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NC7SV74

TinyLogic® ULP-A D-Type Flip-Flop with Preset and Clear

Features

- Space-saving US8 surface-mount package
- MicroPak™ Pb-free leadless package
- 0.9V to 3.6V V_{CC} supply operation
- 3.6V over-voltage tolerant I/Os at V_{CC} from 0.9V to 3.6V
- Extremely High Speed t_{PD}
 - 1.0 ns typ for 2.7V to 3.6V V_{CC}
 - 1.2 ns typ for 2.3V to 2.7V V_{CC}
 - 1.9 ns typ for 1.65V to 1.95V V_{CC}
 - 3.2 ns typ for 1.4V to 1.6V V_{CC}
 - 6.0 ns typ for 1.1V to 1.3V V_{CC}
 - 13.0 ns typ for 0.9V V_{CC}
- Power-off high-impedance inputs and outputs
- High static drive (I_{OH}/I_{OL})
 - ±24.0 mA @ 3.00V V_{CC}
 - ±18.0 mA @ 2.30V V_{CC}
 - ±6.0 mA @ 1.65V V_{CC}
 - ±4.0 mA @ 1.4V V_{CC}
 - ±2.0 mA @ 1.1V V_{CC}
 - ±0.1 mA @ 0.9V V_{CC}
- Ultra low dynamic power

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General Description

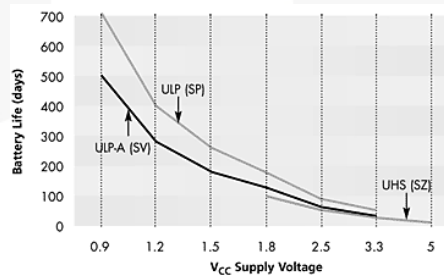
The NC7SV74 is a single D-type CMOS flip-flop with preset and clear from Fairchild's Ultra Low Power-A (ULP-A) series of TinyLogic products, in space-saving US8 and MicroPak™ packages. ULP-A is ideal for applications that require extreme high speed, high drive, and low power.

This product is designed for a wide low-voltage operating range (0.9V to 3.6V V_{CC}) and applications that require more drive and speed than the TinyLogic ULP series, but still require low power consumption.

The NC7SV74 is uniquely designed for optimized power and speed, and is fabricated with an advanced CMOS technology to achieve high-speed operation while maintaining low CMOS power dissipation.

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

Battery Life vs. V_{CC} Supply Voltage



TinyLogic ULP and ULP-A with up to 50% less power consumption can extend your battery life significantly.

$$\text{Battery Life} = (V_{\text{battery}} * I_{\text{battery}} * .9) / (P_{\text{device}}) / 24\text{hrs/day}$$

$$\text{where: } P_{\text{device}} = (I_{CC} * V_{CC}) + (C_{PD} + C_L) * V_{CC}^2 * f$$

Assumes ideal 3.6V Lithium Ion battery with current rating of 900mAh and derated 90% and device frequency at 10MHz, with C_L = 15 pF load.

Ordering Information

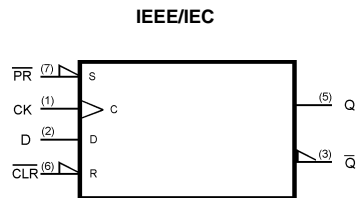
| Order Number | Package Number | Product Code Top Mark | Package Description | Supplied As |
|--------------|----------------|-----------------------|---|---------------------------|
| NC7SV74K8X | MAB08A | V74 | 8-Lead US8, JEDEC MO-187, Variation CA 3.1mm Wide | 3k Units on Tape and Reel |
| NC7SV74L8X | MAC08A | Z4 | Pb-Free 8-Lead MicroPak, 1.6 mm Wide | 5k Units on Tape and Reel |

Pb-Free package per JEDEC J-STD-020B.

Pin Descriptions

| Pin Names | Description |
|--------------|---------------------|
| D | Data Input |
| CK | Clock Pulse Input |
| CLR | Direct Clear Input |
| Q, \bar{Q} | Flip-Flop Output |
| PR | Direct Preset Input |

Logic Symbol/s



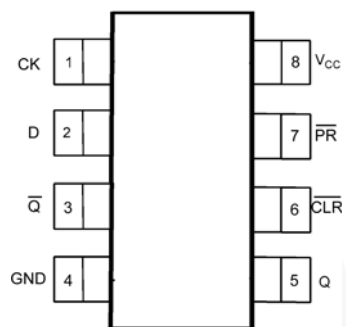
Truth Table/s

| Inputs | | | | Outputs | | Function |
|--------|----|---|----|---------|-------------|-----------|
| CLR | PR | D | CK | Q | \bar{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 | \bar{Q}_n | No Change |

H = HIGH Logic Level
 L = LOW Logic Level
 Q_n = No change in data
 X = Immaterial
 Z = High Impedance
 - = Rising Edge
 ' = Falling edge

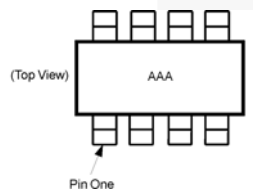
Connection Diagram/s

Pin Assignments for US8



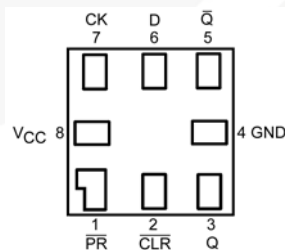
(Top View)

Pin One Orientation Diagram



AAA represents Product Code Top Mark - see ordering info
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



(Top Through View)

Absolute Maximum Ratings

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. I_O Absolute Maximum Rating must be observed.

| | |
|---|--------------------------|
| Supply Voltage (V_{CC}) | -0.5V to +4.6V |
| DC Input Voltage (V_{IN}) | -0.5V to +4.6V |
| DC Output Voltage (V_{OUT}) | |
| HIGH or LOW State | -0.5V to $V_{CC} + 0.5V$ |
| $V_{CC} = 0V$ | -0.5V to +4.6V |
| DC Input Diode Current (I_{IK}) $V_{IN} < 0V$ | ± 50 mA |
| DC Output Diode Current (I_{OK}) | |
| $V_{OUT} < 0V$ | -50 mA |
| $V_{OUT} > V_{CC}$ | +50 mA |
| DC Output Source/Sink Current (I_{OH}/I_{OL}) | ± 50 mA |
| DC V_{CC} or Ground Current per | |
| Supply Pin (I_{CC} or Ground) | ± 50 mA |
| Storage Temperature Range (T_{STG}) | -65°C to +150°C |

Recommended Operating Conditions

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

| | |
|--|----------------|
| Power Supply | 0.9V to 3.6V |
| Input Voltage (V_{IN}) | 0V to 3.6V |
| Output Voltage (V_{OUT}) | |
| $V_{CC} = 0.0V$ | 0V to 3.6V |
| HIGH or LOW State | 0V to V_{CC} |
| Output Current in I_{OH}/I_{OL} | |
| $V_{CC} = 3.0V$ to 3.6V | ± 24.0 mA |
| $V_{CC} = 2.3V$ to 2.7V | ± 18.0 mA |
| $V_{CC} = 1.65V$ to 1.95V | ± 6.0 mA |
| $V_{CC} = 1.4V$ to 1.6V | ± 4.0 mA |
| $V_{CC} = 1.1V$ to 1.3V | ± 2.0 mA |
| $V_{CC} = 0.9V$ | ± 0.1 mA |
| Free Air Operating Temperature (T_A) | -40°C to +85°C |
| Minimum Input Edge Rate (dt/dv) | |
| $V_{IN} = 0.8V$ to 2.0V, $V_{CC} = 3.0V$ | 10 ns/V |

DC Electrical Characteristics

| Symbol | Parameter | V _{CC} (V) | T _A = +25°C | | T _A = -40°C to +85°C | | Units | Conditions |
|-------------------------------|------------------------------|-------------------------------|------------------------|------|---------------------------------|------|-------|--|
| | | | Min. | Max. | Min. | Max. | | |
| V _{IH} | HIGH Level Input Voltage | 0.90 | 0.65 x V _{CC} | | 0.65 x V _{CC} | | V | |
| | | 1.10 ≤ V _{CC} ≤ 1.30 | 0.65 x V _{CC} | | 0.65 x V _{CC} | | | |
| | | 1.40 ≤ V _{CC} ≤ 1.60 | 0.65 x V _{CC} | | 0.65 x V _{CC} | | | |
| | | 1.65 ≤ V _{CC} ≤ 1.95 | 0.65 x V _{CC} | | 0.65 x V _{CC} | | | |
| | | 2.30 ≤ V _{CC} ≤ 2.70 | 1.6 | | 1.6 | | | |
| V _{IL} | LOW Level Input Voltage | 0.90 | 0.35 x V _{CC} | | 0.35 x V _{CC} | | V | |
| | | 1.10 ≤ V _{CC} ≤ 1.30 | 0.35 x V _{CC} | | 0.35 x V _{CC} | | | |
| | | 1.40 ≤ V _{CC} ≤ 1.60 | 0.35 x V _{CC} | | 0.35 x V _{CC} | | | |
| | | 1.65 ≤ V _{CC} ≤ 1.95 | 0.35 x V _{CC} | | 0.35 x V _{CC} | | | |
| | | 2.30 ≤ V _{CC} ≤ 2.70 | 0.7 | | 0.7 | | | |
| V _{OH} | HIGH Level Output Voltage | 0.90 | V _{CC} - 0.1 | | V _{CC} - 0.1 | | V | I _{OH} = -100 mA |
| | | 1.10 ≤ V _{CC} ≤ 1.30 | V _{CC} - 0.1 | | V _{CC} - 0.1 | | | |
| | | 1.40 ≤ V _{CC} ≤ 1.60 | V _{CC} - 0.2 | | V _{CC} - 0.2 | | | |
| | | 1.65 ≤ V _{CC} ≤ 1.95 | V _{CC} - 0.2 | | V _{CC} - 0.2 | | | |
| | | 2.30 ≤ V _{CC} ≤ 2.70 | V _{CC} - 0.2 | | V _{CC} - 0.2 | | | |
| | | 2.70 ≤ V _{CC} ≤ 3.60 | V _{CC} - 0.2 | | V _{CC} - 0.2 | | | |
| | | 1.10 ≤ V _{CC} ≤ 1.30 | 0.75 x V _{CC} | | 0.75 x V _{CC} | | | |
| | | 1.40 ≤ V _{CC} ≤ 1.60 | 0.75 x V _{CC} | | 0.75 x V _{CC} | | | |
| | | 1.65 ≤ V _{CC} ≤ 1.95 | 1.25 | | 1.25 | | | |
| | | 2.30 ≤ V _{CC} ≤ 2.70 | 2.0 | | 2.0 | | | |
| | | 2.30 ≤ V _{CC} ≤ 2.70 | 1.8 | | 1.8 | | | |
| | | 2.70 ≤ V _{CC} ≤ 3.60 | 2.2 | | 2.2 | | | |
| | | 2.30 ≤ V _{CC} ≤ 2.70 | 1.7 | | 1.7 | | | |
| | | 2.70 ≤ V _{CC} ≤ 3.60 | 2.4 | | 2.4 | | | |
| 2.70 ≤ V _{CC} ≤ 3.60 | 2.2 | | 2.2 | | | | | |
| V _{OL} | LOW Level Output Voltage | 0.90 | 0.1 | | 0.1 | | V | I _{OL} = 100 mA |
| | | 1.10 ≤ V _{CC} ≤ 1.30 | 0.1 | | 0.1 | | | |
| | | 1.40 ≤ V _{CC} ≤ 1.60 | 0.2 | | 0.2 | | | |
| | | 1.65 ≤ V _{CC} ≤ 1.95 | 0.2 | | 0.2 | | | |
| | | 2.30 ≤ V _{CC} ≤ 2.70 | 0.2 | | 0.2 | | | |
| | | 2.70 ≤ V _{CC} ≤ 3.60 | 0.2 | | 0.2 | | | |
| | | 1.10 ≤ V _{CC} ≤ 1.30 | 0.25 x V _{CC} | | 0.25 x V _{CC} | | | |
| | | 1.40 ≤ V _{CC} ≤ 1.60 | 0.25 x V _{CC} | | 0.25 x V _{CC} | | | |
| | | 1.65 ≤ V _{CC} ≤ 1.95 | 0.3 | | 0.3 | | | |
| | | 2.30 ≤ V _{CC} ≤ 2.70 | 0.4 | | 0.4 | | | |
| | | 2.70 ≤ V _{CC} ≤ 3.60 | 0.4 | | 0.4 | | | |
| | | 2.30 ≤ V _{CC} ≤ 2.70 | 0.6 | | 0.6 | | | |
| | | 2.70 ≤ V _{CC} ≤ 3.60 | 0.4 | | 0.4 | | | |
| | | 2.70 ≤ V _{CC} ≤ 3.60 | 0.55 | | 0.55 | | | |
| I _{IN} | Input Leakage Current | 0.90 to 3.60 | ±0.1 | | ±0.5 | | mA | 0 ≤ V _I ≤ 3.6V |
| I _{OFF} | Power Off Leakage Current | 0 | 0.5 | | 0.5 | | mA | 0 ≤ (V _I , V _O) ≤ 3.6V |
| I _{CC} | Quiescent Supply Current | 0.90 to 3.60 | 0.9 | | 0.9 | | mA | V _I = V _{CC} or GND V _{CC} ≤ V _I ≤ 3.6V |
| | | 0.90 to 3.60 | | | ±0.9 | | | |

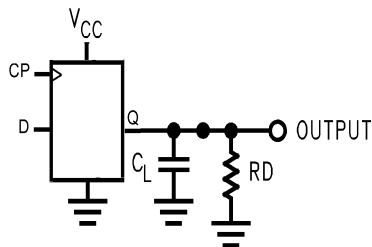
AC Electrical Characteristics

| 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. | | | |
| f _{MAX} | Maximum Clock Frequency | 0.90 | 50 | | | | | MHz | C _L = 15 pF, R _L = 1 MΩ | Figure 1 Figure 5 |
| | | 1.10 ≤ V _{CC} ≤ 1.30 | 150 | | | 150 | | | C _L = 15 pF, R _L = 2 kΩ | |
| | | 1.40 ≤ V _{CC} ≤ 1.60 | 200 | | | 200 | | | C _L = 30 pF, R _L = 500Ω | |
| | | 1.65 ≤ V _{CC} ≤ 1.95 | 200 | | | 200 | | | | |
| | | 2.30 ≤ V _{CC} ≤ 2.70 | 200 | | | 200 | | | | |
| 2.70 ≤ V _{CC} ≤ 3.60 | 200 | | | 200 | | | | | | |
| t _{PLH} t _{PHL} | Propagation Delay CK to Q, \bar{Q} | 0.90 | 13.0 | | | | | ns | C _L = 15 pF, R _L = 1 MΩ | Figure 1 Figure 3 |
| t _{PHL} | | 1.10 ≤ V _{CC} ≤ 1.30 | 3.0 | 6.0 | 9.9 | 1.0 | 14.6 | | C _L = 15 pF, R _L = 2 kΩ | |
| | | 1.40 ≤ V _{CC} ≤ 1.60 | 1.0 | 3.2 | 6.0 | 1.0 | 7.2 | | C _L = 30 pF, R _L = 500 Ω | |
| | | 1.65 ≤ V _{CC} ≤ 1.95 | 1.0 | 1.9 | 4.5 | 1.0 | 5.3 | | | |
| | | 2.30 ≤ V _{CC} ≤ 2.70 | 0.8 | 1.2 | 3.0 | 0.7 | 3.7 | | | |
| 2.70 ≤ V _{CC} ≤ 3.60 | 0.7 | 1.0 | 2.8 | 0.6 | 3.2 | | | | | |
| t _{PLH} t _{PHL} | Propagation Delay \overline{CLR} , \overline{PR} , to Q, \bar{Q} | 0.90 | 14.0 | | | | | ns | C _L = 15 pF, R _L = 1 MΩ | Figure 1 Figure 3 |
| t _{PHL} | | 1.10 ≤ V _{CC} ≤ 1.30 | 3.0 | 6.5 | 10.5 | 1.0 | 15.1 | | C _L = 15 pF, R _L = 2 kΩ | |
| | | 1.40 ≤ V _{CC} ≤ 1.60 | 1.0 | 3.2 | 6.0 | 1.0 | 7.2 | | C _L = 30 pF, R _L = 500 Ω | |
| | | 1.65 ≤ V _{CC} ≤ 1.95 | 1.0 | 1.9 | 4.5 | 1.0 | 5.3 | | | |
| | | 2.30 ≤ V _{CC} ≤ 2.70 | 0.8 | 1.2 | 3.0 | 0.7 | 3.7 | | | |
| 2.70 ≤ V _{CC} ≤ 3.60 | 0.7 | 1.0 | 2.8 | 0.6 | 3.2 | | | | | |
| t _S | Setup Time, CK to D | 0.90 | 6.5 | | | 6.5 | | ns | C _L = 15 pF, R _L = 1 MΩ | Figure 1 Figure 4 |
| t _S | | 1.10 ≤ V _{CC} ≤ 1.30 | 3.5 | | | | 3.5 | | C _L = 15 pF, R _L = 2 kΩ | |
| | | 1.40 ≤ V _{CC} ≤ 1.60 | 2.0 | | | | 2.0 | | C _L = 30 pF, R _L = 500 Ω | |
| | | 1.65 ≤ V _{CC} ≤ 1.95 | 1.5 | | | | 1.5 | | | |
| | | 2.30 ≤ V _{CC} ≤ 2.70 | 2.0 | | | | 2.0 | | | |
| 2.70 ≤ V _{CC} ≤ 3.60 | 1.5 | | | | 1.5 | | | | | |
| t _H | Hold Time, CK to D | 0.90 | 0.5 | | | 0.5 | | ns | C _L = 15 pF, R _L = 1 MΩ | Figure 1 Figure 4 |
| t _H | | 1.10 ≤ V _{CC} ≤ 1.30 | 0.5 | | | | 0.5 | | C _L = 15 pF, R _L = 2 kΩ | |
| | | 1.40 ≤ V _{CC} ≤ 1.60 | 0.5 | | | | 0.5 | | C _L = 30 pF, R _L = 500 Ω | |
| | | 1.65 ≤ V _{CC} ≤ 1.95 | 0.5 | | | | 0.5 | | | |
| | | 2.30 ≤ V _{CC} ≤ 2.70 | 0.5 | | | | 0.5 | | | |
| 2.70 ≤ V _{CC} ≤ 3.60 | 0.5 | | | | 0.5 | | | | | |
| t _W | Pulse Width, CK, \overline{PR} , \overline{CLR} | 0.90 | 7.0 | | | 7.0 | | ns | C _L = 15 pF, R _L = 1 MΩ | Figure 1 Figure 5 |
| t _W | | 1.10 ≤ V _{CC} ≤ 1.30 | 4.0 | | | | 4.0 | | C _L = 15 pF, R _L = 2 kΩ | |
| | | 1.40 ≤ V _{CC} ≤ 1.60 | 3.0 | | | | 3.0 | | C _L = 30 pF, R _L = 500Ω | |
| | | 1.65 ≤ V _{CC} ≤ 1.95 | 3.0 | | | | 3.0 | | | |
| | | 2.30 ≤ V _{CC} ≤ 2.70 | 3.0 | | | | 3.0 | | | |
| 2.70 ≤ V _{CC} ≤ 3.60 | 3.0 | | | | 3.0 | | | | | |
| t _{REC} | Recover Time \overline{CLR} , \overline{PR} to CK | 0.90 | 8.0 | | | 8.0 | | ns | C _L = 15 pF, R _L = 1 MΩ | Figure 1 Figure 4 |
| t _{REC} | | 1.10 ≤ V _{CC} ≤ 1.30 | 4.5 | | | | 4.5 | | C _L = 15 pF, R _L = 2 kΩ | |
| | | 1.40 ≤ V _{CC} ≤ 1.60 | 3.0 | | | | 3.0 | | C _L = 30 pF, R _L = 500Ω | |
| | | 1.65 ≤ V _{CC} ≤ 1.95 | 3.0 | | | | 3.0 | | | |
| | | 2.30 ≤ V _{CC} ≤ 2.70 | 3.0 | | | | 3.0 | | | |
| 2.70 ≤ V _{CC} ≤ 3.60 | 3.0 | | | | 3.0 | | | | | |

Capacitance

| Symbol | Parameter | Typ. | Max. | Units | Conditions |
|------------------|-------------------------------|------|------|-------|--|
| C _{IN} | Input Capacitance | 2.0 | | pF | V _{CC} = 0V |
| C _{OUT} | Output Capacitance | 4.5 | | pF | V _{CC} = 0V |
| C _{PD} | Power Dissipation Capacitance | 20.0 | | pF | V _I = V _{CC} or 0V, f = 10 MHz |

AC Loading and Waveforms

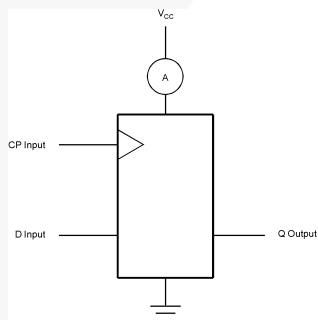


C_L includes load and stray capacitance

Input PRR = 1.0 MHz; $t_w = 500$ ns

AC Test Circuit

| Test | Switch |
|-----------------------|--|
| t_{PLH} , t_{PHL} | Open |
| t_{PZL} , t_{PLZ} | 6V at $V_{CC} = 3.3V \pm 0.3V$ $V_{CC} \times 2$ at $V_{CC} = < 3.0V$ |
| t_{PZH} , t_{PHZ} | GND |

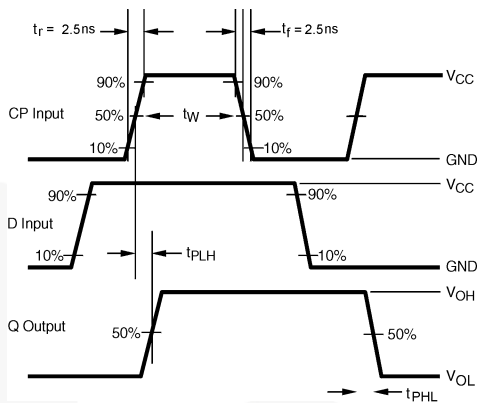


CP Input = AC Waveform; $t_r = t_f = 2.5$ ns;

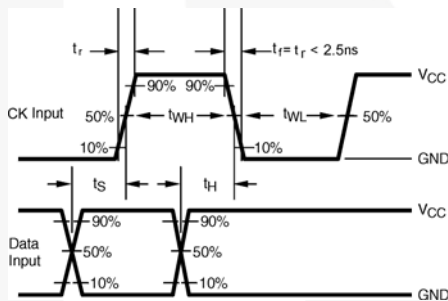
CP Input PRR = 10 MHz; Duty Cycle = 50%

D Input PRR = 5MHz; Duty Cycle = 50%

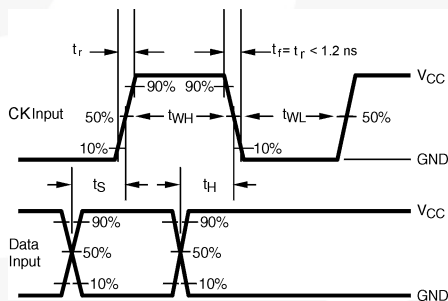
I_{CCD} Test Circuit



AC Waveforms

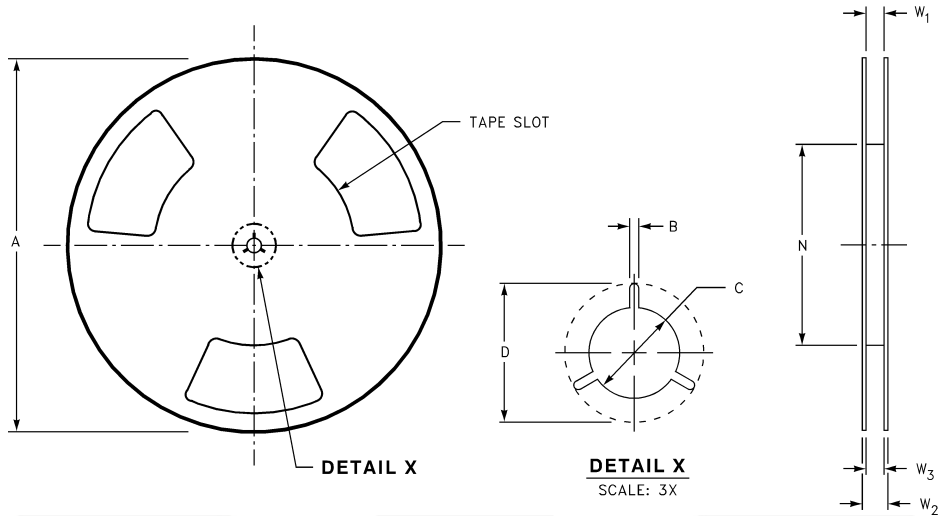


AC Waveforms



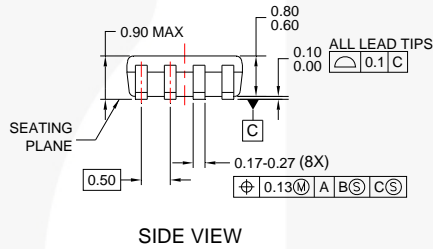
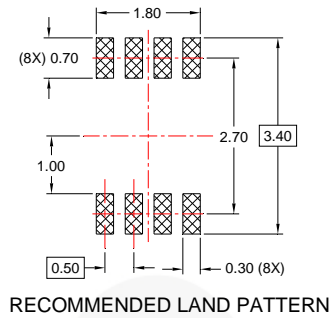
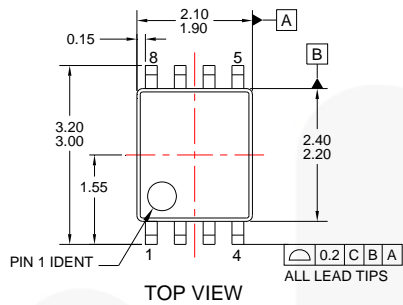
AC Waveforms

REEL DIMENSIONS inches (millimeters)



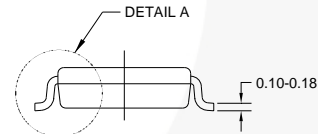
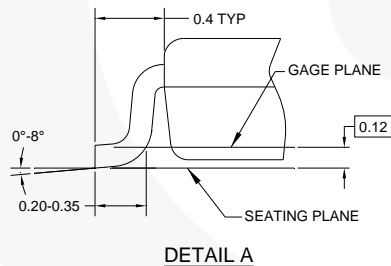
| Tape Size | A | B | C | D | N | W1 | W2 | W3 |
|-----------|----------------|-----------------|------------------|------------------|------------------|---|------------------|--|
| 8 mm | 7.0 (177.8) | 0.059 (1.50) | 0.512 (13.00) | 0.795 (20.20) | 2.165 (55.00) | 0.331 + 0.059/-0.000 (8.40 + 1.50/-0.00) | 0.567 (14.40) | W1 + 0.078/-0.039 (W1 + 2.00/-1.00) |

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

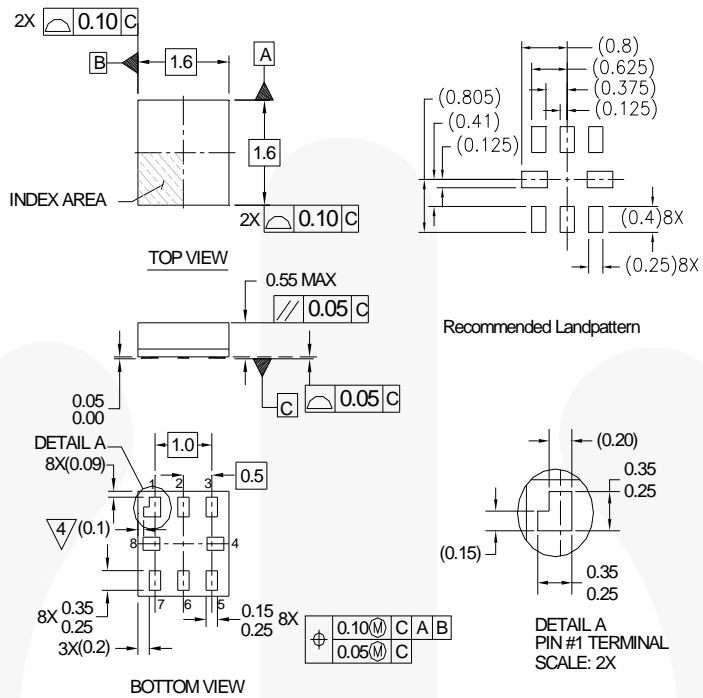


8-Lead US8, JEDEC MO-187, Variation CA 3.1mm Wide Package Number MAB08A

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<http://www.fairchildsemi.com/dwg/MA/MAB08A.pdf>

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

**Pb-Free 8-Lead MicroPak, 1.6 mm Wide
Package Number MAC08A**

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