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**TITLE : HV320FHB-F40**

**Product Specification**

**Rev.O**

**BEIJING BOE Display TECHNOLOGY Co., LTD**

SPEC. NUMBER  
SB-64-8A-278

PRODUCT GROUP  
TFT-LCD

Rev. O

ISSUE DATE  
2020.02.26

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| REVISION HISTORY              |  |  |  |  |
| ( ) preliminary specification |  |  |  |  |
| (√) Final specification       |  |  |  |  |

| Revision No. | Page             | Description of changes                                                | Date       | Prepared |
|--------------|------------------|-----------------------------------------------------------------------|------------|----------|
| P0           |                  | Initial Release                                                       | 2019.10.08 | Lin Zhun |
| P1           | P5/24<br>P34     | Open Cell Transmittance Update<br>Open Cell Outline Dimensions Update | 2019.10.21 | Lin Zhun |
| P2           | P24<br>P30/31/32 | Reproduction of Color Update<br>Pcanking Update                       | 2020.01.09 | Lin Zhun |
| P3           | P8<br>P19        | Characteristics Update<br>Timing Parameters Update                    | 2020.01.09 | Lin Zhun |
| O            |                  | Final specification                                                   | 2020.02.26 | Lin Zhun |
|              |                  |                                                                       |            |          |
|              |                  |                                                                       |            |          |
| ...          |                  |                                                                       |            |          |
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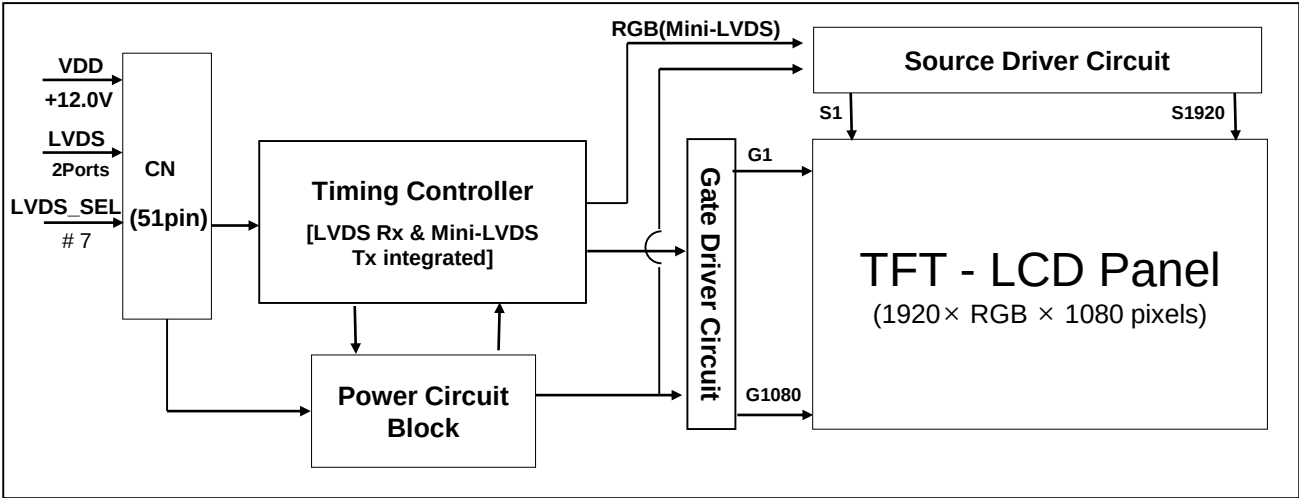
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# 1.0 GENERAL DESCRIPTION

## 1.1 Introduction

HV320FHB-F40 is a color active matrix TFT LCD open cell using amorphous silicon TFT’s (Thin Film Transistors) as an active switching devices. This module has a 31.51 inch diagonally measured active area with FHD resolutions (1920 horizontal by 1080 vertical pixel array). Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical stripe and this module can display 16.7M colors. The TFT-LCD panel used for this module is adapted for a low reflection and higher color type.



## 1.2 Features

- LVDS interface with 2 port 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

|                              |                                                          |                 |
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### 1.3 Application

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

### 1.4 General Specification

< Table 1. General Specifications >

| Parameter               | Specification                                                     | Unit   | Remark                       |
|-------------------------|-------------------------------------------------------------------|--------|------------------------------|
| Active area             | 698.4(H) × 392.85 (V)                                             | mm     |                              |
| Number of pixels        | 1920(H) × 1080(V)                                                 | pixels |                              |
| Pixel pitch             | 121.25(H) × RGB × 363.75(V)                                       | μm     |                              |
| Pixel arrangement       | Pixels RGB Vertical stripe                                        |        |                              |
| Display colors          | 16.7M (8bits-true)                                                | colors | 8bit driver IC               |
| Display mode            | Transmission mode, Normally Black                                 |        |                              |
| Open Cell Transmittance | 5.0 (typ.)                                                        | %      | At center point with BOE BLU |
| Weight                  | 850                                                               | gram   |                              |
| Power Consumption       | 4.0                                                               | Watt   | With TCON board              |
| Surface Treatment       | Haze 1% , 2H(Min), Anti-Glare Layer (for Front) , Clear(for Rear) |        |                              |

## 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.

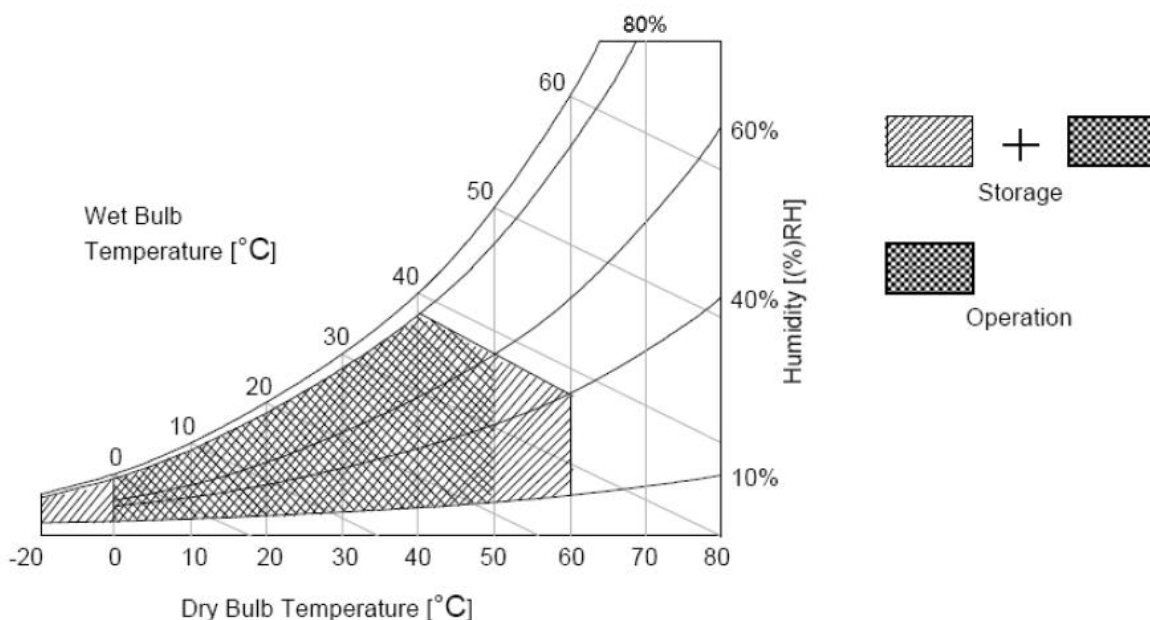
< Table 2. Open Cell Absolute Maximum Ratings >

[VSS=GND=0V]

| Parameter                  | Symbol           | Min. | Max. | Unit | Remark |
|----------------------------|------------------|------|------|------|--------|
| Operating Temperature      | T <sub>OP</sub>  | 0    | +50  | °C   | Note 1 |
| Storage Temperature        | T <sub>SUR</sub> | -20  | +60  | °C   |        |
|                            | T <sub>ST</sub>  | -20  | +60  | °C   |        |
| Operating Ambient Humidity | H <sub>op</sub>  | 10   | 80   | %RH  |        |
| Storage Humidity           | H <sub>st</sub>  | 10   | 80   | %RH  |        |

Note 1 : Temperature and relative humidity range are shown in the figure below.

Wet bulb temperature should be 39 °C max. and no condensation of water.



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3.0 ELECTRICAL SPECIFICATIONS

3.1 TFT LCD Open Cell

< Table 3. Open Cell Electrical Specifications > [Ta =25± 2 °C]

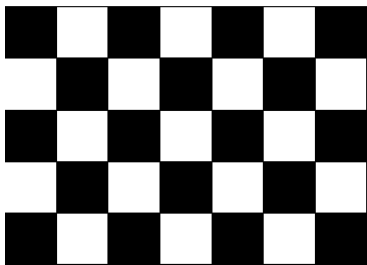
| Parameter                   |                                           | Symbol | Values |     |      | Unit | Remark |
|-----------------------------|-------------------------------------------|--------|--------|-----|------|------|--------|
|                             |                                           |        | Min    | Typ | Max  |      |        |
| Power Supply Input Voltage  |                                           | VDD    | 10.8   | 12  | 13.2 | Vdc  |        |
| Power Supply Ripple Voltage |                                           | VRP    | -      | -   | 300  | mV   |        |
| Power Supply Current        |                                           | IDD    | -      | 333 | 630  | mA   | Note 1 |
| Power Consumption           |                                           | PDD    | -      | 4.0 | 7.6  | Watt |        |
| Rush current                |                                           | IRUSH  | -      | -   | 4    | A    | Note 2 |
| LVDS Interface              | Differential Input High Threshold Voltage | VLVTH  | +100   | -   | +300 | mV   |        |
|                             | Differential Input Low Threshold Voltage  | VLVTL  | -300   | -   | -100 | mV   |        |
|                             | Common Input Voltage                      | VLVC   | 1.0    | 1.2 | 1.4  | V    |        |
| CMOS Interface              | Input High Threshold Voltage              | VIH    | 2.7    | -   | 3.3  | V    |        |
|                             | Input Low Threshold Voltage               | VIL    | 0      | -   | 0.6  | V    |        |

Note 1 : The supply voltage is measured and specified at the interface connector of LCM.

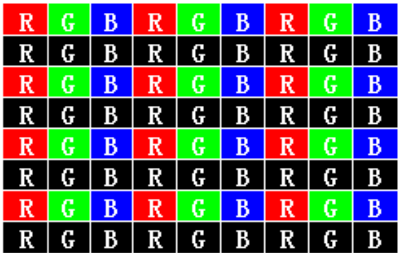
The current draw and power consumption specified is for VDD=12.0V,  
Frame rate f<sub>v</sub>=60Hz and Clock frequency = 74.25MHz.

Test Pattern of power supply current

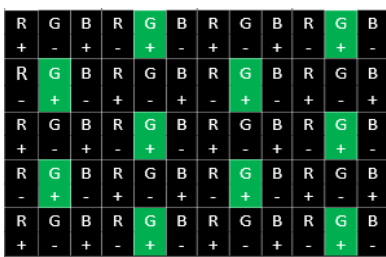
a) Typ : Mosaic 7X5 (L0/L255)



b) Max : Horizontal 1 Line (L0/L255)



c) Flicker Test Pattern



|                              |                                                          |                 |
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3.2 TCON Characteristics

< Table 4. TCON Characteristics >

| Parameter                | Symbol          | Values |     |     | Unit | Remark |
|--------------------------|-----------------|--------|-----|-----|------|--------|
|                          |                 | Min    | Typ | Max |      |        |
| TCON Surface Temperature | T <sub>TS</sub> | -      | -   | 110 | °C   | Note   |

Note 1 : Any point on the TCON surface must be less than 110 °C under any conditions.

Note 2 : This test condition is based on BOE module.

3.3 Driver Characteristics

< Table 5. Driver Characteristics >

| Parameter                  | Symbol          | Values |     |     | Unit | Remark |
|----------------------------|-----------------|--------|-----|-----|------|--------|
|                            |                 | Min    | Typ | Max |      |        |
| Driver Surface Temperature | T <sub>DS</sub> | -      | -   | 125 | °C   | Note   |

Note 3 : Any point on the driver surface must be less than 125 °C under any conditions.

Note 4: This test condition is based on BOE module.

3.4 PMIC Characteristics

< Table 6. PMIC Characteristics >

| Parameter                | Symbol          | Values |     |     | Unit | Remark |
|--------------------------|-----------------|--------|-----|-----|------|--------|
|                          |                 | Min    | Typ | Max |      |        |
| PMIC Surface Temperature | T <sub>PS</sub> | -      | -   | 100 | °C   | Note   |

Note 5 : Any point on the PMIC surface must be less than 100 °C under any conditions.

Note 6: This test condition is based on BOE module.



## 3.5 VCOM I2C Bus Format

## Step1 Reset

\*Device Address is 0x74 or 0x75(7Bits)

| S | Slave Address      | W | A | Index | Address 0       | A | Control Byte    | A | P |
|---|--------------------|---|---|-------|-----------------|---|-----------------|---|---|
|   | 1 1 1 0 1 0 0 0    |   |   |       | 0 0 0 0 0 0 0 0 |   | 0 0 0 1 0 0 1 0 |   |   |
|   | 0xE8               |   |   |       | 0x00            |   | 0x12            |   |   |
|   | Device Address + W |   |   |       | Control Address |   | Reset + OUT_EN  |   |   |

## Step2 Read VCOM

\*Data = 7Bits

| S | Slave Address      | W | A | Index | Address 1       | SR | Slave Address      | R | A | DATA 0/1        | NA | P |
|---|--------------------|---|---|-------|-----------------|----|--------------------|---|---|-----------------|----|---|
|   | 1 1 1 0 1 0 0 0    |   |   |       | 0 0 0 0 0 0 0 1 |    | 1 1 1 0 1 0 0 1    |   |   | X X X X X X X X |    |   |
|   | 0xE8               |   |   |       | 0X01            |    | 0XE9               |   |   |                 |    |   |
|   | Device address + W |   |   |       | VCOM Address    |    | Device address + R |   |   | Data            |    |   |

## Step3 Adjust VCOM

\*DVCOM= 8Bits

| S | Slave Address      | W | A | Index | Address 1       | A | DVCOM             | A | P |
|---|--------------------|---|---|-------|-----------------|---|-------------------|---|---|
|   | 1 1 1 0 1 0 0 0    |   |   |       | 0 0 0 0 0 0 0 1 |   | 0000000X~1111111X |   |   |
|   | 0XE8               |   |   |       | 0X01            |   | 0x00~0xFF         |   |   |
|   | Device address + W |   |   |       | VCOM Address    |   | VCOM value        |   |   |

## Step4 Write VCOM

| S | Slave Address      | W | A | Index | Address 1       | A | Control Byte   (0x02)     | A | P |
|---|--------------------|---|---|-------|-----------------|---|---------------------------|---|---|
|   | 1 1 1 0 1 0 0 0    |   |   |       | 0 0 0 0 0 0 0 0 |   | 0 0 0 0 1 0 1 0           |   |   |
|   | 0xE8               |   |   |       | 0x00            |   | 0X0A                      |   |   |
|   | Device Address + W |   |   |       | Control Address |   | Write DAC to NVM + OUT_EN |   |   |

## Step5 Reset

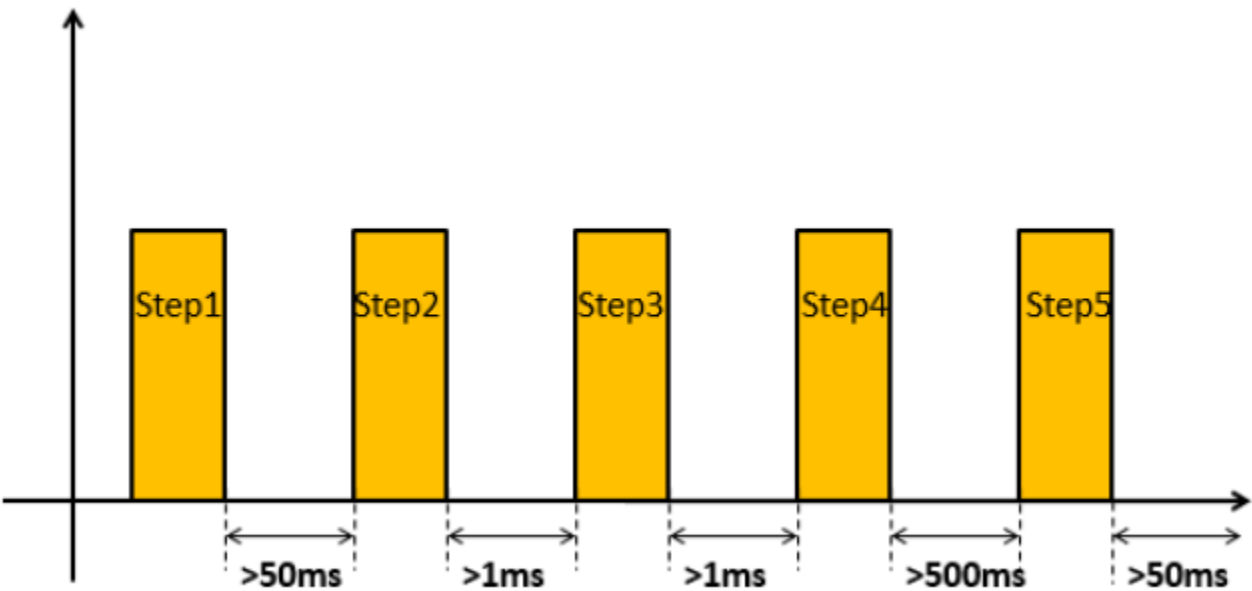
\*Device Address is 0x74 or 0x75(7Bits)

| S | Slave Address      | W | A | Index | Address 0       | A | Control Byte    | A | P |
|---|--------------------|---|---|-------|-----------------|---|-----------------|---|---|
|   | 1 1 1 0 1 0 0 0    |   |   |       | 0 0 0 0 0 0 0 0 |   | 0 0 0 1 0 0 1 0 |   |   |
|   | 0xE8               |   |   |       | 0x00            |   | 0x12            |   |   |
|   | Device Address + W |   |   |       | Control Address |   | Reset + OUT_EN  |   |   |

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### 3.6 Interval of step to step

Step to step interval must follow below figure



|                              |                                                          |                  |
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**4.0 INTERFACE CONNECTION****4.1 Open Cell Input Signal & Power**

&lt; Table 7. Open Cell Input Connector Pin Configuration &gt;

| Pin No | Symbol  | Description                                              | Pin No | Symbol    | Description                                               |
|--------|---------|----------------------------------------------------------|--------|-----------|-----------------------------------------------------------|
| 1      | NC      | No Connection                                            | 21     | GND       | Ground                                                    |
| 2      | SDA     | I <sup>2</sup> C Data                                    | 22     | CH1[3]-   | First pixel negative LVDS differential data input. Pair3  |
| 3      | SCL     | I <sup>2</sup> C Clock                                   | 23     | CH1[3]+   | First pixel positive LVDS differential data input. Pair3  |
| 4      | NC      | Not Connected                                            | 24     | NC        | Not Connected                                             |
| 5      | NC      | Not Connected                                            | 25     | NC        | Not Connected                                             |
| 6      | NC      | Not Connected                                            | 26     | NC or GND | Not Connected                                             |
| 7      | SELLVDS | High: JEIDA<br>Low or Open: VESA                         | 27     | NC        | Not Connected                                             |
| 8      | NC      | Not Connected                                            | 28     | CH2[0]-   | Second pixel negative LVDS differential data input. Pair0 |
| 9      | NC      | Not Connected                                            | 29     | CH2[0]+   | Second pixel positive LVDS differential data input. Pair0 |
| 10     | NC      | Not Connected                                            | 30     | CH2[1]-   | Second pixel negative LVDS differential data input. Pair1 |
| 11     | GND     | Ground                                                   | 31     | CH2[1]+   | Second pixel positive LVDS differential data input. Pair1 |
| 12     | CH1[0]- | First pixel negative LVDS differential data input. Pair0 | 32     | CH2[2]-   | Second pixel negative LVDS differential data input. Pair2 |
| 13     | CH1[0]+ | First pixel positive LVDS differential data input. Pair0 | 33     | CH2[2]+   | Second pixel positive LVDS differential data input. Pair2 |
| 14     | CH1[1]- | First pixel negative LVDS differential data input. Pair1 | 34     | GND       | Ground                                                    |
| 15     | CH1[1]+ | First pixel positive LVDS differential data input. Pair1 | 35     | CH2CLK-   | Second pixel negative LVDS clock                          |
| 16     | CH1[2]- | First pixel negative LVDS differential data input. Pair2 | 36     | CH2CLK+   | Second pixel positive LVDS clock                          |
| 17     | CH1[2]+ | First pixel positive LVDS differential data input. Pair2 | 37     | GND       | Ground                                                    |
| 18     | GND     | Ground                                                   | 38     | CH2[3]-   | Second pixel negative LVDS differential data input. Pair3 |
| 19     | CH1CLK- | First pixel negative LVDS clock                          | 39     | CH2[3]+   | Second pixel positive LVDS differential data input. Pair3 |
| 20     | CH1CLK+ | First pixel positive LVDS clock                          |        |           |                                                           |

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| Pin No | Symbol    | Description   | Pin No | Symbol | Description        |
|--------|-----------|---------------|--------|--------|--------------------|
| 40     | NC        | Not Connected | 46     | GND    | Ground             |
| 41     | NC        | Not Connected | 47     | NC     | Not Connected      |
| 42     | NC or GND | Not Connected | 48     | VCC    | Input Voltage +12V |
| 43     | NC or GND | Not Connected | 49     | VCC    | Input Voltage +12V |
| 44     | NC or GND | Ground        | 50     | VCC    | Input Voltage +12V |
| 45     | GND       | Ground        | 51     | VCC    | Input Voltage +12V |

Notes : 1. NC(Not Connected) : This pins are only used for BOE internal operations.

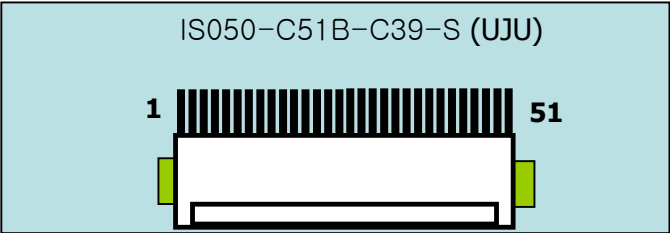
2. Input Level of LVDS signal is based on the IEA 664 Standard.

3. LVDS\_SEL : This pin is used for selecting LVDS signal data format.

    If this Pin : High (3.3V) →JEIDA LVDS format

    Otherwise : Low (GND) or Open (NC) → Normal NS LVDS format

Rear view of LCM



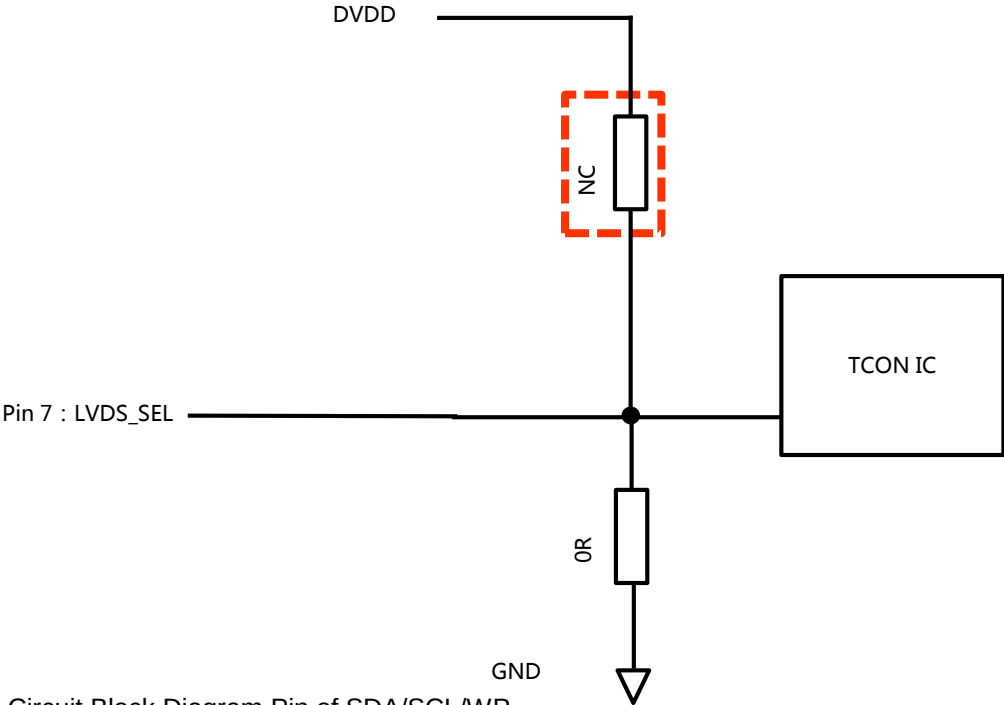
BIST Pattern

| PT1: Black<br>(1 sec) | PT1: White<br>(1 sec) | PT1: Red<br>(1 sec) | PT1: Green<br>(1 sec) | PT1: Blue<br>(1 sec) |
|-----------------------|-----------------------|---------------------|-----------------------|----------------------|
| <div></div>           | <div></div>           | <div></div>         | <div></div>           | <div></div>          |

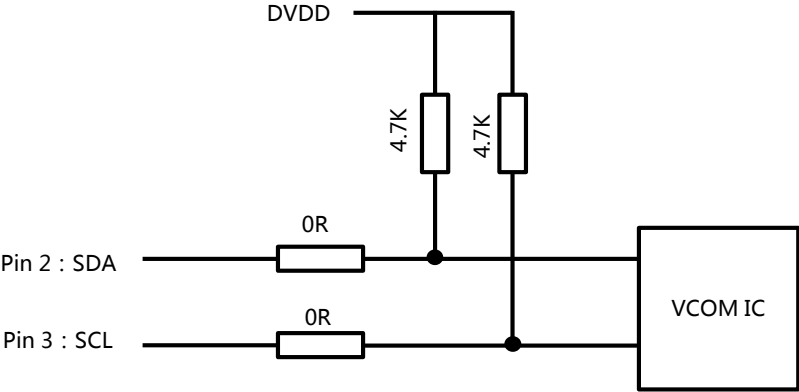
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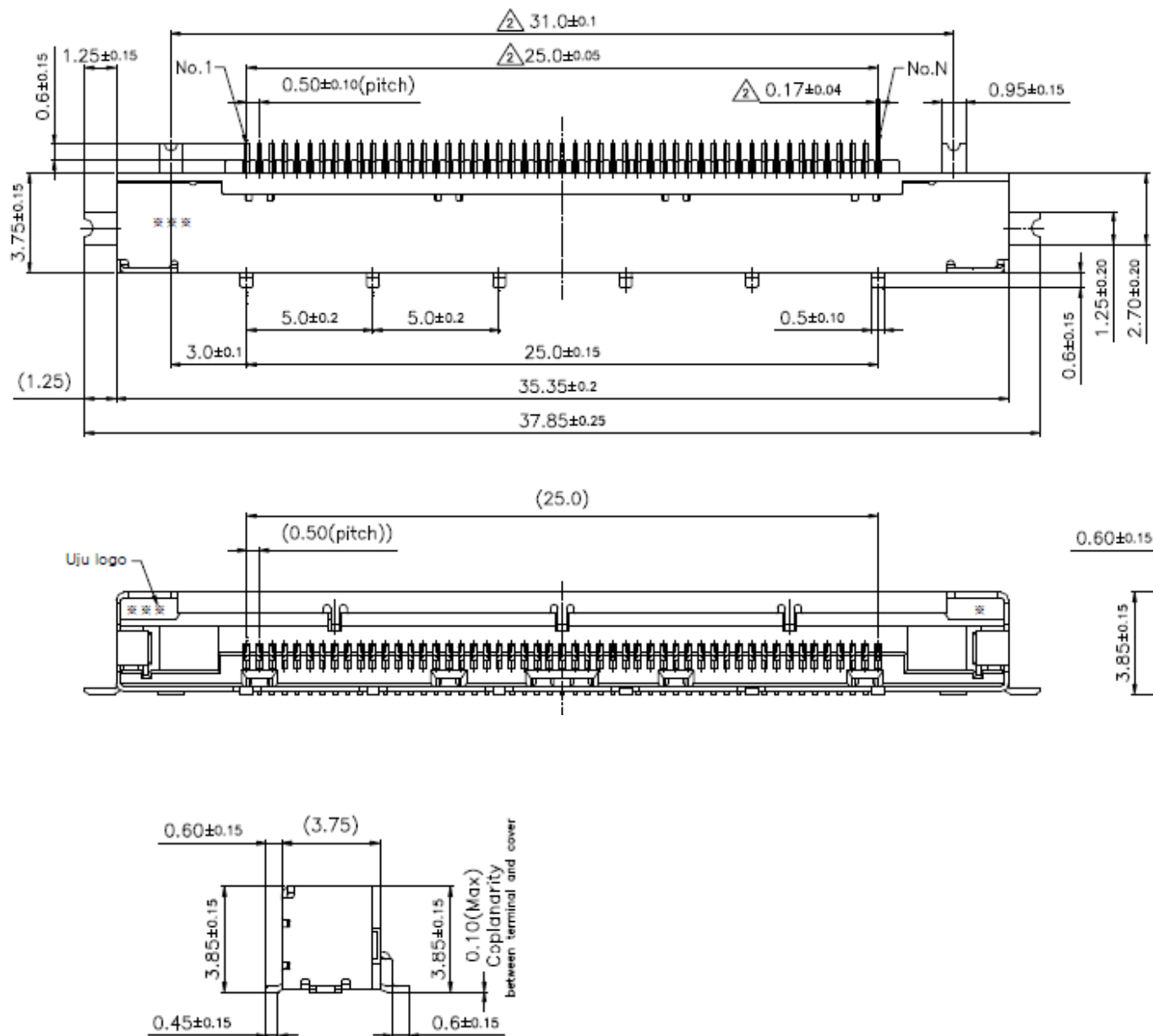
- Notes : 1. NC(Not Connected) : This pins are only used for BOE internal operations.
2. Input Level of LVDS signal is based on the IEA 664 Standard.
3. LVDS\_SEL : This pin is used for selecting LVDS signal data format.  
 If this Pin : High (3.3V) or Open (NC) → Normal NS LVDS format  
 Otherwise : Low (GND) → JEIDA LVDS format
4. BIST : This pin is used for selecting display pattern mode when input DE or input CLOCK quits toggling.  
 If this Pin : Low (GND) or Open (NC) → Free run mode(Black Pattern)  
 Otherwise : High( 3.3V) → BIST mode(BIST Pattern)  
 Sequence : On = VDD ≥LVDS Option , BIST Option ≥Interface signal  
 Off = Interface signal ≥ LVDS Option , BIST Option ≥ VDD
- 5 Circuit Block Diagram of HTPDN/LOCKN/SEL\_SECTION.



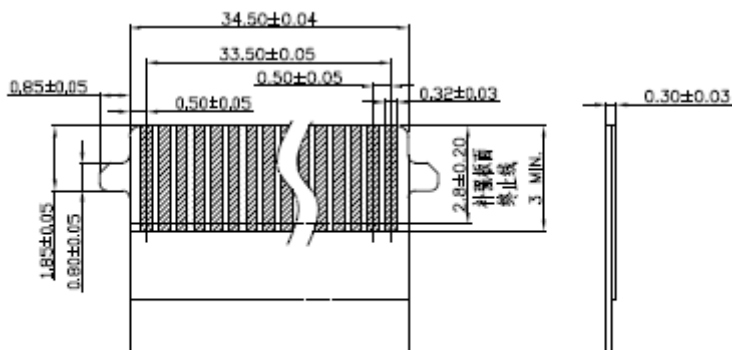
6. Circuit Block Diagram Pin of SDA/SCL/WP.



-51pin Connector: IS050-C51B-C39-S



-68pin FFC

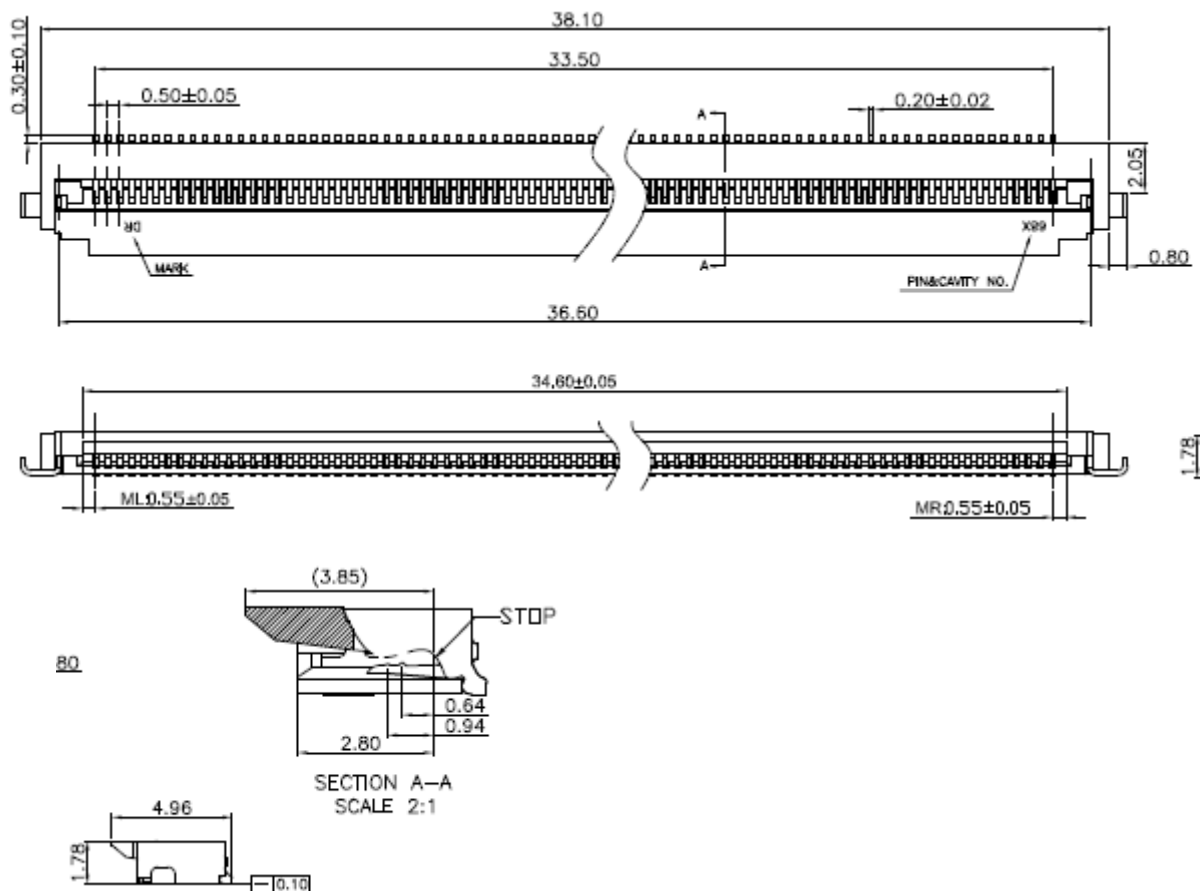


RECOMMENDED FPC/FFC DIM.

THICKNESS:  $0.3 \pm 0.03$

Notes: This FFC drawing are supplied by the connector vendor.

-68pin Connector: CONN\_40.1\*4.96\*1.78MM\_68P\_0.5MM



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5.0 SIGNAL TIMING WAVEFORMS OF INTERFACE SIGNAL

5.1 LVDS Interface

<Table 9. LVDS Receiver : Timing Controller (LVDS Rx merged) / LVDS Data : Pixel Data>

| Channel No. | Data No. | 8-bit LVDS Type |       |
|-------------|----------|-----------------|-------|
|             |          | NS              | JEIDA |
| 0           | Bit-0    | R0              | R2    |
|             | Bit-1    | R1              | R3    |
|             | Bit-2    | R2              | R4    |
|             | Bit-3    | R3              | R5    |
|             | Bit-4    | R4              | R6    |
|             | Bit-5    | R5              | R7    |
|             | Bit-6    | G0              | G2    |
| 1           | Bit-0    | G1              | G3    |
|             | Bit-1    | G2              | G4    |
|             | Bit-2    | G3              | G5    |
|             | Bit-3    | G4              | G6    |
|             | Bit-4    | G5              | G7    |
|             | Bit-5    | B0              | B2    |
|             | Bit-6    | B1              | B3    |
| 2           | Bit-0    | B2              | B4    |
|             | Bit-1    | B3              | B5    |
|             | Bit-2    | B4              | B6    |
|             | Bit-3    | B5              | B7    |
|             | Bit-4    | HS              | HS    |
|             | Bit-5    | VS              | VS    |
|             | Bit-6    | DE              | DE    |
| 3           | Bit-0    | R6              | R0    |
|             | Bit-1    | R7              | R1    |
|             | Bit-2    | G6              | G0    |
|             | Bit-3    | G7              | G1    |
|             | Bit-4    | B6              | B0    |
|             | Bit-5    | B7              | B1    |
|             | Bit-6    | -               | -     |

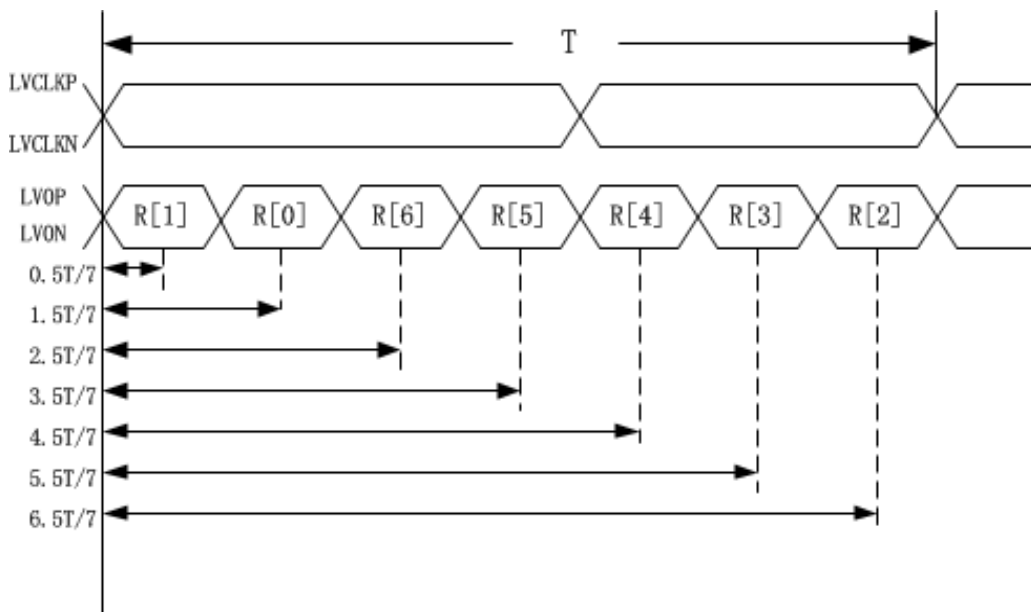


## 5.2 LVDS Rx Interface Timing Parameter

The Specification of the LVDS Rx interface timing parameter is shown in Table10

< Table 10. LVDS Rx Interface Timing Specification >

| Item         | Symbol | Min          | Typ      | Max          | Unit | Note |
|--------------|--------|--------------|----------|--------------|------|------|
| CLKIN Period | T      | 11.8         | 13.5     | 17.9         | nsec |      |
| Input Data0  | tRCIP1 | $0.5T/7-0.4$ | $0.5T/7$ | $0.5T/7+0.4$ | nsec |      |
| Input Data1  | tRCIP0 | $1.5T/7-0.4$ | $1.5T/7$ | $1.5T/7+0.4$ | nsec |      |
| Input Data2  | tRCIP6 | $2.5T/7-0.4$ | $2.5T/7$ | $2.5T/7+0.4$ | nsec |      |
| Input Data3  | tRCIP5 | $3.5T/7-0.4$ | $3.5T/7$ | $3.5T/7+0.4$ | nsec |      |
| Input Data4  | tRCIP4 | $4.5T/7-0.4$ | $4.5T/7$ | $4.5T/7+0.4$ | nsec |      |
| Input Data5  | tRCIP3 | $5.5T/7-0.4$ | $5.5T/7$ | $5.5T/7+0.4$ | nsec |      |
| Input Data6  | tRCIP2 | $6.5T/7-0.4$ | $6.5T/7$ | $6.5T/7+0.4$ | nsec |      |



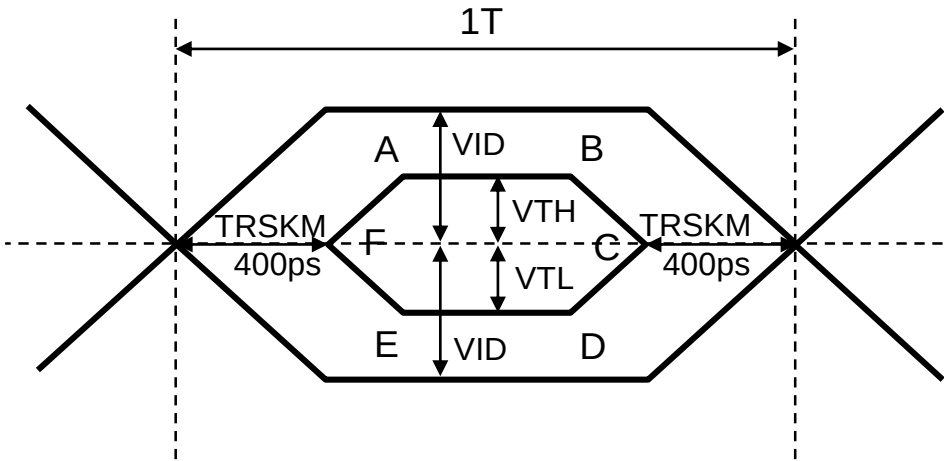
Notes: Input frequency range from 25MHz to 110MHz

### 5.3 LVDS Rx Interface Eye Diagram & DC SPEC

< Table 11. LVDS DC Specification>

| Symbol | Min  | Typ | Max  | Unit | Remark |
|--------|------|-----|------|------|--------|
| A      | 100  | -   | -    | mV   |        |
| B      | 100  | -   | -    | mV   |        |
| C      | 0    | -   | -    | mV   |        |
| D      | -100 | -   | -    | mV   |        |
| E      | -100 | -   | -    | mV   |        |
| F      | 0    | -   | -    | mV   |        |
| VTH    | +100 | -   | -    | mV   |        |
| VTL    | -    | -   | -100 | mV   |        |
| VID    | ±100 | -   | ±600 | mV   |        |

- Notes:
1. TRSKM: 600ps@65MHz, 530ps@74.25MHz, 495ps@79.8MHz, 400ps@85MHz.
  2. VID /VTH/VTL measure point is below timing. Vid measurement can be judge at the center of Eye.



# 6.0 SIGNAL TIMING SPECIFICATION

## 6.1 Timing Parameters

< Table 12. Timing Table >

| Item                           |           | Symbols |                 | Min  | Typ   | Max  | Unit             |
|--------------------------------|-----------|---------|-----------------|------|-------|------|------------------|
| Clock                          | Frequency | 1/Tc    |                 | 58   | 74.25 | 97   | MHz              |
|                                | High Time | Tch     |                 | -    | 4/7Tc | -    |                  |
|                                | Low Time  | Tcl     |                 | -    | 4/7Tc | -    |                  |
| Frame Period                   |           | Tv      |                 | 1100 | 1125  | 1149 | lines            |
|                                |           |         |                 | 47   | 60    | 78   | Hz               |
| Horizontal Active Display Term |           | Valid   | t <sub>HV</sub> | -    | 960   | -    | t <sub>CLK</sub> |
|                                |           | Total   | t <sub>HP</sub> | 1060 | 1100  | 1200 | t <sub>CLK</sub> |
| Vertical Active Display Term   |           | Valid   | t <sub>VV</sub> | -    | 1080  | -    | t <sub>HP</sub>  |
|                                |           | Total   | t <sub>VP</sub> | 1100 | 1125  | 1149 | t <sub>HP</sub>  |

| Item                           |           | Symbols |                 | Min  | Typ   | Max  | Unit             |
|--------------------------------|-----------|---------|-----------------|------|-------|------|------------------|
| Clock                          | Frequency | 1/Tc    |                 | 60   | 74.25 | 78   | MHz              |
|                                | High Time | Tch     |                 | -    | 4/7Tc | -    |                  |
|                                | Low Time  | Tcl     |                 | -    | 4/7Tc | -    |                  |
| Frame Period                   |           | Tv      |                 | 1308 | 1350  | 1380 | lines            |
|                                |           |         |                 | 47   | 50    | 53   | Hz               |
| Horizontal Active Display Term |           | Valid   | t <sub>HV</sub> | -    | 960   | -    | t <sub>CLK</sub> |
|                                |           | Total   | t <sub>HP</sub> | 1060 | 1100  | 1200 | t <sub>CLK</sub> |
| Vertical Active Display Term   |           | Valid   | t <sub>VV</sub> | -    | 1080  | -    | t <sub>HP</sub>  |
|                                |           | Total   | t <sub>VP</sub> | 1308 | 1350  | 1380 | t <sub>HP</sub>  |

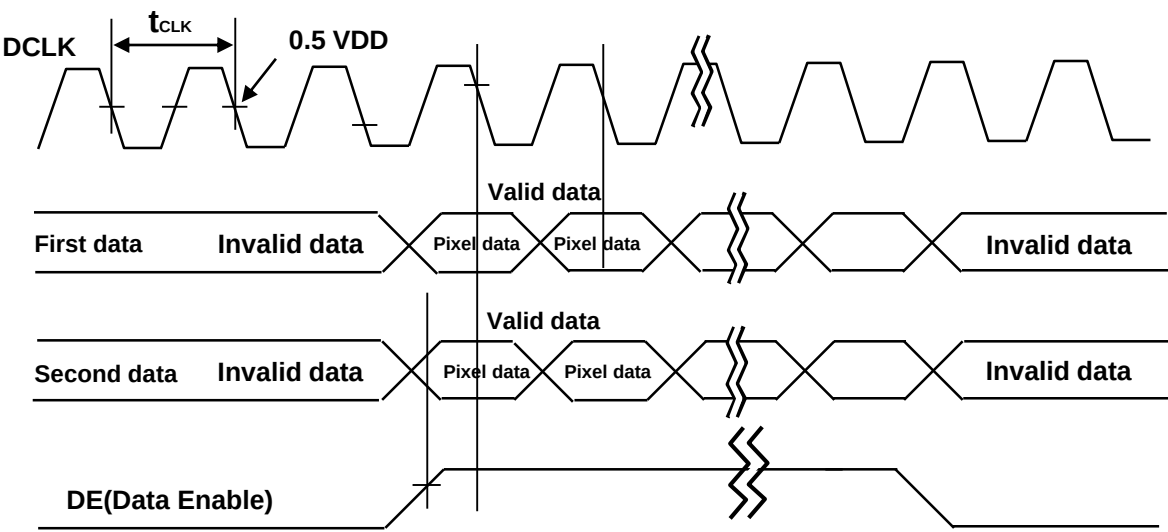
Notes: This product is DE only mode. The input of Hsync & Vsync signal does not have an effect on normal operation.

< Table 13. LVDS Input SSCG>

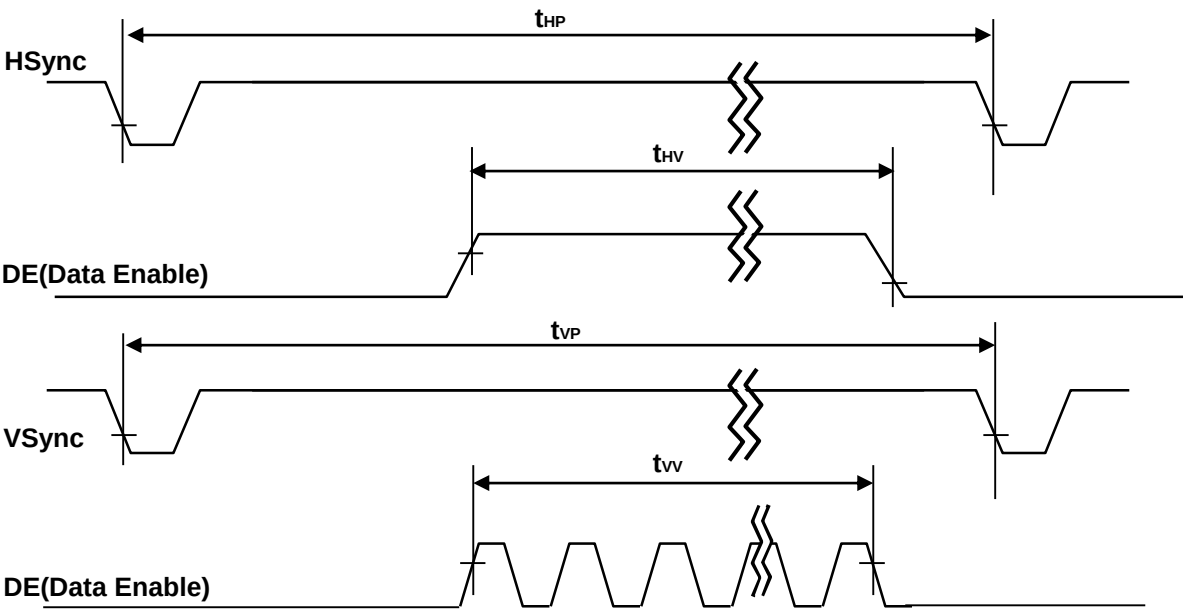
| Symbol             | Parameter                                             | Condition                                                    | Min                | Typ             | Max           | Unit |
|--------------------|-------------------------------------------------------|--------------------------------------------------------------|--------------------|-----------------|---------------|------|
| F                  | LVDS Input frequency                                  | -                                                            | 58                 | 74.25<br>(92.8) | 97            | MHz  |
| T <sub>LVSK</sub>  | LVDS channel to channel skew                          | F=100MHz<br>V <sub>IC</sub> =1.2V<br>V <sub>ID</sub> =±200mV | -(1/<br>F)*3<br>0% | -               | (1/F)*<br>30% | ps   |
| F <sub>LVMOD</sub> | Modulating frequency of input clock during SSC        | F=85MHz<br>V <sub>IC</sub> =1.2V<br>V <sub>ID</sub> =±200mV  | 0                  | -               | 200           | KHz  |
| F <sub>LVDEV</sub> | Maximum deviation of input clock frequency during SSC |                                                              | -3                 | -               | +3            | %    |
| T <sub>CY-CY</sub> | Cycle to Cycle jitter                                 |                                                              | -                  | -               | 50            | ps   |

|                |                  |        |            |
|----------------|------------------|--------|------------|
| <div>BOE</div> | PRODUCT GROUP    | REV    | ISSUE DATE |
|                | TFT- LCD PRODUCT | Rev. O | 2020.02.26 |

## 6.2 Signal Timing Waveform



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



|                              |                                                          |                  |
|------------------------------|----------------------------------------------------------|------------------|
| SPEC. NUMBER<br>SB-64-8A-278 | SPEC. TITLE<br>HV320FHB-F40 Product Specification Rev. O | PAGE<br>21 OF 36 |
|------------------------------|----------------------------------------------------------|------------------|

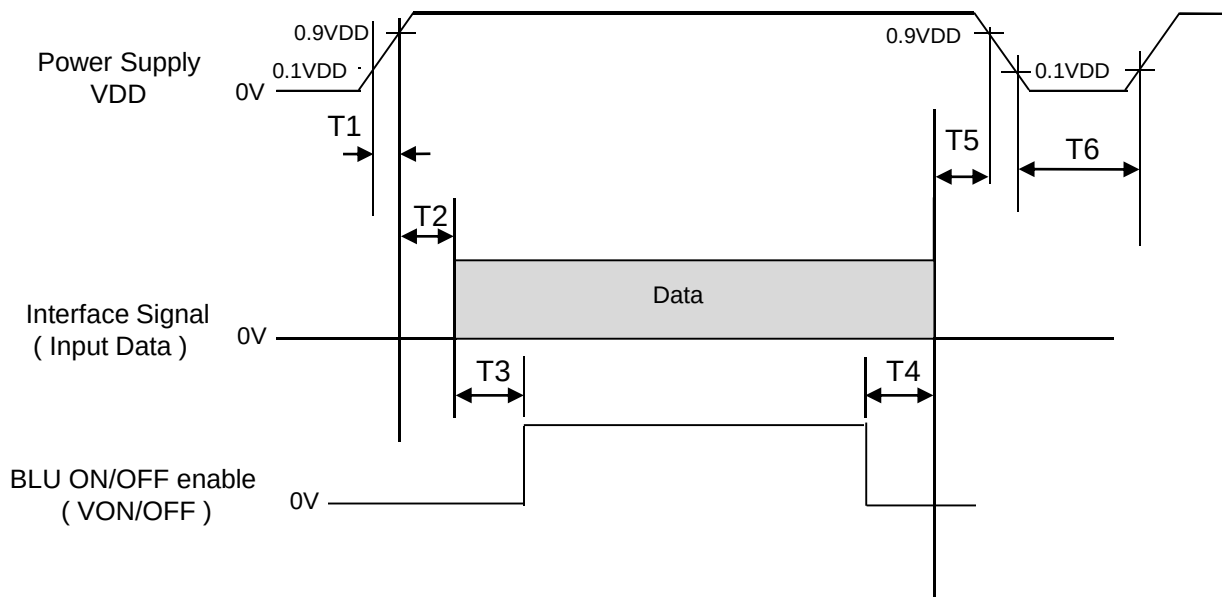
## 6.3 Input Signals, Basic Display Colors and Gray Scale of Colors

&lt; Table 10. Input Signal and Display Color Table &gt;

| Color & Gray Scale  |          | Input Data Signal |    |    |    |    |    |    |    |            |    |    |    |    |    |    |    |           |    |    |    |    |    |    |    |   |
|---------------------|----------|-------------------|----|----|----|----|----|----|----|------------|----|----|----|----|----|----|----|-----------|----|----|----|----|----|----|----|---|
|                     |          | Red Data          |    |    |    |    |    |    |    | Green Data |    |    |    |    |    |    |    | Blue Data |    |    |    |    |    |    |    |   |
|                     |          | R7                | R6 | R5 | R4 | R3 | R2 | R1 | R0 | G7         | G6 | G5 | G4 | G3 | G2 | G1 | G0 | B7        | B6 | B5 | B4 | B3 | B2 | B1 | B0 |   |
| Basic Colors        | Black    | 0                 | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0          | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0         | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |
|                     | Blue     | 0                 | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0          | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1         | 1  | 1  | 1  | 1  | 1  | 1  | 1  |   |
|                     | Green    | 0                 | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1          | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0         | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |
|                     | Cyan     | 0                 | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1          | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1         | 1  | 1  | 1  | 1  | 1  | 1  | 1  |   |
|                     | Red      | 1                 | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0          | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0         | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |
|                     | Magenta  | 1                 | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0          | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1         | 1  | 1  | 1  | 1  | 1  | 1  | 1  |   |
|                     | Yellow   | 1                 | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1          | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0         | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |
|                     | White    | 1                 | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1          | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1         | 1  | 1  | 1  | 1  | 1  | 1  | 1  |   |
| Gray Scale of Red   | Black    | 0                 | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0          | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0         | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |
|                     | △        | 0                 | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0          | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0         | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |
|                     | Darker   | 0                 | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0          | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0         | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |
|                     | △        | ↑                 |    |    |    |    |    |    |    | ↑          |    |    |    |    |    |    |    | ↑         |    |    |    |    |    |    |    |   |
|                     | ▽        | ↓                 |    |    |    |    |    |    |    | ↓          |    |    |    |    |    |    |    | ↓         |    |    |    |    |    |    |    |   |
|                     | Brighter | 1                 | 1  | 1  | 1  | 1  | 1  | 0  | 1  | 0          | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0         | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0 |
|                     | ▽        | 1                 | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0          | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0         | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |
|                     | Red      | 1                 | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0          | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0         | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |
| Gray Scale of Green | Black    | 0                 | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0          | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0         | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |
|                     | △        | 0                 | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0          | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0         | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |
|                     | Darker   | 0                 | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0          | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0         | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |
|                     | △        | ↑                 |    |    |    |    |    |    |    | ↑          |    |    |    |    |    |    |    | ↑         |    |    |    |    |    |    |    |   |
|                     | ▽        | ↓                 |    |    |    |    |    |    |    | ↓          |    |    |    |    |    |    |    | ↓         |    |    |    |    |    |    |    |   |
|                     | Brighter | 0                 | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1          | 1  | 1  | 1  | 1  | 1  | 0  | 1  | 0         | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0 |
|                     | ▽        | 0                 | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1          | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0         | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |
|                     | Green    | 0                 | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1          | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0         | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0 |
| Gray Scale of Blue  | Black    | 0                 | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0          | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0         | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |
|                     | △        | 0                 | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0          | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0         | 0  | 0  | 0  | 0  | 0  | 0  | 1  |   |
|                     | Darker   | 0                 | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0          | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0         | 0  | 0  | 0  | 0  | 0  | 1  | 0  |   |
|                     | △        | ↑                 |    |    |    |    |    |    |    | ↑          |    |    |    |    |    |    |    | ↑         |    |    |    |    |    |    |    |   |
|                     | ▽        | ↓                 |    |    |    |    |    |    |    | ↓          |    |    |    |    |    |    |    | ↓         |    |    |    |    |    |    |    |   |
|                     | Brighter | 0                 | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0          | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1         | 1  | 1  | 1  | 1  | 1  | 0  | 1  |   |
|                     | ▽        | 0                 | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0          | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1         | 1  | 1  | 1  | 1  | 1  | 1  | 0  |   |
|                     | Blue     | 0                 | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0          | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1         | 1  | 1  | 1  | 1  | 1  | 1  | 1  |   |
| Gray Scale of White | Black    | 0                 | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0          | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0         | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |
|                     | △        | 0                 | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0          | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0         | 0  | 0  | 0  | 0  | 0  | 0  | 1  |   |
|                     | Darker   | 0                 | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0          | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0         | 0  | 0  | 0  | 0  | 0  | 1  | 0  |   |
|                     | △        | ↑                 |    |    |    |    |    |    |    | ↑          |    |    |    |    |    |    |    | ↑         |    |    |    |    |    |    |    |   |
|                     | ▽        | ↓                 |    |    |    |    |    |    |    | ↓          |    |    |    |    |    |    |    | ↓         |    |    |    |    |    |    |    |   |
|                     | Brighter | 1                 | 1  | 1  | 1  | 1  | 1  | 0  | 1  | 1          | 1  | 1  | 1  | 1  | 1  | 0  | 1  | 1         | 1  | 1  | 1  | 1  | 0  | 1  | 1  |   |
|                     | ▽        | 1                 | 1  | 1  | 1  | 1  | 1  | 0  | 1  | 1          | 1  | 1  | 1  | 1  | 1  | 0  | 1  | 1         | 1  | 1  | 1  | 1  | 1  | 1  | 0  |   |
|                     | White    | 1                 | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1          | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1         | 1  | 1  | 1  | 1  | 1  | 1  | 1  |   |

## 6.4 Power Sequence

To prevent a latch-up or DC operation of the Open Cell, the power on/off sequence shall be as shown in below



< Table 7. Sequence Table >

| Parameter | Values |     |     | Units |
|-----------|--------|-----|-----|-------|
|           | Min    | Typ | Max |       |
| T1        | 0.5    | -   | 20  | ms    |
| T2        | 10     | -   | 50  | ms    |
| T3        | 250    | -   | -   | ms    |
| T4        | 100    | -   | -   | ms    |
| T5        | 0      | -   | 50  | ms    |
| T6        | 1      | -   | -   | s     |

- Notes: 1. Even though T1 is over the specified value, there is no problem if I2T spec of fuse is satisfied.  
 2. Back Light must be turn on after power for logic and interface signal are valid.  
 3. If exceed T2(max), enter to BIST mode.

## 7.0 OPTICAL SPECIFICATION

The test of optical specifications shall be measured in a dark room (ambient luminance $\leq$ 1 lux and temperature $=25\pm 2^{\circ}\text{C}$ ) with the equipment of Luminance meter system (Goniometer system and PR730) and test unit shall be located at an approximate distance 180cm from the LCD surface at a viewing angle of  $\theta$  and  $\Phi$  equal to  $0^{\circ}$ . We refer to  $\theta_{\Phi=0}$  ( $=\theta_3$ ) as the 3 o'clock direction (the "right"),  $\theta_{\Phi=90}$  ( $=\theta_{12}$ ) as the 12 o'clock direction ("upward"),  $\theta_{\Phi=180}$  ( $=\theta_9$ ) as the 9 o'clock direction ("left") and  $\theta_{\Phi=270}$  ( $=\theta_6$ ) as the 6 o'clock direction ("bottom"). While scanning  $\theta$  and/or  $\Phi$ , 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  $\pm$ 10% at  $25^{\circ}\text{C}$ . Optimum viewing angle direction is 6 'clock.

< Table 12. Optical Table >

[VDD = 12.0V, Frame rate = 60Hz, Ta  $=25\pm 2^{\circ}\text{C}$ ]

| Parameter             |            | Symbol        | Condition                                                    | Min            | Typ    | Max            | Unit | Remark                 |        |
|-----------------------|------------|---------------|--------------------------------------------------------------|----------------|--------|----------------|------|------------------------|--------|
| Viewing Angle         | Horizontal | $\Theta_3$    | CR > 10                                                      |                | 89     |                | Deg. | -                      |        |
|                       |            | $\Theta_9$    |                                                              |                | 89     |                | Deg. |                        |        |
|                       | Vertical   | $\Theta_{12}$ |                                                              |                | 89     |                | Deg. |                        |        |
|                       |            | $\Theta_6$    |                                                              |                | 89     |                | Deg. |                        |        |
| Contrast ratio        |            | CR            | $\Theta = 0^\circ$<br>(Center)<br>Normal<br>Viewing<br>Angle | 1000:1         | 1200:1 | -              |      | -                      |        |
| Reproduction of color | White      | $W_x$         |                                                              | TYP.<br>- 0.03 | 0.263  | TYP.<br>+ 0.03 |      | Based on BOE Backlight |        |
|                       |            | $W_y$         |                                                              |                | 0.265  |                |      |                        |        |
|                       | Red        | $R_x$         |                                                              |                | 0.643  |                |      |                        |        |
|                       |            | $R_y$         |                                                              |                | 0.332  |                |      |                        |        |
|                       | Green      | $G_x$         |                                                              |                | 0.275  |                |      |                        |        |
|                       |            | $G_y$         |                                                              |                | 0.642  |                |      |                        |        |
|                       | Blue       | $B_x$         |                                                              |                | 0.151  |                |      |                        |        |
|                       |            | $B_y$         |                                                              |                | 0.043  |                |      |                        |        |
| Response Time         | G to G     | $T_g$         |                                                              | -              | 8      | 10             | ms   | -                      |        |
| Gamma Scale           |            |               |                                                              |                | 2.0    | 2.2            | 2.4  |                        |        |
| Cell Transmittance    |            |               |                                                              |                | 4.5    | 5.0            |      | %                      | 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  $\theta = 0^\circ$  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 12. 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. The BLU is used by BOE.
4. Response time  $T_g$  is the average time required for display transition by switching the input signal as below table and is based on Frame rate  $f_V = 60\text{Hz}$  to optimize.  
Each time in below table 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

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

8.0 RELIABILITY TEST

The Reliability test items and its conditions are shown in below.

< Table 13. Reliability Test Parameters >

| No | Test Items                                      | Conditions                              |
|----|-------------------------------------------------|-----------------------------------------|
| 1  | High temperature storage test                   | Ta = 60 °C, 240 hrs                     |
| 2  | Low temperature storage test                    | Ta = -20 °C, 240 hrs                    |
| 3  | High temperature & high humidity operation test | Ta = 50 °C, 80%RH, 240hrs               |
| 4  | High temperature operation test                 | Ta = 50 °C, 240hrs                      |
| 5  | Low temperature operation test                  | Ta = -5 °C, 240hrs                      |
| 6  | Thermal shock                                   | Ta = -20 °C ↔ 60 °C (0.5 hr), 100 cycle |

This test condition is based on BOE module.

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## 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.

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## 9.0 HANDLING & CAUTIONS

### (6) Other cautions

- In particular in winter, Before putting Panel boxes on the line, aging process is required to make the temperature of products similar to the temperature of workplace.
- Response time depends on the temperature.(In lower temperature, it becomes longer.)
- 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.
- Product assembled into module should be stored in the bag(cover case).
- Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.
- Be careful not to give any extra mechanical stress to the panel when designing the set, and BLU.
- Do not pull, fold or bend the source COF and the gate COF in any processes
- If the liquid crystal material leaks from the panel, this should be kept away from the eyes or mouth. If this contacts to hands, legs, or clothes, you must washed it away with soap thoroughly and see a doctor for the medical examination.

|                              |                                                          |                  |
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10.0 PRODUCT SERIAL NUMBER



|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 |   | 2 |   | 3 |   | 4 |   | 5 |   | 6 |   |   |   | 7 |   |   |   |   |   |
| X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |

1. Control Number
2. Rank / Grade
3. Line Classification
4. Year (2011 : 11, 2012 : 12, ...)
5. Month (1,2,3, ... , 9, X, Y, Z)
6. Internal Use
7. Serial Number

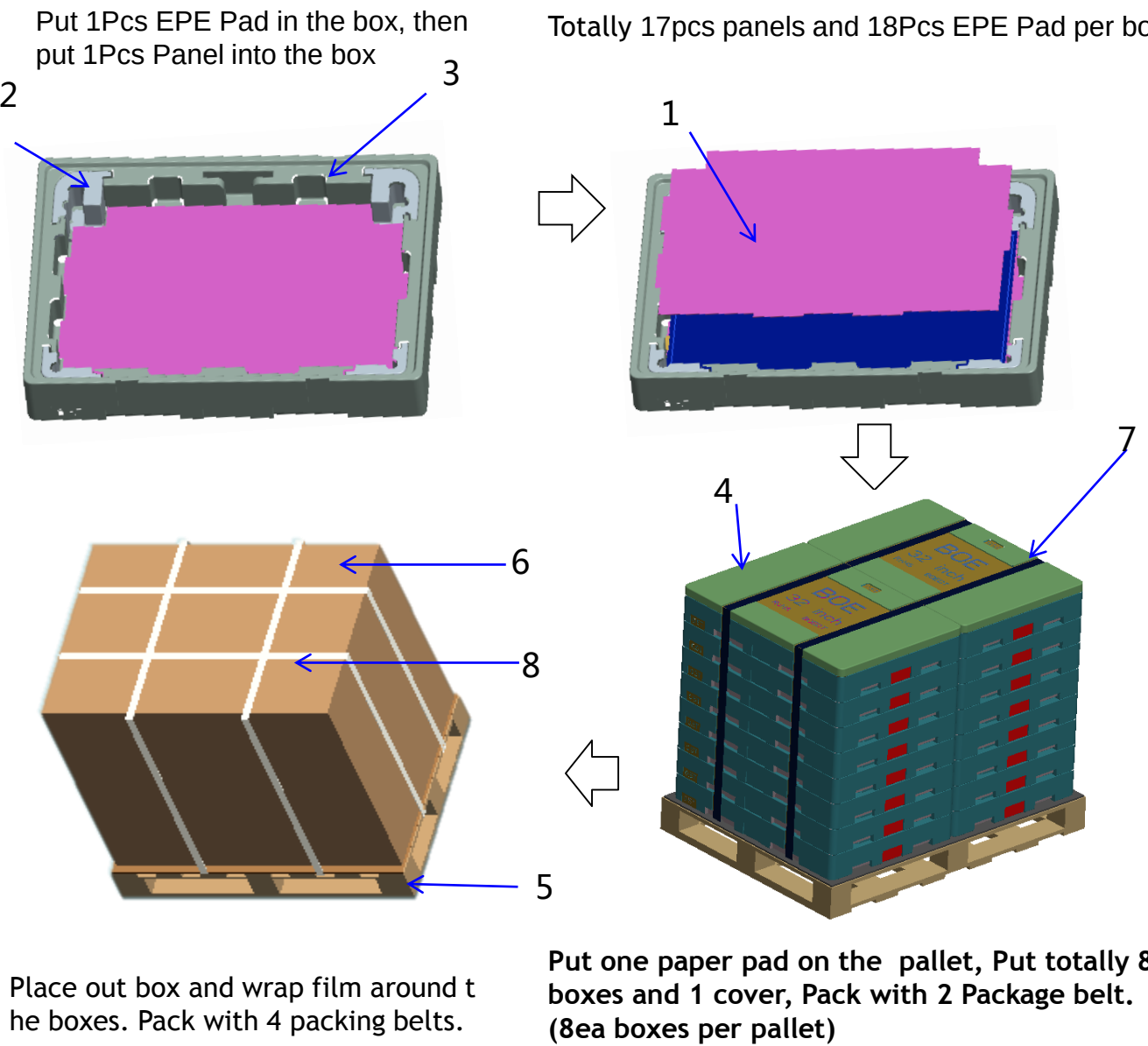
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11.0 PACKING

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



|                              |                                                          |                  |
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| N0. | Description  | Material |
|-----|--------------|----------|
| 1   | Pad          | EPE      |
| 2   | Cushion      | EPP      |
| 3   | Bottom       | EPO      |
| 4   | Cover        | EPO      |
| 5   | Pallet       | Wood     |
| 6   | OUT Box      | Paper    |
| 7   | Band         | PP       |
| 8   | Packing Belt | Nylon    |

|                              |                                                          |                  |
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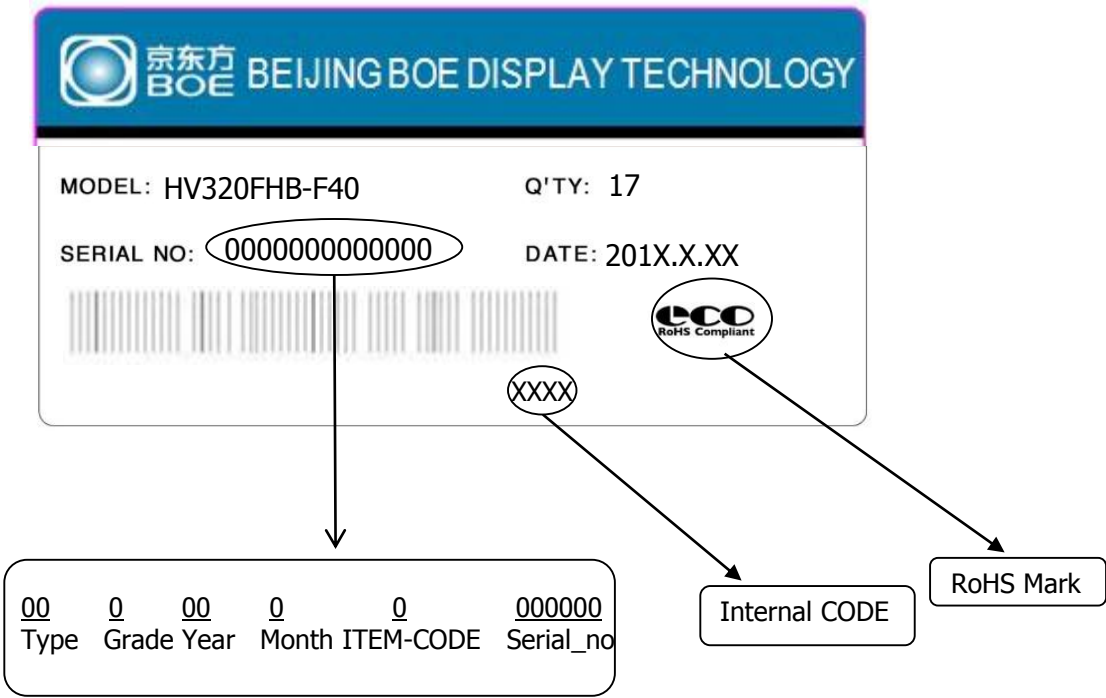
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11.2 Packing Note

- Box Dimension : 860mmL×560mmW×123mmH
- Package Quantity in one Box : 17pcs

11.3 Box Label

- Label Size : 110 mm (L) × 55 mm (W)
- Contents
  - Model : HV320FHB-F40
  - Q`ty : 17 Open Cell in one box.
  - Serial No. : Box Serial No. See next page for detail description.
  - Date : Packing Date
  - FG Code : FG Code of Product



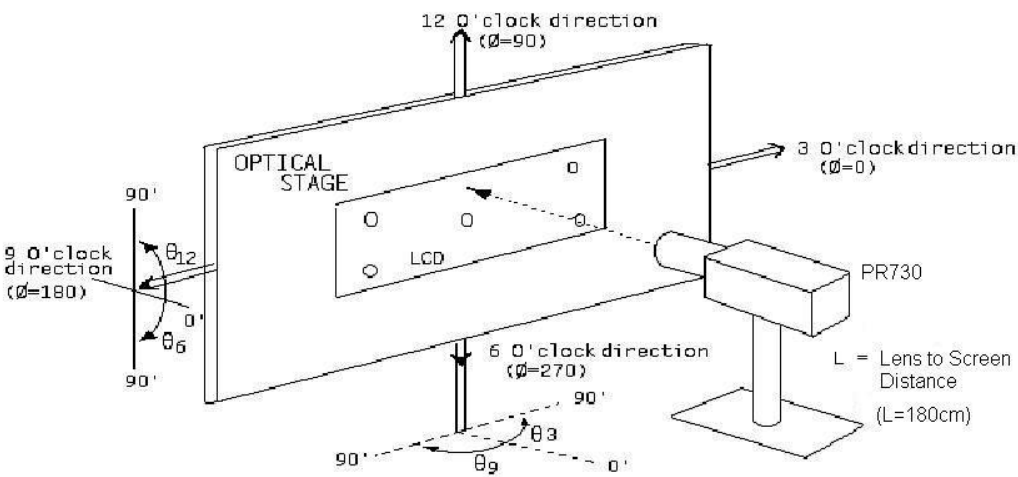
|                              |                                                          |                  |
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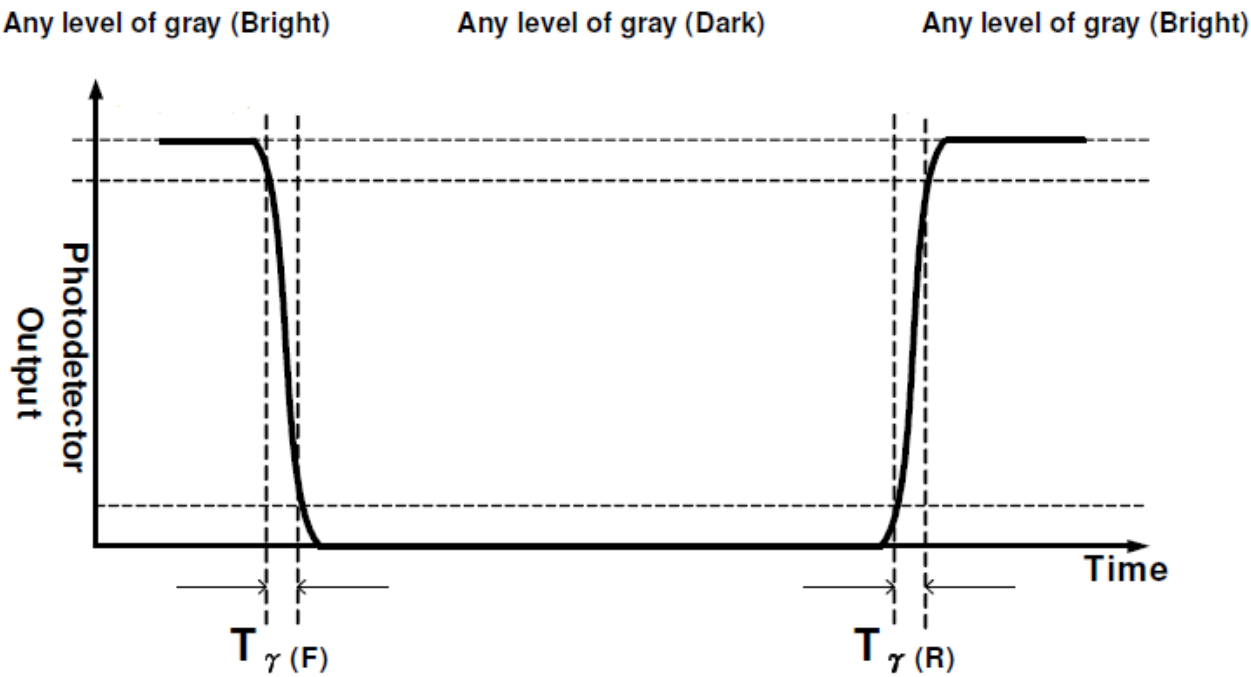
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12.0 APPENDIX 1

< Figure 1. Measurement Set Up >



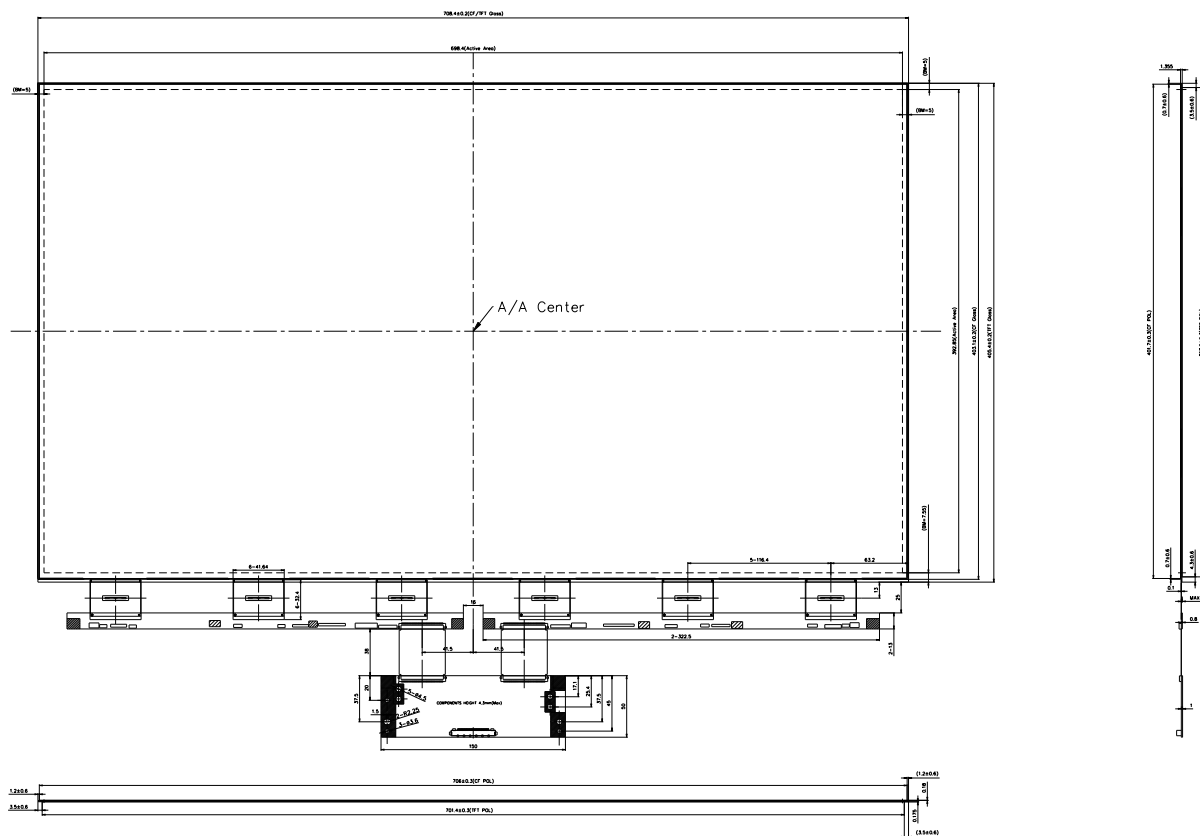
< Figure 2. Response Time Testing >



|                              |                                                          |                  |
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## 12.0 APPENDIX 2

&lt; Figure 3. TFT-LCD Open Cell Outline Dimensions (Front View) &gt;



PANEL SIZE:

TFT-GLASS SIZE:708.4X405.4X0.5T

CF-GLASS SIZE:708.4X403.1X0.5T

## TOLERANCE TABLE(±)

| DIMENSION          | 1 GRADE | 2 GRADE | 3 GRADE | 4 GRADE |
|--------------------|---------|---------|---------|---------|
| $L \leq 20$        | 0.05    | 0.1     | 0.1     | 0.2     |
| $20 < L \leq 50$   | 0.1     | 0.15    | 0.2     | 0.25    |
| $50 < L \leq 100$  | 0.15    | 0.2     | 0.25    | 0.3     |
| $100 < L \leq 200$ | 0.2     | 0.25    | 0.3     | 0.5     |
| $200 < L$          | 0.25    | 0.3     | 0.5     | 0.8     |

UNLESS OTHERWISE SPECIFIED

SPEC. NUMBER

SB-64-8A-278

SPEC. TITLE

HV320FHB-F40 Product Specification Rev. O

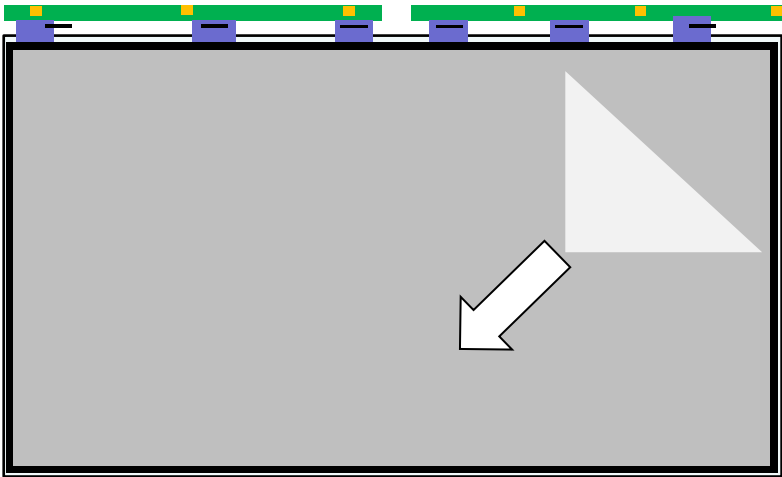
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12.0 APPENDIX 3

< Figure 4. TFT POL Protect Film Peeling Method >



1. Be sure to peel off slowly(recommended more than 7sec) and constant speed.
2. Peeling direction shows in Figure 4.
3. Be sure to ground person with adequate methods such as the anti-static wrist band.
4. Be sure to ground each S-PCB while peeling off the protection film.
5. Ionized air should be blown over during peeling action.
6. The protection film must not touch drivers and S-PCBs.
7. If adhesive may remain on the polarizer after the protection film peeling off, please remove with isopropyl-alcohol.

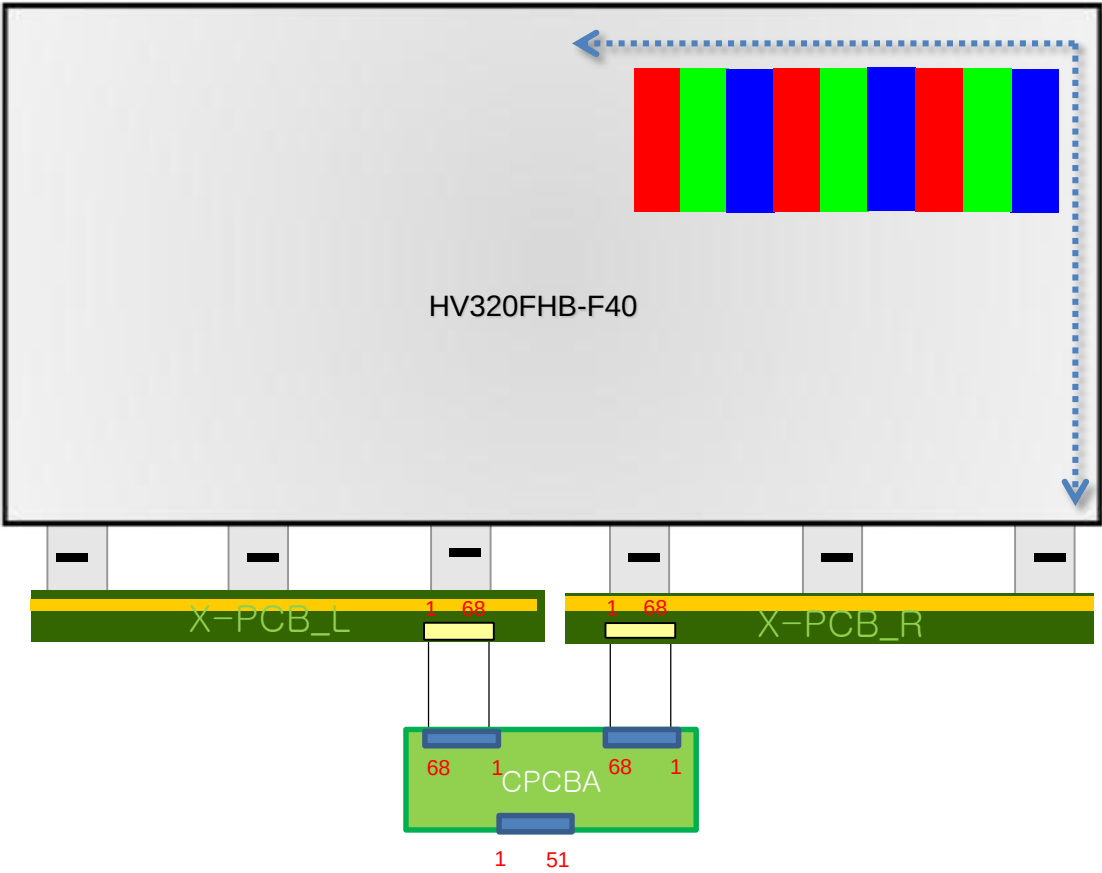
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12.0 APPENDIX 4

< Figure 5. Display Mode>

(a)This Product is Reverse type display. V by One data mapping scan direction : from left-up to right-down.



Notes : NC(Not Connected) : This pins are only used for BOE internal operations.

|                              |                                                          |                  |
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