

# HD74HC1G86

2-input Exclusive-OR Gate

# HITACHI

ADE-205-300B (Z)  
3rd. Edition  
April 2001

## Description

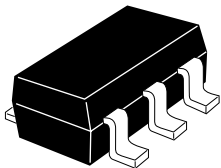
The HD74HC1G86 is high speed CMOS two input exclusive-OR gate using silicon gate CMOS process. With CMOS low power dissipation, it provides high speed equivalent to LS-TTL series. The internal circuit of three stages construction with buffer provides wide noise margin and stable output.

## Features

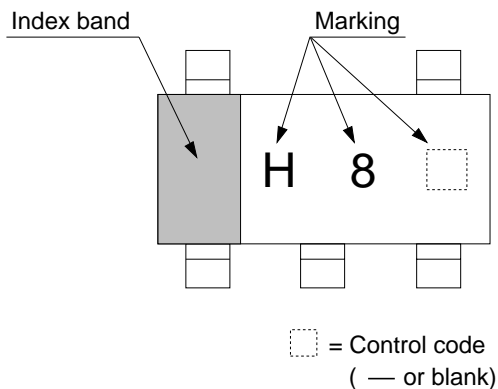
- The basic gate function is lined up as hitachi uni logic series.
- Supplied on emboss taping for high speed automatic mounting.
- Electrical characteristics equivalent to the HD74HC86
  - Supply voltage range : 2 to 6 V
  - Operating temperature range : -40 to +85°C
- $|I_{OH}| = I_{OL} = 2 \text{ mA (min)}$

## Outline and Article Indication

- HD74HC1G86



CMPAK-5



# HD74HC1G86

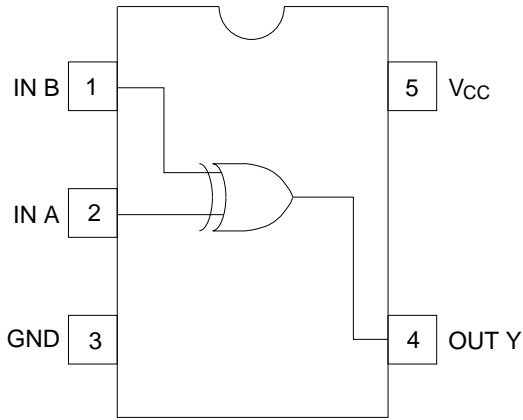
## Function Table

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

H : High level

L : Low level

## Pin Arrangement



(Top view)

**Absolute Maximum Ratings**

Item	Symbol	Ratings	Unit	Test Conditions
Supply voltage range	$V_{CC}$	-0.5 to 7.0	V	
Input voltage range <sup>*1</sup>	$V_I$	-0.5 to $V_{CC} + 0.5$	V	
Output voltage range <sup>*1,2</sup>	$V_O$	-0.5 to $V_{CC} + 0.5$	V	Output : H or L
Input clamp current	$I_{IK}$	$\pm 20$	mA	$V_I < 0$ or $V_I > V_{CC}$
Output clamp current	$I_{OK}$	$\pm 20$	mA	$V_O < 0$ or $V_O > V_{CC}$
Continuous output current	$I_O$	$\pm 25$	mA	$V_O = 0$ to $V_{CC}$
Continuous current through $V_{CC}$ or GND	$I_{CC}$ or $I_{GND}$	$\pm 25$	mA	
Maximum power dissipation $P_T$ at $T_a = 25^\circ\text{C}$ (in still air) <sup>*3</sup>		200	mW	
Storage temperature	$T_{stg}$	-65 to 150	$^\circ\text{C}$	

Notes: The absolute maximum ratings are values which must not individually be exceeded, and furthermore, no two of which may be realized at the same time.

1. The input and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
2. This value is limited to 5.5 V maximum.
3. The maximum package power dissipation was calculated using a junction temperature of  $150^\circ\text{C}$ .

**Recommended Operating Conditions**

Item	Symbol	Min	Max	Unit	Test Conditions
Supply voltage range	$V_{CC}$	2	6	V	
Input voltage range	$V_I$	0	$V_{CC}$	V	
Output voltage range	$V_O$	0	$V_{CC}$	V	
Output current	$I_{OL}$	—	2.0	mA	$V_{CC} = 4.5\text{ V}$
		—	2.6		$V_{CC} = 6.0\text{ V}$
	$I_{OH}$	—	-2.0	mA	$V_{CC} = 4.5\text{ V}$
		—	-2.6		$V_{CC} = 6.0\text{ V}$
Input rise / fall time (10% to 90%)	$t_r, t_f$	0	1000	ns	$V_{CC} = 2.0\text{ V}$
		0	500		$V_{CC} = 4.5\text{ V}$
		0	400		$V_{CC} = 6.0\text{ V}$
Operating temperature	$T_a$	-40	85	$^\circ\text{C}$	

Note: Unused or floating inputs must be held high or low.

## Electrical Characteristics

Item	Symbol	V <sub>CC</sub> (V)	T <sub>a</sub> = 25°C			T <sub>a</sub> = -40 to 85°C		Unit	Test Conditions		
			Min	Typ	Max	Min	Max				
Input voltage	V <sub>IH</sub>	2.0	1.5	—	—	1.5	—	V			
		4.5	3.15	—	—	3.15	—				
		6.0	4.2	—	—	4.2	—				
	V <sub>IL</sub>	2.0	—	—	0.5	—	0.5				
		4.5	—	—	1.35	—	1.35				
		6.0	—	—	1.8	—	1.8				
Output voltage	V <sub>OH</sub>	2.0	1.9	2.0	—	1.9	—	V	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OH</sub> = -20 μA	
		4.5	4.4	4.5	—	4.4	—				
		6.0	5.9	6.0	—	5.9	—				
		4.5	4.18	4.31	—	4.13	—				I <sub>OH</sub> = -2 mA
		6.0	5.68	5.80	—	5.63	—				I <sub>OH</sub> = -2.6 mA
		6.0	—	0.0	0.1	—	0.1				I <sub>OL</sub> = 20 μA
	V <sub>OL</sub>	4.5	—	0.0	0.1	—	0.1				
		6.0	—	0.0	0.1	—	0.1				
		4.5	—	0.17	0.26	—	0.33	I <sub>OL</sub> = 2 mA			
		6.0	—	0.18	0.26	—	0.33	I <sub>OL</sub> = 2.6 mA			
		Input current	I <sub>IN</sub>	6.0	—	—	±0.1	—	±1.0	μA	V <sub>IN</sub> = V <sub>CC</sub> or GND
		Operating current	I <sub>CC</sub>	6.0	—	—	1.0	—	10.0	μA	V <sub>IN</sub> = V <sub>CC</sub> or GND

**Switching Characteristics**

Item	Symbol	T <sub>a</sub> = 25°C			Unit	Test Conditions
		Min	Typ	Max		
Output rise / fall time	t <sub>TLH</sub>	—	4	8	ns	Test circuit
	t <sub>THL</sub>	—	4	8		
Propagation delay time	t <sub>PLH</sub>	—	10	17	ns	Test circuit
	t <sub>PHL</sub>	—	10	17		

(C<sub>L</sub> = 15 pF, t<sub>r</sub> = t<sub>f</sub> = 6 ns, V<sub>CC</sub> = 5 V)

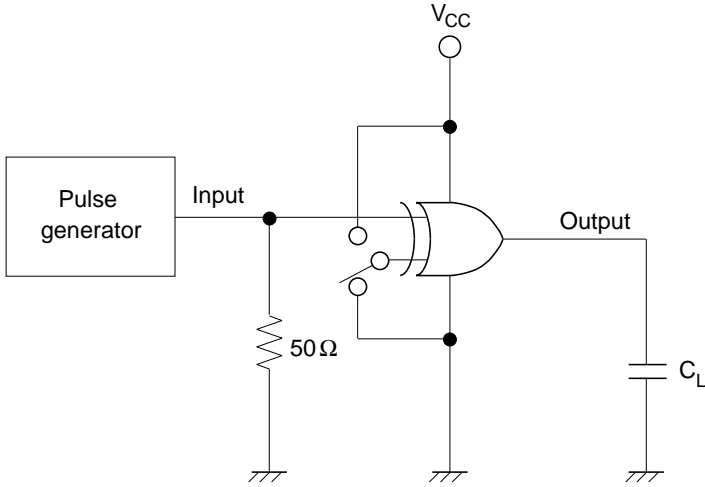
Item	Symbol	T <sub>a</sub> = 25°C			T <sub>a</sub> = -40 to 85°C		Unit	Test Conditions	
		V <sub>CC</sub>	Min	Typ	Max	Min			Max
Output rise / fall time	t <sub>TLH</sub>	2.0	—	50	125	—	155	ns	Test circuit
	t <sub>THL</sub>	4.5	—	14	25	—	31		
		6.0	—	12	21	—	26		
Propagation delay time	t <sub>PLH</sub>	2.0	—	48	100	—	125	ns	Test circuit
	t <sub>PHL</sub>	4.5	—	12	20	—	25		
		6.0	—	9	17	—	21		
Input capacitance	C <sub>IN</sub>	—	—	2.5	5	—	5	pF	
Equivalent capacitance	C <sub>PD</sub>	—	—	10	—	—	—	pF	

(C<sub>L</sub> = 50 pF, t<sub>r</sub> = t<sub>f</sub> = 6 ns)

Note: C<sub>PD</sub> is equivalent capacitance inside of the IC calculated from the operating current without load (see test circuit). The average operating current without load is calculated according to the expression below.

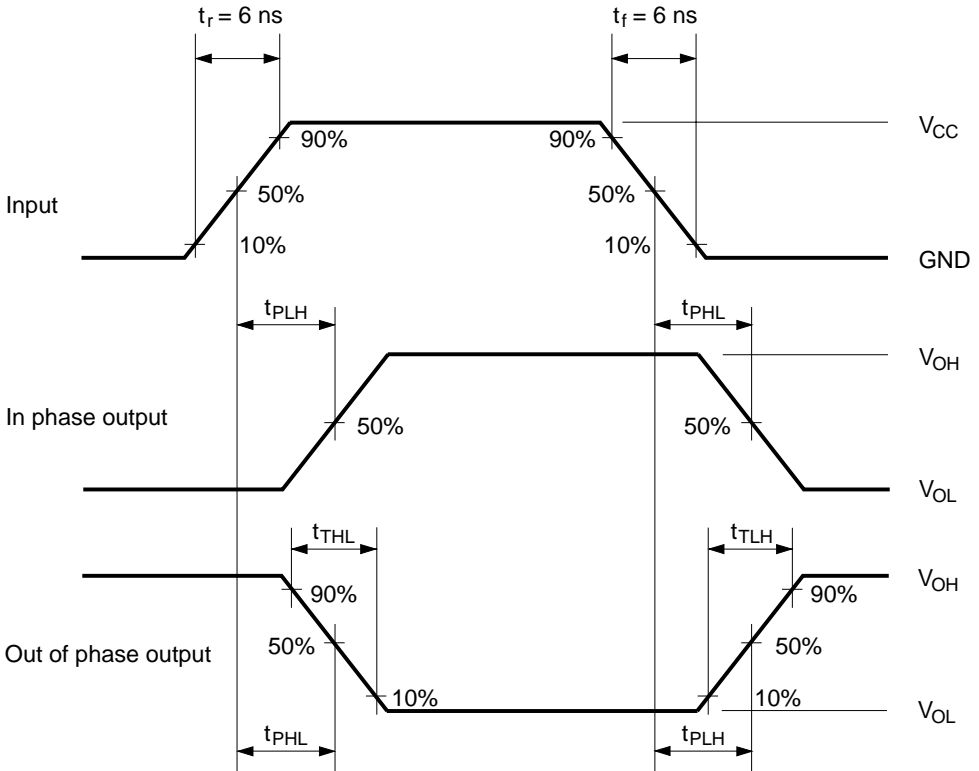
$$I_{CC}(\text{opr}) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$$

## Test Circuit



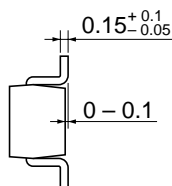
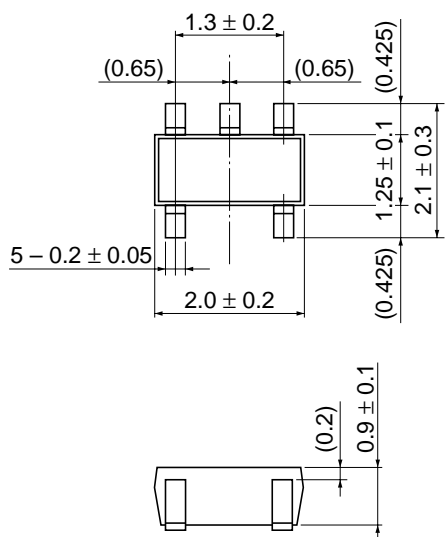
Note: 1.  $C_L$  includes probe and jig capacitance.

### • Waveforms



Package Dimensions

As of January, 2001  
Unit: mm



Hitachi Code	CMPAK-5
JEDEC	—
EIAJ	Conforms
Mass (reference value)	0.006 g

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