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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 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
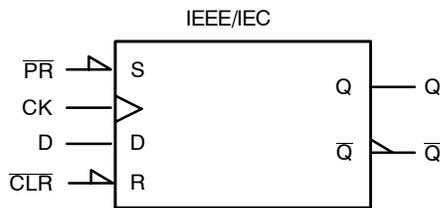
Figure 1. Logic Symbol

ON Semiconductor®

MARKING DIAGRAMS

UQFN8
1.6X1.6, 0.5P
CASE 523AY

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CCKK
XYZ
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US8
CASE 846AN

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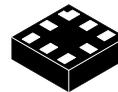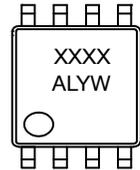
CC, XXXX	= Specific Device Code
KK	= 2−Digit Lot Run Traceability Code
XY	= 2−Digit Date Code Format
Z	= Assembly Plant Code
A	= Assembly Site
L	= Wafer Lot Number
YW	= Assembly Start Week

(Note: Microdot may be in either location)

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

ORDERING INFORMATION

NC7SV74A
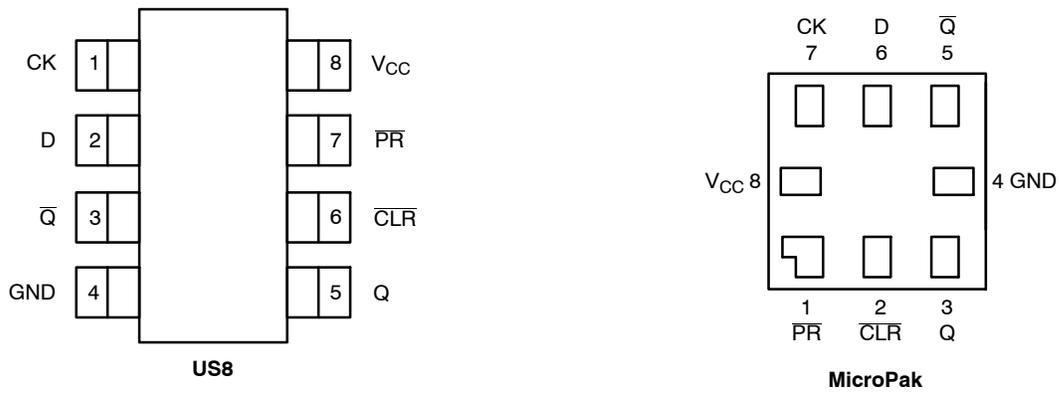
Figure 2. Pinouts (Top Views)

PIN ASSIGNMENT

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

FUNCTION TABLE

Input				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

X − Immaterial ↑− Rising Edge
Q_n − No change in data ↓− Falling Edge

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.

Table 3. DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Condition	V_{CC} (V)	$T_A = 25°C$ Min	Typ	Max	$T_A = -40°C$ to $+85°C$ Min	Max	Unit
V_{IH}	High−Level Input Voltage		0.9	–	0.5	–	–	–	V
			1.1 to 1.3	$0.65 \times V_{CC}$	–	–	$0.65 \times V_{CC}$	–	
			1.4 to 1.6	$0.65 \times V_{CC}$	–	–	$0.65 \times V_{CC}$	–	
			1.65 to 1.95	$0.65 \times V_{CC}$	–	–	$0.65 \times V_{CC}$	–	
			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	–	–	$0.35 \times V_{CC}$	–	$0.35 \times V_{CC}$	
			1.4 to 1.6	–	–	$0.35 \times V_{CC}$	–	$0.35 \times V_{CC}$	
			1.65 to 1.95	–	–	$0.35 \times V_{CC}$	–	$0.35 \times V_{CC}$	
			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
		$I_{OH} = -100\ \mu A$	0.9	–	$V_{CC} - 0.1$	–	–	–	
			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	$0.75 \times V_{CC}$	–	–	$0.75 \times V_{CC}$	–	
		$I_{OH} = -4\ mA$	1.4 to 1.6	$0.75 \times V_{CC}$	–	–	$0.75 \times V_{CC}$	–	
		$I_{OH} = -6\ mA$	1.65 to 1.95	1.25	–	–	1.25	–	
			2.3 to < 2.7	2.0	–	–	2.0	–	
		$I_{OH} = -12\ mA$	2.3 to < 2.7	1.8	–	–	1.8	–	
			2.7 to 3.6	2.2	–	–	2.2	–	
		$I_{OH} = -18\ mA$	2.3 to < 2.7	1.7	–	–	1.7	–	
			2.7 to 3.6	2.4	–	–	2.4	–	
		$I_{OH} = -24\ mA$	2.7 to 3.6	2.2	–	–	2.2	–	

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.
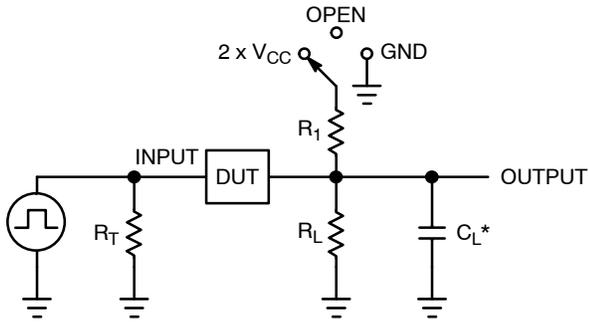
Table 4. AC ELECTRICAL CHARACTERISTICS

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

NC7SV74A

CAPACITIVE CHARACTERISTICS

Symbol	Parameter	Test Condition	Typical (T_A = 25°C)	Unit
C_{IN}	Input Capacitance	V_{CC} = 0 V	2.0	pF
C_{OUT}	Output Capacitance	V_{CC} = 0 V	4.5	pF
C_{PD}	Power Dissipation Capacitance (Note 5)	f = 10 MHz, V_{CC} = 0.9 V to 3.6 V, V_{IN} = 0 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 $I_{CC(OPR)} = C_{PD} \bullet V_{CC} \bullet f_{in} + I_{CC}$. C_{PD} is used to determine the no–load dynamic power consumption: $P_D = C_{PD} \bullet V_{CC}^2 \bullet f_{in} + I_{CC} \bullet V_{CC}$.

Test	Switch Position
t_{PLH} / t_{PHL}	Open
t_{PLZ} / t_{PZL}	2 x V_{CC}
t_{PHZ} / t_{PZH}	GND

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

Figure 3. Test Circuit
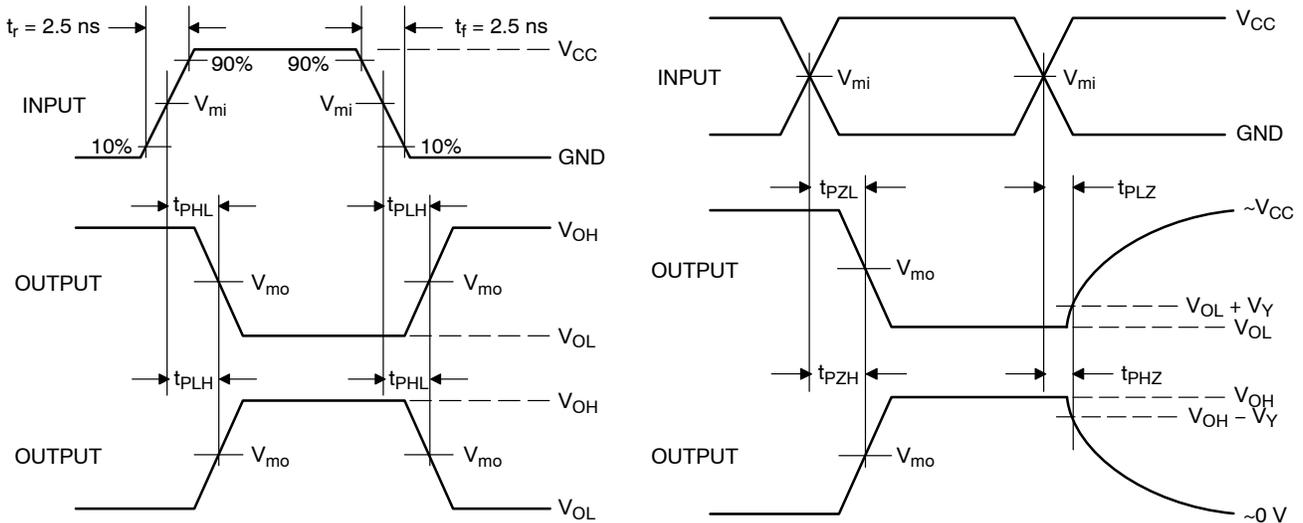
Figure 4. Switching Waveforms
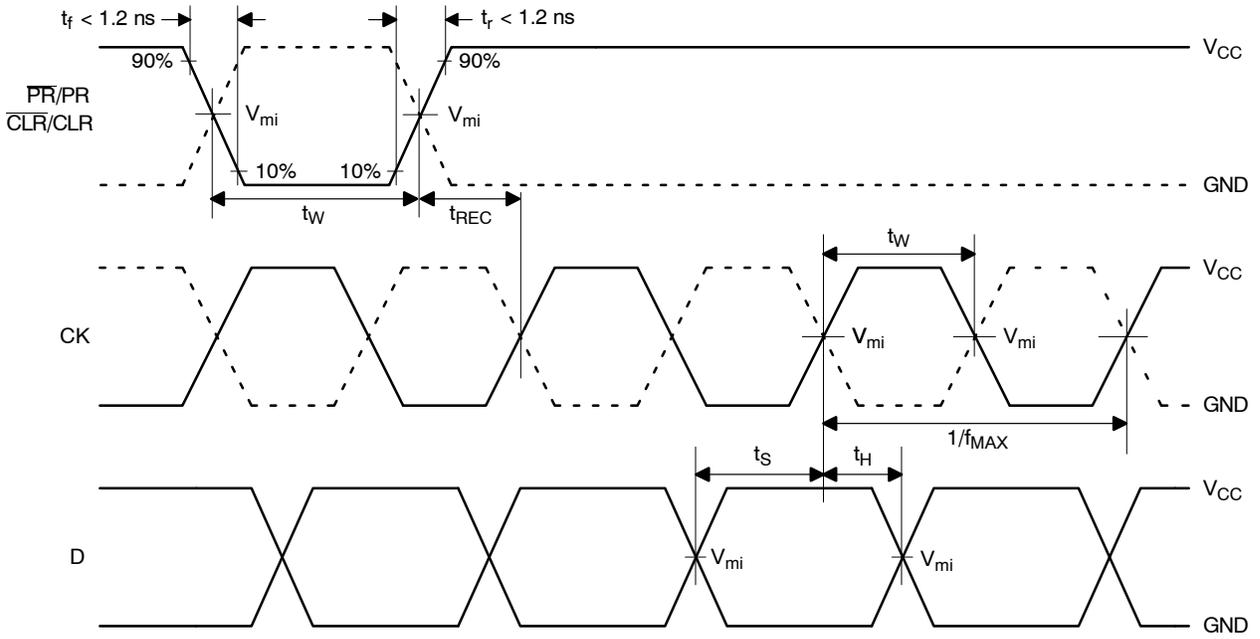
Figure 5. Setup, Hold and Recovery Time Waveforms

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
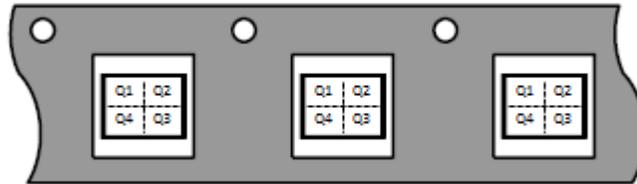
MicroPak is trademark of Semiconductor Components Industries, LLC (SCILLC) or its subsidiaries in the United States and/or other countries.

NC7SV74A

PACKAGE DIMENSIONS

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

TOP VIEW

SIDE VIEW
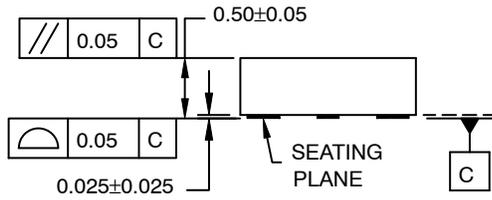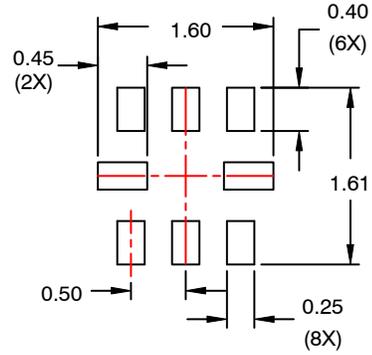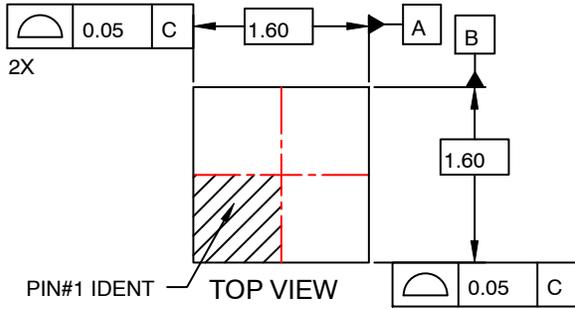
BOTTOM VIEW
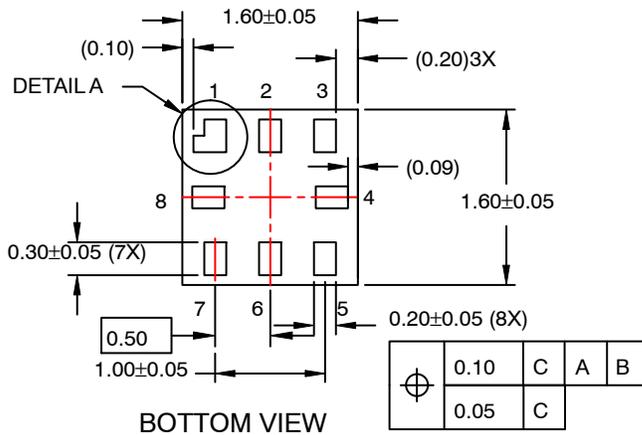
RECOMMENDED
LAND PATTERN

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.

DETAIL A
SCALE : 2X
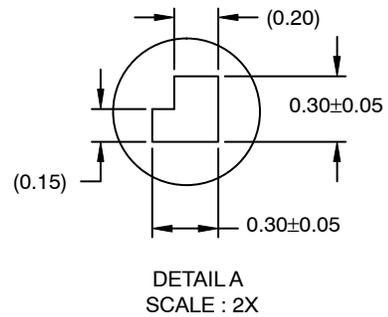
NC7SV74A

PACKAGE DIMENSIONS

US8
CASE 846AN
ISSUE O

TOP VIEW

2.10
1.90

0.15

8   5

3.20
3.00

2.40
2.20

1.55

PIN 1 IDENT

1   4

△ 0.2 C B A
ALL LEAD TIPS

SIDE VIEW

0.80
0.60

0.90 MAX

0.10
0.00

ALL LEAD TIPS
△ 0.1 C

SEATING
PLANE

C

0.50

0.17-0.27 (8X)

⊕ 0.13 Ⓜ A BⓈ CⓈ

RECOMMENDED LAND PATTERN

1.80

(8X) 0.70

2.70   3.40

1.00

0.50   0.30 (8X)
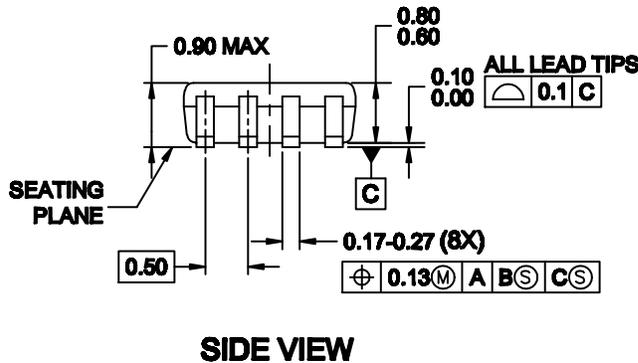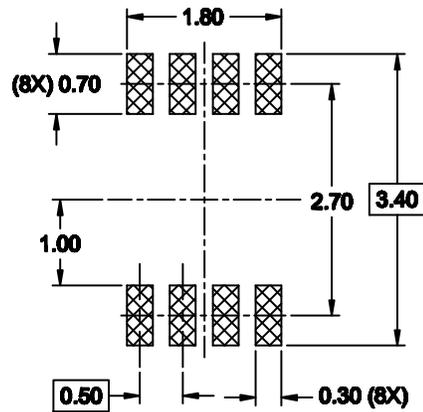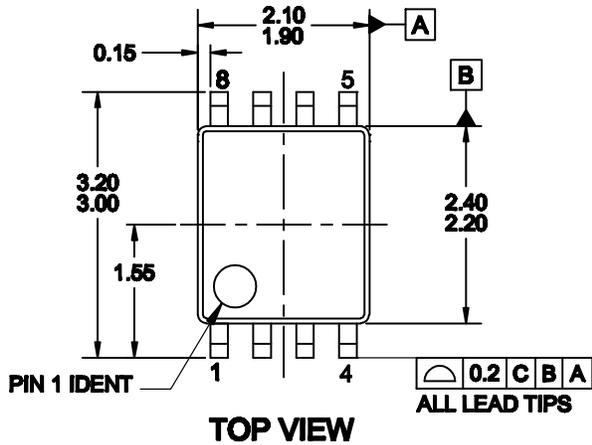
NOTES:

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

0.4 TYP

GAGE PLANE

0.12

0°-8°

0.20-0.35

SEATING PLANE

DETAIL A

0.10-0.18

NC7SV74A

PUBLICATION ORDERING INFORMATION

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