# *INNOLUX* DISPLAY CORPORATION

## BT101IW02 V.0 LCD MODULE SPECIFICATION

(  ) Tentative Specification
(●) Preliminary Specification
(  ) Final Specification

| Customer | Checked & Approved by |
|---|---|
|  |  |

| Approved by | Checked by | Prepared by |
|---|---|---|
| MKT | PD | PM |
|  |  |  |

Date: 2009/03/16

## Innolux Display Corporation

**No.160 Kesyue Rd., Chu-Nan Site, Hsinchu Science Park,**

**Chu-Nan 350, Miao-Li County, Taiwan**

**Tel: 886-37-586000        Fax: 886-37-586060**

Version: 0

## Record of Revision

| Version | Revise Date | Page | Content |
|---------|-------------|------|---------|
| 0 | 2009/03/26 | All | First Edition issued |
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## 1. General Specifications

| NO. | Item | Specification | Unit |
|:---:|:---:|:---:|:---:|
| 1 | Display resolution (pixel) | 1024(H) X 600(V), SD resolution | |
| 2 | Active area | 222.72(H) X 125.28(V) | mm |
| 3 | Screen size | 10.1 inches diagonal | Inches |
| 4 | Pixel pitch | 217.5x208.8 | um |
| 5 | Color configuration | R, G, B vertical stripe | |
| 6 | Overall dimension | 235 (W) X 143(H) X 5.2(D) (max) | mm |
| 7 | Weight | 190Max. | Grams |
| 8 | Surface treatment | Glare | |
| 9 | Input color signal | 6 bit LVDS | |
| 10 | Display colors | 262K (6 bit) | |
| 11 | Optimum viewing direction | 6 o'clock | |
| 12 | Backlight | W-LED | |
| 13 | RoHS | RoHS compliance | |

## 2. Electrical Specifications

### 2-1 Pin Assignment

a. Panel connector
Connector Part No.: 20455-040E-0* or equivalent
User's connector Part No: 20455-040E-0* or equivalent

| PIN NO | Symbol | Function |
|--------|--------|----------|
| 1 | NC | NC |
| 2 | VDD | Power Supply, 3.3 V (typical) |
| 3 | VDD | Power Supply, 3.3 V (typical) |
| 4 | V EEDID | DDC 3.3V power |
| 5 | NC | NC |
| 6 | Clk EEDID | DDC Clock |
| 7 | DATA EEDID | DDC Data |
| 8 | Odd_Rin0- | - LVDS differential data input (R0-R5, G0) (odd pixels) |
| 9 | Odd_Rin0+ | + LVDS differential data input (R0-R5, G0) (odd pixels) |
| 10 | VSS | Ground – Shield |
| 11 | Odd_Rin1- | - LVDS differential data input (G1-G5, B0-B1) (odd pixels) |
| 12 | Odd_Rin1+ | + LVDS differential data input (G1-G5, B0-B1) (odd pixels) |
| 13 | VSS | Ground – Shield |
| 14 | Odd_Rin2- | - LVDS differential data input (B2-B5, HS, VS, DE) (odd pixels) |
| 15 | Odd_Rin2+ | + LVDS differential data input (B2-B5, HS, VS, DE) (odd pixels) |
| 16 | VSS | Ground – Shield |
| 17 | Odd_ClkIN- | - LVDS differential clock input (odd pixels) |
| 18 | Odd_ClkIN+ | + LVDS differential clock input (odd pixels) |
| 19 | VSS | Ground – Shield |
| 20 | NC | NC |
| 21 | NC | NC |
| 22 | VSS | Ground – Shield |
| 23 | NC | NC |
| 24 | NC | NC |
| 25 | VSS | Ground – Shield |
| 26 | NC | NC |
| 27 | NC | NC |
| 28 | VSS | Ground – Shield |
| 29 | NC | NC |
| 30 | NC | NC |
| 31 | VSSLED | Ground - LED |
| 32 | VSSLED | Ground - LED |
| 33 | VSSLED | Ground - LED |
| 34 | NC | NC |
| 35 | PWM | System PWM Signal Input (+3.3V Swing) |
| 36 | LED_EN | LED enable pin (+3.3V Input) |
| 37 | NC | NC |
| 38 | VDDLED | 6V – 21V LED power |
| 39 | VDDLED | 6V – 21V LED power |
| 40 | VDDLED | 6V – 21V LED power |

b. General Block Diagram



Connector : 20455-040(I-PEX)
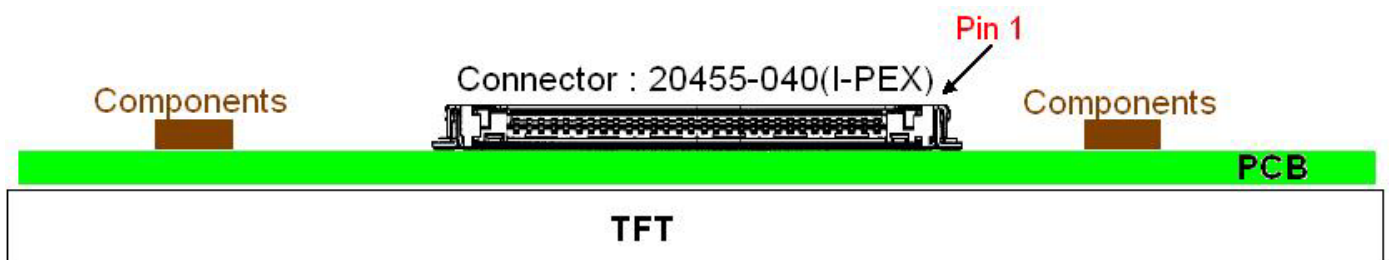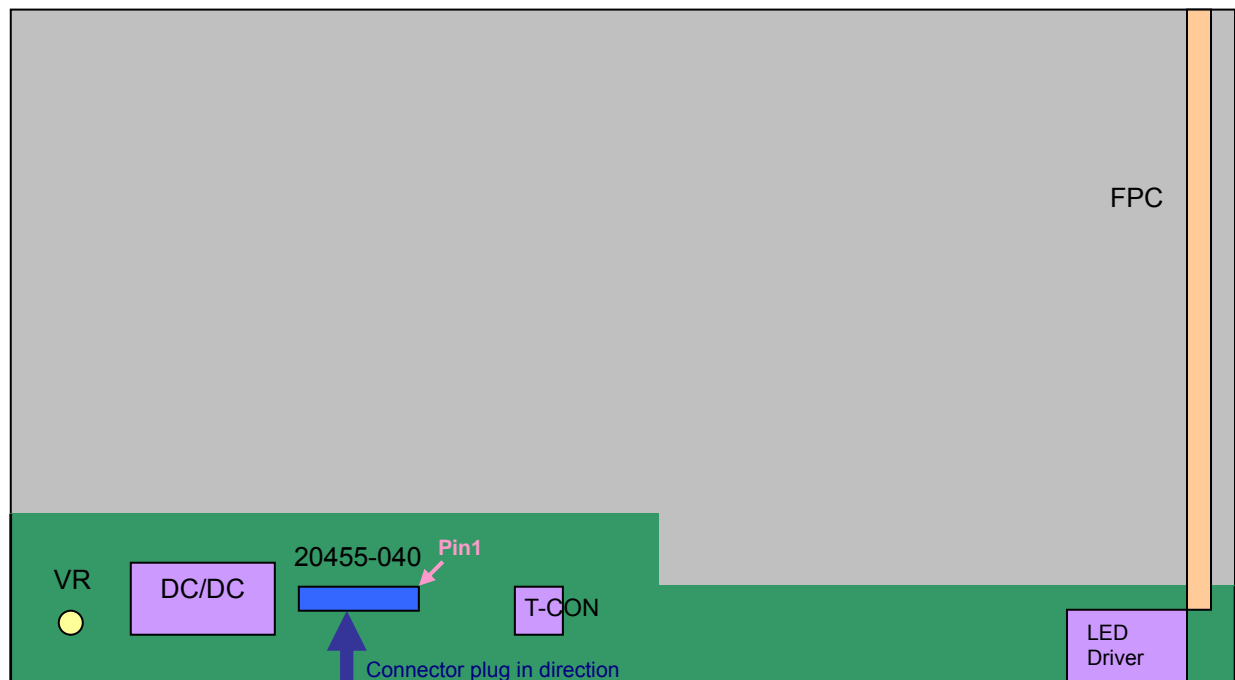
## 2-2. Absolute Maximum Ratings

| Parameter | Symbol | Values | | Unit | Remark |
|---|---|---|---|---|---|
| | | Min. | Max. | | |
| Power input voltage | $V_{CC}$ | - 0.3 | 4.0 | V | At 25°C |
| Input signal voltage | $V_{IN}$ | - 0.3 | 4.0 | V | At 25°C |
| Operating temperature | Top | 0 | 50 | °C | Note 1 |
| Storage temperature | $T_{ST}$ | - 20 | 60 | °C | Note 2 |
| Re-screw | | - | 5 | Times | |
| Assured torque at side mount | | - | 2 | kgf.cm | |

Note 1: The relative humidity must not exceed 90% non-condensing at temperatures of 40°C or less. At temperatures greater than 40°C, the wet bulb temperature must not exceed 39°C.

Note 2: The unit should not be exposed to corrosive chemicals.

**Relative Humidity (%RH)**
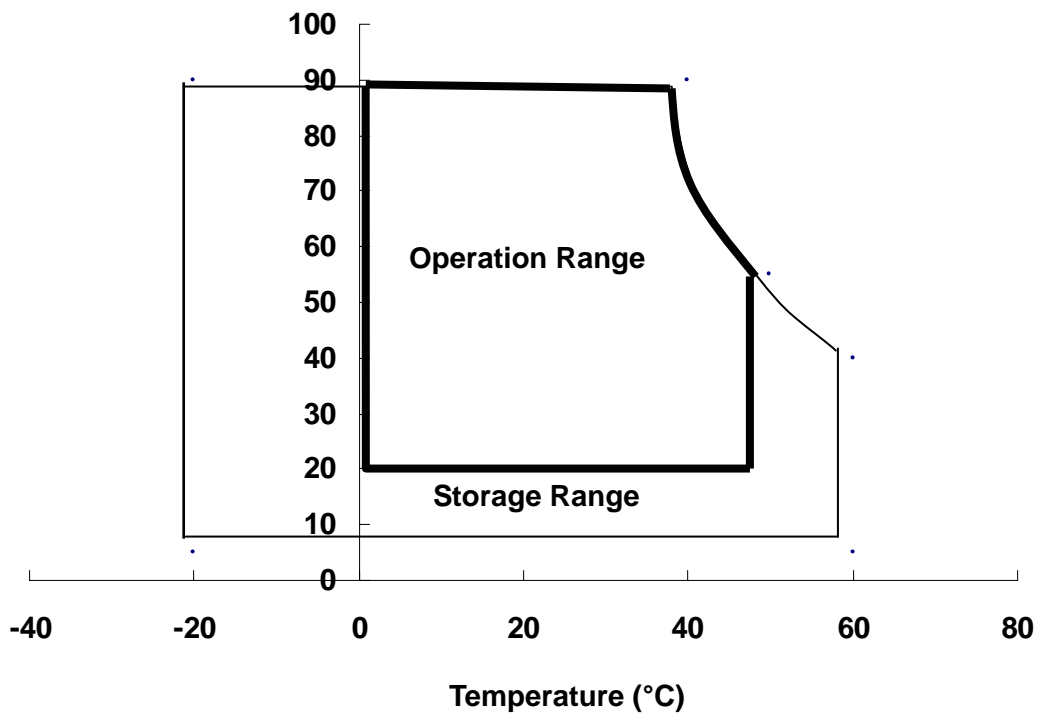
### 2-3. Electrical Characteristics

a. Typical operating conditions

| Item | | Symbol | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|---|
| Power input voltage | | $V_{CC}$ | 3 | 3.3 | 3.6 | V | |
| Permissive power input ripple | | $V_{RF}$ | - | - | 0.1 | V | |
| Power input current | | $I_{CC}$ | - | (220) | 400 | mA | Note 1 |
| Power consumption | | $P_C$ | - | (0.65) | 1 | Watts | Note 1 |
| LVDS interface | Differential input high threshold voltage | $V_{LVTH}$ | - | - | +100 | mV | $V_{LVC}$=1.2V, Note 2 |
| | Differential input low threshold voltage | $V_{LVTL}$ | -100 | - | - | mV | $V_{LVC}$=1.2V, Note 2 |
| | Common input voltage | $V_{LVC}$ | 0.1 | 1.2 | 1.4 | V | Note 2 |
| | Terminating resistor | $R_T$ | 90 | 100 | 110 | ohm | |
| Rush current | | $I_{Rush}$ | - | - | 1.5 | A | Note 3 |

Note 1: The specified input current and power consumption are under the $V_{cc}$ =3.3 V, 25 °C, $f_V$=60Hz (frame frequency) condition whereas black pattern is displayed.
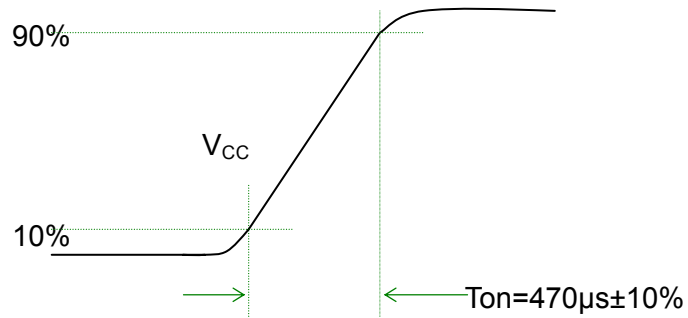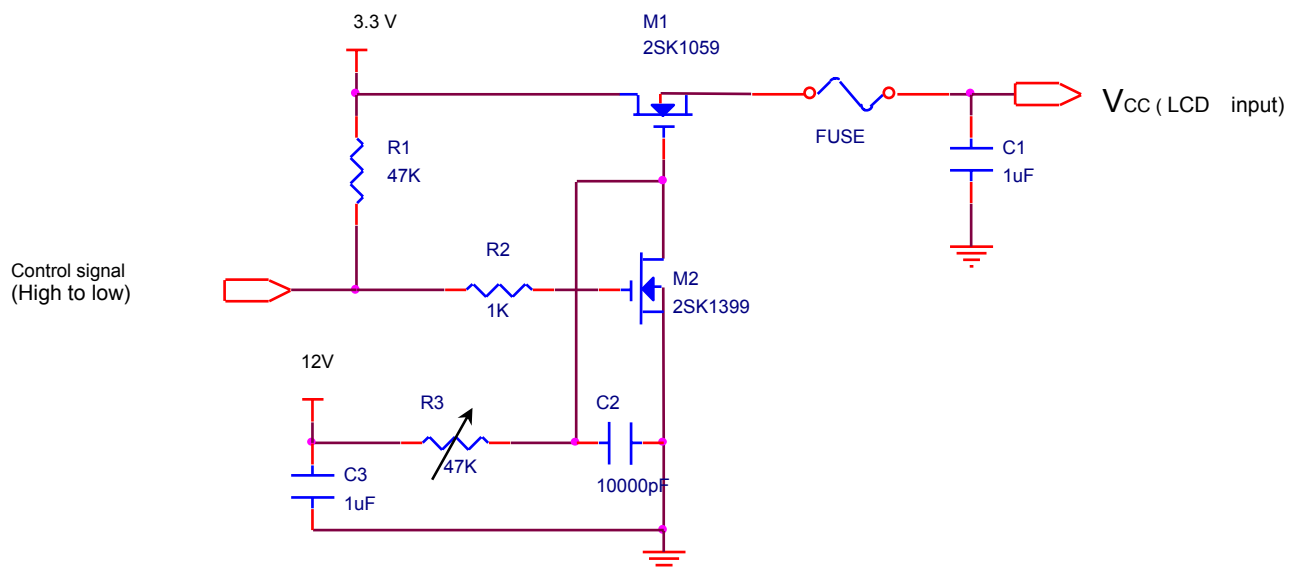
Note 2: LVDS waveform diagram

Rxin+/CLK+



Rxin-/CLK-

$V_{LVTH}$

$V_{LVTL}$

$V_{LVC}$

GND
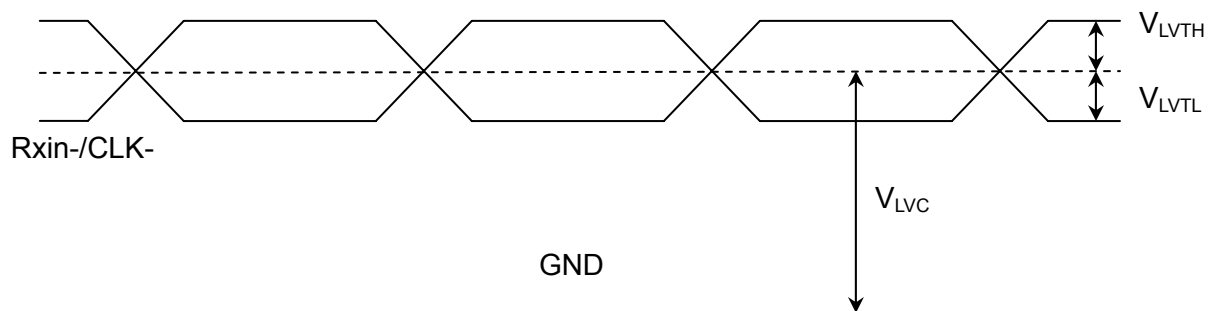
Note 3: Test condition

(1) Pattern: Black pattern

(2) $V_{CC}$ = 3.3 V, $V_{CC}$ rising time = 470 $\mu$s ± 10%
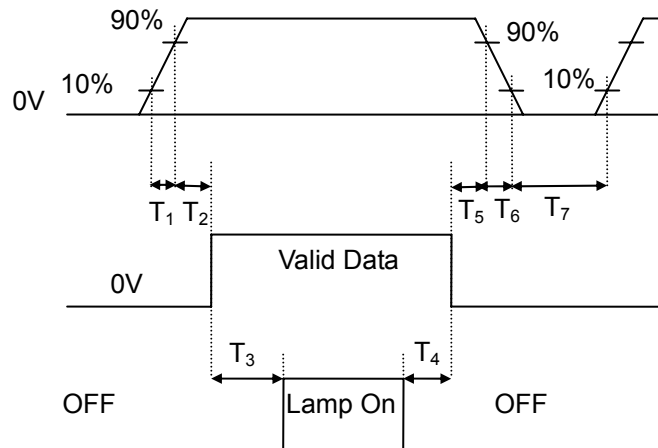


(3) Test circuit

b. Power sequence



Power supply for LCD, $V_{CC}$

Interface data signal, $V_i$
(LVDS signal of transmitter)

Backlight on/off

Power sequence timing table

| Parameter | Value | | | Units |
|---|---|---|---|---|
| | Min. | Typ. | Max. | |
| $T_1$ | 0.5 | - | 10 | ms |
| $T_2$ | 0 | - | 50 | ms |
| $T_3$ | 200 | - | - | ms |
| $T_4$ | 200 | - | - | ms |
| $T_5$ | 0 | - | 50 | ms |
| $T_6$ | 0 | - | 10 | ms |
| $T_7$ | 400 | - | - | ms |

c. Display color vs. input data signals

| Signal Name | Description | Remark |
|---|---|---|
| R5 | Red Data 5 (MSB) | Red-pixel data. Each red pixel's brightness data consists of these 6 bits pixel data. |
| R4 | Red Data 4 | |
| R3 | Red Data 3 | |
| R2 | Red Data 2 | |
| R1 | Red Data 1 | |
| R0 | Red Data 0 (LSB) | |
| | **Red-pixel Data** | |
| G5 | Green Data 5 (MSB) | Green-pixel data. Each green pixel's brightness data consists of these 6 bits pixel data. |
| G4 | Green Data 4 | |
| G3 | Green Data 3 | |
| G2 | Green Data 2 | |
| G1 | Green Data 1 | |
| G0 | Green Data 0 (LSB) | |
| | **Green-pixel Data** | |
| B5 | Blue Data 5 (MSB) | Blue-pixel data. Each blue pixel's brightness data consists of these 6 bits pixel data. |
| B4 | Blue Data 4 | |
| B3 | Blue Data 3 | |
| B2 | Blue Data 2 | |
| B1 | Blue Data 1 | |
| B0 | Blue Data 0 (LSB) | |
| | **Blue-pixel Data** | |
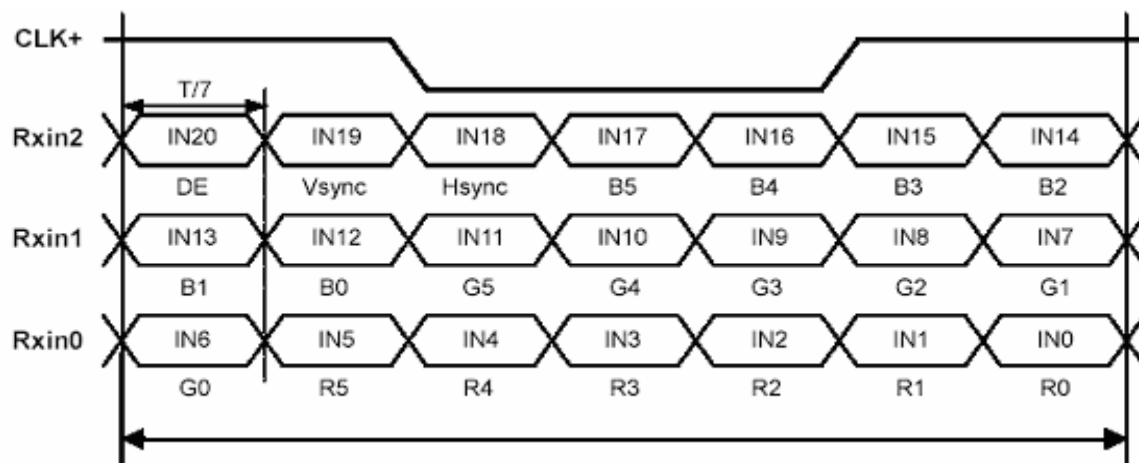


Signal for 1 DCLK cycle (t$_{CLK}$)

d. Input signal timing

Timing table

| Description | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Frame rate | -- | --- | 60 | -- | Hz |
| Clock freq. | $1/t_{CLK}$ | (40) | 45 | (51) | MHz |
| Line cycle time | $t_H$ | (1160) | 1344 | (1240) | $t_{CLK}$ |
| Line width-active | $t_{Hd}$ | --- | 1024 | --- | $t_{CLK}$ |
| Frame cycle time | $t_V$ | (612) | 638 | (638) | $t_H$ |
| V width-active | $t_{Vd}$ | --- | 600 | --- | $t_H$ |
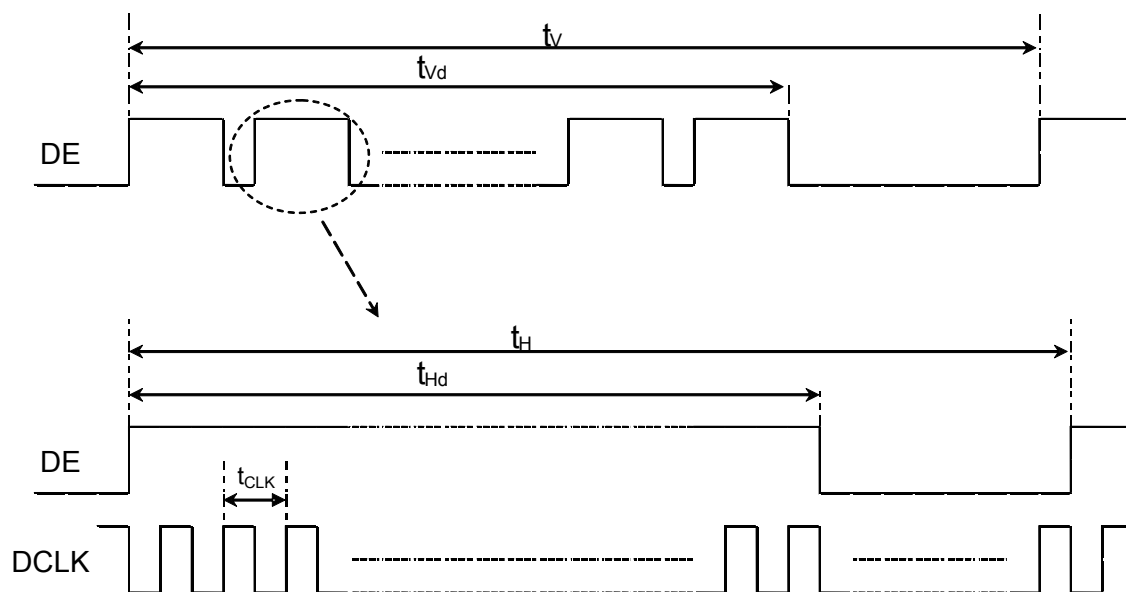
e. Display position

| | | | | | | |
|---|---|---|---|---|---|---|
| D(1, 1) | D(2, 1) | …… | D(673, 1) | …… | D(1023, 1) | D(1024, 1) |
| D(1, 2) | D(2, 2) | …… | D(673, 2) | …… | D(1023, 2) | D(1024, 2) |
| ⋮ | | …… | ⋮ | …… | ⋮ | ⋮ |
| D(1, 384) | D(2, 300) | …… | D(673, 384) | …… | D(1023, 300) | D(1024, 300) |
| ⋮ | | …… | ⋮ | …… | ⋮ | ⋮ |
| D(1, 767) | D(2, 599) | …… | D(673, 599) | …… | D(1023, 599) | D(1024, 599) |
| D(1, 768) | D(2, 600) | …… | D(673, 600) | …… | D(1023, 600) | D(1024, 600) |

f. Backlight driving conditions

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|
| LED Forward Voltage | $V_F$ | 3 | 3.2 | 3.4 | $V_{rms}$ | T = 25℃ |
| LED Forward Current | $I_F$ | | 20 | | $mA_{rms}$ | T = 25℃ |
| Power consumption | $P_{LED}$ | | (2.1) | (2.3) | W | T = 25℃ |
| Output PWM frequency | $F_{PWM}$ | 200 | | 20000 | Hz | T = 25℃ |
| Duty ratio | - | 20 | | 100 | % | |
| LED life time | - | 15,000 | | | Hr | T = 25℃ , Note 1 |

Note 1: LED life time definition is Brightness decrease to 50% of initial or abnormal lighting.

g. Module function block
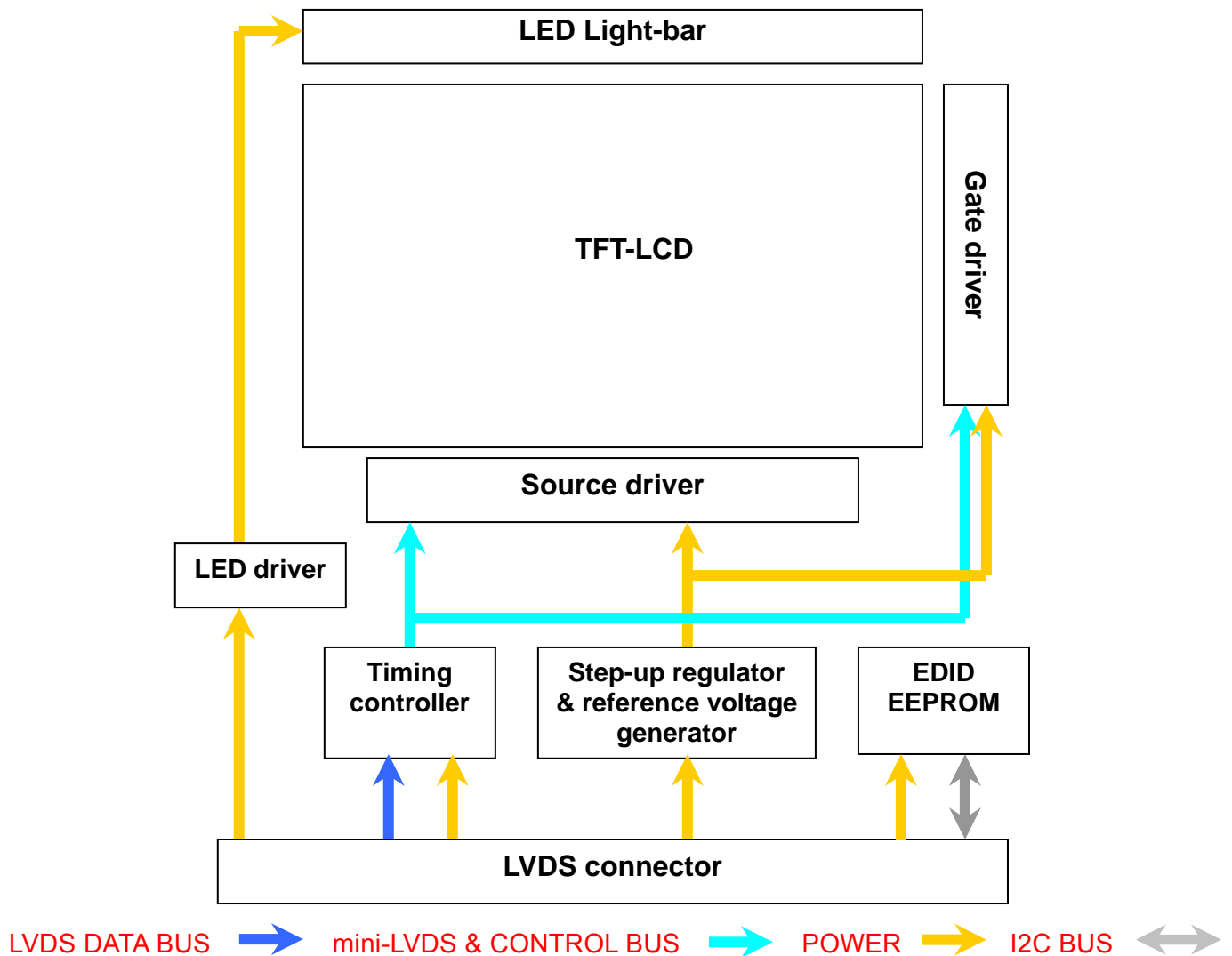


h. EDID Code
   (TBD)

## 3. Optical specifications

| Item | Symbol | Condition | Specification Min. | Specification Typ. | Specification Max. | Unit | Remark |
|---|---|---|---|---|---|---|---|
| Response time | Tr+Tf | θ= 0° | | (8) | TBD | ms | Note 4 |
| Contrast ratio | CR | θ= 0° | | (500:1) | | | Note 3,5 |
| Viewing angle | Top | CR≧10 | 15 | | | deg | Note 3,5,7 |
| | Bottom | CR≧10 | 30 | | | | |
| | Left | CR≧10 | 40 | | | | |
| | Right | CR≧10 | 40 | | | | |
| Brightness (5 points average) | $Y_L$ | | 150 | 180 | | nit | Note 3,6 |
| Color chromaticity (CIE) | $W_x$ | θ= 0° | -0.03 | 0.313 | +0.03 | | Note 3 |
| | $W_y$ | | | 0.329 | | | |
| | $R_x$ | | | (0.559) | | | |
| | $R_y$ | | | (0.326) | | | |
| | $G_x$ | | | (0.341) | | | |
| | $G_y$ | | | (0.568) | | | |
| | $B_x$ | | | (0.146) | | | |
| | $B_y$ | | | (0.102) | | | |
| Color Gamut | NTSC | CIE1931 | 40 | 45 | | % | - |
| White uniformity (5 points) | $\delta_{W(5)}$ | | -- | -- | -- | % | Note 3,8 |
| White uniformity (13 points) | $\delta_{W(13)}$ | | 65 | -- | -- | % | Note 3,8 |

Note 1: Ambient temperature = 25°C.

Note 2: To be measured in dark room after backlight warm up 30 minutes in windless and dark room.

Note 3: To be measured with a viewing cone of 2°by Topcon luminance meter BM-5A.

Note 4: Definition of response time:
   The output signals of BM-7 are measured when the input signals are changed from "Black" to "White" (falling time) and from "White" to "Black" (rising time), respectively. The response time interval is between 10% and 90% of amplitudes. Refer to figure as below.
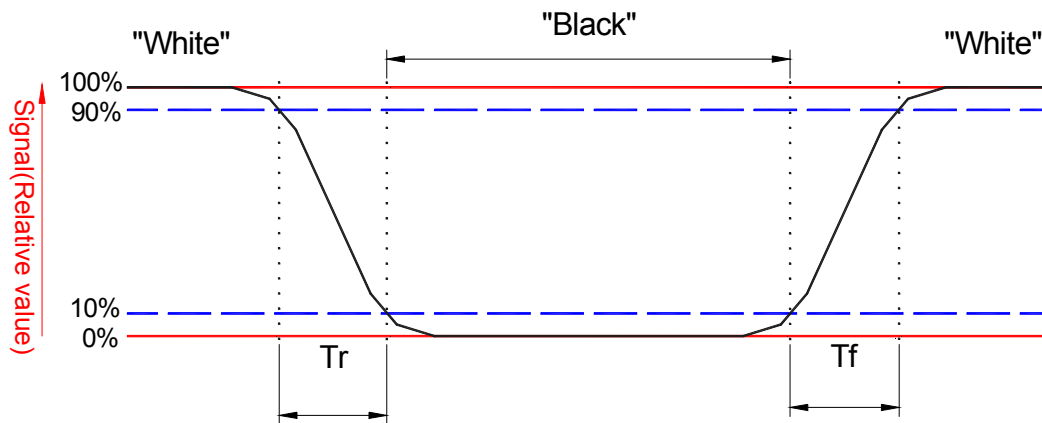
Note 5: Definition of contrast ratio:

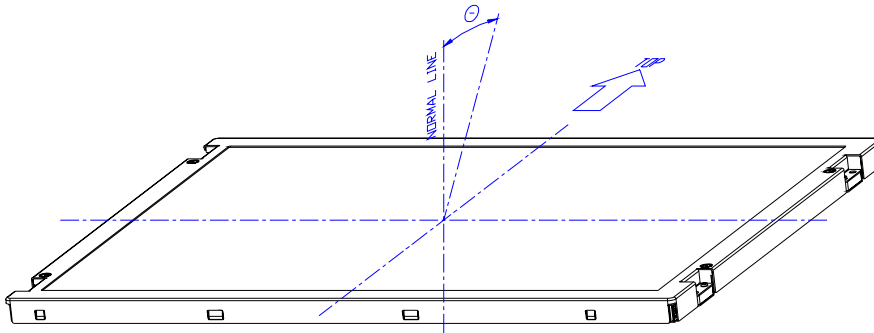Contrast ratio is calculated with the following formula:

$$\text{Contrast ratio (Avg of 5pts)} = \frac{L \text{ white (Avg of 5pts.)}}{L \text{ Black (Avg of 5pts.)}}$$

Note 6: Driving current for LED should be 20 mA.

Luminance are measured at the following thirteen points (1~13):

$$Y_L = (Y5+Y10+Y11+Y12+Y13) / 5$$

Note 7: Definition of viewing angle



Note 8: Definition white uniformity:

Luminance are measured at the following thirteen points (1~13):
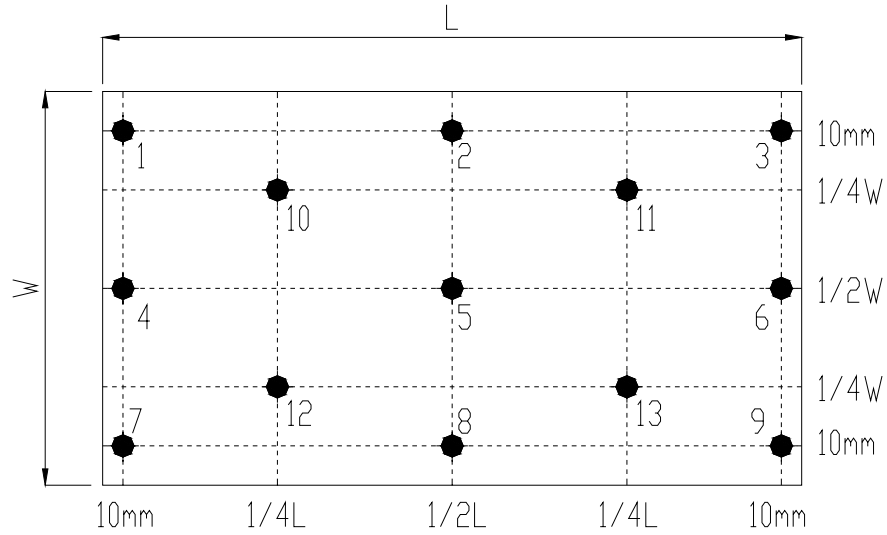
$$\delta_{W(13)} = \frac{\text{Minimum Brightness of thirteen points}}{\text{Maximum Brightness of thirteen points}}$$

$$\delta_{W(5)} = \frac{\text{Minimum Brightness of five points}}{\text{Maximum Brightness of five points}}$$

13 point measuring locations refer to the point 1,~13.
5 point measuring locations refer to the point 5,10~13.
L and W are active area dimensions. Active area center refer to attached drawing

## 4. Reliability test items

| Test Item | Test Condition | Judgment | Remark |
|---|---|---|---|
| High temperature storage | 60°C, 240 hours | Note 1 | Note 2 |
| Low temperature storage | -20°C, 240 hours | Note 1 | Note 2 |
| High temperature & high humidity operation | 40°C, 90% RH, 240 hours (No condensation) | Note 1 | Note 2 |
| High temperature operation | 50°C, 240 hours | Note 1 | Note 2 |
| Low temperature operation | 0°C, 240 hours | Note 1 | Note 2 |
| Thermal Shock (Non-operation) | -25°C / 30 mins ~ 65°C / 30 mins 100 cycles | Note 1 | Note 2 |
| Electrostatic discharge (ESD) | 150 pF, 330Ω, Contact: ±8kV, Air: ±15kV | Note 1 | |
| Vibration (Non-operation) | 1.5G, 10 to 500 Hz random ; 0.5hr in each perpendicular axes ( X, Y, Z ). | Note 1 | Note 2 |
| Mechanical shock (Non-operation) | 220G/2ms, Half sine wave, ±X, ±Y, ±Z one time for each direction | Note 1 | Note 2 |

Note 1: Pass: Normal display image with no obvious non-uniformity and no line defect.
　　　　 Partial transformation of the module parts should be ignored.
　　　　Fail: No display image, obvious non-uniformity, or line defects.

Note 2: Evaluation should be tested after storage at room temperature for one hour.

### 5. Safety

5-1. Sharp edge requirements

There will be no sharp edges or corners on the display assembly that could cause injury.

5-2. Materials

a. Toxicity

There will be no carcinogenic materials used anywhere in the display module. If toxic materials are used, they will be reviewed and approved by the responsible InnoLux Toxicologist.

b. Flammability

All components including electrical components that do not meet the flammability grade UL94-V0 in the module will complete the flammability rating exception approval process. The printed circuit board will be made from material rated 94-V0 or better. The actual UL flammability rating will be printed on the printed circuit board.

c. Capacitors

If any polarized capacitors are used in the display assembly, provisions will be made to keep them from being inserted backwards.

## 6. Display quality

The display quality of the color TFT-LCD module should be in compliance with the InnoLux incoming inspection standard.

## 7. Handling precaution

(1)  Do not apply rough force such as bending or twisting to the module during assembly.

(2) To assemble or install module into user's system can be only in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.

(3) It's not permitted to have pressure or impulse on the module because the LCD panel and Backlight will be damaged.

(4) Always follow the correct power sequence when LCD module is connecting and operating.

(5)  Do not pull the I/F connector in or out while the module is operating.

(6)  Do not disassemble the module.

(7) Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.

(8) It is dangerous that moisture come into or contacted the LCD module, because moisture may damage LCD module when it is operating.

(9) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.
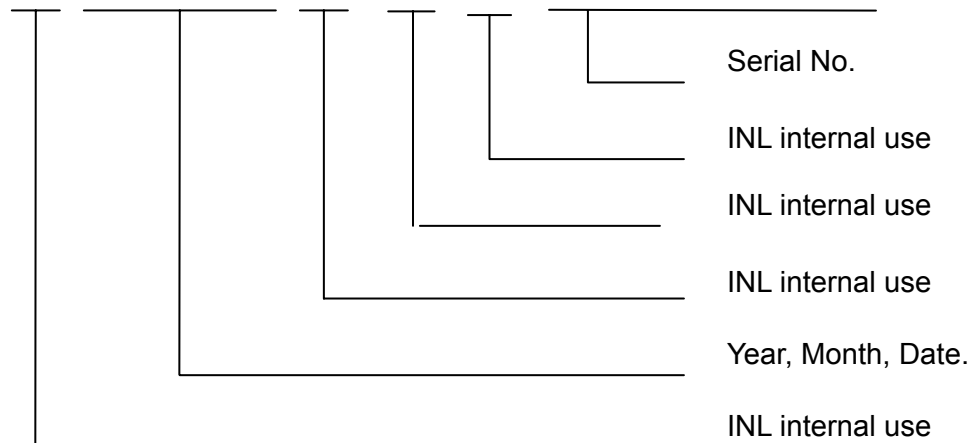
# 8. Label Definition

## 8-1. Module label
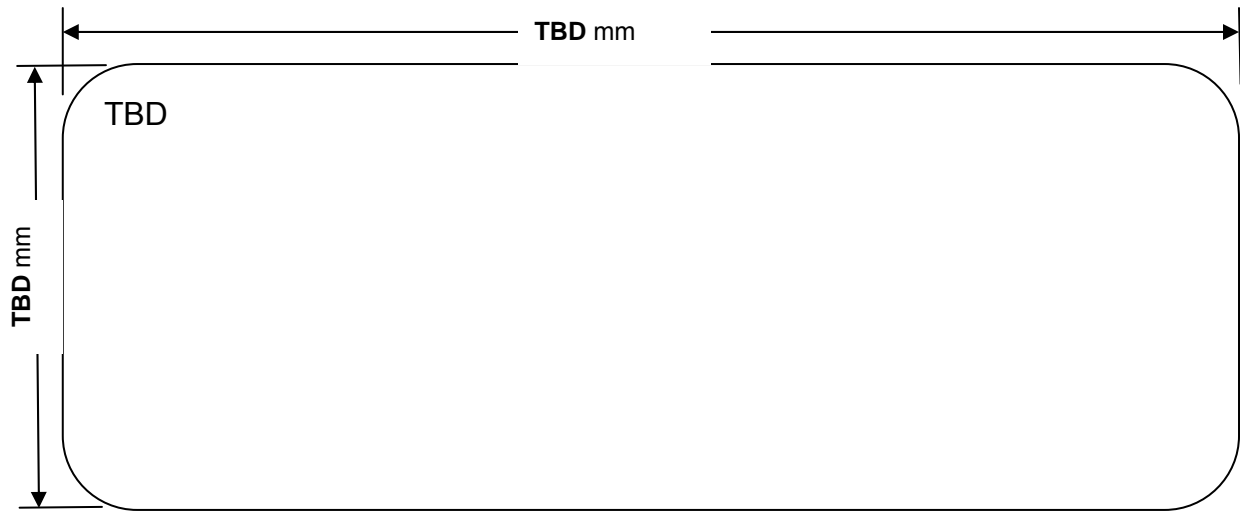


(a) Model Number : BT101IW02 V.0

(b) Product Number : AB101000200X

(c) Serial ID I : $Z_1$  $Z_2$  $Z_3$  $Z_4$  $Z_5$  $Z_6$ - $Z_7$ - $Z_8$  $Z_9$  $Z_{10}$  $Z_{11}$  $Z_{12}$

Serial No.

INL internal use

INL internal use

INL internal use
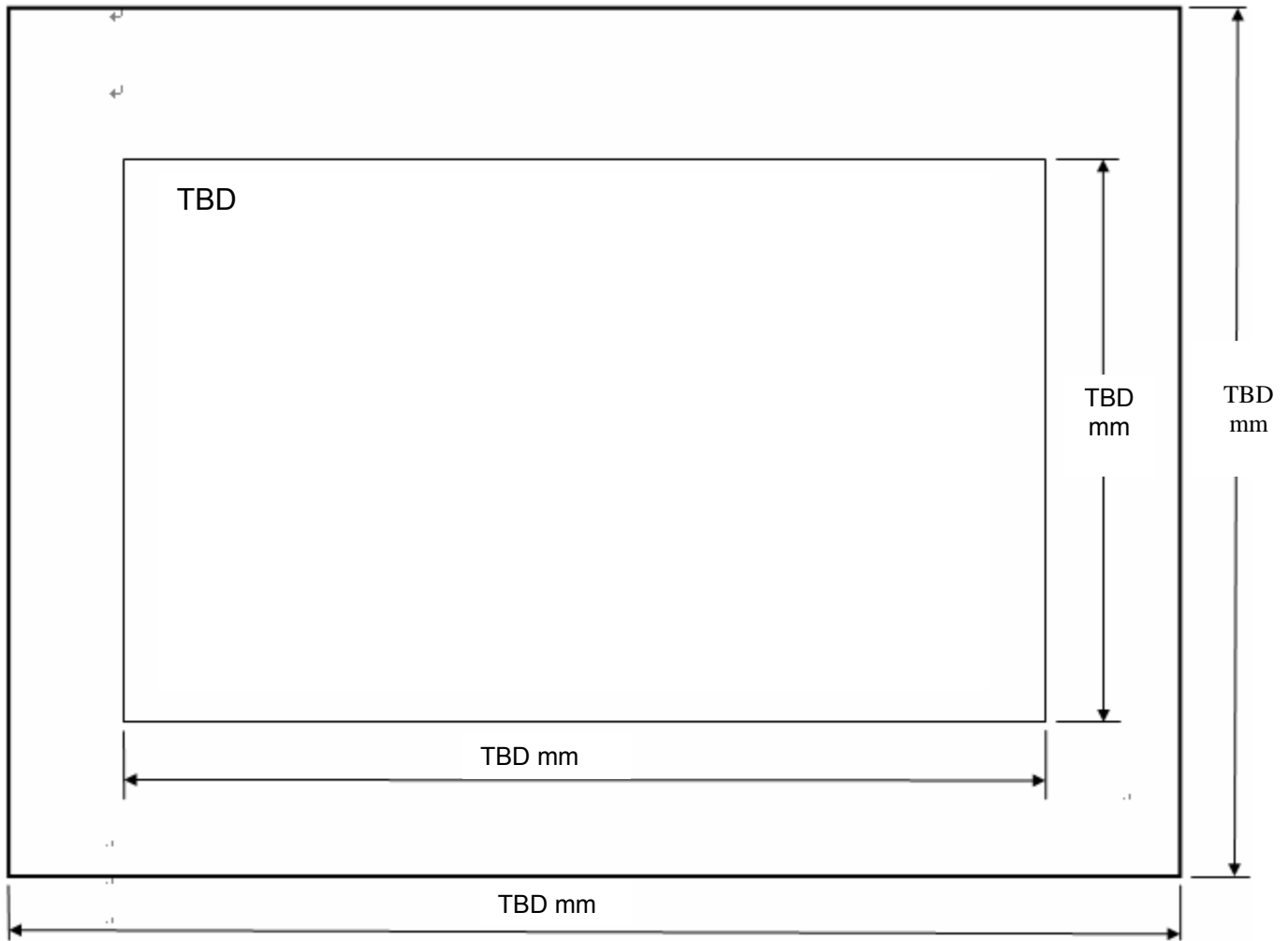
Year, Month, Date.

INL internal use

Serial ID includes the information as below:

Manufactured Date: Year: 0~9, for 2000~2009

Month: 1~9 & A~C for Jan.~Dec.

Date: 1~9 & A~Z (exclude I, O, Q, U) for 1th~31th
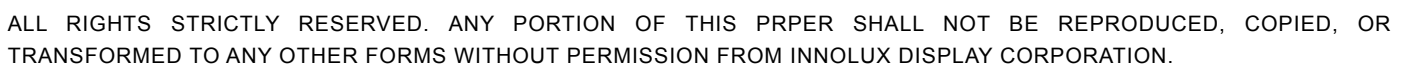
Serial No.: Module manufactures sequential number.

**8-2. Carton label**

TBD

TBD mm

TBD mm

TBD mm

TBD mm

(a) BOX ID (INL internal use)：XXXX-X-XXXX
(b) Model Number：BT101IW02 V.0
(c) Product Number：AB101000200X

## 9. Packing Form

TBD

# 10. Mechanical drawings

## 10-1 Front Side

## 10-2 Rear Side