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TinyLogic ULP-A Buffer with Schmitt-Trigger Input

NC7SP17

The NC7SP17 is a single buffer with Schmitt−Trigger Input in tiny footprint packages. The device is designed to operate for V_{CC} = 0.9 V to 3.6 V.

Features

- Designed for 0.9 V to 3.6 V V_{CC} Operation
- 2.6 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

MARKING DIAGRAMS

SIP6 1.45X1.0 MicroPak CASE 127EB

CCKK
XYZ
Pin 1
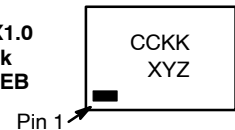
UDFN6 MicroPak2 CASE 517DP

CCKK
XYZ
Pin 1
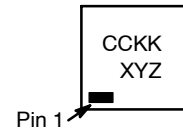
CC	= Specific Device Code
KK	= 2−Digit Lot Run Traceability Code
XY	= 2−Digit Date Code
Z	= Assembly Plant Code
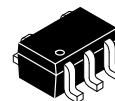
SC−88A CASE 419AC

XXXM■
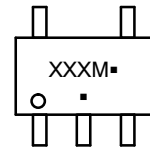
XXX = Specific Device Code
M = Date Code
■ = Pb−Free Package

ORDERING INFORMATION

See detailed ordering, marking and shipping information on page 6 of this data sheet.

Figure 1. Pinout Diagrams (Top Views)

Figure 2. Logic Symbol

PIN ASSIGNMENT

Pin	SC−88A	MicroPak
1	N.C.	N.C.
2	A	A
3	GND	GND
4	Y	Y
5	V_{CC}	N.C.
6	–	V_{CC}

N.C. = No Connect

FUNCTION TABLE

Input	Output
A	Y
L	L
H	H

X = Don't Care
Z = High Impedance State

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		±50	mA
I_{CC} or I_{GND}	DC Supply Current per Supply Pin or Ground Pin		±50	mA
T_{STG}	Storage Temperature Range		−65 to +150	°C
T_L	Lead Temperature, 1 mm from Case for 10 Seconds		260	°C
T_J	Junction Temperature Under Bias		+150	°C
θ_{JA}	Thermal Resistance (Note 2)	SC−88A MicroPak	377 154	°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	–
V_{ESD}	ESD Withstand Voltage (Note 3)	Human Body Model Charged Device Model	2000 1000	V
$I_{Latchup}$	Latchup Performance (Note 4)		±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.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter		Min	Max	Unit
V_{CC}	Positive DC Supply Voltage		0.9	3.6	V
V_{IN}	DC Input Voltage		0	3.6	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 0 0	V_{CC} 3.6 3.6	
T_A	Operating Temperature Range		−40	+85	°C
t_r , t_f	Input Transition Rise and Fall Time		0	No Limit	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.

NC7SP17

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Condition	V_{CC} (V)	$T_A = 25°C$			$T_A = −40°C$ to $+85°C$		Unit
				Min	Typ	Max	Min	Max	
V_P	Positive Threshold Voltage		0.9	–	0.62	–	–	–	V
			1.1	–	–	1.0	–	1.0	
			1.4	–	–	1.2	–	1.2	
			1.65	–	–	1.5	–	1.5	
			2.3	–	–	1.9	–	1.9	
			3.0	–	–	2.6	–	2.6	
V_N	Negative Threshold Voltage		0.9	–	0.34	–	–	–	V
			1.1	0.15	–	–	0.15	–	
			1.4	0.2	–	–	0.2	–	
			1.65	0.25	–	–	0.25	–	
			2.3	0.4	–	–	0.4	–	
			3.0	0.6	–	–	0.6	–	
V_H	Hysteresis Voltage		0.9	–	0.29	–	–	–	V
			1.1	0.08	–	0.6	0.08	0.6	
			1.4	0.09	–	0.8	0.09	0.8	
			1.65	0.1	–	1.0	0.1	1.0	
			2.3	0.25	–	1.1	0.25	1.1	
			3.0	0.6	–	1.8	0.6	1.8	
V_{OH}	High−Level Output Voltage	$V_{IN} = V_P$ or V_N							V
		$I_{OH} = −20\ \mu A$	0.9	–	$V_{CC} − 0.1$	–	–	–	
			1.1 to 1.3	$V_{CC} − 0.1$	–	–	$V_{CC} − 0.1$	–	
			1.4 to 1.6	$V_{CC} − 0.1$	–	–	$V_{CC} − 0.1$	–	
			1.65 to 1.95	$V_{CC} − 0.1$	–	–	$V_{CC} − 0.1$	–	
			2.3 to 2.7	$V_{CC} − 0.1$	–	–	$V_{CC} − 0.1$	–	
			3.0 to 3.6	$V_{CC} − 0.1$	–	–	$V_{CC} − 0.1$	–	
		$I_{OH} = −0.5\ mA$	1.1 to 1.3	$0.75 \times V_{CC}$	–	–	$0.75 \times V_{CC}$	–	
		$I_{OH} = −1\ mA$	1.4 to 1.6	1.07	–	–	0.99	–	
		$I_{OH} = −1.5\ mA$	1.65 to 1.95	1.24	–	–	1.22	–	
		$I_{OH} = −2.1\ mA$	2.3 to 2.7	1.95	–	–	1.87	–	
		$I_{OH} = −2.6\ mA$	3.0 to 3.6	2.61	–	–	2.55	–	

DC ELECTRICAL CHARACTERISTICS (continued)

Symbol	Parameter	Condition	V_{CC} (V)	T_A = 25°C			T_A = −40°C to +85°C		Unit
				Min	Typ	Max	Min	Max	
V_{OL}	Low−Level Output Voltage	V_{IN} = V_P or V_N							V
		I_{OL} = 20 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	–	–	0.1	–	0.1	
			2.3 to 2.7	–	–	0.1	–	0.1	
			3.0 to 3.6	–	–	0.1	–	0.1	
		I_{OL} = 0.5 mA	1.1 to 1.3	–	–	0.3 x V_{CC}	–	0.3 x V_{CC}	
		I_{OL} = 1 mA	1.4 to 1.6	–	–	0.31	–	0.37	
		I_{OL} = 1.5 mA	1.65 to 1.95	–	–	0.31	–	0.35	
		I_{OL} = 2.1 mA	2.3 to 2.7	–	–	0.31	–	0.33	
		I_{OL} = 2.6 mA	3.0 to 3.6	–	–	0.31	–	0.33	
I_{IN}	Input Leakage Current	V_{IN} = 0 V to 3.6 V	0.9 to 3.6	–	–	±0.1	–	±0.5	μA
I_{OFF}	Power Off Leakage Current	V_{IN} = 0 V to 3.6 V or V_{OUT} = 0 V to 3.6 V	0	–	–	0.5	–	0.5	μA
I_{CC}	Quiescent Supply Current	V_{IN} = V_{CC} 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_{CC} (V)	T_A = 25°C			T_A = −40°C to +85°C		Unit
				Min	Typ	Max	Min	Max	
t_{PLH}, t_{PHL}	Propagation Delay, A to Y (Figures 3 and 4)	R_L = 1 MΩ, C_L = 10 pF	0.9	–	64.4	–	–	–	ns
			1.10 to 1.30	–	16.4	39.3	–	46.6	
			1.40 to 1.60	–	6.7	14.8	–	15.0	
			1.65 to 1.95	–	4.7	12.0	–	12.2	
			2.3 to 2.7	–	3.2	9.4	–	9.9	
			3.0 to 3.6	–	2.6	8.3	–	9.0	
t_{PLH}, t_{PHL}	Propagation Delay, A to Y (Figures 3 and 4)	R_L = 1 MΩ, C_L = 15 pF	0.9	–	66.3	–	–	–	ns
			1.10 to 1.30	–	16.9	40.7	–	48.2	
			1.40 to 1.60	–	7.1	15.5	–	16.5	
			1.65 to 1.95	–	5.1	12.6	–	13.6	
			2.3 to 2.7	–	3.4	9.9	–	10.8	
			3.0 to 3.6	–	2.8	8.7	–	9.5	
t_{PLH}, t_{PHL}	Propagation Delay, A to Y (Figures 3 and 4)	R_L = 1 MΩ, C_L = 30 pF	0.9	–	72.1	–	–	–	ns
			1.10 to 1.30	–	18.3	44.9	–	53.0	
			1.40 to 1.60	–	8.4	17.8	–	18.2	
			1.65 to 1.95	–	6.2	14.4	–	15.9	
			2.3 to 2.7	–	4.1	11.3	–	12.8	
			3.0 to 3.6	–	3.3	9.2	–	10.7	

NC7SP17

CAPACITIVE CHARACTERISTICS

Symbol	Parameter	Test Condition	Typical (T_A = 25°C)	Unit
C_{IN}	Input Capacitance	V_{CC} = 0 V	2.0	pF
C_{OUT}	Output Capacitance	V_{CC} = 0 V	4.0	pF
C_{PD}	Power Dissipation Capacitance (Note 5)	f = 10 MHz, V_{CC} = 0.9 to 3.6 V, V_{IN} = 0 V or V_{CC}	8.0	pF

5. C_{PD} 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 $I_{CC(OPR)} = C_{PD} \bullet V_{CC} \bullet f_{in} + I_{CC}$. C_{PD} is used to determine the no−load dynamic power consumption: $P_D = C_{PD} \bullet V_{CC}^2 \bullet f_{in} + I_{CC} \bullet V_{CC}$.

Test	Switch Position
t_{PLH} / t_{PHL}	Open
t_{PLZ} / t_{PZL}	2 x V_{CC}
t_{PHZ} / t_{PZH}	GND
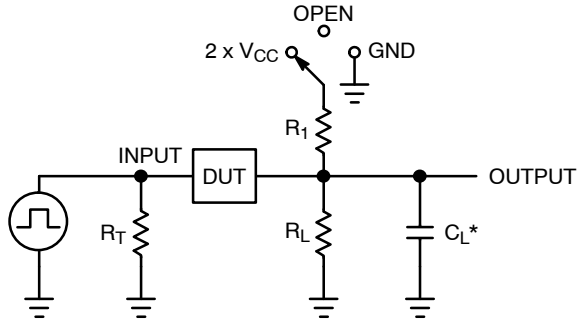
C_L includes probe and jig capacitance
R_T is Z_{OUT} of pulse generator (typically 50 Ω)
f = 1 MHz

Figure 3. Test Circuit
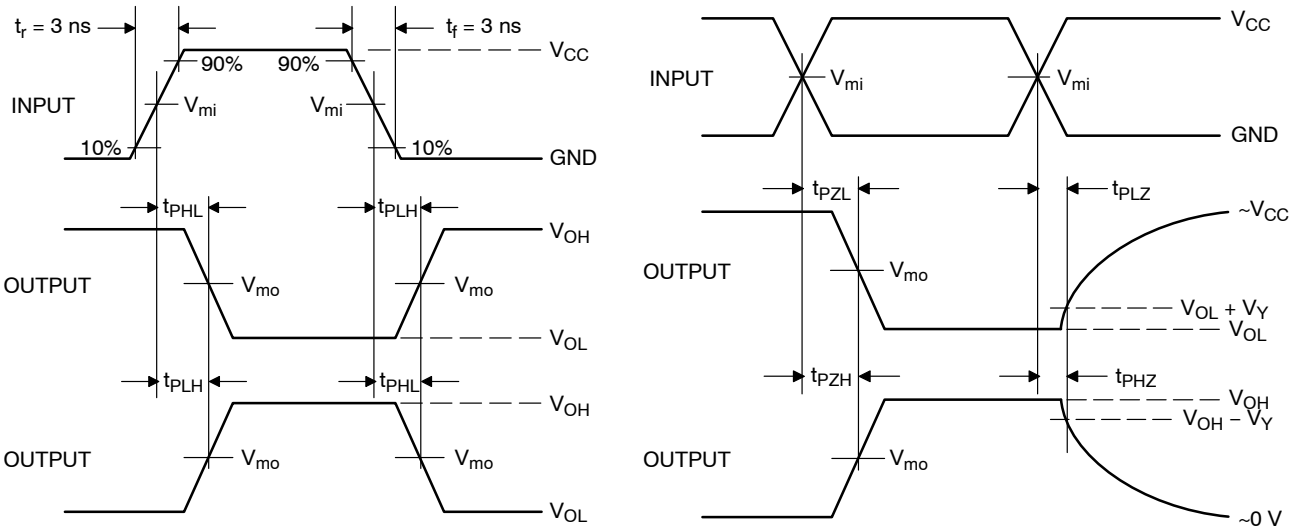
V_{CC}, V	V_{mi}, V	V_{mo}, V	V_Y, V
0.9	V_{CC} / 2	V_{CC} / 2	0.1
1.1 to 1.3	V_{CC} / 2	V_{CC} / 2	0.1
1.4 to 1.6	V_{CC} / 2	V_{CC} / 2	0.1
1.65 to 1.95	V_{CC} / 2	V_{CC} / 2	0.15
2.3 to 2.7	V_{CC} / 2	V_{CC} / 2	0.15
3.0 to 3.6	1.5	1.5	0.3

Figure 4. Switching Waveforms

ORDERING INFORMATION

Device	Package	Marking	Pin 1 Orientation (See below)	Shipping†
NC7SP17P5X	SC−88A	P17	Q4	3000 / Tape & Reel
NC7SP17L6X	MicroPak	K4	Q4	5000 / Tape & Reel
NC7SP17FHX	MicroPak2	K4	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
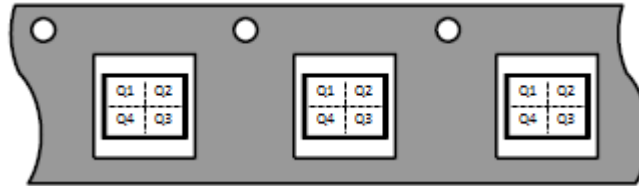
SIP6 1.45X1.0
CASE 127EB
ISSUE O

DATE 31 AUG 2016

2X

| ⌒ | 0.05 | C |

1.45

B

2X

| ⌒ | 0.05 | C |

1.00

(0.254)

PIN 1 IDENTIFIER

△5

TOP VIEW

A

(1)

(0.49)
5X

(0.75)

(0.52)
1X

(0.30)
6X

PIN 1

0.50±0.05

0.05
0.00

| ⌒ | 0.05 | C |

C

RECOMMENED
LAND PATTERN

0.35±0.05

1.45±0.05

1.0

DETAIL A

0.20±0.05 6X

| ⊕ | 0.10 Ⓜ | C | B | A |
| | 0.05 Ⓜ | C | | |

0.30±0.05 5X

1.00±0.05

0.35±0.05 5X

0.40±0.05

(0.050)
6X

0.5

(0.125)
4X

0.075 X 45°
CHAMFER

DETAIL A
PIN 1 TERMINAL

BOTTOM VIEW
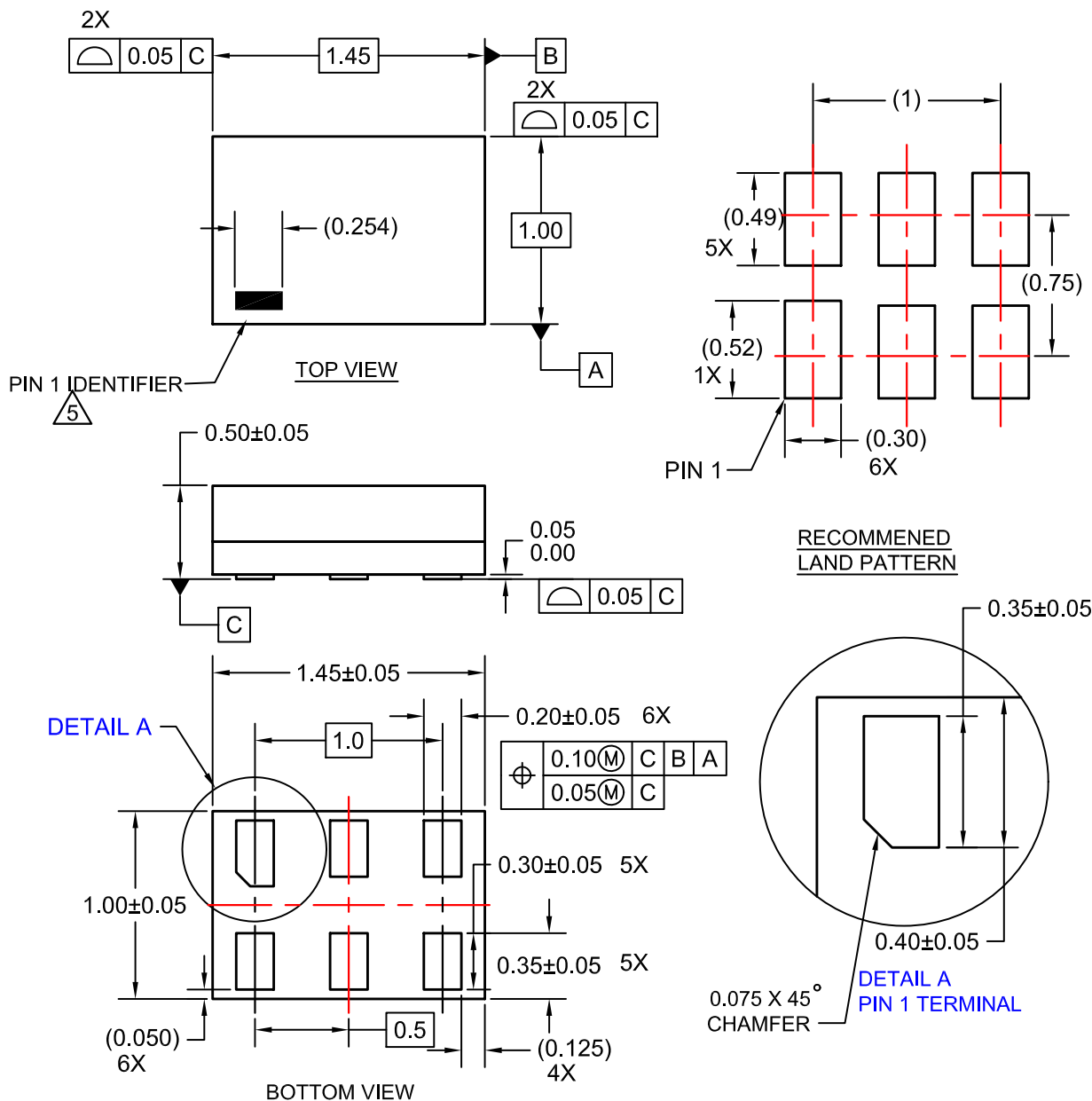
NOTES:

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 | | |
| DESCRIPTION: | SIP6 1.45X1.0 | | PAGE 1 OF 1 |

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

DATE 29 JUN 2010
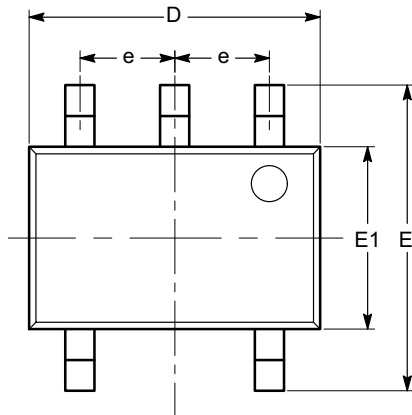
TOP VIEW

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		
θ	0º		8º
θ1	4º		10º
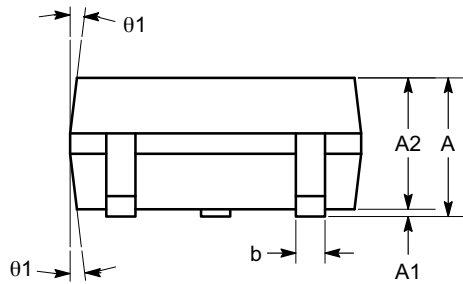
SIDE VIEW
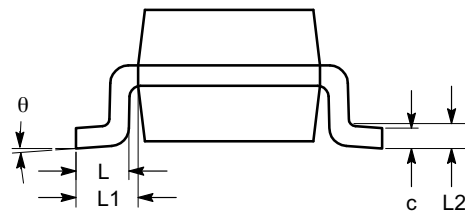
END VIEW

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

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

DATE 31 AUG 2016

TOP VIEW

SIDE VIEW

DETAIL A

BOTTOM VIEW
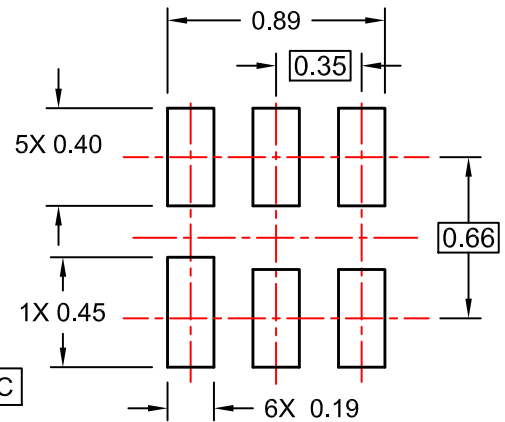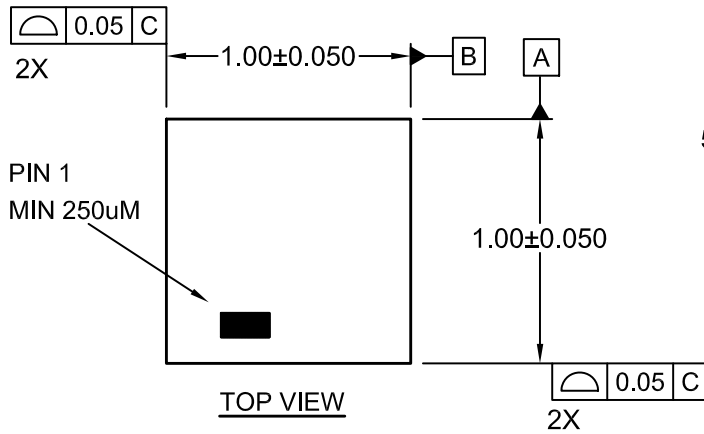
RECOMMENDED LAND PATTERN
FOR SPACE CONSTRAINED PCB
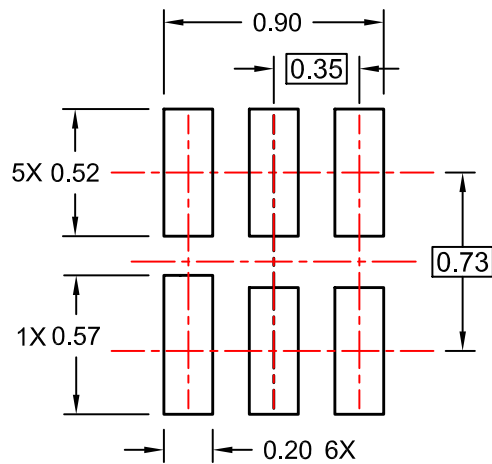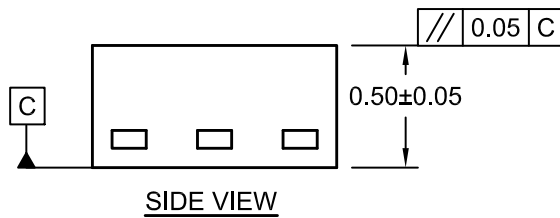
ALTERNATIVE LAND PATTERN
FOR UNIVERSAL APPLICATION

DETAIL A
PIN 1 LEAD SCALE: 2X

0.075X45°
CHAMFER
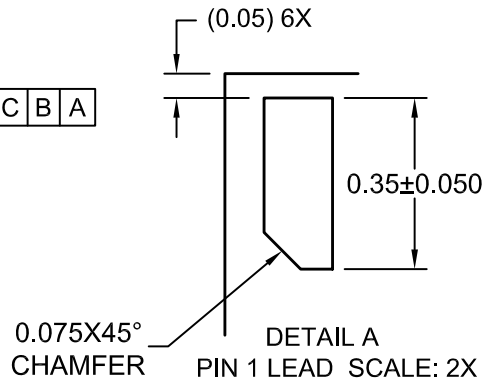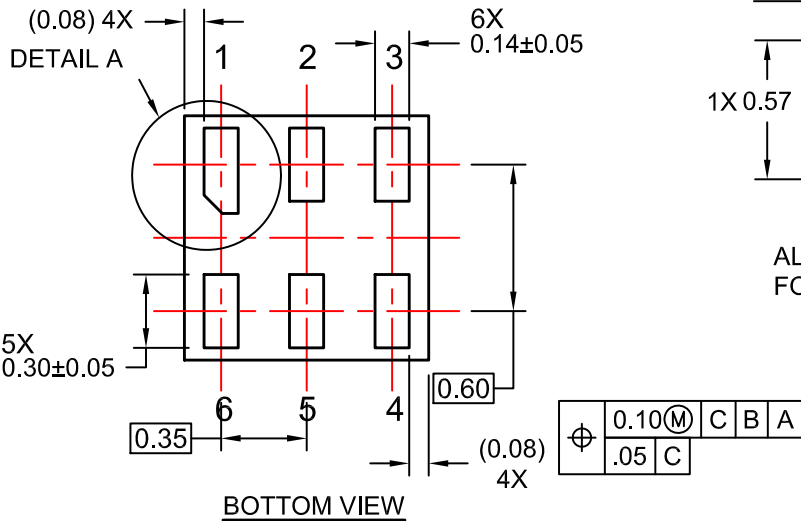
NOTES:

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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DESCRIPTION:	UDFN6 1.0X1.0, 0.35P		PAGE 1 OF 1

ADDITIONAL INFORMATION

◊