HD74ALVCH16374

16-bit D-type Flip Flops with 3-state Outputs

HITACHI

ADE-205-123B (Z)
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Description

The HD74ALVCH16374 has sixteen edge trigger D type flip flops with three state outputs in a 48 pin package. Data at the D inputs meeting set up requirements, are transferred to the Q outputs on positive going transitions of the clock input. When the latch enable goes low, data at the D inputs will be retained at the outputs until latch enable returns high again. When a high logic level is applied to the output control input, all outputs go to a high impedance state, regardless of what signals are present at the other inputs and the state of the storage elements. Low voltage and high speed operation is suitable at the battery drive product (note type personal computer) and low power consumption extends the life of a battery for long time operation.

Features

- V_{CC} = 2.3 V to 3.6 V
- Typical V_{OL} ground bounce < 0.8 V (@V_{CC} = 3.3 V, Ta = 25°C)
- Typical V_{OH} undershoot > 2.0 V (@V_{CC} = 3.3 V, Ta = 25°C)
- High output current ±24 mA (@V_{CC} = 3.0 V)
- Bus hold on data inputs eliminates the need for external pullup / pulldown resistors.

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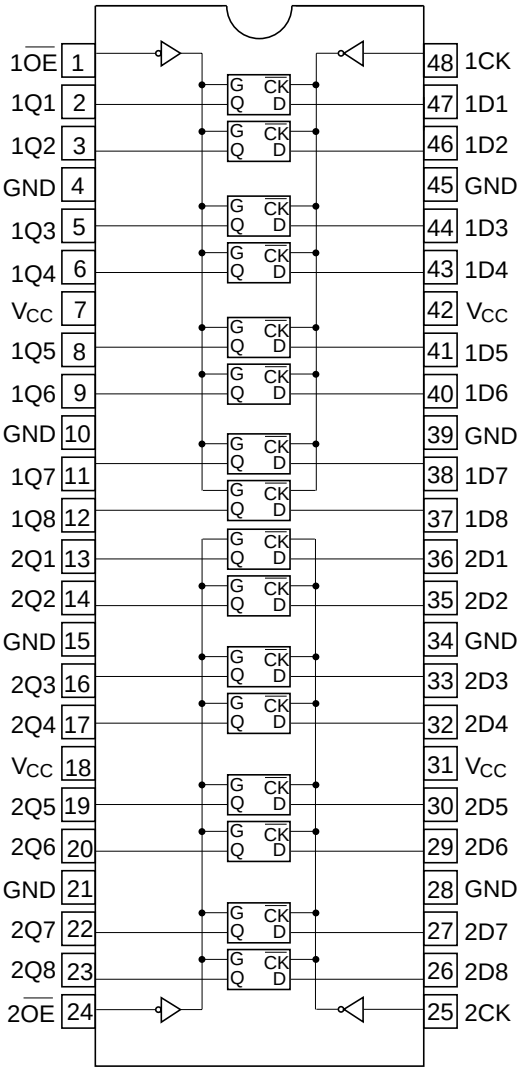
Function Table

Inputs			
$\overline{OE}$	CK	D	Output Q
H	X	X	Z
L	↑	L	L
L	↑	H	H
L	H or L	X	Q_0

H : High level
L : Low level
X : Immaterial
Z : High impedance
↑ : Low to high transition
Q_0 : 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 [*1]	V_I	–0.5 to 4.6	V	
Output voltage [*1, 2]	V_O	–0.5 to V_{CC}+0.5	V	
Input clamp current	I_{IK}	–50	mA	$V_I < 0$
Output clamp current	I_{OK}	±50	mA	$V_O < 0$ or $V_O > V_{CC}$
Continuous output current	I_O	±50	mA	V_O = 0 to V_{CC}
V_{CC}, GND current / pin	I_{CC} or I_{GND}	±100	mA	
Maximum power dissipation at Ta = 55°C (in still air) [*3]	P_T	0.85	W	TSSOP
Storage temperature	Tstg	–65 to +150	°C	

Notes: Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute maximum rated conditions for extended periods may affect device reliability.

1. The input and output negative 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 is calculated using a junction temperature of 150°C and a board trace length of 750 mils.

Recommended Operating Conditions

Item	Symbol	Ratings	Unit	Conditions
Supply voltage	V_{CC}	2.3 to 3.6	V	
Input / Output voltage	V_I	0 to V_{CC}	V	$\overline{OE}$, CK, D
	V_O	0 to V_{CC}	V	Q
Operating temperature	Ta	–40 to 85	°C	
Output current	I_{OH}	–12	mA	V_{CC} = 2.3 V
		–12	mA	V_{CC} = 2.7 V
		–24	mA	V_{CC} = 3.0 V
	I_{OL}	12	mA	V_{CC} = 2.3 V
		12	mA	V_{CC} = 2.7 V
		24	mA	V_{CC} = 3.0 V
Input rise / fall time	t_r, t_f	10	ns/V	

Note: Unused or floating control pins must be held high or low.

Electrical Characteristics

Item	Symbol	V_{CC} (V)*1	Ta = –40 to 85°C Min	Max	Unit	Test Conditions
Input voltage	V_{IH}	2.3 to 2.7	1.7	—	V	
		2.7 to 3.6	2.0	—	V	
	V_{IL}	2.3 to 2.7	—	0.7	V	
		2.7 to 3.6	—	0.8	V	
Output voltage	V_{OH}	Min to Max	V_{CC}–0.2	—	V	I_{OH} = –100 µA
		2.3	2.0	—	V	I_{OH} = –6 mA, V_{IH} = 1.7 V
		2.3	1.7	—	V	I_{OH} = –12 mA, V_{IH} = 1.7 V
		2.7	2.2	—	V	I_{OH} = –12 mA, V_{IH} = 2.0 V
		3.0	2.4	—	V	I_{OH} = –12 mA, V_{IH} = 2.0 V
		3.0	2.0	—	V	I_{OH} = –24 mA, V_{IH} = 2.0 V
	V_{OL}	Min to Max	—	0.2	V	I_{OL} = 100 µA
		2.3	—	0.4	V	I_{OL} = 6 mA, V_{IL} = 0.7 V
		2.3	—	0.7	V	I_{OL} = 12 mA, V_{IL} = 0.7 V
		2.7	—	0.4	V	I_{OL} = 12 mA, V_{IL} = 0.8 V
		3.0	—	0.55	V	I_{OL} = 24 mA, V_{IL} = 0.8 V
Input current	I_{IN}	3.6	—	±5.0	µA	V_{IN} = V_{CC} or GND
	$I_{IN(hold)}$	2.3	45	—	µA	V_{IN} = 0.7 V
		2.3	–45	—	µA	V_{IN} = 1.7 V
		3.0	75	—	µA	V_{IN} = 0.8 V
		3.0	–75	—	µA	V_{IN} = 2.0 V
		3.6	—	±500	µA	V_{IN} = 0 to 3.6 V
Off state output current *2	I_{OZ}	3.6	—	±10	µA	V_{OUT} = V_{CC} or GND
Quiescent supply current	I_{CC}	3.6	—	40	µA	V_{IN} = V_{CC} or GND
	ΔI_{CC}	3.0 to 3.6	—	750	µA	One input at (V_{CC}–0.6)V, other inputs at V_{CC} or GND

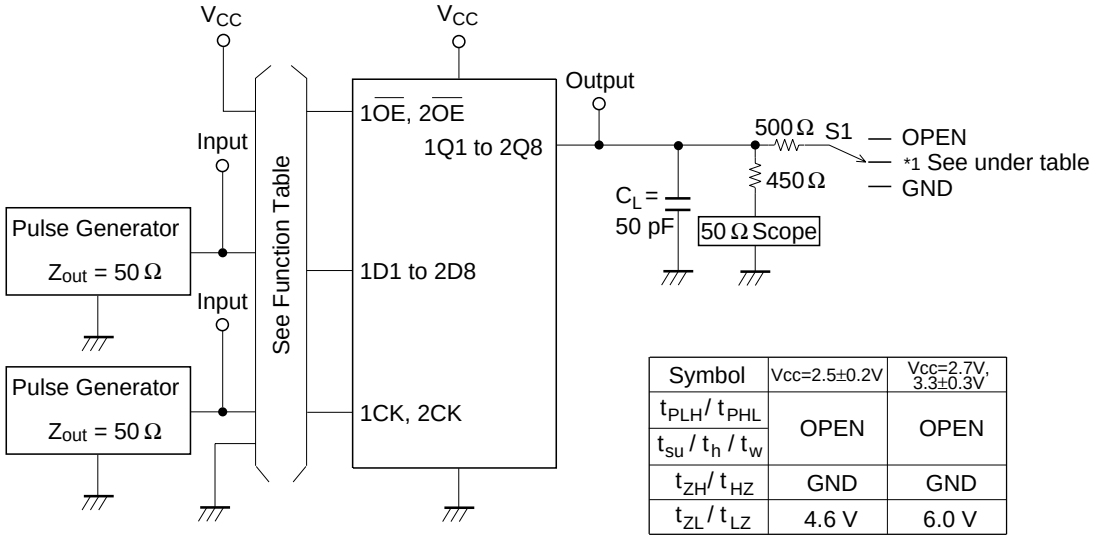
Notes: 1. For conditions shown as Min or Max, use the appropriate values under recommended operating conditions.

2. For I/O ports, the parameter I_{OZ} includes the input leakage current.

Switching Characteristics

			Ta = –40 to 85°C					
Item	**Symbol**	**V_{CC} (V)**	**Min**	**Typ**	**Max**	**Unit**	**From (Input)**	**To (Output)**
Maximum clock	f_{max}	2.5±0.2	150	—	—	MHz		
frequency		2.7	150	—	—	MHz		
		3.3±0.3	150	—	—	MHz		
Propagation delay time	t_{PLH}	2.5±0.2	1.0	—	5.3	ns	CK	Q
	t_{PHL}	2.7	—	—	4.9	ns		
		3.3±0.3	1.0	—	4.2	ns		
Output enable time	t_{ZH}	2.5±0.2	1.0	—	6.2	ns	$\overline{OE}$	Q
	t_{ZL}	2.7	—	—	5.9	ns		
		3.3±0.3	1.0	—	4.8	ns		
Output disable time	t_{HZ}	2.5±0.2	1.7	—	5.3	ns	$\overline{OE}$	Q
	t_{LZ}	2.7	—	—	4.7	ns		
		3.3±0.3	1.2	—	4.3	ns		
Setup time	t_{su}	2.5±0.2	2.1	—	—	ns		
		2.7	2.2	—	—	ns		
		3.3±0.3	1.9	—	—	ns		
Hold time	t_h	2.5±0.2	0.6	—	—	ns		
		2.7	0.5	—	—	ns		
		3.3±0.3	0.5	—	—	ns		
Pulse width	t_w	2.5±0.2	3.3	—	—	ns		
		2.7	3.3	—	—	ns		
		3.3±0.3	3.3	—	—	ns		
Input capacitance	C_{IN}	3.3	—	3.0	—	pF	Control inputs	
		3.3	—	6.0	—	pF	Inputs	
Output capacitance	C_O	3.3	—	7.0	—	pF		

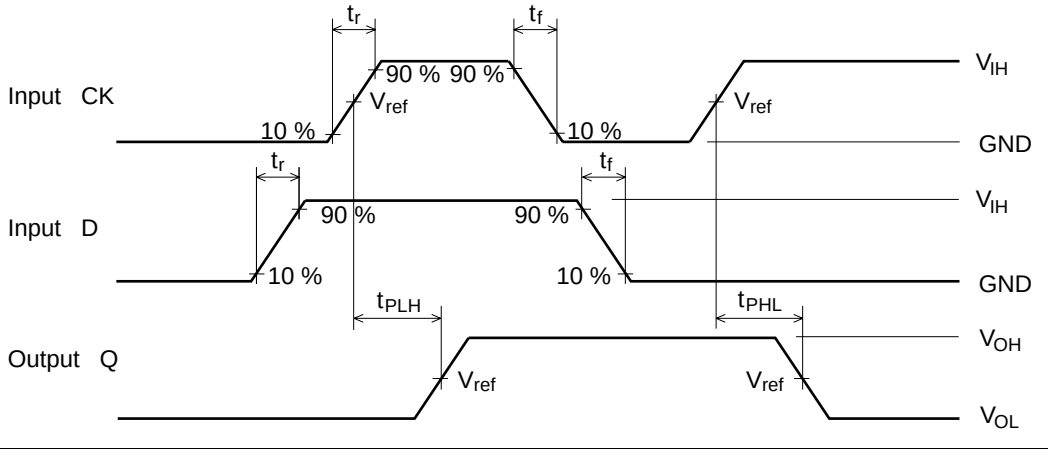
Test Circuit



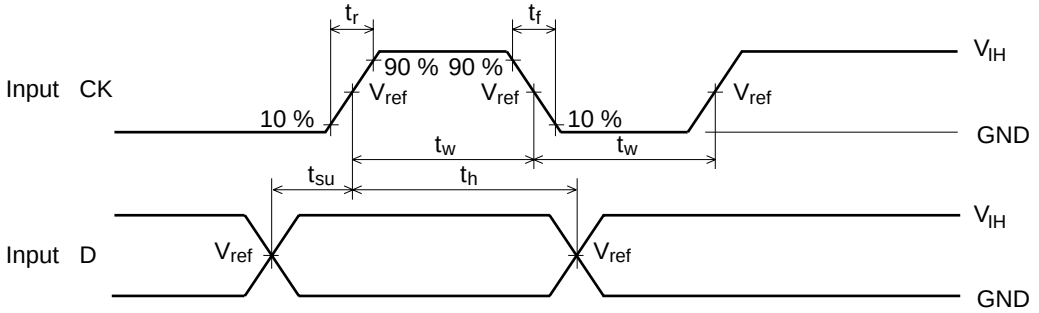
Symbol	Vcc=2.5±0.2V	Vcc=2.7V, 3.3±0.3V
t_{PLH}/ t_{PHL}	OPEN	OPEN
t_{su} / t_h / t_w		
t_{ZH}/ t_{HZ}	GND	GND
t_{ZL}/ t_{LZ}	4.6 V	6.0 V

Note: 1. C_L includes probe and jig capacitance.

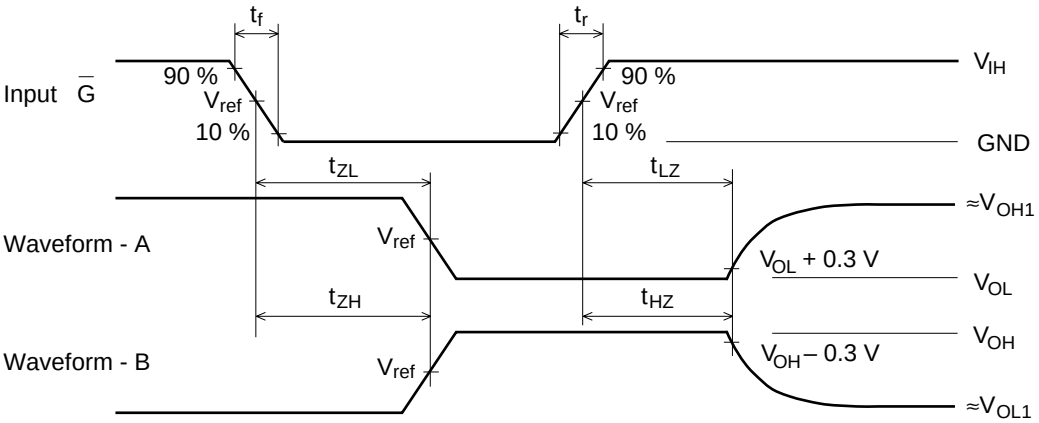
Waveforms – 1



Waveforms – 2



Waveforms – 3

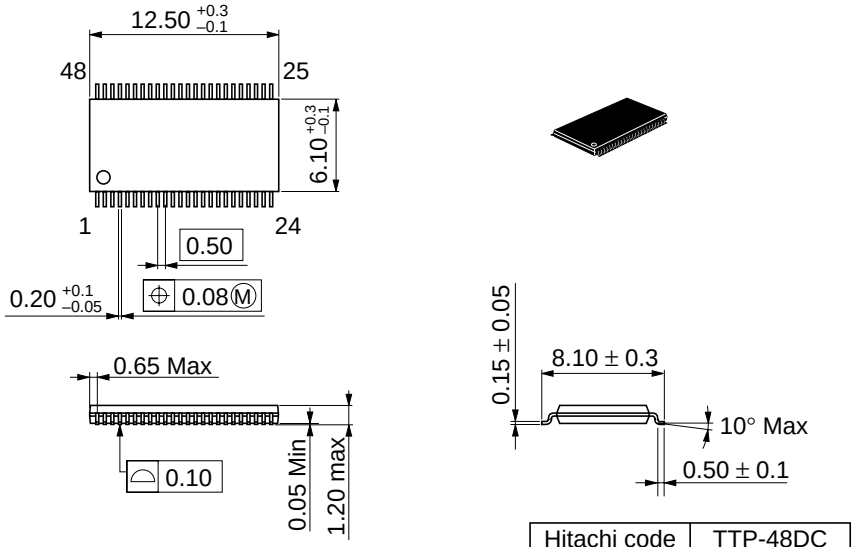


TEST	Vcc=2.5±0.2V	Vcc=2.7V, 3.3±0.3V
V_{IH}	2.3 V	2.7 V
V_{ref}	1.2 V	1.5 V
V_{OH1}	2.3 V	3.0 V
V_{OL1}	GND	GND

Notes:
1. t_r = 2.5 ns, t_f = 2.5 ns
2. Input waveform : PRR = 10 MHz, duty cycle 50%.
3. Waveform–A shows input conditions such that the output is "L" level when enable by the output control.
4. Waveform–B shows input conditions such that the output is "H" level when enable by the output control.

Package Dimensions

Unit : mm



Hitachi code	TTP-48DC
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