OLED DISPLAY MODULE DATASHEET

Datasheet Release Date 2020-06-12
for
CFAL16032A0-018P-W

Revision A2

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1. General Information

Datasheet Revision History
Datasheet Release: **2020-06-12** Datasheet for the CFAL16032A0-018P-W OLED graphic display module.

Product Change Notifications
You can check for or subscribe to Part Change Notices for this display module on our website.

Variations
Slight variations between lots are normal (e.g., contrast, color, or intensity).

Volatility
This display module has volatile memory.

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2. Module Description

This is a white monochrome OLED graphic display module with a high contrast ratio and fast response time. This display is light-weight, thin, and durable. This display has a built-in Solomon Systech SSD1320 controller.

Please see Solomon Systech SSD1320 LCD Datasheet for further reference.

3. Features

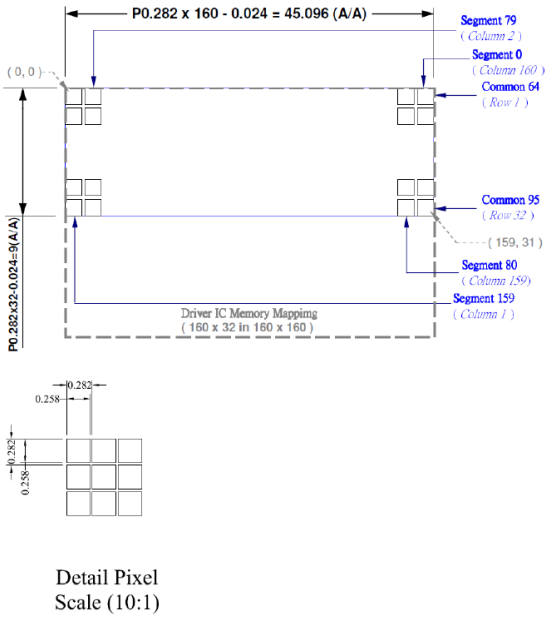
- 160*32 Dot Matrix
- Built-in Controller: SSD1320 (or equivalent)
- 3.3V Logic
- 12V Power
- 1/32 Duty
- Interface: 3-Wire SPI

4. Mechanical Data

Item	Specification (mm)	Specification (inch, reference)
Overall Width and Height	113.30 (W) x 14.94 (H) x 0.3 (D)	4.461 (W) x 0.5882 (H) x 0.012 (D)
Viewing Area	45.89 (W) x 9.8 (H)	1.807 (W) x 0.386 (H)
Active Area	45.096 (W) x 9.0 (H)	1.775 (W) x 0.354 (H)
Pixel Size	0.258 (W) x 0.258 (H)	0.010 (W) x 0.010 (H)
Pixel Pitch	0.282 (W) x 0.282 (H)	0.011 (W) x 0.011 (H)
Weight (Typical)	0.4 grams	0.14 ounces

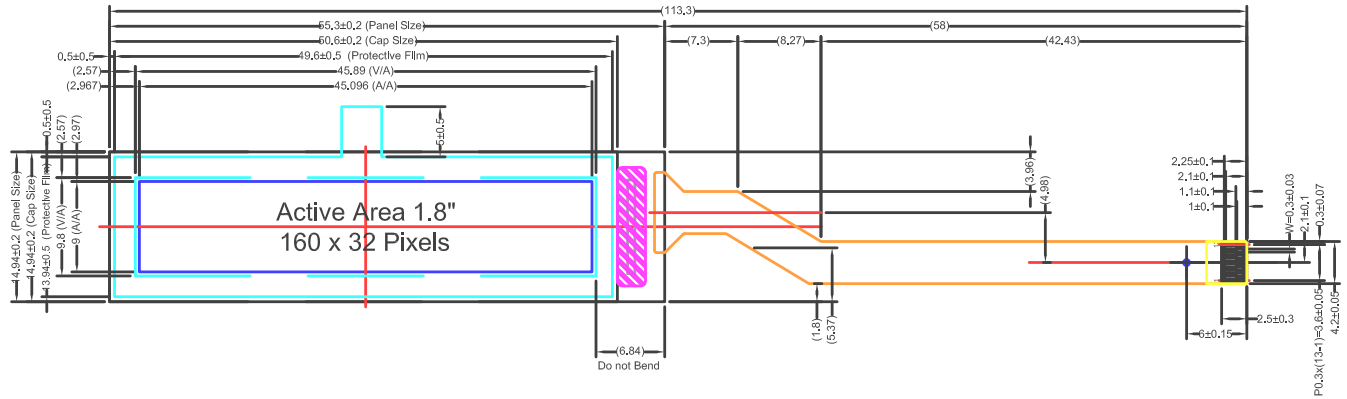
5. Active Area

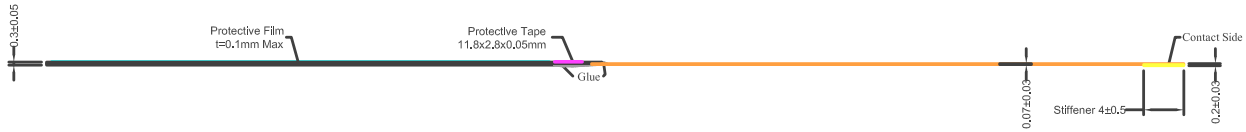
5.1. Memory Mapping & Pixel Construction

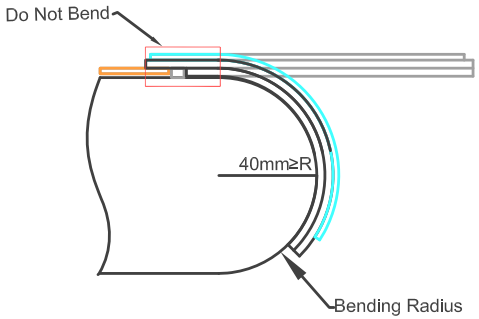


Detail Pixel
Scale (10:1)

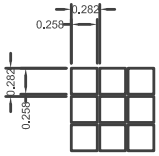
6. Mechanical Drawing



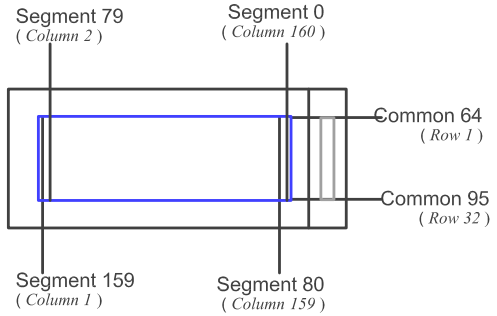




(Reference Mechnical Design)



Detail Pixel
Scale (10:1)



Crystalfontz	PART NUMBER(S)	SCALE Not to Scale	COPYRIGHT © 2017 BY CRYSTALFONTZ AMERICA, INC. WWW.CRYSTALFONTZ.COM
	DRAWING NUMBER	UNITS Millimeters	DATE

7. Interface Pin Function

Pin	Symbol	I/O	Function
1	VCC	P	**Power Supply for OEL Panel** This is the most positive voltage supply pin of the chip. It must be connected to an external source.
2	VLSS	P	**Ground of Analog Circuit** This is an analog ground pin. It should be connected to V_{SS} externally.
3	VSS	P	**Ground of Logic Circuit** This is a ground pin. It acts as a reference for the logic pins. It must be connected to an external ground.
4	CS#	I	**Chip Select** This pin is the chip select input. The chip is enabled for MCU communication only when CS# is pulled low.
5	RES#	I	**Power Reset for Controller and Driver** This pin is reset signal input. When the pin is low, initialization of the chip is executed. Keep this pin pulled high during normal operation.
6	SCLK	I	**Serial Clock Input Signal** The transmission of information in the bus is low, initialization of the chip is executed. Keep this pin pulled high during normal operation.
7	SDIN	I	**Serial Data Input Signal** This pin acts as a communication channel. The input data through SDIN are latched at the rising edge of SCLK in the sequence of MSB first and converted to 8-bit parallel data and handled at the rising edge of last serial clock. SDIN is identified to display data or command by D/C# bit data at the rising of the first SCLK.
8	VSS	P	**Ground of Logic Circuit** This is a ground pin. It acts as a reference for the logic pins. It must be connected to an external ground.
9	VLSS	P	**Ground of Analog Circuit** This is an analog ground pin. It should be connected to V_{SS} externally.
10	VDD	P	**Power Supply for Logic** This is a voltage supply pin. It must be connected to an external ground.
11	N.C.	-	**Reserved Pin** The N.C. pins between function pins are reserved for compatible and flexible design.
12	VCOMH	O	**Voltage Output High Level for COM Signal** This pin is the input pin for the voltage output high level for COM signals. A capacitor should be connected between this pin and V_{SS}.
13	VCC	P	**Power Supply for OEL Panel** This is the most positive voltage supply pin of the chip. It must be connected to an external source.

8. Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit	Notes
Supply Voltage for Logic	V_{DD}	-0.3	4	V	(1)(2)
Supply Voltage for Display	V_{CC}	0	14	V	(1)(2)
Operating Temperature	T_{OP}	-40	+60	°C	(3)
Storage Temperature	T_{STG}	-40	+75	°C	-

Notes:
(1) The above voltages are based on V_{SS}=0V.
(2) Functional operation should be restricted to the limits in the Electrical Characteristics table below.
(3) Operating the OLED with a large number of pixels illuminated at their full brightness will generate more heat. Please assure that your mechanical and thermal installation allows for the heat to escape, reduce the brightness, or reduce the number of pixels illuminated so that the maximum operating temperature is not exceeded.

9. Electrical Characteristics

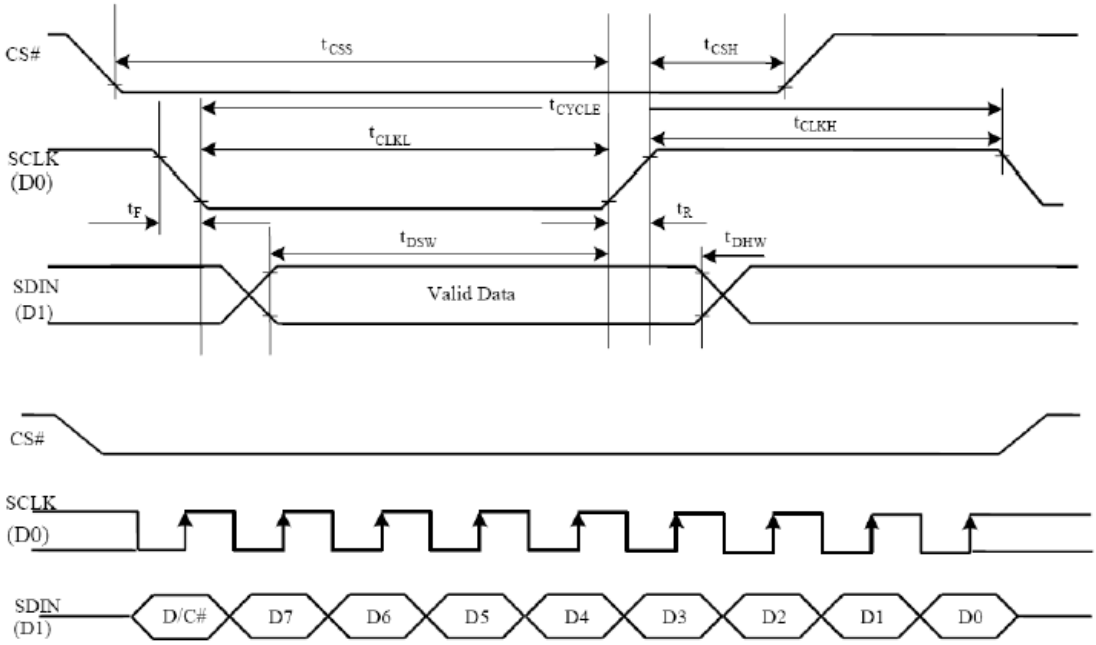
Item	Symbol	Condition	Min	Typ	Max	Unit	Note
Supply Voltage for Logic	V_{DD}		1.65	2.8	3.5	V	-
Supply Voltage for Display	V_{CC}	-	11.5	12.0	12.5	V	(1)
High-level Input	V_{IH}	-	0.8 x V_{DD}	-	V_{DD}	V	-
Low-level Input	V_{IL}	-	0	-	0.2 x V_{DD}	V	-
High-level Output	V_{OH}	I_{OUT} = 100µA, 10MHz	0.9 x V_{DD}	-	V_{DD}	V	-
Low-level Output	V_{OL}		0	-	0.1 x V_{DD}	V	-
Operating Current for V_{DD}	I_{DD}		-	350	700	µA	-
Operating Current for V_{CC}	I_{CC}	-	-	13.3	16.6	mA	(2)
			-	20.5	25.6	mA	(3)
			-	36.7	45.9	mA	(4)
Sleep Mode Current for V_{DD}	$I_{DD, SLEEP}$		-	-	10	µA	-
Sleep Mode Current for V_{CC}	$I_{CC, SLEEP}$		-	-	10	µA	-

Notes:
(1) Brightness (L_{br}) and Supply Voltage for Display (V_{CC}) are subject to the change of the panel characteristics.
(2) V_{DD} = 3.0V, V_{CC} = 12.0V, 30% Display Area Turn On.
(3) V_{DD} = 3.0V, V_{CC} = 12.0V, 50% Display Area Turn On.
(4) V_{DD} = 3.0V, V_{CC} = 12.0V, 100% Display Area Turn On.

10. AC Characteristics

10.1. Serial Interface Timing Characteristics (3-wire SPI)

V_{DD} – V_{SS} = 1.65V to 3.5V, Ta= 25°C				
Symbol	**Description**	**Min**	**Max**	**Unit**
t_{CYCLE}	Clock Cycle Time	66	-	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



11. Functional Specification

11.1. Commands

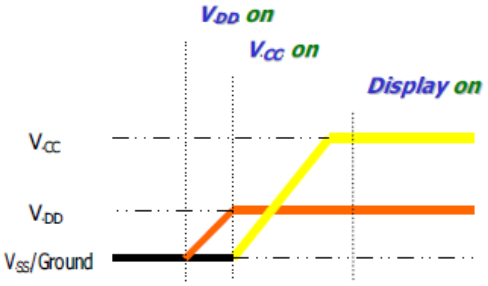
Please refer to the Solomon Systech SSD1320 LCD Datasheet.

11.2. Power Down and Power Up Sequence

To protect OEL panel and extend the panel life time, the driver IC power up/down routine should include a delay period between high voltage and low voltage power sources during turn on/off. It gives the OEL panel enough time to complete the action of charge and discharge before/after the operation.

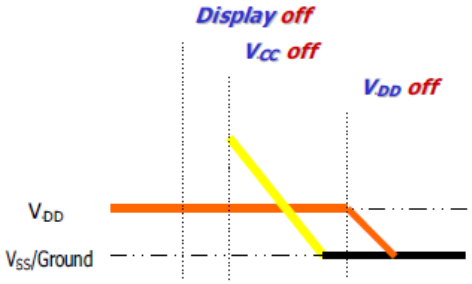
Power Up Sequence:

1. Power Up V_{DD}
2. Send Display OFF command
3. Initialization
4. Clear Screen
5. Power up V_{CC}
6. Delay 100ms
   (When V_{CC} is stable)
7. Send Display on command



Power Down Sequence:

1. Send Display OFF command
2. Power down V_{CC}
3. Delay 100ms
   (When V_{CC} is reach 0 and panel is completely discharges)
4. Power down V_{DD}



Notes:

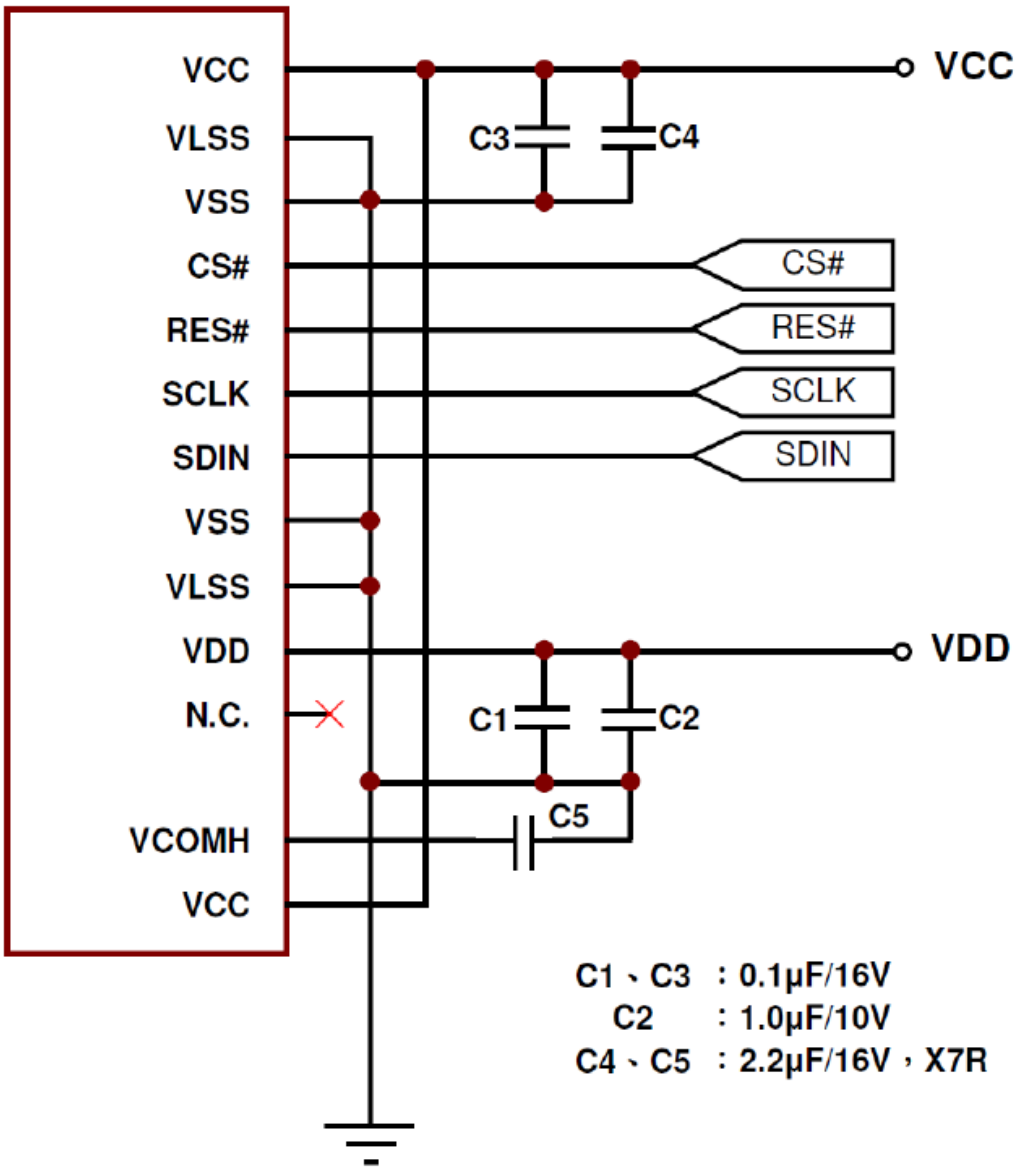
(1) Since an ESD protection circuit is connected between V_{DD} and V_{CC} inside the driver IC, V_{CC} becomes lower than V_{DD} whenever V_{DD} is ON and V_{CC} is OFF.
(2) V_{CC} should be kept disabled when it is OFF.
(3) Power Pins (V_{DD}, V_{CC}) can never be pulled to ground under any circumstance.
(4) V_{DD} should not be powered down before V_{CC} is powered down.

11.3. Reset Circuit

When RES# input is low, the chip is initialized with the following status:

1. Display is OFF
2. 160×160 Display Mode
3. Normal segment and display data column and row address mapping (SEG0 mapped to column address 00h and COM0 mapped to row address 00h)
4. Shift register data clear in serial interface
5. Display start line is set at display RAM address 0
6. Column address counter is set at 0
7. Normal scan direction of the COM outputs
8. Contrast control register is set at 7Fh
9. Normal display mode (equivalent to A4h command)

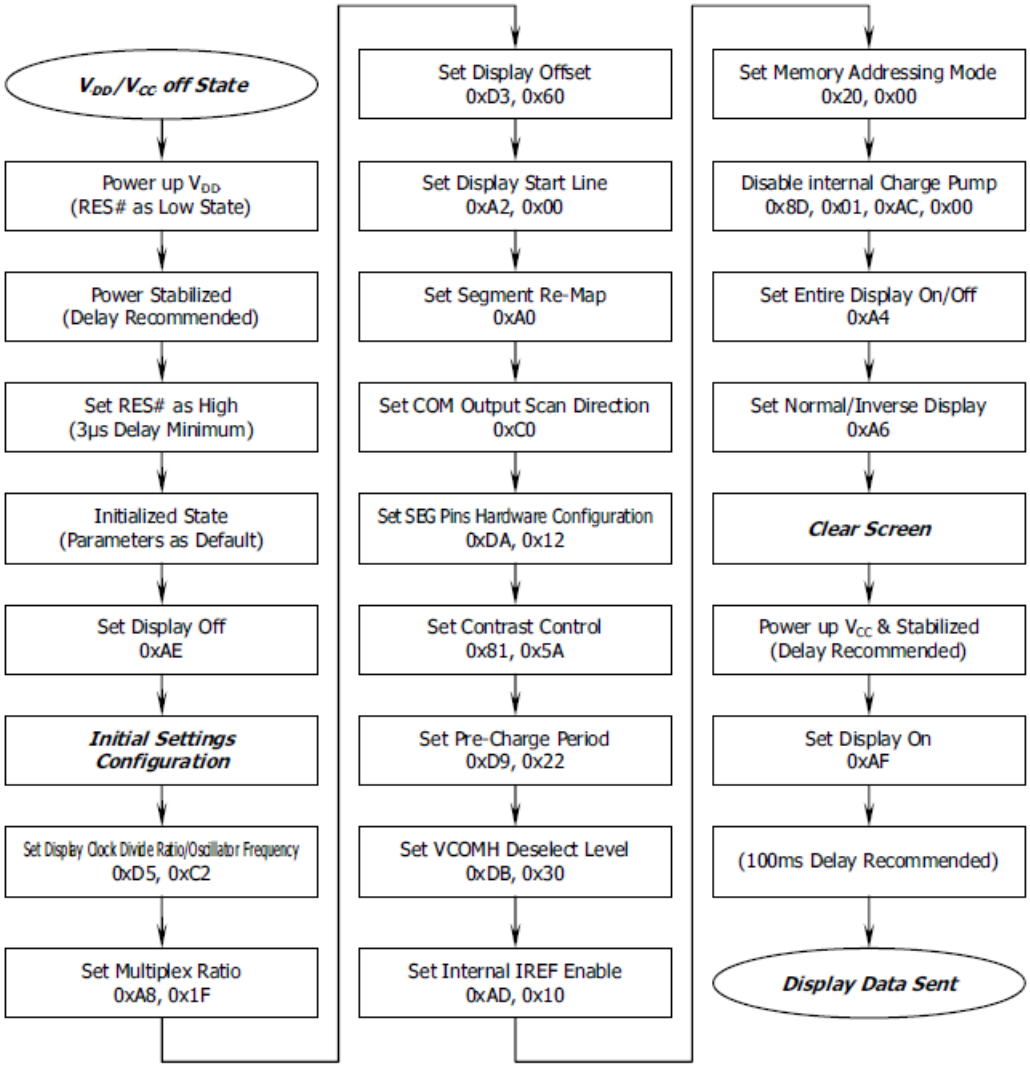
11.4. Application Circuit



11.5. Actual Application Example

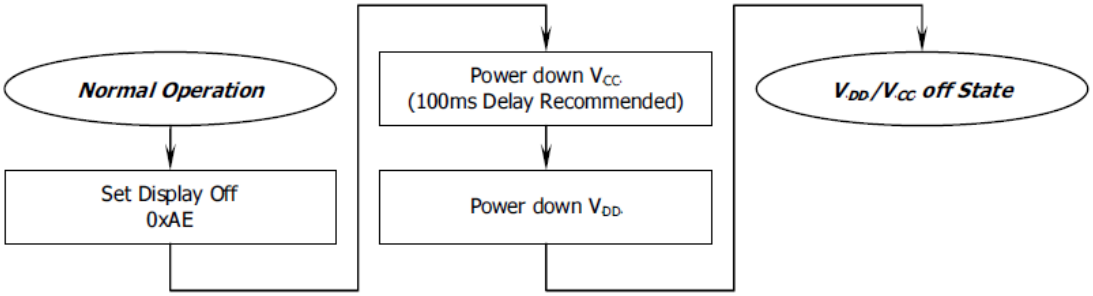
Command usage with explanation.

<Power up Sequence>

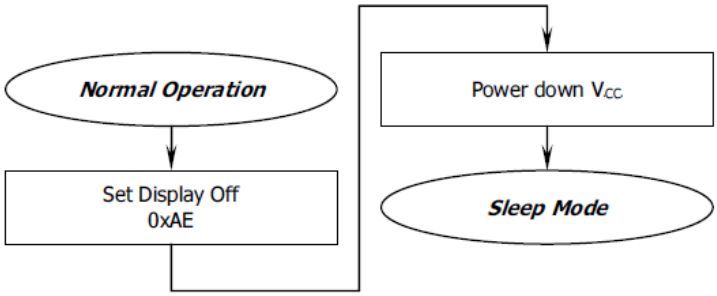


Note: If the noise accidentally occurs at the displaying window during the operation, please reset the display in order to recover the display function.

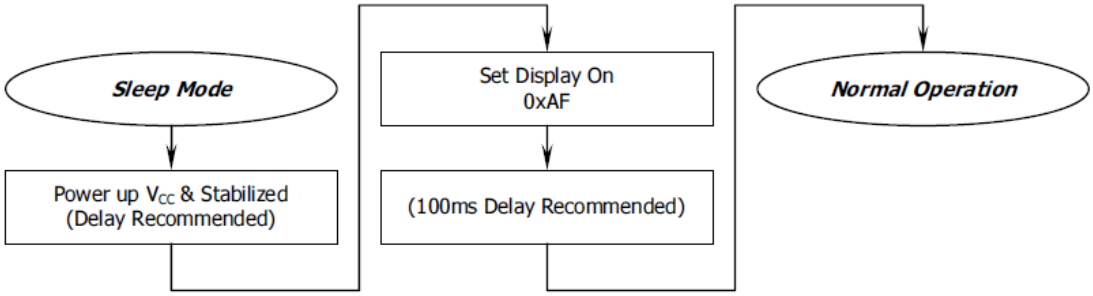
<Power down Sequence>



<Entering Sleep Mode>

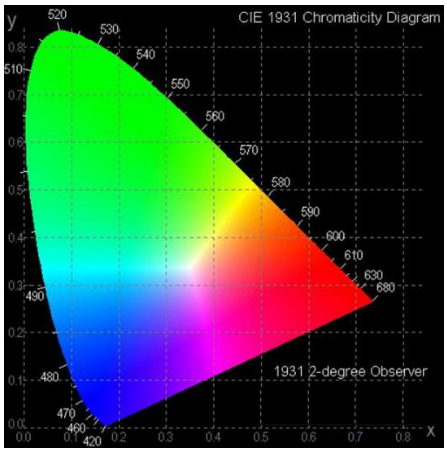


<Exiting Sleep Mode>



12. Optical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit
Viewing Direction	-	V_{DD}=3.0V, V_{CC}= 12.0V	-	All	-	-
Contrast Ratio	CR	Dark Room	-	>10,000:1	-	-
Brightness	L_{br}	Brightness (L_{br}) and Supply Voltage for Display (V_{CC}) are subject to the change of the panel characteristics.	420	600	-	cd/m^2
CIE (White)	x	CIE 1931	0.25	0.29	0.33	-
CIE (White)	y		0.29	0.33	0.37	-



13. OLED Lifetime

Item	Conditions	Min	Typ	Notes
Operating Lifetime	Ta=25°C Initial 50% check board brightness Typical Value	3,000 Hrs.	-	(1)(2)(3)

Notes:

(1) Lifetime is defined as the amount of time when the luminance has decayed to <50% of the initial value.

(2) This analysis method uses life data obtained under accelerated conditions to extrapolate an estimated Probability Density Function (PDF) for the product under normal use conditions.

(3) Screen saving mode will extend OLED lifetime.

14. OLED Module Precautions

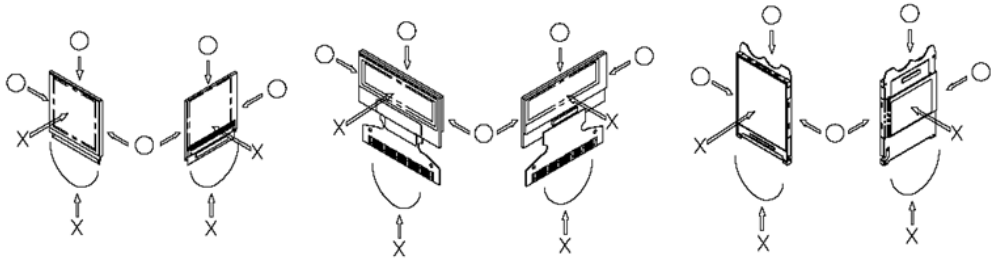
The precautions below should be followed when using OLED modules to help ensure personal safety, module performance, and compliance of environmental regulations.

14.1. Modules

- Avoid applying excessive shocks to module or making any alterations or modifications to it.
- Do not make extra holes on the printed circuit board, modify its shape or change the components of OLED display module.
- Do not disassemble the OLED display module.
- Do not operate the OLED display module above the absolute maximum rating.
- Do not drop, bend or twist the OLED display module.
- Soldering: only to the I/O terminals.
- Store in an anti-static electricity container and clean environment.
- It is common to use the "screen saver" to extend the lifetime of the OLED display module.
  - Do not use the fixed information for long periods of time in real application.
  - Do not use fixed information in OLED panel for long periods of time to extend "screen burn" effect time.
- Crystalfontz has the right to change the passive components, including R2 and R3 adjust resistors. (Resistors, capacitors and other passive components will have different appearance and color caused by the different supplier.)
- Crystalfontz have the right to change the PCB Rev. (In order to satisfy the supplying stability, management optimization and the best product performance, etc., under the premise of not affecting the electrical characteristics and external dimensions, Crystalfontz has the right to modify the version.).

14.2. Handling Precautions

- Since the display panel is made of glass, do not apply mechanical impacts such as dropping from a high position.
- If the display panel is accidently broken, and the internal organic substance leaks out, be careful not to inhale or touch the organic substance.
- If pressure is applied to the display surface or its neighborhood of the OLED display module, the cell structure may be damaged, so be careful not to apply pressure to these sections.
- The polarizer covering the surface of the OLED display module is soft and can be easily scratched. Please be careful when handling the OLED display module.
- Clean the surface of the polarizer covering the OLED display module if it becomes soiled using following adhesion tape.
  - Scotch Mending Tape No. 810 or an equivalent
  - Never breathe the soiled surface or wipe the surface using a cloth containing solvent such as ethyl alcohol, since the surface of the polarizer will become cloudy.
  - The following liquids/solvents may spoil the polarizer:
    - Water
    - Ketone
    - Aromatic Solvents
- Hold the OLED display module very carefully when placing the OLED display module into the system housing.
- Do not apply excessive stress or pressure to the OLED display module. And, do not over bend the film with electrode pattern layouts. These stresses will influence the display performance. Also, be sure to secure the sufficient rigidity for the outer cases.



- Do not apply stress to the LSI chips and the surrounding molded sections.
- Do not disassemble or modify the OLED display module.
- Do not apply input signals while the logic power is off.
- Pay sufficient attention to the working environments when handing the OLED display module to prevent occurrence of element breakage accidents by static electricity.
    - Be sure to make human body grounding when handling OLED display modules.
    - Be sure to ground tools to use for assembly such as soldering irons.
    - To suppress generation of static electricity, avoid carrying out assembly work under dry environments.
    - Protective film is being applied to the surface of the display panel of the OLED display module. Be careful since static electricity may be generated when exfoliating the protective film.
- Protection film is being applied to the surface of the display panel and removes the protection film before assembling it. At this time, if the OLED display module has been stored for a long period of time, residue adhesive material of the protection film may remain on the surface of the display panel after the film has been removed. In such a case, remove the residue material by the method discussed above.
- If electric current is applied when the OLED display module is being dewed or when it is placed under high humidity environments, the electrodes may become corroded. If this happens proceed with caution when handling the OLED display module.

14.3. Storage Precautions

- When storing the OLED display modules put them in static electricity preventive bags to avoid exposure to direct sunlight and fluorescent lamps. Also avoid high temperature and high humidity environments and low temperatures (less than 0°C) environments. (We recommend you store these modules in the packaged state when they were shipped from Crystalfontz). Be careful not to let water drops adhere to the packages or bags, and do not let dew gather on them.
- If electric current is applied when water drops are adhering to the surface of the OLED display module the OLED display module may have become dewed. If a dewed OLED display module is placed under high humidity environments it may cause the electrodes to become corroded. If this happens proceed with caution when handling the OLED display module.

14.4. Designing Precautions

- The absolute maximum ratings are the ratings that cannot be exceeded for OLED display module. If these values are exceeded, panel damage may happen.
- To prevent occurrence of malfunctioning by noise pay attention to satisfy the V_{IL} and V_{IH} specifications and, at the same time, to make the signal line cable as short as possible.
- We recommend that you install excess current preventive unit (fuses, etc.) to the power circuit (V_{DD}). (Recommend value: 0.5A)
- Pay sufficient attention to avoid occurrence of mutual noise interference with the neighboring devices.
- As for EMI, take necessary measures on the equipment side.
- When fastening the OLED display module, fasten the external plastic housing section.
- If the power supply to the OLED display module is forcibly shut down, by such errors as taking out the main battery while the OLED display panel is in operation, we cannot guarantee the quality of this OLED display module.
    - Connection (contact) to any other potential than the above may lead to rupture of the IC.

14.5. Disposing Precautions

- Request the qualified companies to handle the industrial wastes when disposing of the OLED display modules. Or, when burning them, be sure to observe the environmental and hygienic laws and regulations.

14.6. Other Precautions

- When an OLED display module is operated for a long period of time with a fixed pattern, the fixed pattern may remain as an after image or a slight contrast deviation may occur.
    - If the operation is interrupted and left unused for a while, normal state can be restored.

  - This will not cause a problem in the reliability of the module.
- To protect the OLED display module from performance drops by static electricity rapture, etc., do not touch the following sections whenever possible while handling the OLED display modules.
  - Pins and electrodes
  - Pattern layouts such as the TCP & FPC
- With this OLED display module, the OLED driver is being exposed. Generally speaking, semiconductor elements change their characteristics when light is radiated according to the principle of the solar battery. Consequently, if this OLED driver is exposed to light, malfunctioning may occur.
  - Design the product and installation method so that the OLED driver may be shielded from light in actual usage.
  - Design the product and installation method so that the OLED driver may be shielded from light during the inspection processes.
- Although this OLED display module stores the operation state data by the commands and the indication data, when excessive external noise, etc. enters into the module, the internal status may be changed. Therefore, it is necessary to take appropriate measures to suppress noise generation or to protect from influences of noise on the system design.
- We recommend that you construct its software to make periodical refreshment of the operation statuses (re-setting of the commands and re-transference of the display data), to cope with catastrophic noise.
- Resistors, capacitors, and other passive components will have different appearance and color caused by the different supplier.
- Crystalfontz has the right to upgrade and modify the product function.
- The limitation of FPC bending: