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SPEC. NUMBER	Rev. P0	ISSUE DATE	PAGE
S8-65-AA-166		2022.07.08	1 OF 32

DV286FBB-NV0 Product Specification

HEFEI BOE DISPLAY TECHNOLOGY CO., LTD

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REVISION HISTORY

(√)preliminary specification
( )Final specification

Revision No.	Page	Description of changes	Date	Prepared
P0	-	Initial Release	2022/07/08	ZHOU LIWEI

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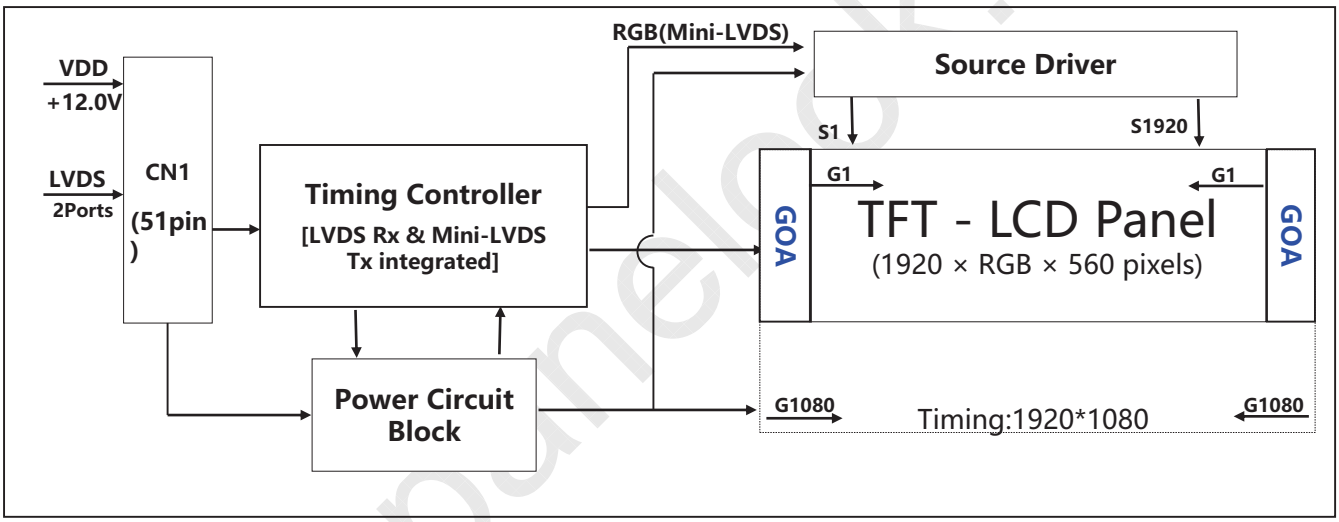
Contents

1.0 GENERAL DESCRIPTION

1.1 Introduction

DV286FBB-NV0 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 28.6inch diagonally measured active area with resolutions (1920 horizontal by 560 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 Open Cell is adapted for a low reflection and higher color type.



1.2 Features

- 0.485T Glass (Single)
- 8-bit color depth, display 16.7M colors
- LVDS Interface with 2 pixel / clock
- DE (Data Enable) only
- Forward Type
- High luminance and contrast ratio, low reflection and wide viewing angle
- GOA mode
- ADS technology is applied for high display quality
- RoHS compliant
- Landscape and Portrait Enabled
- 7*24hrs usage support with dynamic video

1.3 Application

- Indoor Guide Board Display
- Indoor Display Terminals for Control System
- Indoor Landscape and Portrait Signage Display

1.4 General Specification

< Table 1. General Specifications >

Parameter	Specification	Unit	Remarks
Active area	698.4 (H) ×203.7(V)	mm	
Number of pixels	1920(H) ×560V)	pixels	
Pixel pitch	121.25(H) ×RGB×363.75(V)	um	
Pixel arrangement	Pixels RGB Vertical stripe		
Display colors	16.7M	colors	True 8 bits
Display mode	Normally Black		
Contrast Ratio	1200:1		Typ.
Viewing Angle(CR>10)	89/89/89/89	deg	
Response Time	8	ms	OD ON
Open Cell Transmittance	5.6	%	Center point with BOE BLU
Dimensional outline	708.4(H) × 216.1(V)	mm	Detail refer to drawing
Weight	TBD	g	Typ.
Power Consumption	3.6	Watt	Typ.
Surface Treatment	Haze1%,3H,(Front Polarizer) Clear (Bottom Polarizer)		

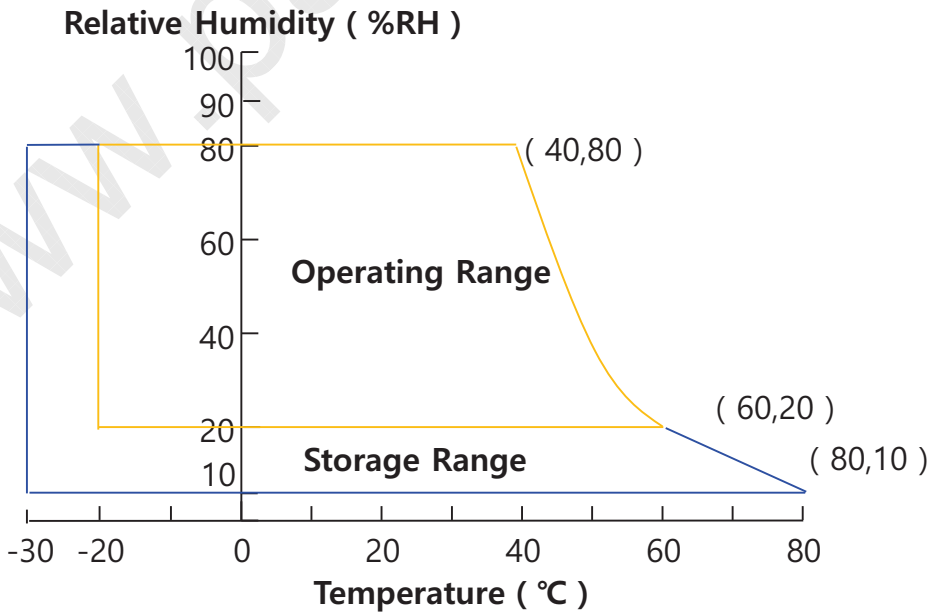
2.0 ABSOLUTE MAXIMUM RATINGS

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
Power Supply Voltage	VDD	VSS-0.3	13.5	V	Ta = 25 ℃
Operating Temperature	T_{OP}	0	+50	℃	Note 1
	T_{SUR}	0	+60	℃	
Storage Temperature	T_{ST}	-20	+60	℃	
Operating Ambient Humidity	Hop	10	80	%RH	
Storage Humidity	Hst	10	80	%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.

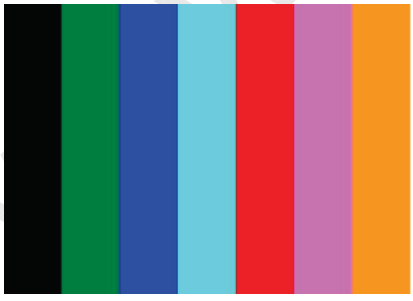


3.0 ELECTRICAL SPECIFICATIONS

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

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	-	330	-	mA	Note 1
Power Consumption		PDD	-	3.6	-	Watt	
Rush current		IRUSH	-	-	3.0	A	Note 2
LVDS Interface	Differential Input High Threshold Voltage	VLVTH	+100	-	+600	mV	
	Differential Input Low Threshold Voltage	VLVTL	-600	-	-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_V=60Hz and Clock frequency = 74.25MHz.
Test Pattern of power supply current
a) Typ : Color Test (L0/L255)



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

Note 2 : The duration of rush current is about 2ms and rising time of Power Input is 1ms(min)

4.0 INTERFACE CONNECTION

4.1 Interface Input Signal & Power : Cable length suggest less than 500mm

-. Connector : IS050-C51B-C39-S (UJU) / FI-RE51S-HF-R1500 (JAE) or Equivalent.

< Table 4. Open Cell Input Connector Pin Configuration >

Pin No	Symbol	Description	Pin No	Symbol	Description
1	NC	Not Connected	20	ROCLK+	Odd LVDS clock input +
2	SDA_PG	IIC SDA	21	GND	Ground
3	SCL_PG	IIC SCL	22	RO3-	Odd LVDS data input Pair3 -
4	NC	Not Connected	23	RO3+	Odd LVDS data input Pair3 +
5	Bist	High +3.3V bist on; Low or Open: bist off	24	NC	Not Connected
6	NC	Not Connected	25	NC	Not Connected
7	LVDS Select	High : VESA +3.3V; Low or Open: JEIDA	26	NC	Not Connected
8	NC	Not Connected	27	NC	Not Connected
9	SDA_T	Not Connected (1)	28	RE0-	Even LVDS data input Pair0 -
10	SCL_T	Not Connected (1)	29	RE0+	Even LVDS data input Pair0 +
11	GND	Ground	30	RE1-	Even LVDS data input Pair1 -
12	RO0-	Odd LVDS data input Pair0 -	31	RE1+	Even LVDS data input Pair1 +
13	RO0+	Odd LVDS data input Pair0 +	32	RE2-	Even LVDS data input Pair2 -
14	RO1-	Odd LVDS data input Pair1 -	33	RE2+	Even LVDS data input Pair2 +
15	RO1+	Odd LVDS data input Pair1 +	34	GND	Ground
16	RO2-	Odd LVDS data input Pair2 -	35	RECLK-	Even LVDS clock input -
17	RO2+	Odd LVDS data input Pair2 +	36	RECLK+	Even LVDS clock input +
18	GND	Ground	37	GND	Ground
19	ROCLK-	Odd LVDS clock input -	38	RE3-	Even LVDS data input Pair3 -

Pin No	Symbol	Description	Pin No	Symbol	Description
39	RE3+	Even LVDS data input Pair3 +	46	GND	Ground
40	NC	Not Connected	47	NC	Not Connected
41	NC	Not Connected	48	VDD	Input Voltage +12V
42	NC	Not Connected	49	VDD	Input Voltage+12V
43	NC	Not Connected	50	VDD	Input Voltage+12V
44	GND	Ground	51	VDD	Input Voltage+12V
45	GND	Ground			

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. Pin 7 SELLVDS : This pin is used for selecting LVDS signal data format.

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

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

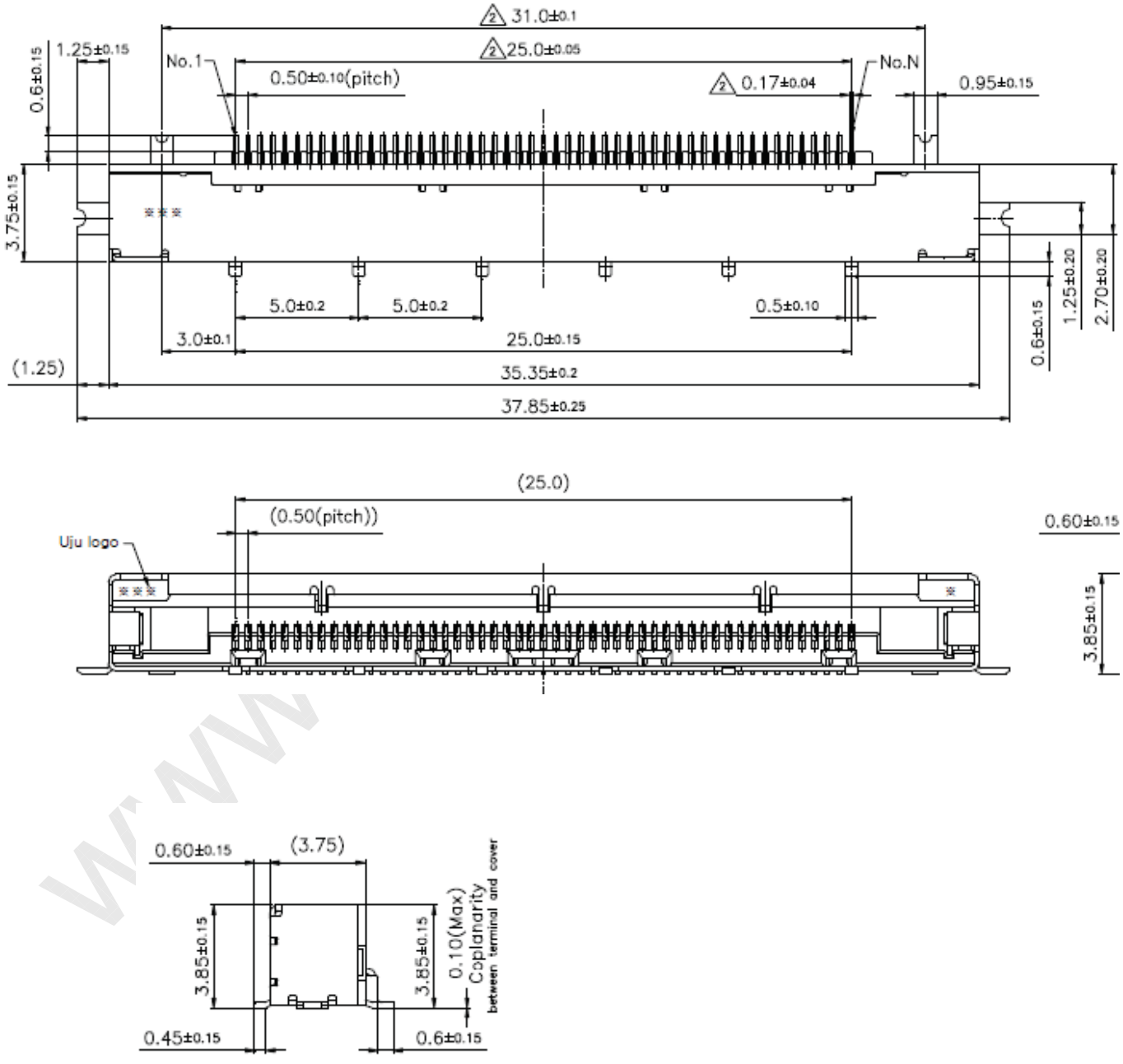
Rear view of LCM

BIST Pattern

4.2 Dimension

CNT Dimension

-51 pin LVDS Connector ——IS050-C51B-C39-S(UJU)



4.3 LVDS Interface

- LVDS Receiver : Timing Controller (LVDS Rx merged) / LVDS Data : Pixel Data

< Table 5. 8-bit LVDS Type >

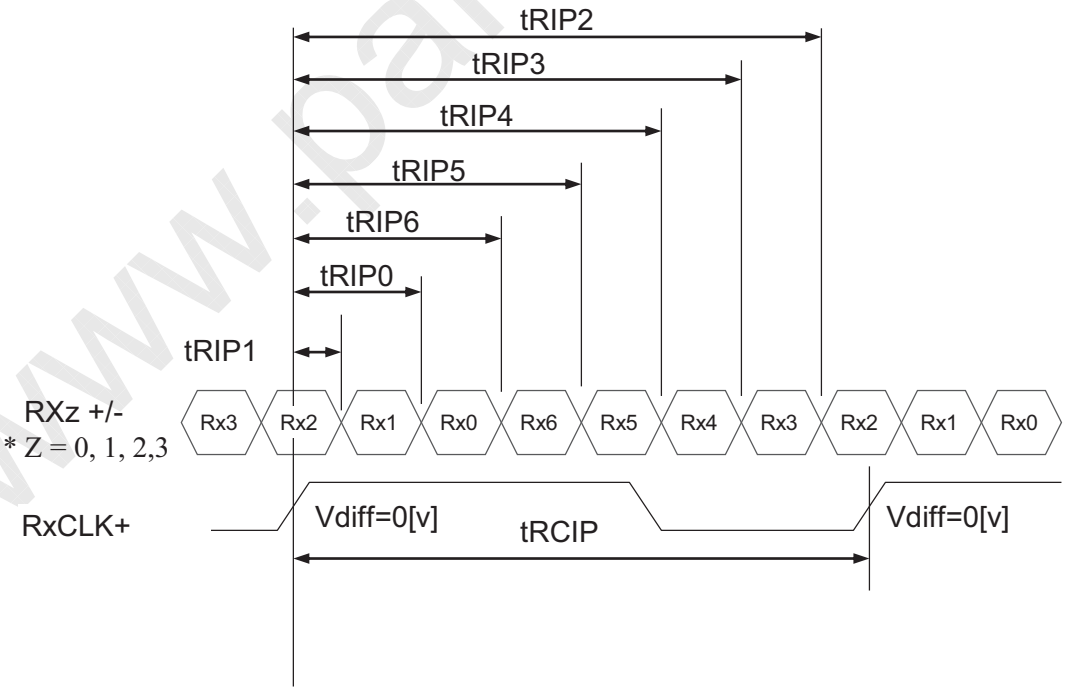
Channel No.	Data No.	8-bit LVDS Type	
		VESA	JEIDA
0	Bit-0	R0	R2
	Bit-1	R1	R3
	Bit-2	R2	R4
	Bit-3	R3	R5
	Bit-4	R4	R6
	Bit-5	R5	R7
	Bit-6	G0	G2
1	Bit-0	G1	G3
	Bit-1	G2	G4
	Bit-2	G3	G5
	Bit-3	G4	G6
	Bit-4	G5	G7
	Bit-5	B0	B2
	Bit-6	B1	B3
2	Bit-0	B2	B4
	Bit-1	B3	B5
	Bit-2	B4	B6
	Bit-3	B5	B7
	Bit-4	HS	HS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

4.4 LVDS Rx Interface Timing Parameter

The specification of the LVDS Rx interface timing parameter is shown in Table 6.

<Table 6. LVDS Rx Interface Timing Specification>

Item	Symbol	Min	Typ	Max	Unit	Remark
CLKIN Period	tRCIP	10	13.47(10.78)	25	nsec	
Receiver Data Input Margin	tRMG	-0.30	-	+0.30	nsec	fCLKIN=100MHz
		-0.45	-	+0.45	nsec	fCLKIN=85MHz
		-0.60	-	0.60	nsec	fCLKIN=65MHz
Input Data 0	tRIP1	-0.45	0.0	+0.45	nsec	
Input Data 1	tRIP0	tRCIP/7-0.45	tRCIP/7	tRCIP/7+0.45	nsec	
Input Data 2	tRIP6	2 ×tRCIP/7-0.45	2 ×tRCIP/7	2 ×tRCIP/7+0.45	nsec	
Input Data 3	tRIP5	3 ×tRCIP/7-0.45	3 ×tRCIP/7	3 ×tRCIP/7+0.45	nsec	
Input Data 4	tRIP4	4 ×tRCIP/7-0.45	4 ×tRCIP/7	4 ×tRCIP/7+0.45	nsec	
Input Data 5	tRIP3	5 ×tRCIP/7-0.45	5 ×tRCIP/7	5 ×tRCIP/7+0.45	nsec	
Input Data 6	tRIP2	6 ×tRCIP/7-0.45	6 ×tRCIP/7	6 ×tRCIP/7+0.45	nsec	

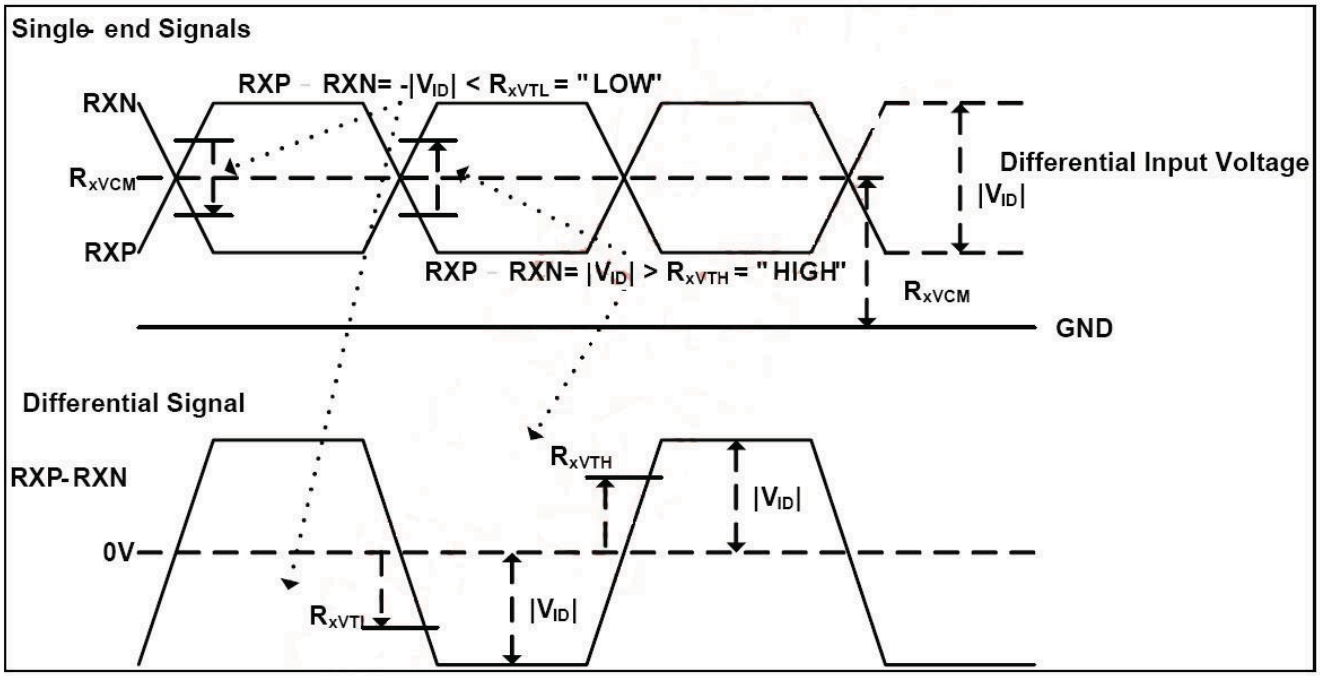


* Vdiff = (RXz+)-(RXz-),…. ,(RXCLK+)-(RXCLK-)

4.5 LVDS Receiver Differential Input (DC Characteristics)

< Table 7-1. LVDS Rx DC Characteristics >

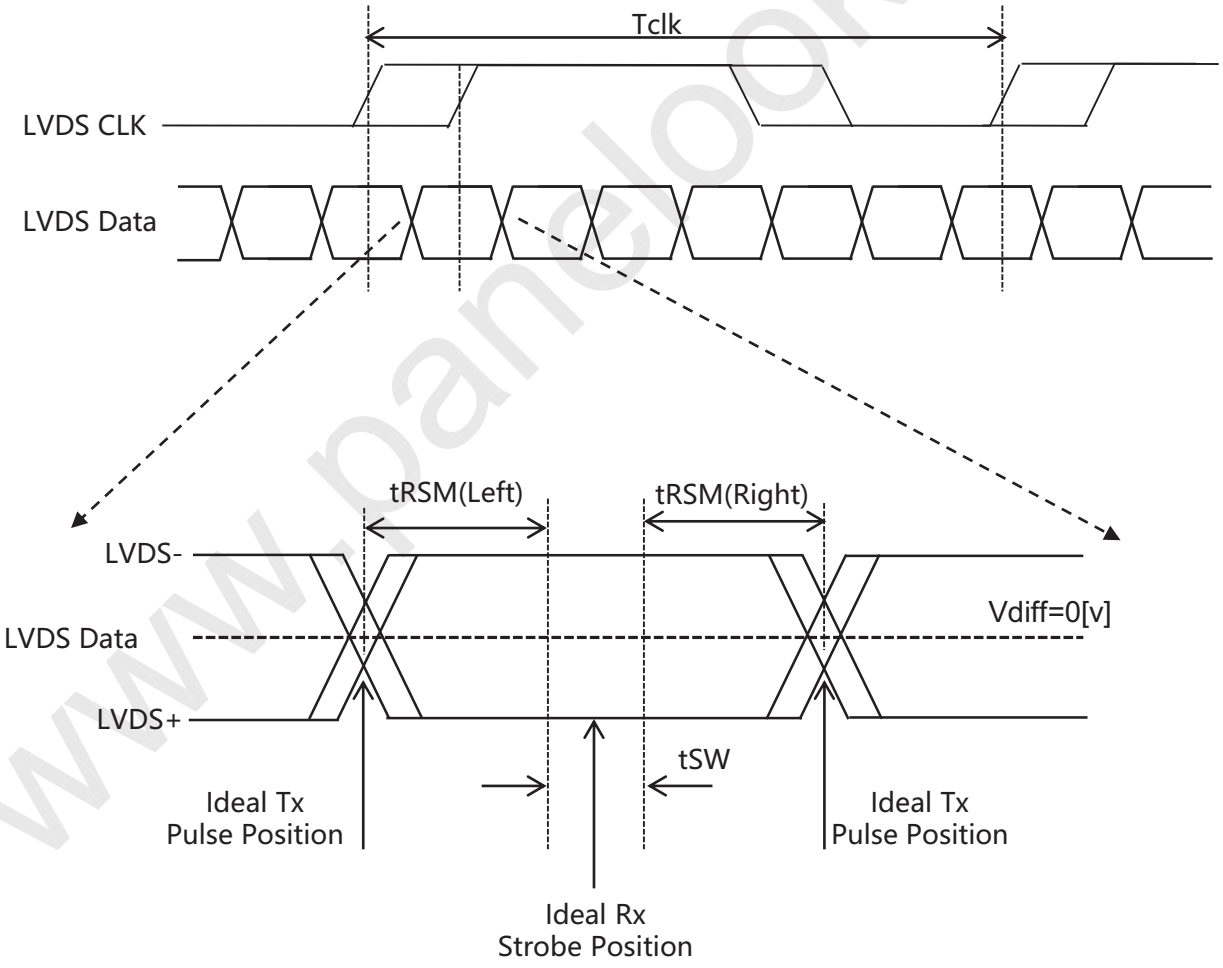
Parameter	Symbol	Min	Typ	Max	Unit	Notes
Differential Input High Threshold Voltage	VTH	-	-	+100	mV	VCM=1.2V
Differential Input Low Threshold Voltage	VTL	-100	-	-	mV	
Differential Input Common Mode Voltage	VCM	-	1.2	-	V	
Differential Input Voltage	| VID |	100	350	600	mV	



4.6 LVDS Receiver Differential Input (AC Characteristics)

< Table 7-1. LVDS Rx AC Characteristics >

Parameter	Symbol	Min	Typ	Max	Unit	Notes
LVDS Strobe Width	tSW	200	-	-	ps	Vcm=1.2V VID = 400mV @65MHz
LVDS Receiver Skew Margin	tRSM	400	-	-	ps	



Note:
RSM: Receiver Skew Margin
SW: Strobe Width (Setup and Hold time; TCON Internal data sampling window)

5.0 SIGNAL TIMING SPECIFICATION

5.1 Timing Parameters (DE only mode)

< Table 8. Timing Table >

Item	Symbols		Min	Typ	Max	Unit	Note
DCLK	Period	tCLK	12.35	13.47	13.98	ns	
	Frequency	-	71.55	74.25	81	MHz	
Horizontal	Horizontal Period	tHP	1060	1100	1200	tCLK	
	Horizontal Valid	tHV		960		tCLK	
	Horizontal Blank	tHB	100	140	240		
	Frequency	fH	56	67.5	84.5	KHz	
Vertical	Vertical Period	tVP	1110	1125	1149	tHP	
	Vertical Valid	tVV		560		tHP	
	Vertical Blank	tVB	540	565	589	tHP	
	Frequency	fV	57	60	63	Hz	
LVDS Receiver Clock	Cycle to Cycle Jitter	TCY-CY	0	-	200	ps	

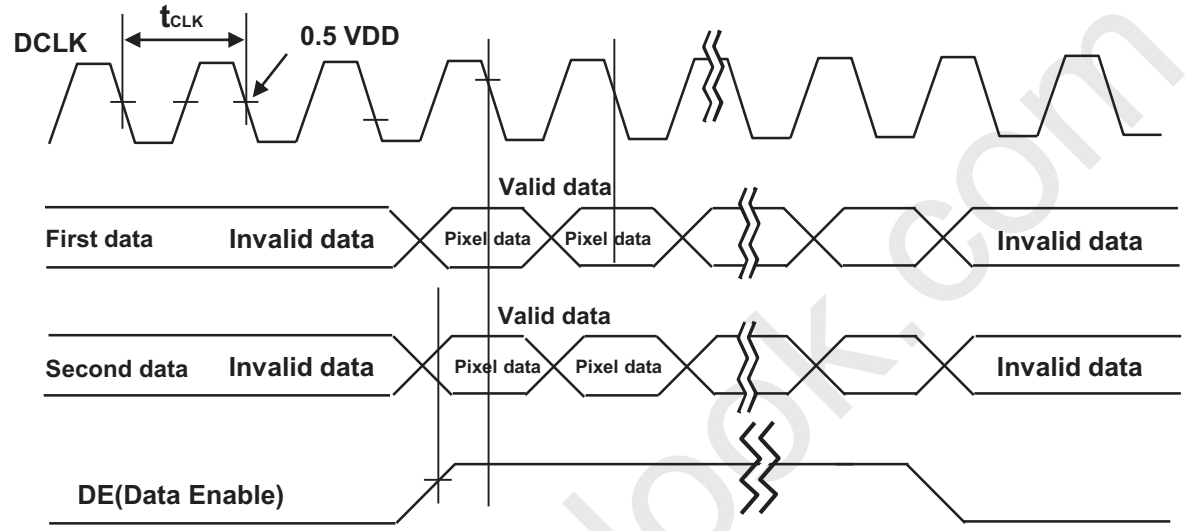
Note

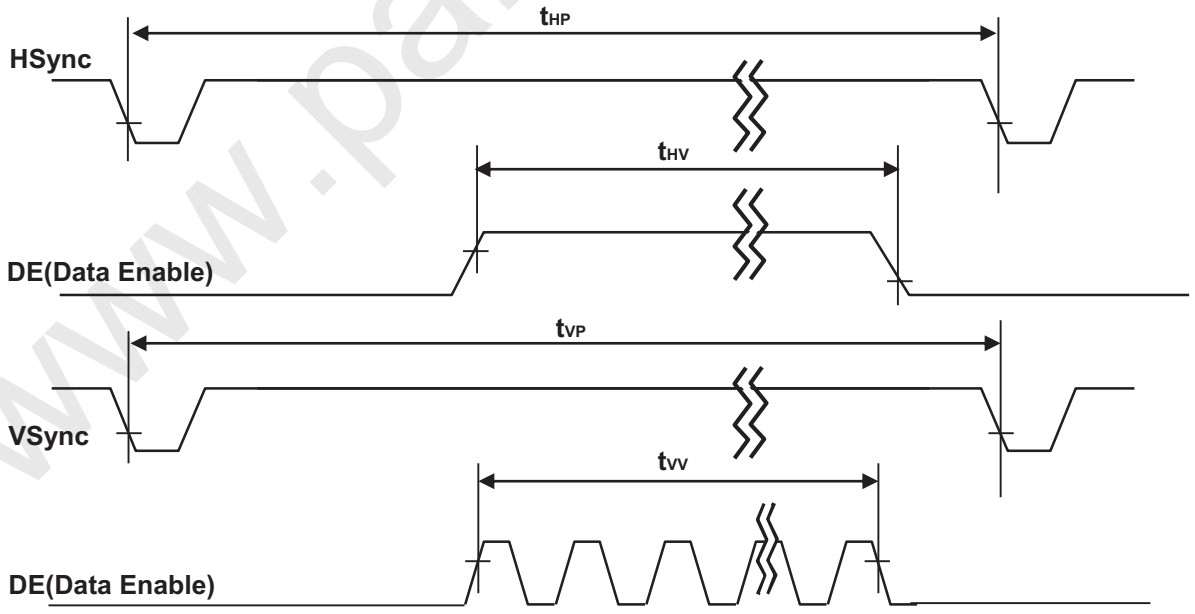
1. DE Only Mode, While operation, DE signal should be have the same cycle. The input of HSYNC & VSYNC signal does not have an effect on normal operation.
2. Best operation clock frequency is 74.25 Mhz.
3. Frequency] = [H Total] * [V Total] * [vertical Frame rate]
   H Total, V Total and Frame rate should operate within the range between Frequency_Min and Max
4. Except Best operation clock frequency, FOS(Flicker & Brightness & Crosstalk, Etc.) are not guaranteed.
5. Main frequency Max is 81Mhz MHz without spread spectrum

< Table 9. LVDS Input SSCG>

Symbol	Parameter	Condition	Min	Typ	Max	Unit
F_{LVMOD}	Modulating frequency of input clock during SSC	F=75MHz	30	-	200	KHz
F_{LVDEV}	Maximum deviation of input clock frequency during SSC		-3	-	+3	%

5.2 Signal Timing Waveform





Note: While operation, DE signal should be have the same cycle and continuous;

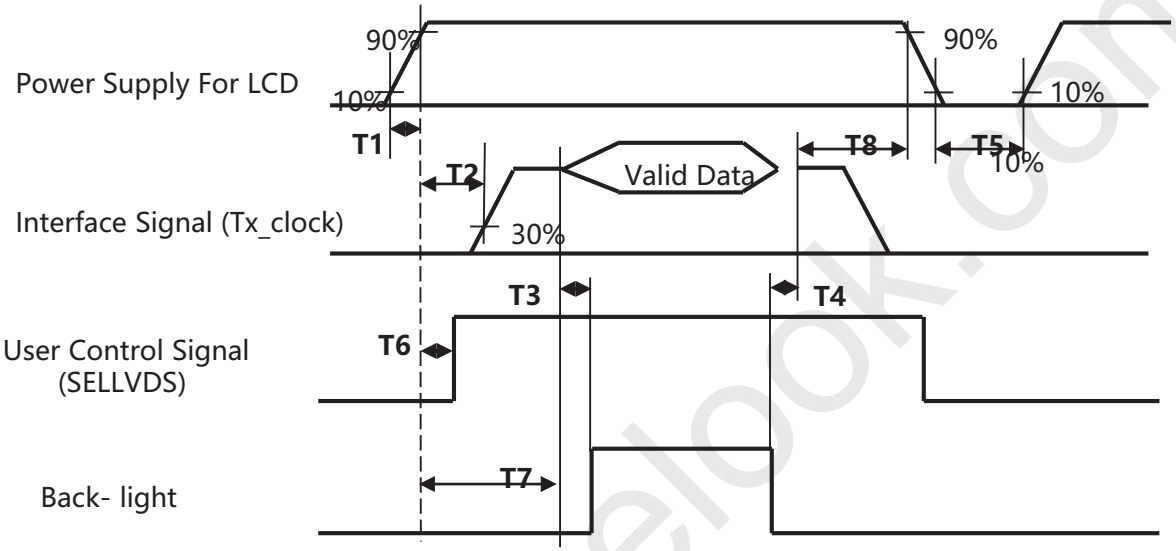
5.3 Input Signals, Basic Display Colors and Gray Scale of Colors

< Table 10. Input Signal and Display Color Table >

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
	▽	1	1	1	1	1	1	1	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	1	1	1	1	1	1	1	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
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	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	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

5.4 Power Sequence

LCD driver circuit: To prevent a latch-up or DC operation of the LCD module, the power on/off sequence shall be as shown in below



< Table 11. Sequence Table >

Parameter	Values			Units
	Min	Typ	Max	
T1	0.5	-	10	ms
T2	0.1	-	T7	ms
T3	400	-	-	ms
T4	200	-	-	ms
T5	5	-	-	sec
T6	0.1	-	T2	ms
T7	1	-	10	sec
T8	100	-	-	ms

Note 1: Even though T1 is over the specified value, there is no problem if the rush current is within Spec.
Note 2: The T3 / T4 is recommended value, the case when failed to meet a minimum specification, abnormal display would be shown. There is no reliability problem.
Note 3: It is recommendation specification that T8 has to be 100ms as a minimum value.
※ Please avoid floating state of interface signal at invalid period.
※ When the power supply for LCD (VDD) is off, be sure to pull down the valid and invalid data to 0V.
Note 4: T5 should be measured after the Module has been fully discharged between power off and on period
Note 5: If the on time of signals (Interface signal and user control signals) precedes the on time of Power (VLCD),it will be happened abnormal display. When T6 is NC status, T6 doesn't need to be measured
Note 6: T9: Voltage of VDD must decay smoothly after power-off. (customer system decide this value)

6.0 OPTICAL SPECIFICATIONS

The test of view angle range shall be measured in a dark room (ambient luminance ≤ 1lux and temperature = 25±2℃) with the equipment of Luminance meter system (Goniometer system and TOPCON CS2000/CA310) 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 $\theta_{Ø=0}$ (=θ3) as the 3 o' clock direction (the "right"), $\theta_{Ø=90}$ (= θ12) as the 12 o' clock direction ("upward"), $\theta_{Ø=180}$ (= θ9) as the 9 o' clock direction ("left") and $\theta_{Ø=270}$(= θ6) 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 luminance, color and uniformity (etc) should be tested by CS2000/CA310. The backlight should be operating for 10 minutes prior to measurement. VDD shall be 12±+/-10% at 25°C. Optimum viewing angle direction is 6 ' clock

< Table 12. Optical Table >

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

Parameter		Symbol	Condition	Min	Typ	Max	Unit	Remark
Viewing Angle	Horizontal	Θ_3	CR > 10	-	89	-	Deg.	Note 1
		Θ_9		-	89	-	Deg.	
	Vertical	Θ_{12}		-	89	-	Deg.	
		Θ_6		-	89	-	Deg.	
Contrast ratio		CR	Θ = 0° (Center) Normal Viewing Angle	800:1	1200:1	-		Note 2
Reproduction of color	White	W_x		TYP. - 0.03	0.278	TYP. + 0.03		
		W_y			0.293			
	Red	R_x			0.634			
		R_y			0.329			
	Green	G_x			0.308			
		G_y			0.602			
	Blue	B_x			0.155			
		B_y			0.064			
Color Gamut				-	68	-	%	Note 6
Response Time	G to G	T_g		-	8	10	ms	Note 4
Gamma Scale			25°C	2.0	2.2	2.4		
Cell Transmittance			25°C	-	5.6	-	%	Note 5

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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 OC. The BLU is used by BOE.
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 ti me in below table is defined as Figure 2 and 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

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

6.Definition of Color of CIE Coordinate and NTSC Ratio
7.Polarization Direction Definition(see FIGURE 3).
8. Definition of gray inversion angle(see FIGURE 4).

7.0 MECHANICAL CHARACTERISTICS

7.1 Dimensional Requirements

Figure 3(located in Appendix) shows mechanical outlines for the model DV286FBB-NV0. Other parameters are shown in Table 13.

< Table 13. Dimensional Parameters >

Parameter	Specification	Unit
Dimensional outline	708.4(H) × 216.1 (V)	mm
Active area	698.4(H) ×203.7(V)	mm
Pixel pitch	363.75(H) ×363.75(V)	um
Number of pixels	1920(H)×560(V) (1 pixel = R + G + B dots)	pixels
Weight	TBD	gram

7.2 Mounting

See FIGURE 3.(shown in Appendix)

7.3 Surface treatment

The surface of the LCD has an anti-glare coating to prevent glare and reduce scratching. (For Front Polarizer)

8.0 RELIABILITY TEST

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

< Table 14. Reliability Test Parameters >

No	Test Items	Conditions	Remark
1	High temperature storage test	Ta = 60 ℃, 240 hrs	-
2	Low temperature storage test	Ta = -20 ℃, 240 hrs	
3	High temperature & high humidity operation test	Ta = 50 ℃, 80%RH, 240hrs	
4	High temperature operation test	Ta = 50 ℃, 240hrs	
5	Low temperature operation test	Ta = -5 ℃, 240hrs	
6	Thermal shock	Ta = -20 ℃ ↔ 60 ℃ (per 0.5 hr), 100 cycle	-
7	ESD test	Air Voltage:±8KV&±15KV Contact Voltage:±8KV R: 330Ω C: 150pF 5 time	-

Note: This test condition is based on BOE module. After the reliability test, the product only guarantee function normally without any fatal defect (non-display, line defect, abormal display etc). All the cosmetic specification is judged before the reliablity test.

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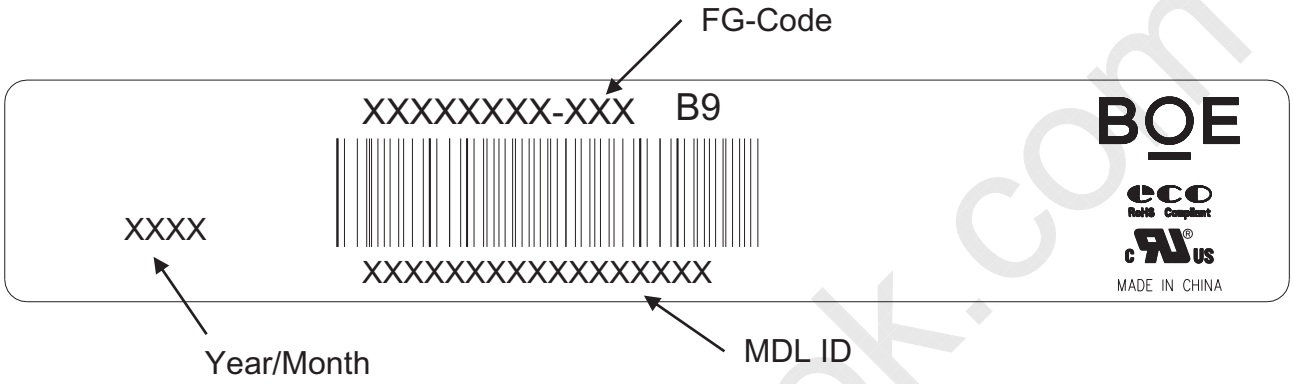
9.0 PRODCUT SERIAL NUMBER



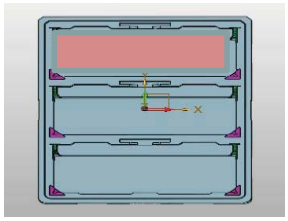
MDL ID Naming Rule:

Digit / Code	1	2	3	4	5	6	7	8	9	10	11
Description	Model Code GBN		Grade	Line	Year		Month	Model Extension Code			
Digit / Code	12	13	14	15	16	17	18				
Description	Serial No						扫码不显示，BOE厂内用				

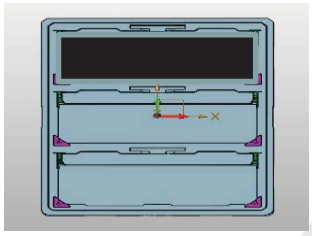
10.0 PACKING INFORMATION

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.

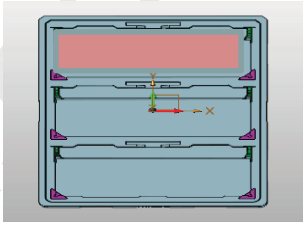
10.1 Packing Order



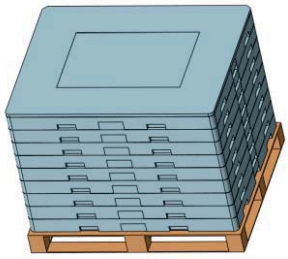
•Place 1pcs 2t Spacer in a slot of the Box



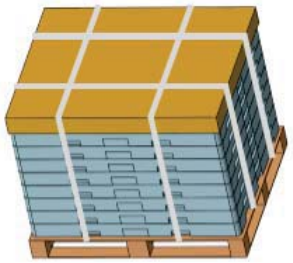
•Place one piece O/C on the Spacer
•In this way, put 13 pcs O/C and 13 pcs Spacer into the box in turn



•Put 1 pcs 2t Spacer on the top layer
•Fill the other 3 product tanks in the same way
•Put 1 bag of desiccant into 3 desiccant tanks respectively
•Total: 39 pcs OC/Box, 42 pcs 2t Spacer/Box, 3 ea desiccant



•Stack the box on the Pallet, stack it vertically in 9 layers, a total of 1 column, and place 1ea cover on the top
•Total: 9 Box/Pallet, 1 Cover/Pallet, 351 pcs OC/Pallet



•Wrap it with wrapping film (≥ 3 layers), place 1ea paper cover, and then fix it with binding tape

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10.2 Packing Note

- Box Dimension : 1120mm(L)×840mm(W)×113mm(H)
- Package Quantity in one Box : 39pcs

10.3 Box Label

- Label Size : 100 mm (L) × 50 mm (W)
  - Contents
    Model : DV286FBB-NV0
    Q`ty : OC 39 Q`ty in one box
    Serial No. : Box Serial No.
    Date : Packing Date

Digit	1		2	3	4		5	6	7				
Code	x	x	x	x	x	x	x	x	x	x	x	x	x
Des.	1. Model Code GBN 2. Grade 3. Line 4. Year(2016:16, 2017:17, ...) 5. Month(1, 2, 3, ..., 9, X, Y, Z) 6. Revision Code 7. Serial Number												

11.0 PRECAUTIONS

Please pay attention to the followings when you use this TFT LCD open cell (OC).

11.1 Mounting Precautions

- Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
- You must mount a OC using specified mounting holes (Details refer to the drawings)
- You should consider the mounting structure so that uneven force (ex. Twisted stress, Concentrated stress)is not applied to the OC. And the case on which a OC is mounted should have sufficient strength so that external force is not transmitted directly to the OC.
- Abnormal display cause by pressing some parts of OC during assembly process , do not belong to product failure, the press should be agreed by two sides.
- Do not apply mechanical stress or static pressure on OC , and avoid impact, vibration and falling.
- You should adopt radiation structure to satisfy the temperature specification.
- 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 to prevent water & chemicals contact the OC surface.
- Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment.
- Do not touch the surface of polarizer for bare hand or greasy cloth.(Some cosmetics are detrimental to the polarizer.)
- When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with petroleum benzine. Normal-hexane & alcohol is recommended for cleaning the adhesives used to attach front / rear polarizers. Do not use acetone, toluene , because they cause chemical damage to the polarizer.
- Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
- This OC has its circuitry PCB' s on the rear side and Driver IC, should be handled carefully in order not to be stressed.
- Avoid impose stress on PCB and Driver IC during assembly process ,Do not drawing, bending, COF package & wire
- Do not disassemble the OC.

11.2 Operating Precautions

- Do not connector or disconnect the cable to/from the OC at the "Power On" Condition.
- When the OC is operating, do not lose CLK, ENAB signals. If any one of these signals is lost, the OC would be damaged.
- Obey the supply voltage sequence. If wrong sequence is applied, the OC would be damaged.
- The electrochemical reaction caused by DC voltage will lead to LCD panel degradation, so DC drive should be avoided.
- The LCD panels use C-MOS LSI drivers, so customers are recommended that any unused input terminal would be connected to Vdd or Vss, do not input any signals before power is turn on, and ground you body, work/assembly area, assembly equipment to protect against static electricity.
- Do not exceed the absolute maximum rating value. (supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on) Otherwise the OC may be damaged.
- OC has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimized the interference.
- Design the length of cable to connect between the connector for back-light and the converter as shorter as possible and the shorter cable shall be connected directly , The long cable between back-light and Converter may cause the Luminance of LED to lower and need a higher startup voltage
- The cables should be as short as possible between System Board and PCB interface.
- Connectors are precision devices to transmit electrical signals, and operators should plug in parallel
- Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
- Long side LED Bar design is recommended when using E-LED type Back Light.
- For long-term lighting products, it is recommended to shut down periodically.
- If the product is used for a long time under the condition of 7*24 hrs, it is strongly recommended to contact BOE for filed application engineering advice.
- Long time and large angle forward use or unconventional use , It is strongly recommended to contact BOE for filed application engineering advice.

11.3 Electrostatic Discharge Precautions

- Avoid the use work clothing made of synthetic fibers. We recommend cotton clothing or other conductivity-treated fibers.
- Since a OC is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc.
- Do not close to static electricity to avoid product damage.
- Do not touch interface pin directly.

11.4 Precautions for Strong Light Exposure

- Do not leave the OC operation or storage in Strong light . Strong light exposure causes degradation of polarizer and color filter.

11.5 Precautions for Storage

A. Atmosphere Requirement

ITEM	UNIT	MIN	TYP	MAX
Storage Temperature	(℃)	5	25	35
Storage Humidity	(%rH)	35	50	75
Storage Life	6 months			
Storage Condition	• The storage room should be equipped with a dark and good ventilation facility. • Prevent products from being exposed to the direct sunlight, moisture and water. • The product need to keep away from organic solvent and corrosive gas. • Be careful for condensation at sudden temperature change. • Storage condition is guaranteed under packing conditions.			

B. Package Requirement

- Product Should be placed on the pallet, Which is away from the floor, Be cautions not to pile the product up.
- The polarizer surface should not come in contact with any other object. It is recommended that they be stored in the container in which they were shipped.
- As the original protective film, do not use the adhesive protective film to avoid change of Pol color and characteristic.

11.6 Precautions for protection film

- Remove the protective film slowly, keeping the removing direction approximate 30-degree not vertical from OC surface, If possible, under ESD control device like ion blower, and the humidity of working room should be kept over 50%RH to reduce the risk of static charge.
- People who peeled off the protection film should wear anti-static strap and grounded well.

11.7 Appropriate Condition for Commercial Display

-Generally large-sized LCD panels are designed for consumer applications . Accordingly, long-term display like in Commercial Display application, can cause uneven display including image sticking. To optimize OC's lifetime and function, several operating usages are required.

1. Normal operating condition
   - Temperature: 20±15℃
   - Operating Ambient Humidity : 55±20%
   - Display pattern: dynamic pattern (Real display)
2. Special operating condition

a. Ambient condition

- Well-ventilated place is recommended to set up Commercial Display system.

b. Power and screen save

- Periodical power-off or screen save is needed after long-term display.

c. As the low temperature, the response time is greatly delayed. As the high temperatures (higher than the operating temperature) the LCD panel may turn black screen. The above phenomenon cannot explain the failure of the display. When the temperature returns to the normal operating temperature, the LCD panel will return to normal display.

d. When expose to drastic fluctuation of temperature (hot to cold or cold to hot) ,the LCD panel may be affected; Specifically, drastic temperature fluctuation from cold to hot, produces dew on the LCD panel 's surface which may affect the operation of the polarizer and LCD panel

e. Do not exceed the absolute maximum rating value. (supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on) Otherwise the OC may be damaged.

f. Product reliability and functions are only guaranteed when the product is used under right operation usages. If product will be used in extreme conditions such as high temperature, high humidity, high altitude, special display images, running time, long time operation, outdoor operation, etc. It is strongly recommended to contact BOE for filed application engineering advice. Otherwise, its reliability and function may not be guaranteed. Extreme conditions are commonly found at airports, transit stations, banks, stock market and controlling systems.

3. Operating usages to protect against image sticking due to long-term static display.
   a. Suitable operating time: under 24 hours a day.
   b. Static information display recommended to use with moving image.
   - Cycling display between 5 minutes' information(static) display and 10 seconds' moving image.
   c. Background and character (image) color change
   - Use different colors for background and character, respectively.
   - Change colors themselves periodically.
   d. Avoid combination of background and character with large different luminance.
   1) Abnormal condition just means conditions except normal condition.
   2) Black image or moving image is strongly recommended as a screen save
4. Lifetime in this spec. is guaranteed only when Commercial Display is used according to operating usages.
5. Open Cell should be turned clockwise based on front view when used in portrait mode.

11.8 Other Precautions

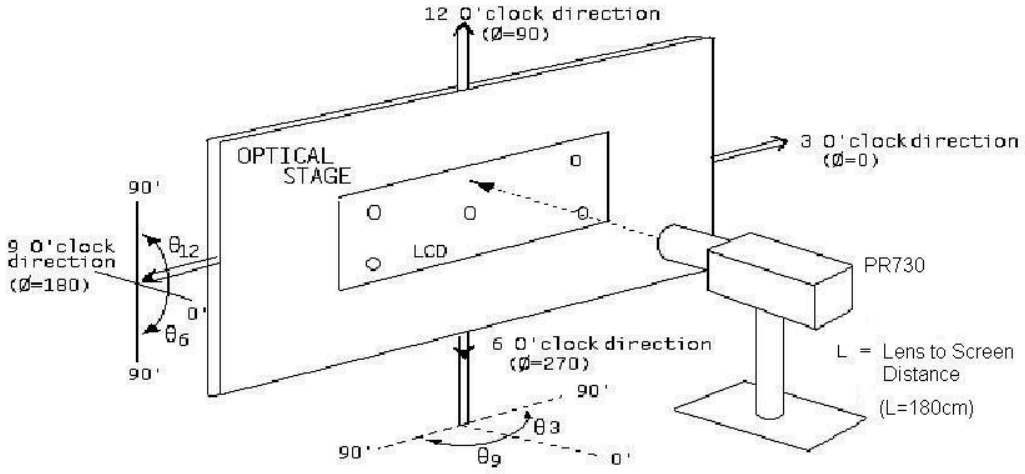
A. LC Leak
- If the liquid crystal material leaks from the OC, it is recommended to wash the LC with acetone or ethanol and then burn it.
- If the liquid crystal material leaks from the OC, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.
- If LC in mouth, mouth need to be washed, drink plenty of water to induce vomiting and follow medical advice.
- If LC touch eyes, eyes need to be washed with running water at least 15 minutes.

B. Rework
- When returning the OC for repair or etc., Please pack the OC not to be broken. We recommend to use the original shipping packages.

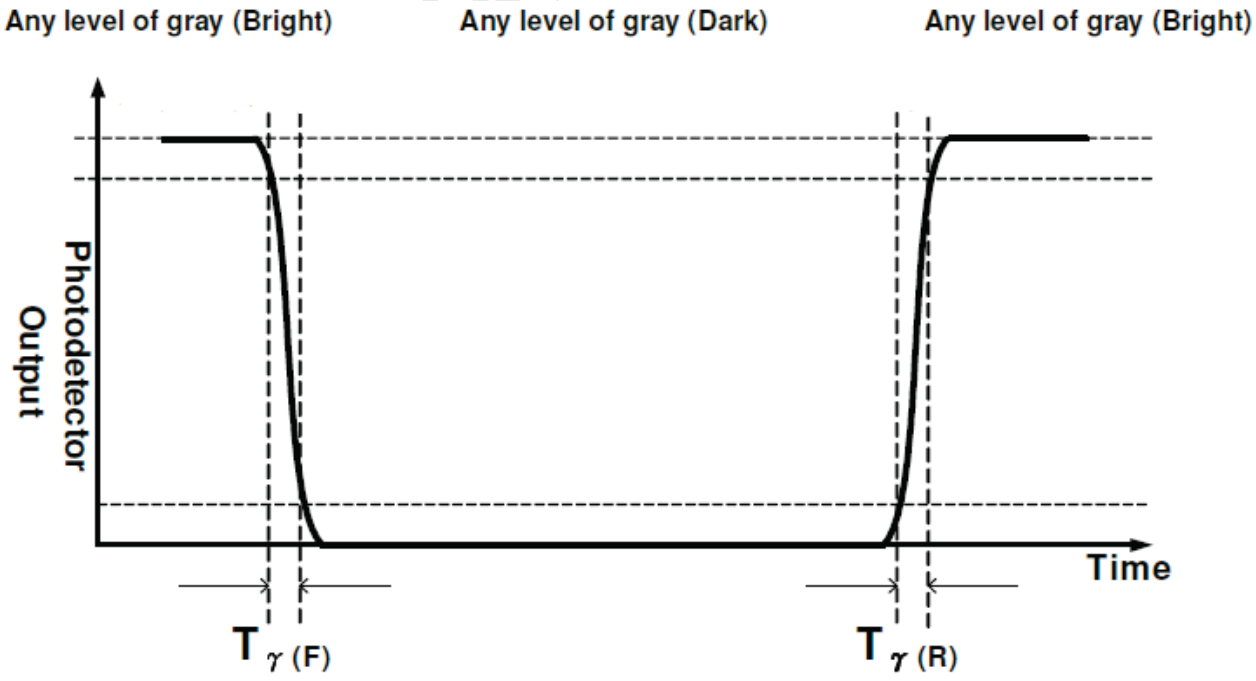
C. In order to prevent potential problems, flicker should be adjusted by optimizing the Vcom value in customer panel Line through the I2C Interface.

12.0 APPENDIX

< Figure 1. Measurement Set Up >



< Figure 2. Response Time Testing >



PROPRIETARY NOTE

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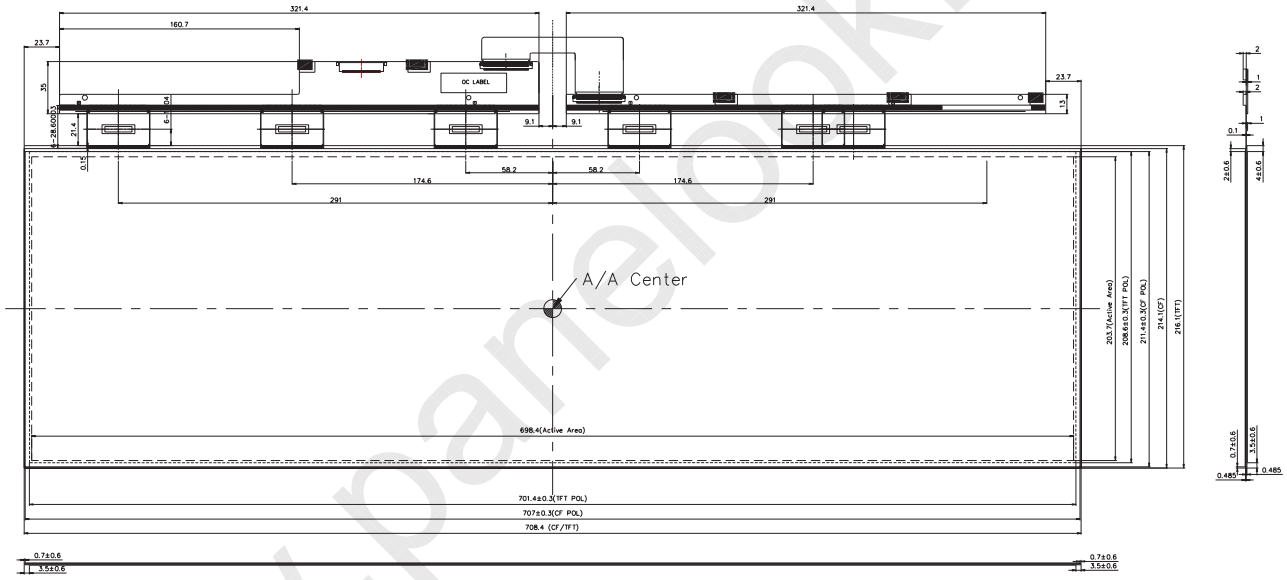
< Figure 3.TFT-LCD Open Cell Outline Dimensions >



TOLERANCE TABLE(±)				
DIMENSION	1 GRADE	2 GRADE	3 GRADE	4 GRADE
L ≤ 20	0.05	0.1	0.1	0.2
20 < L ≤ 50	0.1	0.15	0.2	0.25
50 < L ≤ 100	0.15	0.2	0.25	0.3
100 < L ≤ 200	0.2	0.25	0.3	0.5
200 < L	0.25	0.3	0.5	0.8
UNLESS OTHERWISE SPECIFIED