B3 DV190FBM-NB0 Product Specification Rev.P0

SUPPLIER	HEFEI BOE Optoelectronics Technology CO., LTD
FG-Code	DV190FBM-NB0

ITEM	BUYER SIGNATURE	DATE

ITEM	SUPPLIER SIGNATURE	DATE
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REVISION HISTORY

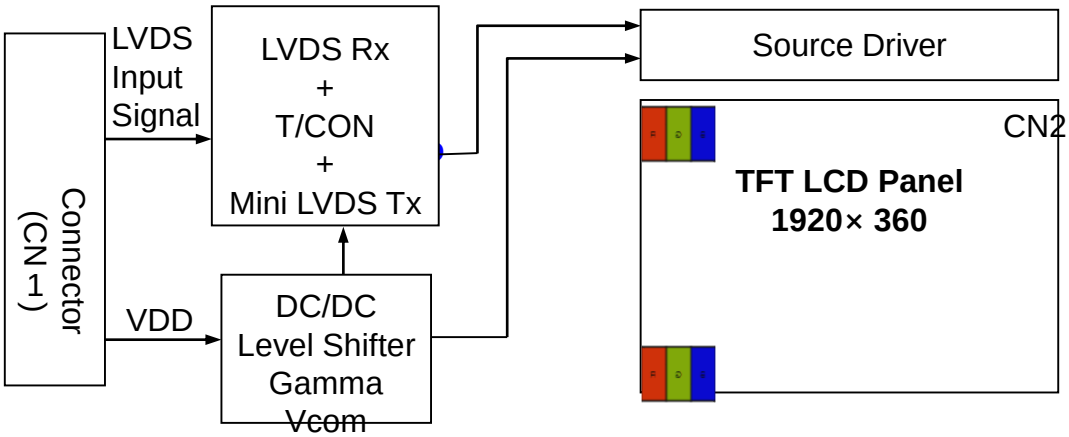
REV.	ECN NO.	DESCRIPTION OF CHANGES	DATE	PREPARED
P0	-	Initial Release	2022.06.28	Chen Yu

Contents

1.0 GENERAL DESCRIPTION

1.0.1 Introduction

DV190FBM-NB0 is a color active matrix TFT LCD module using amorphous silicon TFT's (Thin Film Transistors) as an active switching devices. This module has a 19 inch diagonally measured active area with WXGA resolutions (1920 horizontal by 360 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.



1.0.2 Features

- LVDS Interface with 1 pixel / clock
- Low power consumption
- 6-bit (Hi-FRC) color depth, display 16. 7M colors
- Incorporated edge type back-light (One Light Bar)
- High luminance and contrast ratio, low reflection and normal viewing angle
- DE (Data Enable) only
- RoHS
- ES 6.0 compliant
- Gamma correction

1.0.3 Application

- Desktop Type of PC & Workstation Use
- Slim-Size Display for Stand-alone Monitor
- Display Terminals for Control System
- Monitors for Process Controller

1.0.4 General Specification

< Table 1. General Specifications >

Parameter	Specification	Unit	Remarks
Active area	476.64(H) × 89.37(V)	mm	
Number of pixels	1920(H) ×360(V)	pixels	
Pixel pitch	0.24825(H) ×0.24825(V)	mm	
Pixel arrangement	RGB Vertical stripe		
Display colors	16.7M	colors	
Display mode	Normally Black		
Dimensional outline	491.5(H) × 109.5(V) × 8.4(B)	mm	Detail refer to drawing
Surface treatment	Haze 25%		
Bezel width (L/R/U/D)	6/6/11/6	mm	
Weight	780（typ.）	g	
Back-light	Up edge side, 1- LED Light bar		

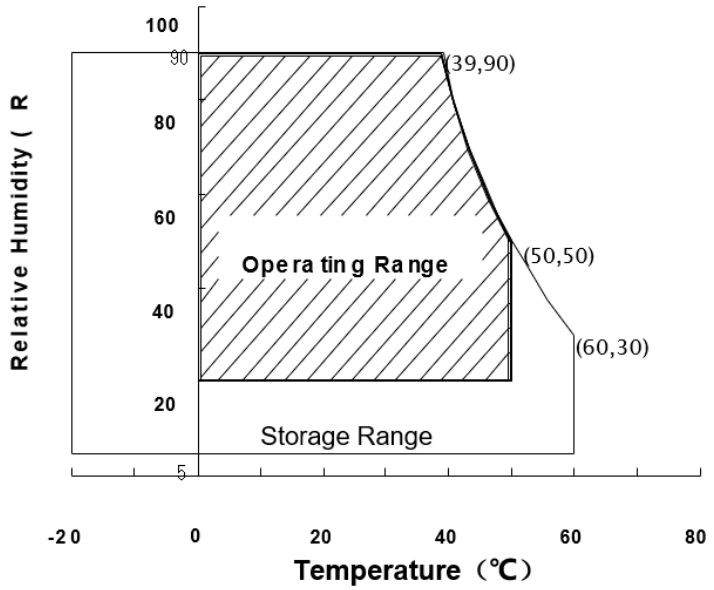
2.0 ABSOLUTE MAXIMUM RATINGS

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. Absolute Maximum Ratings> [VSS=GND=0V]

Parameter	Symbol	Min.	Max.	Unit	Remarks
Power Supply Voltage	V_{DD}	-0.3	7	V	Ta = 25 ℃
Logic Supply Voltage	V_{IN}	VSS-0.3	V_{DD}+0.3	V	
LED Channel Current	I_{BL}	-	85	mA	
Operating Temperature	T_{OP}	0	+60	℃	
Storage Temperature	T_{ST}	-20	+60	℃	

Note : 1) Temperature and relative humidity range are shown in the figure below.
Wet bulb temperature should be 39 ^{O}C max. and no condensation of water.



3.0 ELECTRICAL SPECIFICATIONS

3.0.1 TFT LCD Module

< Table 3. LCD Module Electrical Specifications >

[Ta =25±2 ℃]

Parameter		Min.	Typ.	Max.	Unit	Remarks
Power Supply Voltage	V_{DD}	4.5	5.0	5.5	V	Note1
Power Supply Current	I_{DD}	-	500	630	mA	
Power Consumption	P_D	-	3	4	W	
In-Rush Current	I_{RUSH}	-	2	3	A	Note 2
Permissible Input Ripple Voltage	V_{RP}	-	-	300	mV	Note1,3
High Level Differential Input Threshold Voltage	V_{IH}	-	-	+100	mV	
Low Level Differential Input Threshold Voltage	V_{IL}	-100	-	-	mV	
Differential input voltage	$\|V_{ID}\|$	200	-	600	mV	
Differential input common mode voltage	Vcm	1.0	1.2	1.5		V_{IH}=100mV, V_{IL}=-100mV
LED Channel Voltage	V_L	50.4	54	55.8	V	
LED Channel Current	I_L	-	32	40	mA	
LED Lifetime		50,000	-	-	Hrs	
Power Consumption	P_D	-	2.5	3.15	W	@60Hz
	P_{BL}	-	6.9	8.9	W	
	P_{total}	-	9.9	12.9	W	

Notes : 1. The supply voltage is measured and specified at the interface connector of LCM.
The current draw and power consumption specified is for VDD=5.0V, Frame rate=60Hz and Clock frequency = 75.4MHz. Test Pattern of power supply current

a) Typ: Color Test

b) Max: Skip Sub Pixel

a)

b)

2. Duration of rush current is about 2 ms and rising time of VDD is 520 μs ± 20 %
3. Ripple Voltage should be covered by Input voltage Spec.
4. Calculated value for reference (V_L × I_L) ×4(channel) excluding driver loss. (LED Light bar: 18S4P)

3.0.2 Back-light Unit

< Table 4. LED Backlight Unit >

Parameter		Min.	Typ.	Max.	Unit	Remarks
LED Light Bar Input Voltage Per Input Pin	VPIN	50.4	54	55.8	V	Duty 100%
LED Light Bar Input Current Per Input Pin	IPIN	-	32	40	mA	Note1,2,
LED Power Consumption	P_{BL}	-	6.9	8.9	W	Note 3
LED Life-Time	-	50,000	-		Hrs	Note 4

LED bar consists of 72LED packages,4 strings(parallel)*18packages(serial)
Note1: There are one light bar ,and the specified current is input LED chip 100% duty current
Note2: The sense current of each input pin is 32mA
Note3: PBL=4 Input pins*VPIN ×IPIN
Note4: The lifetime is determined as the time at which luminance of LED become 50% of the initial brightness or not normal lighting at IPIN=32mA on condition of continuous operating at 25 ±2 ℃

4.0 INTERFACE CONNECTION.

4.0.1 Electrical Interface Connection

The electronics interface Module Side Connector : UJU IS100-30O-C23 or Equivalent
User Side Connector : JAE FI-X30H or Equivalent

The connector interface pin assignments are listed in Table 5 .

<Table 5. Pin Assignments for the Interface Connector>

Pin No	Symbol	Function	Remark
1	RXO0-	Negative Transmission data of Pixel 0 (ODD)	
2	RXO0+	Positive Transmission data of Pixel 0 (ODD)	
3	RXO1-	Negative Transmission data of Pixel 1 (ODD)	
4	RXO1+	Positive Transmission data of Pixel 1 (ODD)	
5	RXO2-	Negative Transmission data of Pixel 2 (ODD)	
6	RXO2+	Positive Transmission data of Pixel 2 (ODD)	
7	GND	Power Ground	
8	RXOC-	Negative Transmission Clock (ODD)	
9	RXOC+	Positive Transmission Clock (ODD)	
10	RXO3-	Negative Transmission data of Pixel 3 (ODD)	
11	RXO3+	PositiveTransmission data of Pixel 3 (ODD)	
12	RXE0-	Negative Transmission data of Pixel 0 (EVEN)	
13	RXE0+	Positive Transmission data of Pixel 0 (EVEN)	
14	GND	Power Ground	
15	RXE1-	Negative Transmission data of Pixel 1 (EVEN)	
16	RXE1+	Positive Transmission data of Pixel 1 (EVEN)	
17	GND	Power Ground	
18	RXE2-	Negative Transmission data of Pixel 2 (EVEN)	
19	RXE2+	Positive Transmission data of Pixel 2 (EVEN)	
20	RXEC-	Negative Transmission Clock (EVEN)	
21	RXEC+	Positive Transmission Clock (EVEN)	
22	RXE3-	Negative Transmission data of Pixel 3 (EVEN)	
23	RXE3+	Positive Transmission data of Pixel 3 (EVEN)	
24	GND	Power Ground	
25	CTL	CTL_DVR for LCD manufacturer	
26	CE	CE_DVR for LCD manufacturer	
27	NC	Not connection	
28	VDD1	Power Supply:+5V	
29	VDD2		
30	VDD3		

4.0 INTERFACE CONNECTION.

4.0.2 LED Light Bar Interface

-LED connector：CI1407M1VL0-NH manufactured by Entry

< Table 6. LED Light Bar>

Pin No	Symbol	Description
1	IRLED1	LED current sense for string1
2	IRLED2	LED current sense for string2
3	VLED	LED power supply
4	VLED	LED power supply
5	VLED	LED power supply
6	IRLED3	LED current sense for string3
7	IRLED4	LED current sense for string4

4.0.3 LVDS Interface (UJU IS100-30O-C23 or Equivalent)

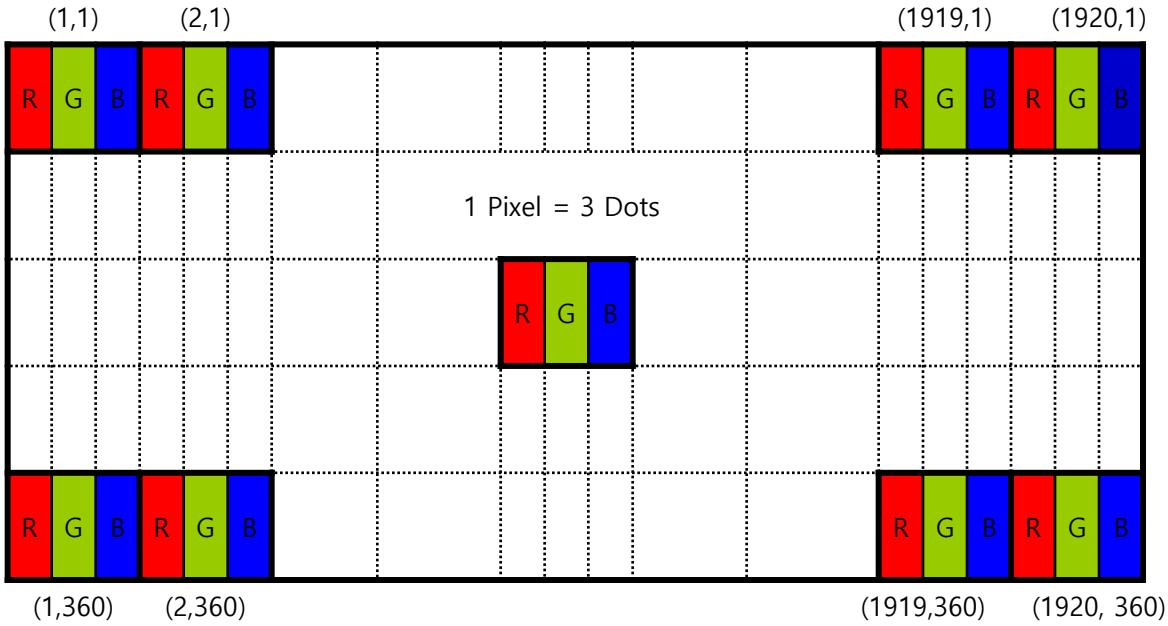
	Input Signal	Transmitter		Interface		(CN11)	Remark
		Pin No.	Pin No.	System (Tx)	TFT-LCD (Rx)	Pin No.	
ODD LVDS	OR0	51	48 47	OUT0- OUT0+	RXO0- RXO0+	1 2	
	OR1	52					
	OR2	54					
	OR3	55					
	OR4	56					
	OR5	3					
	OG0	4					
	OG1	6	46 45	OUT1- OUT1+	RXO1- RXO1+	3 4	
	OG2	7					
	OG3	11					
	OG4	12					
	OG5	14					
	OB0	15					
	OB1	19					
	OB2	20	42 41	OUT2- OUT2+	RXO2- RXO2+	5 6	
	OB3	22					
	OB4	23					
	OB5	24					
	Hsync	27					
	Vsync	28					
	DE	30		CLK	RXO		
	MCLK	31	40 39	OUT- CLK	CLK- RXO	8 9	
	OR6	50	38 37	OUT+ OUT3- OUT3+	CLK+ RXO3- RXO3+	10 11	
	OR7	2					
	OG6	8					
	OG7	10					
	OB6	16					
	OB7	18					
	RSVD	25					

4.0.3 LVDS Interface (UJU IS100-30O-C23 or Equivalent)

	Input Signal	Transmitter		Interface		(CN11)	Remark
		Pin No.	Pin No.	System (Tx)	TFT-LCD (Rx)	Pin No.	
EVEN LVDS	ER0	51	48 47	OUT0- OUT0+	RXE0- RXE0+	12 13	
	ER1	52					
	ER2	54					
	ER3	55					
	ER4	56					
	ER5	3					
	EG0	4					
	EG1	6	46 45	OUT1- OUT1+	RXE1- RXE1+	15 16	
	EG2	7					
	EG3	11					
	EG4	12					
	EG5	14					
	EB0	15					
	EB1	19					
	EB2	20	42 41	OUT2- OUT2+	RXE2- RXE2+	18 19	
	EB3	22					
	EB4	23					
	EB5	24					
	Hsync	27					
	Vsync	28					
	DE	30		CLK	RXE		
	MCLK	31	40 39	OUT- CLK	CLK- RXE	20 21	
	ER6	50	38 37	OUT+ OUT3- OUT3+	CLK+ RXE3- RXE3+	22 23	
	ER7	2					
	EG6	8					
	EG7	10					
	EB6	16					
	EB7	18					
	RSVD	25					

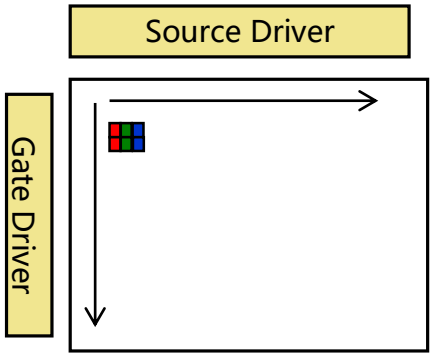
4.1.0 Data Input Format

Figure 1. Pixel Format



Display Position of Input Data (V-H)

Figure 2. Scan direction



5.0 SIGNAL TIMING SPECIFICATION

5.0.1 The DV190FBM-NB0 is operated by the DE only.

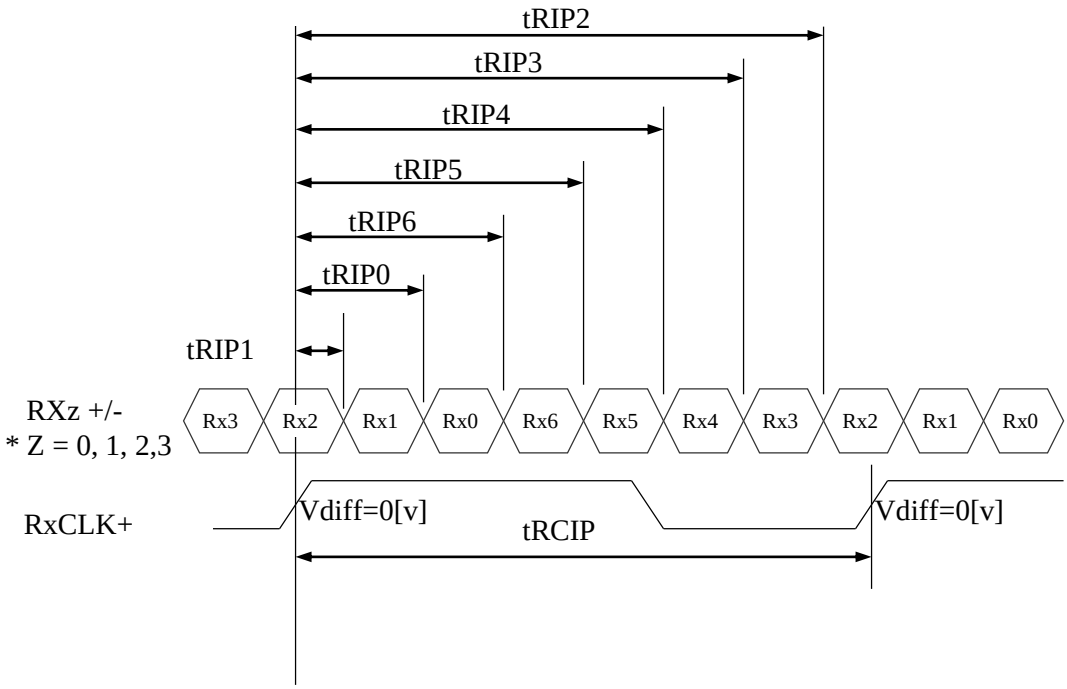
Item		Symbols	Min	Typ	Max	Unit
Clock	Frequency	1/Tc	61.93	74.32	92.90	MHz
	High Time	Tch	-	4/7 Tc	-	
	Low Time	Tcl	-	3/7 Tc	-	
Frame Period		Tv	1091	1125	1149	lines
			50	60	75	Hz
			20	16.67	13.33	ms
Vertical Display Period		Tvd	-	360	-	lines
One line Scanning Period		Th	1060	1100	1200	clocks
Horizontal Display Period		Thd	-	960	-	clocks
Modulating frequency of input clock during SSC		FLVMOD(F=85MHz,VIC=1.2V,VID=±200mV)	10	-	300	KHz
Maximum deviation of input clock during SSC		FLVDEV(F=85MHz,VIC=1.2V,VID=±200mV)	-3	-	+3	%

6.0. LVDS Rx Interface Timing Parameter

6.0.1 The specification of the LVDS Rx interface timing parameter is shown in Table 7

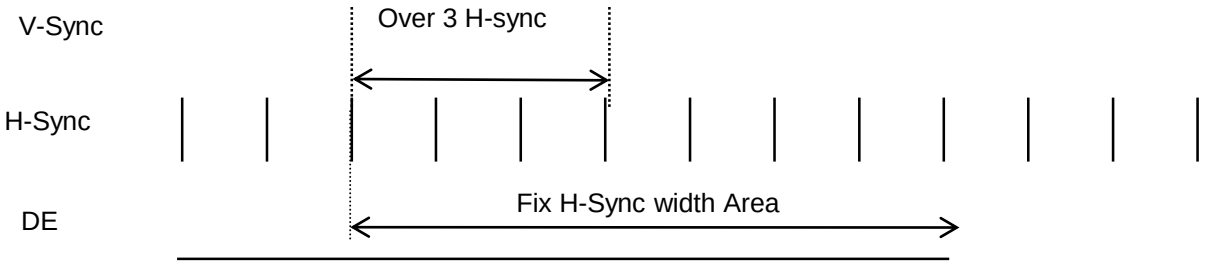
<Table 7. LVDS Rx Interface Timing Specification>

Item	Symbol	Min	Typ	Max	Unit	Remark
CLKIN Period	tRCIP	10.60	13.25	20.00	nsec	
Input Data 0	tRIP1	-0.4	0.0	+0.4	nsec	
Input Data 1	tRIP0	tRCIP/7-0.4	tRCIP/7	tRCIP/7+0.4	nsec	
Input Data 2	tRIP6	2 ×tRCIP/7-0.4	2 ×tRCIP/7	2 ×tRCIP/7+0.4	nsec	
Input Data 3	tRIP5	3 ×tRCIP/7-0.4	3 ×tRCIP/7	3 ×tRCIP/7+0.4	nsec	
Input Data 4	tRIP4	4 ×tRCIP/7-0.4	4 ×tRCIP/7	4 ×tRCIP/7+0.4	nsec	
Input Data 5	tRIP3	5 ×tRCIP/7-0.4	5 ×tRCIP/7	5 ×tRCIP/7+0.4	nsec	
Input Data 6	tRIP2	6 ×tRCIP/7-0.4	6 ×tRCIP/7	6 ×tRCIP/7+0.4	nsec	



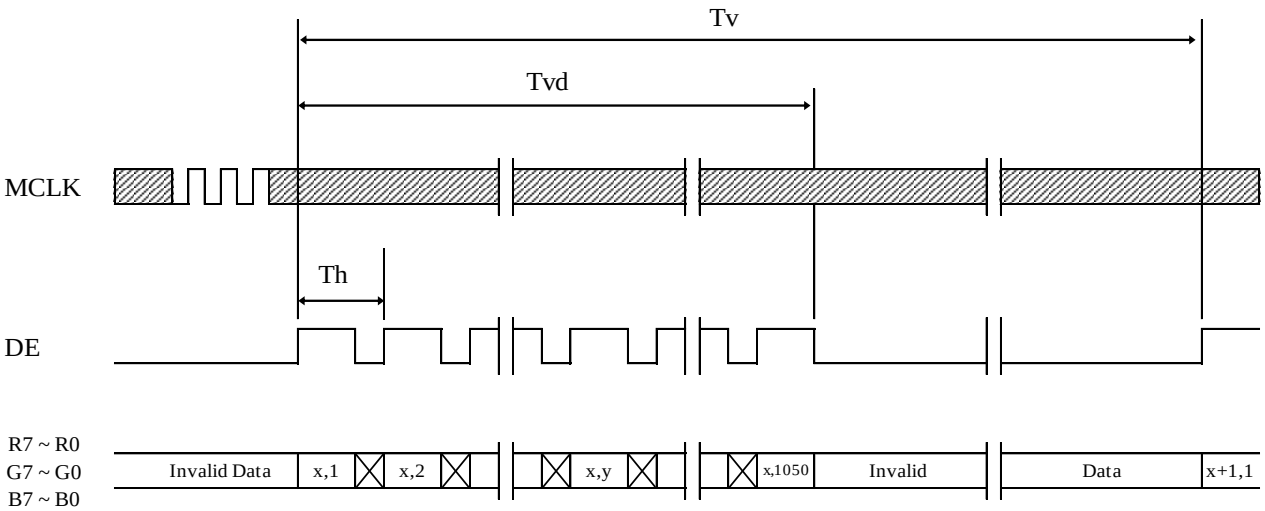
7.0 SIGNAL TIMING WAVEFORMS OF INTERFACE SIGNAL

7.0.1 Sync Timing Waveforms

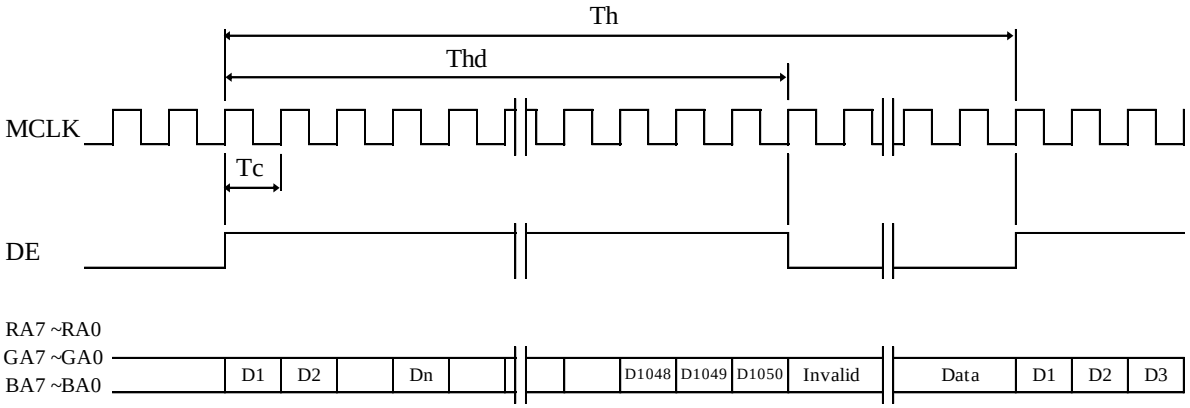


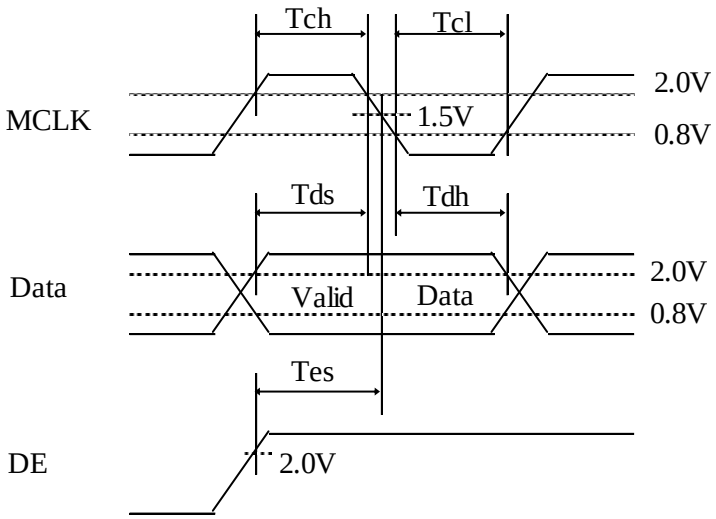
1) Need over 3 H-sync during V-Sync Low
2) Fix H-Sync width from V-Sync falling edge to first rising edge

7.0.2 Vertical Timing Waveforms



7.0.3 Horizontal Timing Waveforms



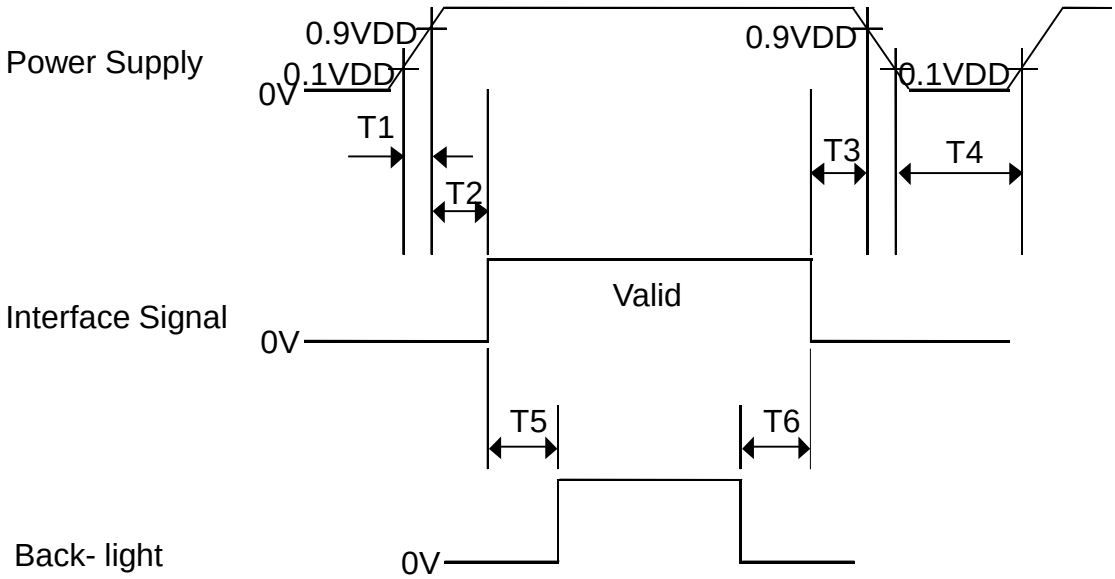


8.0 INPUT SIGNALS, BASIC DISPLAY COLORS & GRAY SCALE OF COLORS

Color & Gray Scale		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

9.0 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



Parameter	Values			Units
	Min	Typ	Max	
T1	0.5	-	10	ms
T2	0	-	50	ms
T3	0	-	50	ms
T4	1000	-	-	ms
T5	200	-	-	ms
T6	200	-	-	ms
T7	0.5	-	10	ms

10.0 OPTICAL SPECIFICATION

10.0.1 Overview

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 TOPCONE PR730) and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of θ and Φ equal to 0°. We refer to $\theta_{Ø=0}$ (=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 5.0V +/- 10% at 25°C. Optimum viewing angle direction is 6 'clock.

10.0.2 Optical Specifications

[VDD = 5.0V, Frame rate = 60Hz, Clock = 75.4MHz, I_{BL} = 128mA, Ta =25±2 ℃]

< Table 8. Module Optical >

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle range	Horizontal	Θ_3	CR > 10	85	89	-	Deg.	Note 1
		Θ_9		85	89	-	Deg.	
	Vertical	Θ_{12}		85	89	-	Deg.	
		Θ_6		85	89	-	Deg.	
Luminance Contrast ratio		CR	Θ = 0° (Center) Normal Viewing Angle	900	1200	-		Note 2
Luminance of White		Y_w		250	300	-	cd/m²	Note 3
White luminance uniformity		ΔY		75	80	-	%	Note 4
Reproduction of color	White	W_x		0.281	0.311	0.341	-	@BLU
		W_y		0.296	0.326	0.356		
	Red	R_x		0.624	0.654	0.684		
		R_y		0.299	0.329	0.359		
	Green	G_x		0.27	0.300	0.33		
		G_y		0.577	0.607	0.637		
	Blue	B_x		0.121	0.151	0.181		
		B_y		0.045	0.075	0.105		
Color Gamut				-	72	-	%	
Response Time	TR	Tr+Tf		-	30	35	ms	Note 5

Notes : 1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles 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 (see FIGURE 1).

2. Contrast measurements shall be made at viewing angle of Θ= 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) Luminance Contrast Ratio (CR) is defined mathematically.

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

3. Luminance of white is defined as luminance values of center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white. This measurement shall be taken at the locations shown in FIGURE 2 for a total of the measurements per display. The luminance is measured by CS2000/CA310 when the LED current is set at 60mA.

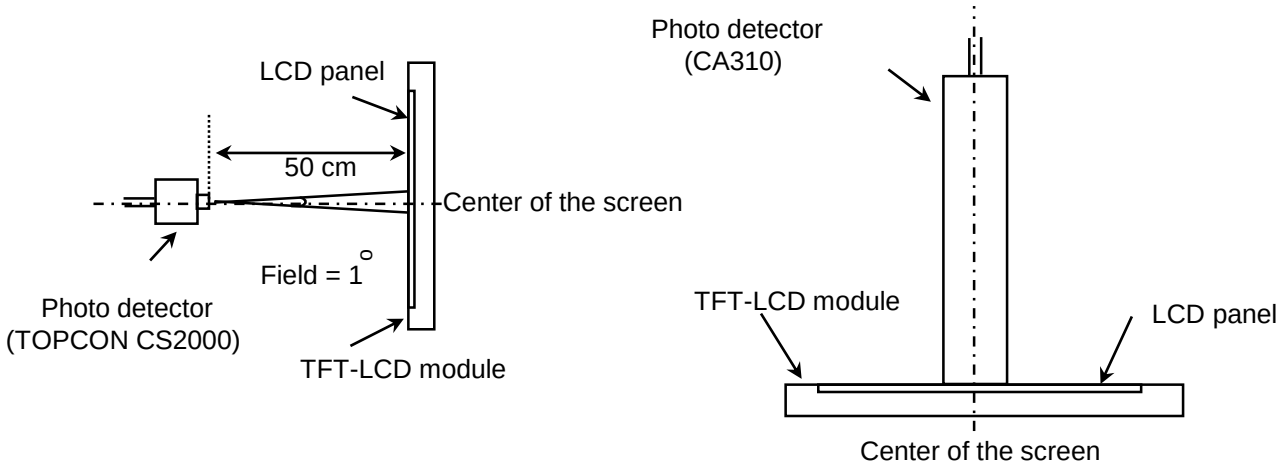
4. The White luminance uniformity on LCD surface is then expressed as : ΔY = Minimum Luminance of 9 points / Maximum Luminance of 9 points (See FIGURE 2).

5. The color chromaticity coordinates specified in Table 5. 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.

6. The electro-optical response time measurements shall be made as FIGURE 3 by switching the "data" input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is Tr, and 90% to 10% is Td.

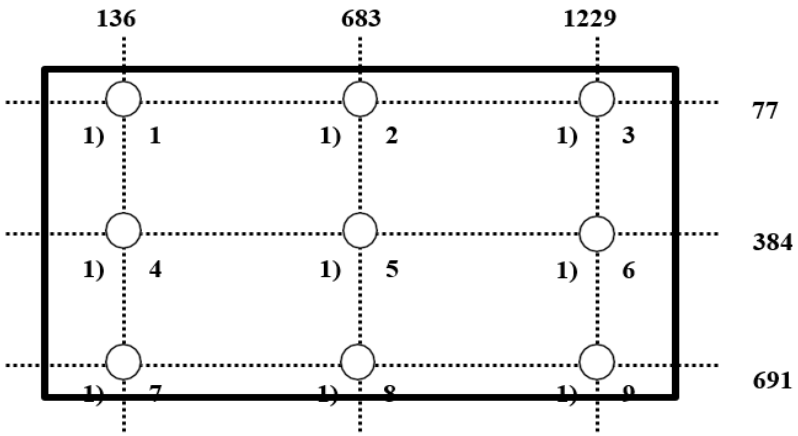
10.0.3Optical measurements

Figure 1. Measurement Set Up



View angel range, uniformity, etc. measurement setup Flicker, measurement setup

Figure 2. White Luminance and Uniformity Measurement Locations (9 points)



Luminance of white is defined as luminance values of center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white. This measurement shall be taken at the locations shown in FIGURE 2 for a total of the measurements per display.
The White luminance uniformity on LCD surface is then expressed as : ΔY9 = Minimum Luminance of 9 points / Maximum Luminance of 9points (see FIGURE 2).

Figure 3. Response Time Testing

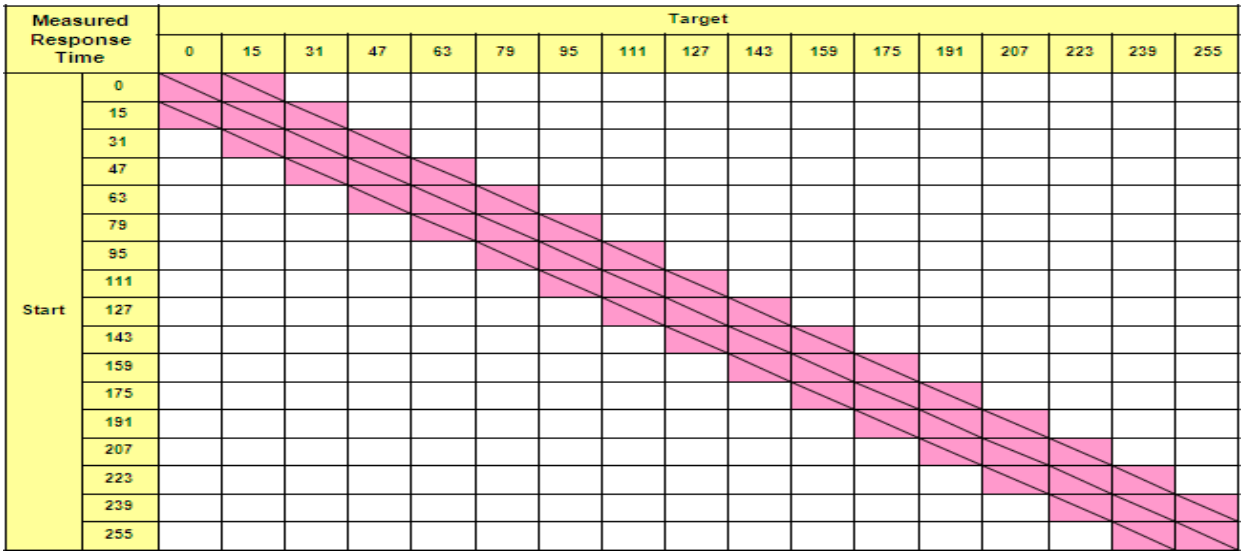
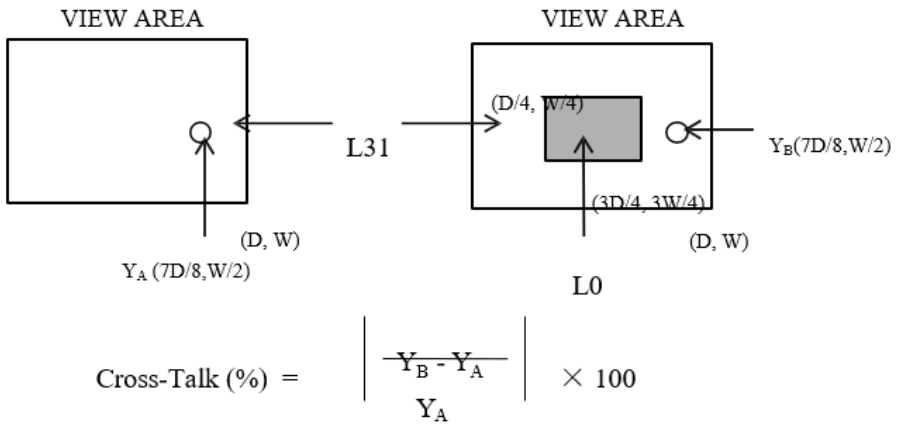


Figure 4. Cross Modulation Test Description



$$\text{Cross-Talk (\%)} = \left| \frac{Y_B - Y_A}{Y_A} \right| \times 100$$

Where: YA = Initial luminance of measured area (cd/m2)

YB = Subsequent luminance of measured area (cd/m2)

The location measured will be exactly the same in both patterns

11.0 MECHANICAL CHARACTERISTICS

11.0.1 Dimensional Requirements

<Table 9. Dimensional Parameters>

Parameter	Specification	Unit
Dimensional outline	491.5(H) × 109.5(V) × 8.4(B)	mm
Weight	780(typ.)	gram
Active area	476.64(H) × 89.37(V)	mm
Pixel pitch	0.24825(H) ×0.24825(V)	mm
Number of pixels	1920(H)×360(V) (1 pixel = R + G + B dots)	pixels
Back-light	Up edge side 1-LED Light bar Type	

11.0.2 Anti-Glare and Polarizer Hardness.

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

11.0.3 Light Leakage

There shall not be visible light from the back-lighting system around the edges of the screen as seen from a distance 50cm from the screen with an overhead light level of 350lux.

12.0 RELIABILITY TEST

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

<Table 10. Reliability test>

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	
4	High temperature operation test	Ta = 60 ℃, 240hrs	
5	Low temperature operation test	Ta = 0 ℃, 240hrs	
6	Thermal shock	Ta = -20 ℃ ↔ 60 ℃ (0.5 hr), 100 cycle	
7	Vibration test (non-operating)	Frequency Gravity / AMP Period	1 ~ 200 Hz, Sweep rate 30 min 1.47 G X, Y, Z 30 min
8	Shock test (non-operating)	Gravity	220G
		Pulse width	2msec, half sine wave
		Direction	± X, ± Y, ± Z Once for each
9	Electro-static discharge (non-operating)	Air : 150 pF, 330Ω, 15 KV Contact : 150 pF, 330Ω, 8 KV	

Note：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.

• 13.0 Precautions

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

• **13.1 Mounting Precautions**

• (1) Use fingerstalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.

• (2) You must mount a module using specified mounting holes (Details refer to the drawings).

• (3) Please make sure to avoid external forces applied to the Source PCB or FPC and D-IC during the process of handling or assembling. If not, It causes panel damage or malfunction.

• (4) Note that polarizers are very fragile and could be easily damaged. 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.

• (5) Do not pull or fold the source D-IC which connect the source PCB or FPC and the panel.

• Do not pull or fold the LED wire.

• (6) After removing the protective film, when the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with alcohol or purified water.

• Do not strong polar solvent because they cause chemical damage to the polarizer.

• (7) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.

• (8) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.

• (9) Since the LCD is made of glass, do not apply strong mechanical impact or static load onto it. Handling with care since shock, vibration, and careless handling may seriously affect the product. If it falls from a high place or receives a strong shock, the glass may be broken.

• (10) Do not disassemble the module.

• (11) To determine the optimum mounting angle, refer to the viewing angle range in the specification for each model.

• (12) If the customer's set presses the main parts of the LCD, the LCD may show the abnormal display. But this phenomenon does not mean the malfunction of the LCD and should be pressed by the way of mutual agreement.

• (13)Do not drop water or any chemicals onto the LCD’s surface.

13.2 Operating Precautions

- (1) 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.
- (2) 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.
- (3) The electrochemical reaction caused by DC voltage will lead to LCD degradation, so DC drive should be avoided.
- (4) 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 equipments to protect against static electricity.
- (5) 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.
- (6) Design the length of cable to connect between the connector for back-light and the converter as short as possible and the shorter cable shall be connected directly.
The longer cable between that of back-light and that of converter may cause the luminance of LED to lower and need a higher startup voltage(Vs).
- (7) Connectors are precise devices for connecting PCB and transmitting electrical signals. Operators should insert and unplug MDL in parallel when assembling MDL.
- (8) Do not connect or disconnect the cable to/ from the module at the "Power On" condition.
- (9) When the module is operating, do not lose CLK, ENAB signals. If any one these signals is lost, the LCD panel would be damaged.
- (10) Obey the supply voltage sequence. If wrong sequence is applied, the module would be damaged.
- (11) Do not re-adjust variable resistor or switch etc.
- (12) For the Q/Single/OC Product, If the LED designed side view, LED bar should be putted in the Long side ; Otherwise, its reliability and function may not be guaranteed.

13.3 Electrostatic Discharge Control

- (1) 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. And don't touch interface pin directly. Keep products as far away from static electricity as possible.
- (2) Avoid the use work clothing made of synthetic fibers. We recommend cotton clothing or other conductivity-treated fibers.

13.4 Precautions for Strong Light Exposure &High Temp& EMI

•It is not allowed to store or run directly in strong light or in high temperature and humidity for a long time; Strong light exposure causes degradation of polarizer and color filter.

•It is not allowed to store or run directly in High Temp & EMI condition for a long time;

13.5 Storage Precautions

When storing modules as spares for a long time, the following precautions are necessary.

•(1) 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.
Temperature : 5 ~ 40 ℃

•(2) Humidity : 35 ~ 75 %RH

•(3) Period : 6 months

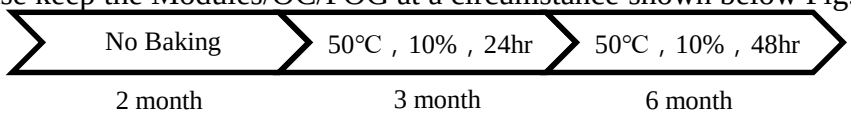
•(4) Control of ventilation and temperature is necessary.

•(5) Please make sure to protect the product from strong light exposure, water or moisture.
Be careful for condensation.

•(6) Store in a polyethylene bag with sealed so as not to enter fresh air outside in it.

•(7)Do not store the LCD near organic solvents or corrosive gasses.

•(8) Please keep the Modules/OC/FOG at a circumstance shown below Fig.



13.6 Precautions for Protection Film

• (1) Remove the protective film slowly, keeping the removing direction approximate 30-degree not vertical from panel 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.

• (2) In handling the LCD, wear non-charged material gloves. And the conducting wrist to the earth and the conducting shoes to the earth are necessary.

13.7 Appropriate Condition for Display

•(1) Normal operating condition
- Temperature: 0 ~ 40℃
- Operating Ambient Humidity : 10 ~ 90 %
- Display pattern: dynamic pattern (Real display)
-Suitable operating time: under 12 hours a day.（ Please contract BOE in advance for 7*24hrs or more than suggested Operating time&BOE does not recommend using static for a long timeframe ）

If the product will be used in extreme conditions such as high temperature, humidity, display patterns or 7*24hrs operation time etc.., It is strongly recommended to contact BOE for Application engineering advice. Otherwise, its reliability and function may not be guaranteed.

•(3)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) Please contract BOE in advance when you want to switch between portrait and landscape screen
- (6) Please contact BOE in advance for outdoor operation.
- (7) Please contact BOE in advance when you display the same pattern for a long time.
- (8) If the Module keeps displaying the same pattern for a long period of time, the image may be "sticked" to the screen. To avoid image sticking, it is recommended to use a screen saver or turn off.
- (9) 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.
- (10) Dew drop atmosphere should be avoided.
- (11) The storage room should be equipped with a good ventilation facility, which has a temperature controlling system.
- (12) When expose to drastic fluctuation of temperature (hot to cold or cold to hot ） ,the LCD may be affected; Specifically, drastic temperature fluctuation from cold to hot ,produces dew on the LCD's surface which may affect the operation of the polarizer and the LCD.
- (13) Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD may turn black at temperature above its operational range. However those phenomena do not mean malfunction or out of order with the LCD. The LCD will revert to normal operation once the temperature returns to the recommended temperature range for normal operation

13.8 Others

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.
- 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.

14.0 LABEL

(1) Product label

产品标签空白，所有内容打印添加，规格40mm*12mm

产品ID标签说明

① MODEL：FG-Code前11位

② Module ID条形码

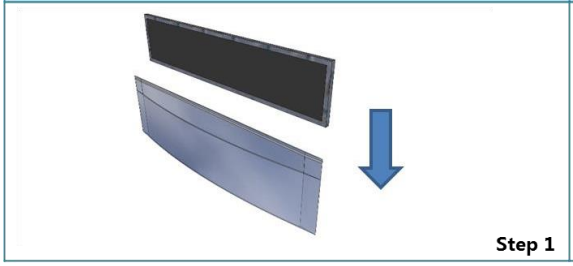
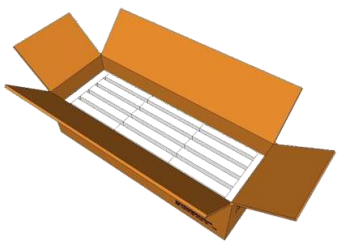
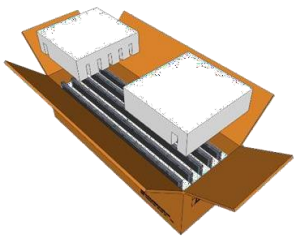
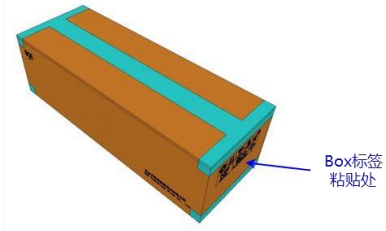
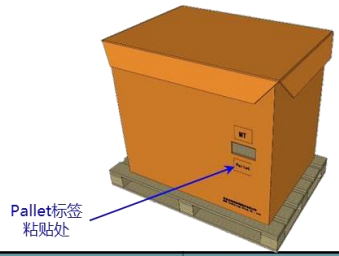
③ Module ID 17位

Module ID编码原则

Digit	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Code	1	9	A	3	2	2	4	D	8	5	1	W	7	0	0	0	1
Description	GBN代码→19		等级第一码	line B3	Year		Month 1~9, X、Y、Z	FG-CODE后四位 D851				创维工厂代码 W7		流水码 0000~9,A~F			

15.0 PACKING INFORMATION

15.0.1 Packing Order

将MDL放入防尘袋内，并用防尘袋自带双面胶封口。**产品PCB侧朝下，封口胶带置于产品金属背板侧。** 1 MDL/ Bag	将Bottom缓冲材放置于箱底，**放置方式详见Cushion Instructions。**
 Step 1	 Step 2
降装好防尘袋的产品竖直插入缓冲Bottom内。**产品PCB侧朝上。** 5 MDL/Inner Box	加盖缓冲Cover。
 Step 3	 Step 4
采用“H”形封箱方式，对Box进行封箱，并在Box的Mark处粘贴相应标签。 5 MDL/Inner Box	按如下图片所示对Inner Box进行码拍。 24 Inner Box/Pallet
 Step 5	 Step 6
套上Outer Box和Top Cover，用打包带打包，并粘贴相应标签。 120 MDL/Pallet	
 Step 7	

15.0 PACKING INFORMATION

15.2.0 Packing Note

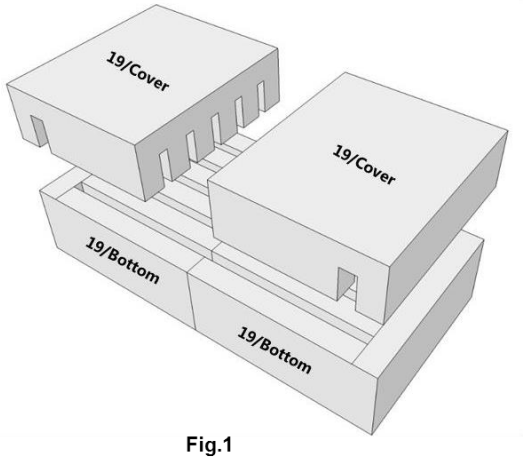
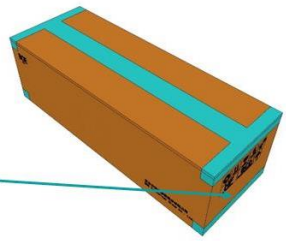


Fig.1

-. 盛装19FHD MDL
-. Bottom使用数量：2ea/Inner Box
-. Cover使用数量：2ea/Inner Box
-. 装配方式如Fig.1

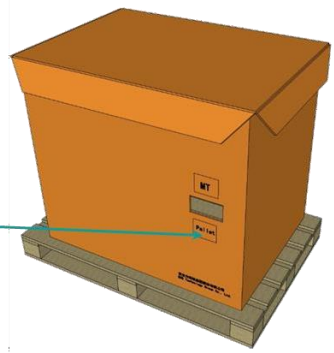
15.3.0 Box label

数量：1 Label/Box



Remark：标签粘贴时请按Box左侧Mark框的左上角为基准。

数量：1 Label/Pallet



16.0 MECHANICAL OUTLINE DIMENSION

Figure 5. TFT-LCD Module Outline Dimension (Front View)

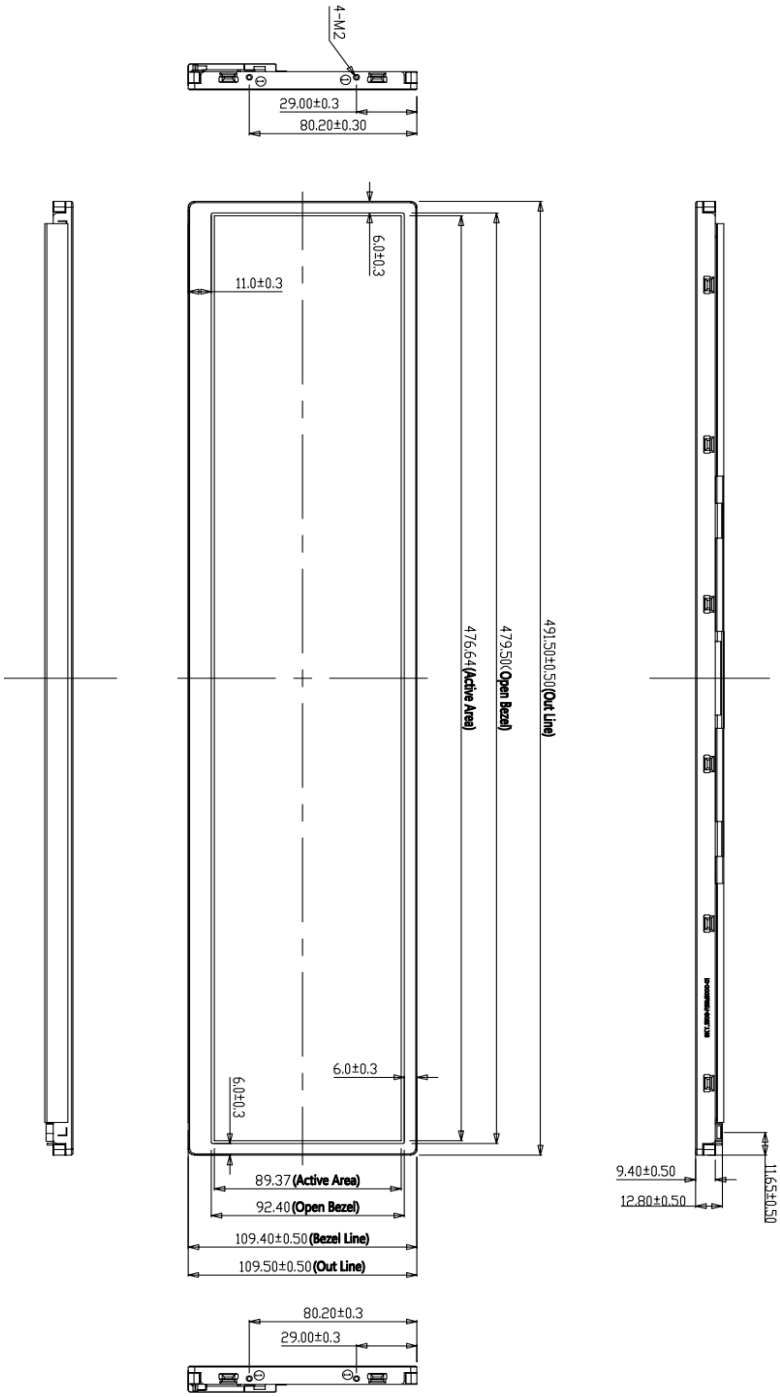


Figure 6. TFT-LCD Module Outline Dimensions (Rear view)