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# ON Semiconductor®

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September 2011

# NC7SV05 TinyLogic<sup>®</sup> ULP-A Inverter (Open-Drain Output)

#### **Features**

- 0.9V to 3.6V V<sub>CC</sub> Supply Operation
- 3.6V Over-Voltage Tolerant I/Os at Vcc from 0.9V to 3.6V
- Extremely High Speed tpd
  - 1.0ns: Typical for 2.7V to 3.6V V<sub>CC</sub>
  - 1.2ns: Typical for 2.3V to 2.7V V<sub>CC</sub>
  - 2.0ns: Typical for 1.65V to 1.95V V<sub>CC</sub>
  - 3.2ns: Typical for 1.4V to 1.6V V<sub>CC</sub>
  - 6.0ns: Typical for 1.1V to 1.3V  $V_{CC}$
  - 13.0ns: Typical for 0.9V V<sub>CC</sub>
- Power-Off High-Impedance Inputs and Outputs
- High Static Drive (I<sub>OH</sub>/I<sub>OL</sub>)
  - $\pm 24$ mA at 3.00V  $V_{CC}$
  - $\pm$ 18mA at 2.30V V<sub>CC</sub>
  - $\pm$ 6mA at 1.65V V<sub>CC</sub>
  - $\pm 4mA$  at 1.4V  $V_{CC}$
  - $\pm 2mA$  at 1.1V  $V_{CC}$
  - $\pm 0.1$ mA at 0.9V V<sub>CC</sub>
- Uses Proprietary Quiet Series<sup>™</sup> Noise/EMI Reduction Circuitry
- Ultra-Small MicroPak™ Packages
- Ultra-Low Dynamic Power

## **Description**

The NC7SV05 is a single inverter with open-drain output 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  $V_{\rm CC}$ ) and applications that require more drive and speed than the TinyLogic® ULP series, but still offer best-in-class, low-power operation.

The NC7SV05 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.

## **Ordering Information**

Part Number	Top Mark	Package	Packing Method
NC7SV05P5X	V05	5-Lead SC70, EIAJ SC-88a, 1.25mm Wide	3000 Units on Tape & Reel
NC7SV05L6X	F9	6-Lead MicroPak™, 1.00mm Wide	5000 Units on Tape & Reel
NC7SV05FHX	F9	6-Lead, MicroPak2, 1x1mm Body, .35mm Pitch	5000 Units on Tape & Reel

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MicroPak™ and Quiet Series™ are trademarks of Fairchild Semiconductor Corporation.

# **Battery Life**

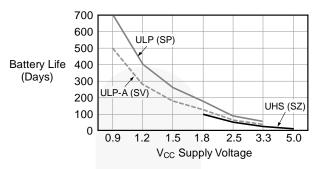


Figure 1. Battery Life vs. V<sub>CC</sub> Supply Voltage

#### Notes:

- 1. TinyLogic<sup>®</sup> ULP and ULP-A with up to 50% less power consumption can extend battery life significantly. Battery Life = (V<sub>battery</sub>•l<sub>battery</sub>•9)/(P<sub>device</sub>)/24hrs/day
  where P<sub>very</sub> = (log•V<sub>oo</sub>) + (Crop+C<sub>i</sub>)•V<sub>oo</sub>• f
- where, P<sub>device</sub> = (I<sub>CC</sub> V<sub>CC</sub>) + (C<sub>PD</sub> + C<sub>L</sub>) V<sub>CC2</sub> f.

  2. Assumes ideal 3.6V Lithium Ion battery with current rating of 900mAH and derated 90% and device frequency at 10MHz, with C<sub>L</sub>=15pF load.

# **Connection Diagram**

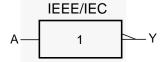
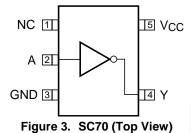


Figure 2. Logic Symbol

# **Pin Configurations**



NC 1 6 VCC
A 2 5 NC
GND 3 4 Y

Figure 4. MicroPak (Top Through View)

## **Pin Definitions**

Pin # SC70	Pin # MicroPak	Name	Description
1	1, 5	NC	No Connect
2	2	A	Input
3	3	GND	Ground
4	4	Υ	Output
5	6	V <sub>cc</sub>	Supply Voltage

# **Function Table**

Inputs	Output
A	Y
L	*H
Н	L

H=HIGH Logic Level

L=LOW Logic Level

\*H=HIGH Impedance Output Status (Open Drain)

# **Absolute Maximum Ratings**

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Par	Parameter			Unit
V <sub>CC</sub>	Supply Voltage		-0.5	4.6	V
V <sub>IN</sub>	DC Input Voltage		-0.5	4.6	V
$V_{OUT}$	DC Output Voltage		-0.5	4.6	V
I <sub>IK</sub>	DC Input Diode Current	V <sub>IN</sub> < 0V		-50	mA
I <sub>OK</sub>	DC Output Diode Current	V <sub>OUT</sub> < 0V		-50	mA
I <sub>OL</sub>	DC Output Sink Current		+50	mA	
I <sub>CC</sub> or I <sub>GND</sub>	DC V <sub>CC</sub> or Ground Current per		±50	mA	
T <sub>STG</sub>	Storage Temperature Range		-65	+150	°C
TJ	Junction Temperature Under E	Bias		+150	°C
TL	Junction Lead Temperature, S	oldering 10 Seconds		+260	°C
		SC70-5		150	
$P_D$	Power Dissipation at +85°C	MicroPak-6		130	mW
		MicroPak2-6		120	
ESD	Human Body Model, JEDEC:JESD22-A114			4000	V
ESD	Charge Device Model, JEDEC	:JESD22-C101		2000	]

# **Recommended Operating Conditions**

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. Fairchild does not recommend exceeding them or designing to Absolute Maximum Ratings.

Symbol	Parameter	Conditions	Min.	Max.	Unit	
V <sub>CC</sub>	Supply Voltage		0.9	3.6	V	
V <sub>IN</sub>	Input Voltage		0	3.6	V	
$V_{OUT}$	Output Voltage		0	3.6	V	
		V <sub>CC</sub> =3.0V to 3.6V		+24.0		
		V <sub>CC</sub> =2.3V to 3.6V		+18.0		
	Output Current in I	V <sub>CC</sub> =1.65V to 1.95V		+6.0	mA	
I <sub>OL</sub>	Output Current in I <sub>OL</sub>	V <sub>CC</sub> =1.4V to 1.6V		+4.0		
		V <sub>CC</sub> =1.1V to 1.3V		+2.0		
		V <sub>CC</sub> =0.9V		+0.1	$\supset 1$	
$T_A$	Operating Temperature, Free Air		-40	+85	°C	
Δt/ΔV	Minimum Input Edge Rate	$V_{IN}$ =0.8V to 2.0, $V_{CC}$ =3.0V		10	ns/V	
		SC70-5		425	°C/W	
$\theta_{\sf JA}$	Thermal Resistance	MicroPak-6		500		
		MicroPak2-6		560	1	

#### Note:

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

# **DC Electrical Characteristics**

0	D	.,	0	T <sub>A</sub> =2	25°C	T <sub>A</sub> =-40	to 85°C	Units
Symbol	Parameter	V <sub>cc</sub>	Conditions	Min.	Max.	Min.	Max.	Units
		0.90		.65 x V <sub>CC</sub>		.65 x V <sub>CC</sub>		
		1.10 ≤ V <sub>CC</sub> ≤ 1.30		.65 x V <sub>CC</sub>		.65 x V <sub>CC</sub>		
.,	HIGH Level Input	$1.40 \le V_{CC} \le 1.60$		.65 x V <sub>CC</sub>		.65 x V <sub>CC</sub>		l
$V_{IH}$	Voltage	$1.65 \leq V_{CC} \leq 1.95$		.65 x V <sub>CC</sub>		.65 x V <sub>CC</sub>		V
		$2.30 \leq V_{CC} \leq 2.70$		1.6		1.6		
		$2.70 \leq V_{CC} \leq 3.60$		2.0		2.0		
		0.90			.35 x V <sub>CC</sub>		.35 x V <sub>CC</sub>	
		$1.10 \le V_{CC} \le 1.30$			.35 x V <sub>CC</sub>		.35 x V <sub>CC</sub>	
	LOW Level Input	$1.40 \leq V_{CC} \leq 1.60$			.35 x V <sub>CC</sub>		.35 x V <sub>CC</sub>	.,
$V_{IL}$	Voltage	$1.65 \leq V_{CC} \leq 1.95$			.35 x V <sub>CC</sub>		.35 x V <sub>CC</sub>	V
		$2.30 \leq V_{CC} \leq 2.70$			0.7		0.7	
		$2.70 \leq V_{CC} \leq 3.60$			0.8		0.8	
		0.90			0.1		0.1	
		$1.10 \le V_{CC} \le 1.30$	- I <sub>OL</sub> =100μA		0.1		0.1	
		$1.40 \le V_{CC} \le 1.60$			0.2		0.2	
		$1.65 \le V_{CC} \le 1.95$			0.2	\	0.2	
		$2.30 \leq V_{CC} \leq 2.70$			0.2		0.2	
	1	$2.70 \leq V_{CC} \leq 3.60$			0.2		0.2	
.,	LOW Level Output	$1.10 \le V_{CC} \le 1.30$	I <sub>OL</sub> =2mA		0.25 x V <sub>CC</sub>		0.25 x V <sub>CC</sub>	V
$V_{OL}$	Voltage	$1.40 \le V_{CC} \le 1.60$	I <sub>OL</sub> =4mA		0.25 x V <sub>CC</sub>		0.25 x V <sub>CC</sub>	
		$1.65 \le V_{CC} \le 1.95$	I <sub>OL</sub> =6mA		0.3		0.3	
		$2.30 \leq V_{CC} \leq 2.70$			0.4		0.4	
		$2.70 \leq V_{CC} \leq 3.60$	I <sub>OL</sub> =12mA		0.4		0.4	
		2.30≤ V <sub>CC</sub> ≤ 2.70	101		0.6		0.6	
		$2.70 \leq V_{CC} \leq 3.60$	I <sub>OL</sub> =18mA		0.4		0.4	
		$2.70 \leq V_{CC} \leq 3.60$	I <sub>OL</sub> =24mA		0.55	A	0.55	
I <sub>IN</sub>	Input Leakage Current	0.90 to 3.60	$0 \leq V_{IN} \leq 3.60$		±0.1		±0.5	μΑ
I <sub>OFF</sub>	Power Off Leakage Current	0	$\begin{array}{l} 0 \leq \left(V_{\text{IN},}  V_{\text{O}}\right) \\ \leq 3.60 \end{array}$		0.5		0.5	μΑ
	Quiescent Supply	0.00 to 2.60	V <sub>IN</sub> =V <sub>CC</sub> , or GND		0.9		0.9	^
I <sub>CC</sub>	Current	0.90 to 3.60	$V_{CC} \le V_{IN} \le 3.6V$				±0.9	μA

# **AC Electrical Characteristics**

Symbol	Parameter	V	Conditions		T <sub>A</sub> =25°(	2	T <sub>A</sub> =-40	to 85°C	Units	Figure
Symbol	Parameter	V <sub>cc</sub>	Conditions	Min.	Тур.	Max.	Min.	Max.	Units	Figure
		0.90	$C_L=15pF$ , $R_U=R_D=1k\Omega$		13					
		$1.10 \le V_{CC} \le 1.30$	C <sub>L</sub> =30pF,	3.0	6.0	15.0	1.0	18.6		
t <sub>PZL</sub> , t <sub>PLZ</sub>	Propagation Delay	$1.40 \le V_{CC} \le 1.60$	$R_U=R_D=1k\Omega$	1.0	3.2	8.7	1.0	9.7	ns	Figure 5 Figure 6
	Delay	$1.65 \leq V_{CC} \leq 1.95$		1.0	2.0	6.0	1.0	6.8		Figure 6
		$2.30 \leq V_{CC} \leq 2.70$	$C_L=30pF$ , $R_U=R_D=1k\Omega$	0.8	1.2	3.6	0.7	4.7		
		$2.70 \leq V_{CC} \leq 3.60$	110 115 1111	0.7	1.0	3.3	0.6	4.0		
C <sub>IN</sub>	Input Capacitance	0			2				pF	
C <sub>PD</sub>	Power Dissipation Capacitance	0.90 to 3.60	V <sub>IN</sub> =0V or V <sub>CC</sub> , f=10MHz		10				pF	

# **AC Loadings and Waveforms**

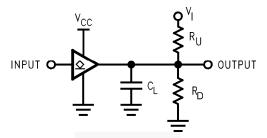


Figure 5. AC Test Circuit

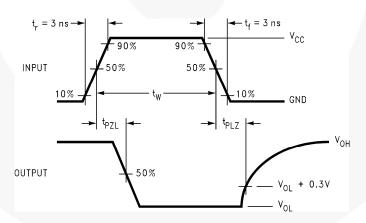


Figure 6. AC Waveforms for Inverting and Non-Inverting Functions

		V <sub>cc</sub>					
Symbol	3.3V ± 0.3V	2.5V ± 0.2V	1.8V ± 0.15V	1.5V ± 0.1V	1.2V ± 0.1V	0.9V	
$V_{mi}$	1.5V	V <sub>CC</sub> /2					
$V_{mo}$	V <sub>OL</sub> + 0.30V	V <sub>OL</sub> + 0.15V	V <sub>OL</sub> + 0.15V	V <sub>OL</sub> + 0.10V	V <sub>OL</sub> + 0.10V	V <sub>OL</sub> + 0.10V	

# **Physical Dimensions**

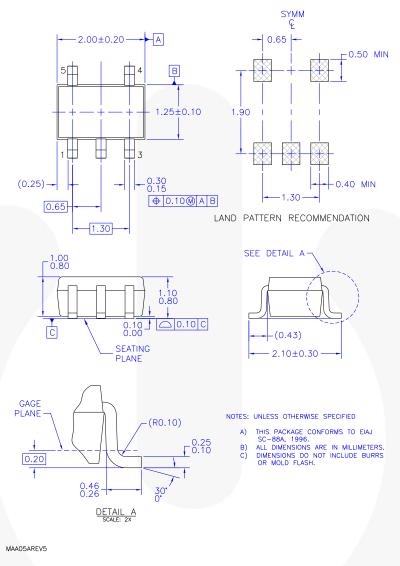


Figure 7. 5-Lead, SC70, EIAJ SC-88a, 1.25mm Wide

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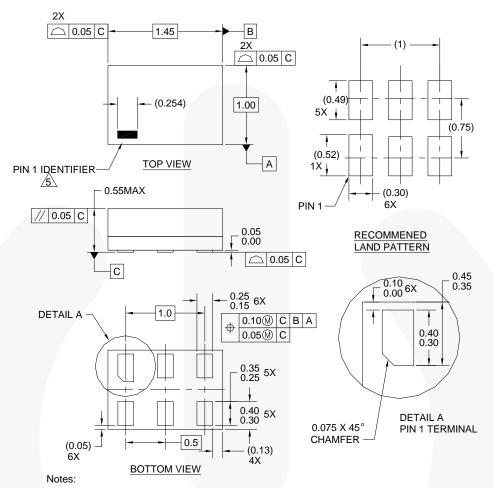
Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings: <a href="http://www.fairchildsemi.com/packaging/">http://www.fairchildsemi.com/packaging/</a>.

## **Tape and Reel Specification**

Please visit Fairchild Semiconductor's online packaging area for the most recent tape and reel specifications: <a href="http://www.fairchildsemi.com/products/analog/pdf/sc70-5">http://www.fairchildsemi.com/products/analog/pdf/sc70-5</a> tr.pdf.

Package Designator	Tape Section	<b>Cavity Number</b>	Cavity Status	Cover Type Status
	Leader (Start End)	125 (Typical)	Empty	Sealed
P5X	Carrier	3000	Filled	Sealed
	Trailer (Hub End)	75 (Typical)	Empty	Sealed

# **Physical Dimensions**



- 1. CONFORMS TO JEDEC STANDARD M0-252 VARIATION UAAD
- 2. DIMENSIONS ARE IN MILLIMETERS
- 3. DRAWING CONFORMS TO ASME Y14.5M-1994 4. FILENAME AND REVISION: MAC06AREV4
- 5. PIN ONE IDENTIFIER IS 2X LENGTH OF ANY OTHER LINE IN THE MARK CODE LAYOUT.

Figure 8. 6-Lead, MicroPak™, 1.0mm Wide

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Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings: http://www.fairchildsemi.com/packaging/.

#### **Tape and Reel Specification**

Please visit Fairchild Semiconductor's online packaging area for the most recent tape and reel specifications: http://www.fairchildsemi.com/products/logic/pdf/micropak\_tr.pdf.

Package Designator	Tape Section	Cavity Number	<b>Cavity Status</b>	Cover Type Status
	Leader (Start End)	125 (Typical)	Empty	Sealed
L6X	Carrier	5000	Filled	Sealed
	Trailer (Hub End)	75 (Typical)	Empty	Sealed

#### **Physical Dimensions** 0.89 ○ 0.05 C 0.35 В 1.00 5X 0.40 PIN 1 0.66 MIN 250uM 1.00 1X 0.45 6X 0 19 ○ 0.05 C TOP VIEW RECOMMENDED LAND PATTERN 2X FOR SPACE CONSTRAINED PCB // 0.05 C 0.55MAX С 5X 0 52 SIDE VIEW 0.73 (0.08) 4X 1X 0.57 0.09 0.19 6X DETAIL A 2 - 0.20 6X ALTERNATIVE LAND PATTERN FOR UNIVERSAL APPLICATION (0.05) 6X5X 0.35 0.25 0.60 0.10M C B A Ф 0.40 (0.08).05 C 0.30 4X **BOTTOM VIEW** NOTES: A. COMPLIES TO JEDEC MO-252 STANDARD B. DIMENSIONS ARE IN MILLIMETERS.

Figure 9. 6-Lead, MicroPak2, 1x1mm Body, .35mm Pitch

0.075X45°

CHAMFER

**DETAIL A** 

PIN 1 LEAD SCALE: 2X

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C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994

D. LANDPATTERN RECOMMENDATION IS BASED ON FSC

E. DRAWING FILENAME AND REVISION: MGF06AREV3

#### **Tape and Reel Specification**

DESIGN

Please visit Fairchild Semiconductor's online packaging area for the most recent tape and reel specifications: http://www.fairchildsemi.com/packaging/MicroPAK2 6L tr.pdf.

Package Designator	Tape Section	Cavity Number	<b>Cavity Status</b>	Cover Type Status	
	Leader (Start End)	125 (Typical)	Empty	Sealed	
FHX	Carrier	5000	Filled	Sealed	
	Trailer (Hub End)	75 (Typical)	Empty	Sealed	





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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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#### PRODUCT STATUS DEFINITIONS

#### Definition of Torm

Datasheet Identification	Product Status	Definition
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