

Product Specification

NHD-C12832DA-FSW-FBW-3V3

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

NHD-	Newhaven Display
C12832-	128 x 32 Pixels
DA-	Model
F-	Transflective
SW-	Side white LED Backlight
F-	FSTN (+)
B-	6:00 Optimal View
W-	Wide Temperature
3V3-	3.0V LCD, 3.0V Backlight

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Additional Resources

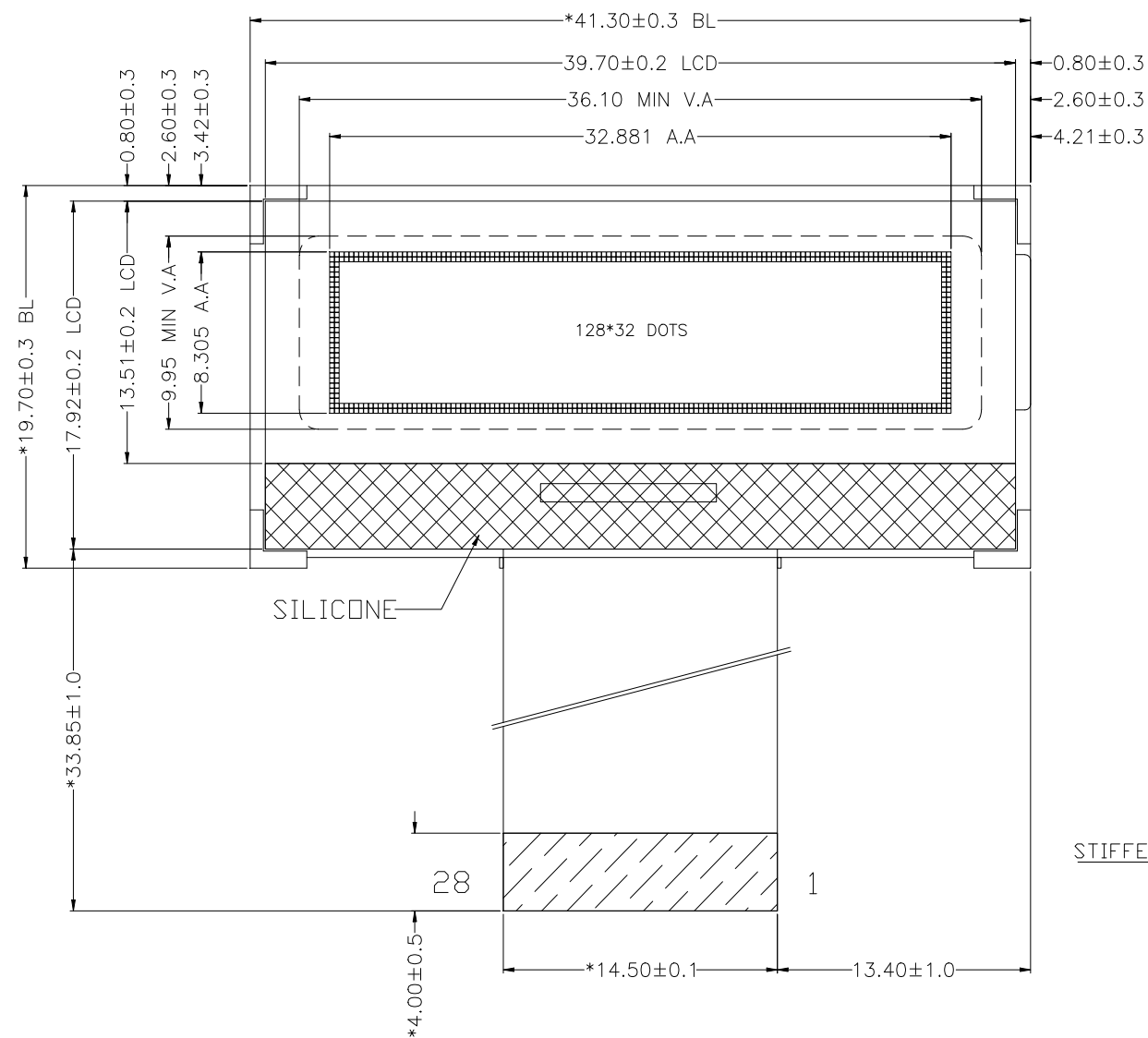
- **Support Forum:** <https://support.newhavendisplay.com/hc/en-us/community/topics>
- **GitHub:** <https://github.com/newhavendisplay>
- **Example Code:** <https://support.newhavendisplay.com/hc/en-us/categories/4409527834135-Example-Code/>
- **Knowledge Center:** https://www.newhavendisplay.com/knowledge_center.html
- **Quality Center:** 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>



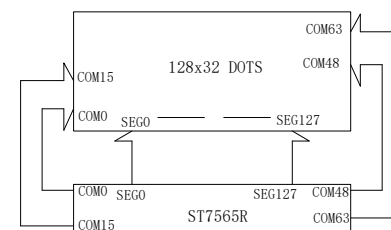
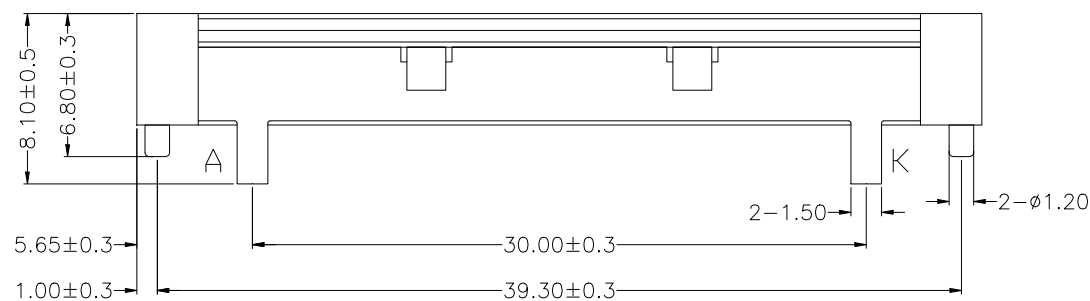
Document Revision History

Revision	Date	Description	Changed By
-	03/19/2025	Initial Release	KL

Mechanical Drawing

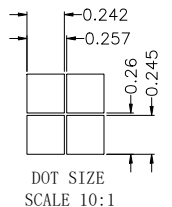
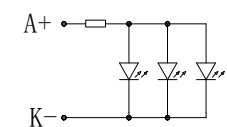


VIEWING DIRECTION



COM&SEG LAYOUT

CIRCUIT DIAGRAM



1	2	3	4	5	6	7	8	9	10	11	12	13	14
/CS1	/RES	A0	R/W	E	D0	D1	D2	D3	D4	D5	D6	D7	VDD
15	16	17	18	19	20	21	22	23	24	25	26	27	28
VSS	VOUT	CAP3-	CAP1+	CAP1-	CAP2-	CAP2+	V1	V2	V3	V4	V5	P/S	C86

Product Description: 128x32 Graphic COG LCD

1. Driver IC: ST7565R

2. Driving Mode: 1/33 Duty, 1/6 Bias

3. Interface: 8-bit 6800/8080 Parallel, 4-Wire SPI

4. Power Requirement: 3.0V LCD

5. Optical Features: FSTN (+) Transflective, 6:00 View, White Backlight

Standard Tolerance:
(Unless otherwise specified)

Linear: ±0.3mm

NEWHAVEN DISPLAY
INTERNATIONAL

Drawing/Part Number:

NHD-C12832DA-FSW-FBW-3V3

Revision:

1A

Unless otherwise specified:

• Dimensions are in Millimeters

• Third Angle Projection

Drawn By: K. Lewis

Drawn Date: 03/19/2025

Approved By: K. Lewis

Approved Date: 03/19/2025

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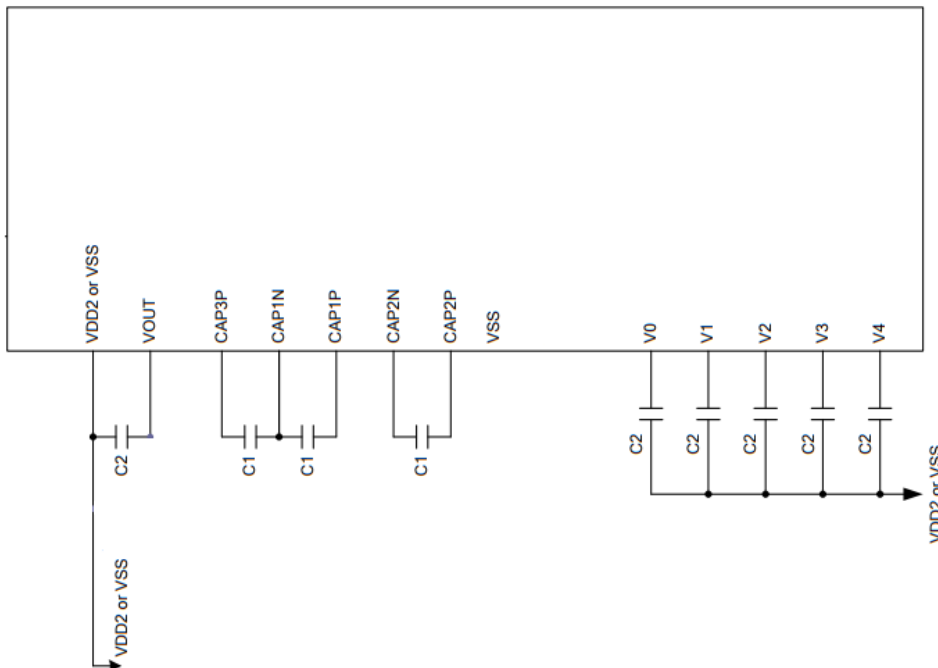
Pin Description

Pin No.	Symbol	External Connection	Function Description
1	CS1B	MPU	Active LOW Chip select signal
2	/RES	MPU	Active LOW Reset signal
3	A0	MPU	Register select signal. A0=1: Data; A0=0: Command
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
5	E /RD	MPU	6800 Mode: Active High Enable signal 8080 Mode: Active LOW Read signal
6-13	D0-D7	MPU	Parallel interface: 8-bit directional data bus Serial interface: DB0-DB5 = No Connect D6=Serial clock (SCL) D7= Serial Data (SI)
14	VDD	Power Supply	Supply Voltage for LCD and Logic (+3.0V)
15	VSS	Power Supply	Ground
16	VOUT	Power Supply	Connect 1 μ F – 2.2 μ F Capacitor to VDD or VSS
17	CAP3-	Power Supply	Connect 1 μ F – 2.2 μ F Capacitor to CAP1+ (pin 18)
18	CAP1+	Power Supply	Connect 1 μ F – 2.2 μ F Capacitor to CAP1- (pin 19) and CAP3- (pin 17)
19	CAP1-	Power Supply	Connect 1 μ F – 2.2 μ F Capacitor to CAP1+ (pin 18)
20	CAP2-	Power Supply	Connect 1 μ F – 2.2 μ F Capacitor to CAP2+ (pin 21)
21	CAP2+	Power Supply	Connect 1 μ F – 2.2 μ F Capacitor to CAP2- (pin 20)
22-26	V1-V5	Power Supply	0.1 μ F – 1 μ F Capacitor to VDD or VSS
27	P/S	Power Supply	Interface Mode select signal. P/S=1: Parallel; P/S=0: Serial
28	C86	MPU	MPU Interface select signal. C86=1: 6800; C86=0: 8080
A	LED+	Power Supply	Backlight Anode (40mA)
K	LED-	Power Supply	Backlight Cathode (Ground)

Recommended LCD connector: 0.5mm pitch, 28-pin FFC. Molex 524372871 or equivalent.

Recommended Breakout Board: NHD-FFC28

Wiring Diagram



Electrical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Temperature Range	T _{OP}	Absolute Max	-20	-	+70	°C
Storage Temperature Range	T _{ST}	Absolute Max	-30	-	+80	°C
Supply Voltage	V _{DD}	-	2.8	3.0	3.3	V
Supply Current	I _{DD}	T _{OP} = 25°C, V _{DD} = 3.0V	-	0.15	0.5	mA
Supply for LCD (contrast)	V _{LCD}	T _{OP} = 25°C	6.6	6.9	7.2	V
"H" Level input	V _{IH}	-	0.8 * V _{DD}	-	V _{DD}	V
"L" Level input	V _{IL}	-	V _{SS}	-	0.2 * V _{DD}	V
"H" Level output	V _{OH}	-	0.8 * V _{DD}	-	V _{DD}	V
"L" Level output	V _{OL}	-	V _{SS}	-	0.2 * V _{DD}	V
Backlight supply voltage	V _{LED}	I _{LED} = 45	3.0	3.2	3.4	V
Backlight supply current	I _{LED}	-	-	45	60	mA

Optical Characteristics

Item		Symbol	Condition	Min.	Typ.	Max.	Unit
Optimal Viewing Angles	Top	φY+	CR ≥ 2	-	40	-	°
	Bottom	φY-		-	40	-	°
	Left	θX-		-	40	-	°
	Right	θX+		-	30	-	°
Contrast Ratio		CR	-	2	5.0	-	-
Response Time	Rise	T _R	T _{OP} = 25°C	-	72	150	ms
	Fall	T _F		-	109	200	ms

Controller Information

Built-in ST7565R Controller: <https://support.newhavendisplay.com/hc/en-us/articles/4414899357591-ST7565R>



Table of Commands

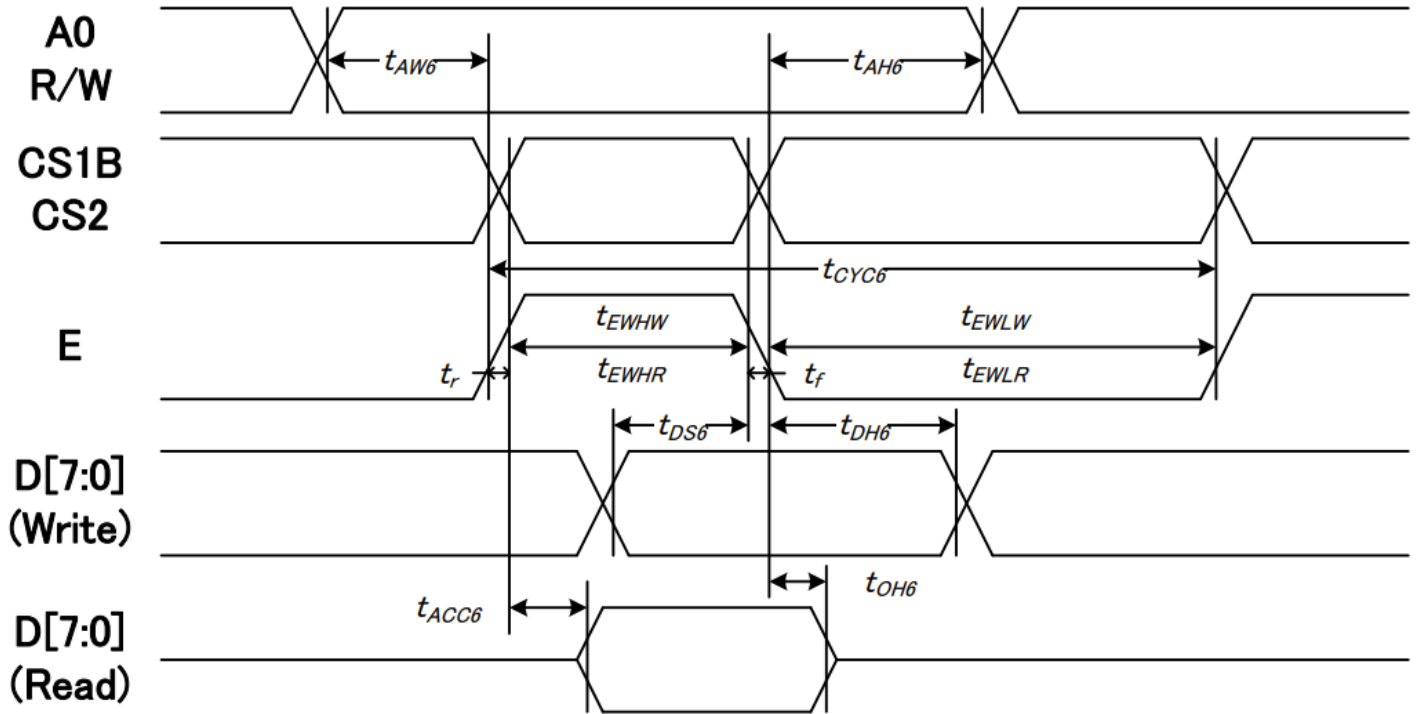
INSTRUCTION	A0	R/W (RWR)	COMMAND BYTE								DESCRIPTION
			D7	D6	D5	D4	D3	D2	D1	D0	
Display ON/OFF	0	0	1	0	1	0	1	1	1	D	D=1, display ON D=0, display OFF
Set Start Line	0	0	0	1	S5	S4	S3	S2	S1	S0	Set display start line
Set Page Address	0	0	1	0	1	1	Y3	Y2	Y1	Y0	Set page address
Set Column Address	0	0	0	0	0	1	X7	X6	X5	X4	Set column address (MSB)
	0	0	0	0	0	0	X3	X2	X1	X0	Set column address (LSB)
Read Status	0	1	BUSY	MX	D	RST	0	0	0	0	Read IC Status
Write Data	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write display data to RAM
Read Data	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read display data from RAM
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
Inverse Display	0	0	1	0	1	0	0	1	1	INV	INV =1, inverse display INV =0, normal display
All Pixel ON	0	0	1	0	1	0	0	1	0	AP	AP=1, set all pixel ON AP=0, normal display
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)
Read-modify-Write	0	0	1	1	1	0	0	0	0	0	Column address increment: Read:+0 , Write:+1
END	0	0	1	1	1	0	1	1	1	0	Exit Read-modify-Write mode
RESET	0	0	1	1	1	0	0	0	1	0	Software reset
COM Direction	0	0	1	1	0	0	MY	-	-	-	Set output direction of COM MY=1, reverse direction MY=0, normal direction
Power Control	0	0	0	0	1	0	1	VB	VR	VF	Control built-in power circuit ON/OFF
Regulation Ratio	0	0	0	0	1	0	0	RR2	RR1	RR0	Select regulation resistor ratio
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	
Power Save Mode Set	0	0	1	0	1	0	1	1	0	MD	MD=0, sleep mode MD=1, normal
	0	0	0	0	0	0	0	0	0	0	
Power Save	0	0	Compound Command								Display OFF + All Pixel ON
Set Booster	0	0	1	1	1	1	1	0	0	0	Double command!! Set booster level: BL[1:0]=(0,0), x2, x3, x4 BL[1:0]=(0,1), x5 BL[1:0]=(1,1), x6
	0	0	0	0	0	0	0	0	BL1	BL0	
NOP	0	0	1	1	1	0	0	0	1	1	No operation
Test	0	0	1	1	1	1	-	-	-	-	Do NOT use. Reserved for testing.

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



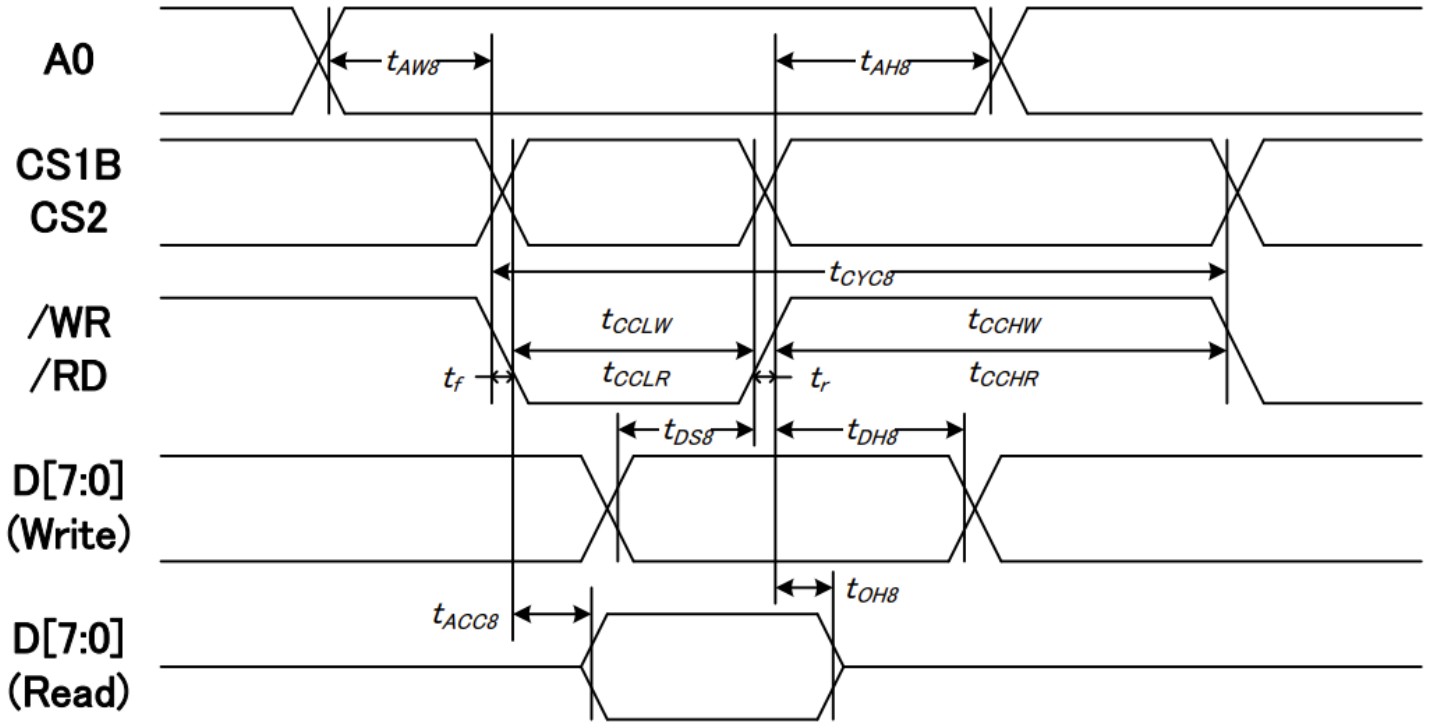
Timing Characteristics

System Bus Timing for 6800 Series MPU



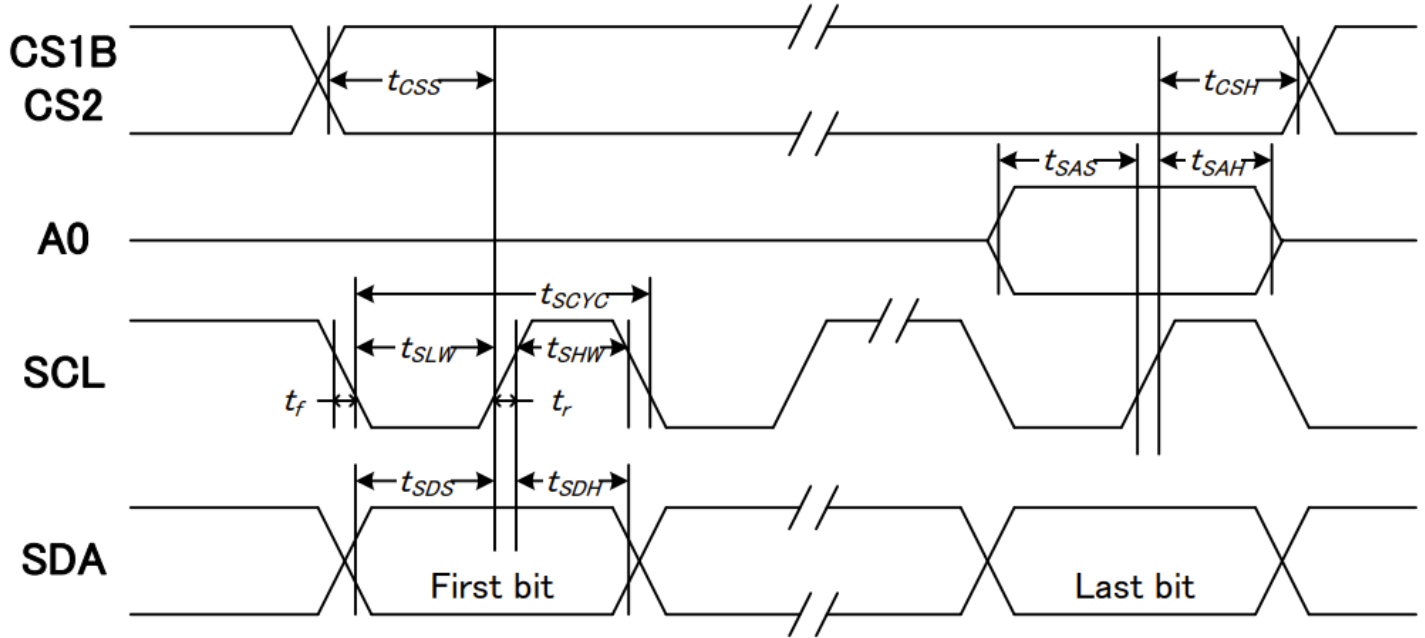
Item	Signal	Symbol	Condition	Min.	Max.	Unit
Address setup time	A0	t_{AW6}		0	—	ns
Address hold time		t_{AH6}		0	—	
System cycle time	E	t_{CYC6}		240	—	
Enable L pulse width (WRITE)		t_{EHLW}		80	—	
Enable H pulse width (WRITE)		t_{EHLH}		80	—	
Enable L pulse width (READ)		t_{EWLR}		80	—	
Enable H pulse width (READ)	D[7:0]	t_{EWHR}		140	—	
Write data setup time		t_{DS6}		40	—	
Write data hold time		t_{DH6}		10	—	
Read data access time		t_{ACC6}	CL = 100 pF	—	70	
Read data output disable time		t_{OH6}	CL = 100 pF	5	50	

System Bus Timing for 8080 Series MPU



Item	Signal	Symbol	Condition	Min.	Max.	Unit
Address setup time	A0	t_{AW8}		0	—	ns
Address hold time		t_{AH8}		0	—	
System cycle time	/WR	t_{CYC8}		240	—	
/WR L pulse width (WRITE)		t_{CCLW}		80	—	
/WR H pulse width (WRITE)		t_{CCHW}		80	—	
/RD L pulse width (READ)	RD	t_{CCLR}		140	—	
/RD H pulse width (READ)		t_{CCHR}		80	—	
WRITE Data setup time	D[7:0]	t_{DS8}		40	—	
WRITE Data hold time		t_{DH8}		20	—	
READ access time		t_{ACC8}	CL = 100 pF	—	70	
READ Output disable time		t_{OH8}	CL = 100 pF	5	50	

System Bus Timing for 4-Wire SPI

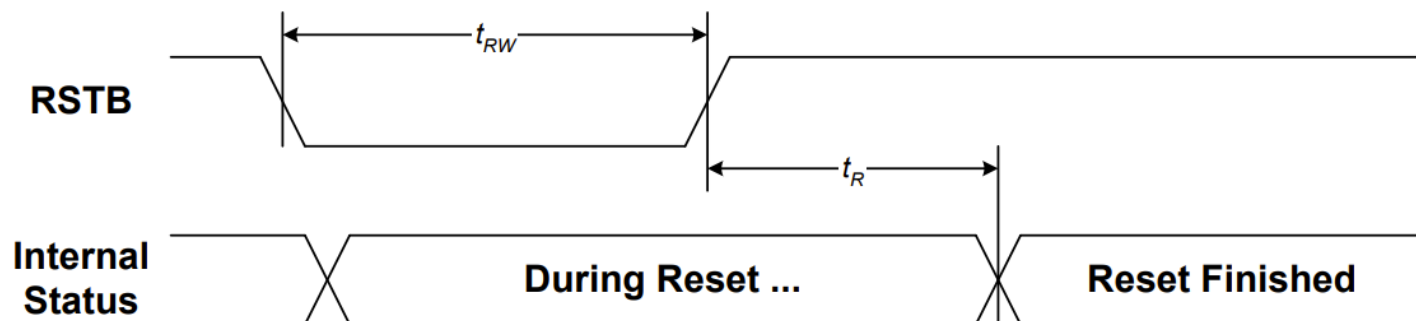


Item	Signal	Symbol	Condition	Min.	Max.	Unit
Serial clock period	SCLK	tSCYC		50	—	ns
SCLK "H" pulse width		tSHW		25	—	
SCLK "L" pulse width		tSLW		25	—	
Address setup time	A0	tSAS		20	—	
Address hold time		tSAH		10	—	
Data setup time	SDA	tSDS		20	—	
Data hold time		tSDH		10	—	
CS-SCLK time	CS1B	tCSS		20	—	
CS-SCLK time	CS2	tCSH		40	—	

*1 The input signal rise and fall time (t_r , t_f) are specified at 15 ns or less.

*2 All timing is specified using 20% and 80% of V_{DD} as the standard.

Reset Timing



Item	Symbol	Condition	Min.	Max.	Unit
Reset time	tR		—	1.0	us
Reset “L” pulse width	tRW		1.0	—	

Example Initialization Program

```
void data_out(unsigned char i) //Data Output Serial Interface
{
    unsigned int n;
    CS = 0;
    A0 = 1;
    for(n=0; n<8; n++){
        i <<=1;
        SCL = 0;
        P1 = i;
        delay(2);
        SCL = 1;
    }
    CS = 1;
}

void comm_out(unsigned char j) //Command Output Serial Interface
{
    unsigned int n;
    CS = 0;
    A0 = 0;
    for(n=0; n<8; n++){
        j <<=1;
        SCL = 0;
        P1 = j;
        delay(2);
        SCL = 1;
    }
    CS = 1;
}

/*****
*      Initialization For controller      *
*****/
void init_LCD()
{
    comm_out(0xA0);
    comm_out(0xAE);
    comm_out(0xC0);
    comm_out(0xA2);
    comm_out(0x2F);
    comm_out(0x21);
    comm_out(0x81);
    comm_out(0x3F);
}
/*****/
```

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, 5 min-> 70°C, 30min = 1 cycle 10 cycles	
Vibration test	Endurance test applying vibration to simulate transportation and use.	10-50Hz, 1.5mm amplitude. 2g Acceleration. 60 sec in each of 3 directions X, Y, Z for 30 minutes	3
Static electricity test	Endurance test applying electric static discharge.	Air: ±8kV	
		Contact: ±4kV	

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.