

# TinyLogic ULP-A Buffer with Three-State Output



**ON Semiconductor®**

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## NC7SV125

The NC7SV125 is a single non-inverting 3-state buffer in tiny footprint packages. The device is designed to operate for  $V_{CC} = 0.9\text{ V}$  to  $3.6\text{ V}$ .

### Features

- Designed for 0.9 V to 3.6 V  $V_{CC}$  Operation
- 1.0 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

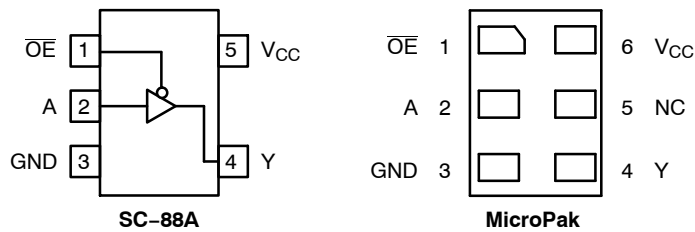


Figure 1. Pinout Diagrams (Top Views)

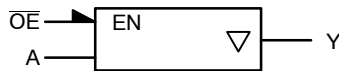
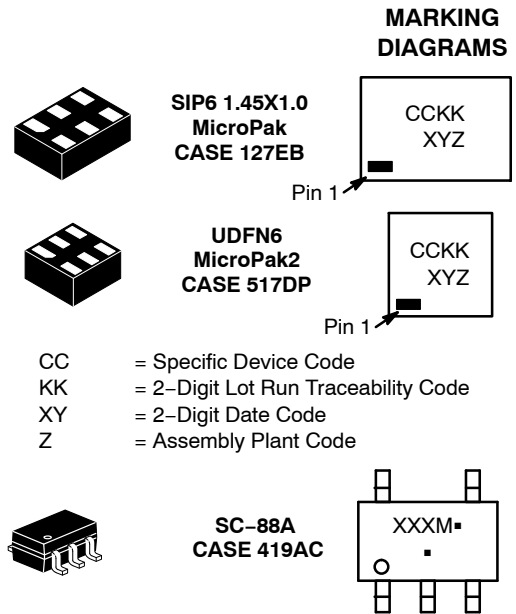


Figure 2. Logic Symbol

### PIN ASSIGNMENT

Pin	SC88A	MicroPak
1	$\overline{OE}$	$\overline{OE}$
2	A	A
3	GND	GND
4	Y	Y
5	$V_{CC}$	N.C.
6	-	$V_{CC}$

N.C. = No Connect



CC = Specific Device Code  
 KK = 2-Digit Lot Run Traceability Code  
 XY = 2-Digit Date Code  
 Z = Assembly Plant Code

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

### ORDERING INFORMATION

See detailed ordering, marking and shipping information on page 7 of this data sheet.

### FUNCTION TABLE

Input		Output
$\overline{OE}$	A	Y
L	L	L
L	H	H
H	X	Z

X = Don't Care  
 Z = High Impedance State

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## MAXIMUM RATINGS

Symbol	Characteristics	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
$I_{OUT}$	DC Output Source/Sink Current	$\pm 50$	mA
$I_{CC}$ or $I_{GND}$	DC Supply Current per Supply Pin or Ground Pin	$\pm 50$	mA
$T_{STG}$	Storage Temperature Range	-65 to +150	$^{\circ}C$
$T_L$	Lead Temperature, 1 mm from Case for 10 Seconds	260	$^{\circ}C$
$T_J$	Junction Temperature Under Bias	+150	$^{\circ}C$
$\theta_{JA}$	Thermal Resistance (Note 2)	SC-88A MicroPak 377 154	$^{\circ}C/W$
$P_D$	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	-
$I_{Latchup}$	Latchup Performance (Note 4)	$\pm 100$	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.

1. Applicable to devices with outputs that may be tri-stated.
2. 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.
3. 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.

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## RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
V <sub>CC</sub>	Positive DC Supply Voltage	0.9	3.6	V
V <sub>IN</sub>	DC Input Voltage	0	3.6	V
V <sub>OUT</sub>	DC Output Voltage Active-Mode (High or Low State) Tri-State Mode (Note 1) Power-Down Mode (V <sub>CC</sub> = 0 V)	0	V <sub>CC</sub>	
		0	3.6	
		0	3.6	
T <sub>A</sub>	Operating Temperature Range	-40	+85	°C
t <sub>r</sub> , t <sub>f</sub>	Input Transition Rise and Fall Time V <sub>CC</sub> = 3.3 V ± 0.3 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

Symbol	Parameter	Condition	V <sub>CC</sub> (V)	T <sub>A</sub> = 25°C			T <sub>A</sub> = -40°C to +85°C		Unit
				Min	Typ	Max	Min	Max	
V <sub>IH</sub>	High-Level Input Voltage		0.9	-	0.5	-	-	-	V
			1.1 to 1.3	0.65 x V <sub>CC</sub>	-	-	0.65 x V <sub>CC</sub>	-	
			1.4 to 1.6	0.65 x V <sub>CC</sub>	-	-	0.65 x V <sub>CC</sub>	-	
			1.65 to 1.95	0.65 x V <sub>CC</sub>	-	-	0.65 x V <sub>CC</sub>	-	
			2.3 to <2.7	1.6	-	-	1.6	-	
			2.7 to 3.6	2.0	-	-	2.0	-	
V <sub>IL</sub>	Low-Level Input Voltage		0.9	-	0.5	-	-	-	V
			1.1 to 1.3	-	-	0.35 x V <sub>CC</sub>	-	0.35 x V <sub>CC</sub>	
			1.4 to 1.6	-	-	0.35 x V <sub>CC</sub>	-	0.35 x V <sub>CC</sub>	
			1.65 to 1.95	-	-	0.35 x V <sub>CC</sub>	-	0.35 x V <sub>CC</sub>	
			2.3 to <2.7	-	-	0.7	-	0.7	
			2.7 to 3.6	-	-	0.8	-	0.8	
V <sub>OH</sub>	High-Level Output Voltage	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>							V
		I <sub>OH</sub> = -100 μA	0.9	-	V <sub>CC</sub> - 0.1	-	-	-	
			1.1 to 1.3	V <sub>CC</sub> - 0.1	-	-	V <sub>CC</sub> - 0.1	-	
			1.4 to 1.6	V <sub>CC</sub> - 0.1	-	-	V <sub>CC</sub> - 0.1	-	
			1.65 to 1.95	V <sub>CC</sub> - 0.2	-	-	V <sub>CC</sub> - 0.2	-	
			2.3 to <2.7	V <sub>CC</sub> - 0.2	-	-	V <sub>CC</sub> - 0.2	-	
			2.7 to 3.6	V <sub>CC</sub> - 0.2	-	-	V <sub>CC</sub> - 0.2	-	
		I <sub>OH</sub> = -2 mA	1.1 to 1.3	0.75 x V <sub>CC</sub>	-	-	0.75 x V <sub>CC</sub>	-	
			1.4 to 1.6	0.75 x V <sub>CC</sub>	-	-	0.75 x V <sub>CC</sub>	-	
		I <sub>OH</sub> = -4 mA	1.65 to 1.95	1.25	-	-	1.25	-	
			2.3 to <2.7	2.0	-	-	2.0	-	
		I <sub>OH</sub> = -6 mA	2.3 to <2.7	1.8	-	-	1.8	-	
			2.7 to 3.6	2.2	-	-	2.2	-	
		I <sub>OH</sub> = -12 mA	2.3 to <2.7	1.7	-	-	1.7	-	
			2.7 to 3.6	2.4	-	-	2.4	-	
I <sub>OH</sub> = -18 mA	2.7 to 3.6	2.2	-	-	2.2	-			
	2.7 to 3.6	2.2	-	-	2.2	-			

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## DC ELECTRICAL CHARACTERISTICS (continued)

Symbol	Parameter	Condition	V <sub>CC</sub> (V)	T <sub>A</sub> = 25°C			T <sub>A</sub> = -40°C to +85°C		Unit	
				Min	Typ	Max	Min	Max		
V <sub>OL</sub>	Low-Level Output Voltage	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>							V	
		I <sub>OL</sub> = 100 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	-	-	0.2	-	0.2		-
			2.3 to < 2.7	-	-	0.2	-	0.2		-
			2.7 to 3.6	-	-	0.2	-	0.2		-
		I <sub>OL</sub> = 2 mA	1.1 to 1.3	-	-	0.25 x V <sub>CC</sub>	-	0.25 x V <sub>CC</sub>		-
		I <sub>OL</sub> = 4 mA	1.4 to 1.6	-	-	0.25 x V <sub>CC</sub>	-	0.25 x V <sub>CC</sub>		-
		I <sub>OL</sub> = 6 mA	1.65 to 1.95	-	-	0.3	-	0.3		-
			2.3 to < 2.7	-	-	0.4	-	0.4		-
		I <sub>OL</sub> = 12 mA	2.3 to < 2.7	-	-	0.4	-	0.4		-
			2.7 to 3.6	-	-	0.4	-	0.4		-
I <sub>OL</sub> = 18 mA	2.3 to < 2.7	-	-	0.6	-	0.6	-			
	2.7 to 3.6	-	-	0.4	-	0.4	-			
I <sub>OL</sub> = 24 mA	2.7 to 3.6	-	-	0.55	-	0.55	-			
I <sub>IN</sub>	Input Leakage Current	V <sub>IN</sub> = 0 V to 3.6 V	0.9 to 3.6	-	-	±0.1	-	±0.5	μA	
I <sub>OZ</sub>	3-State Output Leakage Current	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> V <sub>OUT</sub> = 0 V to 3.6 V	0.9 to 3.6	-	-	±0.5	-	±0.5	μA	
I <sub>OFF</sub>	Power Off Leakage Current	V <sub>IN</sub> = 0 V to 3.6 V or V <sub>OUT</sub> = 0 V to 3.6 V	0	-	-	0.5	-	0.5	μA	
I <sub>CC</sub>	Quiescent Supply Current	V <sub>IN</sub> = V <sub>CC</sub> or GND	0.9 to 3.6	-	-	0.9	-	0.9	μA	

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

Symbol	Parameter	Condition	V <sub>CC</sub> (V)	T <sub>A</sub> = 25°C			T <sub>A</sub> = -40°C to +85°C		Unit
				Min	Typ	Max	Min	Max	
t <sub>PLH</sub> , t <sub>PHL</sub>	Propagation Delay, A to Y (Figures 3 and 4)	R <sub>L</sub> = 1 MΩ, C <sub>L</sub> = 15 pF	0.9	-	13	-	-	-	ns
			1.1 to 1.3	-	6.0	9.8	-	14.9	
		R <sub>L</sub> = 500 Ω, C <sub>L</sub> = 30 pF	1.4 to 1.6	-	3.5	5.3	-	5.7	
			1.65 to 1.95	-	3.0	4.3	-	4.6	
			2.3 to 2.7	-	2.0	2.8	-	3.0	
			2.7 to 3.6	-	1.0	2.6	-	2.8	
t <sub>PZH</sub> , t <sub>PZL</sub>	Output Enable Time, OE to Y (Figures 3 and 4)	R <sub>1</sub> = R <sub>L</sub> = 1 kΩ, C <sub>L</sub> = 30 pF	0.9	-	14	-	-	-	ns
			1.1 to 1.3	-	6.0	9.7	-	16.4	
			1.4 to 1.6	-	4.0	6.0	-	7.5	
			1.65 to 1.95	-	3.0	4.5	-	5.0	
			2.3 to 2.7	-	2.0	3.0	-	3.4	
			2.7 to 3.6	-	1.2	2.6	-	2.9	

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## AC ELECTRICAL CHARACTERISTICS (continued)

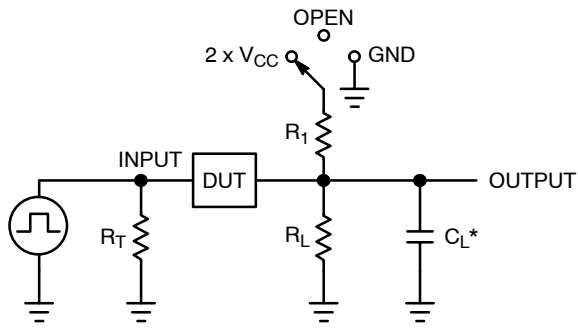
Symbol	Parameter	Condition	V <sub>CC</sub> (V)	T <sub>A</sub> = 25°C			T <sub>A</sub> = -40°C to +85°C		Unit
				Min	Typ	Max	Min	Max	
t <sub>PHZ</sub> , t <sub>PLZ</sub>	Output Disable Time, OE to Y (Figures 3 and 4)	R <sub>1</sub> = R <sub>L</sub> = 1 kΩ, C <sub>L</sub> = 30 pF	0.9	-	14	-	-	-	ns
			1.1 to 1.3	-	5.0	9.5	-	14.0	
			1.4 to 1.6	-	3.0	5.5	-	7.0	
			1.65 to 1.95	-	2.0	5.6	-	5.8	
			2.3 to 2.7	-	1.5	4.2	-	5.0	
			2.7 to 3.6	-	1.0	3.9	-	4.2	

## CAPACITIVE CHARACTERISTICS

Symbol	Parameter	Test Condition	Typical (T <sub>A</sub> = 25°C)	Unit
C <sub>IN</sub>	Input Capacitance	V <sub>CC</sub> = 0 V	2.0	pF
C <sub>OUT</sub>	Output Capacitance	V <sub>CC</sub> = 0 V	4.5	pF
C <sub>PD</sub>	Power Dissipation Capacitance (Note 5)	f = 10 MHz, V <sub>CC</sub> = 0.9 to 3.6 V, V <sub>IN</sub> = 0 V or V <sub>CC</sub>	10.0	pF

5. C<sub>PD</sub> 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  $I_{CC(OPR)} = C_{PD} \cdot V_{CC} \cdot f_{in} + I_{CC}$ . C<sub>PD</sub> is used to determine the no-load dynamic power consumption:  $P_D = C_{PD} \cdot V_{CC}^2 \cdot f_{in} + I_{CC} \cdot V_{CC}$ .

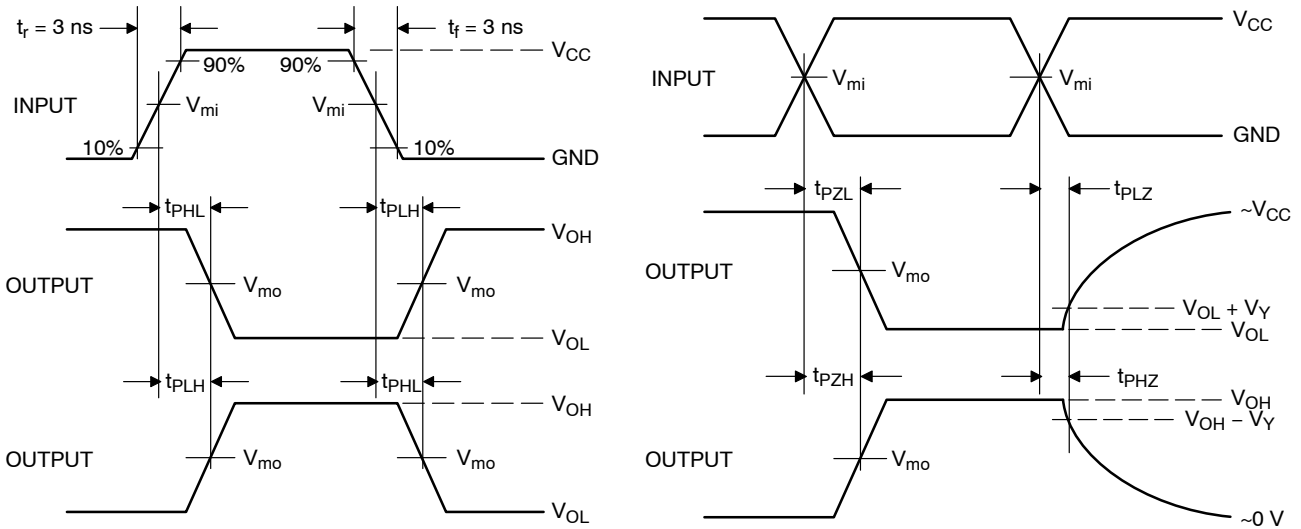
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$C_L$  includes probe and jig capacitance  
 $R_T$  is  $Z_{OUT}$  of pulse generator (typically 50  $\Omega$ )  
 $f = 1$  MHz

Test	Switch Position
$t_{PLH} / t_{PHL}$	Open
$t_{PLZ} / t_{PZL}$	$2 \times V_{CC}$
$t_{PHZ} / t_{PZH}$	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

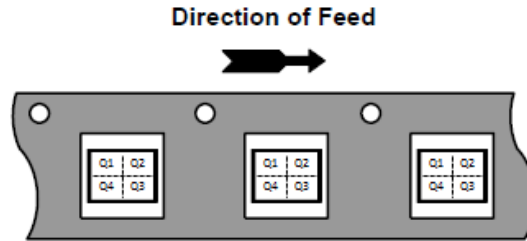
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## ORDERING INFORMATION

Device	Package	Marking	Pin 1 Orientation (See below)	Shipping†
NC7SV125P5X	SC-88A	V25	Q4	3000 / Tape & Reel
NC7SV125L6X	MicroPak	H6	Q4	5000 / Tape & Reel
NC7SV125FHX (In Development)	MicroPak2	TBD	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

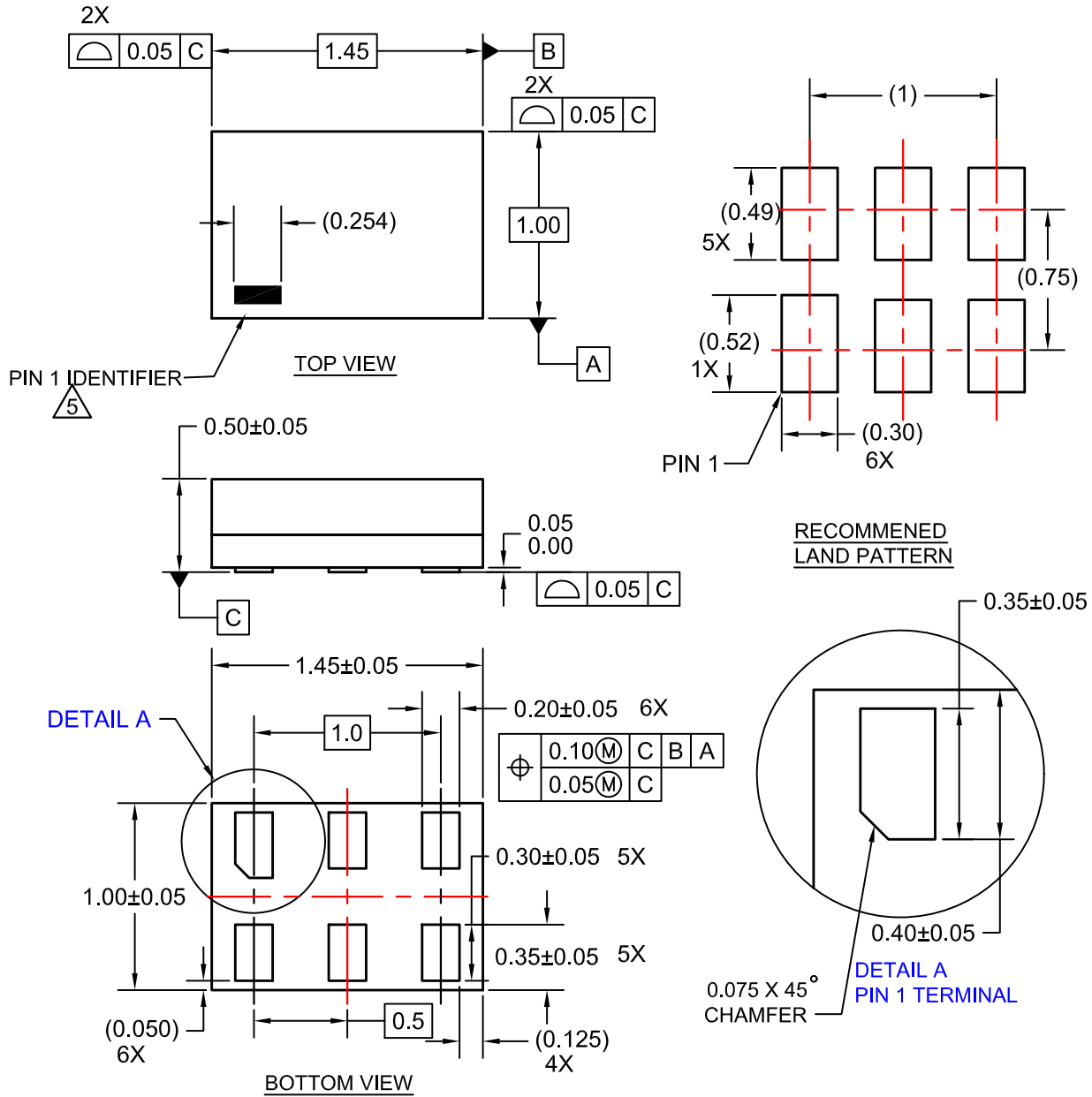


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## PACKAGE DIMENSIONS

SIP6 1.45X1.0  
CASE 127EB  
ISSUE O



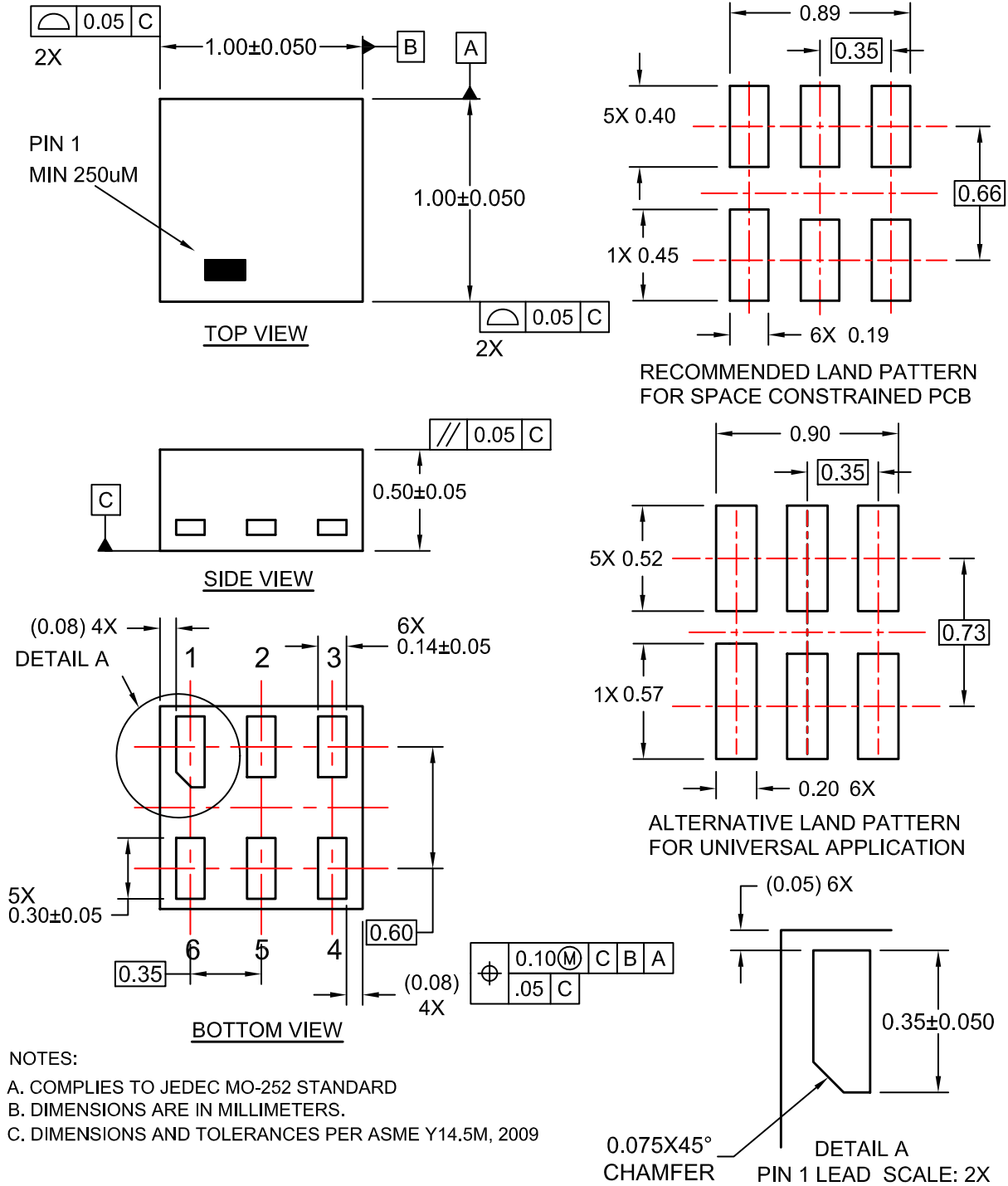
**NOTES:**

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.

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## PACKAGE DIMENSIONS

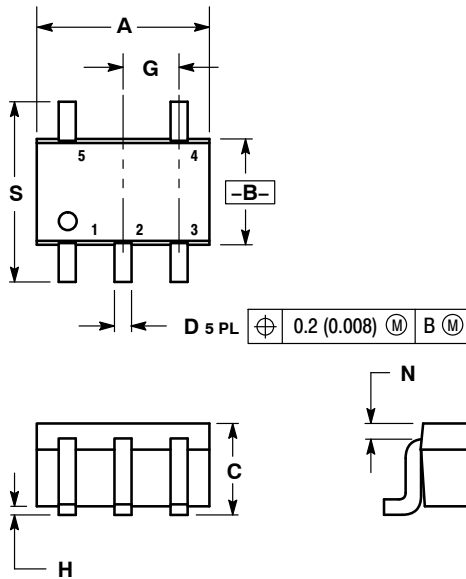
UDFN6 1.0X1.0, 0.35P  
CASE 517DP  
ISSUE O



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## PACKAGE DIMENSIONS

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

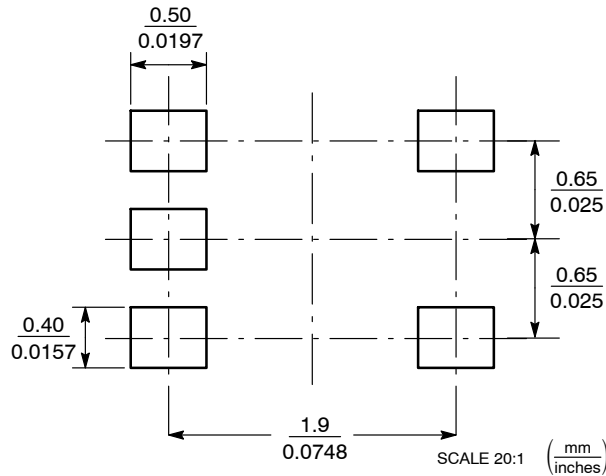


**NOTES:**

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

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