NC7SZ86
TinyLogic® UHS 2-Input Exclusive-OR Gate

General Description
The NC7SZ86 is a single 2-Input Exclusive-OR Gate from Fairchild’s Ultra High Speed Series of TinyLogic®. 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 VCC operating range. The device is specified to operate over the 1.65V to 5.5V VCC range. The inputs and output are high impedance when VCC is 0V. Inputs tolerate voltages up to 6V independent of VCC operating voltage.

Features
- Space saving SOT23 or SC70 5-lead package
- Ultra small MicroPak™ leadless package
- Ultra High Speed; tPD 2.9 ns typ into 50 pF at 5V VCC
- High Output Drive; ± 24 mA at 3V VCC
- Broad VCC Operating Range; 1.65V to 5.5V
- Matches the performance of LCX when operated at 3.3V
- Power down high impedance inputs/output
- Overvoltage tolerant inputs facilitate 5V to 3V translation
- Patented noise/EMI reduction circuitry implemented

Ordering Code:

<table>
<thead>
<tr>
<th>Order Number</th>
<th>Package Number</th>
<th>Product Code</th>
<th>Package Description</th>
<th>Supplied As</th>
</tr>
</thead>
<tbody>
<tr>
<td>NC7SZ86M5X</td>
<td>MA05B</td>
<td>726</td>
<td>5-Lead SOT23, JEDEC MO-178, 1.6mm</td>
<td>3k Units on Tape and Reel</td>
</tr>
<tr>
<td>NC7SZ86P5X</td>
<td>MAA05A</td>
<td>296</td>
<td>5-Lead SC70, EIAJ SC-88a, 1.25mm Wide</td>
<td>3k Units on Tape and Reel</td>
</tr>
<tr>
<td>NC7SZ86L6X</td>
<td>MAC06A</td>
<td>B3</td>
<td>6-Lead MicroPak, 1.0mm Wide</td>
<td>5k Units on Tape and Reel</td>
</tr>
</tbody>
</table>

Logic Symbol

IEEE/IEC

Pin Descriptions

<table>
<thead>
<tr>
<th>Pin Names</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>A, B</td>
<td>Input</td>
</tr>
<tr>
<td>Y</td>
<td>Output</td>
</tr>
<tr>
<td>NC</td>
<td>No Connect</td>
</tr>
</tbody>
</table>

Function Table

Y = A ⊕ B

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>L</td>
<td>H</td>
</tr>
<tr>
<td>H</td>
<td>L</td>
</tr>
<tr>
<td>H</td>
<td>H</td>
</tr>
</tbody>
</table>

H = HIGH Logic Level  L = LOW Logic Level

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Absolute Maximum Ratings (Note 1)

Supply Voltage ($V_{CC}$) $-0.5$V to $+6$V
DC Input Voltage ($V_{IN}$) $-0.5$V to $+6$V
DC Output Voltage ($V_{OUT}$) $-0.5$V to $+6$V
DC Input Diode Current ($I_{IP}$)
- $V_{IN} < -0.5$V $-50$ mA
- $V_{IN} > 6$V $+20$ mA
DC Output Diode Current ($I_{OK}$)
- $V_{OUT} < -0.5$V $-50$ mA
- $V_{OUT} > 6$V, $V_{CC} = GND$ $+20$ mA
DC $V_{CC}$/GND Current ($I_{CC}$/GND) $+50$ mA
DC VCC/GND Current ($I_{CC}$/GND) $+50$ mA
Storage Temperature (TSTG) $-65$°C to $+150$°C
Junction Temperature under Bias (TJ) 150°C
Junction Lead Temperature (TL) (Soldering, 10 seconds) 260°C
Power Dissipation (PD) @ $+85$°C
- SOT23-5 200 mW
- SC70-5 150 mW

Recommended Operating Conditions (Note 2)

Input Voltage ($V_{IN}$)
- 0V to $V_{CC}$
Output Voltage ($V_{OUT}$)
- 0V to $V_{CC}$
Operating Temperature (TJ) $-40$°C to $+85$°C

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

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>$V_{CC}$ (V)</th>
<th>$T_{A} = -25$°C</th>
<th>$T_{A} = -40$°C to $+85$°C</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>VHI</td>
<td>HIGH Level Input Voltage</td>
<td>1.65 to 1.95</td>
<td>0.75 $V_{CC}$</td>
<td>0.75 $V_{CC}$</td>
<td>$V_{IN} = V_{HI}, V_{IL}$ $I_{IH} = -100$ µA</td>
</tr>
<tr>
<td>VIL</td>
<td>LOW Level Input Voltage</td>
<td>1.65 to 1.95</td>
<td>0.25 $V_{CC}$</td>
<td>0.25 $V_{CC}$</td>
<td>$V_{IN} = V_{HI}, V_{IL}$ $I_{IH} = -100$ µA</td>
</tr>
<tr>
<td>VOH</td>
<td>HIGH Level Output Voltage</td>
<td>1.65</td>
<td>1.55</td>
<td>1.55</td>
<td>$V_{IN} = V_{HI}, V_{IL}$ $I_{IH} = -100$ µA</td>
</tr>
<tr>
<td>VOL</td>
<td>LOW Level Output Voltage</td>
<td>1.65</td>
<td>0.00</td>
<td>0.01</td>
<td>$V_{IN} = V_{HI}, V_{IL}$ $I_{IH} = -100$ µA</td>
</tr>
<tr>
<td>IIN</td>
<td>Input Leakage Current</td>
<td>0 to 5.5</td>
<td>$\pm 1$</td>
<td>$\pm 10$</td>
<td>$\mu$A</td>
</tr>
<tr>
<td>IOFF</td>
<td>Power Off Leakage Current</td>
<td>0.0</td>
<td>1</td>
<td>10</td>
<td>$\mu$A</td>
</tr>
<tr>
<td>ICC</td>
<td>Quiescent Supply Current</td>
<td>1.65 to 5.5</td>
<td>2.0</td>
<td>20</td>
<td>$\mu$A</td>
</tr>
</tbody>
</table>

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AC Electrical Characteristics

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>$V_{CC}$ (V)</th>
<th>$TA = +25^\circ C$</th>
<th>$TA = -40^\circ C$ to $+85^\circ C$</th>
<th>Units Conditions</th>
<th>Figure Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>$t_{PLH}$</td>
<td>Propagation Delay</td>
<td>1.65</td>
<td>2.0</td>
<td>6.9</td>
<td>13.8</td>
<td>ns</td>
</tr>
<tr>
<td>$t_{PHL}$</td>
<td>Propagation Delay</td>
<td>1.8</td>
<td>2.0</td>
<td>5.7</td>
<td>11.5</td>
<td>2.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.5 ± 0.2</td>
<td>0.8</td>
<td>3.8</td>
<td>8.0</td>
<td>0.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.3 ± 0.3</td>
<td>0.5</td>
<td>3.0</td>
<td>5.7</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.0 ± 0.5</td>
<td>0.5</td>
<td>2.4</td>
<td>5.0</td>
<td>0.5</td>
</tr>
<tr>
<td>$C_{PD}$</td>
<td>Power Dissipation Capacitance</td>
<td>3.3</td>
<td>25</td>
<td></td>
<td></td>
<td>pF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.0</td>
<td>31</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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:

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

AC Loading and Waveforms

**FIGURE 1. AC Test Circuit**

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

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

Input = AC Waveform; $t_t = t_r = 1.8$ ns
PRR = 10 MHz; Duty Cycle = 50%

**FIGURE 3. AC Waveforms**

$V_{OH}$

$t_{PLH}$

$V_{OL}$

$V_{PHL}$

$V_{OHL}$

$t_{PHL}$

$t_{PLH}$

$V_{CC}$
### Tape and Reel Specification

**TAPE FORMAT for SC70 and SOT23**

<table>
<thead>
<tr>
<th>Package Designator</th>
<th>Tape Section</th>
<th>Number Cavities</th>
<th>Cavity Status</th>
<th>Cover Tape Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>M5X, P5X</td>
<td>Leader (Start End)</td>
<td>125 (typ)</td>
<td>Empty</td>
<td>Sealed</td>
</tr>
<tr>
<td></td>
<td>Carrier</td>
<td>3000</td>
<td>Filled</td>
<td>Sealed</td>
</tr>
<tr>
<td></td>
<td>Trailer (Hub End)</td>
<td>75 (typ)</td>
<td>Empty</td>
<td>Sealed</td>
</tr>
</tbody>
</table>

#### TAPE DIMENSIONS inches (millimeters)

- **DIMENSIONS:**
  - **DIM A:** 0.093 (2.35)
  - **DIM B:** 0.096 (2.45)
  - **DIM F:** 0.138 ± 0.004 (3.5 ± 0.10)
  - **DIM K₀:** 0.053 ± 0.004 (1.35 ± 0.10)
  - **DIM P₁:** 0.157 (4)
  - **DIM W:** 0.315 ± 0.004 (8 ± 0.1)

- **SC70-5**
  - **Tape Size:** 8 mm
  - **DIMENSIONS:**
    - **DIM A:** 0.130 (3.3)
    - **DIM B:** 0.130 (3.3)
    - **DIM F:** 0.138 ± 0.002 (3.5 ± 0.05)
    - **DIM K₀:** 0.055 ± 0.004 (1.4 ± 0.11)
    - **DIM P₁:** 0.157 (4)
    - **DIM W:** 0.315 ± 0.012 (8 ± 0.3)

- **SOT23-5**
  - **Tape Size:** 8 mm
  - **DIMENSIONS:**
    - **DIM A:** 0.093 (2.35)
    - **DIM B:** 0.096 (2.45)
    - **DIM F:** 0.138 ± 0.004 (3.5 ± 0.10)
    - **DIM K₀:** 0.053 ± 0.004 (1.35 ± 0.10)
    - **DIM P₁:** 0.157 (4)
    - **DIM W:** 0.315 ± 0.004 (8 ± 0.1)
Tape and Reel Specification (Continued)

**TAPE FORMAT for MicroPak**

<table>
<thead>
<tr>
<th>Package Designator</th>
<th>Tape Section</th>
<th>Number Cavities</th>
<th>Cavity Status</th>
<th>Cover Tape Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>L6X</td>
<td>Leader (Start End)</td>
<td>125 (typ)</td>
<td>Empty</td>
<td>Sealed</td>
</tr>
<tr>
<td></td>
<td>Carrier</td>
<td>5000</td>
<td>Filled</td>
<td>Sealed</td>
</tr>
<tr>
<td></td>
<td>Trailer (Hub End)</td>
<td>75 (typ)</td>
<td>Empty</td>
<td>Sealed</td>
</tr>
</tbody>
</table>

**REEL DIMENSIONS** inches (millimeters)

<table>
<thead>
<tr>
<th>Tape Size</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>N</th>
<th>W1</th>
<th>W2</th>
<th>W3</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 mm</td>
<td>7.0</td>
<td>0.059</td>
<td>0.512</td>
<td>0.795</td>
<td>2.165</td>
<td>0.331 + 0.058 – 0.000</td>
<td>0.567</td>
<td>W1 + 0.078 / – 0.039</td>
</tr>
<tr>
<td></td>
<td>(177.8)</td>
<td>(1.50)</td>
<td>(13.00)</td>
<td>(20.20)</td>
<td>(55.00)</td>
<td>(8.40 + 1.50 / – 0.00)</td>
<td>(14.40)</td>
<td>(W1 + 2.00 / – 1.00)</td>
</tr>
</tbody>
</table>

![Section A-A Diagram](image1)

![Section B-B Diagram](image2)

![Detail X Diagram](image3)
Physical Dimensions inches (millimeters) unless otherwise noted

5-Lead SOT23, JEDEC MO-178, 1.6mm
Package Number MA05B
Physical Dimensions inches (millimeters) unless otherwise noted (Continued)

NOTES:
A. CONFORMS TO EIAJ REGISTERED OUTLINE DRAWING SC-88A.
B. DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH.
C. DIMENSIONS ARE IN MILLIMETERS.

5-Lead SC70, EIAJ SC-88a, 1.25mm Wide
Package Number MAA05A
Physical Dimensions inches (millimeters) unless otherwise noted (Continued)

6-Lead MicroPak, 1.0mm Wide
Package Number MAC06A

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