

## NC7SZ175

### TinyLogic® UHS D-Type Flip-Flop with Asynchronous Clear

#### General Description

The NC7SZ175 is a single positive edge-triggered D-type CMOS Flip-Flop with Asynchronous Clear 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  $V_{CC}$  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. This single flip-flop will store the state of the D input that meets the setup and hold time requirements on the LOW-to-HIGH Clock (CP) transition. A LOW input to Clear sets the Q output to LOW level. The Clear input is independent of clock.

#### 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;  $\pm 24$  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
- Proprietary noise/EMI reduction circuitry implemented

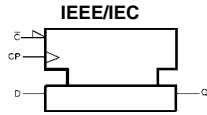
#### Ordering Code:

| Order Number | Package Number | Product Code Top Mark | Package Description                 | Supplied As               |
|--------------|----------------|-----------------------|-------------------------------------|---------------------------|
| NC7SZ175P6X  | MAA06A         | Z75                   | 6-Lead SC70, EIAJ SC88, 1.25mm Wide | 3k Units on Tape and Reel |
| NC7SZ175L6X  | MAC06A         | C4                    | 6-Lead MicroPak, 1.0mm Wide         | 5k Units on Tape and Reel |

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NC7SZ175 TinyLogic® UHS D-Type Flip-Flop with Asynchronous Clear

**Logic Symbol**



**Function Table**

| Inputs |   |    | Output |
|--------|---|----|--------|
| CP     | D | C̄ | Q      |
| ~      | L | H  | L      |
| ~      | H | H  | H      |
| ~      | X | H  | Qn     |
| X      | X | L  | L      |

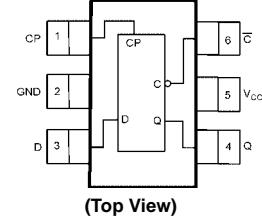
H = HIGH Logic Level    Qn = No change in data  
 L = LOW Logic Level    X = Immaterial

**Pin Descriptions**

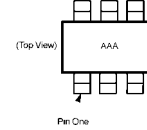
| Pin Names | Description       |
|-----------|-------------------|
| D         | Data Input        |
| CP        | Clock Pulse Input |
| C̄        | Clear Input       |
| Q         | Flip-Flop Output  |

**Connection Diagrams**

**Pin Assignments for SC70**

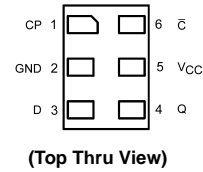


**Pin One Orientation Diagram**



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**



### Absolute Maximum Ratings (Note 1)

|  |                 |
|--|-----------------|
| Supply Voltage ( $V_{CC}$ )                  | -0.5V to +7.0V  |
| DC Input Voltage ( $V_{IN}$ )                | -0.5V to +7.0V  |
| DC Output Voltage ( $V_{OUT}$ )              | -0.5V to +7.0V  |
| DC Input Diode Current ( $I_{IK}$ )          |                 |
| $V_{IN} < 0V$                                | -50 mA          |
| DC Output Diode Current ( $I_{OK}$ )         |                 |
| $V_{OUT} < 0V$                               | -50 mA          |
| DC Output ( $I_{OUT}$ ) Source/Sink Current  | $\pm 50$ mA     |
| DC $V_{CC}/GND$ Current ( $I_{CC}/I_{GND}$ ) | $\pm 50$ 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 seconds)                      | 260°C           |
| Power Dissipation ( $P_D$ ) @+85°C           | 180 mW          |

### Recommended Operating Conditions (Note 2)

|   |                |
|---|----------------|
| Power Supply                            |                |
| Operating ( $V_{CC}$ )                  | 1.65V to 5.5V  |
| Data Retention                          | 1.5V to 5.5V   |
| Input Voltage ( $V_{IN}$ )              | 0V to 5.5V     |
| Output Voltage ( $V_{OUT}$ )            | 0V to $V_{CC}$ |
| Input Rise and Fall Time ( $t_r, t_f$ ) |                |
| $V_{CC} = 1.8V, 2.5V \pm 0.2V$          | 0 to 20 ns/V   |
| $V_{CC} = 3.3V \pm 0.3V$                | 0 to 10 ns/V   |
| $V_{CC} = 5.5V \pm 0.5V$                | 0 to 5 ns/V    |
| Operating Temperature ( $T_A$ )         | -40°C to +85°C |
| Thermal Resistance ( $\theta_{JA}$ )    | 350° C/W       |

**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                            | $V_{CC}$<br>(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<br>Input Voltage  | 1.65 to 1.95<br>2.3 to 5.5 | 0.75 $V_{CC}$<br>0.7 $V_{CC}$ |      |      | 0.75 $V_{CC}$<br>0.7 $V_{CC}$        |     | V                                |   |  |
| $V_{IL}$  | LOW Level Control<br>Input Voltage   | 1.65 to 1.95<br>2.3 to 5.5 | 0.25 $V_{CC}$<br>0.3 $V_{CC}$ |      |      | 0.25 $V_{CC}$<br>0.3 $V_{CC}$        |     | V                                |   |  |
| $V_{OH}$  | HIGH Level Control<br>Output Voltage | 1.65                       | 1.55                          | 1.65 | 1.55 |                                      | V   | $V_{IN} = V_{IH}$<br>or $V_{IL}$ | $I_{OH} = -100 \mu A$   |  |
|           |                                      | 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  |                                      |     |                                  |   |  |
|           |                                      | 1.65                       | 1.24                          | 1.52 | 1.29 |                                      |     |                                  | $I_{OH} = -4 \text{ mA}$<br>$I_{OH} = -8 \text{ mA}$<br>$I_{OH} = -16 \text{ mA}$<br>$I_{OH} = -24 \text{ mA}$<br>$I_{OH} = -32 \text{ mA}$ |  |
|           |                                      | 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  |                                      |     |                                  |   |  |
| 4.5       | 3.8                                  | 4.2                        | 3.8                           |      |      |                                      |     |                                  |   |  |
| $V_{OL}$  | LOW Level Control<br>Output Voltage  | 1.65                       | 0.0                           |      |      | 0.1                                  |     | V                                | $V_{IN} = V_{IL}$<br>or $V_{IH}$  | $I_{OL} = 100 \mu A$   |
|           |                                      | 1.8                        | 0.0                           |      |      | 0.1                                  |     |                                  |   |  |
|           |                                      | 2.3                        | 0.0                           |      |      | 0.1                                  |     |                                  |   |  |
|           |                                      | 3.0                        | 0.0                           |      |      | 0.1                                  |     |                                  |   |  |
|           |                                      | 4.5                        | 0.0                           |      |      | 0.1                                  |     |                                  |   |  |
|           |                                      | 1.65                       | 0.08                          |      |      | 0.24                                 |     |                                  |   | $I_{OL} = 4 \text{ mA}$<br>$I_{OL} = 8 \text{ mA}$<br>$I_{OL} = 16 \text{ mA}$<br>$I_{OL} = 24 \text{ mA}$<br>$I_{OL} = 32 \text{ mA}$ |
|           |                                      | 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                   |                               |      |      | $\pm 0.1$                            |     | $\mu A$                          | $0 \leq V_{IN} \leq 5.5V$   |  |
| $I_{OFF}$ | Power Off Leakage Current            | 0.0                        |                               |      |      | 1.0                                  |     | $\mu A$                          | $V_{IN}$ or $V_{OUT} = 5.5V$  |  |
| $I_{CC}$  | Quiescent Supply Current             | 1.65 to 5.5                |                               |      |      | 1.0                                  |     | $\mu A$                          | $V_{IN} = 5.5V, GND$  |  |

| AC Electrical Characteristics        |                                  |                        |                        |     |      |                                 |      |       |   |               |
|--------------------------------------|----------------------------------|------------------------|------------------------|-----|------|---------------------------------|------|-------|---|---------------|
| Symbol                               | Parameter                        | V <sub>CC</sub><br>(V) | T <sub>A</sub> = +25°C |     |      | T <sub>A</sub> = -40°C to +85°C |      | Units | Conditions  | Figure Number |
|                                      |                                  |                        | Min                    | Typ | Max  | Min                             | Max  |       |   |               |
| f <sub>MAX</sub>                     | Maximum Clock Frequency          | 1.65                   |                        |     |      | 100                             |      | MHz   | C <sub>L</sub> = 50 pF<br>R <sub>L</sub> = 500 Ω                      | Figures 1, 4  |
|                                      |                                  | 1.8                    |                        |     |      | 100                             |      |       |   |               |
|                                      |                                  | 2.5 ± 0.2              |                        |     |      | 125                             |      |       |   |               |
|                                      |                                  | 3.3 ± 0.3              |                        |     |      | 150                             |      |       |   |               |
|                                      |                                  | 5.0 ± 0.5              |                        |     |      | 175                             |      |       |   |               |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay CP to Q        | 1.65                   | 2.5                    | 9.8 | 15.0 | 2.5                             | 16.5 | ns    | C <sub>L</sub> = 15 pF<br>R <sub>L</sub> = 1 MΩ                       | Figures 1, 3  |
|                                      |                                  | 1.8                    | 2.5                    | 6.5 | 10.0 | 2.5                             | 11.0 |       |   |               |
|                                      |                                  | 2.5 ± 0.2              | 2.0                    | 3.8 | 6.5  | 2.0                             | 7.0  |       |   |               |
|                                      |                                  | 3.3 ± 0.3              | 1.5                    | 2.8 | 4.5  | 1.4                             | 5.0  |       |   |               |
|                                      |                                  | 5.0 ± 0.5              | 1.0                    | 2.2 | 3.5  | 1.0                             | 3.8  |       |   |               |
|                                      |                                  | 3.3 ± 0.3              | 2.0                    | 3.4 | 5.5  | 1.6                             | 6.2  |       | C <sub>L</sub> = 50 pF<br>R <sub>L</sub> = 500 Ω                      | Figures 1, 3  |
|                                      |                                  | 5.0 ± 0.5              | 1.5                    | 2.6 | 4.0  | 1.4                             | 4.7  |       |   |               |
| t <sub>PHL</sub>                     | Propagation Delay $\bar{C}$ to Q | 1.65                   | 2.5                    | 9.8 | 13.5 | 2.5                             | 15.0 | ns    | C <sub>L</sub> = 15 pF<br>R <sub>L</sub> = 1 MΩ                       | Figures 1, 3  |
|                                      |                                  | 1.8                    | 2.5                    | 6.5 | 9.0  | 2.5                             | 10.0 |       |   |               |
|                                      |                                  | 2.5 ± 0.2              | 2.0                    | 3.8 | 6.0  | 2.0                             | 6.4  |       |   |               |
|                                      |                                  | 3.3 ± 0.3              | 1.5                    | 2.8 | 4.3  | 1.2                             | 4.6  |       |   |               |
|                                      |                                  | 5.0 ± 0.5              | 1.5                    | 2.2 | 3.2  | 1.0                             | 3.5  |       |   |               |
|                                      |                                  | 3.3 ± 0.3              | 1.5                    | 3.4 | 5.3  | 1.5                             | 5.8  |       | C <sub>L</sub> = 50 pF<br>R <sub>L</sub> = 500 Ω                      | Figures 1, 3  |
|                                      |                                  | 5.0 ± 0.5              | 1.0                    | 2.7 | 4.0  | 1.2                             | 4.5  |       |   |               |
| t <sub>S</sub>                       | Setup Time CP to D               | 2.5 ± 0.2              |                        |     |      | 2.5                             |      | ns    | C <sub>L</sub> = 50 pF<br>R <sub>L</sub> = 500 Ω                      | Figures 1, 4  |
|                                      |                                  | 3.3 ± 0.3              |                        |     |      | 2.0                             |      |       |   |               |
|                                      |                                  | 5.0 ± 0.5              |                        |     |      | 1.5                             |      |       |   |               |
| t <sub>H</sub>                       | Hold Time, CP to D               | 2.5 ± 0.2              |                        |     |      | 1.5                             |      | ns    | C <sub>L</sub> = 50 pF<br>R <sub>L</sub> = 500 Ω                      | Figures 1, 4  |
|                                      |                                  | 3.3 ± 0.3              |                        |     |      | 1.5                             |      |       |   |               |
|                                      |                                  | 5.0 ± 0.5              |                        |     |      | 1.5                             |      |       |   |               |
| t <sub>W</sub>                       | Pulse Width, CP                  | 2.5 ± 0.2              |                        |     |      | 3.0                             |      | ns    | C <sub>L</sub> = 50 pF<br>R <sub>L</sub> = 500 Ω                      | Figures 1, 4  |
|                                      |                                  | 3.3 ± 0.3              |                        |     |      | 2.8                             |      |       |   |               |
|                                      |                                  | 5.0 ± 0.5              |                        |     |      | 2.5                             |      |       |   |               |
|                                      | Pulse Width, $\bar{C}$           | 2.5 ± 0.2              |                        |     |      | 3.0                             |      | ns    | Clock HIGH or LOW<br>C <sub>L</sub> = 50 pF<br>R <sub>L</sub> = 500 Ω | Figures 1, 4  |
|                                      |                                  | 3.3 ± 0.3              |                        |     |      | 2.8                             |      |       |   |               |
|                                      |                                  | 5.0 ± 0.5              |                        |     |      | 2.5                             |      |       |   |               |
| t <sub>rec</sub>                     | Recovery Time, $\bar{C}$ to CP   | 2.5 ± 0.2              |                        |     |      | 1.0                             |      | ns    | C <sub>L</sub> = 50 pF<br>R <sub>L</sub> = 500 Ω                      | Figures 1, 4  |
|                                      |                                  | 3.3 ± 0.3              |                        |     |      | 1.0                             |      |       |   |               |
|                                      |                                  | 5.0 ± 0.5              |                        |     |      | 1.0                             |      |       |   |               |

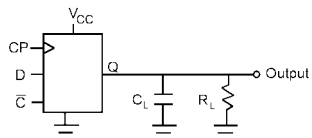
| Capacitance (Note 3) |  |     |     |       |   |
|----------------------|--|-----|-----|-------|---|
| Symbol               | Parameter                              | Typ | Max | Units | Conditions  |
| C <sub>IN</sub>      | Input Capacitance                      | 3   |     | pF    | V <sub>CC</sub> = Open, V <sub>IN</sub> = 0V or V <sub>CC</sub> |
| C <sub>OUT</sub>     | Output Capacitance                     | 4   |     | pF    | V <sub>CC</sub> = 3.3V, V <sub>IN</sub> = 0V or V <sub>CC</sub> |
| C <sub>PD</sub>      | Power Dissipation Capacitance (Note 4) | 10  |     | pF    | V <sub>CC</sub> = 3.3V  |
|                      |  | 12  |     |       | V <sub>CC</sub> = 5.0V  |

**Note 3:** T<sub>A</sub> = +25°C, f = 1MHz.

**Note 4:** C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is derived from dynamic operating current consumption (I<sub>CCD</sub>) at no output loading and operating at 50% duty cycle. (See Figure 2)

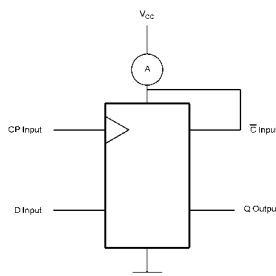
C<sub>PD</sub> is related to I<sub>CCD</sub> dynamic operating current by the expression: I<sub>CCD</sub> = (C<sub>PD</sub>)(V<sub>CC</sub>)(f<sub>IN</sub>) + (I<sub>CC</sub>static).

## AC Loading and Waveforms



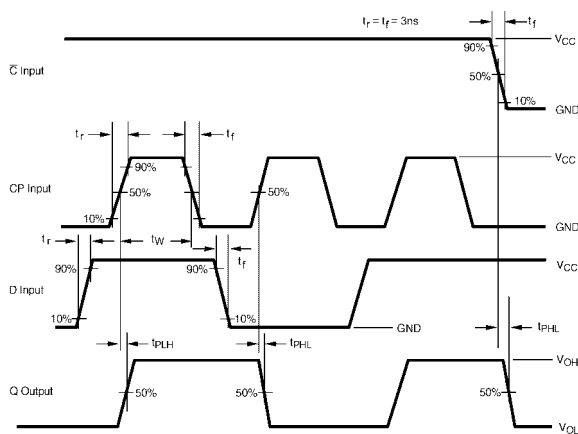
$C_L$  includes load and stray capacitance  
 Input PRR = 1.0 MHz,  $t_w = 500$  ns

**FIGURE 1. AC Test Circuit**

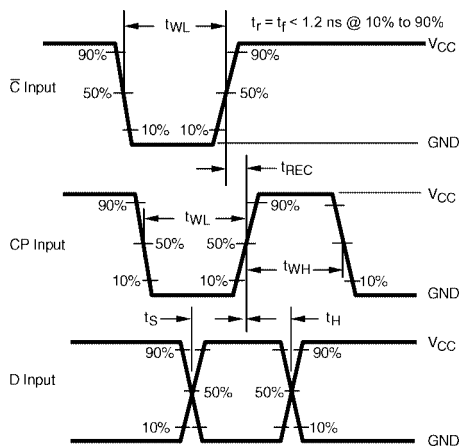


CP Input = AC Waveform;  $t_r = t_f = 1.8$  ns;  
 CP Input PRR = 10 MHz; Duty Cycle = 50%  
 D Input PRR = 5MHz; Duty Cycle = 50%

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



**FIGURE 3. AC Waveforms**



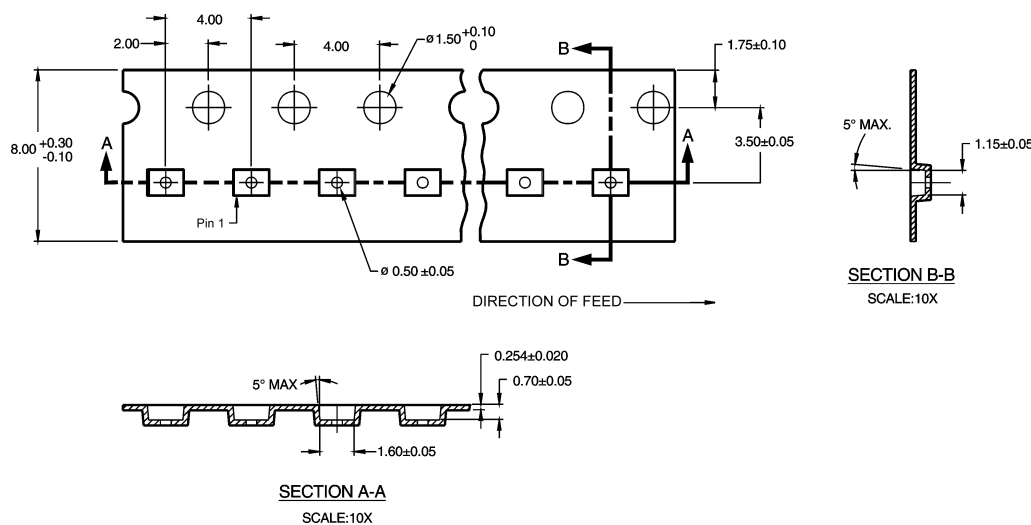
**FIGURE 4. AC Waveforms**



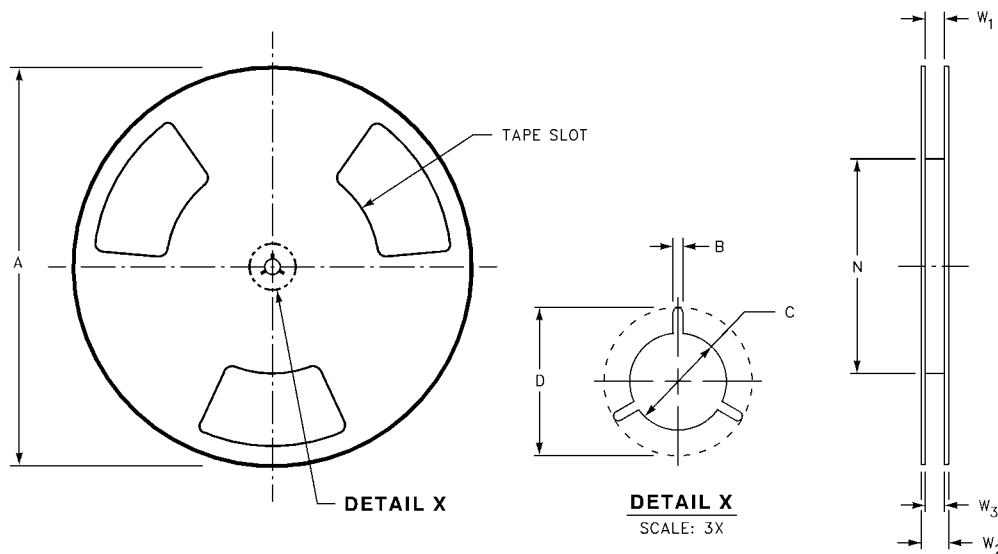
### Tape and Reel Specification (Continued)

#### TAPE FORMAT for MicroPak

| Package Designator | Tape Section       | Number Cavities | Cavity Status | Cover Tape Status |
|--------------------|--------------------|-----------------|---------------|-------------------|
| L6X                | Leader (Start End) | 125 (typ)       | Empty         | Sealed            |
|                    | Carrier            | 5000            | Filled        | Sealed            |
|                    | Trailer (Hub End)  | 75 (typ)        | Empty         | Sealed            |

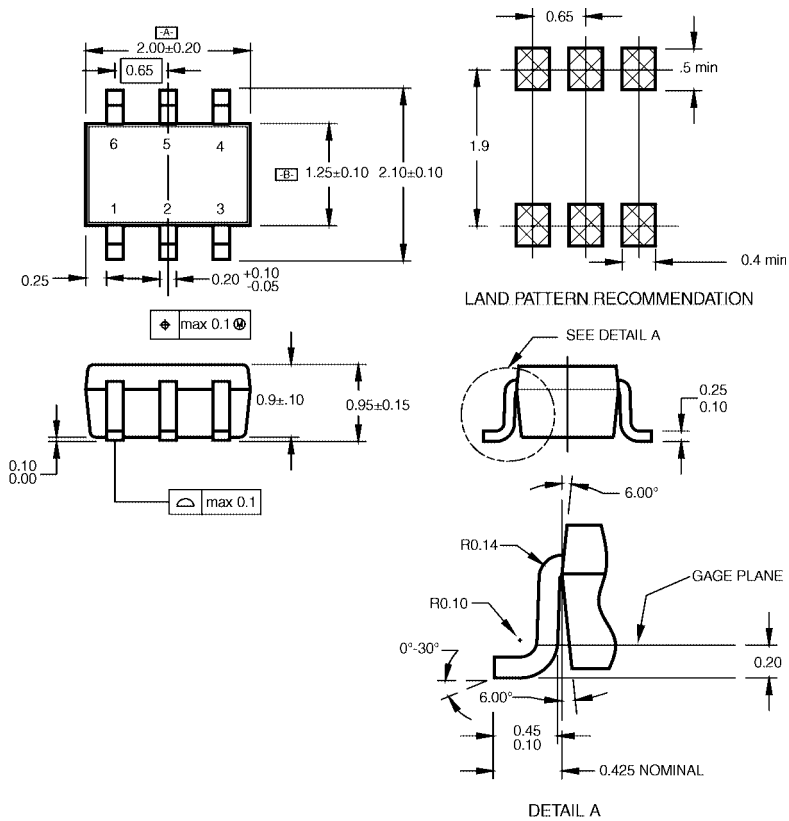


#### REEL DIMENSIONS inches (millimeters)



| Tape Size | A              | B               | C                | D                | N                | W1  | W2               | W3                                       |
|-----------|----------------|-----------------|------------------|------------------|------------------|---|------------------|--|
| 8 mm      | 7.0<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



NOTES:

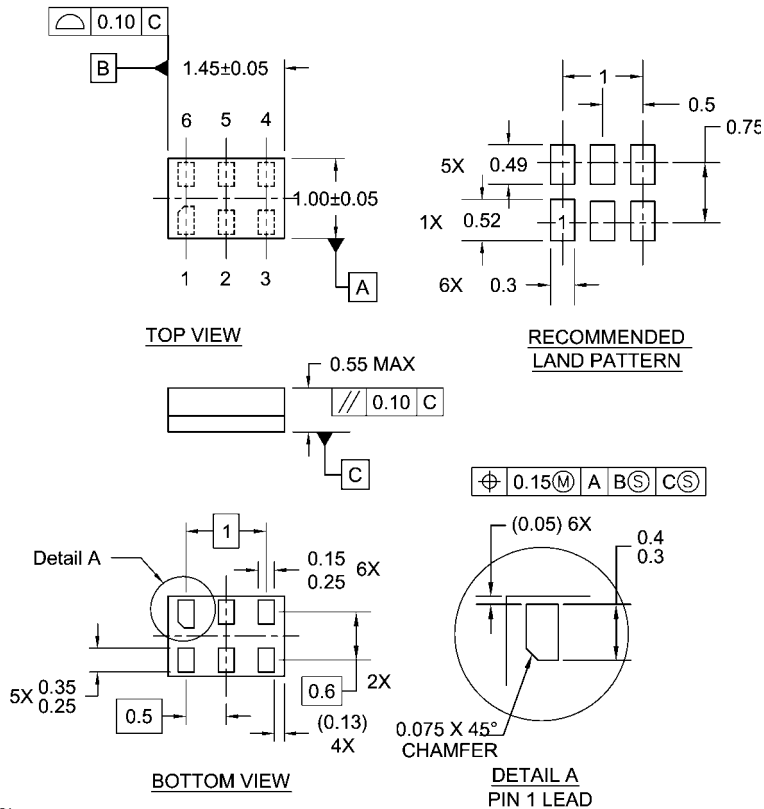
- A. CONFORMS TO EIAJ REGISTERED OUTLINE DRAWING SC88.
- B. DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH.
- C. DIMENSIONS ARE IN MILLIMETERS.

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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2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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