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TFT-LCD

P0

2017.12.20

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NT156WHM-N10

Preliminary Product Specification

Rev. P0

Chongqing BOE OPTOELECTRONICS TECHNOLOGY CO.,LTD



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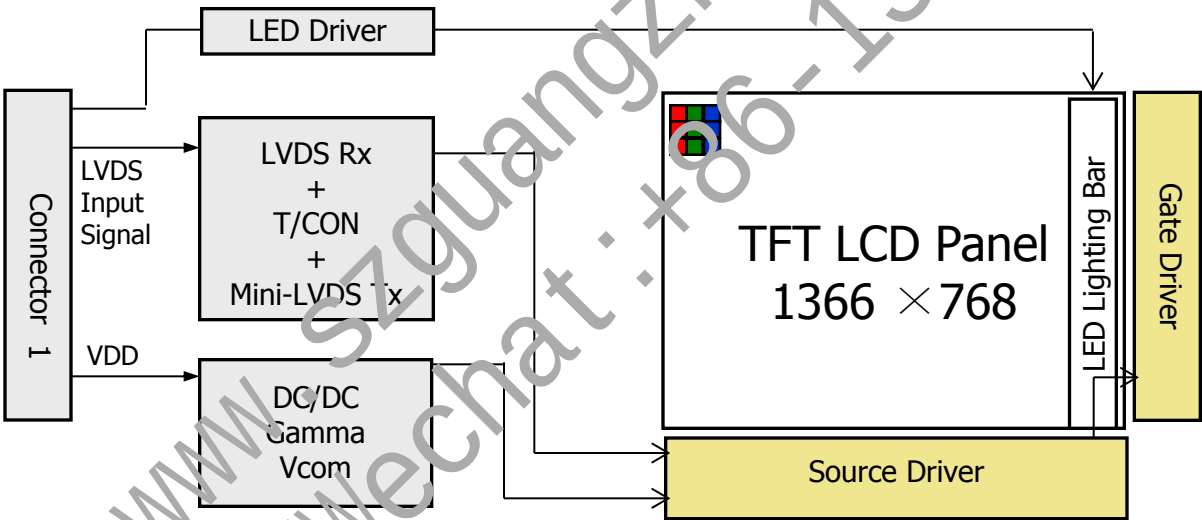
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1.0 GENERAL DESCRIPTION

1.1 Introduction

NT156WHM-N10 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 HD resolutions (1366 horizontal by 768 vertical pixel array). Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical Stripe and this module can display 262,144 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 LVDS interface compatible.



1.2 Features

- 1 Channel LVDS Interface with 1 pixel / clock
- Thin and light weight
- 6-bit color depth, display 262K colors
- Single LED Lighting Bar. (Down side/Horizontal Direction)
- Data enable signal mode
- Up/Down 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 NT156WHM-N10. (listed in Table 1.)

<Table 1. General Specifications>

Parameter	Specification	Unit	Remarks
Active area	344.23(H) × 193.54(V)	mm	
Number of pixels	1366 (H) × 768 (V)	pixels	
Pixel pitch	0.252 (H) X 0.252 (V)	mm	
Pixel arrangement	RGB Vertical stripe		
Display colors	262K	colors	
Display mode	Normally White		
Dimensional outline	359.5(H)*223.8(V) (W/PCB)*3.8(Max) 359.5(H)*206.5(V)*3.8(Max)	mm	
Weight	420 (max)	g	
Surface treatment	Glare		
Back-light	Lower Down side, 1-LED Lighting Bar type		Note 1
Power consumption	P _D : 1.2 (max)	W	Note 2
	P _{BL} :2.6(max)	W	
	P _{total} :3.8(max)	W	

Note 1: LED Lighting Bar (32*LED Array)
Note 2: @VDD=3.3V @60Hz @ mosaic pattern

2.0 ABSOLUTE MAXIMUM RATINGS

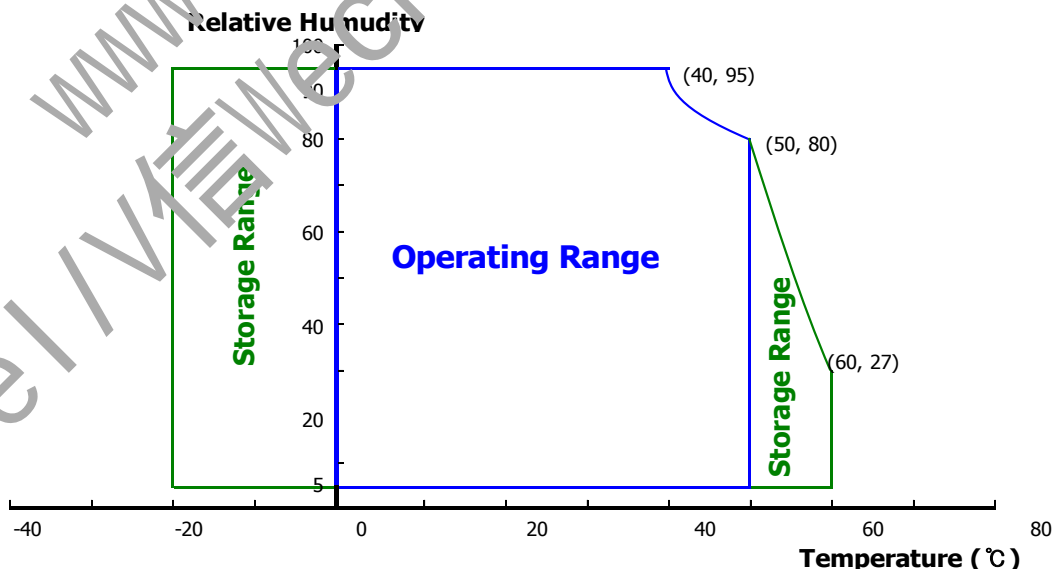
The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit. The operational and non-operational maximum voltage and current values are listed in Table 2.

< Table 2. Absolute Maximum Ratings >

Ta = 25 $^{\circ}$ C $\pm$ 2 $^{\circ}$ C

Parameter	Symbol	Min.	Max.	Unit	Remarks
Power Supply Voltage	V _{DD}	-0.3	1.0	V	Note 1
Logic Supply Voltage	V _{IN}	V _{SS} -0.3	V _{DD} +0.3	V	
Operating Temperature	T _{OP}	0	+50	$^{\circ}$ C	Note 2
Storage Temperature	T _{ST}	-20	+60	$^{\circ}$ 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 $^{\circ}$ C $\geq$ Ta)
- Maximum wet - bulb temperature at 39 $^{\circ}$ C or less. (Ta > 40 $^{\circ}$ C) No condensation.



3.0 ELECTRICAL SPECIFICATIONS

3.1 Electrical Specifications

< Table 3. Electrical specifications >

Ta=25+/-2°C

Parameter		Min.	Typ.	Max.	Unit	Remarks
Power Supply Voltage	V_{DD}	3.0	3.3	3.6	V	Note 1
Permissible Input Ripple Voltage	V_{RF}	-	-	300	mV	At $V_{DD} = 3.3V$
Power Supply Current	I_{DD}	-	300	-	mA	Note 1
Differential Input Voltage	V_{IL}	200	-	600	mV	
Power Consumption	P_D	-	1.0	1.2	W	Note 1
	P_{BL}	-	-	2.6	W	Note 2
	P_{total}	-	-	3.8	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.@ Mosaic Pattern
2. Calculated value for reference ($V_{LED} \times I_{LED}$)

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3.2 Backlight Unit

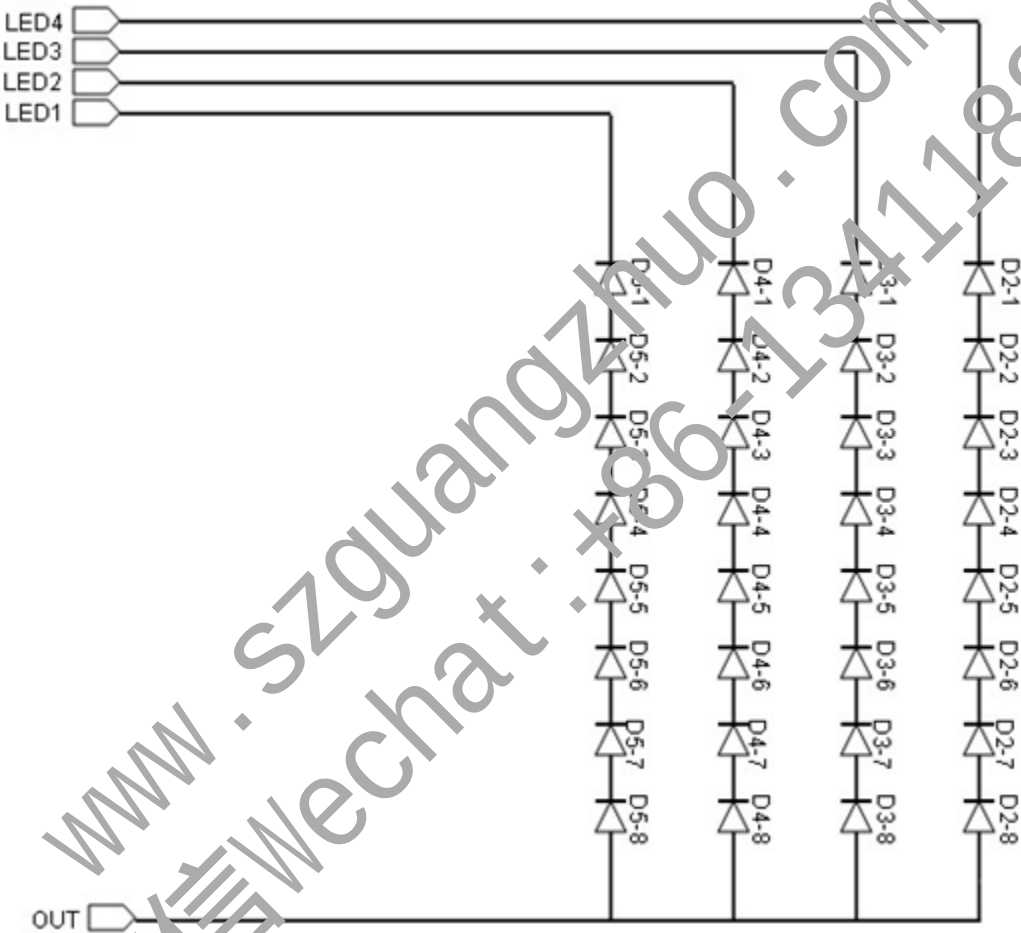
< Table 4. LED Driving guideline specifications > Ta=25+/-2℃

Parameter		Min.	Typ.	Max.	Unit	Remarks	
LED Forward Voltage		V _F	-	-	3.1	V	-
LED Forward Current		I _F	-	21.5	-	mA	-
LED Power Consumption		P _{LED}	-	-	2.6	W	Note 1
LED Life-Time		N/A	15,000	-	-	Hour	I _F = 20mA
Power supply voltage for LED Driver		V _{LED}	-	-	24.8	V	
EN Control Level	Backlight on		2.5		5.0	V	
	Backlight off		0		1.0	V	
PWM Control Level	PWM High Level		2.5		5.0	V	
	PWM Low Level		0		0.1	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 $I_F \times V_F \times 32 / \text{efficiency} = P_{LED}$
 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.

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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±2℃) with the equipment of Luminance meter system (Goniometer system and TOPCON BM-5) and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of θ and Φ equal to 0°. We refer to θ0=0 (=θ3) as the 3 o'clock direction (the “right”), θ0=90 (= θ12) as the 12 o'clock direction (“upward”), θ0=180 (= θ9) as the 9 o'clock direction (“left”) and θ0=270(= θ6) 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+/- 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	$CR > 10$	-	45	-	Deg.	Note 1
		Θ_9		-	45	-	Deg.	
	Vertical	Θ_{12}		-	20	-	Deg.	
		Θ_6		-	40	-	Deg.	
Luminance Contrast ratio		CR	$\Theta = 0^\circ$	-	500			Note 2
Luminance of White	5 Points	Y_w	$\Theta = 0^\circ$ $I_{LED}=21.5mA$	187	220	-	cd/m ²	Note 3
White Luminance uniformity	5 Points	ΔY_5		80	-	-		Note 4
	13 Points	ΔY_{13}		65	-	-		
White Chromaticity		x_w	$\Theta = 0^\circ$	0.283	0.313	0.343		Note 5
		y_w		0.299	0.329	0.359		
Reproduction of color	Red	x_R	$\Theta = 0^\circ$	-0.03	0.590	+0.03		
		y_R			0.350			
	Green	x_G			0.330			
		y_G			0.555			
	Blue	x_B			0.153			
		y_B			0.119			
Gamut					45		%	
Response Time (Rising + Falling)		T_{RT}	$T_a= 25^\circ C$ $\Theta = 0^\circ$	-	12	-	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 =

Luminance when displaying a white raster

Luminance when displaying a black raster

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

4. The White luminance uniformity on LCD surface is then expressed as : ΔY =Minimum Luminance of 5(or 13) points / Maximum Luminance of 5(or 13) points.
(see FIGURE 2 and FIGURE 3).

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

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

7. Cross-Talk of one area of the LCD surface by another shall be measured by comparing the luminance (YA) of a 25mm diameter area, with all display pixels set to a gray level, to the luminance (YB) of that same area when any adjacent area is driven dark.
(See FIGURE 5).

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4.3 Optical measurements

Figure 1. Measurement Set Up

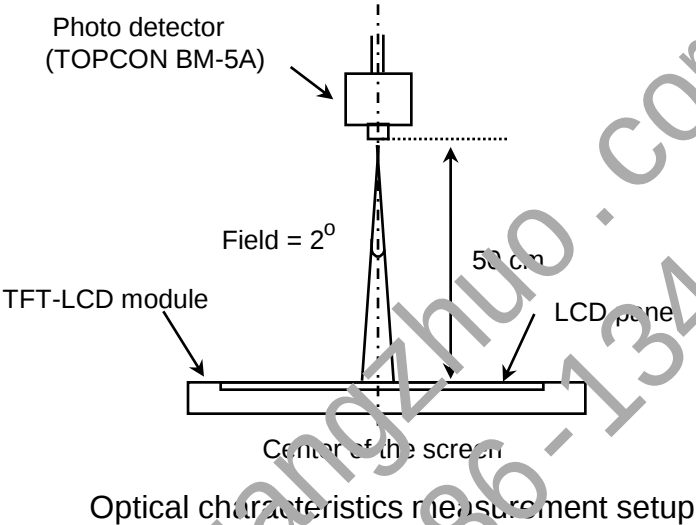
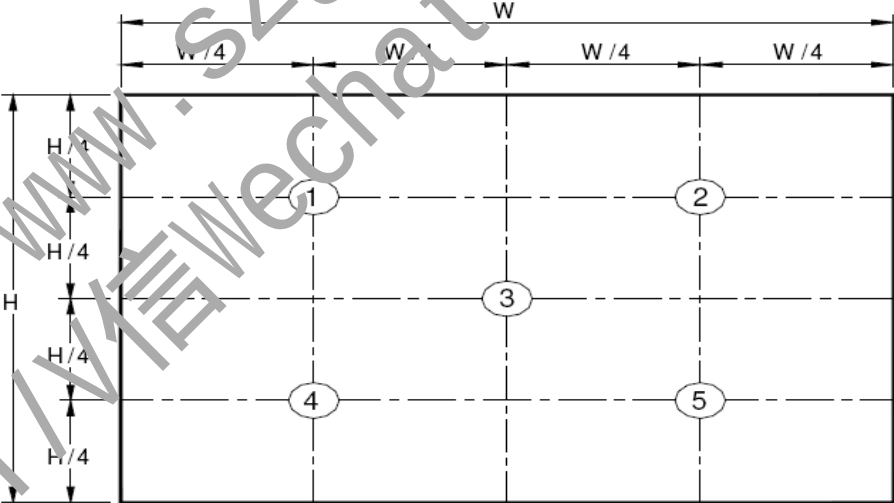
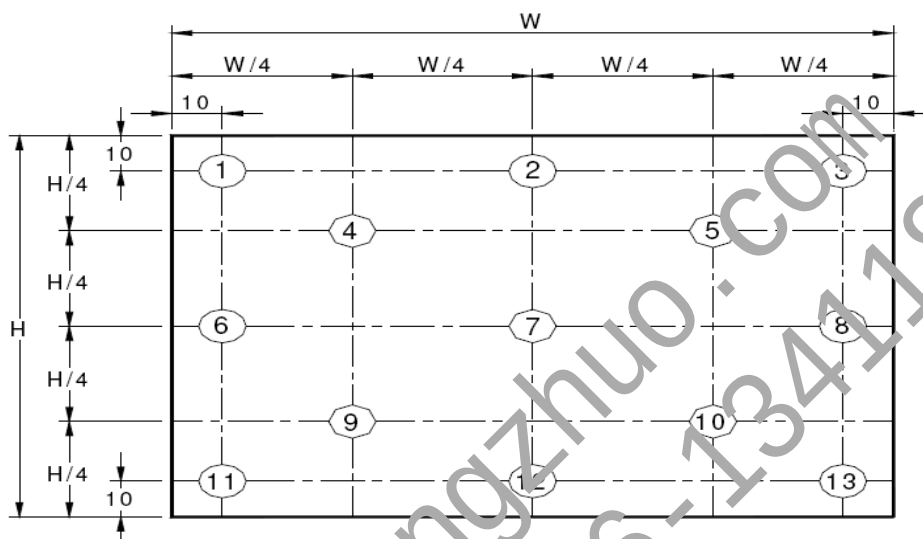


Figure 2. White Luminance and Uniformity Measurement Locations (5 points)



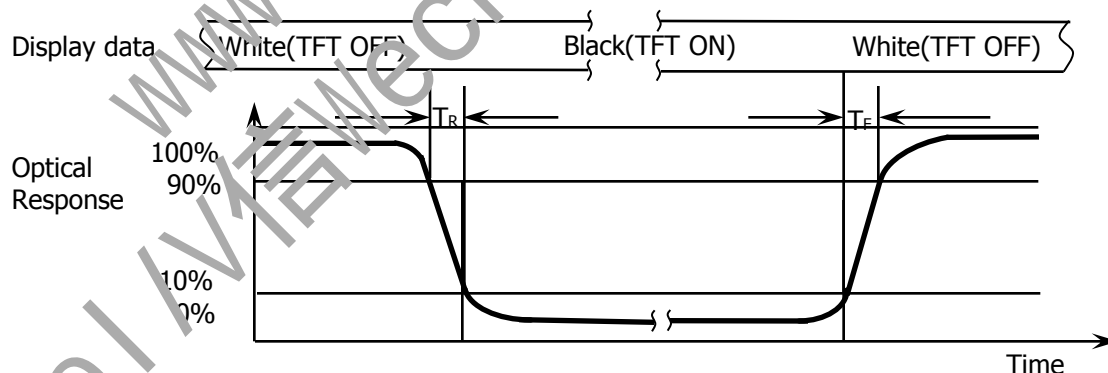
Center Luminance of white is defined as luminance values of center 5 points across the LCD surface. Luminance shall be measured with all pixels in the view field set first to white. This measurement shall be taken at the locations shown in FIGURE 2 for a total of the measurements per display.

Figure 3. Uniformity Measurement Locations (13 points)



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

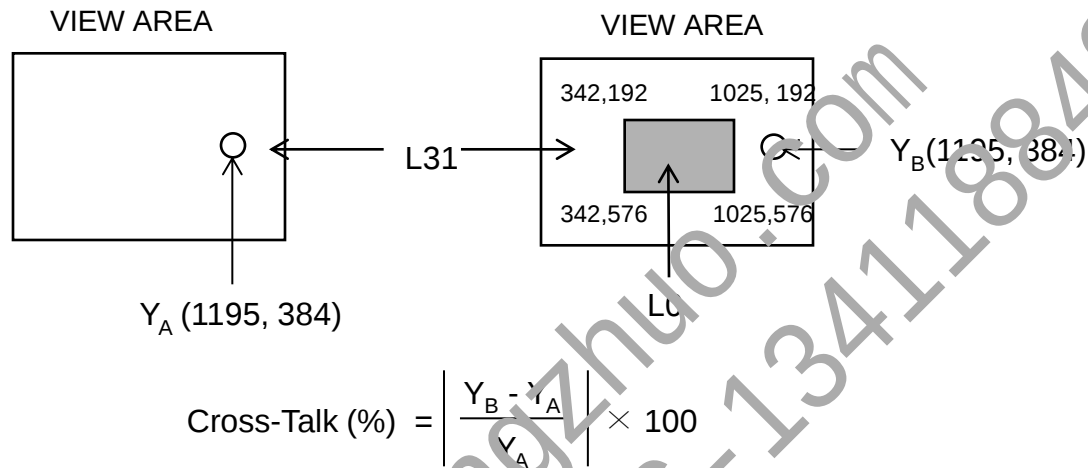
Figure 4. Response Time Testing



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



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

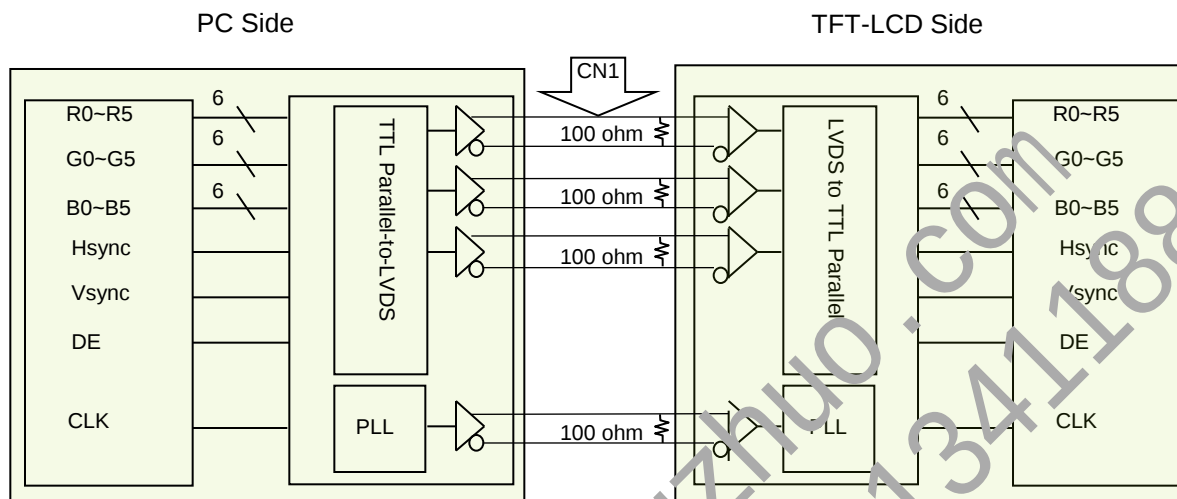
The electronics interface connector is UJU IS050-L30B-C10 or Compatible.
The connector interface pin assignments are listed in Table 6.

<Table 6. Pin Assignments for the Interface Connector>

Terminal	Symbol	Functions
Pin No.	Symbol	Description
1	NC	No Connection
2	VDDIN	Power Supply, 3.3V (typ)
3	VDDIN	Power Supply, 3.3V (typ)
4	VDC	VDC 3.3Vpower for EDID
5	NC	No Connection
6	CLK EDID	EDID Clock
7	Data EDID	EDID Data
8	RxIN0-	Transmission Data of 0 Negative -
9	RxIN0+	Transmission Data of 0 Positive +
10	GND	Ground
11	RxIN1-	Transmission Data of 1 Negative -
12	RxIN1+	Transmission Data of 1 Positive +
13	GND	Ground
14	RxIN2-	Transmission Data of 2 Negative -
15	RxIN2+	Transmission Data of 2 Positive +
16	GND	Ground
17	RxCLKIN	Sampling Clock of Negative -
18	RxCLKIN+	Sampling Clock of Positive +
19	NC	No Connection
20	NC	No Connection
21	NC	No Connection
22	GND	Ground
23	NC	No Connection
24	NC	No Connection
25	GND	Ground
26	NC	No Connection
27	NC	No Connection
28	GND	Ground
29	NC	No Connection
30	NC	No Connection

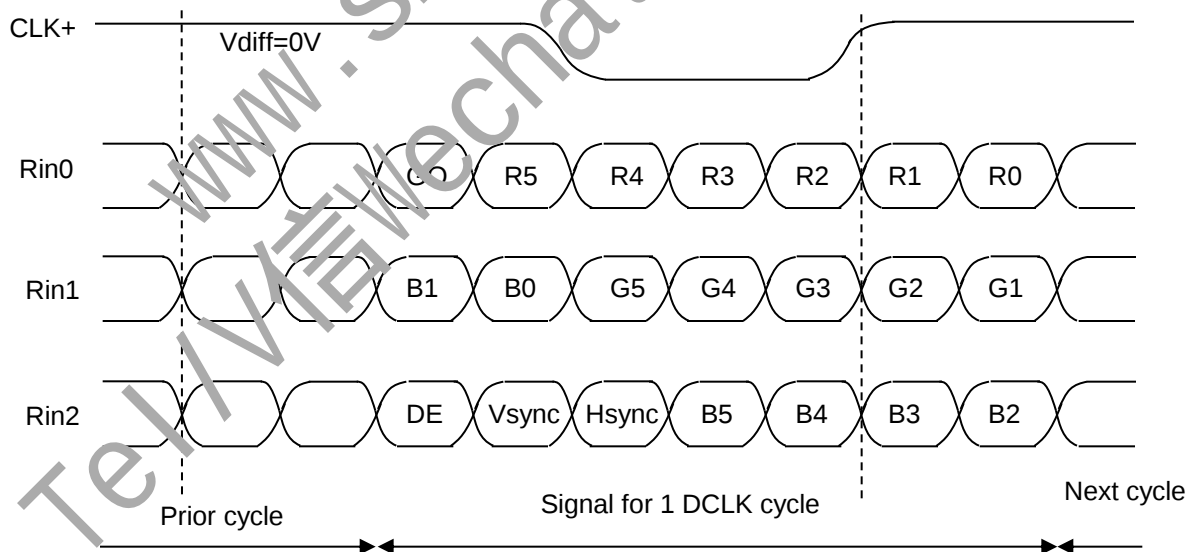
Terminal	Symbol	Functions
Pin No.	Symbol	Description
31	VLED_GND	LED Ground
32	VLED_GND	LED Ground
33	VLED_GND	LED Ground
34	NC	No Connection
35	PWM	System PWM Signal Input
36	LED_EN	LED enable pin(+3.3V Input)
37	NC	No Connection
38	VLED	LED Power Supply 6V-21V
39	VLED	LED Power Supply 6V-21V
40	VLED	LED Power Supply 6V-21V

5.2 LVDS Interface



Note. Transmitter : Thine THC63LVDM63A or equivalent.
Transmitter is not contained in Module.

5.3.1 LVDS Input signal

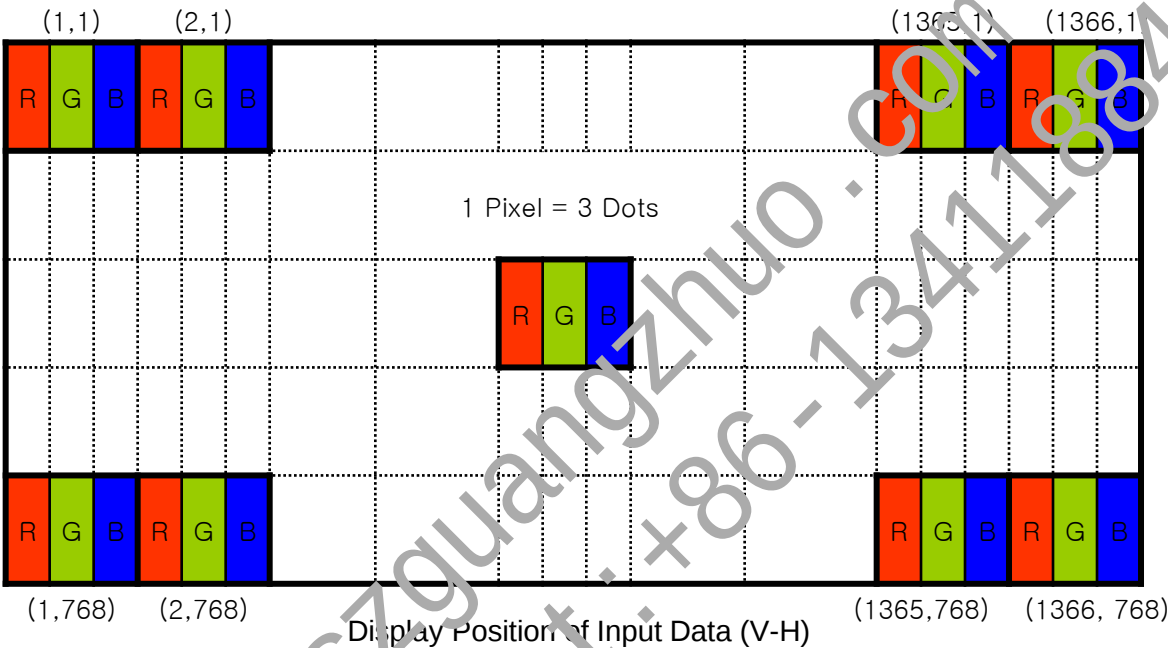


Note. Pin connection in case of using Thine THC63LVDM63A

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5.3.2 Data Input Format

<Table 6. Pin Assignments for the BLU & LCM Connector>



5.4 Back-light & LCM Interface Connection

Interface Connector: CRT 098-10WL0AO or Equivalent

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

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

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6.0 SIGNAL TIMING SPECIFICATION

6.1 The NT156WHM-N10 is operated by the DE only.

Item		Symbols	Min	Typ	Max	Unit
Clock	Frequency	1/Tc	67.5	72.3	76.3	MHz
	High Time	Tch	-	4/7	-	tc
	Low Time	Tcl	-	3/7	-	Tc
Frame Period		Tv	778	790	802	lines
			-	60	-	Hz
			-	16.7	-	ms
Vertical Display Period		Tvd	768	768	768	lines
One line Scanning Period		Th	1440	1526	1586	clocks
Horizontal Display Period		Thd	1366	1366	1366	clocks

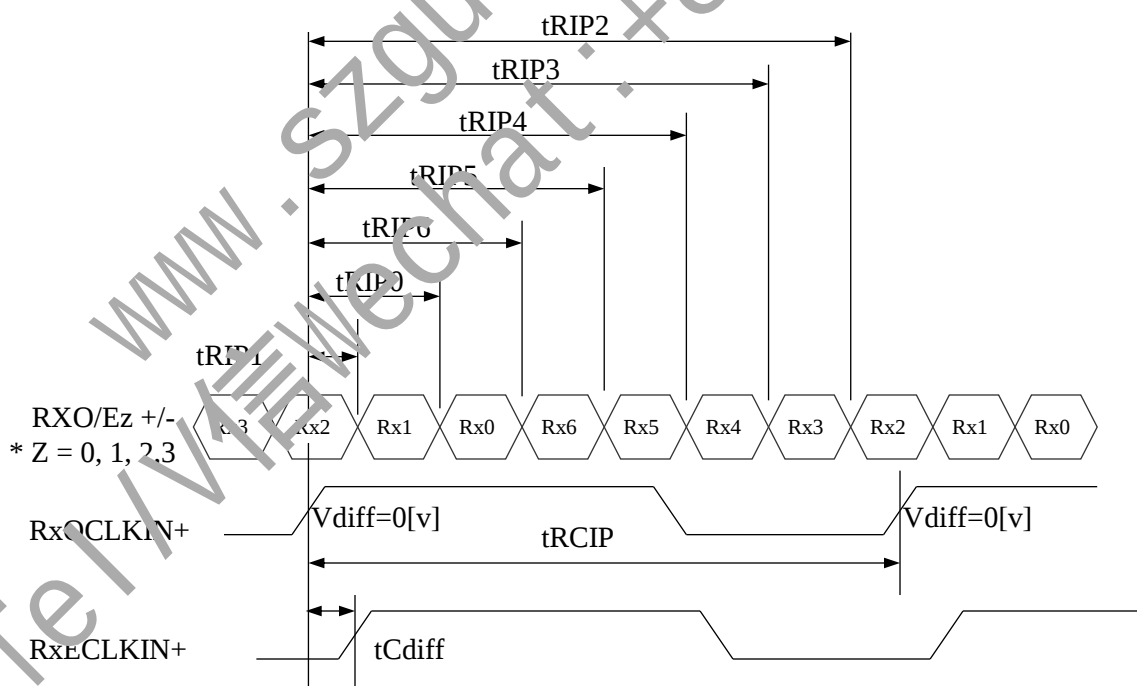
Note※: This Module can support low frame refresh rate 50Hz & 40Hz.

6.2 LVDS Rx Interface Timing Parameter

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

<Table 8. LVDS Rx Interface Timing Specification>

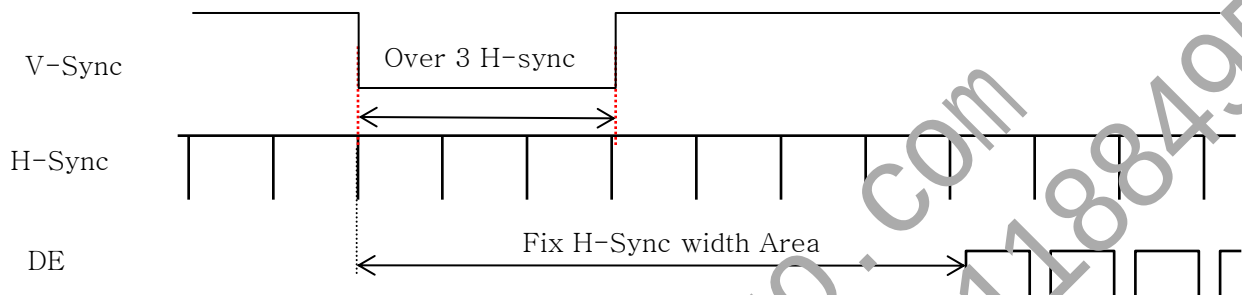
Item	Symbol	Min	Typ	Max	Unit	Remark
CLKIN Period	tRCIP	-	13.83	25	nsec	
CLK Difference	tCdiff	-tRCIP*(3/7)	0	+tRCIP*(1/7)	nsec	
Input Data 0	tRIP1	-0.4	0.0	+0.4	nsec	
Input Data 1	tRIP0	tRCIP/7-0.4	tRCIP/7	tRCIP/7+0.4	nsec	
Input Data 2	tRIP6	$2 \times tRCIP/7-0.4$	$2 \times tRCIP/7$	$2 \times tRCIP/7+0.4$	nsec	
Input Data 3	tRIP5	$3 \times tRCIP/7-0.4$	$3 \times tRCIP/7$	$3 \times tRCIP/7+0.4$	nsec	
Input Data 4	tRIP4	$4 \times tRCIP/7-0.4$	$4 \times tRCIP/7$	$4 \times tRCIP/7+0.4$	nsec	
Input Data 5	tRIP3	$5 \times tRCIP/7-0.4$	$5 \times tRCIP/7$	$5 \times tRCIP/7+0.4$	nsec	
Input Data 6	tRIP2	$6 \times tRCIP/7-0.4$	$6 \times tRCIP/7$	$6 \times tRCIP/7+0.4$	nsec	



* $V_{diff} = (RXO/Ez+) - (RXO/Ez-), \dots, (RXO/ECLK+) - (RXO/ECLK-)$

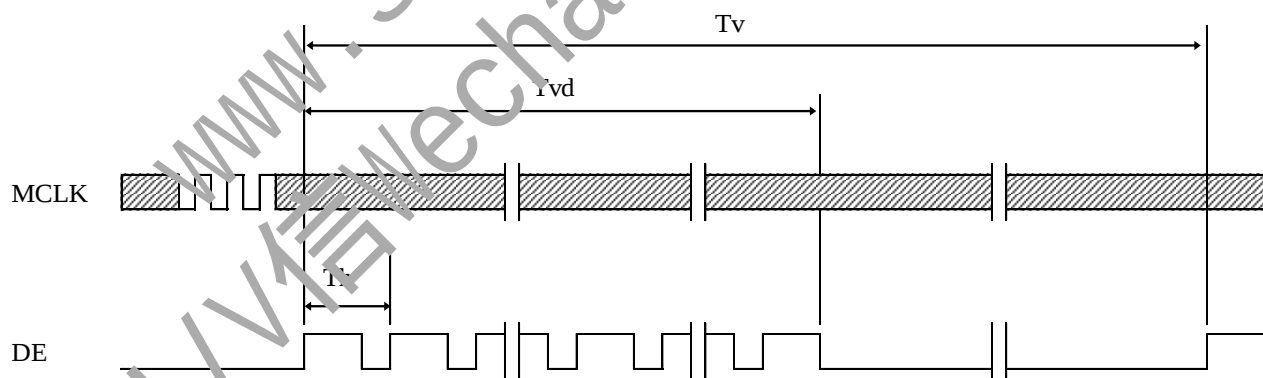
7.0 SIGNAL TIMING WAVEFORMS OF INTERFACE SIGNAL

7.1 Sync Timing Waveforms



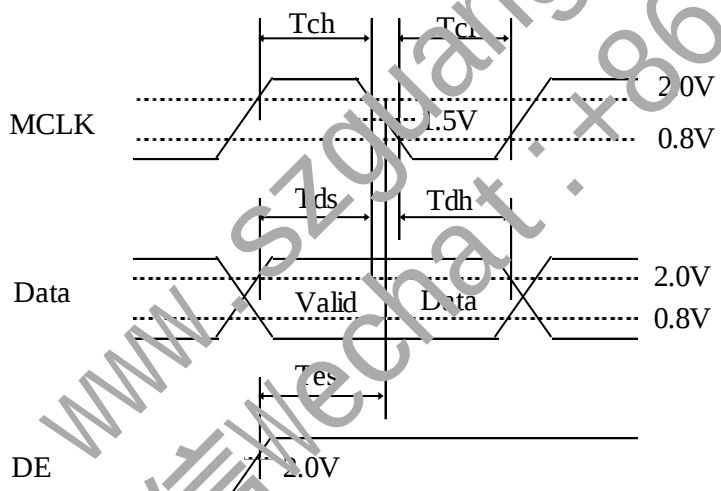
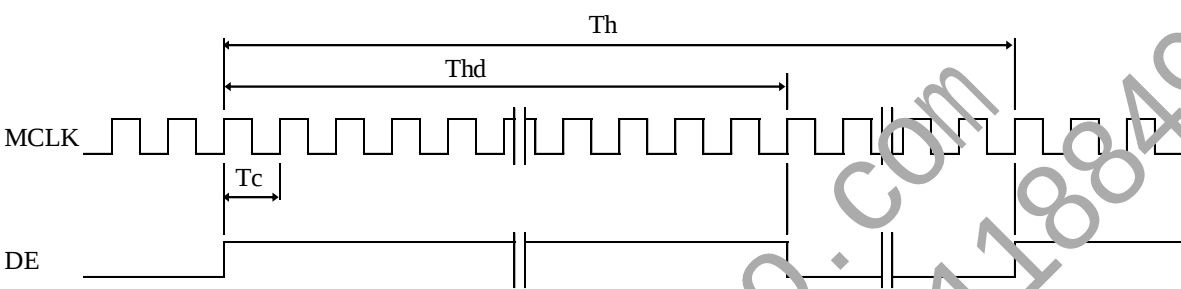
- 1) Need over 3 H-sync during V-Sync Low
- 2) Fix H-Sync width from V-Sync falling edge to first rising edge

7.2 Vertical Timing Waveforms



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7.3 Horizontal Timing Waveforms



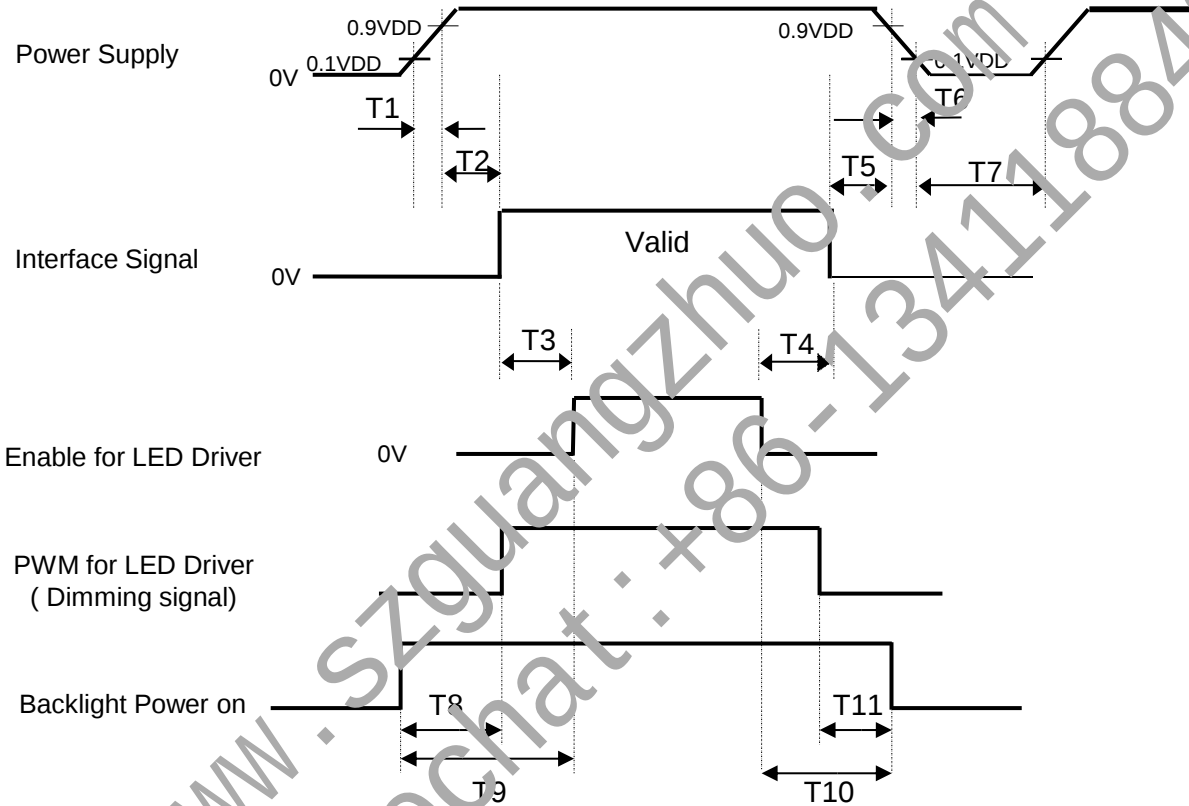
8.0 INPUT SIGNALS, BASIC DISPLAY COLORS & GRAY SCALE OF COLORS

	Colors & Gray scale	Data signal																	
		R0	R1	R2	R3	R4	R5	G0	G1	G2	G3	G4	G5	B0	B1	B2	B3	B4	B5
Basic colors	Black	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	1	1	1	1	1	1
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Light Blue	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Purple	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	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
Gray scale of Red	Black	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
	Darker	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	↑					↑					↑							
	▽	↓					↓					↓							
	Brighter	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	▽	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	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	1	0	0	0	0	0	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	△	↑					↑					↑							
	▽	↓					↓					↓							
	Brighter	0	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0	0	0
	▽	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	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	1	0	0	0	0	0
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
	△	↑					↓					↑							
	▽	↓					↓					↓							
	Brighter	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1
	▽	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	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
	△	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0
	Darker	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0
	△	↑					↑					↑							
	▽	↓					↓					↓							
	Brighter	1	0	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1
	▽	0	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

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9.0 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

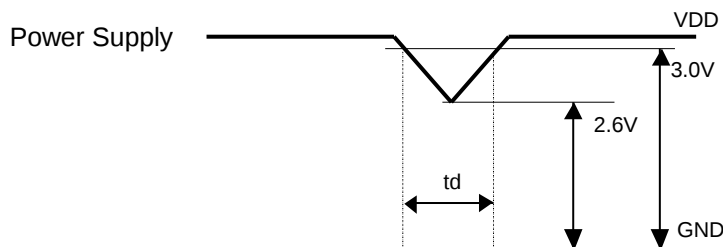


- 0.5ms ≤ T1 ≤ 10 ms
 - 0 ms ≤ T2 ≤ 50 ms
 - 200 ms ≤ T3
 - 0 ms ≤ T4
 - 0ms ≤ T5
- 0 ms ≤ T6 ≤ 100 ms
 - 150ms ≤ T7
 - 0 ms ≤ T8
 - 0 ms ≤ T9
 - 0ms ≤ T10
 - 0ms ≤ T11

Notes:

1. When the power supply VDD is 0V, keep the level of input signals on the low or keep high impedance.
2. Do not keep the interface signal high impedance when power is on.
Back Light must be turn on after power for logic and interface signal are valid.

9.1 Momentary voltage



● $t_d \leq 10 \text{ ms}$

Notes:

When momentary voltage $VDD \geq 2.6V$ during t_d , the unit can work normally when VDD return to 3.0V.

10.0 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.

10.1 TFT LCD Module

Connector Name /Description	For Signal Connector
Manufacturer	STM or Compatible
Type/ Part Number	MSAK24025P40G or Compatible
Mating housing/ Part Number	I-PEX 20455-040T-11 or Compatible

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11.0 MECHANICAL CHARACTERISTICS

11.1 Dimensional Requirements

FIGURE 6 shows mechanical outlines for the model NT156WHM-N50
Other parameters are shown in Table 9.

<Table 9. Dimensional Parameters>

Parameter	Specification	Unit
Active Area	344.23 (H) × 193.54 (V)	
Number of pixels	1366 (H) X 768 (V) (1 pixel = R + G + B dots)	
Pixel pitch	0.252 (H) X 0.252 (V)	
Pixel arrangement	RGB Vertical stripe	
Display colors	262K	
Display mode	Normally white	
Dimensional outline	359.5(H)*223.8(V) (W/PCB)*3.8(Max) 359.5(H)*206.5(V)*3.8(Max)	mm
Weight	420(Max)	gram
Back Light	Connector :	
	LED, Horizontal-LED Array type	

11.2 Mounting

See FIGURE 6.

11.3 Glare and Polarizer Hardness.

The surface of the LCD has an glare coating to maximize readability and hard coating to reduce scratching.

11.4 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.

12.0 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

13.0 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

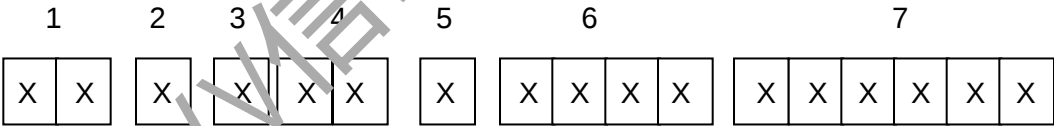
- When the module is operating, do not lose CLK, ENAB signals. If any one of these signals is lost, the LCD panel would be damaged.
- Obey the supply voltage sequence. If wrong sequence is applied, the module would be damaged.

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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

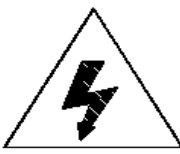
(1) MDL label



- Type designation
- No 1. Control Number
- No 2. Rank / Grade
- No 3. Line classification
- No 4. Year (10 : 2010, 11: 2011, ...)
- No 5. Month (1, 2, 3, ..., 9, X, Y, Z)
- No 6. Product Identification (FG)
- No 7. Serial Number

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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 ORDINANCES OR REGULATIONS FOR DISPOSAL.

(3) Box label


 CHONGQING BOE OPTOELECTRONICS TECHNOLOGY CO., LTD

MODEL: XXXXXXXX-XXX

SERIAL NO: XXXXXXXXXXXX

BOX 印 条 码

XXXXXXXXXX XXXX XXXX

Q'TY: XX

DATE: XXXXXXXX


 RoHS Compliant

序列号标注部分需打印, 说明如下:

1. FG-CODE(前12位)

2. 产品数量

3. Box ID

4. 包装日期

5. 客户端段物料号(客户端)---暂不打印,预留空间

6. FG-Code后四位

7. 供应商代码 ---暂不打印

Total Size:100×50mm

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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14.0 PACKING INFORMATION

14.1 Packing order

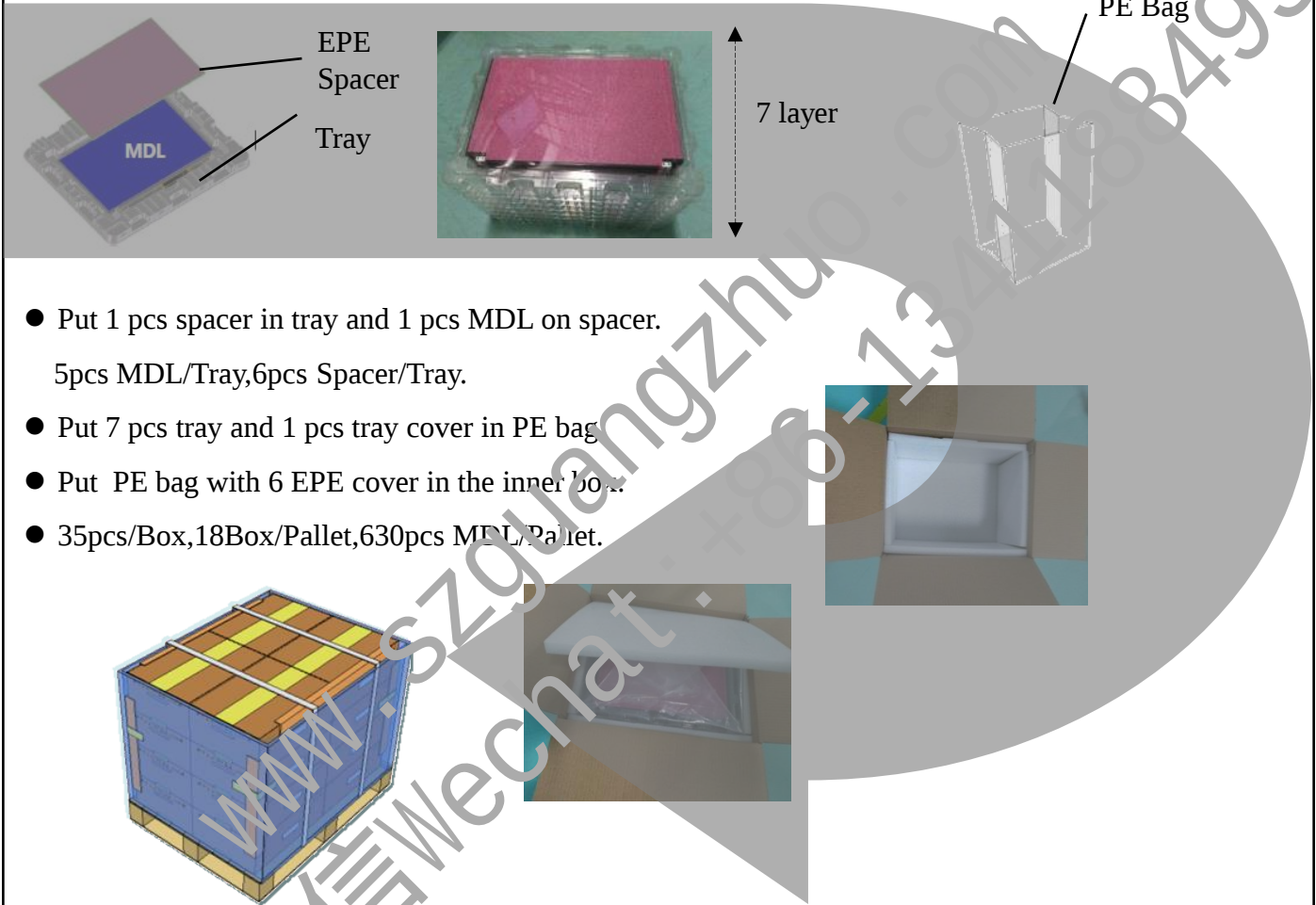
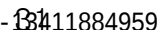


Figure 22. Packing Order

14.2 Note

- Box dimension: 480mm*350mm*285mm
- Package quantity in one box: 35pcs
- Total weight: 15.7kg/Box

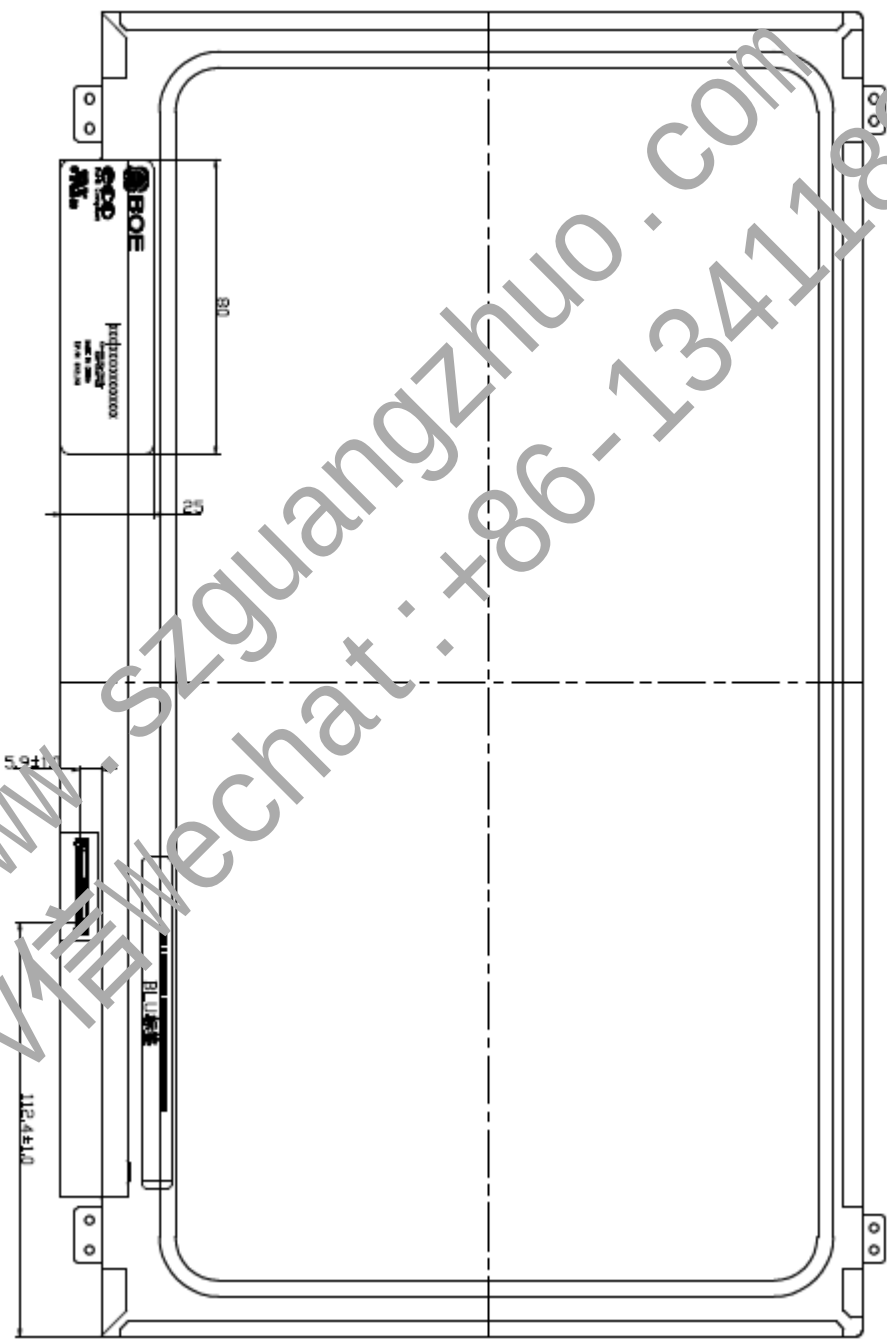
Figure 6. TFT-LCD Module Outline Dimension (Front View)



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16.0 MECHANICAL OUTLINE DIMENSION

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



17.0 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	8B	139	1931	ID = 1931
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	1B	27	2017	Manufactured in 2017
12	EDID Structure Ver.	01	1	1	EDID Ver 1.0
13	EDID revision #	03	3	3	EDID Rev. 0.3
14	Video input definition	95	149	-	
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
19	Red/Green low bits	24	36	-	Red / Green Low Bits
1A	Blue/White low bits	10	16	-	Blue / White Low Bits
1B	Red x high bits	97	151	0.590	Red (x) = 10010111 (0.590)
1C	Red y high bits	59	89	0.350	Red (y) = 01011000 (0.350)
1D	Green x high bits	54	84	0.330	Green (x) = 01010100 (0.330)
1E	Green y high bits	8E	142	0.555	Green (y) = 10010010 (0.555)
1F	Blue x high bits	27	39	0.153	Blue (x) = 00100110 (0.153)
20	Blue y high bits	1E	30	0.119	Blue (y) = 00011101 (0.119)
21	White x high bits	50	80	0.313	White (x) = 01010000 (0.313)
22	White y high bits	54	84	0.329	White (y) = 01010100 (0.329)
23	Established timing 1	00	0	-	
24	Established timing 2	00	0	-	

17.0 EDID Table

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	3E	62	72.3	72.3MHz Main clock
37		1C	28		
38		56	86	1366	Hor Active = 1366
39		A0	160	160	Hor Blanking = 160
3A		50	80	-	4 bits of Hor. Active + 4 bits of Hor. Blanking
3B		00		768	Ver Active = 768
3C		16	22	22	Ver Blanking = 22
3D		3C	48	-	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

17.0 EDID Table

Address (HEX)	Function	Hex	Dec	crc	Input values.	Notes
48	Detailed timing/monitor descriptor #2	00	0		0	
49		00	0		0	
4A		00	0		0	
4B		00	0		0	
4C		00	0		0	
4D		00	0		0	
4E		00	0		0	
4F		00	0		0	
50		00	0		0	
51		00	0		0	
52		00	0		0	
53		00	0		0	
54		00	0		0	
55		00	0		0	
56		00	0		0	
57		00	0		0	
58		00	0		0	
59		1A	26			Refer to right table
5A	Detailed timing/monitor descriptor #3	00	0			Manufacture name: BOECQ
5B		00	0			
5C		00	0			
5D		FE	254			
5E		00	0			
5F		42	66		B	
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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17.0 EDID Table

Address (HEX)	Function	Hex	Dec	crc	Input values.	Notes
6C	Detailed timing/monitor descriptor #4	00	0		0	Detailed Timing Description #4
6D		00	0		0	Flag
6E		00	0		0	Reserved
6F		FE	254			For Brightness Table and Power consumption
70		00	0		0	Flag
71		4E	78		N	Model name: NT156WHM-N10
72		54	84		T	
73		31	49		1	
74		35	53		-	
75		36	54		6	
76		57	87		W	
77		48	72		H	
78		4D	77		M	
79		2D	45		-	
7A		4E	78		N	
7B		31	49		1	
7C		30	48		0	
7D		0A	10			Flags
7E	Extension flag	00	0		1	
7F	Checksum	F9	249	249	-	