



CLOVER DISPLAY LTD.

LCD MODULE SPECIFICATION

Model : ZCV240128M - _ _ _ - _ _ _ - _ _

Preliminary

Revision	Preliminary
Engineering	Z.Y.XU
Date	09 July 2014
Our Reference	

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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:**ZCV240128M - LW - SF - W6 - 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

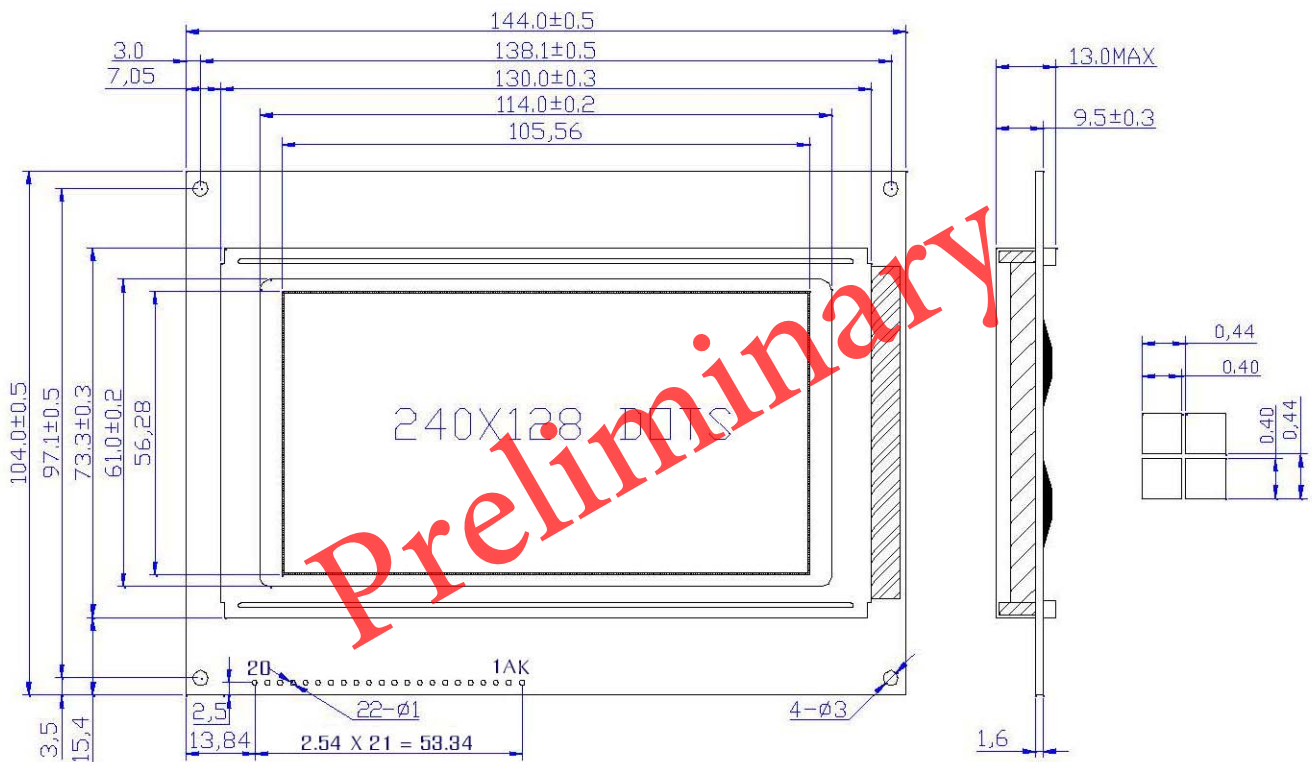
*(8)---Special code for other requirements

- (Can be omitted if not used)
T – Touch panel (Analog)
P – Touch panel (Digital)

GENERAL DESCRIPTION

- Display mode : 240 X 128 dots, Graphic LCD module
- Interface : 8-bit parallel
- Driving method : 1/128 duty, 1/12 bias
- Controller IC : RAIO RA6963 or equivalent
For the detailed information, please refer to the IC specifications.

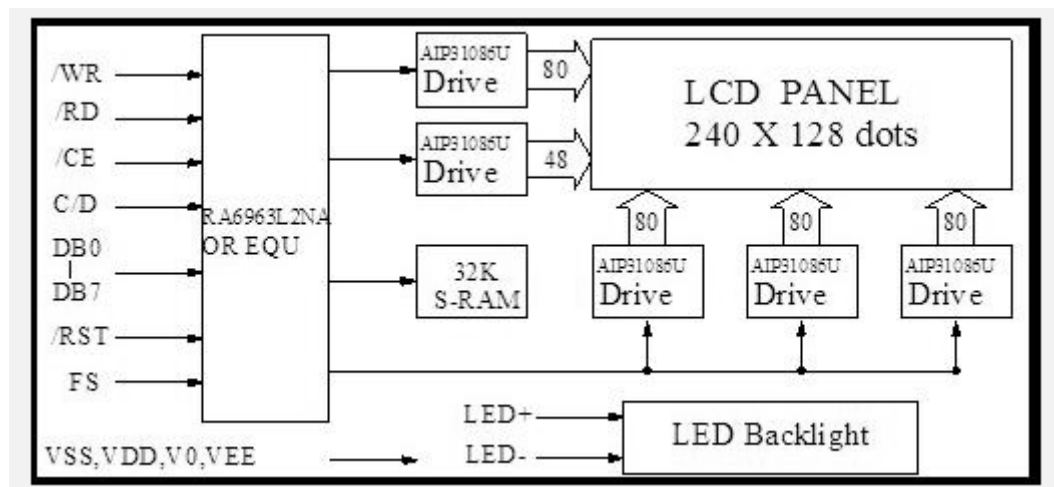
COUNTER DRAWING OF MODULE DIMENSION



MECHANICAL DIMENSIONS

Item	Dimension	Unit	Item	Dimension	Unit
Outline Dimension	144.0(L)x104.0(W)x 13.0Max(H)	mm	Dot Pitch	0.44(L)x0.44(W)	mm
Viewing Area	114.0(L)x61.0(W)	mm	Dot Size	0.40(L)x0.40(W)	mm
Active Area	105.56(L)x56.28(W)	mm			

COUNTER DRAWING OF BLOCK DIAGRAM



CONNECTOR PIN ASSIGNMENT

Pin No.	Symbol	Function	Pin No.	Symbol	Function
1	VSS	Ground	12	DB5	Data Bus Line
2	VDD	Supply Voltage For Logic	13	DB6	Data Bus Line
3	V0	Input Voltage For LCD	14	DB7	Data Bus Line
4	C/D	Register Select Input	15	/CE	Chip Enable
5	/RD	Read Signal	16	/RST	Reset
6	/WR	Write Signal	17	VEE	Input Negative Voltage for LCD
7	DB0	Data Bus Line	18	MD2	Columns Select Input
8	DB1	Data Bus Line	19	FS1	Font Select Input
9	DB2	Data Bus Line	20	A	Supply Voltage for Backlight (+VE)
10	DB3	Data Bus Line	21	A	Supply Voltage for Backlight (+VE)
11	DB4	Data Bus Line		K	Supply Voltage for Backlight (-VE)

ELECTRICAL CHARACTERISTICS

Conditions: VSS=0V, Ta=25°C

Item	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage for Logic	VDD	4.8	5.0	5.2	V
Supply Current for Logic	IDD	—	20	25	mA
Input Voltage for LCD	V0	—	-12.8	—	V
'High' Level Input Voltage	VIH	0.8VDD	—	—	V
'Low' Level Input Voltage	VIL	—	—	0.2VDD	V
Backlight Voltage	V _{BL}	4.8	5.0	5.2	V
Backlight Current	I _{BL}	—	150	200	mA

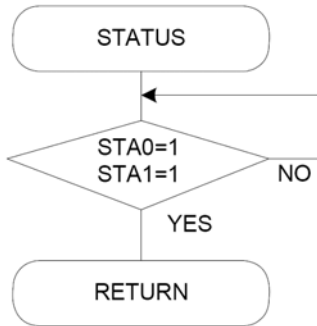
Note (*): There is tolerance in optimum LCD driving voltage during production and it will be within the specified range.

FLOWCHART OF COMMUNICATIONS WITH MPU

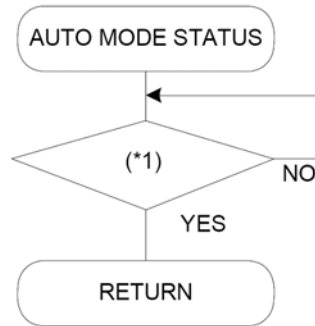
Status Read

Status Checking Flow

a)



b)

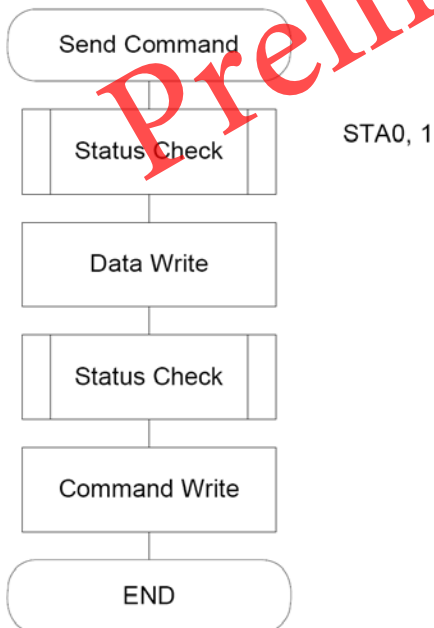


(*1)
STA2=1 (Read)
or
STA3=1 (Write)

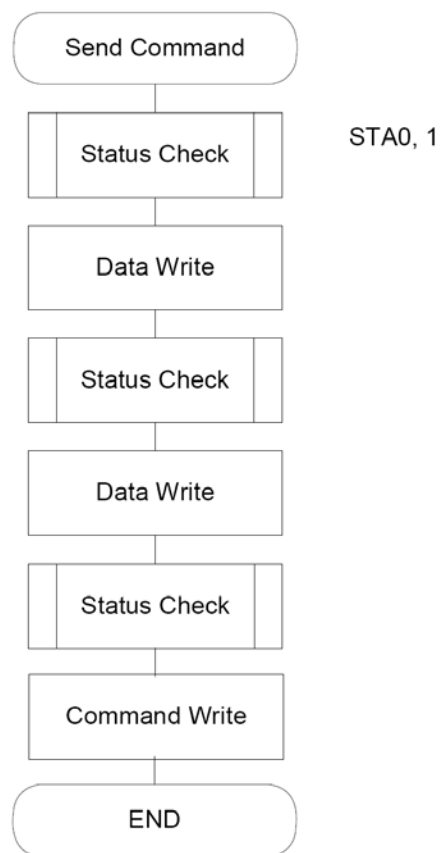
Data Set

Procedure for Sending a Command

a) The case of 1 data



b) The case of 2 data



INSTRUCTIONS

Command	Code	D1	D2	Function
Registers Setting	00100001	X address	Y address	Set cursor pointer
	00100010	Data	00h	Set Offset Register
	00100100	Low address	High address	Set Address pointer
Set Control Word	01000000	Low address	High address	Set Text Home Address
	01000001	Columns	00h	Set Text Area
	01000010	Low address	High address	Set Graphic Home Address
	01000011	Columns	00h	Set Graphic Area
Mode Set	1000X000	--	--	OR mode
	1000X001	--	--	EXOR mode
	1000X011	--	--	AND mode
	1000X100	--	--	Text Attribute mode
	10000XXX	--	--	Internal CG ROM mode
	10001XXX	--	--	External CG RAM mode
Display Mode	10010000	--	--	Display off
	1001XX10	--	--	Cursor on, blink off
	1001XX11	--	--	Cursor on, blink on
	100101XX	--	--	Text on, graphic off
	100110XX	--	--	Text off, graphic on
	100111XX	--	--	Text on, graphic on
Cursor Pattern Select	10100000	--	--	1-line cursor
	10100001	--	--	2-line cursor
	10100010	--	--	3-line cursor
	10100011	--	--	4-line cursor
	10100100	--	--	5-line cursor
	10100101	--	--	6-line cursor
	10100110	--	--	7-line cursor
	10100111	--	--	8-line cursor
Data Read/Write	11000000	Data	--	Data Write and Increment ADP
	11000001	--	--	Data Read and Increment ADP
	11000010	Data	--	Data Write and Decrement ADP
	11000011	--	--	Data Read and Decrement ADP
	11000100	Data	--	Data Write and Non-variable ADP
	11000101	--	--	Data Read and Non-variable ADP
Data auto Read/Write	10110000	--	--	Set Data Auto Write
	10110001	--	--	Set Data Auto Read
	10110010	--	--	Auto Reset
Screen Peek	11100000	--	--	Screen Peek
Screen Copy	11101000	--	--	Screen Copy
Bit Set/Reset	11110XXX	--	--	Bit Reset
	11111XXX	--	--	Bit Set
	1111X000	--	--	Bit 0 (LSB)
	1111X001	--	--	Bit 1
	1111X010	--	--	Bit 2
	1111X011	--	--	Bit 3
	1111X100	--	--	Bit 4
	1111X101	--	--	Bit 5
	1111X110	--	--	Bit 6
	1111X111	--	--	Bit 7 (MSB)
Screen Reverse	11010000	Data	--	Whole screen reverse

				Data Bit 0 0 : Normal 1 : Reverse
Blink Time	01010000	Data	Don't care (Note)	If Frame = 60Hz Data Bit 2:0 000 : 0.066s 001 : 0.25s 010 : 0.5s (Default) 011 : 0.75s 100 : 1s 101 : 1.25s 110 : 1.5s 111 : 2s
Cursor Auto Moving	01100000	Data	Don't care (Note)	Data Bit 0 0 : Disable.(Default) 1 : Enable.
CGROM Font Select	01110000	Data	Don't care (Note)	Data Bit 1:0 00 : Do not care.(Default) 01 : Do not care. 10 : CGROM Font-01. 11 : CGROM Font-02.

Note : In these functions, it must be sent two data before sending the command, but the contents of the second datum (D2) can be any values.

Preliminary

ADDRESS CONFIGURATION OF DISPLAY DATA RAM

Set Control Word

< Table 6-7 >

Code	Hex.	Function	D1	D2
01000000	40h	Set Text Home Address	Low Address	High Address
01000001	41h	Set Text Area	Columns	00h
01000010	42h	Set Graphic Home Address	Low Address	High Address
01000011	43h	Set Graphic Area	Columns	00h

The home address and column size are defined by this command.

6-7-1 Set Text Home Address

The starting address in the external display RAM for text display is defined by this command. The text home address indicates the leftmost and uppermost position.

The Relationship between Display RAM Address and Display Position

< Table 6-8 >

TH	.....	TH + CL
TH + TA	.....	TH + TA + CL
(TH + TA) + TA	.....	TH + 2TA + CL
(TH + 2TA) + TA	.....	TH + 3TA + CL
⋮	⋮	⋮
⋮	⋮	⋮
⋮	⋮	⋮
⋮	⋮	⋮
TH + (n-1) TA	.....	TH + (n-1) TA + CL

TH: Text home address

TA: Text area number (columns)

CL: Columns are fixed by hardware (pin-programmable).

(Example)

Text Home Address : 0000h
Text Area : 0020h
MD2=H, MD3=H : 32 Columns
DUAL =H, MDS=L, MD0=L, MD1=H : 4 Lines

< Table 6-9 >

0000h	0001h	.....	001Eh	001Fh
0020h	0021h	.....	003Eh	002Fh
0040h	0041h	.....	005Eh	005Fh
0060h	0061h	.....	007Eh	007Fh

! Set Graphic Home Address

The starting address of the external display RAM used for graphic display is defined by this Command. The graphic home address indicates the leftmost and uppermost position.

The Relationship between External Display RAM Address and Display Position

< Table 6-10 >

GH	.....	GH + CL
GH + GA	.....	GH + GA + CL
(GH + GA) + GA	.....	GH + 2GA + CL
(GH + 2GA) + GA	.....	GH + 3GA + CL
⋮	⋮	⋮
GH + (n-1) GA	.....	GH + (n-1) GA + CL

GH: Graphic Home Address

GA: Graphic Area Number (columns)

CL: Columns are fixed by hardware (pin-programmable).

(Example)

Graphic Home Address : 0000h
 Graphic Area : 0020h
 MD2=H, MD3=H : 32 columns
 DUAL =H, MDS=L, MD0=H, MD1=H : 2 lines

< Table 6-11 >

0000h	0001h	.....	001Eh	001Fh
0020h	0021h	.....	003Eh	003Fh
0040h	0041h	.....	005Eh	005Fh
0060h	0061h	.....	007Eh	007Fh
0080h	0081h	.....	009Eh	009Fh
00A0h	00A1h	.....	00BEh	00BFh
00C0h	00C1h	.....	00DEh	00DFh
00E0h	00E1h	.....	00FEh	00FFh
0100h	0101h	.....	011Eh	011Fh
0120h	0121h	.....	013Eh	013Fh
0140h	0141h	.....	015Eh	015Fh
0160h	0161h	.....	017Eh	017Fh
0180h	0181h	.....	019Eh	019Fh
01A0h	01A1h	.....	01BEh	01BFh
01C0h	01C1h	.....	01DEh	01DFh
01E0h	01E1h	.....	01FEh	01FFh

Set Text Area

The display columns are defined by the hardware setting. This command can be used adjust the columns of the display.

(Example)

LCD Size : 20 columns, 4 lines
 Text Home Address : 0000h
 Text Area : 0014h
 MD2=H, MD3=H : 32 columns
 DUAL =H , MDS =L, MD0= L, MD1=H : 4 lines

< Table 6-12 >

0000	0001	.....	0013	0014	.....	001F
0014	0015	.....	0027	0028	.....	0033
0028	0029	.....	003B	003C	.....	0047
003C	003D	.....	004F	0050	.....	005B



Set Graphic Area

The display columns are defined by the hardware setting. This command can be used to adjust the columns of the graphic display.

(Example)

LCD Size : 20 columns, 2 lines
 Graphic Home Address : 0000h
 Graphic Area : 0014h
 MD2=H, MD3=H : 32 columns
 $\overline{\text{DUAL}} = \text{H}$, MDS=L MD0=H, MD1=H : 2 lines

< Table 6-13 >

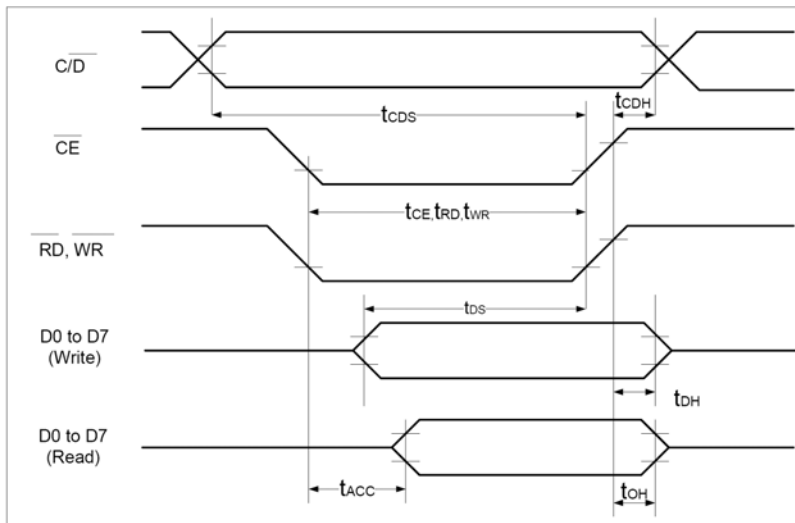
0000	0001	.....	0013	0014	.....	001F
0014	0015	.....	0027	0028	.....	0033
0028	0029	.....	003B	003C	.....	0047
003C	003D	.....	004F	0050	.....	005B
0050	0051	.....	0063	0064	.....	006F
0064	0065	.....	0077	0078	.....	0083
0078	0079	.....	008B	008C	.....	0097
008C	008D	.....	009F	00A0	.....	00AB
00A0	00A1	.....	00B3	00B4	.....	00BF
00B4	00B5	.....	00C7	00C8	.....	00D3
00C8	00C9	.....	00DB	00DC	.....	00E7
00DC	00DD	.....	00EF	00F0	.....	00FD
00F0	00F1	.....	0103	0104	.....	011F
0104	0105	.....	0127	0128	.....	0123
0128	0129	.....	013B	013C	.....	0147
013C	013D	.....	014F	0150	.....	015B



If the graphic area setting is set to match the desired number of columns on the LCD, the addressing scheme will be automatically modified so that the start address of each line equals the end address of the previous line +1.

TIMING CHARACTERISTICS OF COMPATIBLE CONTROLLER CHIPS

MPU Interface Timing



< Figure 8-1 >

< Table 8-3 >

(V_{DD}=+5V±5%, GND=0V, Ta= -20 to +70°C)

Item	Symbol	Test Conditions	Min.	Max.	Unit
C/ \bar{D} Set Up Time	t _{CDS}	--	100	--	ns
C/ \bar{D} Hold Time	t _{CDH}	--	10	--	ns
\bar{CE} , \bar{RD} , \bar{WR} Pulse Width	t _{CE, tRD, tWR}	--	80	--	ns
Data Set Up Time	t _{DS}	--	80	--	ns
Data Hold Time	t _{DH}	--	40	--	ns
Access Time	t _{ACC}	--	--	150	ns
Output Hold Time	t _{OH}	--	10	50	ns

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

Preliminary

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

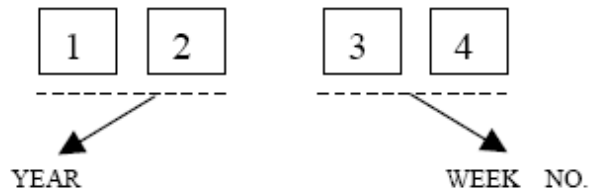
CLOVER will replace or repair any of her LCD module in accordance with her LCD specification for a period of one year from date of shipment. The warranty liability of Clover is limited to repair and/or replacement. Clover will not be responsible for any subsequent or consequential event.

APPENDIX

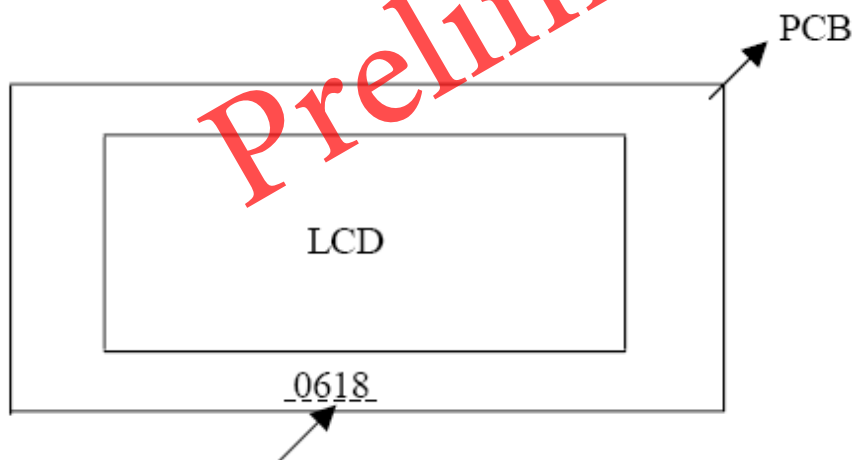
LOT INDICATION OF LCD MODULE

CODING SYSTEM:

4-DIGIT CODE:



LOCATION AS SHOWN BELOW:



e.g. WEEK 18 OF YEAR 2006