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FAIRCHILD SEMICONDUCTOR™

July 2001
Revised November 2005

# NC7NZ17
# TinyLogic® UHS Triple Buffer with Schmitt Trigger Inputs

## General Description

The NC7NZ17 is a triple buffer with Schmitt trigger inputs from Fairchild's Ultra High Speed Series of TinyLogic® in the US8 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 1.65V to 5.5V $V_{CC}$ range. The inputs and outputs are high impedance when $V_{CC}$ is 0V. Inputs tolerate voltages up to 7V independent of $V_{CC}$ operating voltage. Schmitt trigger inputs typically achieve 1V hysteresis between the positive going and negative going input threshold voltage at 5V $V_{CC}$.

## Features

- Space saving US8 surface mount package
- MicroPak™ Pb-Free leadless package
- Ultra High Speed: $t_{PD}$ 3.6 ns Typ into 50 pF at 5V $V_{CC}$
- High Output Drive: ±24 mA at 3V $V_{CC}$
- Broad $V_{CC}$ Operating Range; 1.65V to 5.5V
- Power down high impedance inputs/outputs
- Overvoltage tolerant inputs facilitate 5V to 3V translation
- Proprietary noise/EMI reduction circuitry implemented

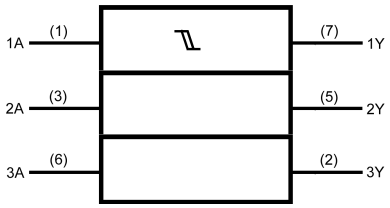
## Ordering Code:

| Order Number | Package Number | Product Code Top Mark | Package Description | Supplied As |
|---|---|---|---|---|
| NC7NZ17K8X | MAB08A | NZ17 | 8-Lead US8, JEDEC MO-187, Variation CA 3.1mm Wide | 3k Units on Tape and Reel |
| NC7NZ17L8X | MAC08A | U4 | Pb-Free 8-Lead MicroPak, 1.6 mm Wide | 5k Units on Tape and Reel |

Pb-Free package per JEDEC J-STD-020B.

## Logic Symbol

IEEE/IEC




## Pin Descriptions

| Pin Names | Description |
|---|---|
| $A_1$, $A_2$, $A_3$ | Data Inputs |
| $Y_1$, $Y_2$, $Y_3$ | Output |

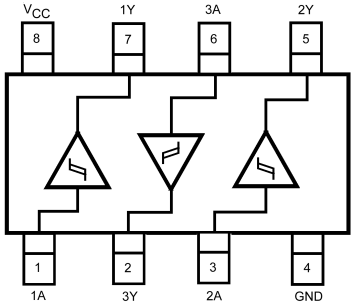
## Function Table

**Y = A**

| Input | Output |
|---|---|
| **A** | **Y** |
| L | L |
| H | H |

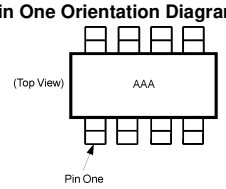
H = HIGH Logic Level  L = LOW Logic Level

## Connection Diagrams




**(Top View)**

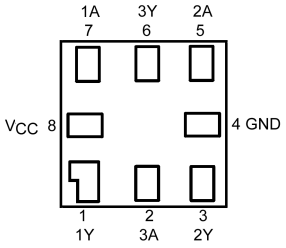
**Pin One Orientation Diagram**




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).

**Pad Assignments for MicroPak**




**(Top Thru View)**

## Absolute Maximum Ratings (Note 1)

| | |
|---|---|
| Supply Voltage ($V_{CC}$) | −0.5V to +7V |
| DC Input Voltage ($V_{IN}$) | −0.5V to +7V |
| DC Output Voltage ($V_{OUT}$) | −0.5V to +7V |
| DC Input Diode Current ($I_{IK}$) | |
| @ $V_{IN}$ < −0.5V | −50 mA |
| DC Output Diode Current ($I_{OK}$) | |
| @ $V_{OUT}$ < −0.5V | −50 mA |
| DC Output Current ($I_{OUT}$) | ±50 mA |
| DC $V_{CC}$/GND Current ($I_{CC}$/$I_{GND}$) | ±100 mA |
| Storage Temperature ($T_{STG}$) | −65°C to +150°C |
| Junction Temperature under Bias ($T_J$) | 150°C |
| Junction Lead Temperature ($T_L$) | |
| (Soldering, 10 seconds) | 260°C |
| Power Dissipation ($P_D$) @ +85°C | 250 mW |

## Recommended Operating Conditions (Note 2)

| | |
|---|---|
| Supply Voltage Operating ($V_{CC}$) | 1.65V 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 ($T_A$) | −40°C to +85°C |
| Thermal Resistance ($\theta_{JA}$) | 250°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. Fairchild does not recommend operation outside datasheet specifications.

**Note 2:** Unused inputs must be held HIGH or LOW. They may not float.

## DC Electrical Characteristics

| Symbol | Parameter | $V_{CC}$ | $T_A$ = +25°C | | | $T_A$ = −40°C to +85°C | | Units | Conditions | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | (V) | Min | Typ | Max | Min | Max | | | |
| $V_P$ | Positive Threshold | 1.65 | 0.7 | 1.07 | 1.5 | 0.7 | 1.5 | | | |
| | Voltage | 2.3 | 1.0 | 1.38 | 1.8 | 1.0 | 1.8 | | | |
| | | 3.0 | 1.3 | 1.74 | 2.2 | 1.3 | 2.2 | V | | |
| | | 4.5 | 1.9 | 2.43 | 3.1 | 1.9 | 3.1 | | | |
| | | 5.5 | 2.2 | 2.88 | 3.6 | 2.2 | 3.6 | | | |
| $V_N$ | Negative Threshold | 1.65 | 0.25 | 0.56 | 0.9 | 0.25 | 0.9 | | | |
| | Voltage | 2.3 | 0.40 | 0.75 | 1.15 | 0.40 | 1.15 | | | |
| | | 3.0 | 0.6 | 0.98 | 1.5 | 0.6 | 1.5 | V | | |
| | | 4.5 | 1.0 | 1.42 | 2.0 | 1.0 | 2.0 | | | |
| | | 5.5 | 1.2 | 1.68 | 2.3 | 1.2 | 2.3 | | | |
| $V_H$ | Hysteresis Voltage | 1.65 | 0.15 | 0.51 | 1.0 | 0.15 | 1.0 | | | |
| | | 2.3 | 0.25 | 0.62 | 1.1 | 0.25 | 1.1 | | | |
| | | 3.0 | 0.4 | 0.76 | 1.2 | 0.4 | 1.2 | V | | |
| | | 4.5 | 0.6 | 1.01 | 1.5 | 0.6 | 1.5 | | | |
| | | 5.5 | 0.7 | 1.20 | 1.7 | 0.7 | 1.7 | | | |
| $V_{OH}$ | HIGH Level Output | 1.65 | 1.55 | 1.65 | | 1.55 | | | | |
| | Voltage | 2.3 | 2.2 | 2.3 | | 2.2 | | | | |
| | | 3.0 | 2.9 | 3.0 | | 2.9 | | | | $I_{OH}$ = −100 µA |
| | | 4.5 | 4.4 | 4.5 | | 4.4 | | | | |
| | | 1.65 | 1.29 | 1.52 | | 1.29 | | V | $V_{IN}$ = $V_{IH}$ | $I_{OH}$ = −4 mA |
| | | 2.3 | 1.9 | 2.14 | | 1.9 | | | | $I_{OH}$ = −8 mA |
| | | 3.0 | 2.4 | 2.75 | | 2.4 | | | | $I_{OH}$ = −16 mA |
| | | 3.0 | 2.3 | 2.62 | | 2.3 | | | | $I_{OH}$ = −24 mA |
| | | 4.5 | 3.8 | 4.13 | | 3.8 | | | | $I_{OH}$ = −32 mA |
| $V_{OL}$ | LOW Level Output | 1.65 | | 0.0 | 0.1 | | 0.1 | | | |
| | Voltage | 2.3 | | 0.0 | 0.1 | | 0.1 | | | |
| | | 3.0 | | 0.0 | 0.1 | | 0.1 | | | $I_{OL}$ = 100 µA |
| | | 4.5 | | 0.0 | 0.1 | | 0.1 | | | |
| | | 1.65 | | 0.08 | 0.24 | | 0.24 | V | $V_{IN}$ = $V_{IL}$ | $I_{OL}$ = 4 mA |
| | | 2.3 | | 0.10 | 0.3 | | 0.3 | | | $I_{OL}$ = 8 mA |
| | | 3.0 | | 0.16 | 0.4 | | 0.4 | | | $I_{OL}$ = 16 mA |
| | | 3.0 | | 0.24 | 0.55 | | 0.55 | | | $I_{OL}$ = 24 mA |
| | | 4.5 | | 0.25 | 0.55 | | 0.55 | | | $I_{OL}$ = 32 mA |
| $I_{IN}$ | Input Leakage Current | 0 to 5.5 | | | ±0.1 | | ±1.0 | µA | $V_{IN}$ = 5.5V, GND | |
| $I_{OFF}$ | Power Off Leakage Current | 0.0 | | | 1 | | 10 | µA | $V_{IN}$ or $V_{OUT}$ = 5.5V | |

## DC Electrical Characteristics (Continued)

| Symbol | Parameter | $V_{CC}$ (V) | $T_A = +25°C$ | | | $T_A = -40°C$ to $+85°C$ | | Units | Conditions |
|---|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | Min | Max | | |
| $I_{CC}$ | Quiescent Supply Current | 1.65 to 5.5 | | | 1.0 | | 10 | μA | $V_{IN}$ = 5.5V, GND |

## AC Electrical Characteristics

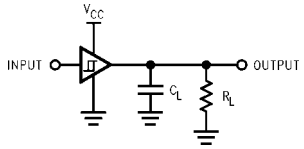
| Symbol | Parameter | $V_{CC}$ (V) | $T_A = +25°C$ | | | $T_A = -40°C$ to $+85°C$ | | Units | Conditions | Figure Number |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | Min | Max | | | |
| $t_{PLH}$ $t_{PHL}$ | Propagation Delay | 1.8 ± 0.15 | 2.0 | 6.9 | 11.9 | 2.0 | 13.1 | ns | $C_L$ = 15 pF, $R_L$ = 1 MΩ | Figures 1, 3 |
| | | 2.5 ± 0.2 | 1.5 | 4.8 | 8.2 | 1.5 | 9.0 | | | |
| | | 3.3 ± 0.3 | 1.0 | 3.7 | 5.6 | 1.0 | 6.2 | | | |
| | | 5.0 ± 0.5 | 0.8 | 3.0 | 4.7 | 0.8 | 5.2 | | | |
| $t_{PLH}$ $t_{PHL}$ | Propagation Delay | 3.3 ± 0.3 | 1.5 | 4.3 | 6.6 | 1.5 | 7.3 | ns | $C_L$ = 50 pF, $R_L$ = 500Ω | Figures 1, 3 |
| | | 5.0 ± 0.5 | 1.0 | 3.6 | 5.6 | 1.0 | 6.2 | | | |
| $C_{IN}$ | Input Capacitance | 0 | | 2.5 | | | | pF | | |
| $C_{PD}$ | Power Dissipation | 3.3 | | 9 | | | | pF | (Note 3) | Figure 2 |
| | Capacitance | 5.0 | | 11 | | | | | | |

**Note 3:** $C_{PD}$ 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: $I_{CCD} = (C_{PD})(V_{CC})(f_{IN}) + (I_{CC}static)$.

## Dynamic Switching Characteristics

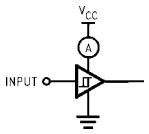
| Symbol | Parameter | Conditions | $V_{CC}$ (V) | $T_A = 25°C$ Typical | Unit |
|---|---|---|---|---|---|
| $V_{OLP}$ | Quiet Output Dynamic Peak $V_{OL}$ | $C_L$ = 50pF, $V_{IH}$ = 5.0V, $V_{IL}$ = 0V | 5.0 | 0.8 | V |
| $V_{OLV}$ | Quiet Output Dynamic Valley $V_{OL}$ | $C_L$ = 50pF, $V_{IH}$ = 5.0V, $V_{IL}$ = 0V | 5.0 | −0.8 | V |

## 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; $t_r = t_f$ = 1.8 ns;
PRR = variable; Duty Cycle = 50%

**FIGURE 2. $I_{CCD}$ Test Circuit**

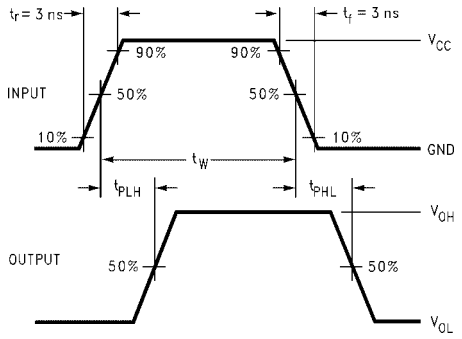


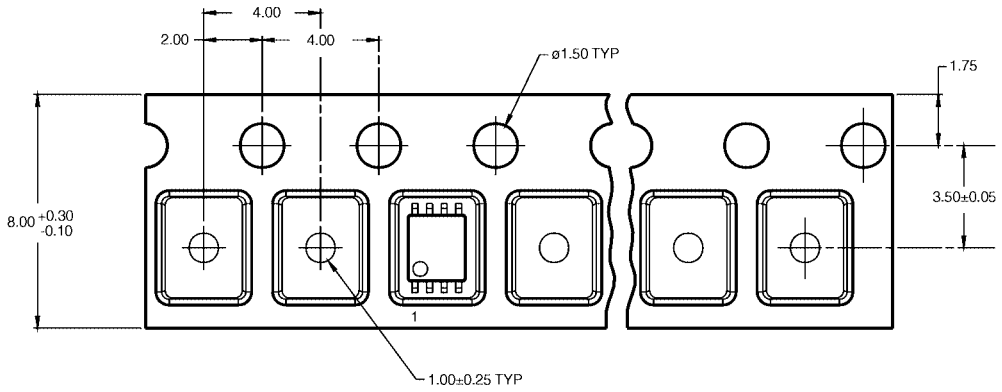

**FIGURE 3. AC Waveforms**

## Tape and Reel Specification

**TAPE FORMAT for US8**

| Package Designator | Tape Section | Number Cavities | Cavity Status | Cover Tape Status |
|---|---|---|---|---|
| K8X | Leader (Start End) | 125 (typ) | Empty | Sealed |
| | Carrier | 3000 | Filled | Sealed |
| | Trailer (Hub End) | 75 (typ) | Empty | Sealed |

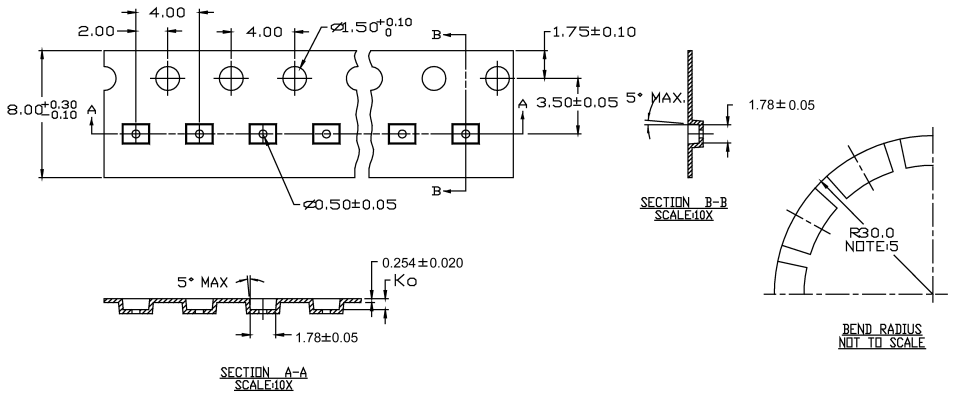
**TAPE DIMENSIONS** inches (millimeters)




**TAPE FORMAT for MicroPak**

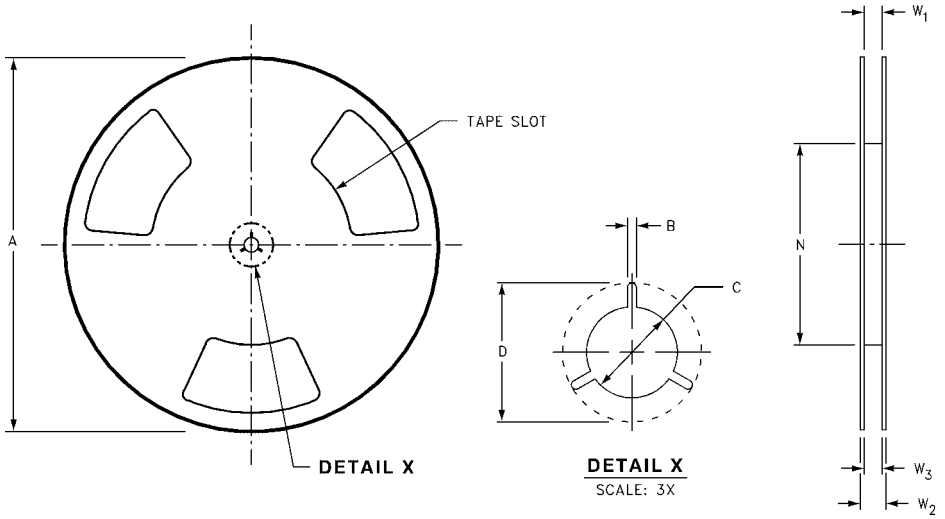
| Package Designator | Tape Section | Number Cavities | Cavity Status | Cover Tape Status |
|---|---|---|---|---|
| L8X | Leader (Start End) | 125 (typ) | Empty | Sealed |
| | Carrier | 3000 | Filled | Sealed |
| | Trailer (Hub End) | 75 (typ) | Empty | Sealed |

**TAPE DIMENSIONS** inches (millimeters)



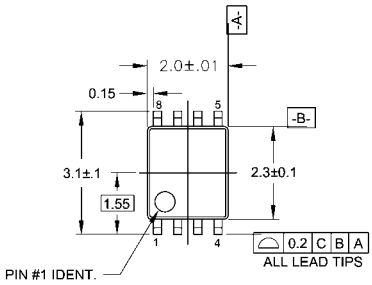
## Tape and Reel Specification (Continued)

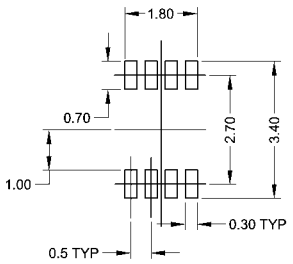
**REEL DIMENSIONS** inches (millimeters)



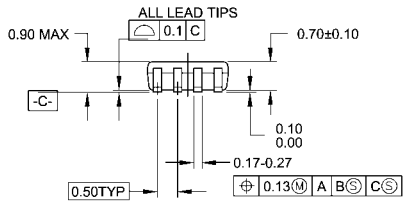

| Tape Size | A | B | C | D | N | W1 | W2 | W3 |
|---|---|---|---|---|---|---|---|---|
| 8 mm | 7.0<br>(177.8) | 0.059<br>(1.50) | 0.512<br>(13.00) | 0.795<br>(20.20) | 2.165<br>(55.00) | 0.331 + 0.059/–0.000<br>(8.40 + 1.50/–0.00) | 0.567<br>(14.40) | W1 + 0.078/–0.039<br>(W1 + 2.00/–1.00) |

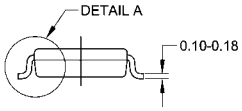
## Physical Dimensions inches (millimeters) unless otherwise noted

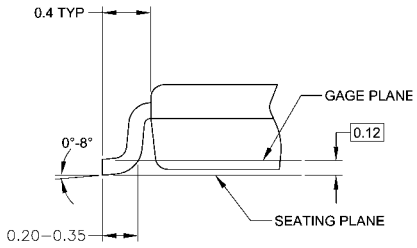



LAND PATTERN RECOMMENDATION




DETAIL A

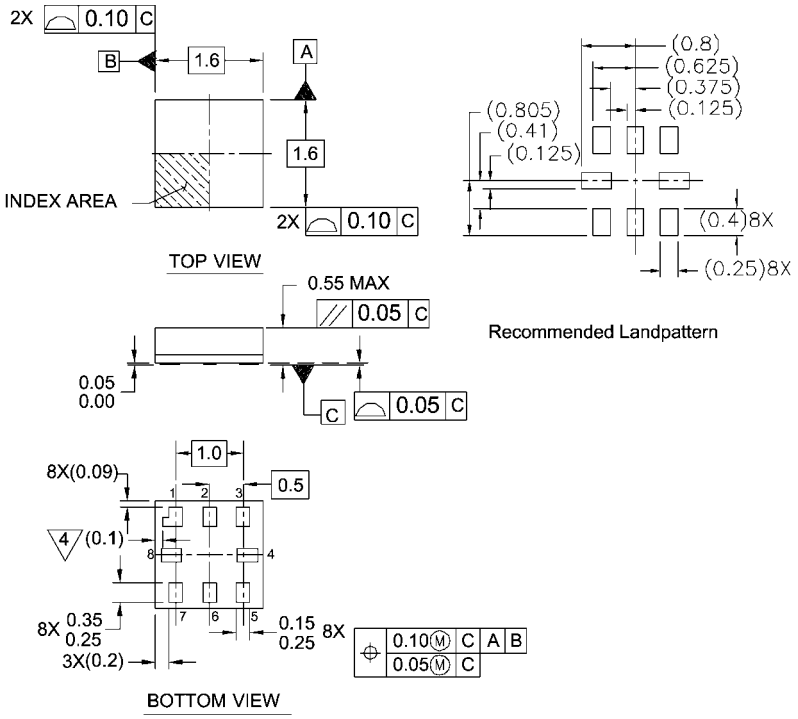
NOTES:

A. CONFORMS TO JEDEC REGISTRATION MO-187
B. DIMENSIONS ARE IN MILLIMETERS.
C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
D. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M, 1982.

MAB08AREVC

**8-Lead US8, JEDEC MO-187, Variation CA 3.1mm Wide**
**Package Number MAB08A**

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




Notes:

1. PACKAGE CONFORMS TO JEDEC MO-255 VARIATION UAAD
2. DIMENSIONS ARE IN MILLIMETERS
3. DRAWING CONFORMS TO ASME Y.14M-1994
4. PIN 1 FLAG, END OF PACKAGE OFFSET.

MAC08AREVC

**Pb-Free 8-Lead MicroPak, 1.6 mm Wide**
**Package Number MAC08A**



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