
HD74ALVCF162334

16-bit Universal Bus Driver with 3-state Outputs

HITACHI

ADE-205-237A (Z)

Preliminary

2nd. Edition

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Description

This HD74ALVCF162334 is a 16-bit universal bus driver is designed for 2.3 V to 3.6 V V_{CC} operation.

Data flow from A to Y is controlled by the output enable ($\overline{OE}$) input. The device operates in the transparent mode when the latch enable ($\overline{LE}$) input is low. When $\overline{LE}$ is high, the A data is latched if the clock (CLK) input is held at a high or low logic level. If $\overline{LE}$ is high, the A data is stored in the latch/flip flop on the low to high transition of CLK. When $\overline{OE}$ is high, the outputs are in the high impedance state.

To ensure the high impedance state during power up or power down, $\overline{OE}$ should be tied to V_{CC} through a pullup resistor; the minimum value of the resistor is determined by the current sinking capability of the driver.

All outputs, which are designed to sink up to 12 mA, include equivalent 26 Ω resistors to reduce overshoot and undreshoot.

Features

- $V_{CC} = 2.3 \text{ V to } 3.6 \text{ V}$
- Typical V_{OL} ground bounce $< 0.8 \text{ V}$ ($@V_{CC} = 3.3 \text{ V}$, $T_a = 25^\circ\text{C}$)
- Typical V_{OH} undershoot $> 2.0 \text{ V}$ ($@V_{CC} = 3.3 \text{ V}$, $T_a = 25^\circ\text{C}$)
- High output current $\pm 12 \text{ mA}$ ($@V_{CC} = 3.0 \text{ V}$)
- All outputs have equivalent 26 Ω series resistors, so no external resistors are required
- t_{pd} (CLK to Y) = 3.5 ns (Max) ($@V_{CC} = 3.3 \pm 0.3 \text{ V}$, $T_a = 0 \text{ to } 85^\circ\text{C}$)

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Function Table

Inputs				Output Y
OE	LE	CLK	A	
H	X	X	X	Z
L	L	X	L	L
L	L	X	H	H
L	H	↑	L	L
L	H	↑	H	H
L	H	L or H	X	Y ₀ ^{*1}

H : High level

L : Low level

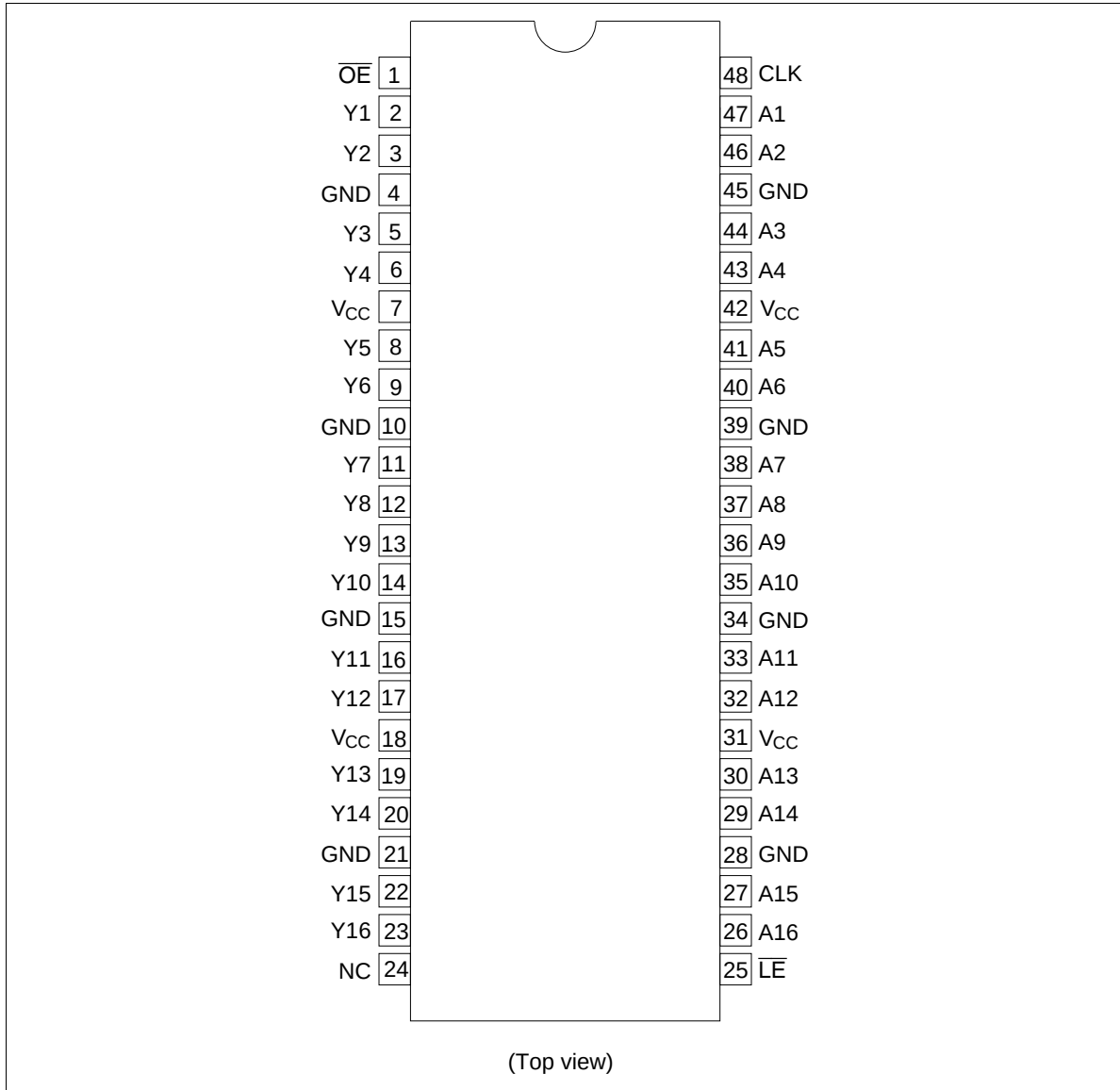
X : Immaterial

Z : High impedance

↑ : Low to high transition

Note: 1. Output level before the indicated steady state input conditions were established.

Pin Arrangement



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Absolute Maximum Ratings

Item	Symbol	Ratings	Unit	Conditions
Supply voltage	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 $T_a = 55^\circ\text{C}$ (in still air) ^{*3}	P_T	0.85	W	TSSOP
Storage temperature	T_{stg}	−65 to 150	$^\circ\text{C}$	

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.

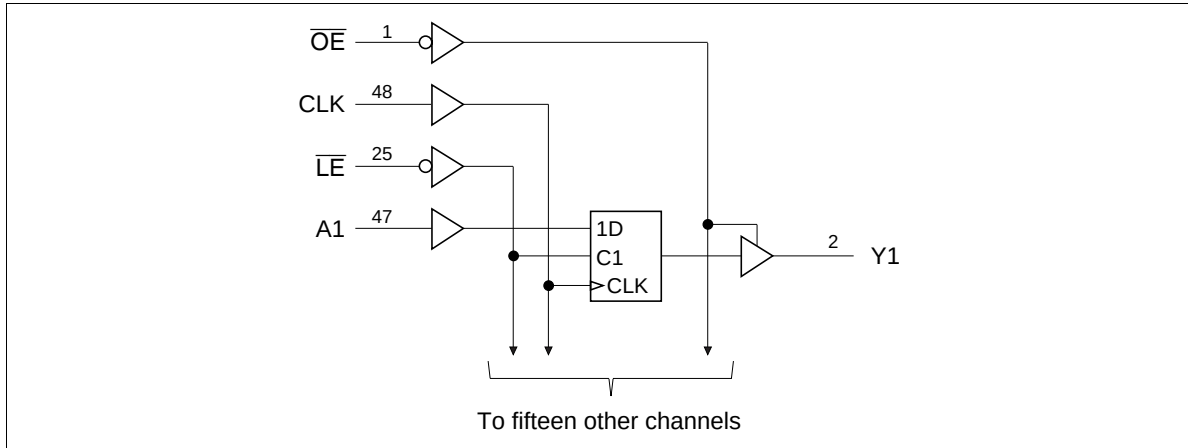
1. The input and output negative voltage ratings may be exceeded if the input and output clamp current ratings are observed.
2. This value is limited to 4.6 V maximum.
3. The maximum package power dissipation is calculated using a junction temperature of 150°C and a board trace length of 750 mils.

Recommended Operating Conditions

Item	Symbol	Min	Max	Unit	Conditions
Supply voltage	V_{CC}	2.3	3.6	V	
Input voltage	V_I	0	V_{CC}	V	
Output voltage	V_O	0	V_{CC}	V	
High level output current	I_{OH}	—	−6	mA	$V_{CC} = 2.3\text{ V}$
		—	−8		$V_{CC} = 2.7\text{ V}$
		—	−12		$V_{CC} = 3.0\text{ V}$
Low level output current	I_{OL}	—	6	mA	$V_{CC} = 2.3\text{ V}$
		—	8		$V_{CC} = 2.7\text{ V}$
		—	12		$V_{CC} = 3.0\text{ V}$
Input transition rise or fall rate	$\Delta t / \Delta v$	0	10	ns / V	
Operating temperature	T_a	−40	85	$^\circ\text{C}$	

Note: Unused control inputs must be held high or low to prevent them from floating.

Logic Diagram



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Electrical Characteristics (Ta = -40 to 85°C)

Item	Symbol	V _{CC} (V)	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 _{IL}	2.3 to 2.7	—	0.7		
		2.7 to 3.6	—	0.8		
Output voltage	V _{OH}	2.3 to 3.6	V _{CC} -0.2	—	V	I _{OH} = -100 µA
		2.3	1.9	—		I _{OH} = -4 mA, V _{IH} = 1.7 V
		2.3	1.7	—		I _{OH} = -6 mA, V _{IH} = 1.7 V
		3.0	2.4	—		I _{OH} = -6 mA, V _{IH} = 2.0 V
		2.7	2.0	—		I _{OH} = -8 mA, V _{IH} = 2.0 V
		3.0	2.0	—		I _{OH} = -12 mA, V _{IH} = 2.0 V
	V _{OL}	2.3 to 3.6	—	0.2		I _{OL} = 100 µA
		2.3	—	0.4		I _{OL} = 4 mA, V _{IL} = 0.7 V
		2.3	—	0.55		I _{OL} = 6 mA, V _{IL} = 0.7 V
		3.0	—	0.55		I _{OL} = 6 mA, V _{IL} = 0.8 V
		2.7	—	0.6		I _{OL} = 8 mA, V _{IL} = 0.8 V
		3.0	—	0.8		I _{OL} = 12 mA, V _{IL} = 0.8 V
Input current	I _{IN}	3.6	—	±5	µA	V _{IN} = V _{CC} or GND
Off state output current	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	V _{IN} = one input at (V _{CC} -0.6) V, other inputs at V _{CC} or GND

Switching Characteristics (Ta = -40 to 85°C)

Item	Symbol	V _{CC} (V)	Min	Typ	Max	Unit	FROM (Input)	TO (Output)
Maximum clock frequency	f _{max}	2.5±0.2	150	—	—	MHz		
		2.7	150	—	—			
		3.3±0.3	150	—	—			
Propagation delay time	t _{PLH}	2.5±0.2	1.0	—	3.9	ns	A	Y
	t _{PHL}	2.7	—	—	4.5			
		3.3±0.3	1.1	—	3.9			
	t _{PHL}	2.5±0.2	1.0	—	5.0		$\overline{LE}$	Y
		2.7	—	—	6.0			
		3.3±0.3	1.3	—	5.0			
		2.5±0.2	1.0	—	4.9		CLK	Y
		2.7	—	—	5.4			
		3.3±0.3	1.0	—	4.9			
Output enable time	t _{ZH}	2.5±0.2	1.0	—	5.4	ns	$\overline{OE}$	Y
	t _{ZL}	2.7	—	—	6.4			
		3.3±0.3	1.1	—	5.4			
Output disable time	t _{HZ}	2.5±0.2	1.0	—	5.0	ns	$\overline{OE}$	Y
	t _{LZ}	2.7	—	—	5.1			
		3.3±0.3	1.7	—	5.0			
Input capacitance	C _{IN}	3.3	—	5.5	—	pF	Control inputs	
		3.3	—	6.0	—		Data inputs	
Output capacitance	C _O	3.3	—	8.0	—	pF	Outputs	

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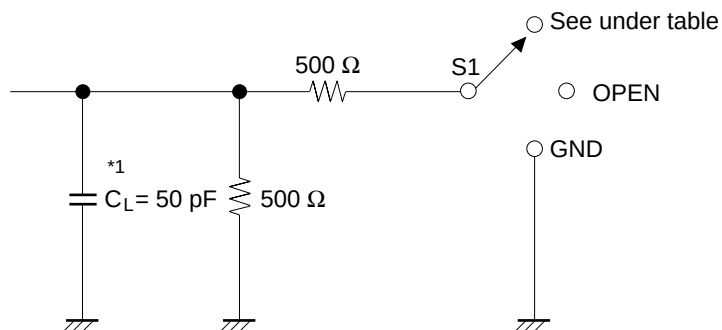
Switching Characteristics (Ta = -40 to 85°C) (cont)

Item	Symbol	V _{CC} (V)	Min	Typ	Max	Unit	FROM (Input)
Setup time	t _{su}	2.5±0.2	1.4	—	—	ns	Data before CLK↑
		2.7	1.7	—	—		
		3.3±0.3	1.5	—	—		
		2.5±0.2	1.2	—	—		Data before $\overline{LE}$ ↑
		2.7	1.6	—	—		CLK "H"
		3.3±0.3	1.3	—	—		
		2.5±0.2	1.4	—	—		Data before $\overline{LE}$ ↑
		2.7	1.5	—	—		CLK "L"
		3.3±0.3	1.2	—	—		
Hold time	t _h	2.5±0.2	0.9	—	—	ns	Data after CLK↑
		2.7	0.8	—	—		
		3.3±0.3	0.9	—	—		
		2.5±0.2	1.2	—	—		Data after $\overline{LE}$ ↑
		2.7	1.1	—	—		CLK "H" or "L"
		3.3±0.3	1.1	—	—		
Pulse width	t _w	2.5±0.2	3.3	—	—	ns	$\overline{LE}$ "L"
		2.7	3.3	—	—		
		3.3±0.3	3.3	—	—		
		2.5±0.2	3.3	—	—		CLK "H" or "L"
		2.7	3.3	—	—		
		3.3±0.3	3.3	—	—		

Switching Characteristics (Ta = 0 to 85°C)

Item	Symbol	V _{CC} (V)	Min	Typ	Max	Unit	FROM (Input)	TO (Output)
Propagation delay time	C _L =50pF t _{PLH} , t _{PHL}	3.3±0.3	1.4	—	3.5	ns	CLK	Y
Setup time	t _{su}	3.3±0.3	1.0	—	—	ns	Data before CLK↑	
Hold time	t _h	3.3±0.3	0.6	—	—	ns	Data after CLK↑	

Test Circuit



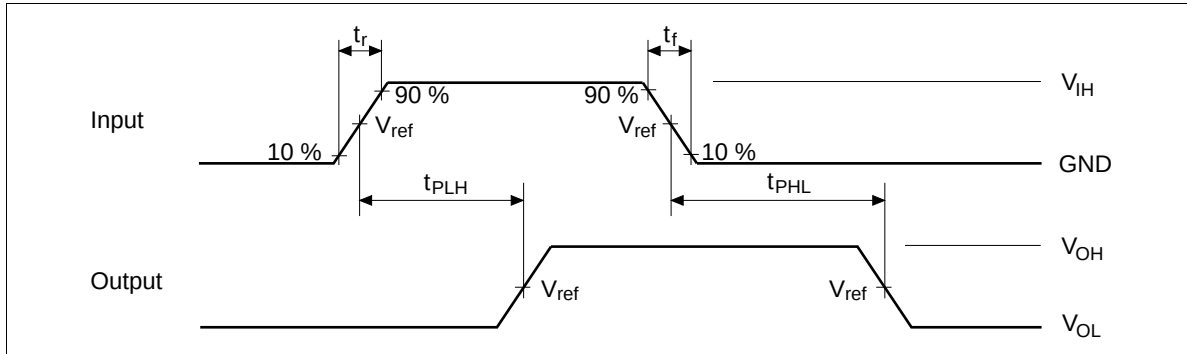
Load Circuit for Outputs

Symbol	V _{CC} =2.5±0.2V	V _{CC} =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}	2 × V _{CC}	6.0 V

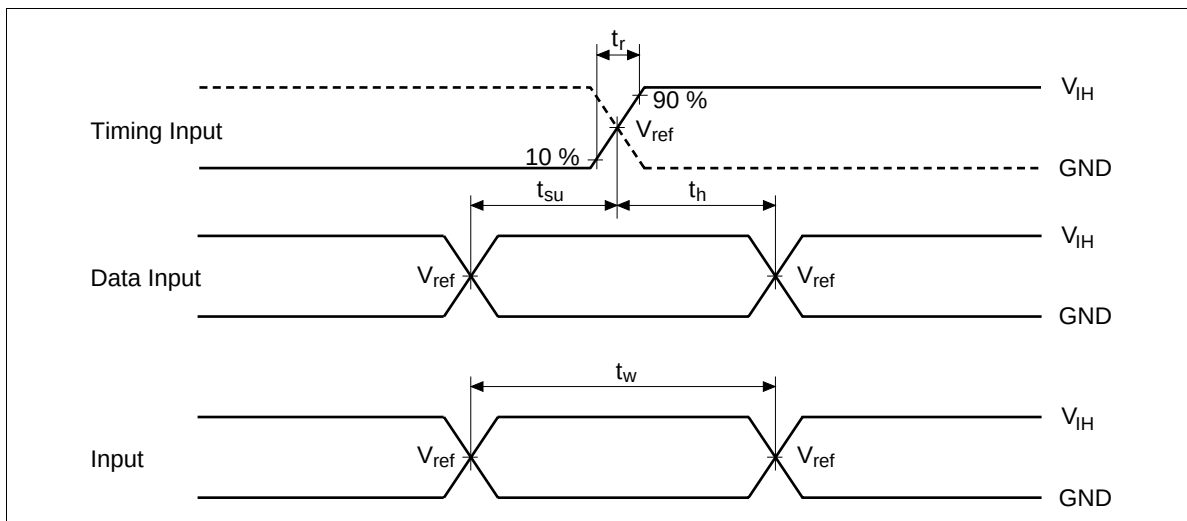
Note: 1. C_L includes probe and jig capacitance.

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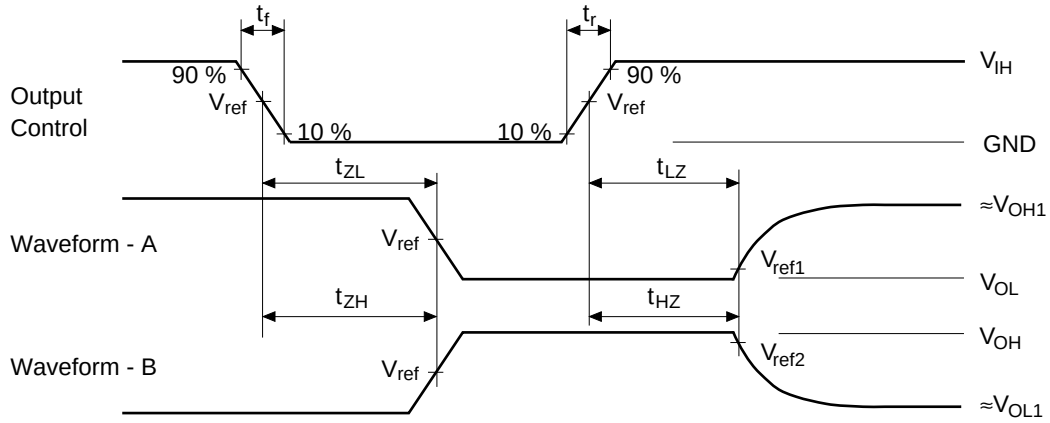
Waveforms – 1



Waveforms – 2



Waveforms – 3



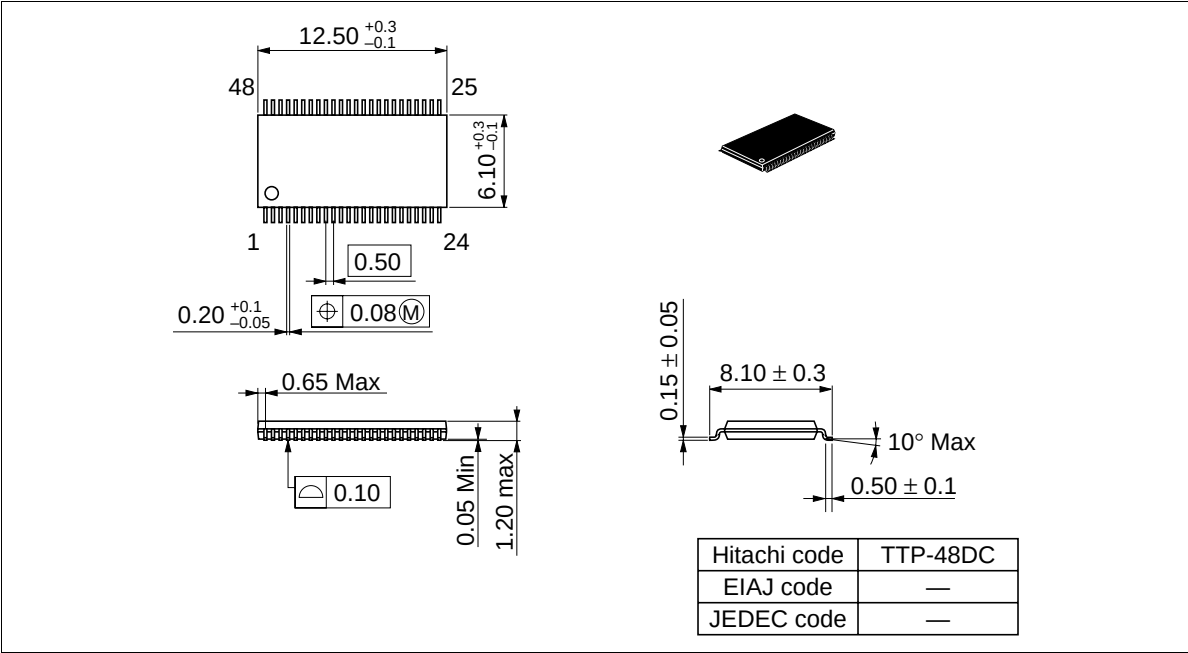
TEST	$V_{CC}=2.5\pm0.2V$	$V_{CC}=2.7V, 3.3\pm0.3V$
V_{IH}	V_{CC}	2.7 V
V_{ref}	$1/2 V_{CC}$	1.5 V
V_{ref1}	$V_{OL} + 0.15 V$	$V_{OL} + 0.3 V$
V_{ref2}	$V_{OH} - 0.15 V$	$V_{OH} - 0.3 V$
V_{OH1}	V_{CC}	3.0 V
V_{OL1}	GND	GND

- Notes:
1. All input pulses are supplied by generators having the following characteristics :
 $PRR \leq 10 \text{ MHz}$, $Z_o = 50 \Omega$, $t_r \leq 2.0 \text{ ns}$, $t_f \leq 2.0 \text{ ns}$. ($V_{CC} = 2.5\pm0.2 V$)
 $PRR \leq 10 \text{ MHz}$, $Z_o = 50 \Omega$, $t_r \leq 2.5 \text{ ns}$, $t_f \leq 2.5 \text{ ns}$. ($V_{CC} = 2.7 V, 3.3\pm0.3 V$)
 2. Waveform – A is for an output with internal conditions such that the output is low except when disabled by the output control.
 3. Waveform – B is for an output with internal conditions such that the output is high except when disabled by the output control.
 4. The output are measured one at a time with one transition per measurement.

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Package Dimensions

Unit : mm



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