

HD74ALVC162835A

18-bit Universal Bus Driver with 3-state Outputs

HITACHI

ADE-205-294C (Z)

Rev. 3
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Description

The HD74ALVC162835A is an 18-bit universal bus driver designed for 2.3 V to 3.6 V V_{cc} operation.

Data flow from A to Y is controlled by the output enable ($\overline{OE}$). The device operates in the transparent mode when the latch enable (LE) is high. When LE is low, the A data is latched if the clock (CLK) input is held at a high or low logic level. If the LE is low, 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 series dumping resistors to reduce overshoot and undershoot.

Features

- Supports PC133 and meets "PC SDRAM registered DIMM specification, Rev. 1.1"
- $V_{CC} = 2.3\text{ V to }3.6\text{ V}$
- Typical VOL ground bounce $< 0.8\text{ V}$ ($@V_{CC} = 3.3\text{ V}$, $T_a = 25^\circ\text{C}$)
- Typical VOH 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 series dumping resistors, so no external resistors are required
- $t_{pd}(\text{CLK to Y}) = 3.5\text{ ns (Max)}$ ($@V_{CC} = 3.3 \pm 0.3\text{ V}$, $CL = 50\text{ pF}$, $T_a = 0\text{ to }85^\circ\text{C}$)
- $t_{pd}(\text{CLK to Y}) = 2.5\text{ ns (Max)}$ ($@V_{CC} = 3.3 \pm 0.3\text{ V}$, $CL = 30\text{ pF}$, $T_a = 0\text{ to }85^\circ\text{C}$)
- Package type

Package type	Package code	Package suffix	Taping code
TSSOP-56pin	TTP-56DAV	T	EL(1000pcs / Reel)
TVSOP-56pin	TTP-56DBV	N	EL(1000pcs / Reel)

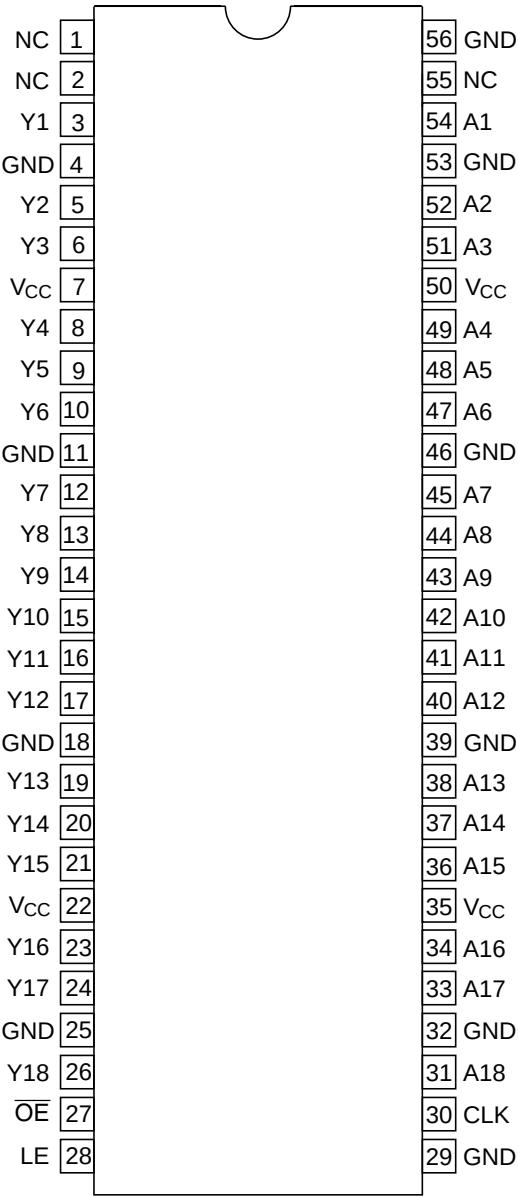
Function Table

Inputs				
OE	LE	CLK	A	Output Y
H	X	X	X	Z
L	H	X	L	L
L	H	X	H	H
L	L	↑	L	L
L	L	↑	H	H
L	L	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



(Top view)

Absolute Maximum Ratings

Item	Symbol	Ratings	Unit	Conditions
Supply voltage range	V_{CC}	−0.5 to 4.6	V	
Input voltage range ^{*1}	V_I	−0.5 to 4.6	V	
Output voltage range ^{*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	1	W	TSSOP TVSOP
Storage temperature range	T_{stg}	−65 to 150	°C	

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 condition” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

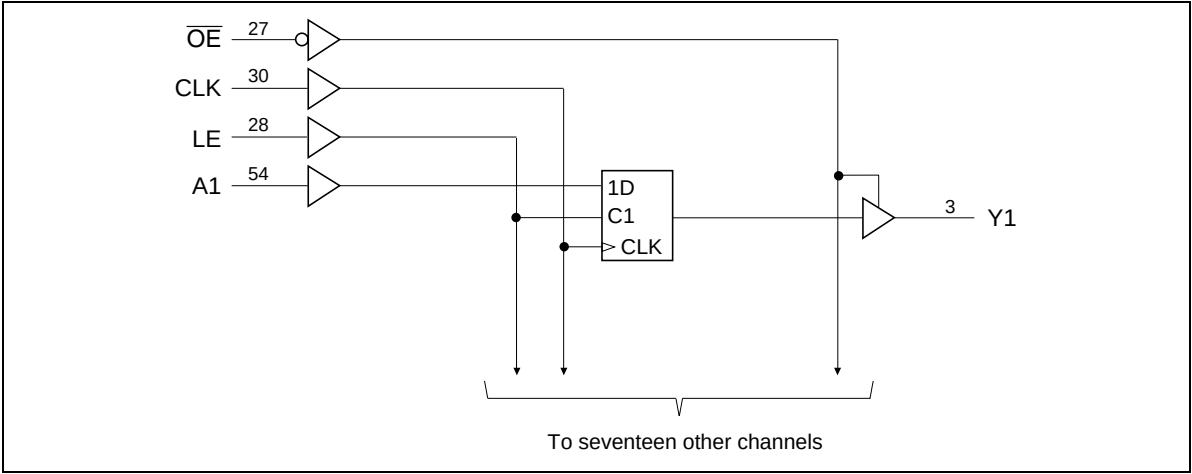
- Notes:
1. The input and output negative-voltage ratings may be exceeded if the input and output clamp current ratings are observed.
 2. The input and output positive-voltage ratings may be exceeded up to 4.6 V if the input and output clamp-current ratings are observed.
 3. The maximum power dissipation is calculated using a junction temperature of 150°C and 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	$\text{d}t/\text{d}v$	0	10	ns/V	
Operating free-air temperature	T_a	−40	85	°C	

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

Logic Diagram



Electrical Characteristics

Item	Symbol	V _{CC} (V)	Ta = -40 to 85°C		Unit	Test Conditions
			Min	Max		
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	V	
		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	V	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	—	±5.0	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	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	—	5.0	ns	A	Y
	t _{PHL}	2.7	—	—	5.0			
		3.3±0.3	1.0	—	4.2			
		2.5±0.2	1.3	—	5.9	LE	Y	
		2.7	—	—	5.8			
		3.3±0.3	1.3	—	5.1			
		2.5±0.2	1.4	—	6.3			CLK
		2.7	—	—	6.1			
	3.3±0.3	1.4	—	5.4				
	Output enable time	t _{ZH}	2.5±0.2	1.4	—	6.3	ns	OE
t _{ZL}		2.7	—	—	6.5			
		3.3±0.3	1.1	—	5.5			
Output disable time	t _{HZ}	2.5±0.2	1.0	—	4.7	ns	OE	Y
	t _{LZ}	2.7	—	—	4.9			
		3.3±0.3	1.3	—	4.5			
Input capacitance	C _{IN}	3.3	3.3	4.0	4.5	pF	Control inputs	
		3.3	3.0	6.0	9.0		Data inputs	
Output capacitance	C _O	3.3	3.0	7.0	9.0	pF	Y ports	

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	2.2	—	—	ns	Data before CLK↑
		2.7	2.1	—	—		
		3.3±0.3	1.7	—	—		
		2.5±0.2	1.9	—	—		Data before LE↓
		2.7	1.6	—	—		CLK “H”
		3.3±0.3	1.5	—	—		
		2.5±0.2	1.3	—	—		Data before LE↓
		2.7	1.1	—	—		CLK “L”
		3.3±0.3	1.0	—	—		
Hold time	t _h	2.5±0.2	0.6	—	—	ns	Data after CLK↑
		2.7	0.6	—	—		
		3.3±0.3	0.7	—	—		
		2.5±0.2	1.4	—	—		Data after LE↓
		2.7	1.7	—	—		CLK “H” or “L”
		3.3±0.3	1.4	—	—		
Pulse width	t _w	2.5±0.2	3.3	—	—	ns	LE “H”
		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)

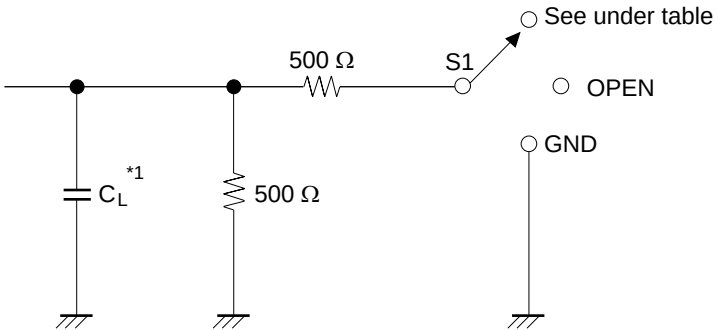
Item		Symbol	V _{CC} (V)	Min	Typ	Max	Unit	FROM (Input)	TO (Output)
Propagation delay time	C _L =50pF	t _{PLH} , t _{PHL}	3.3±0.3	1.4	—	3.5	ns	CLK	Y
	C _L =30pF		3.3±0.3	0.7	—	2.5		CLK	Y
Setup time		t _{su}	3.3±0.3	1.0	—	—	ns	Data before CLK↑	
Hold time		t _h	3.3±0.3	0.6	—	—	ns	Data after CLK↑	

Operating Characteristics

(Ta = 25°C)

Item		Symbol	V _{cc} = 2.5±0.2 V	V _{cc} = 3.3±0.3 V	Unit	Test Conditions
			Typ	Typ		
Power dissipation capacitance	Outputs enable	C _{pd}	22.0	24.5	pF	C _L = 0, f = 10 MHz
	Outputs disable		5.0	6.0		

Test Circuit

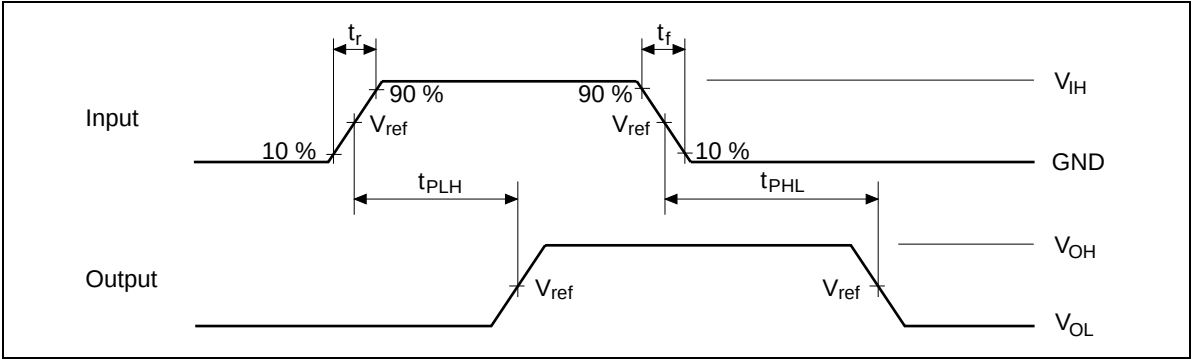


Load Circuit for Outputs

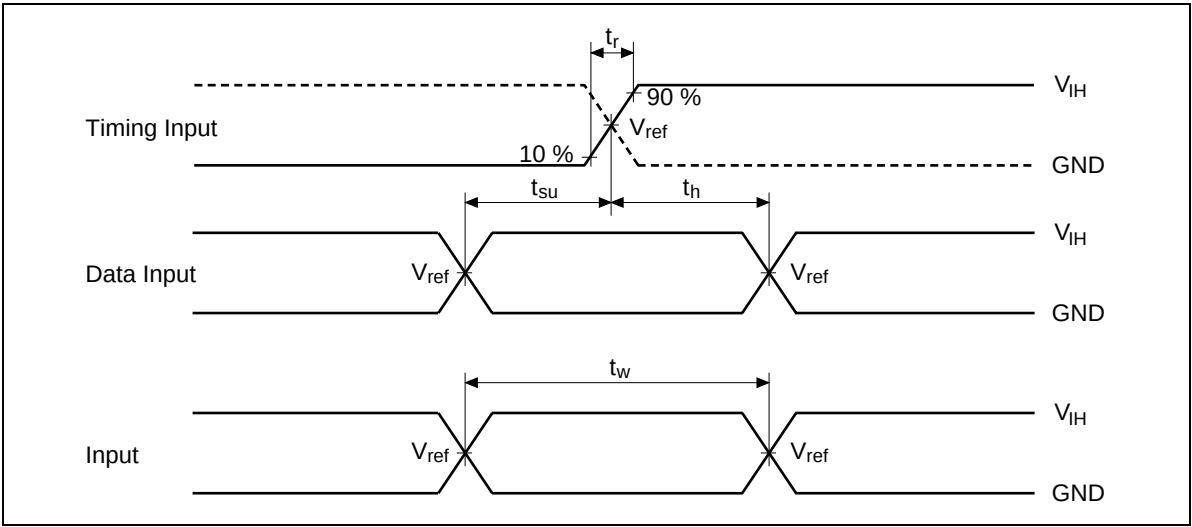
Symbol	Vcc=2.5±0.2V	Vcc=2.7V, 3.3±0.3V
t _{PLH} /t _{PHL}	OPEN	OPEN
t _{su} /t _h /t _w		
t _{ZH} /t _{HZ}	GND	GND
t _{ZL} /t _{LZ}	2 ×V _{CC}	6.0 V
C _L	30 pF	50 pF

Note: 1. C_L includes probe and jig capacitance.

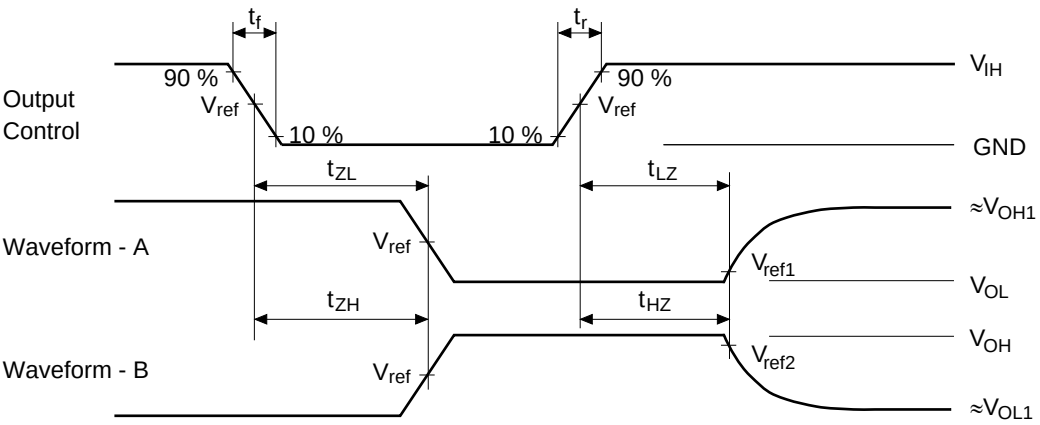
Waveforms – 1



Waveforms – 2



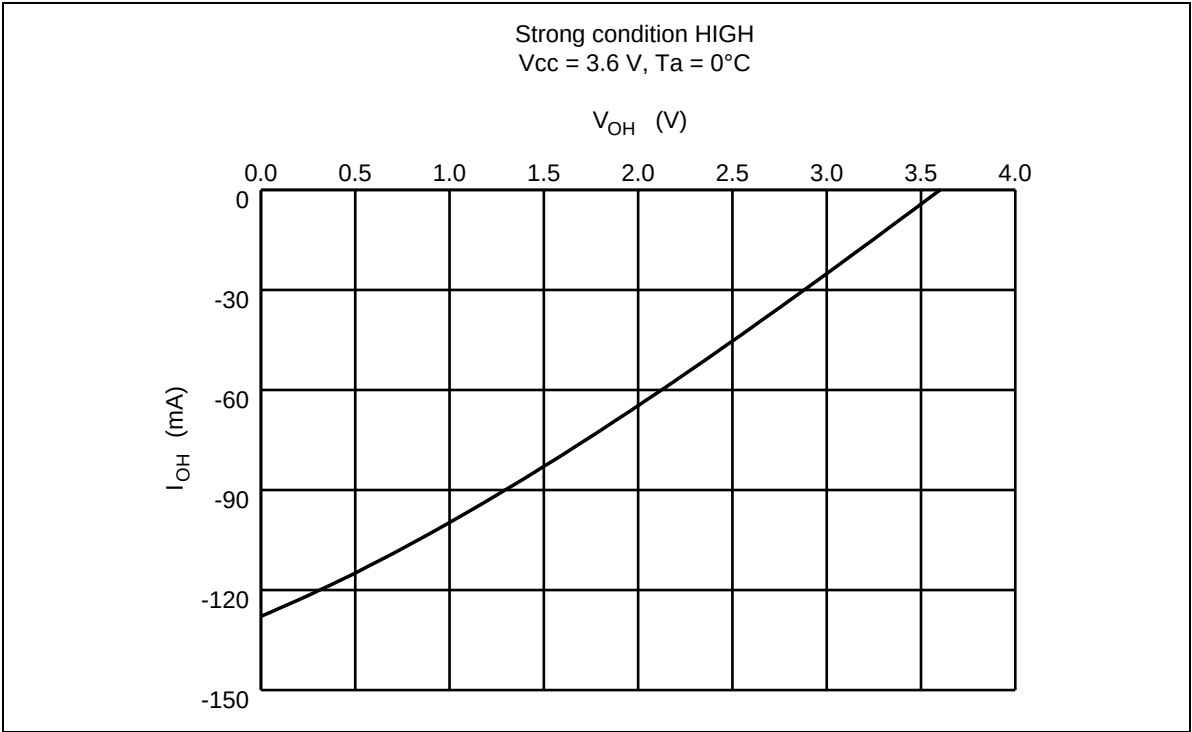
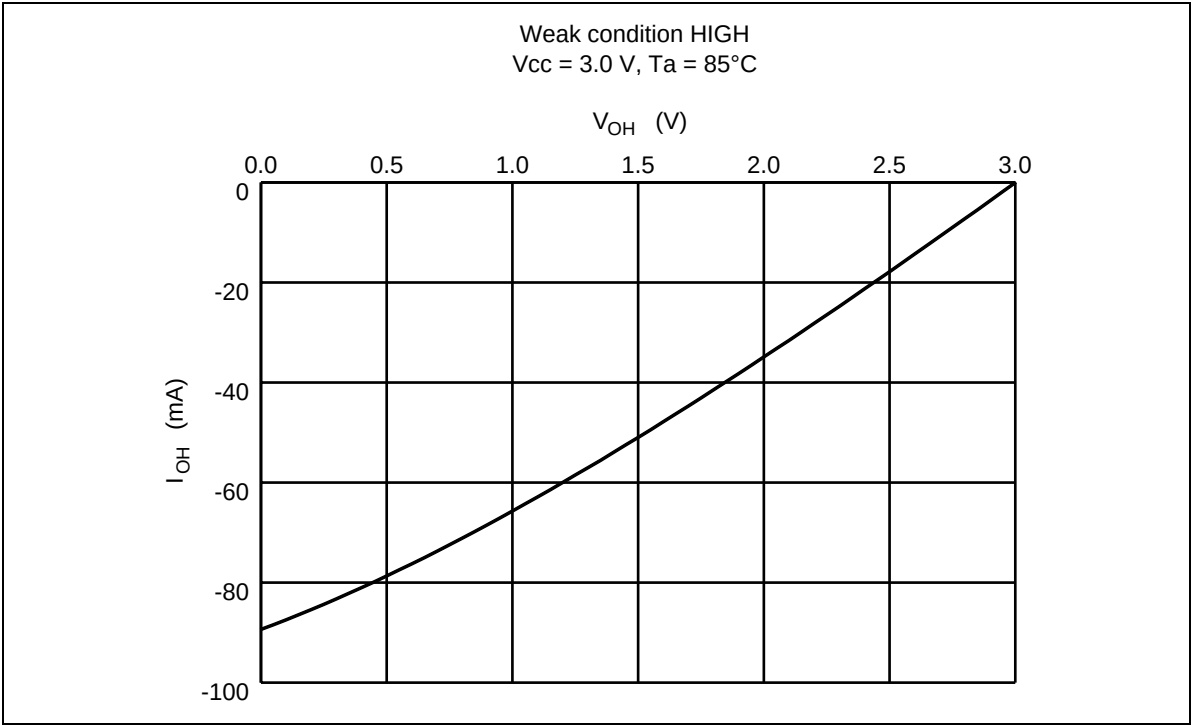
Waveforms – 3



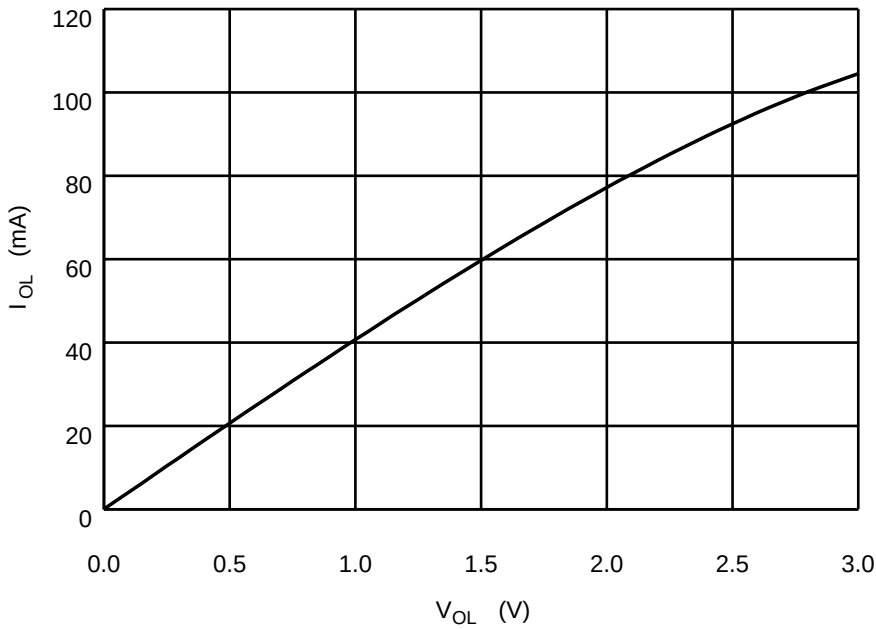
TEST	$V_{CC}=2.5\pm0.2V$	$V_{CC}=2.7V, 3.3\pm0.3V$
V_{IH}	V_{CC}	2.7 V
V_{ref}	$1/2 V_{CC}$	1.5 V
V_{ref1}	$V_{OL} + 0.15 V$	$V_{OL} + 0.3 V$
V_{ref2}	$V_{OH} - 0.15 V$	$V_{OH} - 0.3 V$
V_{OH1}	V_{CC}	3.0 V
V_{OL1}	GND	GND

- Notes:
1. All input pulses are supplied by generators having the following characteristics :
PRR • 10 MHz, $Z_o = 50 \Omega$, $t_r \bullet 2.0 \text{ ns}$, $t_f \bullet 2.0 \text{ ns}$. ($V_{cc} = 2.5\pm0.2 \text{ V}$)
PRR • 10 MHz, $Z_o = 50 \Omega$, $t_r \bullet 2.5 \text{ ns}$, $t_f \bullet 2.5 \text{ ns}$. ($V_{cc} = 2.7 \text{ V}, 3.3\pm0.3 \text{ V}$)
 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.

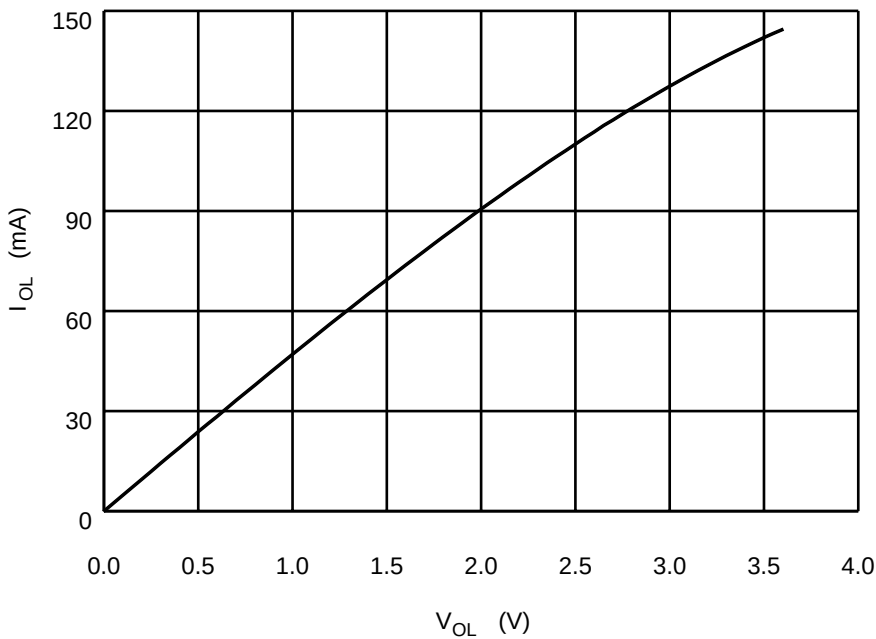
IV Characteristics for Register Output (Measured value)



Weak condition LOW
 $V_{CC} = 3.0\text{ V}$, $T_a = 85^\circ\text{C}$

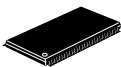
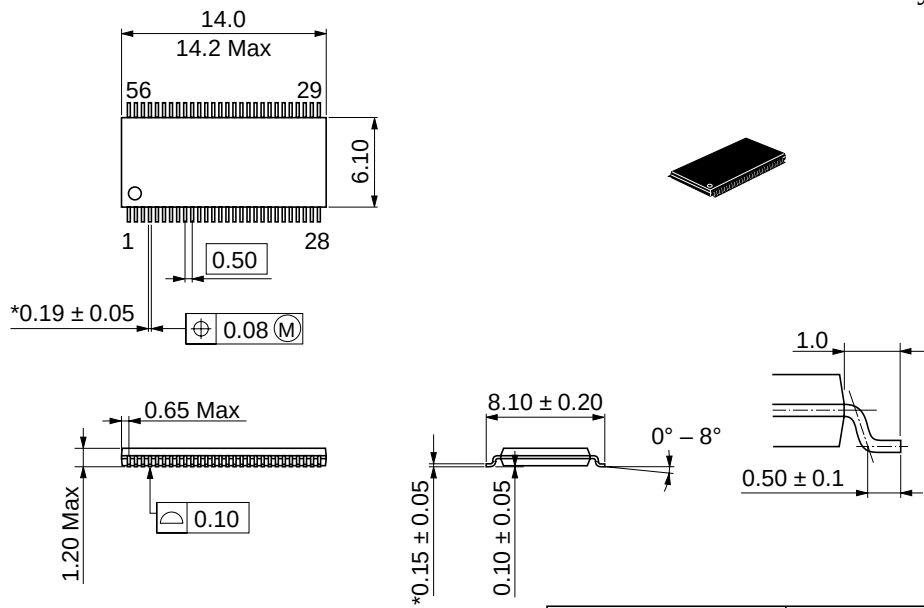


Strong condition LOW
 $V_{CC} = 3.6\text{ V}$, $T_a = 0^\circ\text{C}$



Package Dimensions

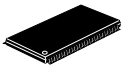
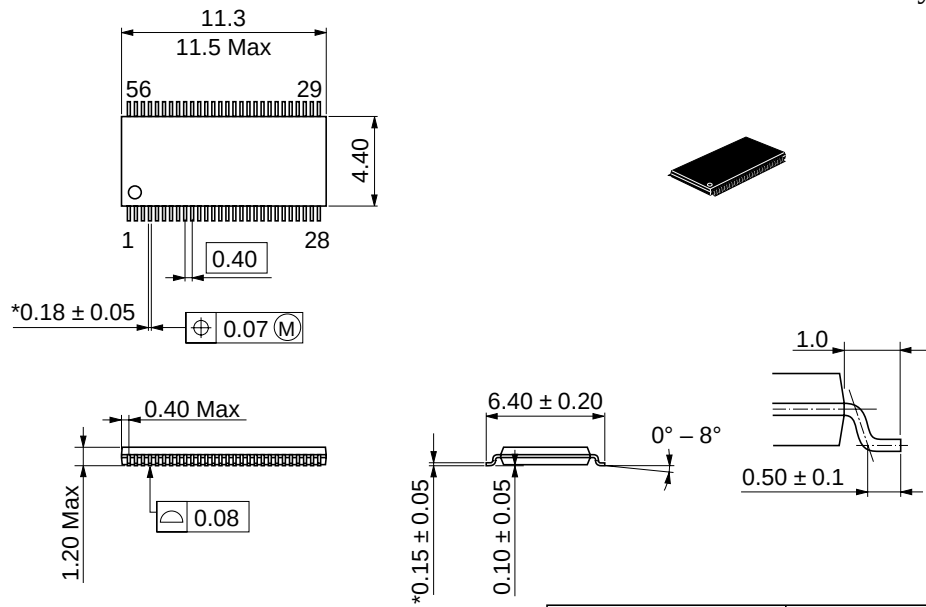
As of July, 2001
Unit: mm



*Pd plating

Hitachi Code	TTP-56DAV
JEDEC	—
JEITA	—
Mass (reference value)	0.32 g

As of July, 2001
Unit: mm



*Pd plating

Hitachi Code	TTP-56DBV
JEDEC	—
JEITA	—
Mass (reference value)	—

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Hitachi, Ltd.

Semiconductor & Integrated Circuits
Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan
Tel: (03) 3270-2111 Fax: (03) 3270-5109

URL <http://www.hitachisemiconductor.com/>

For further information write to:

Hitachi Semiconductor (America) Inc.
179 East Tasman Drive
San Jose, CA 95134
Tel: <1> (408) 433-1990
Fax: <1> (408) 433-0223

Hitachi Europe Ltd.
Electronic Components Group
Whitebrook Park
Lower Cookham Road
Maidenhead
Berkshire SL6 8YA, United Kingdom
Tel: <44> (1628) 585000
Fax: <44> (1628) 585200

Hitachi Europe GmbH
Electronic Components Group
Dornacher Straße 3
D-85622 Feldkirchen
Postfach 201, D-85619 Feldkirchen
Germany
Tel: <49> (89) 9 9180-0
Fax: <49> (89) 9 29 30 00

Hitachi Asia Ltd.
Hitachi Tower
16 Collyer Quay #20-00
Singapore 049318
Tel: <65>-538-6533/538-8577
Fax: <65>-538-6933/538-3877
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Hitachi Asia Ltd.
(Taipei Branch Office)
4/F, No. 167, Tun Hwa North Road
Hung-Kuo Building
Taipei (105), Taiwan
Tel: <886>-(2)-2718-3666
Fax: <886>-(2)-2718-8180
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Hitachi Asia (Hong Kong) Ltd.
Group III (Electronic Components)
7/F., North Tower
World Finance Centre,
Harbour City, Canton Road
Tsim Sha Tsui, Kowloon Hong Kong
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