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TinyLogic HST 2-Input Exclusive-OR Gate

NC7ST86

Description

The NC7ST86 is a single 2–Input high performance CMOS Exclusive–OR Gate, with TTL–compatible inputs. Advanced Silicon Gate CMOS fabrication assures high speed and low power circuit operation. ESD protection diodes inherently guard both inputs and outputs with respect to the V_{CC} and GND rails. High gain circuitry offers high noise immunity and reduced sensitivity to input edge rate. The TTL–compatible inputs facilitate TTL to NMOS / CMOS interfacing. Device performance is similar to MM74HCT but with $1/_2$ the output current drive of HC / HCT.

Features

- Space Saving SOT23-5, SC-74A and SC-88A 5-Lead Package
- Ultra Small MicroPakTM Leadless Package
- High Speed: $t_{PD} < 8$ ns Typ, $V_{CC} = 5$ V, $C_L = 15$ pF
- Low Quiescent Power: $I_{CC} < 1 \mu A$ Typ, $V_{CC} = 5.5 V$
- Balanced Output Drive: 2 mA I_{OL}, –2 mA I_{OH}
- TTL-compatible Inputs
- These Devices are Pb–Free, Halogen Free/BFR Free and are RoHS Compliant

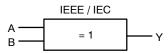


Figure 1. Logic Symbol

		CASE 127EB	XYZ
	v	Pin 1	*
OS on uit nd try		SC-74A CASE 318BQ	8S86M• 0 •
tte. DS $\frac{1}{2}$	ALL A	SOT23–5 CASE 527AH	
	A	SC-88A CASE 419A-02	П П Т86М• о •
HS	D6, 8S86, T86 KK XY Z	= Specific Device = 2-Digit Lot Run = 2-Digit Date Co = Assembly Plant	Traceability Code de Format

SIP6

XY	= 2–Digit Date Code Forma
Z	= Assembly Plant Code
Μ	= Date Code*

*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 4 of this data sheet.

NOTE: Some of the devices on this data sheet have been **DISCONTINUED**. Please refer to the table on page 4.

MARKING DIAGRAMS

D6KK

Pin Configurations

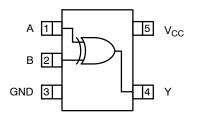


Figure 2. SOT23-5, SC-88A and SC-74A (Top View)

PIN DESCRIPTIONS

Pin Name	Description
A, B	Input
Y	Output
NC	No Connect

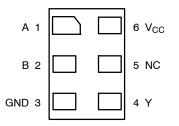


Figure 3. MicroPak (Top Through View)

FUNCTION TABLE $(Y = A \oplus B)$

Inp	Inputs		
А	Y		
L	L	L	
L	Н	Н	
Н	L	Н	
Н	Н	L	

H = HIGH Logic Level L = LOW Logic Level

ABSOLUTE MAXIMUM RATINGS

Symbol	Param	eter	Min	Max	Unit
V _{CC}	Supply Voltage		-0.5	6.5	V
I _{IK}	DC Input Diode Current	V _{IN} < 0 V	-	-20	mA
		$V_{IN} > V_{CC}$	-	+20	
V _{IN}	DC Input Voltage		-0.5	V _{CC} + 0.5	V
I _{OK} DC Output Diode Current		V _{OUT} < 0 V	-	-20	mA
		V _{OUT} > V _{CC}	-	+20	
V _{OUT}	Output Voltage		-0.5	V _{CC} + 0.5	V
I _{OUT}	DC Output Source or Sink Currer	nt	-	±12.5	mA
I_{CC} or I_{GND}	DC V _{CC} or Ground Current per S	upply Pin	-	±25	mA
T _{STG}	Storage Temperature		-65	+150	°C
TJ	Junction Temperature		-	+150	°C
ΤL	Lead Temperature (Soldering, 10	Seconds)	-	+260	°C
PD	Power Dissipation in Still Air	SC-74A / SOT23-5	-	390	mW
		SC-88A	-	332	1
		MicroPak-6	_	812	

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		4.5	5.5	V
V _{IN}	Input Voltage		0	V _{CC}	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} = 5.0 V	0	10	ns/V
θ_{JA}	Thermal Resistance	SC-74A / SOT23-5	-	320	°C/W
		SC-88A	-	377	
		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.

DC ELECTICAL CHARACTERISTICS

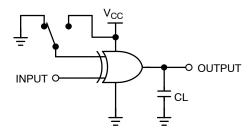
				$T_{A} = +25^{\circ}C$ $T_{A} = -40$ to -		to +85°C			
Symbol	Parameter	V _{CC} (V)	Conditions	Min	Тур	Max	Min	Max	Unit
VIH	HIGH Level Input Voltage	4.5 – 5.5		2.0	-	-	2.0	-	V
V _{IL}	LOW Level Input Voltage	4.5 – 5.5		-	-	0.8	-	0.8	V
V _{OH}	HIGH Level Output Voltage	4.5	I_{OH} = -20 μ A, V _{IN} = V _{IL} ,	4.4	4.5	-	4.4	-	V
		4.5	V _{IH} I _{OH} = -2 mA	4.18	4.35	-	4.13	-	
V _{OL}	LOW Level Output Voltage	4.5	$I_{OL}=20~\mu\text{A},~V_{IN}=V_{IL},$	-	0	0.1	-	0.1	V
		4.5	V _{IH} I _{OL} = 2 mA	-	0.10	0.26	-	0.33	
I _{IN}	Input Leakage Current	5.5	$0 \leq V_{IN} \leq 5.5 \ V$	-	-	±0.1	-	±1.0	μA
I _{CC}	Quiescent Supply Current	5.5	$V_{IN} = V_{CC}$ or GND	-	-	1.0	-	10.0	μA
I _{CCT}	I _{CC} per Input	5.5	One Input $V_{IN} = 0.5 \text{ V or}$ 2.4 V, Other Input V_{CC} or GND	_	_	2.0	_	2.9	mA

AC ELECTRICAL CHARACTERISTICS

					T _A = +25°C	2	T _A = -40	to +85°C	
Symbol	Parameter	V _{CC} (V)	Conditions	Min	Тур	Max	Min	Max	Unit
t _{PLH} , t _{PHL}	Propagation Delay (Figure 4, 6)	5.0	C _L = 15 pF	-	4.4	14	-	-	ns
				-	7.4	19	-	-	
		4.5	C _L = 50 pF	-	6.6	18	-	22	
				-	13.1	29	-	33	
		5.5		-	5.6	16	-	20	
				-	12.5	28	-	32	
t _{TLH} , t _{THL}	Output Transition Time	5.0	C _L = 15 pF	-	4	10	-	-	ns
	(Figure 4, 6)	4.5	C _L = 50 pF	-	11	25	-	31	
		5.5		-	10	21	-	26	
C _{IN}	Input Capacitance	Open		-	2	10	-	-	pF
C _{PD}	Power Dissipation Capacitance (Figure 5)	5.0	(Note 2)	-	8	-	-	-	pF

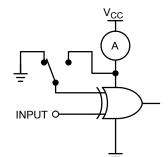
2. C_{PD} is defined as the value of the internal equivalent capacitance which is derived from dynamic operating current. Current consumption (I_{CCD}) at no output loading and operating at 50% duty cycle. (See Figure 5) C_{PD} is related to I_{CCD} dynamic operating current by the expression: $I_{CCD} = (C_{PD}) (V_{CC}) (f_{IN}) + (I_{CC} static)$.

AC Loading and Waveforms



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

Figure 4. AC Test Circuit



Input = AC Waveforms; PRR = Variable; Duty Cycle = 50%.

Figure 5. I_{CCD} Test Circuit

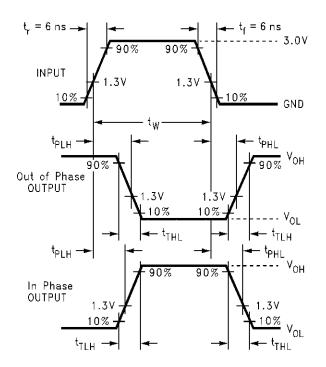


Figure 6. AC Waveforms

ORDERING INFORMATION

Order Number	Top Mark	Package Description	Shipping [†]
NC7ST86M5X	8S86	SC-74A	3000 / Tape & Reel
NC7ST86P5X	T86	SC-88A	3000 / Tape & Reel
NC7ST86L6X	D6	SIP6, MicroPak	5000 / Tape & Reel

DISCONTINUED (Note 3)

NC7ST86M5X-L22090	8S86	SOT23-5	3000 / Tape & Reel
NC7ST86P5X-L22057	T86	SC-88A	3000 / Tape & Reel
NC7ST86L6X-L22175	D6	SIP6, MicroPak	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.

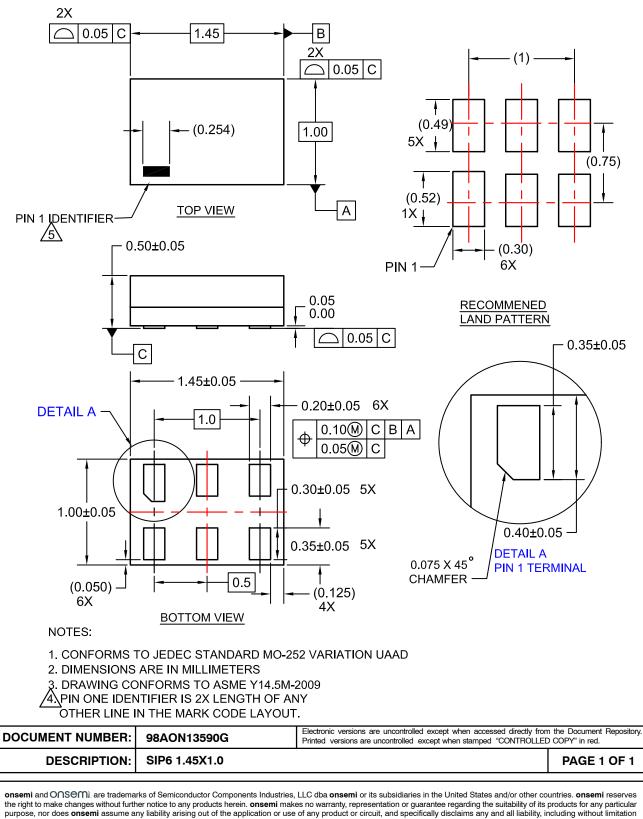
 DISCONTINUED: These devices are not recommended for new design. Please contact your onsemi representative for information. The most current information on these devices may be available on <u>www.onsemi.com</u>.

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SIP6 1.45X1.0 CASE 127EB ISSUE O

DATE 31 AUG 2016



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SC-74A-5 3.00x1.50x0.95, 0.95P CASE 318BQ **ISSUE C** DATE 26 FEB 2024 NOTES: 5X b ⊕ 0.20 M C A B DIMENSIONING AND TOLERANCING CONFORM TO ASME 1. Y14.5-2018. 2. ALL DIMENSION ARE IN MILLIMETERS (ANGLES IN DEGREES). В 3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, Ē 4 E1 PROTRUSIONS OF GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.15 PER SIDE. MILLIMETERS ○ 0.15 C DIM NOM. MIN. MAX. 2X е 0.90 1.00 1.10 А A A1 0.01 0.18 0.10 0.95 REF Α2 TOP VIEW 0.25 0.37 0.50 b DETAIL A (A2) 0.10 0.18 0.26 С Α D 2.85 3.00 3.15 Ε 2.75 BSC E1 1.35 1.50 1.65 0.05 C SEATING е 0.95 BSC Α1 Ċ PLANE END VIEW SIDE VIEW L 0.20 0.40 0.60 L1 0.62 REF 0.25 BSC 12 GAUGE PLANE L2 5° 10° Θ 0° 1.90 0.95 Ð, (L1)"A" DETAIL SCALE 2:1 2.40 GENERIC **MARKING DIAGRAM*** 1.00 0.70 XXX M= -O RECOMMENDED MOUNTING FOOTPRINT* FOR ADDITIONAL INFORMATION ON OUR Pb-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ON SEMICONDUCTOR SOLDERING AND MOUNTING XXX = Specific Device Code = Date Code Μ TECHNIQUES REFERENCE MANUAL, SOLDERRM/D. = 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. Electronic versions are uncontrolled except when accessed directly from the Document Repository. **DOCUMENT NUMBER:** 98AON66279G Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red. **DESCRIPTION:** SC-74A-5 3.00x1.50x0.95, 0.95P PAGE 1 OF 1

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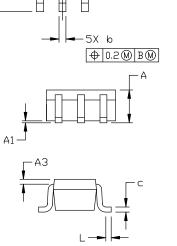
DATE 11 APR 2023



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

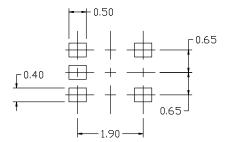
NDTES:

- 1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
- 2. CONTROLLING DIMENSION: MILLIMETERS
- 3. 419A-01 DBSDLETE. NEW STANDARD 419A-02
- 4. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.1016MM PER SIDE.



e

F1



RECOMMENDED MOUNTING FOOTPRINT

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

DIM	MILLIMETERS					
MIM	MIN.	NDM,	MAX.			
А	0.80	0.95	1.10			
A1			0.10			
AЗ		0.20 REF				
b	0.10	0.20	0.30			
С	0.10		0.25			
D	1.80	2.00	2.20			
E	2.00	2.10	2,20			
E1	1.15	1.25	1.35			
e		0.65 BS	С			
L	0.10	0.15	0.30			

GENERIC MARKING





*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.

XXX = Specific Device Code

M = Date Code = Pb-Free Package

(Note: Microdot may be in either location)

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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 ANOD 3. CATHODE 2 4. CATHODE 3 5. CATHODE 4	E

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PIN 1

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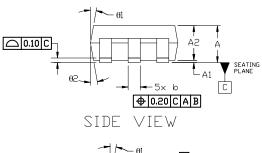
NDTES:

A

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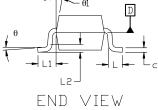
В

- 1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 19894
- 2. CONTROLLING DIMENSION: MILLIMETERS
- MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.
- 4. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.25 PER SIDE. D AND E1 DIMENSIONS ARE DETERMINED AT DATUM D.
- 5. DIMENSION 'b' DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08mm TOTAL IN EXCESS OF THE 'b' DIMENSION AT MAXIMUM MATERIAL CONDITION. MINIMUM SPACE BETWEEN PROTRUSION AND AN ADJACENT LEAD SHALL NOT BE LESS THAN 0.07mm.



-e

TOP VIEW



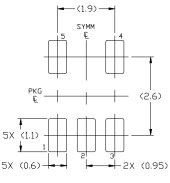
GENERIC MARKING DIAGRAM*



XXX = Specific Device CodeM = Date Code

*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.

	MILLIMETERS		
DIM	MIN.	NDM.	MAX.
Α	0.90	—	1.45
A1	0.00	_	0.15
A2	0.90	1.15	1.30
b	0.30	—	0.50
C	0.08	_	0.22
D	2.90 BSC		
Е	2.80 BSC		
E1	1.60 BSC		
e	0.95 BSC		
L	0.30	0.45	0.60
L1	0.60 REF		
L2	0.25 REF		
θ	0*	4°	8*
01	0°	10°	15°
θ 2	0°	10°	15°



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