



**CLOVER DISPLAY LTD.**

## LCD MODULE SPECIFICATION

**Model : CV12816A - \_ \_ - \_ \_ - \_ \_ - \_**

Revision	03
Engineering	Yamaha Yam
Date	29 September 2003
Our Reference	4533

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**MODE OF DISPLAY****Display mode**

- 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:**

CV12816A- 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

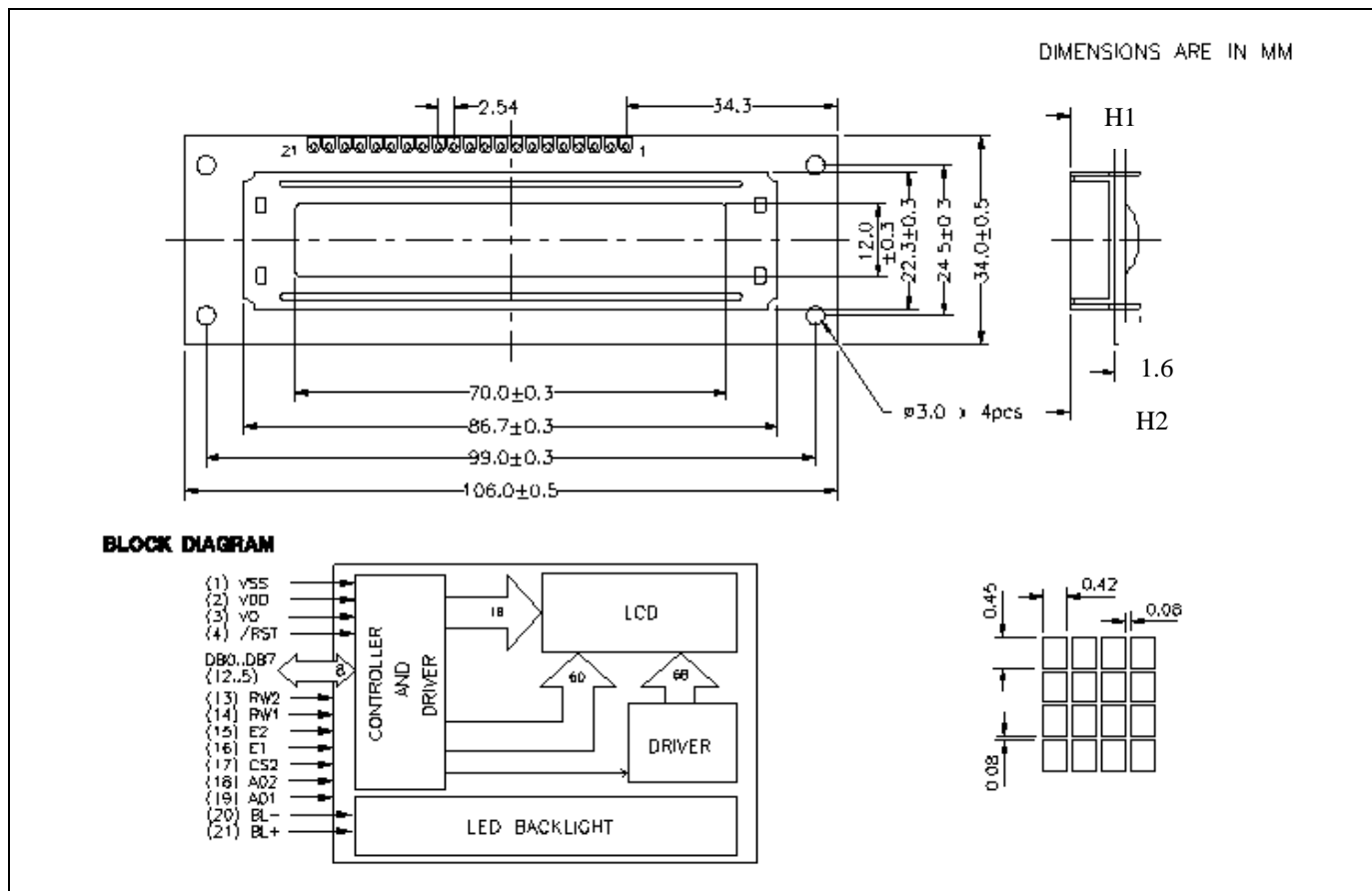
(Can be omitted if not used)

- T – Touch panel (Analog)  
P – Touch panel (Digital)

**GENERAL DESCRIPTION**

Display mode : 128 X 16 dot, graphic LCD module  
 Interface : 8-bit parallel  
 Driving method : 1/16 duty, 1/5 bias  
 Controller IC : JRC NJU6450 or equivalent

For the detailed information, please refer to the IC specifications.



**MECHANICAL DIMENSIONS**

Item	Dimension	Unit	Item	Dimension	Unit
Outline Dimension	106.0(L)x34.0(W)x (H1/H2)	mm	Dot Pitch	0.50(L)x0.53(W)	mm
Viewing Area	70.0(L)x12.0(W)	mm	Dot Size	0.42(L)x0.45(W)	mm
No Backlight (N)	H1	—	Side Backlight (L)	H1	—
	H2	—		H2	—
EL Backlight (E)	H1	—	Array Backlight (M)	H1	8.0
	H2	—		H2	12.5

**CONNECTOR PIN ASSIGNMENT**

Pin No.	Symbol	Function	Pin No.	Symbol	Function
1	VSS	0V Power Supply	12	DB0	Data Bus Line
2	VDD	5V Power Supply	13	RW2	Read/Write **
3	VO	LCD Drive, 0V to VDD	14	RW1	Read/Write *
4	/RST	Reset Signal	15	E2	Enable Signal **
5	DB7	Data Bus Line	16	E1	Enable Signal *
6	DB6	Data Bus Line	17	CS2	Chip Select
7	DB5	Data Bus Line	18	A02	Register Select Input **
8	DB4	Data Bus Line	19	A01	Register Select Input *
9	DB3	Data Bus Line	20	BL-	Backlight Power Supply (-)
10	DB2	Data Bus Line	21	BL+	Backlight Power Supply (+)
11	DB1	Data Bus Line	—	—	—

\* RW1, E1, A01 are used to control the left part of the display screen.

\*\* RW2, E2, A02 are used to control the right part of the display screen.

**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	2.2	—	VDD	V
Supply Current	IDD	—	0.40	—	mA	"L"Level Input Voltage	VIL	0	—	0.6	V
Supply Voltage for LCD	VO	—	0.00	—	V	—	—	—	—	—	—
<b>Backlight Voltage</b>						<b>Backlight Current</b>					
EL (@ Frequency 400Hz)	VEL	—	—	—	V <sub>rms</sub>	—	—	—	—	—	—
<b>Side-lited LED</b>						<b>Side-lited LED</b>					
White	VBL	—	—	—	V	White	IBL	—	—	—	mA
Blue	VBL	—	—	—	V	Blue	IBL	—	—	—	mA
Yellow Green	VBL	—	—	—	V	Yellow Green	IBL	—	—	—	mA
<b>Array LED</b>						<b>Array LED</b>					
Yellow Green	VBL	4.00	4.20	4.40	V	Yellow Green	IBL	—	150	—	mA
Amber	VBL	—	—	—	V	Amber	IBL	—	—	—	mA
Orange	VBL	—	—	—	V	Orange	IBL	—	—	—	mA
Soft Orange	VBL	—	—	—	V	Soft Orange	IBL	—	—	—	mA
<b>CCFL</b>						<b>CCFL</b>					
White	VBL	—	—	—	V <sub>rms</sub>	White	IBL	—	—	—	mArms

**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 <sub>opr</sub>	0 to 50	-20 to 70	°C
Storage Temperature	T <sub>stg</sub>	-10 to 60	-30 to 80	°C

## INSTRUCTIONS

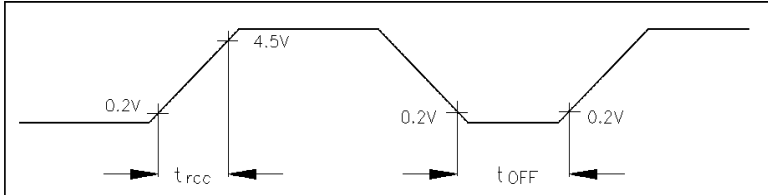
Instruction	Code										Description
	A0	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	
Display On/Off	0	0	1	0	1	0	1	1	1	0/1	Whole display On/Off. 1: On, 0: Off
Display Start Line	0	0	1	1	0	Display Start Address (0-31)				Determine the display line correspond to the COM0	
Page Address Set	0	0	1	0	1	1	1	0	Page (0-3)		Set the page of display data Ram to the page register.
Column Address Set	0	0	0	Column Address (0-59)							Set the column address of display data RAM to the column register.
Status Read	0	1	Busy	ADC	ON/OFF	RESET	0	0	0	0	Read the status. BUSY 1: Working 0: Ready ADC 1: Clockwise output 0: Counterclockwise ON/OFF 1: Display Off 0: Display On RESET 1: Reset 0: Normal
Write Display Data	1	0	Write Data								Write the data to the display data RAM *
Read Display Data	1	1	Read Data								Read the data from the display data RAM *
ADC Select	0	0	1	0	1	0	0	0	0	0/1	Determine the clockwise or counterclockwise reading of the display data RAM. 0: Clockwise output 1: Counterclockwise output
Static Drive On/Off	0	0	1	0	1	0	0	1	0	0/1	Select the dynamic or static driving. 1: Static driving 0: Dynamic driving
Duty Ratio Select	0	0	1	0	1	0	1	0	0	0/1	Select the duty ratio. 1: 1/32 duty 0: 1/16 duty
Read Modify Write	0	0	1	1	1	0	0	0	0	0	Increment the column address register when writing but no-change when reading
End	0	0	1	1	1	0	1	1	1	0	Release from the read modify write mode.
Reset	0	0	1	1	1	0	0	0	1	0	Set the display start line register to 1st line, column add. counter and page add. register to "0"

\*note: Access the predetermined address of the display data RAM. The column address increment "1" after read or write.

**TIMING CHARACTERISTICS OF COMPATIBLE CONTROLLER CHIPS**

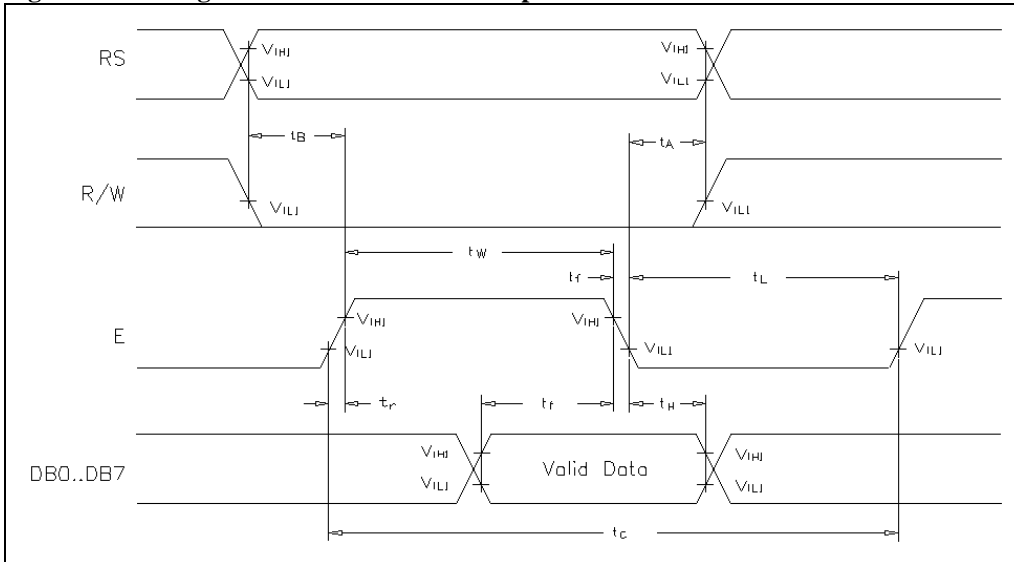
Parameters	Symbol	Recommended timing	Parameters	Symbol	Recommended timing
Enable Cycle Time	tC (min)	1000ns	Set-up Time	tB(min)	20ns
Enable Pulse Width	tW(min)	100ns	Data Set-up Time	tI (min)	80ns
			Data Delay Time	tD (max)	90ns
			Address Hold Time	tA(min)	10ns
Enable Raise Time	tr (max)	15ns	Input Data Hold Time	tH (min)	10ns
Enable Fall Time	tf (max)	15ns	Output Data Hold Time	tD (min)	10ns

**Figure 1 Power On Timing Diagram**

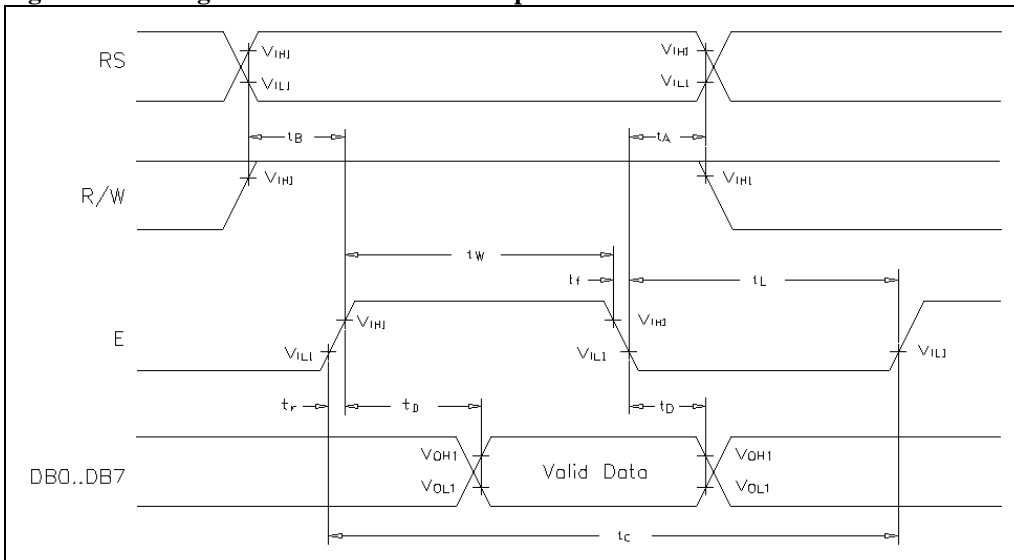


**Note:** Power on initialization depends on the rise time of the power supply when it is turned on. When the above power supply conditions is not met, the internal reset circuit will not operate normally and initialization will not be performed. Initialization by manual instruction is required.

**Figure 2 Timing Characteristics of Write Operation**



**Figure 3 Timing Characteristics of Read Operation**



**INITIALIZATION METHOD**

The module will automatically perform initialization by detecting the rising or falling edge of the RST input after the power is turned on. The following instructions are executed during initialization.

1. Display Off
2. Set the 1st line to the display start register
3. Static drive Off
4. Set the address "0" to the column address counter
5. Set the page "3" to the page address register
6. Select the 1/32 duty
7. Select the ADC : Clockwise output
8. Read modify write mode Off

**DISPLAY DD RAM POSITION OF DRIVER I & II**

## Driver I

Page Address D1,D2	Data								
0,0	DB0 to DB7	Page 0							
0,1	DB0 to DB7	Page 1							
1,0	DB0 to DB7	Page 2							
1,1	DB0 to DB7	Page 3							
Column Address	ADC DB0=0	00	01	02	.....	39	3A	3B	
	ADC DB0=1	3B	3A	39	.....	02	01	00	

## Driver II

Page Address D1,D2	Data								
0,0	DB0 to DB7	Page 0							
0,1	DB0 to DB7	Page 1							
1,0	DB0 to DB7	Page 2							
1,1	DB0 to DB7	Page 3							
Column Address	ADC DB0=0	00	01	02	.....	42	43	44	
	ADC DB0=1	44	43	42	.....	02	01	00	

**ELECTRO-OPTICAL CHARACTERISTICS**

MEASURING CONDITION: POWER SUPPLY =  $V_{OP} / 64 \text{ Hz}$   
 TEMPERATURE =  $22 \pm 5 \text{ }^\circ\text{C}$   
 RELATIVE HUMIDITY =  $60 \pm 15 \%$

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 $\geq$ 2)	V3:00	$^\circ$	20	20
	V6:00	$^\circ$	20	40
	V9:00	$^\circ$	20	20
	V12:00	$^\circ$	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**

<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 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.