CLOVER DISPLAY LTD.

LCD MODULE SPECIFICATION

Model : CV9003A - _ _ - _ _ - _ _ - _

Revision	04
Engineering	Brian Leung
Date	13 October 2003
Our Reference	9003

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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:

CV9003A- 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 Digits + Icons, COG LCD module
Driving method   :   1/4 Duty, 1/3Bias
Interface   :   I^{2}C serial
Controller IC   :   Philips PCF8576 or equivalent
                       For the detailed information, please refer to IC specifications.
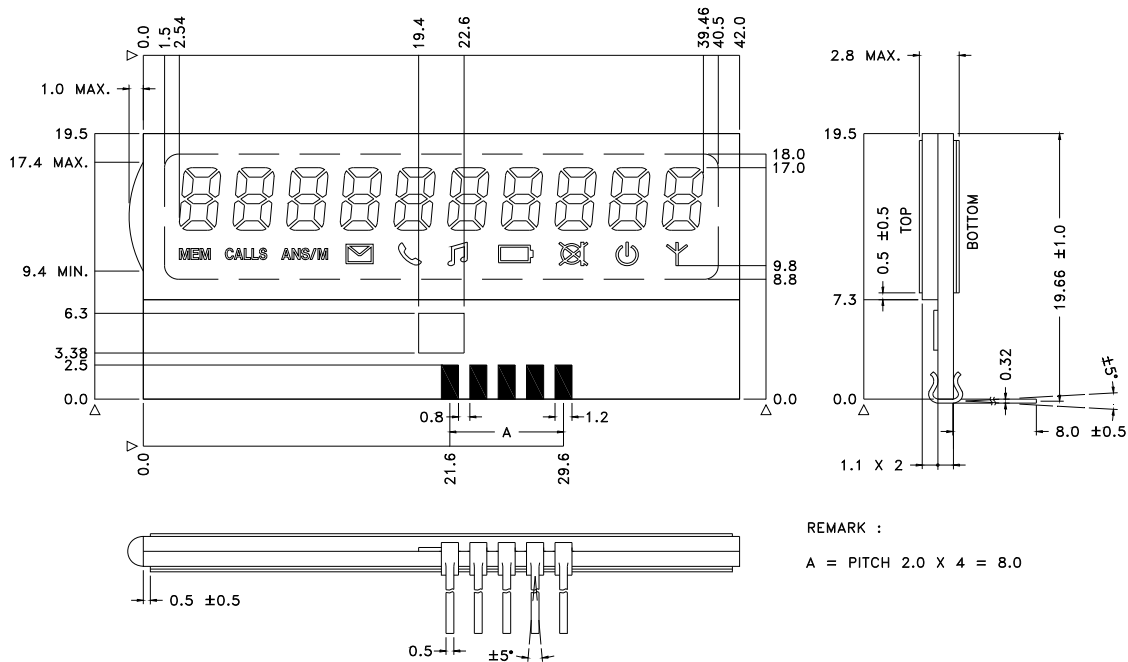
IC PIN	BP0	BP1	BP2	BP3
S16	1A	1F	1E	MEM
S17	1B	1G	1C	1D
S18	2A	2F	2E	CALLS
S19	2B	2G	2C	2D
S20	3A	3F	3E	ANS/M
S21	3B	3G	3C	3D
S22	4A	4F	4E	S1
S23	4B	4G	4C	4D
S24	5A	5F	5E	S2
S25	5B	5G	5C	5D
S26	6A	6F	6E	S3
S27	6B	6G	6C	6D
S28	7A	7F	7E	S4
S29	7B	7G	7C	7D
S30	8A	8F	8E	S5
S31	8B	8G	8C	8D
S32	9A	9F	9E	S6
S33	9B	9G	9C	9D
S34	10A	10F	10E	S7
S35	10B	10G	10C	10D
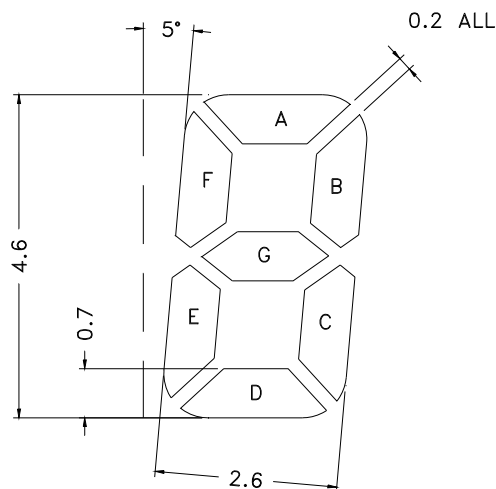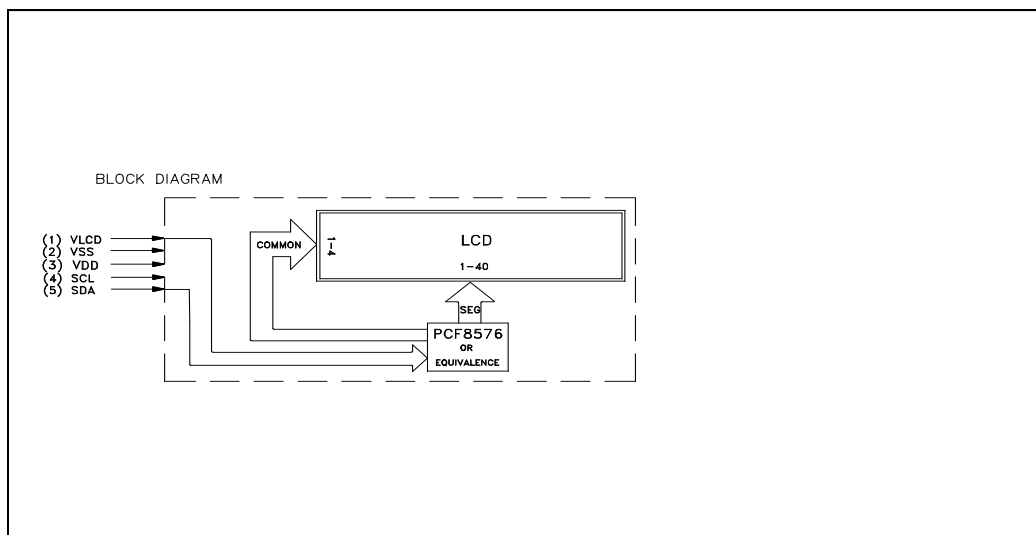
MECHANICAL DIMENSIONS

Item	Dimension	Unit
Outline Dimension	42.0(L)x19.5(W)x2.8 Max.(H)	mm
Viewing Area	39.0(L)x9.2(W)	mm

CONNECTOR PIN ASSIGNMENT

Pin No.	Symbol	Function
1	VLCD	Power Supply for LCD
2	VSS	Power Supply (GND)
3	VDD	Power Supply For Logic
4	SCL	I^{2}C Serial Clock Input
5	SDA	I^{2}C Serial Data

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}	—	0.20	—	μA	"L"Level Input Voltage	V_{IL}	0	—	$0.3V_{DD}$	V
LCD Voltage (VLCD)	V_{LCD}	-0.20	0	0.20	V	—	—	—	—	—	—
Backlight Voltage						**Backlight Current**					
EL (@ Frequency 400Hz)	—	—	—	—	—	—	—	—	—	—	—
Side-lited LED						**Side-lited LED**					
White	V_{BL}	—	—	—	V	White	I_{BL}	—	—	—	mA
Blue	V_{BL}	—	—	—	V	Blue	I_{BL}	—	—	—	mA
Yellow Green	V_{BL}	—	—	—	V	Yellow Green	I_{BL}	—	—	—	mA

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

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 A2 ,are transferred to the subaddress
	Bits A0 A1 A2				
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

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) tSU(max)	105µs 155µs	Stop condition set-up time	tSU(min) tS(max)	105µs 155µs

Figure 1   Bit transfer Timing Diagram
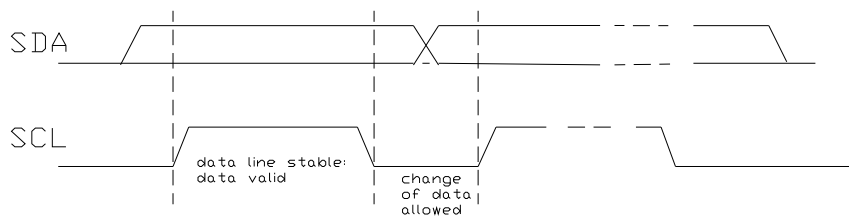
Figure 2   Definition of start and stop condition
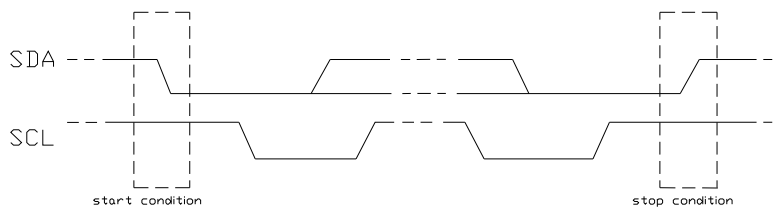
Figure 3   Timing Characteristics of I²C bus low-speed mode
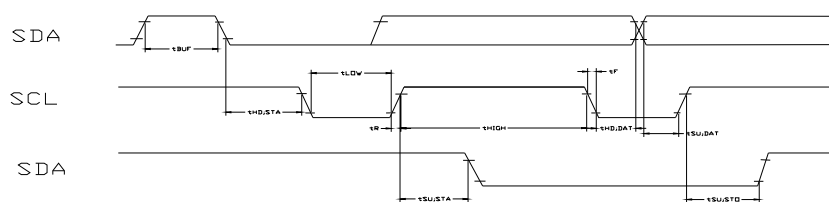
ELECTRO-OPTICAL CHARACTERISTICS

MEASURING CONDITION: POWER SUPPLY = V_{OP} / 64 Hz
$\qquad\qquad\qquad\qquad\quad$ TEMPERATURE = 22 ± 5 °C
$\qquad\qquad\qquad\qquad\quad$ RELATIVE HUMIDITY = 60 ± 15 %

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
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
$\qquad\qquad\qquad\qquad$ 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
	$0.3 < d \leq 0.4$	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
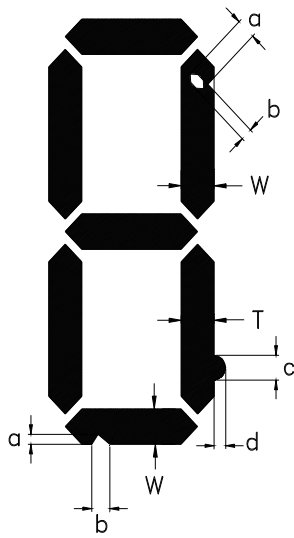
fig . 1
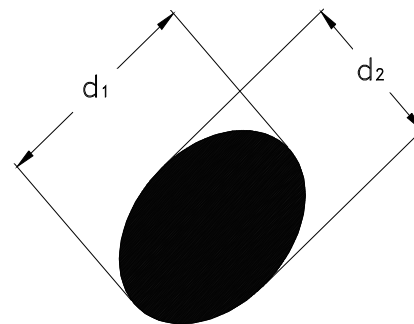
POLARIZER BUBBLES / SPOTS
fig . 2
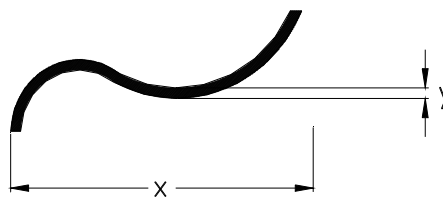
LINE SCRATCHES / BLACK LINE
fig . 3

QUALITY STANDARD (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
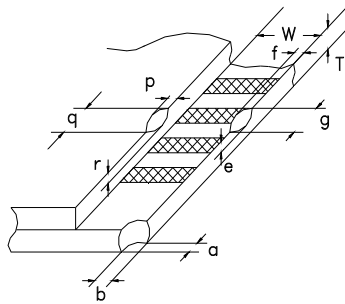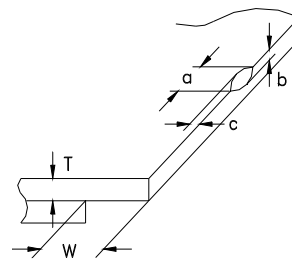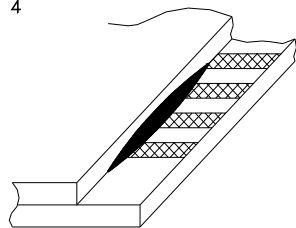

fig . 4

fig . 5

fig . 6

HANDLING PRECAUTIONS

(1) CAUTION OF LCD HANDLING & CLEANING
Use soft cloth with solvent (recommended below) to clean the display surface and wipe lightly.
- Isopropyl alcohol, ethyl alcohol, trichlorotriflorothane

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 recommend 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 ^{o}C or hand soldering at 280 ^{o}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.