NHD-C12864WO-B1TMI#-M

Chip-On-Glass Liquid Crystal Display Module

NHD-	Newhaven Display
C12864-	128x64 Pixels
WO-	Display Type: COG
B1-	Model
T-	White LED Backlight
M-	STN (-), Blue
I-	Transmissive, Wide Temperature, 6:00 Optimal View
M-	Mounting Holes

REACH Compliant

RoHS Compliant

Table of Contents

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
0	09/01/2008	Initial Release	-
1	11/12/2009	User Guide Reformat	MC
2	12/14/2009	Updated Block Diagram	MC
3	01/12/2010	Added –M to p/n to signify this part has Mounting Holes	MC
4	03/09/2010	Block Diagram Updated	BE
5	05/04/2010	Block diagram and Pin Description	MP
6	05/05/2010	Backlight Connector Updated	BE
7	05/14/2010	Pin Description Updated	MP
8	05/02/2011	Example Initialization Code Updated	AK
9	05/13/2011	Block Diagram Updated	AK
10	05/19/2011	Block Diagram & Pin Description Updated	AK
11	01/10/2012	Pin Description & Controller link Updated	AK
12	06/15/2012	Timing Characteristics Updated	AK
13	04/04/2013	Backlight Mating Connector, LCD Voltage Levels Updated	AK
14	04/17/2013	Optical Characteristics Updated	AK
15	03/16/2015	Pin Description Updated	RM
16	12/30/2016	Electrical Characteristics & Response Time Updated	SB
17	02/06/2017	ILED Updated	SB
18	07/27/2017	Backlight Characteristics Updated	SB
19	12/26/2018	Backlight Voltage Updated	SB
20	04/22/2020	Initialization Code Updated	TM
21	03/03/2021	Updated Tolerance on 2D Mechanical Drawing, Typical LCD Contrast & Quality Information	AS
22	01/11/2022	Controller IC changed from ST7565P to ST7567, Pin Description Updated, Part Revision Upgraded to Rev1A	ZP
23	04/04/2022	Backlight Info and Drawing Label Updated	ZP
24	05/04/2022	Corrected Static Electricity Typo "kΩ -> Ω"	ZP

25	08/12/2022	Added Wiring Diagram	CJ
26	11/03/2022	Updated Backlight Voltage and Current Conditions	KL
27	12/16/2022	Updated Pin Description and Wiring Diagram	KL

Mechanical Drawing

30.1±0.8 15.5±0.15

100.0±1.0

CN2 1 — 30

1

A(Red)

1.15 8.15 10.0 13.005

49.8±0.5 (LCD)
47.5 (LCD)
40.5
36.5 (VA)
31.97 (AA)

128x64 DOTS

Pull tape

5.865
3.35
1.35
7.0

63.97(AA)
69.0(VA)
73.0(LCD)
75.7±0.3
89.7±0.5

0.3±0.1

Supporting tape   Contact side

JST :PHR-2 or Equivalent

4.8   9.6

40.2   30.6

6.00±0.5

30 — 1

CN2

2 1

K(Black) A(Red)

100.0±10.0

12-R2.0

4-∅ 3.2 PTH

82.7   3.5

4.0±0.5
8.0±1.0

1   30

w=0.3
P0.5*29=14.5
15.5

Contact Side
SCALE 2/1

0.5
0.47

0.5
0.47

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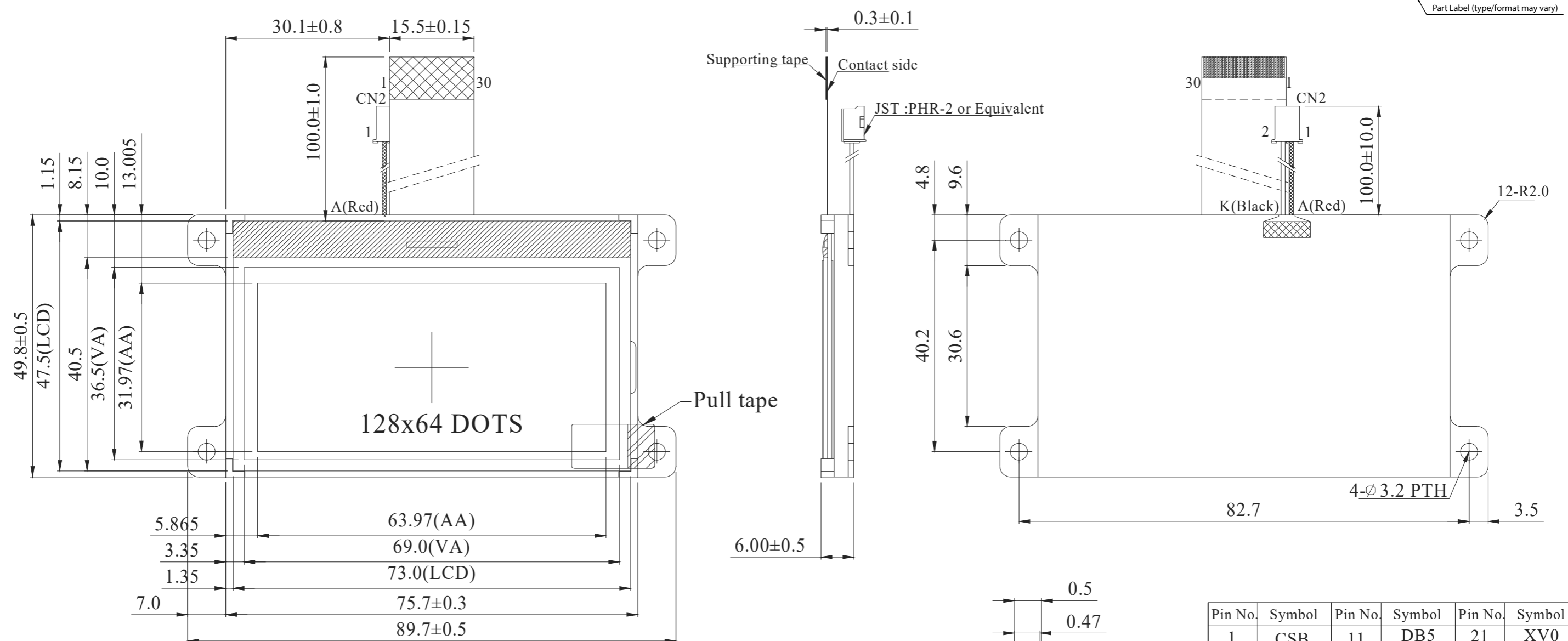
Pin No.	Symbol	Pin No.	Symbol	Pin No.	Symbol
1	CSB	11	DB5	21	XV0
2	RSTB	12	DB6	22	VG
3	A0	13	DB7	23	NC
4	R/W	14	VDD	24	NC
5	E	15	Vss	25	NC
6	DB0	16	NC	26	NC
7	DB1	17	NC	27	NC
8	DB2	18	NC	28	C86
9	DB3	19	NC	29	PSB
10	DB4	20	V0	30	NC

Product Description: 128x64 Graphic LCD

1. Driver IC: ST7567

2. Driving Mode: 1/65 Duty, 1/9 Bias

3. Inteface: 8-bit 6800/8080 Parallel, 4-Line SPI

4. Power Requirement: 3V LCD, 3.5V/64mA Backlight

5. Optical Features: STN (-) Blue, Transmissive, 6:00 View, White Backlight

6. Recommended FFC Connector: 30pin, 0.5mm pitch; Ex. Molex 52892-3095

Pin Description

LCD:

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^{DD}	Power Supply	Supply Voltage for logic
15	V^{SS}	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_{SS}
23-27	NC	-	No Connect
28	C86	MPU	Select MPU interface pin. C86= H:6800; C86= L:8080
29	PSB	MPU	Parallel/Serial select. PS= H: Parallel; PS= L: Serial
30	NC	-	No connect

Recommended LCD Connector: 0.5mm Pitch, 30pin FFC connector. **Molex P/N:** 52892-3095

Wiring Diagram
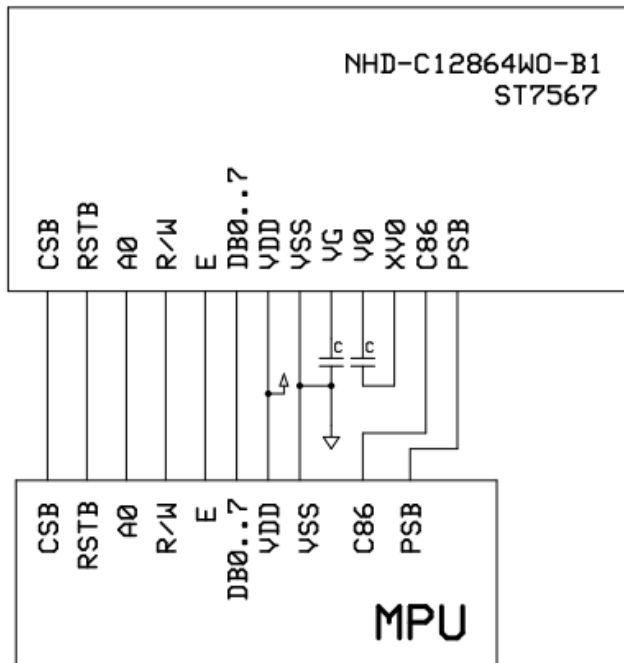
Electrical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Temperature Range	TOP	Absolute Max	-20	-	+70	°C
Storage Temperature Range	TST	Absolute Max	-30	-	+80	°C
Supply Voltage	VDD	-	2.8	3.0	3.2	V
Supply Current	IDD	Ta=25°C, VDD=3.0V	-	0.7	1.0	mA
Supply for LCD (contrast)	VDD-V0	Ta=25°C	9.3	9.5	9.7	V
"H" Level input	Vih	-	0.7*VDD	-	VDD	V
"L" Level input	Vil	-	VSS	-	0.3*VDD	V
"H" Level output	Voh	-	0.8*VDD	-	VDD	V
"L" Level output	Vol	-	VSS	-	0.2*VDD	V
LED Backlight voltage	VLED	-	3.4	3.5	3.6	V
LED Backlight current	ILED	V_{LED} =3.5V	20	64	80	mA

Optical Characteristics

Item		Symbol	Condition	Min.	Typ.	Max.	Unit
Optimal Viewing Angles	Top	φY+		-	20	-	°
	Bottom	φY-	Cr ≥ 2	-	40	-	°
	Left	θX-		-	30	-	°
	Right	θX+		-	30	-	°
Contrast Ratio		Cr	-	-	3	-	-
Response Time	Rise	Tr	-	-	200	300	ms
	Fall	Tf	-	-	250	350	ms

Controller Information

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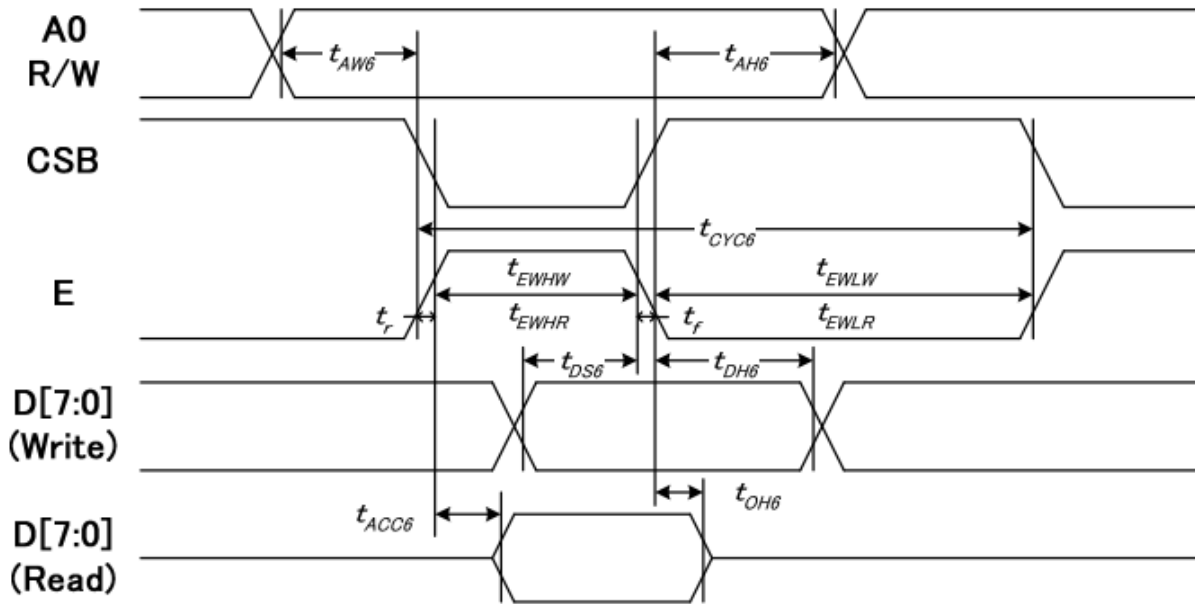
Timing Characteristics

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	tAW6		0	—	ns
Address hold time		tAH6		10	—	
System cycle time	E	tCYC6		240	—	
Enable L pulse width (WRITE)		tEWLW		80	—	
Enable H pulse width (WRITE)		tEWHW		80	—	
Enable L pulse width (READ)		tEWLR		80	—	
Enable H pulse width (READ)		tEWHR		140		
Write data setup time	D[7:0]	tDS6		40	—	
Write data hold time		tDH6		10	—	
Read data access time		tACC6	CL = 16 pF	—	70	
Read data output disable time		tOH6	CL = 16 pF	5	50	

8080 Parallel
System Bus Timing for 8080 Series MPU
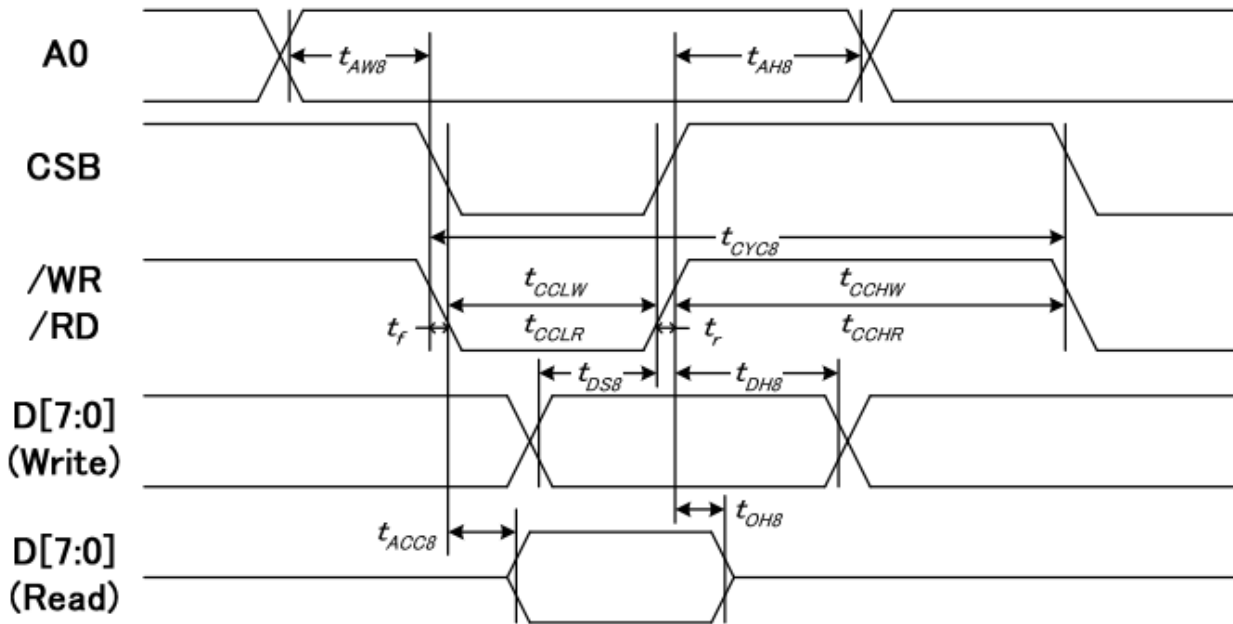
(VDD1 = 3.3V , Ta =25°C)

Item	Signal	Symbol	Condition	Min.	Max.	Unit
Address setup time	A0	tAW8		0	—	
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	—	ns
/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
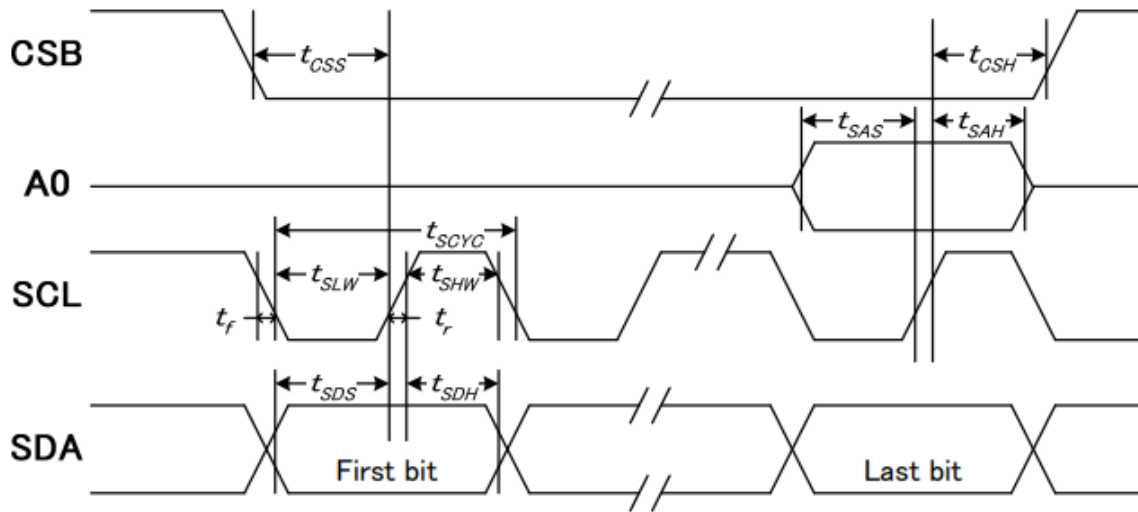
(VDD1 = 3.3V , Ta =25°C)

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	—	

Table of Commands

INSTRUCTION	A0	R/W (RWR)	D7	D6	D5	D4	D3	D2	D1	D0	DESCRIPTION
(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	0	0	0	Double command!!
	0	0	0	0	0	0	0	0	0	BL	Set booster level: BL=0: 4X BL=1: 5X
(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".

Quality Information

Test Item	Content of Test	Test Condition	Note
High Temperature storage	Endurance test applying the high storage temperature for a long time.	+80⁰C , 200hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-30⁰C , 200hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time.	+70⁰C 200hrs	2
Low Temperature Operation	Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time.	-20⁰C , 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.	+60⁰C , 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.	-20⁰C,30min -> 25⁰C,5min -> 70⁰C,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.	VS=800V, RS=330Ω, CS=150pF 10 times	

Note 1: No condensation to be observed.
Note 2: Conducted after 4 hours of storage at 25⁰C, 0%RH.
Note 3: Test performed on product itself, not inside a container.