

NC7SZ373 TinyLogic® UHS D-Type Latch with 3-STATE Output

General Description

The NC7SZ373 is a single positive edge-triggered D-type CMOS Latch with 3-STATE output from Fairchild's Ultra High Speed Series of TinyLogic® in the space saving SC70 6-lead 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 range. The inputs and output are high impedance when V_{CC} is 0V. Inputs tolerate voltages up to 7V independent of V_{CC} operating voltage. The latch appears transparent to the data when Latch Enable (LE) is HIGH. When LE is LOW, the data that meets the setup time is latched. The output tolerates voltages above V_{CC} in the 3-STATE condition.

Features

- Space saving SC70 6-lead package
- Ultra small MicroPak™ leadless package
- Ultra High Speed; t_{PD} 2.6 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
- Matches the performance of LCX when operated at 3.3V V_{CC}
- Power down high impedance inputs/output
- Overvoltage tolerant inputs facilitate 5V to 3V translation
- Patented noise/EMI reduction circuitry implemented

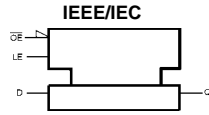
Ordering Code:

| Order Number | Package Number | Product Code Top Mark | Package Description | Supplied As |
|--------------|----------------|-----------------------|-------------------------------------|---------------------------|
| NC7SZ373P6X | MAA06A | Z73 | 6-Lead SC70, EIAJ SC88, 1.25mm Wide | 3k Units on Tape and Reel |
| NC7SZ373L6X | MAC06A | D4 | 6-Lead MicroPak, 1.0mm Wide | 5k Units on Tape and Reel |

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NC7SZ373 TinyLogic® UHS D-Type Latch with 3-STATE Output

Logic Symbol



Pin Descriptions

| Pin Names | Description |
|-----------------|---------------------|
| D | Data Input |
| LE | Latch Enable Input |
| \overline{OE} | Output Enable Input |
| Q | Latch Output |

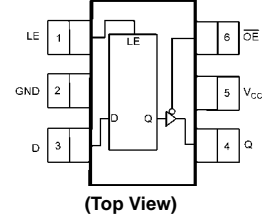
Function Table

| Inputs | | | Output |
|--------|---|-----------------|-----------|
| LE | D | \overline{OE} | Q |
| H | L | L | L |
| H | H | L | H |
| L | X | L | Q_{n-1} |
| X | X | H | Z |

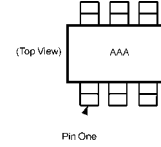
H = HIGH Logic Level X = Immaterial
 L = LOW Logic Level Z = HIGH Impedance
 Q_{n-1} = Previous state prior to HIGH-to-LOW transition of latch enable

Connection Diagrams

Pin Assignments for SC70

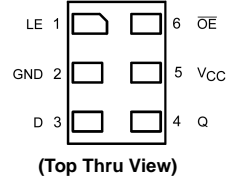


Pin One Orientation Diagram



AAA = 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



| Absolute Maximum Ratings (Note 1) | | | Recommended Operating Conditions (Note 2) | | |
|--|-----------------|--|---|--------------------------------|----------------|
| Supply Voltage (V_{CC}) | -0.5V to +7.0V | | Power Supply | Operating (V_{CC}) | 1.65V to 5.5V |
| DC Input Voltage (V_{IN}) | -0.5V to +7.0V | | Data Retention | | 1.5V to 5.5V |
| DC Output Voltage (V_{OUT}) | -0.5V to +7.0V | | Input Voltage (V_{IN}) | | 0V to 5.5V |
| DC Input Diode Current (I_{IK}) | | | Output Voltage (V_{OUT}) | Active State | 0V to V_{CC} |
| $V_{IN} < 0V$ | -50 mA | | 3-STATE | | 0V to 5.5V |
| DC Output Diode Current (I_{OK}) | | | Input Rise and Fall Time (t_r, t_f) | $V_{CC} = 1.8V, 2.5V \pm 0.2V$ | 0 to 20 ns/V |
| $V_{OUT} < 0V$ | -50 mA | | | $V_{CC} = 3.3V \pm 0.3V$ | 0 to 10 ns/V |
| DC Output (I_{OUT}) Source/Sink Current | ± 50 mA | | | $V_{CC} = 5.5V \pm 0.5V$ | 0 to 5 ns/V |
| DC V_{CC}/GND Current (I_{CC}/I_{GND}) | ± 50 mA | | Operating Temperature (T_A) | | -40°C to +85°C |
| Storage Temperature Range (T_{STG}) | -65°C to +150°C | | Thermal Resistance (θ_{JA}) | | 350° C/W |
| Junction Temperature under Bias (T_J) | 150°C | | | | |
| Junction Lead Temperature (T_L) | | | | | |
| (Soldering, 10 seconds) | 260°C | | | | |
| Power Dissipation (P_D) @+85°C | 180 mW | | | | |

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 maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

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

DC Electrical Characteristics

| Symbol | Parameter | V_{CC} (V) | $T_A = +25^\circ C$ | | | $T_A = -40^\circ C$ to $+85^\circ C$ | | Unit | Conditions | |
|-----------|---------------------------|-----------------|---------------------|------|------|--------------------------------------|-----|---|--|----------------------|
| | | | Min | Typ | Max | Min | Max | | | |
| V_{IH} | HIGH Level Control | 1.65 to 1.95 | 0.75 V_{CC} | | | 0.75 V_{CC} | | V | | |
| | Input Voltage | 2.3 to 5.5 | 0.7 V_{CC} | | | 0.7 V_{CC} | | | | |
| V_{IL} | LOW Level Control | 1.65 to 1.95 | 0.25 V_{CC} | | | 0.25 V_{CC} | | V | | |
| | Input Voltage | 2.3 to 5.5 | 0.3 V_{CC} | | | 0.3 V_{CC} | | | | |
| V_{OH} | HIGH Level Control | 1.65 | 1.55 | 1.65 | 1.55 | | V | $V_{IN} = V_{IH}$ | $I_{OH} = -100 \mu A$ | |
| | | 1.8 | 1.7 | 1.8 | 1.7 | | | | | |
| | | 2.3 | 2.2 | 2.3 | 2.2 | | | | | |
| | | 3.0 | 2.9 | 3.0 | 2.9 | | | | | |
| | | 4.5 | 4.4 | 4.5 | 4.4 | | | | | |
| | Output Voltage | 1.65 | 1.24 | 1.52 | 1.29 | | | $I_{OH} = -4$ mA $I_{OH} = -8$ mA $I_{OH} = -16$ mA $I_{OH} = -24$ mA $I_{OH} = -32$ mA | | |
| | | 2.3 | 1.9 | 2.15 | 1.9 | | | | | |
| | | 3.0 | 2.4 | 2.8 | 2.4 | | | | | |
| | | 3.0 | 2.3 | 2.68 | 2.3 | | | | | |
| | | 4.5 | 3.8 | 4.2 | 3.8 | | | | | |
| V_{OL} | LOW Level Control | 1.65 | 0.0 | | | 0.0 | | V | $V_{IN} = V_{IL}$ | $I_{OL} = 100 \mu A$ |
| | | 1.8 | 0.0 | | | 0.1 | | | | |
| | | 2.3 | 0.0 | | | 0.1 | | | | |
| | | 3.0 | 0.0 | | | 0.1 | | | | |
| | | 4.5 | 0.0 | | | 0.1 | | | | |
| | Output Voltage | 1.65 | 0.08 | | | 0.24 | | | $I_{OL} = 4$ mA $I_{OL} = 8$ mA $I_{OL} = 16$ mA $I_{OL} = 24$ mA $I_{OL} = 32$ mA | |
| | | 2.3 | 0.10 | | | 0.3 | | | | |
| | | 3.0 | 0.15 | | | 0.4 | | | | |
| | | 3.0 | 0.22 | | | 0.55 | | | | |
| | | 4.5 | 0.22 | | | 0.55 | | | | |
| I_{IN} | Input Leakage Current | 0 to 5.5 | ± 0.1 | | | ± 1.0 | | μA | $0 \leq V_{IN} \leq 5.5V$ | |
| I_{OZ} | 3-STATE Output Leakage | 1.65 to 5.5 | ± 0.5 | | | ± 5.0 | | μA | $V_{IN} = V_{IL}$ or V_{IH} $0 \leq V_{OUT} \leq 5.5V$ | |
| I_{OFF} | Power-Off Leakage Current | 0.0 | 1.0 | | | 10 | | μA | V_{IN} or $V_{OUT} = 5.5V$ | |
| 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 D to Q | 1.65 | 2.0 | 9.0 | 15.0 | 2.0 | 16.0 | ns | C _L = 15 pF R _D = 1 MΩ S ₁ = Open | Figures 1, 3 |
| | | 1.8 | 2.0 | 6.1 | 10.0 | 2.0 | 10.5 | | | |
| | | 2.5 ± 0.2 | 1.5 | 3.6 | 6.5 | 1.6 | 6.8 | | | |
| | | 3.3 ± 0.3 | 1.0 | 2.7 | 4.6 | 1.2 | 5.0 | | | |
| | | 5.0 ± 0.5 | 1.0 | 2.0 | 3.4 | 1.0 | 3.7 | | | |
| | | 3.3 ± 0.3 | 1.5 | 3.3 | 5.5 | 1.5 | 6.2 | | | |
| | | 5.0 ± 0.5 | 1.0 | 2.6 | 4.3 | 1.3 | 4.8 | | C _L = 50 pF R _D = 500Ω, S ₁ = Open | Figures 1, 3 |
| t _{PLH} t _{PHL} | Propagation Delay LE to Q | 1.65 | 2.0 | 9.0 | 1.45 | 2.0 | 15.0 | ns | C _L = 15 pF R _D = 1 MΩ S ₁ = Open | Figures 1, 3 |
| | | 1.8 | 2.0 | 6.0 | 9.6 | 2.0 | 10.0 | | | |
| | | 2.5 ± 0.2 | 1.8 | 3.5 | 6.1 | 1.5 | 6.6 | | | |
| | | 3.3 ± 0.3 | 1.3 | 2.6 | 4.4 | 1.0 | 4.8 | | | |
| | | 5.0 ± 0.5 | 1.0 | 2.0 | 3.2 | 0.8 | 3.5 | | | |
| | | 3.3 ± 0.3 | 1.5 | 3.3 | 5.3 | 1.5 | 6.2 | | | |
| | | 5.0 ± 0.5 | 1.3 | 2.6 | 4.2 | 1.2 | 4.6 | | C _L = 50 pF R _D = 500Ω, S ₁ = Open | Figures 1, 4 |
| t _{PZL} t _{PZH} | Output Enable Time | 1.65 | 2.0 | 9.0 | 13.5 | 2.0 | 14.6 | ns | C _L = 50 pF, V _I = 2x V _{CC} R _U , R _D = 500Ω S ₁ = GND for t _{PZH} S ₁ = V _I for t _{PZL} | Figures 1, 4 |
| | | 1.8 | 2.0 | 6.0 | 9.0 | 2.0 | 9.5 | | | |
| | | 2.5 ± 0.2 | 2.0 | 3.7 | 6.0 | 1.8 | 6.6 | | | |
| | | 3.3 ± 0.3 | 1.5 | 2.8 | 5.0 | 1.4 | 5.3 | | | |
| | | 5.0 ± 0.5 | 1.0 | 2.2 | 3.7 | 1.0 | 3.9 | | | |
| t _{PLZ} t _{PHZ} | Output Disable Time | 1.65 | 2.0 | 7.7 | 12.0 | 2.0 | 13.0 | ns | C _L = 50 pF, V _I = 2x V _{CC} R _U , R _D = 500Ω S ₁ = GND for t _{PHZ} S ₁ = V _I for t _{PLZ} | Figures 1, 4 |
| | | 1.8 | 2.0 | 5.1 | 8.0 | 2.0 | 8.5 | | | |
| | | 2.5 ± 0.2 | 2.0 | 3.5 | 6.0 | 1.8 | 6.3 | | | |
| | | 3.3 ± 0.3 | 1.5 | 2.8 | 4.5 | 1.4 | 4.7 | | | |
| | | 5.0 ± 0.5 | 1.0 | 2.3 | 3.7 | 1.0 | 3.9 | | | |
| t _S | Setup Time, D to LE | 2.5 ± 0.2 | | | | 2.0 | | ns | C _L = 50 pF R _D = 500 Ω, S ₁ = Open | Figures 1, 5 |
| | | 3.3 ± 0.3 | | | | 1.5 | | | | |
| | | 5.0 ± 0.5 | | | | 1.5 | | | | |
| t _H | Hold Time, D to LE | 2.5 ± 0.2 | | | | 1.5 | | ns | C _L = 50 pF R _D = 500 Ω, S ₁ = Open | Figures 1, 5 |
| | | 3.3 ± 0.3 | | | | 1.5 | | | | |
| | | 5.0 ± 0.5 | | | | 1.5 | | | | |
| t _W | Pulse Width, LE | 2.5 ± 0.2 | | | | 3.0 | | ns | C _L = 50 pF R _D = 500 Ω, S ₁ = Open | Figures 1, 5 |
| | | 3.3 ± 0.3 | | | | 3.0 | | | | |
| | | 5.0 ± 0.5 | | | | 3.0 | | | | |

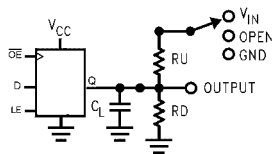
Capacitance (Note 3)

| Symbol | Parameter | Typ | Max | Units | Conditions |
|------------------|---|----------|-----|-------|---|
| C _{IN} | Input Capacitance | 3 | | pF | V _{CC} = Open, V _{IN} = 0V or V _{CC} |
| C _{OUT} | Output Capacitance | 4 | | pF | V _{CC} = 3.3V, V _{IN} = 0V or V _{CC} |
| C _{PD} | Power Dissipation Capacitance (Note 4) | 14 17 | | pF | V _{CC} = 3.3V V _{CC} = 5.0V |

Note 3: T_A = +25C, f = 1 MHz.

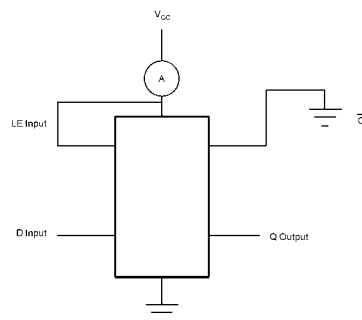
Note 4: C_{PD} is defined as the value of the internal equivalent capacitance which is derived from dynamic operating current consumption (I_{CCD}) at no output loading and operating at 50% duty cycle. (See Figure 2) C_{PD} is related to I_{CCD} dynamic operating current by the expression:
I_{CCD} = (C_{PD})(V_{CC})(f_{IN}) + (I_{CC}Static).

AC Loading and Waveforms



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

FIGURE 1. AC Test Circuit



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

FIGURE 2. I_{CCD} Test Circuit

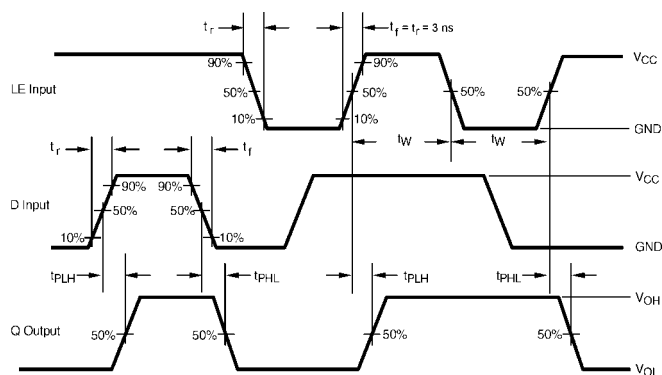


FIGURE 3. AC Waveforms

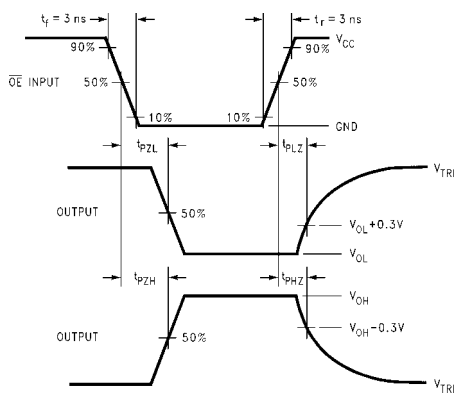


FIGURE 4. AC Waveforms

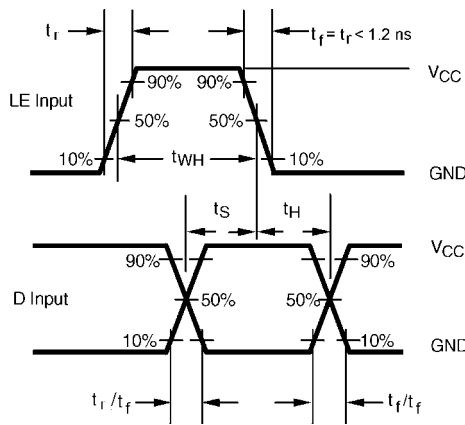


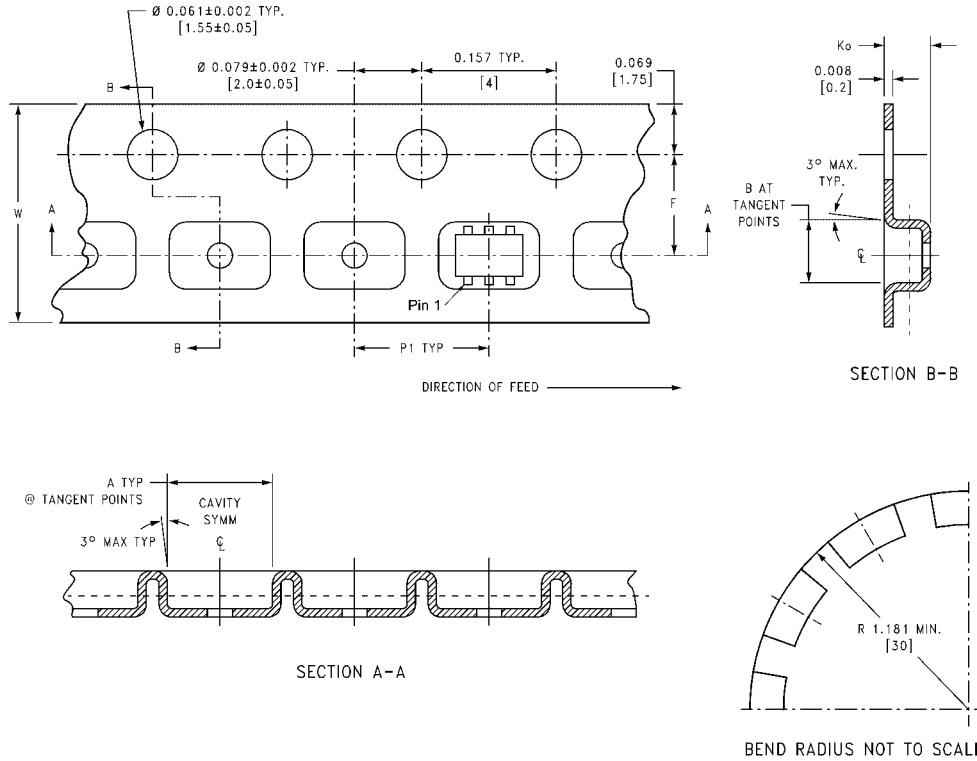
FIGURE 5. AC Waveforms

Tape and Reel Specification

TAPE FORMAT for SC70

| Package Designator | Tape Section | Number Cavities | Cavity Status | Cover Tape Status |
|--------------------|--------------------|-----------------|---------------|-------------------|
| P6X | Leader (Start End) | 125 (typ) | Empty | Sealed |
| | Carrier | 3000 | Filled | Sealed |
| | Trailer (Hub End) | 75 (typ) | Empty | Sealed |

TAPE DIMENSIONS inches (millimeters)

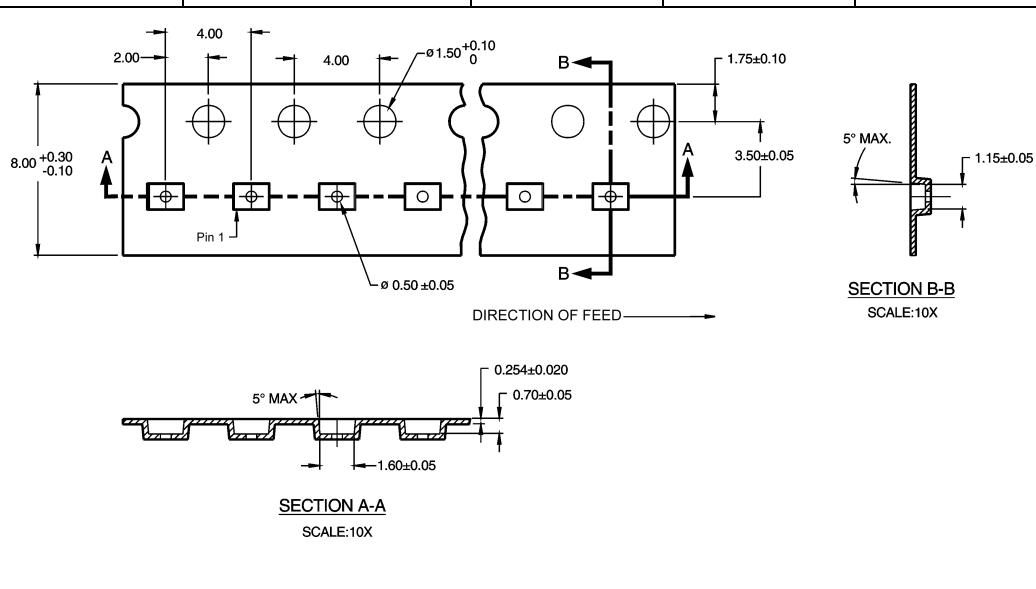


| Package | Tape Size | DIM A | DIM B | DIM F | DIM K ₀ | DIM P1 | DIM W |
|---------|-----------|-----------------|-----------------|-------------------------------|--------------------------------|--------------|----------------------------|
| SC70-6 | 8 mm | 0.093 (2.35) | 0.096 (2.45) | 0.138 ± 0.004 (3.5 ± 0.10) | 0.053 ± 0.004 (1.35 ± 0.10) | 0.157 (4) | 0.315 ± 0.004 (8 ± 0.1) |

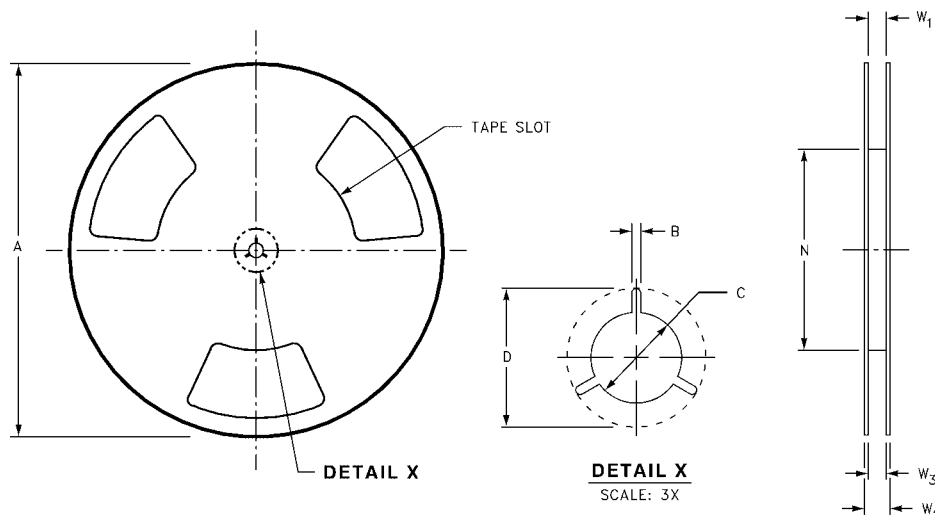
Tape and Reel Specification (Continued)

TAPE FORMAT for MicroPak

| Package Designator | Tape Section | Number Cavities | Cavity Status | Cover Tape Status |
|--------------------|--------------------|-----------------|---------------|-------------------|
| L6X | Leader (Start End) | 125 (typ) | Empty | Sealed |
| | Carrier | 3000 | Filled | Sealed |
| | Trailer (Hub End) | 75 (typ) | Empty | Sealed |



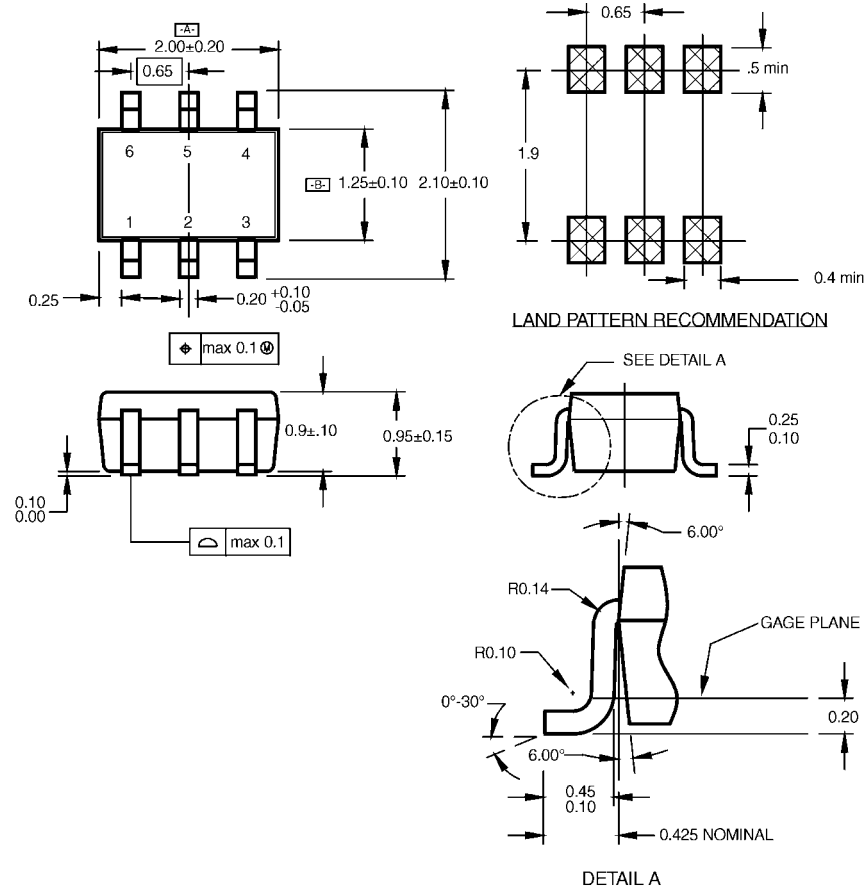
REEL DIMENSIONS inches (millimeters)



| 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) |

NC7SZ373

Physical Dimensions inches (millimeters) unless otherwise noted



NOTES:

- A. CONFORMS TO EIAJ REGISTERED OUTLINE DRAWING SC88.
- B. DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH.
- C. DIMENSIONS ARE IN MILLIMETERS.

MAA06ARevC

**6-Lead SC70, EIAJ SC88, 1.25mm Wide
Package Number MAA06A**

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



- Notes:
1. JEDEC PACKAGE REGISTRATION IS ANTICIPATED
 2. DIMENSIONS ARE IN MILLIMETERS
 3. DRAWING CONFORMS TO ASME Y14.5M-1994

MAC06ARevB

**6-Lead MicroPak, 1.0mm Wide
Package Number MAC06A**

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