CLOVER DISPLAY LTD.

LCD MODULE SPECIFICATION

Model : CV4402C - _ _ - _ _ - _ _ - _

Revision	02
Engineering	Timmy Kwan
Date	08 April 09
Our Reference	4907

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MODE OF DISPLAY

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

LCD MODULE NUMBER NOTATION:

<u>CV4402C</u>- <u>L</u> <u>W</u> - <u>S</u> <u>F</u> - <u>N</u> <u>6</u> – <u>T</u>
   | | | | | | | |
  (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   :   40 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

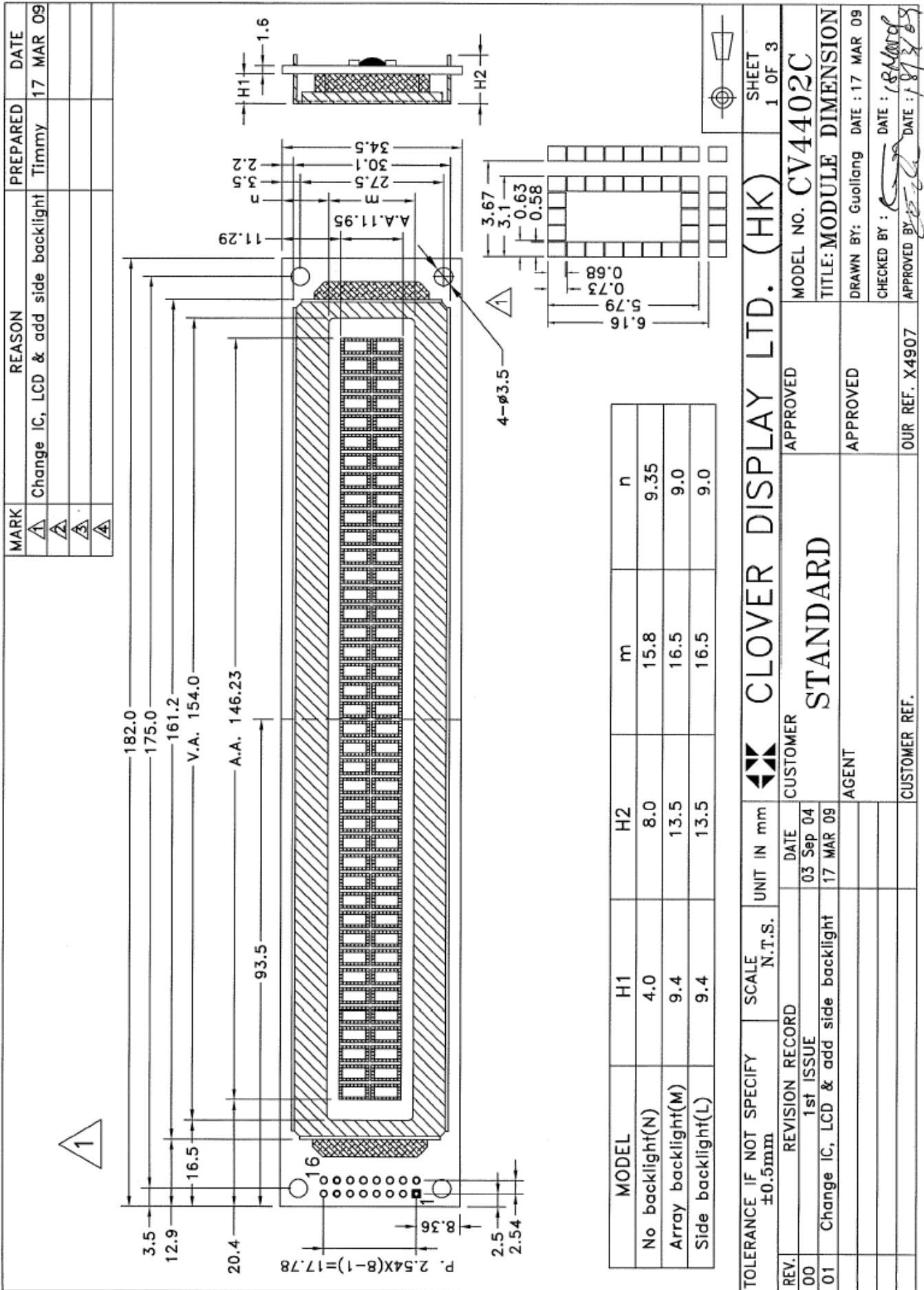   For the detailed information, please refer to IC specifications.

MECHANICAL DIMENSIONS

Item	Dimension		Unit	Item	Dimension		Unit
Outline Dimension	182.0(L)x34.5(W)x (H1/H2)		mm	Character Pitch	3.67(L)x6.16(W)		mm
Viewing Area	154.0(L)x16.5(W)		mm	Dot Size	0.58(L)x0.68(W)		mm
Character Size	3.10(L)x5.79(W)		mm	—	—		—
No Backlight (N)	H1	4.0	mm	Side Backlight (L)	H1	9.4	mm
	H2	8.0	mm		H2	13.5	mm
EL Backlight (E)	H1	—	mm	Array Backlight (M)	H1	9.4	mm
	H2	—	mm		H2	13.5	mm

CONNECTOR PIN ASSIGNMENT

Pin No.	Symbol	Function	Pin No.	Symbol	Function
1	V_{SS}	Ground	9	DB_2	
2	V_{DD}	Supply Voltage for Logic	10	DB_3	
3	V_0	Input Voltage for LCD	11	DB_4	
4	RS	Register Select	12	DB_5	Data Bus Line
5	R/W	Read/Write	13	DB_6	
6	E	Enable Signal	14	DB_7	
7	DB_0	Data Bus Line	15	BL+	Backlight Power Supply (+)
8	DB_1		16	BL -	Backlight Power Supply (-)

COUNTER DRAWING OF MODULE DIMENSION

MARK	REASON	PREPARED	DATE
1	Change IC, LCD & add side backlight	Timmy	17 MAR 09
2			
3			
4			

Dimensions (drawing annotations):

1.6, H1, H2, 34.5, 30.1, 27.5, 2.2, 3.5, n, m, A.A.11.95, 11.29, 3.67, 3.1, 0.63, 0.58, 0.68, 0.73, 5.79, 6.16, 4-φ3.5

182.0, 175.0, 161.2, V.A. 154.0, A.A. 146.23, 93.5, 16.5, 12.9, 3.5, 20.4, 8.36, 2.5, 2.54

P. 2.54X(8-1)=17.78

16 ... 1

MODEL		H1	H2	m	n
No backlight(N)		4.0	8.0	15.8	9.35
Array backlight(M)		9.4	13.5	16.5	9.0
Side backlight(L)		9.4	13.5	16.5	9.0

CLOVER DISPLAY LTD. (HK)

STANDARD

CUSTOMER			APPROVED
AGENT			APPROVED
CUSTOMER REF.			

MODEL NO. CV4402C

TITLE: MODULE DIMENSION

DRAWN BY: Guoliang   DATE : 17 MAR 09

CHECKED BY :   DATE :

APPROVED BY :   DATE :

OUR REF. X4907

SHEET 1 OF 3

UNIT IN mm

SCALE N.T.S.

TOLERANCE IF NOT SPECIFY ±0.5mm

REV.	REVISION RECORD	DATE
00	1st ISSUE	03 Sep 04
01	Change IC, LCD & add side backlight	17 MAR 09

COUNTER DRAWING OF PIN OUT & BLOCK DIAGRAM

PIN NO.	SYMBOL	FUNCTION
1	VSS	Ground
2	VDD	Supply voltage for Logic
3	V0	Input voltage for LCD
4	RS	Register select
5	R/W	Read / Write
6	E	Enable signal
7	DB0	
8	DB1	
9	DB2	
10	DB3	Data bus line
11	DB4	
12	DB5	
13	DB6	
14	DB7	
*15	BL+	Supply voltage for backlight (+VE)
*16	BL−	Supply voltage for backlight (−VE)

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

LCD PANEL

COM1 to COM16

SEG1 to SEG40　　SEG41 to SEG200

ST7065C OR EQUIVALENT

LED BACKLIGHT

ST7066U OR EQUIVALENT

(1)VSS
(2)VDD
(3)V0
(4)RS
(5)R/W
(6)E

DB0~DB7
(7~14)

*(15)BL+
*(16)BL−

CLOVER DISPLAY LTD. (HK)

STANDARD

		MODEL NO.	CV4402C
CUSTOMER	APPROVED	TITLE: PIN OUT & BLOCK DIAGRAM	
AGENT	APPROVED	DRAWN BY: Guoliang DATE: 17 MAR 09	
		CHECKED BY DATE:	
CUSTOMER REF.		APPROVED BY DATE:	
		OUR REF. X4907	SHEET 2 OF 3

	UNIT IN mm		
TOLERANCE IF NOT SPECIFY ±0.5mm	SCALE N.T.S.		

REV.	REVISION RECORD	DATE
00	1st ISSUE	03 Sep 04
01	Change IC, LCD & add side backlight	17 MAR 09

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

Item	Symbol	MIN.	TYP.	MAX.	Unit	Item	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage	V_{DD}	4.8	5.0	5.2	V	"H"Level Input Voltage	V_{IH}	2.2	—	VDD	V
Supply Current	I_{DD}	—	1.5	2.3	mA	"L"Level Input Voltage	V_{IL}	-0.3	—	0.6	V
Input Voltage for LCD	$V0$	-0.2	0	0.2	V						

EL Backlight Voltage (V_{EL})											
EL (@ Frequency 400Hz)	V_{BL}	—	—	—	Vrms	—	—	—	—	—	—

Side-lited LED Backlight Forward Voltage (V_F)						**Side-lited LED Backlight Forward Current (I_F)**					
White	V_{BL}	4.8	5.0	5.2	V	White	I_{BL}	—	30	40	mA
Blue	V_{BL}	—	—	—	V	Blue	I_{BL}	—	—	—	mA
Yellow Green	V_{BL}	—	—	—	V	Yellow Green	I_{BL}	—	—	—	mA

Array LED Backlight Forward Voltage (V_F)						**Array LED Backlight Forward Current (I_F)**					
Yellow Green	V_{BL}	3.8	4.0	4.2	V	Yellow Green	I_{BL}	—	360	700	mA
Amber	V_{BL}	—	—	—	V	Amber	I_{BL}	—	—	—	mA
Orange	V_{BL}	—	—	—	V	Orange	I_{BL}	—	—	—	mA
Soft Orange	V_{BL}	—	—	—	V	Soft Orange	I_{BL}	—	—	—	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	V_{DD}	-0.3 to 7.0	-0.3 to 7.0	V
Input Voltage	V_T	-0.3 to V_{DD} +0.3	-0.3 to V_{DD} +0.3	V
Operating Temperature	T_{opr}	0 to 50	-20 to 70	℃
Storage Temperature	T_{stg}	-10 to 60	-30 to 80	℃

INSTRUCTIONS TABLE

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

I / D	= 1: Increment	DD RAM: Display data RAM	
I / D	= 0: Decrement	CG RAM: Character generator RAM	
S	= 1: Accompanies display shift	ACG: CG RAM address	
S / C	= 1: Display shift	ADD: DD RAM address :	
S / C	= 0: Cursor move	Corresponds to cursor address	
R / L	= 1: shift to the right	AC: Address counter used for both	
R / L	= 0: shift to the left	DD and CG RAM address.	
DL	= 1: 8 bits		
DL	= 0: 4 bits	∗ Don't care	
N	= 1: 2 lines		
N	= 0: 1 line		
F	= 1: 5 x 10 dots		
F	= 0: 5 x 7 dots		
BF	= 1: Internally operating		
BF	= 0: Can accept instruction		

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

40x2, 1/16 DUTY CYCLE

	1	2		40	DISPLAY POSITION
line 1	00	01	· · · · · · · · · · · · · · · · · · · · · · · · · · · · · ·	27	DD RAM ADDRESS
line 2	40	41	· · · · · · · · · · · · · · · · · · · · · · · · · · · · · ·	67	

TIMING CHARACTERISTICS OF COMPATIBLE CONTROLLER CHIPS

Parameters	Symbol	Recommended timing	Parameters	Symbol	Recommended timing
Enable Cycle Time	tC (min)	1000ns	Set-up Time	tB(min)	140ns
Enable Pulse Width			Data Set-up Time	tl (min)	195ns
High level	tW(min)	450ns	Data Delay Time	t_D (max)	320ns
Low level	tL (min)	450ns	Address Hold Time	tA(min)	10ns
Enable Raise Time	tr (max)	25ns	Input Data Hold Time	tH (min)	10ns
Enable Fall Time	tf (max)	25ns	Output Data Hold Time	tD (min)	20ns

Figure 1   Power On Timing Diagram
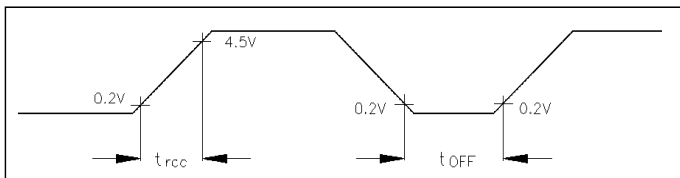
Note: Power on initialization depends on the rise time of the power supply when it is turned on. When the above power supply conditions is not met, the internal reset circuit will not operate normally and initialization will not be performed. Initialization by manual instruction is required. Use the procedure in figures 4 and 5 for initialization.

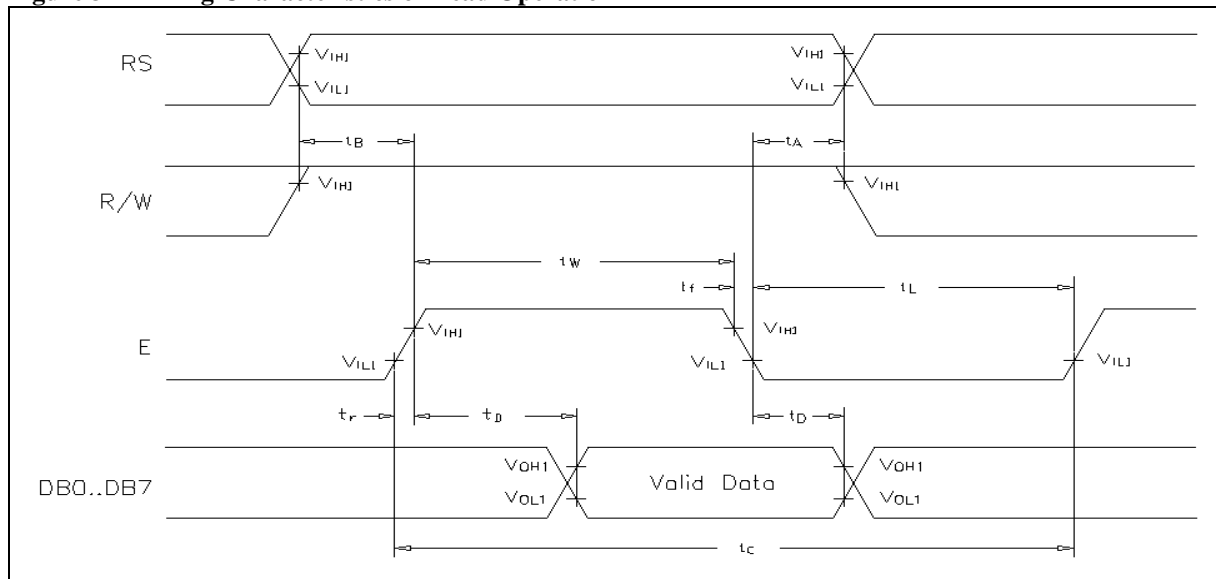**Figure 2   Timing Characteristics of Write Operation**
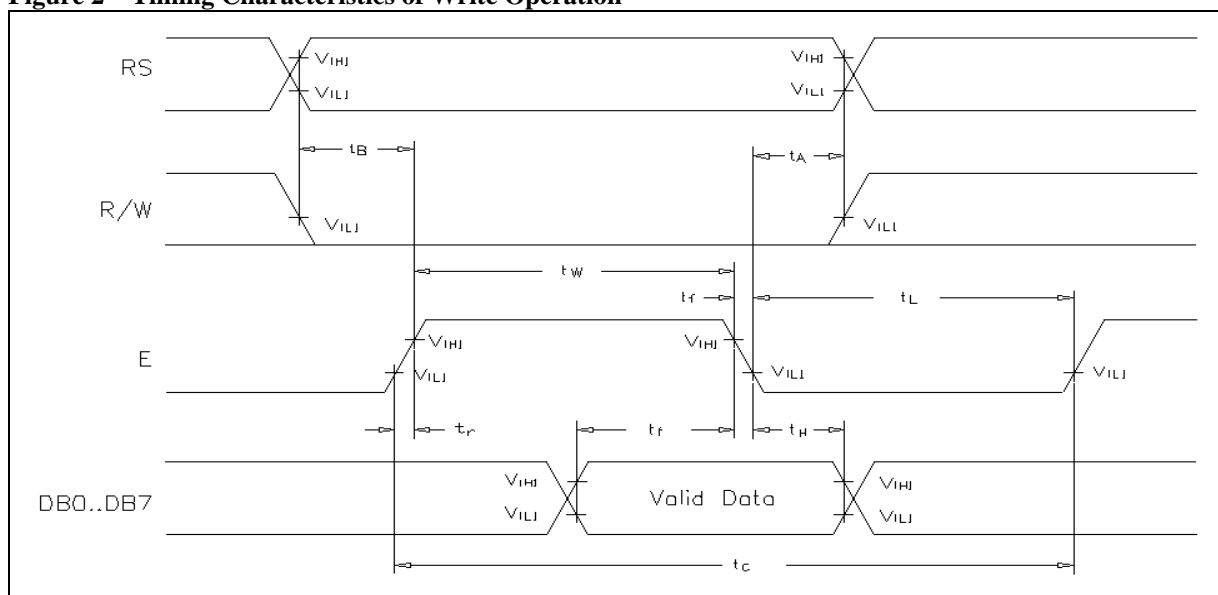
Figure 3   Timing Characteristics of Read Operation

Reset Function

Initializing by Internal Reset Circuit:

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.

INITIALIZATION METHOD

The module will automatically perform initialization using internal reset circuit when power is turned on. The following instructions are executed during initialization.

1.   Display Clear

     The busy flag is kept in busy state high (BF=1).   The busy state is 15ms..

2.   Function set: DL   = 1: 8 bit long interface data

                                                                                  N   = 0: 1 line display

                                                                              F   = 0: 5 x 7 dot character font

3.   Display on / off control: D   = 0: Display off

                                                                             C   = 0: Cursor off

                                                                              B   = 0: Blink off

4.   Entry mode set: I / D = 1: +1 (increment)
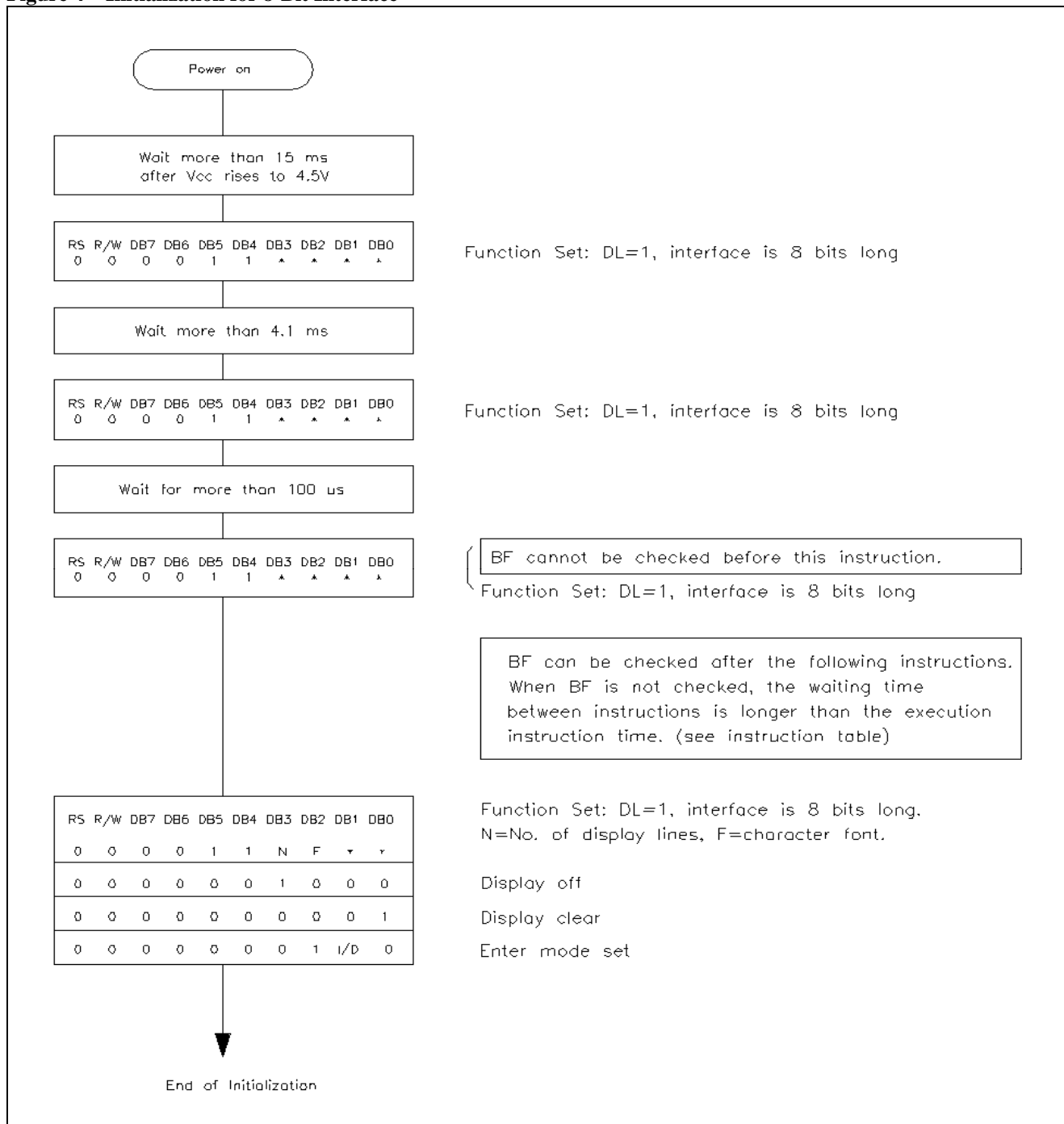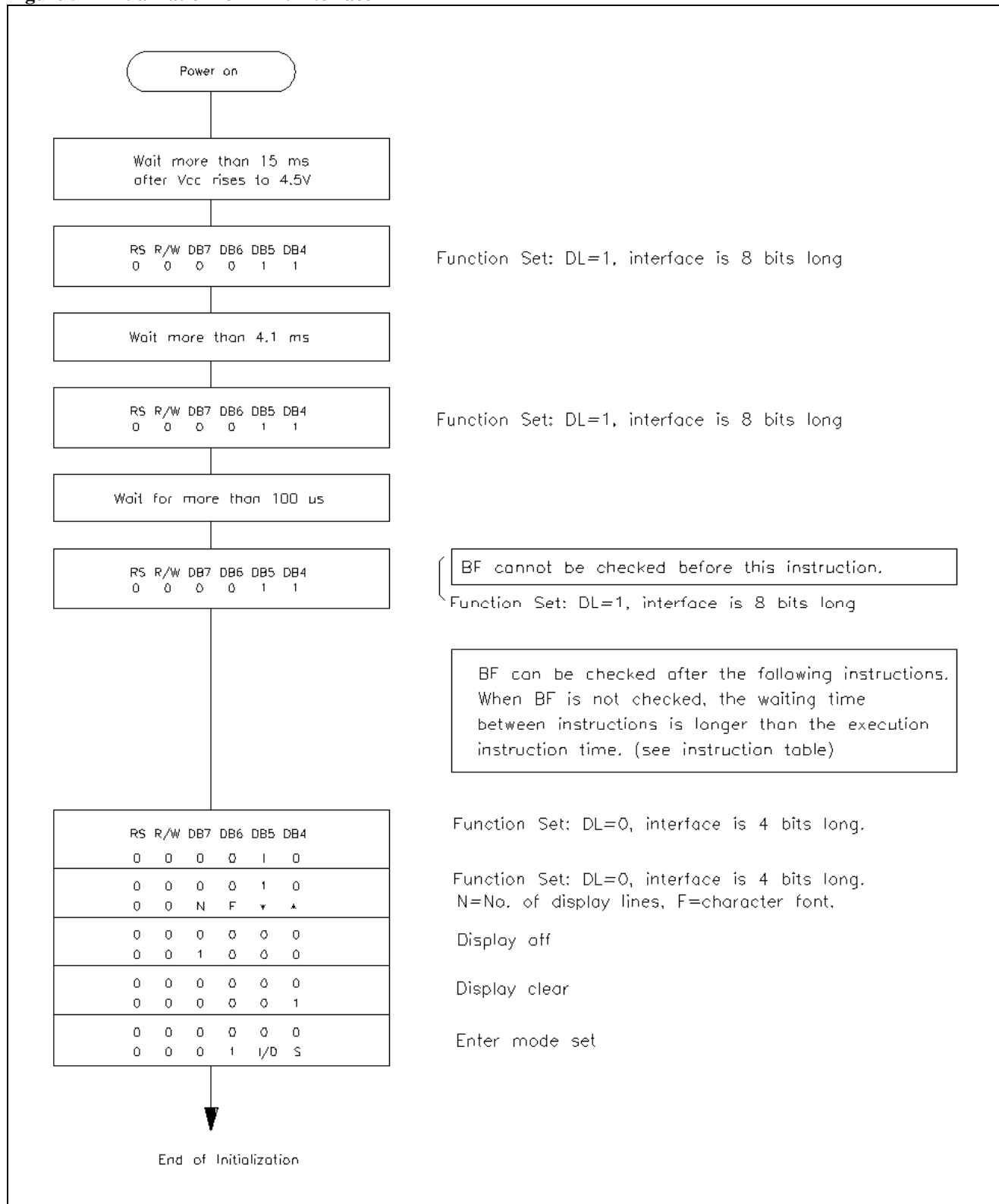
                                                               S   = 0: No shift

Figure 4   Initialization for 8-Bit Interface

Figure 5   Initialization for 4-Bit interface

Power on

Wait more than 15 ms
after Vcc rises to 4.5V

| RS | R/W | DB7 | DB6 | DB5 | DB4 |
| 0 | 0 | 0 | 0 | 1 | 1 |

Function Set: DL=1, interface is 8 bits long

Wait more than 4.1 ms

| RS | R/W | DB7 | DB6 | DB5 | DB4 |
| 0 | 0 | 0 | 0 | 1 | 1 |

Function Set: DL=1, interface is 8 bits long

Wait for more than 100 us

| RS | R/W | DB7 | DB6 | DB5 | DB4 |
| 0 | 0 | 0 | 0 | 1 | 1 |

BF cannot be checked before this instruction.
Function Set: DL=1, interface is 8 bits long

BF can be checked after the following instructions.
When BF is not checked, the waiting time
between instructions is longer than the execution
instruction time. (see instruction table)

| RS | R/W | DB7 | DB6 | DB5 | DB4 |
| 0 | 0 | 0 | 0 | 1 | 0 |

Function Set: DL=0, interface is 4 bits long.

| 0 | 0 | 0 | 0 | 1 | 0 |
| 0 | 0 | N | F | ∗ | ∗ |

Function Set: DL=0, interface is 4 bits long.
N=No. of display lines, F=character font.

| 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 | 0 | 0 |

Display off

| 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 1 |

Display clear

| 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 1 | I/D | S |

Enter mode set

End of Initialization

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	C_r	-	10	10
VIEWING ANGLE (6 O'clock) ($C_r \geq 2$)	$V_{3:00}$	°	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 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

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.

SPECIFICATION REVISION RECORD