National Semiconductor

December 1996

NC7SZ32
Tiny UHS 2-Input OR Gate

General Description

The NC7SZ32 is a single 2-Input OR Gate from National's Ultra High Speed Series of TinyLogic in the space saving TinyPak™ package. 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 very broad V_{CC} operating range. The device is specified to operate over the 1.8V–5.5V V_{CC} range. The inputs and output are high impedance when V_{CC} is 0V. Inputs tolerate voltages up to 6V independent of V_{CC} operating voltage.

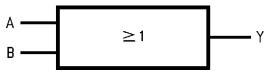
Features

- Space saving 5-lead surface mount SOT23 package
- Ultra high speed t_{PD} 2.4 ns Typ into 50 pF at 5V V_{CC}
- High output drive ±24 mA at 3V V_{CC}
- Broad V_{CC} operating range 1.8V–5.5V
- Matches the performance of LCX when operated at 3.3V V_{CC}
- Power down high impedance inputs/output
- Overvoltage tolerant inputs facilitate 5V–3V translation
- Quiet Series™ noise/EMI reduction circuitry implemented

Product Code	Package	Package Drawing	Package Top Mark	Supplied As
NC7SZ32M5	5-Pin SOT-23-5	MA05B	7Z32	250 Units on Tape and Reel
NC7SZ32M5X	5-Pin SOT-23-5	MA05B	7Z32	3k Units on Tape and Reel

Logic Symbol

IEEE/IEC



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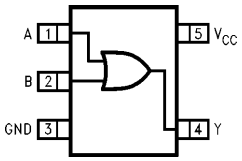
Connection Diagram

Pin Assignment for SOT-23-5 Package



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Top View

Function Table

$Y = A + B$

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

H = HIGH Logic Level
L = LOW Logic Level

Pin Descriptions

Pin Names	Description
A, B	Inputs
Y	Output

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Absolute Maximum Ratings (Note 1)

Supply Voltage (V_{CC})	−0.5V to +6V
DC Input Voltage (V_{IN})	−0.5V to +6V
DC Output Voltage (V_{OUT})	−0.5V to +6V
DC Input Diode Current (I_{IK})	
@ $V_{IN} < -0.5V$	−50 mA
@ $V_{IN} > 6V$	+20 mA
DC Output Diode Current (I_{OK})	
@ $V_{OUT} < -0.5V$	−50 mA
@ $V_{OUT} > 6V$, V_{CC} = GND	+20 mA
DC Output Current (I_{OL}/I_{OH})	±50 mA
DC V_{CC}/GND Current (I_{CC}/I_{GND})	±50 mA
Storage Temperature (T_{STG})	−65°C to +150°C
Junction Temperature under Bias (T_J)	150°C
Junction Lead Temp (T_L); Soldering, 10 sec)	260°C
Package Power Dissipation @ +70°C	200 mW
ESD Tolerance (Human Body Model) MIL-STD-883D Method 3015.7	1000V
DC Latchup Tolerance (JEDEC Method 17)	
Negative Source Current (NIT)	−500 mA
Positive Source Voltage (PVT)	+8V

Recommended Operating Conditions

Supply Voltage Operating (V_{CC})	1.8V to 5.5V
Supply Voltage Data Retention (V_{CC})	1.5V to 5.5V
Input Voltage (V_{IN})	0V to 5.5V
Output Voltage (V_{OUT})	0V to V_{CC}
Operating Temperature (T_{OPR})	−40°C to +85°C
Input Rise and Fall Time (t_r, t_f)	
V_{CC} = 1.8V, 2.5V ±0.2V	0 ns/V to 20 ns/V
V_{CC} = 3.3V ±0.3V	0 ns/V to 10 ns/V
V_{CC} = 5.0V ±0.5V	0 ns/V to 5 ns/V
Thermal Resistance (θ_{JA} in Free Air)	300°C/W

Note 1: *Absolute Maximum Ratings are DC values beyond which the device may be damaged or have its useful life impaired. The datasheet specifications should be met, without exception, to ensure that the system design is reliable over its power supply, temperature, and output/input loading variables. National does not recommend operation outside datasheet specifications.*

DC Electrical Characteristics

Symbol	Parameter	V_{CC} (V)	NC7SZ32 T_A = +25°C			NC7SZ32 T_A = −40°C to +85°C		Units	Conditions	
			Min	Typ	Max	Min	Max			
V_{IH}	High Level Input Voltage	1.8 2.3 to 5.5	0.75 V_{CC} 0.7 V_{CC}			0.75 V_{CC} 0.7 V_{CC}		V		
V_{IL}	Low Level Input Voltage	1.8 2.3 to 5.5			0.25 V_{CC} 0.3 V_{CC}		0.25 V_{CC} 0.3 V_{CC}	V		
V_{OH}	High Level Output Voltage	1.8 2.3 3.0 4.5	1.7 2.2 2.9 4.4	1.8 2.3 3.0 4.5		1.7 2.2 2.9 4.4		V	V_{IN} = V_{IH} or V_{IL}	I_{OH} = −100 μA
		2.3 3.0 3.0 4.5	1.9 2.4 2.3 3.8	2.15 2.80 2.68 4.20		1.9 2.4 2.3 3.8		V		I_{OH} = −8 mA I_{OH} = −16 mA I_{OH} = −24 mA I_{OH} = −32 mA
V_{OL}	Low Level Output Voltage	1.8 2.3 3.0 4.5		0.0 0.0 0.0 0.0	0.1 0.1 0.1 0.1		0.1 0.1 0.1 0.1	V	V_{IN} = V_{IH} or V_{IL}	I_{OL} = 100 μA
		2.3 3.0 3.0 4.5		0.10 0.15 0.22 0.22	0.3 0.4 0.55 0.55		0.3 0.4 0.55 0.55	V		I_{OL} = +8 mA I_{OL} = +16 mA I_{OL} = +24 mA I_{OL} = +32 mA
I_{IN}	Input Leakage Current	5.5			±1		±10	μA	V_{IN} = 5.5V, GND	
I_{OFF}	Power Off Leakage Current	0.0			1		10	μA	V_{IN} or V_{OUT} = 5.5V	
I_{CC}	Quiescent Supply Current	5.5			2.0		20	μA	V_{IN} = 5.5V, GND	

AC Electrical Characteristics

Symbol	Parameter	V_{CC} (V)	NC7SZ32 $T_A = +25°C$			NC7SZ32 $T_A = -40°C$ to $+85°C$		Units	Conditions	Fig. No.
			Min	Typ	Max	Min	Max			
t_{PLH}, t_{PHL}	Propagation Delay	1.8	2.0	4.6	10	2.0	10.5	ns	$C_L = 15$ pF, $R_L = 1$ MΩ	1, 2
		2.5 ±0.2	0.8	3.0	7.0	0.8	7.5			
		3.3 ±0.3	0.5	2.4	4.7	0.5	5.0			
		5.0 ±0.5	0.5	1.9	4.1	0.5	4.4			
t_{PLH}, t_{PHL}	Propagation Delay	3.3 ±0.3	1.5	3.0	5.2	1.5	5.5	ns	$C_L = 50$ pF, $R_L = 500\Omega$	1, 2
		5.0 ±0.5	0.8	2.4	4.5	0.8	4.8			
C_{IN}	Input Capacitance	0		4				pF		
C_{PD}	Power Dissipation Capacitance	3.3		20				pF	(Note 1)	3
		5.0		26						

Note 1: 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 3*.)

C_{PD} is related to I_{CCD} dynamic operating current by the expression: $I_{CCD} = (C_{PD})(V_{CC})(f_{IN}) + (I_{CC}\text{static})$.

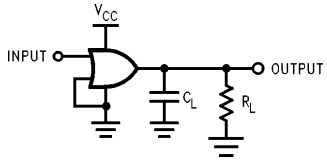

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FIGURE 1. AC Test Circuit

Note 2: C_L includes load and stray capacitance.

Note 3: Input PRR = 1.0 MHz; t_W = 500 ns.

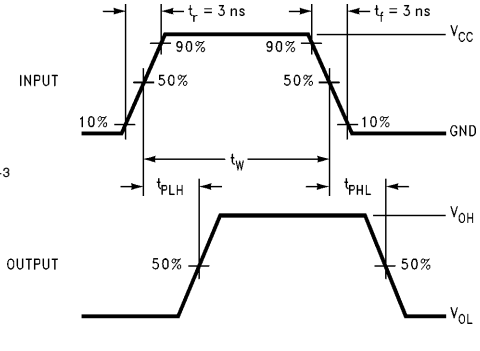

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FIGURE 2. AC Waveforms

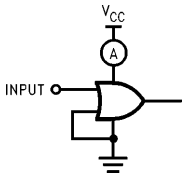

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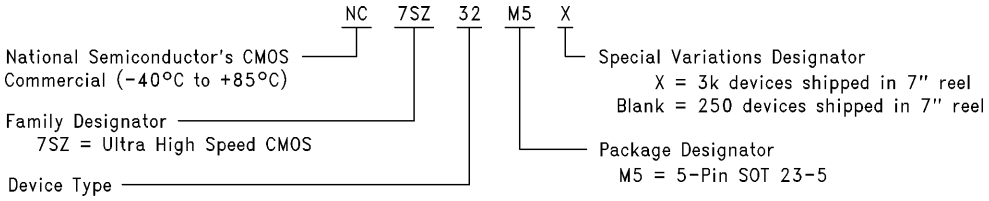
FIGURE 3. I_{CCD} Test Circuit

Note 4: Input = AC Waveform; $t_r = t_f = 1.8$ ns; PRR = 10 MHz; Duty Cycle = 50%

Ordering Information

The device number is used to form part of a simplified purchasing code where the package type and temperature range are defined as follows:



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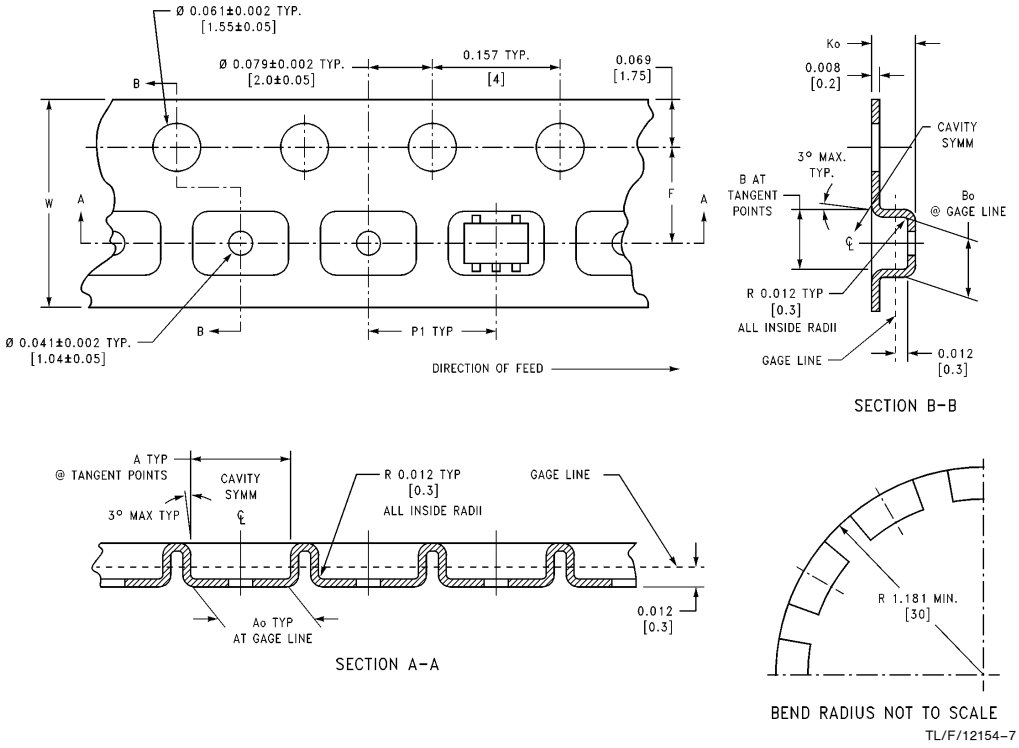
SOT-23-5 Tape and Reel Specification

Tape Format

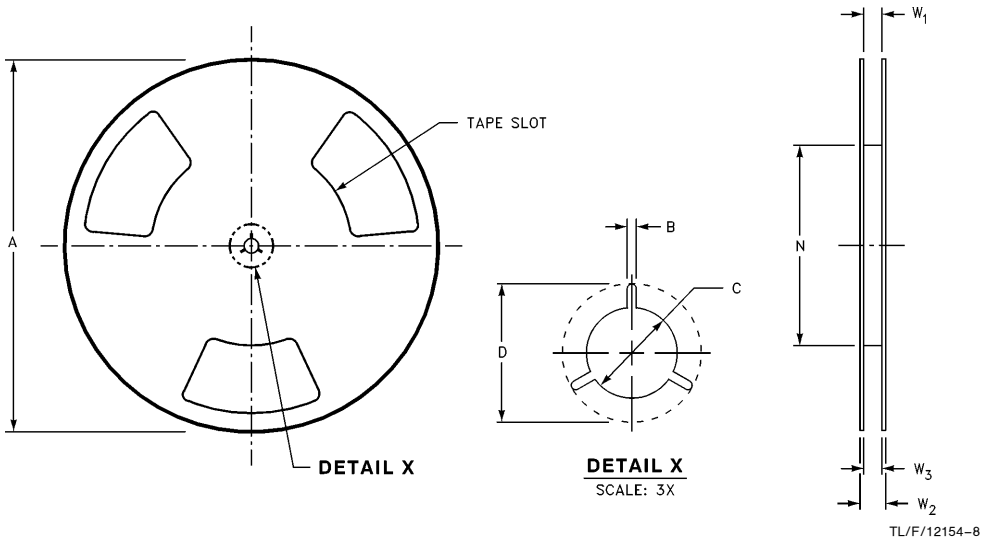
Tape Section	# Cavities	Cavity Status	Cover Tape Status
Leader (Start End)	0 (min)	Empty	Unsealed
	75 (min)	Empty	Sealed
Carrier	3000	Filled	Sealed
	250	Filled	Sealed
Trailer (Hub End)	125 (min)	Empty	Sealed
	0 (min)	Empty	Unsealed

Tape Dimensions inches (millimeters)



8mm	0.130 (3.3)	0.124 (3.15)	0.130 (3.3)	0.126 (3.2)	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)
Tape Size	DIM A	DIM Ao	DIM B	DIM Bo	DIM F	DIM Ko	DIM P1	DIM W

Reel Dimensions inches (millimeters)



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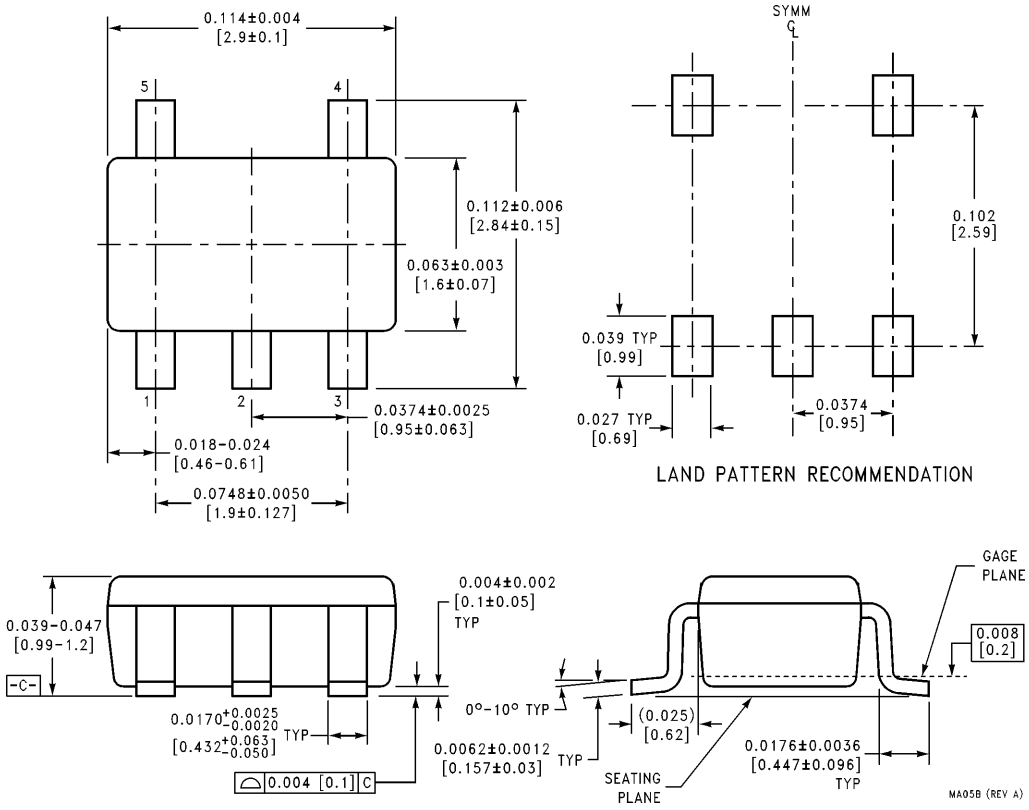
8 mm	7.00 (177.8)	0.059 (1.50)	0.512 (13.00)	0.795 (20.20)	2.165 (55.00)	0.331 + 0.059/−0.000 (8.40 | 1.50/−0.00)	0.567 (14.40)	W1 + 0.078/−0.039 (W1 | 2.00/−1.00)
Tape Size	A	B	C	D	N	W1	W2	W3

Physical Dimensions inches (millimeters) unless otherwise noted



5-Lead Molded SOT-23, Enhanced Thermal
Order Number NC7SZ32M5 or NC7SZ32M5X
NS Package Number MA05B

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