# CLOVER DISPLAY LTD.

# LCD MODULE SPECIFICATION

## Model : CV4162D - _ _ - _ _ - _ _ - _

| | |
|---|---|
| Revision | 10 |
| Engineering | Jackson Fung |
| Date | 17 October 2016 |
| Our Reference | 4406 |

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## *MODE OF DISPLAY*

**Display mode**
- ☐ TN positive
- ☐ TN negative
- STN : ☐ Yellow green
  - ☐ Grey
  - ☐ Blue (negative)
- ☐ FSTN positive
- ☐ FSTN 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:*

CV4162D- 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)
- E – EBTN (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 2 lines 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 | 3.53(L)x5.92(W) | | mm |
| Viewing Area | 61.0(L)x15.8(W) | | mm | Dot Size | 0.55(L)x0.65(W) | | mm |
| Character Size | 2.95(L)x5.55(W) | | mm | — | — | | — |
| No Backlight (N) | H1 | 5.0 | mm | Side Backlight (L) | H1 | 8.0 | mm |
| | H2 | 9.1 | mm | | H2 | 12.1 | mm |
| EL Backlight (M) | H1 | — | mm | Array Backlight (M) | H1 | 8.0 | mm |
| | H2 | — | mm | | H2 | 12.1 | 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 | Operating voltage for LCD | 11 | DB4 | Data Bus Line |
| 4 | RS | Register Select | 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+ | Supply voltage for Backlight (+VE) |
| 8 | DB1 | Data Bus Line | *16 | BL - | Supply voltage for Backlight (-VE) |

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

## COUNTER DRAWING OF MODULE DIMENSION



SCALE 10 : 1

| Model | H1 | H2 | m | n |
|---|---|---|---|---|
| No backlight (N) | 5.0 | 9.1 | 66.2 | 25.0 |
| Array backlight (M) | 8.0 | 12.1 | 77.2 | 24.6 |
| Side backlight (L) | 8.0 | 12.1 | 77.2 | 24.6 |

3.53
2.95
0.55
0.60
0.70
0.65
5.55
5.92

1.6
H1
H2

36.0
31.0±0.3
2.5
n±0.3
5.7
V.A.15.8±0.3
10.1
A.A.11.47

2.54

P.2.54X(16-1)=38.1

A.A. 55.9
V.A. 61.0±0.3
m ±0.3
75.0±0.3
80.0

8.0
9.5
2.5
4-∅2.5

16
1
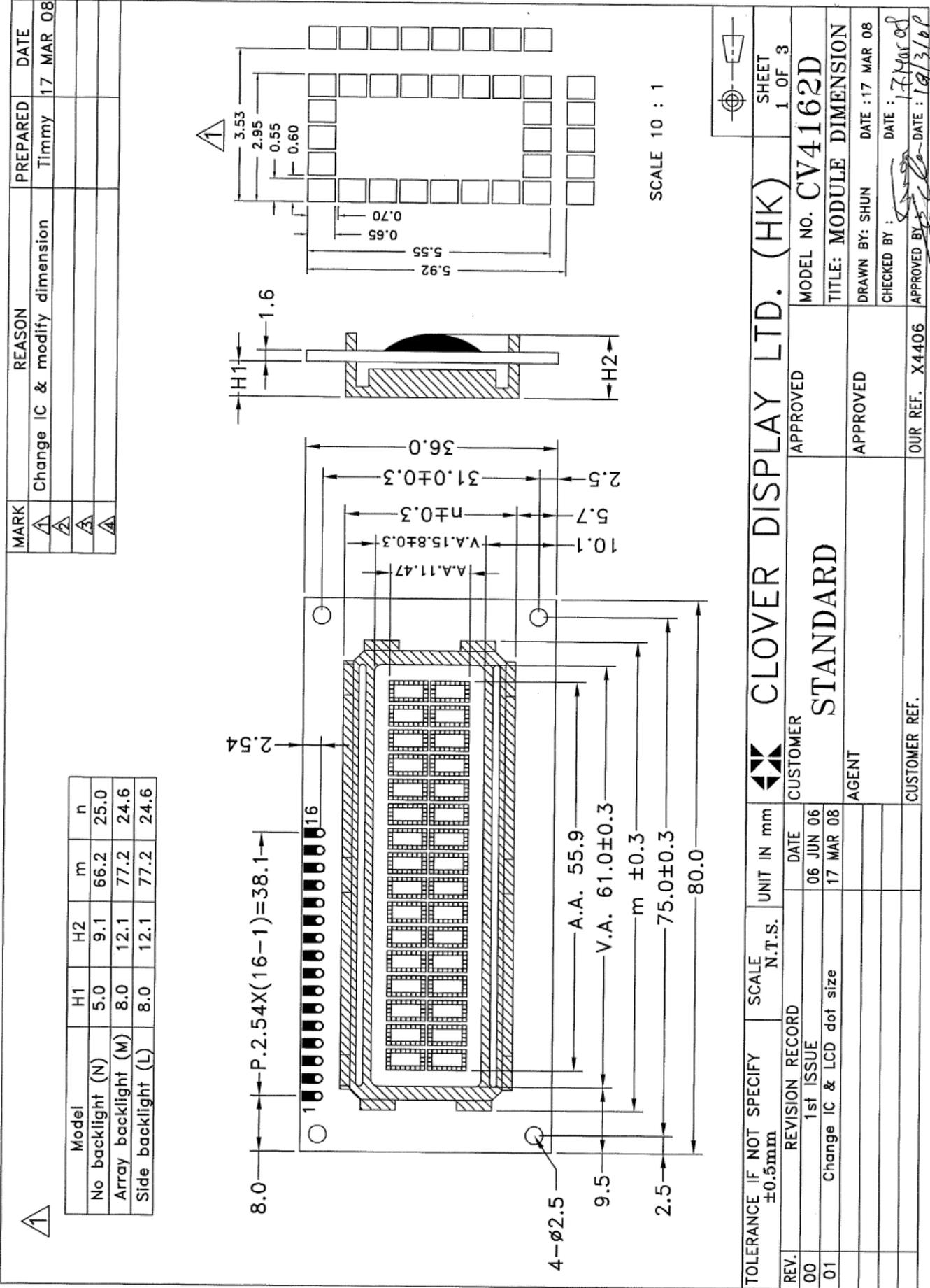
| MARK | REASON | PREPARED | DATE |
|---|---|---|---|
| 1 | Change IC & modify dimension | Timmy | 17 MAR 08 |
| 2 | | | |
| 3 | | | |
| 4 | | | |

CLOVER DISPLAY LTD. (HK)

STANDARD

| | | | |
|---|---|---|---|
| CUSTOMER | | APPROVED | |
| AGENT | | APPROVED | |
| CUSTOMER REF. | | | |

MODEL NO. CV4162D
TITLE: MODULE DIMENSION
DRAWN BY: SHUN    DATE :17 MAR 08
CHECKED BY :    DATE :
APPROVED BY:    DATE :

OUR REF. X4406

SHEET 1 OF 3

| TOLERANCE IF NOT SPECIFY ±0.5mm | SCALE N.T.S. | UNIT IN mm | |
|---|---|---|---|
| REVISION RECORD | | | |
| REV. | | | DATE |
| 00 | 1st ISSUE | | 06 JUN 06 |
| 01 | Change IC & LCD dot size | | 17 MAR 08 |

## COUNTER DRAWING OF PIN OUT & BLOCK DIAGRAM

| PIN NO. | SYMBOL | FUNCTION |
|---|---|---|
| 1 | VSS | Ground |
| 2 | VDD | Supply voltage for logic |
| 3 | V0 | Operating voltage for LCD |
| 4 | RS | Register select |
| 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+ | Supply voltage for backlight (+VE) |
| *16 | BL− | Supply voltage for backlight (−VE) |

LCD PANEL

COM9 to COM16

S1 to S40    S41 to S80

COM1 to COM8

ST7065C OR EQUIVALENCE

LED BACKLIGHT

ST7066U OR EQUIVALENCE

(4) RS
(5) R/W
(6) E
DB0..DB7 (7..14)
(3) V0
(2) VDD
(1) VSS
*(15) BL+
*(16) BL−

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

CLOVER DISPLAY LTD. (HK)

STANDARD

| TOLERANCE IF NOT SPECIFY ±0.5mm | | SCALE N.T.S. | UNIT IN mm | CUSTOMER | | APPROVED | MODEL NO. CV4162D |
|---|---|---|---|---|---|---|---|
| REVISION RECORD | | | | | | | TITLE: PIN OUT & BLOCK DIAGRAM |
| REV. | | DATE | | AGENT | | APPROVED | DRAWN BY: SHUN    DATE : 17 MAR 08 |
| 00 | 1st ISSUE | 06 JUN 06 | | | | | CHECKED BY : |
| 01 | Change IC & LCD dot size | 17 MAR 08 | | CUSTOMER REF. | | | APPROVED BY : |
| | | | | OUR REF. X4406 | | | SHEET 2 OF 3 |

DATE : 17 MAR 08
DATE :

## ELECTRICAL CHARACTERISTICS

Conditions: VSS=0V, @Ta=25℃

| Item | Symbol | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|
| Supply Voltage | $V_{DD}$ | 4.75 | 5.00 | 5.25 | V |
| Supply Current | $I_{DD}$ | — | 0.88 | 1.20 | mA |
| Input Voltage for LCD (*) | $V0$ | -0.2 | 0 | 0.2 | V |
| Input Voltage for EBTN LCD (*) | $V0$ | -4.45- | -4.00 | -3.55 | V |
| "H"Level Input Voltage | $V_{IH}$ | 0.7VDD | — | $V_{DD}$ | V |
| "L"Level Input Voltage | $V_{IL}$ | -0.3 | — | 0.6 | V |

**Note (*): There is tolerance in optimum LCD driving voltage during production and it will be within the specified range. The corresponding LCD voltage = VDD –V0, is 5V or 9V for optimum contrast.**

**Side-lited LED**

Constant voltage driving:

| Item | Symbol | MIN. | TYP. | MAX. | Unit | Condition |
|---|---|---|---|---|---|---|
| White Backlight current | $I_{BL}$ | — | 20 | 23 | mA | $V_{BL} = 3.5V$ |
| White Backlight current (For EBTN Version) | $I_{BL}$ | — | 40 | 46 | mA | |

Constant current driving:

| Item | Symbol | MIN. | TYP. | MAX. | Unit | Condition |
|---|---|---|---|---|---|---|
| Yellow Green Backlight Voltage | $V_{BL}$ | — | 2.0 | 2.4 | V | $I_{BL} = 40mA$ |

**Array LED**

Constant current driving:

| Item | Symbol | MIN. | TYP. | MAX. | Unit | Condition |
|---|---|---|---|---|---|---|
| Yellow Green Backlight Voltage | $V_{BL}$ | — | 4.05 | 4.25 | V | $I_{BL} =110mA$ |

## 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 | $V_{DD}$ | -0.3 to 7 | -0.3 to 7 | V |
| Input Voltage | $V_T$ | -0.3 to VDD +0.3 | -0.3 to VDD +0.3 | V |
| Operating Temperature | $T_{opr}$ | 0 to 50 | -20 to 70 | ℃ |
| Storage Temperature | $T_{stg}$ | -10 to 60 | -30 to 80 | ℃ |

## 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 | 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 | 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 | 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 | 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 | 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 DDRAM AND CHARACTER POSITION

16x2, 1/16 DUTY CYCLE

| | 1 | 2 | | 16 | DISPLAY POSITION |
|---|---|---|---|---|---|
| line 1 | 00 | 01 | · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · | 0F | DD RAM ADDRESS |
| line 2 | 40 | 41 | · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · | 4F | |

## TIMING CHARACTERISTICS OF COMPATIBLE CONTROLLER CHIPS

TA = 25℃, VCC = 5V

| Write Mode (Writing data from MPU to ST7066U) | | | | | | |
|---|---|---|---|---|---|---|
| $T_C$ | Enable Cycle Time | Pin E | 1200 | - | - | ns |
| $T_{PW}$ | Enable Pulse Width | Pin E | 140 | - | - | 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 | 40 | - | - | ns |
| $T_H$ | Data Hold Time | Pins: DB0 - DB7 | 10 | - | - | ns |
| Read Mode (Reading Data from ST7066U to MPU) | | | | | | |
| $T_C$ | Enable Cycle Time | Pin E | 1200 | - | - | ns |
| $T_{PW}$ | Enable Pulse Width | Pin E | 140 | - | - | 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 | - | - | 100 | ns |
| $T_H$ | Data Hold Time | Pins: DB0 - DB7 | 10 | - | - | ns |

**Write Mode Timing Diagram (Writing Data from MPU to ST7066U)**
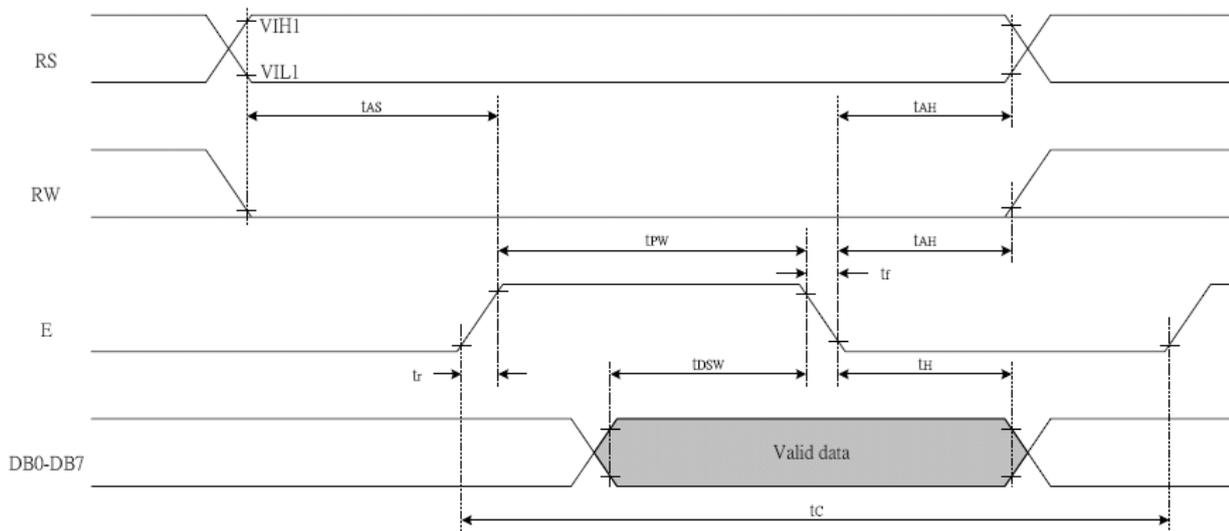
**Read Mode Timing Diagram (Reading Data from ST7066U to MPU)**
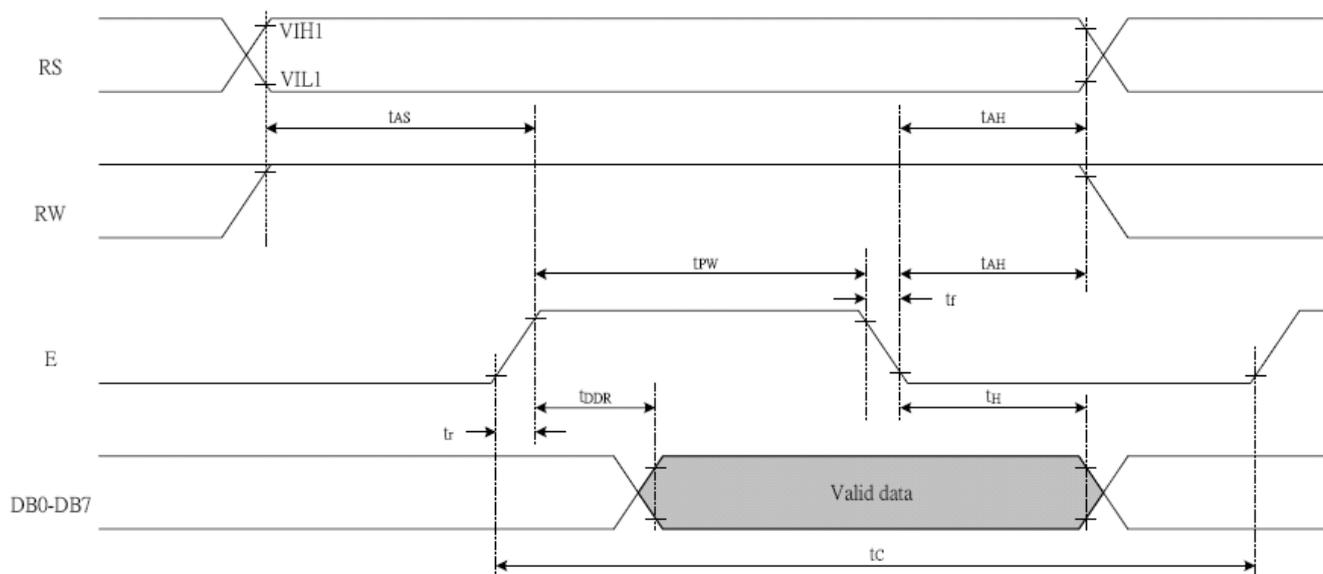


## INITIALIZATION METHOD

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

**Initialization for 8-Bit Interface**

POWER ON

↓

Wait time >40mS
After Vcc >4.5V

↓

**Function set**

| RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0  | 0   | 0   | 0   | 1   | 1   | N   | F   | X   | X   |

← BF cannot be checked before this instruction.

↓

Wait time >37uS

↓

**Function set**

| RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0  | 0   | 0   | 0   | 1   | 1   | N   | F   | X   | X   |

← BF cannot be checked before this instruction

↓

Wait time >37uS

↓

**Display ON/OFF control**

| RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0  | 0   | 0   | 0   | 0   | 0   | 1   | D   | C   | B   |

↓

Wait time >37uS

↓

**Display clear**

| RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0  | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 1   |

↓

Wait time >1.52mS

↓

**Entry mode set**

| RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0  | 0   | 0   | 0   | 0   | 0   | 0   | 1   | I/D | S   |

↓

Initialization end

**Initialization for 4-Bit Interface**

POWER ON

↓

Wait time >40mS
After Vcc >4.5V

↓

**Function set**

| RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0  | 0   | 0   | 0   | 1   | 1   | X   | X   | X   | X   |

◄------- BF cannot be checked before this instruction.

↓

Wait time >37uS

↓

**Function set**

| RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0  | 0   | 0   | 0   | 1   | 0   | X   | X   | X   | X   |
| 0  | 0   | N   | F   | X   | X   | X   | X   | X   | X   |

◄------- BF cannot be checked before this instruction.

↓

Wait time >37uS

↓

**Function set**

| RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0  | 0   | 0   | 0   | 1   | 0   | X   | X   | X   | X   |
| 0  | 0   | N   | F   | X   | X   | X   | X   | X   | X   |

◄------- BF cannot be checked before this instruction

↓

Wait time >37uS

↓

**Display ON/OFF control**

| RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0  | 0   | 0   | 0   | 0   | 0   | X   | X   | X   | X   |
| 0  | 0   | 1   | D   | C   | B   | X   | X   | X   | X   |

↓

Wait time >37uS

↓

**Display clear**

| RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0  | 0   | 0   | 0   | 0   | 0   | X   | X   | X   | X   |
| 0  | 0   | 0   | 0   | 0   | 1   | X   | X   | X   | X   |

↓

Wait time >1.52mS

↓

**Entry mode set**

| RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0  | 0   | 0   | 0   | 0   | 0   | X   | X   | X   | X   |
| 0  | 0   | 0   | 1   | I/D | S   | X   | X   | X   | X   |

↓

Initialization end

## ELECTRO-OPTICAL CHARACTERISTICS

MEASURING CONDITION:    POWER SUPPLY = $V_{OP}$ / 64 Hz

                                    TEMPERATURE = 23 ± 5 °C

                                    RELATIVE HUMIDITY = 60 ± 20 %

| ITEM | SYMBOL | UNIT | TYP. TN | TYP. STN | TYP. EBTN |
|---|---|---|---|---|---|
| RESPONSE TIME | $T_{on}$ | ms | 130 | 150 | 60 |
| | $T_{off}$ | ms | 170 | 190 | 80 |
| CONTRAST RATIO | Cr | - | 8 | 15 | 500 |
| VIEWING ANGLE (6 O'clock) (Cr ≥ 2) | $V_{3:00}$ | ° | 70 | 45 | 80 |
| | $V_{6:00}$ | ° | 45 | 70 | 80 |
| | $V_{9:00}$ | ° | 70 | 45 | 80 |
| | $V_{12:00}$ | ° | 5 | 60 | 10 |

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 |

# SAMPLING METHOD

SAMPLING PLAN   :   ANSI/ASQ Z1.4

CLASS OF AQL      :   LEVEL II / SINGLE SAMPLING
MAJOR – 0.65%          MINOR – 1.5%

## QUALITY SATNADARD

| DEFECT | CRITERIA | | TYPE | FIGURE |
|---|---|---|---|---|
| SHORT CIRCUIT | - | | MAJOR | - |
| MISSING SEGMENT | - | | MAJOR | - |
| UNEVEN / POOR CONTRAST | - | | MAJOR | - |
| CROSS TALK | - | | MAJOR | - |
| PIN HOLE | $MAX(a,b) \leq 1/4\ W$ <br> DOT MATRIX: <br> IF $0.6 \leq W$,  $MAX(a,b) < 0.3$ N.A.** <br> IF $0.4 \leq W < 0.6$,  $MAX(a,b) < 0.25$ N.A.** <br> IF  $W < 0.4$,  $MAX(a,b) < 0.2$ N.A.** | | MINOR | 1 |
| EXCESS SEGMENT | $MAX(c,d) \leq 1/4\ T$ | | MINOR | 1 |
| BUBBLES | $d* \geq 0.3$ | QTY=0 | MINOR | 2 |
| SPOTS | $d \leq 0.3$ <br> $0.3 < d \leq 0.4$ <br> $0.4 < d$ | N.A.** <br> QTY≤2 <br> QTY=0 | MINOR | 2 |
| LINE SCRATCHES | x≥0.7   y≥0.05 | QTY=0 | MINOR | 3 |
| BLACK LINE | x≥0.7   y≥0.05 | QTY=0 | MINOR | 3 |

* $d = MAX\ (d_1, d_2)$          ** N. A . = NOT APPLICABLE                    DEFECT TABLE : C
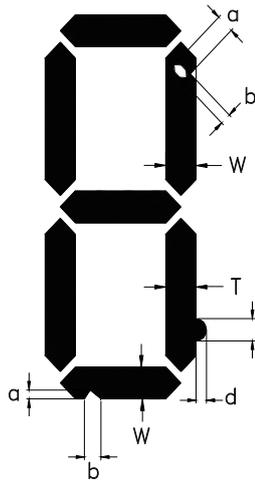


fig . 1
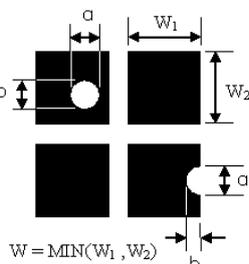
$W = MIN(W_1, W_2)$
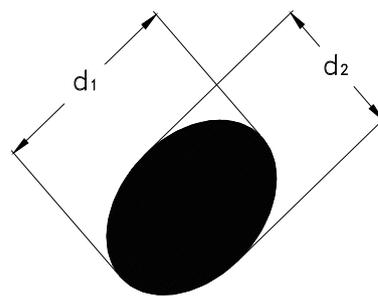
POLARIZER BUBBLES / SPOTS
fig . 2
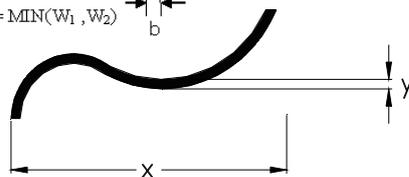
LINE SCRATCHES / BLACK LINE
fig . 3

**QUALITY STANDARD ( CONT .)**

| DEFECT | | CRITERIA | TYPE | FIGURE |
|---|---|---|---|---|
| CHIPS | CONTACT EDGE | e≤1/2T    f≤1/3W    g≤4.0 | MINOR | 4 |
| | BOTTOM GLASS | p≤1.5        q≤3.5          r≤1/2T | | 4 |
| | CORNER | a≤2.0      b≤W | | 4 |
| | TOP GLASS | a≤3.5      b≤1/2T      c≤1/3W | | 5 |
| GLASS PROTRUSION | | a ≤ 1/4 W | MINOR | 6 |
| RAINBOW | | - | MINOR | - |

UNLESS STATE OTHERWISE ,      ALL UNIT ARE IN MILLIMETER .                    DEFECT TABLE : C
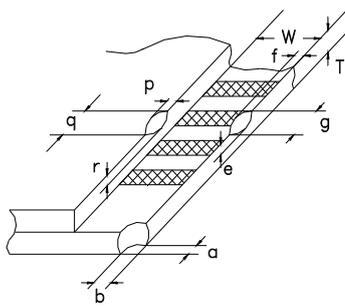
fig . 4
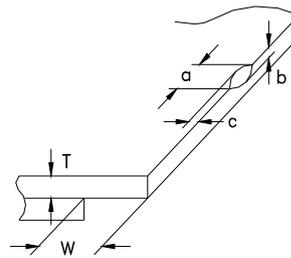
fig . 5
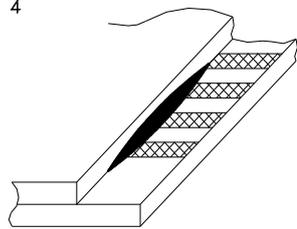
fig . 6

## 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 VO.

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.