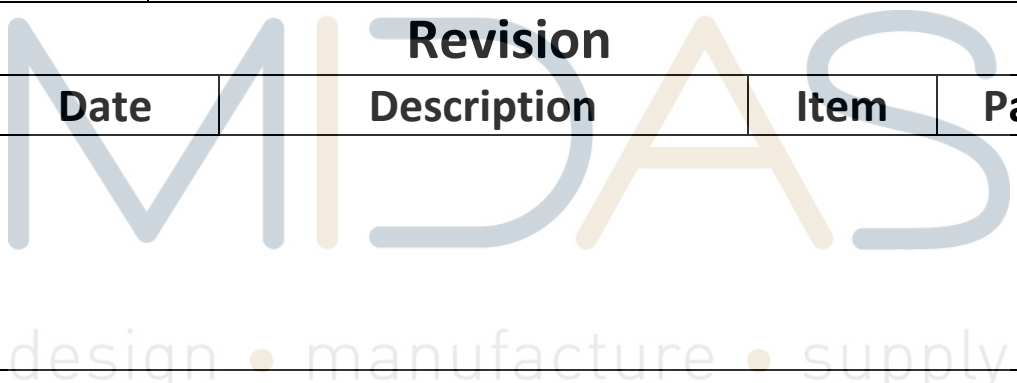


| Specification | | | | |
|---|--------------------------|-------------|------|------|
| Part Number: | MC42005A6W-BNMLWS | | | |
| Version: | 1 | | | |
| Date: | 17/05/2013 | | | |
| Revision | | | | |
| No. | Date | Description | Item | Page |
|  | | | | |

Contents

1. Module Classification Information
2. Precautions in use of LCD Modules
3. General Specification
4. Absolute Maximum Ratings
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14. Initializing of LCM
15. Quality Assurance
16. Reliability

MIDAS
design • manufacture • supply

Midas LCD Part Number System

MC COG 132033 A * 6 W * * - S N T L W * *
1 2 3 4 5 6 7 8 9 - 10 11 12 13 14 15 16

- 1 = **MC:** Midas Components
- 2 = **Blank:** COB (chip on board) **COG:** chip on glass
- 3 = **No of dots** (e.g. 240064 = 240 x 64 dots) (e.g. 21605 = 2 x 16 5mm C.H.)
- 4 = **Series**
- 5 = **Series Variant:** A to Z – see addendum
- 6 = **3:** 3 o'clock **6:** 6 o'clock **9:** 9 o'clock **12:** 12 o'clock
- 7 = **S:** Normal (0 to + 50 deg C) **W:** Wide temp. (-20 to + 70 deg C) **X:** Extended temp (-30 + 80 Deg C)
- 8 = **Character Set**

Blank: Standard (English/Japanese)
C: Chinese Simplified (Graphic Displays only)
CB: Chinese Big 5 (Graphic Displays only)
H: Hebrew
K: European (std) (English/German/French/Greek)
L: English/Japanese (special)
M: European (English/Scandinavian)
R: Cyrillic
W: European (English/Greek)
U: European (English/Scandinavian/Icelandic)

9 = **Bezel Height** (where applicable /available)

| | Top of Bezel to Top of PCB | LED Connection Common (via pins 1 and 2) via pins 15+ 16- | Array or Edge Lit |
|--------------|----------------------------|--|-------------------|
| Blank | 9.5mm / not applicable | | Array |
| 2 | 8.9 mm | Common | Array |
| 3 | 7.8 mm | Separate | Array |
| 4 | 7.8 mm | Common | Array |
| 5 | 9.5 mm | Separate | Array |
| 6 | 7 mm | Common | Array |
| 7 | 7 mm | Separate | Array |
| 8 | 6.4 mm | Common | Edge |
| 9 | 6.4 mm | Separate | Edge |
| A | 5.5 mm | Common | Edge |
| B | 5.5 mm | Separate | Edge |
| D | 6.0mm | Separate | Edge |
| E | 5.0mm | Separate | Edge |
| F | 4.7mm | Common | Edge |
| G | 3.7mm | Separate | EL |
| H | 7 mm | Separate | Edge |

- 10 = **T:** TN **S:** STN **B:** STN Blue **G:** STN Grey **F:** FSTN **F2:** FFSTN **V:** VA (Vertically Aligned)
- 11 = **P:** Positive **N:** Negative
- 12 = **R:** Reflective **M:** Transmissive **T:** Transflective
- 13 = **Backlight:** **Blank:** Reflective **L:** LED
- 14 = **Backlight Colour:** **Y:** Yellow-Green **W:** White **B:** Blue **R:** Red **A:** Amber **O:** Orange **G:** Green **RGB:** R.G.B.
- 15 = **Driver Chip:** **Blank:** Standard **I:** I²C **S:** SPI **T:** Toshiba T6963C **A:** Avant SAP1024B **R:** Raio RA6963
- 16 = **Voltage Variant:** e.g. **3** = 3v

2. Precautions in use of LCD Modules

- (1) Avoid applying excessive shocks to the module or making any alterations or modifications to it.
- (2) Don't make extra holes on the printed circuit board, modify its shape or change the components of LCD module.
- (3) Don't disassemble the LCM.
- (4) Don't operate it above the absolute maximum rating.
- (5) Don't drop, bend or twist LCM.
- (6) Soldering: only to the I/O terminals.
- (7) Storage: please storage in anti-static electricity container and clean environment.

3. General Specification

| Item | Dimension | Unit |
|---------------------------------------|-----------------------------------|-------------|
| Number of Characters | 20characters x 4 Lines | — |
| Module dimension (With LED Backlight) | 98.0 x 60.0 x 13.5 (MAX) | mm |
| View area | 76.0 x 25.2 | mm |
| Active area | 70.40 x 20.80 | mm |
| Dot size | 0.55 x 0.55 | mm |
| Dot pitch | 0.60 x 0.60 | mm |
| Character size | 2.95 x 4.75 | mm |
| Character pitch | 3.55 x 5.35 | mm |
| LCD type | STN, Blue, Negative, Transmissive | |
| Duty | 1/16 | |
| View direction | 6 o'clock | |
| Backlight Type | White LED backlight | |

4. Absolute Maximum Ratings

| Item | | Symbol | Min | Max | Unit |
|--------------------------|-----------------|-----------------|--------------|--------------|------|
| Input Voltage | | V_I | -0.3 | $V_{DD}+0.3$ | V |
| Supply Voltage For Logic | | $V_{DD}-V_{SS}$ | -0.3 | 5.5 | V |
| Supply Voltage For LCD | | $V_{DD}-V_0$ | $V_{dd}-7.0$ | $V_{dd}+0.3$ | V |
| Wide Temperature LCM | Operating Temp. | T_{op} | -20 | 70 | °C |
| | Storage Temp. | T_{str} | -30 | 80 | °C |

5. Electrical Characteristics

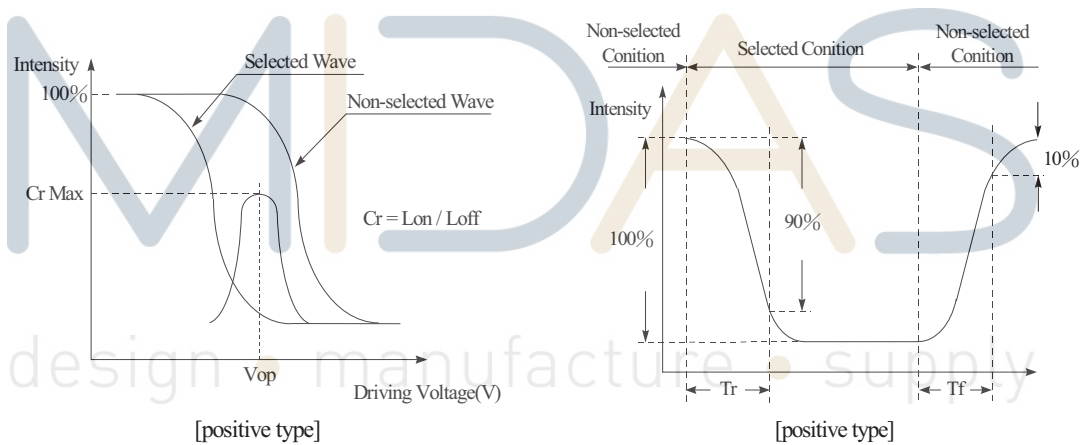
| Item | Symbol | Condition | Min | Typ | Max | Unit |
|-----------------------------------|-----------------|---|--------------|-----|--------------|------|
| Supply Voltage For Logic | $V_{DD}-V_{SS}$ | — | 4.5 | 5.0 | 5.5 | V |
| Supply Voltage For LCD | $V_{DD}-V_0$ | $T_a=25^{\circ}\text{C}$ | 4.2 | 4.5 | 4.8 | V |
| Input High Volt. | V_{IH} | — | $0.7 V_{DD}$ | — | V_{DD} | V |
| Input Low Volt. | V_{IL} | — | V_{SS} | — | $0.3 V_{DD}$ | V |
| Supply Current | I_{DD} | $V_{DD}=5\text{V}$ | 0.8 | 1.2 | 2.0 | mA |
| Supply Voltage of White backlight | V_{LED} | Forward current =30 mA Number of LED die 1x2=2 | 3.8 | 4.0 | 4.2 | V |

6. Optical Characteristics

| Item | Symbol | Condition | Min | Typ | Max | Unit |
|----------------|--------------|-------------|-----|-----|-----|------|
| View Angle | (V) θ | $CR \geq 2$ | -20 | — | 35 | deg |
| | (H) ϕ | $CR \geq 2$ | -30 | — | 30 | deg |
| Contrast Ratio | CR | — | — | 3 | — | — |
| Response Time | T rise | — | — | — | 250 | ms |
| | T fall | — | — | — | 250 | ms |

Definition of Operation Voltage (Vop)

Definition of Response Time (Tr, Tf)



Conditions:

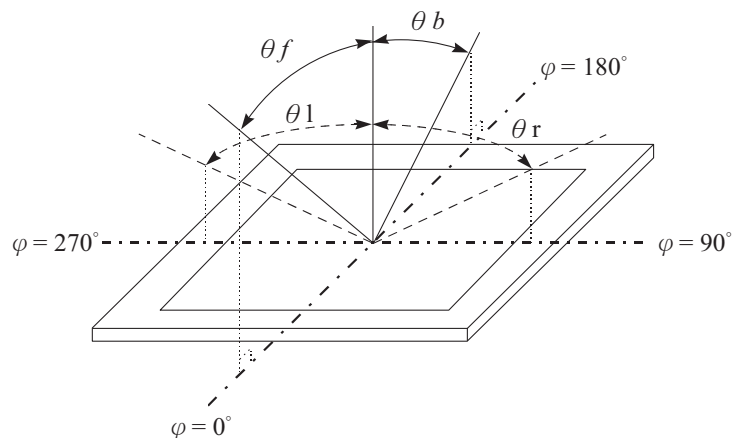
Operating Voltage: Vop

Viewing Angle (θ , ϕ): 0° , 0°

Frame Frequency: 64 HZ

Driving Waveform: 1/N duty, 1/a bias

Definition of viewing angle ($CR \geq 2$)



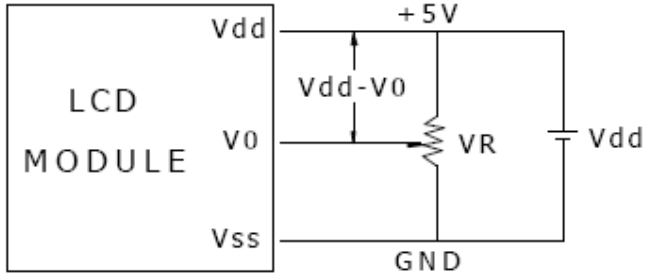
7. Interface Pin Function

| Pin No. | Symbol | Level | Description |
|----------------|-----------------|--------------|---------------------------|
| 1 | LED(+) | | Anode of LED Backlight |
| 2 | LED(-) | | Cathode of LED Backlight |
| 3 | V _{SS} | 0V | Ground |
| 4 | V _{DD} | 5.0V | Supply Voltage for logic |
| 5 | SCLK | H/L | Serial Clock |
| 6 | SID | H/L | Serial Data |
| 7 | V ₀ | (Variable) | Operating voltage for LCD |
| 8 | /CSB | H/L | Chip Select |
| 9 | RS | H/L | Register Select |
| 10 | NC | | No Connection |

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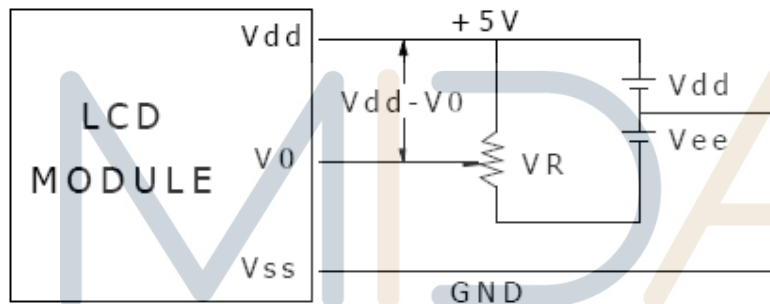
8. Power Supply

SINGLE SUPPLY VOLTAGE TYPE



Vdd-V0: LCD Driving Voltage
VR: 10K - 20K

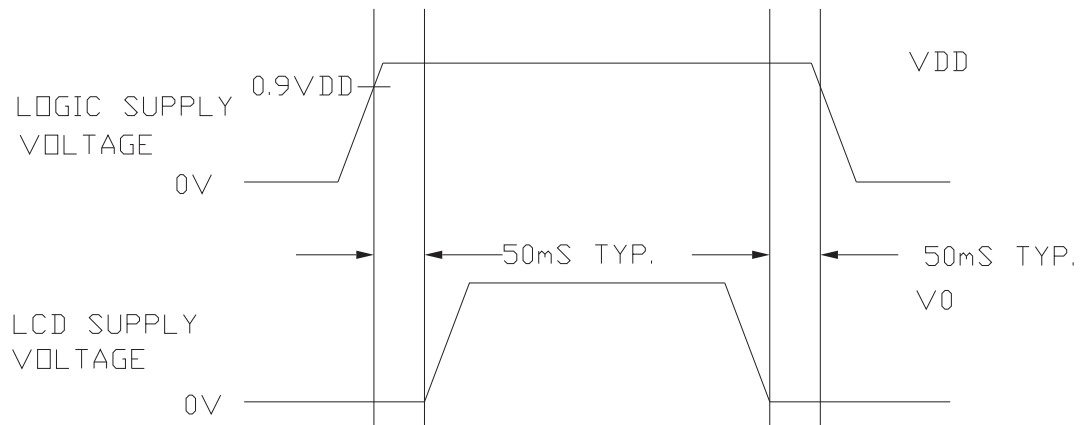
DUAL SUPPLY VOLTAGE TYPE



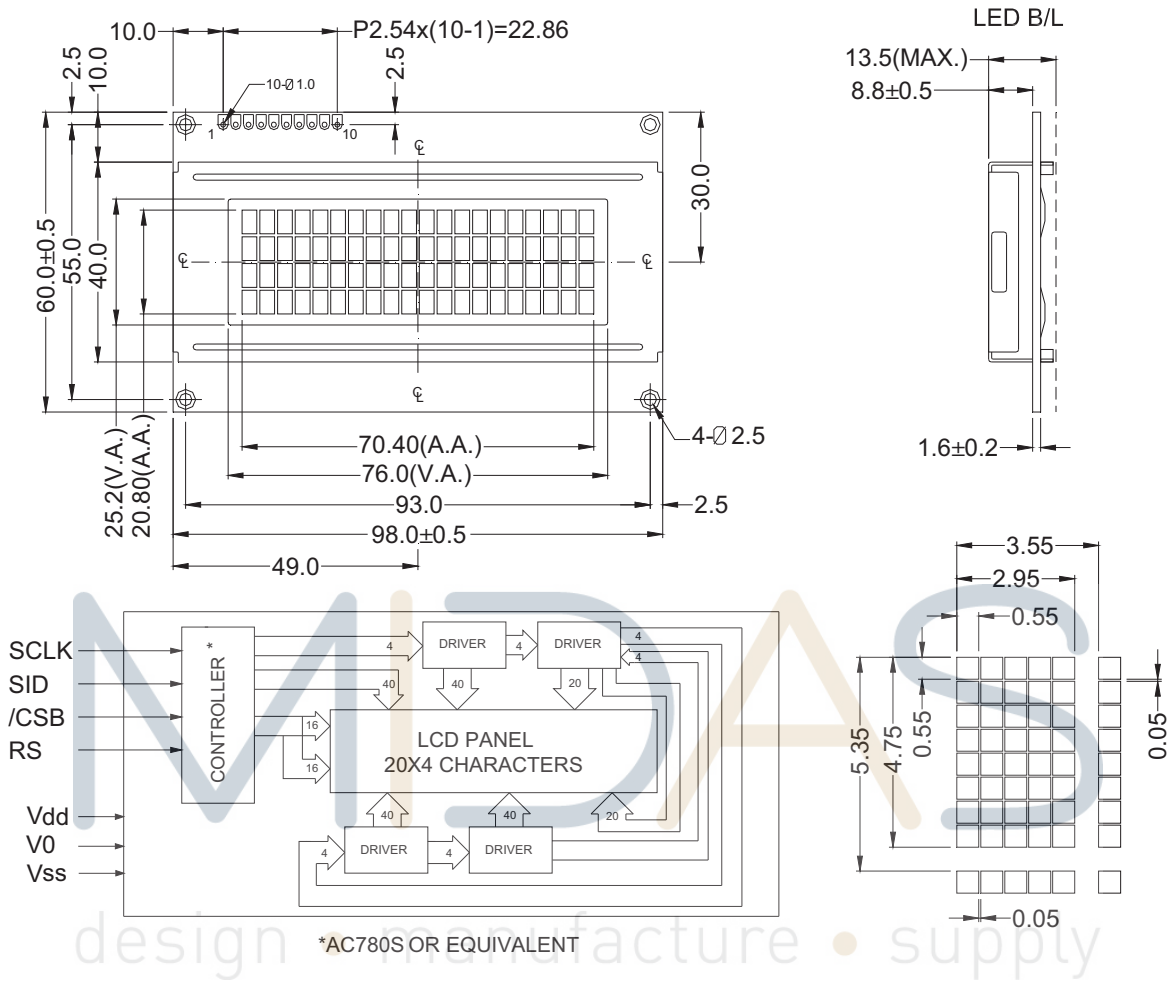
Vdd-V0: LCD Driving Voltage
VR: 10K - 20K

Timing Diagram of VDD Against V0.

Power on sequence shall meet the requirement of Figure 4, the timing diagram of VDD against V0.



9. Contour Drawing & Block Diagram



10. Function Description

The LCD display Module is built in a LSI controller, the controller has two 8-bit registers, an instruction register (IR) and a data register (DR).

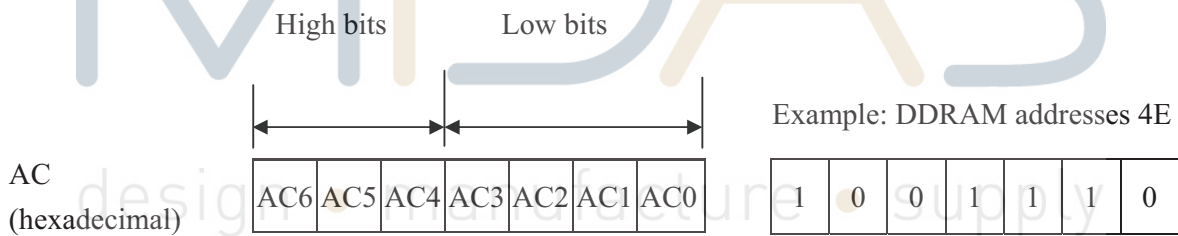
The IR stores instruction codes, such as display clear and cursor shift, and address information for display data RAM (DDRAM) and character generator (CGRAM). The IR can only be written from the MPU. The DR temporarily stores data to be written or read from DDRAM or CGRAM. When address information is written into the IR, then data is stored into the DR from DDRAM or CGRAM.

Address Counter (AC)

The address counter (AC) assigns addresses to both DDRAM and CGRAM

Display Data RAM (DDRAM)

This DDRAM is used to store the display data represented in 8-bit character codes. Its extended capacity is 80×8 bits or 80 characters. Below figure is the relationships between DDRAM addresses and positions on the liquid crystal display.



Display position DDRAM address

| | | | | | | | | | | | | | | | | | | | |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 0A | 0B | 0C | 0D | 0E | 0F | 10 | 11 | 12 | 13 |
| 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 4A | 4B | 4C | 4D | 4E | 4F | 50 | 51 | 52 | 53 |
| 14 | 15 | 16 | 17 | 18 | 19 | 1A | 1B | 1C | 1D | 1E | 1F | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 |
| 54 | 55 | 56 | 57 | 58 | 59 | 5A | 5B | 5C | 5D | 5E | 5F | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 |

4-Line by 20-Character Display

Character Generator ROM (CGROM)

The CGROM generate 5×8 dot or 5×10 dot character patterns from 8-bit character codes. See Table 2.

Character Generator RAM (CGRAM)

In CGRAM, the user can rewrite character by program. For 5×8 dots, eight character patterns

can be written, and for 5×10 dots, four character patterns can be written.

Write into DDRAM the character code at the addresses shown as the left column of table 1. To show the character patterns stored in CGRAM.

Relationship between CGRAM Addresses, Character Codes (DDRAM) and Character patterns

Table 1

For 5 * 8 dot character patterns

| Character Codes (DDRAM data) | | CGRAM Address | | Character Patterns (CGRAM data) | |
|------------------------------|--|---------------|-------|---------------------------------|--|
| 7 6 5 4 3 2 1 0 | | 5 4 3 2 1 0 | | 7 6 5 4 3 2 1 0 | |
| High Low | | High Low | | High Low | |
| 0 0 0 0 * 0 0 0 | | 0 0 0 | 0 0 0 | * * * 0 | |
| | | | 0 0 1 | * * * 0 0 0 | |
| | | | 0 1 0 | * * * 0 0 0 | |
| | | | 0 1 1 | * * * 0 | |
| | | | 1 0 0 | * * * 0 0 0 | |
| | | | 1 0 1 | * * * 0 0 0 | |
| | | | 1 1 0 | * * * 0 0 0 | |
| | | | 1 1 1 | * * * 0 0 0 0 0 | |
| | | | 0 0 0 | * * * 0 0 0 | |
| | | | 0 0 1 | * * * 0 0 0 | |
| 0 0 0 0 * 0 0 1 | | 0 0 1 | 1 0 0 | * * * 0 0 0 | |
| | | | 1 0 1 | * * * 0 0 0 | |
| | | | 1 1 0 | * * * 0 0 0 | |
| | | | 1 1 1 | * * * 0 0 0 0 0 | |
| | | | 0 0 0 | * * * | |
| | | | 0 0 1 | * * * | |

For 5 * 10 dot character patterns

| Character Codes (DDRAM data) | | CGRAM Address | | Character Patterns (CGRAM data) | |
|------------------------------|--|---------------|---------|---------------------------------|--|
| 7 6 5 4 3 2 1 0 | | 5 4 3 2 1 0 | | 7 6 5 4 3 2 1 0 | |
| High Low | | High Low | | High Low | |
| 0 0 0 0 * 0 0 0 | | 0 0 | 0 0 0 0 | * * * 0 0 0 0 0 | |
| | | | 0 0 0 1 | * * * 0 0 0 0 0 | |
| | | | 0 0 1 0 | * * * 0 0 0 0 | |
| | | | 0 0 1 1 | * * * 0 0 0 | |
| | | | 0 1 0 0 | * * * 0 0 0 | |
| | | | 0 1 0 1 | * * * 0 0 0 | |
| | | | 0 1 1 0 | * * * 0 | |
| | | | 0 1 1 1 | * * * 0 0 0 0 0 | |
| | | | 1 0 0 0 | * * * 0 0 0 0 0 | |
| | | | 1 0 0 1 | * * * 0 0 0 0 0 | |
| | | | 1 0 1 0 | * * * 0 0 0 0 0 | |
| | | | 1 1 1 1 | * * * * * * * * | |

■ : " High "

11. Character Generator ROM Pattern

| $\frac{b7 \rightarrow 4}{b3 \rightarrow 0}$ | | 0000 | 0001 | 0010 | 0011 | 0100 | 0101 | 0110 | 0111 | 1000 | 1001 | 1010 | 1011 | 1100 | 1101 | 1110 | 1111 |
|---|-------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 0000 | CG RAM [00] | | | 0 | a | P | \ | P | | | | - | 9 | 3 | 0 | P | |
| 0001 | CG RAM [01] | | ! | 1 | A | Q | a | 9 | | | . | 7 | f | G | a | 9 | |
| 0010 | CG RAM [02] | | " | 2 | B | R | b | r | | | 7 | / | 9 | x | P | P | |
| 0011 | CG RAM [03] | | # | 3 | C | S | c | s | | | J | 0 | T | E | s | s | |
| 0100 | CG RAM [04] | | \$ | 4 | D | T | d | t | | | \ | T | T | P | H | s | |
| 0101 | CG RAM [05] | | % | 5 | E | U | e | u | | | - | * | * | 1 | s | 0 | |
| 0110 | CG RAM [06] | | & | 6 | F | V | f | v | | | 9 | 0 | 3 | 9 | P | 2 | |
| 0111 | CG RAM [07] | | * | 7 | G | W | g | w | | | 7 | * | x | 9 | 9 | x | |
| 1000 | CG RAM [00] | | (| 8 | H | X | h | x | | | 4 | 0 | * | 1 | J | X | |
| 1001 | CG RAM [01] | |) | 9 | I | Y | i | y | | | 0 | 0 | J | U | ' | Y | |
| 1010 | CG RAM [02] | | * | * | J | Z | j | z | | | x | 0 | 0 | U | U | J | * |
| 1011 | CG RAM [03] | | + | + | K | k | k | k | | | * | 0 | 0 | 0 | 0 | * | * |
| 1100 | CG RAM [04] | | , | < | L | l | l | l | | | P | 0 | 0 | 0 | 0 | P | |
| 1101 | CG RAM [05] | | - | = | M | m | m | m | | | a | x | s | U | t | * | * |
| 1110 | CG RAM [06] | | . | > | N | n | n | n | | | a | 0 | 0 | 0 | n | | |
| 1111 | CG RAM [07] | | / | ? | O | o | o | e | | | w | U | 0 | " | 0 | | |

12. Instruction Table

| Instruction | Instruction Code | | | | | | | | | | Description | Execution time (fosc=210Khz) |
|-------------------------|------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|---------------------------------|
| | RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | | |
| Clear Display | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | Write "20H" to DDRAM and set DDRAM address to "00H" from AC | 1.98ms |
| Return Home | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | — | Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed. | 1.98ms |
| Entry Mode Set | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | I/D | SH | Assign cursor moving direction and enable the shift of entire display. | 48μs |
| Display ON/OFF | 0 | 0 | 0 | 0 | 0 | 0 | 1 | D | C | B | Set display (D), cursor (C), and blinking of cursor (B) on/off control bit. | 48μs |
| Cursor or Display Shift | 0 | 0 | 0 | 0 | 0 | 1 | S/C | R/L | — | — | Set cursor moving and display shift control bit, and the direction, without changing of DDRAM data. | 48μs |
| Function Set | 0 | 0 | 0 | 0 | 1 | DL | N | F | — | — | Set interface data length (DL:8-bit/4-bit), numbers of display line (N:2-line/1-line)and, display font type (F:5×11 dots/5×8 dots) | 48μs |
| Set CGRAM Address | 0 | 0 | 0 | 1 | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | Set CGRAM address in address counter. | 48μs |
| Set DDRAM Address | 0 | 0 | 1 | AC6 | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | Set DDRAM address in address counter. | 48μs |
| Write Data to RAM | 1 | 0 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Write data into internal RAM (DDRAM/CGRAM). | 48μs |

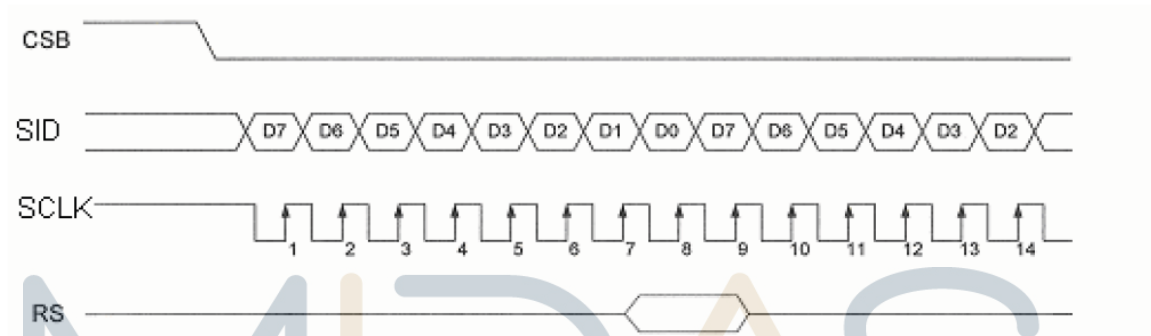
design • manufacture • supply * ”—” : N/A

13. Interface with MPU

- For serial interface data, bus lines (DB5 to DB7) are used. 4-Line SPI

If 4-Pin SPI mode is used, CSB (DB5), SID (DB7), SCLK (DB6), and RS are used. They are chip selection; serial input data, serial clock input, and data/instruction section, relatively. The example of timing sequence is shown below.

- Example of timing sequence

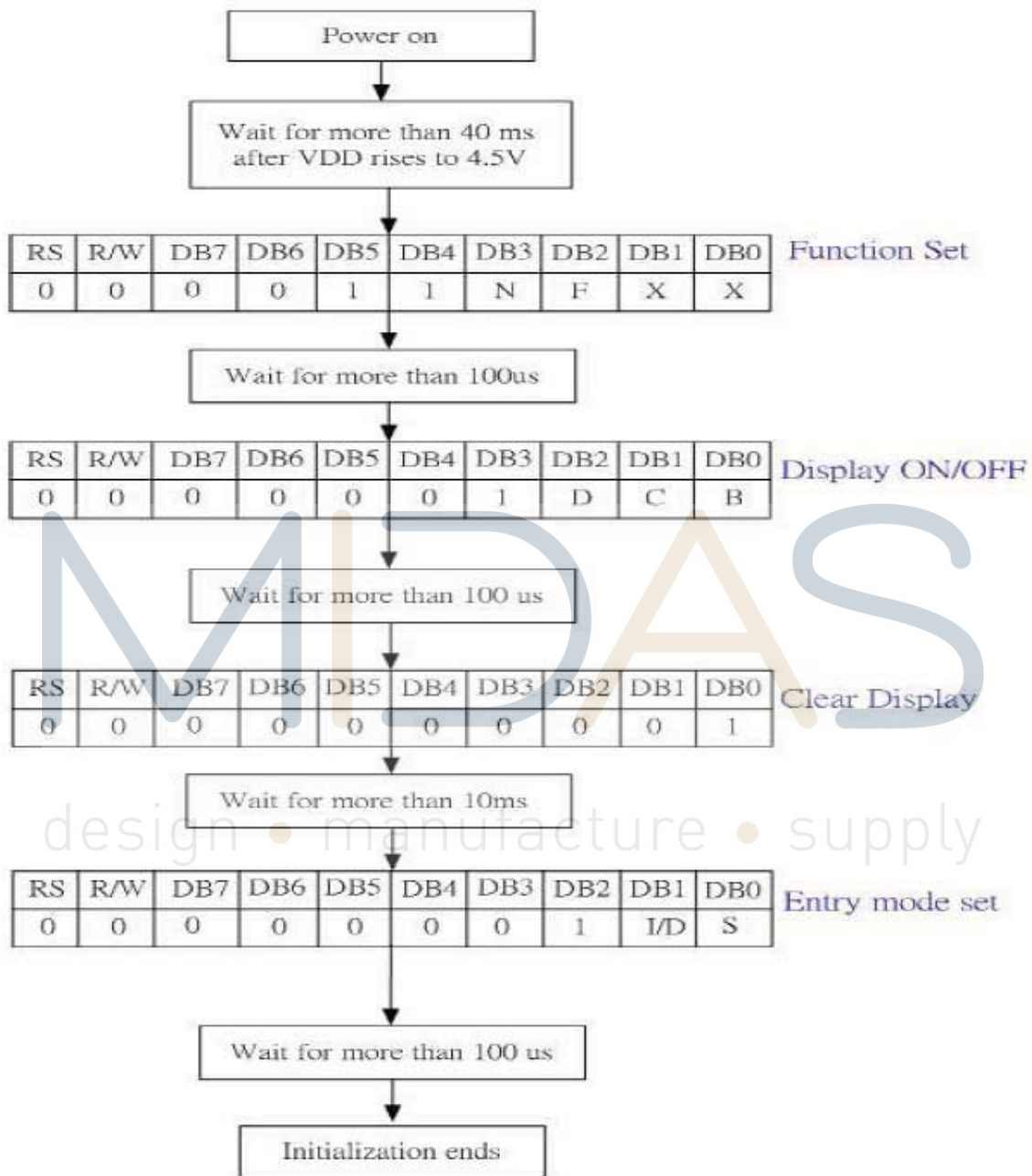


Note: Following is the master SPI clock mode of MPU.

Idle state for clock is a high level · data transmitted on rising edge of SCLK, and data is hold during low level.

design • manufacture • supply

14. Initializing of LCM



Initial Code:

```
void InitRW1063(void)
```

```
{
```

```
    WriteInst (0x38); //DL=1: 8 bits; N=1: 2 line; F=0: 5 x 8dots
```

```
    WriteInst (0x0c); // D=1, display on; C=B=0; cursor off; blinking off;
```

```
    WriteInst (0x06); // I/D=1: Increment by 1; S=0: No shift
```

```
}
```

15. Quality Assurance

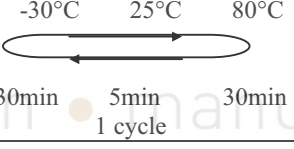
Screen Cosmetic Criteria

| Item | Defect | Judgment Criterion | Partition | | | | | | | | | | | | | | | | | | | | |
|--------------------|--------------------------------------|--|-------------------|--------------------------------------|--------------|-----------|--------------------|---|--------------------|---|-----------|---|-------------------|--------------------------------------|--------------|-----------|--------------------|---|--------------------|---|-----------|---|-------|
| 1 | Spots | <p>A)Clear</p> <table border="0"> <tr> <td><u>Size: d mm</u></td> <td><u>Acceptable Qty in active area</u></td> </tr> <tr> <td>$d \leq 0.1$</td> <td>Disregard</td> </tr> <tr> <td>$0.1 < d \leq 0.2$</td> <td>6</td> </tr> <tr> <td>$0.2 < d \leq 0.3$</td> <td>2</td> </tr> <tr> <td>$0.3 < d$</td> <td>0</td> </tr> </table> <p>Note: Including pin holes and defective dots which must be within one pixel size.</p> <p>B)Unclear</p> <table border="0"> <tr> <td><u>Size: d mm</u></td> <td><u>Acceptable Qty in active area</u></td> </tr> <tr> <td>$d \leq 0.2$</td> <td>Disregard</td> </tr> <tr> <td>$0.2 < d \leq 0.5$</td> <td>6</td> </tr> <tr> <td>$0.5 < d \leq 0.7$</td> <td>2</td> </tr> <tr> <td>$0.7 < d$</td> <td>0</td> </tr> </table> | <u>Size: d mm</u> | <u>Acceptable Qty in active area</u> | $d \leq 0.1$ | Disregard | $0.1 < d \leq 0.2$ | 6 | $0.2 < d \leq 0.3$ | 2 | $0.3 < d$ | 0 | <u>Size: d mm</u> | <u>Acceptable Qty in active area</u> | $d \leq 0.2$ | Disregard | $0.2 < d \leq 0.5$ | 6 | $0.5 < d \leq 0.7$ | 2 | $0.7 < d$ | 0 | Minor |
| <u>Size: d mm</u> | <u>Acceptable Qty in active area</u> | | | | | | | | | | | | | | | | | | | | | | |
| $d \leq 0.1$ | Disregard | | | | | | | | | | | | | | | | | | | | | | |
| $0.1 < d \leq 0.2$ | 6 | | | | | | | | | | | | | | | | | | | | | | |
| $0.2 < d \leq 0.3$ | 2 | | | | | | | | | | | | | | | | | | | | | | |
| $0.3 < d$ | 0 | | | | | | | | | | | | | | | | | | | | | | |
| <u>Size: d mm</u> | <u>Acceptable Qty in active area</u> | | | | | | | | | | | | | | | | | | | | | | |
| $d \leq 0.2$ | Disregard | | | | | | | | | | | | | | | | | | | | | | |
| $0.2 < d \leq 0.5$ | 6 | | | | | | | | | | | | | | | | | | | | | | |
| $0.5 < d \leq 0.7$ | 2 | | | | | | | | | | | | | | | | | | | | | | |
| $0.7 < d$ | 0 | | | | | | | | | | | | | | | | | | | | | | |
| 2 | Bubbles in Polarizer | <table border="0"> <tr> <td><u>Size: d mm</u></td> <td><u>Acceptable Qty in active area</u></td> </tr> <tr> <td>$d \leq 0.3$</td> <td>Disregard</td> </tr> <tr> <td>$0.3 < d \leq 1.0$</td> <td>3</td> </tr> <tr> <td>$1.0 < d \leq 1.5$</td> <td>1</td> </tr> <tr> <td>$1.5 < d$</td> <td>0</td> </tr> </table> | <u>Size: d mm</u> | <u>Acceptable Qty in active area</u> | $d \leq 0.3$ | Disregard | $0.3 < d \leq 1.0$ | 3 | $1.0 < d \leq 1.5$ | 1 | $1.5 < d$ | 0 | Minor | | | | | | | | | | |
| <u>Size: d mm</u> | <u>Acceptable Qty in active area</u> | | | | | | | | | | | | | | | | | | | | | | |
| $d \leq 0.3$ | Disregard | | | | | | | | | | | | | | | | | | | | | | |
| $0.3 < d \leq 1.0$ | 3 | | | | | | | | | | | | | | | | | | | | | | |
| $1.0 < d \leq 1.5$ | 1 | | | | | | | | | | | | | | | | | | | | | | |
| $1.5 < d$ | 0 | | | | | | | | | | | | | | | | | | | | | | |
| 3 | Scratch | In accordance with spots cosmetic criteria. When the light reflects on the panel surface, the scratches are not to be remarkable. | Minor | | | | | | | | | | | | | | | | | | | | |
| 4 | Allowable Density | Above defects should be separated more than 30mm each other. | Minor | | | | | | | | | | | | | | | | | | | | |
| 5 | Coloration | Not to be noticeable coloration in the viewing area of the LCD panels. Back-light type should be judged with back-light on state only. | Minor | | | | | | | | | | | | | | | | | | | | |

design • manufacture • supply

16. Reliability

Content of Reliability Test

| Environmental Test | | | |
|--------------------------------------|--|---|---------------------|
| Test Item | Content of Test | Test Condition | Applicable Standard |
| High Temperature storage | Endurance test applying the high storage temperature for a long time. | 80°C 96hrs | — |
| Low Temperature storage | Endurance test applying the high storage temperature for a long time. | -30°C 96hrs | — |
| High Temperature Operation | Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time. | 70°C 96hrs | — |
| Low Temperature Operation | Endurance test applying the electric stress under low temperature for a long time. | -20°C 96hrs | — |
| High Temperature/ Humidity Storage | Endurance test applying the high temperature and high humidity storage for a long time. | 80°C, 90%RH 96hrs | — |
| High Temperature/ Humidity Operation | Endurance test applying the electric stress (Voltage & Current) and temperature / humidity stress to the element for a long time. | 70°C, 90%RH 96hrs | — |
| Temperature Cycle | Endurance test applying the low and high temperature cycle.  | -30→80°C 10 cycles | — |
| Mechanical Test | | | |
| Vibration test | Endurance test applying the vibration during transportation and using. | 10~22Hz→1.5mmp-p 22~500Hz→1.5G Total 0.5hrs | — |
| Shock test | Constructional and mechanical endurance test applying the shock during transportation. | 50G Half sign wave 11 msdc 3 times of each direction | — |

***Supply voltage for logic system=5V. Supply voltage for LCD system =Operating voltage at 25°C