CLOVER DISPLAY LTD.

LCD MODULE SPECIFICATION

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

Revision	07
Engineering	Kemp Huang
Date	03 NOV 2014
Our Reference	9004

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	:	I^2C serial
Controller IC	:	Philips PCF8576 or equivalent
		For the detailed information, please refer to IC specifications.

MECHANICAL DIMENSIONS

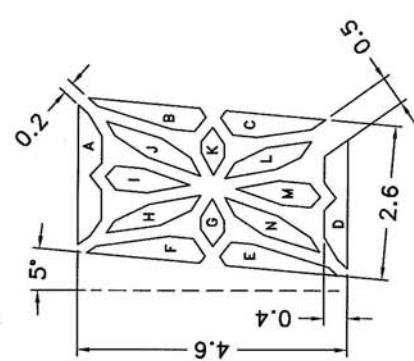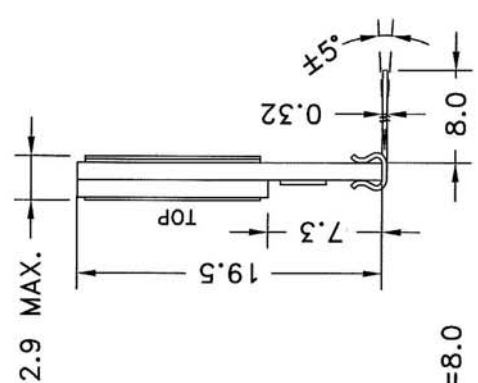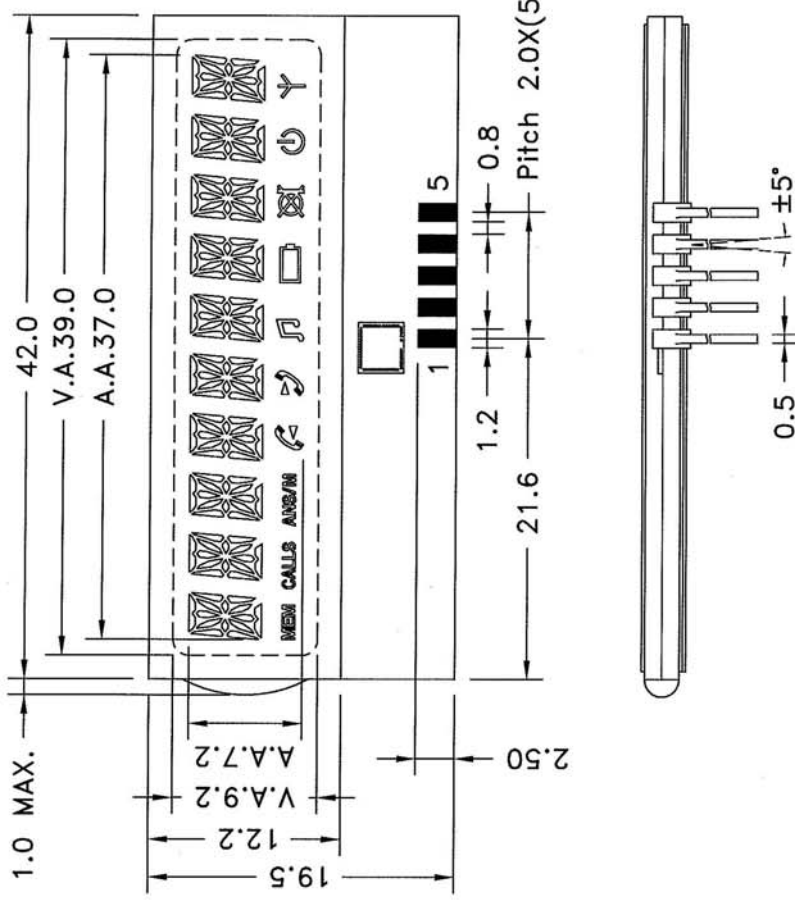| Item	Dimension	Unit
Outline Dimension	42.0(L)x19.5(W)x2.9 Max.(H) [Non backlight version]	mm
	42.0(L)x19.5(W)x6.7 Max.(H) [LED backlight version]	mm
Viewing Area	39.0(L)x9.2(W)	mm

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^2C Serial Clock Input
5	SDA	I^2C Serial Data Input/ Output
*6	BL+	Supply voltage for backlight (+VE)
*7	BL-	Supply voltage for backlight (-VE)

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

COUNTER DRAWING OF MODULE DIMENSION

SCALE: 9 : 1

CLOVER DISPLAY LTD. (HK)

STANDARD

MODEL NO.	CV9004A	
TITLE: MODULE DIMENSION		
DRAWN BY:	LRJ	DATE: 21 SEP 10
CHECKED BY:		DATE:
APPROVED BY:		DATE:

SHEET 1 OF 5

OUR REF. X9004

	REASON	PREPARED	DATE
⚠	Add backlight information	Timmy	02 JUN 09
⚠	Change backlight current	Timmy	21 SEP 10

MARK			
⚠			
⚠			
⚠			
⚠			

No backlight version

TOLERANCE IF NOT SPECIFY ±0.5mm		SCALE N.T.S.	UNIT IN mm			CUSTOMER	APPROVED
REV.	REVISION RECORD			DATE			
00	1st ISSUE			26 FEB 04			
01	Add backlight information			02 JUN 09	AGENT		APPROVED
02	Change backlight current			21 SEP 10			
					CUSTOMER REF.		

COUNTER DRAWING OF MODULE DIMENSION

Side-lited backlight version

SCALE: 9 : 1
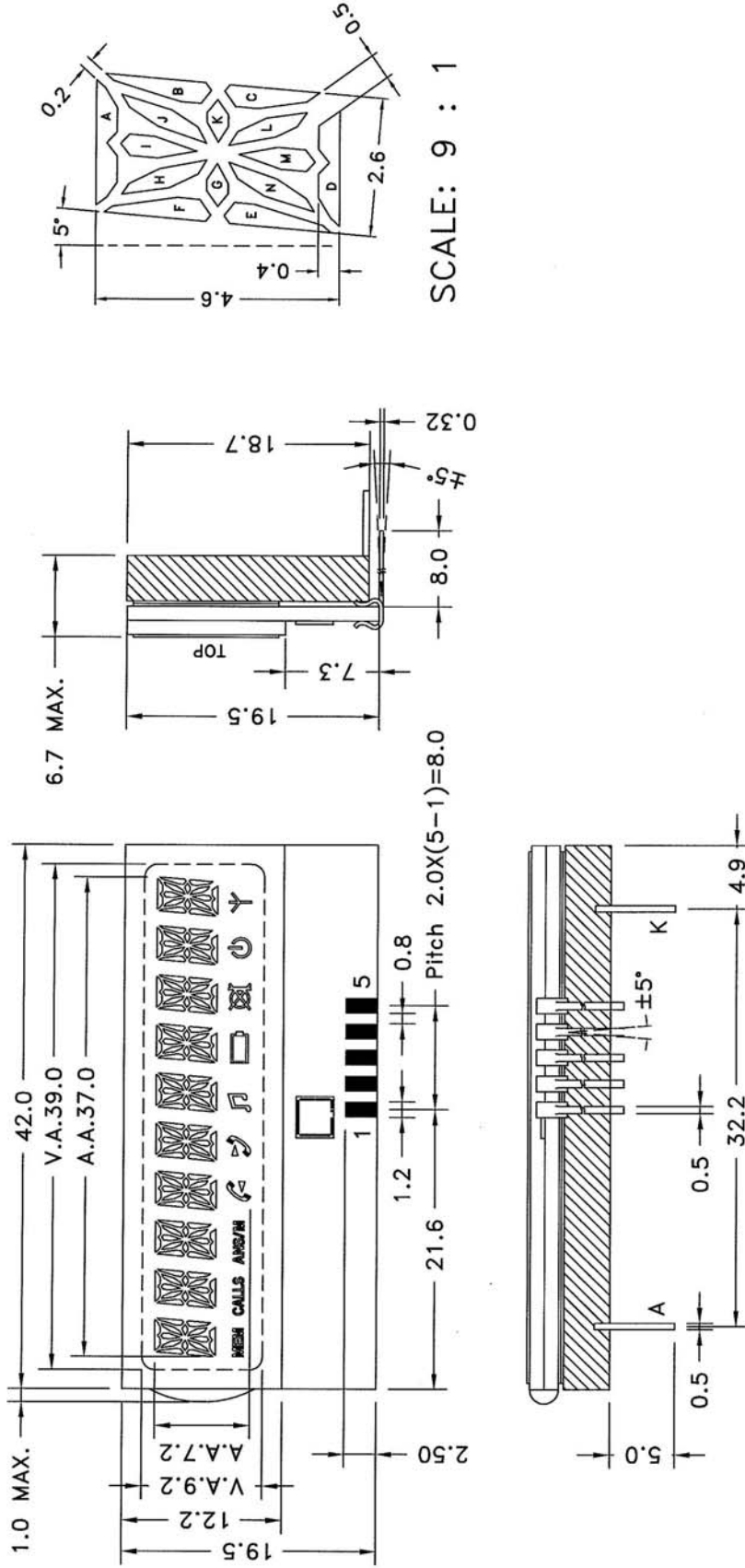
TOLERANCE IF NOT SPECIFY ±0.5mm	SCALE N.T.S.	UNIT IN mm		CLOVER DISPLAY LTD. (HK)		MODEL NO. CV9004A	SHEET 2 OF 5
			CUSTOMER	STANDARD	APPROVED	TITLE: MODULE DIMENSION	
REVISION RECORD		DATE				DRAWN BY: LRJ	DATE: 21 SEP 10
REV.			AGENT	APPROVED		CHECKED BY:	DATE:
00	1st ISSUE	26 Feb 04					
01	Add backlight information	02 Jun 09	CUSTOMER REF.			APPROVED BY:	DATE:
02	Change backlight current	21 SEP 10				OUR REF. X9004	

COUNTER DRAWING OF PIN OUT & BLOCK DIAGRAM
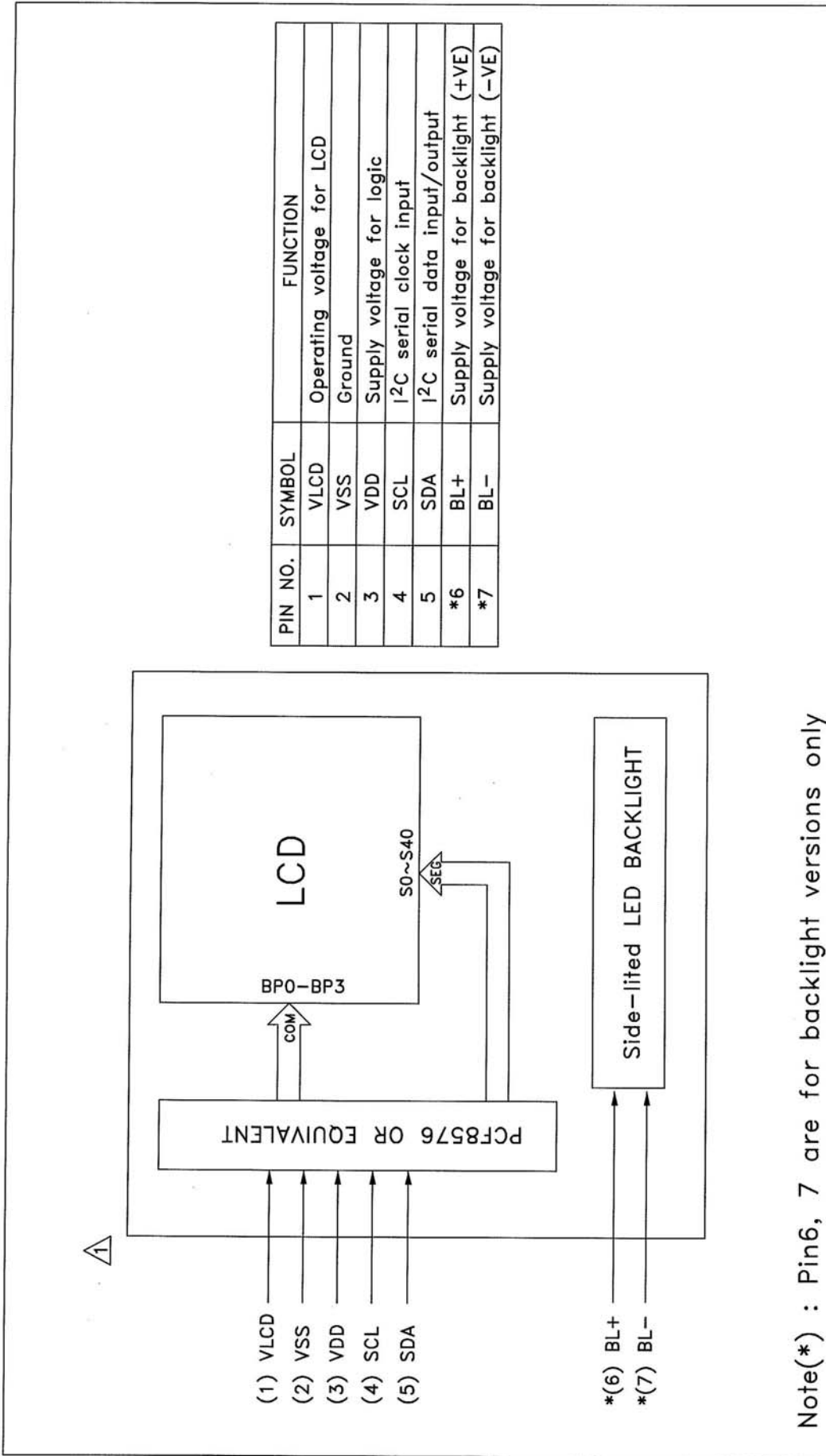
PIN NO.	SYMBOL	FUNCTION
1	VLCD	Operating voltage for LCD
2	VSS	Ground
3	VDD	Supply voltage for logic
4	SCL	I²C serial clock input
5	SDA	I²C serial data input/output
*6	BL+	Supply voltage for backlight (+VE)
*7	BL−	Supply voltage for backlight (−VE)

LCD

BP0–BP3   COM

S0~S40   SEG

PCF8576 OR EQUIVALENT

(1) VLCD
(2) VSS
(3) VDD
(4) SCL
(5) SDA

*(6) BL+
*(7) BL−

Side−lited LED BACKLIGHT

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

CLOVER DISPLAY LTD. (HK)

REV.	REVISION RECORD	DATE
00	1st ISSUE	26 Feb 04
01	Add backlight information	02 Jun 09
02	Change backlight current	21 SEP 10

TOLERANCE IF NOT SPECIFY ±0.5mm

SCALE N.T.S.

UNIT IN mm

CUSTOMER   STANDARD

APPROVED

AGENT   APPROVED

CUSTOMER REF.

MODEL NO. CV9004A

TITLE: PIN OUT & BLOCK DIAGRAM

DRAWN BY: LRJ   DATE: 21 SEP 10

CHECKED BY: DATE:

APPROVED   DATE:

OUR REF. X9004

SHEET 3 OF 5

COUNTER DRAWING OF ICON MAPPING

IC PIN	BP0	BP1	BP2	BP3
S0	/	1F	1E	1D
S1	1H	1G	1N	1M
S2	1I	1J	1K	1L
S3	1A	1B	1C	MEM
S4	/	2F	2E	2D
S5	2H	2G	2N	2M
S6	2I	2J	2K	2L
S7	2A	2B	2C	CALLS
S8	/	3F	3E	3D
S9	3H	3G	3N	3M
S10	3I	3J	3K	3L
S11	3A	3B	3C	ANS/M
S12	/	4F	4E	4D
S13	4H	4G	4N	4M
S14	4I	4J	4K	4L
S15	4A	4B	4C	S1
S16	/	5F	5E	5D
S17	5H	5G	5N	5M
S18	5I	5J	5K	5L
S19	5A	5B	5C	S2

IC PIN	BP0	BP1	BP2	BP3
S20	/	6F	6E	6D
S21	6H	6G	6N	6M
S22	6I	6J	6K	6L
S23	6A	6B	6C	S3
S24	/	7F	7E	7D
S25	7H	7G	7N	7M
S26	7I	7J	7K	7L
S27	7A	7B	7C	S4
S28	/	8F	8E	8D
S29	8H	8G	8N	8M
S30	8I	8J	8K	8L
S31	8A	8B	8C	S5
S32	/	9F	9E	9D
S33	9H	9G	9N	9M
S34	9I	9J	9K	9L
S35	9A	9B	9C	S6
S36	/	10F	10E	10D
S37	10H	10G	10N	10M
S38	10I	10J	10K	10L
S39	10A	10B	10C	S7

MEM   CALLS   ANS/M   S1   S7

1 5

CLOVER DISPLAY LTD. (HK)

MODEL NO. CV9004A

TITLE: ICON MAPPING

STANDARD

CUSTOMER	APPROVED
AGENT	APPROVED
CUSTOMER REF.	

DRAWN BY: LRJ   DATE: 21 SEP 10
CHECKED BY: DATE:
APPROVED BY: DATE:

OUR REF. X9004

SHEET 5 OF 5

UNIT IN mm   SCALE N.T.S.

TOLERANCE IF NOT SPECIFY ±0.5mm

REVISION RECORD

REV.		DATE
00	1st Issue	26 Feb 04
01	Add backlight information	02 JUN 09
02	Change backlight current	21 SEP 10

ELECTRICAL CHARACTERISTICS

Conditions: VSS=0V, @Ta=25℃

Item	Symbol	MIN.	TYP.	MAX.	Unit	Item	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage	V_{DD}	2.75	3.00	3.25	V	"H"Level Input Voltage	V_{IH}	$0.7V_{DD}$	—	V_{DD}	V
Supply Current	I_{DD}	—	20	30	μA	"L"Level Input Voltage	V_{IL}	0	—	$0.3V_{DD}$	V
Supply Voltage for LCD (*)	V_{LCD}	-0.2	0	0.2	V	—	—	—	—	—	—

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

Side Backlight

Constant voltage driving:

Item	Symbol	MIN.	TYP.	MAX.	Unit	Condition
White Backlight Current	I_{BL}	10	12	14	mA	$V_{BL} = 5.0V$

Constant current driving:

Item	Symbol	MIN.	TYP.	MAX.	Unit	Condition
Yellow Green Backlight Voltage	V_{BL}	—	2.0	2.4	V	$I_{BL} = 40mA$

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}	7.0	7.0	V
Input Voltage	V_{IN}	-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	℃

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 bios			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 tranferred to the data pointer to
	6-bits binary value of 0 to 39					define one of forty display RAM addresses
DEVICE SELECT						Three bits of immediate data, bits A0 to
	Bits A0 A1 A2					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 1		Defines input bank selection
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		Defines output bank selectoon
	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 frewuency	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 frequncy
	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

I^{2}C BUS ADDRESS OF THE MODULE

I^{2}C-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) tSU(max)	105μs 155μs	Stop condition set-up time	tSU(min) tS(max)	105μs 155μs

Figure 1   Bit transfer Timing Diagram
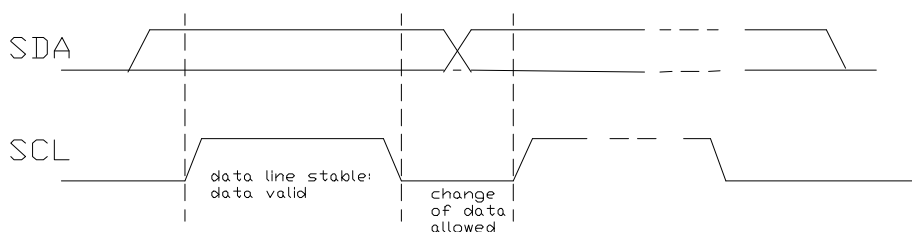
Figure 2   Definition of start and stop condition
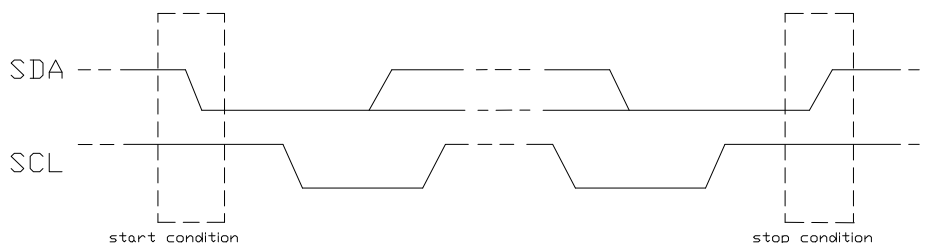
Figure 3   Timing Characteristics of I^{2}C bus low-speed mode
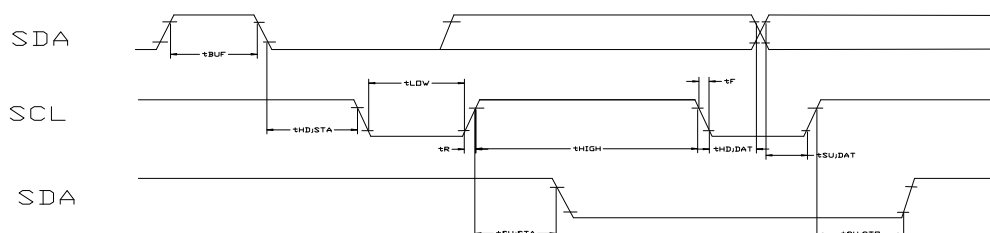
ELECTRO-OPTICAL CHARACTERISTICS

MEASURING CONDITION: POWER SUPPLY = V_{OP} / 64 Hz

TEMPERATURE = 23 ± 5 °C

RELATIVE HUMIDITY = 60 ± 20 %

ITEM	SYMBOL	UNIT	TYP. TN
RESPONSE TIME	Ton	ms	85
	Toff	ms	115
CONTRAST RATIO	Cr	-	12
	V3:00	°	70
VIEWING ANGLE	V6:00	°	55
(6 O'clock)	V9:00	°	70
Cr ≥ 2	V12:00	°	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 (d$_1$,d$_2$)   ** N. A . = NOT APPLICABLE   DEFECT TABLE : B
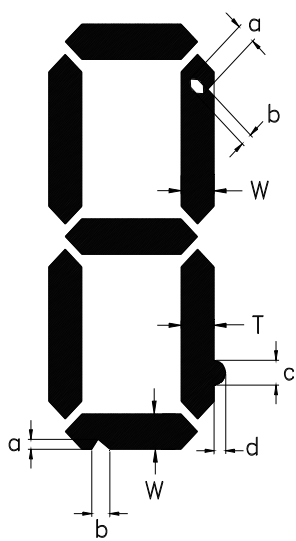
fig . 1
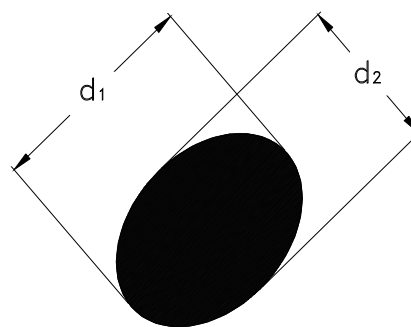
POLARIZER BUBBLES / SPOTS
fig . 2
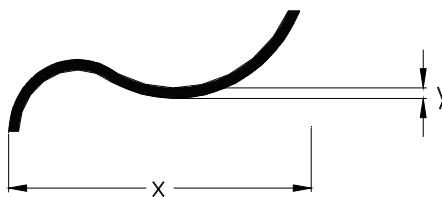
LINE SCRATCHES / BLACK LINE
fig . 3

QUALITY STANDARD OF LCD MODULE (CONT .)

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

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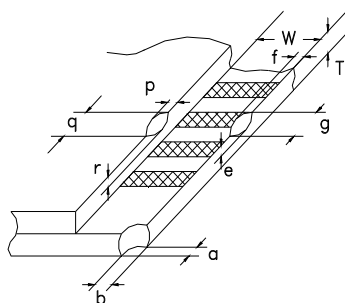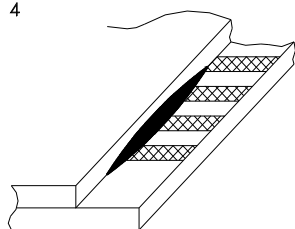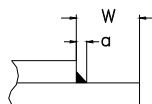
fig . 4
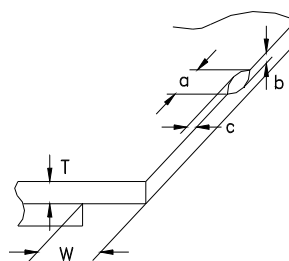
fig . 5

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 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.