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# NC7SZ74

## TinyLogic® UHS D-Type, Flip-Flop with Preset and Clear

### Features

- Ultra-High Speed:  $t_{PD}$  2.6ns (Typical) into 50pF at 5V  $V_{CC}$
- High Output Drive:  $\pm 24mA$  at 3V  $V_{CC}$
- Broad  $V_{CC}$  Operating Range: 1.65V to 5.5V
- Power Down High-Impedance Inputs/Outputs
- Over-Voltage Tolerance Inputs Facilitate 5V to 3V Translation
- Proprietary Noise/EMI Reduction Circuitry
- Ultra-Small MicroPak™ Package
- Space-Saving US8 Surface Mount Package

### Description

The NC7SZ74 is a single, D-type, CMOS flip-flop with preset and clear 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  $V_{CC}$  operating range of 1.65V to 5.5V  $V_{CC}$ . The inputs and outputs are high impedance when  $V_{CC}$  is 0V. Inputs tolerate voltages up to 7V, independent of  $V_{CC}$  operating voltage.

The signal level applied to the D input is transferred to the Q output during the positive-going transition of the CLK pulse.

### Ordering Information

| Part Number | Top Mark | Package  | Packing Method            |
|-------------|----------|--|---------------------------|
| NC7SZ74K8X  | SZ74     | 8-Lead US8, JEDEC MO-187, Variation CA 3.1mm Wide- | 3000 Units on Tape & Reel |
| NC7SZ74L8X  | N9       | 8-Lead MicroPak, 1.6 mm Wide                       | 5000 Units on Tape & Reel |

## Connection Diagrams

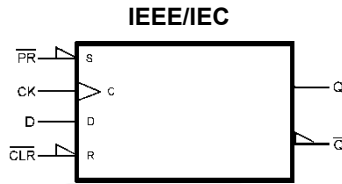


Figure 1. Logic Symbol

## Pin Configurations

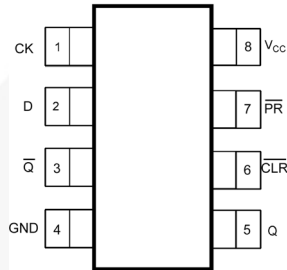


Figure 2. US8 (Top View)

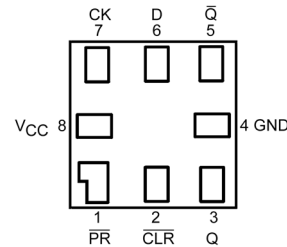


Figure 3. MicroPak™ (Top Through View)

## Pin Definitions

| Pin # US8 | Pin # MicroPak | Name            | Description         |
|-----------|----------------|-----------------|---------------------|
| 1         | 7              | CK              | Clock Pulse Input   |
| 2         | 6              | D               | Data Input          |
| 3         | 5              | /Q              | Flip-Flop Output    |
| 4         | 4              | GND             | Ground              |
| 5         | 3              | Q               | Flip-Flop Output    |
| 6         | 2              | /CLR            | Direct Clear Input  |
| 7         | 1              | /PR             | Direct Preset Input |
| 8         | 8              | V <sub>CC</sub> | Supply Voltage      |

## Function Table

| Inputs |     |   |    | Output         |                 | Function  |
|--------|-----|---|----|----------------|-----------------|-----------|
| /CLR   | /PR | D | CK | Q              | /Q              |           |
| L      | H   | X | X  | L              | H               | Clear     |
| H      | L   | X | X  | H              | L               | Preset    |
| L      | L   | X | X  | H              | H               |           |
| H      | H   | L | ↑  | L              | H               |           |
| H      | H   | H | ↑  | H              | L               |           |
| H      | H   | X | ↓  | Q <sub>n</sub> | /Q <sub>n</sub> | No Change |

H = HIGH Logic Level

L = LOW Logic Level

Q<sub>n</sub> = No change in data

Z = High Impedance

X = Immaterial

↑ = Rising Edge

↓ = Falling Edge

## Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

| Symbol                | Parameter   | Min.           | Max. | Unit |
|-----------------------|---|----------------|------|------|
| $V_{CC}$              | Supply Voltage                                    | -0.5           | 7.0  | V    |
| $V_{IN}$              | DC Input Voltage                                  | -0.5           | 7.0  | V    |
| $V_{OUT}$             | DC Output Voltage                                 | -0.5           | 7.0  | V    |
| $I_{IK}$              | DC Input Diode Current                            | $V_{IN} < 0V$  | -50  | mA   |
| $I_{OK}$              | DC Output Diode Current                           | $V_{OUT} < 0V$ | -50  | mA   |
| $I_{OUT}$             | DC Output Source/Sink Current                     |                | ±50  | mA   |
| $I_{CC}$ or $I_{GND}$ | DC $V_{CC}$ or Ground Current                     |                | ±50  | mA   |
| $T_{STG}$             | Storage Temperature Range                         | -65            | +150 | °C   |
| $T_J$                 | Junction Temperature Under Bias                   |                | +150 | °C   |
| $T_L$                 | Junction Lead Temperature (Soldering, 10 Seconds) |                | +260 | °C   |
| $P_D$                 | Power Dissipation at +85°C                        |                | 250  | mW   |
| ESD                   | Human Body Model, JEDEC:JESD22-A114               |                | 5000 | V    |
|                       | Charge Device Model: JEDEC:JESD22-C101            |                | 2000 |      |

## Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. Fairchild does not recommend exceeding them or designing to Absolute Maximum Ratings.

| Symbol        | Parameter                     | Conditions                   | Min. | Max.     | Unit |
|---------------|-------------------------------|------------------------------|------|----------|------|
| $V_{CC}$      | Supply Voltage Operating      |                              | 1.65 | 5.50     | V    |
|               | Supply Voltage Data Retention |                              | 1.50 | 5.50     |      |
| $V_{IN}$      | Input Voltage                 |                              | 0    | 5.5      | V    |
| $V_{OUT}$     | Output Voltage                | Active State                 | 0    | $V_{CC}$ | V    |
|               |                               | 3-State                      | 0    | 5.5      |      |
| $t_r, t_f$    | Input Rise and Fall Times     | $V_{CC}=1.8V, 2.5V \pm 0.2V$ | 0    | 20       | ns/V |
|               |                               | $V_{CC}=3.3V \pm 0.3V$       | 0    | 10       |      |
|               |                               | $V_{CC}=5.0V \pm 0.5V$       | 0    | 5        |      |
| $T_A$         | Operating Temperature         |                              | -40  | +85      | °C   |
| $\theta_{JA}$ | Thermal Resistance            | US8                          |      | 250      | °C/W |
|               |                               | MicroPak™-8                  |      | 280      |      |

**Note:**

- Unused inputs must be held HIGH or LOW. They may not float.

### DC Electrical Characteristics

| Symbol           | Parameter                        | V <sub>CC</sub> | Conditions  | T <sub>A</sub> =+25°C |      |                     | T <sub>A</sub> =-40 to +85°C |                     | Units |
|------------------|----------------------------------|-----------------|---|-----------------------|------|---------------------|------------------------------|---------------------|-------|
|                  |                                  |                 |   | Min.                  | Typ. | Max.                | Min.                         | Max.                |       |
| V <sub>IH</sub>  | HIGH Level Control Input Voltage | 1.65 to 1.95    |   | 0.75V <sub>CC</sub>   |      |                     | 0.75V <sub>CC</sub>          |                     | V     |
|                  |                                  | 2.30 to 5.50    |   | 0.70V <sub>CC</sub>   |      |                     | 0.70V <sub>CC</sub>          |                     |       |
| V <sub>IL</sub>  | LOW Level Control Input Voltage  | 1.65 to 1.95    |   |                       |      | 0.25V <sub>CC</sub> |                              | 0.25V <sub>CC</sub> | V     |
|                  |                                  | 2.30 to 5.50    |   |                       |      | 0.30V <sub>CC</sub> |                              | 0.30V <sub>CC</sub> |       |
| V <sub>OH</sub>  | HIGH Level Output Voltage        | 1.65            | V <sub>IN</sub> =V <sub>IH</sub> ,<br>I <sub>OH</sub> =-100μA | 1.55                  | 1.65 |                     | 1.55                         |                     | V     |
|                  |                                  | 2.30            |   | 2.20                  | 2.30 |                     | 2.20                         |                     |       |
|                  |                                  | 3.00            |   | 2.90                  | 3.00 |                     | 2.90                         |                     |       |
|                  |                                  | 4.50            |   | 4.40                  | 4.50 |                     | 4.40                         |                     |       |
|                  |                                  | 1.65            | I <sub>OH</sub> =-4mA   | 1.29                  | 1.52 |                     | 1.29                         |                     |       |
|                  |                                  | 2.30            | I <sub>OH</sub> =-8mA   | 1.90                  | 2.15 |                     | 1.90                         |                     |       |
|                  |                                  | 3.00            | I <sub>OH</sub> =-16mA  | 2.40                  | 2.80 |                     | 2.40                         |                     |       |
|                  |                                  | 3.00            | I <sub>OH</sub> =-24mA  | 2.30                  | 2.68 |                     | 2.30                         |                     |       |
|                  |                                  | 4.50            | I <sub>OH</sub> =-32mA  | 3.80                  | 4.20 |                     | 3.80                         |                     |       |
| V <sub>OL</sub>  | LOW Level Control Output Voltage | 1.65            | V <sub>IN</sub> =V <sub>IH</sub> ,<br>I <sub>OL</sub> =100μA  |                       |      | 0.10                |                              | 0.10                | V     |
|                  |                                  | 2.30            |   |                       |      | 0.10                |                              | 0.10                |       |
|                  |                                  | 3.00            |   |                       |      | 0.10                |                              | 0.10                |       |
|                  |                                  | 4.50            |   |                       |      | 0.10                |                              | 0.10                |       |
|                  |                                  | 1.65            | I <sub>OL</sub> =4mA  |                       | 0.80 | 0.24                |                              | 0.24                |       |
|                  |                                  | 2.30            | I <sub>OL</sub> =8mA  |                       | 0.10 | 0.30                |                              | 0.30                |       |
|                  |                                  | 3.00            | I <sub>OL</sub> =16mA   |                       | 0.15 | 0.40                |                              | 0.40                |       |
|                  |                                  | 3.00            | I <sub>OL</sub> =24mA   |                       | 0.22 | 0.55                |                              | 0.55                |       |
|                  |                                  | 4.50            | I <sub>OL</sub> =32mA   |                       | 0.22 | 0.55                |                              | 0.55                |       |
| I <sub>IN</sub>  | Input Leakage Current            | 0 to 5.5        | 0 ≤ V <sub>IN</sub> ≤ 5.5V                                    |                       |      | ±0.1                |                              | ±1.0                | μA    |
| I <sub>OFF</sub> | Power Off Leakage Current        | 0               | V <sub>IN</sub> or V <sub>OUT</sub> =5.5V                     |                       |      | 1                   |                              | 10                  | μA    |
| I <sub>CC</sub>  | Quiescent Supply Current         | 1.65 to 5.50    | V <sub>IN</sub> =5.5V, GND                                    |                       |      | 1                   |                              | 10                  | μA    |

### AC Electrical Characteristics

| Symbol                              | Parameter                               | V <sub>CC</sub> | Conditions   | T <sub>A</sub> =+25°C |      |      | T <sub>A</sub> =-40 to +85°C |      | Units | Figure               |
|-------------------------------------|---|-----------------|--|-----------------------|------|------|------------------------------|------|-------|----------------------|
|                                     |   |                 |  | Min.                  | Typ. | Max. | Min.                         | Max. |       |                      |
| f <sub>MAX</sub>                    | Maximum Clock Frequency                 | 1.80 ± 0.15     | C <sub>L</sub> =15pF<br>R <sub>D</sub> =1MΩ<br>S <sub>1</sub> =Open    | 75                    |      |      | 75                           |      | ns    | Figure 4<br>Figure 8 |
|                                     |   | 2.50 ± 0.20     |  | 150                   |      |      | 150                          |      |       |                      |
|                                     |   | 3.30 ± 0.30     |  | 200                   |      |      | 200                          |      |       |                      |
|                                     |   | 5.00 ± 0.50     |  | 250                   |      |      | 250                          |      |       |                      |
|                                     |   | 3.30 ± 0.50     | C <sub>L</sub> =50pF<br>R <sub>D</sub> =500Ω,<br>S <sub>1</sub> =Open  | 175                   |      |      | 175                          |      |       |                      |
|                                     |   | 5.00 ± 0.50     |  | 200                   |      |      | 200                          |      |       |                      |
| t <sub>PLH</sub> , t <sub>PHL</sub> | Propagation Delay<br>CK to Q, /Q        | 1.80 ± 0.15     | C <sub>L</sub> =15pF,<br>R <sub>D</sub> =1MΩ<br>S <sub>1</sub> =Open   | 2.5                   | 6.5  | 12.5 | 2.5                          | 13.0 | ns    | Figure 4<br>Figure 6 |
|                                     |   | 2.50 ± 0.20     |  | 1.5                   | 3.8  | 7.5  | 1.5                          | 8.0  |       |                      |
|                                     |   | 3.30 ± 0.30     |  | 1.0                   | 2.8  | 6.5  | 1.0                          | 7.0  |       |                      |
|                                     |   | 5.00 ± 0.50     |  | 0.8                   | 2.2  | 4.5  | 0.8                          | 5.0  |       |                      |
|                                     |   | 3.30 ± 0.30     | C <sub>L</sub> =50pF<br>R <sub>D</sub> =500Ω,<br>S <sub>1</sub> =Open  | 1.0                   | 3.4  | 7.0  | 1.0                          | 7.5  |       |                      |
|                                     |   | 5.00 ± 0.50     |  | 1.0                   | 2.6  | 5.0  | 1.0                          | 5.5  |       |                      |
| t <sub>PLH</sub> , t <sub>PHL</sub> | Propagation Delay<br>/CLR, /PR to Q, /Q | 1.80 ± 0.15     | C <sub>L</sub> =15pF,<br>R <sub>L</sub> =1MΩ<br>S <sub>1</sub> =Open   | 2.5                   | 6.5  | 14.0 | 2.5                          | 14.5 | ns    | Figure 4<br>Figure 6 |
|                                     |   | 2.50 ± 0.20     |  | 1.5                   | 3.8  | 9.0  | 1.5                          | 9.5  |       |                      |
|                                     |   | 3.30 ± 0.30     |  | 1.0                   | 2.8  | 6.5  | 1.0                          | 7.0  |       |                      |
|                                     |   | 5.00 ± 0.50     |  | 0.8                   | 2.2  | 5.0  | 0.8                          | 5.5  |       |                      |
|                                     |   | 3.30 ± 0.30     | C <sub>L</sub> =50pF,<br>R <sub>D</sub> =500Ω,<br>S <sub>1</sub> =Open | 1.0                   | 3.4  | 7.0  | 1.0                          | 7.5  |       |                      |
|                                     |   | 5.00 ± 0.50     |  | 1.0                   | 2.6  | 5.0  | 1.0                          | 5.5  |       |                      |
| t <sub>S</sub>                      | Setup Time CK to D                      | 1.80 ± 0.15     | C <sub>L</sub> =15pF,<br>R <sub>L</sub> =1MΩ<br>S <sub>1</sub> =Open   | 6.5                   |      |      | 6.5                          |      | ns    | Figure 4<br>Figure 7 |
|                                     |   | 2.50 ± 0.20     |  | 3.5                   |      |      | 3.5                          |      |       |                      |
|                                     |   | 3.30 ± 0.30     |  | 2.0                   |      |      | 2.0                          |      |       |                      |
|                                     |   | 5.00 ± 0.50     |  | 1.5                   |      |      | 1.5                          |      |       |                      |
|                                     |   | 3.30 ± 0.30     | C <sub>L</sub> =50pF,<br>R <sub>D</sub> =500Ω,<br>S <sub>1</sub> =Open | 2.0                   |      |      | 2.0                          |      |       |                      |
|                                     |   | 5.00 ± 0.50     |  | 1.5                   |      |      | 1.5                          |      |       |                      |
| t <sub>H</sub>                      | Hold Time, CK to D                      | 1.80 ± 0.15     | C <sub>L</sub> =15pF,<br>R <sub>L</sub> =1MΩ<br>S <sub>1</sub> =Open   | 0.5                   |      |      | 0.5                          |      | ns    | Figure 4<br>Figure 7 |
|                                     |   | 2.50 ± 0.20     |  | 0.5                   |      |      | 0.5                          |      |       |                      |
|                                     |   | 3.30 ± 0.30     |  | 0.5                   |      |      | 0.5                          |      |       |                      |
|                                     |   | 5.00 ± 0.50     |  | 0.5                   |      |      | 0.5                          |      |       |                      |
|                                     |   | 3.30 ± 0.30     | C <sub>L</sub> =50pF,<br>R <sub>D</sub> =500Ω,<br>S <sub>1</sub> =Open | 0.5                   |      |      | 0.5                          |      |       |                      |
|                                     |   | 5.00 ± 0.50     |  | 0.5                   |      |      | 0.5                          |      |       |                      |
| t <sub>w</sub>                      | Pulse Width, CK,<br>/PR, /CLR           | 1.80 ± 0.15     | C <sub>L</sub> =15pF,<br>R <sub>L</sub> =1MΩ<br>S <sub>1</sub> =Open   | 6.0                   |      |      | 6.0                          |      | ns    | Figure 4<br>Figure 8 |
|                                     |   | 2.50 ± 0.20     |  | 4.0                   |      |      | 4.0                          |      |       |                      |
|                                     |   | 3.30 ± 0.30     |  | 3.0                   |      |      | 3.0                          |      |       |                      |
|                                     |   | 5.00 ± 0.50     |  | 2.0                   |      |      | 2.0                          |      |       |                      |
|                                     |   | 3.30 ± 0.30     | C <sub>L</sub> =50pF,<br>R <sub>D</sub> =500Ω,<br>S <sub>1</sub> =Open | 3.0                   |      |      | 3.0                          |      |       |                      |
|                                     |   | 5.00 ± 0.50     |  | 2.0                   |      |      | 2.0                          |      |       |                      |
| t <sub>REC</sub>                    | Recover Time /CLR,<br>/PR to CK         | 1.80 ± 0.15     | C <sub>L</sub> =15pF,<br>R <sub>L</sub> =1MΩ<br>S <sub>1</sub> =Open   | 8.0                   |      |      | 8.0                          |      | ns    | Figure 4<br>Figure 7 |
|                                     |   | 2.50 ± 0.20     |  | 4.5                   |      |      | 4.5                          |      |       |                      |
|                                     |   | 3.30 ± 0.30     |  | 3.0                   |      |      | 3.0                          |      |       |                      |
|                                     |   | 5.00 ± 0.50     |  | 3.0                   |      |      | 3.0                          |      |       |                      |
|                                     |   | 3.30 ± 0.30     | C <sub>L</sub> =50pF,<br>R <sub>D</sub> =500Ω,<br>S <sub>1</sub> =Open | 3.0                   |      |      | 3.0                          |      |       |                      |
|                                     |   | 5.00 ± 0.50     |  | 3.0                   |      |      | 3.0                          |      |       |                      |

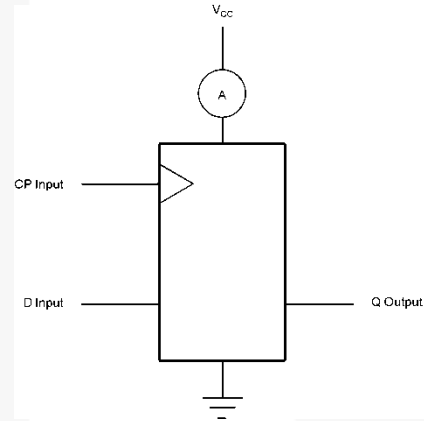
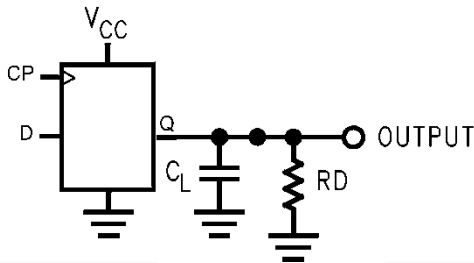
Continued on the following page...

## AC Electrical Characteristics

| Symbol           | Parameter                                    | V <sub>CC</sub> | Conditions | T <sub>A</sub> =+25°C |      | T <sub>A</sub> =-40 to +85°C |      | Units | Figure |
|------------------|--|-----------------|------------|-----------------------|------|------------------------------|------|-------|--------|
|                  |  |                 |            | Min.                  | Typ. | Min.                         | Typ. |       |        |
| C <sub>IN</sub>  | Input Capacitance                            | 0               |            |                       | 3    |                              |      | pF    |        |
| C <sub>OUT</sub> | Output Capacitance                           | 0               |            |                       | 4    |                              |      | pF    |        |
| C <sub>PD</sub>  | Power Dissipation Capacitance <sup>(2)</sup> | 3.30            |            |                       | 10   |                              |      | pF    |        |
|                  |  | 5.00            |            |                       | 12   |                              |      |       |        |

**Note:**

2. 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. C<sub>PD</sub> is related to I<sub>CCD</sub> dynamic operating current by the expression:  $I_{CCD} = (C_{PD})(V_{CC})(f_{IN}) + (I_{CCstatic})$ .



**Note:**

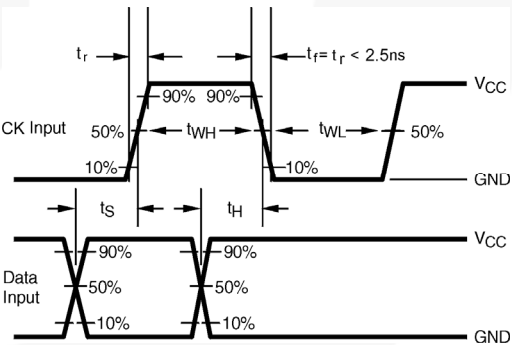
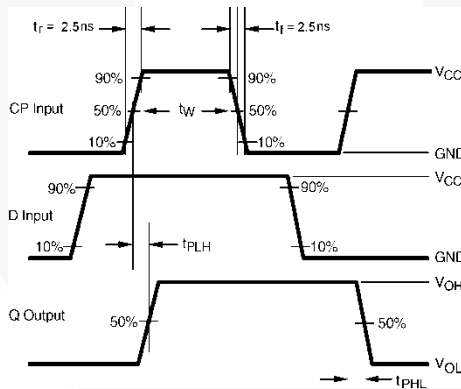
3. C<sub>L</sub> includes load and stray capacitance. Input PRR=1.0MHz t<sub>w</sub>=500ns.

**Notes:**

4. CP input=AC Waveforms t<sub>r</sub>=t<sub>f</sub>=2.5ns.  
 5. CP input PRR=10MHz; Duty Cycle=50%.  
 6. D input PRR=5MHz; Duty Cycle=50%.

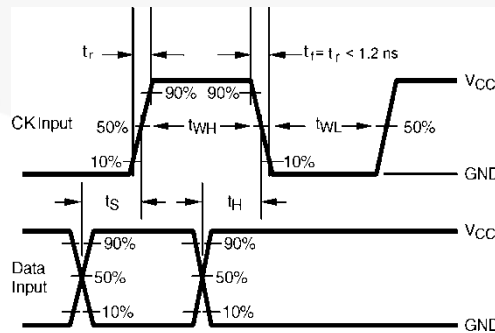
**Figure 4. AC Test Circuit**

**Figure 5. I<sub>CCD</sub> Test Circuit**



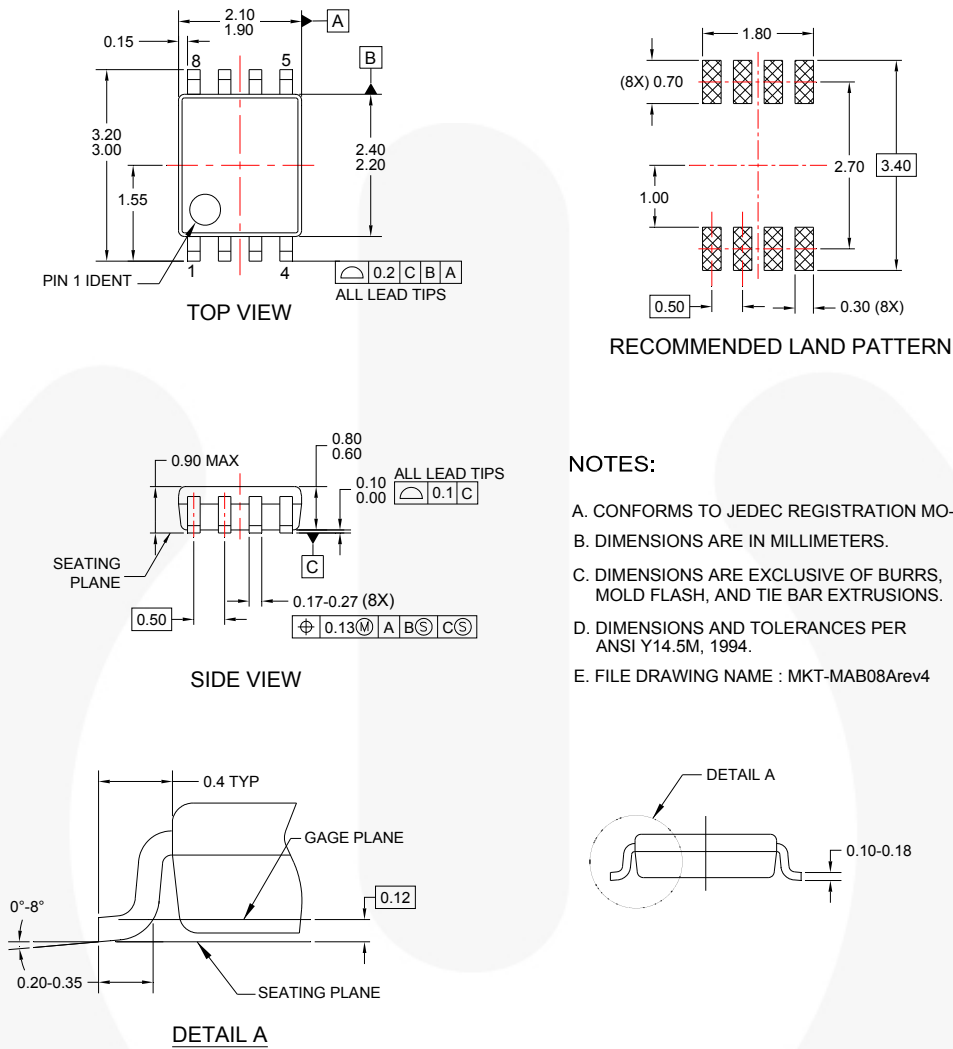
**Figure 6. AC Waveforms**

**Figure 7. AC Waveforms**



**Figure 8. AC Waveforms**

## Physical Dimensions



### 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, 1994.
- E. FILE DRAWING NAME : MKT-MAB08Arev4

**Figure 9. 8-Lead US8, JEDEC MO-187, Variation CA 3.1mm Wide**

Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.

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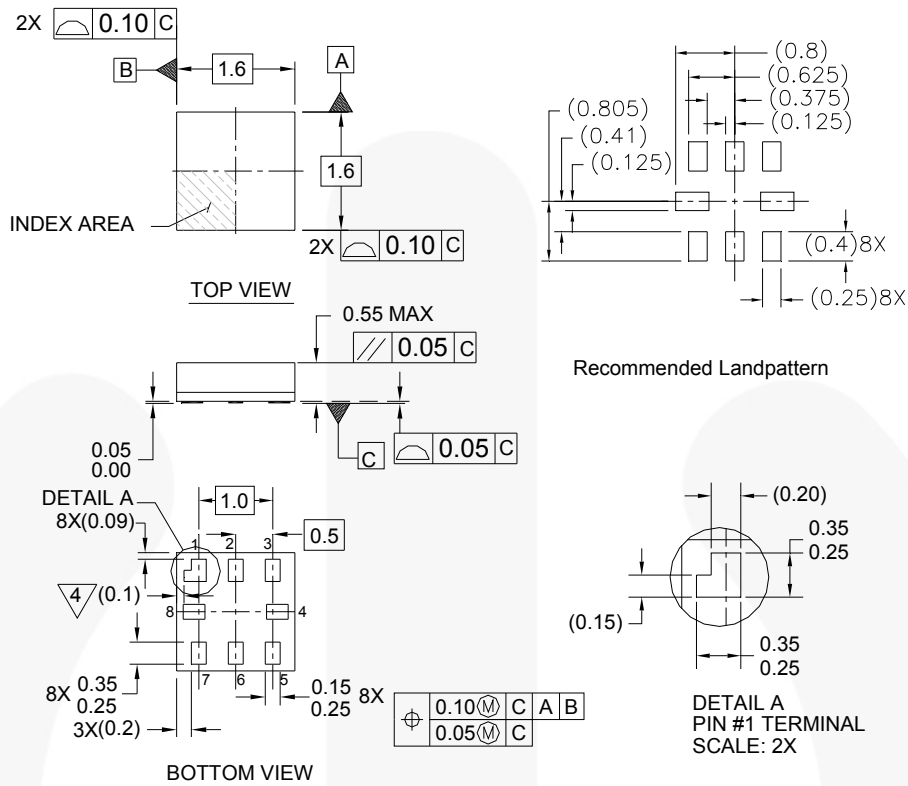
## Tape and Reel Specifications

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[http://www.fairchildsemi.com/products/analog/pdf/sc70-5\\_tr.pdf](http://www.fairchildsemi.com/products/analog/pdf/sc70-5_tr.pdf).

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



## Physical Dimensions



**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
5. DRAWING FILE NAME: MKT-MAC08AREV4

MAC08AREV4

**Figure 10.8-Lead, MicroPak™, 1.6mm Wide**

Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.

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## Tape and Reel Specifications

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| Package Designator | Tape Section       | Cavity Number | Cavity Status | Cover Type Status |
|--------------------|--------------------|---------------|---------------|-------------------|
| L8X                | Leader (Start End) | 125 (Typical) | Empty         | Sealed            |
|                    | Carrier            | 5000          | Filled        | Sealed            |
|                    | Trailer (Hub End)  | 75 (Typical)  | Empty         | Sealed            |



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| AccuPower™               | FPST™  |  | SYSTEM GENERAL®*           |
| Auto-SPM™                | F-PFET™  |  | The Power Franchise®       |
| AX-CAP™                  | FRFET™   |  | <b>the power franchise</b> |
| BitSiC®                  | Global Power Resource™                         |  | TinyBoost™                 |
| Build it Now™            | Green FPS™                                     |  | TinyBuck™                  |
| CorePLUS™                | Green FPS™ e-Series™                           |  | TinyCalc™                  |
| CorePOWER™               | Gmax™  |  | TinyLogic®                 |
| CROSSVOLT™               | GTO™   |  | TINYOPTO™                  |
| CTL™                     | IntelliMAX™                                    |  | TinyPower™                 |
| Current Transfer Logic™  | ISOPLANAR™                                     |  | TinyPWM™                   |
| DEUXPEED®                | Making Small Speakers Sound Louder and Better™ |  | TinyWire™                  |
| Dual Cool™               | MegaBuck™                                      |  | TranSiC®                   |
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| EfficientMax™            | MicroFET™                                      |  | TRUECURRENT®*              |
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