

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



ON Semiconductor®

[www.onsemi.com](http://www.onsemi.com)

## NC7SZ74

### Description

The NC7SZ74 is a single, D-type, CMOS flip-flop with preset and clear from ON Semiconductor 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:  $\pm 24$  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 DIAGRAMS

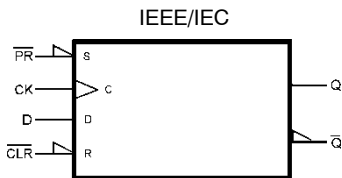


Figure 1. Logic Symbol

### Pin Configurations

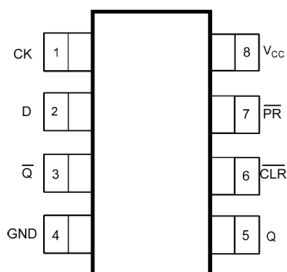


Figure 2. USB (Top View)

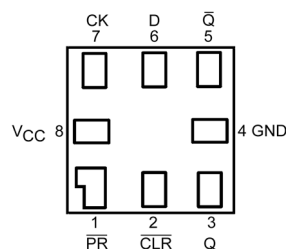
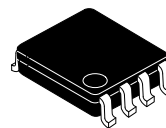
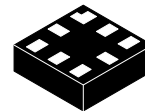
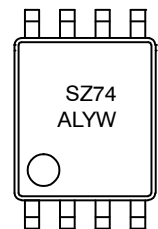


Figure 3. MicorPak™ (Top Through View)

### MARKING DIAGRAMS



US8  
CASE 846AN



UQFN8  
1.6X1.6, 0.5P  
CASE 523AY



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

### 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	Vcc	Supply Voltage

## FUNCTION TABLE

Inputs				Output		Function
$\bar{CLR}$	$\bar{PR}$	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 <sub>n</sub>	$\bar{Q}_n$	No Change

H = HIGH Logic Level

Q<sub>n</sub> = 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 <sub>CC</sub>	Supply Voltage	-0.5	6.5	V
V <sub>IN</sub>	DC Input Voltage	-0.5	6.5	V
V <sub>OUT</sub>	DC Output Voltage	-0.5	6.5	V
I <sub>IK</sub>	DC Input Diode Current	-	-50	mA
I <sub>OK</sub>	DC Output Diode Current	-	-50	mA
I <sub>OUT</sub>	DC Output Source/Sink Current	-	±50	mA
I <sub>CC</sub> or I <sub>GND</sub>	DC V <sub>CC</sub> or Ground Current	-	±50	mA
T <sub>STG</sub>	Storage Temperature Range	-65	+150	°C
T <sub>J</sub>	Junction Temperature Under Bias	-	+150	°C
T <sub>L</sub>	Junction Lead Temperature (Soldering, 10 Seconds)	-	+260	°C
P <sub>D</sub>	Power Dissipation in Still Air	-	500 539	mW
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 <sub>CC</sub>	Supply Voltage Operating		1.65	5.50	V
	Supply Voltage Data Retention		1.50	5.50	
V <sub>IN</sub>	Input Voltage		0	5.5	V
V <sub>OUT</sub>	Output Voltage	Active State	0	V <sub>CC</sub>	V
		3-State	0	5.5	
t <sub>r</sub> , t <sub>f</sub>	Input Rise and Fall Times	V <sub>CC</sub> = 1.8 V, 2.5 V ± 0.2 V	0	20	ns/V
		V <sub>CC</sub> = 3.3 V ± 0.3 V	0	10	
		V <sub>CC</sub> = 5.0 V ± 0.5 V	0	5	
T <sub>A</sub>	Operating Temperature		-40	+85	°C
θ <sub>JA</sub>	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 <sub>CC</sub>	Conditions	T <sub>A</sub> = +25°C			T <sub>A</sub> = -40 to +85°C		Units
				Min.	Typ.	Max.	Min.	Max.	
V <sub>IH</sub>	HIGH Level Control Input Voltage	1.65 to 1.95		0.65 V <sub>CC</sub>			0.65 V <sub>CC</sub>		V
		2.30 to 5.50		0.70 V <sub>CC</sub>			0.70 V <sub>CC</sub>		
V <sub>IL</sub>	LOW Level Control Input Voltage	1.65 to 1.95				0.35 V <sub>CC</sub>		0.35 V <sub>CC</sub>	V
		2.30 to 5.50				0.30 V <sub>CC</sub>		0.30 V <sub>CC</sub>	
V <sub>OH</sub>	HIGH Level Output Voltage	1.65	V <sub>IN</sub> = V <sub>IH</sub> , I <sub>OH</sub> = -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 <sub>OH</sub> = -4 mA	1.29	1.52		1.29		
		2.30	I <sub>OH</sub> = -8 mA	1.90	2.15		1.90		
		3.00	I <sub>OH</sub> = -16 mA	2.40	2.80		2.40		
		3.00	I <sub>OH</sub> = -24 mA	2.30	2.68		2.30		
		4.50	I <sub>OH</sub> = -32 mA	3.80	4.20		3.80		
V <sub>OL</sub>	LOW Level Control Output Voltage	1.65	V <sub>IN</sub> = V <sub>IH</sub> , I <sub>OL</sub> = 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 <sub>OL</sub> = 4 mA		0.10	0.24		0.24	
		2.30	I <sub>OL</sub> = 8 mA		0.10	0.30		0.30	
		3.00	I <sub>OL</sub> = 16 mA		0.15	0.40		0.40	
		3.00	I <sub>OL</sub> = 24 mA		0.22	0.55		0.55	
		4.50	I <sub>OL</sub> = 32 mA		0.22	0.55		0.55	

# NC7SZ74

## DC ELECTRICAL CHARACTERISTICS (continued)

$I_{IN}$	Input Leakage Current	1.65 to 5.5	$0 \leq V_{IN} \leq 5.5 V$			$\pm 0.1$		$\pm 1.0$	$\mu A$
$I_{OFF}$	Power Off Leakage Current	0	$V_{IN}$ or $V_{OUT} = 5.5 V$			1		10	$\mu A$
$I_{CC}$	Quiescent Supply Current	1.65 to 5.50	$V_{IN} = 5.5 V, GND$			1		10	$\mu A$

## AC ELECTRICAL CHARACTERISTICS

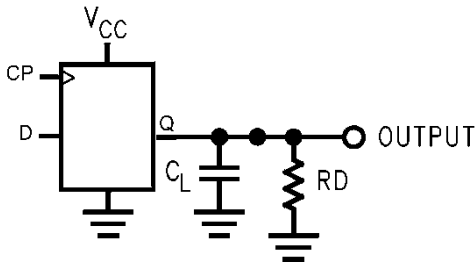
Symbol	Parameter	$V_{CC}$	Conditions	$T_A = +25^\circ C$			$T_A = -40$ to $+85^\circ C$		Units	Figure
				Min.	Typ.	Max.	Min.	Max.		
$f_{MAX}$	Maximum Clock Frequency	$1.80 \pm 0.15$	$C_L = 15 pF$ $R_D = 1 M\Omega$ $S_1 = Open$	75			75		ns	Figure 4 Figure 8
		$2.50 \pm 0.20$		150			150			
		$3.30 \pm 0.30$		200			200			
		$5.00 \pm 0.50$		250			250			
		$3.30 \pm 0.50$	$C_L = 50 pF$ $R_D = 500 \Omega$ $S_1 = Open$	175			175			
		$5.00 \pm 0.50$		200			200			
$t_{PLH}, t_{PHL}$	Propagation Delay CK to Q, /Q	$1.80 \pm 0.15$	$C_L = 15 pF$ $R_D = 1 M\Omega$ $S_1 = Open$		6.5	12.5		13.0	ns	Figure 4 Figure 6
		$2.50 \pm 0.20$			3.8	7.5		8.0		
		$3.30 \pm 0.30$			2.8	6.5		7.0		
		$5.00 \pm 0.50$			2.2	4.5		5.0		
		$3.30 \pm 0.30$	$C_L = 50 pF$ $R_D = 500 \Omega$ $S_1 = Open$		3.4	7.0		7.5		
		$5.00 \pm 0.50$			2.6	5.0		5.5		
$t_{PLH}, t_{PHL}$	Propagation Delay /CLR, /PR to Q, /Q	$1.80 \pm 0.15$	$C_L = 15 pF$ $R_L = 1 M\Omega$ $S_1 = Open$		6.5	14.0		14.5	ns	Figure 4 Figure 6
		$2.50 \pm 0.20$			3.8	9.0		9.5		
		$3.30 \pm 0.30$			2.8	6.5		7.0		
		$5.00 \pm 0.50$			2.2	5.0		5.5		
		$3.30 \pm 0.30$	$C_L = 50 pF$ $R_D = 500 \Omega$ $S_1 = Open$		3.4	7.0		7.5		
		$5.00 \pm 0.50$			2.6	5.0		5.5		
$t_S$	Setup Time CK to D	$1.80 \pm 0.15$	$C_L = 15 pF$ $R_L = 1 M\Omega$ $S_1 = Open$	6.5			6.5		ns	Figure 4 Figure 7
		$2.50 \pm 0.20$		3.5			3.5			
		$3.30 \pm 0.30$		2.0			2.0			
		$5.00 \pm 0.50$		1.5			1.5			
		$3.30 \pm 0.30$	$C_L = 50 pF$ $R_D = 500 \Omega$ $S_1 = Open$	2.0			2.0			
		$5.00 \pm 0.50$		1.5			1.5			
$t_H$	Hold Time, CK to D	$1.80 \pm 0.15$	$C_L = 15 pF$ $R_L = 1 M\Omega$ $S_1 = Open$	0.5			0.5		ns	Figure 4 Figure 7
		$2.50 \pm 0.20$		0.5			0.5			
		$3.30 \pm 0.30$		0.5			0.5			
		$5.00 \pm 0.50$		0.5			0.5			
		$3.30 \pm 0.30$	$C_L = 50 pF$ $R_D = 500 \Omega$ $S_1 = Open$	0.5			0.5			
		$5.00 \pm 0.50$		0.5			0.5			

# NC7SZ74

## AC ELECTRICAL CHARACTERISTICS (continued)

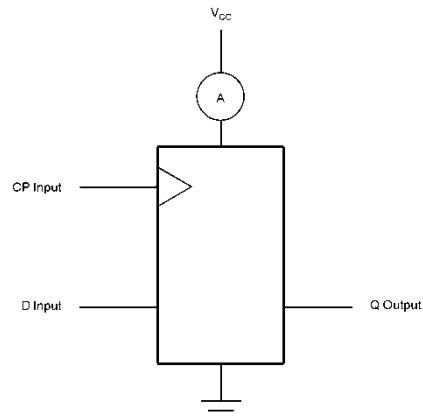
Symbol	Parameter	V <sub>CC</sub>	Conditions	T <sub>A</sub> = +25°C			T <sub>A</sub> = -40 to +85°C		Units	Figure
				Min.	Typ.	Max.	Min.	Max.		
t <sub>w</sub>	Pulse Width, CK, /PR, /CLR	1.80 ± 0.15	C <sub>L</sub> = 15 pF, R <sub>L</sub> = 1 MΩ S <sub>1</sub> = Open	6.0			6.0		ns	Figure 4 Figure 8
		2.50 ± 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 <sub>L</sub> = 50pF, R <sub>D</sub> = 500Ω, S <sub>1</sub> = Open	3.0			3.0			
		5.00 ± 0.50		2.0			2.0			
t <sub>REC</sub>	Recover Time /CLR, /PR to CK	1.80 ± 0.15	C <sub>L</sub> = 15 pF, R <sub>L</sub> = 1 MΩ S <sub>1</sub> = 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 <sub>L</sub> = 50 pF, R <sub>D</sub> = 500 Ω, S <sub>1</sub> = Open	3.0			3.0			
		5.00 ± 0.50		3.0			3.0			
C <sub>IN</sub>	Input Capacitance	0			3				pF	
C <sub>OUT</sub>	Output Capacitance	0			4				pF	
C <sub>PD</sub>	Power Dissipation Capacitance (Note 1)	3.30			10				pF	
		5.00			12					

1. C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is derived from dynamic operating current consumption (I<sub>CCD</sub>) at no output loading and operating at 50% duty cycle. C<sub>PD</sub> is related to I<sub>CCD</sub> dynamic operating current by the expression: I<sub>CCD</sub> = (C<sub>PD</sub>)(V<sub>CC</sub>)(f<sub>IN</sub>) + (I<sub>CC</sub>static).



2. C<sub>L</sub> includes load and stray capacitance.  
Input PRR = 1.0 MHz t<sub>w</sub> = 500 ns.

**Figure 4. AC Test Circuit**



3. CP input = AC Waveforms t<sub>r</sub> = t<sub>f</sub> = 2.5 ns.  
4. CP input PRR = 10 MHz; Duty Cycle = 50%.  
5. D input PRR = 5 MHz; Duty Cycle = 50%.

**Figure 5. AC Test Circuit**

# NC7SZ74

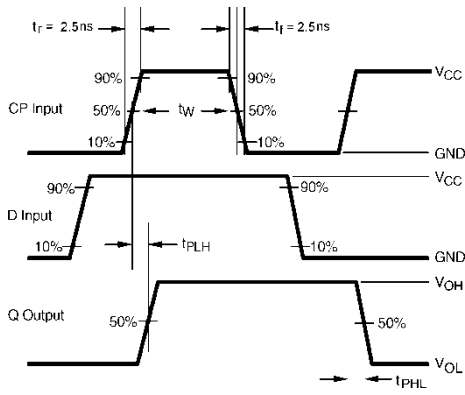


Figure 6. AC Waveforms

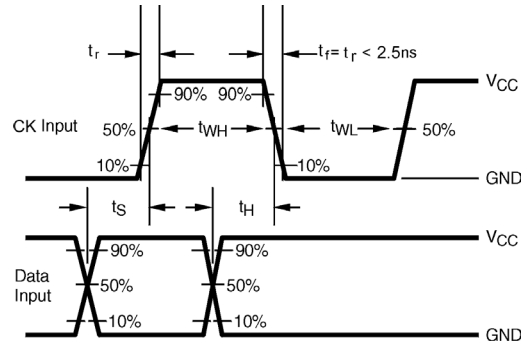


Figure 7. AC Waveforms

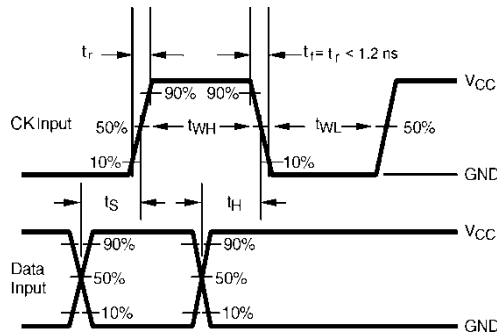


Figure 8. AC Waveforms

## 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

†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





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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