

**QUADRUPLE 2-INPUT EXCLUSIVE OR GATES**

**Description**

The 74LV86A provides provides four independent 2-input Exclusive OR gates with standard push-pull outputs. The device is designed for operation with a power supply range of 2.0V to 5.5V.

The inputs are tolerant to 5.5V allowing this device to be used in a mixed voltage environment. The device is fully specified for partial power down applications using I<sub>OFF</sub>. The I<sub>OFF</sub> circuitry disables the output preventing damaging current backflow when the device is powered down.

The gates perform the Boolean function:

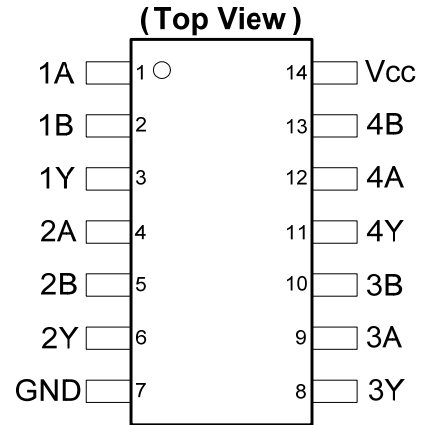
$$Y = A \oplus B \text{ or } Y = \overline{A}B + A\overline{B}$$

**Features**

- Wide Supply Voltage Range from 2.0V to 5.5V
- Sinks or sources 12mA at V<sub>CC</sub> = 4.5V
- CMOS low power consumption
- I<sub>OFF</sub> Supports Partial -Power Down Operation
- Inputs or Outputs accept up to 5.5V
- Inputs can be driven by 3.3V or 5V allowing for voltage translation applications.
- Schmitt Trigger Action at All Inputs
- ESD Protection Tested per JESD 22
  - Exceeds 200-V Machine Model (A115)
  - Exceeds 2000-V Human Body Model (A114)
  - Exceeds 1000-V Charged Device Model (C101)
- Latch-Up Exceeds 100mA per JESD 78, Class I
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

Notes: 1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.  
 2. See [http://www.diodes.com/quality/lead\\_free.html](http://www.diodes.com/quality/lead_free.html) for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.  
 3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

**Pin Assignments**



**SO-14 / TSSOP-14**

**Applications**

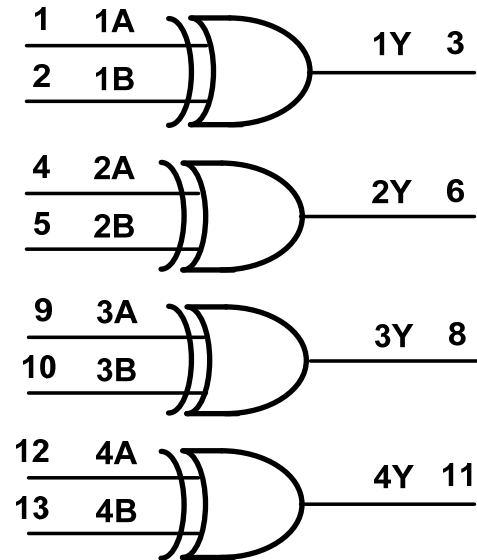
- General Purpose Logic
- Power Down Signal Isolation
- Wide array of products such as:
  - PCs, networking, notebooks, ultrabooks, netbooks
  - Computer peripherals, hard drives, CD/DVD ROM
  - TV, DVD, DVR, set top box

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**Pin Descriptions**

Pin Number	Pin Name	Description
1	1A	Data Input
2	1B	Data Input
3	1Y	Data Output
4	2A	Data Input
5	2B	Data Input
6	2Y	Data Output
7	GND	Ground
8	3Y	Data Output
9	3A	Data Input
10	3B	Data Input
11	4Y	Data Output
12	4A	Data Input
13	4B	Data Input
14	Vcc	Supply Voltage

**Logic Diagram**



**Function Table**

Inputs		Output
A	B	Y
L	L	L
L	H	H
H	L	H
H	H	L

**Absolute Maximum Ratings** (Note 4)

Symbol	Description	Rating	Unit
ESD HBM	Human Body Model ESD Protection	2	kV
ESD CDM	Charged Device Model ESD Protection	1	kV
ESD MM	Machine Model ESD Protection	200	V
V <sub>CC</sub>	Supply Voltage Range	-0.5 to 7.0	V
V <sub>I</sub>	Input Voltage Range note 4	-0.5 to 7.0	V
I <sub>IK</sub>	Input Clamp Current V <sub>I</sub> < 0V	-20	mA
I <sub>OK</sub>	Output Clamp Current V <sub>O</sub> < -0V	-50	mA
I <sub>O</sub>	Continuous Output Current - 0.5V < V <sub>O</sub> < V <sub>CC</sub> + 0.5V	+/- 25	mA
I <sub>CC</sub>	Continuous Current Through Vcc	50	mA
I <sub>GND</sub>	Continuous Current Through GND	-50	mA
T <sub>J</sub>	Operating Junction Temperature	-40 to 150	°C
T <sub>STG</sub>	Storage Temperature	-65 to 150	°C
P <sub>TOT</sub>	Total Power Dissipation	500	mW

Note: 4. Stresses beyond the absolute maximum may result in immediate failure or reduced reliability. These are stress values and device operation should be within recommend values.

**Recommended Operating Conditions** (Note 5)

Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>CC</sub>	Supply Voltage	–	2.0	5.5	V
V <sub>I</sub>	Input Voltage	–	0	5.5	V
V <sub>O</sub>	Output Voltage	–	0	V <sub>CC</sub>	V
I <sub>OH</sub>	High-Level Output Current	2.0V	–	-50	mA
		2.3V to 2.7V	–	-2	μA
		3.0V to 3.6V	–	-6	mA
		4.5V to 5.5V	–	-12	mA
I <sub>OL</sub>	Low-Level Output Current	2.0V	–	50	μA
		2.3V to 2.7V	–	2	mA
		3.0V to 3.6V	–	6	mA
		4.5V to 5.5V	–	12	mA
Δt/ΔV	Input Transition Rise or Fall Rate	2.3V to 2.7V	–	200	ns/V
		3.0V to 3.6V	–	100	
		4.5V to 5.5V	–	20	
T <sub>A</sub>	Operating Free-Air Temperature	–	-40	+125	°C

Note: 5. Unused inputs should be held at V<sub>CC</sub> or Ground.

**Electrical Characteristics**

Symbol	Parameter	Test Conditions	V <sub>cc</sub>	T <sub>A</sub> = -40 to +85°C		T <sub>A</sub> = -40 to +125°C		Unit
				Min	Max	Min	Max	
V <sub>IH</sub>	High-Level Input Voltage	–	2.0V	1.5	–	1.5	–	V
		–	2.3V to 2.7V	V <sub>CC</sub> X 0.7	–	V <sub>CC</sub> X 0.7	–	
		–	3.0V to 3.6V	V <sub>CC</sub> X 0.7	–	V <sub>CC</sub> X 0.7	–	
		–	4.5V to 5.5V	V <sub>CC</sub> X 0.7	–	V <sub>CC</sub> X 0.7	–	–
V <sub>IL</sub>	Low-Level Input Voltage	–	2.0V	–	0.5	–	0.5	V
		–	2.3V to 2.7V	–	V <sub>CC</sub> X 0.3	–	V <sub>CC</sub> X 0.3	
		–	3.0V to 3.6V	–	V <sub>CC</sub> X 0.3	–	V <sub>CC</sub> X 0.3	
		–	4.5V to 5.5V	–	V <sub>CC</sub> X 0.3	–	V <sub>CC</sub> X 0.3	–
V <sub>OH</sub>	High-Level Output Voltage	I <sub>OH</sub> = -50μA	2.0V to 5.5V	V <sub>CC</sub> -0.1	–	V <sub>CC</sub> -0.1	–	V
		I <sub>OH</sub> = -2mA	2.3V	2.0	–	2.0	–	
		I <sub>OH</sub> = -6mA	3.0V	2.48	–	2.48	–	
		I <sub>OH</sub> = -12mA	4.5V	3.8	–	3.8	–	
V <sub>OL</sub>	Low-Level Output Voltage	I <sub>OL</sub> = 50μA	2.0V to 5.5V	–	0.1	–	0.1	V
		I <sub>OL</sub> = 2mA	2.3V	–	0.4	–	0.4	
		I <sub>OL</sub> = 6mA	3.0V	–	0.44	–	0.44	
		I <sub>OL</sub> = 12mA	4.5V	–	0.55	–	0.55	
I <sub>OFF</sub>	Power Down Leakage Current	V <sub>I</sub> or V <sub>O</sub> = 0 to 5.5V	0V	–	5	–	5	μA
I <sub>I</sub>	Input Current	V <sub>I</sub> = GND or 5.5V	0 to 5.5V	–	±1	–	±1	μA
I <sub>CC</sub>	Supply Current	V <sub>I</sub> = GND or V <sub>CC</sub> I <sub>O</sub> = 0	5.5V	–	20	–	20	μA

### Switching Characteristics

Symbol	Parameter	Test Conditions	V <sub>CC</sub>	T <sub>A</sub> = +25°C			-40 to +85°C		-40 to +125°C		Unit
				Min	Typ.	Max	Min	Max	Min	Max	
t <sub>PD</sub>	Propagation Delay A <sub>N</sub> to Y <sub>N</sub>	Figure 1 C <sub>L</sub> = 15pF	2.5V ± 0.2V	-	7.9	17.6	1	21	1	22	ns
			3.3V ± 0.3V	-	5.5	11	1	13	1	14	
			5.0V ± 0.5V	-	3.7	6.8	1	8	1	9	
		Figure 1 C <sub>L</sub> = 50 pF	2.5V ± 0.2V	-	10.5	22.6	1	26.5	1	27.5	ns
			3.3V ± 0.3V	-	7.4	14.5	1	16.5	1	17.5	
			5.0V ± 0.5V	-	5.3	8.8	1	10	1	11	

### Operating Characteristics

T<sub>A</sub> = +25°C

Parameter		Test Conditions	V <sub>CC</sub>	TYP	Unit
C <sub>pd</sub>	Power Dissipation Capacitance per Gate	F = 10MHz C <sub>L</sub> = 50pF	3.3V	8.4	pF
			5.0V	8.8	

### Noise Characteristics

V<sub>CC</sub> = 3V, C<sub>L</sub> = 50pF T<sub>A</sub> = +25°C

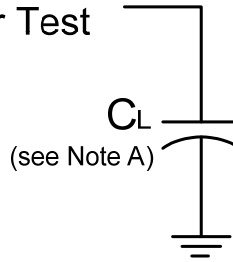
Symbol	Parameter	Min	Typ.	Max	Unit
V <sub>OL(p)</sub>	Quiet output, maximum dynamic V <sub>OL</sub>	-	0.2	0.8	V
V <sub>OL(V)</sub>	Quiet output, minimum dynamic V <sub>OL</sub>	-	-0.1	-0.8	V
V <sub>OH(V)</sub>	Quiet output, minimum dynamic V <sub>OH</sub>	-	3.1	-	V
V <sub>IH(D)</sub>	High Level dynamic input voltage	2.31	-	-	V
V <sub>IL(D)</sub>	Low Level dynamic input voltage	-	-	0.99	V

### Package Characteristics

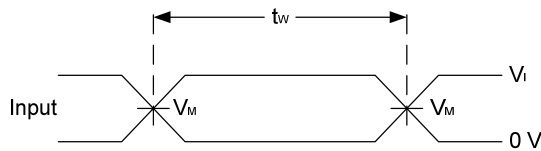
Symbol	Parameter	Test Conditions	V <sub>CC</sub>	Min	Typ.	Max	Unit
C <sub>i</sub>	Input Capacitance	V <sub>i</sub> = V <sub>CC</sub> – or GND	2.0 to 5.5V	-	3.3	10	pF

**Parameter Measurement Information**

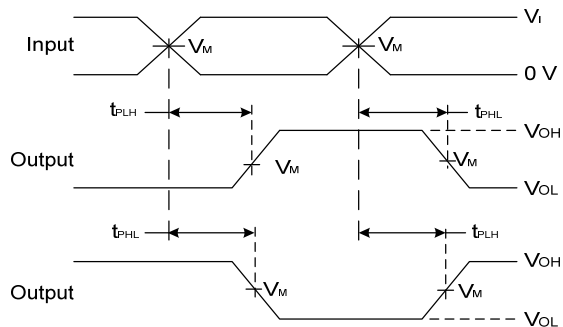
From Output Under Test



V <sub>CC</sub>	Inputs		V <sub>M</sub>	C <sub>L</sub>
	V <sub>I</sub>	t <sub>r</sub> /t <sub>f</sub>		
2.0V to 5.5V	V <sub>CC</sub>	<3ns	V <sub>CC</sub> /2	15pF or 50pF



**Voltage Waveform Pulse Duration**

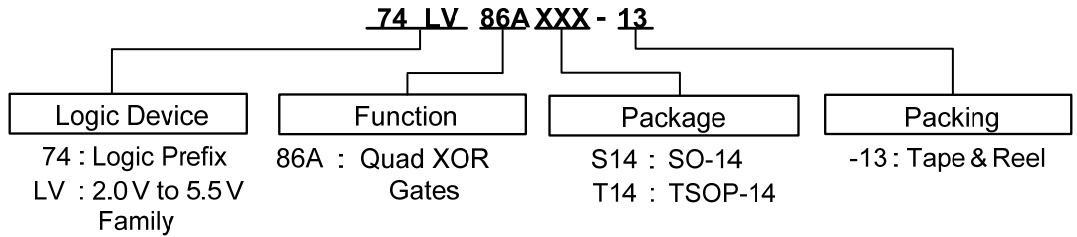


**Voltage Waveform Propagation Delay Times Inverting and Non Inverting Outputs**

- Notes:
- A . Includes test lead and test apparatus capacitance.
  - B. All pulses are supplied at pulse repetition rate ≤ 10MHz
  - C. Inputs are measured separately one transition per measurement
  - D. t<sub>PLH</sub> and t<sub>PHL</sub> are the same as t<sub>PD</sub>

**Figure 1. Load Circuit and Voltage Waveforms**

**Ordering Information**

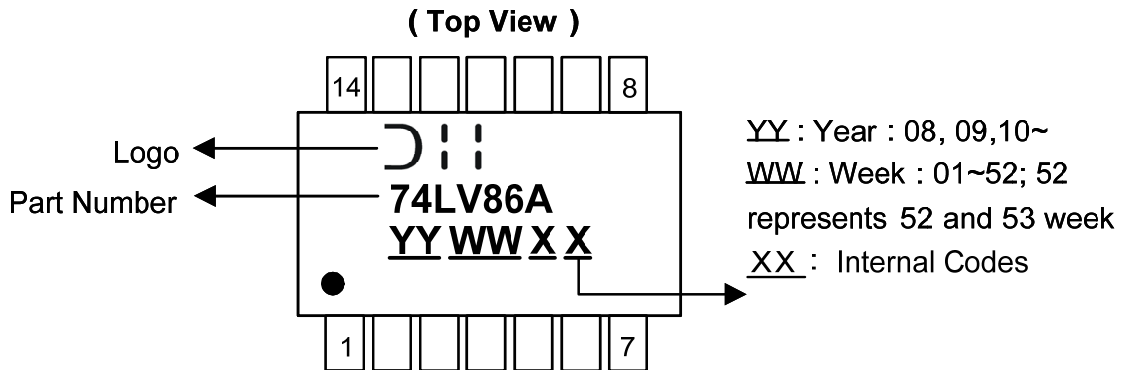


Device	Package Code	Packaging (Note 6)	13" Tape and Reel	
			Quantity	Part Number Suffix
74LV86AS14-13	S14	SO-14	2500/Tape & Reel	-13
74LV86AT14-13	T14	TSSOP-14	2500/Tape & Reel	-13

Note: 6. The taping orientation and tape details can be found at <http://www.diodes.com/datasheets/ap02007.pdf>

**Marking Information**

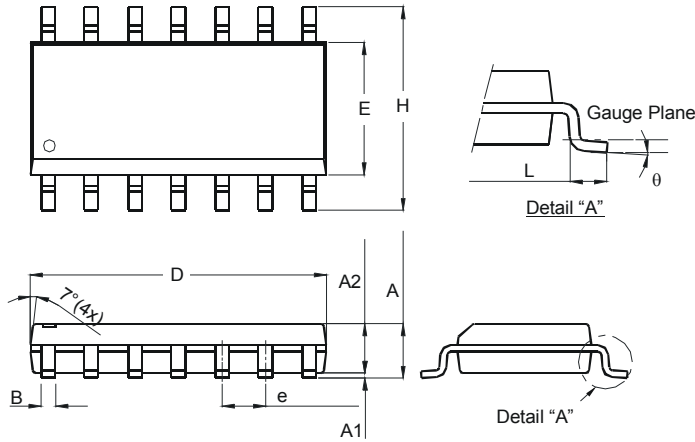
(1) SO14, TSSOP14



Part Number	Package
74LV86AS14	SO-14
74LV86AT14	TSSOP-14

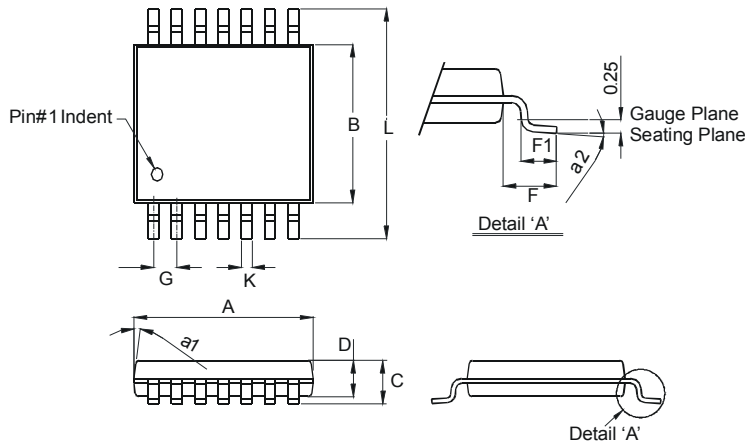
**Package Outline Dimensions (All Dimensions in mm)**

**Package Type: SO-14**



SO-14		
Dim	Min	Max
A	1.47	1.73
A1	0.10	0.25
A2	1.45 Typ	
B	0.33	0.51
D	8.53	8.74
E	3.80	3.99
e	1.27 Typ	
H	5.80	6.20
L	0.38	1.27
θ	0°	8°
<b>All Dimensions in mm</b>		

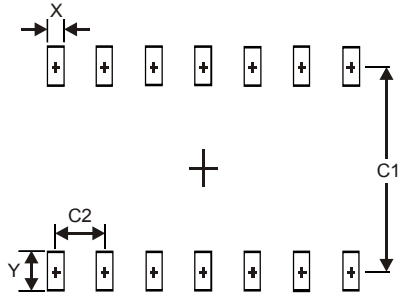
**Package Type: TSSOP-14**



TSSOP-14		
Dim	Min	Max
a1	7° (4X)	
a2	0°	8°
A	4.9	5.10
B	4.30	4.50
C	—	1.2
D	0.8	1.05
F	1.00 Typ	
F1	0.45	0.75
G	0.65 Typ	
K	0.19	0.30
L	6.40 Typ	
<b>All Dimensions in mm</b>		

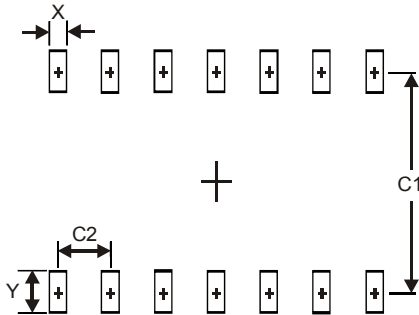
**Suggested Pad Layout**

Package Type: SO-14



Dimensions	Value (in mm)
X	0.60
Y	1.50
C1	5.4
C2	1.27

Package Type: TSSOP-14



Dimensions	Value (in mm)
X	0.45
Y	1.45
C1	5.9
C2	0.65



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