



CLOVER DISPLAY LTD.

LCD MODULE SPECIFICATION

Model : CV4404D - _ _ - _ _ - _ _ - _ _

Revision	00
Engineering	Longson Yeung
Date	21 June 2012
Our Reference	X4957

ADDRESS : 1st FLOOR, EFFICIENCY HOUSE, 35 TAI YAU STREET, SAN PO KONG,
KOWLOON, HONG KONG.

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

FAX : (852) 2357 4237 (SALES OFFICE)

E-MAIL : cdl@cloverdisplay.com

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

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:

CV4404D- L W - F F - N 6 -
| | | | | | | |
(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 : 40 characters x 4 lines LCD module
 Interface : 4 bit or 8 bit parallel
 Driving method : 1/16 duty , 1/5 bias
 Controller IC : SITRONIX ST7066U or equivalent
 For the detailed information, please refer to the IC specifications.

MECHANICAL DIMENSIONS

Item	Dimension		Unit	Item	Dimension		Unit
Outline Dimension	280.0(L)x88.0(W)x (H1/H2)		mm	Viewing Area	244.0(L)x68.0(W)		mm
No Backlight	H1	6.2	mm	Character size	5.20(L)x14.51(W)		mm
	H2	11.3 Max.	mm	Character pitch	6.0(L)x16.38(W)		mm
LED Backlight	H1	11.2	mm	Dot Size	1.0(L)x1.77(W)		mm
	H2	16.3 Max.	mm	Dot Pitch	1.05(L)x1.82(W)		mm

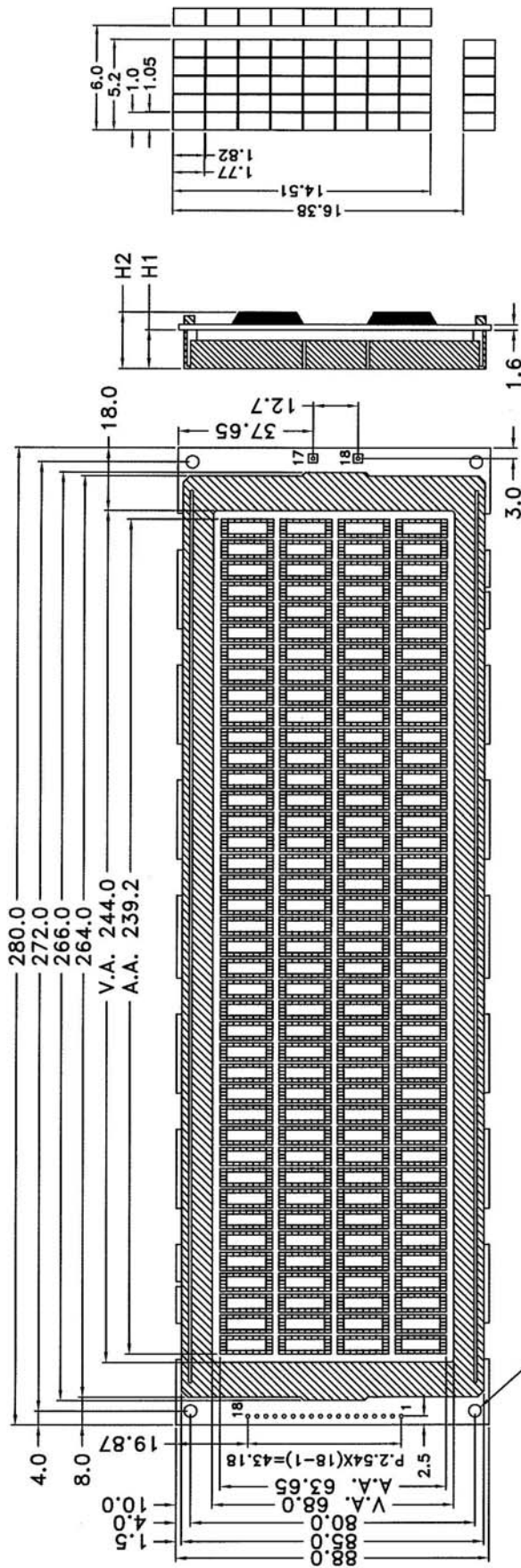
CONNECTOR PIN ASSIGNMENT

Pin No.	Symbol	Function	Pin No.	Symbol	Function
1	VSS	Ground	11	DB4	Data Bus
2	VDD	Supply voltage for logic	12	DB5	
3	V0	Input Voltage for LCD	13	DB6	
4	RS	Register Select	14	DB7	
5	R/W	Read/Write	15	E2	Enable Signal 2
6	E1	Enable Signal 1	16	NC	No connection
7	DB0	Data Bus	*17	BL+	Supply Voltage for Backlight(+VE)
8	DB1		*18	BL-	Supply Voltage for Backlight(-VE)
9	DB2				
10	DB3				

Note (*) : Pin 17,18 are used for backlight version

COUNTER DRAWING OF MODULE DIMENSION

MARK	REASON	PREPARED	DATE
A			
A			
A			
A			



Model	H1	H2
LED Backlight	11.2	16.3MAX
No Backlight	6.2	11.3MAX

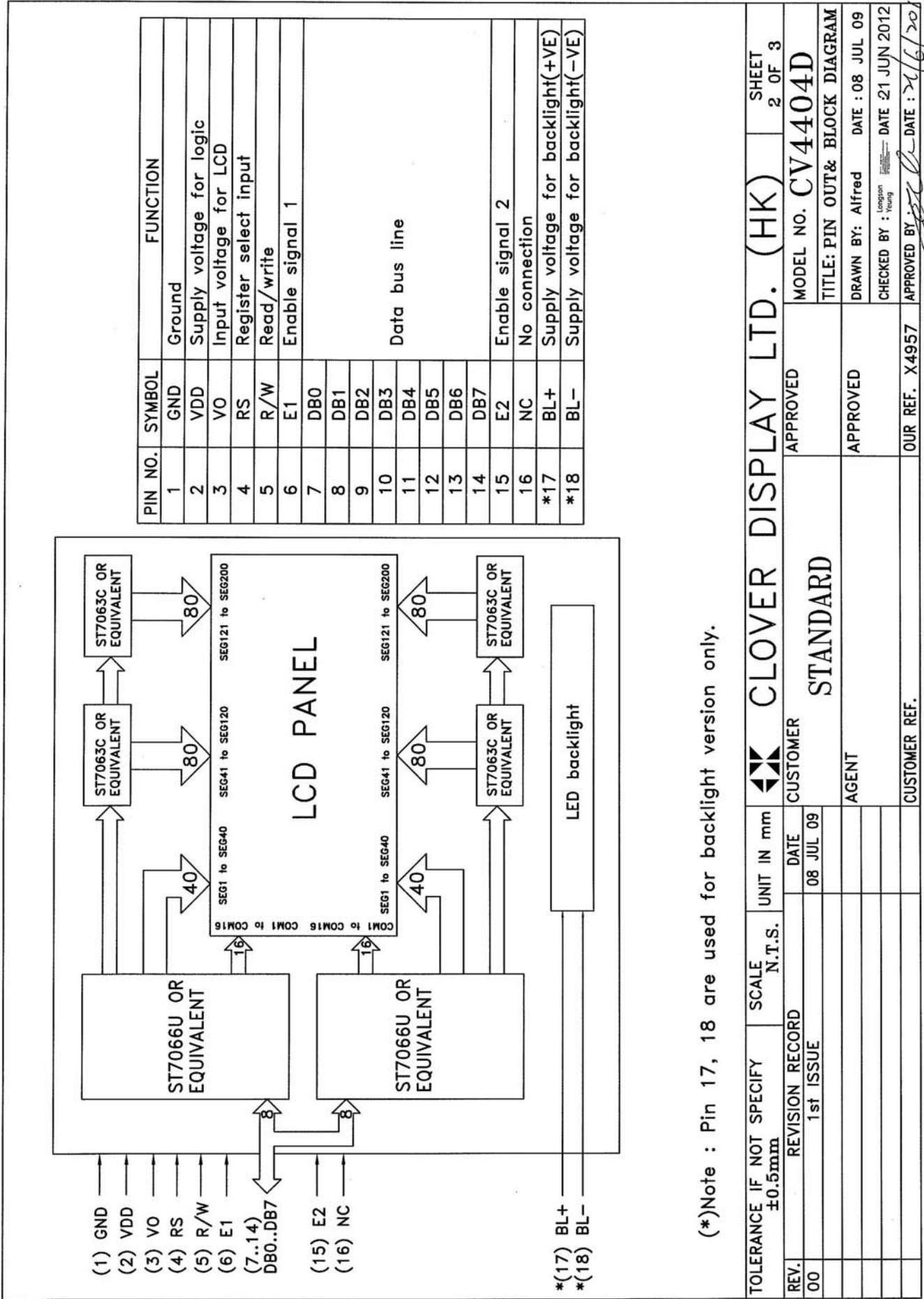
TOLERANCE IF NOT SPECIFY ±0.5mm	SCALE	N.T.S.	UNIT IN mm	CLOVER DISPLAY LTD. (HK)	SHEET 1 OF 3
	REVISION RECORD	1st ISSUE	DATE			MODEL NO. CV4404D
00	REVISION RECORD	1st ISSUE	08 JUL 09	CUSTOMER	TITLE: MODULE DIMENSION
	REVISION RECORD			AGENT	DRAWN BY: Alfred DATE :08 JUL 09
	REVISION RECORD			CUSTOMER REF.	CHECKED BY : <small>Longson</small> DATE :21 JUN 2012
	REVISION RECORD			OUR REF. X4957	APPROVED BY: <i>John</i> DATE :21/6/2012

APPROVED

APPROVED

STANDARD

COUNTER DRAWING OF PIN OUT & BLOCK DIAGRAM



PIN NO.	SYMBOL	FUNCTION
1	GND	Ground
2	VDD	Supply voltage for logic
3	VO	Input voltage for LCD
4	RS	Register select input
5	R/W	Read/write
6	E1	Enable signal 1
7	DB0	Data bus line
8	DB1	
9	DB2	
10	DB3	
11	DB4	
12	DB5	
13	DB6	
14	DB7	Enable signal 2
15	E2	No connection
16	NC	Supply voltage for backlight(+VE)
*17	BL+	Supply voltage for backlight(-VE)
*18	BL-	

TOLERANCE IF NOT SPECIFY ±0.5mm		SCALE N.T.S.	UNIT IN mm	CLOVER DISPLAY LTD. (HK)		SHEET 2 OF 3
REV. 00	REVISION RECORD 1st ISSUE		DATE 08 JUL 09	CUSTOMER STANDARD	APPROVED	MODEL NO. CV4404D
				AGENT	APPROVED	TITLE: PIN OUT& BLOCK DIAGRAM
				CUSTOMER REF.	OUR REF. X4957	DRAWN BY: Alfred DATE : 08 JUL 09
						CHECKED BY : Longson DATE 21 JUN 2012
						APPROVED BY : <i>[Signature]</i> DATE : 21/6/2012

ELECTRICAL CHARACTERISTICS

Conditions: VSS=0V, Ta=25°C

Item	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage for Logic	VDD	4.75	5.00	5.25	V
Supply Current for Logic	IDD	—	135	202	mA
Input Voltage for LCD (*)	V0	-1.8	-1.5	-1.2	V
“H” Level Input Voltage	VIH	0.7VDD	—	VDD	V
“L” Level Input Voltage	VIL	-0.3	—	0.6	V

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

Side-lit LED

Constant voltage driving:

Item	Symbol	MIN.	TYP.	MAX.	Unit	Condition
White Backlight current	I _{BL}	—	120	150	mA	V _{BL} = 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	-0.3to7	-0.3to7	V
Input Voltage	VT	-0.3 to VDD +0.3	-0.3 to VDD +0.3	V
Operating Temperature	T _{opr}	0 to 50	-20 to 70	°C
Storage Temperature	T _{stg}	-10 to 60	-30 to 80	°C

INSTRUCTIONS TABLE

■ Instructions

There are four categories of instructions that:

- Designate ST7066U functions, such as display format, data length, etc.
- Set internal RAM addresses
- Perform data transfer with internal RAM
- Others

Instruction Table:

Instruction	Instruction Code										Description	Description Time (270KHz)	
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0			
Clear Display	0	0	0	0	0	0	0	0	0	0	1	Write "20H" to DDRAM. and set DDRAM address to "00H" from AC	1.52 ms
Return Home	0	0	0	0	0	0	0	0	0	1	x	Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.	1.52 ms
Entry Mode Set	0	0	0	0	0	0	0	0	1	I/D	S	Sets cursor move direction and specifies display shift. These operations are performed during data write and read.	37 us
Display ON/OFF	0	0	0	0	0	0	0	1	D	C	B	D=1:entire display on C=1:cursor on B=1:cursor position on	37 us
Cursor or Display Shift	0	0	0	0	0	0	1	S/C	R/L	x	x	Set cursor moving and display shift control bit, and the direction, without changing DDRAM data.	37 us
Function Set	0	0	0	0	0	1	DL	N	F	x	x	DL:interface data is 8/4 bits N:number of line is 2/1 F:font size is 5x11/5x8	37 us
Set CGRAM address	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0		Set CGRAM address in address counter	37 us
Set DDRAM address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0		Set DDRAM address in address counter	37 us
Read Busy flag and address	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0		Whether during internal operation or not can be known by reading BF. The contents of address counter can also be read.	0 us
Write data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0		Write data into internal RAM (DDRAM/CGRAM)	37 us
Read data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0		Read data from internal RAM (DDRAM/CGRAM)	37 us

Note:

Be sure the ST7066U is not in the busy state (BF = 0) before sending an instruction from the MPU to the ST7066U. If an instruction is sent without checking the busy flag, the time between the first instruction and next instruction will take much longer than the instruction time itself. Refer to Instruction Table for the list of each instruction execution time.

RECOMMENDED INITIAL SETTINGS

Function set :38H
Clear display :01H
Display On/off control :0EH
Entry Mode Set :06H

■ Instruction Description● **Clear Display**

	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Code	0	0	0	0	0	0	0	0	0	1

Clear all the display data by writing "20H" (space code) to all DDRAM address, and set DDRAM address to "00H" into AC (address counter). Return cursor to the original status, namely, bring the cursor to the left edge on first line of the display. Make entry mode increment (I/D = "1").

● **Return Home**

	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Code	0	0	0	0	0	0	0	0	1	x

Return Home is cursor return home instruction. Set DDRAM address to "00H" into the address counter. Return cursor to its original site and return display to its original status, if shifted. Contents of DDRAM does not change.

● **Entry Mode Set**

	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Code	0	0	0	0	0	0	0	1	I/D	S

Set the moving direction of cursor and display.

- **I/D : Increment / decrement of DDRAM address (cursor or blink)**
 When I/D = "High", cursor/blink moves to right and DDRAM address is increased by 1.
 When I/D = "Low", cursor/blink moves to left and DDRAM address is decreased by 1.
 * CGRAM operates the same as DDRAM, when read from or write to CGRAM.
- **S: Shift of entire display**
 When DDRAM read (CGRAM read/write) operation or S = "Low", shift of entire display is not performed. If S = "High" and DDRAM write operation, shift of entire display is performed according to I/D value (I/D = "1" : shift left, I/D = "0" : shift right).

S	I/D	Description
H	H	Shift the display to the left
H	L	Shift the display to the right

- **Display ON/OFF**

	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Code	0	0	0	0	0	0	1	D	C	B

Control display/cursor/blink ON/OFF 1 bit register.

- **D : Display ON/OFF control bit**
When D = "High", entire display is turned on.
When D = "Low", display is turned off, but display data is remained in DDRAM.
- **C : Cursor ON/OFF control bit**
When C = "High", cursor is turned on.
When C = "Low", cursor is disappeared in current display, but I/D register remains its data.
- **B : Cursor Blink ON/OFF control bit**
When B = "High", cursor blink is on, that performs alternate between all the high data and display character at the cursor position.
When B = "Low", blink is off.

- **Cursor or Display Shift**

	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Code	0	0	0	0	0	1	S/C	R/L	x	x

Without writing or reading of display data, shift right/left cursor position or display. This instruction is used to correct or search display data. During 2-line mode display, cursor moves to the 2nd line after 40th digit of 1st line. Note that display shift is performed simultaneously in all the line. When displayed data is shifted repeatedly, each line shifted individually. When display shift is performed, the contents of address counter are not changed.

S/C	R/L	Description	AC Value
L	L	Shift cursor to the left	AC=AC-1
L	H	Shift cursor to the right	AC=AC+1
H	L	Shift display to the left. Cursor follows the display shift	AC=AC
H	H	Shift display to the right. Cursor follows the display shift	AC=AC

- **Function Set**

	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Code	0	0	0	0	1	DL	N	F	x	x

- **DL : Interface data length control bit**
When DL = "High", it means 8-bit bus mode with MPU.
When DL = "Low", it means 4-bit bus mode with MPU. So to speak, DL is a signal to select 8-bit or 4-bit bus mode.
When 4-bit bus mode, it needs to transfer 4-bit data by two times.
- **N : Display line number control bit**
When N = "Low", it means 1-line display mode.
When N = "High", 2-line display mode is set.
- **F : Display font type control bit**
When F = "Low", it means 5 x 8 dots format display mode
When F = "High", 5 x 11 dots format display mode.

N	F	No. of Display Lines	Character Font	Duty Factor
L	L	1	5x8	1/8
L	H	1	5x11	1/11
H	x	2	5x8	1/16

- **Set CGRAM Address**

RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0

Set CGRAM address to AC.

This instruction makes CGRAM data available from MPU.

- **Set DDRAM Address**

RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0

Set DDRAM address to AC.

This instruction makes DDRAM data available from MPU.

When 1-line display mode (N = 0), DDRAM address is from "00H" to "4FH".

In 2-line display mode (N = 1), DDRAM address in the 1st line is from "00H" to "27H", and DDRAM address in the 2nd line is from "40H" to "67H".

- **Read Busy Flag and Address**

	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Code	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0

When BF = "High", indicates that the internal operation is being processed. So during this time the next instruction cannot be accepted.

The address Counter (AC) stores DDRAM/CGRAM addresses, transferred from IR.

After writing into (reading from) DDRAM/CGRAM, AC is automatically increased (decreased) by 1.

- **Write Data to CGRAM or DDRAM**

	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Code	1	0	D7	D6	D5	D4	D3	D2	D1	D0

Write binary 8-bit data to DDRAM/CGRAM.

The selection of RAM from DDRAM, CGRAM, is set by the previous address set instruction : DDRAM address set, CGRAM address set. RAM set instruction can also determine the AC direction to RAM.

After write operation, the address is automatically increased/decreased by 1, according to the entry mode.

- **Read Data from CGRAM or DDRAM**

	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Code	1	1	D7	D6	D5	D4	D3	D2	D1	D0

Read binary 8-bit data from DDRAM/CGRAM.

The selection of RAM is set by the previous address set instruction. If address set instruction of RAM is not performed before this instruction, the data that read first is invalid, because the direction of AC is not determined. If you read RAM data several times without RAM address set instruction before read operation, you can get correct RAM data from the second, but the first data would be incorrect, because there is no time margin to transfer RAM data.

In case of DDRAM read operation, cursor shift instruction plays the same role as DDRAM address set instruction : it also transfer RAM data to output data register. After read operation address counter is automatically increased/decreased by 1 according to the entry mode. After CGRAM read operation, display shift may not be executed correctly.

* In case of RAM write operation, after this AC is increased/decreased by 1 like read operation. In this time, AC indicates the next address position, but you can read only the previous data by read instruction.

DISPLAY DD RAM AND CHARACTER POSITION

40x4, 1/16 DUTY CYCLE

Controller I&II

	1	2		40	
line 1	00	01	. . . . .	27	DISPLAY POSITION Controller I
line 2	40	41	. . . . .	67	DD RAM ADDRESS Controller II
line 3	00	01	. . . . .	27	
line 4	40	41	. . . . .	67	DD RAM ADDRESS

AC CHARACTERISTICS

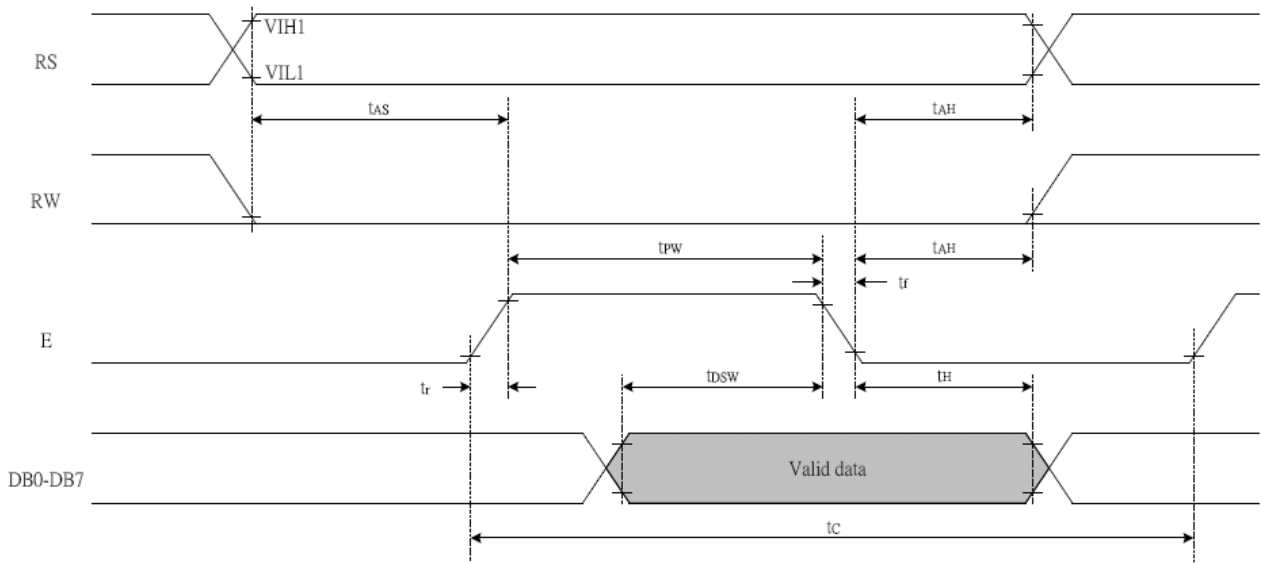
Write mode (writing data from MPU to ST7066)

Symbol	Characteristics	Test Condition	Min.	Typ.	Max.	Unit
T _C	Enable Cycle Time	Pin E	1200	-	-	ns
T _{PW}	Enable Pulse Width	Pin E	460	-	-	ns
T _{R,T_F}	Enable Rise/Fall Time	Pin E	-	-	25	ns
T _{AS}	Address Setup Time	Pins: RS,RW,E	0	-	-	ns
T _{AH}	Address Hold Time	Pins: RS,RW,E	10	-	-	ns
T _{DSW}	Data Setup Time	Pins: DB0 - DB7	80	-	-	ns
T _H	Data Hold Time	Pins: DB0 - DB7	10	-	-	ns

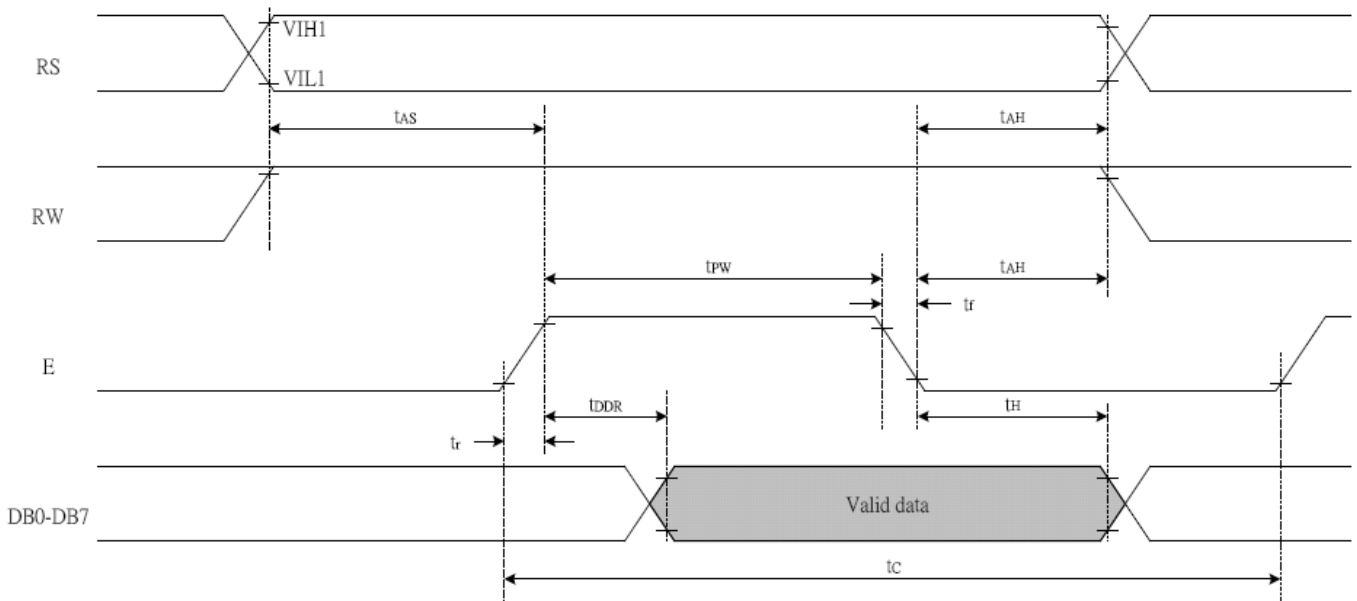
Read mode (Reading data from ST7066 to MPU)

Symbol	Characteristics	Test Condition	Min.	Typ.	Max.	Unit
T _C	Enable Cycle Time	Pin E	1200	-	-	ns
T _{PW}	Enable Pulse Width	Pin E	480	-	-	ns
T _{R,T_F}	Enable Rise/Fall Time	Pin E	-	-	25	ns
T _{AS}	Address Setup Time	Pins: RS,RW,E	0	-	-	ns
T _{AH}	Address Hold Time	Pins: RS,RW,E	10	-	-	ns
T _{DDR}	Data Setup Time	Pins: DB0 - DB7	-	-	320	ns
T _H	Data Hold Time	Pins: DB0 - DB7	10	-	-	ns

Writing data from MPU to ST7066U



Reading data from ST7066U to MPU



THE RESET CIRCUIT

An internal reset circuit automatically initializes the ST7066U when the power is turned on. The following instructions are executed during the initialization. The busy flag (BF) is kept in the busy state until the initialization ends (BF = 1). The busy state lasts for 40 ms after VCC rises to 4.5 V.

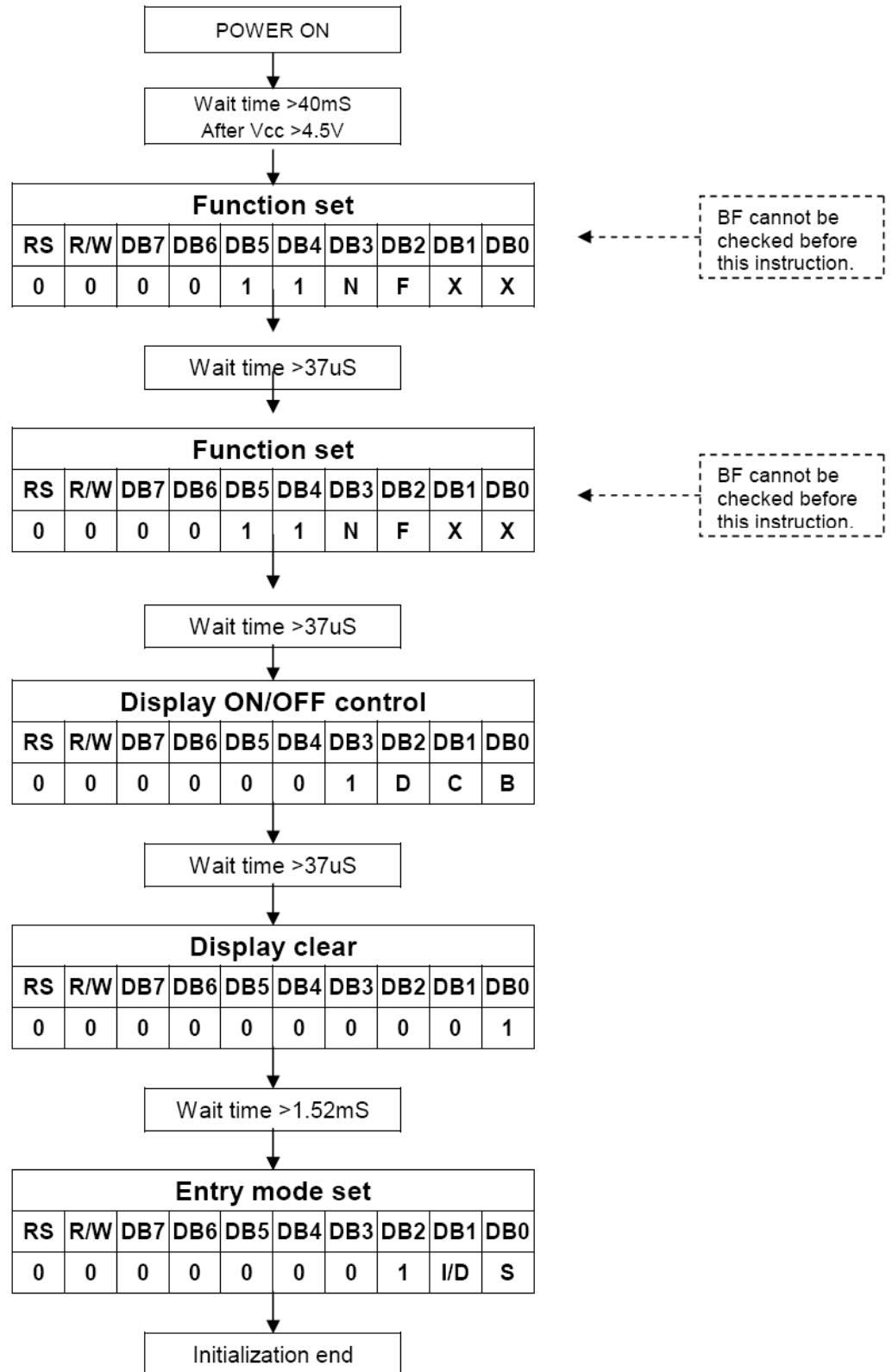
1. Display clear
2. Function set:
 - DL = 1; 8-bit interface data
 - N = 0; 1-line display
 - F = 0; 5x8 dot character font
3. Display on/off control:
 - D = 0; Display off
 - C = 0; Cursor off
 - B = 0; Blinking off
4. Entry mode set:
 - I/D = 1; Increment by 1
 - S = 0; No shift

Note:

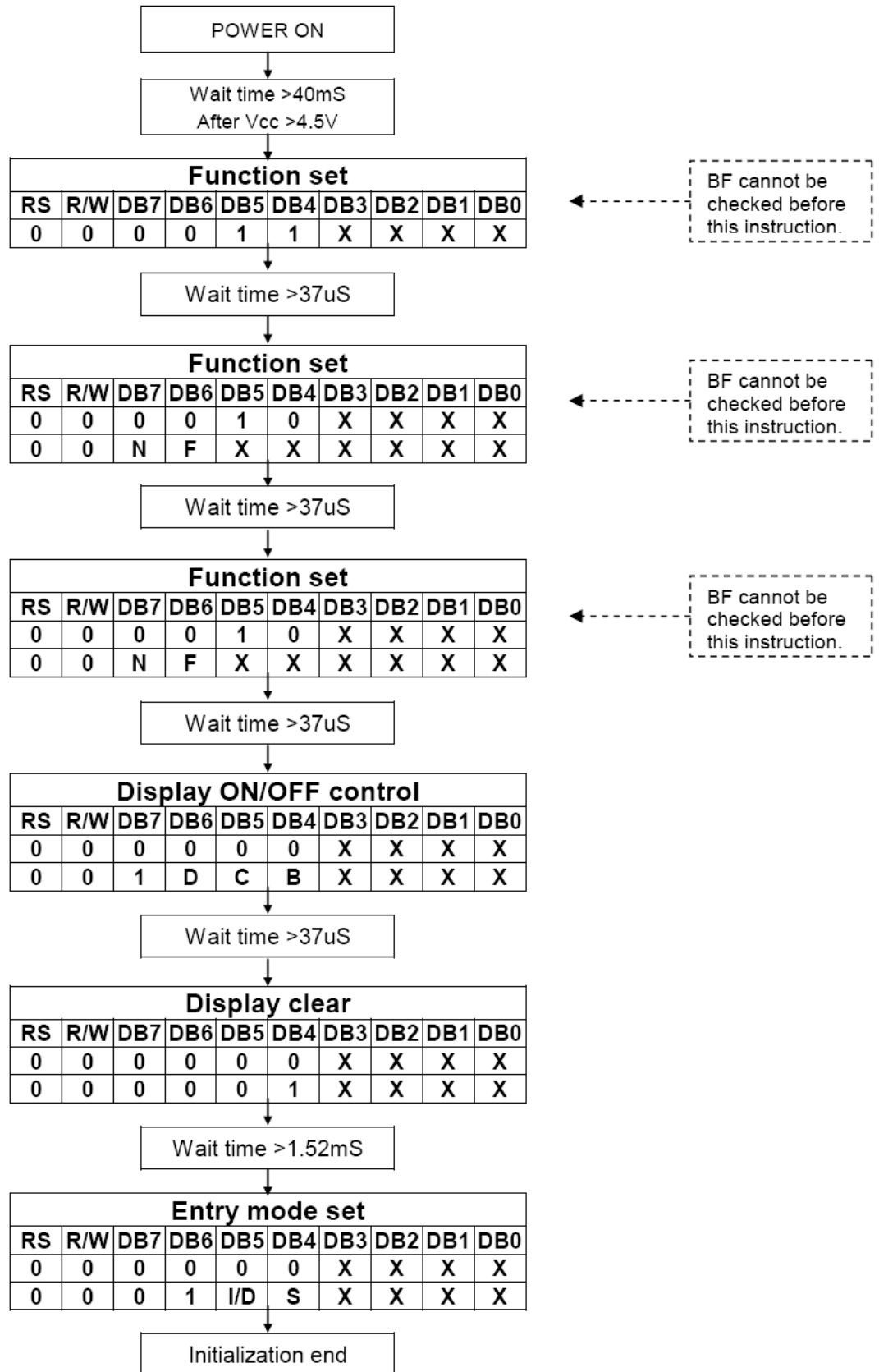
If the electrical characteristics conditions listed under the table Power Supply Conditions using Internal Reset Circuit are met, the internal reset circuit will not operate normally and will fail to initialize the ST7066U. For such a case, initialization must be performed by the MPU as explain by the following figure.

INITIALIZING WITHOUT THE BUILT-IN POWER SUPPLY CIRCUITS

- 8-bit Interface (fosc=270KHz)



● 4-bit Interface (fosc=270KHz)



CHARACTER CODES AND CHARACTER PATTERN
NO.7066-0A

b7-b4 b3-b0	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0000	CG RAM (1)			0	a	P	^	P				—	3	3	0	P
0001	(2)		!	1	A	Q	a	q			.	7	*	4	8	q
0010	(3)		"	2	B	R	b	r			7	4	9	×	P	0
0011	(4)		#	3	C	S	c	s			J	7	T	E	e	∞
0100	(5)		\$	4	D	T	d	t			.	1	T	P	μ	0
0101	(6)		%	5	E	U	e	u			.	7	*	1	∞	0
0110	(7)		&	6	F	V	f	v			7	4	2	3	P	2
0111	(8)		'	7	G	W	g	w			7	*	2	7	g	g
1000	(1)		(	8	H	X	h	x			4	0	*	U	7	2
1001	(2)		)	9	I	Y	i	y			e	7	J	U	7	U
1010	(3)		*	:	J	Z	j	z			2	2	n	V	J	7
1011	(4)		+	;	K	L	k	l			*	7	E	0	*	7
1100	(5)		,	<	L	F	l	f			P	0	0	0	0	7
1101	(6)		—	=	M	N	m	n			2	2	2	0	2	7
1110	(7)		.	>	N	^	n	^			2	2	0	0	n	
1111	(8)		/	?	O	L	o	e			0	0	7	0	0	

ELECTRO-OPTICAL CHARACTERISTICS

MEASURING CONDITION: POWER SUPPLY = $V_{OP} / 64 \text{ Hz}$
 TEMPERATURE = $22 \pm 5 \text{ }^\circ\text{C}$
 RELATIVE HUMIDITY = $60 \pm 15 \%$

ITEM	SYMBOL	UNIT	TYP. STN
RESPONSE TIME	T_{on}	ms	150
	T_{off}	ms	190
CONTRAST RATIO	Cr	-	15
VIEWING ANGLE (6 O'clock) (Cr \geq 2)	V3:00	$^\circ$	45
	V6:00	$^\circ$	70
	V9:00	$^\circ$	45
	V12:00	$^\circ$	60

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	—

QUALITY STANDARD OF LCD MODULE

1.0	Sampling Method		
	Sampling Plan : MIL STD 105 E Class of AQL : Level II/Single Sampling Critical : 0.25% Major 0.65% Minor 1.5%		
2.0	Defect Group	Failure Category	Failure Reasons
	Critical Defect 0.25%(AQL)	Malfunction	Open Short Burnt or dead component Missing part/improper part P.C.B. Broken
	Major Defect 0.65%(AQL)	Poor Insulation	Potential short High current Component damage or scratched or Lying too close improper coating
		Poor Conduction	Damage joint Wrong polarity Wrong spec. part Uneven/intermittent contact Loose part Copper peeling Rust or corrosion or dirt's
	Minor Defect 1.5%(AQL)	Cosmetic Defect	Minor scratch Flux residue Thin solder Poor plating Poor marking Crack solder Poor bending Poor packing Wrong size

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) 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.

(4) 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%.

(5) 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 leaks out of a damaged glass cell comes in contact with your hands, wash it off with soap and water immediately.

WARRANTY

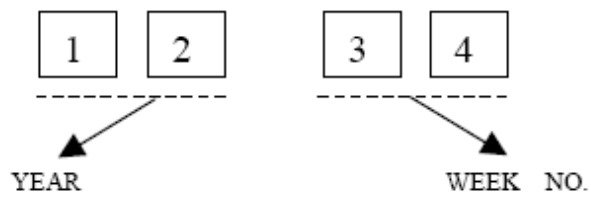
CLOVER will replace or repair any of her LCD module in accordance with her LCD specification for a period of one year from date of shipment. The warranty liability of Clover is limited to repair and/or replacement. Clover will not be responsible for any subsequent or consequential event.

APPENDIX

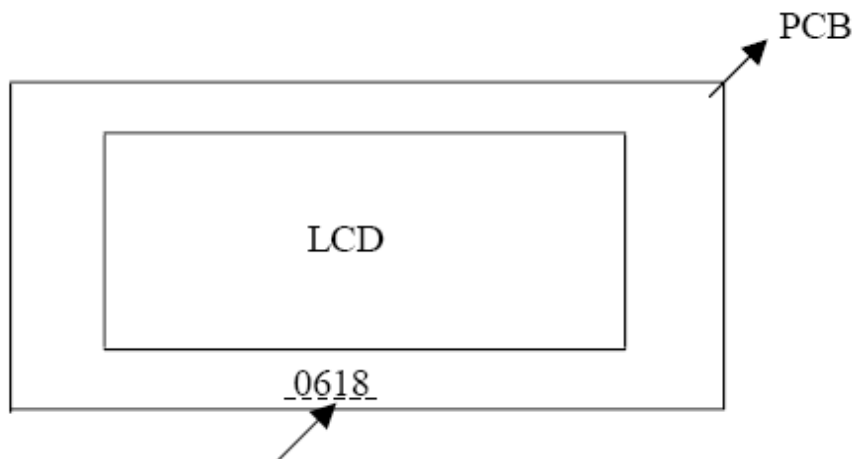
LOT INDICATION OF LCD MODULE

CODING SYSTEM:

4-DIGIT CODE:



LOCATION AS SHOWN BELOW:



e.g. WEEK 18 OF YEAR 2006