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 μA 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

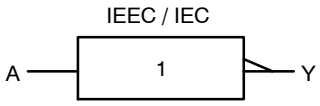


Figure 1. Logic Symbol

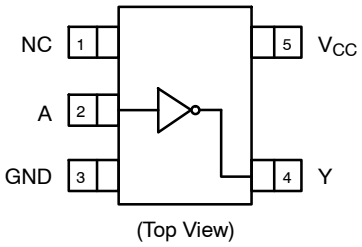
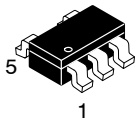
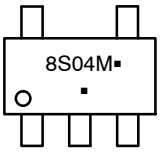


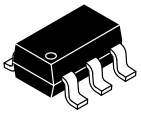
Figure 2. Connection Diagram

MARKING DIAGRAMS

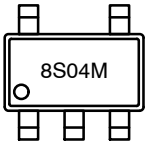


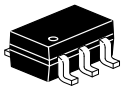
SC−74A
CASE 318BQ



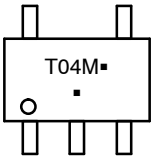


SOT23−5
CASE 527AH





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 = $\overline{A}$)

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.

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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} < 0 V	−	−20	mA
		V_{IN} > V_{CC}	−	+20	
V_{IN}	DC Input Voltage		−0.5	V_{CC} + 0.5 V	V
I_{OK}	DC Output Diode Current	V_{OUT} < 0 V	−	−20	mA
		V_{OUT} > V_{CC}	−	+20	
V_{OUT}	DC Output Voltage		−0.5	V_{CC} + 0.5 V	V
I_{OUT}	DC Output Source or Sink Current		−	±12.5	mA
I_{CC} or I_{GND}	DC V_{CC} or Ground Current per Supply Pin		−	±25	mA
T_{STG}	Storage Temperature Range		−65	+150	°C
T_J	Junction Temperature		−	150	°C
	DC V_{CC} or Ground Current per (Soldering, 10 Seconds)		−	+260	°C
P_D	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_{CC}	Supply Voltage		4.5	5.5	V
V_{IN}	Input Voltage		0	V_{CC}	V
V_{OUT}	Output Voltage		0	V_{CC}	V
T_A	Operating Temperature		−40	+85	°C
t_r, t_f	Input Rise and Fall Times	V_{CC} = 5.0 V	0	10	ns/V
θ_{JA}	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 ELECTICAL CHARACTERISTICS

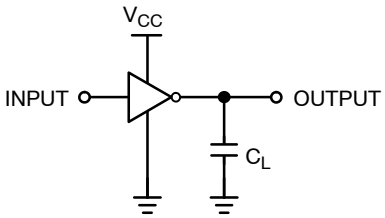
Symbol	Parameter	V_{CC} (V)	Conditions	T_A = +25°C			T_A = −40 to +85°C		Unit
				Min	Typ	Max	Min	Max	
V_{IH}	HIGH Level Input Voltage	4.5 – 5.5		2.0	−	−	2.0	−	V
V_{IL}	LOW Level Input Voltage	4.5 – 5.5		−	−	0.8	−	0.8	V
V_{OH}	HIGH Level Output Voltage	4.5	I_{OH} = −20 μA, V_{IN} = V_{IH} or V_{IL}, I_{OH} = −2 mA	4.4	4.5	−	4.4	−	V
		4.5		4.18	4.35	−	4.13	−	
V_{OL}	LOW Level Output Voltage	4.5	I_{OL} = 20 μA, V_{IN} = V_{IH} or V_{IL}, I_{OL} = 2 mA	−	0	0.1	−	0.1	V
		4.5		−	0.10	0.26	−	0.33	
I_{IN}	Input Leakage Current	5.5	0 ≤ V_{IN} ≤ 5.5 V	−	−	±0.1	−	±1.0	μA
I_{CC}	Quiescent Supply Current	5.5	V_{IN} = V_{CC} or GND	−	−	1.0	−	10.0	μA
I_{CCT}	I_{CC} per Input	5.5	Input V_{IN} = 0.5 V or 2.4 V	−	−	2.0	−	2.9	mA

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 3, 5)	5.0	C_L = 15 pF	–	3.5	12	–	–	ns
				–	6.0	17	–	–	
		4.5	C_L = 50 pF	–	6.2	16	–	20	
				–	11.4	27	–	31	
		5.5		–	4.3	14	–	18	
				–	11.1	26	–	30	
t_{TLH}, t_{THL}	Output Transition Time (Figure 3, 5)	5.0	C_L = 15 pF	–	4	10	–	–	ns
		4.5	C_L = 50 pF	–	11	25	–	31	
		5.5		–	10	21	–	26	
C_{IN}	Input Capacitance	Open		–	2	10	–	–	pF
C_{PD}	Power Dissipation Capacitance (Figure 4)	5.00	(Note 2)	–	6	–	–	–	pF

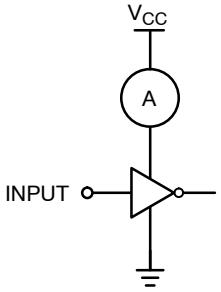
2. C_{PD} is defined as the value of the internal equivalent capacitance which is derived from dynamic operating current consumption (I_{CCD}) at no output lading and operating at 50% duty cycle. C_{PD} is related to I_{CCD} dynamic operating current by the expression: $I_{CCD} = (C_{PD})\ (V_{CC})\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

AC Loading and Waveforms



C_L includes load and stray capacitance;
inputs PRR = 1.0 MHz, t_W = 500 ns.

Figure 3. AC Test Circuit



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

Figure 4. I_{CCD} Test Circuit

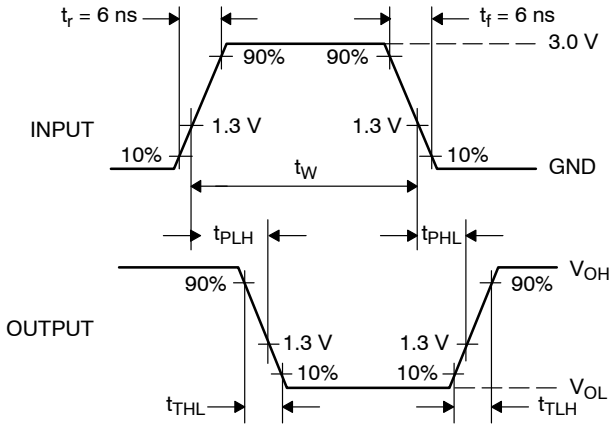


Figure 5. AC Waveforms

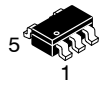
DEVICE ORDERING INFORMATION

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

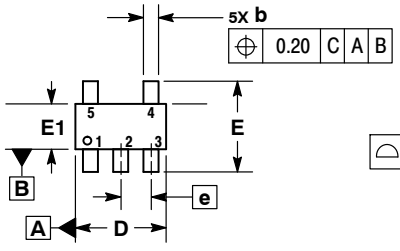
ON Semiconductor®

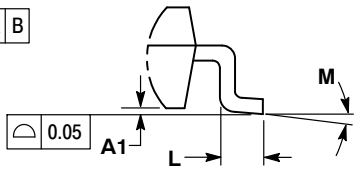


SCALE 2:1

SC−74A
CASE 318BQ
ISSUE B

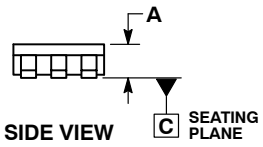
DATE 18 JAN 2018

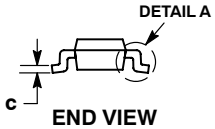




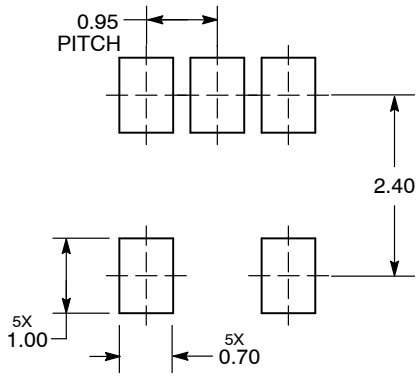
NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.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

	MILLIMETERS	
DIM	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 °





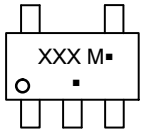
RECOMMENDED SOLDERING FOOTPRINT*



DIMENSIONS: MILLIMETERS

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

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.

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DESCRIPTION:	SC−74A		PAGE 1 OF 1

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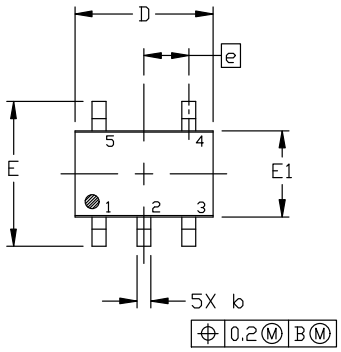
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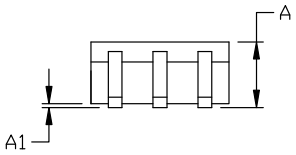
MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

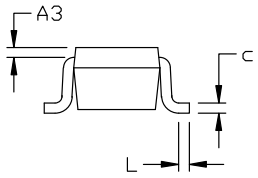
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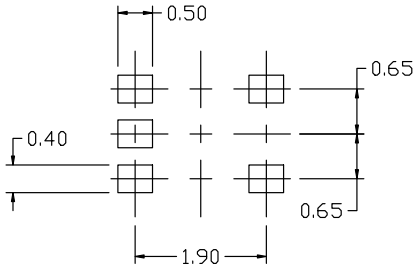
SC−88A (SC−70−5/SOT−353)
CASE 419A−02
ISSUE M

DATE 11 APR 2023









RECOMMENDED
MOUNTING FOOTPRINT

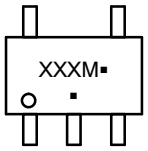
* For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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:
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

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.

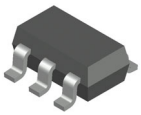
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DESCRIPTION:	SC−88A (SC−70−5/SOT−353)	PAGE 1 OF 1

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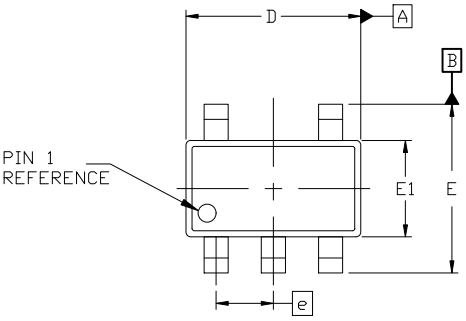
MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

ON Semiconductor®

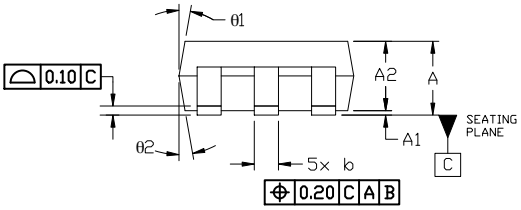


SOT−23, 5 Lead
CASE 527AH
ISSUE A

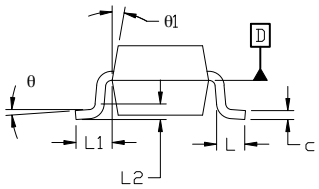
DATE 09 JUN 2021



TOP VIEW



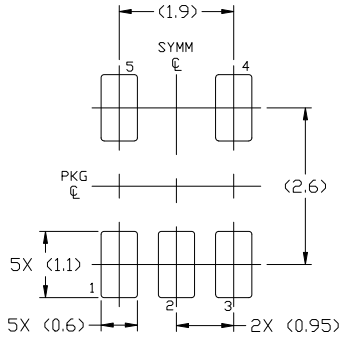
SIDE VIEW



END VIEW

NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 19894
2. CONTROLLING DIMENSION: MILLIMETERS
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.
4. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.25 PER SIDE. D AND E1 DIMENSIONS ARE DETERMINED AT DATUM D.
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.

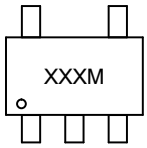
	MILLIMETERS		
DIM	MIN.	NOM.	MAX.
A	0.90	—	1.45
A1	0.00	—	0.15
A2	0.90	1.15	1.30
b	0.30	—	0.50
c	0.08	—	0.22
D	2.90 BSC		
E	2.80 BSC		
E1	1.60 BSC		
e	0.95 BSC		
L	0.30	0.45	0.60
L1	0.60 REF		
L2	0.25 REF		
θ	0°	4°	8°
θ1	0°	10°	15°
θ2	0°	10°	15°



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, SOLDERRM/D.

GENERIC MARKING DIAGRAM*



XXX = Specific Device Code
M = Date Code

*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.

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DESCRIPTION:	**SOT−23, 5 LEAD**	**PAGE 1 OF 1**

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