ALL SHORE INDUSTRIES

ASI-O-293LAWWH60/M

No.	Items	Specification	Unit
1	Display Mode	Passive Matrix OLED	-
2	Display Color	Monochrome (White)	-
3	Duty	1/16	-
4	Characters x lines	20 x 2	Pixel
5	Character Font	5 x 8	-
6	Active Area	73.52 (W) x 11.52 (H)	mm
7	Module Size	116.0 (W) x 37.0 (H) x 5.8 (D)	mm
8	Panel Size	84.50 (W) x 19.28 (H) x 2.00 (D)	mm
9	Character pitch	3.70 (W) x 5.95 (H)	mm
10	Character size	3.22 (W) x 5.57 (H)	mm
11	Pixel Pitch	0.65 (W) x 0.70 (H)	mm
12	Pixel Size	0.62 (W) x 0.67 (H)	mm
13	Driver IC	US2066	-
14	Interface	8-bit 6800 parallel	-
15	Weight	TBD	g

REVISION RECORD

REV NO.	REV DATE	CONTENTS	REVISED PAGE NO.
1.0	2014-05-14	First Release	

CONTENT

■ PHYSICAL DATA

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■ EXTERNAL DIMENSIONS

Notes:

1. Color: White
2. Driver IC: US2066
3. Interface:
   8-bit 68XX Parallel
4. General Tolerance: ±0.30

5.8 Max.
1.6±0.1 (PCB)
2±0.1 (OLED)

Polarizer t=0.2mm

(Reference Mechnical Design)

Componer Area

Remove Tape t=0.15mm Max

Protective Tape 11.8x3.5x0.05mm

37±0.5 (PCB)
29
P2.54x(8-1)=17.78
4
8.34
18.5
2.54
18.54
19.04±0.5
(21.24)
(22.24)
2.54

Active Area 2.93"
20 x 2 Character

116±0.5 (PCB)
84.5 (Panel Size)
79.5 (Polarizer)
75.52 (V/A)
73.52 (A/A)

59
108

73.5 PTH
5.5 PAD

11.52 (A/A)
13.52 (V/A)
19.28 (Panel Size)
12.74
(11.74)
8.86

29±0.5
8±0.5
13.9±0.5

Componer Area
Componer Area
Componer Area

16-φ1.0 PTH

Segment 40
Segment 59 (Column 79)
Common 0
Segment 0 (Column 0)
Segment 19 (Column 19)
Common 15 (Row 15)
Common 0 (Row 0)
Segment 79 (Column 39)

Detail "A"
Scale (2:1)

5.95
5.57
0.7
0.67
0.38
0.65
0.62
3.7
3.22
0.48

Pin	Symbol
1	VSS
2	VDD
3	N.C.
4	D/C#
5	R/W#(WR#)
6	E(RD#)
7	D0
8	D1
9	D2
10	D3
11	D4
12	D5
13	D6
14	D7
15	N.C.
16	N.C.

CUSTOMER APPL	DRAWN	DFTG CHK	ENGR CHK	APPROVAL	DATE	SCALE	UNIT mm	MODEL	TITLE	DWG NO	PAGE 1/1

■ ABSOLUTE MAXIMUM RATINGS

Items	Symbol	Min	Typ.	Max	Unit	Notes
Supply voltage for logic	V_{DD}	-0.3	-	6.0	V	1,2
Operating temperature	T_{OP}	-40	-	85	℃	3
Storage temperature	T_{ST}	-40	-	90	℃	3
Life time(100cd/m²)	-	50,000	-	-	hour	-
Life time(120cd/m²)	-	30,000	-	-	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 electro-optical 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 temperature of the polarizer should be 80°C.

Note 4: V_{DD}= 5.0V, T_a = 25°C, 50% Checkerboard.
Software configuration follows Actual Application Example .
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.

■ ELECTRICAL CHARACTERISTICS

◆DC Characteristics

Items	Symbol	Conditions	Min	Typ.	Max	Unit
Supply voltage for display	V_{DD}		4.4	5.0	5.5	V
High level input	V_{IH}	$I_{OUT} = 100\,\mu A$, 3.3MH	$0.8 \times V_{DD}$	-	V_{DD}	V
Low level input	V_{IL}	$I_{OUT} = 100\,\mu A$, 3.3MH	0	-	$0.2 \times V_{DD}$	V
High level output	V_{OH}	$I_{OUT} = 100\,\mu A$, 3.3MH	$0.9 \times V_{DD}$	-	V_{DD}	V
Low level output	V_{OL}	$I_{OUT} = 100\,\mu A$, 3.3MH	0	-	$0.1 \times V_{DD}$	V
Operating current for V_{DD}	I_{DD}	Note 5	-	43.34	54.23	mA
		Note 6	-	61.02	76.34	mA
		Note 7	-	103.62	129.58	mA
Standby mode current for V_{DD}	$I_{DD,Standby}$		-	400	600	µA

Note 5: V_{DD} = 5.0V, 30% Display Area Turn on.
Note 6: V_{DD} = 5.0V, 50% Display Area Turn on.
Note 7: V_{DD} = 5.0V, 100% Display Area Turn on.

Software configuration follows Actual Application Example .

◆AC Characteristics

1. 68XX-Series MPU Parallel Interface Timing Characteristics:

Symbol	Description	Min	Max	Unit
t_{cycle}	Clock Cycle Time (Write Cycle)	400	-	ns
t_{AS}	Address Setup Time	13	-	ns
t_{AH}	Address Hold Time	17	-	ns
t_{DSW}	Write Data Setup Time	35	-	ns
t_{DHW}	Write Data Hold Time	18	-	ns
t_{DHR}	Read Data Hold Time	13	-	ns
t_{OH}	Output Disable Time	-	90	ns
t_{ACC}	Access Time (RAM)	-	200	ns
	Access Time (Command)			
PW_{CSL}	Chip Select Low Pulse Width (Read RAM)	250	-	ns
	Chip Select Low Pulse Width (Read Command)	250		
	Chip Select Low Pulse width (Write)	50		
PW_{CSH}	Chip Select High Pulse Width (Read)	155	-	ns
	Chip Select High Pulse Width (Write)	55		
t_R	Rise Time	-	15	ns
t_F	Fall Time	-	15	ns

* (V_{DD} - V_{SS} = 4.4V to 5.5V, T_a = 25°C)
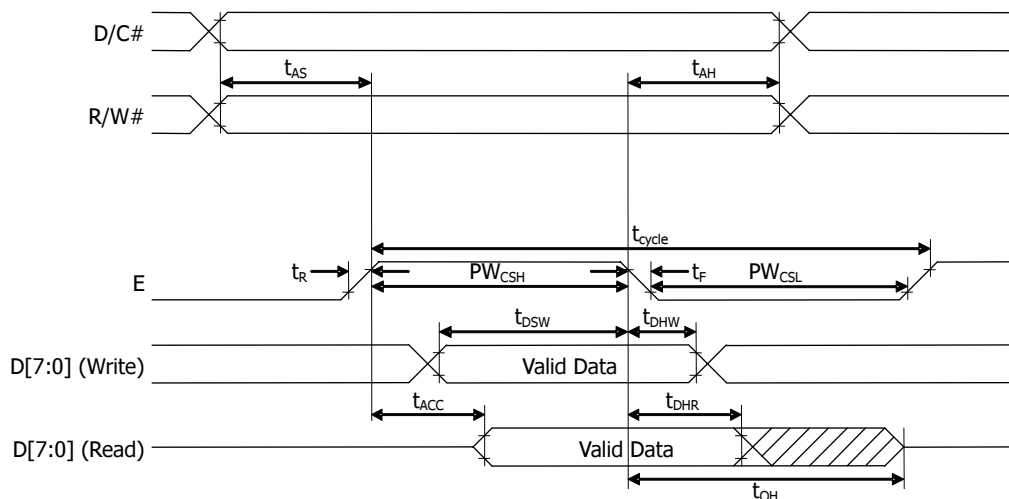
◆Functional Specification

1. Commands

Command Set

Command	IS	RE	Instruction Code										Description
			D/C#	R/W# (WR#)	D7	D6	D5	D4	D3	D2	D1	D0	
Clear Display	X	X	0	0	0	0	0	0	0	0	0	1	Write "20H" to DDRAM and set DDRAM address to "00H" from AC.
Return Home	X	0	0	0	0	0	0	0	0	0	1	*	Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.
Entry Mode Set	X	0	0	0	0	0	0	0	0	1	I/D	S	Assign cursor / blink moving direction with DDRAM address. I/D = "1": cursor/ blink moves to right and DDRAM address is increased by 1 (POR) I/D = "0": cursor/ blink moves to left and DDRAM address is decreased by 1 Assign display shift with DDRAM address. S = "1": make display shift of the enabled lines by the DS4 to DS1 bits in the shift enable instruction. Left/ right direction depends on I/D bit selection. S = "0": display shift disable (POR)
	X	1	0	0	0	0	0	0	0	1	BDC	BDS	Common bi-direction function. BDC = "0": COM31 -> COM0 BDC = "1": COM0 -> COM31 Segment bi-direction function. BDS = "0": SEG99 -> SEG0, BDS = "1": SEG0 -> SEG99
Display ON / OFF Control	X	0	0	0	0	0	0	0	1	D	C	B	Set display/cursor/blink ON/OFF D = "1": display ON, D = "0": display OFF (POR), C = "1": cursor ON, C = "0": cursor OFF (POR), B = "1": blink ON, B = "0": blink OFF (POR).
Extended Function Set	X	1	0	0	0	0	0	0	1	FW	B/W	NW	Assign font width, black/white inverting of cursor, and 4-line display mode control bit. FW = "1": 6-dot font width, FW = "0": 5-dot font width (POR), B/W = "1": black/white inverting of cursor enable, B/W = "0": black/white inverting of cursor disable (POR) NW = "1": 3-line or 4-line display mode NW = "0": 1-line or 2-line display mode

1. Commands(Continued)

Command Set

Command	IS	RE	D/C#	R/W#(WR#)	D7	D6	D5	D4	D3	D2	D1	D0	Description
Cursor or Display Shift	0	0	0	0	0	0	0	1	S/C	R/L	*	*	Set cursor moving and display shift control bit, and the direction, without changing DDRAM data. S/C = "1": display shift, S/C = "0": cursor shift, R/L = "1": shift to right, R/L = "0": shift to left
Double Height (4-line) / Display-dot shift	0	1	0	0	0	0	0	1	UD2	UD1	*	DH'	UD2~1: Assign different doubt height format (POR=11b) DH' = "1": display shift enable DH' = "0": dot scroll enable (POR)
Shift Enable	1	1	0	0	0	0	0	1	DS4	DS3	DS2	DS1	DS[4:1]=1111b (POR) when DH' = 1b Determine the line for display shift. DS1 = "1/0": 1st line display shift enable/disable DS2 = "1/0": 2nd line display shift enable/disable DS3 = "1/0": 3rd line display shift enable/disable DS4 = "1/0": 4th line display shift enable/disable.
Scroll Enable	1	1	0	0	0	0	0	1	HS4	HS3	HS2	HS1	HS[4:1]=1111b (POR) when DH' = 0b Determine the line for horizontal smooth scroll. HS1 = "1/0": 1st line dot scroll enable/disable HS2 = "1/0": 2nd line dot scroll enable/disable HS3 = "1/0": 3rd line dot scroll enable/disable HS4 = "1/0": 4th line dot scroll enable/disable.
Function Set	X	0	0	0	0	0	1	*	N	DH	RE(0)	IS	Numbers of display line, N when N = "1": 2-line (NW=0b) / 4-line (NW=1b), when N = "0": 1-line (NW=0b) / 3-line (NW=1b) DH = " 1/0": Double height font control for 2-line mode enable/ disable (POR=0) Extension register, RE ("0") Extension register, IS
	X	1	0	0	0	0	1	*	N	BE	RE(1)	REV	CGRAM blink enable BE = 1b: CGRAM blink enable BE = 0b: CGRAM blink disable (POR) Extension register, RE ("1") Reverse bit REV = "1": reverse display, REV = "0": normal display (POR)

1. Commands(Continued)

Command Set

Command	IS	RE	D/C#	R/W# (WR#)	D7	D6	D5	D4	D3	D2	D1	D0	Description
								Instruction Code					
Set CGRAM address	0	0	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter. (POR=00 0000)
Set DDRAM Address	X	0	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in address counter. (POR=000 0000)
Set Scroll Quantity	X	1	0	0	1	*	SQ5	SQ4	SQ3	SQ2	SQ1	SQ0	Set the quantity of horizontal dot scroll. (POR=00 0000) Valid up to SQ[5:0] = 110000b
Read Busy Flag and Address/ Part ID	X	X	0	1	BF	AC6 / ID6	AC5 / ID5	AC4 / ID4	AC3 / ID3	AC2 / ID2	AC1 / ID1	AC0 / ID0	Can be known whether during internal operation or not by reading BF. The contents of address counter or the part ID can also be read. When it is read the first time, the address counter can be read. When it is read the second time, the part ID can be read. BF = "1": busy state BF = "0": ready state
Write data	X	X	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM / CGRAM).
Read data	X	X	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM / CGRAM).

Extended Command Set (Double Byte Command)

| Command	IS	RE	D/C#	R/W# (WR#)	D7	D6	D5	D4	D3	D2	D1	D0	Description
								Instruction Code					
Function Selection B	X	1	0	0	0	1	1	1	0	0	1	0	OPR[1:0]: Select the character no. of character generator OPR[1:0] / CGROM / CGRAM 00b / 240 / 8 01b / 248 / 8 10b / 250 / 6 11b / 256 / 0
			1	0	*	*	*	*	ROM1	ROM0	OPR1	OPR0	ROM[1:0]: Select character ROM RO[1:0] / ROM 00b / A 01b / B 10b / C 11b / Invalid

* POR stands for Power on Reset Values, and "*" and "X" stand for "Don't care".

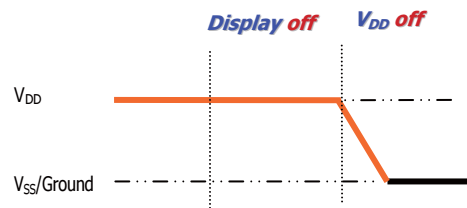# ■ TIMING OF POWER SUPPLY

1. Power down and Power up Sequence

1.1 Power up Sequence:

1. Power up V_{DD}
2. Send Display off command
3. Delay 100ms
   (When DC/DC booster is stable)
4. Initialization
5. Clear Screen
6. Send Display on command
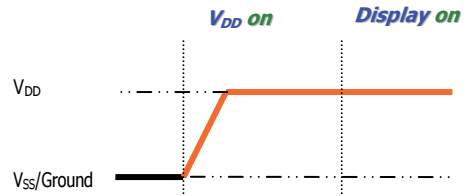
1.2 Power down Sequence:

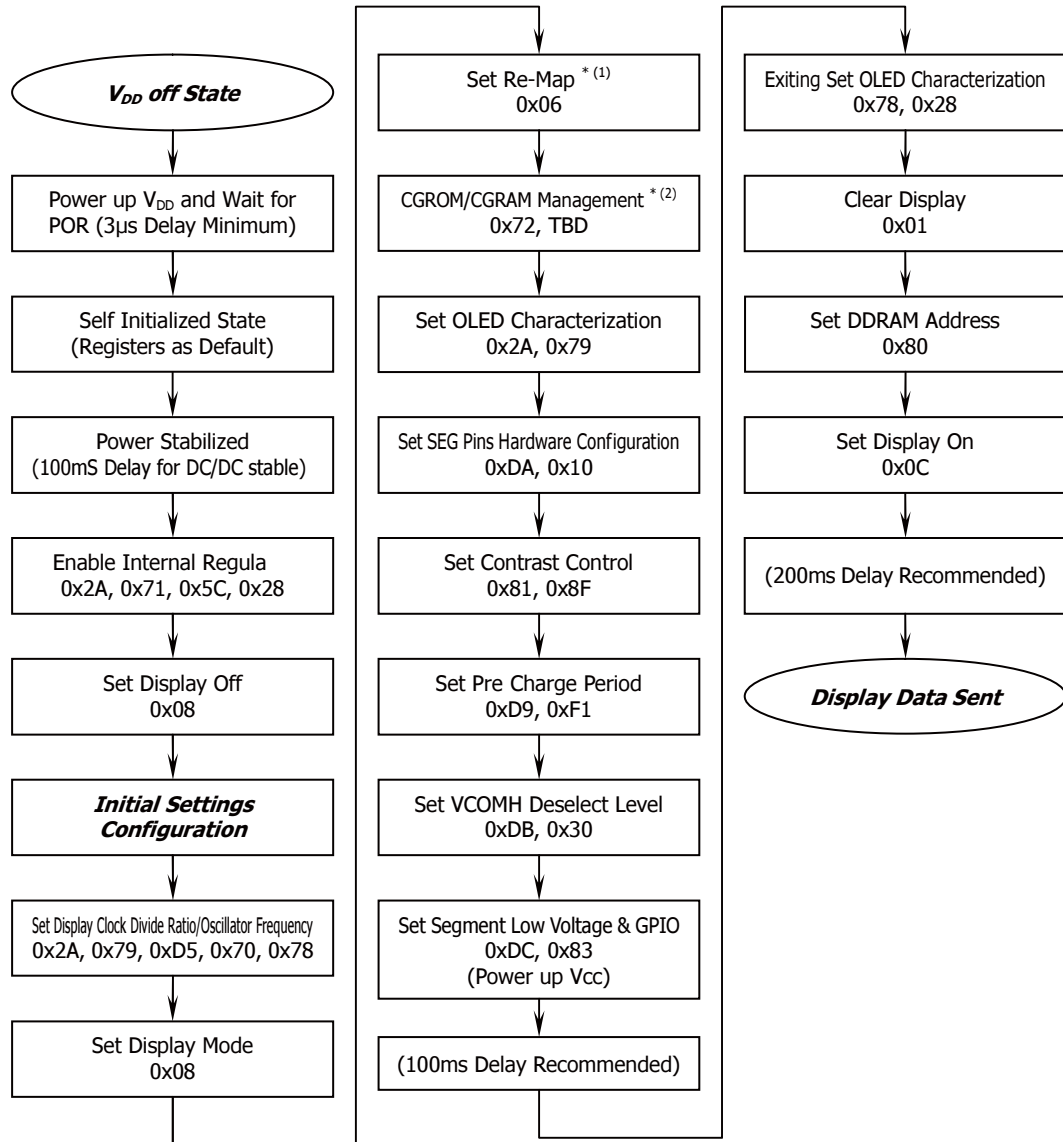1. Send Display off command
2. Power down V_{DD}

2. Reset Circuit

After power up, the chip is initialized with the following status automatically:
1. Display is OFF
2. 5×8 Character Mode
3. Display start position is set at display RAM address 0
4. CGRAM address counter is set at 0
5. Cursor is OFF
6. Blink is OFF
7. Contrast control register is set at 7Fh
8. OLED command set is disabled
9. 4-Line display mode

3. Actual Application Example

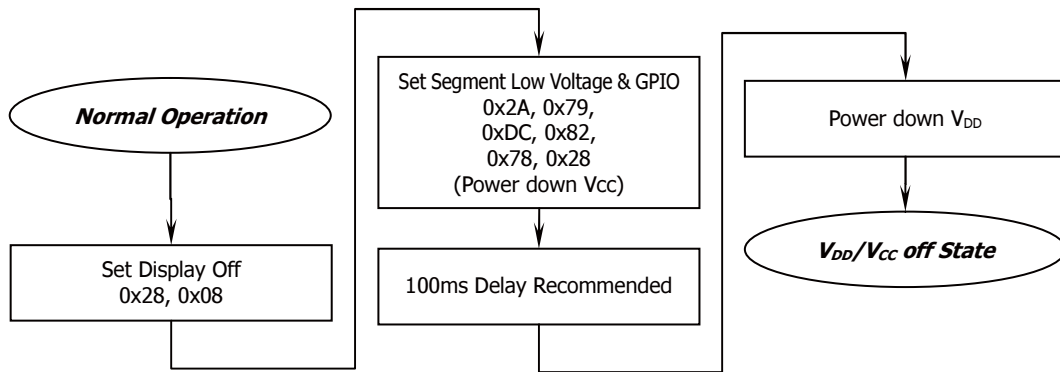Command usage and explanation of an actual example

<Power up Sequence>

```
┌──────────────────────┐     ┌──────────────────────┐     ┌──────────────────────┐
│     V_DD off State   │     │   Set Re-Map * (1)   │     │ Exiting Set OLED     │
│                      │     │         0x06         │     │ Characterization     │
└──────────────────────┘     └──────────────────────┘     │     0x78, 0x28       │
           │                            │                  └──────────────────────┘
           ▼                            ▼                             │
┌──────────────────────┐     ┌──────────────────────┐                ▼
│ Power up V_DD and    │     │ CGROM/CGRAM          │     ┌──────────────────────┐
│ Wait for POR (3µs    │     │ Management * (2)      │     │    Clear Display     │
│ Delay Minimum)       │     │     0x72, TBD        │     │        0x01          │
└──────────────────────┘     └──────────────────────┘     └──────────────────────┘
           │                            │                             │
           ▼                            ▼                             ▼
┌──────────────────────┐     ┌──────────────────────┐     ┌──────────────────────┐
│ Self Initialized     │     │ Set OLED             │     │  Set DDRAM Address   │
│ State (Registers as  │     │ Characterization     │     │        0x80          │
│ Default)             │     │     0x2A, 0x79       │     └──────────────────────┘
└──────────────────────┘     └──────────────────────┘                │
           │                            │                             ▼
           ▼                            ▼                  ┌──────────────────────┐
┌──────────────────────┐     ┌──────────────────────┐     │   Set Display On     │
│ Power Stabilized     │     │ Set SEG Pins         │     │        0x0C          │
│ (100mS Delay for     │     │ Hardware             │     └──────────────────────┘
│ DC/DC stable)        │     │ Configuration        │                │
└──────────────────────┘     │     0xDA, 0x10       │                ▼
           │                 └──────────────────────┘     ┌──────────────────────┐
           ▼                            │                  │ (200ms Delay         │
┌──────────────────────┐               ▼                  │ Recommended)         │
│ Enable Internal      │     ┌──────────────────────┐     └──────────────────────┘
│ Regula               │     │ Set Contrast Control │                │
│ 0x2A, 0x71, 0x5C,    │     │     0x81, 0x8F       │                ▼
│ 0x28                 │     └──────────────────────┘     ┌──────────────────────┐
└──────────────────────┘                │                 │  Display Data Sent   │
           │                            ▼                  └──────────────────────┘
           ▼                 ┌──────────────────────┐
┌──────────────────────┐     │ Set Pre Charge       │
│ Set Display Off      │     │ Period               │
│      0x08            │     │     0xD9, 0xF1       │
└──────────────────────┘     └──────────────────────┘
           │                            │
           ▼                            ▼
┌──────────────────────┐     ┌──────────────────────┐
│ Initial Settings     │     │ Set VCOMH Deselect   │
│ Configuration        │     │ Level                │
└──────────────────────┘     │     0xDB, 0x30       │
           │                 └──────────────────────┘
           ▼                            │
┌──────────────────────┐               ▼
│ Set Display Clock    │     ┌──────────────────────┐
│ Divide Ratio/        │     │ Set Segment Low      │
│ Oscillator Frequency │     │ Voltage & GPIO       │
│ 0x2A, 0x79, 0xD5,    │     │     0xDC, 0x83       │
│ 0x70, 0x78           │     │ (Power up Vcc)       │
└──────────────────────┘     └──────────────────────┘
           │                            │
           ▼                            ▼
┌──────────────────────┐     ┌──────────────────────┐
│ Set Display Mode     │     │ (100ms Delay         │
│      0x08            │     │ Recommended)         │
└──────────────────────┘     └──────────────────────┘
```

*(1) This command could be programmable or defined by pin configuration.
*(2) This command could be programmable or defined by pin configuration.
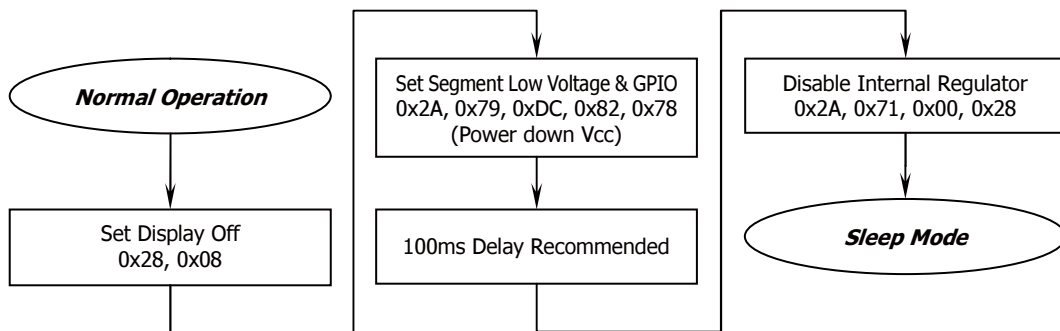   The written value of the parameter should depend on the selection from Section 4 & 5

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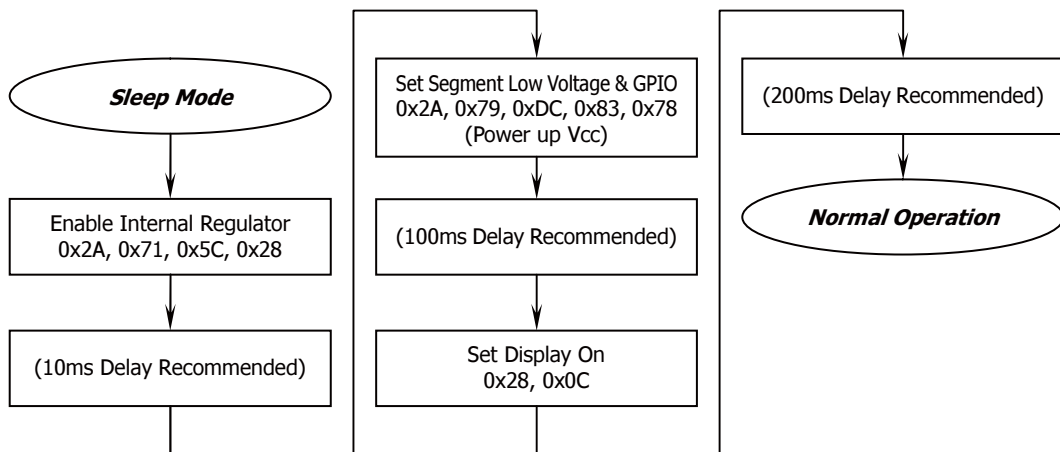
<Power down Sequence>

```
Normal Operation          Set Segment Low Voltage & GPIO        Power down V_DD
                          0x2A, 0x79,
                          0xDC, 0x82,
                          0x78, 0x28
     │                    (Power down Vcc)                           │
     ▼                                                               ▼
Set Display Off                    │                          V_DD/V_CC off State
0x28, 0x08                         ▼
                          100ms Delay Recommended
```

<Entering Standby Mode>

```
Normal Operation          Set Segment Low Voltage & GPIO     Disable Internal Regulator
                          0x2A, 0x79, 0xDC, 0x82, 0x78       0x2A, 0x71, 0x00, 0x28
     │                    (Power down Vcc)                           │
     ▼                                                               ▼
Set Display Off                    │                              Sleep Mode
0x28, 0x08                         ▼
                          100ms Delay Recommended
```

<Exiting Standby Mode>

```
Sleep Mode                Set Segment Low Voltage & GPIO     (200ms Delay Recommended)
                          0x2A, 0x79, 0xDC, 0x83, 0x78
     │                    (Power up Vcc)                             │
     ▼                                                               ▼
Enable Internal Regulator          │                          Normal Operation
0x2A, 0x71, 0x5C, 0x28             ▼
     │                    (100ms Delay Recommended)
     ▼                             │
(10ms Delay Recommended)           ▼
                          Set Display On
                          0x28, 0x0C
```

4. Built-in CGROM (Character Generator ROM)

ROM A (ROM[1:0] = 00b)

Language: English, Irish, Spanish, Dutch (2), Danish, Norwegian, Swedish, Finnish, Czech (7), Slovene, Hungarian (2), Turkish (1)

The number in the parentheses is showing how many letters might be needed to build and define additionally at CGRAM. The darker background is showing the maximum addresses (00h~07h) those could be allocated by OPR[1:0] setting.

ROM B (ROM[1:0] = 01b for default setting)

Language: English, Irish, Portuguese, Spanish, French (1), Italian, German, Dutch (2), Icelandic, Danish, Norwegian, Swedish, Polish (8), Czech (8), Hungarian (2), Romanian (5), Turkish, Vietnamese (6), Russian (Small Letters)
The number in the parentheses is showing how many letters might be needed to build and define additionally at CGRAM. The darker background is showing the maximum addresses (00h~07h) those could be allocated by OPR[1:0] setting.

ROM C (ROM[1:0] = 10b)

Language: English, Dutch (2), Japanese, Greek (Small Letters)
The number in the parentheses is showing how many letters might be needed to build and define additionally at CGRAM. The darker background is showing the maximum addresses (00h~07h) those could be allocated by OPR[1:0] setting.

ROM D (ROM[1:0] = [1:1])

Language: English, Dutch (1), Greek, Russian, Belorussian, Ukrainian, Serbian (10), Macedonian (10), Bulgarian, Kazakh (12), Mongolian

The number in the parentheses is showing how many letters might be needed to build and define additionally at CGRAM. The darker background is showing the maximum addresses (00h~07h) those could be allocated by OPR[1:0] setting.

5. Self-Defined CGRAM (Character Generator RAM)

8 Addresses Available for Self-Defined Characters (OPR[1:0] = 00b')

8 Addresses Available for Self-Defined Characters (OPR[1:0] = 01b for default setting)

6 Addresses Available for Self-Defined Characters (OPR[1:0] = 10b)

0 Address Available for Self-Defined Characters (OPR[1:0] = 11b)

■ ELECTRO-OPTICAL CHARACTERISTICS (Ta=25℃)

Items		Symbol	Min.	Typ.	Max.	Unit	Remark
Operating Luminance		L	100	120	-	cd /m^2	White
Color Coordinate	White	CIE x	0.25	0.29	0.33	CIE1931	Darkroom
		CIE y	0.27	0.31	0.35		
Contrast Ratio		Cr	10000 :1	-	-		Darkroom
Viewing Angle Uniformity		△ θ	-	Free	-	Degree	-

Optical measurement taken at V_{DD} = 5.0V

Software configuration follows Actual Application Example .

■ INTERFACE PIN CONNECTIONS

1. Block Diagram
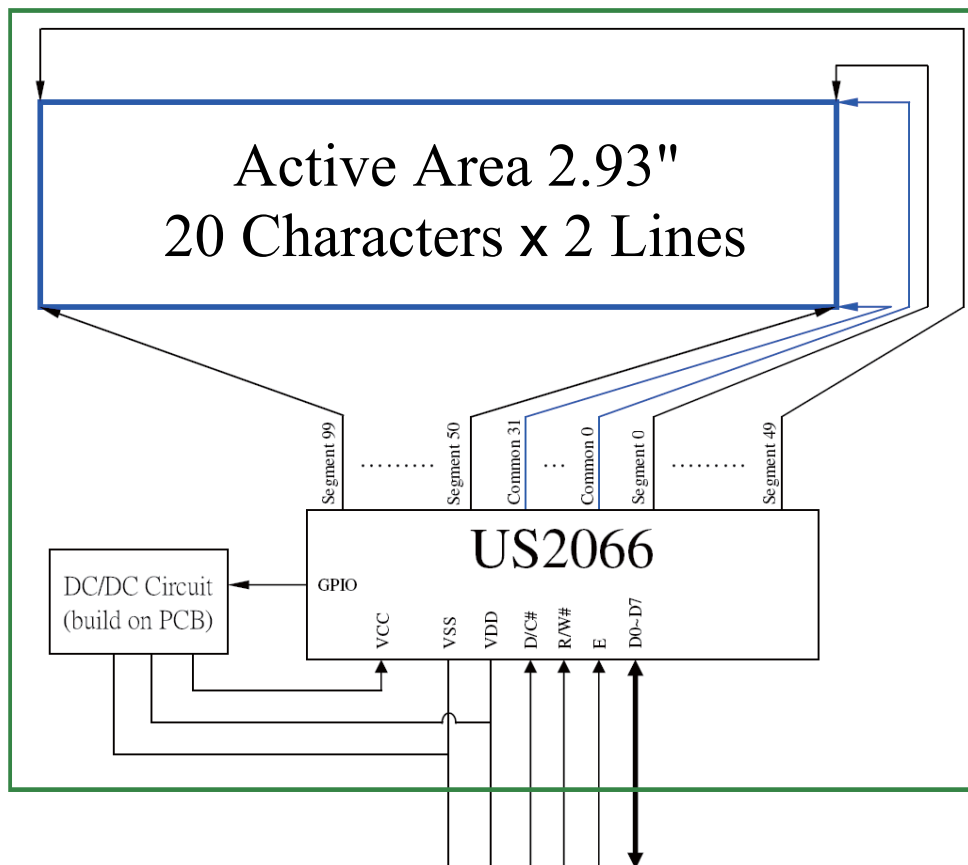
Pins connected to MCU interface: D/C#, R/W#, E, and D0~D7

2. Pin Definition

2.1 IF1

Pin Number	Symbol	I/O	Function
Power Supply			
1	VSS	P	**Ground of OEL System** This is a ground pin. It also acts as a reference for the logic pins, the OEL driving voltages, and the analog circuits. It must be connected to external ground.
2	VDD	P	**Power Supply for OLED Module** This is a voltage supply pin. It should match with the MCU interface voltage level and must be connected to external source. It will also generate the power supply to the OLED driver through the DC/DC booster on the PCBA.
Interface			
4	D/C#	I	**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. For detail relationship to MCU interface signals, please refer to the Timing Characteristics Diagrams.
5	R/W#	I	**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.
6	E	I	**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.
7~14	D0~D7	I/O	**Host Data Input/Output Bus** These pins are 8-bit bi-directional data bus to be connected to the microprocessor's data bus.
Reserve			
3, 15, 16	N.C.	-	**Reserved Pin** These pins are recommended to keep floating.

2.1 IF2

IF2 is reserved design. Please Keep these pins floating.

■ RELIABILITY TESTS

Item	Conditions	Criteria
High Temperature Operation	85°C, 240 hrs	The operational functions work.
Low Temperature Operation	-40°C, 240 hrs	
High Temperature Storage	90°C, 240 hrs	
Low Temperature Storage	-40°C, 240 hrs	
High Temperature/Humidity Operation	60°C, 90% RH, 240 hrs	
Thermal Shock	-40°C ⇔ 85°C, 100 cycles 60 mins dwell	

* The samples used for the above tests do not include polarizer.

* No moisture condensation is observed during tests.

■OUTGOING QUALITY CONTROL SPECIFICATION

1. Environment Required

Customer's test & measurement are required to be conducted under the following conditions:

Temperature: $23 \pm 5°C$

Humidity: $55 \pm 15\%$ RH

Fluorescent Lamp: 30W

Distance between the Panel & Lamp: ≥ 50cm

Distance between the Panel & Eyes of the Inspector: ≥ 30cm

Finger glove (or finger cover) must be worn by the inspector.

Inspection table or jig must be anti-electrostatic.
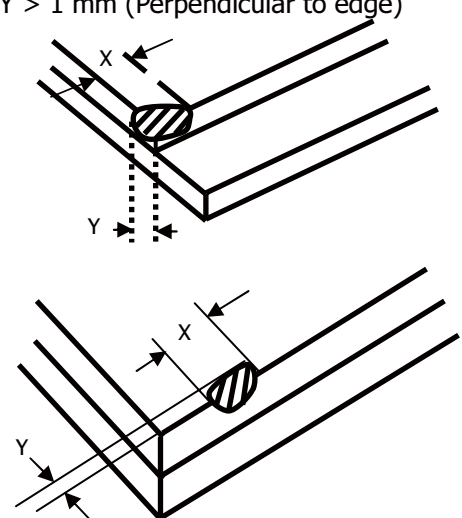
2. Sampling Plan
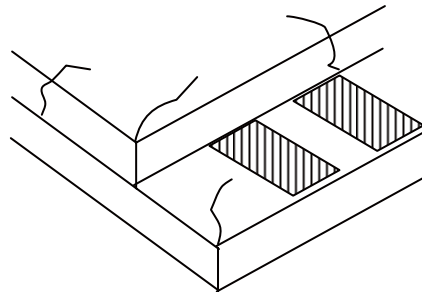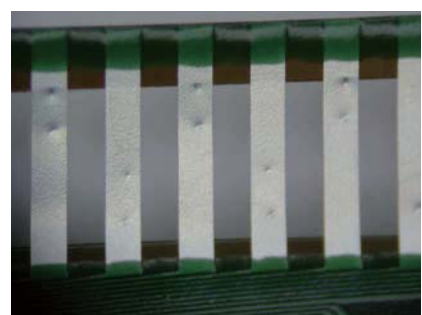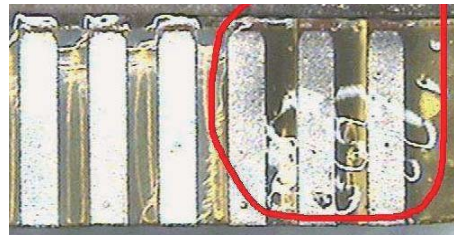
Level II, Normal Inspection, Single Sampling, MIL-STD-105E

3. Criteria & Acceptable Quality Level

Partition	AQL	Definition
Major	0.65	Defects in Pattern Check (Display On)
Minor	1.0	Defects in Cosmetic Check (Display Off)

3.1 Cosmetic Check (Display Off) in Non-Active Area
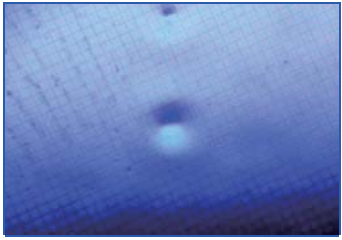
Check Item	Classification	Criteria
Panel General Chipping	Minor	X > 6 mm (Along with Edge) Y > 1 mm (Perpendicular to edge)

Check Item	Classification	Criteria
Panel Crack	Minor	Any crack is not allowable.
Copper Exposed (Even Pin or Film)	Minor	Not Allowable by Naked Eye Inspection
Film or Trace Damage	Minor	
Terminal Lead Prober Mark	Acceptable	
Glue or Contamination on Pin (Couldn't Be Removed by Alcohol)	Minor	
PCB	Major	Wrong parts, missing parts or excess parts.
	Major	Short circuits in components on PCB.
	Minor	Oxidation or contamination PCB terminals.
	Minor	The solder gets on bezel tab pads, OLED pad or screw hold pad are not smooth.
	Minor	Cold solder joints, missing solder connections, oxidation or icicle.
	Minor	Residue or solder balls on PCB.
Ink Marking on PCBA (Exclude on COG module)	Acceptable	Ignore for Any

3.2 Cosmetic Check (Display Off) in Active Area

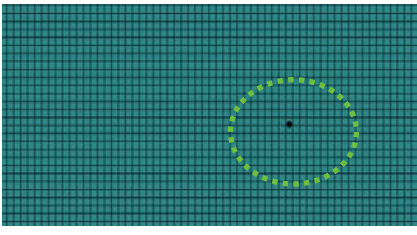It is recommended to execute in clear room environment (class 10k) if actual in necessary.
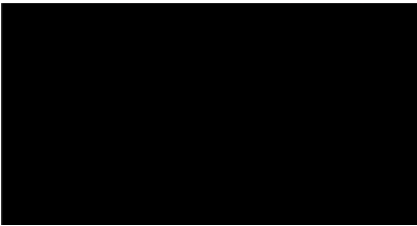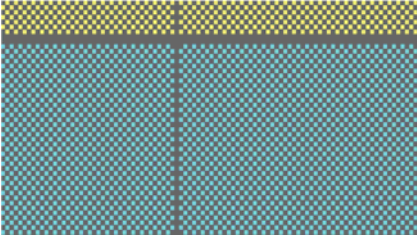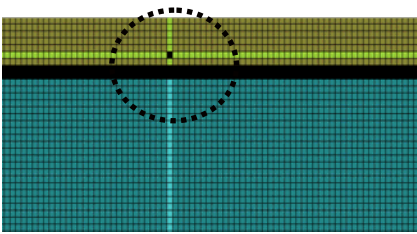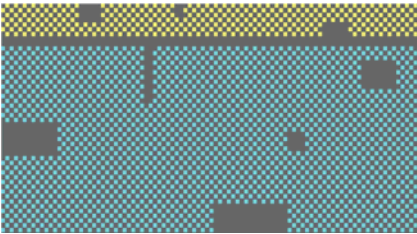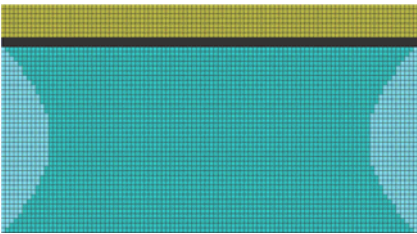
Check Item	Classification	Criteria		
Any Dirt & Scratch on Polarizer's Protective Film	Acceptable	Ignore for not Affect the Polarizer		
Scratches, Fiber, Line-Shape Defect (On Polarizer)	Minor	$W \leq 0.1$ $W > 0.1$ $L \leq 2$ $L > 2$	Ignore $n \leq 1$ $n = 0$	
Dirt, Black Spot, Foreign Material, (On Polarizer)	Minor	$\Phi \leq 0.1$ $0.1 < \Phi \leq 0.25$ $0.25 < \Phi$	Ignore $n \leq 1$ $n = 0$	
Dent, Bubbles, White spot (Any Transparent Spot on Polarizer)	Minor	$\Phi \leq 0.5$ ➜ Ignore if no Influence on Display $0.5 < \Phi \qquad n = 0$ 		
Fingerprint, Flow Mark (On Polarizer)	Minor	Not Allowable		

*   Protective film should not be tear off when cosmetic check.
** Definition of W & L & Φ (Unit: mm): $\Phi = (a + b) / 2$
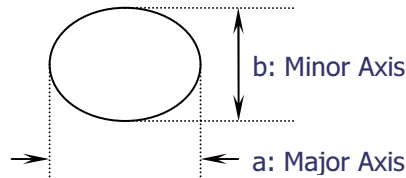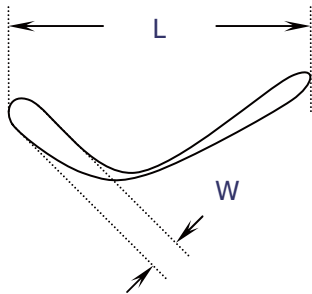
3.3 Pattern Check (Display On) in Active Area

Check Item	Classification	Criteria
No Display	Major	
Missing Line	Major	
Pixel Short	Major	
Darker Pixel	Major	
Wrong Display	Major	
Un-uniform	Major	

■ CAUTIONS IN USING OLED MODULE
◆ Precautions For Handling OLED Module:

1. OLED module consists of glass and polarizer. Pay attention to the following items when handling:

    i. Avoid drop from high, avoid excessive impact and pressure.

    ii. Do not touch, push or rub the exposed polarizers with anything harder than an HB pencil lead.

    iii. If the surface becomes dirty, breathe on the surface and gently wipe it off with a soft dry cloth. If it is terrible dirty, moisten the soft cloth with Isopropyl alcohol or Ethyl alcohol. Other solvents may damage the polarizer. Especially water, Ketone and Aromatic solvents.

    iv. Wipe off saliva or water drops immediately, contact the polarizer with water over a long period of time may cause deformation.

    v. Please keep the temperature within specified range for use and storage. Polarization degradation, bubble generation or polarizer peeling-off may occur with high temperature and high humidity.

    vi. Condensation on the surface and the terminals due to cold or anything will damage, stain or dirty the polarizer, so make it clean as the way of iii.

2. Do not attempt to disassemble or process the OLED Module.

3. Make sure the TCP or the FPC of the Module is free of twisting, warping and distortion, do not pull or bend them forcefully, especially the soldering pins. On the other side, the SLIT part of the TCP is made to bend in the necessary case.

4. When assembling the module into other equipment, give the glass enough space to avoid excessive pressure on the glass, especially the glass cover which is much more fragile.

5. Be sure to keep the air pressure under 120 kPa, otherwise the glass cover is to be cracked.

6. Be careful to prevent damage by static electricity:

    i. Be sure to ground the body when handling the OLED Modules.

    ii. All machines and tools required for assembling, such as soldering irons, must be properly grounded.

    iii. Do not assemble and do no other work under dry conditions to reduce the amount of static electricity generated. A relative humidity of 50%-60% is recommended.

    iv. Peel off the protective film slowly to avoid the amount of static electricity generated.

    v. Avoid to touch the circuit, the soldering pins and the IC on the Module by the body.

    vi. Be sure to use anti-static package.

7. Contamination on terminals can cause an electrochemical reaction and corrade the terminal circuit, so make it clean anytime.

8. All terminals should be open, do not attach any conductor or semiconductor on the terminals.

9. When the logic circuit power is off, do not apply the input signals.

10. Power on sequence: $V_{DD} \rightarrow V_{PP}$ and power off sequence: $V_{PP} \rightarrow V_{DD}$

11. Be sure to keep temperature, humidity and voltage within the ranges of the spec, otherwise shorten Module's life time, even make it damaged.

12. Be sure to drive the OLED Module following the Specification and Datasheet of IC controller, otherwise something wrong may be seen.

13. When displaying images, keep them rolling, and avoid one fixed image displaying more than 30 seconds, otherwise the residue image is to be seen. This is the speciality of OLED.

◆ Precautions For Soldering OLED Module:

1. Soldering temperature : 260°C ± 10°C.
2. Soldering time : 3-4 sec.
3. Repeating time : no more than 3 times.
4. If soldering flux is used, be sure to remove any remaining flux after finishing soldering operation. (This does not apply in the case of a non-halogen type of flux.) It is recommended to protect the surface with a cover during soldering to prevent any damage due to flux spatters.

◆ Precautions For Storing OLED Module:

1. Be sure to store the OLED Module in the vacuum bag with dessicant.
2. If the Module can not be used up in 1 month after the bag being opened, make sure to seal the Module in the vacuum bag with dessicant again.
3. Store the Module in a dark place, do not expose to sunlight or fluorescent light.
4. The polarizer surface should not touch any other objects. It is recommended to store the Module in the shipping container.
5. It is recommended to keep the temperature between 0°C and 30°C , the relative humidity not over 60%.

◆ Limited Warranty

Unless relevant quality agreements signed with customer and law enforcement, for a period of 12 months from date of production, all products (except automotive products) All Shore will replace or repair any of its OLED modules which are found to be functional defect when inspected in accordance with All Sohre OLED acceptance standards (copies available upon request). Cosmetic/visual defects must be returned to All Shore within 90 days of shipment. Confirmation of such date should be based on freight documents. The warranty liability of All Shore is limited to repair and/or replacement on the terms above. All Shore will not be responsible for any subsequent or consequential events.

◆ Return OLED Module Under Warranty:

1. No warranty in the case that the precautions are disregarded.
2. Module repairs will be invoiced to the customer upon mutual agreement. Modules must be returned with sufficient description of the failures or defects.