

# NL17SG04

## Single Inverter

The NL17SG04 MiniGate™ is an advanced high-speed CMOS Inverter in ultra-small footprint.

The NL17SG04 input structures provides protection when voltages up to 4.6 V are applied.

### Features

- Wide Operating  $V_{CC}$  Range: 0.9 V to 3.6 V
- High Speed:  $t_{PD} = 2.3$  ns (Typ) at  $V_{CC} = 3.0$  V,  $C_L = 15$  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
- These are Pb-Free and Halide-Free Devices

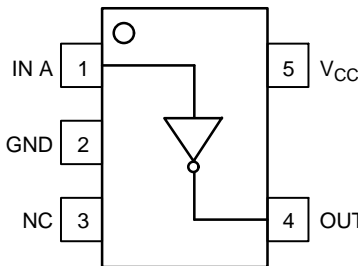


Figure 1. SOT-953 (Top Thru View)

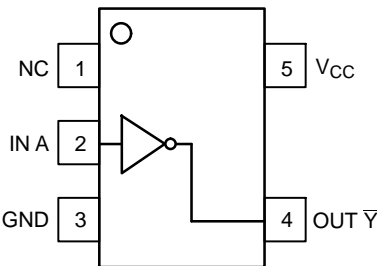


Figure 2. SC-88A (Top View)

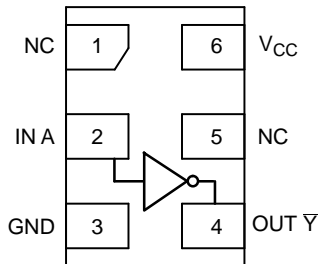


Figure 3. UDFN (Top View)

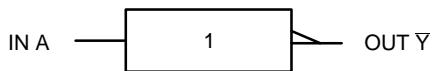


Figure 4. Logic Symbol



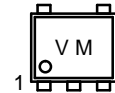
ON Semiconductor®

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

### MARKING DIAGRAMS



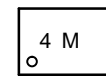
SOT-953  
CASE 527AE



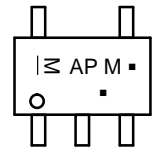
UDFN6  
1.0 x 1.0  
CASE 517BX



UDFN6  
1.45 x 1.0  
CASE 517AQ



SC-88A  
DF SUFFIX  
CASE 419A



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.

### PIN ASSIGNMENT

	SOT-953	SC-88A	UDFN6
1	IN A	NC	NC
2	GND	IN A	IN A
3	NC	GND	GND
4	OUT $\bar{Y}$	OUT $\bar{Y}$	OUT $\bar{Y}$
5	$V_{CC}$	$V_{CC}$	NC
6			$V_{CC}$

### FUNCTION TABLE

A Input	$\bar{Y}$ Output
L	H
H	L

### ORDERING INFORMATION

See detailed ordering and shipping information on page 5 of this data sheet.

# NL17SG04

## MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
$V_{CC}$	DC Supply Voltage	-0.5 to +5.5	V
$V_{IN}$	DC Input Voltage	-0.5 to +4.6	V
$V_{OUT}$	DC Output Voltage Output at High or Low State Power-Down Mode ( $V_{CC} = 0\text{ V}$ )	-0.5 to $V_{CC} + 0.5$ -0.5 to +4.6	V
$I_{IK}$	DC Input Diode Current $V_{IN} < \text{GND}$	-20	mA
$I_{OK}$	DC Output Diode Current $V_{OUT} < \text{GND}$	-20	mA
$I_{OUT}$	DC Output Source/Sink Current	$\pm 20$	mA
$I_{CC}$	DC Supply Current per Supply Pin	$\pm 20$	mA
$I_{GND}$	DC Ground Current per Ground Pin	$\pm 20$	mA
$T_{STG}$	Storage Temperature Range	-65 to +150	$^{\circ}\text{C}$
$T_L$	Lead Temperature, 1 mm from Case for 10 Seconds	260	$^{\circ}\text{C}$
$T_J$	Junction Temperature Under Bias	+150	$^{\circ}\text{C}$
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 Human Body Model (Note 2) Machine Model (Note 3)	>2000 >100	V
$I_{LATCHUP}$	Latchup Performance Above $V_{CC}$ and Below GND at 125 $^{\circ}\text{C}$ (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. 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
$V_{CC}$	Positive DC Supply Voltage	0.9	3.6	V
$V_{IN}$	Digital Input Voltage	0.0	3.6	V
$V_{OUT}$	Output Voltage Output at High or Low State Power-Down Mode ( $V_{CC} = 0\text{ V}$ )	0.0 0.0	$V_{CC}$ 3.6	V
$T_A$	Operating Temperature Range	-55	+125	$^{\circ}\text{C}$
$\Delta t / \Delta V$	Input Transition Rise or Fall 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.

# NL17SG04

## DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Conditions	V <sub>CC</sub> (V)	T <sub>A</sub> = 25°C		T <sub>A</sub> = -55°C to +125°C		Unit
				Min	Max	Min	Max	
V <sub>IH</sub>	High-Level Input Voltage		0.9	V <sub>CC</sub>		V <sub>CC</sub>		V
			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 Voltage		0.9		GND		GND	V
			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> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OH</sub> = -20 μA	0.9	0.75		0.75	V
			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	V <sub>CC</sub> -0.45		V <sub>CC</sub> -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 Output Voltage	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> = 20 μA	0.9		0.1	0.1	V
			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	μA
I <sub>CC</sub>	Quiescent Supply Current	V <sub>IN</sub> = V <sub>CC</sub> or GND	3.6		0.5		10.0	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.

# NL17SG04

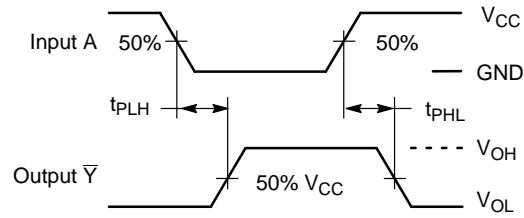
## AC ELECTRICAL CHARACTERISTICS Input $t_r = t_f = 3.0$ ns

Symbol	Parameter	Test Condition	$V_{CC}$ (V)	$T_A = 25^\circ\text{C}$			$T_A = -55^\circ\text{C to } +125^\circ\text{C}$		Unit
				Min	Typ	Max	Min	Max	
$t_{PLH}$ , $t_{PHL}$	Propagation Delay, A to Y	$C_L = 10$ pF, $R_L = 1$ M $\Omega$	0.9	-	10.0	13.3	-	17.0	ns
			1.1 to 1.3	-	8.7	11.2	-	14.0	
			1.4 to 1.6	-	4.9	8.5	-	10.0	
			1.65 to 1.95	-	3.8	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	
		$C_L = 15$ pF, $R_L = 1$ M $\Omega$	0.9	-	11.55	13.7	-	19.7	ns
			1.1 to 1.3	-	7.2	10.8	-	15.6	
			1.4 to 1.6	-	5.4	9.3	-	11.2	
			1.65 to 1.95	-	4.2	6.9	-	7.1	
			2.3 to 2.7	-	2.8	4.4	-	5.0	
			3.0 to 3.6	-	2.3	3.4	-	3.9	
		$C_L = 30$ pF, $R_L = 1$ M $\Omega$	0.9	-	16.85	18.9	-	22.3	ns
			1.1 to 1.3	-	10.2	13.4	-	17.5	
			1.4 to 1.6	-	7.4	13.1	-	15.9	
			1.65 to 1.95	-	5.6	9.2	-	9.6	
			2.3 to 2.7	-	3.7	5.7	-	6.1	
			3.0 to 3.6	-	2.9	4.4	-	4.8	
$C_{IN}$	Input Capacitance		0 to 3.6		3	-	-	pF	
$C_{PD}$	Power Dissipation Capacitance (Note 5)	$f = 10$ MHz	0.9 to 3.6	-	4	-	-	pF	

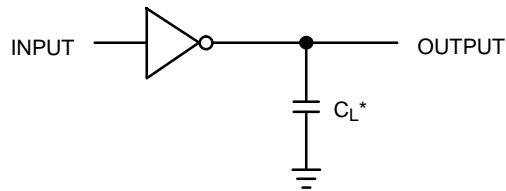
Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

5.  $C_{PD}$  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:  $I_{CC(OPR)} = C_{PD} \cdot V_{CC} \cdot f_{in} + I_{CC}$ .  $C_{PD}$  is used to determine the no-load dynamic power consumption;  $P_D = C_{PD} \cdot V_{CC}^2 \cdot f_{in} + I_{CC} \cdot V_{CC}$ .

# NL17SG04



**Figure 5. Switching Waveforms**



\*Includes all probe and jig capacitance.  
A 1-MHz square input wave is recommended for propagation delay tests.

**Figure 6. Test Circuit**

## ORDERING INFORMATION

Device	Package	Shipping†
NL17SG04P5T5G	SOT-953 (Pb-Free)	8000 / Tape & Reel
NL17SG04DFT2G	SC-88A (Pb-Free)	3000 / Tape & Reel
NL17SG04AMUTCG	UDFN6 1.45x1 mm (Pb-Free)	3000 / Tape & Reel
NL17SG04CMUTCG	UDFN6 1x1 mm (Pb-Free)	3000 / Tape & Reel

†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.

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

ON Semiconductor®



SCALE 2:1

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

DATE 17 JAN 2013



### SOLDER FOOTPRINT

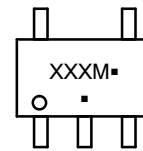


NOTES:

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.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.071	0.087	1.80	2.20
B	0.045	0.053	1.15	1.35
C	0.031	0.043	0.80	1.10
D	0.004	0.012	0.10	0.30
G	0.026 BSC		0.65 BSC	
H	---	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

### GENERIC MARKING DIAGRAM\*



- XXX = Specific Device Code
- M = 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.

- |  |  |  |  |  |
|--|--|--|--|--|
| <p>STYLE 1:<br/>PIN 1. BASE<br/>2. EMITTER<br/>3. BASE<br/>4. COLLECTOR<br/>5. COLLECTOR</p>                   | <p>STYLE 2:<br/>PIN 1. ANODE<br/>2. EMITTER<br/>3. BASE<br/>4. COLLECTOR<br/>5. CATHODE</p>  | <p>STYLE 3:<br/>PIN 1. ANODE 1<br/>2. N/C<br/>3. ANODE 2<br/>4. CATHODE 2<br/>5. CATHODE 1</p> | <p>STYLE 4:<br/>PIN 1. SOURCE 1<br/>2. DRAIN 1/2<br/>3. SOURCE 1<br/>4. GATE 1<br/>5. GATE 2</p> | <p>STYLE 5:<br/>PIN 1. CATHODE<br/>2. COMMON ANODE<br/>3. CATHODE 2<br/>4. CATHODE 3<br/>5. CATHODE 4</p>  |
| <p>STYLE 6:<br/>PIN 1. EMITTER 2<br/>2. BASE 2<br/>3. EMITTER 1<br/>4. COLLECTOR<br/>5. COLLECTOR 2/BASE 1</p> | <p>STYLE 7:<br/>PIN 1. BASE<br/>2. EMITTER<br/>3. BASE<br/>4. COLLECTOR<br/>5. COLLECTOR</p> | <p>STYLE 8:<br/>PIN 1. CATHODE<br/>2. COLLECTOR<br/>3. N/C<br/>4. BASE<br/>5. EMITTER</p>      | <p>STYLE 9:<br/>PIN 1. ANODE<br/>2. CATHODE<br/>3. ANODE<br/>4. ANODE<br/>5. ANODE</p>           | <p>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.</p> |

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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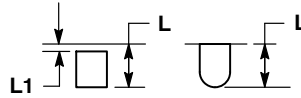
# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



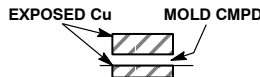
SCALE 4:1

UDFN6, 1.45x1.0, 0.5P  
CASE 517AQ  
ISSUE O

DATE 15 MAY 2008



**DETAIL A**  
OPTIONAL  
CONSTRUCTIONS



**DETAIL B**  
OPTIONAL  
CONSTRUCTIONS

**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 0.30 mm FROM THE TERMINAL TIP.

MILLIMETERS		
DIM	MIN	MAX
A	0.45	0.55
A1	0.00	0.05
A2	0.07 REF	
b	0.20	0.30
D	1.45 BSC	
E	1.00 BSC	
e	0.50 BSC	
L	0.30	0.40
L1	---	0.15

**MOUNTING FOOTPRINT**



DIMENSIONS: MILLIMETERS

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

**GENERIC  
MARKING DIAGRAM\***



X = Specific Device Code  
M = Date 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.

<b>DOCUMENT NUMBER:</b>	<b>98AON30313E</b>	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
<b>DESCRIPTION:</b>	<b>UDFN6, 1.45x1.0, 0.5P</b>	<b>PAGE 1 OF 1</b>

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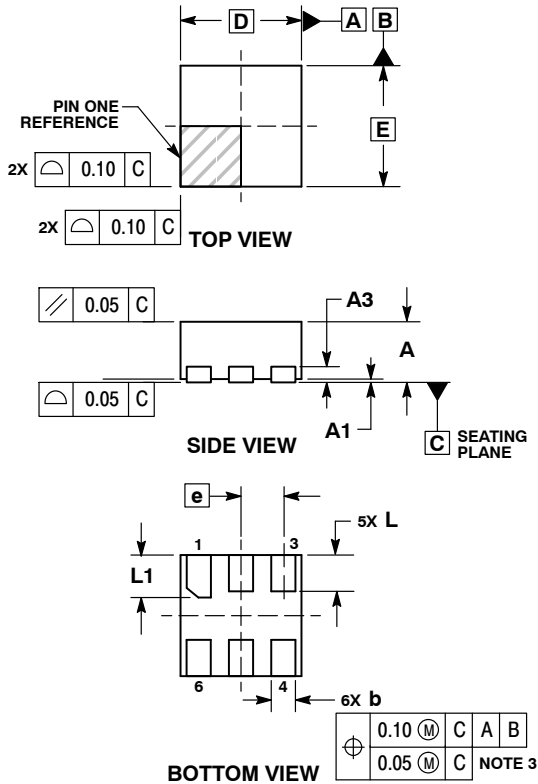
# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



UDFN6, 1x1, 0.35P  
CASE 517BX  
ISSUE O

SCALE 4:1

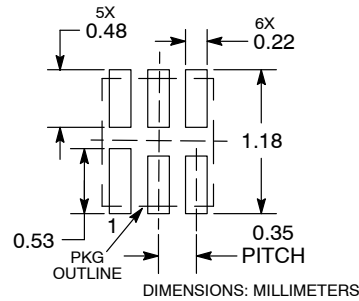
DATE 18 MAY 2011



- 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.

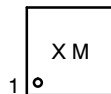
MILLIMETERS		
DIM	MIN	MAX
A	0.45	0.55
A1	0.00	0.05
A3	0.13	REF
b	0.12	0.22
D	1.00	BSC
E	1.00	BSC
e	0.35	BSC
L	0.25	0.35
L1	0.30	0.40

### 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.

### GENERIC MARKING DIAGRAM\*



X = Specific Device Code  
M = Date 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. Some products may not follow the Generic Marking.

<b>DOCUMENT NUMBER:</b>	<b>98AON56787E</b>	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
<b>DESCRIPTION:</b>	<b>UDFN6, 1x1, 0.35P</b>	<b>PAGE 1 OF 1</b>

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# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

ON Semiconductor®



SCALE 4:1

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

DATE 02 AUG 2011



TOP VIEW

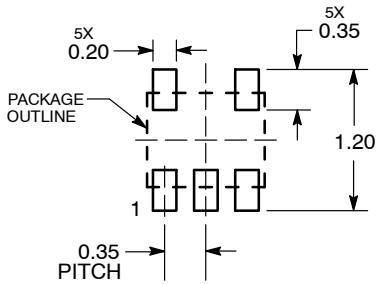


SIDE VIEW



BOTTOM VIEW

### SOLDERING FOOTPRINT\*



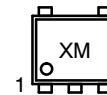
DIMENSIONS: MILLIMETERS

### 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.

DIM	MILLIMETERS		
	MIN	NOM	MAX
A	0.34	0.37	0.40
b	0.10	0.15	0.20
C	0.07	0.12	0.17
D	0.95	1.00	1.05
E	0.75	0.80	0.85
e	0.35 BSC		
H <sub>E</sub>	0.95	1.00	1.05
L	0.175 REF		
L2	0.05	0.10	0.15
L3	---	---	0.15

### GENERIC MARKING DIAGRAM\*



X = Specific Device Code  
M = 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.

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

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