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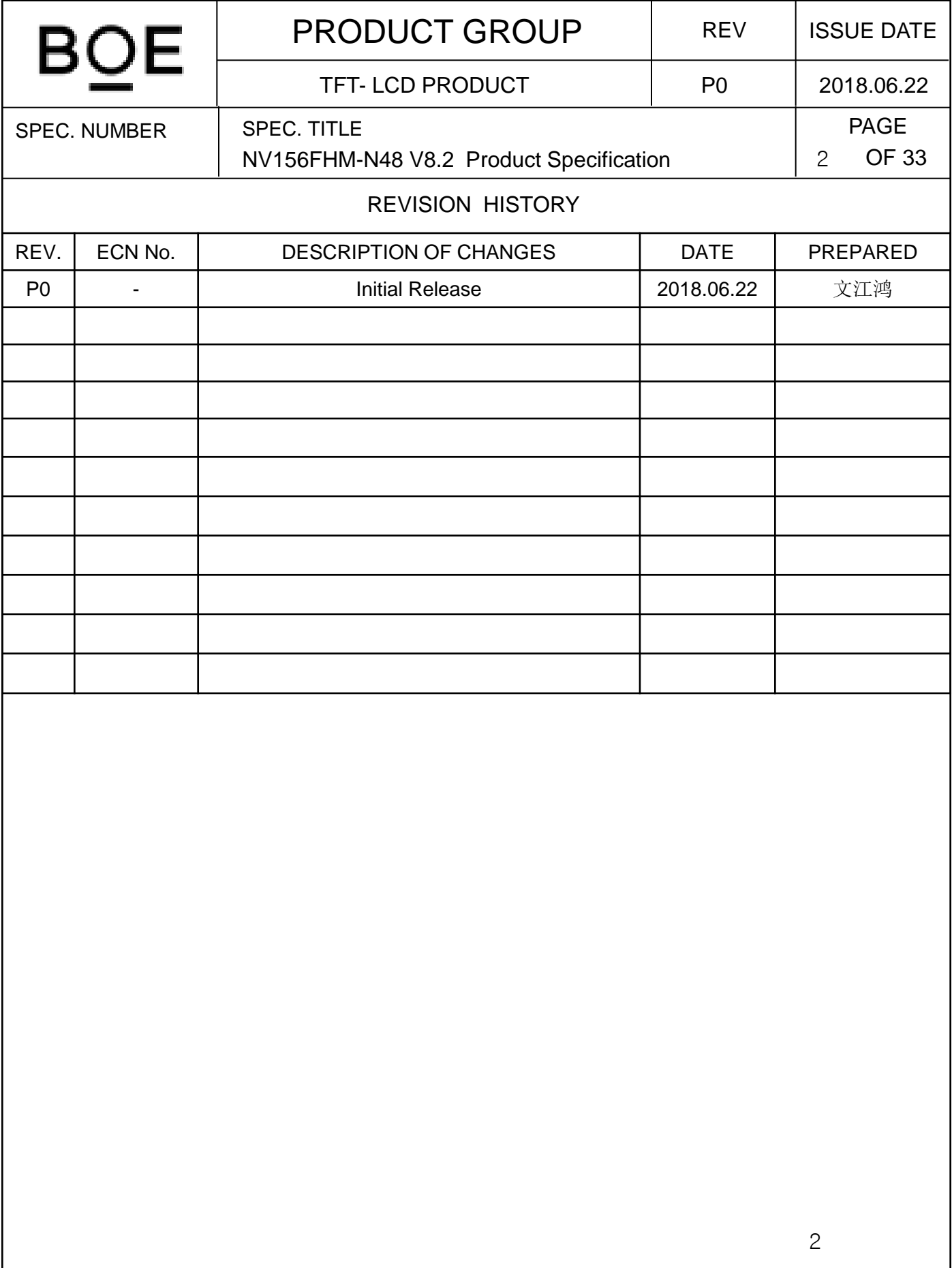
TFT-LCD

P0

2018.06.22

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NV156FHM-N48 V8.2**Product Specification****Rev. P0****BOE Optoelectronics Technology Co., Ltd**



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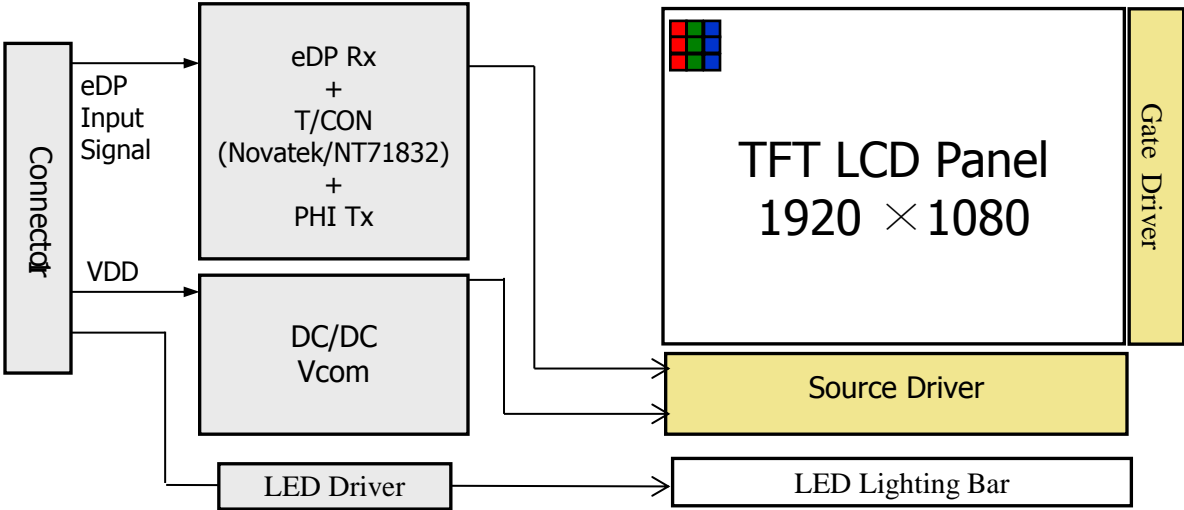
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1.0 GENERAL DESCRIPTION

1.1 Introduction

NV156FHM-N48 V8.2 is a color active matrix TFT LCD module using amorphous silicon TFT's (Thin Film Transistors) as an active switching devices. This module has a 15.6 inch diagonally measured active area with FHD resolutions (1920 horizontal by 1080vertical pixel array). Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical Stripe and this module can display 6bit+FRC colors and color gamut 45%. 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 eDP1.2 interface compatible.



1.2 Features

- 2 lane eDP interface with 2.7Gbps link rates
- Thin and light weight
- 6bit+FRC color depth, color gamut 45%
- 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

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1.3 Application

- Notebook PC (Wide type)

1.4 General Specification

The followings are general specifications at the model NV156FHM-N48 V8.2. (listed in Table 1.)

<Table 1. General Specifications>

Parameter	Specification	Unit	Remarks
Active area	344.16 (H) × 193.59 (V)	mm	
Number of pixels	1920 (H) × 1080 (V)	pixels	
Pixel pitch	0.17925 (H) X 0.17925 (V)	mm	
Pixel arrangement	RGB Vertical stripe		
Display colors	6bit+FRC	colors	
Display mode	Normally Black		
Dimensional outline	350.66(H)*216.245(V) (W/PCB)*3.2(Max)	mm	
Weight	360 (max)	g	
Surface treatment	Fine Anti-Glare		
Back-light	Lower Down side, 1-LED Lighting Bar type		Note 1
Power consumption	P _D : 0.88 (max)	W	@mosaic
	P _{BL} :2.85(max)	W	
	P _{total} :3.73(max)	W	@mosaic

Notes : 1. LED Lighting Bar (40*LED Array)

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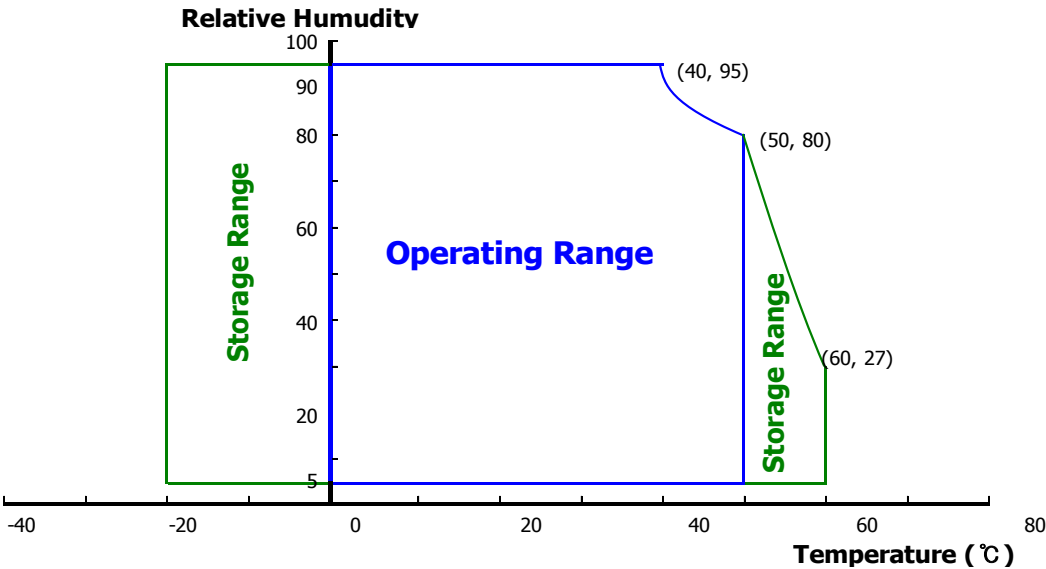
2.0 ABSOLUTE MAXIMUM RATINGS

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	+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. 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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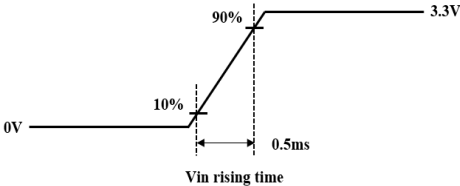
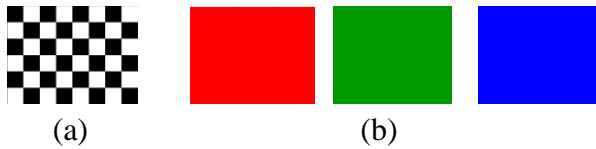
3.0 ELECTRICAL SPECIFICATIONS

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 _{DD}	-	267	-	mA	Note 1
Power Supply Inrush Current	I _{inrush}	-	-	2	A	Note3
Power Consumption	P _D	-	0.88	1.6	W	Note 1
	P _{BL}	-	-	2.85	W	Note 2
	P _{total}	-	-	4.45	W	

- Notes :
- 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.
 - Typ : Mosaic pattern 8*8
 - Max : R/G/B patterns



- Calculated value for reference (V_{LED} × I_{LED})
- Measure condition

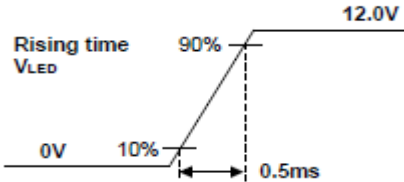
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3.2 Backlight Unit

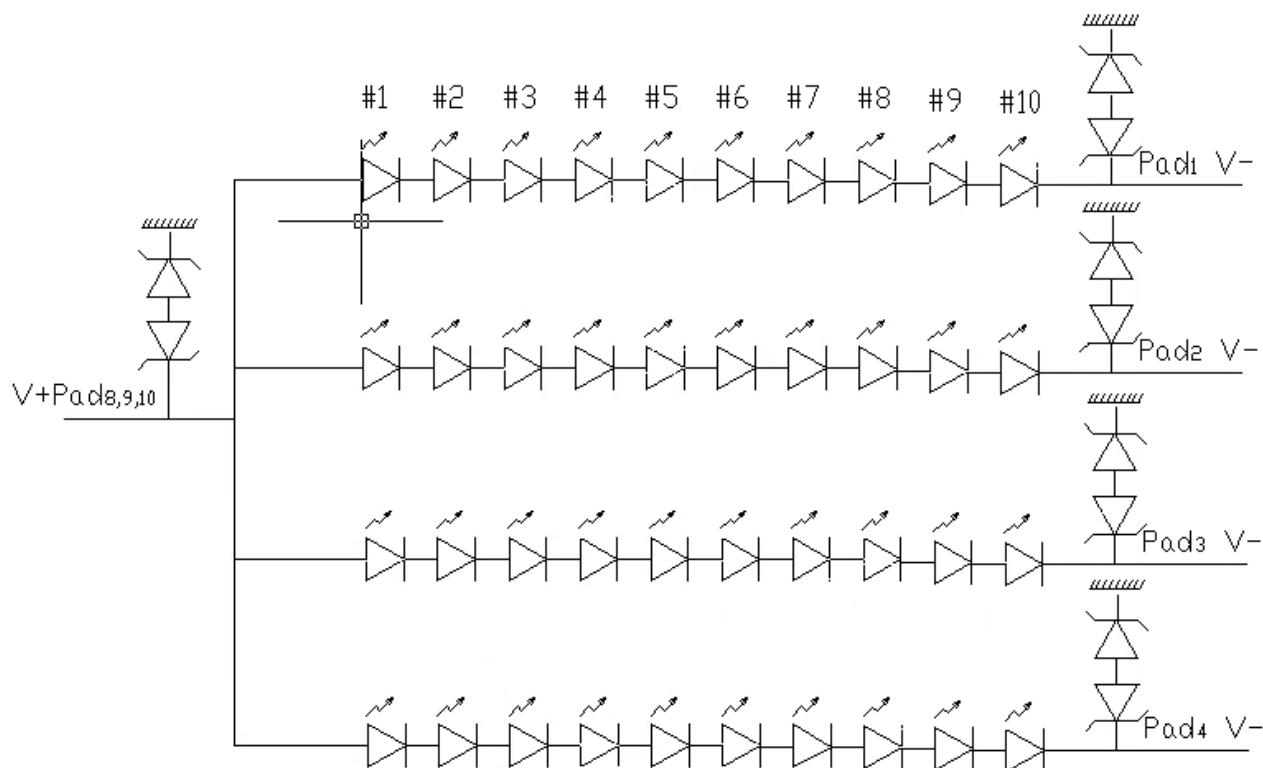
< Table 4. LED Driving guideline specifications > Ta=25+/-2°C

Parameter		Min.	Typ.	Max.	Unit	Remarks	
LED Forward Voltage		V _F	-	-	2.9	V	-
LED Forward Current		I _F	-	20	-	mA	-
LED Power Consumption		P _{LED}		-	2.85	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	
Power Supply Voltage for LED Driver Inrush		I _{led inrush}	-	-	2	A	Note 4
EN Control Level	Backlight on		2.2		5.0	V	
	Backlight off		0		0.6	V	
PWM Control Level	PWM High Level		2.2		5.0	V	
	PWM Low Level		0		0.6	V	
PWM Control Frequency		F _{PWM}	100	-	10,000	Hz	
Duty Ratio		-	1	-	100	%	Note3

- Notes :
1. Power supply voltage12V for LED Driver
 Calculator Value for reference $I_F \times V_F \times 40 / \text{efficiency} = P_{LED}$
 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 1KHz.
 4. Measure condition .



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±2℃) with the equipment of Luminance meter system (Goniometer system and PR730) 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℃. 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	$\Theta = 0^\circ$	-	800			Note 2
Luminance of White	5 Points	Y_w	$\Theta = 0^\circ$ ILED = 20.0mA	212.5	250	287.5	cd/m ²	Note 3
White Luminance uniformity	5 Points	$\Delta Y5$		80	-	-		Note 4
	13 Points	$\Delta Y13$		65	-	-		
White Chromaticity		xw	$\Theta = 0^\circ$	0.283	0.313	0.343		Note 5
		yw		0.299	0.329	0.359		
Reproduction of color	Red	xR	$\Theta = 0^\circ$	-0.03	0.585	+0.03		
		yR			0.364			
	Green	xG			0.350			
		yG			0.580			
	Blue	xB			0.163			
		yB			0.143			
Gamut					45		%	
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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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 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).

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4.3 Optical measurements

Figure 1. Measurement Set Up

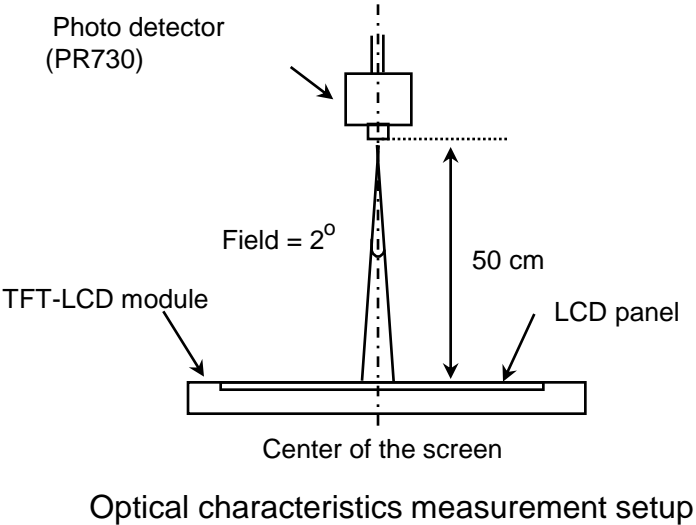
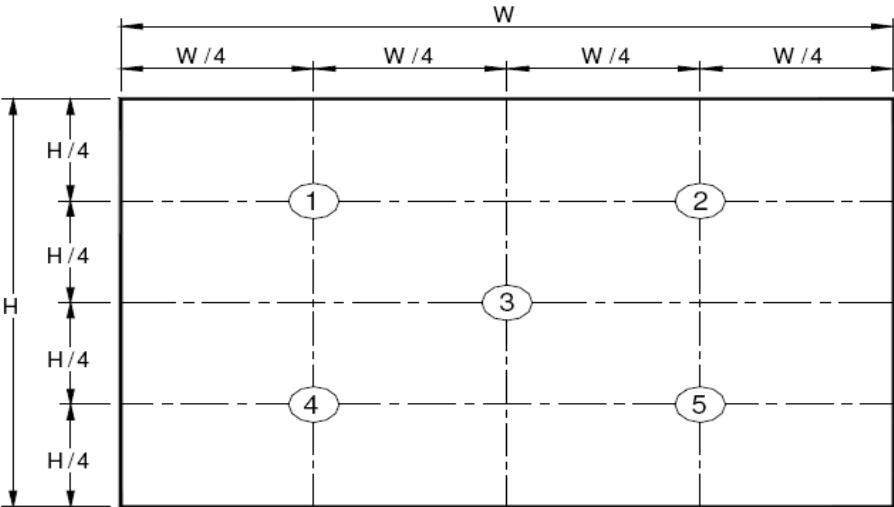


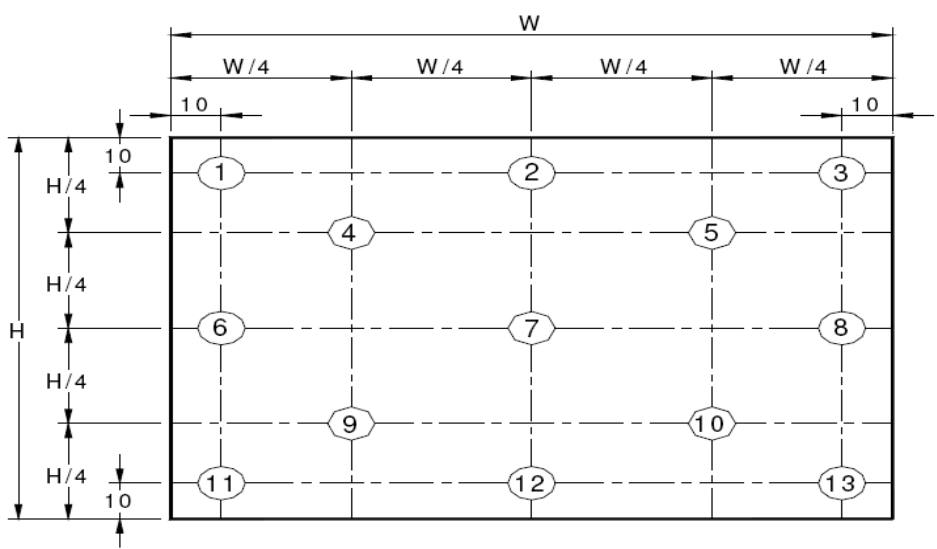
Figure 2. White Luminance and Uniformity Measurement Locations (5 points)



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.

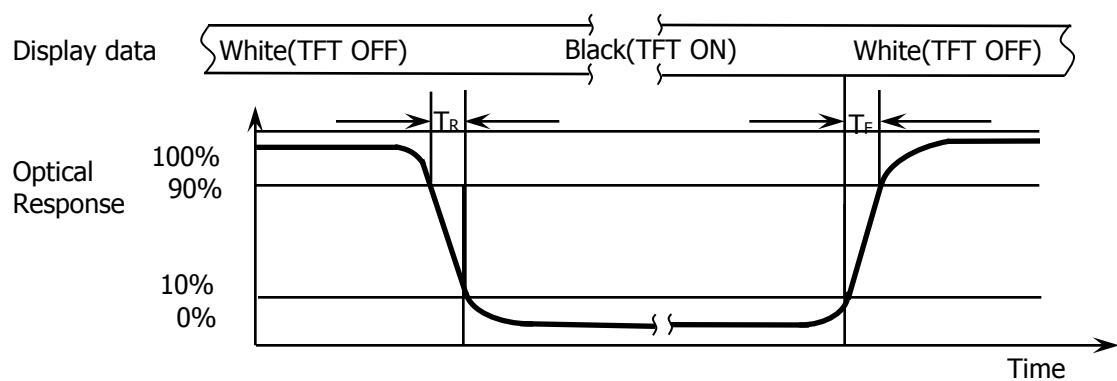
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Figure 3. Uniformity Measurement Locations (13 points)



The White luminance uniformity on LCD surface is then expressed as : $\Delta Y5$ = Minimum Luminance of five points / Maximum Luminance of five points (see FIGURE 2) , $\Delta Y13$ = Minimum Luminance of 13 points /Maximum Luminance of 13 points (see FIGURE 3).

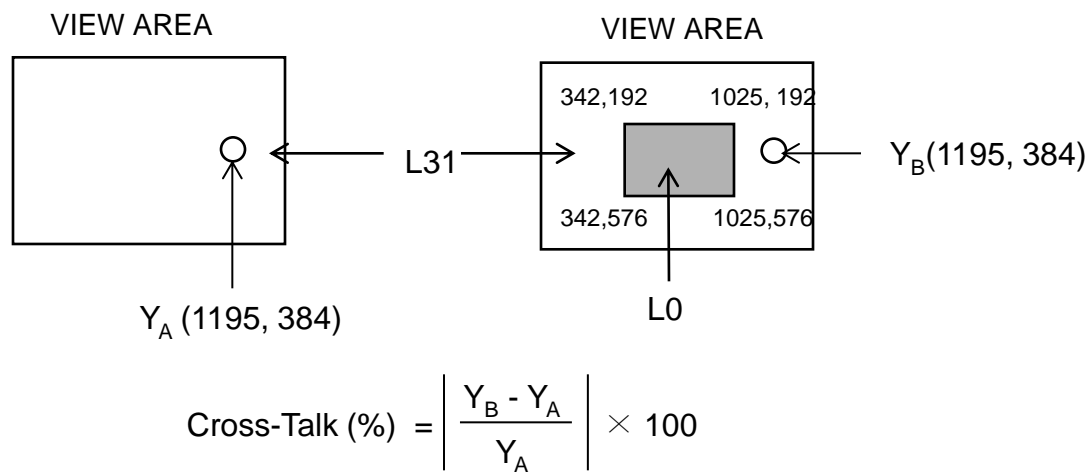
Figure 4. Response Time Testing



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.

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Figure 5. Cross Modulation Test Description



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

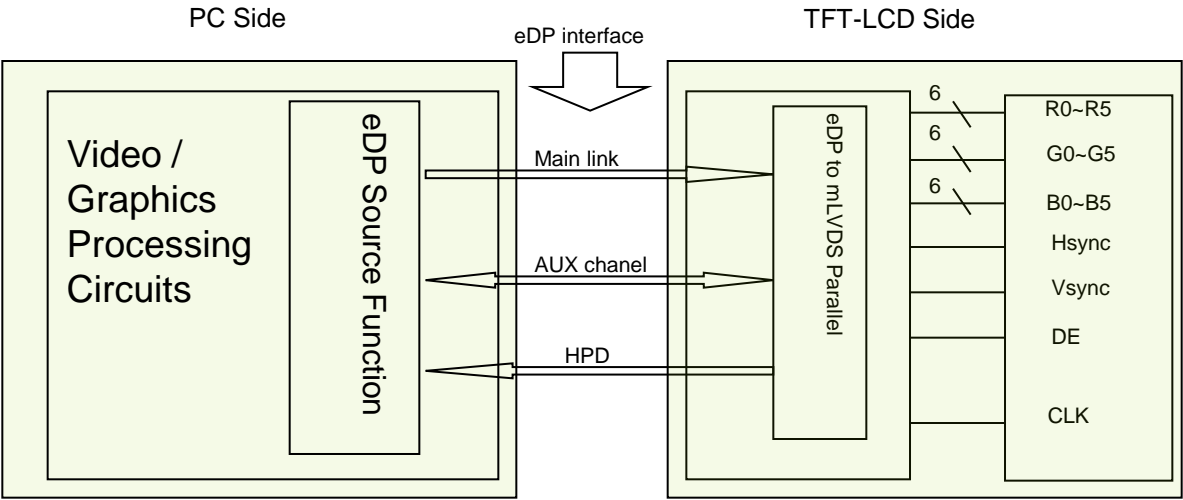
The electronics interface connector is UJU IS050-L30B-C10.
The connector interface pin assignments are listed in Table 6.

<Table 6. Pin Assignments for the Interface Connector>

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

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5-2. eDP Interface



Note. Transmitter : Parade DP501 or equivalent.
Transmitter is not contained in Module.

5.3.eDP Input signal

Lane 0	Lane 1
R0-7:0	R1-7:0
G0-7:0	G1-7:0
B0-7:0	B1-7:0
R2-7:0	R3-7:0
G2-7:0	G3-7:0
B2-7:0	B3-7:0
R4-7:0	R5-7:0
G4-7:0	G5-7:0
B4-7:0	B5-7:0

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5.4 Back-light & LCM Interface Connection

Interface Connector: **STM MSK24022P10 or BOE-120521-01**

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

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

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6.0 SIGNAL TIMING SPECIFICATION

6.1 The NV156FHM-N48 is operated by the DE only.

Item		Symbols	Min	Typ	Max	Unit
Clock	Frequency	1/Tc	101	152.6	158	MHz
Frame Period		Tv	1100	1140	1200	lines
			-	60	-	Hz
			-	16.7	-	ms
Vertical Display Period		Tvd	-	1080	-	lines
One line Scanning Period		Th	2080	2230	2400	clocks
Horizontal Display Period		Thd	-	1920	-	clocks

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

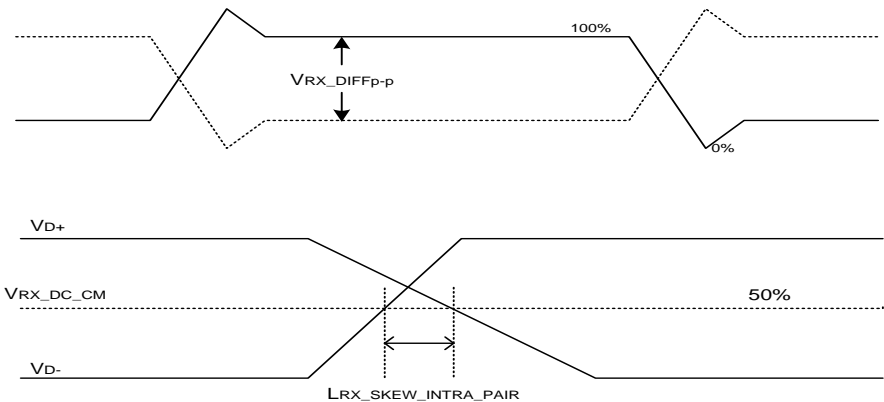
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6.2 eDP Rx Interface Timing Parameter

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

<Table 8. eDP Main-Link RX TP4 Package Pin Parameters>

Item	Symbol	Min	Typ	Max	Unit	Remark
Spread spectrum clock	ssc	0	-	0.5	%	
Differential peak-to-peak input voltage at package pins	VRX-DIFFp-p	120	-	1200	mV	
Rx input DC common mode voltage	VRX_DC_CM	0	-	2	V	
Differential termination resistance	RRX-DIFF	80	-	120	Ω	
Single-ended termination resistance	RRX-SE	40	-	60	Ω	
Rx short circuit current limit	IRX_SHORT	-	-	50	mA	
Intra-pair skew at Rx package pins (HBR) RX intra-pair skew tolerance at HBR	LRX_SKEW_INTRA_PAIR	-	-	60	ps	



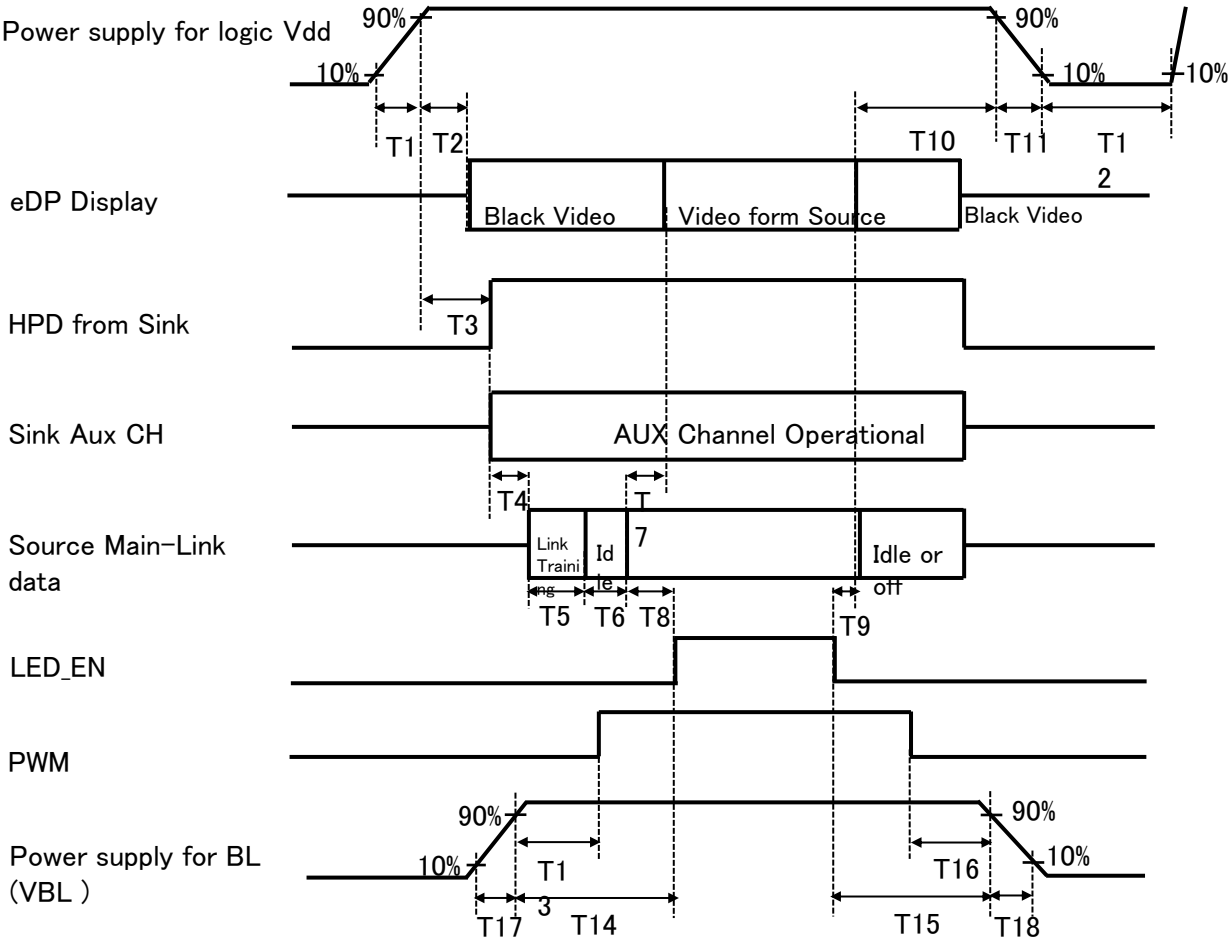
7.0 INPUT SIGNALS, BASIC DISPLAY COLORS & GRAY SCALE OF COLORS

	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	

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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
 - T3+T4+T5+T6+T8>200ms
 - 0ms < T7 ≤ 50ms
 - T7 < T8
 - 0ms < T9
- 0ms < T10 < 500 ms
 - 0.5ms ≤ T11 ≤ 10 ms
 - (Figure 16)
 - 500ms ≤ T12
 - 0ms < T13
 - 0ms < T14
 - 0ms < T15
- 0ms < T16
 - 0.5ms ≤ T17
 - 0.5ms ≤ 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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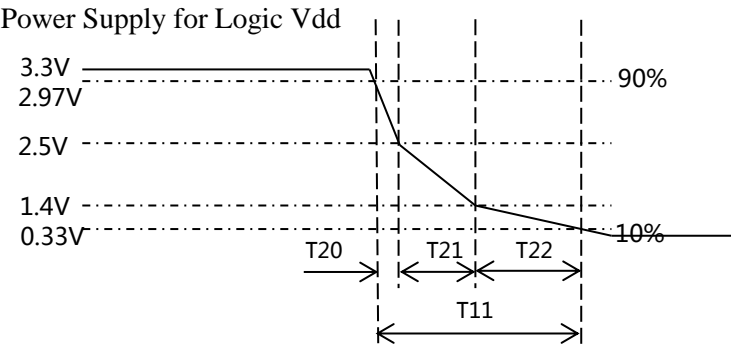


Figure 16. T11 timing requirements

- 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

Connector Name /Description	For Signal Connector
Manufacturer	UJU
Type/ Part Number	IS050-L30B-C10
Mating housing/ Part Number	I-PEX 20454-030T or Compatible

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10.0 MECHANICAL CHARACTERISTICS

10.1 Dimensional Requirements

FIGURE 6 shows mechanical outlines for the model NV156FHM-N48 V8.2.
Other parameters are shown in Table 9.

<Table 9. Dimensional Parameters>

Parameter	Specification	Unit
Active Area	344.16 (H) × 193.59(V)	
Number of pixels	1920 (H) X 1080 (V) (1 pixel = R + G + B dots)	
Pixel pitch	0.17925 (H) X 0.17925 (V)	mm
Pixel arrangement	RGB Vertical stripe	
Display colors	6bit+FRC	
Display mode	Normally Black	
Dimensional outline	350.66(H)*216.245(V) (W/PCB)*3.2(Max)	mm
Weight	360(Max)	gram
Back Light	Connector :STM MSK24022P10 or BOE-120521-01	
	LED, Horizontal-LED Array type	

10.2 Mounting

See FIGURE 6.

10.3 Anti-Glare and Polarizer Hardness.

The surface of the LCD has an AG coating to minimize reflection and a coating to reduce s cratching. The Polarizer Hardness is 3H.

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 = -20 °C ↔ 60 °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) MDL label

NV156FHM-N48 V8.2



XXXXXXXXXXXXXXXXXXXX

P/N 5D10S68976

FRU XXXXXXXX



MADE IN CHINA 8S5D10S68976B1CQYMDXXXX




MADE IN CHINA

LCM ID 编码规则:


序列号	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
代码	S	L	S	T	1	2	3	5	9	4	2	0	0	0	1	D	B
描述	GBN		等级	line	年		月	FG-Code后4位				Serial Number					

客户Serial Number码规则：

	YMD	####
Part Number	MFG Date	S/N
13 digit: num-alphabet	3 digit: Num-alphabet	4 digit: Num-alphabet
Follow Timi PN Rule MD10000004337	Skip "I,O,Q"	SN:4bit, use 0~9 and A~Z numeral-alphabet, skip letter "I,O,Q,U" ; SN must NOT be duplicated.
	Year=last digit of year	
	Month=1-9 for Jan-Sept, A=Oct, B=Nov, C=Dec	
	Day=1-9 for 1 st thru 9 th , A=10, B=11, etc. skip "I,O,Q,U"	

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(2) High voltage caution label



HIGH VOLTAGE
CAUTION

RISK OF ELECTRIC SHOCK.
DISCONNECT THE ELECTRIC
POWER BEFORE SERVICING

COLD CATHODE FLUORESCENT LAMP IN LCD
 PANEL CONTAINS A SMALL AMOUNT
 OF MERCURY. PLEASE FOLLOW LOCAL OR-
 DINANCES OR REGULATIONS FOR DISPOSAL.

(3) Box label

Label Size: 110 mm (L) × 55 mm (W)

Contents

Model: NV156FHM-N48 V8.2

Q`ty: Module Q`ty in one box

Serial No.: Box Serial No.

Date: Packing Date

Internal use of Product

BOE

CHONGQING BOE OPTOELECTRONICS
TECHNOLOGY Co., LTD


MODEL: NV156FHM-N48 V8.2

QTY: XX

SERIAL NO: XXXXXXXXXXXXX

DATE: XXXXXXXXX

BOX ID 条形码



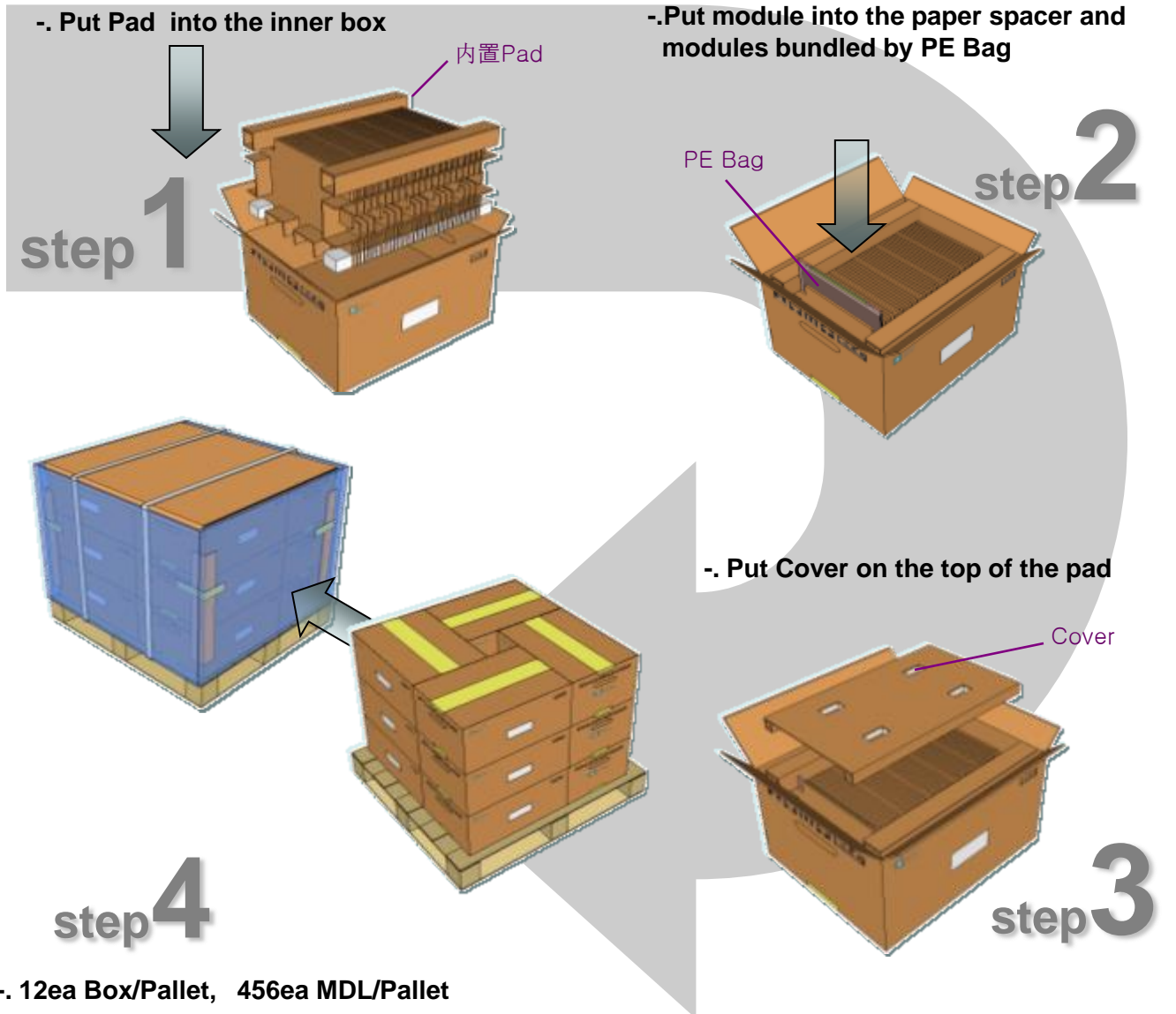
8940

Digit	1	2	3	4	5	6	7	8	9	10	11	12	13
Code	S	L	S	5	1	2	3	D	0	0	0	6	8
Description	Products GBN		Grade	Line	Year		Month	Revision Code	SerialNo				

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15.0 PACKING INFORMATION

15.1 Packing order



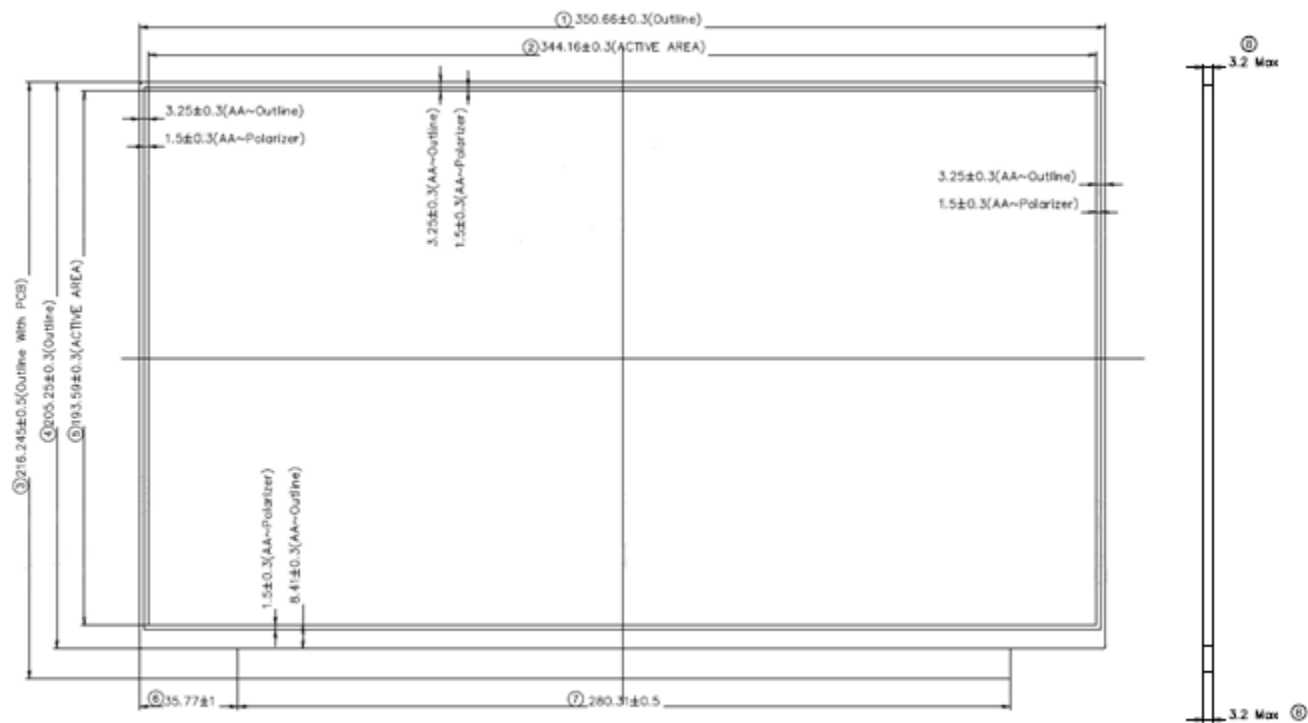
15.2 Notes

- Box Dimension: 580mm×488mm×303mm
- Package Quantity in one Box: 38 pcs
- Total Weight: 19.3kg/Box

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16.0 MECHANICAL OUTLINE DIMENSION

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

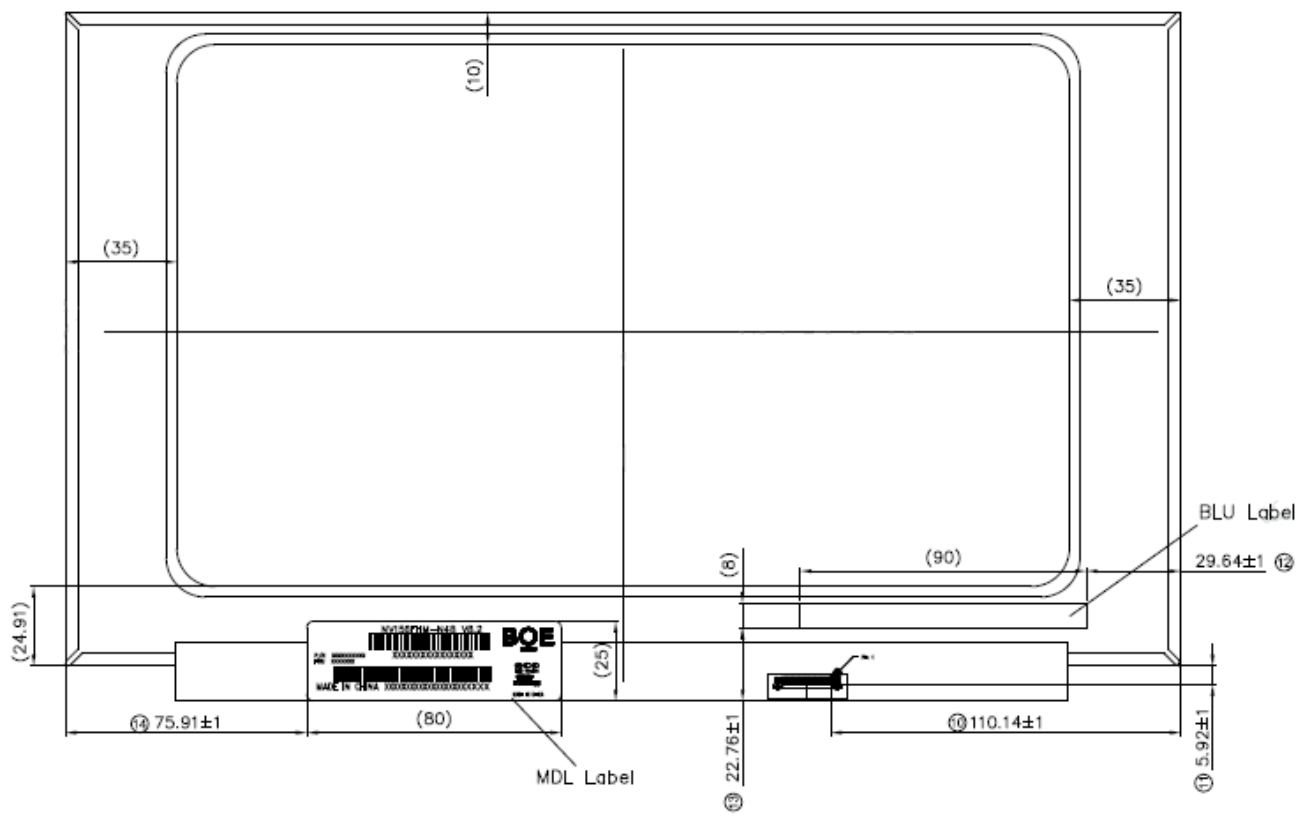


Note:

1. Top Polarizer is the highest part.
2. Curve Spec: 0<=d<=0.5mm.
3. No light leakage from all 4 corners of LCM.
5. Size Unit: mm.

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



- Note:
- 1. Top Polarizer is the highest part.
 - 2. Curve Spec: 0<=d<=0.5mm.
 - 3. No light leakage from all 4 corners of LCM.
 - 5. Size Unit: mm.

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17.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	00	0		1792	ID = 1792
0B		07	7			
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		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		-	digital signal/DP input
15	Max H image size	22	34		34	34 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			RGB display, Preferred Timming mode/RGB 4:4:4
19	Red/Green low bits	C9	201		-	Red / Green Low Bits
1A	Blue/White low bits	A0	160		-	Blue / White Low Bits
1B	Red x high bits	95	149	599	0.585	Red (x) = 10010101 (0.585)
1C	Red y high bits	5D	93	372	0.364	Red (y) = 01011101 (0.364)
1D	Green x high bits	59	89	358	0.35	Green (x) = 01011001 (0.35)
1E	Green y high bits	94	148	593	0.58	Green (y) = 10010100 (0.58)
1F	Blue x high bits	29	41	166	0.163	Blue (x) = 00101001 (0.163)
20	BLue y high bits	24	36	146	0.143	Blue (y) = 00100100 (0.143)
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		-	
24	Established timing 2	00	0		-	

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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	9C	156	152.6	152.6MHz Main clock
37		3B	59		
38		80	128	1920	Hor Active = 1920
39		36	54	310	Hor Blanking = 310
3A		71	113	-	4 bits of Hor. Active + 4 bits of Hor. Blanking
3B		38	56	1080	Ver Active = 1080
3C		3C	60	60	Ver Blanking = 60
3D		40	64	-	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		36	54	3	V sync Offset = 3 line
41		00	0	6	V Sync Pulse width : 6 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

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48	Detailed timing/monitor descriptor #2	00	0	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		
5A	Detailed timing/monitor descriptor #3	00	0		ASCII Data Sting Tag
5B		00	0		
5C		00	0		
5D		FE	254		
5E		00	0		
5F		42	66	B	Manufacture name : BOECQ
60		4F	79	O	
61		45	69	E	
62		20	32		
63		43	67	C	
64		51	81	Q	
65		0A	10		
66		20	32		
67		20	32		
68		20	32		
69		20	32		
6A		20	32		
6B		20	32		

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6C	Detailed timing/monitor descriptor #4	00	0			Product Name Tag (ASCII)
6D		00	0			
6E		00	0			
6F		FE	254			
70		00	0			
71		4E	78		N	Model name : NV156FHM-N48 V8.2
72		56	86		V	
73		31	49		1	
74		35	53		5	
75		36	54		6	
76		46	70		F	
77		48	72		H	
78		4D	77		M	
79		2D	45		-	
7A		4E	78		N	
7B		34	52		4	
7C		38	56		8	
7D		0A	10			
7E	Extension flag	00	0			
7F	Checksum	7C	124	124	-	