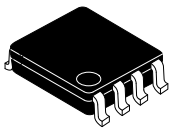
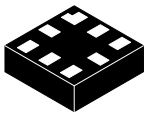
TinyLogic UHS D-Type, Flip-Flop with Preset and Clear

NC7SZ74



US8
CASE 846AN



UQFN8
1.6X1.6, 0.5P
CASE 523AY

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

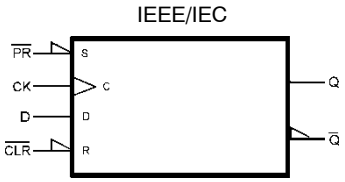
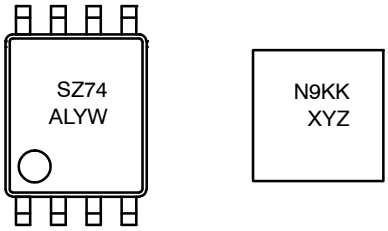


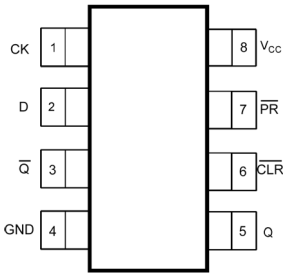
Figure 1. Logic Symbol

MARKING DIAGRAMS

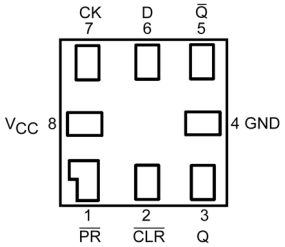


SZ74, N9	= Specific Device Code
A	= Assembly Site
L	= Wafer Lot Number
YW	= Assembly Start Wee
KK	= 2−Digit Lot Run Traceability Code
XY	= 2−Digit Date Code Format
Z	= Assembly Plant Code

PIN CONFIGURATIONS



USB (Top View)



MicroPak™ (Top Through View)

ORDERING INFORMATION

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

PIN DEFINITIONS

Pin # US8	Pin # MicroPak	Name	Description
1	7	CK	Clock Pulse Input
2	6	D	Data Input
3	5	$\overline{Q}$	Flip−Flop Output
4	4	GND	Ground
5	3	Q	Flip−Flop Output
6	2	$\overline{CLR}$	Direct Clear Input
7	1	$\overline{PR}$	Direct Preset Input
8	8	VCC	Supply Voltage

FUNCTION TABLE

Inputs				Output		
$\overline{CLR}$	$\overline{PR}$	D	CK	Q	$\overline{Q}$	Function
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

H = HIGH Logic Level Qn = 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	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} 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 MicroPak−8	− −	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.

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	Vcc	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	Vcc	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	I_{OH} = −8 mA	1.90	2.15		1.90		
		3.00	I_{OH} = −16 mA	2.40	2.80		2.40		
		3.00	I_{OH} = −24 mA	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	I_{OL} = 8 mA		0.10	0.30		0.30	
		3.00	I_{OL} = 16 mA		0.15	0.40		0.40	
		3.00	I_{OL} = 24 mA		0.22	0.55		0.55	
		4.50	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_{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

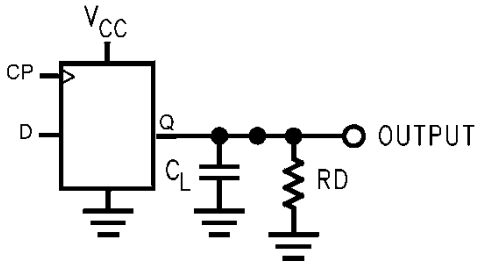
AC ELECTRICAL CHARACTERISTICS

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, $\overline{Q}$	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 $\overline{CLR}$, $\overline{PR}$ to Q, $\overline{Q}$	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, $\overline{PR}$, $\overline{CLR}$	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 $\overline{CLR}$, $\overline{PR}$ 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			

AC ELECTRICAL CHARACTERISTICS (continued)

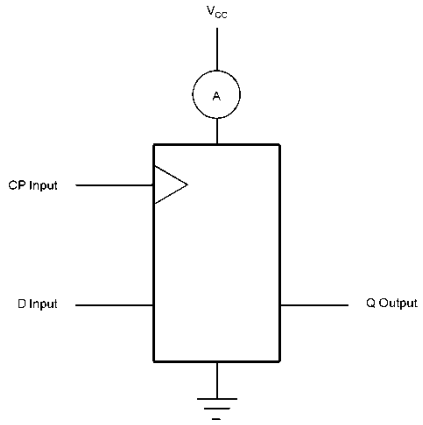
Symbol	Parameter	V_{CC}	Conditions	T_A = +25°C			T_A = −40 to +85°C		Units	Figure
				Min.	Typ.	Max.	Min.	Max.		
C_{IN}	Input Capacitance	0			3				pF	
C_{OUT}	Output Capacitance	0			4				pF	
C_{PD}	Power Dissipation Capacitance (Note 1)	3.30			10				pF	
		5.00			12					

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: $I_{CCD} = (C_{PD})(V_{CC})(f_{IN}) + (I_{CC}static)$.



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

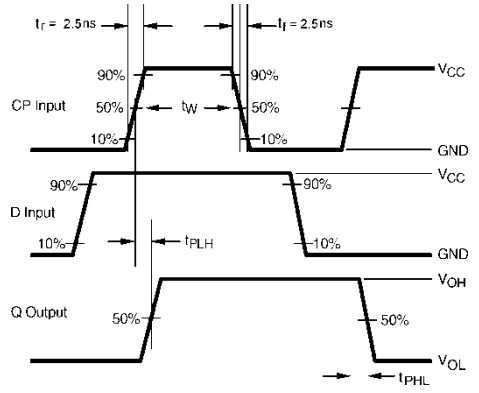


Figure 4. AC Waveforms

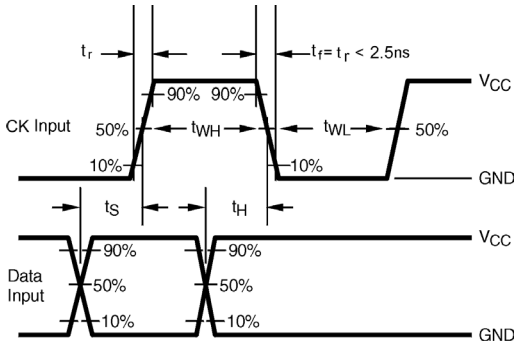


Figure 5. AC Waveforms

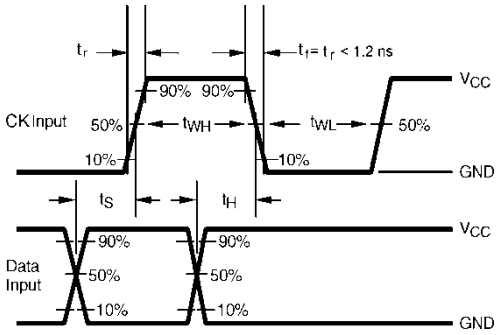


Figure 6. AC Waveforms

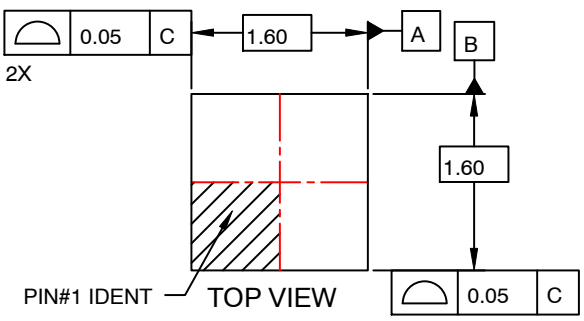
ORDERING INFORMATION

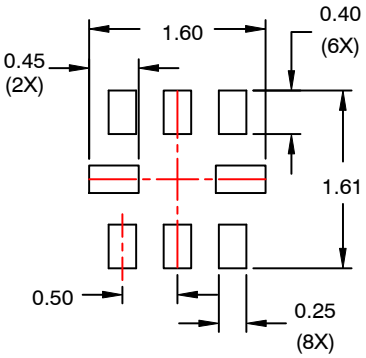
Part Number	Top Mark	Package	Packing Method†
NC7SZ74K8X	SZ74	8−Lead US8, JEDEC MO−187, Variation CA 3.1mm Wide	3000 Units on Tape & Reel
NC7SZ74K8X−L22236	SZ74	8−Lead US8, JEDEC MO−187, Variation CA 3.1mm Wide	3000 Units on Tape & Reel
NC7SZ74L8X	N9	8−Lead MicroPak, 1.6 mm Wide	5000 Units on Tape & Reel

†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

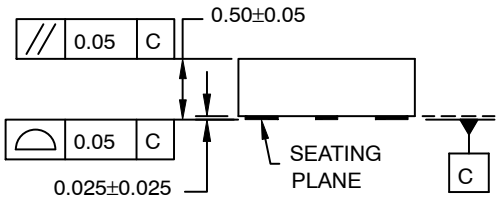
UQFN8 1.6X1.6, 0.5P
CASE 523AY
ISSUE O

DATE 31 AUG 2016





RECOMMENDED
LAND PATTERN



SIDE VIEW

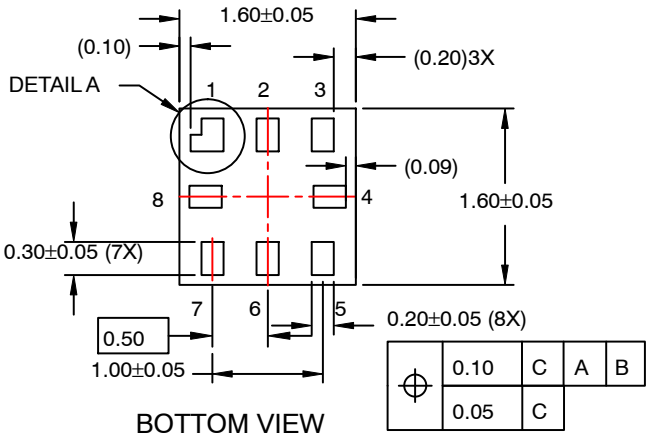
NOTES:

A. PACKAGE CONFORMS TO JEDEC MO−255 VARIATION UAAD.

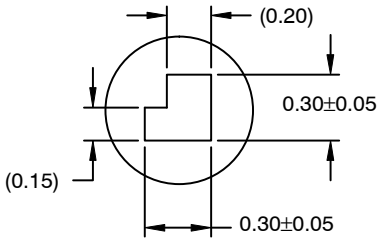
B. DIMENSIONS ARE IN MILLIMETERS.

C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 2009.

D. LAND PATTERN RECOMMENDATION IS EXISTING INDUSTRY LAND PATTERN.



BOTTOM VIEW



DETAIL A
SCALE : 2X

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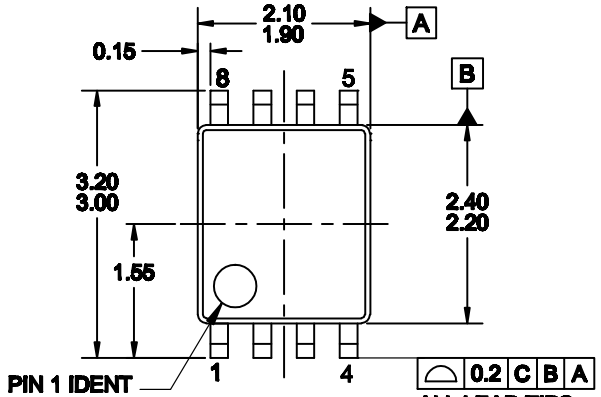
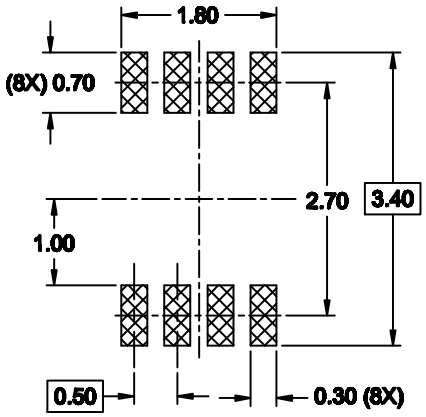
DESCRIPTION:	**UQFN8 1.6X1.6, 0.5P**	**PAGE 1 OF 1**

US8
CASE 846AN
ISSUE O

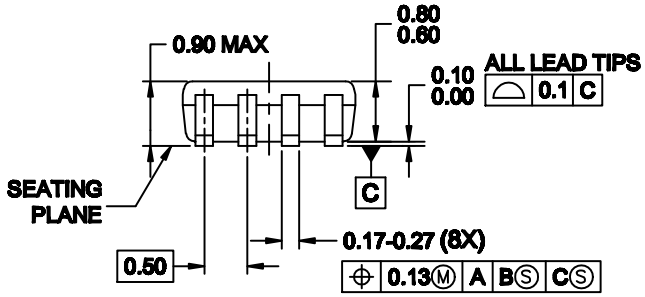
DATE 31 DEC 2016



TOP VIEW



RECOMMENDED LAND PATTERN



SIDE VIEW

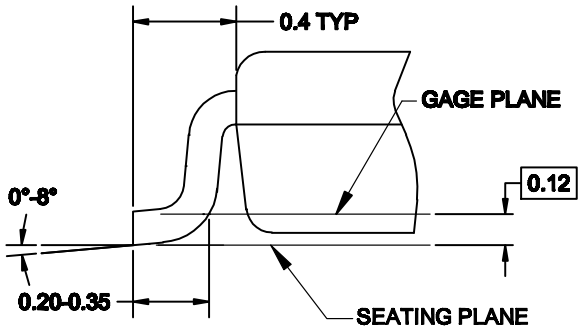
NOTES:

A. CONFORMS TO JEDEC REGISTRATION MO-187

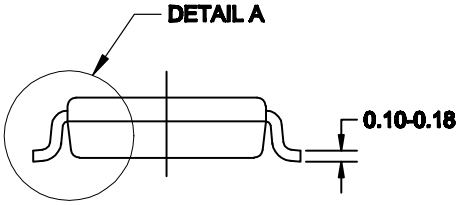
B. DIMENSIONS ARE IN MILLIMETERS.

C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.

D. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M, 1994.



DETAIL A



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