

HD74SSTV16859

1:2 13-bit SSTL_2 Registered Buffer

HITACHI

ADE-205-337G (Z)

Rev.7
June 2001

Description

The HD74SSTV16859 is a 1:2 13-bit registered buffer designed for 2.3 V to 2.7 V Vcc operation and LVCMOS reset ($\overline{\text{RESET}}$) input / SSTL_2 data (D) inputs and CLK input.

Data flow from D to QA, QB is controlled by differential clock pins (CLK, $\overline{\text{CLK}}$) and the $\overline{\text{RESET}}$. Data is triggered on the positive edge of the positive clock (CLK), and the negative clock ($\overline{\text{CLK}}$) must be used to maintain noise margins. When $\overline{\text{RESET}}$ is low, all registers are reset and all outputs are low.

To ensure defined outputs from the register before a stable clock has been supplied, $\overline{\text{RESET}}$ must be held in the low state during power up.

Features

- Supports LVCMOS reset ($\overline{\text{RESET}}$) input / SSTL_2 data (D) inputs and CLK input
- Differential SSTL_2 (Stub series terminated logic) CLK signal
- Flow through architecture optimizes PCB layout

Function Table

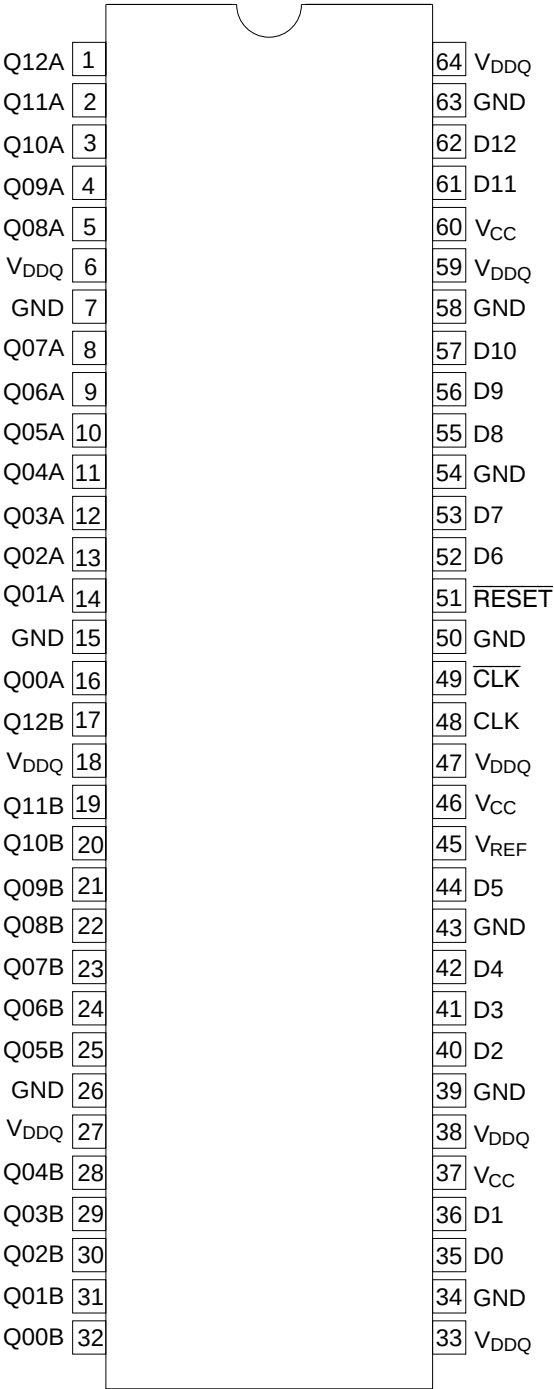
Inputs				Outputs	
$\overline{\text{RESET}}$	$\overline{\text{CLK}}$	CLK	D	QA	QB
L	X	X	X	L	L
H	↓	↑	H	H	H
H	↓	↑	L	L	L
H	L or H	H or L	X	Q ₀ ^{*1}	Q ₀ ^{*1}

H : High level
L : Low level
X : Immaterial
↑ : Low to high transition
↓ : High to low 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	V_{CC} or V_{DDQ}	−0.5 to 3.6	V	
Input voltage ^{*1}	V_I	−0.5 to $V_{DDQ}+0.5$	V	
Output voltage ^{*1}	V_O	−0.5 to $V_{DDQ}+0.5$	V	
Input clamp current	I_{IK}	±50	mA	$V_I < 0$ or $V_I > V_{CC}$
Output clamp current	I_{OK}	±50	mA	$V_O < 0$ or $V_O > V_{DDQ}$
Continuous output current	I_O	±50	mA	$V_O = 0$ to V_{DDQ}
V_{CC} , V_{DDQ} or GND current / pin	I_{CC} , I_{DDQ} or I_{GND}	±100	mA	
Maximum power dissipation at $T_a = 55^{\circ}\text{C}$ (in still air)	P_T	1	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.

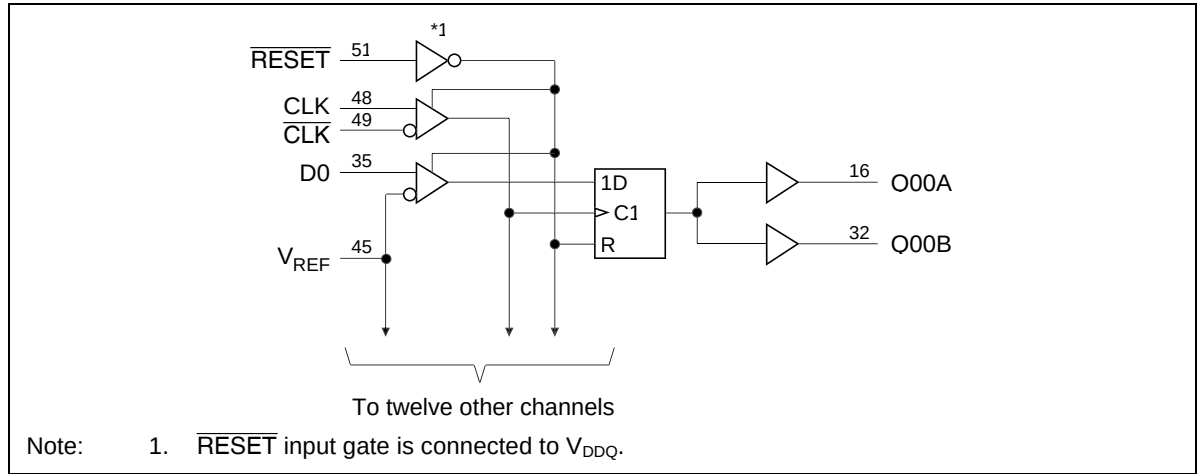
1. The input and output negative voltage ratings may be exceeded if the input and output clamp current ratings are observed.

Recommended Operating Conditions

Item	Symbol	Min	Typ	Max	Unit	Conditions
Supply voltage	V _{CC}	V _{DDQ}	2.5	2.7	V	
Output supply voltage	V _{DDQ}	2.3	2.5	2.7	V	
Reference voltage	V _{REF}	1.15	1.25	1.35	V	V _{REF} = 0.5 × V _{DDQ}
Termination voltage	V _{TT}	V _{REF} −40 mV	V _{REF}	V _{REF} +40 mV	V	
Input voltage	V _I	0	—	V _{CC}	V	
AC high level input voltage	V _{IH}	V _{REF} +310 mV	—	—	V	D
AC low level input voltage	V _{IL}	—	—	V _{REF} −310 mV	V	D
DC high level input voltage	V _{IH}	V _{REF} +150 mV	—	—	V	D
DC low level input voltage	V _{IL}	—	—	V _{REF} −150 mV	V	D
High level input voltage	V _{IH}	1.7	—	V _{DDQ} +0.3	V	$\overline{\text{RESET}}$
Low level input voltage	V _{IL}	−0.3	—	0.7	V	$\overline{\text{RESET}}$
Differential (Common mode range)	V _{CMR}	0.97	—	1.53	V	CLK, $\overline{\text{CLK}}$
input voltage (Minimum peak to peak input)	V _{PP}	360	—	—	mV	CLK, $\overline{\text{CLK}}$
High level output current	I _{OH}	—	—	−20	mA	
Low level output current	I _{OL}	—	—	20	mA	
Operating temperature	T _a	0	—	70	°C	

Note: The $\overline{\text{RESET}}$ input of the device must be held at V_{DDQ} or GND to ensure proper device operation.
The differential inputs must not be floating, unless $\overline{\text{RESET}}$ is low.

Logic Diagram



Electrical Characteristics

Item		Symbol	V _{CC} (V)	Min	Typ	Max	Unit	Test Conditions
Input diode voltage		V _{IK}	2.3	—	—	−1.2	V	I _{IN} = −18 mA
Output voltage	V _{OH}		2.3 to 2.7	V _{CC} −0.2	—	—	V	I _{OH} = −100 μA
			2.3	1.95	—	V _{DDQ}	I _{OH} = −16 mA	
	V _{OL}		2.3 to 2.7	—	—	0.2		I _{OL} = 100 μA
			2.3	0	—	0.35	I _{OL} = 16 mA	
Input current (All inputs)	I _{IN}	2.7	—	—	±5	μA	V _{IN} = 2.7 V or 0	
Quiescent supply current	I _{CC} ^{*2}	2.7	—	—	45	mA	V _{IN} = V _{IH(AC)} or V _{IL(AC)} , I _O = 0	
Standby current	I _{CC} (stdy)	2.7	—	—	10	μA	$\overline{\text{RESET}}$ = GND	
Dynamic operating clock only	I _{CCD} ^{*2}	2.7	—	—	90	μA/ clock MHz	$\overline{\text{RESET}}$ = V _{CC} , V _I = V _{IH(AC)} or V _{IL(AC)} , CLK and $\overline{\text{CLK}}$ switching 50% duty cycle	
Dynamic operating per each data input	I _{CCD} ^{*2}	2.7	—	—	20	μA/ clock MHz/ data input	$\overline{\text{RESET}}$ = V _{CC} , V _I = V _{IH(AC)} or V _{IL(AC)} , CLK and $\overline{\text{CLK}}$ switching 50% duty cycle. One data input switching at half clock frequency, 50% duty cycle.	
Output high ^{*3}	r _{OH}	2.3 to 2.7	7	—	22 ^{*4}	Ω	I _{OH} = −20 mA	
Output low ^{*3}	r _{OL}	2.3 to 2.7	7	—	22 ^{*4}	Ω	I _{OL} = 20 mA	
r _{OH} − r _{OL} each separate bit ^{*3}	r _{O(Δ)}	2.5	—	—	4	Ω	I _O = 20 mA, Ta = 25°C	
Input capacitance	Data inputs	C _{IN}	2.5 ^{*1}	2.5	—	3.5	pF	V _I = V _{REF} ±310 mV
	CLK and $\overline{\text{CLK}}$			2.5	—	3.5		V _{CMR} = 1.25 V, V _{PP} = 360 mV
	$\overline{\text{RESET}}$			—	3.0	—		V _I = V _{CC} or GND

- Notes: 1. All typical values are at V_{CC} = 2.5 V, Ta = 25°C.
2. Total I_{CC} (max) = I_{CC} + {I_{CCD} (clock)×f(clock)} + {I_{CCD} (Data)×1/2f(clock)×13}
3. This is effective in the case that it did terminate by resistance.
4. See figure. 1, 2

Switching Characteristics

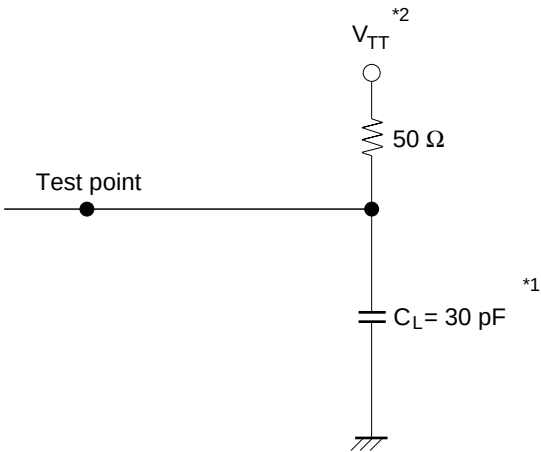
Item	Symbol	V _{CC} = 2.5 ± 0.2 V		Unit	Test Condition
		Min	Max		
Clock frequency ^{*1}	f _{clock}	—	200	MHz	
Setup time	Fast slew rate ^{*4, 6} t _{su}	0.75	—	ns	Data before CLK↑, CLK↓
	Slow slew rate ^{*5, 6}	0.9	—		
Hold time	Fast slew rate ^{*4, 6} t _h	0.75	—	ns	Data after CLK↑, CLK↓
	Slow slew rate ^{*5, 6}	0.9	—		
Differential inputs active time	t _{act}	22	—	ns	Data inputs must be low after RESET high.
Differential inputs inactive time	t _{inact}	22	—	ns	Data and clock inputs must be held at valid levels (not floating) after RESET low.
Pulse width	t _w	2.5	—	ns	CLK, CLK "H" or "L"
Output slew ^{*3}	t _{SL}	1	4	volt/ns	

(C_L = 30 pF, R_L = 50 Ω, V_{REF} = V_{TT} = V_{DDQ} × 0.5)

Item	Symbol	V _{CC} = 2.5 ± 0.2 V			Unit	FROM	TO
		Min	Typ	Max		(Input)	(Output)
Maximum clock frequency	f _{max}	200	—	—	MHz		
Propagation delay time ^{*2}	t _{PLH} , t _{PHL}	1.1	—	2.8	ns	CLK, CLK	QA, QB
	t _{PHL}	—	—	5.0		RESET	QA, QB

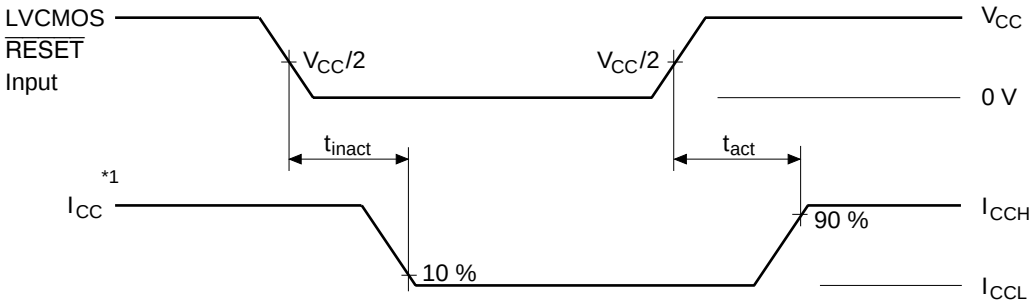
- Notes:
- 1. Although the clock is differential, all timing is relative to CLK going high and CLK going low.
 - 2. This timing relationship is specified into test load (see waveforms – 3, 4) with all of the outputs switching.
 - 3. Assumes into an equivalent, distributed load to the address net structure defined in the application information provided in this specification.
 - 4. For data signal input slew rate ≥ 1 V/ns.
 - 5. For data signal input slew rate ≥ 0.5 V/ns and < 1 V/ns.
 - 6. CLK, CLK signals input slew rates are ≥ 1 V/ns.

Test Circuit

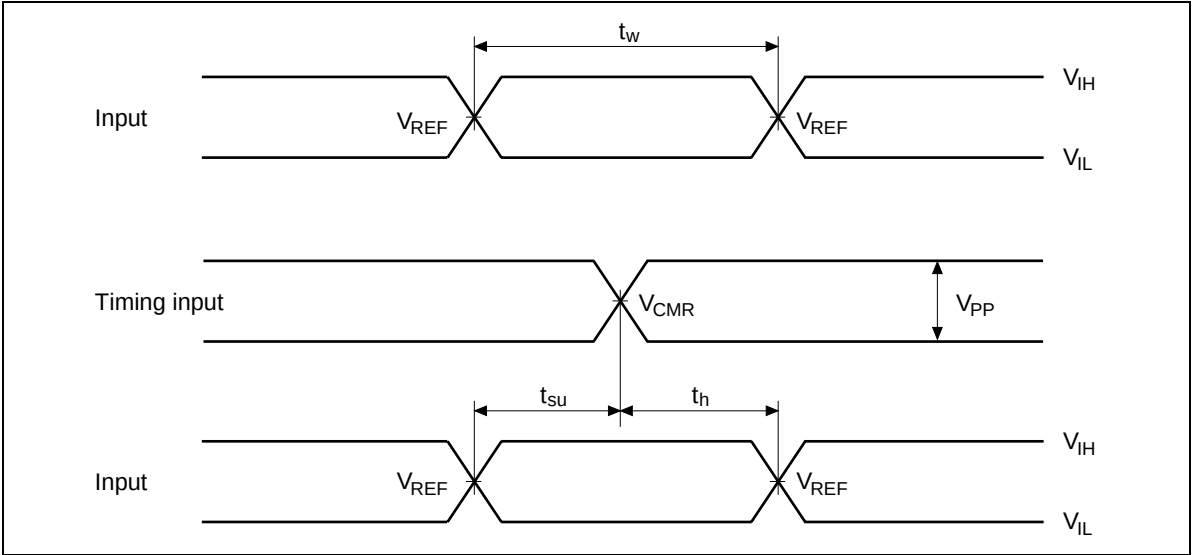


- Notes:
1. C_L includes probe and jig capacitance.
 2. $V_{TT} = V_{REF} = V_{DDQ} \times 0.5$

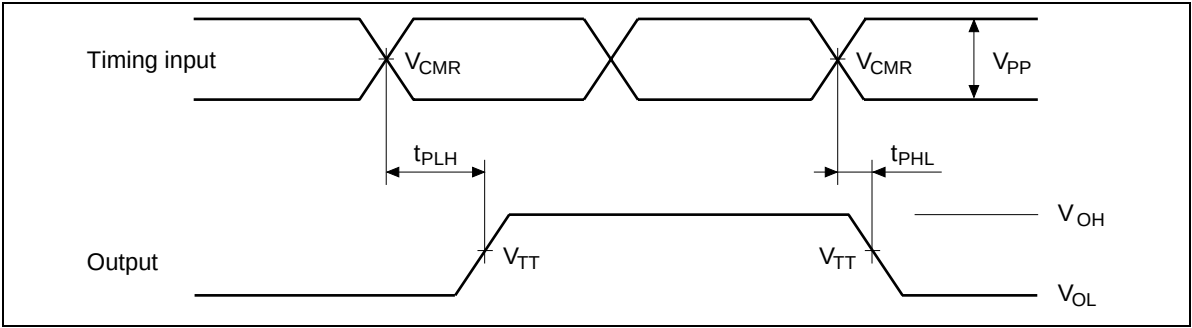
Waveforms – 1



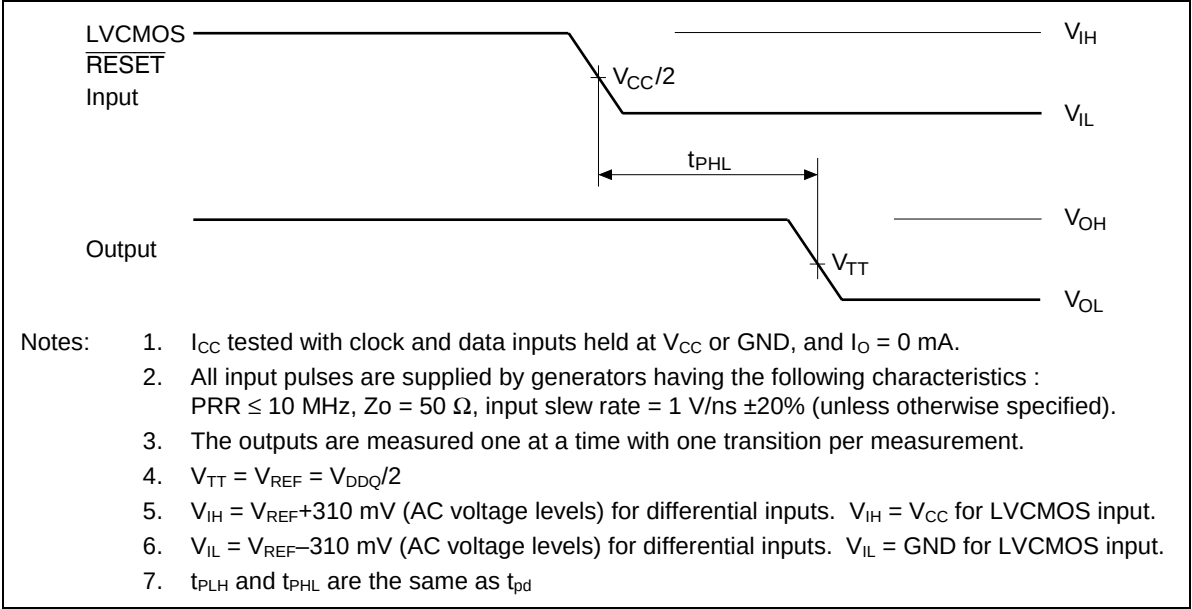
Waveforms – 2



Waveforms – 3



Waveforms – 4



Application Data

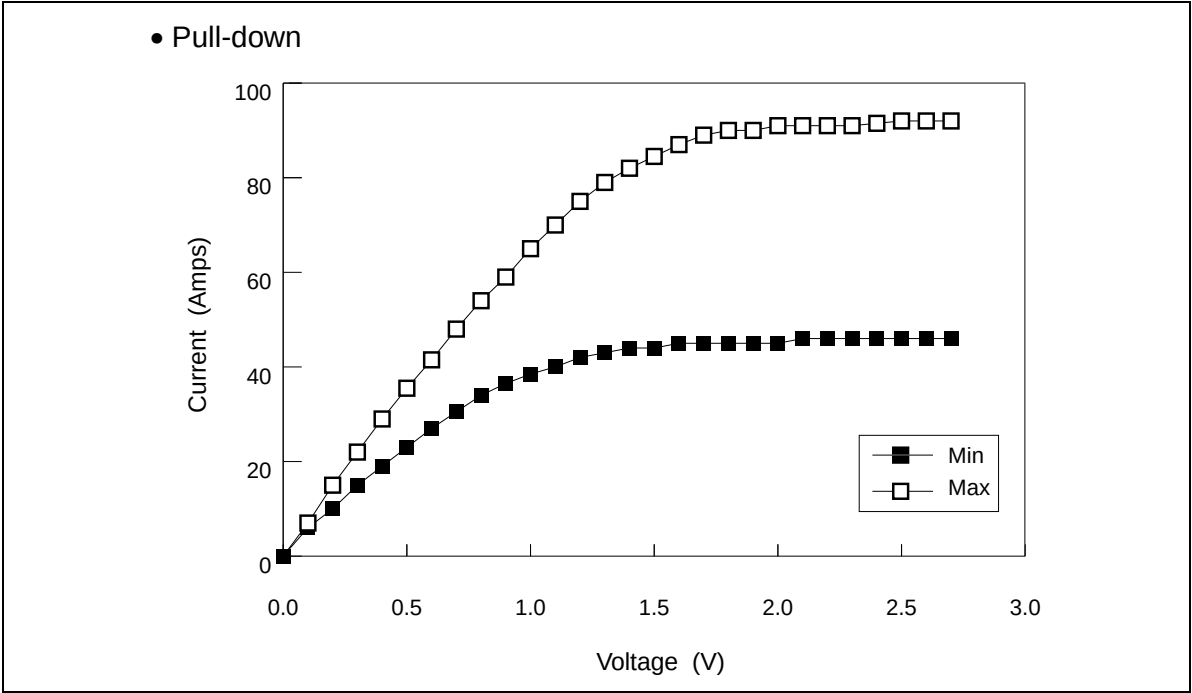


Figure . 1

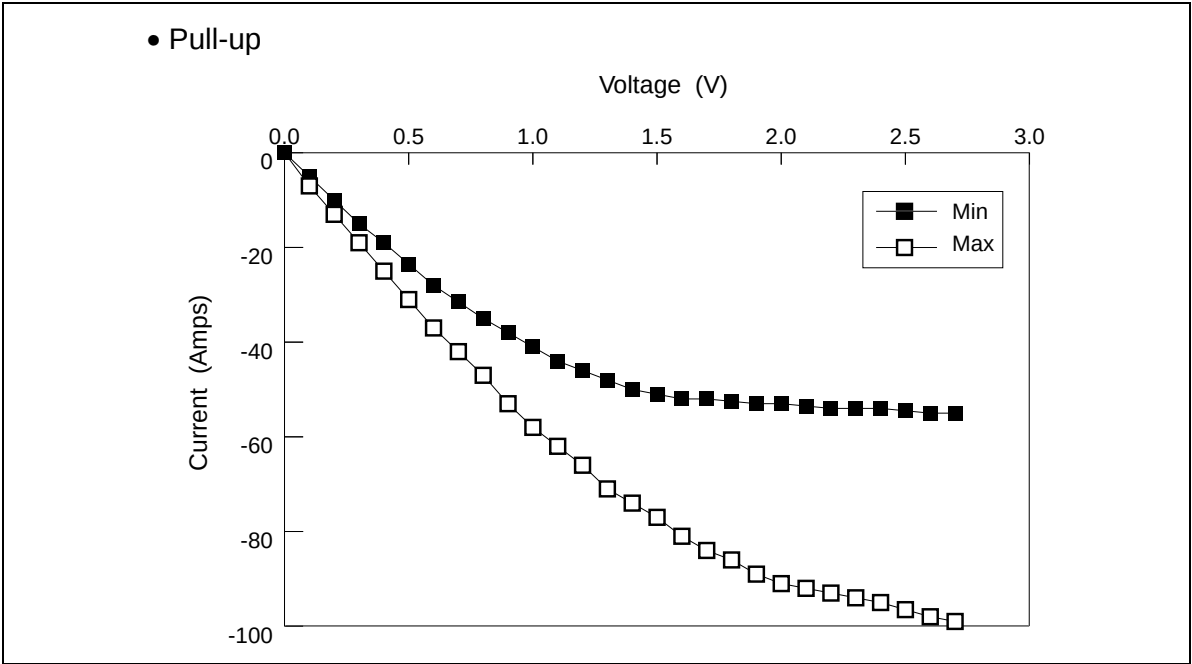


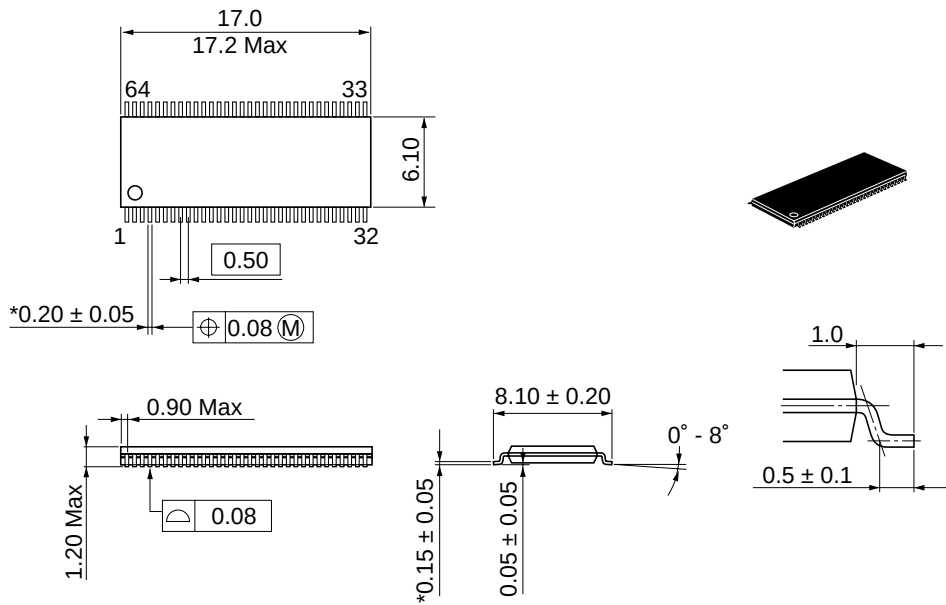
Figure . 2

Curve Data

Voltage (V)	Pull-down		Pull-up	
	I (mA)	I (mA)	I (mA)	I (mA)
	Min	Max	Min	Max
0.0	0	0	0	0
0.1	6	7	−5	−7
0.2	10	15	−10	−13
0.3	15	22	−15	−19
0.4	19	29	−19	−25
0.5	23	35.5	−23.5	−31
0.6	27	41.5	−28	−37
0.7	30.5	48	−31.5	−42
0.8	34	54	−35	−47
0.9	36.5	59	−38	−53
1.0	38.5	65	−41	−58
1.1	40	70	−44	−62
1.2	42	75	−46	−66
1.3	43	79	−48	−71
1.4	44	82	−50	−74
1.5	44	84.5	−51	−77
1.6	45	87	−52	−81
1.7	45	89	−52	−84
1.8	45	90	−52.5	−86
1.9	45	90	−53	−89
2.0	45	91	−53	−91
2.1	46	91	−53.5	−92
2.2	46	91	−54	−93
2.3	46	91	−54	−94
2.4	46	91.5	−54	−95
2.5	46	92	−54.5	−96.5
2.6	46	92	−55	−98
2.7	46	92	−55	−99

Package Dimensions

Unit : mm



*Pd plating

Hitachi Code	TTP-64D
JEDEC	—
EIAJ	Conforms
Weight (reference value)	0.47 g

Disclaimer

1. Hitachi neither warrants nor grants licenses of any rights of Hitachi’s or any third party’s patent, copyright, trademark, or other intellectual property rights for information contained in this document. Hitachi bears no responsibility for problems that may arise with third party’s rights, including intellectual property rights, in connection with use of the information contained in this document.

2. Products and product specifications may be subject to change without notice. Confirm that you have received the latest product standards or specifications before final design, purchase or use.

3. Hitachi makes every attempt to ensure that its products are of high quality and reliability. However, contact Hitachi’s sales office before using the product in an application that demands especially high quality and reliability or where its failure or malfunction may directly threaten human life or cause risk of bodily injury, such as aerospace, aeronautics, nuclear power, combustion control, transportation, traffic, safety equipment or medical equipment for life support.

4. Design your application so that the product is used within the ranges guaranteed by Hitachi particularly for maximum rating, operating supply voltage range, heat radiation characteristics, installation conditions and other characteristics. Hitachi bears no responsibility for failure or damage when used beyond the guaranteed ranges. Even within the guaranteed ranges, consider normally foreseeable failure rates or failure modes in semiconductor devices and employ systemic measures such as fail-safes, so that the equipment incorporating Hitachi product does not cause bodily injury, fire or other consequential damage due to operation of the Hitachi product.

5. This product is not designed to be radiation resistant.

6. No one is permitted to reproduce or duplicate, in any form, the whole or part of this document without written approval from Hitachi.

7. Contact Hitachi’s sales office for any questions regarding this document or Hitachi semiconductor products.

Sales Offices

HITACHI

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	NorthAmerica	: http://semiconductor.hitachi.com/
	Europe	: http://www.hitachi-eu.com/hel/ecg
	Asia	: http://sicapac.hitachi-asia.com
	Japan	: http://www.hitachi.co.jp/Sicd/indx.htm

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 StraÙe 3 D-85622 Feldkirchen, Munich 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 URL : http://www.hitachi.com.sg 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 Telex : 23222 HAS-TP URL : http://www.hitachi.com.tw	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 Tel : <852>-(2)-735-9218 Fax : <852>-(2)-730-0281 URL : http://semiconductor.hitachi.com.hk
---	--	--	---

Copyright © Hitachi, Ltd., 2001. All rights reserved. Printed in Japan.
Colophon 4.0