

Product Specification

Customer:

Basic Model:

SAT101BO50R04D-FG235143TK

Model Name:

10.1"

ERP NO.:

1091010040

☒ **Preliminary Specification**

☐ **Final Specification**

Approved by	Comment

Prepared by	Reviewed by	Approved by

Revision Status

Version	Revise Date	Page	Content	Modified by
V1.0	2020.07.20	-	First Issued.	LHR

Table of Contents

NO.	CONTENTS	PAGE
	Revision Status.....	2
	Table of Contents.....	3
1.	General Description.....	4
1.1.	LCM Characteristics.....	4
1.2.	Touch Characteristics.....	5
2.	PIN Description.....	6
2.1	LCM PIN Description.....	6
2.2	TP PIN Description.....	7
3.	Electrical Characteristics.....	8
3.1	Absolute Maximum Ratings.....	8
3.1.1	Typical Operation Range.....	8
3.1.2	Current Consumption.....	9
3.1.3	Backlight Driving Conditions.....	9
3.2	Power Sequence.....	10
3.3	Timing Characteristics.....	12
3.3.1	AC Electrical Characteristics.....	12
3.3.2	Input Clock and Data Timing Diagram.....	12
3.3.3	Timing.....	13
3.3.4	Data Input Format.....	14
4.	Sequential Chart.....	15
4.1	Reset input timings.....	15
4.2	Timings for DSI Video mode.....	16
5.	Optical Characteristics.....	17
6.	Reliability Test Items.....	20
7.	General Precaution.....	21
8.	Numbering System.....	22
9.	Mechanical Specification.....	23
10.	Package Drawing.....	24

1. General Description

10.1" is a color active matrix thin film transistor (TFT) TN liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. It is composed of a TFT LCD panel, Driver IC, FPC and Backlight.

1.1 LCD Characteristics

No.	Item	Specification	Remark
1	LCD size	10.1 inch(Diagonal)	
2	Driver element	a-Si TFT active matrix	
3	Resolution	1024 × 3(RGB) × 600	
4	Display mode	Normally White, Transmissive	
5	Pixel pitch	0.2175(H) X 0.2088(V) X RGB mm	
6	Active area	222.72(H) X 125.28(V) mm	
7	Outline dimensions	235(H) X 143(V) X 5.0(D) mm	
8	Surface treatment	Anti-Glare	
9	Color arrangement	RGB-stripe	
10	Interface	TTL RGB-24bit parallel interface	
11	Backlight Power consumption	TBD	
12	Panel Power consumption	TBD	
13	Weight	TBD	

Note 1: Color tune is slightly changed by temperature and driving voltage.

Note 2: LCM weight tolerance: ±5%

1.2 Touch Characteristics

Parameter	Specification	Unit	Remarks
Type of Master IC	/	-	
Touch Structure	F+G	-	
ITO Film Out Size	235.0(W)x143.0(H)x0.188(D)	mm	
ITO Film View Area	225.72(W)x128.28(H)	mm	
ITO Film Action Area	222.72(W)x125.28(H)	mm	
ITO Glass Out Size	164.1(W)x99.2(H)x1.1(D)	mm	
Operating Voltage	5.0V	-	
Signal Voltage	5.0V	-	
Insulation Resistance	$\geq 20\text{M}\Omega$ DC 25V	-	
Transmittance	$\geq 76\%$	-	
Operating Temperature	-20 ℃ ~ 60 ℃	-	
Storage Temperature	-20 ℃ ~ 70 ℃	-	

2. PIN Description

2.1. LCM PIN Description

No.	Symbol	Function	Remarks
1-2	VLED+	Power for LED backlight(anode)	
3-4	VLED-	Power for LED backlight(Cathode)	
5	GND	Power Ground	
6	VCOM	Common Voltage	
7	DVDD	Power for Digital Circuit	
8	MODE	DE/SYNC mode select	
9	DE	Data input enable	
10	VS	Vertical Sync input	
11	HS	Horizontal Sync input	
12~19	B7~B0	Blue data	
20~37	G7~G0	Green data	
28~35	R7~R0	Red data	
36	GND	Power Ground	
37	DCLK	Sample clock	
38	GND	Power ground	
39	L/R	Left/right selection	
40	U/D	Up/Down selection	
41	VGH	Gate On Voltage	
42	VGL	Gate Off Voltage	
43	AVDD	Power for Analog Circuit	
44	RESET	Global reset pin	
45	NC	No connection	
46	VCOM	Common Voltage	
47	DITHB	Dithering function	
48	GND	Power ground	
49-50	NC	GND	

2.2. TP PIN Description

[illegible]

3. Electrical Characteristics

3.1. Absolute Maximum Ratings

Voltage (AGND=GND=0V, Ta = 25°C)

Item	Symbol	Values		Unit	Remark
		Min.	Max.		
Power Voltage	DVDD	-0.3	5.0	V	
	AVDD	-0.5	15	V	
	VGH	-0.3	40.0	V	
	VGL	-20.0	0.3	V	
	VGH-VGL	-	40.0	V	
Operating Temperature	T _{op}	-20	55	°C	
Storage Temperature	T _{st}	-20	60	°C	

Note: The absolute maximum rating values of this product are not allowed to be exceeded at any time. Should a module be used with any of the absolute maximum ratings case, the module may be permanently destroyed.

3.1.1. Typical Operation Range

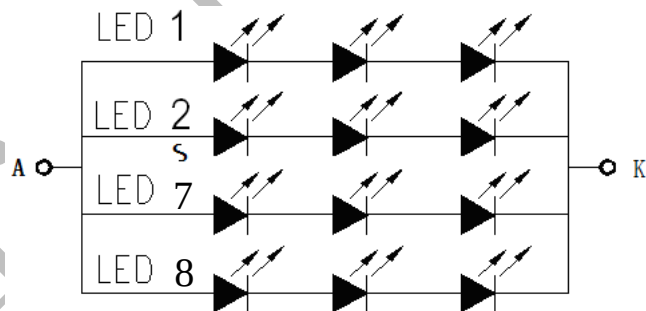
Item	Symbol	values			Unit
		Min.	Typ.	Max.	
Power Voltage	DVDD	3.0	3.3	3.6	V
	AVDD	10.65	10.85	11.05	
	VGH	17	18	19	
	VGL	-7	-6	-5	
	VCOM	3.6	3.8	4.0	
Input logic high voltage	V _{IH}	0.7DV _{DD}	-	DV _{DD}	V
Input logic low voltage	V _{IL}	0	-	0.3DV _{DD}	V

3.1.2. Current Consumption

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Current for Driver	I_{GH}	-	5.6	-	mA	$V_{GH} = 21V$
	I_{GL}	-	8.1	-	mA	$V_{GL} = -5.5V$
	IDV_{DD}	-	12.2	-	mA	$V_{DD} = 3.3V$
	IAV_{DD}	-	29.7	-	mA	$AV_{DD} = 10.85V$

3.1.3. Backlight Driving Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Supply voltage of white LED backlight	VL	8.7	9.6	10.5	V	Note 1
Current for LED backlight	IL	120	160	200	mA	
Luminance (on the module surface,BM-7)		130	180	-	cd/m ²	
LED life time	-	30,000	-	-	Hr	Note 2

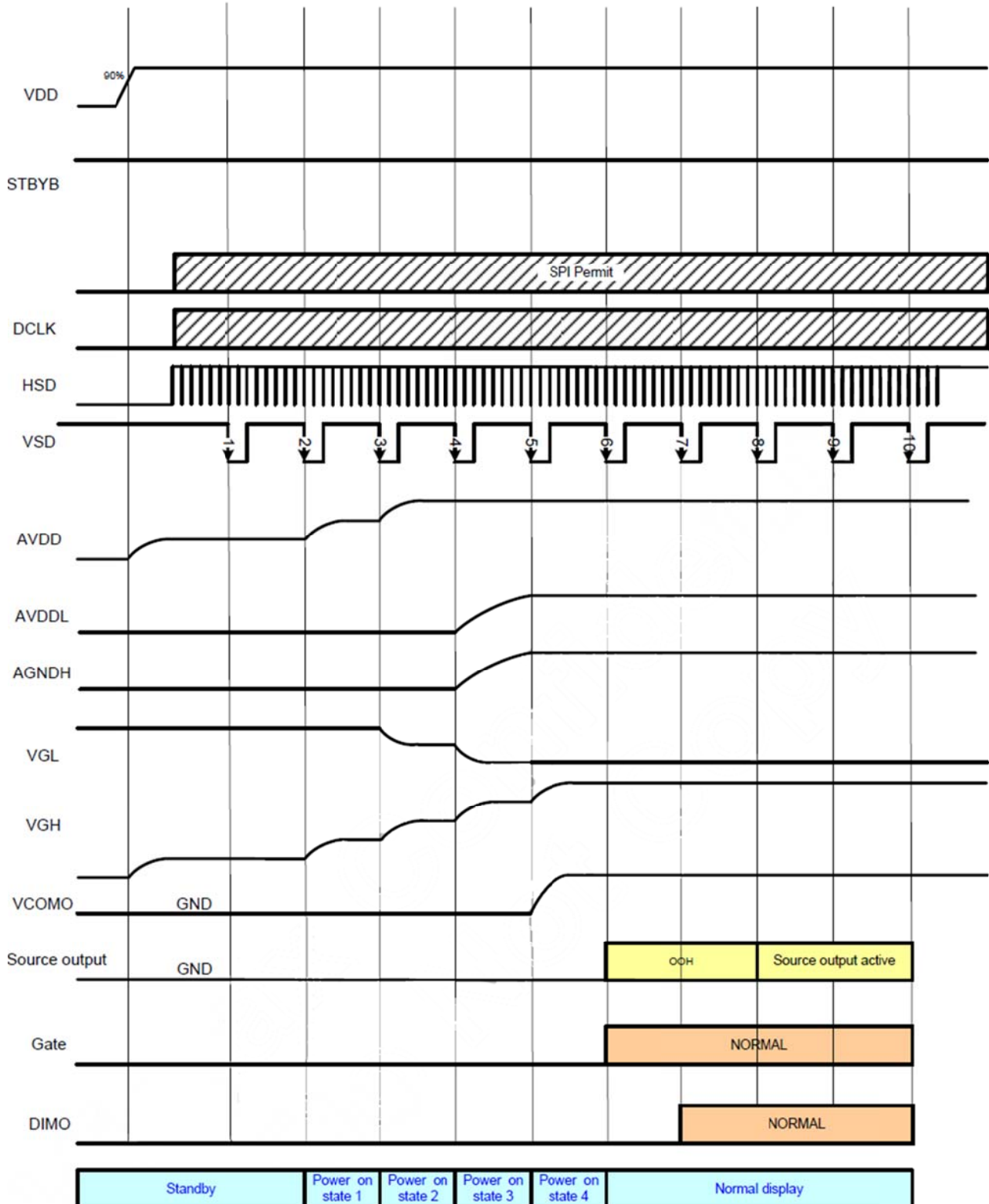


3.2. Power Sequence

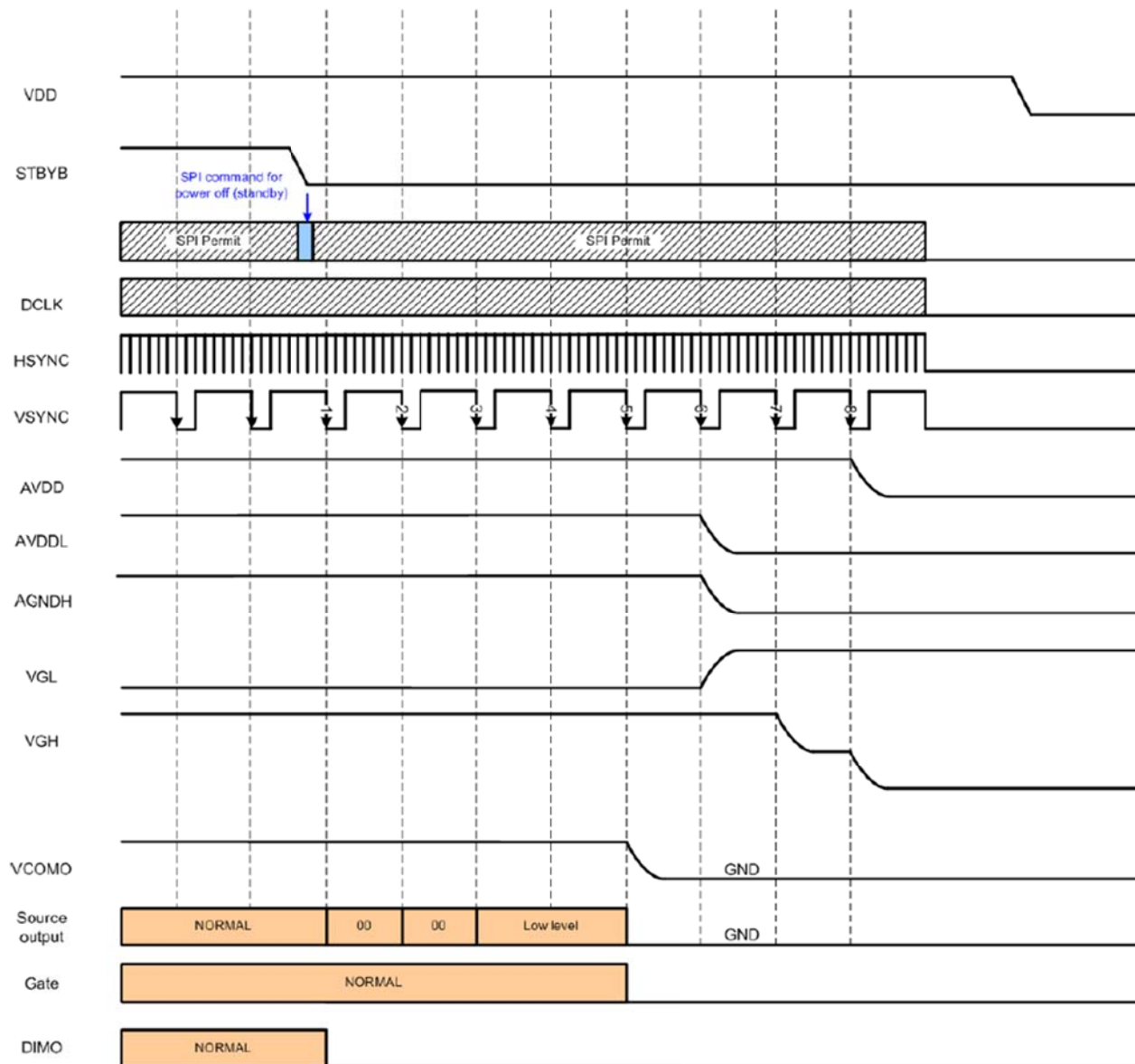
To prevent the device damage from latch up, the power on/off sequence shown below must be followed.

Power on: VDD, GND → AVDD, AGND → V1 to V14

Power off: V1 to V14 → AVDD, AGND → VDD, GND



Power on timing sequence



Power off timing sequence

Note: Low level=3FH, when NBW=L (Normally white)

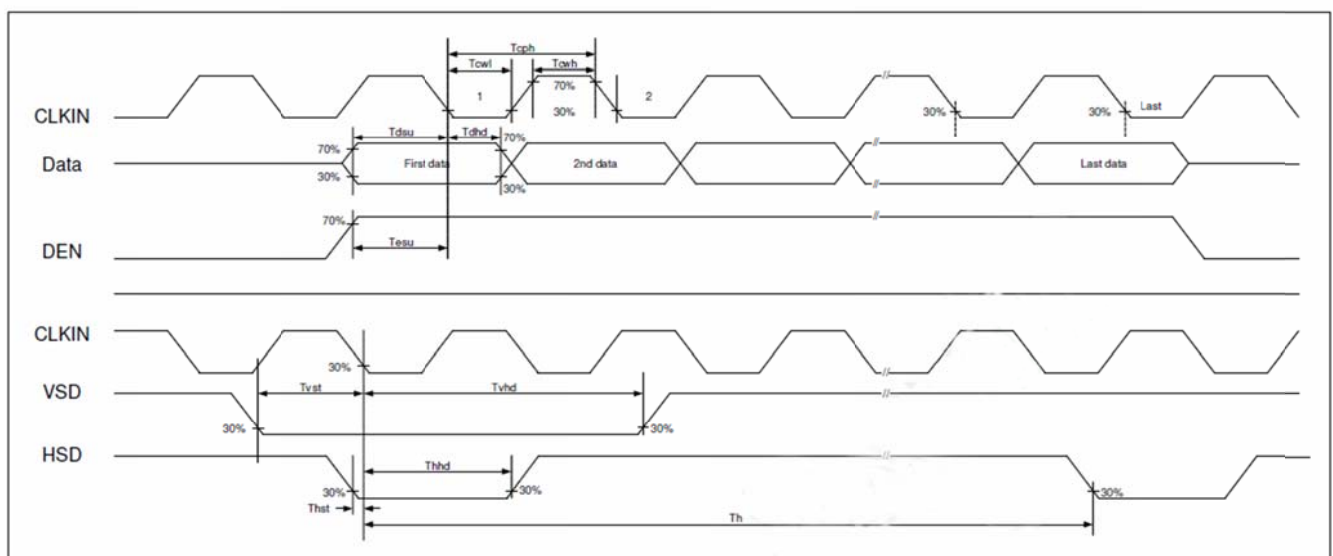
Low level=00H, when NBW=H (Normally black)

3.3. Timing Characteristics

3.3.1. AC Electrical Characteristics

Parameter	Symbol	Spec.			Unit	Condition
		Min.	Typ.	Max.		
VDD Power On Slew rate	T_{POR}	-	-	20	ms	From 0V to 90% VDD
GRB pulse width	T_{Rst}	50	-	-	us	DCLK=65MHz
DCLK cycle time	T_{cph}	14	-	-	ns	
DCLK pulse duty	T_{cwh}	40	50	60	%	
VSD setup time	T_{vst}	5	-	-	ns	
VSD hold time	T_{vhd}	5	-	-	ns	
HSD setup time	T_{hst}	5	-	-	ns	
HSD hold time	T_{hhd}	5	-	-	ns	
Data set-up time	T_{dsu}	5	-	-	ns	D0[7:0], D1[7:0], D2[7:0] to DCLK
Data hold time	T_{dhd}	5	-	-	ns	D0[7:0], D1[7:0], D2[7:0] to DCLK
DE setup time	T_{esu}	5	-	-	ns	
DE hold time	T_{ehd}	5	-	-	ns	
Output stable time	T_{sst}	-	-	6	us	10% to 90% target voltage.CL=90pF, R=10K ohm(Cascade)
				3		Dual gate

3.3.2. Input Clock and Data Timing Diagram



3.3.3. Timing

DE mode

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
DCLK Frequency	fclk	40.8	51.2	67.2	MHz
Horizontal Display Area	thd	1024			DCLK
HSD Period	th	1114	1344	1400	DCLK
HSD Blanking	thb+ thfp	90	320	376	DCLK
Vertical Display Area	tvd	600			TH
VSD Period	tv	610	635	800	TH
VSD Blanking	tvbp+ tvfp	10	35	200	TH

HV mode

Horizontal timing

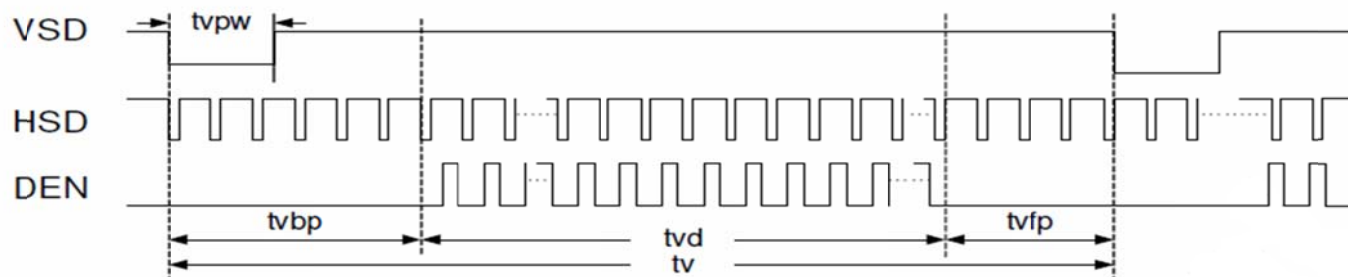
Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
DCLK Frequency	fclk	44.9	51.2	63	MHz
Horizontal Display Area	thd	1024			DCLK
HSD Period	th	1200	1344	1400	DCLK
HSD Pulse Width	thpw	1	-	140	DCLK
HSD Back Porch	thbp	160			DCLK
HSD Front Porch	thfp	16	160	216	DCLK

Vertical Timing

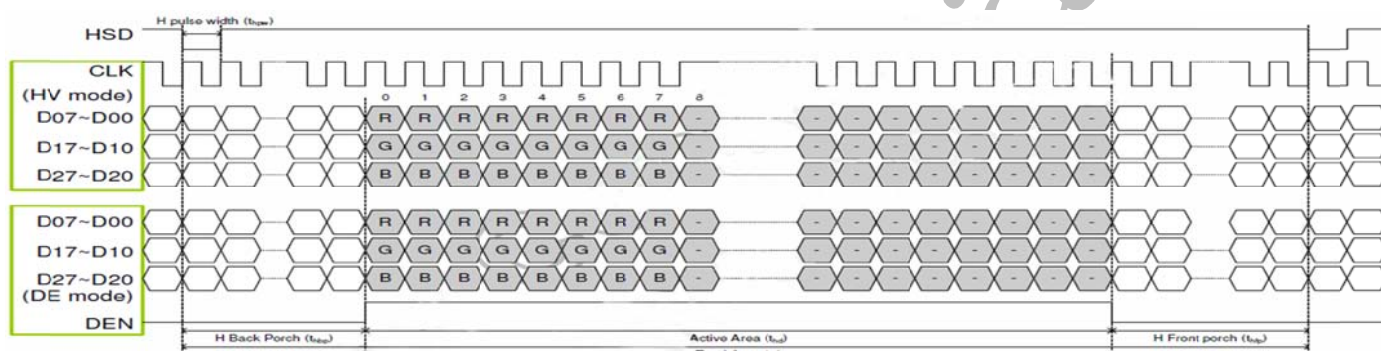
Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
Vertical Display Area	tvd	600			TH
VSD Period	tv	624	635	750	TH
VSD Pulse Width	tvpw	1	-	20	TH
VSD Back Porch	tvbp	23			TH
VSD Front Porch	tvfp	1	12	127	TH

3.3.4. Data Input Format

Vertical Timing

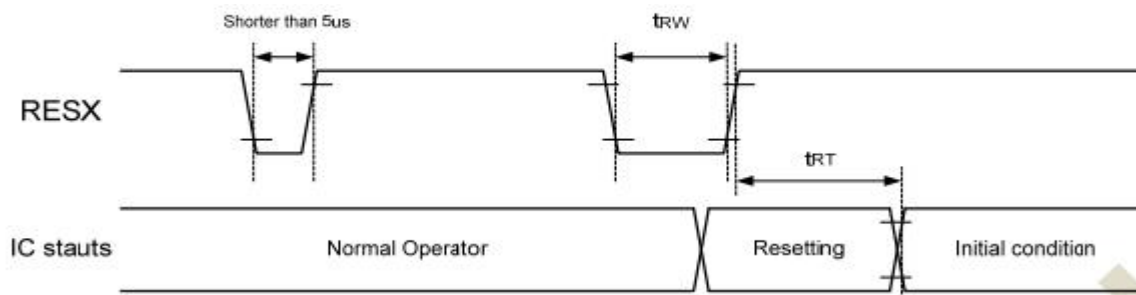


Horizontal Timing



4. Sequential Chart

4.1 Reset input timings



Symbol	Parameter	Related pins	Min.	Max.	Unit
t_{RW}	Reset pulse width ⁽²⁾	RESX	10	-	μs
t_{RT}	Reset complete time ⁽³⁾	-	-	5 (Note 5)	ms
		-	-	120 (Note 6, 7)	ms

Note:

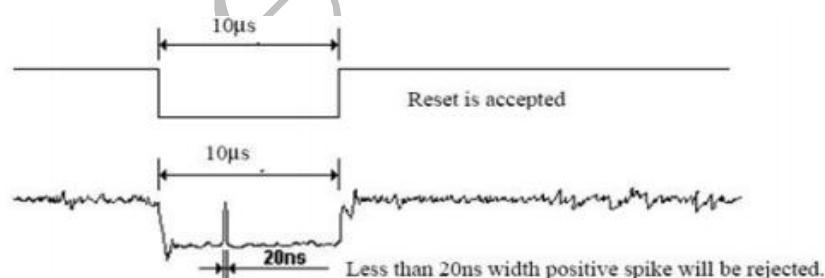
(1) The reset complete time also required time for loading ID bytes from OTP to registers. This loading is done every time when there is HW reset cancel time (t_{RT}) within 5 ms after a rising edge of RESX.

(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 5 μs	Reset Rejected
Longer than 10 μs	Reset
Between 5 μs and 10 μs	Reset Start

(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 returns to Default condition for H/W reset.

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



(5) When Reset is applied during Sleep In Mode.

(6) When Reset is applied during Sleep Out Mode.

(7) It is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120msec.

4.2. Timings for DSI Video mode

Vertical Timings

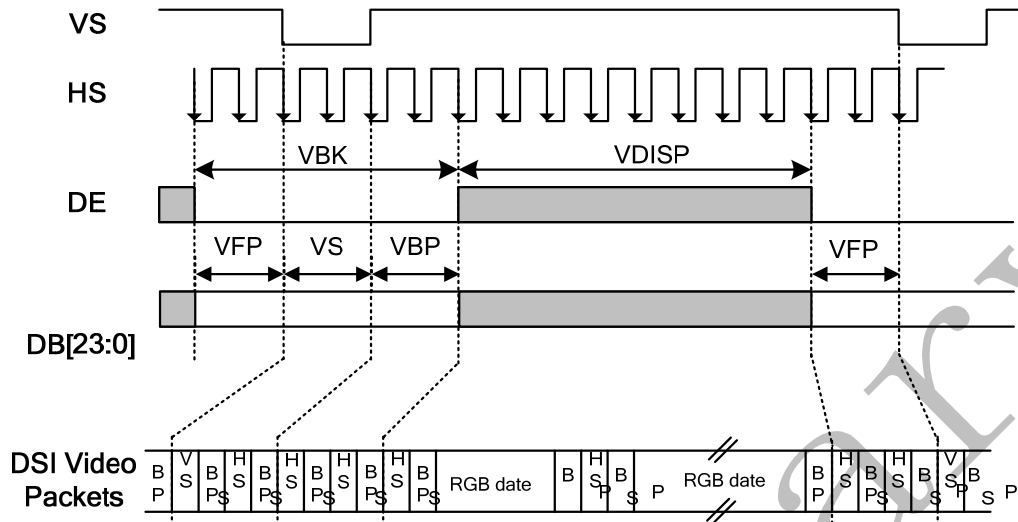


Figure 11.9: Vertical Timings for DPI I/F

Resolution=800x1280($T_A=25^{\circ}\text{C}$, IOVCC=1.8V, VCIP=2.8V, VCI=2.8V)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Vertical low pulse width	VS	-	2	4	200 Note(1)	Line
Vertical front porch	VFP	-	4	20	200	Line
Vertical back porch	VBP	-	2	10	200 Note(1)	Line
Vertical blanking period	VBK	VS+VBP+VFP	8	34	250	Line
Vertical active area	-	VDISP	-	1280	-	Line
Vertical Refresh rate	VRR	-	-	60	-	Hz

Note: (1) The VS and VBP pulse width are related to GIP start pulse and GIP clock pulse timing. The GIP start pulse and GIP clock pulse must be set at corresponding position for LCD normal display.

Resolution=768x1280 ($T_A=25^{\circ}\text{C}$, IOVCC=1.8V, VCIP=2.8V, VCI=2.8V)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Vertical low pulse width	VS	-	2	-	200 Note(1)	Line
Vertical front porch	VFP	-	4	-	200	Line
Vertical back porch	VBP	-	2	-	200 Note(1)	Line
Vertical blanking period	VBK	VS+VBP+VFP	8	-	250	Line
Vertical active area	-	VDISP	-	1280	-	Line
Vertical Refresh rate	VRR	-	-	60	-	Hz

Note: (1) The VS and VBP pulse width are related to GIP start pulse and GIP clock pulse timing. The GIP start pulse and GIP clock pulse must be set at corresponding position for LCD normal display.

5.Optical Characteristics

Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles		θT	CR≥10	30	40	--	Degree	Note1
		θB		40	50	--		
		θL		40	50	--		
		θR		40	50	--		
Contrast Ratio		CR	θ=0°	400	450	--		Note4
Response Time		T _{ON} + T _{OFF}	25℃	--	8	--	ms	Note3
Chromaticity	White	x	Backlight is on	0.242	0.282	0.322		Note2 Note5 Note6
		y		0.282	0.321	0.362		
	Red	x		0.547	0.577	0.607		
		y		0.310	0.340	0.370		
	Green	x		0.285	0.315	0.345		
		y		0.588	0.618	0.648		
	Blue	x		0.119	0.149	0.179		
		y		0.094	0.124	0.154		
Uniformity		U		70	75	--	%	Note7
NTSC				--	52	--	%	
Luminance		L		130	180	--	cd/m ²	Note6

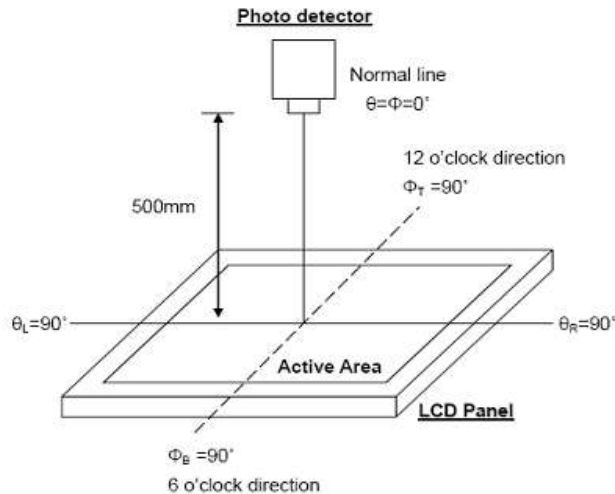
Note: The parameter is slightly changed by temperature, driving voltage and materiel

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 BM-7 (Φ8mm)

Measuring condition:

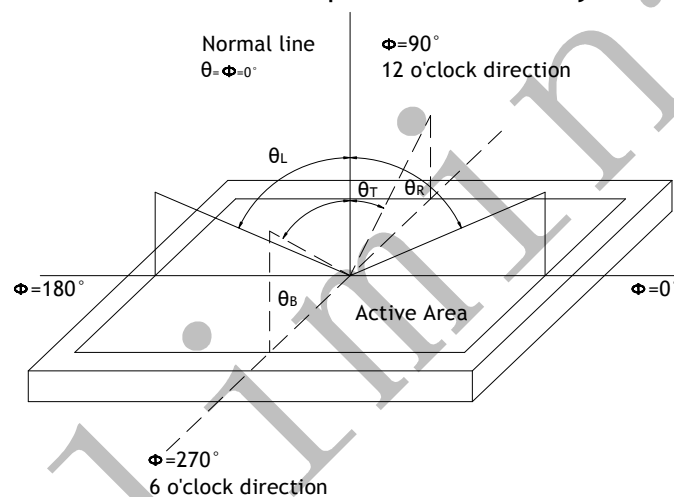
- Measuring surroundings: Dark room.
- Measuring temperature: Ta=25°C.
- Adjust operating voltage to get optimum contrast at the center of the display.

The measured value is more than 5 minutes at the center point of the LCD panel, and the backlight is turned on at the same time.



Note2: Definition of viewing angle range and measurement system

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



Note3: Definition of Response time

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

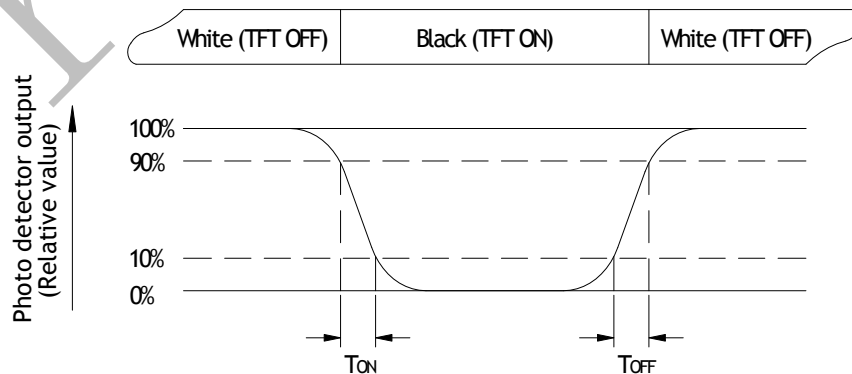


Fig. 6-3 Definition of response time

Note4: Definition of contrast ratio

Luminance measured when LCD on the Whitestate

Contrast ratio(CR)= **Luminance measured when LCD on the Blackstate**

“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.

Note5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

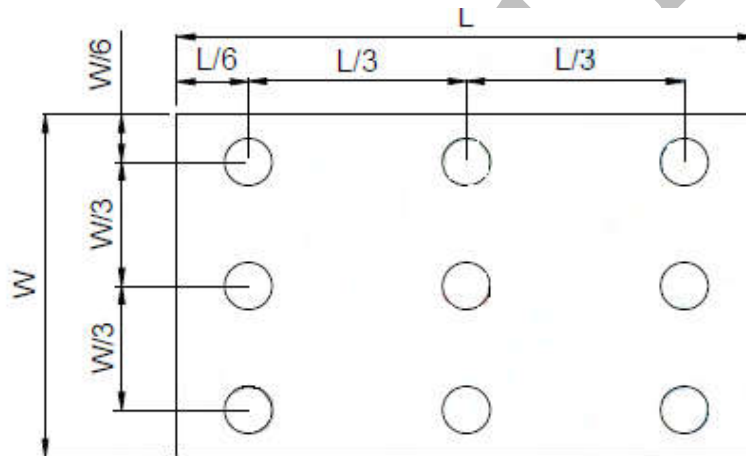
Note6: All input terminals LCD panel must be ground while measuring the center area of the panel. The LED driving condition is IL=180mA.

Note7: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas. Every measuring point is placed at the center of each measuring area.

Luminance Uniformity (U) = L_{min} / L_{max}

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



Bmax: The measured maximum luminance of all measurement position.

Bmin: The measured minimum luminance of all measurement position.

6. Reliability Test Items

Item	Test Conditions	Remark
High Temperature Storage	Ta=70℃;24Hrs	Note1 ,Note4
Low Temperature Storage	Ta=-20℃;24Hrs	Note1, Note4
High Temperature Operation	Ts=60℃;24Hrs	Note2 ,Note4
Low Temperature Operation	Ts=-10℃;24Hrs	Note4
Operation at High Temperature and Humidity	+40℃,90%RH;24Hrs (no condensation)	Note4
Thermal Shock	-10℃/30min~+55℃/30min for a total 48 cycles	Start with cold temperature and end with high temperature
Package Drop Test	Height 60cm 1corner , 3edges , 6surfaces	
Elector Static Discharge	150pF/330Ω, Contact: ±2KV,Air: ±4KV	Human Body Mode
Image Sticking	25℃ ; 30min	Note5

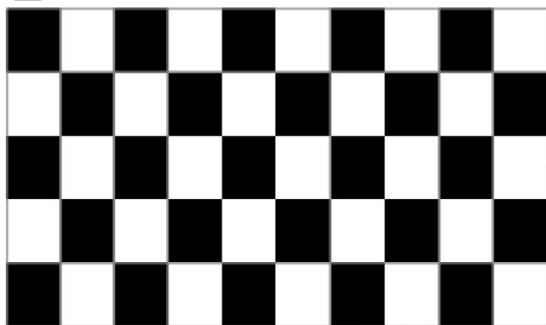
Note1: Ta is the ambient temperature of samples.

Note2: Ts is the temperature of panel's surfaces.

Note3: In the standard condition, there shall be no practical problem that may affect the display function. After the reliability test, the product only guarantees operation, but don't guarantee all of the cosmetic specification.

Note4: before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.

Note5: Condition of image sticking test :25℃±2℃ , Operation with test pattern sustained for 30min,then change to gray pattern immediately. after 5 mins, the mura must be disappeared completely.



(a) Test Pattern (chess board Pattern)



(b) Gray Pattern (127 Gray)

7. General Precaution

7.1 Safety

1. Do not swallow any liquid crystal, even if there is no proof that liquid crystal is poisonous.
2. If the LCD panel breaks, be careful not to get liquid crystal to touch your skin.
3. If skin is exposed to liquid crystal, wash the area thoroughly with alcohol or soap.

7.2 Storage Conditions

1. Store the panel or module in a dark place where the temperature is $23 \pm 5^{\circ} \text{C}$ and the humidity is below $50 \pm 20\% \text{RH}$.
2. Store in anti-static electricity container.
3. Store in clean environment, free from dust, active gas, and solvent.
4. Do not place the module near organic solvents or corrosive gases.
5. Do not crush, shake, or jolt the module.

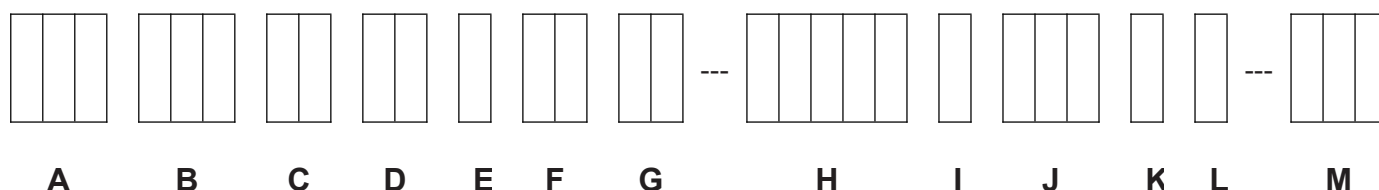
7.3 Handling Precautions

- (1) Avoid static electricity which can damage the CMOS LSI.
- (2) The polarizing plate of the display is very fragile. So, please handle it very carefully.
- (3) Do not give external shock.
- (4) Do not apply excessive force on the surface.
- (5) Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of plate.
- (6) Do not use ketone solvent & Aromatic solvent, use with a soft cloth soaked with a cleaning naphtha solvent.
- (7) Do not operate it above the absolute maximum rating.
- (8) Do not remove the panel or frame from the module.
- (9) When the module is assembled, it should be attached to the system firmly. Be careful not to twist and bend the module.
- (10) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, staining and discoloration may occur.
- (11) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs or clothes, it must be washed away thoroughly with soap.

7.4 Warranty

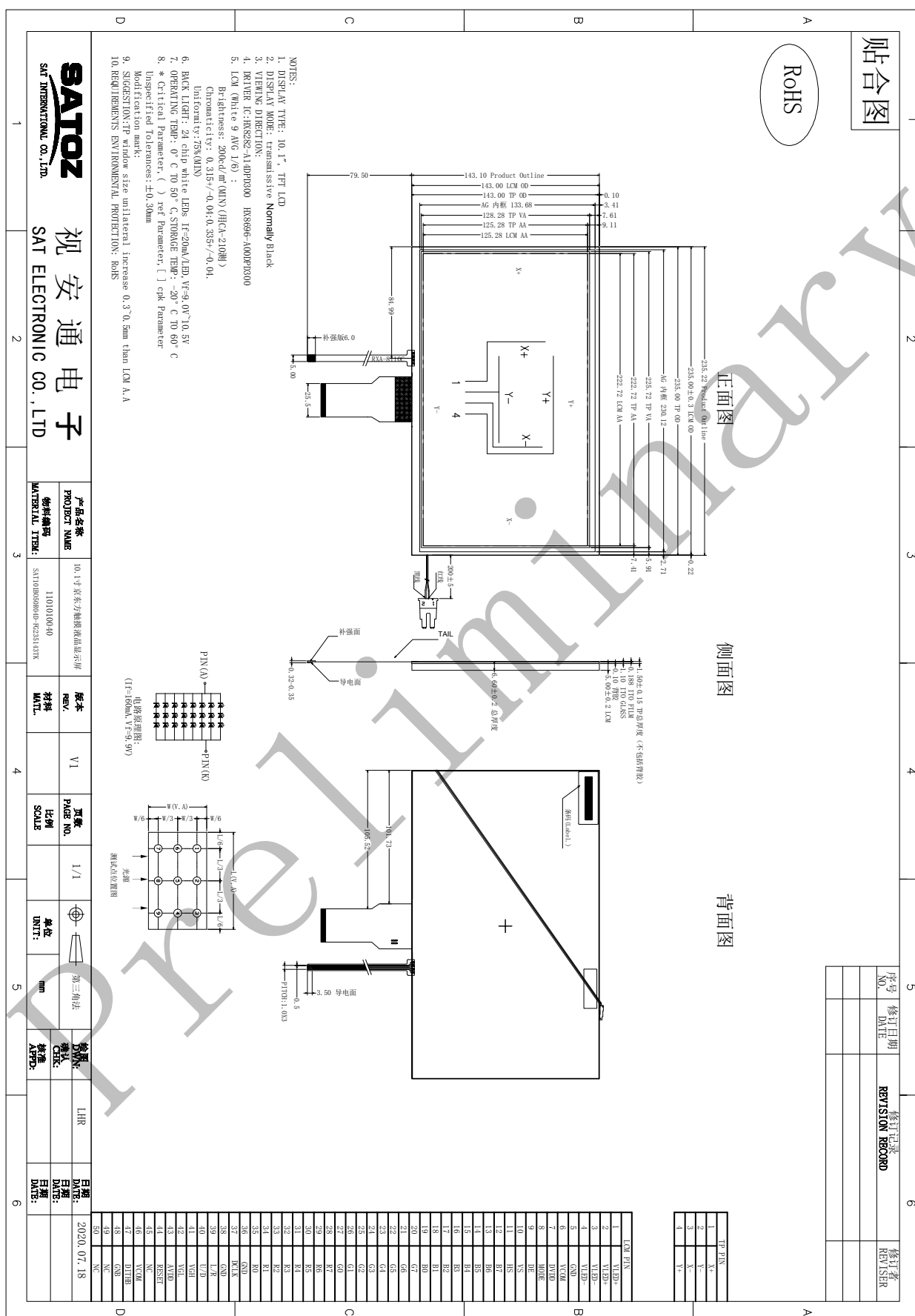
- (1) The period is within twelve months since the date of shipping out under normal using and storage conditions.
- (2) Do not repaired or modified the LCM. It may cause function to lose efficacy. PINGBO does not warrant the LCM.
- (3) All process and material comply ROHS.

8. Numbering System



NO.	Definition	Specifications
A	Company code	SAT INTERNATIONAL CO.LTD.
B	Display monitor opposite angle line size	Unit : inch (size<10inch:take two integers;size>=10inch:takes three integers)
C	LCD Brands	AU-AUO; CP-CPT; IV-IVO; TM-TIANMA; HS-HSD; CM-CMO; BO-BOE; AT--INNOLUX;
D	Interface PIN Number	Arabic numerals from 01 to 99
E	LCD Type	A--Alternated Video Signal; D--Data Video Signal; H--High Definition ; I--IPS
F	Backlight LED Number	Arabic numerals from 01 to 99
G	Backlight Color Are	Include R1、R2、Y0、Y1、B1、B2;
H	Structure Size	Include module length and width size
I	Interface Mode	T:TTL L:LVDS M:MIPI
J	FPC Length	It represents the length of FPC with three figures, divided into long rows ,middle rows and short rows
K	View Angles	Z : represent narrow viewing angle K : represent wide viewing angle I : represent all viewing angle
L	Operating Mode	D: DE mode V: VSD mode F: Inverting mode N: No mode requirements
M	Suffix	1. NULL ; 2. TP/CTP-- Touch panel; 3. other--Insignificance

9. Mechanical Drawing



10.Package Drawing

