Display Module SPECIFICATION
Model: PV0133012W0230N

Customer	
Customer NO.	
Approve By	

For Solution ---13.3inch ;1920(W)XRGBX1080(H)

Owner:
Version: V01
Document ID:

Record of Revisions

Rev	Date	Sub-Model	Description of change
V01	**Sept. 14th 2022**		**Preliminary Product Specification was first issued.**

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1. General description

1.1 Introduction

PV0133012W0230N **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 13.3 (16:9) inch diagonally measured active display area with Full HD (1920 horizontal by 1080 vertical pixel) resolution.**

1.2 Features

13.3 (16:9 diagonal) inch configuration
EDP(Embedded display port) Ver1.2 interface
1920x3x1080 dots panel with 16.7M colors
Edp Transfer rate Specification:Edp1.2/2.7 Gbps/2lane
LED Backlight
RoHS & Reach Compliance

1.3 Applications

Mobile NB,
Personal Navigation Device
Multimedia applications and Others AV system

1.4 General information

Item		Specification	Unit
Outline Dimension		307.60 x 183.05x 5.5 (Typ.)	mm
Display area		293.76(H) x165.24(V)	mm
Number of Pixel		1920 RGB(H) x 1080(V)	pixels
Pixel pitch		0.153(H) x 0.153(V)	mm
Pixel arrangement		RGB Vertical stripe	
Display mode /NTSC		Normally black(FFS) /72%	
Surface treatment		Antiglare, Hard-Coating(3H)	
Weight		TBD(Typ.)	G
Back-light		Single LED (Side-Light type)	
Power Consumption	B/L System	11.0(Max)	W

1.5 Mechanical Information

item		Min.	Typ.	Max.	Unit
Module Size	Horizontal(H)	307.30	307.60	307.90	mm
	Vertical(V)	182.75	183.05	183.35	mm
	Depth(D)	5.2	5.5	5.8	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	LCD_VCC	-0.3	4.0	V	GND=0
				V	GND=0
				V	GND=0
				V	
				V	
Input Voltage(eDP)	V1	-0.3	1.5	V	

2.1.2 Back-Light Unit

Item	Symbol	MIN.	TYP.	MAX.	Unit	Note
Forward voltage	Vf	--	27	31.5	V	(1)(2)(3)
Forward current	If	--	400		mA	(1)(2) (3)
Power Consumption	PBL	--	10.8		W	

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 400mA

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	Tr	25℃	--	10	15	msec	θ =0 °,φ=0 ° (Note 1,3)
	Tf	25℃	--	20	25		
Contrast Rate	Cr	25℃	600	1000	--	--	θ =0 °, φ=0 ° LED:ON, LIGHT:OFF(Note1,2)
Brightness	YL	25℃	850	1000		Cd/m2	(IL=400mA)(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		75			%	Θ =0(Note5,7)
Visual angle			free				(Note 6)

Item	Symbol	Transmissive			Conditions
		Min.	Typ.	Max.	
Red	XR	0.625	0.655	0.685	**Reference:** LCD **Panel,** **CIE (x, y)** **chromaticity** **(Note 1,4)**
	YR	0.295	0.325	0.355	
Green	XG	0.234	0.264	0.294	
	YG	0.548	0.578	0.608	
Blue	XB	0.110	0.140	0.170	
	YB	0.057	0.087	0.117	
White	XW	0.274	0.304	0.334	
	YW	0.301	0.331	0.361	

3.2 Measuring Condition

Measuring surrounding: dark room ,LED current IL : 400mA

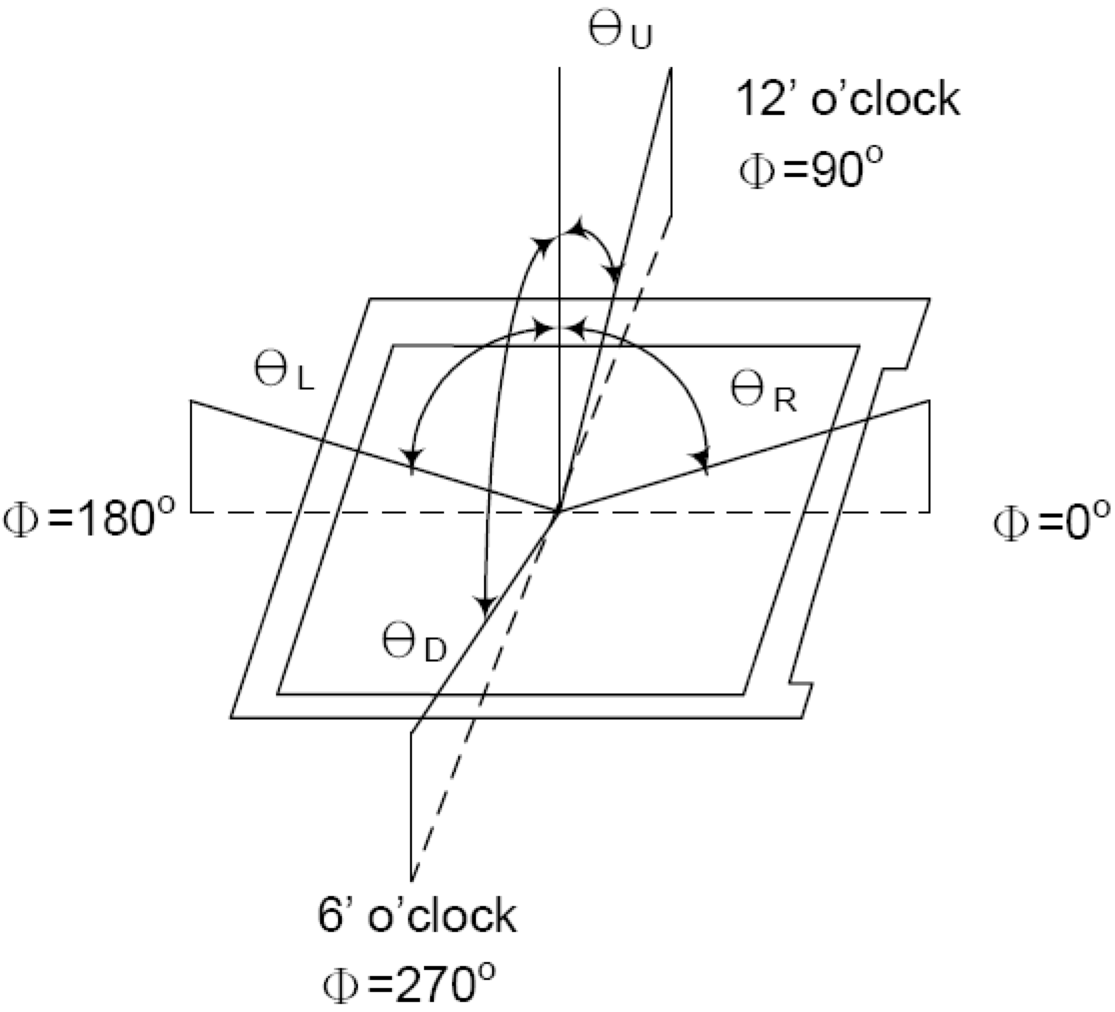
Ambient temperature: 25±2oC

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

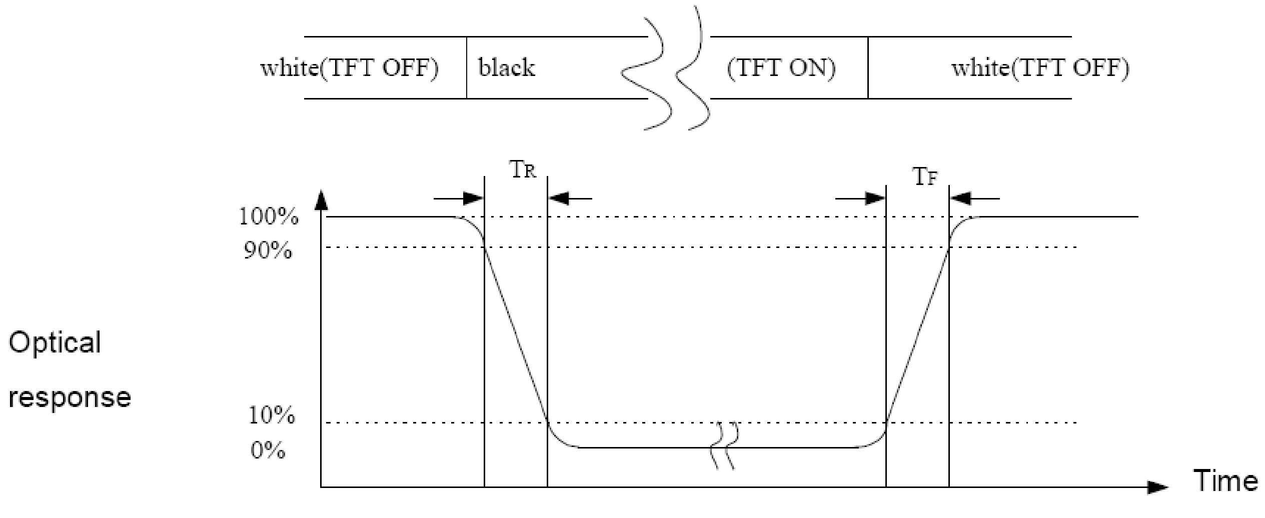
Note (1) Definition of Viewing Angle :


ΘU
12’ o’clock
Φ=90°
ΘL
ΘR
Φ=180°
Φ=0°
ΘD
6’ o’clock
Φ=270°

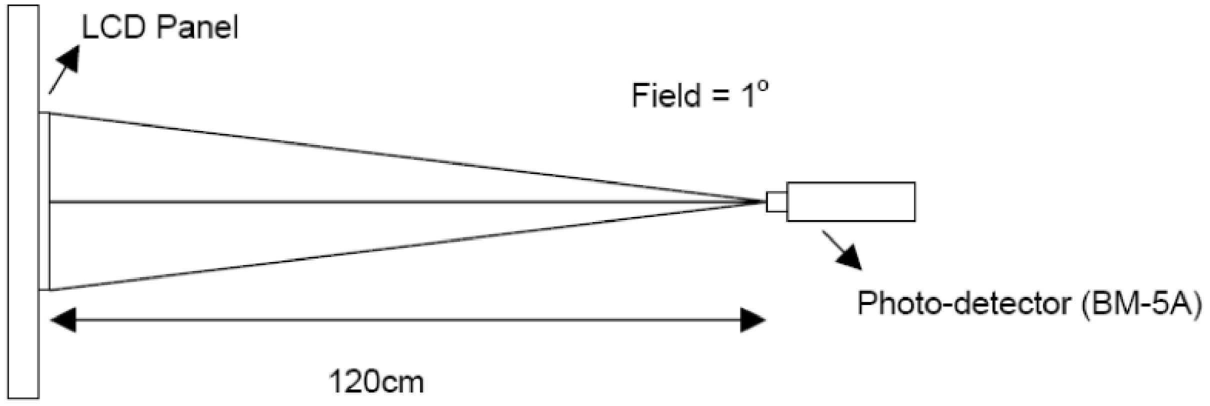
Note (2) Definition of Contrast Ratio (CR):
Measured at the center point of panel

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

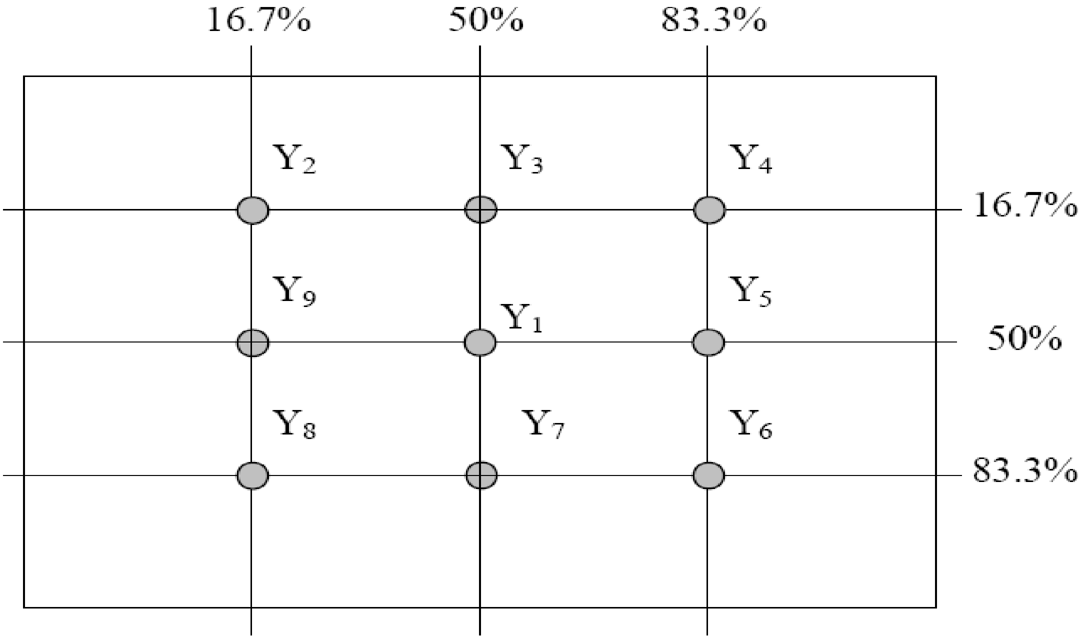
Note (3) Definition of Response Time: Sum of TR and TF


white(TFT OFF)
black
(TFT ON)
white(TFT OFF)
TR
TF
100%
90%
Optical response
10%
0%
Time

Note (4) Definition of optical measurement setup


LCD Panel
Field = 1°
Photo-detector (BM-5A)
120cm

Note (5) Definition of brightness uniformity



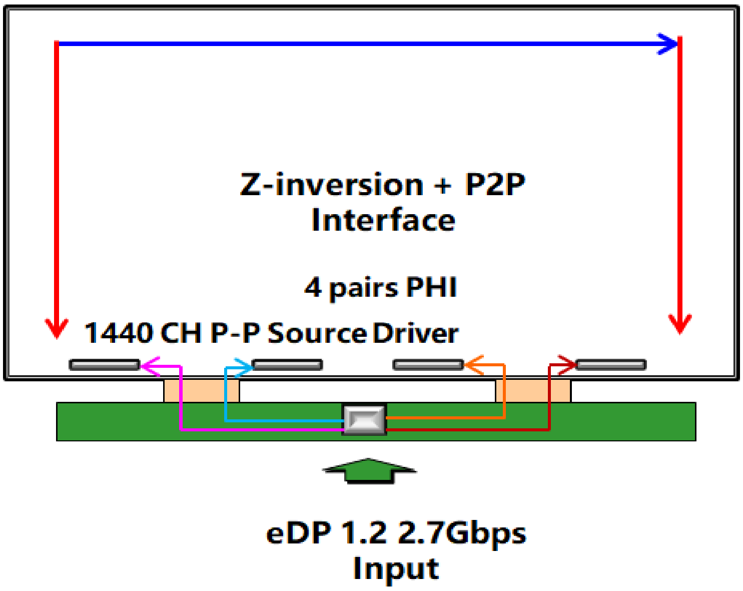
$$\text{Luminance uniformity} = \frac{\text{(Min Luminance of 9 points)}}{\text{(Max Luminance of 9 points)}} \times 100\%$$

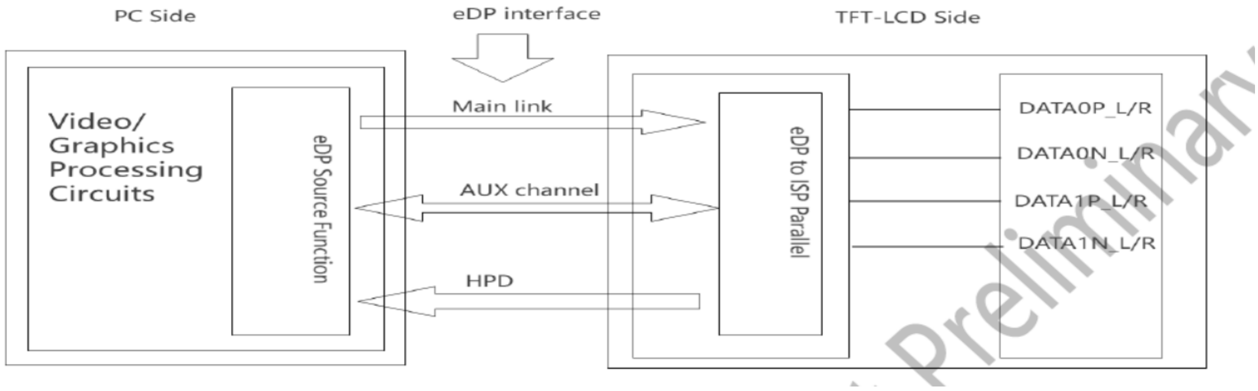
Note (6) Rubbing Direction (The different Rubbing Direction will cause the different optimal view direction).

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

4.0 BLOCK DIAGRAM

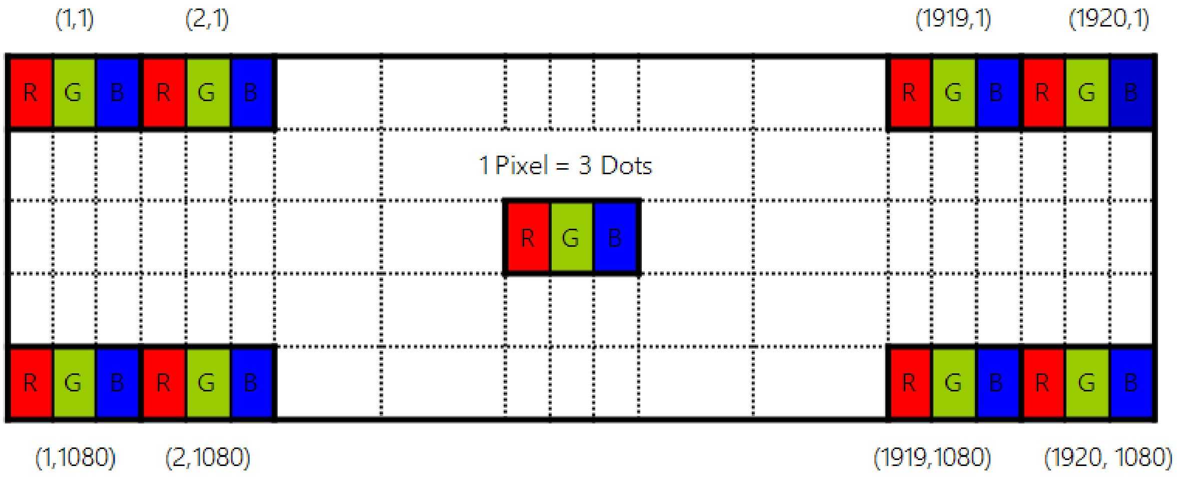
4.1 TFT LCD Module


Z-inversion + P2P
Interface
4 pairs PHI
1440 CH P-P Source Driver
eDP 1.2 2.7Gbps
Input


PC Side
eDP interface
TFT-LCD Side
Video/
Graphics
Processing
Circuits
eDP Source Function
Main link
AUX channel
HPD
eDP to ISP Parallel
DATA0P_L/R
DATA0N_L/R
DATA1P_L/R
DATA1N_L/R

Preliminary

4.2 data input format


(1,1)
(2,1)
(1919,1)
(1920,1)
R G B R G B
R G B R G B
1 Pixel = 3 Dots
R G B
R G B R G B
R G B R G B
(1,1080)
(2,1080)
(1919,1080)
(1920, 1080)

Display Position of Input Data (V-H)

5.0 Interface Pin Connection

5.1 Driver interface of PWB

(CN1:20455-030E-76(I-PEX) (EDP Signal ,3.3V DC Supply)

Corresponding connector : 20453-030T (I-PEX)

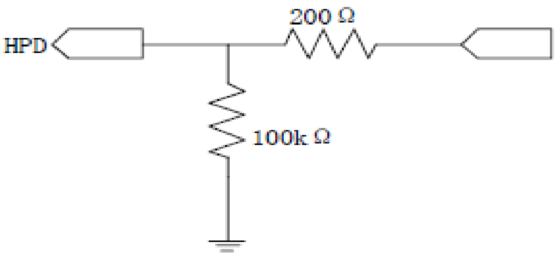
Terminal No.	Symbol	IO	Functions
1	CABC-EN	I	CABC-EN(Not connected)
2	GND	P	High Speed Power ground
3	Lane1_N	I	Complement signal link Lane1
4	Lane1_P	I	True signal Link Lane1
5	GND	P	High Speed Power ground
6	Lane0_N	I	Complement signal link Lane0
7	Lane0_P	I	True signal Link Lane0
8	GND	P	High Speed Power ground
9	AUX_CH_P	I	True signal Auxiliary channel
10	AUX_CH_N	I	Complement signal Auxiliary channel
11	GND	P	High Speed Power ground
12	LCD_VCC	P	LCD logic and driver Power
13	LCD_VCC	P	LCD logic and driver Power
14	LCD_TEST	--	Panel Self test enable
15	GND	P	LCD logic and driver ground
16	GND	P	LCD logic and driver ground
17	HPD	O	Hot Plug detect output
18	NC	P	Not connected
19	NC	P	Not connected
20	NC	P	Not connected
21	NC	P	Not connected
22	NC	P	Not connected
23	NC	P	Not connected
24	NC	P	Not connected
25	NC	P	Not connected
26	NC	P	Not connected
27	NC	P	Not connected
28	NC	P	Not connected
29	NC	P	Not connected
30	NC	P	Not connected

Notes:

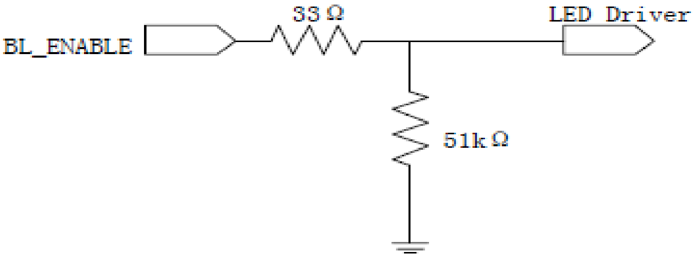
*1 P: POWER I: Input O: Output
The shielding case is connected with signal GND
- Connector used :20455-030E-76 (I-PEX)
- Corresponding connector : 20453-030T (I-PEX)

(Panda is not responsible to its product quality, if the user applies a connector not corresponding to the above model.)
All terminals except NC terminal must be connected to input signal desicribed as above or supply voltage or GND each.
[Note 4-1-1] Do not input any signals or any powers into a NC pin. Keep the NC pin open.

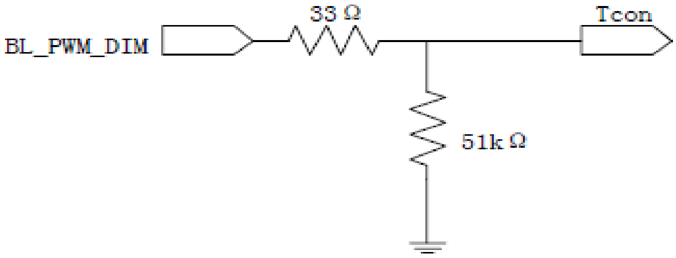
[Note 4-1-2] Output circuit is as below.



[Note 4-1-3]Input circuit is as below.



[Note 4-1-4]Input circuit is as below.



6.0 ELECTRICAL CHARACTERISTICS

Item	Symbol	Min.	Type	Max.	Unit.	Note
Power supply voltage	LCD_VCC	3.0	3.3	3.6	V	GND=0
Positive-going input	VIT+			+100	mV	Vcc=+3.3V
Negative-going input	VIT-	-100			mV	
	IVCC	-	212	364	mA	
	Irush			1.0	A	
Operation Temperature	Top	-20		70	℃	
Storage Temperature	Tst	-30		80	℃	

6.1 TFT LCD Module

eDP HPD Signal Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
HPD High level output voltage	VOH$_{HPD}$		VDD-0.1	-		
HPD Low level output voltage	VOL$_{HPD}$	-	0			

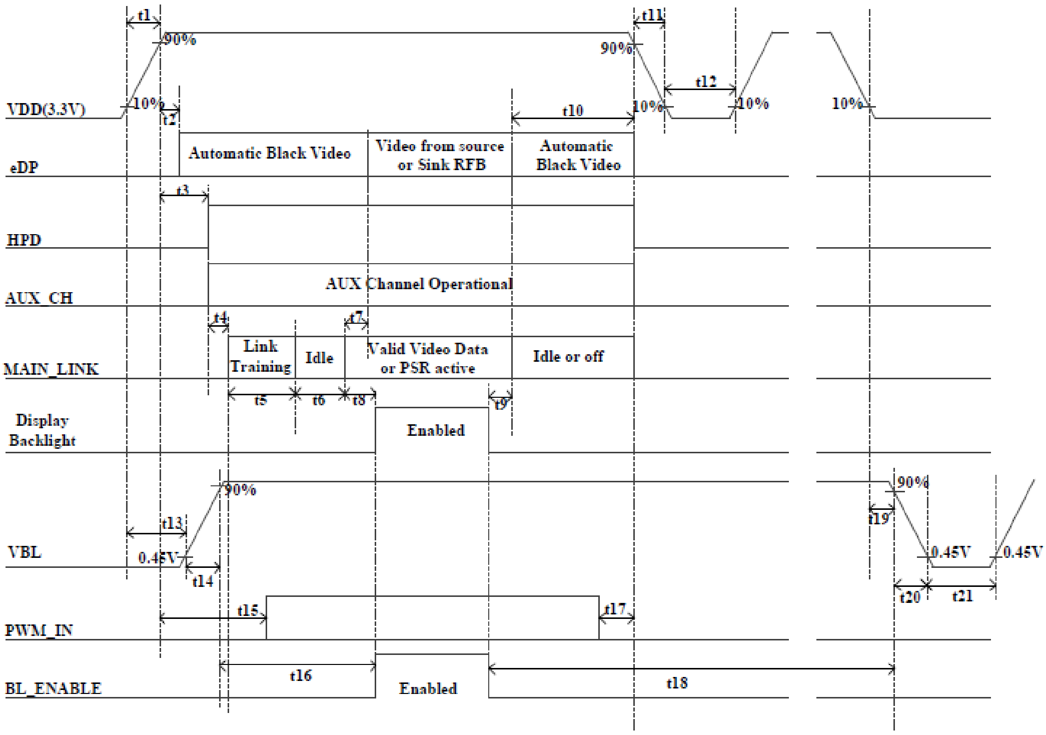
eDP AUX Channel Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Unit Interval for AUX channel	UI$_{AUX}$	0.4	0.5	0.6	µS	
Peak-to-peak voltage at TP1	V$_{AUX-DIFF-pp}$	0.32	-	1.36	V	
AUX DC Common mode Voltage	V$_{AUX-DC-CM}$	0	-	2.0	V	
AUX Short current limit	I$_{AUX\_SHORT}$	-	-	90	mA	
AUX CH termination Cresistor	R$_{AUX\_TERM}$	-	100	-	Ω	Differential input
AUX AC coupling capacitor	C$_{AUX}$	75	-	200	nF	
Number of pre-charge pulses	Pre-charge pulses	10	-	16	-	

eDP Main Link Receiver Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Link clock down spreading	Down_Spread_Amplitude	0		0.5	%	
Differential Peak-to-peak Input Voltage at Rx package pins	V$_{RX-DIFFp-p}$	120	-	1200	mV	
Differential Return Loss at 1.35GHz at Rx package pins	RL$_{RX-DIFF}$	9	-	-	dB	
Differential termination resistance	R$_{RX-TERM}$	-	100	-	Ω	
RX short circuit Current Limit	I$_{RX-SHORT}$	-	-	50	mA	
Lane Intra-pair Skew at RX package pins	T$_{RX-SKEW-INTRA-PAIR-High-Bit-Rate}$	-	-	50	ps	

[Note 6-1-1] ON-OFF conditions for supply voltage


VDD(3.3V)
eDP
HPD
AUX_CH
MAIN_LINK
Display Backlight
VBL
PWM_IN
BL_ENABLE
t1
90%
10%
t2
t3
t4
t5
t6
t7
t8
t9
t10
t11
t12
t13
t14
t15
t16
t17
t18
t19
t20
t21
0.45V
Automatic Black Video
Video from source or Sink RFB
Automatic Black Video
AUX Channel Operational
Link Training
Idle
Valid Video Data or PSR active
Idle or off
Enabled
Enabled

[Note] Do not keep the interface signal high-impedance or unusual signal when power is on.

Symbol	Min	Max	Unit	Note
t1	0.5	10	ms	
t2	0	100	ms	
t3	0	100	ms	
t4	-	-	ms	
t5	-	-	ms	
t6	-	-	ms	
t7	0	50	ms	
t8			ms	
t9			ms	
t10	0	500	ms	
t11	1	50	ms	[Note1]
t12	500	-	ms	
t13	-	-	ms	
t14	0.5	10	ms	
t15	100		ms	
t16	-	-	ms	
t17	0	-	ms	
t18	-	-	ms	
t19	-	-	ms	
t20	0.1	-	ms	
t21	100		ms	

6.2 Back-Light Unit

CN LED Power Source (BHSR-02VS-1) or equivalent

Mating connector:(SBHT-002T-P0.5) or equivalent

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

Item	**Symbol**	**Min.**	**Typ.**	**Max.**	**Unit**	**Note**
LED current	**IL**	**-**	**400**	**-**	**mA**	**(2)**
LED Voltage	**VL**	**-**	**27.0**	**31.5**	**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=400mA. The LED lifetime could be decreased if operating IL is larger than 400mA. The constant current driving method is suggested.

6.3 Signal Timing Characteristics

Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
DCLK Frequency	fclk	-	477	-	MHz
Horizontal display area	thd	1920			pixel
HSYNC period time	th	-	2142	-	pixel
HSYNC blanking	thb+ thfp	-	222	-	pixel
Vertical display area	Tvd	1080			H
Frequency	fV	48	60	65	Hz
VSYNC period time	Tv	-	1100	-	H
VSYNC blanking	Tvb+ Tvfp	-	20	-	H

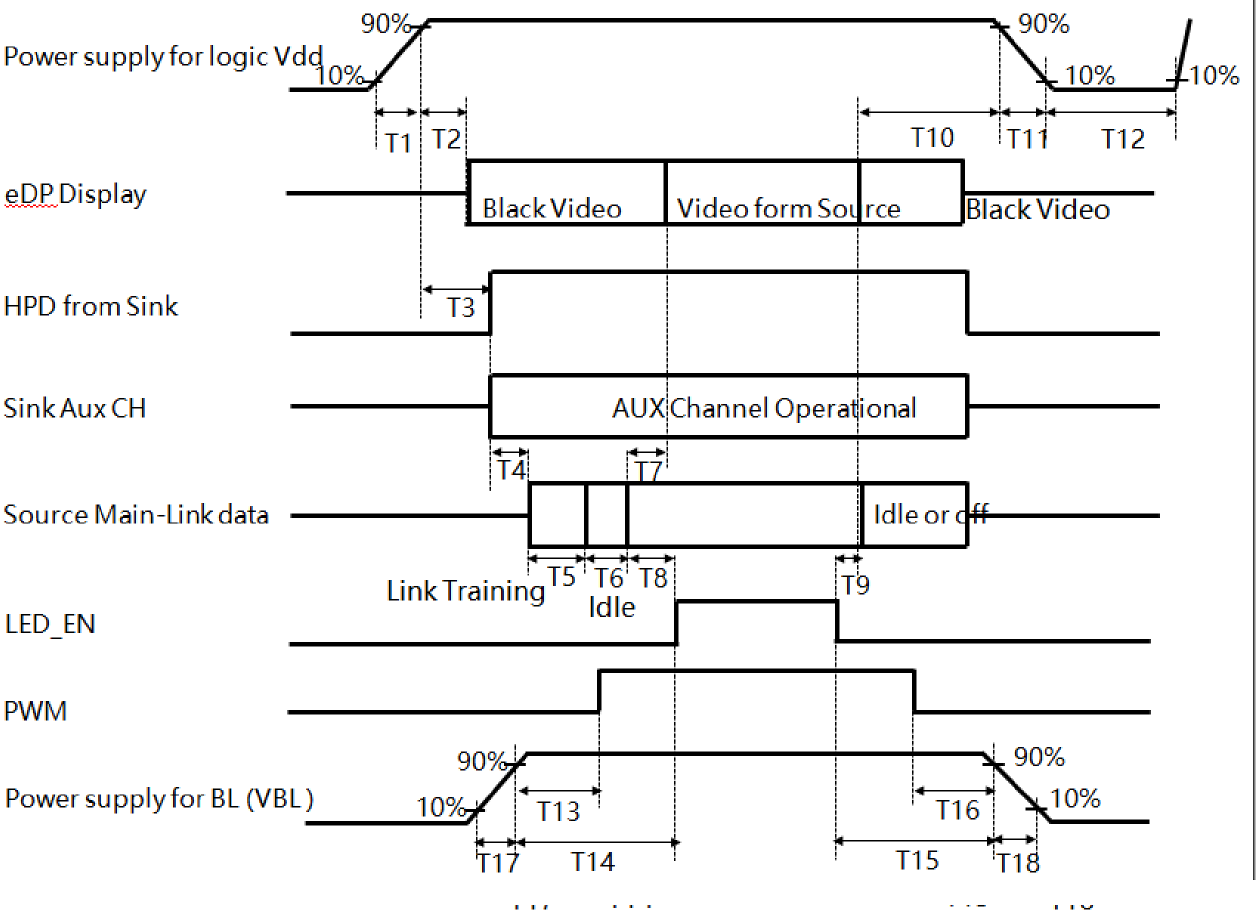
6.4 input signal ,basic display colors and gray scale of each color

	Colors & Gray Scale	Gray Scale	Data signal																							
			R0	R1	R2	R3	R4	R5	R6	R7	G0	G1	G2	G3	G4	G5	G6	G7	B0	B1	B2	B3	B4	B5	B6	B7
			LSB							MSB	LSB							MSB	LSB							MSB
Basic Color	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	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	GS1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	GS2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	↓	↓								↓								↓							
	⇩	↓	↓								↓								↓							
	Brighter	GS253	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇩	GS254	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	GS255	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	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	GS1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	GS2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	↓	↓								↓								↓							
	⇩	↓	↓								↓								↓							
	Brighter	GS253	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	⇩	GS254	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Green	GS255	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	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	GS1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	Darker	GS2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	⇧	↓	↓								↓								↓							
	⇩	↓	↓								↓								↓							
	Brighter	GS253	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1
	⇩	GS254	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
	Blue	GS255	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

0: Low level voltage,   1: High level voltage.

6.5: 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


Power supply for logic Vdd
90%
10%
90%
10%
10%
T1
T2
T10
T11
T12
eDP Display
Black Video
Video form Source
Black Video
HPD from Sink
T3
Sink Aux CH
AUX Channel Operational
T4
T7
Source Main-Link data
Idle or off
Link Training
T5
T6
T8
Idle
T9
LED_EN
PWM
Power supply for BL (VBL)
90%
10%
T13
90%
10%
T16
T17
T14
T15
T18

- 0.5ms ≤ T1 ≤ 10 ms
- 0ms ≤ T2 ≤ 200 ms
- 0ms ≤ T3 ≤ 200 ms
- 0ms ≤ T13
- 0ms ≤ T14
- 0ms ≤ T17
- 80ms ≤ T8
- 0ms ≤ T7 ≤ 50ms
- 0ms ≤ T10 ≤ 500 ms
- 0.5ms ≤ T11 ≤ 10 ms
- 500ms ≤ T12
- 0ms ≤ T15
- 0ms ≤ T16
- 0ms ≤ T18

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. Back Light must be turn on after power for logic and interface signal are valid.

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

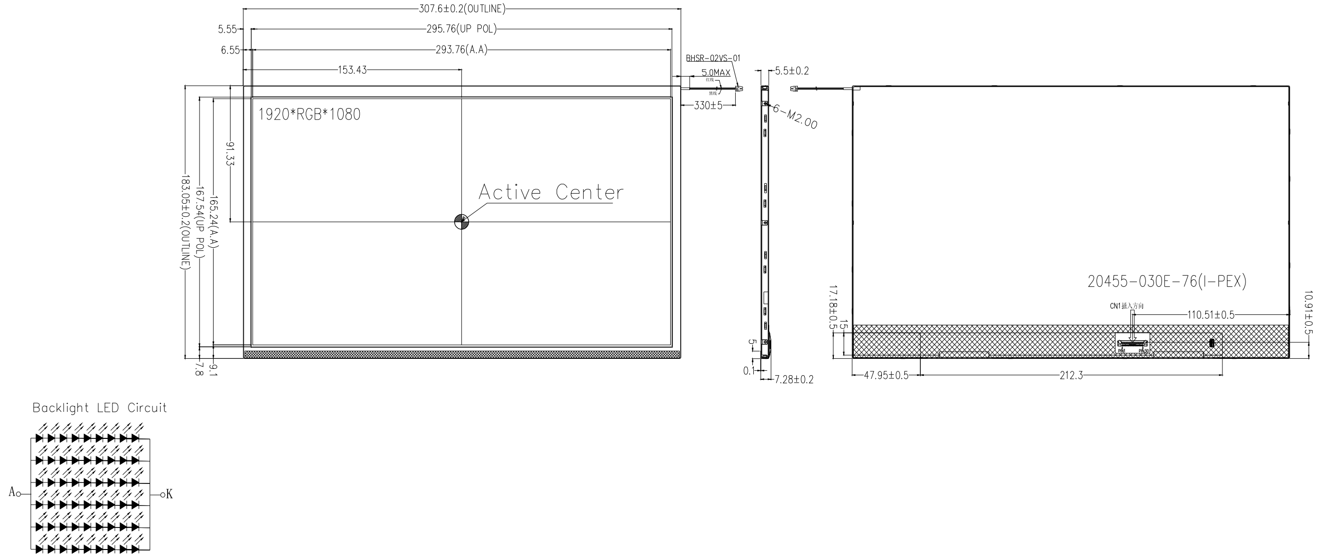
3.for damp proof test, Pure water(resistance>10M ohm)should be used

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

1	CABC-EN
2	GND
3	Lane1_N
4	Lane1_P
5	GND
6	Lane0_N
7	Lane0_P
8	GND
9	AUX_CH_P
10	AUX_CH_N
11	GND
12	LCD_VCC
13	LCD_VCC
14	LCD-TEST
15	GND
16	GND
17	HPD
18	NC
19	NC
20	NC
21	NC
22	NC
23	NC
24	NC
25	NC
26	NC
27	NC
28	NC
29	NC
30	NC


307.6±0.2(OUTLINE)
295.76(UP POL)
293.76(A.A)
5.55
6.55
153.43
91.33
1920*RGB*1080
Active Center
165.24(A.A)
167.54(UP POL)
183.05±0.2(OUTLINE)
9.1
7.8
BHSR-02VS-01
5.0MAX
330±5
5.5±0.2
6-M2.00
5
0.1
7.28±0.2
17.18±0.5
15
20455-030E-76(I-PEX)
CN1插入方向
110.51±0.5
10.91±0.5
47.95±0.5
212.3
Backlight LED Circuit
A
K

NOTE:
1 DISPLAY: 13.3''TFT TRANSMISIVE
2 VIEW DIRECTION: ALL
3 DRIVER IC:
4 BL LED:
5 OPERATION TEMP.: -20°C~+70°C
6 STORAGE TEMP.: -30°C~+80°C
7 UNSPECIFIED TOLERANCES IS ±0.2mm
8 ALL MATERIAL AND PROCESSING SHOULD BE LEAD FREE
9 CRITICAL DEMENSION MARKED *

光电参数(Ta=25° C):

项目		符号	最小值	典型值	最大值	单位	测定条件 Condition
主屏 (含 LCD, TP)	亮度 Luminance	Lv	850	1000		cd/m²	BL If= 400 mA (恒定电流测试) (亮度值为九点平均值)
	均匀性 Uniformity	AVG	70%				
	色度坐标 Colour Coordinate	X	0.27		0.35		
		Y	0.27		0.35		
正向电压	Forward Voltage	Vf	25	27	29	V	
反向电流	Reverse Current	Ir			10	μA	Vr= 30 V

V00	初版		
版本	更改内容	拟定	日期

Kingtech Group Co.,Ltd.

部品名称: LCM外形图		型号: PV0133012W0230N		
部品编码:		设计	审核	确认
单位: mm	比例: 1:1			
第1页 共1页	版本: 00			
日期: 2022.06.18	A4	第三视角:		

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. HannStar 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 temperature 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.

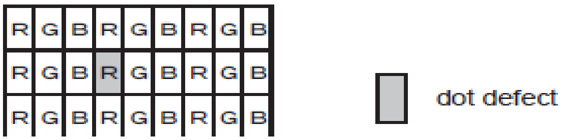
9.10 Disposal

When disposing LCD module, obey the local environmental regulations.

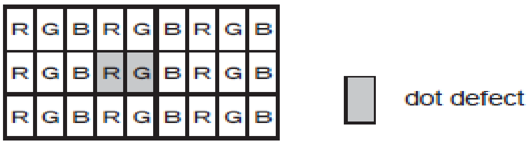
10. Package Specification

10.1 Packing format

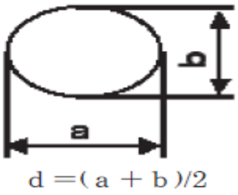
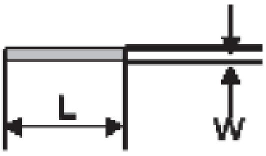
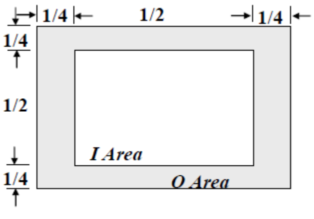
11.Visuals Specification: 1)Note

<table>
<tr><td>General</td><td colspan="3">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</td></tr>
<tr><td rowspan="7">Definition of inspection item</td><td rowspan="3">Dot defect</td><td>Bright dot defect</td><td>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.


R G B R G B R G B
R G B R G B R G B
R G B R G B R G B
dot defect

</td></tr>
<tr><td>Black dot defect</td><td>The dot is constantly “off” when power applied to the LCD, even when all “White” data sent to the screen.</td></tr>
<tr><td>Adjacent dot</td><td>Adjacent dot defect is defined as two or more bright dot defects or black dot defects.


R G B R G B R G B
R G B R G B R G B
R G B R G B R G B
dot defect

</td></tr>
<tr><td rowspan="2">External inspection</td><td>Bubble ,scratch(foreign Particle polarizer, Cell, Backlight)</td><td>Visible operating (all pixels “Black” or “White”) and non operating.</td></tr>
<tr><td>Appearance inspection</td><td>Does not satisfy the value at the spec.</td></tr>
<tr><td>Others</td><td>LED wires</td><td>Damaged to the LED wires, connector, pin, functional failure or appearance failure.</td></tr>
<tr><td>Definition of Size</td><td colspan="2">Definition of circle :

definition of linear size

definition Area I/O
 </td></tr>
</table>

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≤4	
		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≤0.2mm:No count 2:0.2mm<D≤0.5mm,N≤3 3:D>0.5mm:Not allowable	
			Linear foreign material: bright or dark line	Invisible under ND5% 0.1mm<W≤0.3mm, 0.3mm<L≤5mm,N≤3 Visible under ND5% 0.03mm≤w≤0.1mm, 0.3mm≤L≤3mm,N≤2	
		Polarizer	Linear scratch	1:BM:No Count 2:Pixel area 0.05mm≤w≤0.2mm, 1.0mm≤L≤5.0mm,N≤3	
			Bubble peeling	1:BM:No Count 2:Pixel area 0.2mm≤D<0.5mm,N≤4	
		Mura & leak		ND5%	