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CLOVER DISPLAY LTD.

LCD MODULE SPECIFICATION

Model : CV4162C - _ _ - _ _ - _ _ - _

Revision	04
Engineering	Brian Leung
Date	4 August 2003
Our Reference	4938

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MODE OF DISPLAY**Display mode** TN positive TN negativeSTN : 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:**CV4162C- 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**

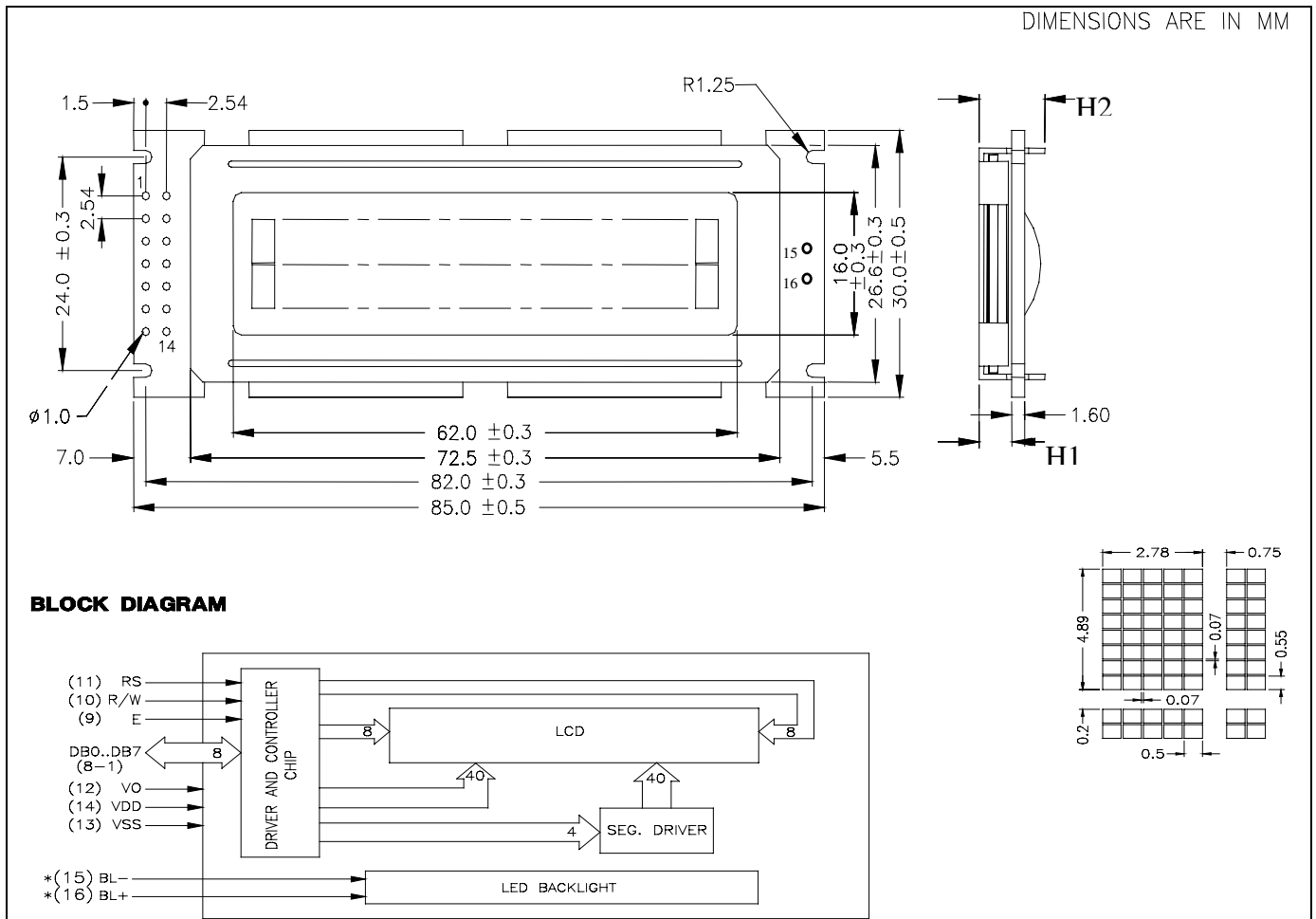
(Can be omitted if not used)

T – Touch panel (Analog)

P – Touch panel (Digital)

GENERAL DESCRIPTION

- Display mode : 16 characters x 2 lines LCD module
 - Interface : 4-bit or 8-bit parallel
 - Driving method : 1/16 duty, 1/5 bias
 - Controller IC : Samsung KS0066 or Equivalent
- For the detailed information, please refer to IC specifications.



MECHANICAL DIMENSIONS

Item	Dimension		Unit	Item	Dimension		Unit
Outline Dimension	85.0(L)x30.0(W)x (H1/H2)		mm	Character Pitch	3.53(L)x5.09(W)		mm
Viewing Area	62.0(L)x16(W)		mm	Dot Size	0.5(L)x0.55(W)		mm
Character Size	2.78(L)x4.89(W)		mm		-		-
No Backlight (N)	H1	5.0	mm	Side Backlight (L)	H1	-	mm
	H2	9.1	mm		H2	-	mm
EL Backlight (E)	H1	5.0	mm	Array Backlight (M)	H1	8.4	mm
	H2	9.1	mm		H2	12.5	mm

CONNECTOR PIN ASSIGNMENT

Pin No.	Symbol	Function	Pin No.	Symbol	Function
1	DB7	Data Bus Line	9	E	Enable Signal
2	DB6	Data Bus Line	10	R/W	Read/Write
3	DB5	Data Bus Line	11	RS	Register Select Input
4	DB4	Data Bus Line	12	VO	LCD Drive, 0V to VDD
5	DB3	Data Bus Line	13	VSS	0V Power Supply
6	DB2	Data Bus Line	14	VDD	5V Power Supply
7	DB1	Data Bus Line	15	BL-	Backlight Power Supply (-)
8	DB0	Data Bus Line	16	BL+	Backlight Power Supply (+)

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	5.0	5.25	V	“H”Level Input Voltage	VIH	2.2	—	VDD	V
Supply Current	IDD	—	1.2	1.9	mA	“L”Level Input Voltage	VIL	0	—	0.6	V
Backlight Voltage						Backlight Current					
EL (@ Frequency 400Hz)	VEL	—	100	150	V _{rms}	—	—	—	—	—	—
Side-lited LED						Side-lited LED					
White	VBL	—	—	—	V	White	IBL	—	—	—	mA
Blue	VBL	—	—	—	V	Blue	IBL	—	—	—	mA
Yellow Green	VBL	—	—	—	V	Yellow Green	IBL	—	—	—	mA
Array LED						Array LED					
Yellow Green	VBL	3.85	4.05	4.25	V	Yellow Green	IBL	—	110	200	mA
Amber	VBL	—	—	—	V	Amber	IBL	—	—	—	mA
Orange	VBL	—	—	—	V	Orange	IBL	—	—	—	mA
Soft Orange	VBL	—	—	—	V	Soft Orange	IBL	—	—	—	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	VDD	7	7	V
Input Voltage	VT	-0.3 to VDD +0.3	-0.3 to VDD +0.3	V
Operating Temperature	T _{opr}	0 to 50	-20 to 70	°C
Storage Temperature	T _{stg}	-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

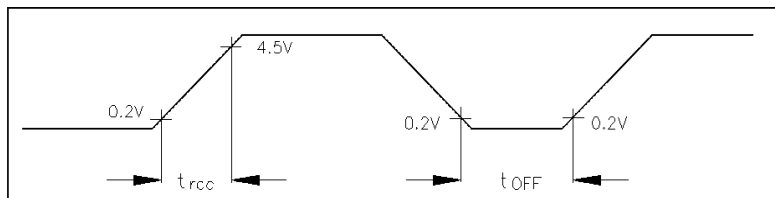
16x2, 1/16 DUTY CYCLE

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

TIMING CHARACTERISTICS OF COMPATIBLE CONTROLLER CHIPS

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
			Data Delay Time	tD (max)	320ns
High level	tL (min)	450ns	Address Hold Time	tA(min)	10ns
Low level	tL (min)	450ns	Input Data Hold Time	tH (min)	10ns
Enable Raise Time	t _r (max)	25ns	Output Data Hold Time	tD (min)	20ns
Enable Fall Time	t _f (max)	25ns			

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

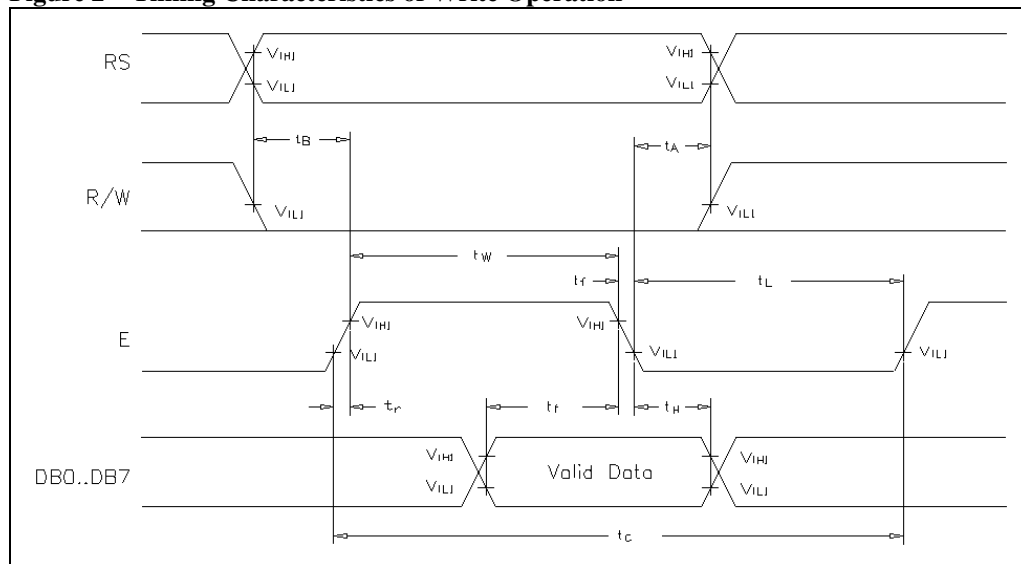
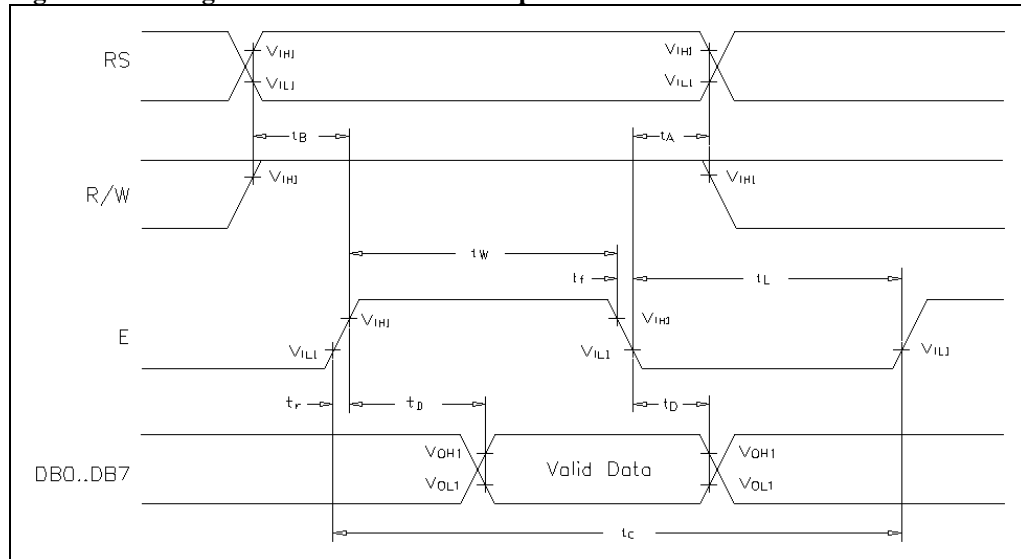


Figure 3 Timing Characteristics of Read Operation



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

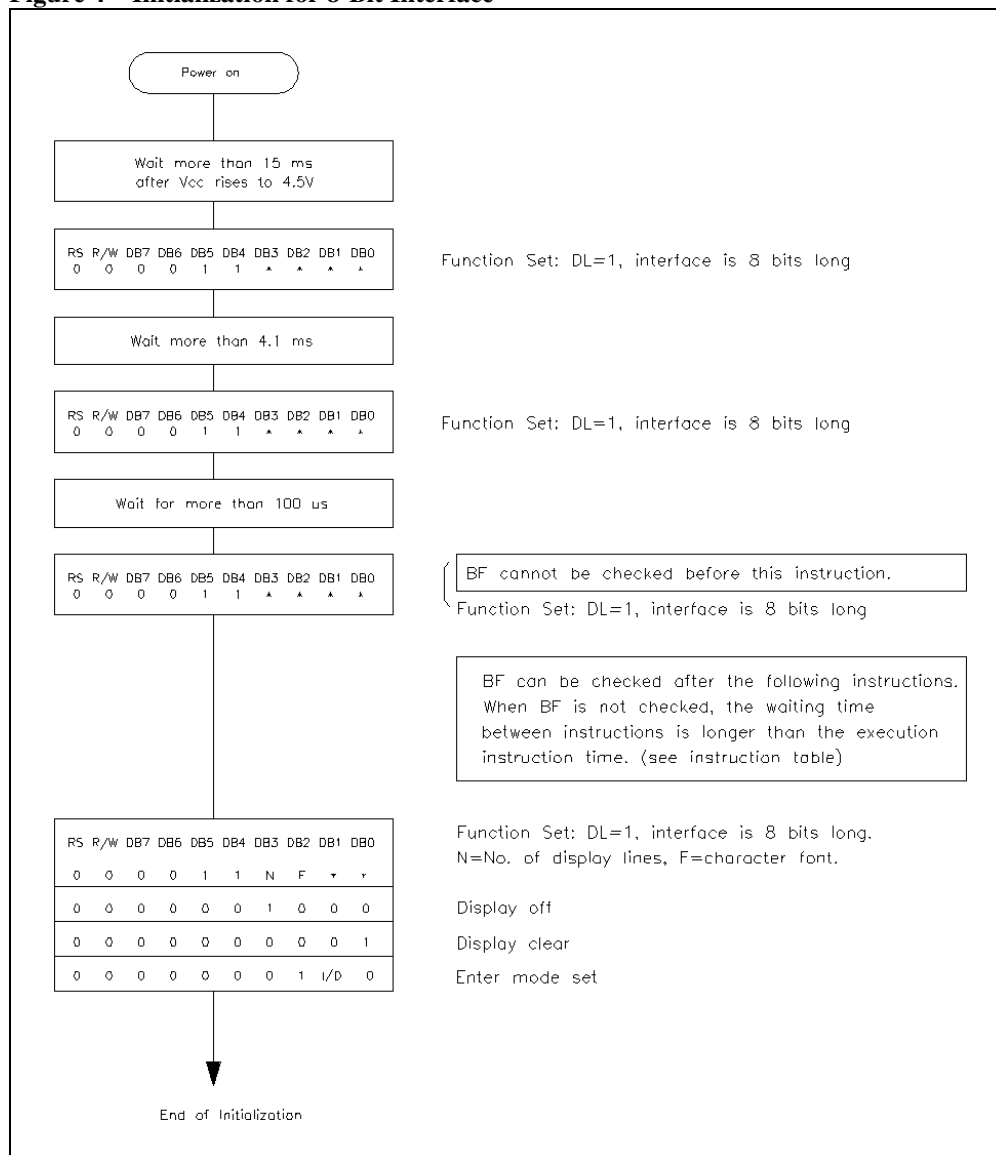
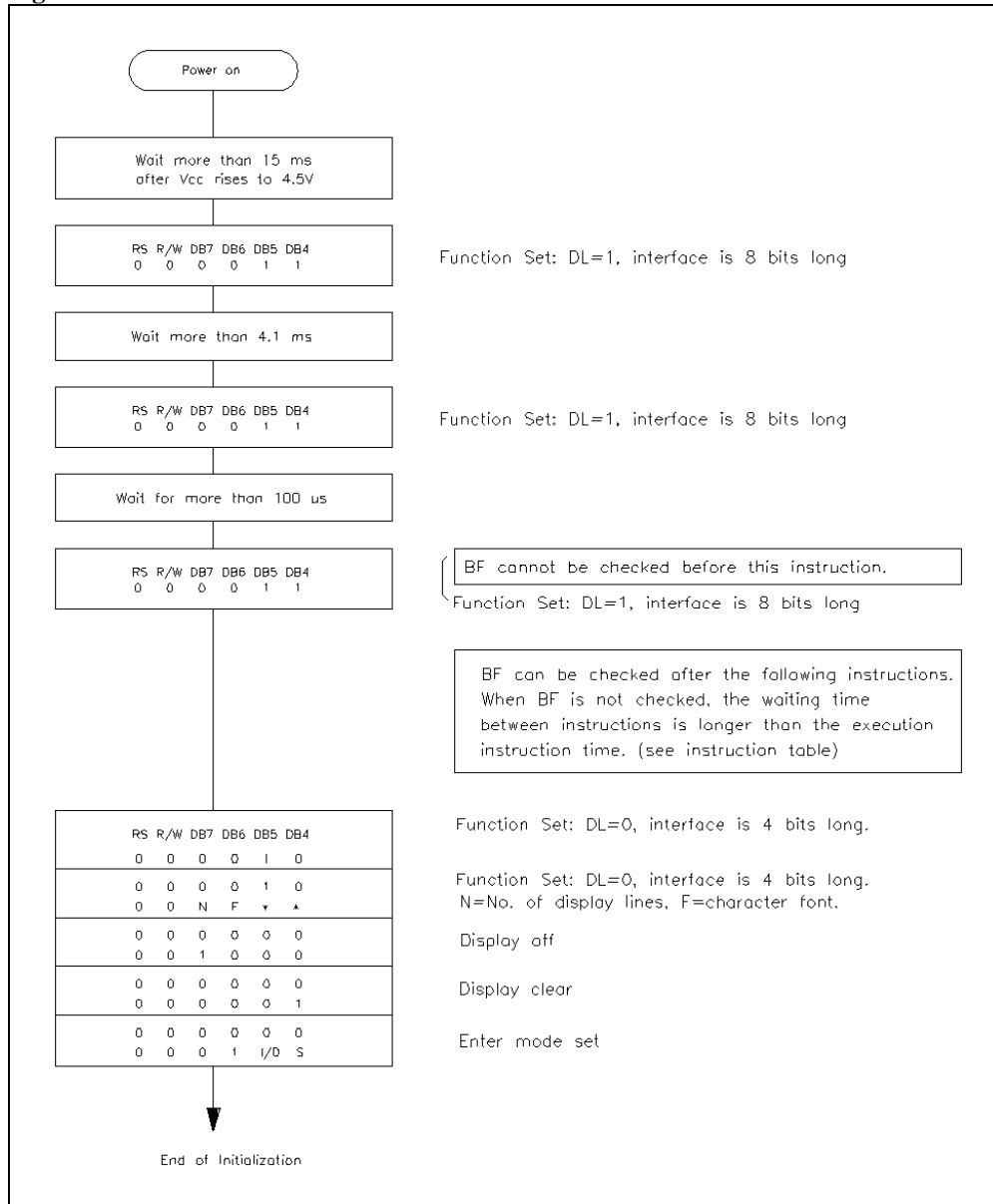


Figure 5 Initialization for 4-Bit interface



ELECTRO-OPTICAL CHARACTERISTICS

MEASURING CONDITION: POWER SUPPLY = Vop / 64 Hz
 TEMPERATURE = 22 ± 5 °C
 RELATIVE HUMIDITY = 60 ± 15 %

ITEM	SYMBOL	UNIT	TYP. TN	TYP. STN
RESPONSE TIME	Ton	ms	100	200
	Toff	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	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, trichlorotrifluoroethane

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 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 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.