Customer	
Customer NO.	PV09705W0230E
Approve By	

For Solution ---9.7 inch ;1024(W)XRGBX768(H)

Owner:

Version: V01

Document ID: PV09705W0230E

Approved by

Record of Revisions

Rev	Date	Sub-Model	Description of change
V01	**July 6th , 2020**	**PV09705W0230E**	**Preliminary Product Specification was first issued.**

Table of contents

1. General description

1.1 Introduction

PV09705W0230E is a color active matrix thin film transistor (TFT) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. This model is composed of a TFT LCD panel, a driving circuit and a back light system. This TFT LCD has a 9.7 inch 4:3 diagonally measured active display area with XGA (1024 horizontal by 768 vertical pixel) resolution.

1.2 Features

9.7 inch configuration
6bit LVDS interface
LED Backlight
RoHS Compliance

1.3 Applications

Personal Navigation Device
Multimedia applications and Others AV system

1.4 General information

Item	Specification	Unit
Outline Dimension	210.2 x 162.7 x 2.8(Typ.)	mm
Display area	196.608(H) x 147.456(V)	mm
Number of Pixel	1024 RGB(H) x 768(V)	pixels
Pixel pitch	0.192 (H) x 0.192(V)	mm
Pixel arrangement	RGB Vertical stripe	
Display mode	Normally black	
Surface treatment	Antiglare, Hard-Coating(3H)	
Weight	250	g
Back-light	Single LED (Side-Light type)	
Power Consumption	3.36	w

1.5 Mechanical Information

item		Min.	Typ.	Max.	Unit
Module Size	Horizontal(H)	210.0	210.2	210.5	mm
	Vertical(V)	162.5	162.7	162.9	mm
	Depth(D)	2.6	2.8	3.0	mm

2.0 ABSOLUTE MAXIMUM RATINGS

2.1 Electrical Absolute Rating

2.1.1 TFT LCD Module

Item	Symbol	Min.	Max.	Unit.	Note
Power supply voltage	Vcc	-0.3	5.0	V	GND=0
	Vin	-0.5	5.0	V	GND=0
Logic Signal Input Level					

2.1.2 Back-Light Unit

Item	Symbol	MIN.	TYP.	MAX.	Unit	Note
Forward voltage	Vf	--	19.2	21.0	V	(1)(2)(3)
Forward current	If	--	120		mA	(1)(2) (3)
Power Consumption	PBL	--	2304		mW	

Note:

(1) Permanent damage may occur to the LCD module if beyond this specification. Functional operation should be restricted to the conditions described under normal operating conditions.

(2) Ta =25±2℃

(3) Test Condition: LED current 140 mA

2.2 Environment Absolute Rating

Item	**Symbol**	**Min.**	**Max.**	**Unit**	**Remarks**
Operating Temperature	**Topa**	**-20**	**+70**	℃	
Storage Temperature	**Tstg**	**-30**	**+80**	℃	

3.0 OPTICAL CHARACTERISTICS

3.1 Optical specification:

Item	Symbol	Temp.	Min.	Typ.	Max.	Unit	Condition
Response Time	Tg	25℃	--	20	25	msec	θ =0 °,φ=0 ° (Note 1,3)
		25℃	--				
Contrast Rate	Cr	25℃	700	900	--	--	θ =0 °, φ=0 ° LED:ON, LIGHT:OFF(Note1,2)
Brightness	YL	25℃	300	350		Cd/m2	(IL=120mA)(Note1,4)
Visual angle range front and rear	θ	25℃	(θ L) 85 (θ R)85			De-gree	Φ = 0°, CR≧10 LED:ON LIGHT:OFF(Note 1,4)
Visual angle range left and right	θ	25℃	(θ U) 85 (θ D) 85			De-gree	Φ =90°, CR≧10 LED:ON LIGHT:OFF(Note 1,4)
Brightness uniformity	BUNI		70			%	Θ =0(Note5,7)

Item	Symbol	Transmissive			Conditions
		Min.	Typ.	Max.	
Red	XR				Reference: LCD Panel, CIE (x, y) chromaticity (Note 1,4)
	YR				
Green	XG				
	YG				
Blue	XB				
	YB				
White	XW	0.246	0.296	0.346	
	YW	0.286	0.336	0.386	

3.2 Measuring Condition

Measuring surrounding: dark room ,LED current IL : 120mA

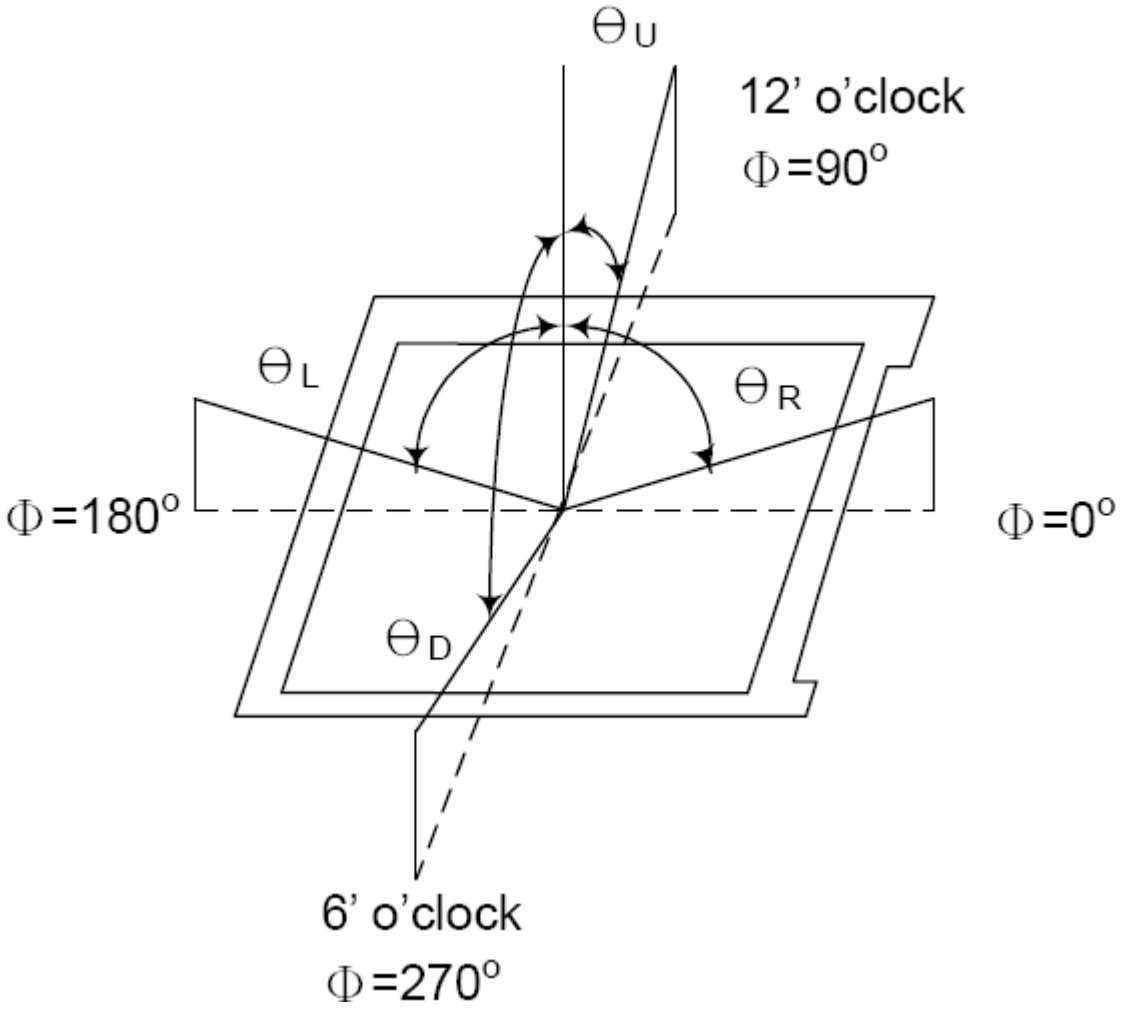
Ambient temperature: 25±2oC

15min. warm-up time.

3.3 Measuring Equipment

FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics. Measuring spot size: 20 ~ 21 mm

Note (1) Definition of Viewing Angle :

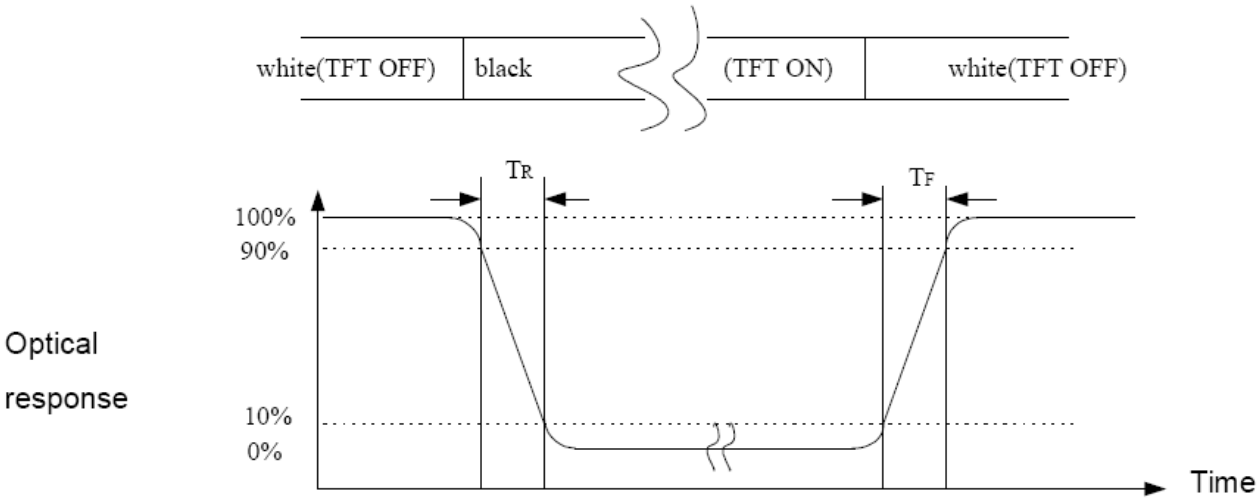


Note (2) Definition of Contrast Ratio (CR):

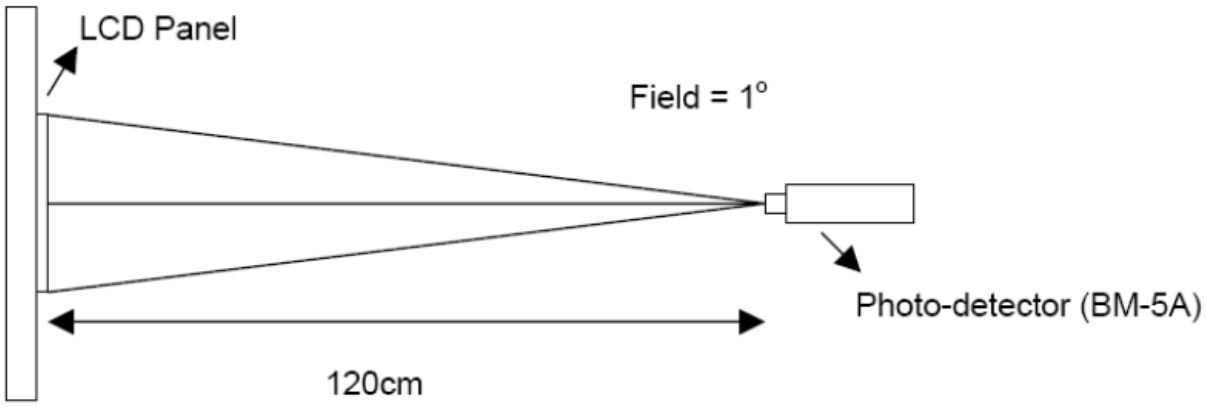
Measured at the center point of panel

$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

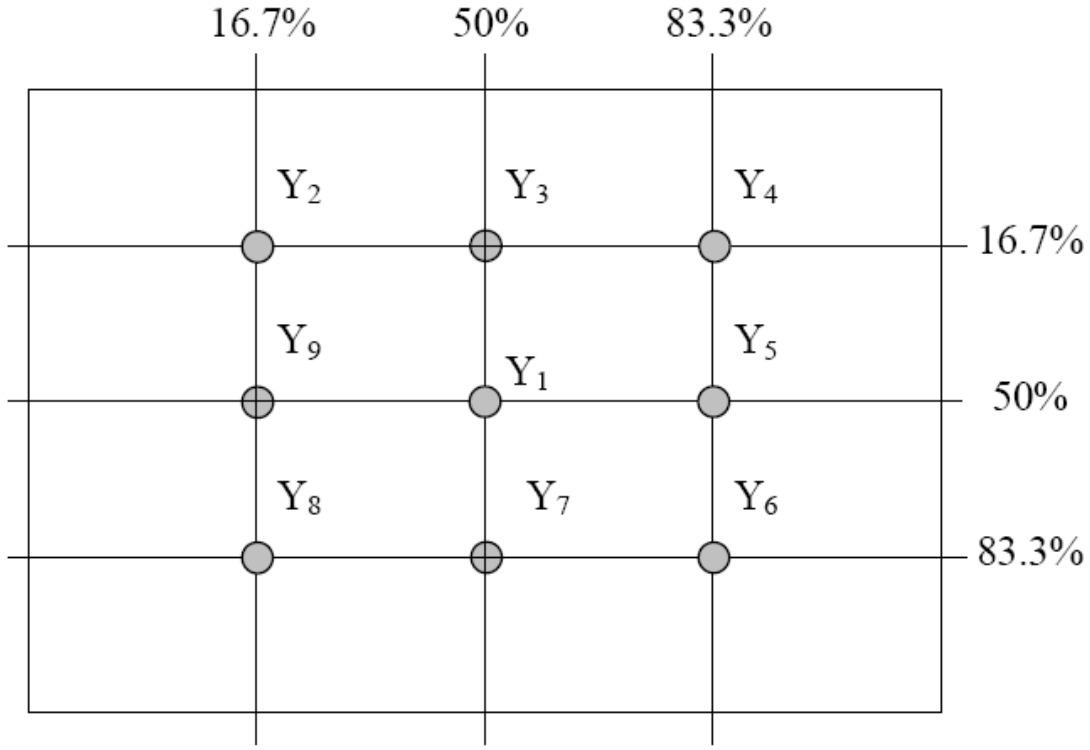
Note (3) Definition of Response Time: Sum of TR and TF



Note (4) Definition of optical measurement setup



Note (5) Definition of brightness uniformity



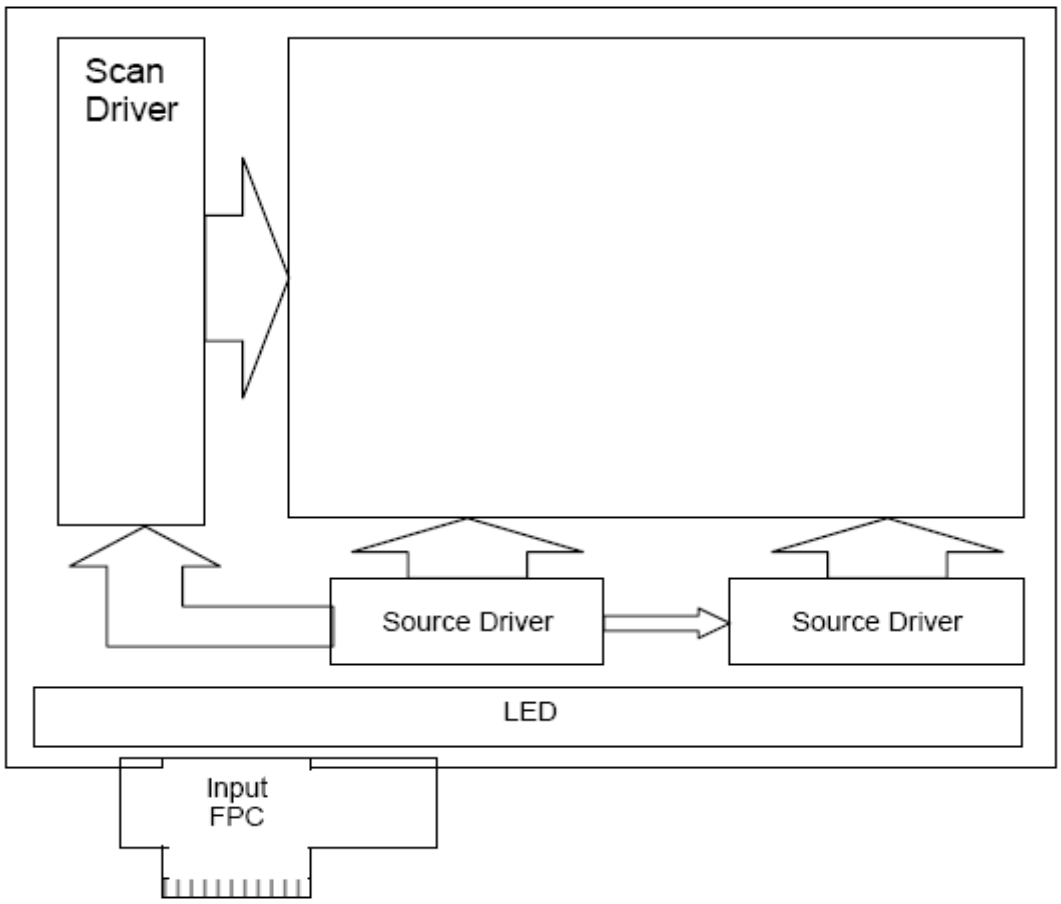
$$\text{Luminance uniformity} = \frac{\text{(Min Luminance of 9 points)}}{\text{(Max Luminance of 9 points)}} \times 100\%$$

Note (6) Rubbing Direction (The different Rubbing Direction will cause the different optimal view direction).

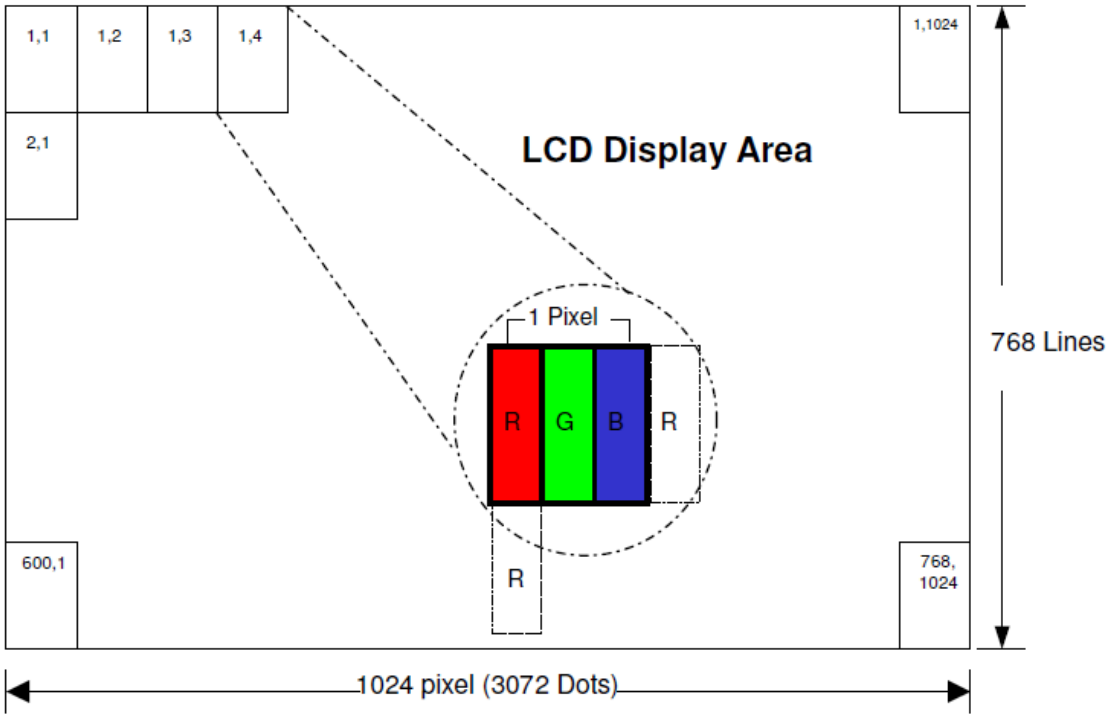
Note (7) Measured at the brightness of the panel when all terminals of LCD panel are electrically open.

4.0 BLOCK DIAGRAM

4.1 TFT LCD Module



4.2 Pixel Block



5.0 INTERFACE PIN CONNECTION

5.1 LVDS Pin assignment and the Connector type : MSAK240P30

Pin No.	Symbol	I/O	Function	Remark
1	GND	P	Ground	
2	VCC	P	Power Voltage for digital circuit	
3	VCC	P	Power Voltage for digital circuit	
4	VEEDID	P	DDC 3.3V	
5	GSP	--	Not connected	
6	CLK EEDID	I	DDC clock	
7	Data EEDID	I	DDC data	
8	RXIN0-	I	- LVDS differential data input	
9	RXIN0+	I	+ LVDS differential data input	
10	GND	P	Power ground	
11	RXIN1-	I	- LVDS differential data input	
12	RXIN1+	I	+ LVDS differential data input	
13	GND	P	Power ground	
14	RXIN2-	I	- LVDS differential data input	
15	RXIN2+	I	+ LVDS differential data input	
16	GND	P	Ground	
17	RXCLKIN-	I	- LVDS differential clock input	
18	RXCLKIN+	I	+ LVDS differential clock input	
19	GND	P	Ground	
20	NC	-	Not connected	
21	LED+	P	LED Anode	
22	LED+	P	LED Anode	
23	NC	--	Not connect	
24	LED-	P	LED cathode	
25	LED-	P	LED cathode	
26	LED-	P	LED cathode	
27	LED-	P	LED cathode	

28	LED-	P	LED cathode	
29	LED-	P	LED cathode	
30	NC	--	Not connected	

Note1：

I :Input Pin, O: Output Pin, P: Power/Ground ,N: No connected

Input voltage include R_{IN} 0-/ R_{IN} 0+、R_{IN} 1-/ R_{IN} 1+、R_{IN} 2-/ R_{IN} 2+、CIk_{IN} -/ CIk_{IN} + .
Ta means the ambient temperature.
It is necessary to limit the relative humidity to the specified temperature range.
Condensation on the module is not allowed.

6.0 ELECTRICAL CHARACTERISTICS

6.1 TFT LCD Module

Item	Symbol	Min.	Type	Max.	Unit.	Note
Power supply voltage	VCC	3.0	3.3	3.6	V	GND=0
						GND=0
						GND=0
Input signal voltage	Vih	0.7Vcc		Vcc	V	
	Vil	0		0.3Vcc	V	
Current of Power Supply	Idvdd	--	271	--	mA	Vcc=3.3V
	Iadd	--		--	mA	AVdd=10V(Black)
	Igh	--		--	mA	Vgh=15V
	Igl	--		--	mA	Vgl=-7V
Input level of V1-V5						
Input level of V6-V10						
LED Reverse Voltage	Vr	-		(5)		Each LED
LED Forward Current	If	-		(35)	V	Each LED

6.2 Back-Light Unit

The backlight system is an edge-lighting type with 36 LED.

The characteristics of the LED are shown in the following tables.

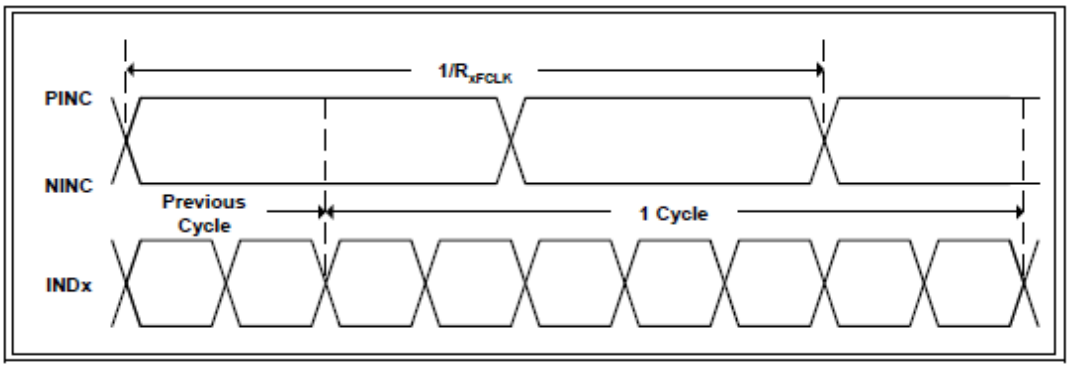
Item	Symbol	Min.	Typ.	Max.	Unit	Note
LED current	IL	-	120	-	mA	(2)
LED Voltage	VL	-	19.2	21.0	V	
Operating LED life time	Hr	50000	-	-	Hour	(1)(2)

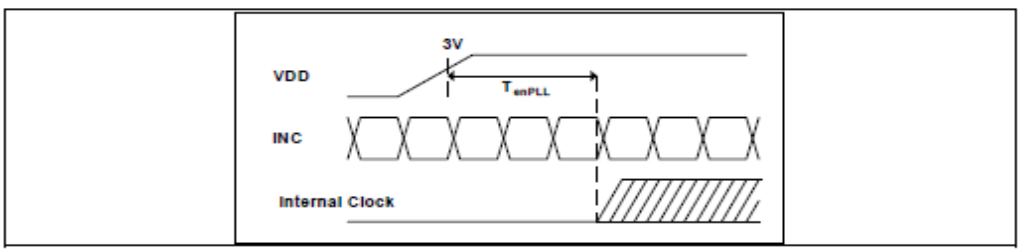
Note (1) LED life time (Hr) can be defined as the time in which it continues to operate under the condition: Ta=25±3 ℃, typical IL value indicated in the above table until the brightness becomes less than 50%.

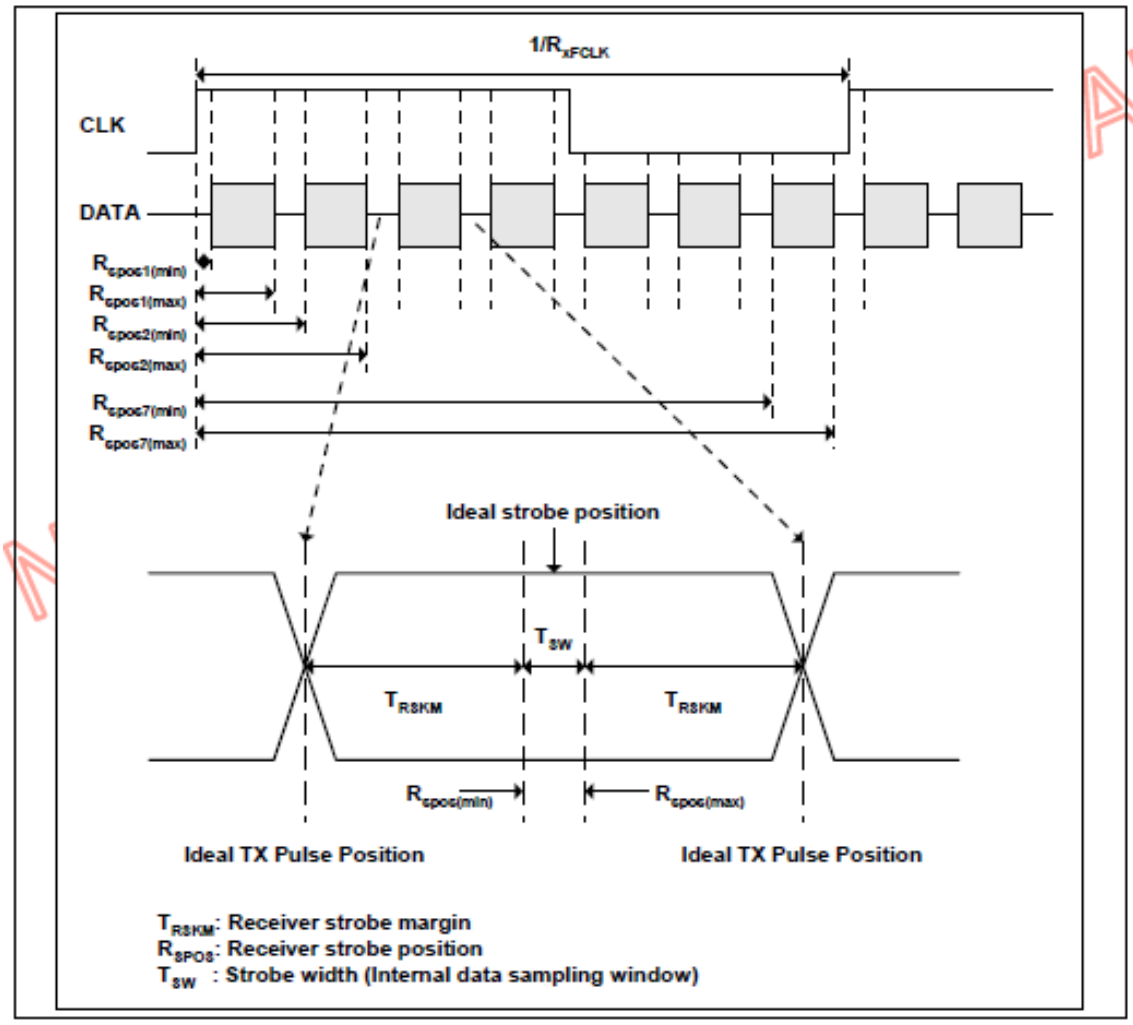
Note (2) The "LED life time" is defined as the module brightness decrease to 50% original brightness at Ta=25℃ and IL=140mA. The LED lifetime could be decreased if operating IL is larger than 140mA. The constant current driving method is suggested.

6.3 AC Electronical characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Clock frequency	R_{xFCLK}	20		71	MHz	
Input data skew margin	T_{RSKM}	500			pS	$\|V_{ID}\|$ = 400mV R_{xVCM} = 1.2V R_{xFCLK} = 71 MHz
Clock high time	T_{LVCH}		4/(7* R_{xFCLK})		ns	
Clock low time	T_{LVCL}		3/(7* R_{xFCLK})		ns	
PLL wake-up time	T_{enPLL}			150	uS	







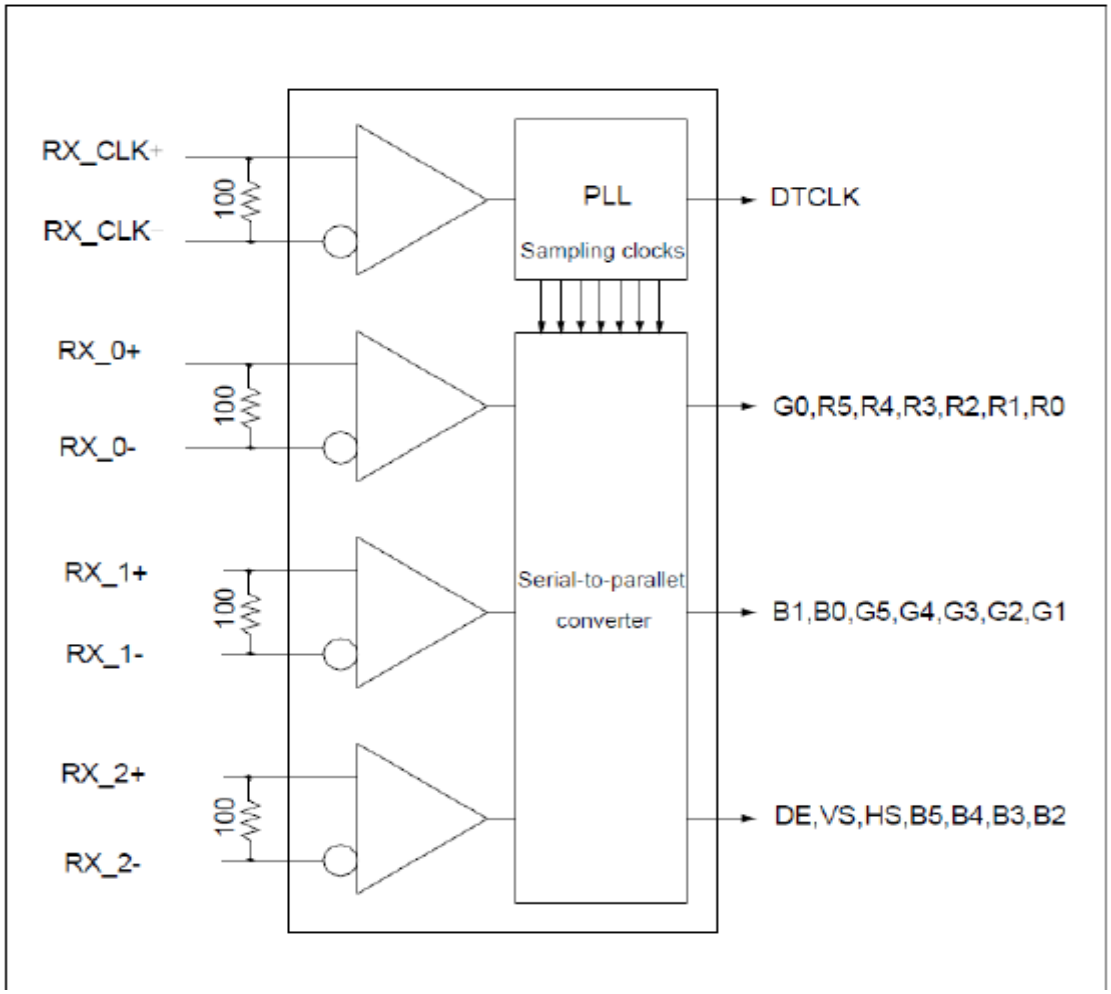
SSC torence of LVDS receiver						
Symbol	parameter	condition	Min.	Typ.	Max.	Units
SSCMF	Modulation Frequency		23		93	KHz
SSCMR	Modulation Rate	LVDS clock = 71MHz center spread			±3	%

Output timing table

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
DCLK Frequency	Fclk	-	65	71	MHz	VDD = 2.3V ~3.6V
DCLK Cycle Time	Tclk	14.1	15.4	-	ns	
DCLK Pulse Duty	Tcwh	40	50	60	%	Tclk
Time from HSD to Source Output	Thso	-	64	-	DCLK	
Time from HSD to LD	Thld	-	64	-	DCLK	
Time from HSD to STV	Thstv	-	2	-	DCLK	
Time from HSD to CKV	Thckv	-	20	-	DCLK	
Time from HSD to OEV	Thoev	-	4	-	DCLK	
LD Pulse Width	Twld	-	10	-	DCLK	
CKV Pulse Width	Twckv	-	66	-	DCLK	
OEV Pulse Width	Twoev	-	74	-	DCLK	

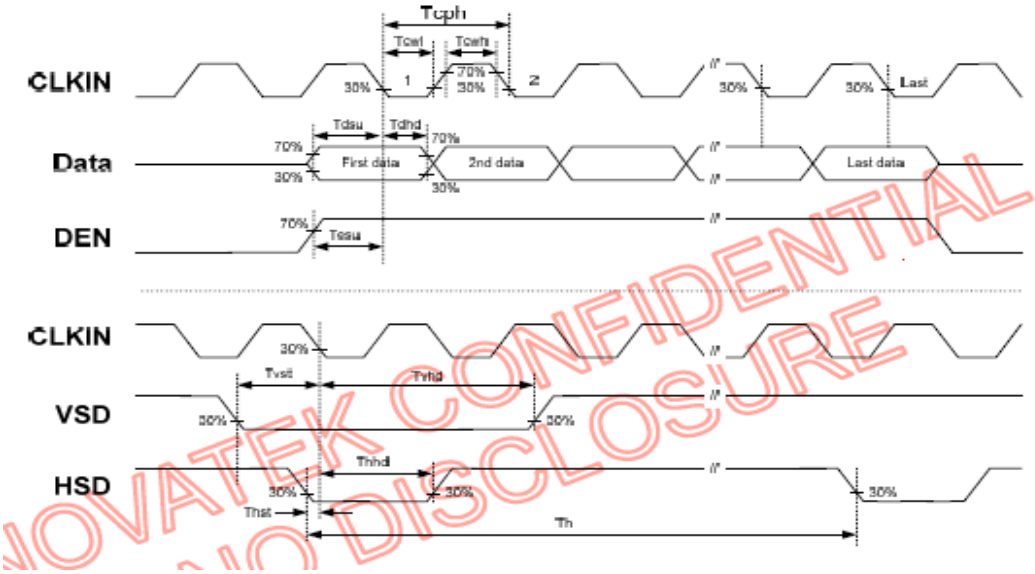
Data Map

LVDS Receiver internal Circuit



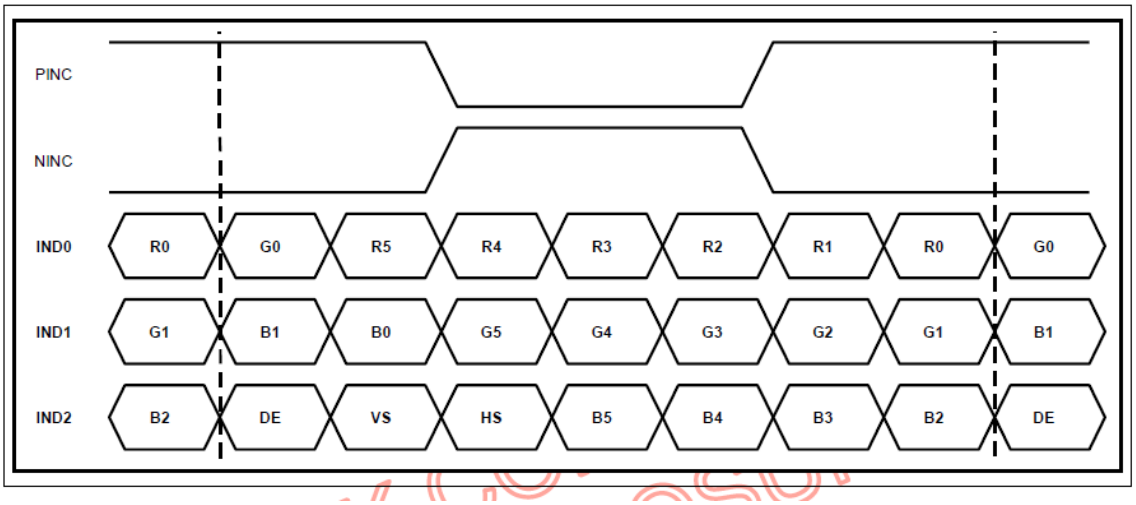
6.4 Timing Diagram

Input Clock and Data Timing Diagram



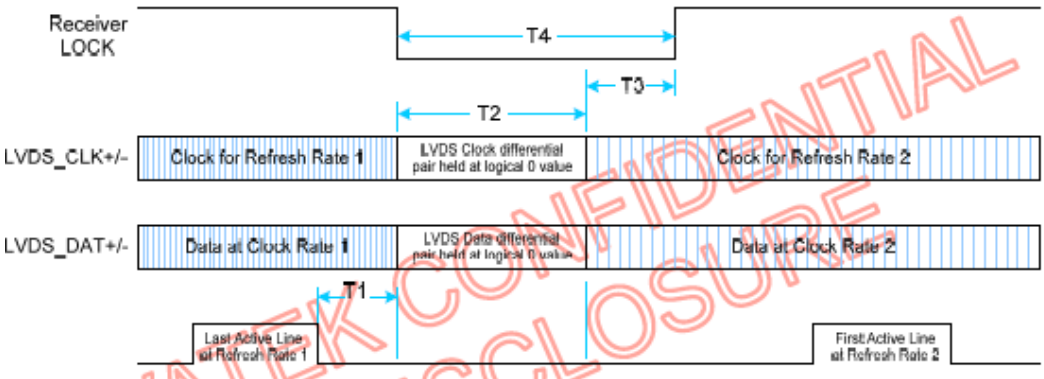
6.5:Data input format for LVDS.

6bit LVDS input



SDRRS (seamless display refresh rate switching)

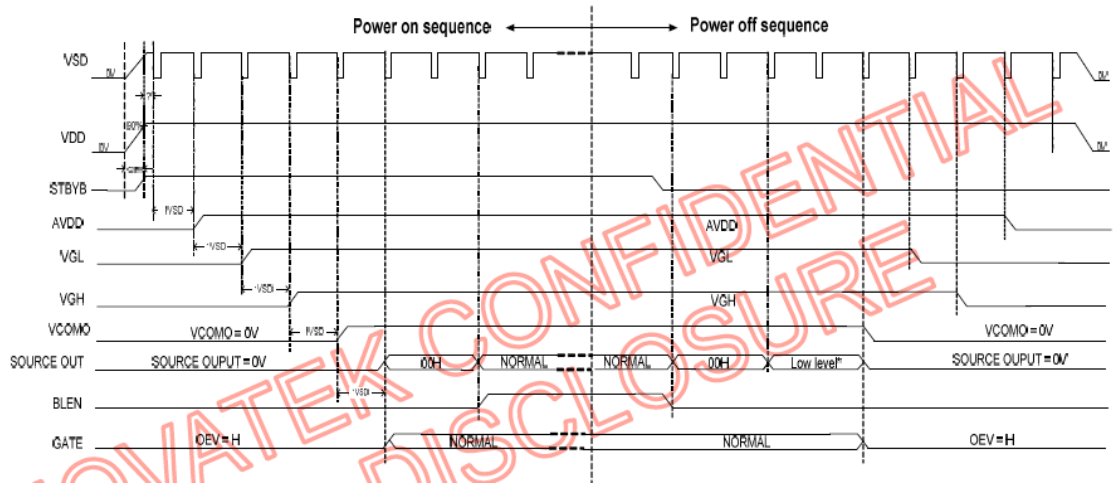
When Showing the still picture, it is accept to reduce the refresh rate from 60Hz to low refresh rate (for example 40Hz). The purpose is mainly for power saving. INTEL defined a timing chart switch between different refresh rate. Following this timing chart, the switch between different refresh rates is seamless for end user.



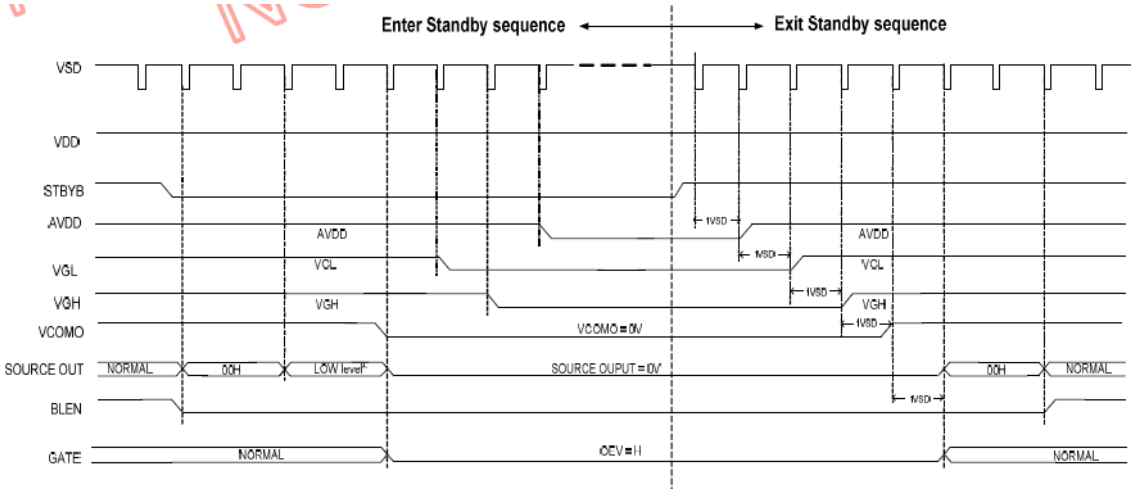
T1 - Min delay from start of vert blank to start of timing change: 2 lines (HSYNC periods)
T2 - Max delay for clock to transition to new frequency: 100us
T3 - Max receiver lock delay from stable clock: Display specific (TBD)
T4 - Max period during which panel maintains display (T2+T3): Display specific (TBD)

6.6 Power Sequence

Power On/ Power off:



6.7 Enter and Exit standby mode sequence:



7.0 Reliability test items

NO.	Item	Conditions	Remark
1	High Temperature Storage	Ta=+80℃,240hrs	Inspection after2～4 hours storage at room temperature, the sample shall be free from defects 1. Air bubble in the LCD 2. Sealleak 3. non-display 4. missing segmnents 5. glass crack 6. current idd is twice higher than initial value.
2	Low Temperature Storage	Ta=-30℃,240hrs	
3	High Temperature Operation	Ta=+70℃,240hrs	
4	Low Temperature Operation	Ta=-20℃,240hrs	
5	High Temperature and High Humidity(Operation)	Ta=+60℃, 90%RH, 240hrs	
6	Thermal cycling Test (non operation)	-20℃(30min)→+70℃(30min),100cycles	
7	Electrostatic discharge	200V 200pf(0ohm) 1time/each terminal	
8	Vibration	1. Random: 1.04 Grms,5～500HZ, X/Y/Z,30min/each direction 2. Sine: Freq. Range:8～33.3hz Stoke:1.3mm Sweep:2.9G,33.3～400HZ X/Z:2hr,Y:4hr,cyc:15min	
9	Shock	100G,6ms,±X, ±Y, ±Z 3 times for each direction	JIS C7021,A-10 (Condition)
10	Vibration(with carton)	Random:0.015G∧2/HZ, 5～200HZ -6dB/octave,200～400HZ XYZ each dirction:2hr	
11	Drop (with carton)	Height:60cm 1corner,3edges,6surfaces	JIS Z0202

Note:

1.There is no display function NG issue occurred, all the cosmetic specification is judged before the reliability stress.

2.the test samples should be applied to only one test item

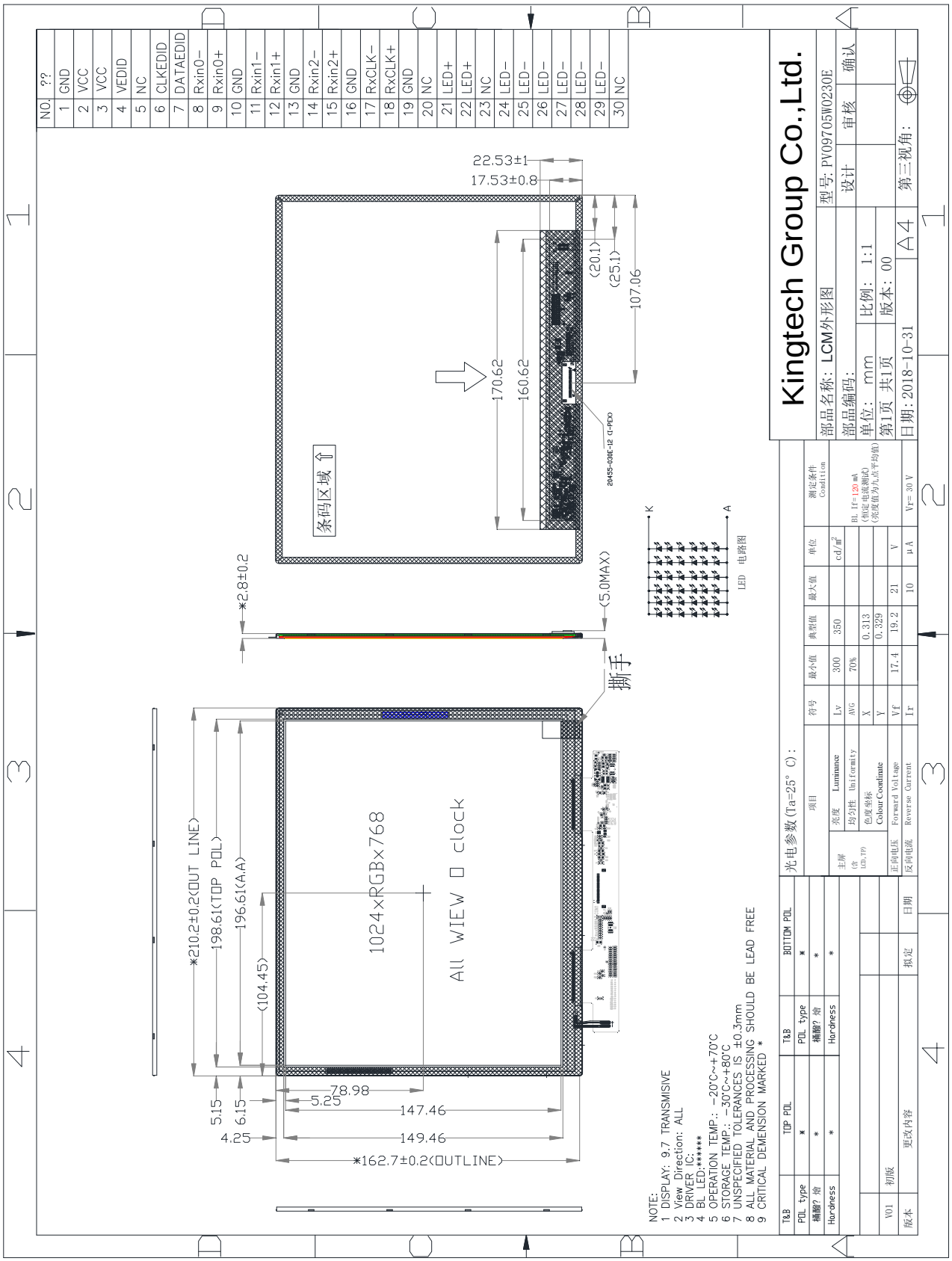
3.for damp proof test, Pure water(resistance>10M ohm)should be used

4.in case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judged as a good part

5.Failure Judgment Criterion:Basic Specification, Electrical Characteristic, Mechanical Charateristic,Optical Characteristic

8.0 OUTLINE DIMENSION

Outline Dimension:



9.0 GENERAL PRECAUTION

9.1 Use Restriction

This product is not authorized for use in life supporting systems, aircraft navigation control systems, military systems and any other application where performance failure could be life threatening or otherwise catastrophic.

9.2 Disassembling or Modification

Do not disassemble or modify the module. It may damage sensitive parts inside LCD module, and may cause scratches or dust on the display. Kingtech does not warrant the module, if customers disassemble or modify the module.

9.3 Breakage of LCD Panel

9.3.1.If LCD panel is broken and liquid crystal spills out, do not ingest or inhale liquid crystal, and do not contact liquid crystal with skin.

9.3.2. If liquid crystal contacts mouth or eyes, rinse out with water immediately.

9.3.3. If liquid crystal contacts skin or cloths, wash it off immediately with alcohol and rinse thoroughly with water.

9.3.4. Handle carefully with chips of glass that may cause injury, when the glass is broken.

9.4 Electric Shock

9.4.1. Disconnect power supply before handling LCD module.

9.4.2. Do not pull or fold the LED cable.

9.4.3. Do not touch the parts inside LCD modules and the fluorescent LED's connector or cables in order to prevent electric shock.

9.5 Absolute Maximum Ratings and Power Protection Circuit

9.5.1. Do not exceed the absolute maximum rating values, such as the supply voltage variation, input voltage variation, variation in parts' parameters, environmental temperature, etc., otherwise LCD module may be damaged. 9.5.2. Please do not leave LCD module in the environment of high humidity and high temperatur e for a long time. 11.5.3. It's recommended to employ protection circuit for power supply.

9.6 Operation

9.6.1 Do not touch, push or rub the polarizer with anything harder than HB pencil lead.

9.6.2 Use fingerstalls of soft gloves in order to keep clean display quality, when persons handle the LCD module for incoming inspection or assembly.

9.6.3 When the surface is dusty, please wipe gently with absorbent cotton or other soft

material.

9.6.4 Wipe off saliva or water drops as soon as possible. If saliva or water drops contact with polarizer for a long time, they may causes deformation or color fading.

9.6.5 When cleaning the adhesives, please use absorbent cotton wetted with a little petroleum benzine or other adequate solvent.

9.7 Mechanism

Please mount LCD module by using mouting holes arranged in four corners tightly.

9.8 Static Electricity

9.8.1 Protection film must remove very slowly from the surface of LCD module to prevent from electrostatic occurrence.

9.8.2. Because LCD module use CMOS-IC on circuit board and TFT-LCD panel, it is very weak to electrostatic discharge. Please be careful with electrostatic discharge. Persons who handle the module should be grounded through adequate methods.

9.9 Strong Light Exposure

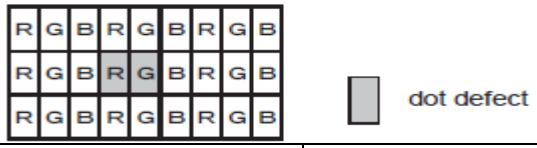
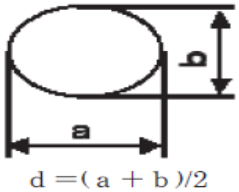
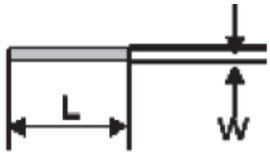
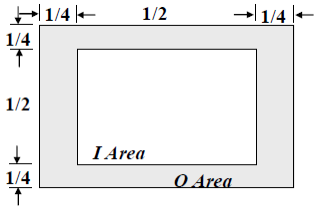
The module shall not be exposed under strong light such as direct sunlight. Otherwise, display characteristics may be changed.

9.10 Disposal

When disposing LCD module, obey the local environmental regulations.

10. Package Specification

11.Visuals Specification: 1)Note

General	1. Customer identified anomalies not defined within this inspection standard shall be reviewed by LowKey, and an additional standard shall be determined by mutual consent. 2. This inspection standard about the image quality shall be applied to any defect within the effective viewing area and shall not be applicable to outside of the area. 3. Inspection conditions Luminance : 500 Lux min. Inspection distance : 300 mm. Temperature : 25±5°C Direction : Directly above		
Definition of inspection item	Dot defect	Bright dot defect	The dot is constantly "on" when power applied to the LCD, even when all "Black" data sent to the screen. Inspection tool: 5% Transparency neutral density filter.Count dot: If the dot is visible through the filter. Don't count dot: If the dot is not visible through the filter. 
		Black dot defect	The dot is constantly "off" when power applied to the LCD, even when all "White" data sent to the screen.
		Adjacent dot	Adjacent dot defect is defined as two or more bright dot defects or black dot defects. 
	External inspection	Bubble ,scratch(foreign Particle polarizer, Cell, Backlight)	Visible operating (all pixels "Black" or "White") and non operating.
		Appearance inspection	Does not satisfy the value at the spec.
	Others	LED wires	Damaged to the LED wires, connector, pin, functional failure or appearance failure.
	Definition of Size	Definition of circle : 	definition of linear size 	definition Area I/O 

2) Standard

Classification		Inspection item			Judgment Standard	
Defect (in LCD glass)	Dot defect	Area			I	O
		Bright dots(Note: Visible under:ND5%) 1:D≤0.15mm:No count); D>0.15mm acceptable: 2			N≤2	
		Dark dots (0.15mm<D≤0.3mm), D>0.3mm Not allowable			N≤4	
		Bright dot-2Adjacent			N≤0	
		Dark dot-2Adjacent			N≤0	
		Dark or bright dots-3 and more adjacent(note6)			N≤0	
		Total bright and dark dots			N≤4	
		Minimum distance between bright dots			15mm	
		Minimum distance between dark dots			5mm	
		Minimum distance between bright and bright dots			5mm	
	Other	White dot ,dark dot (circle)	Size (mm)		Acceptable number	
			d≤0.2		Neglected	
			0.2mm<D≤0.3mm		N≤4	
			0.3mm<D≤0.4mm		N≤2	
			D>0.4mm		Not allowable	
Visual defect		Foreign partial	Circular foreign material: dark/bright sport		Visible under:ND5% 1:D≤0.15mm:No count 2:0.15mm<D≤0.3mm,N≤4 3:D>0.3mm:Not allowable	
			Linear foreign material: bright or dark line		Invisible under ND5% 0.1mm<W≤0.3mm, 0.3mm<L≤1.5mm,N≤2 Visible under ND5% 0.05mm≤w≤0.1mm, 0.3mm≤L≤0.7mm,N≤1	
		Polarizer	Linear scratch		1:BM:No Count 2:Pixel area 0.05mm≤w≤0.2mm, 1.0mm≤L≤5.0mm,N≤2	
			Bubble peeling		1:BM:No Count 2:Pixel area 0.15mm≤D<0.3mm,N≤4	
		Mura & leak			ND5%	