LCD MODULE SPECIFICATION

■Preliminary Specification

□Final Product Specification

MODEL NO. : IE-A-3228C13R18-CB-1

CUSTOMER P/N:

ISSUED DATE : 2021.10.02

VERSION : 1.0

Prepare by	Check by	Approve by

Customer :

Approve by	Notes

Record of Version

Rev	Issued Date	Description	Editor
1.0	2021-10-2	First Issue	

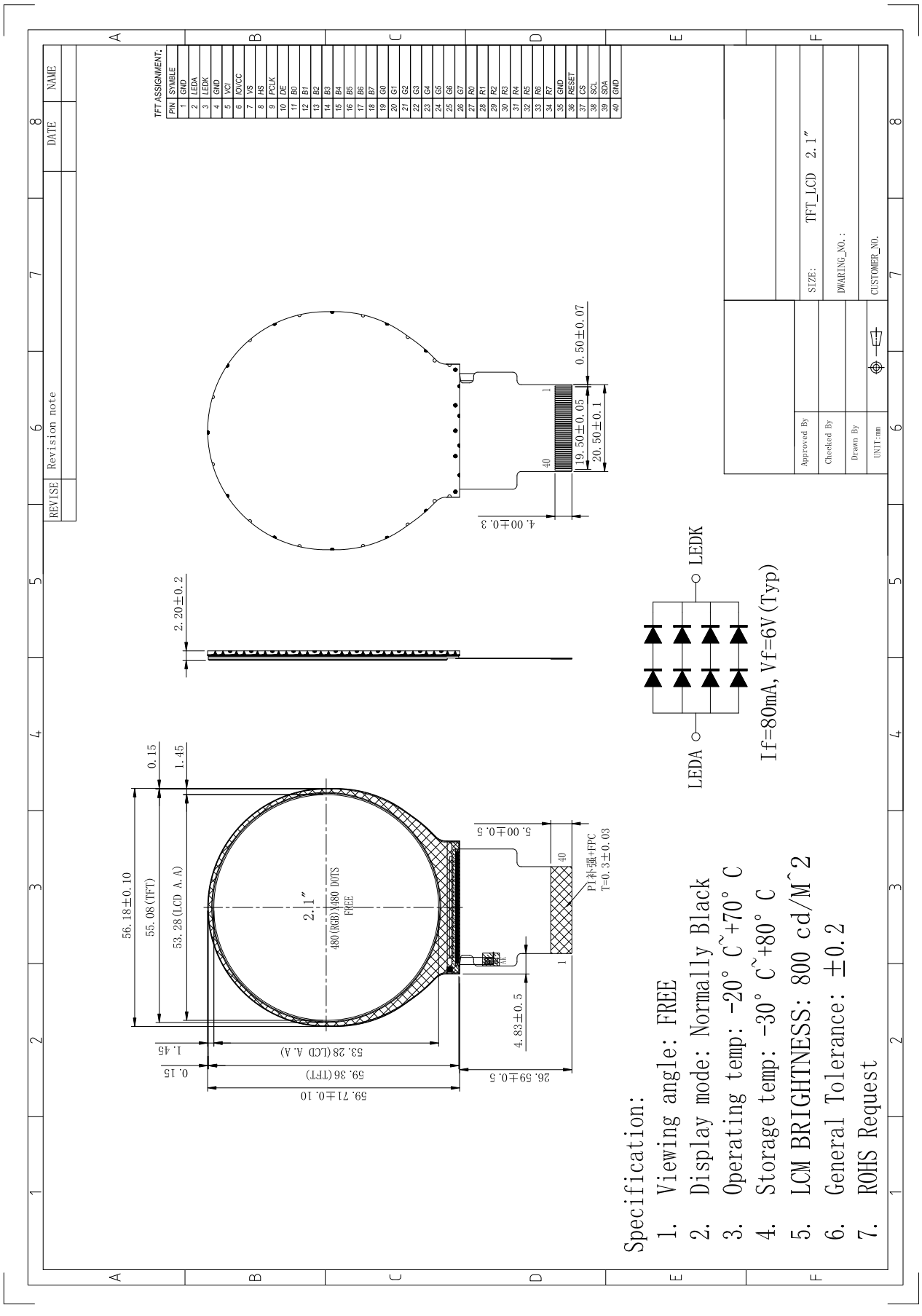
Table of Contents

1. General Specification

1.1. General Specification for LCM

Feature		Spec
Characteristics	Size	2.1 inch
	Resolution	480(RGB) x 480
	Pixel Pitch (um)	111(W) X 111(H)
	Pixel Arrangement	RGB. Vertical Stripe
	Display Mode	Normally Black
	Input Signals	3 Line SPI 24bit
	Viewing Direction	ALL O' Clock
Mechanical Characteristics	Overall dimensions (W x H x D) (mm)	56.18×59.71×2.22
	Active Area(mm)	53.28(W)X53.28(H)
	With /Without TP	Without TP
	Weight (g)	TBD
	LED Numbers	8 LEDs
Electronic	LCD Driver IC	ST7701S

2.Mechanical Drawing



3. PIN Description

Pin No.	Symbol	I/O	**Function**
1	GND	P	Ground
2	LEDA	P	B/L Power input PIN anode
3	LEDK	P	B/L Power input PIN negative
4	GND	P	Ground
5	VCC	P	Interface pin Power supply 2.8V-3.3V
6	IOVCC	P	Logic Power supply +1.8V
7	VS	I	Vertical sync. signal
8	HS	I	Horizontal sync. signal
9	PCLK	I	Dot clock signal
10	DE	I	Data enable signal
11-18	B0-B7	I	data bus
19-26	G0-G7	I	data bus
27-34	R0-R7	I	data bus
35	GND	P	Ground
36	RESET	I	Reset pin
37	CS	I	Chip select signal. Low: chip can be accessed. High: chip
38	SCL	I	Server as serial data clock in serial bus system interface
39	SDA	I	Serial data input
40	GND	P	Ground

4.Absolute Maximum Rating

Ta = 25℃

Item	Symbol	Min	Max	Unit	Remark
Power for Circuit Driving	Vcc	-0.3	4.6	V	-
Power for Circuit Logic	Vt	-0.3	Vcc+0.3	V	-
Storage Humidity	HST	10	-	%RH	At 25±5℃
Storage Temperature	TST	-30	80	℃	
Operating Humidity	H OP	10	-	%RH	
Operating temperature	TOP	-20	70	℃	

5. Electrical Characteristics

5.1. Operating Condition for LCD

Ta = 25℃

Parameter		Symbol	MIN	TYP	MAX	Unit	Remark
Power for Circuit Driving		VCC	2.65	2.8	3.3	V	
Power for Circuit Logic		IOVCC	1.65	1.8	3.3	V	-
Logic Input Voltage	Low Voltage	VIL	-0.3	-	0.2*IOVCC	V	
	HighVoltage	VIH	0.8*IOVCC	-	IOVCC	V	
Logic Output Voltage	Low Voltage	VOL	0	-	0.2*IOVCC	V	
	HighVoltage	VOH	0.8*IOVCC	-	-	V	

5.2. Driving Condition for Backlight

Ta=25℃

Item	Symbol	Min	Typ	Max	Unit	Remark
Forward Current	IF	-	80	-	mA	Constant current driving
Forward Voltage	VF	-	6.0	-	V	
Backlight Power Consumption	WBL	-	-	-	mW	
Operating Life Time	-	-	30.000	-	hrs	

Note 1: (Unless specified, the ambient temperature Ta=25℃)

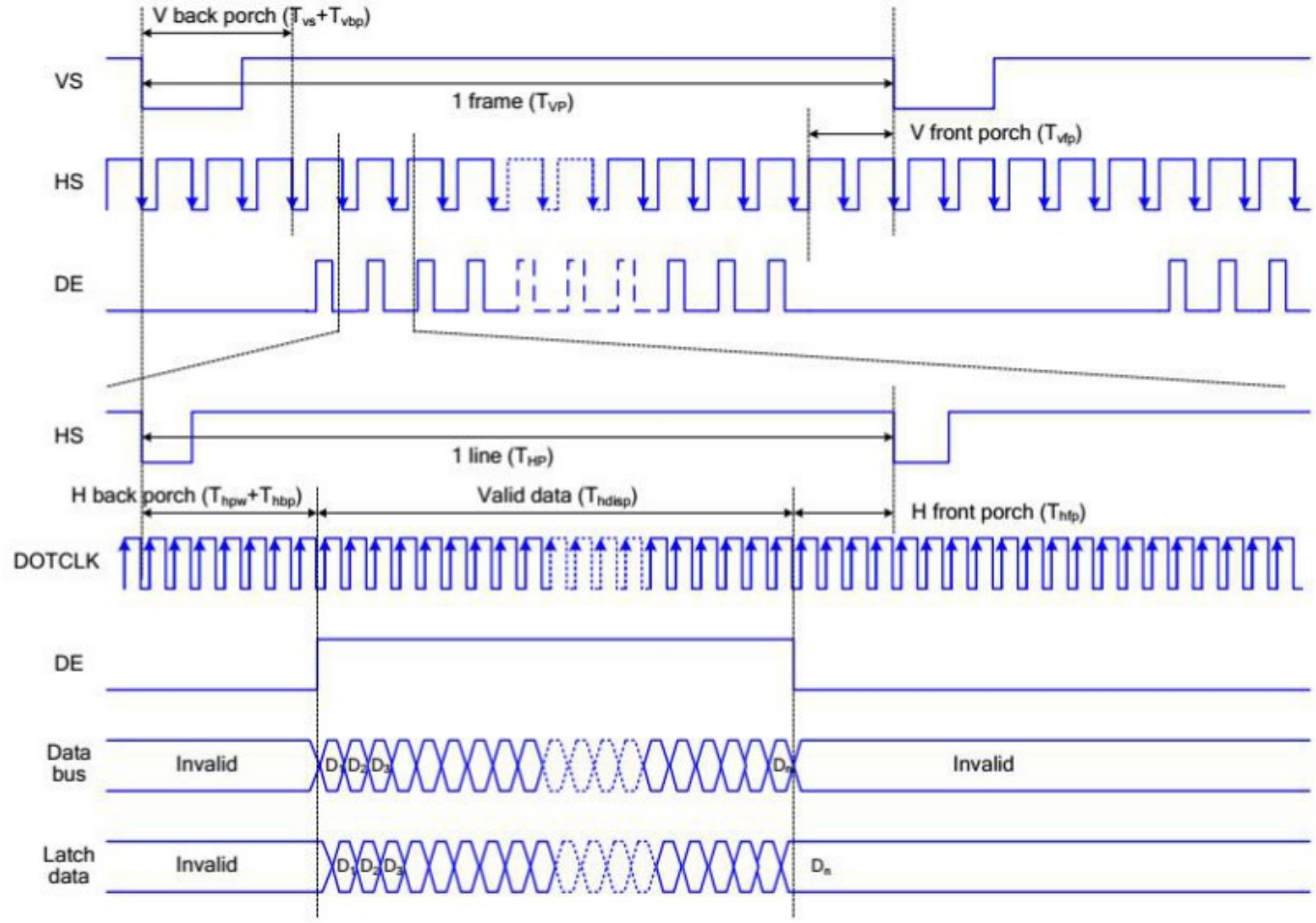
Note 2: The recommended operating conditions refer to a range in which operation of this product is guaranteed. Should this range is exceeded, the operation cannot be guaranteed even if the values may be without the absolute maximum ratings.

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.

6.Timing Chart for LCM

6.1. Display Timing characteristics

The timing chart of RGB interface DE mode is shown as follows.



Note: The setting of front porch and back porch in host must match that in IC as this mode.

Figure 23 Timing Chart of Signals in RGB Interface DE Mode

6.1.1OperationOperation

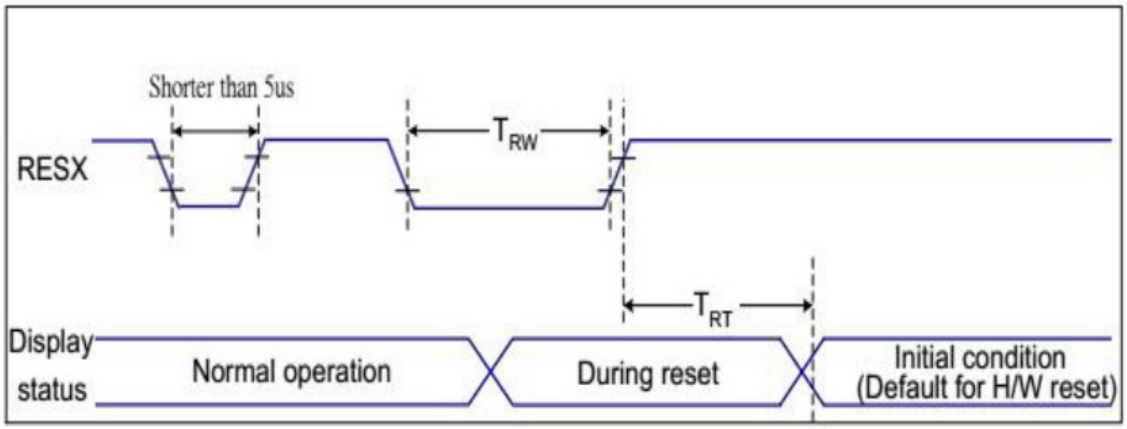


Figure 9 Reset Timing

VDDI=1.8,VDD=2.8, AGND=DGND=0V, Ta=25 ℃

Related Pins	Symbol	Parameter	MIN	MAX	Unit
RESX	TRW	Reset pulse duration	10	-	us
	TRT	Reset cancel	-	5 (Note 1, 5)	ms
				120(Note 1, 6, 7)	ms

Table 9 Reset Timing

Notes:

1. The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from NVM (or similar device) to registers. This loading is done every time when there is HW reset cancel time (tRT) within 5 ms after a rising edge of RESX.

2. Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the table below:

RESX Pulse	Action
Shorter than 5us	Reset Rejected
Longer than 9us	Reset
Between 5us and 9us	Reset starts

3. During the Resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120 ms, when Reset Starts in Sleep Out –mode. The display remains the blank state in Sleep In –mode.) and then return to Default condition for Hardware Reset.

4. Spike Rejection also applies during a valid reset pulse as shown below:

6.2. Gate output timing diagram(Duai grte)

The timing chart of RGB interface HV mode is shown as follows.

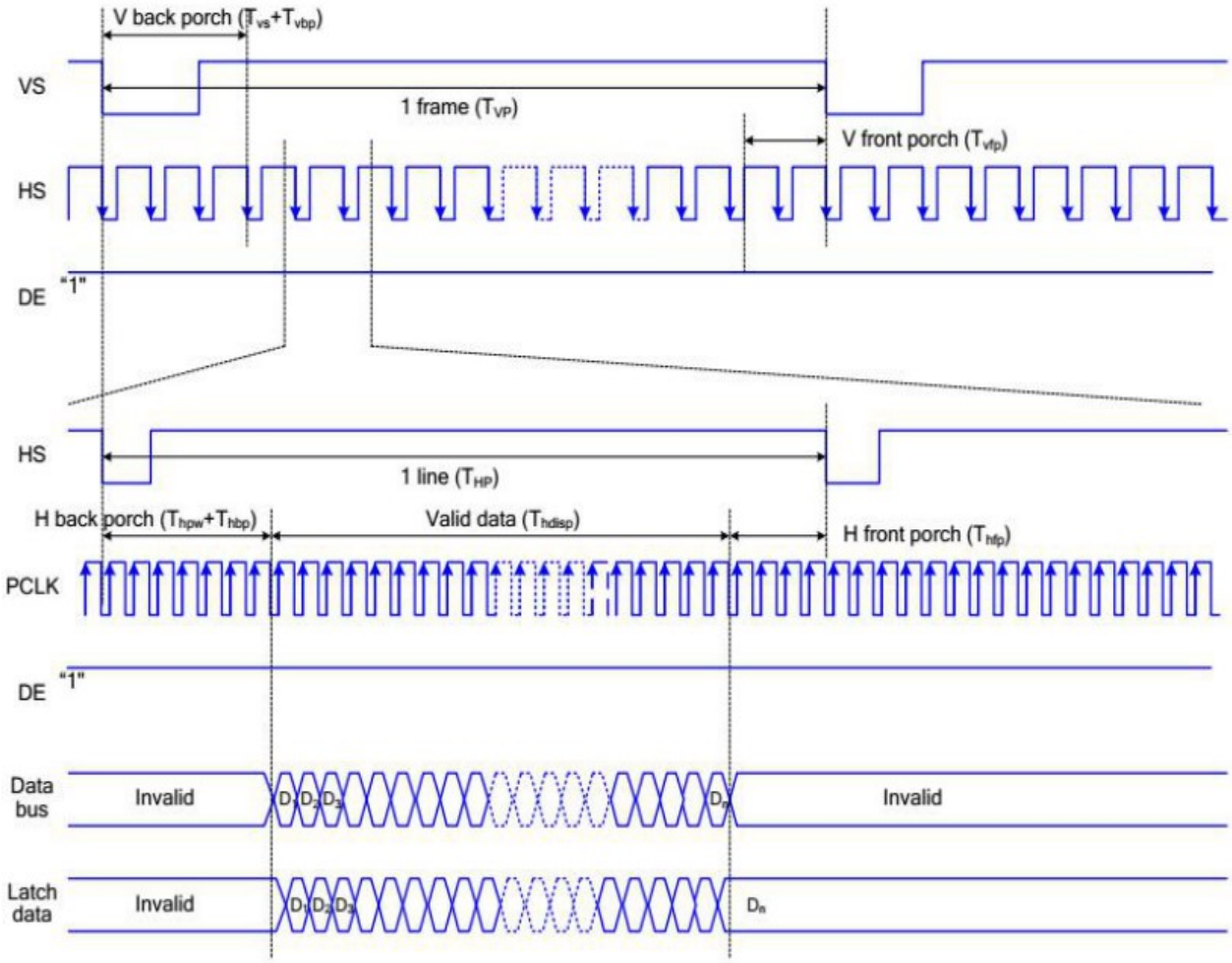


Figure 24 Timing chart of RGB interface HV mod

7. Optical Characteristics

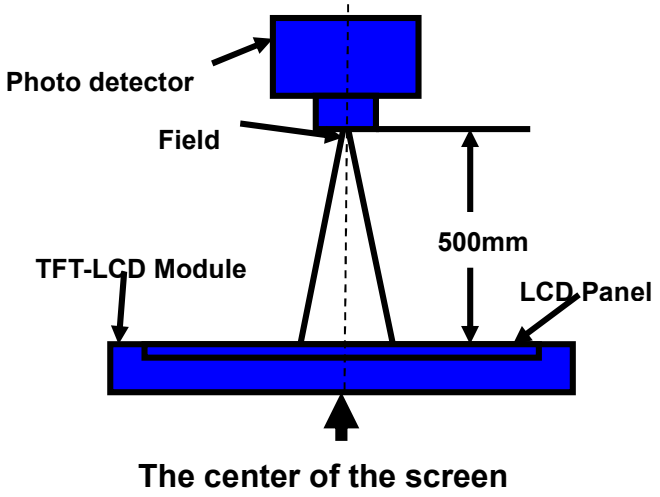
Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angle		θ_T	CR≧10	--	80	--	Degree	Note 2
		θ_B		--	80	--		
		θ_L		--	80	--		
		θ_R		--	80	--		
Contrast Ratio		CR	θ=0°	800	1000	--		Note1 Note3
Response Time		Tr	25℃	--	30	35	ms	Note1 Note4
		Tf						
Chromaticity (CIE1931)	White	x		Typ -0.03	0.3104	Typ +0.03	-	Note1 Note5
		y			0.3446			
	Red	x			0.6274			
		y			0.3465			
	Green	x			0.3478			
		y			0.5810			
	Blue	x			0.1363			
		y			0.0981			
Uniformity		U	-	75	80	--	%	Note1 Note6
Luminance		L	-	--	800	--	cd/m2	Note1 Note7

Test Conditions:

1. IF= 80 mA, and the ambient temperature is 25℃.
2. The test systems refer to Note 1 and Note 2.

Note 1: Definition of optical measurement system.

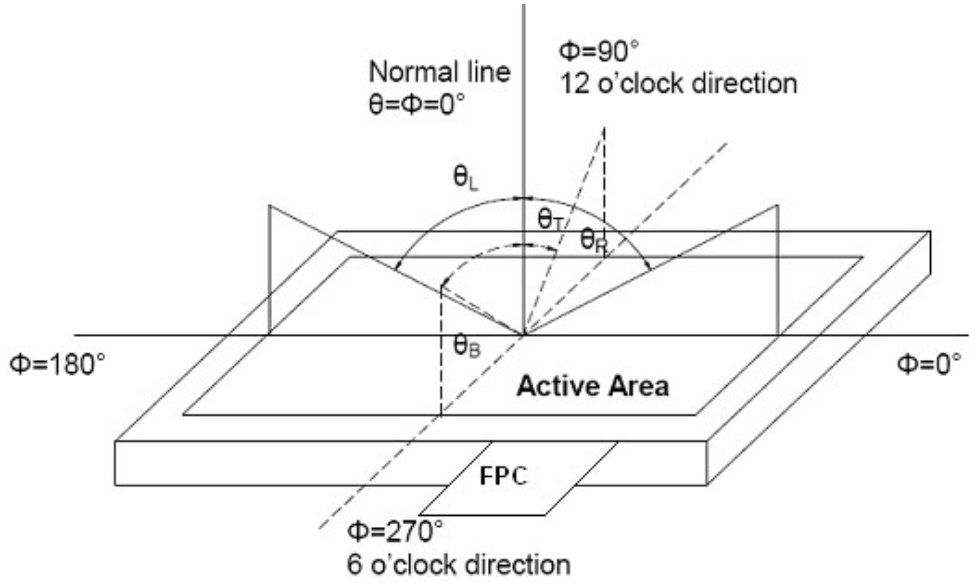
The optical characteristics should be measured in dark room. After 5 Minutes operation, the optical properties are measured at the center point of the LCD screen.



Item	Photo detector	Field
Contrast Ratio	BM-7A	1°
Luminance		
Chromaticity		
Lum Uniformity		

Note 2: Definition of viewing angle range and measurement system.

viewing angle is measured at the center point of the LCD by CONOSCOPE(ergo-80)。



Note 3: Definition of contrast ratio

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

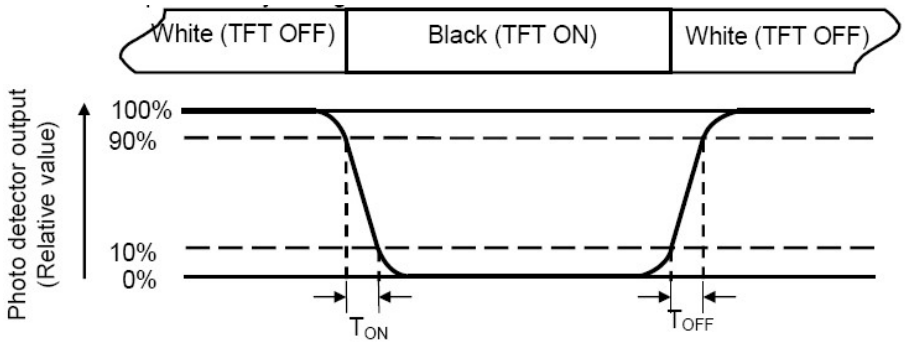
"White" state: The state is that the LCD should drive by Vwhite.

"Black" state: The state is that the LCD should drive by Vblack.

Vwhite: To be determined Vblack: To be determined.

Note 4: Definition of Response time

The response time is defined as the LCD optical switching time interval between "White" state and "Black" state. Rise time (Tr) is the time between photo detector output intensity changed from 90% to 10%. And fall time (Tf) is the time between photo detector output intensity changed from 10% to 90%.



Note 5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

Note 6: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer Fig. 2). Every measuring point is placed at the center of each measuring area.

Luminance Uniformity (U) = Lmin/ Lmax x100%

L-------Active area length W----- Active area width

Note 7: Definition of Luminance:

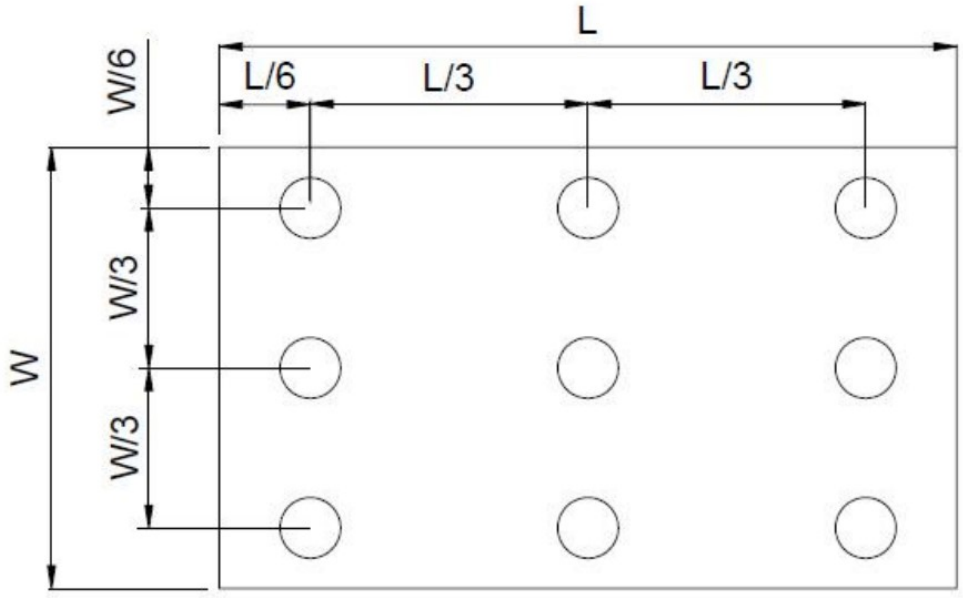
Measure the luminance of white state at center point.

Lmax: The measured Maximum luminance of all measurement position.

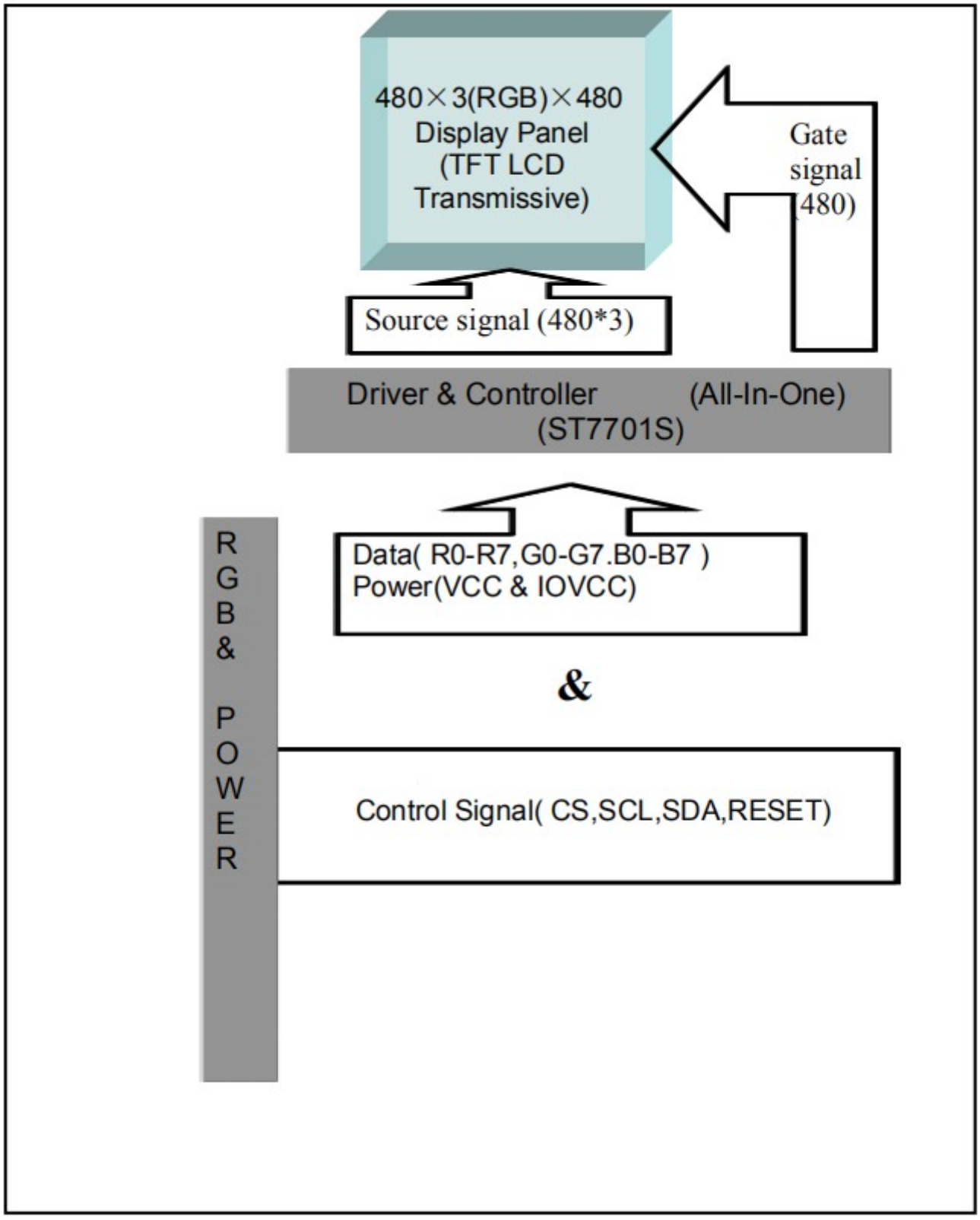
Lmin: The measured Minimum luminance of all measurement position.

$$Luminance\ \ Uniformity\ (Yu) = \frac{B_{min}}{B_{max}}$$

L-------Active area length W----- Active area width



7.2BlockDiagram



8. Reliability Test

Item	Test Conditions	Criterion
High Temperature Storage	Ta = 80℃ 96hrs	A,B,C,D,E
Low Temperature Storage	Ta = -30℃ 96hrs	A,B,C,D,E
High Temperature Operation	Ts = 70℃ 96hrs	A,B,C,D,E
Low Temperature Operation	Ta =-20℃ 96hrs	A,B,C,D,E
Operate at High Temperature and Humidity	+60℃, 90%RH 96hrs	A,B,C,D,E
Thermal Shock(non operation)	-20℃/30 min ~ +70℃/30 min for a total 5 cycles, Start with cold temperature and end with high temperature.	A,B,C,D,E
Vibration Test	Sweep:10Hz~55Hz~10Hz 2G 2 hours for each direction of X. Y. Z. (6 hours for total)	A,B,C,D,E
Package Vibration Test	Random Vibration : 0.015G*G/Hz from 5-200HZ, -6dB/Octave from 200-500HZ 2 hours for each direction of X. Y. Z. (6 hours for total)	A,B,C,D,E
Package Drop Test	Height:60 cm 1 corner, 3 edges, 6 surfaces	A,B,C,D,E
Electro Static Discharge	Contact=+/-2KV, Air=+/-4KV,(R=330R,C=150pF), 1 sec,9point,10times/point;	TBD

※Criterion:

A.LCM each function is OK.

B.LCM appearance inspection without abnormalities (Including scratch, damage, corrosion and serious deformation)

C.LCM brightness above the Min. value of Spec.

D. Luminance uniformity above the Min. value of Spec.

E. Color chromaticity within tolerance range

9. Packing Specification

TBD

10. Precautions

10.1. Handling Precautions

10.1.1. The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.

10.1.2. Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

10.1.3. The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

10.1.4. If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:

- Isopropyl alcohol
- Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:

- Water
- Ketone
- Aromatic solvents

10.1.5. Do not attempt to disassemble the LCD Module.

10.1.6. If the logic circuit power is off, do not apply the input signals.

10.1.7. To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

10.1.8. Be sure to ground the body when handling the LCD Modules.

10.1.9. Tools required for assembly, such as soldering irons, must be properly ground.

10.1.10. To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

10.1.11. The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.

10.2. Storage Precautions

When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:

Temperature : 0℃ ～ 40℃ Relatively humidity: ≤80%

The LCD modules should be stored in the room without acid, alkali and harmful gas.

10.3. Transportation Precautions

The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.