# TITLE : HV320WHB-N86

## Preliminary Product Specification

## Rev. P1

**Chongqing BOE Optoelectronics Technology Co., Ltd**

# REVISION HISTORY

( √ )preliminary specification
(  )Final specification

| Revision No. | Page | Description of changes | Date | Prepared |
|---|---|---|---|---|
| O | 24 | Initial Release | 2017.02.14 | Gao Shaohong |
| P1 | 24 | Update Von/Ripple/Timing | 2017.03.24 | Gao Shaohong |
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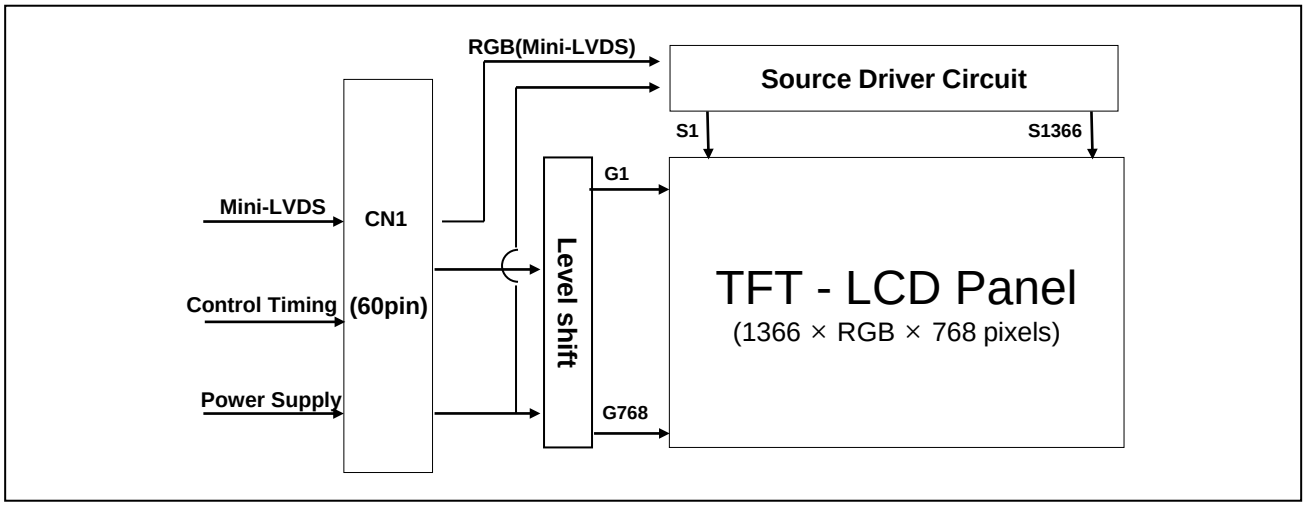
# Contents

# 1.0 GENERAL DESCRIPTION

## 1.1 Introduction

HV320WHB-N86 is a color active matrix TFT LCD open cell using amorphous silicon TFT's (Thin Film Transistors) as an active switching devices. This open cell has a 31.51 inch diagonally measured active area with HD resolutions (1366 horizontal by 768 vertical pixel array). Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical stripe and this open cell can display 16.7M colors. The TFT-LCD panel used for this open cell is adapted for a low reflection and higher color type.




## 1.2 Features

- LVDS interface with 1 pixel / clock
- High-speed response
- Low color shift image quality
- 8-bit color depth, display 16.7M colors
- High luminance and contrast ratio, low reflection and wide viewing angle
- DE (Data Enable) only mode
- ADS technology is applied for high display quality
- RoHS compliant
- 0.5t Glass

## 1.3 Application

- Home Alone Multimedia TFT-LCD TV
- Display Terminals for Control System
- High Definition TV(HD TV)
- TV application Products

## 1.4 General Specification

< Table 1. General Specifications >

| Parameter | Specification | Unit | Remark |
|---|---|---|---|
| Active area | 697.685(H) × 392.256(V) | mm | |
| Number of pixels | 1366(H) ×768(V) | pixels | |
| Pixel pitch | 510.75(H) ×RGB×510.75(V) | ㎛ | |
| Pixel arrangement | Pixels RGB Vertical stripe | | |
| Display colors | 16.7M(8bits-true) | colors | |
| Display mode | Transmission mode, Normally Black | | |
| Open Cell Transmittance | 6.2 (typ.) | % | At center point with BOE BLU |
| Weight | 852 (typ.) | gram | |
| Power Consumption | 4.8 (typ.) | Watt | |
| Surface Treatment | Front Polarizer : Haze 1%, 3H, Anti-glare treatment<br>Bottom Polarizer : Clear | | |

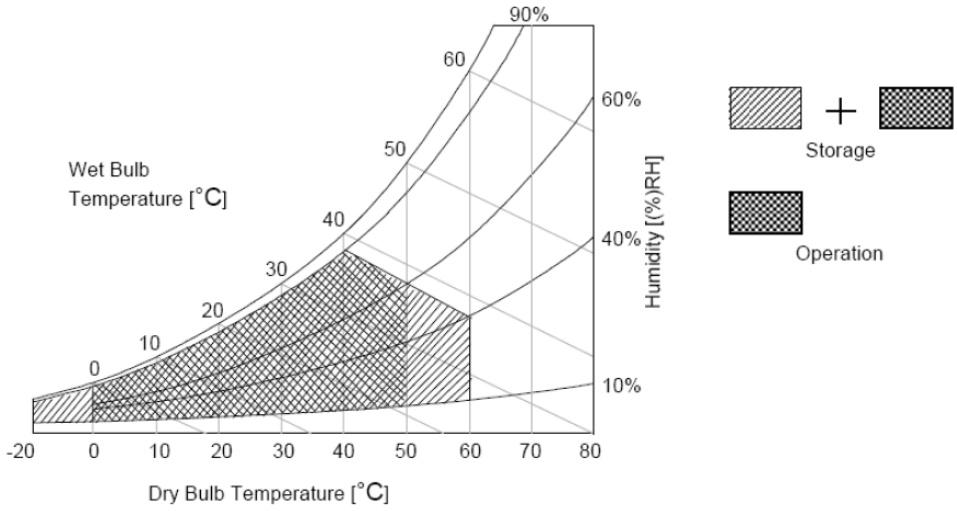
## 2.0 ABSOLUTE MAXIMUM RATINGS

The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit. The operational and non-operational maximum voltage and current values are listed in Table 2.

< Table 2. Open Cell Electrical Specifications > [VSS=GND=0V]

| Parameter | Symbol | Min. | Max. | Unit | Remark |
|---|---|---|---|---|---|
| Operating Temperature | $T_{OP}$ | 0 | +50 | ℃ | Note 1 |
| | $T_{SUR}$ | 0 | +60 | ℃ | |
| Storage Temperature | $T_{ST}$ | -20 | +60 | ℃ | |
| Operating Ambient Humidity | Hop | 10 | 90 | %RH | |
| Storage Humidity | Hst | 10 | 90 | %RH | |

Note 1 : Temperature and relative humidity range are shown in the figure below.
Wet bulb temperature should be 39 ℃ max. and no condensation of water.



## 3.0 ELECTRICAL SPECIFICATIONS

< Table 3. Open Cell Electrical Specifications >

[Ta =25±2 ℃]

| Characteristics | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| DC Supply Voltage | VDDD | 3.0 | 3.3 | 3.6 | V |
| DC Supply Voltage | Voff | -8.3 | -7.8 | -7.3 | V |
| DC Supply Voltage | Von | 30 | 32 | 34 | V |
| DC Supply Voltage | VREF | 15.7 | 16 | 16.3 | V |
| DC Supply Voltage | VCOM | 7.2 | 7.5 | 7.8 | V |
| DC Supply Voltage | VMID | 7.9 | 8.1 | 8.3 | V |
| DC Supply Voltage | AVDD | 15.9 | 16.2 | 16.5 | V |

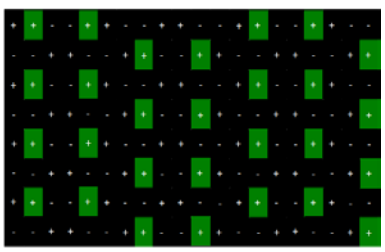
| Characteristics | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| DC Supply Voltage | DVDD | | 50 | 200 | mA |
| DC Supply Voltage | Voff | | 40 | 100 | mA |
| DC Supply Voltage | Von | | 40 | 100 | mA |
| DC Supply Voltage | VREF | | 30 | 200 | mA |
| DC Supply Voltage | VCOM | | 50 | 200 | mA |
| DC Supply Voltage | VMID | | 50 | 200 | mA |
| DC Supply Voltage | AVDD | | 250 | 350 | mA |

Note: Vcom short-circuit current 400mA

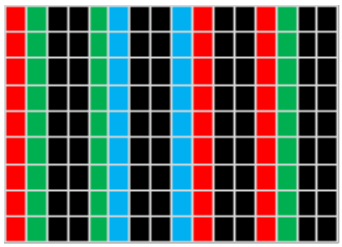
Max Noise

| Characteristics | Symbol | Max | Unit |
|---|---|---|---|
| DC Supply Voltage | DVDD | 165 | mV |
| DC Supply Voltage | Voff | 390 | mV |
| DC Supply Voltage | Von | 1500 | mV |
| DC Supply Voltage | VREF | 800 | mV |
| DC Supply Voltage | VCOM | 375 | mV |
| DC Supply Voltage | VMID | 400 | mV |
| DC Supply Voltage | AVDD | 810 | mV |

Flicker Test Pattern



Max : 2H sub pixel V-stripe



## 4.0 OPTICAL SPECIFICATION

The test of optical specifications shall be measured in a dark room (ambient luminance≤1 lux and temperature=25±2℃) with the equipment of Luminance meter system (Goniometer system and PR730) and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of θ and Φ equal to 0°. We refer to $\theta_{Ø=0}$ (=$\theta_3$ ) as the 3 o'clock direction (the "right"), $\theta_{Ø=90}$ (= $\theta_{12}$ ) as the 12 o'clock direction ("upward"), $\theta_{Ø=180}$ (= $\theta_9$ ) as the 9 o'clock direction ("left") and $\theta_{Ø=270}$(= $\theta_6$ ) as the 6 o'clock direction ("bottom"). While scanning θ and/or Ø, the center of the measuring spot on the Display surface shall stay fixed. The measurement shall be executed after 30 minutes warm-up period. VDD shall be 12.0V +/-10% at 25°C. Optimum viewing angle direction is 6 'clock.

< Table 4. Optical Table >

[VDD = 12.0V, Frame rate = 60Hz, Ta =25±2 ℃]

| Parameter | | Symbol | Condition | Min | Typ | Max | Unit | Remark |
|---|---|---|---|---|---|---|---|---|
| Viewing Angle | Horizontal | $\Theta_3$ | CR > 10 | | 89 | | Deg. | Note 1 |
| | | $\Theta_9$ | | | 89 | | Deg. | |
| | Vertical | $\Theta_{12}$ | | | 89 | | Deg. | |
| | | $\Theta_6$ | | | 89 | | Deg. | |
| Contrast ratio | | CR | Θ = 0° (Center) Normal Viewing Angle With BOE Module | 900:1 | 1200:1 | - | | Note 2 |
| Reproduction of color | White | $W_x$ | | TYP. - 0.03 | 0.260 | TYP. + 0.03 | | Note 3 ((Based on BOE Backlight) |
| | | $W_y$ | | | 0.281 | | | |
| | Red | $R_x$ | | | 0.620 | | | |
| | | $R_y$ | | | 0.327 | | | |
| | Green | $G_x$ | | | 0.297 | | | |
| | | $G_y$ | | | 0.607 | | | |
| | Blue | $B_x$ | | | 0.153 | | | |
| | | $B_y$ | | | 0.056 | | | |
| Response Time | G to G | $T_g$ | | - | 8 | 10 | ms | Note 4 |
| Gamma Scale | | | | 2.0 | 2.2 | 2.4 | | |
| Cell Transmittance | | | | 5.58 | 6.2 | 6.82 | % | Note 5 |

Note :

1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface.
2. Contrast measurements shall be made at viewing angle of $\theta = 0°$ and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state. (See Figure 1 shown in Appendix) Luminance Contrast Ratio (CR) is defined mathematically.

$$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

3. The color chromaticity coordinates specified in Table 9.shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel.
4. Response time Tg is the average time required for display transition by switching the input signal as below table and is based on Frame rate fV =60Hz to optimize.
   Each time in below table is defined as Figure 2and shall be measured by switching the input signal for "any level of gray(bright)"and "any level of gray(dark)".

| Measured Response Time | | Target | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0 | 15 | 31 | 47 | 63 | 79 | 95 | 111 | 127 | 143 | 159 | 175 | 191 | 207 | 223 | 239 | 255 |
| Start | 0 | | | | | | | | | | | | | | | | | |
| | 15 | | | | | | | | | | | | | | | | | |
| | 31 | | | | | | | | | | | | | | | | | |
| | 47 | | | | | | | | | | | | | | | | | |
| | 63 | | | | | | | | | | | | | | | | | |
| | 79 | | | | | | | | | | | | | | | | | |
| | 95 | | | | | | | | | | | | | | | | | |
| | 111 | | | | | | | | | | | | | | | | | |
| | 127 | | | | | | | | | | | | | | | | | |
| | 143 | | | | | | | | | | | | | | | | | |
| | 159 | | | | | | | | | | | | | | | | | |
| | 175 | | | | | | | | | | | | | | | | | |
| | 191 | | | | | | | | | | | | | | | | | |
| | 207 | | | | | | | | | | | | | | | | | |
| | 223 | | | | | | | | | | | | | | | | | |
| | 239 | | | | | | | | | | | | | | | | | |
| | 255 | | | | | | | | | | | | | | | | | |

5. Definition of Transmittance (T%) :
   Module is with white(L255) signal input

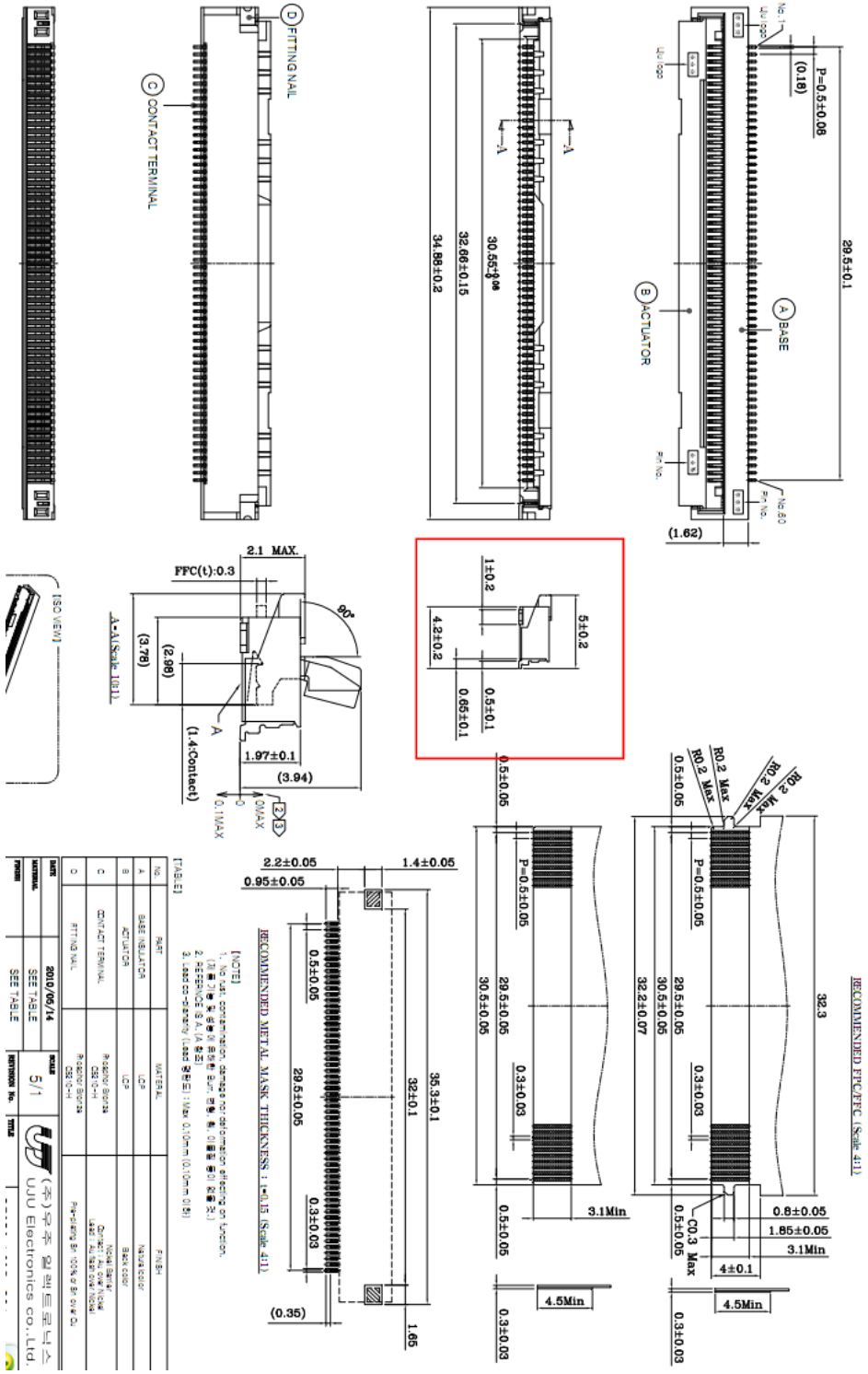
$$\text{Transmittance} = \frac{\text{Luminance of LCD Module}}{\text{Luminance of BLU}} \times 100\ \%$$

# 5.0 INTERFACE CONNECTION.

## 5.1 Connector

| NO. | BOE PINMAP | Description |
|---|---|---|
| 1 | CPV1 | Clock1 input for Levelshift |
| 2 | CPV2 | Clock2 input for Levelshift |
| 3 | STV0 | STV0 input for Levelshift |
| 4 | STV1 | STV1 input for Levelshift |
| 5 | NC | NC |
| 6 | NC | NC |
| 7 | GND | GND |
| 8 , 9 | DVDD | Power supply for digital circuit. |
| 10,11 | VOFF | Negative power supply for Levelshift |
| 12 | GND | GND |
| 13 , 14 | VON | Positive power supply for Levelshift |
| 15 | GREF | Power supply for GAMMA reference |
| 16,17 | VCOM | common electrode for LCD |
| 18 | NC | NC |
| 19 | TP | Source driver latch signal |
| 20 | POL | Source driver polarity inversion signal |
| 21 | PAIRMODE | Selects mini-LVDS input mode： H:6-Pair Mode. (default) L:3-Pair Mode(Suggest “H” for 6 pair). |
| 22 | VMID | Power supply for analog circuit VMID=1/2AVDD |
| 23 | VMID | Power supply for analog circuit VMID=1/2AVDD |
| 24~26 | AVDD | Power supply for analog circuit |
| 27 | GND | GND |
| 28~41 | NC | NC |
| 42 | GND | GND |
| 43 | GND | GND |
| 44 | mLV5N | Differential inputs (mini-LVDS) for 8-bit RGB data and control signal |
| 45 | mLV5P | Differential inputs (mini-LVDS) for 8-bit RGB data and control signal |
| 46 | mLV4N | Differential inputs (mini-LVDS) for 8-bit RGB data and control signal |
| 47 | mLV4P | Differential inputs (mini-LVDS) for 8-bit RGB data and control signal |
| 48 | mLV3N | Differential inputs (mini-LVDS) for 8-bit RGB data and control signal |
| 49 | mLV3P | Differential inputs (mini-LVDS) for 8-bit RGB data and control signal |
| 50 | GND | GND |
| 51 | mLVCLKN | Differential inputs (mini-LVDS) for 8-bit RGB data and control signal |
| 52 | mLVCLKP | Differential inputs (mini-LVDS) for 8-bit RGB data and control signal |
| 53 | GND | GND |
| 54 | mLV2N | Differential inputs (mini-LVDS) for 8-bit RGB data and control signal |
| 55 | mLV2P | Differential inputs (mini-LVDS) for 8-bit RGB data and control signal |
| 56 | mLV1N | Differential inputs (mini-LVDS) for 8-bit RGB data and control signal |
| 57 | mLV1P | Differential inputs (mini-LVDS) for 8-bit RGB data and control signal |
| 58 | mLV0N | Differential inputs (mini-LVDS) for 8-bit RGB data and control signal |
| 59 | mLV0P | Differential inputs (mini-LVDS) for 8-bit RGB data and control signal |
| 60 | GND | GND |

## 5.0 INTERFACE CONNECTION.



## 6.0 SIGNAL TIMING SPECIFICATION

### 6.1 Timing Parameters (DE only mode)

< Table 7. Timing Table >

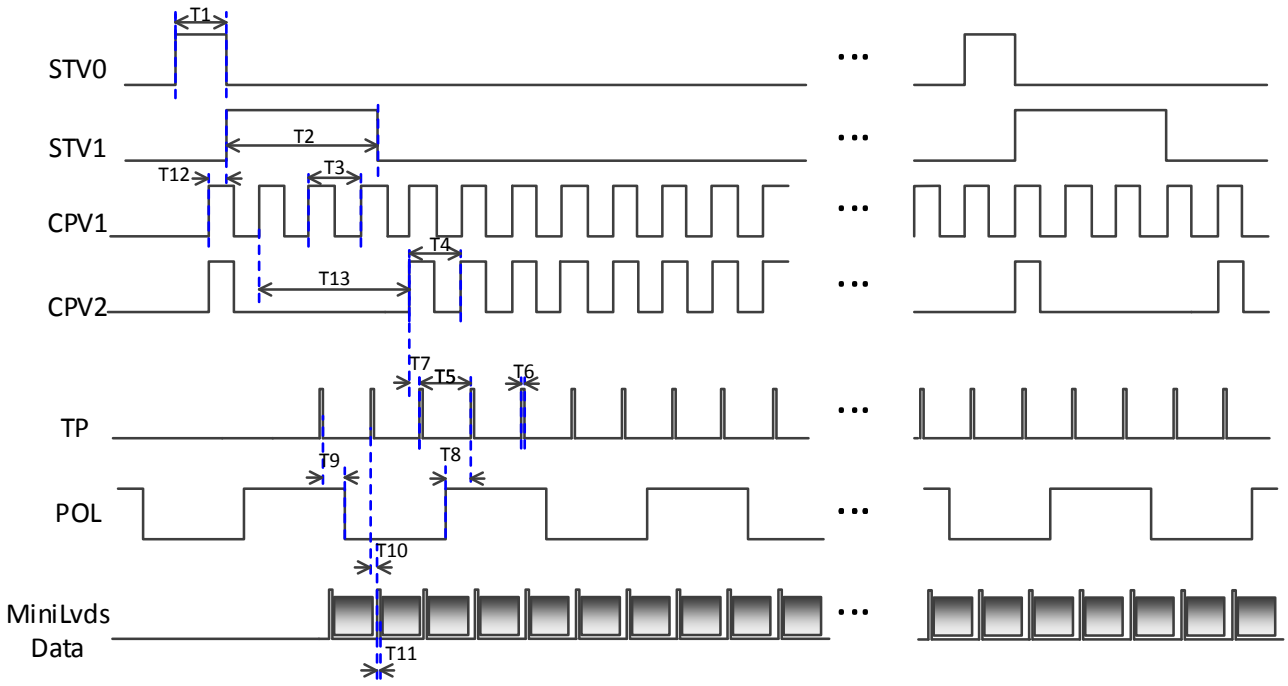
| ITEM | Symbol | | Min | Typ | Max | Unit | Note |
|---|---|---|---|---|---|---|---|
| CLK | Period | $t_{CLK}$ | 11.8 | 13.3 | 17.9 | ns | |
| | Frequency | - | 56 | 75.4 | 85.0 | MHz | |
| Hsync | Period | $t_{HP}$ | 1450 | 1560 | 2000 | $t_{CLK}$ | |
| | Frequency | $f_H$ | 39.4 | 48.4 | 55 | KHz | |
| Vsync | Period | $t_{VP}$ | 778 | 806 | 1200 | $t_{HP}$ | |
| | Frequency | $f_V$ | 47 | 60 | 65 | Hz | |
| Horizontal Active Display Term | Valid | $t_{HV}$ | - | 1366 | - | $t_{CLK}$ | |
| | Total | $t_{HP}$ | 1450 | 1560 | 2000 | $t_{CLK}$ | |
| Vertical Active Display Term | Valid | $t_{VV}$ | - | 768 | - | $t_{HP}$ | |
| | Total | $t_{VP}$ | 780 | 804 | 1200 | $t_{HP}$ | |

Notes: This product is DE only mode. The input of Hsync & Vsync signal does not have an effect on normal operation.

## 6.0 SIGNAL TIMING SPECIFICATION

### 6.3 Signal Timing Waveform

GOA Design : 2STV & 6CLK



| T | Min | Type | Max | Unit | Note |
|---|---|---|---|---|---|
| T1 | | 10.33 | | us | STV0 high Width(1H) |
| T2 | | 31 | | us | STV1 high Width(3H) |
| T3 | | 10.33 | | us | CPV1 period(1H) |
| T4 | | 10.33 | | us | CPV2 period(1H) |
| T5 | | 10.33 | | us | TP period(1H) |
| T6 | 0.2 | 0.6 | | us | TP high Width |
| T7 | | 1.8 | | us | GOE Timing |
| T8 | 0.005 | | | us | from POL rising or falling edge to TP rising edge |
| T9 | 0.006 | | | us | from TP falling edge to POL rising or falling edge |
| T10 | 0.2 | | | us | from TP rising edge to RST rising edge |
| T11 | 3 | | | CLK | RESET(RST)high period |
| T12 | 0.5 | | 3 | us | from CPV rising to STV1 rising edge |
| T13 | | 31 | | us | CPV2 is same to CPV1,but it will be hold zero 3 period(3H) when STV1 rising. |

Notes :1. CPV1 rising edge must be earlier than STV1 a little

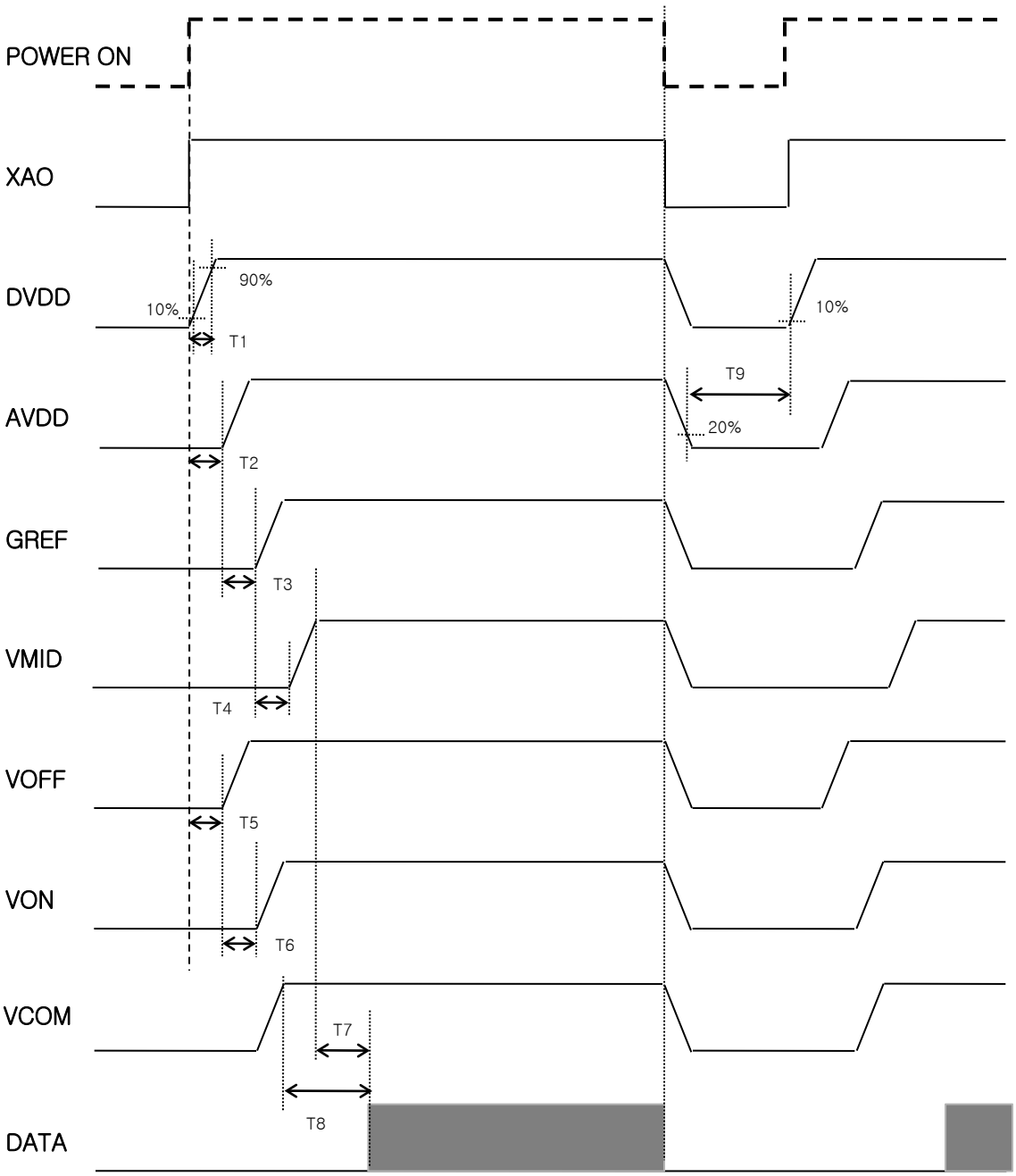
2.The number of the CPV1&CPV2 must be three integer times and all toggles in one frame.

3. Pol inversion at 2lines (TP)

## 6.0 SIGNAL TIMING SPECIFICATION

### 6.3 Power Sequence

Power sequence



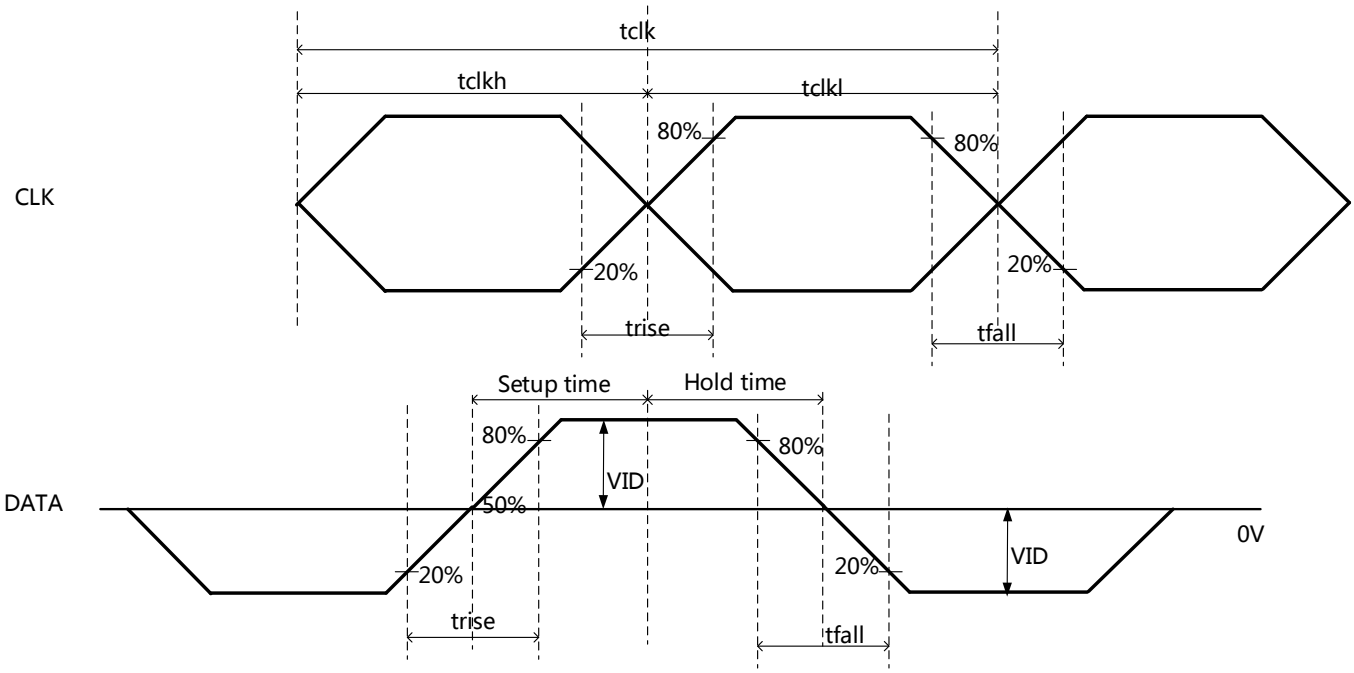
## 6.0 SIGNAL TIMING SPECIFICATION

### 6.3 Power Sequence

| T | Min | Type | Max | Unit | Note |
|---|---|---|---|---|---|
| T1 | 0 | | 10 | ms | |
| T2 | 0 | | | ms | |
| T3 | 0 | | | ms | AVDD must be higher than VMID and GREF all the time |
| T4 | 0 | | | ms | AVDD must be higher than VMID and GREF all the time |
| T5 | 0 | | | ms | |
| T6 | 0 | | | ms | |
| T7 | 0 | | | ms | |
| T8 | 0 | | | ms | |
| T9 | 0 | | | ms | |

## 6.0 SIGNAL TIMING SPECIFICATION

### 6.4 miniLVDS Eye Diagram




< Table 10. Eye Diagram information >

| Parameter | Symbol | Spec | | | |
|---|---|---|---|---|---|
| | | Min | Typ | Max | Unit |
| Clock Period | tclk | 4 | - | - | ns |
| Clock low pulse width | tclkh | 0.4tclk | - | 0.6tclk | ns |
| Clock high pulse width | tclkl | 0.4tclk | - | 0.6tclk | ns |
| Data setup time | tsetup | 0.8 | - | - | ns |
| Data hold time | thold | 0.8 | - | - | ns |
| CLK,Data rising time | trise | - | - | 0.8 | ns |
| CLK,Data falling time | tfall | - | - | 0.8 | ns |
| mini-LVDS different voltage | VID | 150 | - | - | mv |

Condition:Mini-LVDS CLK MAX Frequency≤250Mhz
The Eye Diagram is the source driver received information.

## 7.0 MECHANICAL CHARACTERISTICS

Figure 3 (located in Appendix) shows mechanical outlines for the model HV320WHB-N86. Other parameters are shown in Table 11.

< Table 11. Dimensional Parameters >

| Parameter | Specification | Unit |
|---|---|---|
| Active area | 697.685 (H) ×392.256(V) | mm |
| Pixel pitch | 0.51(H) ×0.51(V) | mm |
| Number of pixels | 1366(H) ×768(V) (1 pixel = R + G + B dots) | pixels |
| Weight | TBD (typ.) | gram |

The surface of the LCD has an semi-glare coating to minimize reflection and a coating to reduce scratching.

## 8.0 RELIABLITY TEST

< Table 12. Reliability Test Condition >

| Item | Test Condition |
|---|---|
| High-Temp/STG | Ta = 60 ℃, 240 hrs |
| Low-Temp/STG | Ta = -20 ℃, 240 hrs |
| Temp-Humi/OP | Ta = 50 ℃, 80%RH, 240hrs |
| High-Temp/OP | Ta = 50 ℃, 240hrs |
| Low-Temp/OP | Ta = -5 ℃, 240hrs |
| TST | Ta = -20 ℃ ↔ 60 ℃ (0.5 hr), 100 cycle |

This test condition is based on BOE module.

## 9.0 HANDLING & CAUTIONS

(1) Cautions when taking out the Panel

- Pick the pouch only, when taking out panel from a shipping package.

(2) Cautions for handling the panel

- As the electrostatic discharges may break the LCD panel, handle the LCD panel with care. Peel a protection sheet off from the LCD panel surface as slowly as possible.
- As the LCD panel and back - light element are made from fragile glass material, impulse and pressure to the LCD panel should be avoided.
- As the surface of the polarizer is very soft and easily scratched, use a soft dry cloth without chemicals for cleaning.
- Do not pull the interface connector in or out while the LCD panel is operating.
- Put the panel display side down on a flat horizontal plane.
- Handle connectors and cables with care.

(3) Cautions for the operation

- When the panel is operating, do not lose CLK, ENAB signals. If any one of these signals is lost, the LCD panel would be damaged.
- Obey the supply voltage sequence. If wrong sequence is applied, the panel would be damaged.

(4) Cautions for the atmosphere

- Dew drop atmosphere should be avoided.
- Do not store and/or operate the LCD panel in a high temperature and/or humidity atmosphere. Storage in an electro-conductive polymer packing pouch and under relatively low temperature atmosphere is recommended.

(5) Cautions for the panel characteristics

- Do not apply fixed pattern data signal to the LCD panel at product aging.
- Applying fixed pattern for a long time may cause image sticking.

(6) Other cautions

- Do not disassemble and/or re-assemble LCD panel.
- Do not re-adjust variable resistor or switch etc.
- When returning the panel for repair or etc., Please pack the panel not to be broken. We recommend to use the original shipping packages.

## 10.0 PRODUCT SERIAL NUMBER


MDL ID Naming Rule:

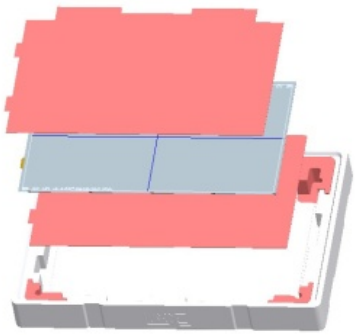
| Digit / Code | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Code | S | L | S | F | 1 | 2 | 3 | 5 | 9 | 0 | 0 | 0 | 0 |
| Description | Model Code /GBN | | Grade | Line | Year | | Month | Model Extension Code | | Serial No 0001-ZZZZ | | | |

## 11.0 Packing

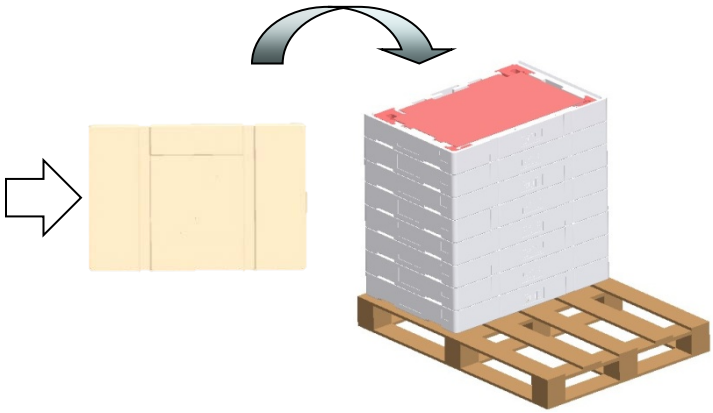
BOE provides the standard shipping container for customers, unless customer specifies their packing information. The standard packing method and Barcode information are shown in below.

### 11.1 Packing Order

**Put EPE pad and panels into the box, 15pcs panels per box**



**Put the box on the pallet,8ea boxes per quarter pallet, a cover on the top of the boxes**



**16ea boxes and 2covers per pallet**

**Use wrapping film to bind up them**

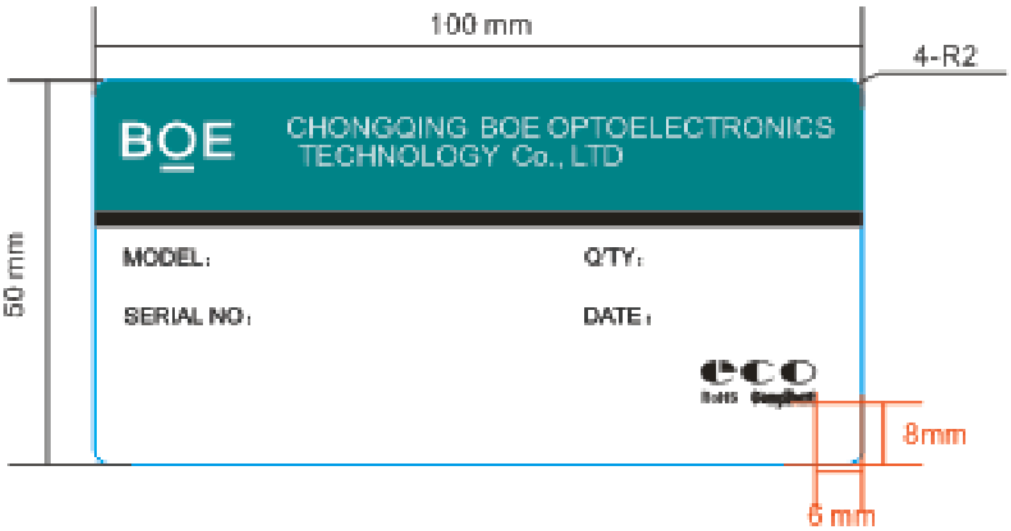
## 11.2 Packing Note

- Box Dimension : 857mm(L)×558mm(W)×142mm(G)
- Package Quantity in one Box : 15pcs

## 11.3 Box Label

- Label Size : 100 mm (L) × 50 mm (W)
- Contents

  Model : HV320WHB-N86
  Q`ty : 15pcs  Open Cell  in one box.
  Serial No. : Box Serial No.
  Date : Packing Date

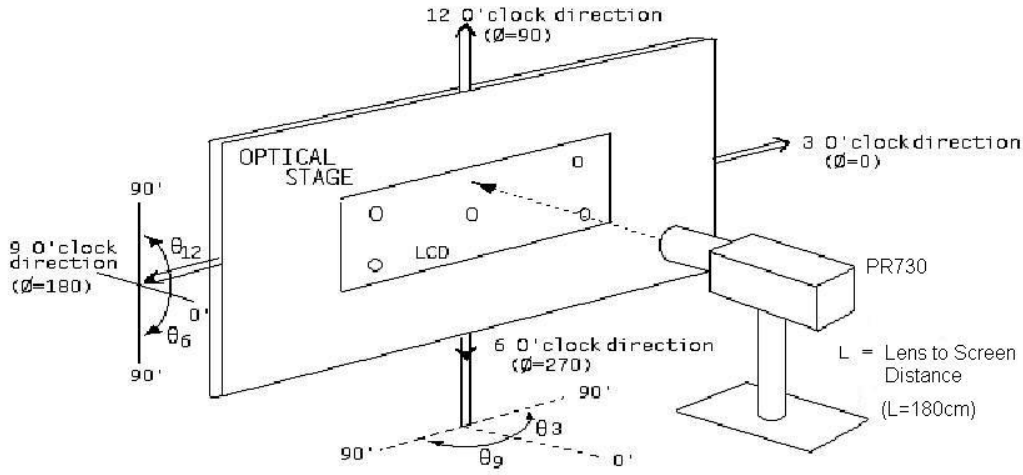



Box ID Naming Rule:

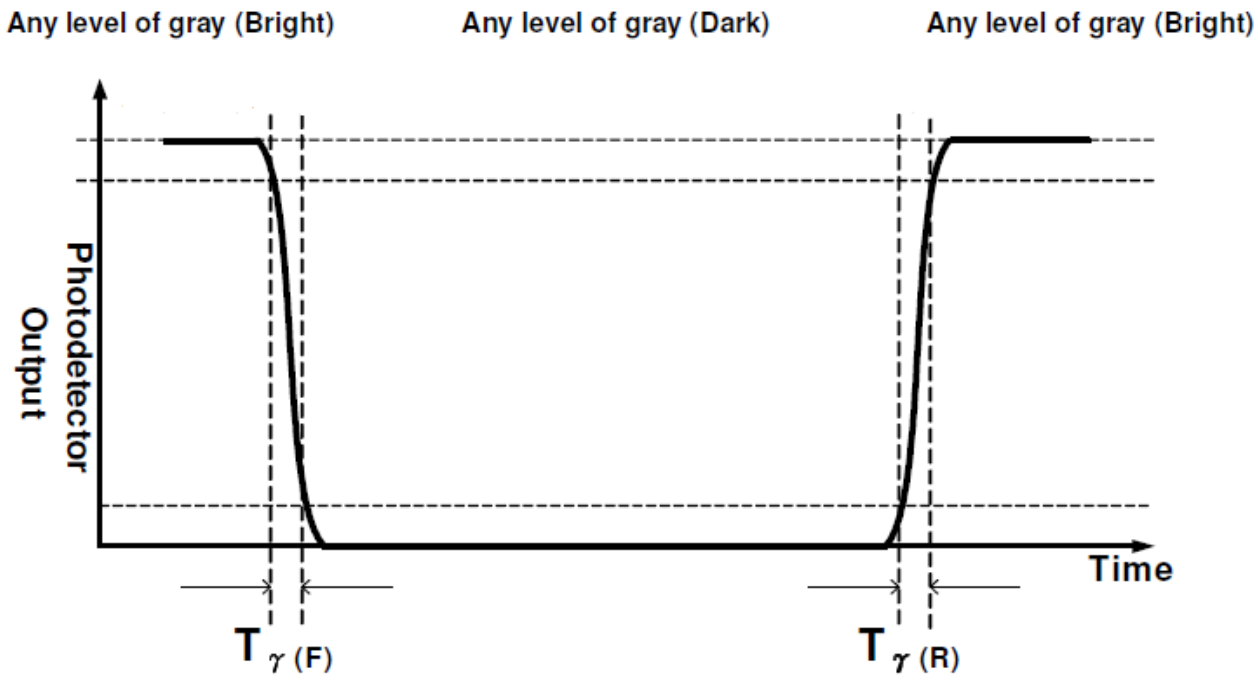
| Digit / Code | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Code | S | L | S | F | 1 | 2 | 3 | D | 0 | 0 | 0 | 6 | 8 |
| Description | Products GBN | | Grade | Line | Year | | Month | Revision Code | Serial No | | | | |

## 12.0 APPENDIX

< Figure 1. Measurement Set Up >




< Figure 2. Response Time Testing >



< Figure 3. TFT-LCD Open Cell Outline Dimensions (Front View) >