



**THE DATASHEET OF  
NC7SZU04L6X**



# NC7SZU04

## TinyLogic UHS Unbuffered Inverter

### Description

The NC7SZU04 is a single unbuffered inverter from ON Semiconductor's Ultra-High Speed series of TinyLogic. The special purpose unbuffered circuit design is primarily intended for crystal oscillator or analog applications. The device is fabricated with advanced CMOS technology to achieve ultra-high speed with high output drive while maintaining low static power dissipation over a broad  $V_{CC}$  operating range. The device is specified to operate over the 1.65 V to 5.5 V  $V_{CC}$  range.

### Features

- Unbuffered for Crystal Oscillator and Analog Applications
- Balanced Output Drive:  $\pm 16$  mA at 4.5 V  $V_{CC}$
- Broad  $V_{CC}$  Operating Range: 1.65 V to 5.5 V
- Matches Performance of LCX Operated at 3.3 V  $V_{CC}$
- Low Quiescent Power:  $I_{CC} < 2 \mu A$ ,  $V_{CC} = 5.5$  V,  $T_A = 25^\circ C$
- Ultra-Small MicroPak™ Packages
- Space-Saving SC-74A and SC-88A Packages
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

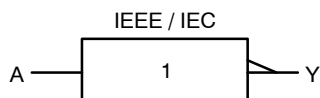


Figure 1. Logic Symbol



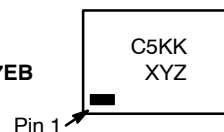
ON Semiconductor®

[www.onsemi.com](http://www.onsemi.com)

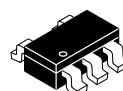
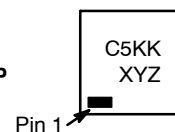
### MARKING DIAGRAMS



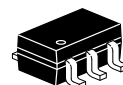
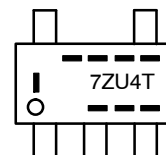
SIP6  
CASE 127EB



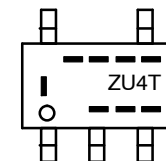
UDFN6  
CASE 517DP



SC-74A  
CASE 318BQ



SC-88A  
CASE 419AC-01



C5, 7ZU4, ZU4 = 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  
 |-- = Plant Code Identifier  
 --- = Eight-Week Datacoding Scheme

### ORDERING INFORMATION

See detailed ordering, marking and shipping information in the package dimensions section on page 6 of this data sheet.

# NC7SZU04

## Pin Configurations

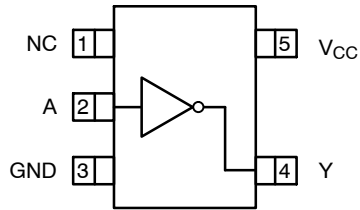


Figure 2. SC88A and SC-74A (Top View)

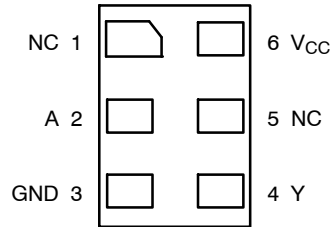


Figure 3. MicroPak (Top Through View)

### PIN DEFINITIONS

Pin # SC-88A / SC74A	Pin # MicroPak	Name	Description
1	1, 5	NC	No Connect
2	2	A	Input
3	3	GND	Ground
4	4	Y	Output
5	6	V <sub>CC</sub>	Supply Voltage

### FUNCTION TABLE (Y = /A)

Inputs	Output
A	Y
L	H
H	L

H = HIGH Logic Level  
L = LOW Logic Level

# NC7SZU04

## ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter		Min	Max	Unit
V <sub>CC</sub>	Supply Voltage		-0.5	6.0	V
V <sub>IN</sub>	DC Input Voltage		-0.5	6.0	V
V <sub>OUT</sub>	DC Output Voltage		-0.5	6.0	V
I <sub>IK</sub>	DC Input Diode Current	V <sub>IN</sub> < -0.5 V	-	-50	mA
		V <sub>IN</sub> > V <sub>CC</sub> + 5.0 V	-	+20	
I <sub>OK</sub>	DC Output Diode Current	V <sub>OUT</sub> < -0.5 V	-	-50	mA
		V <sub>OUT</sub> > 0.5 V, V <sub>CC</sub> = GND	-	+20	
I <sub>OUT</sub>	DC Output Current		-	±50	mA
I <sub>CC</sub> or I <sub>GND</sub>	DC V <sub>CC</sub> or Ground Current		-	±100	mA
T <sub>STG</sub>	Storage Temperature Range		-65	+150	°C
T <sub>J</sub>	Junction Temperature Under Bias		-	+150	°C
T <sub>L</sub>	Junction Lead Temperature (Soldering, 10 Seconds)		-	+260	°C
P <sub>D</sub>	Power Dissipation in Still Air	SC-74A	-	225	mW
		SC-88A	-	190	
		MicroPak-6	-	327	
		MicroPak2™-6	-	327	
ESD	Human Body Model, JEDEC: JESD22-A114		-	4000	V
	Charge Device Model, JEDEC: JESD22-C101		-	2000	

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 Operating		1.65	5.50	V
	Supply Voltage Data Retention		1.50	5.50	
V <sub>IN</sub>	Input Voltage		0	5.5	V
V <sub>OUT</sub>	Output Voltage		0	V <sub>CC</sub>	V
T <sub>A</sub>	Operating Temperature		-40	+85	°C
θ <sub>JA</sub>	Thermal Resistance	SC-74A	-	555	°C/W
		SC-88A	-	659	
		MicroPak-6	-	382	
		MicroPak2-6	-	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.

# NC7SZU04

## DC ELECTRICAL CHARACTERISTICS

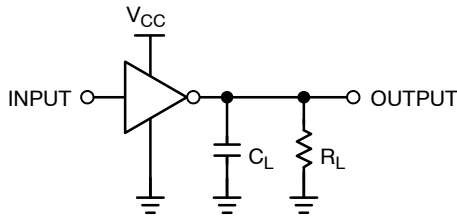
Symbol	Parameter	V <sub>CC</sub> (V)	Conditions	T <sub>A</sub> = +25°C			T <sub>A</sub> = -40 to +85°C		Unit	
				Min	Typ	Max	Min	Max		
V <sub>IH</sub>	HIGH Level Input Voltage	1.8 to 2.7		0.85 V <sub>CC</sub>	-	-	0.85 V <sub>CC</sub>	-	V	
		3.0 to 5.5		0.80 V <sub>CC</sub>	-	-	0.80 V <sub>CC</sub>	-		
V <sub>IL</sub>	LOW Level Input Voltage	1.8 to 2.7		-	-	0.15 V <sub>CC</sub>	-	0.15 V <sub>CC</sub>	V	
		3.0 to 5.5		-	-	0.20 V <sub>CC</sub>	-	0.20 V <sub>CC</sub>		
V <sub>OH</sub>	HIGH Level Output Voltage	1.65	V <sub>IN</sub> = V <sub>IL</sub> , I <sub>OH</sub> = -100 μA	1.55	1.65	-	1.55	-	V	
		1.80		1.60	1.80	-	1.60	-		
		2.30		2.10	2.30	-	2.10	-		
		3.00		2.70	3.00	-	2.70	-		
		4.50		4.00	4.40	-	4.00	-		
		1.65	V <sub>IN</sub> = GND I <sub>OH</sub> = -4 mA	1.29	1.52	-	1.29	-		
		2.30		1.90	2.14	-	1.90	-		
		3.00		2.40	2.75	-	2.40	-		
		3.00		I <sub>OH</sub> = -12 mA	2.30	2.61	-	2.30		-
		4.50		I <sub>OH</sub> = -16 mA	3.80	4.13	-	3.80		-
V <sub>OL</sub>	LOW Level Output Voltage	1.65	V <sub>IN</sub> = V <sub>IH</sub> , I <sub>OL</sub> = 100 μA	-	0.00	0.10	-	0.10	V	
		1.80		-	0.00	0.20	-	0.20		
		2.30		-	0.00	0.20	-	0.20		
		3.00		-	0.00	0.30	-	0.30		
		4.50		-	0.00	0.50	-	0.50		
		1.65	V <sub>IN</sub> = V <sub>CC</sub> I <sub>OL</sub> = 4 mA	-	0.80	0.24	-	0.24		
		2.30		I <sub>OL</sub> = 4 mA	-	0.10	0.30	-		0.30
		3.00		I <sub>OL</sub> = 8 mA	-	0.17	0.40	-		0.40
		3.00		I <sub>OL</sub> = 12 mA	-	0.25	0.55	-		0.55
		4.50		I <sub>OL</sub> = 16 mA	-	0.226	0.55	-		0.55
I <sub>IN</sub>	Input Leakage Current	1.65 to 5.5	V <sub>IN</sub> = 5.5 V, GND	-	-	±1	-	±10	μA	
I <sub>CC</sub>	Quiescent Supply Current	1.65 to 5.50	V <sub>IN</sub> = 5.5 V, GND	-	-	2	-	20	μA	
I <sub>CCPEAK</sub>	Peak Supply Current in Analog Operation	1.8	V <sub>OUT</sub> = Open, V <sub>IN</sub> = Adjust for Peak I <sub>CC</sub> Current	-	2	-	-	-	mA	
		2.5		-	4	-	-			
		3.3		-	10	-	-			
		5.0		-	30	-	-			

# NC7SZU04

## 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 4, 5)	1.65	C <sub>L</sub> = 15 pF, R <sub>L</sub> = 1 MΩ	-	-	11.7	-	12.1	ns
		1.80		-	-	8.5	-	9.0	
		2.50 ±0.20		-	-	6.2	-	6.5	
		3.30 ±0.30		-	-	4.5	-	4.8	
		5.00 ±0.50		-	-	3.9	-	4.1	
		3.30 ±0.30	C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω	-	-	6.0	-	6.5	
		5.00 ±0.50		-	-	5.0	-	5.5	
C <sub>IN</sub>	Input Capacitance	0.00		-	4.5	-	-	-	pF
C <sub>PD</sub>	Power Dissipation Capacitance (Note 2) (Figure 6)	3.30		-	6.3	-	-	-	pF
		5.00		-	9.5	-	-	-	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:  
 $I_{CCD} = (C_{PD}) (V_{CC}) (f_{IN}) + (I_{CCstatic})$ .



NOTE:  
 3. C<sub>L</sub> includes load and stray capacitance.  
 4. Input PRR = 1.0 MHz; t<sub>W</sub> = 500 ns

Figure 4. AC Test Circuit

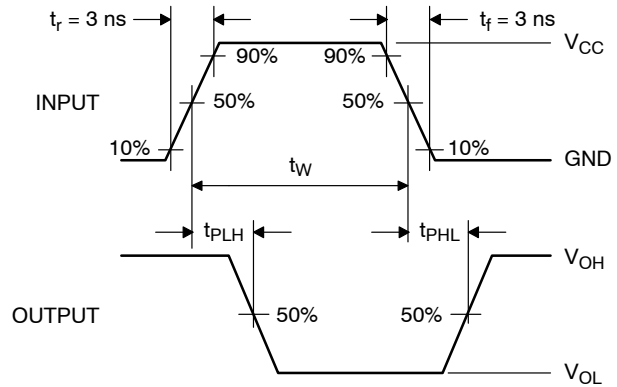
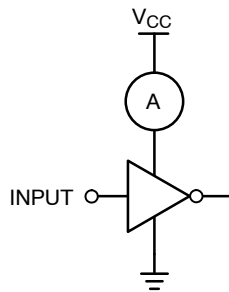


Figure 5. AC Waveforms



NOTE:

- When operating the NC7SZU04's unbuffered output stage in its linear range, as in oscillator applications, care must be taken to observe maximum power rating for the device and package. The high drive nature of the design of the output stage results in substantial simultaneous conduction currents when the stage is in the linear region. See the I<sub>CCPEAK</sub> specification in the [DC Electrical Characteristics table](#).
- Input = AC Waveform; t<sub>r</sub> = t<sub>f</sub> = 1.8 ns; PRR = Variable; Duty Cycle = 50%.

Figure 6. I<sub>CCD</sub> Test Circuit

# NC7SZU04

## ORDERING INFORMATION

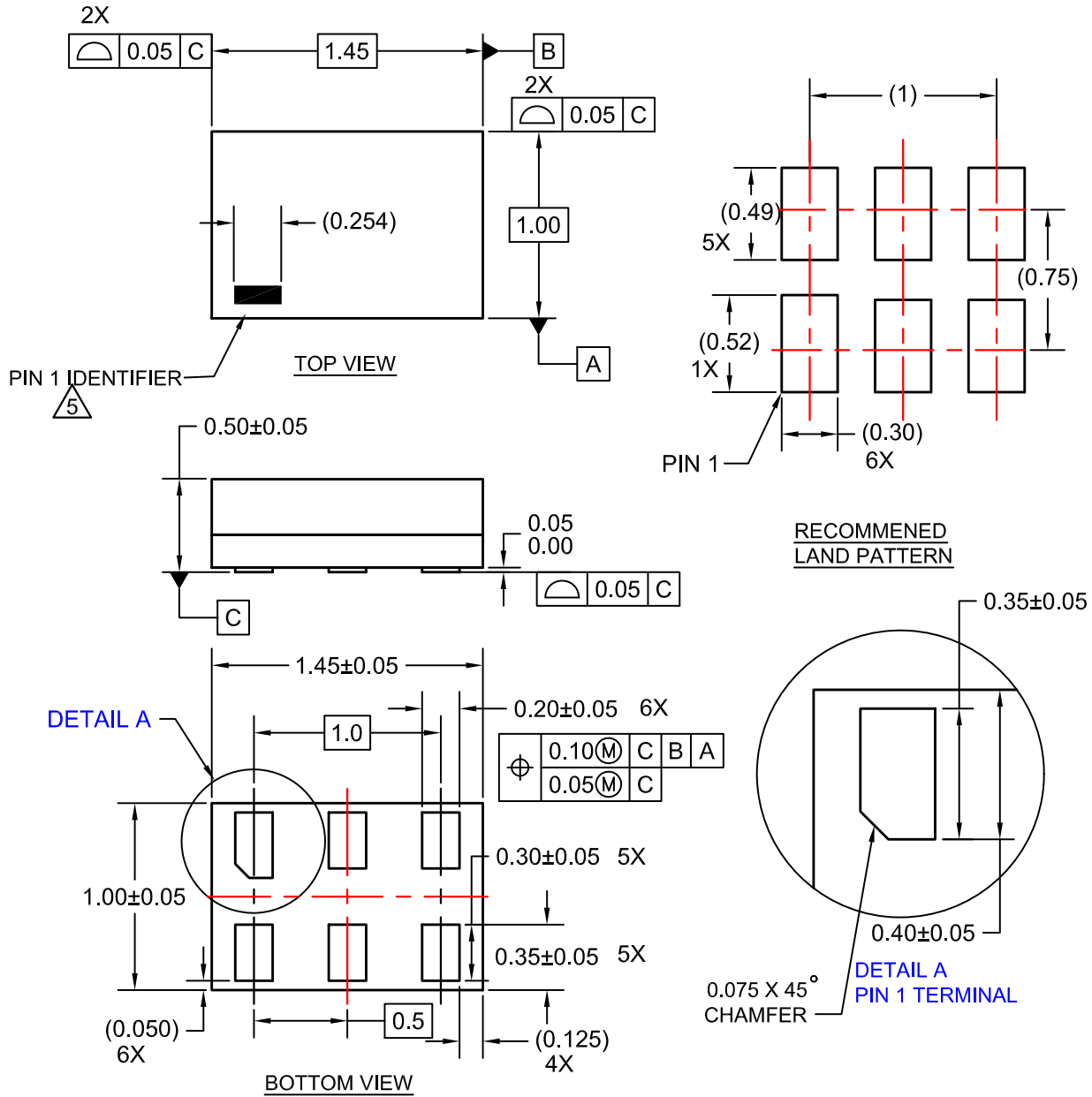
Part Number	Top Mark	Packages	Shipping <sup>†</sup>
NC7SZU04M5X	7ZU4	SC-74A	3000 / Tape & Reel
NC7SZU04P5X	ZU4	SC-88A	3000 / Tape & Reel
NC7SZU04L6X	C5	SIP6, MicroPak	5000 / Tape & Reel
NC7SZU04FHX	C5	UDFN6, MicroPak2	5000 / Tape & Reel

<sup>†</sup>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.

# NC7SZU04

## PACKAGE DIMENSIONS

SIP6 1.45X1.0  
CASE 127EB  
ISSUE O



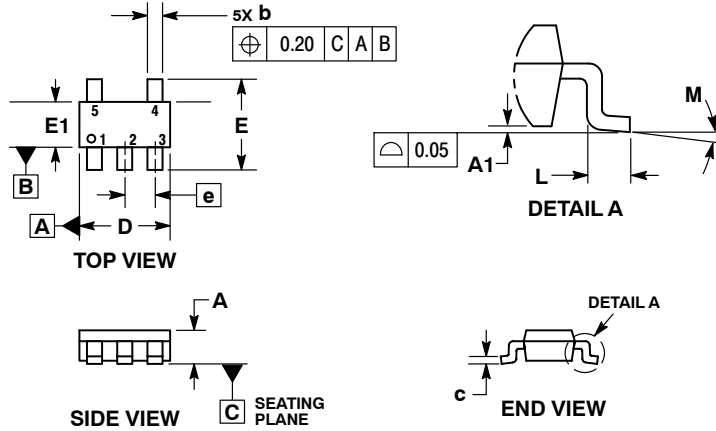
### NOTES:

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.

# NC7SZU04

## PACKAGE DIMENSIONS

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

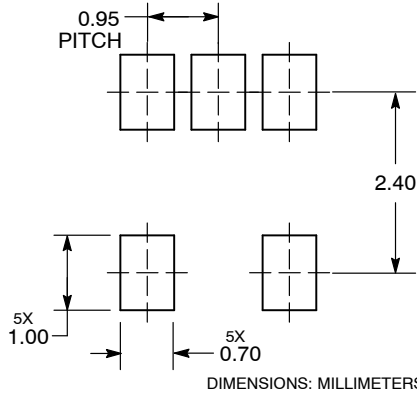


**NOTES:**

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\***

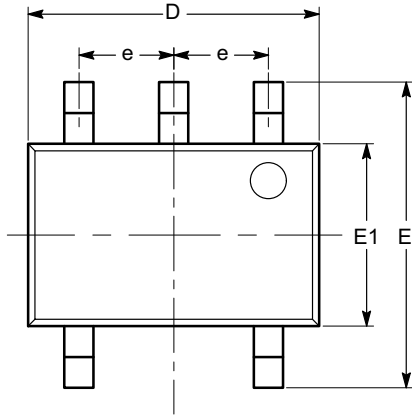


\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

# NC7SZU04

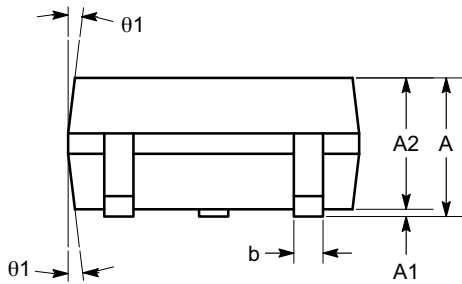
## PACKAGE DIMENSIONS

SC-88A (SC-70 5 Lead), 1.25x2  
CASE 419AC-01  
ISSUE A

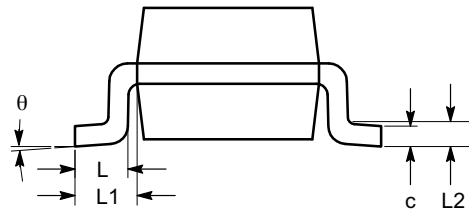


TOP VIEW

SYMBOL	MIN	NOM	MAX
A	0.80		1.10
A1	0.00		0.10
A2	0.80		1.00
b	0.15		0.30
c	0.10		0.18
D	1.80	2.00	2.20
E	1.80	2.10	2.40
E1	1.15	1.25	1.35
e	0.65 BSC		
L	0.26	0.36	0.46
L1	0.42 REF		
L2	0.15 BSC		
$\theta$	0°		8°
$\theta 1$	4°		10°



SIDE VIEW



END VIEW

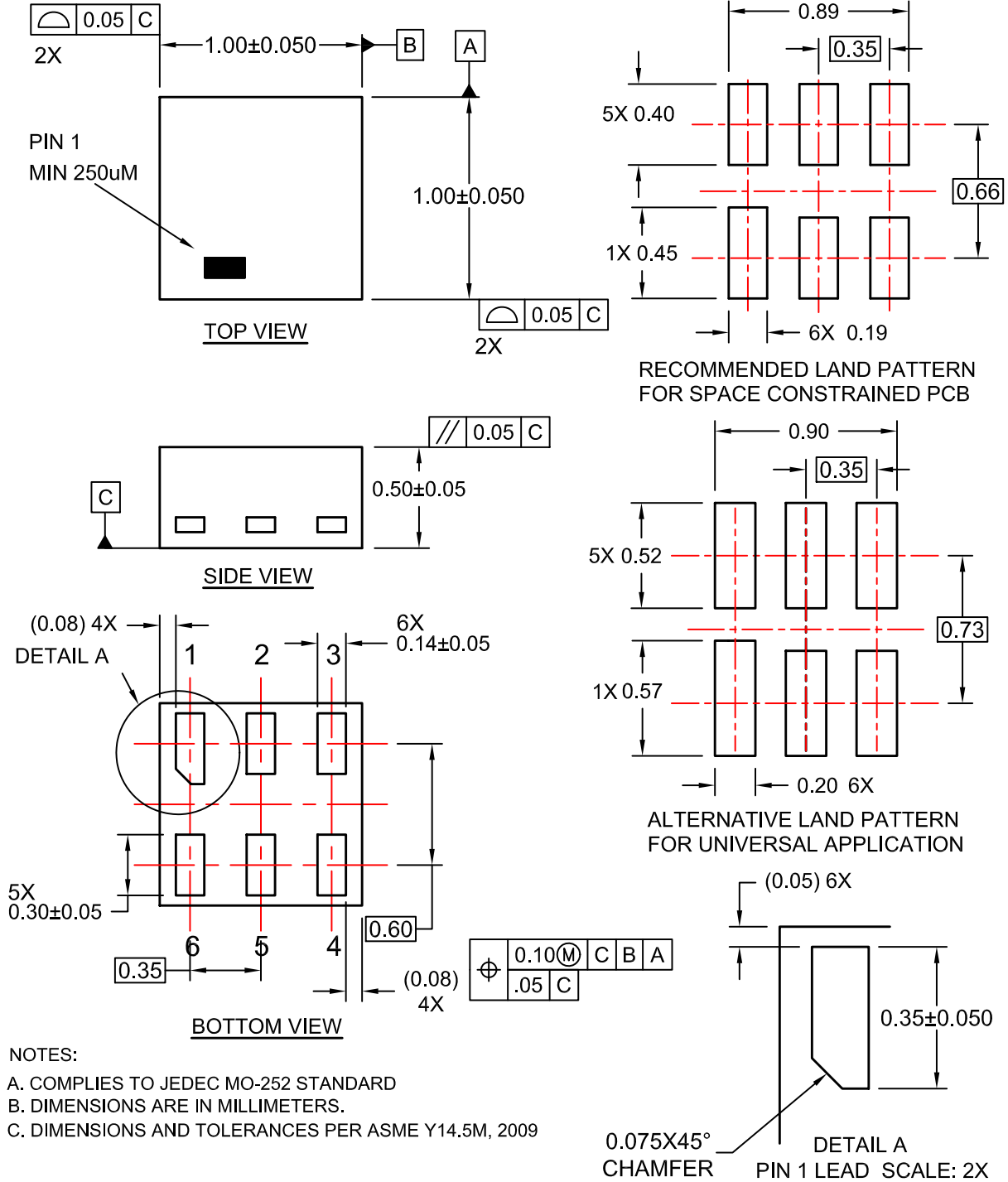
**Notes:**

- (1) All dimensions are in millimeters. Angles in degrees.
- (2) Complies with JEDEC MO-203.

# NC7SZU04

## PACKAGE DIMENSIONS

UDFN6 1.0X1.0, 0.35P  
CASE 517DP  
ISSUE O



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**Email:** [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

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