



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)

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

DIMENSIONS ARE IN MM

The mechanical drawing shows the LCD module with the following dimensions (in mm):

- Top view dimensions:
 - Overall width: 106.0 ± 0.5
 - Overall height: 34.0 ± 0.5
 - Distance from left edge to center: 53.0
 - Distance from center to right edge: 53.0
 - Distance from top edge to center: 17.0
 - Distance from center to bottom edge: 17.0
 - Distance from left edge to mounting hole: 10.0
 - Distance from right edge to mounting hole: 10.0
 - Distance from top edge to mounting hole: 10.0
 - Distance from bottom edge to mounting hole: 10.0
 - Distance between mounting holes: 24.5 ± 0.3
 - Distance between mounting holes (center-to-center): 22.3 ± 0.3
 - Distance between mounting holes (inner): 12.0 ± 0.3
 - Distance between mounting holes (outer): 24.5 ± 0.3
 - Distance between mounting holes (center-to-center): 22.3 ± 0.3
 - Distance between mounting holes (inner): 12.0 ± 0.3
 - Distance between mounting holes (outer): 24.5 ± 0.3
- Side view dimensions:
 - Thickness: 1.6
 - Mounting hole diameter: $\phi 3.0$
 - Mounting hole spacing: 4 pcs

BLOCK DIAGRAM

The block diagram shows the following connections:

- Controller and Driver:**
 - Inputs: (1) VSS, (2) VDD, (3) VO, (4) /RST, DB0..DB7 (12..5), (13) RW2, (14) RW1, (15) E2, (16) E1, (17) CS2, (18) A02, (19) A01, (20) BL-, (21) BL+.
 - Outputs: 18 to LCD, 60 to DRIVER, 66 to DRIVER.
- LCD:** Receives data from the Controller and Driver.
- DRIVER:** Receives data from the Controller and Driver.
- LED BACKLIGHT:** Receives power from the Controller and Driver.

The pinout diagram shows the following dimensions (in mm):

- Pin 1: 0.45
- Pin 2: 0.42
- Pin 3: 0.08
- Pin 4: 0.08
- Pin 5: 0.08
- Pin 6: 0.08
- Pin 7: 0.08
- Pin 8: 0.08
- Pin 9: 0.08
- Pin 10: 0.08
- Pin 11: 0.08
- Pin 12: 0.08
- Pin 13: 0.08
- Pin 14: 0.08
- Pin 15: 0.08
- Pin 16: 0.08
- Pin 17: 0.08
- Pin 18: 0.08
- Pin 19: 0.08
- Pin 20: 0.08
- Pin 21: 0.08

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	—	mm	Side Backlight (L)	H1	—	mm
	H2	—	mm		H2	—	mm
EL Backlight (E)	H1	—	mm	Array Backlight (M)	H1	8.0	mm
	H2	—	mm		H2	12.5	mm

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, OV 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℃

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	—	—	—	—	—	—
Backlight Voltage						Backlight Current					
EL (@ Frequency 400Hz)	VEL	—	—	—	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	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
CCFL						CCFL					
White	VBL	—	—	—	V _{rms}	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 _{opr}	0 to 50	-20 to 70	℃
Storage Temperature	T _{stg}	-10 to 60	-30 to 80	℃

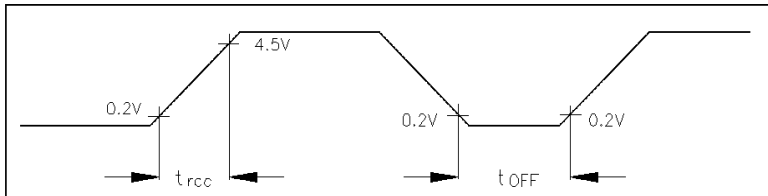
INSTRUCTIONS

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 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”

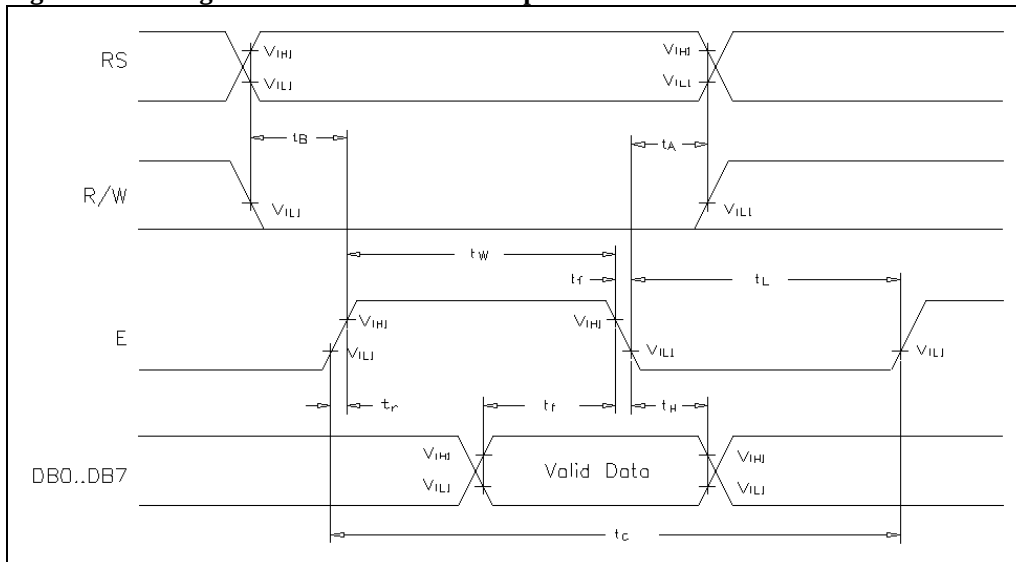
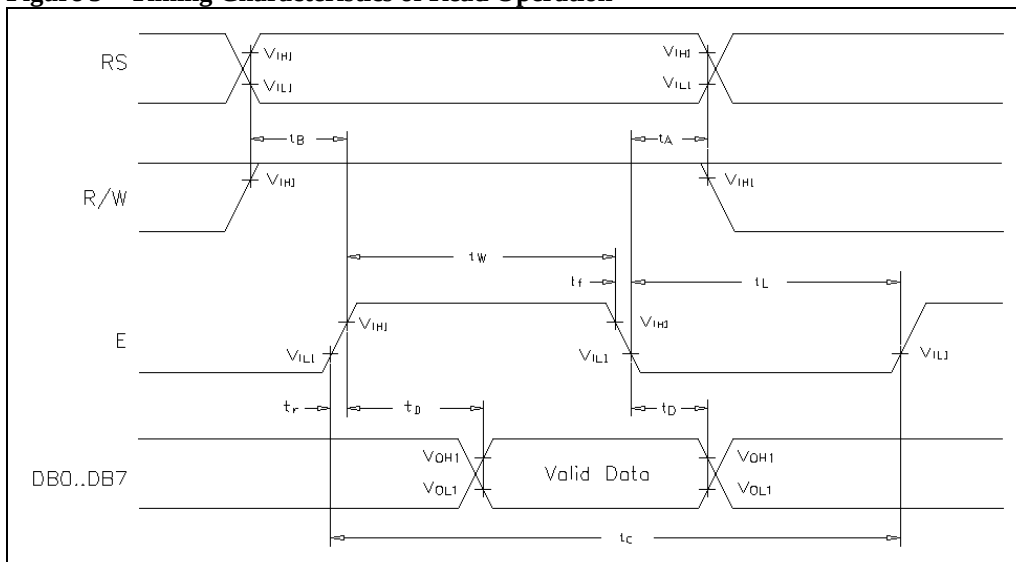
*note: Access the predetermined address of the display data RAM. The column address increment "1" after read or write.

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			Data Set-up Time	tI (min)	80ns
High level	tW(min)	100ns	Data Delay Time	t _D (max)	90ns
Low level	tL (min)	100ns	Address Hold Time	tA(min)	10ns
Enable Raise Time	t _r (max)	15ns	Input Data Hold Time	tH (min)	10ns
Enable Fall Time	t _f (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 ≥ 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

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.