

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

NC7SZ74

Description

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

Features

- Ultra-High Speed: t_{PD} 2.6 ns (Typical) into 50 pF at 5 V V_{CC}
- High Output Drive: ±24 mA at 3 V V_{CC}
- Broad V_{CC} Operating Range: 1.65 V to 5.5 V
- Power Down High-Impedance Inputs/Outputs
- Over-Voltage Tolerance Inputs Facilitate 5 V to 3 V Translation
- Proprietary Noise/EMI Reduction Circuitry

CONNECTION DIAGRAM

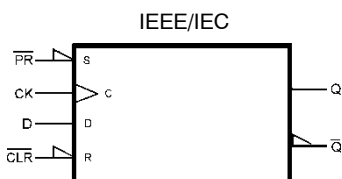
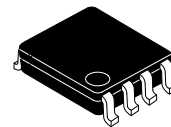
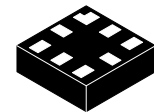


Figure 1. Logic Symbol

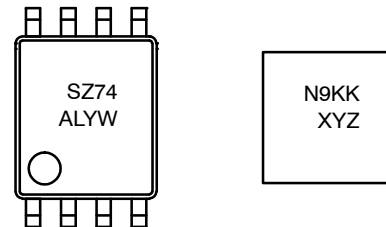


US8
CASE 846AN



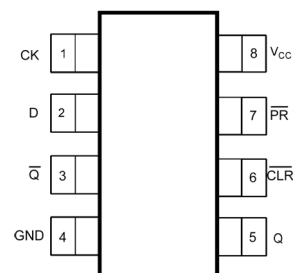
UQFN8
1.6X1.6, 0.5P
CASE 523AY

MARKING DIAGRAMS

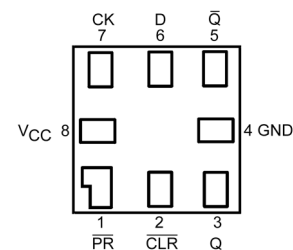


- SZ74, N9 = Specific Device Code
- A = Assembly Site
- L = Wafer Lot Number
- YW = Assembly Start Wee
- KK = 2-Digit Lot Run Traceability Code
- XY = 2-Digit Date Code Format
- Z = Assembly Plant Code

PIN CONFIGURATIONS



USB (Top View)



MicroPak™ (Top Through View)

ORDERING INFORMATION

See detailed ordering and shipping information on page 6 of this data sheet.

NC7SZ74

PIN DEFINITIONS

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

FUNCTION TABLE

| Inputs | | | | Output | | 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

Q_n = No change in data

X = Immaterial

↓ = Falling Edge

L = LOW Logic Level

Z = High Impedance

↑ = Rising Edge

ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Min. | Max. | Unit | |
|-------------------------------------|---|------------|------|------|----|
| V _{CC} | Supply Voltage | -0.5 | 6.5 | V | |
| V _{IN} | DC Input Voltage | -0.5 | 6.5 | V | |
| V _{OUT} | DC Output Voltage | -0.5 | 6.5 | V | |
| I _{IK} | DC Input Diode Current | - | -50 | mA | |
| I _{OK} | DC Output Diode Current | - | -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 in Still Air | US8 | - | 500 | mW |
| | | MicroPak-8 | - | 539 | |
| ESD | Human Body Model: JEDEC:JESD22-A114 | - | 4000 | V | |
| | Charge Device Model: JEDEC:JESD22-C101 | - | 2000 | | |

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.

NC7SZ74

RECOMMENDED OPERATING CONDITIONS

| 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} = 1.8 V, 2.5 V ±0.2 V | 0 | 20 | ns/V |
| | | V _{CC} = 3.3 V ±0.3 V | 0 | 10 | |
| | | V _{CC} = 5.0 V ±0.5 V | 0 | 5 | |
| T _A | Operating Temperature | | -40 | +85 | °C |
| θ _{JA} | Thermal Resistance | US8 | | 250 | °C/W |
| | | MicroPak-8 | | 232 | |

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.

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 | | 0.65 V _{CC} | | | 0.65 V _{CC} | | V |
| | | 2.30 to 5.50 | | 0.70 V _{CC} | | | 0.70 V _{CC} | | |
| V _{IL} | LOW Level Control Input Voltage | 1.65 to 1.95 | | | | 0.35 V _{CC} | | 0.35 V _{CC} | V |
| | | 2.30 to 5.50 | | | | 0.30 V _{CC} | | 0.30 V _{CC} | |
| V _{OH} | HIGH Level Output Voltage | 1.65 | V _{IN} = V _{IH} , I _{OH} = -100 μA | 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} = -4 mA | 1.29 | 1.52 | | 1.29 | | |
| | | 2.30 | | 1.90 | 2.15 | | 1.90 | | |
| | | 3.00 | | 2.40 | 2.80 | | 2.40 | | |
| | | 3.00 | | 2.30 | 2.68 | | 2.30 | | |
| 4.50 | I _{OH} = -32 mA | 3.80 | 4.20 | | 3.80 | | | | |
| V _{OL} | LOW Level Control Output Voltage | 1.65 | V _{IN} = V _{IH} , I _{OL} = 100 μA | | | 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} = 4 mA | | 0.10 | 0.24 | | 0.24 | |
| | | 2.30 | | 0.10 | 0.30 | | 0.30 | | |
| | | 3.00 | | 0.15 | 0.40 | | 0.40 | | |
| | | 3.00 | | 0.22 | 0.55 | | 0.55 | | |
| | | 4.50 | | 0.22 | 0.55 | | 0.55 | | |
| | | 4.50 | | I _{OL} = 32 mA | | 0.22 | 0.55 | | |
| I _{IN} | Input Leakage Current | 1.65 to 5.5 | 0 ≤ V _{IN} ≤ 5.5 V | | | ±0.1 | | ±1.0 | μA |
| I _{OFF} | Power Off Leakage Current | 0 | V _{IN} or V _{OUT} = 5.5 V | | | 1 | | 10 | μA |
| I _{CC} | Quiescent Supply Current | 1.65 to 5.50 | V _{IN} = 5.5 V, GND | | | 1 | | 10 | μA |

NC7SZ74

AC ELECTRICAL CHARACTERISTICS

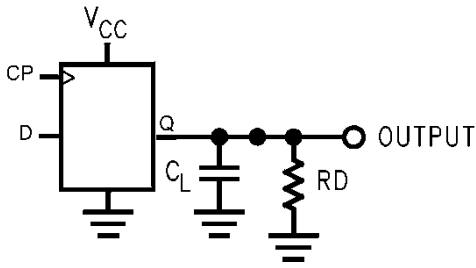
| Symbol | Parameter | V _{CC} | Conditions | T _A = +25°C | | | T _A = -40 to +85°C | | Units | Figure |
|-------------------------------------|--|-----------------|---|------------------------|------|------|-------------------------------|------|-------|----------------------|
| | | | | Min. | Typ. | Max. | Min. | Max. | | |
| f _{MAX} | Maximum Clock Frequency | 1.80 ±0.15 | C _L = 15 pF, R _D = 1 MΩ, 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 = 50 pF, R _D = 500 Ω, S ₁ = Open | 175 | | | 175 | | | |
| | | 5.00 ±0.50 | | 200 | | | 200 | | | |
| t _{PLH} , t _{PHL} | Propagation Delay CK to Q, \bar{Q} | 1.80 ±0.15 | C _L = 15 pF, R _D = 1 MΩ, S ₁ = Open | | 6.5 | 12.5 | | 13.0 | ns | Figure 4 Figure 6 |
| | | 2.50 ±0.20 | | | 3.8 | 7.5 | | 8.0 | | |
| | | 3.30 ±0.30 | | | 2.8 | 6.5 | | 7.0 | | |
| | | 5.00 ±0.50 | | | 2.2 | 4.5 | | 5.0 | | |
| | | 3.30 ±0.30 | C _L = 50 pF, R _D = 500 Ω, S ₁ = Open | | 3.4 | 7.0 | | 7.5 | | |
| | | 5.00 ±0.50 | | | 2.6 | 5.0 | | 5.5 | | |
| t _{PLH} , t _{PHL} | Propagation Delay CLR, PR to Q, \bar{Q} | 1.80 ±0.15 | C _L = 15 pF, R _L = 1 MΩ, S ₁ = Open | | 6.5 | 14.0 | | 14.5 | ns | Figure 4 Figure 6 |
| | | 2.50 ±0.20 | | | 3.8 | 9.0 | | 9.5 | | |
| | | 3.30 ±0.30 | | | 2.8 | 6.5 | | 7.0 | | |
| | | 5.00 ±0.50 | | | 2.2 | 5.0 | | 5.5 | | |
| | | 3.30 ±0.30 | C _L = 50 pF, R _D = 500 Ω, S ₁ = Open | | 3.4 | 7.0 | | 7.5 | | |
| | | 5.00 ±0.50 | | | 2.6 | 5.0 | | 5.5 | | |
| t _S | Setup Time CK to D | 1.80 ±0.15 | C _L = 15 pF, R _L = 1 MΩ, 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 = 50 pF, R _D = 500 Ω, 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 = 15 pF, R _L = 1 MΩ, 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 = 50 pF, R _D = 500 Ω, 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 = 15 pF, R _L = 1 MΩ, 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 = 50 pF, R _D = 500 Ω, 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 = 15 pF, R _L = 1 MΩ, S ₁ = Open | 8.0 | | | 8.0 | | ns | 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 = 50 pF, R _D = 500 Ω, S ₁ = Open | 3.0 | | | 3.0 | | | |
| | | 5.00 ±0.50 | | 3.0 | | | 3.0 | | | |

NC7SZ74

AC ELECTRICAL CHARACTERISTICS (continued)

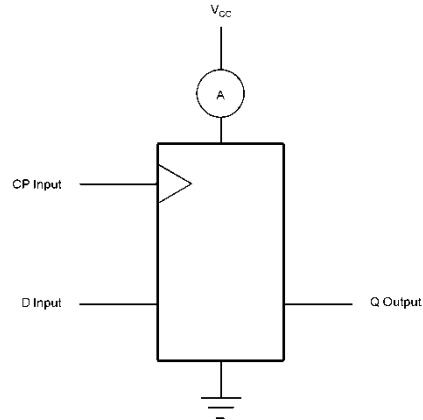
| Symbol | Parameter | V _{CC} | Conditions | T _A = +25°C | | | T _A = -40 to +85°C | | Units | Figure |
|------------------|--|-----------------|------------|------------------------|------|------|-------------------------------|------|-------|--------|
| | | | | Min. | Typ. | Max. | Min. | Max. | | |
| C _{IN} | Input Capacitance | 0 | | | 3 | | | | pF | |
| C _{OUT} | Output Capacitance | 0 | | | 4 | | | | pF | |
| C _{PD} | Power Dissipation Capacitance (Note 1) | 3.30 | | | 10 | | | | pF | |
| | | 5.00 | | | 12 | | | | | |

1. 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}).



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

Figure 2. AC Test Circuit



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

Figure 3. AC Test Circuit

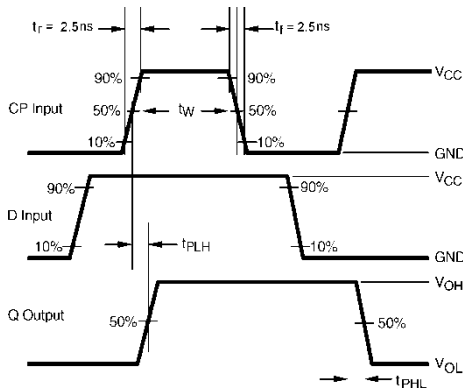


Figure 4. AC Waveforms

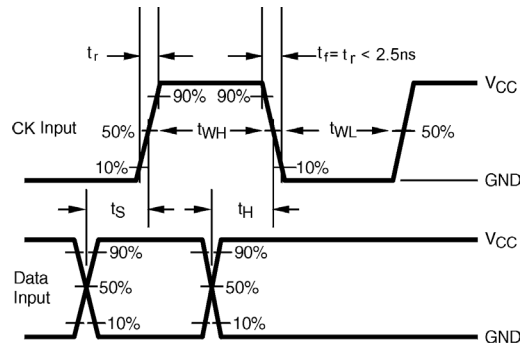


Figure 5. AC Waveforms

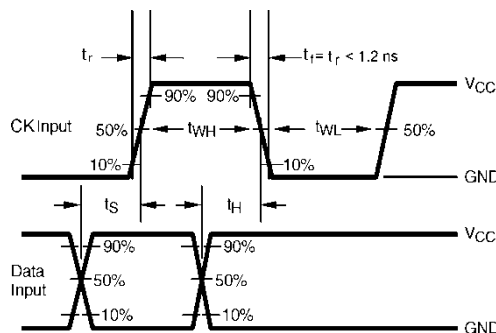


Figure 6. AC Waveforms

NC7SZ74

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 |
| NC7SZ74K8X-L22236 | 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 |

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

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

DATE 31 AUG 2016



**RECOMMENDED
LAND PATTERN**



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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US8
CASE 846AN
ISSUE O

DATE 31 DEC 2016



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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