NHD-C0216CZ-FSW-FBW-3V3

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

NHD-	Newhaven Display
C0216-	COG, 2 Lines x 16 Characters
CZ-	Model
F-	Transflective
SW-	Side White LED Backlight
F-	FSTN (+)
B-	6:00 Optimal View
W-	Wide Temperature
3V3-	3.3V LCD, 3V Backlight
	RoHS Compliant

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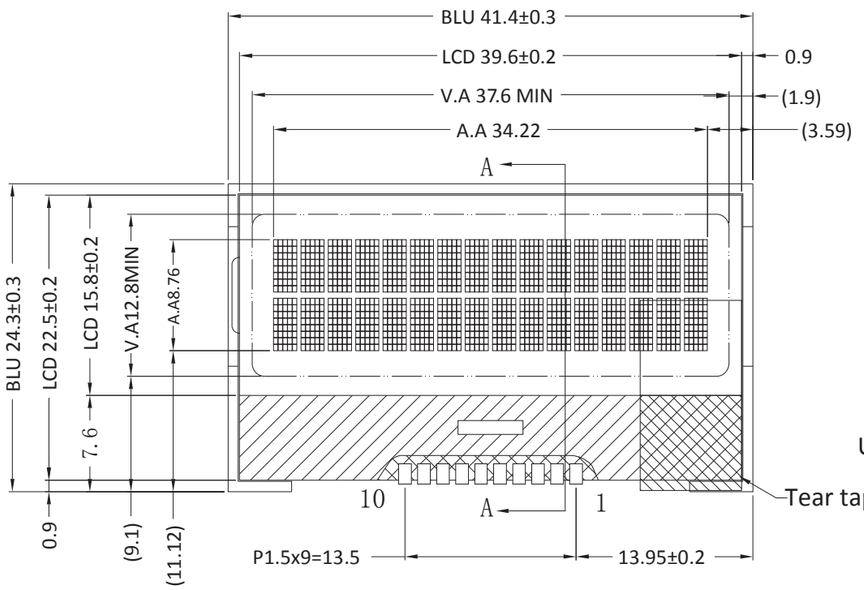
Document Revision History

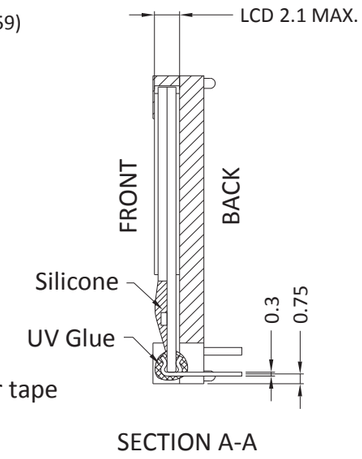
Revision	Date	Description	Changed by
0	11/11/2008	Initial Release	-
1	8/26/2009	User guide reformat	BE
2	10/9/2009	Updated Electrical Characteristics	MC
3	10/22/2009	Font Table Revision	BE
4	10/27/2009	Updated the Block Diagram	MC
5	11/19/2009	Updated backlight supply current	MC
6	12/18/2009	Pin description updated	BE
7	3/2/2012	Interface information updated	AK
8	7/22/2013	Electrical characteristics updated	ML
9	12/10/2014	Recommended connector information updated	AK
10	10/20/16	Mechanical Drawing, Electrical & Optical Char. Updated	SB
11	1/20/17	P/N Printed on Back of Display, Electrical Char. Updated	SB
12	8/24/18	Supply Current Updated	SB
13	11/15/18	Updated Font Table for CGRAM	TM
14	6/24/19	Added PCB Footprint Drawing	AS

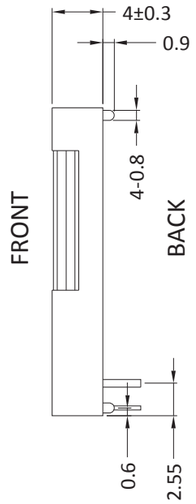
Functions and Features

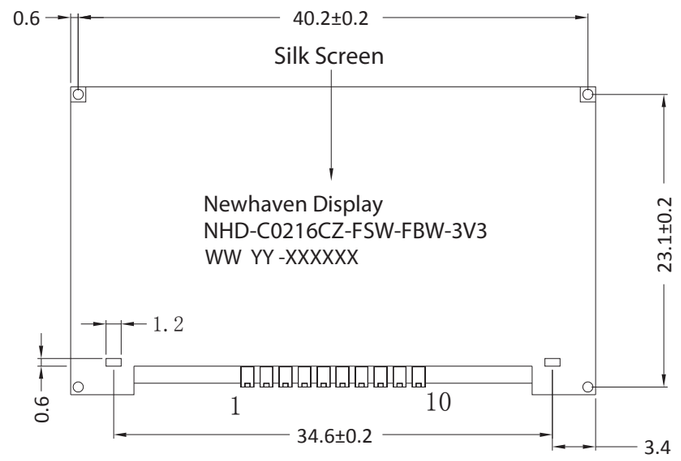
- **2 lines x 16 characters**
- **Built-in controller (ST7032)**
- **5x8 dots with cursor**
- **4-line serial interface**
- **1/16 duty, 1/5 bias**

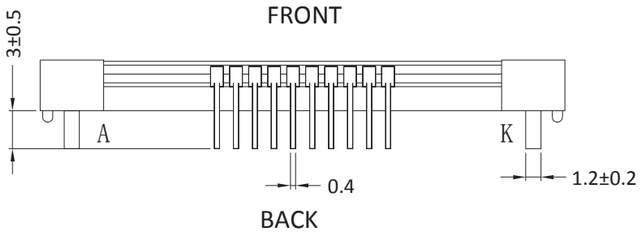
SYMBOL	REVISION	DATE



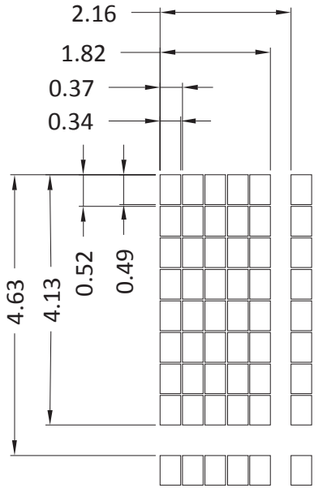


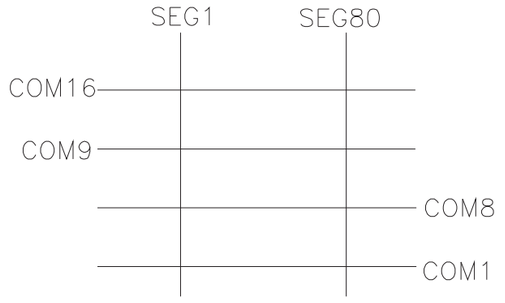






Pin Assignment	
NO.	Symbol
1	RST
2	RS
3	CSB
4	SCL
5	SI
6	VSS
7	VDD
8	VOUT
9	C1+
10	C1−





COM & SEG Layout

Notes:

1. Driver:	1/16 Duty, 1/5 Bias
2. Voltage:	3.3V VDD, 5.5V VLCD
3. Display Mode:	FSTN Positive / Transflective
4. Optimal View:	6:00
5. Backlight:	White LED
6. Driver IC:	ST7032-0D
7. Interface:	Serial

STANDARD TOLERANCES (UNLESS OTHERWISE SPECIFIED)
LINEAR:
XX. ±0.3 mm
XX.X ±0.3 mm
XX.XX ±0.3 mm

UNLESS OTHERWISE SPECIFIED
- DIMENSIONS ARE IN MILLIMETERS
- THIRD ANGLE PROJECTION

NEWHAVEN DISPLAY INTERNATIONAL

DRAWING/PART NUMBER: NHD-C0216CZ-FSW-FBW-3V3
REVISION: 1.0
SIZE: A3
SCALE: NS

DRAWN BY:	CHECKED BY:	APPROVED BY:
S. Baxi	S. Baxi	S. Baxi
DRAWN DATE:	CHECKED DATE:	APPROVED DATE:
08/24/18	08/24/18	08/24/18

DO NOT SCALE DRAWING | SHEET 1 OF 1

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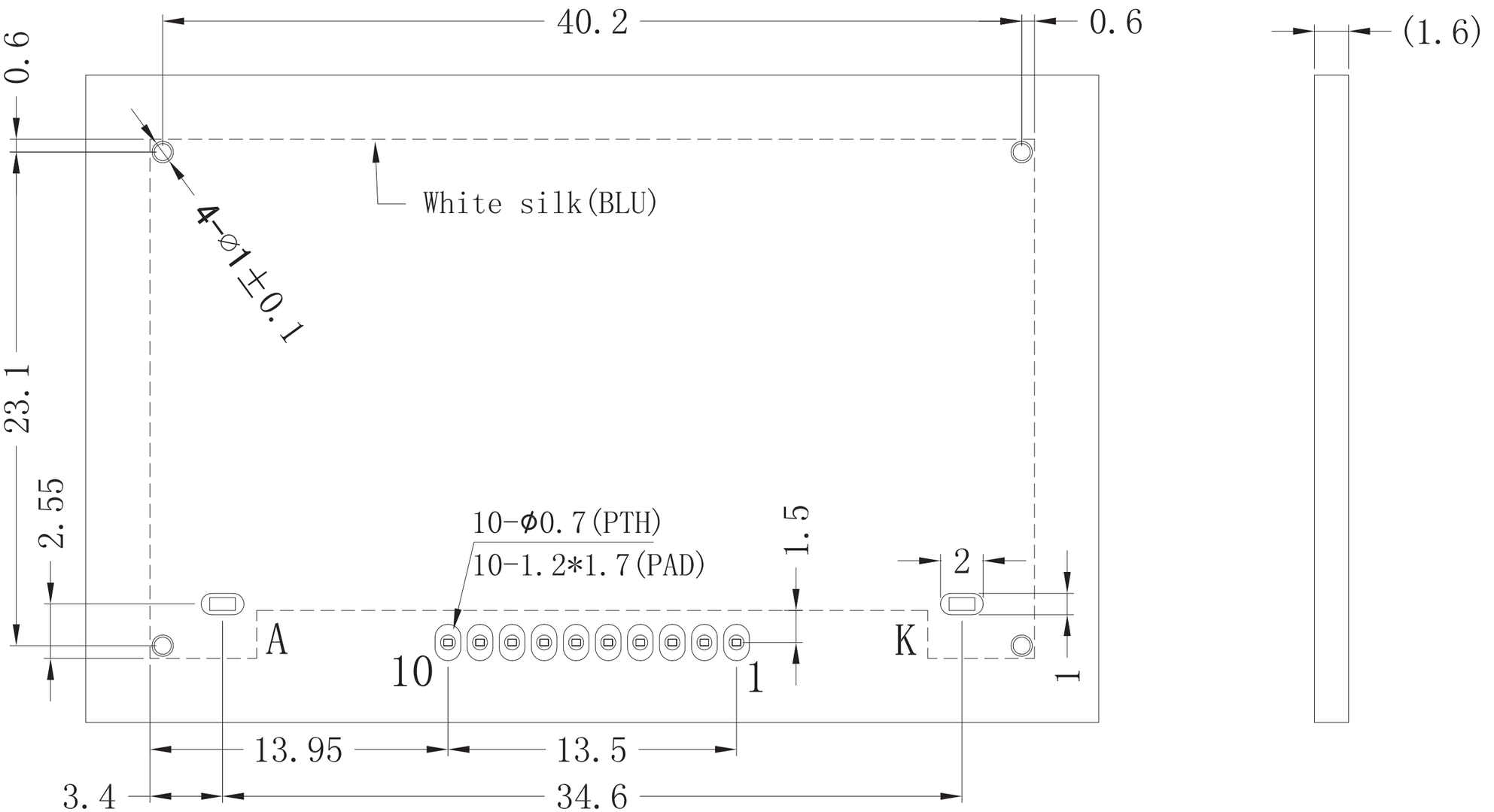
SYMBOL	REVISION	DATE

Recommended PCB Footprint



Applicable Displays:
1) NHD-C0216CZ-NSW-BBW-3V3
2) NHD-C0216CZ-FSW-FBW-3V3

STANDARD TOLERANCE: (UNLESS OTHERWISE SPECIFIED) LINEAR: ±0.3mm	NEWHAVEN DISPLAY INTERNATIONAL	
	DRAWING/PART NUMBER: NHD-C0216CZ-Footprint	REVISION: 1.0
UNLESS OTHERWISE SPECIFIED: - DIMENSIONS ARE IN MILLIMETERS - THIRD ANGLE PROJECTION	DRAWN BY: A. Shah / APPROVED BY: A. Khan	SIZE: A3
	DRAWN DATE: 6/4/19 / APPROVED DATE: 6/4/19	SCALE: NS
	DO NOT SCALE DRAWING	SHEET 1 OF 1

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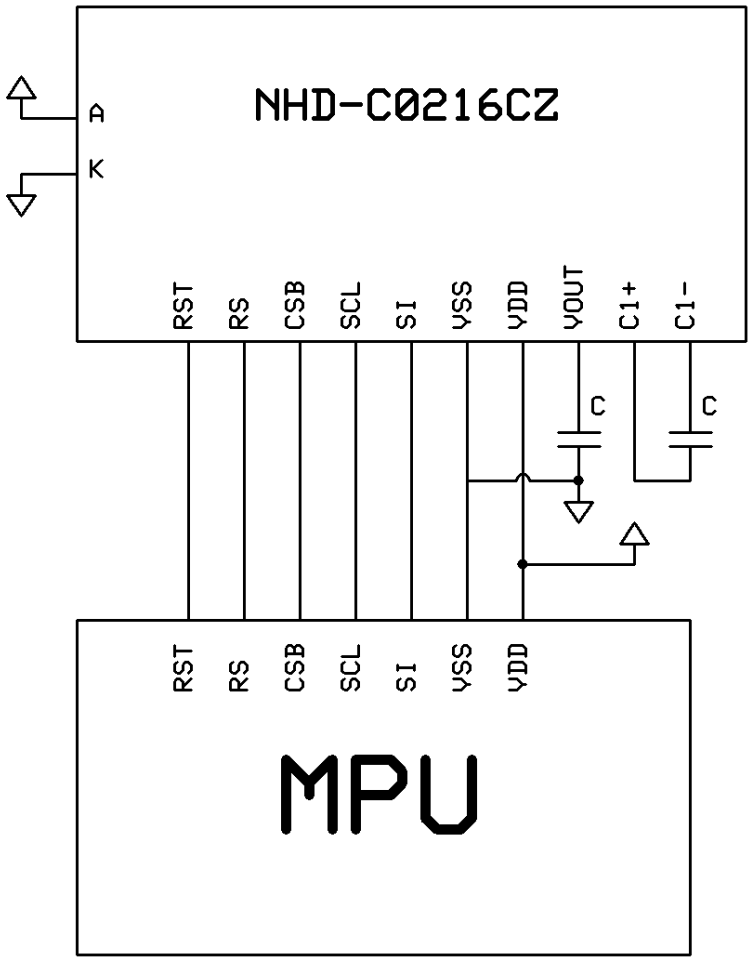
Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description
1	RST	MPU	Active LOW Reset Signal
2	RS	MPU	Register Select Signal. RS=0: instruction; RS=1: data
3	CSB	MPU	Active LOW Chip Select signal
4	SCL	MPU	Serial Clock
5	SI	MPU	Serial Input data
6	V_{SS}	Power Supply	Ground
7	V_{DD}		Power supply for logic for LCD (3.3V).
8	V_{OUT}		DC/DC voltage converter. Connect to 1uF capacitor to V_{DD} or V_{SS}
9	C1+	-	Voltage booster circuit. Connect to 0.47µF-2.2µF cap to PIN10.
10	C1-	-	Voltage booster circuit. Connect to 0.47µF-2.2µF cap to PIN9.
A	LED+	Power Supply	Backlight Anode (3.0V)
K	LED-	Power Supply	Backlight Cathode (Ground)

Recommended LCD connector: LCD pins should be soldered directly onto thru-hole connection on PCB
Backlight connector: Backlight pins should be soldered directly onto thru-hole connection on PCB
Recommended Breakout Board: NHD-PCB0216CZ



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}	V_{DD} = 3.3V	0.16	0.5	0.75	mA
Supply for LCD (contrast)	V_{LCD}	T_{OP} = 25°C	5.2	5.5	5.8	V
"H" Level input	V_{IH}	-	1.9	-	V_{DD}	V
"L" Level input	V_{IL}	-	V_{SS}	-	0.8	V
"H" Level output	V_{OH}	-	0.75 * V_{DD}	-	V_{DD}	V
"L" Level output	V_{OL}	-	V_{SS}	-	0.8	V
Backlight Supply Voltage	V_{LED}	-	3.0	3.1	3.2	V
Backlight Supply Current	I_{LED}	V_{LED} = 3.1V	10	30	36	mA

Optical Characteristics

Item		Symbol	Condition	Min.	Typ.	Max.	Unit
Optimal Viewing Angles	Top	φY+	CR ≥ 2	-	20	-	º
	Bottom	φY-		-	40	-	º
	Left	θX-		-	40	-	º
	Right	θX+		-	40	-	º
Contrast Ratio		CR	-	2	6	-	-
Response Time	Rise	T_R	T_{OP} = 25°C	-	200	300	ms
	Fall	T_F		-	250	350	ms

Controller Information

Built-in ST7032 Controller.
Please download specification at http://www.newhavendisplay.com/app_notes/ST7032.pdf

DDRAM Address

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F

Table of Commands

Instruction	Instruction code										Description	Instruction Execution Time		
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		OSC= 380kHz	OSC = 540kHz	OSC= 700kHz
Clear Display	0	0	0	0	0	0	0	0	0	1	Write “20H” to DDRAM and set DDRAM address to “00H” from AC	**1.08 ms**	**0.76 ms**	**0.59 ms**
Return Home	0	0	0	0	0	0	0	0	1	X	Set DDRAM Address to “00H” from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.	**1.08 ms**	**0.76 ms**	**0.59 ms**
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	Sets cursor move direction and specifies display shift. These parameters are performed during data write and read.	**26.3 µs**	**18.5 µs**	**14.3 µs**
Display ON/OFF	0	0	0	0	0	0	1	D	C	B	D=1: Entire display on C=1: Cursor on B=1: Blinking cursor on	**26.3 µs**	**18.5 µs**	**14.3 µs**
Function set	0	0	0	0	1	DL	N	DH	IS2	IS1	DL: Interface data is 8/4 bits N: Number of lines is 2/1 DH: Double Height Font IS 2~1: Instruction Table Select	**26.3 µs**	**18.5 µs**	**14.3 µs**
Set DDRAM Address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in address counter.	**26.3 µs**	**18.5 µs**	**14.3 µs**
Read busy Flag and Address	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Whether during internal operation or not can be known by reading BF. The contents of address counter can also be read.	**0**	**0**	**0**
Write data To Address	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM).	**26.3 µs**	**18.5 µs**	**14.3 µs**
Read data From RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM/ICONRAM).	**26.3 µs**	**18.5 µs**	**14.3 µs**

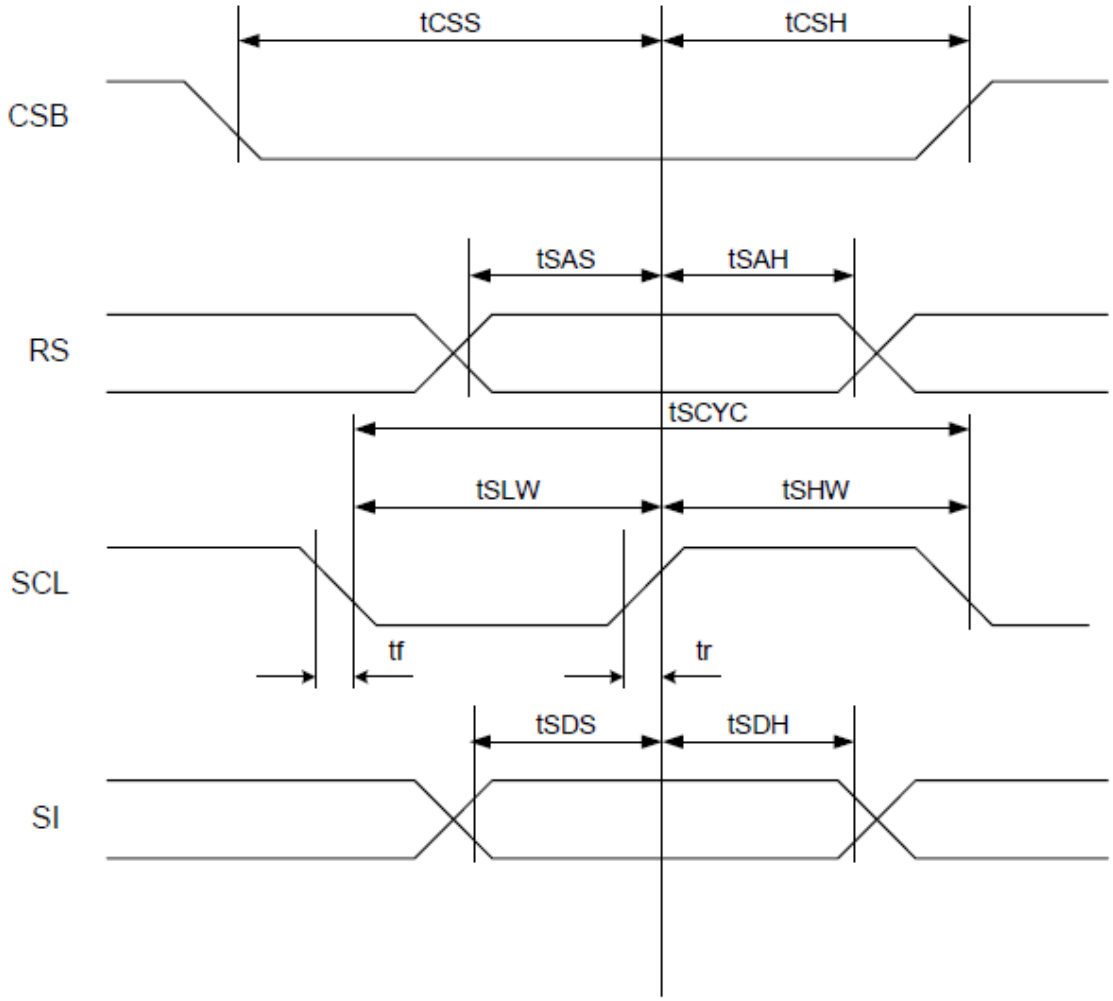
Instruction Table 0 (IS[2:1] = [0,0]))														
Cursor or Display shift	0	0	0	0	0	1	S/C	R/L	X	X	Sets cursor moving and display shift control bit, and the direction without changing DDRAM data.	**26.3 µs**	**18.5 µs**	**14.3 µs**
Set CGRAM	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter	**26.3 µs**	**18.5 µs**	**14.3 µs**

Instruction Table 1 (IS[2:1] = [0,1]))														
Internal OSC Frequency	0	0	0	0	0	1	BS	F2	F1	F0	BS = 1 : 1/4 bias BS= 0 : 1/5 bias F2~0 : Adjust internal OSC frequency for FR frequency	**26.3 µs**	**18.5 µs**	**14.3 µs**
Set ICON Address	0	0	0	1	0	0	AC3	AC2	AC1	AC0	Set ICON address in address counter	**26.3 µs**	**18.5 µs**	**14.3 µs**
Power/ICON control/Contrast set	0	0	0	1	0	1	Ion	Bon	C5	C4	Ion: ICON display on/off Bon: Set booster circuit on/off C5,C4: Contrast set for internal follower mode	**26.3 µs**	**18.5 µs**	**14.3 µs**
Follower Control	0	0	0	1	1	0	Fon	Rab 2	Rab 1	Rab 0	Fon: Set follower circuit on/off Rab 2~0: select follower amplified ratio	**26.3 µs**	**18.5 µs**	**14.3 µs**
Contrast Set	0	0	0	1	1	1	C3	C2	C1	C0	Contrast set for internal follower mode.	**26.3 µs**	**18.5 µs**	**14.3 µs**

Instruction Table 2 ((IS[2:1] = [0,0]))														
Double Height Position Select	0	0	0	0	0	1	UD	X	X	X	UD: Double height position Select	**26.3 µs**	**18.5 µs**	**14.3 µs**
Reserved	0	0	0	1	X	X	X	X	X	X	Do not use (Reserved for Test)	**26.3 µs**	**18.5 µs**	**14.3 µs**

***Instruction Table 3 (IS[2,1] = [1,1]): Do not use (Reserved for Test)**

Timing Characteristics

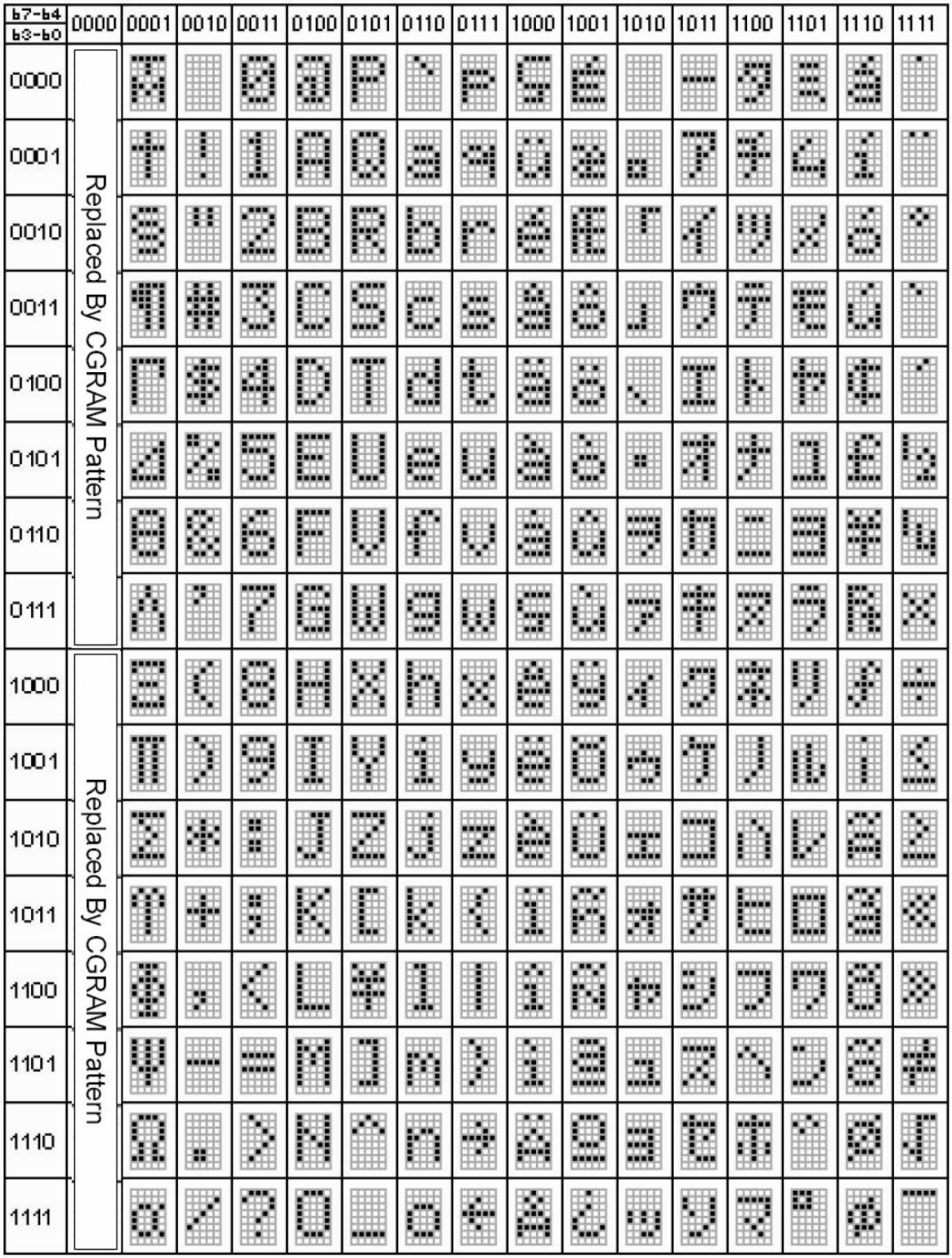


(Ta = 25°C)

Item	Signal	Symbol	Condition	VDD=2.7 to 4.5V Rating		VDD=4.5 to 5.5V Rating		Units
				Min.	Max.	Min.	Max.	
Serial Clock Period	SCL	t_{SCYC}	—	200	-	100	-	ns
SCL "H" pulse width		t_{SHW}		20	-	20	-	
SCL "L" pulse width		t_{SLW}		160	-	120	-	
SCL Rise/Fall time	SCL	tr,tf	—	-	20	-	20	ns
Address setup time	RS	t_{SAS}	—	10	-	10	-	ns
Address hold time		t_{SAH}		250	-	150	-	
Data setup time	SI	t_{SDS}	—	10	-	10	-	ns
Data hold time		t_{SDH}		10	-	20	-	
CS-SCL time	CS	t_{CSS}	—	20	-	20	-	ns
		t_{CSH}		350	-	200	-	

Built-In Font Table

ST7032-0D (ITO option OPR1=0, OPR2=0)



Example Initialization Program

```
void init()
//initialize the LCD
{
  P3 = 1;
 P1 = 1;
 RST = 0;                                    //RESET
 delay(2);
 RST = 1;                                    //end reset
 delay(20);
 Writecom(0x30);                              //wake up
 delay(2);
 Call writecom(0x30);                         //wake up
 Call writecom(0x30);                         //wake up
 Call writecom(0x39);                         //function set
 Call writecom(0x14);                         //internal osc frequency
 Call writecom(0x56);                         //power control
 Call writecom(0x6D);                         //follower control
 Call writecom(0x70);                         //contrast
 Call writecom(0x0C);                         //display on
 Call writecom(0x06);                         //entry mode
 Call writecom(0x01);                         //clear
 delay(10);
}

void writecom(int d)
{
 CS = 0;                                      //CS
 RS = 0;                                      //A0 = Command
 for(serialcounter = 1; serialcounter <= 8; serialcounter++)  //send 8 bits
 {
  if((d&0x80)==0x80)                          //get only the MSB
          SI=1;                               //if 1, then SI=1
  else
          SI=0;                               //if 0, then SI=0
  d=(d<<1);                                   //shift data byte left
  SCL = 0;
  SCL = 1;
  SCL = 0;                                    //SCL
 }
 CS = 1;
}
void writedata(int d)
{
 CS = 0;                                      //CS
 RS = 1;                                      //A0 = Data
 for(serialcounter = 1; serialcounter <= 8; serialcounter++)   //send 8 bits
 {
  if((d&0x80)==0x80)                          //get only the MSB
          SI=1;                               //if 1, then SI=1
  else
          SI=0;                               //if 0, then SI=0
  d=(d<<1);                                   //shift data byte left
  SCL = 0;
  SCL = 1;
  SCL = 0;                                    //SCL
 }
 CS = 1;
}
```

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 , 96hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-30°C , 96hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time.	+70°C , 96hrs	2
Low Temperature Operation	Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time.	-20°C , 96hrs	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.	+40°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,60min -> 25°C,5min -> 70°C,60min = 1 cycle 20 cycles	
Vibration test	Endurance test applying vibration to simulate transportation and use.	10-55Hz, 5G Acceleration. 60 sec in each of 3 directions X,Y,Z for 30 minutes	3
Static electricity test	Endurance test applying electric static discharge.	VS=8kV, RS=330Ω, CS=150pF five 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.

Precautions for using LCDs/LCMs

See Precautions at www.newhavendisplay.com/specs/precautions.pdf

Warranty Information and Terms & Conditions

http://www.newhavendisplay.com/index.php?main_page=terms