Advanced CMOS TTL Input – 74ACT86

Quadruple 2-Input Exclusive OR Gate IC in bare die form

Rev 1.0
06/02/20

Description

The 74ACT86 exclusive OR gate (XOR) is fabricated using a 1.5µm advanced CMOS process which combines the high speed performance of LSTTL with CMOS low power consumption. This device contains four independent gates and performs the Boolean functions $Y = A \oplus B$ or $Y = \overline{A}B + A\overline{B}$. Device inputs directly accept LSTTL or CMOS. All inputs are protected against ESD and excess voltage transients.

Features:

- Inputs directly accept TTL
- Outputs directly interface CMOS, NMOS and TTL
- Outputs Source/Sink 24 mA
- Low Input Current: 1µA
- Functionally compatible with bipolar 74LS86
- Lower power alternative to bipolar logic.

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Ordering Information

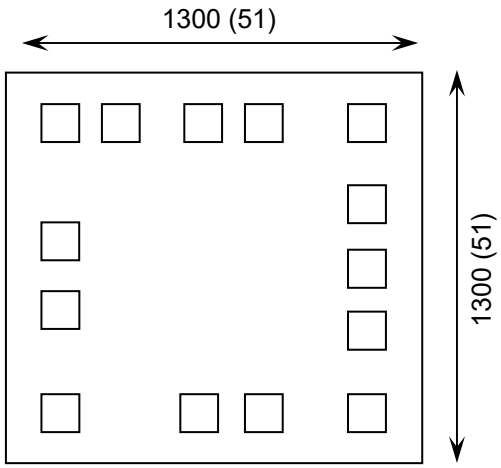
The following part suffixes apply:

- No suffix - MIL-STD-883 /2010B Visual Inspection

For High Reliability versions of this product please see

54ACT86

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)	1300 x 1300 51 x 51`	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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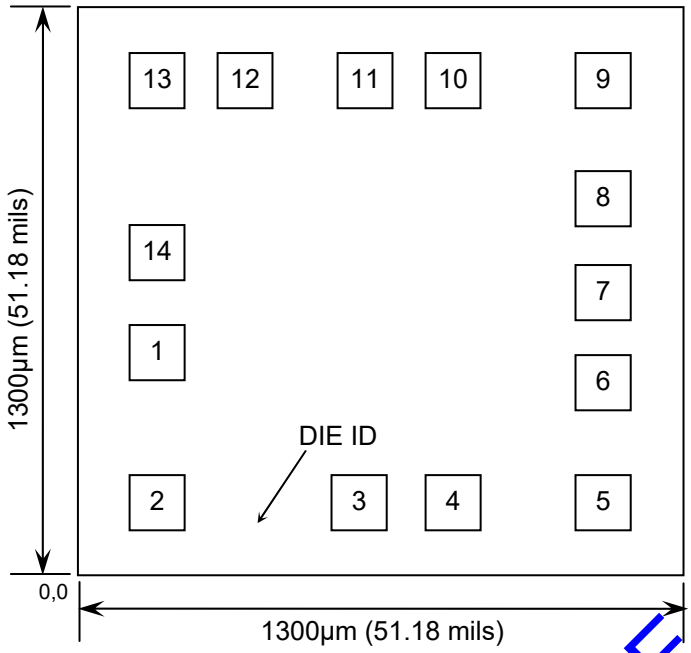
06/02/20

Pad Layout and Functions



PAD	FUNCTION	COORDINATES (µm)	
		X	Y
1	A1	100	439
2	B1	100	100
3	Y1	547	100
4	A2	751	100
5	B2	1088	100
6	Y2	1088	372
7	GND	1088	579
8	Y3	1088	797
9	A3	1088	1070
10	B3	751	1070
11	Y4	566	1070
12	A4	290	1070
13	B4	100	1070
14	V_{CC}	100	671
CONNECT CHIP BACK TO V_{CC} OR FLOAT			

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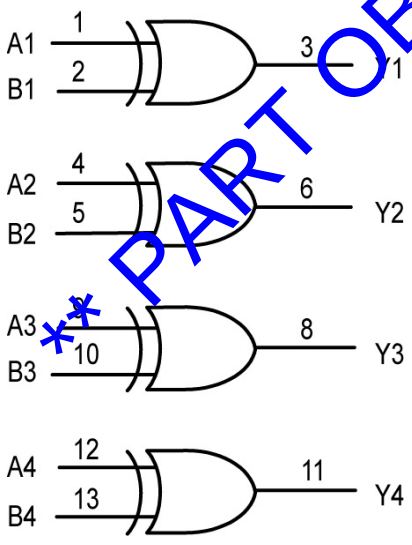
Logic Diagram



$Y = A \oplus B$
$= \overline{A}B + A\overline{B}$

Function Table

INPUTS		OUTPUT
A	B	Y
L	L	L
L	H	H
H	L	H
H	H	L

H = High level (steady state)
L = Low level (steady state)

Rev 1.0
06/02/20

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}	±50	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}	4.5	5.5	V
DC Input or Output Voltage		V_{IN} ,V_{OUT}	0	V_{CC}	V
Operating Temperature Range		T_J	-40	+85	°C
Output current - High		I_{OH}	-	-24	mA
Output current - Low		I_{OL}	-	24	mA
Input Rise or Fall rate (V_{IN} from 0.8V to 2V)	V_{CC} = 4.5V	$\Delta t/\Delta V$	0	10	ns/V
	V_{CC} = 5.5V		0	8	

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}	4.5V	V_{OUT} = 0.1V or V_{CC} -0.1V	2	2	2	V
		5.5V		2	2	2	
Maximum Low-Level Input Voltage	V_{IL}	4.5V	V_{OUT} = 0.1V or V_{CC} -0.1V	0.8	0.8	0.8	V
		5.5V		0.8	0.8	0.8	
Minimum Low-Level Output Voltage	V_{OL}	4.5V	I_{OUT} = 50µA	0.1	0.1	0.1	V
		5.5V		0.1	0.1	0.1	
		4.5V	V_{IN} = V_{IL} or V_{IH}[5] I_{OL} = 24mA	0.36	0.44	0.44	V
		5.5V		0.36	0.44	0.44	
		4.5V	V_{IN} = V_{IL} or V_{IH}[5,6] I_{OL} = 75mA	-	-	1.65	V
		5.5V		-	-	1.65	

4. -55˚C ≤ T_J ≤ +125˚C **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

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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}	4.5V	I_{OUT} = 50µA	4.4	4.4	4.4	V
		5.5V		5.4	5.4	5.4	
		4.5V	V_{IN} = V_{IL} or V_{IH}[5] I_{OH} = -24mA	3.86	3.76	3.76	V
		5.5V		4.86	4.76	4.76	
Maximum Input Leakage Current	I_{IN}	5.5V	V_{IN} = V_{CC} or GND	±0.1	±1.0	±1.0	µA
Additional Maximum I_{CC} / Input	ΔI_{CCT}	5.5V	V_{IN} = V_{CC} -2.1V	0.6	1.5	1.5	mA
Minimum Dynamic Output Current[7]	I_{OLD}	5.5V	V_{OLD} = 1.65V Max	-	75	75	mA
	I_{OHD}	5.5V	V_{OHD} = 3.85V Min	-	-75	-75	
Maximum Quiescent Supply Leakage Current	I_{CC}	5.5V	V_{IN} = V_{CC} or GND I_{OUT} = 0µA	4	40	40	µA

7. Maximum test duration 2ms, one output loaded at a time.

AC Electrical Characteristics[8] V_{CC} = 5.0V ±0.5V

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)	t_{PLH}	5.0V	C_L = 50pF, Input tr = tf =3.0ns	9.5	10	10	ns
	t_{PHL}	5.0V		9.5	10.5	10.5	
Maximum Input Capacitance	C_{IN}	5.0V	T_J = 25°C	TYPICAL			pF
				4.5			
Power Dissipation Capacitance	C_{PD}	5.0V	T_J = 25°C, C_L = 50pF	35			pF

8. Not production tested in die form, characterized by chip design.

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Switching Waveform

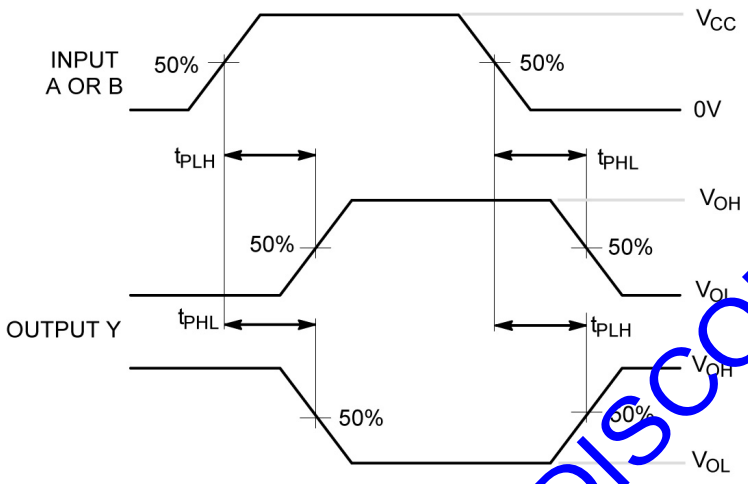
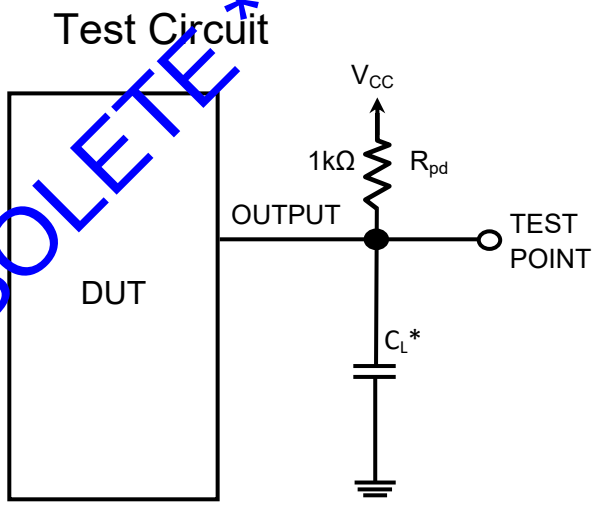


Figure 1 – Propagation Delay



* Includes all probe and jig capacitance

Figure 2

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