

# Single 2-Input NAND Gate with Open Drain Output

## NLV74VHC1G01, NLV74VHC1GT01

The NLV74VHC1G01 / NLV74VHC1GT01 is a 2-input NAND gate with an open drain output in tiny footprint packages. The NLV74VHC1G01 has CMOS-level input thresholds while the NLV74VHC1GT01 has TTL-level inputs.

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

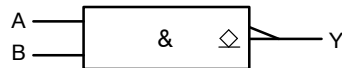
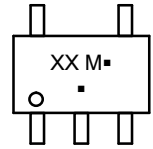


Figure 1. Logic Symbol

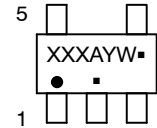
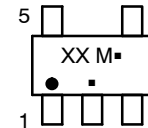
### MARKING DIAGRAMS



SC-88A  
DF SUFFIX  
CASE 419A



TSOP-5  
DT SUFFIX  
CASE 483



- XX = Specific Device Code
- M = Date Code\*
- A = Assembly Location
- Y = Year
- W = Work Week
- = Pb-Free Package

(Note: Microdot may be in either location)

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

### ORDERING INFORMATION

See detailed ordering, marking and shipping information in the package dimensions section on page 7 of this data sheet.

# NLV74VHC1G01, NLV74VHC1GT01

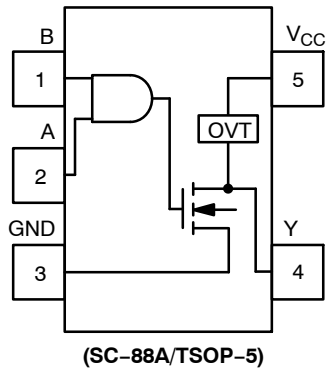


Figure 2. Pinout (Top View)

## 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	Z
L	H	Z
H	L	Z
H	H	L

# NLV74VHC1G01, NLV74VHC1GT01

## MAXIMUM RATINGS

Symbol	Characteristics	Value	Unit
V <sub>CC</sub>	DC Supply Voltage	-0.5 to +7.0	V
V <sub>IN</sub>	DC Input Voltage	-0.5 to +7.0	V
V <sub>OUT</sub>	DC Output Voltage	1Gxx	-0.5 to V <sub>CC</sub> + 0.5
		1GTxx Active-Mode (High or Low State) Tri-State Mode (Note 1) Power-Down Mode (V <sub>CC</sub> = 0 V)	-0.5 to V <sub>CC</sub> + 0.5 -0.5 to +7.0 -0.5 to +7.0
I <sub>IK</sub>	DC Input Diode Current V <sub>IN</sub> < GND	-20	mA
I <sub>OK</sub>	DC Output Diode Current	1Gxx V <sub>OUT</sub> > V <sub>CC</sub> , V <sub>OUT</sub> < GND	±20
		1GTxx V <sub>OUT</sub> < GND	-20
I <sub>OUT</sub>	DC Output Source/Sink Current	±25	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 secs	260	°C
T <sub>J</sub>	Junction Temperature Under Bias	+150	°C
θ <sub>JA</sub>	Thermal Resistance (Note 2)	SC-88A	377
		TSOP-5	320
P <sub>D</sub>	Power Dissipation in Still Air	SC-88A	332
		TSOP-5	390
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	2000
		Charged Device Model	1000
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 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.

## 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	V <sub>CC</sub>	V	
		1GTxx Active-Mode (High or Low State) Tri-State Mode (Note 1) Power-Down Mode (V <sub>CC</sub> = 0 V)	0		V <sub>CC</sub>
			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	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.

# NLV74VHC1G01, NLV74VHC1GT01

## DC ELECTRICAL CHARACTERISTICS (NLV74VHC1G01)

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	1.5	-	-	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 <sub>IL</sub>	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 <sub>OL</sub>	Low-Level Output Voltage	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> I <sub>OL</sub> = 50 μA I <sub>OL</sub> = 50 μA I <sub>OL</sub> = 50 μA I <sub>OL</sub> = 4 mA I <sub>OL</sub> = 8 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 <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>OZ</sub>	3-State Output Leakage Current	V <sub>OUT</sub> = 0 V to 5.5 V	5.5	-	-	±0.25	-	±2.5	-	±2.5	μA
I <sub>OFF</sub>	Power Off Leakage Current	V <sub>IN</sub> = 5.5 V	0.0	-	-	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

# NLV74VHC1G01, NLV74VHC1GT01

## DC ELECTRICAL CHARACTERISTICS (NLV74VHC1GT01)

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>OL</sub>	Low-Level Output Voltage	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> I <sub>OL</sub> = 50 μA	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		
			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>OZ</sub>	3-State Output Leakage Current	V <sub>OUT</sub> = 0 V to 5.5 V	5.5	-	-	±0.25	-	±2.5	-	±2.5	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	

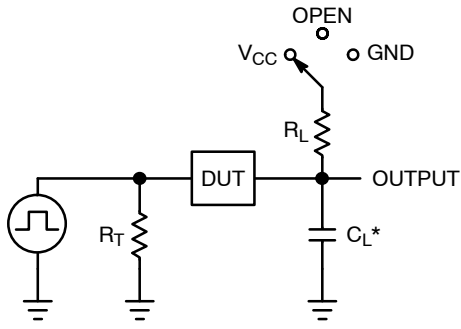
## AC ELECTRICAL CHARACTERISTICS

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>PZL</sub>	Propagation Delay, (A or B) to Y (Figures 3 and 4)	C <sub>L</sub> = 15 pF	3.0 to 3.6	-	5.5	7.9	-	9.5	-	11.0	ns
				C <sub>L</sub> = 50 pF	-	8.0	11.4	-	13.0	-	
		C <sub>L</sub> = 15 pF	4.5 to 5.5	-	3.7	5.5	-	6.5	-	8.0	
				C <sub>L</sub> = 50 pF	-	5.2	7.5	-	8.5	-	
t <sub>PLZ</sub>	Propagation Delay, (A or B) to Y (Figures 3 and 4)	C <sub>L</sub> = 15 pF	3.0 to 3.6	-	6.5	8.5	-	11.5	-	14.5	ns
				C <sub>L</sub> = 50 pF	-	8.0	11.4	-	13.5	-	
		C <sub>L</sub> = 15 pF	4.5 to 5.5	-	4.8	6.8	-	8.0	-	9.5	
				C <sub>L</sub> = 50 pF	-	5.2	7.5	-	8.5	-	
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	
		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>.

# NLV74VHC1G01, NLV74VHC1GT01

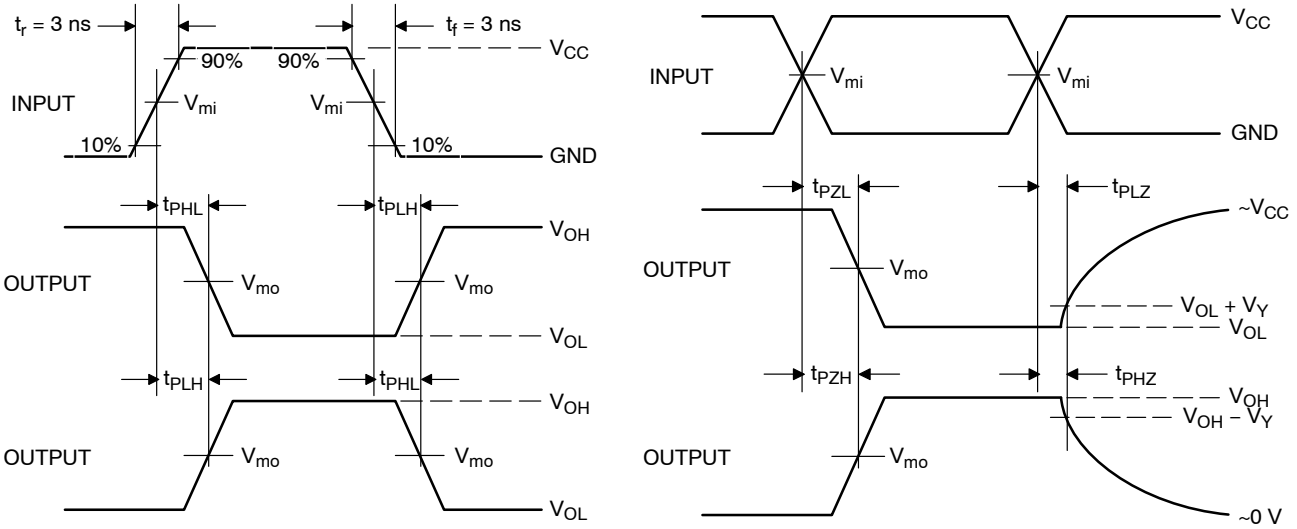


$C_L$  includes probe and jig capacitance  
 $R_T$  is  $Z_{OUT}$  of pulse generator (typically 50  $\Omega$ )  
 $f = 1$  MHz

**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

# NLV74VHC1G01, NLV74VHC1GT01

## ORDERING INFORMATION

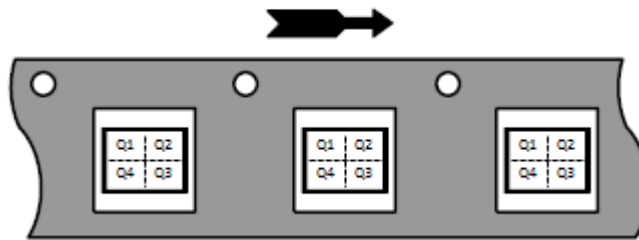
Device	Packages	Specific Device Code	Pin 1 Orientation (See below)	Shipping <sup>†</sup>
MC74VHC1G01DFT1G-L22038	SC-88A	V0	Q2	3000 / Tape & Reel
MC74VHC1G01DFT2G-L22038	SC-88A	V0	Q4	3000 / Tape & Reel
NLV74VHC1G01DFT1G*	SC-88A	V0	Q2	3000 / Tape & Reel
MC74VHC1G01DTT1G	TSOP-5	V0	Q4	3000 / Tape & Reel
NLV74VHC1G01DTT1G*	TSOP-5	V0	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

Direction of Feed



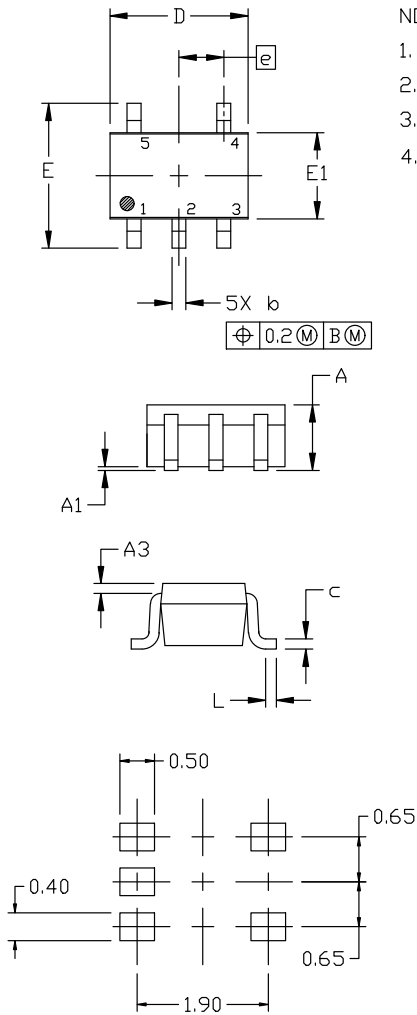
# NLV74VHC1G01, NLV74VHC1GT01

## PACKAGE DIMENSIONS

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

**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

**RECOMMENDED  
MOUNTING FOOTPRINT**

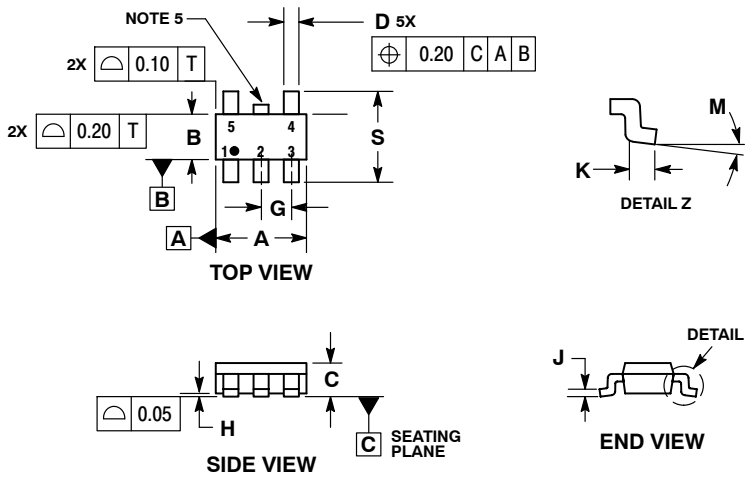
\* For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



# NLV74VHC1G01, NLV74VHC1GT01

## PACKAGE DIMENSIONS

TSOP-5  
CASE 483  
ISSUE N

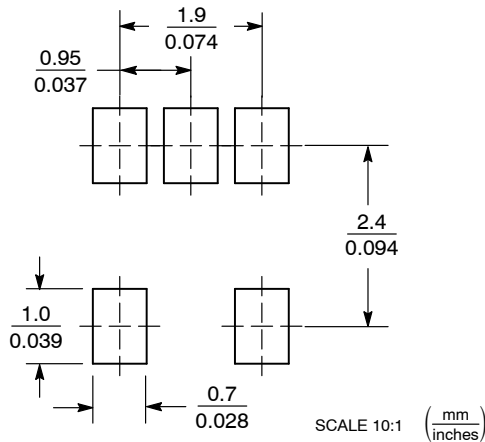


NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.15 PER SIDE. DIMENSION A.
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	MAX
A	2.85	3.15
B	1.35	1.65
C	0.90	1.10
D	0.25	0.50
G	0.95 BSC	
H	0.01	0.10
J	0.10	0.26
K	0.20	0.60
M	0° 10°	
S	2.50	3.00

### SOLDERING FOOTPRINT\*



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

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