**Midas Components Limited**
Electra House
32 Southtown Road
Great Yarmouth
Norfolk
NR31 0DU
England

**Telephone** +44 (0)1493 602602
**Fax** +44 (0)1493 665111
**Email** sales@midasdisplays.com
**Website** www.midasdisplays.com

# Specification

| | |
|---|---|
| Part Number: | MC42005B6WK-SPTLY |
| Version: | 1 |
| Date: | 10/03/2010 |

## Revision

| No. | Date | Description | Item | Page |
|---|---|---|---|---|
| 1 | 08/1999 | Initial Issued | - | - |
| 2 | 03/2005 | Modify the full specification | - | - |
| 3 | 12/2005 | Update the part number system | - | - |
| 4 | 03/2006 | Add Red backlight | - | - |

| DOC. | DATASHEET STATEMENT |
|---|---|

1. The following icons are absolutely designed by Midas independently in 2007-SEP. They are not in common use in the LCD industry yet but just used for marking out Midasproducts' characteristics quickly and simply without any special meaning. Midas reserves the composing right and copyright.
   No one else is allowed to adopt these icons without Midas approval.
2. The ISO9001 logo used in this document is authorized by SGS (www.sgs.com). Midas had already successfully passed the strict and professional ISO9001:2000 Quality Management System Certification and got the certificate (No.: CN07/00404)
3. The technologies/techniques/crafts which denoted by the following icons are not exclusively owned by Midas, but also shared by Midas LCD strategic cooperators, however all these technologies/techniques/crafts have been finally confirmed by Midas professional engineers and QC department.
4. As the difference in test standard and test conditions, also Midas insufficient familiarity with the actual LCD using environment, all the referred information in this DATASHEET (including the icons) only have two functions:
   4.1: providing quick reference when you are judging whether or not the product meets your requirements.
   4.2: listing out definitely the tolerance.

   SAMPLE APPROVAL document rather than consider this DATASHEET as the standard for judging whether or not the LCD meets your requirements. Once you instruct Midas to a mass-production without definite demand for providing sample before, Midas will disclaim all responsibility if the mass-production is proved not meeting with your requirements.
5. The sequence of the icons is random and doesn't indicate the importance grade.
6. Icons explanation

Midas 2006 version logo.Midas is an integrated manufacturer of flat panel display (FPD). Midas supplies TN, HTN, STN, FSTN monochrome LCD panel; COB, COG, TAB LCD module; and all kinds of LED backlight.

**FAST RESPONSE TIME**
This icon on the cover indicates the product is with high response speed; Otherwise not.

**PROTECTION CIRCUIT**
This icon on the cover indicates the product is with protection circuit; Otherwise not.

**HIGH CONTRAST**
This icon on the cover indicates the product is with high contrast; Otherwise not.

**LONG LIFE VERSION**
This icon on the cover indicates the product is long life version (over 9K hours guaranteed); Otherwise not.

**WIDE VIEWING SCOPE**
This icon on the cover indicates the product is with wide viewing scope; Otherwise not.

**Anti UV VERSION**
This icon on the cover indicates the product is against UV line. Otherwise not.

**RoHS COMPLIANCE**
This icon on the cover indicates the product meets ROHS requirements; Otherwise not.

**OPERATION TEMPERATURE RANGE**
This icon on the cover indicates the operating temperature range (X-Y).

**3TIMEs 100% QC EXAMINATION**
This icon on the cover indicates the product has passed Midas thrice 100% QC. Otherwise not.

**TWICE SELECTION OF LED MATERIALS**
This icon on the cover indicates the LED had passed Midas twice strict selection which promises the product's identical color and brightness; Otherwise not.

**Vlcm = 3.0V**
This icon on the cover indicates the product can work at 3.0V exactly; otherwise not.

**N SERIES TECHNOLOGY (2008 developed)**
New structure, new craft, new technology and new materials inside both LCD module and LCD panel to improve the "RainBow"

# Contents

# 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) | Array or Edge Lit |
|---|---|---|---|
| **Blank** | 9.5mm / not applicable | via pins 15+ 16- | 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(No Backlight ) | 98.0 x 60.0 x 10.0（MAX） | mm |
| Module dimension(With LED Backlight ) | 98.0 x 60.0 x 15.0（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 | |
| Duty | 1/16 | |
| View direction | 6 o'clock or 12 o'clock | |
| Backlight Type | Yellow/Green LED backlight | |

# 4. Absolute Maximum Ratings

| Item | | Symbol | Min | Max | Unit |
|---|---|---|---|---|---|
| Input Voltage | | $V_I$ | -0.3 | VDD+0.3 | V |
| Supply Voltage For Logic | | VDD-$V_{SS}$ | -0.3 | 7.0 | V |
| Supply Voltage For LCD | | $V_{DD}$-$V_0$ | Vdd-13.5 | 0 | V |
| Standard Temperature LCM | Operating Temp. | Top | 0 | 50 | ℃ |
| | Storage Temp. | Tstr | -10 | 60 | ℃ |
| Wide Temperature LCM | Operating Temp. | Top | -20 | 70 | ℃ |
| | Storage Temp. | Tstr | -30 | 80 | ℃ |

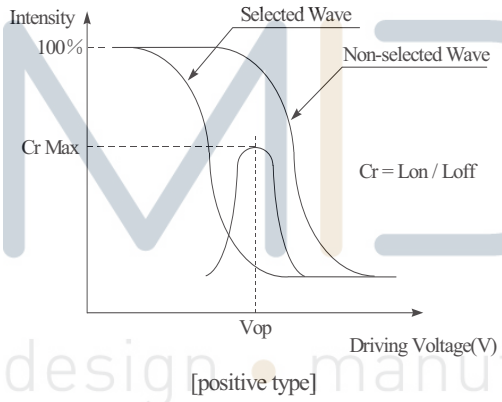
# 5. Electrical Characteristics

| 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 | $V_{DD}$-$V_0$ | Ta=25℃ | 4.5 | 5.0 | 5.5 | 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 | $I_{DD}$ | $V_{DD}$=5V | 0.7 | 0.75 | 1.5 | mA |
| Supply Voltage of Yellow-green backlight | $V_{LED}$ | Forward current =180 mA<br>Number of LED die 2x18= 36 | 4.0 | 4.2 | 4.4 | V |
| Supply Voltage of White backlight | $V_{LED}$ | Forward current =30 mA<br>Number of LED die 2 | 3.8 | 4.0 | 4.2 | V |
| Supply Voltage of RED backlight | $V_{LED}$ | Forward current =180 mA<br>Number of LED die 2x18= 36 | 3.5 | 3.9 | 4.1 | V |

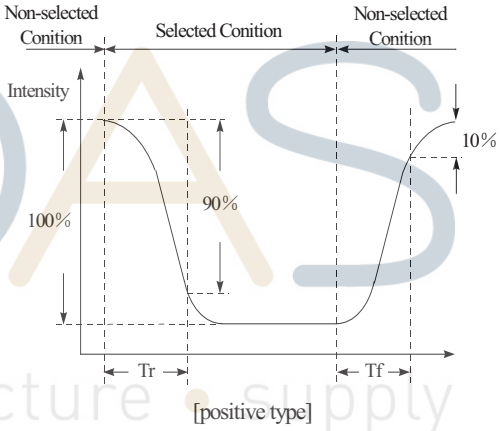
# 6. Optical Characteristics

| Item | Symbol | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| View Angle | (V)θ | CR≧2 | -20 | — | 35 | deg |
| | (H)φ | CR≧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 )**

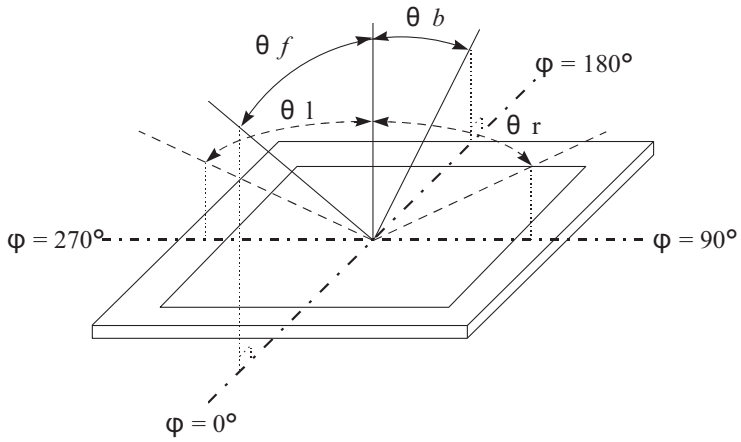



**Conditions :**

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≧2)**

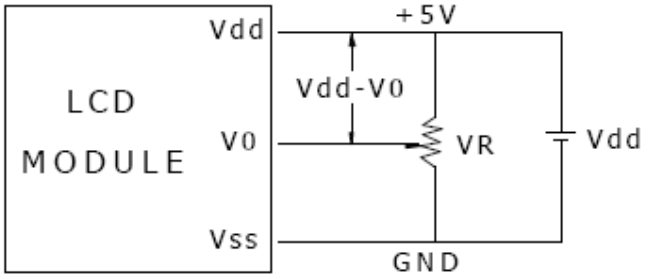


# 7. Interface Pin Function

| Pin No. | Symbol | Level | Description |
|---|---|---|---|
| 1 | $V_{SS}$ | 0V | Ground |
| 2 | $V_{DD}$ | 5.0V | Supply Voltage for logic |
| 3 | V0 | (Variable) | Operating voltage for LCD |
| 4 | RS | H/L | H: DATA, L: Instruction code |
| 5 | R/W | H/L | H: Read(MPU→Module) L: Write(MPU→Module) |
| 6 | E | H,H→L | Chip enable signal |
| 7 | DB0 | H/L | Data bit 0 |
| 8 | DB1 | H/L | Data bit 1 |
| 9 | DB2 | H/L | Data bit 2 |
| 10 | DB3 | H/L | Data bit 3 |
| 11 | DB4 | H/L | Data bit 4 |
| 12 | DB5 | H/L | Data bit 5 |
| 13 | DB6 | H/L | Data bit 6 |
| 14 | DB7 | H/L | Data bit 7 |
| 15 | LED(+) | | Anode of LED Backlight |
| 16 | LED(-) | | Cathode of LED Backlight |

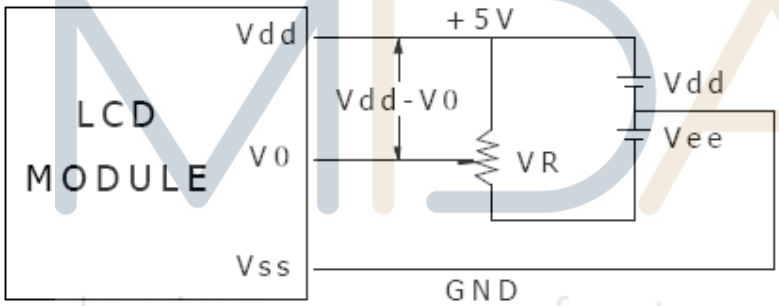
# 8. POWER SUPPLY

**SINGLE SUPPLY VOLTAGE TYPE**



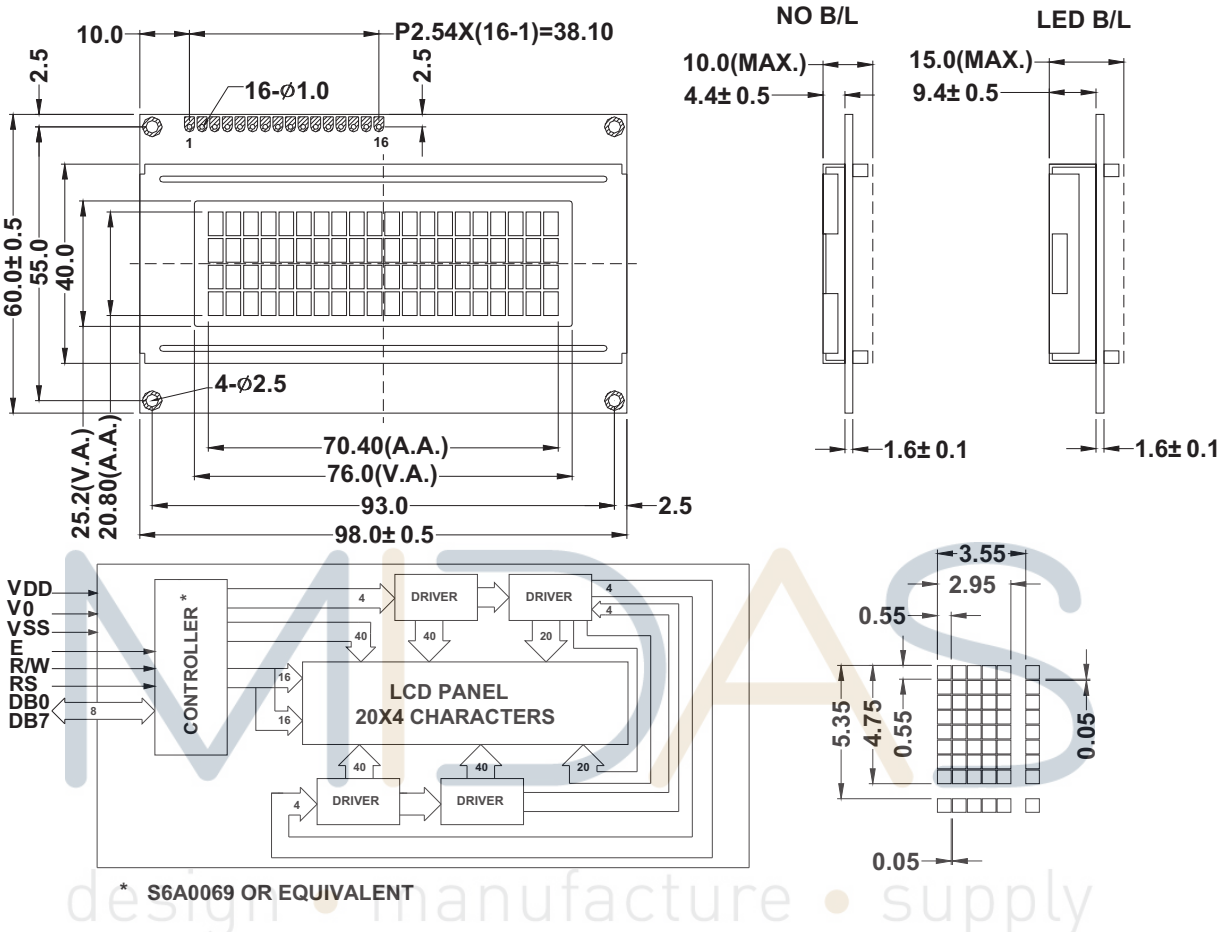

Vdd-V0: LCD Driving Voltage
VR: 10K - 20K

**DUAL SUPPLY VOLTAGE TYPE**




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

# 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. By the register selector (RS) signal, these two registers can be selected.

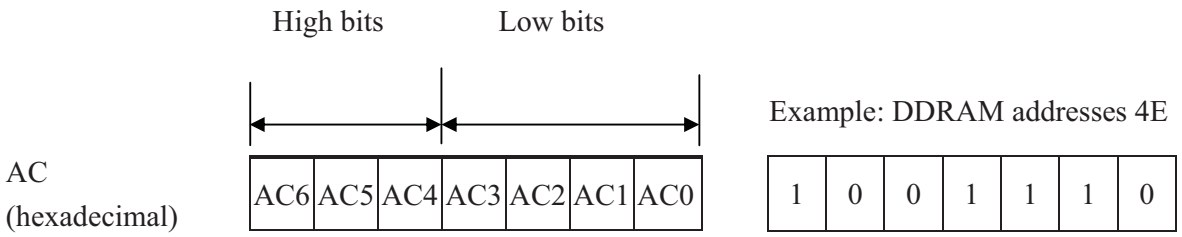
| RS | R/W | Operation |
|---|---|---|
| 0 | 0 | IR write as an internal operation (display clear, etc.) |
| 0 | 1 | Read busy flag (DB7) and address counter (DB0 to DB7) |
| 1 | 0 | Write data to DDRAM or CGRAM (DR to DDRAM or CGRAM) |
| 1 | 1 | Read data from DDRAM or CGRAM (DDRAM or CGRAM to DR) |

**Busy Flag (BF)**
When the busy flag is 1, the controller LSI is in the internal operation mode, and the next instruction will not be accepted. When RS=0 and R/W=1, the busy flag is output to DB7. The next instruction must be written after ensuring that the busy flag is 0.

**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 |
| 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 8A | 8B | 8C | 8D | 8E | 8F | 90 | 91 | 92 | 93 |
| C0 | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | C9 | CA | CB | CC | CD | CE | CF | D0 | D1 | D2 | D3 |

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

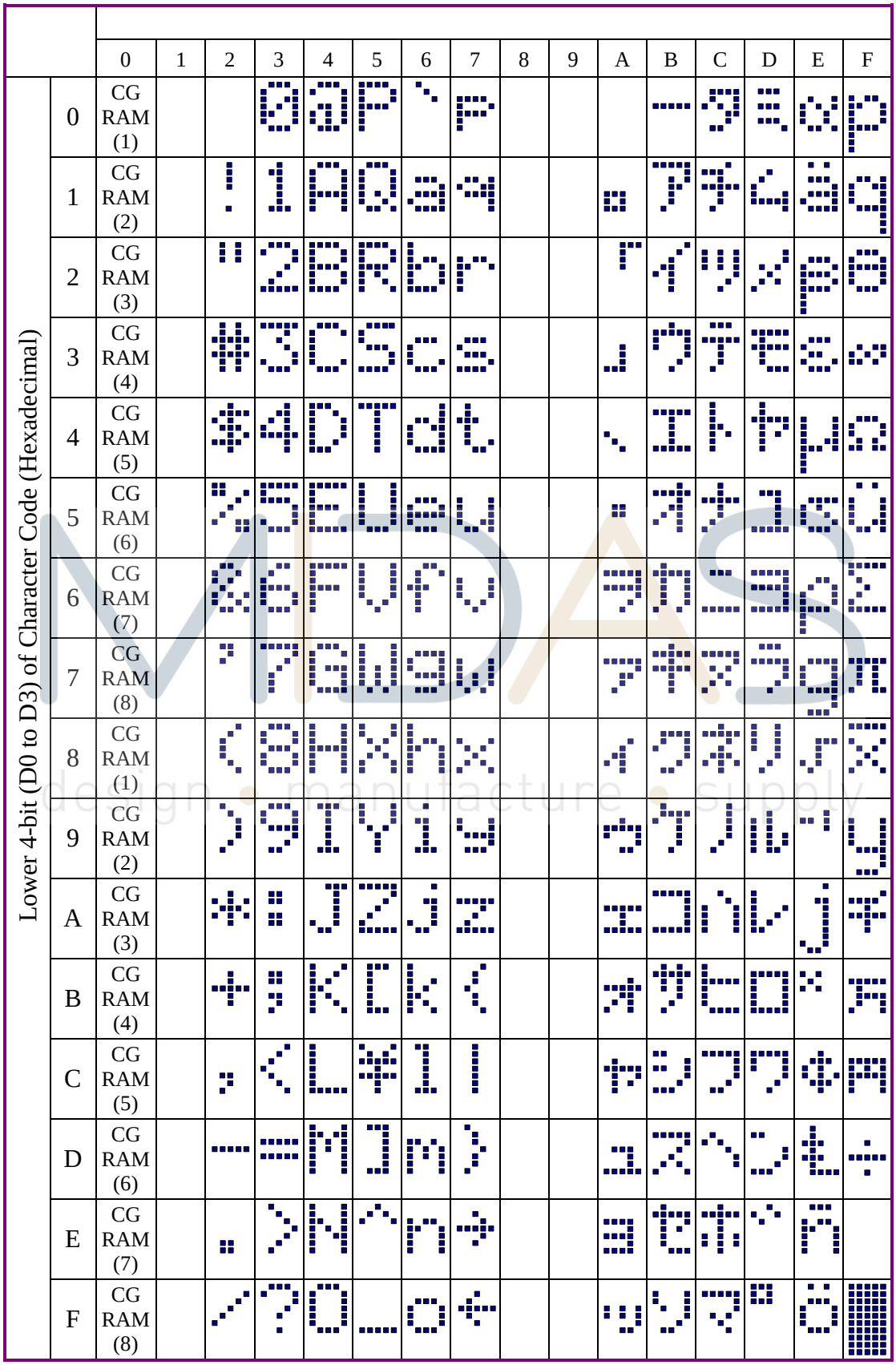
| Character Codes (DDRAM data) | CGRAM Address | Character Patterns (CGRAM data) | |
|---|---|---|---|
| 7 6 5 4 3 2 1 0 | 5 4 3 2 1 0 | 7 6 5 4 3 2 1 0 | |
| High Low | High Low | High Low | |
| 0 0 0 0 * 0 0 0 | 0 0 0 0 0 0 | * * * ■■■■■ 0 | Character pattern( 1 ) |
| | 0 0 1 | * * * ■ 0 0 0 ■ | |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

■ : " High "

# 11. Character Generator ROM Pattern



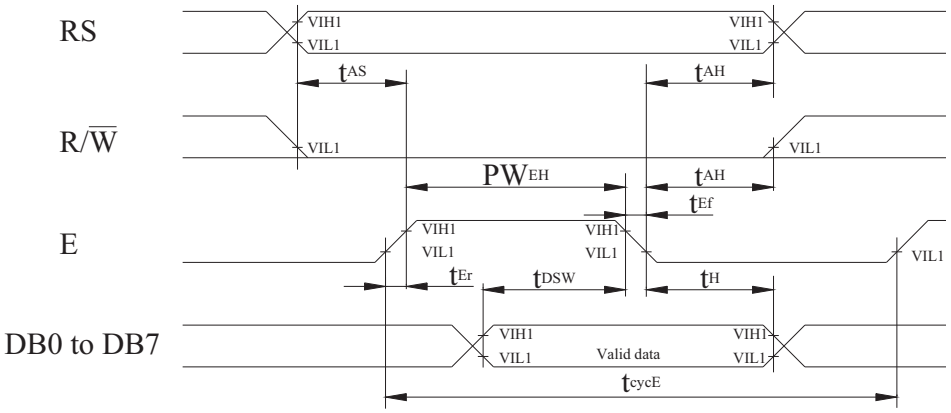
# 12. Instruction Table

| Instruction | Instruction Code | | | | | | | | | | Description | Execution time (fosc=270Khz) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | | |
| Clear Display | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | Write “00H” to DDRAM and set DDRAM address to “00H” from AC | 1.53ms |
| 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. | 1.53ms |
| 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. | 39μs |
| Display ON/OFF Control | 0 | 0 | 0 | 0 | 0 | 0 | 1 | D | C | B | Set display (D), cursor (C), and blinking of cursor (B) on/off control bit. | 39μs |
| 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. | 39μs |
| 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) | 39μs |
| Set CGRAM Address | 0 | 0 | 0 | 1 | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | Set CGRAM address in address counter. | 39μs |
| Set DDRAM Address | 0 | 0 | 1 | AC6 | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | Set DDRAM address in address counter. | 39μs |
| Read Busy Flag and Address | 0 | 1 | BF | AC6 | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | Whether during internal operation or not can be known by reading BF. The contents of address counter can also be read. | 0μs |
| Write Data to RAM | 1 | 0 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Write data into internal RAM (DDRAM/CGRAM). | 43μs |
| Read Data from RAM | 1 | 1 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Read data from internal RAM (DDRAM/CGRAM). | 43μs |

＊ ”—”：don’t care

# 13. Timing Characteristics

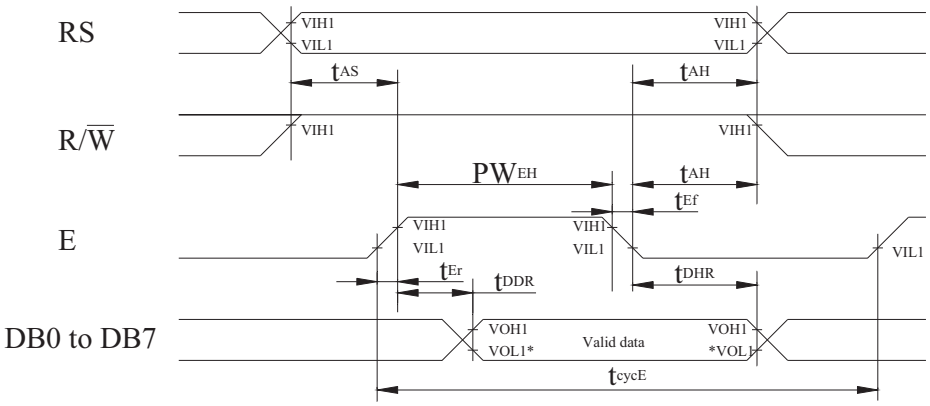
## 13.1 Write Operation




Ta=25℃, VDD=5.0± 0.5V

| Item | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Enable cycle time | $t_{cycE}$ | 1200 | — | — | ns |
| Enable pulse width (high level) | $PW_{EH}$ | 140 | — | — | ns |
| Enable rise/fall time | $t_{Er}$,$t_{Ef}$ | — | — | 25 | ns |
| Address set-up time (RS, R/W to E) | $t_{AS}$ | 0 | — | — | ns |
| Address hold time | $t_{AH}$ | 10 | — | — | ns |
| Data set-up time | $t_{DSW}$ | 40 | — | — | ns |
| Data hold time | $t_H$ | 10 | — | — | ns |

## 13.2 Read Operation



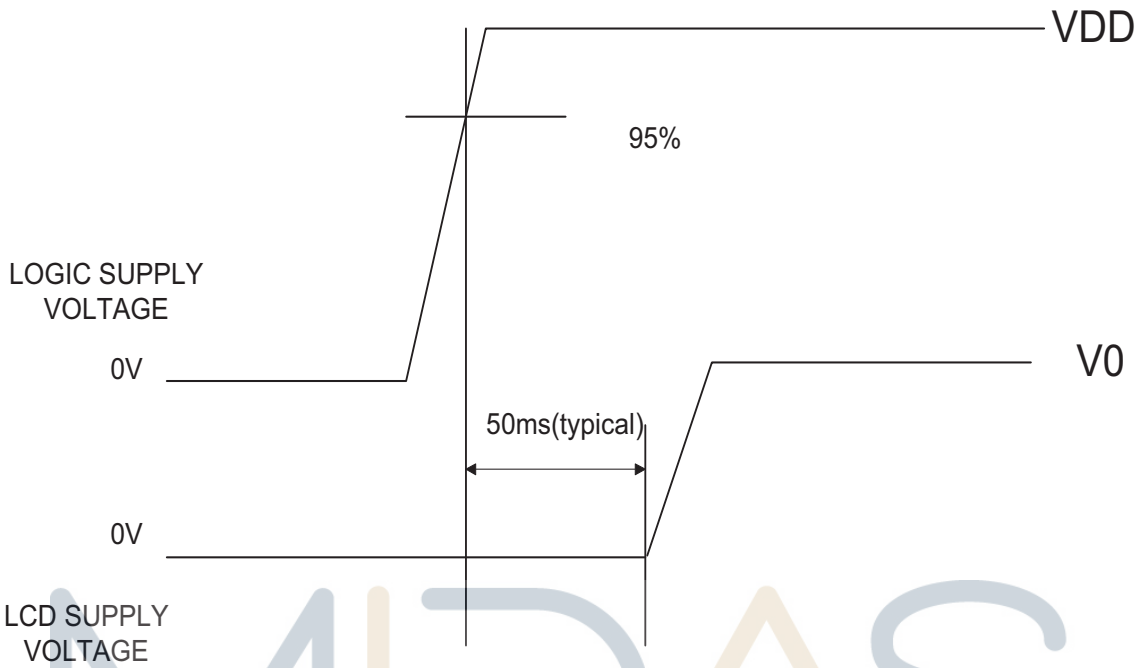

NOTE: *VOL1 is assumed to be 0.8V at 2 MHZ operation.

Ta=25℃, VDD=5.0± 0.5V

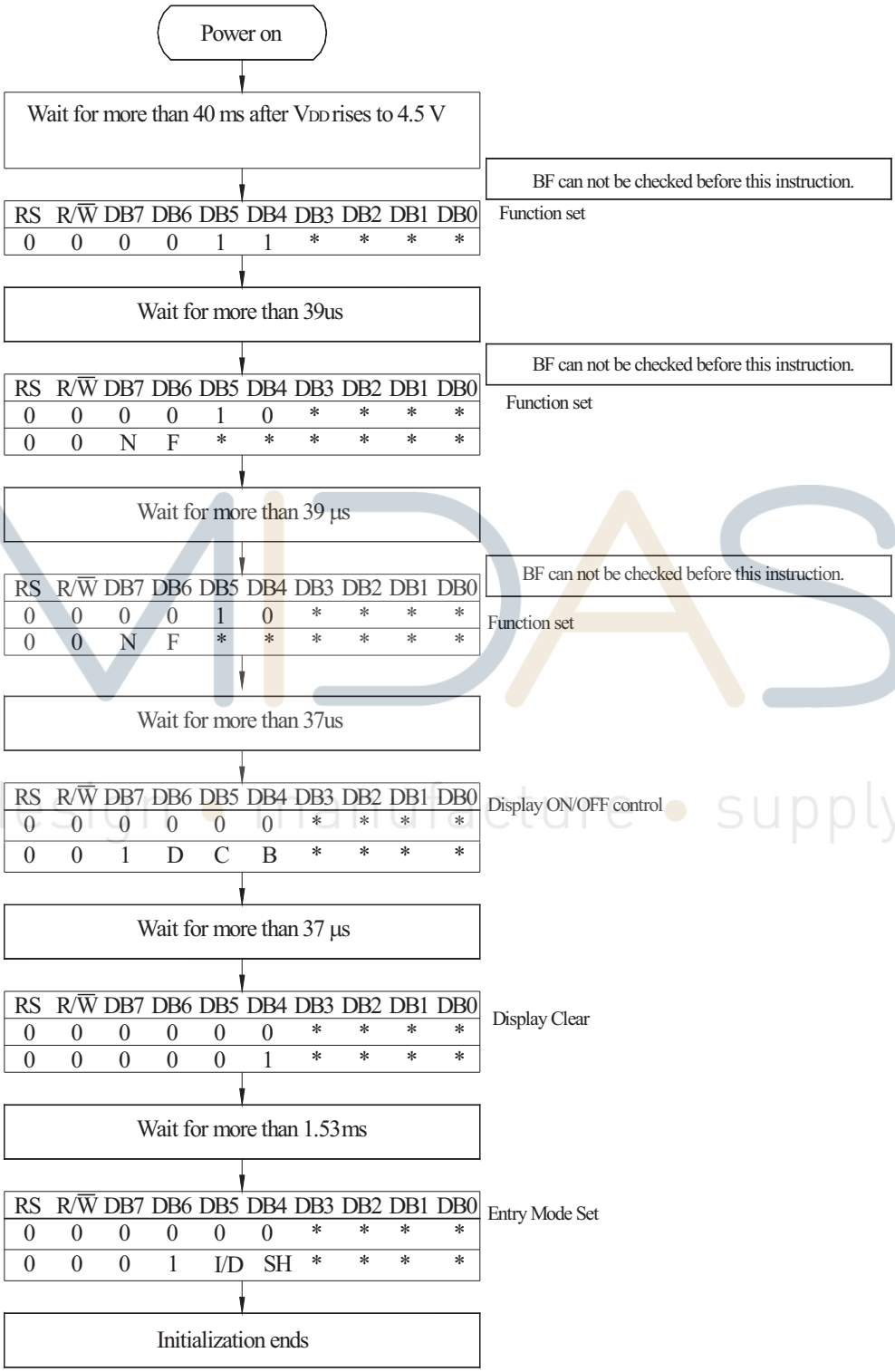
| Item | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Enable cycle time | $t_{cycE}$ | 1200 | — | — | ns |
| Enable pulse width (high level) | $PW_{EH}$ | 140 | — | — | ns |
| Enable rise/fall time | $t_{Er}$,$t_{Ef}$ | — | — | 25 | ns |
| Address set-up time (RS, R/W to E) | $t_{AS}$ | 0 | — | — | ns |
| Address hold time | $t_{AH}$ | 10 | — | — | ns |
| Data delay time | $t_{DDR}$ | — | — | 100 | ns |
| Data hold time | $t_{DHR}$ | 10 | — | — | ns |

## 13.3 Timing Diagram of VDD Against V0.

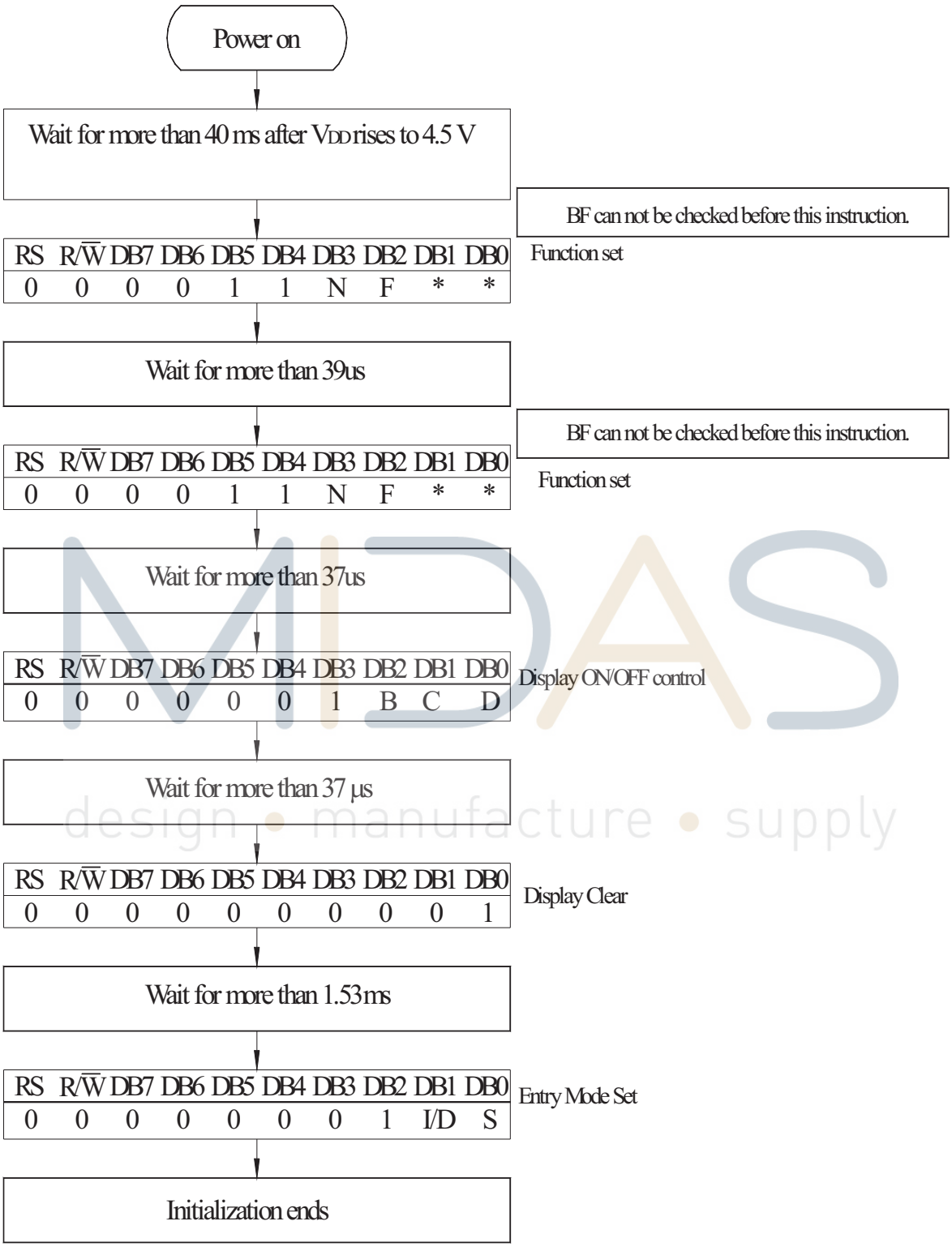
Power on sequence shall meet the requirement of Figure 4, the timing diagram of VDD against V0.



# 14.Initializing of LCM




4-Bit Ineterface




8-Bit Ineterface

# 15.Quality Assurance

**Screen Cosmetic Criteria**

| Item | Defect | Judgment Criterion | Partition |
|---|---|---|---|
| 1 | Spots | A)Clear<br>Size: d mm — Acceptable Qty in active area<br>d ≦0.1 — Disregard<br>0.1<d≦0.2 — 6<br>0.2<d≦0.3 — 2<br>0.3<d — 0<br>Note: Including pin holes and defective dots which must be within one pixel size.<br>B)Unclear<br>Size: d mm — Acceptable Qty in active area<br>d ≦0.2 — Disregard<br>0.2<d≦0.5 — 6<br>0.5<d≦0.7 — 2<br>0.7<d — 0 | Minor |
| 2 | Bubbles in Polarizer | Size: d mm — Acceptable Qty in active area<br>d≦0.3 — Disregard<br>0.3<d≦1.0 — 3<br>1.0<d≦1.5 — 1<br>1.5<d — 0 | Minor |
| 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.<br>Back-light type should be judged with back-light on state only. | Minor |

# 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. | 60℃<br>96hrs | ——— |
| Low Temperature storage | Endurance test applying the high storage temperature for a long time. | -10℃<br>96hrs | ——— |
| High Temperature Operation | Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time. | 50℃<br>96hrs | ——— |
| Low Temperature Operation | Endurance test applying the electric stress under low temperature for a long time. | 0℃<br>96hrs | ——— |
| High Temperature/ Humidity Storage | Endurance test applying the high temperature and high humidity storage for a long time. | 60℃,90%RH<br>96hrs | ——— |
| High Temperature/ Humidity Operation | Endurance test applying the electric stress (Voltage & Current) and temperature / humidity stress to the element for a long time. | 50℃,90%RH<br>96hrs | ——— |
| Temperature Cycle | Endurance test applying the low and high temperature cycle.<br>-10℃ 25℃ 60℃<br>30min 5min 30min<br>1 cycle | -10℃/60℃<br>10 cycles | ——— |
| Mechanical Test | | | |
| Vibration test | Endurance test applying the vibration during transportation and using. | 10~22Hz→1.5mmp-p<br>22~500Hz→1.5G<br>Total 0.5hrs | ——— |
| Shock test | Constructional and mechanical endurance test applying the shock during transportation. | 50G Half sign wave 11 msedc<br>3 times of each direction | ——— |

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