CLOVER DISPLAY LTD.

LCD MODULE SPECIFICATION

Model : CV9020B - _ _ - _ _ - _ _ - _

Revision	03
Engineering	Timmy Kwan
Date	13 September 2010
Our Reference	9029

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MODE OF DISPLAY

Display mode	Display condition	Viewing direction
STN : ☐ Yellow green	☐ Reflective type	☐ 6 O' clock
☐ Grey	☐ Transflective type	☐ 12 O' clock
☐ Blue (negative)	☐ Transmissive type	☐ 3 O' clock
☐ FSTN positive	☐ Others	☐ 9 O' clock
☐ FSTN negative		

LCD MODULE NUMBER NOTATION:

CV9020B- MY - S F - 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)
       T – Touch panel (Analog)
       P – Touch panel (Digital)

GENERAL DESCRIPTION

Display mode   :   128 x 64 dots, Graphic COG LCD module

Interface   :   8-bit parallel (6800 mode)

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	34.4(L)x31.6(W)xH2(H)	mm	Dot Pitch	0.22(L)x0.30(W)	mm
Viewing Area	30.4(L)x20.9(W)	mm	Dot Size	0.195(L)x0.275 (W)	mm
No backlight (N)	H2	2.1	mm	Side backlight (L)	H2	5.5	mm

CONNECTOR PIN ASSIGNMENT
CN1

Pin No.	Symbol	Function	Pin No.	Symbol	Function
1	V0	Power supply for LCD	15	D7(SI)	Data bus line
2	V1		16	D6	
3	V2		17	D5	
4	V3		18	D4	
5	V4		19	D3	
6	CAP2N	Voltage converter	20	D2	
7	CAP2P		21	D1	
8	CAP1P		22	D0	
9	CAP1N		23	/RD(E)	Enable select signal for 6800 series
10	CAP3P		24	/WR(R/W)	Read/write select signal for 6800 series
11	VOUT	Voltage converter input / output	25	A0	Register select signal
12	VSS	Ground	26	/RES	Reset signal
13	NC	No connection	27	CS2	Chip select signal
14	VDD	Supply voltage for logic	—	—	—

CN2

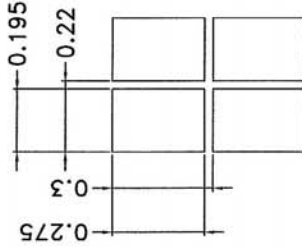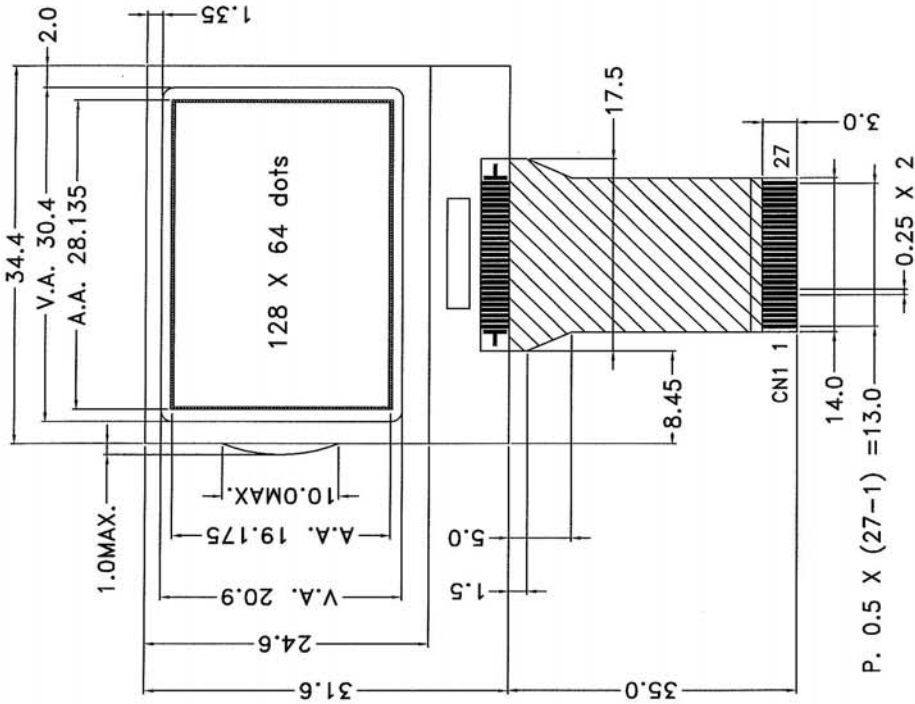| Pin No.	Symbol	Function
* 1	BL+	Supply voltage for backlight(+)
* 2	BL-	Supply voltage for backlight(-)

Note (*) : CN2 pin 1, 2 are used for side backlight version only.

COUNTER DRAWING OF MODULE DIMENSION (NO BACKLIGHT)

No backlight version

128 X 64 dots

2.1 MAX.

FPC (Copper type)

Silicone

Contact side

Stiffener

0.9

0.3±0.05

0.195

0.22

0.3

0.275

2.0

1.35

34.4

V.A. 30.4

A.A. 28.135

1.0 MAX.

10.0 MAX.

A.A. 19.175

V.A. 20.9

24.6

31.6

35.0

17.5

3.0

27

CN1 1

8.45

14.0

5.0

1.5

0.25 X 2

P. 0.5 X (27-1) =13.0

MARK	REASON	PREPARED	DATE
3	Add BL voltage & change the side BL dimension	Roger	27 SEP 06
4	Change operating voltage for LCD	TIMMY	28 DEC 07
5	Change IC & cancel EL backlight version	TIMMY	20 MAR 08
6	Change white color side backlight current	TIMMY	03 SEP 10

CLOVER DISPLAY LTD. (HK)

CUSTOMER	STANDARD	APPROVED	MODEL NO. CV9020B
			TITLE: MODULE DIMENSION
AGENT		APPROVED	DRAWN BY: Ruifang DATE : 03 SEP 10
			CHECKED BY : DATE :
CUSTOMER REF.		OUR REF. X9029	APPROVED BY : DATE :

SHEET 1 OF 4

TOLERANCE IF NOT SPECIFY ±0.5mm		SCALE N.T.S.	UNIT IN mm	
REV.	REVISION RECORD		DATE	
01	Change the dimension of EL backlight		09 DEC 05	
02	Add side backlight version		22 DEC 05	
03	Add BL voltage & change the side BL dimension		27 SEP 06	
04	Change operating voltage for LCD		28 DEC 07	
05	Change IC & cancel EL backlight version		20 MAR 08	
06	Change white color side backlight current		03 SEP 10	

COUNTER DRAWING OF MODULE DIMENSION (SIDE BACKLIGHT)

Side backlight version

128 X 64 dots

P. 0.5 X (27-1) = 13.0
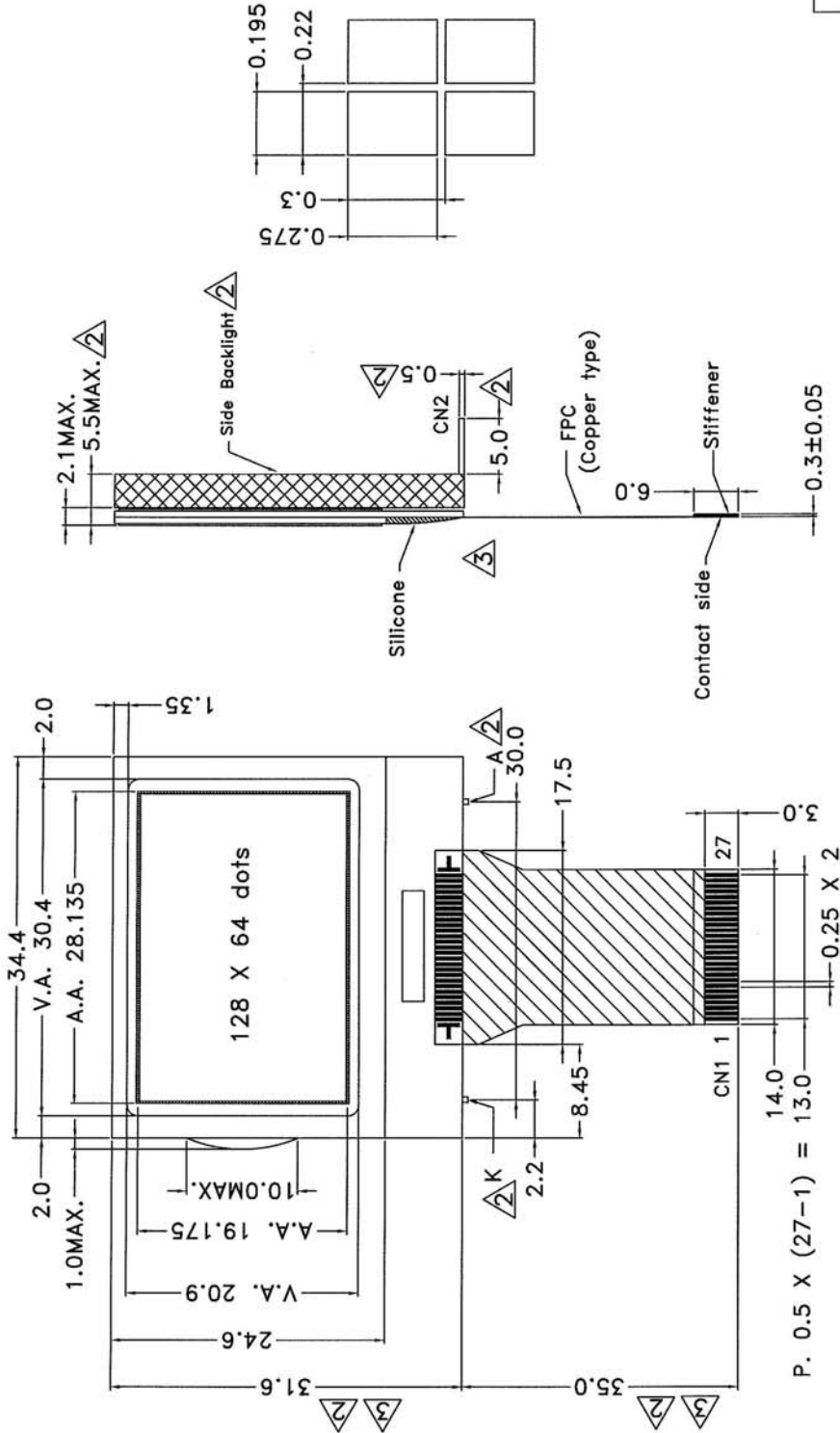
			TOLERANCE IF NOT SPECIFY ±0.5mm	SCALE N.T.S.	UNIT IN mm		CLOVER DISPLAY LTD. (HK)		APPROVED	MODEL NO. CV9020B
REV.	REVISION RECORD				DATE					TITLE: MODULE DIMENSION
01	Change the dimension of EL backlight				09 DEC 05	CUSTOMER	STANDARD		APPROVED	DRAWN BY: Ruifang DATE: 03 SEP 10
02	Add Side backlight version				22 DEC 05					CHECKED BY :
03	Add BL voltage & change the BL dimension				27 SEP 06	AGENT			APPROVED	APPROVED BY
04	Change operating voltage for LCD				28 DEC 07					
05	Change IC & cancel EL backlight version				20 MAR 08					OUR REF. X9029
06	Change white color side backlight current				03 SEP 10	CUSTOMER REF.				SHEET 2 OF 4

COUNTER DRAWING OF PIN OUT & BLOCK DIAGRAM

CN1

PIN NO.	SYMBOL	FUNCTION
1	V0	
2	V1	
3	V2	Power supply for LCD
4	V3	
5	V4	
6	CAP2N	
7	CAP2P	Voltage converter
8	CAP1P	
9	CAP1N	
10	CAP3P	
11	VOUT	Voltage converter input/output
12	VSS	Ground
13	NC	No connection
14	VDD	Supply voltage for logic
15	DB7(SI)	
16	DB6	
17	DB5	
18	DB4	Data bus line
19	DB3	
20	DB2	
21	DB1	
22	DB0	
23	/RD(E)	Enable select signal for 6800 series
24	/WR(R/W)	Read/write select signal for 6800 series
25	A0	Register select signal
26	/RES	Reset signal
27	CS2	Chip select signal

CN2

PIN NO.	SYMBOL	FUNCTION
* 1	BL+	Supply voltage for backlight(+)
* 2	BL−	Supply voltage for backlight(−)

LCD — ST7565P or equivalent
C1 TO C32 / 32 COM
S1 TO S128 / 128 SEG
C33 TO C64 / 32 COM
SEG0 TO SEG127   COM31 TO COM0   COM63 TO COM32

LED backlight

CN1
(1)V0
(2)V1
(3)V2
(4)V3
(5)V4
(6)CAP2N
(7)CAP2P
(8)CAP1P
(9)CAP1N
(10)CAP3P
(11)VOUT
(12)VSS
(13)NC
(14)VDD
(15−22) DB7−DB0
(23)/RD(E)
(24)/WR(R/W)
(25)A0
(26)/RES
(27)CS2

CN2
* (1) BL+
* (2) BL−
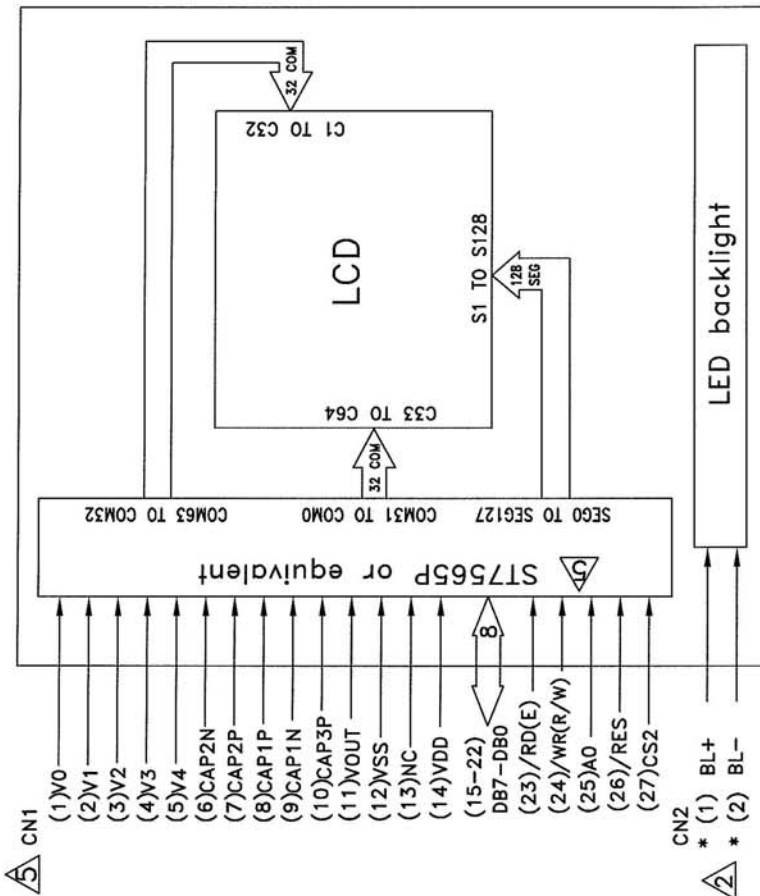
Note (*) : CN2 Pin 1,2 are for side backlight versions only.

		CLOVER DISPLAY LTD. (HK)	CV9020B
			SHEET 3 OF 4

		APPROVED	MODEL NO. CV9020B
CUSTOMER	STANDARD		TITLE: PIN OUT & BLOCK DIAGRAM
AGENT		APPROVED	DRAWN BY: Ruifang DATE : 03 SEP 10
			CHECKED BY : __ DATE : 06 Sep10
CUSTOMER REF.		OUR REF. X9029	APPROVED BY __ DATE 06/9/10

TOLERANCE IF NOT SPECIFY ±0.5mm
SCALE N.T.S.
UNIT IN mm

REV.	REVISION RECORD	DATE
01	Change the dimension of EL backlight	09 DEC 05
02	Add Side backlight version	22 DEC 05
03	Add BL voltage & change the side BL dimension	27 SEP 06
04	Change operating voltage for LCD	28 DEC 07
05	Change IC & cancel EL backlight version	20 MAR 08
06	Change white color side backlight current	03 SEP 10

ELECTRICAL CHARACTERISTICS

Conditions: VSS=0V, Ta=25℃

Item	Symbol	MIN.	TYP.	MAX.	Unit	Item	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage for Logic	VDD	3.05	3.3	3.55	V	"H"Level Input Voltage	VIH	0.8VDD	—	VDD	V
Supply Current for Logic	IDD	—	0.12	0.18	mA	"L"Level Input Voltage	VIL	0	—	0.2VDD	V
Operating Voltage for LCD (*)	VLCD	7.3	7.5	7.7	V	—	—	—	—	—	—

Note(*): The module VLCD 7.5V±0.2V represents operating voltage of LCD for optimum contrast.

Side-lited LED Backlight

Constant voltage driving:

Item	Symbol	MIN.	TYP.	MAX.	Unit	Condition
White Backlight current	IBL	17	20	23	mA	VBL=5.0V
Yellow Green Backlight current	IBL	30	35	40	mA	VBL=5.0V
Blue Backlight current	IBL	30	35	40	mA	VBL=5.0V

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	℃
Storage Temperature	Tstg	-10 to 60	-30 to 80	℃

REFERENCE CIRCUIT EXAMPLE
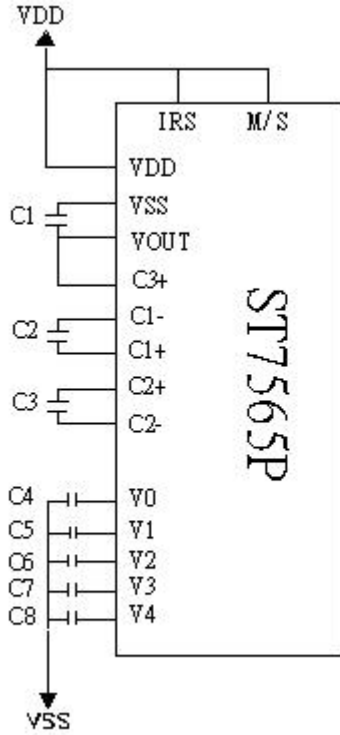
Item	Value	Unit
C1-C8	1	μF

Three times boosting circuit

INSTRUCTIONS TABLE

Table 16: Table of ST7565P Commands
(Note) *: disabled data

Command	A0	/RD	/WR	D7	D6	D5	D4	D3	D2	D1	D0	Function
(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	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) V0 voltage regulator internal resistor ratio set	0	1	0	0	0	1	0	0	Resistor ratio			Select internal resistor ratio(Rb/Ra) mode
(18) Electronic volume mode set	0	1	0	1	0	0	0	0	0	0	1	Set the V0 output voltage electronic volume register
Electronic volume register set				0	0	Electronic volume value						
(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	Mode	Set the flashing mode
(20) Booster ratio set	0	1	0	1	1	1	1	1	0	0	0	select booster ratio 00: 2x,3x,4x 01: 5x 11: 6x
				0	0	0	0	0	0	step-up value		
(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
ADC Select : A0H
SHL Select : C0H
LCD Bias Select : A2H
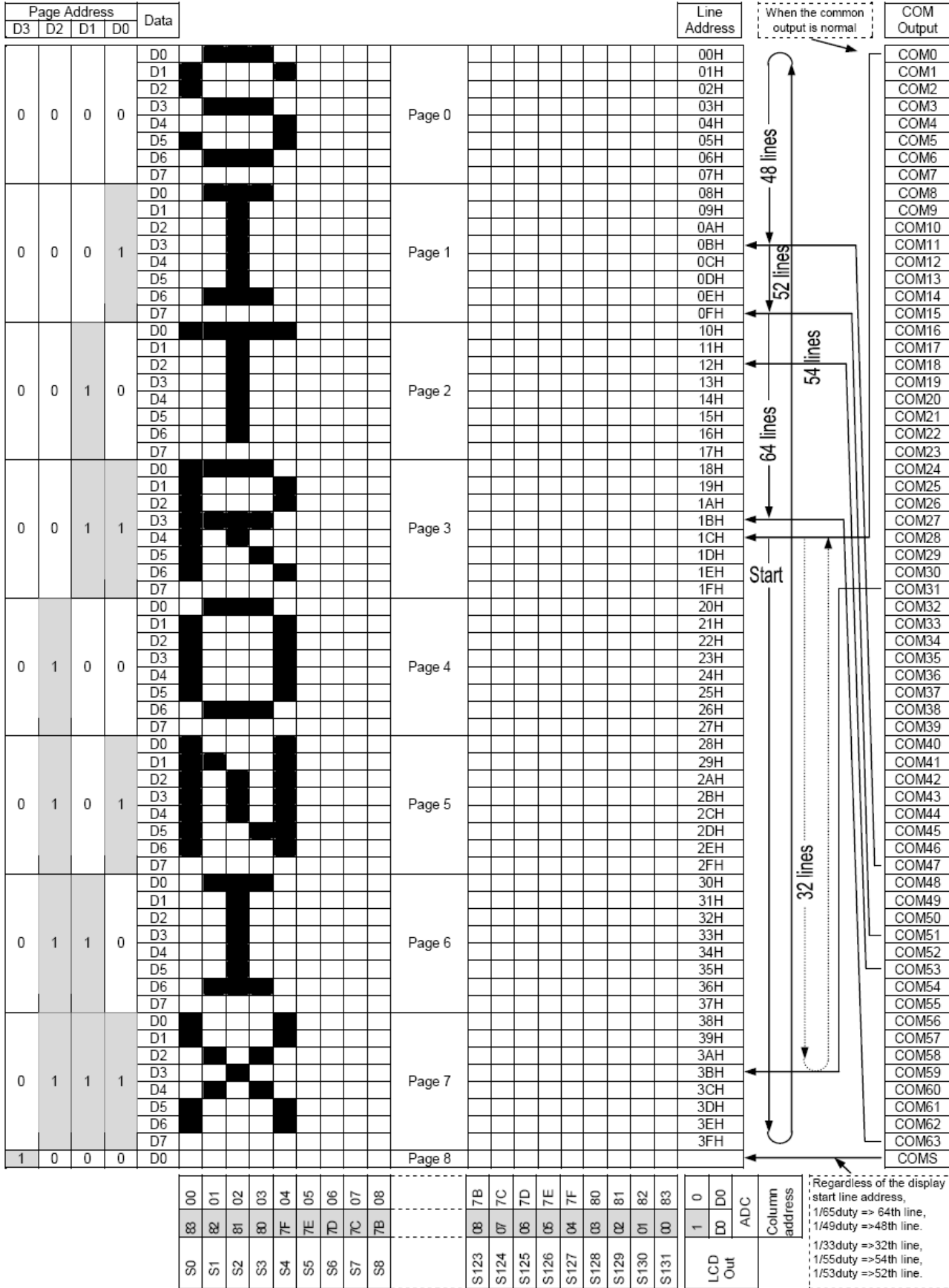Power Control (booster on) : 2CH
Power Control (voltage regulator on) : 2EH
Power Control (voltage follower on) : 2FH
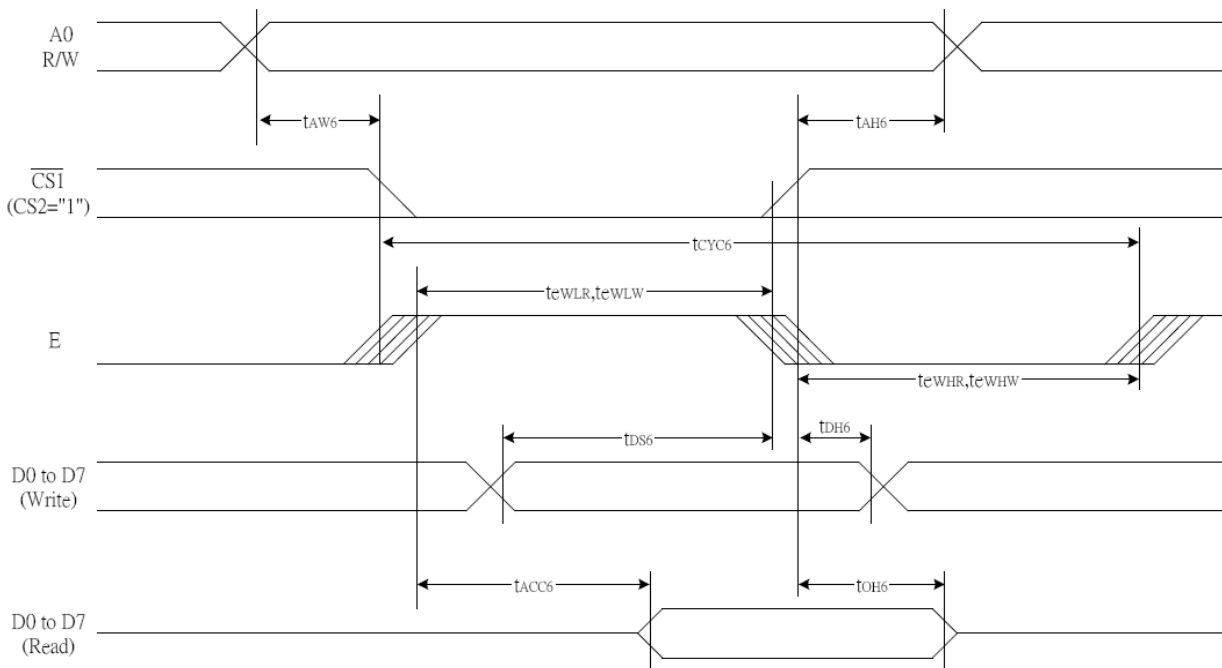Regulator Resistor Select : 24H
Set Reference Voltage Register : 11H
Display ON : AFH

DISPLAY DATA RAM (DDRAM)

Page Address				Data		Page	Line Address	When the common output is normal	COM Output
D3	D2	D1	D0						
0	0	0	0	D0		Page 0	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		Page 1	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		Page 2	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		Page 3	18H		COM24
				D1			19H		COM25
				D2			1AH		COM26
				D3			1BH		COM27
				D4			1CH		COM28
				D5			1DH		COM29
				D6			1EH		COM30
				D7			1FH	Start	COM31
0	1	0	0	D0		Page 4	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		Page 5	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		Page 6	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		Page 7	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		Page 8			COMS

48 lines / 52 lines / 54 lines / 64 lines / 32 lines

	00	01	02	03	04	05	06	07	08	...	7B	7C	7D	7E	7F	80	81	82	83	0		D0	Column address
	83	82	81	80	7F	7E	7D	7C	7B	...	08	07	06	05	04	03	02	01	00	1		D0	ADC
	S0	S1	S2	S3	S4	S5	S6	S7	S8	...	S123	S124	S125	S126	S127	S128	S129	S130	S131			LCD Out	

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.

READ / WRITE CHARACTERISTICS (6800 SERIES)

6800 INTERFACE READ / WRITE TIMING CHARACTERISTICS

(V$_{DD}$ = 3.3V, Ta = −30 to 85℃)

Item	Signal	Symbol	Condition	Rating Min.	Rating Max.	Units
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$_{ACC6}$	C$_L$ = 100 pF	—	70	
READ Output disable time		t$_{OH6}$	C$_L$ = 100 pF	5	50	

RESET TIMING DIAGRAM
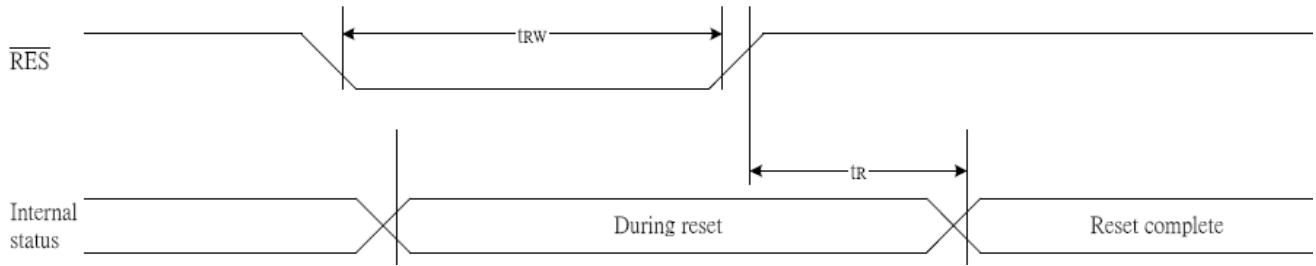
RESET TIMING

(VDD = 3.3V, Ta = −30 to 85°C)

Item	Signal	Symbol	Condition	Rating			Units
				Min.	Typ.	Max.	
Reset time		tR		—	—	1.0	us
Reset "L" pulse width	/RES	tRW		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

```
┌─────────────────────────────────┐
│      Power ON Flow: Start        │
└─────────────────────────────────┘
                │
┌─────────────────────────────────┐
│        Turn ON the power         │
│   and keep /RES pin at "L"       │
└─────────────────────────────────┘
                │
┌─────────────────────────────────┐
│   Wait for the power stabilized  │
└─────────────────────────────────┘
                │
┌─────────────────────────────────┐
│ Release reset state (/RES = "H") │
│ Wait for reset circuit finished  │
│            (<1ms)                │
└─────────────────────────────────┘
                │
┌─────────────────────────────────┐
│  Initialized state (Default) ...*1 │
└─────────────────────────────────┘
                │
┌─────────────────────────────────┐
│  Function setup by command       │
│  (user setting)                  │
│  (11) LCD bias setting ...*2      │
│  (8) ADC selection ...*3          │
│  (15) Common output mode          │
│   selection ...*4                 │
└─────────────────────────────────┘
                │
┌─────────────────────────────────┐
│  Function setup by command       │
│  (user setting)                  │
│  (17) Set internal V0 regulator  │
│   resistor ratio for V0 voltage  │
│   ...*5                           │
│  (18) Electronic volume control  │
│   ...*6                           │
└─────────────────────────────────┘
                │
┌─────────────────────────────────┐
│  Function setup by command       │
│  (user setting)                  │
│  (16) Power control setting ...*7 │
└─────────────────────────────────┘
                │
┌─────────────────────────────────┐
│  Initialize DDRAM (Page 0~8)     │
└─────────────────────────────────┘
                │
┌─────────────────────────────────┐
│     Initialization Finished      │
└─────────────────────────────────┘
```

Arrange to execute all these procedures from releasing the reset state to setting the power control within 5ms. In case of other models, execute the procedures from turning on the power to setting the power control in 5ms.

* 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 radio 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 Hz

TEMPERATURE = 23 ± 5 °C

RELATIVE HUMIDITY = 60 ± 20 %

ITEM	SYMBOL	UNIT	TYP.
RESPONSE TIME	T_{on}	ms	220
	T_{off}	ms	280
CONTRAST RATIO	Cr	-	12
VIEWING ANGLE (Cr ≥ 2)	$V_{3:00}$	°	40
	$V_{6:00}$	°	70
	$V_{9:00}$	°	40
	$V_{12:00}$	°	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.**	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
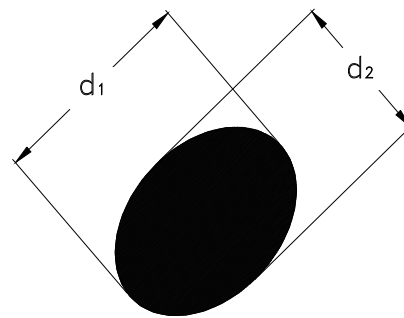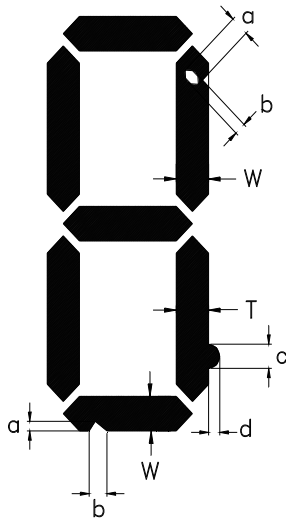
POLARIZER BUBBLES / SPOTS
fig . 2
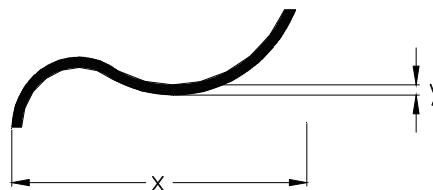
LINE SCRATCHES / BLACK LINE
fig . 3

QUALITY STANDARD (CONT .)

DEFECT		CRITERIA	TYPE	FIGURE
CHIPS	CONTACT EDGE	$e\leq 1/2T$ $f\leq 1/3W$ $g\leq 3.5$	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
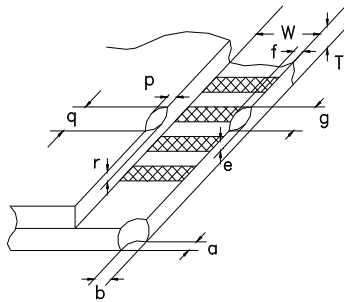
fig . 4
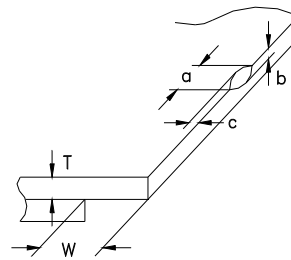
fig . 5
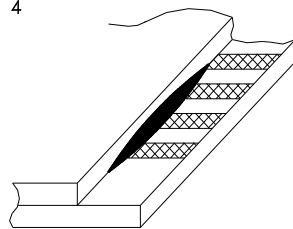
fig . 6

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, 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.

For Internal Use ONLY

SPECIFICATION REVISION RECORD

Revision No.	Description	Date(DD/MM/YY)
00	1st Issue	26/09/06
01	2nd Issue	12/10/06
02	Update Connector Pin Assignment on page.2, Update Counter Drawing to 05 on page.3-4, Update Electrical Characteristics on page.6& Update Electro-Optical Characteristics on page.15	13/10/08
03	Update Counter Drawing to 06 on page.3-4, Update Side Backlight (White) current on page.6	03/09/10

Sample REVISION Record

Sample No.	Description	Date(DD/MM/YY)
00	1st Issue	26/09/06
01	2nd Issue	12/10/06
02	Sample with New IC (ST7565P)	13/10/08