8 **US SUFFIX**

CASE 493-02



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#### NOTES:

**R 0.10 TYP** 

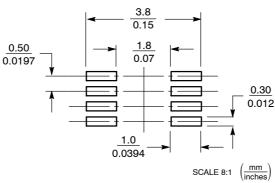
- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
   CONTROLLING DIMENSION: MILLIMETERS.
   DIMENSION "A" DOES NOT INCLUDE MOLD
- FLASH, PROTRUSION OR GATE BURR.
  MOLD FLASH, PROTRUSION AND GATE BURR SHALL NOT EXCEED 0.140 MM
- DOMESTIC NOT EXCEED 0.140 MIN (0.0055") PER SIDE. DIMENSION "B" DOES NOT INCLUDE INTER-LEAD FLASH OR PROTRUSION. INTER-LEAD FLASH AND PROTRUSION SHALL NOT E3XCEED 0.140 (0.0055") PER SIDE
- LEAD FINISH IS SOLDER PLATING WITH THICKNESS OF 0.0076-0.0203 MM. (300–800 °).
  ALL TOLERANCE UNLESS OTHERWISE
- SPECIFIED ±0.0508 (0.0002 ").

	MILLIN	IETERS	INC	HES	
DIM	MIN	MAX	MIN	MAX	
Α	1.90	2.10	0.075	0.083	
В	2.20	2.40	0.087	0.094	
С	0.60	0.90	0.024	0.035	
D	0.17	0.25	0.007	0.010	
F	0.20	0.35	0.008	0.014	
G	0.50	BSC	0.020	BSC	
Н	0.40	REF	0.016	REF	
J	0.10	0.18	0.004	0.007	
K	0.00	0.10	0.000	0.004	
L	3.00	3.20	0.118	0.126	
M	0 °	6 °	0 °	6 °	
N	5 °	10 °	5 °	10 °	
Р	0.23	0.34	0.010	0.013	
R	0.23	0.33	0.009	0.013	
S	0.37	0.47	0.015	0.019	
U	0.60	0.80	0.024	0.031	
V	0.12	BSC	0.005 BSC		

#### **SOLDERING FOOTPRINT\***

**DETAIL E** 

F



\*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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