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**TITLE :**

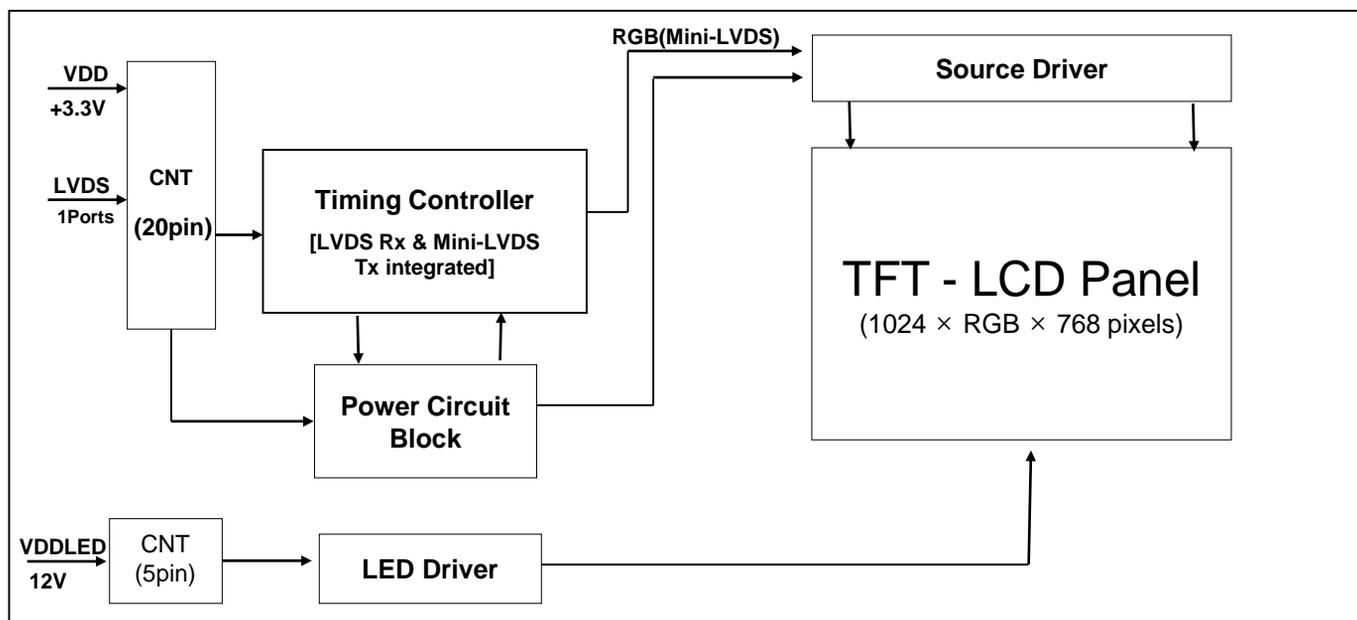
**DV150X0M-N10 Product Specification**

Fuzhou BOE Optoelectronics Technology Co.,Ltd

## 1.0 GENERAL DESCRIPTION

### 1.1 Introduction

DV150X0M-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 15 inch diagonally measured active area with XGA resolutions (1024 horizontal by 768 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 1 pixel / clock
- High-speed response
- Low color shift image quality
- 6-bit +FRC color depth, display 16.7M colors
- Wide viewing angle
- DE (Data Enable) only mode
- ADS 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	304.128(H) × 228.096(V)	mm	
Number of pixels	1024(H) × 768(V)	pixels	
Pixel pitch	0.099(H) × 0.297(V)	mm	
Pixel arrangement	Pixels RGB Vertical stripe		
Display colors	16.7M	colors	6bits+FRC
Display mode	Normally Black		
Dimensional outline	326.5(H) × 253.5(V) × 9.7(Total)	mm	Detail refer to drawing
Weight	930	g	
Power Consumption	11.5	Watt	Typ.
Bezel width (L/R/U/D)	10/10/11.7/11.7	mm	
Surface Treatment	Haze 25%, 3H		
Back-light	E-LED Light bar Type		
LED life	50000		
Display Direction	landscape & Portrait		

## 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.

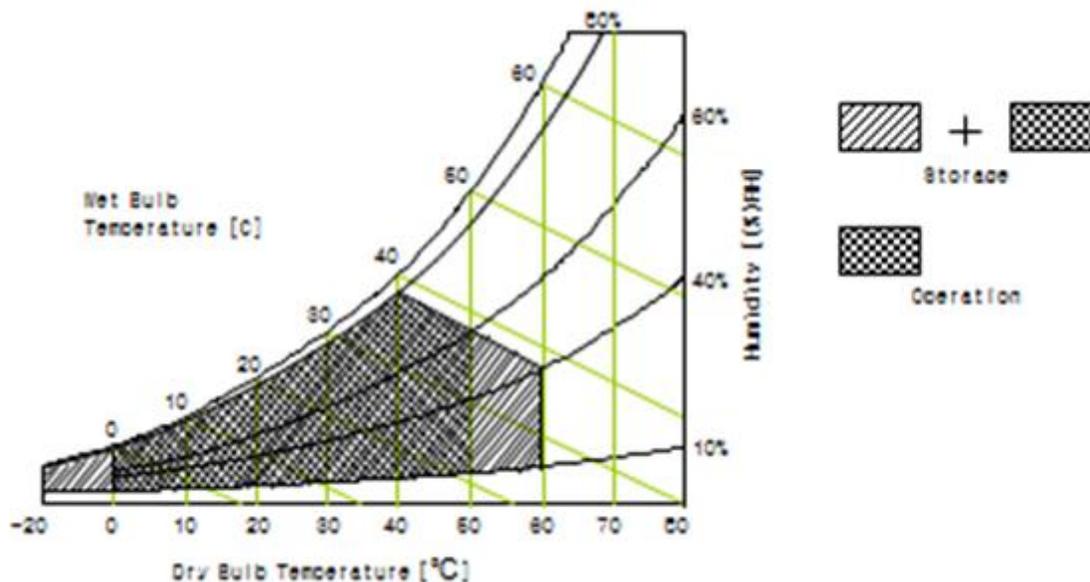
< Table 2. Open Cell Electrical Specifications >

[VSS=GND=0V]

Parameter	Symbol	Min.	Max.	Unit	Remark
Power Supply Voltage	VDD	-0.3	4	V	Ta = 25 °C
Operating Temperature	T <sub>OP</sub>	-20	+70	°C	Note 1
Storage Temperature	T <sub>SUR</sub>	-20	+70	°C	
	T <sub>ST</sub>	-20	+70	°C	
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 °C 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 °C]

Parameter	Symbol	Values			Unit	Remark	
		Min	Typ	Max			
Power Supply Input Voltage	VDD	3.0	3.3	3.6	V	Note 1	
Power Supply Current	IDD	-	410	740	mA		
Power Supply Ripple Voltage	VRP	-	-	300	mV		
Rush Current	IRUSH	-	2	3	A	Note 2	
LVDS Interface	Differential Input High Threshold Voltage	VLVTH	-	-	+100	mV	VLVC=1.2V
	Differential Input Low Threshold Voltage	VLVTL	-100	-	-	mV	
	Common Input Voltage	VLVC	0.7	-	1.6	V	
CMOS Interface	Input High Threshold Voltage	VIH	0.7VDD	-	VDD	V	
	Input Low Threshold Voltage	VIL	0	-	0.3VDD	V	

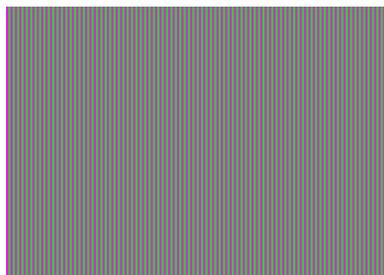
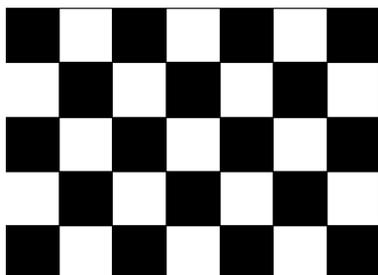
Note 1 : The supply voltage is measured and specified at the interface connector of LCM.

The current draw and power consumption specified is for VDD=3.3V,

Test Pattern of power supply current

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

b) Max : Vline Subline (L255)



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

Note 3 : Calculated value for reference (Input pins\*VPIN × IPIN) excluding inverter loss.

### 3.0 ELECTRICAL SPECIFICATIONS

&lt; Table 4. Backlight Unit Electrical Specifications &gt;

[Ta =25±2 °C]

parameter	Symbol	VALUES			Unit	Notes	
		MIN	TYP	MAX			
Power supply input voltage	VBL		12	.	VDC	1	
Power supply input current	IBL_A	-	0.85	-	A	VBR=3.3V	
Power consumption	PBL		10.2		W	VBR=3.3V	
Input signal for inverter control	On/off	on	V on	2.5	-	5	V
		off	V off	0	-	0.5	V
	Brightness adjust	EXTVBR-B	35		100	%	Automatic sensitization control

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

- LVDS Connector : MSB240420HEA or Compatible.

< Table 4. Open Cell Input Connector Pin Configuration >

Pin No	Symbol	Description	Pin No	Symbol	Description
1	VDD	Power Supply, 3.3V(typ.)	11	RIN2-	-LVDS differential data input 2
2	VDD	Power Supply,3.3V(typ.)	12	RIN2+	+LVDS differential data input 2
3	VSS	Ground	13	VSS	Ground
4	NC	No Connection	14	CLKIN-	-LVDS differential clock input CLK
5	RIN0-	-LVDS differential data input 0	15	CLKIN+	+LVDS differential clock input CLK
6	RIN0+	+LVDS differential data input 0	16	VSS	Ground
7	VSS	Ground	17	RIN3-	-LVDS differential data input 3
8	RIN1-	-LVDS differential data input 1	18	RIN3+	+LVDS differential data input 3
9	RIN1+	+LVDS differential data input 1	19	VSS	Ground
10	VSS	Ground	20	NC	No Connection

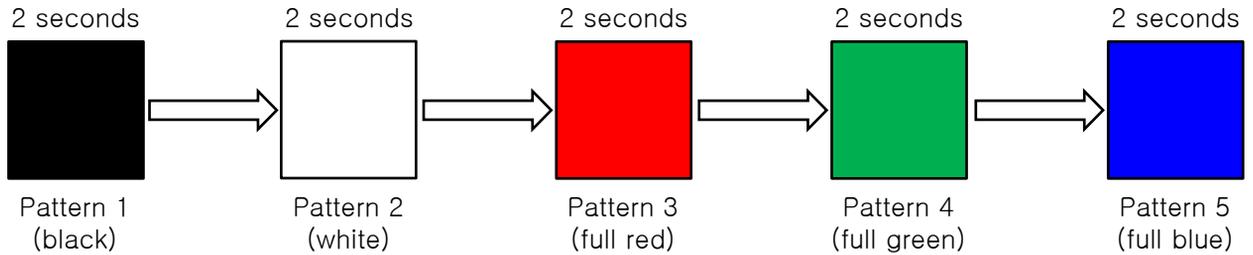
## 4.2 LED Light Bar

&lt; Table 5. LED Light Bar &gt;

Input connector /输入插座: CN1			
Pin No./引脚	Symbol/符号	Description/ 描述	Parameter /参数
1、 2	+12V	Supply voltage/供电	11.5~13V
5、 6	GND	Ground/接地	0V
4	DIM 0V	Dimming control/亮度控制	0V=Brightness Max 亮度最大 5V=Brightness Min 亮度最小
3	N/F	Standby/Operation/开关控制	On =2--5.0V Off=0-0.5V
	NC	-	空

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.

### BIST Pattern



### 4.2 LVDS Interface

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

< Table 6. Open Cell Input Connector Pin Configuration >

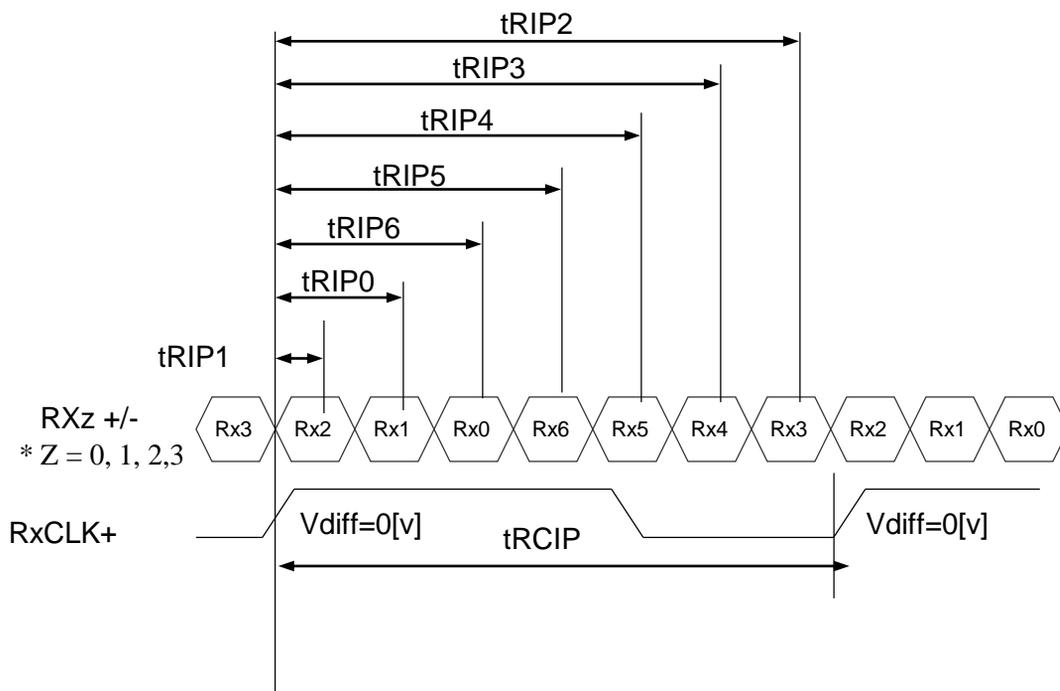
	Input Signal	Transmitter		Interface		HT236F01-100 (CN11)	Remark
		Pin No.	Pin No.	System (Tx)	TFT-LCD (Rx)	Pin No.	
L V D S	OR0	51	48 47	OUT0- OUT0+	RX00- RX00+	1 2	
	OR1	52					
	OR2	54					
	OR3	55					
	OR4	56					
	OR5	3					
	OG0	4	46 45	OUT1- OUT1+	RX01- RX01+	3 4	
	OG1	6					
	OG2	7					
	OG3	11					
	OG4	12					
	OG5	14					
	OB0	15	42 41	OUT2- OUT2+	RX02- RX02+	5 6	
	OB1	19					
	OB2	20					
	OB3	22					
	OB4	23					
	OB5	24					
	Hsync	27	40 39	CLK OUT- CLK OUT+	RXO CLK- RXO CLK+	8 9	
	Vsync	28					
DE	30	38 37	OUT3- OUT3+	RX03- RX03+	10 11		
MCLK	31						
OR6	50						
OR7	2						
OG6	8						
OG7	10						
OB6	16						
OB7	18						
RSVD	25						

### 4.3 LVDS Rx Interface Timing Parameter

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

<Table 7. LVDS Rx Interface Timing Specification>

Item	Symbol	Min	Typ	Max	Unit	Remark
CLKIN Period	tRCIP	10.31	13.47	15.87	nsec	
Input Data 0	tRIP1	$0.5 \times tRCIP/7-0.4$	$0.5 \times tRCIP/7$	$0.5 \times tRCIP/7 + 0.4$	nsec	
Input Data 1	tRIP0	$1.5 \times tRCIP/7 - 0.4$	$1.5 \times tRCIP/7$	$1.5 \times tRCIP/7 + 0.4$	nsec	
Input Data 2	tRIP6	$2.5 \times tRCIP/7-0.4$	$2.5 \times tRCIP/7$	$2.5 \times tRCIP/7+0.4$	nsec	
Input Data 3	tRIP5	$3.5 \times tRCIP/7-0.4$	$3.5 \times tRCIP/7$	$3.5 \times tRCIP/7+0.4$	nsec	
Input Data 4	tRIP4	$4.5 \times tRCIP/7-0.4$	$4.5 \times tRCIP/7$	$4.5 \times tRCIP/7+0.4$	nsec	
Input Data 5	tRIP3	$5.5 \times tRCIP/7-0.4$	$5.5 \times tRCIP/7$	$5.5 \times tRCIP/7+0.4$	nsec	
Input Data 6	tRIP2	$6.5 \times tRCIP/7-0.4$	$6.5 \times tRCIP/7$	$6.5 \times tRCIP/7+0.4$	nsec	



\*  $V_{diff} = (RXz+) - (RXz-), \dots, (RXCLK+) - (RXCLK-)$

## 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	52	58	71	MHz	
	High Time	Tch	-	4/7Tc	-		
	Low Time	Tcl	-	3/7Tc	-		
Frame Period		Tv	48	60	63	Hz	
Horizontal Active Display Term		Valid	t <sub>HV</sub>	-	1024	-	t <sub>CLK</sub>
		Total	t <sub>HP</sub>	1200	1344	1400	t <sub>CLK</sub>
Vertical Active Display Term		Valid	t <sub>VV</sub>	-	768	-	t <sub>HP</sub>
		Total	t <sub>VP</sub>	788	806	845	t <sub>HP</sub>

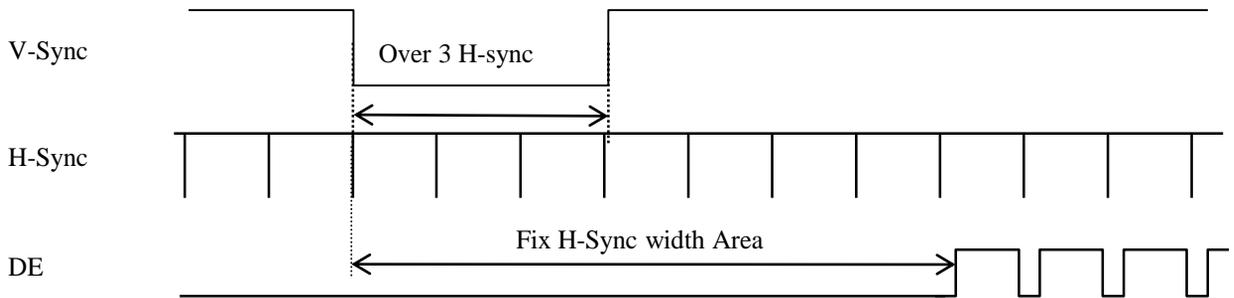
Notes: This product is DE only mode. The input of Hsync & Vsync signal does not have an effect on normal operation.

< Table 9. LVDS Input SSCG >

Symbol	Parameter	Condition	Min	Typ	Max	Unit
F	LVDS Input frequency	-	25	-	100	MHz
T <sub>LVSK</sub>	LVDS channel to channel skew	F=58MHz V <sub>IC</sub> =1.2V V <sub>ID</sub> =±200mV	-600	-	+600	ps
F <sub>LVMOD</sub>	Modulating frequency of input clock during SSC	F=58MHz V <sub>IC</sub> =1.2V V <sub>ID</sub> =±200mV	10	-	300	KHz
F <sub>LVDEV</sub>	Maximum deviation of input clock frequency during SSC		-3	-	+3	%
T <sub>CY-CY</sub>	Cycle to Cycle jitter		-	-	200	ps

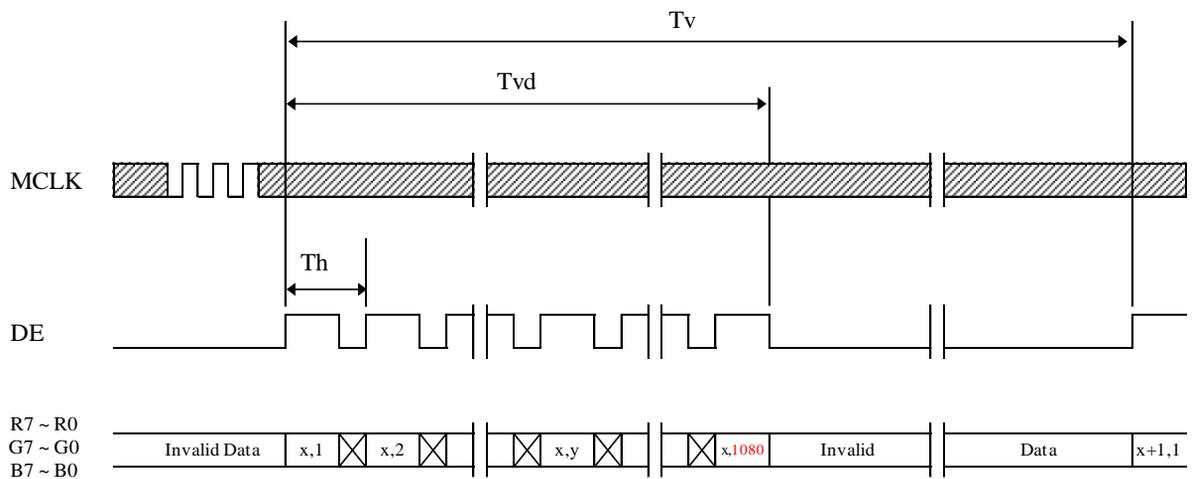
## 5.2 Signal Timing Waveform

### 5.2.1 Sync Timing Waveform

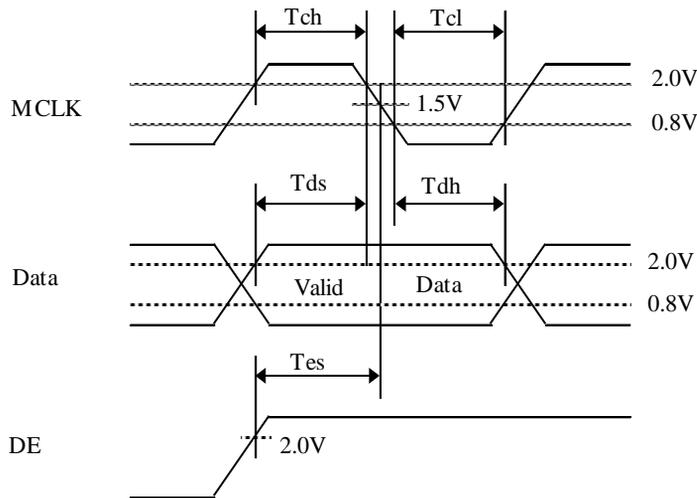
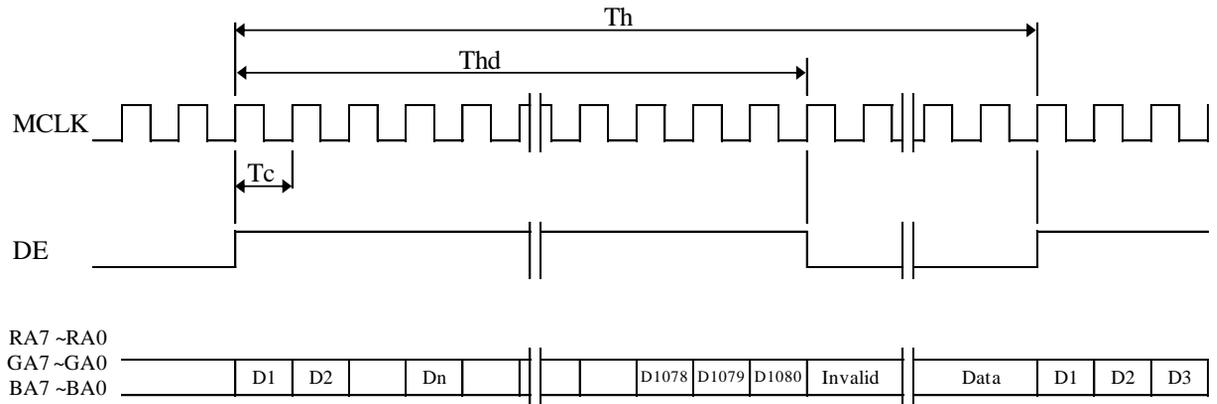


- 1) Need over 3 H-sync during V-Sync Low
- 2) Fix H-Sync width from V-Sync falling edge to first rising edge

### 5.2.2 Vertical Timing Waveform



### 5.2.3 Horizontal Timing Waveform



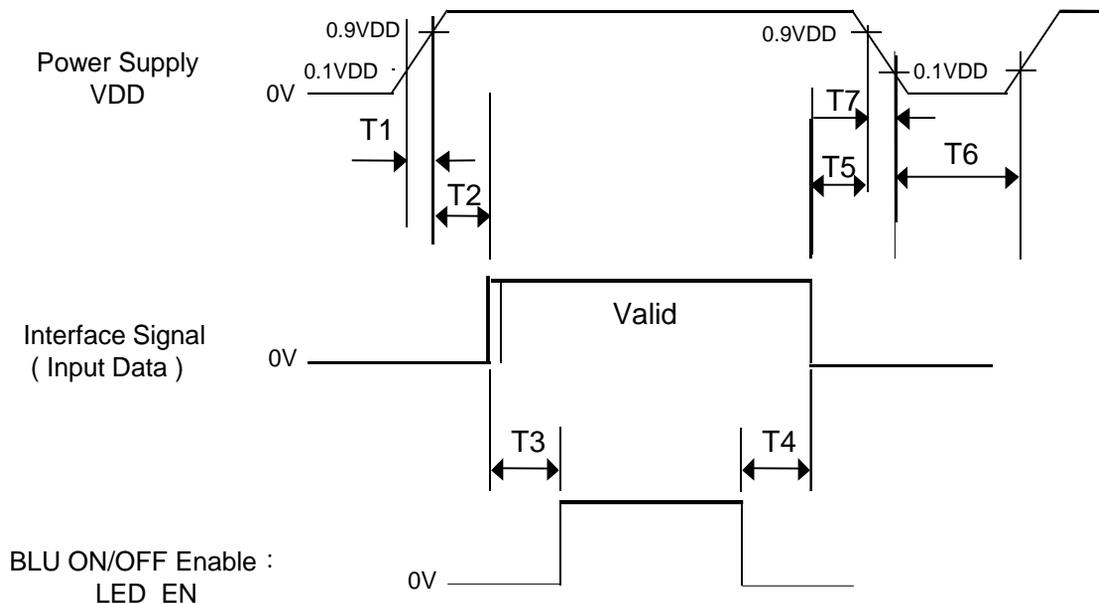
## 5.3 Input Signals, Basic Display Colors and Gray Scale of Colors

< 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 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	-	50	ms
T3	500	-	-	ms
T4	500	-	-	ms
T5	0	-	30	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 0.5 volts.

### 6.0 OPTICAL SPECIFICATIONS

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 PR788) 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 at  $25^\circ\text{C}$ . Optimum viewing angle direction is 6 'clock.

< Table 12. Optical Table >

[VDD = 5.0V, 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	85	89		Deg.	Note 1
		$\Theta_9$		85	89		Deg.	
	Vertical	$\Theta_{12}$		85	89		Deg.	
		$\Theta_6$		85	89		Deg.	
Brightness		Lv	$\Theta = 0^\circ$	1000	1200		nit	
Uniformity	9 Points	$\Delta Y_9$	ILED=55m A	75%	80%			Note 2
Contrast ratio		CR	$\Theta = 0^\circ$	700:1	1000:1	-		Note 3
Reproduction of color	White	Wx	$\Theta = 0^\circ$ (Center) Normal Viewing Angle	TYP. - 0.03	0.313	TYP. + 0.03		Note 4
		Wy			0.329			
	Red	Rx			0.649			
		Ry			0.338			
	Green	Gx			0.323			
		Gy			0.627			
	Blue	Bx			0.155			
		By			0.056			
Color Gamut				67	72	-	%	
Response Time	Tr+Tf			-	30	35	ms	Note 5
Gamma Scale				2.0	2.2	2.4		

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. The White luminance uniformity on LCD surface is then expressed as :  $\Delta Y = \text{Minimum Luminance of 9 points} / \text{Maximum Luminance of 9 points.}$ (see Figure 1 shown in Appendix).
3. 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 2 shown in Appendix) Luminance Contrast Ratio (CR) is defined mathematically.

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

4. The color chromaticity coordinates specified in Table 9.shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel. The BLU is used by BOE.
5. 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 is defined as Figure 3 and shall be measured by switching the

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

6. Definition of Transmittance (T%) :

Module is with white(L255) signal input

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

## 7.0 MECHANICAL CHARACTERISTICS

### 7.1 Dimensional Requirements

Figure 3(located in Appendix) shows mechanical outlines for the model DV170YGM-N10 . Other parameters are shown in Table 13.

< Table 13. Dimensional Parameters >

Parameter	Specification	Unit
<u>Dimensional outline</u>	326.5(H) × 253.5(V) × 9.7(D)	<u>mm</u>
Weight	930	gram
Active area	304.128(H) × 228.096(V)	mm
Pixel pitch	0.099(H) × 0.297(V)	mm
Number of pixels	1024(H) × 768(V) (1 pixel = R + G + B dots)	pixels

### 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

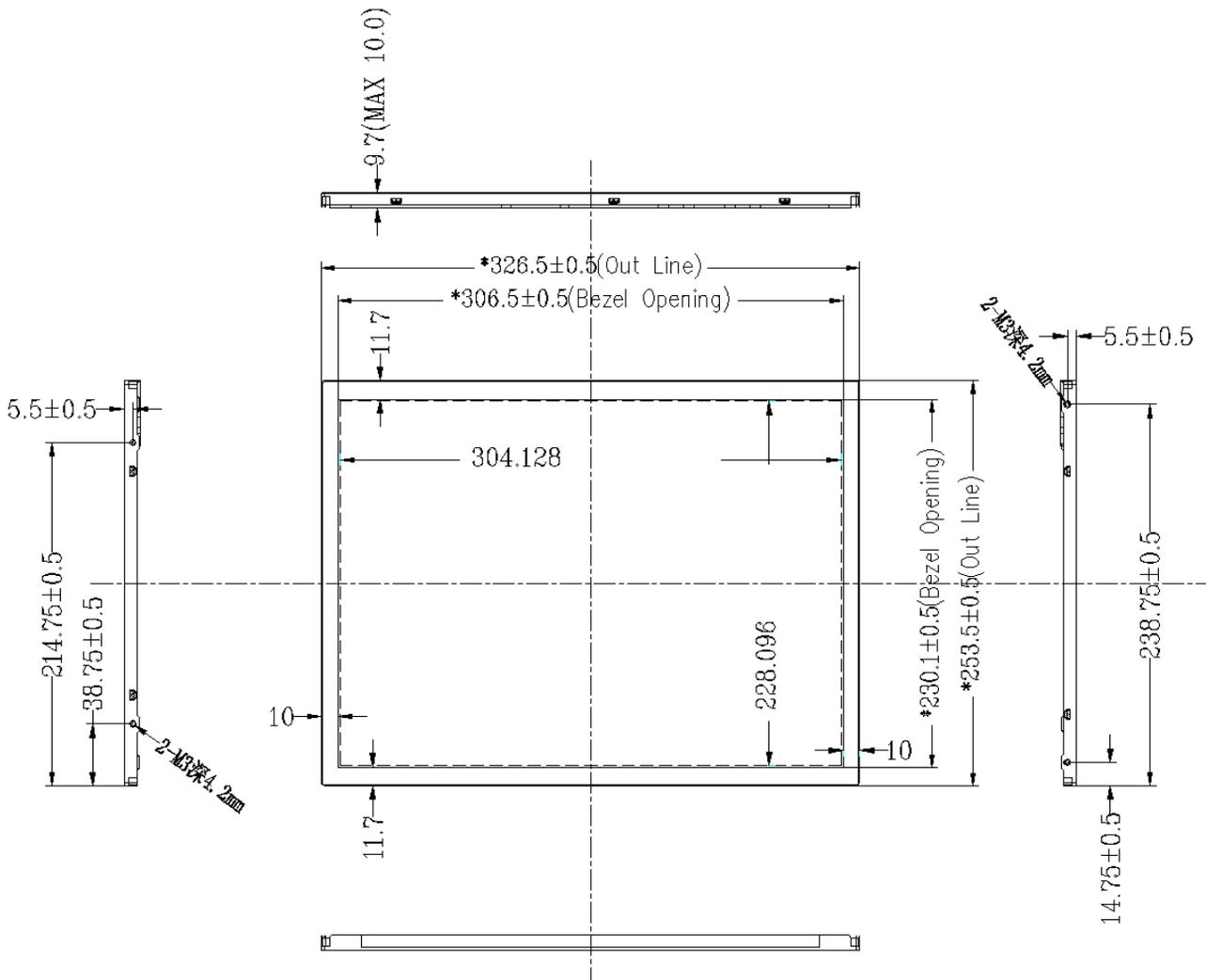
The Reliability test items and its conditions are shown in below.

< Table 14. Reliability Test Parameters >

No	Test Items	Conditions
1	High temperature storage test	Ta = 70 °C, 8 hrs
2	Low temperature storage test	Ta = -20 °C, 4 hrs
3	High temperature & high humidity storage test	Ta = 40 °C, 95%RH, 2hrs
4	High temperature operation test	Ta = 70 °C, 72 hrs
5	Low temperature operation test	Ta = -20°C, 24hrs
6	High temperature & high humidity operation test	Ta = 40 °C, 95%RH, 12hrs
7	Thermal shock	Ta = -20 °C ↔ 70 °C (per 6 hr), 4 cycle

This test condition is based on Client-Server Model.

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



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

