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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

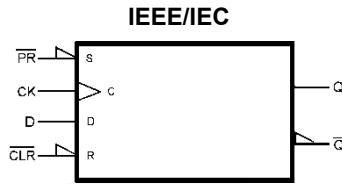


Figure 1. Logic Symbol

Pin Configurations

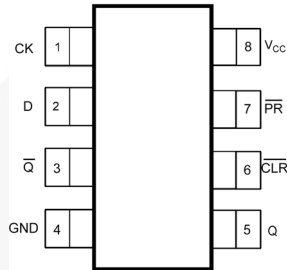


Figure 2. US8 (Top View)

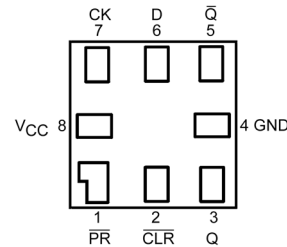


Figure 3. MicroPak™ (Top Through View)

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 _{CC} | 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 _n | /Q _n | No Change |

H = HIGH Logic Level

L = LOW Logic Level

Q_n = 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 ± 0.2V | 0 | 20 | ns/V |
| | | V _{CC} =3.3V ± 0.3V | 0 | 10 | |
| | | V _{CC} =5.0V ± 0.5V | 0 | 5 | |
| T _A | Operating Temperature | | -40 | +85 | °C |
| θ _{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 _{CC} | Conditions | T _A =+25°C | | | T _A =-40 to +85°C | | Units |
|------------------|----------------------------------|-----------------|---|-----------------------|------|---------------------|------------------------------|---------------------|-------|
| | | | | Min. | Typ. | Max. | Min. | Max. | |
| V _{IH} | HIGH Level Control Input Voltage | 1.65 to 1.95 | | 0.75V _{CC} | | | 0.75V _{CC} | | V |
| | | 2.30 to 5.50 | | 0.70V _{CC} | | | 0.70V _{CC} | | |
| V _{IL} | LOW Level Control Input Voltage | 1.65 to 1.95 | | | | 0.25V _{CC} | | 0.25V _{CC} | V |
| | | 2.30 to 5.50 | | | | 0.30V _{CC} | | 0.30V _{CC} | |
| V _{OH} | HIGH Level Output Voltage | 1.65 | V _{IN} =V _{IH} , I _{OH} =-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 _{OH} =-4mA | 1.29 | 1.52 | | 1.29 | | |
| | | 2.30 | I _{OH} =-8mA | 1.90 | 2.15 | | 1.90 | | |
| | | 3.00 | I _{OH} =-16mA | 2.40 | 2.80 | | 2.40 | | |
| | | 3.00 | I _{OH} =-24mA | 2.30 | 2.68 | | 2.30 | | |
| | | 4.50 | I _{OH} =-32mA | 3.80 | 4.20 | | 3.80 | | |
| V _{OL} | LOW Level Control Output Voltage | 1.65 | V _{IN} =V _{IH} , I _{OL} =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 _{OL} =4mA | | 0.80 | 0.24 | | 0.24 | |
| | | 2.30 | I _{OL} =8mA | | 0.10 | 0.30 | | 0.30 | |
| | | 3.00 | I _{OL} =16mA | | 0.15 | 0.40 | | 0.40 | |
| | | 3.00 | I _{OL} =24mA | | 0.22 | 0.55 | | 0.55 | |
| | | 4.50 | I _{OL} =32mA | | 0.22 | 0.55 | | 0.55 | |
| I _{IN} | Input Leakage Current | 0 to 5.5 | 0 ≤ V _{IN} ≤ 5.5V | | | ±0.1 | | ±1.0 | μA |
| I _{OFF} | Power Off Leakage Current | 0 | V _{IN} or V _{OUT} =5.5V | | | 1 | | 10 | μA |
| I _{CC} | Quiescent Supply Current | 1.65 to 5.50 | V _{IN} =5.5V, GND | | | 1 | | 10 | μA |

AC Electrical Characteristics

| Symbol | Parameter | V _{CC} | Conditions | T _A =+25°C | | | T _A =-40 to +85°C | | Units | Figure |
|-------------------------------------|---|-----------------|--|-----------------------|------|------|------------------------------|------|-------|----------------------|
| | | | | Min. | Typ. | Max. | Min. | Max. | | |
| f _{MAX} | Maximum Clock Frequency | 1.80 ± 0.15 | C _L =15pF R _D =1MΩ S ₁ =Open | 75 | | | 75 | | ns | Figure 4 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 _L =50pF R _D =500Ω, S ₁ =Open | 175 | | | 175 | | | |
| | | 5.00 ± 0.50 | | 200 | | | 200 | | | |
| t _{PLH} , t _{PHL} | Propagation Delay CK to Q, /Q | 1.80 ± 0.15 | C _L =15pF, R _D =1MΩ S ₁ =Open | 2.5 | 6.5 | 12.5 | 2.5 | 13.0 | ns | Figure 4 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 _L =50pF R _D =500Ω, S ₁ =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 _{PLH} , t _{PHL} | Propagation Delay /CLR, /PR to Q, /Q | 1.80 ± 0.15 | C _L =15pF, R _L =1MΩ S ₁ =Open | 2.5 | 6.5 | 14.0 | 2.5 | 14.5 | ns | Figure 4 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 _L =50pF, R _D =500Ω, S ₁ =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 _S | Setup Time CK to D | 1.80 ± 0.15 | C _L =15pF, R _L =1MΩ S ₁ =Open | 6.5 | | | 6.5 | | ns | Figure 4 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 _L =50pF, R _D =500Ω, S ₁ =Open | 2.0 | | | 2.0 | | | |
| | | 5.00 ± 0.50 | | 1.5 | | | 1.5 | | | |
| t _H | Hold Time, CK to D | 1.80 ± 0.15 | C _L =15pF, R _L =1MΩ S ₁ =Open | 0.5 | | | 0.5 | | ns | Figure 4 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 _L =50pF, R _D =500Ω, S ₁ =Open | 0.5 | | | 0.5 | | | |
| | | 5.00 ± 0.50 | | 0.5 | | | 0.5 | | | |
| t _w | Pulse Width, CK, /PR, /CLR | 1.80 ± 0.15 | C _L =15pF, R _L =1MΩ S ₁ =Open | 6.0 | | | 6.0 | | ns | Figure 4 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 _L =50pF, R _D =500Ω, S ₁ =Open | 3.0 | | | 3.0 | | | |
| | | 5.00 ± 0.50 | | 2.0 | | | 2.0 | | | |
| t _{REC} | Recover Time /CLR, /PR to CK | 1.80 ± 0.15 | C _L =15pF, R _L =1MΩ S ₁ =Open | 8.0 | | | 8.0 | | ns | Figure 4 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 _L =50pF, R _D =500Ω, S ₁ =Open | 3.0 | | | 3.0 | | | |
| | | 5.00 ± 0.50 | | 3.0 | | | 3.0 | | | |

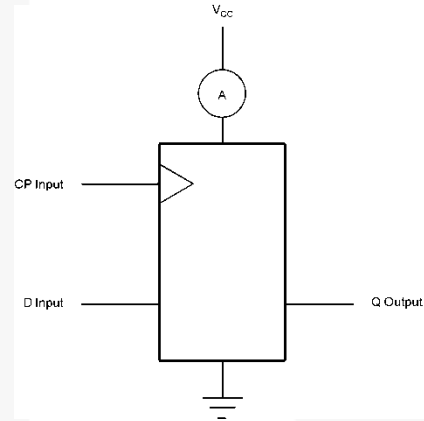
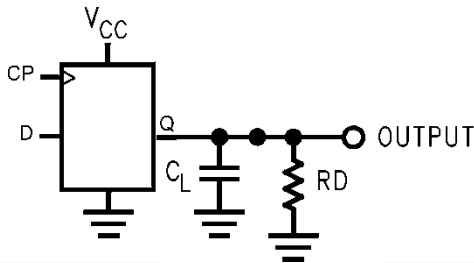
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AC Electrical Characteristics

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

Note:

- 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. C_{PD} is related to I_{CCD} dynamic operating current by the expression: $I_{CCD} = (C_{PD})(V_{CC})(f_{IN}) + (I_{CCstatic})$.



Note:

- C_L includes load and stray capacitance. Input PRR=1.0MHz t_w=500ns.

Notes:

- CP input=AC Waveforms t_r=t_f=2.5ns.
- CP input PRR=10MHz; Duty Cycle=50%.
- D input PRR=5MHz; Duty Cycle=50%.

Figure 4. AC Test Circuit

Figure 5. I_{CCD} Test Circuit

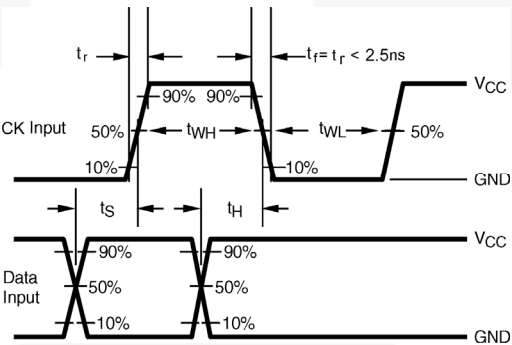
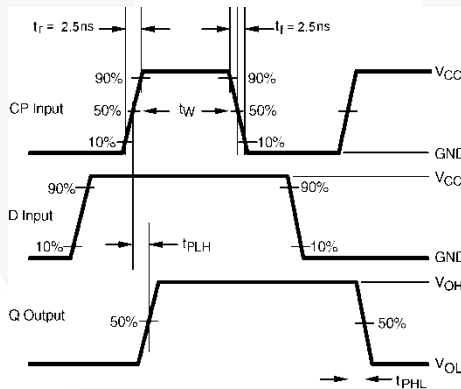


Figure 6. AC Waveforms

Figure 7. AC Waveforms

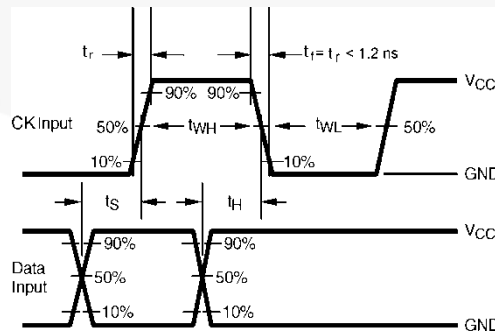


Figure 8. AC Waveforms

Physical Dimensions

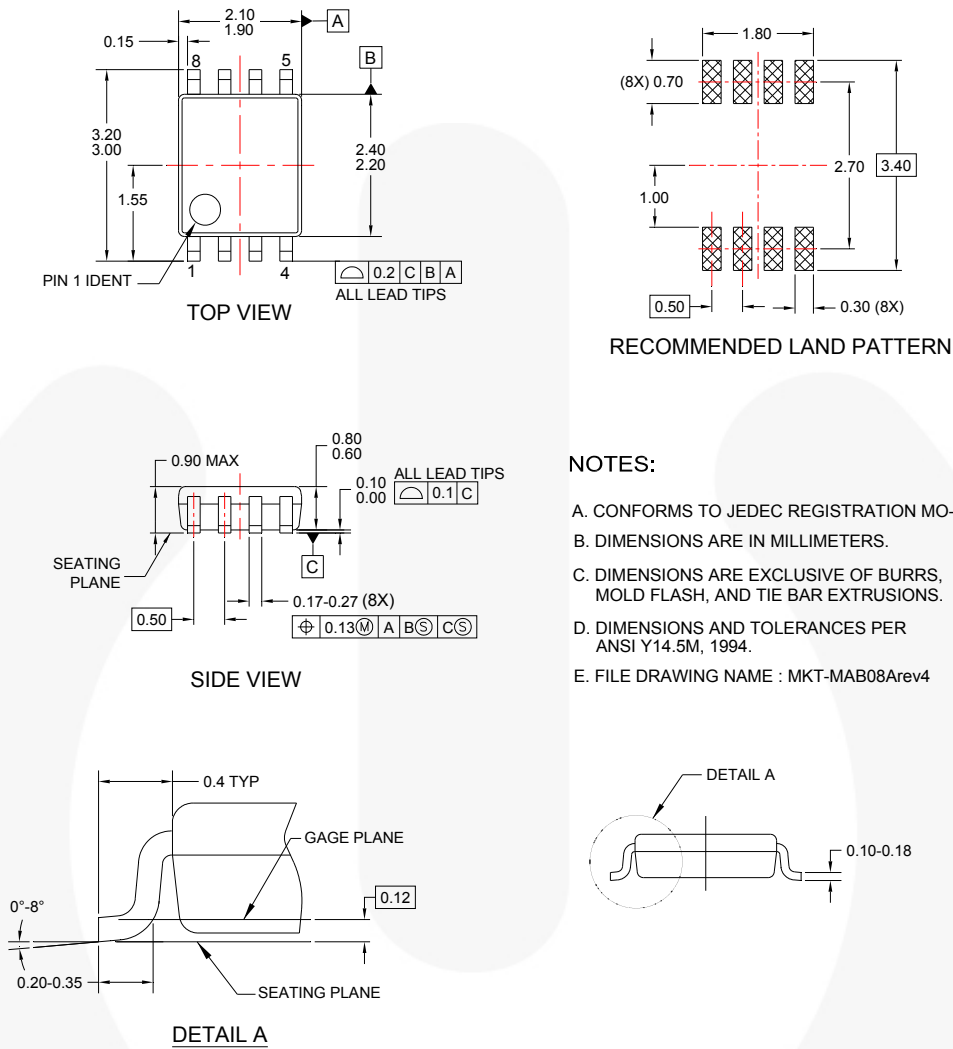


Figure 9. 8-Lead US8, JEDEC MO-187, Variation CA 3.1mm Wide

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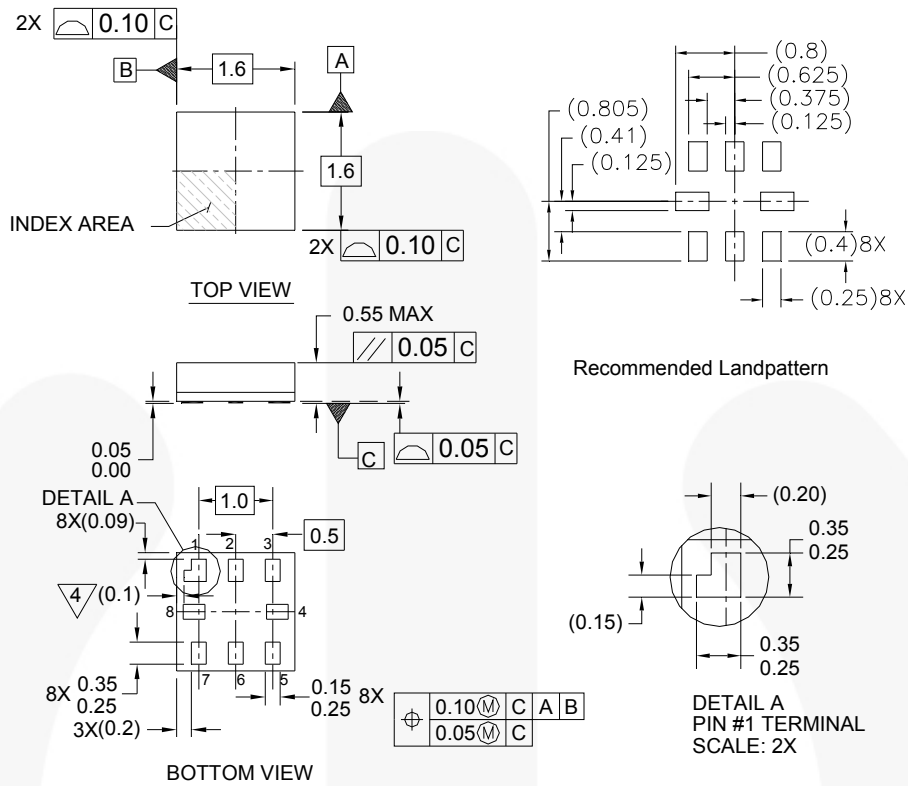
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<http://www.fairchildsemi.com/packaging/>.

Tape and Reel Specifications

Please visit Fairchild Semiconductor's online packaging area for the most recent tape and reel specifications:
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

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Tape and Reel Specifications

Please visit Fairchild Semiconductor's online packaging area for the most recent tape and reel specifications:
http://www.fairchildsemi.com/products/logic/pdf/micropak_tr.pdf

| 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®x |
| Auto-SPM™ | F-PFET™ | | The Power Franchise® |
| AX-CAP™ | FRFET™ | |  |
| 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® |
| EcoSPARK® | MICROCOUPLER™ | | TriFault Detect™ |
| EfficientMax™ | MicroFET™ | | TRUECURRENT®x |
| ESBC™ | MicroPak™ | | µSerDes™ |
|  | MicroPak2™ | |  |
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| | | QST™ | |
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| | | SPM® | |
| | | STEALTH™ | |
| | | SuperFET® | |
| | | SuperSOT™.3 | |
| | | SuperSOT™.6 | |
| | | SuperSOT™.8 | |
| | | SupreMOS® | |
| | | SyncFET™ | |

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| Datasheet Identification | Product Status | Definition |
|--------------------------|-----------------------|---|
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Rev. I56

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