CLOVER DISPLAY LTD.

LCD MODULE SPECIFICATION

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

Revision	03
Engineering	Timmy Kwan
Date	22 September 2010
Our Reference	X9032

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

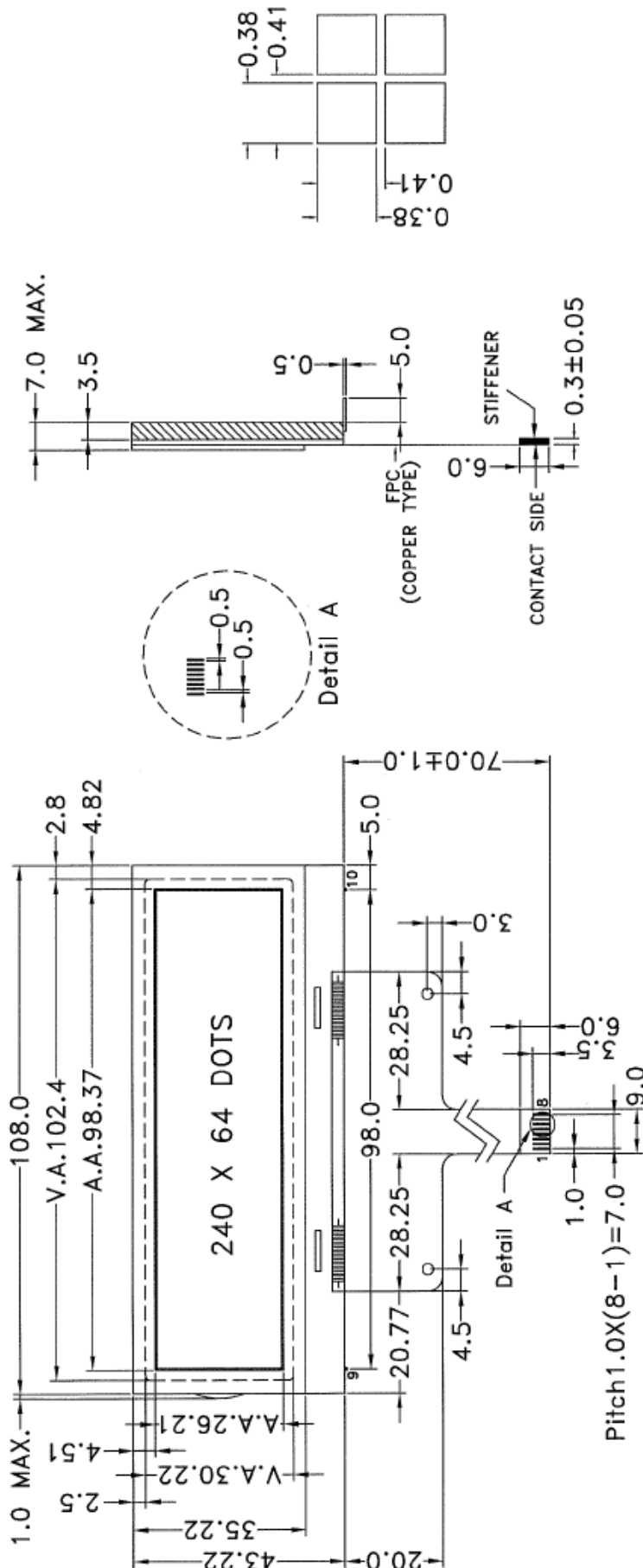|		
Display mode	:	240 X 64 dots, graphic COG LCD module
Interface	:	Serial
Driving method	:	1/65 duty, 1/7 bias
Controller IC	:	SUNPLUS SPLC502A x 2 For the detailed information, please refer to the IC specifications.

MECHANICAL DIMENSIONS

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

240 X 64 DOTS

108.0
V.A.102.4
A.A.98.37

2.8
4.82

1.0 MAX.
4.51
2.5
A.A.26.21
V.A.30.22
35.22
43.22
20.0

70.0±1.0
5.0
3.0
28.25
4.5
6.0
5.0
9.0
98.0
28.25
20.77
4.5
1.0

Pitch1.0X(8−1)=7.0

Detail A

7.0 MAX.
3.5
0.5
5.0
0.3±0.05
6.0
FPC (COPPER TYPE)
CONTACT SIDE
STIFFENER

−0.38
−0.41
0.41
−0.38

0.5
0.5
Detail A

MARK	REASON	PREPARED	DATE
	Change backlight current	Timmy	21 OCT 09

CLOVER DISPLAY LTD. (HK)

STANDARD

		UNIT IN mm		
	CUSTOMER			APPROVED
	AGENT			APPROVED
	CUSTOMER REF.			

MODEL NO. CG24064A
TITLE: MODULE DIMENSION
DRAWN BY: MEN   DATE :28 OCT 09
CHECKED BY :   DATE :
APPROVED BY :   DATE :
OUR REF. X9032

SHEET 1 OF 3

REV.	REVISION RECORD	DATE
00	1ST Issue	01 Nov 06
01	Change backlight current	28 OCT 09

TOLERANCE IF NOT SPECIFY ±0.5mm
SCALE N.T.S.

COUNTER DRAWING OF PIN OUT & BLOCK DIAGRAM

PIN NO.	SYMBOL	FUNCTION
1	RES	Reset
2	CSA	Master Chip select signal
3	CSB	Slave Chip select signal
4	A0	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

(1) RES
(2) CSA
(3) CSB
(4) A0
(5) SCLK
(6) SID
(7) VDD
(8) VSS

*(9) A
*(10) K

LCD 240X64

SPLC502A SEG0 to SEG119 COM0 to COM31

SPLC502A SEG12 to SEG131 COM32 to COM63

Bias and DC-DC convertor circuit

BACKLIGHT

CLOVER DISPLAY LTD. (HK)

STANDARD

CUSTOMER

AGENT

CUSTOMER REF.

			APPROVED	MODEL NO. CG24064A
				TITLE: PIN OUT & BLOCK DIAGRAM
			APPROVED	DRAWN BY: MEN　DATE :28 OCT 09
				CHECKED BY :　　DATE :
				OUR REF. X9032　APPROVED BY　DATE :

TOLERANCE IF NOT SPECIFY ±0.5mm		UNIT IN mm	SCALE N.T.S.	SHEET 2 OF 3
REVISION RECORD				
REV.		DATE		
00	1ST Issue	01 Nov 06		
01	Change backlight current	28 OCT 09		

ELECTRICAL CHARACTERISTICS

Conditions: VSS=0V, Ta=25

Item	Symbol	MIN.	TYP.	MAX.	Unit	Item	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage for Logic	V_{DD}	2.75	3.0	3.25	V	"H"Level Input Voltage	V_{IH}	0.8VDD		VDD	V
Supply Current for Logic	I_{DD}		0.36	0.54	mA	"L"Level Input Voltage	V_{IL}	VSS		0.2VDD	V
Operating Voltage for LCD(*)	V_{LCD}	7.6	8.0	8.4	V						

Note (*): There is tolerance in optimum LCD driving voltage during production and it will be within the specified range.

Side-lited LED Backlight

Constant voltage driving:

Item	Symbol	MIN.	TYP.	MAX.	Unit	Condition
White Backlight current	I_{BL}	43	51	59	mA	V_{BL} = 5.0V
Blue Backlight current	I_{BL}	90	105	120	mA	V_{BL} = 5.0V

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	V_{DD}	3.0	3.0	V
Input Voltage	V_T	-0.3 to V_{DD} +0.3	-0.3 to V_{DD} +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	A0P	RD̄	WR̄	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Function
1). Display ON/OFF	0	1	0	1	0	1	0	1	1	1	0 / 1	LCD display ON/OFF 0: OFF, 1: ON
2). Display start line set	0	1	0	0	1			Display start address				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 / 1	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 / 1	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 / 1	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 / 1	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 / 1	*	*	*	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				1	0	1	0	1	1	0	0		0: OFF, 1: ON
											1		
Static indicator Register set				*	*	*	*	*	*	Mode			Set the flashing mode
20). Page Blink	0	1	0	1	1	0	1	0	1	0	1		
Page selection	0	1	0	P7	P6	P5	P4	P3	P2	P1	P0		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
				1	1	0	1	0	1	0	0		

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.
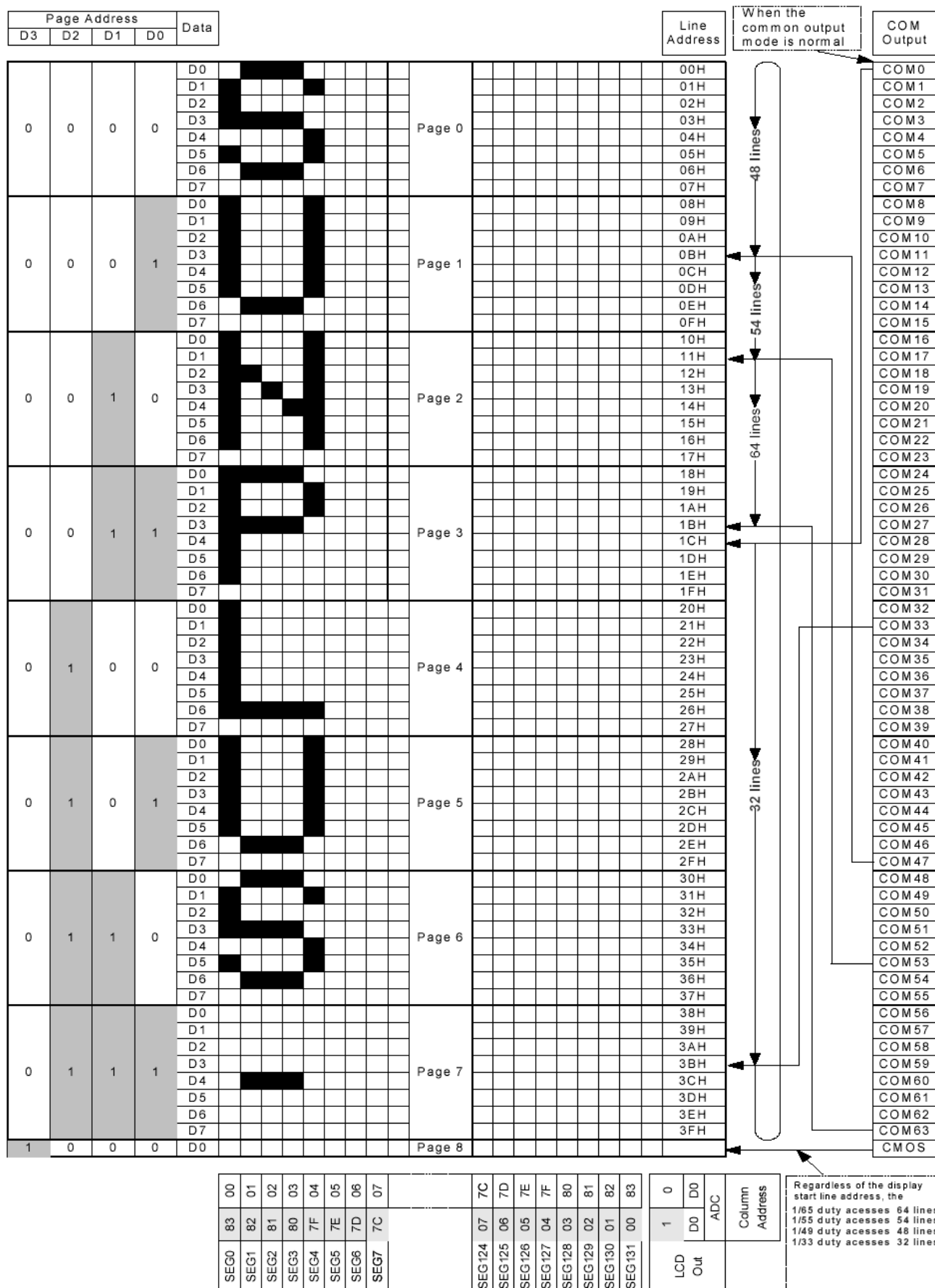

Display data RAM   Liquid crystal display

THE ADDRESS CIRCUIT

Page Address				Data	... (bitmap) ...	Line Address	When the common output mode is normal	COM Output
D3	D2	D1	D0					
0	0	0	0	D0		00H		COM0
				D1		01H		COM1
				D2		02H		COM2
				D3		03H	Page 0	COM3
				D4		04H		COM4
				D5		05H	48 lines	COM5
				D6		06H		COM6
				D7		07H		COM7
0	0	0	1	D0		08H		COM8
				D1		09H		COM9
				D2		0AH		COM10
				D3		0BH	Page 1	COM11
				D4		0CH		COM12
				D5		0DH	54 lines	COM13
				D6		0EH		COM14
				D7		0FH		COM15
0	0	1	0	D0		10H		COM16
				D1		11H		COM17
				D2		12H		COM18
				D3		13H	Page 2	COM19
				D4		14H		COM20
				D5		15H	64 lines	COM21
				D6		16H		COM22
				D7		17H		COM23
0	0	1	1	D0		18H		COM24
				D1		19H		COM25
				D2		1AH		COM26
				D3		1BH	Page 3	COM27
				D4		1CH		COM28
				D5		1DH		COM29
				D6		1EH		COM30
				D7		1FH		COM31
0	1	0	0	D0		20H		COM32
				D1		21H		COM33
				D2		22H		COM34
				D3		23H	Page 4	COM35
				D4		24H		COM36
				D5		25H		COM37
				D6		26H		COM38
				D7		27H		COM39
0	1	0	1	D0		28H		COM40
				D1		29H		COM41
				D2		2AH		COM42
				D3		2BH	Page 5	COM43
				D4		2CH		COM44
				D5		2DH	32 lines	COM45
				D6		2EH		COM46
				D7		2FH		COM47
0	1	1	0	D0		30H		COM48
				D1		31H		COM49
				D2		32H		COM50
				D3		33H	Page 6	COM51
				D4		34H		COM52
				D5		35H		COM53
				D6		36H		COM54
				D7		37H		COM55
0	1	1	1	D0		38H		COM56
				D1		39H		COM57
				D2		3AH		COM58
				D3		3BH	Page 7	COM59
				D4		3CH		COM60
				D5		3DH		COM61
				D6		3EH		COM62
				D7		3FH		COM63
1	0	0	0	D0		Page 8		CMOS

	00	01	02	03	04	05	06	07		7C	7D	7E	7F	80	81	82	83		0	D0	ADC
	83	82	81	80	7F	7E	7D	7C		07	06	05	04	03	02	01	00		1	D0	
	SEG0	SEG1	SEG2	SEG3	SEG4	SEG5	SEG6	SEG7		SEG124	SEG125	SEG126	SEG127	SEG128	SEG129	SEG130	SEG131		LCD Out		Column Address

Regardless of the display start line address, the
1/65 duty acesses 64 lines
1/55 duty acesses 54 lines
1/49 duty acesses 48 lines
1/33 duty acesses 32 lines

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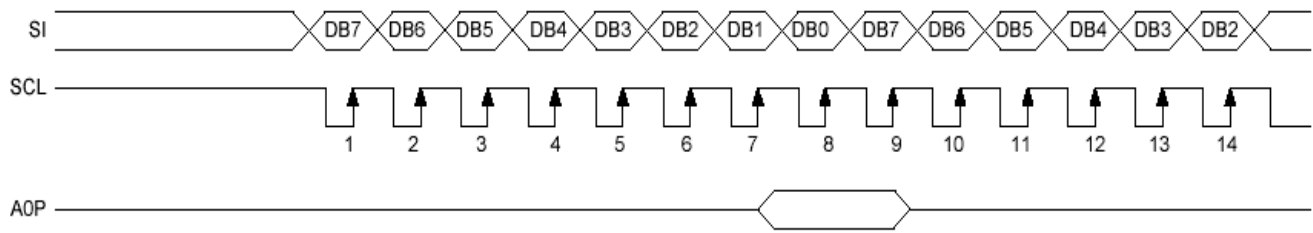
TIMING DIAGRAM AND CHARACTERISTICS
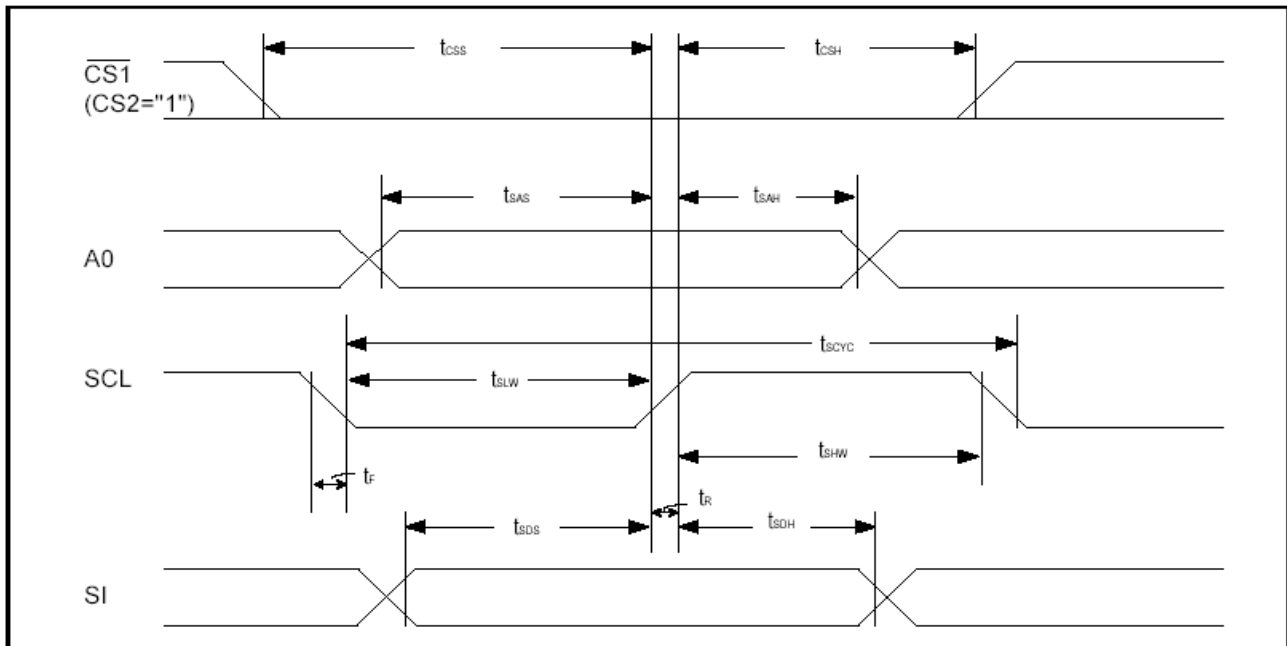
Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Serial Clock Period	SCL	t_{SCYC}	-	250	-	ns
SCL 'H' pulse width		t_{SHW}	-	100	-	ns
SCL 'L' pulse width		t_{SLW}	-	100	-	ns
Address setup time	A0P	t_{SAS}	-	150	-	ns
Address hold time		t_{SAH}	-	150	-	ns
Data setup time	SI	t_{SDS}	-	100	-	ns
Data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

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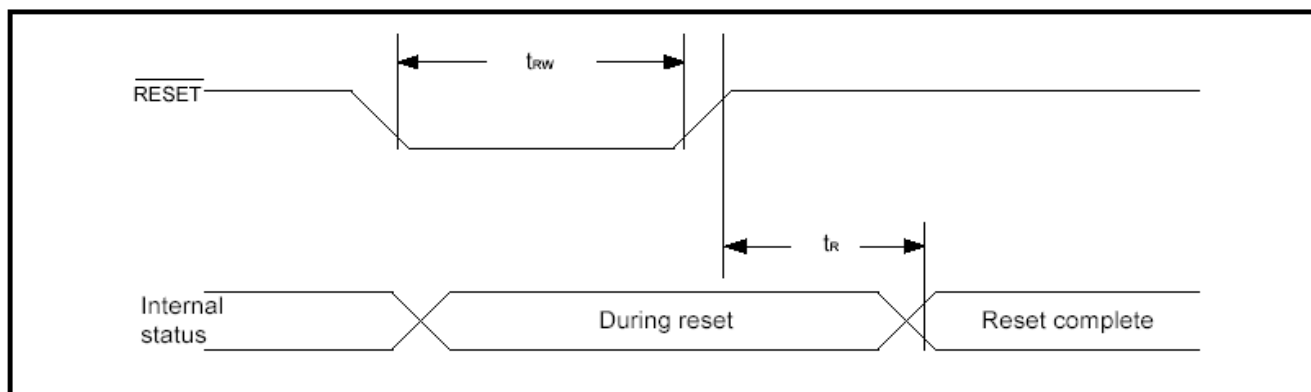
Item	Signal	Symbol	Condition	Rating			Units
				Min.	Typ.	Max.	
Reset time		t_R	-	-	-	1.0	μs
Reset 'L' pulse width	RES	t_{RW}		1.0	-	-	μs

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)

```
┌────────────────────────────────────────────┐
│ Turn ON the VDD-VSS power keeping the      │
│ RESET pin = "L".                            │
└────────────────────────────────────────────┘
                    │
                    ▼
┌────────────────────────────────────────────┐
│ When the power is stabilized                │
└────────────────────────────────────────────┘
                    │
                    ▼
┌────────────────────────────────────────────┐
│ Release the reset state. (RESET pin = "H")  │
└────────────────────────────────────────────┘
                    │
                    ▼
┌────────────────────────────────────────────┐
│ Initialized state (Default) *1              │
└────────────────────────────────────────────┘
                    │
                    ▼
┌────────────────────────────────────────────┐
│ Function setup by command input(User setup) │
│ (11) LCD bias setting *2                    │
│ (8)  ADC selection *3                       │
│ (15) Common output state selection *4       │
└────────────────────────────────────────────┘
                    │
                    ▼
┌────────────────────────────────────────────┐
│ Function setup by command input(User setup) │
│ (17) Setting the built-in resistance radio  │
│      for regulation of the V₅ voltage *5    │
│ (18) Electronic volume control *6           │
└────────────────────────────────────────────┘
                    │
                    ▼
┌────────────────────────────────────────────┐
│ Function setup by command input(User setup) │
│ (16) Power control setting *7               │
└────────────────────────────────────────────┘
                    │
                    ▼
┌────────────────────────────────────────────┐
│ This concludes the initialization           │
└────────────────────────────────────────────┘
```

Arrange to execute all the procedures from releasing the reset state through setting the power control within 5ms. Execute the procedures from turning on the power to setting the power control in 5ms.

Note1: The target time of 5ms varied depending on the panel characteristics and the capacitance of the smoothing apacitor. 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 radio for regulation of the V_5 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 Hz

TEMPERATURE = 23 ± 5 °C

RELATIVE HUMIDITY = 60 ± 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 ≥ 2)	$V_{3:00}$	°	-	40
	$V_{6:00}$	°	-	70
	$V_{9:00}$	°	-	40
	$V_{12:00}$	°	-	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 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.**	MINOR	2
	$0.3<d\leq0.4$	QTY$\leq$1		
	$0.4<d$	QTY=0		
LINE SCRATCHES	$x\geq0.7$ $y\geq0.05$	QTY=0	MINOR	3
BLACK LINE	$x\geq0.7$ $y\geq0.05$	QTY=0	MINOR	3

$*d = MAX(d_1,d_2)$ ** N. A . = NOT APPLICABLE   DEFECT TABLE : B
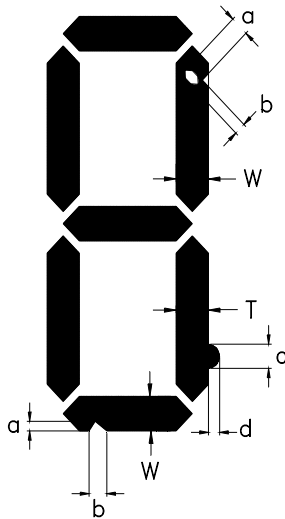
fig . 1
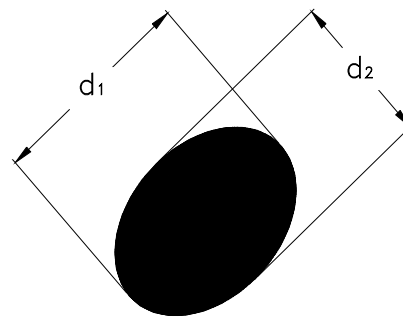
POLARIZER BUBBLES / SPOTS
fig . 2
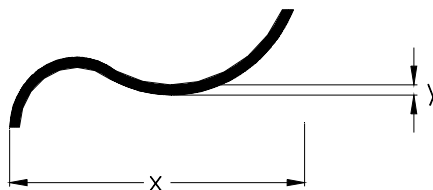
LINE SCRATCHES / BLACK LINE
fig . 3

QUALITY STANDARD (CONT .)

DEFECT		CRITERIA	TYPE	FIGURE
CHIPS	CONTACT EDGE	$e\leq1/2T$ $f\leq1/3W$ $g\leq3.5$	MINOR	4
	BOTTOM GLASS	$p\leq1.0$ $q\leq3.5$ $r\leq1/2T$		4
	CORNER	$a\leq1.5$ $b\leq W$		4
	TOP GLASS	$a\leq3.0$ $b\leq1/3T$ $c\leq1/2W$		5
GLASS PROTRUSION		$a \leq 1/4 W$	MINOR	6
RAINBOW		-	MINOR	-

UNLESS STATE OTHERWISE , ALL UNIT ARE IN MILLIMETER .   DEFECT TABLE : B
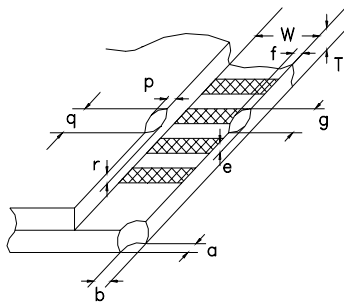
fig . 4
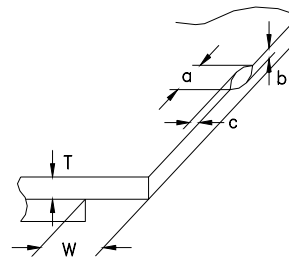
fig . 5
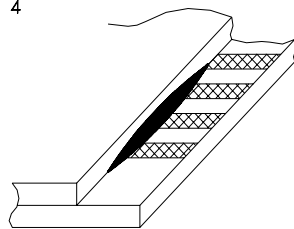
fig . 6
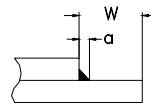
HANDLING PRECAUTIONS

(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 VO.

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.