

NHD-C0216CU-FSW-GBW-3V3

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

NHD- Newhaven Display
C0216- COG, 2 Lines x 16 Characters
CU- Model
F- Transflective
SW- Side White LED Backlight
G- STN Positive, Gray
B- 6:00 Optimal View
W- Wide Temp
3V3- 3VDD, 3.2V Backlight
RoHS Compliant

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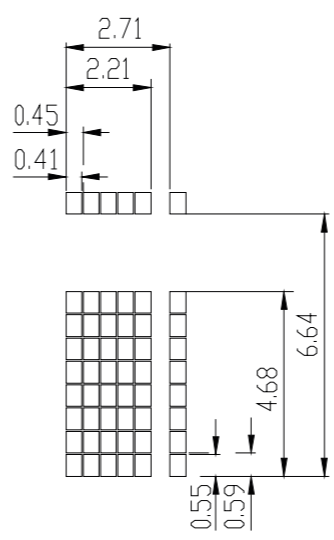
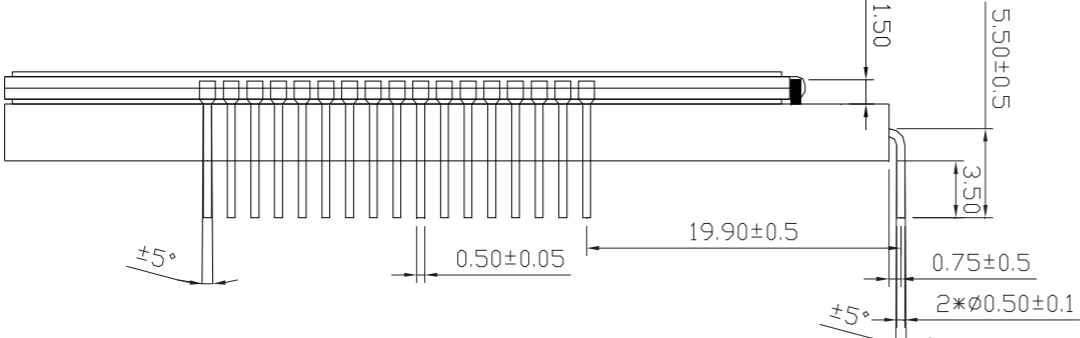
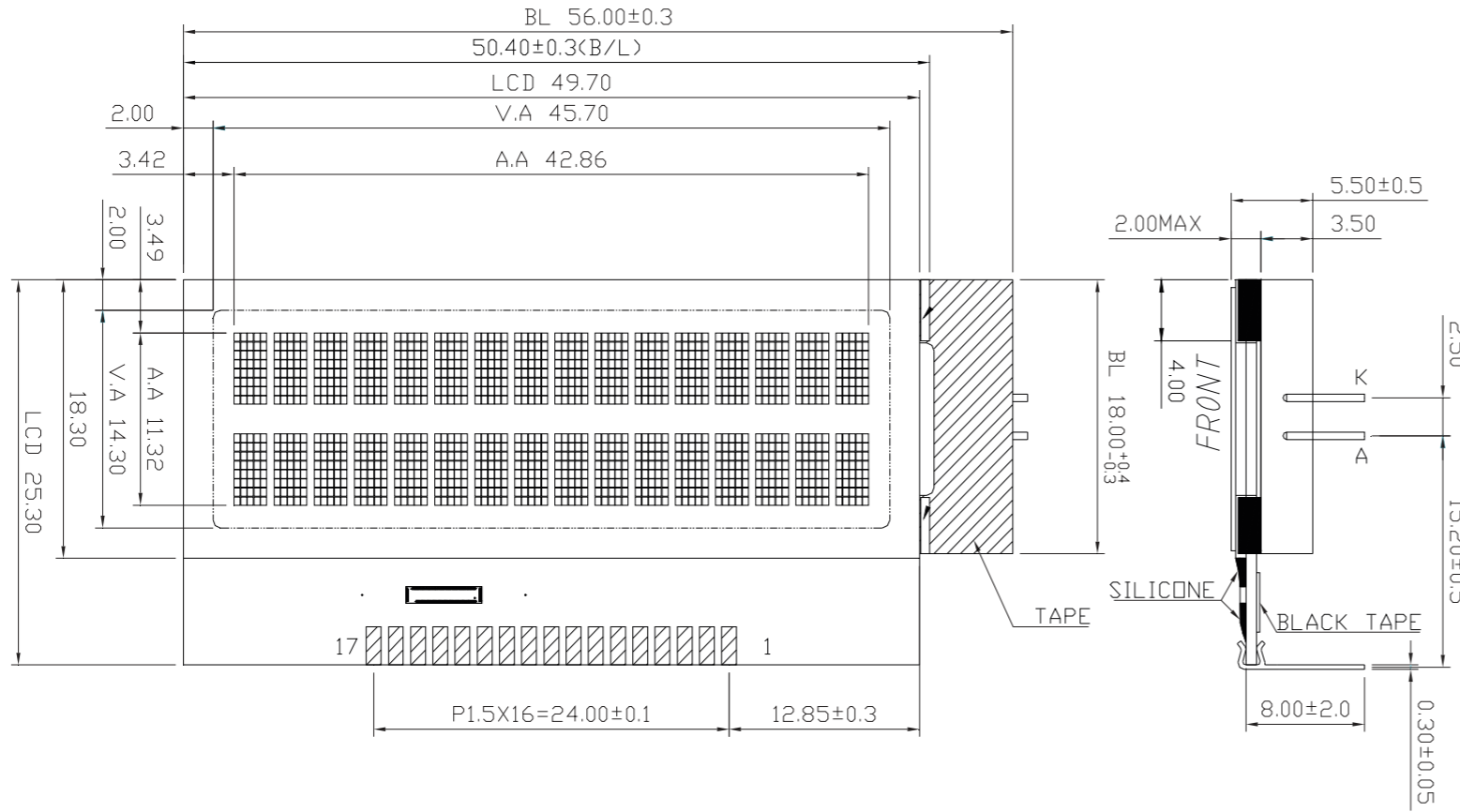
Document Revision History

Revision	Date	Description	Changed by
0	8/29/08	Initial Release	-
1	9/10/09	User guide reformat	BE
2	10/9/09	Updated Electrical Characteristics	MC
3	10/22/09	Mechanical Drawing dimensions added	BE
4	11/19/09	Updated backlight current	MC
5	8/5/10	Electrical Characteristics Update	MP
6	5/17/11	Updated Pin Description	BE
7	7/26/12	Mechanical drawing updated	AK
8	5/18/16	Mechanical Drawing, Electrical and Optical Char. Updated	SB
9	2/17/17	Backlight Characteristics Updated	SB
10	6/24/19	Added PCB Footprint Drawing	AS
11	9/4/19	Mechanical Drawing, Footprint & Current Updated	SB

Functions and Features

- 2 lines x 16 characters
- Built-in ST7032-0D controller
- +3.0V power supply
- 8-bit parallel data input from MPU
- 1/16 duty, 1/5 bias
- No CGRAM available
- RoHS Compliant

SYMBOL	REVISION	DATE



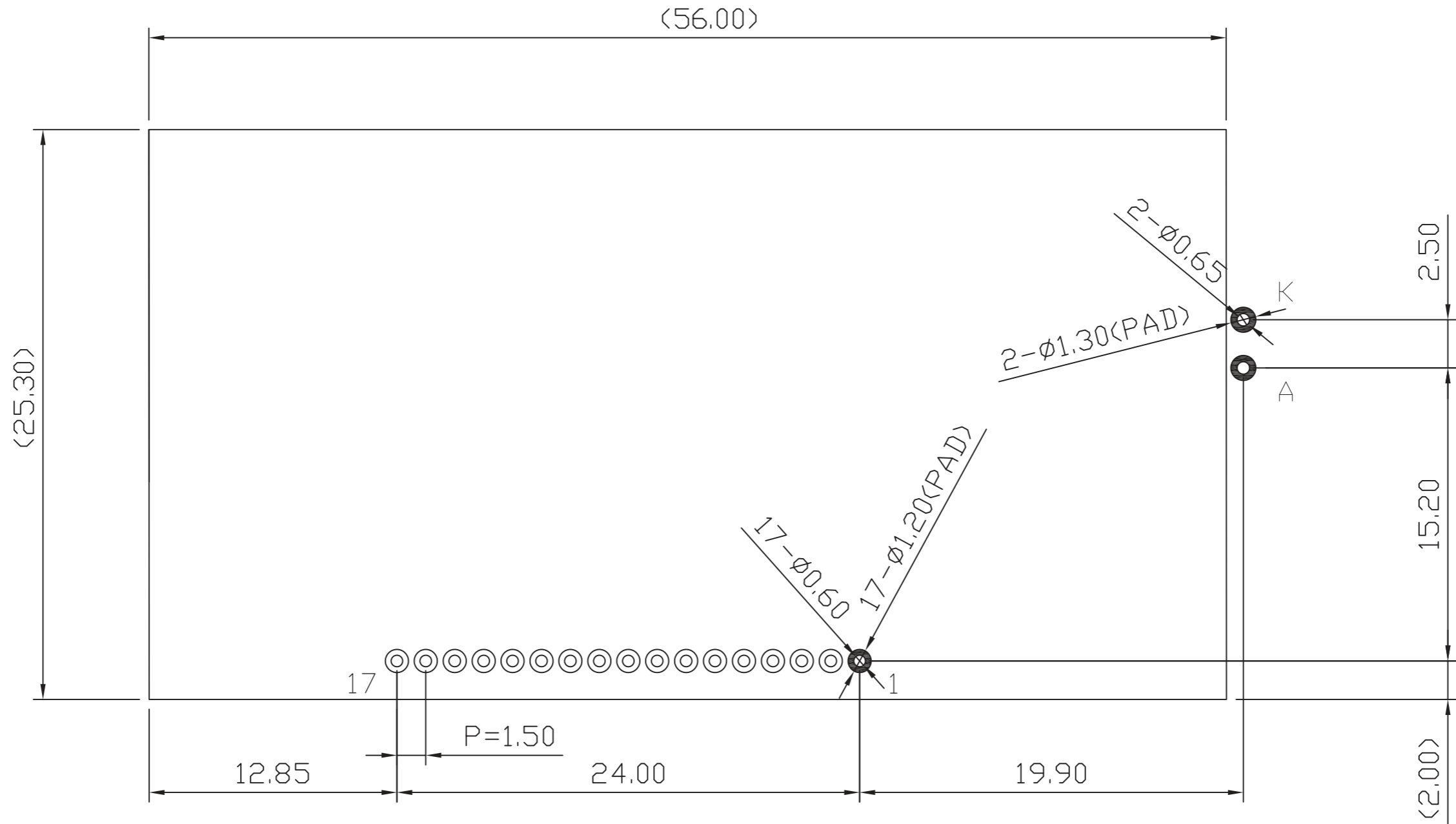
PIN NO	SIGNAL
1	XRESET
2	RS
3	R/W
4	E
5	DB0
6	DB1
7	DB2
8	DB3
9	DB4
10	DB5
11	DB6
12	DB7
13	VSS
14	VDD
15	VOUT
16	CAP1P
17	CAPIN

- Notes:**
1. Driver: 1/16 Duty, 1/5 Bias
 2. Voltage: 3V V_{DD}, 5V V_{LCD}
 3. Display Mode: STN Positive / Gray / Transflective
 4. Optimal View: 6:00
 5. Backlight: White LED
 6. Driver IC: ST7032i-0D - 8/4 Bit Parallel Interface



STANDARD TOLERANCE: (UNLESS OTHERWISE SPECIFIED)		
LINEAR: ±0.3mm	DRAWING/PART NUMBER: NHD-0216CU-FSW-GBW-3V3	REVISION: 1.0
UNLESS OTHERWISE SPECIFIED: - DIMENSIONS ARE IN MILLIMETERS - THIRD ANGLE PROJECTION	DRAWN BY: S. Baxi	APPROVED BY: S. Baxi
	DRAWN DATE: 9/5/19	APPROVED DATE: 9/5/19
	DO NOT SCALE DRAWING	
	SHEET 1 OF 1	
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Recommended PCB Footprint

SYMBOL	REVISION	DATE



Applicable Displays:
1) NHD-C0216CU-FSW-GBW-3V3

STANDARD TOLERANCE: (UNLESS OTHERWISE SPECIFIED)	 NEWHAVEN DISPLAY INTERNATIONAL	
LINEAR: $\pm 0.3\text{mm}$	DRAWING/PART NUMBER: NHD-C0216CU-Footprint	SIZE: A3
UNLESS OTHERWISE SPECIFIED: - DIMENSIONS ARE IN MILLIMETERS - THIRD ANGLE PROJECTION 	DRAWN BY: S. Baxi	APPROVED BY: S. Baxi
	DRAWN DATE: 9/5/19	APPROVED DATE: 9/5/19
	DO NOT SCALE DRAWING SHEET 1 OF 1	
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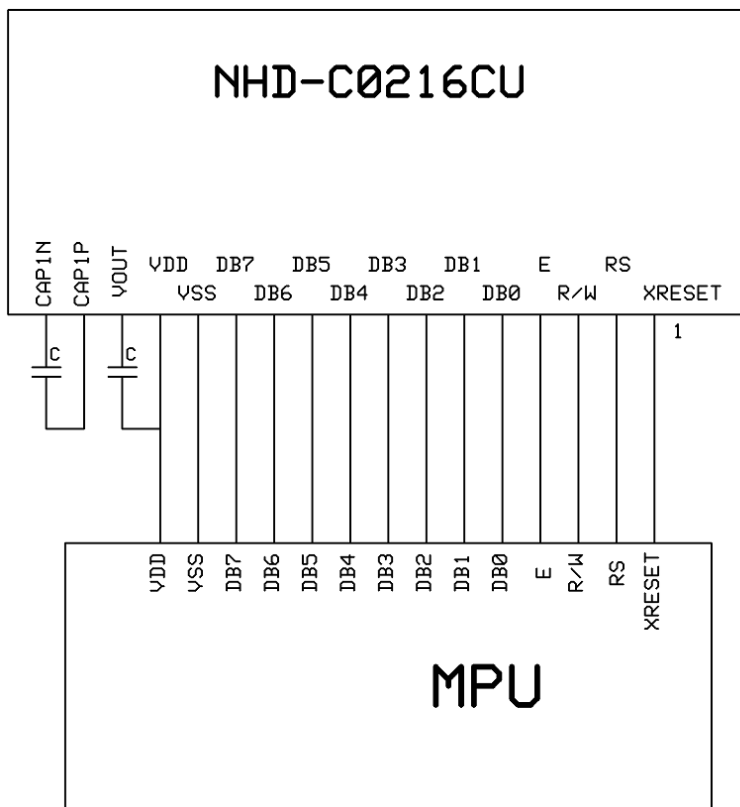
Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description
1	XRESET	MPU	Active LOW Reset Signal
2	RS	MPU	Register Select signal. RS=0: instruction; RS=1: data
3	R/W	MPU	Read/Write select signal, R/W=1: Read R/W: =0: Write
4	E	MPU	Operation Enable signal. Falling edge triggered.
5-12	DB0-DB7	MPU	8-bit bi-directional data bus lines
13	V _{SS}	Power Supply	Ground
14	V _{DD}		Supply Voltage for logic for LCD (+3.0V)
15	V _{OUT}		DC/DC voltage converter. Connect to 1uF capacitor to V _{DD}
16	CAP1P		Voltage booster circuit. Connect to 0.47uF-2.2uF cap to PIN17.
17	CAP1N		Voltage booster circuit. Connect to 0.47uF-2.2uF cap to PIN16.
A	LED+	Power Supply	Power supply for Backlight (20mA)
K	LED-	Power Supply	Backlight Ground

Recommended LCD connector: 1.5mm pitch pins, solder to PCB

Backlight connector: --- Mates with: - - -

Recommended Breakout Board: [NHD-PCB40](#)



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}	-	2.7	3.0	3.5	V
Supply Current	I _{DD}	V _{DD} = 3.0V	150	300	600	μA
Supply for LCD (contrast)	V _{LCD}	T _{OP} = 25°C	4.7	5.0	5.3	V
"H" Level input	V _{IH}	-	0.7 * V _{DD}	-	V _{DD}	V
"L" Level input	V _{IL}	-	V _{SS}	-	0.2 * V _{DD}	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 Current*	I _{LED}	-	-	20	25	mA
Backlight Voltage	V _{LED}	I _{LED} = 20mA	2.8	3.2	3.4	V

*Backlight is current driven; do not supply more than 30 mA. Luminance is directly related to Backlight Supply Current.

Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Optimal Viewing Angle	Top	φY+	-	30	-	°
	Bottom	φY-	-	40	-	°
	Left	θX-	-	40	-	°
	Right	θX+	-	40	-	°
Contrast Ratio	CR	-	2	5	-	-
Response Time	Rise	T _R	-	90	100	ms
	Fall	T _F	-	110	180	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

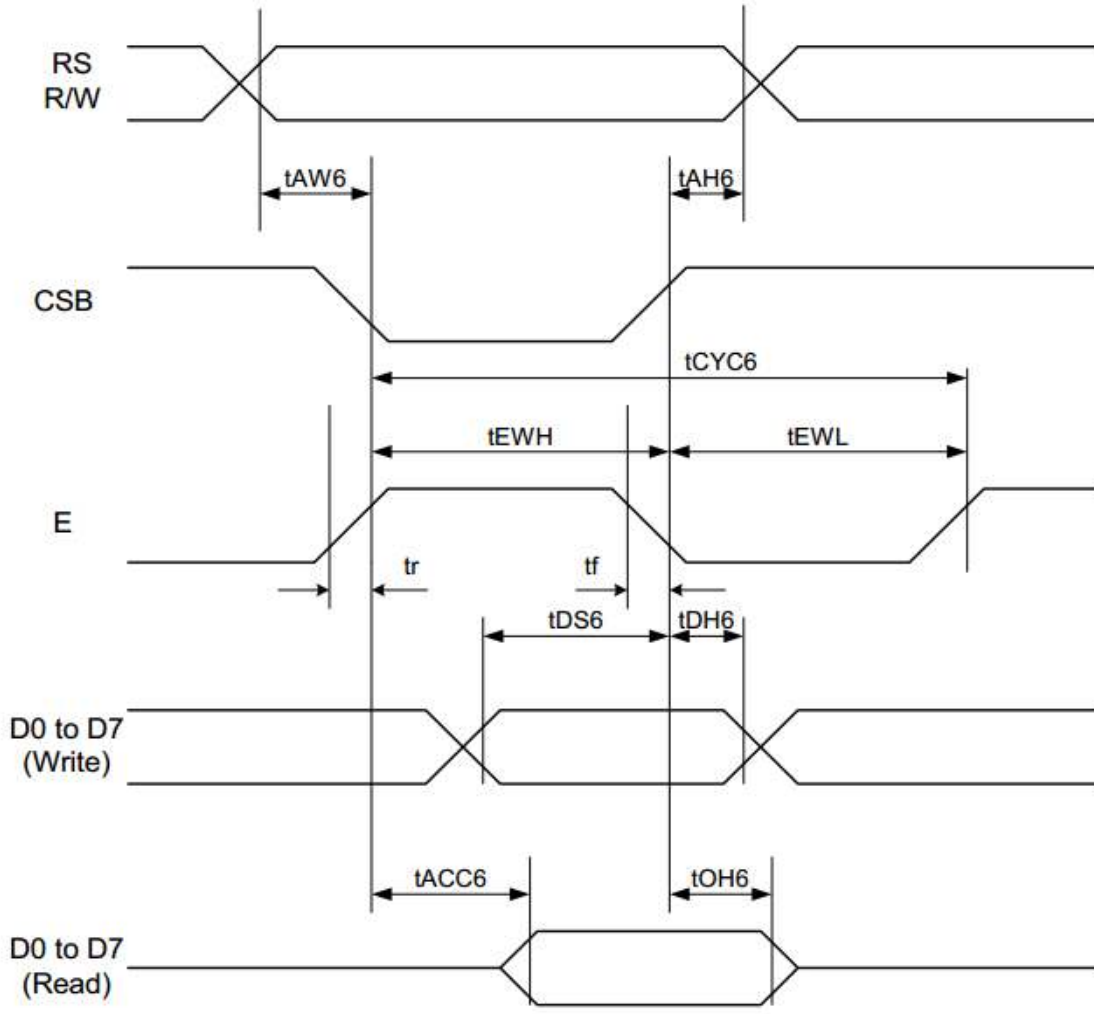
Instruction	Instruction Code										Description	Instruction Execution Time		
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		OSC=380KHz	OSC=540KHz	OSC=700KHz
Clear Display	0	0	0	0	0	0	0	0	0	1		1.08 ms	0.76 ms	0.59 ms
Return Home	0	0	0	0	0	0	0	0	0	1	x	1.08 ms	0.76 ms	0.59 ms
Entry Mode Set	0	0	0	0	0	0	0	0	1	I/D	S	26.3 us	18.5 us	14.3 us
Display ON/OFF	0	0	0	0	0	0	0	1	D	C	B	26.3 us	18.5 us	14.3 us
Function Set	0	0	0	0	1	DL	N	DH	*0	IS		26.3 us	18.5 us	14.3 us
Set DDRAM address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0		26.3 us	18.5 us	14.3 us
Read Busy flag and address	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0		0	0	0
Write data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0		26.3 us	18.5 us	14.3 us
Read data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0		26.3 us	18.5 us	14.3 us

Note *: this bit is for test command, and must always set to "0"

Instruction table 0 (IS=0)															
Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	x	x		S/C and R/L: Set cursor moving and display shift control bit, and the direction, without changing DDRAM data.	26.3 us	18.5 us	14.3 us
Set CGRAM	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0		Set CGRAM address in address counter	26.3 us	18.5 us	14.3 us

Instruction table 1 (IS=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 us	18.5 us	14.3 us
Set ICON address	0	0	0	1	0	0	AC3	AC2	AC1	AC0		Set ICON address in address counter.	26.3 us	18.5 us	14.3 us
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 us	18.5 us	14.3 us
Follower control	0	0	0	1	1	0	Fon	Rab2	Rab1	Rab0		Fon: set follower circuit on/off Rab2~0: select follower amplified ratio.	26.3 us	18.5 us	14.3 us
Contrast set	0	0	0	1	1	1	C3	C2	C1	C0		Contrast set for internal follower mode.	26.3 us	18.5 us	14.3 us

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.	
Address hold time	RS	tAH6	—	20	-	20	-	ns
Address setup time	RS	tAW6	—	20	-	20	-	
System cycle time	RS	tCYC6	—	400	-	280	-	ns
Data setup time	D0 to D7	tDS6	—	100	-	80	-	ns
Data hold time	D0 to D7	tDH6		40	-	20	-	
Access time	D0 to D7	tACC6	CL = 100 pF	-	500	-	400	ns
Output disable time	D0 to D7	tOH6		300	-	150	-	
Enable Rise/Fall time	E	tr,tf	—	-	20	-	20	ns
Enable H pulse time	E	tEWH	—	200	-	120	-	ns
Enable L pulse time	E	tEWL	—	150	-	130	-	ns

Note: All timing is specified using 20% and 80% of VDD as the reference.

Built-in Font Table

ST7032-0D (ITO option OPR1=1, OPR2=1)

b7-b4 b3-b0	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0000	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
0001	!	"	#	\$	%	&	'	()	*	+	,	-	.	/	:
0010	;	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N
0011	O	P	Q	R	S	T	U	V	W	X	Y	Z	[]	^	_
0100	~	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>
0101	!	"	#	\$	%	&	'	()	*	+	,	-	.	/	:
0110	;	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N
0111	O	P	Q	R	S	T	U	V	W	X	Y	Z	[]	^	_
1000	~	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>
1001	!	"	#	\$	%	&	'	()	*	+	,	-	.	/	:
1010	;	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1011	O	P	Q	R	S	T	U	V	W	X	Y	Z	[]	^	_
1100	~	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>
1101	!	"	#	\$	%	&	'	()	*	+	,	-	.	/	:
1110	;	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1111	O	P	Q	R	S	T	U	V	W	X	Y	Z	[]	^	_

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 c)
{
RW = 0;                  //Write
RS = 0;                  //Command
E = 1;
P1 = c;
E = 0;
}
/*****
void writedata(int d)
{
RW = 0;                  //Write
RS = 1;                  //Data
E = 1;
P1 = d;
E = 0;
}
/*****
/*****

```

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 , 240hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-30°C , 240hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time.	+70°C , 240hrs	2
Low Temperature Operation	Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time.	-20°C , 240hrs	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 , 240hrs	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 10 cycles	
Vibration test	Endurance test applying vibration to simulate transportation and use.	10-55Hz , 15mm amplitude. 60 sec in each of 3 directions X,Y,Z For 10 minutes	3
Static electricity test	Endurance test applying electric static discharge.	VS=800V, RS=1.5kΩ, CS=100pF One time	

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