



**CLOVER DISPLAY LTD.**

## LCD MODULE SPECIFICATION

**Model: CV9007E - \_ \_ - \_ \_ - \_ \_ - \_ \_**

Revision	02
Engineering	Timmy Kwan
Date	18 November 2009
Our Reference	9026

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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:**

CV9007E- 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 : 128 X 64 dots, Graphic COG LCD module  
 Interface : 8-bit parallel  
 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	59.0 (L)x30.35(W)	mm
No Backlight (N)	64.0(L)x47.35(W)x2.9max.(H)	mm	Dot Pitch	0.4(L)x0.4(W)	mm
LED Sided Backlight(L)	64.0(L)x47.35(W)x7.0max.(H)	mm	Dot Size	0.35(L)x0.35(W)	mm

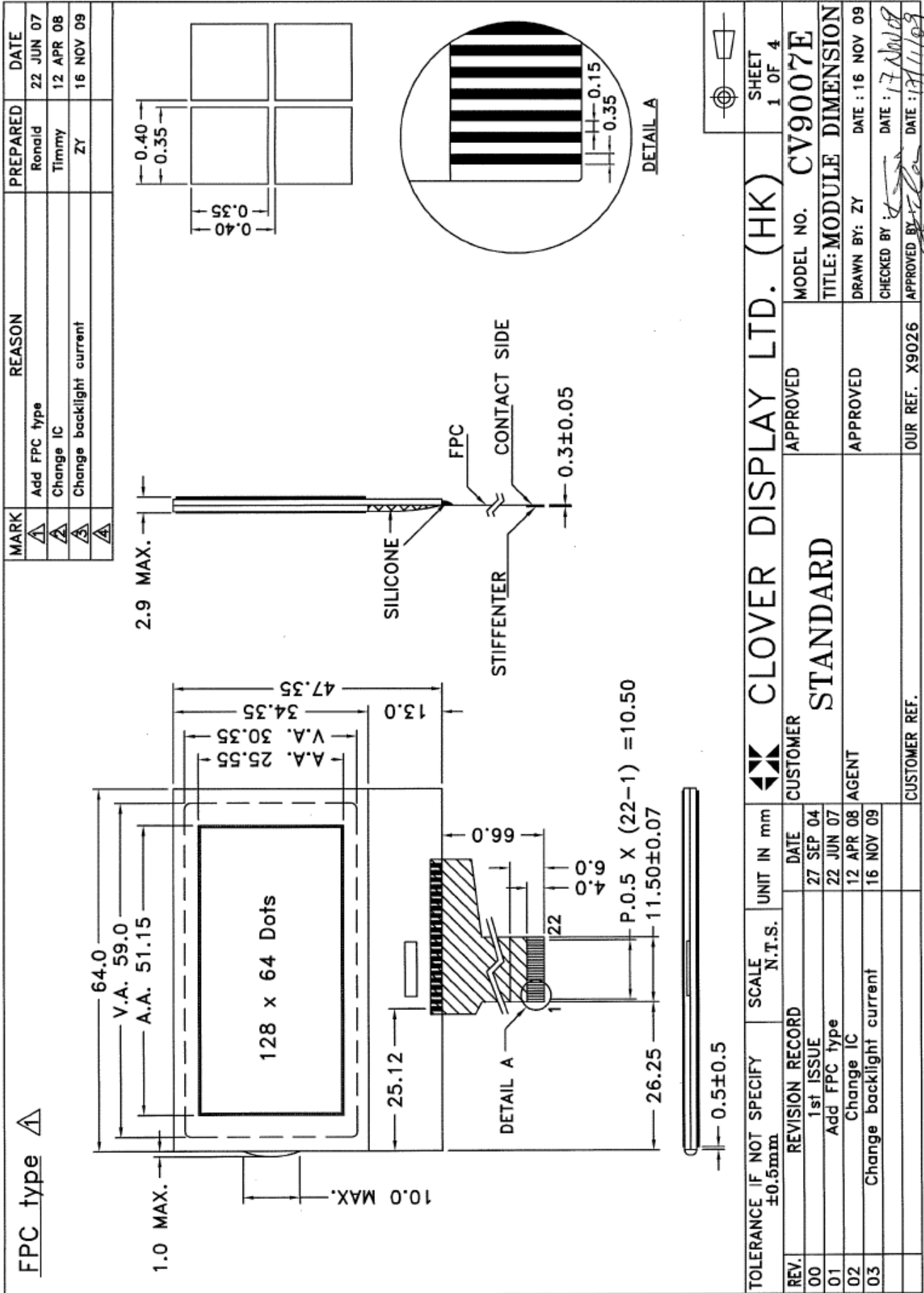
**CONNECTOR PIN ASSIGNMENT**

Pin No.	Symbol	Function	Pin No.	Symbol	Function
1	V0	Power supply for LCD	13	DB3	Data bus
2	V1		14	DB2	
3	V2		15	DB1	
4	V3		16	DB0	
5	V4		17	/RD(E)	Read signal
6	VOOUT	Voltage converter input	18	/WR(R/W)	Write signal
7	VSS	Ground	19	A0	Register select input
8	VDD	Power supply for logic	20	/RES	External reset input
9	DB7(SI)	Data bus	21	CS2	Chip select
10	DB6(SCL)		*22	NC	No connection
11	DB5		* 23	A	Supply voltage for backlight (+VE)
12	DB4		* 24	K	Supply voltage for backlight (-VE)

**Note (\*) : Pin 22 are for FPC type only.**

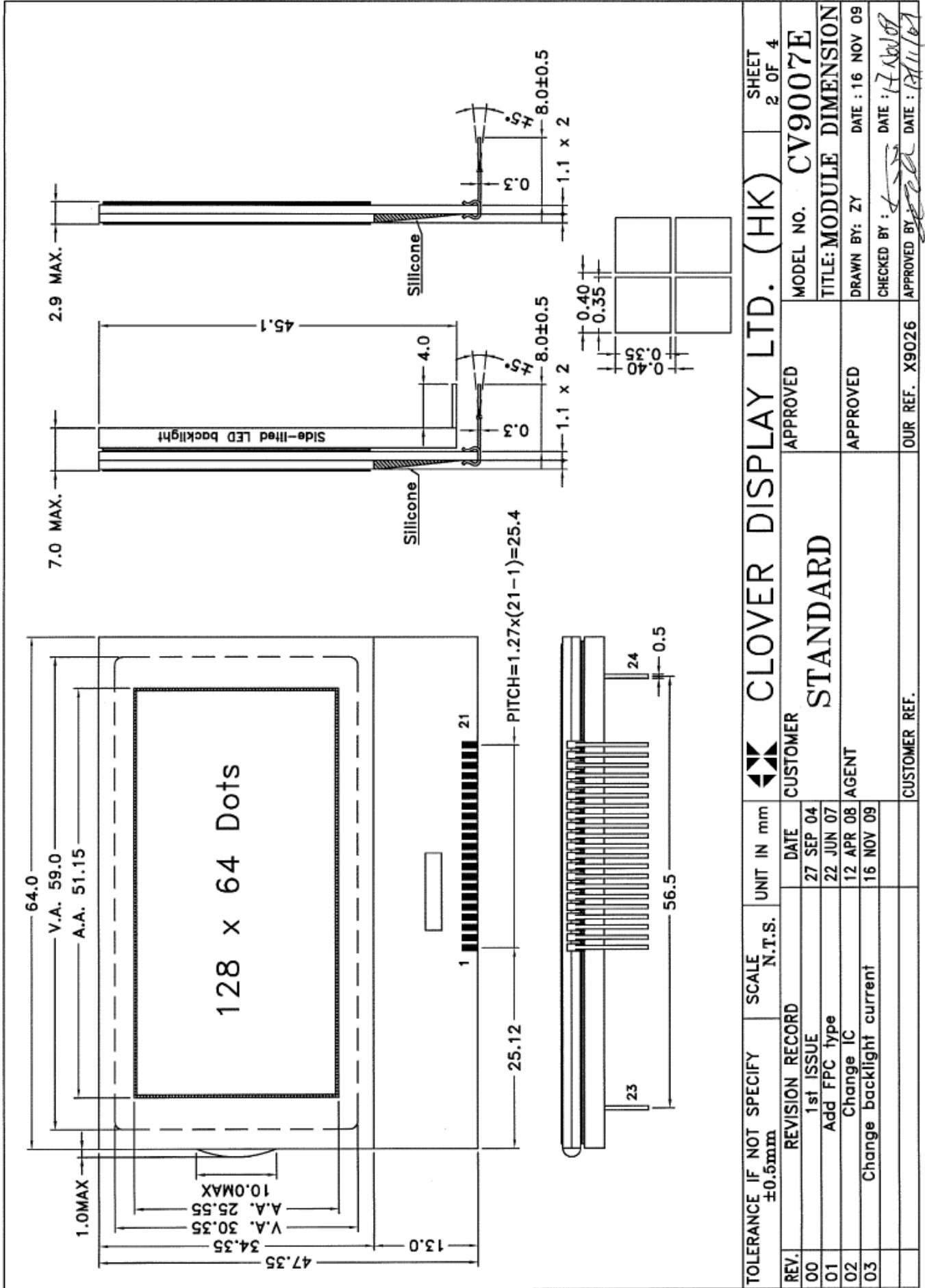
**Pin 23,24 are for backlight versions only.**

COUNTER DRAWING OF MODULE DIMENSION



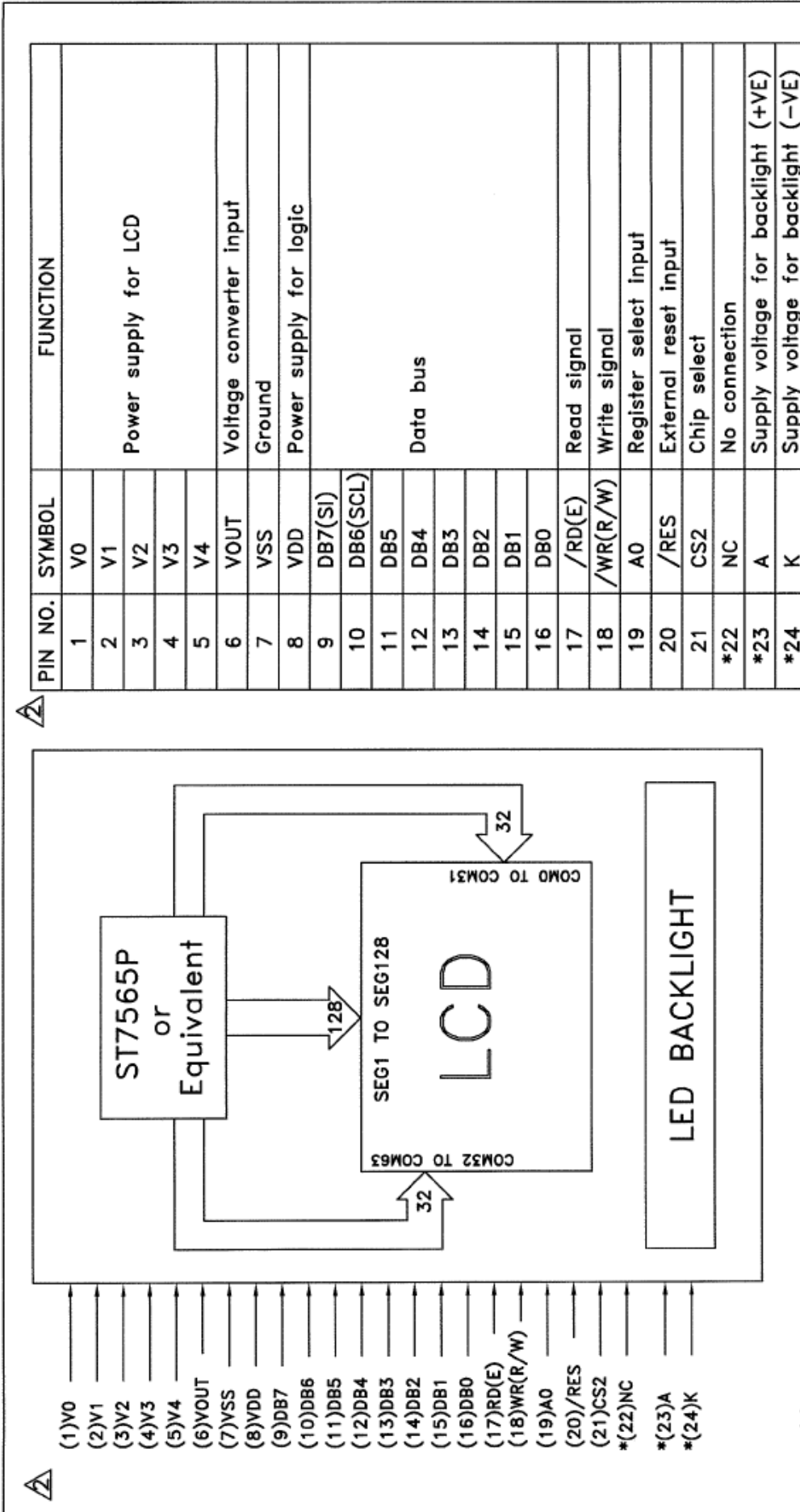
\*Special Code F must be used for FPC type

COUNTER DRAWING OF MODULE DIMENSION 2



TOLERANCE IF NOT SPECIFY ±0.5mm		SCALE N.T.S.	UNIT IN mm	CLOVER DISPLAY LTD. (HK)		SHEET 2 OF 4		
REV.	REVISION RECORD	DATE	CUSTOMER	APPROVED	MODEL NO.	CV9007E		
00	1st ISSUE	27 SEP 04	STANDARD	APPROVED	TITLE:	MODULE DIMENSION		
01	Add FPC type	22 JUN 07			DRAWN BY:	ZY	DATE:	16 NOV 09
02	Change IC	12 APR 08			CHECKED BY:		DATE:	17 Nov 09
03	Change backlight current	16 NOV 09	CUSTOMER REF.	OUR REF.	X9026	APPROVED BY:		

COUNTER DRAWING OF PIN OUT & BLOCK DIAGRAM



Note (\*) : Pin 22 are for FPC type versions only.  
 Pin 23,24 are for backlight versions only.

TOLERANCE IF NOT SPECIFY ±0.5mm		SCALE N.T.S.	UNIT IN mm	CLOVER DISPLAY LTD. (HK)		SHEET 3 OF 4
REV.	REVISION RECORD	DATE	CUSTOMER	APPROVED	MODEL NO.	CV9007E
00	1st ISSUE	27 SEP 04	STANDARD		TITLE: PIN OUT & BLOCK DIAGRAM	
01	Add FPC type	22 JUN 07	AGENT	APPROVED	DRAWN BY: ZY	DATE: 16 NOV 09
02	Change IC	12 APR 08			CHECKED BY: <i>[Signature]</i>	DATE: 17 Nov 09
03	Change backlight current	16 NOV 09			APPROVED BY: <i>[Signature]</i>	DATE: <i>[Signature]</i>
			CUSTOMER REF.	OUR REF. X9026		

**ELECTRICAL CHARACTERISTICS**

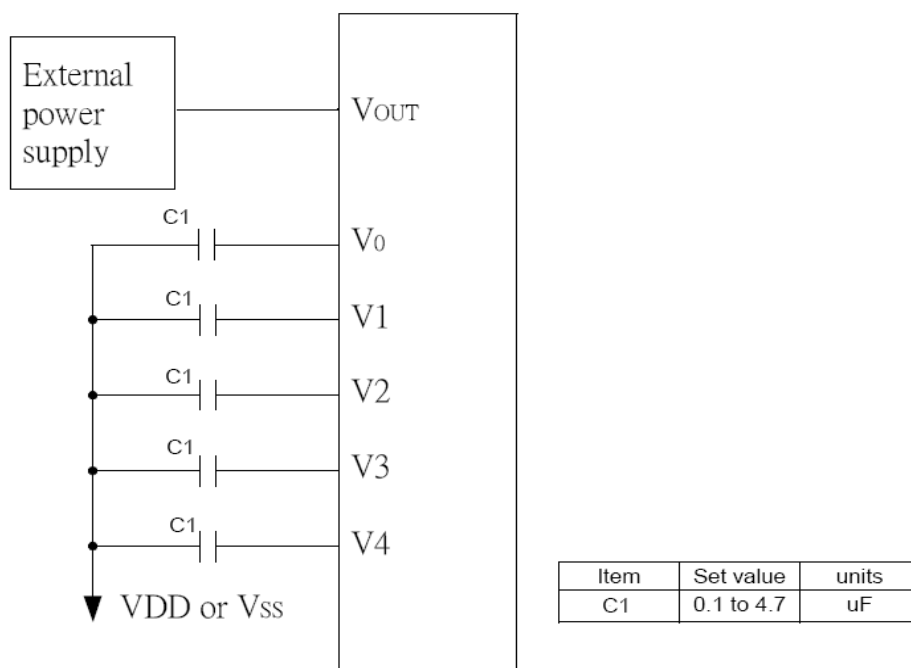
Conditions: VSS=0V, @Ta=25°C

Item	Symbol	MIN.	TYP.	MAX.	Unit	Item	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage	VDD	2.75	3.00	3.25	V	“H”Level Input Voltage	VIH	0.8VDD	—	VDD	V
Supply Current	IDD	—	13	30	μA	“L”Level Input Voltage	VIL	VSS	—	0.2VDD	V
Voltage Converter input	VLCD	11.8	12.0	12.2	V	—	—	—	—	—	—
<b>EL Backlight Voltage (VEL)</b>						<b>Backlight Current</b>					
EL (@ Frequency 400Hz)	—	—	—	—	—	—	—	—	—	—	—
<b>Side-lited LED Backlight Forward Voltage (VF)</b>						<b>Side-lited LED Backlight Forward Current (IF)</b>					
White	VBL	—	3.5	—	V	White	IBL	26	30	35	mA
Blue	VBL	—	3.3	4.0	V	Blue	IBL	—	80	—	mA
Yellow Green	VBL	—	2.0	2.4	V	Yellow Green	IBL	—	80	—	mA

Note: To operate this module, please note the follow software settings.

- 1) Power Control Register (VC, VR, VF)=(0, 1, 1)
- 2) V0 voltage regulator internal resistor ratio set=(1, 1, 1)
- 3) Electronic volume register set=(1, 0, 1, 1, 1, 0)
- 4) For Optimum Contrast VLCD=12.0V±0.2V

**REFERENCE CIRCUIT EXAMPLE**



**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
Operating Temperature	Topr	0 to 50	-20 to 70	°C
Storage Temperature	Tstg	-10 to 60	-30 to 80	°C

## INSTRUCTIONS 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					0	Sets the display RAM display start line address	
(3) Page address set	0	1	0	1	0	1	1	Page address				0	Sets the display RAM page address
(4) Column address set upper bit	0	1	0	0	0	0	1	Most significant column address				0	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				0	Sets the least significant 4 bits of the display RAM column address.
(5) Status read	0	0	1	Status				0	0	0	0	0	Reads the status data
(6) Display data write	1	1	0	Write data							0	Writes to the display RAM	
(7) Display data read	1	0	1	Read data							0	Reads from the display RAM	
(8) ADC select	0	1	0	1	0	1	0	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	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	0	Clear read/modify/write
(14) Reset	0	1	0	1	1	1	0	0	0	1	0	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			0	Select internal power supply operating mode
(17) V0 voltage regulator internal resistor ratio set	0	1	0	0	0	1	0	0	Resistor ratio			0	Select internal resistor ratio(Rb/Ra) mode
(18) Electronic volume mode set	0	1	0	1	0	0	0	0	0	0	0	1	Set the V0 output voltage electronic volume register
Electronic volume register set				0	0	Electronic volume value				0			
(19) Static indicator ON/OFF	0	1	0	1	0	1	0	1	1	0	0	0	0: OFF, 1: ON Set the flashing mode
Static indicator register set				0	0	0	0	0	0	0	0	0	
(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	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**

- LCD Bias Select : A2H
- ADC Select: A0H
- Common output mode select : C0H
- Regulator Resistor Select : 27H
- Electronic volume register set : 2EH
- Power control set: 2BH

**DISPLAY DATA RAM**

The display data RAM stores the dot data for the LCD. It has a 65 (8 page x 8 bit +1) x 132 bit structure. As is shown in Figure 3, the D7 to D0 display data from the MPU corresponds to the LCD display common direction; there are few constraints at the time of display data transfer when multiple ST7565P are used, thus and display structures can be created easily and with a high degree of

freedom. Moreover, reading from and writing to the display RAM from the MPU side is performed through the I/O buffer, which is an independent operation from signal reading for the liquid crystal driver. Consequently, even if the display data RAM is accessed asynchronously during liquid crystal display, it will not cause adverse effects on the display (such as flickering).

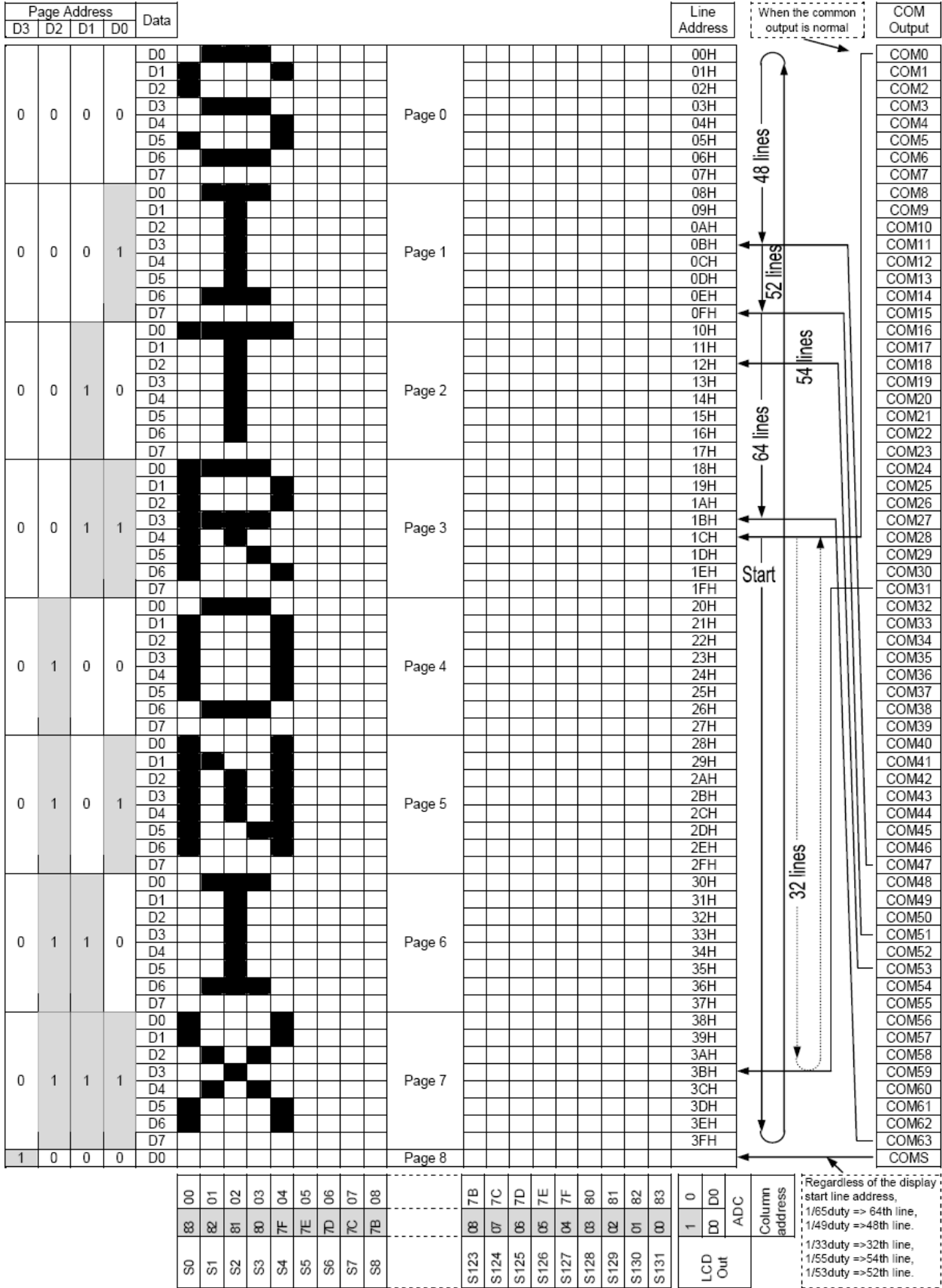
D0	0	1	1	1		0
D1	1	0	0	0		0
D2	0	0	0	0		0
D3	0	1	1	1		0
D4	1	0	0	0		0
-						

Display data RAM

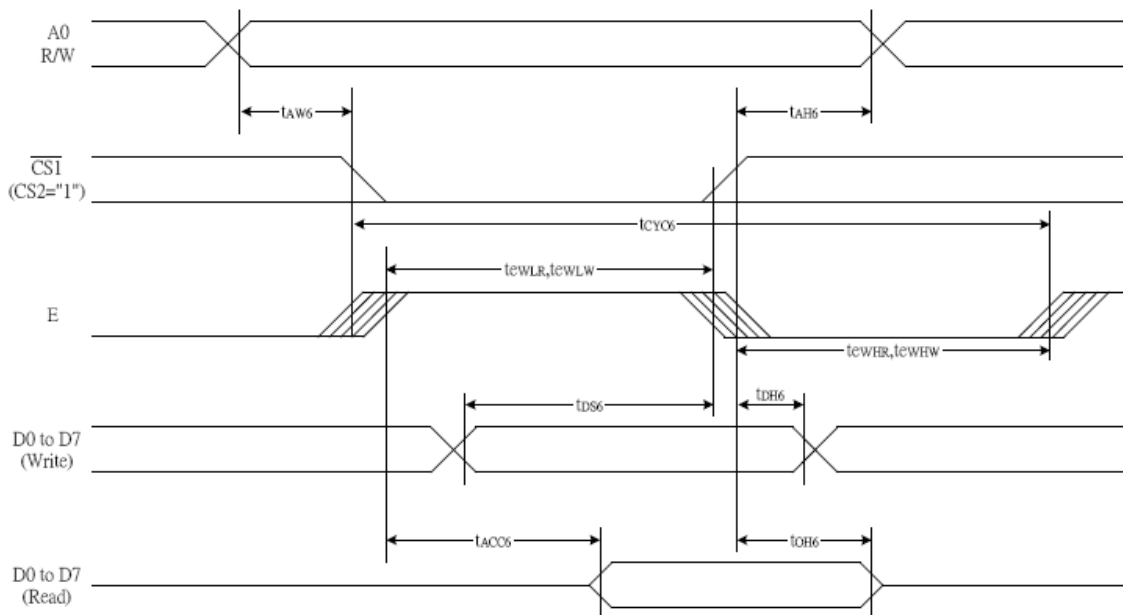
COM0						
COM1						
COM2						
COM3						
COM4						
-						

Liquid crystal display

DISPLAY DATA RAM MAP



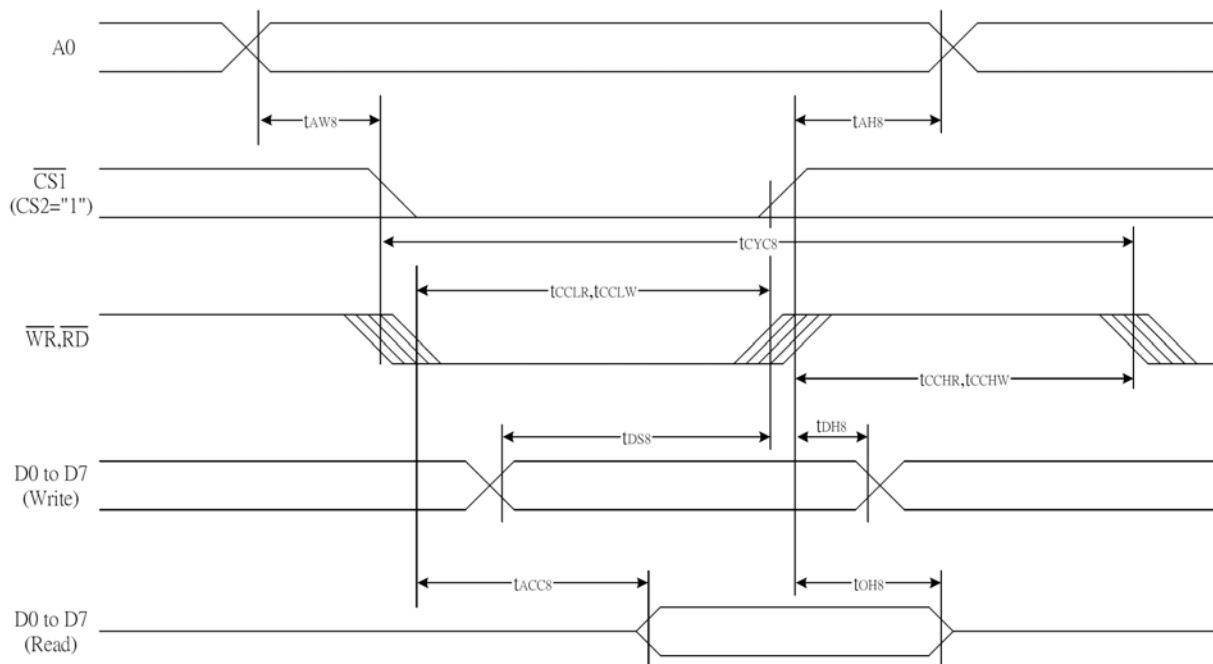
**READ / WRITE CHARACTERISTICS (6800 SERIES)**



(VDD = 3.3V, Ta = -30 to 85°C)

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Address hold time	A0	$t_{AH6}$		0	—	ns
Address setup time		$t_{AW6}$		0	—	
System cycle time		$t_{CYC6}$		240	—	
Enable L pulse width (WRITE)	WR	$t_{EWLW}$		80	—	
Enable H pulse width (WRITE)		$t_{EWHW}$		80	—	
Enable L pulse width (READ)	RD	$t_{EWLR}$		80	—	
Enable H pulse width (READ)		$t_{EWHR}$		140	—	
WRITE Data setup time	D0 to D7	$t_{DS6}$		40	—	
WRITE Address hold time		$t_{DH6}$		0	—	
READ access time		$t_{ACC6}$	CL = 100 pF	—	70	
READ Output disable time		$t_{OH6}$	CL = 100 pF	5	50	

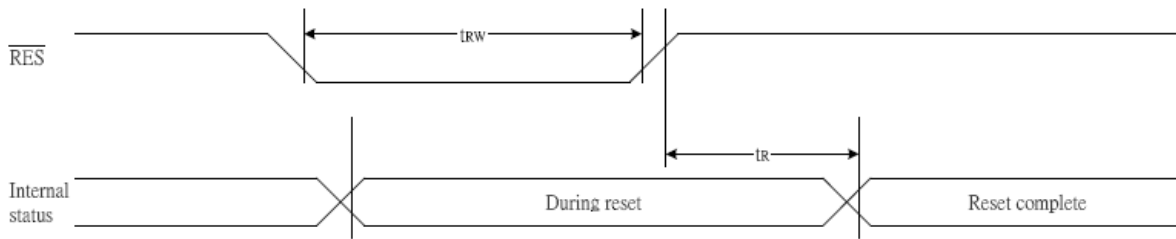
**READ / WRITE CHARACTERISTICS (8080 SERIES)**



(VDD = 3.3V, Ta = -30 to 85°C)

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Address hold time	A0	tAHS		0	—	Ns
Address setup time		tAWS		0	—	
System cycle time		tCYCS		240	—	
Enable L pulse width (WRITE)	WR	tCCLW		80	—	
Enable H pulse width (WRITE)		tCCHW		80	—	
Enable L pulse width (READ)	RD	tCCLR		140	—	
Enable H pulse width (READ)		tCCHR		80	—	
WRITE Data setup time	D0 to D7	tDSS		40	—	
WRITE Address hold time		tDH8		0	—	
READ access time		tACC8	CL = 100 pF	—	70	
READ Output disable time		tOHS	CL = 100 pF	5	50	

**RESET INPUT TIMING**



(VDD = 3.3V, Ta = -30 to 85°C)

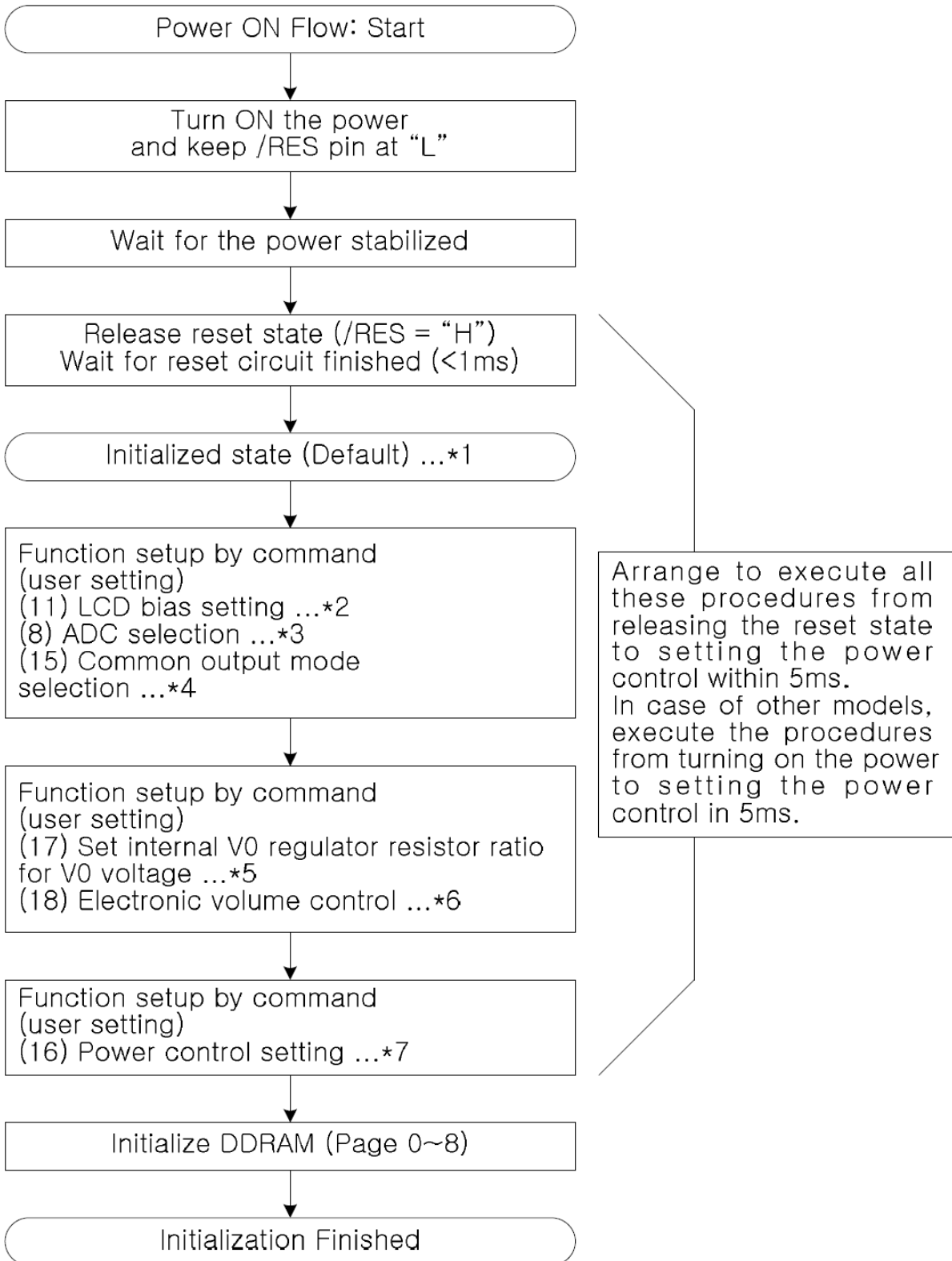
Item	Signal	Symbol	Condition	Rating			Units
				Min.	Typ.	Max.	
Reset time		t <sub>R</sub>		—	—	1.0	us
Reset "L" pulse width	/RES	t <sub>RW</sub>		1.0	—	—	us

## 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.  $V_0$  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.  $V_0$  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

## INITIALIZING WITH THE BUILT-IN POWER SUPPLY CIRCUITS



**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	Ton	ms	220
	Toff	ms	280
CONTRAST RATIO	Cr	-	12
VIEWING ANGLE (6 O'clock) 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	—

**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 (d<sub>1</sub>,d<sub>2</sub>)

\*\* N. A . = NOT APPLICABLE

DEFECT TABLE : B

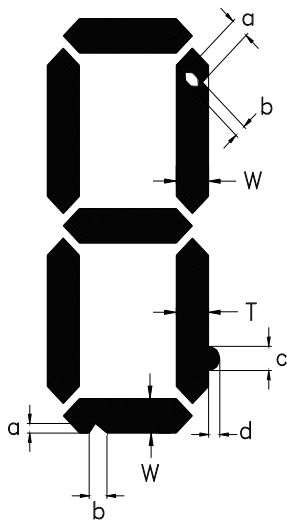
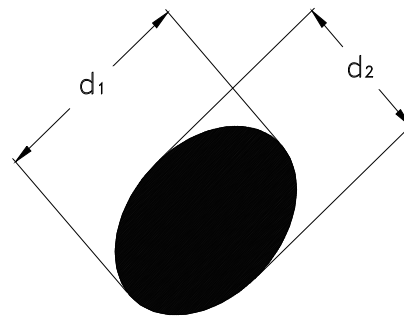
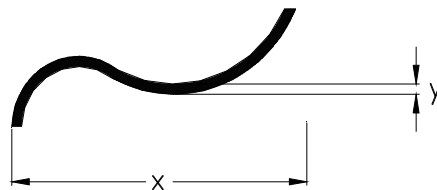


fig . 1



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

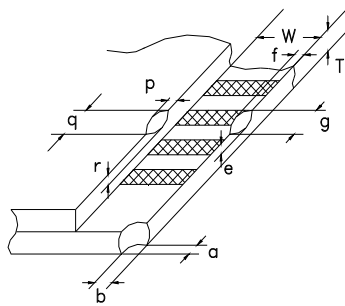


fig . 4

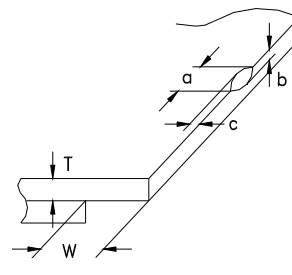


fig . 5

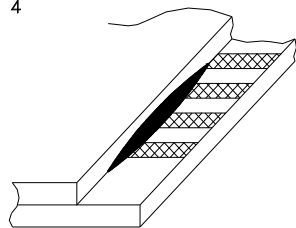


fig . 6

## HANDLING PRECAUTIONS

### (1) CAUTION OF LCD HANDLING & CLEANING

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.