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TITLE : QT156WHM-N50

Product Specification

Rev. P3

BOE Optoelectronics Technology Co., Ltd

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	TFT-LCD	P3	2018.10.24	1 OF 35

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REVISION HISTORY

Revision No.	Page	Description of Changes	Date	Prepared
P0	-	Preliminary Release	2018.09.10	Wang Xin
P1	10	Change Luminance of White Data	2018.09.28	Dong Lei
P2	10	Change Luminance of White Data	2018.10.08	Dong Lei
P3	32	Change EDID	2018.10.24	Han Wenchu

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1.0 GENERAL DESCRIPTION

1.1 Introduction

QT156WHM-N50 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 Full-HD resolutions (1366horizontal 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 262k(6bit) 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 LVDS interface compatible.

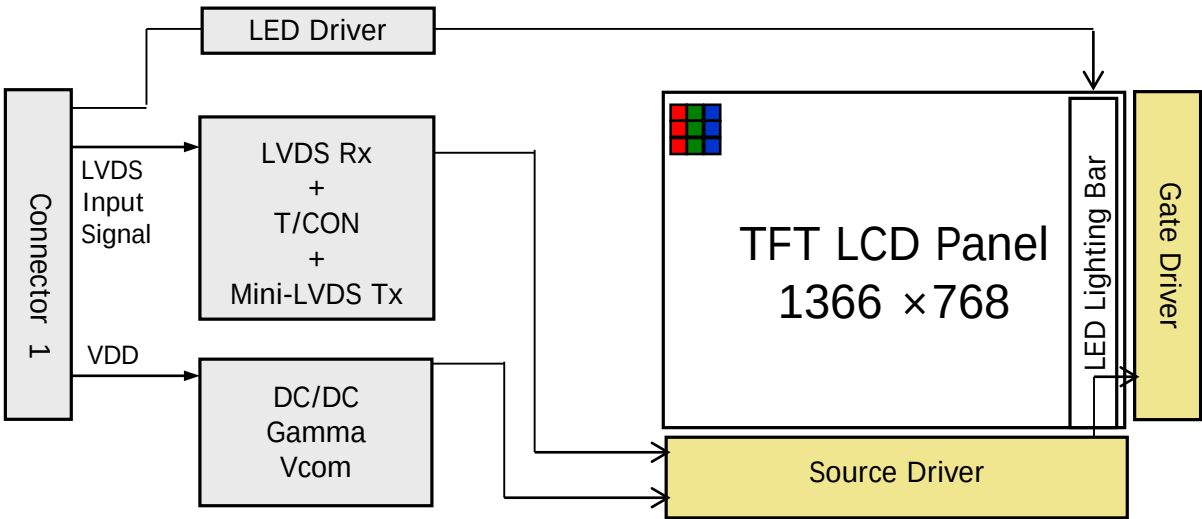


Figure 1. Drive Architecture

1.2 Features

- 1 Channel LVDS Interface with 1 pixel / clock
- Thin and light weight
- 262k(6bit) 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 QT156WHM-N50. (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)	um	
Pixel arrangement	RGB Vertical stripe		
Display colors	262k(6bit)		
Color gamut	45%		
Display mode	Normally white		
Dimensional outline	359.32(H)*209.54(V) (W/PCB)*5.5(Max)	mm	
Weight	450(max)	g	
Surface treatment	Anti-Glare		
Surface hardness	3H		
Back-light	Bottom edge side, 1-LED lighting bar type		Note 1
Power consumption	P _D : 1.2(max)	W	@Skip sub pixel255
	P _{BL} : 2.3(max)	W	
	P _{Total} : 3.5(max)	W	@Skip sub pixel255

Notes : 1. LED Lighting Bar (27*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.

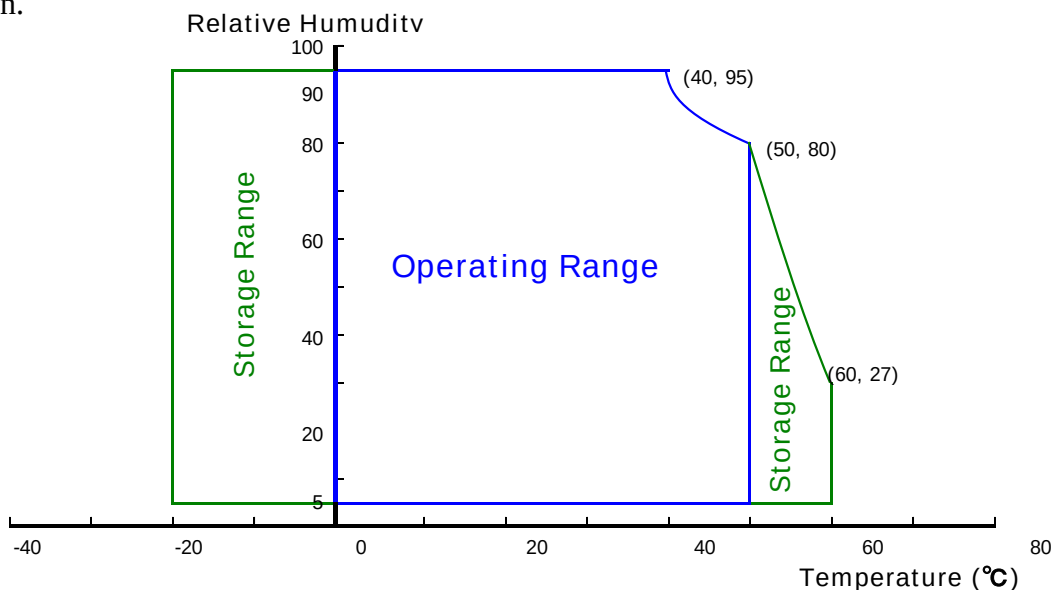


Figure 2. Temperature and Relative Humidity Range

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3.0 ELECTRICAL SPECIFICATIONS

3.1 Electrical Specifications

< Table 3. Electrical Specifications >

Ta=25+/-2°C

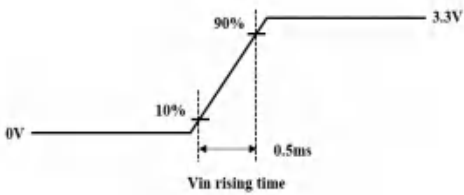
Parameter		Min.	Typ.	Max.	Unit	Remarks
Power Supply Voltage	V _{DD}	3.0	3.3	3.6	V	Note 1
Permissible Input Ripple Voltage	V _{RF}	-10%*V _{DD}	-	10%*V _{DD}	V	Note 4
Power Supply Current	I _{DD}	-	300	-	mA	Note 1
Power Supply Inrush Current	I _{nrush}	-	0.57	0.7	A	Note3
Power Consumption	P _D	-	0.9	1.2	W	Note 1
	P _{BL}	-	-	2.3	W	Note 2
	P _{total}	-	-	3.5	W	Note 1
LVDS Common Mode Voltage	V _{IC}	0.7	-	1.6	V	

Notes :

1. The supply voltage is measured and specified at the interface connector of LCM.
The current draw and power consumption specified is for 3.3V at 25 °C.

a) Typ : Mosaic Pattern

b) Max : Skip sub pixel255
2. Calculated value for reference (V_LED × I_LED)
3. Measure condition (Figure 4)
4. Input voltage range:3.0~3.6V.Test condition: Oscilloscope bandwidth 20MHz, AC coupling.



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3.2 Backlight Unit

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

Parameter		Min.	Typ.	Max.	Unit	Remarks	
LED Forward Voltage		V _F	-	-	3.2	V	-
LED Forward Current		I _F	-	22.5	-	mA	-
LED Power Consumption		P _{LED}		-	2.3	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	-	-	1.5	A	Note 4
EN Control Level	Backlight On		2.5	-	5.0	V	
	Backlight Off		0	-	1.0	V	
PWM Control Level	High Level		2.5	-	5.0	V	
	Low Level		0	-	1.0	V	
PWM Control Frequency		F _{PWM}	100	-	10,000	Hz	
Duty Ratio			1	-	100	%	Note 3

Notes :

- Power supply voltage12V for LED driver.
Calculator value for reference IF × VF ×36 /driver efficiency = PLED
- The LED life-time define as the estimated time to 50% degradation of initial luminous.
- 1% duty cycle is achievable with a dimming frequency less than 1KHz
- Measure condition (Figure 5)

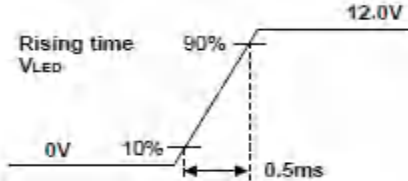


Figure 5. Inrush Measure Condition

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3.3 LED Structure

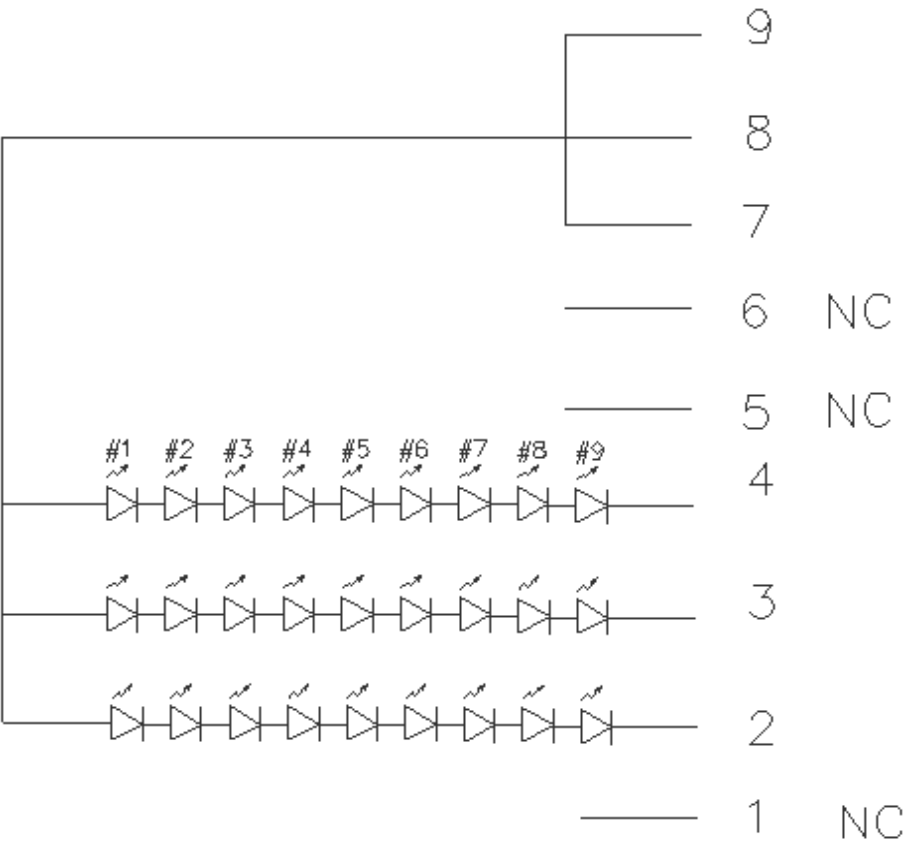


Figure 6. LED Structure

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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±2°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 θØ=0 (=θ3) as the 3 o’clock direction (the “right”), θØ=90 (= θ12) as the 12 o’clock direction (“upward”), θØ=180 (= θ9) as the 9 o’clock direction (“left”) and θØ=270(= θ6) as the 6 o’clock direction (“bottom”). While scanning θand/or Ø, the center of the measuring spot on the display surface shall stay fixed. The backlight should be operating for 30 minutes prior to measurement. VDD shall be 3.3+/- 0.3V at 25°C. Optimum viewing angle direction is 6 ’clock.

4.2 Optical Specifications

<Table 5. Optical Specifications>

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle Range	Horizontal	Θ_3	CR > 10	40	45	-	Deg.	Note 1
		Θ_9		40	45	-	Deg.	
	Vertical	Θ_{12}		15	20	-	Deg.	
		Θ_6		30	40	-	Deg.	
Luminance Contrast Ratio		CR	$\Theta = 0^\circ$	400	500	-		Note 2
Luminance of White	5 Points	Y_w	$\Theta = 0^\circ$ $I_{LED} = 22.5mA$	150	200	-	cd/m ²	Note 3
White Luminance Uniformity	5 Points	$\Delta Y5$		80	-	-		Note 4
	13 Points	$\Delta Y13$		65	-	-		
White Chromaticity		W_x	$\Theta = 0^\circ$	0.283	0.313	0.343		Note 5
		W_y		0.299	0.329	0.359		
Reproduction of Color	Red	R_x	$\Theta = 0^\circ$	-0.03	0.590	+0.03		
		R_y			0.350			
	Green	G_x			0.330			
		G_y			0.555			
	Blue	B_x			0.153			
		B_y			0.119			
Color Gamut				-	45	-	%	
Response Time (Rising + Falling)		T_{RT}	Ta= 25°C $\Theta = 0^\circ$	-	12	16	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 7).
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 7) Luminance Contrast Ratio (CR) is defined mathematically.

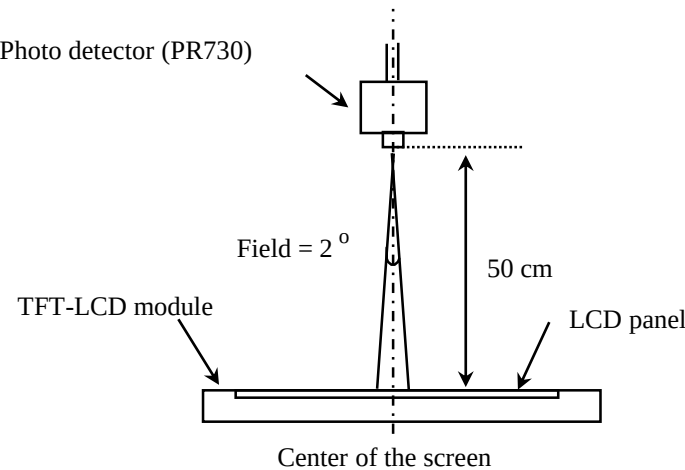
$$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

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 : $\Delta Y = \text{Minimum Luminance of 5(or 13) points} / \text{Maximum Luminance of 5(or 13) points.}$ (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 T_i , and 90% to 10% is T_r .
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 11).

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4.3 Optical Measurements



Optical characteristics measurement setup

Figure 7. Measurement Set Up

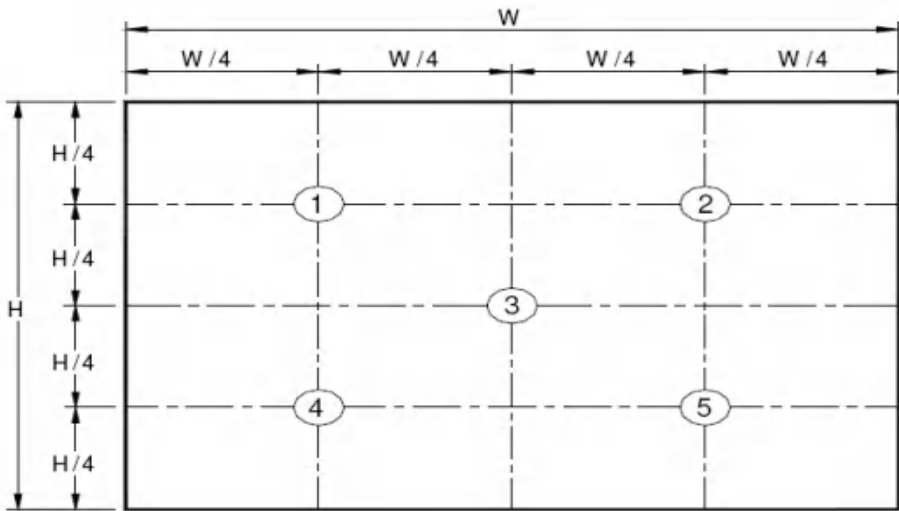


Figure 8. White Luminance and Uniformity Measurement Locations (5 points)

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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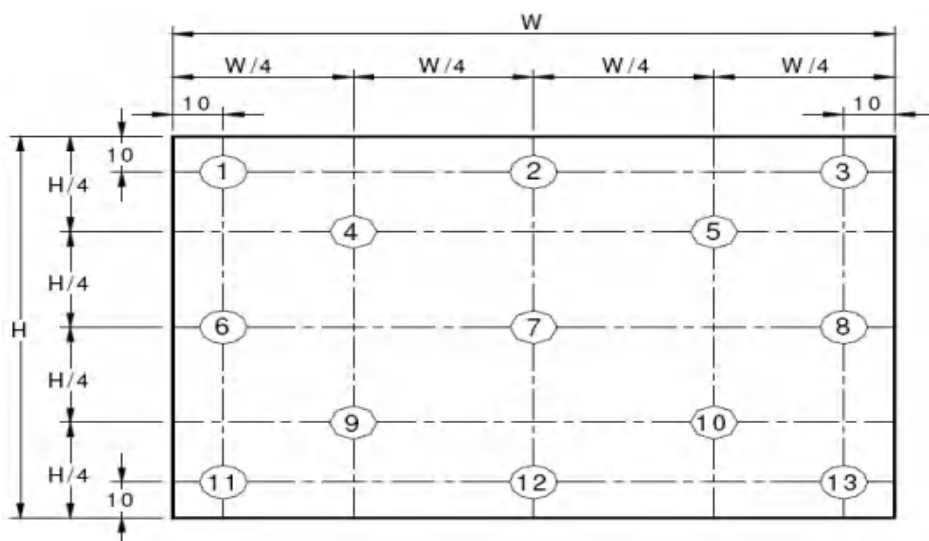


Figure 9. Uniformity Measurement Locations (13 points)

The White luminance uniformity on LCD surface is then expressed as : $\Delta Y5$ = Minimum Luminance of five points / Maximum Luminance of five points (see Figure 8) , $\Delta Y13$ = Minimum Luminance of 13 points / Maximum Luminance of 13 points (see Figure 9).

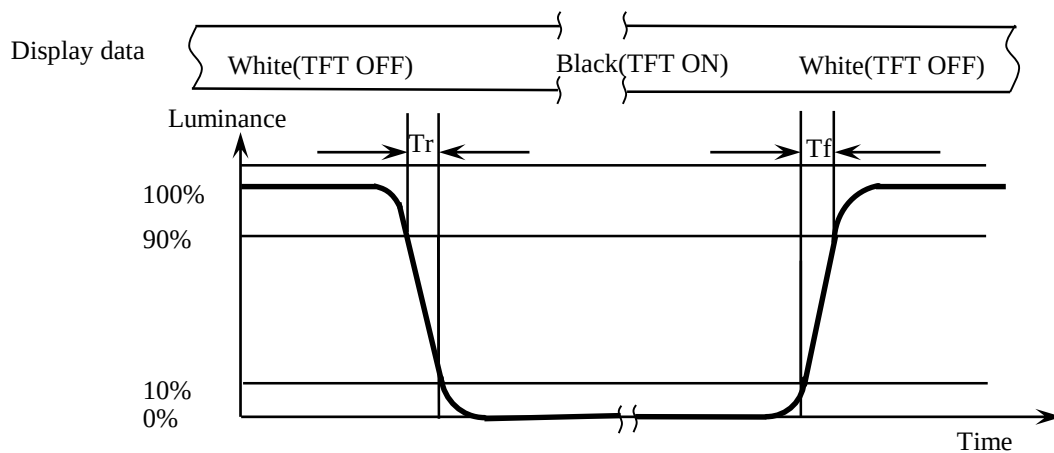
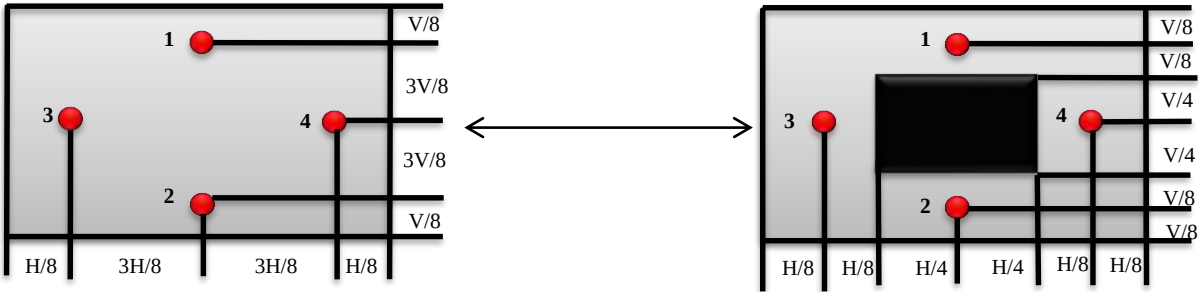


Figure 10. Response Time Testing

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

Figure 11. Cross Talk Modulation Test Description

Where:

Y_A = Initial luminance of measured area (cd/m²)

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

The location 1/2/3/4 measured will be exactly the same in both patterns. The test background gray is from L64 to L192.Take the largest data as the result.

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)

The test system: PR730

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5.0 INTERFACE CONNECTION

5.1 Electrical Interface Connection

The electronics interface connector is STM MSAK24025P40G .

The connector interface pin assignments are listed in Table 6.

<Table 6. Pin Assignments for the Interface Connector>

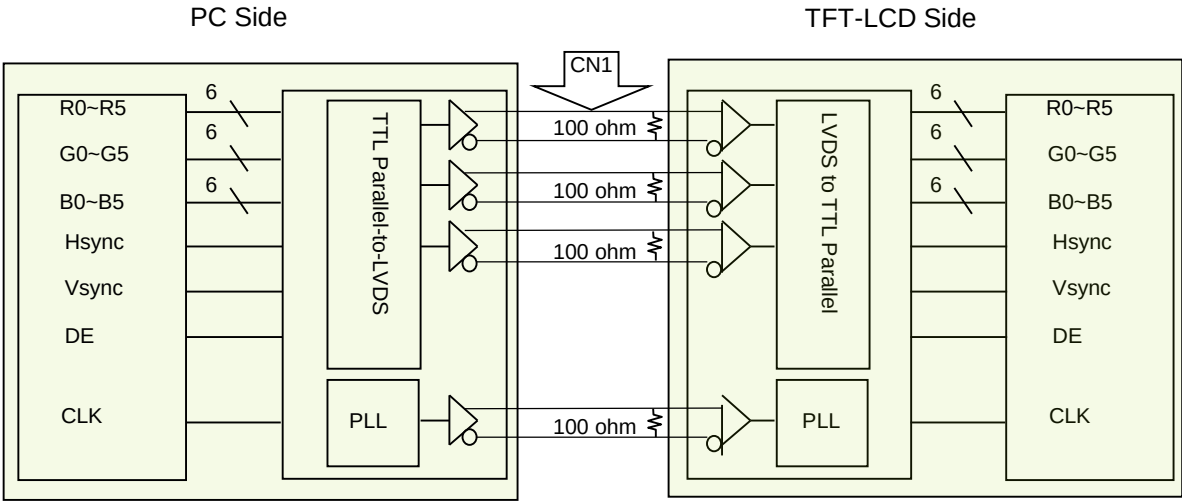
Terminal	Symbol	Functions
1	NC	No Connection
2	VDDIN	Power Supply, 3.3V (typ.)
3	VDDIN	Power Supply, 3.3V (typ.)
4	VDC	VDC 3.3Vpower for EDID
5	NC	No Connection
6	CLK EDID	EDID Clock
7	Data EDID	EDID Data
8	RxIN0-	Transmission Data of 0 Negative -
9	RxIN0+	Transmission Data of 0 Positive +
10	GND	Ground
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	(CE)	No Connection
27	(CTL)	No Connection
28	GND	Ground
29	NC	No Connection
30	NC	No Connection

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Terminal	Symbol	Functions
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

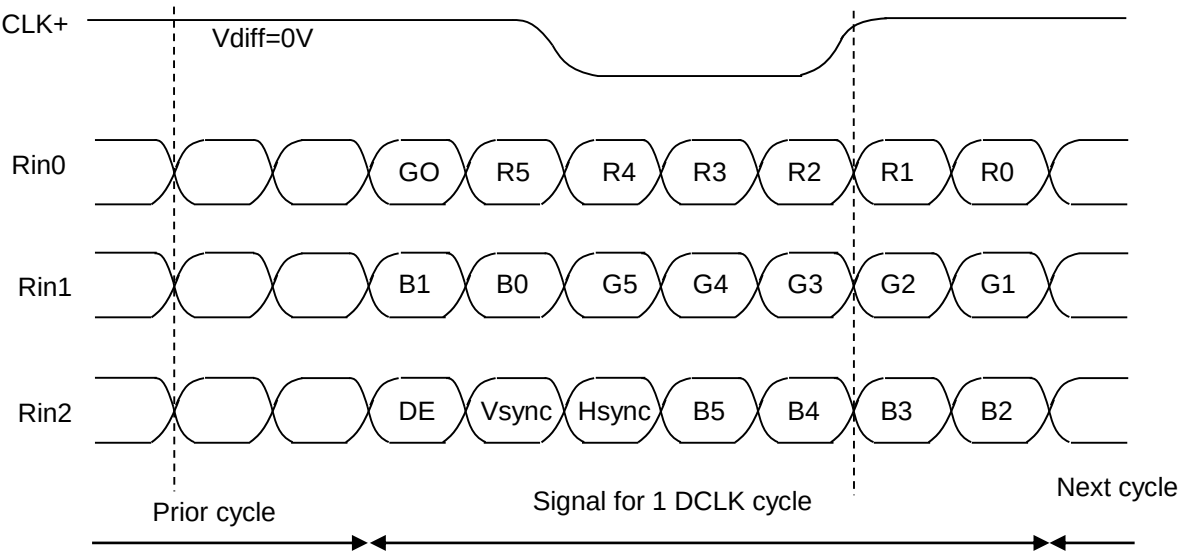
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5.2 LVDS Interface



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

5.3 LVDS Input signal



Note. Pin connection in case of using Thine THC63LVDM63A

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5.4 Data Input Format

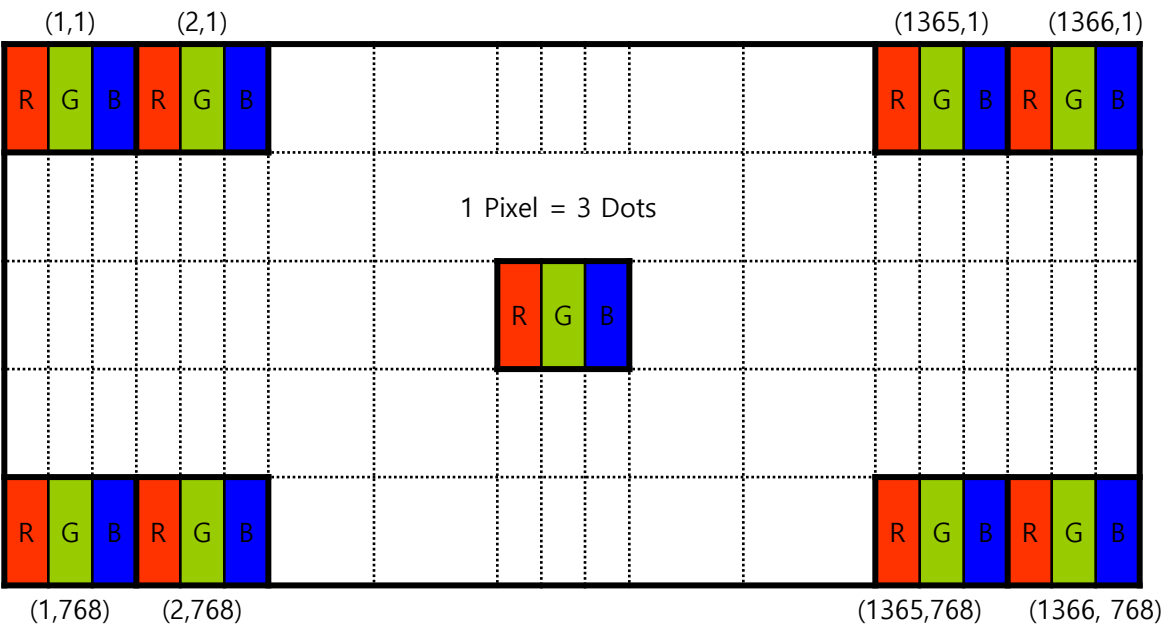


Figure 13. Display Position of Input Data (V-H)

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5.5 Back-light & LCM Interface Connection

BLU Interface Connector: UJU PF040-B09B-C09.

<Table 7. Pin Assignments for the BLU Connector>

Pin No.	Symbol	Description	Pin No.	Symbol	Description
1	LED1	NC	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			

6.0 SIGNAL TIMING SPECIFICATION

6.1 The QT156WHM-N50 Is Operated By The DE Only

< Table 8. Signal Timing Specification >

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	1446	1526	1586	clocks
Horizontal Display Period		Thd	1366	1366	1366	clocks

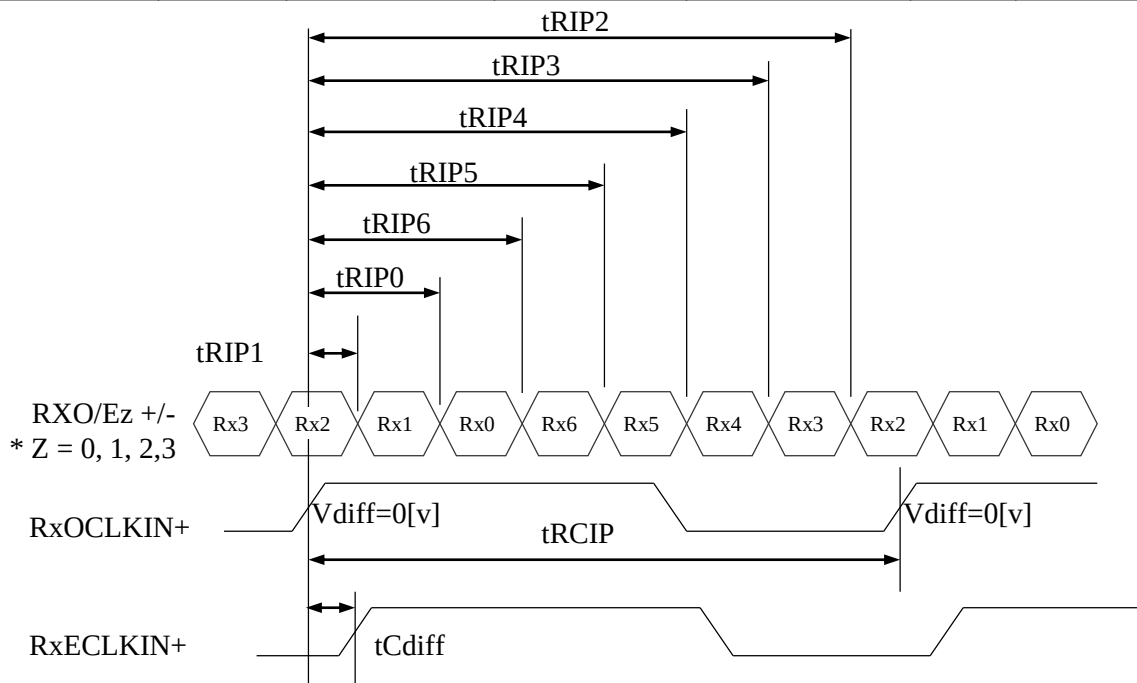
Note※: This Module can support low frame refresh rate 50Hz & 40Hz.

6.2 LVDS Rx Interface Timing Parameter

The specification of the LVDS Rx interface timing parameter is shown in Table 9.

<Table9. LVDS Rx Interface Timing Specification>

Item	Symbol	Min	Typ	Max	Unit	Remark
CLKIN Period	tRCIP	-	13.83	25	nsec	
CLK Difference	tCdiff	-	-	-	nsec	
Input Data 0	tRIP1	-0.6	0.0	+0.6	nsec	F=65MHZ VIC=1.2V VID=±200mV
Input Data 1	tRIP0	tRIPC/7-0.4	tRIPC/7	tRIPC/7+0.4	nsec	
Input Data 2	tRIP6	2 × tRIPC/7-0.4	2 × tRIPC/7	2 × tRIPC/7+0.4	nsec	
Input Data 3	tRIP5	3 × tRIPC/7-0.4	3 × tRIPC/7	3 × tRIPC/7+0.4	nsec	
Input Data 4	tRIP4	4 × tRIPC/7-0.4	4 × tRIPC/7	4 × tRIPC/7+0.4	nsec	
Input Data 5	tRIP3	5 × tRIPC/7-0.4	5 × tRIPC/7	5 × tRIPC/7+0.4	nsec	
Input Data 6	tRIP2	6 × tRIPC/7-0.4	6 × tRIPC/7	6 × tRIPC/7+0.4	nsec	



* Vdiff = (RXO/Ez+)-(RXO/Ez-),..., (RXO/ECLK+)-(RXO/ECLK-)

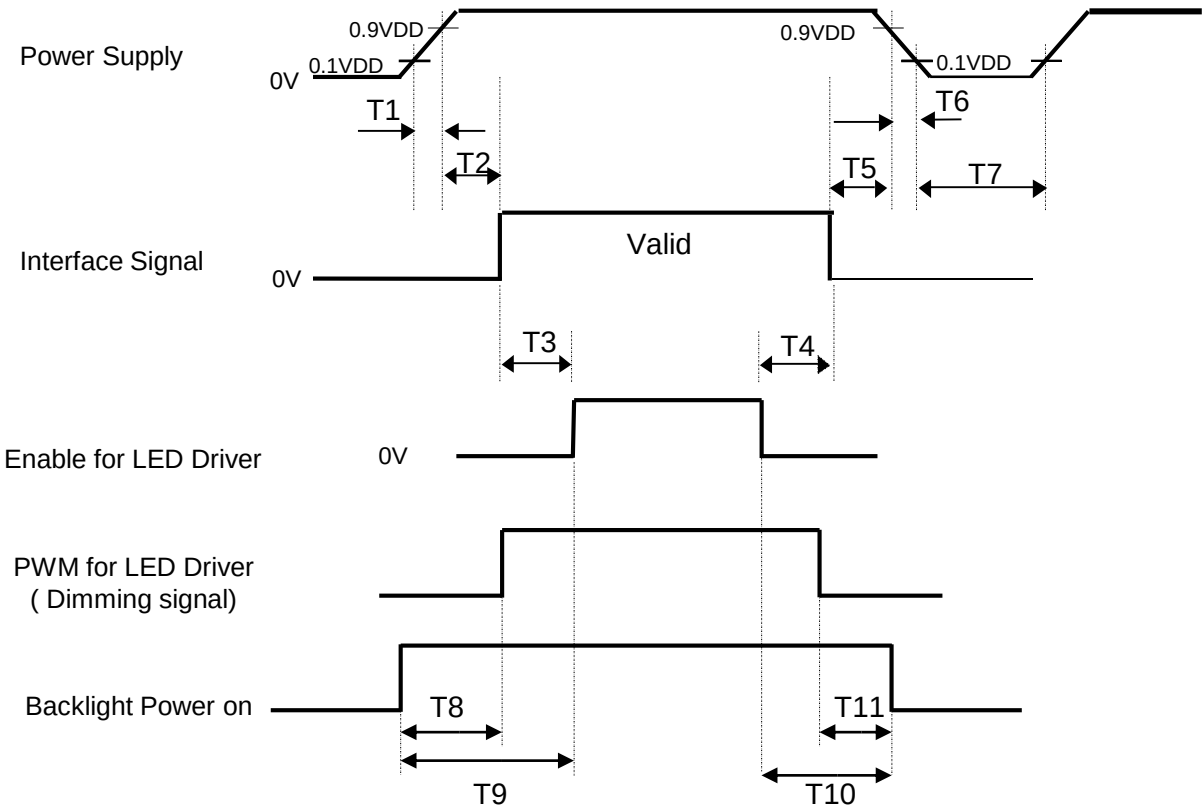
7.0 INPUT SIGNALS, BASIC DISPLAY COLORS & GRAY SCALE OF COLORS

<Table 10. Input Signal & 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

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

Notes:

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

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9.0 Connector Description

Physical interface is described as for the connector on LCM.
 These connectors are capable of accommodating the following signals and will be following components.

9.1 TFT LCD Module

< Table 11. Signal Connector >

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

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10.0 MECHANICAL CHARACTERISTICS

10.1 Dimensional Requirements

Figure 21 shows mechanical outlines for the model QT156WHM-N50
Other parameters are shown in Table 12.

<Table 12. Dimensional Parameters>

Parameter	Specification	Unit
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)	um
Pixel arrangement	RGB Vertical stripe	
Display colors	262K(6bit)	
Display mode	Normally white	
Dimensional outline	359.5(H)*223.8(V) (W/PCB)*3.2(Max) 359.5 (H)×206.5(V)×3.2 (Max)	mm
Weight	450(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 = 60°C , 60%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	High temperature operation test	Ta = 50°C , 60%RH, 240 hrs
5	Low temperature operation test	Ta = 0°C , 240 hrs
6	Thermal shock	Ta = -20 °C ↔ 60 °C (0.5 hr), 60%±3%RH, 100 cycle
7	Vibration test (non-operating)	Ta = 25°C , 60%RH, 1.5G, 10~500Hz, Sine X,Y,Z / Sweep rate : 1 hour
8	Shock test (non-operating)	Ta = 25°C , 60%RH, 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 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



Figure 17. Product Label

Module ID Naming Rule:

<Table 14. Module ID Naming Rule>

Digit Code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Code	B	9	A	F	1	7	8	8	D	3	8	0	0	0	0	6	8
Description	Product Name		Product Grade	8	Year		Month	Model Extension Code (Last 4 Digits of FG CODE)				Serial No. 00001-ZZZZZZ					

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(2) High voltage caution label

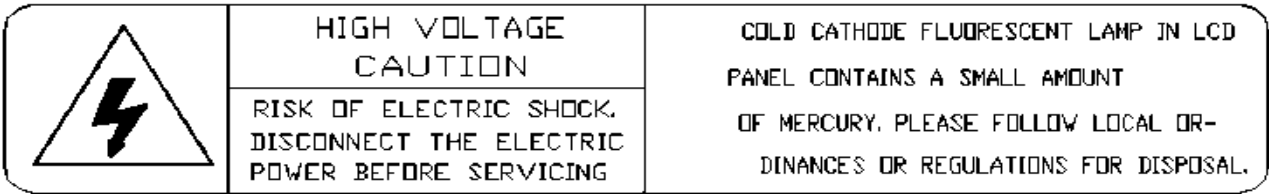


Figure 18. High Voltage Caution Label

(3) Box Label



Figure 19. 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. The client section material number(The client)
 6. FG-Code After four
 7. The supplier code
- Total Size:100×50mm

<Table 15. Box Label Naming Rule >

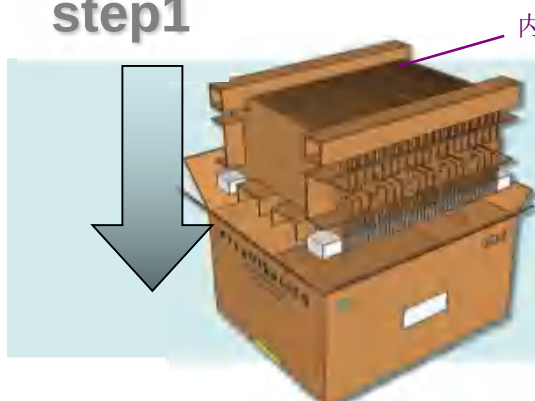
Digit Code	1	2	3	4	5	6	7	8	9	10	11	12	13
Code	B	9	A	F	1	7	8	N	0	0	3	2	7
Description	Product Name		Product Grade	B8	Year		Month	Revision	BOX Serial Number				

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14.0 PACKING INFORMATION

14.1 Packing order

step1



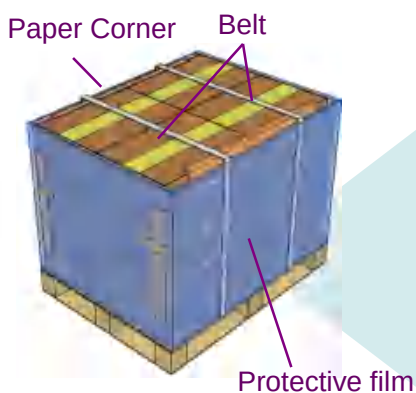
-. Put Pad into the inner box

step2



- . Put module into the paper spacer and modules bundled by PE Bag
- . Put Cover on the top of the pad
- . Capa.: 38pcs MDL/Inner Box

step4



-. Pack with paper corner & belt , and use wrapping film to bind up them

step3



-. 12ea Box/Pallet, 456 ea MDL/Pallet

14.2 Notes

- Box Dimension: 588*488*303mm
- Package Quantity in one Box: 38pcs
- Total Weight: 19.3kg/Box

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15.0 MECHANICAL OUTLINE DIMENSION

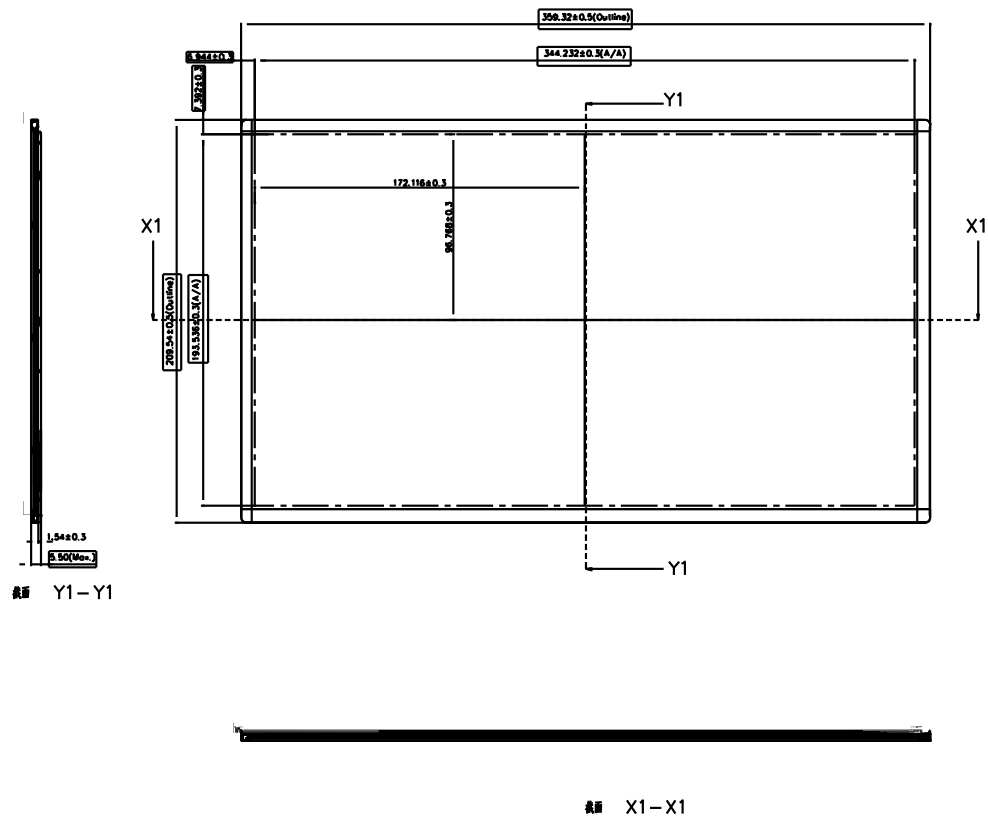


Figure 21. TFT-LCD Module Outline Dimension (Front View)

- NOTES:
- BACK LIGHT:LED WHITE,27 LED,
IF=22.5mA×3=67.5mA . VF=28.8V MAX.
LCM BRIGHTNESS(5P.AVG):187cd/m²(MIN.);220cd/m²(Typ.);
 - OPERATION TEMP:0°C TO 50°C,
STORAGE TEMP:−20°C TO 60°C;
 - GENERAL TOLERANCE:±0.3mm;
 - CRITICAL CONTROL POINT: ☐ ,
REFERENCED DIMENSION:();
 - CONFORMITY WITH RoHS AND HALOGEN FREE.

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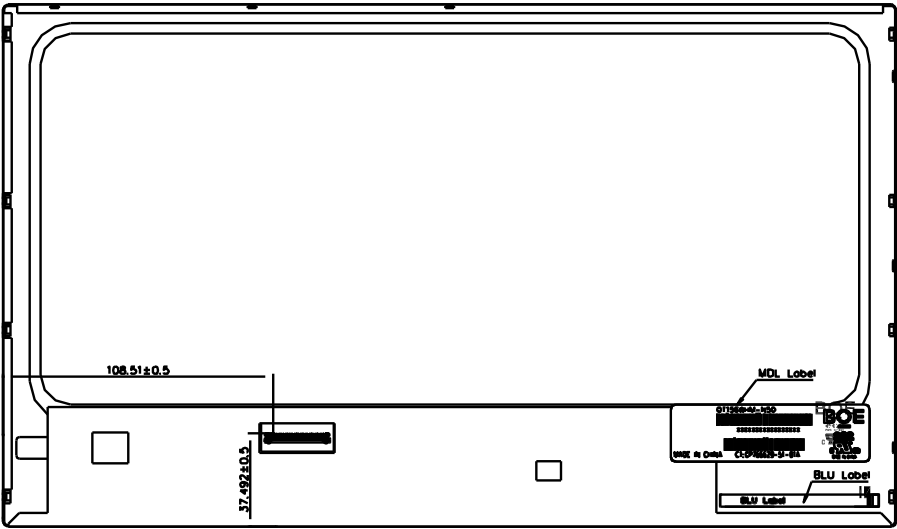


Figure 23. TFT-LCD Module Outline Dimensions (Rear view)

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**16.0 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	D3	211	1747	ID = 1747
0B		06	6		
0C	32-bit serial No.	00	0		
0D		00	0		
0E		00	0		
0F		00	0		
10	Week of manufacture	01	1	1	
11	Year of Manufacture	1A	26	2016	Manufactured in 2016
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	-	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	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 (0.59)
1C	Red y high bits	59	89	0.350	Red (y) = 01011001 (0.35)
1D	Green x high bits	54	84	0.330	Green (x) = 01010100 (0.33)
1E	Green y high bits	8E	142	0.555	Green (y) = 10001110 (0.555)
1F	Blue x high bits	27	39	0.153	Blue (x) = 00100111 (0.153)
20	BLue y high bits	1E	30	0.119	Blue (y) = 00011110 (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	-	

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25	Established timing 3	00	0	-	Not Used	
26	Standard timing #1	01	1			
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	0	768	Ver Active = 768	
3C		16	22	22	Ver Blanking = 22	
3D		30	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	

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48	Detailed timing/monitor descriptor #2	00	0	0	0MHz Main clock
49		00	0		
4A		00	0	0	Hor Active = 0
4B		00	0	0	Hor Blanking = 0
4C		00	0	-	4 bits of Hor. Active + 4 bits of Hor. Blanking
4D		00	0	0	Ver Active = 0
4E		00	0	0	Ver Blanking = 0
4F		00	0	-	4 bits of Ver. Active + 4 bits of Ver. Blanking
50		00	0	0	Hor Sync Offset = 0
51		00	0	0	H Sync Pulse Width = 0
52		00	0	0	V sync Offset =0 line
53		00	0	0	V Sync Pulse width : 0 line
54		00	0	0	Horizontal Image Size = 0 mm (Low 8 bits)
55		00	0	0	Vertical Image Size =0 mm (Low 8 bits)
56		00	0	-	4 bits of Hor Image Size + 4 bits of Ver Image Size
57		00	0	0	Hor Border (pixels)
58		00	0	0	Vertical Border (Lines)
59		1A	26		
5A	Detailed timing/monitor descriptor #3	00	0		ASCII Data Sting Tag
5B		00	0		
5C		00	0		
5D		FE	254		
5E		00	0		Manufacture name : BOECQ
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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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 : NT156WHM-N50
72		54	84	T	
73		31	49	1	
74		35	53	5	
75		36	54	6	
76		57	87	W	
77		48	72	H	
78		4D	77	M	
79		2D	45	-	
7A		4E	78	N	
7B		35	53	5	
7C		30	48	0	
7D		0A	10		
7E	Extension flag	00	0		
7F	Checksum	AF	175		

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