# MULTI-INNO TECHNOLOGY CO., LTD.

## www.multi-inno.com

# LCD MODULE SPECIFICATION

## Model : MI1010ET-2

This module uses ROHS material

### For Customer's Acceptance:

| Customer | |
|----------|---|
| Approved | |
| Comment | |

| This specification may change without prior notice in order to improve performance or quality. Please contact Multi-Inno for updated specification and product status before design for this product or release of this order. | Revision | 1.0 |
|---|---|---|
| | Engineering | |
| | Date | 2013-09-18 |
| | Our Reference | |

## REVISION RECORD

| REV NO. | REV DATE | CONTENTS | REMARKS |
|---------|----------|----------|---------|
| 1.0 | 2013-09-18 | First Release | |
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# CONTENTS

# ■ GENERAL INFORMATION

| Item | Contents | Unit |
|---|---|---|
| LCD type | TFT/Transmissive/Normally black | / |
| Size | 10.1 | Inch |
| Viewing direction | Full viewing angle | O' Clock |
| LCM (W × H × D ) | 241.40×159.10×5.10 | mm$^3$ |
| Active area (W×H) | 216.96×135.60 | mm$^2$ |
| Pixel pitch (W×H) | 0.0565×0.1695 | mm$^2$ |
| Number of dots | 1280(RGB) × 800 | / |
| CTP IC driver | MCU NCB3061 | / |
| Backlight type | 30 LEDs | / |
| Interface type | LVDS | / |
| Color depth | 262K | / |
| Color arrangement | RGB-stripe | / |
| Cover lens surface treatment | Glare,Hard coating(7H) | / |
| Backlight power consumption | 1.86 | W |
| Panel power consumption | 1.0 | W |
| Input voltage | 3.3 | V |
| With/Without TSP | With CTP | / |
| Weight | TBD | g |

Note 1:Viewing direction for best image quality is different from TFT definition, there is a 180 degree shift.
Note 2 : RoHS compliant;
Note 3: LCM weight tolerance: ± 5% .

# ■ EXTERNAL DIMENSIONS
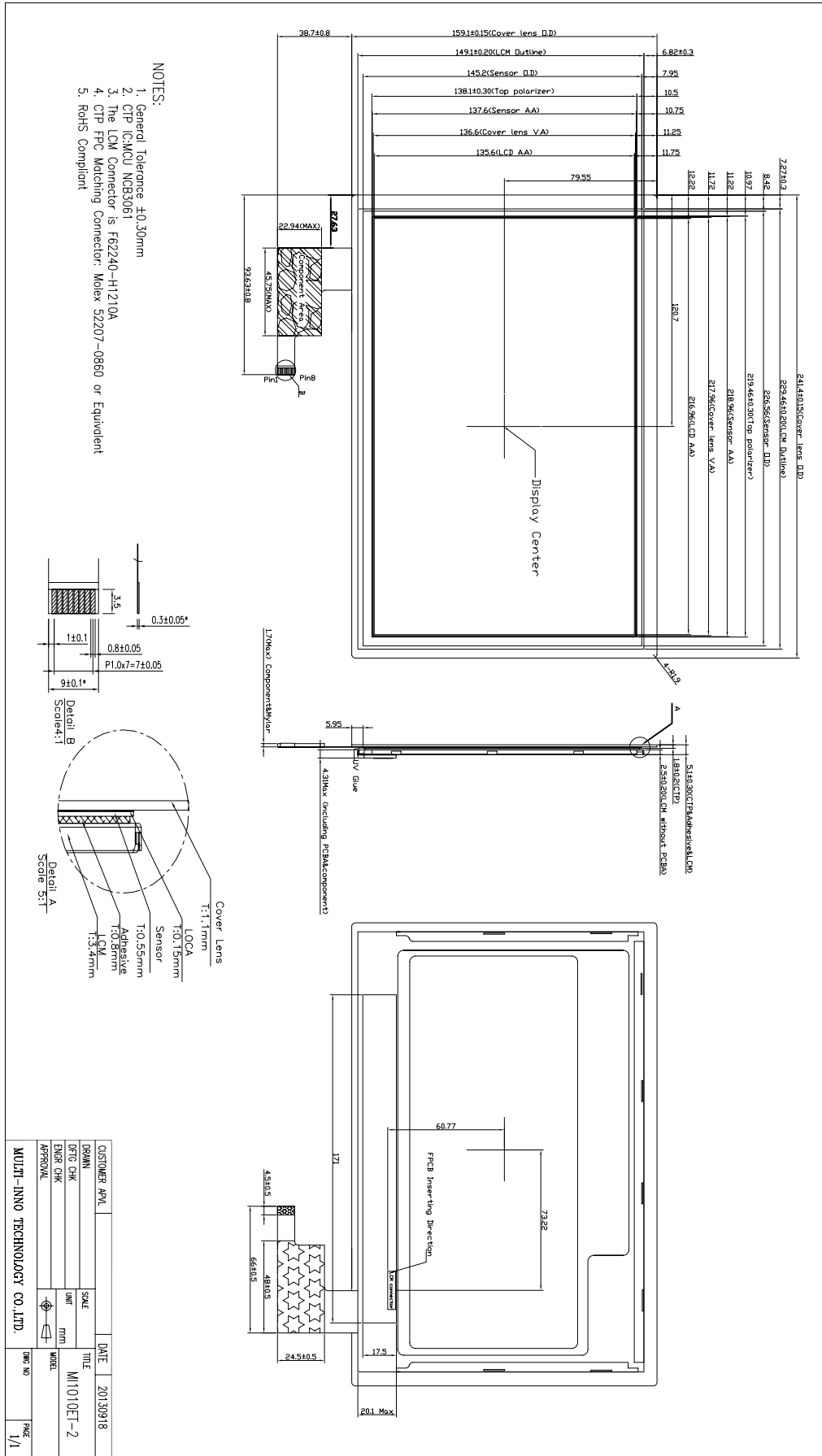
# ■ABSOLUTE MAXIMUM RATINGS

| Parameter | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| Power voltage | VDD | -0.3 | 3.9 | V |
| | AVDD | -0.3 | 14 | V |
| | VGH | -0.3 | 42 | V |
| | VGL | -19 | 0.3 | V |
| | VGH-VGL | 12 | 40 | V |
| LED reverse voltage(each LED) | $V_R$ | - | 1.2 | V |
| LED forward current(each LED) | $I_F$ | - | 25 | mA |
| Operating temperature | $T_{OP}$ | 0 | 50 | °C |
| Storage temperature | $T_{ST}$ | -20 | 60 | °C |
| Humidity | RH | - | 90%(Max60°C) | RH |

# ■ELECTRICAL CHARACTERISTICS

### DC CHARACTERISTICS

| Parameter | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Power voltage | VDD | 2.3 | 2.5 | 2.7 | V |
| | AVDD | 8.0 | 8.2 | 8.4 | V |
| | VGH | 21.7 | 22 | 22.3 | V |
| | VGL | -7.3 | -7 | -6.7 | V |
| Input signal voltage | VCOM | 3.0 | 3.3 | 3.6 | V |
| Input voltage ' H ' level | $V_{IH}$ | 0.8VDD | - | VDD | V |
| Input voltage ' L ' level | $V_{IL}$ | 0 | - | 0.2VDD | V |

Note 1:Be sure to apply VDD and VGL to the LCD first, and then apply VGH.

Note 2:VDD setting should match the signals output voltage (refer to Note 3)of customer's system board.

Note 3:Typical VCOM is only a reference value, it must be optimized according to each LCM. Be sure to use VR.
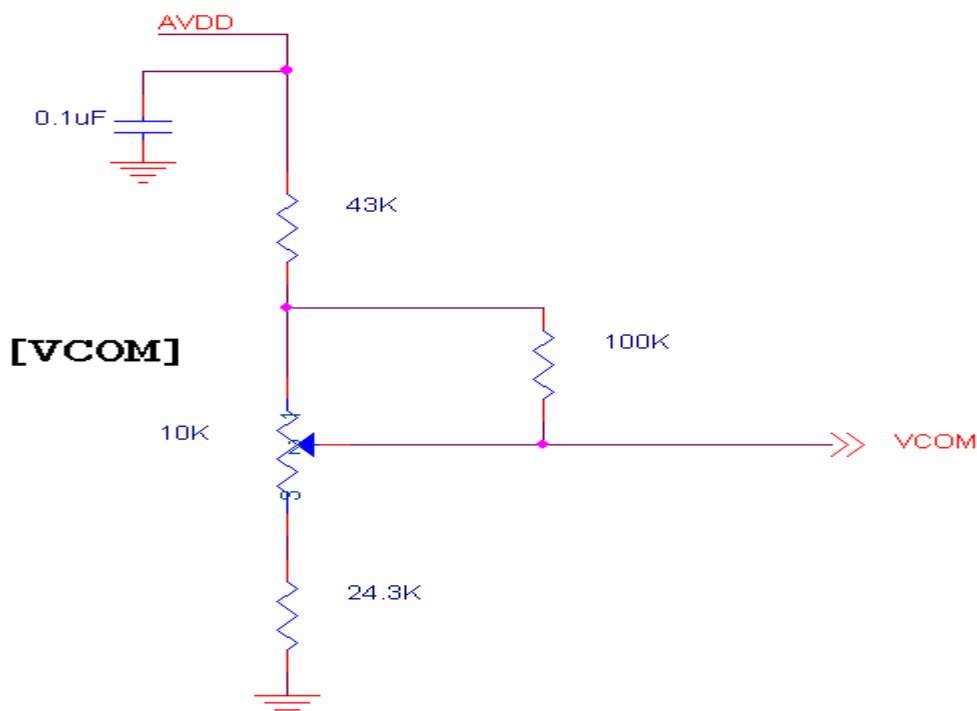
## ■ BACKLIGHT CHARACTERISTICS

| Item | Symbol | Min. | Typ. | Max. | Unit | Condition |
|---|---|---|---|---|---|---|
| Forward voltage | Vf | 8.7 | 9.3 | 9.9 | V | Note 1 |
| Forward current | If | 180 | 200 | 220 | mA | |
| Operating life time | - | 15000 | 20000 | - | Hrs | Note 2 |

Note 1:The LED supply voltage is defined by the number of LED at Ta=25℃ and If=200mA.

Note 2:The "LED  life time" is defined as the module brightness decrease to 50% original brightness at Ta=25    and If=200mA.The LED lifetime could be decreased if operating If is lager than 200mA.

## ■ELECTRO-OPTICAL CHARACTERISTICS

| Item | | Symbol | Condition | Min | Typ | Max | Unit | Remark | Note |
|---|---|---|---|---|---|---|---|---|---|
| Response time | | Tr+Tf | θ=0°<br>∅=0°<br>Ta=25℃ | - | 25 | 50 | ms | FIG 1. | 4 |
| Contrast ratio | | Cr | | 600 | 800 | - | --- | FIG 2. | 1 |
| Luminance uniformity | | δ WHITE | | 70 | 75 | - | % | FIG 2. | 3 |
| Surface Luminance | | Lv | | 250 | 290 | - | cd/m$^2$ | FIG 2. | 2 |
| Viewing angle range | | θ | ∅ = 90° | 75 | 85 | - | deg | FIG 3. | 6 |
| | | | ∅ = 270° | 75 | 85 | - | deg | FIG 3. | |
| | | | ∅ = 0° | 75 | 85 | - | deg | FIG 3. | |
| | | | ∅ = 180° | 75 | 85 | - | deg | FIG 3. | |
| CIE (x, y) chromaticity | Red | x | θ=0°<br>∅=0°<br>Ta=25℃ | - | - | - | | FIG 2. | 5 |
| | | y | | - | - | - | | | |
| | Green | x | | - | - | - | | | |
| | | y | | - | - | - | | | |
| | Blue | x | | - | - | - | | | |
| | | y | | - | - | - | | | |
| | White | x | | 0.26 | 0.31 | 0.36 | | | |
| | | y | | 0.28 | 0.33 | 0.28 | | | |

Note 1. Contrast Ratio(CR) is defined mathematically as For more information see FIG 2.

$$Contrast\ Ratio = \frac{Average\ Surface\ Luminance\ with\ all\ white\ pixels\ (P1, P2, P3, P4, P5)}{Average\ Surface\ Luminance\ with\ all\ black\ pixels\ (P1, P2, P3, P4, P5)}$$

Note 2. Surface luminance is the LCD surface from the surface with all pixels displaying white. For more information see FIG 2.

$$Lv = Average\ Surface\ Luminance\ with\ all\ white\ pixels\ (P1, P2, P3, P4, P5)$$

Note 3. The uniformity in surface luminance ，δ WHITE is determined by measuring luminance at each test position 1 through 5, and then dividing the maximum luminance of 5 points luminance by minimum luminance   of 5 points luminance.   For more information see FIG 2.

$$δ\ WHITE = \frac{Minimum\ Surface\ Luminance\ with\ all\ white\ pixels\ (P1, P2, P3, P4, P5)}{Maximum\ Surface\ Luminance\ with\ all\ white\ pixels\ (P1, P2, P3, P4, P5)}$$

Note 4. Response time is the time required for the display to transition from White to black(Rise Time, Tr) and from black to white(Decay Time, Tf). For additional information see FIG 1. The test equipment is Autronic-Melchers's ConoScope. Series.

Note 5. CIE (x, y) chromaticity，The x, y value is determined by measuring luminance at each test position 1 through 5,and then make average value.

Note 6. Viewing angle is the angle at which the contrast ratio is greater than 2. For TFT module the conrast ratio is greater than 10. The angles are     determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface.    For more information see FIG 3.

Note 7. For viewing angle and response time testing, the testing data is base on Autronic-Melchers's ConoScope. Series Instruments For contrast ratio, Surface Luminance, Luminance uniformity, CIE The test data is base on TOPCON's BM-5 photo detector.

**FIG. 1 The definition of Response Time**

The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white".
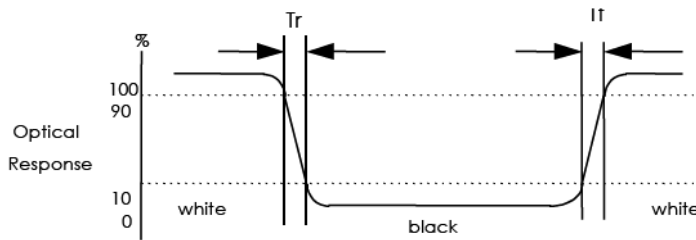


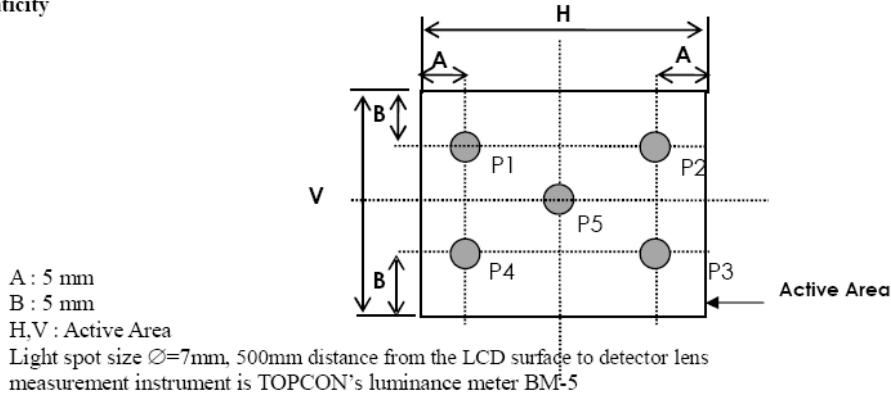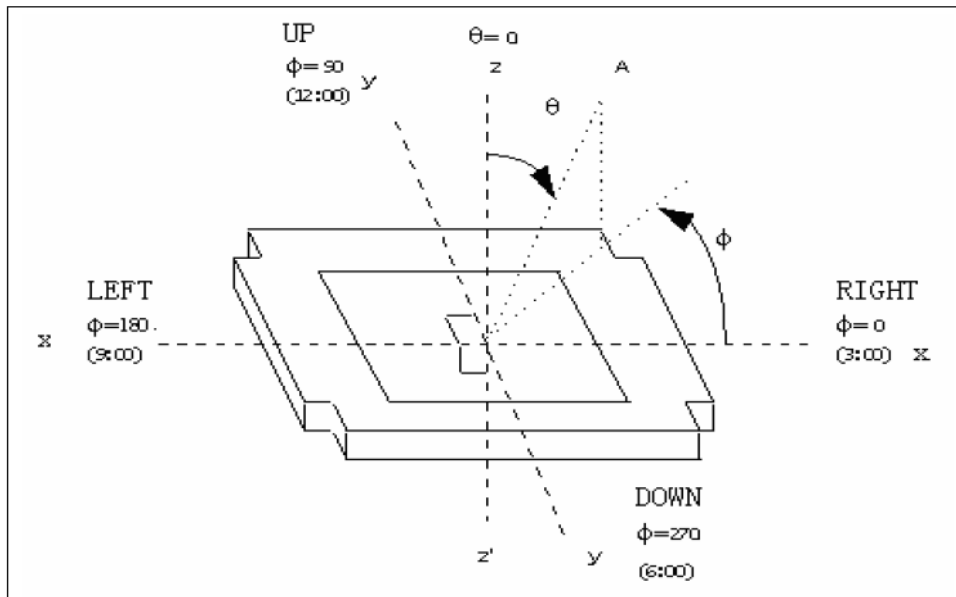**FIG. 2 Measuring method for Contrast ratio, surface luminance, Luminance uniformity , CIE (x, y) chromaticity**



A : 5 mm
B : 5 mm
H,V : Active Area
Light spot size ∅=7mm, 500mm distance from the LCD surface to detector lens
measurement instrument is TOPCON's luminance meter BM-5

**FIG. 3 The definition of viewing angle**

# ■ INTERFACE DESCRIPTION

A 40pin connector is used for the module electronics interface. The recommended model is F62240-H1210A manufactured by Vigorconn.

| Pin No. | Symbol | I/O | Function | Remark |
|---------|--------|-----|----------|--------|
| 1 | VCOM | P | Common Voltage | |
| 2 | VDD | P | Power Supply | |
| 3 | VDD | P | Power Supply | |
| 4 | NC | --- | No connection | |
| 5 | NC | --- | No connection | |
| 6 | NC | --- | No connection | |
| 7 | GND | P | Ground | |
| 8 | Rxin0- | I | -LVDS Differential Data Input | R0-R5, G0 |
| 9 | Rxin0+ | I | +LVDS Differential Data Input | |
| 10 | GND | P | Ground | |
| 11 | Rxin1- | I | -LVDS Differential Data Input | G1~G5, B0,B1 |
| 12 | Rxin1+ | I | +LVDS Differential Data Input | |
| 13 | GND | P | Ground | |
| 14 | Rxin2- | I | -LVDS Differential Data Input | B2-B5,HS,VS, DE |
| 15 | Rxin2+ | I | +LVDS Differential Data Input | |
| 16 | GND | P | Ground | |
| 17 | RxCLK- | I | -LVDS Differential Clock Input | LVDS CLK |
| 18 | RxCLK+ | I | +LVDS Differential Clock Input | |
| 19 | GND | P | Ground | |
| 20 | Rxin3- | I | -LVDS Differential Data Input | R6, R7, G6, G7, B6, B7 |
| 21 | Rxin3+ | I | +LVDS Differential Data Input | |
| 22 | GND | P | Ground | |
| 23 | NC | --- | No connection | |
| 24 | NC | --- | No connection | |
| 25 | GND | P | Ground | |
| 26 | NC | --- | No connection | |

| 27 | LED_PWM | O | CABC controller signal output for backlight | Note2 |
|----|---------|---|---------------------------------------------|-------|
| 28 | NC | --- | No connection | |
| 29 | AVDD | P | Power for Analog Circuit | |
| 30 | GND | P | Ground | |
| 31 | LED- | P | LED Cathode | |
| 32 | LED- | P | LED Cathode | |
| 33 | NC | --- | No connection | |
| 34 | NC | --- | No connection | |
| 35 | VGL | P | Gate OFF Voltage | |
| 36 | NC | --- | No connection | |
| 37 | CABC_EN | I | CABC Enable Input | Note1 |
| 38 | VGH | P | Gate ON Voltage | |
| 39 | LED+ | P | LED Anode | |
| 40 | LED+ | P | LED Anode | |

I: input, O: output, P: Power

Note1: The setting of CABC function are as follows.

| Pin | Enable | Disable |
|-----|--------|---------|
| CABC_EN | High Voltage | Low Voltage or open |

Note2: LED_PWM is used to adjust backlight brightness.



Luminance Bright

Luminance Dark

Duty (0%)　　　　　Duty (100%)
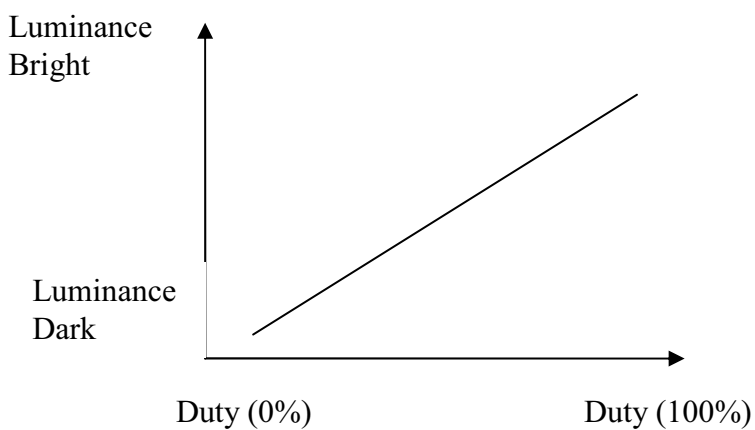
# ■ APPLICATION NOTES

## 1 LVDS SIGNAL TIMING CHARACTERISTICS

### 1.1 AC ELECTRICAL CHARACTERISTICS

| Parameter | Symbol | Values | | | Unit | Remark |
|-----------|--------|--------|--------|--------|------|--------|
| | | Min. | Typ. | Max. | | |
| LVDS Differential input high Threshold voltage | $R_{xVTH}$ | - | - | +100 | mV | $R_{XVCM}$=1.2V |
| LVDS Differential input low Threshold voltage | $R_{xVTL}$ | -100 | - | - | mV | |
| LVDS Differential input common mode voltage | $R_{xVCM}$ | 0.7 | - | 1.6 | V | |
| LVDS Differential voltage | $|V_{ID}|$ | 100 | - | 600 | mV | |
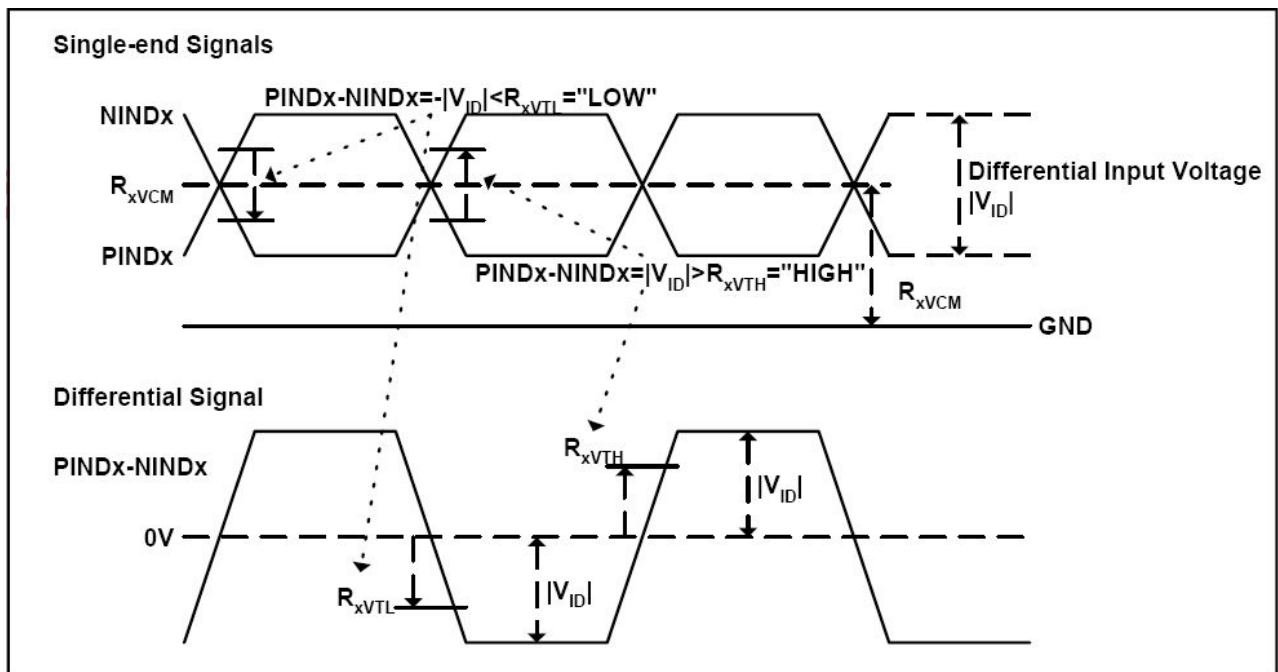
1.2 TIMING TABLE

| Item | Symbol | Values | | | Unit | Remark |
|------|--------|--------|--------|--------|------|--------|
| | | Min. | Typ. | Max. | | |
| Clock Frequency | 1/Tc | (68.9) | 71.1 | (73.4) | MHz | Frame rate =60Hz |
| Horizontal display area | $t_{HD}$ | 1280 | | | Tc | |
| HS period time | $t_H$ | (1410) | 1440 | (1470) | Tc | |
| HS Width +Back Porch +Front Porch | $t_{HW}$+ $t_{HBP}$ +$t_{HFP}$ | (60) | 160 | (190) | Tc | |
| Vertical display area | $t_{VD}$ | 800 | | | $t_H$ | |
| VS period time | tv | (815) | 823 | (833) | $t_H$ | |
| VS Width +Back Porch +Front Porch | $t_{VW}$+ $t_{VBP}$ +$t_{VFP}$ | (15) | 23 | (33) | $t_H$ | |
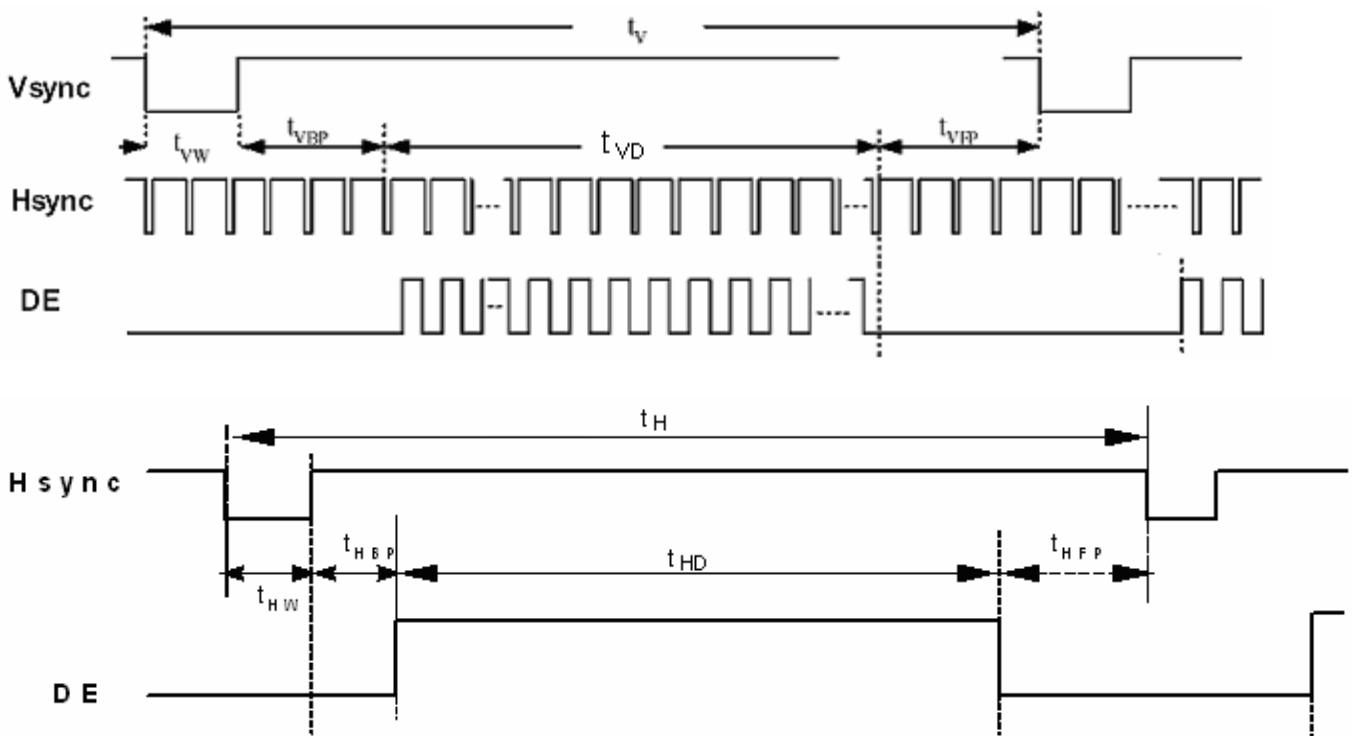
### 1.3 LVDS DATA INPUT FORMAT
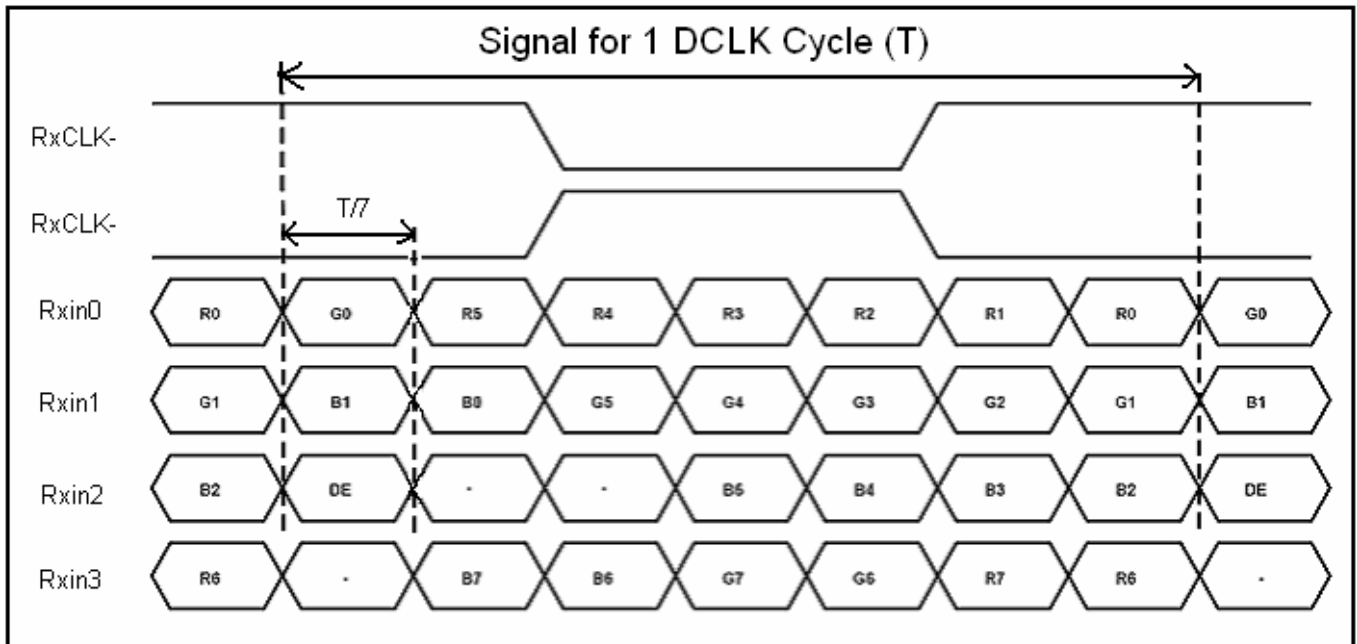


## 2. POWER SEQUENCE

### a. Power on:

**b. Power off:**

VDD

$0.5ms< T_1 <10ms$

$0< T_2 <50ms$

LVDS
Signal

Normal signal

VGH

VGL

>0ms

AVDD

>0ms

VCOM

>=0ms

B/L
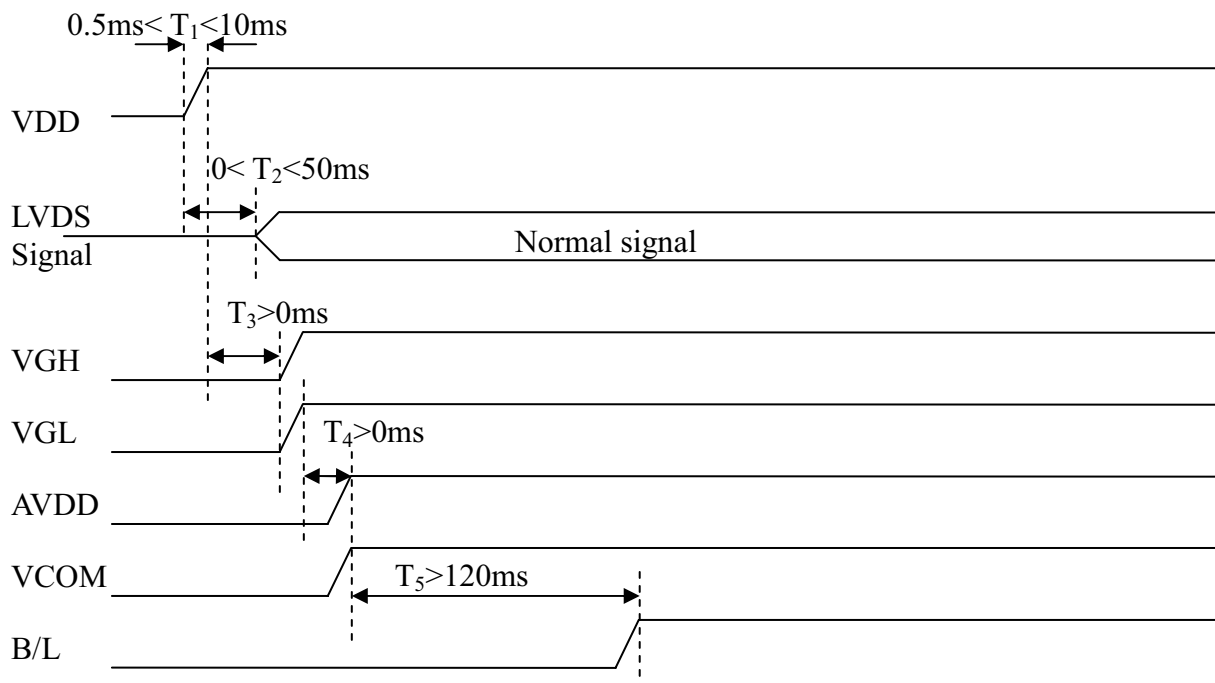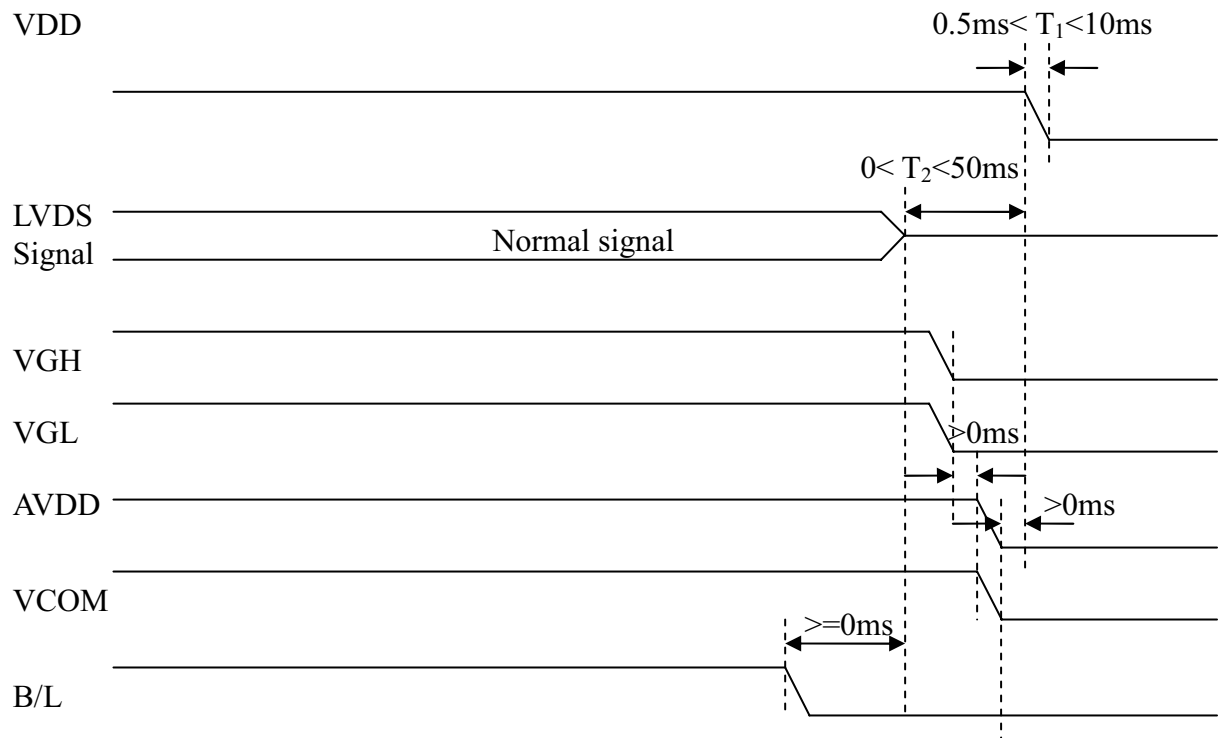
## ■ CTP GENERAL SPECIFICATIONS

### 1. CTP main feature

| Item | Specification | Unit |
|---|---|---|
| Type | Transparent type projected capacitive touch panel | |
| Input mode | Human's finger | |
| Finger | 10 | |
| Transparency | ≧83 | % |
| Haze | ≦5.0 | % |
| Response time | TBD | ms |
| Report rate | TBD | Points/sec |
| Point hitting life time | 1,000,000 times min. | Note 1 |

Note 1: Use 8 mm diameter silicon rubber/force 3N to knock on the same point twice per second

(no-operating), after test function check pass.



central point
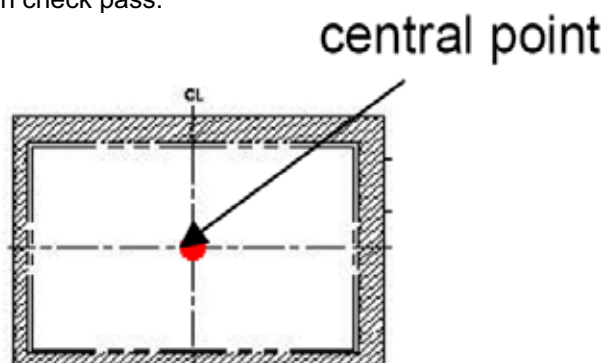
### 2. CTP Absolute Maximum Rating

| Symbol | Description | Min | Typ | Max | Unit | Notes |
|---|---|---|---|---|---|---|
| VDD1 | Supply voltage | 0.3 | - | 5.5 | V | |
| V_IO | DC input voltage | -0.3 | - | VDD1 +0.3 | V | |

### 3. CTP Electrical Characteristic

| Symbol | Description | Min | Typ | Max | Unit | Notes |
|---|---|---|---|---|---|---|
| VDD1 | Supply voltage | 2.7 | - | 5.5 | V | |
| GND | Supply voltage | -0.3 | - | - | V | |
| I | Active Mode | - | 30 | - | mA | AtVDD1=3.3V |
| V_IH | Input H voltage | 0.4 VDD1 | - | VDD1+0.5 | V | |
| V_IL | Input L voltage | -0.5 | - | 0.2 VDD1 | V | |

### 4. CTP Pin Connections

| No. | Name | I/O | Description |
|---|---|---|---|
| 1 | VDD1 | P | Power Voltage for digital circuit |
| 2 | GND | P | Power ground |
| 3 | GND | P | Power ground |
| 4 | SCL | I | Clock; 100KHz |
| 5 | SDA | I/O | Serial data access |
| 6 | GND | P | Power ground |
| 7 | INT | O | Active low when data output from touch panel |
| 8 | RESET | I | Reset |

## 5. Timing Characteristic

### 5.1 Host Interface

The interface to host consist the following signals:
- I2C slave interface
- Interrupt(INT) from NCB3061 to Host

The details of the I2C slave address are described in section. The interrupt (INT) signal is used for NCB3061 to inform the host when the point data is ready for the host to receive.

### 5.2 I2C Slave Interface

NCB3061 supports I2C slave interface with provide two wires, serial data (SDA) and serial clock (SCL), to carry information transfers at up to 1000 kbit/s(Fast mode plus). Data is transferred synchronously to SCL on the SDA line on a byte-by-byte basis. Each data byte is 8 bits long. Each transaction begins with a START (S) and can be terminated by a STOP (P). Please refer the following section for the details.

#### 5.2.1 Slave Address transfer

The first byte of data transferred by the host is the slave address. The slave address is

7 bits long followed by a R/W bit. NCB3061 will be respond by retuning an acknowledge bit by pulling the SDA low at the 9th   when the slave address is matching.

#### 5.2.2 Data Transfer

Data is transferred on a byte-by-byte basis in the direction specified by the R/W bit sent by the master. Each transferred byte is followed by an acknowledge bit on the 9th SCL clock cycle. For Read operation, the master as the receiving device signals a NACK to the slave, the slave will release the SDA line and get into standby for next transaction. For write operation, the slave signals a NACK, the master can generate a STOP command to abort the current transaction
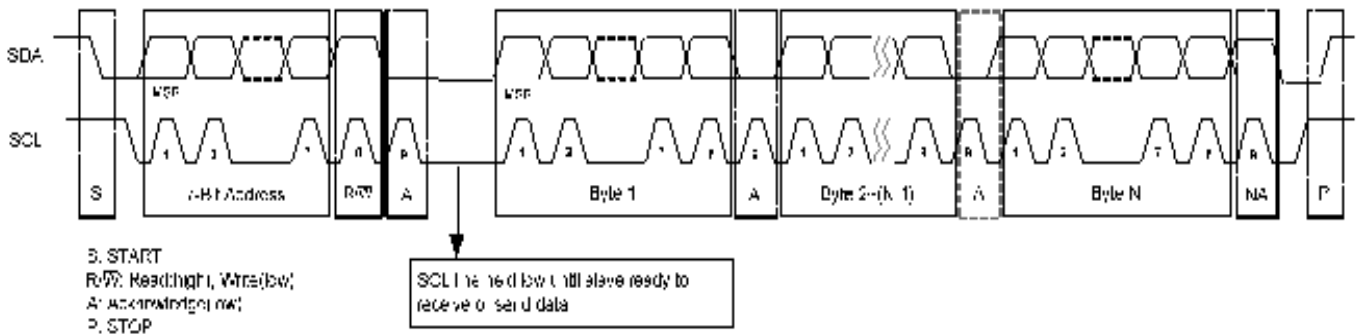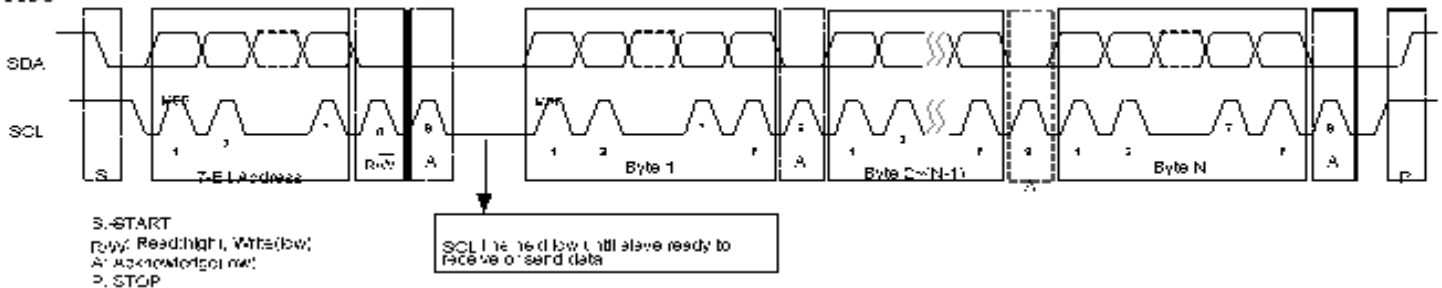


Figure5-1 I2C Waveform

## 6. CTP Interface and Data Format
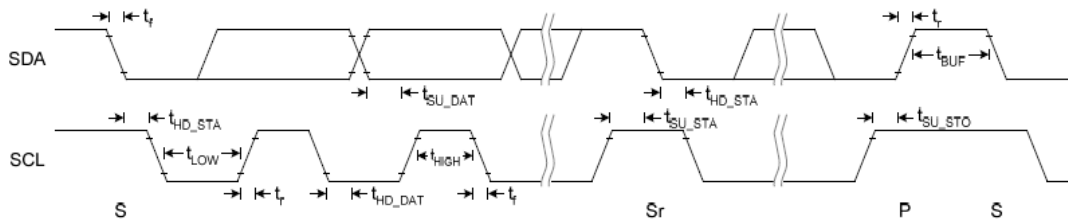
Figure6-2 is the waveform of I2C fast mode timing



Figure6-2 I2C Waveform

Table is the timing characteristic of I2C fast mode plus

Conditions: DVDD=3.3V, GND=0V, $T_{OP}$=25

| Parameter | Symbol | Specification | | | |
|---|---|---|---|---|---|
| | | MIN. | TYP. | MAX. | UNIT |
| SCL clock frequency | $f_{SCL}$ | 0 | - | 1000 | kHz |
| Low period of the SCL clock | $t_{LOW}$ | 0.5 | - | - | us |
| High period of the SCL clock | $t_{HIGH}$ | 0.26 | - | - | us |
| Set up time for a repeated START condition | $t_{SU\_STA}$ | 0.26 | - | - | us |
| Hold time for a repeated START condition. After this period, the first clock pulse is generated | $t_{HD\_STA}$ | 0.26 | - | - | us |
| Data set up time | tSU DAT | 50 | - | - | ns |
| Data hold time | tHD DAT | 0 | - | - | us |
| Signal falling time of SDA and SCL | tf | | - | 120 | ns |
| Signal rising time of SDA and SCL | tr | | | 120 | ns |
| Data set up time | tSU DAT | 100 | | | ns |
| Data hold time | tHD DAT | 0 | | 0.9 | us |
| Set up time for STOP condition | $t_{SU\_STO}$ | 0.26 | | | us |
| Bus free time between a STOP and START condition | tBUF | 0.5 | | | us |
| Capacitive load for each bus line | Cb | | | 550 | pF |

# ■ RELIABILITY TEST

| No. | Test Item | Test Condition | Inspection after test |
|---|---|---|---|
| 1 | High Temperature Storage | 60±2℃/120 hours | Note 1,Note 4 |
| 2 | Low Temperature Storage | -20±2℃/120 hours | Note 1,Note 4 |
| 3 | High Temperature Operating | 50±2℃/120 hours | Note 2,Note 4 |
| 4 | Low Temperature Operating | 0±2℃/120 hours | Note 1,Note 4 |
| 5 | Temperature Cycle | -20±2℃~25~60±2℃×100cycles | Note 4 |
| 6 | Damp Proof Test | 40℃±5℃×90%RH/120 hours | Note 4 |
| 7 | Vibration Test | Frequency range: 10Hz~55Hz<br>Stroke:1.5mm,<br>Sweep:10Hz~55Hz~10Hz 2hours<br>for each direction of X,Y,Z.<br>(6 hours for total) | |
| 8 | Mechanical Shock | 100G 6ms, ±X,±Y,±Z 3times for each direction | |
| 9 | Package Drop Test | Height:60 cm<br>1 corner, 3 edges, 6 surfaces | |
| 10 | Package Vibration Test | Random Vibration :<br>ISTA-3A 1Hz~200Hz,Grms=0.53<br>Half hours for direction of Z. | |
| 11 | ESD test | ±2KV,Human Body Mode,<br>100pF,/1500Ω | |

Note 1: Ta is the ambient temperature of samples.

Note 2: Ts is the temperature of panel's surface.

Note 3: In the standard condition, there shall be no practical problem that may affect the display function.After the reliability test, the product only guarantees operation, but doesn't guarantee all the cosmetic specification.

Note 4: Before cosmetic and function tests, the product must have enough recovery time,at least 2 hours at room temperature.

# ■ INSPECTION CRITERION

## 1. Appearance Specification

1.1 Inspection condition
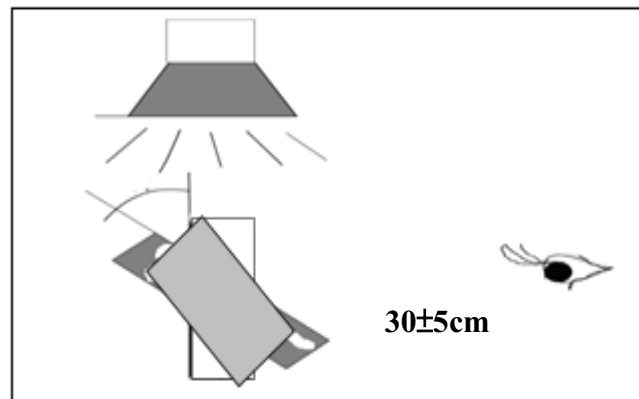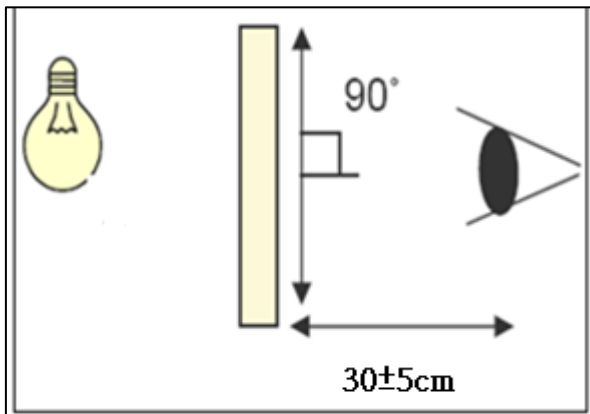
  1.1.1 Inspection conditions

    1.1.1.1 Inspection Distance : 30 ± 5 cm

     1.1.1.2 View Angle:

      (1) Inspection that light pervious to the product: 90±15°

      (2) Inspection that light reflects on the product: 90±15°



  1.1.2   Environment conditions:

| | |
|---|---|
| Ambient Temperature : | 25±5℃ |
| Ambient Humidity : | 30~75%RH |
| Ambient Illumination | 600~800 lux |

1.2   Inspection  Parameters

Appearance inspection standard (D: diameter, L: length; W: width, Z: height, T: glass thickness)

| Inspection item | Inspection standard | | | Description |
|---|---|---|---|---|
| Foreign material in dot shape | SPEC (unit: mm) | | Acceptable |  D= (L + W) / 2 |
| | D≦0.5 | | Ignored | |
| | 0.5<D≦0.8, distance>5 | | n≦3 | |
| | D＞0.8 | | 0 | |
| Foreign material in line shape | SPEC | | Acceptable |  L : Long W : Width |
| | W≦0.05 and L≦7 | | Ignored | |
| | 0.05<W≦0.08, L≦7, distance >5 | | n≦3 | |
| | W>0.08 or   L>7 | | 0 | |
| Contamination | It is acceptable if the dirt can be wiped. | | | |

| Scratch | SPEC | Acceptable | |
|---|---|---|---|
| | W≦0.05 and L≦7 | Ignored | |
| | 0.05<W≦0.08, L≦7, distance >5 | n≦3 | |
| | 0.08<W≦0.1, L≦7, distance >5 | n≦2 | |
| | W>0.1 or　L>7 | 0 | |

| Inspection item | SPEC | | Description |
|---|---|---|---|
| Bubble | SPEC (unit: mm) | Acceptable | |
| | D≦0.2 | Ignored | |
| | Non visible area | Ignored | |
| | 0.2<D≦0.3, distance >5 | n≦3 | |
| | D＞0.3 | 0 | |

D= (L + W) / 2

| Cover & Sensor Crack | Prohibited | | |
|---|---|---|---|

| Cover angle missing | SPEC (unit: mm) | Acceptable | |
|---|---|---|---|
| | Side/Bottom | Ignored | |
| | It is prohibited if the defect appears on the front. | 0 | |

| Inspection item | SPEC | | Description |
|---|---|---|---|
| Cover edge break | SPEC (unit: mm) | Acceptable | |
| | X≦ 2.0, Y≦ 2.0, Z≦T | Ignored | |
| | X>2.0, Y>2.0, Z＞T | 0 | |

| Sensor angle missing/edge break | SPEC (unit: mm) | Acceptable | |
|---|---|---|---|
| | Damage circuit or function. | 0 | |
| | It can be seen from the front of cover visible area. | 0 | |

| Sensor flange | SPEC (unit: mm) | Acceptable |  |
| | Do not affect assembly. | Ignored | |
| Ink | SPEC (unit: mm) | Acceptable | |
| | word unclear, inverted, mistake, break line | 0 | |
| Bubble under protection film | SPEC (unit: mm) | Acceptable | |
| | NA | | |
| Function | Prohibited | | |

1.3 Sampling Condition

Unless otherwise agree in written, the sampling inspection shall be applied to the incoming inspection of customer.
Lot size: Quantity of shipment lot per model.
Sampling type: normal inspection, single sampling
Sampling table: MIL-STD-105E
Inspection level: Level II

| | | | Definition |
|---|---|---|---|
| **Class of defects** | | AQL 0.65% | It is a defect that is likely to result in failure or to reduce materially the usability of the product for the intended function. |
| | | AQL 1.5% | It is a defect that will not result in functioning problem with deviation classified. |

## ■ PRECAUTIONS FOR USING LCD MODULES

**Handing Precautions**

(1) The display panel is made of glass and polarizer. As glass is fragile. It tends to become or chipped during handling especially on the edges. Please avoid dropping or jarring. Do not subject it to a mechanical shock by dropping it or impact.

(2) If the display panel is damaged and the liquid crystal substance leaks out, be sure not to get any in your mouth. If the substance contacts your skin or clothes, wash it off using soap and water.

(3) Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary. Do not touch the display with bare hands. This will stain the display area and degraded insulation between terminals (some cosmetics are determined to the polarizer).

(4) The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully. Do not touch, push or rub the exposed polarizers with anything harder than an HB pencil lead (glass, tweezers, etc.). Do not put or attach anything on the display area to avoid leaving marks on. Condensation on the surface and contact with terminals due to cold will damage, stain or dirty the polarizer. After products are tested at low temperature they must be warmed up in a container before coming is contacting with room temperature air.

(5) If the display surface becomes contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, moisten cloth with one of the following solvents

　　　- Isopropyl alcohol
　　　- Ethyl alcohol
Do not scrub hard to avoid damaging the display surface.

(6) Solvents other than those above-mentioned may damage the polarizer. Especially, do not use the following.

　　　- Water
　　　- Ketone
　　　- Aromatic solvents
Wipe off saliva or water drops immediately, contact with water over a long period of time may cause deformation or color fading. Avoid contacting oil and fats.

(7) Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.

(8) Install the LCD Module by using the mounting holes. When mounting the LCD module make sure it is free of twisting, warping and distortion. In particular, do not forcibly pull or bend the I/O cable or the backlight cable.

(9) Do not attempt to disassemble or process the LCD module.

(10) NC terminal should be open. Do not connect anything.

(11) If the logic circuit power is off, do not apply the input signals.

(12) Electro-Static Discharge Control，Since this module uses a CMOS LSI, the same careful attention should be paid to electrostatic discharge as for an ordinary CMOS IC. To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

　　　- Before remove LCM from its packing case or incorporating it into a set, be sure the module and your body have the same electric potential. Be sure to ground the body when handling the LCD modules.

　　　- Tools required for assembling, such as soldering irons, must be properly grounded. make certain the AC power source for the soldering iron does not leak. When using an electric screwdriver to attach LCM, the screwdriver should be of ground potentiality to minimize as much as possible any transmission of electromagnetic waves produced sparks coming from the commutator of the motor.

　　　- To reduce the amount of static electricity generated, do not conduct assembling and other work under dry conditions. To reduce the generation of static electricity be careful that the air in the work is not too dried. A relative humidity of 50%-60% is recommended. As far as possible make the electric potential of your work clothes and that of the work bench the ground potential

　　　- The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated

（13）Since LCM has been assembled and adjusted with a high degree of precision, avoid applying excessive shocks to the module or making any alterations or modifications to it.

- Do not alter, modify or change the shape of the tab on the metal frame.
- Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.
- Do not damage or modify the pattern writing on the printed circuit board.
- Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector.
- Except for soldering the interface, do not make any alterations or modifications with a soldering iron.
- Do not drop, bend or twist LCM.

**Storage Precautions**

When storing the LCD modules, the following precaution is necessary.

(1) Store them in a sealed polyethylene bag. If properly sealed, there is no need for the dessicant.

(2) Store them in a dark place. Do not expose to sunlight or fluorescent light, keep the temperature between 0°C and 35°C.

(3) The polarizer surface should not come in contact with any other objects. (We advise you to store them in the container in which they were shipped).

**Others**

Liquid crystals solidify under low temperature (below the storage temperature range) leading to defective orientation or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subject to a low temperature.

If the LCD modules have been operating for a long time showing the same display patterns, the display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. A normal operating status can be regained by suspending use for some time. It should be noted that this phenomenon does not adversely affect performance reliability.

To minimize the performance degradation of the LCD modules resulting from destruction caused by static electricity etc., exercise care to avoid holding the following sections when handling the modules.
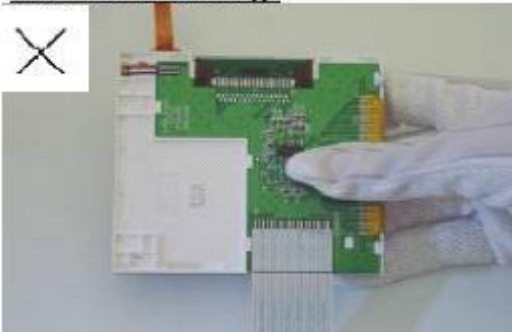
- Exposed area of the printed circuit board.
-Terminal electrode sections.
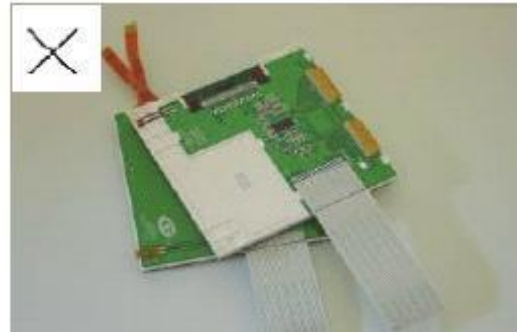
**Handling precaution for LCM**

LCM is easy to be damaged.
Please note below and be careful for handling!
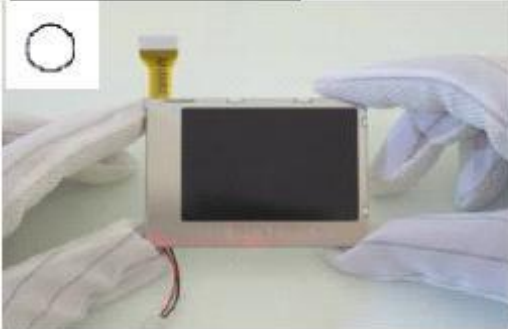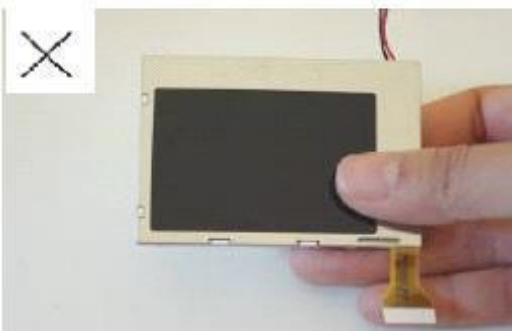
## Correct handling:



As above picture, please handle with anti-static gloves around LCM edges.
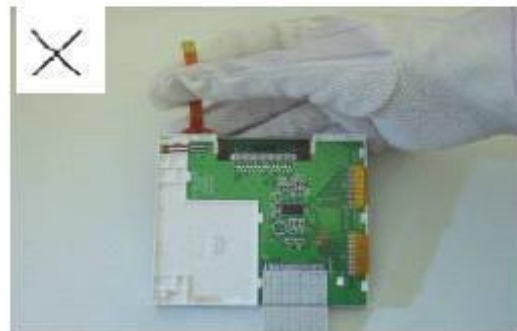
## Incorrect handling:



Please don't touch IC directly.
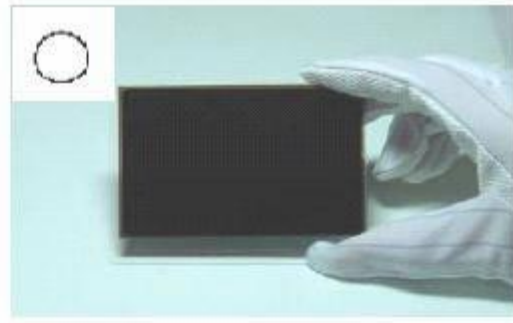


Please don't stack LCM.



Please don't hold the surface of panel.



Please don't stretch interface of output, such as FPC cable.
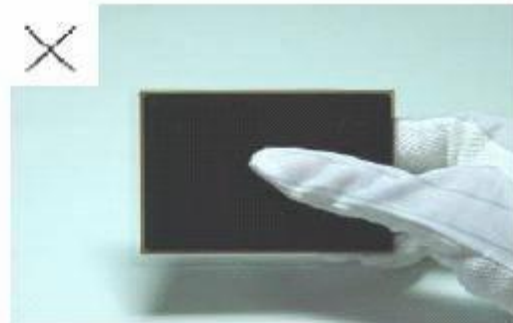
**Handling precaution for LCD**

LCD is easy to be damaged.
Please note below and be careful for handling!

### Correct handling:



As above photo, please handle with anti-static gloves around LCD edges.
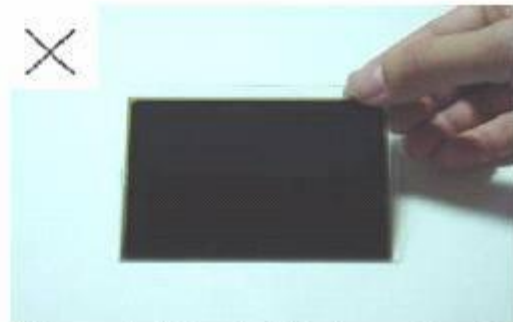
### Incorrect handling:



Please don't stack the LCDS.



Please don't hold the surface of LCD.



Please don't operate with sharp stick such as pens.



Please don't touch ITO glass without anti-static gloves.

## Storage Precautions

When storing the LCD modules, the following precaution is necessary.

(1) Store them in a sealed polyethylene bag. If properly sealed, there is no need for the dessicant.

(2) Store them in a dark place. Do not expose to sunlight or fluorescent light, keep the temperature between 0°C and 35°C, and keep the relative humidity between 40%RH and 60%RH.

(3) The polarizer surface should not come in contact with any other objects. (We advise you to store them in the anti-static electricity container in which they were shipped.

Others

Liquid crystals solidify under low temperature (below the storage temperature range) leading to defective orientation or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subject to a low temperature.

If the LCD modules have been operating for a long time showing the same display patterns, the display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. A normal operating status can be regained by suspending use for some time. It should be noted that this phenomenon does not adversely affect performance reliability.

To minimize the performance degradation of the LCD modules resulting from destruction caused by static electricity etc., exercise care to avoid holding the following sections when handling the modules.
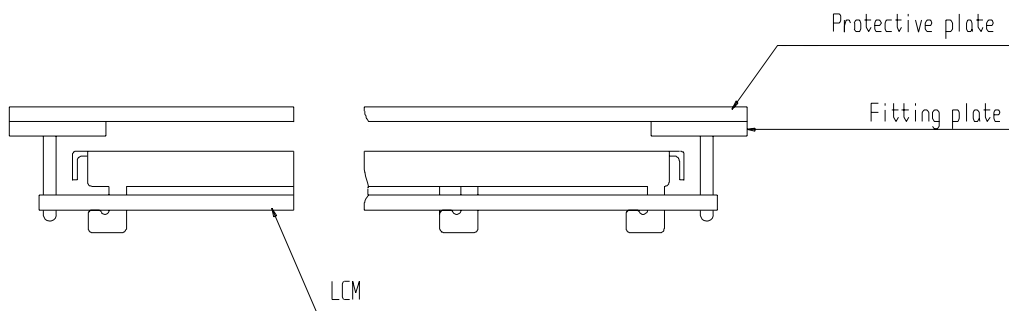
- Exposed area of the printed circuit board.

-Terminal electrode sections.

## USING LCD MODULES

### Installing LCD Modules

The hole in the printed circuit board is used to fix LCM as shown in the picture below. Attend to the following items when installing the LCM.

(1) Cover the surface with a transparent protective plate to protect the polarizer and LC cell.



(2) When assembling the LCM into other equipment, the spacer to the bit between the LCM and the fitting plate should have enough height to avoid causing stress to the module surface, refer to the individual specifications for measurements. The measurement tolerance should be ±0.1mm.

### Precaution for assemble the module with BTB connector:

Please note the position of the male and female connector position,don't assemble or assemble like the method which the following picture shows
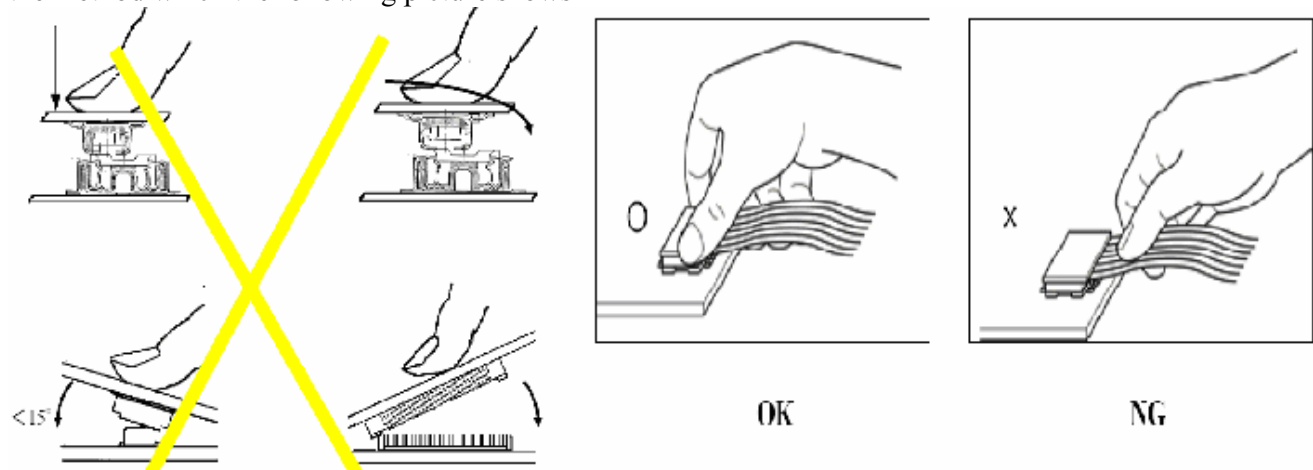
**Precaution for soldering to the LCM**

|  | Hand soldering | Machine drag soldering | Machine press soldering |
|---|---|---|---|
| No ROHS product | 290°C ~350°C.<br>Time : 3-5S. | 330°C ~350°C.<br>Speed : 4-8 mm/s. | 300°C ~330°C.<br>Time : 3-6S.<br>Press: 0.8~1.2Mpa |
| ROHS product | 340°C ~370°C.<br>Time : 3-5S. | 350°C ~370°C.<br>Time : 4-8 mm/s. | 330°C ~360°C.<br>Time : 3-6S.<br>Press: 0.8~1.2Mpa |

(1) If soldering flux is used, be sure to remove any remaining flux after finishing to soldering operation. (This does not apply in the case of a non-halogen type of flux.) It is recommended that you protect the LCD surface with a cover during soldering to prevent any damage due to flux spatters.

(2) When soldering the electroluminescent panel and PC board, the panel and board should not be detached more than three times. This maximum number is determined by the temperature and time conditions mentioned above, though there may be some variance depending on the temperature of the soldering iron.

(3) When remove the electroluminescent panel from the PC board, be sure the solder has completely melted, the soldered pad on the PC board could be damaged.

**Precautions for Operation**

(1) Viewing angle varies with the change of liquid crystal driving voltage (VLCD). Adjust VLCD to show the best contrast.

(2) It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage then the limit cause the shorter LCD life. An electrochemical reaction due to direct current causes LCD's undesirable deterioration, so that the use of direct current drive should be avoided.

(3) Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD's show dark color in them. However those phenomena do not mean malfunction or out of order with LCD's, Which will come back in the specified operating temperature.

(4) If the display area is pushed hard during operation, the display will become abnormal. However, it will return to normal if it is turned off and then back on.

(5) A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit. Usage under the maximum operating temperature,50%RH or less is required.

(6) Input each signal after the positive/negative voltage becomes stable.

(7) Please keep the temperature within specified range for use and storage. Polarization degradation, bubble generation or polarizer peel-off may occur with high temperature and high humidity.
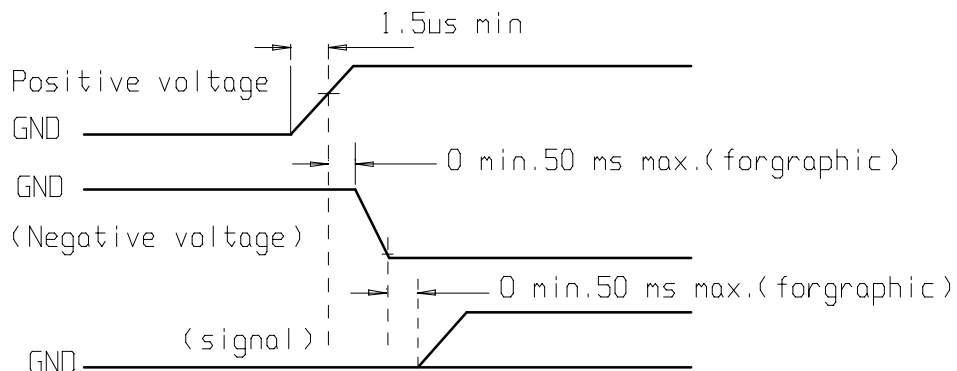
**Safety**

(1) It is recommended to crush damaged or unnecessary LCDs into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned.

(2) If any liquid leaks out of a damaged glass cell and comes in contact with the hands, wash off thoroughly with soap and water.

**Limited Warranty**

Unless agreed between Multi-Inno and customer, Multi-Inno will replace or repair any of its LCD modules which are found to be functionally defective when inspected in accordance with Multi-Inno LCD acceptance standards (copies available upon request) for a period of one year from date of production. Cosmetic/visual defects must be returned to Multi-Inno within 90 days of shipment. Confirmation of such date shall be based on data code on product. The warranty liability of Multi-Inno limited to repair and/or replacement on the terms set forth above. Multi-Inno will not be responsible for any subsequent or consequential events.

**Return LCM under warranty**

No warranty can be granted if the precautions stated above have been disregarded. The typical examples of violations are :

- Broken LCD glass.
- PCB eyelet is damaged or modified.
- PCB conductors damaged.
- Circuit modified in any way, including addition of components.
- PCB tampered with by grinding, engraving or painting varnish.
- Soldering to or modifying the bezel in any manner.

Module repairs will be invoiced to the customer upon mutual agreement. Modules must be returned with sufficient description of the failures or defects. Any connectors or cable installed by the customer must be removed completely without damaging the PCB eyelet, conductors and terminals.

## ■ PRIOR CONSULT MATTER

1.①For Multi-Inno standard products, we keep the right to change material, process ... for improving the product property without notice on our customer.

②For OEM products, if any change needed which may affect the product property, we will consult with our customer in advance.

2. If you have special requirement about reliability condition, please let us know before you start the test on our samples.