# **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
- 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

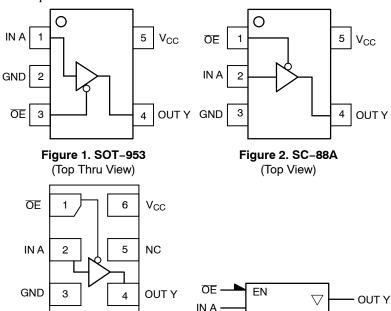


Figure 3. UDFN6 (Top View)

Figure 4. Logic Symbol

# **PIN ASSIGNMENT**

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>



#### ON Semiconductor®

http://onsemi.com

# MARKING DIAGRAMS



SOT-953 CASE 527AE



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



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.

#### **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 ver-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 <sub>GND</sub>	DC Ground Current per Ground Pin		±20	mA
T <sub>STG</sub>	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
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
I <sub>LATCHUP</sub>	Latchup Performance Above V <sub>CC</sub> and B	elow 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 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 V $\pm$ 0.3 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

Symbol					T <sub>A</sub> =	25°C		. = ) +125°C		
	Parameter	C	onditions	V <sub>CC</sub> (V)	Min	Max	Min	Max	Unit	
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 <sub>IL</sub>	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>	1	
				2.3 to 2.7		0.7		0.7		
				3.0 to 3.6		0.8		0.8		
V <sub>OH</sub> High-Level	High-Level Output Voltage	_	V <sub>IN</sub> =	I <sub>OH</sub> = -20 μA	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>		1	
				I <sub>OH</sub> = -1.7 mA	1.4 to 1.6	0.75xV <sub>CC</sub>		0.75xV <sub>CC</sub>		1
			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	1	
I <sub>IN</sub>	Input Leakage Current	$0 \le V_{IN} \le 3.6 \text{ V}$		0 to 3.6		±0.1		±1.0	μΑ	
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>OU</sub>	= V <sub>IH</sub> or V <sub>IL</sub> <sub>r</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 ns)

					T <sub>A</sub> = 25 °(	<b></b>	T <sub>/</sub> -55°C to	. = ) +125°C	
Symbol	Parameter	Test Condition	V <sub>CC</sub> (V)	Min	Тур	Max	Min	Max	Unit
t <sub>PLH</sub> ,	Propagation Delay,	C <sub>L</sub> = 10 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 <sub>L</sub> = 15 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 <sub>L</sub> = 30 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 <sub>L</sub> = 10 pF;							ns
$t_{PZL}$	OE to 1	$R_L = 100 \text{ k}\Omega$	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	
		$R_L = 5 \text{ k}\Omega$	5 kΩ 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	1
		$R_L = 5 \text{ k}\Omega$	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	1
		$R_L = 5 \text{ k}\Omega$	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

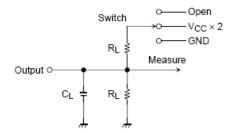
# AC ELECTRICAL CHARACTERISTICS (Input $t_r = t_f = 3.0 \text{ ns}$ ) (continued)

					T <sub>A</sub> = 25 °C	<b>:</b>	T⊿ -55°C to	) = 0 +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
$t_{PLZ}$	OE 10 Y	$R_L$ = 100 $k\Omega$	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 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 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
C <sub>O</sub>	Output Capacitance	V <sub>O</sub> = GND	0		3	-	-	-	pF
$C_{PD}$	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 for the listed test conditions.

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>.



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

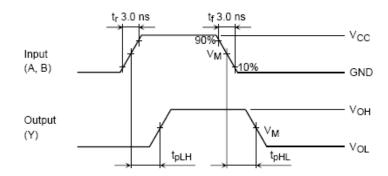


Figure 6. t<sub>PLH</sub>, t<sub>PHL</sub> Waveforms

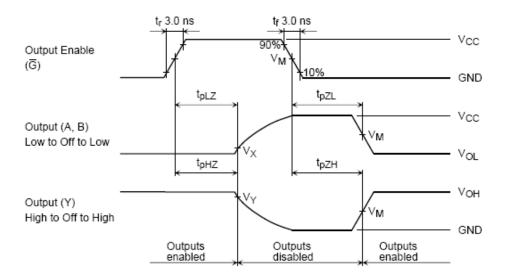


Figure 7.  $t_{PLZ}$ ,  $t_{PHZ}$ ,  $t_{PZH}$ ,  $t_{PZL}$  Waveforms

#### **ORDERING INFORMATION**

Device	Package	Shipping <sup>†</sup>
NL17SG125P5T5G	SOT-953 (Pb-Free)	8000 / Tape & Reel
NL17SG125DFT2G	SC-88A (Pb-Free)	3000 / Tape & Reel
NLV17SG125DFT2G*	SC-88A (Pb-Free)	3000 / Tape & Reel
NL17SG125MU1TCG**	UDFN6 1.45 x 1 mm (Pb-Free)	3000 / Tape & Reel
NL17SG125MU3TCG**	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.
\*NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP

MiniGate is a trademark of Semiconductor Components Industries, LLC (SCILLC).

Capable.

<sup>\*\*</sup>In Development



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

**DATE 17 JAN 2013** 



- TIES:
  DIMENSIONING AND TOLERANCING
  PER ANSI Y14.5M, 1982.
  CONTROLLING DIMENSION: INCH.
  419A-01 OBSOLETE. NEW STANDARD 3.
- 419A-02.
  DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

	INC	HES	MILLIN	IETERS	
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	





XXX = Specific Device Code

= Date Code

= 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.

# -B-S D 5 PL 0.2 (0.008) M B M

	0.50 0.0197			
	<del>-</del>	<u> </u>	- —  - — <b> </b>	0.65
0.40			. —	0.65 0.025
0.0157 <u></u>		1.9		
	_	0.0748	SCALE 20:1	$\left(\frac{\text{mm}}{\text{inches}}\right)$

**SOLDER FOOTPRINT** 

STYLE 1:	STYLE 2:	STYLE 3:	STYLE 4:	STYLE 5:
PIN 1. BASE	PIN 1. ANODE	PIN 1. ANODE 1	PIN 1. SOURCE 1	PIN 1. CATHODE
2. EMITTER	2. EMITTER	2. N/C	2. DRAIN 1/2	<ol><li>COMMON ANODE</li></ol>
3. BASE	3. BASE	3. ANODE 2	<ol><li>SOURCE 1</li></ol>	<ol><li>CATHODE 2</li></ol>
4. COLLECTOR	4. COLLECTOR	<ol><li>CATHODE 2</li></ol>	4. GATE 1	<ol><li>CATHODE 3</li></ol>
<ol><li>COLLECTOR</li></ol>	<ol><li>CATHODE</li></ol>	<ol><li>CATHODE 1</li></ol>	5. GATE 2	<ol><li>CATHODE 4</li></ol>

5. COLLECTOR	5. CATHODE	5. CATHODE 1	5. GATE 2	5. CATHODE 4
STYLE 6: PIN 1. EMITTER 2 2. BASE 2 3. EMITTER 1	STYLE 7: PIN 1. BASE 2. EMITTER 3. BASE	STYLE 8: PIN 1. CATHODE 2. COLLECTOR 3. N/C	STYLE 9: PIN 1. ANODE 2. CATHODE 3. ANODE	Note: Please refer to datasheet for style callout. If style type is not called out in the datasheet refer to the device
<ol> <li>COLLECTOR</li> <li>COLLECTOR 2/BASE 1</li> </ol>	4. COLLECTOR 5. COLLECTOR	4. BASE 5. EMITTER	4. ANODE 5. ANODE	datasheet pinout or pin assignment.

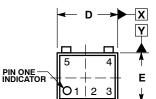
DOCUMENT NUMBER:	98ASB42984B	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.	
DESCRIPTION:	SC-88A (SC-70-5/SOT-353)		PAGE 1 OF 1

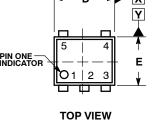
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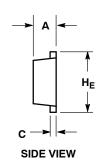


CASE 527AE **ISSUE E** 

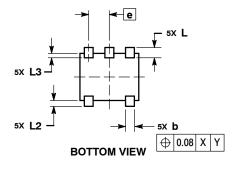
**DATE 02 AUG 2011** 



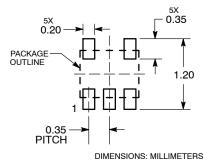




SOT-953



#### **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.

#### NOTES:

- DIMENSIONING AND TOLERANCING PER ASME
- Y14.5M, 1994.
  2. CONTROLLING DIMENSION: MILLIMETERS
- MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE
- MINIMUM THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL. 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		
E	0.75	0.80	0.85		
е	0.35 BSC				
HE	0.95	1.00	1.05		
L	0.175 REF				
L2	0.05	0.10	0.15		
L3			0.15		

#### **GENERIC MARKING DIAGRAM\***



= Specific Device Code = Month Code

\*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.

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