

# HD74ALVC1G79

Single Positive Edge-triggered D-type Flip Flop

## HITACHI

ADE-205-637A (Z)

Rev.1  
August 2001

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### Description

The HD74ALVC1G79 has D-type flip flop in a 5 pin package. The input data is transferred to the output at the rising edge of clock pulse CLK. Low voltage and high speed operation is suitable for the battery powered products (e.g., notebook computers), and the low power consumption extends the battery life.

### Features

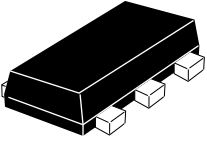
- The basic gate function is lined up as hitachi uni logic series.
- Supplied on emboss taping for high speed automatic mounting.
- Supply voltage range : 1.2 to 3.6 V  
Operating temperature range : -40 to +85°C
- All inputs  $V_{IH}$  (Max.) = 3.6 V (@ $V_{CC}$  = 0 V to 3.6 V)  
All outputs  $V_O$  (Max.) = 3.6 V (@ $V_{CC}$  = 0 V)
- Output current      $\pm 2$  mA (@ $V_{CC}$  = 1.2 V)  
                           $\pm 4$  mA (@ $V_{CC}$  = 1.4 V to 1.6 V)  
                           $\pm 6$  mA (@ $V_{CC}$  = 1.65 V to 1.95 V)  
                           $\pm 18$  mA (@ $V_{CC}$  = 2.3 V to 2.7 V)  
                           $\pm 24$  mA (@ $V_{CC}$  = 3.0 V to 3.6 V)
- Package type

Package type	Package code	Package suffix	Taping code
VSON-5 pin	TNP-5D	VS	E (3,000 pcs / Reel)

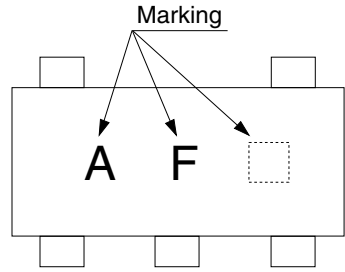
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## Outline and Article Indication

- HD74ALVC1G79



VSON-5



□ = Control code

## Function Table

### Inputs

CLK	D	Output Q
↑	H	H
↑	L	L
L	X	Q <sub>0</sub>

H: High level

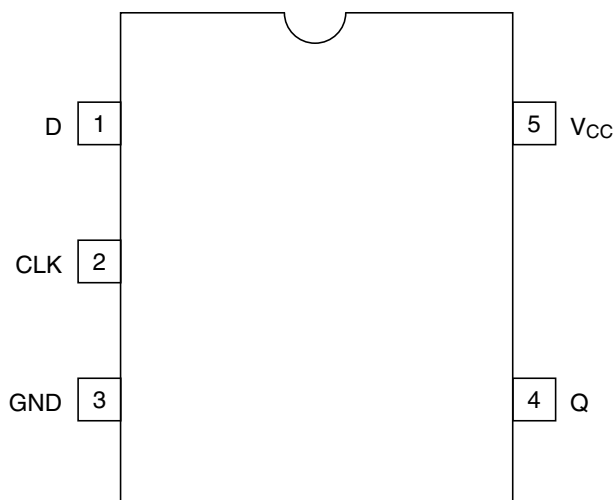
L: Low level

X: Immaterial

↑: Low to high transition

Q<sub>0</sub>: Level of Q before the indicated steady input conditions were established.

**Pin Arrangement**



(Top view)

**Absolute Maximum Ratings**

Item	Symbol	Ratings	Unit	Conditions
Supply voltage range	$V_{CC}$	-0.5 to 4.6	V	
Input voltage range <sup>1</sup>	$V_I$	-0.5 to 4.6	V	
Output voltage range <sup>1,2</sup>	$V_O$	-0.5 to $V_{CC}+0.5$ -0.5 to 4.6	V	Output : H or L $V_{CC}$ : OFF
Input clamp current	$I_{IK}$	-50	mA	$V_I < 0$
Output clamp current	$I_{OK}$	$\pm 50$	mA	$V_O < 0$ or $V_O > V_{CC}$
Continuous output current	$I_O$	$\pm 50$	mA	$V_O = 0$ to $V_{CC}$
Continuous current through $V_{CC}$ or GND	$I_{CC}$ or $I_{GND}$	$\pm 100$	mA	
Maximum power dissipation at $T_a = 25^\circ\text{C}$ (in still air) <sup>3</sup>	$P_T$	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 4.6 V maximum.
  3. The maximum package power dissipation was calculated using a junction temperature of 150 $^\circ\text{C}$ .

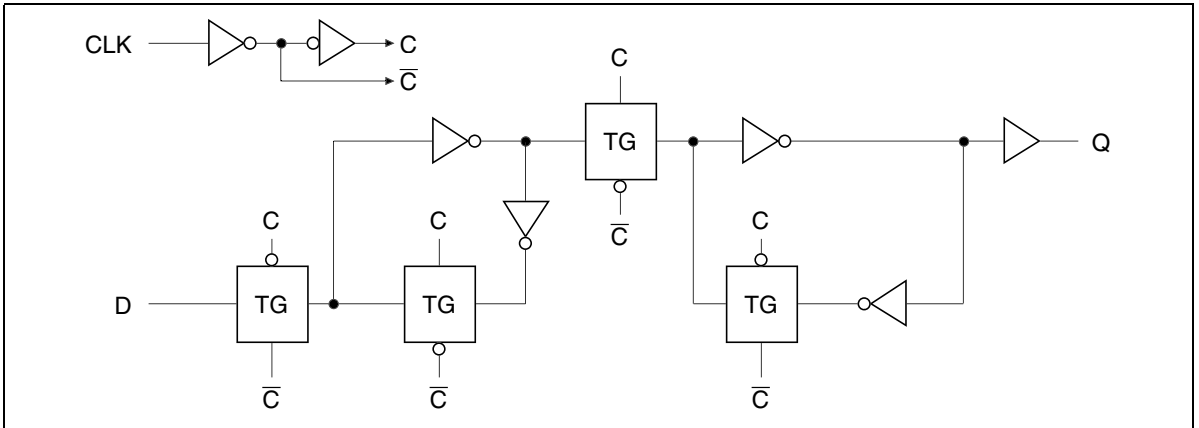
# HD74ALVC1G79

## Recommended Operating Conditions

Item	Symbol	Min	Max	Unit	Conditions
Supply voltage range	$V_{CC}$	1.2	3.6	V	
Input voltage range	$V_I$	0	3.6	V	
Output voltage range	$V_O$	0	$V_{CC}$	V	
Output current	$I_{OH}$	—	-2	mA	$V_{CC} = 1.2\text{ V}$
		—	-4		$V_{CC} = 1.4\text{ V}$
		—	-6		$V_{CC} = 1.65\text{ V}$
		—	-18		$V_{CC} = 2.3\text{ V}$
		—	-24		$V_{CC} = 3.0\text{ V}$
	$I_{OL}$	—	2		$V_{CC} = 1.2\text{ V}$
		—	4		$V_{CC} = 1.4\text{ V}$
		—	6		$V_{CC} = 1.65\text{ V}$
		—	18		$V_{CC} = 2.3\text{ V}$
		—	24		$V_{CC} = 3.0\text{ V}$
Input transition rise or fall rate	$\Delta t / \Delta v$	0	20	ns / V	$V_{CC} = 1.2\text{ to }2.7\text{ V}$
		0	10		$V_{CC} = 3.3 \pm 0.3\text{ V}$
Operating free-air temperature	$T_a$	-40	85	°C	

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

## Logic Diagram



Electrical Characteristics

(Ta = -40 to 85°C)

Item	Symbol	V <sub>cc</sub> (V)†	Min	Typ	Max	Unit	Test conditions		
Input voltage	V <sub>IH</sub>	1.2	V <sub>cc</sub> ×0.75	—	—	V			
		1.4 to 1.6	V <sub>cc</sub> ×0.7	—	—				
		1.65 to 1.95	V <sub>cc</sub> ×0.7	—	—				
		2.3 to 2.7	1.7	—	—				
		3.0 to 3.6	2.0	—	—				
	V <sub>IL</sub>	1.2	—	—	V <sub>cc</sub> ×0.25				
		1.4 to 1.6	—	—	V <sub>cc</sub> ×0.3				
		1.65 to 1.95	—	—	V <sub>cc</sub> ×0.3				
		2.3 to 2.7	—	—	0.7				
		3.0 to 3.6	—	—	0.8				
Output voltage	V <sub>OH</sub>	Min to Max	V <sub>cc</sub> -0.2	—	—	V	I <sub>OH</sub> = -100 μA		
		1.2	0.9	—	—		I <sub>OH</sub> = -2 mA		
		1.4	1.1	—	—		I <sub>OH</sub> = -4 mA		
		1.65	1.2	—	—		I <sub>OH</sub> = -6 mA		
		2.3	1.7	—	—		I <sub>OH</sub> = -18 mA		
		3.0	2.2	—	—		I <sub>OH</sub> = -24 mA		
	V <sub>OL</sub>	Min to Max	—	—	0.2	I <sub>OL</sub> = 100 μA			
		1.2	—	—	0.3	I <sub>OL</sub> = 2 mA			
		1.4	—	—	0.3	I <sub>OL</sub> = 4 mA			
		1.65	—	—	0.3	I <sub>OL</sub> = 6 mA			
		2.3	—	—	0.55	I <sub>OL</sub> = 18 mA			
		3.0	—	—	0.55	I <sub>OL</sub> = 24 mA			
		Input current	I <sub>IN</sub>	3.6	—	—	±5	μA	V <sub>IN</sub> = 3.6 V or GND
		Quiescent supply current	I <sub>CC</sub>	3.6	—	—	10	μA	V <sub>IN</sub> = V <sub>cc</sub> or GND, I <sub>O</sub> = 0
Output leakage current	I <sub>OFF</sub>	0	—	—	5	μA	V <sub>IN</sub> or V <sub>O</sub> = 0 to 3.6 V		
Input capacitance	C <sub>IN</sub>	3.3	—	4.0	—	pF	V <sub>IN</sub> = V <sub>cc</sub> or GND		

Note: For conditions shown as Min or Max, use the appropriate values under recommended operating conditions.

## Switching Characteristics

( $T_a = -40$  to  $85^\circ\text{C}$ )

- $V_{CC} = 1.2\text{ V}$

Item	Symbol	Min	Typ	Max	Unit	Test conditions	FROM (Input)	TO (Output)
Maximum clock frequency	$f_{\max}$	—	200	—	MHz	$C_L = 15\text{ pF}$		
Propagation delay time	$t_{\text{PLH}}$ $t_{\text{PHL}}$	—	7.0	—	ns	$C_L = 15\text{ pF}$	CLK	Q
Setup time	$t_{\text{su}}$	—	4.5	—	ns		D	
Hold time	$t_{\text{h}}$	—	-4.5	—	ns			
Pulse width	$t_{\text{w}}$	—	2.0	—	ns		CLK "H" or "L"	

- $V_{CC} = 1.5 \pm 0.1\text{ V}$

Item	Symbol	Min	Typ	Max	Unit	Test conditions	FROM (Input)	TO (Output)
Maximum clock frequency	$f_{\max}$	100	350	—	MHz	$C_L = 15\text{ pF}$		
Propagation delay time	$t_{\text{PLH}}$ $t_{\text{PHL}}$	2.0	—	8.0	ns	$C_L = 15\text{ pF}$	CLK	Q
Setup time	$t_{\text{su}}$	4.5	—	—	ns		D	
Hold time	$t_{\text{h}}$	0.0	—	—	ns			
Pulse width	$t_{\text{w}}$	3.5	—	—	ns		CLK "H" or "L"	

- $V_{CC} = 1.8 \pm 0.15\text{ V}$

Item	Symbol	Min	Typ	Max	Unit	Test conditions	FROM (Input)	TO (Output)
Maximum clock frequency	$f_{\max}$	160	350	—	MHz	$C_L = 30\text{ pF}$		
Propagation delay time	$t_{\text{PLH}}$ $t_{\text{PHL}}$	1.5	—	7.0	ns	$C_L = 30\text{ pF}$	CLK	Q
Setup time	$t_{\text{su}}$	3.5	—	—	ns		D	
Hold time	$t_{\text{h}}$	0.0	—	—	ns			
Pulse width	$t_{\text{w}}$	2.5	—	—	ns		CLK "H" or "L"	

**Switching Characteristics (cont)**

- $V_{CC} = 2.5 \pm 0.2$  V

Item	Symbol	Min	Typ	Max	Unit	Test conditions	FROM (Input)	TO (Output)
Maximum clock frequency	$f_{max}$	160	400	—	MHz	$C_L = 30$ pF		
Propagation delay time	$t_{PLH}$ $t_{PHL}$	1.0	—	4.0	ns	$C_L = 30$ pF	CLK	Q
Setup time	$t_{su}$	2.5	—	—	ns		D	
Hold time	$t_h$	0.0	—	—	ns			
Pulse width	$t_w$	2.5	—	—	ns		CLK "H" or "L"	

- $V_{CC} = 3.3 \pm 0.3$  V

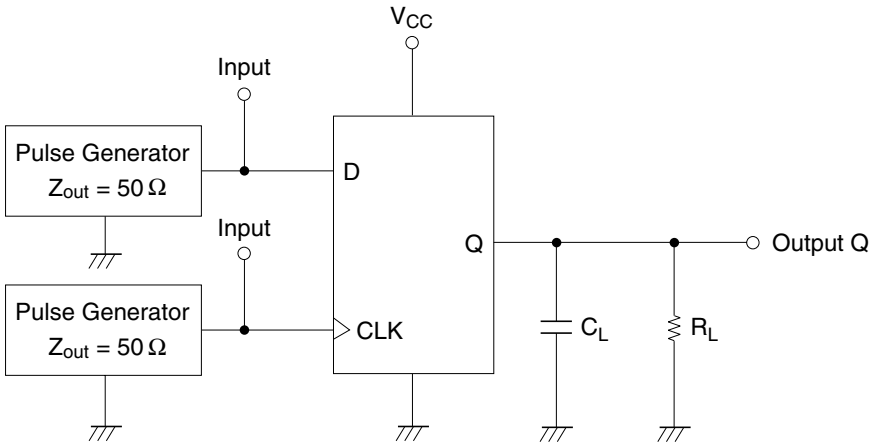
Item	Symbol	Min	Typ	Max	Unit	Test conditions	FROM (Input)	TO (Output)
Maximum clock frequency	$f_{max}$	200	450	—	MHz	$C_L = 30$ pF		
Propagation delay time	$t_{PLH}$ $t_{PHL}$	1.0	—	3.0	ns	$C_L = 30$ pF	CLK	Q
Setup time	$t_{su}$	2.0	—	—	ns		D	
Hold time	$t_h$	0.0	—	—	ns			
Pulse width	$t_w$	2.0	—	—	ns		CLK "H" or "L"	

**Operating Characteristics**

( $T_a = 25^\circ\text{C}$ )

Item	Symbol	$V_{CC}$ (V)	Min	Typ	Max	Unit	Test conditions
Power dissipation capacitance	$C_{PD}$	1.5	—	7.5	—	pF	$f = 10$ MHz
		1.8	—	7.5	—		
		2.5	—	8.0	—		
		3.3	—	11.0	—		

## Test Circuit

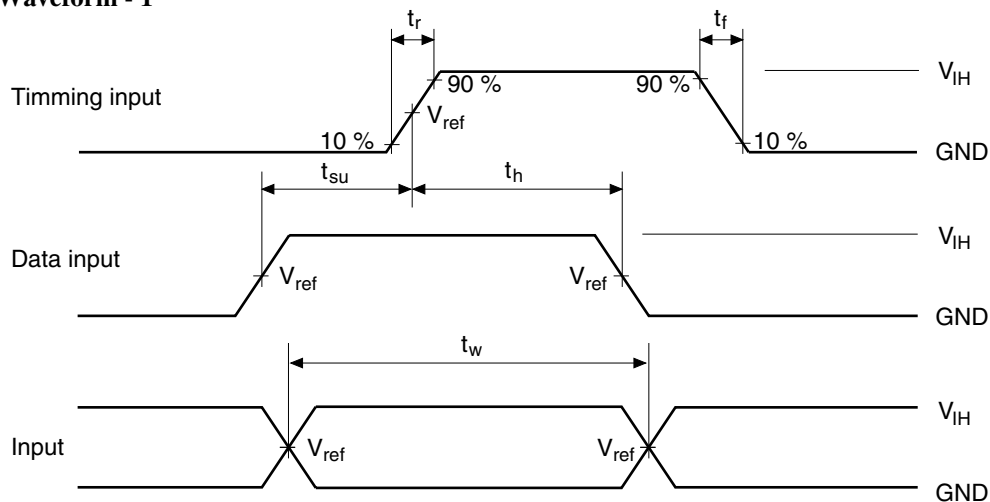


Symbol	$V_{CC} = 1.2 \text{ V},$ $1.5 \pm 0.1 \text{ V}$	$V_{CC} = 1.8 \pm 0.15 \text{ V}$	$V_{CC} = 2.5 \pm 0.2 \text{ V},$ $3.3 \pm 0.3 \text{ V}$
$R_L$	2.0 k $\Omega$	1.0 k $\Omega$	500 $\Omega$
$C_L$	15 pF	30 pF	30 pF

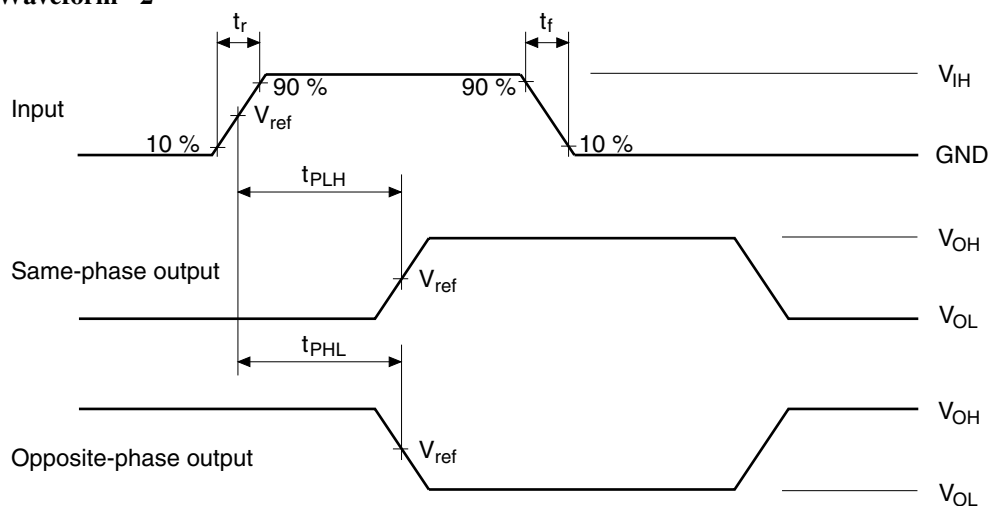
Note:  $C_L$  includes probe and jig capacitance.



• **Waveform - 1**



• **Waveform - 2**

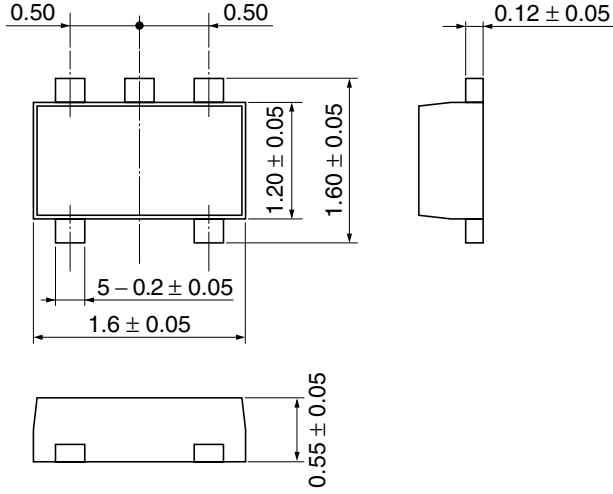


Symbol	$V_{CC} = 1.2 \text{ V},$ $1.5 \pm 0.1 \text{ V},$ $1.8 \pm 0.15 \text{ V}$	$V_{CC} = 2.5 \pm 0.2 \text{ V}$	$V_{CC} = 3.3 \pm 0.3 \text{ V}$
$t_r / t_f$	2.0 ns	2.5 ns	2.5 ns
$V_{IH}$	$V_{CC}$	$V_{CC}$	2.7 V
$V_{ref}$	50%	50%	1.5 V

Note: Input waveform : PRR = 10 MHz, duty cycle 50%

## Package Dimensions

As of January, 2001  
Unit: mm



Hitachi Code	TNP-5D
JEDEC	—
EIAJ	—
Mass (reference value)	—

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