

June 2002 Revised January 2003

NC7SV57 • NC7SV58 TinyLogic® ULP-A Universal Configurable 2-Input Logic Gates

General Description

The NC7SV57 and NC7SV58 are universal configurable 2-input logic gates from Fairchild's Ultra Low Power (ULP-A) Series of TinyLogic®. ULP-A is ideal for applications that require extreme high speed, high drive and low power. This product is designed for a wide low voltage operating range (0.9V to 3.6V $\ensuremath{\text{V}_{\text{CC}}}\xspace)$ and applications that require more drive and speed than the TinyLogic ULP series, but still offer best in class low power operation. Each device is capable of being configured for 1 of 5 unique 2-input logic functions. Any possible 2-input combinatorial logic function can be implemented as shown in the Function Selection Table. Device functionality is selected by how the device is wired at the board level. Figure 1 through Figure 10 illustrate how to connect the NC7SV57 and NC7SV58 respectively for the desired logic function. All inputs have been implemented with hysteresis.

The NC7SV57 and NC7SV58 are uniquely designed for optimized power and speed, and are fabricated with an advanced CMOS technology to achieve high-speed operation while maintaining low CMOS power dissipation.

Features

- 0.9V to 3.6V V_{CC} supply operation
- 3.6V overvoltage tolerant I/O's at V_{CC} from 0.9V to 3.6V
- Extremely High Speed tpD

2.5 ns typ for 2.7V to 3.6V $\rm V_{\rm CC}$

3.1 ns typ for 2.3V to 2.7V $\rm V_{\rm CC}$

4.0 ns typ for 1.65V to 1.95V $\rm V_{\rm CC}$

6.0 ns typ for 1.4V to 1.6V V_{CC}

8.0 ns typ for 1.1V to 1.3V $\rm V_{\rm CC}$

23.0 ns typ for 0.9V $\ensuremath{\text{V}_{\text{CC}}}$

- Power-Off high impedance inputs and outputs
- High Static Drive (I_{OH}/I_{OL})

 $\pm 24~\text{mA}$ @ 3.00V V_{CC}

±18 mA @ 2.30V V_{CC}

±6 mA @ 1.65V V_{CC}

 ± 4 mA $\,$ @ 1.4V V_{CC}

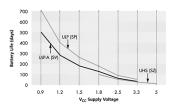
 $\pm 2 \text{ mA}$ @ 1.1V V_{CC} $\pm 0.1 \text{ mA}$ @ 0.9V V_{CC}

- Uses patented Quiet Series™ noise/EMI reduction
- Ultra small MicroPak™ leadfree package
- Ultra low Dynamic Power

Ordering Code:

Order Number Package		Product Code	Package Description	Supplied As
Order Number	Number	Top Mark	i ackage bescription	Supplied As
NC7SV57P6X	MAA06A	V57	6-Lead SC70, EIAJ SC88, 1.25mm Wide	3k Units on Tape and Reel
NC7SV57L6X	MAC06A	H3	6-Lead MicroPak, 1.0mm Wide	5k Units on Tape and Reel
NC7SV58P6X	MAA06A	V58	6-Lead SC70, EIAJ SC88, 1.25mm Wide	3k Units on Tape and Reel
NC7SV58L6X	MAC06A	H4	6-Lead MicroPak, 1.0mm Wide	5k Units on Tape and Reel

Battery Life vs. V_{CC} Supply Voltage



TinyLogic ULP and ULP-A with up to 50% less power consumption can extend your battery life significantly. Battery Life = $(V_{battery} *l_{battery} *.9)/(P_{device})/24hrs/day$

Where, $P_{\text{device}} = (I_{CC} * V_{CC}) + (C_{PD} + C_L) * V_{CC}^2 * f$

Assumes ideal 3.6V Lithium Ion battery with current rating of 900mAH and derated 90% and device frequency at 10MHz, with $\rm C_L=15~pF$ load

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Pin Descriptions

Pin Name	Description
l ₀ , l ₁ , l ₂	Data Inputs
Υ	Output

Function Table

	Inputs	;	NC7SV57	NC7SV58		
l ₂	I ₁	I ₀	$Y = (I_0) \bullet (I_2) + (I_1) \bullet (I_2)$	$Y = (I_0) \bullet (\bar{I}_2) + (\bar{I}_1) \bullet (I_2)$		
L	L	L	Н	L		
L	L	Н	L	Н		
L	Н	L	Н	L		
L	Н	Н	L	Н		
Н	L	L	L	Н		
Н	L	Н	L	Н		
Н	Н	L	Н	L		
Н	Н	Н	Н	L		

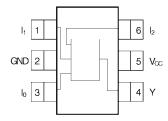
H = HIGH Logic Level L = LOW Logic Level

Function Selection Table

2-Input Logic Function	Device	Connection
2-input Logic Function	Selection	Configuration
2-Input AND	NC7SV57	Figure 1
2-Input AND with inverted input	NC7SV58	Figures 7, 8
2-Input AND with both inputs inverted	NC7SV57	Figure 4
2-Input NAND	NC7SV58	Figure 6
2-Input NAND with inverted input	NC7SV57	Figures 2, 3
2-Input NAND with both inputs inverted	NC7SV58	Figure 9
2-Input OR	NC7SV58	Figure 9
2-Input OR with inverted input	NC7SV57	Figures 2, 3
2-Input OR with both inputs inverted	NC7SV58	Figure 6
2-Input NOR	NC7SV57	Figure 4
2-Input NOR with inverted input	NC7SV58	Figures 7, 8
2-Input NOR with both inputs inverted	NC7SV57	Figure 1
2-Input XOR	NC7SV58	Figure 10
2-Input XNOR	NC7SV57	Figure 5

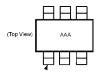
Connection Diagrams

Pin Assignments for SC70



(Top View)

Pin One Orientation Diagram

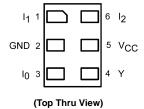


Pin One

AAA represents Product Code Top Mark - see ordering code

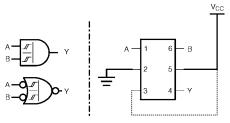
Note: Orientation of Top Mark determines Pin One location. Read the top
product code mark left to right, Pin One is the lower left pin (see diagram).

Pad Assignments for MicroPak



Logic Configurations NC7SV57

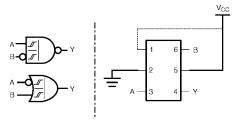
Figure 1 through Figure 5 show the logical functions that can be implemented using the NC7SV57. The diagrams show the DeMorgan's equivalent logic duals for a given 2-input function. Next to the logical implementation is the board level physical implementation of how the pins of the function should be connected.



A-O/// Y
B-O/// Y
A-1 6-B
2 5
3 4-Y

FIGURE 1. 2-Input AND Gate

FIGURE 2. 2-Input NAND with Inverted A Input



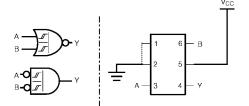


FIGURE 3. 2-Input NAND with Inverted B Input

FIGURE 4. 2-Input NOR Gate

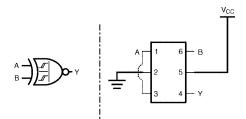
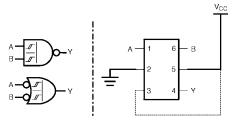


FIGURE 5. 2-Input XNOR Gate

Logic Configurations NC7SV58

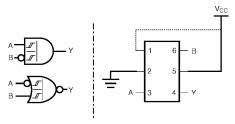
Figure 6 through Figure 10 show the logical functions that can be implemented using the NC7SV58. The diagrams show the DeMorgan's equivalent logic duals for a given 2-input function. Next to the logical implementation is the board level physical implementation of how the pins of the function should be connected.



A-O// Y
B-O// Y
B-O//

FIGURE 6. 2-Input NAND Gate

FIGURE 7. 2-Input AND with Inverted A Input



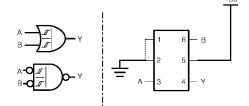


FIGURE 8. 2-Input AND with Inverted B Input

FIGURE 9. 2-Input OR Gate

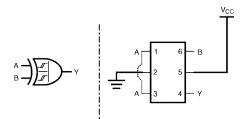


FIGURE 10. 2-Input XOR Gate

Absolute Maximum Ratings(Note 1)

 $\begin{array}{lll} \mbox{Supply Voltage (V$_{CC}$)} & -0.5 \mbox{V to } +4.6 \mbox{V} \\ \mbox{DC Input Voltage (V$_{IN}$)} & -0.5 \mbox{V to } +4.6 \mbox{V} \\ \end{array}$

DC Output Voltage (V_{OUT}) HIGH or LOW State (Note 2)

$$\label{eq:local_problem} \begin{split} & \text{HIGH or LOW State (Note 2)} & -0.5 \text{V to V}_{\text{CC}} + 0.5 \text{V} \\ & \text{V}_{\text{CC}} = 0 \text{V} & -0.5 \text{V to } + 4.6 \text{V} \\ & \text{DC Input Diode Current (I}_{\text{IK}}) \text{ V}_{\text{IN}} < 0 \text{V} & \pm 50 \text{ mA} \end{split}$$

DC Output Diode Current (I_{OK})

$$\label{eq:control_out} \begin{split} &V_{OUT} < 0V & -50 \text{ mA} \\ &V_{OUT} > V_{CC} & +50 \text{ mA} \\ &DC \text{ Output Source/Sink Current (I}_{OH}/I_{OL}) & \pm 50 \text{ mA} \end{split}$$

 $\operatorname{DC}\operatorname{V}_{\operatorname{CC}}$ or Ground Current per

Supply Pin (I_{CC} or Ground) \pm 50 mA Storage Temperature Range (T_{STG}) -65° C to +150 $^{\circ}$ C

Recommended Operating Conditions (Note 3)

Supply Voltage 0.9V to 3.6VInput Voltage (V_{IN}) 0V to 3.6V

Output Voltage (V_{OUT})

 $V_{CC} = 0.0V$ 0V to 3.6V HIGH or LOW State 0V to V_{CC}

Output Current in I_{OH}/I_{OL}

Free Air Operating Temperature (T_A) $-40^{\circ}C$ to $+85^{\circ}C$

Minimum Input Edge Rate (Δt/ΔV)

 $V_{IN} = 0.8V$ to 2.0V, $V_{CC} = 3.0V$ 10 ns/V

Note 1: Absolute Maximum Ratings: are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

Note 2: IO Absolute Maximum Rating must be observed.

Note 3: Unused inputs must be held HIGH or LOW. They may not float.

DC Electrical Characteristics

Symbol	Parameter	v _{cc}	T _A = -	+25°C	$T_A = -40^{\circ}C \text{ to } +85^{\circ}C$		Units	Conditions
Cymbol		(V)	Min	Max	Min	Max	Ullits	Conditions
V _P	Positive Threshold Voltage	0.90	0.3	0.7	0.3	0.7		
		1.10	0.4	1.0	0.4	1.0		
		1.40	0.5	1.4	0.5	1.4	V	
		1.65	0.7	1.5	0.7	1.5	v	
		2.30	1.0	1.8	1.0	1.8		
		2.70	1.3	2.2	1.3	2.2		
V _N	Negative Threshold Voltage	0.90	0.10	0.6	0.1	0.6		
		1.10	0.15	0.7	0.15	0.7		
		1.40	0.2	0.8	0.2	8.0	V	
		1.65	0.25	0.9	0.25	0.9	v	
		2.30	0.4	1.15	0.4	1.15		
		2.70	0.6	1.5	0.6	1.5		
V _H Hysteresis Voltage	Hysteresis Voltage	0.90	0.07	0.5	0.07	0.5		
		1.10	0.08	0.6	0.08	0.6		
		1.40	0.1	8.0	0.1	8.0	v	
		1.65	0.15	1.0	0.15	1.0	V	
		2.30	0.25	1.1	0.25	1.1		
		2.70	0.40	1.2	0.40	1.2		

DC Electrical Characteristics (Continued)

Cumbal	Parameter	V _{cc}	T _A = +	+25°C	$T_A = -40^{\circ}C \text{ to } +85^{\circ}C$		Units	Conditions
Symbol	Parameter	(V)	Min	Max	Min	Max	Units	Conditions
V _{OH}	HIGH Level	0.90	V _{CC} - 0.1		V _{CC} - 0.1			
	Output Voltage	$1.10 \le V_{CC} \le 1.30$	V _{CC} - 0.1		V _{CC} - 0.1			
		$1.40 \le V_{CC} \le 1.60$	V _{CC} - 0.2		V _{CC} - 0.2			1004
		$1.65 \le V_{CC} \le 1.95$	$V_{CC} - 0.2$		V _{CC} - 0.2			$I_{OH} = -100 \mu A$
		$2.30 \le V_{CC} < 2.70$	$V_{CC} - 0.2$		V _{CC} - 0.2			
		$2.70 \le V_{CC} \le 3.60$	$V_{CC} - 0.2$		V _{CC} - 0.2			
		$1.10 \le V_{CC} \le 1.30$	0.75 x V _{CC}		0.75 x V _{CC}			$I_{OH} = -2 \text{ mA}$
		$1.40 \le V_{CC} \le 1.60$	0.75 x V _{CC}		0.75 x V _{CC}		V	$I_{OH} = -4 \text{ mA}$
		$1.65 \le V_{CC} \le 1.95$	1.25		1.25			I _{OH} = -6 mA
		$2.30 \le V_{CC} < 2.70$	2.0		2.0			IOH = -0 IIIX
		$2.30 \le V_{CC} < 2.70$	1.8		1.8			I _{OH} = -12 mA
		$2.70 \leq V_{CC} \leq 3.60$	2.2		2.2			IOH = -12 IIIA
		$2.30 \le V_{CC} < 2.70$	1.7		1.7			I _{OH} = -18 mA
	$2.70 \leq V_{CC} \leq 3.60$	2.4		2.4			IOH = -10 IIIA	
	$2.70 \leq V_{CC} \leq 3.60$	2.2		2.2			$I_{OH} = -24 \text{ mA}$	
V _{OL}	LOW Level	0.90		0.1		0.1		
	Output Voltage	$1.10 \le V_{CC} \le 1.30$		0.1		0.1		
		$1.40 \le V_{CC} \le 1.60$		0.2		0.2		I _{OL} = 100 μA
		$1.65 \le V_{CC} \le 1.95$		0.2		0.2		10Ε = 100 μ/
		$2.30 \le V_{CC} < 2.70$		0.2		0.2		
		$2.70 \leq V_{CC} \leq 3.60$		0.2		0.2		
		$1.10 \le V_{CC} \le 1.30$		0.25 x V _{CC}		0.25 x V _{CC}	V	I _{OL} = 2 mA
		$1.40 \le V_{CC} \le 1.60$		0.25 x V _{CC}		0.25 x V _{CC}		$I_{OL} = 4 \text{ mA}$
		$1.65 \le V_{CC} \le 1.95$		0.3		0.3		$I_{OL} = 6 \text{ mA}$
		$2.30 \le V_{CC} < 2.70$		0.4		0.4		I _{OL} = 12 mA
		$2.70 \le V_{CC} \le 3.60$		0.4		0.4		10L 1211111
		$2.30 \le V_{CC} < 2.70$		0.6		0.6		I _{OL} = 18 mA
		$2.70 \le V_{CC} \le 3.60$		0.4		0.4		10L 1011111
		$2.70 \le V_{CC} \le 3.60$		0.55		0.55		I _{OL} = 24 mA
I _{IN}	Input Leakage Current	0.90 to 3.60		±0.1		±0.9	μА	$0 \le V_1 \le 3.6V$
l _{OFF}	Power Off Leakage Current	0		1		5	μΑ	$0 \le (V_I, V_O) \le 3.6V_O$
I _{CC}	Quiescent Supply Current	0.90 to 3.60		0.9		5	μА	$V_I = V_{CC}$ or GND
		0.90 to 3.60			_	±5	μι	$V_{CC} \le V_I \le 3.6V$

AC Electrical Characteristics

Symbol	Symbol Parameter	V _{CC}	T _A = +25°C		$T_A = -40^{\circ}C \text{ to } +85^{\circ}C$		Units	Conditions	Figure	
Symbol		(V)	Min	Тур	Max	Min	Max	Units	Conditions	Number
t _{PHL}	Propagation Delay	0.90		15					$C_L = 15 \text{ pF}, R_L = 1 \text{ M}\Omega$	
t _{PLH}		$1.10 \le V_{CC} \le 1.30$	4.0	8	16.5	3.3	31.0	.'	$C_L = 15 \text{ pF}, R_L = 2 \text{ k}\Omega$	
		$1.40 \le V_{CC} \le 1.60$	2.0	6	10.0	2.0	12.0	ns		Figures
		$1.65 \le V_{CC} \le 1.95$	2.0	4	9.1	1.9	10.0	115	C _L = 30 pF	11, 12
		$2.30 \leq V_{CC} < 2.70$	1.5	3.1	6.2	1.4	6.7		$R_L = 500\Omega$	
		$2.70 \leq V_{CC} \leq 3.60$	1.2	2.5	5.4	1.2	6.1			
C _{IN}	Input Capacitance	0		8.0				pF		
C _{OUT}	Output Capacitance	0		12.0				pF		
C _{PD}	Power Dissipation	0.90 to 3.60		10				pF	$V_I = 0V \text{ or } V_{CC}$	
	Capacitance	0.90 10 3.00		10				þΓ	f = 10 MHz	

AC Loading and Waveforms

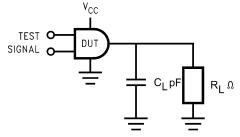


FIGURE 11. AC Test Circuit

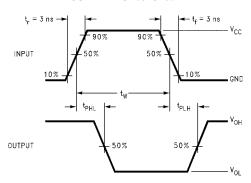


FIGURE 12. AC Waveforms

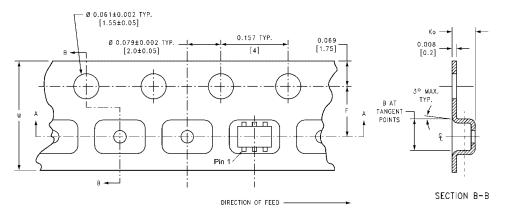
Symbol	V _{cc}								
- Cymbol	3.3V ± 0.3V	2.5V ± 0.2V	$1.8V \pm 0.15V$	1.5V ± 0.10V	1.2V ± 0.10V	0.9V			
V _{mi}	1.5V	V _{CC} /2							
V _{mo}	1.5V	V _{CC} /2							

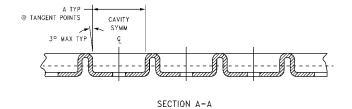
Tape and Reel Specification

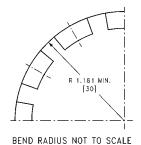
TAPE FORMAT for SC70

= . •								
Package	Tape	Number	Cavity	Cover Tape				
Designator	Section	Cavities	Status	Status				
	Leader (Start End)	125 (typ)	Empty	Sealed				
P6X	Carrier	3000	Filled	Sealed				
	Trailer (Hub End)	75 (typ)	Empty	Sealed				

TAPE DIMENSIONS inches (millimeters)







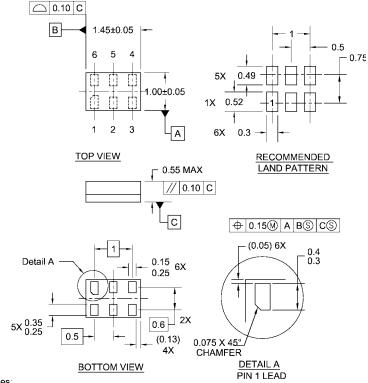
Package	MicroPak Ta	ре	1	Number	Cavity	Cover Tape
Designator		tion		Cavities	Status	Status
	Leader (S	Start End)		125 (typ)	Empty	Sealed
L6X	Car	rier		5000	Filled	Sealed
	Trailer (H	lub End)		75 (typ)	Empty	Sealed
APE DIMENSIONS	S inches (millimete	1.00	∕-ø1.50 ^{+0.1}	B ■	1.75±0.10	
00 +0.30 -0.10	Pin 1		0±0.05	B B B B B B B B B B B B B B B B B B B	3.50±0.05	SECTION B-B SCALE:10X
<u></u>	5° MAX	-1.60±0	0.05	- 0.254±0.020 - 0.70±0.05		
		<u>ON A-A</u> LE:10X				
EEL DIMENSION	S inches (millimete	rs)				
						→ → W ₁
	ļ					
				TAPE SLOT	С	N
		DET.	AIL X	SCAL	AIL X E: 3X	₩ ₃
Tape A Size	ВС	D	N	W1	W2	W3
7.0	0.059 0.512	0.795	2.165	0.331 + 0.059/-0.000	0.567	W1 + 0.078/-0.03
3 mm						

Physical Dimensions inches (millimeters) unless otherwise noted 0.65 B 1.25±0.10 2.10±0.10 0.20 +0.10 LAND PATTERN RECOMMENDATION ♦ max 0.1 **9** SEE DETAIL A 0.95±0.15 max 0.1 R0.14 GAGE PLANE R0.10 0.20 -- 0.425 NOMINAL DETAIL A NOTES: A. CONFORMS TO EIAJ REGISTERED OUTLINE DRAWING SC88. MAA06ARevC

- B. DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH.
- C. DIMENSIONS ARE IN MILLIMETERS.

6-Lead SC70, EIAJ SC88, 1.25mm Wide Package Number MAA06A

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



Notes:

- 1. JEDEC PACKAGE REGISTRATION IS ANTICIPATED 2. DIMENSIONS ARE IN MILLIMETERS
- 3. DRAWING CONFORMS TO ASME Y14.5M-1994

MAC06ARevB

6-Lead MicroPak, 1.0mm Wide Package Number MAC06A

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- 2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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