| Specification | |
|---|---|
| Part Number: | MCOT096016AY-WI |
| Version: | 2 |
| Date: | 31/03/2015 |
| **Revision** | |
| | |

# Content

# Midas Displays OLED Part Number System

| MCO | B | 21605 | A | * | V | - | E | W | I | * |
|-----|---|-------|---|---|---|---|---|---|---|----|
| 1 | 2 | 3 | 4 | 5 | 6 | | 7 | 8 | 9 | 10 |

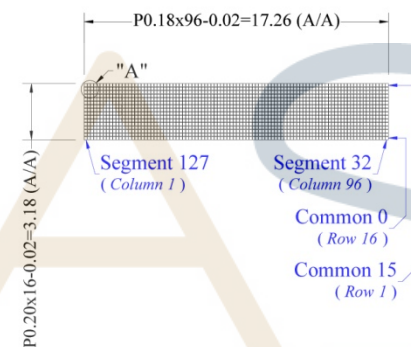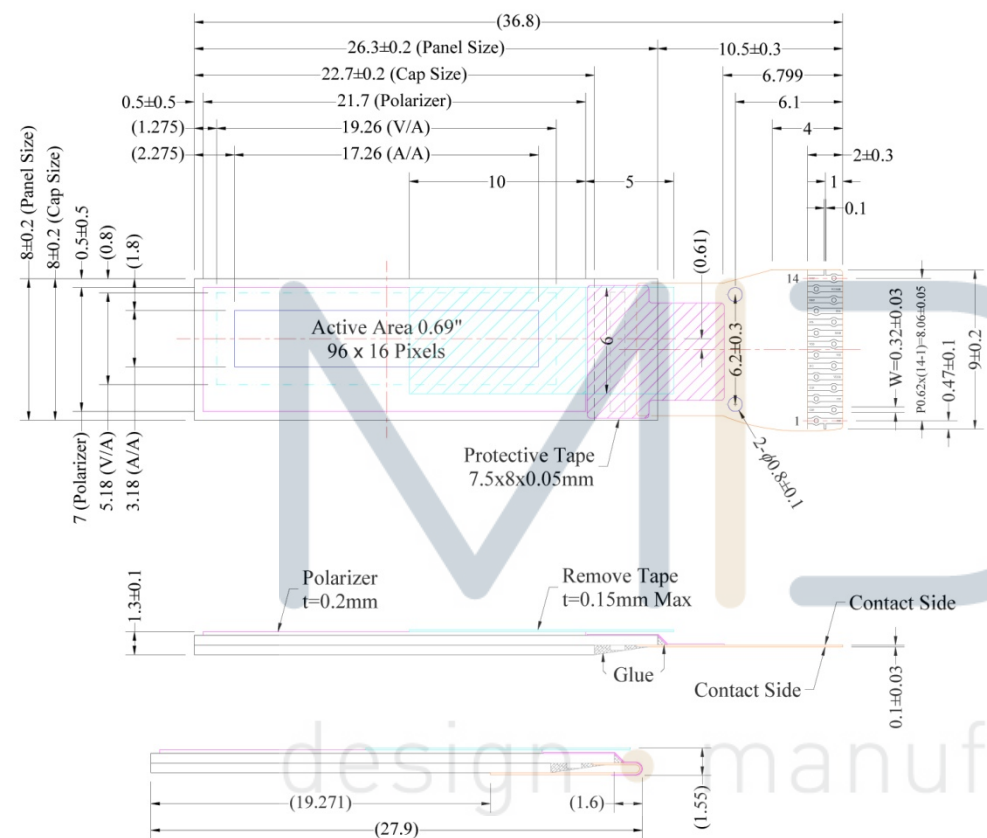| | | | |
|---|---|---|---|
| 1 | = | **MCO:** | Midas Displays OLED |
| 2 | = | **Blank:** | **B**: COB (Chip on Board)   **T**: TAB (Taped Automated Bonding) |
| 3 | = | **No of dots:** | **(**e.g. 240064 = 240 x 64 dots)   (e.g. 21605 = 2 x 16 5mm C.H.) |
| 4 | = | **Series** | A to Z |
| 5 | = | **Series Variant:** | A to Z and 1 to 9 **– see addendum** |
| 6 | = | **Operating Temp Range:** | **A:** -30+85° C   **V:** -40+80° C   **Y:** -40 +70° C   **Z:** -30+70° C<br>**X**: -40 +85° C |
| 7 | = | **Character Set:** | **Blank**: Not Applicable<br>**E:** Multi European Font Set (English/Japanese – Western European (K) – Cyrillic (R)) |
| 8 | = | **Colour:** | **Y:** Yellow   **W:** White   **B:** Blue   **R:** Red   **G:** Green   **RGB**: Full Colour |
| 9 | = | **Interface:** | **P:** Parallel   **I:** I²C   **S:** SPI   **M:** Multi |
| 10 | = | **Voltage Variant:** | e.g. **3** = 3v |

# Functions and Features

- 96X16 Graphic
- Built-in controller
- viewing angle Free
- Wide Temperature-40℃ ~ +80℃ óOperating)
- RoHS compliant

# Mechanical Specification

| Item | Description | |
|---|---|---|
| Product No. | MCOT096016AY-WI | |
| Inch | 0.69” | |
| Color | White | |
| Active Area | 17.26(W)×3.18(H) | mm |
| Panel Size | 26.30(W)×8.00(H)×1.30 (D)mm | mm |
| Dot Size | 0.16(W)×0.18(H) | mm |
| Dot Pitch | 0.18(W)×0.20(H) | mm |
| Display Format | 96 ×16 | |
| Duty Ratio | 1/16 Duty | Duty |
| Controller | SSD1306 or Equivalent | |
| Operation Temperature | -40~80 | °C |
| Storage Temperature | -40~85 | °C |
| Response Time | ≤10 | us |
| Assembly | Soldering | |

MIDAS
design • manufacture • supply

# Mechanical Drawing



(36.8)

26.3±0.2 (Panel Size)

22.7±0.2 (Cap Size)

21.7 (Polarizer)

19.26 (V/A)

17.26 (A/A)

10.5±0.3

6.799

6.1

4

2±0.3

0.5±0.5

(1.275)

(2.275)

10

5

1

0.1

(0.61)

8±0.2 (Panel Size)

8±0.2 (Cap Size)

0.5±0.5

(0.8)

(1.8)

Active Area 0.69"
96 x 16 Pixels

6.2±0.3

W=0.32±0.03

P0.62x(14-1)=8.06±0.05

0.47±0.1

9±0.2

14

1

9

2-φ0.8±0.1

7 (Polarizer)

5.18 (V/A)

3.18 (A/A)

Protective Tape
7.5x8x0.05mm

P0.18x96-0.02=17.26 (A/A)

"A"

Segment 127
( Column 1 )

Segment 32
( Column 96 )

Common 0
( Row 16 )

Common 15
( Row 1 )

P0.20x16-0.02=3.18 (A/A)

Polarizer
t=0.2mm

Remove Tape
t=0.15mm Max

Contact Side

1.3±0.1

Glue

Contact Side

0.1±0.03

(19.271)

(1.6)

(1.55)

(27.9)

0.18

0.16

0.2

0.18

Detail "A"
Scale (10:1)

B

Notes:

(Reference Mechnical Design)

1. Color: White
2. Driver IC: SSD1306
3. FPC Number: UT-0206-P02
4. Interface: I2C
5. General Tolerance: ±0.30
6. The total thickness (1.40 Max) is without polarizer protective film & remove tape.
   The actual assembled total thickness with above materials should be 1.65 Max.
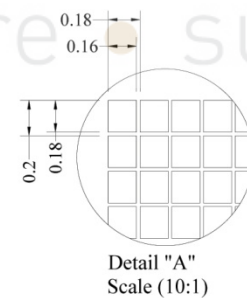
| Pin | Symbol |
|-----|--------|
| 1 | C2P |
| 2 | C2N |
| 3 | C1P |
| 4 | C1N |
| 5 | VDDB |
| 6 | N.C. |
| 7 | VSS |
| 8 | VDD |
|  | RES# |
|  | SCL |
| 11 | SDA |
| 12 | IREF |
| 13 | VCOMH |
| 14 | VCC |

# Pin Description

**Power Supply**

| Pin Number | Symbol | Type | Function |
|---|---|---|---|
| 8 | VDD | | **Power Supply for Logic Circuit**<br>This is a voltage supply pin. It must be connected to external source. |
| 7 | VSS | P | **Ground of OEL System**<br>This is a ground pin. It also acts as a reference for the logic pins. It must be connected to external ground. |
| 14 | VCC | | **Power Supply for OEL Panel**<br>This is the most positive voltage supply pin of the chip. It must be supplied externally. |

**Driver**

| Pin Number | Symbol | Type | Function |
|---|---|---|---|
| 12 | IREF | I | **Current reference for Brightness Adjustment**<br>This pin is segment current reference pin. A resistor should be connected between this pin and VSS. Set the current at 10μA maximum. |
| 13 | VCOMH | O | **Voltage Output High Level for COM Signal**<br>This pin is the input pin for the voltage output high level for COM signals. A tantalum capacitor should be connected between this pin and VSS. |

**DC/DC Converter**

| Pin Number | Symbol | Type | Function |
|---|---|---|---|
| 5 | VDDB | P | **Power Supply for DC/DC Converter Circuit**<br>This is the power supply pin for the internal buffer of the DC/DC voltage converter. It must be connected to external source when the converter is used. It should be connected to V$_{DD}$ when the converter is not used. |
| 3/4<br>1/2 | C1P/C1N<br>C2P/C2N | I | **Positive Terminal of the Flying Inverting　Capacitor**<br>**Negative Terminal of the Flying　Boost　Capacitor**<br>The charge-pump capacitors are required between the terminals. They must be floated when the converter is not used. |

**Interface**

| Pin Number | Symbol | Type | Function |
|---|---|---|---|
| 9 | RES# | I | **Power Reset for Controller and Driver**<br>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. |
| 10 | SCL | | **I2C Bus Clock Signal**<br>The transmission if information in the I2C bus is following a clock signal. Each transmission of data bit is taken place during a single clock period of this pin. |
| 11 | SDA | I/O | **I2C Bus Data Signal**<br>This pin acts as a communication channel between the transmitter and the receiver. |

**Reserve**

| Pin Number | Symbol | Type | Function |
|---|---|---|---|
| 6 | N.C. | - | **Reserved Pin**<br>The N.C. pin between function pins is reserved for compatible and flexible design. It must be floated. |

# Block Diagram
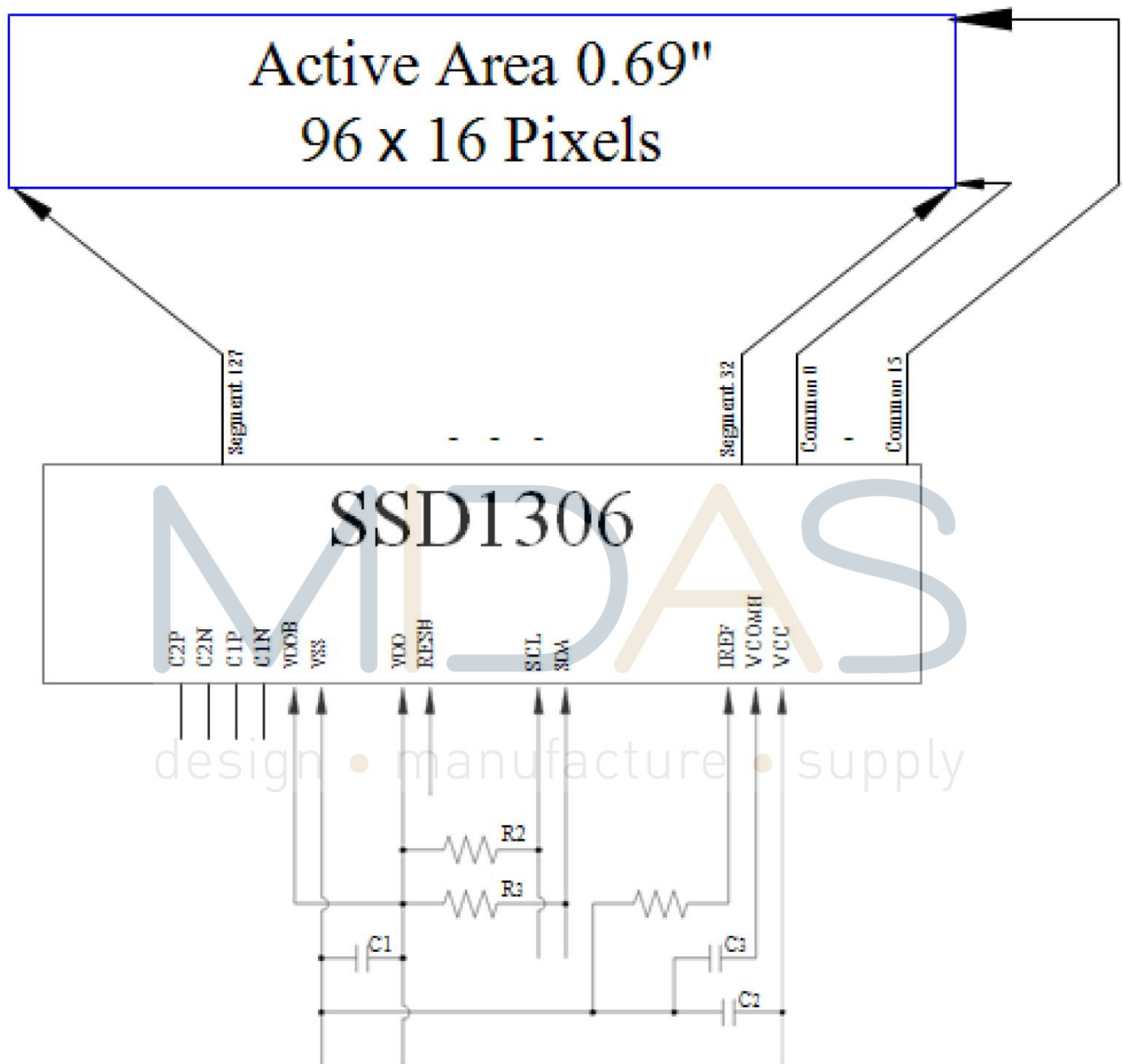
Pins connected to MCU interface: RES#, SCL, and SDA

C1: 1µF

C2: 4.7µF

C3: 4.7µF / 16V X7R

R1: 820kΩ, R1 = (Voltage at IREF - VSS) / IREF
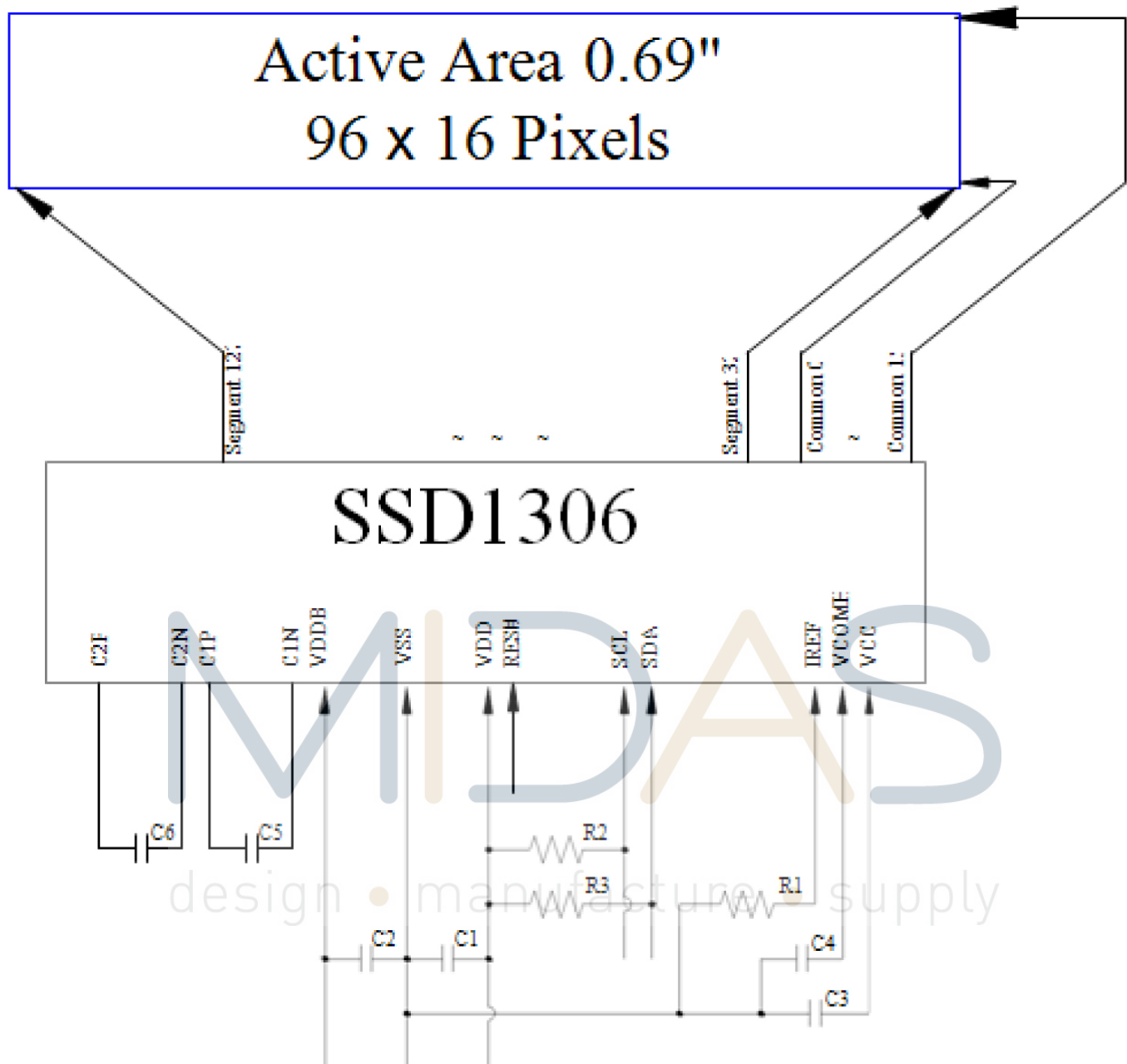
R2, R3: 2k

Pins connected to MCU interface: RES#, SCL, and SDA

C1, C2: 1µF

C3: 2.2µF

C4: 4.7µF / 16V X7R

C5, C6: 1µF / 16V X5R

R1: 820kΩ, R1 = (Voltage at IREF - VSS) / IREF

R2, R3: 2k

# DC Characteristics

| Item | Symbol | Condition | Min. | Type | Max. | Unit |
|---|---|---|---|---|---|---|
| Supply Voltage for Logic | VCI | | 1.65 | 2.8 | 3.3 | Volt |
| Supply Voltage for Display (Supplied Externally) | VCC | Note 4 (Internal DC/DC Disable) | 7.0 | 7.25 | 7.5 | Volt |
| Supply Voltage for DC/DC | VDDB | Internal DC/DC Enable | 3.3 | - | 4.2 | Volt |
| Supply Voltage for Display (Generated by Internal DC/DC) | VCC | Note 4 (Internal DC/DC Disable) | 7.0 | - | 7.5 | Volt |
| Operating Current for VDD | IDD | | - | 180 | 300 | µA |
| Operating Current for VCC (VCC Supplied Externally) | ICC | Note 5 | - | 2.0 | 3.0 | mA |
| | | Note 6 | - | 2.5 | 3.8 | mA |
| | | Note 7 | - | 5.0 | 7.5 | mA |
| Operating Current for VCC (VCC Generated by Internal DC/DC) | IDDB | Note 5 | - | 3.5 | 5.3 | mA |
| | | Note 6 | - | 4.0 | 6.0 | mA |
| | | Note 7 | - | 4.5 | 6.8 | mA |
| Sleep Mode Current for VDD | IDD,SLEEP | | | 1 | 5 | µA |
| Sleep Mode Current for VCC | ICC,SLEEP | | - | 2 | 10 | µA |

Note 4: Brightness (Lbr) and Supply Voltage for Display (VCC) are subject to the change of the panel characteristics and the customer's request.

Note 5: VDD = 2.8V, VCC = 7.25V, 30% Display Area Turn on.

Note 6: VDD = 2.8V, VCC = 7.25V, 50% Display Area Turn on.

Note 7: VDD = 2.8V, VCC = 7.25V, 100% Display Area Turn on.

# Optical Characteristics

| Item | Symbol | Conditions | Min. | Typ | Max. | Unit |
|---|---|---|---|---|---|---|
| Brightness(White) | Lbr | Note 4 | 120 | 150 | - | cd/$m^2$ |
| C.I.E. (White) | (X) | C.I.E 1931 | 0.25 | 0.29 | 0.33 | |
| | (Y) | | 0.27 | 0.31 | 0.35 | |
| Dark Room Contrast | CR | - | - | >10000:1 | - | |
| Viewing angle range | - | - | - | Free | - | Degree |

* Optical measurement taken at VDD = 2.8V, VCC = 7.25V.

# Absolute Maximum rating

| Item | Symbol | Min. | Typ. | Max. | Unit | Notes |
|------|--------|------|------|------|------|-------|
| Supply Voltage for Logic | VDD | -0.3 | - | 4 | Volt | 1,2 |
| Supply Voltage for Display | Vcc | 0 | - | 11 | Volt | 1,2 |
| Life Time (80 cd/$\mathrm{m^2}$) | | --- | 40,000 | --- | Hour | 3 |

Note 1: All the above voltages are on the basis of "VSS = 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 Section 3. "Optics ". If this module is used beyond these conditions, malfunctioning of the module can occur and the reliability of the module may deteriorate.

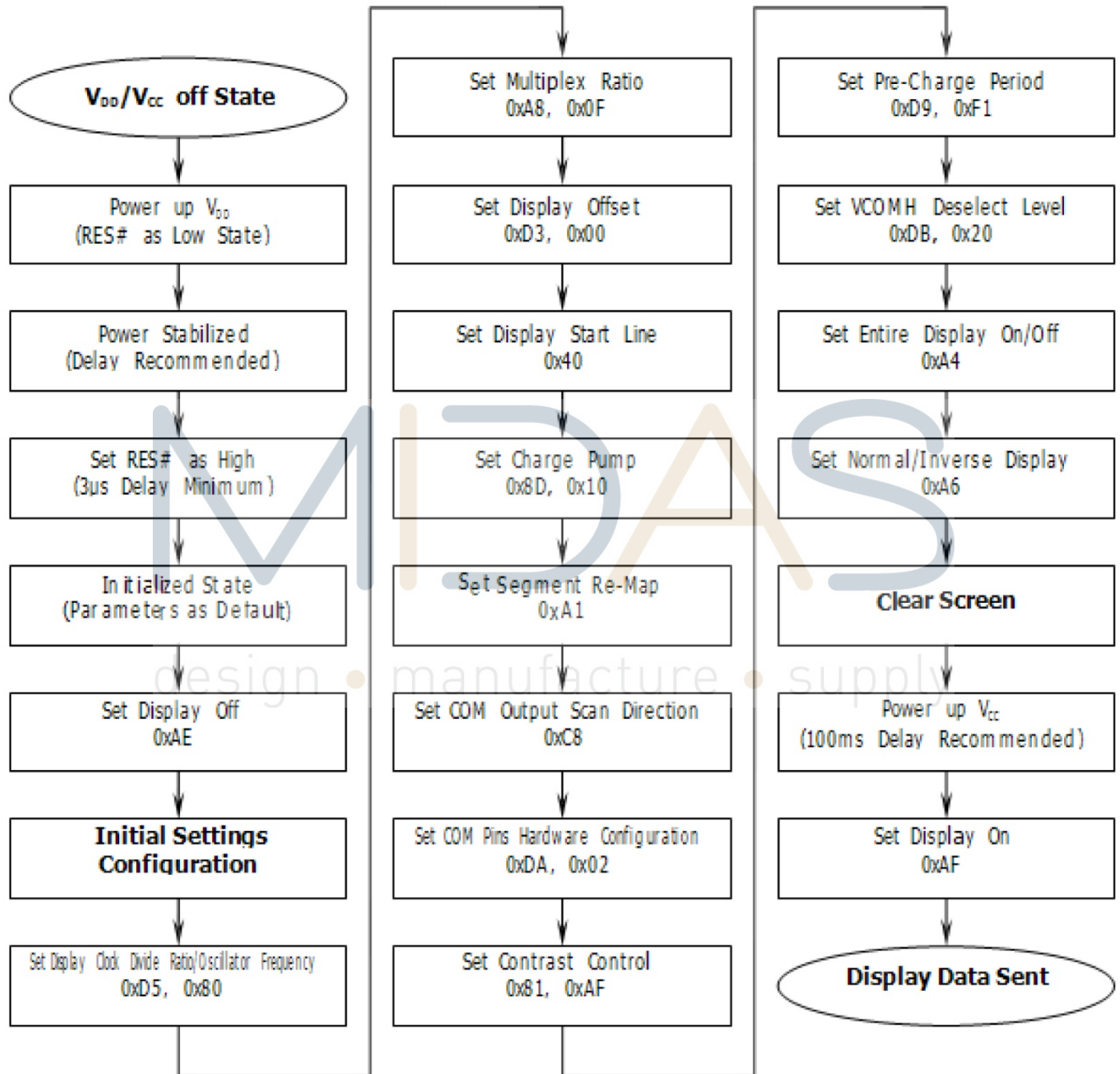Note 3: VCC = 7.25V, Ta = 25°C, 50% Checkerboard.


# AC Characteristics

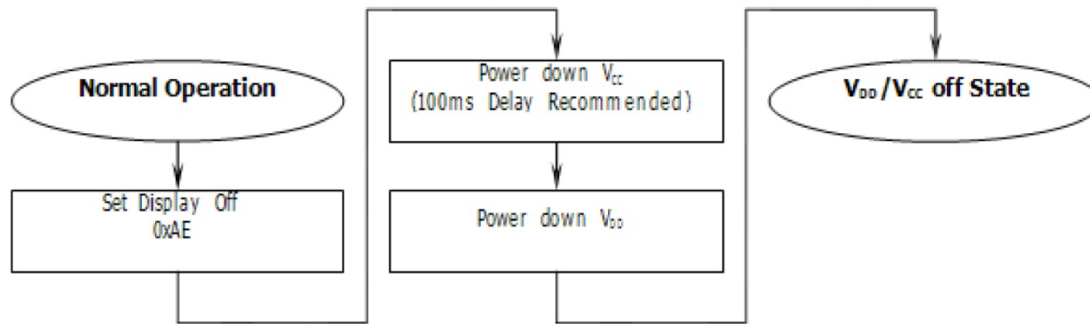please refer "SSD1306 specification.

# Actual Application Example

Command usage and explanation of an actual example

< Initialization>

**Column 1:**

**V$_{DD}$/V$_{CC}$ off State**

↓

Power up V$_{DD}$
(RES# as Low State)

↓

Power Stabilized
(Delay Recommended)

↓

Set RES# as High
(3µs Delay Minimum)

↓

Initialized State
(Parameters as Default)

↓

Set Display Off
0xAE

↓

**Initial Settings Configuration**

↓

Set Display Clock Divide Ratio/Oscillator Frequency
0xD5, 0x80

**Column 2:**

Set Multiplex Ratio
0xA8, 0x0F

↓

Set Display Offset
0xD3, 0x00

↓

Set Display Start Line
0x40

↓

Set Charge Pump
0x8D, 0x10

↓

Set Segment Re-Map
0xA1

↓

Set COM Output Scan Direction
0xC8

↓

Set COM Pins Hardware Configuration
0xDA, 0x02

↓

Set Contrast Control
0x81, 0xAF

**Column 3:**

Set Pre-Charge Period
0xD9, 0xF1

↓

Set VCOMH Deselect Level
0xDB, 0x20

↓

Set Entire Display On/Off
0xA4

↓

Set Normal/Inverse Display
0xA6

↓

**Clear Screen**

↓

Power up V$_{CC}$
(100ms Delay Recommended)

↓

Set Display On
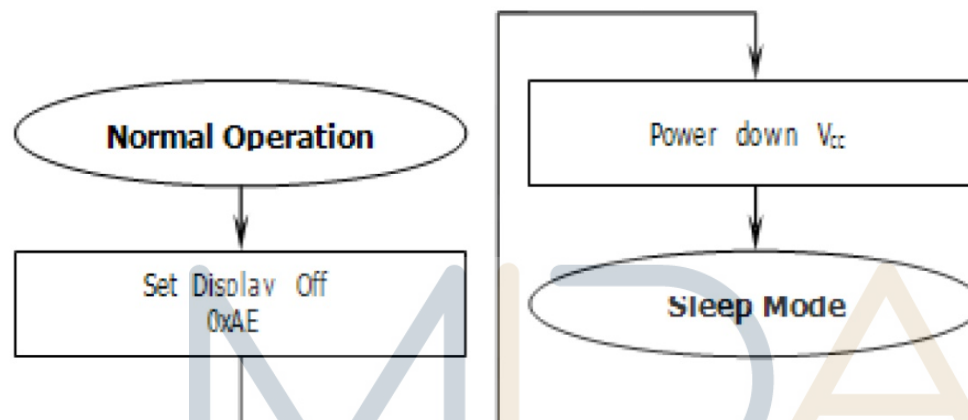0xAF

↓

**Display Data Sent**

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          Power down V_cc              V_DD/V_cc off State
                      (100ms Delay Recommended)

Set Display Off            Power down V_DD
    0xAE
```

<Entering Sleep Mode>

```
Normal Operation          Power down V_cc

Set Display Off           Sleep Mode
    0xAE
```

<Exiting Sleep Mode>

```
Sleep Mode                Set Display On
                              0xAF

Power up V_cc             Normal Operation
(100ms Delay Recommended)
```