

# TinyLogic ULP-A Universal Configurable Logic Gates

## NC7SV57, NC7SV58

The NC7SV57 and NC7SV58 are universal configurable logic gates in tiny footprint packages. The devices are designed to operate for  $V_{CC} = 0.9\text{ V}$  to  $3.6\text{ V}$ .

### Features

- Designed for  $0.9\text{ V}$  to  $3.6\text{ V}$   $V_{CC}$  Operation
- $2.4\text{ ns}$   $t_{PD}$  at  $3.3\text{ V}$  (Typ)
- Inputs/Outputs Over-Voltage Tolerant up to  $3.6\text{ V}$
- $I_{OFF}$  Supports Partial Power Down Protection
- Source/Sink  $24\text{ mA}$  at  $3.3\text{ V}$
- Available in SC-88 and MicroPak™ Packages
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

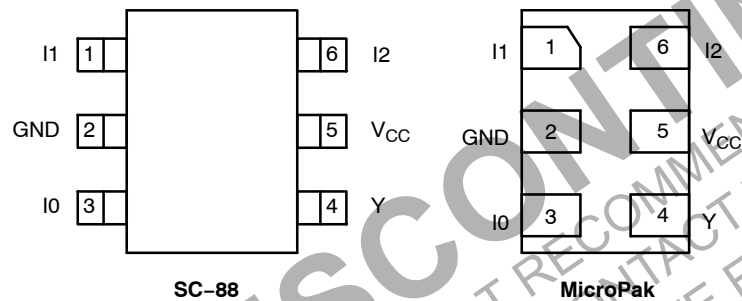


Figure 1. Pinout Diagrams (Top Views)

### PIN ASSIGNMENT

Pin	SC-88	MicroPak
1	I1	I1
2	GND	GND
3	I0	I0
4	Y	Y
5	$V_{CC}$	$V_{CC}$
6	I2	I2

### MARKING DIAGRAM



SIP6 1.45X1.0  
MicroPak  
CASE 127EB

Pin 1

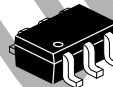


UDFN6 1.0X1.0, 0.35P  
MicroPak2™  
CASE 517DP

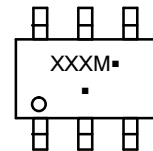
Pin 1



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



SC-88  
CASE 419AD



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

### ORDERING INFORMATION

See detailed ordering, marking and shipping information on page 9 of this data sheet.

# NC7SV57, NC7SV58

**FUNCTION TABLE**

Inputs			NC7SV57	NC7SV58
I2	I1	I0	$Y = (\overline{I0}) \cdot (\overline{I2}) + (I1) \cdot (I2)$	$Y = (I0) \cdot (\overline{I2}) + (\overline{I1}) \cdot (I2)$
L	L	L	H	L
L	L	H	L	H
L	H	L	H	L
L	H	H	L	H
H	L	L	L	H
H	L	H	L	H
H	H	L	H	L
H	H	H	H	L

**FUNCTION SELECTION TABLE**

2-Input Logic Function	Device Selection	Connection Configuration
2-Input AND	NC7SV57	Figure 2
2-Input AND with inverted input	NC7SV58	Figure 8, 9
2-Input AND with both inputs inverted	NC7SV57	Figure 5
2-Input NAND	NC7SV58	Figure 7
2-Input NAND with inverted input	NC7SV57	Figure 3, 4
2-Input NAND with both inputs inverted	NC7SV58	Figure 10
2-Input OR	NC7SV58	Figure 10
2-Input OR with inverted input	NC7SV57	Figure 3, 4
2-Input OR with both inputs inverted	NC7SV58	Figure 7
2-Input NOR	NC7SV57	Figure 5
2-Input NOR with inverted input	NC7SV58	Figure 8, 9
2-Input NOR with both inputs inverted	NC7SV57	Figure 2
2-Input XOR	NC7SV58	Figure 11
2-Input XNOR	NC7SV57	Figure 6

Logic Configurations NC7SV57

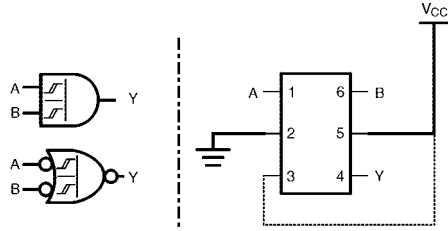


Figure 2. 2-Input AND Gate

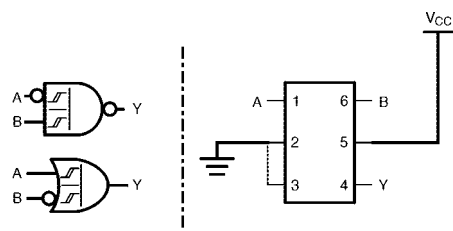


Figure 3. 2-Input NAND with Inverted A Input

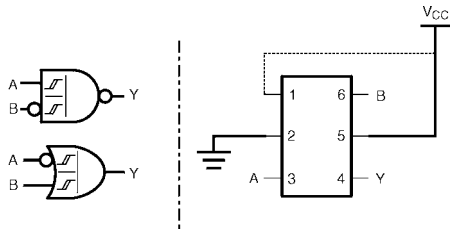


Figure 4. 2-Input NAND with Inverted B Input

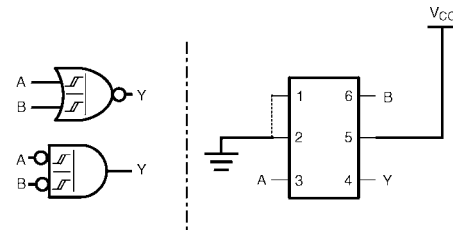


Figure 5. 2-Input NOR Gate

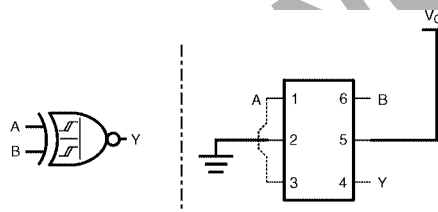


Figure 6. 2-Input XNOR Gate

NOTE: Figure 2 through Figure 6 show the logical functions that can be implemented using the NC7SV57. The diagrams show the DeMorgan's equivalent logic duals for a given 2-input function. Next to the logical implementation is the board level physical implementation of how the pins of the function should be connected.

# NC7SV57, NC7SV58

## Logic Configurations NC7SV58

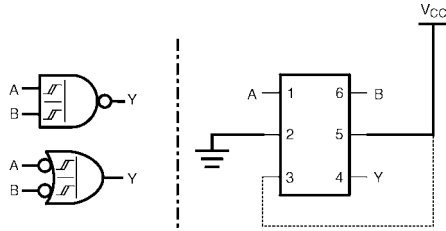


Figure 7. 2-Input NAND Gate

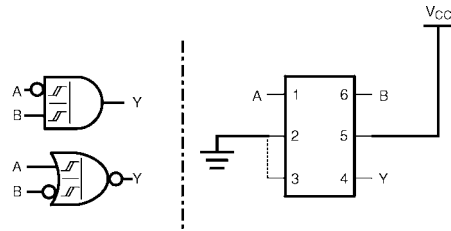


Figure 8. 2-Input AND with Inverted A Input

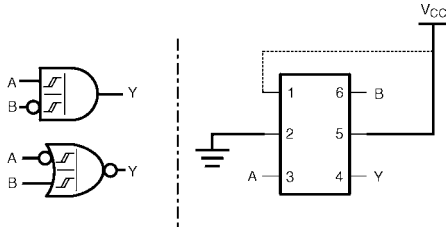


Figure 9. 2-Input AND with Inverted B Input

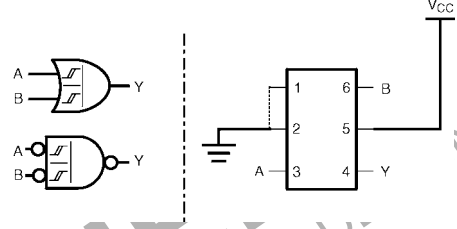


Figure 10. 2-Input OR Gate

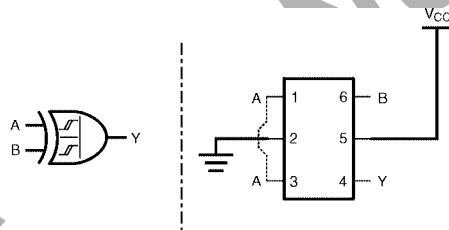


Figure 11. 2-Input XOR Gate

NOTE: Figure 7 through Figure 11 show the logical functions that can be implemented using the NC7SV58. The diagrams show the DeMorgan's equivalent logic duals for a given 2-input function. Next to the logical implementation is the board level physical implementation of how the pins of the function should be connected.

# NC7SV57, NC7SV58

## 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	°C
$T_L$	Lead Temperature, 1 mm from Case for 10 Seconds	260	°C
$T_J$	Junction Temperature Under Bias	+150	°C
$\theta_{JA}$	Thermal Resistance (Note 2) SC-88 MicroPak	377 154	°C/W
$P_D$	Power Dissipation in Still Air SC-88 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) Charged Device Model Human Body Model	2000 1000	V
$I_{Latchup}$	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.

## 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 5) Power-Down Mode ( $V_{CC} = 0$ V)	0 0 0	$V_{CC}$ 3.6 3.6	V
$T_A$	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.

5. Applicable to devices with outputs that may be tri-stated.

# NC7SV57, NC7SV58

## 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>P</sub>	Positive Threshold Voltage		0.9	–	0.62	–	–	–	V
			1.1	–	–	1.0	–	1.0	
			1.4	–	–	1.25	–	1.25	
			1.65	–	–	1.5	–	1.5	
			2.3	–	–	1.8	–	1.8	
			2.7	–	–	2.2	–	2.2	
V <sub>N</sub>	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	–	
			2.7	0.6	–	–	0.6	–	
V <sub>H</sub>	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	0.15	–	1.0	0.15	1.0	
			2.3	0.25	–	1.1	0.25	1.1	
			2.7	0.6	–	1.2	0.6	1.2	
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>	–	
		I <sub>OH</sub> = -4 mA	1.4 to 1.6	0.75 x V <sub>CC</sub>	–	–	0.75 x V <sub>CC</sub>	–	
		I <sub>OH</sub> = -6 mA	1.65 to 1.95	1.25	–	–	1.25	–	
			2.3 to <2.7	2.0	–	–	2.0	–	
		I <sub>OH</sub> = -12 mA	2.3 to <2.7	1.8	–	–	1.8	–	
			2.7 to 3.6	2.2	–	–	2.2	–	
		I <sub>OH</sub> = -18 mA	2.3 to <2.7	1.7	–	–	1.7	–	
			2.7 to 3.6	2.4	–	–	2.4	–	
		I <sub>OH</sub> = -24 mA	2.7 to 3.6	2.2	–	–	2.2	–	

# NC7SV57, NC7SV58

## 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	
		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>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

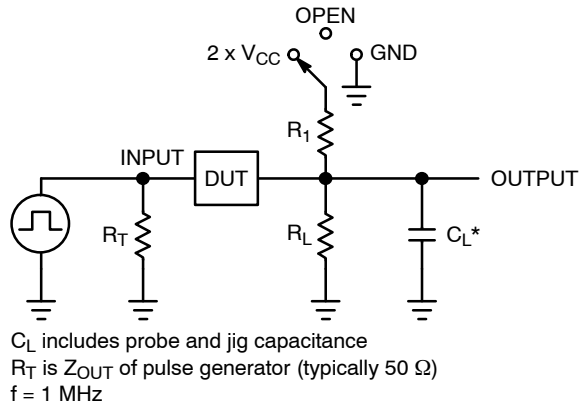
Symbol	Parameter	Condition	V <sub>CC</sub> (V)	T <sub>A</sub> = 25°C			T <sub>A</sub> = -40°C to +85°C		Unit
				Min	Typ	Max	Min	Max	
t <sub>PLH</sub> , t <sub>PHL</sub>	Propagation Delay, (I <sub>O</sub> or I <sub>1</sub> or I <sub>2</sub> ) to Y (Figures 12 and 13)	R <sub>L</sub> = 1 MΩ, C <sub>L</sub> = 15 pF	0.9	–	22.2	–	–	–	ns
		R <sub>L</sub> = 2 kΩ, C <sub>L</sub> = 15 pF	1.10 to 1.30	–	7.1	16.5	–	31.0	
			1.40 to 1.60	–	4.4	10.0	–	12.0	
		R <sub>L</sub> = 500 Ω, C <sub>L</sub> = 30 pF	1.65 to 1.95	–	3.7	9.1	–	10.0	
			2.3 to 2.7	–	2.9	6.2	–	6.7	
			3.0 to 3.6	–	2.4	5.4	–	6.1	

## 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	8.0	pF
C <sub>OUT</sub>	Output Capacitance	V <sub>CC</sub> = 0 V	12	pF
C <sub>PD</sub>	Power Dissipation Capacitance (Note 6)	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	pF

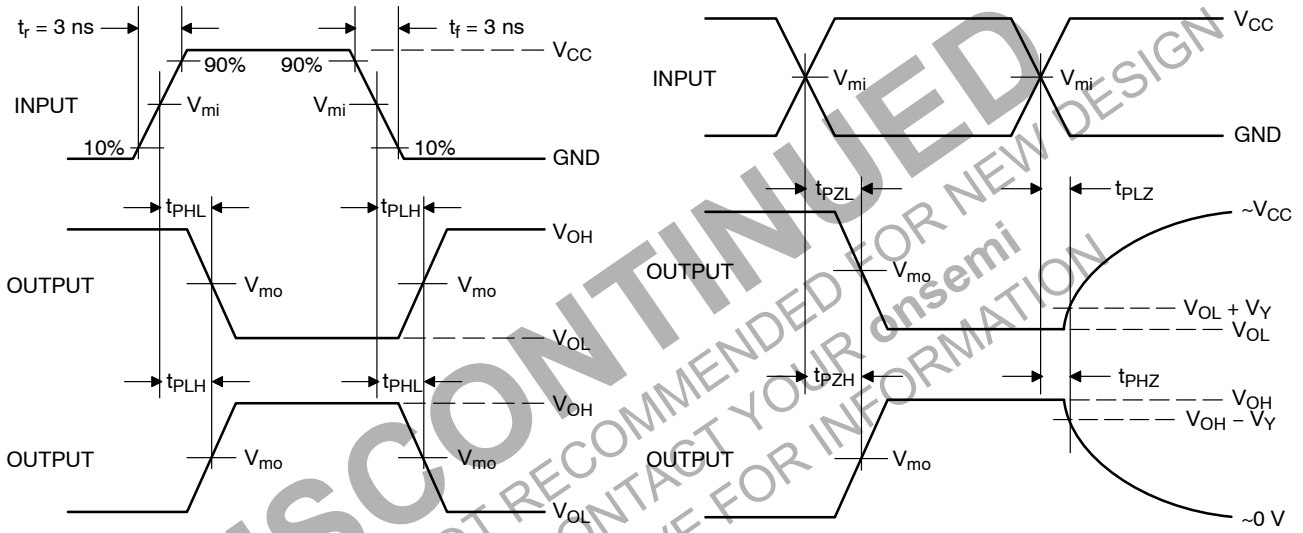
6. C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation I<sub>CC(OPR)</sub> = C<sub>PD</sub> • V<sub>CC</sub> • f<sub>in</sub> + I<sub>CC</sub>. C<sub>PD</sub> is used to determine the no-load dynamic power consumption: P<sub>D</sub> = C<sub>PD</sub> • V<sub>CC</sub><sup>2</sup> • f<sub>in</sub> + I<sub>CC</sub> • V<sub>CC</sub>.

# NC7SV57, NC7SV58



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

Figure 12. 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 13. Switching Waveforms



## NC7SV57, NC7SV58

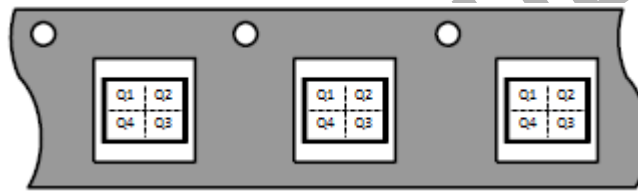
### ORDERING INFORMATION

Device	Package	Marking	Pin 1 Orientation (See below)	Shipping <sup>†</sup>
NC7SV57P6X	SC-88	V57	Q4	3000 / Tape & Reel
NC7SV57L6X	MicroPak	H3	Q4	5000 / Tape & Reel
NC7SV57FHX	MicroPak2	H3	Q4	5000 / Tape & Reel
NC7SV57FHX-L22780	MicroPak2	H3	Q4	5000 / Tape & Reel
NC7SV58P6X	SC-88	V58	Q4	3000 / Tape & Reel
NC7SV58L6X	MicroPak	H4	Q4	5000 / Tape & Reel
NC7SV58FHX	MicroPak2	H4	Q4	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.

### PIN 1 ORIENTATION IN TAPE AND REEL

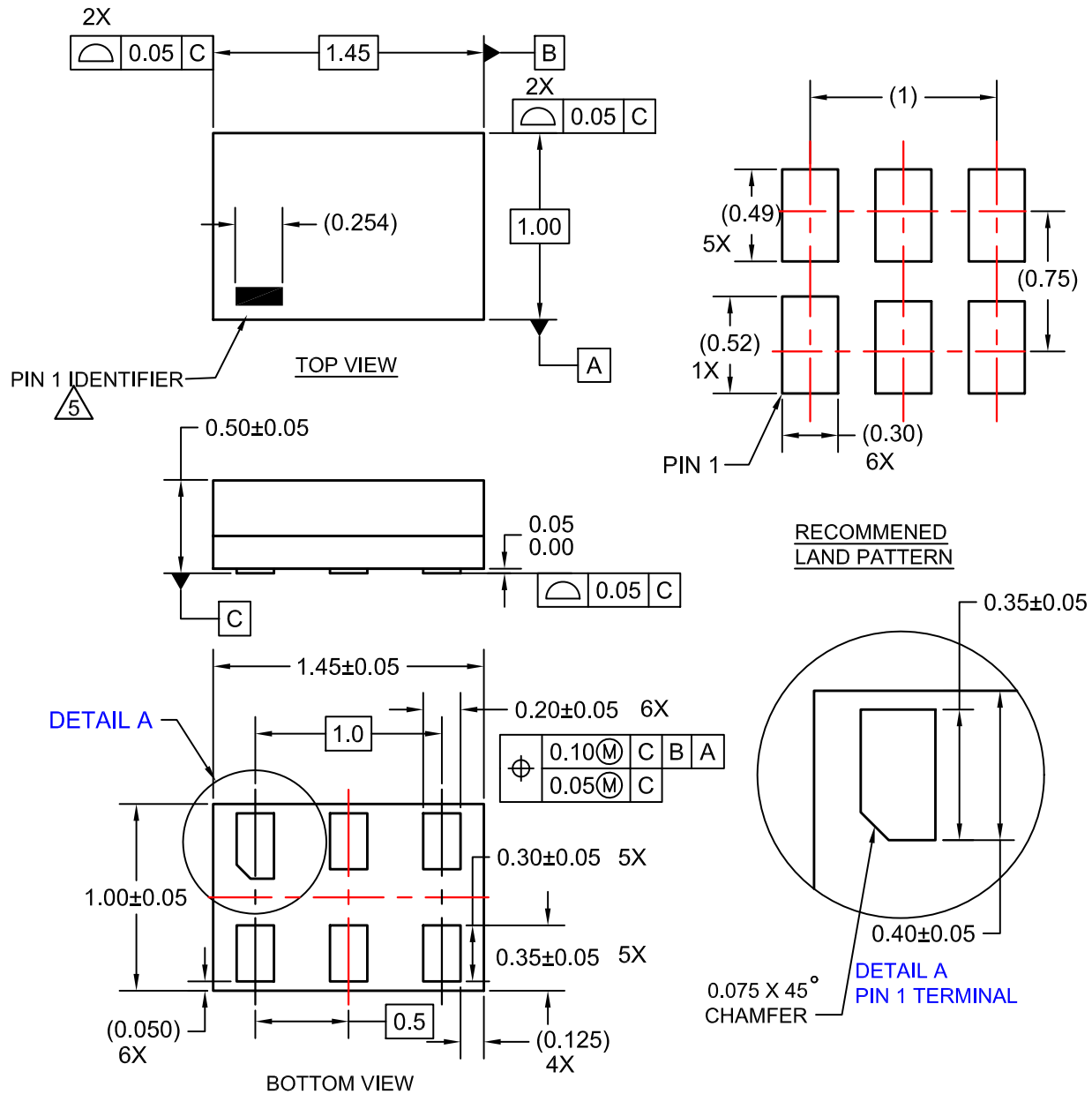
Direction of Feed



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

DATE 31 AUG 2016

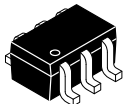


## NOTES:

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.

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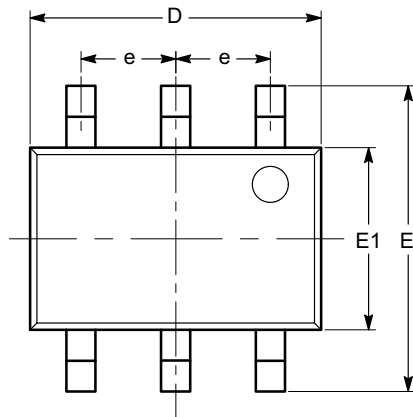
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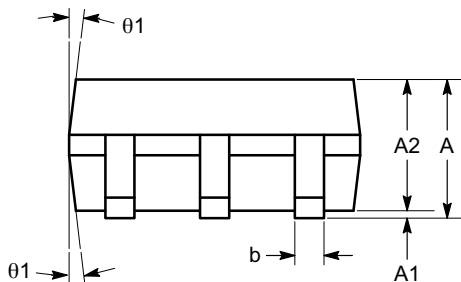
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**SC-88 (SC-70 6 Lead), 1.25x2**  
**CASE 419AD**  
**ISSUE A**

DATE 07 JUL 2010

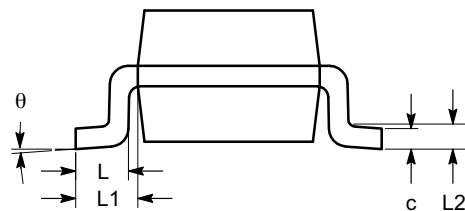


**TOP VIEW**



**SIDE 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	0°		8°
θ1	4°		10°



**END VIEW**

**Notes:**

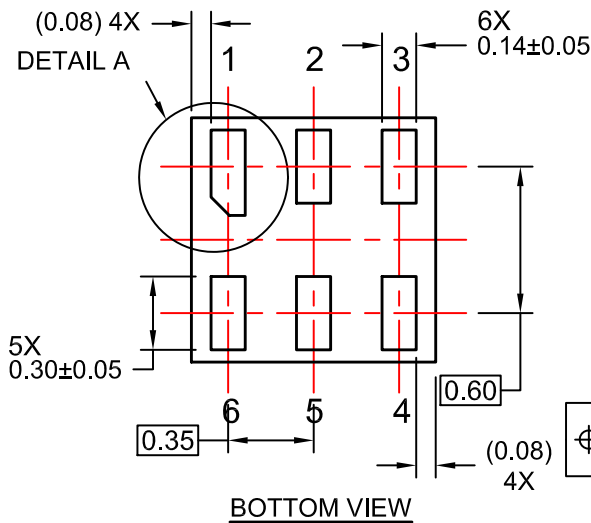
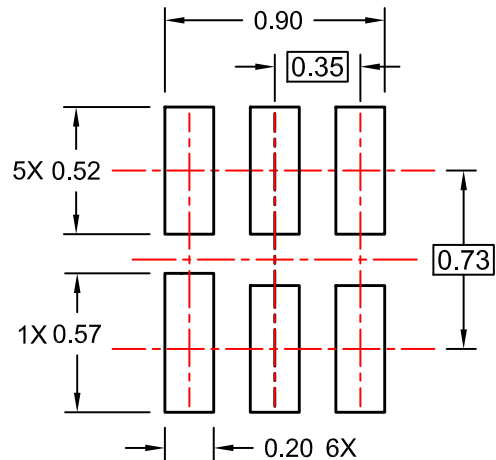
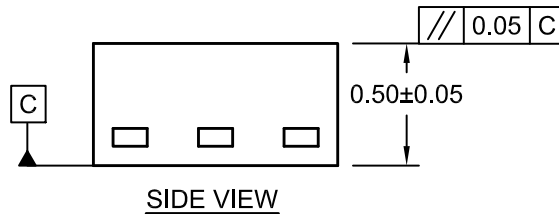
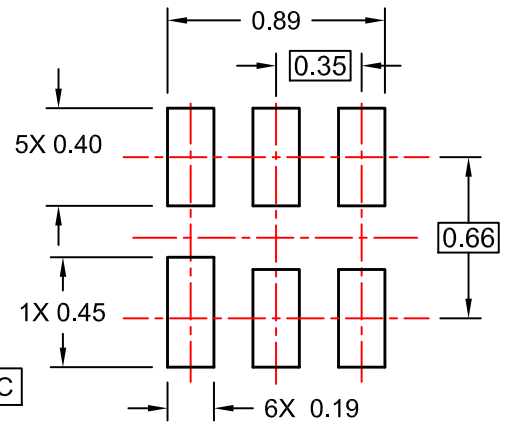
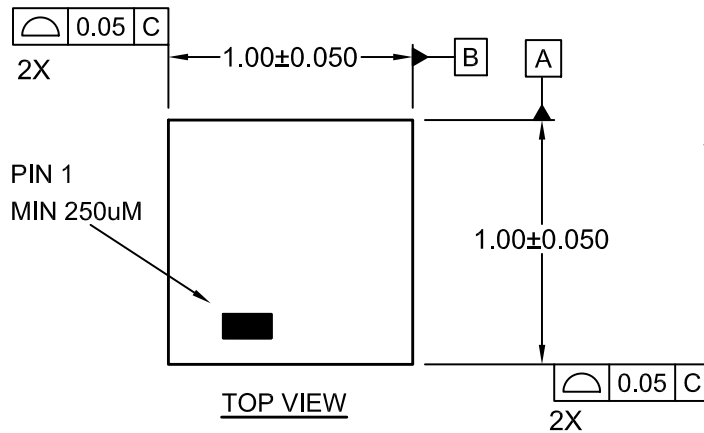
- (1) All dimensions are in millimeters. Angles in degrees.
- (2) Complies with JEDEC MO-203.

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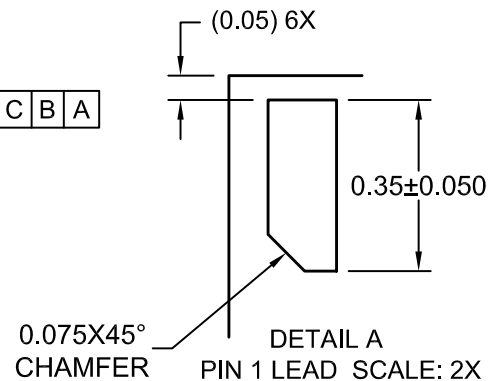
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CASE 517DP  
ISSUE O

DATE 31 AUG 2016



**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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