NEWHAVEN DISPLAY INTERNATIONAL

Product Specification

NHD-C0420AZ-FSW-FBW-3V3

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

NHD-	Newhaven Display
C0420-	COG, 4 Lines x 20 Characters
AZ-	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

Newhaven Display International, Inc.
2661 Galvin Court, Elgin, IL 60124 USA

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REACH Compliant

RoHS Compliant

NEWHAVEN DISPLAY INTERNATIONAL

Table of Contents

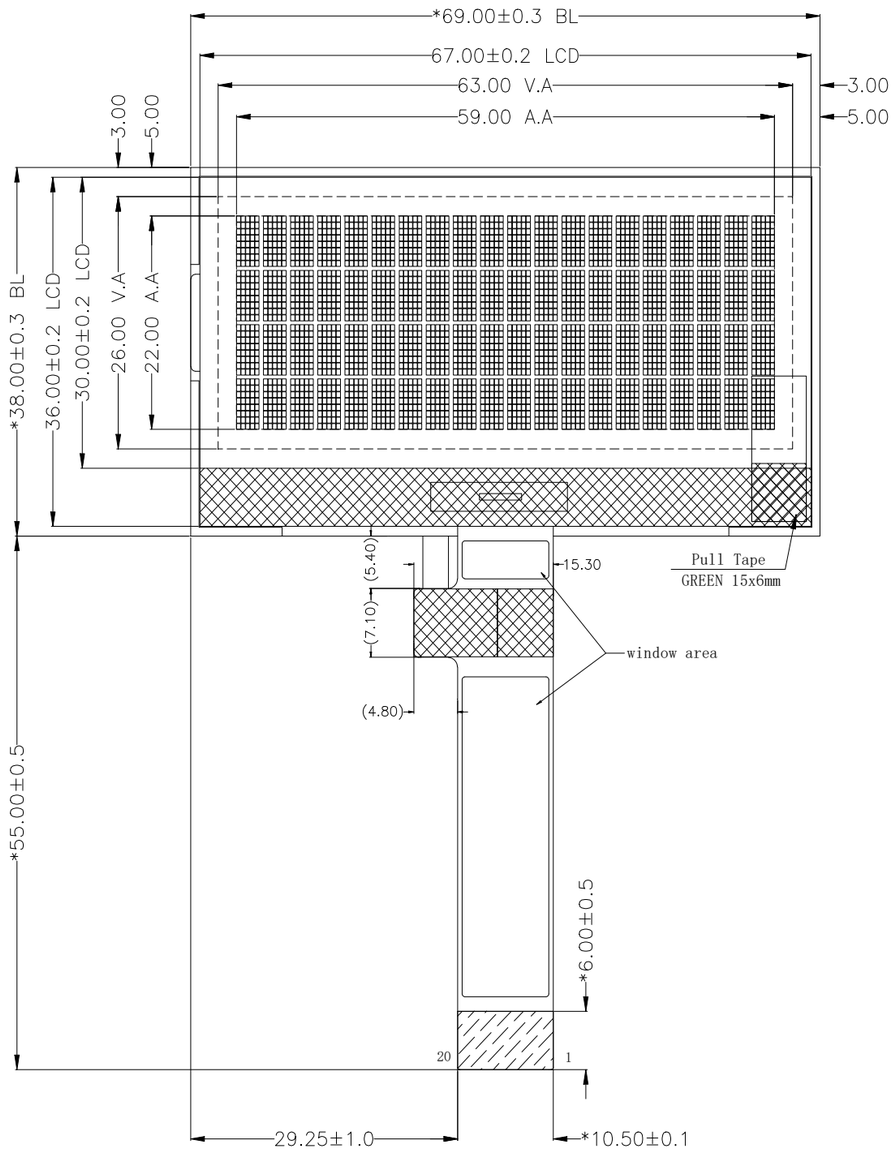
Additional Resources

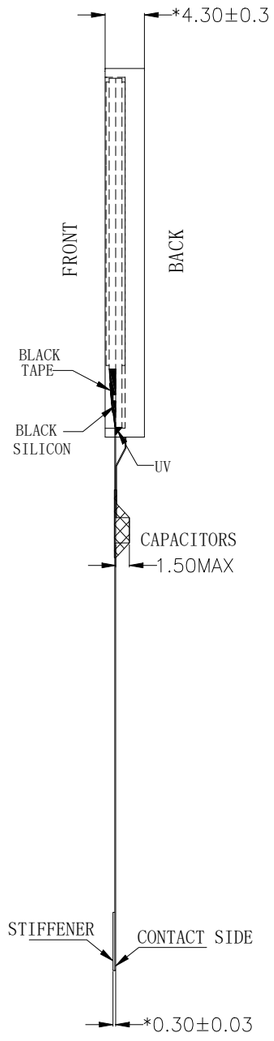
- **Support Forum:** https://support.newhavendisplay.com/hc/en-us/community/topics
- **GitHub:** https://github.com/newhavendisplay
- **Example Code:** https://support.newhavendisplay.com/hc/en-us/categories/4409527834135-Example-Code/
- **Knowledge Center:** https://www.newhavendisplay.com/knowledge_center.html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

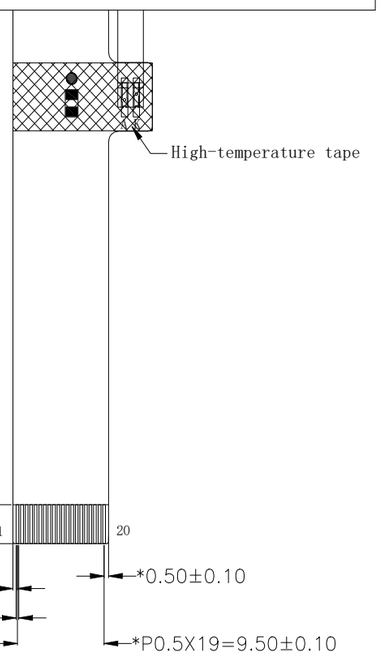
Revision	Date	Description	Changed By
-	01/11/2026	Initial Release	KL

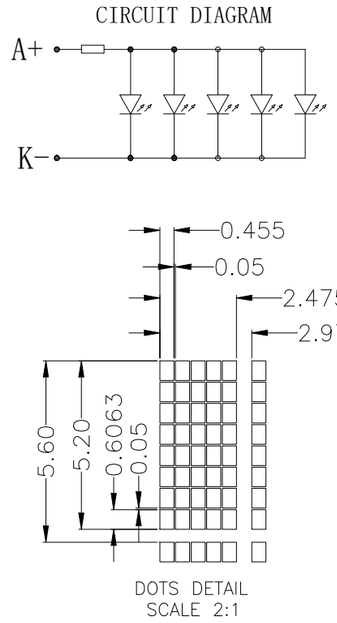
Mechanical Drawing





NEWHAVEN DISPLAY
NHD-C0420AZ-FSW-FBW-3V3
LOT-YYWW





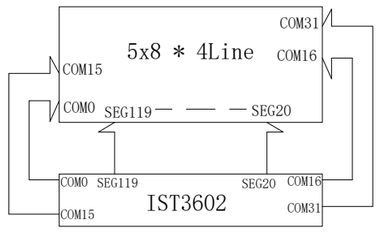
PIN	SIGNAL
1	VSS
2	VDD
3	CSB
4	RESB
5	A0
6	R/W
7	E
8	DB0
9	DB1
10	DB2
11	DB3
12	DB4
13	DB5
14	DB6
15	DB7
16	C68
17	PS
18	IIC
19	LED-A
20	LED-K

Viewing Direction

Product Description: 4x20 Character COG LCD

1. Driver IC: IST3602
2. Driving Mode: 1/33 Duty, 1/7 Bias
3. Interface: 8-bit 6800/8080 Parallel, 3/4-wire SPI, I²C
4. Power Requirement: 3.3V LCD, 3.0V/60mA Backlight
5. Optical Features: FSTN(+), Transflective, 6:00 View, White Backlight
6. Recommended FFC Connector: 20pin 0.5mm pitch

COM&SEG LAYOUT



Standard Tolerance:
(Unless otherwise specified)
Linear: ±0.3mm

NEWHAVEN DISPLAY INTERNATIONAL

Drawing/Part Number: NHD-C0420AZ-FSW-FBW-3V3
Revision: -

Unless otherwise specified:
• Dimensions are in Millimeters
• Third Angle Projection

Drawn By: K. Lewis
Approved By: K. Lewis
Drawn Date: 07/22/2025
Approved Date: 07/22/2025

Pin Description

Pin No.	Symbol	External Connection	Function Description
1	V_{SS}	Power Supply	Ground
2	V_{DD}	Power Supply	Supply voltage for logic (3.3V)
3	CSB	MPU	Active LOW Chip Select signal
4	RESB	MPU	Active LOW Reset signal
5	A0	MPU	Register Select Signal. A0=0: Command, A0=1: Data
6	R/W /WR	MPU	**6800 Mode:** Read/Write select signal, R/W=1: Read R/W=0: Write **8080 Mode:** Active LOW Write signal
7	E /RD	MPU	**6800 Mode:** Operation Enable signal. Falling edge triggered. **8080 Mode:** Active LOW Read signal
8-15	DB0-DB7	MPU	**Parallel Interface:** DB0-DB7: Bi-direction 8-bit data bus **Serial Interface:** DB6: Serial Clock (SCL) DB7: Serial Data (SDA)
16	C68	MPU	Select MPU interface pin. C86=H: 6800; C86=L: 8080
17	PS	MPU	Parallel/Serial Select. PS= H: Parallel; PS=L: Serial (IIC=H)
18	IIC	MPU	I^2C mode select. IIC=H: I^2C mode disabled; IIC=L: I^2C mode enabled
19	LED-A	Power Supply	Backlight Anode (3.0V)
20	LEK-K	Power Supply	Backlight Cathode (Ground)

Recommended LCD connector: 20pin 0.5mm pitch

Interface Selection

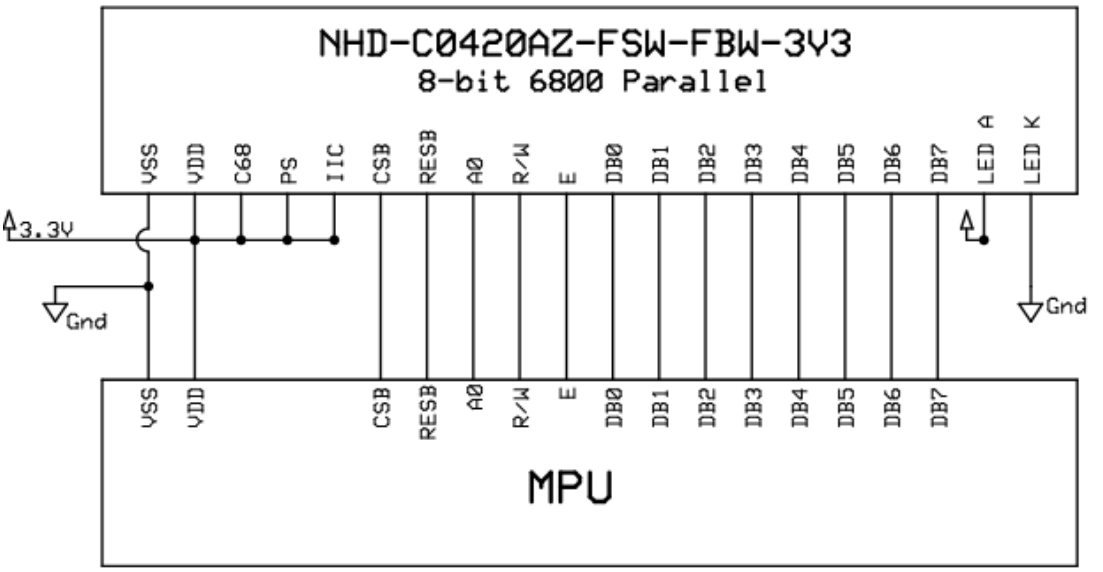
Pin Name	IIC	PS	C68
8-bit 6800 Parallel	H	H	H
8-bit 8080 Parallel	H	H	L
3-wire SPI	H	L	H
4-wire SPI	H	L	L
I^2C	L	ID1	ID0

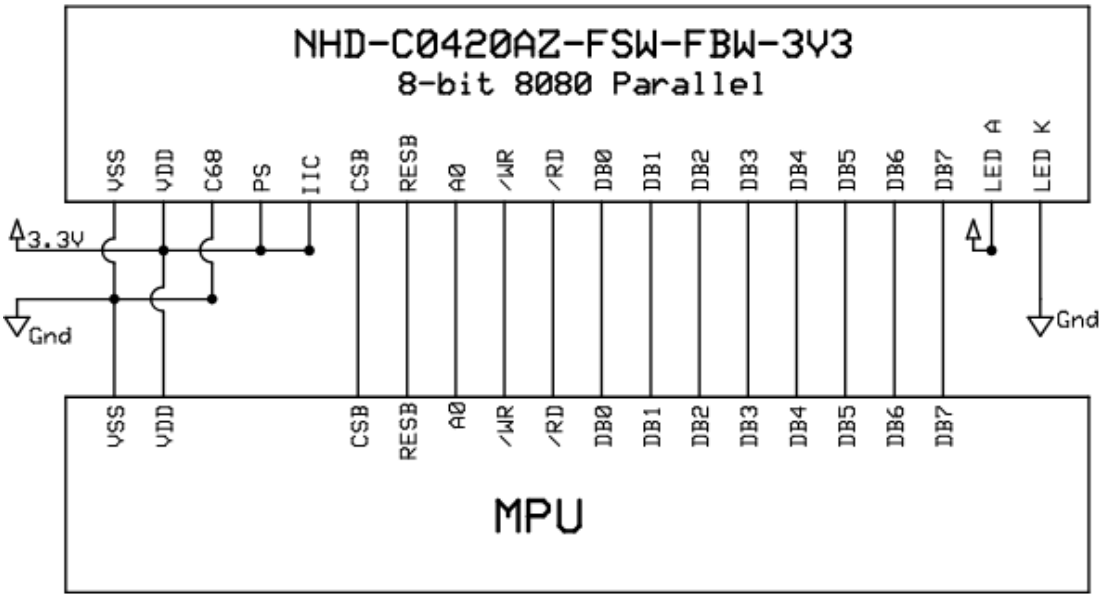
The PS and C68 pins configure the least significant bits of the I^2C slave address (ID1 and ID0), allowing four options: 0111100 (C68=0, PS=0), 0111101 (C68=0, PS=1), 0111110 (C68=1, PS=0), and 0111111 (C68=1, PS=1).

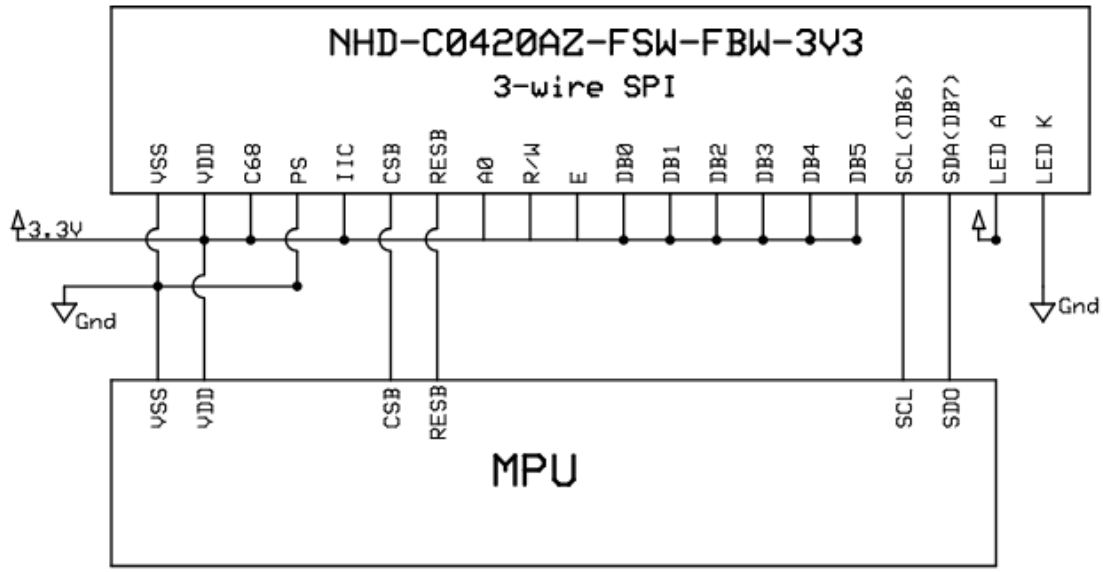
DDRAM address

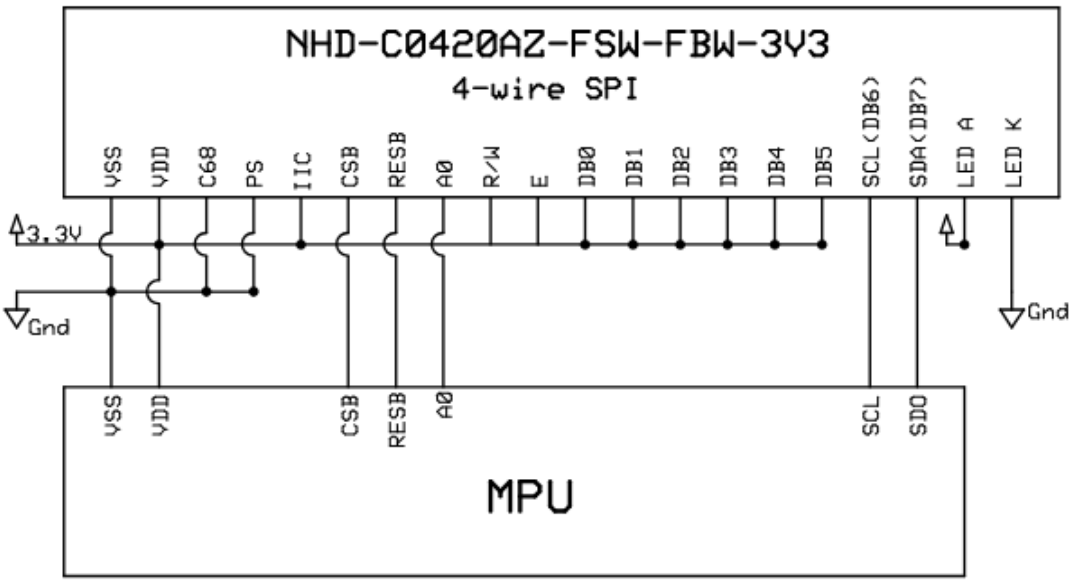
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	10	11	12	13
18	19	1A	1B	1C	1D	1E	1F	20	21	22	23	24	25	26	27	28	29	2A	2B
30	31	32	33	34	35	36	37	38	39	3A	3B	3C	3D	3E	3F	40	41	42	43
48	49	4A	4B	4C	4D	4E	4F	50	51	52	53	54	55	56	57	58	59	5A	5B

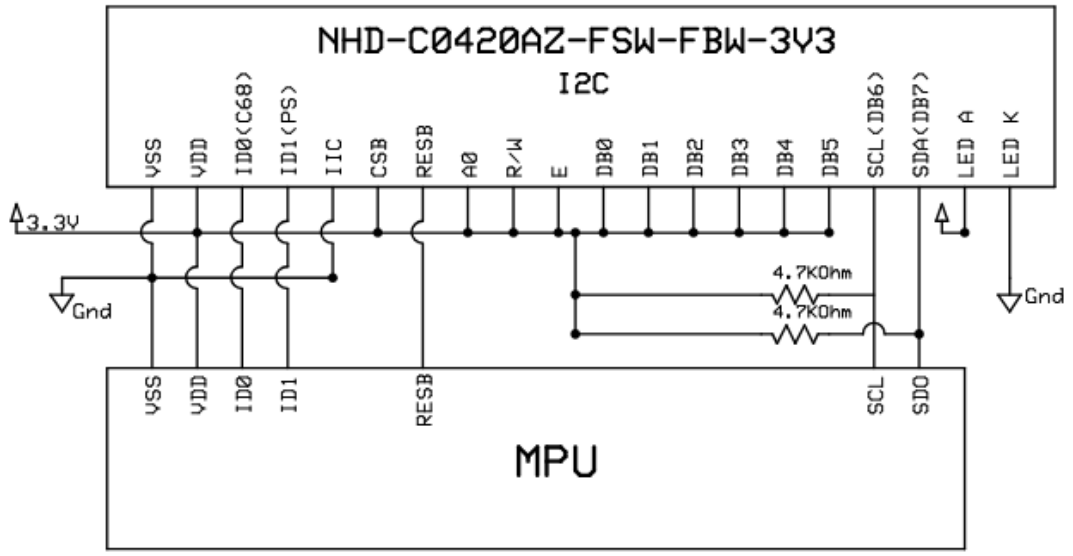
Wiring Diagram








NHD-C0420AZ-FSW-FBW-3V3
4-wire SPI
VSS
VDD
C68
PS
IIC
CSB
RESB
A0
R/W
E
DB0
DB1
DB2
DB3
DB4
DB5
SCL(DB6)
SDA(DB7)
LED A
LED K
3.3V
Gnd
Gnd
VSS
VDD
CSB
RESB
A0
SCL
SDO
MPU


NHD-C0420AZ-FSW-FBW-3V3
I2C
VSS
VDD
ID0(C68)
ID1(PS)
IIC
CSB
RESB
A0
R/W
E
DB0
DB1
DB2
DB3
DB4
DB5
SCL(DB6)
SDA(DB7)
LED A
LED K
3.3V
Gnd
4.7KOhm
4.7KOhm
Gnd
VSS
VDD
ID0
ID1
RESB
SCL
SDO
MPU

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}	-	3.0	3.3	3.6	V
Supply Current	I_{DD}	T_{OP} =25°C, V_{DD}=3.3V	0.5	1.25	2.5	mA
Supply for LCD (contrast)	V_{LCD}		8.30	8.50	8.70	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}	-	Vss	V
"L" Level output	V_{OL}	-	V_{SS}	-	0.2 V_{DD}	V
Backlight Supply Current	I_{LED}	-	30	60	90	mA
Backlight Supply Voltage	V_{LED}	I_{LED} = 60mA	2.7	3.0	3.3	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	φY+	CR ≥ 2	-	30	-	o
	Bottom	φY-		-	40	-	o
	Left	θX-		-	30	-	o
	Right	θX+		-	30	-	o
Contrast Ratio		CR	-	2	3	-	-
Response Time	Rise	T_R	T_{OP} = 25°C	-	90	250	ms
	Fall	T_F		-	110	350	ms

Controller Information

Built-in IST3602 Controller: https://support.newhavendisplay.com/hc/en-us/articles/33466233169175-IST3602

Table of Commands

Default Instruction Table
IS[1:0]=Don't Care

No	Instruction	A0	W/R	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description	Instruction Time
1	Display Clear	0	0	0	0	0	0	0	0	0	1	Display clear and set AC to "00H". Set AC to "00H". It will return cursor	1ms
2	AC Return Zero	0	0	0	0	0	0	0	0	1	X	Return to the original position if shifted. The contents in DDRAM are not changed.	20us
3	Set Entry Mode	0	0	0	0	0	0	0	1	I/D	0	Set cursor move direction. The effects are performed after each data access (write or read).	20us
4	Display Control	0	0	0	0	0	0	1	D	C	B	D=1: Entire display on; C=1: Cursor on; B=1: Cursor position blinks.	20us
5	Function Set	0	0	0	0	1	0	0	0	IS1	IS0	DL: Interface data is 8/4 bits; IS[1:0]: select instruction table.	20us
6	Set DDRAM Address	0	0	1	0	0	1	0	0	0	0	Set DDRAM address into AC (address counter).	20us
		0	0	0	AC6	AC5	AC4	AC3	AC2	AC1	AC0		
7	Read Status	0	1	0	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Read the content of AC (address counter)	20us
8	Write Data	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/ CGRAM/ ICONRAM)	20us
9	Read Data	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/ CGRAM/ ICONRAM)	20us

IS[1:0]=(0,0)

No	Instruction	A0	W/R	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description	Instruction Time
1	Cursor Shift or Display Shift	0	0	0	0	0	1	S/C	R/L	0	0	S/C and R/L: Immediately move cursor or shift display by 1.	20us
2	Set CGRAM Address	0	0	1	0	0	1	0	0	0	1	Set CGRAM address into AC (address counter)	20us
		0	0	0	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address into AC (address counter)	

IS[1:0]=(0,1)

No	Instruction	A0	W/R	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description	Instruction Time
1	Follows Control	0	0	0	0	0	1	0	0	BS1	BS0	BS[1:0]: Bias select	20us
2	Set ICON RAM Address	0	0	0	1	0	AC4	AC3	AC2	AC1	AC0	Set ICON address into AC (address counter).	20us
3	Power Control 1	0	0	0	0	1	1	0	0	0	SLEEP	Enter sleep mode	20us
4	ICON/Power Control2	0	0	0	1	1	0	Icon	Bon	Ron	Fon	Ion: ICON display on/off Bon: Set booster circuit on/off Ron: Set regulator circuit on/off Fon: Set follower circuit on/off.	1ms
5	V0 Control 2	0	0	0	1	1	1	0	0	BT[1:0]		Set booster	20us

IS[1:0]=(1,0)

No	Instruction	A0	W/R	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description	Instruction Time
1	Set Display Mode	0	0	0	0	0	1	DH1	DH0	N2	N1	DH[2:1]:Set n-Line height N[2:1]: Display line number	20us
2	Set Display pattern	0	0	0	1	1	0	0	0	INV	AP	INV: reverse display AP : Pixel all on	20us
3	Select CGRAM & COM/SEG direction	0	0	0	1	0	0	OPR 2	OPR 1	SHLS	SHL C	OPR[2:1]: Set CGRAM mapping SHLS: Set SEG scan direction SHLC: Set COM scan direction	20us

IS[1:0]=(1,1)

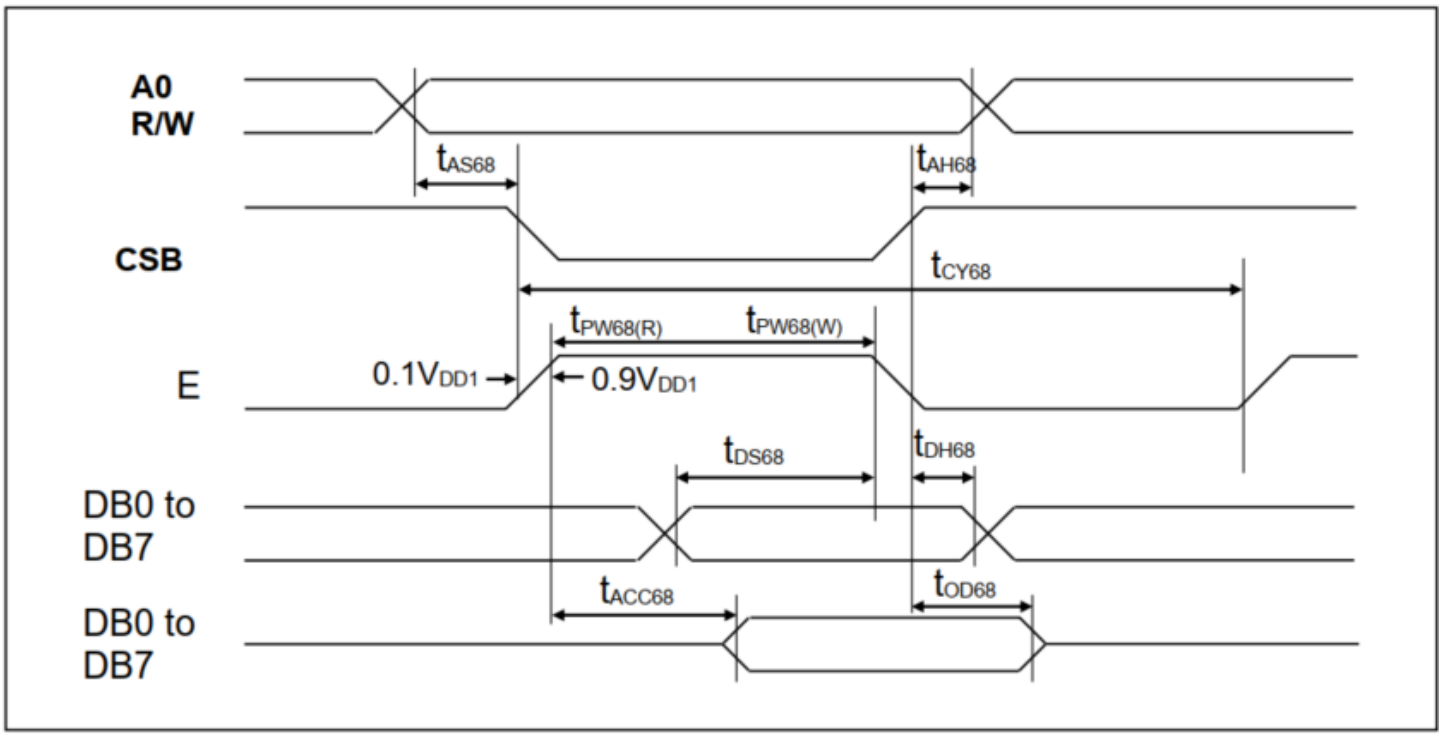
No	Instruction	A0	W/R	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description	Instruction Time
1	Power Loss Detection	0	0	0	0	0	1	0	0	0	1	PLD: Set the function of power loss detection	20us
		0	0	0	0	1	0	0	VBON	0	0		
2	Start line	0	0	1	0	0	0	0	0	1	0	start line setting	20us
		0	0	0	0	ST[5:0]							
3	Contrast	0	0	1	0	0	0	0	0	0	1	CT setting	20us
		0	0	CT[7:0]									
4	Rgain set	0	0	1	0	1	0	RGR[3:0]				Rgain set	20us
5	Soft reset	0	0	1	1	1	0	0	0	1	0	soft reset	20us
6	spi3&spi4 read ram command	0	0	0	0	1	1	0	1	1	1	spi read ram data command	20us
7	spi3&spi4 read status command	0	0	0	0	1	1	0	1	1	0	spi3&spi4&iic read status command	20us

IST Test Mode

No	Instruction	A0	W/R	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description	Instruction Time
1	IST command entry	0	0	1	0	0	0	1	0	0	0	Test command entry	20us
2	Frame rate adjusting enable	0	0	0	0	1	0	FMEN	0	0	0	Frame rate adjusting enable	20us
3	Frame rate control(3B)	0	0	1	0	1	1	0	0	1	0	Set frame rate control	20us
				LN7	LN6	LN5	LN4	LN3	LN2	LN1	LN0		
				LN15	LN14	LN13	LN12	LN11	LN10	LN9	LN8		
4	OSC clock select	0	0	1	0	0	1	0	0	VCK_SEL [1:0]		DCDC pump clock select	20us
5	OSC Divide Select	0	0	1	0	0	1	1	OSC_DIV[2:0]			Select 1,1/2,1/4,1/8 Oscillator frequency for display operation	20us
6	Exit entry	0	0	1	1	1	0	0	0	1		Exit test entry	`20us

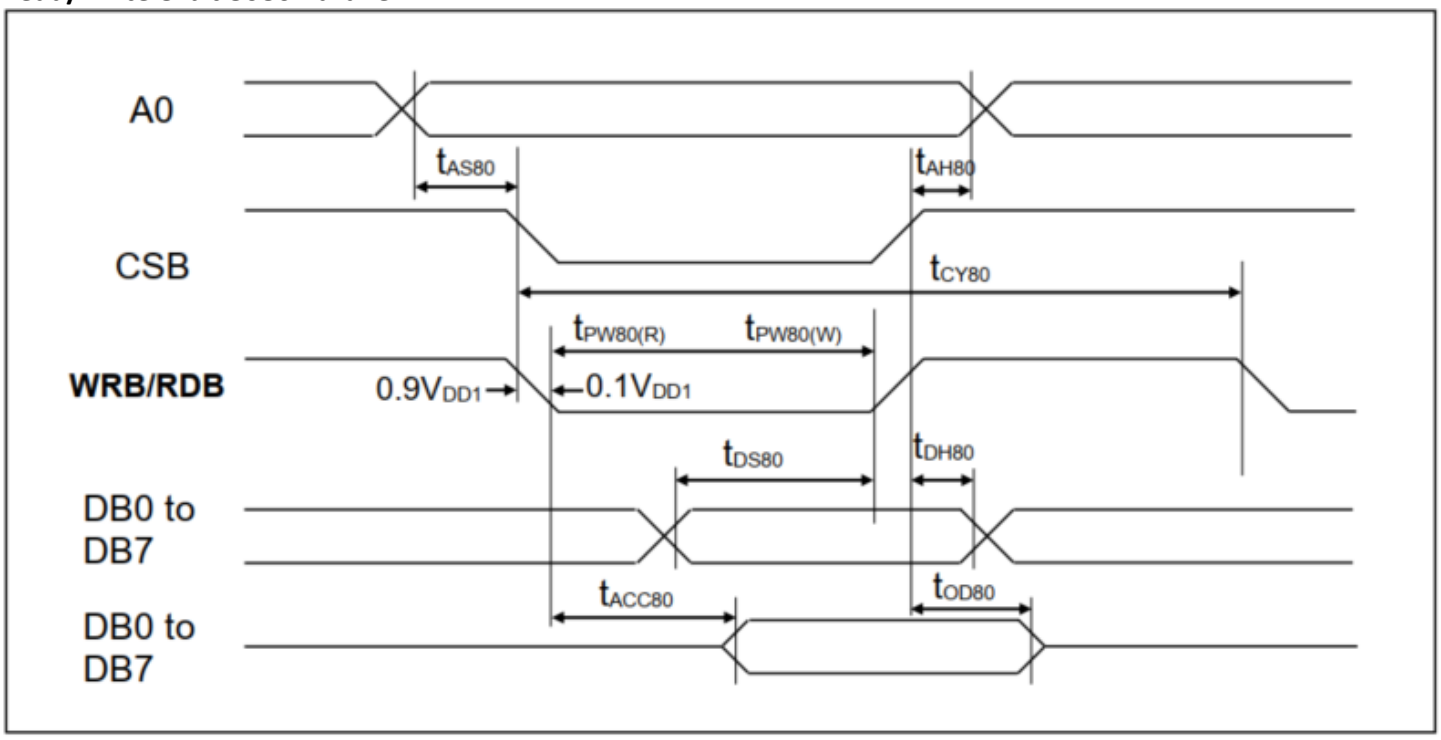
Timing Characteristics

Read/write 8-bit 6800 Parallel



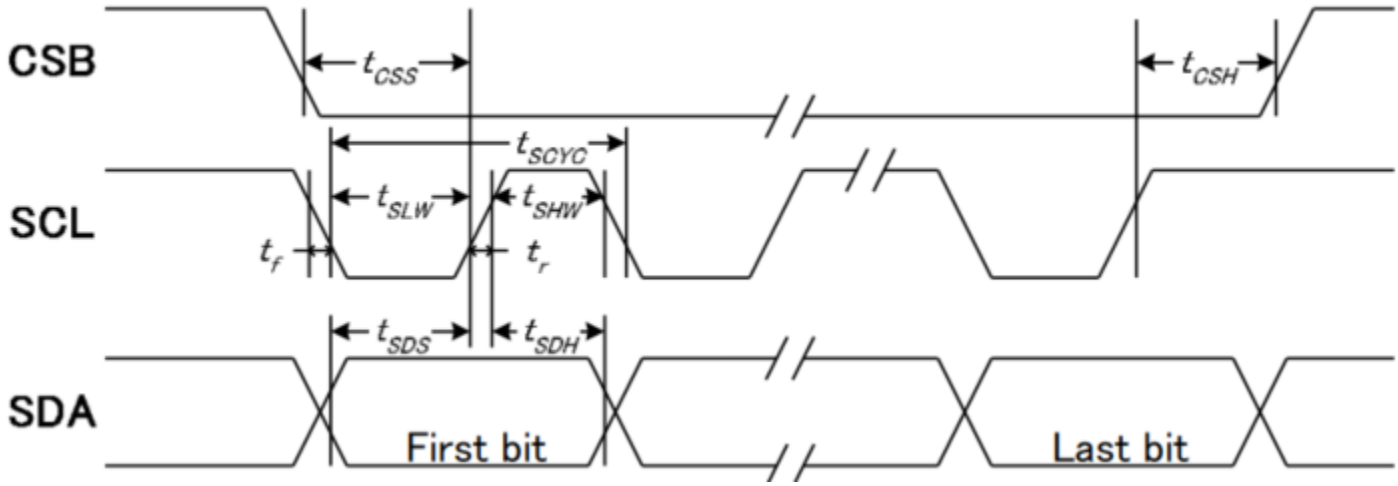
Item	Signal	Symbol	Min.	Typ.	Max.	Unit	Remark
Address setup time Address hold time	A0	tAS68 tAH68	0 0	-	-	ns	
System cycle time		tCY68	300	-	-	ns	
Pulse width (E)	RW_WRB	tPW68(W)	150	-	-	ns	
Pulse width (E)	E_RDB	tPW68(R)	150	-	-	ns	
Data setup time Data hold time	DB7 to DB0	tDS68 tDH68	60 0	-	-	ns	
Read access time Output disable time		tACC68 tOD68	140 -	-	- 10	ns	(No load)

Read/write 8-bit 8080 Parallel



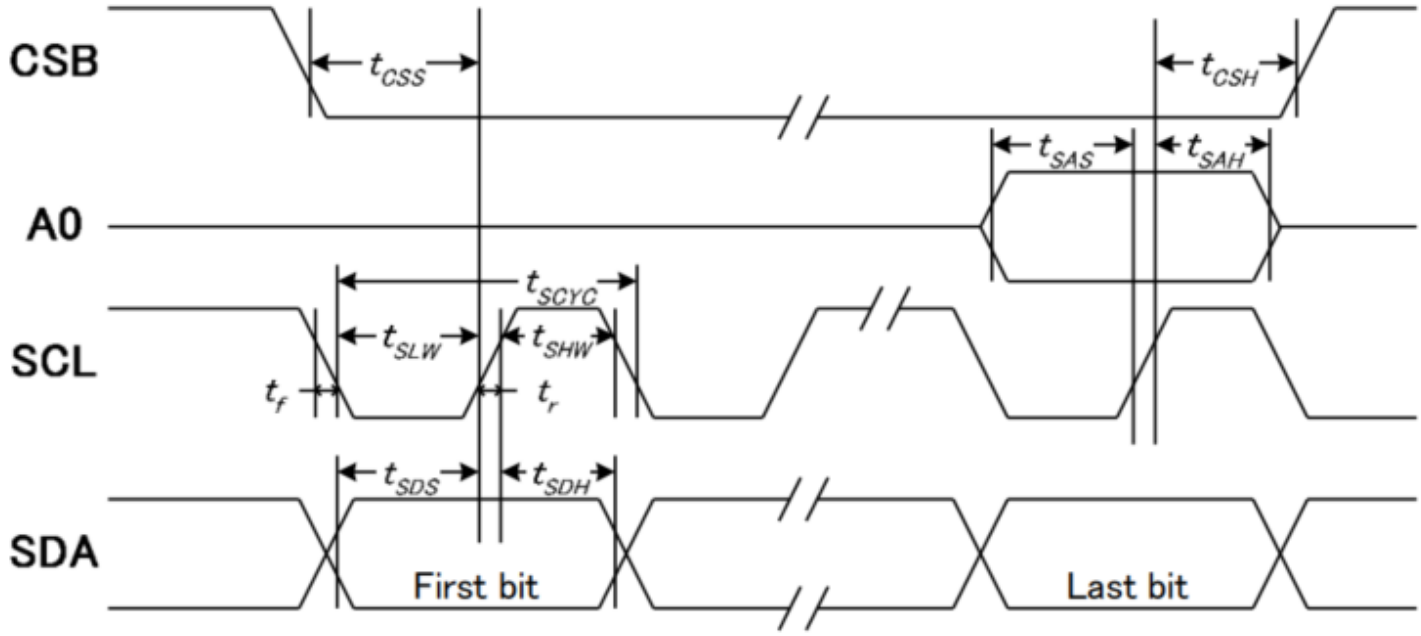
Item	Signal	Symbol	Min.	Typ.	Max.	Unit	Remark
Address setup time Address hold time	A0	tAS80 tAH80	0 0	-	-	ns	
System cycle time		tCY80	300	-	-	ns	
Pulse width (WRB)	RW_WRB	tPW80(W)	150	-	-	ns	
Pulse width (RDB)	E_RDB	tPW80(R)	150	-	-	ns	
Data setup time Data hold time	DB7 to DB0	tDS80 tDH80	60 0	-	-	ns	
Read access time Output disable time		tACC80 tOD80	140 -	-	- 10	ns	(No load)

3-Wire SPI Interface



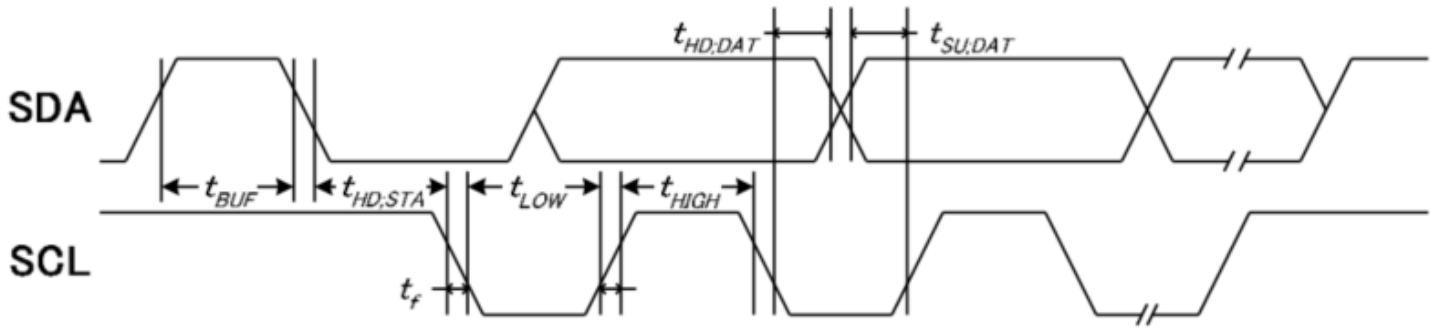
Item	Signal	Symbol	VDD1=1.8V		VDD1=2.8V		VDD1=3.3V		Unit
			Min.	Max.	Min.	Max.	Min.	Max.	
Serial Clock Period	SCL	tSCYC	200	-	200	-	200	-	ns
SCL "H" pulse width		tSHW	90	-	90	-	90	-	
SCL "L" pulse width		tSLW	90	-	90	-	90	-	
Data setup time	SDA	tSDS	45	-	45	-	45	-	ns
Data hold time		tSDH	45	-	45	-	45	-	
Chip select setup time	CSB	tCSS	90	-	90	-	90	-	ns
Chip select hold time		tCSH	90	-	90	-	90	-	

4-wire SPI Interface



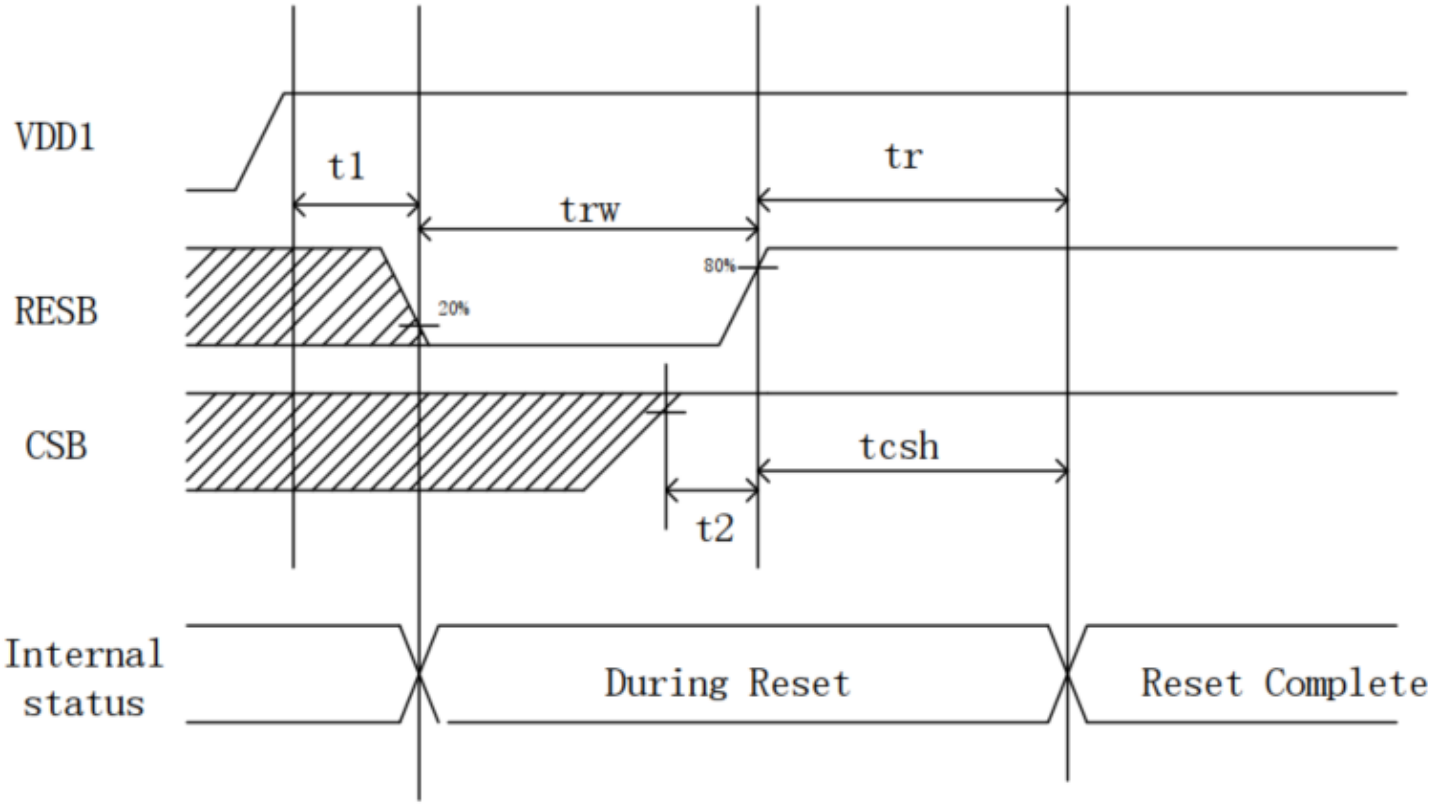
Item	Signal	Symbol	VDD1=2.8V		VDD1=3.3V		Unit
			Min.	Max.	Min.	Max.	
Serial Clock Period	SCL	tSCYC	200	-	200	-	ns
SCL "H" pulse width		tSHW	90	-	90	-	
SCL "L" pulse width		tSLW	90	-	90	-	
Address setup time	A0	tSAS	45	-	45	-	ns
Address hold time		tSAH	45	-	45	-	
Data setup time	SI	tSDS	45	-	45	-	ns
Data hold time		tSDH	45	-	45	-	
Chip select setup time	CSB	tCSS	90	-	90	-	ns
Chip select hold time		tCSH	90	-	90	-	

I²C Interface



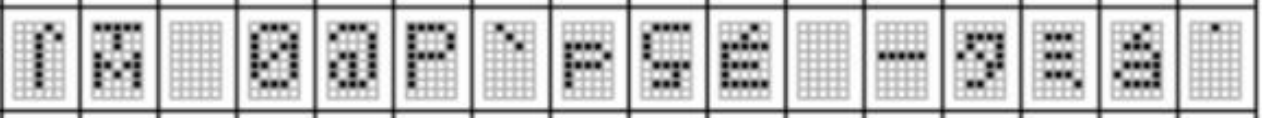
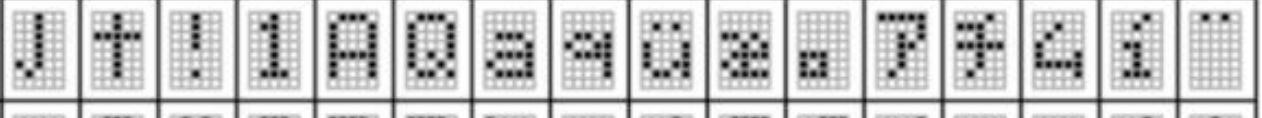
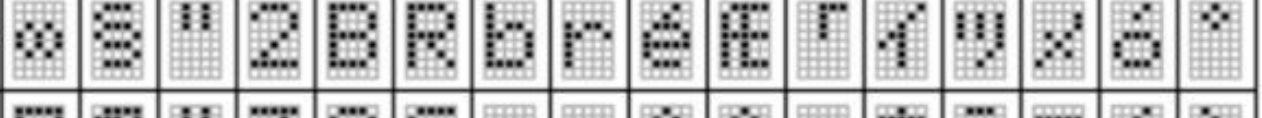
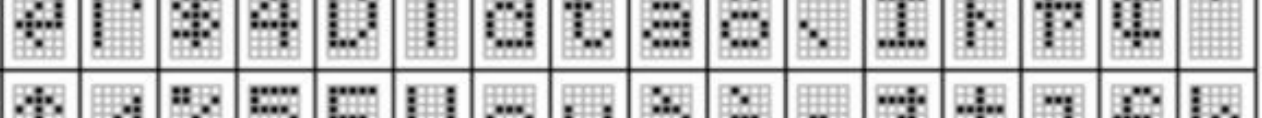
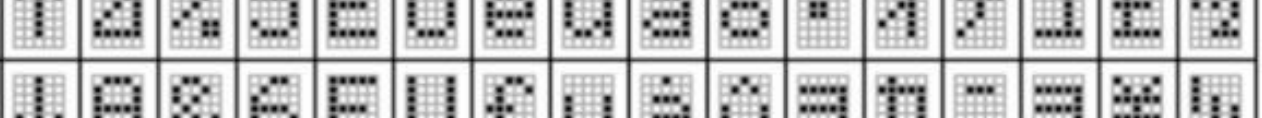
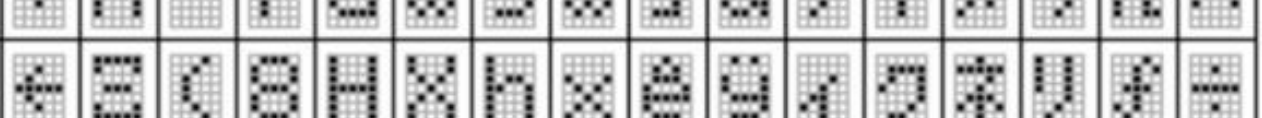
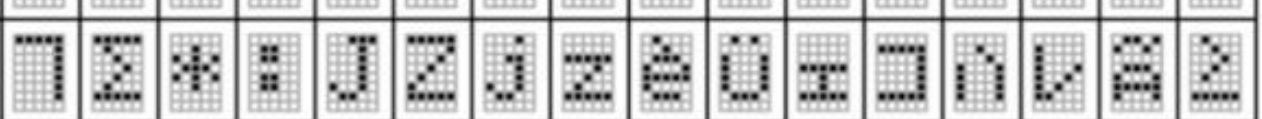
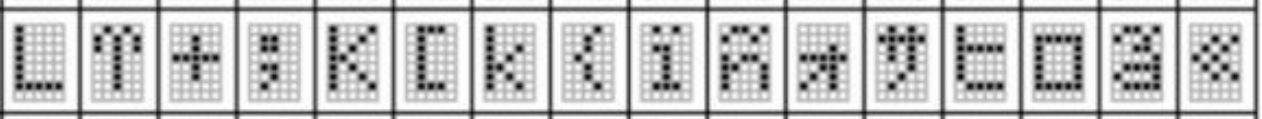
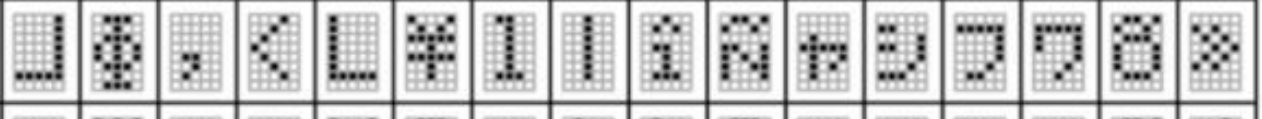
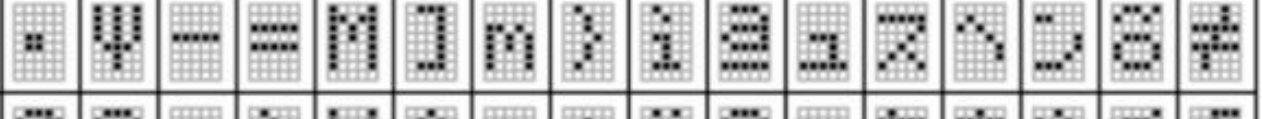
Item	Signal	Symbol	Min.	Typ.	Max.	Unit	Remark
SCL clock frequency		fSCL	0	-	400	kHz	
Set-up time for START condition		tSU/STA	600	-	-	ns	
Hold time for START condition		tHD/STA	600	-	-	ns	
Low period of the SCL clock		tLow	1300	-	-	ns	
High period of the SCL clock		tHIGH	600	-	-	ns	
Data set-up time		tSU/DAT	100	-	-	ns	
Data hold time		tHD/DAT	-	-	900	ns	
Rise time of both SDA and SCL signals		tr	-	-	30	ns	
Fall time of both SDA and SCL signals		tf	-	-	30	ns	
Set-up time for STOP condition		tSU/STO	600	-	-	ns	

Reset Input Timing



Item	Signal	Symbol	Min.	Typ.	Max.	Unit	Remark
Reset low pulse width	RESB	t_{RW}	50	-	-	us	
Reset time	-	t_R	50	-		us	
Reset after VDD stable	RESB	t1	0	-	-	us	
CSB to RESB pull High	CSB	t2	0			us	
CSB hold	CSB	tcsh	50			us	

Built-in Font Table

b7-b4 / b3-b0	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0000																
0001																
0010																
0011																
0100																
0101																
0110																
0111																
1000																
1001																
1010																
1011																
1100																
1101																
1110																
1111																

Example Initialization Code

```
void LCD_Cmd(unsigned char command)
{
  digitalWrite(CSB, LOW);
  digitalWrite(A0, LOW);
  digitalWrite(RD, HIGH);
  PORTD = command;
  digitalWrite(WR, LOW);
    digitalWrite(WR, HIGH);
  digitalWrite(CSB, HIGH);
   delay(100);
}
void LCD_data(unsigned char data)
{
  digitalWrite(CSB, LOW);
  digitalWrite(A0, HIGH);
  digitalWrite(RD, HIGH);
  PORTD = data;
  digitalWrite(WR, LOW);
  digitalWrite(WR, HIGH);
  digitalWrite(CSB, HIGH);
}
void LCD_Initialize()
{
delay(50);
digitalWrite(RESB, LOW);
delay(50);
digitalWrite(RESB, HIGH);
delay(50);

// ================================================================

// IS Instruction Table 2
LCD_Cmd(0x22); //Function Set
LCD_Cmd(0x13); //Set Display Mode : Normal font, 4-line
LCD_Cmd(0x60); //Set Display pattern : Normal mode,All Pixels on Function not enable.
LCD_Cmd(0x44); //Select CGRAM & COM/SEG direction (8, Column address 119~0, Row address 31~0 (Invert))
//LCD_Cmd(0x47);
 delay(10);

// ================================================================

// IS Instruction Table 3
LCD_Cmd(0x23); //Function Set : 0 0 1 0 0 0 IS2 IS1
LCD_Cmd(0x82); //start line setting
LCD_Cmd(0x00); //start line setting : 0 0 ST[5:0]
// LCD_Cmd(0xab); //Regulator Set: RGR[3:0]=1011(RGR=7.5)
LCD_Cmd(0xA7); //Rgain set :1 0 1 0 RR[3:0]
LCD_Cmd(0x81); //Contrast: VOP SET
LCD_Cmd(0x4B); // VOP SET contrast value 142  (//132=84)//75 = 4B
 delay(10);
```

```
LCD_Cmd(0x21);//Function set: Table IS[1:0]=01
LCD_Cmd(0x13);//Follow Control: BS[2:1]=(1,1):1/7 BIAS
LCD_Cmd(0x30);//Power Save: Sleep=0(Out Sleep Mode)
LCD_Cmd(0x71);//V0 Control 2: BT[1:0]=01(Booster Will Be 6X)
 delay(100);
LCD_Cmd(0x61);//ICON/Power Control: ICON OFF, VB OFF, VR OFF, VF ON
 delay(20);
LCD_Cmd(0x63);//ICON/Power Control: ICON OFF, VB OFF, VR ON, VF ON
 delay(20);
LCD_Cmd(0x67);//ICON/Power Control: ICON OFF, VB ON, VR ON, VF ON
 delay(20);
LCD_Cmd(0x6F);//ICON/Power Control: ICON ON, VB ON, VR ON, VF ON
delay(20);

// ============================================================
// IS Instruction Table 4
LCD_Cmd(0x23); //Function Set
LCD_Cmd(0x88); // Set 88H 4 times to entry IST test command mode
LCD_Cmd(0x88);
LCD_Cmd(0x88);
LCD_Cmd(0x88);
LCD_Cmd(0x28); //Frame rate adjusting enable
delay(20);
LCD_Cmd(0xB2); //1st Frame rate control
LCD_Cmd(0x71); //FR=Fdck/(LN[15:0]+1)/Duty (FR=200Hz,Duty=33,LN[15:0]=0x0071])
LCD_Cmd(0x00);
LCD_Cmd(0x93); //OSC Clock Select :Fdck= 750KHz/1=750KHz
LCD_Cmd(0x99); //OSC Divide Select :750KHz
LCD_Cmd(0xE3); //Exit IST test command
delay(20);
LCD_Cmd(0x20); //Function Set
LCD_Cmd(0x01); //Clear Display
delay(20);
LCD_Cmd(0x90); //Set DDRAM address
LCD_Cmd(0x00); //Set DDRAM address
LCD_Cmd(0x06); //Set Entry Mode (I/D = "1", cursor moves right and DDRAM addressn increased by 1)
LCD_Cmd(0x0C); //Display Control(Entire display on, cursor off, blink off)
 delay(100);
LCM_Write_CGRAM();
 delay(100);
}
```

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, 200 Hrs.	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-30°C, 200 Hrs.	1,2
High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time.	+70°C, 200 Hrs.	2
Low Temperature Operation	Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time.	-20°C, 200 Hrs.	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, 96 Hrs.	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 For 10 cycles	
Vibration test	Endurance test applying vibration to simulate transportation and use.	10-55Hz, 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. (5 Times)	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.