NL17SZ04

Single Inverter

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

Features

- Tiny SOT−353 and SOT−553 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
- Pb−Free Packages are Available

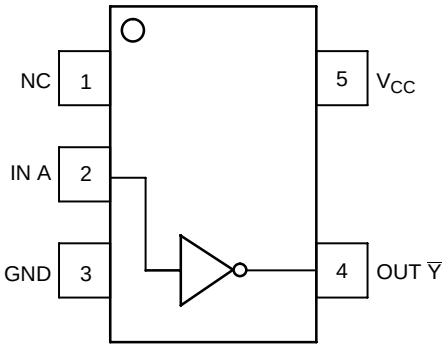


Figure 1. Pinout (Top View)

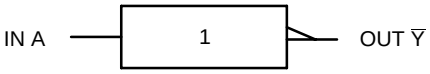
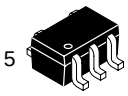


Figure 2. Logic Symbol

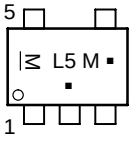
ON Semiconductor®

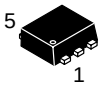
http://onsemi.com

MARKING DIAGRAMS

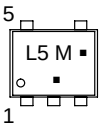


SOT−353/SC70−5/SC−88A
DF SUFFIX
CASE 419A





SOT−553
XV5 SUFFIX
CASE 463B



L5 = 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.

PIN ASSIGNMENT

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

FUNCTION TABLE

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

ORDERING INFORMATION

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

MAXIMUM RATINGS

Symbol	Parameter		Value	Unit
V_{CC}	DC Supply Voltage		−0.5 to +7.0	V
V_I	DC Input Voltage		−0.5 ≤ V_I ≤ +7.0	V
V_O	DC Output Voltage	Output in Higher or Low State (Note 1)	−0.5 ≤ V_O ≤ +7.0	V
I_{IK}	DC Input Diode Current	V_I < GND	−50	mA
I_{OK}	DC Output Diode Current	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	°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	SOT−353 (Note 2) SOT−553	350 496	°C/W
P_D	Power Dissipation in Still Air at 85°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 IC Class A N/A	

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

1. IO 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.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter		Min	Max	Unit
V_{CC}	DC Supply Voltage	Operating Data Retention	1.65 1.5	5.5 5.5	V
V_{IN}	DC Input Voltage		0	5.5	V
V_{OUT}	DC Output Voltage	(High or Low State)	0	5.5	V
T_A	Operating Temperature Range		−40	+85	°C
t_r, t_f	Input Rise and Fall Time	V_{CC} = 2.5 V ± 0.2 V V_{CC} = 3.0 V ± 0.3 V V_{CC} = 5.0 V ± 0.5 V	0 0 0	20 10 5	ns/V

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Condition	V_{CC} (V)	T_A = 25°C			−40°C ≤ T_A ≤ 85°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 μA	1.65 to 5.5	V_{CC} − 0.1	V_{CC}		V_{CC} − 0.1		V
		I_{OH} = −3 mA	1.65	1.29	1.52		1.29		
		I_{OH} = −8 mA	2.3	1.9	2.1		1.9		
		I_{OH} = −12 mA	2.7	2.2	2.4		2.2		
		I_{OH} = −16 mA	3.0	2.4	2.7		2.4		
		I_{OH} = −24 mA	3.0	2.3	2.5		2.3		
		I_{OH} = −32 mA	4.5	3.8	4.0		3.8		
V_{OL}	Low−Level Output Voltage V_{IN} = V_{IH}	I_{OL} = 100 μA	1.65 to 5.5		0.0	0.1		0.1	V
		I_{OH} = 3 mA	1.65		0.08	0.24		0.24	
		I_{OL} = 8 mA	2.3		0.20	0.3		0.3	
		I_{OL} = 12 mA	2.7		0.22	0.4		0.4	
		I_{OL} = 16 mA	3.0		0.28	0.4		0.4	
		I_{OL} = 24 mA	3.0		0.38	0.55		0.55	
		I_{OL} = 32 mA	4.5		0.42	0.55		0.55	
I_{IN}	Input Leakage Current	V_{IN} = V_{CC} or GND	0 to 5.5		±1.0			±10.0	μA
I_{OFF}	Power Off Leakage Current	V_{OUT} = 5.5 V or V_{IN} = 5.5 V	0			1		10	μA
I_{CC}	Quiescent Supply Current	V_{IN} = V_{CC} or GND	1.65 to 5.5			1		10	μA

AC ELECTRICAL CHARACTERISTICS $t_R = t_F$ = 2.5 ns; C_L = 50 pF; R_L = 500 Ω

Symbol	Parameter	Condition	V_{CC} (V)	T_A = 25°C			−40°C ≤ T_A ≤ 85°C		Unit
				Min	Typ	Max	Min	Max	
t_{PLH} t_{PHL7}	Propagation Delay (Figure 3 and 4)	R_L = 1 MΩ, C_L = 15 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 MΩ, C_L = 15 pF	2.5 ± 0.2	0.2	3.5	6.5	0.8	7.0	
		R_L = 1 MΩ, C_L = 15 pF	3.3 ± 0.3	0.8	2.1	4.5	0.5	4.7	
		R_L = 500 Ω, C_L = 50 pF		1.2	2.9	5.5	1.5	5.2	
		R_L = 1 MΩ, C_L = 15 pF	5.0 ± 0.5	0.5	1.8	3.9	0.5	4.1	
		R_L = 500 Ω, C_L = 50 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 V, V_I = 0 V or V_{CC}	> 2.5	pF
C_{PD}	Power Dissipation Capacitance (Note 6)	10 MHz, V_{CC} = 3.3 V, V_I = 0 V or V_{CC} 10 MHz, V_{CC} = 5.5 V, V_I = 0 V or V_{CC}	9 11	pF

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

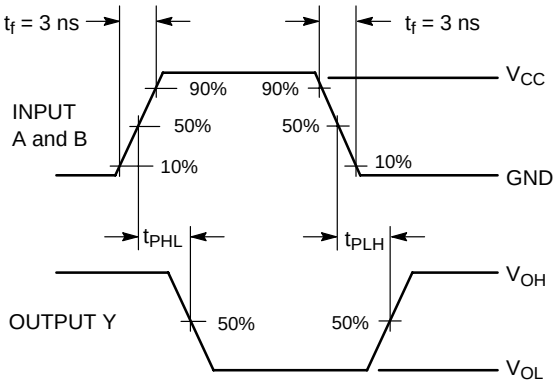
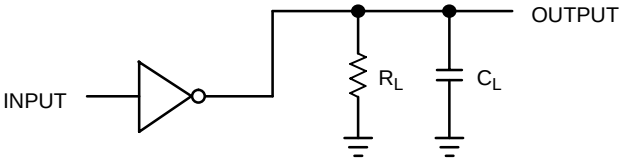


Figure 3. Switching Waveform



A 1−MHz square input wave is recommended for propagation delay tests.

Figure 4. Test Circuit

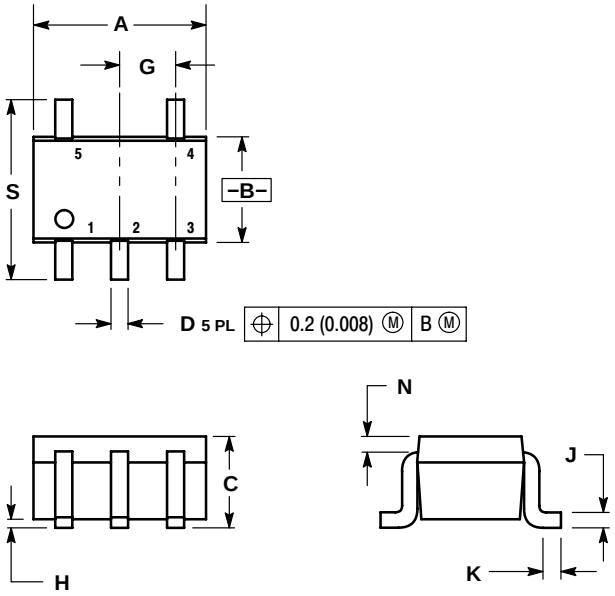
ORDERING INFORMATION

Device	Package	Shipping†
NL17SZ04DFT2	SC−88A/SOT−353/SC70−5	3000 Units / Tape & Reel, 178 mm
NL17SZ04DFT2G	SC−88A/SOT−353/SC70−5 (Pb−Free)	3000 Units / Tape & Reel, 178 mm
NL17SZ04XV5T2	SOT−553*	4000 Units / Tape & Reel, 178 mm
NL17SZ04XV5T2G	SOT−553*	4000 Units / Tape & Reel, 178 mm

†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.
*All Devices in Package SOT553 are Inherently Pb−Free.

PACKAGE DIMENSIONS

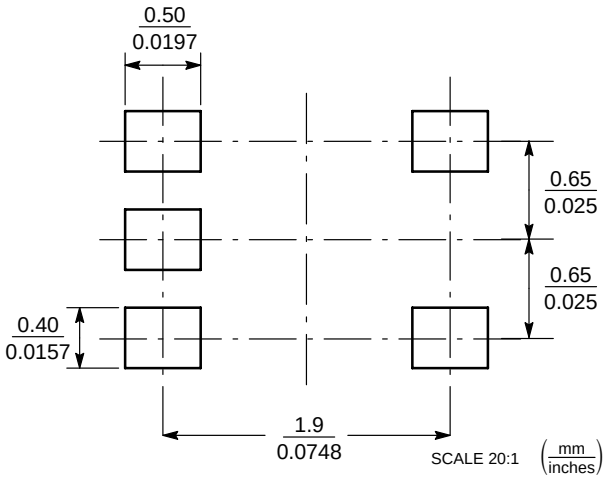
SOT−353
DF SUFFIX
5−LEAD PACKAGE
CASE 419A−02
ISSUE J



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.

	INCHES		MILLIMETERS	
DIM	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

SOLDERING FOOTPRINT*

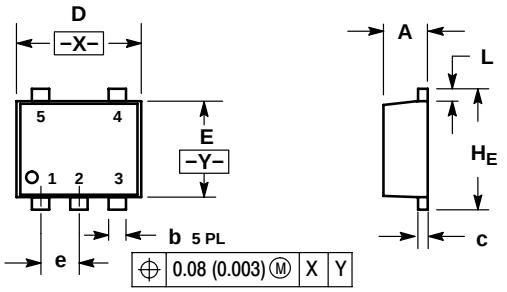


*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

NL17SZ04

PACKAGE DIMENSIONS

SOT−553
XV5 SUFFIX
5−LEAD PACKAGE
CASE 463B−01
ISSUE B



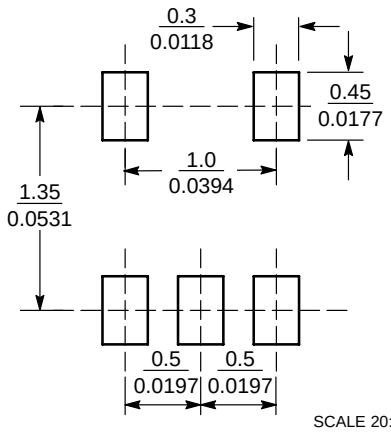
NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETERS
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.

	MILLIMETERS			INCHES		
DIM	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
H_E	1.50	1.60	1.70	0.059	0.063	0.067

STYLE 1:
PIN 1. BASE 1
2. EMITTER 1/2
3. BASE 2
4. COLLECTOR 2
5. COLLECTOR 1

STYLE 2:
PIN 1. CATHODE
2. ANODE
3. CATHODE
4. CATHODE
5. CATHODE

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.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
P.O. Box 61312, Phoenix, Arizona 85082−1312 USA
Phone: 480−829−7710 or 800−344−3860 Toll Free USA/Canada
Fax: 480−829−7709 or 800−344−3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800−282−9855 Toll Free USA/Canada

Japan: ON Semiconductor, Japan Customer Focus Center
2−9−1 Kamimeguro, Meguro−ku, Tokyo, Japan 153−0051
Phone: 81−3−5773−3850

ON Semiconductor Website: http://onsemi.com

Order Literature: http://www.onsemi.com/litorder

For additional information, please contact your local Sales Representative.