QUADRUPLE 2-INPUT EXCLUSIVE OR GATES

Description

The 74LVC86A provides four independent 2-input exclusive OR gates. The device is designed for operation with a power supply range of 1.65V 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 IOFF. The IOFF circuitry disables the output preventing damaging current backflow when the device is powered down.

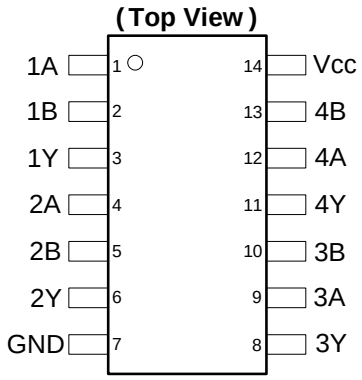
The gates perform the positive Boolean function:

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

Features

- Supply Voltage Range from 1.65V to 5.5V
- Sinks 24mA at V_{CC} = 3.3V
- CMOS low power consumption
- IOFF Supports Partial-Power-Down Mode Operation
- Inputs or outputs accept up to 5.5V
- Inputs can be driven by 3.3V or 5.5V allowing for voltage translation applications.
- ESD Protection Exceeds JESD 22
  - 200-V Machine Model (A115-A)
  - 2000-V Human Body Model (A114-A)
  - Latch-Up Exceeds 250mA per JESD 78, Class II
  - Exceeds 1000-V Charged Device Model (C101C)
- Range of Package Options SO-14 and TSSOP-14
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

Pin Assignments



SO-14 / TSSOP-14

Applications

- Voltage Level Shifting
- 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

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 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.

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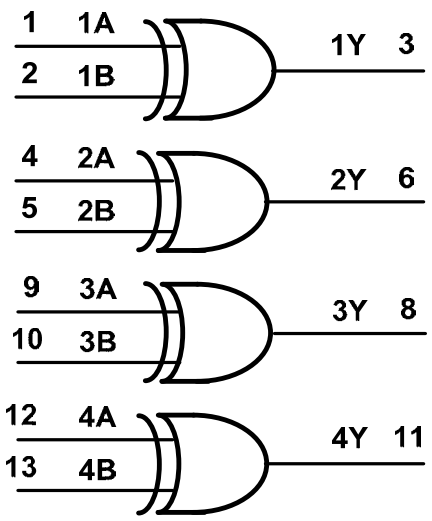
Pin Descriptions

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	V_{CC}	Supply Voltage

Logic Diagram



Function Table

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

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Absolute Maximum Ratings (Note 4) (@T_A = +25°C, unless otherwise specified.)

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_{CC}	Supply Voltage Range	-0.5 to 6.5	V
V_I	Input Voltage Range	-0.5 to 6.5	V
V_O	Voltage applied to output in high impedance or I_{OFF} state	-0.5 to 6.5	V
V_O	Voltage applied to output in high or low state	-0.3 to V_{CC} +0.5	V
I_{IK}	Input Clamp Current V_I <0	-50	mA
I_{OK}	Output Clamp Current V_O <0	-50	mA
I_O	Continuous output current	50	mA
I_{CC}, I_{GND}	Continuous current through Vcc or GND	±100	mA
T_J	Operating Junction Temperature	-40 to +150	°C
T_{STG}	Storage Temperature	-65 to +150	°C
P_{TOT}	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) (@T_A = +25°C, unless otherwise specified.)

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CC}	Supply Voltage		1.65	5.50	V
V_I	Input Voltage		0	5.5	V
V_O	Output Voltage	Active Mode	0	V_{CC}	V
		V_{CC} = 0V; Power Down Mode	0	5.5	V
Δt/ΔV	Input transition rise or fall rate	V_{CC} = 1.65V to 2.7V		20	ns/V
		V_{CC} = 2.7V to 5.5V		10	
T_A	Operating free-air temperature		-40	+125	°C

Note: 5. Unused inputs should be held at V_{CC} or Ground.

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Electrical Characteristics (@T_A = +25°C, unless otherwise specified.)

Symbol	Parameter	Test Conditions	V_{CC}	T_A = -40°C to +85°C		T_A = -40°C to +125°C		Unit
				Min	Max	Min	Max	
V_{IH}	High-level Input Voltage		1.65V to 1.95V	0.65 X V_{CC}		0.65 X V_{CC}		V
			2.3V to 2.7V	1.7		1.6		
			2.7V to 3.6V	2.0		2.0		
			4.5V to 5.5V	0.7 X V_{CC}		2.0		
V_{IL}	Low-level input voltage		1.65V to 1.95V		0.35 X V_{CC}		0.35 X V_{CC}	V
			2.3V to 2.7V		0.7		0.7	
			2.7V to 3.6V		0.8		0.8	
			4.5V to 5.5 V		0.3 X V_{CC}		0.3 X V_{CC}	
V_{OH}	High Level Output Voltage	I_{OH} = -100µA	1.65V to 3.6V	V_{CC} – 0.2		V_{CC} – 0.3		V
		I_{OH} = -4mA	1.65V	1.2				
		I_{OH} = -8mA	2.3V	1.9				
		I_{OH} = -12mA	2.7V	2.2		2.05		
			3.0V	2.3		2.1		
		I_{OH} = -24mA	3.0V	2.2		2.0		
V_{OL}	High-level Output Voltage	I_{OH} = 100µA	1.65V to 5.5V		0.2		0.3	V
		I_{OH} = 4mA	1.65V		0.45		0.6	
		I_{OH} = 8mA	2.3V		0.70		0.85	
		I_{OH} = 12mA	2.7V		0.40		0.6	
			3.0V		0.55		0.6	
		I_{OH} =-24mA	3.0V		0.55		0.6	
I_I	Input Current	V_I =GND to 5.5V	3.6V		±5		±20	µA
I_{OFF}	Power Down Leakage Current	V_I or V_O = 0V to 3.6V	0		10		20	µA
I_{CC}	Supply Current	V_I = GND or V_{CC} I_O=0	3.6V		10		40	µA
ΔI_{CC}	Additional Supply Current	One input at V_{CC} –0.6V Other	2.7V to 3.6V		500		5000	µA

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Switching Characteristics

Symbol	Parameter	Test Conditions	V_{CC}	T_A = +25°C			-40°C to +85°C		-40°C to +125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
t_{PD}	Propagation Delay A_N or B_N to Y_N	Figure 1	1.65V to1.95V	1.0	4.1	9.4	1.0	9.9	1.0	11.4	ns
			2.3V to 2.7V	1.0	2.9	7.1	1.0	7.6	1.0	9.7	
			2.7V	1.0	2.8	5.4	1.0	5.6	1.0	7.1	
			3.0V to 3.6V	1.0	2.5	4.4	1.0	4.6	1.0	5.8	
$t_{SK(0)}$	Output Skew Time		3.0V to 3.6V					1.0		1.5	ns

Operating Characteristics (@T_A = +25°C, unless otherwise specified.)

Parameter		Test Conditions	V_{CC} = 1.8V	V_{CC} = 2.5V	V_{CC} = 3.3V	Unit
			Typ	Typ	Typ	
C_{pd}	Power dissipation capacitance per gate	f = 10 MHz	6.4	7.4	8.4	pF
C_I	Input Capacitance	V_i = V_{CC} – or GND	4	4	4	pF

Package Characteristics

Symbol	Parameter	Test Conditions	V_{CC}	Min	Typ	Max	Unit
θ_{JA}	Thermal Resistance Junction-to-Ambient	SO-14	(Note 6)		TBD		°C/W
		TSSOP-14			159		
θ_{JC}	Thermal Resistance Junction-to-Case	SO-14	(Note 6)		TBD		°C/W
		TSSOP-14			25		

Note: 6. Test condition for SO-14 and TSSOP-14: Device mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.

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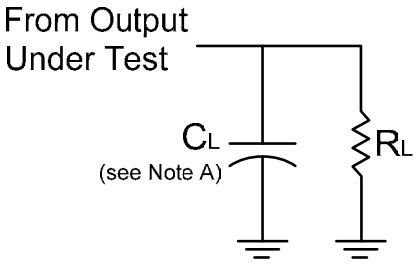
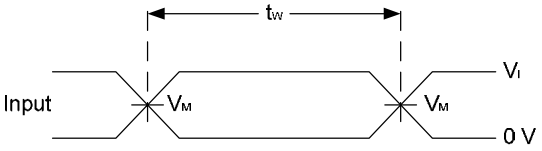
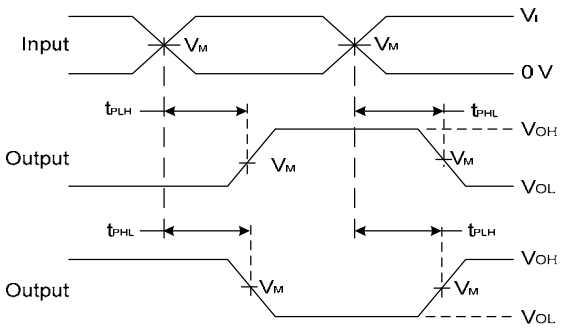
Parameter Measuement Information



V_{CC}	Inputs		V_M	C_L	R_L
	V_I	t_r/t_f			
1.8V±0.15V	V_{CC}	≤2ns	$V_{CC}/2$	30pF	1KΩ
2.5V±0.2V	V_{CC}	≤2ns	$V_{CC}/2$	30pF	500Ω
2.7V	2.7V	≤2.5ns	1.5V	50pF	500Ω
3.3V±0.3V	2.7V	≤2.5ns	1.5V	50pF	500Ω



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 ≤ 10 MHz
C. Inputs are measured separately one transition per measurement
D. t_{PLH} and t_{PHL} are the same as t_{PD}

Figure 1. Load Circuit and Voltage Waveforms

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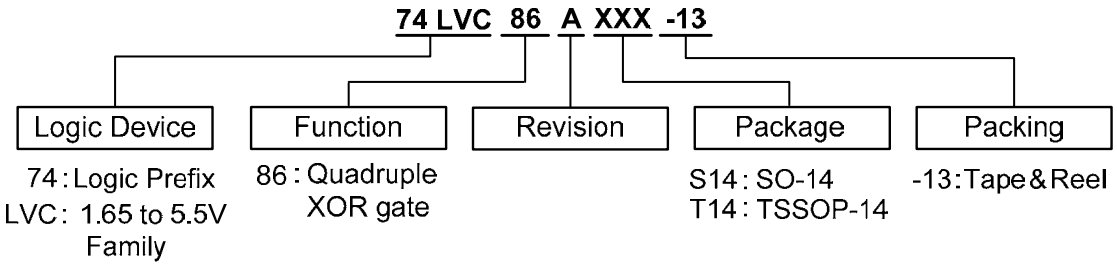
Ordering Information

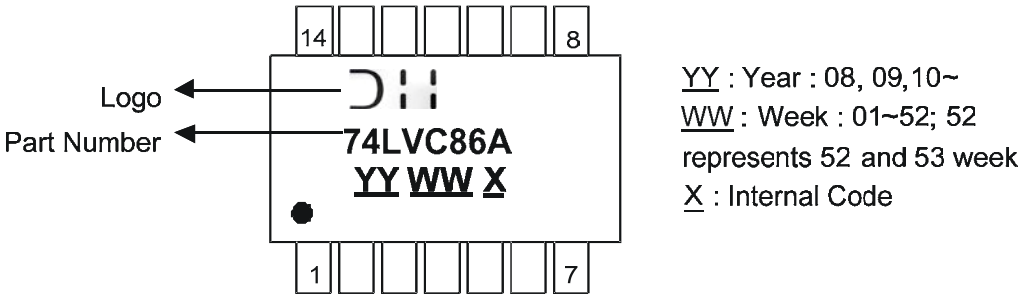


Device	Package Code	Packaging (Note 7)	13" Tape and Reel	
			Quantity	Part Number Suffix
74LVC86AS14-13	S14	SO-14	2500/Tape & Reel	-13
74LVC86AT14-13	T14	TSSOP-14	2500/Tape & Reel	-13

Notes: 7. The taping orientation and tape details can be found at http://www.diodes.com/datasheets/ap02007.pdf

Marking Information

(1) SO-14, TSSOP-14



Part Number	Package
74LVC86AS14	SO-14
74LVC86AT14	TSSOP-14

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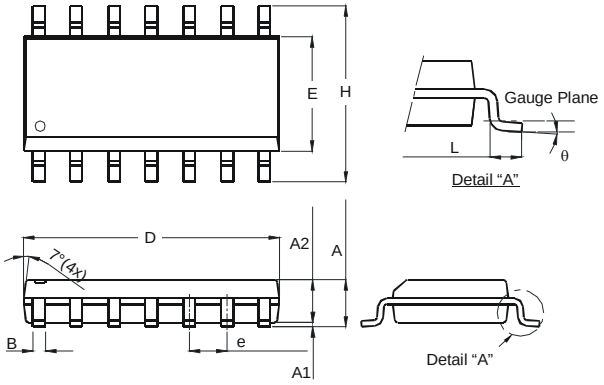
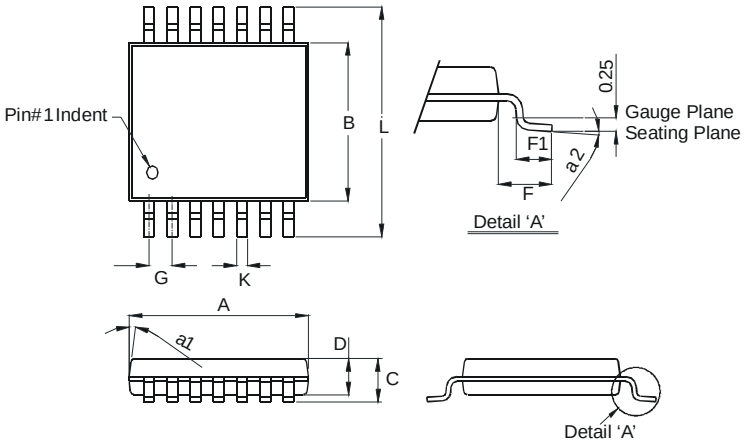
Package Outline Dimensions (All dimensions in mm.)

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°
All Dimensions in mm		

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	
All Dimensions in mm		

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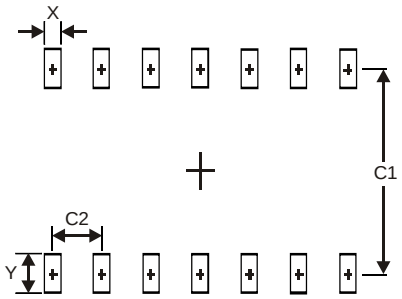
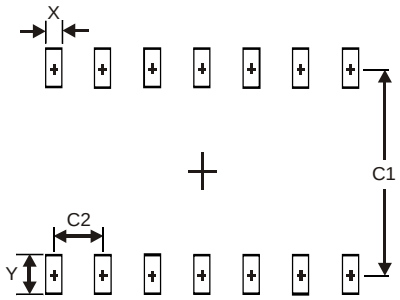
Suggested Pad Layout

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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