Advanced CMOS Logic – 54AC00

Quad 2-Input NAND Gates in bare die form

Rev 1.0
19/02/21

Description

54AC00 provides x4 independent 2-input NAND gates performing the Boolean function $Y = \overline{A \bullet B}$ or $Y = \overline{A} + \overline{B}$. The device is fabricated using a 1.5µm 5V CMOS process combining high speed LSTTL performance with CMOS low power. Internal circuitry comprises of 3 stages and includes buffered output for high noise immunity and stability. Device inputs are compatible with standard CMOS outputs; with pull-up resistors, they are compatible with LSTTL outputs. All inputs are equipped with protection circuits against static discharge and transient excess voltage.

Features:

- Outputs Sink/Source 24mA
- Low Input Current: 1µA
- Outputs directly interface CMOS, NMOS and TTL
- Operating Voltage Range: 2V to 6V
- CMOS High Noise Immunity
- Function compatible with 54HC00 or 54LS00
- Full Military Temperature Range.

Ordering Information

The following part suffixes apply:

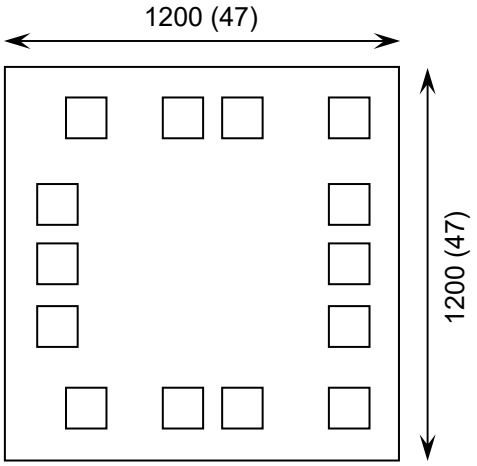
- No suffix - MIL-STD-883 /2010B Visual Inspection
- "**H**" - MIL-STD-883 /2010B Visual Inspection
  + MIL-PRF-38534 Class H LAT
- "**K**" - MIL-STD-883 /2010A Visual Inspection (Space)
  + MIL-PRF-38534 Class K LAT

LAT = Lot Acceptance Test.

For further information on LAT process flows see below.

www.siliconsupplies.com\quality\bare-die-lot-qualification

Die Dimensions in µm (mils)



Supply Formats:

- Default – Die in Waffle Pack (400 per tray capacity)
- Sawn Wafer on Tape – On request
- Unsawn Wafer – On request
- Die Thickness <> 350µm(14 Mils) – On request
- Assembled into Ceramic Package – On request

Mechanical Specification

Die Size (Unsawn)	1200 x 1200 47 x 47	µm mils
Minimum Bond Pad Size	120 x 120 4.72 x 4.72	µm mils
Die Thickness	350 (±20) 13.78 (±0.79)	µm mils
Top Metal Composition	Al 1%Si 1.1µm	
Back Metal Composition	N/A – Bare Si	

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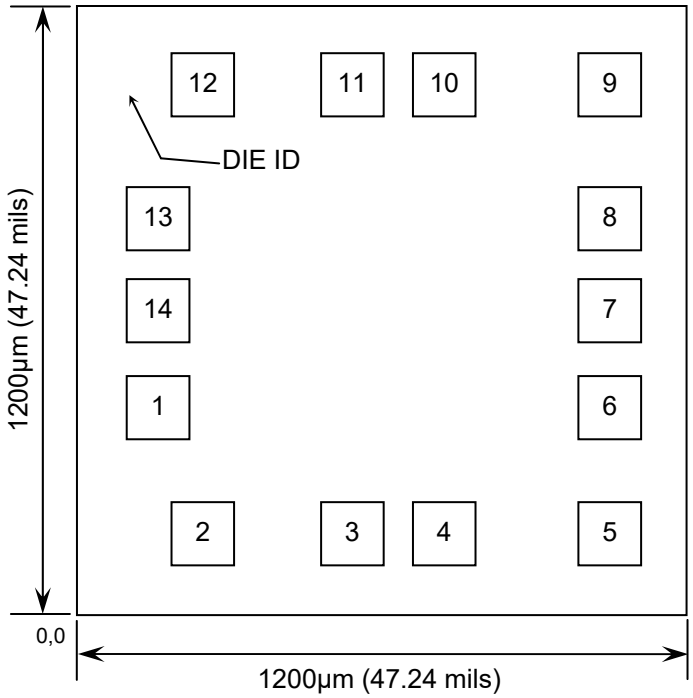
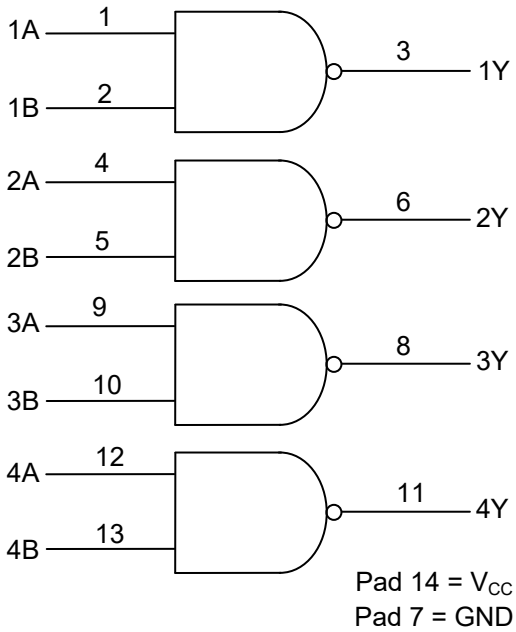
Pad Layout and Functions



PAD	FUNCTION	COORDINATES (µm)	
		X	Y
1	1A	100	350
2	1B	150	100
3	1Y	480	100
4	2A	660	100
5	2B	990	100
6	2Y	990	350
7	GND	990	540
8	3Y	990	720
9	3A	990	980
10	3B	660	980
11	4Y	480	980
12	4A	150	980
13	4B	100	720
14	V_{CC}	100	540
CONNECT CHIP BACK TO V_{CC} OR FLOAT			

Logic Diagram



Pad 14 = V_{CC}
Pad 7 = GND

Function Table

INPUTS		OUTPUT
A	B	Y
L	L	H
L	H	H
H	L	H
H	H	L
H = High level (steady state) L = Low level (steady state)		

Absolute Maximum Ratings[1]

PARAMETER	SYMBOL	VALUE	UNIT
DC Supply Voltage (Referenced to GND)	V_{CC}	-0.5 to +7.0	V
DC Input Voltage (Referenced to GND)	V_{IN}	-0.5 to V_{CC} +0.5	V
DC Output Voltage (Referenced to GND)	V_{OUT}	-0.5 to V_{CC} +0.5	V
DC Input Current	I_{IN}	±20	mA
DC Output Current, per pad	I_{OUT}	±25	mA
DC Supply Current, V_{CC} or GND, per pad	I_{CC}	±50	mA
Power Dissipation in Still Air[2]	P_D	750	mW
Storage Temperature Range	T_{STG}	-65 to 150	°C

1. Operation above the absolute maximum rating may cause device failure. Operation at the absolute maximum ratings, for extended periods, may reduce device reliability. **2.** Measured in plastic DIP package, results in die form are dependent on die attach and assembly method.

Recommended Operating Conditions[3] (Voltages referenced to GND)

PARAMETER		SYMBOL	MIN	MAX	UNITS
DC Supply Voltage		V_{CC}	2	6	V
DC Input or Output Voltage		V_{IN} ,V_{OUT}	0	V_{CC}	V
Operating Temperature Range		T_J	-55	+125	°C
Output Current – High		I_{OH}	-	-24	mA
Output Current – Low		I_{OL}	-	24	mA
Input Rise and Fall Time (V_{IN} from 30% to 70%)	V_{CC} = 3.0V	t_r, t_f	0	150	ns/V
	V_{CC} = 4.5V		0	40	
	V_{CC} = 5.5V		0	24	

3. This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high-impedance circuit. For proper operation, V_{IN} and V_{OUT} should be constrained to the range GND ≤ (V_{IN} or V_{OUT}) ≤ V_{CC}. Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or V_{CC}). Unused outputs must be left open.

DC Electrical Characteristics (Voltages Referenced to GND)

PARAMETER	SYMBOL	V_{CC}	CONDITIONS	LIMITS			UNITS
				25°C	85°C	FULL RANGE[4]	
Minimum High-Level Input Voltage	V_{IH}	3.0V	V_{OUT} = 0.1V or V_{CC} -0.1V $\lvert I_{OUT} \rvert$ ≤ 20µA	2.1	2.1	2.1	V
		4.5V		3.15	3.15	3.15	
		5.5V		3.85	3.85	3.85	
Maximum Low-Level Input Voltage	V_{IL}	3.0V	V_{OUT} = 0.1V or V_{CC} -0.1V $\lvert I_{OUT} \rvert$ ≤ 20µA	0.9	0.9	0.9	V
		4.5V		1.35	1.35	1.35	
		5.5V		1.65	1.65	1.65	

4. -55˚C ≤ T_J ≤ +125˚C

DC Electrical Characteristics Continued (Voltages Referenced to GND)

PARAMETER	SYMBOL	V_{CC}	CONDITIONS	LIMITS			UNITS
				25°C	85°C	FULL RANGE[4]	
Minimum High-Level Output Voltage	V_{OH}	3.0V	I_{OUT} = -50µA	2.9	2.9	2.9	V
		4.5V		4.4	4.4	4.4	
		5.5V		5.4	5.4	5.4	
		3.0V	$V_{IN} = V_{IL}$ or V_{IH} I_{OH} = -12 mA	2.56	2.46	2.40	
		4.5V	$V_{IN} = V_{IL}$ or V_{IH} I_{OH} = -24mA[5]	3.86	3.76	3.70	
		5.5V	$V_{IN} = V_{IL}$ or V_{IH} I_{OH} = -24mA[5]	4.86	4.76	4.70	
		5.5V	$V_{IN} = V_{IL}$ or V_{IH} I_{OH} = -50mA[6]	-	-	3.85	
Maximum Low-Level Output Voltage	V_{OL}	3.0V	I_{OUT} = 50µA	0.1	0.1	0.1	V
		4.5V		0.1	0.1	0.1	
		5.5V		0.1	0.1	0.1	
		3.0V	$V_{IN} = V_{IH}$ or V_{IL} $\lvert I_{OUT} \rvert \leq$ 12mA	0.36	0.44	0.5	
		4.5V	$V_{IN} = V_{IH}$ or V_{IL} $\lvert I_{OUT} \rvert \leq$ 24mA[5]	0.36	0.44	0.5	
		5.5V	$V_{IN} = V_{IH}$ or V_{IL} $\lvert I_{OUT} \rvert \leq$ 24mA[5]	0.36	0.44	0.5	
		5.5V	$V_{IN} = V_{IH}$ or V_{IL} $\lvert I_{OUT} \rvert$ 50mA[6]	-	-	1.65	
Maximum Input Leakage Current	I_{IN}	5.5V	$V_{IN} = V_{CC}$ or GND	±0.1	±1.0	±1.0	µA
Minimum Dynamic Output Current[7]	I_{OLD}	5.5V	V_{OLD} = 1.65V Max	-	75	50	mA
	I_{OHD}	5.5V	V_{OHD} = 3.85V Min	-	-75	-50	
Maximum Quiescent Supply Current	I_{CC}	5.5V	$V_{IN} = V_{CC}$ or GND I_{OUT} = 0µA	4	40	80	µA

AC Electrical Characteristics[8] (V_{CC} 3.3V ±0.3V, V_{CC} 5V ±0.3V)

PARAMETER	SYMBOL	V_{CC}	CONDITIONS	LIMITS			UNITS
				25°C	85°C	FULL RANGE[4]	
Maximum Propagation Delay, Input A or B to Output Y (Figure 1,2)	t_{PLH}	3.3V	C_L = 50pF, Input $t_r = t_f$ = 3ns	9.5	10.0	11	ns
		5.0V		8	8.5	9	
	t_{PHL}	3.3V	C_L = 50pF, Input $t_r = t_f$ = 3ns	8.0	8.5	8.5	ns
		5.0V		6.5	7.0	7.0	

AC Electrical Characteristics Continued[8]

PARAMETER	SYMBOL	V_{CC}	CONDITIONS	LIMITS			UNITS
				25°C	85°C	FULL RANGE[4]	
Maximum Input Capacitance	C_{IN}	5	-	4.5	4.5	4.5	pF
Power Dissipation Capacitance Per Gate[6]	C_{PD}	-	T_A = 25°C, V_{CC} =5.0V	TYPICAL			pF
				30			

5. All outputs loaded; thresholds on input associated with output under test. **6.** Test time 1sec max, measurement made by forcing indicated current and measuring voltage to minimize power dissipation. Test verifies a minimum 75Ω transmission-line drive capability at 125°C **7.** Maximum test duration 2ms, one output loaded at a time Not production tested in die form, characterized by chip design and tested in package. **8.** Used to determine the no-load dynamic power consumption: $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$.

Switching Waveform

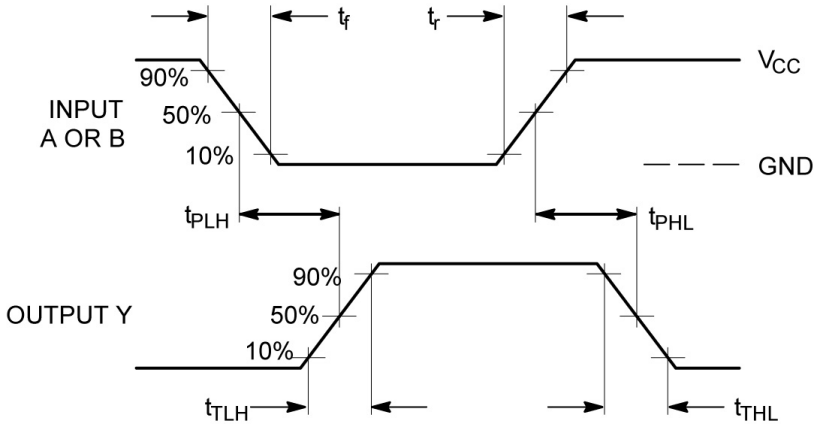
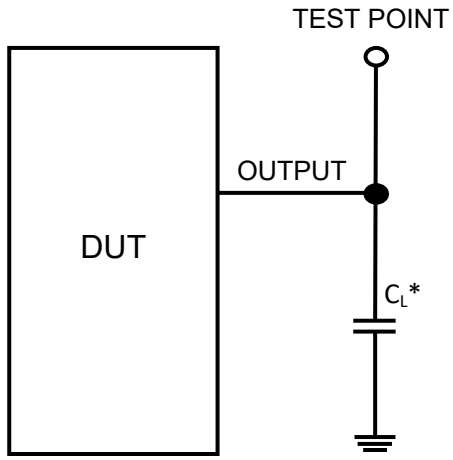


Figure 1 – Propagation Delay & Output Transition Time

Test Circuit



* Includes all probe and jig capacitance

Figure 2