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TinyLogic UHS 3-Input NAND Gate

NC7SZ10

Description

The NC7SZ10 is a single 3–Input NAND Gate from **onsemi**'s Ultra High Speed Series of TinyLogic. The device is fabricated with advanced CMOS technology to achieve ultra high speed with high output drive while maintaining low static power dissipation over a broad V_{CC} operating range. The device is specified to operate over the 1.65 V to 5.5 V V_{CC} operating range. The inputs and output are high impedance when V_{CC} is 0 V. Inputs tolerate voltages up to 5.5 V independent of V_{CC} operating voltage.

Features

- Space Saving SC88 6-Lead Package
- Ultra Small MicroPakTM Leadless Package
- Ultra High Speed: $t_{PD} = 2.4 \text{ ns Typ}$ 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 5.5 V
- Power Down High Impedance Inputs / Output
- Overvoltage Tolerant Inputs Facilitate 5 V to 3 V Translation
- Patented Noise / EMI Reduction Circuitry Implemented
- These Devices are Pb–Free, Halogen Free/BFR Free and are RoHS Compliant

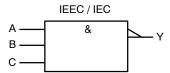


Figure 1. Logic Symbol

MARKING DIAGRAMS



SIP6 1.45x1.0 CASE 127EB





SC-88 CASE 419B-02



E6, Z10 = Specific Device Code

KK = 2-Digit Lot Run Traceability Code

XY = 2-Digit Date Code Format

Z = Assembly Plant Code

M = Data Code*

= Pb-Free Package

(Note: Microdot may be in either location)

*Date Code orientation and/or position may vary depending upon manufacturing location.

ORDERING INFORMATION

See detailed ordering, marking and shipping information in the package dimensions section on page 6 of this data sheet.

NOTE: Some of the devices on this data sheet have been **DISCONTINUED**. Please refer to the table on page 6.

Connection Diagrams

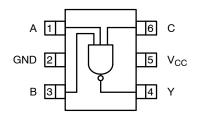


Figure 2. SC-88 (Top View)

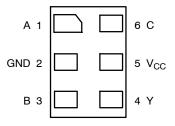
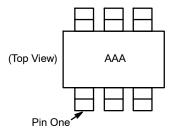


Figure 4. MicroPak (Top Through View)



AAA represents Product Code Top Mark – see ordering code.

NOTE: Orientation of Top Mark determines Pin One location. Read the Top Product Code Mark left to right, Pin One is the lower left pin (see diagram).

Figure 3. Pin 1 Orientation

PIN DESCRIPTIONS

Pin Name	Description
A, B, C	Inputs
Υ	Output

FUNCTION TABLE $(Y = \overline{ABC})$

	Output		
Α	В	С	Υ
Х	Х	L	Н
Х	L	Х	Н
L	Х	Х	Н
Н	Н	Н	L

H = HIGH Logic Level L = LOW Logic Level X = Either LOW or HIGH Logic Level

NC7SZ10

ABSOLUTE MAXIMUM RATINGS

Symbol	Param	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
l _{ok}	DC Output Diode Current	V _{OUT} < 0 V	-	-50	mA
I _{OUT}	DC Output Current		-	±50	mA
I _{CC} / I _{GND}	DC V _{CC} / GND Current	DC V _{CC} / GND Current		±50	mA
T _{STG}	Storage Temperature		-65	+150	°C
TJ	Junction Temperature under Bias		-	+150	°C
T _L	Junction Lead Temperature (Soldering, 10 Seconds)		-	+260	°C
P_{D}	Power Dissipation in Still Air	SC-88A	-	332	mW
		MicroPak-6	-	812	7

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.

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
t _r , t _f	Input Rise and Fall Time	V _{CC} @ 1.8 V, 2.5 V ±0.2 V	0	20	ns/V
		V _{CC} @ 3.3 V ±0.3 V	0	10	
		V _{CC} @ 5.0 V ±0.5 V	0	5	
$\theta_{\sf JA}$	Thermal Resistance	SC70-5	-	377	°C/W
		MicroPak-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.

NC7SZ10

DC ELECTICAL CHARACTERISTICS

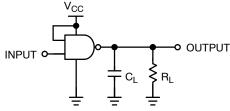
					T,	դ = +25°	°C	T _A = -40	to +85°C		
Symbol	Parameter	V _{CC} (V)	Coi	nditions	Min	Тур	Max	Min	Max	Unit	
V _{IH}	HIGH Level Input	1.65 to 1.95	1.65 to 1.95		0.65 V _{CC}	_	-	0.65 V _{CC}	-	V	
	Voltage	2.3 to 5.5			0.70 V _{CC}	-	-	0.70 V _{CC}	-	1	
V _{IL}	LOW Level Input	1.65 to 1.95			-	_	0.35 V _{CC}	-	0.35 V _{CC}	V	
	Voltage	2.3 to 5.5			_	_	0.30 V _{CC}	-	0.30 V _{CC}	1	
V _{OH}	HIGH Level Output	1.65	$V_{IN} = V_{IH}$	I _{OH} = -100 μA	1.55	1.65	-	1.55	-	V	
	Voltage	2.3	or V _{IL}		2.2	2.3	-	2.2	-	1	
		3.0			2.9	3.0	-	2.9	-	1	
		4.5			4.4	4.5	-	4.4	-	1	
		1.65		I _{OH} = -4 mA	1.29	1.52	-	1.29	-	1	
	2.3	2.3		I _{OH} = -8 mA	1.9	2.15	-	1.9	-	1	
			I _{OH} = -16 mA	2.4	2.80	-	2.4	-	1		
		3.0		I _{OH} = -24 mA	2.3	2.68	-	2.3	-	1	
		4.5		I _{OH} = -32 mA	3.8	4.20	-	3.8	-	1	
V _{OL}	V _{OL} LOW Level Output	1.65	V _{IN} = V _{IH} I _{OL} =	I _{OL} = 100 μA	-	0.0	0.1	-	0.1	V	
	Voltage	2.3		IL	_	0.0	0.1	-	0.1	1	
		3.0		1		_	0.0	0.1	-	0.1	1
		4.5			_	0.0	0.1	-	0.1	1	
		1.65		I _{OL} = 4 mA	-	0.08	0.24	-	0.24	1	
		2.3		I _{OL} = 8 mA	-	0.10	0.3	-	0.3	1	
		3.0		I _{OL} = 16 mA	-	0.15	0.4	-	0.4	1	
		3.0		I _{OL} = 24 mA	-	0.22	0.55	-	0.55	1	
		4.5		I _{OL} = 32 mA	-	0.22	0.55	-	0.55	1	
I _{IN}	Input Leakage Current	1.65 to 5.5	V _{IN} = 5.5 \	/, GND	-	_	±1	-	±10	μΑ	
I _{OFF}	Power Off Leakage Current	0.0	V _{IN} or V _{OL}	_{JT} = 5.5 V	-	_	1	-	10	μΑ	
I _{CC}	Quiescent Supply Current	1.65 to 5.5	V _{IN} = 5.5 \	/, GND	-	_	2.0	-	20	μΑ	

AC ELECTRICAL CHARACTERISTICS

				•	Γ _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	1.8 ±0.15	C _L = 15 pF,	-	7.0	17.5	-	18.0	ns
	(Figure 5, 7)	2.5 ±0.2	$R_L = 1 M\Omega$	-	3.0	10.5	-	11.0	
		3.3 ±0.3		-	2.4	7.5	-	8.0	
		5.0 ±0.5		-	2.0	5.5	-	6.0	
		3.3 ±0.3	C _L = 50 pF,	-	2.9	8.5	-	9.0	
		5.0 ±0.5	$R_L = 500 \Omega$	_	2.4	7.5	-	8.0	
C _{IN}	Input Capacitance	0		-	4	_	-	_	pF
C _{PD} Power Dissipation Capacitance	3.3	(Note 2)	_	24	-	-	_	pF	
	(Figure 6)	5.0		-	30	-	-	_	

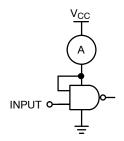
^{2.} C_{PD} is defined as the value of the internal equivalent capacitance which is derived from dynamic operating current consumption (I_{CCD}) at no output loading and operating at 50% duty cycle.(See Figure 6) C_{PD} is related to I_{CCD} dynamic operating current by the expression: I_{CCD} = (C_{PD}) (V_{CC}) (f_{IN}) + (I_{CC}static).

AC Loading and Waveforms



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

Figure 5. AC Test Circuit



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

Figure 6. I_{CCD} Test Circuit

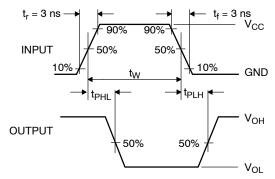


Figure 7. AC Waveforms

NC7SZ10

DEVICE ORDERING INFORMATION

Device	Top Mark	Packages	Shipping [†]
NC7SZ10P6X	Z10	6-Lead SC70, EIAJ SC88, 1.25 mm Wide	3000 / Tape & Reel

DISCONTINUED (Note 3)

NC7SZ10P6X-L22347	Z10	6-Lead SC70, EIAJ SC88, 1.25 mm Wide	3000 / Tape & Reel
NC7SZ10L6X	E6	6-Lead MicroPak, 1.00 mm Wide	5000 / Tape & Reel

[†]For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging

MicroPak is trademark of Semiconductor Components Industries, LLC (SCILLC) or its subsidiaries in the United States and/or other countries.

Specifications Brochure, BRD8011/D.

3. **DISCONTINUED:** These devices are not recommended for new design. Please contact your **onsemi** representative for information. The most current information on these devices may be available on www.onsemi.com.



ISSUE O DATE 31 AUG 2016 2X 0.05 C 1.45 В 2X (1) \bigcirc 0.05 C (0.49)(0.254)1.00 5X \ (0.75)(0.52)TOP VIEW Α 1X <u>1</u> PIN 1 IDENTIFIER /5\ 0.50±0.05 (0.30)6X PIN 1 0.05 RECOMMENED 0.00 LAND PATTERN 0.05 C - 0.35±0.05 С 1.45±0.05 -0.20±0.05 6X DETAIL A 1.0 0.10M|C|B|A

0.05(M)

0.30±0.05 5X

0.35±0.05 5X

(0.125)

4X

SIP6 1.45X1.0 CASE 127EB

NOTES:

1.00±0.05

(0.050)

6X

1. CONFORMS TO JEDEC STANDARD MO-252 VARIATION UAAD

0.5

- 2. DIMENSIONS ARE IN MILLIMETERS
- 3. DRAWING CONFORMS TO ASME Y14.5M-2009

BOTTOM VIEW

- 4.PIN ONE IDENTIFIER IS 2X LENGTH OF ANY
 - OTHER LINE IN THE MARK CODE LAYOUT.

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0.40±0.05

PIN 1 TERMINAL

DETAIL A

0.075 X 45°

CHAMFER





E1

6X 0.30 -

e

В

SC-88 2.00x1.25x0.90, 0.65P CASE 419B-02 **ISSUE Z**

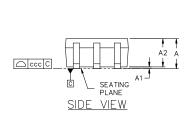
DATE 18 APR 2024

NOTES:

- DIMENSIONING AND TOLERANCING CONFORM TO ASME Y14.5-2018.
- ALL DIMENSION ARE IN MILLIMETERS.
- DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.20 PER END.
- DIMENSIONS D AND E1 AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY AND DATUM H.
 DATUMS A AND B ARE DETERMINED AT DATUM H.
- DIMENSIONS 6 AND c APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.08 AND 0.15 FROM THE TIP. 6.
- DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 TOTAL IN EXCESS OF DIMENSION 6 AT MAXIMUM MATERIAL CONDITION. THE DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OF THE FOOT.

DIM

MIN



TOP VIEW

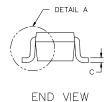
∆aaa H A−B

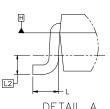
<u></u> БЬБ С

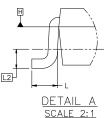
⊕ ddd M C A−B D

6X 0.66

2.50







GENERIC MARKING DIAGRAM*



Α			1.10		
A1	0.00		0.10		
A2	0.70	0.90	1.00		
b	0.15	0.20	0.25		
С	0.08	0.15	0.22		
D	:	2.00 BSC	;		
E		2.10 BSC			
E1		1.25 BSC			
е		0.65 BSC	;		
L	0.26	0.36	0.46		
L2		0.15 BSC	:		
aaa	0.15				
bbb	0.30				
ccc	0.10				
ddd		0.10			

MILLIMETERS

NOM

RECOMMENDED MOUNTING FOOTPRINT*

FOR ADDITIONAL INFORMATION ON OUR Pb-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ONSEMI SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.

XXX = Specific Device Code

= Date Code*

= Pb-Free Package

(Note: Microdot may be in either location)

- *Date Code orientation and/or position may vary depending upon manufacturing 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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DATE 18 APR 2024

STYLE 1: PIN 1. EMITTER 2 2. BASE 2 3. COLLECTOR 1 4. EMITTER 1 5. BASE 1 6. COLLECTOR 2	STYLE 2: CANCELLED	STYLE 3: CANCELLED	STYLE 4: PIN 1. CATHODE 2. CATHODE 3. COLLECTOR 4. EMITTER 5. BASE 6. ANODE	STYLE 5: PIN 1. ANODE 2. ANODE 3. COLLECTOR 4. EMITTER 5. BASE 6. CATHODE	STYLE 6: PIN 1. ANODE 2 2. N/C 3. CATHODE 1 4. ANODE 1 5. N/C 6. CATHODE 2
STYLE 7: PIN 1. SOURCE 2 2. DRAIN 2 3. GATE 1 4. SOURCE 1 5. DRAIN 1 6. GATE 2	STYLE 8: CANCELLED	STYLE 9: PIN 1. EMITTER 2 2. EMITTER 1 3. COLLECTOR 1 4. BASE 1 5. BASE 2 6. COLLECTOR 2	STYLE 10: PIN 1. SOURCE 2 2. SOURCE 1 3. GATE 1 4. DRAIN 1 5. DRAIN 2 6. GATE 2	STYLE 11: PIN 1. CATHODE 2 2. CATHODE 2 3. ANODE 1 4. CATHODE 1 5. CATHODE 1 6. ANODE 2	STYLE 12: PIN 1. ANODE 2 2. ANODE 2 3. CATHODE 1 4. ANODE 1 5. ANODE 1 6. CATHODE 2
STYLE 13: PIN 1. ANODE 2. N/C 3. COLLECTOR 4. EMITTER 5. BASE 6. CATHODE	STYLE 14: PIN 1. VREF 2. GND 3. GND 4. IOUT 5. VEN 6. VCC	STYLE 15: PIN 1. ANODE 1 2. ANODE 2 3. ANODE 3 4. CATHODE 3 5. CATHODE 2 6. CATHODE 1	STYLE 16: PIN 1. BASE 1 2. EMITTER 2 3. COLLECTOR 2 4. BASE 2 5. EMITTER 1 6. COLLECTOR 1	STYLE 17: PIN 1. BASE 1 2. EMITTER 1 3. COLLECTOR 2 4. BASE 2 5. EMITTER 2 6. COLLECTOR 1	STYLE 18: PIN 1. VIN1 2. VCC 3. VOUT2 4. VIN2 5. GND 6. VOUT1
STYLE 19: PIN 1. I OUT 2. GND 3. GND 4. V CC 5. V EN 6. V REF	STYLE 20: PIN 1. COLLECTOR 2. COLLECTOR 3. BASE 4. EMITTER 5. COLLECTOR 6. COLLECTOR	STYLE 21: PIN 1. ANODE 1 2. N/C 3. ANODE 2 4. CATHODE 2 5. N/C 6. CATHODE 1	STYLE 22: PIN 1. D1 (i) 2. GND 3. D2 (i) 4. D2 (c) 5. VBUS 6. D1 (c)	STYLE 23: PIN 1. Vn 2. CH1 3. Vp 4. N/C 5. CH2 6. N/C	STYLE 24: PIN 1. CATHODE 2. ANODE 3. CATHODE 4. CATHODE 5. CATHODE 6. CATHODE
STYLE 25: PIN 1. BASE 1 2. CATHODE 3. COLLECTOR 2 4. BASE 2 5. EMITTER 6. COLLECTOR 1	STYLE 26: PIN 1. SOURCE 1 2. GATE 1 3. DRAIN 2 4. SOURCE 2 5. GATE 2 6. DRAIN 1	STYLE 27: PIN 1. BASE 2 2. BASE 1 3. COLLECTOR 1 4. EMITTER 1 5. EMITTER 2 6. COLLECTOR 2	STYLE 28: PIN 1. DRAIN 2. DRAIN 3. GATE 4. SOURCE 5. DRAIN 6. DRAIN	STYLE 29: PIN 1. ANODE 2. ANODE 3. COLLECTOR 4. EMITTER 5. BASE/ANODE 6. CATHODE	STYLE 30: PIN 1. SOURCE 1 2. DRAIN 2 3. DRAIN 2 4. SOURCE 2 5. GATE 1 6. DRAIN 1

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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 $\textbf{Technical Library:} \ \underline{www.onsemi.com/design/resources/technical-documentation}$

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