TinyLogic UHS Inverter with Schmitt Trigger Input

NC7SZ14

Description

The NC7SZ14 is a single inverter with Schmitt trigger input from ON Semiconductor's Ultra–High Speed (UHS) series of TinyLogic. The device is fabricated w ith advanced CMOS technology to achieve ultra–high speed with high output drive while maintaining low static power dissipation over a very broad $V_{\rm CC}$ operating range. The device is specified to operate over the 1.65 V to 5.5 V $V_{\rm CC}$ range. The inputs and outputs are high–impedance when $V_{\rm CC}$ is 0 V. Inputs tolerate voltages up to 5.5 V independent of $V_{\rm CC}$ operating voltage.

Features

- Ultra-High Speed: $t_{PD} = 3.7$ ns (Typical) into 50 pF at 5 V V_{CC}
- High Output Drive: ±24 mA at 3 V V_{CC}
- Broad V_{CC} Operating Range: 1.65 V to 5.5 V
- Matches Performance of LCX when Operated at 3.3 V V_{CC}
- Power Down High Impedance Inputs / Outputs
- Over-Voltage Tolerance Inputs Facilitate 5 V to 3 V Translation
- Proprietary Noise / EMI Reduction Circuitry
- Ultra-Small MicroPakTM Packages
- Space-Saving SC-74A and SC-88A Packages
- These Devices are Pb–Free, Halogen Free/BFR Free and are RoHS Compliant

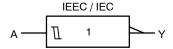


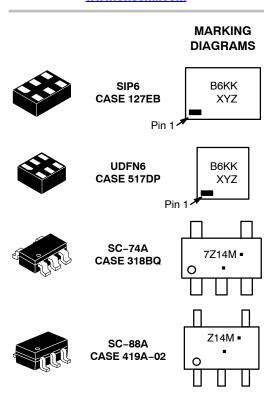
Figure 1. Logic Symbol

1



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B6, 7Z14, Z14 = Specific Device Code

KK = 2-Digit Lot Run Traceability Code

XY = 2-Digit Date Code Format

Z = Assembly Plant Code

M = Date Code

Pb-Free Package

(Note: Microdot may be in either location)

ORDERING INFORMATION

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

Pin Configurations

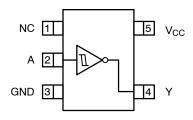


Figure 2. SC-88A and SC-74A (Top View)

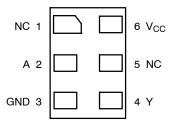


Figure 3. MicroPak (Top Through View)

PIN DEFINITIONS

Pin # SC-88A / SC74A	Pin # MicroPak	Name	Description
1	1, 5	NC	No Connect
2	2	Α	Input
3	3	GND	Ground
4	4	Υ	Output
5	6	V _{CC}	Supply Voltage

FUNCTION TABLE

Inputs	Output
Α	Y
L	Н
Н	L

H = HIGH Logic Level L = LOW Logic Level

ABSOLUTE MAXIMUM RATINGS

Symbol	Parame	Min	Max	Unit	
V _{CC}	Supply Voltage		-0.5	6.5	V
V _{IN}	DC Input Voltage		-0.5	6.5	V
V _{OUT}	DC Output Voltage		-0.5	6.5	V
I _{IK}	DC Input Diode Current	V _{IN} < 0 V	-	-50	mA
I _{OK}	DC Output Diode Current	V _{OUT} < 0 V	-	-50	mA
I _{OUT}	DC Output Current	-	±50	mA	
I _{CC} or I _{GND}	DC V _{CC} or Ground Current	-	±50	mA	
T _{STG}	Storage Temperature Range	-65	+150	°C	
TJ	Junction Temperature Under Bias		-	+150	°C
T_L	Junction Lead Temperature (Solde	ering, 10 Seconds)	-	+260	°C
P_{D}	Power Dissipation in Still Air	SC-74A	-	390	mW
		SC-88A	-	332	
		MicroPak-6	-	812	
		MicroPak2™-6	-	812	
ESD	Human Body Model, JEDEC: JESD22-A114		-	2000	V
	Charge Device Model, JEDEC: JE	SD22-C101	-	1000	

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.

NC7SZ14

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Conditions	Min	Max	Unit
V _{CC}	Supply Voltage Operating		1.65	5.5	V
	Supply Voltage Data Retention		1.5	5.5	
V _{IN}	Input Voltage		0	5.5	V
V _{OUT}	Output Voltage		0	V _{CC}	V
T _A	Operating Temperature		-40	+85	°C
θ_{JA}	Thermal Resistance	SC-74A	-	320	°C/W
		SC-88A	-	377	
		MicroPak-6	-	154	
		MicroPak2-6	-	154	

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.

1. Unused inputs must be held HIGH or LOW. They may not float.

DC ELECTRICAL CHARACTERISTICS

				$T_A = +25^{\circ}C$ $T_A = -40 \text{ to } +85$			to +85°C		
Symbol	Parameter	V _{CC} (V)	Conditions	Min	Тур	Max	Min	Max	Unit
V _P	Positive Threshold Voltage	1.65		_	1.00	1.40	-	1.40	V
		1.80		_	1.10	1.50	-	1.50	
		2.30		-	1.40	1.80	-	1.80	
		3.00		-	1.75	2.20	-	2.20	
		4.50		-	2.45	3.10	-	3.10	
		5.50		-	2.90	3.60	-	3.60	
V _N	Negative Threshold Voltage	1.65		0.20	0.50	_	0.20	-	V
		1.80		0.25	0.55	_	0.25	-	
		2.30		0.40	0.75	_	0.40	-	
		3.00		0.60	1.00	_	0.60	-	
		4.50		1.00	1.43	_	1.00	-	
		5.50		1.20	1.70	_	1.20	-	
V _H	Hysteresis Voltage	1.65		0.10	0.48	0.90	0.10	0.90	V
		1.80		0.15	0.54	1.00	0.15	1.00	
		2.30		0.25	0.65	1.10	0.25	1.10	
		3.00		0.40	0.77	1.20	0.40	1.20	
		4.50		0.60	1.01	1.50	0.60	1.50	
		5.50		0.70	1.18	1.70	0.70	1.70	

NC7SZ14

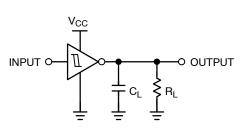
DC ELECTRICAL CHARACTERISTICS (continued)

					T _A = +25°C	;	T _A = -40	to +85°C	
Symbol	Parameter	V _{CC} (V)	Conditions	Min	Тур	Max	Min	Max	Unit
V _{OH}	HIGH Level Output Voltage	1.65	$V_{IN} = V_P \text{ or } V_N$	1.55	1.65	-	1.55	-	V
		1.80	I _{OH} = -100 μA	1.70	1.80	-	1.70	-	
		2.30		2.20	2.30	-	2.20	-	
		3.00		2.90	3.00	-	2.90	-	
		4.50]	4.40	4.50	-	4.40	_	
		1.65	I _{OH} = -4 mA	1.29	1.52	-	1.29	_	
		2.30	I _{OH} = -8 mA	1.90	2.15	-	1.90	-	
		3.00	I _{OH} = -16 mA	2.40	2.80	-	2.40	-	
		3.00	I _{OH} = -24 mA	2.30	2.68	-	2.30	-	
		4.50	I _{OH} = -32 mA	3.80	4.20	-	3.80	-	
V _{OL}	LOW Level Output Voltage	1.65	$\begin{aligned} V_{IN} &= V_P \text{ or } V_N, \\ I_{OL} &= 100 \mu A \end{aligned}$	1	0.00	0.10	-	0.10	V
		1.80		_	0.00	0.10	-	0.10	
		2.30		_	0.00	0.10	-	0.10	
		3.00		_	0.00	0.10	-	0.10	
		4.50		_	0.00	0.10	-	0.10	
		1.65	I _{OL} = 4 mA	_	0.08	0.24	-	0.24	
		2.30	I _{OL} = 8 mA	_	0.10	0.30	-	0.30	
		3.00	I _{OL} = 16 mA	_	0.15	0.40	-	0.40	
		3.00	I _{OL} = 24 mA	-	0.22	0.55	-	0.55	
		4.50	I _{OL} = 32 mA	_	0.22	0.55	-	0.55	
I _{IN}	Input Leakage Current	1.65 to 5.5	V _{IN} = 5.5 V, GND	ı	_	±0.1	-	±1.0	μΑ
I _{OFF}	Power Off Leakage Current	0	V _{IN} or V _{OUT} = 5.5 V	ı	_	1	-	10	μΑ
I _{CC}	Quiescent Supply Current	1.65 to 5.5	V _{IN} = 5.5 V, GND	-	_	1.0	-	10	μΑ

AC ELECTRICAL CHARACTERISTICS

				T _A = +25°C		;	T _A = -40	to +85°C	
Symbol	Parameter	V _{CC} (V)	Conditions	Min	Тур	Max	Min	Max	Unit
t _{PLH} , t _{PHL}	Propagation Delay	1.65	C _L = 15 pF,	_	9.1	15.0	-	15.6	ns
	(Figure 4, 5)	1.80	$R_L = 1 M\Omega$	_	7.6	12.5	-	13.0	
		2.50 ±0.20		-	5.0	9.0	-	9.5	
		3.30 ±0.30		_	3.7	6.3	-	6.5	
		5.00 ±0.50		_	3.1	5.2	-	5.5	
		3.30 ±0.30	C _L = 50 pF,	_	4.4	7.2	-	7.5	
		5.00 ±0.50	$R_L = 500 \Omega$	_	3.7	5.9	-	6.2	
C _{IN}	Input Capacitance	0.00		_	4	-	-	_	pF
C _{PD} Power Dissipation Capacitance	3.30		_	24	-	-	_	pF	
	(Note 2) (Figure 6)			-	30	-	-	_	

^{2.} C_{PD} is defined as the value of the internal equivalent capacitance which is derived from dynamic operating current consumption (I_{CCD}) at no output loading and operating at 50% duty cycle. C_{PD} is related to I_{CCD} dynamic operating current by the expression: I_{CCD} = (C_{PD}) (V_{CC}) (f_{IN}) + (I_{CC}static).



NOTE:

4. C_L includes load and stray capacitance; Input PRR = 1.0 MHz; t_W = 500 ns

Figure 4. AC Test Circuit

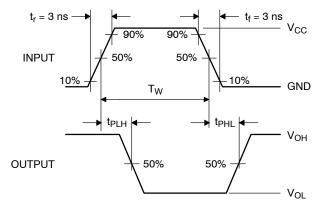
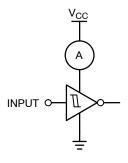


Figure 5. AC Waveforms



NOTE:

3. Input = AC Waveform; $t_r = t_f = 1.8 \text{ ns}$; PRR = 10 MHz; Duty Cycle = 50%.

Figure 6. I_{CCD} Test Circuit

ORDERING INFORMATION

Part Number	Top Mark	Operating Temperature	Packages	Shipping [†]
NC7SZ14M5X	7Z14	−40 to +85°C	SC-74A	3000 / Tape & Reel
NC7SZ14P5X	Z14	−40 to +85°C	SC-88A	3000 / Tape & Reel
NC7SZ14L6X	B6	−40 to +85°C	SIP6, MicroPak	5000 / Tape & Reel
NC7SZ14FHX	B6	–40 to +85°C	UDFN6, MicroPak2	5000 / 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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DATE 31 AUG 2016



NOTES:

- 1. CONFORMS TO JEDEC STANDARD MO-252 VARIATION UAAD
- 2. DIMENSIONS ARE IN MILLIMETERS
- 3. DRAWING CONFORMS TO ASME Y14.5M-2009
 4. PIN ONE IDENTIFIER IS 2X LENGTH OF ANY

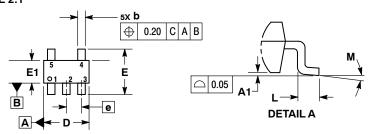
 - OTHER LINE IN THE MARK CODE LAYOUT.

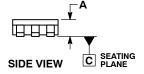
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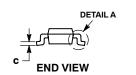
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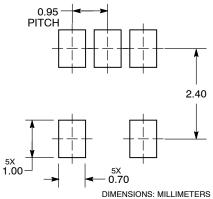
DATE 18 JAN 2018







RECOMMENDED SOLDERING 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.

NOTES:

- DIMENSIONING AND TOLERANCING PER ASME
 Y14.5M, 1994.
 CONTROLLING DIMENSION: MILLIMETERS.
 MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH
 THICKNESS. MINIMUM LEAD THICKNESS IS THE
 MINIMUM THICKNESS OF BASE MATERIAL.
- DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.15 PER SIDE.

	MILLIMETERS					
DIM	MIN	MAX				
Α	0.90	1.10				
A1	0.01	0.10				
b	0.25	0.50				
С	0.10	0.26				
D	2.85	3.15				
E	2.50	3.00				
E1	1.35	1.65				
е	0.95	BSC				
L	0.20	0.60				
М	0 °	10°				

GENERIC MARKING DIAGRAM*



XXX = Specific Device Code

Μ = 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.

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

DATE 17 JAN 2013



- TES:
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 CONTROLLING DIMENSION: INCH.
 419A-01 OBSOLETE. NEW STANDARD 3.
- 419A-02.
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	INCHES		MILLIN	ILLIMETERS	
DIM	MIN	MAX	MIN	MAX	
Α	0.071	0.087	1.80	2.20	
В	0.045	0.053	1.15	1.35	
С	0.031	0.043	0.80	1.10	
D	0.004	0.012	0.10	0.30	
G	0.026	BSC	0.65 BSC		
Н		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

= 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.



0.50 0.0197 0.65 0.025 0.65 0.025 0.40 0.0157 1.9 mm 0.0748 SCALE 20:1

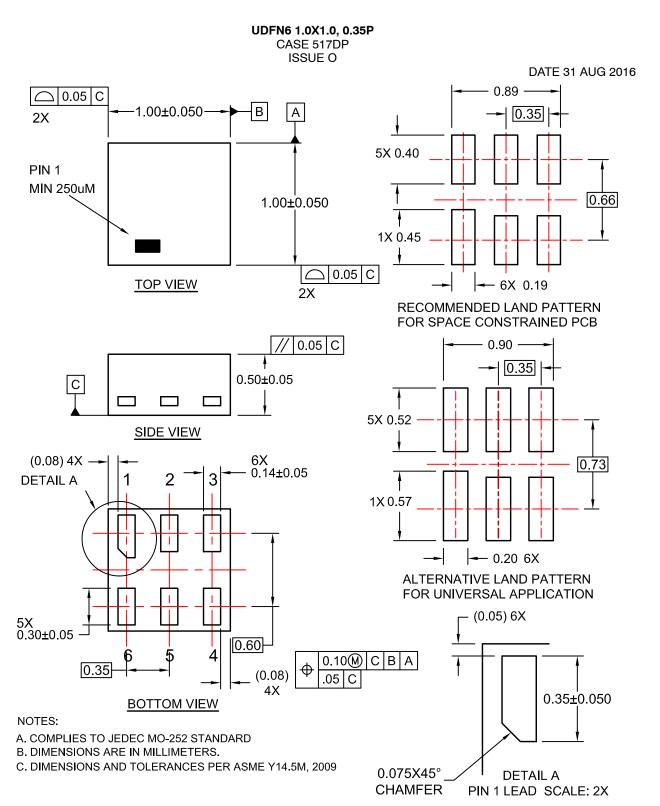
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STYLE 1: PIN 1. BASE 2. EMITTER 3. BASE 4. COLLECTOR 5. COLLECTOR	STYLE 2: PIN 1. ANODE 2. EMITTER 3. BASE 4. COLLECTOR 5. CATHODE	STYLE 3: PIN 1. ANODE 1 2. N/C 3. ANODE 2 4. CATHODE 2 5. CATHODE 1	STYLE 4: PIN 1. SOURCE 1 2. DRAIN 1/2 3. SOURCE 1 4. GATE 1 5. GATE 2	STYLE 5: PIN 1. CATHODE 2. COMMON ANODE 3. CATHODE 2 4. CATHODE 3 5. CATHODE 4

5. COLLECTOR	5. CATHODE	5. CATHODE I	5. GATE 2	5. CATHODE 4
STYLE 6: PIN 1. EMITTER 2 2. BASE 2 3. EMITTER 1 4. COLLECTOR 5. COLLECTOR 2/BASE 1	STYLE 7: PIN 1. BASE 2. EMITTER 3. BASE 4. COLLECTOR 5. COLLECTOR	STYLE 8: PIN 1. CATHODE 2. COLLECTOR 3. N/C 4. BASE 5. EMITTER	STYLE 9: PIN 1. ANODE 2. CATHODE 3. ANODE 4. ANODE 5. ANODE	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.

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