



**CLOVER DISPLAY LTD.**

## LCD MODULE SPECIFICATION

**Model: CV4162F - \_ \_ - \_ \_ - \_ \_ - \_ \_**

Revision	04
Engineering	Timmy Kwan
Date	29 July 2010
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:**

**CV4162F- 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  
 M – Mutli Colour

\* (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 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 the 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**

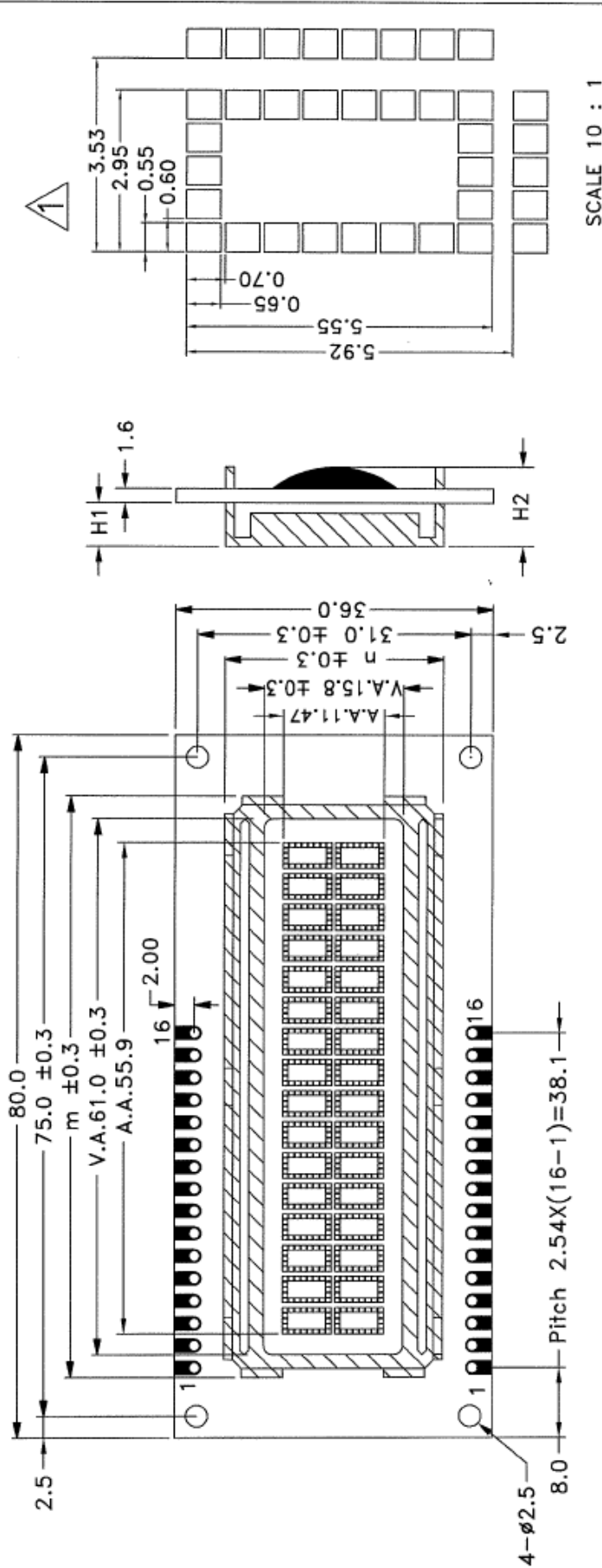
Pin No.	Symbol	Function	Pin No.	Symbol	Function
1	VSS	Ground	9	DB2	Data Bus Line
2	VDD	Supply voltage for logic	10	DB3	Data Bus Line
3	V <sub>0</sub>	Input voltage for LCD	11	DB4	Data Bus Line
4	RS	Register Select	12	DB5	Data Bus Line
5	R/W	Read/Write	13	DB6	Data Bus Line
6	E	Enable Signal	14	DB7	Data 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

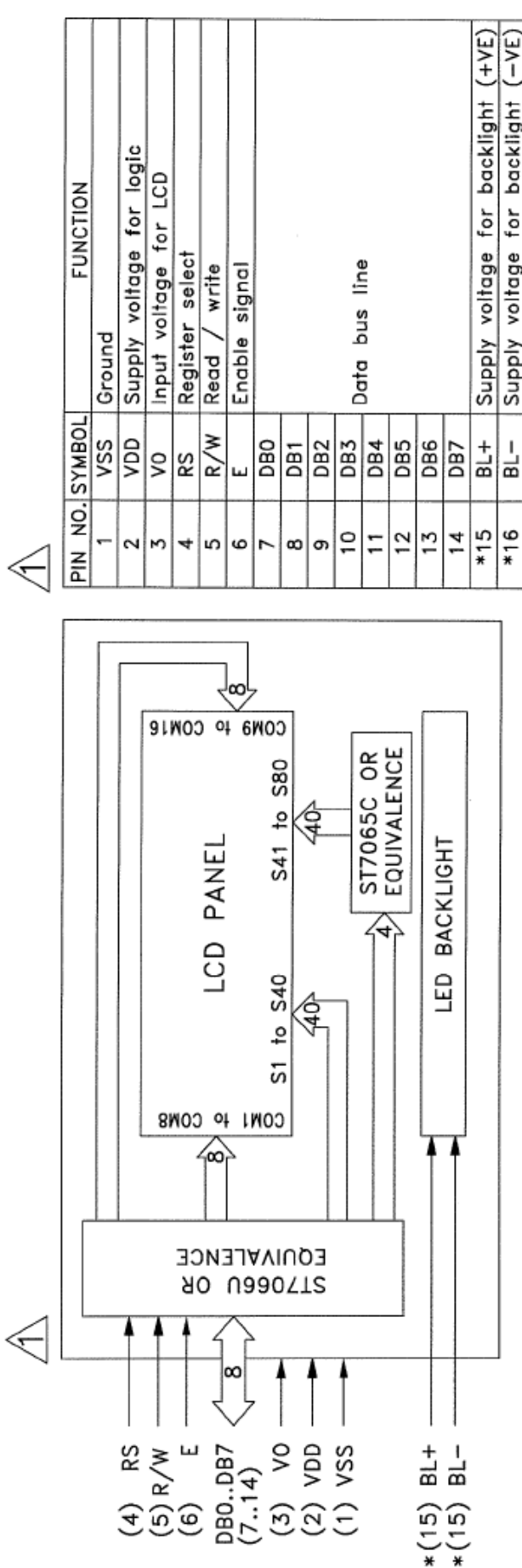
MARK	REASON	PREPARED	DATE
△	Change IC & LCD dot size	Timmy	17 MAR 08
△	Change backlight current	Timmy	05 JUL 10
△			
△			

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



TOLERANCE IF NOT SPECIFY ±0.5mm		SCALE N.T.S.	UNIT IN mm	CLOVER DISPLAY LTD. (HK)		SHEET 1 OF 3
REV.	REVISION RECORD	DATE	CUSTOMER	APPROVED	MODEL NO. CV4162F	
00	1st ISSUE	22 Jan 00	STANDARD		TITLE: MODULE DIMENSION	
01	Change IC & LCD dot size	17 Mar 08	AGENT	APPROVED	DRAWN BY: FAN	DATE: 05 Jul 10
02	Change backlight current	05 Jul 10			CHECKED BY: <i>[Signature]</i>	DATE: 05 Jul 10
					APPROVED BY: <i>[Signature]</i>	DATE: 05 Jul 10
			CUSTOMER REF.	OUR REF. X4406		

COUNTER DRAWING OF PIN OUT & BLOCK DIAGRAM



(\*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. CV4162F	
00	1st ISSUE	22 Jan 00	STANDARD		TITLE: PINOUT & BLOCK DIAGRAM	
01	Change IC & LCD dot size	17 Mar 08	AGENT	APPROVED	DRAWN BY: FAN	DATE: 05 JUL 10
02	Change backlight current	05 JUL 10			CHECKED BY: <i>[Signature]</i>	DATE: 05 Jul 10
			CUSTOMER REF.	OUR REF. X4406	APPROVED BY: <i>[Signature]</i>	DATE: 07/10

**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	—	0.88	1.2	mA	“L”Level Input Voltage	VIL	-0.3	—	0.6	V
Input Voltage for LCD(*)	V0	-0.2	0	0.2	V	—	—	—	—	—	—

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

Side Backlight:

Constant voltage driving:

Item	Symbol	MIN.	TYP.	MAX.	Unit	Condition
White Backlight current	IBL	15	18	21	mA	VBL = 5.0V
Blue Backlight current	IBL	30	35	40	mA	VBL = 5.0V
Yellow Green Backlight current	IBL	30	35	40	mA	VBL = 5.0V

Array Backlight:

Constant voltage driving:

Item	Symbol	MIN.	TYP.	MAX.	Unit	Condition
Yellow Green Backlight Voltage	VBL	3.85	4.05	4.25	V	IBL = 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	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	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**

16x2, 1/16 DUTY CYCLE

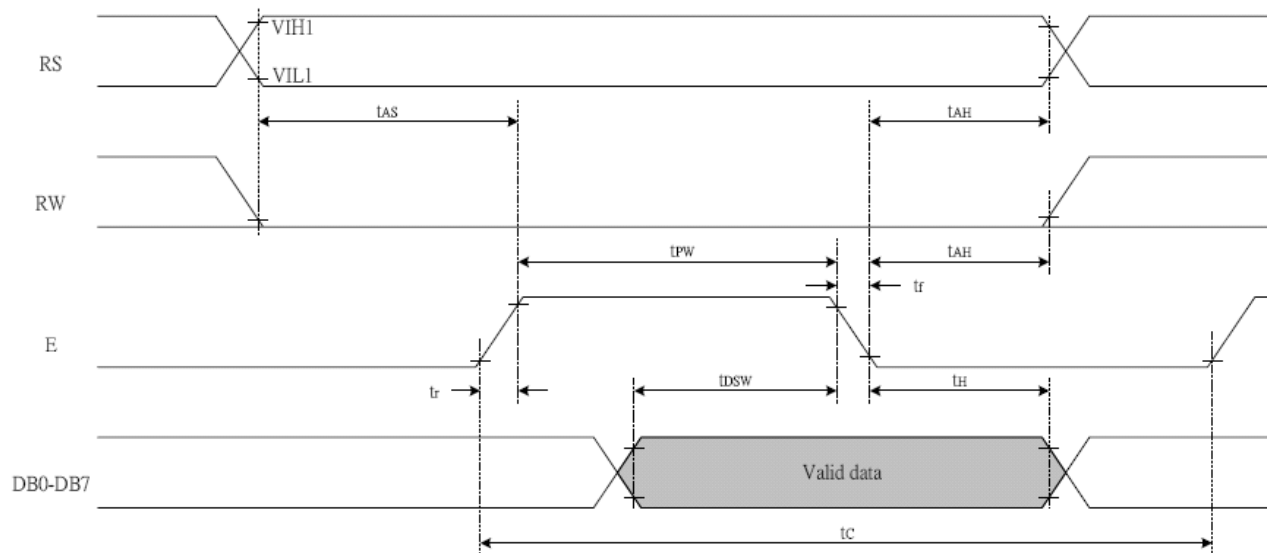
	1	2		16	DISPLAY POSITION
line 1	00	01	.....	0F	DD RAM ADDRESS
line 2	40	41	.....	4F	

**TIMING CHARACTERISTICS OF COMPATIBLE CONTROLLER CHIPS**

TA = 25°C, VCC = 5V

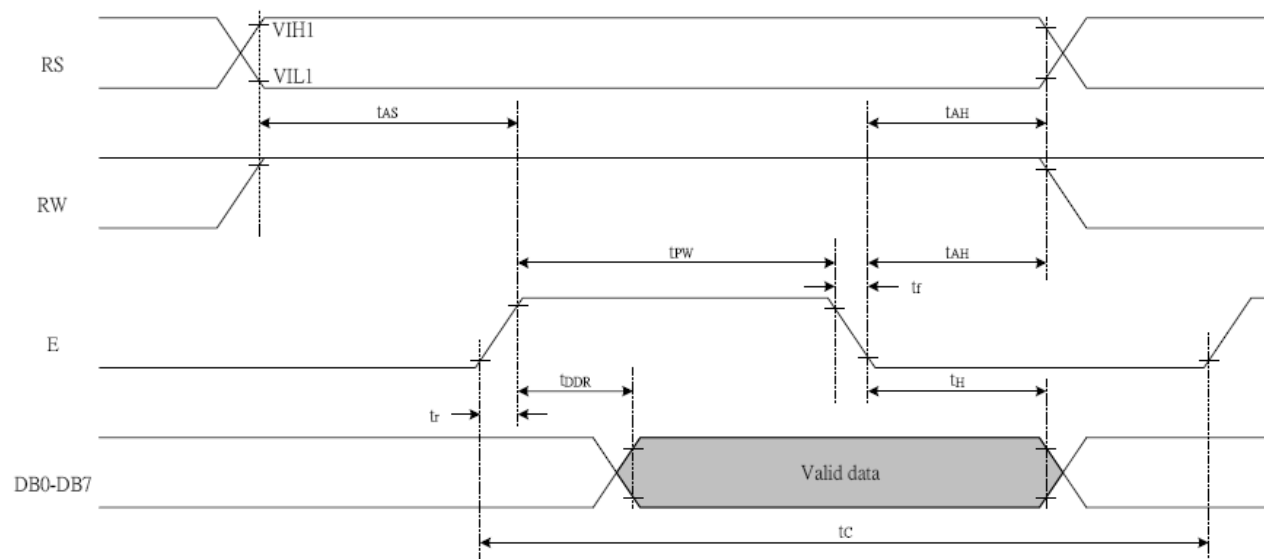
<i>Write Mode (Writing data from MPU to ST7066U)</i>						
T <sub>C</sub>	Enable Cycle Time	Pin E	1200	-	-	ns
T <sub>PW</sub>	Enable Pulse Width	Pin E	140	-	-	ns
T <sub>R</sub> , T <sub>F</sub>	Enable Rise/Fall Time	Pin E	-	-	25	ns
T <sub>AS</sub>	Address Setup Time	Pins: RS,RW,E	0	-	-	ns
T <sub>AH</sub>	Address Hold Time	Pins: RS,RW,E	10	-	-	ns
T <sub>DSW</sub>	Data Setup Time	Pins: DB0 - DB7	40	-	-	ns
T <sub>H</sub>	Data Hold Time	Pins: DB0 - DB7	10	-	-	ns
<i>Read Mode (Reading Data from ST7066U to MPU)</i>						
T <sub>C</sub>	Enable Cycle Time	Pin E	1200	-	-	ns
T <sub>PW</sub>	Enable Pulse Width	Pin E	140	-	-	ns
T <sub>R</sub> , T <sub>F</sub>	Enable Rise/Fall Time	Pin E	-	-	25	ns
T <sub>AS</sub>	Address Setup Time	Pins: RS,RW,E	0	-	-	ns
T <sub>AH</sub>	Address Hold Time	Pins: RS,RW,E	10	-	-	ns
T <sub>DDR</sub>	Data Setup Time	Pins: DB0 - DB7	-	-	100	ns
T <sub>H</sub>	Data Hold Time	Pins: DB0 - DB7	10	-	-	ns

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





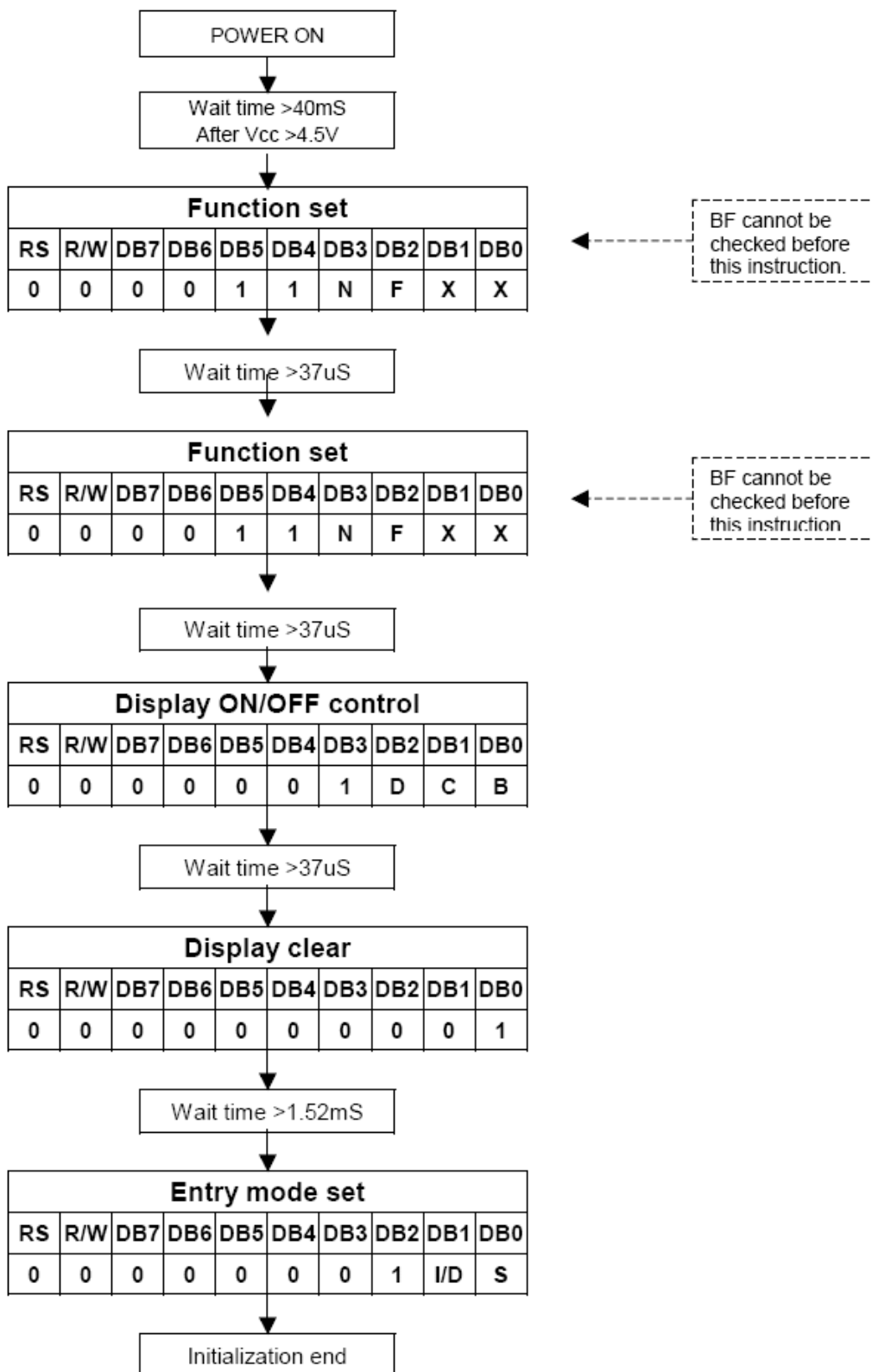
## Read Mode Timing Diagram (Reading Data from ST7066U to MPU)

**INITIALIZATION METHOD**

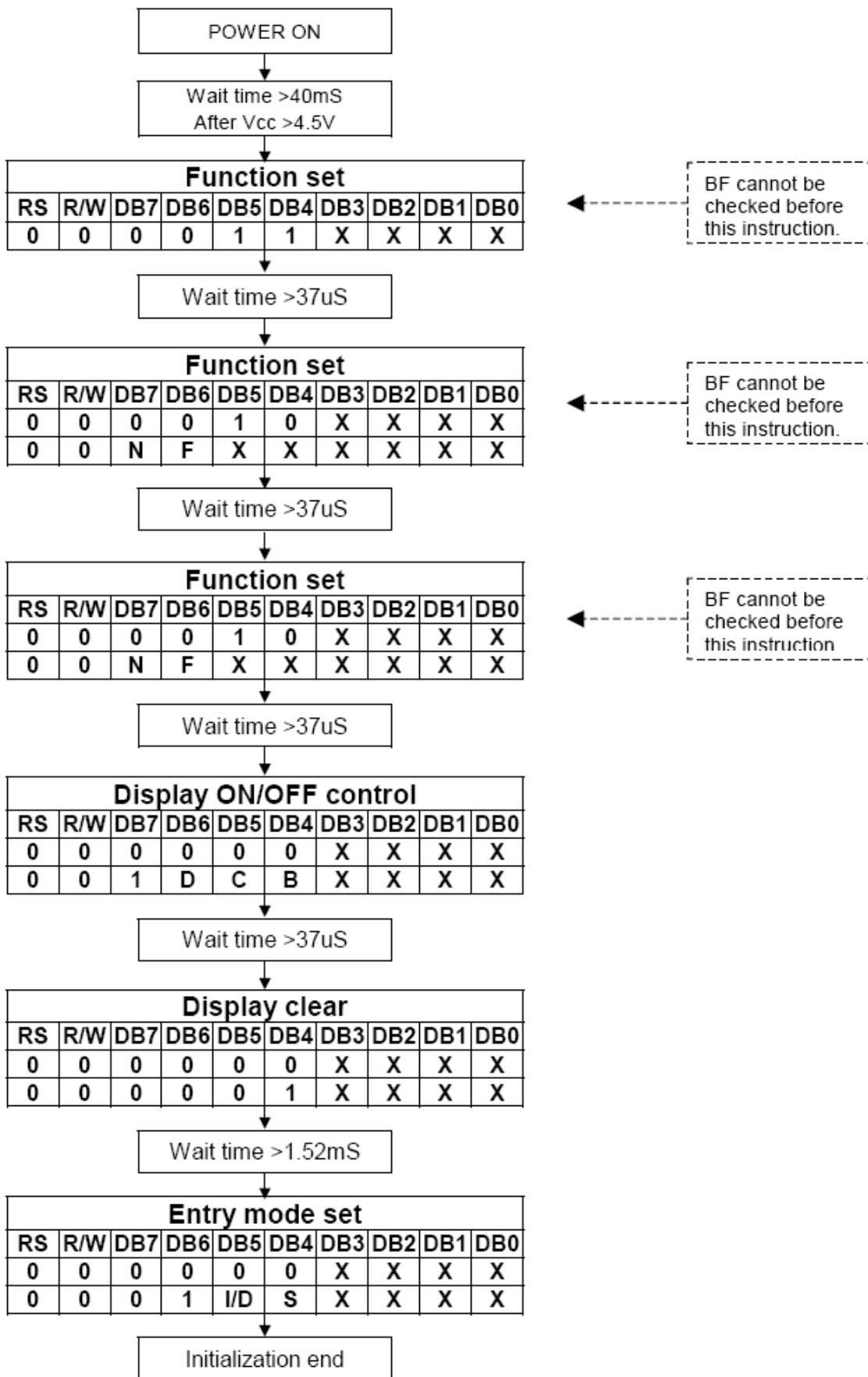
An internal reset circuit automatically initializes the ST7066U when the power is turned on. The following instructions are executed during the initialization. The busy flag (BF) is kept in the busy state until the initialization ends (BF = 1). The busy state lasts for 40 ms after VCC rises to 4.5 V.

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



Initialization for 4-Bit Interface



**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 $\geq$ 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
Vibration Test at LCM Level	Freq 10-55 Hz Sweep rate: 10-55-10 at 1 min Sweep mode Linear Displacement: 2 mm p-p 1 Hour each for X, Y, Z	Freq 10-55 Hz Sweep rate: 10-55-10 at 1 min Sweep mode Linear Displacement: 2 mm p-p 1 Hour each for X, Y, Z	—

## QUALITY STANDARD OF LCD MODULE

<b>1.0</b>	<b>Sampling Method</b>		
	Sampling Plan : MIL STD 105 E Class of AQL : Level II/Single Sampling Critical : 0.25% Major 0.65% Minor 1.5%		
<b>2.0</b>	<b>Defect Group</b>	<b>Failure Category</b>	<b>Failure Reasons</b>
	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.