

# TinyLogic UHS Inverter with Schmitt Trigger Input

## NC7SZ14

### Description

The NC7SZ14 is a single inverter with Schmitt trigger input from onsemi's Ultra-High Speed (UHS) series of TinyLogic. 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 very broad V<sub>CC</sub> operating range. The device is specified to operate over the 1.65 V to 5.5 V V<sub>CC</sub> range. The inputs and outputs are high-impedance when V<sub>CC</sub> is 0 V. Inputs tolerate voltages up to 5.5 V independent of V<sub>CC</sub> operating voltage.

### Features

- Ultra-High Speed: t<sub>PD</sub> = 3.7 ns (Typical) into 50 pF at 5 V V<sub>CC</sub>
- High Output Drive:  $\pm 24$  mA at 3 V V<sub>CC</sub>
- Broad V<sub>CC</sub> Operating Range: 1.65 V to 5.5 V
- Matches Performance of LCX when Operated at 3.3 V V<sub>CC</sub>
- Power Down High Impedance Inputs / Outputs
- Over-Voltage Tolerance Inputs Facilitate 5 V to 3 V Translation
- Proprietary Noise / EMI Reduction Circuitry
- Ultra-Small MicroPak™ Packages
- Space-Saving SOT23-5, SC-74A and SC-88A Packages
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

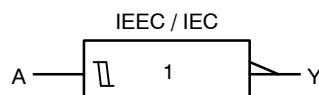
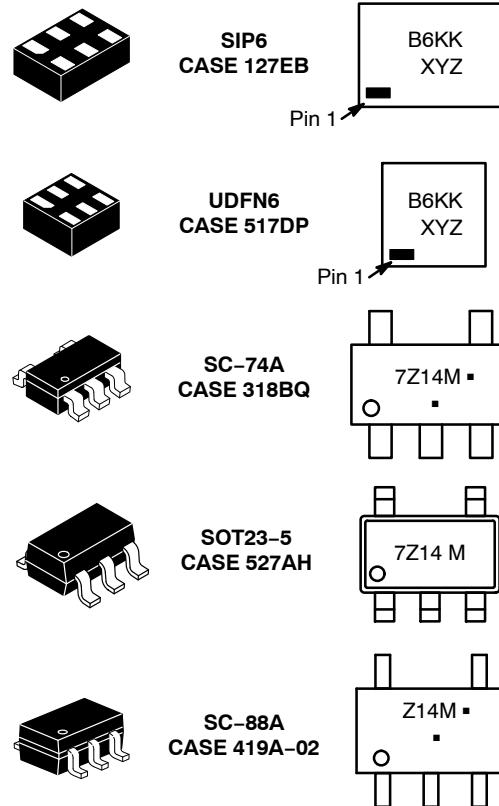


Figure 1. Logic Symbol

### MARKING DIAGRAMS



B6, 7Z14, Z14 = Specific Device Code  
 KK = 2-Digit Lot Run Traceability Code  
 XY = 2-Digit Date Code Format  
 Z = Assembly Plant Code  
 M = Date Code  
 ■ = Pb-Free Package

(Note: Microdot may be in either location)

### ORDERING INFORMATION

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

## Pin Configurations

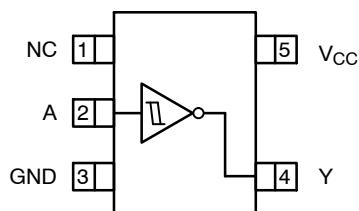


Figure 2. SOT23-5, SC-88A and SC-74A (Top View)

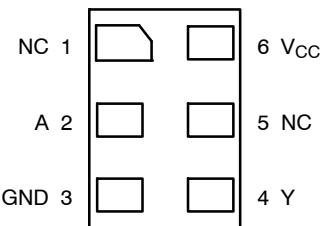


Figure 3. MicroPak (Top Through View)

## PIN DEFINITIONS

Pin # SC-88A / SC74A/ SOT23-5	Pin # MicroPak	Name	Description
1	1, 5	NC	No Connect
2	2	A	Input
3	3	GND	Ground
4	4	Y	Output
5	6	VCC	Supply Voltage

## FUNCTION TABLE

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 <sub>CC</sub>	Supply Voltage		-0.5	6.5	V
V <sub>IN</sub>	DC Input Voltage		-0.5	6.5	V
V <sub>OUT</sub>	DC Output Voltage		-0.5	6.5	V
I <sub>IK</sub>	DC Input Diode Current	V <sub>IN</sub> < 0 V	-	-50	mA
I <sub>OK</sub>	DC Output Diode Current	V <sub>OUT</sub> < 0 V	-	-50	mA
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		-	±50	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 / SOT23-5	-	390	mW
		SC-88A	-	332	
		MicroPak-6	-	812	
		MicroPak2™-6	-	812	
ESD	Human Body Model, JEDEC: JESD22-A114		-	2000	V
	Charge Device Model, JEDEC: JESD22-C101		-	1000	

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 Operating		1.65	5.5	V
	Supply Voltage Data Retention		1.5	5.5	
$V_{IN}$	Input Voltage		0	5.5	V
$V_{OUT}$	Output Voltage		0	$V_{CC}$	V
$T_A$	Operating Temperature		-40	+85	°C
$\theta_{JA}$	Thermal Resistance	SC-74A / SOT23-5	-	320	°C/W
		SC-88A	-	377	
		MicroPak-6	-	154	
		MicroPak2-6	-	154	

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.

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

## DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	$V_{CC}$ (V)	Conditions	$T_A = +25^\circ C$			$T_A = -40 \text{ to } +85^\circ C$		Unit
				Min	Typ	Max	Min	Max	
$V_P$	Positive Threshold Voltage	1.65		-	1.00	1.40	-	1.40	V
		1.80		-	1.10	1.50	-	1.50	
		2.30		-	1.40	1.80	-	1.80	
		3.00		-	1.75	2.20	-	2.20	
		4.50		-	2.45	3.10	-	3.10	
		5.50		-	2.90	3.60	-	3.60	
$V_N$	Negative Threshold Voltage	1.65		0.20	0.50	-	0.20	-	V
		1.80		0.25	0.55	-	0.25	-	
		2.30		0.40	0.75	-	0.40	-	
		3.00		0.60	1.00	-	0.60	-	
		4.50		1.00	1.43	-	1.00	-	
		5.50		1.20	1.70	-	1.20	-	
$V_H$	Hysteresis Voltage	1.65		0.10	0.48	0.90	0.10	0.90	V
		1.80		0.15	0.54	1.00	0.15	1.00	
		2.30		0.25	0.65	1.10	0.25	1.10	
		3.00		0.40	0.77	1.20	0.40	1.20	
		4.50		0.60	1.01	1.50	0.60	1.50	
		5.50		0.70	1.18	1.70	0.70	1.70	

## DC ELECTRICAL CHARACTERISTICS (continued)

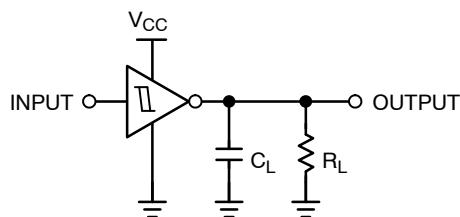
Symbol	Parameter	V <sub>CC</sub> (V)	Conditions	T <sub>A</sub> = +25°C			T <sub>A</sub> = -40 to +85°C		Unit
				Min	Typ	Max	Min	Max	
V <sub>OH</sub>	HIGH Level Output Voltage	1.65	V <sub>IN</sub> = V <sub>P</sub> or V <sub>N</sub> , I <sub>OH</sub> = -100 μA	1.55	1.65	–	1.55	–	V
		1.80		1.70	1.80	–	1.70	–	
		2.30		2.20	2.30	–	2.20	–	
		3.00		2.90	3.00	–	2.90	–	
		4.50		4.40	4.50	–	4.40	–	
		1.65	I <sub>OH</sub> = -4 mA	1.29	1.52	–	1.29	–	
		2.30	I <sub>OH</sub> = -8 mA	1.90	2.15	–	1.90	–	
		3.00	I <sub>OH</sub> = -16 mA	2.40	2.80	–	2.40	–	
		3.00	I <sub>OH</sub> = -24 mA	2.30	2.68	–	2.30	–	
		4.50	I <sub>OH</sub> = -32 mA	3.80	4.20	–	3.80	–	
V <sub>OL</sub>	LOW Level Output Voltage	1.65	V <sub>IN</sub> = V <sub>P</sub> or V <sub>N</sub> , I <sub>OL</sub> = 100 μA	–	0.00	0.10	–	0.10	V
		1.80		–	0.00	0.10	–	0.10	
		2.30		–	0.00	0.10	–	0.10	
		3.00		–	0.00	0.10	–	0.10	
		4.50		–	0.00	0.10	–	0.10	
		1.65	I <sub>OL</sub> = 4 mA	–	0.08	0.24	–	0.24	
		2.30	I <sub>OL</sub> = 8 mA	–	0.10	0.30	–	0.30	
		3.00	I <sub>OL</sub> = 16 mA	–	0.15	0.40	–	0.40	
		3.00	I <sub>OL</sub> = 24 mA	–	0.22	0.55	–	0.55	
		4.50	I <sub>OL</sub> = 32 mA	–	0.22	0.55	–	0.55	
I <sub>IN</sub>	Input Leakage Current	1.65 to 5.5	V <sub>IN</sub> = 5.5 V, GND	–	–	±0.1	–	±1.0	μA
I <sub>OFF</sub>	Power Off Leakage Current	0	V <sub>IN</sub> or V <sub>OUT</sub> = 5.5 V	–	–	1	–	10	μA
I <sub>CC</sub>	Quiescent Supply Current	1.65 to 5.5	V <sub>IN</sub> = 5.5 V, GND	–	–	1.0	–	10	μA

## 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	–	9.1	15.0	–	15.6	ns
		1.80		–	7.6	12.5	–	13.0	
		2.50 ± 0.20		–	5.0	9.0	–	9.5	
		3.30 ± 0.30		–	3.7	6.3	–	6.5	
		5.00 ± 0.50		–	3.1	5.2	–	5.5	
		3.30 ± 0.30	C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω	–	4.4	7.2	–	7.5	
		5.00 ± 0.50		–	3.7	5.9	–	6.2	
C <sub>IN</sub>	Input Capacitance	0.00		–	4	–	–	–	pF
C <sub>PD</sub>	Power Dissipation Capacitance (Note 2) (Figure 6)	3.30		–	24	–	–	–	pF
		5.00		–	30	–	–	–	

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<sub>CCD</sub> = (C<sub>PD</sub>) (V<sub>CC</sub>) (f<sub>IN</sub>) + (I<sub>CCstatic</sub>).

# NC7SZ14



NOTE:

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

Figure 4. AC Test Circuit

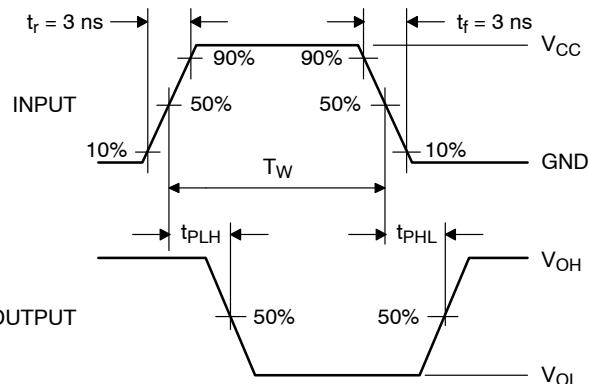
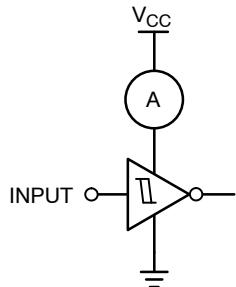


Figure 5. AC Waveforms



NOTE:

3. Input = AC Waveform;  $t_r = t_f = 1.8$  ns;  
PRR = 10 MHz; Duty Cycle = 50%.

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

## ORDERING INFORMATION

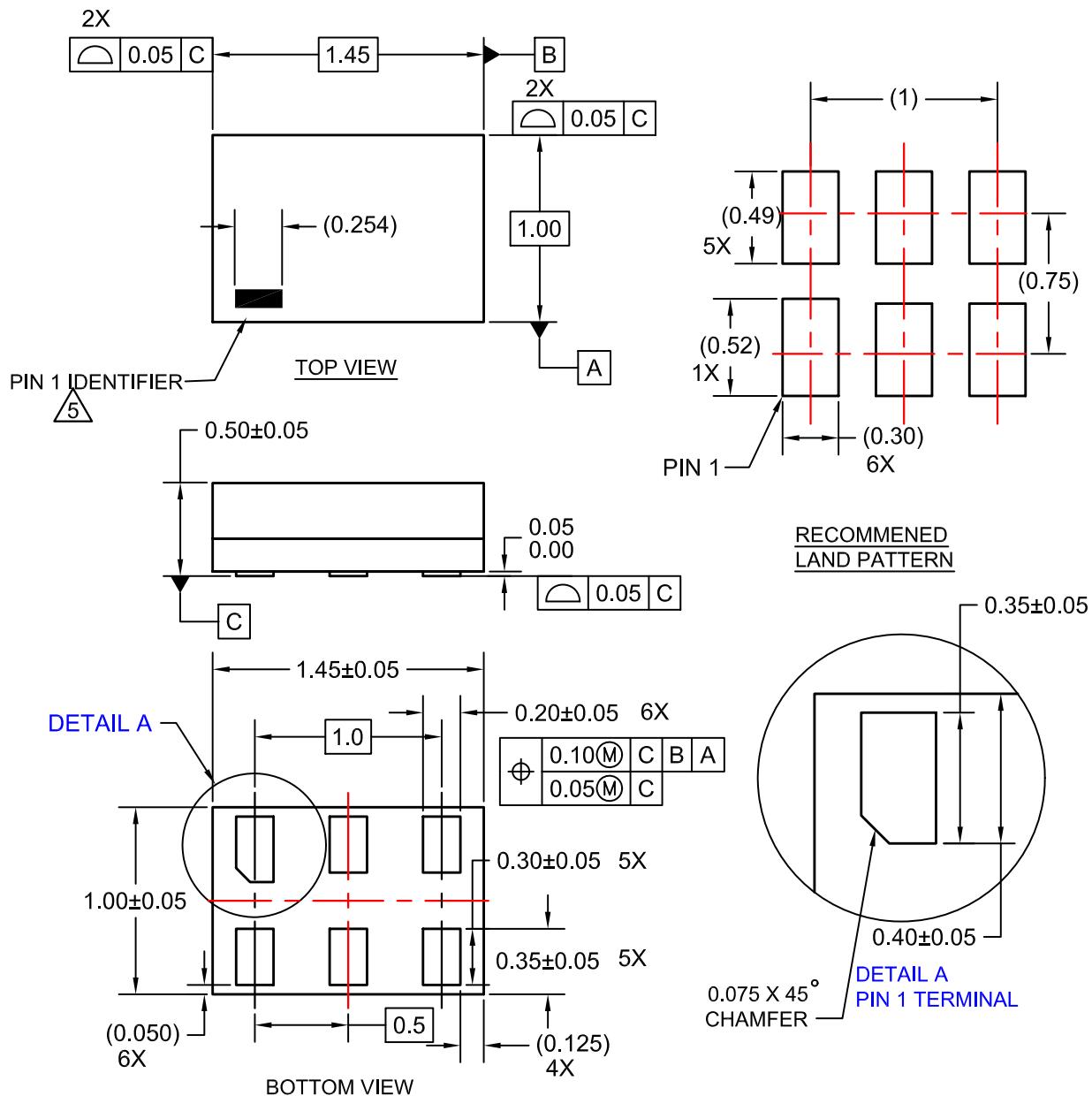
Part Number	Top Mark	Operating Temperature	Packages	Shipping <sup>†</sup>
NC7SZ14M5X	7Z14	-40 to +85°C	SC-74A	3000 / Tape & Reel
NC7SZ14M5X-L22090	7Z14	-40 to +85°C	SOT23-5	3000 / Tape & Reel
NC7SZ14P5X	Z14	-40 to +85°C	SC-88A	3000 / Tape & Reel
NC7SZ14P5X-L22057	Z14	-40 to +85°C	SC-88A	3000 / Tape & Reel
NC7SZ14L6X	B6	-40 to +85°C	SIP6, MicroPak	5000 / Tape & Reel
NC7SZ14L6X-L22175	B6	-40 to +85°C	SIP6, MicroPak	5000 / Tape & Reel
NC7SZ14FHX	B6	-40 to +85°C	UDFN6, MicroPak2	5000 / Tape & Reel
NC7SZ14FHX-L22175	B6	-40 to +85°C	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.

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**SIP6 1.45X1.0**  
CASE 127EB  
ISSUE O

DATE 31 AUG 2016



NOTES:

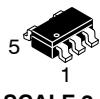
1. CONFORMS TO JEDEC STANDARD MO-252 VARIATION UAAD
2. DIMENSIONS ARE IN MILLIMETERS
3. DRAWING CONFORMS TO ASME Y14.5M-2009
4. PIN ONE IDENTIFIER IS 2X LENGTH OF ANY OTHER LINE IN THE MARK CODE LAYOUT.

DOCUMENT NUMBER:	98AON13590G	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	SIP6 1.45X1.0	PAGE 1 OF 1

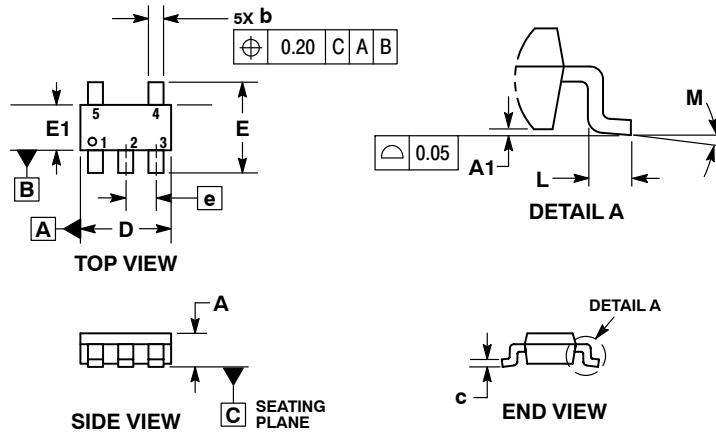
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**MECHANICAL CASE OUTLINE**  
PACKAGE DIMENSIONS

**onsemi**<sup>TM</sup>



SCALE 2:1



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

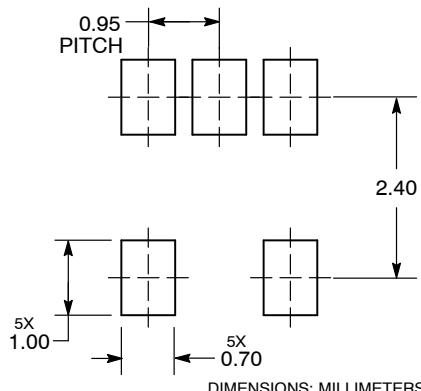
DATE 18 JAN 2018

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 MM PER SIDE.

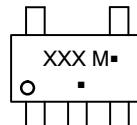
DIM	MILLIMETERS	
	MIN	MAX
A	0.90	1.10
A1	0.01	0.10
b	0.25	0.50
c	0.10	0.26
D	2.85	3.15
E	2.50	3.00
E1	1.35	1.65
e	0.95 BSC	
L	0.20	0.60
M	0°	10°

**RECOMMENDED  
SOLDERING FOOTPRINT\***



DIMENSIONS: MILLIMETERS

**GENERIC  
MARKING DIAGRAM\***



XXX = Specific Device Code

M = Date Code

▪ = Pb-Free Package

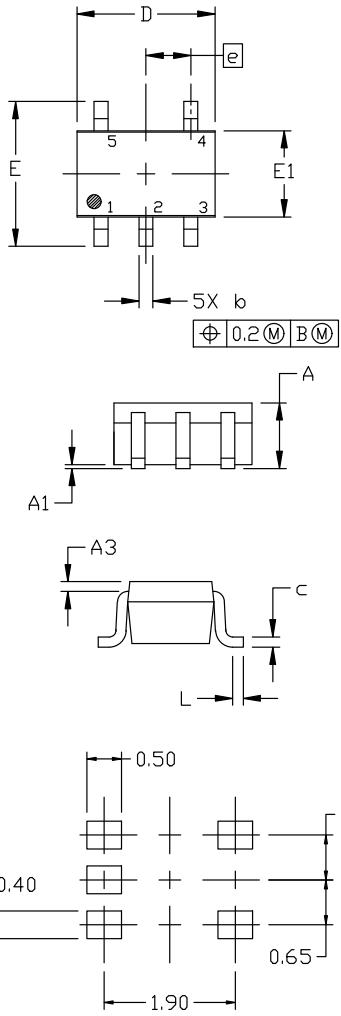
(Note: Microdot may be in either location)

\*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 **onsemi** Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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DESCRIPTION:	SC-74A	PAGE 1 OF 1

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**RECOMMENDED  
MOUNTING FOOTPRINT**

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

**STYLE 1:**  
PIN 1. BASE  
2. Emitter  
3. BASE  
4. COLLECTOR  
5. COLLECTOR

**STYLE 6:**  
PIN 1. Emitter 2  
2. BASE 2  
3. Emitter 1  
4. COLLECTOR  
5. COLLECTOR 2/BASE 1

**STYLE 2:**  
PIN 1. ANODE  
2. Emitter  
3. BASE  
4. COLLECTOR  
5. CATHODE

**STYLE 7:**  
PIN 1. BASE  
2. Emitter  
3. BASE  
4. COLLECTOR  
5. COLLECTOR

**STYLE 3:**  
PIN 1. ANODE 1  
2. N/C  
3. ANODE 2  
4. CATHODE 2  
5. CATHODE 1

**STYLE 8:**  
PIN 1. CATHODE  
2. COLLECTOR  
3. N/C  
4. BASE  
5. Emitter

**STYLE 4:**  
PIN 1. SOURCE 1  
2. DRAIN 1/2  
3. SOURCE 1  
4. GATE 1  
5. GATE 2

**STYLE 9:**  
PIN 1. ANODE  
2. CATHODE  
3. ANODE  
4. ANODE  
5. ANODE

**STYLE 5:**  
PIN 1. CATHODE  
2. COMMON ANODE  
3. CATHODE 2  
4. CATHODE 3  
5. CATHODE 4

**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.

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

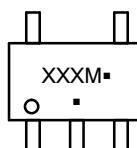
DATE 11 APR 2023

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

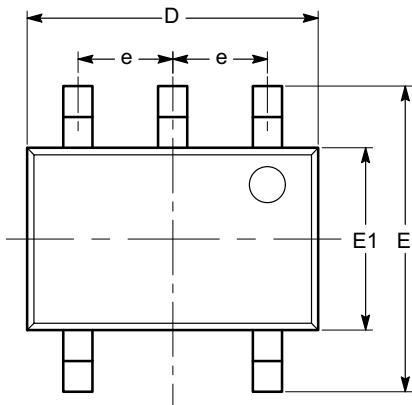
(Note: Microdot may be in either location)

<b>DOCUMENT NUMBER:</b>	98ASB42984B	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
<b>DESCRIPTION:</b>	SC-88A (SC-70-5/SOT-353)	<b>PAGE 1 OF 1</b>

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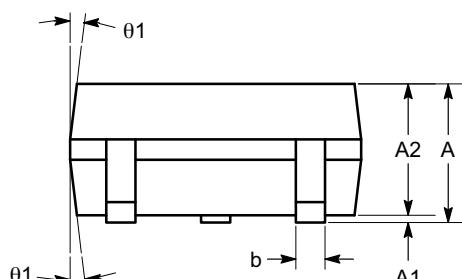
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CASE 419AC-01  
ISSUE A

DATE 29 JUN 2010

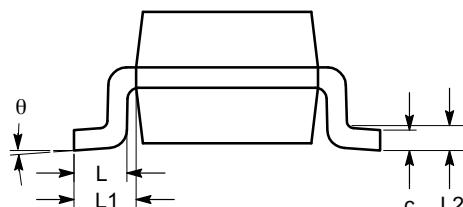


TOP VIEW

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	
$\theta$	$0^\circ$		$8^\circ$
$\theta_1$	$4^\circ$		$10^\circ$



SIDE VIEW



END VIEW

**Notes:**

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

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DESCRIPTION:	SC-88A (SC-70 5 LEAD), 1.25X2	PAGE 1 OF 1

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# MECHANICAL CASE OUTLINE

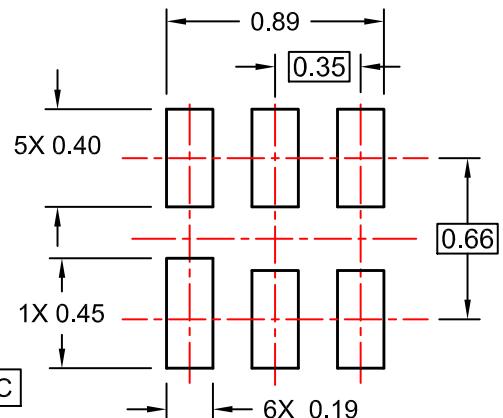
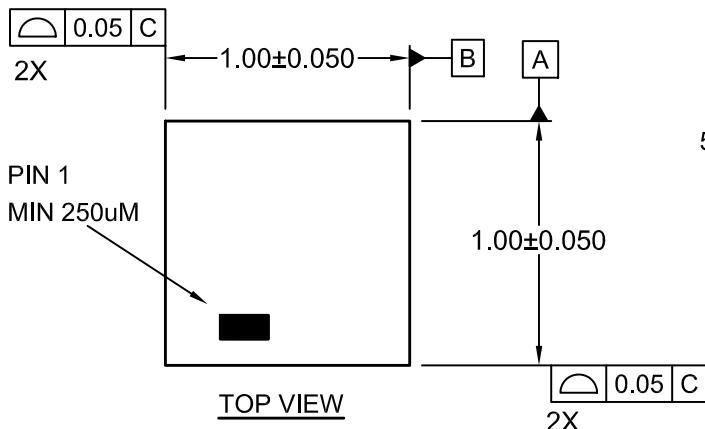
## PACKAGE DIMENSIONS

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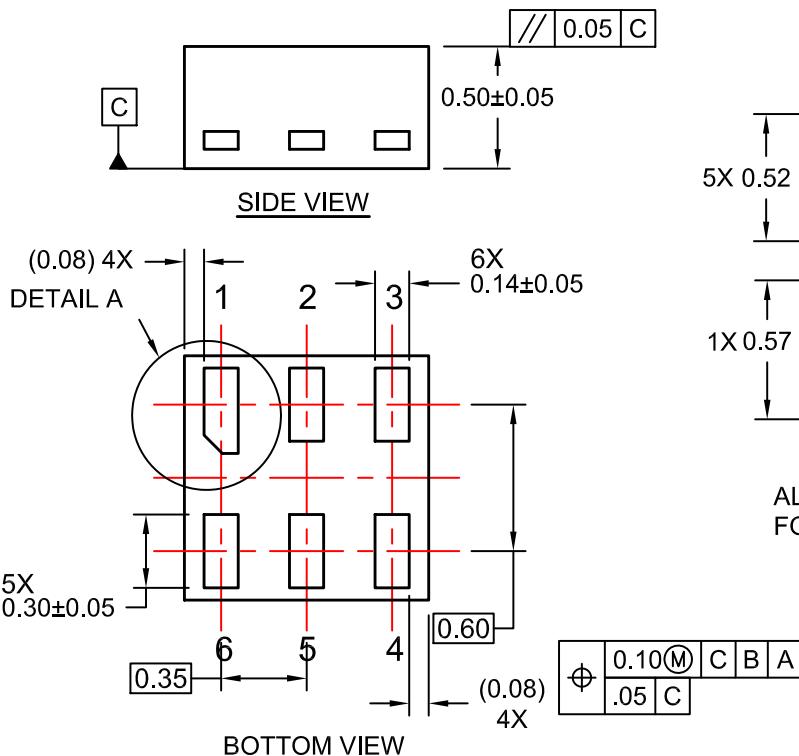
ON

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

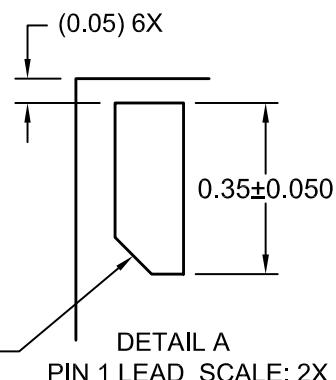
DATE 31 AUG 2016



## RECOMMENDED LAND PATTERN FOR SPACE CONSTRAINED PCB



## ALTERNATIVE LAND PATTERN FOR UNIVERSAL APPLICATION



## NOTES:

- A. COMPLIES TO JEDEC MO-252 STANDARD
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 2009

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