



CLOVER DISPLAY LTD.

LCD MODULE SPECIFICATION

Model: CV14412A - _ _ _ - _ _ _ - _ _

| | |
|---------------|------------------|
| Revision | 01 |
| Engineering | Timmy Kwan |
| Date | 13 December 2009 |
| Our Reference | X4952 |

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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:

CV14412A- 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 : 144 X 12 dots, graphic COB LCD module

Fonts type built in : Chinese Traditional & Simplified, English, Europeans Eastern & Western, Japanese, Korean, Latin, Greek, Arabic & Symbol

Interface : 4 bits parallel

Driving method : 1/24 duty, 1/5 bias

Driver IC : CHIPMAST ET7010 or equivalent
For the detailed information, please refer to the IC specifications.

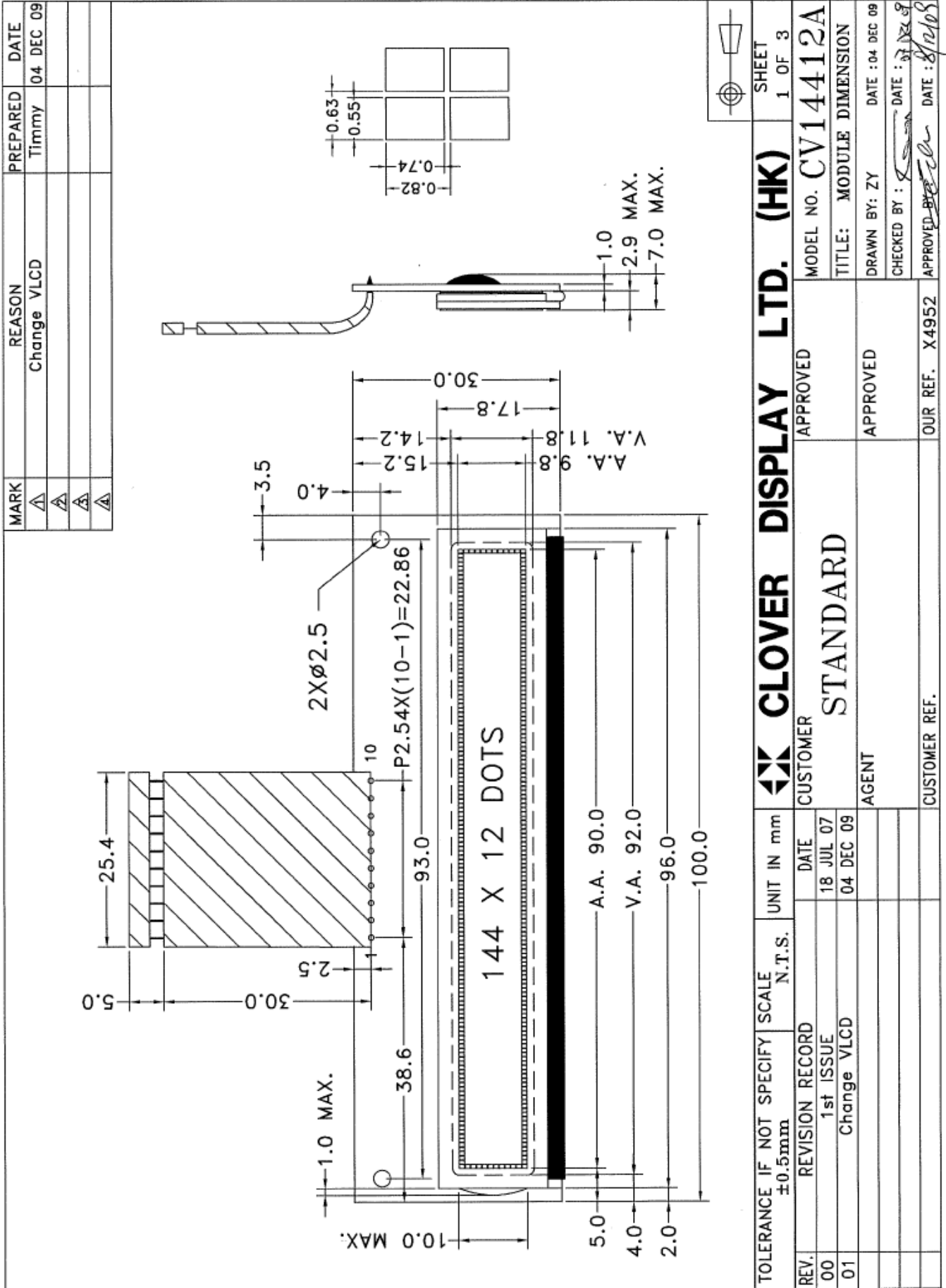
MECHANICAL DIMENSIONS

| Item | Dimension | Unit | Item | Dimension | Unit |
|-------------------|---------------------------------|------|--------------|-------------------|------|
| Outline Dimension | 100.0(L) X 30.0(W) X 7.0MAX.(H) | mm | Viewing Area | 92.0 (L)x11.8 (W) | mm |
| Dot Pitch | 0.63 (L)x0.82(W) | mm | Dot Size | 0.55(L)x0.74(W) | mm |

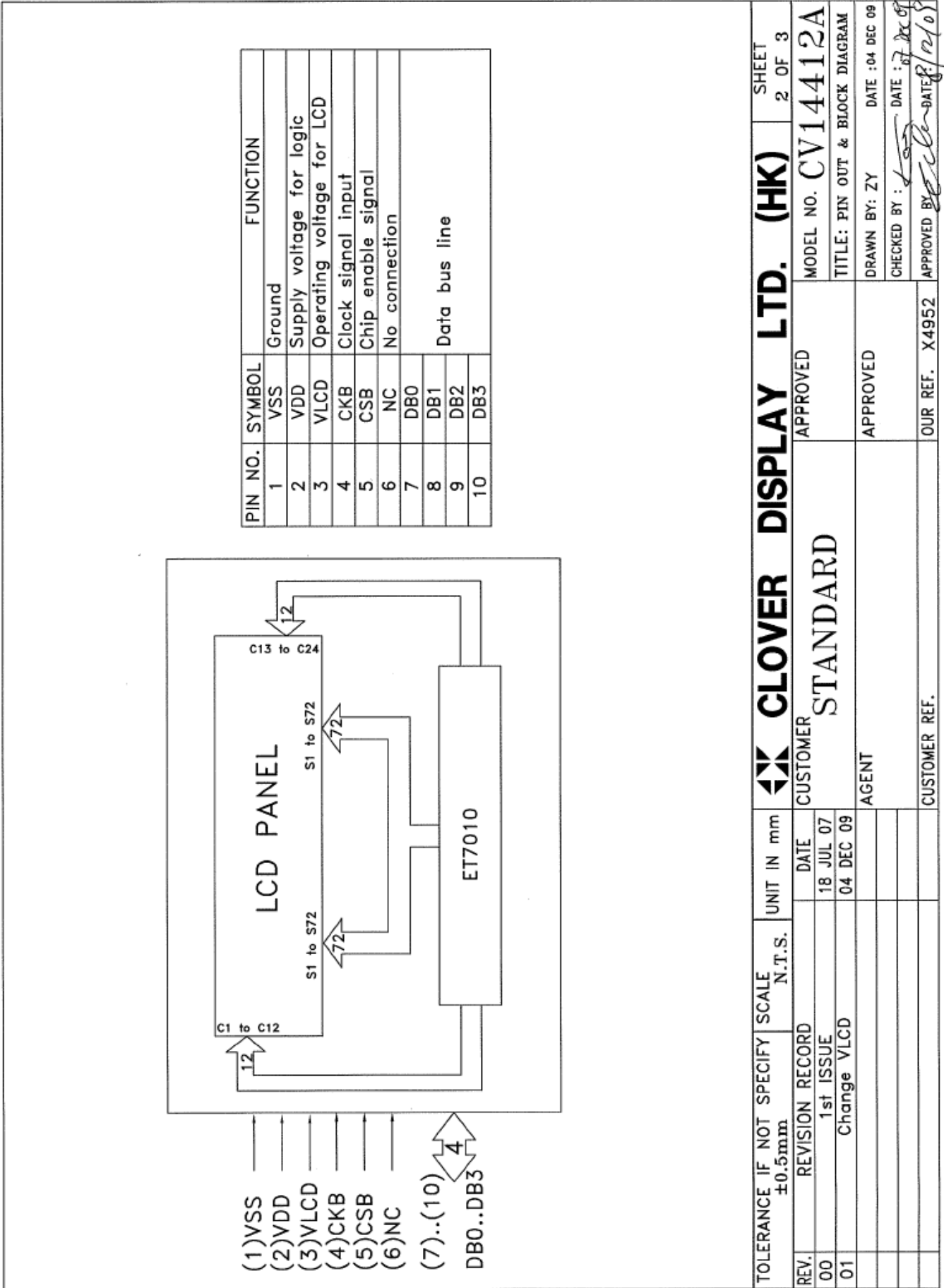
CONNECTOR PIN ASSIGNMENT

| PIN NO. | SYMBOL | FUNCTION |
|---------|--------|---------------------------|
| 1 | VSS | Ground |
| 2 | VDD | Supply voltage for logic |
| 3 | VLCD | Operating voltage for LCD |
| 4 | CKB | Clock signal input |
| 5 | CSB | Chip enable signal |
| 6 | NC | No connection |
| 7 | DB0 | Data bus line |
| 8 | DB1 | |
| 9 | DB2 | |
| 10 | DB3 | |

COUNTER DRAWING OF MODULE DIMENSION



COUNTER DRAWING OF PIN OUT & BLOCK DIAGRAM



| PIN NO. | SYMBOL | FUNCTION |
|---------|--------|---------------------------|
| 1 | VSS | Ground |
| 2 | VDD | Supply voltage for logic |
| 3 | VLCD | Operating voltage for LCD |
| 4 | CKB | Clock signal input |
| 5 | CSB | Chip enable signal |
| 6 | NC | No connection |
| 7 | DB0 | Data bus line |
| 8 | DB1 | |
| 9 | DB2 | |
| 10 | DB3 | |

| | | | | | | |
|------------------------------------|-----------------|-----------------|------------|---------------------------------|---------------------------------|------------------------|
| TOLERANCE IF NOT SPECIFY ±0.5mm | | SCALE N.T.S. | UNIT IN mm | CLOVER DISPLAY LTD. (HK) | | SHEET 2 OF 3 |
| REV. | REVISION RECORD | DATE | DATE | APPROVED | MODEL NO. CV14412A | |
| 00 | 1st ISSUE | 18 JUL 07 | 04 DEC 09 | | TITLE: PIN OUT & BLOCK DIAGRAM | |
| 01 | Change VLCD | | | AGENT | DRAWN BY: ZY | DATE: 04 DEC 09 |
| | | | | APPROVED | CHECKED BY: <i>[Signature]</i> | DATE: <i>07 Dec 09</i> |
| | | | | | APPROVED BY: <i>[Signature]</i> | DATE: <i>07 Dec 09</i> |
| | | | | OUR REF. X4952 | | |
| | | | | CUSTOMER REF. | | |

ELECTRICAL CHARACTERISTICS

Conditions: VSS=0V, Ta=25

| Item | Symbol | MIN. | TYP. | MAX. | Unit | Item | Symbol | MIN. | TYP. | MAX. | Unit |
|-------------------------------|--------|------|------|------|------|------------------------|--------|--------|------|--------|------|
| Supply Voltage for Logic | VDD | 4.75 | 5.0 | 5.25 | V | “H”Level Input Voltage | VIH | 0.8VDD | - | VDD | V |
| Supply Current for Logic | IDD | - | 60 | 90 | μA | “L”Level Input Voltage | VIL | VSS | - | 0.2VDD | V |
| Operating voltage for LCD (*) | VLCD | 4.7 | 6.0 | 6.3 | V | - | - | - | - | - | - |

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

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 range | V _{DD} | -0.3 to 7.0 | -0.3 to 7.0 | V |
| | V _{LCD} | -0.3 to 8.0 | -0.3 to 8.0 | V |
| Input voltage range | V _{IN} | -0.3 to VDD+0.3 | -0.3 to VDD+0.3 | V |
| Operating Temperature | T _{opr} | 0 to 50 | -20 to 70 | |
| Storage Temperature | T _{stg} | -10 to 60 | -30 to 80 | |

COMMANDS TABLE

1-byte CMD

| Name | CMD code | | | | | | | | | | Function |
|----------|----------|-----|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|--|
| | R/W | Hex | b ₇ | b ₆ | b ₅ | b ₄ | b ₃ | b ₂ | b ₁ | b ₀ | |
| Continue | W | 00H | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Continue to access the DDRAM or CGROM data |
| Reset | W | 01H | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | Device reset; the device will ready after 4 system clocks. |
| Write++ | W | 20H | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | Writing data to memory then auto increment address |
| Read++ | W | 21H | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | Reading data from memory then auto increment address |
| RDTWR++ | W | 22H | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | The first Reading data from memory, second writing to memory then auto increment address |
| WRTRD++ | W | 23H | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | The first writing data to memory, second reading from memory then auto increment address |
| LPage | W | 1xH | 0 | 0 | 0 | 1 | P3 | P2 | P1 | P0 | DDRAM page address setting |
| LColumn | W | | 1 | A6 | A5 | A4 | A3 | A2 | A1 | A0 | DDRAM column address setting |

2-byte CMD

| Name | R/W | Hex | CMD code | | | | | | | | | | | | | | PWR initial | Function | | |
|--------|-----|-----|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|-------------|--------------------|--------------------------|------------------------|
| | | | First byte | | | | | | | | Second byte | | | | | | | | | |
| | | | b ₇ | b ₆ | b ₅ | b ₄ | b ₃ | b ₂ | b ₁ | b ₀ | b ₇ | b ₆ | b ₅ | b ₄ | b ₃ | b ₂ | | | b ₁ | b ₀ |
| SYS0 | W | 30H | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | - | - | - | - | - | LRM | UDM | ---- -xxx | System control register0 | |
| SYS1 | W | 31H | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | - | - | - | - | CA | - | DT[1:0] | ---- 0-xx | System control register1 | |
| SYS2 | W | 32H | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | M[1:0] | - | BO | - | - | - | - | 00-0 ---- | System control register2 | |
| STARTL | W | 33H | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | - | - | St5 | St4 | St3 | St2 | St1 | St0 | --00 0000 | LCD scan starting line |
| Frame | W | 34H | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | Fr[7:0] | | | | | | 1111 1111 | Frame rate counter | | |
| CLine | R | 3DH | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | RD | - | L5 | L4 | L3 | L2 | L1 | L0 | ---- ---- | Current-line |

3-byte CMD

| Name | R/W | CMD code | | | | | | | | | | | | | | | | | | Function | | | | | | |
|----------|-----|----------------|----------------|----------------|----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|--------------------------------------|
| | | First byte | | | | | | Second byte | | | | | | Third byte | | | | | | | | | | | | |
| | | b ₇ | b ₆ | b ₅ | b ₄ | b ₃ | b ₂ | b ₁ | b ₀ | b ₇ | b ₆ | b ₅ | b ₄ | b ₃ | b ₂ | b ₁ | b ₀ | b ₇ | b ₆ | | b ₅ | b ₄ | b ₃ | b ₂ | b ₁ | b ₀ |
| MAddress | W | 0 | 1 | - | - | A ₁₉ | A ₁₈ | A ₁₇ | A ₁₆ | A ₁₅ | A ₁₄ | A ₁₃ | A ₁₂ | A ₁₁ | A ₁₀ | A ₉ | A ₈ | A ₇ | A ₆ | A ₅ | A ₄ | A ₃ | A ₂ | A ₁ | A ₀ | Setting CGROM memory started address |

System Control Register0 (30H)

| Name | CMD code | | | | | | | | | | | | | | PWR initial | Function | | |
|------|----------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|-------------|----------|----------------|--------------------------|
| | R/W | First byte | | | | | | | Second byte | | | | | | | | | |
| | | b ₇ | b ₆ | b ₅ | b ₄ | b ₃ | b ₂ | b ₁ | b ₀ | b ₇ | b ₆ | b ₅ | b ₄ | b ₃ | | | b ₂ | b ₁ |
| SYS0 | W | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | - | - | - | - | - | LRM | UDM | ---- -xxx | System control register0 |

UDM: Common mirror select

0: Normal

1: Common mirror (Common will scroll to 0 if C_{n+#} > 63)

| Duty | Common | | | | | | |
|------|-------------------|-------------------|-------------------|-------|-------------------|-------------------|-------------------|
| 16 | C _n | C _{n+1} | C _{n+2} | ----- | C _{n+13} | C _{n+14} | C _{n+15} |
| | C _{n+15} | C _{n+14} | C _{n+13} | ----- | C _{n+2} | C _{n+1} | C _n |
| 24 | C _n | C _{n+1} | C _{n+2} | ----- | C _{n+21} | C _{n+22} | C _{n+23} |
| | C _{n+23} | C _{n+22} | C _{n+21} | ----- | C _{n+2} | C _{n+1} | C _n |
| 32 | C _n | C _{n+1} | C _{n+2} | ----- | C _{n+29} | C _{n+30} | C _{n+31} |
| | C _{n+31} | C _{n+30} | C _{n+29} | ----- | C _{n+2} | C _{n+1} | C _n |
| 48 | C _n | C _{n+1} | C _{n+2} | ----- | C _{n+45} | C _{n+46} | C _{n+47} |
| | C _{n+47} | C _{n+46} | C _{n+45} | ----- | C _{n+2} | C _{n+1} | C _n |
| 64 | C _n | C _{n+1} | C _{n+2} | ----- | C _{n+61} | C _{n+62} | C _{n+63} |
| | C _{n+63} | C _{n+62} | C _{n+61} | ----- | C _{n+2} | C _{n+1} | C _n |

2: Data mirror (mirror every 8 common, n=0~56)

| Duty | Common | | | | | | | |
|----------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| 16/24/32 | C _n | C _{n+1} | C _{n+2} | C _{n+3} | C _{n+4} | C _{n+5} | C _{n+6} | C _{n+7} |
| 48/64 | C _{n+7} | C _{n+6} | C _{n+5} | C _{n+4} | C _{n+3} | C _{n+2} | C _{n+1} | C _n |

3: Reserved

LRM: This option ***inverts*** relation of assignment between Display data RAM ***column*** address and segment outputs.

0: Normal

1: Segment mirror

| Duty | SEG0 | SEG1 | SEG2 | --- | SEG62 | SEG63 | --- | SEG70 | SEG71 | --- | SEG78 | SEG79 |
|------|-------|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|
| 16 | SEG79 | SEG78 | SEG77 | --- | SEG17 | SEG16 | --- | SEG9 | SEG8 | --- | SEG1 | SEG0 |
| 24 | SEG71 | SEG70 | SEG69 | --- | SEG9 | SEG8 | --- | SEG1 | SEG0 | X | X | X |
| 32 | SEG63 | SEG62 | SEG61 | --- | SEG1 | SEG0 | X | X | X | X | X | X |

Frame rate Register (34H)

| Name | CMD code | | | | | | | | | | | | | | | | PWR initial | Function | |
|-------|----------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|-------------|-----------|--------------------|
| | R/W | First byte | | | | | | | | Second byte | | | | | | | | | |
| | | b ₇ | b ₆ | b ₅ | b ₄ | b ₃ | b ₂ | b ₁ | b ₀ | b ₇ | b ₆ | b ₅ | b ₄ | b ₃ | b ₂ | b ₁ | | | b ₀ |
| Frame | W | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | Fr[7:0] | | | | | | | | 1111 1111 | Frame rate counter |

$$\text{Frame Rate} = 32768 / ((Fr + 1) / \text{duty}) \quad (\text{duty depend on R1 bit3,1,0})$$

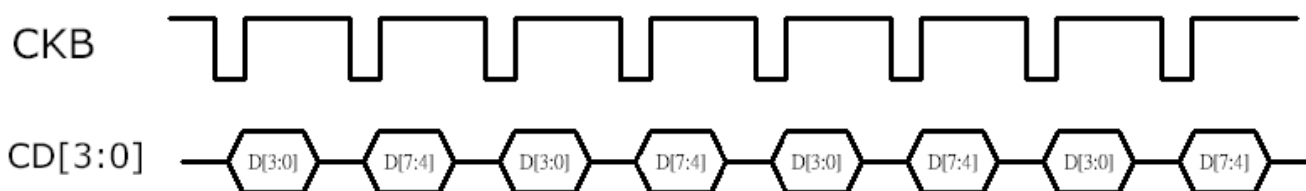
Current-line Register (3DH)

| Name | CMD code | | | | | | | | | | | | | | | | PWR initial | Function | |
|-------|----------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|-------------|-----------|----------------|
| | R/W | First byte | | | | | | | | Second byte | | | | | | | | | |
| | | b ₇ | b ₆ | b ₅ | b ₄ | b ₃ | b ₂ | b ₁ | b ₀ | b ₇ | b ₆ | b ₅ | b ₄ | b ₃ | b ₂ | b ₁ | | | b ₀ |
| CLine | R | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | RD | - | L5 | L4 | L3 | L2 | L1 | L0 | ---- ---- | Current line |

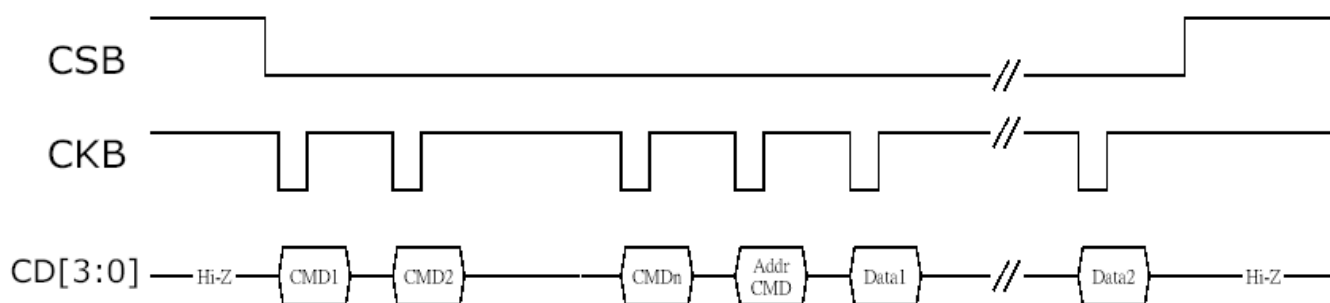
L[5:0]: This register is a pointer which line scan out now.

RD: Device Ready flag. 1: ready 0: not ready

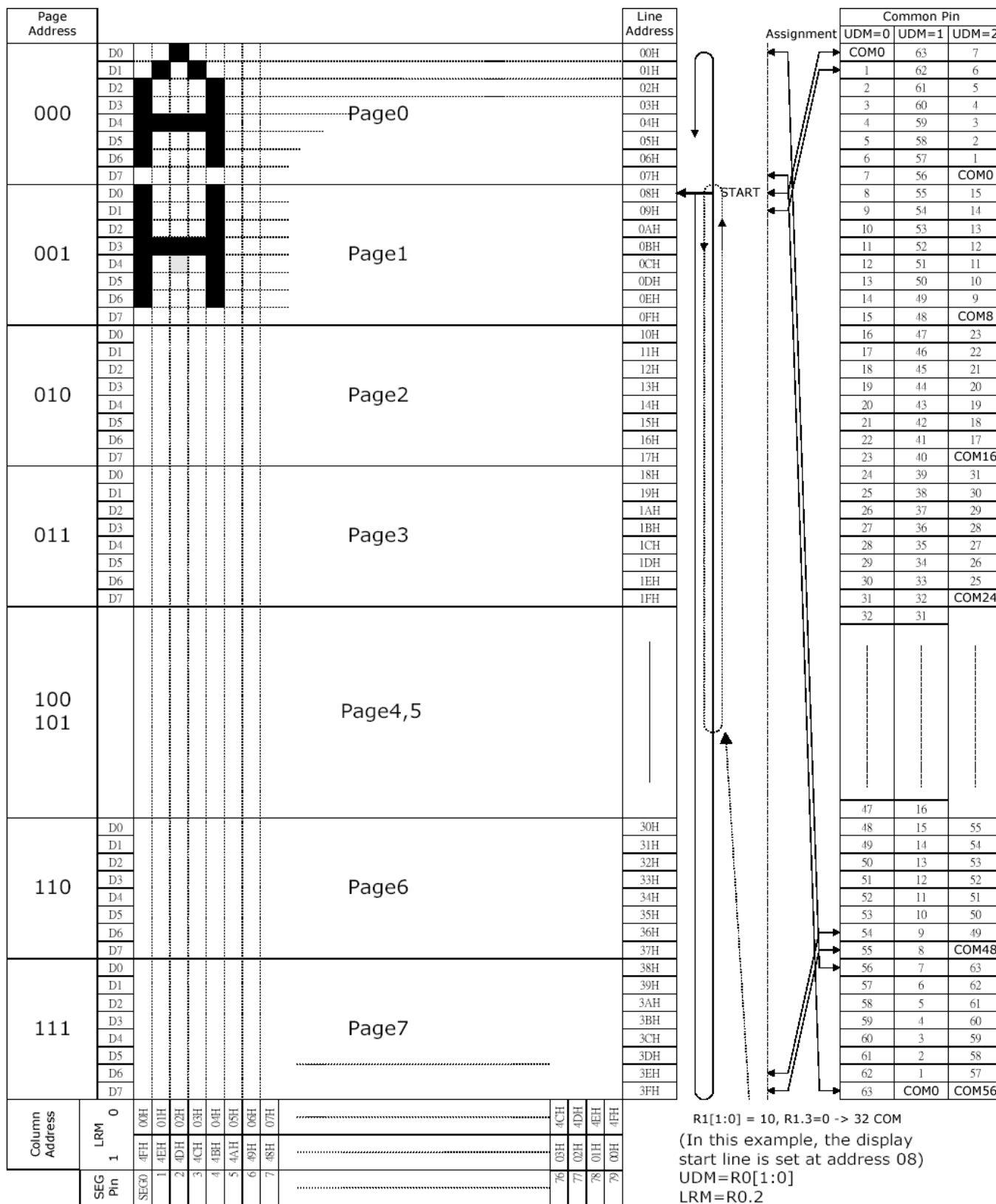
DATA SEQUENCE MODE

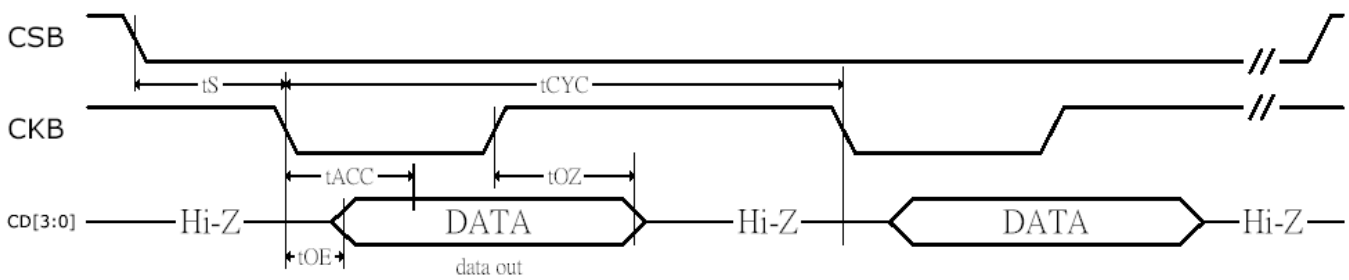
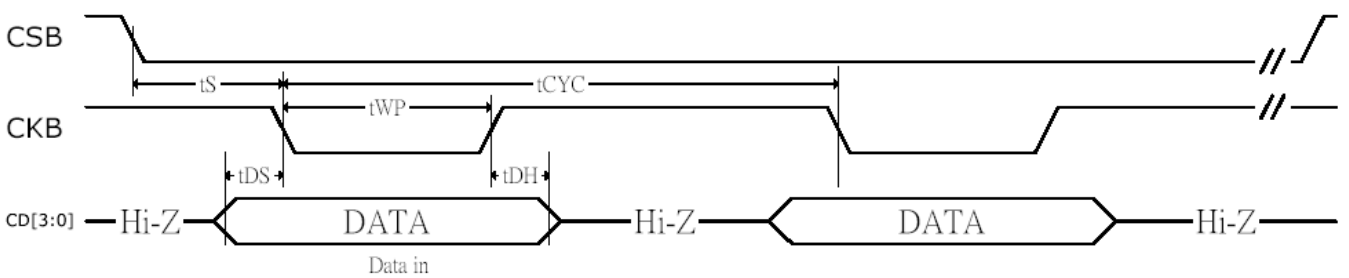


COMMAND WAVEFORM



DISPLAY DATA RAM



READ MODE DIAGRAM**WRITE MODE DIAGRAM****TIMING CHARACTERISTICS**

| Name | Content | Min. | Typ. | Max. | Units |
|-----------|---|------|------|------|-------|
| t_S | CKB setup time | 0 | - | - | ns |
| t_{OE} | Output Enable time | 0 | - | 250 | ns |
| t_{ACC} | Data Access time | 0 | - | 250 | ns |
| t_{OZ} | Data Disable time | 0 | - | 250 | ns |
| t_{WP} | Write pulse width time | 250 | - | - | ns |
| t_{DH} | Data Hold time | 250 | - | - | ns |
| t_{CYC} | Read/Write cycles time | 1 | - | - | us |
| t_E | The time between End of CSB and last Data | 1 | - | - | us |
| t_{BI} | Byte to Byte interval | 1 | - | - | us |

ELECTRO-OPTICAL CHARACTERISTICS

MEASURING CONDITION: POWER SUPPLY = $V_{OP} / 64 \text{ Hz}$
 TEMPERATURE = $23 \pm 5 \text{ }^\circ\text{C}$
 RELATIVE HUMIDITY = $60 \pm 20 \%$

| ITEM | SYMBOL | UNIT | TYP. TN | TYP. STN |
|---------------------------|------------------|------|---------|----------|
| RESPONSE TIME | T _{on} | ms | 140 | 170 |
| | T _{off} | ms | 180 | 220 |
| CONTRAST RATIO | Cr | - | 7 | 15 |
| VIEWING ANGLE (Cr ≥ 2) | V3:00 | ° | 70 | 40 |
| | V6:00 | ° | 43 | 70 |
| | V9:00 | ° | 70 | 40 |
| | V12:00 | ° | 3 | 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 | — |

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.

Do not expose to direct sunlight or fluorescent light for a long time

(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 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%.

(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.