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TinyLogic® ULP D-Type Flip-Flop with Present and Clear

NC7SV74A

The NC7SV74A is a single D-Type Flip-Flop with preset and clear in tiny footprint packages. The device is designed to operate for $V_{CC} = 0.9\text{ V}$ to 3.6 V .

Features

- Designed for 0.9 V to 3.6 V V_{CC} Operation
- 2.2 ns t_{PD} at 3.3 V (Typ)
- Inputs/Outputs Over-Voltage Tolerant up to 3.6 V
- I_{OFF} Supports Partial Power Down Protection
- Source/Sink 24 mA at 3.3 V
- Available in US8 and MicroPak™ Packages
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

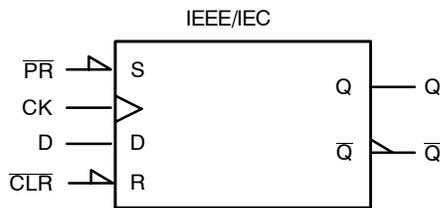


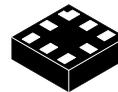
Figure 1. Logic Symbol



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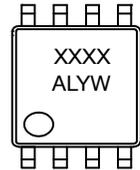
MARKING DIAGRAMS



UQFN8
1.6X1.6, 0.5P
CASE 523AY



US8
CASE 846AN



CC, XXXX = Specific Device Code
 KK = 2-Digit Lot Run Traceability Code
 XY = 2-Digit Date Code Format
 Z = Assembly Plant Code
 A = Assembly Site
 L = Wafer Lot Number
 YW = Assembly Start Week

(Note: Microdot may be in either location)

*Date Code orientation and/or position may vary depending upon manufacturing location.

ORDERING INFORMATION

See detailed ordering, marking and shipping information in the package dimensions section on page 9 of this data sheet.

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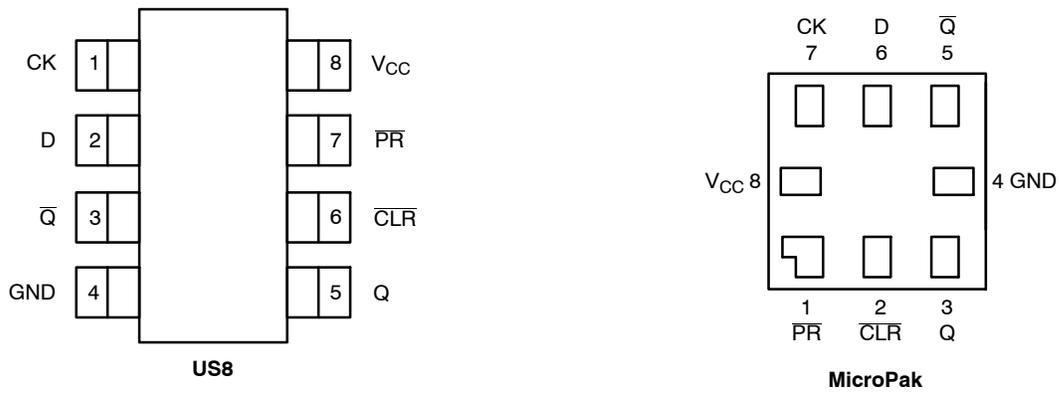


Figure 2. Pinouts (Top Views)

PIN ASSIGNMENT

| Pins | Description |
|--------------------------|---------------------|
| D | Data Input |
| CK | Clock Pulse Input |
| $\overline{\text{CLR}}$ | Direct Clear Input |
| Q, $\overline{\text{Q}}$ | Flip-Flop Output |
| $\overline{\text{PR}}$ | Direct Preset Input |

FUNCTION TABLE

| Input | | | | Output | | Function |
|-------|----|---|----|--------|-----------------------|-----------|
| CLR | PR | D | CK | Q | $\overline{\text{Q}}$ | |
| 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 | \overline{Q}_n | No Change |

X - Immaterial
 Q_n - No change in data

↑ - Rising Edge
 ↓ - Falling Edge

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Table 1. MAXIMUM RATINGS

| Symbol | Characteristics | Value | Unit |
|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|------|
| V _{CC} | DC Supply Voltage | -0.5 to +4.3 | V |
| V _{IN} | DC Input Voltage | -0.5 to +4.3 | V |
| V _{OUT} | DC Output Voltage Active-Mode (High or Low State) Tri-State Mode (Note 1) Power-Down Mode (V _{CC} = 0 V) | -0.5 to V _{CC} + 0.5 -0.5 to +4.3 -0.5 to +4.3 | V |
| I _{IK} | DC Input Diode Current V _{IN} < GND | -50 | mA |
| I _{OK} | DC Output Diode Current V _{OUT} < GND | -50 | mA |
| I _{OUT} | DC Output Source/Sink Current | ±50 | mA |
| I _{CC} or I _{GND} | DC Supply Current per Supply Pin or Ground Pin | ±50 | mA |
| T _{STG} | Storage Temperature Range | -65 to +150 | °C |
| T _L | Lead Temperature, 1 mm from Case for 10 Seconds | 260 | °C |
| T _J | Junction Temperature Under Bias | +150 | °C |
| θ _{JA} | Thermal Resistance (Note 2) US8 MicroPak | 250 210 | °C/W |
| P _D | Power Dissipation in Still Air US8 MicroPak | 500 595 | mW |
| MSL | Moisture Sensitivity | Level 1 | - |
| F _R | Flammability Rating Oxygen Index: 28 to 34 | UL 94 V-0 @ 0.125 in | - |
| V _{ESD} | ESD Withstand Voltage (Note 3) Human Body Model Charged Device Model | 2000 1000 | V |
| I _{LATCHUP} | Latchup Performance (Note 4) | ±100 | mA |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Applicable to devices with outputs that may be tri-stated.
2. Measured with minimum pad spacing on an FR4 board, using 10 mm-by-1 inch, 2 ounce copper trace no air flow per JESD51-7.
3. HBM tested to EIA / JESD22-A114-A. CDM tested to JESD22-C101-A. JEDEC recommends that ESD qualification to EIA/JESD22-A115A (Machine Model) be discontinued.
4. Tested to EIA/JESD78 Class II.

Table 2. RECOMMENDED OPERATING CONDITIONS

| Symbol | Parameter | Min | Max | Unit |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------|-------------|-------------------------------|------|
| V _{CC} | Positive DC Supply Voltage | 0.9 | 3.6 | V |
| V _{IN} | Digital Input Voltage | 0 | 3.6 | V |
| V _{OUT} | Output Voltage Active-Mode (High or Low State) Tri-State Mode (Note 1) Power Down Mode (V _{CC} = 0 V) | 0 0 0 | V _{CC} 3.6 3.6 | V |
| T _A | Operating Free-Air Temperature | -40 | +85 | °C |
| t _r , t _f | Input Transition Rise or Fall Rate V _{CC} = 3.3 V ± 0.3 V | 0 | 10 | ns/V |

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

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Table 3. DC ELECTRICAL CHARACTERISTICS

| Symbol | Parameter | Condition | V _{CC} (V) | T _A = 25°C | | | T _A = -40°C to +85°C | | Unit | |
|-----------------|---------------------------|------------------------------------------------------|---------------------|------------------------|-----------------------|------------------------|---------------------------------|------------------------|------|---|
| | | | | Min | Typ | Max | Min | Max | | |
| V _{IH} | High-Level Input Voltage | | 0.9 | - | 0.5 | - | - | - | V | |
| | | | 1.1 to 1.3 | 0.65 × V _{CC} | - | - | 0.65 × V _{CC} | - | | |
| | | | 1.4 to 1.6 | 0.65 × V _{CC} | - | - | 0.65 × V _{CC} | - | | |
| | | | 1.65 to 1.95 | 0.65 × V _{CC} | - | - | 0.65 × V _{CC} | - | | |
| | | | 2.3 to < 2.7 | 1.6 | - | - | 1.6 | - | | |
| | | | 2.7 to 3.6 | 2.0 | - | - | 2.0 | - | | |
| V _{IL} | Low-Level Input Voltage | | 0.9 | - | 0.5 | - | - | - | V | |
| | | | 1.1 to 1.3 | - | - | 0.35 × V _{CC} | - | 0.35 × V _{CC} | | |
| | | | 1.4 to 1.6 | - | - | 0.35 × V _{CC} | - | 0.35 × V _{CC} | | |
| | | | 1.65 to 1.95 | - | - | 0.35 × V _{CC} | - | 0.35 × V _{CC} | | |
| | | | 2.3 to < 2.7 | - | - | 0.7 | - | 0.7 | | |
| | | | 2.7 to 3.6 | - | - | 0.8 | - | 0.8 | | |
| V _{OH} | High-Level Output Voltage | V _{IN} = V _{IH} or V _{IL} | | | | | | | V | |
| | | I _{OH} = -100 μA | 0.9 | - | V _{CC} - 0.1 | - | - | V _{CC} - 0.1 | | - |
| | | | 1.1 to 1.3 | V _{CC} - 0.1 | - | - | V _{CC} - 0.1 | - | | |
| | | | 1.4 to 1.6 | V _{CC} - 0.2 | - | - | V _{CC} - 0.2 | - | | |
| | | | 1.65 to 1.95 | V _{CC} - 0.2 | - | - | V _{CC} - 0.2 | - | | |
| | | | 2.3 to < 2.7 | V _{CC} - 0.2 | - | - | V _{CC} - 0.2 | - | | |
| | | | 2.7 to 3.6 | V _{CC} - 0.2 | - | - | V _{CC} - 0.2 | - | | |
| | | I _{OH} = -2 mA | 1.1 to 1.3 | 0.75 × V _{CC} | - | - | 0.75 × V _{CC} | - | | |
| | | | 1.4 to 1.6 | 0.75 × V _{CC} | - | - | 0.75 × V _{CC} | - | | |
| | | I _{OH} = -4 mA | 1.65 to 1.95 | 1.25 | - | - | 1.25 | - | | |
| | | | 2.3 to < 2.7 | 2.0 | - | - | 2.0 | - | | |
| | | I _{OH} = -6 mA | 2.3 to < 2.7 | 1.8 | - | - | 1.8 | - | | |
| | | | 2.7 to 3.6 | 2.2 | - | - | 2.2 | - | | |
| | | I _{OH} = -12 mA | 2.3 to < 2.7 | 1.7 | - | - | 1.7 | - | | |
| | | | 2.7 to 3.6 | 2.4 | - | - | 2.4 | - | | |
| | | I _{OH} = -18 mA | 2.7 to 3.6 | 2.2 | - | - | 2.2 | - | | |
| | | | | | | | | | | |

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Table 3. DC ELECTRICAL CHARACTERISTICS (continued)

| Symbol | Parameter | Condition | V _{CC} (V) | T _A = 25°C | | | T _A = -40°C to +85°C | | Unit | |
|-------------------------|---------------------------|--------------------------------------------------------------------|---------------------|-----------------------|-----|------------------------|---------------------------------|------------------------|------|---|
| | | | | Min | Typ | Max | Min | Max | | |
| V _{OL} | Low-Level Output Voltage | V _{IN} = V _{IH} or V _{IL} | | | | | | | V | |
| | | I _{OL} = 100 μA | 0.9 | - | 0.1 | - | - | - | | - |
| | | | 1.1 to 1.3 | - | - | 0.1 | - | 0.1 | | - |
| | | | 1.4 to 1.6 | - | - | 0.2 | - | 0.2 | | - |
| | | | 1.65 to 1.95 | - | - | 0.2 | - | 0.2 | | - |
| | | | 2.3 to < 2.7 | - | - | 0.2 | - | 0.2 | | - |
| | | | 2.7 to 3.6 | - | - | 0.2 | - | 0.2 | | - |
| | | I _{OL} = 2 mA | 1.1 to 1.3 | - | - | 0.25 x V _{CC} | - | 0.25 x V _{CC} | | - |
| | | I _{OL} = 4 mA | 1.4 to 1.6 | - | - | 0.25 x V _{CC} | - | 0.25 x V _{CC} | | - |
| | | I _{OL} = 6 mA | 1.65 to 1.95 | - | - | 0.3 | - | 0.3 | | - |
| | | | 2.3 to < 2.7 | - | - | 0.3 | - | 0.3 | | - |
| | | I _{OL} = 12 mA | 2.3 to < 2.7 | - | - | 0.4 | - | 0.4 | | - |
| | | | 2.7 to 3.6 | - | - | 0.4 | - | 0.4 | | - |
| | | I _{OL} = 18 mA | 2.3 to < 2.7 | - | - | 0.6 | - | 0.6 | | - |
| 2.7 to 3.6 | - | | - | 0.4 | - | 0.4 | - | | | |
| I _{OL} = 24 mA | 2.7 to 3.6 | - | - | 0.55 | - | 0.55 | - | | | |
| I _{IN} | Input Leakage Current | V _{IN} = 0 V to 3.6 V | 0.9 to 3.6 | - | - | ±0.1 | - | ±0.5 | μA | |
| I _{OFF} | Power Off Leakage Current | V _{IN} = 0 V to 3.6 V; V _{OUT} = 0 V to 3.6 V | 0 | - | - | 0.5 | - | 0.5 | μA | |
| I _{CC} | Quiescent Supply Current | V _{IN} = 3.6 V or V _{CC} or GND | 0.9 to 3.6 | - | - | 0.9 | - | 0.9 | μA | |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

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Table 4. AC ELECTRICAL CHARACTERISTICS

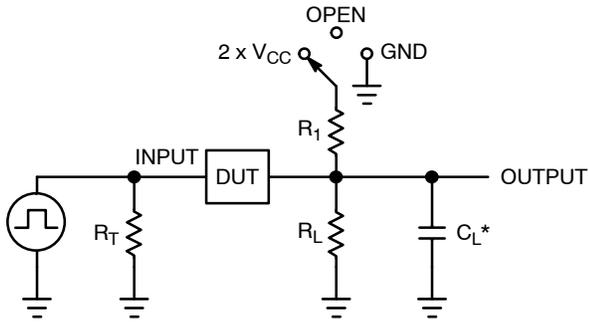
| Symbol | Parameter | Test Condition | V _{CC} (V) | T _A = 25°C | | | T _A = -40°C to +85°C | | Unit |
|----------------------------------------|----------------------------------------------------------------------------------|------------------------------------------------|---------------------|-----------------------|------|------|---------------------------------|------|------|
| | | | | Min | Typ | Max | Min | Max | |
| f _{MAX} | Maximum Clock Frequency (Figures 3 and 5) | R _L = 1 MΩ, C _L = 15 pF | 0.9 | - | 60 | - | - | - | MHz |
| | | R _L = 2 kΩ, C _L = 15 pF | 1.1 to 1.3 | 120 | - | - | 120 | - | |
| | | | 1.4 to 1.6 | 200 | - | - | 200 | - | |
| | | R _L = 500 Ω, C _L = 30 pF | 1.65 to 1.95 | 200 | - | - | 200 | - | |
| | | | 2.3 to 2.7 | 200 | - | - | 200 | - | |
| 3.0 to 3.6 | 200 | | - | - | 200 | - | | | |
| t _{PLH} , t _{PHL} | Propagation Delay, CK to Q, \bar{Q} (Figures 3 and 4) | R _L = 1 MΩ, C _L = 15 pF | 0.9 | - | 24.2 | - | - | - | ns |
| | | R _L = 2 kΩ, C _L = 15 pF | 1.1 to 1.3 | - | 7.5 | 14.4 | - | 14.6 | |
| | | | 1.4 to 1.6 | - | 4.6 | 7.6 | - | 7.7 | |
| | | R _L = 500 Ω, C _L = 30 pF | 1.65 to 1.95 | - | 3.7 | 5.8 | - | 6.2 | |
| | | | 2.3 to 2.7 | - | 2.6 | 4.0 | - | 4.3 | |
| 3.0 to 3.6 | - | | 2.2 | 3.2 | - | 3.3 | | | |
| t _{PLH} , t _{PHL} | Propagation Delay, CLR, $\bar{P}\bar{R}$ to Q, \bar{Q} (Figures 3 and 4) | R _L = 1 MΩ, C _L = 15 pF | 0.9 | - | 19.4 | - | - | - | ns |
| | | R _L = 2 kΩ, C _L = 15 pF | 1.1 to 1.3 | - | 6.6 | 13.1 | - | 15.1 | |
| | | | 1.4 to 1.6 | - | 4.1 | 7.0 | - | 7.2 | |
| | | R _L = 500 Ω, C _L = 30 pF | 1.65 to 1.95 | - | 3.4 | 5.8 | - | 6.2 | |
| | | | 2.3 to 2.7 | - | 2.5 | 4.0 | - | 4.3 | |
| 3.0 to 3.6 | - | | 2.1 | 2.8 | - | 3.2 | | | |
| t _S | Setup Time, CK to D (Figures 3 and 5) | R _L = 1 MΩ, C _L = 15 pF | 0.9 | - | 3.1 | - | - | - | ns |
| | | R _L = 2 kΩ, C _L = 15 pF | 1.1 to 1.3 | 3.5 | - | - | 3.5 | - | |
| | | | 1.4 to 1.6 | 2.0 | - | - | 2.0 | - | |
| | | R _L = 500 Ω, C _L = 30 pF | 1.65 to 1.95 | 1.5 | - | - | 1.5 | - | |
| | | | 2.3 to 2.7 | 2.0 | - | - | 2.0 | - | |
| 3.0 to 3.6 | 1.5 | | - | - | 1.5 | - | | | |
| t _H | Hold Time, CK to D (Figures 3 and 5) | R _L = 1 MΩ, C _L = 15 pF | 0.9 | - | 1.5 | - | - | - | ns |
| | | R _L = 2 kΩ, C _L = 15 pF | 1.1 to 1.3 | 1.5 | - | - | 1.5 | - | |
| | | | 1.4 to 1.6 | 0.5 | - | - | 0.5 | - | |
| | | R _L = 500 Ω, C _L = 30 pF | 1.65 to 1.95 | 0.5 | - | - | 0.5 | - | |
| | | | 2.3 to 2.7 | 0.5 | - | - | 0.5 | - | |
| 3.0 to 3.6 | 0.5 | | - | - | 0.5 | - | | | |
| t _W | Pulse Width, CK, CLR, $\bar{P}\bar{R}$ (Figures 3 and 5) | R _L = 1 MΩ, C _L = 15 pF | 0.9 | - | 7.0 | - | - | - | ns |
| | | R _L = 2 kΩ, C _L = 15 pF | 1.1 to 1.3 | 4.0 | - | - | 4.0 | - | |
| | | | 1.4 to 1.6 | 3.0 | - | - | 3.0 | - | |
| | | R _L = 500 Ω, C _L = 30 pF | 1.65 to 1.95 | 3.0 | - | - | 3.0 | - | |
| | | | 2.3 to 2.7 | 3.0 | - | - | 3.0 | - | |
| 3.0 to 3.6 | 3.0 | | - | - | 3.0 | - | | | |
| t _{REC} | Recovery Time, CLR, $\bar{P}\bar{R}$ to CK (Figures 3 and 5) | R _L = 1 MΩ, C _L = 15 pF | 0.9 | - | 8.0 | - | - | - | ns |
| | | R _L = 2 kΩ, C _L = 15 pF | 1.1 to 1.3 | 4.5 | - | - | 4.5 | - | |
| | | | 1.4 to 1.6 | 3.0 | - | - | 3.0 | - | |
| | | R _L = 500 Ω, C _L = 30 pF | 1.65 to 1.95 | 3.0 | - | - | 3.0 | - | |
| | | | 2.3 to 2.7 | 3.0 | - | - | 3.0 | - | |
| 3.0 to 3.6 | 3.0 | | - | - | 3.0 | - | | | |

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CAPACITIVE CHARACTERISTICS

| Symbol | Parameter | Test Condition | Typical ($T_A = 25^\circ\text{C}$) | Unit |
|-----------|----------------------------------------|---------------------------------------------------------------------------------------------------|--------------------------------------|------|
| C_{IN} | Input Capacitance | $V_{CC} = 0\text{ V}$ | 2.0 | pF |
| C_{OUT} | Output Capacitance | $V_{CC} = 0\text{ V}$ | 4.5 | pF |
| C_{PD} | Power Dissipation Capacitance (Note 5) | $f = 10\text{ MHz}$, $V_{CC} = 0.9\text{ V to } 3.6\text{ V}$, $V_{IN} = 0\text{ V or } V_{CC}$ | 20.0 | pF |

5. C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the dynamic operating current consumption without load. Average operating current can be obtained by the equation $I_{CC(OPR)} = C_{PD} \cdot V_{CC} \cdot f_{in} + I_{CC}$. C_{PD} is used to determine the no-load dynamic power consumption: $P_D = C_{PD} \cdot V_{CC}^2 \cdot f_{in} + I_{CC} \cdot V_{CC}$.



C_L includes probe and jig capacitance
 R_T is Z_{OUT} of pulse generator (typically $50\ \Omega$)
 $f = 1\text{ MHz}$

| Test | Switch Position |
|---------------------|-------------------|
| t_{PLH} / t_{PHL} | Open |
| t_{PLZ} / t_{PZL} | $2 \times V_{CC}$ |
| t_{PHZ} / t_{PZH} | GND |

Figure 3. Test Circuit

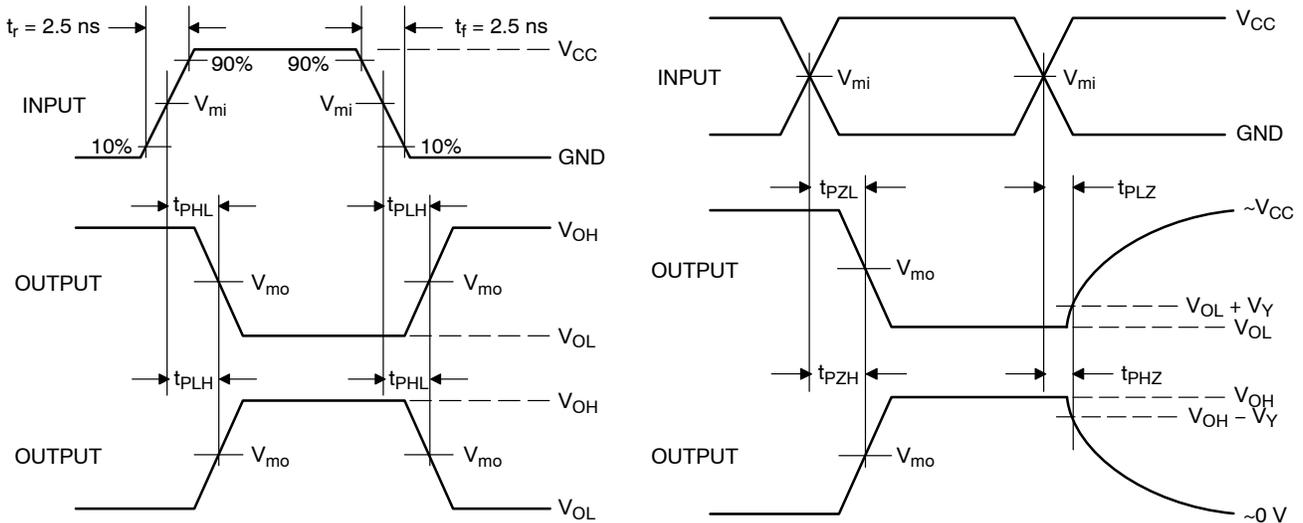


Figure 4. Switching Waveforms

NC7SV74A

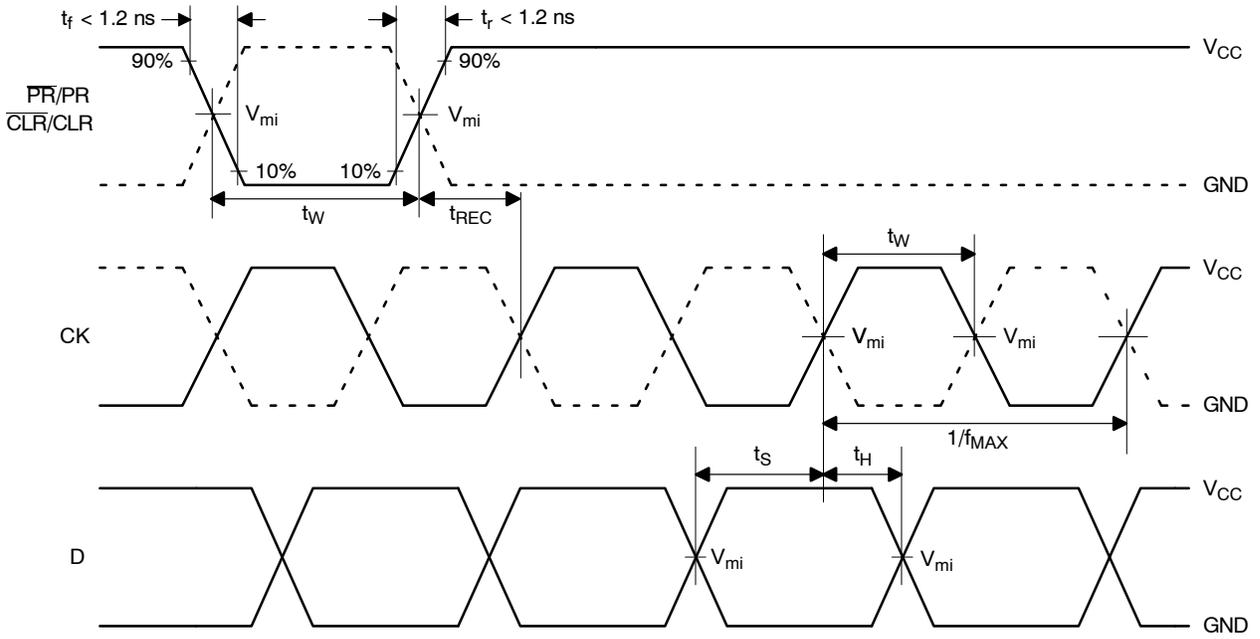


Figure 5. Setup, Hold and Recovery Time Waveforms

| V_{CC}, V | V_{mi}, V | V_{mo}, V | V_Y, V |
|--------------------|--------------------|--------------------|-----------------|
| 0.9 | $V_{CC}/2$ | $V_{CC}/2$ | 0.1 |
| 1.1 to 1.3 | $V_{CC}/2$ | $V_{CC}/2$ | 0.1 |
| 1.4 to 1.6 | $V_{CC}/2$ | $V_{CC}/2$ | 0.1 |
| 1.65 to 1.95 | $V_{CC}/2$ | $V_{CC}/2$ | 0.15 |
| 2.3 to 2.7 | $V_{CC}/2$ | $V_{CC}/2$ | 0.15 |
| 3.0 to 3.6 | 1.5 | 1.5 | 0.3 |

NC7SV74A

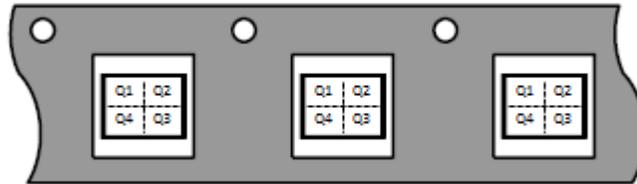
ORDERING INFORMATION

| Device | Package | Marking | Pin 1 Orientation (See below) | Shipping [†] |
|-------------|-----------------|---------|----------------------------------|-----------------------|
| NC7SV74AK8X | US8 | SV74 | Q4 | 3000 / Tape & Reel |
| NC7SV74AL8X | MicroPak, UQFN8 | AA | Q4 | 5000 / Tape & Reel |

[†]For complete information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

Pin 1 Orientation in Tape and Reel

Direction of Feed

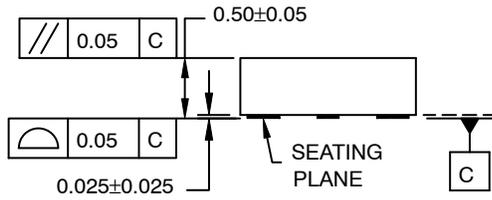
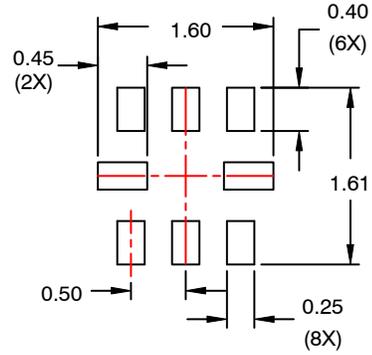
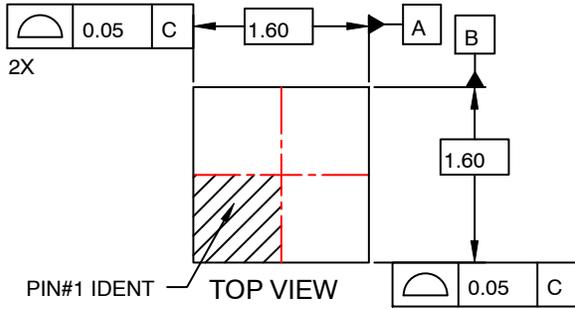


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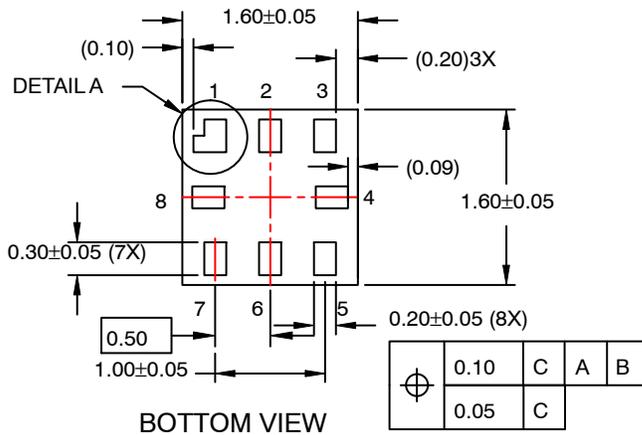
NC7SV74A

PACKAGE DIMENSIONS

UQFN8 1.6X1.6, 0.5P
CASE 523AY
ISSUE O



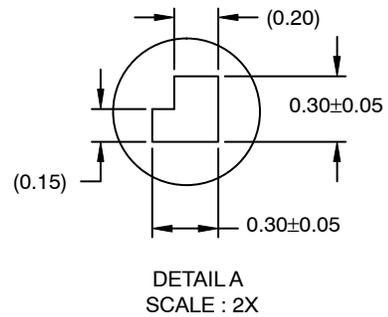
SIDE VIEW



BOTTOM VIEW

NOTES:

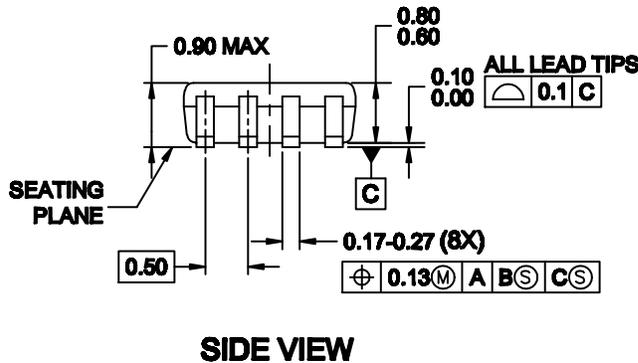
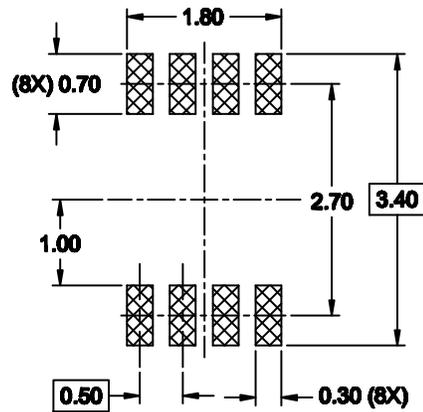
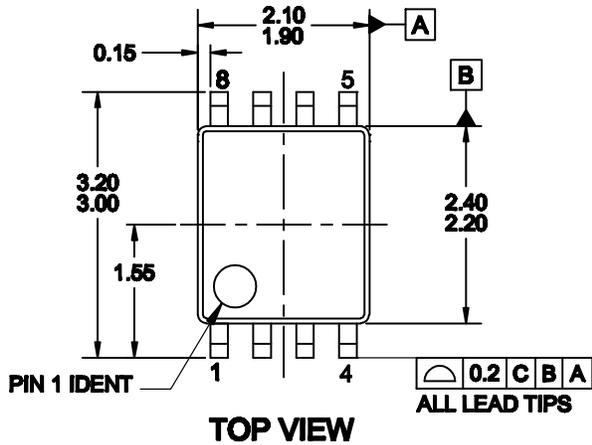
- A. PACKAGE CONFORMS TO JEDEC MO-255 VARIATION UAAD.
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 2009.
- D. LAND PATTERN RECOMMENDATION IS EXISTING INDUSTRY LAND PATTERN.



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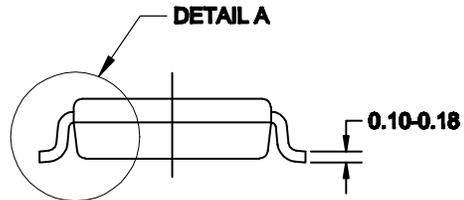
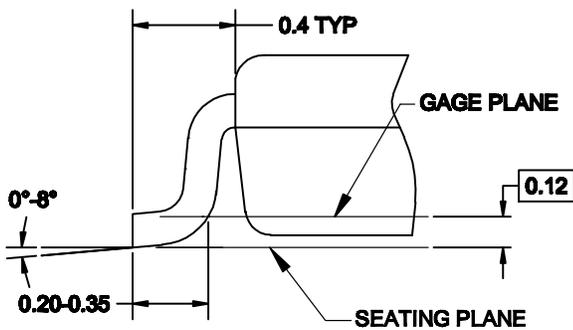
PACKAGE DIMENSIONS

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CASE 846AN
ISSUE O



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.



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