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NV156QUM-N51

Product Specification

Rev. P1

BEIJING BOE DISPLAY TECHNOLOGY

BOE	PRODUCT GROUP	REV	ISSUE DATE
	TFT- LCD PRODUCT	P1	2017.01.13
SPEC. NUMBER	SPEC. TITLE NV156QUM-N51 Product Specification		PAGE 2 OF 34

REVISION HISTORY

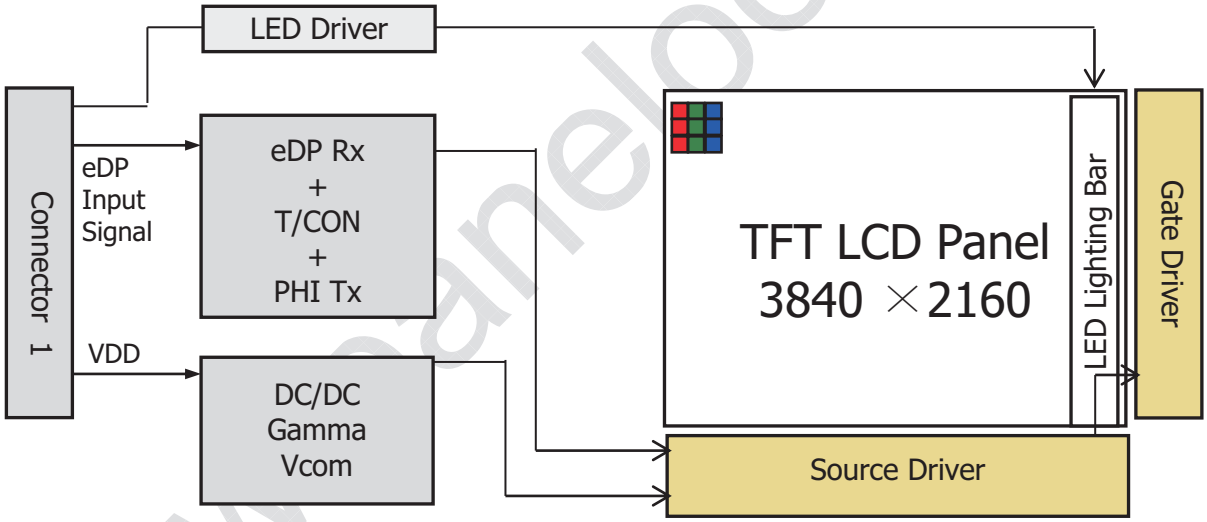
REV.	ECN No.	DESCRIPTION OF CHANGES	DATE	PREPARED
P0	-	Initial Release	2016.08.08	程律
P1	10	Reproduction of color	2017.01.13	程律

Contents

1.0 GENERAL DESCRIPTION

1.1 Introduction

NV156QUM-N51 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 15.6 inch diagonally measured active area with Ultra-HD resolutions (3840 horizontal by 2160 vertical pixel array). Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical Stripe and this module can display 16.7M colors. The TFT-LCD panel used for this module is a low reflection and higher color type. Therefore, this module is suitable for Notebook PC. The LED Driver for back-light driving is built in this model.
All input signals are eDP interface compatible.



1.2 Features

- 4 lane eDP Interface with 5.4Gbps Link Rates
- Thin and light weight
- 8-bit color depth, display 16.7M colors
- 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

1.3 Application

- Notebook PC (Wide type)

1.4 General Specification

The followings are general specifications at the model NV156QUM-N51. (listed in Table 1.)

<Table 1. General Specifications>

Parameter	Specification	Unit	Remarks
Active area	345.6(H) ×194.4(V)	mm	
Number of pixels	3840 (H) ×2160 (V)	pixels	
Pixel pitch	0.09(H) ×0.09 (V)	mm	
Pixel arrangement	RGB Vertical stripe		
Display colors	16.7M	colors	
Display mode	Normally Black		
Dimensional outline	351.9 (H)×206.4(V)×2.6 (D)(max)	mm	
Weight	305 (max)	g	
Surface treatment	**HC, 3H, (Front Polarizer)**		
Back-light	Bottom edge side, 1-LED Lighting Bar type		Note 1
Power consumption	P_D : 1.6	W	Note 2
	P_{BL} : 4.5	W	
	P_{total} : 6.1	W	

Notes : 1. LED Lighting Bar (72*LED Array)
Notes: 2. Typical Measurement Condition : Mosaic Pattern

2.0 ABSOLUTE MAXIMUM RATINGS

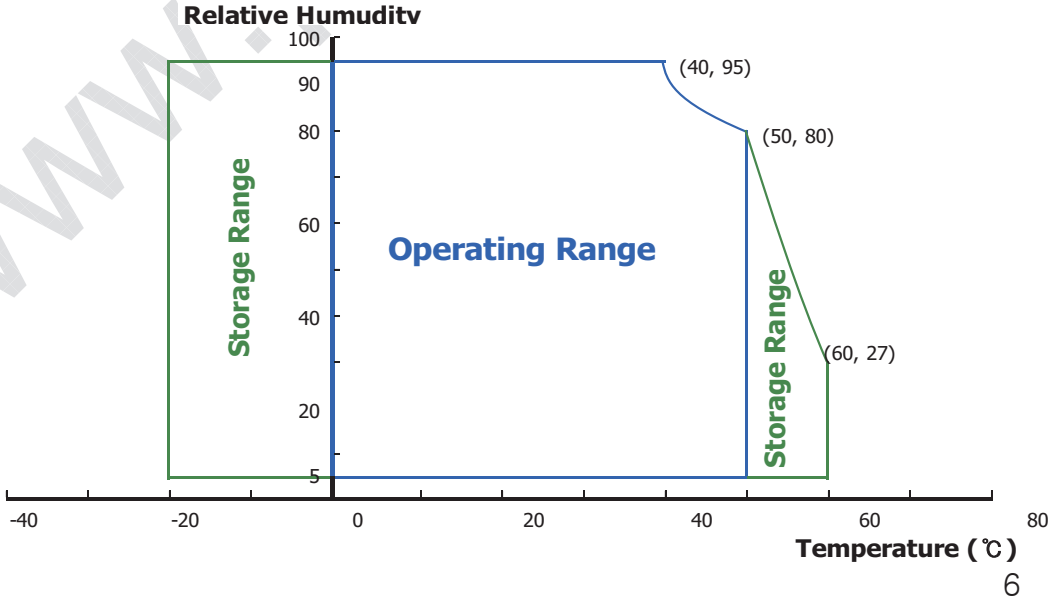
The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit. The operational and non-operational maximum voltage and current values are listed in Table 2.

< 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
Logic Supply Voltage	V_{IN}	V_{ss}-0.3	V_{DD}+0.3	V	
Operating Temperature	T_{OP}	0	+50	℃	Note 2
Storage Temperature	T_{ST}	-20	+60	℃	

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 ^{O}C ≥ Ta)
Maximum wet - bulb temperature at 39 ^{O}C or less. (Ta > 40 ^{O}C) No condensation.



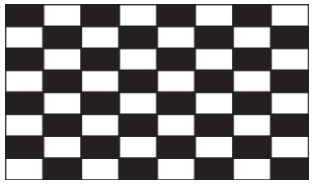
3.0 ELECTRICAL SPECIFICATIONS

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	At V_{DD} = 3.3V
Power Supply Current	I_{DD}	-	485	700	mA	Note 1
Positive-going Input Threshold Voltage	V_{IT+}	-	-	100	mV	V_{cm} = 1.2V typ.
Negative-going Input Threshold Voltage	V_{IT-}	-100	-	-	mV	
Differential Input Voltage	V_{ID}	200	-	600	mV	
Power Consumption	P_D	-	1.6	2.0	W	Note 1
	P_{BL}	-	4.5	-	W	Note 2
	P_{total}	-	6.1	-	W	

Notes : 1. The supply voltage is measured and specified at the interface connector of LCM.
The current draw and power consumption specified is for 3.3V at 25℃.
a) Typ : Mosaic 32x32
b) Max : Vertical 2 line skip pattern



2. Calculated value for reference (V_{LED} × I_{LED}/ Driiver Eff.)

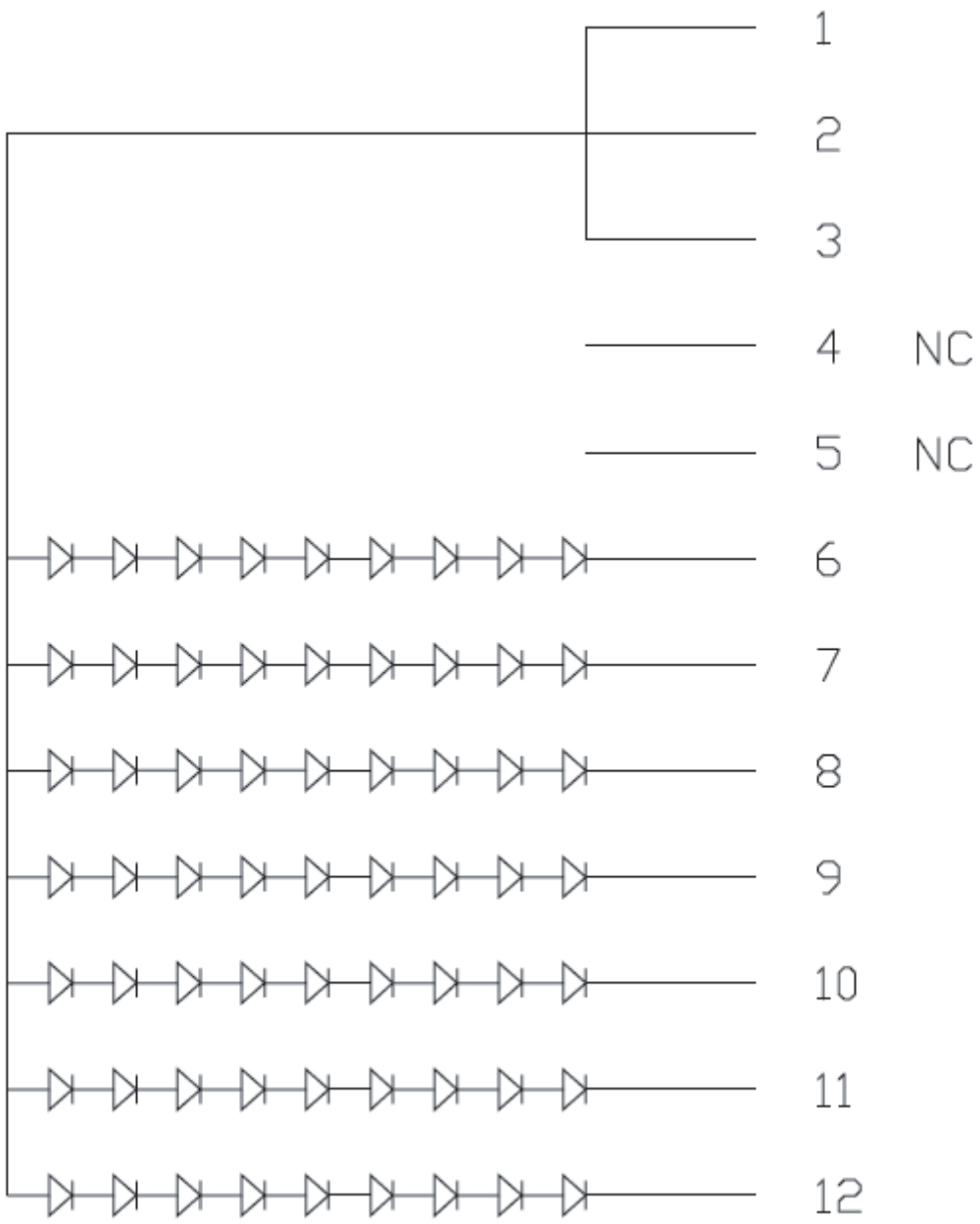
3.2 Backlight Unit

< 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	-	21	-	mA	-
LED Power Consumption		P_{LED}		-	4.5	W	Note 1
LED Life-Time		N/A	15,000	-	-	Hour	I_F = 20mA
Power supply voltage for LED Driver		V_{LED}	5	12	21	V	
EN Control Level	Backlight on		2.1		5.0	V	
	Backlight off		0		0.8	V	
PWM Control Level	PWM High Level		2.1		5.0	V	
	PWM Low Level		0		0.8	V	
PWM Control Frequency		F_{PWM}	200	-	10,000	Hz	
Duty Ratio		-	1	-	100	%	

Notes : 1. Power supply voltage12V for LED Driver, Driver efficiency 88%,
Calculator Value for reference $I_F \times V_F \times 72 / 0.88 = P_{LED}$
2. The LED Life-time define as the estimated time to 50% degradation of initial luminous.

3.3 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 TOPCON 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		85	-	Deg.	Note 1
		Θ_9			85	-	Deg.	
	Vertical	Θ_{12}			85	-	Deg.	
		Θ_6			85	-	Deg.	
Luminance Contrast ratio		CR	Θ = 0°	-	1000			Note 2
Luminance of White	5 Points	Y_w	Θ = 0° I_{LED} = 21.5mA	255	300	-	cd/m^2	Note 3
White Luminance uniformity	5 Points	ΔY5		80	-	-		Note 4
	13 Points	ΔY13		60	-	-		
White Chromaticity		x_w	Θ = 0°	0.283	0.313	0.343		Note 5
		y_w		0.299	0.329	0.359		
Reproduction of color	Red	x_R	Θ = 0°	-0.03	0.650	+0.03		
		y_R			0.342			
	Green	x_G			0.326			
		y_G			0.625			
	Blue	x_B			0.152			
		y_B			0.067			
Gamut				67	72	-	%	
Response Time (Rising + Falling)		T_{RT}	Ta= 25° C Θ = 0°	-	30	35	ms	Note 6
Cross Talk		CT	Θ = 0°	-	-	2.0	%	Note 7

Notes :

1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface (see FIGURE 1).

2. Contrast measurements shall be made at viewing angle of Θ= 0 and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state .
(see FIGURE 1) Luminance Contrast Ratio (CR) is defined mathematically.

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

3. 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 2 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 2 and FIGURE 3).

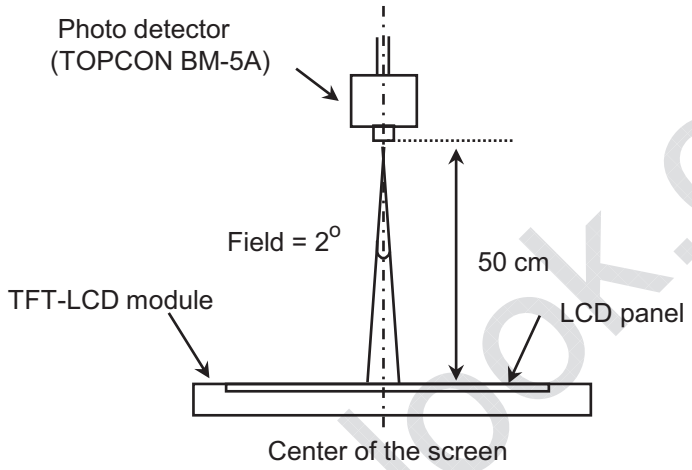
5. The color chromaticity coordinates specified in Table 5 shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel.

6. The electro-optical response time measurements shall be made as FIGURE 4 by switching the "data" input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is Tr, and 90% to 10% is Td.

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 5).

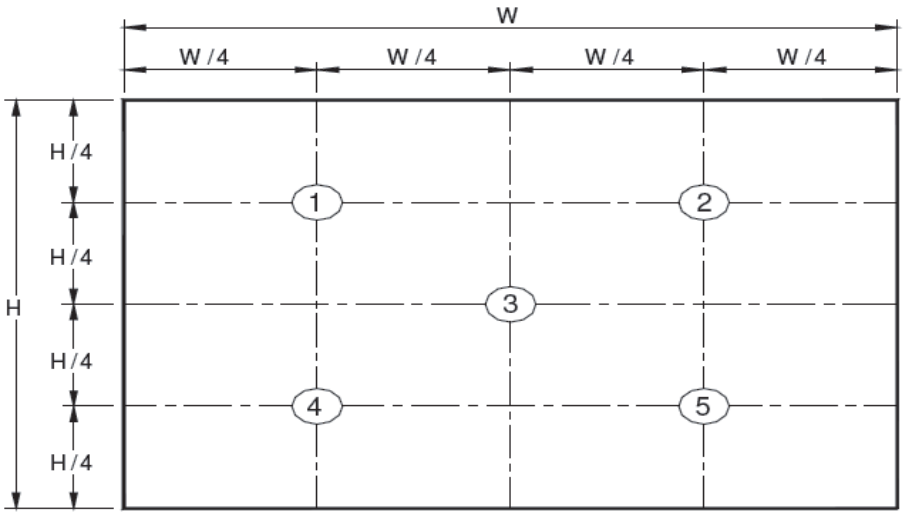
4.3 Optical measurements

Figure 1. Measurement Set Up



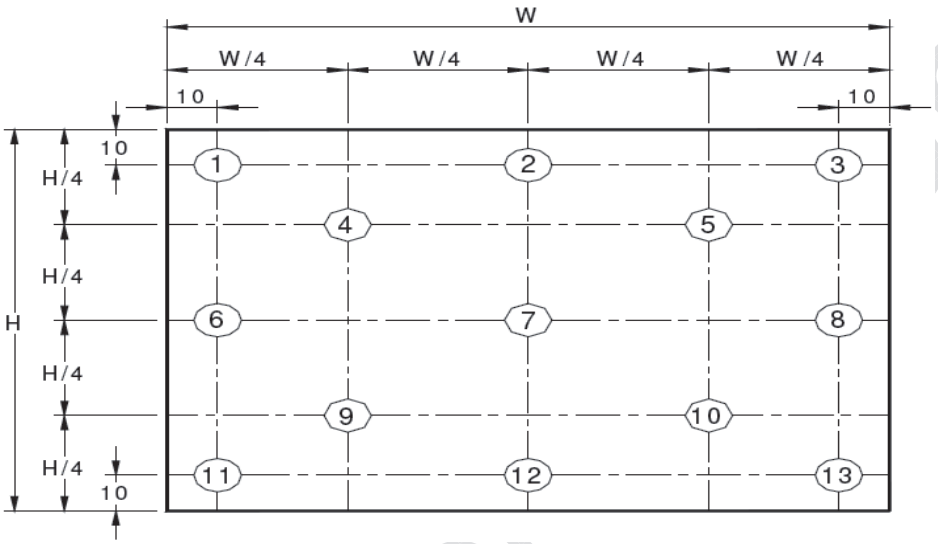
Optical characteristics measurement setup

Figure 2. White Luminance and Uniformity Measurement Locations (5 points)



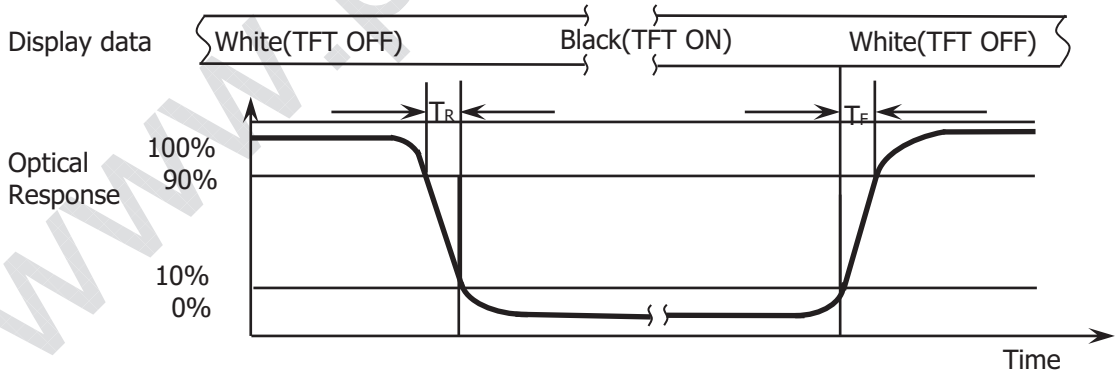
Center Luminance of white is defined as luminance values of center 5 points across the LCD surface. Luminance shall be measured with all pixels in the view field set first to white. This measurement shall be taken at the locations shown in FIGURE 2 for a total of the measurements per display.

Figure 3. Uniformity Measurement Locations (13 points)



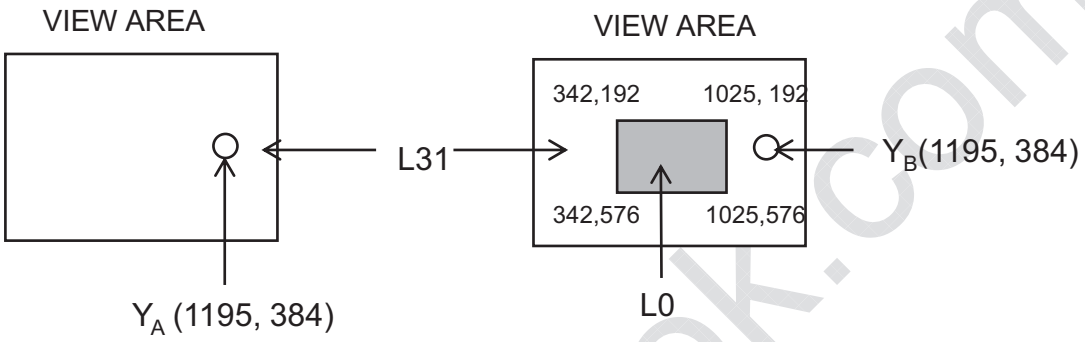
The White luminance uniformity on LCD surface is then expressed as : ΔY5 = Minimum Luminance of five points / Maximum Luminance of five points (see FIGURE 2) , ΔY13 = Minimum Luminance of 13 points /Maximum Luminance of 13 points (see FIGURE 3).

Figure 4. Response Time Testing



The electro-optical response time measurements shall be made as shown in FIGURE 4 by switching the “data” input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is Td and 90% to 10% is Tr.

Figure 5. Cross Modulation Test Description



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

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

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 5).

5.0 INTERFACE CONNECTION.

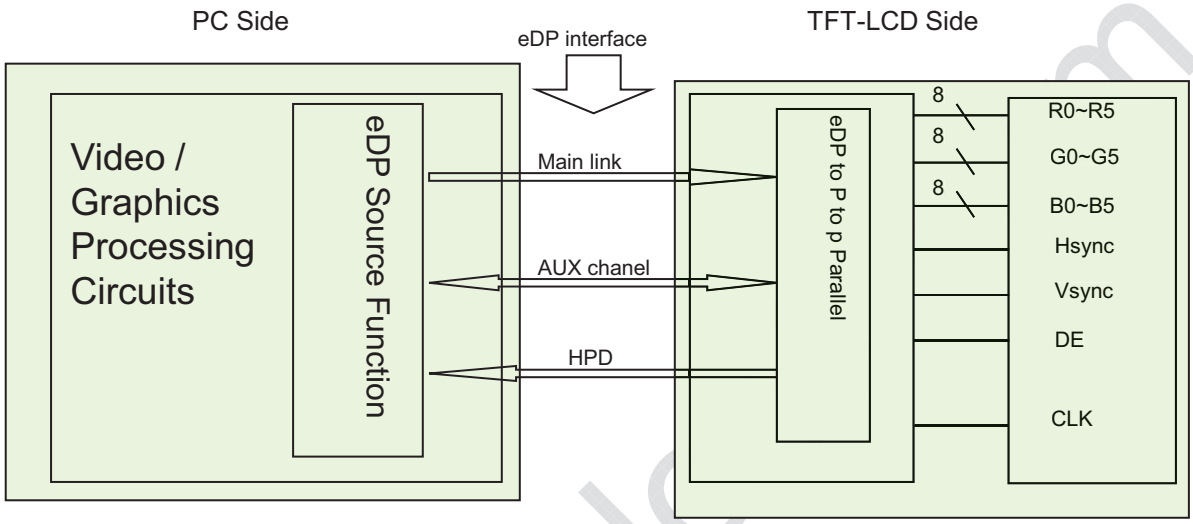
5.1 Electrical Interface Connection

The electronics interface connector is STM. The mating connector part number is STM MSAK24025P40. The connector interface pin assignments are listed in Table 6.

<Table 6. Pin Assignments for the Interface Connector>

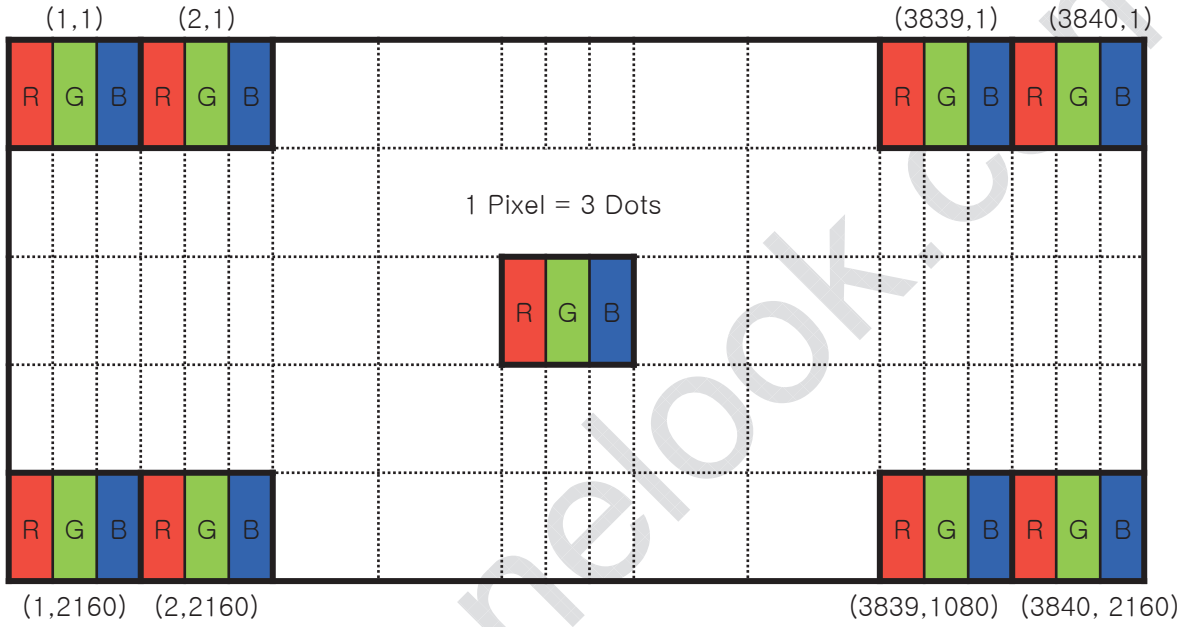
Terminal	**Symbol**	**Functions**
PIN No.	Symbol	Description
1	G-Sync	G-Sync
2	H_GND	eDP lane Up to 5.4G
3	Lane3_N	
4	Lane3_P	
5	H_GND	
6	Lane2_N	
7	Lane2_P	
8	H_GND	
9	Lane1_1N	
10	Lane1_1P	
11	H_GND	
12	Lane1_0N	
13	Lane1_0P	
14	H_GND	
15	AUX_CH_P	
16	AUX_CH_N	
17	H_GND	
18	LCD_VCC	LCD Logic Power (3.3±0.3V)
19	LCD_VCC	
20	LCD_VCC	
21	LCD_VCC	
22	LCD_Self_Test(BIST)	BIST（IN Port)
23	LCD_GND	Logic GND (Connect to GND in Module)
24	LCD_GND	
25	LCD_GND	
26	LCD_GND	
27	HPD	HPD（OUT Port 2.5V/3.3V)
28	BL_GND	BLU GND (Connect to GND in Module)
29	BL_GND	
30	BL_GND	
31	BL_GND	
32	BL_ENABLE	IN Port
33	BL_PWM	IN Port
34	H_sync	H_sync（OUT Port ）
35	NC	NC
36	BL_PWR	BLU Power (5~21V)
37	BL_PWR	
38	BL_PWR	
39	BL_PWR	
40	Color Engine	NC

5-2. eDP Interface



5.3 Data Input Format

<Table 6. Pin Assignments for the Interface Connector>



Display Position of Input Data (V-H)

5.4 Back-light & LCM Interface Connection

Interface Connector: MSK24022P12

<Table 7. Pin Assignments for the BLU & LCM Connector>

Pin No.	Symbol	Description	Pin No.	Symbol	Description
1	**Vout**	**LED anode connection**	**7**	**LED2**	**LED cathode connection**
2	**Vout**	**LED anode connection**	**8**	**LED3**	**LED cathode connection**
3	**Vout**	**LED anode connection**	**9**	**LED4**	**LED cathode connection**
4	**NC**	**No Connection**	**10**	**LED5**	**LED cathode connection**
5	**NC**	**No Connection**	**11**	**LED6**	**LED cathode connection**
6	**LED1**	**LED cathode connection**	**12**	**LED7**	**LED cathode connection**

6.0 SIGNAL TIMING SPECIFICATION

6.1 The NV156QUM-N51 is operated by the DE only.

Item		Symbols	Min	Typ	Max	Unit
Clock	Frequency	1/Tc	355.52	533.25	586.6	MHz
	High Time	Tch	-	4/7Tc	-	Tc
	Low Time	Tcl	-	3/7Tc	-	Tc
Frame Period		Tv	3900	4000	4050	lines
			-	60	-	Hz
			25	16.67	15.15	ms
Vertical Display Period		Tvd	-	2160	-	lines
One line Scanning Period		Th	2180	2222	2240	clocks
Horizontal Display Period		Thd	-	3840	-	clocks

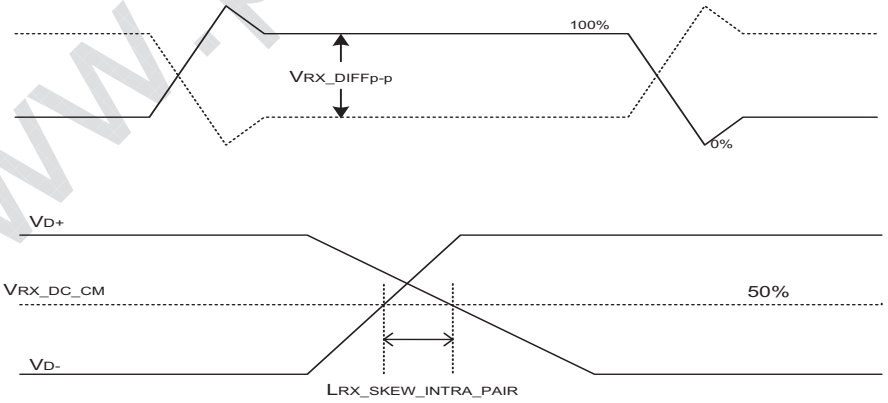
Note : This module can support low frame refresh rate 50Hz&40Hz.

6.2 eDP Rx Interface Timing Parameter

The specification of the eDP Rx interface timing parameter is shown in Table 8.

<Table 8. eDP Rx Interface Timing Specification>

Item	Symbol	Min	Typ	Max	Unit	Remark
Spread spectrum clock	ssc		0.5		%	
Differential peak-to-peak input voltage at package pins	$V_{RX-DIFFp-p}$	100	0	1320	mV	
Rx input DC common mode voltage	$V_{RX\_DC\_CM}$	-	GND	-	V	
Differential termination resistance	$R_{RX-DIFF}$	80	-	100	Ω	
Single-ended termination resistance	R_{RX-SE}	40	-	60	Ω	
Rx short circuit current limit	I_{RX_SHORT}	-	-	50	mA	
Intra-pair skew at Rx package pins (HBR) RX intra-pair skew tolerance at HBR	$L_{RX\_SKEW\_INTRA\_PAIR\ HBR2}$	-	-	50	ps	

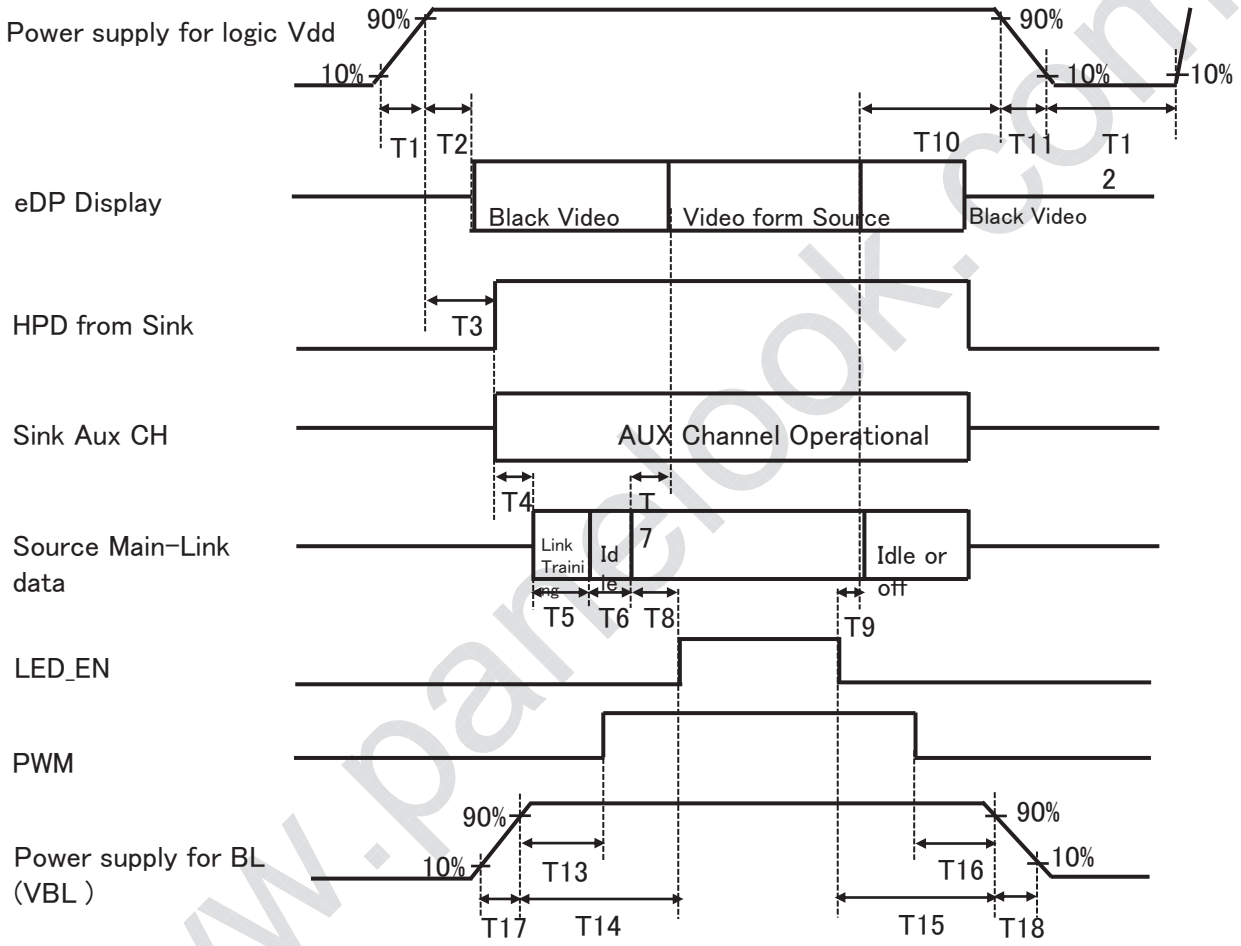


7.0 INPUT SIGNALS, BASIC DISPLAY COLORS & GRAY SCALE OF COLORS

	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



- 0.5ms ≤ T1 ≤ 10 ms
- 0ms ≤ T2 ≤ 200 ms
- 0ms ≤ T3 ≤ 200 ms
- 0ms ≤ T13
- 0ms ≤ T14
- 0ms ≤ T17
- 0ms ≤ T7 ≤ 50ms
- 0ms ≤ T10 ≤ 500 ms
- 0 ms ≤ T11 ≤ 10 ms
- 500ms ≤ T12
- 0ms ≤ T15
- 0ms ≤ T16
- 0ms ≤ 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.

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

Connector Name /Description	For Signal Connector
Manufacturer	STM
Type/ Part Number	MSAK24025P40
Mating housing/ Part Number	I-PEX 20455-040E

10.0 MECHANICAL CHARACTERISTICS

10.1 Dimensional Requirements

FIGURE 6 shows mechanical outlines for the model HB140FH1-401.
Other parameters are shown in Table 9.

<Table 9. Dimensional Parameters>

Parameter	Specification	Unit
Active Area	345.6 (H) ×194.4 (V)	Mm
Number of pixels	3840 (H) X 2160 (V) (1 pixel = R + G + B dots)	-
Pixel pitch	0.09(H) ×0.09 (V)	mm
Pixel arrangement	RGB Vertical stripe	
Display colors	16.7M	
Display mode	Normally Black	
Dimensional outline	351.9 (H)×206.4(V)×2.6 (D)(max)	mm
Weight	305 (max)	g

10.2 Mounting

See FIGURE 6.

10.3 Glare and Polarizer Hardness.

The surface of the LCD has HC 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 10. Reliability test>

No	Test Items	Conditions
1	High temperature storage test	Ta = 70 ℃, 240 hrs
2	Low temperature storage test	Ta = -30 ℃, 240 hrs
3	High temperature & high humidity operation test	Ta = 60 ℃, 90%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)	1.47G, 10~200Hz,Half Sine X,Y,Z / Sweep rate : 30min
8	Shock test (non-operating)	220G, Half Sine Wave 2msec ±X, ±Y, ±Z Once for each direction
9	Electro-static discharge test (non-operating)	Air : 150 pF, 330Ω, ±15 KV Contact : 150 pF, 330Ω, ±8 KV

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.

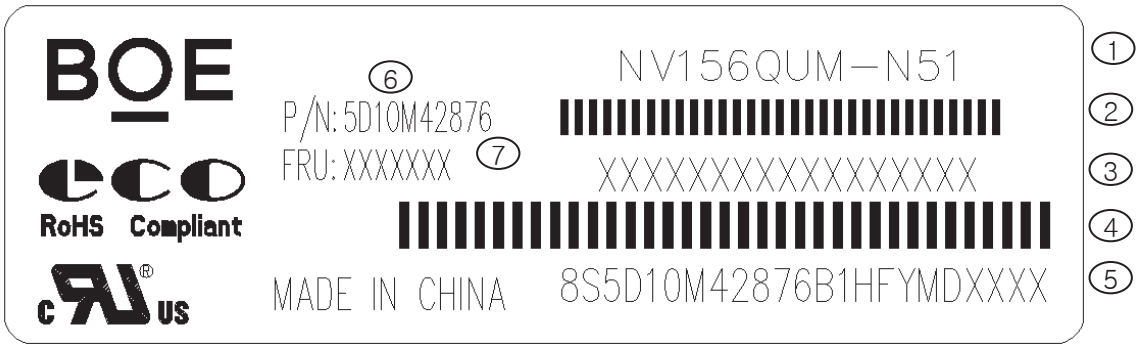
(4) Cautions for the atmosphere
- Dew drop atmosphere should be avoided.
- Do not store and/or operate the LCD module in a high temperature and/or humidity atmosphere. Storage in an electro-conductive polymer packing pouch and under relatively low temperature atmosphere is recommended.

(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

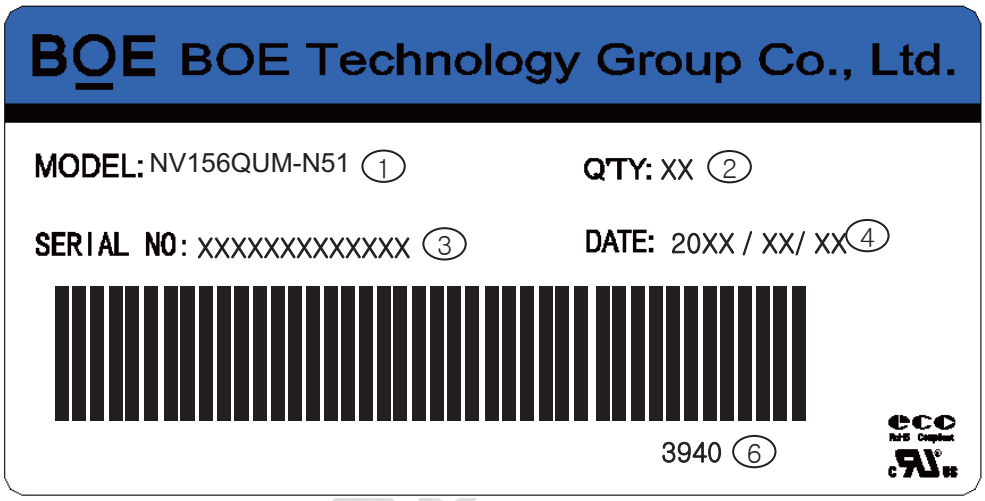
(1) Product label



标签尺寸：80mm × 25mm，厚度0.08mm
1. FG-CODE: NV156QUM-N510
2. MDL ID 条纹码
3. MDL ID
4. 8S 码对应条纹码
5. 8S码
6. P/N 码
7. FRU 码

(2) Box label

Label Size: 109.5 mm (L) × 55 mm (W)
Contents
Model: NV156QUM-N51
Q`ty: Module Q`ty in one box
Serial No.: Box Serial No. See next figure for detail description.
Date: Packing Date
Internal use of Product



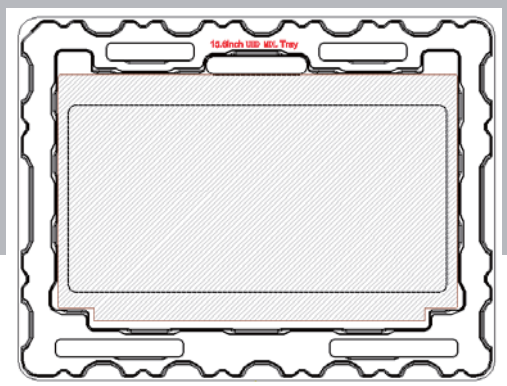
1. FG-CODE
2. Box product quantity
3. Box ID, code rule
4. Box Packing Date
5. FG-CODE

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

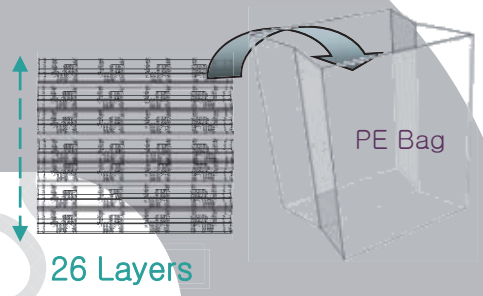
15.1 Packing order

-. 将1pcs MDL 水平放入Tray



-. 将26pcs PET Tray 平放入PE Bag
顶部1pcs 空Tray

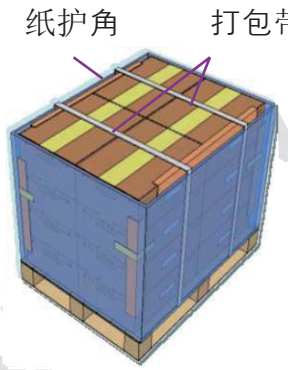
-. Tray 不旋转码放



-. 每个Pallet上放3层Box1层4箱,共计12ea Box

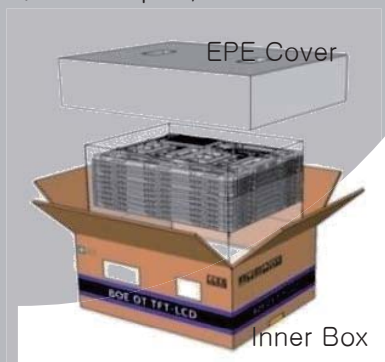
-. Pallet外进行缠膜包装

-. 容量: 300pcs/Pallet



-. .将PET Tray堆码后平放入Inner Box
上下放置EPE Cover

-. 容量：25pcs/Inner Box



step 3

15.2 Notes

- Box Dimension: 500mm(W) x 400mm(D) x 300mm(H)
- Package Quantity in one Box: 25pcs
- Total Weight: TBD kg

15.0 MECHANICAL OUTLINE DIMENSION

Figure 6. TFT-LCD Module Outline Dimension (Front View)

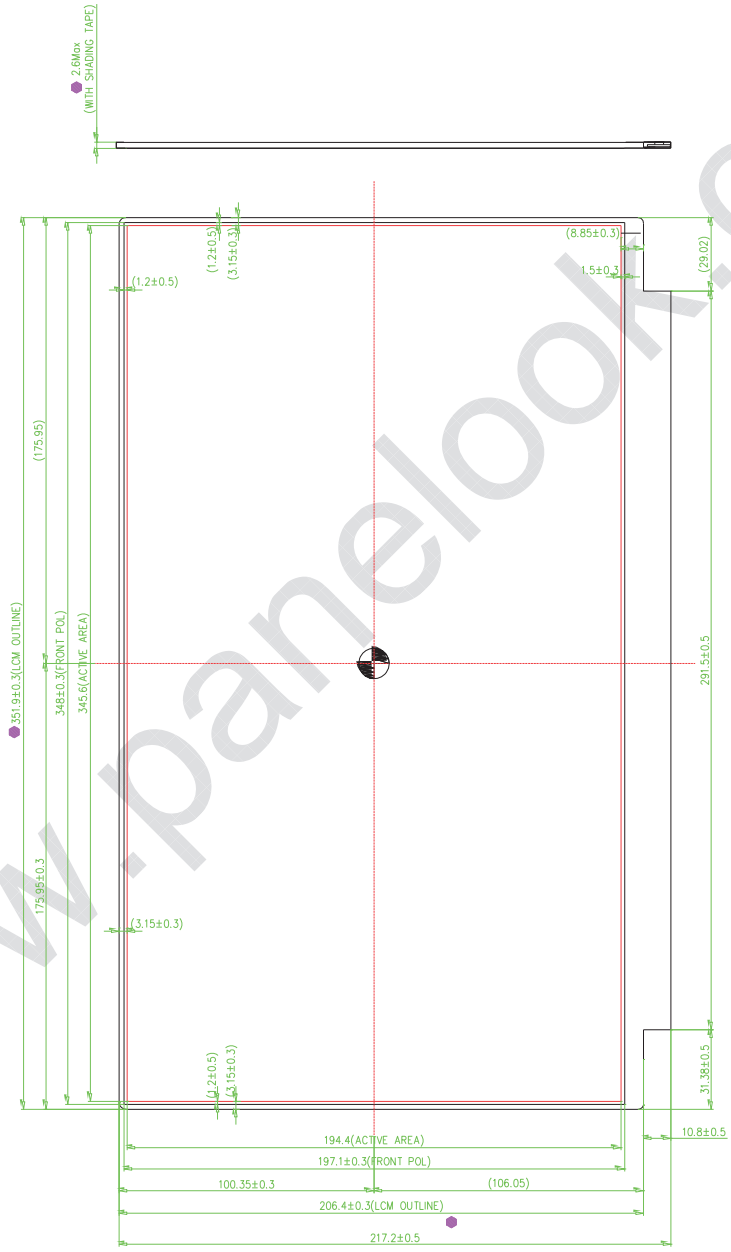
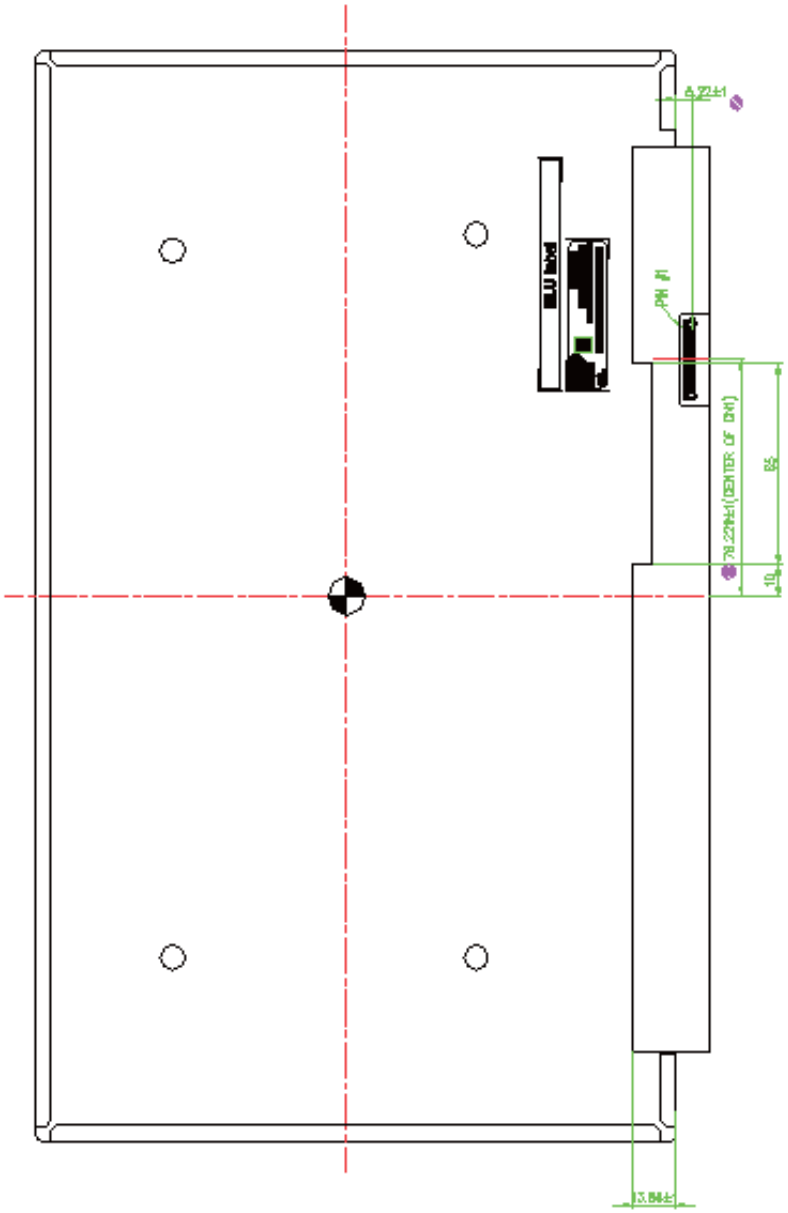


Figure 7. TFT-LCD Module Outline Dimensions (Rear view)



16.0 EDID Table

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	
08	ID Manufacturer Name	09	9		BOE	ID = BOE
09		E5	229			
0A	ID Product Code	F4	244		1780	ID = 1780
0B		06	6			
0C	32-bit serial No.	00	0		0	
0D		00	0		0	
0E		00	0		0	
0F		00	0		0	
10	Week of manufacture	01	1		1	
11	Year of Manufacture	1A	26		2016	Manufactured in 2016
12	EDID Structure Ver.	01	1		1	EDID Ver 1.0
13	EDID revision #	04	4		4	EDID Rev. 0.4
14	Video input definition	A5	165		-	Refer to right table
15	Max H image size	23	35		35	35 cm (Approx)
16	Max V image size	13	19		19	19.44 cm (Approx)
17	Display Gamma	78	120		2.2	Gamma curve = 2.2
18	Feature support	02	2		-	Refer to right table
19	Red/Green low bits	A2	162		-	Red / Green Low Bits
1A	Blue/White low bits	60	96		-	Blue / White Low Bits
1B	Red x high bits	A4	164	658	0.643	Red (x) = 10100100 (0.643)
1C	Red y high bits	57	87	350	0.342	Red (y) = 01010111 (0.342)
1D	Green x high bits	50	80	320	0.313	Green (x) = 01010000 (0.313)
1E	Green y high bits	A0	160	642	0.627	Green (y) = 10100000 (0.627)
1F	Blue x high bits	25	37	149	0.146	Blue (x) = 00100101 (0.146)
20	BLue y high bits	14	20	82	0.081	Blue (y) = 00010100 (0.081)
21	White x high bits	50	80	320	0.313	White (x) = 01010000 (0.313)
22	White y high bits	54	84	336	0.329	White (y) = 01010100 (0.329)
23	Established timing 1	00	0		-	Refer to right table
24	Established timing 2	00	0		-	

Address (HEX)	Function	Hex	Dec	crc	Input values.	Notes
25	Established timing 3	00	0		-	
26	Standard timing #1	01	1			Not Used
27		01	1			
28	Standard timing #2	01	1			Not Used
29		01	1			
2A	Standard timing #3	01	1			Not Used
2B		01	1			
2C	Standard timing #4	01	1			Not Used
2D		01	1			
2E	Standard timing #5	01	1			Not Used
2F		01	1			
30	Standard timing #6	01	1			Not Used
31		01	1			
32	Standard timing #7	01	1			Not Used
33		01	1			
34	Standard timing #8	01	1			Not Used
35		01	1			
36	Detailed timing/monitor descriptor #1	4D	77		533.3	533.25MHz Main clock
37		D0	208			
38		00	0		3840	Hor Active = 3840
39		A0	160		160	Hor Blanking = 160
3A		F0	240		-	4 bits of Hor. Active + 4 bits of Hor. Blanking
3B		70	112		2160	Ver Active = 2160
3C		3E	62		62	Ver Blanking = 62
3D		80	128		-	4 bits of Ver. Active + 4 bits of Ver. Blanking
3E		30	48		48	Hor Sync Offset = 48
3F		20	32		32	H Sync Pulse Width = 32
40		35	53		3	V sync Offset = 3 line
41		00	0		5	V Sync Pulse width : 5 line
42		59	89		346	Horizontal Image Size = 345.6 mm (Low 8 bits)
43		C2	194		194	Vertical Image Size = 194.4 mm (Low 8 bits)
44		10	16		-	4 bits of Hor Image Size + 4 bits of Ver Image Size
45		00	0		0	Hor Border (pixels)
46		00	0		0	Vertical Border (Lines)
47		1A	26		-	Refer to right table

Address (HEX)	Function	Hex	Dec	crc	Input values.	Notes
48	Detailed timing/monitor descriptor #2	00	0		0	0MHz Main clock
49		00	0			
4A		00	0		0	Hor Active = 0
4B		00	0		0	Hor Blanking = 0
4C		00	0		-	4 bits of Hor. Active + 4 bits of Hor. Blanking
4D		00	0		0	Ver Active = 0
4E		00	0		0	Ver Blanking = 0
4F		00	0		-	4 bits of Ver. Active + 4 bits of Ver. Blanking
50		00	0		0	Hor Sync Offset = 0
51		00	0		0	H Sync Pulse Width = 0
52		00	0		0	V sync Offset = 0 line
53		00	0		0	V Sync Pulse width : 0 line
54		00	0		0	Horizontal Image Size = 0 mm (Low 8 bits)
55		00	0		0	Vertical Image Size = 0 mm (Low 8 bits)
56		00	0		-	4 bits of Hor Image Size + 4 bits of Ver Image Size
57		00	0		0	Hor Border (pixels)
58		00	0		0	Vertical Border (Lines)
59		00	0		-	Refer to right above table
5A	Detailed timing/monitor descriptor #3	00	0			Indicates descriptor #3 is a display Descriptor
5B		00	0			
5C		00	0			Reserved
5D		FE	254			Tag：ASCII String
5E		00	0			Reserved
5F		42	66		B	Manufacture name : BOEHF
60		4F	79		O	
61		45	69		E	
62		20	32			
63		48	72		H	
64		46	70		F	
65		0A	10			
66		20	32			
67		20	32			
68		20	32			
69		20	32			
6A		20	32			
6B		20	32			

Address (HEX)	Function	Hex	Dec	crc	Input values.	Notes
6C	Detailed timing/monitor descriptor #4	00	0			Indicates descriptor #4 is a display Descriptor
6D		00	0			
6E		00	0			Reserved
6F		FE	254			Tag：ASCII String
70		00	0			Reserved
71		4E	78		N	Model name : NV156QUM-N51
72		56	86		V	
73		31	49		1	
74		35	53		5	
75		36	54		6	
76		51	81		Q	
77		55	85		U	
78		4D	77		M	
79		2D	45		-	
7A		4E	78		N	
7B		35	53		5	
7C		31	49		1	
7D		0A	10			
7E	Extension flag	00	0		1	0 ：1個EDID；N-1：N个EDID
7F	Checksum	C2	194	194	-	