



CLOVER DISPLAY LTD.

LCD MODULE SPECIFICATION

Model: CV9004A - _ _ - _ _ - _ _ - _ _

Revision	05
Engineering	Timmy Kwan
Date	08 JUN 2009
Our Reference	9004

ADDRESS : ROOM 1006, 10/F WESTIN CENTRE, 26 HUNG TO ROAD, KWUN TONG,
KOWLOON, HONG KONG.

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

FAX : (852) 2357 4237 (SALES OFFICE) (852) 2341 8785 (GENERAL OFFICE)

E-MAIL : cdl@cloverdisplay.com

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

MODE OF DISPLAY

Display mode	Display condition	Viewing direction
TN positive	Reflective type	6 O' clock
TN negative	Transflective type	12 O' clock
	Transmissive type	3 O' clock
	Others	9 O' clock

LCD MODULE NUMBER NOTATION:

CV9004A- 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 : 10 Alphanumerics + Icons, COG LCD module
 Driving method : 1/4 Duty, 1/3Bias
 Interface : I²C serial
 Controller IC : Philips PCF8576 or equivalent
 For the detailed information, please refer to IC specifications.

MECHANICAL DIMENSIONS

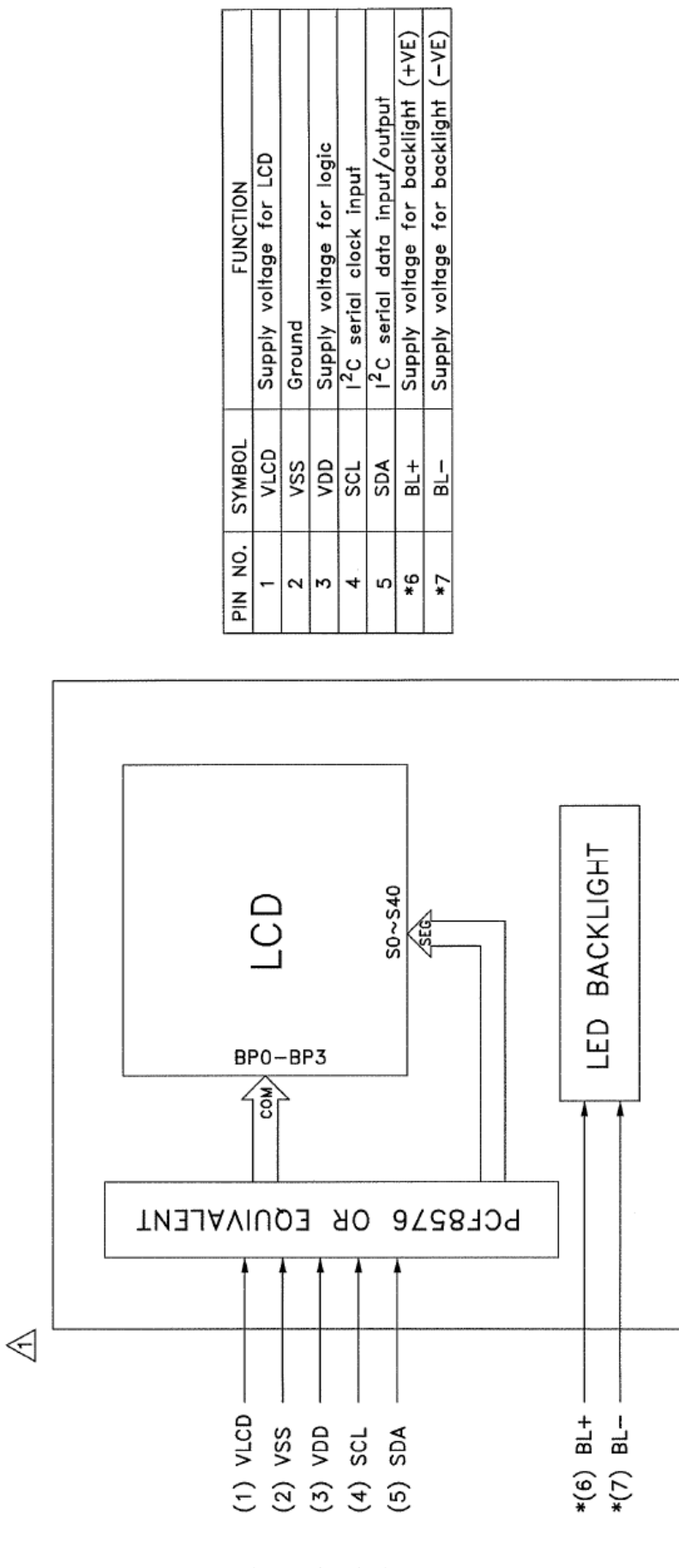
Item	Dimension	Unit
Outline Dimension	42.0(L)x19.5(W)x2.9 Max.(H) [Non backlight version]	mm
	42.0(L)x19.5(W)x6.7 Max.(H) [LED backlight version]	mm
Viewing Area	39.0(L)x9.2(W)	mm

CONNECTOR PIN ASSIGNMENT

Pin No.	Symbol	Function
1	VLCD	Supply Voltage for LCD
2	VSS	Ground
3	VDD	Supply Voltage for Logic
4	SCL	I ² C Serial Clock Input
5	SDA	I ² C Serial Data Input/ Output
*6	BL+	Supply voltage for backlight (+VE)
*7	BL-	Supply voltage for backlight (-VE)

Note (*): Pin 6, 7 are for backlight version only

COUNTER DRAWING OF MODULE DIMENSION



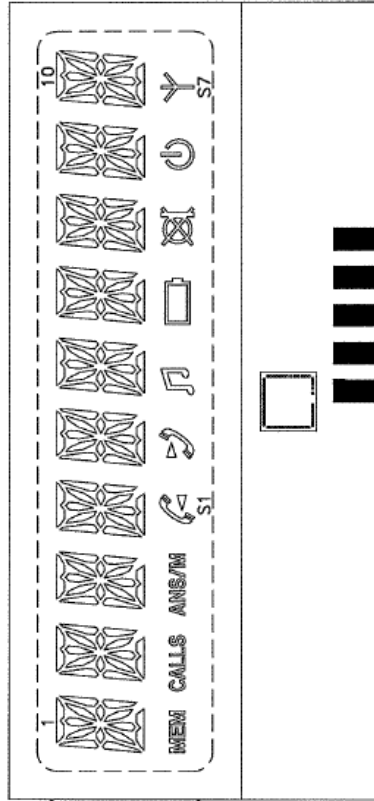
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Note(*) : Pin6, 7 are for backlight versions only

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. CV9004A	
00	1st ISSUE	26 Feb 04	AGENT	APPROVED	TITLE: PIN OUT & BLOCK DIAGRAM	
01	Add backlight information	02 Jun 09			DRAWN BY: CGL	DATE: 02 JUN 09
					CHECKED BY: <i>dejun 09</i>	DATE: <i>dejun 09</i>
					APPROVED BY: <i>dejun 09</i>	DATE: <i>dejun 09</i>
			CUSTOMER REF.	OUR REF. X9004		

COUNTER DRAWING OF ICON MAPPING

IC PIN	BP0	BP1	BP2	BP3	IC PIN	BP0	BP1	BP2	BP3
S0	/	1F	1E	1D	S20	/	6F	6E	6D
S1	1H	1G	1N	1M	S21	6H	6G	6N	6M
S2	1I	1J	1K	1L	S22	6I	6J	6K	6L
S3	1A	1B	1C	MEM	S23	6A	6B	6C	S3
S4	/	2F	2E	2D	S24	/	7F	7E	7D
S5	2H	2G	2N	2M	S25	7H	7G	7N	7M
S6	2I	2J	2K	2L	S26	7I	7J	7K	7L
S7	2A	2B	2C	CALLS	S27	7A	7B	7C	S4
S8	/	3F	3E	3D	S28	/	8F	8E	8D
S9	3H	3G	3N	3M	S29	8H	8G	8N	8M
S10	3I	3J	3K	3L	S30	8I	8J	8K	8L
S11	3A	3B	3C	ANS/M	S31	8A	8B	8C	S5
S12	/	4F	4E	4D	S32	/	9F	9E	9D
S13	4H	4G	4N	4M	S33	9H	9G	9N	9M
S14	4I	4J	4K	4L	S34	9I	9J	9K	9L
S15	4A	4B	4C	S1	S35	9A	9B	9C	S6
S16	/	5F	5E	5D	S36	/	10F	10E	10D
S17	5H	5G	5N	5M	S37	10H	10G	10N	10M
S18	5I	5J	5K	5L	S38	10I	10J	10K	10L
S19	5A	5B	5C	S2	S39	10A	10B	10C	S7



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00	1st Issue	26 Feb 04	AGENT	APPROVED	TITLE: ICON MAPPING	
01	Add backlight information	02 JUN 09	CUSTOMER REF.	OUR REF. X9004	DRAWN BY: CGL	DATE: 02 JUN 09
					CHECKED BY: <i>[Signature]</i>	DATE: <i>04 Jun 09</i>
					APPROVED BY: <i>[Signature]</i>	DATE: <i>04 Jun 09</i>

ELECTRICAL CHARACTERISTICS

Conditions: VSS=0V, @Ta=25

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	0.7VDD	-	VDD	V
Supply Current	IDD	-	20	-	μA	“L”Level Input Voltage	VIL	0	-	0.3VDD	V
Supply Voltage for LCD	VLCD	-0.20	0	0.20	V	-	-	-	-	-	-
EL Backlight Voltage(VEL)											
EL (@ Frequency 400Hz)	-	-	-	-	-	-	-	-	-	-	-
Side-lited LED Backlight Forward Voltage (VF) *						Side-lited LED Backlight Forward Current (IF)					
White	VBL	-	5.0	-	V	White	IBL	-	35	40	mA
Blue	VBL	-	-	-	V	Blue	IBL	-	-	-	mA
Yellow Green	VBL	-	2.0	-	V	Yellow Green	IBL	-	40	50	mA
Array LED Backlight Forward Voltage (VF)						Array LED Backlight Forward Current (IF)					
Yellow Green	-	-	-	-	V	Yellow Green	-	-	-	-	mA
Amber	-	-	-	-	V	Amber	-	-	-	-	mA
Orange	-	-	-	-	V	Orange	-	-	-	-	mA
Soft Orange	-	-	-	-	V	Soft Orange	-	-	-	-	mA

*To meet the optimum brightness, the backlight should be driven by constant voltage

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	7.0	7.0	V
Input Voltage	VIN	-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	

INSTRUCTION TABLE

command/opcode	options		description
MODE SET	LCD drive mode	bits M1 M0	Defines LCD drive mode
	static(1 BP)	0 1	
C 10 LP E B M1 MO	1:2 MUX(2BP)	1 0	
	1:3 MUX(3BP)	1 1	
	1:4 MUX(4BP)	0 0	
	LCD bias	bits B	Defines LCD bias configuration
	1/3 bias	0	
	1/2 bias	1	
	display status	bits E	Defines display status
	disabled(blank)	0	The possibility to disable the display
	enable	1	allows implementation of blinking under external control
	mode	bits LP	Defines power dissipation mode
	normal mode	0	
	power-saving mode	1	
LOAD DATA POINTER			Six bits of immediate data, bits P5 to P0
C 0 P5 P4 P3 P2 P1 P0	Bits P5 P4 P3 P2 P1 P0		are transferred to the data pointer to
	6-bits binary value of 0 to 39		define one of forty display RAM addresses
DEVICE SELECT	Bits A0 A1 A2		Three bits of immediate data, bits A0 to A2 ,are transferred to the subaddress
C 1 1 0 0 A2 A1 A0	3-bits binary value of 0 to 7		counter to define one of eight hardware subaddress
BANK SELECT	static	1:2 MUX	bits I
C 1 1 1 1 0 I O	RAM bits 0	RAM bit 0,1	0 (storage of arriving display Data)
	RAM bits 2	RAM bits 2,3	1
	static	1:2 MUX	bits O
	RAM bit 0	RAM bits 0,1	0 (retrival of LCD display data)
	RAM bit 2	RAM bits 2,3	1
			The BANK SELECT command has no effect in 1:3 and 1:4 multiplex drive modes
BLINK			Defines the blinking frequency
C 1 1 1 0 A BF1 BF0	blink frewency	bits BF1 BF0	
	off	0 0	
	2Hz	0 1	
	1Hz	1 0	
	0,5Hz	1 1	
	blink mode	bits A	Select the blinking mode;
	normal blinking	0	normal operation with frequency
	aiteration blinking	1	set by bits BF1,BF0,or blinking by
			Alternation blinking does not apply in
			1:3 and 1: 4 multiplex drive modes

I²C BUS ADDRESS OF THE MODULE

I²C-bus slave address (SA0) = 0

Hardware address (A0, A1, A2) = 000

TIMING CHARACTERISTICS OF COMPATIBLE CONTROLLER CHIPS

Parameters	Symbol	Recommended timing	Parameters	Symbol	Recommended timing
Bus free time	tBUF(min)	105µs	Data hold time	tHD(min)	365µs
Start condition hold time	tHD(min)	365µs	Data Set-up Time	tSU (min)	250ns
SCL LOW time	tLOW(min)	105µs	Rise time	tR(max)	1µs
SCL HIGH time	tHIGH (min)	365µs	Fall Time	tF(max)	300ns
Start condition set-up time	tSU(min)	105µs	Stop condition set-up time	tSU(min)	105µs
	tSU(max)	155µs		tS(max)	155µs

Figure 1 Bit transfer Timing Diagram

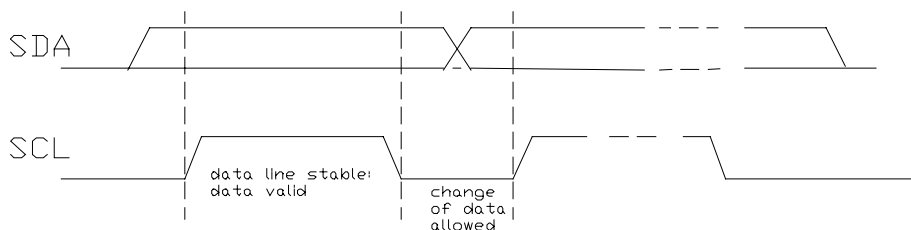


Figure 2 Definition of start and stop condition

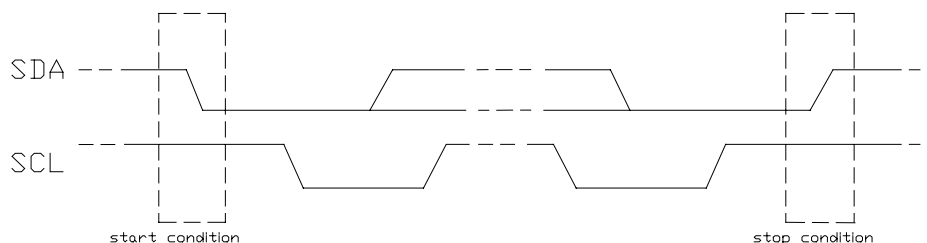
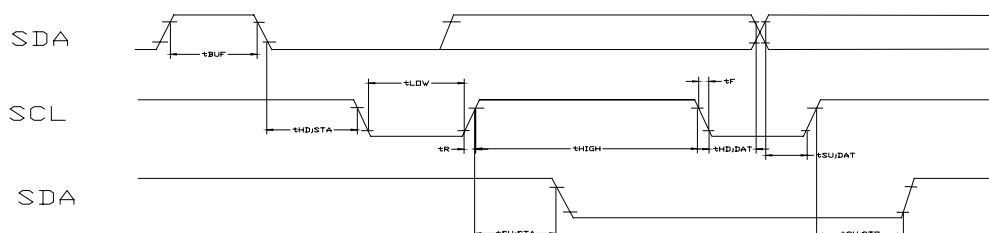


Figure 3 Timing Characteristics of I²C bus low-speed mode



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
RESPONSE TIME	Ton	ms	85
	Toff	ms	115
CONTRAST RATIO	Cr	-	12
VIEWING ANGLE (6 O'clock) Cr ≥ 2	V3:00	$^\circ$	70
	V6:00	$^\circ$	55
	V9:00	$^\circ$	70
	V12:00	$^\circ$	15

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

SAMPLING METHOD

SAMPLING PLAN: MIL-STD 105E

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

QUALITY STANDARD OF LCD MODULE

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
	$0.3 < d \leq 0.4$ QTY \leq 1		
	$0.4 < d$ QTY=0		
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

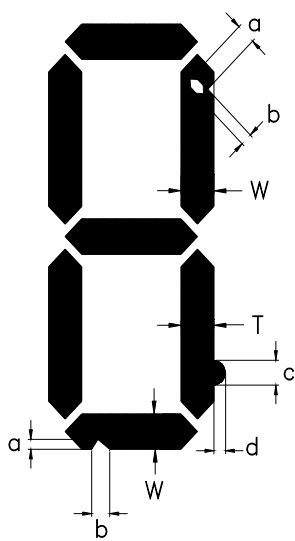
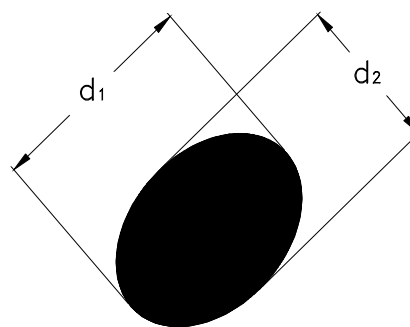
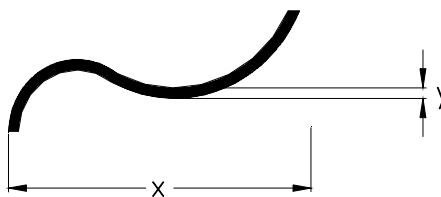


fig . 1



POLARIZER BUBBLES / SPOTS
fig . 2



LINE SCRATCHES / BLACK LINE
fig . 3

QUALITY STANDARD OF LCD MODULE (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

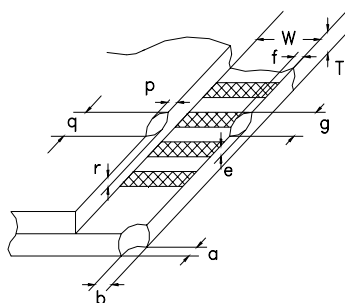


fig . 4

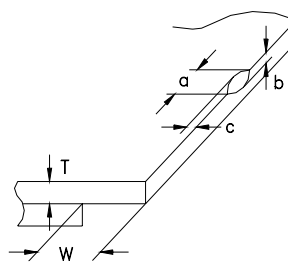


fig . 5

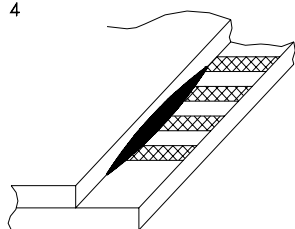


fig . 6

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.

(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.