FAIRCHILD SEMICONDUCTOR™

January 1998

NC7SZD384
UHS TinyLogic™ 1-Bit Low Power Bus Switch with Level Shifting

General Description

The NC7SZD384 provides 1-bit of high-speed CMOS TTL-compatible bus switch. The low on resistance of the switch allows inputs to be connected to outputs with minimal propagation delay and without generating additional ground bounce noise. The device is organized as a 1-bit switch with a bus enable ($\overline{BE}$) signal. When $\overline{BE}$ is low, the switch is on and Port A is connected to Port B. When $\overline{BE}$ is high, the switch is open and a high-impedance state exists between the two ports. Reduced voltage drive to the gate of the FET switch permits nominal level shifting of 5V to 3.3V thru the switch.

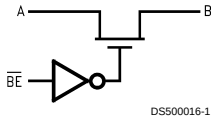
Features

- Space saving SOT23 or SC70 5-lead surface mount package.
- 5Ω switch connection between two ports.
- Designed to be used in level-shifting applications.
- Minimal propagation delay through the switch.
- Low I_{CC}.
- Zero bounce in flow-through mode.
- Control inputs compatible with TTL level.

Ordering Code:

Package Code	Package	Package Drawing	Package Top Mark	Supplied As
NC7SZD384M5	SOT23-5	MA05B	8Z4D	250 Units on Tape and Reel
NC7SZD384M5X	SOT23-5	MA05B	8Z4D	3k Units on Tape and Reel
NC7SZD384P5	SC70-5	MAA05A	Z4D	250 Units on Tape and Reel
NC7SZD384P5X	SC70-5	MAA05A	Z4D	3k Units on Tape and Reel

Logic Symbol



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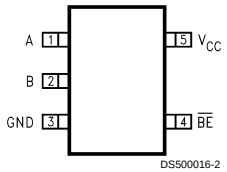
Pin Descriptions

Pin Name	Description
$\overline{BE}$	Bus Switch Enable
A	Bus A
B	Bus B

Connection Diagram

Pin Assignment for 5-lead Packages



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(Top View)

Function Table

$\overline{BE}$	B_O	Function
L	A_O	Connect
H	HIGH-Z State	Disconnect

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Absolute Maximum Ratings (Note 1)

Supply Voltage (V_{CC})	0.5V to +7.0V
DC Switch Voltage (VS)	−0.5V to +7.0V
DC Input Voltage (V_{IN}) (Note 2)	−0.5V to +7.0V
DC Input Diode Current (I_{IK}) V_{IN} < 0V	−50 mA
DC Output (I_{OUT}) Sink Current	128 mA
DC V_{CC}/GND Current (I_{CC}/GND)	±100 mA
Storage Temperature Range (T_{STG})	−65˚C to +150˚C
Junction Temperature under bias (T_J)	+150˚C
Junction Lead Temperature (T_L) (Soldering, 10 sec.)	+260˚C
Power Dissipation (P_D) @ +85˚C	
SOT23-5	200 mW
SC70-5	150 mW
ESD Tolerance (Human Body Model)	
MIL-STD-883D Method 17	4000V
DC Latchup Tolerance (JEDEC 3015.7)	
Negative Source Current (NIT)	500mA
Positive Source Voltage (PVT)	7.5V

Recommended Operating Conditions

Power Supply Operating (V_{CC})	4.5V to 5.5V
Input Voltage (V_{IN})	0V to 5.5V
Output Voltage (V_{OUT})	0V to 5.5V
Input Rise and Fall Time (t_r, t_f)	
Switch Control Input	0 ns/V to 5 ns
Switch I/O	0 ns/V to DC
Operating Temperature (T_A)	−40˚C to +85˚C
Thermal Resistance (θ_{JA})	
SOT23-5	300˚C/Watt
SC70-5	425˚C/Watt

Note 1: The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maxmum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

Note 2: The input and output negative voltage ratings may be exceeded if the input and output diode current ratings are observed.

DC Electrical Characteristics

Symbol	Parameter	V_{CC} (V)	NC7SZD384 T_A = 40˚C to +85˚C			Units	Conditions
			Min	Typ (Note 5)	Max		
V_{IK}	Maximum Clamp Diode Voltage	4.5			−1.2	−V	I_{IN} = −18 mA
V_{IH}	High Level Input Voltage	4.5–5.5	2.0			V	
V_{IL}	Low Level Input Voltage	4.5–5.5			0.8	V	
V_{OH}	High Level Output Voltage						
I_I	Input Leakage Current	0–5.5			±1.0	µA	0 ≤ V_{IN} ≤ 5.5V
I_{OFF}	"OFF" Leakage Current	5.5			±10.0	µA	0 ≤ A, B, ≤ V_{CC}
R_{ON}	Switch On Resistance (Note 3)	4.5		5	7	Ω	V_{IN} = 0V, I_I = 64 mA
				5	7	Ω	V_{IN} = 0V, I_I = 30 mA
				35	50	Ω	V_{IN} = 2.4V, I_I = 15 mA
I_{CC}	Quiescent Supply Current						V_{IN} = V_{CC} or GND, I_O = 0
	Switch On	5.5		0.8	1.5	mA	/BE=GND
	Switch Off	5.5			10	µA	/BE=VCC
ΔI_{CC}	Increase in I_{CC} per Input (Note 4)	5.5		0.8	2.5	mA	/BE = 3.4V, I_O = 0, Control Input only.

Note 3: Measured by the voltage drop between A and B pins at the indicated current through the switch. On resistance is determined by the lower of the voltages on the two (A or B) pins.

Note 4: Per TTL driven input (V_{IN} = 3.4V, control input only). A and B pins do not contribute to I_{CC}.

Note 5: All typical values are at V_{CC} = 5.0V, T_A= 25˚C.

AC Electrical Characteristics

Symbol	Parameter	V_{CC} (V)	NC7SZD384 $T_A = 40^\circ C$ to $+85^\circ C$ $C_L = 50$ pF, RU=RD=500Ω			Units	Conditions	Fig. No.
			Min	Typ (Note 6)	Max			
t_{PHL}, t_{PLH}	Prop Delay Bus to Bus (Note 7)	4.5–5.5			0.25	ns	V_I = Open	*Figures 1, 2*
t_{PZL}, t_{PZH}	Output Enable Time	4.5–5.5	1.5		7.5	ns	V_I = 7V for t_{PZL} V_I = OPEN for t_{PZH}	*Figures 1, 2*
t_{PLZ}, t_{PHZ}	Output Disable Time	4.5–5.5	1.0		6.0	ns	V_I = 7V for t_{PLZ} V_I = OPEN for t_{PHZ}	*Figures 1, 2*

Note 6: All typical values are V_{CC} = 5.0V, $T_A = 25^\circ C$.

Note 7: This parameter is guaranteed by design but is not tested. The bus switch contributes no propagation delay other than the RC delay of the typical On resistance of the switch and the 50 pF load capacitance, when driven by an ideal voltage source (zero output impedance).

Capacitance

(Note 8)

Symbol	Parameter	Typ	Max	Units	Conditions
C_{IN}	Control Pin Input Capacitance	2	5	pF	V_{CC} = 5.0V
$C_{I/O}$	Input/Output Capacitance	4.5	10	pF	V_{CC} = 5.0V

Note 8: Capacitance is characterized but not tested.

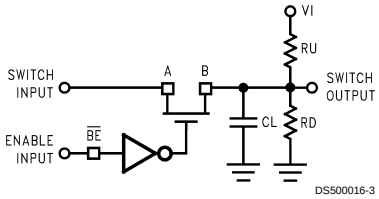


FIGURE 1. AC Test Circuit

Note: Input driven by 50Ω source terminated in 50Ω.

C_L includes load and stray capacitance.

Input PRR = 1.0 MHz t_w = 500 ns.

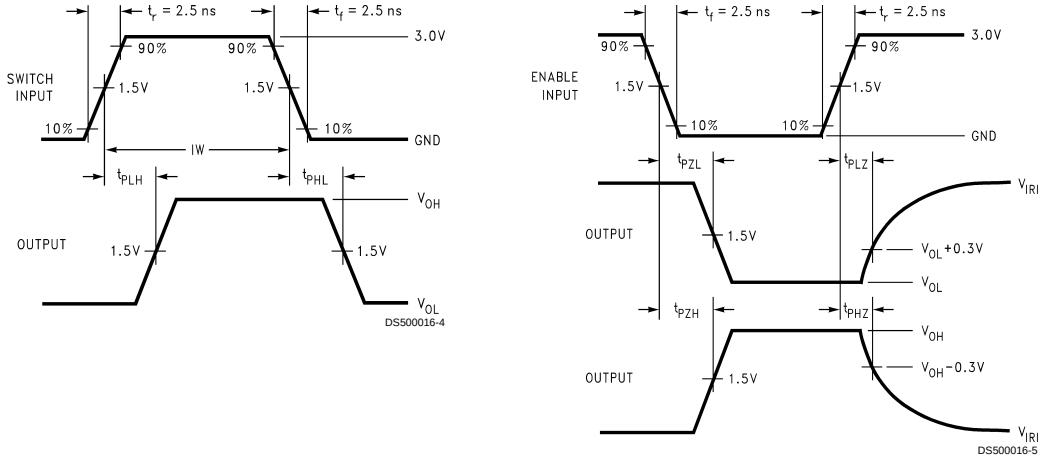
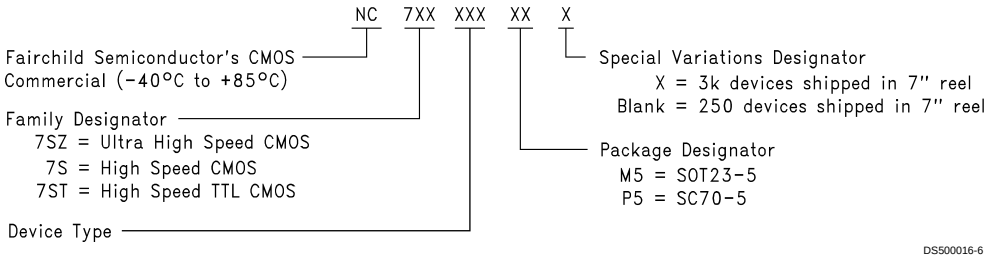


FIGURE 2. AC Waveforms

Ordering Information

The devce 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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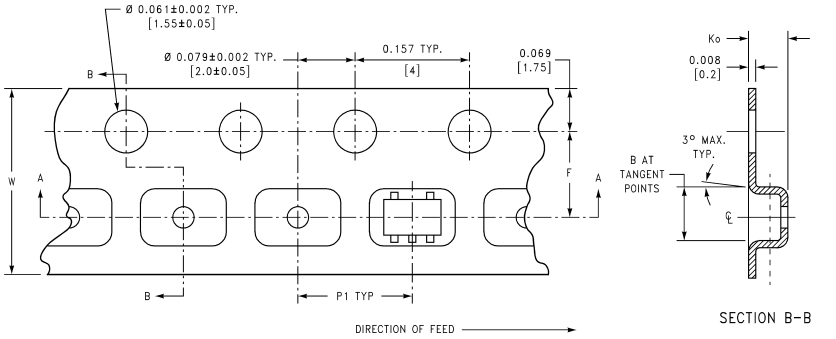
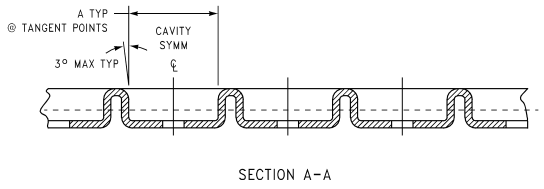
Tape and Reel Specification

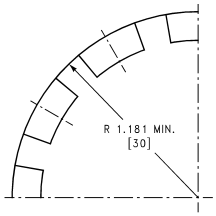
TAPE FORMAT

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

TAPE DIMENSIONS inches (millimeters)







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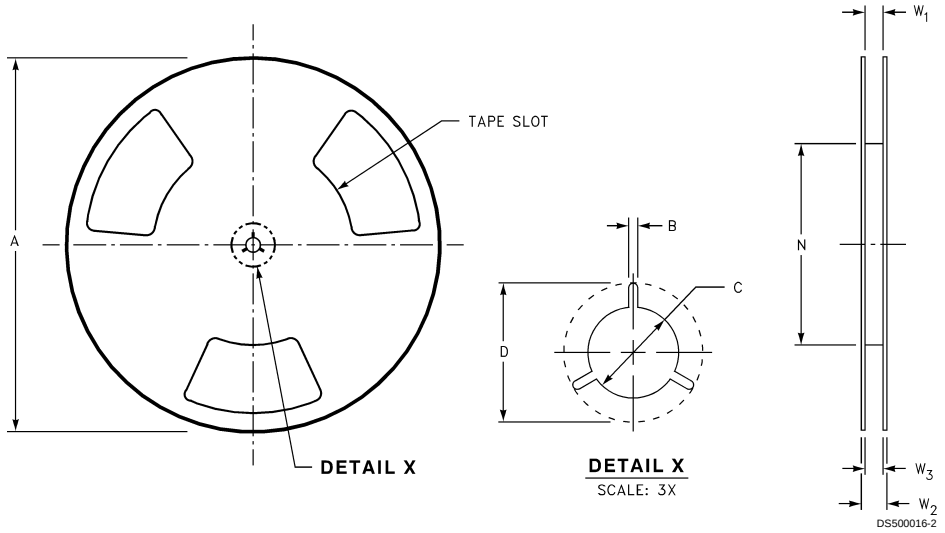
Pkg	Tape Size	DIM A	DIM B	DIM F	DIM K_o	DIM P1	DIM W
SC70-5	8 mm	0.093 (2.35)	0.096 (2.45)	0.138 ±0.004 (3.5 ±0.10)	0.053 ±0.004 (1.35 ±0.10)	0.157 (4)	0.315 ±0.004 (8 ±0.1)
SOT23-5	8 mm	0.130 (3.3)	0.130 (3.3)	0.138 ±0.002 (3.5 ±0.05)	0.055 ±0.004 (1.4 ±0.11)	0.157 (4)	0.315 ±0.012 (8 ±0.3)

Tape and Reel Specification

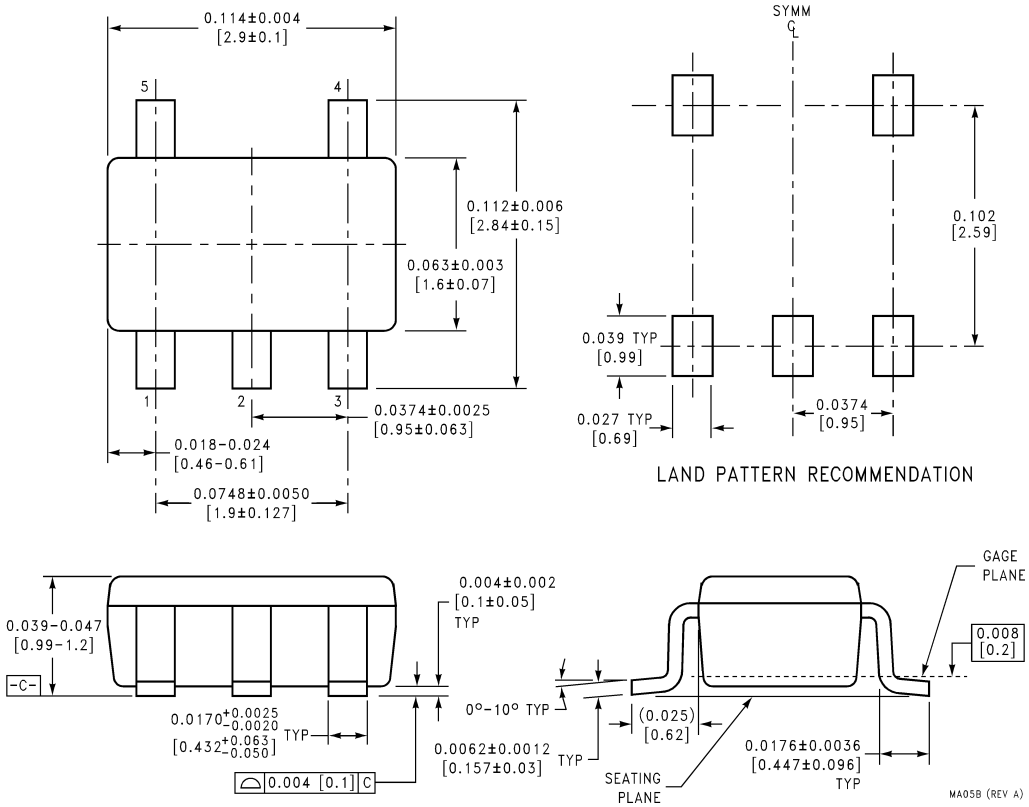
(Continued)

REEL DIMENSIONS inches (millimeters)



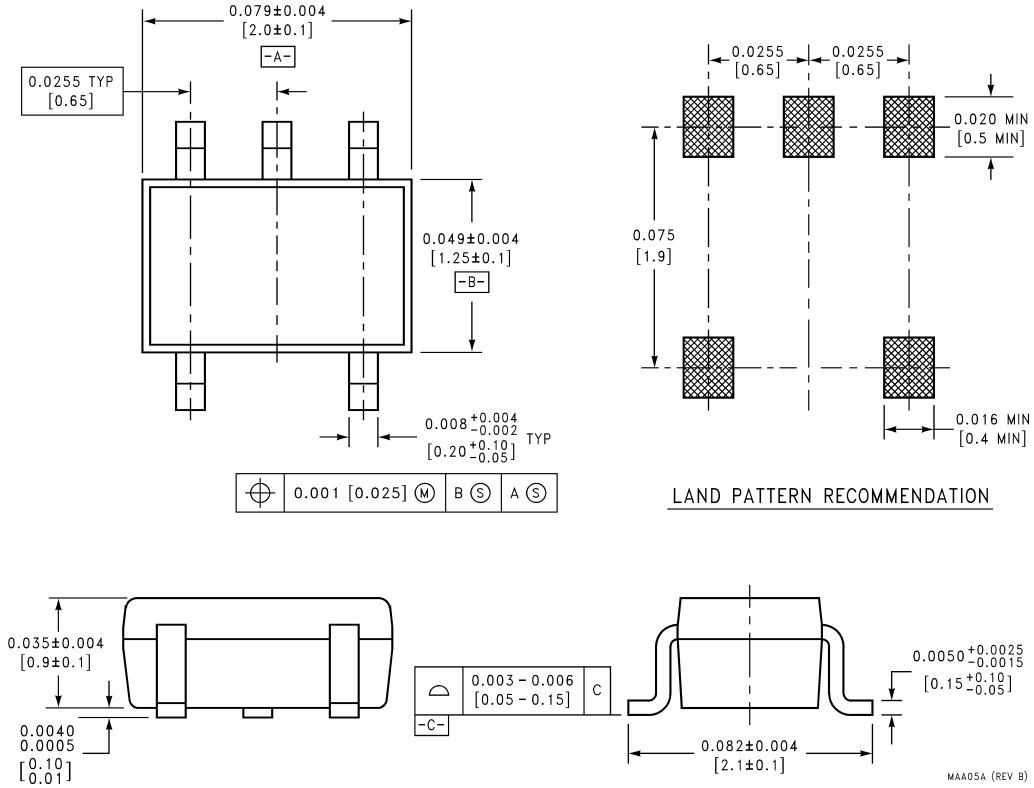
Tape Size	A	B	C	D	N	W1	W2	W3
8 mm	7.0 (177.8)	0.059 (1.50)	0.512 (13.00)	0.795 (20.20)	2.165 (55.00)	0.331 +0.059/−0.000 (8.40 +1.50/−0.00)	0.567 (14.40)	W1 +0.078/−0.039 (W1 +2.00/−1.00)

Physical Dimensions inches (millimeters) unless otherwise noted



5-Lead Molded SOT23, Enhanced Thermal
Package Number MA05B

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



5-Lead Molded SC70, Enhanced Thermal
Package Number MAA05A

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