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 Positive.
B-	6:00 Optimal View
W-	Wide Temperature
3V3-	3.3V LCD, 3V Backlight
	RoHS Compliant

Document Revision History

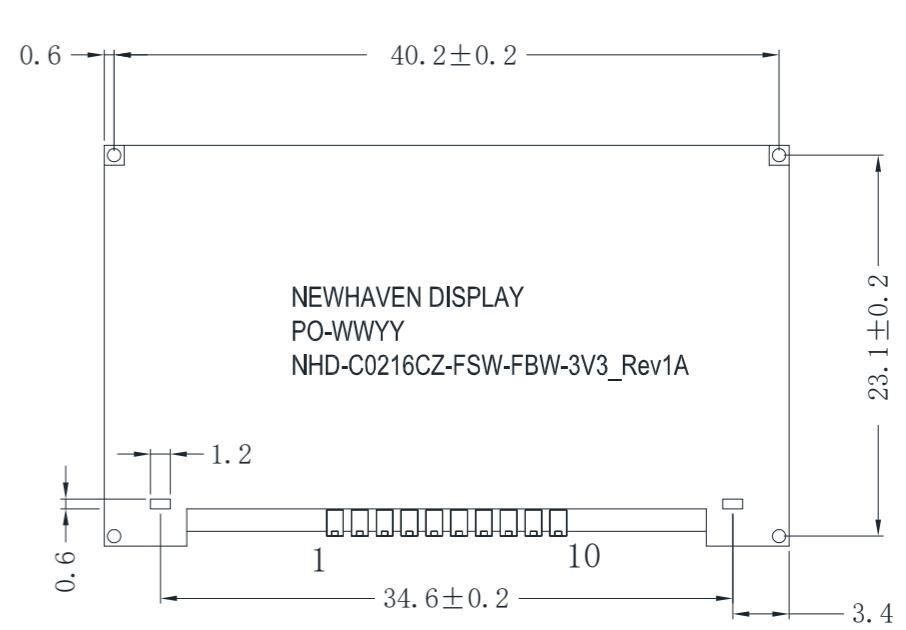| Revision	Date	Description	Changed by
0	11/11/2008	Initial Release	-
1	8/26/2009	User guide reformat	BE
2	10/9/2009	Updated Electrical Characteristics	MC
3	10/22/2009	Font Table Revision	BE
4	10/27/2009	Updated the Block Diagram	MC
5	11/19/2009	Updated backlight supply current	MC
6	12/18/2009	Pin description 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
15	9/12/19	Supply Current Updated	SB

Functions and Features

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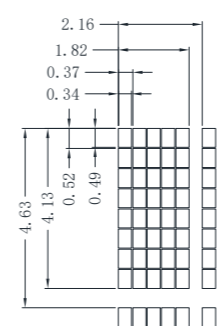- **4-line serial interface**
- **1/16 duty, 1/5 bias**

BLU 41.4±0.3
LCD 39.6±0.2
V.A 37.6 MIN
A.A 34.22
0.9
(1.9)
(3.59)

BLU 24.3±0.3
LCD 22.5±0.2
LCD 15.8±0.2
V.A12.8MIN
A.A8.76
7.6
0.9
(9.1)
(11.12)

Tear tape

10   1

P1.5x9=13.5
13.95±0.2

LCD 2.1 MAX.

FRONT   BACK

Silicone
UV Glue

0.3
0.75

4±0.3
0.9

FRONT   BACK

0.6
2.55

0.6

40.2±0.2

NEWHAVEN DISPLAY
PO-WWYY
NHD-C0216CZ-FSW-FBW-3V3_Rev1A

4-Ø0.8

23.1±0.2

1.2

0.6

1   10

34.6±0.2

3.4

3±0.5

FRONT

A   K

0.4   1.2±0.2

BACK

COM & SEG Layout

SEG1   SEG80

COM16

COM9

COM8

COM1
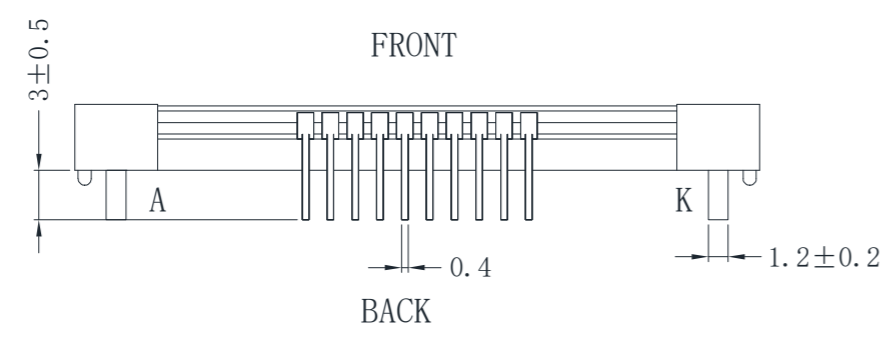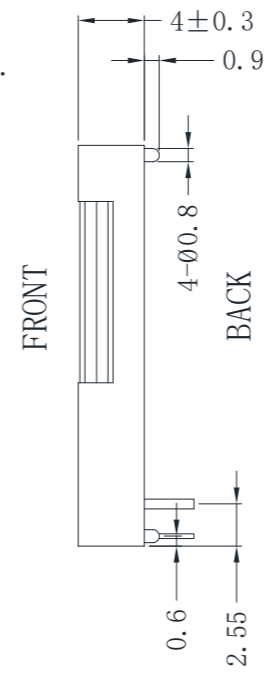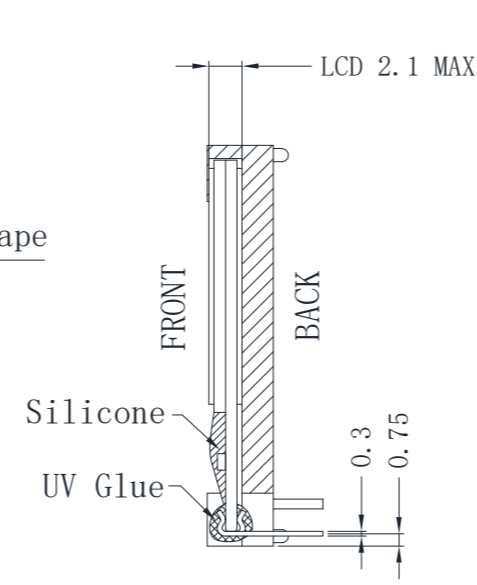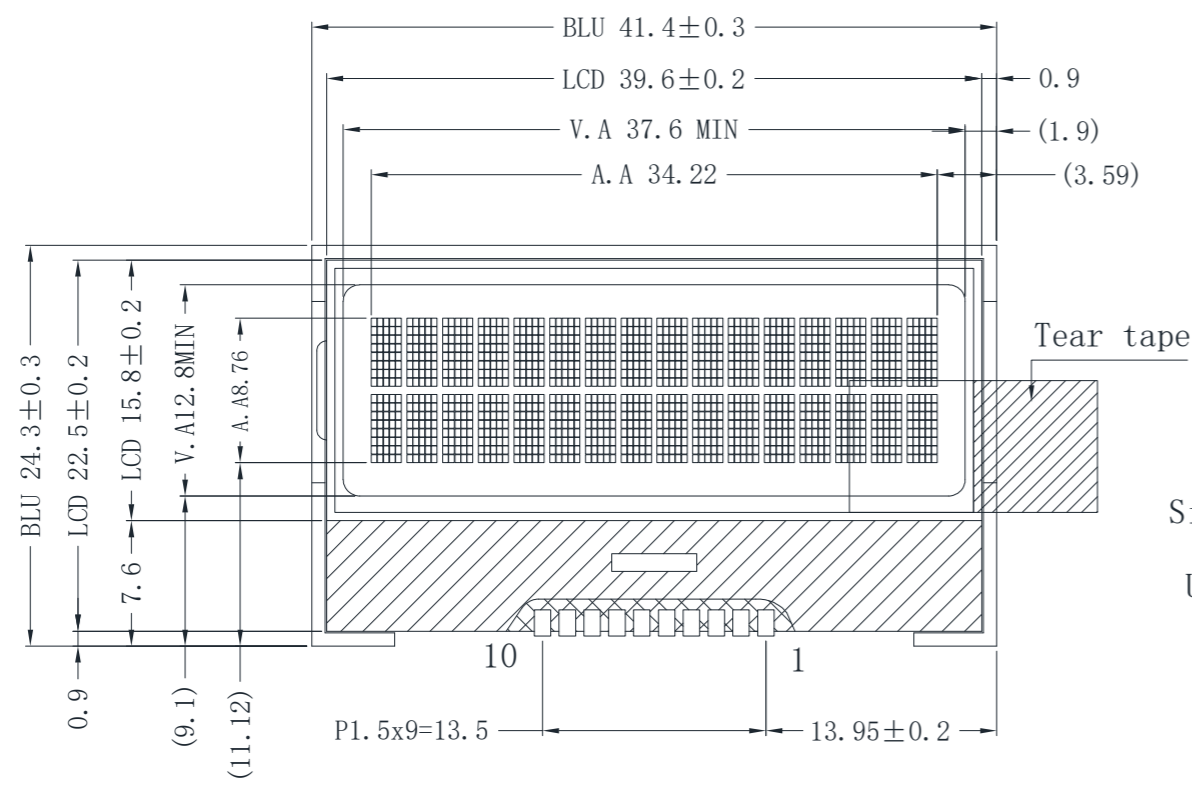
Pin Assignment	
NO.	Symbol
1	RST
2	RS
3	CSB
4	SCL
5	SI
6	VSS
7	VDD
8	VOUT
9	C1+
10	C1-

2.16
1.82
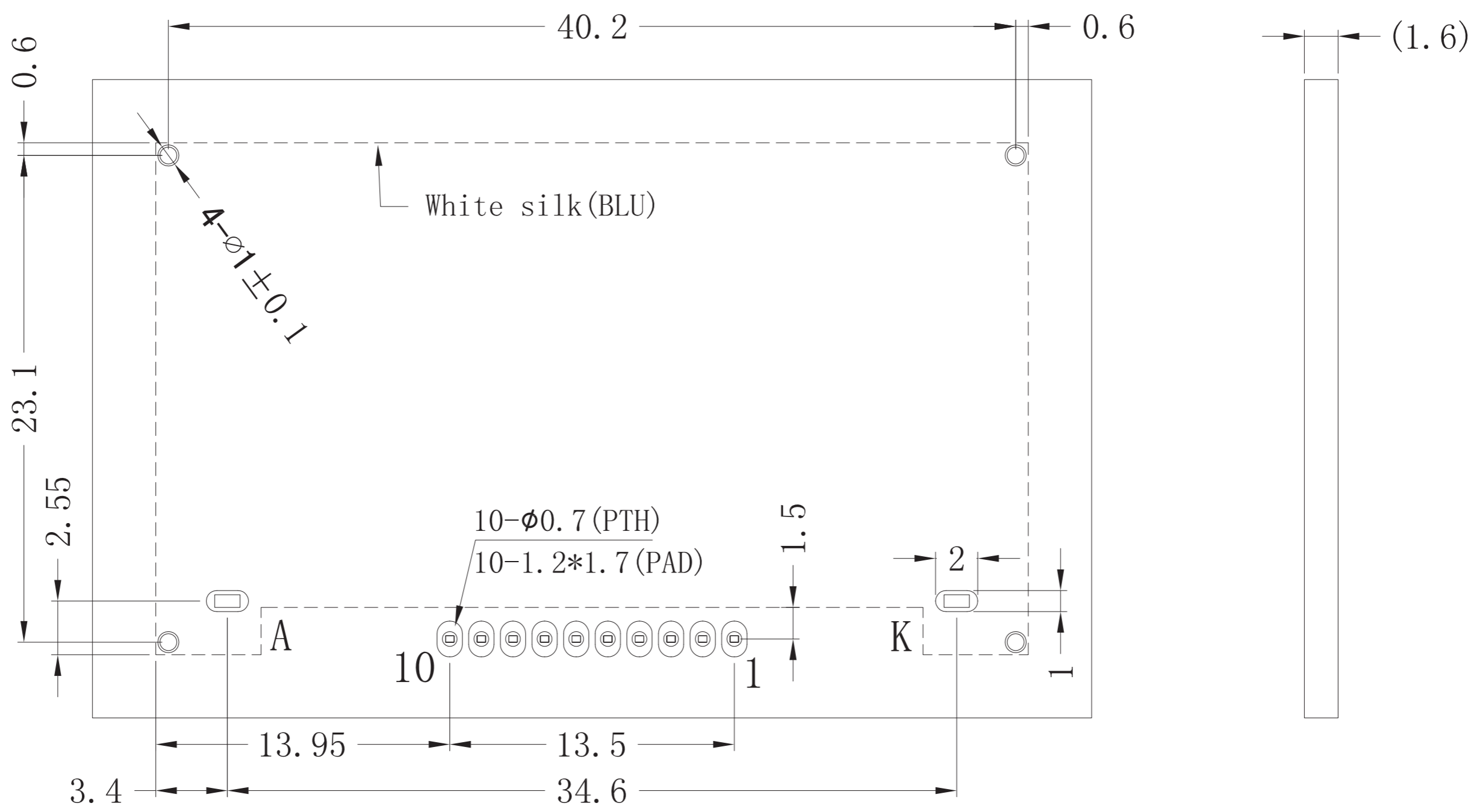0.37
0.34

4.63
4.13
0.52
0.49

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

Recommended PCB Footprint

40.2

0.6

(1.6)

0.6

White silk(BLU)

4-ϕ1$\pm$0.1

23.1

2.55

10-ϕ0.7(PTH)
10-1.2*1.7(PAD)

1.5

2

A

K

10

1

1

13.95

13.5

3.4

34.6

SYMBOL	REVISION		DATE

STANDARD TOLERANCE:
(UNLESS OTHERWISE SPECIFIED)

LINEAR: ±0.3mm

UNLESS OTHERWISE SPECIFIED:

- DIMENSIONS ARE IN MILLIMETERS

- THIRD ANGLE PROJECTION

NEWHAVEN DISPLAY
INTERNATIONAL

DRAWING/PART NUMBER:
NHD-C0216CZ-Footprint

REVISION:
1.0

SIZE:
A3

SCALE:
NS

DRAWN BY: A. Shah
APPROVED BY: A. Khan
DRAWN DATE: 6/4/19
APPROVED DATE: 6/4/19

DO NOT SCALE DRAWING

SHEET 1 OF 1

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}		Ground
7	V_{DD}	Power Supply	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

[5]
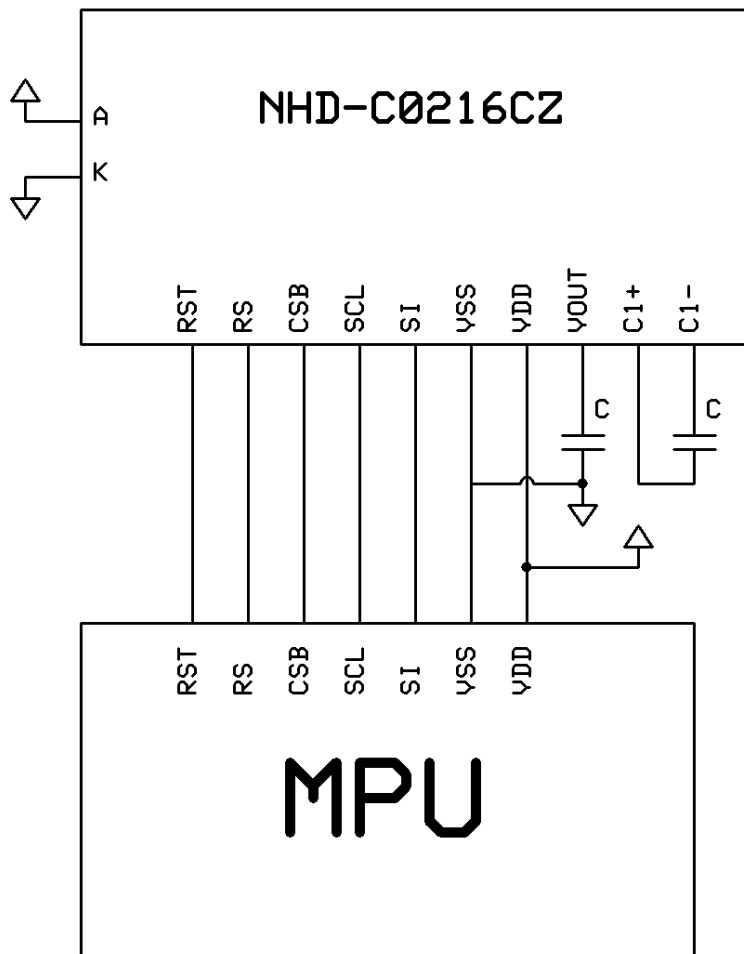
Electrical Characteristics

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}	$V_{DD} = 3.3V$	40	170	300	μA
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+		-	20	-	°
	Bottom	φY-	CR ≥ 2	-	40	-	°
	Left	θX-		-	40	-	°
	Right	θX+		-	40	-	°
Contrast Ratio		CR	-	2	4	-	-
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
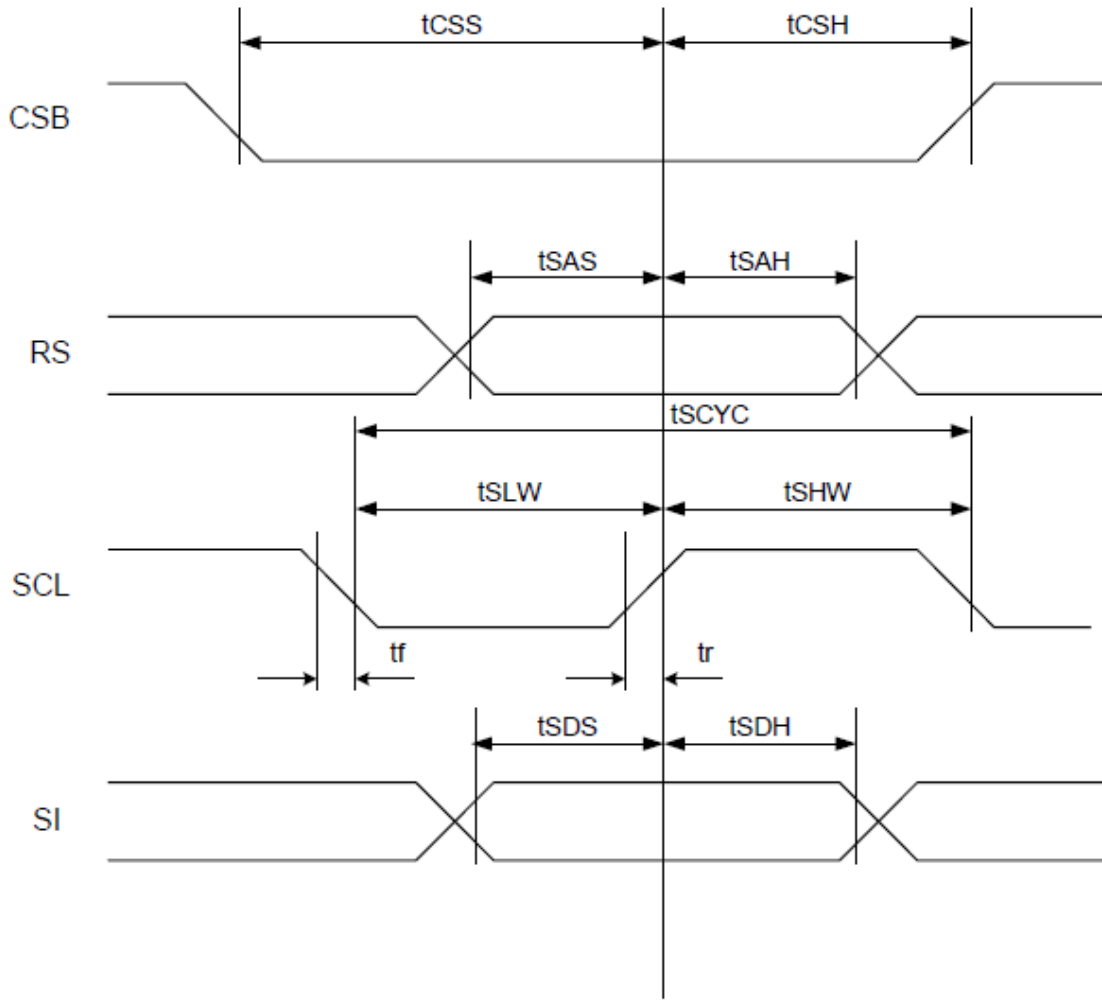
Item	Signal	Symbol	Condition	VDD=2.7 to 4.5V Rating		VDD=4.5 to 5.5V Rating		Units
				Min.	Max.	Min.	Max.	
Serial Clock Period	SCL	tSCYC		200	-	100	-	ns
SCL "H" pulse width		tSHW	—	20	-	20	-	
SCL "L" pulse width		tSLW		160	-	120	-	
SCL Rise/Fall time	SCL	tr,tf	—	-	20	-	20	ns
Address setup time	RS	tSAS	—	10	-	10	-	ns
Address hold time		tSAH		250	-	150	-	
Data setup time	SI	tSDS	—	10	-	10	-	ns
Data hold time		tSDH		10	-	20	-	
CS-SCL time	CS	tCSS	—	20	-	20	-	ns
		tCSH		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