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■ Preliminary Specifications
□ Final Specifications

Title	10.1-inch LCM Product Specifications
Model Name	ET101FH01-R
Version	V1

Customer

Approved by Date

Notice: This Specification is subject to change without notice.

Approved By	Prepared By
Leo 2024-01-24	Aurice 2024-01-24

REVISION HISTORY

Version	Description of Changes	Date	Prepared
V0	First Edition	2023-9-25	Aurice
V1	Correction of LED voltage parameters	2024-1-24	Aurice

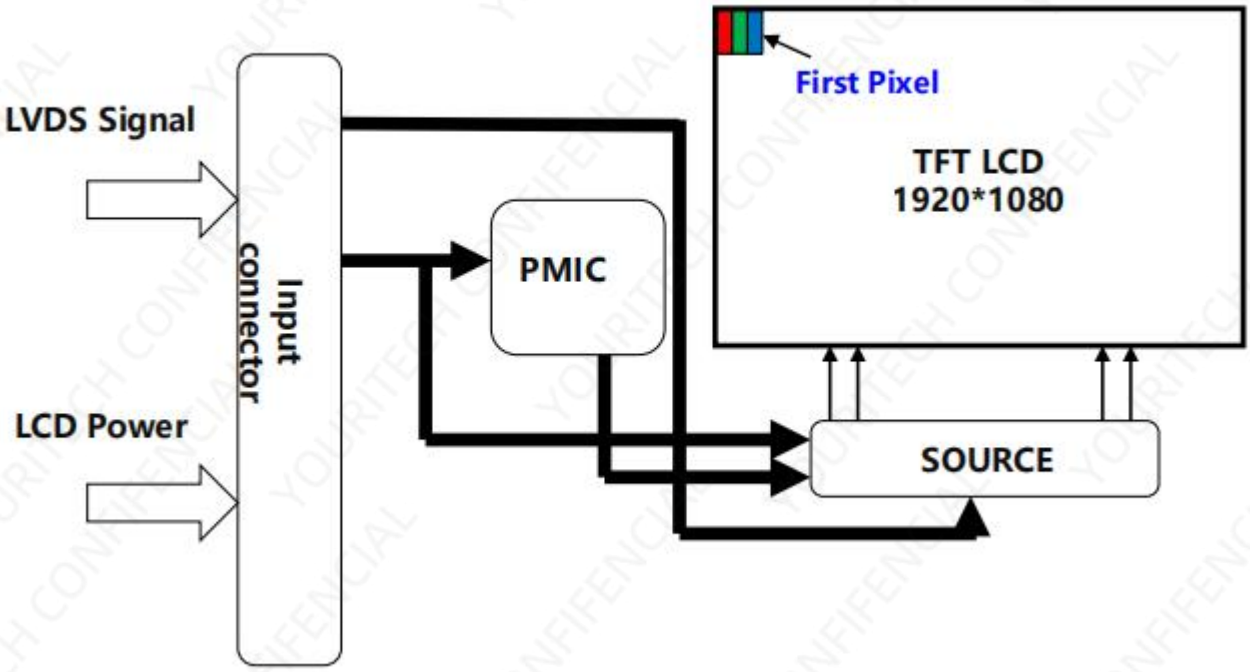
Contents

1. General Specifications

ET101FH01-R is a TFT-LCD module. It is composed of a TFT-LCD panel, driver IC, FPC, a back light unit. The 10.1'' display area contains 1920 x 1080 pixels and can display up to 16.7M colors.

Item	Contents	Unit	Note
LCD size	10.1	inch	
Driver element	TFT		
Display mode	Normally Black		
Number of Pixels	1920(H)×RGB×1080(V)	pixels	
Module size	135.81(H)*229.95(V)*3.02	mm	1
Active Area(W×H)	125.712(H) x 223.488(V)	mm	
Pixel Pitch	0.0376H)xRGBx0.1128(V)	mm	
Pixel Arrangement	RGB Vertical Stripe		
color	16.7M		
Surface treatment	HC		
Luminance	1000(Typ.)	nits	
Viewing Direction	85/85/85/85 (Typ.)	Deg.	
Color Gamut	NTSC：60%(Typ.)		
Interface	2-port LVDS (8bit)		
IC	/		
Power consumption	TBD		
Operating temperature	-20~+70	℃	
Storage temperature	-30~+80	℃	
Weight	TBD	g	

Note 1：Refer to Mechanical Drawing. Without FPC and Connector etc.



2. Absolute Maximum Ratings

Absolute Maximum Ratings.

(Vss=0V ,Ta=25℃)

Parameter	Symbol	Min.	Max.	Unit	Remarks
Operating Temperature	TOP	-20	+70	℃	
Storage Temperature	TST	-30	+80	℃	

Notes:

1.If the module is above these absolute maximum ratings. It may become permanently damaged. Using the module within the following electrical characteristic conditions are also exceeded, the module will malfunction and cause poor reliability.

2.VCC >VSS must be maintained.

3.Please be sure users are grounded when handing LCD Module.

3. Interface Pin Assignment

The Interface Connector assignments are listed in Table.

Pin No.	Symbol	Description	I/O
1	VLED-	LED Cathode	P
2	VLED-	LED Cathode	P
3	VLED+	LED Anode	P
4	VLED+	LED Anode	P
5	GND	ground	P
6	OD0N	- LVDS differential data 0 (ODD)	I
7	OD0P	+ LVDS differential data 0 (ODD)	I
8	GND	ground	P
9	OD1N	- LVDS differential data 1 (ODD)	I
10	OD1P	+ LVDS differential data 1 (ODD)	I
11	GND	ground	P
12	OCLKN	- LVDS differential clock (ODD)	I
13	OCLKP	+ LVDS differential clock (ODD)	I
14	GND	ground	P
15	OD2N	- LVDS differential data 2 (ODD)	I
16	OD2P	+ LVDS differential data 2 (ODD)	I
17	GND	ground	P
18	OD3N	- LVDS differential data 3(ODD)	I
19	OD3P	+ LVDS differential data 3 (ODD)	I
20	GND	ground	P
21	ED0N	- LVDS differential data 0 (EVEN)	I
22	ED0P	+ LVDS differential data 0 (EVEN)	I
23	GND	ground	P
24	ED1N	- LVDS differential data 1 (EVEN)	I
25	ED1P	+ LVDS differential data 1 (EVEN)	I
26	GND	ground	P
27	ECLKN	- LVDS differential clock (EVEN)	I
28	ECLKP	+ LVDS differential clock (EVEN)	I
29	GND	ground	P
30	ED2N	- LVDS differential data 2 (EVEN)	I
31	ED2P	+ LVDS differential data 2 (EVEN)	I
32	GND	ground	P
33	ED3N	- LVDS differential data 3 (EVEN)	I
34	ED3P	+ LVDS differential data 3 (EVEN)	I
35	STBYB	Stbyb Pin,Low active	P
36	I2C_SDA	Serial address and data for I2C	I
37	I2C_SCL	Clock signal for I2C interface	I
38	RESET	Reset Pin,Low active	I
39	VDDIN	Power supply VDDIN=3.3(TYP)	P
40	VDDIN	Power supply VDDIN=3.3(TYP)	P

Connector：MSAK24025P40G

4. Electrical Specifications

4.1 Electrical characteristics(Vss=0V ,Ta=25℃)

Parameter	Symbol	Min	Typ	Max	Unit	Note
Power supply	VDDIN	3.0	3.3	3.6	V	
Power Supply Current	IDDIN	-	240	330	mA	Note 1
Power Consumption	PLCD	-	792	990	mW	
Rush current	IRUSH	-	-	1.2	A	Note 2

Note:

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=3.3V, Frame rate f_V=60Hz

Test Pattern of power supply current

a) Typ : Mosaic 5 x 5 Pattern(L0/L255)

b) Max : skip column (L0/L255)

2. The duration of rush current is about 2ms and rising time of Power Input is 1ms(min)

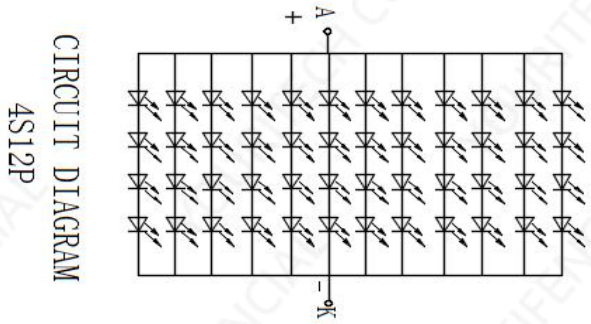
4.2 LED Backlight specification

Item	Symbol	Min	Typ	Max	Unit	Note
Luminance	Lv	850	1000	-	cd/m²	
Forward Voltage	Vf	-	24.0	25.6	V	
Forward Current	I_F	-	240	-	mA	
Backlight Power consumption	W_{BL}	-	6.14	-	W	
LED Lifetime		30000	-	-	Hrs	

Note 1: Each LED: IF =20mA, VF =6.0±0.4V.

Note 2: Optical performance should be evaluated at Ta=25℃ only.

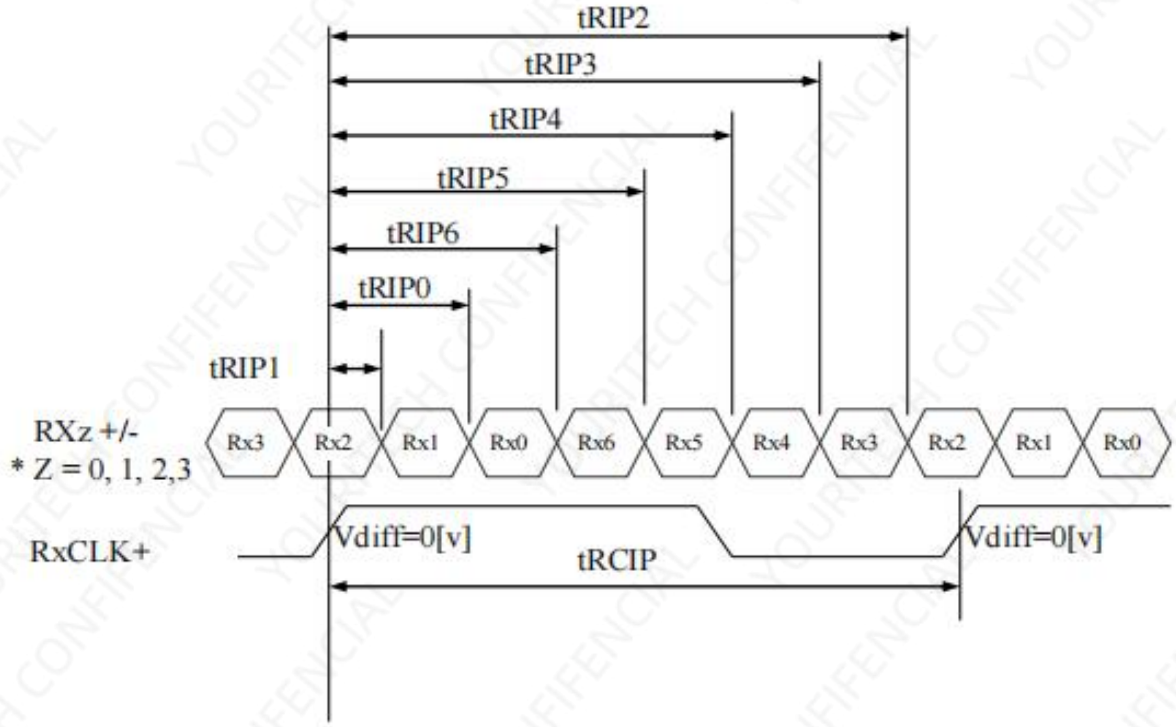
Note 3: If LED is driven by high current, high ambient temperature & humidity condition. The life Time of LED will be reduced. Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.



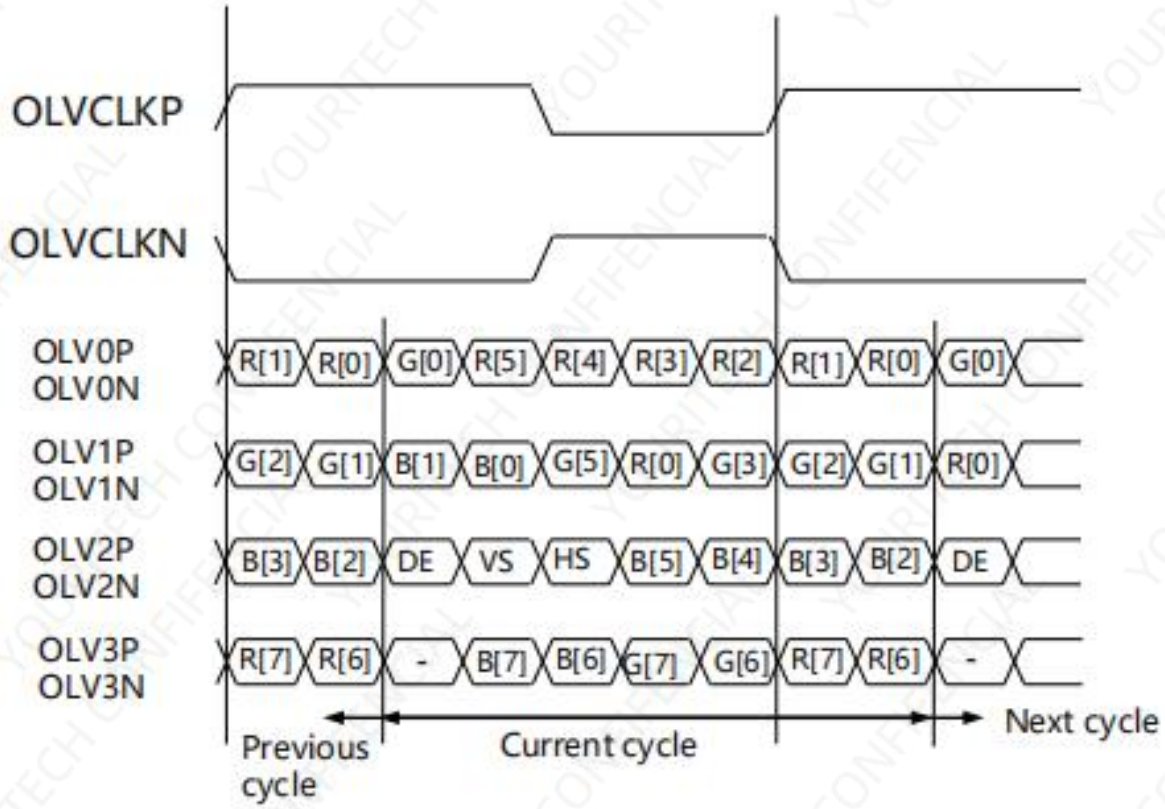
4.3 LVDS Interface Characteristic

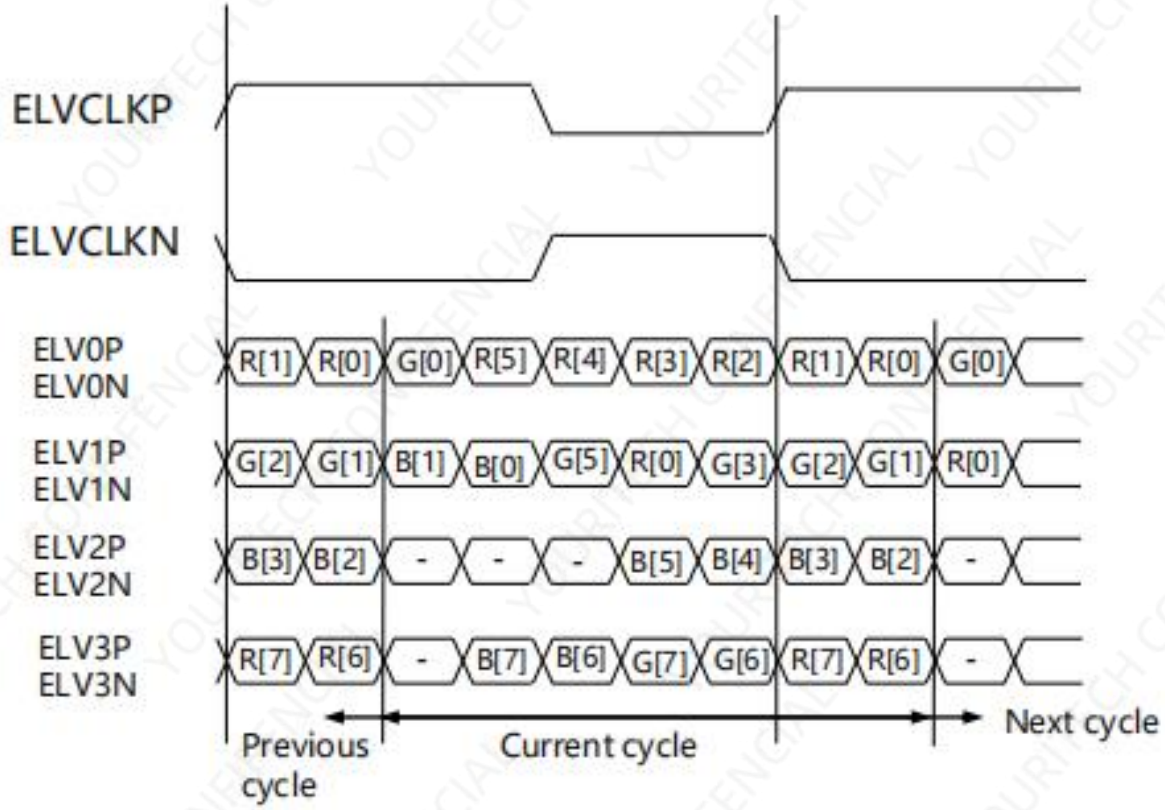
< Table6. LVDS mode electrical Specification >

Item	Symbol	Min	Typ	Max	Unit	Remark
CLKIN Period	tRCIP	11.76	-	-	nsec	
Input Data 0	tRIP1	-0.1	0.0	0.1	UI	
Input Data 1	tRIP0	0.7	1	1.1	UI	
Input Data 2	tRIP6	1.7	2	2.1	UI	
Input Data 3	tRIP5	2.7	3	3.1	UI	
Input Data 4	tRIP4	3.7	4	4.1	UI	
Input Data 5	tRIP3	4.7	5	5.1	UI	
Input Data 6	tRIP2	5.7	6	6.1	UI	



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


OLVCLKP
OLVCLKN
OLV0P
OLV0N
OLV1P
OLV1N
OLV2P
OLV2N
OLV3P
OLV3N
R[1] R[0] G[0] R[5] R[4] R[3] R[2] R[1] R[0] G[0]
G[2] G[1] B[1] B[0] G[5] R[0] G[3] G[2] G[1] R[0]
B[3] B[2] DE VS HS B[5] B[4] B[3] B[2] DE
R[7] R[6] - B[7] B[6] G[7] G[6] R[7] R[6] -
Previous cycle
Current cycle
Next cycle

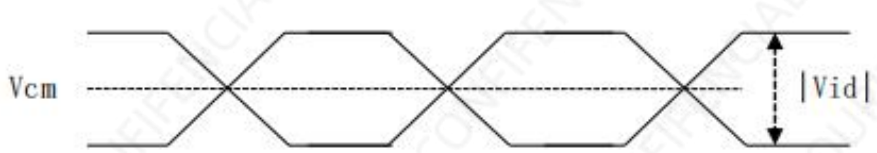

ELVCLKP
ELVCLKN
ELV0P
ELV0N
ELV1P
ELV1N
ELV2P
ELV2N
ELV3P
ELV3N
R[1] R[0] G[0] R[5] R[4] R[3] R[2] R[1] R[0] G[0]
G[2] G[1] B[1] B[0] G[5] R[0] G[3] G[2] G[1] R[0]
B[3] B[2] - - - B[5] B[4] B[3] B[2] -
R[7] R[6] - B[7] B[6] G[7] G[6] R[7] R[6] -
Previous cycle
Current cycle
Next cycle

< 2-port LVDS,VESA format>

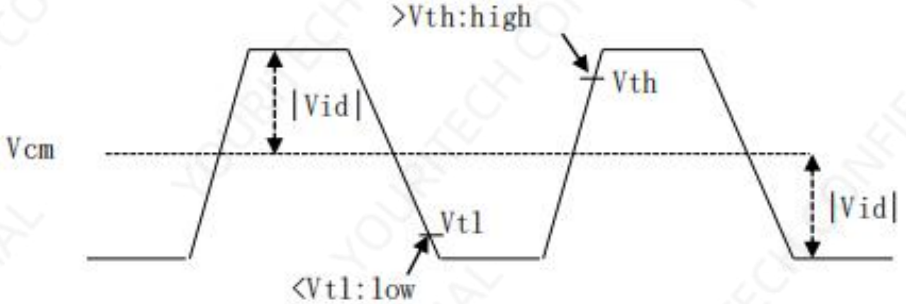
Parameter	Symbol	Condition	Spec			Unit
			Min	Typ	Max	
Differential input high Threshold Voltage	Vth	Vcm=1.2V	-	-	+0.1	V
Differential input low Threshold Voltage	Vtl	-	-0.1	-	-	V
Differential input common Mode Voltage	Vcm	-	1	1.2	1.7-|Vid|/2	V
LVDS input voltage	Vinlv	-	0.7	-	1.7	V
Different input voltage	|Vid|	-	0.1	-	0.6	V
Differernt input leakage Current	Ilvleak	-	-10	-	+10	uA

< Table7. LVDS mode DC electrical characteristics>

Single-ended:
LVCLKP(R),
LVCLKN(R),
LVD[3:0]P(R),
LVD[3:0]N(R)



Differential:
LVCLKP(R)-LVCLKN(R),
LVD[3:0]P(R)-
LVD[3:0]N(R)



4.4 Interface timing Parameter

< Table8. SSC limitation of LVDS interface>

Parameter	Symbol	comdition	Spec			Unit
			Min.	Typ.	Max	
Modulation frequency	SSCmf	LVDS clock frequency center at 80MHZ	-	-	200	KHZ
		LVDS clock frequency center at 60MHZ	-	-	150	KHZ
		LVDS clock frequency center at 40MHZ	-	-	100	KHZ
		LVDS clock frequency center at 20MHZ	-	-	50	KHZ
Modulation rate	SSCmr	LVDS clock frequency +SSCMR in the range of 20MHZ~80MHZ	-	-	±3	%

< Table9. Timing Parameter >

Item			Symbol	min	typ	max	UNIT
LCD	Frame Rate		-	-	60	-	Hz
Timing	DCLK	Frequency	fCLK	-	68.4	-	MHz
	Horizontal	Horizontal total time	tHP	-	1014	-	t_{CLK}
		Horizontal Valid data	thd		960		t_{CLK}
		Horizontal Pulse Width	tHsync	-	12	-	t_{CLK}
		Horizontal Back Porch	tHBP	-	16	-	t_{CLK}
		Horizontal Front Porch	tHFP	-	38	-	t_{CLK}
	Vertical	Vertical total time	tvp	-	1124	-	t_H
		Vertical Valid time	tvd		1080		t_H
		Vertical Pulse Width	tVsync	-	5	-	t_H
		Vertical Back Porch	tVBP	-	24	-	t_H
		Vertical Front Porch	tVFP	-	20	-	t_H

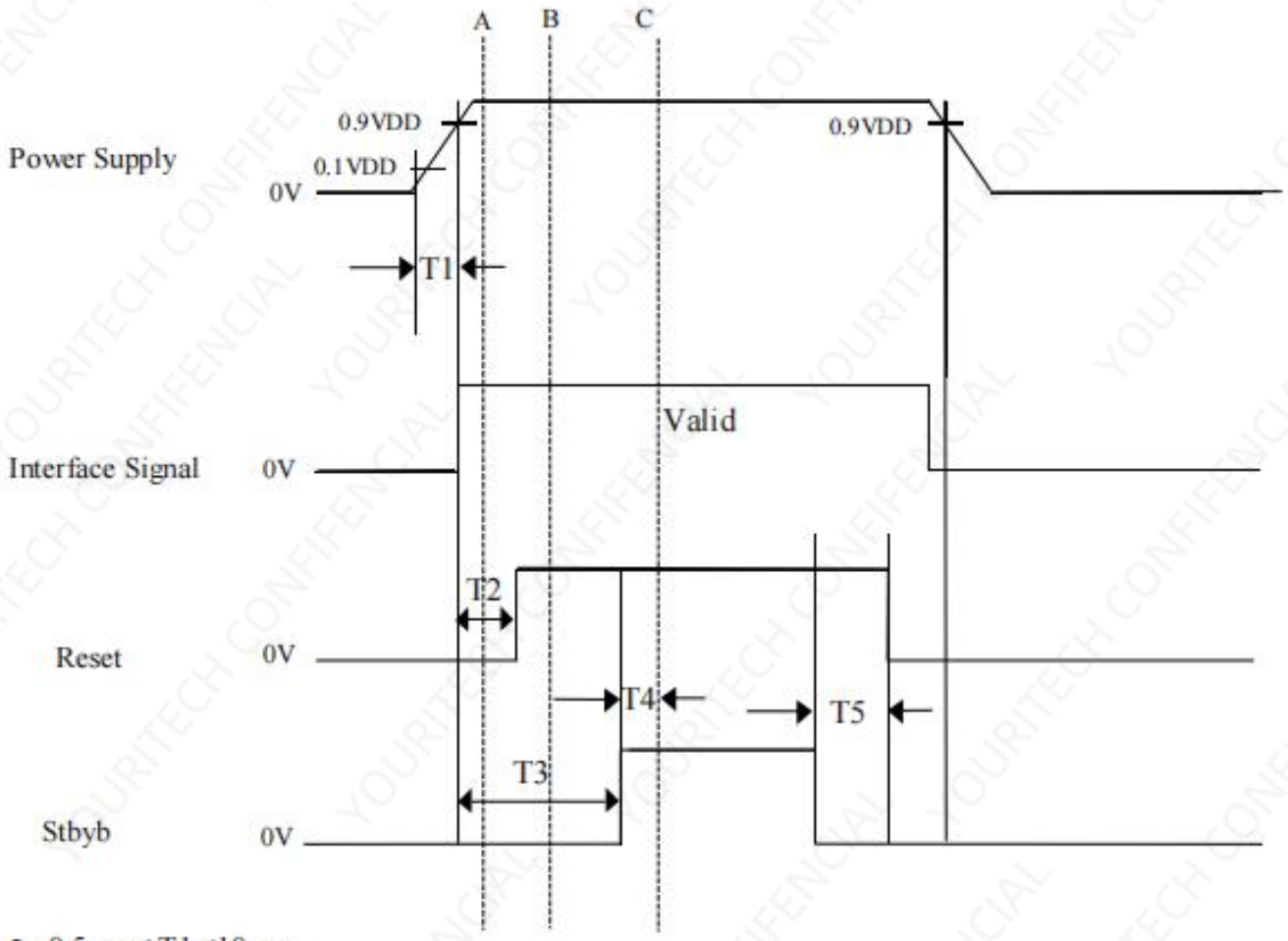
4.5 Input Color Data Mapping

< Table14. Input Signal and Display Color Table >

Color & Gray Scale		Input Data Signal																							
		Red Data								Green Data								Blue Data							
		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

5.0 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
- T2 > 10 us
- T3 > 16 ms
- T4 <150 ms
- T5> 90 ms

Notes:

1. The valid LVDS signals(clock pair and all data pairs in toggling state) must be consistent with panel resolution and suggestions.
2. The application system can apply LVDS signals from point A (VCC1 is reday and not reset completeted) ,B(reset completeted and in standby mode , or C(reset comoleted and non-standby mode)

6.Optical Characteristics

Item	Symbol		Condition	Min.	Typ.	Max.	Unit	Note
Luminance	Lv		θ=0° Φ=0°	850	1000	-	cd/m²	1
Uniformity	⊿Bp			75	80	-	%	1,2
Viewing Angle	3:00		Cr≥10	-	85	-	Deg	3
	6:00			-	85	-		
	9:00			-	85	-		
	12:00			-	85	-		
Contrast Ratio	CR		θ=0° Φ=0°	700	900	-	-	4
Response Time	T_r+T_f			-	25	35	ms	5
Color of CIE Coordinate	W	x	θ=0° Φ=0°	-0.04	0.300	+0.04	-	1,6
		y			0.341		-	
	R	x			TBD		-	
		y			TBD		-	
	G	x			TBD		-	
		y			TBD		-	
	B	x			TBD		-	
		y			TBD		-	
NTSC Ratio	S			70	75	-	%	

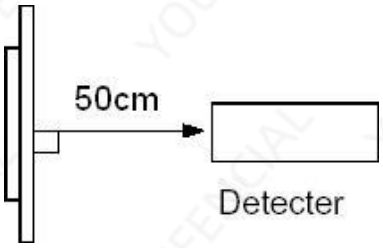
Note：The parameter is slightly changed by temperature, driving voltage and materiel

Note 1: The data are measured after LEDs are turned on for 5 minutes. LCM displays full white. The brightness is the average value of 9 measured spots. Measurement equipment PR-705 (Φ8mm)

Measuring condition:

- Measuring surroundings: Dark room.
- Measuring temperature: Ta=25℃.
- Adjust operating voltage to get optimum contrast at the center of the display.

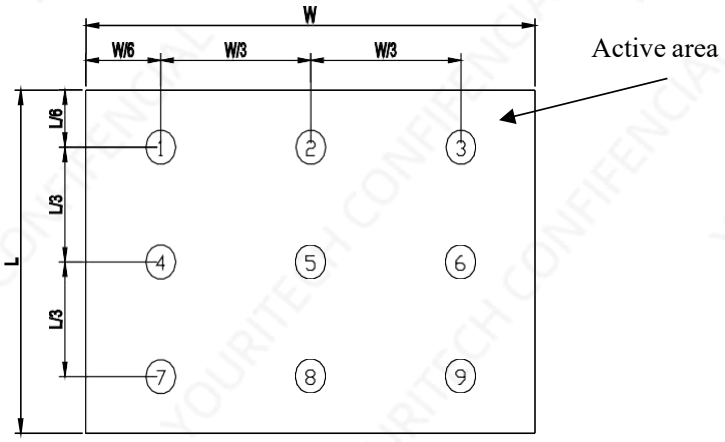
Measured value at the center point of LCD panel after more than 5 minutes while backlight turning on.



Note 2: The luminance uniformity is calculated by using following formula.

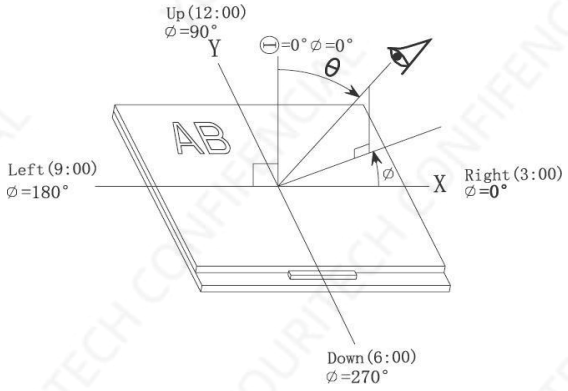
⊿Bp = Bp (Min.) / Bp (Max.)×100 (%)

Bp (Max.) = Maximum brightness in 9 measured spotsBp (Min.) = Minimum brightness in 9 measured spots.



Note 3: The definition of viewing angle:

Refer to the graph below marked by θ and Φ

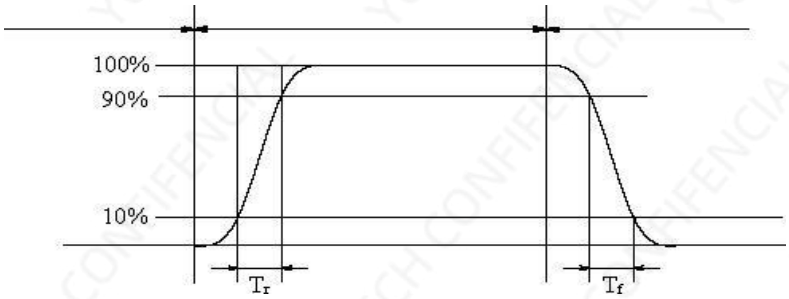


Note 4: Definition of contrast ratio.

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD on the "White" state}}{\text{Luminance measured when LCD on the "Black" state}}$$

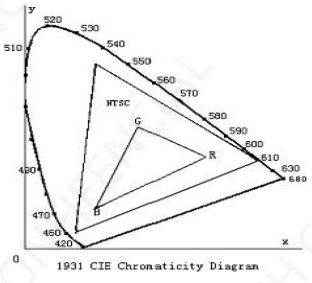
Note 5: Definition of Response time.

The output signals of photo detector are measured when the input signals are changed from “black” to “white”(falling time) and from “white” to “black”(rising time), respectively. The response time is defined as the time interval between the 10% and 90% of amplitudes. Refer to figure as below.



The definition of response time

Note 6: Definition of Color of CIE Coordinate and NTSC Ratio.



Color gamut:

$$S = \frac{\text{area of RGB triangle}}{\text{area of NTSC triangle}} \times 100\%$$

7. Reliability Test Items

No.	Item	Test Conditions
1	High Temperature Storage	80℃, 240hrs, Non-operational
2	Low Temperature Storage	-30℃, 240hrs, Non-operational
3	High Temperature Operation	70℃, 240hrs, operational
4	Low Temperature Operation	-20℃, 240hrs, operational
5	High Temperature and High Humidity operation test	60℃, 90%RH, 240hrs, operational
6	Thermal shock	-30℃←→80℃,1hr/cycle, 100 cycle, Non-operational

Note1: Temperature is the ambient temperature of sample.

Note2: Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at roomtemperature.

Note3: In the standard condition, there shall be no practical problem that may affect the display function. After thereliability test, the product's function only be guaranteed, but not for all of the cosmetic specification.

Note4: Suitable operating time: under 12 hours a day. Long-term lighting products recommended regular shutdown.

8.General Precautions

1 Handling

1. The LCD panel is plate glass. Do not subject the panel to mechanical shock or to excessive force on its surface.
2. The polarizer attached to the display is easily damaged. Please handle it carefully to avoid scratch or other damages.
3. To avoid contamination on the display surface, do not touch the module surface with bare hands.
4. Keep a space so that the LCD panels do not touch other components.
5. Put cover board such as acrylic board on the surface of LCD panel to protect panel from damages.
6. Transparent electrodes may be disconnected if you use the LCD panel under environmental conditions where the condensation of dew occurs.
7. Do not leave module in direct sunlight to avoid malfunction of the ICs.
8. Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.
9. Pins of I/F connector shall not be touched directly with bare hands.

2 Safety

Liquid crystal is poisonous. Do not put it in your mouth. If liquid crystal touches your skin or clothes, wash it off immediately by using soap and water.

3 Static Electricity

1. Be sure to ground module before turning on power or operating module.
2. Do not apply voltage which exceeds the absolute maximum rating value.
3. Remove the protective film slowly, keeping the removing direction approximate 30-degree not vertical from panel surface, If possible, under ESD control device like ion blower, and the humidity of working room should be kept over 50%RH to reduce the risk of static charge.
4. In handling the LCD, wear non-charged material gloves. And the conducting wrist to the earth and the conducting shoes to the earth are necessary.

4 Storage

1. Store the module in a dark room where must keep at 25±10℃ and 65%RH or less.
2. Do not store the module in surroundings containing organic solvent or corrosive gas.
3. Store the module in an anti-electrostatic container or bag.
4. It is not allowed to store or run directly in strong light or in high temperature and humidity for a long time; Strong light exposure causes degradation of polarizer and color filter.

5 Operation

1. Do not connect, disconnect the module in the “Power On” condition.
2. Power supply should always be turned on/off by following item “POWER ON OFF SEQUENCE ”.
3. Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimize the interference.
4. The FPC cable between the LED chips and its converter power supply shall be a minimized length and be connected directly. The longer cable between the back-light and the converter may cause lower luminance of light source (LED).

6 Cleaning

1. Do not wipe the polarizer with dry cloth. It might cause scratch.
2. Only use a soft sloth with IPA to wipe the polarizer, other chemicals might permanent damage to the polarizer.

7 Other

1. Ultra-violet ray filter is necessary for outdoor operation.
2. Avoid condensation of water. It may result in improper operation or disconnection of electrode.
3. Do not exceed the absolute maximum rating value. (the supply voltage variation, input voltage variation, Variation in part contents and environmental temperature, so on) Otherwise the module may be damaged.
4. If the module displays the same pattern continuously for a long period of time, it can be the situation when the image “sticks” to the screen.
5. This module has its circuitry PCB’s on the front or rear side and should be handled carefully in order not to be stressed.
6. The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.

9.Mechanical Drawing

Unit： mm