# **Bus Buffer with 3-State Output**

The NL17SG125 MiniGate<sup>™</sup> is an advanced high-speed CMOS Bus Buffer with 3-State Output in ultra-small footprint.

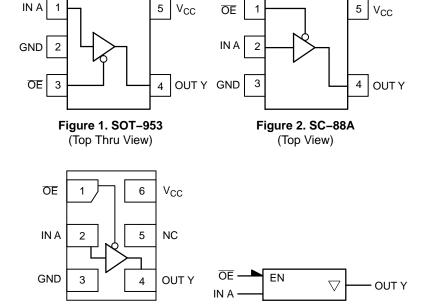
The NL17SG125 input structures provides protection when voltages up to 4.6 V are applied.

#### **Features**

- Wide Operating V<sub>CC</sub> Range: 0.9 V to 3.6 V
- High Speed:  $t_{PD} = 2.4 \text{ ns}$  (Typ) at  $V_{CC} = 3.0 \text{ V}$ ,  $C_L = 15 \text{ pF}$
- Low Power Dissipation:  $I_{CC} = 0.5 \mu A$  (Max) at  $T_A = 25^{\circ}C$
- 4.6 V Overvoltage Tolerant (OVT) Input Pins
- Ultra-Small Packages

O

• These are Pb-Free and Halide-Free Devices



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#### **PIN ASSIGNMENT**

Figure 3. UDFN6

(Top View)

Pin Number	SOT-953	SC-88A	UDFN6
1	IN A	ŌĒ	ŌĒ
2	GND	IN A	IN A
3	ŌĒ	GND	GND
4	OUT Y	OUT Y	OUT Y
5	V <sub>CC</sub>	V <sub>CC</sub>	NC
6			V <sub>CC</sub>



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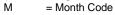
#### MARKING DIAGRAMS



SOT-953 CASE 527AE



F = Specific Device Code (F with 90 degree clockwise rotation)





UDFN6 1.0 x 1.0 CASE 517BX



K = Specific Device Code (K with 270 degree clockwise rotation) M = Month Code



UDFN6 1.45 x 1.0 CASE 517AQ



R = Specific Device Code
(R with 180 degree clockwise rotation)
M = Month Code



SC-88A DF SUFFIX CASE 419A



A4 = 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.

#### **FUNCTION TABLE**

A Input	OE Input	Y Output
L	L	L
Н	L	Н
X	н	Z

#### ORDERING INFORMATION

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

Figure 4. Logic Symbol

#### **MAXIMUM RATINGS**

Symbol	Parameter		Value	Unit
V <sub>CC</sub>	DC Supply Voltage		-0.5 to +5.5	V
V <sub>IN</sub>	DC Input Voltage		-0.5 to +4.6	V
V <sub>OUT</sub>	DC Output Voltage	Output at High or Low State Power–Down Mode (V <sub>CC</sub> = 0 V)	-0.5 to V <sub>CC</sub> +0.5 -0.5 to +4.6	V
I <sub>IK</sub>	DC Input Diode Current	V <sub>IN</sub> < GND	-20	mA
I <sub>OK</sub>	DC Output Diode Current	V <sub>OUT</sub> < GND	-20	mA
I <sub>OUT</sub>	DC Output Source/Sink Current		±20	mA
I <sub>CC</sub>	DC Supply Current per Supply Pin		±20	mA
$I_{GND}$	DC Ground Current per Ground Pin		±20	mA
T <sub>STG</sub>	Storage Temperature Range		-65 to +150	°C
TL	Lead Temperature, 1 mm from Case for 10 Seconds		260	°C
TJ	Junction Temperature Under Bias		+150	°C
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	Human Body Model (Note 2) Machine Model (Note 3)	>2000 >100	V
ILATCHUP	Latchup Performance Above V <sub>CC</sub>	and Below GND at 125°C (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. Measured with minimum pad spacing on an FR4 board, using 10 mm-by-1 inch, 2-ounce copper trace with no air flow.

- 2. Tested to EIA/JESD22-A114-A.
- 3. Tested to EIA/JESD22-A115-A.
- 4. Tested to EIA/JESD78.

#### RECOMMENDED OPERATING CONDITIONS

Symbol	Characteristics	Min	Max	Unit
V <sub>CC</sub>	Positive DC Supply Voltage	0.9	3.6	V
V <sub>IN</sub>	Digital Input Voltage	0.0	3.6	V
V <sub>OUT</sub>	Output Voltage Output at High or Low State Power–Down Mode ( $V_{CC} = 0 \text{ V}$ )	0.0 0.0	V <sub>CC</sub> 3.6	V
T <sub>A</sub>	Operating Temperature Range	-55	+125	°C
Δt / ΔV	Input Transition Rise or Fail Rate $V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$	0	10	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.

#### DC ELECTRICAL CHARACTERISTICS

					T <sub>A</sub> =	25°C	T <sub>A</sub> = -55°C to +125°C			
Symbol	Parameter	Parameter Conditions		V <sub>CC</sub> (V)	Min	Max	Min	Max	Uni	
V <sub>IH</sub>	High-Level Input			0.9	V <sub>CC</sub>		V <sub>CC</sub>		V	
	Voltage			1.1 to 1.3	0.7xV <sub>CC</sub>		0.7xV <sub>CC</sub>			
				1.4 to 1.6	0.65xV <sub>CC</sub>		0.65xV <sub>CC</sub>			
				1.65 to 1.95	0.65xV <sub>CC</sub>		0.65xV <sub>CC</sub>			
				2.3 to 2.7	1.7		1.7			
				3.0 to 3.6	2.0		2.0			
$V_{IL}$	Low-Level Input			0.9		GND		GND	V	
	Voltage			1.1 to 1.3		0.3xV <sub>CC</sub>		0.3xV <sub>CC</sub>		
				1.4 to 1.6		0.35xV <sub>CC</sub>		0.35xV <sub>CC</sub>		
				1.65 to 1.95		0.35xV <sub>CC</sub>		0.35xV <sub>CC</sub>		
				2.3 to 2.7		0.7		0.7		
				3.0 to 3.6		0.8		0.8		
V <sub>OH</sub>	High-Level Output Voltage		V <sub>IN</sub> =	$I_{OH} = -20 \mu A$	0.9	0.75		0.75		V
		V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OH</sub> = -0.3 mA	1.1 to 1.3	0.75xV <sub>CC</sub>		0.75xV <sub>CC</sub>			
			I <sub>OH</sub> = -1.7 mA	1.4 to 1.6	0.75xV <sub>CC</sub>		0.75xV <sub>CC</sub>			
			I <sub>OH</sub> = -3.0 mA	1.65 to 1.95	Vcc-0.45		Vcc-0.45			
			I <sub>OH</sub> = -4.0 mA	2.3 to 2.7	2.0		2.0			
			I <sub>OH</sub> = -8.0 mA	3.0 to 3.6	2.48		2.48			
V <sub>OL</sub>	Low-Level	V <sub>IN</sub> =	I <sub>OL</sub> = 20 μA	0.9		0.1		0.1	V	
	Output Voltage	V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> = 0.3 mA	1.1 to 1.3		0.25xV <sub>CC</sub>		0.25xV <sub>CC</sub>		
			I <sub>OL</sub> = 1.7 mA	1.4 to 1.6		0.25xV <sub>CC</sub>		0.25xV <sub>CC</sub>		
			I <sub>OL</sub> = 3.0 mA	1.65 to 1.95		0.45		0.45		
			I <sub>OL</sub> = 4.0 mA	2.3 to 2.7		0.4		0.4		
			I <sub>OL</sub> = 8.0 mA	3.0 to 3.6		0.4		0.4		
I <sub>IN</sub>	Input Leakage Current	0 ≤	V <sub>IN</sub> ≤ 3.6 V	0 to 3.6		±0.1		±1.0	μΔ	
I <sub>CC</sub>	Quiescent Supply Current	V <sub>IN</sub> =	V <sub>CC</sub> or GND	3.6		1.0		10.0	μΑ	
l <sub>OZ</sub>	3-State Output Leakage Current	V <sub>IN</sub> V <sub>OUT</sub>	= V <sub>IH</sub> or V <sub>IL</sub> -= 0 to 3.6 V	0.9 to 3.6		1.0		10.0	μΑ	

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 (Input $t_r = t_f = 3.0 \text{ ns}$ )

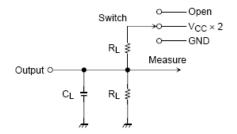
					T <sub>A</sub> = 25 °C	;	T <sub>/</sub> -55°C to	= 0 +125°C	
Symbol	Parameter	Test Condition	V <sub>CC</sub> (V)	Min	Тур	Max	Min	Max	Unit
t <sub>PLH</sub> ,	Propagation Delay,	$C_L = 10 \text{ pF},$	0.9	-	11.3	13.6	-	15.9	ns
t <sub>PHL</sub>	A to Y	$R_L = 1 M\Omega$	1.1 to 1.3	-	8.3	10.4	-	12.8	
			1.4 to 1.6	-	5.0	8.5	-	10.0	
			1.65 to 1.95	-	4.0	6.2	-	6.7	
			2.3 to 2.7	-	2.6	3.9	-	4.4	
			3.0 to 3.6	-	2.1	3.1	-	3.7	
		$C_L = 15 \text{ pF},$	0.9	-	12.6	14.7	-	17.0	ns
		$R_L = 1 M\Omega$	1.1 to 1.3	-	9.6	11.5	-	15.2	
			1.4 to 1.6	-	5.6	9.3	-	11.2	
			1.65 to 1.95	-	4.5	6.9	-	7.1	
			2.3 to 2.7	-	2.9	4.4	-	5.0	
			3.0 to 3.6	-	2.4	3.4	-	3.9	
		$C_L = 30 \text{ pF},$	0.9	-	14.5	16.3	-	19.6	ns
		$R_L = 1 M\Omega$	1.1 to 1.3	-	11.3	13.6	-	17.5	
			1.4 to 1.6	-	8.2	13.1	-	15.9	
			1.65 to 1.95	-	6	9.2	-	9.6	
			2.3 to 2.7	-	4	5.7	-	6.1	
			3.0 to 3.6	-	3.3	4.4	-	4.8	]
t <sub>PZH</sub> ,	Output Enable Time, OE to Y	$C_L = 10 \text{ pF};$							ns
t <sub>PZL</sub>	OE 10 Y	$R_L = 100 \text{ k}\Omega$	0.9	-	11.0	13.3	-	15.8	
		$R_L = 5 \text{ k}\Omega$	1.1 to 1.3	-	8.4	10.9	-	13.0	
		$R_L = 5 \text{ k}\Omega$	1.4 to 1.6	-	5.3	7.8	-	8.3	
		$R_L = 5 \text{ k}\Omega$	1.65 to 1.95	-	3.9	5.5	-	5.9	
		$R_L = 5 \text{ k}\Omega$	2.3 to 2.7	-	2.5	3.5	-	3.8	
		$R_L = 5 \text{ k}\Omega$	3.0 to 3.6	-	2.1	2.7	-	3	
		C <sub>L</sub> = 15 pF;							ns
		$R_L = 100 \text{ k}\Omega$	0.9	-	12.0	14.8	-	17.0	
		$R_L = 5 \text{ k}\Omega$	1.1 to 1.3	-	9.0	11.7	-	13.8	
		$R_L = 5 \text{ k}\Omega$	1.4 to 1.6	-	5.9	8.9	-	11	
		$R_L = 5 \text{ k}\Omega$	1.65 to 1.95	-	4.4	6.3	-	6.5	
		$R_L = 5 \text{ k}\Omega$	2.3 to 2.7	-	2.9	3.9	-	4.2	
		$R_L = 5 \text{ k}\Omega$	3.0 to 3.6	-	2.3	3	-	3.3	
		C <sub>L</sub> = 30 pF;							ns
		$R_L = 100 \text{ k}\Omega$	0.9	-	13.0	15.2	-	18.3	
		$R_L = 5 \text{ k}\Omega$	1.1 to 1.3	-	10.0	13.1	-	15.2	
		$R_L = 5 \text{ k}\Omega$	1.4 to 1.6	-	8.3	12.2	-	13.7	1
		$R_L = 5 \text{ k}\Omega$	1.65 to 1.95	-	6.1	8.6	-	9.7	
		$R_L = 5 \text{ k}\Omega$	2.3 to 2.7	-	3.8	5	-	5.5	1
		$R_L = 5 \text{ k}\Omega$	3.0 to 3.6	-	2.9	3.8	-	4.2	1

#### AC ELECTRICAL CHARACTERISTICS (Input $t_r = t_f = 3.0 \text{ ns}$ ) (continued)

					T <sub>A</sub> = 25 °(	;	T⊿ -55°C to	∖ = o +125°C	
Symbol	Parameter	Test Condition	V <sub>CC</sub> (V)	Min	Тур	Max	Min	Max	Unit
t <sub>PHZ</sub> ,	Output Disable Time,	C <sub>L</sub> = 10 pF;							ns
t <sub>PLZ</sub>	OE 10 Y	$R_L = 100 \text{ k}\Omega$	0.9	-	100.4	-	-	-	
		$R_L = 5 \text{ k}\Omega$	1.1 to 1.3	-	9.1	14.4	-	22.4	
		$R_L = 5 \text{ k}\Omega$	1.4 to 1.6	-	7.1	9.1	-	10.4	
		$R_L = 5 \text{ k}\Omega$	1.65 to 1.95	-	6.5	8.3	-	9	
		$R_L = 5 \text{ k}\Omega$	2.3 to 2.7	-	5.8	7.3	-	8.8	
		$R_L = 5 \text{ k}\Omega$	3.0 to 3.6	-	5.4	6.9	-	7.6	
		C <sub>L</sub> = 15 pF;							ns
		$R_L = 100 \text{ k}\Omega$	0.9	-	122.2	-	-	-	
		$R_L = 5 \text{ k}\Omega$	1.1 to 1.3	-	9.8	15.3	-	25.1	
		$R_L = 5 \text{ k}\Omega$	1.4 to 1.6	-	7.8	9.8	-	11.3	
		$R_L = 5 \text{ k}\Omega$	1.65 to 1.95	-	7.2	9.2	-	10.6	
		$R_L = 5 \text{ k}\Omega$	2.3 to 2.7	-	7	8.2	-	10.3	
		$R_L = 5 \text{ k}\Omega$	3.0 to 3.6	-	6.6	7.7	-	9.5	
		C <sub>L</sub> = 30 pF;							ns
		$R_L = 100 \text{ k}\Omega$	0.9	-	217.1	-	-	-	
		$R_L = 5 \text{ k}\Omega$	1.1 to 1.3	-	13.2	19.6	-	31.9	
		$R_L = 5 \text{ k}\Omega$	1.4 to 1.6	-	12.2	13.5	-	14.9	
		$R_L = 5 \text{ k}\Omega$	1.65 to 1.95	-	11.4	12.7	-	13.9	
		$R_L = 5 \text{ k}\Omega$	2.3 to 2.7	-	11.3	12.2	-	13.5	
		$R_L = 5 \text{ k}\Omega$	3.0 to 3.6	-	10.2	11.5	-	12.9	
C <sub>IN</sub>	Input Capacitance		0 to 3.6		3	-	-	-	pF
Co	Output Capacitance	V <sub>O</sub> = GND	0		3	-	-	-	pF
C <sub>PD</sub>	Power Dissipation Capacitance (Note 5)	f = 10 MHz	0.9 to 3.6	-	4	-	-	-	pF

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, unless otherwise noted. Floatic performance may not be indicated by the Electrical Characteristics if operated under different conditions, unless otherwise noted. Floating performance may not be indicated by the Electrical Characteristics if operated under different conditions, unless otherwise noted. Floating performance may not be indicated by the Electrical Characteristics if operated under different conditions, unless otherwise noted. Floating performance may not be indicated by the Electrical Characteristics if operated under different conditions, unless otherwise noted. Floating performance may not be indicated by the Electrical Characteristics if operated under different conditions, unless otherwise noted. Floating performance may not be indicated by the Electrical Characteristics if operated under different conditions, unless otherwise noted. Floating performance may not be indicated by the Electrical Characteristics if operated under different conditions, unless otherwise noted. Floating performance may not be indicated by the Electrical Characteristics if operated under different conditions, unless otherwise noted. Floating performance may not be indicated by the Electrical Characteristics in the floating performance may not be indicated by the Electrical Characteristics in the floating performance may not be indicated by the Electrical Characteristics in the floating performance may not be indicated by the Electrical Characteristics in the floating performance may not be indicated by the Electrical Characteristics in the floating performance may not be indicated by the Electrical Characteristics in the floating performance may not be indicated by the Electrical Characteristics in the floating performance may not be indicated by the Electrical Characteristics in the floating performance may not be indicated by the Electrical Characteristics in the floating performance may not be indicated by the



Characteristics	Switch
t <sub>pLH</sub> , t <sub>pHL</sub>	Open
t <sub>pLZ</sub> , t <sub>pZL</sub>	V <sub>CC</sub> × 2
t <sub>pHZ,</sub> t <sub>pZH</sub>	GND

Figure 5. Test Circuit

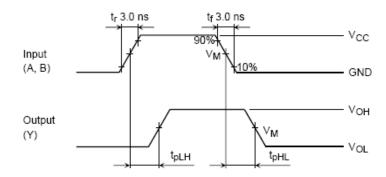


Figure 6. t<sub>PLH</sub>, t<sub>PHL</sub> Waveforms

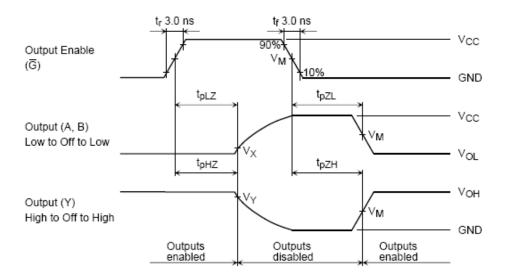


Figure 7.  $t_{PLZ}$ ,  $t_{PHZ}$ ,  $t_{PZH}$ ,  $t_{PZL}$  Waveforms

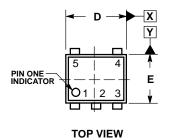
#### **ORDERING INFORMATION**

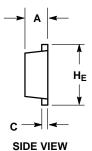
Device	Package	Shipping <sup>†</sup>
NL17SG125P5T5G	SOT-953 (Pb-Free)	8000 / Tape & Reel
NL17SG125DFT2G	SC-88A (Pb-Free)	3000 / Tape & Reel
NL17SG125AMUTCG*	UDFN6 1.45 x 1 mm (Pb-Free)	3000 / Tape & Reel
NL17SG125CMUTCG*	UDFN6 1 x 1 mm (Pb-Free)	3000 / Tape & Reel

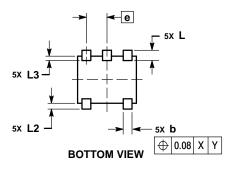
<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.
\*In Development

#### **PACKAGE DIMENSIONS**

#### SOT-953 CASE 527AE ISSUE E







- NOTES:

  1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.

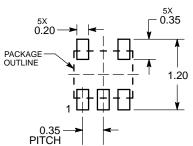
  2. CONTROLLING DIMENSION: MILLIMETERS

  3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.

  4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

	MILLIMETERS						
DIM	MIN	NOM	MAX				
Α	0.34	0.37	0.40				
b	0.10	0.15	0.20				
С	0.07 0.12 0.17						
D	0.95	1.00	1.05				
Е	0.75	0.80	0.85				
е		0.35 BS	С				
HE	0.95	1.00	1.05				
L	0.175 REF						
L2	0.05	0.10	0.15				
L3			0.15				

#### **SOLDERING FOOTPRINT\***

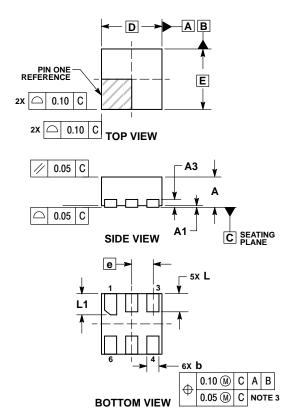


DIMENSIONS: MILLIMETERS

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

#### **PACKAGE DIMENSIONS**

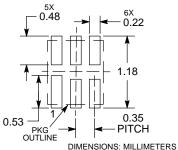
UDFN6 1.0x1.0, 0.35P CASE 517BX **ISSUE O** 



- NOTES:
  1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
  2. CONTROLLING DIMENSION: MILLIMETERS.
  3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.20 MM FROM TERMINAL TIP.
  4. PACKAGE DIMENSIONS EXCLUSIVE OF BURRS AND MOLD FLASH.

	MILLIMETERS				
DIM	MIN MAX				
Α	0.45	0.55			
A1	0.00 0.05				
A3	0.13 REF				
b	0.12	0.22			
D	1.00	BSC			
E	1.00	BSC			
е	0.35 BSC				
L	0.25	0.35			
L1	0.30	0.40			

# 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.

#### **PACKAGE DIMENSIONS**

#### UDFN6 1.45x1.0, 0.5P CASE 517AQ **ISSUE O** D NOTES: 1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994. 2. CONTROLLING DIMENSION: MILLIMETERS. 3. DIMENSION & APPLIES TO PLATED TERMINAL В AND IS MEASURED BETWEEN 0.15 AND 0.30 mm FROM THE TERMINAL TIP. **DETAIL A** PIN ONE REFERENCE OPTIONAL CONSTRUCTIONS Е | MILLIMETERS | DIM | MIN | MAX | A | 0.45 | 0.55 | A1 | 0.00 | 0.05 | 0.10 C **EXPOSED** Cu MOLD CMPD 0.07 REF A2 **TOP VIEW** 0.20 0.30 |△| 0.10 | C D E e 1.45 BSC 1.00 BSC 0.50 BSC DETAIL B **DETAIL B** 0.30 0.40 --- 0.15 OPTIONAL CONSTRUCTIONS 0.05 C **MOUNTING FOOTPRINT** 0.05 C C SEATING PLANE 6X 0.30 SIDE VIEW **A2** PACKAGE OUTLINE е 6X L 1.24 DETAIL A 6X 0.53 0.50 **PITCH** DIMENSIONS: MILLIMETERS

0.10

0.05

**BOTTOM VIEW** 

C A B

C NOTE 3

\*For additional information on our Pb-Free strategy and soldering

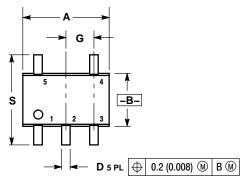
Mounting Techniques Reference Manual, SOLDERRM/D.

details, please download the ON Semiconductor Soldering and

#### PACKAGE DIMENSIONS

#### SC-88A (SC-70-5/SOT-353)

CASE 419A-02 ISSUE L

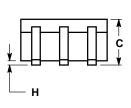


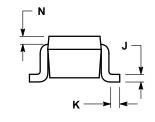
#### NOTES:

- 1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982. 2. CONTROLLING DIMENSION: INCH. 3. 419A-01 OBSOLETE. NEW STANDARD
- 419A-02.

4.	DIMENSIONS A AND B DO NOT INCLUDE
	MOLD FLASH, PROTRUSIONS, OR GATE
	BURRS.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
Α	0.071	0.087	1.80	2.20
В	0.045	0.053	1.15	1.35
С	0.031	0.043	0.80	1.10
D	0.004	0.012	0.10	0.30
G	0.026 BSC		0.65 BSC	
Н		0.004		0.10
J	0.004	0.010	0.10	0.25
K	0.004	0.012	0.10	0.30
N	0.008 REF		0.20 REF	
S	0.079	0.087	2.00	2.20





## **SOLDER FOOTPRINT\*** 0.50 0.0197 0.65 0.025 0.65 0.025

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

1.9

0.0748

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