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Renesas Technology Corp.
Customer Support Dept.
April 1, 2003

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HD74SSTV16859

1:2 13-bit SSTL_2 Registered Buffer



ADE-205-337H (Z)

Rev.8
June 2001

Description

The HD74SSTV16859 is a 1:2 13-bit registered buffer designed for 2.3 V to 2.7 V V_{CC} 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
- Package type

Package type	Package code	Package suffix	Taping code
TSSOP-64 pin	TTP-64D	T	EL (1,000 pcs / Reel)

Function Table

Inputs				Outputs	
RESET	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

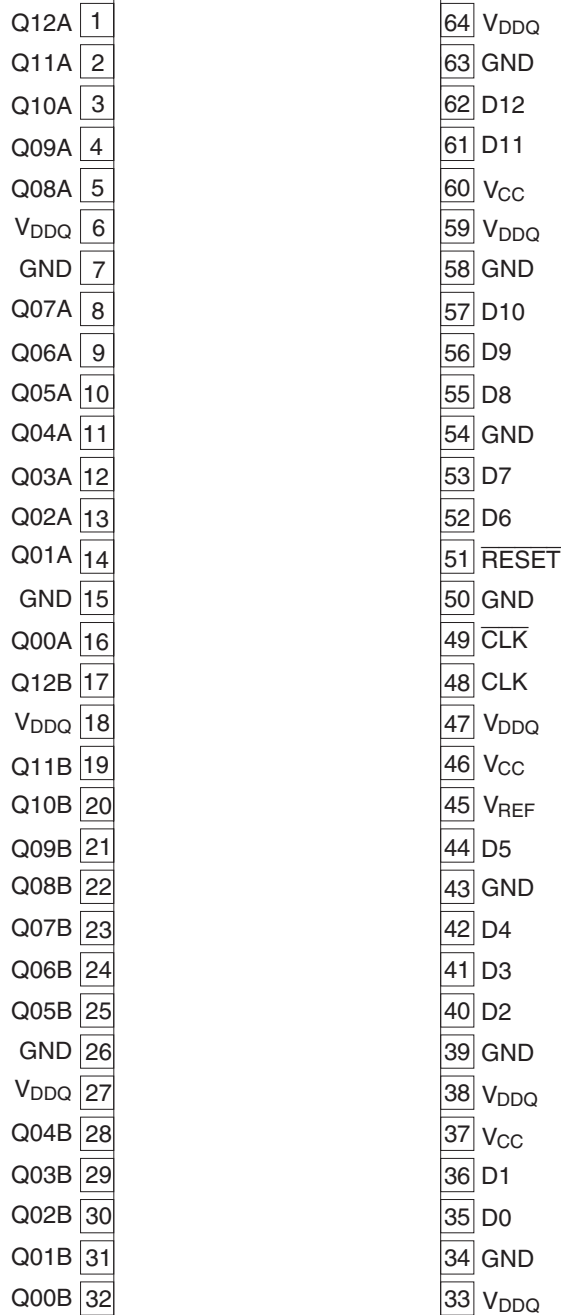
X : Immaterial

↑ : 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	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.

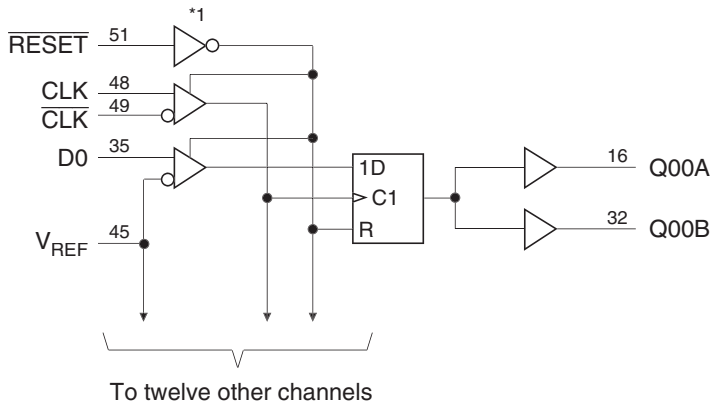
1. The input and output negative voltage ratings may be exceeded if the input and output clamp current ratings are observed.

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	$V_{REF} = 0.5 \times V_{DDQ}$
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



Note: 1. $\overline{\text{RESET}}$ input gate is connected to V_{DDQ} .

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}	V	I _{OH} = -16 mA	
	V _{OL}	2.3 to 2.7	—	—	0.2	V	I _{OL} = 100 μA	
		2.3	0	—	0.35	V	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/ MHz	$\overline{\text{RESET}}$ = V _{CC} , clock 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/ MHz	$\overline{\text{RESET}}$ = V _{CC} , clock V _I = V _{IH(AC)} or V _{IL(AC)} , CLK and $\overline{\text{CLK}}$ switching 50% / duty cycle. One data input data switching at half clock input 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	pF	V _{CMR} = 1.25 V, V _{PP} = 360 mV	
	$\overline{\text{RESET}}$		—	3.0	—	—	pF	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

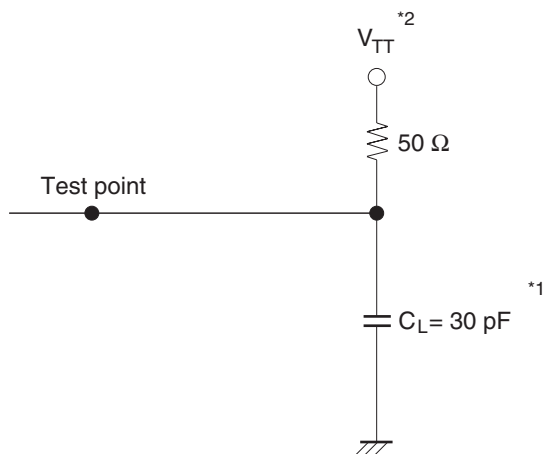
Item	Symbol	$V_{CC} = 2.5 \pm 0.2 \text{ V}$		Unit	Test Condition	
		Min	Max			
Clock frequency ^{*1}	f_{clock}	—	200	MHz		
Setup time	Fast slew rate ^{*4, 6}	t_{su}	0.75	—	ns	Data before $\text{CLK}\uparrow$, $\overline{\text{CLK}}\downarrow$
	Slow slew rate ^{*5, 6}		0.9	—		
Hold time	Fast slew rate ^{*4, 6}	t_{h}	0.75	—	ns	Data after $\text{CLK}\uparrow$, $\overline{\text{CLK}}\downarrow$
	Slow slew rate ^{*5, 6}		0.9	—		
Differential inputs active time	t_{act}	22	—	ns	Data inputs must be low after $\overline{\text{RESET}}$ high.	
Differential inputs inactive time	t_{inact}	22	—	ns	Data and clock inputs must be held at valid levels (not floating) after $\overline{\text{RESET}}$ low.	
Pulse width	t_{w}	2.5	—	ns	CLK , $\overline{\text{CLK}}$ "H" or "L"	
Output slew ^{*3}	t_{SL}	1	4	volt/ns		

$$(C_L = 30 \text{ pF}, R_L = 50 \Omega, V_{\text{REF}} = V_{\text{TT}} = V_{\text{DDQ}} \times 0.5)$$

Item	Symbol	$V_{CC} = 2.5 \pm 0.2 \text{ V}$			Unit	FROM (Input)	TO (Output)
		Min	Typ	Max			
Maximum clock frequency	f_{max}	200	—	—	MHz		
Propagation delay time ^{*2}	$t_{\text{PLH}}, t_{\text{PHL}}$	1.1	—	2.8	ns	CLK , $\overline{\text{CLK}}$	QA, QB
	t_{PHL}	—	—	5.0			$\overline{\text{RESET}}$

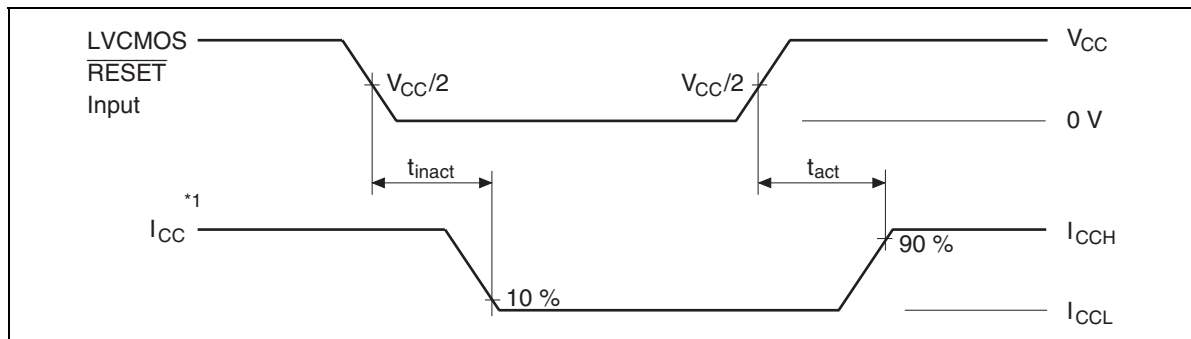
- Notes:
1. Although the clock is differential, all timing is relative to CLK going high and $\overline{\text{CLK}}$ going low.
 2. This timing relationship is specified into test load (see waveforms – 3, 4) with all of the outputs switching.
 3. Assumes into an equivalent, distributed load to the address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

Test Circuit

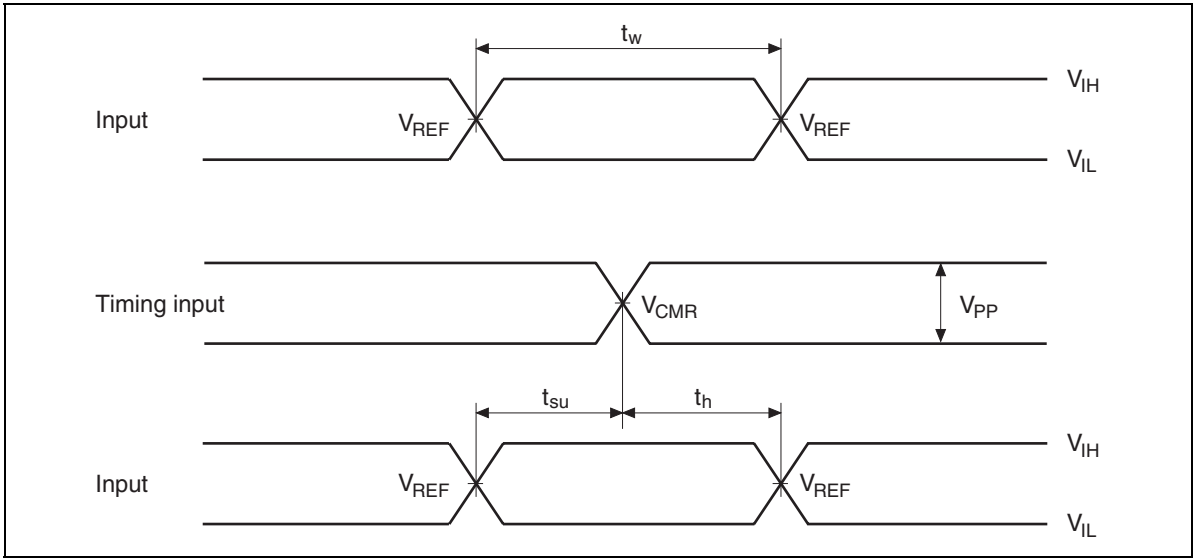


- Notes:
1. C_L includes probe and jig capacitance.
 2. $V_{TT} = V_{REF} = V_{DDQ} \times 0.5$

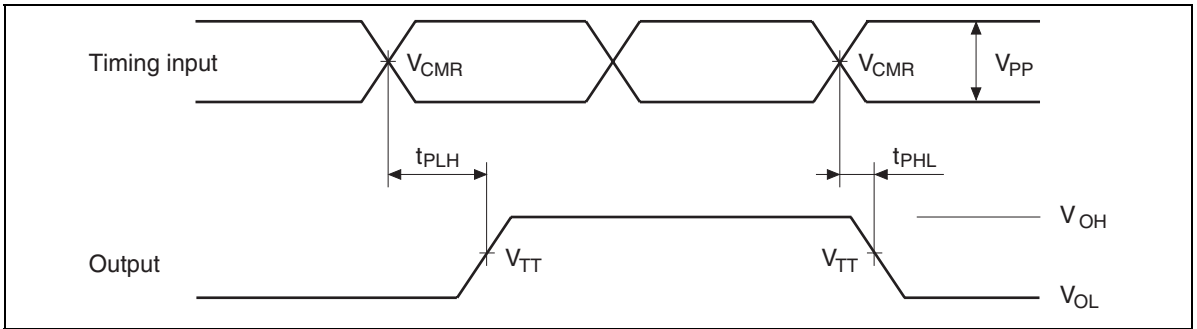
Waveforms - 1



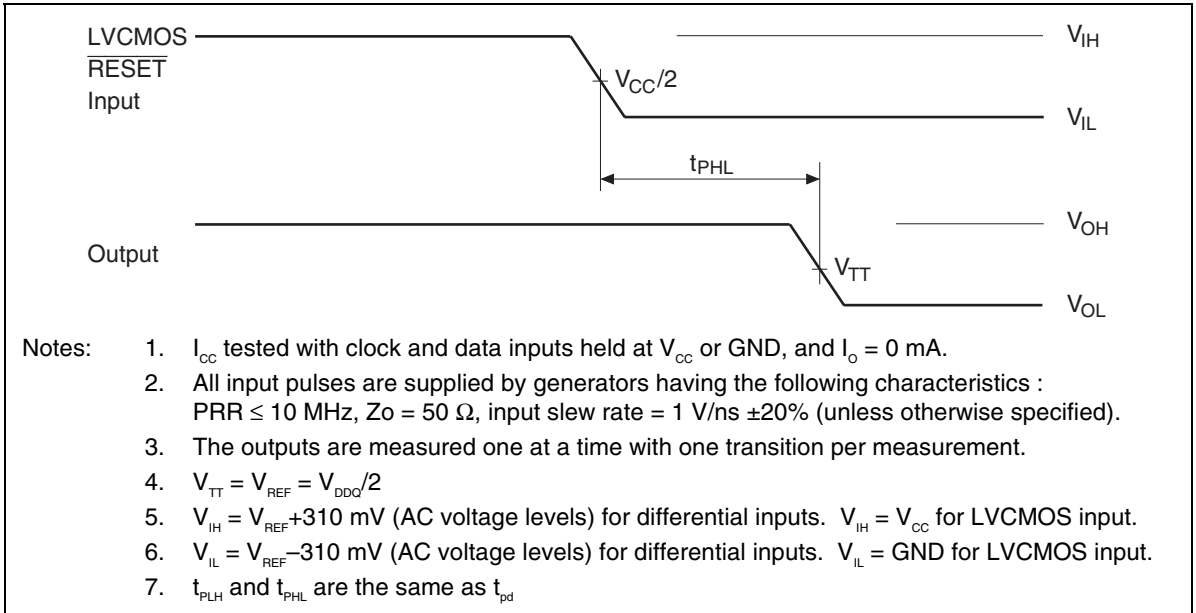
Waveforms – 2



Waveforms – 3



Waveforms – 4



Application Data

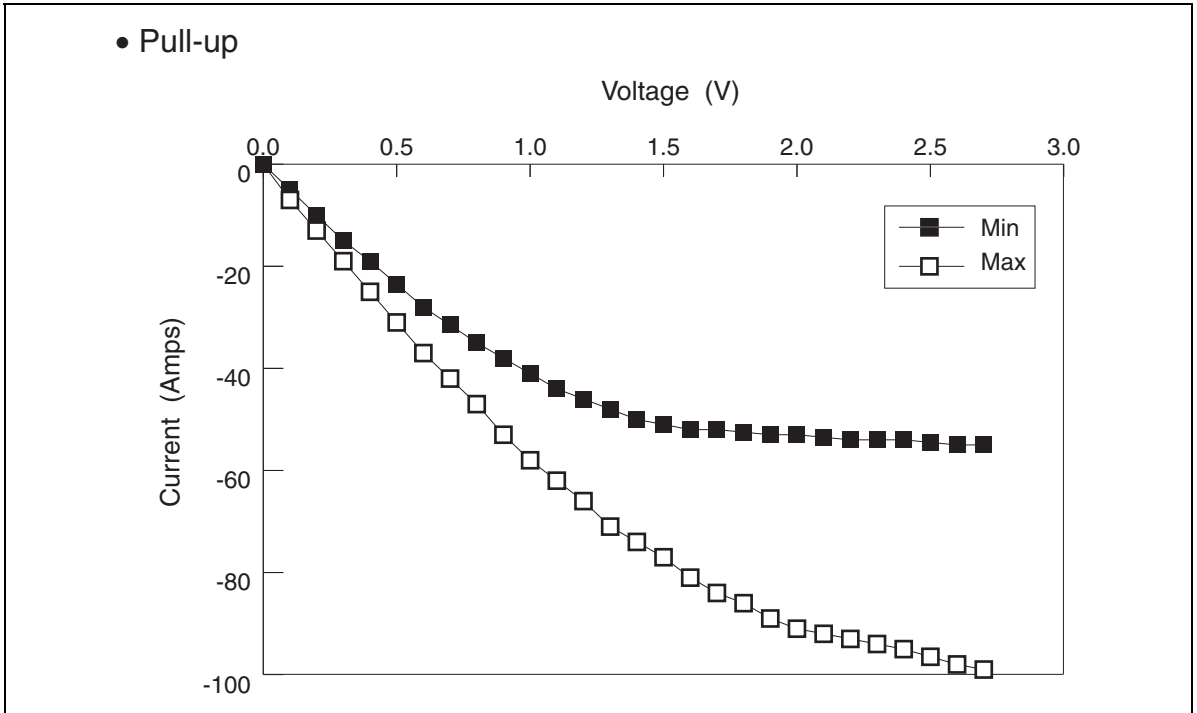


Figure . 1

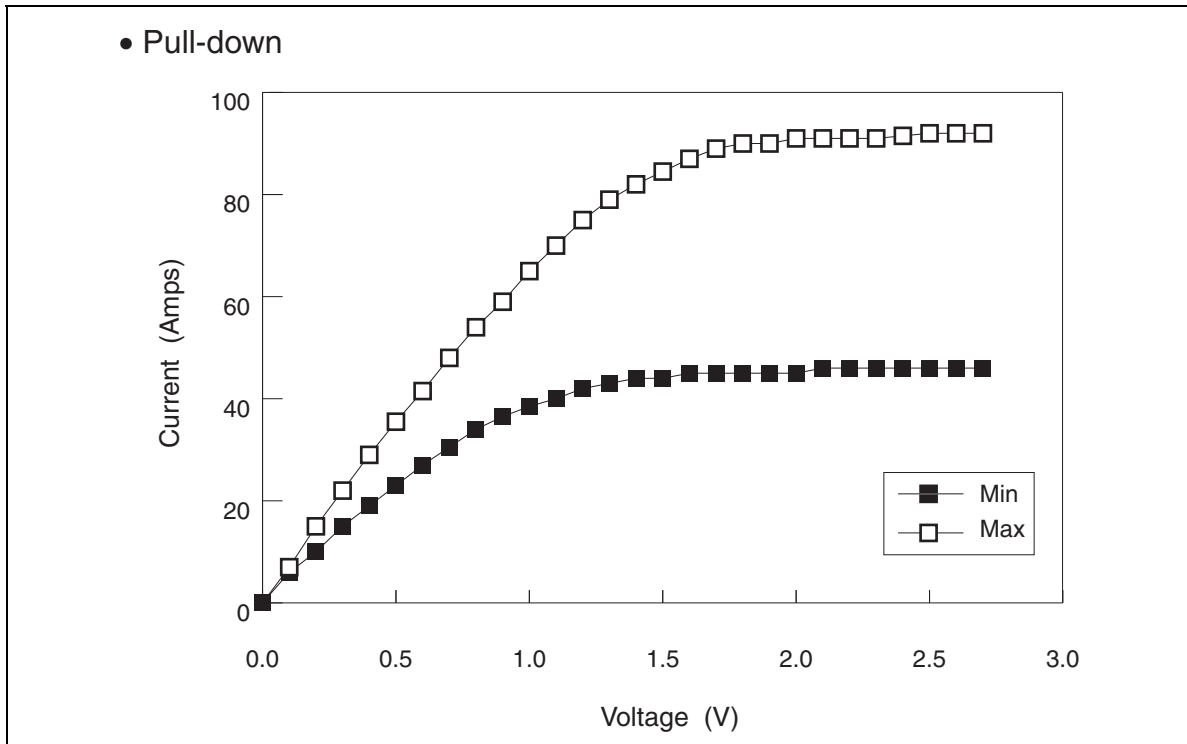


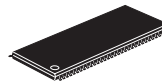
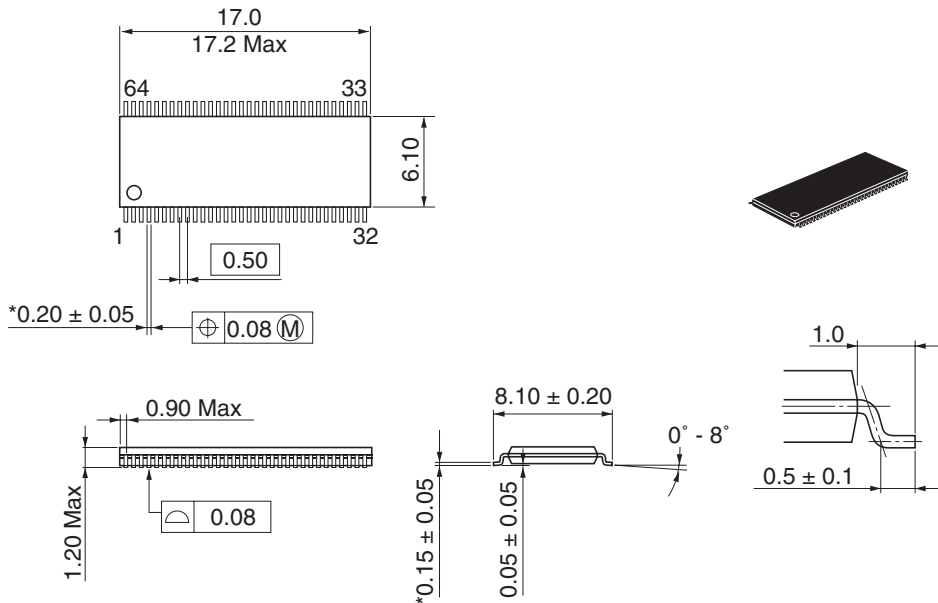
Figure . 2

Curve Data

Voltage (V)	Pull-down		Pull-up	
	I (mA)		I (mA)	
	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

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