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NE156QUM-N66 V3.0

Product Specification

Rev. P0

BOE Optoelectronics Technology Co., Ltd

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	TFT-LCD	P0	2018.07.12	1 OF 34
B2014-Q011-O (1/3)				A4(210 X 297)

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REVISION HISTORY

(√)Preliminary Specification

( )Final Specification

Revision No.	Page	Description of Changes	Date	Prepared
P0	34	Initial Release	2018. 07.12	Xu Dezhi

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1.0 GENERAL DESCRIPTION

1.1 Introduction

NE156QUM-N66 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 15.6 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 8bit+2bit FRC 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.
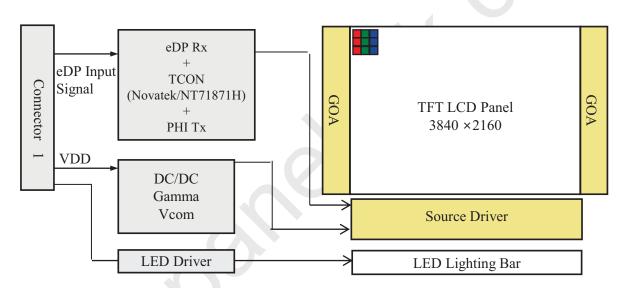All input signals are eDP interface compatible.

Figure 1. Drive Architecture

1.2 Features

- 4 lane eDP 1.3(Support PSR1) Interface with 5.4Gbps Link Rates
- Thin and light weight
- 8bit+2bit FRC 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
- HDR400

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1.3 Application

● Notebook PC (Wide type)

1.4 General Specification

The followings are general specifications at the model NE156QUM-N66 V3.0. (listed in Table 1)

<Table 1. General Specifications>

Parameter	Specification	Unit	Remarks
Active area	344.2176(H) *193.6224(V)	mm	
Number of pixels	3840(H) ×2160(V)	pixels	
Pixel pitch	29.88 x89.64um	um	
Pixel arrangement	RGB Vertical stripe		
Display colors	**1074M(8bit+2bit FRC)**		
Color gamut	Adobe100%		
Display mode	Normally black		
Dimensional outline	350.6576 (H)*205.3724 (V)*2.6(Max)	mm	No PCB side
Weight	285(max)	g	
Surface treatment	AG		
Surface hardness	3H		
Back-light	Bottom edge side, 1-LED lighting bar type		Note 1
Power consumption	P_D : 1.7	W	Typ.@ Mosaic pattern@60Hz
	PBL :7.9	W	Max
	P_{Total} : 9.6	W	Max

Notes : 1. LED Lighting Bar (80*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}	0	+50	°C	Note 2
Storage Temperature	T_{ST}	-20	+70	°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.
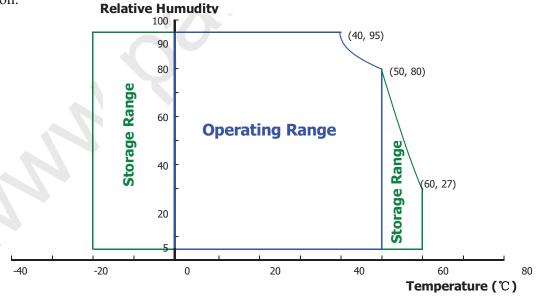

Figure 2. Temperature and Relative Humidity Range

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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}	-	-	660	mV	@ V_{DD} = 3.3V
BIST Control Level	High Level	2	-	3.6	V	
	Low Level	0	-	0.6	V	
Power Supply Current	I_{DD}	-	516	-	mA	Note 1
Power Supply Inrush Current	Inrush	-	-	2	A	Note3
Power Consumption	P_D	-	1.7	-	W	Note 1
	P_{BL}	-	-	7.9	W	Note 2
	P_{total}	-	-	9.6	W	Note 1

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.
   Pattern type : Mosaic pattern
2. Calculated value for reference ($V_{LED} \times I_{LED}$)
3. When peak current is 2A,VDD should be more than 2.75V
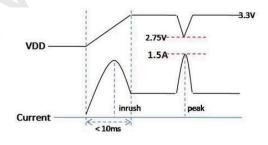4. Measure condition (Figure 4)

Figure 4. Inrush Measure Condition

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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	-	-	5.8	V	
LED Forward Current	I_F	-	18.9	-	mA	
LED Power Consumption	P_{LED}	-	-	7.9	W	Note 1
LED Life-Time	N/A	15,000	-	-	Hour	$I_F = 20.3mA$
Power Supply Voltage for LED Driver	V_{LED}	5	12	21	V	
Power Supply Voltage for LED Driver Inrush	Iled inrush	-	-	2	A	Note 4
EN Control Level	Backlight On	2.0	-	3.6	V	
	Backlight Off	0	-	0.6	V	
PWM Control Level	High Level	2.0	-	3.6	V	
	Low Level	0	-	0.6	V	
PWM Control Frequency	F_{PWM}	200	-	2,000	Hz	
Duty Ratio		1	-	100	%	Note 3
PWM control resolution		0.5			%	@1Khz Note5

Notes :

1. Power supply voltage12V for LED driver.
   Calculator value for reference $IF \times VF \times 80$ /driver efficiency = PLED

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

3. 1% duty cycle is achievable with a dimming frequency less than 2KHz.

4. Measure condition (Figure 5)

5. 0.4% PWM duty change can be detected when Fpwm is 1Khz.

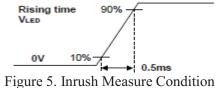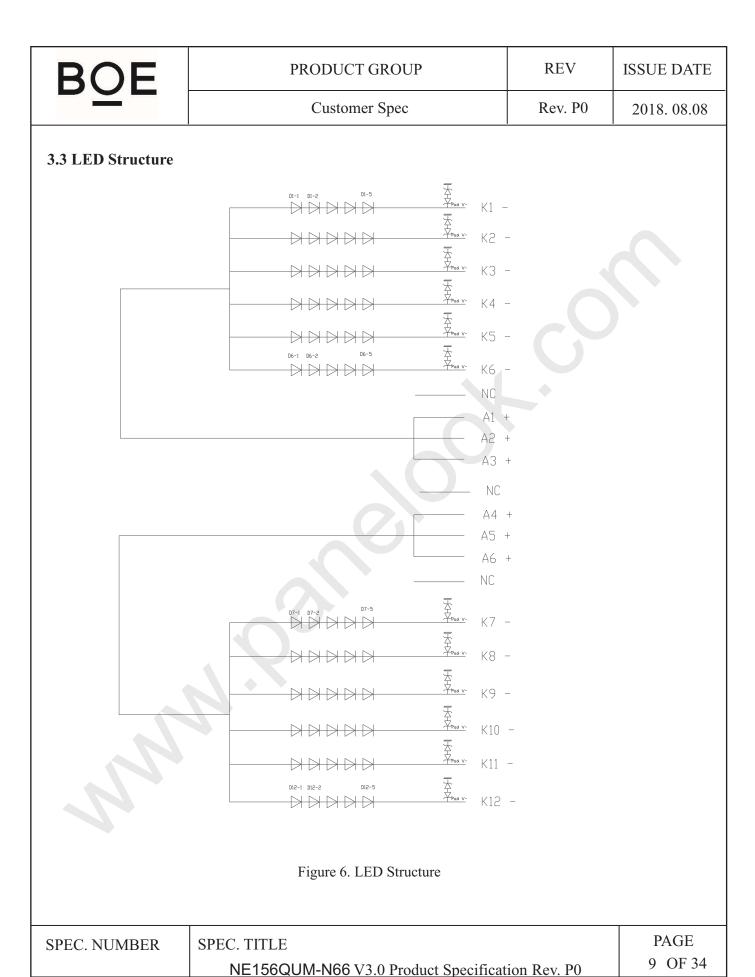Figure 5. Inrush Measure Condition

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3.3 LED Structure

Figure 6. 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 = $25\pm2\,^{\circ}\text{C}$) with the equipment of luminance meter system (PR730&PR810) 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 $\theta\varnothing=0$ (=$\theta3$) as the 3 o'clock direction (the "right"), $\theta\varnothing=90$ (= $\theta12$) as the 12 o'clock direction ("upward"), $\theta\varnothing=180$ (= $\theta9$) as the 9 o'clock direction ("left") and $\theta\varnothing=270$(= $\theta6$) as the 6 o'clock direction ("bottom"). While scanning $\theta$and/or $\varnothing$, 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.

4.2 Optical Specifications

<Table 5. Optical Specifications>

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle Range	Horizontal	Θ_3	CR > 10	-	89	-	Deg.	Note 1
		Θ_9		-	89	-	Deg.	
	Vertical	Θ_{12}		-	89	-	Deg.	
		Θ_6		-	89	-	Deg.	
Luminance Contrast Ratio		CR	$\Theta = 0°$	1200	1400			Note 2
Luminance of White	5 Points	Y_w	$\Theta = 0°$ $I_{LED} = 21.4mA$	425	500	-	cd/m^2	Note 3
White Luminance Uniformity	5 Points	$\Delta Y5$		80	-	-		Note 4
	13 Points	$\Delta Y13$		60	-	-		
White Chromaticity		W_x	$\Theta = 0°$	-0.03	0.313	+0.03		Note 5
		W_y			0.329			
Reproduction of Color	Red	R_x	$\Theta = 0°$	-0.03	0.64	+0.03		CIE1931
		R_y			0.33			
	Green	G_x			0.21			
		G_y			0.71			
	Blue	B_x			0.15			
		B_y			0.06			
Color Gamut				-	100	-	%	Adobe
Response Time (Rising + Falling)		T_{RT}	Ta= 25℃ $\Theta = 0°$	-	25		ms	Note 6
Cross Talk		CT	$\Theta = 0°$	-	-	4.0	%	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 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 Tf, and 90% to 10% is Tr.

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 levell(L0/L255), to the luminance (YB) of
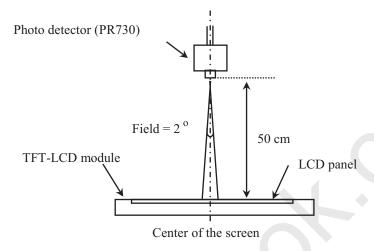that same area when any adjacent area is driven white or dark. (See Figure 11).

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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.

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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 90% to 10% ,Tf: The luminance to change from 10% to 90% .

The test system : PR810

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Condition A

Condition B

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

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 L255 and L0.

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). Both condition should be spec in(≤4%)

The test system: PR730

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5.0 INTERFACE CONNECTION

5.1 Electrical Interface Connection

The electronics interface connector 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	NC	NC
2	H_GND	
3	Lane3_N	
4	Lane3_P	
5	H_GND	
6	Lane2_N	
7	Lane2_P	
8	H_GND	eDP lane
9	Lane1_N	
10	Lane1_P	Up to 5.4G
11	H_GND	
12	Lane0_N	
13	Lane0_P	
14	H_GND	
15	AUX_CH_P	
16	AUX_CH_N	
17	H_GND	
18	LCD_VCC	
19	LCD_VCC	LCD Logic Power
20	LCD_VCC	(3.3±0.3V)
21	LCD_VCC	
22	LCD_Self_Test(BIST)	BIST（IN Port）
23	LCD_GND	
24	LCD_GND	Logic GND
25	LCD_GND	(Connect to GND in Module)
26	LCD_GND	
27	HPD	HPD（OUT Port typ.2.5V）
28	BL_GND	
29	BL_GND	BLU GND
30	BL_GND	(Connect to GND in Module)
31	BL_GND	
32	BL_ENABLE	IN Port
33	BL_PWM	IN Port
34	NC	NC
35	NC	NC
36	BL_PWR	
37	BL_PWR	BLU Power
38	BL_PWR	(5~21V)
39	BL_PWR	
40	NC	NC

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5.2 eDP Interface

Figure 12. eDP Interface Architecture

5.3 eDP Mainlink eye diagram test point

Mainlink eye diagram test point

Notes: Mainlink eye diagram at TP3 needs to be measured on the sink side(LCD Panel). The spec of sink eye vertices at TP3 should follow VESA DisplayPort™ Standard Version1. Revision 1a and Vesa Embedded DisplayPort Standard Version 1.4.

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5.4 Data Input Format

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

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5.5 Back-light & LCM Interface Connection

BLU Interface Connector: IPEX 20599-021E-01.

<Table 7. Pin Assignments for the BLU Connector>

Pin No.	Symbol	Description	Pin No.	Symbol	Description
1	1LED1-	1LED1 cathode connection	12	2LED+	2LED anode connection
2	1LED2-	1LED2 cathode connection	13	2LED+	2LED anode connection
3	1LED3-	1LED3 cathode connection	14	2LED+	2LED anode connection
4	1LED4-	1LED4 cathode connection	15	NC	
5	1LED5-	1LED5 cathode connection	16	2LED1-	2LED1 cathode connection
6	1LED6-	1LED6 cathode connection	17	2LED2-	2LED2 cathode connection
7	NC	NC	18	2LED3-	2LED3 cathode connection
8	1LED+	1LED anode connection	19	2LED4-	2LED4 cathode connection
9	1LED+	1LED anode connection	20	2LED5-	2LED5 cathode connection
10	1LED+	1LED anode connection	21	2LED6-	2LED6 cathode connection
11	NC	NC			

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6.0 SIGNAL TIMING SPECIFICATION

6.1 The NE156QUM-N66 V3.0 Is Operated By The DE Only

< Table 8. Signal Timing Specification >

Item		Symbols	Min	Typ	Max	Unit
Clock	Frequency	1/Tc	355.52	533.25	586.6	MHz
			-	4/7Tc	-	
			-	3/7Tc	-	
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 : The above is as optimized setting.

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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	%	
Differential peak-to-peak input voltage at package pins	$V_{RX-DIFFp-p}$	70	-	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	$L_{RX\_SKEW\_INTRA\_PAIR}$	-	-	50	ps	

Figure 14. $V_{RX-DIFFp-p}$ & $L_{RX\_SKEW\_INTRA\_PAIR}$

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

<Table 10. Input Signal & Basic Display Colors & Gray Scale of Colors >

Color & Gray Scale		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale of Red	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△			↑										↑								↑			
	▽			↓										↓								↓			
	Brighter	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	▽	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale of Green	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	△			↑										↑								↑			
	▽			↓										↓								↓			
	Brighter	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	▽	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Gray Scale of Blue	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	△			↑										↑								↑			
	▽			↓										↓								↓			
	Brighter	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
	▽	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Gray Scale of White	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
	Darker	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0
	△			↑										↑								↑			
	▽			↓										↓								↓			
	Brighter	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1
	▽	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

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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 15. Power Sequence

- 0.5ms ≤ T1 ≤ 10 ms
- 0ms < T2 ≤ 200 ms
- 0ms < T3 ≤ 200 ms
- T3+T4+T5+T6+T8>200ms
- 0ms < T7 ≤ 50ms
- T7 < T8
- 0ms < T9

- 0ms < T10 < 500 ms
- 0.5ms ≤ T11 ≤ 10 ms
- 500ms ≤ T12
- 0ms < T13
- 0ms < T14
- 0ms < T15

- 0ms < 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.

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Power Supply for Logic Vdd

Figure 16. T11 timing requirements

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

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 11. Signal Connector >

Connector Name /Description	For Signal Connector
Manufacturer	I-PEX
Type/ Part Number	20455-040E-66
Mating Housing/ Part Number	I-PEX 20453-040T-03

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10.0 MECHANICAL CHARACTERISTICS

10.1 Dimensional Requirements

Figure 21 shows mechanical outlines for the model NE156QUM-N66 V3.0.
Other parameters are shown in Table 12.

<Table 12. Dimensional Parameters>

Parameter	Specification	Unit
Active Area	344.2176(H) *193.6224(V)	mm
Number of pixels	3840(H) ×2160(V)(1 pixel = R + G + B dots)	pixels
Pixel pitch	26.85 x80.55um	um
Pixel arrangement	RGB Vertical stripe	
Display colors	**1074M(8bit+2bit FRC)**	
Display mode	Normally black	
Dimensional outline	350.6576(H)*205.3724(V)*2.6(Max)	mm
Weight	280(max)	g

10.2 Mounting

See Figure 21.

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 250lux.

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11.0 RELIABILITY TEST

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

<Table 13. Reliability Test>

No	Test Items	Conditions
1	High temperature storage test	Ta = 50°C , 80%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	Low temperature operation test	Ta = 0 ℃, 240 hrs
5	Thermal shock	Ta = -20 °C ↔ 60 °C (0.5 hr), 60%±3%RH, 100 cycle
6	Vibration test (non-operating)	Ta = 25°C , 60%RH, 1.47G, 5~200Hz, Half Sine X,Y,Z / Sweep rate : 1 hour
7	Drop test (non-operating)	根据 BOX重量 1Angle，3Edge，6Face
8	Electro-static discharge test (non-operating)	Air : 150 pF, 330Ω, 15 KV Contact : 150 pF, 330Ω, 8 KV Ta = 25°C , 60%RH

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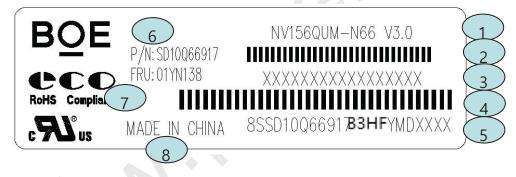
(5) Cautions for the module characteristics
  • Do not apply fixed pattern data signal to the LCD module at product aging.
  • Applying fixed pattern for a long time may cause image sticking.

(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:
Label size: 80mm × 25mm
1.　FG-CODE:　NE156QUM-N66 V3.0
2.　MDL ID bar code
3.　MDL ID
4.　8S code corresponding bar code
5.　8S code
6.　P/N code:SD10Q66917
7.　FRU code:01YN138
8.　Made in china

Figure 17. Product Label

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(2) Box Label

Figure 18. Box Label

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

1. FG-CODE(Before 12 bit)   2. Product quantity

3. Box ID   4. Date

5. FG-Code After four

序列号	1	2	3	4	5	6	7	8	9	10	11	12	13
代码	X	X	S	3	1	5	B	0	0	0	1	H	D
描述	GBN		Grade	B3	Year		Month	Rev		Serial No			

<Table 15. Box Label Naming Rule >

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14.0 PACKING INFORMATION

14.1 Packing Order

- Put 1 pcs MDL in tray and 1 pcs Spacer on MDL
- Put 26 pcs tray and 1 pcs tray cover in PE bag.
- Put PE bag with 2 EPE cover in the inner box.
- 25pcs/Box,12Box/Pallet,300pcs MDL/Pallet.

14.2 Note

- Box dimension: 500mm*400mm*300mm
- Package quantity in one box: 25pcs

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15.0 MECHANICAL OUTLINE DIMENSION

Figure 21. 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.Warps and deformation are 0.5mm.

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Figure 22. TFT-LCD Module Outline Dimensions (Rear view)

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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	09	9		2057	ID = 2057
0B		08	8			
0C	32-bit serial No.	00	0		0	
0D		00	0		0	
0E		00	0		0	
0F		00	0		0	
10	Week of manufacture	1E	30		30	
11	Year of Manufacture	1C	28		2018	Manufactured in 2018
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	B5	181		-	Refer to right table
15	Max H image size	23	35		35	35 cm (Approx)
16	Max V image size	13	19		19	19 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	DF	223		-	Red / Green Low Bits
1A	Blue/White low bits	50	80		-	Blue / White Low Bits
1B	Red x high bits	A3	163	655	0.640	Red (x) = 10100011 (0.64)
1C	Red y high bits	54	84	337	0.330	Red (y) = 01010100 (0.33)
1D	Green x high bits	35	53	215	0.210	Green (x) = 00110101 (0.21)
1E	Green y high bits	B5	181	727	0.710	Green (y) = 10110101 (0.71)
1F	Blue x high bits	26	38	153	0.150	Blue (x) = 00100110 (0.15)
20	BLue y high bits	0F	15	61	0.060	Blue (y) = 00001111 (0.06)
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		-	
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			

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36		50	80		533.3	533.28MHz 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	Detailed timing/monitor descriptor #1	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		58	88		344	Horizontal Image Size = 344 mm (Low 8 bits)
43		C2	194		194	Vertical Image Size = 194 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
48		A6	166		427	426.624MHz Main clock
49		A6	166			
4A		00	0		3840	Hor Active = 3840
4B		A0	160		160	Hor Blanking = 160
4C		F0	240		-	4 bits of Hor. Active + 4 bits of Hor. Blanking
4D		70	112		2160	Ver Active = 2160
4E		3E	62		62	Ver Blanking = 62
4F		80	128		-	4 bits of Ver. Active + 4 bits of Ver. Blanking
50	Detailed timing/monitor descriptor #2	30	48		48	Hor Sync Offset = 48
51		20	32		32	H Sync Pulse Width = 32
52		35	53		3	V sync Offset = 3 line
53		00	0		5	V Sync Pulse width : 5 line
54		58	88		344	Horizontal Image Size = 344 mm (Low 8 bits)
55		C2	194		194	Vertical Image Size = 194 mm (Low 8 bits)
56		10	16		-	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		1A	26		-	Refer to right table
5A		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	
60		4F	79		O	
61		45	69		E	
62	Detailed timing/monitor descriptor #3	20	32			
63		48	72		H	
64		46	70		F	
65		0A	10			Manufacture name : BOEHF
66		20	32			
67		20	32			
68		20	32			
69		20	32			
6A		20	32			
6B		20	32			

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6C		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	
72		45	69		E	
73		31	49		1	
74	Detailed timing/monitor descriptor #4	35	53		5	
75		36	54		6	
76		51	81		Q	Model name : NE156QUM-N66
77		55	85		U	
78		4D	77		M	
79		2D	45		-	
7A		4E	78		N	
7B		36	54		6	
7C		36	54		6	
7D		0A	10			
7E	Extension flag	01	1		1	0 : 1個EDID ; N : N+1个EDID
7F	Checksum	92	146	146	-	