



**CLOVER DISPLAY LTD.**

## LCD MODULE SPECIFICATION

Model : CV12864B - \_ \_ - \_ \_ - \_ \_ - \_ \_

Revision	09
Engineering	Kemp Huang
Date	05 September 2014
Our Reference	4912

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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:**

**CV12864B- 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  
 L – Side-lited LED backlight  
 M – Array LED backlight

\* (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 64 dots, graphic COB LCD module

Interface : 8-bit parallel

Driving method : 1/64 duty, 1/9 bias

Controller IC : Avant Electronics SBN0064G or equivalent

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

**MECHANICAL DIMENSIONS**

Item	Dimension		Unit	Item	Dimension		Unit
Outline Dimension	78.0(L)x70.0(W)x (H1/H2)		mm	Dot Pitch	0.44(L)x0.60(W)		mm
Viewing Area	62.0(L)x44.0(W)		mm	Dot Size	0.39(L)x0.55(W)		mm
No Backlight (N)	H1	4.9	mm	Side Backlight (L)	H1	10.0	mm
	H2	9.0	mm		H2	14.1	mm
Array Backlight (M)	H1	10.0	mm				
	H2	14.1	mm				

**CONNECTOR PIN ASSIGNMENT**

Pin No.	Symbol	Function	Pin No.	Symbol	Function
1	\CS1	Chip select *	10	DB1	Data bus line
2	\CS2	Chip select **	11	DB2	Data bus line
3	VSS	Ground	12	DB3	Data bus line
4	VDD	Supply voltage for logic	13	DB4	Data bus line
5	V0	Input voltage for LCD	14	DB5	Data bus line
6	RS	Register select signal	15	DB6	Data bus line
7	R/W	Read/write signal	16	DB7	Data bus line
8	E	Chip enable	*** 17	BL-	Supply voltage for backlight (-VE)
9	DB0	Data bus line	*** 18	BL+	Supply voltage for backlight (+VE)

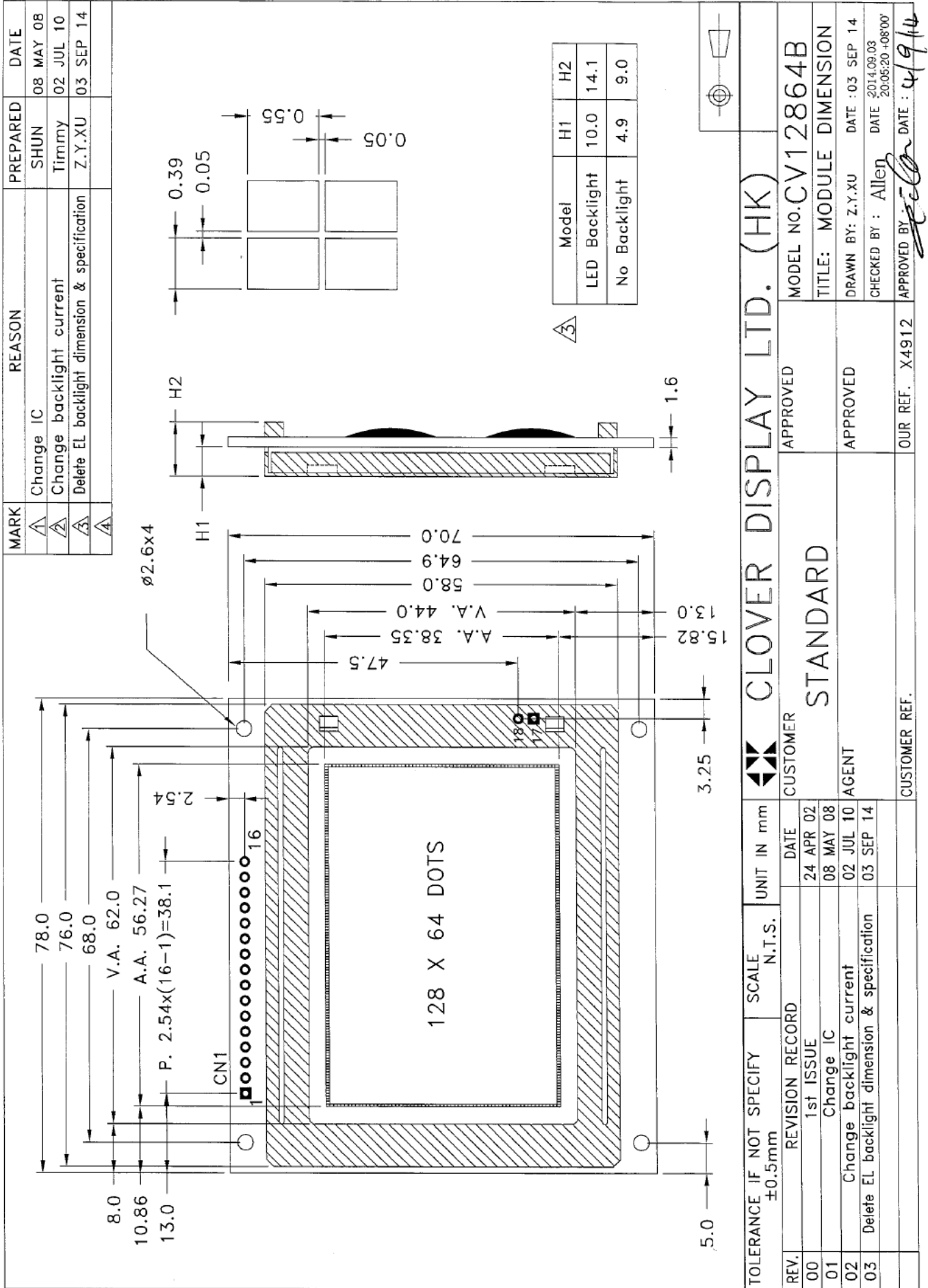
Note:

\* : \CS1 is used to control the left part of display screen.

\*\* : \CS2 is used to control the right part of display screen.

\*\*\* : Pin 17, 18 are used for backlight version only

COUNTER DRAWING OF MODULE DIMENSION



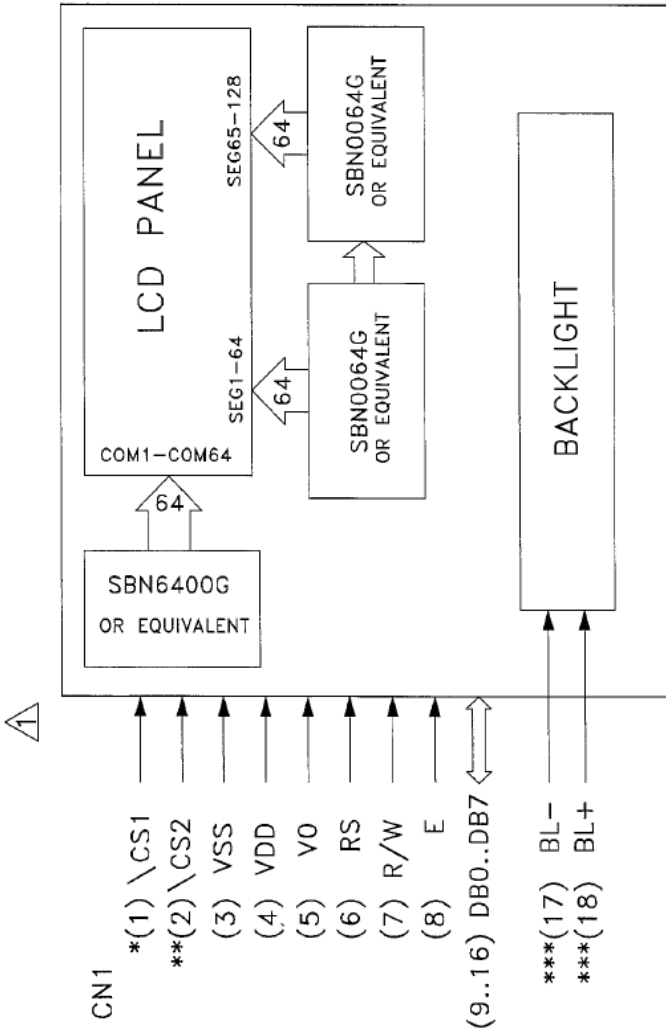
CLOVER DISPLAY LTD. (HK)

REV.	REVISION RECORD	SCALE	UNIT IN mm	DATE
00	1st ISSUE	N.T.S.		24 APR 02
01	Change IC			08 MAY 08
02	Change backlight current			02 JUL 10
03	Delete EL backlight dimension & specification			03 SEP 14

TOLERANCE IF NOT SPECIFY	APPROVED	MODEL NO.
±0.5mm	APPROVED	CV12864B
	APPROVED	TITLE: MODULE DIMENSION
	OUR REF. X4912	DRAWN BY: Z.Y.XU DATE: 03 SEP 14
	CUSTOMER REF.	CHECKED BY: Allen DATE: 2014.09.03
		APPROVED BY: <i>[Signature]</i> DATE: 4/9/14

COUNTER DRAWING OF PIN OUT & BLOCK DIAGRAM

CN1



PIN NO.	SYMBOL	FUNCTION
1	\CS1	Chip select
2	\CS2	Chip select
3	VSS	Ground
4	VDD	Supply voltage for logic
5	V0	Input voltage for LCD
6	RS	Register select signal
7	R/W	Read/write signal
8	E	Chip enable
9	DB0	Data bus line
10	DB1	
11	DB2	
12	DB3	
13	DB4	
14	DB5	
15	DB6	
16	DB7	
17	BL-	Supply voltage for backlight (-VE)
18	BL+	Supply voltage for backlight (+VE)

Note :

- \* Pin 1(\CS1) is used to control the left part of display.
- \*\* Pin 2(\CS2) is used to control the right part of display.
- \*\*\* Pin 17, 18 are used for backlight version only.

TOLERANCE IF NOT SPECIFY ±0.5mm		SCALE N.T.S.	UNIT IN mm	CLOVER DISPLAY LTD. (HK)	
REV.	REVISION RECORD			APPROVED	MODEL NO. CV12864B
00	1st ISSUE	24 APR 02			TITLE: PIN OUT & BLOCK DIAGRAM
01	Change IC	08 MAY 08			DRAWN BY: Z.Y.XU DATE: 03 SEP 14
02	Change backlight current	02 JUL 10	AGENT		CHECKED BY: Allen DATE: 20.05.31 +08'00'
03	Delete EL backlight dimension & specification	03 SEP 14			APPROVED BY: <i>[Signature]</i> DATE: 4/9/14
				OUR REF. X4912	
					CUSTOMER REF.

**ELECTRICAL CHARACTERISTICS**

Conditions: VSS=0V, @Ta=25°C

Item	Symbol	MIN.	TYP.	MAX.	Unit	Item	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage for Logic	VDD	4.75	5.0	5.25	V	"H"Level Input Voltage	V <sub>IH</sub>	VDD-2.2	—	VDD	V
Supply Current for Logic	I <sub>DD</sub>	—	2.50	3.20	mA	"L"Level Input Voltage	V <sub>IL</sub>	0	—	0.8	V
Input voltage for LCD(*)	VO	-4.03	-3.6	-3.17	V	—	—	—	—	—	—

Note(\*):The corresponding LCD voltage = VDD-VO, is  $8.6V \pm 5\%$  for optimum contrast.**Side Backlight:**

Constant voltage driving:

Item	Symbol	MIN.	TYP.	MAX.	Unit	Condition
White Backlight current	I <sub>BL</sub>	51	60	69	mA	V <sub>BL</sub> = 3.2V
Blue Backlight current	I <sub>BL</sub>	—	80	100	mA	V <sub>BL</sub> = 3.2V

**Array Backlight:**

Constant current driving:

Item	Symbol	MIN.	TYP.	MAX.	Unit	Condition
Yellow Green Backlight voltage	V <sub>BL</sub>	3.85	4.05	4.25	V	I <sub>BL</sub> = 240mA

**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	-0.3 to 7.0	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 TABLE

Setting of the data bus for programming the Display ON/OFF Register

D7(MSB)	D6	D5	D4	D3	D2	D1	D0(LSB)
0	0	1	1	1	1	1	D0

When D0=1, the code is 3F(Hex) and the display is turned ON. When D0=0, the code is 3E(Hex) and the display is turned OFF.

The setting of the data bus for programming the Display Start Line Register

D7(MSB)	D6	D5	D4	D3	D2	D1	D0(LSB)
1	1	A5	A4	A3	A2	A1	A0

A5 ~ A0 are Display Start Line address bits and can be programmed with a value in the range from 0 to 63. Therefore, the code can be from 1100 0000 (C0 Hex) to 1111 1111 (FF Hex).

The setting of the data bus for programming the Page Address Register

D7(MSB)	D6	D5	D4	D3	D2	D1	D0(LSB)
1	0	1	1	1	A2	A1	A0

A2, A1 and A0 are page address bits and can be programmed with a value in the range from 0 to 7. A2 A1 A0=000 selects Page 0; A2 A1 A0=001 selects Page 1; A2 A1 A0=010 selects Page 2, and A2 A1 A0=011 selects Page 3...etc. Therefore, the code can be from 1011 1000 (B8 Hex) to 1011 1111 (BF Hex).

The setting of the data bus for programming the Column Address Register

D7(MSB)	D6	D5	D4	D3	D2	D1	D0(LSB)
0	1	A5	A4	A3	A2	A1	A0

A5~A0 are column address bits and can be programmed with a value in the range from 0 to 63. Therefore, the code can be from 0100 0000 (40 Hex) to 0111 1111 (7F Hex).

The Status Register bit allocation

D7(MSB)	D6	D5	D4	D3	D2	D1	D0(LSB)
BUSY	0	ON/OFF	RESET	0	0	0	0

The Status Register bit description

Bit	Description
BUSY	BUSY=1 indicates that the SBN0064G is currently busy and can not accept new code or data. The SBN0064G is executing an internal operation. BUSY=0 indicates that the SBN0064G is not busy and is ready to accept new code or data.
ON/OFF	The ON/OFF bit indicates the current of status of display. If ON/OFF=0, the display has been turned ON. If ON/OFF=1, the display has been turned OFF. Note that the polarity of this bit is inverse to that of the Display ON/OFF Register.
RESET	RESET=1 indicates that the SBN0064G is currently in the process of being reset. RESET=0 indicates that the SBN0064G is currently in normal operation.

READ/WRITE operation

Operation	DATA								Description
	D7	D6	D5	D4	D3	D2	D1	D0	
Write Display Data	Data to be written into the Display Data Memory.								Write a byte of data to the Display Data Memory. The data to be written is put on the data bus by the host microcontroller.
Read Display Data	Data read from the Display Data Memory output latch.								Read a byte of data from the Display Data Memory. The data read from the internal 8-bit output latch (refer to Fig. 12) appears on the data bus. A dummy read is needed to get correct value.

**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 OFF
2. Set display start line register line 0.

While reset is proceeding, no instruction except status read can be accepted. Therefore, execute other instructions after making sure that DB4 (clear RESET) and DB7 (ready) by status read instruction.



### Mapping between Memory Columns and Segments

The mapping relation between the column outputs of the Display Data Memory and the Segment outputs SEG0~SEG63 is decided by the CSM (Column/Segment Mapping) input.

If CSM input is connected to HIGH, then data from column 0 of the Display Data Memory is output from SEG0. This type of mapping is called *normal mapping*.

If CSM input is connected to LOW, then the data from column 63 of the Display Data Memory is output from SEG0. This type of mapping is called *inverted mapping*.

By use of this input, the flexibility of component placement and routing on a PCB can be increased.

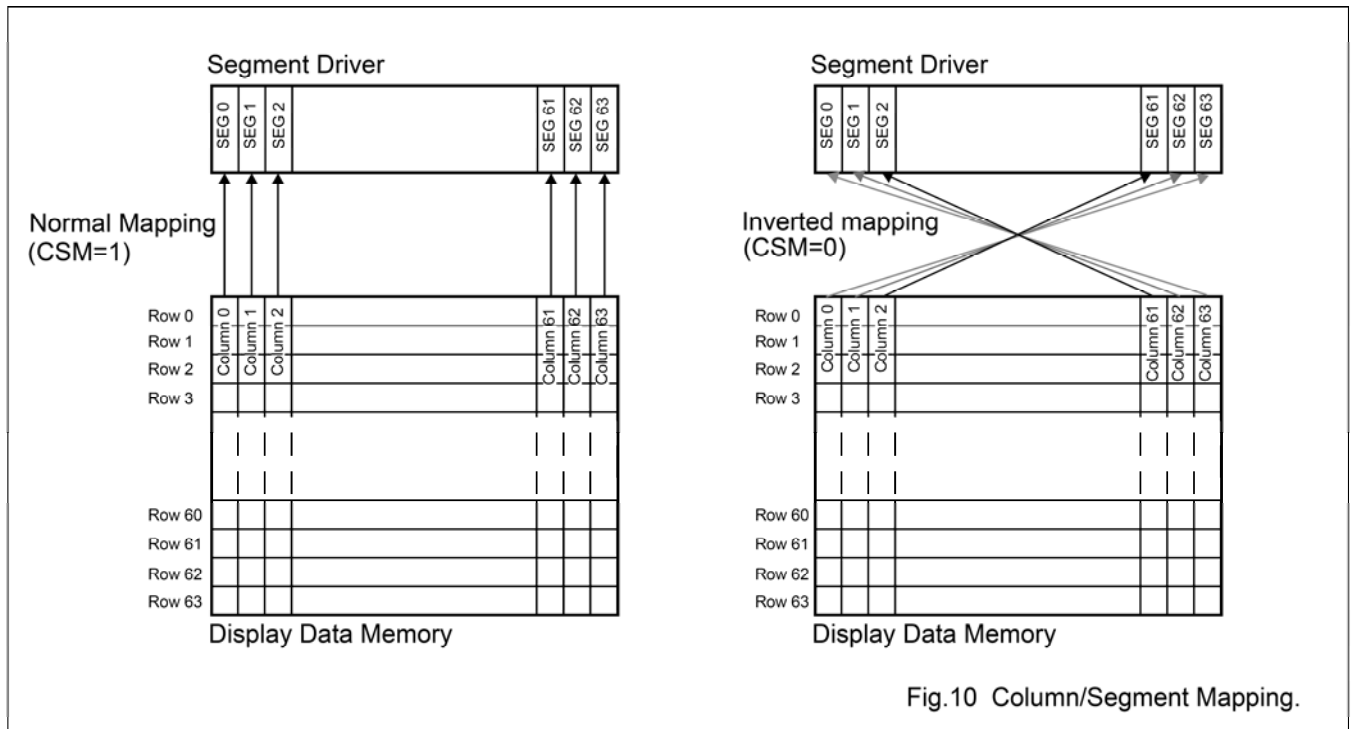


Fig.10 Column/Segment Mapping.

### Display Data Memory Page and the Page Address Register

The Display Data Memory is divided into 8 pages: Page 0 ~ Page 7, with each page having 64 bytes in horizontal direction. Page 0 is from Row 0 to Row 7, Page 1 from Row 8 to Row 15, Page 2 from Row 16 to Row 23, and Page 3 from Row 24 to Row 31,...etc, as shown in Fig 11. When the host microcontroller intends to perform a READ/WRITE operation to the Display Data Memory, it has to program the Page Address Register to indicate which page it intends to access.

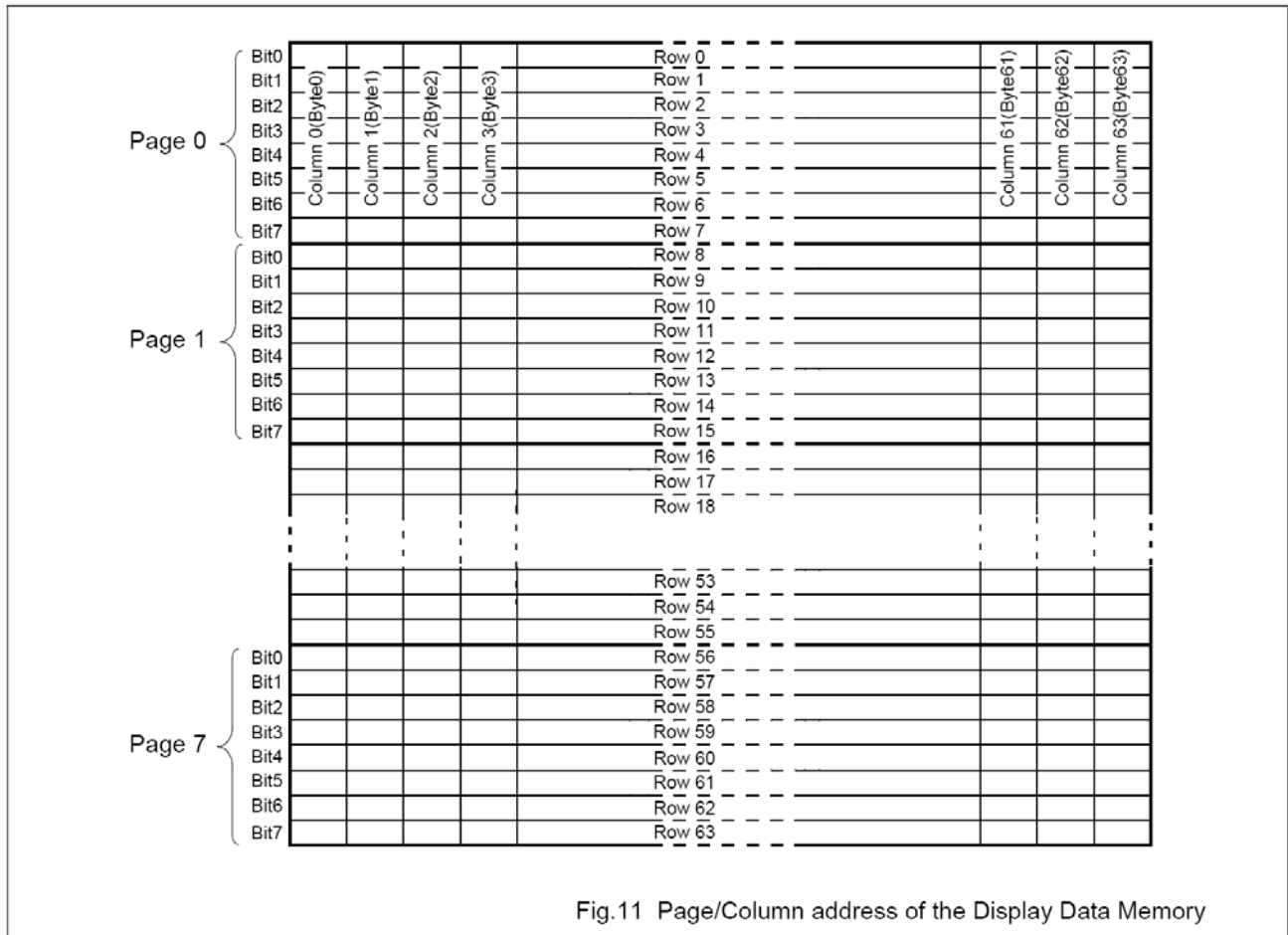
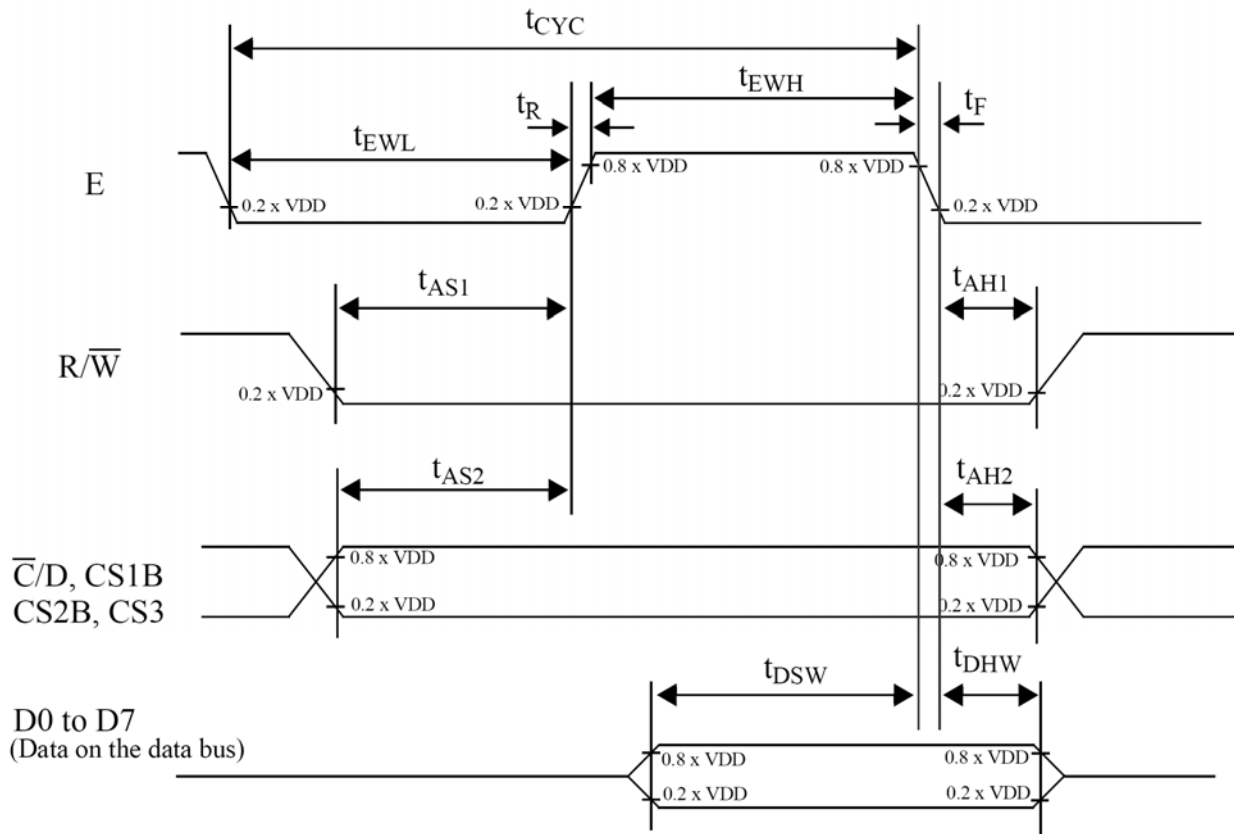


Fig.11 Page/Column address of the Display Data Memory

Microcontroller interface timing for writing to the SBN0064G

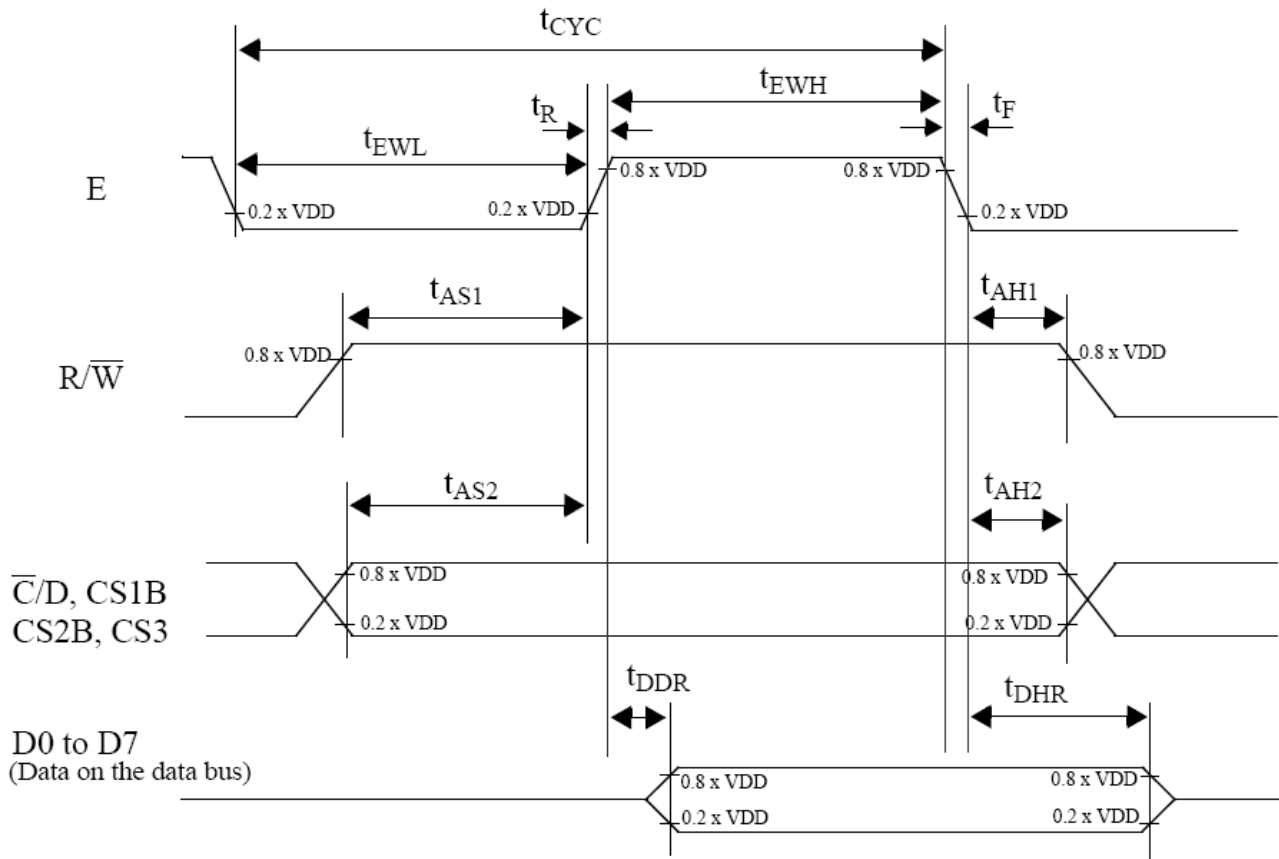


AC timing for writing to the SBN0064G

$V_{DD} = 5\text{ V} \pm 10\%$ ;  $V_{SS} = 0\text{ V}$ ;  $T_{amb} = -20\text{ }^{\circ}\text{C}$  to  $+75\text{ }^{\circ}\text{C}$ .

symbol	parameter	min.	max.	test conditions	unit
$t_{CYC}$	Enable (E) cycle time	1000			ns
$t_{EWL}$	Enable (E) LOW width	450			
$t_{EWH}$	Enable (E) HIGH width	450			
$t_R$	Enable (R) rise time		20		
$t_F$	Enable (F) fall time		20		
$t_{AS1}$	Write set-up time	140			
$t_{AH1}$	Write hold time	10			
$t_{AS2}$	C/D, CS1B, CS2B, CS3 set-up time	140			
$t_{AH2}$	C/D, CS1B, CS2B, CS3 hold time	10			
$t_{DSW}$	Data setup time (on the data bus)	200		The loading on the data bus is shown in Fig. 18.	
$t_{DHW}$	Data hold time (on the data bus)	10			

Microcontroller interface timing for reading from the SBN0064G



AC timing for reading from the SBN0064G

$V_{DD} = 5V \pm 10\%$ ;  $V_{SS} = 0V$ ;  $T_{amb} = -20^{\circ}C$  to  $+75^{\circ}C$ .

symbol	parameter	min.	max.	test conditions	unit
$t_{CYC}$	Enable (E) cycle time	1000			ns
$t_{EWL}$	Enable (E) LOW width	450			
$t_{EWH}$	Enable (E) HIGH width	450			
$t_R$	Enable (R) rise time		20		
$t_F$	Enable (F) fall time		20		
$t_{AS1}$	READ set-up time	140			
$t_{AH1}$	READ hold time	20			
$t_{AS2}$	C/D, CS1B, CS2B, CS3 set-up time	140			
$t_{AH2}$	C/D, CS1B, CS2B, CS3 hold time	10			
$t_{DDR}$	Data delay time (on the data bus)	320		The loading on the data bus is shown in Fig. 18.	
$t_{DHR}$	Data hold time (on the data bus)	20			

## THE RESET CIRCUIT

### Registers and their states after hardware RESET

The SBN0064G has 5 registers. Four of them must be programmed by the host microcontroller after hardware reset. The Status Register can be read by the host microcontroller to check the current status of the SBN0064G.

The registers and their states after RESET is given in Table 5.

Registers and their states after RESET

Register Name	Description	States after RESET
Display ON/OFF Register	The Display ON/OFF Register is a 1-bit register. After RESET, its value is LOW and, therefore, the LCD display is turned OFF.	0
Display Start Line Register	The Display Start Line Register is a 6-bit register. After RESET, its value is 00 0000 and, therefore, Row 0 of the Display Data Memory is mapped to COM0 of LCD panel.	00 0000
Page Address Register	The Page Address Register is a 3-bit register. It point to a page of the Display Data Memory.	xxx
Column Address Register	The Column Address Register is a 6-bit register.	xx xxxx
Status Register	The Status Register shows the current state of the SBN0064G. It is a 3-bit register, with each bit showing the status of a programmed function.	0010 0000

**ELECTRO-OPTICAL CHARACTERISTICS**

MEASURING CONDITION: POWER SUPPLY = VOP / 64 Hz  
 TEMPERATURE = 23 ± 5 °C  
 RELATIVE HUMIDITY = 60 ± 20 %

ITEM	SYMBOL	UNIT	TYP. TN/ TYP. STN
RESPONSE TIME	Ton	ms	220
	Toff	ms	280
CONTRAST RATIO	Cr	-	12
VIEWING ANGLE (6 O'clock) (Cr ≥ 2)	V3:00	°	40
	V6:00	°	70
	V9:00	°	40
	V12:00	°	50

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.



## SPECIFICATION REVISION RECORD

<b>Revision No.</b>	<b>Description</b>	<b>Date(DD/MM/YY)</b>
08	Update Counter Drawing to 02 on page 3-4 & Update Electrical Characteristics on page 5	16/08/10
09	Delete Mechanical Dimensions of EL& CCFL Backlight on page 3 Update Counter Drawing to 03 on page 4-5 Delete Electrical Characteristics of EL Backlight on page 6	04/09/14