



CLOVER DISPLAY LTD.

LCD MODULE SPECIFICATION

Model : CV9021A – _ _ – _ _ – _ _ – _ _

Revision	05
Engineering	Timmy Kwan
Date	25 July 2008
Our Reference	9021

ADDRESS : 1st FLOOR, EFFICIENCY HOUSE, 35 TAI YAU STREET, SAN PO KONG,
KOWLOON, HONG KONG.

TEL : (852) 2341 3238 (SALES OFFICE) (852) 2342 8228 (GENERAL OFFICE)

FAX : (852) 2357 4237 (SALES OFFICE)

E-MAIL : cdl@cloverdisplay.com

URL : <http://www.cloverdisplay.com>

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:CV9021A- 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	:	100 x 65 dots, Graphic COG LCD module
Interface	:	Serial
Driving method	:	1/65 duty, 1/9 bias
Controller IC	:	SITRONIX ST7565P or equivalent For the detailed information, please refer to the IC specifications

MECHANICAL DIMENSIONS

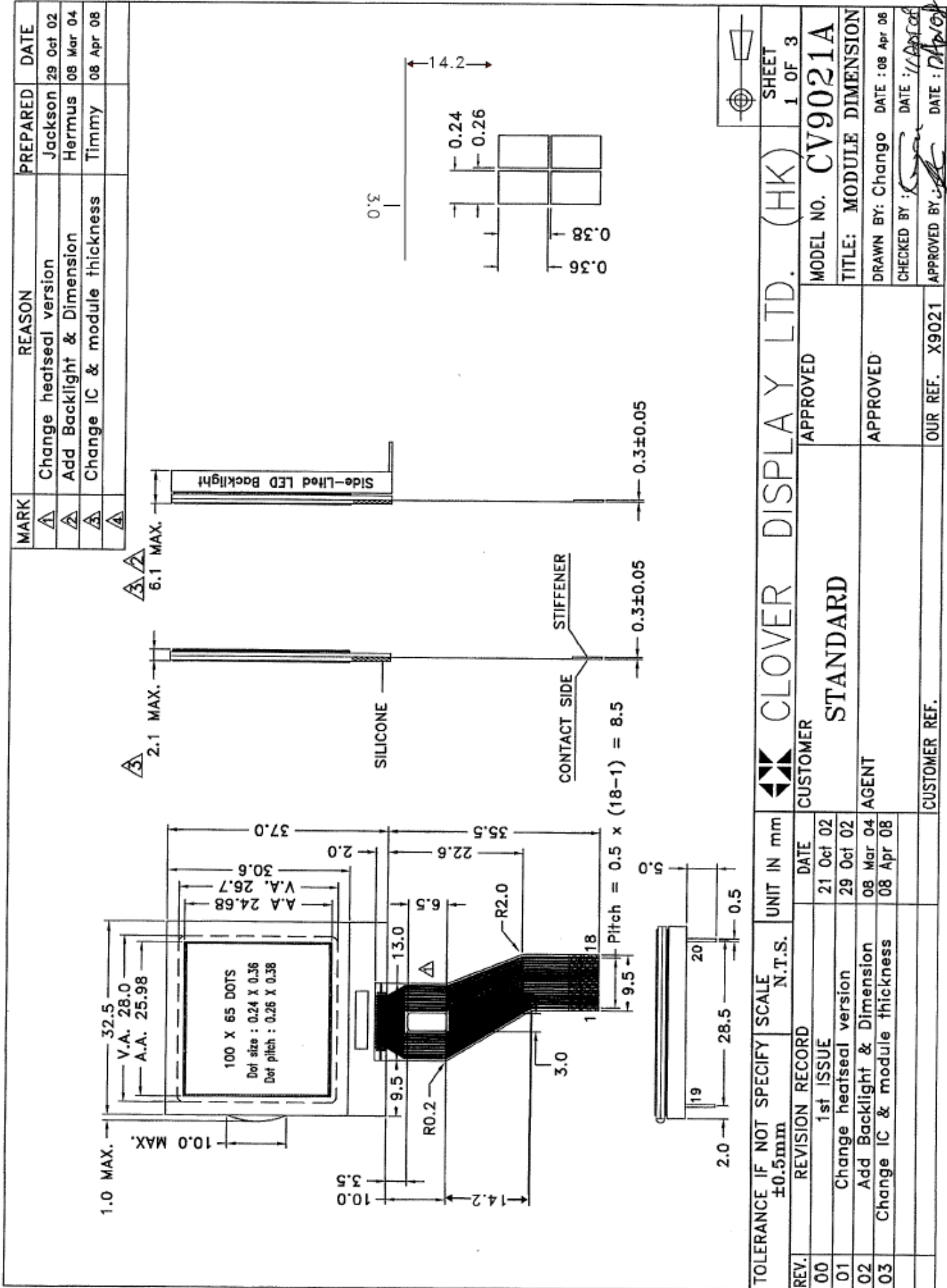
Item	Dimension	Unit	Item	Dimension	Unit
Outline Dimension			Viewing Area	28.0(L)x26.7(W)	mm
No Backlight (N)	32.5(L)x37.0(W)x2.1(Max)(H)	mm	Dot Pitch	0.26(L)x0.38(W)	mm
LED Sided Backlight(L)	32.5(L)x37.0(W)x6.1(Max)(H)	mm	Dot Size	0.24(L)x0.36(W)	mm

CONNECTOR PIN ASSIGNMENT

Pin No.	Symbol	Function
1	V0	Power supply for LCD
2	V1	
3	V2	
4	V3	
5	V4	
6	CAP2N	Voltage Converter
7	CAP2P	
8	CAP1P	
9	CAP1N	
10	CAP3P	
11	VOUT	Ground
12	VSS	
13	VDD	Supply voltage for Logic
14	D7(SI)	Serial data input
15	D6(SCL)	Serial clock input
16	A0	Register select input
17	/RES	Reset
18	/CS1	Chip select signal
*19	BL+	Supply Voltage for backlight(+VE)
*20	BL-	Supply Voltage for backlight(-VE)

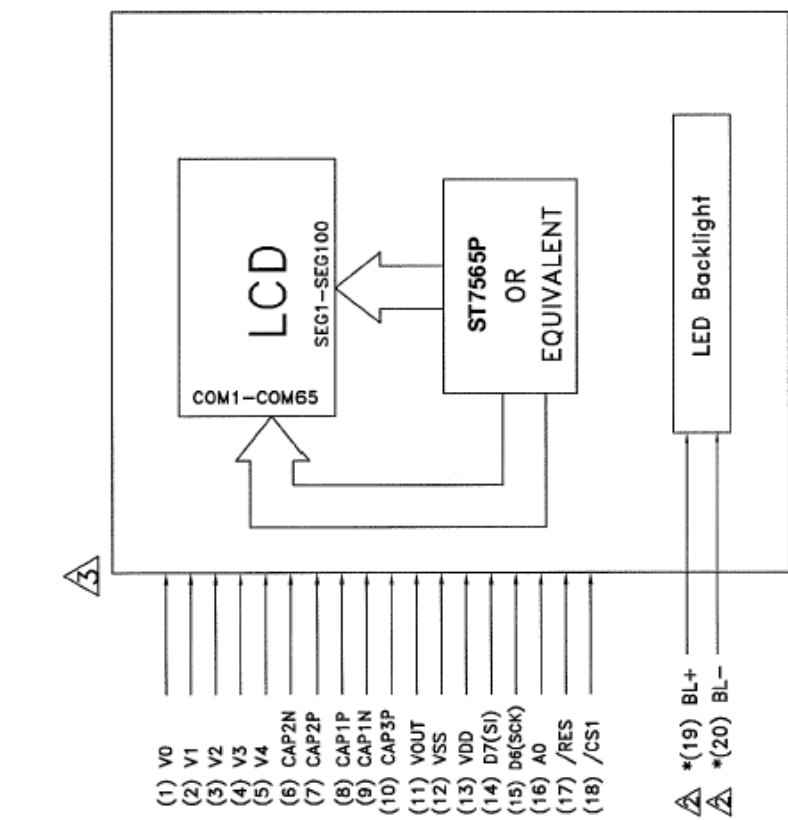
Note (*): Pin 19, 20 are for side-lited LED backlight versions only

COUNTER DRAWING OF MODULE DIMENSION



COUNTER DRAWING OF PIN OUT & BLOCK DIAGRAM

PIN NUMBER	SYMBOL	FUNCTION
1	V0	Power supply for LCD
2	V1	
3	V2	
4	V3	
5	V4	
6	CAP2N	Voltage converter
7	CAP2P	
8	CAP1P	
9	CAP1N	
10	CAP3P	
11	VOUT	Ground
12	VSS	
13	VDD	Supply voltage for logic
14	D7(SI)	Serial data input
15	D6(SCL)	Serial clock input
16	A0	Register select input
17	/RES	External reset input
18	/CS1	Chip select signal
19	BL+	Supply voltage for backlight(+VE)
20	BL-	Supply voltage for backlight(-VE)



(*Note: Pin19, 20 are used for backlight versions only.

TOLERANCE IF NOT SPECIFY ±0.5mm		SCALE N.T.S.	UNIT IN mm	CLOVER DISPLAY LTD. (HK)		SHEET 2 OF 3
REV.	REVISION RECORD	DATE	CUSTOMER	APPROVED	MODEL NO. CV9021A	
00	1st ISSUE	21 Oct 02	CUSTOMER		TITLE: BLOCK DIAGRAM	
01	Change heatseal version	29 Oct 02	AGENT	APPROVED	DRAWN BY: Chango	DATE : 08 Apr 08
02	Add Backlight & Dimension	08 Mar 04			CHECKED BY: [Signature]	DATE : 11 April 08
03	Change IC & module thickness	08 Apr 08			APPROVED BY: [Signature]	DATE : 12 April 08
			CUSTOMER REF.	OUR REF. X9021		

ELECTRICAL CHARACTERISTICS

Conditions: VSS=0V, @Ta=25°C

Item	Symbol	MIN.	TYP.	MAX.	Unit	Item	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage	VDD	3.05	3.30	3.55	V	“H”Level Input Voltage	VIH	0.8 VDD	—	VDD	V
Supply Current	IDD	—	150	—	μA	“L”Level Input Voltage	VIL	VSS	—	0.2 VDD	V
Operating voltage for LCD (*)	VOUT	11.8	12.0	12.2	V	—	—	—	—	—	—
EL Backlight Voltage (VEL)						Backlight Current					
EL (@ Frequency 400Hz)	—	—	—	—	—	—	—	—	—	—	—
Side-lited LED Backlight Forward Voltage (VF)						Side-lited LED Backlight Forward Current (IF)					
White	VBL	—	3.2	3.5	V	White	IBL	—	40	50	mA

Note (*): Please refer to Connection Example (4X Boosting Circuit)

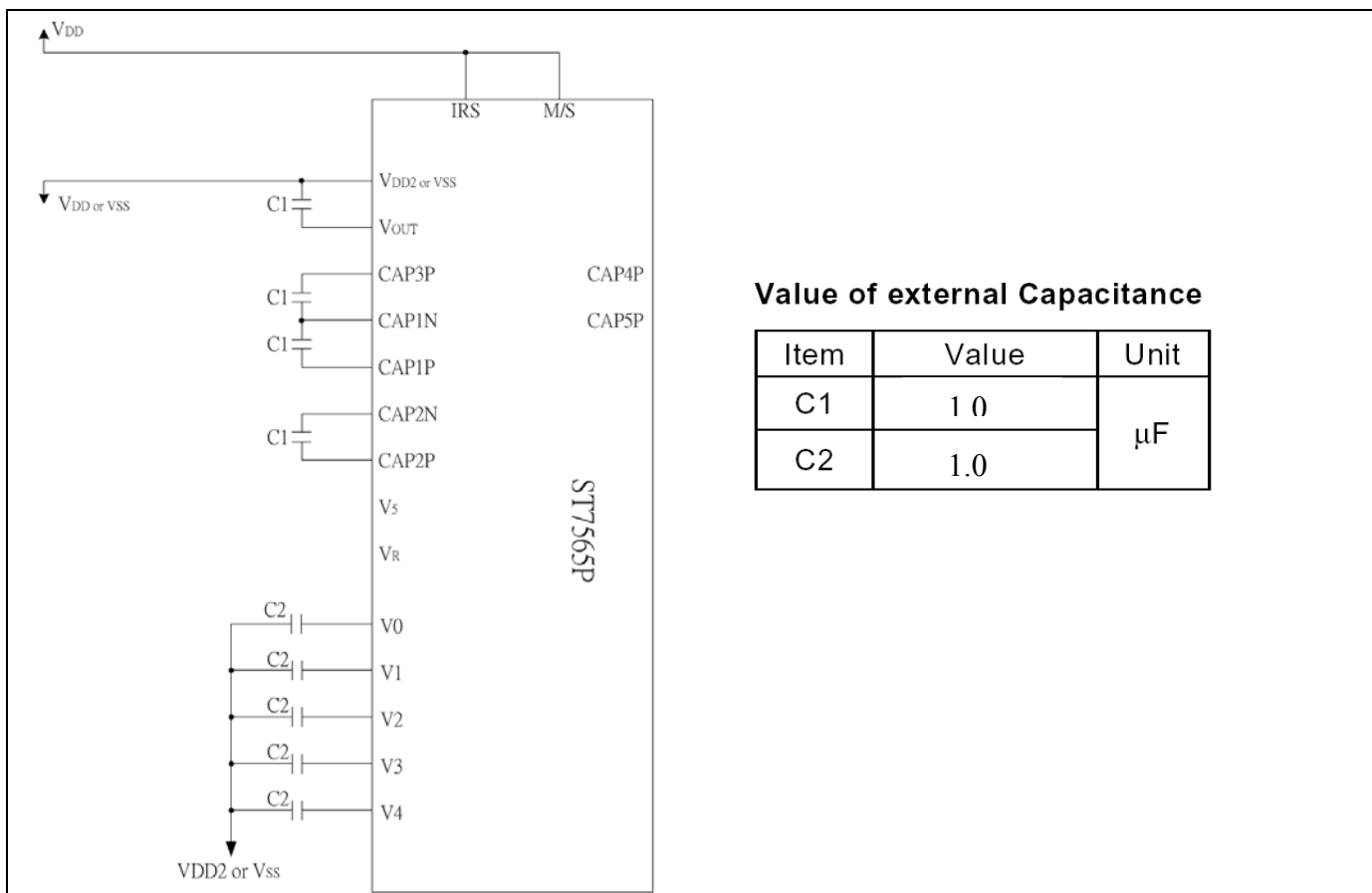
ABSOLUTE MAXIMUM RATINGS

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 3.6	-0.3 to 3.6	V
Input Voltage	Vin	-0.3 to VDD+0.3	-0.3 to VDD+0.3	V
Operating Temperature	Topr	0 to 50	-20 to 70	°C
Storage Temperature	Tstg	-10 to 60	-30 to 80	°C

CONNECTION EXAMPLE

4X Boosting Circuit



Value of external Capacitance

Item	Value	Unit
C1	1.0	μF
C2	1.0	

INSTRUCTION TABLE

Table 16: Table of ST7565P Commands

(Note) *: disabled data

Command	Command Code										Function		
	A0	/RD	/WR	D7	D6	D5	D4	D3	D2	D1		D0	
(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				Sets 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 drive voltage bias ratio 0: 1/9 bias, 1: 1/7 bias (ST7565P)
(12) Read/modify/write	0	1	0	1	1	1	0	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) V ₀ voltage regulator internal resistor ratio set	0	1	0	0	0	1	0	0	Resistor ratio			Select internal resistor ratio(R _b /R _a) mode	
(18) Electronic volume mode set	0	1	0	1	0	0	0	0	0	0	0	1	Set the V ₀ output voltage
Electronic volume register set				0	0	Electronic volume value						electronic volume register	
(19) Static indicator ON/OFF	0	1	0	1	0	1	0	1	1	0	0	1	0: OFF, 1: ON
Static indicator register set				0	0	0	0	0	0	0	0	Mode	Set the flashing mode
(20) Booster ratio set	0	1	0	1	1	1	1	1	0	0	0	0	select booster ratio 00: 2x,3x,4x 01: 5x 11: 6x
(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	

RECOMMENDED INITIAL SETTINGS

Initial Display Line : 40H
LCD Bias Select : A2H
Power Control : 2FH
Regulator Resistor Select : 26H
Set Reference Voltage Register : 36H
SHL Select : C8H

DISPLAY DATA RAM (DDRAM)

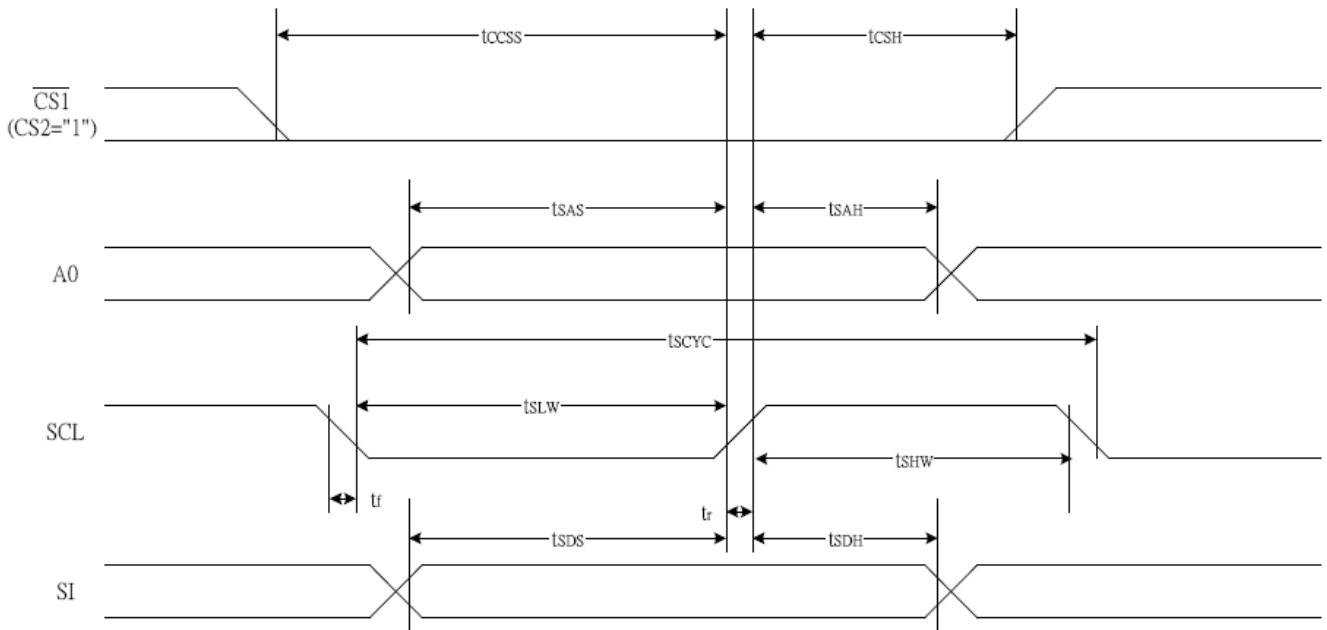
Page Address				Data	Line Address	COM Output
D3	D2	D1	D0			
0	0	0	0	D0	00H	COM0
				D1	01H	COM1
				D2	02H	COM2
				D3	03H	COM3
				D4	04H	COM4
				D5	05H	COM5
				D6	06H	COM6
				D7	07H	COM7
0	0	0	1	D0	08H	COM8
				D1	09H	COM9
				D2	0AH	COM10
				D3	0BH	COM11
				D4	0CH	COM12
				D5	0DH	COM13
				D6	0EH	COM14
				D7	0FH	COM15
0	0	1	0	D0	10H	COM16
				D1	11H	COM17
				D2	12H	COM18
				D3	13H	COM19
				D4	14H	COM20
				D5	15H	COM21
				D6	16H	COM22
				D7	17H	COM23
0	0	1	1	D0	18H	COM24
				D1	19H	COM25
				D2	1AH	COM26
				D3	1BH	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	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	COM43
				D4	2CH	COM44
				D5	2DH	COM45
				D6	2EH	COM46
				D7	2FH	COM47
0	1	1	0	D0	30H	COM48
				D1	31H	COM49
				D2	32H	COM50
				D3	33H	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	COM59
				D4	3CH	COM60
				D5	3DH	COM61
				D6	3EH	COM62
				D7	3FH	COM63
1	0	0	0	D0		COMS

S0	S1	S2	S3	S4	S5	S6	S7	S8	S123	S124	S125	S126	S127	S128	S129	S130	S131
80	81	82	83	84	85	86	87	88	0B	0C	0D	0E	0F	10	11	12	13

LCD Out	ADC	Column address
0	D0	
1	D0	

Regardless of the display start line address,
 1/65duty => 64th line,
 1/49duty => 48th line,
 1/33duty => 32th line,
 1/55duty => 54th line,
 1/53duty => 52th line.

SERIAL INTERFACE TIMING DIAGRAM

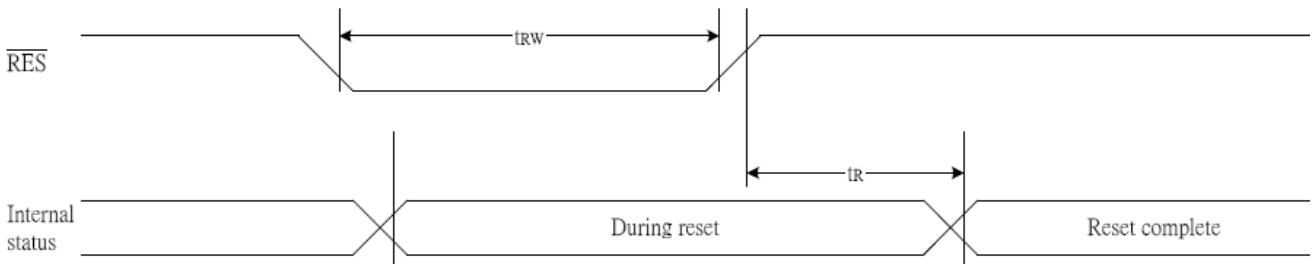


SERIAL INTERFACE TIMING CHARACTERISTICS

(VDD = 3.3V, Ta = -30 to 85°C)

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Serial Clock Period	SCL	T_{scyc}		50	—	ns
SCL "H" pulse width		T_{shw}		25	—	
SCL "L" pulse width		T_{slw}		25	—	
Address setup time	A0	T_{sas}		20	—	
Address hold time		T_{sah}		10	—	
Data setup time	SI	T_{sds}		20	—	
Data hold time		T_{sdh}		10	—	
CS-SCL time	CS	T_{css}		20	—	
CS-SCL time		T_{csh}		40	—	

RESET TIMING DIAGRAM



RESET TIMING

(VDD = 3.3V, Ta = -30 to 85°C)

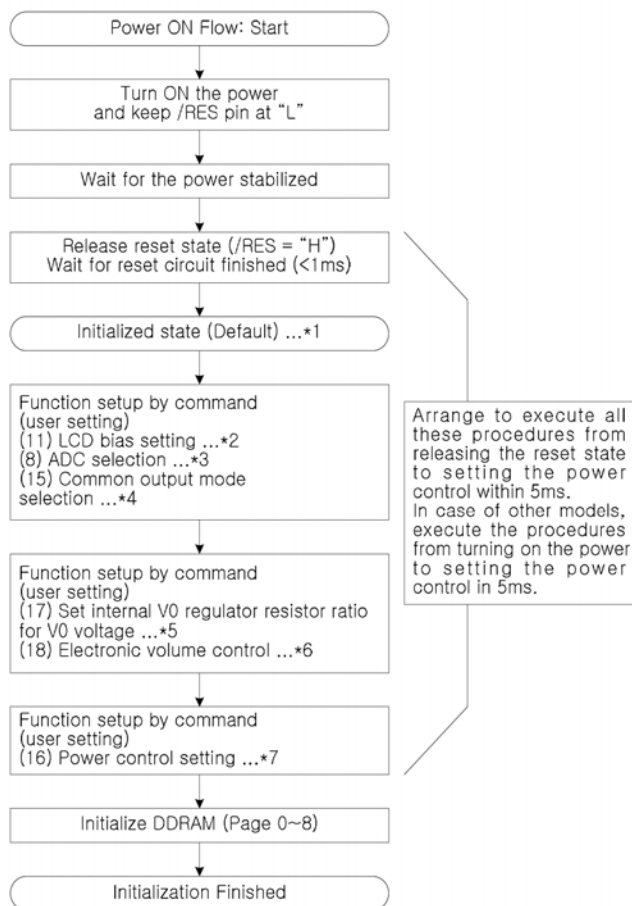
Item	Signal	Symbol	Condition	Rating			Units
				Min.	Typ.	Max.	
Reset time		t_r		—	—	1.0	us
Reset "L" pulse width	/RES	t_{RW}		1.0	—	—	us

THE RESET CIRCUIT

When the /RES 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 D0 = "L")
4. Power control register: (D2, D1, D0) = (0, 0, 0)
5. Serial interface internal register data clear
6. LCD power supply bias rate:
 - 1/65 DUTY = 1/9 bias
 - 1/49, 1/55, 1/53 DUTY = 1/8 bias
 - 1/33 DUTY = 1/6 bias
7. All-indicator lamps-on OFF (All-indicator lamps ON/OFF command D0 = "L")
8. Power saving clear
9. V₀ voltage regulator internal resistors Ra and Rb separation
10. Output conditions of SEG and COM terminals
SEG=VSS, COM=VSS
11. Read modify write OFF
12. Static indicator OFF Static indicator register : (D1, D2) = (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 :
(D5, D4, D3, D2, D1, D0) = (1, 0, 0, 0, 0, 0)
19. Test mode clear

INITIALIZATION METHOD



* The target time of 5ms will result to vary depending on the panel characteristics and the capacitance of the smoothing capacitor. Therefore, we suggest you to conduct an operation check using the actual equipment.

Notes: Refer to respective sections or paragraphs listed below.

*1: Description of functions; Resetting 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 V0 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. STN
RESPONSE TIME	T_{on}	ms	220
	T_{off}	ms	280
CONTRAST RATIO	Cr	-	12
VIEWING ANGLE (6 O'clock) $Cr \geq 2$	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 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	—

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

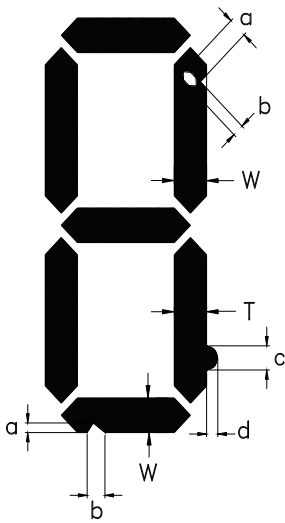
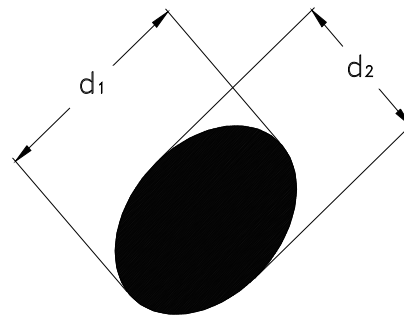
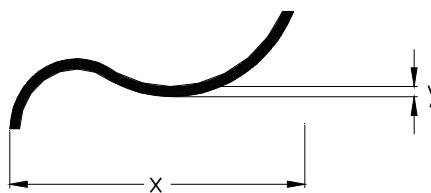


fig . 1



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

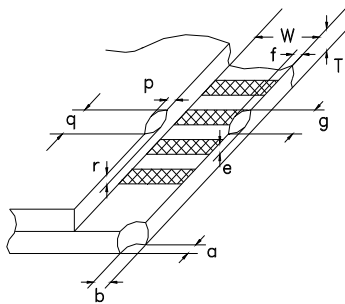


fig . 4

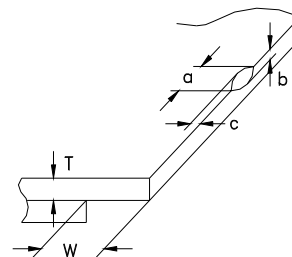


fig . 5

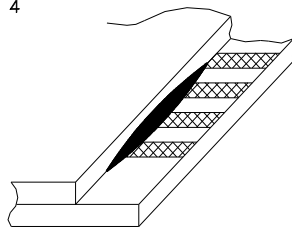


fig . 6

HANDLING PRECAUTIONS

(1) CAUTION OF LCD HANDLING & CLEANING

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.

Remove the protective film slowly and, if possible, under ESD control device like ion blower and humidity of working room should be kept over 50%RH to reduce risk of static charge.

(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) SOLDERING (for Pin type)

It is recommended to complete dip soldering at 270 °C or hand soldering at 280 °C within 3 seconds. The soldering position is at least 3mm apart from the pin head. Wave or reflow soldering are not recommended. Metal pins should not be soldered for more than 3 times and each soldering should be done after cool down of metal pins

(6) 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.