

Single Schmitt-Trigger Inverter

NLV74VHC1G14, NLV74VHC1GT14

The NLV74VHC1G14 / NLV74VHC1GT14 is a single Schmitt-Trigger Inverter in tiny footprint packages. The NLV74VHC1G14 has CMOS-level input thresholds while the NLV74VHC1GT14 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
- 4.0 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, TSOP-5 and SOT-953 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

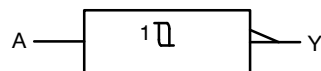
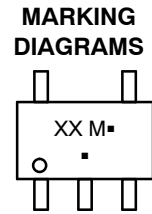


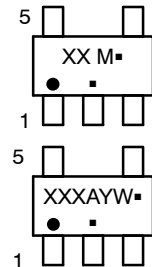
Figure 1. Logic Symbol



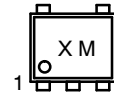
SC-88A
DF SUFFIX
CASE 419A



TSOP-5
DT SUFFIX
CASE 483



SOT-953
P5 SUFFIX
CASE 527AE



XX = Specific 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.

ORDERING INFORMATION

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

NLV74VHC1G14, NLV74VHC1GT14

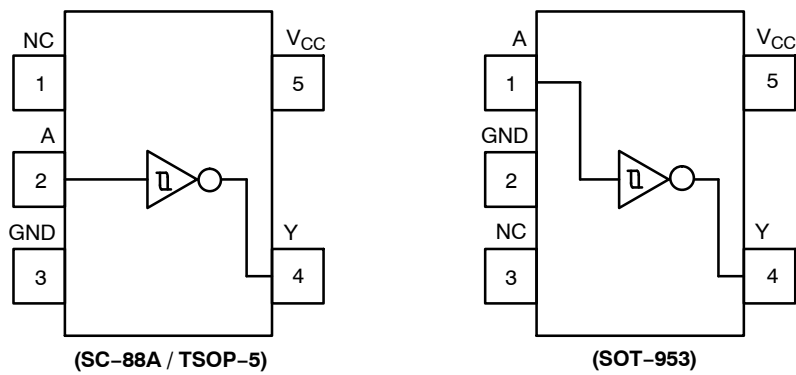


Figure 2. Pinout (Top View)

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

Pin	Function
1	NC
2	A
3	GND
4	Y
5	V _{CC}

PIN ASSIGNMENT (SOT-953)

Pin	Function
1	A
2	GND
3	NC
4	Y
5	V _{CC}

FUNCTION TABLE

A Input	Y Output
L	H
H	L

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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 $V_{OUT} > V_{CC}, V_{OUT} < GND$	± 20	mA
		1GTxx $V_{OUT} < GND$	-20	
I_{OUT}	DC Output Source/Sink Current		± 25	mA
I_{CC} or I_{GND}	DC Supply Current per Supply Pin or Ground Pin		± 50	mA
T_{STG}	Storage Temperature Range		-65 to +150	°C
T_L	Lead Temperature, 1 mm from Case for 10 secs		260	°C
T_J	Junction Temperature Under Bias		+150	°C
θ_{JA}	Thermal Resistance (Note 2)		SC-88A	°C/W
			TSOP-5	
			SOT-953	
P_D	Power Dissipation in Still Air		SC-88A	mW
			TSOP-5	
			SOT-953	
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	V
			Charged Device Model	
$I_{Latchup}$	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_{CC}	Positive DC Supply Voltage		2.0	5.5	V
V_{IN}	DC Input Voltage		0	5.5	V
V_{OUT}	DC Output Voltage	1Gxx	0	V_{CC}	V
		1GTxx Active-Mode (High or Low State) Tri-State Mode (Note 5) Power-Down Mode ($V_{CC} = 0$ V)	0 0 0	V_{CC} 5.5 5.5	
T_A	Operating Temperature Range		-55	+125	°C
t_r, t_f	Input Rise and Fall Time $V_{CC} = 3.0$ V to 3.6 V $V_{CC} = 4.5$ V to 5.5 V		0	No Limit	ns/V
			0	No Limit	

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.

5. Applicable to devices with outputs that may be tri-stated.

NLV74VHC1G14, NLV74VHC1GT14

DC ELECTRICAL CHARACTERISTICS (NLV74VHC1G14)

Symbol	Parameter	Test Conditions	V _{CC} (V)	T _A = 25°C			-40°C ≤ T _A ≤ 85°C		-55°C ≤ T _A ≤ 125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
V _{T+}	Positive Input Threshold Voltage		3.0 4.5 5.5	1.2 1.75 2.15	2.0 3.0 3.6	2.2 3.15 3.85	– – –	2.2 3.15 3.85	– – –	2.2 3.15 3.85	V
V _{T–}	Negative Input Threshold Voltage		3.0 4.5 5.5	0.9 1.35 1.65	1.5 2.3 2.9	1.9 2.75 3.35	0.9 1.35 1.65	– – –	0.9 1.35 1.65	– – –	V
V _H	Hysteresis Voltage		3.0 4.5 5.5	0.30 0.40 0.50	0.57 0.67 0.74	1.20 1.40 1.60	0.30 0.40 0.50	1.20 1.40 1.60	0.30 0.40 0.50	1.20 1.40 1.60	V
V _{OH}	High-Level Output Voltage	V _{IN} = V _{IH} or V _{IL} I _{OH} = –50 μA I _{OH} = –50 μA I _{OH} = –50 μA I _{OH} = –4 mA I _{OH} = –8 mA	2.0 3.0 4.5 3.0 4.5	1.9 2.9 4.4 2.58 3.94	2.0 3.0 4.5 – –	– – – – –	1.9 2.9 4.4 2.48 3.80	– – – – –	1.9 2.9 4.4 2.34 3.66	– – – – –	V
V _{OL}	Low-Level Output Voltage	V _{IN} = V _{IH} or V _{IL} I _{OL} = 50 μA I _{OL} = 50 μA I _{OL} = 50 μA I _{OL} = 4 mA I _{OL} = 8 mA	2.0 3.0 4.5 3.0 4.5	– – – – –	0.0 0.0 0.0 – –	0.1 0.1 0.1 0.36 0.36	– – – – –	0.1 0.1 0.1 0.44 0.44	– – – – –	0.1 0.1 0.1 0.52 0.52	V
I _{IN}	Input Leakage Current	V _{IN} = 5.5 V or GND	2.0 to 5.5	–	–	±0.1	–	±1.0	–	±1.0	μA
I _{OFF}	Power Off Leakage Current	V _{IN} = 5.5 V	0.0	–	–	1.0	–	10	–	10	μA
I _{CC}	Quiescent Supply Current	V _{IN} = V _{CC} or GND	5.5	–	–	1.0	–	20	–	40	μA

NLV74VHC1G14, NLV74VHC1GT14

DC ELECTRICAL CHARACTERISTICS (NLV74VHC1GT14)

Symbol	Parameter	Test Conditions	V _{CC} (V)	T _A = 25°C			-40°C ≤ T _A ≤ 85°C		-55°C ≤ T _A ≤ 125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
V _{T+}	Positive Input Threshold Voltage		3.0 4.5 5.5	1.2 1.58 1.79	1.4 1.74 1.94	1.6 2.0 2.1	– – –	1.6 2.0 2.1	– – –	1.6 2.0 2.1	V
V _{T–}	Negative Input Threshold Voltage		3.0 4.5 5.5	0.35 0.5 0.6	0.76 1.01 1.13	0.93 1.18 1.29	0.35 0.5 0.6	– – –	0.35 0.5 0.6	– – –	V
V _H	Hysteresis Voltage		3.0 4.5 5.5	0.30 0.40 0.50	0.64 0.73 0.81	1.20 1.40 1.60	0.30 0.40 0.50	1.20 1.40 1.60	0.30 0.40 0.50	1.20 1.40 1.60	V
V _{OH}	High-Level Output Voltage	V _{IN} = V _{IH} or V _{IL} I _{OH} = –50 μA I _{OH} = –50 μA I _{OH} = –50 μA I _{OH} = –4 mA I _{OH} = –8 mA	2.0 3.0 4.5 3.0 4.5	1.9 2.9 4.4 2.58 3.94	2.0 3.0 4.5 – –	– – – – –	1.9 2.9 4.4 2.48 3.80	– – – – –	1.9 2.9 4.4 2.34 3.66	– – – – –	V
V _{OL}	Low-Level Output Voltage	V _{IN} = V _{IH} or V _{IL} I _{OL} = 50 μA I _{OL} = 50 μA I _{OL} = 50 μA I _{OL} = 4 mA I _{OL} = 8 mA	2.0 3.0 4.5 3.0 4.5	– – – – –	0.0 0.0 0.0 – –	0.1 0.1 0.1 0.36 0.36	– – – – –	0.1 0.1 0.1 0.44 0.44	– – – – –	0.1 0.1 0.1 0.52 0.52	V
I _{IN}	Input Leakage Current	V _{IN} = 5.5 V or GND	2.0 to 5.5	–	–	±0.1	–	±1.0	–	±1.0	μA
I _{OFF}	Power Off Leakage Current	V _{IN} = 5.5 V or V _{OUT} = 5.5 V	0	–	–	1.0	–	10	–	10	μA
I _{CC}	Quiescent Supply Current	V _{IN} = V _{CC} or GND	5.5	–	–	1.0	–	20	–	40	μA
I _{CCT}	Increase in Quiescent Supply Current per Input Pin	One Input: V _{IN} = 3.4 V; Other Input at V _{CC} or GND	5.5	–	–	1.35	–	1.5	–	1.65	mA

AC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Conditions	V _{CC} (V)	T _A = 25°C			-40°C ≤ T _A ≤ 85°C		-55°C ≤ T _A ≤ 125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
t _{PLH} , t _{PHL}	Propagation Delay, A to Y (Figures 3 and 4)	C _L = 15 pF	3.0 to 3.6	–	7.0	12.8	–	15.0	–	17.0	ns
		C _L = 50 pF		–	8.5	16.3	–	18.5	–	20.5	
		C _L = 15 pF	4.5 to 5.5	–	4.0	8.6	–	10.0	–	11.5	
		C _L = 50 pF		–	5.5	10.6	–	12.0	–	13.5	
C _{IN}	Input Capacitance			–	4.0	10	–	10	–	10	pF
C _{OUT}	Output Capacitance	Output in High Impedance State		–	6.0	–	–	–	–	–	pF

C _{PD}	Power Dissipation Capacitance (Note 6)	Typical @ 25°C, V _{CC} = 5.0 V	pF
		8.0	

6. 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} • V_{CC} • f_{in} + I_{CC}. C_{PD} is used to determine the no-load dynamic power consumption; P_D = C_{PD} • V_{CC}² • f_{in} + I_{CC} • V_{CC}.

NLV74VHC1G14, NLV74VHC1GT14

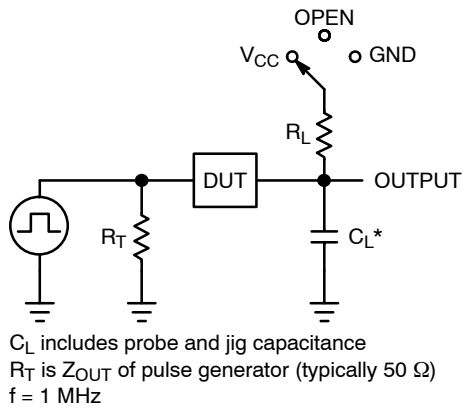


Figure 3. Test Circuit

Test	Switch Position	C_L , pF	R_L , Ω
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

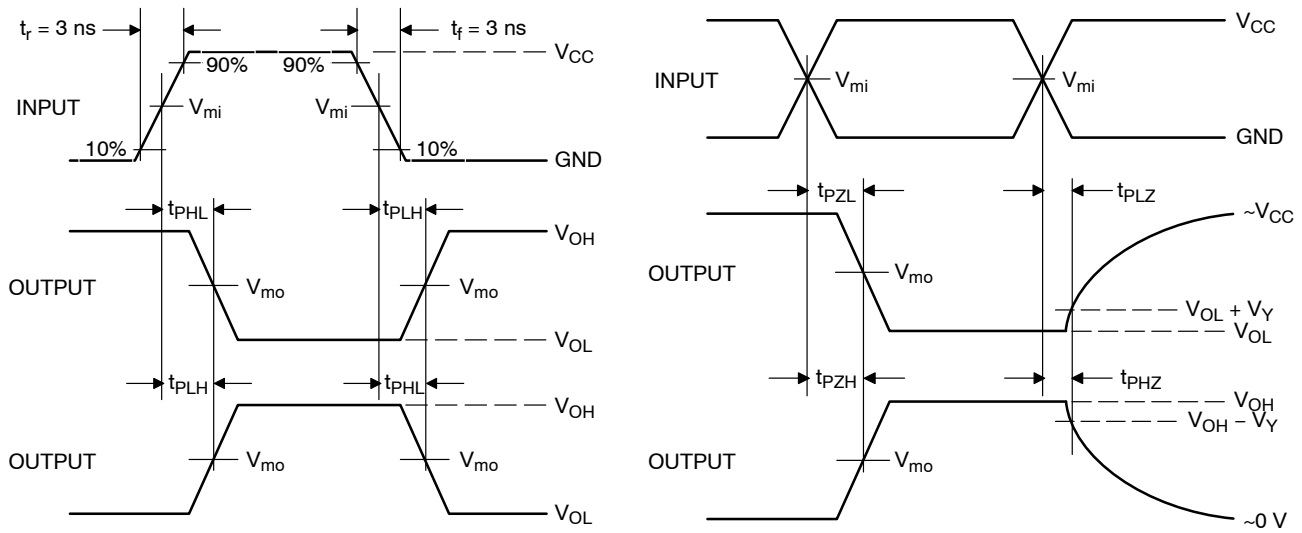


Figure 4. Switching Waveforms

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

NLV74VHC1G14, NLV74VHC1GT14

ORDERING INFORMATION

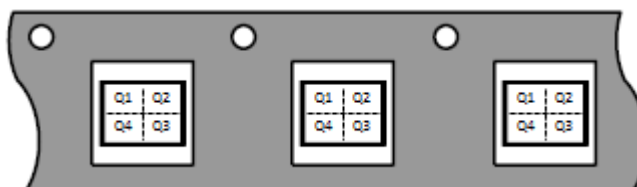
Device	Packages	Specific Device Code	Pin 1 Orientation (See below)	Shipping [†]
MC74VHC1G14DFT2G-F22038	SC-88A	VA	Q4	3000 / Tape & Reel
NLVVHC1G14DFT1G*	SC-88A	VA	Q2	3000 / Tape & Reel
NLVVHC1G14DFT2G*	SC-88A	VA	Q4	3000 / Tape & Reel
M74VHC1GT14DFT1G-L22038	SC-88A	VC	Q2	3000 / Tape & Reel
M74VHC1GT14DFT2G-L22038	SC-88A	VC	Q4	3000 / Tape & Reel
NLVVHC1GT14DFT1G*	SC-88A	VC	Q2	3000 / Tape & Reel
NLVVHC1GT14DFT2G*	SC-88A	VC	Q4	3000 / Tape & Reel
MC74VHC1G14DTT1G	TSOP-5	VA	Q4	3000 / Tape & Reel
NLVVHC1G14DTT1G*	TSOP-5	VA	Q4	3000 / Tape & Reel
M74VHC1GT14DTT1G	TSOP-5	VC	Q4	3000 / Tape & Reel
MC74VHC1G14P5T5G-L22088	SOT-953	R	Q2	8000 / 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.

*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



NLV74VHC1G14, NLV74VHC1GT14

PACKAGE DIMENSIONS

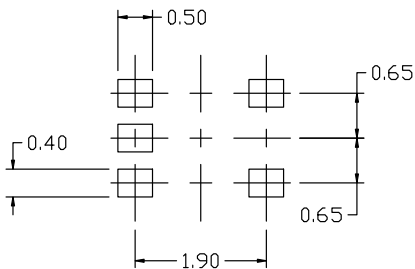
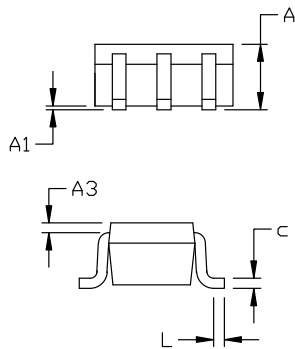
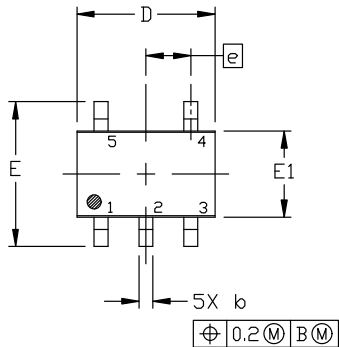
SC-88A (SC-70-5/SOT-353)

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.



RECOMMENDED MOUNTING FOOTPRINT

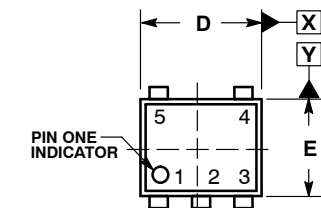
- * For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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

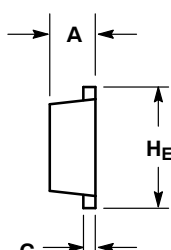
NLV74VHC1G14, NLV74VHC1GT14

PACKAGE DIMENSIONS

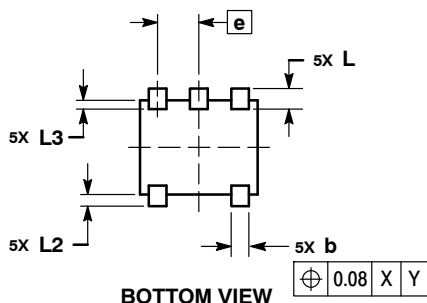
SOT-953
CASE 527AE
ISSUE E



TOP VIEW



SIDE VIEW



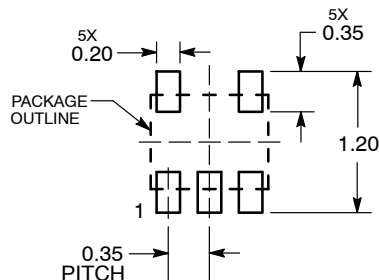
BOTTOM VIEW

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 _E	0.95	1.00	1.05
L	0.175 REF		
L2	0.05	0.10	0.15
L3	---	---	0.15

SOLDERING FOOTPRINT*



DIMENSIONS: MILLIMETERS

*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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Phone: 011 421 33 790 2910

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