

# TinyLogic HST Inverter

## NC7ST04

### Description

The NC7ST04 is a single high performance CMOS Inverter, with TTL-compatible inputs. Advanced Silicon Gate CMOS fabrication assures high speed and low power circuit operation. ESD protection diodes inherently guard both input and output with respect to the  $V_{CC}$  and GND rails. High gain circuitry offers high noise immunity and reduced sensitivity to input edge rate. The TTL-compatible input facilitates TTL to NMOS/CMOS interfacing. Device performance is similar to MM74HCT but with  $1/2$  the output current drive of HC/HCT.

### Features

- Space Saving SOT23-5, SC-74A and SC-88A 5-Lead Packages
- High Speed;  $t_{PD} < 7$  ns typ,  $V_{CC} = 5$  V,  $C_L = 15$  pF
- Low Quiescent Power;  $I_{CC} < 1$   $\mu$ A typ,  $V_{CC} = 5.5$  V
- Balanced Output Drive; 2 mA  $I_{OL}$ , -2 mA  $I_{OH}$
- TTL-compatible Inputs
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

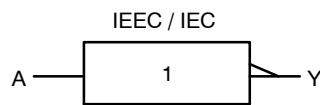


Figure 1. Logic Symbol

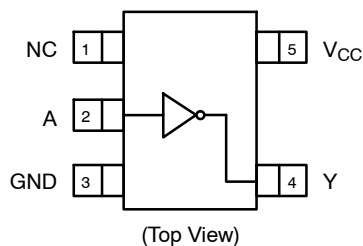
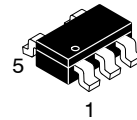
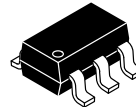
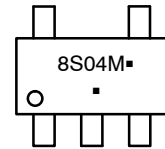


Figure 2. Connection Diagram

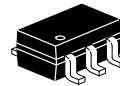
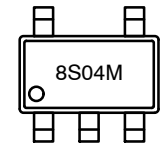
### MARKING DIAGRAMS



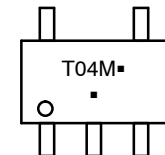
SC-74A  
CASE 318BQ



SOT23-5  
CASE 527AH



SC-88A  
CASE 419A-02



8S04, T04 = Specific Device Code  
M = Date Code\*

\*Date Code orientation and/or position may vary depending upon manufacturing location.

### PIN ASSIGNMENT

Pin Name	Description
A	Input
Y	Output
NC	No Connect

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

Input	Output
A	Y
L	H
H	L

H = HIGH Logic Level  
L = LOW Logic Level

### ORDERING INFORMATION

See detailed ordering, marking and shipping information in the package dimensions section on page 3 of this data sheet.

# NC7ST04

## ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Min	Max	Unit	
V <sub>CC</sub>	Supply Voltage	-0.5	6.5	V	
I <sub>IK</sub>	DC Input Diode Current	V <sub>IN</sub> < 0 V	-	-20	mA
		V <sub>IN</sub> > V <sub>CC</sub>	-	+20	
V <sub>IN</sub>	DC Input Voltage	-0.5	V <sub>CC</sub> + 0.5 V	V	
I <sub>OK</sub>	DC Output Diode Current	V <sub>OUT</sub> < 0 V	-	-20	mA
		V <sub>OUT</sub> > V <sub>CC</sub>	-	+20	
V <sub>OUT</sub>	DC Output Voltage	-0.5	V <sub>CC</sub> + 0.5 V	V	
I <sub>OUT</sub>	DC Output Source or Sink Current	-	±12.5	mA	
I <sub>CC</sub> or I <sub>IGND</sub>	DC V <sub>CC</sub> or Ground Current per Supply Pin	-	±25	mA	
T <sub>STG</sub>	Storage Temperature Range	-65	+150	°C	
T <sub>J</sub>	Junction Temperature	-	150	°C	
	DC V <sub>CC</sub> or Ground Current per (Soldering, 10 Seconds)	-	+260	°C	
P <sub>D</sub>	Power Dissipation in Still Air	SC-74A / SOT23-5	-	390	mW
		SC-88A	-	332	

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 <sub>CC</sub>	Supply Voltage		4.5	5.5	V
V <sub>IN</sub>	Input Voltage		0	V <sub>CC</sub>	V
V <sub>OUT</sub>	Output Voltage		0	V <sub>CC</sub>	V
T <sub>A</sub>	Operating Temperature		-40	+85	°C
t <sub>r</sub> , t <sub>f</sub>	Input Rise and Fall Times	V <sub>CC</sub> = 5.0 V	0	10	ns/V
θ <sub>JA</sub>	Thermal Resistance	SC-74A / SOT23-5	-	320	°C/W
		SC-88A	-	377	

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 <sub>CC</sub> (V)	Conditions	T <sub>A</sub> = +25°C			T <sub>A</sub> = -40 to +85°C		Unit
				Min	Typ	Max	Min	Max	
V <sub>IH</sub>	HIGH Level Input Voltage	4.5 – 5.5		2.0	-	-	2.0	-	V
V <sub>IL</sub>	LOW Level Input Voltage	4.5 – 5.5		-	-	0.8	-	0.8	V
V <sub>OH</sub>	HIGH Level Output Voltage	4.5	I <sub>OH</sub> = -20 μA, V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> , I <sub>OH</sub> = -2 mA	4.4	4.5	-	4.4	-	V
		4.5		4.18	4.35	-	4.13	-	
V <sub>OL</sub>	LOW Level Output Voltage	4.5	I <sub>OL</sub> = 20 μA, V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> , I <sub>OL</sub> = 2 mA	-	0	0.1	-	0.1	V
		4.5		-	0.10	0.26	-	0.33	
I <sub>IN</sub>	Input Leakage Current	5.5	0 ≤ V <sub>IN</sub> ≤ 5.5 V	-	-	±0.1	-	±1.0	μA
I <sub>CC</sub>	Quiescent Supply Current	5.5	V <sub>IN</sub> = V <sub>CC</sub> or GND	-	-	1.0	-	10.0	μA
I <sub>CC</sub> T	I <sub>CC</sub> per Input	5.5	Input V <sub>IN</sub> = 0.5 V or 2.4 V	-	-	2.0	-	2.9	mA

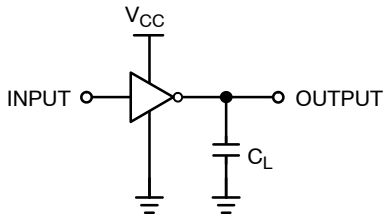
# NC7ST04

## AC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	V <sub>CC</sub> (V)	Conditions	T <sub>A</sub> = 25°C			T <sub>A</sub> = -40 to 85°C		Unit
				Min	Typ	Max	Min	Max	
t <sub>PLH</sub> , t <sub>PHL</sub>	Propagation Delay (Figure 3, 5)	5.0	C <sub>L</sub> = 15 pF	-	3.5	12	-	-	ns
				-	6.0	17	-	-	
		4.5	C <sub>L</sub> = 50 pF	-	6.2	16	-	20	
				-	11.4	27	-	31	
				5.5	-	4.3	14	-	
-	11.1	26	-	30					
t <sub>TLH</sub> , t <sub>THL</sub>	Output Transition Time (Figure 3, 5)	5.0	C <sub>L</sub> = 15 pF	-	4	10	-	-	ns
		4.5	C <sub>L</sub> = 50 pF	-	11	25	-	31	
		5.5	-	10	21	-	26		
C <sub>IN</sub>	Input Capacitance	Open		-	2	10	-	-	pF
C <sub>PD</sub>	Power Dissipation Capacitance (Figure 4)	5.00	(Note 2)	-	6	-	-	-	pF

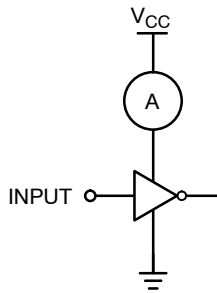
2. C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is derived from dynamic operating current consumption (I<sub>CCD</sub>) at no output loading and operating at 50% duty cycle. C<sub>PD</sub> is related to I<sub>CCD</sub> dynamic operating current by the expression: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

## AC Loading and Waveforms



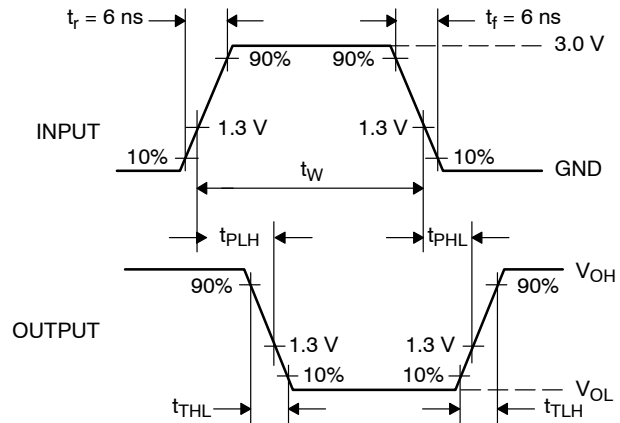
C<sub>L</sub> includes load and stray capacitance; inputs PRR = 1.0 MHz, t<sub>W</sub> = 500 ns.

**Figure 3. AC Test Circuit**



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

**Figure 4. I<sub>CCD</sub> Test Circuit**



**Figure 5. AC Waveforms**

## DEVICE ORDERING INFORMATION

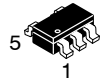
Device	Top Mark	Packages	Shipping†
NC7ST04M5X	8S04	SC-74A	3000 / Tape & Reel
NC7ST04M5X-L22090	8S04	SOT23-5	3000 / Tape & Reel
NC7ST04P5X	T04	SC-88A	3000 / Tape & Reel
NC7ST04P5X-L22057	T04	SC-88A	3000 / Tape & Reel

†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.

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

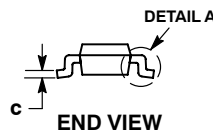
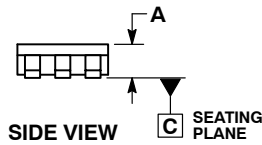
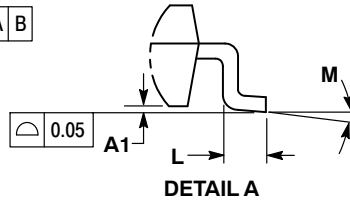
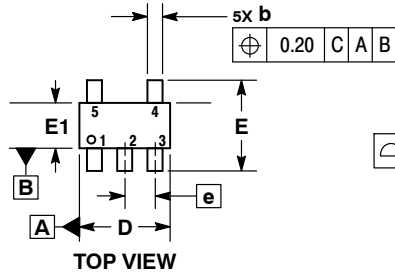
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SCALE 2:1

### SC-74A CASE 318BQ ISSUE B

DATE 18 JAN 2018

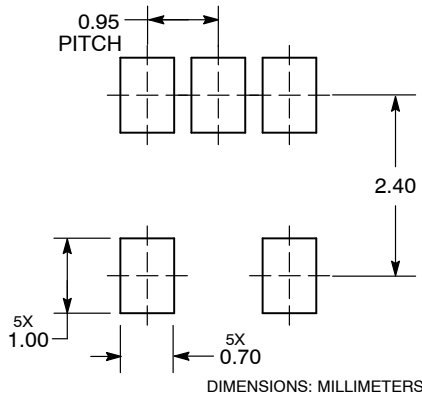


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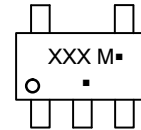
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH,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



#### GENERIC MARKING DIAGRAM\*



- XXX = Specific Device Code
- M = Date Code
- = Pb-Free Package

(Note: Microdot may be in either location)

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "■", may or may not be present. Some products may not follow the Generic Marking.

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

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<b>DESCRIPTION:</b>	<b>SC-74A</b>	<b>PAGE 1 OF 1</b>

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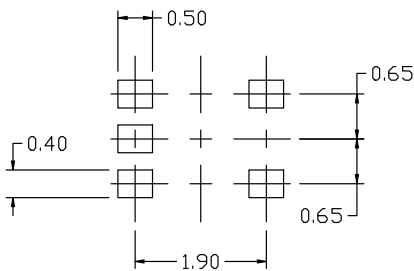
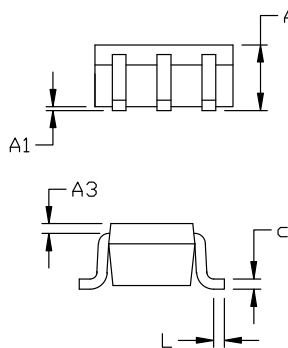
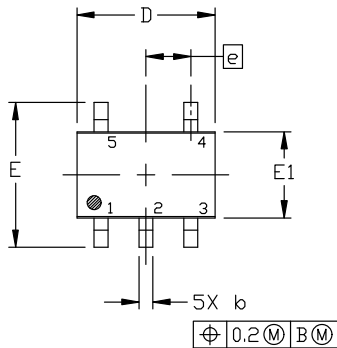
# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



SCALE 2:1

## SC-88A (SC-70-5/SOT-353) CASE 419A-02 ISSUE M

DATE 11 APR 2023



RECOMMENDED  
MOUNTING FOOTPRINT

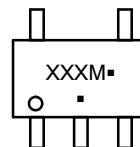
\* For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERM/D.

### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETERS
3. 419A-01 OBSOLETE. NEW STANDARD 419A-02
4. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.1016MM PER SIDE.

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.80	0.95	1.10
A1	---	---	0.10
A3	0.20 REF		
b	0.10	0.20	0.30
c	0.10	---	0.25
D	1.80	2.00	2.20
E	2.00	2.10	2.20
E1	1.15	1.25	1.35
e	0.65 BSC		
L	0.10	0.15	0.30

### GENERIC MARKING DIAGRAM\*



\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

XXX = Specific Device Code

M = Date Code

▪ = Pb-Free Package

(Note: Microdot may be in either location)

#### STYLE 1:

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

#### STYLE 2:

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

#### STYLE 3:

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

#### STYLE 4:

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

#### STYLE 5:

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

#### STYLE 6:

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

#### STYLE 7:

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

#### STYLE 8:

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

#### STYLE 9:

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

Note: Please refer to datasheet for style callout. If style type is not called out in the datasheet refer to the device datasheet pinout or pin assignment.

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<b>DESCRIPTION:</b>	<b>SC-88A (SC-70-5/SOT-353)</b>	<b>PAGE 1 OF 1</b>

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# MECHANICAL CASE OUTLINE

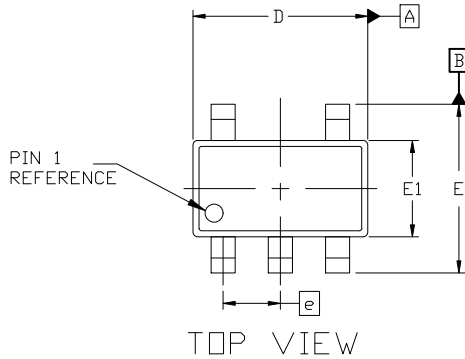
## PACKAGE DIMENSIONS

ON Semiconductor®



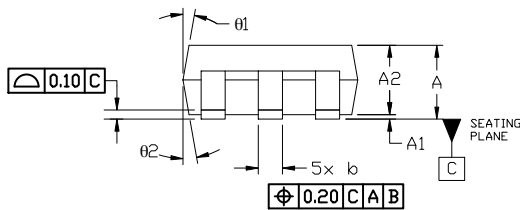
### SOT-23, 5 Lead CASE 527AH ISSUE A

DATE 09 JUN 2021

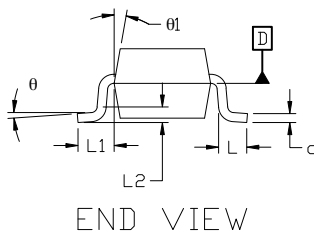


NOTES:

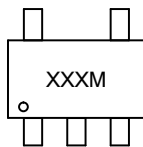
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5. DIMENSION 'b' DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08mm TOTAL IN EXCESS OF THE 'b' DIMENSION AT MAXIMUM MATERIAL CONDITION. MINIMUM SPACE BETWEEN PROTRUSION AND AN ADJACENT LEAD SHALL NOT BE LESS THAN 0.07mm.



DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.90	—	1.45
A1	0.00	—	0.15
A2	0.90	1.15	1.30
b	0.30	—	0.50
c	0.08	—	0.22
D	2.90 BSC		
E	2.80 BSC		
E1	1.60 BSC		
e	0.95 BSC		
L	0.30	0.45	0.60
L1	0.60 REF		
L2	0.25 REF		
theta	0°	4°	8°
theta1	0°	10°	15°
theta2	0°	10°	15°

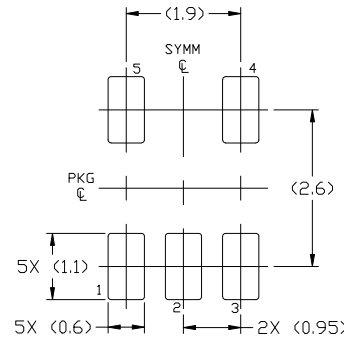


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\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "•", may or may not be present. Some products may not follow the Generic Marking.



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

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<b>DESCRIPTION:</b>	<b>SOT-23, 5 LEAD</b>	<b>PAGE 1 OF 1</b>

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