

NL17SZ04

Single Inverter

The NL17SZ04 is an inverter in three tiny footprint packages. The device performs much as LCX multi-gate products in speed and drive.

Features

- Tiny SOT-353, SOT-553 and SOT-953 Packages
- 24 mA Sink and Source Output Capability
- Over-Voltage Tolerant Inputs and Outputs
- Pin For Pin with NC7SZ04P5X, TC7SZ04FU and TC7SZ04AFE
- Chip Complexity: FETs = 20
- Designed for 1.65 V to 5.5 V V_{CC} Operation
- 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 and are RoHS Compliant

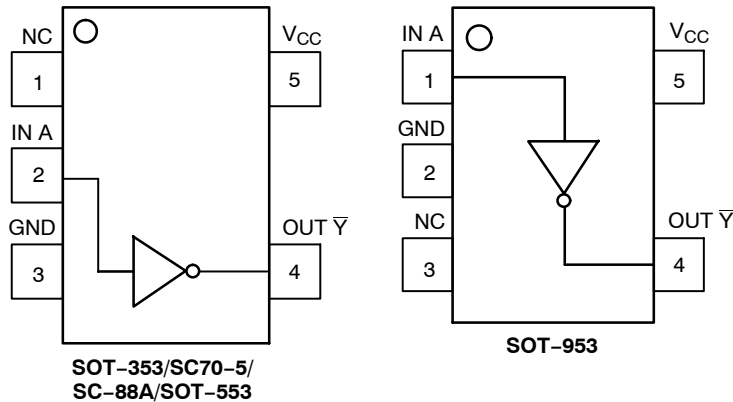


Figure 1. Pinout (Top View)

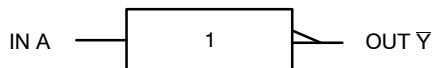
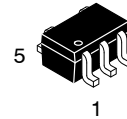


Figure 2. Logic Symbol



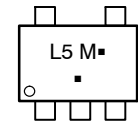
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**SOT-353/SC70-5/SC-88A
DF SUFFIX
CASE 419A**

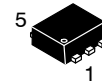
MARKING DIAGRAMS



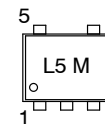
L5 = Specific Device Marking
M = Date Code*
▪ = Pb-Free Package

(Note: Microdot may be in either location)

*Date Code orientation and/or position may vary depending upon manufacturing location.



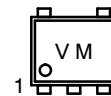
**SOT-553
XV5 SUFFIX
CASE 463B**



L5 = Specific Device Marking
M = Date Code



**SOT-953
CASE 527AE**



V = Specific Device Code
M = Month Code

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 4 of this data sheet.

NL17SZ04

PIN ASSIGNMENT (SOT-353/SC70-5/SC-88A/SOT-553)

Pin	Function
1	NC
2	IN A
3	GND
4	OUT \bar{Y}
5	V_{CC}

PIN ASSIGNMENT (SOT-953)

Pin	Function
1	IN A
2	GND
3	NC
4	OUT \bar{Y}
5	V_{CC}

FUNCTION TABLE

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

MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CC}	DC Supply Voltage	-0.5 to +7.0	V
V_I	DC Input Voltage	$-0.5 \leq V_I \leq +7.0$	V
V_O	DC Output Voltage Output in Higher or Low State (Note 1) (SOT-353/SC70-5/SC-88A/SOT-553 Packages)	-0.5 to $V_{CC} + 0.5$	V
V_O	DC Output Voltage Output in Higher or Low State (Note 1) Power-Down Mode ($V_{CC} = 0$ V) (SOT-953 Package)	-0.5 to $V_{CC} + 0.5$ -0.5 to +0.5	V
I_{IK}	DC Input Diode Current $V_I < GND$	-50	mA
I_{OK}	DC Output Diode Current (SOT-353/SC70-5/SC-88A/SOT-553 Packages) $V_O < GND, V_O > V_{CC}$	± 50	mA
I_{OK}	DC Output Diode Current (SOT-953 Package) $V_O < GND$	-50	mA
I_O	DC Output Sink Current	± 50	mA
I_{CC}	DC Supply Current per Supply Pin	± 100	mA
I_{GND}	DC Ground Current per Supply Pin	± 100	mA
T_{STG}	Storage Temperature Range	-65 to +150	$^{\circ}C$
T_L	Lead Temperature, 1 mm from Case for 10 Seconds	260	$^{\circ}C$
T_J	Junction Temperature Under Bias	+150	$^{\circ}C$
θ_{JA}	Thermal Resistance SOT-353 (Note 2) SOT-553	350 496	$^{\circ}C/W$
P_D	Power Dissipation in Still Air at 85 $^{\circ}C$ SOT-353 SOT-553	186 135	mW
MSL	Moisture Sensitivity	Level 1	
F_R	Flammability Rating Oxygen Index: 28 to 34	UL 94 V-0 @ 0.125 in	
ESD	ESD Classification Human Body Model (Note 3) Machine Model (Note 4) Charged Device Model (Note 5)	Class 2 Class C N/A	
$I_{LATCHUP}$	Latchup Performance Above V_{CC} and Below GND at 125 $^{\circ}C$ (Note 6)	± 100	mA

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. I_O absolute maximum rating must be observed.
2. Measured with minimum pad spacing on an FR4 board, using 10 mm-by-1 inch, 2-ounce copper trace with no air flow.
3. Tested to EIA/JESD22-A114-A, rated to EIA/JESD22-A114-B.
4. Tested to EIA/JESD22-A115-A, rated to EIA/JESD22-A115-A.
5. Tested to JESD22-C101-A.
6. Tested to EIA/JESD78.

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RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
V_{CC}	DC Supply Voltage	1.65 1.5	5.5 5.5	V
V_{IN}	DC Input Voltage	0	5.5	V
V_{OUT}	DC Output Voltage (SOT-353/SC70-5/SC-88A/SOT-553 Packages)	0	5.5	V
V_{OUT}	DC Output Voltage (SOT-953 Package)	0	V_{CC}	V
T_A	Operating Temperature Range	-55	+125	°C
t_r, t_f	Input Rise and Fall Time	$V_{CC} = 2.5 V \pm 0.2 V$ $V_{CC} = 3.0 V \pm 0.3 V$ $V_{CC} = 5.0 V \pm 0.5 V$	0 10 5	ns/V

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Condition	V_{CC} (V)	$T_A = 25^\circ C$			$-55^\circ C \leq T_A \leq 125^\circ C$		Unit
				Min	Typ	Max	Min	Max	
V_{IH}	High-Level Input Voltage		1.65 to 1.95 2.3 to 5.5	$0.75 V_{CC}$ $0.7 V_{CC}$			$0.75 V_{CC}$ $0.7 V_{CC}$		V
V_{IL}	Low-Level Input Voltage		1.65 to 1.95 2.3 to 5.5			$0.25 V_{CC}$ $0.3 V_{CC}$		$0.25 V_{CC}$ $0.3 V_{CC}$	V
V_{OH}	High-Level Output Voltage $V_{IN} = V_{IL}$	$I_{OH} = -100 \mu A$	1.65 to 5.5	$V_{CC} - 0.1$	V_{CC}		$V_{CC} - 0.1$		V
		$I_{OH} = -3 \text{ mA}$	1.65	1.29	1.52		1.29		
		$I_{OH} = -8 \text{ mA}$	2.3	1.9	2.1		1.9		
		$I_{OH} = -12 \text{ mA}$	2.7	2.2	2.4		2.2		
		$I_{OH} = -16 \text{ mA}$	3.0	2.4	2.7		2.4		
		$I_{OH} = -24 \text{ mA}$	3.0	2.3	2.5		2.3		
V_{OL}	Low-Level Output Voltage $V_{IN} = V_{IH}$	$I_{OL} = 100 \mu A$	1.65 to 5.5		0.0	0.1		0.1	V
		$I_{OH} = 3 \text{ mA}$	1.65		0.08	0.24		0.24	
		$I_{OL} = 8 \text{ mA}$	2.3		0.20	0.3		0.3	
		$I_{OL} = 12 \text{ mA}$	2.7		0.22	0.4		0.4	
		$I_{OL} = 16 \text{ mA}$	3.0		0.28	0.4		0.4	
		$I_{OL} = 24 \text{ mA}$	3.0		0.38	0.55		0.55	
I_{IN}	Input Leakage Current	$V_{IN} = 5.5 \text{ V}$ or GND	0 to 5.5		± 0.1			± 1.0	μA
		$V_{IN} = 5.5 \text{ V}$ or $V_{OUT} = 5.5 \text{ V}$	0			1		10	μA
I_{OFF}	Power Off Leakage Current (SOT-353/ SC70-5/SC-88A/ SOT-553 Packages)	$V_{IN} = 5.5 \text{ V}$ or $V_{OUT} = 5.5 \text{ V}$	0			1		10	μA
I_{CC}	Quiescent Supply Current	$V_{IN} = 5.5 \text{ V}$ or GND	5.5			1		10	μA

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AC ELECTRICAL CHARACTERISTICS $t_R = t_F = 2.5 \text{ ns}$; $C_L = 50 \text{ pF}$; $R_L = 500 \Omega$

Symbol	Parameter	Condition	V_{CC} (V)	$T_A = 25^\circ\text{C}$			$-55^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$		Unit
				Min	Typ	Max	Min	Max	
t_{PLH} t_{PHL7}	Propagation Delay (Figure 3 and 4)	$R_L = 1 \text{ M}\Omega$, $C_L = 15 \text{ pF}$	1.65 1.8	2.0 2.0	5.3 4.4	11.4 9.5	2.0 2.0	12.0 10.0	ns
		$R_L = 1 \text{ M}\Omega$, $C_L = 15 \text{ pF}$	2.5 ± 0.2	0.2	3.5	6.5	0.8	7.0	
		$R_L = 1 \text{ M}\Omega$, $C_L = 15 \text{ pF}$	3.3 ± 0.3	0.8	2.1	4.5	0.5	4.7	
		$R_L = 500 \Omega$, $C_L = 50 \text{ pF}$		1.2	2.9	5.5	1.5	5.2	
		$R_L = 1 \text{ M}\Omega$, $C_L = 15 \text{ pF}$	5.0 ± 0.5	0.5	1.8	3.9	0.5	4.1	
		$R_L = 500 \Omega$, $C_L = 50 \text{ pF}$		0.8	2.4	4.3	0.8	4.5	

CAPACITIVE CHARACTERISTICS

Symbol	Parameter	Condition	Typical	Unit
C_{IN}	Input Capacitance	$V_{CC} = 5.5 \text{ V}$, $V_I = 0 \text{ V}$ or V_{CC}	>2.5	pF
C_{PD}	Power Dissipation Capacitance (Note 7)	10 MHz, $V_{CC} = 3.3 \text{ V}$, $V_I = 0 \text{ V}$ or V_{CC} 10 MHz, $V_{CC} = 5.5 \text{ V}$, $V_I = 0 \text{ V}$ or V_{CC}	9 11	pF

7. 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; $P_D = C_{PD} \cdot V_{CC}^2 \cdot f_{in} + I_{CC} \cdot V_{CC}$.

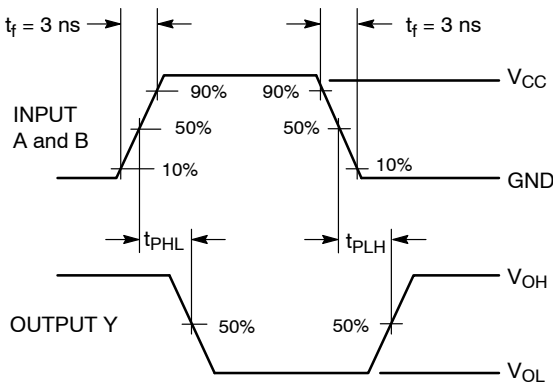


Figure 3. Switching Waveform

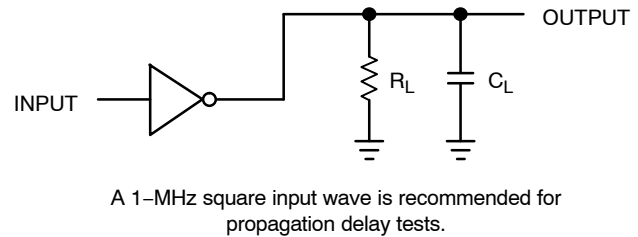


Figure 4. Test Circuit

ORDERING INFORMATION

Device	Package	Shipping†
NL17SZ04DFT2G	SC-88A/SOT-353/SC-70-5 (Pb-Free)	3000 / Tape & Reel
NLV17SZ04DFT2G*	SC-88A/SOT-353/SC-70-5 (Pb-Free)	3000 / Tape & Reel
NL17SZ04XV5T2G	SOT-553 (Pb-Free)	4000 / Tape & Reel
NL17SZ04P5T5G	SOT-953 (Pb-Free)	8000 / Tape & Reel

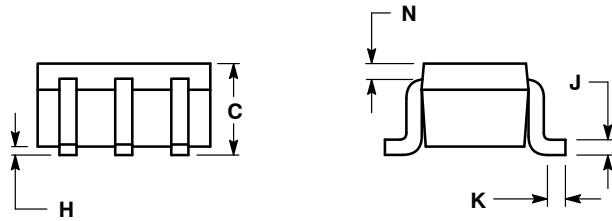
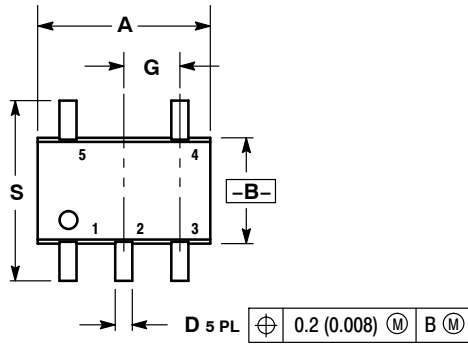
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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

NL17SZ04

PACKAGE DIMENSIONS

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

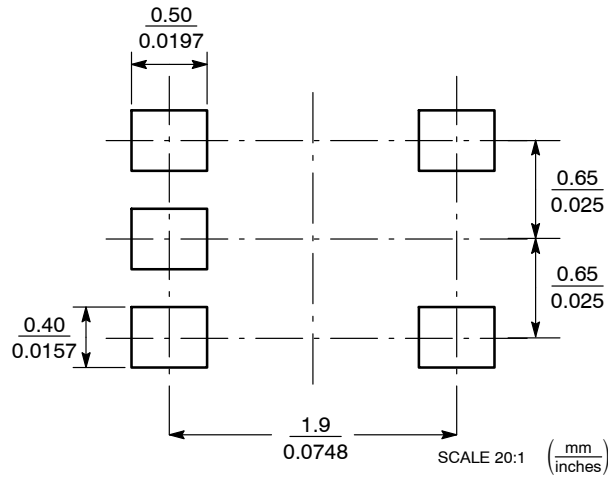


NOTES:

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.

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

SOLDER FOOTPRINT*

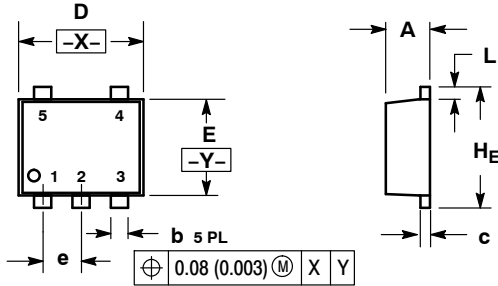


*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

NL17SZ04

PACKAGE DIMENSIONS

SOT-553
XV5 SUFFIX
CASE 463B
ISSUE B

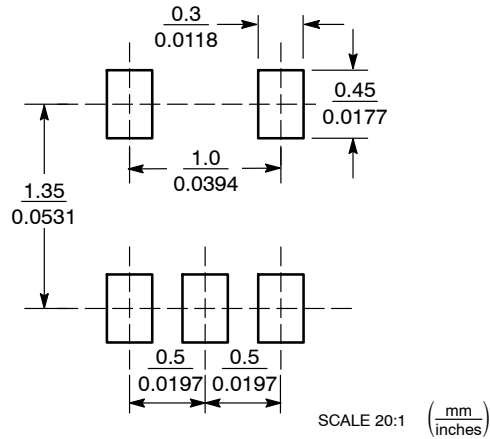


NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETERS
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.50	0.55	0.60	0.020	0.022	0.024
b	0.17	0.22	0.27	0.007	0.009	0.011
c	0.08	0.13	0.18	0.003	0.005	0.007
D	1.50	1.60	1.70	0.059	0.063	0.067
E	1.10	1.20	1.30	0.043	0.047	0.051
e	0.50 BSC			0.020 BSC		
L	0.10	0.20	0.30	0.004	0.008	0.012
HE	1.50	1.60	1.70	0.059	0.063	0.067

SOLDERING FOOTPRINT*

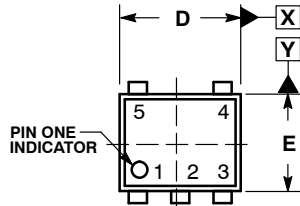


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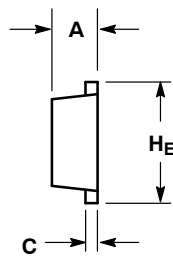
NL17SZ04

PACKAGE DIMENSIONS

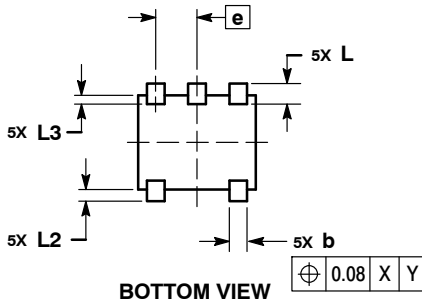
SOT-953
CASE 527AE
ISSUE E



TOP VIEW



SIDE VIEW



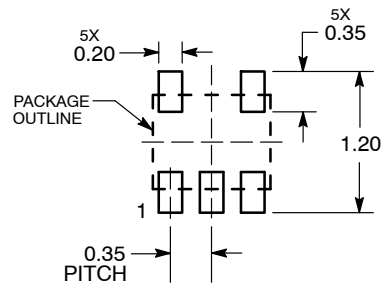
BOTTOM VIEW

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		
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

*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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