

# Single 2-Input Exclusive OR Gate

## NLV74VHC1G86, NLV74VHC1GT86

The NLV74VHC1G86 / NLV74VHC1GT86 is a 2-input Exclusive OR Gate in tiny packages. The NLV74VHC1G86 has CMOS level input thresholds while the NLV74VHC1GT86 has TTL level input thresholds.

The internal circuit is composed of three stages, including a buffered output which provides high noise immunity and stable output.

The input structures provide protection when voltages up to 5.5 V are applied, regardless of the supply voltage. This allows the device to be used to interface 5 V circuits to 3 V circuits. Some output structures also provide protection when  $V_{CC} = 0$  V and when the output voltage exceeds  $V_{CC}$ . These input and output structures help prevent device destruction caused by supply voltage – input/output voltage mismatch, battery backup, hot insertion, etc.

### Features

- Designed for 2.0 V to 5.5 V  $V_{CC}$  Operation
- 3.5 ns  $t_{PD}$  at 5 V (typ)
- Inputs/Outputs Over-Voltage Tolerant up to 5.5 V
- $I_{OFF}$  Supports Partial Power Down Protection
- Source/Sink 8 mA at 3.0 V
- Available in SC-88A and TSOP-5 Packages
- Chip Complexity < 100 FETs
- NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

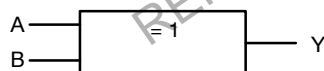
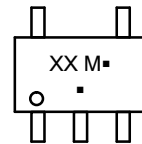


Figure 1. Logic Symbol

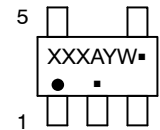
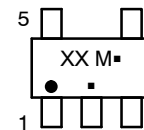
### MARKING DIAGRAMS



SC-88A  
DF SUFFIX  
CASE 419A




TSOP-5  
DT SUFFIX  
CASE 483



XX = Specific Device Code  
M = Date Code\*  
■ = Pb-Free Package  
(Note: Microdot may be in either location)

### ORDERING INFORMATION

See detailed ordering, marking and shipping information on page 7 of this data sheet.

# NLV74VHC1G86, NLV74VHC1GT86

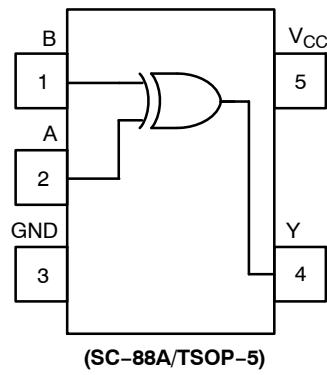


Figure 2. Pinout (Top View)

## PIN ASSIGNMENT (SC-88A/TSOP-5)

Pin	Function
1	B
2	A
3	GND
4	Y
5	V <sub>CC</sub>

## FUNCTION TABLE

Input		Output
A	B	Y
L	L	L
L	H	H
H	L	H
H	H	L

# NLV74VHC1G86, NLV74VHC1GT86

## MAXIMUM RATINGS

Symbol	Characteristics		Value	Unit
$V_{CC}$	DC Supply Voltage		-0.5 to +7.0	V
$V_{IN}$	DC Input Voltage		-0.5 to +7.0	V
$V_{OUT}$	DC Output Voltage	1Gxx	-0.5 to $V_{CC} + 0.5$	V
		1GTxx 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 +7.0 -0.5 to +7.0	
$I_{IK}$	DC Input Diode Current $V_{IN} < GND$		-20	mA
$I_{OK}$	DC Output Diode Current	1Gxx $V_{OUT} > V_{CC}, V_{OUT} < GND$	$\pm 20$	mA
		1GTxx $V_{OUT} < GND$	-20	
$I_{OUT}$	DC Output Source/Sink Current		$\pm 25$	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	$^{\circ}C$
$T_L$	Lead Temperature, 1 mm from Case for 10 secs		260	$^{\circ}C$
$T_J$	Junction Temperature Under Bias		+150	$^{\circ}C$
$\theta_{JA}$	Thermal Resistance (Note 2)	SC-88A	377	$^{\circ}C/W$
		TSOP-5	320	
$P_D$	Power Dissipation in Still Air	SC-88A	332	mW
		TSOP-5	390	
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	2000	V
		Charged Device Model	1000	
$I_{Latchup}$	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 10mm-by-1inch, 2 ounce copper trace no air flow per JESD51-7.
3. HBM tested to ANSI/ESDA/JEDEC JS-001-2017. CDM tested to EIA/JESD22-C101-F. JEDEC recommends that ESD qualification to EIA/JESD22-A115-A (Machine Model) be discontinued per JEDEC/JEP172A.
4. Tested to EIA/JESD78 Class II.

# NLV74VHC1G86, NLV74VHC1GT86

## RECOMMENDED OPERATING CONDITIONS

Symbol	Characteristics		Min	Max	Unit
V <sub>CC</sub>	Positive DC Supply Voltage		2.0	5.5	V
V <sub>IN</sub>	DC Input Voltage		0	5.5	V
V <sub>OUT</sub>	DC Output Voltage	1Gxx	0	V <sub>CC</sub>	V
		1GTxx	0	V <sub>CC</sub>	
		Active–Mode (High or Low State)	0	5.5	
		Tri–State Mode (Note 1)	0	5.5	
		Power–Down Mode (V <sub>CC</sub> = 0 V)	0	5.5	
T <sub>A</sub>	Operating Temperature Range		–55	+125	°C
t <sub>r</sub> , t <sub>f</sub>	Input Rise and Fall Time				ns/V
		V <sub>CC</sub> = 3.0 V to 3.6 V	0	100	
		V <sub>CC</sub> = 4.5 V to 5.5 V	0	20	

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.

## DC ELECTRICAL CHARACTERISTICS (NLV74VHC1G86)

Symbol	Parameter	Test Conditions	$V_{CC}$ (V)	$T_A = 25^\circ\text{C}$			$-40^\circ\text{C} \leq T_A \leq 85^\circ\text{C}$		$-55^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$		Unit
				Min	Typ	Max	Min	Max	Min	Max	
$V_{IH}$	High-Level Input Voltage		2.0	1.5	–	–	1.5	–	1.5	–	V
			3.0	2.1	–	–	2.1	–	2.1	–	
			4.5	3.15	–	–	3.15	–	3.15	–	
			5.5	3.85	–	–	3.85	–	3.85	–	
$V_{IL}$	Low-Level Input Voltage		2.0	–	–	0.5	–	0.5	–	0.5	V
			3.0	–	–	0.9	–	0.9	–	0.9	
			4.5	–	–	1.35	–	1.35	–	1.35	
			5.5	–	–	1.65	–	1.65	–	1.65	
$V_{OH}$	High-Level Output Voltage	$V_{IN} = V_{IH}$ or $V_{IL}$ $I_{OH} = -50 \mu\text{A}$ $I_{OH} = -50 \mu\text{A}$ $I_{OH} = -50 \mu\text{A}$ $I_{OH} = -4 \text{ mA}$ $I_{OH} = -8 \text{ mA}$	2.0	1.9	2.0	–	1.9	–	1.9	–	V
			3.0	2.9	3.0	–	2.9	–	2.9	–	
			4.5	4.4	4.5	–	4.4	–	4.4	–	
			3.0	2.58	–	–	2.48	–	2.34	–	
			4.5	3.94	–	–	3.80	–	3.66	–	
$V_{OL}$	Low-Level Output Voltage	$V_{IN} = V_{IH}$ or $V_{IL}$ $I_{OL} = 50 \mu\text{A}$ $I_{OL} = 50 \mu\text{A}$ $I_{OL} = 50 \mu\text{A}$ $I_{OL} = 4 \text{ mA}$ $I_{OL} = 8 \text{ mA}$	2.0	–	0.0	0.1	–	0.1	–	0.1	V
			3.0	–	0.0	0.1	–	0.1	–	0.1	
			4.5	–	0.0	0.1	–	0.1	–	0.1	
			3.0	–	–	0.36	–	0.44	–	0.52	
			4.5	–	–	0.36	–	0.44	–	0.52	
$I_{IN}$	Input Leakage Current	$V_{IN} = 5.5$ V or GND	2.0 to 5.5	–	–	$\pm 0.1$	–	$\pm 1.0$	–	$\pm 1.0$	$\mu\text{A}$
$I_{OFF}$	Power Off Leakage Current	$V_{IN} = 5.5$ V	0.0	–	–	1.0	–	10	–	10	$\mu\text{A}$
$I_{CC}$	Quiescent Supply Current	$V_{IN} = V_{CC}$ or GND	5.5	–	–	1.0	–	20	–	40	$\mu\text{A}$

# NLV74VHC1G86, NLV74VHC1GT86

## DC ELECTRICAL CHARACTERISTICS (NLV74VHC1GT86)

Symbol	Parameter	Test Conditions	V <sub>CC</sub> (V)	T <sub>A</sub> = 25°C			-40°C ≤ T <sub>A</sub> ≤ 85°C		-55°C ≤ T <sub>A</sub> ≤ 125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
V <sub>IH</sub>	High-Level Input Voltage		2.0	1.0	–	–	1.0	–	1.0	–	V
			3.0	1.4	–	–	1.4	–	1.4	–	
			4.5	2.0	–	–	2.0	–	2.0	–	
			5.5	2.0	–	–	2.0	–	2.0	–	
V <sub>IL</sub>	Low-Level Input Voltage		2.0	–	–	0.28	–	0.28	–	0.28	V
			3.0	–	–	0.45	–	0.45	–	0.45	
			4.5	–	–	0.8	–	0.8	–	0.8	
			5.5	–	–	0.8	–	0.8	–	0.8	
V <sub>OH</sub>	High-Level Output Voltage	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	2.0	1.9	2.0	–	1.9	–	1.9	–	V
		I <sub>OH</sub> = –50 μA	3.0	2.9	3.0	–	2.9	–	2.9	–	
		I <sub>OH</sub> = –50 μA	4.5	4.4	4.5	–	4.4	–	4.4	–	
		I <sub>OH</sub> = –4 mA	3.0	2.58	–	–	2.48	–	2.34	–	
		I <sub>OH</sub> = –8 mA	4.5	3.94	–	–	3.80	–	3.66	–	
V <sub>OL</sub>	Low-Level Output Voltage	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	2.0	–	0.0	0.1	–	0.1	–	0.1	V
		I <sub>OL</sub> = 50 μA	3.0	–	0.0	0.1	–	0.1	–	0.1	
		I <sub>OL</sub> = 50 μA	4.5	–	0.0	0.1	–	0.1	–	0.1	
		I <sub>OL</sub> = 4 mA	3.0	–	–	0.36	–	0.44	–	0.52	
		I <sub>OL</sub> = 8 mA	4.5	–	–	0.36	–	0.44	–	0.52	
I <sub>IN</sub>	Input Leakage Current	V <sub>IN</sub> = 5.5 V or GND	2.0 to 5.5	–	–	±0.1	–	±1.0	–	±1.0	μA
I <sub>OFF</sub>	Power Off Leakage Current	V <sub>IN</sub> = 5.5 V or V <sub>OUT</sub> = 5.5 V	0	–	–	1.0	–	10	–	10	μA
I <sub>CC</sub>	Quiescent Supply Current	V <sub>IN</sub> = V <sub>CC</sub> or GND	5.5	–	–	1.0	–	20	–	40	μA
I <sub>CCT</sub>	Increase in Quiescent Supply Current per Input Pin	One Input: V <sub>IN</sub> = 3.4 V; Other Input at V <sub>CC</sub> or GND	5.5	–	–	1.35	–	1.5	–	1.65	mA

## AC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Conditions	V <sub>CC</sub> (V)	T <sub>A</sub> = 25°C			-40°C ≤ T <sub>A</sub> ≤ 85°C		-55°C ≤ T <sub>A</sub> ≤ 125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
t <sub>PLH</sub> , t <sub>PHL</sub>	Propagation Delay, (A or B) to Y (Figures 3 and 4)	C <sub>L</sub> = 15 pF	3.0 to 3.6	–	4.4	11.0	–	13.0	–	15.5	ns
		C <sub>L</sub> = 50 pF		–	5.7	14.5	–	16.5	–	19.5	
		C <sub>L</sub> = 15 pF	4.5 to 5.5	–	3.5	6.8	–	8.0	–	10.0	
		C <sub>L</sub> = 50 pF		–	4.2	8.8	–	10.0	–	12.0	
C <sub>IN</sub>	Input Capacitance			–	4.0	10	–	10	–	10	pF
C <sub>OUT</sub>	Output Capacitance	Output in High Impedance State		–	6.0	–	–	–	–	–	pF

C <sub>PD</sub>	Power Dissipation Capacitance (Note 5)	Typical @ 25°C, V <sub>CC</sub> = 5.0 V	pF
		8.0	

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>.

# NLV74VHC1G86, NLV74VHC1GT86

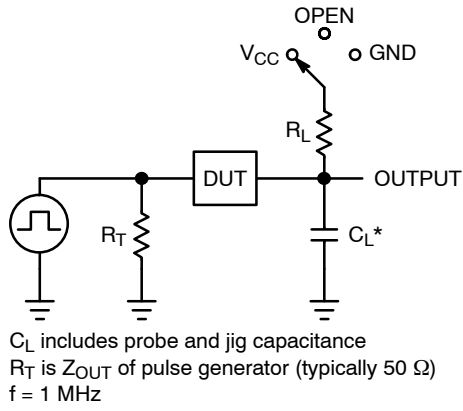


Figure 3. Test Circuit

Test	Switch Position	$C_L$ , pF	$R_L$ , $\Omega$
$t_{PLH} / t_{PHL}$	Open	See AC Characteristics Table	X
$t_{PLZ} / t_{PZL}$	$V_{CC}$		1 k
$t_{PHZ} / t_{PZH}$	GND		1 k

X = Don't Care

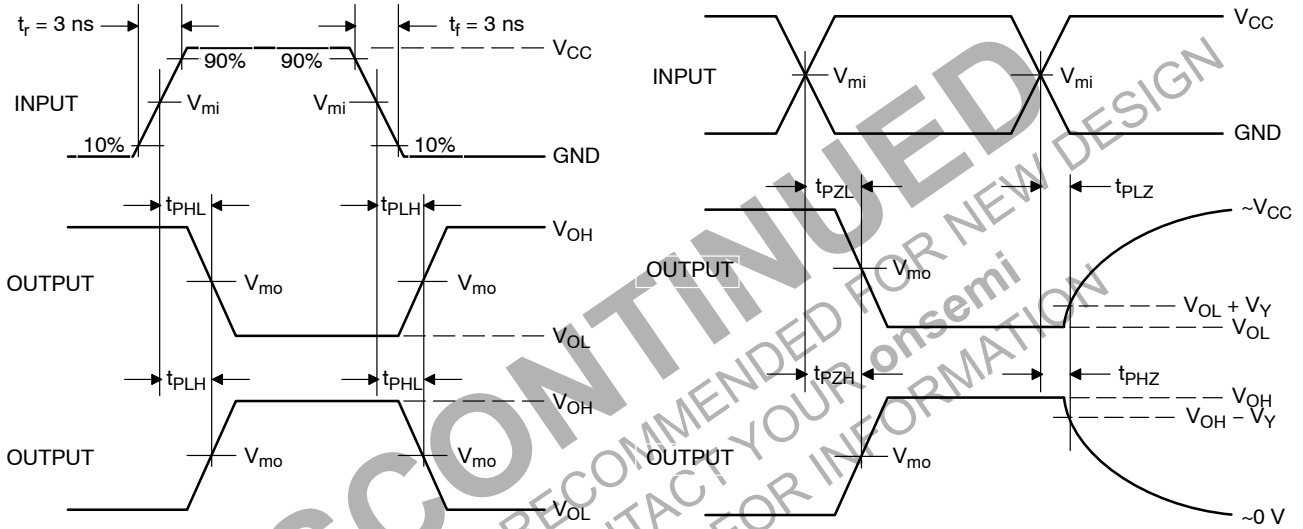


Figure 4. Switching Waveforms

$V_{CC}$ , V	$V_{mi}$ , V	$V_{mo}$ , V		$V_Y$ , V
		$t_{PLH}$ , $t_{PHL}$	$t_{PZL}$ , $t_{PLZ}$ , $t_{PZH}$ , $t_{PHZ}$	
3.0 to 3.6	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$	0.3
4.5 to 5.5	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$	0.3

# NLV74VHC1G86, NLV74VHC1GT86

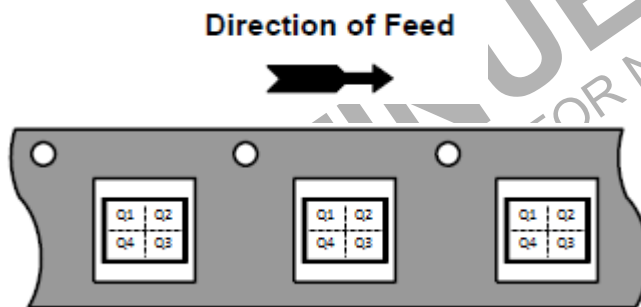
## ORDERING INFORMATION

Device	Packages	Specific Device Code	Pin 1 Orientation (See below)	Shipping <sup>†</sup>
MC74VHC1G86DFT2G-L22038	SC-88A	V8	Q4	3000 / Tape & Reel
NLVVHC1G86DFT1G*	SC-88A	V8	Q2	3000 / Tape & Reel
NLVVHC1G86DFT2G*	SC-88A	V8	Q4	3000 / Tape & Reel
NLVVHC1GT86DFT1G*	SC-88A	VM	Q2	3000 / Tape & Reel
MC74VHC1G86DTT1G	TSOP-5	V8	Q4	3000 / Tape & Reel
NLVVHC1G86DTT1G*	TSOP-5	V8	Q4	3000 / Tape & Reel
NLV74VHC1GT86DTT1G*	TSOP-5	VM	Q4	3000 / Tape & Reel
M74VHC1GT86DTT1G	TSOP-5	VM	Q4	3000 / 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.

\*NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable.

## PIN 1 ORIENTATION IN TAPE AND REEL

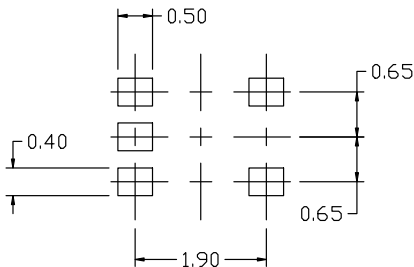
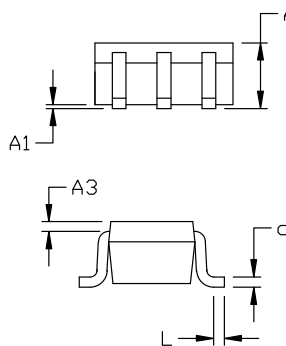
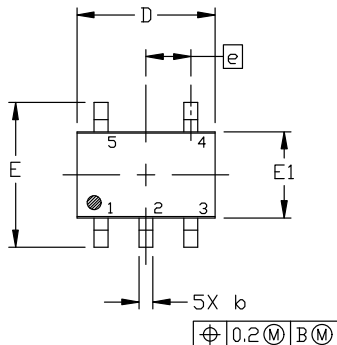




SCALE 2:1

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

DATE 11 APR 2023



RECOMMENDED  
MOUNTING FOOTPRINT

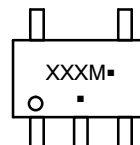
\* For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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)

STYLE 1:

- PIN 1. BASE
2. EMITTER
3. BASE
4. COLLECTOR
5. COLLECTOR

STYLE 2:

- PIN 1. ANODE
2. EMITTER
3. BASE
4. COLLECTOR
5. CATHODE

STYLE 3:

- PIN 1. ANODE 1
2. N/C
3. ANODE 2
4. CATHODE 2
5. CATHODE 1

STYLE 4:

- PIN 1. SOURCE 1
2. DRAIN 1/2
3. SOURCE 1
4. GATE 1
5. GATE 2

STYLE 5:

- PIN 1. CATHODE
2. COMMON ANODE
3. CATHODE 2
4. CATHODE 3
5. CATHODE 4

STYLE 6:

- PIN 1. EMITTER 2
2. BASE 2
3. EMITTER 1
4. COLLECTOR
5. COLLECTOR 2/BASE 1

STYLE 7:

- PIN 1. BASE
2. EMITTER
3. BASE
4. COLLECTOR
5. COLLECTOR

STYLE 8:

- PIN 1. CATHODE
2. COLLECTOR
3. N/C
4. BASE
5. EMITTER

STYLE 9:

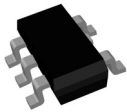
- PIN 1. ANODE
2. CATHODE
3. ANODE
4. ANODE
5. ANODE

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.

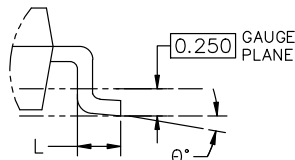
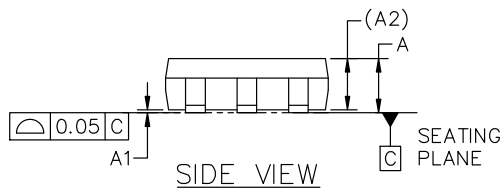
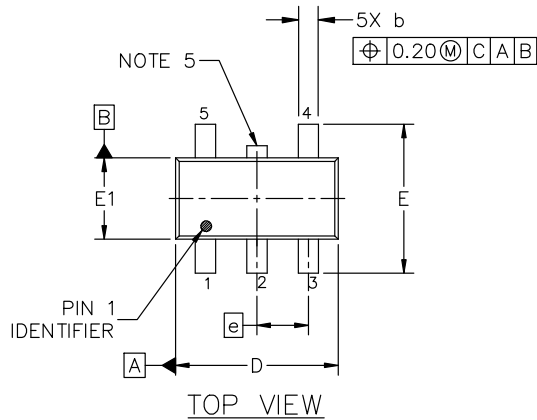
DOCUMENT NUMBER:	98ASB42984B	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	SC-88A (SC-70-5/SOT-353)	PAGE 1 OF 1

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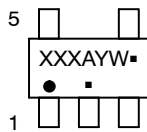
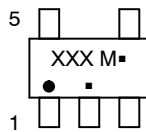



**TSOP-5 3.00x1.50x0.95, 0.95P**  
**CASE 483**  
**ISSUE P**

DATE 01 APR 2024



DETAIL "A"  
SCALE 2:1

**GENERIC  
MARKING DIAGRAM\***

**Analog**

**Discrete/Logic**

XXX = Specific Device Code  
A = Assembly Location  
Y = Year  
W = Work Week  
▪ = Pb-Free Package

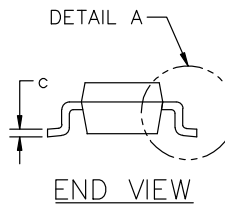
(Note: Microdot may be in either location)

\*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.

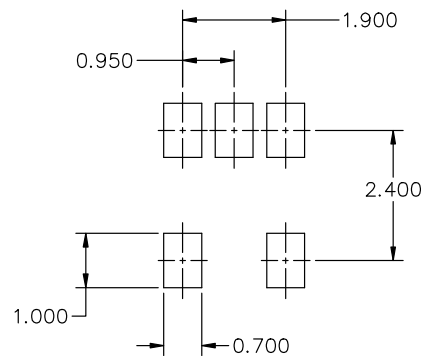
**NOTES:**

1. DIMENSIONING AND TOLERANCING CONFORM TO ASME Y14.5-2018.
2. ALL DIMENSION ARE IN MILLIMETERS (ANGLES IN DEGREES).
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OF GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.15 PER SIDE. DIMENSION D.
5. OPTIONAL CONSTRUCTION: AN ADDITIONAL TRIMMED LEAD IS ALLOWED IN THIS LOCATION. TRIMMED LEAD NOT TO EXTEND MORE THAN 0.2 FROM BODY.

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.900	1.000	1.100
A1	0.010	0.055	0.100
A2	0.950 REF.		
b	0.250	0.375	0.500
c	0.100	0.180	0.260
D	2.850	3.000	3.150
E	2.500	2.750	3.000
E1	1.350	1.500	1.650
e	0.950 BSC		
L	0.200	0.400	0.600
θ	0°	5°	10°



END VIEW


**RECOMMENDED MOUNTING FOOTPRINT\***

\* FOR ADDITIONAL INFORMATION ON OUR Pb-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ON SEMICONDUCTOR SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERM/D.

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**DESCRIPTION: TSOP-5 3.00x1.50x0.95, 0.95P**
**PAGE 1 OF 1**

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