DisplayModule

DM-OLED24-630

2.42" 128 × 64 Monochrome OLED Display Module-SPI

Contents

1 Revision History

Date	Changes
2019-05-29	First release
2020-04-24	Second release

2 Main Features

Item	Specification	Unit
Diagonal Size	2.42	inch
Display Mode	Passive Matrix OLED	-
Display Colors	Monochrome (White/Yellow/Blue/Green)	Colors
Drive Duty	1/64	duty
Resolution	128 x 64	pixel
Controller IC	SSD1309	-
Interface	4wire SPI	-
Active Area	55.01 x 27.49	mm
Panel Dimension	60.50 x 37.00 x 2.00	mm
Module Dimension	72.00 x 43.00 x 2.70	mm
Pixel Pitch	0.43 x 0.43	mm
Weight	8.60	g

3 Pin Description

3.1 Panel Pin Description

<table>
<tr><th>Pin No.</th><th>Symbol</th><th>Function Description</th></tr>
<tr><td>1,24</td><td>N.C. (GND)</td><td>Reserved Pin (Supporting Pin)
The supporting pins can reduce the influences from stresses on the function pins.These pins must be connected to external ground as the ESD protection circuit.</td></tr>
<tr><td>2</td><td>VLSS</td><td>Ground of Analog Circuit
This is an analog ground pin. It should be connected to V_{SS} externally.</td></tr>
<tr><td>3</td><td>VSS</td><td>Ground of Logic Circuit
This is a ground pin. It also acts as a reference for the logic pins. It must be connected to external ground.</td></tr>
<tr><td>4</td><td>N.C.</td><td>Reserved Pin
The N.C. pin between function pins is reserved for compatible and flexible design.</td></tr>
<tr><td>5</td><td>VDD</td><td>Power Supply for Logic Circuit
This is a voltage supply pin. It must be connected to external source.</td></tr>
<tr><td>6</td><td>BS0</td><td rowspan="2">Communicating Protocol Select
These pins are MCU interface selection input. See the following table:
<table>
<tr><td></td><td>BS0</td><td>BS1</td></tr>
<tr><td>I2C</td><td>1</td><td>0</td></tr>
<tr><td>4-wire Serial</td><td>0</td><td>0</td></tr>
<tr><td>8-bit 68XX Parallel</td><td>1</td><td>1</td></tr>
<tr><td>8-bit 80XX Parallel</td><td>0</td><td>1</td></tr>
</table></td></tr>
<tr><td>7</td><td>BS1</td></tr>
<tr><td>8</td><td>CS#</td><td>Chip Select
This pin is the chip select input. The chip is enabled for MCU communication only when CS# is pulled low.</td></tr>
<tr><td>9</td><td>RES#</td><td>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 pull high during normal operation.</td></tr>
<tr><td>10</td><td>D/C#</td><td>Data/Command Control
This pin is Data/Command control pin. When the pin is pulled high, the input at D7~D0 will be interpreted as display data. When the pin is pulled low, the input at D7~D0 will be transferred to the command register.
When the pin is pulled high and serial interface mode is selected, the data at SDIN will be interpreted as data. When it is pulled low, the data at SDIN will be transferred to the command register. In I2C mode, this pin acts as SA0 for slave address selection.
For detail relationship to MCU interface signals, please refer to the Timing Characteristics Diagrams.</td></tr>
<tr><td>11</td><td>R/W#</td><td>Read/Write Select or Write
This pin is MCU interface input. When interfacing to a 68XX-series microprocessor, this pin will be used as Read/Write (R/W#) selection input. Pull this pin to “High” for read mode and pull it to “Low” for write mode.
When 80XX interface mode is selected, this pin will be the Write (WR#) input. Data write operation is initiated when this pin is pulled low and the CS# is pulled low.
When serial or I2C mode is selected, this pin must be connected to V_{SS}.</td></tr>
</table>

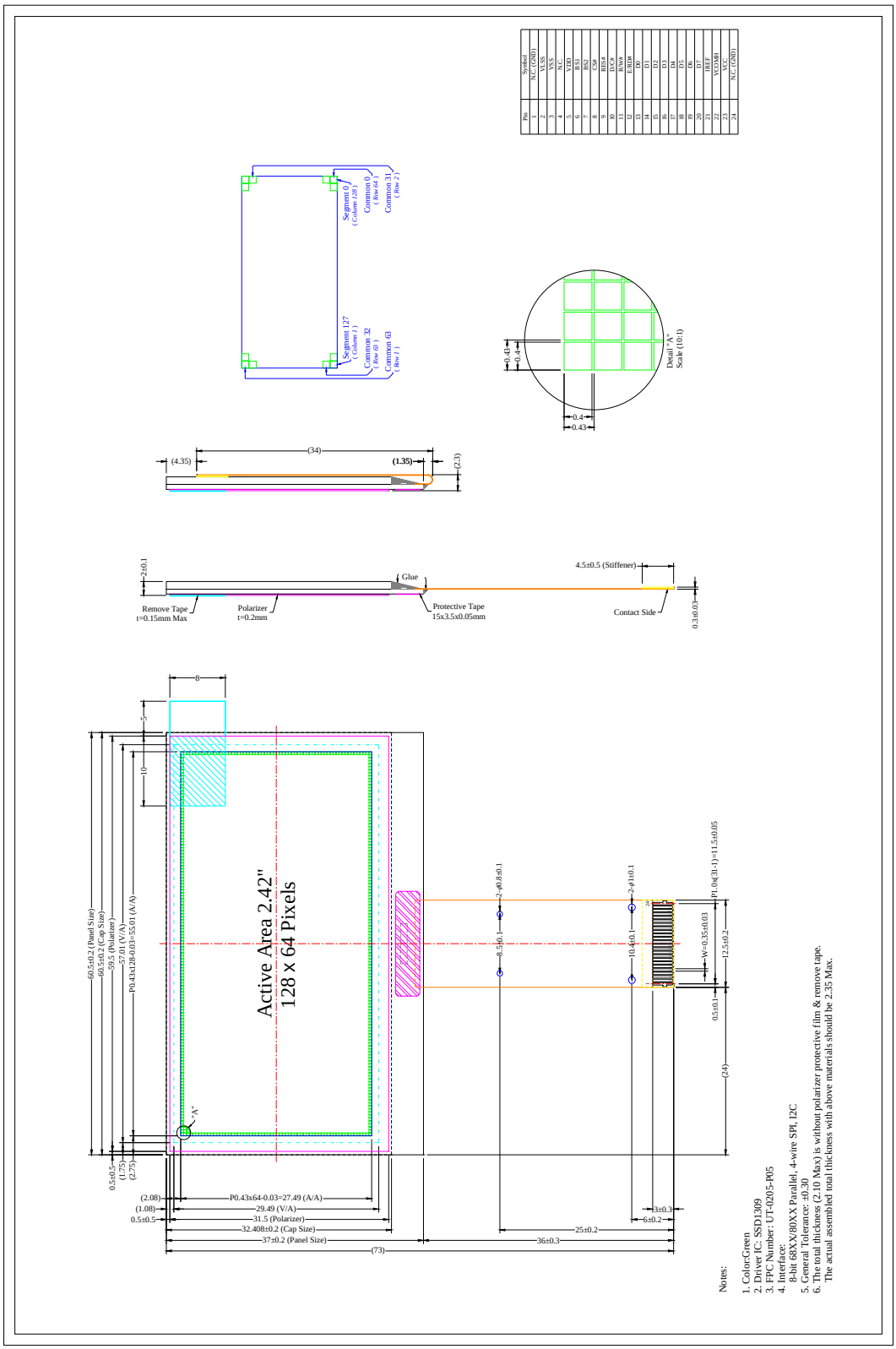
12	E/RD#	**Read/Write Enable or Read** This pin is MCU interface input. When interfacing to a 68XX-series microprocessor, this pin will be used as the Enable (E) signal. Read/write operation is initiated when this pin is pulled high and the CS# is pulled low. When connecting to an 80XX-microprocessor, this pin receives the Read (RD#) signal. Data read operation is initiated when this pin is pulled low and CS# is pulled low. When serial or I2C mode is selected, this pin must be connected to V_{SS}.
13~20	D0~D7	**Host Data Input/Output Bus** These pins are 8-bit bi-directional data bus to be connected to the microprocessor's data bus. When serial mode is selected, D1 will be the serial data input SDIN and D0 will be the serial clock input SCLK. When I2C mode is selected, D2, D1 should be tired together and serve as SDAOUT, SDAIN in application and D0 is the serial clock input, SCL. Unused pins must be connected to V_{SS} except for D2 in serial mode.

3.2 Module Pin Description

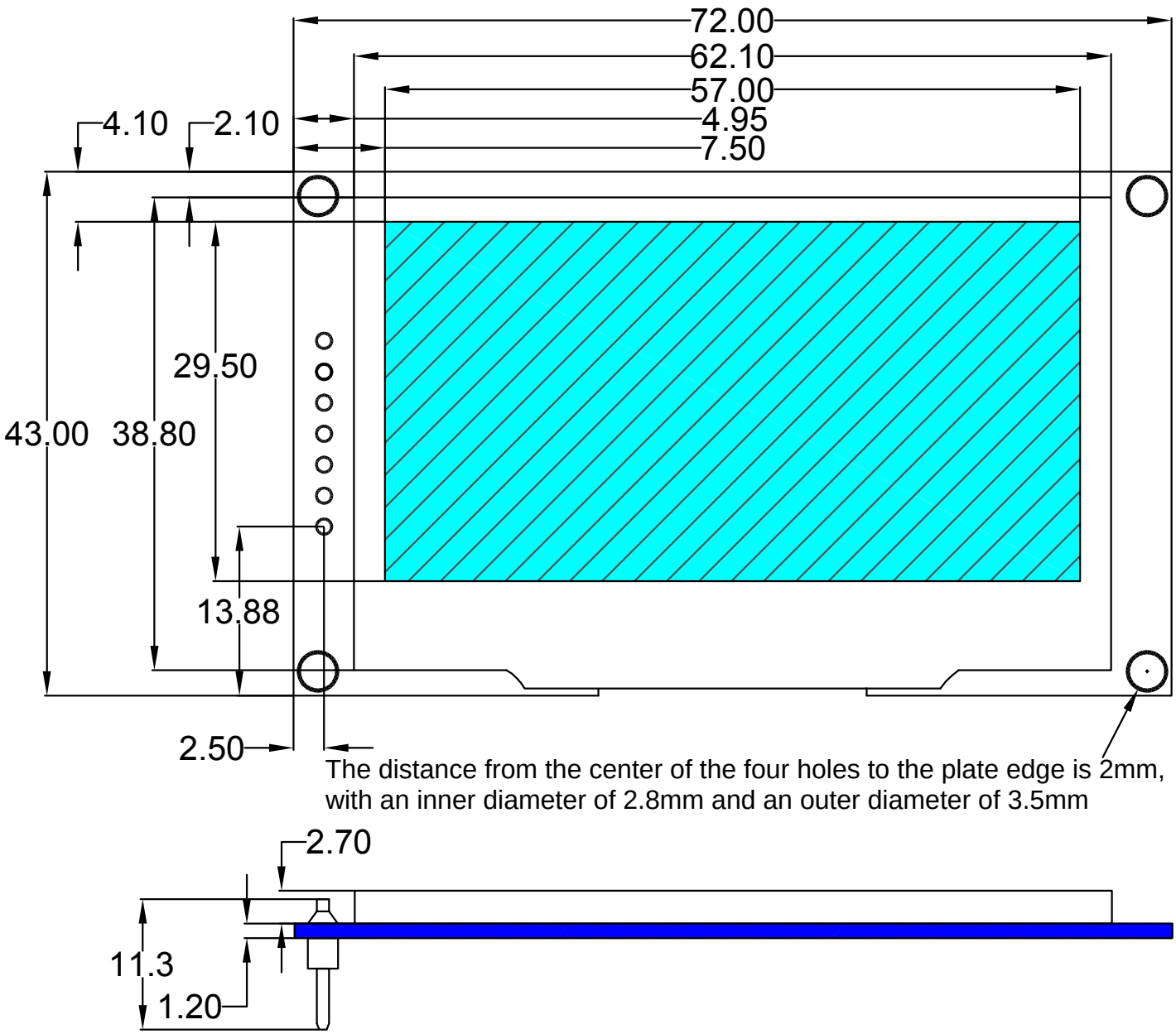
Pin No.	Symbol	Function Description
1	GND	Ground
2	VCC	Power Supply 3.3V
3	SCL	SPI Clock
4	SDA	SPI DATA
5	RES	OLED reset Pin Reset once after energizing.
6	D/C	Data/Command Control This pin is Data/Command control pin.
7	CS	Chip Select This pin is pulled low to active. Connect to ground if no used .

4 Mechanical Drawing

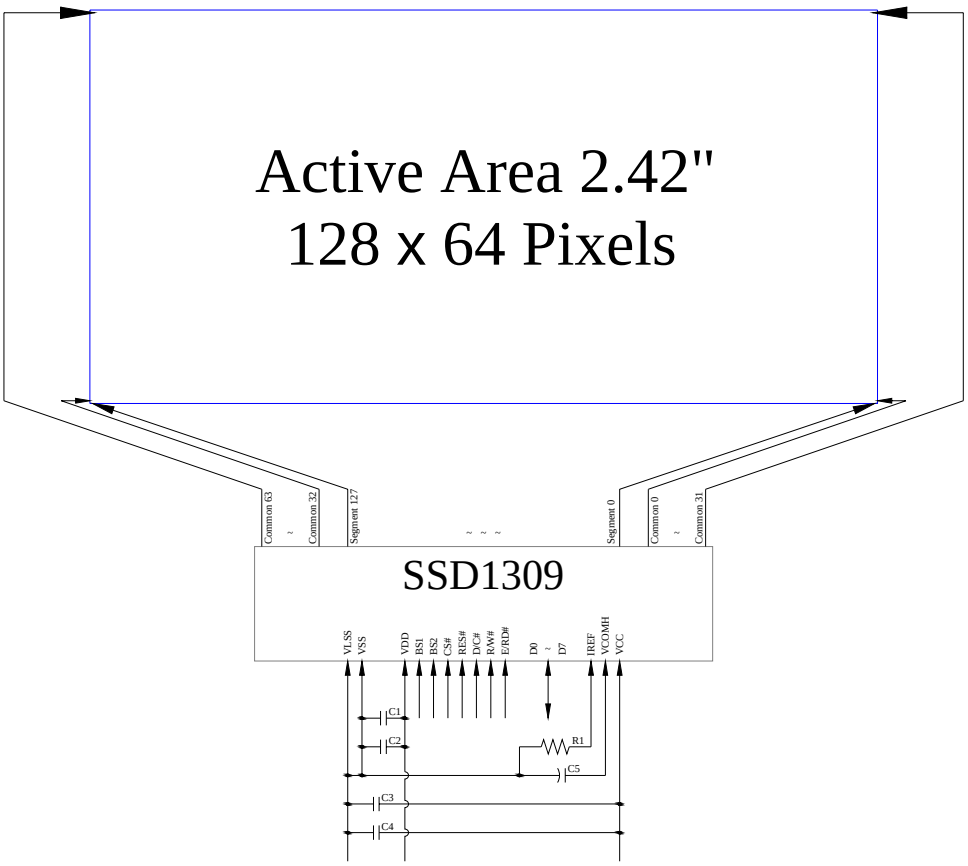
4.1 Panel Mechanical Drawing



4.2 Module Mechanical Drawing



5 Function Block Diagram



MCU Interface Selection: BS1 and BS2

Pins connected to MCU interface: D7~D0, E/RD#, R/W#, D/C#, RES#, and CS#

C1,C3: 0.1µF

C2: 4.7µF

C4: 10µF

C5: 4.7µF / 25V Tantalum Capacitor

R1: 910k Ω , R1 = (Voltage at IREF - BGGND) / IREF

6 Optics & Electrical Characteristics

6.1 Optical Characteristics

Item	Symbol	Min	Typ	Max	Unit
View Angles		-	Free	-	°
C.I.E. (Green) C.I.E. 1931	(x) (y)	0.25 0.62	0.29 0.66	0.33 0.70	-
Brightness	L_{br}	100	120	-	cd/m²
Dark room Contrast Ratio	CR	-	>10,000:1	-	-

* Optical measurement taken at V_{CI} = 2.8V, V_{CC} = 13.0V.

6.2 Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit	Notes
Logic Supply Voltage for panel	V_{DD}	-0.3	4	V	1, 2
Display Supply Voltage for panel	V_{CC}	0	15	V	1, 2
Operating Temperature	T_{OP}	-40	70	℃	3
Storage Temperature	T_{STG}	-40	85	℃	3
Life Time (100 cd/m²)		20,000	-	hour	4
Life Time (80 cd/m²)		40,000	-	hour	4

Note 1: All the above voltages are on the basis of "V_{SS} = 0V".

Note 2: When this module is used beyond the above absolute maximum ratings, permanent breakage of the module may occur. Also, for normal operations, it is desirable to use this module under the conditions according to "Optics & Electrical Characteristics". If this module is used beyond these conditions, malfunctioning of the module can occur and the reliability of the module may deteriorate.

Note 3: The defined temperature ranges do not include the polarizer. The maximum withstood temperature of the polarizer should be 80℃.

Note 4: V_{CC} = 13.0V, Ta = 25℃, 50% Checkerboard.
End of lifetime is specified as 50% of initial brightness reached. The average operating lifetime at room temperature is estimated by the accelerated operation at high temperature conditions.

6.3 DC Characteristics

Item	Symbol	Condition	Min	Typ.	Max	Unit
Logic Supply Voltage for panel	V_{DD}		1.65	2.8	3.3	V
Display Supply Voltage for panel	V_{CC}	Note5	12.5	13.0	13.5	V
Operating Current V_{DD}	I_{DD}		-	180	300	µA
Operating Current V_{CC}	I_{CC}	Note6	-	15.3	19.1	mA
		Note7	-	21.2	26.5	mA
		Note8	-	31.7	39.6	mA
Sleep Mode Current V_{CI}	$I_{CI,SLEEP}$		-	1	5	µA
Sleep Mode Current V_{DDIO}	$I_{DDIO,SLEEP}$		-	2	10	µA
Low Level Input Voltage	V_{IL}		0	-	0.2 x V_{DD}	V
High Level Input Voltage	V_{IH}		0.8 x V_{DD}	-	V_{DD}	V
Low Level Output Voltage	V_{OL}	I_{out} =100µA	0	-	0.1 x V_{DD}	V
High Level Output Voltage	V_{OH}	I_{out} =100µA	0.9 x V_{DD}	-	V_{DD}	V

Note 5: Brightness (L_{br}) and Supply Voltage for Display (V_{CC}) are subject to the change of the panel characteristics and the customer's request.

Note 6: V_{CI} = 2.8V, V_{CC} = 13.0V, 30% Display Area Turn on.

Note 7: V_{CI} = 2.8V, V_{CC} = 13.0V, 50% Display Area Turn on.

Note 8: V_{CI} = 2.8V, V_{CC} = 13.0V, 100% Display Area Turn on.

6.4 AC Characteristics

6.4.1 4-wire Serial Interface Timing Characteristics:

Symbol	Description	Min	Max	Unit
t_{cycle}	Clock Cycle Time	2.5	-	µs
t_{HSTART}	Start Condition Hold Time	0.6	-	µs
t_{HD}	Data Hold Time (for "SDAOUT" Pin) Data Hold Time (for "SDAIN" Pin)	0 300	-	ns
t_{SD}	Data Setup Time	100	-	ns
t_{SSTART}	Start Condition Setup Time (Only relevant for a repeated Start condition)	0.6	-	µs
t_{SSTOP}	Stop Condition Setup Time	0.6	-	µs
t_R	Rise Time for Data and Clock Pin	-	300	ns
t_F	Fall Time for Data and Clock Pin	-	300	ns
t_{IDLE}	Idle Time before a New Transmission can Start	1.3	-	µs

* (V_{DD} -V_{SS} = 1.65V-3.5V, Ta = 25°C)

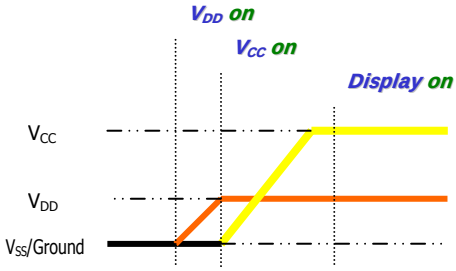
7 Functional Specification

7.1 Commands

Refer to the Technical Manual for the SSD1309

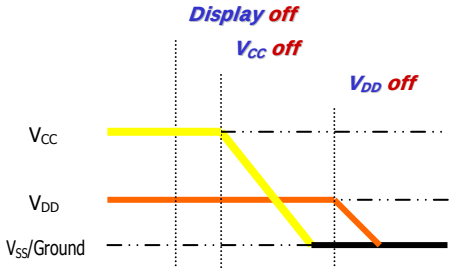
7.2 Power down and Power up Sequence

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.



7.2.1 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



7.2.2 Power down Sequence:

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

Note 9:

1) Since an ESD protection circuit is connected between V_{DD} and V_{CC} inside the driver IC, V_{CC} becomes lower than V_{CI} whenever V_{DD} is ON and V_{CC} is OFF.
2) V_{CC} should be kept float (disable) 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 power down before V_{CC} power down.

7.3 Reset Circuit

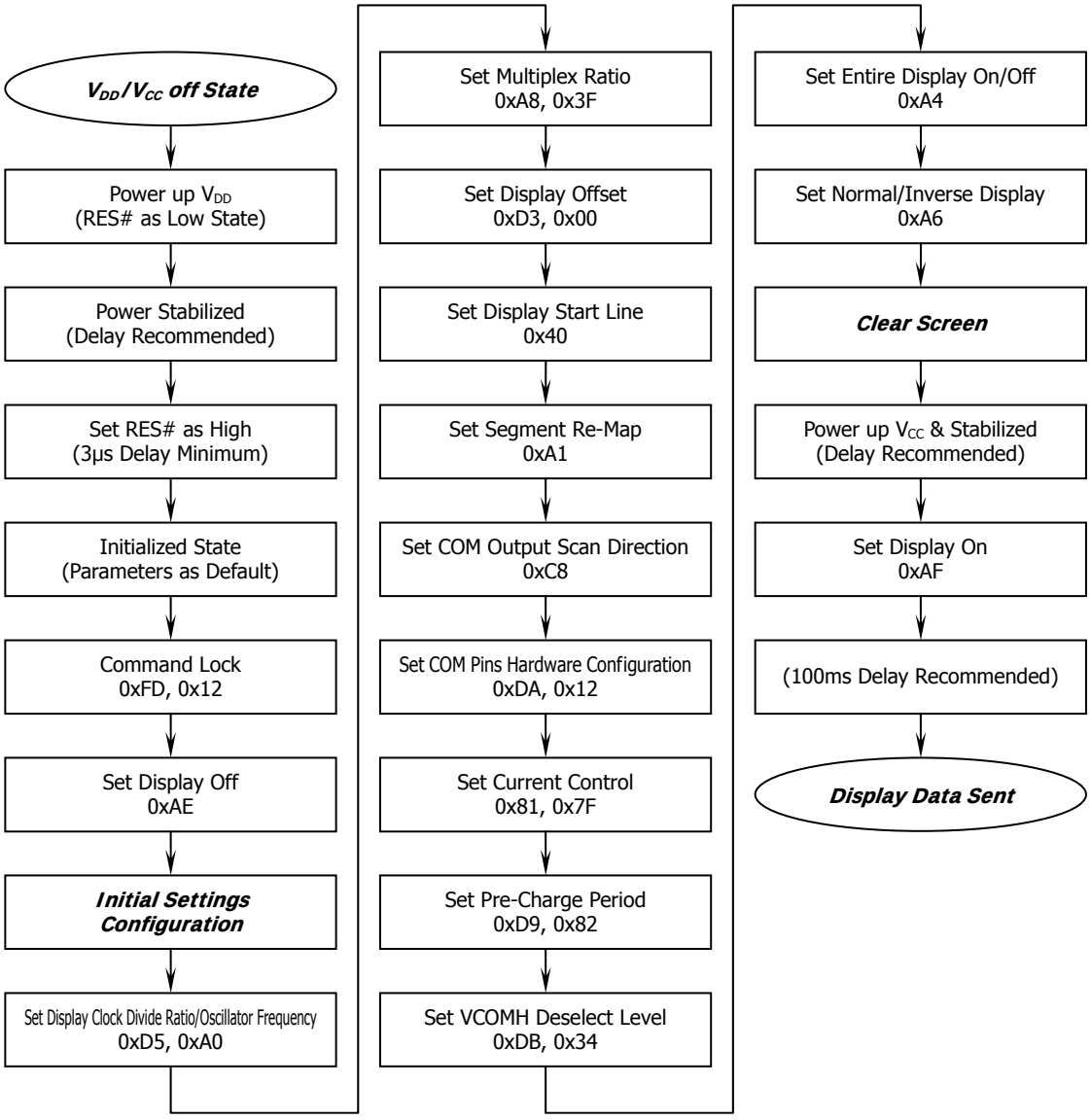
When RES# input is low, the chip is initialized with the following status:

1. Display is OFF
2. 128 x 64 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)

7.4 Actual Application Example

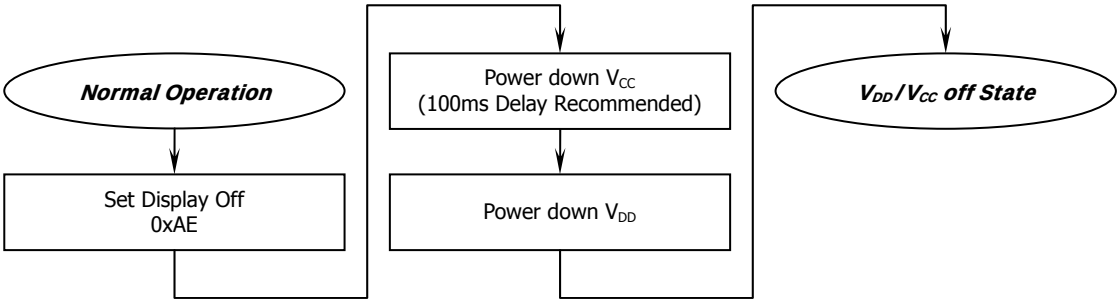
Command usage and explanation of an actual example

Power up Sequence

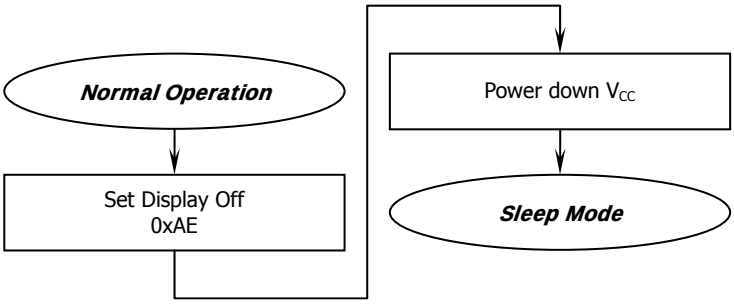


If the noise is accidentally occurred at the displaying window during the operation, please reset the display in order to recover the display function.

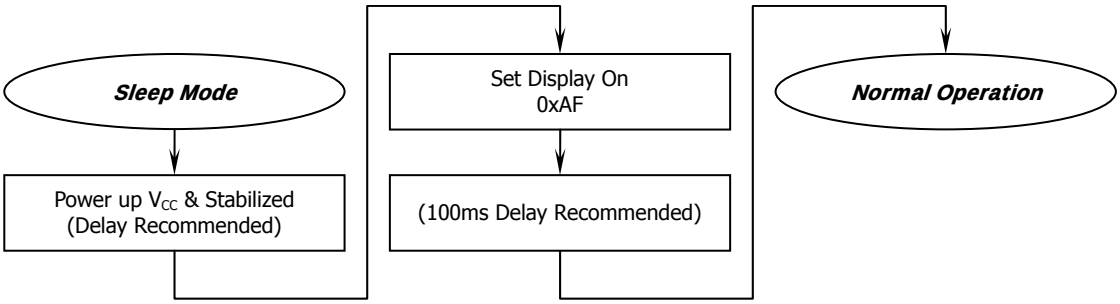
Power down Sequence



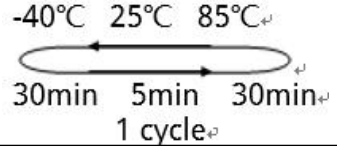
Entering Sleep Mode



Exiting Sleep Mode



8 Reliability

Test Item	Content of Test	Test Condition	Note
High Temperature Storage	Endurance test applying the high storage temperature for a long time.	85℃ 240hrs	2
Low Temperature Storage	Endurance test applying the high storage temperature for a long time.	-40℃ 240hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	70℃ 240hrs	-
Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	-40 ℃ 240hrs	1
High Temperature/ Humidity Operation	The module should be allowed to stand at 60℃,90%RH max, for 96hrs under no-load condition excluding the polarizer. Then taking it out and drying it at normal temperature.	60℃,90%RH 120hrs	1,2
Thermal Shock Resistance	The sample should be allowed stand the following 10 cycles of operation 	-40℃/85℃ 24 cycles	-

Note1: No dew condensation to be observed.

Note2: The function test shall be conducted after 4 hours storage at the normal. Temperature and humidity after remove from the rest chamber.

9 Warranty and Conditions

http://www.displaymodule.com/pages/faq HYPERLINK "http://www.displaymodule.com/pages/faq"