

**Product Specification** 

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# NHD-C12864WO-B1TGH#-M

## Chip-On-Glass (COG) Liquid Crystal Display

<b>NHD -</b>	Newhaven Display
<b>C12864 -</b>	128x64 Pixels
<b>B1 -</b>	Model
<b>T -</b>	White LED Backlight
<b>G -</b>	STN(+) Gray
<b>H -</b>	Transflective, Wide Temperature, 6:00 Optimal View
<b>#-M -</b>	Mounting Holes

## Table of Contents

Document Revision History.....	2
Mechanical Drawing .....	3
Pin Description and Wiring Diagram.....	4
Electrical Characteristics .....	5
Optical Characteristics .....	5
Controller Information.....	5
Table of Commands .....	6
Timing Characteristics.....	7
Quality Information .....	10

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## Additional Resources

- **Support Forum:** <https://support.newhavendisplay.com/hc/en-us/community/topics>
- **GitHub:** <https://github.com/newhavendisplay>
- **Example Code:** <https://support.newhavendisplay.com/hc/en-us/categories/4409527834135-Example-Code/>
- **Knowledge Center:** [https://www.newhavendisplay.com/knowledge\\_center.html](https://www.newhavendisplay.com/knowledge_center.html)
- **Quality Center:** [https://www.newhavendisplay.com/quality\\_center.html](https://www.newhavendisplay.com/quality_center.html)
- **Precautions for using LCDs/LCMs:** <https://www.newhavendisplay.com/specs/precautions.pdf>
- **Warranty / Terms & Conditions:** <https://www.newhavendisplay.com/terms.html>

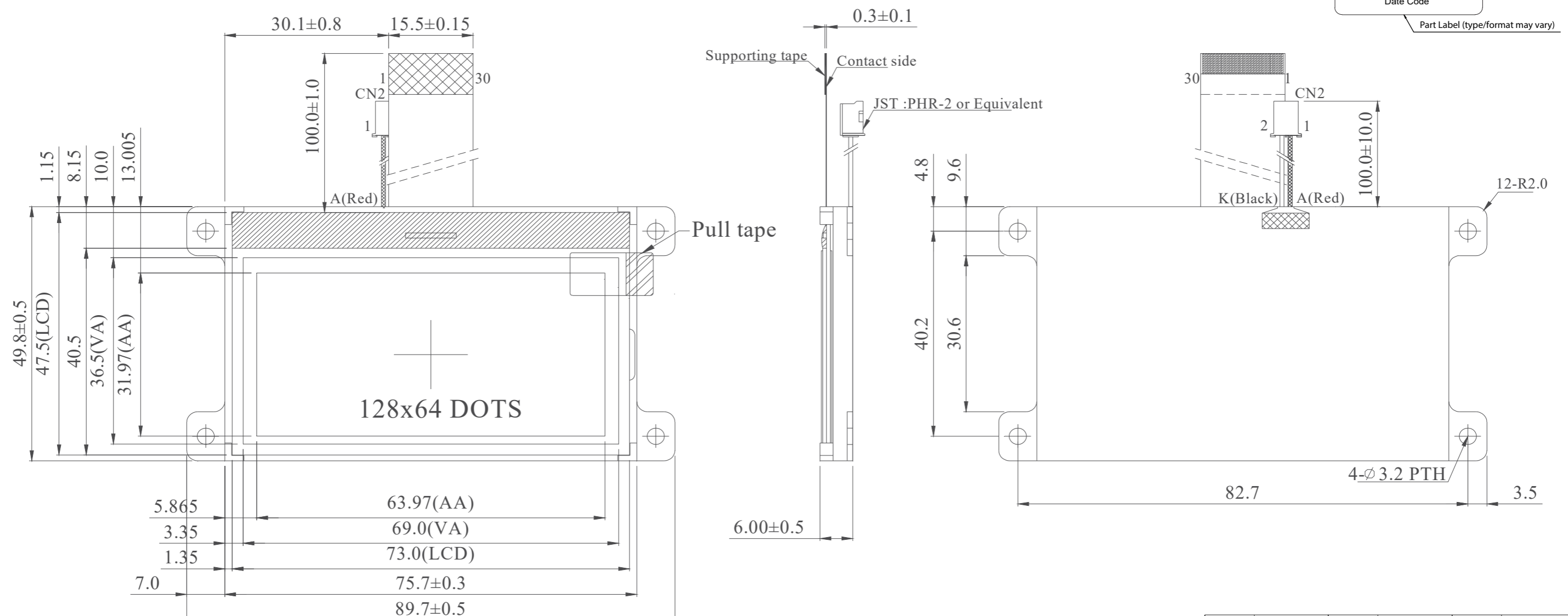


## Document Revision History

Revision	Date	Description	Changed By
0	09/01/2008	Initial Release	-
1	02/26/2010	User Guide Reformat	MC
2	03/09/2010	Block Diagram Updated	BE
3	05/04/2010	Block Diagram and Pin Description	MP
4	05/05/2010	Backlight Connectors Updated	BE
5	05/14/2010	Pin Description Update	MP
6	05/02/2011	Example Initialization Code Updated	AK
7	05/13/2011	Block Diagram Updated	AK
8	05/19/2011	Block Diagram & Pin Description Updated	AK
9	01/10/2012	Pin Description & Controller Link Updated	AK
10	06/15/2012	Timing Characteristics Updated	AK
11	04/04/2013	Backlight Mating Connector, LCD Voltage Levels Updated	AK
12	04/15/2013	Optical Characteristics Updated	AK
13	03/16/2015	Pin Description Updated	RM
14	03/21/2017	Electrical & Optical Characteristics Updated	SB
15	04/22/2020	Initialization Code Updated	TM
16	07/16/2020	Updated 2D Mechanical Drawing format, Contrast Voltage Range, Contrast Ratio & Quality Information	AS
17	04/18/2022	Controller IC changed from ST7565P to ST7567, Pin Description Updated, Part Revision Upgraded to Rev1A	CJ
18	12/07/2022	Updated the Pull tape location in the Mechanical Drawing	JT
19	12/16/2022	Updated the Pin Description, Wiring Diagram, and Mechanical Drawing	KL

# Mechanical Drawing

**Newhaven Display**  
 NHD-C12864WO-B1TGH#-M\_Rev1A  
 Date Code  
 Part Label (type/format may vary)



Pin No.	Symbol	Pin No.	Symbol	Pin No.	Symbol
1	CSB	11	DB5	21	XV0
2	RSTB	12	DB6	22	VG
3	A0	13	DB7	23	NC
4	R/W	14	VDD	24	NC
5	E	15	Vss	25	NC
6	DB0	16	NC	26	NC
7	DB1	17	NC	27	NC
8	DB2	18	NC	28	C86
9	DB3	19	NC	29	PSB
10	DB4	20	V0	30	NC

- Product Description: 128x64 Graphic LCD**
1. Driver IC: ST7567
  2. Driving Mode: 1/65 Duty, 1/9 Bias
  3. Interface: 8-bit 6800/8080 Parallel, 4-Line SPI
  4. Power Requirement: 3.0VLCD, 3.5V/64mA Backlight
  5. Optical Features: STN (+) Gray, Transflective, 6:00 View, White Backlight
  6. Recommended FFC Connector: 30pin, 0.5mm pitch; Ex. Molex 52982-3095

<b>Standard Tolerance:</b> (Unless otherwise specified)  Linear: ±0.3mm		
	Drawing/Part Number: <b>NHD-C12864WO-B1TGH#-M</b>	Revision: <b>1A</b>
<b>Unless otherwise specified:</b> • Dimensions are in Millimeters • Third Angle Projection	Drawn By: K. Lewis	Approved By: K. Lewis
	Drawn Date: 12/16/2022	Approved Date: 12/16/2022
This drawing is solely the property of Newhaven Display International, Inc. The information it contains is not to be disclosed, reproduced or copied in whole or part without written approval from Newhaven Display.		

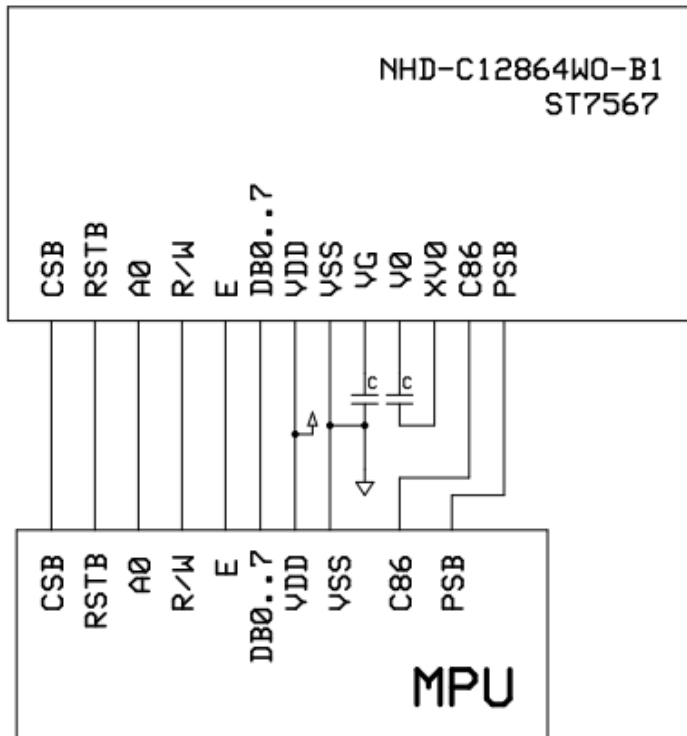
## Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description
1	CSB	MPU	Active LOW Chip Select
2	RSTB	MPU	Active LOW Reset signal
3	A0	MPU	Register Select signal. A0=0: instruction; A0 = 1: data
4	R/W /WR	MPU	6800 Mode: Read/Write select signal. R/W=1: Read R/W: =0: Write 8080 Mode: Active LOW Write Signal Serial Mode: +3V (HIGH)
5	E /RD	MPU	6800 Mode: Active HIGH Enable Signal 8080 Mode: Active LOW Read Signal Serial Mode: +3V (HIGH)
6-13	DB0~DB7	MPU	In parallel interface: 8-bit-directional data bus In serial interface: DB0~DB5 = VDD or NC D6 = Serial clock D7 = Serial data
14	V <sub>DD</sub>	Power Supply	Supply Voltage for Logic
15	V <sub>SS</sub>	Power Supply	Ground
16-19	NC	-	No connect
20	V0	Power Supply	Connect 0.1μF - 1μF Capacitor to XV0 (pin 21)
21	XV0	Power Supply	Connect 0.1μF - 1μF Capacitor to V0 (pin 20)
22	VG	Power Supply	Connect 0.1μF - 1μF Capacitor to V <sub>SS</sub>
23-27	NC	-	No connect
28	C86	MPU	Select MPU interface pin. C86= H:6800; C86= L:8080
29	PSB	MPU	Parallel/Serail select. PS= H: Parallel; PS= L: Serial
30	NC	-	No connect

**Recommended LCD connector:** 0.5mm Pitch, 30 pin FFC. Molex p/n: 52892-3095

**Backlight connector:** A2001H-02P

**Mates with:** A2001WR-2P, A2001WR-S-2P, A2001WV-2P, A2001WV-S-2P



## Electrical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Temperature Range	T <sub>OP</sub>	Absolute Max	-20	-	+70	°C
Storage Temperature Range	T <sub>ST</sub>	Absolute Max	-30	-	+80	°C
Supply Voltage	V <sub>DD</sub>	-	2.8	3.0	3.2	V
Supply Current	I <sub>DD</sub>	V <sub>DD</sub> = 3.0V	-	0.7	1.0	mA
Supply for LCD (contrast)	V <sub>LCD</sub>	T <sub>OP</sub> = 25°C	9.3	9.5	9.7	V
"H" Level input	V <sub>IH</sub>	-	0.7 * V <sub>DD</sub>	-	V <sub>DD</sub>	V
"L" Level input	V <sub>IL</sub>	-	V <sub>SS</sub>	-	0.3 * V <sub>DD</sub>	V
"H" Level output	V <sub>OH</sub>	-	0.8 * V <sub>DD</sub>	-	V <sub>DD</sub>	V
"L" Level output	V <sub>OL</sub>	-	V <sub>SS</sub>	-	0.2 * V <sub>DD</sub>	V
LED Backlight current	I <sub>LED</sub>	-	20	64	80	mA
LED Backlight voltage	V <sub>LED</sub>	I <sub>LED</sub> = 64mA	3.4	3.5	3.6	V

\*The LED of the backlight is driven by current drain; drive voltage is for reference only. Drive voltage must be selected to ensure backlight current drain is below MAX level stated.

## Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Optimal Viewing Angles	Top	CR ≥ 2	-	20	-	°
	Bottom		-	40	-	°
	Left		-	30	-	°
	Right		-	30	-	°
Contrast Ratio	CR	-	-	3	-	-
Response Time	Rise	T <sub>OP</sub> = 25°C	-	200	300	ms
	Fall		-	250	350	ms

## Controller Information

Built-in ST7567 Source Driver: <https://support.newhavendisplay.com/hc/en-us/articles/4414899443607-ST7567>



## Table of Commands

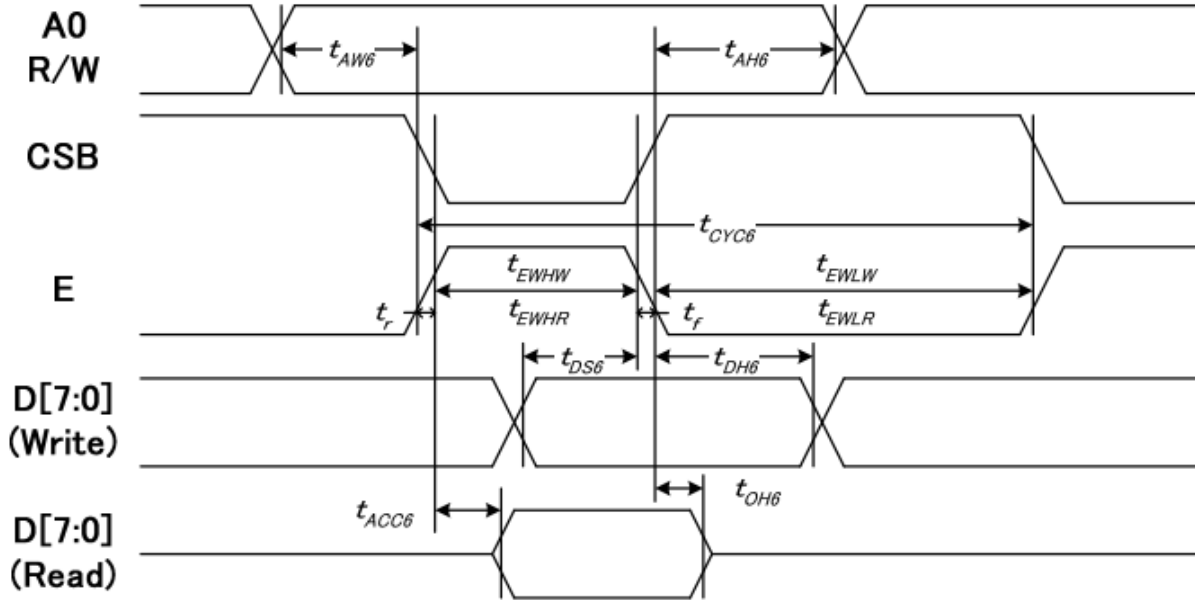
INSTRUCTION	A0	R/W (RWR)	COMMAND BYTE								DESCRIPTION
			D7	D6	D5	D4	D3	D2	D1	D0	
(1) Display ON/OFF	0	0	1	0	1	0	1	1	1	D	D=1, display ON D=0, display OFF
(2) Set Start Line	0	0	0	1	S5	S4	S3	S2	S1	S0	Set display start line
(3) Set Page Address	0	0	1	0	1	1	Y3	Y2	Y1	Y0	Set page address
(4) Set Column Address	0	0	0	0	0	1	X7	X6	X5	X4	Set column address (MSB)
	0	0	0	0	0	0	X3	X2	X1	X0	Set column address (LSB)
(5) Read Status	0	1	0	MX	D	RST	0	0	0	0	Read IC Status
(6) Write Data	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write display data to RAM
(7) Read Data	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read display data from RAM
(8) SEG Direction	0	0	1	0	1	0	0	0	0	MX	Set scan direction of SEG MX=1, reverse direction MX=0, normal direction
(9) Inverse Display	0	0	1	0	1	0	0	1	1	INV	INV =1, inverse display INV =0, normal display
(10) All Pixel ON	0	0	1	0	1	0	0	1	0	AP	AP=1, set all pixel ON AP=0, normal display
(11) Bias Select	0	0	1	0	1	0	0	0	1	BS	Select bias setting 0=1/9; 1=1/7 (at 1/65 duty)
(12) Read-modify-Write	0	0	1	1	1	0	0	0	0	0	Column address increment: Read:+0 , Write:+1
(13) END	0	0	1	1	1	0	1	1	1	0	Exit Read-modify-Write mode
(14) RESET	0	0	1	1	1	0	0	0	1	0	Software reset
(15) COM Direction	0	0	1	1	0	0	MY	-	-	-	Set output direction of COM MY=1, reverse direction MY=0, normal direction
(16) Power Control	0	0	0	0	1	0	1	VB	VR	VF	Control built-in power circuit ON/OFF
(17) Regulation Ratio	0	0	0	0	1	0	0	RR2	RR1	RR0	Select regulation resistor ratio
(18) Set EV	0	0	1	0	0	0	0	0	0	1	Double command!! Set electronic volume (EV) level
	0	0	0	0	EV5	EV4	EV3	EV2	EV1	EV0	
(19) Set Booster	0	0	1	1	1	1	1	1	0	0	Double command!! Set booster level: BL=0: 4X BL=1: 5X
	0	0	0	0	0	0	0	0	0	BL	
(20) Power Save	0	0	Compound Command								Display OFF + All Pixel ON
(21) NOP	0	0	1	1	1	0	0	0	1	1	No operation
(22) Test	0	0	1	1	1	1	1	1	1	-	Do NOT use. Reserved for testing.

Note: Symbol "-" means this bit can be "H" or "L".

# Timing Characteristics

## 6800 Parallel

### System Bus Timing for 6800 Series MPU



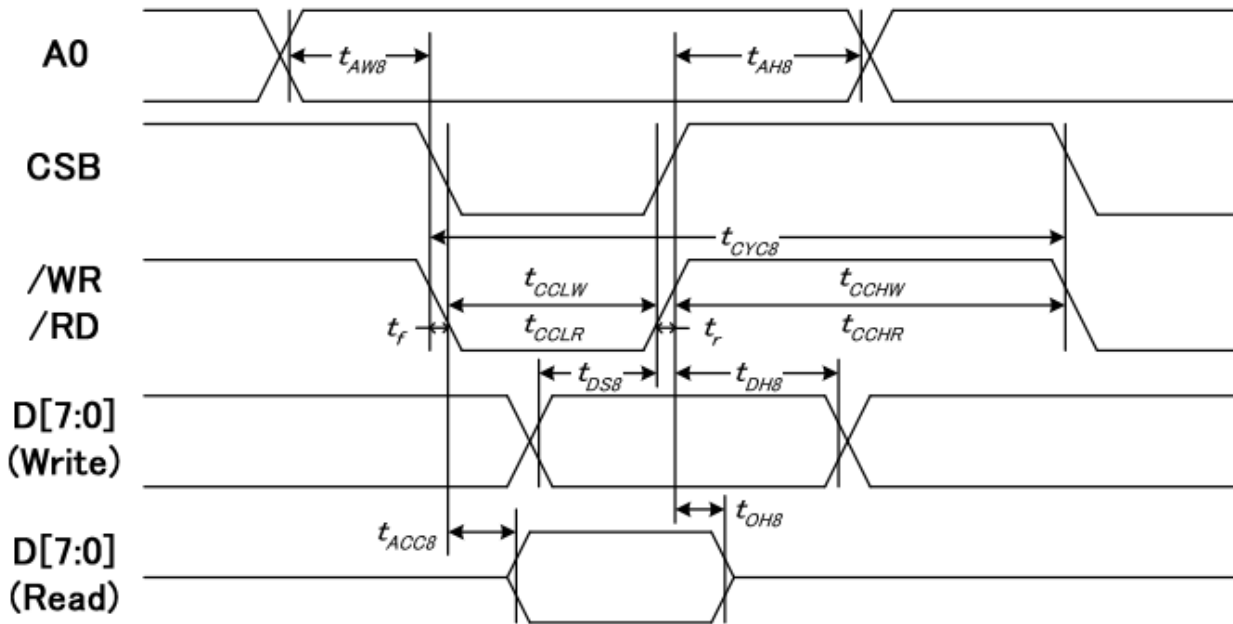
(VDD1 = 3.3V, Ta = 25°C)

Item	Signal	Symbol	Condition	Min.	Max.	Unit
Address setup time	A0	$t_{AW6}$		0	—	ns
Address hold time		$t_{AH6}$		10	—	
System cycle time	E	$t_{CYC6}$		240	—	
Enable L pulse width (WRITE)		$t_{EHLW}$		80	—	
Enable H pulse width (WRITE)		$t_{EHWLW}$		80	—	
Enable L pulse width (READ)		$t_{EHLR}$		80	—	
Enable H pulse width (READ)		$t_{EHWLR}$		140	—	
Write data setup time		D[7:0]	$t_{DS6}$		40	
Write data hold time	$t_{DH6}$			10	—	
Read data access time	$t_{ACC6}$		CL = 16 pF	—	70	
Read data output disable time	$t_{OH6}$		CL = 16 pF	5	50	



## 8080 Parallel

### System Bus Timing for 8080 Series MPU

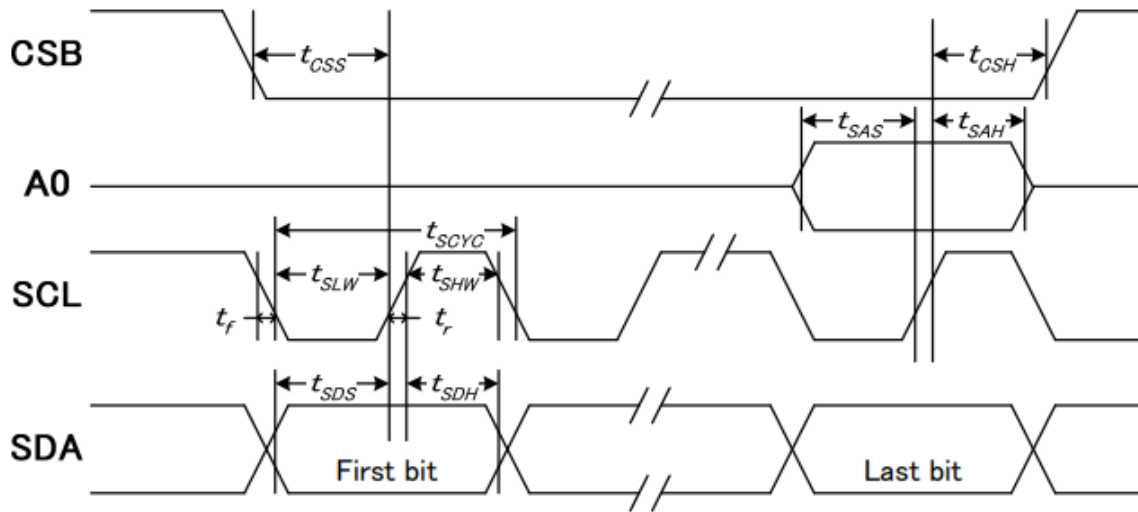


(VDD1 = 3.3V, Ta = 25°C)

Item	Signal	Symbol	Condition	Min.	Max.	Unit
Address setup time	A0	tAW8		0	—	ns
Address hold time		tAH8		10	—	
System cycle time	/WR	tCYC8		240	—	
/WR L pulse width (WRITE)		tCCLW		80	—	
/WR H pulse width (WRITE)		tCCHW		80	—	
/RD L pulse width (READ)		RD	tCCLR		140	
/RD H pulse width (READ)	tCCHR			80	—	
WRITE Data setup time	D[7:0]	tDS8		40	—	
WRITE Data hold time		tDH8		20	—	
READ access time		tACC8	CL = 16 pF	—	70	
READ Output disable time		tOH8	CL = 16 pF	5	50	

## 4-Line SPI

### System Bus Timing for 4-Line Serial Interface



(VDD1 = 3.3V, Ta = 25°C)

Item	Signal	Symbol	Condition	Min.	Max.	Unit
Serial clock period	SCLK	tSCYC		50	—	ns
SCLK "H" pulse width		tSHW		25	—	
SCLK "L" pulse width		tSLW		25	—	
Address setup time	A0	tSAS		20	—	
Address hold time		tSAH		10	—	
Data setup time	SDA	tSDS		20	—	
Data hold time		tSDH		10	—	
CSB-SCLK time	CSB	tCSS		20	—	
CSB-SCLK time		tCSH		40	—	

## Quality Information

Test Item	Content of Test	Test Condition	Note
High Temperature storage	Endurance test applying the high storage temperature for a long time.	+80°C , 200hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-30°C , 200hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time.	+70°C 200hrs	2
Low Temperature Operation	Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time.	-20°C , 200hrs	1,2
High Temperature / Humidity Operation	Endurance test applying the electric stress (voltage & current) and the high thermal with high humidity stress for a long time.	+60°C , 90% RH , 96hrs	1,2
Thermal Shock resistance	Endurance test applying the electric stress (voltage & current) during a cycle of low and high thermal stress.	-20°C,30min -> 25°C,5min -> 70°C,30min = 1 cycle 10 cycles	
Vibration test	Endurance test applying vibration to simulate transportation and use.	10-55Hz , 1.5mm amplitude. 60 sec in each of 3 directions X,Y,Z For 15 minutes	3
Static electricity test	Endurance test applying electric static discharge.	Air: ±800V 150pF/330Ω, 10 Times	
		Contact: ±600V 150pF/330Ω, 10 Times	

**Note 1:** No condensation to be observed.

**Note 2:** Conducted after 4 hours of storage at 25°C, 0%RH.

**Note 3:** Test performed on product itself, not inside a container.