

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 V .

Features

- Designed for 0.9 V to 3.6 V V_{CC} Operation
- 2.4 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 24 mA at 3.3 V
- Available in SC-88 and MicroPak™ Packages
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

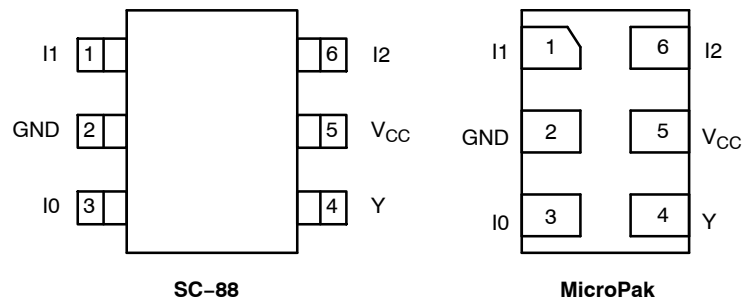


Figure 1. Pinout Diagrams (Top Views)

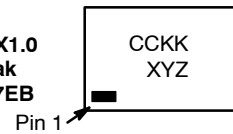
PIN ASSIGNMENT

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

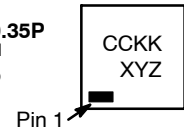
MARKING DIAGRAM



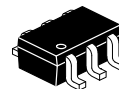
SIP6 1.45X1.0
MicroPak
CASE 127EB



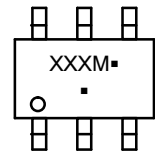
UDFN6 1.0X1.0, 0.35P
MicroPak2™
CASE 517DP



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

NC7SV57, NC7SV58

Logic Configurations NC7SV57

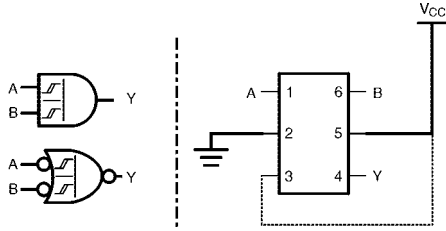


Figure 2. 2-Input AND Gate

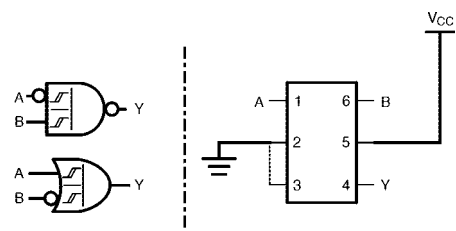


Figure 3. 2-Input NAND with Inverted A Input

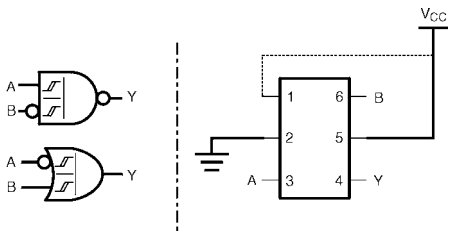


Figure 4. 2-Input NAND with Inverted B Input

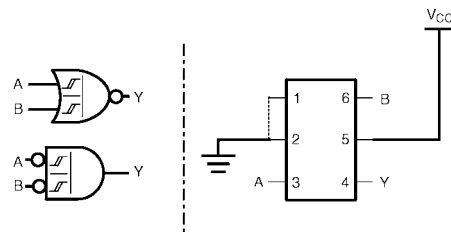


Figure 5. 2-Input NOR Gate

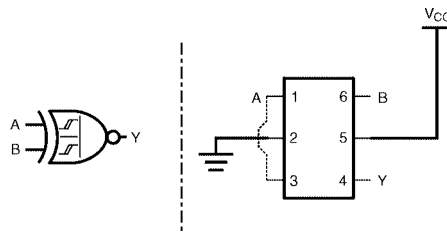


Figure 6. 2-Input XNOR Gate

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

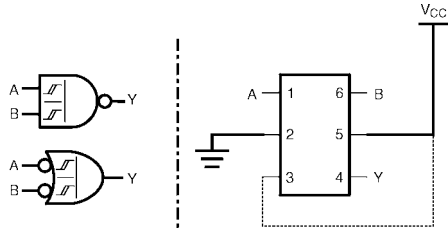


Figure 7. 2-Input NAND Gate

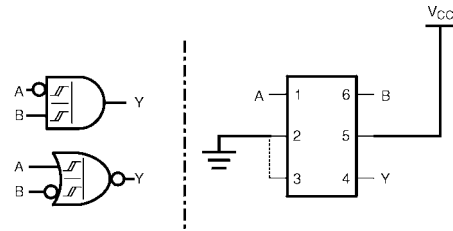


Figure 8. 2-Input AND with Inverted A Input

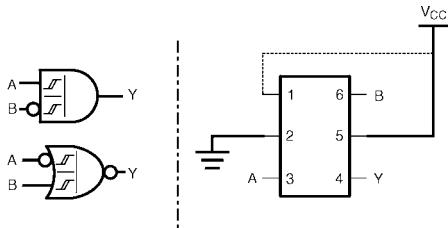


Figure 9. 2-Input AND with Inverted B Input

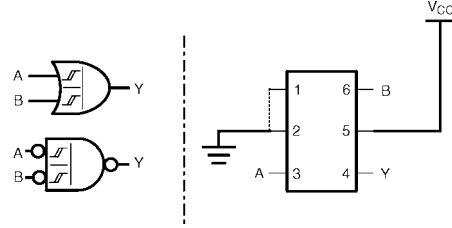


Figure 10. 2-Input OR Gate

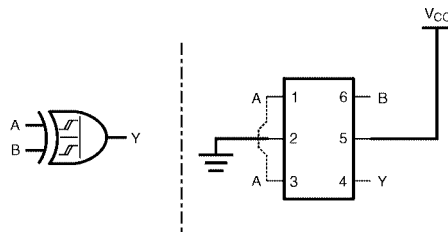


Figure 11. 2-Input XOR Gate

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.

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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	±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-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) 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 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.

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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	-	-	1.25	-	1.25		
			1.65	-	-	1.5	-	1.5		
			2.3	-	-	1.8	-	1.8		
			2.7	-	-	2.2	-	2.2		
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	-		
			2.7	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	0.15	-	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 _{OH}	High-Level Output Voltage	V _{IN} = V _{IH} or V _{IL}							V	
		I _{OH} = -100 μA	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} - 0.2	-	-	V _{CC} - 0.2	-		-
			2.3 to <2.7	V _{CC} - 0.2	-	-	V _{CC} - 0.2	-		-
			2.7 to 3.6	V _{CC} - 0.2	-	-	V _{CC} - 0.2	-		-
		I _{OH} = -2 mA	1.1 to 1.3	0.75 x V _{CC}	-	-	0.75 x V _{CC}	-		-
		I _{OH} = -4 mA	1.4 to 1.6	0.75 x V _{CC}	-	-	0.75 x V _{CC}	-		-
		I _{OH} = -6 mA	1.65 to 1.95	1.25	-	-	1.25	-		-
			2.3 to <2.7	2.0	-	-	2.0	-		-
		I _{OH} = -12 mA	2.3 to <2.7	1.8	-	-	1.8	-		-
			2.7 to 3.6	2.2	-	-	2.2	-		-
		I _{OH} = -18 mA	2.3 to <2.7	1.7	-	-	1.7	-		-
			2.7 to 3.6	2.4	-	-	2.4	-		-
I _{OH} = -24 mA	2.7 to 3.6	2.2	-	-	2.2	-	-			

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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 _{IH} or V _{IL}							V	
		I _{OL} = 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 _{OL} = 2 mA	1.1 to 1.3	-	-	0.25 x V _{CC}	-	0.25 x V _{CC}		-
		I _{OL} = 4 mA	1.4 to 1.6	-	-	0.25 x V _{CC}	-	0.25 x V _{CC}		-
		I _{OL} = 6 mA	1.65 to 1.95	-	-	0.3	-	0.3		-
		I _{OL} = 12 mA	2.3 to < 2.7	-	-	0.4	-	0.4		-
			2.7 to 3.6	-	-	0.4	-	0.4		-
		I _{OL} = 18 mA	2.3 to < 2.7	-	-	0.6	-	0.6		-
			2.7 to 3.6	-	-	0.4	-	0.4		-
I _{OL} = 24 mA	2.7 to 3.6	-	-	0.55	-	0.55	-			
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

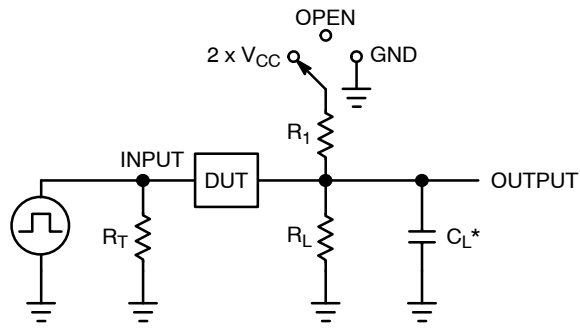
Symbol	Parameter	Condition	V _{CC} (V)	T _A = 25°C			T _A = -40°C to +85°C		Unit
				Min	Typ	Max	Min	Max	
t _{PLH} , t _{PHL}	Propagation Delay, (I ₀ or I ₁ or I ₂) to Y (Figures 12 and 13)	R _L = 1 MΩ, C _L = 15 pF	0.9	-	22.2	-	-	-	ns
		R _L = 2 kΩ, C _L = 15 pF	1.10 to 1.30	-	7.1	16.5	-	31.0	
			1.40 to 1.60	-	4.4	10.0	-	12.0	
		R _L = 500 Ω, C _L = 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 _A = 25°C)	Unit
C _{IN}	Input Capacitance	V _{CC} = 0 V	8.0	pF
C _{OUT}	Output Capacitance	V _{CC} = 0 V	12	pF
C _{PD}	Power Dissipation Capacitance (Note 6)	f = 10 MHz, V _{CC} = 0.9 to 3.6 V, V _{IN} = 0 V or V _{CC}	10	pF

6. 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} • V_{CC} • f_{in} + I_{CC}. C_{PD} is used to determine the no-load dynamic power consumption: P_D = C_{PD} • V_{CC}² • f_{in} + I_{CC} • V_{CC}.

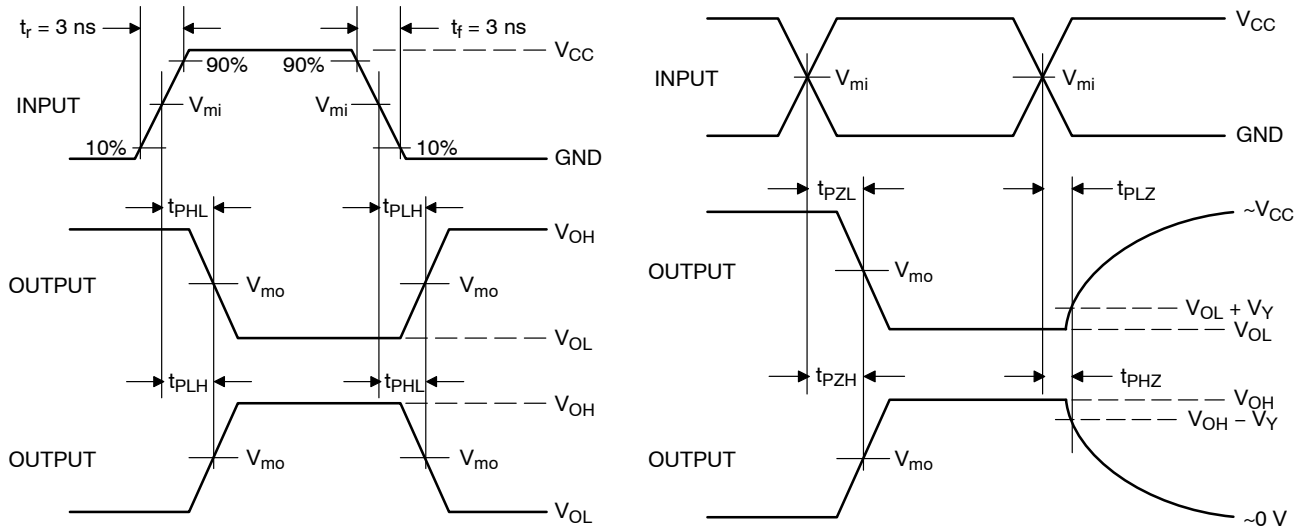
NC7SV57, NC7SV58



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

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

Figure 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

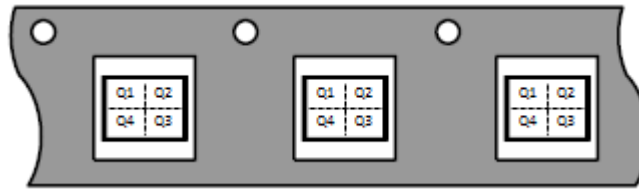
ORDERING INFORMATION

Device	Package	Marking	Pin 1 Orientation (See below)	Shipping [†]
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

[†]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



MicroPak and MicroPak2 are trademarks of Semiconductor Components Industries, LLC dba "onsemi" or its affiliates and/or subsidiaries in the United States and/or other countries.

MECHANICAL CASE OUTLINE

PACKAGE DIMENSIONS

ON Semiconductor®



SIP6 1.45X1.0
CASE 127EB
ISSUE O

DATE 31 AUG 2016



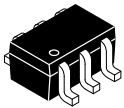
NOTES:

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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DESCRIPTION:	SIP6 1.45X1.0	PAGE 1 OF 1

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MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS



1

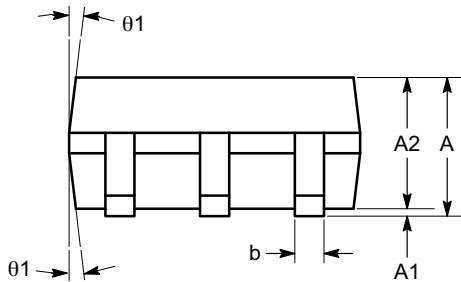
SC-88 (SC-70 6 Lead), 1.25x2
CASE 419AD
ISSUE A

DATE 07 JUL 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	0°		8°
θ_1	4°		10°



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-88 (SC-70 6 LEAD), 1.25X2	PAGE 1 OF 1

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MECHANICAL CASE OUTLINE

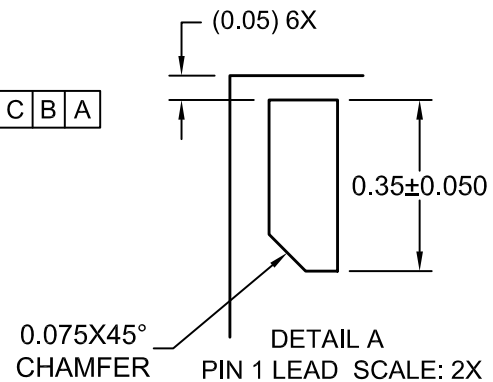
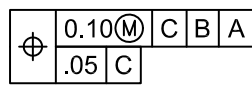
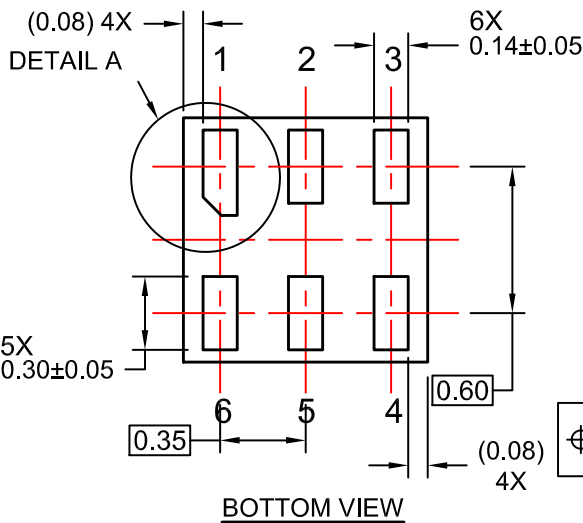
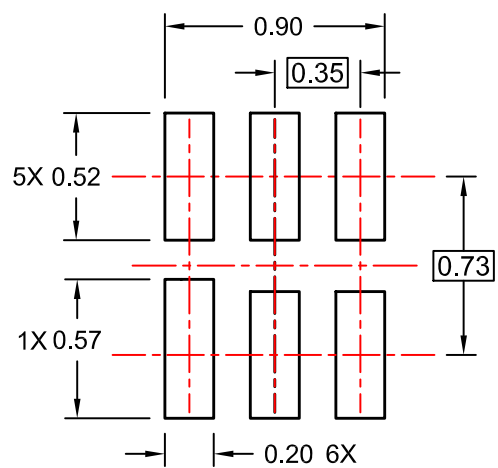
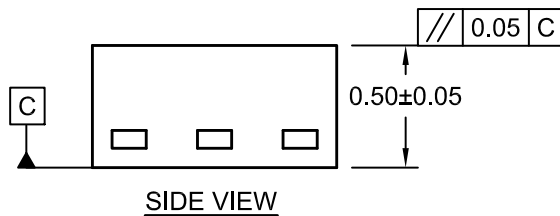
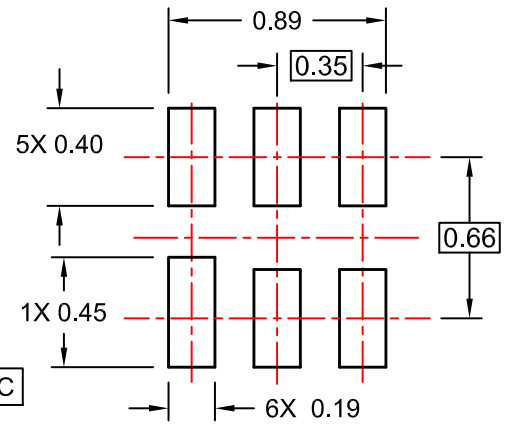
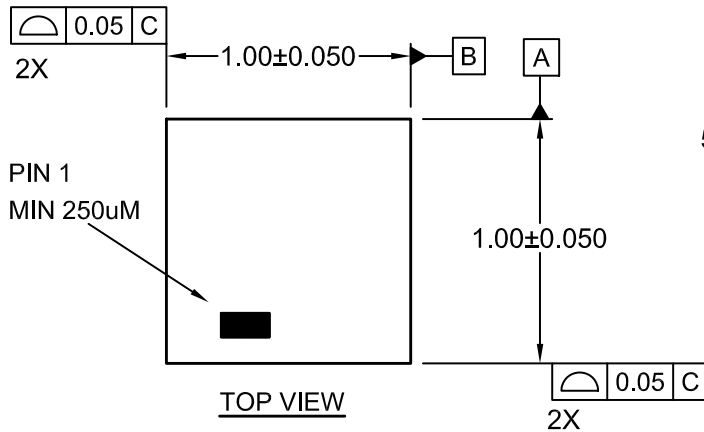
PACKAGE DIMENSIONS

ON Semiconductor®



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

DATE 31 AUG 2016



- 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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