

NC7SU04

TinyLogic HS Unbuffered Inverter

Description

The NC7SU04 is a single special purpose CMOS Inverter. The inverter circuit is designed with a single unbuffered stage to facilitate use in crystal oscillator applications. It is not intended for use in logic inversion applications.

Advanced Silicon Gate CMOS fabrication assures high speed and low power circuit operation over a broad V_{CC} range. ESD protection diodes inherently guard both input and output with respect to the V_{CC} and GND rails.

Features

- Space Saving SC-74A and SC-88A 5-Lead Package
- Ultra Small MicroPak™ Leadless Package
- Unbuffered for Crystal Oscillator Applications
- Low Quiescent Power: $I_{CC} < 1 \mu A$
- Balanced Output Drive: 2 mA I_{OL} , -2 mA I_{OH}
- Broad V_{CC} Operating Range: 2 V – 6 V
- Balanced Propagation Delays
- Specified for 3 V Operation
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

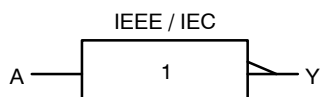


Figure 1. Logic Symbol



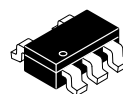
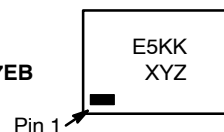
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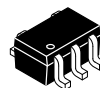
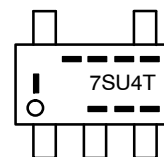
MARKING DIAGRAMS



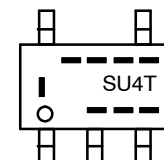
SIP6
CASE 127EB



SC-74A
CASE 318BQ



SC-88A
CASE 419A-02



E5, 7SU4, SU4 = Specific Device Code
KK = 2-Digit Lot Run Traceability Code
XY = 2-Digit Date Code Format
Z = Assembly Plant Code
T = Die Run Code
---- = Year Coding Scheme
I-- = Plant Code Identifier
--- = Eight-Week Datacoding Scheme

ORDERING INFORMATION

See detailed ordering, marking and shipping information in the package dimensions section on page 5 of this data sheet.

Pin Configurations

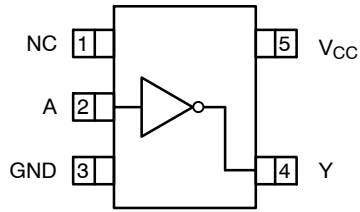


Figure 2. SC-88A and SC-74A (Top View)

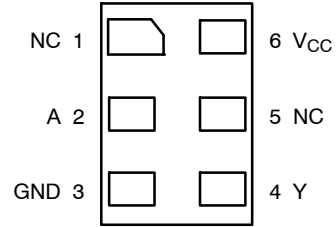


Figure 3. MicroPak (Top Through View)

PIN DESCRIPTIONS

Pin Name	Description
A	Input
Y	Output
NC	No Connect

FUNCTION TABLE ($Y = \bar{A}$)

Inputs	Output
A	Y
L	H
H	L

H = HIGH Logic Level
L = LOW Logic Level

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter		Min	Max	Unit
V_{CC}	Supply Voltage		-0.5	6.5	V
I_{IK}	DC Input Diode Current	$V_{IN} \leq -0.5 \text{ V}$	-	-20	mA
		$V_{IN} \geq V_{CC} + 0.5 \text{ V}$	-	+20	
V_{IN}	DC Input Voltage		-0.5	$V_{CC} + 0.5$	V
I_{OK}	DC Output Diode Current	$V_{OUT} < -0.5 \text{ V}$	-	-20	mA
		$V_{OUT} > V_{CC} + 0.5 \text{ V}$	-	+20	
V_{OUT}	DC Output Voltage		-0.5	$V_{CC} + 0.5$	V
I_{OUT}	DC Output Source or Sink Current		-	± 12.5	mA
I_{CC} or I_{GND}	DC V_{CC} or Ground Current per Output Pin		-	± 25	mA
T_{STG}	Storage Temperature		-65	+150	$^{\circ}\text{C}$
T_J	Junction Temperature		-	+150	$^{\circ}\text{C}$
T_L	Lead Temperature (Soldering, 10 Seconds)		-	+260	$^{\circ}\text{C}$
P_D	Power Dissipation in Still Air	SC-74A	-	225	mW
		SC-88A-5	-	190	
		MicroPak	-	327	

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.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Conditions	Min	Max	Unit
V _{CC}	Supply Voltage		2.0	6.0	V
V _{IN}	Input Voltage		0	V _{CC}	V
V _{OUT}	Output Voltage		0	V _{CC}	V
T _A	Operating Temperature		-40	+85	°C
θ _{JA}	Thermal Resistance	SC-74A	-	555	°C/W
		SC-88A-5	-	659	
		MicroPak	-	382	

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.

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

DC ELECTRICAL CHARACTERISTICS

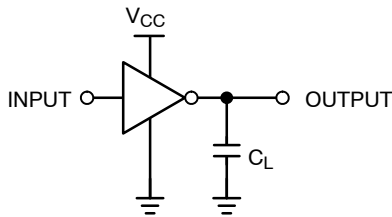
Symbol	Parameter	V _{CC} (V)	Conditions	T _A = +25°C			T _A = −40 to +85°C		Unit		
				Min	Typ	Max	Min	Max			
V _{IH}	HIGH Level Input Voltage	2.0		1.70	−	−	1.70	−	V		
		3.0		2.45	−	−	2.45	−			
		4.5		3.60	−	−	3.60	−			
		6.0		4.80	−	−	4.80	−			
V _{IL}	LOW Level Input Voltage	2.0		−	−	0.30	−	0.30	V		
		3.0		−	−	0.50	−	0.50			
		4.5		−	−	0.90	−	0.90			
		6.0		−	−	1.20	−	1.20			
V _{OH}	HIGH Level Output Voltage	2.0	I _{OH} = −20 μA V _{IN} = V _{IL}	1.80	2.0	−	1.80	−	V		
		3.0		2.50	3.0	−	2.50	−			
		4.5		4.00	4.5	−	4.00	−			
		6.0		5.50	5.9	−	5.50	−			
		3.0	V _{IN} = GND I _{OH} = −1.3 mA I _{OH} = −2.0 mA I _{OH} = −2.6 mA	2.68	2.82	−	2.63	−	V		
		4.5		4.18	4.33	−	4.13	−			
		6.0		5.68	5.76	−	5.63	−			
V _{OL}	LOW Level Output Voltage	2.0	I _{OL} = 20 μA V _{IN} = V _{IH}	−	0.00	0.20	−	0.20	V		
		3.0		−	0.00	0.50	−	0.50			
		4.5		−	0.01	0.50	−	0.50			
		6.0		−	0.04	0.50	−	0.50			
		3.0	V _{IN} = V _{CC} I _{OL} = 1.3 mA I _{OL} = 2.0 mA I _{OL} = 2.6 mA	−	0.11	0.26	−	0.33	V		
		4.5		−	0.12	0.26	−	0.33			
		6.0		−	0.15	0.26	−	0.33			
I _{IN}	Input Leakage Current	6.0	V _{IN} = V _{CC} , GND	−	−	±0.1	−	±1.0	μA		
I _{CC}	Quiescent Supply Current	6.0	V _{IN} = V _{CC} , GND	−	−	1.0	−	10.0	μA		

AC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	V _{CC} (V)	Conditions	T _A = +25°C			T _A = -40 to +85°C		Unit
				Min	Typ	Max	Min	Max	
t _{PLH} , t _{PHL}	Propagation Delay (Figure 4, 6)	5.0	C _L = 15 pF	–	3	15	–	–	ns
		2.0	C _L = 50 pF	–	17	100	–	125	ns
		3.0		–	9	27	–	35	
		4.5		–	7	20	–	25	
		6.0		–	6.5	17	–	21	
t _{TLH} , t _{THL}	Output Transition Time (Figure 4, 6)	5.0	C _L = 15 pF	–	4	10	–	–	ns
		2.0	C _L = 50 pF	–	25	125	–	155	ns
		3.0		–	16	35	–	45	
		4.5		–	12	25	–	31	
		6.0		–	10	21	–	26	
C _{IN}	Input Capacitance	Open		–	2	10	–	10	pF
C _{PD}	Power Dissipation Capacitance (Figure 5)	5.0	(Note 2)	–	4	–	–	–	pF

2. C_{PD} is defined as the value of the internal equivalent capacitance which is derived from dynamic operating current consumption (I_{CCD}) at no output loading and operating at 50% duty cycle. C_{PD} is related to I_{CCD} dynamic operating current by the expression:
I_{CCD} = (C_{PD}) (V_{CC}) (f_{IN}) + (I_{CC}static).

AC Loading and Waveforms



C_L includes load and stray capacitance
Input PRR = 1.0 MHz; t_W = 500 ns

Figure 4. AC Test Circuit

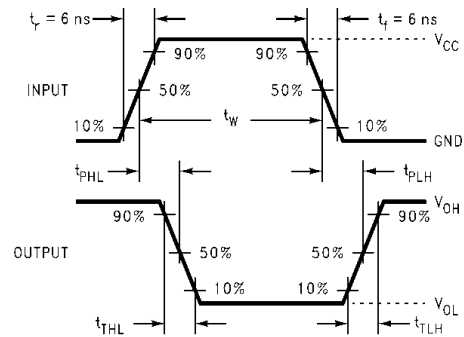
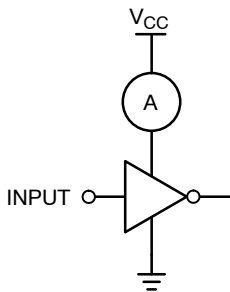


Figure 6. AC Waveforms



Input = AC Waveform;
PRR = Variable; Duty Cycle = 50%.

Figure 5. I_{CCD} Test Circuit

NC7SU04

ORDERING INFORMATION

Order Number	Top Mark	Package Description	Shipping [†]
NC7SU04M5X	7SU4	SC-74A	3000 / Tape & Reel
NC7SU04P5X	SU4	SC-88A	3000 / Tape & Reel
NC7SU04L6X	E5	SIP6, MicroPak	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.

PACKAGE DIMENSIONS

TOP VIEW

2X
0.05 C

1.45

B

2X
0.05 C

1.00

(0.254)

A

PIN 1 IDENTIFIER

5

0.50±0.05

0.05
0.00

C

0.05 C

RECOMMENDED LAND PATTERN

(1)

(0.49)
5X

(0.52)
1X

(0.30)
6X

PIN 1

DETAIL A

1.45±0.05

1.0

0.20±0.05 6X

0.30±0.05 5X

0.35±0.05 5X

1.00±0.05

(0.050)
6X

0.5

(0.125)
4X

0.075 X 45°
CHAMFER

0.35±0.05

0.40±0.05

DETAIL A
PIN 1 TERMINAL

BOTTOM VIEW

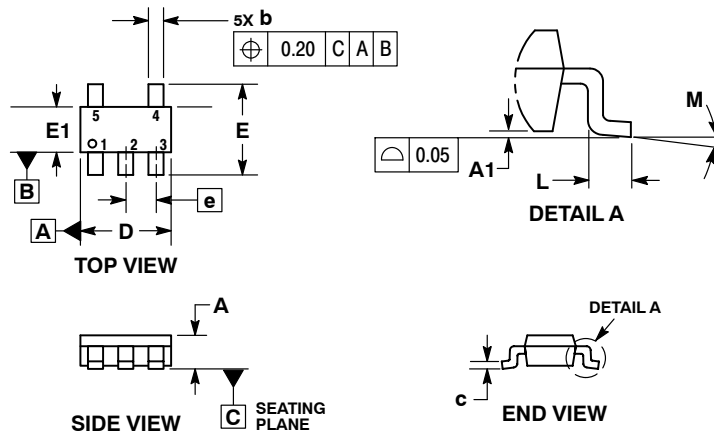
0.10(M) C B A
0.05(M) C

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.

NC7SU04

PACKAGE DIMENSIONS

SC-74A CASE 318BQ ISSUE B

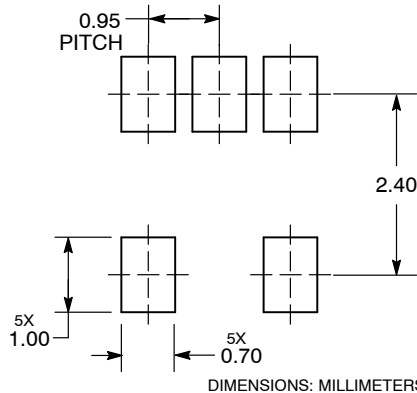


NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.15 PER SIDE.

DIM	MILLIMETERS	
	MIN	MAX
A	0.90	1.10
A1	0.01	0.10
b	0.25	0.50
c	0.10	0.26
D	2.85	3.15
E	2.50	3.00
E1	1.35	1.65
e	0.95 BSC	
L	0.20	0.60
M	0°	10°

RECOMMENDED SOLDERING FOOTPRINT*



*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

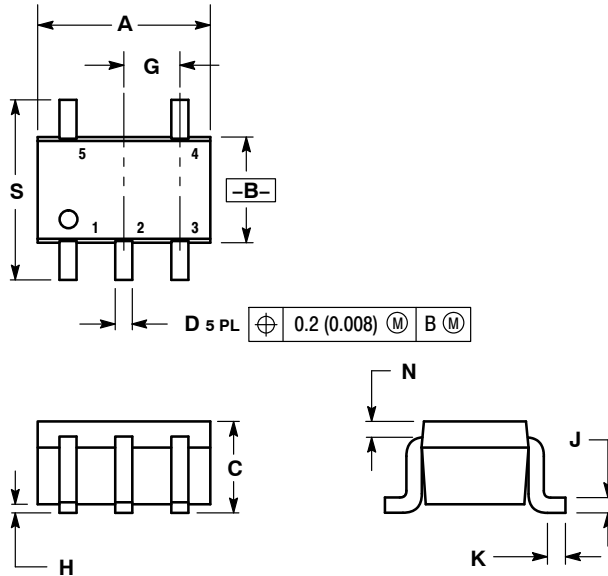
NC7SU04

PACKAGE DIMENSIONS

SC-88A (SC-70-5/SOT-353)

CASE 419A-02

ISSUE L

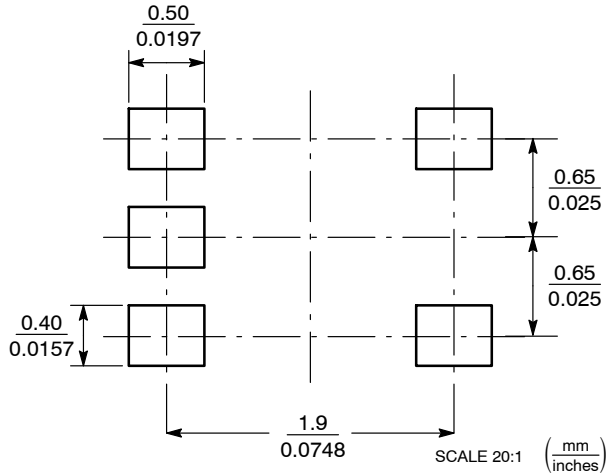


NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 419A-01 OBSOLETE. NEW STANDARD 419A-02.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.071	0.087	1.80	2.20
B	0.045	0.053	1.15	1.35
C	0.031	0.043	0.80	1.10
D	0.004	0.012	0.10	0.30
G	0.026 BSC		0.65 BSC	
H	---	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

SOLDER FOOTPRINT



STYLE 1:

- PIN 1. BASE
2. EMITTER
3. BASE
4. COLLECTOR
5. COLLECTOR

STYLE 2:

- PIN 1. ANODE
2. EMITTER
3. BASE
4. COLLECTOR
5. CATHODE

STYLE 3:

- PIN 1. ANODE 1
2. N/C
3. ANODE 2
4. CATHODE 2
5. CATHODE 1

STYLE 4:

- PIN 1. SOURCE 1
2. DRAIN 1/2
3. SOURCE 1
4. GATE 1
5. GATE 2

STYLE 5:

- PIN 1. CATHODE
2. COMMON ANODE
3. CATHODE 2
4. CATHODE 3
5. CATHODE 4

STYLE 6:

- PIN 1. EMITTER 2
2. BASE 2
3. EMITTER 1
4. COLLECTOR
5. COLLECTOR 2/BASE 1

STYLE 7:

- PIN 1. BASE
2. EMITTER
3. BASE
4. COLLECTOR
5. COLLECTOR

STYLE 8:

- PIN 1. CATHODE
2. COLLECTOR
3. N/C
4. BASE
5. EMITTER

STYLE 9:

- PIN 1. ANODE
2. CATHODE
3. ANODE
4. ANODE
5. ANODE

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