



FOCUS LCDs
LCDs MADE SIMPLE®

Ph. 480-503-4295 | LCD@FocusLCDs.com

TFT | OLED | CHARACTER | GRAPHIC | UWVD | SEGMENT | CUSTOM

Graphic OLED Module

Part Number

012864D-GW-XW3

Overview:

- 128x64 Graphic OLED
- White Pixel Color
- 26.70x30.00mm Module
- 4-Wire Serial Interface
- Anti-glare Polarizer
- Wide Temp Range
- 3.3V
- LCD IC: SSD1306
- RoHS Compliant

Graphic OLED LCD Features

Resolution: 128x64 Dots

Interface(s): 4-Wire Serial

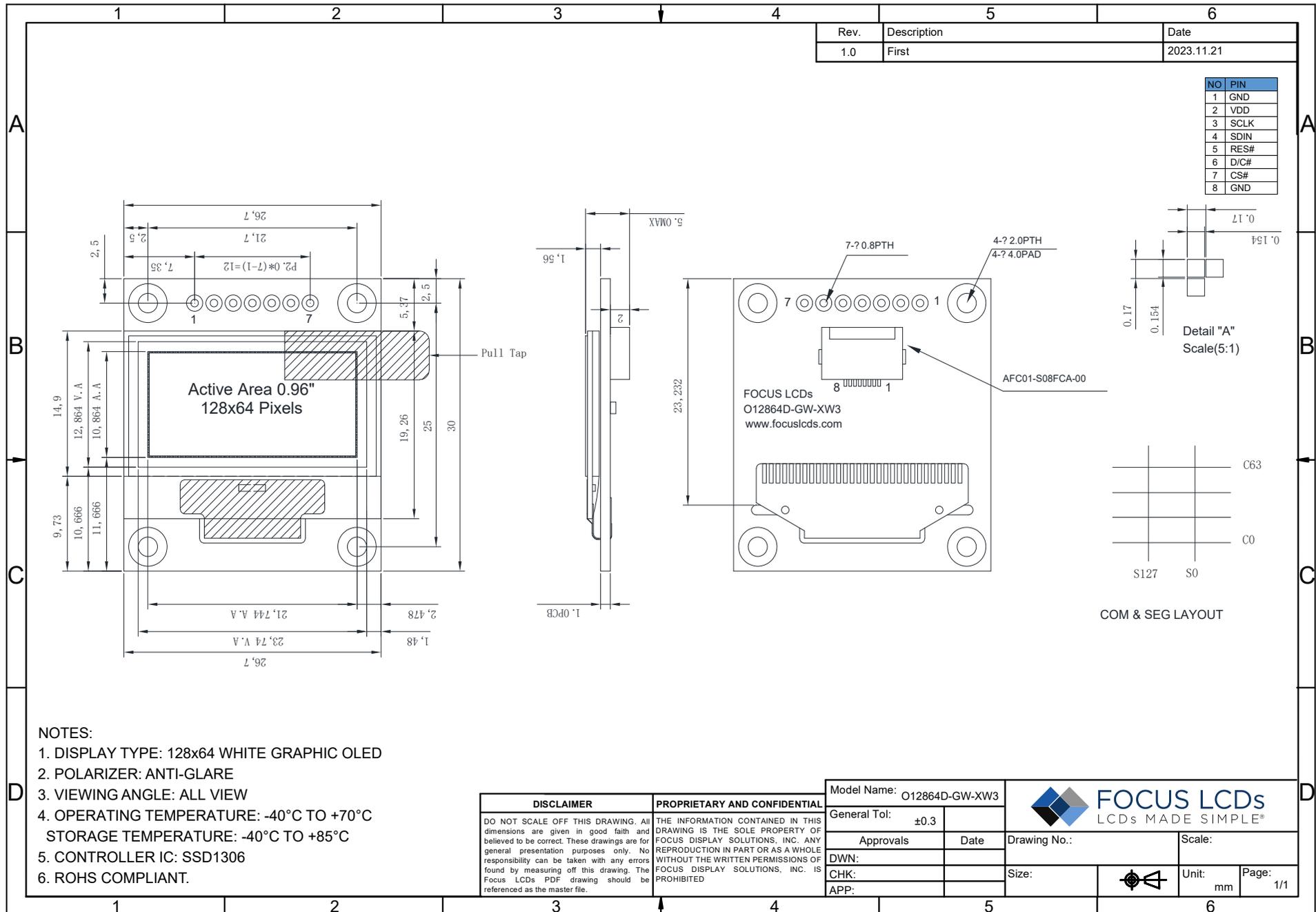
RoHS Compliant

General Information Items	Specification	Unit	Note
	Main Panel		
Viewing Area (VA)	23.74 (H) x 12.86 (V)	mm	--
Pixel Color	White	--	--
Viewing Angle	All	degrees	--
Polarizer	Anti-glare	--	--
Controller IC	SSD1306	--	--
Operating Temperature	-40 to +70	°C	--
Storage Temperature	-40 to +85	°C	--
Voltage	3.3	V	--
Resolution	128x64	--	--

Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	--	26.70	--	mm	--
	Vertical (V)	--	30.00	--	mm	--
	Depth (D)	--	5.00	--	mm	--
Weight		--	5.0	--	g	Approximate

1. Outline Dimensions



2. Input Terminal Pin Assignment

NO.	Symbol	Description	I/O
1	GND	Power supply (0V, GND).	--
2	VDD	Power supply PIN.	P
3	SCLK	Serial clock input.	I
4	SDIN	Serial data input.	I/O
5	RES#	This pin is signal input.	I
6	D/C#	This pin is data/command control pin connecting to the MCU.	I
7	CS#	This pin is the chip select input connecting to the MCU.	I
8	GDN	Ground pin.	P

I: Input, O: Output, P: Power

3. OLED Optical Characteristics

Parameter	Min	Typ.	Max	Units	Comments
Normal Mode Current (IBAT) (Charge Pump)	--	26	27	mA	All pixels on (1)
	--	8	8.5	mA	20% Pixels on (1)
Standby Mode Current (IBAT) (Charge Pump)	--	4.5	5	mA	Standby mode 10% pixels on (2)
IDD Sleep Mode Current	--	--	10	μA	Sleep mode current (3)
IBAT Sleep Mode Current (Charge Pump)	--	-	10	μA	Sleep mode current (3)
Normal Luminance (Charge Pump)	70	80	--	cd/m ²	Display average
Standby Luminance (Charge Pump)	--	45	--	cd/m ²	Display average
CIE _x (White)	0.25	0.29	0.33	--	x,y (CIE 1931)
CIE _y (White)	0.27	0.31	0.35	--	
Dark Room Contrast	2000:1	--	--	--	--
Viewing Angle	160	--	--	degrees	--
Response Time	--	10	--	μs	--

(1) Normal mode condition: (charge Pump)

V_{BAT} = 3.6V;

Contrast setting: 0x66

Frame rate: 105Hz

Duty setting: 1/64

(2) Standby mode condition: (charge Pump)

V_{BAT} = 3.6V;

Contrast setting: 0x00

Frame rate: 105Hz

Duty setting: 1/64

(3) Sleep mode condition:

When send 0xae command OLED display off and memory data will be maintained.

(4) Wake up condition:

When send 0xaf command OLED will be turned on.

4. Electrical Characteristics

4.1 DC Electrical Characteristics

Characteristics		Symbol	Condition	Min	Typ.	Max	Unit
Logic Supply Voltage		VDD	Ta=25°C	1.65	--	3.3	V
Charge Pump Regulator Supply Voltage		VBAT	Ta=25°C	3.5	--	4.2	V
Operating Voltage (For Panel) (Charge Pump)		VCC	Ta=25°C	7.0	7.5	--	V
Input Voltage	H Level	V _{IH}	--	0.8*VDD	--	--	V
	L Level	V _{IL}	--	--	--	0.2*VDD	V
Output Voltage	H Level	V _{OH}	I _{OUT} =100μA 3.3MHz	0.9*VDD	--	--	V
	L Level	V _{OL}	I _{OUT} =100μA 3.3MHz	--	---	0.1*VDD	V

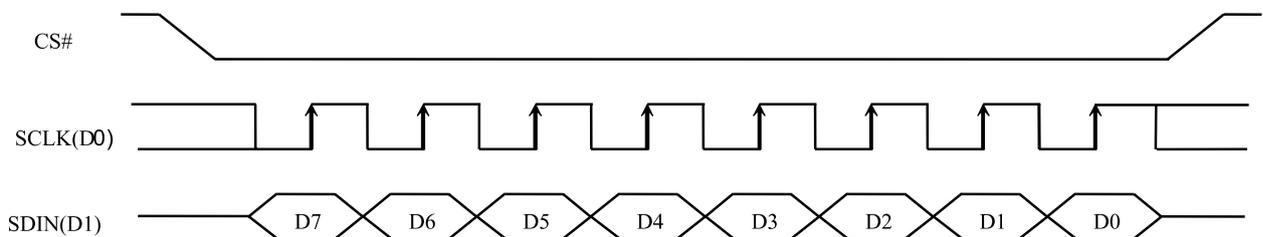
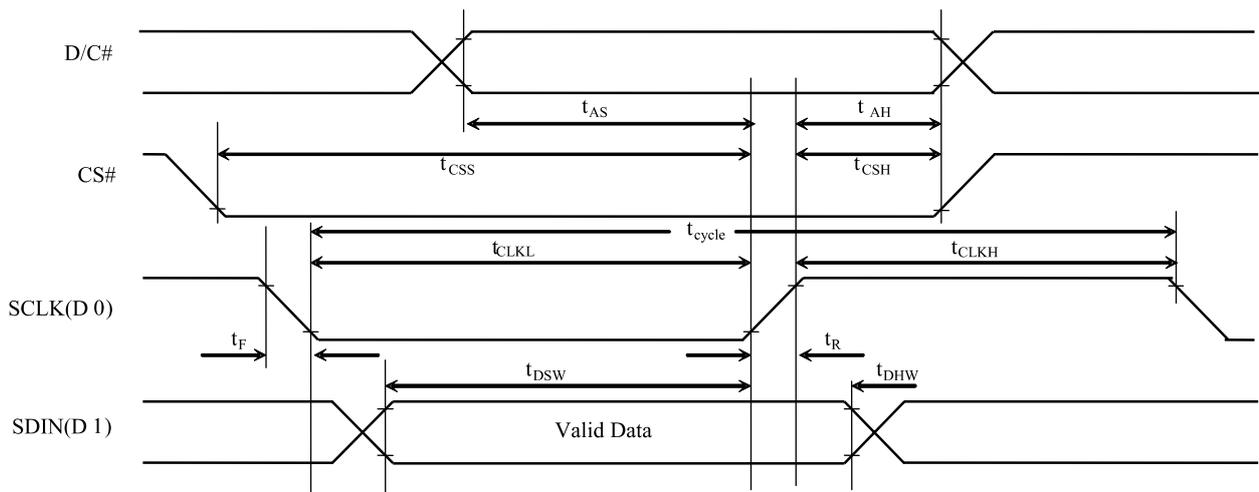
5. Module Function

5.1 Timing Characteristics

4-wire Serial Interface Timing Characteristics

(VDD - VSS = 1.65V to 3.3V, Ta = 25°C)

Parameter	Symbol	Min	Typ	Max	Units
Clock Cycle Time	t_{cycle}	100	--	--	ns
Address Setup Time	t_{AS}	15	--	--	ns
Address Hold Time	t_{AH}	15	--	--	ns
Chip Select Setup Time	t_{CSS}	20	--	--	ns
Chip Select Hold Time	t_{CSH}	10	--	--	ns
Write Data Setup Time	t_{DSW}	15	--	--	ns
Write Data Hold Time	t_{DHW}	15	--	--	ns
Clock Low Time	t_{CLKL}	20	--	--	ns
Clock High Time	t_{CLKH}	20	--	--	ns
Rise Time	t_R	--	--	40	ns
Fall Time	t_F	--	--	40	ns



5.2 LCM Application

Please see information on page 55 of the data sheet for OLED controller SSD1306. The data sheet can be found here: <https://focuslcds.com/wp-content/uploads/Drivers/SSD1306.pdf>

5.3 Command Table

1. Fundamental Command Table											
D/C#	Hex	D7	D6	D5	D4	D3	D2	D1	D0	Command	Description
0 0	81 A[7:0]	1 A ₇	0 A ₆	0 A ₅	0 A ₄	0 A ₃	0 A ₂	0 A ₁	1 A ₀	Set Contrast Control	Double byte command to select 1 out of 256 contrast steps. Contrast increases as the value increases. (RESET = 7Fh)
0	A4/A5	1	0	1	0	0	1	0	X ₀	Entire Display ON	A4h, X ₀ =0b: Resume to RAM content display (RESET) Output follows RAM content A5h, X ₀ =1b: Entire display ON Output ignores RAM content
0	A6/A7	1	0	1	0	0	1	1	X ₀	Set Normal/Inverse Display	A6h, X[0]=0b: Normal display (RESET) 0 in RAM: OFF in display panel 1 in RAM: ON in display panel A7h, X[0]=1b: Inverse display 0 in RAM: ON in display panel 1 in RAM: OFF in display panel
0	AE AF	1	0	1	0	1	1	1	X ₀	Set Display ON/OFF	AEh, X[0]=0b: Display OFF (sleep mode) (RESET) AFh X[0]=1b: Display ON in normal mode

2. Scrolling Command Table																																					
D/C#	Hex	D7	D6	D5	D4	D3	D2	D1	D0	Command	Description																										
0 0 0 0 0 0 0	26/27 A[7:0] B[2:0] C[2:0] D[2:0] E[7:0] F[7:0]	0 0 * * * 0 1	0 0 * * * 0 1	1 0 * * * 0 1	0 0 * * * 0 1	0 0 * * * 0 1	1 0 B ₂ C ₂ D ₂ 0 1	1 0 B ₁ C ₁ D ₁ 0 1	X ₀ 0 B ₀ C ₀ D ₀ 0 1	Continuous Horizontal Scroll Setup	26h, X[0]=0, Right Horizontal Scroll 27h, X[0]=1, Left Horizontal Scroll (Horizontal scroll by 1 column) A[7:0] : Dummy byte (Set as 00h) B[2:0] : Define start page address <table border="1" data-bbox="943 1249 1474 1350"> <tr> <td>000b – PAGE0</td> <td>011b – PAGE3</td> <td>110b – PAGE6</td> </tr> <tr> <td>001b – PAGE1</td> <td>100b – PAGE4</td> <td>111b – PAGE7</td> </tr> <tr> <td>010b – PAGE2</td> <td>101b – PAGE5</td> <td></td> </tr> </table> C[2:0] : Set time interval between each scroll step in terms of frame frequency <table border="1" data-bbox="943 1440 1422 1570"> <tr> <td>000b – 5 frames</td> <td>100b – 3 frames</td> </tr> <tr> <td>001b – 64 frames</td> <td>101b – 4 frames</td> </tr> <tr> <td>010b – 128 frames</td> <td>110b – 25 frame</td> </tr> <tr> <td>011b – 256 frames</td> <td>111b – 2 frame</td> </tr> </table> D[2:0] : Define end page address <table border="1" data-bbox="943 1630 1474 1731"> <tr> <td>000b – PAGE0</td> <td>011b – PAGE3</td> <td>110b – PAGE6</td> </tr> <tr> <td>001b – PAGE1</td> <td>100b – PAGE4</td> <td>111b – PAGE7</td> </tr> <tr> <td>010b – PAGE2</td> <td>101b – PAGE5</td> <td></td> </tr> </table> The value of D[2:0] must be larger or equal to B[2:0] E[7:0] : Dummy byte (Set as 00h) F[7:0] : Dummy byte (Set as FFh)	000b – PAGE0	011b – PAGE3	110b – PAGE6	001b – PAGE1	100b – PAGE4	111b – PAGE7	010b – PAGE2	101b – PAGE5		000b – 5 frames	100b – 3 frames	001b – 64 frames	101b – 4 frames	010b – 128 frames	110b – 25 frame	011b – 256 frames	111b – 2 frame	000b – PAGE0	011b – PAGE3	110b – PAGE6	001b – PAGE1	100b – PAGE4	111b – PAGE7	010b – PAGE2	101b – PAGE5	
000b – PAGE0	011b – PAGE3	110b – PAGE6																																			
001b – PAGE1	100b – PAGE4	111b – PAGE7																																			
010b – PAGE2	101b – PAGE5																																				
000b – 5 frames	100b – 3 frames																																				
001b – 64 frames	101b – 4 frames																																				
010b – 128 frames	110b – 25 frame																																				
011b – 256 frames	111b – 2 frame																																				
000b – PAGE0	011b – PAGE3	110b – PAGE6																																			
001b – PAGE1	100b – PAGE4	111b – PAGE7																																			
010b – PAGE2	101b – PAGE5																																				

2. Scrolling Command Table																											
D/C#	Hex	D7	D6	D5	D4	D3	D2	D1	D0	Command	Description																
0	29/2A	0	0	1	0	1	0	X ₁	X ₀	Continuous Vertical and Horizontal Scroll	29h, X1X0=01b : Vertical and Right Horizontal Scroll																
0	A[2:0]	0	0	0	0	0	0	0	0	Horizontal Scroll Setup	2Ah, X1X0=10b : Vertical and Left Horizontal Scroll (Horizontal scroll by 1 column)																
0	B[2:0]	*	*	*	*	*	B ₂	B ₁	B ₀		A[7:0] : Dummy byte																
0	C[2:0]	*	*	*	*	*	C ₂	C ₁	C ₀		B[2:0] : Define start page address																
0	D[2:0]	*	*	*	*	*	D ₂	D ₁	D ₀		<table border="1"> <tr> <td>000b – PAGE0</td> <td>011b – PAGE3</td> <td>110b – PAGE6</td> </tr> <tr> <td>001b – PAGE1</td> <td>100b – PAGE4</td> <td>111b – PAGE7</td> </tr> <tr> <td>010b – PAGE2</td> <td>101b – PAGE5</td> <td></td> </tr> </table>	000b – PAGE0	011b – PAGE3	110b – PAGE6	001b – PAGE1	100b – PAGE4	111b – PAGE7	010b – PAGE2	101b – PAGE5								
000b – PAGE0	011b – PAGE3	110b – PAGE6																									
001b – PAGE1	100b – PAGE4	111b – PAGE7																									
010b – PAGE2	101b – PAGE5																										
0	E[5:0]	*	*	E ₅	E ₄	E ₃	E ₂	E ₁	E ₀	C[2:0] : Set time interval between each scroll step in terms of frame frequency <table border="1"> <tr> <td>000b – 5 frames</td> <td>100b – 3 frames</td> </tr> <tr> <td>001b – 64 frames</td> <td>101b – 4 frames</td> </tr> <tr> <td>010b – 128 frames</td> <td>110b – 25 frame</td> </tr> <tr> <td>011b – 256 frames</td> <td>111b – 2 frame</td> </tr> </table> D[2:0] : Define end page address <table border="1"> <tr> <td>000b – PAGE0</td> <td>011b – PAGE3</td> <td>110b – PAGE6</td> </tr> <tr> <td>001b – PAGE1</td> <td>100b – PAGE4</td> <td>111b – PAGE7</td> </tr> <tr> <td>010b – PAGE2</td> <td>101b – PAGE5</td> <td></td> </tr> </table> The value of D[2:0] must be larger or equal to B[2:0] E[5:0] : Vertical scrolling offset e.g. E[5:0]= 01h refer to offset =1 row E[5:0] =3Fh refer to offset =63 rows Note (1) No continuous vertical scrolling is available.	000b – 5 frames	100b – 3 frames	001b – 64 frames	101b – 4 frames	010b – 128 frames	110b – 25 frame	011b – 256 frames	111b – 2 frame	000b – PAGE0	011b – PAGE3	110b – PAGE6	001b – PAGE1	100b – PAGE4	111b – PAGE7	010b – PAGE2	101b – PAGE5	
000b – 5 frames	100b – 3 frames																										
001b – 64 frames	101b – 4 frames																										
010b – 128 frames	110b – 25 frame																										
011b – 256 frames	111b – 2 frame																										
000b – PAGE0	011b – PAGE3	110b – PAGE6																									
001b – PAGE1	100b – PAGE4	111b – PAGE7																									
010b – PAGE2	101b – PAGE5																										
0	2E	0	0	1	0	1	1	1	0	Deactivate Scroll	Stop scrolling that is configured by command 26h/27h/29h/2Ah. Note (1) After sending 2Eh command to deactivate the scrolling action, the ram data needs to be rewritten.																
0	2F	0	0	1	0	1	1	1	1	Activate Scroll	Start scrolling that is configured by the scrolling setup commands :26h/27h/29h/2Ah with the following valid sequences: Valid command sequence 1: 26h ;2Fh. Valid command sequence 2: 27h ;2Fh. Valid command sequence 3: 29h ;2Fh. Valid command sequence 4: 2Ah ;2Fh. For example, if “26h; 2Ah; 2Fh.” commands are issued, the setting in the last scrolling setup command, i.e. 2Ah in this case, will be executed. In other words, setting in the last scrolling setup command overwrites the setting in the previous scrolling setup commands.																

3. Addressing Setting Command Table											
D/C#	Hex	D7	D6	D5	D4	D3	D2	D1	D0	Command	Description
0	00~0F	0	0	0	0	X ₃	X ₂	X ₁	X ₀	Set Lower Column Start Address for Page Addressing Mode	Set the lower nibble of the column start address register for Page Addressing Mode using X[3:0] as data bits. The initial display line register is reset to 0000b after RESET. Note (1) This command is only for page addressing mode.
0	10~1F	0	0	0	1	X ₃	X ₂	X ₁	X ₀	Set Higher Column Start Address for Page Addressing Mode	Set the higher nibble of the column start address register for Page Addressing Mode using X[3:0] as data bits. The initial display line register is reset to 0000b after RESET. Note (1) This command is only for page addressing mode.
0 0	20 A[1:0]	0 *	0 *	1 *	0 *	0 *	0 *	0 A ₁	0 A ₀	Set Memory Addressing Mode	A[1:0] = 00b, Horizontal Addressing Mode A[1:0] = 01b, Vertical Addressing Mode A[1:0] = 10b, Page Addressing Mode (RESET) A[1:0] = 11b, Invalid
0 0 0	21 A[6:0] B[6:0]	0 * *	0 A ₆ B ₆	1 A ₅ B ₅	0 A ₄ B ₄	0 A ₃ B ₃	0 A ₂ B ₂	0 A ₁ B ₁	1 A ₀ B ₀	Set Column Address	Setup column start and end address A[6:0] : Column start address, range : 0-127d, (RESET=0d) B[6:0]: Column end address, range : 0-127d, (RESET =127d) Note (1) This command is only for horizontal or vertical addressing mode.

3. Addressing Setting Command Table											
D/C#	Hex	D7	D6	D5	D4	D3	D2	D1	D0	Command	Description
0 0 0	22 A[2:0] B[2:0]	0 * *	0 * *	1 * *	0 * *	0 * *	0 A ₂ B ₂	1 A ₁ B ₁	0 A ₀ B ₀	Set Page Address	Setup page start and end address A[2:0] : Page start Address, range : 0-7d, (RESET = 0d) B[2:0] : Page end Address, range : 0-7d, (RESET = 7d) Note (1) This command is only for horizontal or vertical addressing mode.
0	B0~B7	1	0	1	1	0	X ₂	X ₁	X ₀	Set Page Start Address for Page Addressing Mode	Set GDDRAM Page Start Address (PAGE0~PAGE7) for Page Addressing Mode using X[2:0]. Note (1) This command is only for page addressing mode.

4. Hardware Configuration (Panel Resolution & Layout Related) Command Table

D/C#	Hex	D7	D6	D5	D4	D3	D2	D1	D0	Command	Description
0	40~7F	0	1	X ₅	X ₄	X ₃	X ₂	X ₁	X ₀	Set Display Start Line	Set display RAM display start line register from 0-63 using X ₅ X ₃ X ₂ X ₁ X ₀ . Display start line register is reset to 000000b during RESET.
0	A0/A1	1	0	1	0	0	0	0	X ₀	Set Segment Re-map	A0h, X[0]=0b: column address 0 is mapped to SEG0 (RESET). A1h, X[0]=1b: column address 127 is mapped to SEG0.
0 0	A8 A[5:0]	1 *	0 *	1 A ₅	0 A ₄	1 A ₃	0 A ₂	0 A ₁	0 A ₀	Set Multiplex Ratio	Set MUX ratio to N+1 MUX N=A[5:0] : from 16MUX to 64MUX, RESET= 111111b (i.e. 63d, 64MUX). A[5:0] from 0 to 14 are invalid entry.
0	C0/C8	1	1	0	0	X ₃	0	0	0	Set COM Output Scan Direction	C0h, X[3]=0b: normal mode (RESET) Scan from COM0 to COM[N –1]. C8h, X[3]=1b: remapped mode. Scan from COM[N-1] to COM0. Where N is the Multiplex ratio.
0 0	D3 A[5:0]	1 *	1 *	0 A ₅	1 A ₄	0 A ₃	0 A ₂	0 A ₁	1 A ₀	Set Display Offset	Set vertical shift by COM from 0d~63d. The value is reset to 00h after RESET.
0 0	DA A[5:4]	1 0	1 0	0 A ₅	1 A ₄	1 0	0 0	1 0	0 1	Set COM Pins Hardware Configuration	A[4]=0b, Sequential COM pin configuration A[4]=1b(RESET), Alternative COM pin configuration. A[5]=0b(RESET), Disable COM left/right remap A[5]=1b, Enable COM left/right remap

5. Timing & Driving Scheme Setting Command Table																							
D/C#	Hex	D7	D6	D5	D4	D3	D2	D1	D0	Command	Description												
0 0	D5 A[7:0]	1 A ₇	1 A ₆	0 A ₅	1 A ₄	0 A ₃	1 A ₂	0 A ₁	1 A ₀	Set Display Clock Divide Ratio/Oscillator Frequency	<p>A[3:0] : Define the divide ratio (D) of the display clocks (DCLK): Divide ratio= A[3:0] + 1, RESET is 0000b (divide ratio = 1).</p> <p>A[7:4] : Set the Oscillator Frequency, F_{osc}. Oscillator Frequency increases with the value of A[7:4] and vice versa. RESET is 1000b. Range:0000b~1111b. Frequency increases as setting value increases.</p>												
0 0	D9 A[7:0]	1 A ₇	1 A ₆	0 A ₅	1 A ₄	1 A ₃	0 A ₂	0 A ₁	1 A ₀	Set Pre-Charge Period	<p>A[3:0] : Phase 1 period of up to 15 DCLK clocks 0 is invalid entry (RESET=2h).</p> <p>A[7:4] : Phase 2 period of up to 15 DCLK clocks 0 is invalid entry (RESET=2h).</p>												
0 0	DB A[6:4]	1 0	1 A ₆	0 A ₅	1 A ₄	1 0	0 0	1 0	1 0	Set V _{COMH} Deselect Level	<table border="1"> <thead> <tr> <th>A[6:4]</th> <th>Hex code</th> <th>V_{COMH} deselect level</th> </tr> </thead> <tbody> <tr> <td>000b</td> <td>00h</td> <td>~ 0.65 x VCC</td> </tr> <tr> <td>010b</td> <td>20h</td> <td>~ 0.77 x VCC (RESET)</td> </tr> <tr> <td>011b</td> <td>30h</td> <td>~ 0.83 x VCC</td> </tr> </tbody> </table>	A[6:4]	Hex code	V _{COMH} deselect level	000b	00h	~ 0.65 x VCC	010b	20h	~ 0.77 x VCC (RESET)	011b	30h	~ 0.83 x VCC
A[6:4]	Hex code	V _{COMH} deselect level																					
000b	00h	~ 0.65 x VCC																					
010b	20h	~ 0.77 x VCC (RESET)																					
011b	30h	~ 0.83 x VCC																					
0	E3	1	1	1	0	0	0	1	1	NOP	Command for no operation.												

Note

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

6. Cautions and Handling Precautions

6.1 Handling and Operating the Module

1. When the module is assembled, it should be attached to the system firmly. Do not warp or twist the module during assembly work.
2. Protect the module from physical shock or any force. In addition to damage, this may cause improper operation or damage to the module and back-light unit.
3. Note that polarizer is very fragile and could be easily damaged. Do not press or scratch the surface.
4. Do not allow drops of water or chemicals to remain on the display surface. If you have the droplets for a long time, staining and discoloration may occur.
5. If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.
6. The desirable cleaners are water, IPA (Isopropyl Alcohol) or Hexane. Do not use ketene type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.
7. If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs, or clothes, it must be washed away thoroughly with soap.
8. Protect the module from static; it may cause damage to the CMOS ICs.
9. Use fingerstalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
10. Do not disassemble the module.
11. Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.
12. Pins of I/F connector shall not be touched directly with bare hands.
13. Do not connect, disconnect the module in the "Power ON" condition.
14. Power supply should always be turned on/off by the item Power On Sequence & Power Off Sequence.

6.2 Storage and Transportation

1. Do not leave the panel in high temperature, and high humidity for a long time. It is highly recommended to store the module with temperature from 0 to 35 °C and relative humidity of less than 70%.
2. Do not store the OLED module in direct sunlight.
3. The module shall be stored in a dark place. When storing the modules for a long time, be sure to adopt effective measures for protecting the modules from strong ultraviolet radiation, sunlight, or fluorescent light.
4. It is recommended that the modules should be stored under a condition where no condensation is allowed. Formation of dewdrops may cause an abnormal operation or a failure of the module. In particular, the greatest possible care should be taken to prevent any module from being operated where condensation has occurred inside.
5. This panel has its circuitry FPC on the bottom side and should be handled carefully in order not to be stressed.