

DV471FBM-N10**Preliminary Product Specification****Rev.P0****FUZHOU BOE OPTOELECTRONICS TECHNOLOGY Co.,LTD**

REVISION HISTORY

(✓) preliminary specification

()Final specification

[illegible]

BOE	PRODUCT GROUP	REV	ISSUE DATE
	Customer SPEC	Rev. P0	2019/06/13

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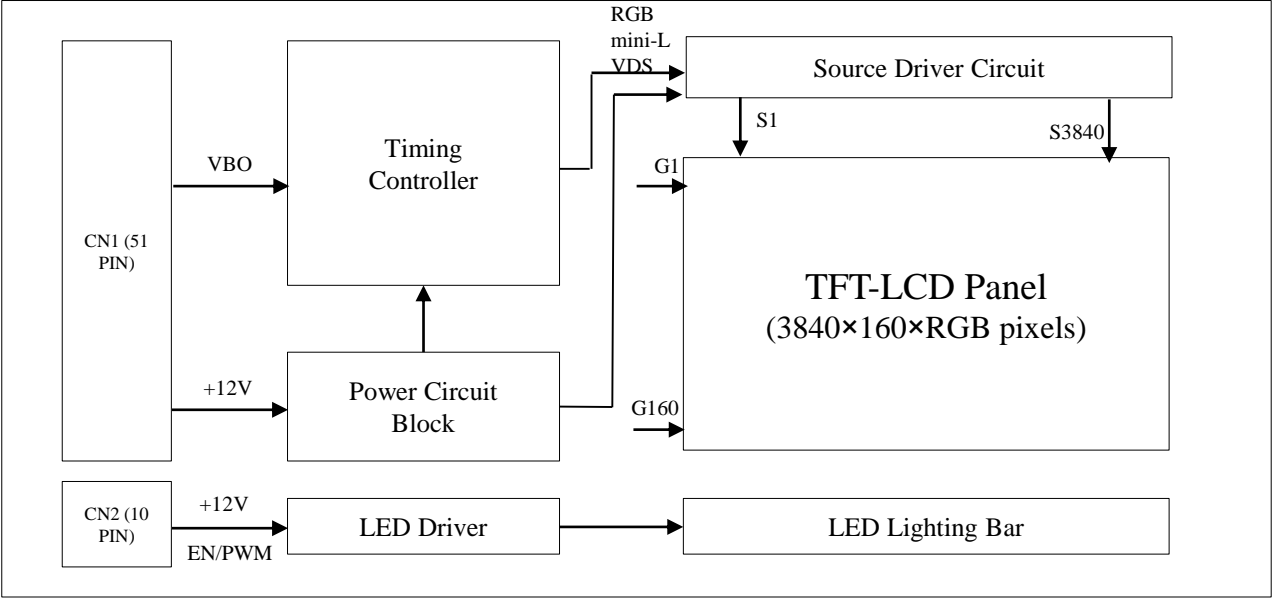
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1.0 GENERAL DESCRIPTION

1.1 Introduction

DV471FBM-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 47.1 inch diagonally measured active area with UHD resolutions (3840 horizontal by 160 vertical pixel array). Each pixel is divided into RED, BLUE ,GREEN,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

- V By One interface with 8 lanes
- High-speed response
- Low color shift image quality
- 8-bit color depth, display 16.7M colors
- Wide viewing angle
- DE (Data Enable) only mode
- ADS technology is applied for high display quality
- RoHS compliant

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1.3 Application

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

1.4 General Specification

< Table 1. General Specifications >

Parameter	Specification	Unit	Remarks
Active area	1196.16(H) × 49.84 (V)	mm	
Number of pixels	3840(H) × 160(V)	pixels	1Pixel=(R+G+B) Dot
Pixel pitch	311.5(H) × 311.5(V)	um	R/G:103.83, B:103.84
Pixel arrangement	Pixels RGB Vertical stripe		
Display colors	16.7M	colors	8bits True
Display mode	Normally Black		
Dimensional outline	1209(H)*62.9(V)*14.5(B)	mm	Detail refer to drawing
Weight	TBD	g	
Power Consumption	17W	Watt	Estimate: 6.5W for Panel, 10.5W for BLU
Bezel width (L/R/U/D)	5.4/5.4/5.2/6.8	mm	
Surface Treatment	Haze 25%		
Back-light	Horizontal arranged, 2-LED Lighting Bar type		

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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 >

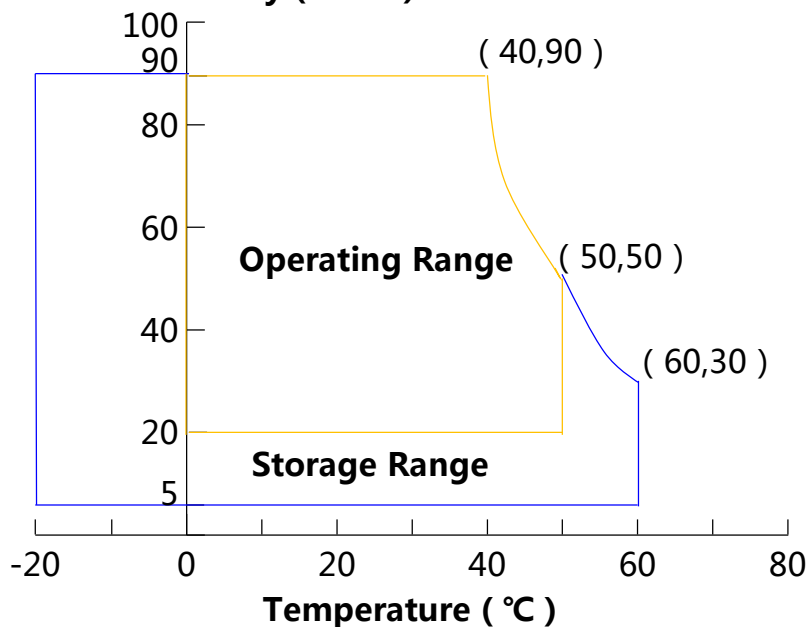
[VSS=GND=0V]

Parameter	Symbol	Min.	Max.	Unit	Remark
Power Supply Voltage	VDD	VSS-0.3	13.2	V	Ta = 25 °C
	VBL	VSS-0.3	13.2	V	
Operating Temperature	T _{OP}	0	+50	°C	Note 1
Storage Temperature	T _{SUR}	-20	+60	°C	
	T _{ST}	-20	+60	°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.

Relative Humidity (%RH)



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3.0 ELECTRICAL SPECIFICATIONS

3.1 TFT LCD Open Cell

< Table 3. Open Cell Electrical Specifications >

[Ta =25 ± 2 °C]

Parameter		Symbol	Values			Unit	Remark
			Min	Typ	Max		
Power Supply Input Voltage		VDD	10.8	12	13.2	Vdc	
Power Supply Ripple Voltage		VRP			300	mV	
Power Supply Current		IDD	-	542	1000	mA	Note 1, 以QE实测为准
Power Consumption		PDD		6.5	13.2	Watt	
Rush current		IRUSH	-		10	A	Note 2, 以QE实测为准
V-by-One Interface	Differential Input High Threshold Voltage	VLVTH	-	-	+50	mV	
	Differential Input Low Threshold Voltage	VLVTL	-50	-	-	mV	
CMOS Interface	Input High Threshold Voltage	VIH	2.0	-	3.3		
	Input Low Threshold Voltage	VIL	0	-	0.8	V	

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

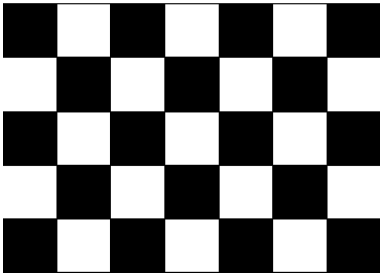
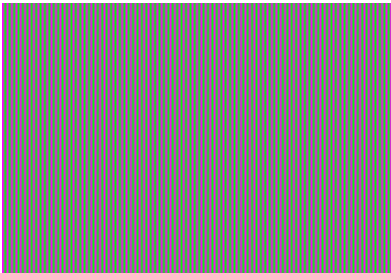
The current draw and power consumption specified is for VDD=12.0V,

Frame rate f_v=60Hz and Clock frequency = 74.25MHz.

Test Pattern of power supply current

a) Typ : 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)

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3.0 ELECTRICAL SPECIFICATIONS

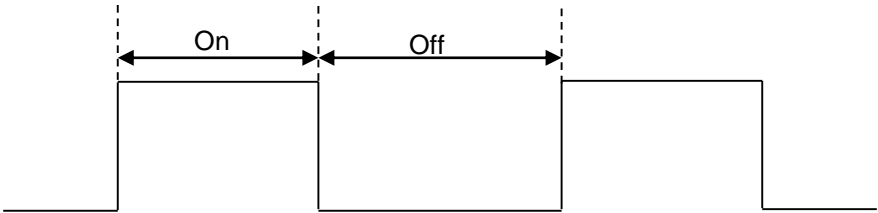
3.2 Backlight Unit Circuit

< Table 3. Backlight Unit Electrical Specifications > [Ta =25±2℃]

Parameter	Symbol	Values			Unit	Remark
		Min	Typ	Max		
Power Supply Input Voltage	VBL	10.8	12	13.2	Vdc	
Power Supply Ripple Voltage	VBLRP	-	-	600	mV	
Power Supply Current	IBL	-	0.875	-	A	
Power Consumption	PBL	-	10.5	11.2	Watt	Note 1, 以QE实测为准
Backlight On/Off Control Voltage	V BLON (off)	0	-	0.3	V	
	V BLON (on)	2.4	3.3	3.6	V	
Backlight PWM	High Level	2.4	3.3	3.6	V	On duty
	Low Level	0	-	0.3	V	Off duty
	PWM Frequency Duty		-	100	%	Note 2

Note 1:The specified current and power consumption are under the typical supply Input voltage, 12V. It is total power consumption.

Note 2 : PWM Duty = On/(On+Off) * 100 , the frequency of PWM is in the range of 20kHz to 22kHz.



3.3 Backlight Unit

< Table 4. LED Backlight Unit >

Parameter		Min.	Typ.	Max.	Unit	Remarks
LED Light Bar Input Voltage Per Input Pin	VPI N	39.2	42	44.8	V	Duty 100%
LED Light Bar Input Current Per Input Pin	IPIN	-	14		mA	Note1,2
LED Power Consumption	P _{BL}	-	10.5	11.2	W	Note 3
LED Life-Time	-	50,000	-		Hrs	Note 4

LED bar consists of 112LED packages,8strings(parallel)*a14pckages(serial)

Note1: There are two light bar ,and the specified current is input LED chip 100% duty current

Note2: The sense current of each input pin is 14mA

Note3: Power supply voltage12V for LED Driver, Driver efficiency 90%,

$$PBL=16Input\ pins*VPIN \times IPIN /0.9$$

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=14mA on condition of continuous operating at
25 ± 2 ℃

4.0 INTERFACE CONNECTION

4.1 V By One Connector : GT05S-51S-H38-E1500 or Equivalent

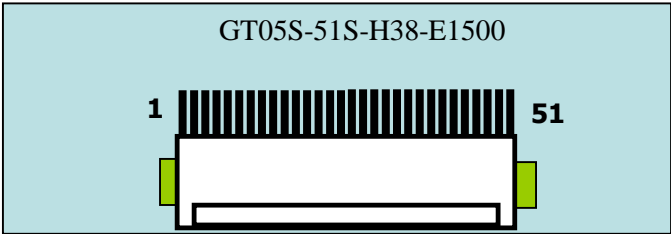
< Table 5. Open Cell Input Connector Pin Configuration >

Pin No	Description	Pin No	Description
1	VDD _12V	16	NC, For BOE Internal use
2	VDD _12V	17	NC, For BOE Internal use
3	VDD _12V	18	NC, For BOE Internal use
4	VDD _12V	19	NC, For BOE Internal use
5	VDD _12V	20	NC
6	VDD _12V	21	NC
7	VDD _12V	22	SEL-Section
8	VDD _12V	23	NC
9	NC	24	GND
10	GND	25	HTPDN
11	GND	26	LOCKN
12	GND	27	GND
13	GND	28	Rx0n
14	NC, For BOE Internal use	29	Rx0p
15	NC, For BOE Internal use	30	GND

Pin No	Description	Pin No	Description
31	Rx1n	42	GND
32	Rx1p	43	Rx5n
33	GND	44	Rx5p
34	Rx2n	45	GND
35	Rx2p	46	Rx6n
36	GND	47	Rx6p
37	Rx3n	48	GND
38	Rx3p	49	Rx7n
39	GND	50	Rx7p
40	Rx4n	51	GND
41	Rx4p		

Notes : 1. NC(Not Connected) : This pins are only used for BOE internal operations.
2. Input Level of V By One signal is based on the VESA Standard.

Rear view of LCM



BIST Pattern

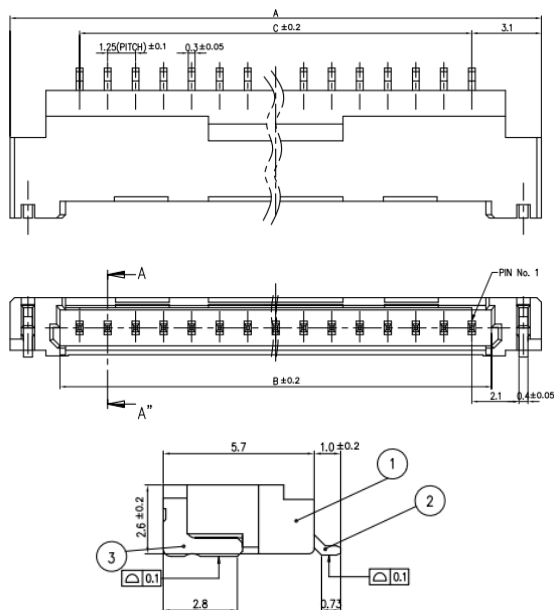


4.2 Backlight Unit Connector: 12507WR-H10L or Equivalent

< Table 6. Backlight Unit Connector >

Pin No	Symbol	Description
1	VIN	Power Supply, +12V
2	VIN	Power Supply, +12V
3	VIN	Power Supply, +12V
4	NC	No Connection
5	GND	Ground and Current Return
6	GND	Ground and Current Return
7	GND	Ground and Current Return
8	ENA	BLU On-Off control
9	EXT_DIM	PWM Control Signal
10	NC	No Connection

No. 10



No. 1

PARTS NO.	A	B	C
12507WR-H02L	7.45	3.00	1.25
✓12507WR-H03L	8.70	4.25	2.50
✓12507WR-H04L	9.95	5.50	3.75
✓12507WR-H05L	11.2	6.75	5.00
✓12507WR-H06L	12.45	8.0	6.25
✓12507WR-H07L	13.7	9.25	7.50
✓12507WR-H08L	14.95	10.5	8.75
✓12507WR-H09L	16.2	11.75	10.0
✓12507WR-H10L	17.45	13.0	11.25

5.0 SIGNAL TIMING SPECIFICATION

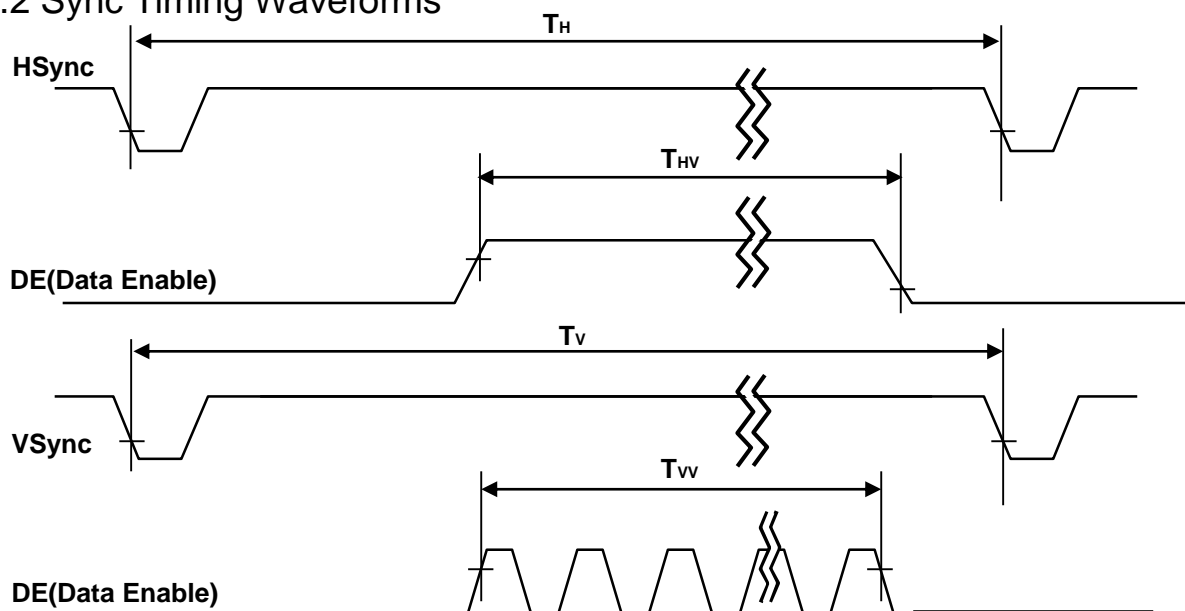
5.1 Timing Parameters (DE only mode)

< Table 7. Timing Table >

Item	Symbol		Min	Typ	Max	Unit	Note
CLK	Period	T_{CLK}	-	13.46	-	ns	Note
	Frequency	f_{clk}	69	74.25	77	MHz	
Horizontal Display Term	Active	T_{HV}	480			CLK	
	Blank	T_{HB}	50	70	90	CLK	
	Total	T_H	530	550	570	CLK	
Vertical Display Term	Active	T_{VV}	2160			lines	
	Blank	T_{VB}	20	90	290	lines	
	Total	T_V	2180	2250	2450	lines	
	Frame rate	f_V	57	60	62	Hz	

Note: This CLK frequency is for each V-by-One lane. There are 8 lanes for UHD resolution.

5.2 Sync Timing Waveforms

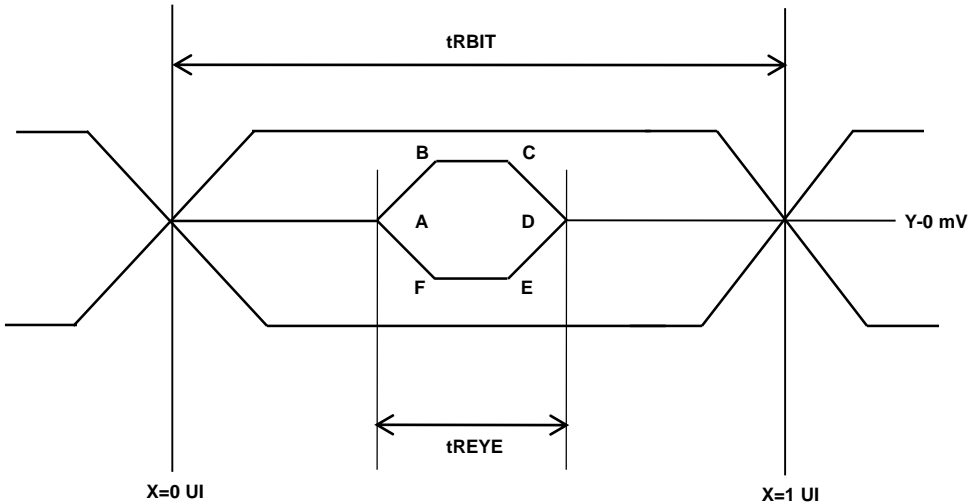


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5.3 V By One Input Signal Timing

<Table 8. V by One Input Signal Timing >

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Unit Interval(VBO Operation Bit Rate)	tRBIT	3-byte	392	tTCIP/30	1667	PS
		4-byte	294	tTCIP/40	1667	PS
Eye Width at Package Pin	tREYE	-	-	0.5	-	UI
Eye Width Position A at Package Pin	tA	-	-	0.25	-	UI
Eye Width Position B at Package Pin	tB	-	-	0.3	-	UI
Eye Width Position Cat Package Pin	tC	-	-	0.7	-	UI
Eye Width Position D at Package Pin	tD	-	-	0.75	-	UI
Eye Width Position E at Package Pin	tE	-	-	0.7	-	UI
Eye Width Position F at Package Pin	tF	-	-	0.3	-	UI
Intra – pair Skew	TTOSK_intra	-	-0.3	-	0.3	UI
Intra – pair Skew	TTOSK_inter	-	-5	-	5	UI



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

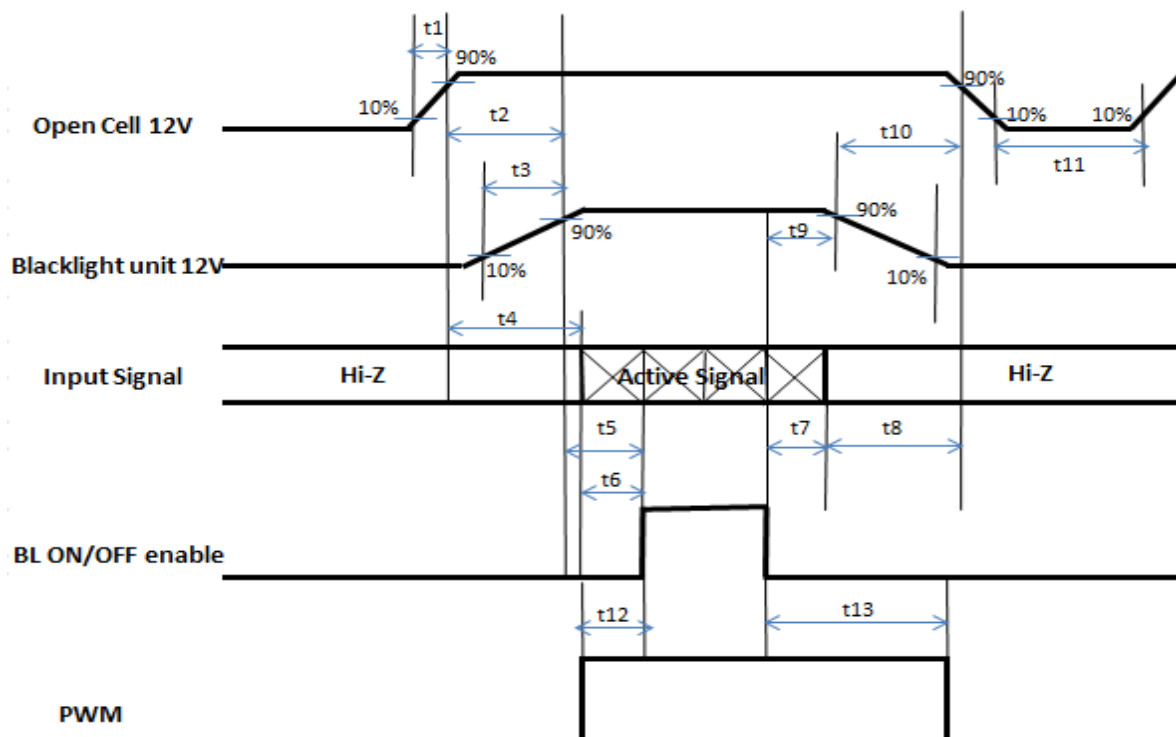
< Table 9. Input Signal and Display Color Table >

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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale of Green	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	▽	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
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	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	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

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5.5 Power Sequence

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



< Table 10. Sequence Table >

Parameter	Values			Units
	Min	Typ	Max	
T1	0.5	-	10	ms
T2	0	-	-	ms
T3	8	-	-	ms
T4	0	-	-	ms
T5	200	-	-	ms
T6	200	-	-	ms
T7	200	-	-	ms
T8	0	-	-	ms
T9	0.5	-	-	ms
T10	200	-	-	ms
T11	1	-	-	S
T12	50	-	-	ms
T13	0	-	-	ms

Note: Back Light must be turn on after power for logic and interface signal are valid.

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6.0 OPTICAL SPECIFICATIONS

The test of optical specifications shall be measured in a dark room (ambient luminance \leq 1 lux and temperature $=25\pm2^{\circ}\text{C}$) with the equipment of Luminance meter system (Goniometer system and PR730) and test unit shall be located at an approximate distance 180cm from the LCD surface at a viewing angle of θ and Φ equal to 0° . 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 θ and/or Φ , the center of the measuring spot on the Display surface shall stay fixed. The measurement shall be executed after 30 minutes warm-up period. VBL 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 $=25\pm2^{\circ}\text{C}$]

Parameter		Symbol	Condition	Min	Typ	Max	Unit	Remark
Viewing Angle	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.	
Brightness		Lv	$\Theta = 0^\circ$ (Center) Normal Viewing Angle	400	500	-	nit	
Contrast ratio		CR		700:1	1000:1	-		Note 2
White luminance uniformity		ΔY		75	-	-	%	Note 3
Reproduction of color	White	W_x		-0.03	0.313	+0.03		Note 4
		W_y						
	Red	R_x						
		R_y						
	Green	G_x						
		G_y						
	Blue	B_x						
		B_y						
Color Gamut				70	72		%	
Response Time	G to G	T _g					ms	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 White luminance uniformity on LCD surface is then expressed as :
 $\Delta Y = (\text{Minimum Luminance of 5 points} / \text{Maximum Luminance of 5 points}) * 100$
(See Figure 5 shown in Appendix).
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 2 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
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

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7.0 MECHANICAL CHARACTERISTICS

7.1 Dimensional Requirements

Figure 3(located in Appendix) shows mechanical outlines for the model DV471FBM-N10 . Other parameters are shown in Table 13.

< Table 13. Dimensional Parameters >

Parameter	Specification	Unit
Dimensional outline	1209(H)*62.9(V)*15(D)	mm
Weight	3260	gram
Active area	1196.16(H)*49.84(V)	mm
Pixel pitch	311.5(H) × 311.5(V)	um
Number of pixels	3840(H) × 160(V)(1 pixel = R + G + B dots)	pixels
Back-light	Horizontal arranged, 2-LED Lighting Bar type	

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.

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8.0 RELIABILITY TEST

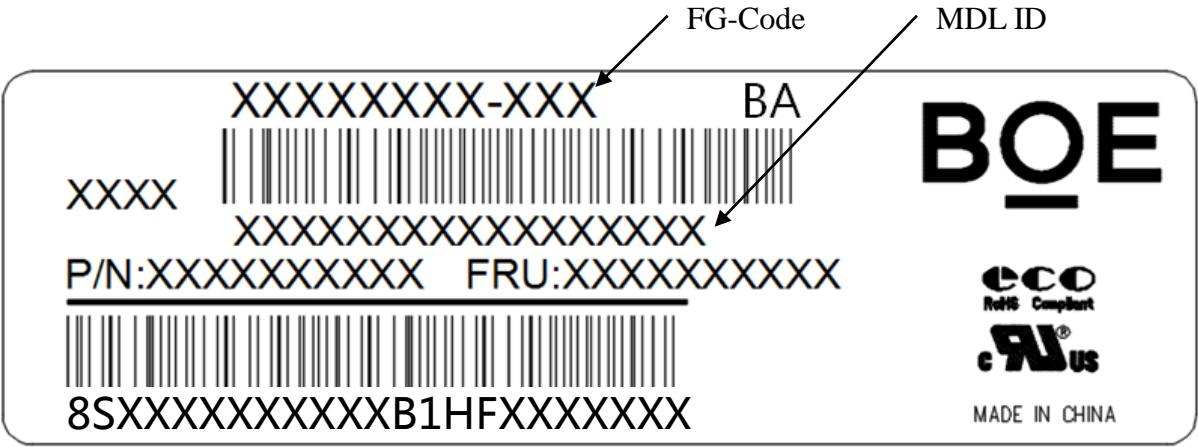
The Reliability test items and its conditions are shown in below.

< Table 14. Reliability Test Parameters >

Item	Test	Condition
1	High temperature storage test	60 °C , 240hours, Storage
2	Low temperature storage test	-20 °C , 240hours, Storage
3	High temperature operation test	60°C, 240hr, Operation
4	Low temperature operation test	-5°C, 240hr, Operation
5	High temperature and Humidity Operation	50°C, 80%, 240hr, Operation
6	Thermal shock	-20~60°C, per 30min, 100cycle, Storage
7	Vibration test	1.5Grms,10-300Hz, Random, +X +Y Sweep 30min
8	Shock test	Acceleration:50G Wave: Half-sine Active time: 11ms Direction: ± X, ± Y (one time for each Axis)
10	Altitude	1. 15000 ft, 0°C / 24 hr, 25°C / 24 hr, 50°C / 24 hr, operation 2. 40000 ft, 0°C / 24 hr, 25 °C / 24 hr, 50 °C / 24 hr, operation 3. 40000 ft, -10°C / 24 hr, 25°C / 24 hr, -10°C / 24 hr, storage

This test condition is based on BOE module.

9.0 PRODCUT SERIAL NUMBER



MDL ID Naming Rule:

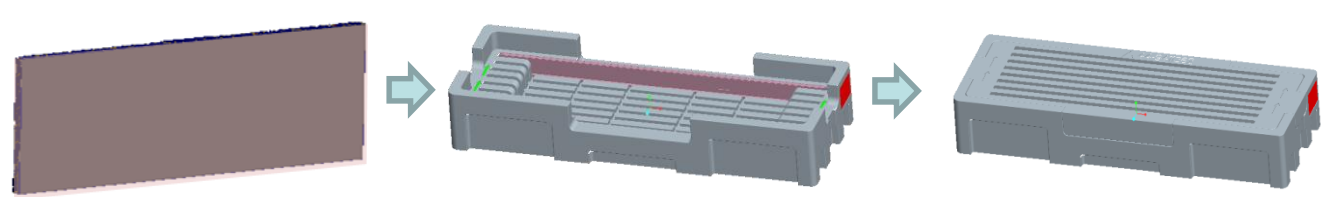
Digit	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Code	S	L	S	A	1	0	8	5	9	4	2	0	0	0	1	D	B
Description	Product Code/GBN→FG-CODE—对应		Grade	line	Year		Month	Model Extension Code (Last 4 Digits of FG-CODE)				Serial No. Hex-Decimal 000000-FFFFFF					

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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



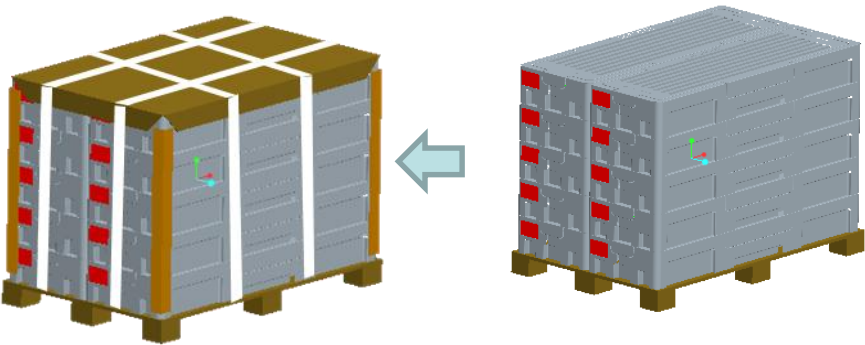
1. Put one MDL in the PE bag. (PCB↑)
2. Put 8pcs MDL in the EPS Box.
3. Put one EPS Cover.



厢车装载方式：双层码放

Pallet摆放方式：一横一竖

12m厢车装载量：3280pcs (41托)



5. Put 4ea Paper Conner and pack with wrap film, then put one Top Cover on the EPS Boxes (80ea MDLs per pallet) and Pack with 4 packing belts.
4. Put the boxes on the pallet (10ea boxes per pallet)

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10.2 Packing Note

- Box Dimension : 1354mm(L)×436mm(W)×177mm(H)
- Package Quantity in one Box : 8pcs

10.3 Box Label

- Label Size : 100mm (L) × 50mm (W)
 - Contents
 - Model : DV471FBM-N01-A930
 - Q`ty : Module 8 Q`ty in one box
 - Serial No. : Box Serial No.
 - Date : Packing Date

BOE

FUZHOU BOE OPTOELECTRONICS
TECHNOLOGY Co.,LTD

MODEL: XXXXXXXX-XXX



Q'TY: XXX

SERIAL NO: XXXXXXXXXXXXX

DATE: XXXX.XX.XX

Box ID 条形码

XXXXXXXXXXXX XXXX

打印内容，说明如下:

- ① FG-CODE
- ② 产品数量
- ③ Box ID, 编码规则如下
- ④ Box Packing 日期
- ⑤ 产品物料号(客户端)
- ⑥ FG-CODE 后四位

Digit Code	1	2	3	4	5	6	7	8	9	10	11	12	13
Code	X	X	X	X	1	6	3	D	0	0	1	A	1
Descripti on	Products G BN		Gra de	Line	Year		Mon th	Revisi on Code	Serial No.				

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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..

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<ul style="list-style-type: none"> • 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. 			
<h2>11.2 Operating Precautions</h2> <ul style="list-style-type: none"> • 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. 			
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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	<ul style="list-style-type: none"> • 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.

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11.6 Precautions for protection film

- 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.
- 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: $20\pm15^{\circ}\text{C}$
- Operating Ambient Humidity : $55\pm20\%$
- 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.

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- 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.
- Suitable operating time: under 20 hours a day.
 - Static information display recommended to use with moving image.
 - Cycling display between 5 minutes' information(static) display and 10 seconds' moving image.
 - Background and character (image) color change
 - Use different colors for background and character, respectively.
 - Change colors themselves periodically.
 - 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

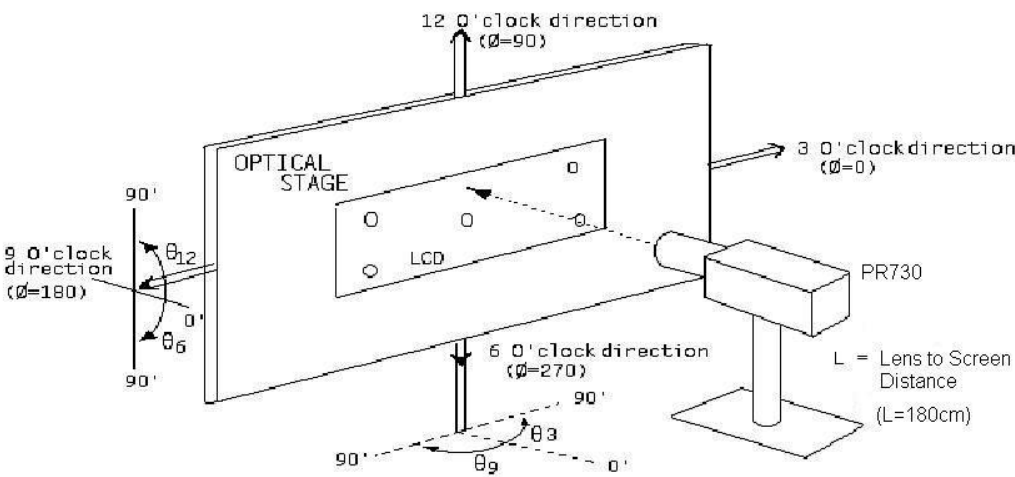
- When returning the module for repair or etc., Please pack the module not to be broken. We recommend to use the original shipping packages.

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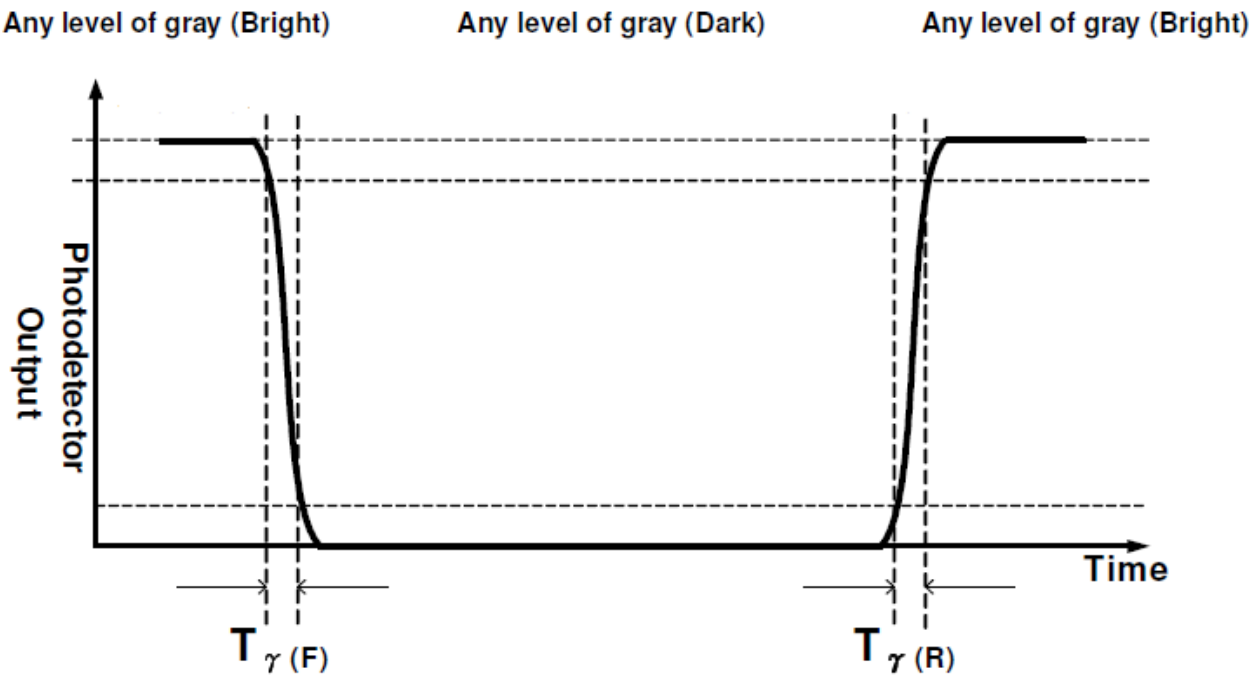
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12.0 APPENDIX

< Figure 1. Measurement Set Up >



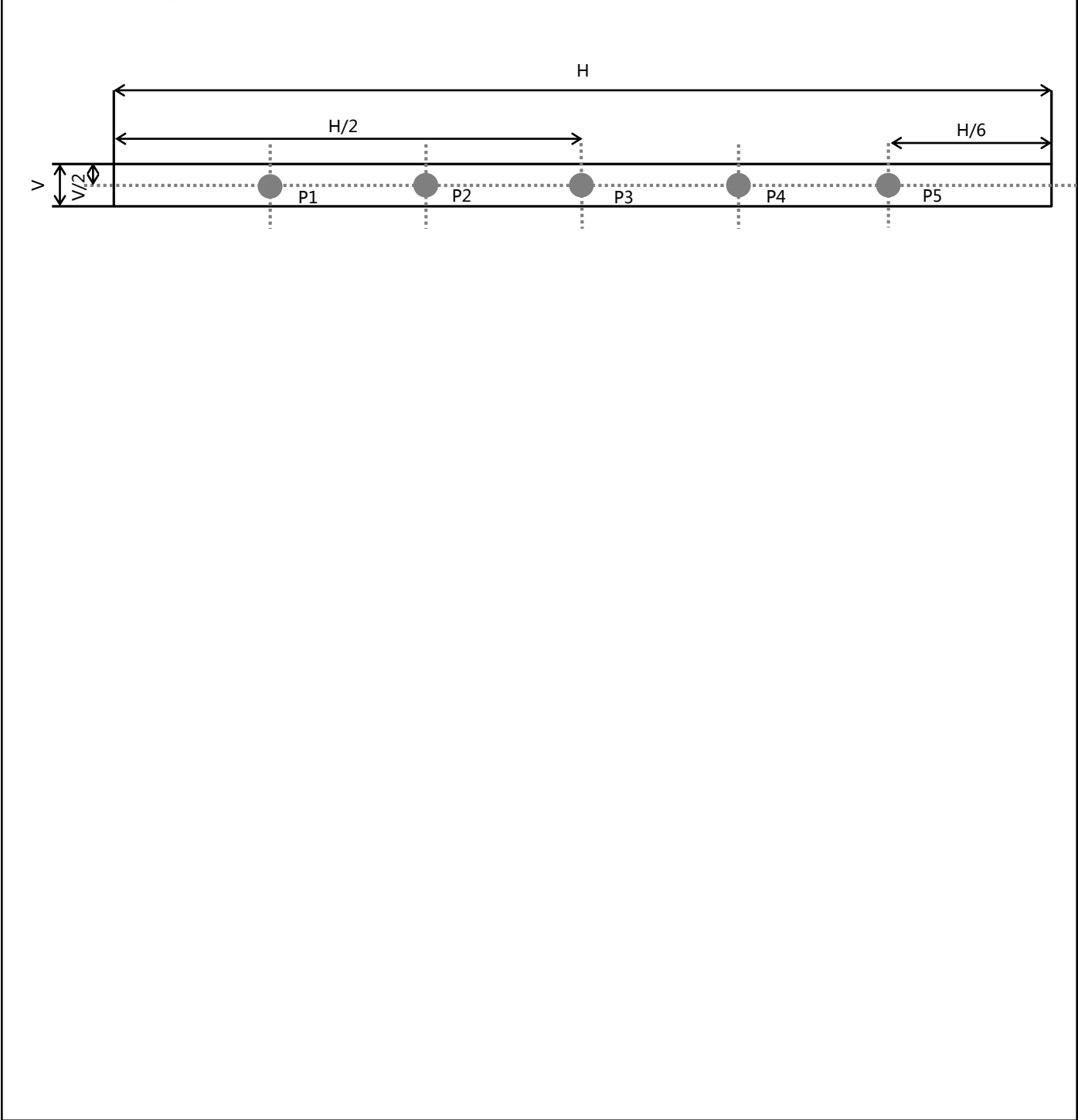
< Figure 2. Response Time Testing >



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Figure 3. White Luminance and Uniformity Measurement Locations (5 points)



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

