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■ Preliminary Specifications

☐ Final Specifications

Title	23.8-inch LCM Product Specifications
Model Name	ET238FH03-R
Version	P1

Customer

Approved by Date

Notice: This Specification is subject to change without notice.

Approved By	Prepared By
Leo 2024-09-11	Aurice 2024-09-11

REVISION HISTORY

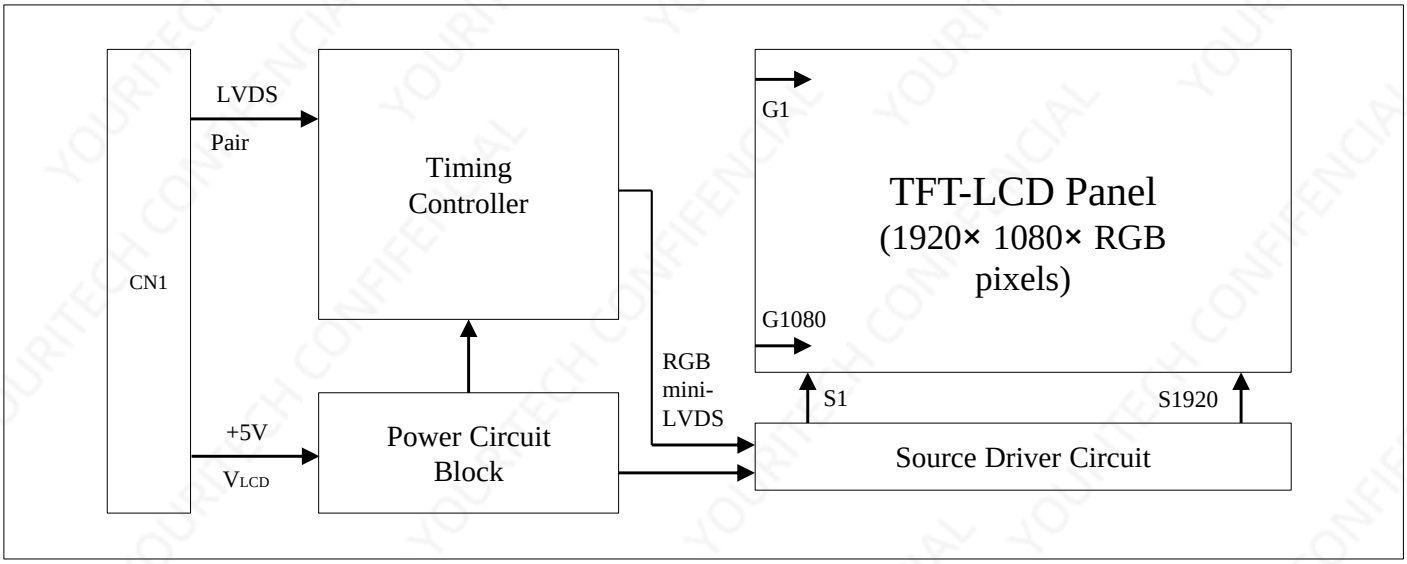
REV.	ECN NO.	DESCRIPTION OF CHANGES	DATE	PREPARED
P0	-	Initial Release	2024.06.12	Aurice
P1	-	Update Parameters	2024.09.11	Aurice

Contents

1.0 GENERAL DESCRIPTION

1.0.1 Introduction

ET238FH03-R 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 238 inch diagonally measured active area with FHD resolutions (1920 horizontal by 1080 vertical pixel array). Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical stripe and this module can display 16.7 M colors.



1.0.2 Features

- LVDS Interface with 2 pixel / clock
- High-speed response
- 6-bit (Hi-FRC) color depth, display 16.7M colors
- DE (Data Enable) only
- OP: -20~70℃
- Temperature Shock Test storage: -20~70℃

1.0.3 Application

- HMI

1.0.4 General Specification

< Table 1. General Specifications >

Parameter	Specification	Unit	Remarks
Active area	527.04(H) × 296.46(V)	mm	
Number of pixels	1920(H) ×1080(V)	Pixels	
Pixel pitch	0.2745 (H) ×0.2745(V)	mm	
Pixel arrangement	RGB Vertical stripe		
Display colors	16.7 M	Colors	6bit+2FRC
Display mode	Normally Black		
Dimensional outline	550.46 (H) × 325.04(V) × 9.1(14.0) Typ.	mm	
Weight	1980	g	
Surface treatment	Haze 25%，3H		

2.0 ABSOLUTE MAXIMUM RATINGS

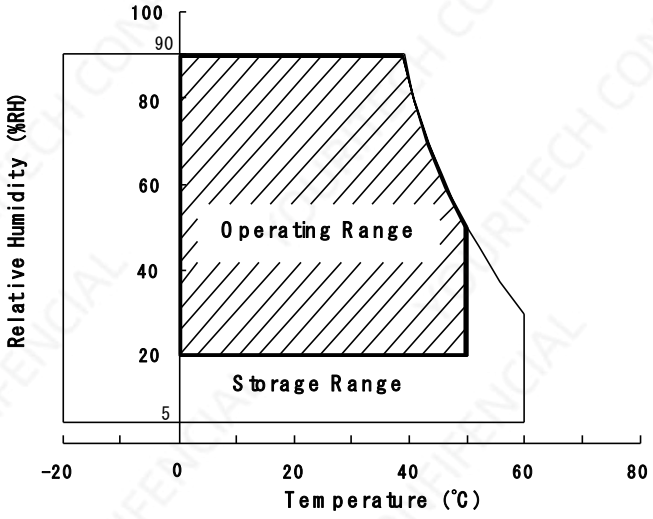
The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit. The operational and non-operational maximum voltage and current values are listed in Table 2.

< Table 2. Environment Absolute Maximum Ratings> [Ta =25±2 ℃]

Parameter	Symbol	Min.	Max.	Unit	Remarks
Power Supply Voltage	V_{DD}	-0.3	6.0	V	Ta = 25 ℃
Logic Supply Voltage	V_{IN}	VSS-0.3	VDD+0.3	V	
Operating Temperature	T_{OP}	-20	70	℃	
Storage Humidity	T_{ST}	-30	80	℃	
Heat Release Requirement	Trls	15		℃	Note3 仅适用于Q/Single/FOG出货项目

Note:

1. Temperature and relative humidity range are shown in the figure belew
   Wet bulb temperature should be 39 ℃ max. and no condensation of water.
2. Panel Surface Temperature should be Min. 0℃ and Max. +65℃ under the VDD = 5.0V, Frame rate = 60Hz,25℃ ambient Temp. no humidity control and LED string current is typical value



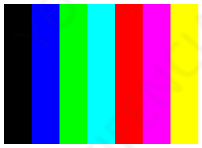
3.0 ELECTRICAL SPECIFICATIONS

3.0.1 TFT LCD Module

< Table 3. Electrical Specifications > [Ta =25±2 ℃]

Parameter	Symbol	Value			Unit	Notes
		Min	Typ	Max		
Power Supply Input Voltage	V_{DD}	4.5	5.0	5.5	V	
Power Supply Current	I_{DD}	-	450	650	mA	
	$I_{DD\ Max}$	-				
In-Rush Current	I_{RUSH}	-		1	A	
Permissible Input Ripple Voltage	V_{RF}	-	-	300	mV	Note1
High Level Differential Input Threshold Voltage	V_{IH}	-	-	+100	mV	
Low Level Differential Input Threshold Voltage	V_{IL}	-100	-	-	mV	
Differential input voltage	V_{ID}	200	-	600	mV	
Differential input voltage	$\|V_{ID}\|$	200	-	600	mV	
Power Consumption	$P_{Typ.}$	-	2.25	3.025	W	Note 1
	P_{Max}	-			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 VDD=5.0V.
a) Typ：Color Bar pattern, Frame rate = 60Hz
b) Max：Vertical Subline pattern,Frame rate = 60Hz



a) Typ：Color bar

b) Max：Vertical SubLine 255

2.Duration of rush current is about 2ms and rising time of VDD is 520 us ± 20%

3.0.2 Backlight Driving

The backlight system is two edge-lighting type with white-LED.

(It is usually required to measure under the following condition: Ta=25℃±2℃)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Supply voltage	V_{BL}	31.8	33.5	40.1	V	BL_PWR
Current dissipation	I_{BL}	-	400	-	mA	LB1
Power consumption	P_{BL}	-	26.8	-	W	LB2
LED Life time	-	-	50000	-	hrs	

LED Connector Type : 3707K-Q06N-01X (Entery)

PIN	Symbol	Description
1	K1	Current Feedback(-)
2	K2	Current Feedback(-)
3	A3	LED Power Supply(+)
4	A4	LED Power Supply(+)
5	K5	Current Feedback(-)
6	K6	Current Feedback(-)

4.0 INTERFACE CONNECTION.

4.0.1 Electrical Interface Connection

The electronics interface connector is LS1030-L4005W480H225-E02.

<Table 6. Pin Assignments for the Interface Connector>

Terminal	Symbol	Functions
Pin No.	Symbol	Description
1	RXO0-	Negative Transmission data of Pixel 0 (ODD)
2	RXO0+	Positive Transmission data of Pixel 0 (ODD)
3	RXO1-	Negative Transmission data of Pixel 1 (ODD)
4	RXO1+	Positive Transmission data of Pixel 1 (ODD)
5	RXO2-	Negative Transmission data of Pixel 2 (ODD)
6	RXO2+	Positive Transmission data of Pixel 2 (ODD)
7	BIST	2.5V BIST ON : Ground/NC BIST OFF
8	RXOC-	Negative Transmission Clock (ODD)
9	RXOC+	Positive Transmission Clock (ODD)
10	RXO3-	Negative Transmission data of Pixel 3 (ODD)
11	RXO3+	Positive Transmission data of Pixel 3 (ODD)
12	RXE0-	Negative Transmission data of Pixel 0 (EVEN)
13	RXE0+	Positive Transmission data of Pixel 0 (EVEN)
14	GND	Power Ground
15	RXE1-	Negative Transmission data of Pixel 1 (EVEN)
16	RXE1+	Positive Transmission data of Pixel 1 (EVEN)
17	GND	Power Ground
18	RXE2-	Negative Transmission data of Pixel 2 (EVEN)
19	RXE2+	Positive Transmission data of Pixel 2 (EVEN)
20	RXEC-	Negative Transmission Clock (EVEN)
21	RXEC+	Positive Transmission Clock (EVEN)
22	RXE3-	Negative Transmission data of Pixel 3 (EVEN)
23	RXE3+	Positive Transmission data of Pixel 3 (EVEN)
24	GND	Power Ground
25	SCL	NC(No Connect, Internal use)
26	SDA	NC(No Connect, Internal use)
27	NC	No. Connection
28	VDD	Power Supply：+5V
29	VDD	
30	VDD	

4.0.2 LVDS Interface (Tx; THC63LVDF83A or Equivalent)

	Input Signal	Transmitter		Interface		MV238FHM-N60 (CN11)	Remark
		Pin No.	Pin No.	System (Tx)	TFT-LCD (Rx)	Pin No.	
LVDS	OR0	51	48 47	OUT0- OUT0+	RXO0- RXO0+	1 2	
	OR1	52					
	OR2	54					
	OR3	55					
	OR4	56					
	OR5	3					
	OG0	4					
	OG1	6	46 45	OUT1- OUT1+	RXO1- RXO1+	3 4	
	OG2	7					
	OG3	11					
	OG4	12					
	OG5	14					
	OB0	15					
	OB1	19					
	OB2	20	42 41	OUT2- OUT2+	RXO2- RXO2+	5 6	
	OB3	22					
	OB4	23					
	OB5	24					
	Hsync	27					
	Vsync	28					
	DE	30					
	MCLK	31	40 39	CLK OUT- CLK OUT+	RXO CLK- RXO CLK+	8 9	
	OR6	50	38 37	OUT3- OUT3+	RXO3- RXO3+	10 11	
	OR7	2					
	OG6	8					
	OG7	10					
	OB6	16					
	OB7	18					
	RSVD	25					

Note: The order of even data is same with odd data.

5.0 SIGNAL TIMING SPECIFICATION

5.0.1 The ET238FH03-R is operated by the DE only.

Item	Symbols		Min	Typ	Max	Unit	Note
DCLK	Period	tCLK	11.57	13.46	14.29	ns	
	Frequency	-	69.96	74.3	86.4	MHz	
Hsync	Period	tHP	1060	1100	1200	tCLK	
	Horizontal Valid	tHV	-	960	-	tCLK	
	Horizontal Blank	tHB	100	140	240	tCLK	
	Frequency	fH				KHz	
Vsync	Period	tVP	1100	1125	1200	tHP	Note 1
	Vertical Valid	tVV	-	1080	-	tHP	
	Vertical Blank	tVB	20	45	120	tHP	
	Frequency	fV	-	60	-	Hz	Note 2
LVDS Receiver clock	Input spread spectrum ratio	SSr	-3	-	+3	%	

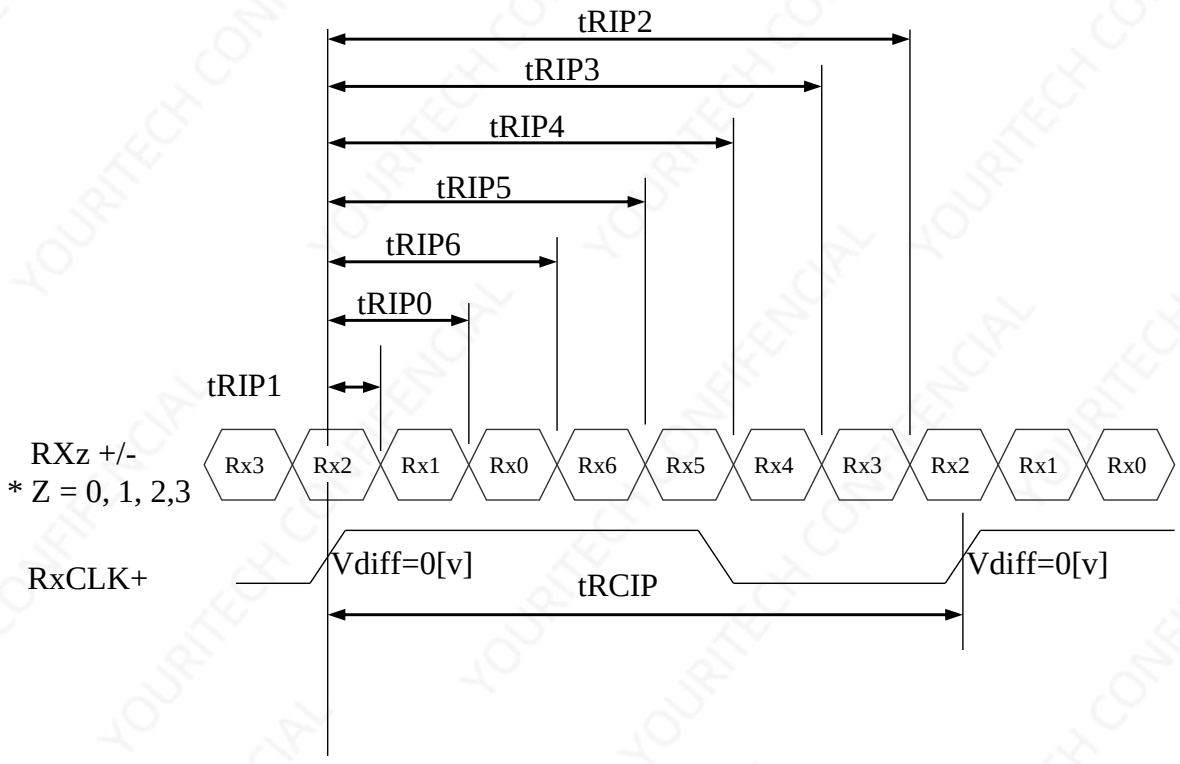
Note: The DCLK range at last line of V-blanking should be set in 0-H-active/2.

5.02 LVDS Rx Interface Timing Parameter

The specification of the LVDS Rx interface timing parameter is shown in Table 4.

<Table 4. LVDS Rx Interface Timing Specification>

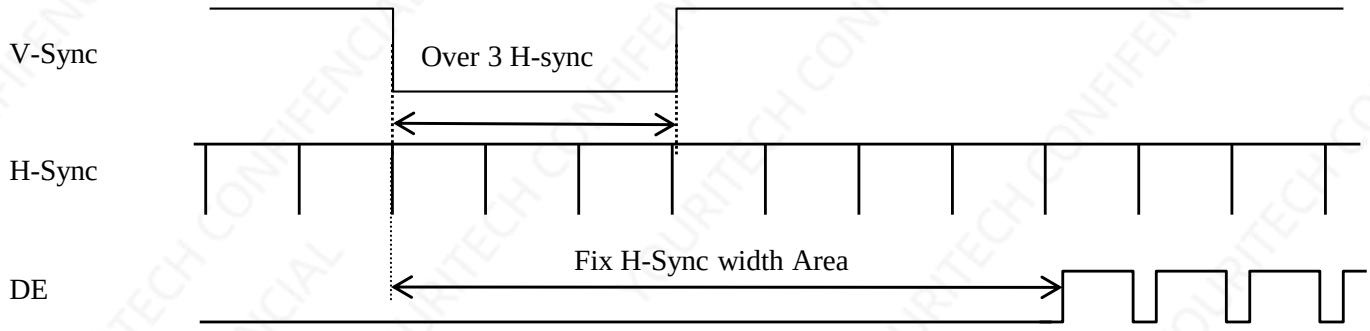
Item	Symbol	Min	Typ	Max	Unit	Remark
CLKIN Period	tRCIP	14.81	18.52	22.22	nsec	
Input Data 0	tRIP1	-0.4	0.0	+0.4	nsec	
Input Data 1	tRIP0	tRCIP/7-0.4	tRCIP/7	tRCIP/7+0.4	nsec	
Input Data 2	tRIP6	2 ×tRCIP/7-0.4	2 ×tRCIP/7	2 ×tRCIP/7+0.4	nsec	
Input Data 3	tRIP5	3 ×tRCIP/7-0.4	3 ×tRCIP/7	3 ×tRCIP/7+0.4	nsec	
Input Data 4	tRIP4	4 ×tRCIP/7-0.4	4 ×tRCIP/7	4 ×tRCIP/7+0.4	nsec	
Input Data 5	tRIP3	5 ×tRCIP/7-0.4	5 ×tRCIP/7	5 ×tRCIP/7+0.4	nsec	
Input Data 6	tRIP2	6 ×tRCIP/7-0.4	6 ×tRCIP/7	6 ×tRCIP/7+0.4	nsec	



* Vdiff = (RXz+)-(RXz-),…. ,(RXCLK+)-(RXCLK-)

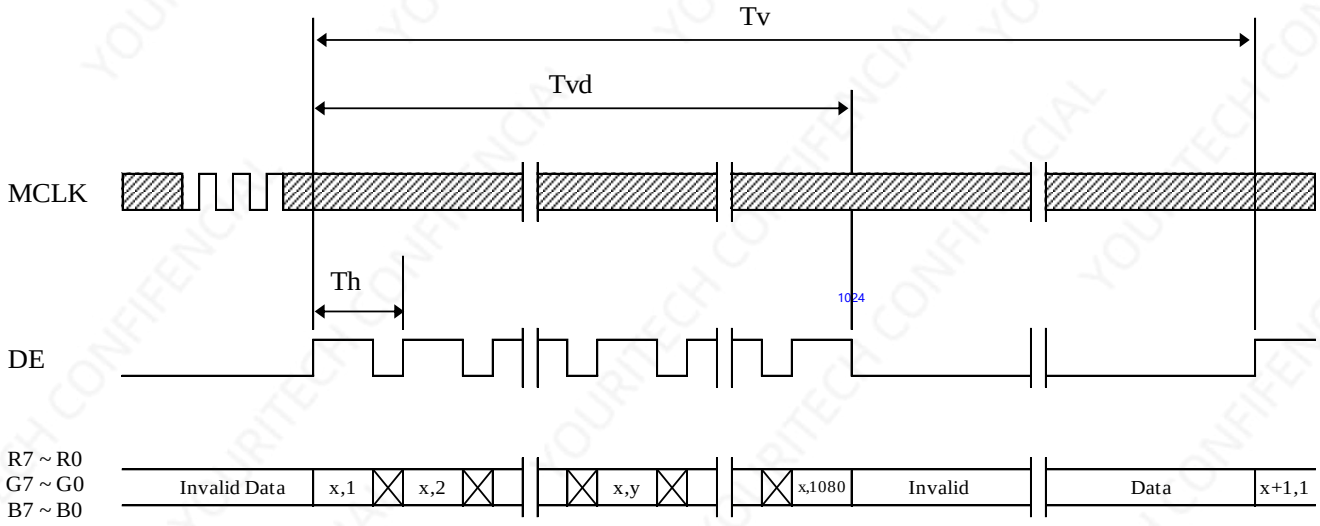
6. SIGNAL TIMING WAVEFORMS OF INTERFACE SIGNAL

6.01 Sync Timing Waveforms

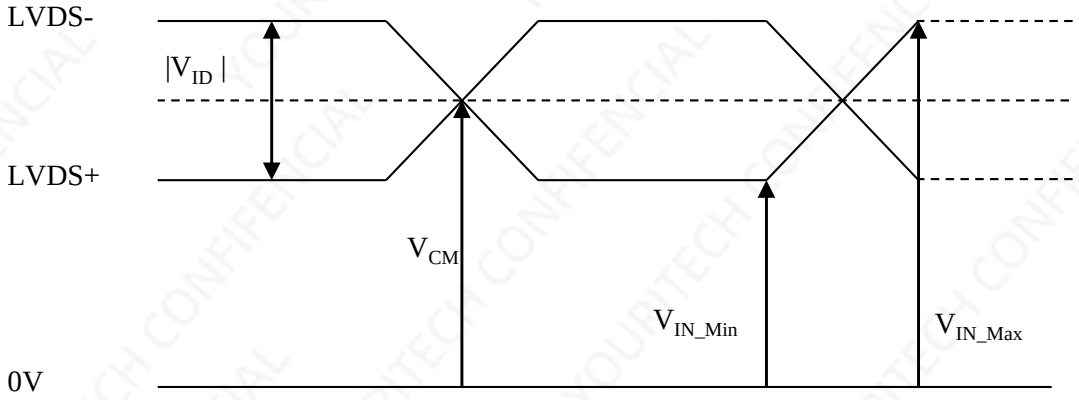


1) Need over 3 H-sync during V-Sync Low
2) Fix H-Sync width from V-Sync falling edge to first rising edge

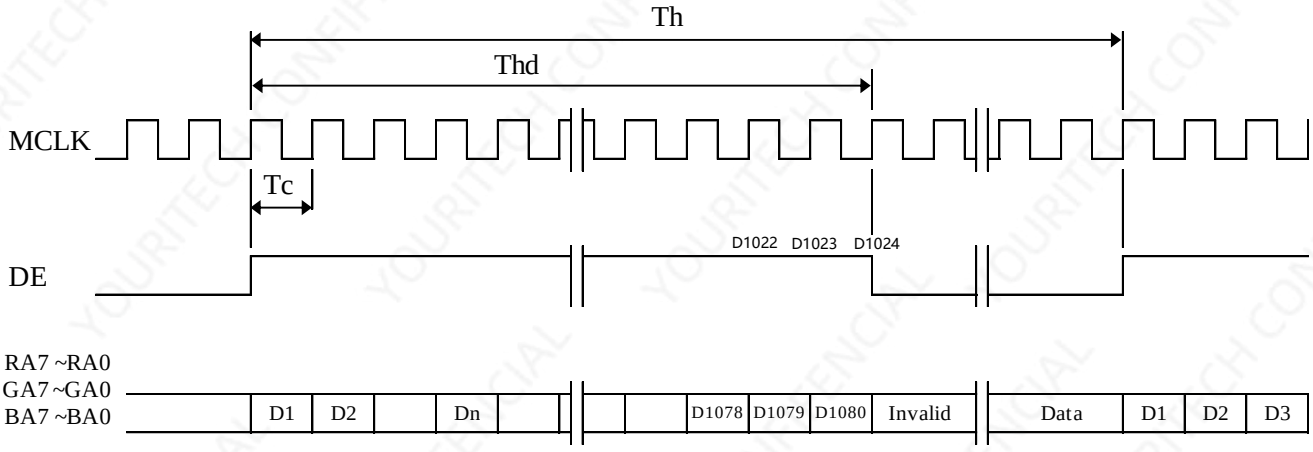
6.02 Vertical Timing Waveforms

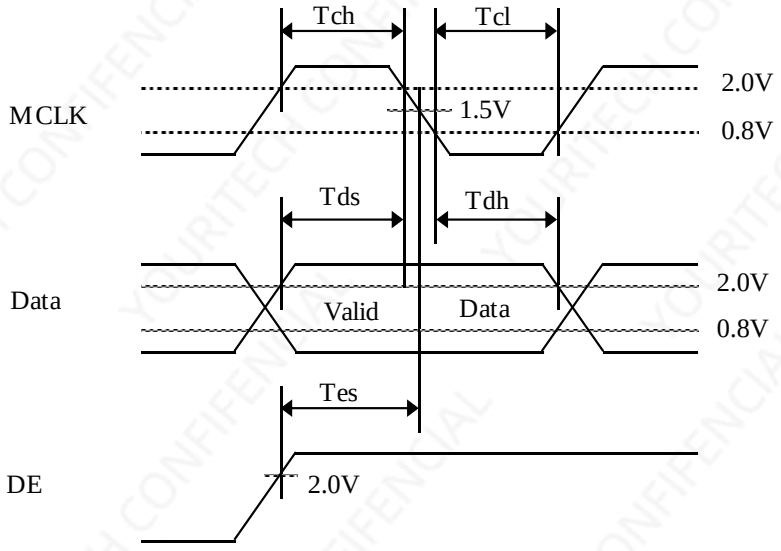


6.03 Horizontal Timing Waveforms



Differential input voltage	$\|V_{ID}\|$	200	-	600	mV
Differential input common mode voltage	V_{CM}	1.0	1.2	1.5	V



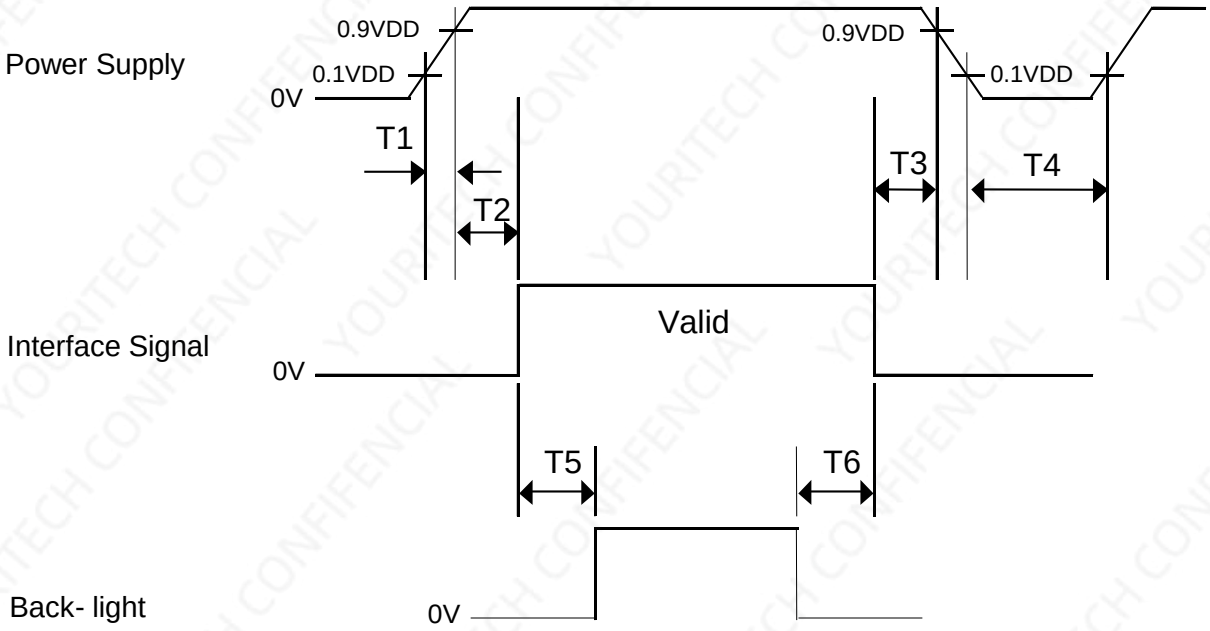


7.0 INPUT SIGNALS,BASIC DISPLAY COLORS & GRAY SCALE OF COLORS

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

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



- 0.5 ms ≤ T1 ≤ 10 ms
- 0 ≤ T2 ≤ 50 ms
- 0 < T3 ≤ 50 ms
- 1 sec ≤ T4
- 200 ms ≤ T5
- 200 ms ≤ T6

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.
3. Back Light must be turn on after power for logic and interface signal are valid.
4. T7 decreases smoothly, there is none re-bouncing voltage.
5. If T3=0ms, there is a risk of flicker when power On/Off.
6. If T6=0ms, there is a risk of abnormal display when power off.

9.0 OPTICAL SPECIFICATION

9.0.1 Overview

The test of view angle range shall be measured in a dark room (ambient luminance ≤ 1lux and temperature = 25±2℃) with the equipment of Luminance meter system (Goniometer system and TOPCON CS2000/CA310) 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"), θ Ø=90 (= θ12) as the 12 o'clock direction ("upward"), θ Ø=180 (= θ9) as the 9 o'clock direction ("left") and θ Ø=270(= θ6) as the 6 o'clock direction ("bottom"). While scanning θ and/or Ø, the center of the measuring spot on the Display surface shall stay fixed. The luminance, color and uniformity (etc) should be tested by CS2000/CA310. The backlight should be operating for 10 minutes prior to measurement. VDD shall be 3.3 ± 0.3V at 25°C. Optimum viewing angle direction is 6 'clock

<Table 5. Optical Specifications>

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle range	Horizontal	Θ_3	CR > 10	85	89	-	Deg.	Note 1
		Θ_9		85	89	-	Deg.	
	Vertical	Θ_{12}		85	89	-	Deg.	
		Θ_6		85	89	-	Deg.	
Luminance Contrast ratio		CR	Θ = 0。	700	1000	-		Note 2
Luminance (AA Center)		L			1300		cd/m²	
Luminance uniformity 9 pt		Yu		70			%	
Color Gamut	sRGB	CIE1931	Θ = 0。	95	99	-	%	Only CF@C Light
Reproduction of color	White	Wx	Θ = 0。	Typ -0.04	0.305	Typ +0.04		
		Wy			0.315			
Response Time		Tr+Td	Ta= 25。C Θ = 0。	-	14	25	ms	Note 6

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 Θ= 0 and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state . (see FIGURE 1) Luminance Contrast Ratio (CR) is defined mathematically.

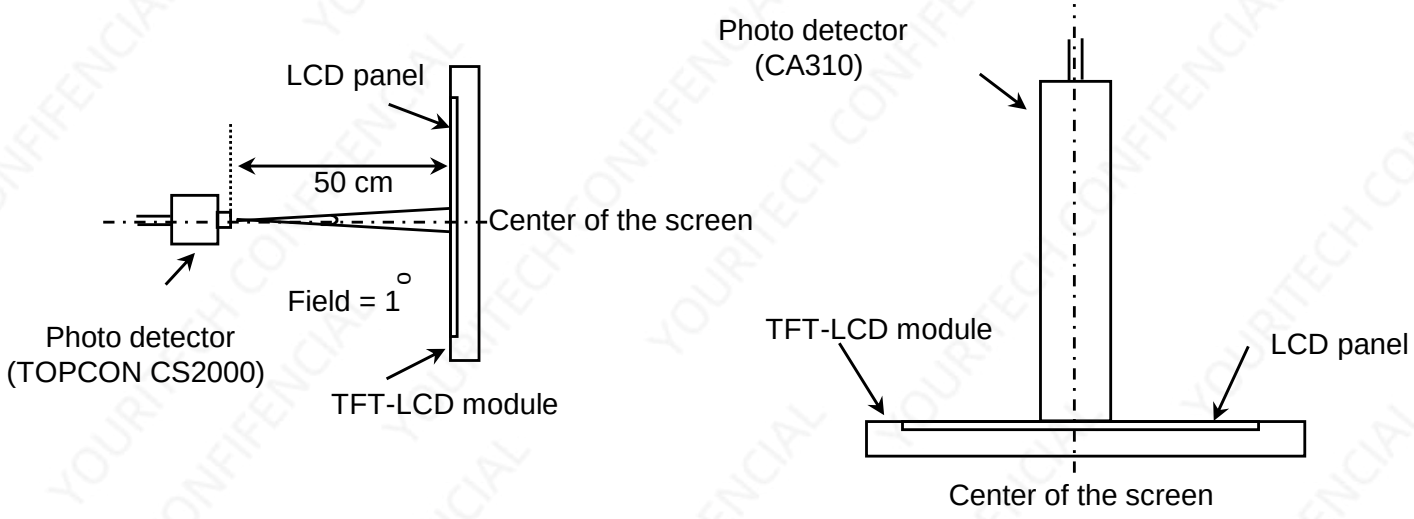
$$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

3. 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.

4. The electro-optical response time measurements shall be made as FIGURE 2 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.

9.0.2 Optical measurements

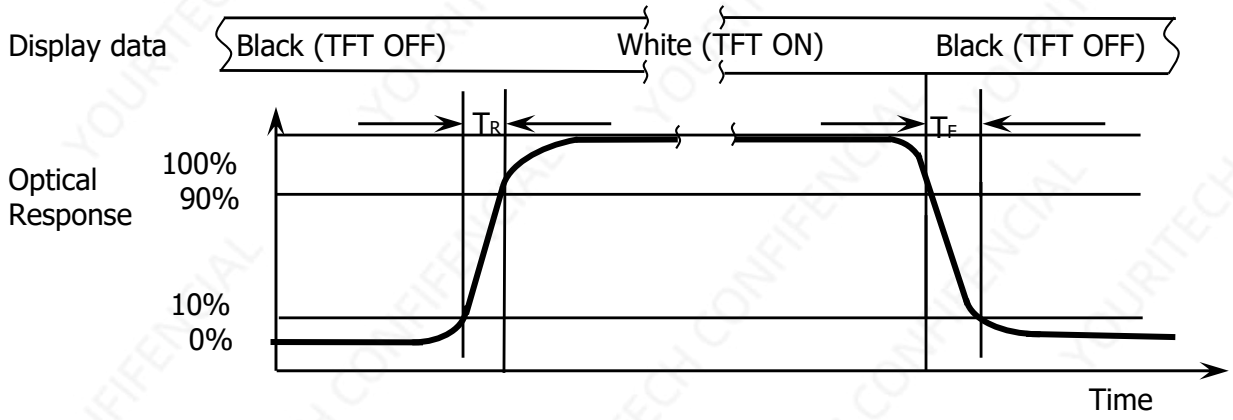
Figure 1. Measurement Set Up



View angel range, uniformity, etc. measurement setup

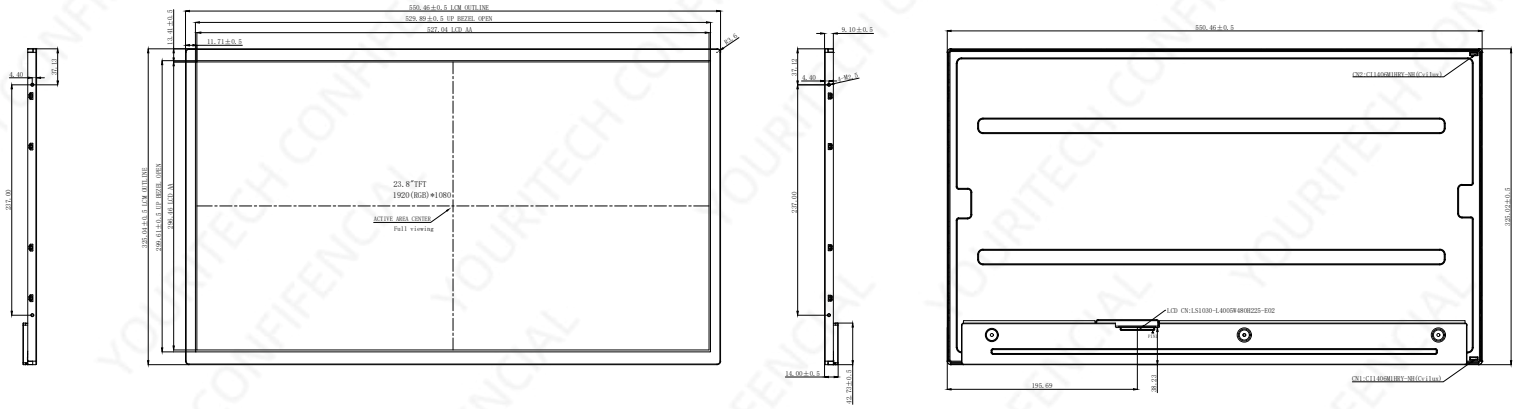
Flicker, measurement setup

Figure 2. Response Time Testing



The electro-optical response time measurements shall be made as shown in FIGURE 3 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.

10.0 MECHANICAL OUTLINE DIMENSION



11.0 RELIABILITY TEST

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

<Table 9. Reliability test>

No	Test Items	Conditions	Remark
1	High temperature storage test	Ta = 80℃, 240 hrs	根据客户规格更新
2	Low temperature storage test	Ta = -30 ℃, 240 hrs	
3	High temperature operation test	Ta = 70℃, 240 hrs	
4	Low temperature operation test	Ta = -20 ℃, 240 hrs	
5	High temperature & high humidity operation test	Ta = 50 ℃, 80%RH, 240 hrs	
6	Thermal shock	Ta = -20 ℃ ↔ 80℃ (0.5 hr), 100 cycle	Non-operation
7	Image Sticking	5*7chess，点灯10h@127，aging 1min，L1@25℃	根据客户规格更新
8	ESD test	Air Voltage:± 8KV&± 15KV Contact Voltage:± 8KV R: 330Ω C: 150pF 5 time	
9	Vibration Test	Random,10 ~ 300 Hz, 30 min/Axis 1.05 Grms +Z 30 min	

Note：After the reliability test, the product only guarantee function normally without any fatal defect (non-display, line defect, abormal display etc). All the cosmetic specification is judged before the reliablity test.