

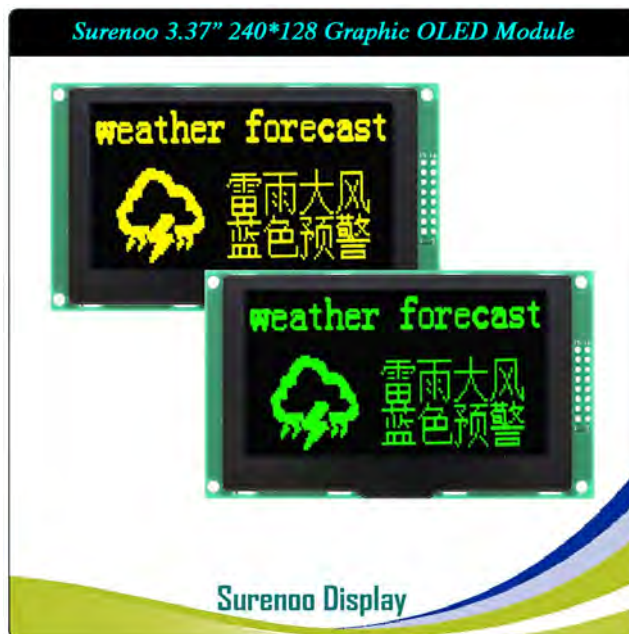


# SURENOO GRAPHIC OLED SERIES DISPLAY

## Product Specification

Part Name: OEL Display Module  
Model No.: SOG240128A\_M337

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Graphic OLED Display Selection Guide

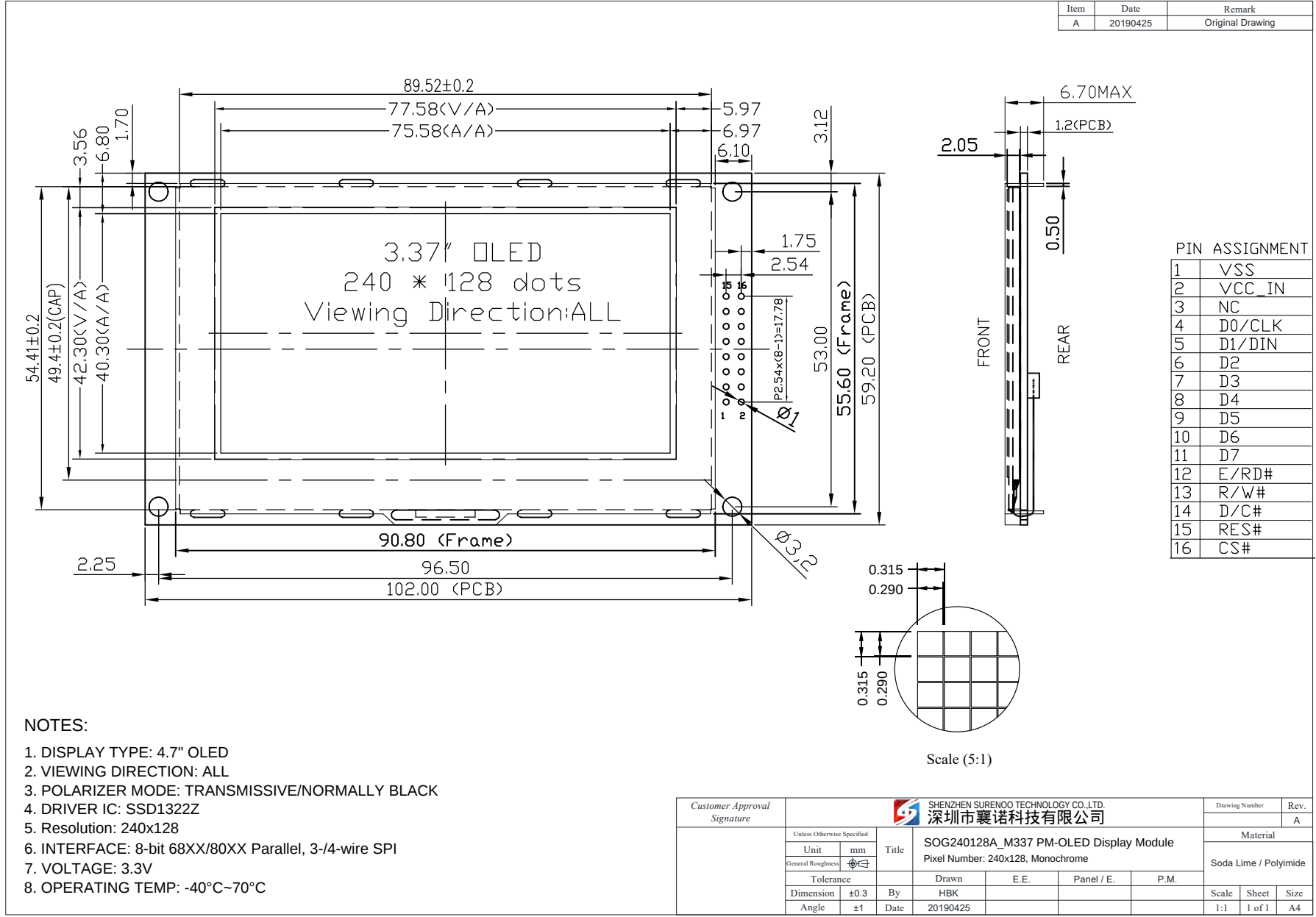
Graphic OLED Module

Graphic OLED Panel

SSD1322



## 1. Outline Drawing



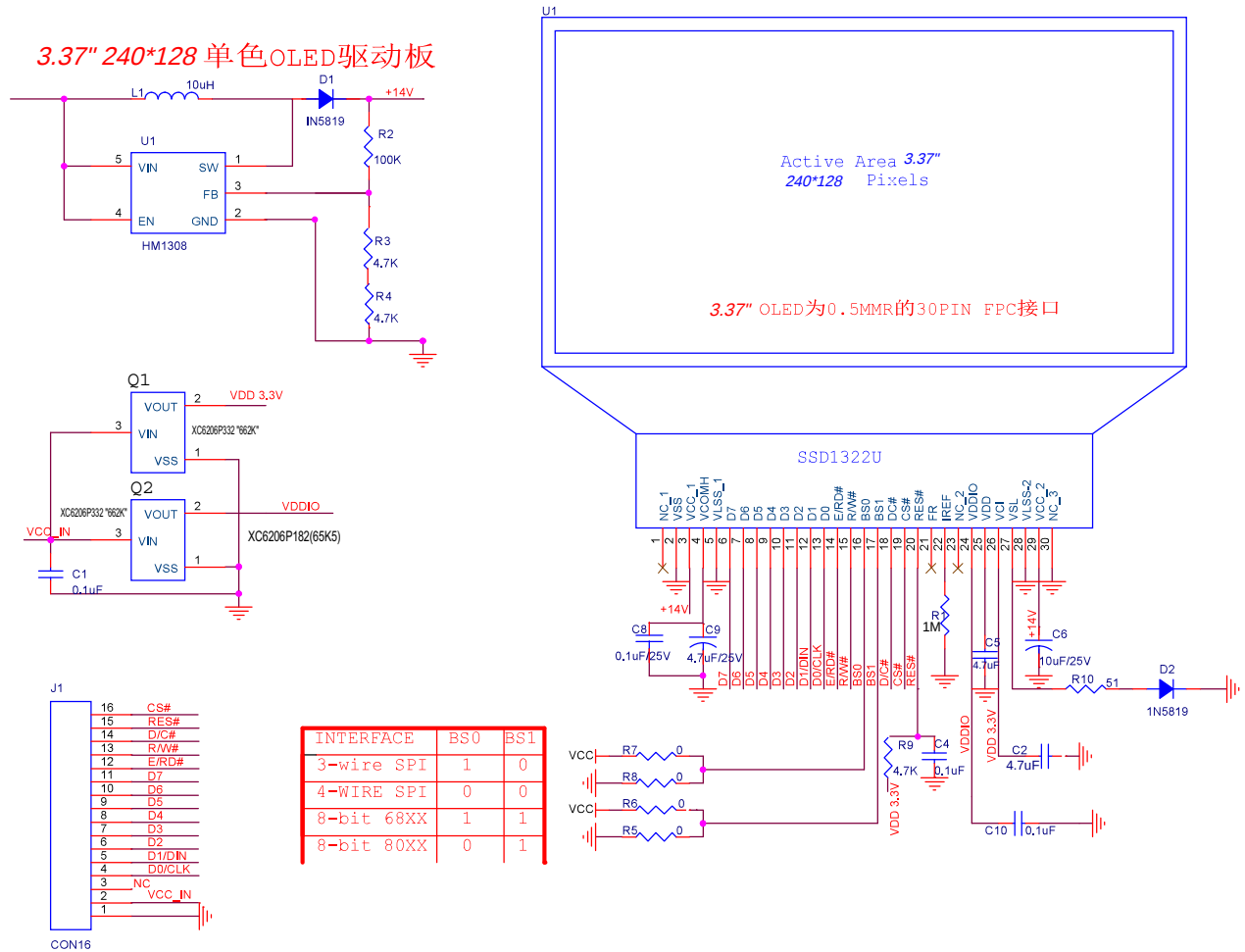
## 2. Function Characters

- 2-1. Dots: 240\*128 Dots
- 2-2. Material: PM-OLED
- 2-3. Color: Yellow / Green
- 2-4. Gray Scale: 16 Levels
- 2-5. OLED Module Voltage: 3-5V
- 2-6. OLED Panel Drive Voltage: 14.0V
- 2-7. Operate Temperature: -30~80°C
- 2-8. Storage Temperature: -40~85°C
- 2-9. Controller: SSD1322 (30P/0.5)
- 2-10. Interface: 6800 /8080 /3-4 Wire SPI
- 2-11. View Angle: All

## 3. Mechanical specifications

- 3-1. Model Size: 102.00(L)\*59.20(W)\*6.70(T) MM
- 3-2. View Area: 77.58(L)\*42.30(W) MM
- 3-3. Active Area: 75.58(L)\*42.30(W) MM
- 3-4. Dot Size: 0.290\*0.290MM
- 3-5. Dot Pitch: 0.315\*0.315MM

## 4. Block Diagram



## 5. PIN Description

| Pin No. | Symbol | Function                                   |
|---------|--------|--------------------------------------------|
| 1       | GND    | Ground.                                    |
| 2       | VCC_IN | Power supply pin for core logic operation. |
| 3       | NC     | No connect                                 |
| 4       | D0/CLK | Data Bus / Clock (SPI)                     |
| 5       | D1/DIN | Data Bus / Data (SPI)                      |
| 6       | D2     | Data Bus                                   |
| 7       | D3     | Data Bus                                   |
| 8       | D4     | Data Bus                                   |
| 9       | D5     | Data Bus                                   |
| 10      | D6     | Data Bus                                   |
| 11      | D7     | Data Bus                                   |
| 12      | E/RD#  | Enable Signal                              |
| 13      | R/W#   | H: Read, L: Write                          |
| 14      | D/C#   | H: Data, L: Command                        |
| 15      | RES#   | Active LOW Reset signal.                   |
| 16      | CS#    | Chip Select                                |

## 6. ELECTRO-OPTICAL CHARACTERISTICS

### 6-1 DC ELECTRO-OPTICAL CHARACTERISTICS

#### DC Characteristics

| Characteristics                 | Symbol          | Conditions                   | Min                   | Typ  | Max                   | Unit    |
|---------------------------------|-----------------|------------------------------|-----------------------|------|-----------------------|---------|
| Supply Voltage for Operation    | $V_{CI}$        |                              | 2.4                   | 2.8  | 3.5                   | V       |
| Supply Voltage for Logic        | $V_{DD}$        |                              | 2.4                   | 2.5  | 2.6                   | V       |
| Supply Voltage for I/O Pins     | $V_{DDIO}$      |                              | 1.65                  | 1.8  | $V_{CI}$              | V       |
| Supply Voltage for Display      | $V_{CC}$        | Note 3                       | 11.5                  | 12   | 12.5                  | V       |
| High Level Input                | $V_{IH}$        |                              | $0.8 \times V_{DDIO}$ | -    | $V_{DDIO}$            | V       |
| Low Level Input                 | $V_{IL}$        |                              | 0                     | -    | $0.2 \times V_{DDIO}$ | V       |
| High Level Output               | $V_{OH}$        | $I_{out} = 100\mu A, 3.3MHz$ | $0.9 \times V_{DDIO}$ | -    | $V_{DDIO}$            | V       |
| Low Level Output                | $V_{OL}$        | $I_{out} = 100\mu A, 3.3MHz$ | 0                     | -    | $0.1 \times V_{DDIO}$ | V       |
| Operating Current for $V_{CI}$  | $I_{CI}$        |                              | -                     | 1.8  | 2.25                  | mA      |
| Operating Current for $V_{CC}$  | $I_{CC}$        | Note 4                       | -                     | 26.3 | 32.9                  | mA      |
|                                 |                 | Note 5                       | -                     | 41.1 | 51.4                  | mA      |
| Sleep Mode Current for $V_{CI}$ | $I_{CI, SLEEP}$ |                              | -                     | 1    | 5                     | $\mu A$ |
| Sleep Mode Current for $V_{CC}$ | $I_{CC, SLEEP}$ |                              | -                     | 1    | 5                     | $\mu A$ |

Note 3: 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 4:  $V_{CI} = 2.8V$ ,  $V_{CC} = 12V$ , 50% Display Area Turn on.

Note 5:  $V_{CI} = 2.8V$ ,  $V_{CC} = 12V$ , 100% Display Area Turn on.

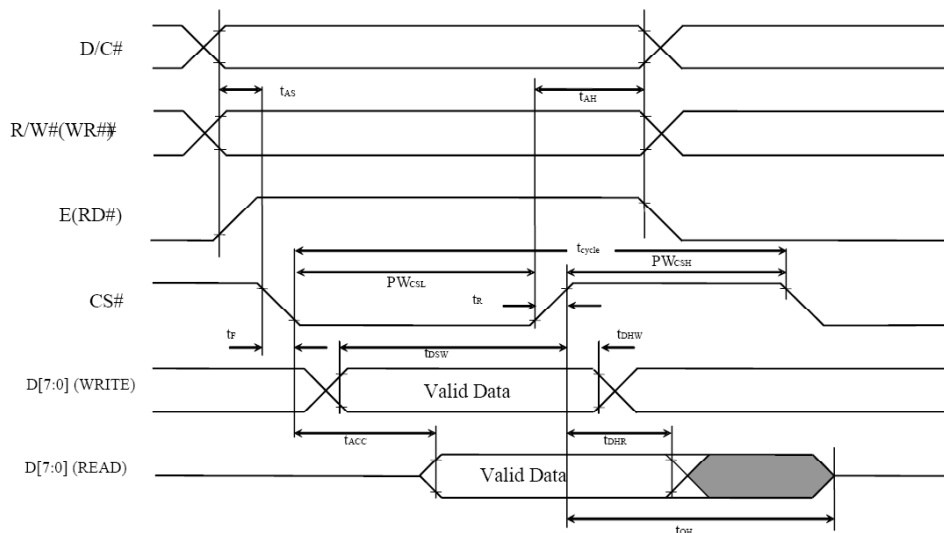
\* Software configuration follows Section 4.4 Initialization.

## 6-2 AC ELECTRO-OPTICAL CHARACTERISTICS

### 6-2.1、68XX-Series MPU Parallel Interface Timing Characteristics:

| Symbol             | Description                          | Min | Max | Unit |
|--------------------|--------------------------------------|-----|-----|------|
| $t_{\text{cycle}}$ | Clock Cycle Time                     | 300 | -   | ns   |
| $t_{\text{AS}}$    | Address Setup Time                   | 10  | -   | ns   |
| $t_{\text{AH}}$    | Address Hold Time                    | 0   | -   | ns   |
| $t_{\text{DSW}}$   | Write Data Setup Time                | 40  | -   | ns   |
| $t_{\text{DHW}}$   | Write Data Hold Time                 | 7   | -   | ns   |
| $t_{\text{DHR}}$   | Read Data Hold Time                  | 20  | -   | ns   |
| $t_{\text{OH}}$    | Output Disable Time                  | -   | 70  | ns   |
| $t_{\text{ACC}}$   | Access Time                          | -   | 140 | ns   |
| $PW_{\text{CSL}}$  | Chip Select Low Pulse Width (Read)   | 120 | -   | ns   |
|                    | Chip Select Low Pulse Width (Write)  | 60  |     |      |
| $PW_{\text{CSH}}$  | Chip Select High Pulse Width (Read)  | 60  | -   | ns   |
|                    | Chip Select High Pulse Width (Write) | 60  |     |      |
| $t_{\text{R}}$     | Rise Time                            | -   | 15  | ns   |
| $t_{\text{F}}$     | Fall Time                            | -   | 15  | ns   |

\* ( $V_{\text{DD}} - V_{\text{SS}} = 2.4\text{V to } 2.6\text{V}$ ,  $V_{\text{DDIO}} = 1.6\text{V}$ ,  $V_{\text{CI}} = 2.8\text{V}$ ,  $T_{\text{a}} = 25^{\circ}\text{C}$ )



6-2.2、80XX-Series MPU Parallel Interface Timing Characteristics:

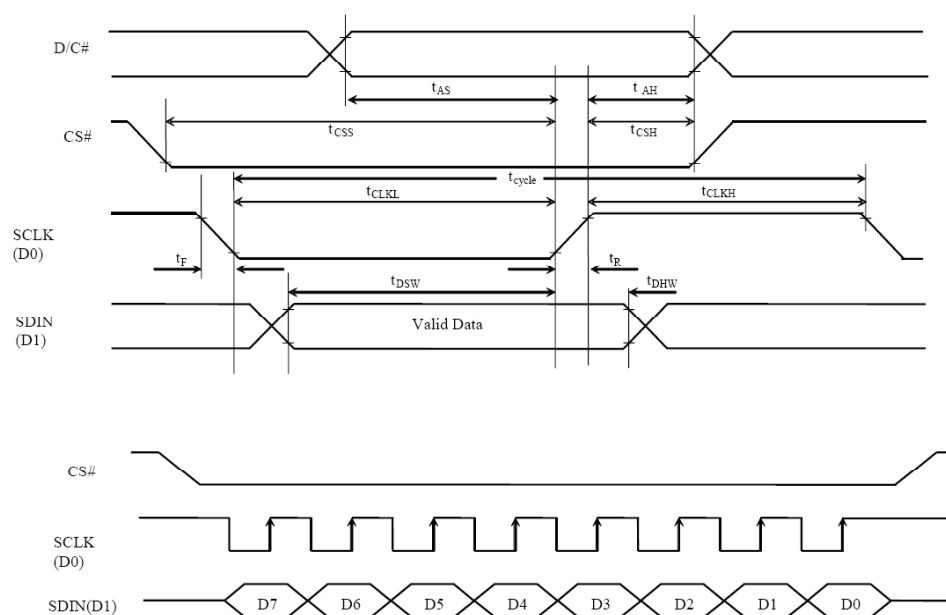
| Symbol      | Description                          | Min | Max | Unit |
|-------------|--------------------------------------|-----|-----|------|
| $t_{cycle}$ | Clock Cycle Time                     | 300 | -   | ns   |
| $t_{AS}$    | Address Setup Time                   | 10  | -   | ns   |
| $t_{AH}$    | Address Hold Time                    | 0   | -   | ns   |
| $t_{DSW}$   | Write Data Setup Time                | 40  | -   | ns   |
| $t_{DHW}$   | Write Data Hold Time                 | 7   | -   | ns   |
| $t_{DHR}$   | Read Data Hold Time                  | 20  | -   | ns   |
| $t_{OH}$    | OutputDisable Time                   | -   | 70  | ns   |
| $t_{ACC}$   | Access Time                          | -   | 140 | ns   |
| $t_{PWL R}$ | Read Low Time                        | 150 | -   | ns   |
| $t_{PWL W}$ | Write Low Time                       | 60  | -   | ns   |
| $t_{PWH R}$ | Read High Time                       | 60  | -   | ns   |
| $t_{PWH W}$ | Write High Time                      | 60  | -   | ns   |
| $t_{CS}$    | Chip Select Setup Time               | 0   | -   | ns   |
| $t_{CSH}$   | Chip Select Hold Time to Read Signal | 0   | -   | ns   |
| $t_{CSF}$   | Chip Select Hold Time                | 20  | -   | ns   |
| $t_R$       | Rise Time                            | -   | 15  | ns   |
| $t_F$       | Fall Time                            | -   | 15  | ns   |

\* ( $V_{DD} - V_{SS} = 2.4V$  to  $2.6V$ ,  $V_{DDIO} = 1.6V$ ,  $V_{CI} = 2.8V$ ,  $T_a = 25^{\circ}C$ )

### 6-2.3、Serial Interface Timing Characteristics: (4-wire SPI)

| Symbol             | Description            | Min | Max | Unit |
|--------------------|------------------------|-----|-----|------|
| $t_{\text{cycle}}$ | Clock Cycle Time       | 100 | -   | ns   |
| $t_{\text{AS}}$    | Address Setup Time     | 15  | -   | ns   |
| $t_{\text{AH}}$    | Address Hold Time      | 15  | -   | ns   |
| $t_{\text{CSS}}$   | Chip Select Setup Time | 20  | -   | ns   |
| $t_{\text{CSH}}$   | Chip Select Hold Time  | 10  | -   | ns   |
| $t_{\text{DSW}}$   | Write Data Setup Time  | 15  | -   | ns   |
| $t_{\text{DHW}}$   | Write Data Hold Time   | 15  | -   | ns   |
| $t_{\text{CLKL}}$  | Clock Low Time         | 20  | -   | ns   |
| $t_{\text{CLKH}}$  | Clock High Time        | 20  | -   | ns   |
| $t_{\text{R}}$     | Rise Time              | -   | 15  | ns   |
| $t_{\text{F}}$     | Fall Time              | -   | 15  | ns   |

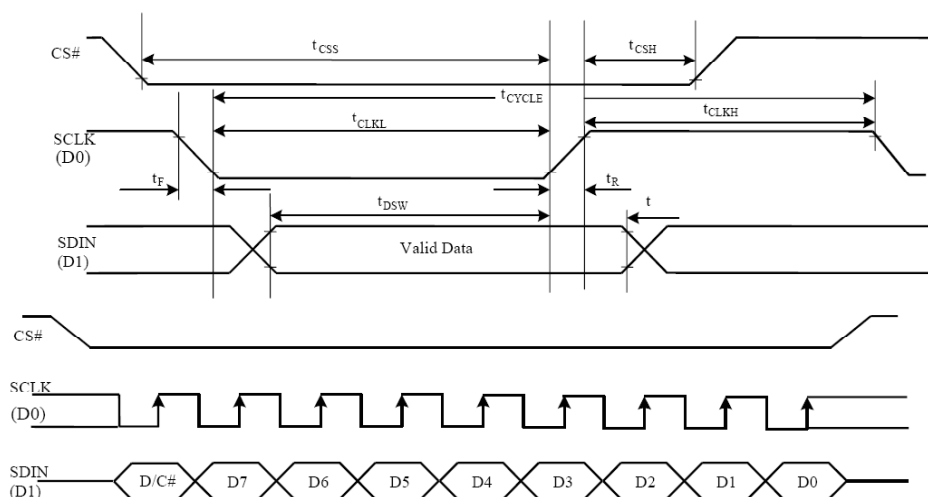
\* ( $V_{\text{DD}} - V_{\text{SS}} = 2.4\text{V to } 2.6\text{V}$ ,  $V_{\text{DDIO}} = 1.6\text{V}$ ,  $V_{\text{CI}} = 2.8\text{V}$ ,  $T_{\text{a}} = 25^{\circ}\text{C}$ )



#### 6-2.4、Serial Interface Timing Characteristics: (3-wire SPI)

| Symbol             | Description            | Min | Max | Unit |
|--------------------|------------------------|-----|-----|------|
| $t_{\text{cycle}}$ | Clock Cycle Time       | 100 | -   | ns   |
| $t_{\text{AS}}$    | Address Setup Time     | 15  | -   | ns   |
| $t_{\text{AH}}$    | Address Hold Time      | 15  | -   | ns   |
| $t_{\text{CSS}}$   | Chip Select Setup Time | 20  | -   | ns   |
| $t_{\text{CSH}}$   | Chip Select Hold Time  | 10  | -   | ns   |
| $t_{\text{DSW}}$   | Write Data Setup Time  | 15  | -   | ns   |
| $t_{\text{DHW}}$   | Write Data Hold Time   | 15  | -   | ns   |
| $t_{\text{CLKL}}$  | Clock Low Time         | 20  | -   | ns   |
| $t_{\text{CLKH}}$  | Clock High Time        | 20  | -   | ns   |
| $t_{\text{R}}$     | Rise Time              | -   | 15  | ns   |
| $t_{\text{F}}$     | Fall Time              | -   | 15  | ns   |

\* ( $V_{\text{DD}} - V_{\text{SS}} = 2.4\text{V}$  to  $2.6\text{V}$ ,  $V_{\text{DDIO}} = 1.6\text{V}$ ,  $V_{\text{CI}} = 2.8\text{V}$ ,  $T_{\text{a}} = 25^{\circ}\text{C}$ )



## 7. Instruction Table

### COMMAND TABLE

(D/C#=0, R/W#(WR#) = 0, E(RD#)=1) unless specific setting is stated)

#### Fundamental Command Table

| D/C#        | Hex                    | D7          | D6                                    | D5                                    | D4                                    | D3                                    | D2                                    | D1                                    | D0                                    | Command                           | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------|------------------------|-------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|-----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0           | 00                     | 0           | 0                                     | 0                                     | 0                                     | 0                                     | 0                                     | 0                                     | 0                                     | Enable Gray Scale table           | This command is sent to enable the Gray Scale table setting (command B8h)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 0<br>1<br>1 | 15<br>A[6:0]<br>B[6:0] | 0<br>*<br>* | 0<br>A <sub>6</sub><br>B <sub>6</sub> | 0<br>A <sub>5</sub><br>B <sub>5</sub> | 1<br>A <sub>4</sub><br>B <sub>4</sub> | 0<br>A <sub>3</sub><br>B <sub>3</sub> | 1<br>A <sub>2</sub><br>B <sub>2</sub> | 0<br>A <sub>1</sub><br>B <sub>1</sub> | 1<br>A <sub>0</sub><br>B <sub>0</sub> | Set Column Address                | Set Column start and end address<br>A[6:0]: Start Address. [reset=0]<br>B[6:0]: End Address. [reset=119]<br>Range from 0 to 119                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 0           | 5C                     | 0           | 1                                     | 0                                     | 1                                     | 1                                     | 1                                     | 0                                     | 0                                     | Write RAM Command                 | Enable MCU to write Data into RAM                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 0           | 5D                     | 0           | 1                                     | 0                                     | 1                                     | 1                                     | 1                                     | 0                                     | 1                                     | Read RAM Command                  | Enable MCU to read Data from RAM                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 0<br>1<br>1 | 75<br>A[6:0]<br>B[6:0] | 0<br>*<br>* | 1<br>A <sub>6</sub><br>B <sub>6</sub> | 1<br>A <sub>5</sub><br>B <sub>5</sub> | 1<br>A <sub>4</sub><br>B <sub>4</sub> | 0<br>A <sub>3</sub><br>B <sub>3</sub> | 1<br>A <sub>2</sub><br>B <sub>2</sub> | 0<br>A <sub>1</sub><br>B <sub>1</sub> | 1<br>A <sub>0</sub><br>B <sub>0</sub> | Set Row Address                   | Set Row start and end address<br>A[6:0]: Start Address. [reset=0]<br>B[6:0]: End Address. [reset=127]<br>Range from 0 to 127                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 0<br>1<br>1 | A0<br>A[7:0]<br>B[4]   | 1<br>0<br>* | 0<br>0<br>*                           | 1<br>A <sub>5</sub><br>0              | 0<br>A <sub>4</sub><br>B <sub>4</sub> | 0<br>0<br>0                           | 0<br>A <sub>2</sub><br>0              | 0<br>A <sub>1</sub><br>0              | 0<br>A <sub>0</sub><br>1              | Set Re-map and Dual COM Line mode | <p>A[0]=0b, Horizontal address increment [reset]<br/>A[0]=1b, Vertical address increment</p> <p>A[1]=0b, Disable Column Address Re-map [reset]<br/>A[1]=1b, Enable Column Address Re-map</p> <p>A[2]=0b, Disable Nibble Re-map [reset]<br/>A[2]=1b, Enable Nibble Re-map</p> <p>A[4]=0b, Scan from COM0 to COM[N-1] [reset]<br/>A[4]=1b, Scan from COM[N-1] to COM0, where N is the Multiplex ratio</p> <p>A[5]=0b, Disable COM Split Odd Even [reset]<br/>A[5]=1b, Enable COM Split Odd Even</p> <p>B[4], Enable / disable Dual COM Line mode<br/>00b, Disable Dual COM mode [reset]<br/>01b, Enable Dual COM mode (MUX ≤ 63)</p> <p><b>Note</b><br/>(1) COM Split Odd Even mode must be disabled (A[5]=0b) when enabling the Dual COM mode (B[4]=1b)</p> <p>Details refer to Section 10.1.6</p> |
| 0<br>1      | A1<br>A[6:0]           | 1<br>*      | 0<br>A <sub>6</sub>                   | 1<br>A <sub>5</sub>                   | 0<br>A <sub>4</sub>                   | 0<br>A <sub>3</sub>                   | 0<br>A <sub>2</sub>                   | 0<br>A <sub>1</sub>                   | 1<br>A <sub>0</sub>                   | Set Display Start Line            | Set display RAM display start line register from 0-127<br>Display start line register is reset to 00h after RESET                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |



| D/C#        | Hex                    | D7                  | D6                                    | D5                                    | D4                                    | D3                                    | D2                                    | D1                                    | D0                                    | Command                | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |        |                |      |         |      |         |      |         |      |         |      |                 |   |   |      |          |        |                |      |         |      |         |      |         |      |         |   |   |      |                 |   |   |      |          |
|-------------|------------------------|---------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|----------------|------|---------|------|---------|------|---------|------|---------|------|-----------------|---|---|------|----------|--------|----------------|------|---------|------|---------|------|---------|------|---------|---|---|------|-----------------|---|---|------|----------|
| 0<br>1      | A2<br>A[6:0]           | 1<br>*              | 0<br>A <sub>6</sub>                   | 1<br>A <sub>5</sub>                   | 0<br>A <sub>4</sub>                   | 0<br>A <sub>3</sub>                   | 0<br>A <sub>2</sub>                   | 1<br>A <sub>1</sub>                   | 0<br>A <sub>0</sub>                   | Set Display Offset     | Set vertical scroll by COM from 0-127<br>The value is reset to 00H after RESET                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |                |      |         |      |         |      |         |      |         |      |                 |   |   |      |          |        |                |      |         |      |         |      |         |      |         |   |   |      |                 |   |   |      |          |
| 0           | A4~A7                  | 1                   | 0                                     | 1                                     | 0                                     | 0                                     | X <sub>2</sub>                        | X <sub>1</sub>                        | X <sub>0</sub>                        | Set Display Mode       | A4h = Entire Display OFF, all pixels turns OFF in GS level 0<br>A5h = Entire Display ON, all pixels turns ON in GS level 15<br>A6h = Normal Display [reset]<br>A7h = Inverse Display (GS0ÆGS15, GS1ÆGS14, GS2ÆGS13, ...)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |        |                |      |         |      |         |      |         |      |         |      |                 |   |   |      |          |        |                |      |         |      |         |      |         |      |         |   |   |      |                 |   |   |      |          |
| 0<br>1<br>1 | A8<br>A[6:0]<br>B[6:0] | 1<br>0<br>0         | 0<br>A <sub>6</sub><br>B <sub>6</sub> | 1<br>A <sub>5</sub><br>B <sub>5</sub> | 0<br>A <sub>4</sub><br>B <sub>4</sub> | 1<br>A <sub>3</sub><br>B <sub>3</sub> | 0<br>A <sub>2</sub><br>B <sub>2</sub> | 0<br>A <sub>1</sub><br>B <sub>1</sub> | 0<br>A <sub>0</sub><br>B <sub>0</sub> | Enable Partial Display | This command turns ON partial mode. The partial mode display area is defined by the following two parameters,<br>A[6:0]: Address of start row in the display area<br>B[6:0]: Address of end row in the display area, where B[6:0] must be A[6:0]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |                |      |         |      |         |      |         |      |         |      |                 |   |   |      |          |        |                |      |         |      |         |      |         |      |         |   |   |      |                 |   |   |      |          |
| 0           | A9                     | 1                   | 0                                     | 1                                     | 0                                     | 1                                     | 0                                     | 0                                     | 1                                     | Exit Partial Display   | This command is sent to exit the Partial Display mode                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |        |                |      |         |      |         |      |         |      |         |      |                 |   |   |      |          |        |                |      |         |      |         |      |         |      |         |   |   |      |                 |   |   |      |          |
| 0<br>1      | AB<br>A[0]             | 1<br>0              | 0<br>0                                | 1<br>0                                | 0<br>0                                | 1<br>0                                | 0<br>0                                | 1<br>0                                | 1<br>A <sub>0</sub>                   | Function Selection     | A[0]=0b, Select external V <sub>DD</sub><br>A[0]=1b, Enable internal V <sub>DD</sub> regulator [reset]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |                |      |         |      |         |      |         |      |         |      |                 |   |   |      |          |        |                |      |         |      |         |      |         |      |         |   |   |      |                 |   |   |      |          |
| 0           | AE~AF                  | 1                   | 0                                     | 1                                     | 0                                     | 1                                     | 1                                     | 1                                     | X <sub>0</sub>                        | Set Sleep mode ON/OFF  | AEh = Sleep mode ON (Display OFF)<br>AFh = Sleep mode OFF (Display ON)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |                |      |         |      |         |      |         |      |         |      |                 |   |   |      |          |        |                |      |         |      |         |      |         |      |         |   |   |      |                 |   |   |      |          |
| 0<br>1      | B1<br>A[7:0]           | 1<br>A <sub>7</sub> | 0<br>A <sub>6</sub>                   | 1<br>A <sub>5</sub>                   | 1<br>A <sub>4</sub>                   | 0<br>A <sub>3</sub>                   | 0<br>A <sub>2</sub>                   | 0<br>A <sub>1</sub>                   | 1<br>A <sub>0</sub>                   | Set Phase Length       | A[3:0] Phase 1 period (reset phase length) of 5~31 DCLK(s) clocks as follow: <table border="1"><tr><td>A[3:0]</td><td>Phase 1 period</td></tr><tr><td>0000</td><td>invalid</td></tr><tr><td>0001</td><td>invalid</td></tr><tr><td>0010</td><td>5 DCLKs</td></tr><tr><td>0011</td><td>7 DCLKs</td></tr><tr><td>0100</td><td>9 DCLKs [reset]</td></tr><tr><td>:</td><td>:</td></tr><tr><td>1111</td><td>31 DCLKs</td></tr></table><br>A[7:4] Phase 2 period (first pre-charge phase length) of 3~15 DCLK(s) clocks as follow: <table border="1"><tr><td>A[7:4]</td><td>Phase 2 period</td></tr><tr><td>0000</td><td>invalid</td></tr><tr><td>0001</td><td>invalid</td></tr><tr><td>0010</td><td>invalid</td></tr><tr><td>0011</td><td>3 DCLKs</td></tr><tr><td>:</td><td>:</td></tr><tr><td>0111</td><td>7 DCLKs [reset]</td></tr><tr><td>:</td><td>:</td></tr><tr><td>1111</td><td>15 DCLKs</td></tr></table> | A[3:0] | Phase 1 period | 0000 | invalid | 0001 | invalid | 0010 | 5 DCLKs | 0011 | 7 DCLKs | 0100 | 9 DCLKs [reset] | : | : | 1111 | 31 DCLKs | A[7:4] | Phase 2 period | 0000 | invalid | 0001 | invalid | 0010 | invalid | 0011 | 3 DCLKs | : | : | 0111 | 7 DCLKs [reset] | : | : | 1111 | 15 DCLKs |
| A[3:0]      | Phase 1 period         |                     |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        |                |      |         |      |         |      |         |      |         |      |                 |   |   |      |          |        |                |      |         |      |         |      |         |      |         |   |   |      |                 |   |   |      |          |
| 0000        | invalid                |                     |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        |                |      |         |      |         |      |         |      |         |      |                 |   |   |      |          |        |                |      |         |      |         |      |         |      |         |   |   |      |                 |   |   |      |          |
| 0001        | invalid                |                     |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        |                |      |         |      |         |      |         |      |         |      |                 |   |   |      |          |        |                |      |         |      |         |      |         |      |         |   |   |      |                 |   |   |      |          |
| 0010        | 5 DCLKs                |                     |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        |                |      |         |      |         |      |         |      |         |      |                 |   |   |      |          |        |                |      |         |      |         |      |         |      |         |   |   |      |                 |   |   |      |          |
| 0011        | 7 DCLKs                |                     |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        |                |      |         |      |         |      |         |      |         |      |                 |   |   |      |          |        |                |      |         |      |         |      |         |      |         |   |   |      |                 |   |   |      |          |
| 0100        | 9 DCLKs [reset]        |                     |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        |                |      |         |      |         |      |         |      |         |      |                 |   |   |      |          |        |                |      |         |      |         |      |         |      |         |   |   |      |                 |   |   |      |          |
| :           | :                      |                     |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        |                |      |         |      |         |      |         |      |         |      |                 |   |   |      |          |        |                |      |         |      |         |      |         |      |         |   |   |      |                 |   |   |      |          |
| 1111        | 31 DCLKs               |                     |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        |                |      |         |      |         |      |         |      |         |      |                 |   |   |      |          |        |                |      |         |      |         |      |         |      |         |   |   |      |                 |   |   |      |          |
| A[7:4]      | Phase 2 period         |                     |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        |                |      |         |      |         |      |         |      |         |      |                 |   |   |      |          |        |                |      |         |      |         |      |         |      |         |   |   |      |                 |   |   |      |          |
| 0000        | invalid                |                     |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        |                |      |         |      |         |      |         |      |         |      |                 |   |   |      |          |        |                |      |         |      |         |      |         |      |         |   |   |      |                 |   |   |      |          |
| 0001        | invalid                |                     |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        |                |      |         |      |         |      |         |      |         |      |                 |   |   |      |          |        |                |      |         |      |         |      |         |      |         |   |   |      |                 |   |   |      |          |
| 0010        | invalid                |                     |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        |                |      |         |      |         |      |         |      |         |      |                 |   |   |      |          |        |                |      |         |      |         |      |         |      |         |   |   |      |                 |   |   |      |          |
| 0011        | 3 DCLKs                |                     |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        |                |      |         |      |         |      |         |      |         |      |                 |   |   |      |          |        |                |      |         |      |         |      |         |      |         |   |   |      |                 |   |   |      |          |
| :           | :                      |                     |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        |                |      |         |      |         |      |         |      |         |      |                 |   |   |      |          |        |                |      |         |      |         |      |         |      |         |   |   |      |                 |   |   |      |          |
| 0111        | 7 DCLKs [reset]        |                     |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        |                |      |         |      |         |      |         |      |         |      |                 |   |   |      |          |        |                |      |         |      |         |      |         |      |         |   |   |      |                 |   |   |      |          |
| :           | :                      |                     |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        |                |      |         |      |         |      |         |      |         |      |                 |   |   |      |          |        |                |      |         |      |         |      |         |      |         |   |   |      |                 |   |   |      |          |
| 1111        | 15 DCLKs               |                     |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        |                |      |         |      |         |      |         |      |         |      |                 |   |   |      |          |        |                |      |         |      |         |      |         |      |         |   |   |      |                 |   |   |      |          |



| D/C#   | Hex            | D7               | D6               | D5               | D4               | D3               | D2               | D1               | D0               | Command                                                 | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |        |        |      |             |      |             |      |             |      |             |      |              |      |              |      |              |      |               |      |               |      |               |      |                |        |         |
|--------|----------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|---------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--------|------|-------------|------|-------------|------|-------------|------|-------------|------|--------------|------|--------------|------|--------------|------|---------------|------|---------------|------|---------------|------|----------------|--------|---------|
| 0      | B3             | 1                | 0                | 1                | 1                | 0                | 0                | 1                | 1                | Set Front Clock<br>Divider /<br>Oscillator<br>Frequency | A[3:0] [reset=0], divide by DIVSET where                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |        |        |      |             |      |             |      |             |      |             |      |              |      |              |      |              |      |               |      |               |      |               |      |                |        |         |
| 1      | A[7:0]         | A <sub>7</sub>   | A <sub>6</sub>   | A <sub>5</sub>   | A <sub>4</sub>   | A <sub>3</sub>   | A <sub>2</sub>   | A <sub>1</sub>   | A <sub>0</sub>   |                                                         | <table><tr><th>A[3:0]</th><th>DIVSET</th></tr><tr><td>0000</td><td>divide by 1</td></tr><tr><td>0001</td><td>divide by 2</td></tr><tr><td>0010</td><td>divide by 4</td></tr><tr><td>0011</td><td>divide by 8</td></tr><tr><td>0100</td><td>divide by 16</td></tr><tr><td>0101</td><td>divide by 32</td></tr><tr><td>0110</td><td>divide by 64</td></tr><tr><td>0111</td><td>divide by 128</td></tr><tr><td>1000</td><td>divide by 256</td></tr><tr><td>1001</td><td>divide by 512</td></tr><tr><td>1010</td><td>divide by 1024</td></tr><tr><td>&gt;=1011</td><td>invalid</td></tr></table> | A[3:0] | DIVSET | 0000 | divide by 1 | 0001 | divide by 2 | 0010 | divide by 4 | 0011 | divide by 8 | 0100 | divide by 16 | 0101 | divide by 32 | 0110 | divide by 64 | 0111 | divide by 128 | 1000 | divide by 256 | 1001 | divide by 512 | 1010 | divide by 1024 | >=1011 | invalid |
| A[3:0] | DIVSET         |                  |                  |                  |                  |                  |                  |                  |                  |                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |        |      |             |      |             |      |             |      |             |      |              |      |              |      |              |      |               |      |               |      |               |      |                |        |         |
| 0000   | divide by 1    |                  |                  |                  |                  |                  |                  |                  |                  |                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |        |      |             |      |             |      |             |      |             |      |              |      |              |      |              |      |               |      |               |      |               |      |                |        |         |
| 0001   | divide by 2    |                  |                  |                  |                  |                  |                  |                  |                  |                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |        |      |             |      |             |      |             |      |             |      |              |      |              |      |              |      |               |      |               |      |               |      |                |        |         |
| 0010   | divide by 4    |                  |                  |                  |                  |                  |                  |                  |                  |                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |        |      |             |      |             |      |             |      |             |      |              |      |              |      |              |      |               |      |               |      |               |      |                |        |         |
| 0011   | divide by 8    |                  |                  |                  |                  |                  |                  |                  |                  |                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |        |      |             |      |             |      |             |      |             |      |              |      |              |      |              |      |               |      |               |      |               |      |                |        |         |
| 0100   | divide by 16   |                  |                  |                  |                  |                  |                  |                  |                  |                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |        |      |             |      |             |      |             |      |             |      |              |      |              |      |              |      |               |      |               |      |               |      |                |        |         |
| 0101   | divide by 32   |                  |                  |                  |                  |                  |                  |                  |                  |                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |        |      |             |      |             |      |             |      |             |      |              |      |              |      |              |      |               |      |               |      |               |      |                |        |         |
| 0110   | divide by 64   |                  |                  |                  |                  |                  |                  |                  |                  |                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |        |      |             |      |             |      |             |      |             |      |              |      |              |      |              |      |               |      |               |      |               |      |                |        |         |
| 0111   | divide by 128  |                  |                  |                  |                  |                  |                  |                  |                  |                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |        |      |             |      |             |      |             |      |             |      |              |      |              |      |              |      |               |      |               |      |               |      |                |        |         |
| 1000   | divide by 256  |                  |                  |                  |                  |                  |                  |                  |                  |                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |        |      |             |      |             |      |             |      |             |      |              |      |              |      |              |      |               |      |               |      |               |      |                |        |         |
| 1001   | divide by 512  |                  |                  |                  |                  |                  |                  |                  |                  |                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |        |      |             |      |             |      |             |      |             |      |              |      |              |      |              |      |               |      |               |      |               |      |                |        |         |
| 1010   | divide by 1024 |                  |                  |                  |                  |                  |                  |                  |                  |                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |        |      |             |      |             |      |             |      |             |      |              |      |              |      |              |      |               |      |               |      |               |      |                |        |         |
| >=1011 | invalid        |                  |                  |                  |                  |                  |                  |                  |                  |                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |        |      |             |      |             |      |             |      |             |      |              |      |              |      |              |      |               |      |               |      |               |      |                |        |         |
|        |                |                  |                  |                  |                  |                  |                  |                  |                  |                                                         | A[7:4] Oscillator frequency, frequency increases as level increases [reset=1100b]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |        |        |      |             |      |             |      |             |      |             |      |              |      |              |      |              |      |               |      |               |      |               |      |                |        |         |
| 0      | B5             | 1                | 0                | 1                | 1                | 0                | 1                | 0                | 1                | Set GPIO                                                | A[1:0] GPIO0: 00 pin HiZ, Input disabled<br>01 pin HiZ, Input enabled<br>10 pin output LOW [reset]<br>11 pin output HIGH                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |        |        |      |             |      |             |      |             |      |             |      |              |      |              |      |              |      |               |      |               |      |               |      |                |        |         |
| 1      | A[3:0]         | *                | *                | *                | *                | A <sub>3</sub>   | A <sub>2</sub>   | A <sub>1</sub>   | A <sub>0</sub>   |                                                         | A[3:2] GPIO1: 00 pin HiZ, Input disabled<br>01 pin HiZ, Input enabled<br>10 pin output LOW [reset]<br>11 pin output HIGH                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |        |        |      |             |      |             |      |             |      |             |      |              |      |              |      |              |      |               |      |               |      |               |      |                |        |         |
| 0      | B6             | 1                | 0                | 1                | 1                | 0                | 1                | 1                | 0                | Set Second<br>Precharge<br>Period                       | A[3:0] Second Pre-charge period<br>0000b 0 dclk<br>0001b 1 dclk<br>.....<br>1000b 8 dclks [reset]<br>.....<br>1111b 15 dclks                                                                                                                                                                                                                                                                                                                                                                                                                                                                |        |        |      |             |      |             |      |             |      |             |      |              |      |              |      |              |      |               |      |               |      |               |      |                |        |         |
| 1      | A[3:0]         | *                | *                | *                | *                | A <sub>3</sub>   | A <sub>2</sub>   | A <sub>1</sub>   | A <sub>0</sub>   |                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |        |      |             |      |             |      |             |      |             |      |              |      |              |      |              |      |               |      |               |      |               |      |                |        |         |
| 0      | B8             | 1                | 0                | 1                | 1                | 1                | 0                | 0                | 0                | Set Gray Scale<br>Table                                 | The next 15 data bytes define Gray Scale (GS) Table by setting the gray scale pulse width in unit of DCLK's (ranges from 0d ~ 180d)                                                                                                                                                                                                                                                                                                                                                                                                                                                         |        |        |      |             |      |             |      |             |      |             |      |              |      |              |      |              |      |               |      |               |      |               |      |                |        |         |
| 1      | A1[7:0]        | A1 <sub>7</sub>  | A1 <sub>6</sub>  | A1 <sub>5</sub>  | A1 <sub>4</sub>  | A1 <sub>3</sub>  | A1 <sub>2</sub>  | A1 <sub>1</sub>  | A1 <sub>0</sub>  |                                                         | A1[7:0]: Gamma Setting for GS1, A2[7:0]: Gamma Setting for GS2,                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |        |      |             |      |             |      |             |      |             |      |              |      |              |      |              |      |               |      |               |      |               |      |                |        |         |
| 1      | A2[7:0]        | A2 <sub>7</sub>  | A2 <sub>6</sub>  | A2 <sub>5</sub>  | A2 <sub>4</sub>  | A2 <sub>3</sub>  | A2 <sub>2</sub>  | A2 <sub>1</sub>  | A2 <sub>0</sub>  |                                                         | :                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |        |        |      |             |      |             |      |             |      |             |      |              |      |              |      |              |      |               |      |               |      |               |      |                |        |         |
| 1      | .              | .                | .                | .                | .                | .                | .                | .                | .                |                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |        |      |             |      |             |      |             |      |             |      |              |      |              |      |              |      |               |      |               |      |               |      |                |        |         |
| 1      | .              | .                | .                | .                | .                | .                | .                | .                | .                |                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |        |      |             |      |             |      |             |      |             |      |              |      |              |      |              |      |               |      |               |      |               |      |                |        |         |
| 1      | .              | .                | .                | .                | .                | .                | .                | .                | .                |                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |        |      |             |      |             |      |             |      |             |      |              |      |              |      |              |      |               |      |               |      |               |      |                |        |         |
| 1      | A14[7:0]       | A14 <sub>7</sub> | A14 <sub>6</sub> | A14 <sub>5</sub> | A14 <sub>4</sub> | A14 <sub>3</sub> | A14 <sub>2</sub> | A14 <sub>1</sub> | A14 <sub>0</sub> |                                                         | A14[7:0]: Gamma Setting for GS14, A15[7:0]: Gamma Setting for GS15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |        |        |      |             |      |             |      |             |      |             |      |              |      |              |      |              |      |               |      |               |      |               |      |                |        |         |
| 1      | A15[7:0]       | A15 <sub>7</sub> | A15 <sub>6</sub> | A15 <sub>5</sub> | A15 <sub>4</sub> | A15 <sub>3</sub> | A15 <sub>2</sub> | A15 <sub>1</sub> | A15 <sub>0</sub> |                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |        |      |             |      |             |      |             |      |             |      |              |      |              |      |              |      |               |      |               |      |               |      |                |        |         |
|        |                |                  |                  |                  |                  |                  |                  |                  |                  |                                                         | Note <sup>(1)</sup> 0 Setting of GS1 < Setting of GS2 < Setting of GS3 < Setting of GS14 < Setting of GS15<br><br>Refer to Section 8.8 for details<br><br><sup>(2)</sup> The setting must be followed by the Enable Gray Scale Table command (00h)                                                                                                                                                                                                                                                                                                                                          |        |        |      |             |      |             |      |             |      |             |      |              |      |              |      |              |      |               |      |               |      |               |      |                |        |         |



| D/C#   | Hex          | D7                     | D6                  | D5                  | D4                  | D3                  | D2                  | D2                  | D0                  | Command                                | Description                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                            |          |                   |                    |       |                        |                        |   |   |      |       |                        |                        |   |   |      |     |                        |
|--------|--------------|------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-------------------|--------------------|-------|------------------------|------------------------|---|---|------|-------|------------------------|------------------------|---|---|------|-----|------------------------|
| 0      | B9           | 1                      | 0                   | 1                   | 1                   | 1                   | 0                   | 0                   | 1                   | Select Default Linear Gray Scale table | The default Linear Gray Scale table is set in unit of DCLK's as follow<br><br>GS0 level pulse width = 0;<br>GS1 level pulse width = 0;<br>GS2 level pulse width = 8;<br>GS3 level pulse width = 16;<br>:<br>:<br>GS14 level pulse width = 104;<br>GS15 level pulse width = 112<br><br>Refer to Section 8.8 for details                                                                                                      |                                                                                                                                                                                                                                                                                                            |          |                   |                    |       |                        |                        |   |   |      |       |                        |                        |   |   |      |     |                        |
| 0<br>1 | BB<br>A[4:0] | 1<br>*                 | 0<br>*              | 1<br>*              | 1<br>A <sub>4</sub> | 1<br>A <sub>3</sub> | 0<br>A <sub>2</sub> | 1<br>A <sub>1</sub> | 1<br>A <sub>0</sub> |                                        | Set Pre-charge voltage                                                                                                                                                                                                                                                                                                                                                                                                      | Set pre-charge voltage level.[reset = 17h]<br><table><tr><th>A[5:1]</th><th>Hex code</th><th>pre-charge voltage</th></tr><tr><td>00000</td><td>00h</td><td>0.20 x V<sub>CC</sub></td></tr><tr><td>:</td><td>:</td><td>:</td></tr><tr><td>11111</td><td>3Eh</td><td>0.60 x V<sub>CC</sub></td></tr></table> | A[5:1]   | Hex code          | pre-charge voltage | 00000 | 00h                    | 0.20 x V <sub>CC</sub> | : | : | :    | 11111 | 3Eh                    | 0.60 x V <sub>CC</sub> |   |   |      |     |                        |
| A[5:1] | Hex code     | pre-charge voltage     |                     |                     |                     |                     |                     |                     |                     |                                        |                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                            |          |                   |                    |       |                        |                        |   |   |      |       |                        |                        |   |   |      |     |                        |
| 00000  | 00h          | 0.20 x V <sub>CC</sub> |                     |                     |                     |                     |                     |                     |                     |                                        |                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                            |          |                   |                    |       |                        |                        |   |   |      |       |                        |                        |   |   |      |     |                        |
| :      | :            | :                      |                     |                     |                     |                     |                     |                     |                     |                                        |                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                            |          |                   |                    |       |                        |                        |   |   |      |       |                        |                        |   |   |      |     |                        |
| 11111  | 3Eh          | 0.60 x V <sub>CC</sub> |                     |                     |                     |                     |                     |                     |                     |                                        |                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                            |          |                   |                    |       |                        |                        |   |   |      |       |                        |                        |   |   |      |     |                        |
| 0<br>1 | BE<br>A[3:0] | 1<br>*                 | 0<br>*              | 1<br>*              | 1<br>*              | 1<br>A <sub>3</sub> | 1<br>A <sub>2</sub> | 1<br>A <sub>1</sub> | 0<br>A <sub>0</sub> | Set V <sub>COMH</sub>                  | Set COM deselect voltage level [reset = 04h]<br>A[3:0] =<br><table><tr><th>A[2:0]</th><th>Hex code</th><th>V<sub>COMH</sub></th></tr><tr><td>0000</td><td>00h</td><td>0.72 x V<sub>CC</sub></td></tr><tr><td>:</td><td>:</td><td>:</td></tr><tr><td>0100</td><td>04h</td><td>0.80 x V<sub>CC</sub></td></tr><tr><td>:</td><td>:</td><td>:</td></tr><tr><td>0111</td><td>07h</td><td>0.86 x V<sub>CC</sub></td></tr></table> | A[2:0]                                                                                                                                                                                                                                                                                                     | Hex code | V <sub>COMH</sub> | 0000               | 00h   | 0.72 x V <sub>CC</sub> | :                      | : | : | 0100 | 04h   | 0.80 x V <sub>CC</sub> | :                      | : | : | 0111 | 07h | 0.86 x V <sub>CC</sub> |
| A[2:0] | Hex code     | V <sub>COMH</sub>      |                     |                     |                     |                     |                     |                     |                     |                                        |                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                            |          |                   |                    |       |                        |                        |   |   |      |       |                        |                        |   |   |      |     |                        |
| 0000   | 00h          | 0.72 x V <sub>CC</sub> |                     |                     |                     |                     |                     |                     |                     |                                        |                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                            |          |                   |                    |       |                        |                        |   |   |      |       |                        |                        |   |   |      |     |                        |
| :      | :            | :                      |                     |                     |                     |                     |                     |                     |                     |                                        |                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                            |          |                   |                    |       |                        |                        |   |   |      |       |                        |                        |   |   |      |     |                        |
| 0100   | 04h          | 0.80 x V <sub>CC</sub> |                     |                     |                     |                     |                     |                     |                     |                                        |                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                            |          |                   |                    |       |                        |                        |   |   |      |       |                        |                        |   |   |      |     |                        |
| :      | :            | :                      |                     |                     |                     |                     |                     |                     |                     |                                        |                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                            |          |                   |                    |       |                        |                        |   |   |      |       |                        |                        |   |   |      |     |                        |
| 0111   | 07h          | 0.86 x V <sub>CC</sub> |                     |                     |                     |                     |                     |                     |                     |                                        |                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                            |          |                   |                    |       |                        |                        |   |   |      |       |                        |                        |   |   |      |     |                        |
| 0<br>1 | C1<br>A[7:0] | 1<br>A <sub>7</sub>    | 1<br>A <sub>6</sub> | 0<br>A <sub>5</sub> | 0<br>A <sub>4</sub> | 0<br>A <sub>3</sub> | 0<br>A <sub>2</sub> | 0<br>A <sub>1</sub> | 1<br>A <sub>0</sub> | Set Contrast Current                   | A[7:0]: Contrast current value, range:00h~FFh, i.e. 256 steps for I <sub>SEG</sub> current [reset = 7Fh]                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                            |          |                   |                    |       |                        |                        |   |   |      |       |                        |                        |   |   |      |     |                        |
| 0<br>1 | C7<br>A[3:0] | 1<br>*                 | 1<br>*              | 0<br>*              | 0<br>*              | 0<br>A <sub>3</sub> | 1<br>A <sub>2</sub> | 1<br>A <sub>1</sub> | 1<br>A <sub>0</sub> | Master Contrast Current Control        | A[3:0] =<br>0000b, reduce output currents for all colors to 1/16<br>0001b, reduce output currents for all colors to 2/16<br>:<br>1110b, reduce output currents for all colors to 15/16<br>1111b, no change [reset]                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                            |          |                   |                    |       |                        |                        |   |   |      |       |                        |                        |   |   |      |     |                        |
| 0<br>1 | CA<br>A[6:0] | 1<br>*                 | 1<br>A <sub>6</sub> | 0<br>A <sub>5</sub> | 0<br>A <sub>4</sub> | 1<br>A <sub>3</sub> | 0<br>A <sub>2</sub> | 1<br>A <sub>1</sub> | 0<br>A <sub>0</sub> | Set MUX Ratio                          | A[6:0]: Set MUX ratio from 16MUX ~ 128MUX<br><br>A[6:0] = 15d represents 16MUX<br>:<br>A[6:0] = 127d represents 128MUX [reset]                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                            |          |                   |                    |       |                        |                        |   |   |      |       |                        |                        |   |   |      |     |                        |
| 0<br>1 | FD<br>A[2]   | 1<br>0                 | 1<br>0              | 1<br>0              | 1<br>1              | 1<br>0              | 1<br>A <sub>2</sub> | 0<br>1              | 1<br>0              | Set Command Lock                       | A[2]: MCU protection status [reset = 12h]<br><br>A[2] = 0b, Unlock OLED driver IC MCU interface from entering command [reset]<br>A[2] = 1b, Lock OLED driver IC MCU interface from entering command<br><br><b>Note</b><br>(1) The locked OLED driver IC MCU interface prohibits all commands and memory access except the FDh command                                                                                       |                                                                                                                                                                                                                                                                                                            |          |                   |                    |       |                        |                        |   |   |      |       |                        |                        |   |   |      |     |                        |

**Note**

<sup>(1)</sup> “\*” stands for “Don’t care”.