# CLOVER DISPLAY LTD.

# LCD MODULE SPECIFICATION

## Model : CV24064B - _ _ - _ _ - _ _ - _

| | |
|---|---|
| Revision | 01 |
| Engineering | Longson Yeung |
| Date | 27 June 2013 |
| Our Reference | 4948 |

## *MODE OF DISPLAY*

| **Display mode** | **Display condition** | **Viewing direction** |
| --- | --- | --- |
| STN : ☐ Yellow green | ☐ Reflective type | ☐ 6 O' clock |
| ☐ Grey | ☐ Transflective type | ☐ 12 O' clock |
| ☐ Blue (negative) | ☐ Transmissive type | ☐ 3 O' clock |
| ☐ FSTN positive | ☐ Others | ☐ 9 O' clock |
| ☐ FSTN negative | | |

## *LCD MODULE NUMBER NOTATION:*

CV24064B- MY - 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          :     240 x 64 dots, graphic COB LCD module

Interface             :     8-bit parallel

Driving method        :     1/64 duty, 1/9 bias

Controller IC         :     Raio RA6963 or equivalent
                            For the detailed information, please refer to the IC specifications.

## MECHANICAL DIMENSIONS

| Item | Dimension | Unit | Item | Dimension | Unit |
|------|-----------|------|------|-----------|------|
| Outline Dimension (LED Backlight version) | 180.0(L)x65.0(W)x16.0MAX(H) | mm | Dot Pitch | 0.53(L)x0.53(W) | mm |
| Outline Dimension (No Backlight version) | 180.0(L)x65.0(W)x9.1MAX(H) | mm | Dot Size | 0.48(L)x0.48(W) | mm |
| Viewing Area | 132.0(L)x39.0 (W) | mm | | | |

## CONNECTOR PIN ASSIGNMENT (CN1)

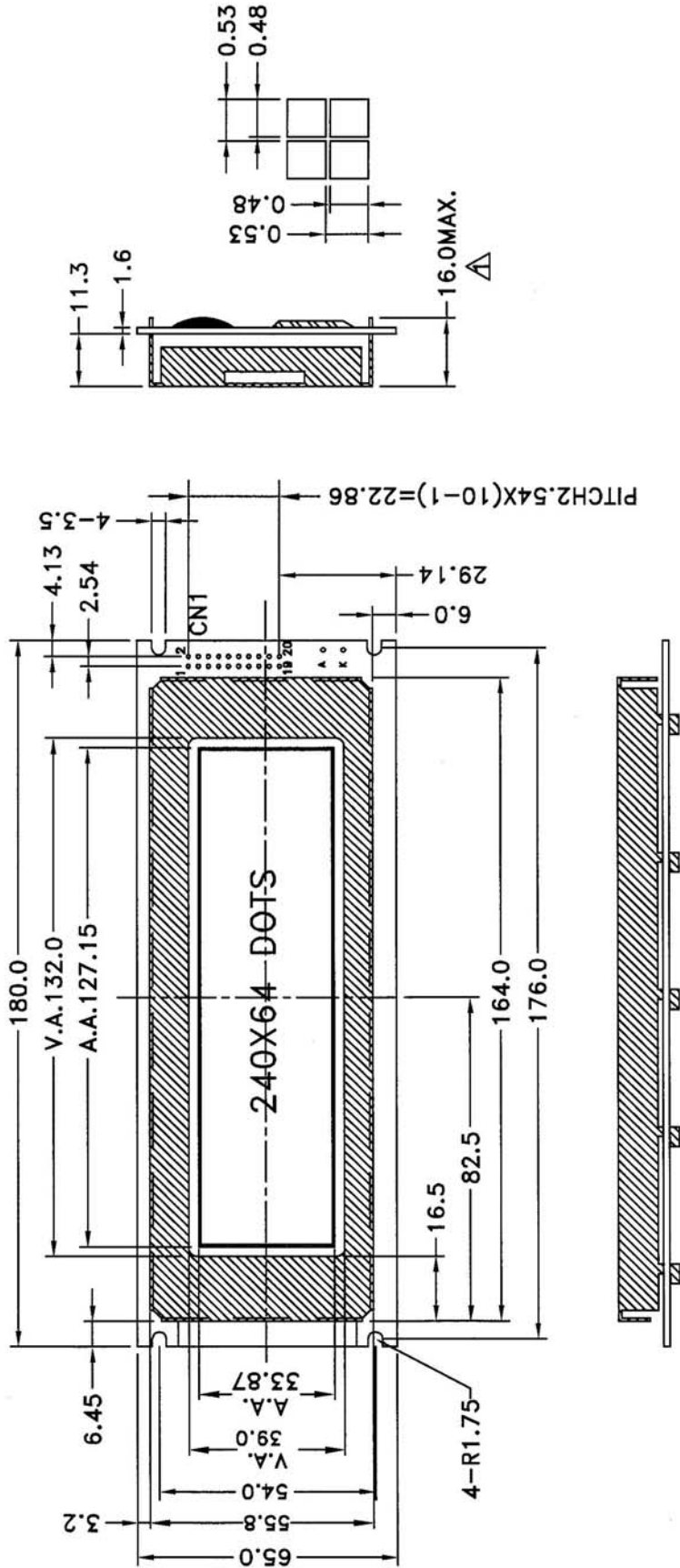| Pin No. | Symbol | Function | Pin No. | Symbol | Function |
|---------|--------|----------|---------|--------|----------|
| 1 | FG | Frame Ground | 12 | DB1 | Data Bus Line |
| 2 | GND | Ground | 13 | DB2 | Data Bus Line |
| 3 | VDD | Supply voltage for logic | 14 | DB3 | Data Bus Line |
| 4(*) | VO | Input voltage for LCD | 15 | DB4 | Data Bus Line |
| 5 | /WR | Write enable | 16 | DB5 | Data Bus Line |
| 6 | /RD | Read enable | 17 | DB6 | Data Bus Line |
| 7 | /CE | Chip Enable | 18 | DB7 | Data Bus Line |
| 8 | C/D | Register Select Input | 19 | FS | Font Select Input |
| 9 | NC | NO Connection | 20 | NC | NO Connection |
| 10 | /RST | Reset Signal | A(**) | BL+ | Supply voltage for backlight (+VE) |
| 11 | DB0 | Data Bus Line | K(**) | BL- | Supply voltage for backlight (-VE) |

Note:

(*) No connection when using internal converter

(**) Used for LED backlight version

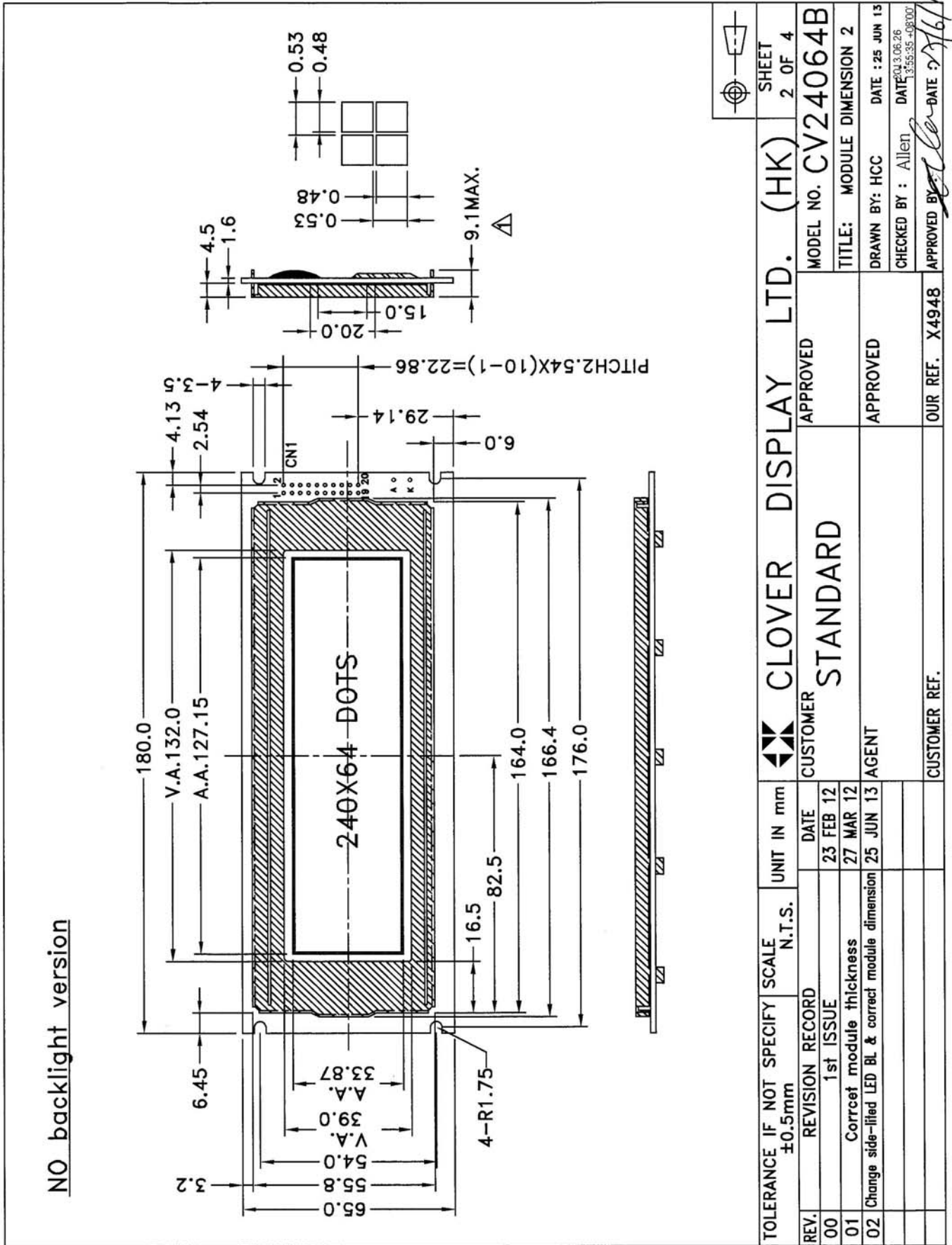## COUNTER DRAWING OF MODULE DIMENSION (LED BACKLIGHT)

## COUNTER DRAWING OF MODULE DIMENSION (NO BACKLIGHT)

## COUNTER DRAWING OF PIN OUT & BLOCK DIAGRAM

CN1

| PIN NO. | SYMBOL | FUNCTION |
|---|---|---|
| 1 | FG | Frame ground |
| 2 | GND | Ground |
| 3 | VDD | Supply voltage for logic |
| *4 | VO | Input voltage for LCD |
| 5 | /WR | Write enable |
| 6 | /RD | Read enable |
| 7 | /CE | Chip enable |
| 8 | C/D | Register select input |
| 9 | NC | No connection |
| 10 | /RST | Reset signal |
| 11 | DB0 | Data Bus |
| 12 | DB1 | |
| 13 | DB2 | |
| 14 | DB3 | |
| 15 | DB4 | |
| 16 | DB5 | |
| 17 | DB6 | |
| 18 | DB7 | |
| 19 | FS | Font select input |
| 20 | NC | No connection |
| **A | BL+ | Supply voltage for backlight (+) |
| **K | BL- | Supply voltage for backlight (-) |

CN1

| | | |
|---|---|---|
| (1) | FG | |
| (2) | GND | |
| (3) | VDD | |
| *(4) | VO | |
| (5) | /WR | |
| (6) | /RD | |
| (7) | /CE | |
| (8) | C/D | |
| (9) | NC | |
| (10) | /RST | |
| (11...18) | DB0...DB7 | |
| (19) | FS | |
| (20) | NC | |
| **A | | |
| **K | | |

LCD

COM. DRIVER 64

RA6963 OR EQUIVALENT 8

SEG. DRIVER 80/ 80/ 80/

RAM

Optional DC/DC Converter

Backlight

NOTE :
* — Pin 4 no connection when using internal converter;
** — A, K pins are used for LED backlight version;

| TOLERANCE IF NOT SPECIFY ±0.5mm | | SCALE N.T.S. | UNIT IN mm | | CLOVER DISPLAY LTD. (HK) | MODEL NO. CV24064B |
|---|---|---|---|---|---|---|
| REV. | REVISION RECORD | | DATE | | CUSTOMER | APPROVED | TITLE: PIN OUT & BLOCK DIAGRAM |

| REV. | REVISION RECORD | DATE |
|---|---|---|
| 00 | 1st ISSUE | 23 FEB 12 |
| 01 | Corrcet module thickness | 27 MAR 12 |
| 02 | Change side-lited LED BL & correct module dimension | 25 JUN 13 |

CUSTOMER

STANDARD

AGENT

CUSTOMER REF.

OUR REF. X4948

MODEL NO. CV24064B

TITLE: PIN OUT & BLOCK DIAGRAM

DRAWN BY: HCC   DATE :25 JUN 13

CHECKED BY : Allen   DATE :2013.06.26 13:55:47 +0800

APPROVED BY : — DATE

SHEET 3 OF 4

**ELECTRICAL CHARACTERISTICS**        Conditions: VSS=0V, @Ta=25℃

| Item | Symbol | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|
| Supply Voltage | VDD | 4.75 | 5.0 | 5.25 | V |
| Supply Current | IDD | – | 12.73 | 19.1 | mA |
| Input voltage for LCD (*) | V0 | -11.8 | -11.0 | -10.2 | V |
| "H"Level Input Voltage | VIH | 2.2VDD | – | VDD | V |
| "L"Level Input Voltage | VIL | – | – | 0.8VDD | V |

**Note (*): There is tolerance in optimum LCD driving voltage during production and it will be within the specified range.**

**Side-lited LED:**

Constant voltage driving:

| Item | Symbol | MIN. | TYP. | MAX. | Unit | Condition |
|---|---|---|---|---|---|---|
| White | $I_{BL}$ | – | 104 | 120 | mA | $V_{BL}$=5.0V |

**Array LED:**

Constant current driving:

| Item | Symbol | MIN. | TYP. | MAX. | Unit | Condition |
|---|---|---|---|---|---|---|
| Yellow Green | $V_{BL}$ | – | 8.0 | 8.4 | V | $I_{BL}$ =270mA |

## 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 | -0.3 to 7.0 | 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 | ℃ |
| Storage Temperature | Tstg | -10 to 60 | -30 to 80 | ℃ |

## FLOWCHART OF COMMUNICATIONS WITH MPU

**Status Read**

### Status Checking Flow

a)

```
   ┌─────────────┐
   │   STATUS    │
   └──────┬──────┘
          │◄──────────────┐
      ╱───┴───╲            │
     ╱ STA0=1  ╲    NO     │
     ╲ STA1=1  ╱───────────┘
      ╲───┬───╱
        YES
   ┌──────┴──────┐
   │   RETURN    │
   └─────────────┘
```

b)

```
   ┌───────────────────┐
   │ AUTO MODE STATUS  │
   └─────────┬─────────┘
             │◄──────────────┐
         ╱───┴───╲            │
        ╱  (*1)   ╲    NO     │
        ╲         ╱───────────┘
         ╲───┬───╱
           YES
   ┌────────┴────────┐
   │     RETURN      │
   └─────────────────┘
```
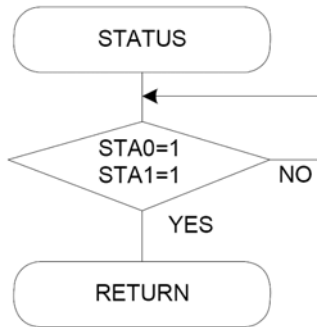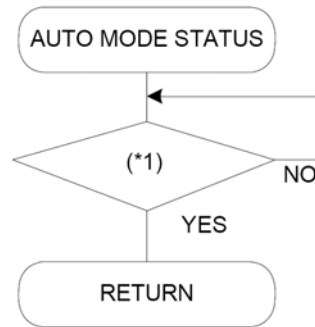
(*1)
STA2=1 (Read)
or
STA3=1(Write)

**Data Set**

### Procedure for Sending a Command

a) The case of 1 data

```
   ┌─────────────────┐
   │  Send Command   │
   └────────┬────────┘
   ┌────────┴────────┐
  ║│  Status Check   │║      STA0, 1
   └────────┬────────┘
   ┌────────┴────────┐
   │   Data Write    │
   └────────┬────────┘
   ┌────────┴────────┐
  ║│  Status Check   │║
   └────────┬────────┘
   ┌────────┴────────┐
   │  Command Write  │
   └────────┬────────┘
   ┌────────┴────────┐
   │      END        │
   └─────────────────┘
```

b) The case of 2 data

```
   ┌─────────────────┐
   │  Send Command   │
   └────────┬────────┘
   ┌────────┴────────┐
  ║│  Status Check   │║      STA0, 1
   └────────┬────────┘
   ┌────────┴────────┐
   │   Data Write    │
   └────────┬────────┘
   ┌────────┴────────┐
  ║│  Status Check   │║
   └────────┬────────┘
   ┌────────┴────────┐
   │   Data Write    │
   └────────┬────────┘
   ┌────────┴────────┐
  ║│  Status Check   │║
   └────────┬────────┘
   ┌────────┴────────┐
   │  Command Write  │
   └────────┬────────┘
   ┌────────┴────────┐
   │      END        │
   └─────────────────┘
```
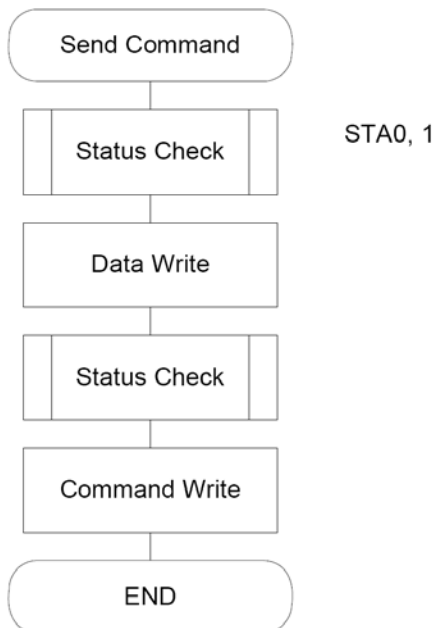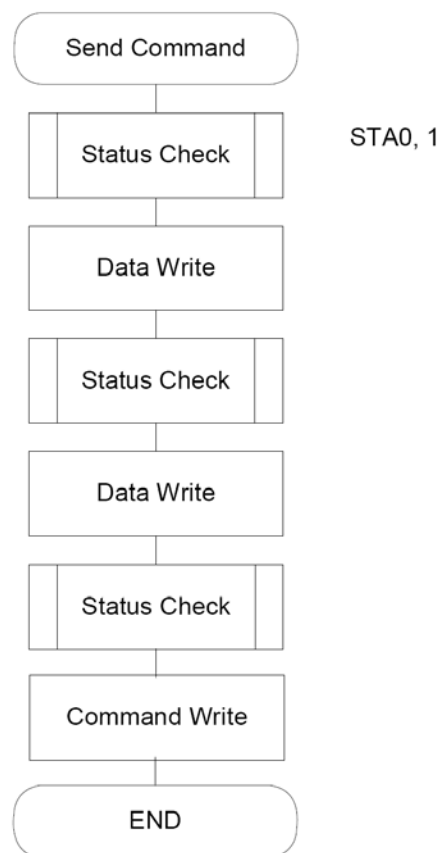
## INSTRUCTIONS

| Command | Code | D1 | D2 | Function |
|---|---|---|---|---|
| **Registers Setting** | 00100001 | X address | Y address | Set cursor pointer |
| | 00100010 | Data | 00h | Set Offset Register |
| | 00100100 | Low address | High address | Set Address pointer |
| **Set Control Word** | 01000000 | Low address | High address | Set Text Home Address |
| | 01000001 | Columns | 00h | Set Text Area |
| | 01000010 | Low address | High address | Set Graphic Home Address |
| | 01000011 | Columns | 00h | Set Graphic Area |
| **Mode Set** | 1000X000 | -- | -- | OR mode |
| | 1000X001 | -- | -- | EXOR mode |
| | 1000X011 | -- | -- | AND mode |
| | 1000X100 | -- | -- | Text Attribute mode |
| | 10000XXX | -- | -- | Internal CG ROM mode |
| | 10001XXX | -- | -- | External CG RAM mode |
| **Display Mode** | 10010000 | -- | -- | Display off |
| | 1001XX10 | -- | -- | Cursor on, blink off |
| | 1001XX11 | -- | -- | Cursor on, blink on |
| | 100101XX | -- | -- | Text on, graphic off |
| | 100110XX | -- | -- | Text off, graphic on |
| | 100111XX | -- | -- | Text on, graphic on |
| **Cursor Pattern Select** | 10100000 | -- | -- | 1-line cursor |
| | 10100001 | -- | -- | 2-line cursor |
| | 10100010 | -- | -- | 3-line cursor |
| | 10100011 | -- | -- | 4-line cursor |
| | 10100100 | -- | -- | 5-line cursor |
| | 10100101 | -- | -- | 6-line cursor |
| | 10100110 | -- | -- | 7-line cursor |
| | 10100111 | -- | -- | 8-line cursor |
| **Data Read/Write** | 11000000 | Data | -- | Data Write and Increment ADP |
| | 11000001 | -- | -- | Data Read and Increment ADP |
| | 11000010 | Data | -- | Data Write and Decrement ADP |
| | 11000011 | -- | -- | Data Read and Decrement ADP |
| | 11000100 | Data | -- | Data Write and Non-variable ADP |
| | 11000101 | -- | -- | Data Read and Non-variable ADP |
| **Data auto Read/Write** | 10110000 | -- | -- | Set Data Auto Write |
| | 10110001 | -- | -- | Set Data Auto Read |
| | 10110010 | -- | -- | Auto Reset |
| **Screen Peek** | 11100000 | -- | -- | Screen Peek |
| **Screen Copy** | 11101000 | | | Screen Copy |
| **Bit Set/Reset** | 11110XXX | -- | -- | Bit Reset |
| | 11111XXX | -- | -- | Bit Set |
| | 1111X000 | -- | -- | Bit 0 (LSB) |
| | 1111X001 | -- | -- | Bit 1 |
| | 1111X010 | -- | -- | Bit 2 |
| | 1111X011 | -- | -- | Bit 3 |
| | 1111X100 | -- | -- | Bit 4 |
| | 1111X101 | -- | -- | Bit 5 |
| | 1111X110 | -- | -- | Bit 6 |
| | 1111X111 | -- | -- | Bit 7 (MSB) |
| **Screen Reverse** | 11010000 | Data | -- | Whole screen reverse |

| | | | | Data Bit 0<br>　0 : Normal<br>　1 : Reverse |
|---|---|---|---|---|
| **Blink Time** | 01010000 | Data | Don't care<br>(Note) | If Frame = 60Hz<br>Data Bit 2:0<br>　000 : 0.066s<br>　001 : 0.25s<br>　010 : 0.5s (Default)<br>　011 : 0.75s<br>　100 : 1s<br>　101 : 1.25s<br>　110 : 1.5s<br>　111 : 2s |
| **Cursor Auto Moving** | 01100000 | Data | Don't care<br>(Note) | Data Bit 0<br>　0 : Disable.(Default)<br>　1 : Enable. |
| **CGROM Font Select** | 01110000 | Data | Don't care<br>(Note) | Data Bit 1:0<br>　00 : Do not care.(Default)<br>　01 : Do not care.<br>　10 : CGROM Font-01.<br>　11 : CGROM Font-02. |

Note： In these functions, it must be sent two data before sending the command, but the contents of the second datum (D2) can be any values.

**ADDRESS CONFIGURATION OF DISPLAY DATA RAM**

## Set Control Word

< Table 6-7 >

| Code | Hex. | Function | D1 | D2 |
|------|------|----------|-----|-----|
| 01000000 | 40h | Set Text Home Address | Low Address | High Address |
| 01000001 | 41h | Set Text Area | Columns | 00h |
| 01000010 | 42h | Set Graphic Home Address | Low Address | High Address |
| 01000011 | 43h | Set Graphic Area | Columns | 00h |

The home address and column size are defined by this command.

### 6-7-1 Set Text Home Address

The starting address in the external display RAM for text display is defined by this command. The text home address indicates the leftmost and uppermost position.

**The Relationship between Display RAM Address and Display Position**

< Table 6-8 >

| TH | ......... | TH + CL |
|----|-----------|---------|
| TH + TA | ......... | TH + TA + CL |
| (TH + TA) + TA | ......... | TH + 2TA + CL |
| (TH + 2TA) + TA | ......... | TH + 3TA + CL |
| $\vdots$ | $\vdots$ | $\vdots$ |
| TH + (n-1) TA | ......... | TH + (n-1) TA + CL |

TH: Text home address
TA: Text area number (columns)
CL: Columns are fixed by hardware (pin-programmable).

(Example)

| Text Home Address | : 0000h |
|---|---|
| Text Area | : 0020h |
| MD2=H, MD3=H | : 32 Columns |
| $\overline{DUAL}$ =H, MDS=L, MD0=L, MD1=H | : 4 Lines |

**< Table 6-9 >**

| 0000h | 0001h | ......... | 001Eh | 001Fh |
|---|---|---|---|---|
| 0020h | 0021h | ......... | 003Eh | 002Fh |
| 0040h | 0041h | ......... | 005Eh | 005Fh |
| 0060h | 0061h | ......... | 007Eh | 007Fh |

## Set Graphic Home Address

The starting address of the external display RAM used for graphic display is defined by this Command. The graphic home address indicates the leftmost and uppermost position.

### The Relationship between External Display RAM Address and Display Position

**< Table 6-10 >**

| GH | ......... | GH + CL |
|---|---|---|
| GH + GA | ......... | GH + GA + CL |
| (GH + GA) + GA | ......... | GH + 2GA + CL |
| (GH + 2GA) + GA | ......... | GH + 3GA + CL |
| : | : | : |
| GH + (n-1) GA | ......... | GH + (n-1) GA + CL |

GH: Graphic Home Address
GA: Graphic Area Number (columns)
CL: Columns are fixed by hardware (pin-programmable).

(Example)

| Graphic Home Address | : 0000h |
|---|---|
| Graphic Area | : 0020h |
| MD2=H, MD3=H | : 32 columns |
| $\overline{DUAL}$ =H, MDS=L, MD0=H, MD1=H | : 2 lines |

< Table 6-11 >

| 0000h | 0001h | ……… | 001Eh | 001Fh |
|---|---|---|---|---|
| 0020h | 0021h | ……… | 003Eh | 003Fh |
| 0040h | 0041h | ……… | 005Eh | 005Fh |
| 0060h | 0061h | ……… | 007Eh | 007Fh |
| 0080h | 0081h | ……… | 009Eh | 009Fh |
| 00A0h | 00A1h | ……… | 00BEh | 00BFh |
| 00C0h | 00C1h | ……… | 00DEh | 00DFh |
| 00E0h | 00E1h | ……… | 00FEh | 00FFh |
| 0100h | 0101h | ……… | 011Eh | 011Fh |
| 0120h | 0121h | ……… | 013Eh | 013Fh |
| 0140h | 0141h | ……… | 015Eh | 015Fh |
| 0160h | 0161h | ……… | 017Eh | 017Fh |
| 0180h | 0181h | ……… | 019Eh | 019Fh |
| 01A0h | 01A1h | ……… | 01BEh | 01BFh |
| 01C0h | 01C1h | ……… | 01DEh | 01DFh |
| 01E0h | 01E1h | ……… | 01FEh | 01FFh |

## Set Text Area

The display columns are defined by the hardware setting. This command can be used adjust the columns of the display.

(Example)

| | |
|---|---|
| LCD Size | : 20 columns, 4 lines |
| Text Home Address | : 0000h |
| Text Area | : 0014h |
| MD2=H, MD3=H | : 32 columns |
| $\overline{DUAL}$ =H , MDS =L, MD0= L, MD1=H | : 4 lines |

< Table 6-12 >

| 0000 | 0001 | ……… | 0013 | 0014 | ……… | 001F |
|---|---|---|---|---|---|---|
| 0014 | 0015 | ……… | 0027 | 0028 | ……… | 0033 |
| 0028 | 0029 | ……… | 003B | 003C | ……… | 0047 |
| 003C | 003D | ……… | 004F | 0050 | ……… | 005B |

← LCD →

## Set Graphic Area

The display columns are defined by the hardware setting. This command can be used to adjust the columns of the graphic display.

(Example)

| | | |
|---|---|---|
| LCD Size | : 20 columns, 2 lines | |
| Graphic Home Address | : 0000h | |
| Graphic Area | : 0014h | |
| MD2=H, MD3=H | : 32 columns | |
| $\overline{DUAL}$ =H, MDS=L MD0=H, MD1=H | : 2 lines | |

### < Table 6-13 >

| 0000 | 0001 | ......... | 0013 | 0014 | ......... | 001F |
|------|------|-----------|------|------|-----------|------|
| 0014 | 0015 | ......... | 0027 | 0028 | ......... | 0033 |
| 0028 | 0029 | ......... | 003B | 003C | ......... | 0047 |
| 003C | 003D | ......... | 004F | 0050 | ......... | 005B |
| 0050 | 0051 | ......... | 0063 | 0064 | ......... | 006F |
| 0064 | 0065 | ......... | 0077 | 0078 | ......... | 0083 |
| 0078 | 0079 | ......... | 008B | 008C | ......... | 0097 |
| 008C | 008D | ......... | 009F | 00A0 | ......... | 00AB |
| 00A0 | 00A1 | ......... | 00B3 | 00B4 | ......... | 00BF |
| 00B4 | 00B5 | ......... | 00C7 | 00C8 | ......... | 00D3 |
| 00C8 | 00C9 | ......... | 00DB | 00DC | ......... | 00E7 |
| 00DC | 00DD | ......... | 00EF | 00F0 | ......... | 00FD |
| 00F0 | 00F1 | ......... | 0103 | 0104 | ......... | 011F |
| 0104 | 0105 | ......... | 0127 | 0128 | ......... | 0123 |
| 0128 | 0129 | ......... | 013B | 013C | ......... | 0147 |
| 013C | 013D | ......... | 014F | 0150 | ......... | 015B |

|———————————→ LCD ←——————————|

If the graphic area setting is set to match the desired number of columns on the LCD, the addressing scheme will be automatically modified so that the start address of each line equals the end address of the previous line +1.

**TIMING CHARACTERISTICS OF COMPATIBLE CONTROLLER CHIPS**

## MPU Interface Timing
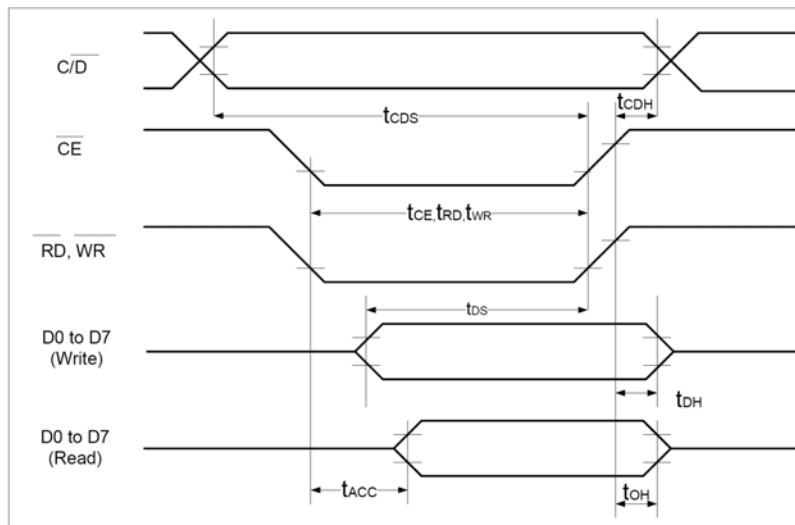


< Figure 8-1 >

< Table 8-3 >

( $V_{DD}$=+5V±5%,GND=0V,Ta= -20 to +70℃ )

| Item | Symbol | Test Conditions | Min. | Max. | Unit |
|---|---|---|---|---|---|
| C/$\overline{D}$ Set Up Time | $t_{CDS}$ | -- | 100 | -- | ns |
| C/$\overline{D}$ Hold Time | $t_{CDH}$ | -- | 10 | -- | ns |
| $\overline{CE}$, $\overline{RD}$, $\overline{WR}$ Pulse Width | $t_{CE}$, $t_{RD}$, $t_{WR}$ | -- | 80 | -- | ns |
| Data Set Up Time | $t_{DS}$ | -- | 80 | -- | ns |
| Data Hold Time | $t_{DH}$ | -- | 40 | -- | ns |
| Access Time | $t_{ACC}$ | -- | -- | 150 | ns |
| Output Hold Time | $t_{OH}$ | -- | 10 | 50 | ns |

## 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 |
|---|---|---|---|---|
| RESPONSE TIME | T$_{on}$ | ms | 100 | 200 |
| | T$_{off}$ | ms | 80 | 200 |
| CONTRAST RATIO | Cr | - | 10 | 10 |
| VIEWING ANGLE (6 O'clock) (Cr ≥ 2) | V$_{3:00}$ | ° | 20 | 20 |
| | V$_{6:00}$ | ° | 20 | 40 |
| | V$_{9:00}$ | ° | 20 | 20 |
| | V$_{12:00}$ | ° | 10 | 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 |

## 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 of 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 dirty |
| | 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

Use soft cloth with solvent (recommended below) to clean the display surface and wipe lightly.
- Isopropyl alcohol, ethyl alcohol, trichlorotriflorothane

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface. Do not use the following solvent;
-water, ketone, aromatics

### (2) CAUTION AGAINST STATIC CHARGE

The LCD modules use CMOS LSI drivers, so customers are recommend 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 direct to sunshine or high temperature/humidity.

### (4) CAUTION FOR OPERATION

It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage than the limit causes the shorter LCD life. The use of direct current drive should be avoided because an electrochemical reaction due to direct current causes LCD's undesirable deterioration.

Response time will be extremely delayed at low temperature, and LCD's show dark color at high temperature. However those phenomena do not mean malfunction or out of order with LCD's.

Some font will be abnormally displayed when the display area is pushed hard during operation. But it resumes normal condition after turning off once.

### (5) SAFETY

For crash damaged or unnecessary LCD's, it is recommended to wash off liquid crystal by either of solvents such as acetone and ethanol and should be burned up later.

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

### 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.