DV290FBM-N10

Product Specification

Rev. P2

HEFEI BOE Optoelectronics Technology CO., LTD

REVISION HISTORY

(√) preliminary specification

( ) Final specification

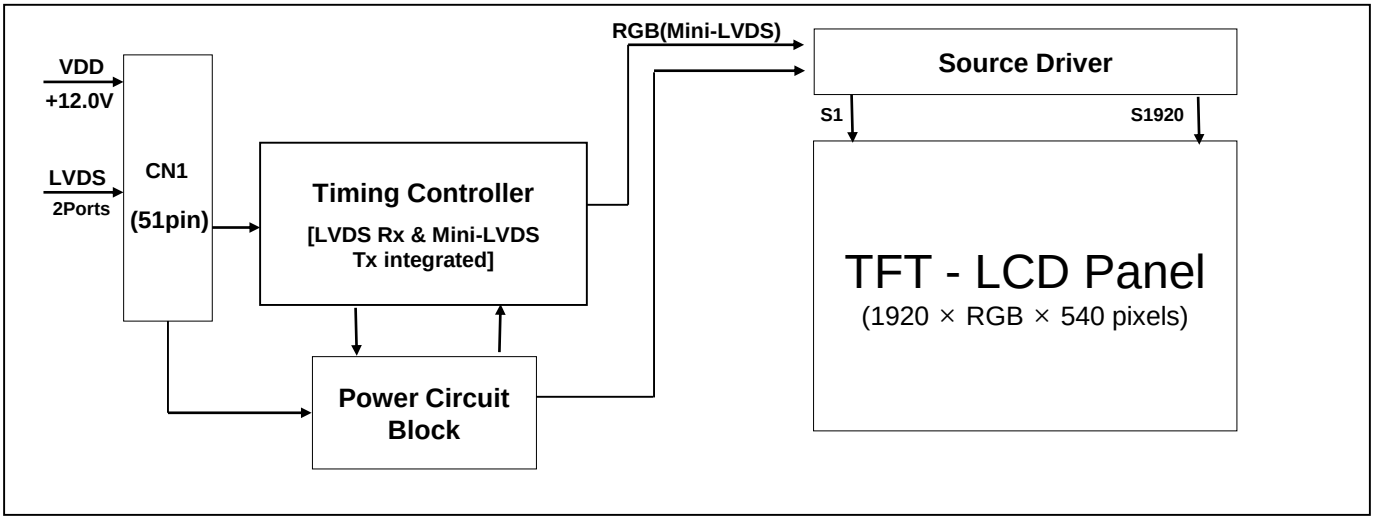
Revision No.	Page	Description of changes	Date	Prepared
P0		Initial Release	2019/06/04	Zhou Kun
P1		更新信赖性条件	2019/07/20	Zhou Kun
P2		更新包材、信赖性等信息	2019/09/04	Zhou Kun

Contents

1.0 GENERAL DESCRIPTION

1.1 Introduction

DV290FBM-N10 is a color active matrix TFT LCD MDL using amorphous silicon TFT's (Thin Film Transistors) as an active switching devices. This MDL has a 29inch diagonally measured active area with FHD resolutions (1920 horizontal by 540 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 MDL panel is adapted for a low reflection and higher color type.



1.2 Features

- LVDS interface with 2 pixel / clock
- High-speed response
- Low color shift image quality
- 8-bit color depth, display 16.7M colors
- Wide viewing angle
- DE (Data Enable) only mode
- HADS technology is applied for high display quality
- RoHS compliant

1.3 Application

- Commercial Digital Display
- Display Terminals for Control System
- Landscape and Portrait Display

1.4 General Specification

< Table 1. General Specifications >

Parameter	Specification	Unit	Remarks
Active area	705.6(H)x198.45(V)	mm	
Number of pixels	1920(H) ×540(V)	pixels	
Pixel pitch	122.5(H) x367.5(V)	um	
Pixel arrangement	Pixels RGB Vertical stripe		
Display colors	16.7M	colors	8bits True
Display mode	Normally Black		
Dimensional outline	720.8(H)*226.25(V)*8.4(Body)	mm	Total thickness 21mm
Weight	2415±100	g	
Power Consumption	35.8	Watt	Typ.
Bezel width (L/R/U/D)	5.6/5.6/11.9/11.9	mm	
Surface Treatment	Haze 25% /3H		
Back-light	E-LED , 2ea LED bar-down side		
Possible display type	Landscape and Portrait Enabled		

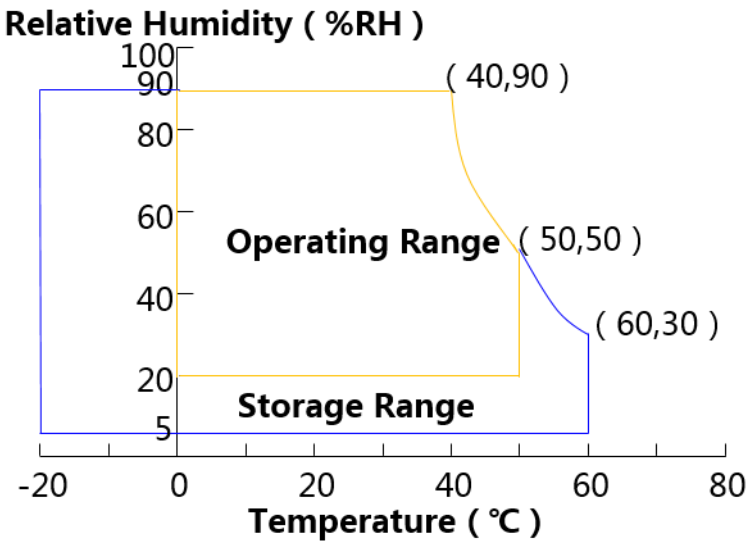
2.0 ABSOLUTE MAXIMUM RATINGS

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. MDL Electrical Specifications >

Parameter	Symbol	Min.	Max.	Unit	Remark
Power Supply Voltage	VDD	8	13.2	V	Ta = 25 ℃
Operating Temperature	T_{OP}	0	+50	℃	
Storage Temperature	T_{SUR}	-20	+60	℃	Note 1
	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

3.1 TFT LCD Open Cell

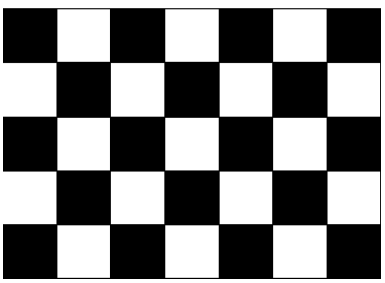
< Table 3. Open Cell Electrical Specifications >

[Ta =25±2 ℃]

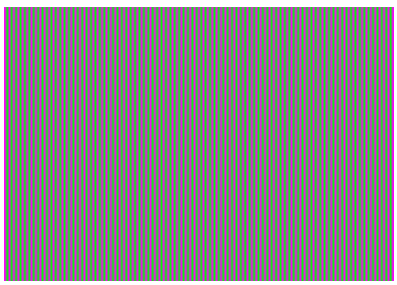
Parameter		Symbol	Values			Unit	Remark
			Min	Typ	Max		
Power Supply Input Voltage		VDD	10.8	12	13.2	Vdc	
Power Supply Ripple Voltage		VRP			400	mV	
Power Supply Current		IDD	-	250	500	mA	Note 1
Power Consumption		PDD	-	3	6.6	Watt	
Rush current		IRUSH	-	-	3.0	A	
LVDS Interface	Differential Input High Threshold Voltage	VTH	-		+100	mV	
	Differential Input Low Threshold Voltage	VTL	-100		-	mV	
	Common Input Voltage	VLC	0.7	-	1.6	V	
	LVDS swing voltage	VID	±100		±600	mV	
CMOS Interface	Input High Threshold Voltage	VIH	2.1	-	3.6	V	
	Input Low Threshold Voltage	VIL	0		1.1	V	
	Input current	IIN	-10	-	10	μA	
	Pull low resistor	RPD	50	100	150	KΩ	

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

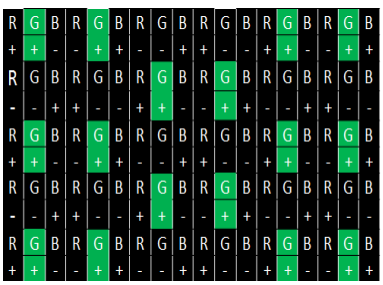
a) Typ : Mosaic 7X5 (L0/L255)



b) Max : Vline Subline (L255))



c) Flicker Pattern



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

3.0 ELECTRICAL SPECIFICATIONS

3.2 Backlight Unit

< Table 3. Backlight Unit Electrical Specifications >

[Ta =25±2℃]

Parameter			Min.	Typ.	Max.	Unit	Remarks
LED Forward Voltage		V_F	-	3.0	3.2	V	-
LED Forward Current		I_F	-	105	-	mA	-
LED Power Consumption		P_{LED}		32.76	34.95	W	BLU Power Consumption
LED Life-Time		N/A	50000	-	-	Hour	IF = 105mA
PWM Control Level	PWM High Level		-	-	-	V	
	PWM Low Level		-	-	-	V	
PWM Control Frequency		F_{PWM}	-	-	-	Hz	
Duty Ratio		-	-	-	-	%	

Notes : 1. LED Power Consumption Calculator Value for reference IF × VF ×104 = PLED
2. The LED Life-time define as the estimated time to 50% degradation of initial luminous.

3.3 Backlight Input Pin Assignments

Connector type : CI1406M1VL0-NH-6pin or equivalent

Pin No.	Symbol	Feature
1	CH1-	I Return CH1,White
2	CH2-	I Return CH2,White
3	CH3+	VLED OUT CH3,Blue
4	CH4+	VLED OUT CH4,Blue
5	CH5-	I Return CH5,White
6	CH6-	I Return CH6,White

DC Input specification

Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
LED forward voltage per channel	VLED	36.4	39	41.6	V
LED forward current per channel	ILED	-	105	-	mA

4.0 INTERFACE CONNECTION

4.1 MDL Input Signal & Power

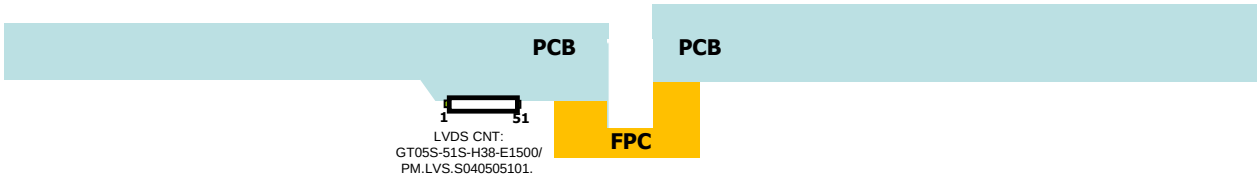
- LVDS Connector : GT05S-51S-H38-E1500/PM.LVS.S040505101.

< Table 4. MDL Input Connector Pin Configuration >

Pin No	Symbol	Description	Pin No	Symbol	Description
1	VDD	Power Supply (12V)	27	ELV1N	Negative Transmission data of Pixel 1 (EVEN)
2	VDD	Power Supply (12V)	28	ELV1P	Positive Transmission data of Pixel 1 (EVEN)
3	VDD	Power Supply (12V)	29	ELV2N	Negative Transmission data of Pixel 2 (EVEN)
4	VDD	Power Supply (12V)	30	ELV2P	Positive Transmission data of Pixel 2 (EVEN)
5	VDD	Power Supply (12V)	31	GND	Ground
6	NC	Not connection, this pin should be open	32	ELVCKN	Negative Transmission Clock(EVEN)
7	GND	Ground	33	ELVCKP	Positive Transmission Clock(EVEN)
8	GND	Ground	34	GND	Ground
9	GND	Ground	35	ELV3N	Negative Transmission data of Pixel 3 (EVEN)
10	OLV0N	Negative Transmission data of Pixel 0 (ODD)	36	ELV3P	Positive Transmission data of Pixel 3 (EVEN)
11	OLV0P	Positive Transmission data of Pixel 0 (ODD)	37	NC	Not connection, this pin should be open
12	OLV1N	Negative Transmission data of Pixel 1 (ODD)	38	NC	Not connection, this pin should be open
13	OLV1P	Positive Transmission data of Pixel 1 (ODD)	39	GND	Ground
14	OLV2N	Negative Transmission data of Pixel 2 (ODD)	40	NC	Not connection, this pin should be open
15	OLV2P	Positive Transmission data of Pixel 2 (ODD)	41	NC	Not connection, this pin should be open
16	GND	Ground	42	NC	Not connection, this pin should be open
17	OLVCKN	Negative Transmission Clock(ODD)	43	NC	Not connection, this pin should be open
18	OLVCKP	Positive Transmission Clock(ODD)	44	NC	Not connection, this pin should be open
19	GND	Ground	45	LVDS_SEL	LVDS format select
20	OLV3N	Negative Transmission data of Pixel 3 (ODD)	46	NC	Not connection, this pin should be open
21	OLV3P	Positive Transmission data of Pixel 3 (ODD)	47	NC	Not connection, this pin should be open
22	NC	Not connection, this pin should be open	48	NC	Not connection, this pin should be open
23	NC	Not connection, this pin should be open	49	SCL_PG	I2C_SCL used for BOE
24	GND	Ground	50	SDA_PG	I2C_SDA used for BOE
25	ELV0N	Negative Transmission data of Pixel 0 (EVEN)	51	NC	Not connection, this pin should be open
26	ELV0P	Positive Transmission data of Pixel 0 (EVEN)			

Notes : 1. NC(Not Connected) : This pins are only used for BOE internal operations.
2. Input Level of LVDS signal is based on the EIA-644 Standard.

TOP view of LCM PCB



BIST Pattern

4.2 LVDS Interface

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

< Table 5. MDL Input Connector Pin Configuration >

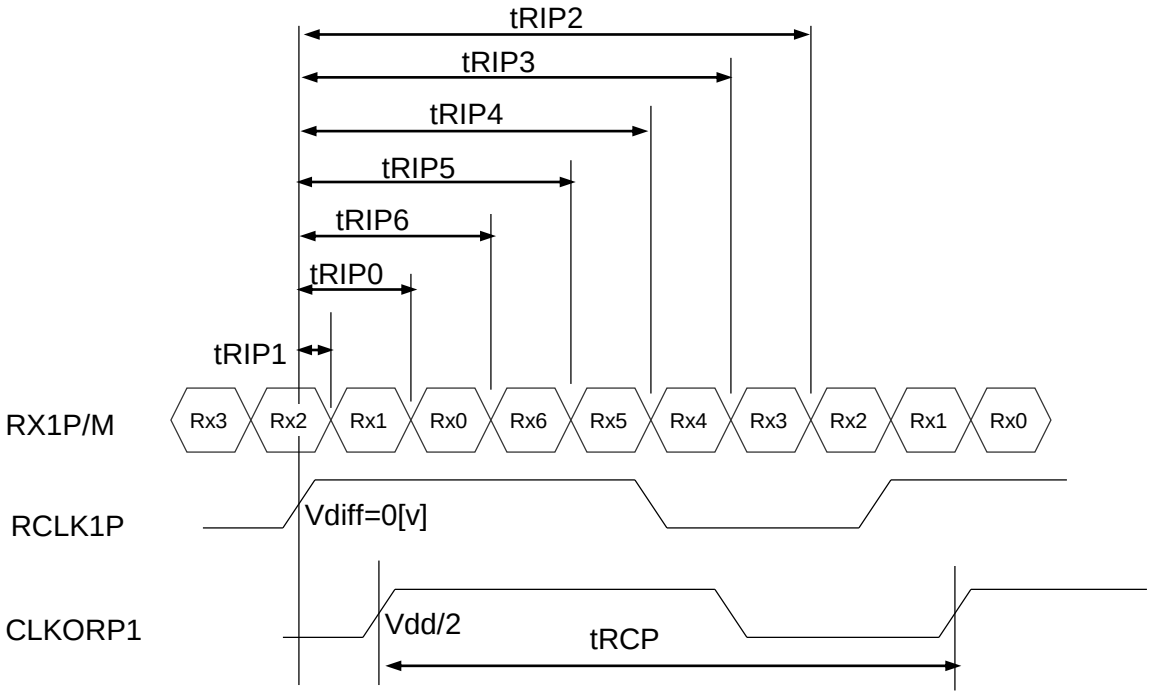
Channel No.	Data No.	8-bit LVDS Type	
		NS	JEIDA
0	Bit-0	R0	R2
	Bit-1	R1	R3
	Bit-2	R2	R4
	Bit-3	R3	R5
	Bit-4	R4	R6
	Bit-5	R5	R7
	Bit-6	G0	G2
1	Bit-0	G1	G3
	Bit-1	G2	G4
	Bit-2	G3	G5
	Bit-3	G4	G6
	Bit-4	G5	G7
	Bit-5	B0	B2
	Bit-6	B1	B3
2	Bit-0	B2	B4
	Bit-1	B3	B5
	Bit-2	B4	B6
	Bit-3	B5	B7
	Bit-4	HS	HS
	Bit-5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

4.3 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	tRCP	9.09	T	40	nsec	
Receiver Data Input Margin	tRMG	-0.35	-	0.35	nsec	fCLKIN=110MHz
		-0.40	-	0.40	nsec	fCLKIN=95MHz
		-0.45	-	0.45	nsec	fCLKIN=85MHz
		-0.60	-	0.60	nsec	fCLKIN=65MHz
Input Data 0	tRIP1	-｜tRMG｜	0.0	｜tRMG｜	Clock	
Input Data 1	tRIP0	T/7-｜tRMG｜	T/7	T/7+｜tRMG｜	Clock	
Input Data 2	tRIP6	2 T/7-｜tRMG｜	2T/7	2T/7+｜tRMG｜	Clock	
Input Data 3	tRIP5	3T/7-｜tRMG｜	3T/7	3T/7+｜tRMG｜	Clock	
Input Data 4	tRIP4	4T/7-｜tRMG｜	4T/7	4T/7+｜tRMG｜	Clock	
Input Data 5	tRIP3	5T/7-｜tRMG｜	5T/7	5T/7+｜tRMG｜	Clock	
Input Data 6	tRIP2	6T/7-｜tRMG｜	6T/7	6T/7+｜tRMG｜	Clock	

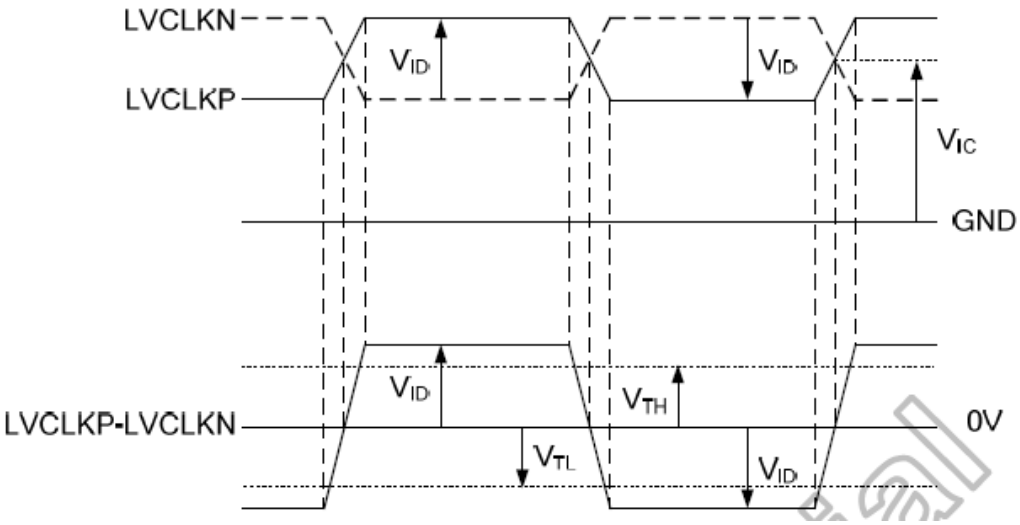


* Vdiff = (RXz+)-(RXz-),…. ,(RXCLK+)-(RXCLK-)

4.4 LVDS Receiver Differential Input

< Table 7-1. LVDS Receiver Differential Input>

Symbol	Parameter	Min	Typ	Max	Unit	Condition
R_{xVTH}	Differential input high threshold voltage	-	-	+0.1	V	RxVCM =1.2V
R_{xVTL}	Differential input low threshold voltage	-0.1	-	-	V	
R_{XVIN}	Input voltage range (singled-end)	0.7		1.6	V	
$\lvert V_{ID} \rvert$	Differential input voltage	0.1		0.6	V	



5.0 SIGNAL TIMING SPECIFICATION

5.1 Timing Parameters (DE only mode)

< Table 8. Timing Table >

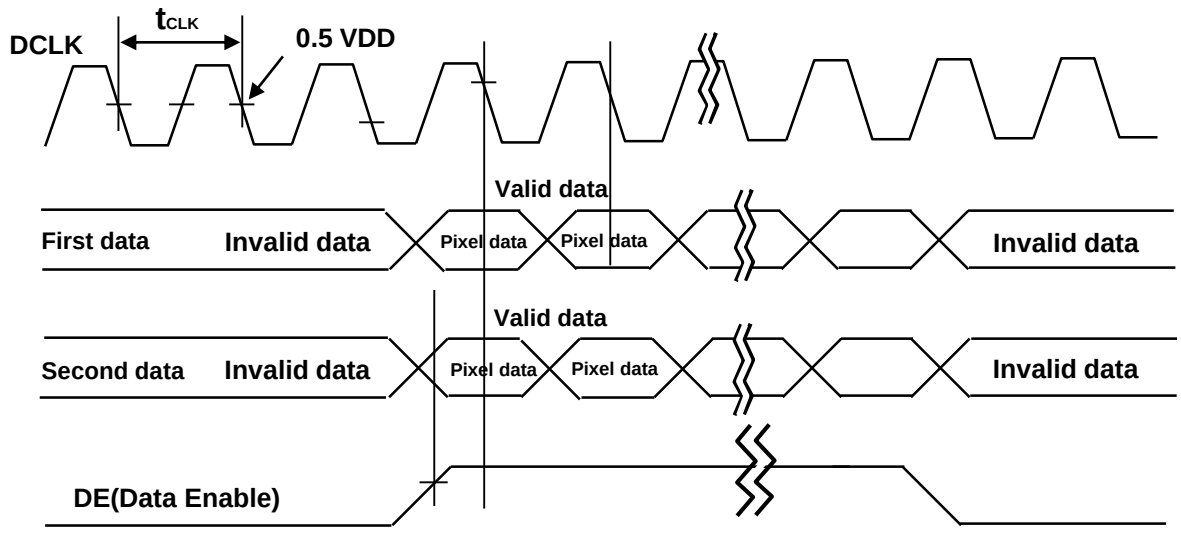
Item		Symbols		Min	Typ	Max	Unit
Clock	Frequency	1/Tc		60	74.25	78	MHz
	High Time	Tch		-	4/7Tc	-	
	Low Time	Tcl		-	3/7Tc	-	
Frame Period		Tv		1100	1125	1149	lines
				48.5	60	63	Hz
Horizontal Active Display Term		Valid	t_{HV}	-	960	-	t_{CLK}
		Total	t_{HP}	1050	1100	1200	t_{CLK}
Vertical Active Display Term		Valid	t_{VV}	-	1080	-	t_{HP}
		Total	t_{VP}	1100	1125	1149	t_{HP}

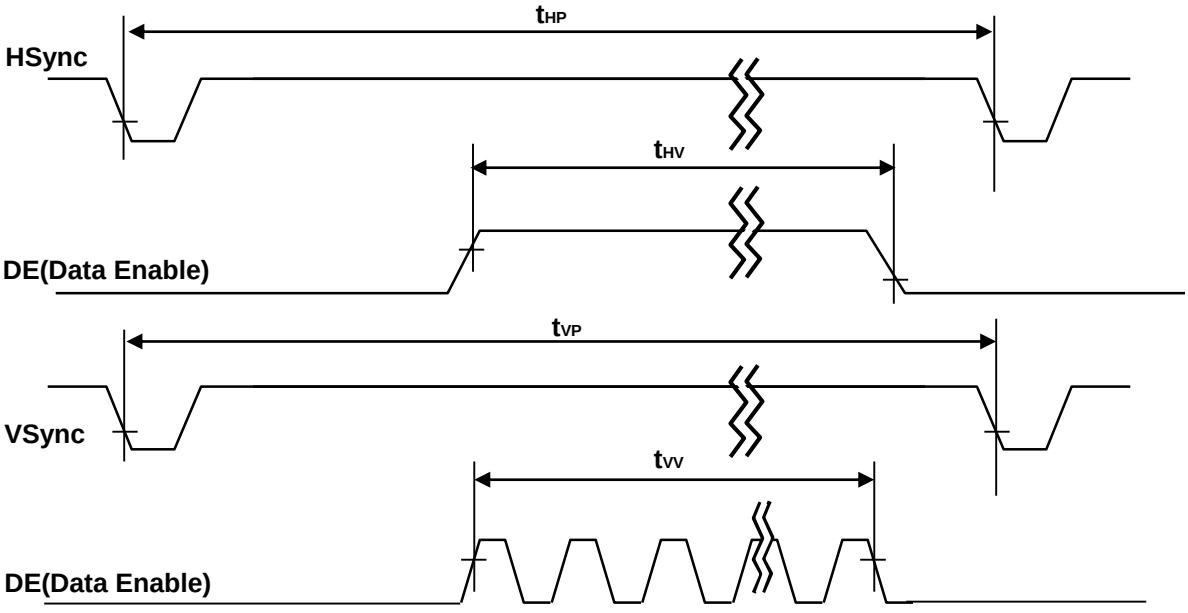
Notes: This product is DE only mode. The input of Hsync & Vsync signal does not have an effect on normal operation.

< Table 9. LVDS Input SSCG>

Symbol	Parameter	Condition	Min	Typ	Max	Unit
F	LVDS Input frequency	-	60	74.25	78	MHz
T_{LVSK}	LVDS channel to channel skew	F=100MHz V_{IC}=1.2V V_{ID}=±400mV	-380	-	+380	ps
F_{LVMOD}	Modulating frequency of input clock during SSC		60	-	85	KHz
F_{LVDEV}	Maximum deviation of input clock frequency during SSC		-3	-	+3	%
T_{CY-CY}	Cycle to Cycle jitter		-	-	100	ps

5.2 Signal Timing Waveform





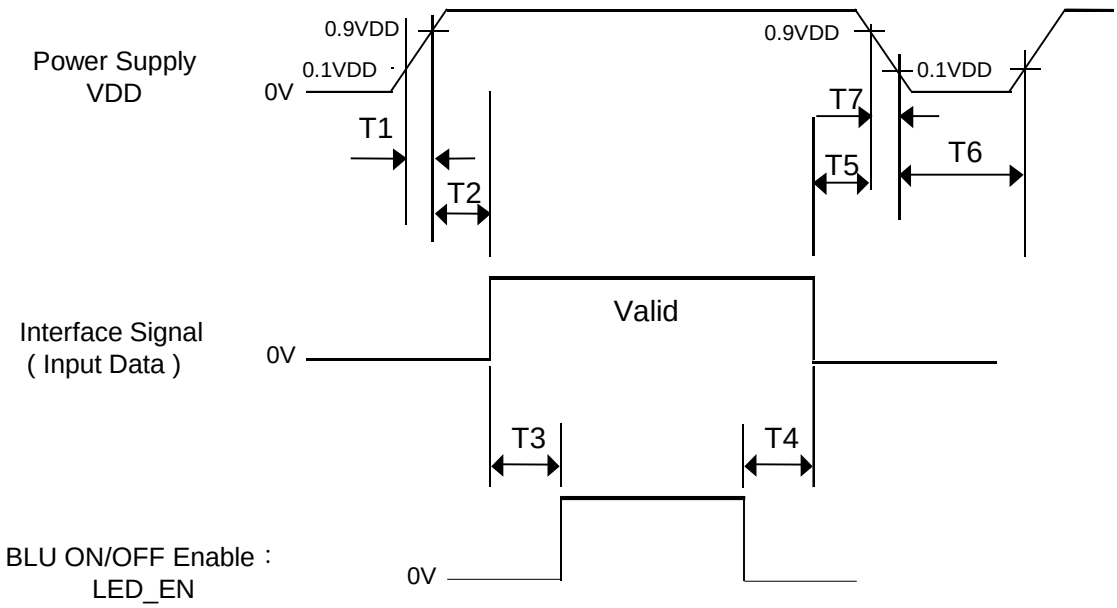
5.3 Input Signals, Basic Display Colors and Gray Scale of Colors

< 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

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



< Table 11. Sequence Table >

Parameter	Values			Units
	Min	Typ	Max	
T1	0.5	-	20	ms
T2	10	-	100	ms
T3	200	-	-	ms
T4	200	-	-	ms
T5	0	-	-	ms
T6	1	-	-	s

Notes: 1. Back Light must be turn on after power for logic and interface signal are valid.
2. Even though T1 is out of SPEC, it is still ok if the inrush current of VDD is below the limit.
3. When VDD<0.9VDD(Typ.),Power off.
4. T7 decreases smoothly, if there were rebounding voltage, it must smaller than 5 volts.

6.0 OPTICAL SPECIFICATIONS

The test of optical specifications shall be measured in a dark room (ambient luminance≤1 lux and temperature=25±2℃) with the equipment of Luminance meter system (Goniometer system and PR730) and test unit shall be located at an approximate distance 180cm from the LCD surface at a viewing angle of θ and Φ equal to 0°. We refer to $\theta_{Ø=0}$ (=θ_3) as the 3 o'clock direction (the "right"), $\theta_{Ø=90}$ (= θ_{12}) as the 12 o'clock direction ("upward"), $\theta_{Ø=180}$ (= θ_9) as the 9 o'clock direction ("left") and $\theta_{Ø=270}$(= θ_6) as the 6 o'clock direction ("bottom"). While scanning θ and/or Ø, the center of the measuring spot on the Display surface shall stay fixed. The measurement shall be executed after 30 minutes warm-up period. VDD shall be 12.0V 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	80	89	-	Deg.	Note 1
		Θ_9		80	89	-	Deg.	
	Vertical	Θ_{12}		80	89	-	Deg.	
		Θ_6		80	89	-	Deg.	
Brightness		Lv	Θ = 0° (Center) Normal Viewing Angle	560	700	-	nit	
Contrast ratio		CR		800:1	1200:1	-		Note 2
White luminance uniformity		ΔY		75	-	-	%	Note 3
Reproduction of color	White	W_x		TYP. - 0.03	0.271	TYP. + 0.03		Note 4
		W_y			0.292			
	Red	R_x			0.650			
		R_y			0.332			
	Green	G_x			0.287			
		G_y			0.616			
	Blue	B_x			0.145			
		B_y			0.082			
Color Gamut				69	72	-	%	
Response Time	G to G	T_g		-	15	-	ms	Note 5

Note :

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

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

3. The White luminance uniformity on LCD surface is then expressed as :
   ΔY = (Minimum Luminance of 9 points / Maximum Luminance of 9 points) * 100
   (See Figure 5 shown in Appendix).
4. 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.
5. Response time Tg is the average time required for display transition by switching the input signal as below table and is based on Frame rate fV =60Hz to optimize.
   Each time in below table is defined as Figure 2 and shall be measured by switching the

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

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

7.0 MECHANICAL CHARACTERISTICS

7.1 Dimensional Requirements

Figure 3(located in Appendix) shows mechanical outlines for the model DV290FBM-N10. Other parameters are shown in Table 13.

< Table 13. Dimensional Parameters >

Parameter	Specification	Unit
Dimensional outline	720.8*226.25*8.4(B)	mm
Weight	2415±100	gram
Active area	705.6(H)*198.45(V)	mm
Pixel pitch	122.5(H) ×367.5(V)	um
Number of pixels	1920(H) ×540(V)(1 pixel = R + G + B dots)	pixels
Back-light	E-LED , 2ea LED bar-down side	

7.2 Mounting

See FIGURE 5. (shown in Appendix)

7.3 Anti-Glare and Polarizer Hardness.

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

8.0 RELIABILITY TEST

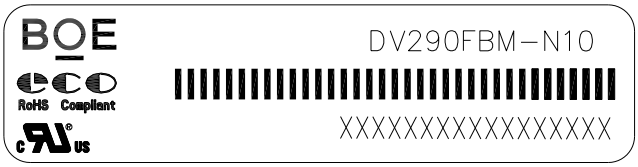
The Reliability test items and its conditions are shown in below.

< Table 14. Reliability Test Parameters >

No	Test Items	Conditions	
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, Operation	
4	High temperature operation test	Ta = 60 ℃, 240hrs	
5	Low temperature operation test	Ta = -5 ℃, 240hrs	
6	8585	85℃, 85%, 240hr, Storage	
7	Thermal shock	Ta = -20 ℃ ↔ 60 ℃ (0.5 hr), 100 cycle	
8	Vibration test (non-operating)	Frequency 5 ~ 200 Hz, Sweep rate 30 min Gravity / AMP 1.47 G Period X, Y, Z 30 min	
9	Shock test (non-operating)	Gravity	220G
		Pulse width	2msec, half sine wave
		Direction	± X, ± Y, ± Z Once for each
10	On/Off	25℃ , 1sec on / 1sec off , 100times ; 10sec on / 5sec off , 30000times , aging 240hr , Operation	

This test condition is based on BOE module.

9.0 PRODCUT SERIAL NUMBER



标签尺寸：48mm × 12mm，厚度0.075mm

1. FG-CODE: DV290FBM-N10
2. MDL ID 对应条形码
3. MDL ID

MDL ID Naming Rule:

序列号	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
代码	X	X	X	3	X	X	X	3	8	5	0	X	X	X	X	X	X
描述	GBN代码		等级	B3	年份		月	FG Code后四位				序列号					

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.

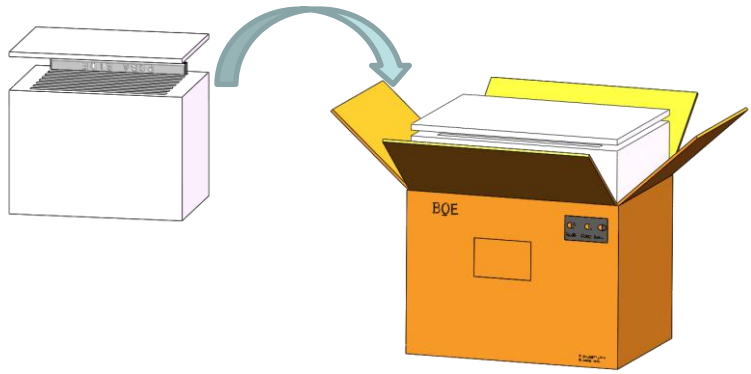
10.1 Packing Order

-. 将 1ea EPE Bottom 放入Inner Box底部

-. 将MDL 套入PE Bag 后PCB 向上竖直插入

- .将4pcs MDL 插入卡槽后,
- 顶部盖上1ea EPE Cover

-. 4pcs/Box



-. 每个Pallet上放3层Box
1层4箱,共计12ea Box

-. Pallet外进行缠膜包装

-. 48pcs LCM / Pallet

10.2 Packing Note

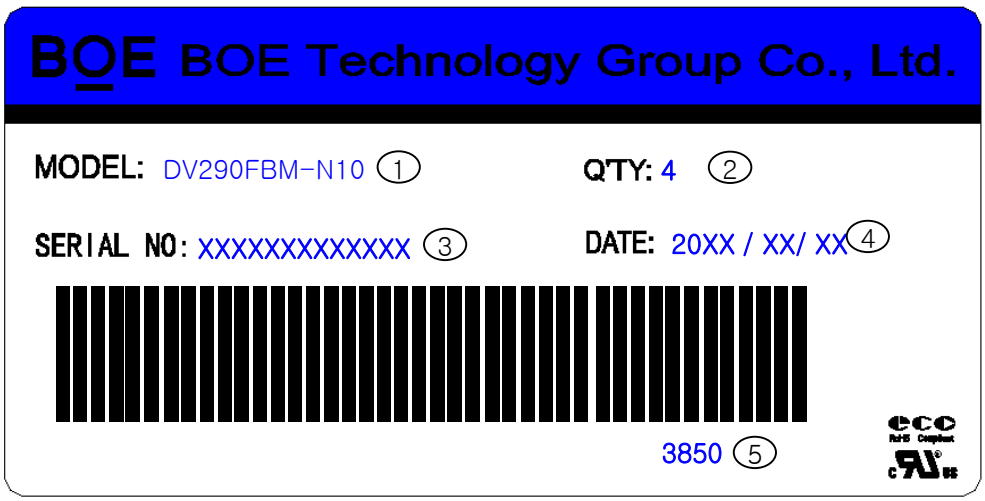
- Box Dimension : 1106mm(L)×477mm(W)×316mm(H)
- Package Quantity in one Box : 8pcs

10.3 Box Label

蓝色字体为后打印标识, 说明如下:

Label Size: 110mm*55mm

1. **FG-CODE:** DV290FBM-N10
2. **Box 产品数量**
3. **Box ID, 编码规则如下**
4. **Box Packing 日期**
5. **FG-CODE 后四位**
   3A50 (New Vision IC)
   3850(Himax IC)



序列号	1	2	3	4	5	6	7	8	9	10	11	12	13
代码	X	X	X	3	X	X	X	X	X	X	X	X	X
描述	GBN代码		等级	B3	年份		月	Rev	序列号				

11.0 PRECAUTIONS

Please pay attention to the followings when you use this TFT LCD Module.

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 module 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 module. And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.
- Do not apply mechanical stress or static pressure on module; Abnormal display cause by pressing some parts of module during assembly process , do not belong to product failure, the press should be agreed by two sides.
- Determine the optimum mounting angle, refer to the viewing angle range in the specification for each model.
- Do not apply mechanical stress or static pressure on module , and avoid impact, vibration and falling.
- 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.
- Protection film for polarizer on the module should be slowly peeled off before display.
- Be careful to prevent water & chemicals contact the module surface.
- You should adopt radiation structure to satisfy the temperature specification.
- 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 module 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 module.

11.2 Operating Precautions

- Do not connector or disconnect the cable to/from the Module at the "Power On" Condition.
- When the module is operating, do not lose CLK, ENAB signals. If any one of these signals is lost, the module would be damaged.
- Obey the supply voltage sequence. If wrong sequence is applied, the module would be damaged.
- Do not allow to adjust the adjustable resistance or switch
- The electrochemical reaction caused by DC voltage will lead to LCD module degradation, so DC drive should be avoided.
- The LCD modules 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 Module may be damaged.
- Module 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.

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 module 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 module 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	MAX
Storage Temperature	(℃)	5	40
Storage Humidity	(%rH)	40	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

- The product should be placed in a sealed polythene bag.
- 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 vertic al from panel surface, If possible, under ESD control device like ion blower, and the humidity of wor king 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 modules are designed for consumer applications . Accordingly, long-term display like in Commercial Display application, can cause uneven display including image sticking. To optimize module'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)
   - Well-ventilated place is recommended to set up Commercial Display system
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 module 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 module will return to normal display.

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

   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 Module 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 20 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.

11.8 Other Precautions

A. LC Leak

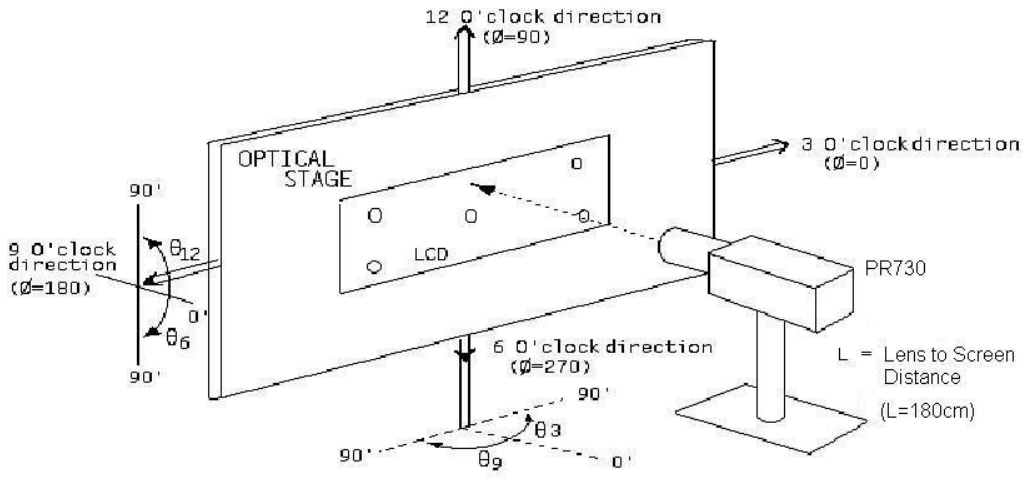
- If the liquid crystal material leaks from the panel, it is recommended to wash the LC with acetone or ethanol and then burn it.
- If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away 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

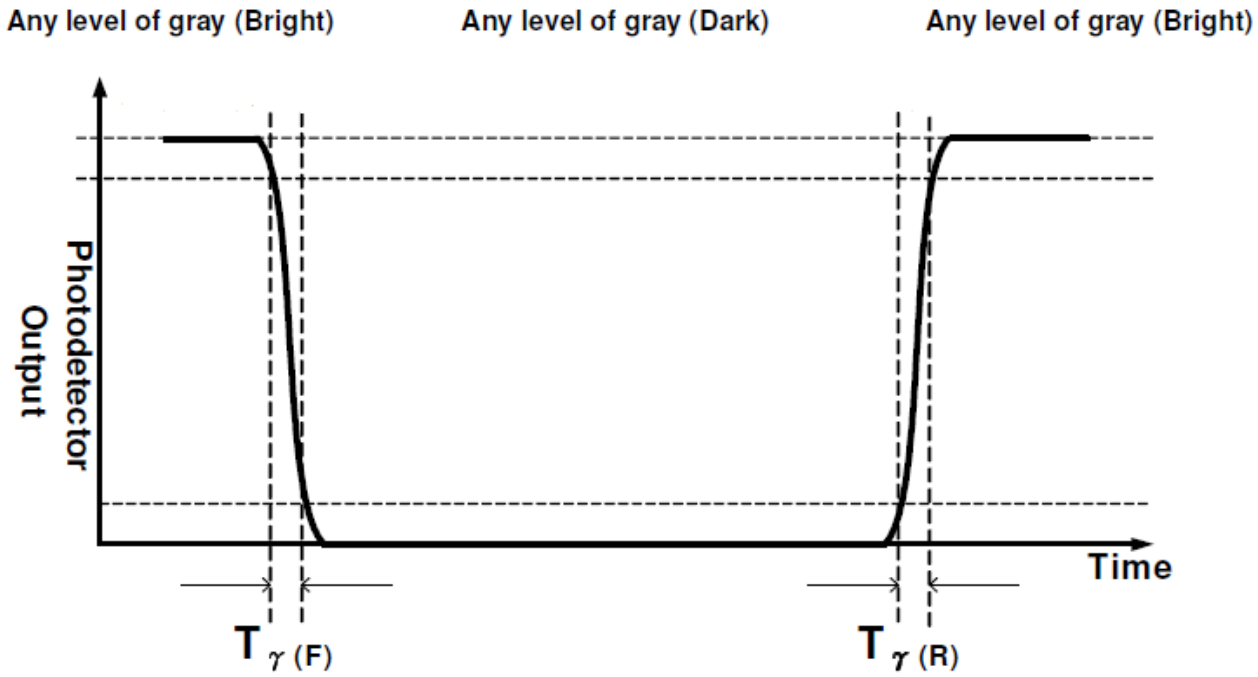
- When returning the module for repair or etc., Please pack the module not to be broken. We recommend to use the original shipping packages.

12.0 APPENDIX

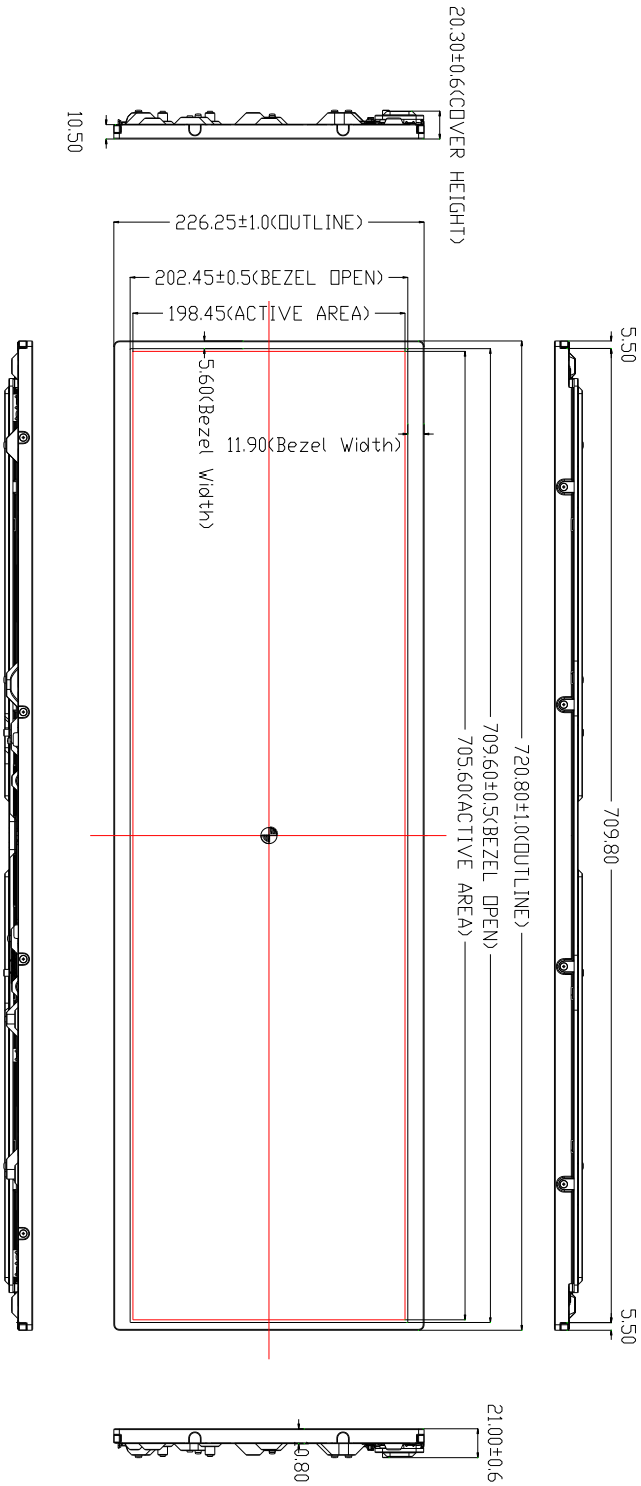
< Figure 1. Measurement Set Up >



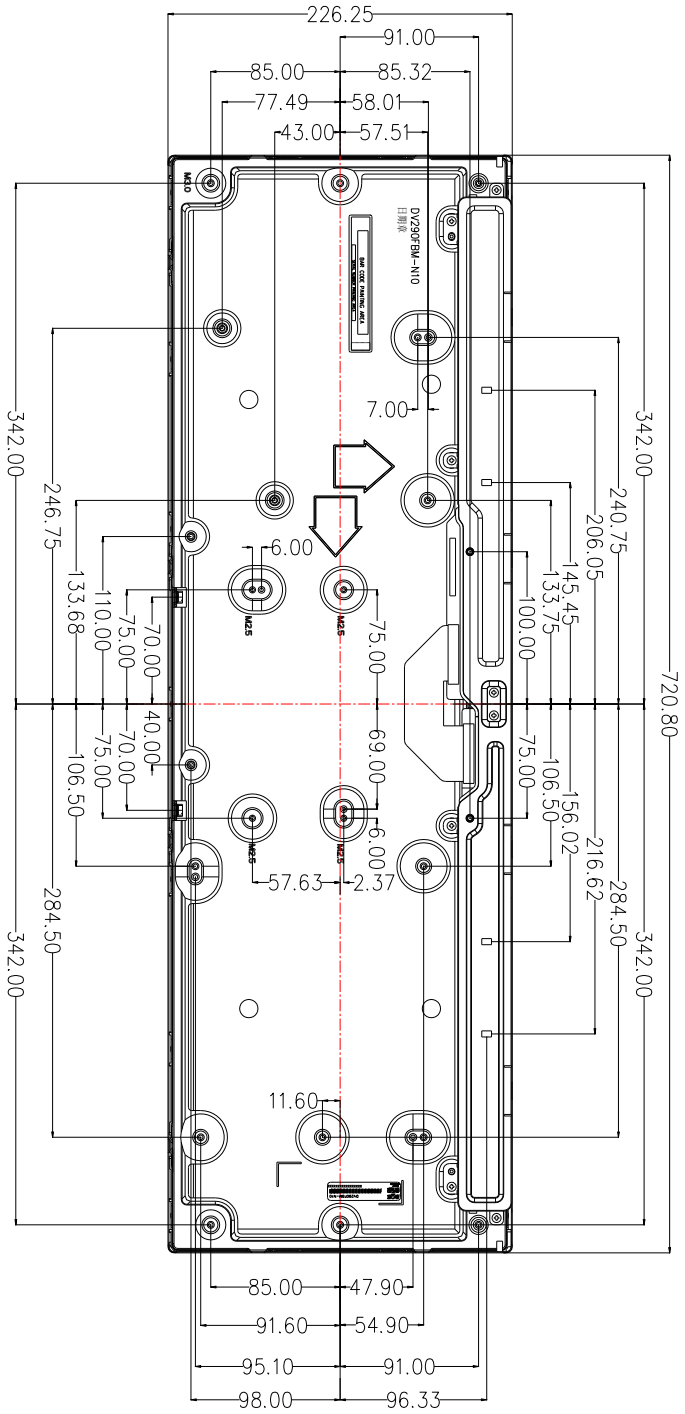
< Figure 2. Response Time Testing >



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



< Figure 4.TFT-LCD Module Outline Dimensions (Rear View) >



< Figure 5. White Luminance and Uniformity Measurement Locations >