

NC7SZ374

TinyLogic UHS D-Type Flip-Flop with 3-STATE Output

Description

The NC7SZ374 is a single positive edge-triggered D-type CMOS Flip-Flop with 3-STATE output from ON Semiconductor's Ultra High Speed Series of TinyLogic in the space saving SC70 6-lead package. 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. The device is specified to operate over the 1.65 V to 5.5 V V_{CC} range. The inputs and output are high impedance when V_{CC} is 0 V. Inputs tolerate voltages up to 5.5 V independent of V_{CC} operating voltage. This single flip-flop will store the state of the D input that meets the setup and hold time requirements on the LOW-to-HIGH Clock (CP) transition. The output tolerates voltages above V_{CC} in the 3-STATE condition.

Features

- Space Saving SC70 6-Lead Package
- Ultra Small MicroPak™ Leadless Package
- Ultra High Speed: t_{PD} 2.6 ns Typ 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
- Matches the Performance of LCX when Operated at 3.3 V V_{CC}
- Power Down High Impedance Inputs / Output
- Overvoltage Tolerant Inputs Facilitate 5 V – 3 V Translation
- Patented Noise / EMI Reduction Circuitry Implemented
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

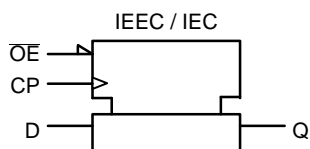


Figure 1. Logic Symbol



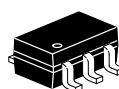
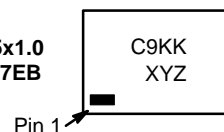
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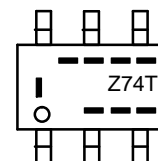
MARKING DIAGRAMS



SIP6 1.45x1.0
CASE 127EB



SC-88
(SC-70 6 Lead)
1.25x2
CASE 419AD-01



| | |
|---------|-------------------------------------|
| C9, Z74 | = Specific Device Code |
| KK | = 2-Digit Lot Run Traceability Code |
| XY | = 2-Digit Date Code Format |
| Z | = Assembly Plant Code |
| ---- | = Year Coding Scheme |
| - | = Plant Code Identifier |
| T | = Die Run Code |
| --- | = Eight-Week Datacoding Scheme |

ORDERING INFORMATION

See detailed ordering, marking and shipping information in the package dimensions section on page 6 of this data sheet.

Connection Diagrams

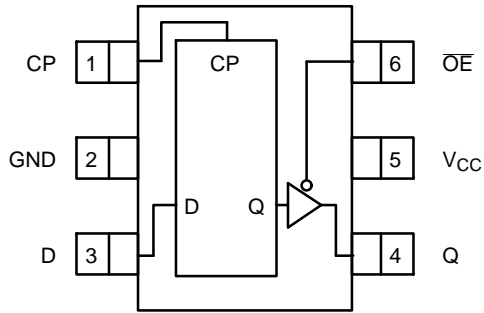


Figure 2. SC70 (Top View)

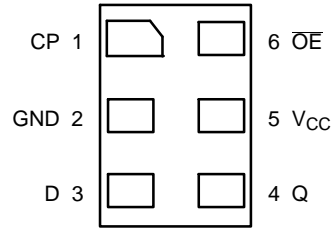
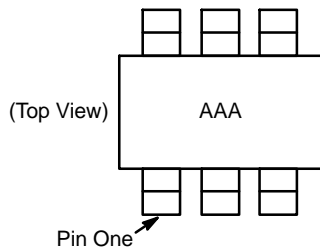


Figure 4. MicroPak (Top Through View)



AAA represents Product Code Top Mark – see ordering code.
 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).

Figure 3. Pin 1 Orientation

PIN DESCRIPTIONS

| Pin Name | Description |
|-----------------|---------------------|
| D | Data Input |
| CP | Clock Pulse Input |
| \overline{OE} | Output Enable Input |
| Q | Flip-Flop Output |

FUNCTION TABLE

| Inputs | | | Output |
|--------|---|-----------------|----------------|
| CP | D | \overline{OE} | Q |
| | L | L | L |
| | H | L | H |
| | X | L | Q _n |
| X | X | H | Z |

H = HIGH Logic Level
 L = LOW Logic Level
 X = Immaterial

Z = High Impedance
 Q_n = No Change in Data

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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 | V _{IN} < 0 V | - | -50 | mA |
| I _{OK} | DC Output Diode Current | V _{OUT} < 0 V | - | -50 | mA |
| I _{OUT} | DC Output Source / Sink Current | | - | ±50 | mA |
| I _{CC} / I _{GND} | DC V _{CC} / GND 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 | SC-70-6 | - | 190 | mW |
| | | MicroPak | - | 327 | |

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.

RECOMMENDED OPERATING CONDITIONS

| Symbol | Parameter | Conditions | Min | Max | Unit |
|---------------------------------|-------------------------------|---------------------------------------|------|-----------------|------|
| V _{CC} | Supply Voltage Operating | | 1.65 | 5.5 | V |
| | Supply Voltage Data Retention | | 1.5 | 5.5 | |
| V _{IN} | Input Voltage | | 0 | 5.5 | V |
| V _{OUT} | Output Voltage | Active State | 0 | V _{CC} | V |
| | | 3-STATE | 0 | 5.5 | V |
| t _r , t _f | Input Rise and Fall Time | 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} = 5.5 V ±0.5 V | 0 | 5 | |
| T _A | Operating Temperature | | -40 | +85 | °C |
| θ _{JA} | Thermal Resistance | SC-70-6 | - | 659 | °C/W |
| | | MicroPak | - | 382 | |

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.

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

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DC ELECTRICAL CHARACTERISTICS

| Symbol | Parameter | V _{CC} (V) | Conditions | | T _A = +25°C | | | T _A = -40 to +85°C | | Unit |
|------------------|-----------------------------------|---------------------|--|---------------------------|-------------------------|------|----------------------|-------------------------------|----------------------|------|
| | | | | | 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 |
| | | 2.3 to 5.5 | | | 0.7 V _{CC} | - | - | 0.7 V _{CC} | - | |
| V _{IL} | LOW Level Control Input Voltage | 1.65 to 1.95 | | | - | - | 0.35 V _{CC} | - | 0.35 V _{CC} | V |
| | | 2.3 to 5.5 | | | - | - | 0.3 V _{CC} | - | 0.3 V _{CC} | |
| V _{OH} | HIGH Level Control Output Voltage | 1.65 | V _{IN} = V _{IH} | I _{OH} = -100 μA | 1.55 | 1.65 | - | 1.55 | - | V |
| | | 1.8 | | | 1.7 | 1.8 | - | 1.7 | - | |
| | | 2.3 | | | 2.2 | 2.3 | - | 2.2 | - | |
| | | 3.0 | | | 2.9 | 3.0 | - | 2.9 | - | |
| | | 4.5 | | | 4.4 | 4.5 | - | 4.4 | - | |
| | | 1.65 | | | I _{OH} = -4 mA | 1.24 | 1.52 | - | 1.29 | |
| | | 2.3 | | I _{OH} = -8 mA | 1.9 | 2.15 | - | 1.9 | - | |
| | | 3.0 | | I _{OH} = -16 mA | 2.4 | 2.8 | - | 2.4 | - | |
| | | 3.0 | | I _{OH} = -24 mA | 2.3 | 2.68 | - | 2.3 | - | |
| | | 4.5 | | I _{OH} = -32 mA | 3.8 | 4.2 | - | 3.8 | - | |
| V _{OL} | LOW Level Control Output Voltage | 1.65 | V _{IN} = V _{IH} | I _{OL} = 100 μA | - | 0.0 | 0.1 | - | 0.1 | V |
| | | 1.8 | | | - | 0.0 | 0.1 | - | 0.1 | |
| | | 2.3 | | | - | 0.0 | 0.1 | - | 0.1 | |
| | | 3.0 | | | - | 0.0 | 0.1 | - | 0.1 | |
| | | 4.5 | | | - | 0.0 | 0.1 | - | 0.1 | |
| | | 1.65 | | I _{OL} = 4 mA | - | 0.08 | 0.24 | - | 0.24 | |
| | | 2.3 | | I _{OL} = 8 mA | - | 0.10 | 0.3 | - | 0.3 | |
| | | 3.0 | | I _{OL} = 16 mA | - | 0.15 | 0.4 | - | 0.4 | |
| | | 3.0 | | I _{OL} = 24 mA | - | 0.22 | 0.55 | - | 0.55 | |
| | | 4.5 | | I _{OL} = 32 mA | - | 0.22 | 0.55 | - | 0.55 | |
| I _{IN} | Input Leakage Current | 1.65 to 5.5 | 0 ≤ V _{IN} ≤ 5.5 V | | - | - | ±0.1 | - | ±1.0 | μA |
| I _{OZ} | 3-STATE Output Leakage | 1.65 to 5.5 | V _{IN} = V _{IL} or V _{IH} 0 ≤ V _{OUT} ≤ 5.5 V | | - | - | ±0.5 | - | ±5.0 | μA |
| I _{OFF} | Power Off Leakage Current | 0.0 | V _{IN} or V _{OUT} = 5.5 V | | - | - | 1.0 | - | 10 | μA |
| I _{CC} | Quiescent Supply Current | 1.65 to 5.5 | V _{IN} = 5.5 V, GND | | - | - | 1.0 | - | 10.0 | μA |

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AC ELECTRICAL CHARACTERISTICS

| Symbol | Parameter | V _{CC} (V) | Conditions | T _A = +25°C | | | T _A = -40 to +85°C | | Unit |
|-------------------------------------|---|---------------------|--|------------------------|------|------|-------------------------------|------|------|
| | | | | Min | Typ | Max | Min | Max | |
| f _{MAX} | Maximum Clock Frequency (Figures 5, 7) | 1.65 | C _L = 50 pF, R _D = 500 Ω, S ₁ = Open | - | - | - | 100 | - | MHz |
| | | 1.8 | | - | - | - | 100 | - | |
| | | 2.5 ±0.2 | | - | - | - | 125 | - | |
| | | 3.3 ±0.3 | | - | - | - | 150 | - | |
| | | 5.0 ±0.5 | | - | - | - | 175 | - | |
| t _{PLH} , t _{PHL} | Propagation Delay CP to Q (Figures 5, 7) | 1.65 | C _L = 15 pF, R _D = 1 MΩ, S ₁ = Open | - | 9.7 | 1.50 | - | 16.5 | ns |
| | | 1.8 | | - | 6.5 | 10.0 | - | 11.0 | |
| | | 2.5 ±0.2 | | - | 3.8 | 6.5 | - | 7.0 | |
| | | 3.3 ±0.3 | | - | 2.8 | 4.5 | - | 5.0 | |
| | | 5.0 ±0.5 | | - | 2.2 | 3.5 | - | 3.8 | |
| | | 3.3 ±0.3 | C _L = 50 pF, R _D = 500 Ω, S ₁ = Open | - | 3.4 | 5.5 | - | 6.2 | |
| | | 5.0 ±0.5 | | - | 2.6 | 4.0 | - | 4.7 | |
| t _{PZL} , t _{PZH} | Output Enable Time (Figures 5, 8) | 1.65 | C _L = 50 pF, V _I = 2 × V _{CC} , R _U , R _D = 500 Ω, S ₁ = GND for t _{PZH} S ₁ = V _I for t _{PZL} | - | 9.0 | 13.5 | - | 14.3 | ns |
| | | 1.8 | | - | 6.0 | 9.0 | - | 9.5 | |
| | | 2.5 ±0.2 | | - | 3.7 | 6.0 | - | 6.6 | |
| | | 3.3 ±0.3 | | - | 2.8 | 5.0 | - | 5.3 | |
| | | 5.0 ±0.5 | | - | 2.2 | 3.7 | - | 3.9 | |
| t _{PLZ} , t _{PHZ} | Output Disable Time (Figures 5, 8) | 1.65 | C _L = 50 pF, V _I = 2 × V _{CC} , R _U , R _D = 500 Ω, S ₁ = GND for t _{PHZ} S ₁ = V _I for t _{PLZ} | - | 7.7 | 12.0 | - | 13.0 | ns |
| | | 1.8 | | - | 5.1 | 8.0 | - | 8.5 | |
| | | 2.5 ±0.2 | | - | 3.5 | 6.0 | - | 6.3 | |
| | | 3.3 ±0.3 | | - | 2.8 | 4.5 | - | 4.7 | |
| | | 5.0 ±0.5 | | - | 2.23 | 3.7 | - | 3.9 | |
| t _S | Setup Time, CP to D (Figures 5, 9) | 2.5 ±0.2 | C _L = 50 pF, R _D = 500 Ω, S ₁ = Open | - | - | - | 2.5 | - | ns |
| | | 3.3 ±0.3 | | - | - | - | 2.0 | - | |
| | | 5.0 ±0.5 | | - | - | - | 1.5 | - | |
| t _H | Hold Time, CP to D (Figures 5, 9) | 2.5 ±0.2 | C _L = 50 pF, R _D = 500 Ω, S ₁ = Open | - | - | - | 1.5 | - | ns |
| | | 3.3 ±0.3 | | - | - | - | 1.5 | - | |
| | | 5.0 ±0.5 | | - | - | - | 1.5 | - | |
| t _W | Pulse Width, CP (Figures 5, 9) | 2.5 ±0.2 | C _L = 50 pF, R _D = 500 Ω, S ₁ = Open | - | - | - | 3.0 | - | ns |
| | | 3.3 ±0.3 | | - | - | - | 2.8 | - | |
| | | 5.0 ±0.5 | | - | - | - | 2.5 | - | |

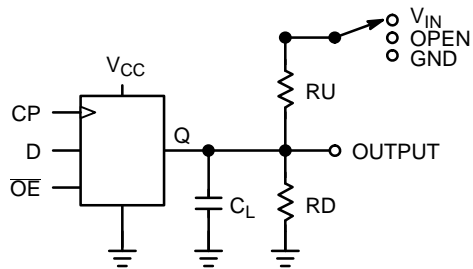
CAPACITANCE (T_A = +25°C, f = 1 MHz)

| Symbol | Parameter | Condition | Typ | Max | Units |
|------------------|--|---|-----|-----|-------|
| C _{IN} | Input Capacitance | V _{CC} = Open, V _{IN} = 0 V or V _{CC} | 3 | - | pF |
| C _{OUT} | Output Capacitance | V _{CC} = 3.3 V, V _{IN} = 0 V or V _{CC} | 4 | - | pF |
| C _{PD} | Power Dissipation Capacitance (Note 2) | V _{CC} = 3.3 V | 10 | - | pF |
| | | V _{CC} = 5.0 V | 12 | - | pF |

2. 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. (See Figure 6)

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

AC Loading and Waveforms



C_L includes load and stray capacitance
Input PRR = 1.0 MHz, $t_W = 500$ ns.

Figure 5. AC Test Circuit

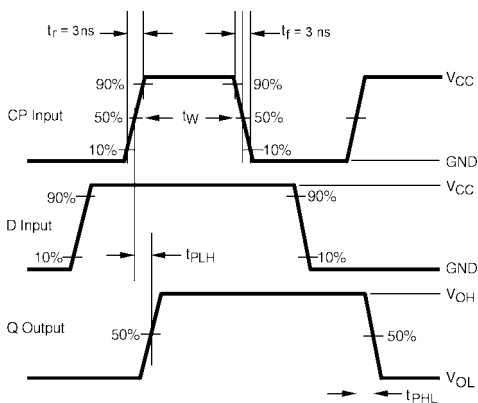
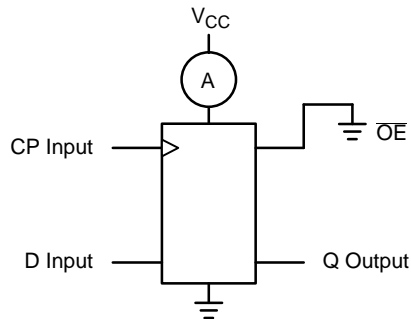


Figure 7. AC Waveforms



CP Input = AC Waveform; $t_r = t_f = 1.8$ ns;
CP Input PRR = 10 MHz; Duty Cycle = 50%
D Input PRR = 5 MHz; Duty Cycle = 50%.

Figure 6. I_{CCD} Test Circuit

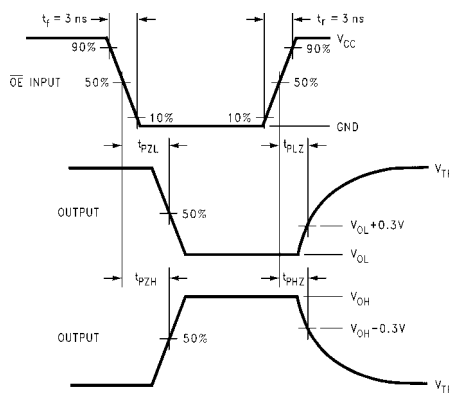


Figure 8. AC Waveforms

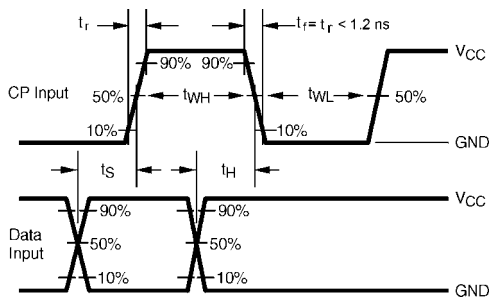


Figure 9. AC Waveforms

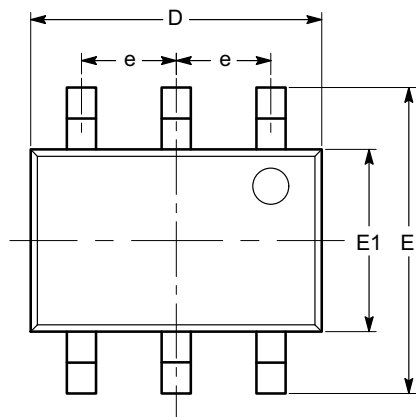
ORDERING INFORMATION

| Device | Top Mark | Packages | Shipping† |
|-------------|----------|--------------------------------------|--------------------|
| NC7SZ374P6X | Z74 | 6-Lead SC70, EIAJ SC88, 1.25 mm Wide | 3000 / Tape & Reel |
| NC7SZ374L6X | C9 | 6-Lead MicroPak, 1.00 mm Wide | 5000 / 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.

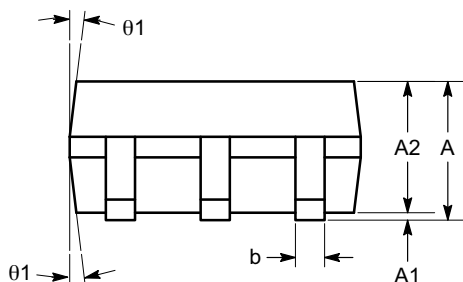
SC-88 (SC-70 6 Lead), 1.25x2
CASE 419AD-01
ISSUE A

DATE 07 JUL 2010

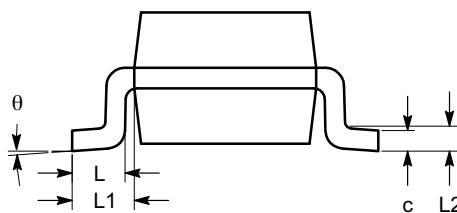


TOP VIEW

| SYMBOL | MIN | NOM | MAX |
|-----------|----------|------|------|
| A | 0.80 | | 1.10 |
| A1 | 0.00 | | 0.10 |
| A2 | 0.80 | | 1.00 |
| b | 0.15 | | 0.30 |
| c | 0.10 | | 0.18 |
| D | 1.80 | 2.00 | 2.20 |
| E | 1.80 | 2.10 | 2.40 |
| E1 | 1.15 | 1.25 | 1.35 |
| e | 0.65 BSC | | |
| L | 0.26 | 0.36 | 0.46 |
| L1 | 0.42 REF | | |
| L2 | 0.15 BSC | | |
| θ | 0° | | 8° |
| $\theta1$ | 4° | | 10° |



SIDE VIEW



END VIEW

Notes:

- (1) All dimensions are in millimeters. Angles in degrees.
- (2) Complies with JEDEC MO-203.

| | | |
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