Display Elektronik GmbH

# DATA SHEET

## STANDARD OLED/PLED

# DEP 096032B-W

***Product Specification*** ***Version : 01***

**02.03.2009**

**History of Version**

| Version | Contents | Date | Note |
|---|---|---|---|
| 01 | NEW VERSION | 2009/03/02 | SPEC. |
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**C O N T E N T S**

## 1. Numbering System

## 2. General Specification

(1) Mechanical Dimension

| Item | Standard Value | Unit |
|---|---|---|
| Number of dots | 96x32 | dots |
| Module dimension (L*W*H) | 28.5*11.5*1.41(MAX) | mm |
| Active area | 19.18*6.38 | mm |
| Dot size | 0.18(W)X0.18(H) | mm |
| Dot pitch | 0.20(W)X0.20 (H) | mm |
| Color | White | |

(2) Controller IC: SSD1307 Controller

(3) Temperature Range

| | |
|---|---|
| Operating | -40 ~ +70℃ |
| Storage | -40 ~ +85℃ |

## 3. Absolute Maximum Ratings

| Item | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Operating Temperature | TOP | -40 | — | +70 | ℃ |
| Storage Temperature | TST | -40 | — | +85 | ℃ |
| Humidity | | — | — | 85 | % |
| Supply Voltage For Logic | VDD | -0.3 | — | 4 | V |
| Supply Voltage For Panel | Vcc | 7 | — | 16 | V |
| Operating lifetime | | | 30,000(*) | | Hrs |

*:100cd/$m^2$ light on

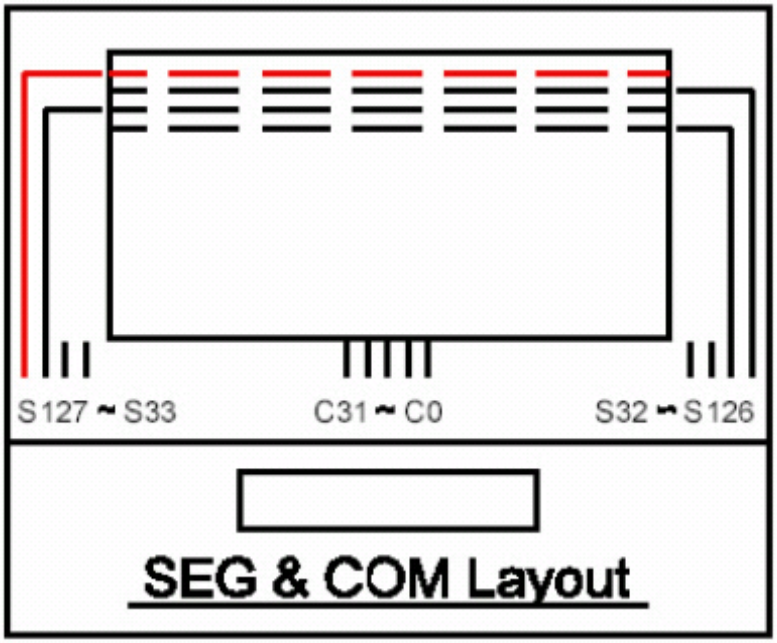
## 4. Electrical Characteristics

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Supply Voltage For Logic | $V_{DD}$-$V_{SS}$ | — | 1.65 | 2.8 | 3.3 | V |
| Supply Voltage For Panel | Vcc-$V_{SS}$ | — | 11.5 | 12 | 12.5 | V |
| Input High Vol | $V_{IH}$ | — | 0.8$V_{DD}$ | — | — | V |
| Input Low Vol | $V_{IL}$ | — | — | — | 0.2$V_{DD}$ | V |
| Output High Vol | $V_{OH}$ | — | 0.9$V_{DD}$ | — | — | V |
| Output Low Vol. | $V_{OL}$ | — | — | — | 0.1$V_{DD}$ | V |
| Supply Current For Logic | $I_{DD}$ | All pixels on | — | 5 | 6 | mA |

## 5. Optical Characteristics

| Item | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|
| View Angle | 160 | — | — | deg |
| Dark Room contrast | 2000:1 | — | — | — |
| Response Time | — | 10 | — | us |

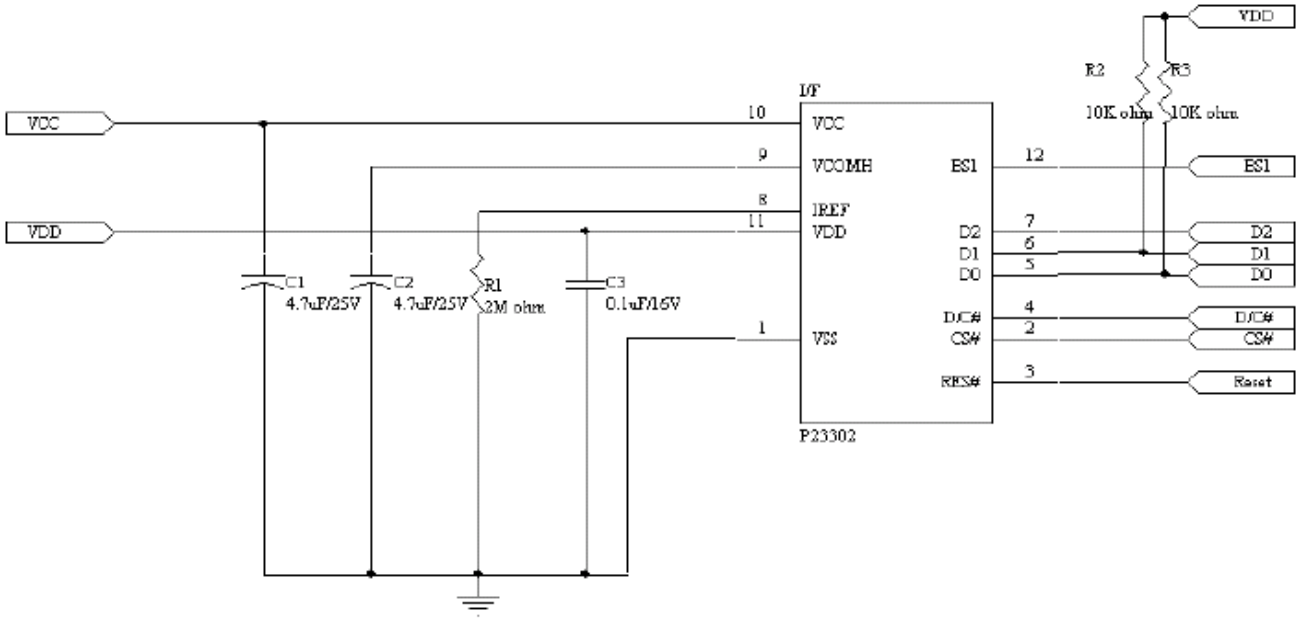
## 6. Panel Layout Diagram



## 7. Interface Pin Function

| Pin No. | Symbol | Description |
|---|---|---|
| 1 | VSS | This is a ground pin. |
| 2 | RES | This pin is the chip select input. |
| 3 | CS | Hardware reset signal |
| 4 | D/C | In 4-wire Serial mode, this is Data/Command control pin. In I2C mode, this pin acts as SA0 for slave address selection. |
| 5 | D0 | 4-wire SPI: SCLK I2C: SCL |
| 6 | D1 | 4-wire SPI: SDIN I2C: SDAIN |
| 7 | D2 | 4-wire SPI: NC I2C: SDAOUT |
| 8 | IREF | The current reference input pin, this pin should be connected to ground through a resistor |
| 9 | VCOMH | The COM voltage reference pin, this pin should be connected to ground through a capacitor. |
| 10 | VCC | Positive OLED high voltage power supply |
| 11 | VDD | Power supply for logic circuit |
| 12 | BS1 | MCU Bus Interface Pin Selection 0: 4-wire Serial Interface 1: I2C Interface |

## 8. Power Supply For LCD Module




**Component：**

**C1、C2：4.7uF/16V(0805)**

**C3：0.1uF/16V(0603)**

**R1：2M ohm 1%(0603)**

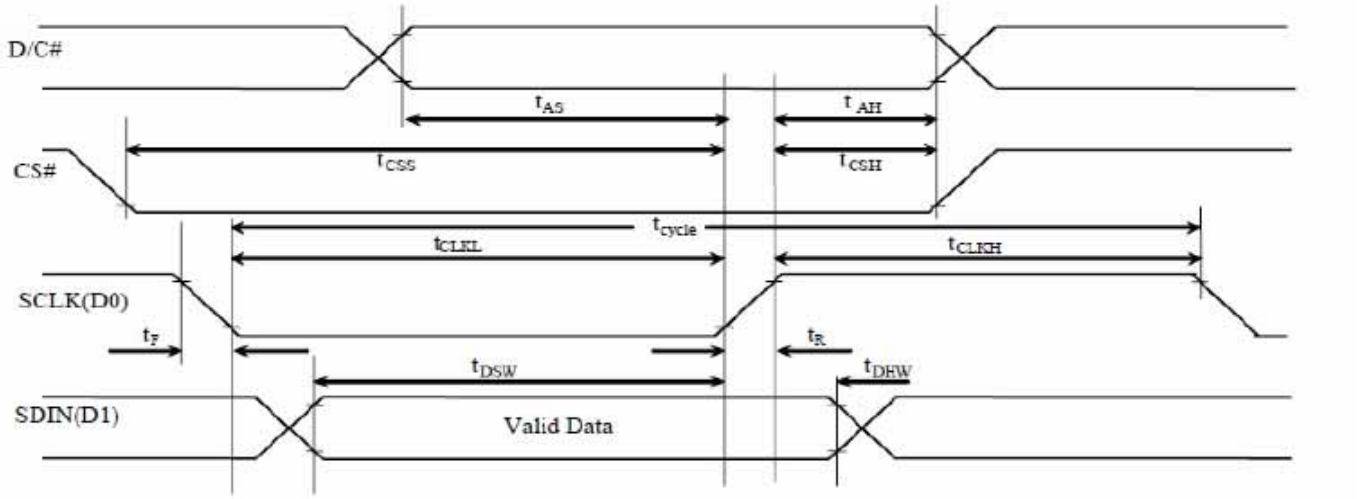
**R2、R3：10K ohm (0603)**

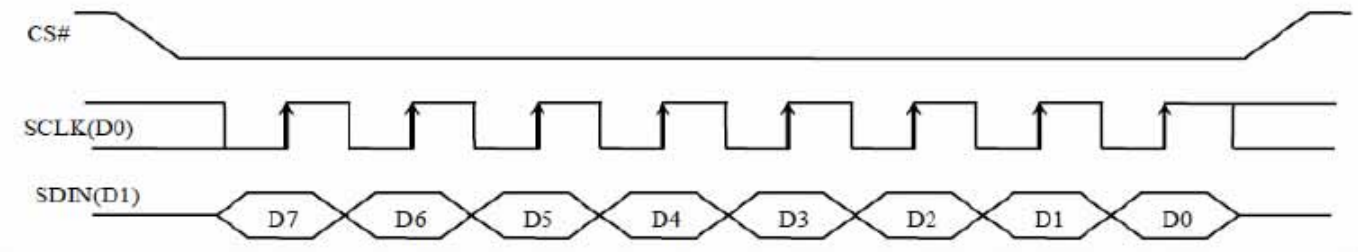
**This circuit is for $I^2C$ Interface**

## 9. Timing Characteristics

9-1.SPI Interface

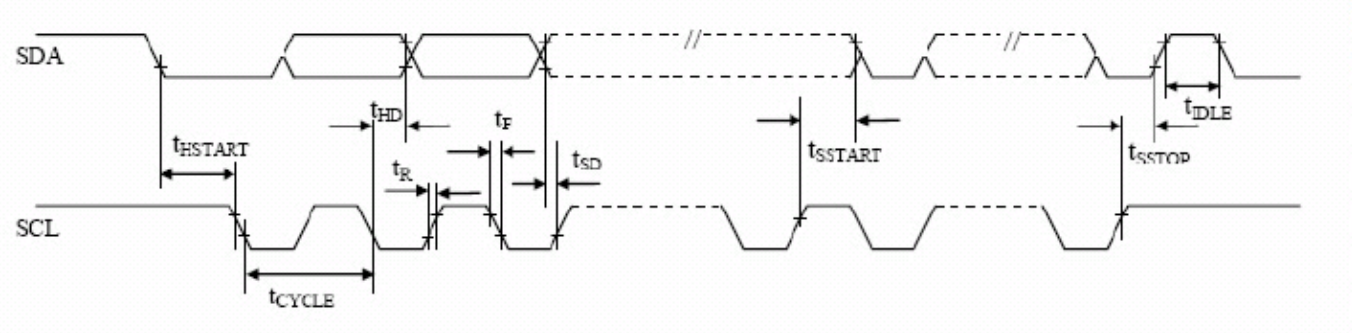
| Symbol | Parameter | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| $t_{cycle}$ | Clock Cycle Time | 100 | - | - | ns |
| $t_{AS}$ | Address Setup Time | 15 | - | - | ns |
| $t_{AH}$ | Address Hold Time | 15 | - | - | ns |
| $t_{CSS}$ | Chip Select Setup Time | 20 | - | - | ns |
| $t_{CSH}$ | 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 | - | - | 40 | ns |
| $t_F$ | Fall Time | - | - | 40 | ns |



9-2.I2C Interface

| Symbol | Parameter | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| $t_{cycle}$ | Clock Cycle Time | 2.5 | - | - | us |
| $t_{HSTART}$ | Start condition Hold Time | 0.6 | - | - | us |
| $t_{HD}$ | Data Hold Time (for "$SDA_{OUT}$" pin) | 0 | - | - | ns |
| | Data Hold Time (for "$SDA_{IN}$" pin) | 300 | - | - | ns |
| $t_{SD}$ | Data Setup Time | 100 | - | - | ns |
| $t_{SSTART}$ | Start condition Setup Time (Only relevant for a repeated Start condition) | 0.6 | - | - | us |
| $t_{SSTOP}$ | Stop condition Setup Time | 0.6 | - | - | us |
| $t_R$ | 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 | - | - | us |

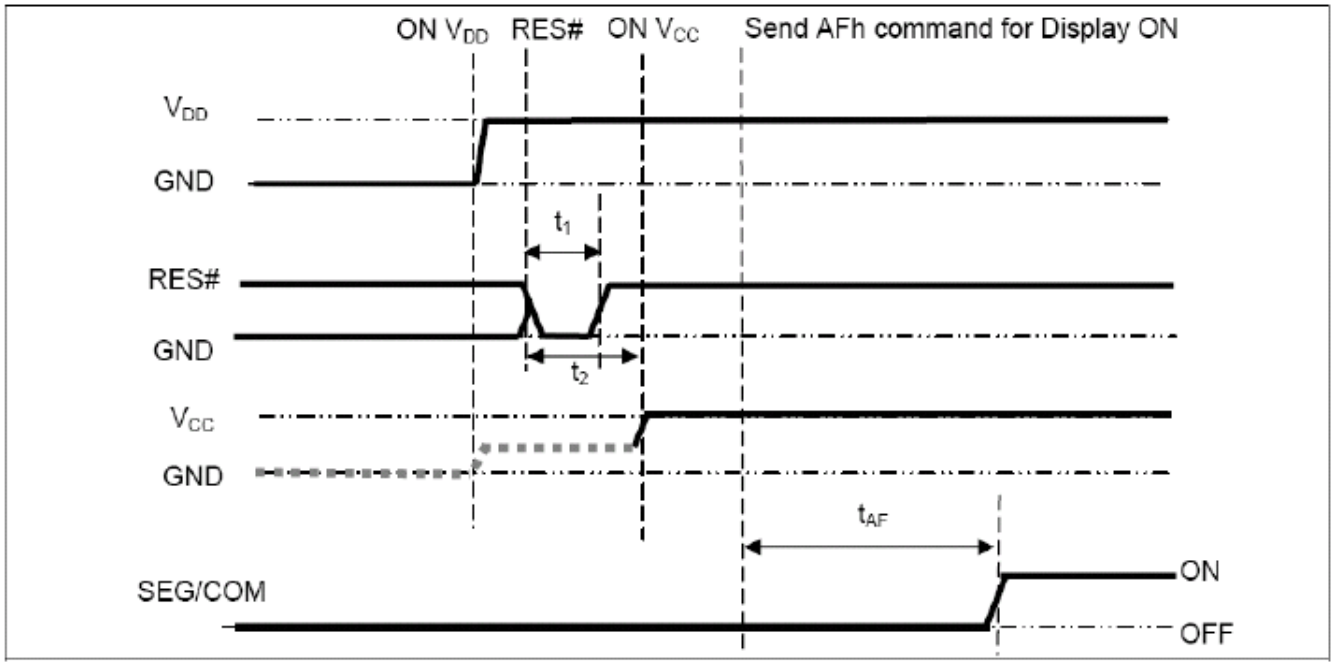


# 10. Power ON / OFF Sequence & Application Circuit

## 10.1 POWER ON / OFF SEQUENCE

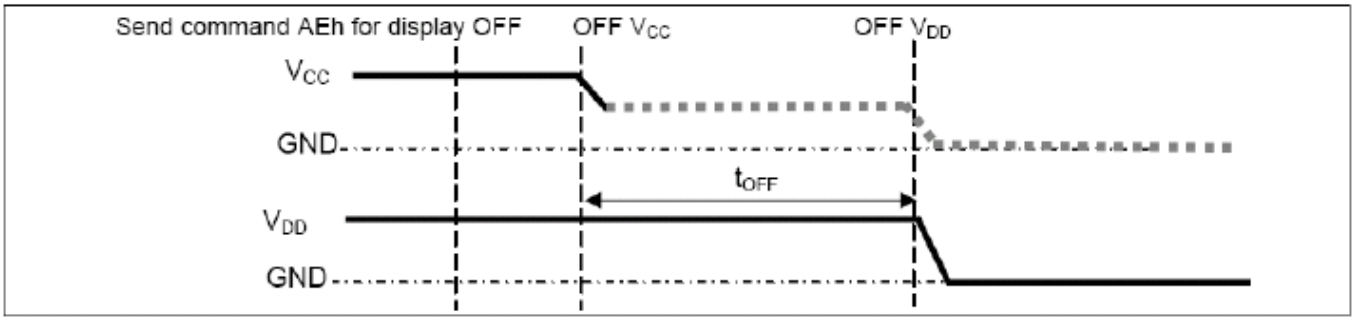
**Power ON sequence**:

1. Power ON $V_{DD}$.
2. After $V_{DD}$ become stable, set RES# pin LOW (logic low) for at least 3us($t_1$) and then HIGH (logic high).
3. After set RES# pin LOW (logic low ), wait for at least 3us($t_2$).Then Power ON $V_{CC}$.(1)
4. After $V_{CC}$ become stable, send command AFh for display ON. SEG/COM wil be ON after 100ms($t_{AF}$).




**Power OFF sequence:**

1. Send command AEh for display OFF.
2. Wait until panel discharges completely.
3. Power OFF $V_{CC}$. (1), (2)
4. Wait for $t_{OFF}$. Power OFF $V_{DD}$. (where Minimum $t_{OFF}$=80ms, Typical $t_{OFF}$=100ms )




Note:

(1) Since an ESD protection circuit is connected between VDD and VCC,VCC becomes lower than VDD whenever VDD is ON and VCC is OFF as shown in the dotted line of VCC in above figures.

(2)VCC should be disabled when it is OFF.

## 11. GRAPHIC DISPLAY DATA RAM ADDRESS MAP

The GDDRAM is a bit mapped static RAM holding the bit pattern to be displayed.

The size of the RAM is 128 x 39 bits and the RAM is divided into five pages, from PAGE0 to PAGE4, which are used for monochrome 128x39 dot matrix display, as shown in below figures.

When one data byte is written into GDDRAM, all the rows image data of the same page of the current column are filled (i.e. the whole column (8 bits) pointed by the column address pointer is filled.). Data bit D0 is written into the top row, while data bit D7 is written into bottom row. For PAGE4, bit D7 is treated as don't care bit.

For mechanical flexibility, re-mapping on both Segment and Common outputs can be selected by software. For vertical shifting of the display, an internal register storing the display start line can be set to control the portion of the RAM data to be mapped to the display (command D3h).

**GDDRAM pages structure of SSD1307**

| Segment re-mapping (command A1h) | | SEG127 | SEG126 | SEG125 | SEG124 | ..... | SEG4 | SEG3 | SEG2 | SEG1 | SEG0 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Segment re-mapping (command A0h [RESET]) | | SEG0 | SEG1 | SEG2 | SEG3 | ..... | SEG123 | SEG124 | SEG125 | SEG126 | SEG127 | | |
| Page | Data | COL0 | COL1 | COL2 | COL3 | ..... | COL123 | COL124 | COL125 | COL126 | COL127 | COM Output Scan Direction (command C0h [RESET]) | COM Output Scan Direction (command C8h) |
| 0 | D0 | | | | | ..... | | | | | | COM0 | COM38 |
| | D1 | | | | | | | | | | | COM1 | COM37 |
| | D2 | | | | | | | | | | | COM2 | COM36 |
| | D3 | | | | | | | | | | | COM3 | COM35 |
| | D4 | | | | | | | | | | | COM4 | COM34 |
| | D5 | | | | | | | | | | | COM5 | COM33 |
| | D6 | | | | | | | | | | | COM6 | COM32 |
| | D7 | | | | | | | | | | | COM7 | COM31 |
| 1 | D0 | | | | | ..... | | | | | | COM8 | COM30 |
| | D1 | | | | | | | | | | | COM9 | COM29 |
| | D2 | | | | | | | | | | | COM10 | COM28 |
| | D3 | | | | | | | | | | | COM11 | COM27 |
| | D4 | | | | | | | | | | | COM12 | COM26 |
| | D5 | | | | | | | | | | | COM13 | COM25 |
| | D6 | | | | | | | | | | | COM14 | COM24 |
| | D7 | | | | | | | | | | | COM15 | COM23 |
| 2 | D0 | | | | | ..... | | | | | | COM16 | COM22 |
| | D1 | | | | | | | | | | | COM17 | COM21 |
| | D2 | | | | | | | | | | | COM18 | COM20 |
| | D3 | | | | | | | | | | | COM19 | COM19 |
| | D4 | | | | | | | | | | | COM20 | COM18 |
| | D5 | | | | | | | | | | | COM21 | COM17 |
| | D6 | | | | | | | | | | | COM22 | COM16 |
| | D7 | | | | | | | | | | | COM23 | COM15 |
| 3 | D0 | | | | | ..... | | | | | | COM24 | COM14 |
| | D1 | | | | | | | | | | | COM25 | COM13 |
| | D2 | | | | | | | | | | | COM26 | COM12 |
| | D3 | | | | | | | | | | | COM27 | COM11 |
| | D4 | | | | | | | | | | | COM28 | COM10 |
| | D5 | | | | | | | | | | | COM29 | COM9 |
| | D6 | | | | | | | | | | | COM30 | COM8 |
| | D7 | | | | | | | | | | | COM31 | COM7 |
| 4 | D0 | | | | | ..... | | | | | | COM32 | COM6 |
| | D1 | | | | | | | | | | | COM33 | COM5 |
| | D2 | | | | | | | | | | | COM34 | COM4 |
| | D3 | | | | | | | | | | | COM35 | COM3 |
| | D4 | | | | | | | | | | | COM36 | COM2 |
| | D5 | | | | | | | | | | | COM37 | COM1 |
| | D6 | | | | | | | | | | | COM38 | COM0 |
| | D7 | Don't care bit | | | | | | | | | | | |

Each box represents one bit of image data

## 12. Reliability

■Content of Reliability Test

| NO. | Items. | Specification | Applicable Standard |
|---|---|---|---|
| **1** | High temp. (Non-operation) | 85°C, 240hrs | —— |
| **2** | High temp. (Operation) | 70°C, 120hrs | —— |
| **3** | Low temp. (Operation) | -40°C, 120hrs | —— |
| **4** | High temp. / High. humidity (Operation) | 65°C, 90%RH, 120hrs | —— |
| **5** | Thermal shock(Non-operation) | -40°C ~85°C (-40°C /30min; transit /3min; 85°C /30min; transit /3min) 1cycle: 66min, 100 cycles. | —— |
| **6** | Vibration | Frequency : 5~50HZ, 0.5G<br>Scan rate : 1 oct/min<br>Time : 2 hrs/axis<br>Test axis : X, Y, Z | —— |
| **7** | Drop | Height: 120cm<br>Sequence : 1 angle、3 edges and faces<br>Cycles: 1 | —— |
| **8** | ESD (Non-operation) | Air discharge model, ±8kV, 10 times | —— |

# 13. Appendix ( Drawing )