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NV080WUM-N61**HW:V3.0****Preliminary Product Specification****Rev. P4****BOE Technology Group CO., LTD**

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REVISION HISTORY

(√) Preliminary Specification
() Final Specification

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P0	32	Initial Spec	2020.04.27	Zhou Kun
P0	32	Correct some mistakes	2020.08.01	Cindy Chen
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1.0 GENERAL DESCRIPTION

1.1 Introduction

NV080WUM-N61 V3.0 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 8 inch diagonally measured active area with WUXGA resolutions (1200 horizontal by 1920 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 sRGB 100% typ.(95% min) The TFT-LCD panel used for this module is a low reflection and higher color type. The LED driver for back-light driving is built in this model. All input signals are MIPI compatible.

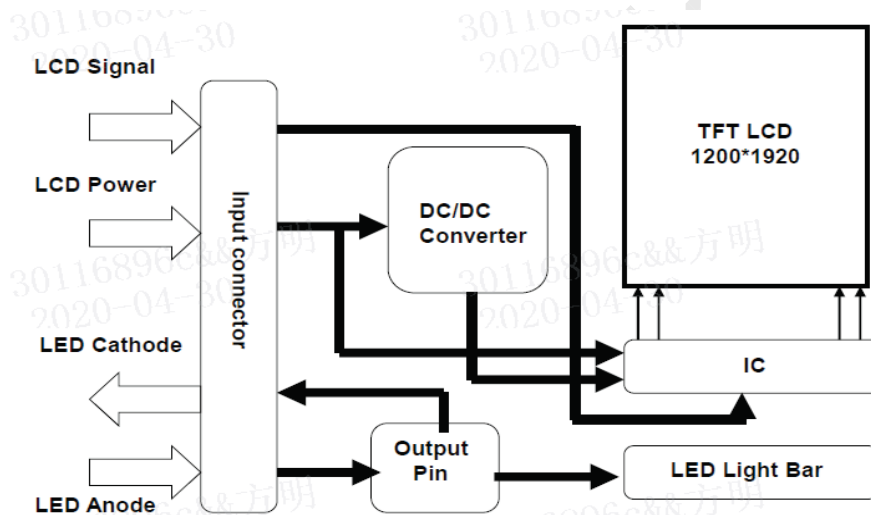


Figure 1. Drive Architecture

1.2 Features

NV080WUM-N61 V3.0 is a 8" color TFT-LCD (Thin Film Transistor Liquid Crystal Display) module composed of LCD panel, MIPI driver ICs, control circuit and backlight. By applying 8 bit digital data, 1200*RGB*1920, 16.7M-color images are displayed on the 8" diagonal screen

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1.3 Application

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1.4 General Specification

The followings are general specifications at the model NV080WUM-N61 V3.0. (listed in Table 1)

<Table 1. General Specifications>

Parameter	Specification	Unit	Remarks
Active area	107.64(H) × 172.224 (V)	mm	
Number of pixels	1200 (H) × 1920(V)	pixels	
Pixel pitch	89.7(H) × 89.7(V)	um	
Pixel arrangement	RGB Vertical stripe		
Display colors	16.7M (8bit)		
Color gamut	sRGB 100%typ. 95%min		
Display mode	HADS		
Dimensional outline	113.14 ± 0.2*182.424 ± 0.2 2.05Max (Body) / 3.68Max (PCB).	mm	
Weight	95 (max)	g	
Surface treatment	HC		
Surface hardness	≥2H		
Back-light	Bottom edge side, 1-LED lighting bar type		Note 1
Power consumption	P _D : 0.55(Max)	W	@Mosaic
	P _{BL} : 1.92(Max)	W	
	P _{Total} : 2.47(Max)	W	@Mosaic

Notes : 1. LED Lighting Bar (27*LED Array)

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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. Absolute Maximum Ratings>

Ta=25+/-2°C

Parameter	Symbol	Min.	Max.	Unit	Remarks
Power Supply Voltage	V _{DD3V3}	-0.3	5.5	V	Note 1
Logic Supply Voltage	V _{IN}	V _{SS} -0.3	V _{DD} +0.3	V	
Operating Temperature	T _{OP}	0	+50	°C	Note 2
Storage Temperature	T _{ST}	-20	+60	°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. the max value of LED forward current is relative to ambient temperature, the correlation is show in figure 3.
3. Temperature and relative humidity range are shown in the figure below.
95 % RH Max. (40 °C ≥ Ta)
Maximum wet - bulb temperature at 39 OC or less. (Ta > 40 OC) No condensation.

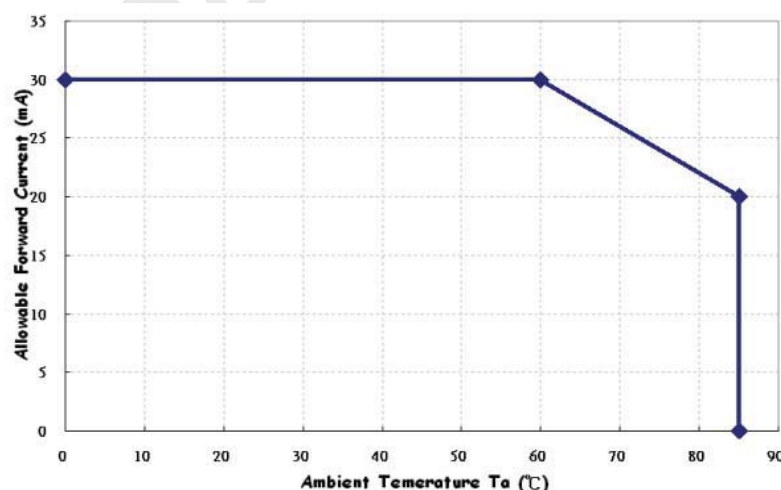


Figure 2. forward current vs ambient temperature

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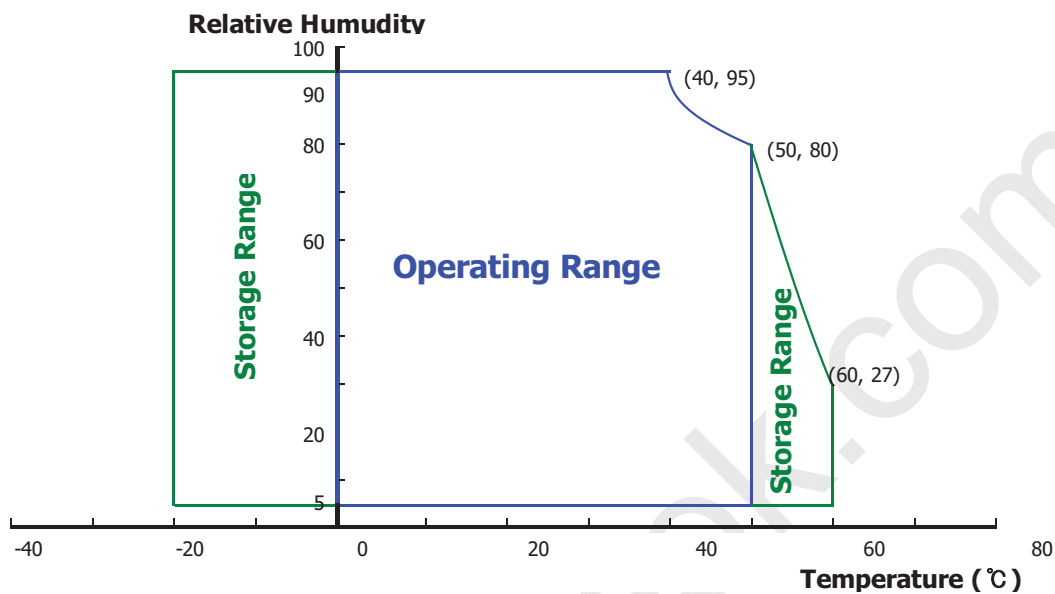


Figure 3. Temperature and Relative Humidity Range

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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	@Mosaic
LED Forward Voltage of every LED string		V _{LED}		-	27	V	9series 3parallels
LED Forward Current of every LED string		I _{LED}	-	23.7	24.2	mA	
Power Supply Current	White	I _{DD}	-	151.5	166.7	mA	@Mosaic
Power Consumption	White	P _M	-	0.5	0.55	W	
	BLU	P _{BL}	-	1.86	1.92	W	-
	Total	P _{Total}	-	2.36	2.47	W	@Mosaic

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3.2 Backlight Unit

< Table 4. LED Driving Guideline Specifications >

Ta=25+/-2°C

Parameter		Min.	Typ.	Max.	Unit	Remarks
LED Life-Time	N/A	15,000	-	-	Hour	I _F = 23.7mA Note 2

Notes :

1. Power supply voltage 12V for LED driver.

Calculator value for reference $I_F \times V_F \times 27 / \text{driver efficiency} = P_{LED}$

2. The LED life-time define as the estimated time to 50% degradation of initial luminous.

3. Measure condition (Figure 4)

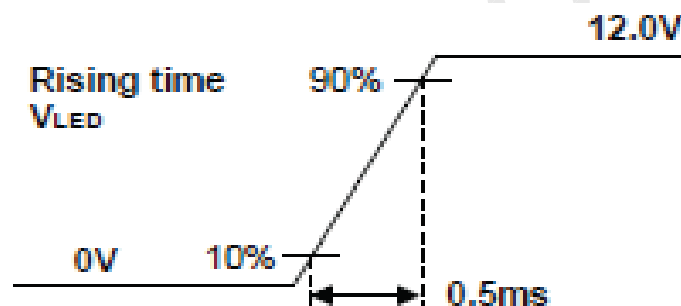
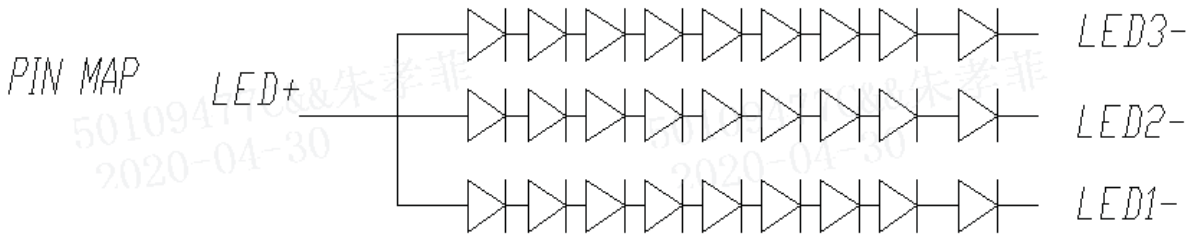


Figure 4. Inrush Measure Condition

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3.3 LED Structure PIN MAP  LED: $3 \times 9 = 27\text{PCS}$; $23.7\text{mA} \times 3 = 71.1\text{mA}$			
Figure 5. LED Structure			
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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 = $25 \pm 2^\circ\text{C}$) with the equipment of luminance meter system (SR3 or CA310&RD80) 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 $\theta=0$ ($=03$) as the 3 o'clock direction (the "right"), $\theta=90$ ($=012$) as the 12 o'clock direction ("upward"), $\theta=180$ ($=09$) as the 9 o'clock direction ("left") and $\theta=270$ ($=06$) 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 backlight should be operating for 30 minutes prior to measurement. VDD shall be $3.3 \pm 0.3\text{V}$ at 25°C . Optimum viewing angle direction is 6 o'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	-	Deg.	Note 1
		Θ_9		80	85	-	Deg.	
	Vertical	Θ_{12}		80	85	-	Deg.	
		Θ_6		80	85	-	Deg.	
Luminance Contrast Ratio		CR	$\Theta = 0^\circ$	900	1200	-		Note 2
Luminance of White	center point	Y_w	$\Theta = 0^\circ$ ILED = 23.7mA	370	435	-	cd/m²	Note 3
White Luminance Uniformity	13 Points	ΔY_{13}		62.5	71.4	-	%	Note 4
White Chromaticity		W_x	$\Theta = 0^\circ$	0.283	0.313	0.343		Note 5
		W_y		0.299	0.329	0.359		
Reproduction of Color	Red	R_x	$\Theta = 0^\circ$	Typ.-0.03	0.651	Typ.+0.03		
		R_y			0.334			
	Green	G_x			0.303			
		G_y			0.621			
	Blue	B_x			0.151			
		B_y			0.055			
	Color Gamut							
Response Time (Rising + Falling)		T_{RT}	Ta= 25°C $\Theta = 0^\circ$	-	30	35	ms	Note 6
Cross Talk		CT	$\Theta = 0^\circ$	-	-	2.0	%	Note 7

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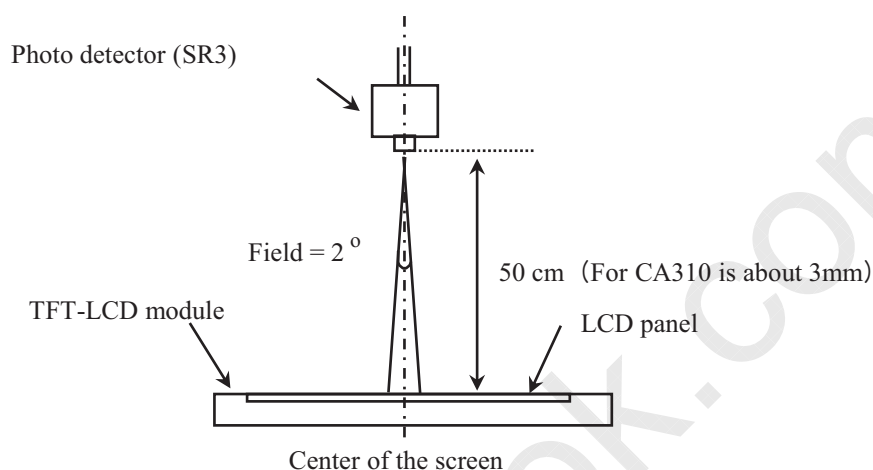
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Notes : - Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface (see Figure 7). - Contrast measurements shall be made at viewing angle of $\Theta = 0$ and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state . (see Figure 7) Luminance Contrast Ratio (CR) is defined mathematically.$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$ - Luminance of white is defined as luminance values of center point 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 8 for a total of the measurements per display. - The White luminance uniformity on LCD surface is then expressed as : $\Delta Y = \text{Minimum Luminance of 13 points} / \text{Maximum Luminance of 13 points.}$(see Figure 8 and Figure 9). - 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. - 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. - Cross-Talk of one area of the LCD surface by another shall be measured by comparing the luminance (YA) of a $10 \pm 1\text{mm}$ diameter area, with all display pixels set to gray 127(of 0 to 255), to the luminance (YB) of that same area when any adjacent area is driven dark.The luminance ratio shall not exceed 1:1.05 (See Figure 11).			
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4.3 Optical Measurements



Optical characteristics measurement setup

Figure 6. Measurement Set Up

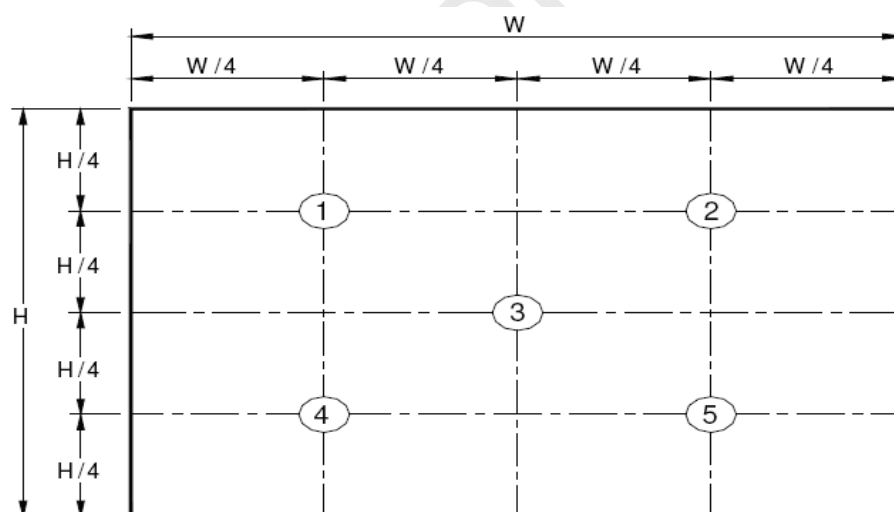


Figure 7. White Luminance (center points)

Center Luminance of white is defined as luminance values 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 6 for a total of the measurements per display.

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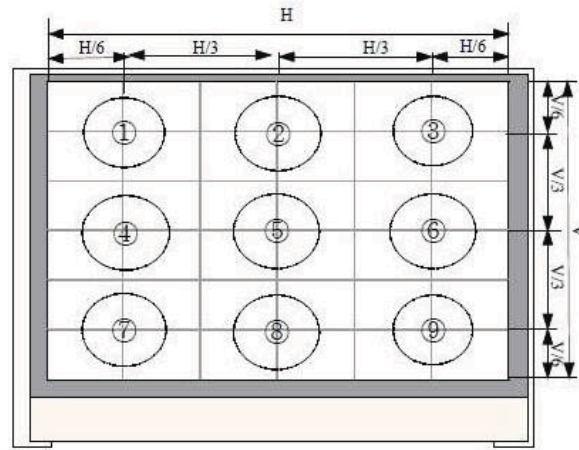


Figure 8. Uniformity Measurement Locations (9 points)

The White luminance uniformity on LCD surface is then expressed as : $\Delta Y_9 = \text{Minimum Luminance of nine points} / \text{Maximum Luminance of nine points}$ (see Figure 8) .

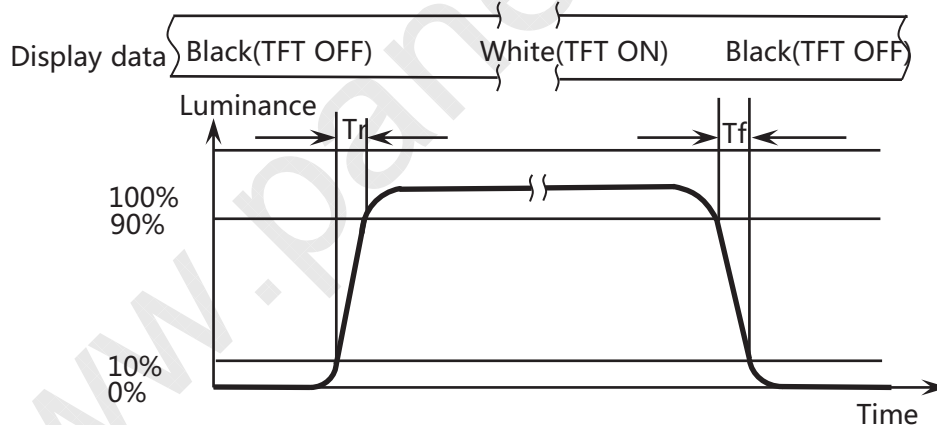


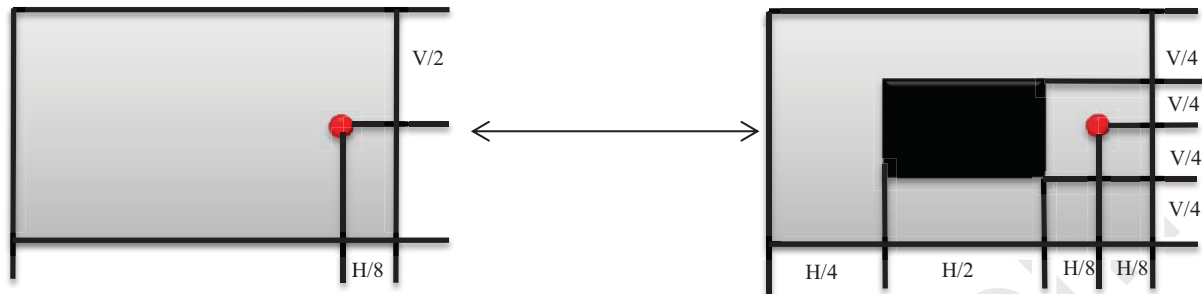
Figure 9. Response Time Testing

The electro-optical response time measurements shall be made as shown in Figure 9 by switching the “data” input signal ON and OFF. T_r : The luminance to change from 10% to 90% , T_f : The luminance to change from 90% to 10% .

The test system : ENC RD80

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

Figure 10. 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 measured will be exactly the same in both patterns. The test background gray is L127.

Cross Talk of one area of the LCD surface by another shall be measured by comparing the luminance (Y_A) of a $10 \pm 1\text{mm}$ diameter area, with all display pixels set to a gray level 127, to the luminance (Y_B) of that same area when any adjacent area is driven dark.(Refer to Figure 10)

The test system: SR3 or CA310

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5.0 INTERFACE CONNECTION

5.1 Electrical Interface Connection

The electronics interface connector is IPEX 20655-045E-01 or compatible

The connector interface pin assignments are listed in Table 6.

<Table 6. Pin Assignments for the Interface Connector>

Terminal	Symbol	Function
1	GND	Ground
2	FB3	LED Current FB3
3	FB2	LED Current FB2
4	FB1	LED Current FB1
5	NC	NC
6	VLED	LED Power
7	VLED	LED Power
8	VLED	LED Power
9	NC	NC
10	NC	NC
11	NC	NC
12	NC	NC
13	NC	NC
14	NC	NC
15	GND	Ground
16	NC	NC
17	NC	NC
18	VDD(3.3V)	LCD Power supply
19	VDD(3.3V)	LCD Power supply
20	VDD(3.3V)	LCD Power supply
21	GND	Ground
22	D0 P	MIPI Positive data singal(+)
23	D0 N	MIPI Negative data singal(-)
24	GND	Ground
25	D1 P	MIPI Positive data singal(+)
26	D1 N	MIPI Negative data singal(-)
27	GND	Ground
28	CLK P	MIPI Positive data singal(+)
29	CLK N	MIPI Negative data singal(-)
30	GND	Ground
31	D2 P	MIPI Positive data singal(+)
32	D2 N	MIPI Negative data singal(-)
33	GND	Ground
34	D3 P	MIPI Positive data singal(+)
35	D3 N	MIPI Negative data singal(-)
36	GND	Ground
37	NC	NC
38	LCD RESET(1.8V)	Reset signal for LCM
39	LCD ID0	ID PIN
40	LCD ID1	ID PIN
41	NC	NC
42	I2C SDA(3.3V)	I2C data sgnal for LCM
43	I2C SCL(3.3V)	I2C clock signal for LCM
44	PWMOUT(1.8V)	PWM OUT
45	GND	Ground

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5.2. MIPI Interface DC/AC Characteristic

(1) DC Specification

< Table 7. DC Specification >

Parameter	Symbol	Min	Typ	Max	Unit	Condition
MIPI digital operation current	I_{VCCIF}	-	-	24	mA	
MIPI digital stand-by current	$I_{VCCIFST}$	-	200	-	uA	
MIPI Characteristics for High Speed Receiver						
Single-ended input low voltage	V_{ILHS}	-40	-	-	mV	
Single-ended input high voltage	V_{IHHS}	-	-	460	mV	
Common-mode voltage	V_{CMRXDC}	155	-	330	mV	
Differential input impedance	Z_{ID}	80	100	125	Ω	
HS transmit differential voltage($V_{OD}=V_{DP}-V_{DN}$)	$ V_{OD} $	140	200	270	mV	
MIPI Characteristics for Low Power Receiver						
Pad signal voltage range	V_I	-50	-	1350	mV	
Ground shift	V_{GNDSH}	-50	-	50	mV	
Output low level	V_{OL}	-50	-	50	mV	
Output high level	V_{OH}	1.1	1.2	1.3	V	

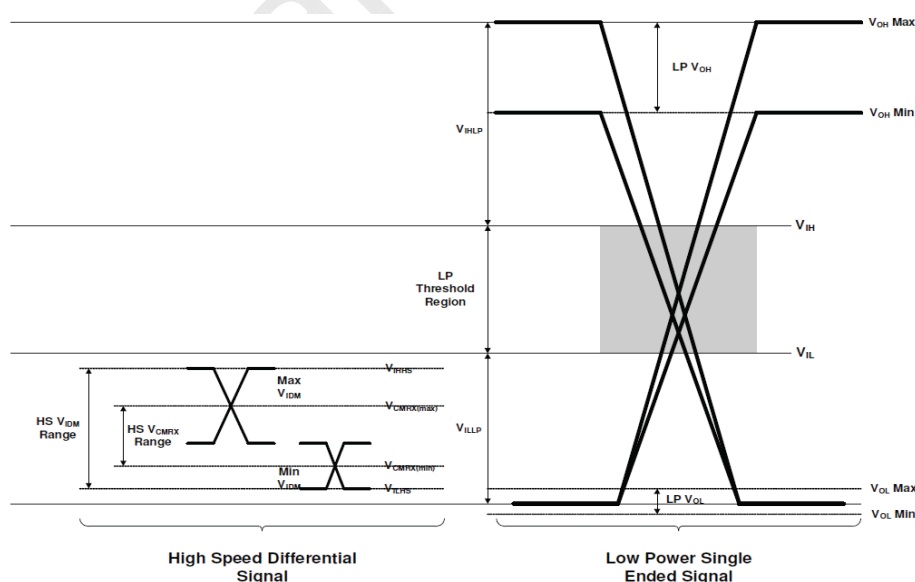


Figure 11. <DC Specification>

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(2) AC Specification

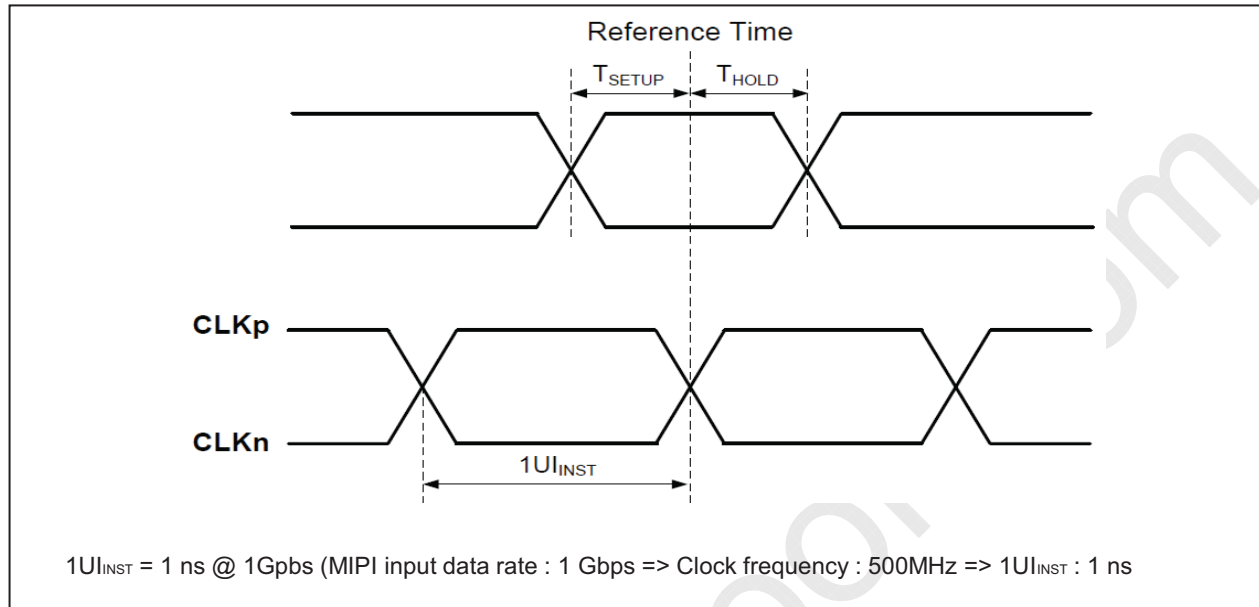


Figure 12. < Timing Diagram of MIPI Transmitter>

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5.3 Data Input Format

< Table 8. AC Specification >

Description	Symbol	Condition	Min	Typ	Max	Unit
Data to Clock Setup Time	T_{SETUP}	-	0.25	-	-	$U_{\text{I_INST}}$
Clock to Data Hold Time	T_{HOLD}	-	0.25	-	-	$U_{\text{I_INST}}$

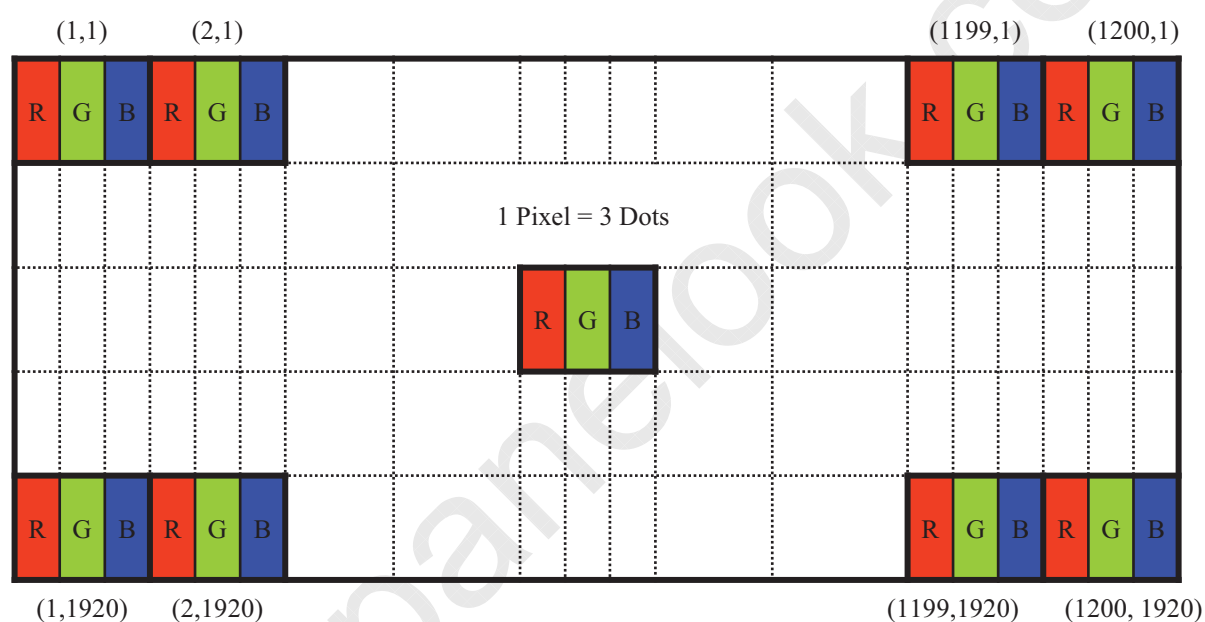


Figure 13. Display Position of Input Data (V-H)

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5.4 Back-light & LCM Interface Connection

<Table 9. Pin Assignments for the BLU Connector>

Pin No.	Symbol	Description	Pin No.	Symbol	Description
1	FB1	LED cathode connection	6	GND	GND
2	FB2	LED cathode connection	7	NC	NC
3	FB3	LED cathode connection	8	VLED	LED anode connection
4	NC	NC	9	VLED	LED anode connection
5	GND	GND	-	-	-

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6.0 SIGNAL TIMING SPECIFICATION

6.1 The NV080WUM-N61 V3.0 Is Operated By The DE Only

< Table 10. Signal Timing Specification >

ITEM			SYMBOL	min	typ	max	UNIT	
LCD	Frame Rate		-	-	60	-	Hz	
	Pixels Rate		-	157.262	157.262	159.9	MHz	
Timing	DCLK	Frequency	fCLK	472	490	498	MHz	
		Period	Tclk	2.01	2.04	2.04	ns	
	Horizontal	Horizontal total time	tHP	1340	1340	1360	t _{CLK}	
		Horizontal Active time	tHadr	1200			t _{CLK}	
		Horizontal Pulse Width	tHsync	10	10	10	t _{CLK}	
		Horizontal Back Porch	tHBP	80	80	80	t _{CLK}	
		Horizontal Front Porch	tHFP	50	50	70	t _{CLK}	
		Vertical	Vertical total time	tvp	1956	1956	1961	t _H
	Vertical Active time		tVadr	1920			t _H	
	Vertical Pulse Width		tVsync	4	4	4	t _H	
	Vertical Back Porch		tVBP	14	14	14	t _H	
	Vertical Front Porch		tVFP	18	18	23	t _H	
	Differential Swing			VDswing	400	500	-	mV
	Bit Rate			TX SPD (MBPS)	944	944	995	Mbps
Pixel Fomat				-	24	-	Data bit/ pixel	
Lane				-	4	-	Lane	

Note : The above is as optimized setting.

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7.0 POWER SEQUENCE

(1) 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

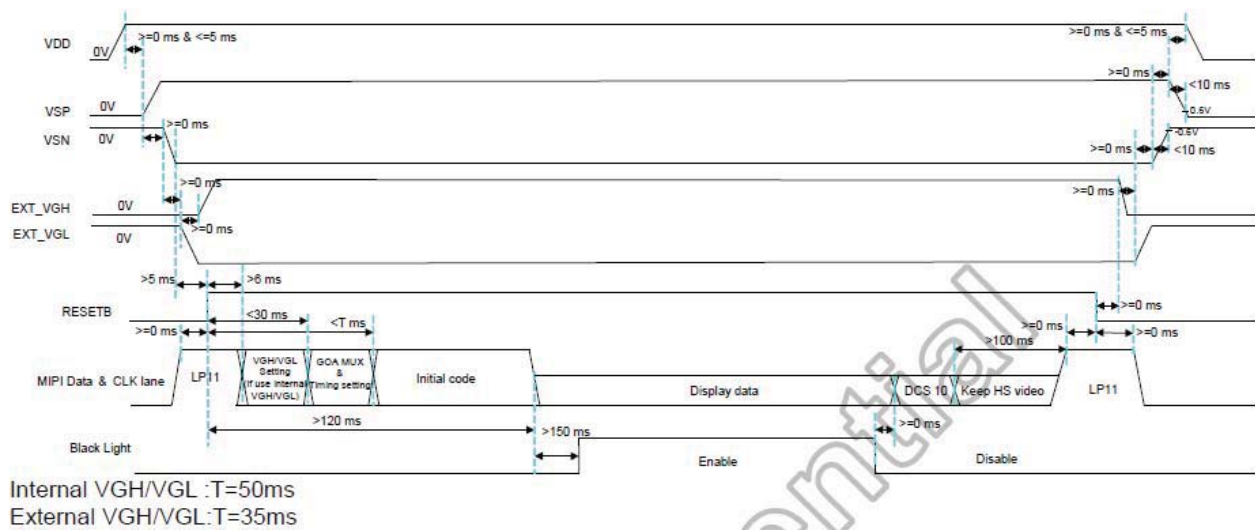


Figure 14. < Power on/off Sequence >

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(2). Software Flow

Commands:

Normal display mode on = NORON

Idle mode off = IDMOFF

Idle mode on = IDMON

Sleep out = SLPOUT

Sleep in = SLPIN

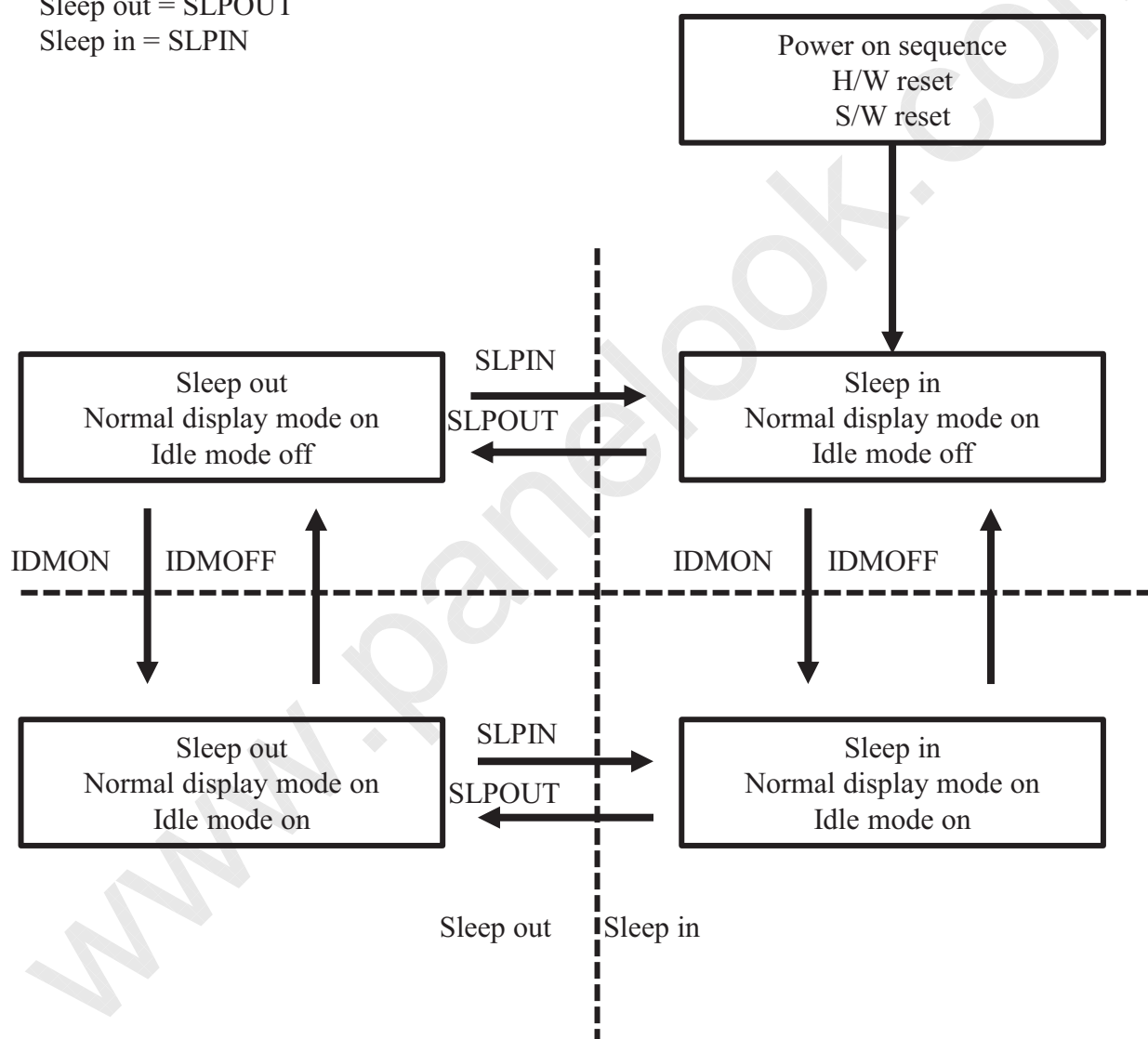


Figure 15. <Software Flow>

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8.0 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.

8.1 TFT LCD Module

< Table 12. Signal Connector >

Connector Name /Description	For Signal Connector
Manufacturer	IPEX
Type/ Part Number	-
Mating Housing/ Part Number	I-PEX 20655-045E-01 or compatible

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9.0 MECHANICAL CHARACTERISTICS

Dimensional Requirements

Figure 20 shows mechanical outlines for the model NV080WUM-N61 V3.0.
Other parameters are shown in Table 13.

<Table 13. Dimensional Parameters>

Parameter	Specification	Unit
Active Area	107.64 (H) × 172.224 (V)	mm
Number of pixels	1200 (H) X 1920 (V) (1 pixel = R + G + B dots)	pixels
Pixel pitch	89.7 (H) X 89.7 (V)	um
Pixel arrangement	RGB Vertical stripe	
Display colors	16.7M (8bit)	
Display mode	HADS	
Dimensional outline	113.14 ± 0.2*182.424 ± 0.2 2.05Max (Body) / 3.68Max (PCB).	mm
Weight	95 (max)	g

9.2 Mounting

See Figure 20.

9.3 Bright-View and Polarizer Hardness.

The surface of the LCD has a coating to reduce scratching, hardness ≥2H.

9.4 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.

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10.0 RELIABILITY TEST

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

<Table 14. Reliability Test>

No	Test Items	Conditions	Remark
1	High temperature storage test	Ta = 60°C , 60%RH, 240 hrs	
2	Low temperature storage test	Ta = -20°C , 240 hrs	
3	High temperature & high humidity operation test	Ta = 50°C , 80%RH, 240 hrs	
4	High temperature operation test	Ta = 60°C , 60%RH, 240 hrs	
5	Low temperature operation test	Ta = -20°C , 240 hrs	
6	Thermal shock	Ta = -20 °C ↔ 60 °C (0.5 hr), 60% ± 3%RH, 100 cycle	
7	Vibration test (non-operating)	Ta = 25° C , 60%RH, 1.47G, 5~200Hz, random X,Y,Z / Sweep 30min	Note 1
8	Shock test (non-operating)	Ta = 25° C , 60%RH, 200G, Half Sine Wave 2msec ± X, ± Y, ± Z Once for each direction	Note 1
9	Electro-static discharge test (operating)	Air : 150 pF, 330Ω, ± 8 KV Contact : 150 pF, 330Ω, ± 4 KV Ta = 25°C , 60%RH,	Note 2
10	Image Sticking	5*5 Mosaic, Aging 1H, Check @Grey L127, 5min disappear	

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.

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11.0 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.

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12.0 LABEL

(1) Product Label

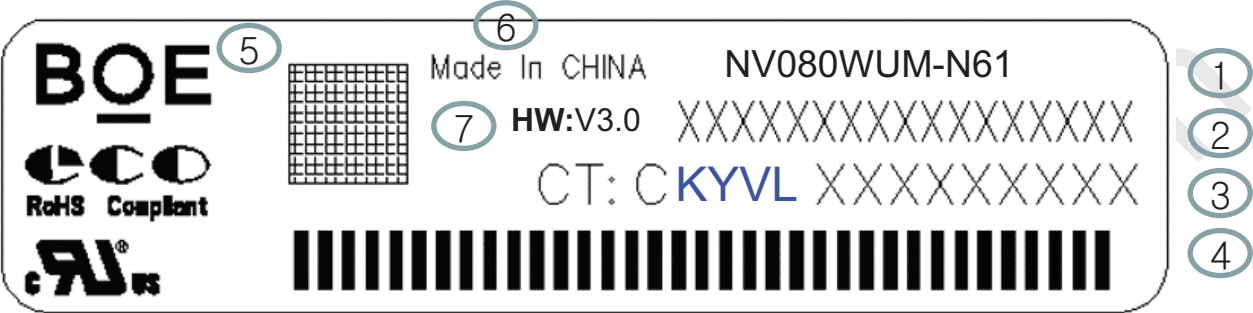


Figure 16. Product Label

Label Size: 48mm × 12mm / 厚度: 0.08mm

- 1. FG-CODE: NV080WUM-N61
- 2. MDL ID
- 3.客户要求PPID
- 4. PPID条码码（客户端使用）
- 5. MDL ID二维码（厂内使用）
- 6. Made In CHINA（产地）
- 7. HW Version

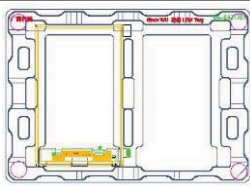
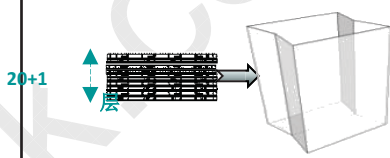
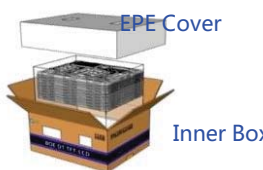
Note：实际排版会依据实际微调

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13.0 PACKING INFORMATION

13.1 Packing Order

将MDL 平放入Tray，上下各放置1pcsEPE Spacer， 2pcs MDL/2pcs Spacer/ Tray	将盛装LCM的Tray叠码20层，然后在整摞Tray顶层加放1个空Tray作盖。(Tray直叠) 40pcs MDL/40pcs Spacer/20pcs Tray	将21层 Tray放入一个PE Bag中， 40pcs LCM/1 PE Bag
		
将1包产品置于EPE Cushion内，将EPE Cushion 扣合（扣合过程中确保EPE Cushion各位置平整、无破损）将扣合好的一包产品放入Outer Box。 40pcs LCM/ 2ea EPE Cushion/Box	每个Pallet上放3层Box 1层4箱,共计12ea Pallet 外 进 行 缠 膜 包 装，容 量： 960pcs/Pallet	厢车装载方式一横一数双层码放 厢车装载量_12m：43200pcs（45托）
		

13.2 Note

- Box dimension: 385mm*2750mm*290mm
- Package quantity in one box: 40pcs

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(2) High voltage caution label

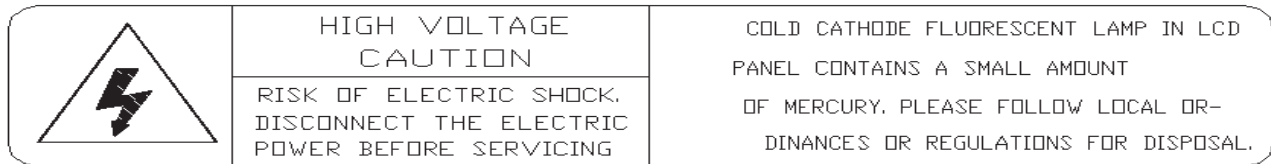


Figure 17. High Voltage Caution Label

(3) Box label

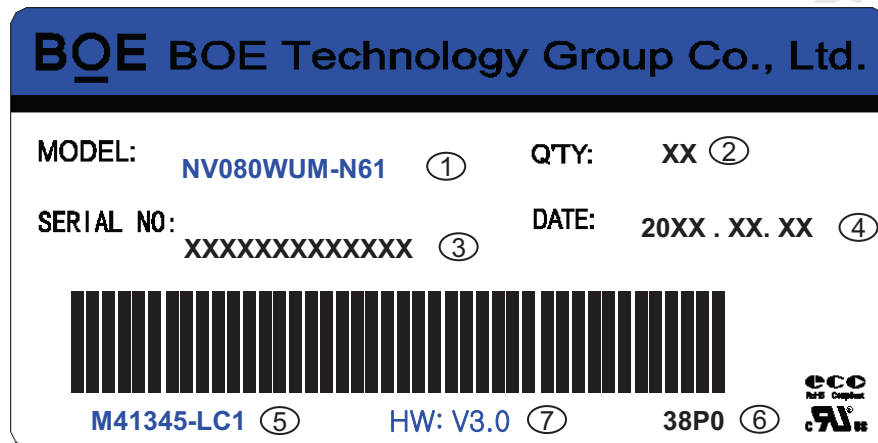


Figure 18. Box Label

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

1. FG-CODE (The first 12 bits)
2. Product quantity
3. Box ID
4. Date
5. The client section material number(The client)
6. FG-Code (The Last 4 bits)
7. HW Version

Total Size:110×55mm

<Table 16. Box Label Naming Rule >

Digit Code	1	2	3	4	5	6	7	8	9	10	11	12	13
Code	B	9	A	F	1	7	8	N	0	0	3	2	7
Description	Product Name		Product Grade	B8	Year		Month	Revision	BOX Serial Number				

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14.0 MECHANICAL OUTLINE DIMENSION

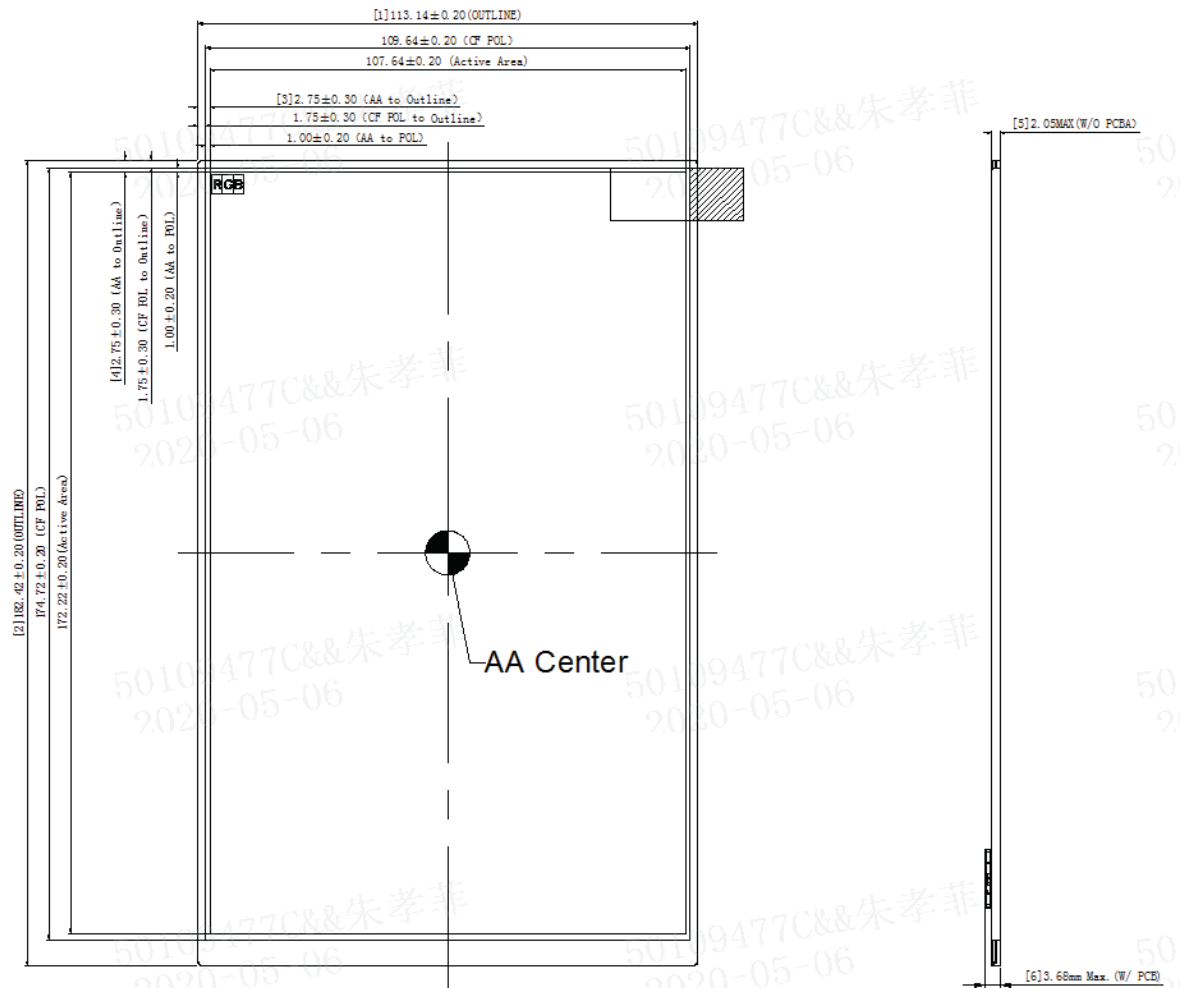


Figure 20. TFT-LCD Module Outline Dimension (Front View)

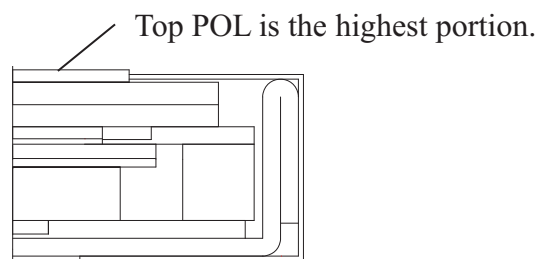


Figure 21. Highest Point Position

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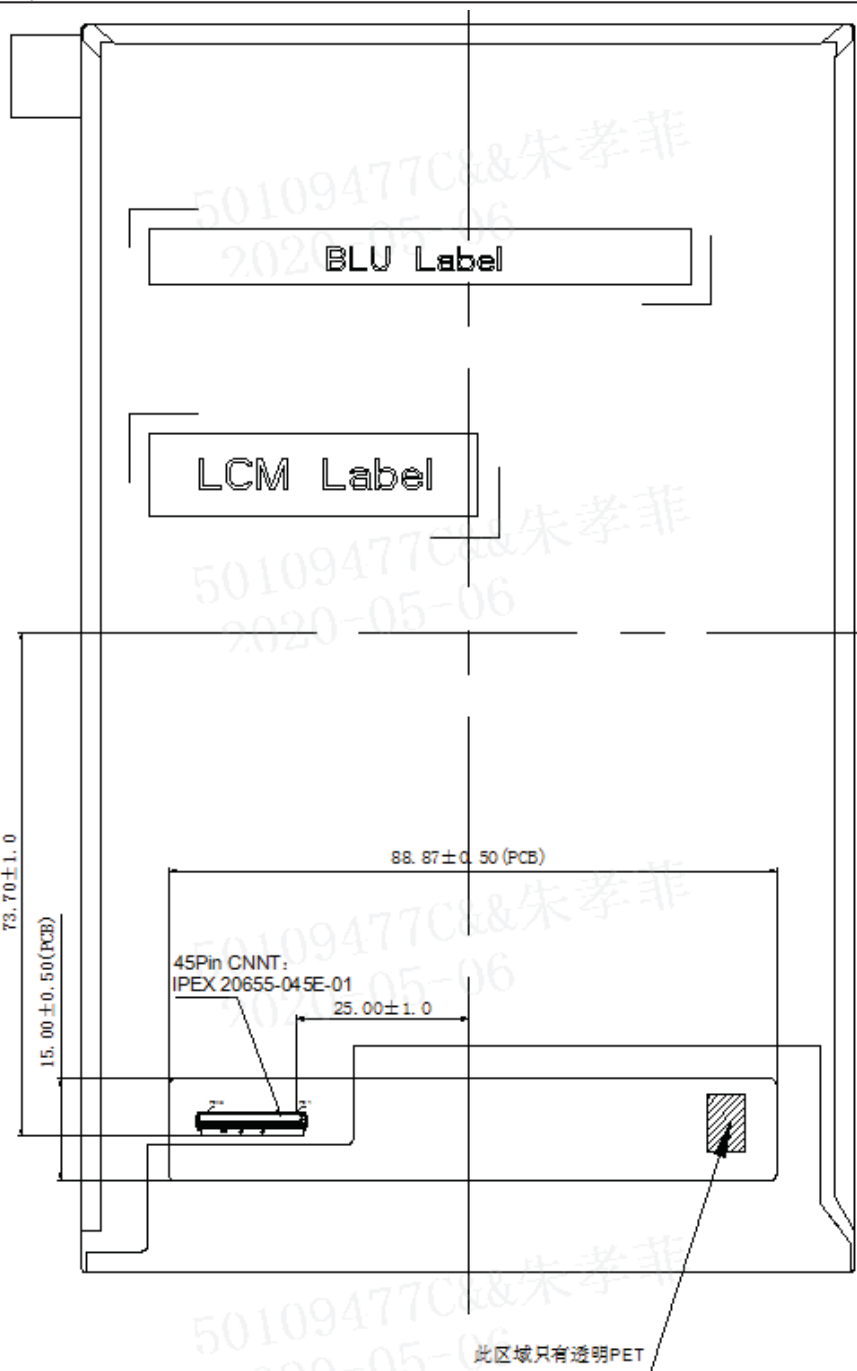
	PRODUCT GROUP	REV	ISSUE DATE
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Figure 22. TFT-LCD Module Outline Dimensions (Rear view)



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	Customer Spec	P4	2021.04.15
15.0 initial code delay 150 R10 delay 10 RB0 05 RB3 52 RB0 01 RC8 00 RC9 00 RCC 26 RCD 26 RDC 00 RDD 00 RE0 26 RE1 26 RB0 03 RC3 2A RE7 2A RC5 2A RDE 2A RB0 00 RB6 03 RBA 87 RBF 15 RC0 12 RC2 0C RC3 02 RC4 0C RC5 02 RB0 06 RC0 A5 RD5 20 RC0 00 RB8 A5 RBC 11 RB8 00 RB0 02			
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RC0 00 RC1 02 RC2 06 RC3 16 RC4 0E RC5 18 RC6 26 RC7 34 RC8 3F RC9 3F RCA 3F RCB 3F RCC 3D RCD 2F RCE 2F RCF 32 RD0 07 RD2 00 RD3 02 RD4 06 RD5 12 RD6 0A RD7 14 RD8 22 RD9 30 RDA 3F RDB 3F RDC 3F RDD 3F RDE 3D RDF 2F RE0 2F RE1 32 RE2 07 RB0 07 RB1 04			
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RB2 05 RB3 2B RB4 55 RB5 77 RB6 97 RB7 CA RB8 FF RB9 66 RBA C5 RBB 63 RBC CC RBD CF RBE 2E RBFB 85 RC0 A9 RC1 CB RC2 DB RC3 E7 RC4 EC RC5 F2 RC6 F9 RC7 FB RC8 FC RC9 00 RCA 00 RCB 5A RCC BF RCD FF RCE FF RB0 08 RB1 04 RB2 16 RB3 2E RB4 56 RB5 78 RB6 98			
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RB7 CB RB8 02 RB9 6A RBA CA RBB 69 RBC D1 RBD D5 RBE 32 RBF 88 RC0 AB RC1 CC RC2 DB RC3 E7 RC4 EC RC5 F2 RC6 F9 RC7 FB RC8 FC RC9 00 RCA 01 RCB 5A RCC BF RCD FF RCE FF RB0 09 RB1 04 RB2 14 RB3 2D RB4 55 RB5 79 RB6 9A RB7 CD RB8 06 RB9 70 RBA D1 RBB 70			
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RBC D8 RBD DB RBE 37 RBF 8B RC0 AD RC1 CD RC2 DC RC3 E8 RC4 EC RC5 F2 RC6 F9 RC7 FB RC8 FC RC9 00 RCA 01 RCB 5A RCC BF RCD FF RCE FF RB0 0A RB1 04 RB2 05 RB3 2B RB4 55 RB5 77 RB6 97 RB7 CA RB8 FF RB9 66 RBA C5 RBB 63 RBC CC RBD CF RBE 2E RBF 85 RC0 A9			
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RC1 CB RC2 DB RC3 E7 RC4 EC RC5 F2 RC6 F9 RC7 FB RC8 FC RC9 00 RCA 00 RCB 5A RCC BF RCD FF RCE FF RB0 0B RB1 04 RB2 16 RB3 2E RB4 56 RB5 78 RB6 98 RB7 CB RB8 02 RB9 6A RBA CA RBB 69 RBC D1 RBD D5 RBE 32 RBf 88 RC0 AB RC1 CC RC2 DB RC3 E7 RC4 EC			
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RC5 F2 RC6 F9 RC7 FB RC8 FC RC9 00 RCA 01 RCB 5A RCC BF RCD FF RCE FF RB0 0C RB1 04 RB2 14 RB3 2D RB4 55 RB5 79 RB6 9A RB7 CD RB8 06 RB9 70 RBA D1 RBB 70 RBC D8 RBD DB RBE 37 RBf 8B RC0 AD RC1 CD RC2 DC RC3 E8 RC4 EC RC5 F2 RC6 F9 RC7 FB			
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RC8 FC RC9 00 RCA 01 RCB 5A RCC BF RCD FF RCE FF RB0 04 RB5 02 RB6 01 RB8 80 delay 10 R11 delay 100 R29 delay 50			
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