



CLOVER DISPLAY LTD.

LCD MODULE SPECIFICATION

Model : CV4161H - _ _ - _ _ - _ _ - _

| | |
|---------------|---------------|
| Revision | 05 |
| Engineering | Timmy Kwan |
| Date | 10 March 2008 |
| Our Reference | 4933 |

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MODE OF DISPLAY**Display mode**

- ☐ TN positive
☐ TN negative
 STN : ☐ Yellow green
 ☐ Grey
 ☐ Blue (negative)

Display condition

- ☐ Reflective type
☐ Transflective type
☐ Transmissive type
☐ Others

Viewing direction

- ☐ 6 O' clock
☐ 12 O' clock
☐ 3 O' clock
☐ 9 O' clock

LCD MODULE NUMBER NOTATION:CV4161H- M Y - S F - N 6 - T

| | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|
| | | | | | | | |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |

*(1)---Model number of standard LCD Modules

*(2)---Backlight type

- N – No backlight
 E – EL backlight
 L – Side-lited LED backlight
 M– Array LED backlight
 C – CCFL

*(3)---Backlight color

- N – No backlight
 A – Amber
 B – Blue
 O– Orange
 W–White
 Y – Yellow green

*(4)---Display mode

- T – TN
 V – TN (Negative)
 S – STN Yellow green
 G – STN Grey
 B – STN Blue (Negative)
 F – FSTN
 N – FSTN (Negative)

*(5)---Rear polarizer type

- R – Reflective
 F – Transflective
 T – Transmissive

*(6)---Temperature range

- N – Normal
 W– Extended

*(7)---Viewing direction

- 6 – 6 O'clock
 2 – 12 O'clock
 3 – 3 O'clock
 9 – 9 O'clock

*(8)---Special code for other requirements**
 (can be omitted if not used)

- T – Touch panel (Analog)
 P – Touch panel (Digital)

GENERAL DESCRIPTION

Display mode : 16 characters x 1 line COB LCD module

Interface : 4-bit or 8-bit parallel

Driving method : 1/16 duty, 1/5 bias

Controller IC : Sitronix ST7066U or equivalent
For the detailed information, please refer to IC specifications.

MECHANICAL DIMENSIONS

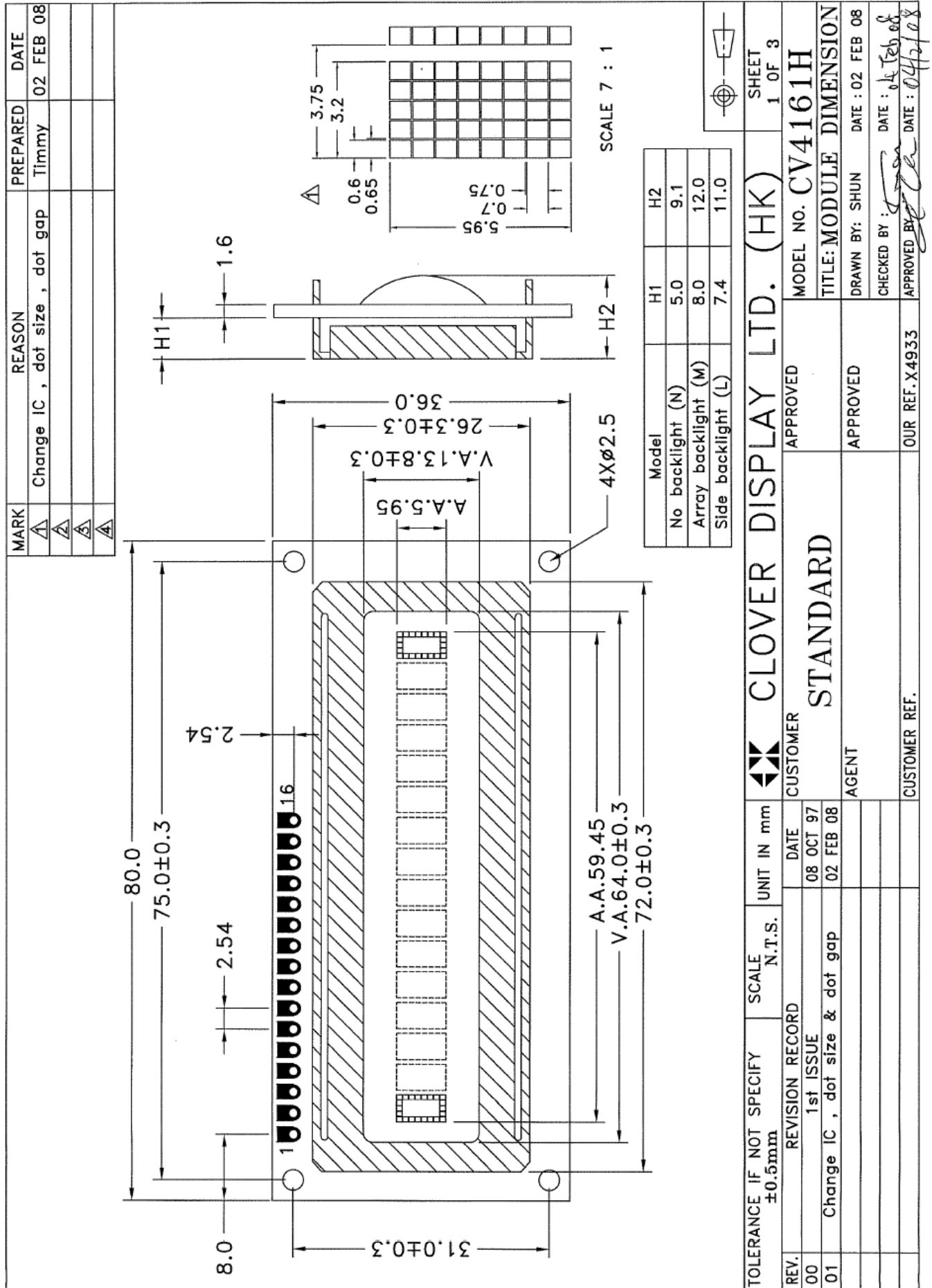
| Item | Dimension | | Unit | Item | Dimension | | Unit |
|-------------------|--------------------------|-----|------|---------------------|-----------------|------|------|
| Outline Dimension | 80.0(L)x36.0(W)x (H1/H2) | | mm | Character Pitch | 3.75(L)x5.95(W) | | mm |
| Viewing Area | 64.0(L)x13.8(W) | | mm | Dot Size | 0.6(L)x0.7(W) | | mm |
| Character Size | 3.2(L)x5.95(W) | | mm | — | — | | — |
| No Backlight (N) | H1 | 5.0 | mm | Side Backlight (L) | H1 | 7.4 | mm |
| | H2 | 9.1 | mm | | H2 | 11.0 | mm |
| EL Backlight (E) | H1 | — | mm | Array Backlight (M) | H1 | 8.0 | mm |
| | H2 | — | mm | | H2 | 12.0 | mm |

CONNECTOR PIN ASSIGNMENT

| Pin No. | Symbol | Function | Pin No. | Symbol | Function |
|---------|--------|--------------------------|---------|--------|----------------------------|
| 1 | VSS | Ground | 9 | DB2 | Data Bus Line |
| 2 | VDD | Supply voltage for logic | 10 | DB3 | Data Bus Line |
| 3 | V0 | Input voltage for LCD | 11 | DB4 | Data Bus Line |
| 4 | RS | Register Select Input | 12 | DB5 | Data Bus Line |
| 5 | R/W | Read/Write | 13 | DB6 | Data Bus Line |
| 6 | E | Enable Signal | 14 | DB7 | Data Bus Line |
| 7 | DB0 | Data Bus Line | *15 | BL+ | Backlight Power Supply (+) |
| 8 | DB1 | Data Bus Line | *16 | BL- | Backlight Power Supply (-) |

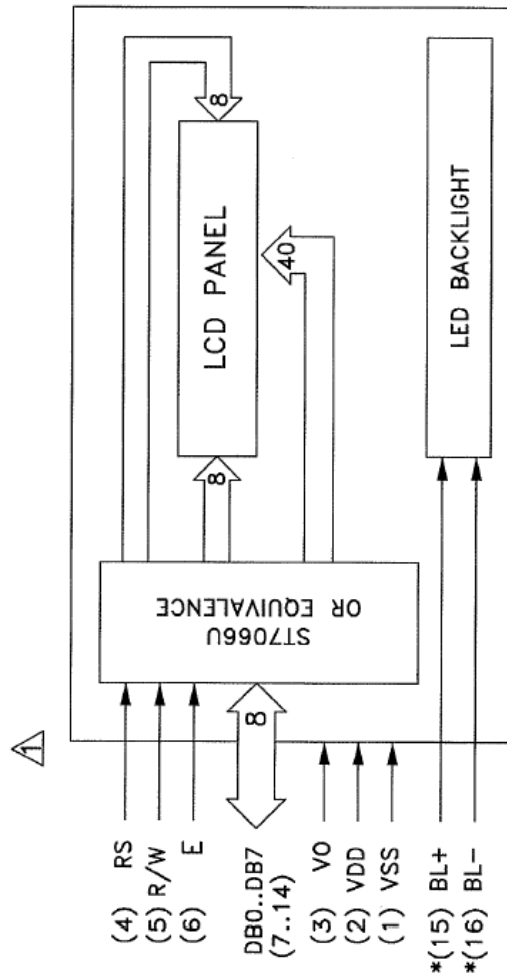
Note (*) : Pin 15, 16 are used for backlight version only.

COUNTER DRAWING OF MODULE DIMENSION



COUNTER DRAWING OF PIN OUT & BLOCK DIAGRAM

| PIN NUMBER | SYMBOL | FUNCTION |
|------------|--------|----------------------------|
| 1 | VSS | Ground |
| 2 | VDD | Supply voltage for logic |
| 3 | V0 | Input voltage for LCD |
| 4 | RS | Register Select Input |
| 5 | R/W | Read/Write |
| 6 | E | Enable Signal |
| 7 | DB0 | Data Bus Line |
| 8 | DB1 | |
| 9 | DB2 | |
| 10 | DB3 | |
| 11 | DB4 | |
| 12 | DB5 | |
| 13 | DB6 | |
| 14 | DB7 | |
| *15 | BL+ | Backlight Power Supply (+) |
| *16 | BL- | Backlight Power Supply (-) |



(*)NOTE: Pin 15, 16 are used for backlight versions only.

| TOLERANCE IF NOT SPECIFY ±0.5mm | | SCALE N.T.S. | UNIT IN mm | CLOVER DISPLAY LTD. (HK) | | SHEET 2 OF 3 |
|------------------------------------|--------------------------------|-----------------|---------------|--------------------------|--------------------------------|-------------------------|
| REV. | REVISION RECORD | DATE | CUSTOMER | APPROVED | MODEL NO. CV4161H | |
| 00 | 1st ISSUE | 08 OCT 97 | STANDARD | | TITLE: PIN OUT & BLOCK DIAGRAM | |
| 01 | Change IC , dot size , dot gap | 02 FEB 08 | AGENT | APPROVED | DRAWN BY: SHUN | DATE : 02 FEB 08 |
| | | | | | CHECKED BY: <i>SA Teboaf</i> | DATE : <i>04 Feb 08</i> |
| | | | CUSTOMER REF. | OUR REF. X4933 | APPROVED BY: <i>SA Teboaf</i> | DATE : <i>04 Feb 08</i> |

ELECTRICAL CHARACTERISTICS

Conditions: VSS=0V, @Ta=25°C

| Item | Symbol | MIN. | TYP. | MAX. | Unit | Item | Symbol | MIN. | TYP. | MAX. | Unit |
|--------------------------|--------|------|------|------|------|--------------------------|--------|--------|------|------|------|
| Supply Voltage | VDD | 4.75 | 5.00 | 5.25 | V | “H”Level Input Voltage | VIH | 0.7VDD | — | VDD | V |
| Supply Current | IDD | — | 1.00 | — | mA | “L”Level Input Voltage | VIL | -0.3 | — | 0.6 | V |
| Input Voltage for LCD | V0 | -0.2 | 0 | 0.2 | V | — | — | — | — | — | — |
| Backlight Voltage | | | | | | Backlight Current | | | | | |
| Side-lited LED | | | | | | Side-lited LED | | | | | |
| White | VBL | — | — | — | V | White | IBL | — | — | — | mA |
| Blue | VBL | — | — | — | V | Blue | IBL | — | — | — | mA |
| Yellow Green | VBL | 4.05 | 4.25 | 4.45 | V | Yellow Green | IBL | — | 40 | 50 | mA |
| Array LED | | | | | | Array LED | | | | | |
| Yellow Green | VBL | 3.85 | 4.05 | 4.25 | V | Yellow Green | IBL | — | 110 | 190 | mA |
| Amber | VBL | — | — | — | V | Amber | IBL | — | — | — | mA |
| Orange | VBL | — | — | — | V | Orange | IBL | — | — | — | mA |
| Red | VBL | — | — | — | V | Red | IBL | — | — | — | mA |

ABSOLUTE MAXIMUM RATINGS

Please make sure not to exceed the following maximum rating values under the worst application conditions

| Item | Symbol | Rating (for normal temperature) | Rating (for wide temperature) | Unit |
|-----------------------|--------|---------------------------------|-------------------------------|------|
| Supply Voltage | VDD | -0.3 to 7 | -0.3 to 7 | V |
| Input Voltage | VT | -0.3 to VDD +0.3 | -0.3 to VDD +0.3 | V |
| Operating Temperature | Topr | 0 to 50 | -20 to 70 | °C |
| Storage Temperature | Tstg | -10 to 60 | -30 to 80 | °C |

INSTRUCTIONS

| Instruction | Instruction Code | | | | | | | | | | Description | Description Time (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 "20H" to DDRAM. and set DDRAM address to "00H" from AC | 1.52 ms |
| Return Home | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 x | Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed. | 1.52 ms |
| Entry Mode Set | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | I/D S | Sets cursor move direction and specifies display shift. These operations are performed during data write and read. | 37 us |
| Display ON/OFF | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | D | C B | D=1:entire display on C=1:cursor on B=1:cursor position on | 37 us |
| Cursor or Display Shift | 0 | 0 | 0 | 0 | 0 | 0 | 1 | S/C | R/L | x x | Set cursor moving and display shift control bit, and the direction, without changing DDRAM data. | 37 us |
| Function Set | 0 | 0 | 0 | 0 | 0 | 1 | DL | N | F | x x | DL:interface data is 8/4 bits N:number of line is 2/1 F:font size is 5x11/5x8 | 37 us |
| Set CGRAM address | 0 | 0 | 0 | 1 | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | Set CGRAM address in address counter | 37 us |
| Set DDRAM address | 0 | 0 | 1 | AC6 | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | Set DDRAM address in address counter | 37 us |
| 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. | 0 us |
| Write data to RAM | 1 | 0 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Write data into internal RAM (DDRAM/CGRAM) | 37 us |
| Read data from RAM | 1 | 1 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Read data from internal RAM (DDRAM/CGRAM) | 37 us |

Note:

Be sure the ST7066U is not in the busy state (BF = 0) before sending an instruction from the MPU to the ST7066U. If an instruction is sent without checking the busy flag, the time between the first instruction and next instruction will take much longer than the instruction time itself. Refer to Instruction Table for the list of each instruction execution time.

DISPLAY DD RAM AND CHARACTER POSITION

16x1, 1/16 DUTY CYCLE

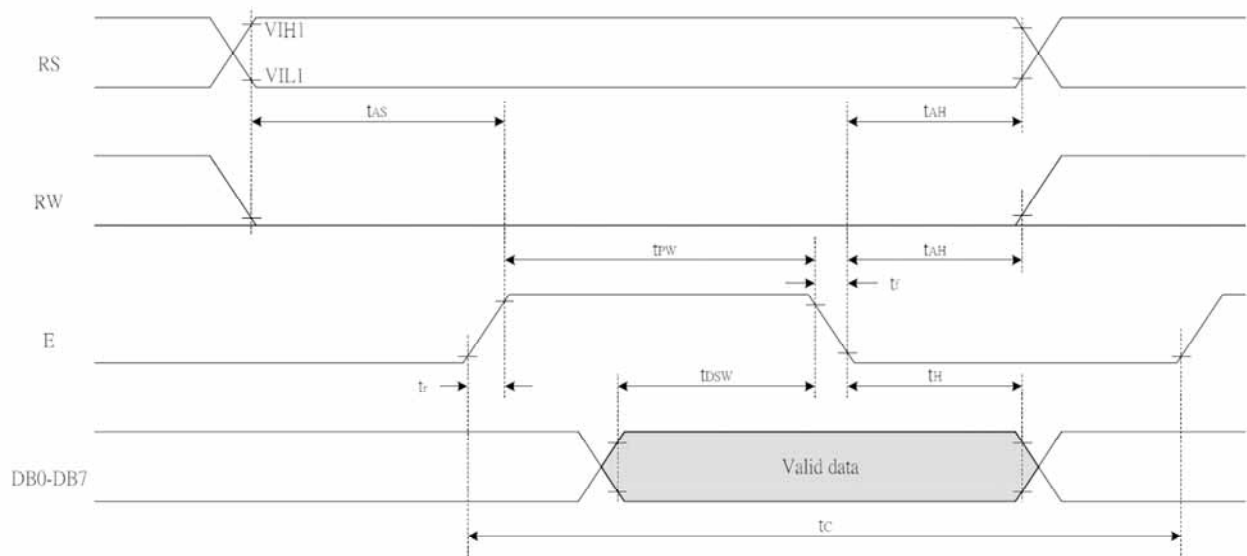
| | | | | | | | | | | | | | | | | |
|--------|----|----|---|---|---|---|---|---|---|---|---|---|---|---|----|------------------|
| | 1 | 2 | | | | | | | | | | | | | 16 | DISPLAY POSITION |
| line 1 | 00 | 01 | . | . | . | . | . | . | . | . | . | . | . | . | 47 | DD RAM ADDRESS |

WRITE MODE AC CHARACTERISTICS

| <i>Write Mode (Writing data from MPU to ST7066U)</i> | | | | | | |
|--|-----------------------|-----------------|------|---|----|----|
| T_C | Enable Cycle Time | Pin E | 1200 | - | - | ns |
| T_{PW} | Enable Pulse Width | Pin E | 460 | - | - | ns |
| T_R, T_F | Enable Rise/Fall Time | Pin E | - | - | 25 | ns |
| T_{AS} | Address Setup Time | Pins: RS, RW, E | 0 | - | - | ns |
| T_{AH} | Address Hold Time | Pins: RS, RW, E | 10 | - | - | ns |
| T_{DSW} | Data Setup Time | Pins: DB0 - DB7 | 80 | - | - | ns |
| T_H | Data Hold Time | Pins: DB0 - DB7 | 10 | - | - | ns |

WRITE MODE TIMING DIAGRAM

- Writing data from MPU to ST7066U

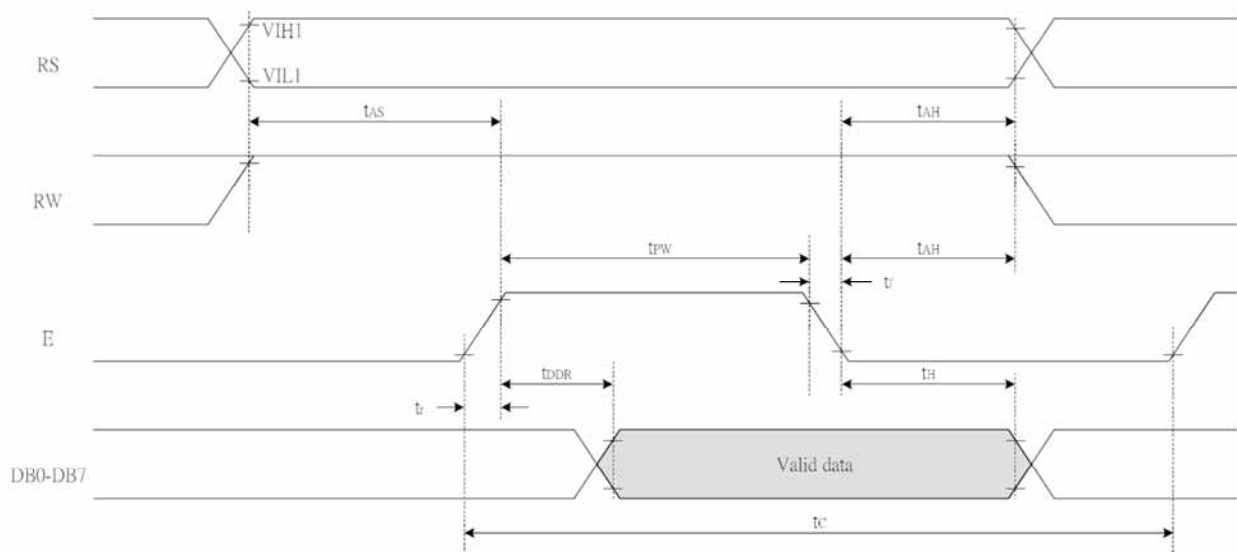


READ MODE AC CHARACTERISTICS

| <i>Read Mode (Reading Data from ST7066U to MPU)</i> | | | | | | |
|---|-----------------------|-----------------|------|---|-----|----|
| T_C | Enable Cycle Time | Pin E | 1200 | - | - | ns |
| T_{PW} | Enable Pulse Width | Pin E | 480 | - | - | ns |
| T_R, T_F | Enable Rise/Fall Time | Pin E | - | - | 25 | ns |
| T_{AS} | Address Setup Time | Pins: RS, RW, E | 0 | - | - | ns |
| T_{AH} | Address Hold Time | Pins: RS, RW, E | 10 | - | - | ns |
| T_{DDR} | Data Setup Time | Pins: DB0 - DB7 | - | - | 320 | ns |
| T_H | Data Hold Time | Pins: DB0 - DB7 | 10 | - | - | ns |

READ MODE TIMING DIAGRAM

- Reading data from ST7066U to MPU



INITIALIZATION METHOD

An internal reset circuit automatically initializes the ST7066U when the power is turned on. The following instructions are executed during the initialization. The busy flag (BF) is kept in the busy state until the initialization ends (BF = 1). The busy state lasts for 40 ms after VCC rises to 4.5 V.

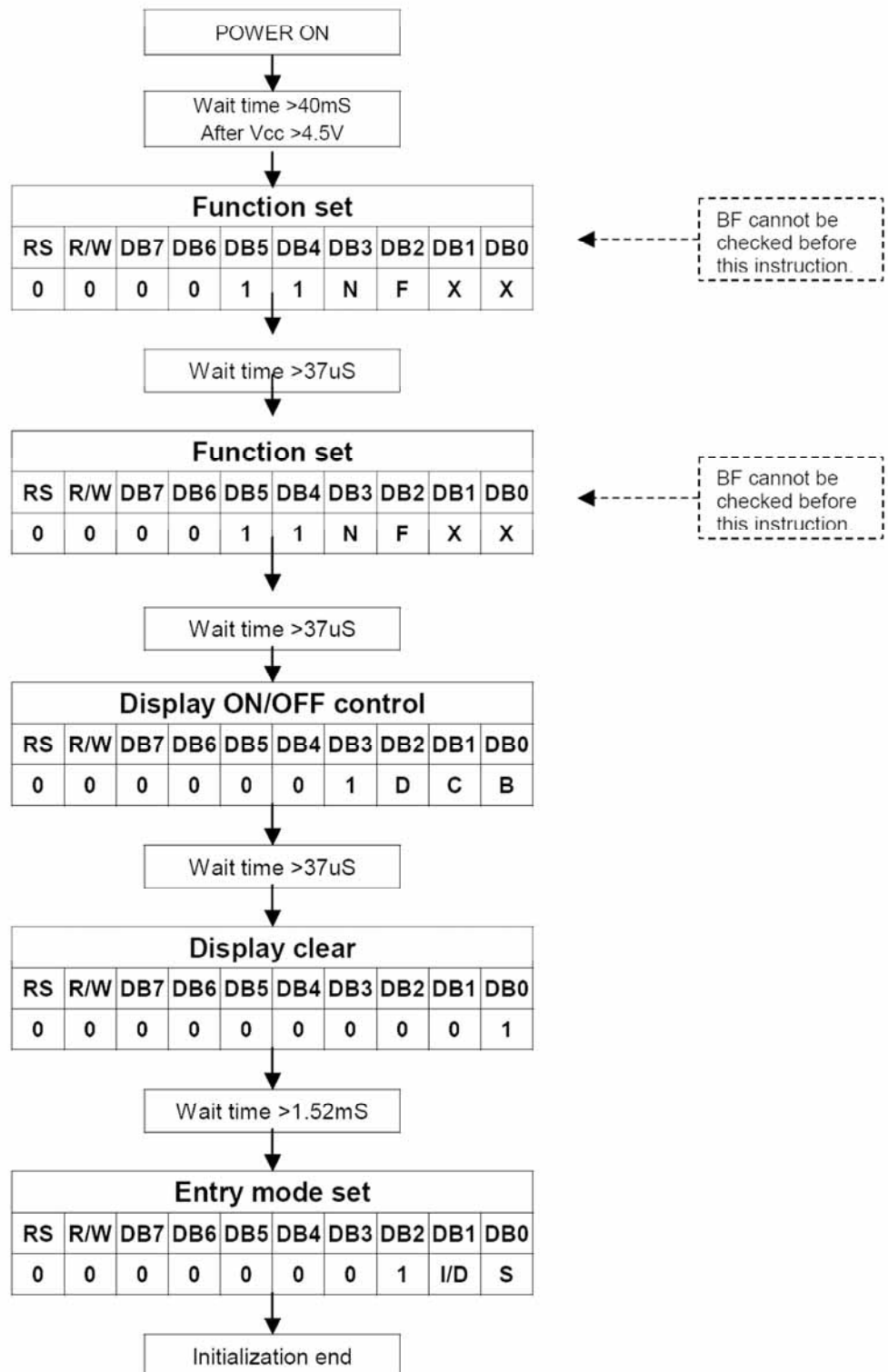
1. Display clear
2. Function set:
 - DL = 1; 8-bit interface data
 - N = 0; 1-line display
 - F = 0; 5x8 dot character font
3. Display on/off control:
 - D = 0; Display off
 - C = 0; Cursor off
 - B = 0; Blinking off
4. Entry mode set:
 - I/D = 1; Increment by 1
 - S = 0; No shift

Note:

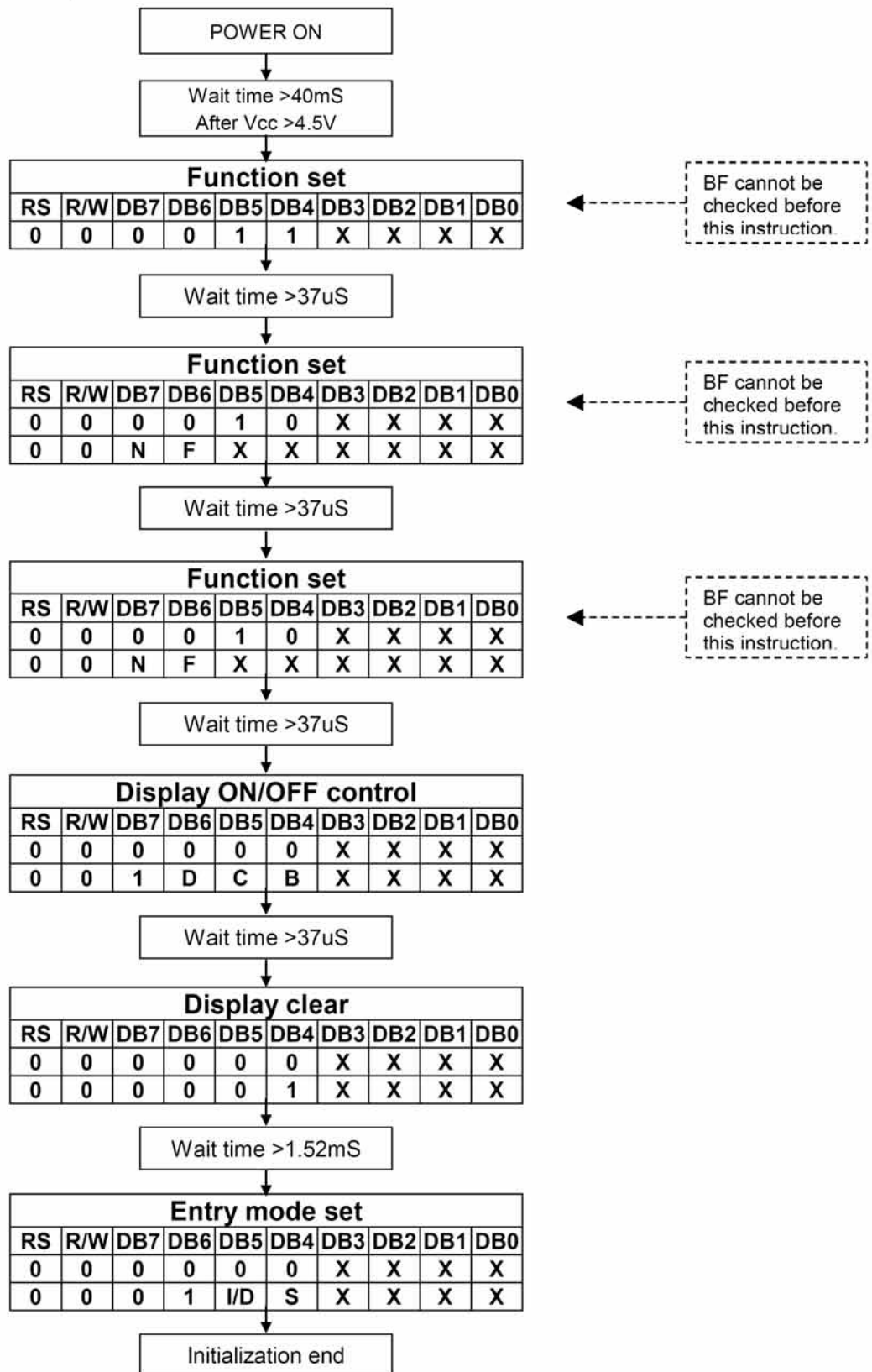
If the electrical characteristics conditions listed under the table Power Supply Conditions Using Internal Reset Circuit are not met, the internal reset circuit will not operate normally and will fail to initialize the ST7066U. For such a case, initialization must be performed by the MPU as explain by the following figure.

INITIALIZING FLOWCHART

- 8-bit Interface (fosc=270KHz)



4-bit Interface (fosc=270KHz)



ELECTRO-OPTICAL CHARACTERISTICS

MEASURING CONDITION: POWER SUPPLY = $V_{OP} / 64 \text{ Hz}$
 TEMPERATURE = $23 \pm 5 \text{ }^{\circ}\text{C}$
 RELATIVE HUMIDITY = $60 \pm 20 \%$

| ITEM | SYMBOL | UNIT | TYP. TN | TYP. STN |
|---|--------|------------|---------|----------|
| RESPONSE TIME | Ton | ms | 130 | 150 |
| | Toff | ms | 170 | 190 |
| CONTRAST RATIO | Cr | - | 8 | 15 |
| VIEWING ANGLE (6 O'clock) (Cr ≥ 2) | V3:00 | $^{\circ}$ | 70 | 45 |
| | V6:00 | $^{\circ}$ | 45 | 70 |
| | V9:00 | $^{\circ}$ | 70 | 45 |
| | V12:00 | $^{\circ}$ | 5 | 60 |

THE ELECTRO-OPTICAL CHARACTERISTICS ARE MEASURED VALUE BUT NOT GUARANTEED ONES.

RELIABILITY OF LCD MODULE

| Item | Test Condition For normal temperature | Test Condition For wide temperature | Time |
|------------------------------|--|--|-----------|
| High temperature operating | 50°C | 70°C | 240 hours |
| Low temperature operating | 0°C | -20°C | 240 hours |
| High temperature storage | 60°C | 80°C | 240 hours |
| Low temperature storage | -10°C | -30°C | 240 hours |
| Temperature-humidity storage | 40°C 90% R.H. | 60°C 90% R.H. | 96 hours |
| Temperature cycling | -10°C to 60°C 30 Min Dwell | -30°C to 80°C 30 Min Dwell | 5 cycles |

QUALITY STANDARD OF LCD MODULE

| | | | |
|-----|---|-------------------------|--|
| 1.0 | Sampling Method | | |
| | Sampling Plan : MIL STD 105 E | | |
| | Class of AQL : Level II/Single Sampling | | |
| | Critical : 0.25% Major 0.65% Minor 1.5% | | |
| | | | |
| 2.0 | Defect Group | Failure Category | Failure Reasons |
| | Critical Defect 0.25%(AQL) | Malfunction | Open Short Burnt or dead component Missing part/improper part P.C.B. Broken |
| | Major Defect 0.65%(AQL) | Poor Insulation | Potential short High current Component damage or scratched or Lying too close improper coating |
| | | Poor Conduction | Damage joint Wrong polarity Wrong spec. part Uneven/intermittent contact Loose part Copper peeling Rust or corrosion or dirt's |
| | Minor Defect 1.5%(AQL) | Cosmetic Defect | Minor scratch Flux residue Thin solder Poor plating Poor marking Crack solder Poor bending Poor packing Wrong size |

HANDLING PRECAUTIONS

(1) CAUTION OF LCD HANDLING & CLEANING

The polarizing plate on the surface of the panel is made from organic substances. Be very careful for chemicals not to touch the plate or it leads the polarizing plate to deteriorate.

If the use of a chemical is unavoidable, wipe the panel lightly with soft materials, such as gauze and absorbent cotton, soaked in a solvent.

*Usable solvent: Alcohol (ethanol, IPA and the like)

*Appropriate solvent: Ketones, ethyl alcohol

Avoid wiping with a dry cloth, since it could damage the surface of the polarizing plate and others.

(2) CAUTION AGAINST STATIC CHARGE

The LCD modules use CMOS LSI drivers, so customers are recommended that any unused input terminal would be connected to V_{DD} or V_{SS} , do not input any signals before power is turned on, and ground your body, work/assembly areas, assembly equipment to protect against static electricity.

(3) PACKAGING

Avoid intense shock and falls from a height and do not operate or store them exposed to direct sunshine or high temperature/humidity for long periods.

(4) CAUTION FOR OPERATION

The viewing angle can be adjusted by varying the LCD driving voltage V_O .

Driving voltage should be kept within specified range, excess voltage shortens display life.

Response time increases with decrease in temperature.

Display may turn black or dark Blue at temperature above its operational range; this is however not destructive and the display will return to normal once the temperature falls back to range.

Mechanical disturbance during operation (such as pressing on the viewing area) may cause the segments to appear "fractured". They will recover once the display is turned off.

Condensation at terminals will cause malfunction and possible electrochemical reaction. Relative humidity of the environment should therefore be kept below 60%.

(5) SAFETY

Liquid crystal may leak out of a damaged LCD, it is recommended to wash off the liquid crystal by using solvents such as acetone or ethanol and should be burned up later.

If any liquid leaks out of a damaged glass cell comes in contact with your hands, wash it off with soap and water immediately.

WARRANTY

CLOVER will replace or repair any of her LCD module in accordance with her LCD specification for a period of one year from date of shipment. The warranty liability of Clover is limited to repair and/or replacement. Clover will not be responsible for any subsequent or consequential event.