

Inverter with Schmitt-Trigger

NL17SG14

The NL17SG14 is a single inverter with Schmitt-trigger input in tiny footprint packages. The device is designed to operate for $V_{CC} = 0.9\text{ V}$ to 3.6 V .

Features

- Designed for 0.9 V to 3.6 V V_{CC} Operation
- 2.4 ns (Typ) at $V_{CC} = 3.0\text{ V}$, $C_L = 15\text{ pF}$
- Inputs/Outputs Over-Voltage Tolerant up to 3.6 V
- I_{OFF} Supports Partial Power Down Protection
- Available in UDFN Package
- -Q Suffix 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 RoHS-Compliant

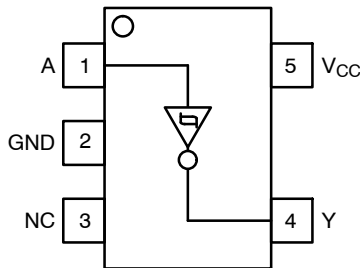


Figure 1. SOT-953
(Top Thru View)

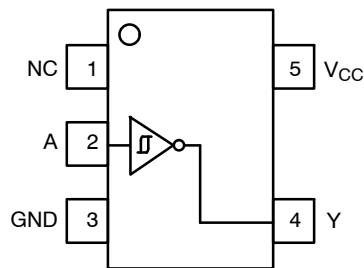


Figure 2. SC-88A
(Top View)

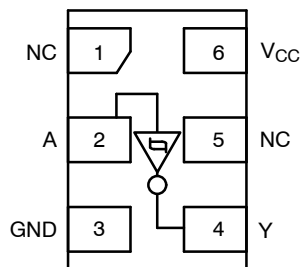


Figure 3. UDFN
(Top View)

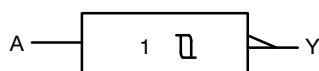
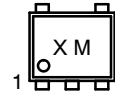


Figure 4. Logic Symbol

MARKING DIAGRAMS



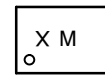
SOT-953
CASE 527AE



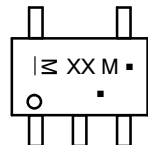
UDFN6
1.0 x 1.0
CASE 517BX



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	A	NC	NC
2	GND	A	A
3	NC	GND	GND
4	Y	Y	Y
5	V_{CC}	V_{CC}	NC
6			V_{CC}

FUNCTION TABLE

A Input	Y Output
L	H
H	L

ORDERING INFORMATION

See detailed ordering, marking and shipping information in the package dimensions section on page 6 of this data sheet.

NOTE: Some of the devices on this data sheet have been **DISCONTINUED**. Please refer to the table on page 6.

NL17SG14

Table 1. MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CC}	DC Supply Voltage	–0.5 to +4.3	V
V_{IN}	DC Input Voltage	–0.5 to +4.3	V
V_{OUT}	DC Output Voltage 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 +4.3 –0.5 to +4.3	V
I_{IK}	DC Input Diode Current $V_{IN} < GND$	–20	mA
I_{OK}	DC Output Diode Current $V_{OUT} < GND$	–20	mA
I_{OUT}	DC Output Source/Sink Current	±20	mA
I_{CC} or I_{GND}	DC Supply Current Per Supply Pin or Ground Pin	±20	mA
T_{STG}	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
θ_{JA}	Thermal Resistance (Note 2)	154	°C/W
P_D	Power Dissipation in Still Air	812	mW
θ_{JA}	Thermal Resistance (Note 2) SC–88A SOT–953 UDFN6	377 254 154	°C/W
P_D	Power Dissipation in Still Air SC–88A SOT–953 UDFN6	332 491 812	mW
MSL	Moisture Sensitivity	Level 1	
FR	Flammability Rating Oxygen Index: 28 to 34	UL 94 V–0 @ 0.125 in	
V_{ESD}	ESD Withstand Voltage (Note 3) Human Body Model Charged Device Model	2000 1000	V
$I_{LATCHUP}$	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 10 mm – by – 1 inch, 2 ounce copper trace no air flow per JESD51–7.
3. HBM tested to EIA / JESD22–A114–A. CDM tested to JESD22–C101–A. JEDEC recommends that ESD qualification to EIA/JESD22–A115A (Machine Model) be discontinued.
4. Tested to EIA/JESD78 Class II.

Table 2. RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
V_{CC}	Positive DC Supply Voltage	0.9	3.6	V
V_{IN}	Digital Input Voltage	0	3.6	V
V_{OUT}	Output Voltage Active Mode (High or Low State) Tri-State Mode (Note 1) Power Down Mode ($V_{CC} = 0$ V)	0 0 0	V_{CC} 3.6 3.6	V
T_A	Operating Free-Air Temperature	–55	+125	°C
t_r, t_f	Input Transition Rise or Fall Rate	0	No Limit	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.

Table 3. DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Conditions	V _{CC} (V)	T _A = 25°C			T _A = -55°C to +125°C		Unit
				Min	Typ	Max	Min	Max	
V _{T+}	Positive Going Input Threshold Voltage		0.9	–	0.7	–	–	–	V
			1.1	–	0.81	0.95	–	0.95	
			1.4	–	0.94	1.16	–	1.16	
			1.65	–	1.06	1.3	–	1.3	
			2.3	–	1.36	1.73	–	1.73	
			3.0	–	1.8	2.24	–	2.24	
V _{T-}	Negative Going Input Threshold Voltage		0.9	–	0.23	–	–	–	V
			1.1	0.15	0.33	–	0.15	–	
			1.4	0.3	0.47	–	0.3	–	
			1.65	0.35	0.6	–	0.35	–	
			2.3	0.55	0.85	–	0.55	–	
			3.0	0.95	1.13	–	0.95	–	
V _H	Hysteresis Voltage		0.9	–	0.27	–	–	–	V
			1.1	0.2	0.35	0.8	0.2	0.8	
			1.4	0.25	0.41	0.86	0.25	0.86	
			1.65	0.30	0.46	0.9	0.30	0.9	
			2.3	0.40	0.56	1.05	0.40	1.05	
			3.0	0.49	0.59	1.1	0.49	1.1	
V _{OH}	High-Level Output Voltage	V _{IN} = V _{IH} or V _{IL}							V
		I _{OH} = -20 μA	0.9	–	0.75	–	–	–	
		I _{OH} = -0.3 mA	1.1 to 1.3	0.75 x V _{CC}	–	–	0.75 x V _{CC}	–	
		I _{OH} = -1.7 mA	1.4 to 1.6	0.75 x V _{CC}	–	–	0.75 x V _{CC}	–	
		I _{OH} = -3.0 mA	1.65 to 1.95	V _{CC} - 0.45	–	–	V _{CC} - 0.45	–	
		I _{OH} = -4.0 mA	2.3 to 2.7	2.0	–	–	2.0	–	
		I _{OH} = -8.0 mA	3.0 to 3.6	2.48	–	–	2.48	–	
V _{OL}	Low-Level Output Voltage	V _{IN} = V _{IH} or V _{IL}							V
		I _{OL} = 20 μA	0.9	–	0.1	–	–	–	
		I _{OL} = 0.3 mA	1.1 to 1.3	–	–	0.25 x V _{CC}	–	0.25 x V _{CC}	
		I _{OL} = 1.7 mA	1.4 to 1.6	–	–	0.25 x V _{CC}	–	0.25 x V _{CC}	
		I _{OL} = 3.0 mA	1.65 to 1.95	–	–	0.45	–	0.45	
		I _{OL} = 4.0 mA	2.3 to 2.7	–	–	0.4	–	0.4	
		I _{OL} = 8.0 mA	2.7 to 3.6	–	–	0.4	–	0.4	
I _{IN}	Input Leakage Current	V _{IN} = 0 V to 3.6 V	0.9 to 3.6	–	–	±0.1	–	±1.0	μA
I _{OFF}	Power Off Leakage Current	V _{IN} = 0 V to 3.6 V; V _{OUT} = 0 V to 3.6 V	0	–	–	1.0	–	10.0	μA
I _{CC}	Quiescent Supply Current	V _{IN} = V _{CC} or GND	0.9 to 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.

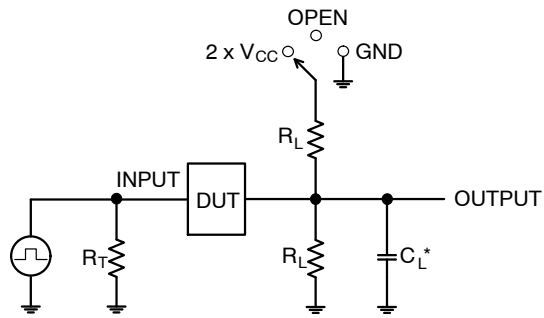
Table 4. AC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test Condition	V _{CC} (V)	T _A = 25°C			T _A = -55°C to +125°C		Unit
				Min	Typ	Max	Min	Max	
t _{PLH} , t _{PHL}	Propagation Delay, A to Y (Figures 5 and 6)	C _L = 10 pF, R _L = 1 MΩ	0.9	–	38.0	–	–	–	ns
			1.1 to 1.3	–	9.7	24.1	–	35.9	
			1.4 to 1.6	–	5.4	10.5	–	11.3	
			1.65 to 1.95	–	3.9	7.8	–	8.2	
			2.3 to 2.7	–	2.8	5.4	–	5.8	
			3.0 to 3.6	–	2.3	4.4	–	4.6	
		C _L = 15 pF, R _L = 1 MΩ	0.9	–	38.4	–	–	–	
			1.1 to 1.3	–	9.9	25.1	–	41.6	
			1.4 to 1.6	–	5.6	11.5	–	12.6	
			1.65 to 1.95	–	4.1	8.4	–	8.7	
			2.3 to 2.7	–	2.9	5.7	–	6.1	
			3.0 to 3.6	–	2.4	4.6	–	5.0	
		C _L = 30 pF, R _L = 1 MΩ	0.9	–	39.6	–	–	–	
			1.1 to 1.3	–	10.5	35.7	–	58.1	
			1.4 to 1.6	–	6.0	15.8	–	17.6	
			1.65 to 1.95	–	4.7	10.7	–	11.7	
			2.3 to 2.7	–	3.2	6.9	–	8.1	
			3.0 to 3.6	–	2.6	5.2	–	6.1	

Table 5. CAPACITIVE CHARACTERISTICS

Symbol	Parameter	Test Condition	Typical (T _A = 25°C)	Unit
C _{IN}	Input Capacitance	V _{CC} = 0 V	3.0	pF
C _{OUT}	Output Capacitance	V _{CC} = 0 V	3.0	pF
C _{PD}	Power Dissipation Capacitance (Note 5)	f = 10 MHz, V _{CC} = 0.9 V to 3.6 V, V _{IN} = 0 V or V _{CC}	4.0	pF

5. C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the dynamic 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}.



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

Figure 5. Test Circuit

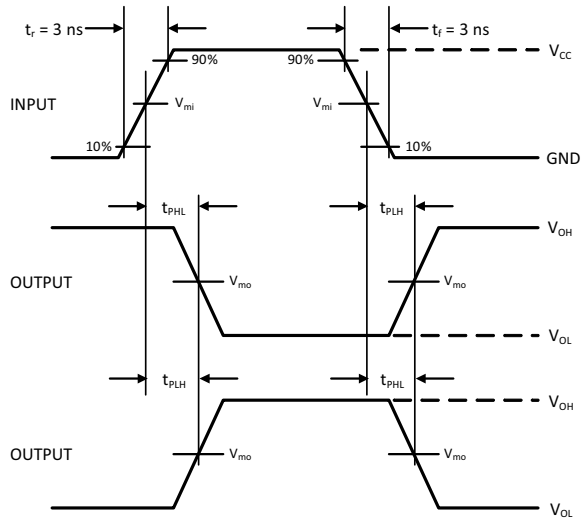


Figure 6. Switching Waveforms

Test	Switch Position
t_{PLH} / t_{PHL}	Open
t_{PLZ} / t_{PZL}	$2 \times V_{CC}$
t_{PHZ} / t_{PZH}	GND

V_{CC}, V	V_{mi}, V	V_{mo}, V	V_Y, V
0.9	$V_{CC}/2$	$V_{CC}/2$	0.1
1.1 to 1.3	$V_{CC}/2$	$V_{CC}/2$	0.1
1.4 to 1.6	$V_{CC}/2$	$V_{CC}/2$	0.1
1.65 to 1.95	$V_{CC}/2$	$V_{CC}/2$	0.15
2.3 to 2.7	$V_{CC}/2$	$V_{CC}/2$	0.15
3.0 to 3.6	1.5	1.5	0.3

NL17SG14

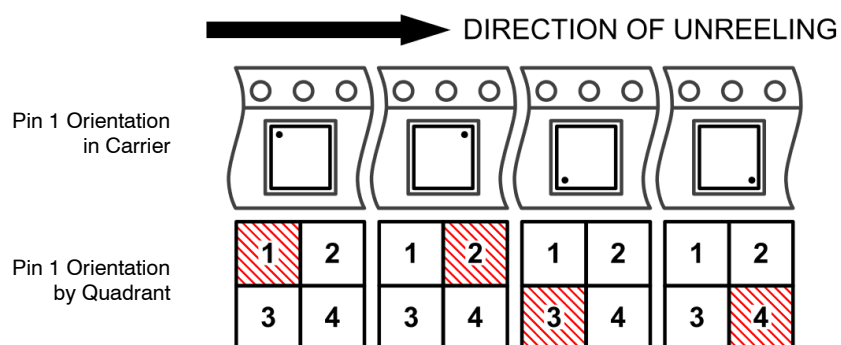
ORDERING INFORMATION

Device	Package	Marking	Pin 1 Quadrant (See below)	Shipping [†]
NL17SG14DFT2G	SC-88A	AR	3	3000 / Tape & Reel
NL17SG14DFT2G-Q*	SC-88A	AR	3	3000 / Tape & Reel
NL17SG14MU1TCG	UDFN6, 1.45 x 1.0	4 (Rotated 180°CW)	3	3000 / Tape & Reel
NL17SG14MU3TCG	UDFN6, 1.0 x 1.0	R	2	3000 / Tape & Reel
NL17SG14P5T5G	SOT-953	2	2	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.

*-Q Suffix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC – Q100 Qualified and PPAP Capable.

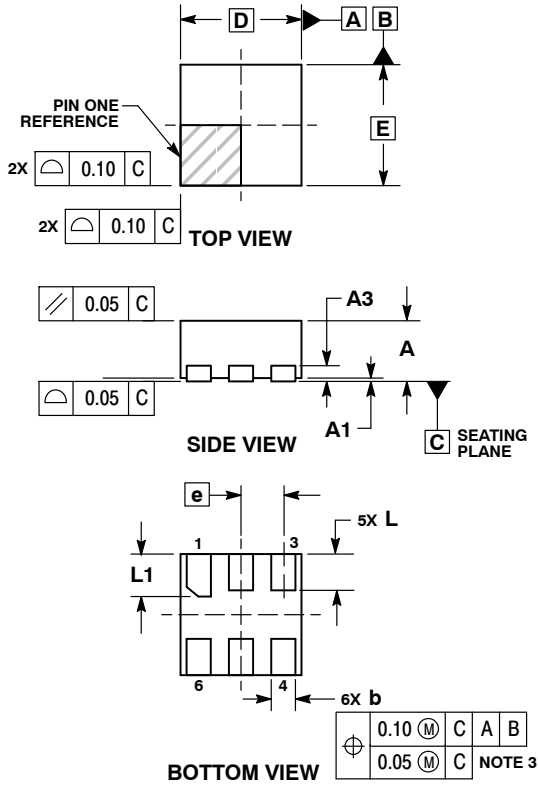
Pin 1 Orientation in Tape and Reel



NL17SG14

PACKAGE DIMENSIONS

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

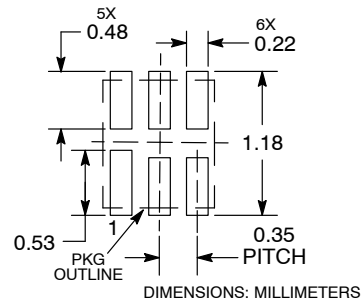


NOTES:

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.

DIM	MILLIMETERS	
	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 **onsemi** Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



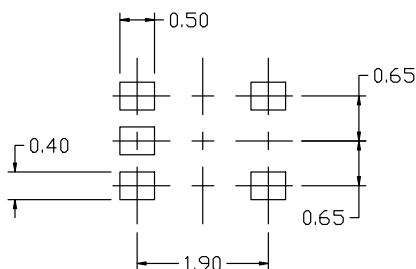
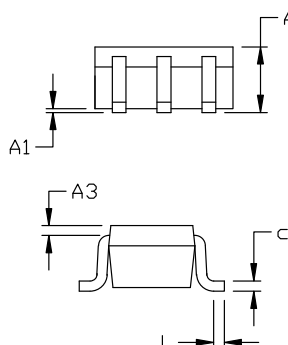
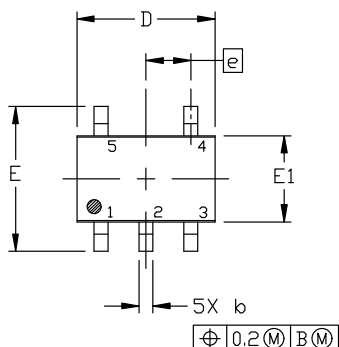
SCALE 2:1

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

CASE 419A-02

ISSUE M

DATE 11 APR 2023

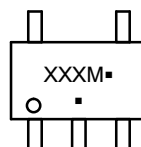

**RECOMMENDED
MOUNTING FOOTPRINT**

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

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

**GENERIC MARKING
DIAGRAM***


*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.

XXX = Specific Device Code

M = Date Code

▪ = Pb-Free Package

(Note: Microdot may be in either location)

STYLE 1:

- PIN 1. BASE
2. EMITTER
3. BASE
4. COLLECTOR
5. COLLECTOR

STYLE 2:

- PIN 1. ANODE
2. EMITTER
3. BASE
4. COLLECTOR
5. CATHODE

STYLE 3:

- PIN 1. ANODE 1
2. N/C
3. ANODE 2
4. CATHODE 2
5. CATHODE 1

STYLE 4:

- PIN 1. SOURCE 1
2. DRAIN 1/2
3. SOURCE 1
4. GATE 1
5. GATE 2

STYLE 5:

- PIN 1. CATHODE
2. COMMON ANODE
3. CATHODE 2
4. CATHODE 3
5. CATHODE 4

STYLE 6:

- PIN 1. EMITTER 2
2. BASE 2
3. EMITTER 1
4. COLLECTOR
5. COLLECTOR 2/BASE 1

STYLE 7:

- PIN 1. BASE
2. EMITTER
3. BASE
4. COLLECTOR
5. COLLECTOR

STYLE 8:

- PIN 1. CATHODE
2. COLLECTOR
3. N/C
4. BASE
5. EMITTER

STYLE 9:

- PIN 1. ANODE
2. CATHODE
3. ANODE
4. ANODE
5. ANODE

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.

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DESCRIPTION:	SC-88A (SC-70-5/SOT-353)	PAGE 1 OF 1

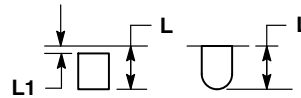
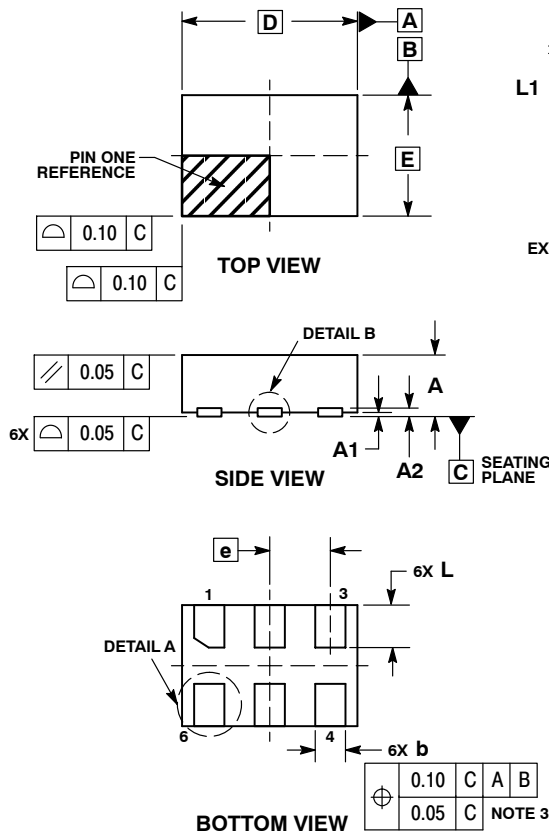
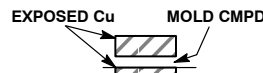
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SCALE 4:1

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

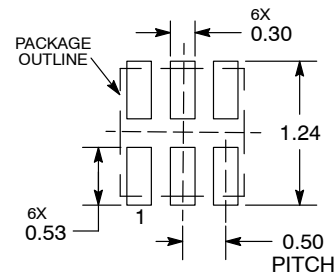
DATE 15 MAY 2008


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 **onsemi** Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

GENERIC
MARKING DIAGRAM*

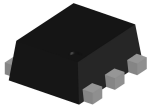
X = Specific Device
Code

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.

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

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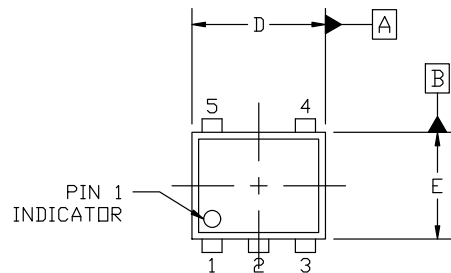


SOT-953 1.00x0.80x0.37, 0.35P
CASE 527AE
ISSUE F

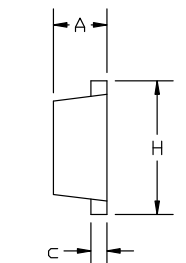
DATE 17 JAN 2024

NOTES:

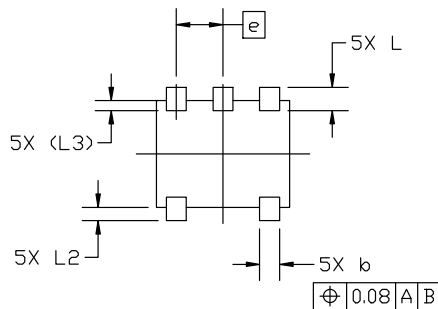
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.



TOP VIEW

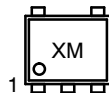


SIDE VIEW



BOTTOM VIEW

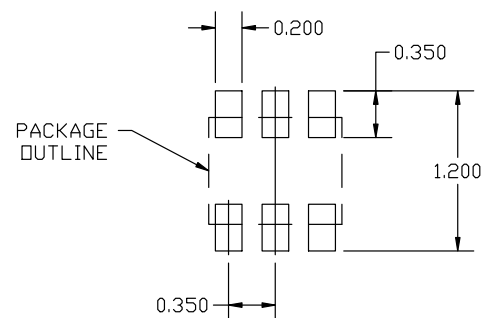
GENERIC MARKING DIAGRAM*



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. Some products may not follow the Generic Marking.

MILLIMETERS			
DIM	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	0.95	1.00	1.05
L	0.125	0.175	0.225
L2	0.05	0.10	0.15
L3	0.075 (REF)		



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.

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DESCRIPTION:	SOT-953 1.00x0.80x0.37, 0.35P	PAGE 1 OF 1

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