



DESCRIPTION

The AL74LS04 is a 6-channel inverter designed to operate over a wide supply voltage range from 1.65 V to 5.5 V. Each inverter implements the Boolean function $Y = \bar{A}$. The AL74LS04 features high output drive capability while maintaining low static power dissipation across the entire VCC operating range. The AL74LS04 is specified for operation over an ambient temperature range of -40°C to $+125^{\circ}\text{C}$. The AL74LS04 is available in DIP14, SOP14 and TSSOP14 packages.

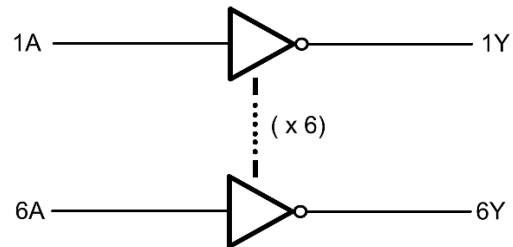
FEATURES

- Operating Voltage Range: 2.0V to 6.0V
- Low Power Consumption: $2\mu\text{A}$ (25°C)
- Operating Temperature Range:
 -40°C to $+125^{\circ}\text{C}$
- Input Accept Voltage to 6.0 V (Max:7.0V)
- High Output Drive: $\pm 25\text{mA}$ at $\text{VCC}=3.0\text{V}$
- Available in DIP14, SOP14 and TSSOP14 Packages

ORDERING INFORMATION

Package Type	Part Number	
DIP14 SPQ: 40pcs/Reel	P14	AL74LS04P14R
SOP14 SPQ: 200pcs/Tube	M14	AL74LS04M14R
TSSOP14 SPQ:200pcs/Tube	TMX14	AL74LS04TMX14R
Note	V: Halogen free Package R: Tape & Reel	
AiT provides all RoHS products		

SIMPLIFIED SCHEMATIC



**PIN DESCRIPTION**

Vcc

14

6A

13

6Y

12

5A

11

5Y

10

4A

9

4Y

8

AL74LS04

SOP14

1

1A

2

1Y

3

2A

4

2Y

5

3A

6

3Y

7

GND

SOP14, M14

Top View

Vcc

14

6A

13

6Y

12

5A

11

5Y

10

4A

9

4Y

8

AL74LS04

TSSOP14

1

1A

2

1Y

3

2A

4

2Y

5

3A

6

3Y

7

GND

TSSOP14, TMX14

Top View

VCC

14

6A

13

6Y

12

5A

11

5Y

10

4A

9

4Y

8

AL74LS04

DIP14

1

1A

2

1Y

3

2A

4

2Y

5

3A

6

3Y

7

GND

DIP14, P14

Top View

PIN#			Symbol	Function
SOP14	TSSOP14	DIP14		
1	1	1	1A	Data input 1
2	2	2	1Y	Data output 1
3	3	3	2A	Data input 2
4	4	4	2Y	Data output2
5	5	5	3A	Data input 3
6	6	6	3Y	Data output 3
7	7	7	GND	Ground
8	8	8	4Y	Data input 4
9	9	9	4A	Data output 4
10	10	10	5Y	Data input 5
11	11	11	5A	Data output 5
12	12	12	6Y	Data input 6
13	13	13	6A	Data output 6
14	14	14	V _{CC}	Power Pin



FUNCTION TABLE

INPUTS	OUTPUT
nA	nY
L	H
H	L

H=High Voltage Level L=Low Voltage Level

ABSOLUTE MAXIMUM RATINGS

T_{amb}=25°C, GND=0V (unless otherwise noted)

V _{CC} , Supply Voltage Range	-0.5V ~ +7V	
I _{IK} , Input Clamp Current	V _I <-0.5V or V _I >V _{CC} +0.5V	±20mA
I _{OK} , Output Clamp Current	V _O <-0.5V or V _O >V _{CC} +0.5V	±20mA
I _O , Continuous Output Current	-0.5V<V _O <V _{CC} +0.5V	±25mA
I _{CC} , Supply Current	50mA	
I _{GND} , Ground Current	-50mA	
P _{tot} , Total Power Dissipation	500mW	
T _L , Soldering Temperature	DIP14	245°C
	SOP14, TSSOP14	260°C
T _{STG} , Storage Temperature	-65°C ~ +150°C	

Stresses above may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated in the Electrical Characteristics are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Conditions	Min	Typ.	Max	Unit
Supply Voltage	V _{CC}	-	2	5	6	V
Input Voltage Range	V _I	-	0	-	V _{CC}	V
Output Voltage	V _O	-	0	-	V _{CC}	V
Input Rising Slew Rate	Δt/ΔV	V _{CC} =2V	-	-	625	ns/V
		V _{CC} =4.5V	-	1.67	139	
		V _{CC} =6V	-	-	83	
Operating Environment	T _{amb}	-	-40	-	+125	°C



ELECTRICAL CHARACTERISTICS

DC Parameters 1

T_A=25°C, GND=0V, unless otherwise noted.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
High Level Input Voltage	V _{IH}	V _{CC} =2V	1.50	1.20	-	V
		V _{CC} =4.5V	3.15	2.40	-	
		V _{CC} =6V	4.20	3.20	-	
Low Level Input Voltage	V _{IL}	V _{CC} =2V	-	0.80	0.50	V
		V _{CC} =4.5V	-	2.10	1.35	
		V _{CC} =6V	-	2.80	1.80	
High Level Output Voltage	V _{OH}	V _I =V _{IH} or V _{IL}	I _O = -20uA, V _{CC} =2.0V	1.90	2	V
			I _O = -20uA, V _{CC} =4.5V	4.40	4.50	
			I _O = -20uA, V _{CC} =6.0V	5.90	6	
			I _O = -4.0mA, V _{CC} =4.5V	3.98	4.32	
			I _O = -5.2mA, V _{CC} =6.0V	5.48	5.81	
Low Level Output Voltage	V _{OL}	V _I =V _{IH} or V _{IL}	I _O =20uA, V _{CC} =2.0V	-	0	V
			I _O =20uA, V _{CC} =4.5V	-	0	
			I _O =20uA, V _{CC} =6.0V	-	0	
			I _O =4.0mA, V _{CC} =4.5V	-	0.15	
			I _O =5.2mA, V _{CC} =6.0V	-	0.16	
Input Leakage Current	I _I	V _I = V _{CC} or GND, V _{CC} =6.0V	-	-	±1	uA
Quiescent Current	I _{CC}	V _I = V _{CC} or GND, I _O =0A, V _{CC} =6.0V	-	-	2	uA
Input Capacitor	C _I	-	-	3.50	-	pF



DC Parameters 2

$T_A = 40^\circ\text{C} \sim +85^\circ\text{C}$, GND=0V

Parameter	Symbol	Conditions		Min	Typ	Max	Unit
High Level Input Voltage	V_{IH}	$V_{CC}=2V$		1.50	-	-	V
		$V_{CC}=4.5V$		3.15	-	-	
		$V_{CC}=6V$		4.20	-	-	
Low Level Input Voltage	V_{IL}	$V_{CC}=2V$		-	-	0.50	V
		$V_{CC}=4.5V$		-	-	1.35	
		$V_{CC}=6V$		-	-	1.80	
High Level Output Voltage	V_{OH}	$V_I = V_{IH} \text{ or } V_{IL}$	$I_O = -20\mu A, V_{CC}=2.0V$	1.90	-	-	V
			$I_O = -20\mu A, V_{CC}=4.5V$	4.40	-	-	
			$I_O = -20\mu A, V_{CC}=6.0V$	5.90	-	-	
			$I_O = -4.0mA, V_{CC}=4.5V$	3.84	-	-	
			$I_O = -5.2mA, V_{CC}=6.0V$	5.34	-	-	
Low Level Output Voltage	V_{OL}	$V_I = V_{IH} \text{ or } V_{IL}$	$I_O = 20\mu A, V_{CC}=2.0V$	-	-	0.10	V
			$I_O = 20\mu A, V_{CC}=4.5V$	-	-	0.10	
			$I_O = 20\mu A, V_{CC}=6.0V$	-	-	0.10	
			$I_O = 4.0mA, V_{CC}=4.5V$	-	-	0.33	
			$I_O = 5.2mA, V_{CC}=6.0V$	-	-	0.33	
Input Leakage Current	I_I	$V_I = V_{CC} \text{ or } GND, V_{CC}=6.0V$		-	-	± 1	μA
Quiescent Current	I_{CC}	$V_I = V_{CC} \text{ or } GND, I_O=0A, V_{CC}=6.0V$		-	-	20	μA



DC Parameters 3

T_A= 40°C ~ +125°C, GND=0V

Parameter	Symbol	Conditions		Min	Typ	Max	Unit
High Level Input Voltage	V _{IH}	V _{CC} =2V		1.50	-	-	V
		V _{CC} =4.5V		3.15	-	-	
		V _{CC} =6V		4.20	-	-	
Low Level Input Voltage	V _{IL}	V _{CC} =2V		-	-	0.50	V
		V _{CC} =4.5V		-	-	1.35	
		V _{CC} =6V		-	-	1.80	
High Level Output Voltage	V _{OH}	V _I =V _{IH} or V _{IL}	I _O = -20uA, V _{CC} =2.0V	1.90	-	-	V
			I _O = -20uA, V _{CC} =4.5V	4.40	-	-	
			I _O = -20uA, V _{CC} =6.0V	5.90	-	-	
			I _O = -4.0mA, V _{CC} =4.5V	3.70	-	-	
			I _O = -5.2mA, V _{CC} =6.0V	5.20	-	-	
Low Level Output Voltage	V _{OL}	V _I =V _{IH} or V _{IL}	I _O =20uA, V _{CC} =2.0V	-	-	0.10	V
			I _O =20uA, V _{CC} =4.5V	-	-	0.10	
			I _O =20uA, V _{CC} =6.0V	-	-	0.10	
			I _O =4.0mA, V _{CC} =4.5V	-	-	0.40	
			I _O =5.2mA, V _{CC} =6.0V	-	-	0.40	
Input Leakage Current	I _I	V _I = V _{CC} or GND, V _{CC} =6.0V		-	-	±1	uA
Quiescent Current	I _{CC}	V _I = V _{CC} or GND, I _O =0A, V _{CC} =6.0V		-	-	40	uA



AC CHARACTERISTICS

T_A=25°C, GND=0V

Parameter	Symbol	Conditions	Min	Typ.	Max	Unit
nA/nB-to-nY Propagation Delay	t _{pd}	Fig. 2	V _{CC} =2V	-	25	ns
			V _{CC} =4.5V	-	9	
			V _{CC} =5.0V, C _L =15pF	-	7	
			V _{CC} =6V	-	7	
Rise/Fall Transition Time	t _t	Fig. 2	V _{CC} =2V	-	19	ns
			V _{CC} =4.5V	-	7	
			V _{CC} =6V	-	6	
Power Dissipation Capacitance	C _{PD}	Per Package, V _I =GND ~ V _{CC} (1)	-	21	-	pF

1. C_{PD} is used to calculate the dynamic power dissipation (P_D), expressed in μW, $P_D = (C_{PD} \times V_{CC}^2 \times f_i \times N) + \sum (C_L \times V_{CC}^2 \times f_o)$,
f_i=Input frequency (MHz) ; f_o= Output frequency (MHz) ; C_L=Output load capacitance(pF) ; V_{CC}=supply Voltage (V) ; N=Switching frequency ; $\sum (C_L \times V_{CC}^2 \times f_o)$ =Total output amount. .

T_A= 40°C ~ +85°C, GND=0V

Parameter	Symbol	Conditions	Min	Typ.	Max	Unit
nA/nB-to-nY Propagation Delay	t _{pd}	Fig. 2	V _{CC} =2V	-	-	ns
			V _{CC} =4.5V	-	-	
			V _{CC} =6V	-	-	
Rise/Fall Transition Time	t _t	Fig. 2	V _{CC} =2V	-	-	ns
			V _{CC} =4.5V	-	-	
			V _{CC} =6V	-	-	

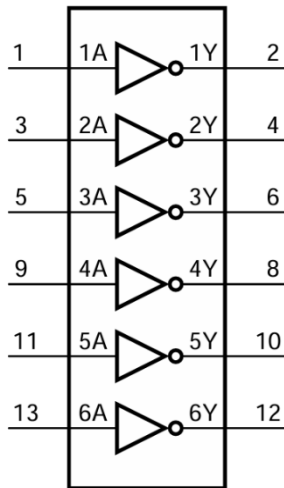
T_A= 40°C ~ +125°C, GND=0V

Parameter	Symbol	Conditions	Min	Typ.	Max	Unit
nA/nB-to-nY Propagation Delay	t _{pd}	Fig. 2	V _{CC} =2V	-	-	ns
			V _{CC} =4.5V	-	-	
			V _{CC} =6V	-	-	
Rise/Fall Transition Time	t _t	Fig. 2	V _{CC} =2V	-	-	ns
			V _{CC} =4.5V	-	-	
			V _{CC} =6V	-	-	

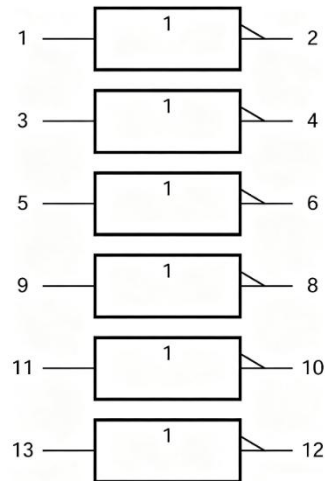


FUNCTION DIAGRAM

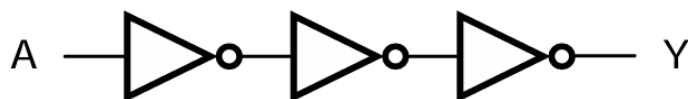
a. Logic Symbol



b. IEC Logic Symbol



c. Logic Block Diagram





PARAMETER MEASUREMENT INFORMATION

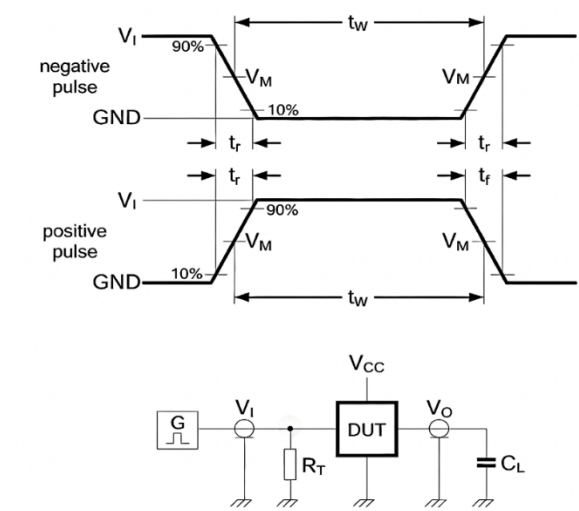


Fig 1. Switching Time Test Circuit

Note:

C_L: Load capacitance, including the capacitance of the probe and clips.
R_T: The termination resistor should match the signal generator's output impedance (Z_o).

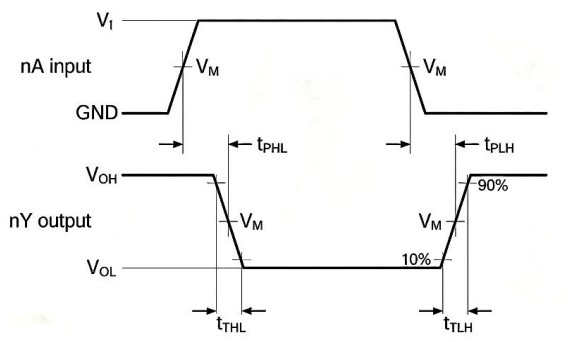


Fig 2. nA-to-nB Propagation Delay and Output Transition Time

Test Point

INPUTS		OUTPUT	
V _M		V _M	
0.5×VCC		0.5×VCC	

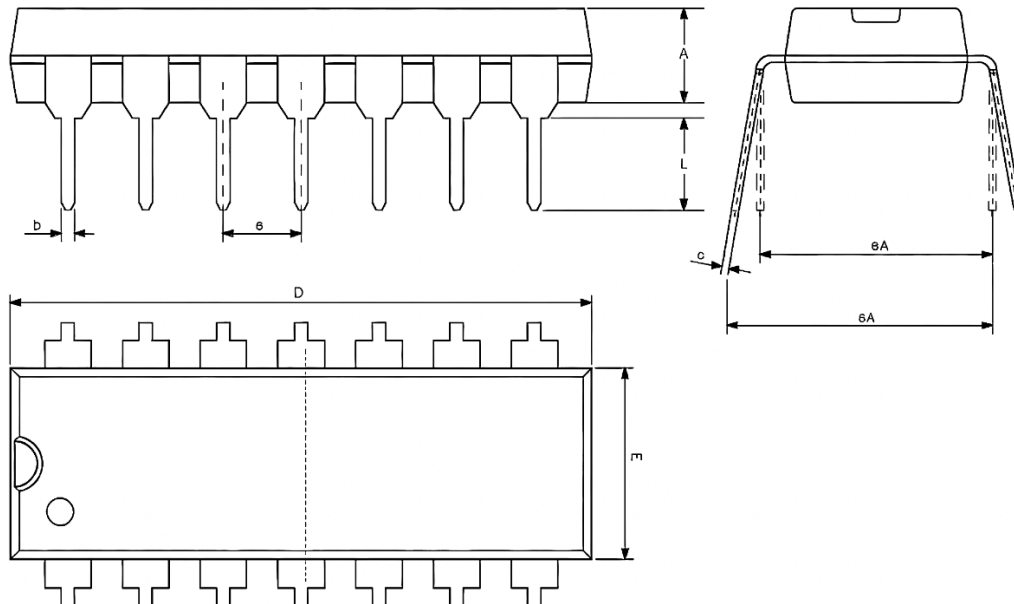
Tested Data

INPUTS		Load	Test Item
V _I	t _r , t _f	C _L	
VCC	6ns	15pF, 50pF	t _{PLH} , t _{PHL}



PACKAGE INFORMATION

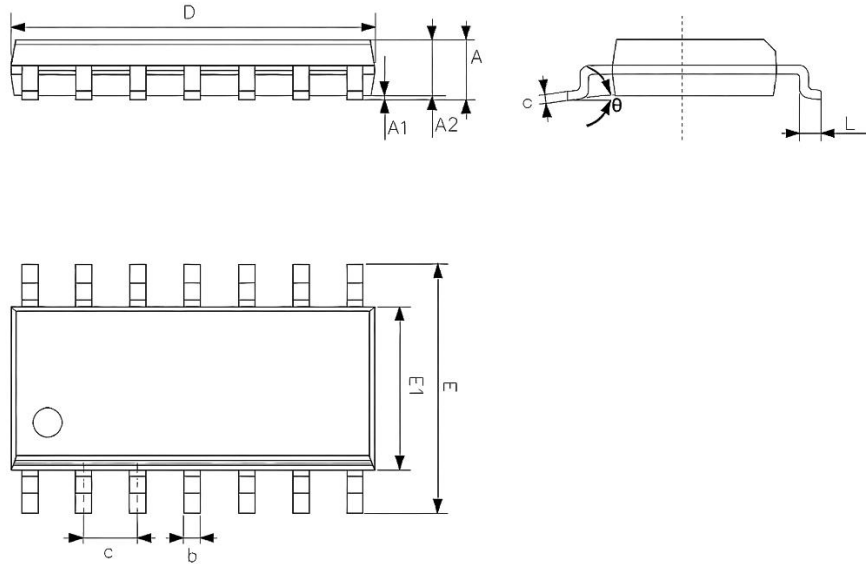
Dimension in DIP14 (Unit: mm)



Symbol	Min.	Max.
A	3.050	3.600
b	0.330	0.560
c	0.200	0.360
D	18.800	19.400
E	6.200	6.600
e	2.540	
eA	7.620	10.900
L	2.920	-



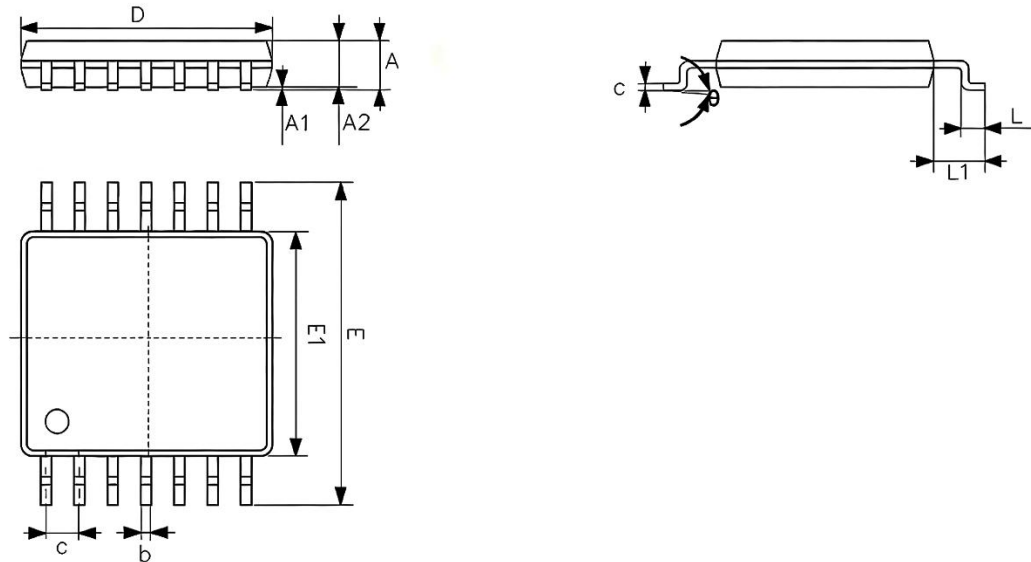
Dimension in SOP14 (Unit: mm)



Symbol	Millimeters	
	Min	Max
A	1.500	1.750
A1	0.050	0.250
A2	1.300	-
b	0.330	0.500
c	0.190	0.250
D	8.430	8.760
e	1.270 BSC	
E	5.800	6.250
E1	3.750	4.000
L	0.400	0.890
θ	0°	8°



Dimension in TSSOP14 (Unit: mm)



Symbol	Millimeters	
	Min	Max
A	-	1.200
A1	0.500	0.150
A2	0.800	1.050
b	0.190	0.300
c	0.090	0.200
D	4.900	5.100
E	6.200	4.500
E1	4.300	6.600
e	0.650 BSC	
L	0.450	0.750
L1	1.000	
θ	0°	8°



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