



CLOVER DISPLAY LTD.

LCD MODULE SPECIFICATION

Model: CG24064A - _ _ _ - _ _ _ - _ _

Revision	02
Engineering	Timmy Kwan
Date	01 November 2009
Our Reference	X9032

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MODE OF DISPLAY

Display mode	Display condition	Viewing direction
STN : Yellow green	Reflective type	6 O' clock
Grey	Transflective type	12 O' clock
Blue (negative)	Transmissive type	3 O' clock
FSTN positive	Others	9 O' clock
FSTN negative		

LCD MODULE NUMBER NOTATION:

CV9007A- N N - S R - 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)

GENERAL DESCRIPTION

Display mode : 240 X 64 dots, graphic COG LCD module
 Interface : Serial
 Driving method : 1/65 duty, 1/7 bias
 Controller IC : SUNPLUS SPLC502A x 2
 For the detailed information, please refer to the IC specifications.

MECHANICAL DIMENSIONS

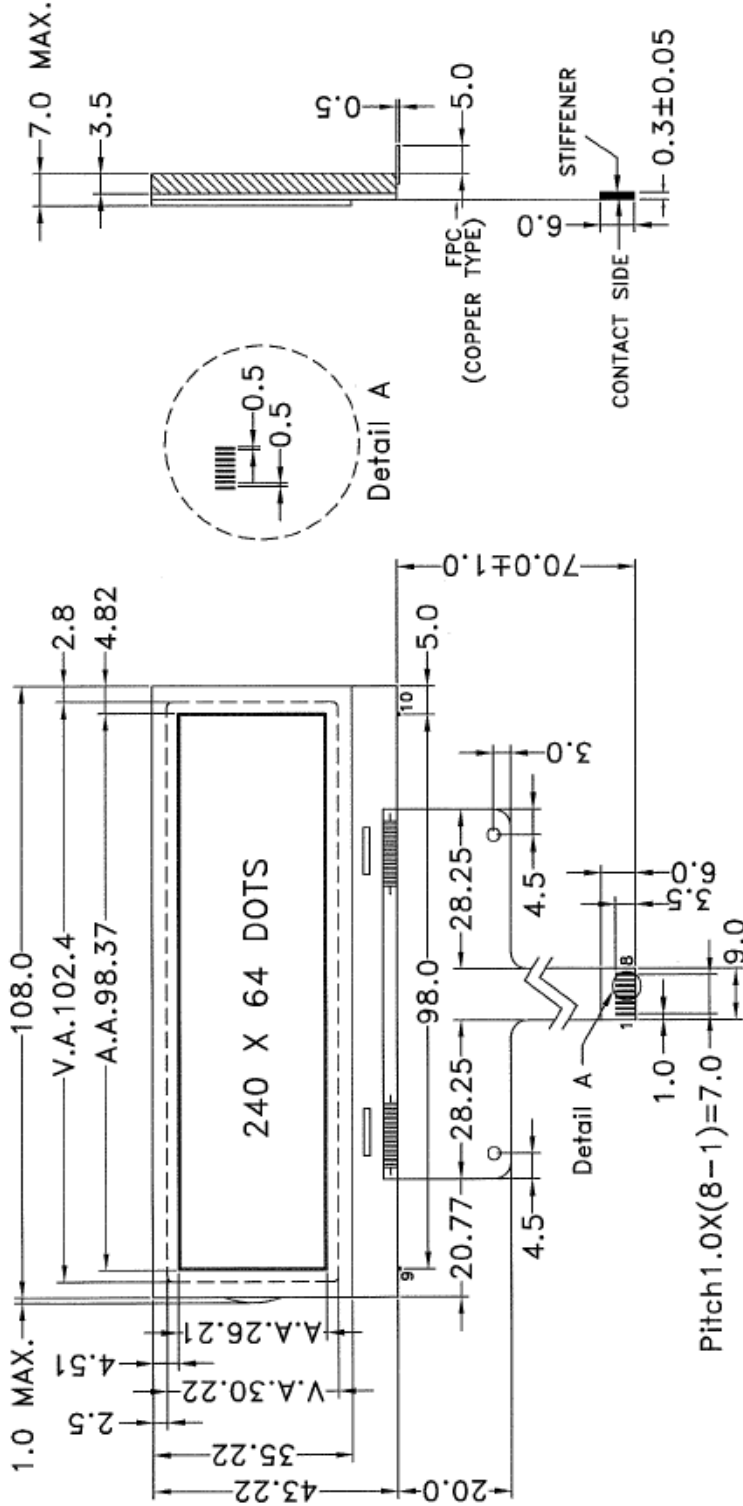
Item	Dimension	Unit	Item	Dimension	Unit
Outline Dimension			Viewing Area	102.4(L)x30.22(W)	mm
Non Backlight (N)	108.0(L)x43.2(W)x 3.5 MAX(H)	mm	Dot Pitch	0.41(L)x0.41(W)	mm
LED Sided Backlight(L)	108.0(L)x43.2(W)x 7.0 MAX(H)	mm	Dot Size	0.38(L)x0.38(W)	mm

CONNECTOR PIN ASSIGNMENT

Pin No	Symbol	Function
1	/RES	Reset
2	/CSA	Master Chip select signal
3	/CSB	Slave Chip select signal
4	AO	Data control signal
5	SCLK	Serial input clock
6	SID	Serial input data
7	VDD	Supply voltage for logic
8	VSS	Ground
9	A	Supply voltage for backlight(+VE)
10	K	Supply voltage for backlight(-VE)

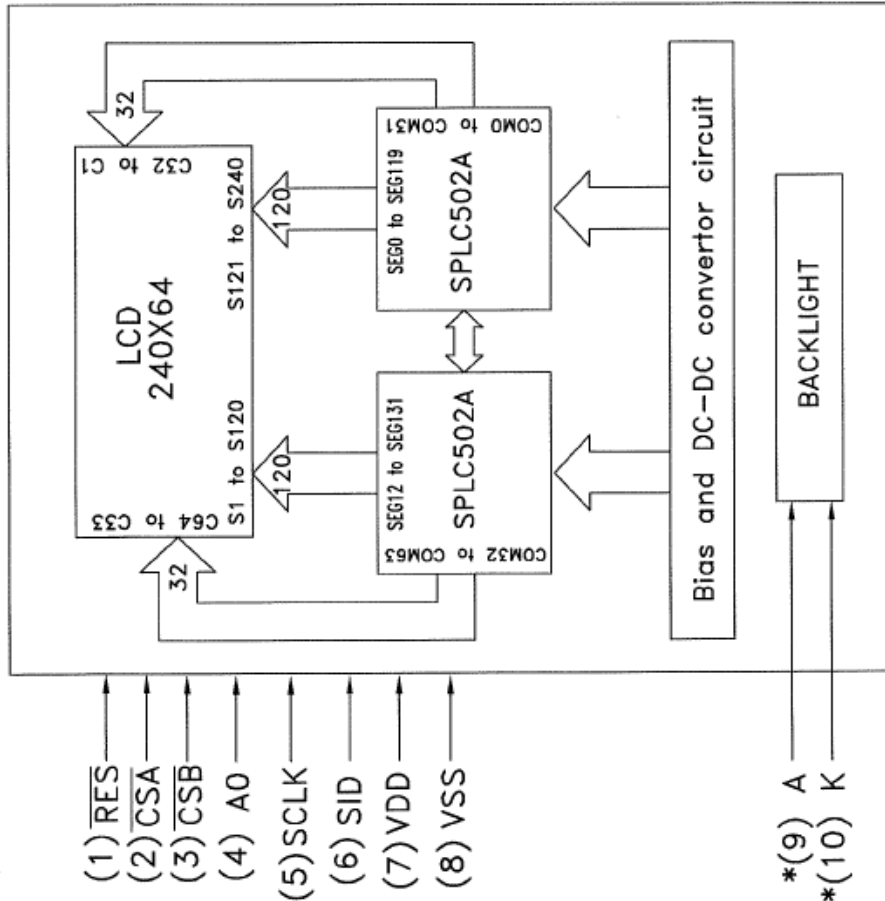
COUNTER DRAWING OF MODULE DIMENSION

MARK	REASON	PREPARED	DATE
A	Change backlight current	Timmy	21 OCT 09
A			
A			
A			



TOLERANCE IF NOT SPECIFY ±0.5mm		SCALE N.T.S.	UNIT IN mm	CLOVER DISPLAY LTD. (HK)		SHEET 1 OF 3
REV.	REVISION RECORD		DATE	APPROVED	MODEL No. CG24064A	
00	1ST Issue		01 Nov 06			
01	Change backlight current		28 OCT 09	APPROVED	TITLE: MODULE DIMENSION	
					DRAWN BY: MEN	DATE: 28 OCT 09
					CHECKED BY: <i>[Signature]</i>	DATE: 28 OCT 09
					APPROVED BY: <i>[Signature]</i>	DATE: 28 OCT 09
				OUR REF. X9032		
				CUSTOMER REF.		

COUNTER DRAWING OF PIN OUT & BLOCK DIAGRAM



PIN NO.	SYMBOL	FUNCTION
1	$\overline{\text{RES}}$	Reset
2	$\overline{\text{CSA}}$	Master Chip select signal
3	$\overline{\text{CSB}}$	Slave Chip select signal
4	AO	Data control signal
5	SCLK	Serial input clock
6	SID	Serial input data
7	VDD	Supply voltage for logic
8	VSS	Ground
*9	A	Supply voltage for backlight (+VE)
*10	K	Supply voltage for backlight (-VE)

Note (*): Pin 9,10 are use for backlight versions only

TOLERANCE IF NOT SPECIFY $\pm 0.5\text{mm}$		SCALE N.T.S.	UNIT IN mm	CLOVER DISPLAY LTD. (HK)		SHEET 2 OF 3
REV.	REVISION RECORD	DATE	CUSTOMER	APPROVED	MODEL NO. CG24064A	
00	1ST Issue	01 Nov 06	STANDARD		TITLE: PIN OUT & BLOCK DIAGRAM	
01	Change backlight current	28 OCT 09	AGENT	APPROVED	DRAWN BY: MEN	DATE : 28 OCT 09
					CHECKED BY :	DATE :
					APPROVED BY :	DATE :
				OUR REF. X9032		
				CUSTOMER REF.		

ELECTRICAL CHARACTERISTICS

Conditions: VSS=0V, Ta=25

Item	Symbol	MIN.	TYP.	MAX.	Unit	Item	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage for Logic	VDD	2.75	3.0	3.25	V	“H”Level Input Voltage	VIH	0.8VDD	-	VDD	V
Supply Current for Logic	IDD	-	0.36	0.40	mA	“L”Level Input Voltage	VIL	VSS	-	0.2VDD	V
Operating Voltage for LCD(*)	VLCD	7.8	8.0	8.2	V	-	-	-	-	-	-
EL Backlight Voltage (VEL)											
EL (@ Frequency 400Hz)	VBL	-	-	-	Vrms	-	-	-	-	-	-
Side-lited LED Backlight Forward Voltage (VF)						Side-lited LED Backlight Forward Current (IF)					
White	VBL	-	5.0	-	V	White	IBL	43	51	59	mA
Blue	VBL	-	5.0	-	V	Blue	IBL	-	105	120	mA
Yellow Green	VBL	-	-	-	V	Yellow Green	IBL	-	-	-	mA

Note(*): The module VLCD 8.0±0.2V represents operating voltage of LCD for optimum contrast.

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	3.0	3.0	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	

COMMANDS TABLE

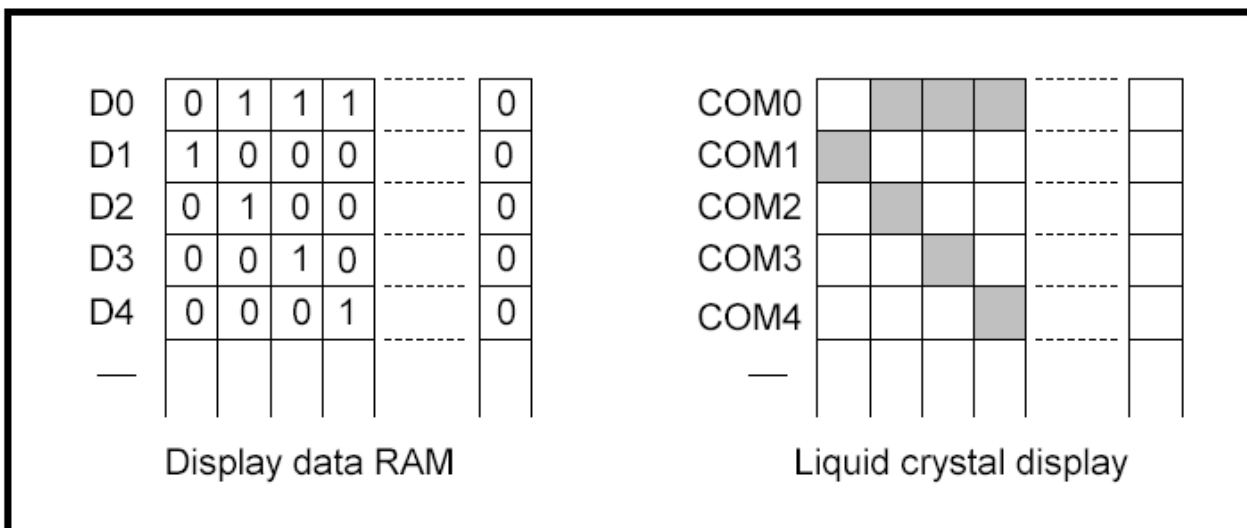
Command	Command Code										Function	
	A0P	$\overline{\text{RD}}$	$\overline{\text{WR}}$	DB7	DB6	DB5	DB4	DB3	DB2	DB1		DB0
1). Display ON/OFF	0	1	0	1	0	1	0	1	1	1	0	LCD display ON/OFF 0: OFF, 1: ON
2). Display start line set	0	1	0	0	1	Display start address					1	Sets the display RAM display start line address
3). Page address set	0	1	0	1	0	1	1	Page address				Sets the display RAM page address
4). Column address set upper bit	0	1	0	0	0	0	1	Most significant column address				Sets the most significant 4 bits of the display RAM column address.
Column address set lower bit	0	1	0	0	0	0	0	Least significant column address				Set the least significant 4 bits of the display RAM column address.
5). Status read	0	0	1	Status				0	0	0	0	Reads the status data
6). Display data write	1	1	0	Write data								Writes to the display RAM
7). Display data read	1	0	1	Read data								Reads from the display RAM
8). ADC select	0	1	0	1	0	1	0	0	0	0	0	Sets the display RAM address SEG output correspondence 0: normal, 1:reverse
9). Display normal/reverse	0	1	0	1	0	1	0	0	1	1	0	Sets the LCD display normal/ reverse 0: normal, 1:reverse
10). Display all points ON/OFF	0	1	0	1	0	1	0	0	1	0	0	Display all points 0: normal display 1: all points ON
11). LCD bias set	0	1	0	1	0	1	0	0	0	1	0	Sets the LCD driver voltage bias ratio SPLC502A.....0:1/9, 1:1/7
12). Read/modify/write	0	1	0	1	1	1	0	0	0	0	0	Column address increment At write: +1 At read: 0
13). End	0	1	0	1	1	1	0	1	1	1	0	Clear read/modify/write
14). Reset	0	1	0	1	1	1	0	0	0	1	0	Internal reset
15). Common output mode select	0	1	0	1	1	0	0	0	*	*	*	Select COM output scan direction 0: normal direction, 1: reverse direction
16). Power control set	0	1	0	0	0	1	0	1	Operating mode			Select internal power supply operating mode
17). V0 voltage regulator internal resistor ratio set	0	1	0	0	0	1	0	0	Resistor ratio			Select internal resistor ratio (Rb/Ra) mode
18). Electronic volume mode set	0	1	0	1	0	0	0	0	0	0	1	Set the V0 output voltage electronic volume register
Electronic volume register set	0	1	0	*	*	Electronic volume value						

COMMANDS TABLE(CONT.)

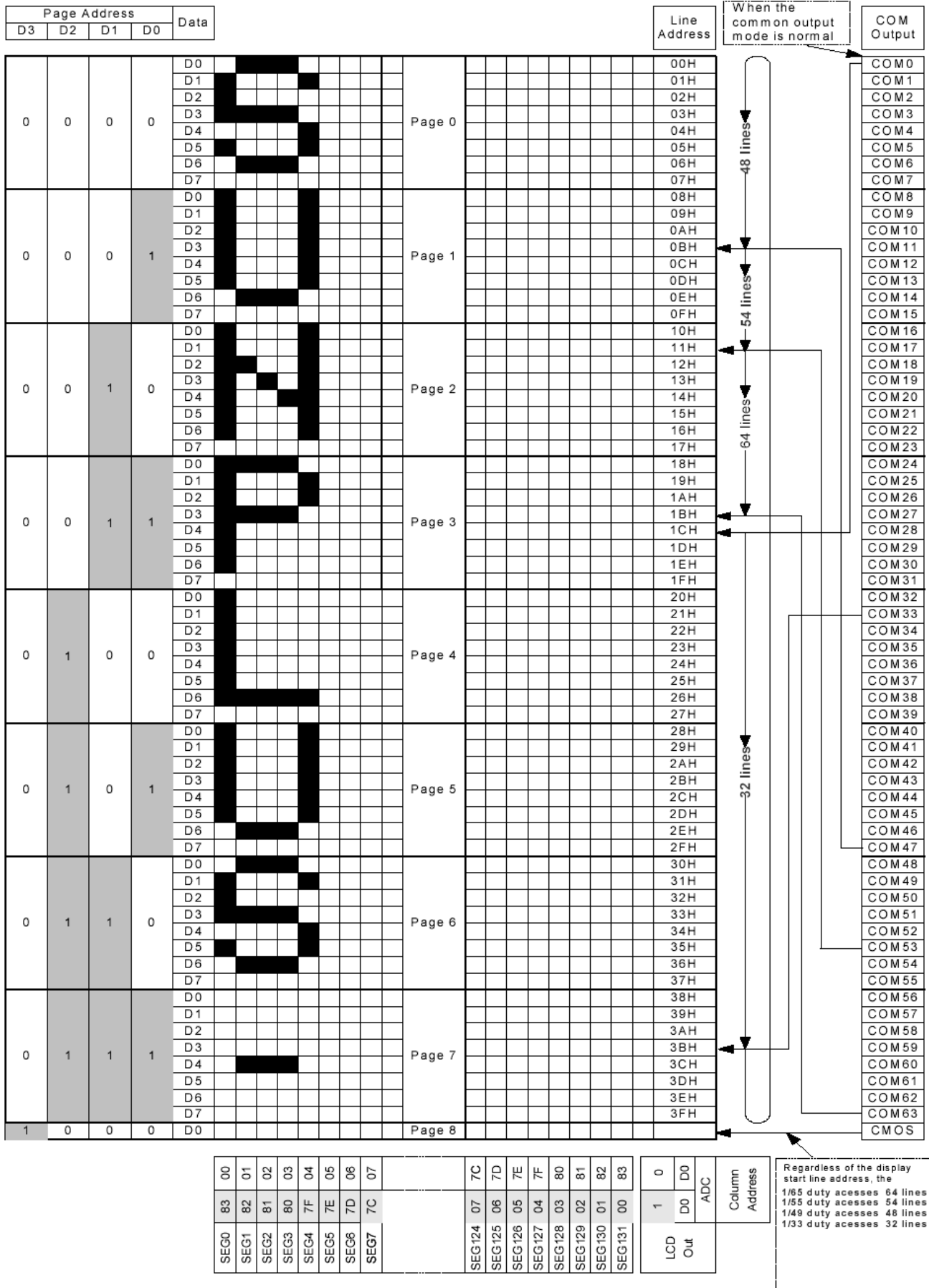
Command	Command Code										Function	
	A0P	RD	WR	DB7	DB6	DB5	DB4	DB3	DB2	DB1		DB0
19). Static indicator ON/OFF Static indicator Register set				1	0	1	0	1	1	0	0	0: OFF, 1: ON 1 Set the flashing mode
20). Page Blink Page selection	0	1	0	1	1	0	1	0	1	0	1	P7 - 0: 1 - blinking page 0 - no blinking, normal display
21). Power saver												Display OFF and display all points ON compound command
22). NOP	0	1	0	1	1	1	0	0	0	1	1	Command for non-operation
23). Test	0	1	0	1	1	1	1	*	*	*	*	Command for IC test. Do not use this command

DISPLAY DATA RAM

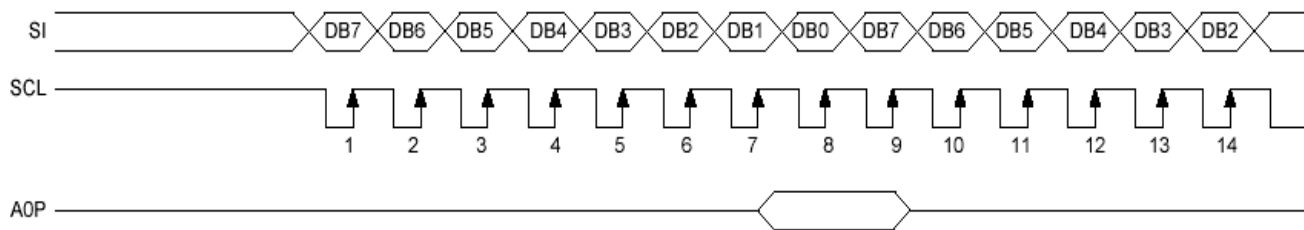
The display data RAM is a RAM that stores the dot data for the display. It has a 65 (8 page x 8 bit +1) x 132-bit structure. It is possible to access the desired bit by specifying the page address and the column address. Because, as is shown in below, the DB7 - 0 display data from the MPU corresponds to the liquid crystal display common direction, there are few constraints at the time of display data transfer when multiple SPLC502A chips are used. Therefore, display structures can be created easily and with a high degree of freedom.



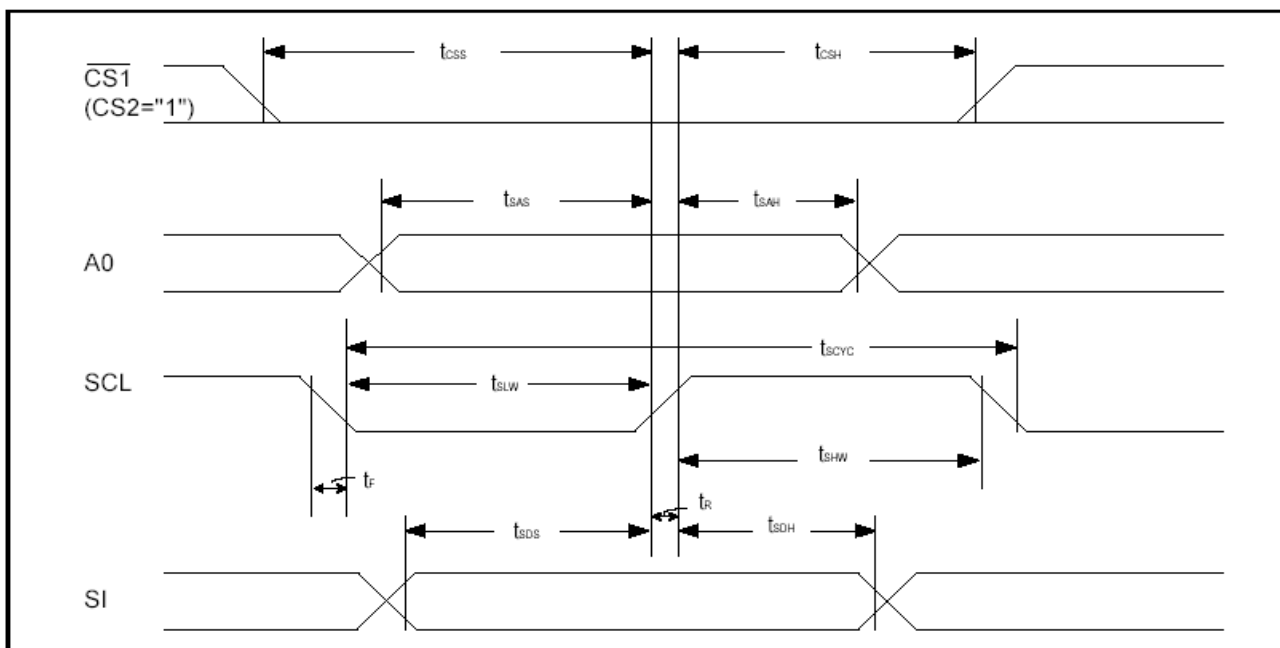
THE ADDRESS CIRCUIT



SERIAL INTERFACE SIGNAL CHART

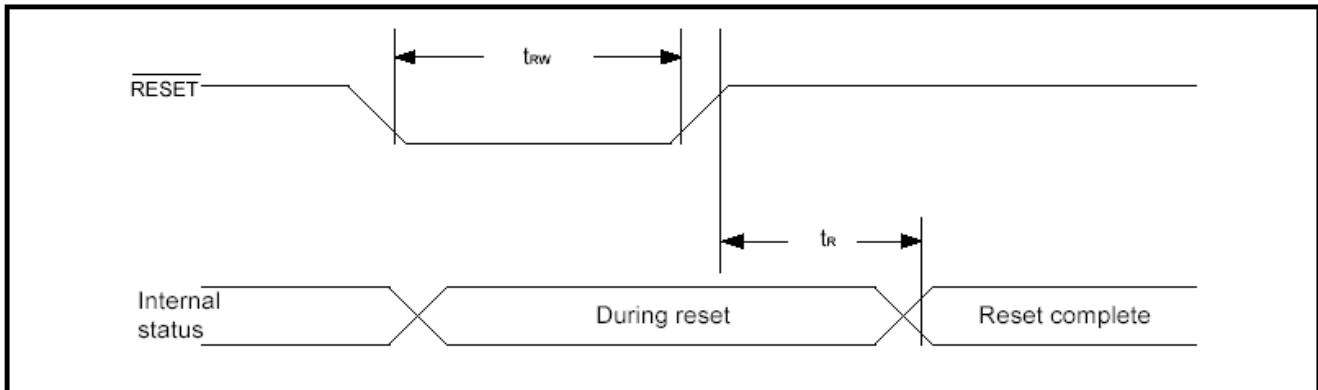


TIMING DIAGRAM AND CHARACTERISTICS



Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Serial Clock Period		t_{SCYC}	-	250	-	ns
SCL 'H' pulse width	SCL	t_{SHW}	-	100	-	ns
SCL 'L' pulse width		t_{SLW}	-	100	-	ns
Address setup time		t_{SAS}	-	150	-	ns
Address hold time	A0P	t_{SAH}	-	150	-	ns
Data setup time		t_{SDS}	-	100	-	ns
Data hold time	SI	t_{SDH}	-	100	-	ns
CS-SCL time	CS	t_{CSS}	-	150	-	ns
		t_{CSH}	-	150	-	ns

RESET TIMING



Item	Signal	Symbol	Condition	Rating			Units
				Min.	Typ.	Max.	
Reset time		t_R	-	-	1.0	μs	
Reset 'L' pulse width	RES	t_{RW}	-	1.0	-	μs	

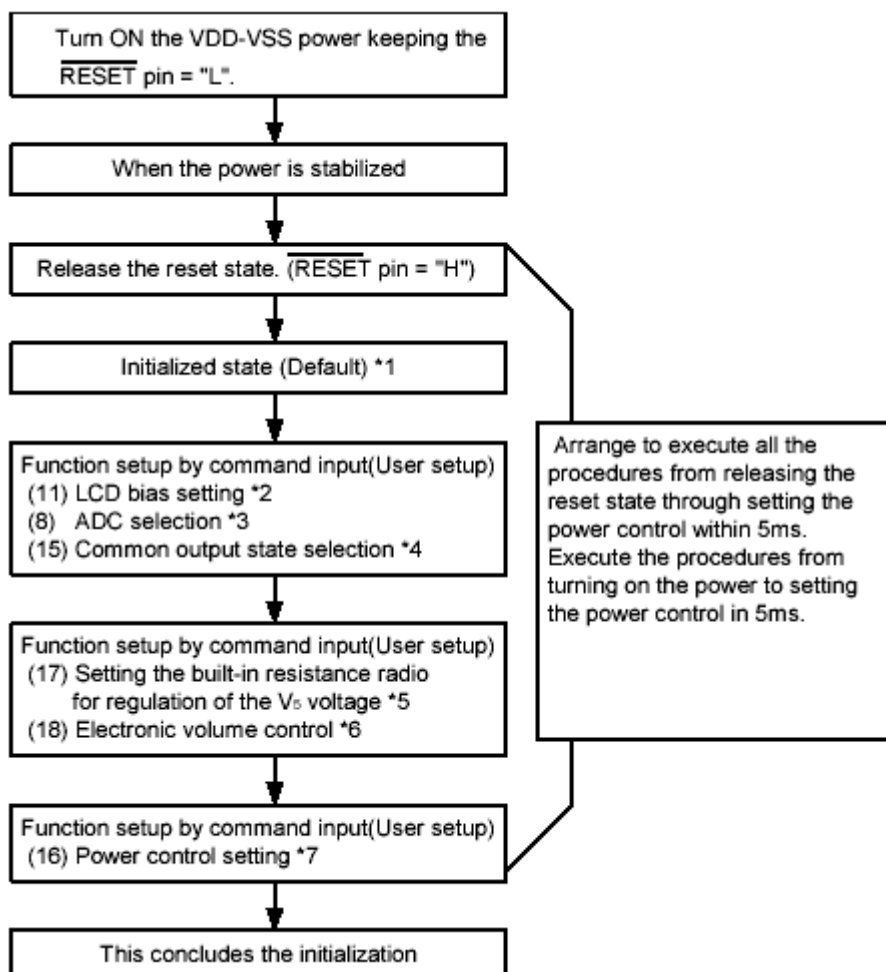
Note: All timing is specified with 20% and 80% of VDD as the standard.

THE RESET CIRCUIT

When the RESET input comes to the 'L' level, these LSIs return to the default state. Their default states are as follows:

- 1). Display OFF
- 2). Normal display
- 3). ADC select: Normal (ADC command DB0 = 'L')
- 4). Power control register: (DB2, DB1, DB0) = (0, 0, 0)
- 5). Serial interface internal register data clear
- 6). LCD power supply bias rate: SPLC502A.....1/9 bias
- 7). All-indicator lamps-on OFF (All-indicator lamps ON/OFF command DB0 = 'L')
- 8). Power saving clear
- 9). V0 voltage regulator internal resistors, Ra and Rb, are connected.
- 10). Output conditions of SEG and COM terminals SEG: VSS, COM: VSS
- 11). Read modify write OFF
- 12). Static indicator OFF Static indicator register: (DB1, DB2) = (0, 0)
- 13). Display start line set to first line
- 14). Column address set to Address 0
- 15). Page address set to Page 0
- 16). Common output status normal
- 17). V0 voltage regulator internal resistor ratio set mode clear
- 18). Electronic volume register set mode clear Electronic volume register: (DB5, DB4, DB3, DB2, DB1, DB0) = (1, 0, 0, 0, 0, 0)
- 19). Test mode clear

INITIALIZATION FLOWCHART(With built-in power supply circuit)



Note1: The target time of 5ms varied depending on the panel characteristics and the capacitance of the smoothing capacitor. Therefore, we suggest users to conduct an operation check using the actual equipment.

Note2: Refer to respective sections or paragraphs listed below.

*1:Description of functions; Reset circuit

*2:Command description; LCD bias setting

*3:Command description; ADC selection

*4:Command description; Common output state selection

*5:Description of functions; Power circuit & Command description;
Setting the built-in resistance ratio for regulation of the V_s voltage

*6:Description of functions; Power circuit & Command description;
Electronic volume control

*7:Description of functions; Power circuit & Command description;
Power control setting.

ELECTRO-OPTICAL CHARACTERISTICS

MEASURING CONDITION: POWER SUPPLY = $V_{OP} / 64 \text{ Hz}$
 TEMPERATURE = $23 \pm 5 \text{ }^\circ\text{C}$
 RELATIVE HUMIDITY = $60 \pm 20 \%$

ITEM	SYMBOL	UNIT	TYP. TN	TYP. STN
RESPONSE TIME	T_{on}	ms	-	220
	T_{off}	ms	-	280
CONTRAST RATIO	Cr	-	-	12
VIEWING ANGLE ($Cr \geq 2$)	V3:00	$^\circ$	-	40
	V6:00	$^\circ$	-	70
	V9:00	$^\circ$	-	40
	V12:00	$^\circ$	-	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 cycle
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

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 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

SAMPLING METHOD

SAMPLING PLAN: MIL-STD 105E

CLASS OF AQL: LEVEL II/ SINGLE SAMPLING
 MAJOR-0.65% MINOR – 1.5%

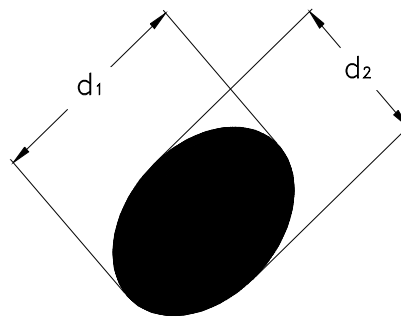
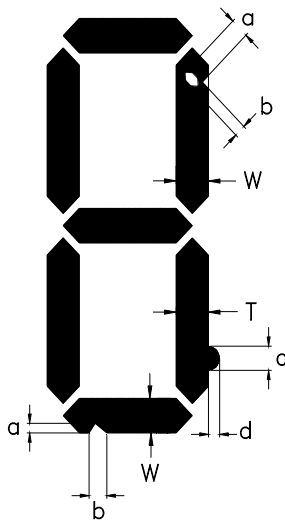
QUALITY STANDARD

DEFECT	CRITERIA	TYPE	FIGURE
SHORT CIRCUIT	-	MAJOR	-
MISSING SEGMENT	-	MAJOR	-
UNEVEN / POOR CONTRAST	-	MAJOR	-
CROSS TALK	-	MAJOR	-
PIN HOLE	$MAX(a,b) \leq 1 / 4 W$	MINOR	1
EXCESS SEGMENT	$MAX(c,d) \leq 1 / 4 T$	MINOR	1
BUBBLES	$d^* \geq 0.2$ QTY=0	MINOR	2
BLACKS SPOTS	$d \leq 0.3$ N.A.** $0.3 < d \leq 0.4$ QTY \leq 1 $0.4 < d$ QTY=0	MINOR	2
LINE SCRATCHES	$x \geq 0.7$ $y \geq 0.05$ QTY=0	MINOR	3
BLACK LINE	$x \geq 0.7$ $y \geq 0.05$ QTY=0	MINOR	3

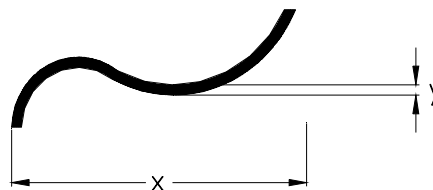
*d = MAX (d₁,d₂)

** N. A . = NOT APPLICABLE

DEFECT TABLE : B



POLARIZER BUBBLES / SPOTS
 fig . 2



LINE SCRATCHES / BLACK LINE
 fig . 3

QUALITY STANDARD (CONT .)

DEFECT		CRITERIA	TYPE	FIGURE
CHIPS	CONTACT EDGE	$e \leq 1/2T$ $f \leq 1/3W$ $g \leq 3.5$	MINOR	4
	BOTTOM GLASS	$p \leq 1.0$ $q \leq 3.5$ $r \leq 1/2T$		4
	CORNER	$a \leq 1.5$ $b \leq W$		4
	TOP GLASS	$a \leq 3.0$ $b \leq 1/3T$ $c \leq 1/2W$		5
GLASS PROTRUSION		$a \leq 1/4 W$	MINOR	6
RAINBOW		-	MINOR	-

UNLESS STATE OTHERWISE , ALL UNIT ARE IN MILLIMETER .

DEFECT TABLE : B

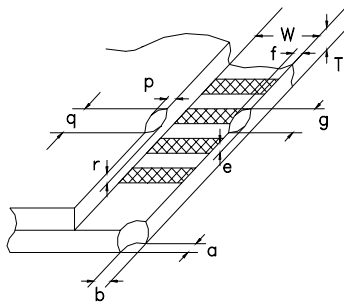


fig . 4

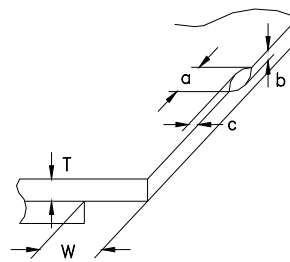


fig . 5

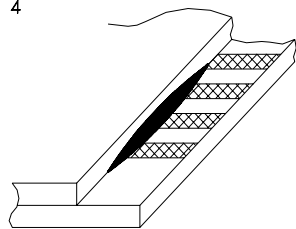
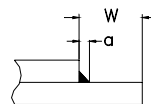


fig . 6



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.

Do not expose to direct sunlight or fluorescent light for a long time.

(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) ESD PRECAUTION

Inputs and outputs are protected against electrostatic discharge in normal handling. However, to be totally safe, it is recommended to take normal precautions appropriate to handling LCM module. For example: product surface grounding.

Always take ESD precaution when handling the *LCD Module*. Components are exposed for direct finger touches and can be damaged unless ESD precaution is taken.

(4) 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.

(5) 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%.

(6) 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 leak 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.