



**CLOVER DISPLAY LTD.**

## **LCD MODULE SPECIFICATION**

Model: CV4404A - \_ \_ - \_ \_ - \_ \_ - \_

Revision	02
Engineering	Yamaha Yam
Date	29 September 2003
Our Reference	4404

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**MODE OF DISPLAY**

<b>Display mode</b>	<b>Display condition</b>	<b>Viewing direction</b>
STN : <input type="checkbox"/> Yellow green	<input type="checkbox"/> Reflective type	<input type="checkbox"/> 6 O' clock
<input type="checkbox"/> Grey	<input type="checkbox"/> Transflective type	<input type="checkbox"/> 12 O' clock
<input type="checkbox"/> Blue (negative)	<input type="checkbox"/> Transmissive type	<input type="checkbox"/> 3 O' clock
<input type="checkbox"/> FSTN positive	<input type="checkbox"/> Others	<input type="checkbox"/> 9 O' clock
<input type="checkbox"/> FSTN negative		

**LCD MODULE NUMBER NOTATION:**CV4404A- 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)

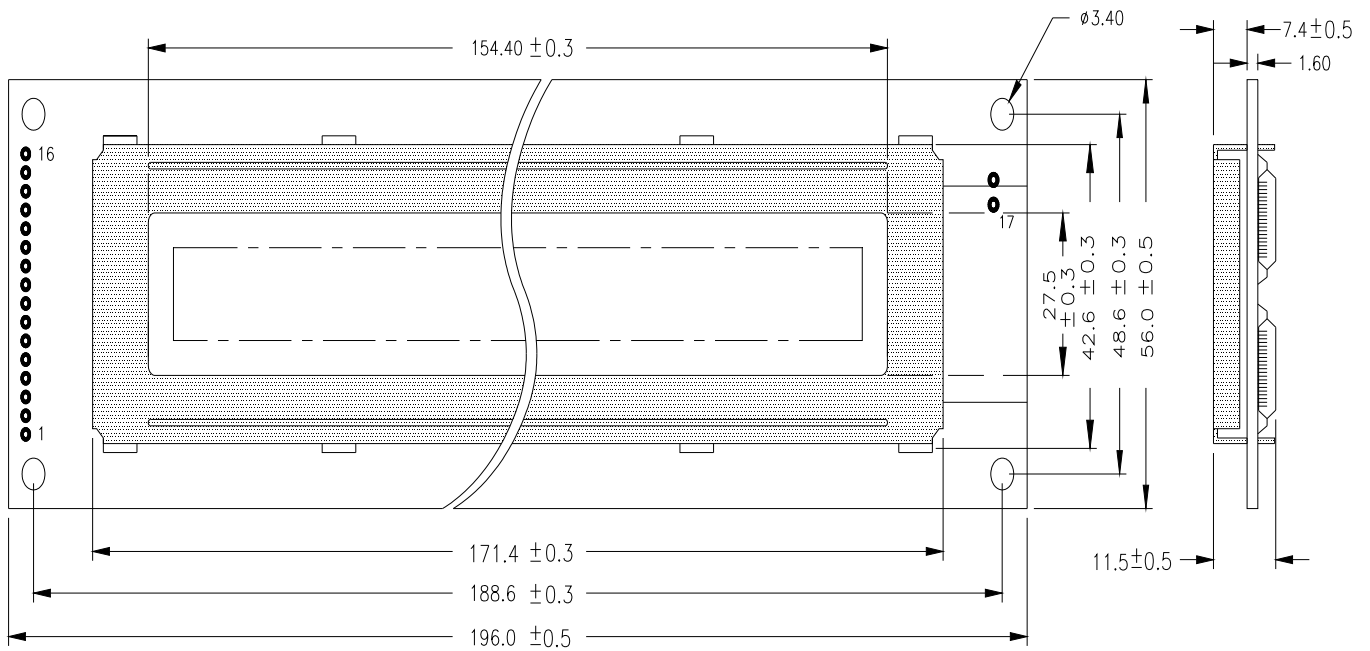
T – Touch panel (Analog)

P – Touch panel (Digital)

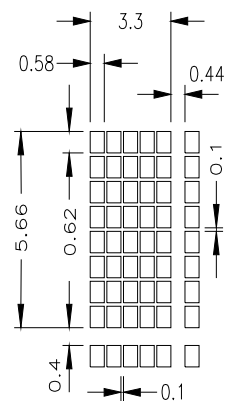
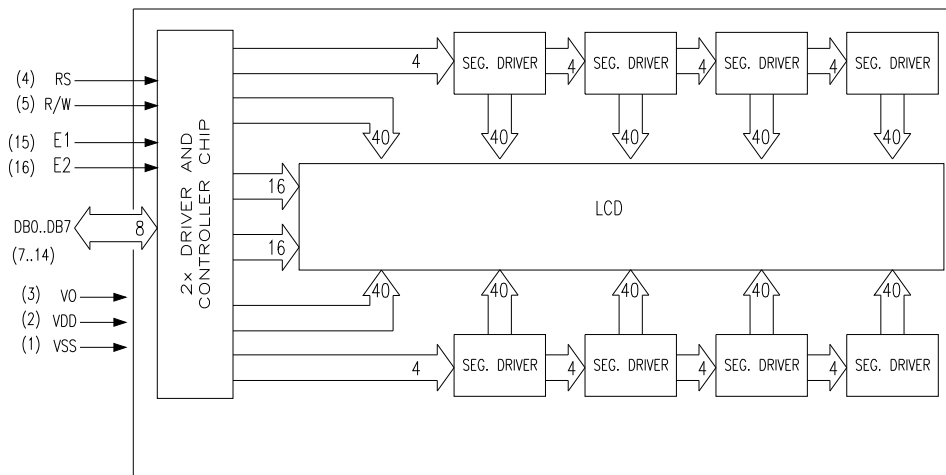
**GENERAL DESCRIPTION**

- Display mode : 40 characters x 4 lines LCD module
- Interface : 4-bit or 8-bit parallel
- Driving method : 1/16 duty, 1/5 bias
- Controller IC : SAMSUNG KS0066 or equivalence  
For the detailed information, please refer to IC specifications

DIMENSIONS ARE IN MM



**BLOCK DIAGRAM**



**MECHANICAL DIMENSIONS**

Item	Dimension		Unit	Item	Dimension		Unit
Outline Dimension	196.0(L)x56.0(W)x(H1/H2)		mm	Character Pitch	3.74(L)x6.06(W)		mm
Viewing Area	154.4(L)x27.5(W)		mm	Dot Size	0.58(L)x0.62(W)		mm
Character Size	3.30(L)x5.66(W)		mm				
No Backlight(N)	H1	7.4	mm	Side Backlight(L)	H1	—	mm
	H2	11.5	mm		H2	—	mm
EL Backlight(E)	H1	7.4	mm	Array Backlight(M)	H1	9.4	mm
	H2	11.5	mm		H2	13.5	mm

**CONNECTOR PIN ASSIGNMENT**

Pin No.	Signal	Function	Pin No.	Signal	Function
1	VSS	0V Power Supply	10	DB3	Data Bus Line
2	VDD	5V Power Supply	11	DB4	Data Bus Line
3	VO	LCD Drive, 0V to VDD	12	DB5	Data Bus Line
4	RS	‘H’Data Input ‘L’Instruction Input	13	DB6	Data Bus Line
5	R/W	‘H’Data Read ‘L’Data Write	14	DB7	Data Bus Line
6	NC	No Connection	15	E1	Enable Signal*
7	DB0	Data Bus Line	16	E2	Enable Signal**
8	DB1	Data Bus Line	17	BL-	Backlight Power Supply (-)
9	DB2	Data Bus Line	18	BL+	Backlight Power Supply (+)

\*E1 is used to control the upper 2 lines of the display.

\*\*E2 is used to control the lower 2 lines of the display.

**ELECTRICAL CHARACTERISTICS**

Item	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage for Logic	VDD	4.75	5.0	5.25	V
Supply Current for Logic	IDD	—	4.00	9.48	mA
‘H’Level Input Voltage	VIH	2.20	—	VDD	V
‘L’Level Input Voltage	VIL	0	—	0.60	V

**EL Backlight(@Frequency 400HZ)**

Symbol	MIN.	TYP.	MAX.	Unit
V <sub>EL</sub>	—	100	150	Vrms

**Array LED Backlight**

Constant voltage driving:

Item	Symbol	MIN.	TYP.	MAX.	Unit	Condition
Yellow Green	I <sub>BL</sub>	—	500	900	mA	V <sub>BL</sub> =4.05V

**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	7	7	V
Input Voltage	V <sub>T</sub>	-0.3 to VDD+0.3	-0.3 to VDD+0.3	V
Operating Temperature	T <sub>opr</sub>	0 to 50	-20 to 70	°C
Storage Temperature	T <sub>stg</sub>	-10 to 60	-30 to 80	°C

**INSTRUCTIONS**

Instruction	Code										Description	Execution Time (max) (when fcp or fosc is 250 kHz)
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
Clear Display	0	0	0	0	0	0	0	0	0	1	Clears entire display	1.64ms
Return Home	0	0	0	0	0	0	0	0	1	*	Moves cursor to first position. DD RAM contents remain unchanged.	1.64ms
Entry Mode Set	0	0	0	0	0	0	0	1	I / D	S	Sets cursor move direction and specifies shift of display. These operations are performed during write and read.	40us
Display On/Off Control	0	0	0	0	0	0	1	D	C	B	Sets display (D) ON/OFF, cursor ON/OFF (C), and blinking ON/OFF (B).	40us
Cursor or Display Shift	0	0	0	0	0	1	S / C	R / L	*	*	Shifts display or moves cursor (S/C) and sets Displayed to shift RIGHT/LEFT (R/L)	40us
Function Set	0	0	0	0	1	DL	N	F	*	*	Sets 8-bit/4-bit interface (DL), no. of lines displayed (N) and character font (F).	40us
Set CG RAM Address	0	0	0	1	ACG					Sets CG RAM address. CG RAM data is sent and received after setting.		40us
Set DD RAM Address	0	0	1	ADD					Sets DD RAM address. DD RAM data is sent and received after this setting.		40us	
Read Busy Flag & Address	0	1	BF	AC					Reads Busy flag (BF) indicating internal operation is being performed. Reads address counter contents.		0 us	
Write Data	1	0	Write Data					Writes data into DD RAM or CG RAM.		40us		
Read Data from CG or DD RAM	1	1	Read Data					Reads data from DD RAM or CG RAM.		40us		
	I / D = 1: Increment I / D = 0: Decrement S = 1: Accompanies display shift S / C = 1: Display shift S / C = 0: Cursor move R / L = 1: shift to the right R / L = 0: shift to the left DL = 1: 8 bits DL = 0: 4 bits 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										DD RAM: Display data RAM CG RAM: Character generator RAM ACG: CG RAM address ADD: DD RAM address : Corresponds to cursor address AC: Address counter used for both DD and CG RAM address.  * Don't care	

**DISPLAY DD RAM AND CHARACTER POSITION**

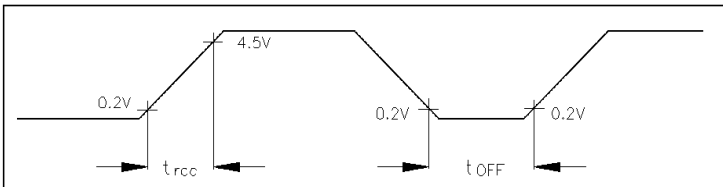
40x4, 1/16 DUTY CYCLE Controller I & II

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

**TIMING CHARACTERISTICS OF COMPATIBLE CONTROLLER CHIPS**

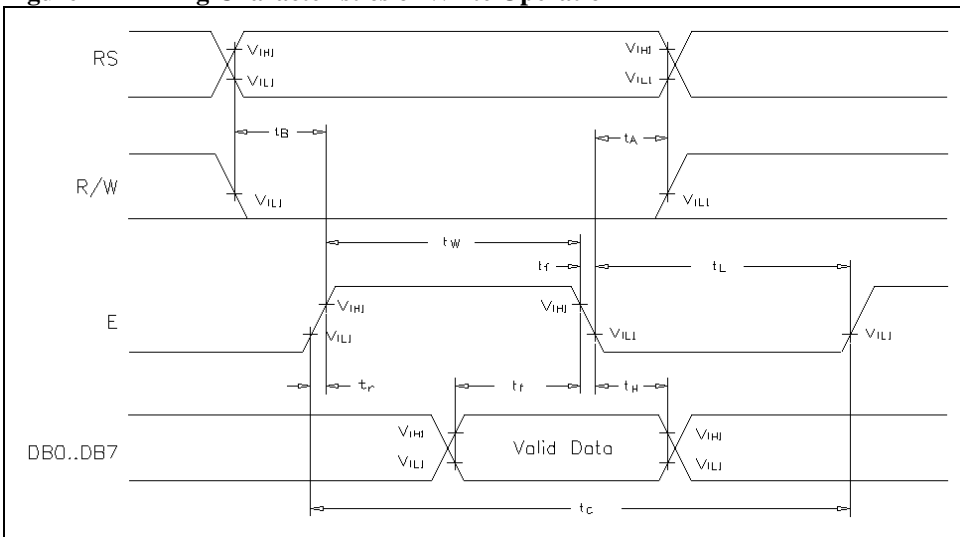
Parameters	Symbol	Recommended timing	Parameters	Symbol	Recommended timing
Enable Cycle Time	tC (min)	1000ns	Set-up Time	tB(min)	140ns
Enable Pulse Width	tW(min)	450ns	Data Set-up Time	tI (min)	195ns
	tL (min)	450ns	Data Delay Time	tD (max)	320ns
Enable Raise Time	t <sub>r</sub> (max)	25ns	Address Hold Time	tA(max)	10ns
Enable Fall Time	t <sub>f</sub> (max)	25ns	Input Data Hold Time	tH (min)	10ns
			Output Data Hold Time	tO (min)	20ns

**Figure 1 Power On Timing Diagram**

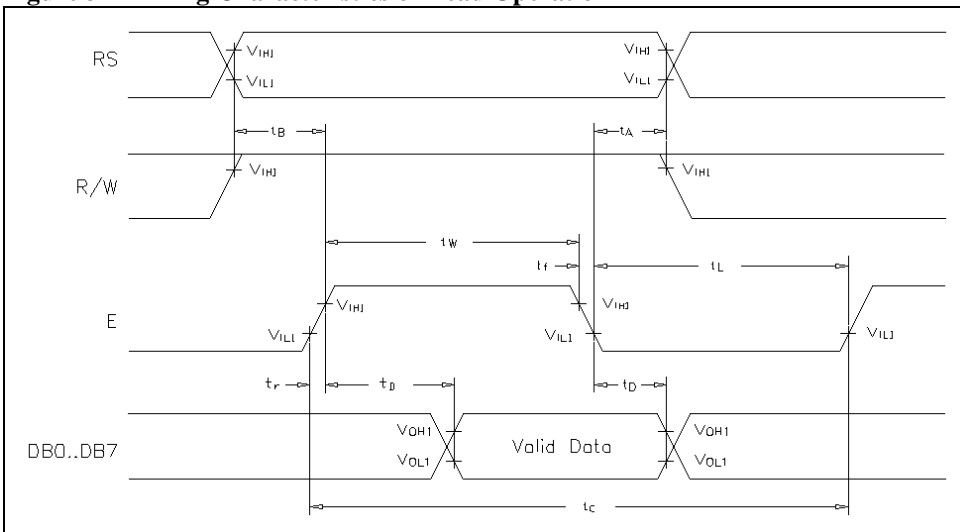


**Note:** Power on initialization depends on the rise time of the power supply when it is turned on. When the above power supply conditions is not met, the internal reset circuit will not operate normally and initialization will not be performed. Initialization by manual instruction is required. Use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

**Figure 2 Timing Characteristics of Write Operation**



**Figure 3 Timing Characteristics of Read Operation**

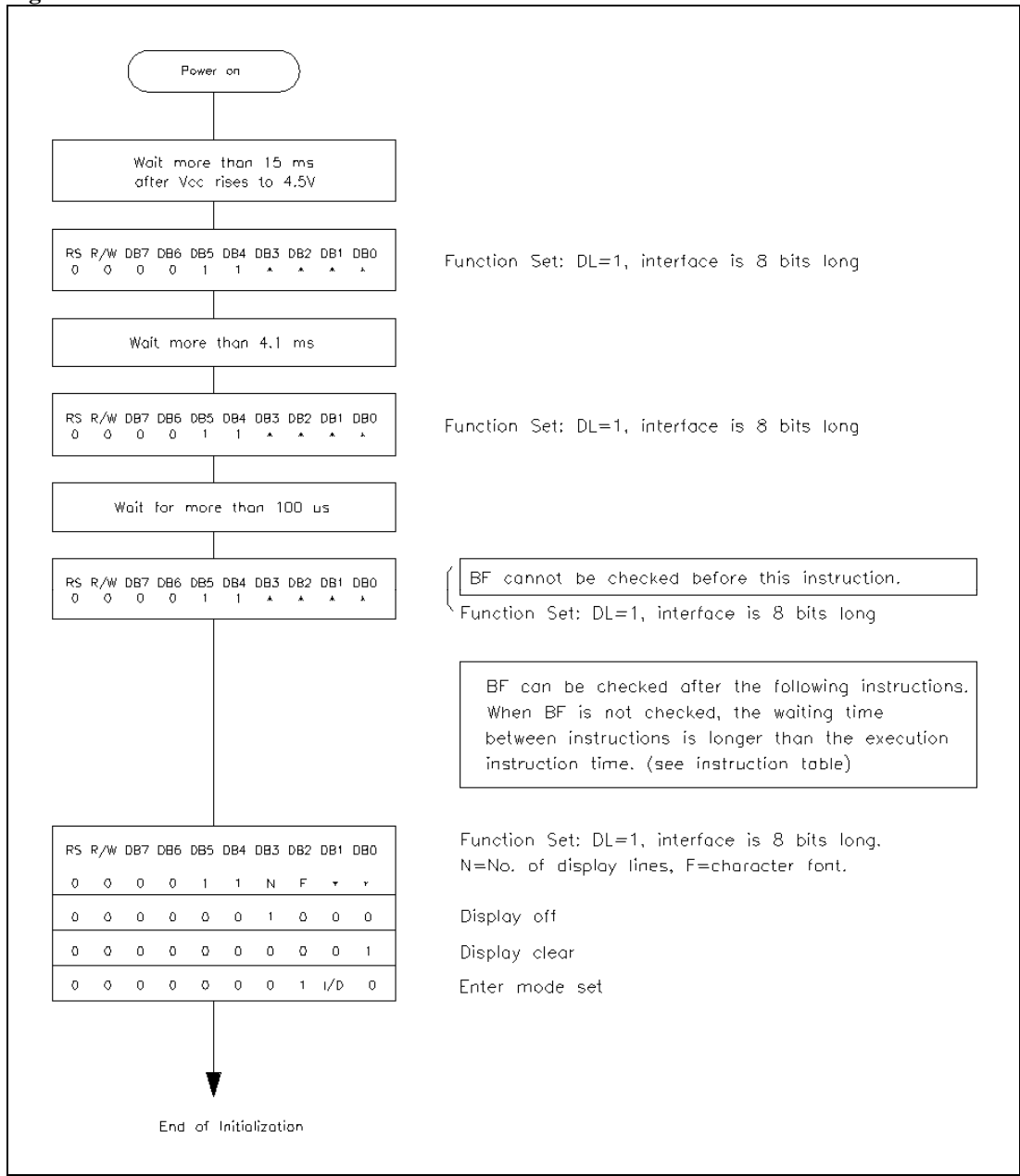


**INITIALIZATION METHOD**

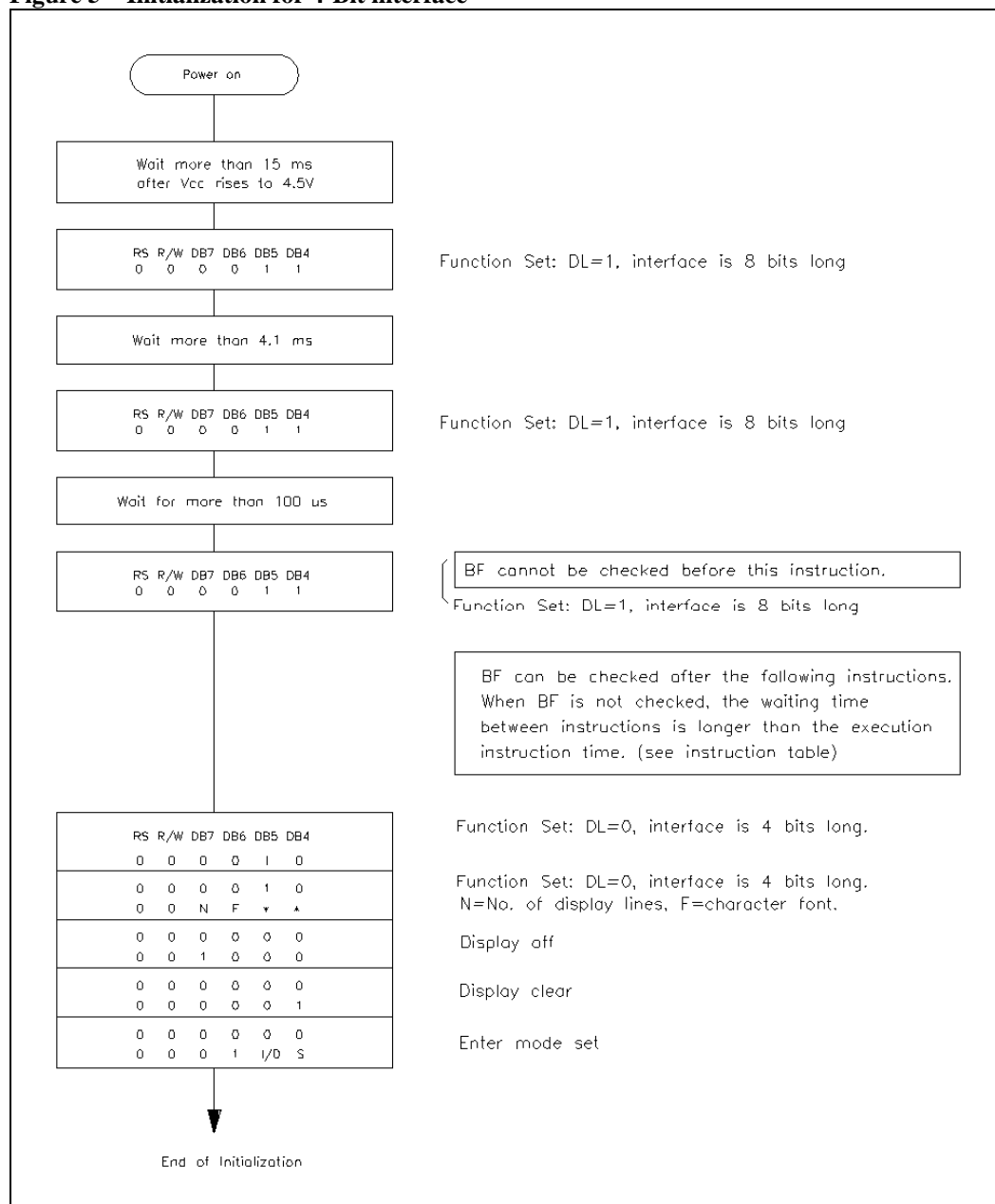
The module will automatically perform initialization using internal reset circuit when power is turned on. The following instructions are executed during initialization.

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**



**ELECTRO-OPTICAL CHARACTERISTICS**

MEASURING CONDITION: POWER SUPPLY = V<sub>OP</sub> / 64 Hz  
 TEMPERATURE = 22 ± 5 °C  
 RELATIVE HUMIDITY = 60 ± 15 %

ITEM	SYMBOL	UNIT	TYP.TN	TYP.STN
RESPONSE TIME	T <sub>on</sub>	ms	100	200
	T <sub>off</sub>	ms	80	200
CONTRAST RATIO	Cr	-	10	10
VIEWING ANGLE (6 O'clock) (Cr ≥ 2)	V3:00	°	20	20
	V6:00	°	20	40
	V9:00	°	20	20
	V12:00	°	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	<b>Sampling Method</b>		
	Sampling Plan : MIL STD 105 D Class of AQL : Level II/Single Sampling Critical : 0.25% Major 0.65% Minor 1.5%		
2.0	<b>Defect Group</b>	<b>Failure Category</b>	<b>Failure Reasons</b>
	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

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.