BOE

TITLE : NV126B5M-N41 V3.2

Customer: ASUS

Product Specification

Rev. P4

BOE Optoelectronics Technology Co., Ltd

REVISION HISTORY

(√)Preliminary Specification

( )Final Specification

Revision No.	Page	Description of Changes	Date	Prepared
P0	41	First Edition	2019.03.14	Li Bin
P1	41	1.Surface treatment:HC+AG40 2.Update LCM Curve Spec,3.Supplier code update	2019.05.20	Li Bin
P2	41	Correct LED structure& Led power input Current, EDID,	2019.06.28	Li Bin
P3	41	1.Correct Duty Ratio,Packing Order, Luminance Contrast Ratio 2.LCM lable Edition From V3.0 To V3.1	2019.07.09	Li Bin
P4	41	1. Increase Insulating Tape To Protect FPC 2. Increase The Opening Of Cell Tape Copper Foil By 1 mm , version V3.1To V3.2	2019.9.26	Li Bin

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Contents

1.0 GENERAL DESCRIPTION

1.1 Introduction

NV126B5M-N41 V3.2 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 12.61inch diagonally measured active area with FHD resolutions (1920 horizontal by 515 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(8bit) colors and color gamut 45% NTSC.The TFT-LCD panel used for this module is a low reflection and higher color type. Therefore, this module is suitable for Notebook Touch bar. The LED driver for back-light driving is built in this model.
All input signals are eDP1.2 interface compatible.

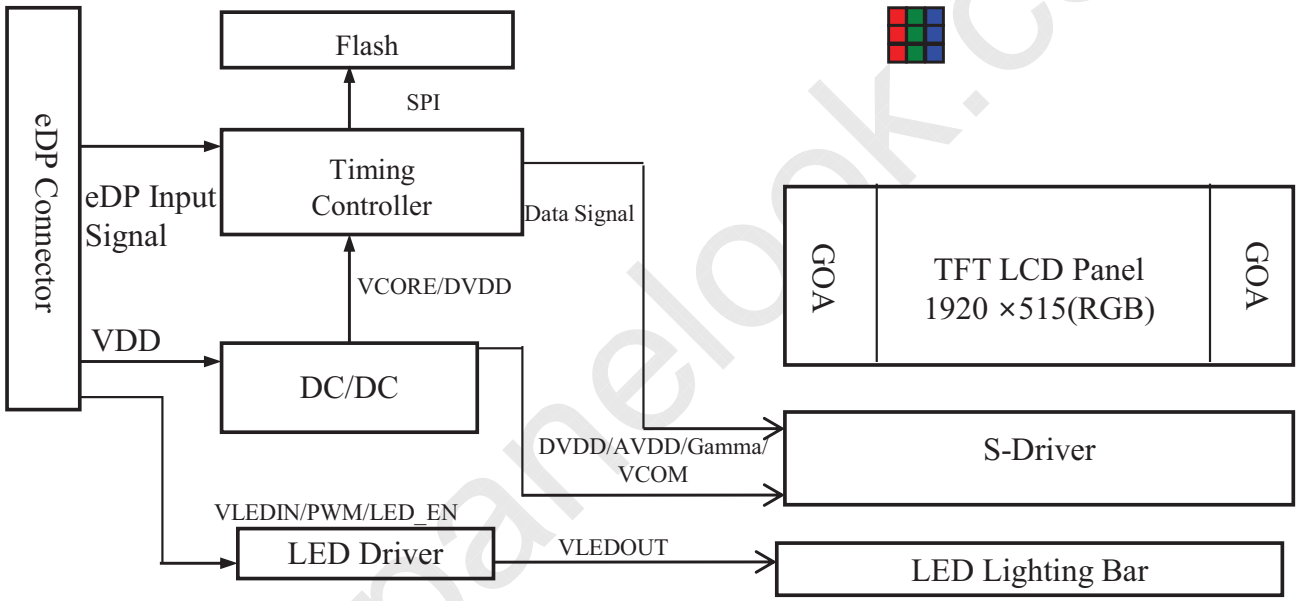


Figure 1. Drive Architecture

1.2 Features

- 2 lane eDP interface with 2.7Gbps link rates
- Thin and light weight
- 16.7M(8bit) color depth, color gamut 45% NTSC.
- Single LED lighting bar (Bottom side/Horizontal Direction)
- Data enable signal mode
- Side mounting frame
- Green product (RoHS & Halogen free product)
- On board LED driving circuit
- Low driving voltage and low power consumption
- On board EDID chip
- DPCD Version 1.4
- Function：SDRRS(on) / CABC(on)
- Edp:1.2

1.0 GENERAL DESCRIPTION

1.3 Application

- Notebook Touch bar (Wide type)

1.4 General Specification

The followings are general specifications at the model NV126B5M-N41 V3.2. (listed in Table 1)

<Table 1. General Specifications>

Parameter	Specification	Unit	Remarks
Active area	309.312(H)×82.9665(V)	mm	
Number of pixels	1920 (H) ×515 (V)	pixels	
Pixel pitch	0.0537 (H) ×0.1611 (V)	mm	
Pixel arrangement	RGB Vertical stripe		
Display colors	16.7M (8Bit)		
Color gamut	45% NTSC (typ.)		
Display mode	Normally Black		
Dimensional outline	315.61±0.3x94.02±0.5	mm	
Weight	175(max)	g	
Surface treatment	HC + AG40		
Surface hardness	3H		
Back-light	Down edge side, 1-LED lighting bar type		Note 1
Power consumption	P_D : 0.5(Max.)	W	@Mosaic
	P_{BL} : 1.5(Max.)	W	
	P_{Total} : 2.0(Max.)	W	@Mosaic

Notes : 1. LED Lighting Bar (48*LED Array)

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>

Ta=25+/-2°C

Parameter	Symbol	Min.	Max.	Unit	Remarks
Power Supply Voltage	V_{DD}	-0.3	4.0	V	Note 1
eDP input Voltage	V_{eDP}	0	1.2	V	
Logic Supply Voltage	V_{IN}	V_{SS}-0.3	V_{DD}+0.3	V	
Operating Temperature	T_{OP}	0	+60	°C	Note 2
Storage Temperature	T_{ST}	-20	+65	°C	

Notes :
1. Permanent damage to the device may occur if maximum values are exceeded functional operation should be restricted to the condition described under normal operating conditions.
2. Temperature and relative humidity range are shown in the figure below.
95 % RH Max. (40 °C ≥ Ta) Maximum wet - bulb temperature at 39 °C or less. (Ta > 40 °C) No condensation.

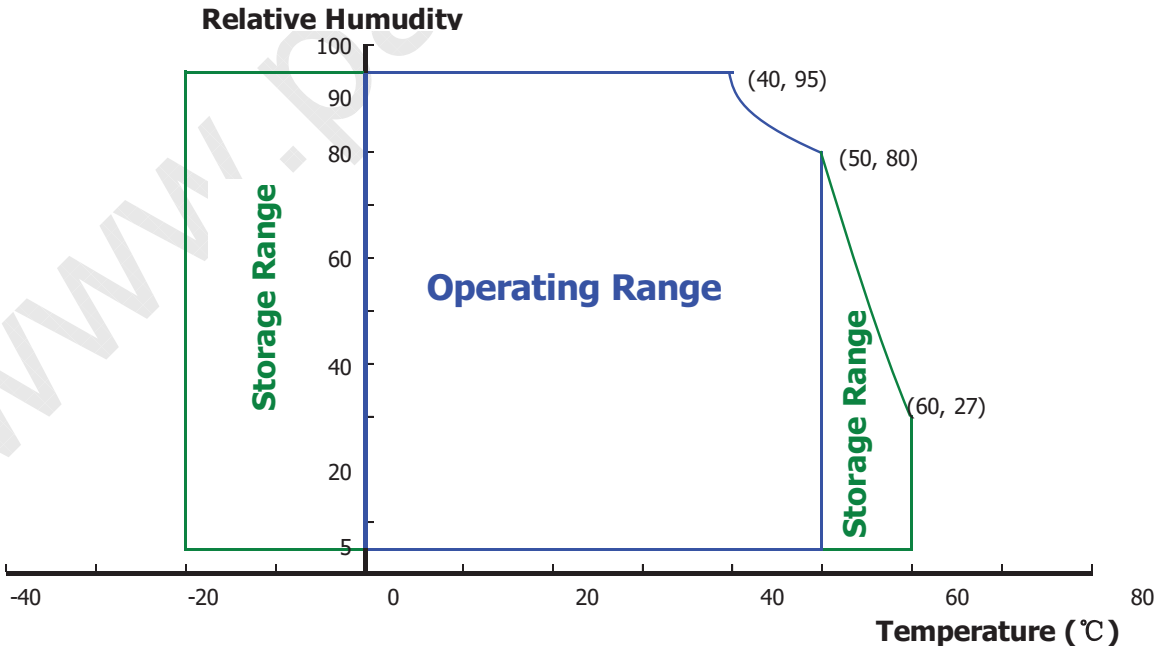


Figure 2. Temperature and Relative Humidity Range

3.0 ELECTRICAL SPECIFICATIONS

3.1 Electrical Specifications

< Table 3. Electrical Specifications > Ta=25+/-2°C

Parameter			Min.	Typ.	Max.	Unit	Remarks
Power Supply Voltage		V_{DD}	3.0	3.3	3.6	V	Note 1
Permissible Input Ripple Voltage		V_{RF}	-	-	100	mV	@ V_{DD} = 3.3V
BIST Control Level		High Level	0.8 VDDIO	-	3.3	V	@V_{DDIO}=1.8 V
		Low Level	0	-	0.15 VDDIO	V	
Power Supply Inrush Current		Inrush	-	-	2	A	Note3
Power Supply Current	Mosaic	I_{DD}	-	136	152	mA	Note 1
	RGB		-	273	303	mA	
Power Consumption	Mosaic	P_M	-	-	0.5	W	
	RGB	P_{RGB}	-	-	1.0	W	
	BLU	P_{BL}	-	-	1.5	W	Note 2
	Total	P_{Total}	-	-	2.0	W	@Mosaic

3.0 ELECTRICAL SPECIFICATIONS

3.1 Electrical Specifications

Notes :

1. The supply voltage is measured and specified at the interface connector of LCM.
   The current draw and power consumption specified is for 3.3V at 25 °C.
   a) Mosaic pattern 8*4
   b) R/G/B patterns (maximum logic power consumption)

(a) (b)

Figure 3. Power Measure Patterns

2. Calculated value for reference (V_{LED} × I_{LED})
3. Measure condition (Figure 4)

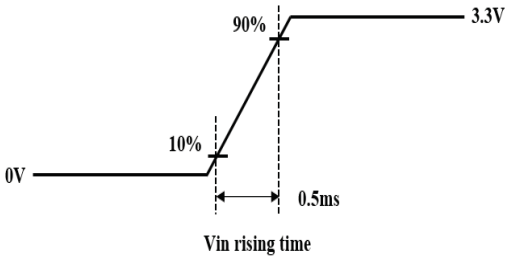


Figure 4. Inrush Measure Condition

3.0 ELECTRICAL SPECIFICATIONS

3.2 Backlight Unit

< Table 4. LED Driving Guideline Specifications > Ta=25+/-2°C

Parameter			Min.	Typ.	Max.	Unit	Remarks
LED Forward Voltage		V_F	-	-	2.9	V	
LED Forward Current		I_F	-	8.5	-	mA	
LED Power Input Voltage		VLED	5	12	21	V	
LED Power Input Current		I_{LED}	-	51	-	mA	Note 1
LED Power Consumption		P_{LED}	-	-	1.5	W	
Power Supply Voltage for LED Driver Inrush		V_{LED}	5	12	21	V	Note 3
LED Life-Time		N/A	15,000	-	-	Hour	I_F = 8.5mA Note 2
EN Control Level	Backlight On	V_{BL_EN}	1.8	2.5	5.0	V	
	Backlight Off		0	-	0.5	V	
PWM Control Level	High Level	V_{BL_PWM}	1.8	2.5	5.0	V	
	Low Level		0	-	0.5	V	
PWM Control Frequency		F_{PWM}	200	-	2,000	Hz	
Duty Ratio			5	-	100	%	

Notes :
1. Power supply voltage12V for LED driver.
   Calculator value for reference IF × VF ×N/driver efficiency = PLED
2. The LED life-time define as the estimated time to 50% degradation of initial luminous.
3. Measure condition (Figure 5)

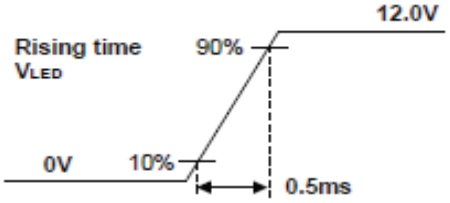


Figure 5. Inrush Measure Condition

3.0 ELECTRICAL SPECIFICATIONS

3.3 LED Structure

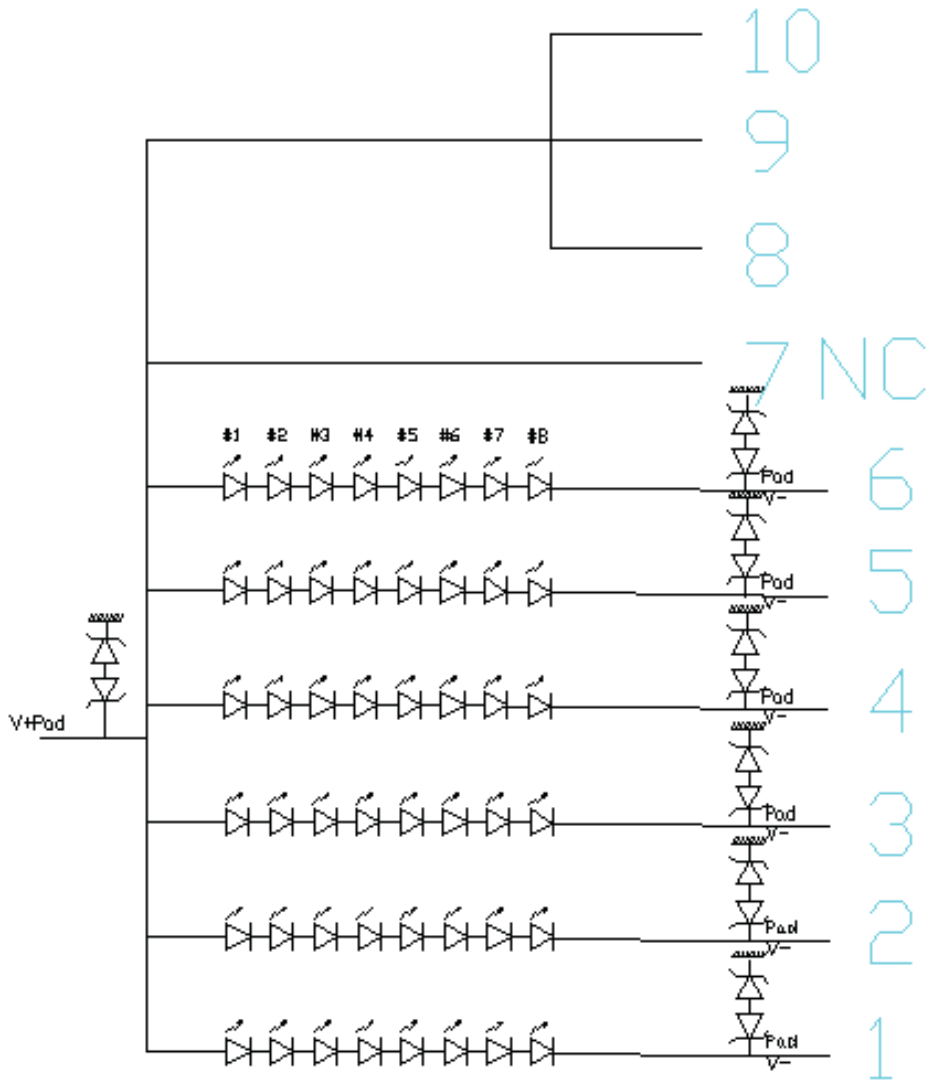


Figure 6. LED Structure

4.0 OPTICAL SPECIFICATION

4.1 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 TOP CON BM-5) 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 θØ=0 (=θ3) as the 3 o'clock direction (the "right"), θØ=90 (= θ12) as the 12 o'clock direction ("upward"), θØ=180 (= θ9) as the 9 o'clock direction ("left") and θØ=270(= θ6) as the 6 o'clock direction ("bottom"). While scanning θand/or Ø, the center of the measuring spot on the display surface shall stay fixed. The backlight should be operating for 30 minutes prior to measurement. VDD shall be 3.3+/- 0.3V at 25°C. Optimum viewing angle direction is 6 'clock.

4.2 Optical Specifications

<Table 5. Optical Specifications>

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle Range	Horizontal	Θ_3	CR > 10	80	85	89	Deg.	Note 1
		Θ_9		80	85	89	Deg.	
	Vertical	Θ_{12}		80	85	89	Deg.	
		Θ_6		80	85	89	Deg.	
Luminance Contrast Ratio		CR	Θ = 0°	1000	1200	-		Note 2
Luminance of White	5 Points	Y_w	Θ = 0° I_{LED} = 8.5mA	212.5	250	-	cd/m²	Note 3
White Luminance Uniformity	5 Points	ΔY5		80	-	-	%	Note 4
	13 Points	ΔY13		67	-	-	%	
White Chromaticity		W_x	Θ = 0°	0.278	0.308	0.338		Note 5
		W_y		0.292	0.322	0.352		
Reproduction of Color	Red	R_x	Θ = 0°	Typ.-0.03	0.574	Typ.+0.03		
		R_y			0.318			
	Green	G_x			0.34			
		G_y			0.553			
	Blue	B_x			0.157			
		B_y			0.096			
Color Gamut		NTSC		40	45		%	
Response Time (Rising + Falling)		T_{RT}	Ta= 25℃ Θ = 0°	-	30	35	ms	Note 6
Cross Talk		CT	Θ = 0°	-	-	2.0	%	Note 7

4.0 OPTICAL SPECIFICATION

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 7).

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 7) Luminance Contrast Ratio (CR) is defined mathematically.

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

3. Center Luminance of white is defined as luminance values of 5 point average across 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 8 for a total of the measurements per display.

4. The White luminance uniformity on LCD surface is then expressed as : ΔY =Minimum Luminance of 5(or 13) points / Maximum Luminance of 5(or 13) points.(see Figure 8 and Figure 9).

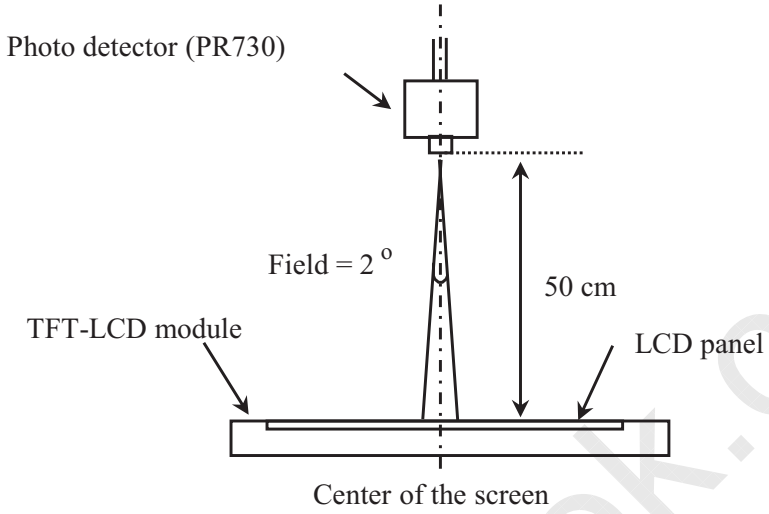
5. The color chromaticity coordinates specified in Table 5 shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel.

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

7. Cross-Talk of one area of the LCD surface by another shall be measured by comparing the luminance (YA) of a 25mm diameter area, with all display pixels set to a gray level, to the luminance (YB) of that same area when any adjacent area is driven dark. (See Figure 11).

4.0 OPTICAL SPECIFICATION

4.3 Optical Measurements



Optical characteristics measurement setup

Figure 7. Measurement Set Up

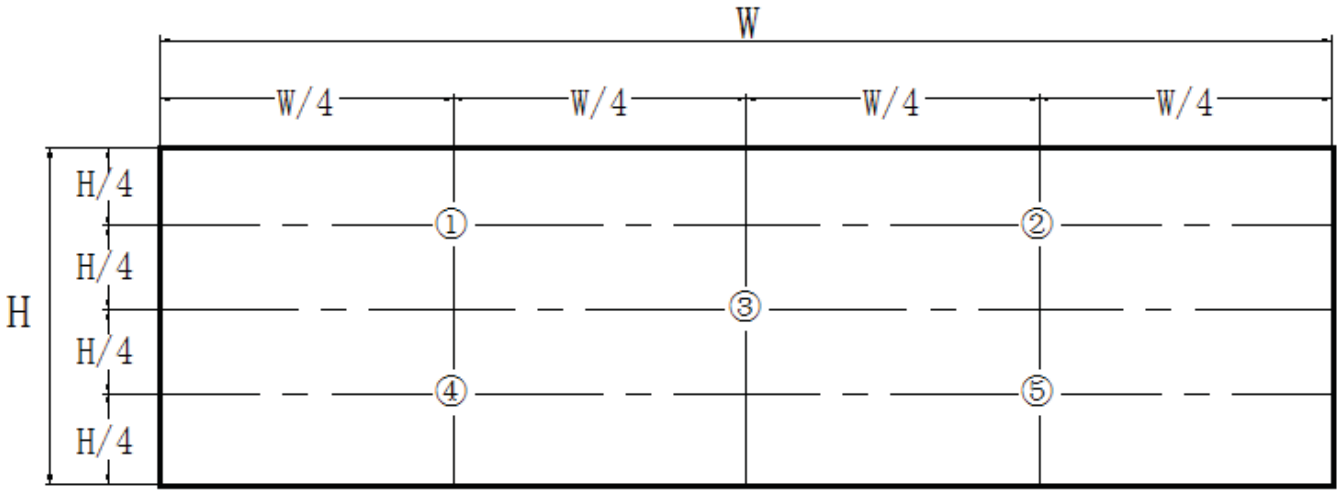


Figure 8. White Luminance and Uniformity Measurement Locations (5 points)

Center Luminance of white is defined as luminance values of center 5 points across 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 7 for a total of the measurements per display.

4.0 OPTICAL SPECIFICATION

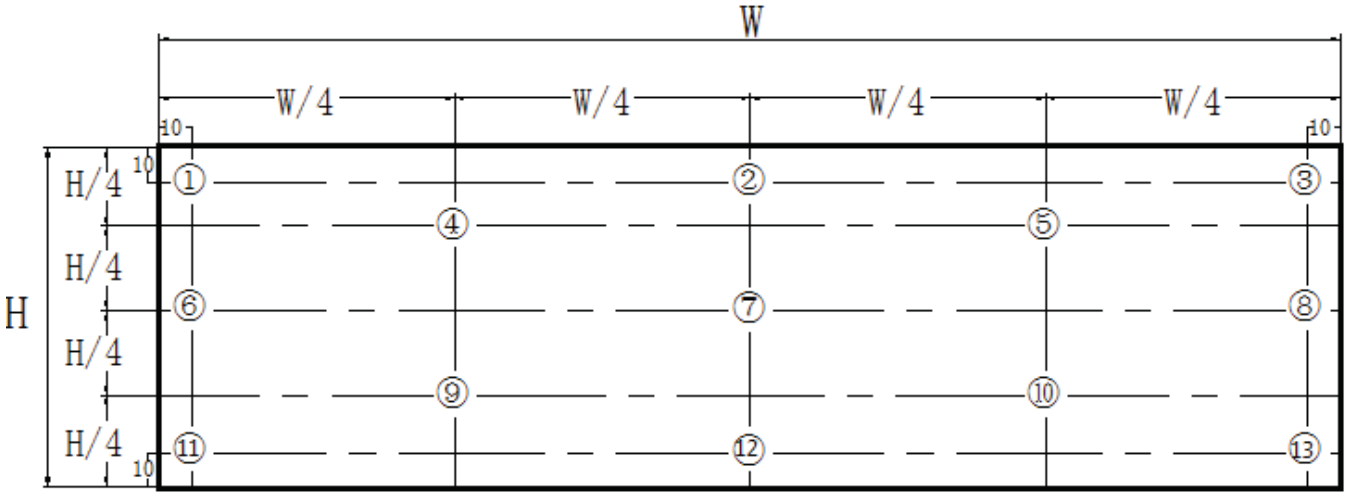


Figure 9. Uniformity Measurement Locations (13 points)

The White luminance uniformity on LCD surface is then expressed as : ΔY5 = Minimum Luminance of five points / Maximum Luminance of five points (see Figure 8) , ΔY13 = Minimum Luminance of 13 points /Maximum Luminance of 13 points (see Figure 9).

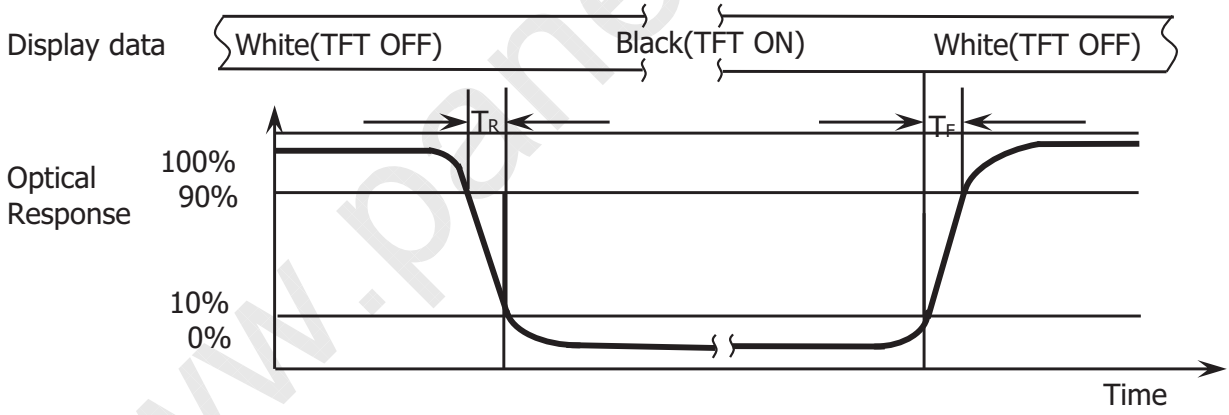
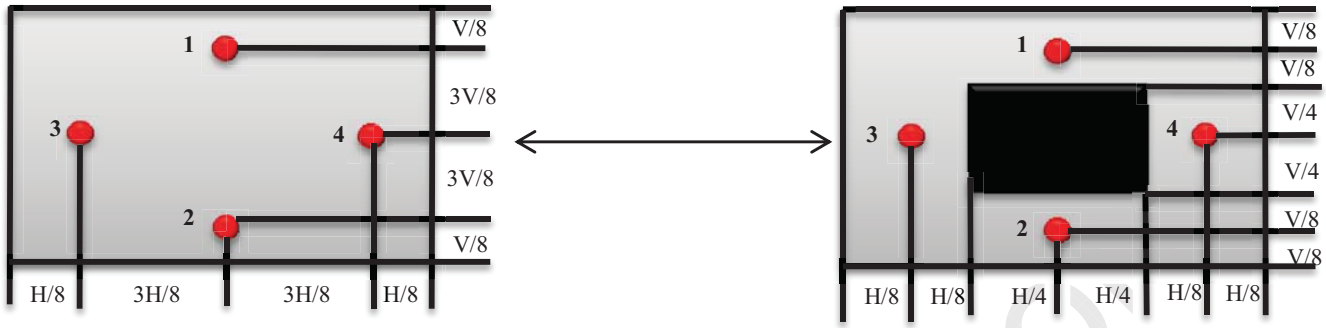


Figure 10. Response Time Testing

The electro-optical response time measurements shall be made as shown in Figure 10 by switching the "data" input signal ON and OFF. Tr: The luminance to change from 10% to 90% ,Tf: The luminance to change from 90% to 10% .

The test system : LMS PR810

4.0 OPTICAL SPECIFICATION



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

Figure 11. Cross Talk Modulation Test Description

Where:

Y_A = Initial luminance of measured area (cd/m^2)

Y_B = Subsequent luminance of measured area (cd/m^2)

The location 1/2/3/4 measured will be exactly the same in both patterns. The test background gray is from L64 to L192.Take the largest data as the result.

Cross Talk of one area of the LCD surface by another shall be measured by comparing the luminance (YA) of a 25mm diameter area, with all display pixels set to a gray level, to the luminance (YB) of that same area when any adjacent area is driven dark.(Refer to Figure 11)

The test system: PR730

5.0 INTERFACE CONNECTION

5.1 Electrical Interface Connection

The electronics interface connector is EDP type. The mating connector part number is I-PEX 20455-040E-66. The connector interface pin assignments are listed in Table 6.

<Table 6. Pin Assignments for the Interface Connector>

Terminal	Symbol	Functions
Pin No.	Symbol	Description
1	CABC	CABC EN PIN
2	H_GND	Ground
3	LANE1_N	eDP RX channel 1 negative
4	LANE1_P	eDP RX channel 1 positive
5	H_GND	Ground
6	LANE0_N	eDP RX channel 0 negative
7	LANE0_P	eDP RX channel 0 positive
8	H_GND	Ground
9	AUX_CH_P	eDP AUX CH positive
10	AUX_CH_N	eDP AUX CH negative
11	H_GND	Ground
12	LCD_VCC	Power Supply, 3.3V (typ.)
13	LCD_VCC	Power Supply, 3.3V (typ.)
14	LCD_Self_Test	Panel self test enable
15	H_GND	Ground
16	H_GND	Ground
17	ASUSD	Hot plug detect output
18	BL_GND	LED Ground
19	BL_GND	LED Ground
20	BL_GND	LED Ground
21	BL_GND	LED Ground
22	BL_ENABLE	LED enable pin(+3.3V Input)
23	BL_PWM	System PWM Signal Input
24	NC	No Connection
25	NC	No Connection
26	BL_POWER	LED Power Supply 5V-20V
27	BL_POWER	LED Power Supply 5V-20V
28	BL_POWER	LED Power Supply 5V-20V
29	BL_POWER	LED Power Supply 5V-20V
30	NC	No Connection

5.0 INTERFACE CONNECTION

5.1 Electrical Interface Connection

The electronics interface connector is LVDS type. The mating connector part number is I-PEX 20455-030E-66. The connector interface pin assignments are listed in Table 6.

<Table 6. Pin Assignments for the Interface Connector>

Terminal	Symbol	Functions
Pin No.	Symbol	Description
31	NC	NC
32	NC	NC
33	GND	Touch GND
34	VTSP(3.3V)	Touch Power Supply
35	VTSP(3.3V)	Touch Power Supply
36	TP_EN	
37	TP_CLK	Touch clock
38	TP_DATA	Touch data
39	TP_INT	
40	NC	

5.0 INTERFACE CONNECTION

5.2 eDP Interface

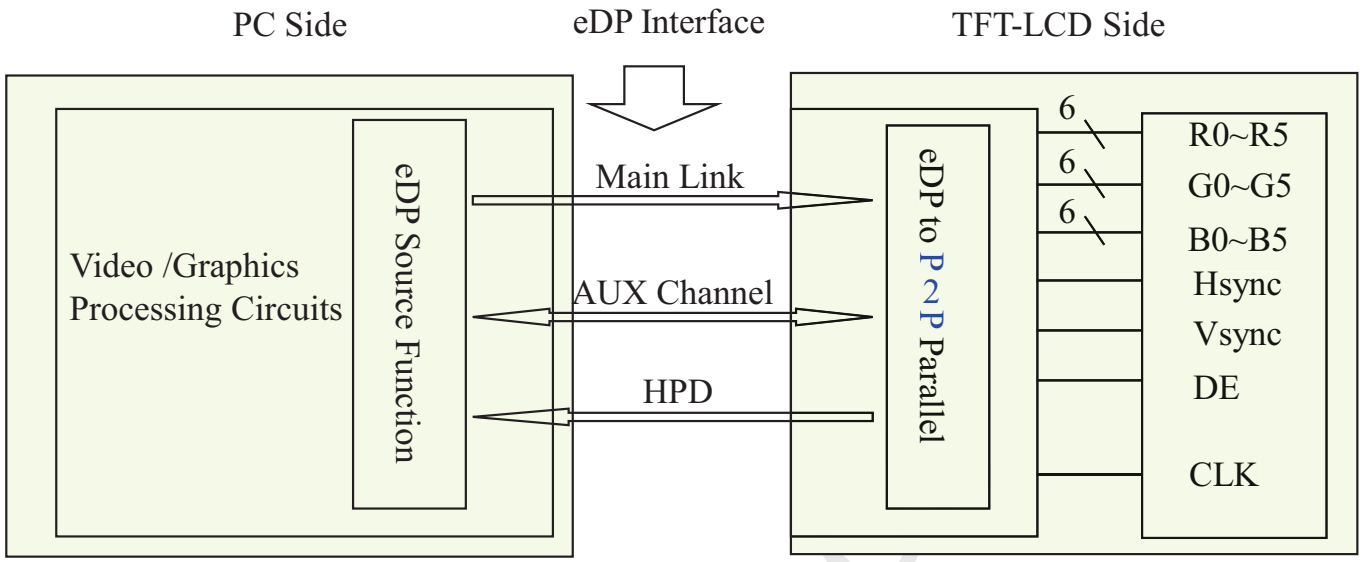


Figure 12. eDP Interface Architecture

Note:
Transmitter : NT71835or equivalent.
Transmitter is not contained in module.

5.0 INTERFACE CONNECTION

5.3 Data Input Format

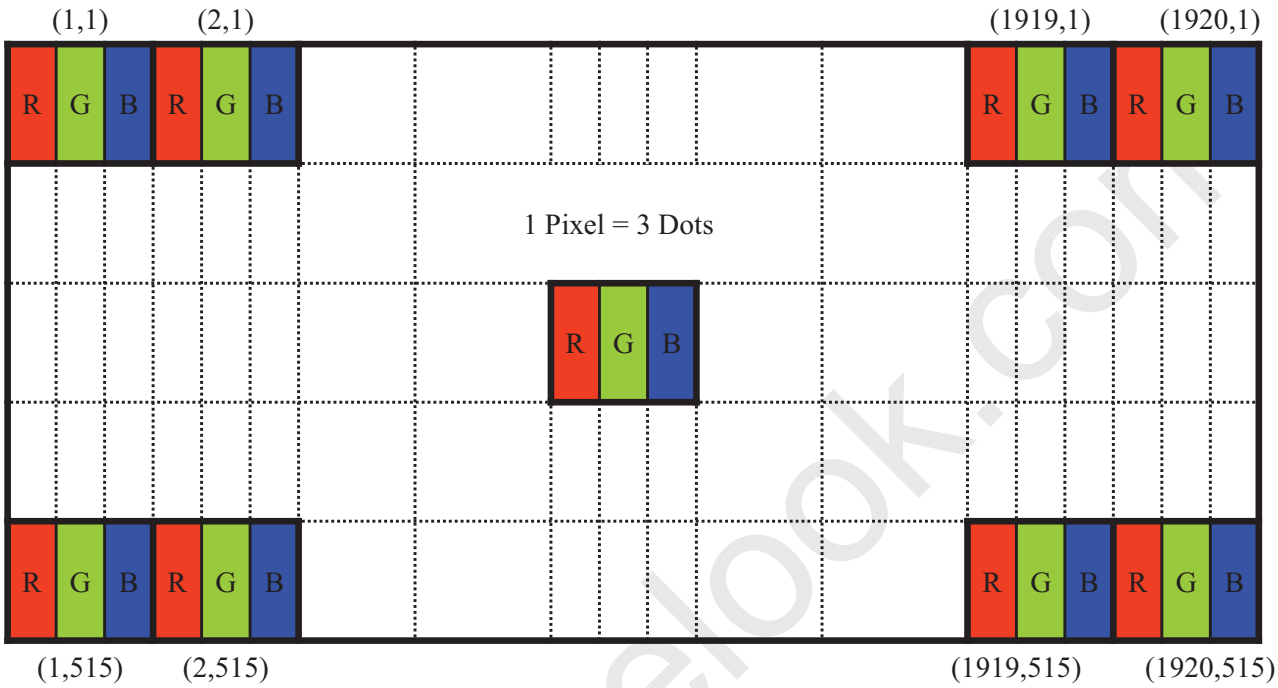


Figure 13. Display Position of Input Data (V-H)

5.0 INTERFACE CONNECTION

5.4 Back-light & LCM Interface Connection

BLU Interface Connector: STM MSK24022P10

<Table 7. Pin Assignments for the BLU Connector>

Pin No.	Symbol	Description	Pin No.	Symbol	Description
1	LED	LED cathode connection	6	LED	LED cathode connection
2	LED	LED cathode connection	7	NC	No Connection
3	LED	LED cathode connection	8	Vout	LED anode connection
4	LED	LED cathode connection	9	Vout	LED anode connection
5	LED	LED cathode connection	10	Vout	LED anode connection

6.0 SIGNAL TIMING SPECIFICATION

6.1 The NV126B5M-N41 V3.2 Is Operated By The DE Only

< Table 8. Signal Timing Specification >

Item		Symbols	Min	Typ	Max	Unit
Clock	Frequency	1/Tc	-	70.6	-	MHz
Frame Period		Tv	-	565	-	lines
			-	60	-	Hz
			-	16.67	-	ms
Vertical Display Period		Tvd	-	515	-	lines
One line Scanning Period		Th	-	2080	-	clocks
Horizontal Display Period		Thd	-	1920	-	clocks

Note : The above is as optimized setting.

6.0 SIGNAL TIMING SPECIFICATION

6.2 eDP Rx Interface Timing Parameter

The specification of the eDP Rx interface timing parameter is shown in Table 9.

<Table 9. eDP Main-Link RX TP4 Package Pin Parameters>

Item	Symbol	Min	Typ	Max	Unit	Remark
Spread spectrum clock (Link clock down-spreading)	ssc	-	-	0.5	%	
EYE width at package pins	VRX-EYE	0.38			UI	
Differential peak-to-peak input voltage at package pins	VRX-DIFFp-p	70	-	1200	mV	
Rx input DC common mode voltage	VRX_DC_CM	0	-	2	V	
Differential termination resistance	RRX-DIFF	80	-	100	Ω	
Single-ended termination resistance	RRX-SE	40	-	60	Ω	
Rx short circuit current limit	IRX_SHORT	-	-	20	mA	
Intra-pair skew at Rx package pins (HBR) RX intra-pair skew tolerance at HBR	LRX_SKEW_ INTRA_PAIR	-	-	60	ps	
AC Coupling Capacitor	CSOURCE_ML	75		200	nF	Source side

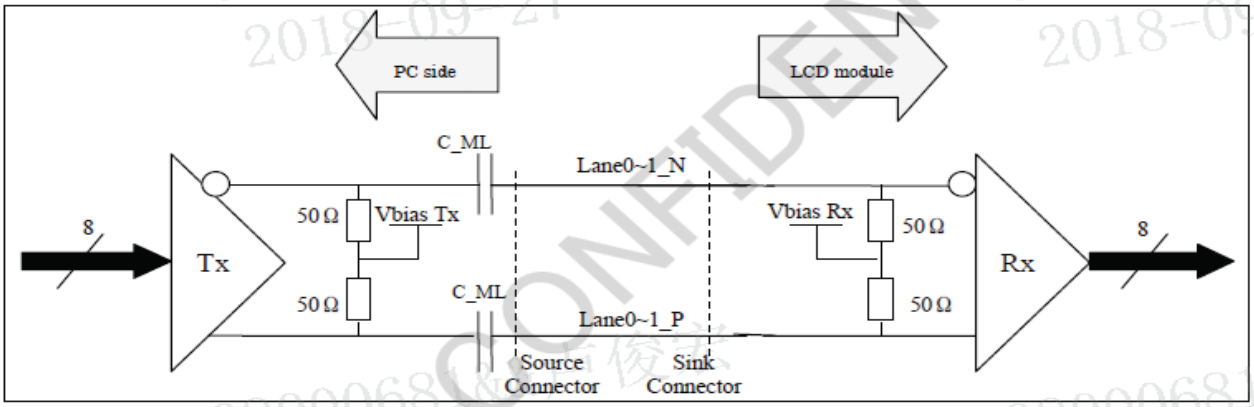


Figure 14. Main link differential pair

6.0 SIGNAL TIMING SPECIFICATION

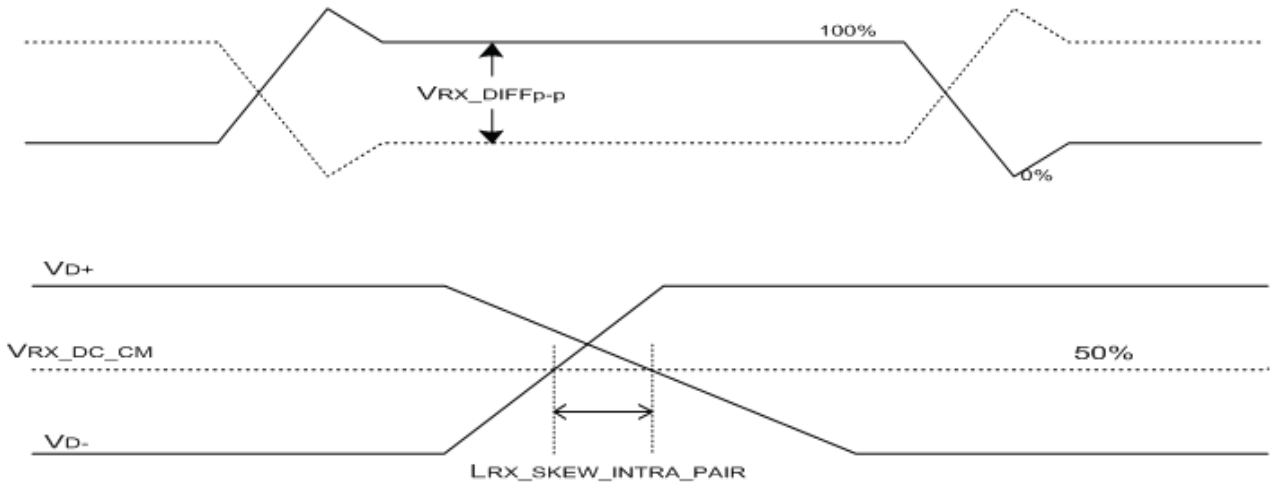


Figure 15. VRX-DIFFp-p & LRX_SKEW_INTRA_PAIR

6.0 SIGNAL TIMING SPECIFICATION

<Table 10. HPD Characteristics>

Item	Symbol	Min	Typ	Max	Unit	Remark
HPD voltage	V_{HPD}	2.25	-	3.6	V	
Hot Plug Detection Threshold	-	2.0	-	-	V	Source side Detecting
Hot Unplug Detection Threshold	-	-	-	0.8V	V	
HPD_IRQ Pulse Width	HPD_IRQ	0.5	-	1	ms	
HPD_TimeOut	-	2.0	-	-	ms	

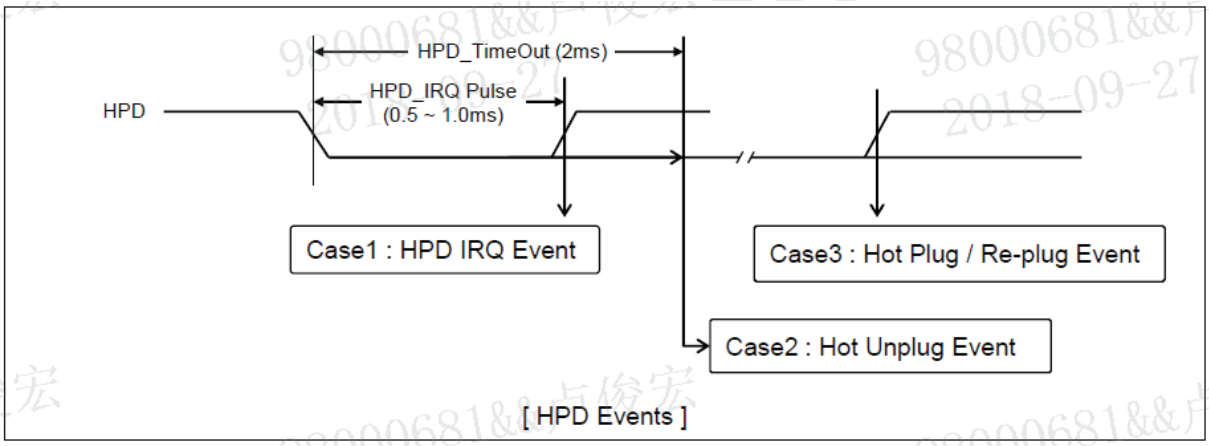


Figure 16. HPD Events

6.0 SIGNAL TIMING SPECIFICATION

<Table 11. AUX Characteristics>

Item	Symbol	Min	Typ	Max	Unit	Remark
AUX unit interval	UIAUX	0.4	0.5	0.6	Us	
AUX peak-to-peak input differential voltage	VAUX-RX-DIFFp-p	0.29	-	1.38	V	
AUX CH termination DC resistance	RAUX-TERM	80	100	120	Ohm	
AUX DC common mode voltage	VAUX-DC-CM	0	-	2	V	
AUX turn around common mode voltage	VAUX-TURN-CM	-	-	0.3	V	
AUX short circuit current limit	IAUX-SHORT	-	-	90	mA	
AUX AC Coupling Capacitor	CSOURCE-AUX	75	-	200	nf	Source side

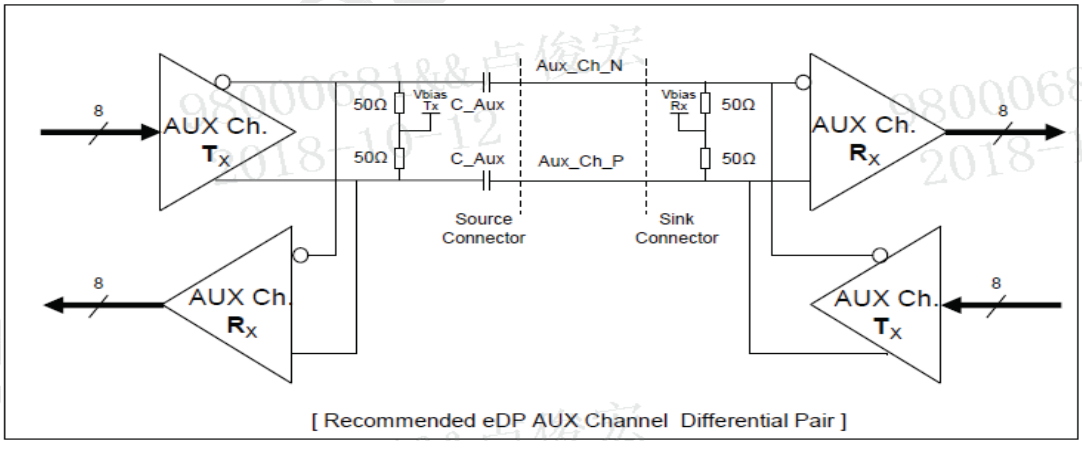


Figure 17. AUX differential pair

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

<Table 12. Input Signal & Basic Display Colors & Gray Scale of Colors >

	Colors & Gray scale	Data signal																			
		R0	R1	R2	R3	R4	R5	R6	R7	G0	G1	G2	G3	G4	G5	G6	G7	B0	B1	B2	B3	B4	B5	B6	B7
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
	Light Blue	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
	Purple	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
	△	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△					↑								↑								↑			
	▽					↓								↓								↓			
	Brighter	1	0	1	1	1	1	1	1	0	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
	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	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△					↑								↑								↑			
	▽					↓								↓								↓			
	Brighter	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	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
	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	1	0	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	△					↑								↑								↑			
	▽					↓								↓								↓			
	Brighter	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1
	▽	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
	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	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
	△	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	Darker	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	△					↑								↑								↑			
	▽					↓								↓								↓			
	Brighter	1	0	1	1	1	1	1	1	1	0	1	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	0	1	1	1	1	1	1	1
	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

8.0 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.

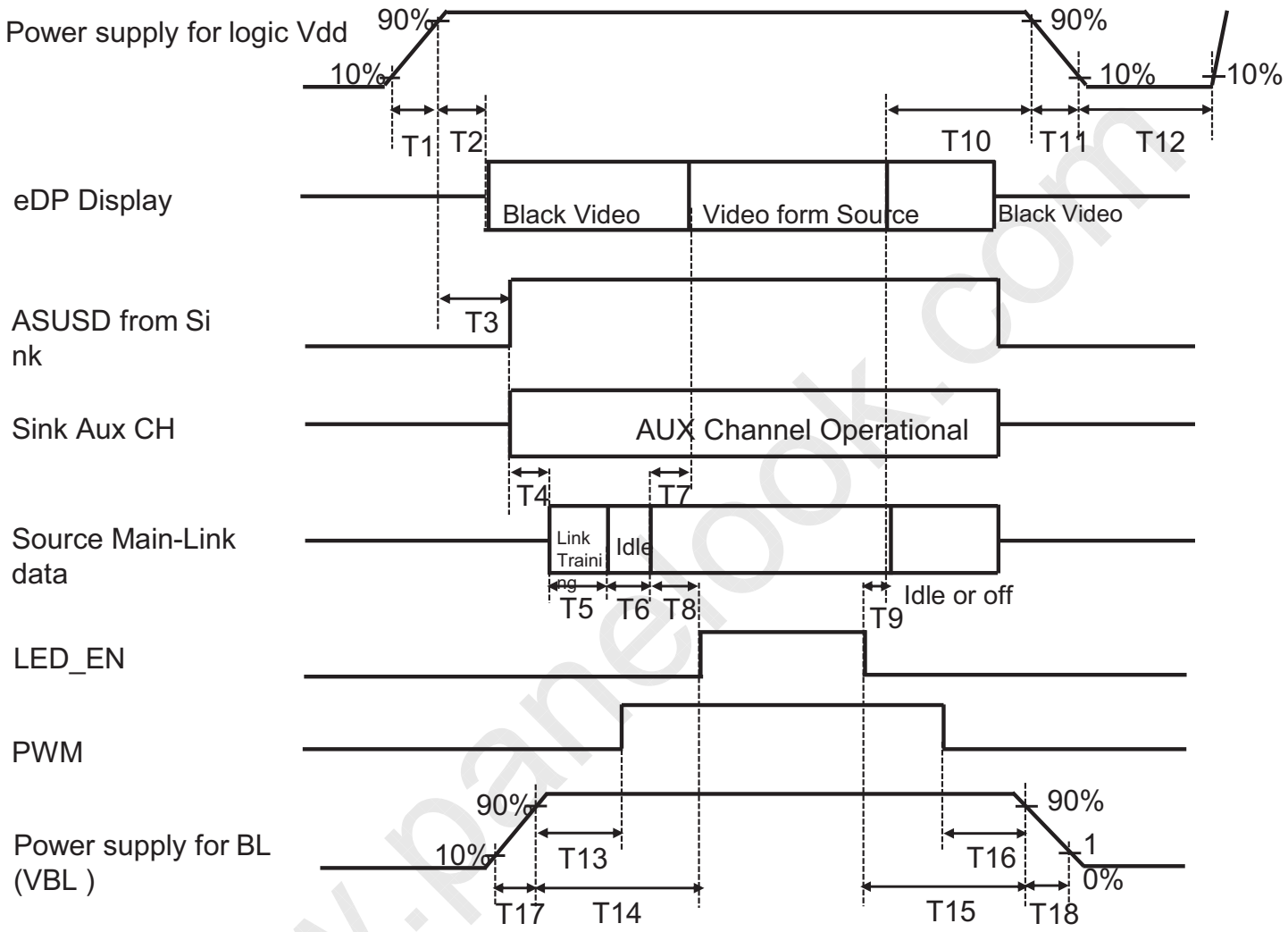


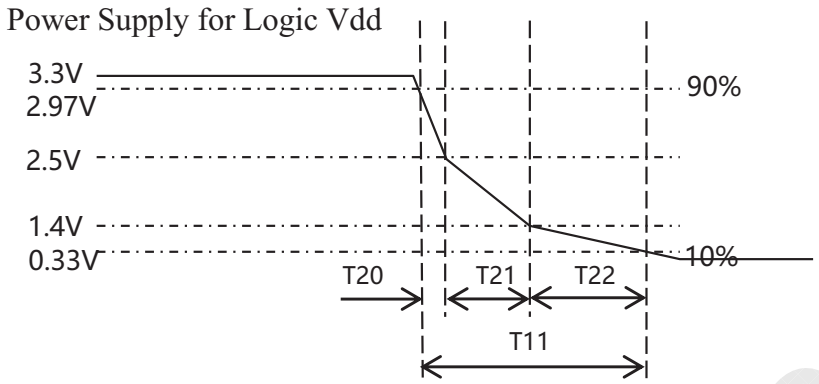
Figure 18. Power Sequence

- 0.5ms ≤ T1 ≤ 10 ms
- 0ms < T2 ≤ 200 ms
- 0ms < T3 ≤ 200 ms
- T3+T4+T5+T6+T8>200ms
- 0ms < T7 ≤ 50ms
- 50ms < T8
- 0ms < T9
- 0ms < T10 < 500 ms
- 0.5ms ≤ T11 ≤ 10 ms
- 500ms ≤ T12
- 10ms < T13
- 20ms < T14
- 20ms < T15
- 10ms < T16
- 0.5ms ≤ T17
- 0.5ms ≤ T18

Notes:

1. When the power supply VDD is 0V, keep the level of input signals on the low or keep high impedance.
2. Do not keep the interface signal high impedance when power is on. Back Light must be turn on after power for logic and interface signal are valid.

8.0 POWER SEQUENCE



- 0.5ms ≤ T11 ≤ 10 ms
- 0.225ms ≤ T21
- T11=T20+T21+T22

Figure 19. T11 timing requirements

9.0 Connector Description

Physical interface is described as for the connector on LCM.
These connectors are capable of accommodating the following signals and will be following components.

9.1 TFT LCD Module

< Table 13. Signal Connector >

Connector Name /Description	For Signal Connector
Manufacturer	I-PEX
Type/ Part Number	20455-040E-66
Mating Housing/ Part Number	I-PEX 20455-040E-66

10.0 MECHANICAL CHARACTERISTICS

10.1 Dimensional Requirements

Figure 23 shows mechanical outlines for the model NV126B5M-N41 V3.2.
Other parameters are shown in Table 14.

<Table 14. Dimensional Parameters>

Parameter	Specification	Unit
Active Area	309.312(H)×82.9665(V)	mm
Number of pixels	1920(H) X 515 (V) (1 pixel = R + G + B dots)	pixels
Pixel pitch	0.0537(H) ×0.1611 (V)	mm
Pixel arrangement	RGB Vertical stripe	
Display colors	16.7M(8bit)	
Display mode	Normally Black	
Dimensional outline	315.61±0.3x94.02±0.5	mm
Weight	175 (max)	g

10.2 Mounting

See Figure 24.

10.3 Anti-Glare and Polarizer Hardness.

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

10.4 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.

11.0 RELIABILITY TEST

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

<Table 15. Reliability Test>

No	Test Items	Conditions	Remark
1	High temperature storage test	Ta = 60 ℃, 240 hrs	
2	Low temperature storage test	Ta = -20℃, 240hrs	
3	High temperature & high humidity operation test	Ta = 50 ℃, 80%RH, 240 hrs	
4	High temperature operation test	Ta = 50 ℃, 240 hrs	
5	Low temperature operation test	Ta = 0 ℃, 240 hrs	
6	Thermal shock	Ta = -20 ℃ ↔ 60 ℃ (0.5 hr), 100 cycle	
7	Vibration test (non-operating)	1.5G/10-200Hz, Sine wave, 30min/cycle, 1cycle for each X,Y,Z	Note 1
8	Shock test (non-operating)	220G, 2ms, half sine wave, 1 time for each direction of ±X,±Y,±Z	Note 1
9	Electro-static discharge test (non-operating)	Air : 150 pF, 330Ω, ±15 KV Contact : 150 pF, 330Ω, ±8 KV	Note 2
	Power on/off test	25℃ , 30s on / 30s off , 3000times	

Notes :

1. The fixture must be hard enough , so that the module would not be twisted or bent.
2. Self- recovery and restart recovery is allowed. No hardware failures.

12.0 HANDLING & CAUTIONS

(1) Cautions when taking out the module
- Pick the pouch only, when taking out module from a shipping package.

(2) Cautions for handling the module
- As the electrostatic discharges may break the LCD module, handle the LCD module with care. Peel a protection sheet off from the LCD panel surface as slowly as possible.
- As the LCD panel and back - light element are made from fragile glass material, impulse and pressure to the LCD module should be avoided.
- As the surface of the polarizer is very soft and easily scratched, use a soft dry cloth without chemicals for cleaning.
- Do not pull the interface connector in or out while the LCD module is operating.
- Put the module display side down on a flat horizontal plane.
- Handle connectors and cables with care.

(3) Cautions for the operation
- When the module is operating, do not lose CLK, ENAB signals. If any one of these signals is lost, the LCD panel would be damaged.
- Obey the supply voltage sequence. If wrong sequence is applied, the module would be damaged.

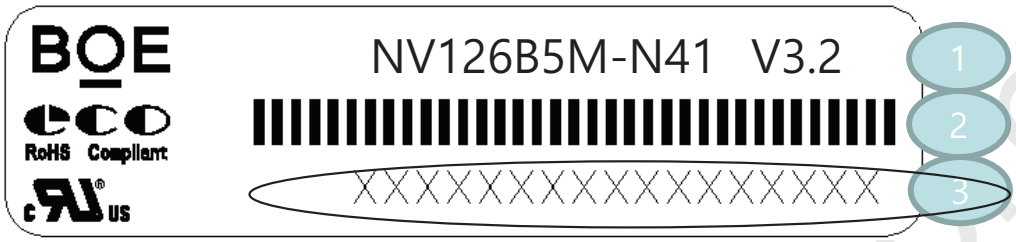
(4) Cautions for the atmosphere
- Dew drop atmosphere should be avoided.
- Do not store and/or operate the LCD module in a high temperature and/or humidity atmosphere. Storage in an electro-conductive polymer packing pouch and under relatively low temperature atmosphere is recommended.

(5) Cautions for the module characteristics
- Do not apply fixed pattern data signal to the LCD module at product aging.
- Applying fixed pattern for a long time may cause image sticking.

(6) Other cautions
- Do not disassemble and/or re-assemble LCD module.
- Do not re-adjust variable resistor or switch etc.
- When returning the module for repair or etc. Please pack the module not to be broken. We recommend to use the original shipping packages.

13.0 LABEL

(1) Product Label



Label Size: 48mm × 12mm / Thickness: 0.08mm

1. FG-CODE: NV126B5M-N41 V3.2
2. MDL ID Bar Code
3. MDL ID

Figure 20. Product Label

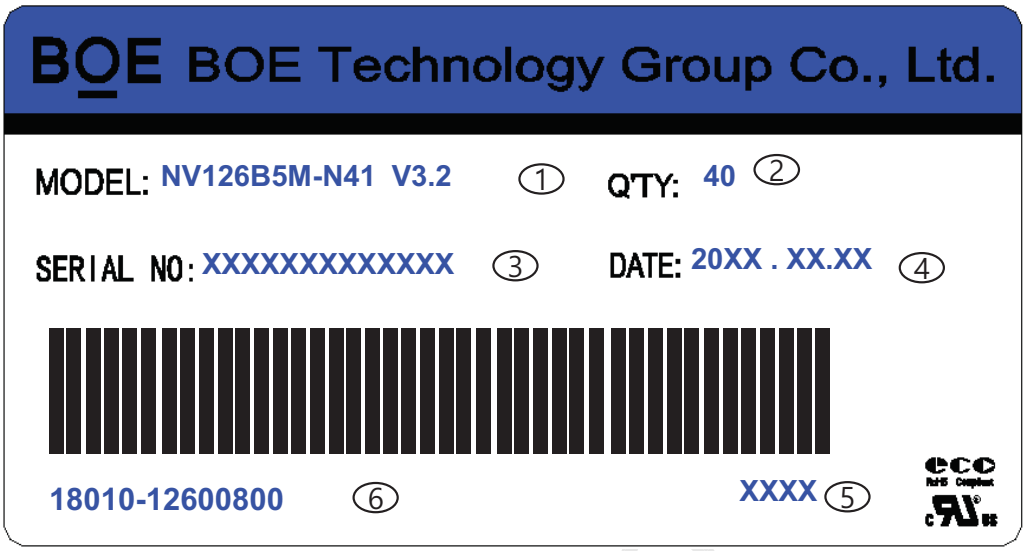
Module ID Naming Rule:

<Table 16. Module 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	9	4	0	X	X	X	X	X	X
描述	GBN		GRADE	B3	Y		M	Last 4 digits of FG Code				Seriers Number					

13.0 LABEL

(3) Box label



Serial number marked part needs to print, show as follows:

1. FG-CODE:NV126B5M-N41 V3.2
2. Module Q`ty in one box
3. Box ID
4. Packing Date
5. Last 4 digits of FG-code
6. The supplier code –18010-12600800
7. Total Size:110×50mm

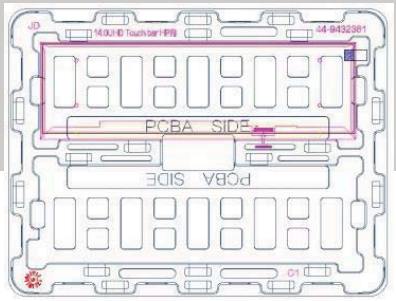
<Table 17. Box Label Naming Rule >

SERIA NO	1	2	3	4	5	6	7	8	9	10	11	12	13
code	X	X	X	X	X	X	X	X	X	X	X	X	X
Description	GBN		Grade	Line	Year		Month	Rev	Serial No.				

14.0 PACKING INFORMATION

14.1 Packing Order

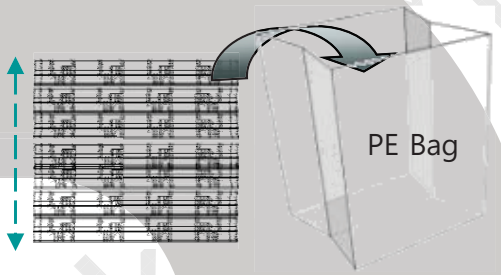
-. -. Place 2pcs LCM on a tray with one EPE spacer upside



Place 21pcs PET tray in a PE bag

1pcs up is umpty

-. Capacity: 40pcs/PE Bag



3 layers per Pallet, 4 inner boxes per layer,
-. Pallet outer package : Protective film & Paper Corner
-. Capacity: 480pcs/Pallet

-. Place packed PET trays into a inner box with EPE boards protecting
-. Capacity : 40pcs/Inner Box

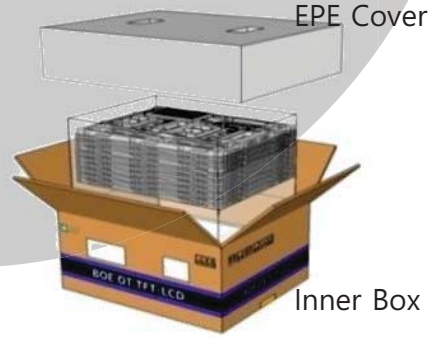


Figure 23. Packing Order

14.2 Note

- Box dimension: 500mm(W) x 400mm(D) x 290mm(H)
- Package quantity in one box: 40pcs
- Total weight: 13.8kg/Box

15.0 MECHANICAL OUTLINE DIMENSION

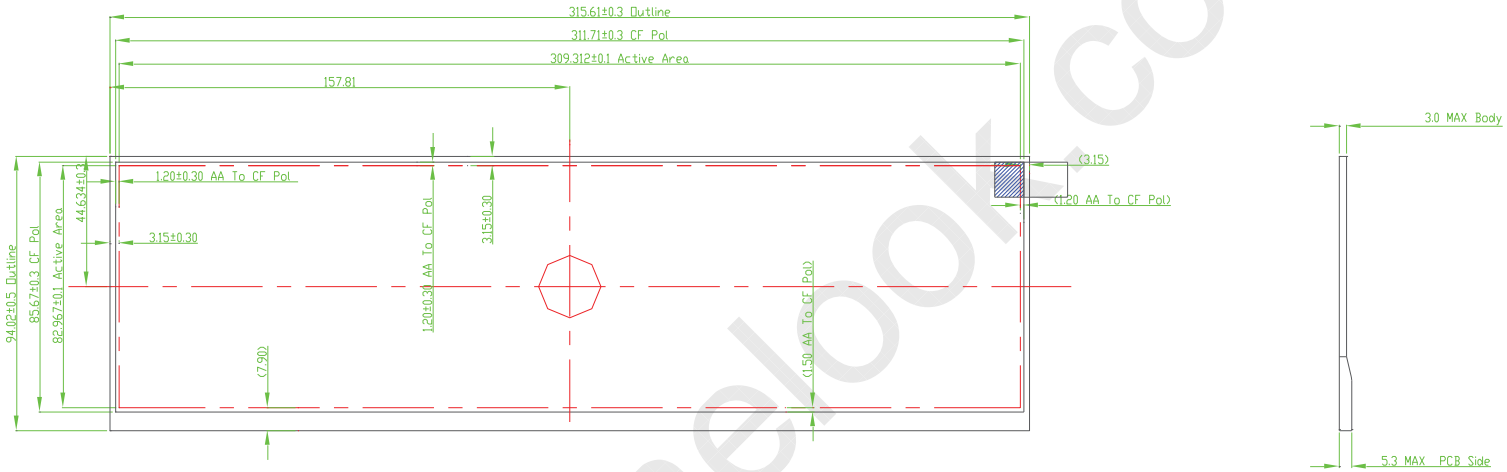


Figure 24. TFT-LCD Module Outline Dimension (Front View)

Note:
1. Top Polarizer is the highest part.
2. Curve Spec: ±0.5mm
3. No light leakage from all 4 corners of LCM.
4. Size Unit: mm.
5. General Tolerance: ±0.3mm.
6. Measurement method refer to Appendix A
7. System matching refer to Appendix B
8. "()"marks the reference dimensions.

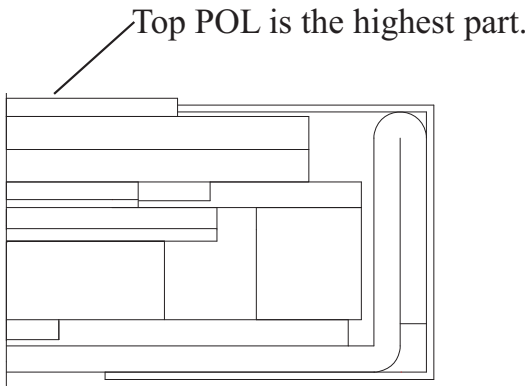


Figure 25. Highest Point Position

15.0 MECHANICAL OUTLINE DIMENSION

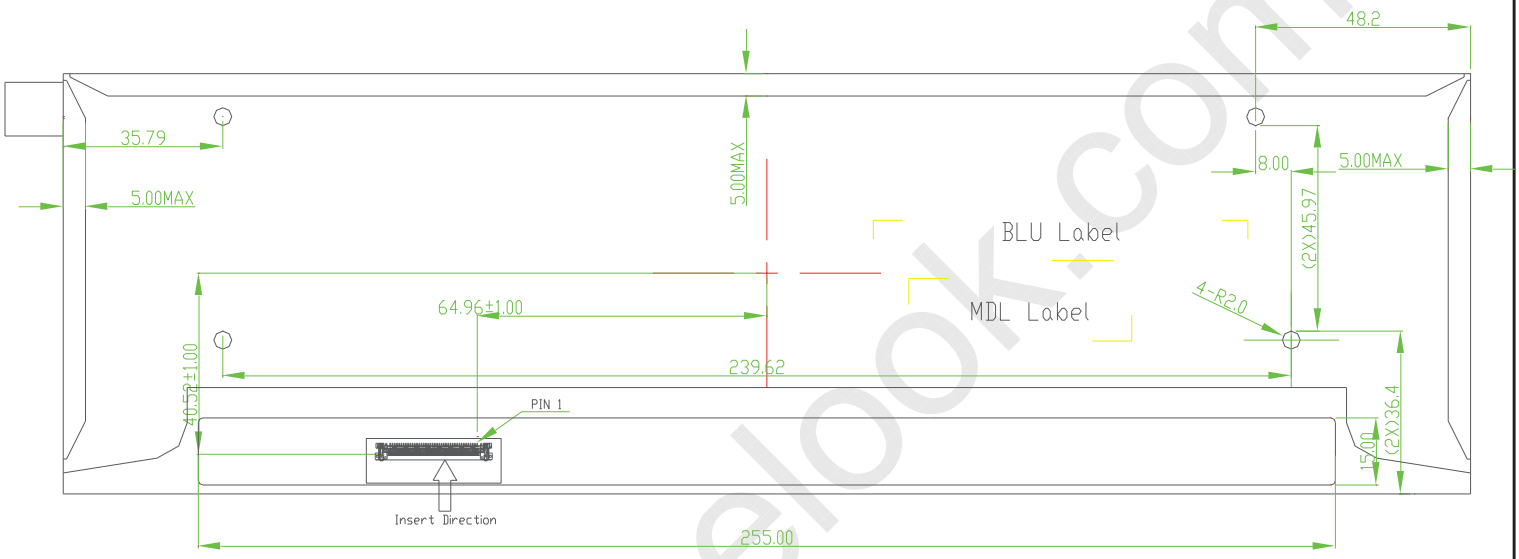


Figure 26. TFT-LCD Module Outline Dimensions (Rear view)

Note:
1. Top Polarizer is the highest part.
2. Curve Spec:±0.5mm
3. No light leakage from all 4 corners of LCM.
4. Size Unit: mm.
5. General Tolerance: ±0.3mm.
6. Measurement method refer to Appendix A
7. System matching refer to Appendix B
8. “()”marks the reference dimensions.

16.0 EDID Table

Check FAE	Check QE	Address (HEX)	Function	Hex	Dec	crc	Input values.	Notes
-	-	00	Header	00	0		0	EDID Header
-	-	01		FF	255		255	
-	-	02		FF	255		255	
-	-	03		FF	255		255	
-	-	04		FF	255		255	
-	-	05		FF	255		255	
-	-	06		FF	255		255	
-	-	07		00	0		0	
V		08	ID Manufacturer Name	09	9		BOE	ID = BOE
V		09		E5	229			
	V	0A	ID Product Code	7F	127		2175	ID = 2175
	V	0B		08	8			
V		0C	32-bit serial No.	00	0			
V		0D		00	0			
V		0E		00	0			
V		0F		00	0			
V		10	Week of manufacture	01	1		1	
V		11	Year of Manufacture	1D	29		2019	Manufactured in 2019
V		12	EDID Structure Ver.	01	1		1	EDID Ver 1.0
V		13	EDID revision #	04	4		4	EDID Rev. 0.4
V	V	14	Video input definition	A5	165		-	
	V	15	Max H image size	1F	31		31	31 cm (Approx)
	V	16	Max V image size	08	8		8	8 cm (Approx)
	V	17	Display Gamma	78	120		2.2	Gamma curve = 2.2
V		18	Feature support	02	2		-	RGB display, Preferred Timming mode
	V	19	Red/Green low bits	D2	210		-	Red / Green Low Bits
	V	1A	Blue/White low bits	2D	45		-	Blue / White Low Bits
	V	1B	Red x high bits	93	147	587	0.574	Red (x) = 10010011 (0.574)
	V	1C	Red y high bits	51	81	325	0.318	Red (y) = 01010001 (0.318)
	V	1D	Green x high bits	57	87	348	0.340	Green (x) = 01010111 (0.34)
	V	1E	Green y high bits	8D	141	566	0.553	Green (y) = 10001101 (0.553)
	V	1F	Blue x high bits	28	40	160	0.157	Blue (x) = 00101000 (0.157)
	V	20	BLue y high bits	18	24	98	0.096	Blue (y) = 00011000 (0.096)
	V	21	White x high bits	4E	78	315	0.308	White (x) = 01001110 (0.308)
	V	22	White y high bits	52	82	329	0.322	White (y) = 01010010 (0.322)
V		23	Established timing 1	00	0		-	
V		24	Established timing 2	00	0		-	
V		25	Established timing 3	00	0		-	

V		26	Standard timing #1	01	1			Not Used
V		27		01	1			
V		28	Standard timing #2	01	1			Not Used
V		29		01	1			
V		2A	Standard timing #3	01	1			Not Used
V		2B		01	1			
V		2C	Standard timing #4	01	1			Not Used
V		2D		01	1			
V		2E	Standard timing #5	01	1			Not Used
V		2F		01	1			
V		30	Standard timing #6	01	1			Not Used
V		31		01	1			
V		32	Standard timing #7	01	1			Not Used
V		33		01	1			
V		34	Standard timing #8	01	1			Not Used
V		35		01	1			
	V	36	Detailed timing/monitor descriptor #1	94	148		70.6	70.6MHz Main clock
	V	37		1B	27			
	V	38		80	128		1920	Hor Active = 1920
	V	39		A0	160		160	Hor Blanking = 160
	V	3A		70	112		-	4 bits of Hor. Active + 4 bits of Hor. Blanking
	V	3B		03	3		515	Ver Active = 1100
	V	3C		32	50		50	Ver Blanking = 50
	V	3D		20	32		-	4 bits of Ver. Active + 4 bits of Ver. Blanking
	V	3E		30	48		48	Hor Sync Offset = 48
	V	3F		20	32		32	H Sync Pulse Width = 32
	V	40		55	85		5	V sync Offset = 5 line
	V	41		00	0		5	V Sync Pulse width : 5 line
	V	42		35	53		309	Horizontal Image Size = 309 mm (Low 8 bits)
	V	43		53	83		83	Vertical Image Size = 83 mm (Low 8 bits)
	V	44		10	16		-	4 bits of Hor Image Size + 4 bits of Ver Image Size
	V	45		00	0		0	Hor Border (pixels)
	V	46		00	0		0	Vertical Border (Lines)
	V	47		1A	26		-	Refer to right table

V		48	Detailed timing/monitor descriptor #2	12	18		56.5	56.5MHz Main clock
V		49		16	22			
V		4A		80	128		1920	Hor Active = 1920
V		4B		A0	160		160	Hor Blanking = 160
V		4C		70	112		-	4 bits of Hor. Active + 4 bits of Hor. Blanking
V		4D		03	3		515	Ver Active = 1100
V		4E		32	50		50	Ver Blanking = 50
V		4F		20	32		-	4 bits of Ver. Active + 4 bits of Ver. Blanking
V		50		30	48		48	Hor Sync Offset = 48
V		51		20	32		32	H Sync Pulse Width = 32
V		52		55	85		5	V sync Offset = 5 line
V		53		00	0		5	V Sync Pulse width : 5 line
V		54		35	53		309	Horizontal Image Size = 309 mm (Low 8 bits)
V		55		53	83		83	Vertical Image Size = 83 mm (Low 8 bits)
V		56		10	16		-	4 bits of Hor Image Size + 4 bits of Ver Image Size
V		57		00	0		0	Hor Border (pixels)
V		58		00	0		0	Vertical Border (Lines)
V		59		1A	26		-	
V		5A	Detailed timing/monitor descriptor #3	00	0			ASCII Data Sting Tag
V		5B		00	0			
V		5C		00	0			
V		5D		FE	254			
V		5E		00	0			
V		5F		42	66		B	Manufacture name : BOEHF
V		60		4F	79		O	
V		61		45	69		E	
V		62		20	32			
V		63		48	72		H	
V		64		46	70		F	
V		65		0A	10			
V		66		20	32			
V		67		20	32			
V		68		20	32			
V		69		20	32			
V		6A		20	32			
V		6B		20	32			

V		6C	Detailed timing/monitor descriptor #4	00	0			Product Name Tag (ASCII)
V		6D		00	0			
V		6E		00	0			
V		6F		FE	254			
V		70		00	0			
V		71		4E	78		N	Model name : NV126B5M-N41
V		72		56	86		V	
V		73		31	49		1	
V		74		32	50		2	
V		75		36	54		6	
V		76		42	66		B	
V		77		35	53		5	
V		78		4D	77		M	
V		79		2D	45		-	
V		7A		4E	78		N	
V		7B		34	52		4	
V		7C		31	49		1	
V		7D		0A	10			
V	V	7E	Extension flag	00	0			
-	-	7F	Checksum	ED	237	237	-	