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PRODUCT SPECIFICATION FOR APPROVAL

Model Name	NV140QUM-N61
Description	14.0 UHD color TFT-LCD with LED backlight
Prepared by	xxxx / Engineer
Checked by	xxxx / Manager
Approved by	xxxx / Dept. Manager

Customer	HP
<hr/> <hr/> <hr/>	
<p>Please return one copy for confirmation with your signature and comments</p>	

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HEFEI BOE DISPLAY TECHNOLOGY

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REVISION HISTORY				
REV.	ECN No.	DESCRIPTION OF CHANGES	DATE	PREPARED
P0	-	Initial Release	2016.12.05	李宁

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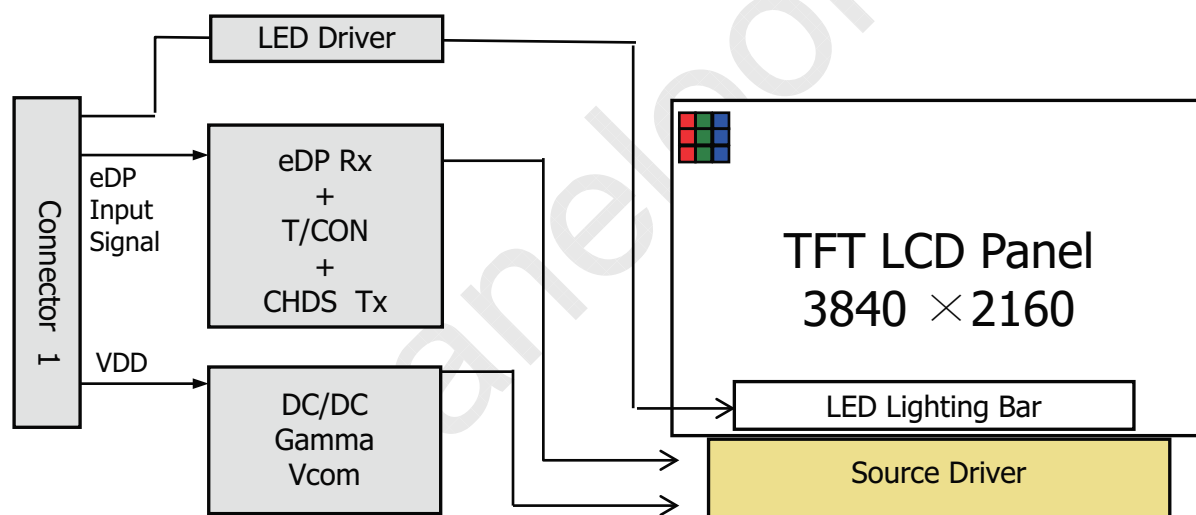
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1.0 GENERAL DESCRIPTION

1.1 Introduction

NV140QUM-N61 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 14.0 inch diagonally measured active area with UHD 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 8-bit 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
- Single LED Lighting Bar. (Down 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

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1.3 Application

- Notebook PC (Wide type)

1.4 General Specification

The followings are general specifications at the model NV140QUM-N51 (listed in Table 1.)

<Table 1. General Specifications>

Parameter	Specification	Unit	Remarks
Active area	309.31(H) × 173.99(V)	mm	
Number of pixels	3840 (H) × 2160 (V)	pixels	
Pixel pitch	0.02685(H) × 0.08055 (V)	mm	
Pixel arrangement	RGB Vertical stripe		
Display colors	16.7M	colors	
Display mode	Normally Black		
Dimensional outline	315.01(H)*199.04 (V)*2.4(Max)	mm	With PCB
Weight	240(max)	g	
Surface treatment	AG40		
Back-light	Down edge side, 1-LED Lighting Bar type		Note 1
Power consumption	PD : 1.6 max	W	@mosic pattern
	PBL :4.81 max.	W	
	Ptotal :6.41 max	W	@mosic pattern

Notes : 1. LED Lighting Bar (64*LED Array)

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2.0 ABSOLUTE MAXIMUM RATINGS

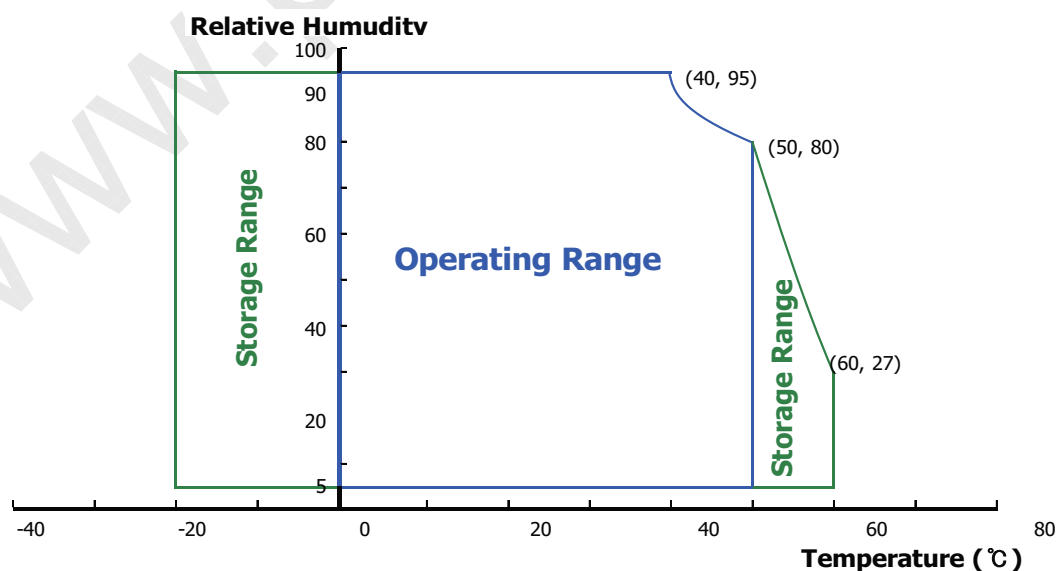
The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit. The operational and non-operational maximum voltage and current values are listed in Table 2.

< Table 2. Absolute Maximum Ratings >

Ta=25+/-2°C

Parameter	Symbol	Min.	Max.	Unit	Remarks
Power Supply Voltage	V _{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}	-20	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.



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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	Note 1
Permissible Input Ripple Voltage	V _{RF}	-	-	100	mV	At V _{DD} = 3.3V
Power Supply Current	I _{DD1}	-	470	485	mA	Note 1
Positive-going Input Threshold Voltage	I _{DD2}	-	-	910	mA	V _{cm} = 1.2V typ.
Negative-going Input Threshold Voltage	V _{IT-}	-100	-	-	mV	
Differential Input Voltage	V _{ID}	380	-	1200	mV	
Power Consumption	P _{D1}	-	1.55	1.60	W	Note 1
	P _{D2}	-	-	3.0	W	Note 2
	P _{BL}	-	-	4.81	W	
	P _{total}	-	-	6.41	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°C.

a) I_{DD1}/P_{D1} max in R/G/B Pattern, work in normal Patterns

b) I_{DD2}/P_{D2} max in 1H1Line Pattern, work in extremely special Pattern.

2. Calculated value for reference (V_{LED} × I_{LED}) , P_{total} in the normal Patterns.

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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 Forward Voltage	V _F	-	-	3.0	V	-
LED Forward Current	I _F	-	21.8	-	mA	-
LED Power Consumption	P _{LED}	-	-	4.81	W	Note 1
LED Life-Time	N/A	15,000	-	-	Hour	IF = 20.8mA
Power supply voltage for LED Driver	V _{LED}	5	12	24	V	
EN Control Level	Backlight on	2.2	3.3	5.0	V	
	Backlight off	0	-	0.6	V	
PWM Control Level	PWM High Level	2.2	3.3	5.0	V	
	PWM Low Level	0	-	0.6	V	
PWM Control Frequency	F _{PWM}	100	-	50K	Hz	
Duty Ratio	-	1	-	100	%	

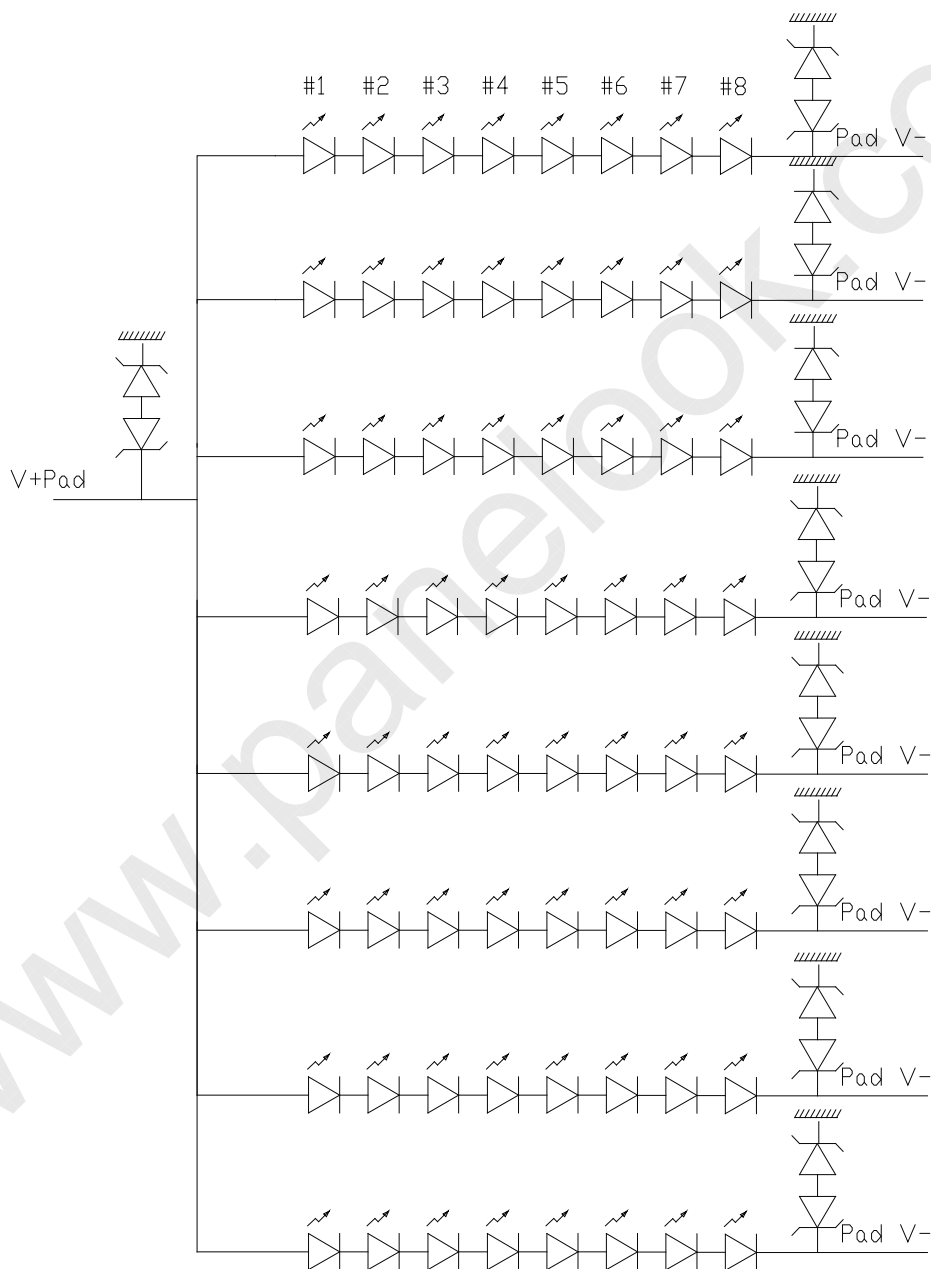
Notes : 1. Power supply voltage 12V for LED Driver,

Calculator Value for reference $IF \times VF \times 60 / \text{efficiency} = P_{LED}$

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

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3.3 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 (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 $\theta=0$ ($=\theta_3$) as the 3 o'clock direction (the "right"), $\theta=90$ ($=\theta_{12}$) as the 12 o'clock direction ("upward"), $\theta=180$ ($=\theta_9$) as the 9 o'clock direction ("left") and $\theta=270$ ($=\theta_6$) as the 6 o'clock direction ("bottom"). While scanning θ and/or Φ , the center of the measuring spot on the Display surface shall stay fixed. The 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	-	85	-	Deg.	Note 1
		θ_9		-	85	-	Deg.	
	Vertical	θ_{12}		-	85	-	Deg.	
		θ_6		-	85	-	Deg.	
Luminance Contrast ratio		CR	$\theta = 0^\circ$	-	800	-		Note 2
Luminance of White	5 Points	Y_w	$\theta = 0^\circ$ ILED = 20.8mA	340	400	-	cd/m ²	Note 3
White Luminance uniformity	5 Points	ΔY_5		80	-	-		Note 4
	13 Points	ΔY_{13}		62.5	-	-		
White Chromaticity		x_w	$\theta = 0^\circ$	-0.03	0.313	+0.03		Note 5
		y_w			0.329			
Reproduction of color	Red	x_R	$\theta = 0^\circ$	-0.03	0.64	+0.03		
		y_R			0.33			
	Green	x_G			0.30			
		y_G			0.60			
	Blue	x_B			0.15			
		y_B			0.06			
Gamut					72		%	
Response Time (Rising + Falling)		T_{RT}	Ta = 25°C $\theta = 0^\circ$	-	35	-	ms	Note 6
Cross Talk		CT	$\theta = 0^\circ$	-	-	2.0	%	Note 7

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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 $\Theta = 0$ 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 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 : $\Delta Y = \text{Minimum Luminance of 5(or 13) points} / \text{Maximum Luminance of 5(or 13) points}$.
(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 T_r , and 90% to 10% is T_d .

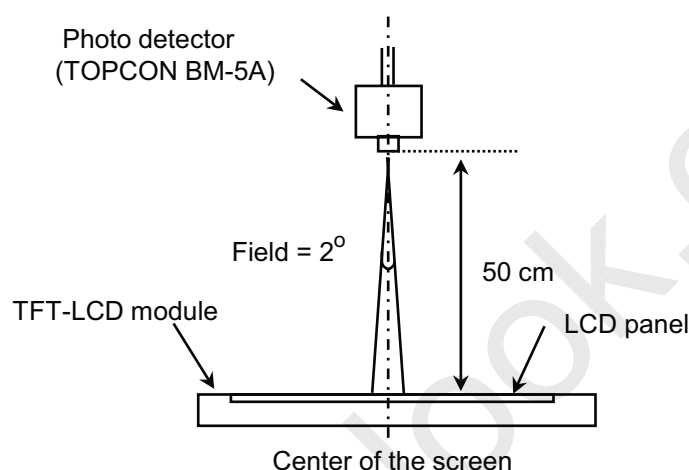
7. Cross-Talk of one area of the LCD surface by another shall be measured by comparing the luminance (Y_A) of a 25mm diameter area, with all display pixels set to a gray level, to the luminance (Y_B) of that same area when any adjacent area is driven dark.

(See FIGURE 5).

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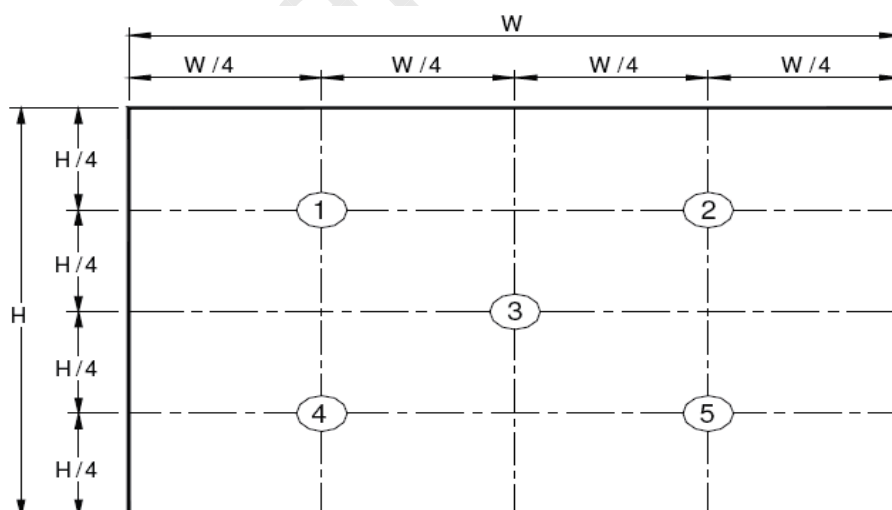
4.3 Optical measurements

Figure 1. Measurement Set Up



Optical characteristics measurement setup

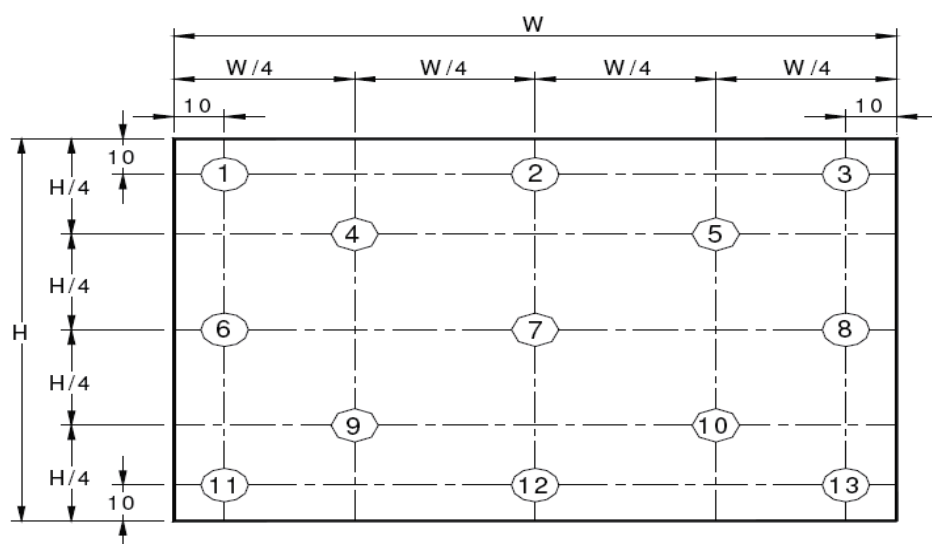
Figure 2. White Luminance and Uniformity Measurement Locations (5 points)



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.

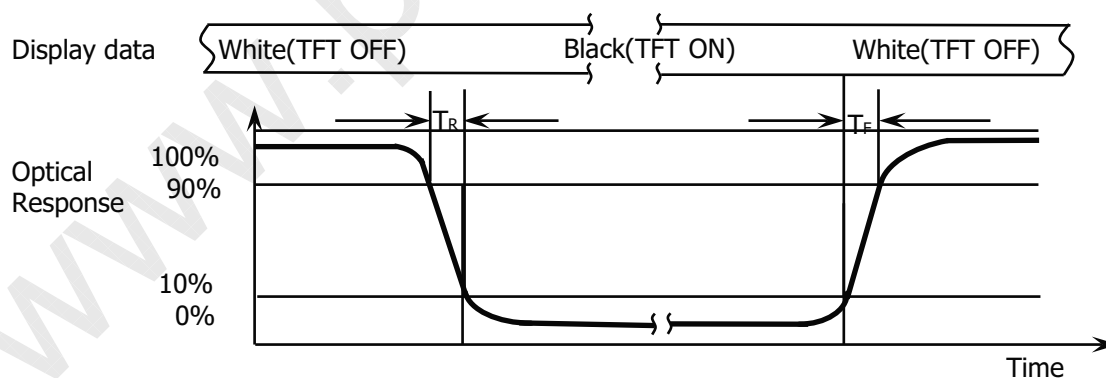
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Figure 3. Uniformity Measurement Locations (13 points)



The White luminance uniformity on LCD surface is then expressed as : $\Delta Y_5 = \text{Minimum Luminance of five points} / \text{Maximum Luminance of five points}$ (see FIGURE 2) , $\Delta Y_{13} = \text{Minimum Luminance of 13 points} / \text{Maximum Luminance of 13 points}$ (see FIGURE 3).

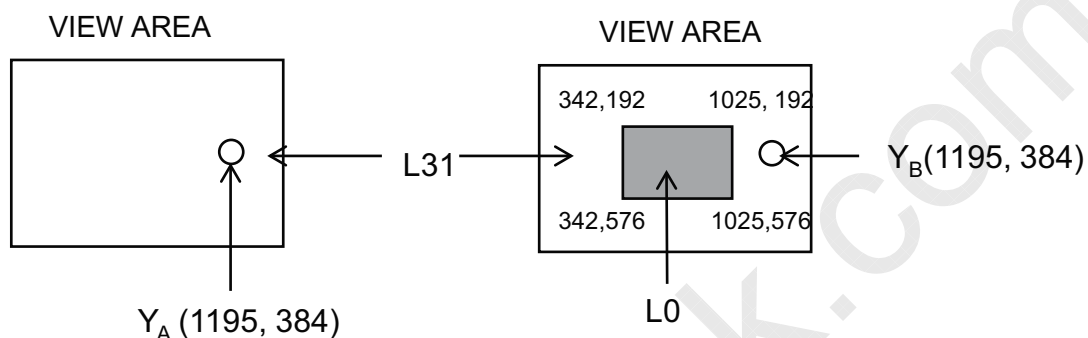
Figure 4. Response Time Testing



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 T_d and 90% to 10% is T_r .

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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/m²)

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

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 (Y_A) of a 25mm diameter area, with all display pixels set to a gray level, to the luminance (Y_B) of that same area when any adjacent area is driven dark (Refer to FIGURE 5).

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5.0 INTERFACE CONNECTION.

5.1 Electrical Interface Connection

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

<Table 6. Pin Assignments for the Interface Connector>

Terminal	Symbol	Functions
Pin No.	Symbol	Description
1	NC	No Connection
2	H_GND	Ground
3	Lane3_N	eDP RX channel 3 negative
4	Lane3_P	eDP RX channel 3 positive
5	H_GND	Ground
6	LANE2_N	eDP RX channel 2 negative
7	LANE2_P	eDP RX channel 2 positive
8	H_GND	Ground
9	LANE1_N	eDP RX channel 1 negative
10	LANE1_P	eDP RX channel 1 positive
11	H_GND	Ground
12	LANE0_N	eDP RX channel 0 negative
13	LANE0_P	eDP RX channel 0 positive
14	H_GND	Ground
15	AUX_CH_P	eDP AUX CH positive
16	AUX_CH_N	eDP AUX CH negative
17	H_GND	Ground
18	LCD_VCC	LCM 3.3V input
19	LCD_VCC	LCM 3.3V input
20	LCD_VCC	LCM 3.3V input
21	LCD_VCC	LCM 3.3V input
22	LCD_self_Test	NC reserved
23	LCD_GND	Ground
24	LCD_GND	Ground
25	LCD_GND	Ground
26	LCD_GND	Ground
27	HPD	Hot Pulse Detection
28	BL_GND	LED Ground
29	BL_GND	LED Ground
30	BL_GND	LED Ground

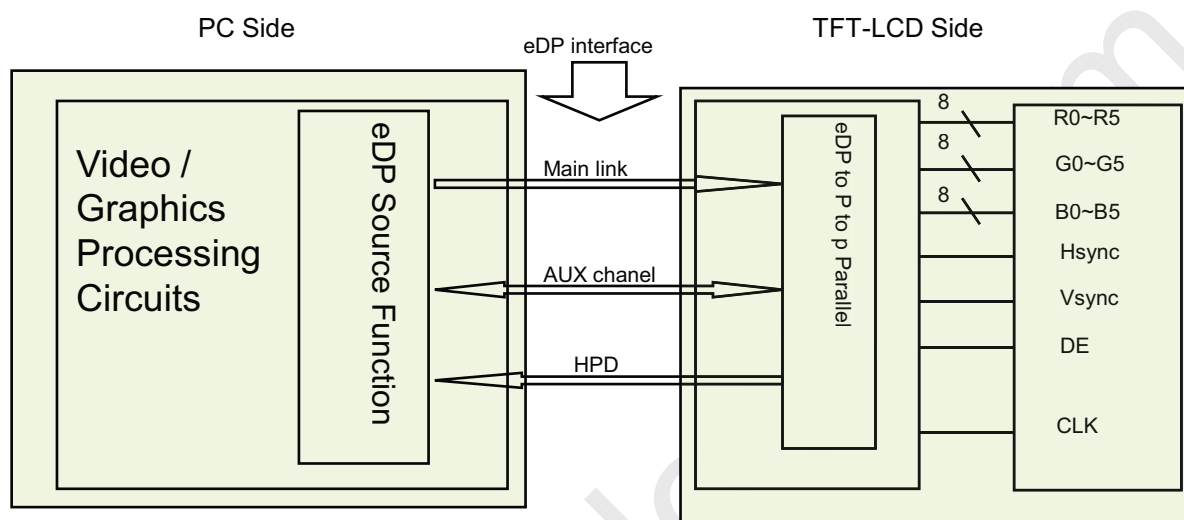
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<Table 6. Pin Assignments for the Interface Connector>

Terminal	Symbol	Functions
Pin No.	Symbol	Description
31	BL_GND	LED Ground
32	BL_EN	LED Driver Enable Pin
33	BL_PWM	PWM IN signal
34	H-sync	H-sync
35	NC-RESERVED	Not connection
36	BL_PWR	LED anode
37	BL_PWR	LED anode
38	BL_PWR	LED anode
39	BL_PWR	LED anode
40	Color_EN	Color enable PIN (Reserved for HP)

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5-2. eDP Interface



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5.3.eDP Input signal

Lan0	Lan1	Lan2	Lan3
R0-7:0	R1-7:0	R2-7:0	R3-7:0
G0-7:0	G1-7:0	G2-7:0	G3-7:0
B0-7:0	B1-7:0	B2-7:0	B3-7:0
R4-7:0	R5-7:0	R6-7:0	R7-7:0
G4-7:0	G5-7:0	G6-7:0	G7-7:0
B4-7:0	B5-7:0	B6-7:0	B7-7:0
R8-7:0	R9-7:0	R10-7:0	R11-7:0
G8-7:0	G9-7:0	G10-7:0	G11-7:0
B8-7:0	B9-7:0	B10-7:0	B11-7:0

5.4 Back-light & LCM Interface Connection

Interface Connector : Manufacturer LS. Model name is GF043 with lock.

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

Pin No	Symbol	Description	Pin No	Symbol	Description
1	LED1-	LED cathode connection	7	LED7-	LED cathode connection
2	LED2-	LED cathode connection	8	LED8-	LED cathode connection
3	LED3-	LED cathode connection	9	NC	Not Connection
4	LED4-	LED cathode connection	10	NC	Not Connection
5	LED5-	LED cathode connection	11	LED1+	LED anode connection
6	LED6-	LED cathode connection	12	LED2+	LED anode connection

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6.0 SIGNAL TIMING SPECIFICATION

6.1 NV140QUM-N51 is operated by the DE only.

Item		Symbols	Min	Typ	Max	Unit
Clock	Frequency	1/Tc	TBD	544.4	TBD	MHz
	High Time	Tch	-	4/7	-	Tc
	Low Time	Td	-	3/7	-	Tc
Frame Period		Tv		2180		lines
			-	60	-	Hz
				16.7	-	ms
Vertical Display Period		Tvd	-	2160	-	lines
One line Scanning Period		Th		4200		clocks
Horizontal Display Period		Thd	-	3840	-	clocks

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

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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	VRX-DIFFp-p	100	0	1320	mV	
Rx input DC common mode voltage	VRX_DC_CM	-	GND	-	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	-	-	150	ps	

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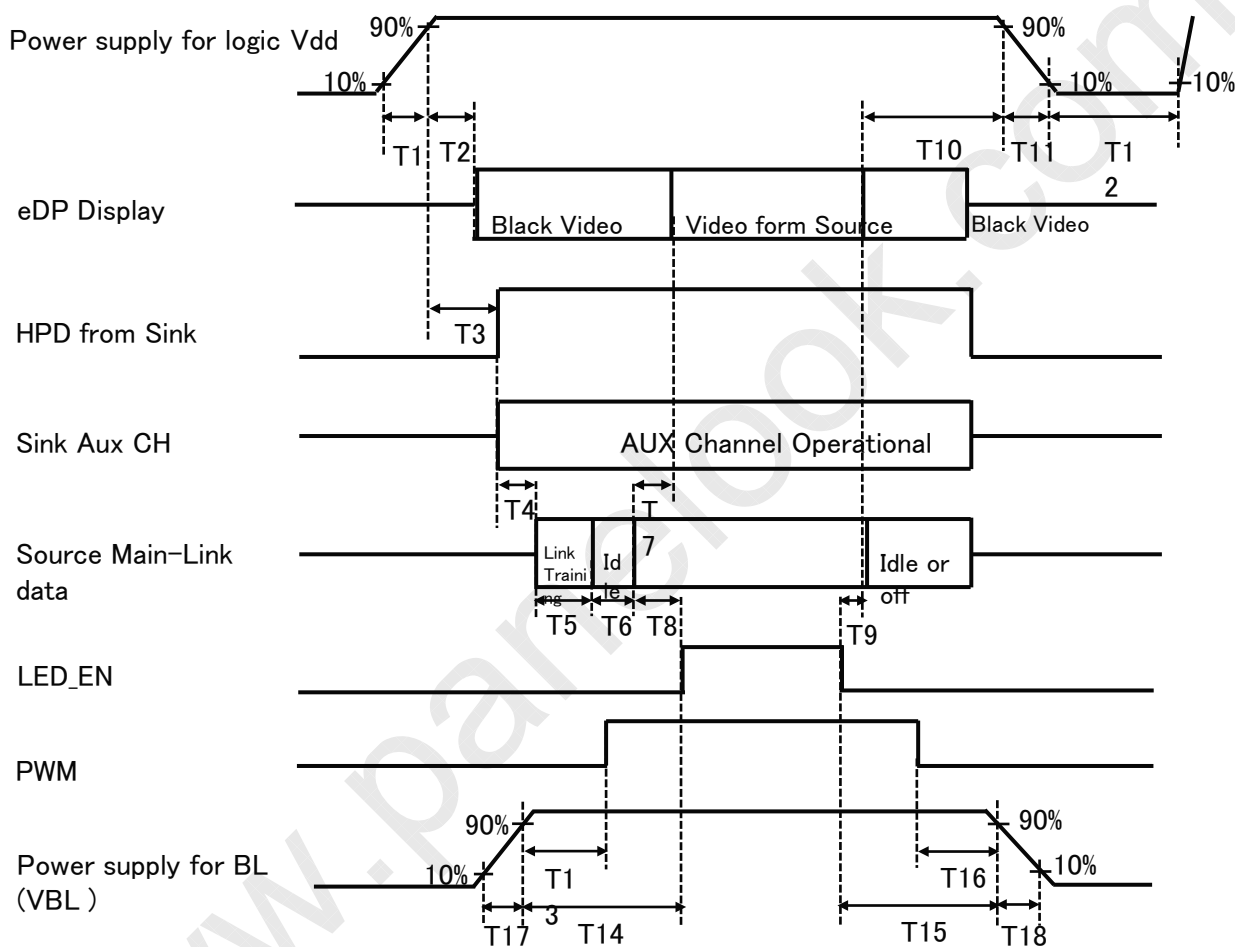
7.0 INPUT SIGNALS, BASIC DISPLAY COLORS & GRAY SCALE OF COLORS

	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	

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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
- 150ms ≤ T12
- 0ms ≤ T15
- 0ms ≤ T16
- 0ms ≤ T18

Notes:

- When the power supply VDD is 0V, keep the level of input signals on the low or keep high impedance.
- 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.

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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/ Model Name	LVDS / MSAK24025P40

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10.0 MECHANICAL CHARACTERISTICS

10.1 Dimensional Requirements

FIGURE 6 shows mechanical outlines for the model NV140QUM-N51 .
Other parameters are shown in Table 9.

<Table 9. Dimensional Parameters>

Parameter	Specification	Unit
Active Area	309.31(H) × 173.99(V)	
Number of pixels	3840 (H) X 2160 (V) (1 pixel = R + G + B dots)	
Pixel pitch	0.02685(H) × 0.08055 (V)	
Pixel arrangement	RGB Vertical stripe	
Display colors	8-bit	
Display mode	Normally Black	
Dimensional outline	315.01(H)*199.04 (V)*2.4(Max)	mm
Weight	240 (max)	gram
Back Light	Connector : MSK24022P12	
	LED, Horizontal-LED Array type	

10.2 Mounting

See FIGURE 6.

10.3 Anti-Glare and Polarizer Hardness.

The surface of the LCD has a AG coating to maximize readability and hard 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.

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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 = 60 °C, 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 = 50 °C, 240 hrs
5	Low temperature operation test	Ta = 0 °C, 240 hrs
6	Thermal shock	Ta = -30 °C ↔ 70 °C (0.5 hr), 100 cycle
7	Vibration test (non-operating)	1.5G, 10~500Hz, Half Sine X,Y,Z / Sweep rate : 1 hour
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

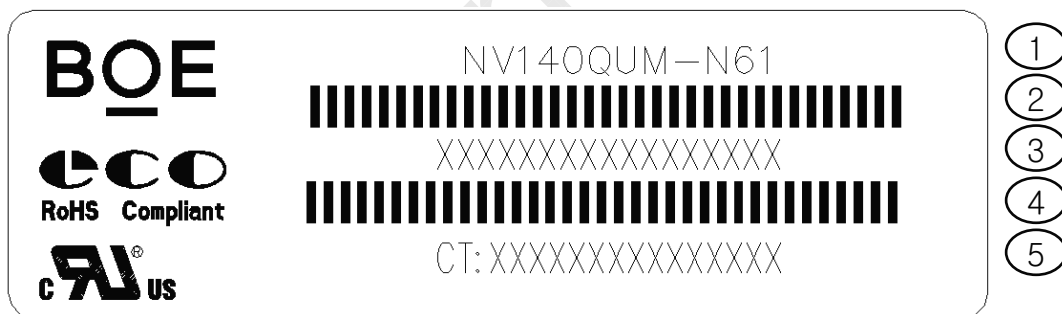
- When the module is operating, do not lose CLK, ENAB signals. If any one of these signals is lost, the LCD panel would be damaged.
- Obey the supply voltage sequence. If wrong sequence is applied, the module would be damaged.

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- (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



Remark:

Remark:

80mm × 25mm*0.08mm

- 1. FG-CODE
- 2. MDL ID Barcode
- 3. MDL ID
- 4. PPID
- 5. PPID Barcode

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(2) Box label

Label Size: 109.5 mm (L) × 55 mm (W)

Contents

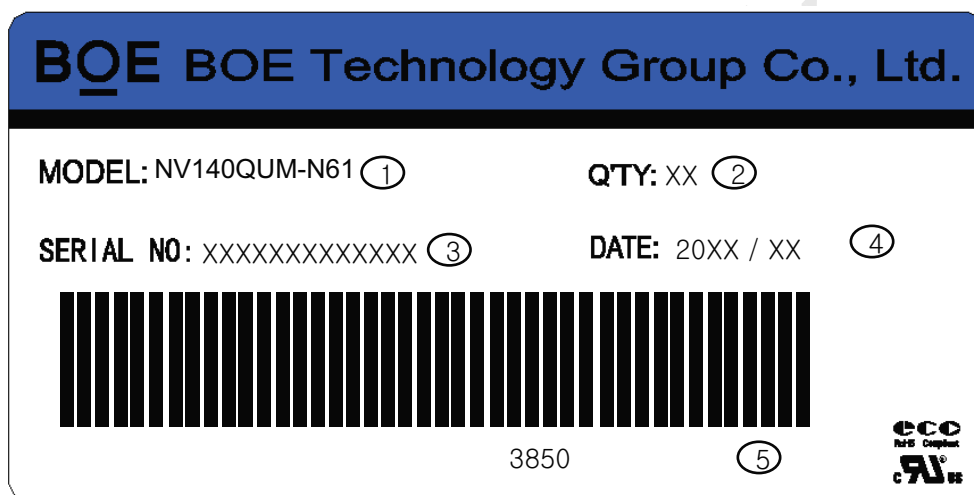
Model: NV140QUM-N61

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



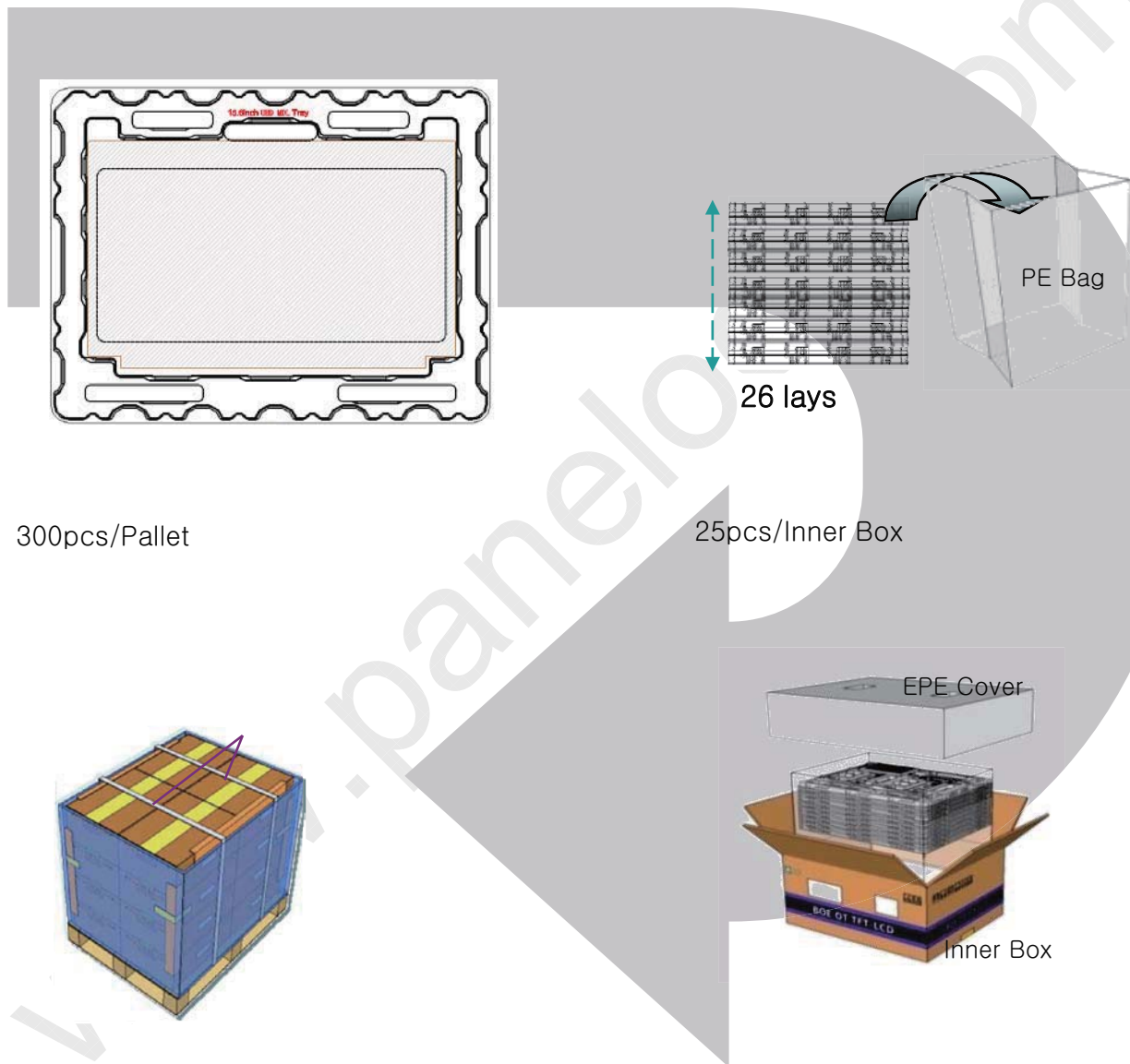
1. FG-CODE
2. Box Qty
3. Box ID
4. Box Packing date
5. FG-CODE

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.				

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14.0 PACKING INFORMATION

14.1 Packing order



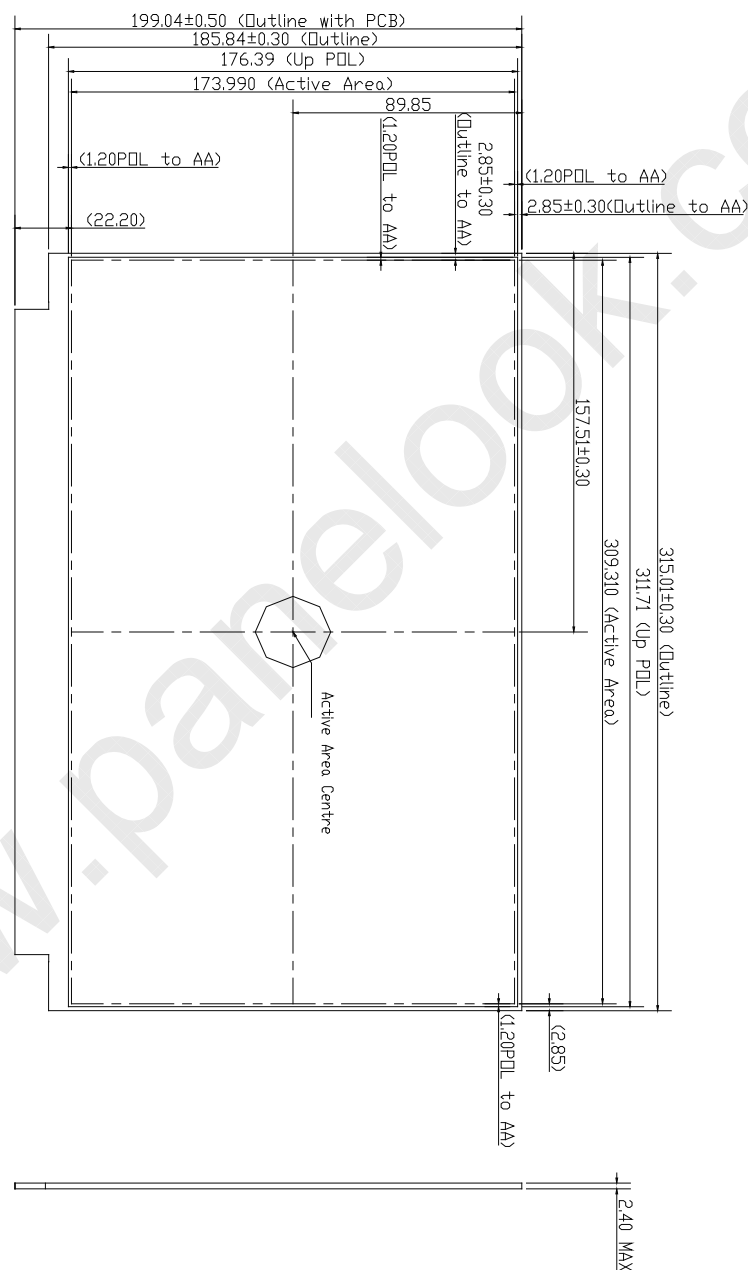
14.2 Notes

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

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15.0 MECHANICAL OUTLINE DIMENSION

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

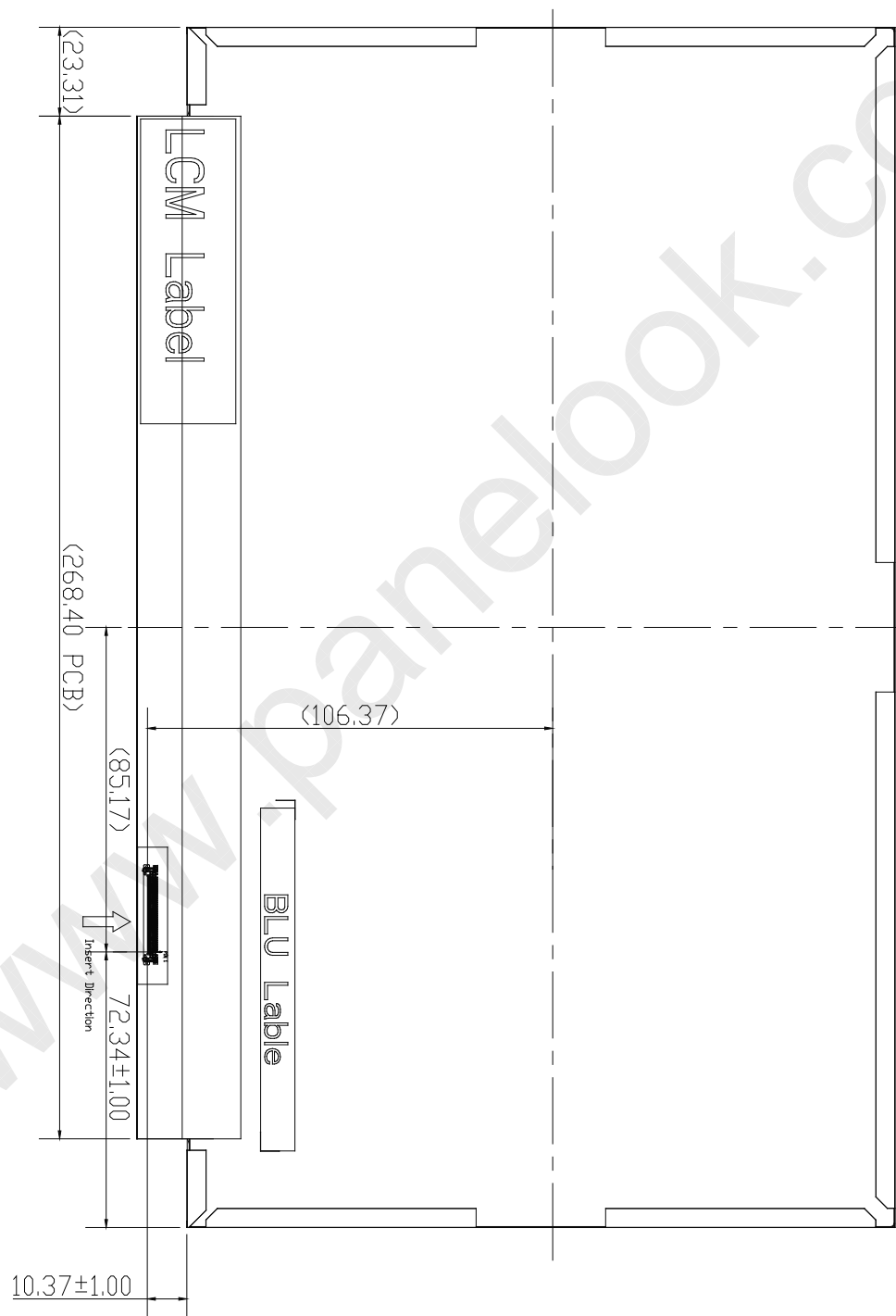


Note:

- 1.PCB side is lower than top polarizer and PCB component is lower than top polarizer
- 2.other side cell is higher only 0.05mm than top polarizer
- 3.Warps and deformation are +/-0.5mm.

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



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16.EDID Table

Address (HEX)	Function	Hex	Dec	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	DE	222	1824	ID = 1824
0B		06	6		
0C	32-bit serial No.	00	0		
0D		00	0		
0E		00	0		
0F		00	0		
10	Week of manufacture	01	1	1	
11	Year of Manufacture	1A	26	2017	Manufactured in 2017
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	-	
15	Max H image size	1F	31	31	31 cm (Approx)
16	Max V image size	11	17	17	17 cm (Approx)
17	Display Gamma	78	120	2.2	Gamma curve = 2.2
18	Feature support	02	2		RGB display, Preferred Timming mode/RGB 4:4:4
19	Red/Green low bits	86	134	-	Red / Green Low Bits
1A	Blue/White low bits	31	49	-	Blue / White Low Bits
1B	Red x high bits	A3	163	0.639	Red (x) = 10100011 (0.639)
1C	Red y high bits	56	86	0.336	Red (y) = 01010110 (0.336)
1D	Green x high bits	4E	78	0.306	Green (x) = 01001110 (0.306)
1E	Green y high bits	9B	155	0.608	Green (y) = 10011011 (0.608)
1F	Blue x high bits	25	37	0.145	Blue (x) = 00100101 (0.145)
20	Blue y high bits	0E	14	0.058	Blue (y) = 00001110 (0.058)
21	White x high bits	4E	78	0.305	White (x) = 01001110 (0.305)
22	White y high bits	54	84	0.330	White (y) = 01010100 (0.33)
23	Established timing 1	00	0		
24	Established timing 2	00	0		

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R2010-6053-O(3/3)

A4(210 X 297)

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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		35	53	309	Horizontal Image Size = 309.312 mm (Low 8 bits)
43		AD	173	174	Vertical Image Size = 173.988 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	

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48	Detailed timing/monitor descriptor #2	E0	224	355.5	355.5
49		8A	138		
4A		00	0	3840	3840
4B		A0	160	160	160
4C		F0	240	-	-
4D		70	112	2160	2160
4E		3E	62	62	62
4F		80	128	-	-
50		30	48	48	48
51		20	32	32	32
52		35	53	3	3
53		00	0	5	5
54		35	53	309	309
55		AE	174	174	174
56		10	16	-	-
57		00	0	0	0
58		00	0	0	0
59		1A	26	-	-
5A		Detailed timing/monitor descriptor #3	00	0	Nvidia nvDPS Lowest refresh rate that does not cause any visual/optical side effect
5B	00		0		
5C	00		0		
5D	00		0		
5E	00		0		
5F	00		0		
60	00		0		
61	00		0		
62	00		0		
63	00		0		
64	00		0		
65	00		0		
66	00		0		
67	00		0		
68	00	0			
69	00	0			
6A	00	0			
6B	00	0			

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6C	Detailed timing/monitor descriptor #4	00	0	0	Detailed Timing Description #4
6D		00	0	0	Flag
6E		00	0	0	Reserved
6F		02	2		For Brightness Table and Power consumption
70		00	0	0	Flag
71		0C	12		PWM % [7:0] @ Step 0
72		2D	45		PWM % [7:0] @ Step 5
73		FF	255		PWM % [7:0] @ Step 10
74		10	16		Nits [7:0] @ Step 0
75		3C	60		Nits [7:0] @ Step 5
76		A6	166		Nits [7:0] @ Step 10
77		32	50		Panel Electronics Power @32x32 Chess Pattern=
78		46	70		Backlight Power @60 nits=
79		3A	58		Backlight Power @Step 10=
7A		A6	166		Nits @ 100% PWM Duty =
7B		00	0	0	Flags
7C		00	0	0	Flags
7D	00	0	0	Flags	
7E	Extension flag	00	0		
7F	Checksum	58	88	-	