

# TinyLogic ULP-A Universal Configurable Logic Gates



ON Semiconductor®

[www.onsemi.com](http://www.onsemi.com)

## NC7SP57, NC7SP58

The NC7SP57 and NC7SP58 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 V to 3.6 V  $V_{CC}$  Operation
- 3.4 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 2.6 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

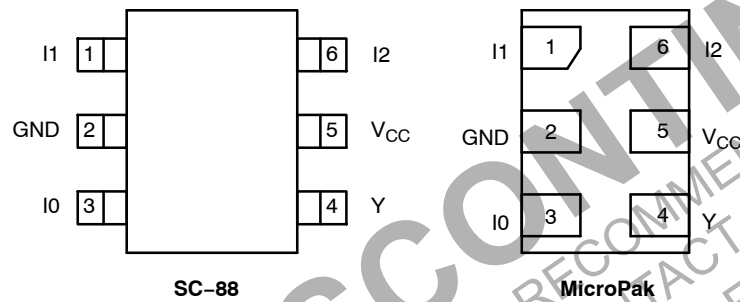


Figure 1. Pinout Diagrams (Top Views)

### 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



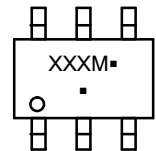
Pin 1

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

### MARKING DIAGRAM



SC-88  
DF SUFFIX  
CASE 419B-02



- 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.

## NC7SP57, NC7SP58

**FUNCTION TABLE**

Inputs			NC7SP57	NC7SP58
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	NC7SP57	Figure 2
2-Input AND with inverted input	NC7SP58	Figure 8, 9
2-Input AND with both inputs inverted	NC7SP57	Figure 5
2-Input NAND	NC7SP58	Figure 7
2-Input NAND with inverted input	NC7SP57	Figure 3, 4
2-Input NAND with both inputs inverted	NC7SP58	Figure 10
2-Input OR	NC7SP58	Figure 10
2-Input OR with inverted input	NC7SP57	Figure 3, 4
2-Input OR with both inputs inverted	NC7SP58	Figure 7
2-Input NOR	NC7SP57	Figure 5
2-Input NOR with inverted input	NC7SP58	Figure 8, 9
2-Input NOR with both inputs inverted	NC7SP57	Figure 2
2-Input XOR	NC7SP58	Figure 11
2-Input XNOR	NC7SP57	Figure 6

# NC7SP57, NC7SP58

## Logic Configurations NC7SP57

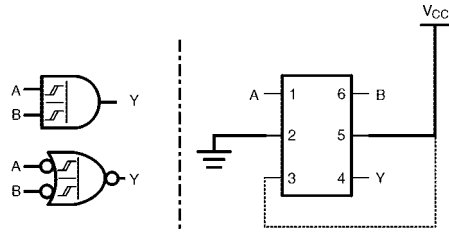


Figure 2. 2-Input AND Gate

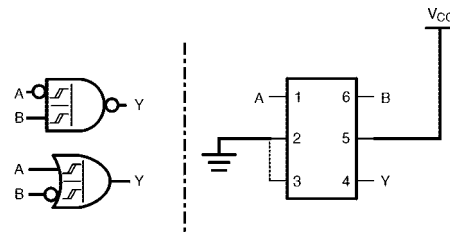


Figure 3. 2-Input NAND with Inverted A Input

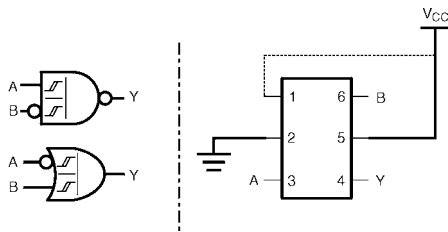


Figure 4. 2-Input NAND with Inverted B Input

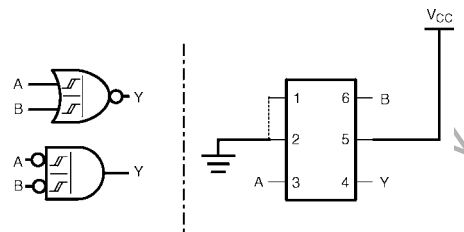


Figure 5. 2-Input NOR Gate

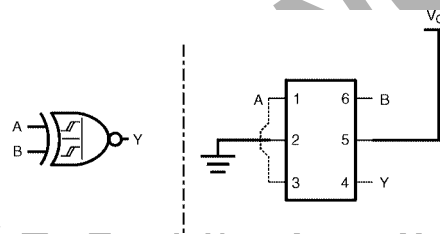


Figure 6. 2-Input XNOR Gate

NOTE: Figure 2 through Figure 6 show the logical functions that can be implemented using the NC7SP57. 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.

# NC7SP57, NC7SP58

## Logic Configurations NC7SP58

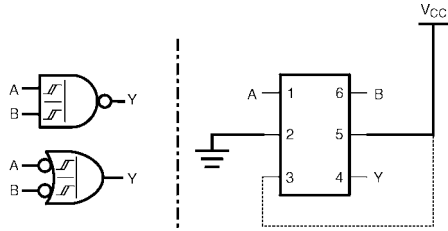


Figure 7. 2-Input NAND Gate

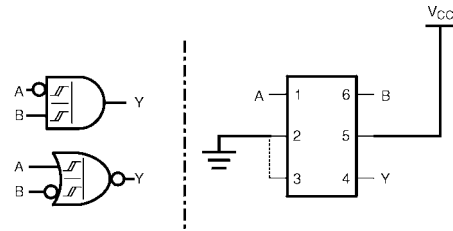


Figure 8. 2-Input AND with Inverted A Input

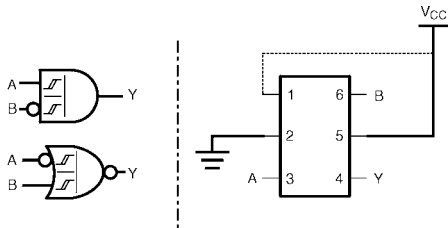


Figure 9. 2-Input AND with Inverted B Input

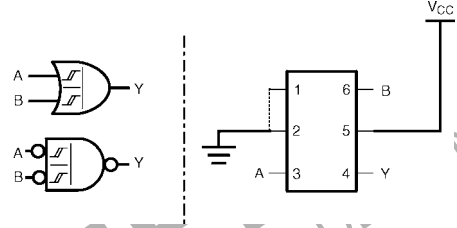


Figure 10. 2-Input OR Gate

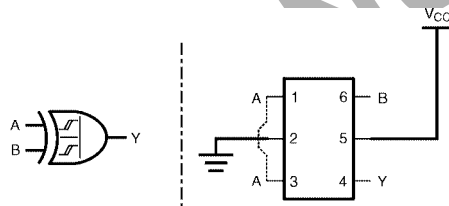


Figure 11. 2-Input XOR Gate

NOTE: Figure 7 through Figure 11 show the logical functions that can be implemented using the NC7SP58. 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.

# NC7SP57, NC7SP58

## MAXIMUM RATINGS

Symbol	Characteristics	Value	Unit
V <sub>CC</sub>	DC Supply Voltage	-0.5 to +4.3	V
V <sub>IN</sub>	DC Input Voltage	-0.5 to +4.3	V
V <sub>OUT</sub>	DC Output Voltage Active-Mode (High or Low State) Tri-State Mode (Note NO TAG) Power-Down Mode (V <sub>CC</sub> = 0 V)	-0.5 to V <sub>CC</sub> + 0.5 -0.5 to +4.3 -0.5 to +4.3	V
I <sub>IK</sub>	DC Input Diode Current V <sub>IN</sub> < GND	-50	mA
I <sub>OK</sub>	DC Output Diode Current V <sub>OUT</sub> < GND	-50	mA
I <sub>OUT</sub>	DC Output Source/Sink Current	±50	mA
I <sub>CC</sub> or I <sub>GND</sub>	DC Supply Current per Supply Pin or Ground Pin	±50	mA
T <sub>STG</sub>	Storage Temperature Range	-65 to +150	°C
T <sub>L</sub>	Lead Temperature, 1 mm from Case for 10 Seconds	260	°C
T <sub>J</sub>	Junction Temperature Under Bias	+150	°C
θ <sub>JA</sub>	Thermal Resistance (Note NO TAG) SC-88 MicroPak	377 154	°C/W
P <sub>D</sub>	Power Dissipation in Still Air SC-88 MicroPak	332 812	mW
MSL	Moisture Sensitivity	Level 1	-
F <sub>R</sub>	Flammability Rating Oxygen Index: 28 to 34	UL 94 V-0 @ 0.125 in	-
V <sub>ESD</sub>	ESD Withstand Voltage (Note 3) Human Body Model Charged Device Model	2000 1000	V
I <sub>Latchup</sub>	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 <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 NO TAG) Power-Down Mode (V <sub>CC</sub> = 0 V)	0 0 0	V <sub>CC</sub> 3.6 3.6	V
T <sub>A</sub>	Operating Temperature Range	-40	+85	°C
t <sub>r</sub> , t <sub>f</sub>	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.

# NC7SP57, NC7SP58

## 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	-	-	1.2	-	1.2		
			1.65	-	-	1.5	-	1.5		
			3.0	-	-	1.9	-	1.9		
			3.0 to 3.6	-	-	2.6	-	2.6		
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	-		
			3.0	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	0.1	-	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 <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> = -20 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> - 0.1	-	-	V <sub>CC</sub> - 0.1	-		
			2.3 to 2.7	V <sub>CC</sub> - 0.1	-	-	V <sub>CC</sub> - 0.1	-		
			3.0 to 3.6	V <sub>CC</sub> - 0.1	-	-	V <sub>CC</sub> - 0.1	-		
			I <sub>OH</sub> = -0.5 mA	1.1 to 1.3	0.75 x V <sub>CC</sub>	-	-	0.70 x V <sub>CC</sub>		-
			I <sub>OH</sub> = -1 mA	1.4 to 1.6	1.07	-	-	0.99		-
			I <sub>OH</sub> = -1.5 mA	1.65 to 1.95	1.24	-	-	1.22		-
			I <sub>OH</sub> = -2.1 mA	2.3 to 2.7	1.95	-	-	1.87		-
			I <sub>OH</sub> = -2.6 mA	3.0 to 3.6	2.61	-	-	2.55		-
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> = 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 <sub>OL</sub> = 0.5 mA	1.1 to 1.3	-	-	0.3 x V <sub>CC</sub>	-		0.3 x V <sub>CC</sub>
			I <sub>OL</sub> = 1 mA	1.4 to 1.6	-	-	0.31	-		0.37
			I <sub>OL</sub> = 1.5 mA	1.65 to 1.95	-	-	0.31	-		0.35
			I <sub>OL</sub> = 2.1 mA	2.3 to 2.7	-	-	0.31	-		0.33
			I <sub>OL</sub> = 2.6 mA	3.0 to 3.6	-	-	0.31	-		0.33

# NC7SP57, NC7SP58

## 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	
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

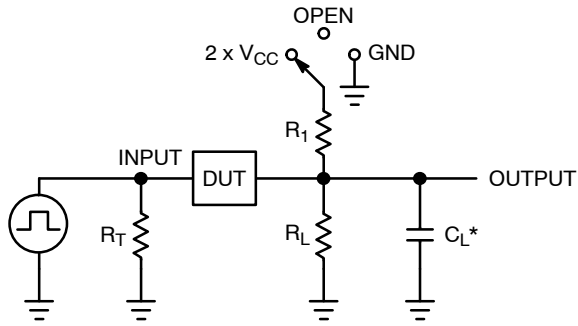
Symbol	Parameter	Condition	V <sub>CC</sub> (V)	T <sub>A</sub> = 25°C			T <sub>A</sub> = -40°C to +85°C		Unit
				Min	Typ	Max	Min	Max	
t <sub>PLH</sub> , t <sub>PHL</sub>	Propagation Delay, (I0 or I1 or I2) to Y (Figures 12 and 13)	R <sub>L</sub> = 1 MΩ, C <sub>L</sub> = 10 pF	0.9	-	54.3	-	-	-	ns
			1.10 to 1.30	-	15.1	30.8	-	51.0	
			1.40 to 1.60	-	8.2	17.0	-	21.0	
			1.65 to 1.95	-	5.9	14.0	-	17.0	
			2.3 to 2.7	-	4.0	10.0	-	13.0	
			3.0 to 3.6	-	3.4	8.0	-	12.0	
t <sub>PLH</sub> , t <sub>PHL</sub>	Propagation Delay, (I0 or I1 or I2) to Y (Figures 12 and 13)	R <sub>L</sub> = 1 MΩ, C <sub>L</sub> = 15 pF	0.9	-	55.8	-	-	-	ns
			1.10 to 1.30	-	15.6	32.1	-	52.0	
			1.40 to 1.60	-	8.6	18.0	-	22.0	
			1.65 to 1.95	-	6.3	15.0	-	18.0	
			2.3 to 2.7	-	4.2	11.0	-	14.0	
			3.0 to 3.6	-	3.6	9.0	-	12.0	
t <sub>PLH</sub> , t <sub>PHL</sub>	Propagation Delay, (I0 or I1 or I2) to Y (Figures 12 and 13)	R <sub>L</sub> = 1 MΩ, C <sub>L</sub> = 30 pF	0.9	-	60.2	-	-	-	ns
			1.10 to 1.30	-	17.2	33.6	-	55.0	
			1.40 to 1.60	-	9.9	20.0	-	24.0	
			1.65 to 1.95	-	7.4	17.0	-	20.0	
			2.3 to 2.7	-	5.0	12.0	-	15.0	
			3.0 to 3.6	-	4.1	11.0	-	14.0	

## 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	4.0	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>	8.0	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<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>.

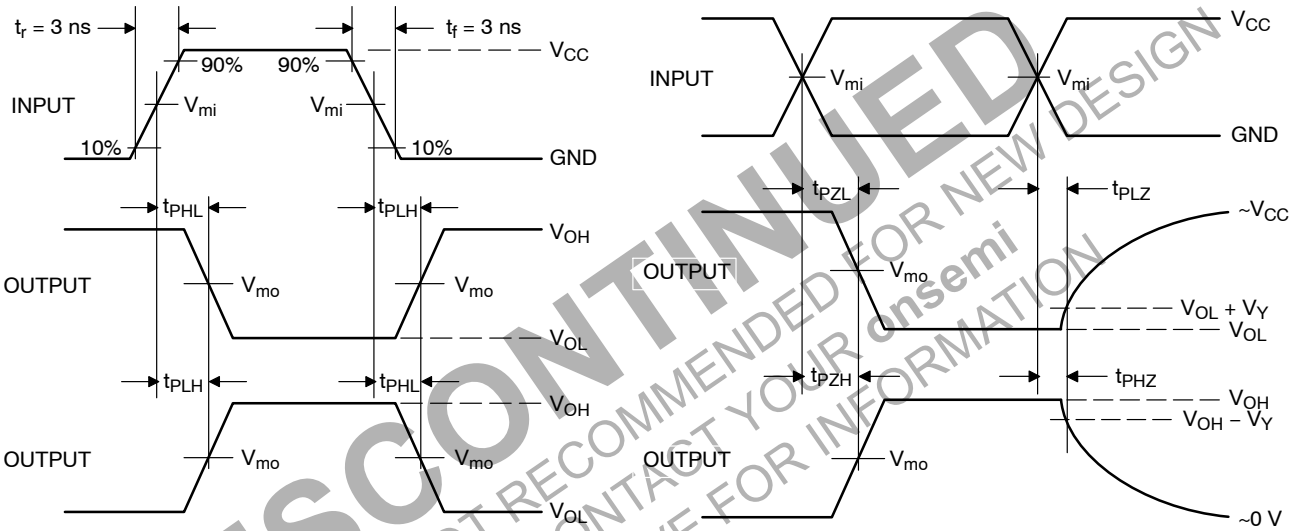
# NC7SP57, NC7SP58



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

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

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



## NC7SP57, NC7SP58

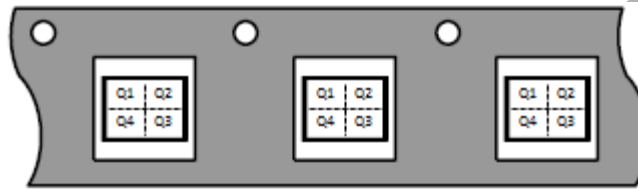
### ORDERING INFORMATION

Device	Package	Marking	Pin 1 Orientation (See below)	Shipping <sup>†</sup>
NC7SP57P6X	SC-88	P57	Q4	3000 / Tape & Reel
NC7SP57L6X	MicroPak	K9	Q4	5000 / Tape & Reel
NC7SP58P6X	SC-88	P58	Q4	3000 / Tape & Reel
NC7SP58L6X	MicroPak	L3	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

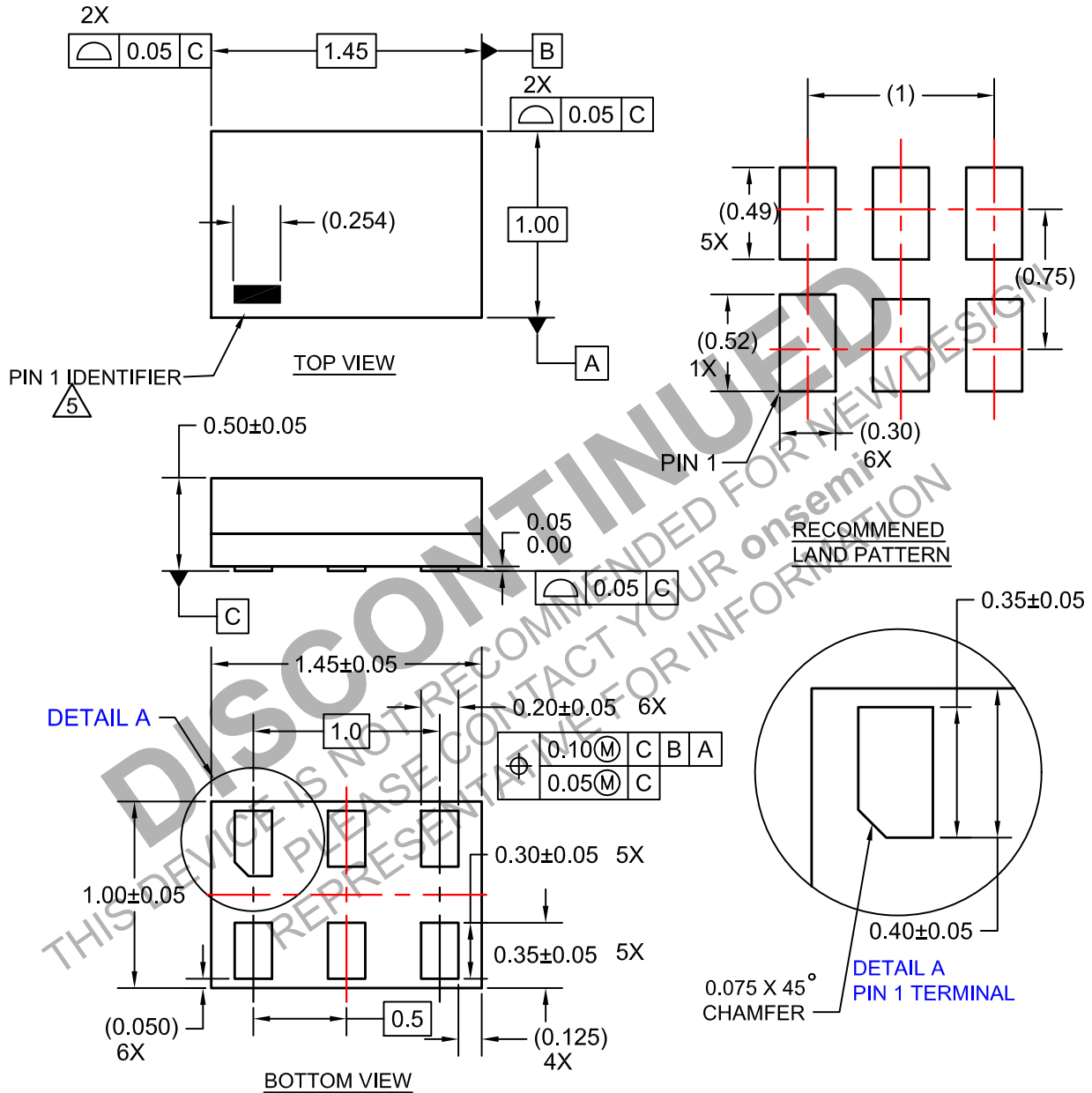


**DISCONTINUED**  
THIS DEVICE IS NOT RECOMMENDED FOR NEW DESIGN  
PLEASE CONTACT YOUR onsemi  
REPRESENTATIVE FOR INFORMATION

# NC7SP57, NC7SP58

## PACKAGE DIMENSIONS

SIP6 1.45X1.0  
CASE 127EB  
ISSUE O



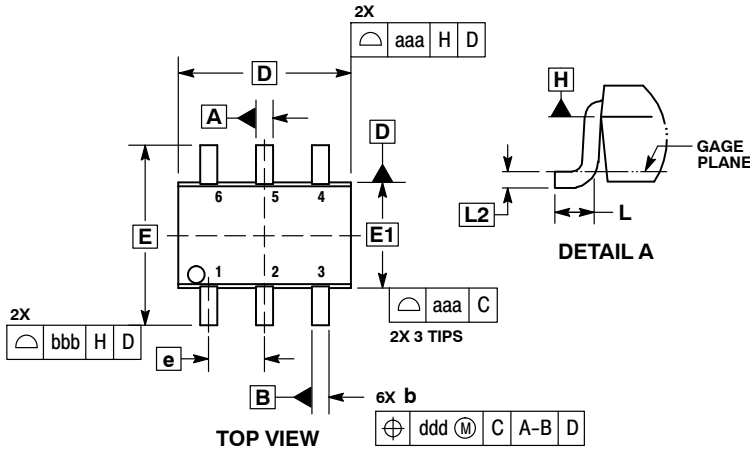
**NOTES:**

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.

# NC7SP57, NC7SP58

## PACKAGE DIMENSIONS

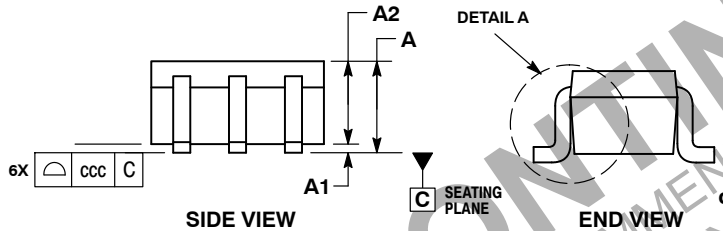
SC-88/SC70-6/SOT-363  
CASE 419B-02  
ISSUE Y



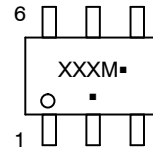
**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.20 PER END.
4. DIMENSIONS D AND E1 AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY AND DATUM H.
5. DATUMS A AND B ARE DETERMINED AT DATUM H.
6. DIMENSIONS b AND c APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.08 AND 0.15 FROM THE TIP.
7. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 TOTAL IN EXCESS OF DIMENSION b AT MAXIMUM MATERIAL CONDITION. THE DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OF THE FOOT.

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	---	---	1.10	---	---	0.043
A1	0.00	---	0.10	0.000	0.035	0.039
A2	0.70	0.90	1.00	0.027	0.035	0.039
b	0.15	0.20	0.25	0.006	0.008	0.010
C	0.08	0.15	0.22	0.003	0.006	0.009
D	1.80	2.00	2.20	0.070	0.078	0.086
E	2.00	2.10	2.20	0.078	0.082	0.086
E1	1.15	1.25	1.35	0.045	0.049	0.053
e	0.65 BSC			0.026 BSC		
L	0.26	0.36	0.46	0.010	0.014	0.018
L2	0.15 BSC			0.006 BSC		
aaa	0.15			0.006		
bbb	0.30			0.012		
ccc	0.10			0.004		
ddd	0.10			0.004		



**GENERIC MARKING DIAGRAM\***



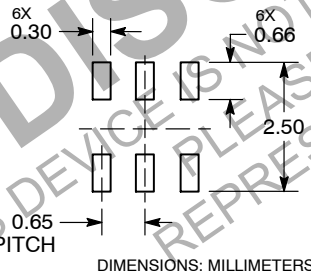
- XXX = Specific Device Code
- M = Date Code\*
- = Pb-Free Package

(Note: Microdot may be in either location)

\*Date Code orientation and/or position may vary depending upon manufacturing 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.

**RECOMMENDED SOLDERING FOOTPRINT\***



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

STYLES ON PAGE 2

# NC7SP57, NC7SP58

SC-88/SC70-6/SOT-363

CASE 419B-02


ISSUE Y

DATE 11 DEC 2012

STYLE 1: PIN 1. EMITTER 2 2. BASE 2 3. COLLECTOR 1 4. EMITTER 1 5. BASE 1 6. COLLECTOR 2	STYLE 2: CANCELLED	STYLE 3: CANCELLED	STYLE 4: PIN 1. CATHODE 2. CATHODE 3. COLLECTOR 4. EMITTER 5. BASE 6. ANODE	STYLE 5: PIN 1. ANODE 2. ANODE 3. COLLECTOR 4. EMITTER 5. BASE 6. CATHODE	STYLE 6: PIN 1. ANODE 2 2. N/C 3. CATHODE 1 4. ANODE 1 5. N/C 6. CATHODE 2
STYLE 7: PIN 1. SOURCE 2 2. DRAIN 2 3. GATE 1 4. SOURCE 1 5. DRAIN 1 6. GATE 2	STYLE 8: CANCELLED	STYLE 9: PIN 1. EMITTER 2 2. EMITTER 1 3. COLLECTOR 1 4. BASE 1 5. BASE 2 6. COLLECTOR 2	STYLE 10: PIN 1. SOURCE 2 2. SOURCE 1 3. GATE 1 4. DRAIN 1 5. DRAIN 2 6. GATE 2	STYLE 11: PIN 1. CATHODE 2 2. CATHODE 2 3. ANODE 1 4. CATHODE 1 5. CATHODE 1 6. ANODE 2	STYLE 12: PIN 1. ANODE 2 2. ANODE 2 3. CATHODE 1 4. ANODE 1 5. ANODE 1 6. CATHODE 2
STYLE 13: PIN 1. ANODE 2. N/C 3. COLLECTOR 4. EMITTER 5. BASE 6. CATHODE	STYLE 14: PIN 1. VREF 2. GND 3. GND 4. IOUT 5. VEN 6. VCC	STYLE 15: PIN 1. ANODE 1 2. ANODE 2 3. ANODE 3 4. CATHODE 3 5. CATHODE 2 6. CATHODE 1	STYLE 16: PIN 1. BASE 1 2. EMITTER 2 3. COLLECTOR 2 4. BASE 2 5. EMITTER 1 6. COLLECTOR 1	STYLE 17: PIN 1. BASE 1 2. EMITTER 1 3. COLLECTOR 2 4. BASE 2 5. EMITTER 2 6. COLLECTOR 1	STYLE 18: PIN 1. VIN1 2. VCC 3. VOUT2 4. VIN2 5. GND 6. VOUT1
STYLE 19: PIN 1. IOUT 2. GND 3. GND 4. V CC 5. V EN 6. V REF	STYLE 20: PIN 1. COLLECTOR 2. COLLECTOR 3. BASE 4. EMITTER 5. COLLECTOR 6. COLLECTOR	STYLE 21: PIN 1. ANODE 1 2. N/C 3. ANODE 2 4. CATHODE 2 5. N/C 6. CATHODE 1	STYLE 22: PIN 1. D1 (j) 2. GND 3. D2 (j) 4. D2 (c) 5. VBUS 6. D1 (e)	STYLE 23: PIN 1. Vn 2. CH1 3. Vp 4. N/C 5. CH2 6. N/C	STYLE 24: PIN 1. CATHODE 2. ANODE 3. CATHODE 4. CATHODE 5. CATHODE 6. CATHODE
STYLE 25: PIN 1. BASE 1 2. CATHODE 3. COLLECTOR 2 4. BASE 2 5. EMITTER 6. COLLECTOR 1	STYLE 26: PIN 1. SOURCE 1 2. GATE 1 3. DRAIN 2 4. SOURCE 2 5. GATE 2 6. DRAIN 1	STYLE 27: PIN 1. BASE 2 2. BASE 1 3. COLLECTOR 1 4. EMITTER 1 5. EMITTER 2 6. COLLECTOR 2	STYLE 28: PIN 1. DRAIN 2. DRAIN 3. GATE 4. SOURCE 5. DRAIN 6. DRAIN	STYLE 29: PIN 1. ANODE 2. ANODE 3. COLLECTOR 4. EMITTER 5. BASE/ANODE 6. CATHODE	STYLE 30: PIN 1. SOURCE 1 2. DRAIN 2 3. DRAIN 2 4. SOURCE 2 5. GATE 1 6. DRAIN 1

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.

MicroPak is trademark of Semiconductor Components Industries, LLC (SCILLC) or its subsidiaries in the United States and/or other countries.

ON Semiconductor and  are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:  
Email Requests to: [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

TECHNICAL SUPPORT  
North American Technical Support:  
Voice Mail: 1 800-282-9855 Toll Free USA/Canada  
Phone: 011 421 33 790 2910

Europe, Middle East and Africa Technical Support:  
Phone: 00421 33 790 2910  
For additional information, please contact your local Sales Representative