ON Semiconductor

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TinyLogic ULP-A Inverter (Open-Drain Output)

NC7SP05

The NC7SP05 is a single inverter with open-drain output in tiny footprint packages. The device is designed to operate for $V_{CC} = 0.9 \text{ V}$ to 3.6 V.

Features

- Designed for 0.9 V to 3.6 V V_{CC} Operation
- 3.2 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 2.6 mA at 3.3 V
- Available in SC−88A and MicroPak[™] Packages
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

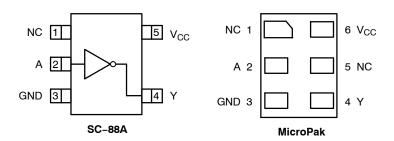


Figure 1. Pinout Diagrams (Top Views)



Figure 2. Logic Symbol

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MARKING DIAGRAMS



SIP6 1.45X1.0 **MicroPak** CASE 127EB



CC = Specific Device Code

= 2-Digit Lot Run Traceability Code ΚK

XY = 2-Digit Date Code = Assembly Plant Code



SC-88A CASE 419A-02



XXX = Specific Device Code

= Date Code

= Pb-Free Package

ORDERING INFORMATION

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

PIN ASSIGNMENT

Pin	SC88A	MicroPak
1	N.C. N.C.	
2	Α	Α
3	GND	GND
4	Υ	Υ
5	V _{CC}	N.C.
6	-	V _{CC}

N.C. = No Connect

FUNCTION TABLE

Input	Output
A	Υ
L	Z
Н	L

H = HIGH Logic Level

L = LOW Logic Level

Z = High-Impedance State

MAXIMUM RATINGS

Symbol	Cha	racteristics	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
l _{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
TJ	Junction Temperature Under Bias		+150	°C
$\theta_{\sf JA}$	Thermal Resistance (Note 2)	SC-88A MicroPak	377 154	°C/W
P _D	Power Dissipation in Still Air	SC-88A MicroPak	332 812	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.

- Applicable to devices with outputs that may be tri-stated.
 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.
 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.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter		Min	Max	Unit
V _{CC}	Positive DC Supply Voltage		0.9	3.6	V
V _{IN}	DC Input Voltage		0	3.6	٧
V _{OUT}	DC Output Voltage	Active–Mode (High or Low State) Tri–State Mode (Note 1) Power–Down Mode ($V_{CC} = 0 \text{ V}$)	0 0 0	V _{CC} 3.6 3.6	
T _A	Operating Temperature Range		-40	+85	°C
t _r , t _f	Input Transition Rise and Fall Time	$V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$	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.

DC ELECTRICAL CHARACTERISTICS

				T,	A = 25°	С	$T_A = -40^{\circ}C \text{ to } +85^{\circ}C$		
Symbol	Parameter	Condition	V _{CC} (V)	Min	Тур	Max	Min	Max	Unit
V _{IH}	High-Level Input		0.9	_	0.5	-	-	_	V
	Voltage		1.1 to 1.3	0.65 x V _{CC}	_	-	0.65 x V _{CC}	_	
			1.4 to 1.6	0.65 x V _{CC}	-	-	0.65 x V _{CC}	-	
			1.65 to 1.95	0.65 x V _{CC}	_	-	0.65 x V _{CC}	_	
			2.3 to 2.7	1.6	-	-	1.6	-	
			3.0 to 3.6	2.1	_	-	2.1	-	
V _{IL}	Low-Level Input		0.9	-	0.5	_	-	_	V
	Voltage		1.1 to 1.3	-	-	0.35 x V _{CC}	-	0.35 x V _{CC}	
			1.4 to 1.6	-	_	0.35 x V _{CC}	-	0.35 x V _{CC}	
			1.65 to 1.95	-	_	0.35 x V _{CC}	-	0.35 x V _{CC}	
			2.3 to 2.7	-	-	0.7	-	0.7	
			3.0 to 3.6	-	_	0.9	-	0.9	
V _{OL}	Low-Level Output	$V_{IN} = V_{IH}$ or V_{IL}							V
	Voltage	I _{OL} = 20 μA	0.9	-	0.1	-	-	-	
			1.1 to 1.3	_	_	0.1	-	0.1	
			1.4 to 1.6	-	_	0.1	-	0.1	
			1.65 to 1.95	_	_	0.1	-	0.1	
			2.3 to 2.7	_	_	0.1	-	0.1	
			3.0 to 3.6	-	_	0.1	-	0.1	
		I _{OL} = 0.5 mA	1.1 to 1.3	-	_	0.3 x V _{CC}	-	0.3 x V _{CC}	
		I _{OL} = 1 mA	1.4 to 1.6	-	_	0.31	-	0.37	
		I _{OL} = 1.5 mA	1.65 to 1.95	-	_	0.31	-	0.35	
		I _{OL} = 2.1 mA	2.3 to 2.7	_	-	0.31	-	0.33	
		I _{OL} = 2.6 mA	3.0 to 3.6	-	-	0.31	-	0.33	
I _{IN}	Input Leakage Current	V _{IN} = 0 V to 3.6 V	0.9 to 3.6	-	_	±0.1	-	±0.5	μΑ
I _{OZ}	3-State Output Leakage Current	$V_{IN} = V_{IH}$ or V_{IL} $V_{OUT} = 0$ V to 3.6 V	0.9 to 3.6	-	-	±0.5	-	±0.5	μΑ
I _{OFF}	Power Off Leakage Current	V _{IN} = 0 V to 3.6 V or V _{OUT} = 0 V to 3.6 V	0	-	_	0.5	-	0.5	μΑ
Icc	Quiescent Supply Current	V _{IN} = V _{CC} or GND	0.9 to 3.6	-	-	0.9	-	0.9	μА

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.

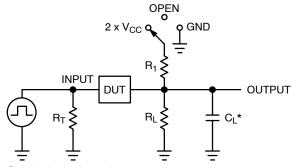
AC ELECTRICAL CHARACTERISTICS

				T _A = 25°C			$T_A = -40^{\circ}C \text{ to } +85^{\circ}C$		
Symbol	Parameter	Condition	V _{CC} (V)	Min	Тур	Max	Min	Max	Unit
t_{PZL} , t_{PLZ}	Propagation Delay,	$C_L = 10 \text{ pF}$	0.9	-	32.1	-	-	-	ns
	A to Y (Figures 3 and 4)		1.10 to 1.30	-	9.6	25.9	-	30.9	
	,		1.40 to 1.60	-	5.4	12.4	-	13.9	
			1.65 to 1.95	-	4.4	9.6	-	12.1	
			2.3 to 2.7	-	3.4	9.0	-	10.0	
			3.0 to 3.6	-	3.2	8.7	-	9.0	
		R1 = R_L = 5 k Ω , C_L = 15 pF	0.9	-	33.6	-	_	-	ns
			1.10 to 1.30	-	10.4	27.2	-	33.9	
			1.40 to 1.60	-	6.0	13.3	_	16.0	
			1.65 to 1.95	-	5.0	10.3	-	12.6	
			2.3 to 2.7	-	4.0	9.4	-	10.2	
			3.0 to 3.6	-	3.8	9.1	-	9.7	
		$R1 = R_L = 5 k\Omega$	0.9	-	39.1	-	_	-	ns
		$C_L = 30 \text{ pF}$	1.10 to 1.30	-	12.7	31.0	-	43.0	
			1.40 to 1.60	-	7.9	16.0	-	18.0	
			1.65 to 1.95	-	7.0	12.0	_	14.0	1
			2.3 to 2.7	-	5.9	11.0	_	12.0	
			3.0 to 3.6	-	5.5	10.6	-	11.0	1

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	4.0	pF
C _{PD}	Power Dissipation Capacitance (Note 5)	$f = 10 \text{ MHz}, V_{CC} = 0.9 \text{ to } 3.6 \text{ V}, V_{IN} = 0 \text{ V or } V_{CC}$	6.0	pF

^{5.} C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation I_{CC(OPR)} = C_{PD} • V_{CC} • f_{in} + I_{CC}. C_{PD} is used to determine the no–load dynamic power consumption: P_D = C_{PD} • V_{CC}² • f_{in} + I_{CC} • V_{CC}.



-	<u>+</u>		-	=
=	=		=	=
C _L includes	s probe and	jig capa	citance	
R _T is Z _{OUT}	of pulse ge	nerator	(typically	50 Ω)
f = 1 MHz				

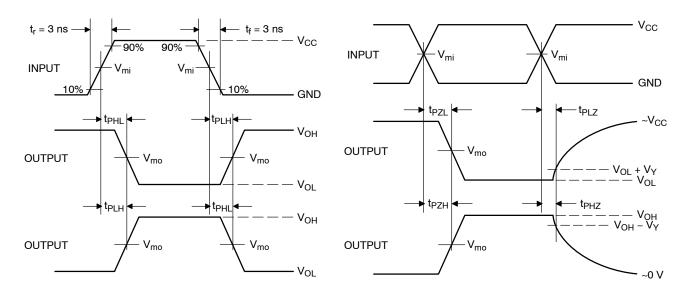
 Test
 Switch Position

 t_{PLH} / t_{PHL}
 Open

 t_{PLZ} / t_{PZL}
 2 x V_{CC}

 t_{PHZ} / t_{PZH}
 GND

Figure 3. Test Circuit



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

Figure 4. Switching Waveforms

ORDERING INFORMATION

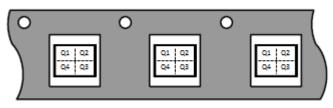
Device	Package	Marking	Pin 1 Orientation (See below)	Shipping [†]
NC7SP05P5X	SC-88A	P05	Q4	3000 / Tape & Reel
NC7SP05L6X	MicroPak	J7	Q4	5000 / Tape & Reel

[†]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.

Pin 1 Orientation in Tape and Reel

Direction of Feed

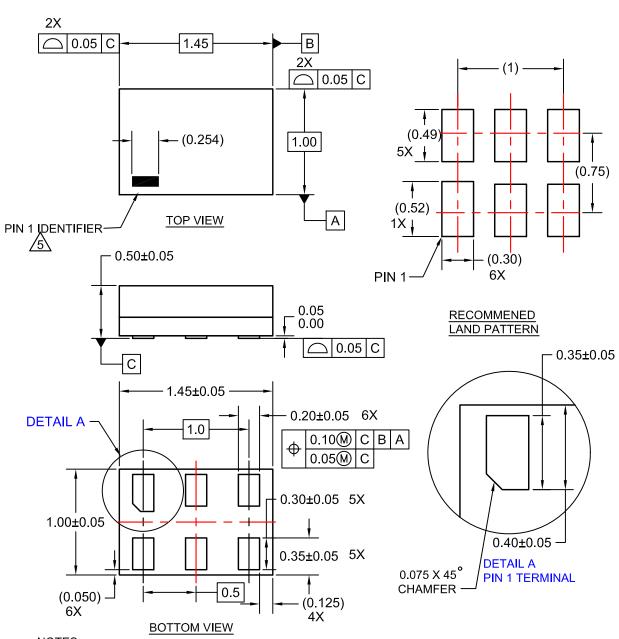




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PACKAGE DIMENSIONS

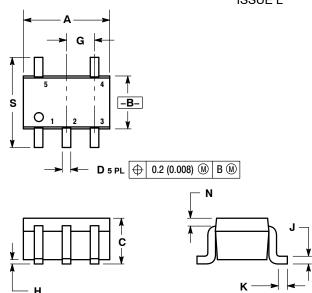
SIP6 1.45X1.0 CASE 127EB ISSUE O



- NOTES:
- 1. CONFORMS TO JEDEC STANDARD MO-252 VARIATION UAAD
- 2. DIMENSIONS ARE IN MILLIMETERS
- 3. DRAWING CONFORMS TO ASME Y14.5M-2009
- 4. PIN ONE IDENTIFIER IS 2X LENGTH OF ANY
 - OTHER LINE IN THE MARK CODE LAYOUT.

PACKAGE DIMENSIONS

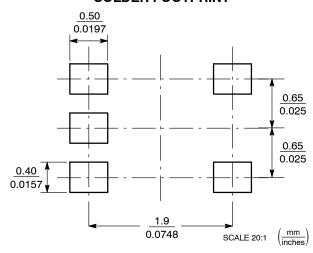
SC-88A (SC-70-5/SOT-353) CASE 419A-02 **ISSUE L**



- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 CONTROLLING DIMENSION: INCH.
- 419A-01 OBSOLETE. NEW STANDARD 419A-02
- DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE

	INC	HES	MILLIN	IETERS
DIM	MIN	MAX	MIN	MAX
Α	0.071	0.087	1.80	2.20
В	0.045	0.053	1.15	1.35
С	0.031	0.043	0.80	1.10
D	0.004	0.012	0.10	0.30
G	0.026	BSC	0.65 BSC	
Н		0.004		0.10
J	0.004	0.010	0.10	0.25
K	0.004	0.012	0.10	0.30
N	0.008 REF		0.20	REF
S	0.079	0.087	2.00	2.20

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