

NC7S86 TinyLogic™ HS 2-Input Exclusive-OR Gate

General Description

The NC7S86 is a single 2-Input high performance CMOS Exclusive-OR Gate. Advanced Silicon Gate CMOS fabrication assures high speed and low power circuit operation over a broad V_{CC} range. ESD protection diodes inherently guard both inputs and output with respect to the V_{CC} and GND rails. Inputs are well buffered from the output to assure high noise immunity and reduced sensitivity to input edge rate.

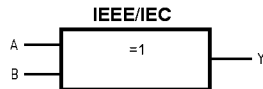
Features

- Space saving SOT23 or SC70 5-lead package
- High Speed; t_{PD} 4.5 ns typ
- Low Quiescent Power; $I_{CC} < 1 \mu A$
- Balanced Output Drive; 2 mA I_{OL} , -2 mA I_{OH}
- Broad V_{CC} Operating Range; 2V-6V
- Balanced Propagation Delays
- Specified for 3V operation

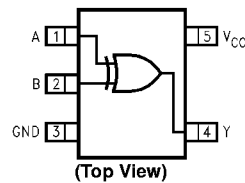
Ordering Code:

Order Number	Package Number	Package Top Mark	Package Description	Supplied As
NC7S86M5	MA05B	7S86	5-Lead, SOT23, JEDEC MO-178, 1.6mm	250 Units on Tape and Reel
NC7S86M5X	MA05B	7S86	5-Lead, SOT23, JEDEC MO-178, 1.6mm	3k Units on Tape and Reel
NC7S86P5	MAA05A	S86	5-Lead SC70, EIAJ SC-88a, 1.25 Wide	250 Units on Tape and Reel
NC7S86P5X	MAA05A	S86	5-Lead SC70, EIAJ SC-88a, 1.25 Wide	3k Units on Tape and Reel

Logic Symbol



Connection Diagram



Pin Descriptions

Pin Names	Description
A, B	Input
Y	Output

Function Table

$Y = A \oplus B$

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

H = HIGH Logic Level
L = LOW Logic Level

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Absolute Maximum Ratings ^(Note 1)		Recommended Operating Conditions	
Supply Voltage (V_{CC})	-0.5V to +7.0V	Supply Voltage (V_{CC})	2.0V to 6.0V
DC Input Diode Current (I_{IK})		Input Voltage (V_{IN})	0V to V_{CC}
@ $V_{IN} \leq -0.5V$	-20 mA	Output Voltage (V_{OUT})	0V to V_{CC}
@ $V_{IN} \geq V_{CC} + 0.5V$	+20 mA	Operating Temperature (T_A)	-40°C to +85°C
DC Input Voltage (V_{IN})	-0.5V to $V_{CC} + 0.5V$	Input Rise and Fall Time (t_r, t_f)	
DC Output Diode Current (I_{OK})		V_{CC} @ 2.0V	0 to 1000 ns
@ $V_{OUT} < -0.5V$	-20 mA	V_{CC} @ 3.0V	0 to 750 ns
@ $V_{OUT} > V_{CC} + 0.5V$	+20 mA	V_{CC} @ 4.5V	0 to 500 ns
DC Output Voltage (V_{OUT})	-0.5V to $V_{CC} + 0.5V$	V_{CC} @ 6.0V	0 to 400 ns
DC Output Source or Sink Current (I_{OUT})	± 12.5 mA	Thermal Resistance (θ_{JA})	
DC V_{CC} or Ground Current per Output Pin (I_{CC} or I_{GND})	± 25 mA	SOT23-5	300°C/W
Storage Temperature (T_{STG})	-65°C to +150°C	SC70-5	425°C/W
Junction Temperature (T_J)	150°C	Note 1: Absolute maximum ratings are those values beyond which damage to the device may occur. The databook specifications should be met, without exception, to ensure that the system design is reliable over its power supply, temperature, and output/input loading variables. Fairchild does not recommend operation of circuits outside databook specifications.	
Lead Temperature (T_L); (Soldering, 10 seconds)	260°C		
Power Dissipation (P_D) @ +85°C			
SOT23-5	200 mW		
SC70-5	150 mW		

DC Electrical Characteristics

Symbol	Parameter	V_{CC} (V)	$T_A = +25^\circ\text{C}$			$T_A = -40^\circ\text{C to } +85^\circ\text{C}$		Units	Conditions
			Min	Typ	Max	Min	Max		
V_{IH}	HIGH Level Input Voltage	2.0 3.0-6.0	1.50 0.7 V_{CC}			1.50 0.7 V_{CC}	V		
V_{IL}	LOW Level Input Voltage	2.0 3.0-6.0			0.50 0.3 V_{CC}	0.50 0.3 V_{CC}	V		
V_{OH}	HIGH Level Output Voltage	2.0 3.0 4.5 6.0	1.90 2.90 4.40 5.90	2.0 3.0 4.5 6.0		1.90 2.90 4.40 5.90	V	$I_{OH} = -20 \mu\text{A}$ $V_{IN} = V_{IH}, V_{IL}$	
		3.0 4.5 6.0	2.68 4.18 5.68	2.85 4.35 5.85		2.63 4.13 5.63	V	$V_{IN} = V_{IH}, V_{IL}$ $I_{OH} = -1.3 \text{ mA}$ $I_{OH} = -2 \text{ mA}$ $I_{OH} = -2.6 \text{ mA}$	
V_{OL}	LOW Level Output Voltage	2.0 3.0 4.5 6.0		0.0 0.0 0.0 0.0	0.10 0.10 0.10 0.10	0.10 0.10 0.10 0.10	V	$I_{OL} = 20 \mu\text{A}$ $V_{IN} = V_{IH} \text{ or } V_{IL}$	
		3.0 4.5 6.0		0.1 0.1 0.1	0.26 0.26 0.26	0.33 0.33 0.33	V	$V_{IN} = V_{IH} \text{ or } V_{IL}$ $I_{OL} = 1.3 \text{ mA}$ $I_{OL} = 2 \text{ mA}$ $I_{OL} = 2.6 \text{ mA}$	
I_{IN}	Input Leakage Current	6.0		± 0.1		± 1.0	μA	$V_{IN} = V_{CC}, \text{ GND}$	
I_{CC}	Quiescent Supply Current	6.0		1.0		10.0	μA	$V_{IN} = V_{CC}, \text{ GND}$	

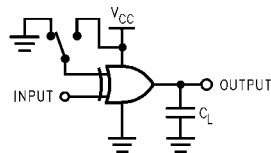
AC Electrical Characteristics

Symbol	Parameter	V _{CC} (V)	T _A = +25°C			T _A = -40°C to +85°C		Units	Conditions	Fig. No.
			Min	Typ	Max	Min	Max			
t _{PLH}	Propagation Delay	5.0	4.5	17			ns	C _L = 15 pF	Figure 1	
t _{PHL}		2.0	22	100		125		C _L = 50 pF	Figure 3	
		3.0	12	27		35	ns			
		4.5	8.5	20		25				
		6.0	7	17		21				
t _{TLH}	Output Transition Time	5.0	3	8			ns	C _L = 15 pF	Figure 1	
t _{THL}		2.0	25	125		155		C _L = 50 pF	Figure 3	
		3.0	16	35		45	ns			
		4.5	11	25		31				
		6.0	9	21		26				
C _{IN}	Input Capacitance	Open	2	10		10	pF			
C _{PD}	Power Dissipation Capacitance	5.0	8				pF	(Note 2)	Figure 2	

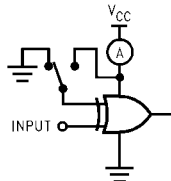
Note 2: C_{PD} is defined as the value of the internal equivalent capacitance which is derived from dynamic operating current consumption (I_{CCD}) at no output loading and operating at 50% duty cycle. (See Figure 2.) C_{PD} is related to I_{CCD} dynamic operating current by the expression:

$$I_{CCD} = (C_{PD})(V_{CC})(f_{IN}) + (I_{CC} \text{static})$$

AC Loading and Waveforms



C_L includes load and stray capacitance
 Input PRR = 1.0 MHz; t_w = 500 ns
FIGURE 1. AC Test Circuit



Input = AC Waveform;
 PRR = variable; Duty Cycle = 50%
FIGURE 2. I_{CCD} Test Circuit

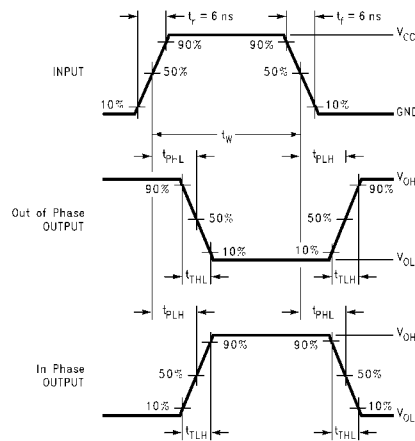
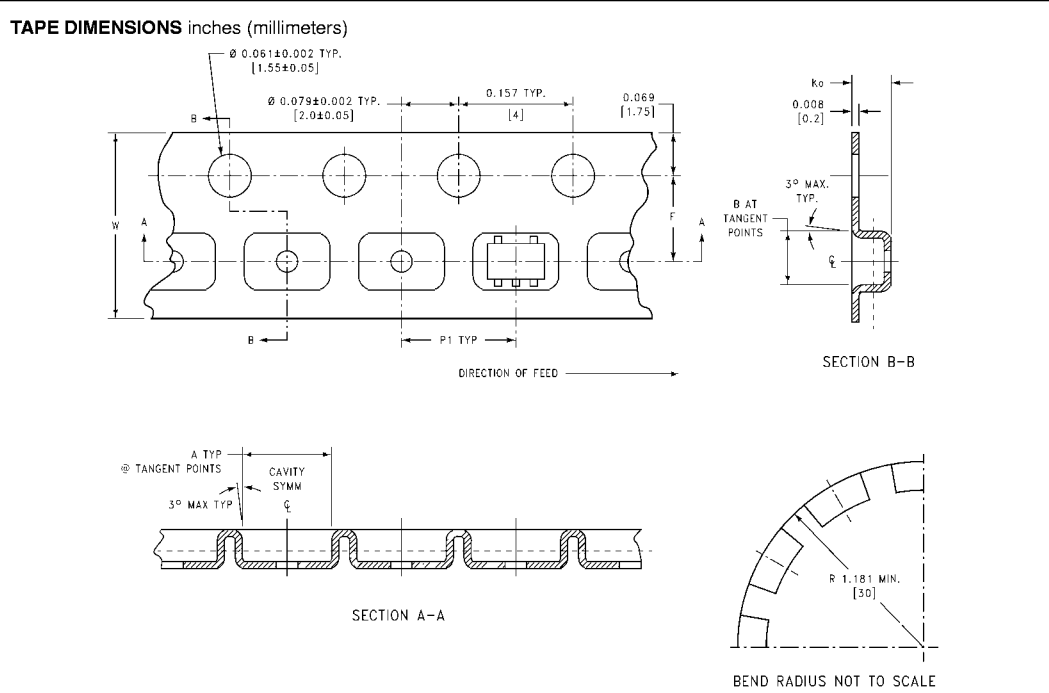


FIGURE 3. AC Waveforms

Tape and Reel Specification

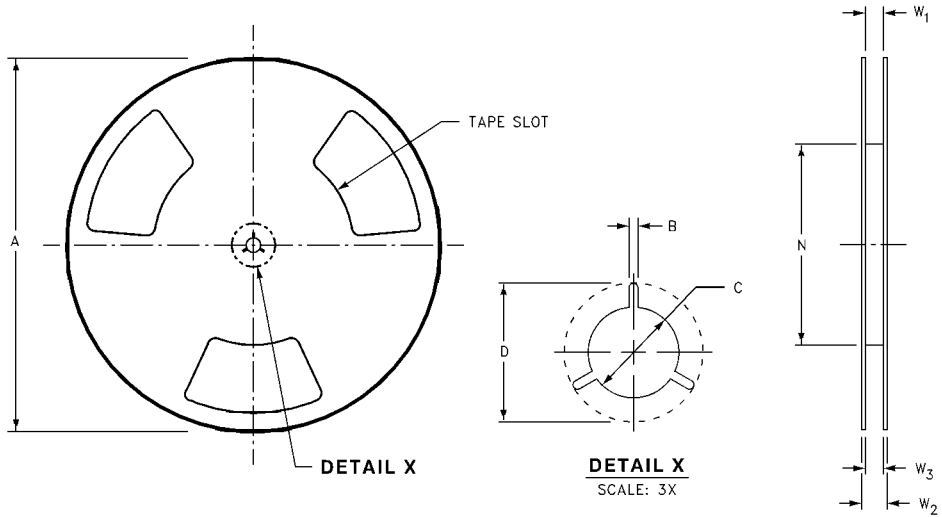
TAPE FORMAT

Package Designator	Tape Section	Number Cavities	Cavity Status	Cover Tape Status
M5, P5	Leader (Start End)	125 (typ)	Empty	Sealed
	Carrier	250	Filled	Sealed
	Trailer (Hub End)	75 (typ)	Empty	Sealed
M5X, P5X	Leader (Start End)	125 (typ)	Empty	Sealed
	Carrier	3000	Filled	Sealed
	Trailer (Hub End)	75 (typ)	Empty	Sealed



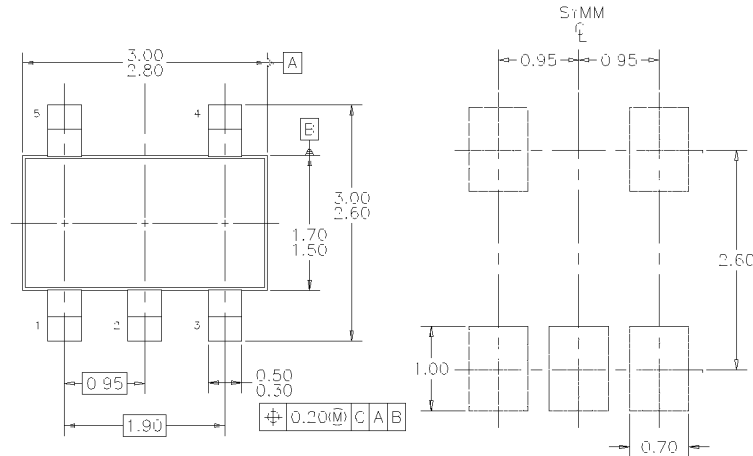
Package	Tape Size	DIM A	DIM B	DIM F	DIM K _o	DIM P1	DIM W
SC70-5	8 mm	0.093 (2.35)	0.096 (2.45)	0.138 ±0.004 (3.5 ±0.10)	0.053 ±0.004 (1.35 ±0.10)	0.157 (4)	0.315 ±0.004 (8 ±0.1)
SOT23-5	8 mm	0.130 (3.3)	0.130 (3.3)	0.138 ±0.002 (3.5 ±0.05)	0.055 ±0.004 (1.4 ±0.11)	0.157 (4)	0.315 ±0.012 (8 ±0.3)

REEL DIMENSIONS inches (millimeters)

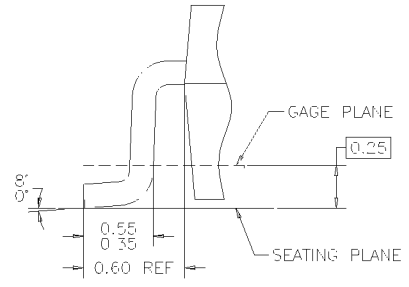
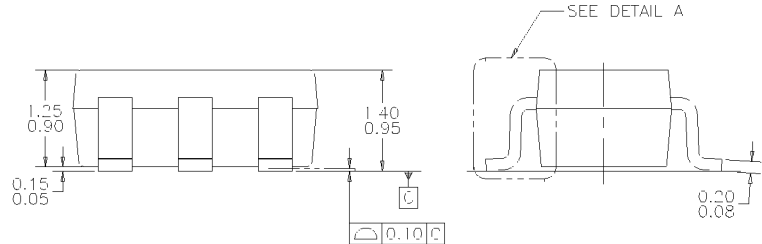


Tape Size	A	B	C	D	N	W1	W2	W3
8 mm	7.0 (177.8)	0.059 (1.50)	0.512 (13.00)	0.795 (20.20)	2.165 (55.00)	0.331 +0.059/-0.000 (8.40 +1.50/-0.00)	0.567 (14.40)	W1 +0.078/-0.039 (W1 +2.00/-1.00)

Physical Dimensions inches (millimeters) unless otherwise noted



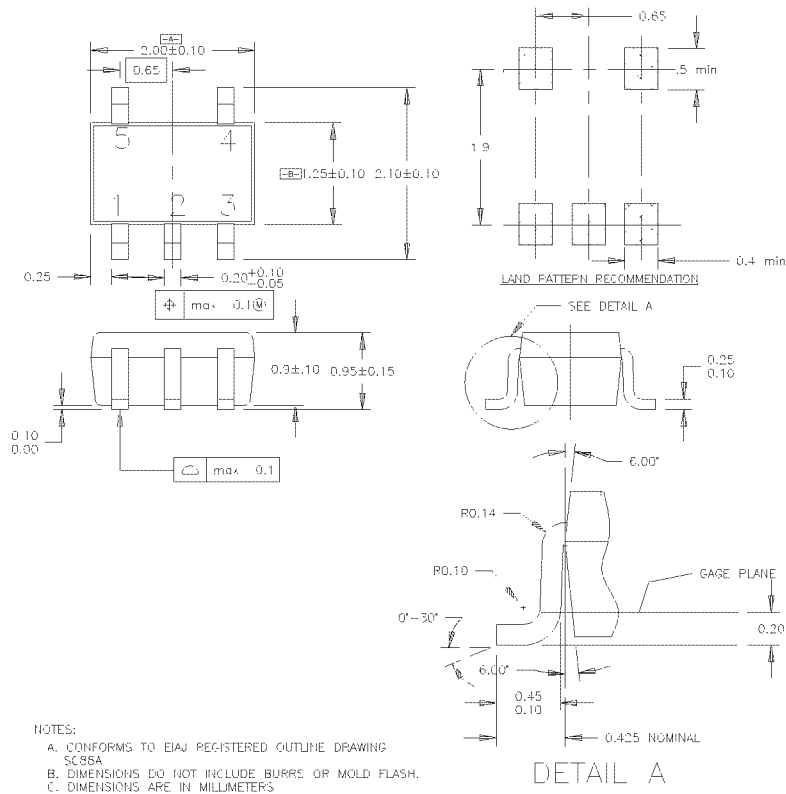
LAND PATTERN RECOMMENDATION



- NOTES: UNLESS OTHERWISE SPECIFIED
- A) THIS PACKAGE CONFORMS TO JEDEC MO-178, ISSUE B, VARIATION AA, DATED JANUARY, 1999.
 - B) ALL DIMENSIONS ARE IN MILLIMETERS.

**5-Lead SOT23, JEDEC MO-178, 1.6mm
Package Number MA05B**

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



**5-Lead SC70, EIAJ SC-88a, 1.25mm Wide
 Package Number MAA05A**

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