HTM-OLED3.12-SPI

产品名称（**Product name**）：OLED LCM

型　　号（**Model**）：HTM-OLED3.12-SPI

编　　号（**Part number**）：

日　　期（**Date**）：2023-02-22

深圳市鑫洪泰电子科技有限公司 **Shenzhen Hot Display Technology Co.,Ltd**		
编制 **Prepared by**	审核 **Checked by**	核准 **Approved by**

编码：QR-R-011　A/0　　序号：

Rev.	Descriptions	Date
01	Prelimiay Release	2023-02-22

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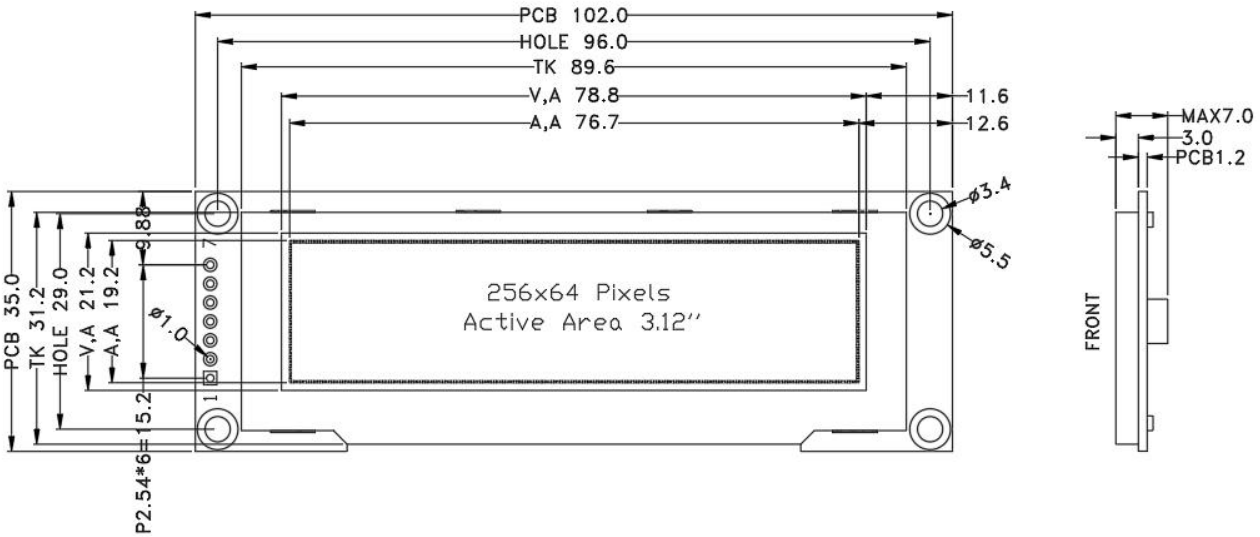
1. Bsaic Specifications

1.1 Display Specifications

1>LCD Display Mode : OLED DISPLAY Passive Matrix
2>Driving Duty : 1/64
3>Driving IC : SSD1322
4>Display Color : Monochrome (ORANGE)
5>Interface : 4line-SPI

1.2 Mechanical Specifications

1>Outline Dimension

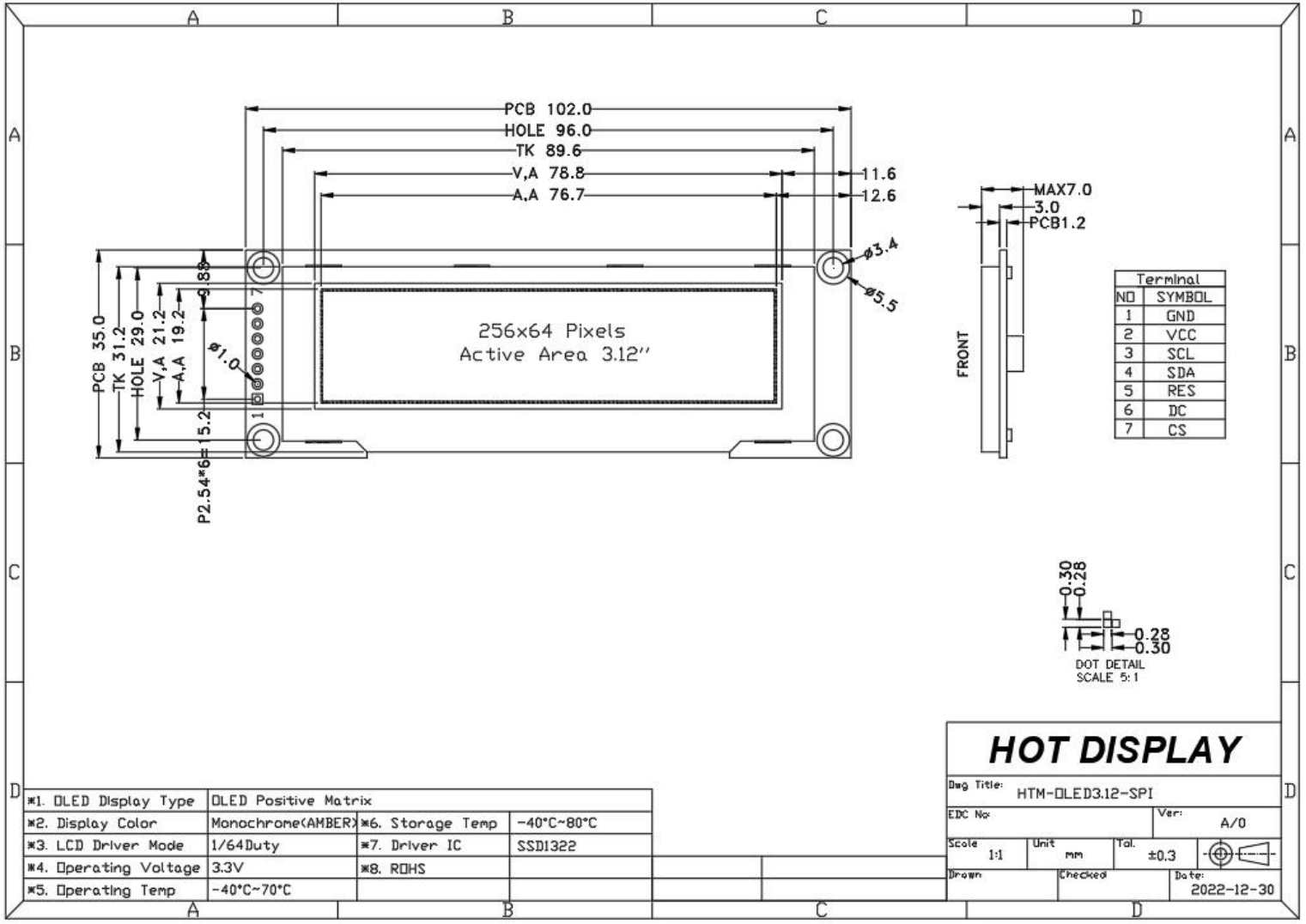


NO.	ITEM	SPECIFICATION	UNIT
1	Dot Matrix	256(W)×64(H)	-
2	Dot Size	0.28(W)×0.28 (H)	mm
3	Dot Pitch	0.30(W)×0.30 (H)	mm
4	Active Area	76.7(W)×19.2 (H)	mm
5	Module Size	102.0(W)×35.0(H)×7.0 (T)	mm
6	Diagonal A/A Size	3.12	inch
7	Module Weight	25±10%	gram

1.3 Terminal Function

Pin No.	Pin Name	Function
1	GND	Negative power supply,0V
2	VCC	Power supply voltage (Positive)
3	SCL	The serial clock input (SCL)
4	SDA	Serial data input (SDA)
5	RES	Reset Pin
6	DC	Data/Command Control
7	CS	This is the chip select signal.

1.4 Product Outline



2. Absolute Maximum Ratings

Items	Symbol	MIN.	MAX.	Unit
Supply Voltage	VBAT	3.0	4.0	V
Logic Signal Voltage	VDDIO	2.5	3.3	V
Driver Supply Voltage	VCC	0	15	V
Vcc Supply Current	ICC		55	mA
Operating Temperature	TOP	-30	+85	℃
Storage Temperature	Tst	-40	+90	℃
Humidity	RH		90%(MAX60℃)	

3. Electrical Characteristics

3.1 DC Characteristics

Vss = 0V,Top = 25℃

Items	Symbol	MIN.	TYP.	MAX.	Unit
Power Supply Voltage	VBAT	2.8	3.3	3.5	V
Logic Signal Voltage	VIH	2.8	-	3.3	
Output High Voltage	VOH	0.8 x VDDIO	-	VDDIO	V
Output Low Voltage	VOL	0	-	0.2 x VDDIO	V
Logic Current	IVBAT	-	250	-	mA
Display Voltage	VCC	11.5	12.0	12.5	V
Brightness(Yellow)	Lbr	60	90	-	Cd/m²
Dark Room Contrast	CR		＞2000:1		
View Angle			Full View		Degree

Note1: This is a voltage supply pin. It must be connected to external source

Note2: From to internally DC/DC Circuit. No need external supply.

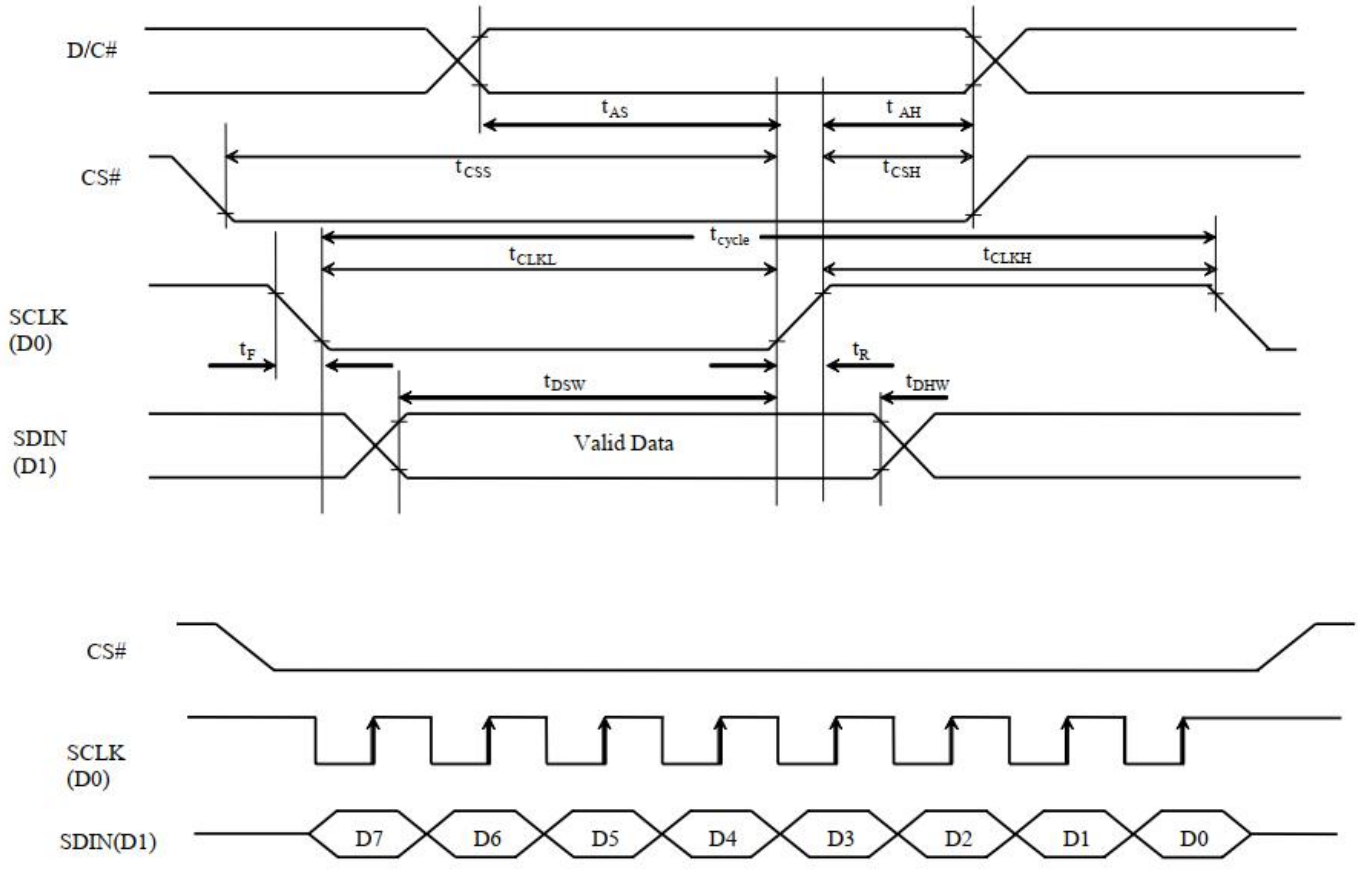
Note3: VDD=3.3V, VCC=12.0V (VDD, VCC Supply by the module internal generate) 100% Display Area Turn on.

3.2 4-line SPI Mode

(V_{DD} - V_{SS} = 2.4 to 2.6V, V_{DDIO}=1.6V, V_{CI} = 3.3V, T_A = 25°C)

Symbol	Parameter	Min	Typ	Max	Unit
t_{cycle}	Clock Cycle Time	100	-	-	ns
t_{AS}	Address Setup Time	15	-	-	ns
t_{AH}	Address Hold Time	15	-	-	ns
t_{CSS}	Chip Select Setup Time	20	-	-	ns
t_{CSH}	Chip Select Hold Time	10	-	-	ns
t_{DSW}	Write Data Setup Time	15	-	-	ns
t_{DHW}	Write Data Hold Time	15	-	-	ns
t_{CLKL}	Clock Low Time	20	-	-	ns
t_{CLKH}	Clock High Time	20	-	-	ns
t_R	Rise Time	-	-	15	ns
t_F	Fall Time	-	-	15	ns

Figure 13-3 : Serial interface characteristics (4-wire SPI)



4. Function specifications

4.1 Display Commands

D/C#	Hex	D7	D6	D5	D4	D3	D2	D2	D0	Command	Description
0	00	0	0	0	0	0	0	0	0	Enable Gray Scale table	This command is sent to enable the Gray Scale table setting (command B8h)
0 1 1	15 A[6:0] B[6:0]	0 * *	0 A_6 B_6	0 A_5 B_5	1 A_4 B_4	0 A_3 B_3	1 A_2 B_2	0 A_1 B_1	1 A_0 B_0	Set Column Address	Set Column start and end address A[6:0]: Start Address. [reset=0] B[6:0]: End Address. [reset=119] Range from 0 to 119
0	5C	0	1	0	1	1	1	0	0	Write RAM Command	Enable MCU to write Data into RAM
0	5D	0	1	0	1	1	1	0	1	Read RAM Command	Enable MCU to read Data from RAM
0 1 1	75 A[6:0] B[6:0]	0 * *	1 A_6 B_6	1 A_5 B_5	1 A_4 B_4	0 A_3 B_3	1 A_2 B_2	0 A_1 B_1	1 A_0 B_0	Set Row Address	Set Row start and end address A[6:0]: Start Address. [reset=0] B[6:0]: End Address. [reset=127] Range from 0 to 127
0 1 1	A0 A[7:0] B[4]	1 0 *	0 0 *	1 A_5 0	0 A_4 B_4	0 0 0	0 A_2 0	0 A_1 0	0 A_0 1	Set Re-map and Dual COM Line mode	A[0]=0b, Horizontal address increment [reset] A[0]=1b, Vertical address increment A[1]=0b, Disable Column Address Re-map [reset] A[1]=1b, Enable Column Address Re-map A[2]=0b, Disable Nibble Re-map [reset] A[2]=1b, Enable Nibble Re-map A[4]=0b, Scan from COM0 to COM[N –1] [reset] A[4]=1b, Scan from COM[N-1] to COM0, where N is the Multiplex ratio A[5]=0b, Disable COM Split Odd Even [reset] A[5]=1b, Enable COM Split Odd Even B[4], Enable / disable Dual COM Line mode 00b, Disable Dual COM mode [reset] 01b, Enable Dual COM mode (MUX ≤ 63) **Note** (1) COM Split Odd Even mode must be disabled (A[5]=0b) when enabling the Dual COM mode (B[4]=1b) Details refer to Section 10.1.6
0 1	A1 A[6:0]	1 *	0 A_6	1 A_5	0 A_4	0 A_3	0 A_2	0 A_1	1 A_0	Set Display Start Line	Set display RAM display start line register from 0-127 Display start line register is reset to 00h after RESET

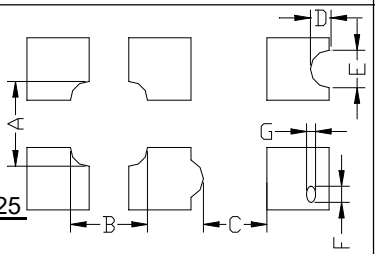
<table>
<tr><th>D/C#</th><th>Hex</th><th>D7</th><th>D6</th><th>D5</th><th>D4</th><th>D3</th><th>D2</th><th>D2</th><th>D0</th><th>Command</th><th>Description</th></tr>
<tr><td>0
1</td><td>A2
A[6:0]</td><td>1
*</td><td>0
A_6</td><td>1
A_5</td><td>0
A_4</td><td>0
A_3</td><td>0
A_2</td><td>1
A_1</td><td>0
A_0</td><td>Set Display Offset</td><td>Set vertical scroll by COM from 0-127
The value is reset to 00H after RESET</td></tr>
<tr><td>0</td><td>A4~A7</td><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>X_2</td><td>X_1</td><td>X_0</td><td>Set Display Mode</td><td>A4h = Entire Display OFF, all pixels turns OFF in GS level 0
A5h = Entire Display ON, all pixels turns ON in GS level 15
A6h = Normal Display [reset]
A7h = Inverse Display (GS0 → GS15, GS1 → GS14, GS2 → GS13, …)</td></tr>
<tr><td>0
1
1</td><td>A8
A[6:0]
B[6:0]</td><td>1
0
0</td><td>0
A_6
B_6</td><td>1
A_5
B_5</td><td>0
A_4
B_4</td><td>1
A_3
B_3</td><td>0
A_2
B_2</td><td>0
A_1
B_1</td><td>0
A_0
B_0</td><td>Enable Partial Display</td><td>This command turns ON partial mode. The partial mode display area is defined by the following two parameters,
A[6:0]: Address of start row in the display area
B[6:0]: Address of end row in the display area, where B[6:0] must be ≥ A[6:0]</td></tr>
<tr><td>0</td><td>A9</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td><td>Exit Partial Display</td><td>This command is sent to exit the Partial Display mode</td></tr>
<tr><td>0
1</td><td>AB
A[0]</td><td>1
0</td><td>0
0</td><td>1
0</td><td>0
0</td><td>1
0</td><td>0
0</td><td>1
0</td><td>1
A_0</td><td>Function Selection</td><td>A[0]=0b, Select external V_{DD}
A[0]=1b, Enable internal V_{DD} regulator [reset]</td></tr>
<tr><td>0</td><td>AE~AF</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>1</td><td>1</td><td>X_0</td><td>Set Sleep mode ON/OFF</td><td>AEh = Sleep mode ON (Display OFF)
AFh = Sleep mode OFF (Display ON)</td></tr>
<tr><td>0
1</td><td>B1
A[7:0]</td><td>1
A_7</td><td>0
A_6</td><td>1
A_5</td><td>1
A_4</td><td>0
A_3</td><td>0
A_2</td><td>0
A_1</td><td>1
A_0</td><td>Set Phase Length</td><td>A[3:0] Phase 1 period (reset phase length) of 5~31 DCLK(s) clocks as follow:
<table>
<tr><th>A[3:0]</th><th>Phase 1 period</th></tr>
<tr><td>0000</td><td>invalid</td></tr>
<tr><td>0001</td><td>invalid</td></tr>
<tr><td>0010</td><td>5 DCLKs</td></tr>
<tr><td>0011</td><td>7 DCLKs</td></tr>
<tr><td>0100</td><td>9 DCLKs [reset]</td></tr>
<tr><td>:</td><td>:</td></tr>
<tr><td>1111</td><td>31 DCLKs</td></tr>
</table>
A[7:4] Phase 2 period (first pre-charge phase length) of 3~15 DCLK(s) clocks as follow:
<table>
<tr><th>A[7:4]</th><th>Phase 2 period</th></tr>
<tr><td>0000</td><td>invalid</td></tr>
<tr><td>0001</td><td>invalid</td></tr>
<tr><td>0010</td><td>invalid</td></tr>
<tr><td>0011</td><td>3 DCLKs</td></tr>
<tr><td>:</td><td>:</td></tr>
<tr><td>0111</td><td>7 DCLKs [reset]</td></tr>
<tr><td>:</td><td>:</td></tr>
<tr><td>1111</td><td>15 DCLKs</td></tr>
</table></td></tr>
</table>

D/C#	Hex	D7	D6	D5	D4	D3	D2	D2	D0	Command	Description
0	B3	1	0	1	1	0	0	1	1	Set Front Clock Divider / Oscillator Frequency	A[3:0] [reset=0], divide by DIVSET where A[3:0] → DIVSET: 0000 divide by 1; 0001 divide by 2; 0010 divide by 4; 0011 divide by 8; 0100 divide by 16; 0101 divide by 32; 0110 divide by 64; 0111 divide by 128; 1000 divide by 256; 1001 divide by 512; 1010 divide by 1024; >=1011 invalid A[7:4] Oscillator frequency, frequency increases as level increases [reset=1100b]
1	A[7:0]	A_7	A_6	A_5	A_4	A_3	A_2	A_1	A_0		
0	B5	1	0	1	1	0	1	0	1	Set GPIO	A[1:0] GPIO0: 00 pin HiZ, Input disabled 01 pin HiZ, Input enabled 10 pin output LOW [reset] 11 pin output HIGH A[3:2] GPIO1: 00 pin HiZ, Input disabled 01 pin HiZ, Input enabled 10 pin output LOW [reset] 11 pin output HIGH
1	A[3:0]	*	*	*	*	A_3	A_2	A_1	A_0		
0	B6	1	0	1	1	0	1	1	0	Set Second Precharge Period	A[3:0] Second Pre-charge period 0000b 0 dclk 0001b 1 dclk ..... 1000b 8 dclks [reset] ..... 1111b 15 dclks
1	A[3:0]	*	*	*	*	A_3	A_2	A_1	A_0		
0	B8	1	0	1	1	1	0	0	0	Set Gray Scale Table	The next 15 data bytes define Gray Scale (GS) Table by setting the gray scale pulse width in unit of DCLK's (ranges from 0d ~ 180d) A1[7:0]: Gamma Setting for GS1, A2[7:0]: Gamma Setting for GS2, : A14[7:0]: Gamma Setting for GS14, A15[7:0]: Gamma Setting for GS15 **Note** (1) 0 ≤ Setting of GS1 < Setting of GS2 < Setting of GS3..... < Setting of GS14 < Setting of GS15 Refer to Section 8.8 for details (2) The setting must be followed by the Enable Gray Scale Table command (00h)
1	A1[7:0]	$A1_7$	$A1_6$	$A1_5$	$A1_4$	$A1_3$	$A1_2$	$A1_1$	$A1_0$		
1	A2[7:0]	$A2_7$	$A2_6$	$A2_5$	$A2_4$	$A2_3$	$A2_2$	$A2_1$	$A2_0$		
1	.	.	.	.	.	.	.	.	.		
1	.	.	.	.	.	.	.	.	.		
1	.	.	.	.	.	.	.	.	.		
1	A14[7:0]	$A14_7$	$A14_6$	$A14_5$	$A14_4$	$A14_3$	$A14_2$	$A14_1$	$A14_0$		
1	A15[7:0]	$A15_7$	$A15_6$	$A15_5$	$A15_4$	$A15_3$	$A15_2$	$A15_1$	$A15_0$		

D/C#	Hex	D7	D6	D5	D4	D3	D2	D2	D0	Command	Description
0	B9	1	0	1	1	1	0	0	1	Select Default Linear Gray Scale table	The default Linear Gray Scale table is set in unit of DCLK's as follow GS0 level pulse width = 0; GS1 level pulse width = 0; GS2 level pulse width = 8; GS3 level pulse width = 16; : : GS14 level pulse width = 104; GS15 level pulse width = 112 Refer to Section 8.8 for details
0 1	BB A[4:0]	1 *	0 *	1 *	1 A_4	1 A_3	0 A_2	1 A_1	1 A_0	Set Pre-charge voltage	Set pre-charge voltage level.[reset = 17h] A[5:1] / Hex code / pre-charge voltage 00000 / 00h / 0.20 x V_{CC} : / : / : 11111 / 3Eh / 0.60 x V_{CC}
0 1	BE A[3:0]	1 *	0 *	1 *	1 *	1 A_3	1 A_2	1 A_1	0 A_0	Set V_{COMH}	Set COM deselect voltage level [reset = 04h] A[3:0] = A[2:0] / Hex code / V_{COMH} 0000 / 00h / 0.72 x V_{CC} : / : / : 0100 / 04h / 0.80 x V_{CC} : / : / : 0111 / 07h / 0.86 x V_{CC}
0 1	C1 A[7:0]	1 A_7	1 A_6	0 A_5	0 A_4	0 A_3	0 A_2	0 A_1	1 A_0	Set Contrast Current	A[7:0]: Contrast current value, range:00h~FFh, i.e. 256 steps for I_{SEG} current [reset = 7Fh]
0 1	C7 A[3:0]	1 *	1 *	0 *	0 *	0 A_3	1 A_2	1 A_1	1 A_0	Master Contrast Current Control	A[3:0] = 0000b, reduce output currents for all colors to 1/16 0001b, reduce output currents for all colors to 2/16 : 1110b, reduce output currents for all colors to 15/16 1111b, no change [reset]
0 1	CA A[6:0]	1 *	1 A_6	0 A_5	0 A_4	1 A_3	0 A_2	1 A_1	0 A_0	Set MUX Ratio	A[6:0]: Set MUX ratio from 16MUX ~ 128MUX A[6:0] = 15d represents 16MUX : A[6:0] = 127d represents 128MUX [reset]
0 1	FD A[2]	1 0	1 0	1 0	1 1	1 0	1 A_2	0 1	1 0	Set Command Lock	A[2]: MCU protection status [reset = 12h] A[2] = 0b, Unlock OLED driver IC MCU interface from entering command [reset] A[2] = 1b, Lock OLED driver IC MCU interface from entering command Note (1) The locked OLED driver IC MCU interface prohibits all commands and memory access except the FDh command

Note
(1) "*" stands for "Don't care".

5. Inspection Standards

Item	Criterion for defects	Defect type
1) Display on inspection	(1) Non display (2) Vertical line is deficient (3) Horizontal line is deficient (4) Cross line is deficient	Major
2) Black / White spot	Size Φ(mm) Acceptable number Φ≤0.3 Ignore (note) 0.3<Φ≤0.45 3 0.45<Φ≤0.6 1 0.6<Φ 0	Minor
3) Black / White line	Length (mm) Width (mm) Acceptable number L≤10 W≤0.03 Ignore 5.0≤L≤10 0.03<W≤0.04 3 5.0≤L≤10 0.04<W≤0.05 2 1.0≤L≤10 0.05<W≤0.06 2 1.0≤L≤10 0.06<W≤0.08 1 L≤10 0.08<W follows 2) point defect Defects separate with each other at an interval of more than 20mm	Minor
4) Display pattern	 $\frac{A+B}{2}\leq 0.28$ | $0<C$ | $\frac{D+E}{2}\leq 0.25$ | $\frac{F+G}{2}\leq 0.25$ Note: 1) Up to 3 damages acceptable 2) Not allowed if there are two or more pinholes every three-fourth inch.	Minor
5) Spot-like contrast irregularity	Size Φ(mm) Acceptable Number Φ≤0.7 Ignore (note) 0.7<Φ≤1.0 3 1.0<Φ≤1.5 1 1.5<Φ 0 Note: 1) Conformed to limit samples. 2) Intervals of defects are more than 30mm.	Minor
6) Bubbles in polarizer	Size Φ(mm) Acceptable Number Φ≤0.4 Ignore (note) 0.4<Φ≤0.65 2 0.65<Φ≤1.2 1 1.2<Φ 0	Minor
7) Scratches and dent on the polarizer	Scratches and dent on the polarizer shall be in the accordance with “2) Black/white spot”, and “3) Black/White line”.	Minor
8) Stains on the surface of LCD panel	Stains which cannot be removed even when wiped lightly with a soft cloth or similar cleaning.	Minor
9) Rainbow color	No rainbow color is allowed in the optimum contrast on state within the active area.	Minor
10) Viewing area encroachment	Polarizer edge or line is visible in the opening viewing area due to polarizer shortness or sealing line.	Minor
11) Bezel appearance	Rust and deep damages that are visible in the bezel are rejected.	Minor
12) Defect of land surface contact	Evident crevices that are visible are rejected.	Minor
13) Parts mounting	(1) Failure to mount parts (2) Parts not in the specifications are mounted (3) For example: Polarity is reversed, HSC or TCP falls off.	Minor
14) Part alignment	(1) LSI, IC lead width is more than 50% beyond pad outline. (2) More than 50% of LSI, IC leads is off the pad outline.	Minor
15) Conductive foreign matter (solder ball, solder hips)	(1) 0.45<Φ, N≥1 (2) 0.3<Φ≤0.45, N≥1, Φ: Average diameter of solder ball (unit: mm) (3) 0.5<L, N≥1, L: Average length of solder chip (unit: mm)	Minor
16) Bezel flaw	Bezel claw missing or not bent	Minor
17) Indication on name plate (sampling indication label)	(1) Failure to stamp or label error, or not legible.(all acceptable if legible) (2) The separation is more than 1/3 for indication discoloration, in which the characters can be checked.	Minor

6. Handling Precautions

6.1 Mounting method

A panel of LCD module made by our company consists of two thin glass plates with polarizers that easily get damaged.
And since the module in so constructed as to be fixed by utilizing fitting holes in the printed circuit board (PCB), extreme care should be used when handling the LCD modules.

6.2 Cautions of LCD handling and cleaning

When cleaning the display surface, use soft cloth with solvent (recommended below) and wipe lightly.
-Isopropyl alcohol
-Ethyl alcohol
-Trichlorotriflorothane
Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.
Do not use the following solvent:
-Water
-Ketene
-Aromatics

6.3 Caution against static charge

The LCD module use C-MOS LSI drivers. So we recommend you:
Connect any unused input terminal to V_{dd} or V_{ss}. Do not input any signals before power is turned on, and ground your body, work/assembly areas, assembly equipment to protect against static electricity.

6.4 Packaging

-Module employs LCD elements, and must be treated as such. Avoid intense shock and falls from a height.
-To prevent modules from degradation, do not operate or store them exposed direct to sunshine or high temperature/humidity.

6.5 Caution for operation

-It is an indispensable condition to drive LCD module within the limits of the specified voltage since the higher voltage over the limits may cause the shorter life of LCD module.
-An electrochemical reaction due to DC (direct current) causes LCD undesirable deterioration so that the uses of DC (direct current) drive should be avoided.
-Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD module may show dark color in them. However those phenomena do not mean malfunction or out of order of LCD module, which will come back in the specified operating temperature.

6.6 Storage

In the case of storing for a long period of time, the following ways are recommended:
-Storage in polyethylene bag with the opening sealed so as not to enter fresh air outside in it. And with not desiccant.
-Placing in a dark place where neither exposure to direct sunlight nor light is. Keeping the storage temperature range.
-Storing with no touch on polarizer surface by any thing else.

6.7 Safety

-It is recommendable to crash damaged or unnecessary LCD into pieces and to wash off liquid crystal by either of solvents such as acetone and ethanol, which should be burned up later.
-When any liquid leaked out of a damaged glass cell comes in contact with your hands, please wash it off well at once with soap and water.