

To: \_\_\_\_\_

# SPECIFICATION


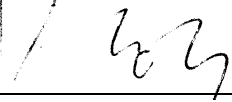

Rev. 0.0

*Application:* \_\_\_\_\_

## VACUUM FLUORESCENT DISPLAY MODULE

*Model No.: 12SS42DA1*

Rev. No.	Issued Date	Revision Descriptions	Remark
0.0	Mar. 31, 2005	* First Edition	-

Issued by	
Checked by	
Approved by	

Customer's Approval

~~~~~ **Index** ~~~~~

**1. SCOPE** ..... Page - 3

**2. FEATURES** ..... Page - 3

**3. PRECAUTIONS** ..... Page - 3

**4. PRODUCT SPECIFICATIONS** ..... Page - 4

    4.1 Type ..... Page - 4

    4.2 Outer Dimensions, Weight ..... Page - 4

    4.3 Environment Conditions ..... Page - 4

    4.4 Absolute Maximum Ratings ..... Page - 4

    4.5 Recommended Operating Conditions ..... Page - 4

    4.6 DC Characteristics ..... Page - 4

    4.7 AC Characteristics ..... Page - 5

    4.8 Timing Chart ..... Page - 5

        4.8.1 Serial Data Input Timing ..... Page - 5

        4.8.2 Power-on Timing..... Page - 5

    4.9 Signal Pin Connection ..... Page - 5

    4.10 System Block Diagram ..... Page - 6

    4.11 Outer Dimensions ..... Page - 6

    4.12 Pattern Details ..... Page - 7

    4.13 Grid & Anode Assignment ..... Page - 7

**5. FUNCTIONS** ..... Page - 8

    5.1 Character Code Write-in ..... Page - 8

        5.1.1 CG-RAM Character ..... Page - 8

        5.1.2 CG-ROM Character ..... Page - 8

    5.2 Control Command Write-in ..... Page - 8

    \* **Character Code Table (CG-RAM & CG-ROM)** ..... Page - 9

        5.2.1 DP: Set Display Position (Write-in Address) ..... Page - 10

        5.2.2 UDF: User Definable Font (Save CG-RAM Font Data) ..... Page - 10

        5.2.3 Reserved (No Effect onto Display) ..... Page - 10

        5.2.4 Reserved (No Effect onto Display) ..... Page - 10

        5.2.5 DIM: Dimming ..... Page - 11

        5.2.6 DLNG: Set Display Length ..... Page - 11

        5.2.7 ALL: All Segments ON/OFF ..... Page - 11

    5.3 Power On Reset ..... Page - 11

    5.4 Recommend Initial setting sequence ..... Page - 11

## **1. SCOPE**

This specification applies to VFD module (Model No: 12SS42DA1) manufactured by Samsung SDI or SSVD (Shanghai Samsung Vacuum Devices.)

## **2. FEATURES**

- \* 3-wired Synchronous Serial Interface: /CS (Chip Select), CLK(Shift Clock) and SDA(Serial Data Input).
- \* +5VDC Single Power Source: Using Compact DC/DC Converter
- \* Built-in 5\*7 Dot Matrix CG-ROM: 248 Kinds of Alphanumeric and Japanese Katakana Characters
- \* Support UDF (User Definable Fonts) Function: 8 CG-RAM Characters
- \* Dimming Levels: 8 Levels by Pulse Width Modulation

## **3. PRECAUTIONS (OPERATING RECOMMENDATIONS)**

- \* Avoid applying excessive shock or vibration beyond the specification for the VFD module.
- \* Since VFDs are made of glass material, careful handling is required. i.e. Direct impact with hard material to the glass surface(especially exhaust tip) may crack the glass.
- \* When mounting the VFD module to your system, leave a slight gap between the VFD glass and your front panel. The module should be mounted without stress to avoid flexing of the PCB.
- \* Avoid plugging or unplugging the interface connection with the power on, otherwise it may cause the severe damage to input circuitry.
- \* Slow starting power supply may cause non-operation because one-chip MCU won't be reset.
- \* Exceeding any of maximum ratings may cause the permanent damage.
- \* Since the VFD modules contain high voltage source, careful handling is required during powered on.
- \* When the power is turned off, the capacitor does not discharge immediately. The high voltage applied to the VFD must not contact to the ICs. And the short-circuitry of mounted components on PCB within 30 seconds after power-off may cause damage to those.
- \* The power supply must be capable of providing at least 10 times the rated current, because the surge current can be more than 5 times the specified current consumption when the power is turned on.
- \* Avoid using the module where excessive noise interference is expected. Noise may affects the interface signal and causes improper operation. And it is important to keep the length of the interface cable less than 50cm.
- \* Since all VFD modules contain C-MOS ICs, anti-static handling procedures are always required.

## 4. PRODUCT SPECIFICATIONS

### 4.1 Type

|                              |                             |
|------------------------------|-----------------------------|
| Type Number (Model)          | 12SS42DA1                   |
| Character Format and Pattern | 12 Digits of 5x7 Dot Matrix |

### 4.2 Outer Dimensions, Weight

| Parameters       | Symbols   | Specification       | Unit |
|------------------|-----------|---------------------|------|
| Outer Dimensions | W * H * t | 120.0 * 27.0 * 18.9 | mm   |
| Glass Size       | W * H     | 100.0 * 20.5        | mm   |
| Display Area     | W * H     | 72.6 * 6.63         | mm   |
| Character Size   | W * H     | 4.06 * 6.63         | mm   |
| Character Pitch  | CP (x)    | 6.18                | mm   |
| Weight           |           | Approx. 100         | g    |

### 4.3 Environment Conditions

| Parameters               | Symbols          | Min. | Max. | Unit |
|--------------------------|------------------|------|------|------|
| Operating Temperature    | T <sub>OPR</sub> | - 20 | + 70 | °C   |
| Storage Temperature      | T <sub>STG</sub> | - 40 | + 85 | °C   |
| Humidity (Operating)     | H <sub>OPR</sub> | 0    | 85   | %    |
| Humidity (Non-operating) | H <sub>STG</sub> | 0    | 90   | %    |
| Vibration (10 ~ 55 Hz)   | -                | -    | 4    | G    |
| Shock                    | -                | -    | 40   | G    |

### 4.4 Absolute Maximum Ratings

| Parameters           | Symbols | Min.  | Max.    | Unit |
|----------------------|---------|-------|---------|------|
| Supply Voltage       | VDD     | - 0.3 | + 6.0   | VDC  |
| Input Signal Voltage | VIS     | - 0.3 | VDD+0.3 | VDC  |

### 4.5 Recommended Operating Conditions

| Parameters                   | Symbols | Min.    | Typ. | Max.    | Unit |
|------------------------------|---------|---------|------|---------|------|
| Supply Voltage               | VDD     | 4.5     | 5.0  | 5.5     | VDC  |
| H-Level Signal Input Voltage | VIH     | 0.7*VDD | -    | -       | VDC  |
| L-Level Signal Input Voltage | VIL     | -       | -    | 0.3*VDD | VDC  |

### 4.6 DC Characteristics (@ Ta = +25°C, VDD = +5.0VDC)

| Parameters            | Test Conditions   | Min.                         | Typ.      | Max. | Unit                      |
|-----------------------|-------------------|------------------------------|-----------|------|---------------------------|
| Supply Current (*)    | All dots are lit. | -                            | 200       | 300  | mA                        |
| H-Level Input Current | VIS = VDD         | -                            | -         | 10.0 | uA                        |
| L-Level Input Current | VIS = 0 VDC       | -                            | -         | -1.0 | mA                        |
| Brightness            | All dots are lit. | 102 (350)                    | 204 (700) | -    | ft-L (cd/m <sup>2</sup> ) |
| Display Color         | All dots are lit. | x = 0.250, y = 0.439 (Green) |           |      | -                         |

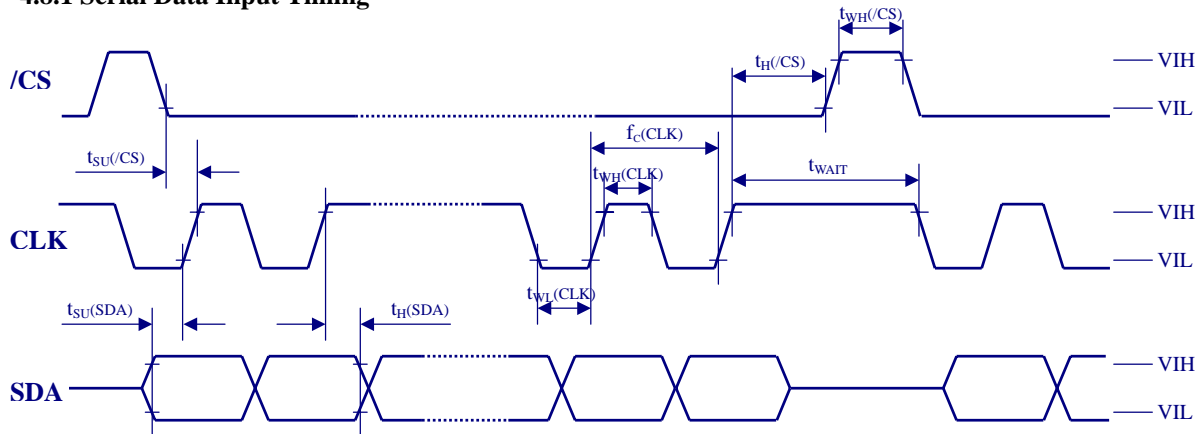
(\*) Note-1: The in-rush current can be approx. 3 times the specified supply current at power on. However, the exact peak in-rush current amplitude and duration are dependent on the characteristics of the host power supply.

**4.7 AC Characteristics** (when Ta = +25°C, VCC = +5.0VDC)

| Parameters              | Symbol    | Min. | Max.  | Unit |
|-------------------------|-----------|------|-------|------|
| Clock Frequency         | fc(CLK)   | -    | 1.0   | MHz  |
| Low Level Width of CLK  | tWL(CLK)  | 300  | -     | ns   |
| High Level Width of CLK | tWH(CLK)  | 300  | -     | ns   |
| Set-up Time of SDA      | tSU(SDA)  | 300  | -     | ns   |
| Hold Time of SDA        | tH(SDA)   | 300  | -     | ns   |
| Set-up Time of /CS      | tSU(/CS)  | 300  | -     | ns   |
| Hold Time of /CS        | tH(/CS)   | 16   | -     | us   |
| Pulse Width of /CS      | tWH(/CS)  | 300  | -     | ns   |
| Data Process Time       | tWAIT     | 8    | -     | us   |
| Wait Time of SDA        | tRS(SDA)  | 300  | -     | ns   |
| VDD Rising Time         | tR(VDD)   | -    | 100.0 | ns   |
| VDD OFF Time            | tOFF(VDD) | 5.0  | -     | ms   |

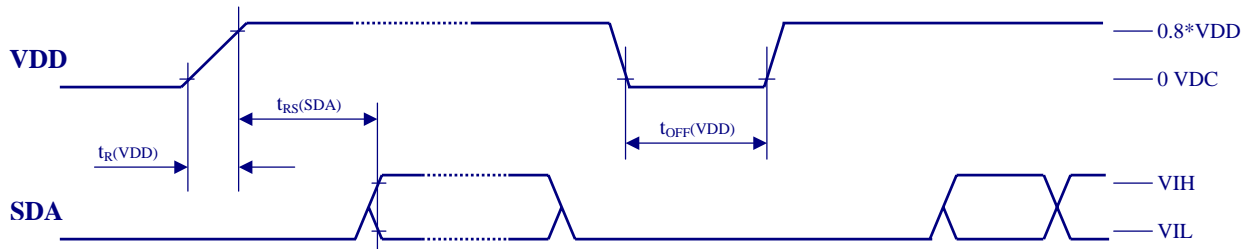
**4.8 Timing Chart**

**4.8.1 Serial Data Input Timing**



**Fig.-1 Data Input Timing Diagram**

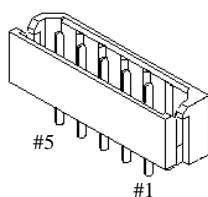
**4.8.2 Power-on Timing**



**Fig.-2 Power-on Timing Diagram**

**4.9 Signal Pin Connection (Interfacing)**

\* Connector (Male): 22-03-5055 (by Molex, 5267-05A) or equivalent



| Pin No. | Signal | Signal Name Description                    |
|---------|--------|--------------------------------------------|
| 1       | VDD    | Power Supply Terminal (+5Vdc is required.) |
| 2       | /CS    | Chip Select Input Pin                      |
| 3       | CLK    | Shift Clock Input Pin                      |
| 4       | SDA    | Serial Data Input Pin                      |
| 5       | GND    | Ground Terminal                            |

4.10 System Block Diagram

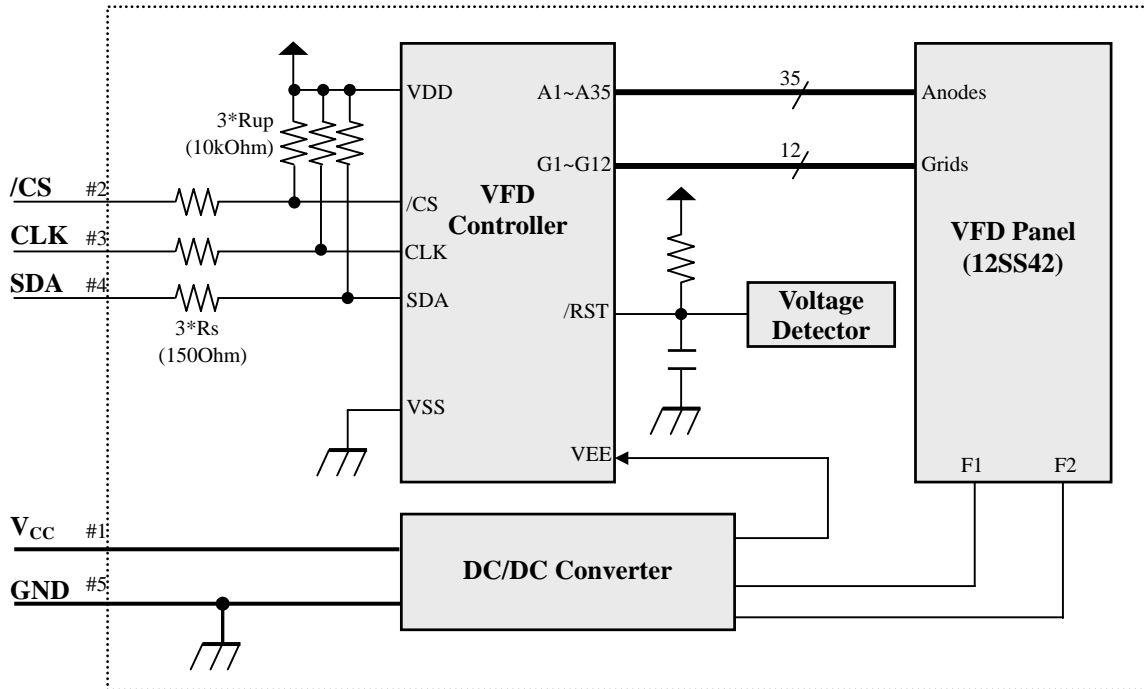


Fig.-3 System Block Diagram

4.11 Outer Dimensions

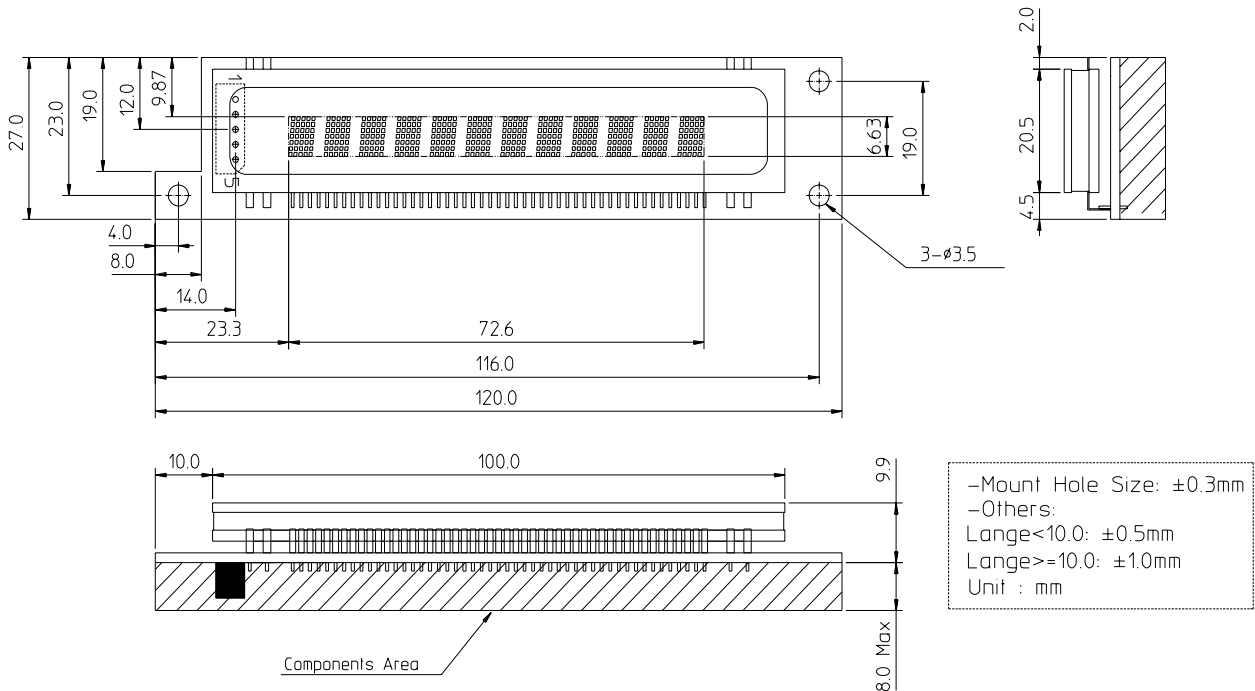
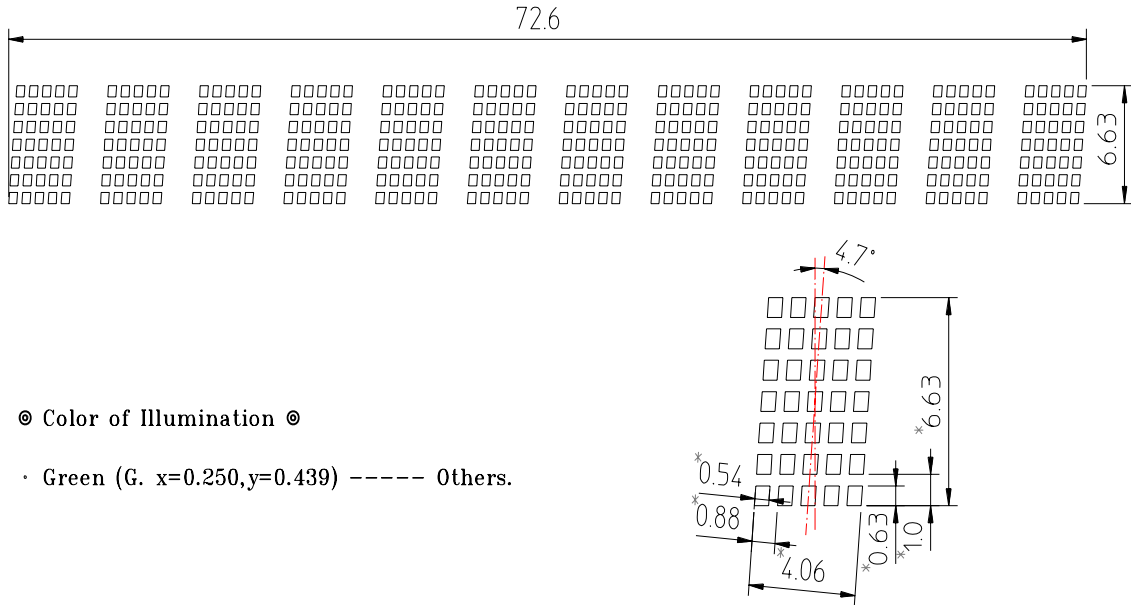


Fig.-4 Drawing for Outer Dimensions

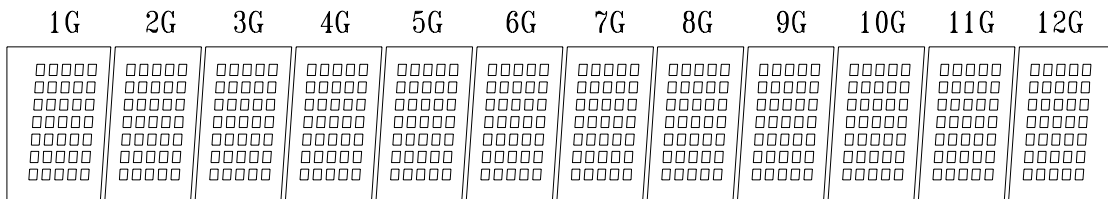
**4.12 Pattern Details**



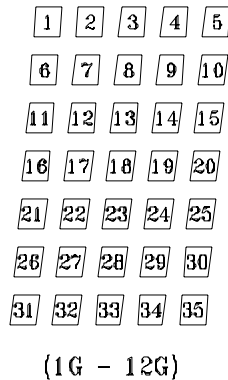
- ◎ Color of Illumination ◎
- Green (G. x=0.250,y=0.439) ----- Others.

**Fig.-5 Drawing for Pattern Details**

**4.13 Grid & Anode Assignment**



**Fig.-6.1 Grid Assignment**



**Fig.-6.2 Anode Assignment**

## 5. FUNCTIONAL DESCRIPTIONS

Display control command and data are written by an 8-bit serial transfer. Write timing is shown in the figure below.

Setting the /CS pin to "Low" level enables a data transfer. Data is 8 bits and is sequentially input into the SDA pin from LSB (LSB first). As shown in the figure below, data is read by the shift register at the rising edge of the shift clock, which is input into the CLK pin. If 8-bit data is input, internal load signals are automatically generated and data is written to each register and RAM. Therefore it is not necessary to input load signals from the outside.

Setting the /CS pin to "High" disables data transfer. Data input from the point when the /CS pin changes from "High" to "Low" is recognized in 8-bit units.

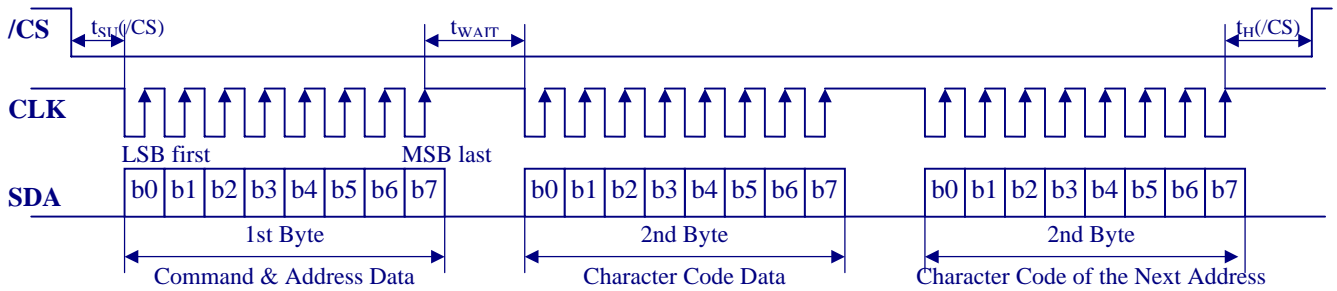


Fig.-8. 3-wired Synchronous Serial Input Sequence

\* When data is written to RAM (DC-RAM, AD-RAM, CG-RAM) continuously, addresses are internally incremented automatically. Therefore it is not necessary to specify the 1st byte to write RAM data for the 2nd and later bytes.

### 5.1 Character Code Write-in

When the first 8-bits data is a command of "DP" (Refer to section 5.2.1) after the /CS pin is changed from "High" to "Low", the following codes are treated as display character data. At this time, the display address (Write-in Position) is shifted to the right one digit automatically.

If a user wants to move the write-in position, he should make a positive pulse on /CS pin and re-enter a "DP" command.

#### 5.1.1 CG-RAM Character (00 Hex ~ 07 Hex)

A user should define the CG-RAM font by UDF function (Refer to section 5.2.2), before entering the CG-RAM code into VFD module.

#### 5.1.2 CG-ROM Character (08 Hex ~ FF Hex)

When the CG-ROM character data code is written-in the module, the corresponding character font (Refer to Character Code Table on next page) is displayed at current address (write-in position).

### 5.2 Control Command Write-in

The control commands should be written-in first after the /CS pin is changed from "High" to "Low". The control commands are listed up at below table and details will be explained.

| Command Symbol | Descriptions                           | Hex Code Range | Binary Code |    |    |    |    |    |    |    |
|----------------|----------------------------------------|----------------|-------------|----|----|----|----|----|----|----|
|                |                                        |                | b7          | b6 | b5 | b4 | b3 | b2 | b1 | b0 |
| DP             | Display Position (Address Set)         | 10 ~ 1B Hex    | 0           | 0  | 0  | 1  | b  | b  | b  | b  |
| UDF            | User Definable Font (Save CG-RAM Data) | 20 ~ 27 Hex    | 0           | 0  | 1  | 0  | *  | b  | b  | b  |
| -              | No Operation                           | 30 ~ 3F Hex    | 0           | 0  | 1  | 1  | *  | *  | *  | *  |
| -              | No Operation                           | 40 ~ 4F Hex    | 0           | 1  | *  | *  | *  | *  | *  | *  |
| DIM            | Dimming (Luminance Control)            | 50 ~ 57 Hex    | 0           | 1  | 0  | 1  | *  | b  | b  | b  |
| DLNG           | Digit Length Set                       | 60 ~ 67 Hex    | 0           | 1  | 1  | 0  | *  | b  | b  | b  |
| ALL            | All Segments ON/OFF                    | 70 ~ 73 Hex    | 0           | 1  | 1  | 1  | *  | *  | b  | b  |

Note) "\*": Don't Care, "b": Selection Bits, "0": Low Level, "1": High Level



\* Character Code Table (CG-ROM & CG-RAM)

| Upper Nibble | Lower Nibble | D7          | 0 | 0 | 0           | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |  |  |
|--------------|--------------|-------------|---|---|-------------|---|---|---|---|---|---|---|---|---|---|---|---|---|--|--|--|
|              |              | D6          | 0 | 0 | 0           | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |  |  |  |
|              |              | D5          | 0 | 0 | 1           | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 |  |  |  |
|              |              | D4          | 0 | 1 | 0           | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |  |  |  |
|              |              | D3 D2 D1 D0 | 0 | 1 | 2           | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |  |  |  |
| 0            | 0            | 0           | 0 | 0 | CG-RAM (#0) |   |   |   |   |   |   |   |   |   |   |   |   |   |  |  |  |
| 0            | 0            | 0           | 1 | 1 | CG-RAM (#1) |   |   |   |   |   |   |   |   |   |   |   |   |   |  |  |  |
| 0            | 0            | 1           | 0 | 2 | CG-RAM (#2) |   |   |   |   |   |   |   |   |   |   |   |   |   |  |  |  |
| 0            | 0            | 1           | 1 | 3 | CG-RAM (#3) |   |   |   |   |   |   |   |   |   |   |   |   |   |  |  |  |
| 0            | 1            | 0           | 0 | 4 | CG-RAM (#4) |   |   |   |   |   |   |   |   |   |   |   |   |   |  |  |  |
| 0            | 1            | 0           | 1 | 5 | CG-RAM (#5) |   |   |   |   |   |   |   |   |   |   |   |   |   |  |  |  |
| 0            | 1            | 1           | 0 | 6 | CG-RAM (#6) |   |   |   |   |   |   |   |   |   |   |   |   |   |  |  |  |
| 0            | 1            | 1           | 1 | 7 | CG-RAM (#7) |   |   |   |   |   |   |   |   |   |   |   |   |   |  |  |  |
| 1            | 0            | 0           | 0 | 8 |             |   |   |   |   |   |   |   |   |   |   |   |   |   |  |  |  |
| 1            | 0            | 0           | 1 | 9 |             |   |   |   |   |   |   |   |   |   |   |   |   |   |  |  |  |
| 1            | 0            | 1           | 0 | A |             |   |   |   |   |   |   |   |   |   |   |   |   |   |  |  |  |
| 1            | 0            | 1           | 1 | B |             |   |   |   |   |   |   |   |   |   |   |   |   |   |  |  |  |
| 1            | 1            | 0           | 0 | C |             |   |   |   |   |   |   |   |   |   |   |   |   |   |  |  |  |
| 1            | 1            | 0           | 1 | D |             |   |   |   |   |   |   |   |   |   |   |   |   |   |  |  |  |
| 1            | 1            | 1           | 0 | E |             |   |   |   |   |   |   |   |   |   |   |   |   |   |  |  |  |
| 1            | 1            | 1           | 1 | F |             |   |   |   |   |   |   |   |   |   |   |   |   |   |  |  |  |

**5.2.1 DP (10 Hex ~ 1B Hex): Set Display Position (Write-in Address)**

This command is used to select a digit to display a character instead of writing the character from the first digit; the write-in starting position can be pointed out by using this command. (Refer to the Fig.-6.1 Grid Assignment)

| Data Order | b7 | b6 | b5 | b4 | b3 | b2 | b1 | b0 | Hex Data | Digit (Grid)     |
|------------|----|----|----|----|----|----|----|----|----------|------------------|
| 1st byte   | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 10 Hex   | 1st Digit (1G)   |
|            |    |    |    |    | 0  | 0  | 0  | 1  | 11 Hex   | 2nd Digit (2G)   |
|            |    |    |    |    | 0  | 0  | 1  | 0  | 12 Hex   | 3rd Digit (3G)   |
|            |    |    |    |    | 0  | 0  | 1  | 1  | 13 Hex   | 4th Digit (4G)   |
|            |    |    |    |    | 0  | 1  | 0  | 0  | 14 Hex   | 5th Digit (5G)   |
|            |    |    |    |    | 0  | 1  | 0  | 1  | 15 Hex   | 6th Digit (6G)   |
|            |    |    |    |    | 0  | 1  | 1  | 0  | 16 Hex   | 7th Digit (7G)   |
|            |    |    |    |    | 0  | 1  | 1  | 1  | 17 Hex   | 8th Digit (8G)   |
|            |    |    |    |    | 1  | 0  | 0  | 0  | 18 Hex   | 9th Digit (9G)   |
|            |    |    |    |    | 1  | 0  | 0  | 1  | 19 Hex   | 10th Digit (10G) |
|            |    |    |    |    | 1  | 0  | 1  | 0  | 1A Hex   | 11th Digit (11G) |
|            |    |    |    |    | 1  | 0  | 1  | 1  | 1B Hex   | 12th Digit (12G) |

**5.2.2 UDF (20 Hex ~ 27 Hex): User Definable Font (Save CG-RAM Font Data)**

The characters can be designed by using this command. These font data are memorized in the CG-RAM of the module. Any 5x7 dots pattern can be stored in the character code location specified by the b0 ~ b2 of 1st byte.

| Data Order | b7 | b6 | b5 | b4 | b3 | b2 | b1 | b0 | Hex Data                                                                                                                                                                      | Location | Description                                     |
|------------|----|----|----|----|----|----|----|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-------------------------------------------------|
| 1st byte   | 0  | 0  | 1  | 0  | *  | 0  | 0  | 0  | 20 Hex                                                                                                                                                                        | CG-RAM_0 | Specify CG-RAM location where to save UDF data. |
|            |    |    |    |    |    | 0  | 0  | 1  | 21 Hex                                                                                                                                                                        | CG-RAM_1 |                                                 |
|            |    |    |    |    |    | 0  | 1  | 0  | 22 Hex                                                                                                                                                                        | CG-RAM_2 |                                                 |
|            |    |    |    |    |    | 0  | 1  | 1  | 23 Hex                                                                                                                                                                        | CG-RAM_3 |                                                 |
|            |    |    |    |    |    | 1  | 0  | 0  | 24 Hex                                                                                                                                                                        | CG-RAM_4 |                                                 |
|            |    |    |    |    |    | 1  | 0  | 1  | 25 Hex                                                                                                                                                                        | CG-RAM_5 |                                                 |
|            |    |    |    |    |    | 1  | 1  | 0  | 26 Hex                                                                                                                                                                        | CG-RAM_6 |                                                 |
|            |    |    |    |    |    | 1  | 1  | 1  | 27 Hex                                                                                                                                                                        | CG-RAM_7 |                                                 |
| 2nd byte   | *  | 31 | 26 | 21 | 16 | 11 | 6  | 1  | Specify ON or OFF of 35 dots position. Refer to the anode map of next table to match dot location. Below example shows the design procedure to define "Euro-currency Symbol". |          |                                                 |
| 3rd byte   | *  | 32 | 27 | 22 | 17 | 12 | 7  | 2  |                                                                                                                                                                               |          |                                                 |
| 4th byte   | *  | 33 | 28 | 23 | 18 | 13 | 8  | 3  |                                                                                                                                                                               |          |                                                 |
| 5th byte   | *  | 34 | 29 | 24 | 19 | 14 | 9  | 4  |                                                                                                                                                                               |          |                                                 |
| 6th byte   | *  | 35 | 30 | 25 | 20 | 15 | 10 | 5  |                                                                                                                                                                               |          |                                                 |

**Anode Map**

|    |    |    |    |    |
|----|----|----|----|----|
| 1  | 2  | 3  | 4  | 5  |
| 6  | 7  | 8  | 9  | 10 |
| 11 | 12 | 13 | 14 | 15 |
| 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 |
| 26 | 27 | 28 | 29 | 30 |
| 31 | 32 | 33 | 34 | 35 |

**Design Example**

|    |    |    |    |    |
|----|----|----|----|----|
| 1  | 2  | 3  | 4  | 5  |
| 6  | 7  | 8  | 9  | 10 |
| 11 | 12 | 13 | 14 | 15 |
| 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 |
| 26 | 27 | 28 | 29 | 30 |
| 31 | 32 | 33 | 34 | 35 |

**Coding Example**

| Data Order | b7 | b6 | b5 | b4 | b3 | b2 | b1 | b0 | Hex Data |
|------------|----|----|----|----|----|----|----|----|----------|
| 2nd byte   | *  | 0  | 0  | 1  | 0  | 1  | 0  | 0  | 14 Hex   |
| 3rd byte   | *  | 0  | 1  | 1  | 1  | 1  | 1  | 0  | 3E Hex   |
| 4th byte   | *  | 1  | 0  | 1  | 0  | 1  | 0  | 1  | 55 Hex   |
| 5th byte   | *  | 1  | 0  | 0  | 0  | 0  | 0  | 1  | 41 Hex   |
| 6th byte   | *  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 20 Hex   |

**5.2.3 Reserved (30 Hex ~ 3F Hex): No Operation**

A user should not use these codes area.

**5.2.4 Reserved (40 Hex ~ 4F Hex): No Operation**

A user should not use these codes area.

**5.2.5 DIM (50 Hex ~ 57 Hex): Dimming**

Brightness can be controlled into 8 levels by using this function.

| Data Order | b7 | b6 | b5 | b4 | b3 | b2 | b1 | b0 | Hex Data | Dimming Level |
|------------|----|----|----|----|----|----|----|----|----------|---------------|
| 1st byte   | 0  | 1  | 0  | 1  | *  | 0  | 0  | 0  | 50 Hex   | 50 %; Default |
|            |    |    |    |    |    | 0  | 0  | 1  | 51 Hex   | 56 %          |
|            |    |    |    |    |    | 0  | 1  | 0  | 52 Hex   | 62 %          |
|            |    |    |    |    |    | 0  | 1  | 1  | 53 Hex   | 69 %          |
|            |    |    |    |    |    | 1  | 0  | 0  | 54 Hex   | 75 %          |
|            |    |    |    |    |    | 1  | 0  | 1  | 55 Hex   | 81 %          |
|            |    |    |    |    |    | 1  | 1  | 0  | 56 Hex   | 87 %          |
|            |    |    |    |    |    | 1  | 1  | 1  | 57 Hex   | 94 %; Maximum |

**5.2.6 DLNG (60Hex ~ 67 Hex): Set Display Length**

This command is used to define the number of display digit.

| Data Order | b7 | b6 | b5 | b4 | b3 | b2 | b1 | b0 | Hex Data | Available Digit       |
|------------|----|----|----|----|----|----|----|----|----------|-----------------------|
| 1st byte   | 0  | 1  | 1  | 0  | *  | 0  | 0  | 0  | 60 Hex   | 1~16 Digit; Default   |
|            |    |    |    |    |    | 0  | 0  | 1  | 61 Hex   | 1~9 Digit             |
|            |    |    |    |    |    | 0  | 1  | 0  | 62 Hex   | 1~10 Digit            |
|            |    |    |    |    |    | 0  | 1  | 1  | 63 Hex   | 1~11 Digit            |
|            |    |    |    |    |    | 1  | 0  | 0  | 64 Hex   | 1~12 Digit; Recommend |
|            |    |    |    |    |    | 1  | 0  | 1  | 65 Hex   | 1~13 Digit            |
|            |    |    |    |    |    | 1  | 1  | 0  | 66 Hex   | 1~14 Digit            |
|            |    |    |    |    |    | 1  | 1  | 1  | 67 Hex   | 1~15 Digit            |

**5.2.7 ALL (70 Hex ~ 73 Hex): All Segments ON/OFF**

All segments can be displayed or non-displayed by using this command.

This command is useful for testing of VFD module, blinking of display or obviating erroneous display pattern at power on.

| Data Order | b7 | b6 | b5 | b4 | b3 | b2 | b1 | b0 | Hex data | Description                  |
|------------|----|----|----|----|----|----|----|----|----------|------------------------------|
| 1st byte   | 0  | 1  | 1  | 1  | *  | *  | 0  | 0  | 70 Hex   | Maintain current state       |
|            |    |    |    |    |    |    | 0  | 1  | 71 Hex   | All segments are turned-off. |
|            |    |    |    |    |    |    | 1  | 0  | 72 Hex   | All segments are turned-on.  |
|            |    |    |    |    |    |    | 1  | 1  | 73 Hex   | All segments are turned-on.  |

**5.3 Power On Reset**

The power on reset function allows the users to re-initialize the display controller, after the power is turned off and then power on.

When the controller is initialized, the reset status is as follows;

- \* CG-RAM data .....All contents are undefined.
- \* All Display Lights ON/OFF ..... All display patterns are turned-off.
- \* Display Digit .....All digits (1~16 digits) are available.
- \* Dimming Level ..... Set to 50% Dimming
- \* Write-in Position .....Set to the 1st Digit (1G).

**5.4 Recommend Initial Setting Sequence**

After power on, next command codes are recommended.

- \* Digits Length (1~12) .....64 Hex
- \* Brightness Level (Maximum) .....57 Hex
- \* Save CG-RAM (UDF) Characters .....20h~27h, UDF Data
- \* Cursor Position (1G) .....10h
- \* Write-in any Character Code .....Any Data on Character Code Table on Page-9