

October 2003 Revised March 2004

NC7WV04

TinyLogic® ULP-A Dual Inverter

General Description

The NC7WV04 is a dual inverter from Fairchild's Ultra Low Power-A (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 V_{CC}) and applications that require more drive and speed than the TinyLogic ULP series, but still offer best in class low power operation.

The NC7WV04 is uniquely designed for optimized power and speed, and is 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

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

1.8 ns typ for 2.3V to 2.7V V_{CC}

2.0 ns typ for 1.65V to 1.95V V_{CC}

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

6.0 ns typ for 1.1V to 1.3V V_{CC}

12 ns typ for 0.9V $V_{\rm CC}$

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

±24 mA @ 3.00V V_{CC}

±18 mA @ 2.30V V_{CC}

±6 mA @ 1.65V V_{CC}

±4 mA @ 1.4V V_{CC}

±2 mA @ 1.1V V_{CC}

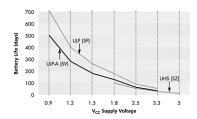
±0.1 mA @ 0.9V V_{CC}

- Uses patented Quiet Series[™] noise/EMI reduction
- Ultra small MicroPak™ leadfree package
- Ultra low dynamic power

Ordering Code:

Order Number	Package Number	Product Code Top Mark	Package Description	Supplied As	
NC7WV04P6X	MAA06A	V04	6-Lead SC70, EIAJ SC88, 1.25mm Wide	3k Units on Tape and Reel	
NC7WV04L6X	MAC06A	BA	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} *I_{battery}*.9)/(P_{device})/24hrs/day

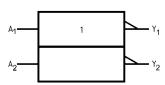
Where, $P_{device} = (I_{CC} * V_{CC}) + (C_{PD} + C_L) * V_{CC}^2 * f$

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

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Logic Symbol

IEEE/IEC



Pin Descriptions

Pin Names	Description		
A ₁ , A ₂	Data Inputs		
Y ₁ , Y ₂	Outputs		

Function Table

$\boldsymbol{Y}=\overline{\boldsymbol{A}}$

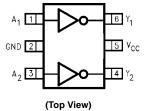
Input	Output
Α	Y
L	Н
Н	L

H = HIGH Logic Level

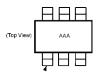
L = LOW Logic Level

Connection Diagrams

Pin Assignments for SC70



Pin One Orientation Diagram



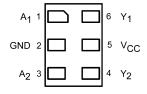
Pin One

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



(Top Thru View)

±24 mA

Absolute Maximum Ratings(Note 1)

DC Output Voltage (V_{OUT}) + 100

 $V_{CC} = 0V \\ DC \ Input \ Diode \ Current \ (I_{IK}) \ V_{IN} < 0V \\ \pm 50 \ mA$

DC Output Diode Current (I_{OK})

 $\begin{array}{lll} \rm V_{OUT} < 0V & -50~mA \\ & \rm V_{OUT} > V_{CC} & +50~mA \\ DC~Output~Source/Sink~Current~(I_{OH}/I_{OL}) & \pm~50~mA \\ \end{array}$

DC V_{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 3.6V Input Voltage (V_{IN}) 0V to 3.6V

Output Voltage (V_{OUT})

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

Output Current in I_{OH}/I_{OL} $V_{CC} = 3.0V$ to 3.6V

 $\begin{array}{lll} \mbox{V}_{CC} = 2.3 \mbox{V to } 2.7 \mbox{V} & \pm 18 \mbox{ mA} \\ \mbox{V}_{CC} = 1.65 \mbox{V to } 1.95 \mbox{V} & \pm 6 \mbox{ mA} \\ \mbox{V}_{CC} = 1.4 \mbox{V to } 1.6 \mbox{V} & \pm 4 \mbox{ mA} \\ \mbox{V}_{CC} = 1.1 \mbox{V to } 1.3 \mbox{V} & \pm 2 \mbox{ mA} \\ \end{array}$

 $V_{CC} = 0.9V \\ \mbox{Free Air Operating Temperature (T_A)} \\ \mbox{-40°C to +85°$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°0	C to +85°C	Units	Conditions
Symbol	raiailletei	(V)	Min	Max	Min	Max	Units	Conditions
V _{IH}	HIGH Level	0.90	0.65 x V _{CC}		0.65 x V _{CC}			
	Input Voltage	$1.10 \le V_{CC} \le 1.30$	0.65 x V _{CC}		0.65 x V _{CC}			
		$1.40 \le V_{CC} \le 1.60$	0.65 x V _{CC}		0.65 x V _{CC}		V	
		$1.65 \le V_{CC} \le 1.95$	0.65 x V _{CC}		0.65 x V _{CC}		v	
		$2.30 \le V_{CC} < 2.70$	1.6		1.6			
		$2.70 \le V_{CC} \le 3.60$	2.0		2.0			
V _{IL}	LOW Level	0.90		0.35 x V _{CC}		0.35 x V _{CC}		
	Input Voltage	$1.10 \le V_{CC} \le 1.30$		$0.35 \times V_{\rm CC}$		$0.35 \times V_{\rm CC}$		
		$1.40 \le V_{CC} \le 1.60$		$0.35 \times V_{\rm CC}$		$0.35 \times V_{\rm CC}$	V	
		$1.65 \le V_{CC} \le 1.95$		$0.35 \times V_{\rm CC}$		$0.35 \times V_{\rm CC}$	v	
		$2.30 \le V_{CC} < 2.70$		0.7		0.7		
		$2.70 \le V_{CC} \le 3.60$		0.8		0.8		
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			I _{OH} = -100 μA
		$1.65 \le V_{CC} \le 1.95$	$V_{CC} - 0.2$		V _{CC} - 0.2			ΙΟΗ = -100 μΑ
		$2.30 \le V_{CC} < 2.70$	$V_{CC} - 0.2$		V _{CC} - 0.2			
		$2.70 \le V_{CC} \le 3.60$	$V_{CC} - 0.2$		V _{CC} - 0.2			
		1.10 ≤ V _{CC} ≤ 1.30	0.75 x V _{CC}		0.75 x V _{CC}			I _{OH} = -2 mA
		1.40 ≤ V _{CC} ≤ 1.60	0.75 x V _{CC}		0.75 x V _{CC}		V	I _{OH} = -4 mA
		1.65 ≤ V _{CC} ≤ 1.95	1.25		1.25			I _{OH} = -6 mA
		$2.30 \le V_{CC} < 2.70$	2.0		2.0			IOHO IIIA
		$2.30 \le V_{CC} < 2.70$	1.8		1.8			I _{OH} = -12 mA
		$2.70 \le V_{CC} \le 3.60$	2.2		2.2			IOH 12 IIIA
		$2.30 \le V_{CC} < 2.70$	1.7		1.7		7	I _{OH} = -18 mA
		$2.70 \le V_{CC} \le 3.60$	2.4		2.4			IOH 10 IIIA
		$2.70 \le V_{CC} \le 3.60$	2.2		2.2			I _{OH} = -24 mA
	•	•						•

DC Electrical Characteristics (Continued)

Symbol	Parameter	V _{CC}	T _A =	+25°C	T _A = -40°	°C to +85°C	Units	Conditions
Symbol	Farameter	(V)	Min	Max	Min	Max	Units	Conditions
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 - 100 ··· A
		$1.65 \le V_{CC} \le 1.95$		0.2		0.2		$I_{OL} = 100 \mu A$
		$2.30 \le V_{CC} < 2.70$		0.2		0.2		
		$2.70 \le V_{CC} \le 3.60$		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}	v	I _{OL} = 4 mA
		$1.65 \le V_{CC} \le 1.95$		0.3		0.3		I _{OL} = 6 mA
		$2.30 \le V_{CC} < 2.70$		0.4		0.4		I _{OL} = 12 mA
		$2.70 \leq V_{CC} \leq 3.60$		0.4		0.4		IOL = 12 IIIA
		$2.30 \le V_{CC} < 2.70$		0.6		0.6		I _{OL} = 18 mA
		$2.70 \leq V_{CC} \leq 3.60$		0.4		0.4		10L = 10 IIIA
		$2.70 \le V_{CC} \le 3.60$		0.55		0.55		I _{OL} = 24 mA
I _{IN}	Input Leakage Current	0.90 to 3.60		±0.1		±0.5	μΑ	$0 \le V_I \le 3.6V$
I _{OFF}	Power Off Leakage Current	0		0.5		0.5	μΑ	$0 \le (V_I, V_O) \le 3.6V$
I _{CC}	Quiescent Supply Current	0.90 to 3.60		0.9		0.9	μА	$V_I = V_{CC}$ or GND
		0.90 to 3.60				±0.9	μΛ	$V_{CC} \le V_I \le 3.6V$

AC Electrical Characteristics

Symbol	Parameter	V _{cc}	$T_A = +25^{\circ}C$		$T_A = -40^{\circ}C \text{ to } +85^{\circ}C$		Units	Conditions	Figure	
Symbol Fara	Farameter	(V)	Min	Тур	Max	Min	Max	Units	Conditions	Number
t _{PHL}	Propagation Delay	0.90		12					$C_L = 15 \text{ pF}, R_L = 1 \text{ M}\Omega$	
t _{PLH}		$1.10 \le V_{CC} \le 1.30$	2.0	6	12.1	1.0	14.9		$C_L = 15 \text{ pF}, R_L = 2 \text{ k}\Omega$	
		$1.40 \leq V_{CC} \leq 1.60$	1.0	3.2	5.4	0.9	6.0	ns		Figures
		$1.65 \le V_{CC} \le 1.95$	1.0	2.0	4.6	0.7	5.2	115	C _L = 30 pF	1, 2
		$2.30 \le V_{CC} < 2.70$	0.8	1.8	3.6	0.6	3.8		$R_L = 500 \text{ k}\Omega$	
		$2.70 \leq V_{CC} \leq 3.60$	0.7	1.5	3.0	0.5	3.3			
C _{IN}	Input Capacitance	0		2.0				pF		
C _{OUT}	Output Capacitance	0		4.5				pF		
C _{PD}	Power Dissipation	0.90 to 3.60		10				pF	$V_I = 0V \text{ or } V_{CC}$	
	Capacitance	0.90 to 3.60		10				þΓ	f = 10 MHz	

AC Loading and Waveforms

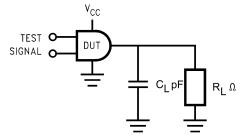


FIGURE 1. AC Test Circuit

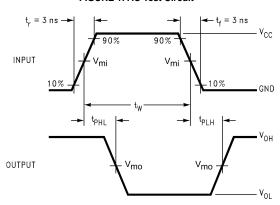


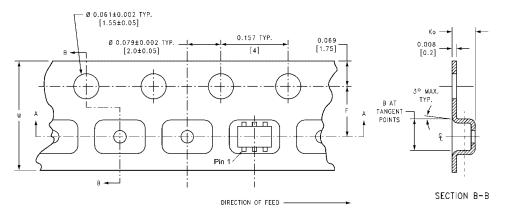
FIGURE 2. AC Waveforms

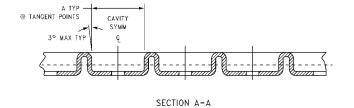
Symbol	V _{CC}								
- Cy	$3.3V \pm 0.3V$	$\textbf{2.5V} \pm \textbf{0.2V}$	1.8V \pm 0.15V	1.5V ± 0.10V	1.2V ± 0.10V	0.9V			
V _{mi}	1.5V	V _{CC} /2	V _{CC} /2	V _{CC} /2	V _{CC} /2	V _{CC} /2			
V _{mo}	1.5V	V _{CC} /2	V _{CC} /2	V _{CC} /2	V _{CC} /2	V _{CC} /2			

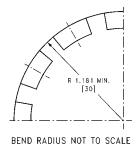
Tape and Reel Specification TAPE FORMAT for \$C70

1741 = 1 014111741 101 4	30.0			
Package	Таре	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)

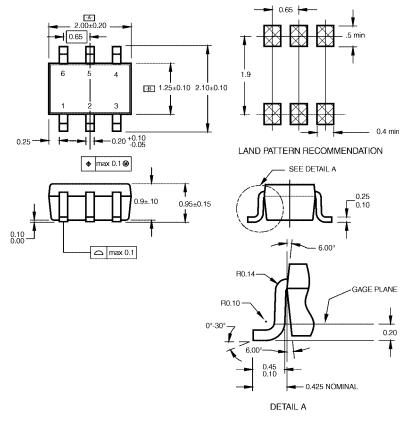






Package	Та	ре		Number	Cavity	Cover Tape
Designator	Sec			Cavities	Status	Status
	Leader (S			125 (typ)	Empty	Sealed
L6X	Car	rier		5000	Filled	Sealed
	Trailer (H	lub End)		75 (typ)	Empty	Sealed
APE DIMENSIONS	inches (millimeter	rs)	+0.1			•
2.00		Ø 0.5	Ø 1.50 +0.1 Ø 1.50 +0.1 Ø 1.50 ±0.05	B B B B B B B B B B B B B B B B B B B	1.75±0.10 A 3.50±0.05	5° MAX. 1.15±0.0 SECTION B-B SCALE:10X
EEL DIMENSIONS	SCA	ON A-A LE:10X	£0.05	- 0.254±0.020 - 0.70±0.05		
_						→ ← W ₁
				TAPE SLOT	C C	
	l	└ DET	AIL X		TAIL X LE: 3X	→ W ₃
Tape A Size	ВС	D	N	W1	W2	W3
7.0 3 mm (177.8)	0.059	0.795 (20.20)	2.165 (55.00)	0.331 + 0.059/-0.000 (8.40 + 1.50/-0.00)	0.567 (14.40)	W1 + 0.078/-0.03 (W1 + 2.00/-1.00

$\begin{picture}(200,0)\put(0,0){\line(1,0){100}} \put(0,0){\line(1,0){100}} \put(0,0){\line(1,0){100$



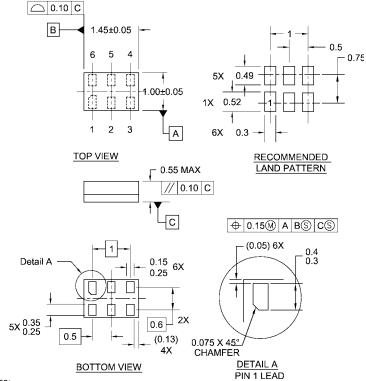
NOTES:

- A. CONFORMS TO EIAJ REGISTERED OUTLINE DRAWING SC88.
- B. DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH.
- C. DIMENSIONS ARE IN MILLIMETERS.

MAA06ARevC

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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