Anders Product Specification

2.1" Circular TFT display module with 320(RGB)x320 pixels and Capacitive Touchscreen with customized cover lens

Product References:

Manufacturer	Yes Opto Electronics Co., Ltd
Manufacturer Part n°	YTC210HLAB-03-100C-V1
Anders Part n°	YTC210HLAB-03-100C-V1
Customer Part n°	-
Specification Revision n°	1.0
Issue Date	2021.06.25

Specification Approval

(to be completed by customer)

Company name	
Product/Project Name	
Printed name	
Job title	
Signature	
Approval Stage:	This product is approved for the following production stage: - ☐ Sample / Prototype ☐ Pre-Production ☐ Mass Production
Approval Date	

Supplied by Anders Electronics plc

PRODUCT	:	LCD MODULE
MODEL NO	:	YTC210HLAB-03-100C-V1
SUPPLIER	:	Yes Optoelectronics Co.,Ltd
DATE	:	Jun.25.2021

SPECIFICATION

Prepared by	Checked	Approved
YANGCHEN	**LIANGYUEYAO**	**XIAOYU**

CUSTOMER:
MODEL NO.:   DATE:

Approved	Checked	Department

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Revision Record

Rev No.	Rev Date	Contents	Remarks
1.0	2021.06.25	New creation	

1. General Specifications

No.	Item	Contents	Unit
1	Size	2.1	inch
2	Resolution	320RGB*320	
3	Interface	MIPI / SPI	
4	Color Depth	16	M
5	Technology Type	a-Si	
6	Pixel Pitch	0.1668*0.1668	mm
7	Pixel Arrangement	R.G.B Vertical Stripe	
8	Display Mode	Normally Black, Transmissive, IPS	
9	Viewing Direction	ALL	
10	LCM (W x H x D)	80*80*3.94	mm
11	Active Area (W x H)	53.38*53.38	mm
12	With/Without TSP	With CTP	
13	LED Numbers	5	

Touch Panel Parameter

No.	Features	Details	Note
1	CTP Technology	Mutual capacitor	
2	Input Method	Finger	
3	Touch point	5 Point	
4	Positional Accuracy	2.5mm at 4 edges and 1.5mm at center	Unit: mm
5	Cover glass	Soda lime glass, chemically hardened	
6	Hardness	6H	
7	Surface treatment	NO	
8	Optical transmittance	87%	
9	Touch controller	ST1633i	
10	Interface to Host	I^{2}C	
11	I2C Address	0X55	
12	Connection Type	ZIF Connector	

2.Mechanical Drawing
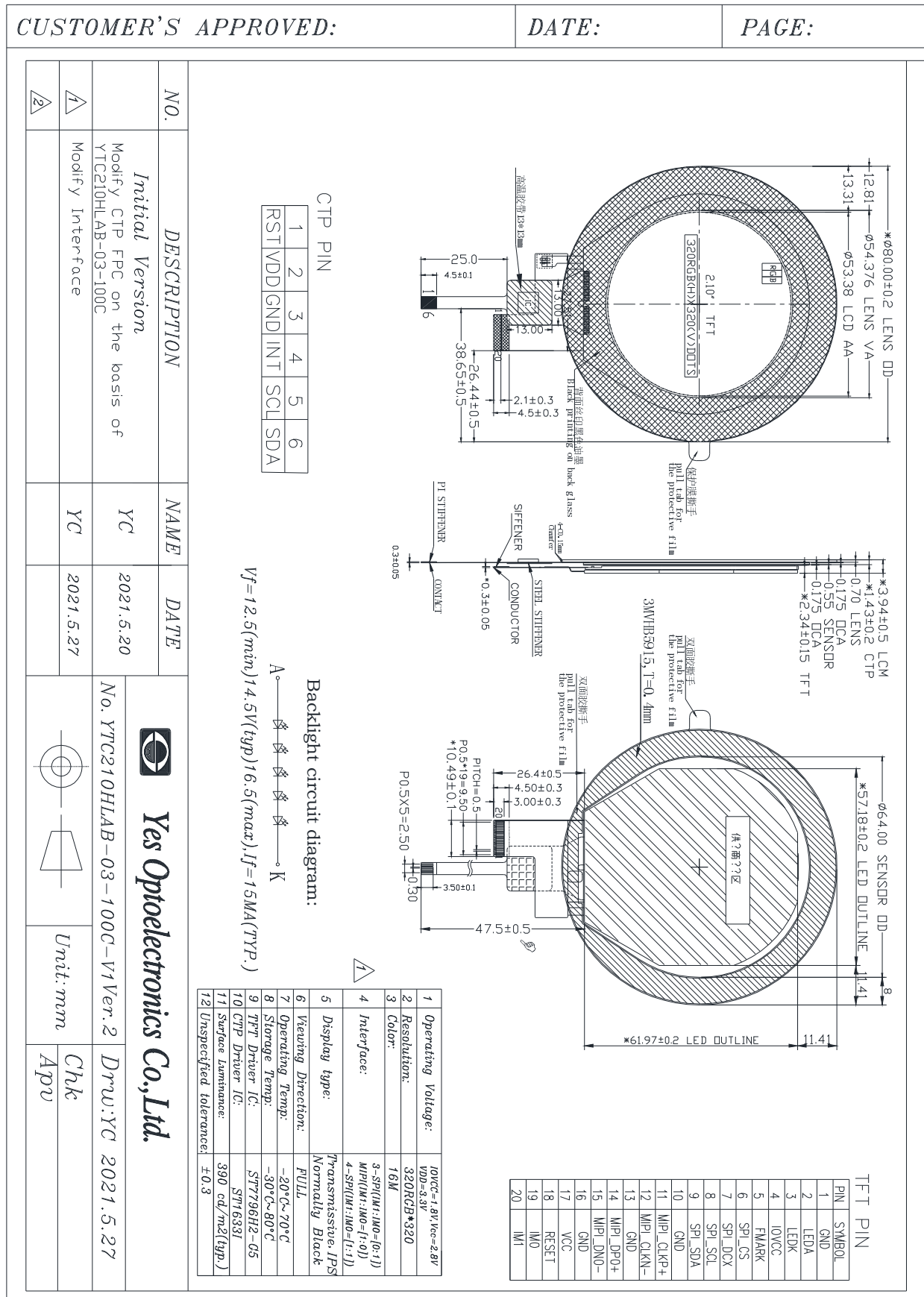
3. PIN Assignment

Interface NO. 接口序号	Symbol 符号	I/O or connect to 输入／出 或 连接到	Description 描述	When not in use 不用时
1	GND	Power	POWER GROUND	/
2	LEDA	LED driver	LED light Anode	OPEN
3	LEDK	LED driver	LED light Cathode	OPEN
4	IOVCC	Power	Power supply for I/O system.	/
5	FMARK	Out	Tearing effect output	OPEN
6	SPI_CS	In	Chip selection pin.	GND/IOVCC
7	SPI_DCX	In	Display data/command selection pin in SPI interface	GND/IOVCC
8	SPI_SCL	In	Serial input clock	GND/IOVCC
9	SPI_SDA	In/Out	SPI interface input/output pin	GND/IOVCC
10	GND	Power	POWER GROUND	/
11	MIPI_CLKP+	In	Positive polarity of low voltage differential clock signal	OPEN
12	MIPI_CLKN-	In	Negative polarity of low voltage differential clock signal	OPEN
13	GND	Power	POWER GROUND	/
14	MIPI_DP0+	In/Out	Positive polarity of low voltage differential data signal	OPEN
15	MIPI_DN0-	In/Out	Negative polarity of low voltage differential data signal	OPEN
16	GND	Power	POWER GROUND	/
17	VCC	Power	Power supply for analog and booster circuits	OPEN
18	RESET	In	Reset the device	/
19	IM0	In	The interface mode select.	/
20	IM1	In	The interface mode select.	/

-The SPI or MIPI interface mode select.

IM1	IM0	MPU Interface Mode	Data pin
0	0	Reserve	-
0	1	3SPI	SPI_SDA
1	0	MIPI	DN0-/DP0+,CLKN-/CLKP+
1	1	4 Line SPI	SPI_SDA

4. Absolute Maximum Rating

Parameter of absolute maximum ratings 参数	Symbol 符号	Min 最小值	Max 最大值	Unit 单位
Supply voltage for logic 逻辑电压	VCC/IOVCC	-0.3	4.6	V
Input voltage 输入电压	VIN	-0.5	IOVCC+0.5	V
Operating temperature 操作温度	Top	-20	70	°C
Storage temperature 储存温度	TST	-30	80	°C
Humidity 湿度	RH	-	90%(Max60 °C)	RH

Note: Absolute maximum ratings means the product can withstand short-term, NOT more than 120 hours. If the product is a long time to withstand these conditions, the life time would be shorter.
备注:极限条件仅指产品能短暂承受的范围,不可超过 120 小时。如果产品长时间在极限条件,将有损产品的使用寿命。

5. Electrical Characteristics

5.1. Recommended Operating Condition

AGND = GND = 0V, Ta = 25℃

Item 项	Symbol 符号	Min. 最小	Typ. 典型	Max. 最大	Unit 单位	Remark 备注
Power Voltage 电源电压	VCC	2.6	2.8	3.3	V	
	IOVCC	1.7	1.8	3.3	V	
	VDD	-	3.3	-	V	
Input Current 输入电流	Idd	-	15.5	23.3	mA	
Input logic high voltage 输入逻辑高电压	VIH	0.7 IOVCC	-	IOVCC	V	
Input logic low voltage 输入逻辑低电压	VIL	GND	-	0.3 IOVCC	V	
Output logic high voltage 输入逻辑高电压	VOH	0.8 IOVCC	-	-		
Output logic low voltage 输入逻辑低电压	VOL	GND	-	0.2 IOVCC		

5.2. Recommended Driving Condition for Backlight

Ta = 25℃

Item of backlight characteristics 项目	Symbol	Min.	Typ.	Max.	Unit	Condition
Forward voltage 正向电压	Vf	12.5	14.5	16.5	V	If=15mA;Ta=25℃
Number of LED 灯数	-	-	5	-	Piece	-
Connection mode 连接类型	P/S	-	Serial	-	-	-

Using condition: constant current driving method If=15mA(+/-10%).

6. Timing Characteristics

6.1. AC Electrical Characteristics

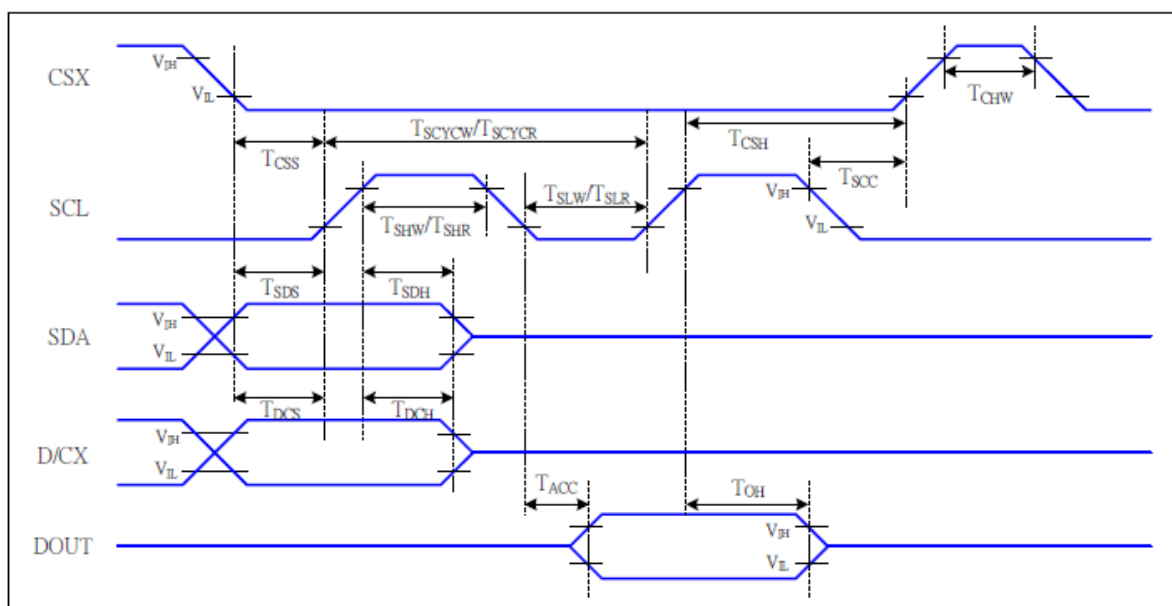### 3-SPI Serial Data Transfer Interface Characteristics:

3-SPI Interface Timing Characteristics

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

Signal	Symbol	Parameter	Min	Max	Unit	Description
CSX	T_{CSS}	Chip select setup time (write)	15		ns	
	T_{CSH}	Chip select hold time (write)	15		ns	
	T_{CSS}	Chip select setup time (read)	60		ns	
	T_{SCC}	Chip select hold time (read)	65		ns	
	T_{CHW}	Chip select "H" pulse width	40		ns	
SCL	T_{SCYCW}	Serial clock cycle (Write)	15		ns	
	T_{SHW}	SCL "H" pulse width (Write)	7		ns	
	T_{SLW}	SCL "L" pulse width (Write)	7		ns	
	T_{SCYCR}	Serial clock cycle (Read)	150		ns	
	T_{SHR}	SCL "H" pulse width (Read)	60		ns	
	T_{SLR}	SCL "L" pulse width (Read)	60		ns	
SDA (DIN)	T_{SDS}	Data setup time	7		ns	
	T_{SDH}	Data hold time	7		ns	
DOUT	T_{ACC}	Access time	10	50	ns	For maximum CL=30pF
	T_{OH}	Output disable time	15	50	ns	For minimum CL=8pF

3-SPI Interface Characteristics

4-SPI Serial Data Transfer Interface Characteristics:

4-SPI Interface Timing Characteristics

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

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
CSX	T_{CSS}	Chip select setup time (write)	15		ns	
	T_{CSH}	Chip select hold time (write)	15		ns	
	T_{CSS}	Chip select setup time (read)	60		ns	
	T_{SCC}	Chip select hold time (read)	65		ns	
	T_{CHW}	Chip select "H" pulse width	40		ns	
SCL	T_{SCYCW}	Serial clock cycle (Write)	15		ns	-write command & data ram
	T_{SHW}	SCL "H" pulse width (Write)	7		ns	
	T_{SLW}	SCL "L" pulse width (Write)	7		ns	
	T_{SCYCR}	Serial clock cycle (Read)	150		ns	-read command & data ram
	T_{SHR}	SCL "H" pulse width (Read)	60		ns	
	T_{SLR}	SCL "L" pulse width (Read)	60		ns	
D/CX	T_{DCS}	D/CX setup time	10		ns	
	T_{DCH}	D/CX hold time	10		ns	
SDA (DIN)	T_{SDS}	Data setup time	7		ns	
	T_{SDH}	Data hold time	7		ns	
DOUT	T_{ACC}	Access time	10	50	ns	For maximum CL=30pF
	T_{OH}	Output disable time	15	50	ns	For minimum CL=8pF

MIPI Interface Characteristics
High Speed Mode – Clock Channel Timing
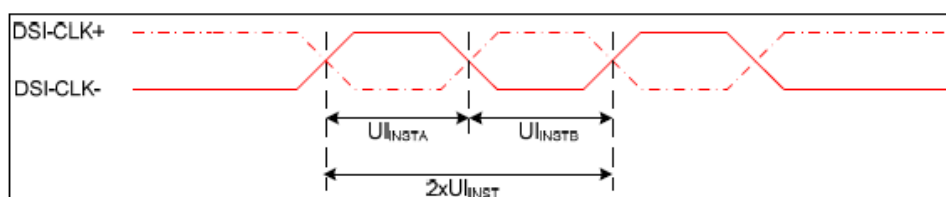
Signal	Symbol	Parameter	MIN	MAX	Unit	Description
DSI-DATA_P/N	2xUI INST	Double UI instantaneous	4	25	ns	
DSI-DATA_P/N	UI INSTA ,UI INSTB	UI instantaneous Half	2	12.5	ns	

High-Speed Data Transmission
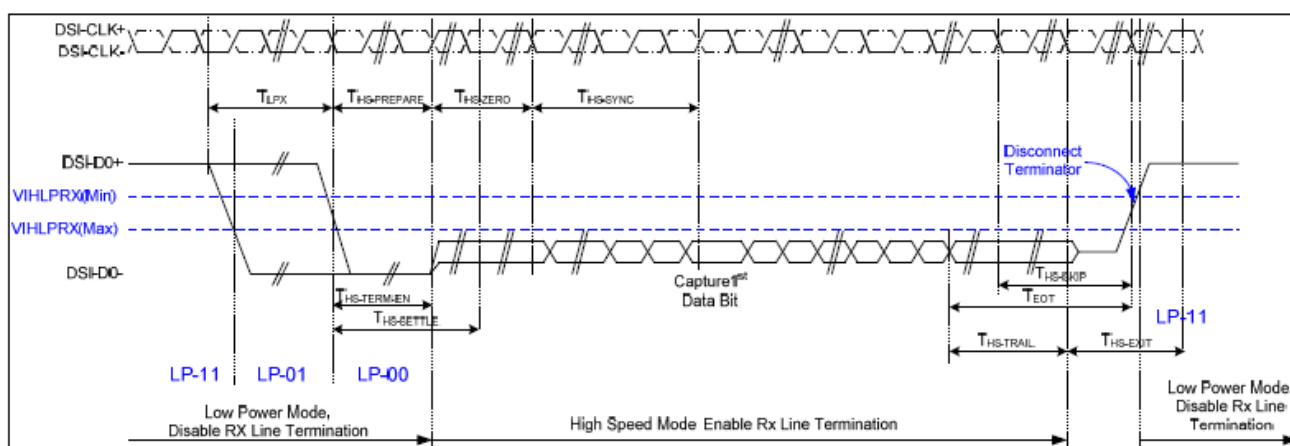
Parameter	Symbol	MIN	TYP	MAX	Unit
Time to drive LP-00 to prepare for HS transmission	$T_{HS-PREPARE}$	40+4UI		85+6UI	ns
Time from start of t HS-TRAIL or t CLK-TRAIL period to start of LP-11 state	T_{EOT}			105+12UI	ns
Time to enable data receiver line termination measured from when Dn crosses VILMAX	$T_{HS-TERM-EN}$			35+4UI	ns
Time to drive flipped differential state after last payload data bit of a HS transmission	$T_{HS-TRAIL}$	60+4UI			ns
Time-out at RX to ignore transition period of EoT	$T_{HS-SKIP}$	40		55+4UI	ns
Time to drive LP-11 after HS burst	$T_{HS-EXIT}$	100			ns
Length of any Low-Power state period	T_{LPX}	50			ns
Sync sequence period	$T_{HS-SYNC}$		8UI		ns
Minimum lead HS-0 drive period before the Sync sequence	$T_{HS-ZERO}$	105+6UI			ns

Switching the Clock Lane between Clock Transmission and Low-Power Mode

Parameter	Symbol	MIN	TYP	MAX	Unit
Time that the transmitter shall continue sending HS clock after the last associated Data Lane has transitioned to LP mode	$T_{CLK-POST}$	60+52UI			ns
Detection time that the clock has stopped toggling	$T_{CLK-MISS}$			60	ns
Time to drive LP-00 to prepare for HS clock transmission	$T_{CLK-PREPARE}$	38		95	ns
Minimum lead HS-0 drive period before starting Clock	$T_{CLK-PREPARE}$ $+T_{CLK-ZERO}$	300			ns
Time to enable Clock Lane receiver line termination measured from when Dn cross VIL,MAX	$T_{HS-TERM-EN}$			38	ns
Minimum time that the HS clock must be set prior to any associated date lane beginning the transmission from LP to HS mode	$T_{CLK-PRE}$	8			UI
Time to drive HS differential state after last payload clock bit of a HS transmission burst	$T_{CLK-TRAIL}$	60			ns

Bus Turnaround Procedure
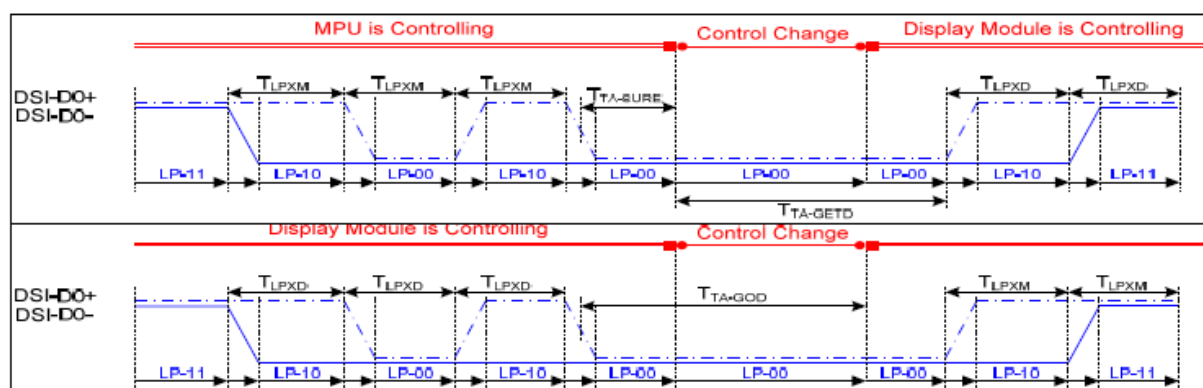
Parameter	Symbol	MIN	TYP	MAX	Unit
Length of any Low-Power state period : Master side	T_{LPX}	50		75	ns
Length of any Low-Power state period : Slave side	T_{LPX}	47.5	50	52.5	ns
Ratio of T_{LPX} (MASTER)/ T_{LPX} (SLAVE) between Master and Slave side	Ratio T_{LPX}	2/3		3/2	
Time-out before new TX side start driving	$T_{TA-SURE}$	T_{LPX}		2 T_{LPX}	ns
Time to drive LP-00 by new TX	T_{TA-GET}		5 T_{LPX}		ns
Time to drive LP-00 after Turnaround Request	T_{TA-GO}		4 T_{LPX}		ns

6. 2.DC Electrical Characteristics

DC Characteristics for MIPI DSI

● MIPI Signaling Voltage Levels
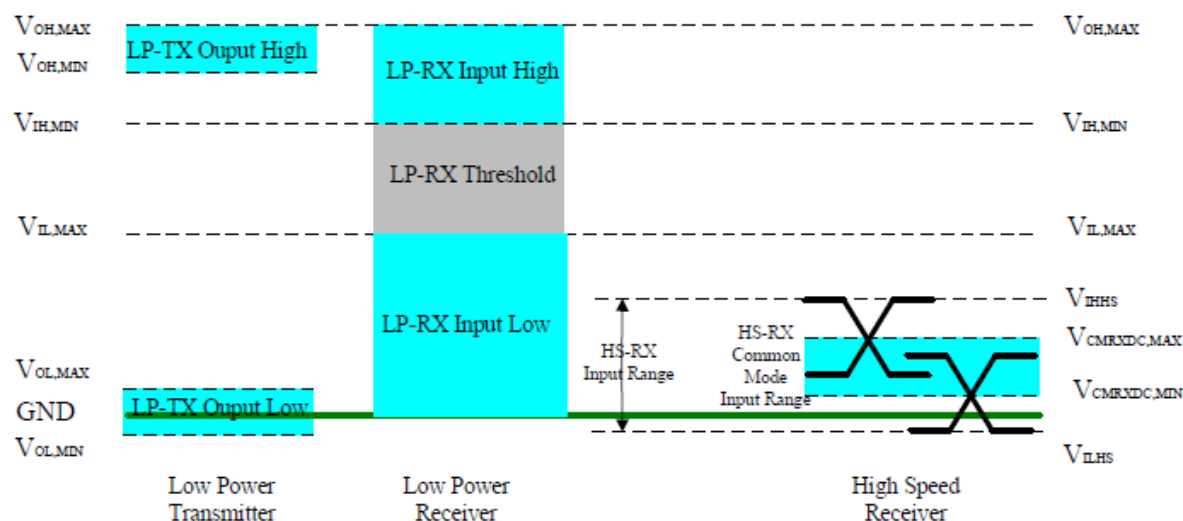
● MIPI DC characteristics

Parameter	Symbol	Specification			Unit
		MIN	TYP	MAX	
Operation Voltage for MIPI Receiver					
Low power mode operating voltage	V_{LPH}	1.1	1.2	1.3	V
MIPI Characteristics for High Speed Receiver					
Single-ended input low voltage	V_{ILHS}	-40	-	-	mV
Single-ended input high voltage	V_{IHHS}	-	-	460	mV
Common-mode voltage	V_{CMRXDC}	70	-	330	mV
Differential input impedance	Z_{ID}	80	100	125	ohm
MIPI Characteristics for Low Power Mode					
Pad signal voltage range	V_I	-50	-	1350	mV
Logic 0 input threshold	V_{IL}	0	-	550	mV
Logic 1 input threshold	V_{IH}	880	-	1350	mV
Output low level	V_{OL}	-50	-	50	mV
Output high level	V_{OH}	1.1	1.2	1.3	V

DC Characteristics for Panel Driving

Parameter	Symbol	Condition	Specification			Unit	Related Pins
			MIN.	TYP.	MAX.		
Power & Operation Voltage							
System Voltage	VDD / VDDA	Operating voltage	2.5	2.8	3.3	V	
Interface Operation Voltage	VDDI	I/O Supply Voltage	1.65	1.8	3.3	V	
Gate Driver High Voltage	VGH		12.54		15.46	V	
Gate Driver Low Voltage	VGL		-12.5		-7.15	V	
Gate Driver Supply Voltage		| VGH-VGL |			27.96	V	
Input / Output							
Logic-High Input Voltage	VIH		0.7VDDI		VDDI	V	Note 1
Logic-Low Input Voltage	VIL		VSS		0.3VDDI	V	Note 1
Differential Input High Threshold Voltage	VIT+			0	50	mV	MIPI_CLK, MIPI_DATA
Differential Input Low Threshold Voltage	VIT-		-50	0		mV	
Single-ended Receiver Input Operation Voltage Range	VIR		0.5		1.2	V	
Logic-High Output Voltage	VOH	IOH = -1.0mA	0.8VDDI		VDDI	V	Note 1
Logic-Low Output Voltage	VOL	IOL = +1.0mA	VSS		0.2VDDI	V	Note 1
Logic-High Input Current	IIH	VIN = VDDI			1	uA	Note 1
Logic-Low Input Current	IIL	VIN = VSS	-1			uA	Note 1
Input Leakage Current	ILI	IOH = -1.0mA	-0.1		+0.1	uA	Note 1
VCOM Voltage							
VCOM Voltage	VCOM			VSS		V	
Source Driver							
Gamma Reference Voltage(Positive)	VAP		4.45		6.4	V	
Gamma Reference Voltage(Negative)	VAN		-4.6		-2.65		
Source Output Settling Time	Tr	Below with 99% precision			20	us	Note 2
Output Offset Voltage	VOFFSET				35	mV	Note 3

Notes:

1. TA= -30 to 85℃.

2. Source channel loading= 2KΩ+12pF/channel, Gate channel loading=5KΩ+40pF/channel.

3. The max. value is between measured point of source output and gamma setting value.

6. 3. Power ON/OFF Sequence

VDDI and VDD can be applied in any order.

VDD and VDDI can be power down in any order.

During power off, if LCD is in the Sleep Out mode, VDD and VDDI must be powered down minimum 120msec after RESX has been released.

During power off, if LCD is in the Sleep In mode, VDDI or VDD can be powered down minimum 0msec after RESX has been released.

CSX can be applied at any timing or can be permanently grounded. RESX has priority over CSX.

Note 1: There will be no damage to the display module if the power sequences are not met.
Note 2: There will be no abnormal visible effects on the display panel during the Power On/Off Sequences.
Note 3: There will be no abnormal visible effects on the display between end of Power On Sequence and before receiving Sleep Out command. Also between receiving Sleep In command and Power Off Sequence.
Note 4: If RESX line is not held stable by host during Power On Sequence as defined in the sequence below, then it will be necessary to apply a Hardware Reset (RESX) after Host Power On Sequence is complete to ensure correct operation. Otherwise function is not guaranteed.

The power on/off sequence is illustrated below

Tr_{PW} = +/- no limit Tf_{PW} = +/- no limit

VDD

VDDI

Timing when the latter signal rises up to 90% of its typical value. e.g. When VDD comes later, this timing is defined at the cross point of 90% of 2.75V, not 90% of 2.6V.

Timing when the latter signal falls up to 90% of its typical value. e.g. When VDD comes later, this timing is defined at the cross point of 90% of 2.75V, not 90% of 2.6V.

Tf_{PW-CSX} = +/- no limit

Tr_{PW-CSX} = +/- no limit

CSX   H or L

$Tr_{PW-RESX}$ = + no limit

RESX
(Power down in sleep-out mode)   30% $Tf_{PW-RESX1}$ = min 120ms

$Tr_{PW-RESX}$ = + no limit $Tf_{PW-RESX2}$ = min 0ms

RESX
(Power down in sleep-in mode)   30%

$Tf_{PW-RESx1}$ is applied to RESX falling in the Sleep Out Mode.
$Tf_{PW-RESx2}$ is applied to RESX falling in the Sleep In Mode.

7. Optical Characteristics

Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles		θT	CR≥10	70	80	-	Degree	Note 2
		θB		70	80	-		
		θL		70	80	-		
		θR		70	80	-		
Contrast Ratio		CR	θ = 0°	250	500	-		Note 1 Note 3
Response Time		$T_{ON}+T_{OFF}$	25°C	-	35	55	ms	Note 1 Note 4
Chromaticity	W_x	x		0.2744	0.3144	0.3544		Note 1 Note 5
	W_y	y		0.2992	0.3392	0.3792		
	R_x	x		0.5897	0.6297	0.6697		
	R_y	y		0.3075	0.3475	0.3875		
	G_x	x		0.2988	0.3388	0.3788		
	G_y	y		0.5779	0.6179	0.6579		
	B_x	x		0.1142	0.1542	0.1942		
	B_y	y		0.0544	0.0944	0.1344		
Uniformity		U		70	-	-	%	Note 5
Luminance		L		-	390	-	cd/m^2	Note 1 Note 5

Test Conditions:

1. If=15mA(Backlight current), VCC = 2.8 V, the ambient temperature is 25°C.

2. The test systems refer to Note 2.

Note1: Definition of optical measurement system.
  The optical characteristics should be measured in dark room. After 5Minutes operation, the optical properties are measured at the center point of the LCD screen. ALL input terminals LCD panel must be ground when measuring the center area of the panel.
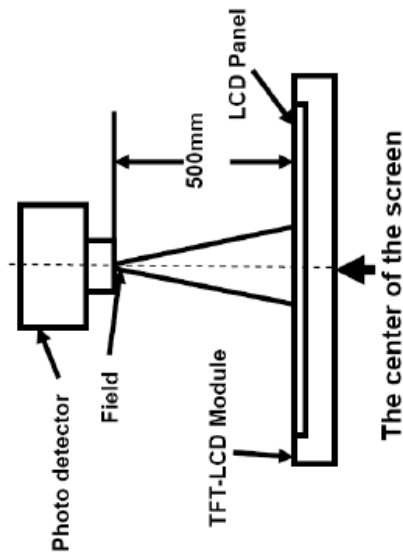
Item	Photo detector	Field
Contrast Ratio		
Luminance	CS1000	1°
Lum Uniformity		
Chromaticity	CS1000	
Response Time	DMS703	-

Note2: Definition of viewing angle range and measurement system.
  Viewing angle is measured at the center point of the LCD by CONOSCOPE (DMS703)
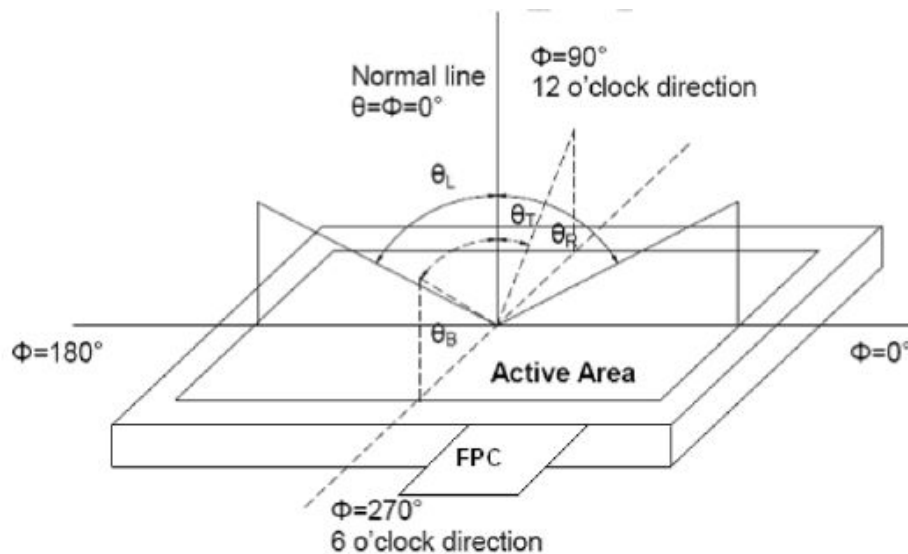
Note3: Definition of contrast ratio
  White state ":The state is that the LCD should drive by Vwhite.

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

  "Black state ":The state is that the LCD should drive by Vblack.
  Vwhite: To be determined Vblack: To be determined

Note4: 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% to90%.
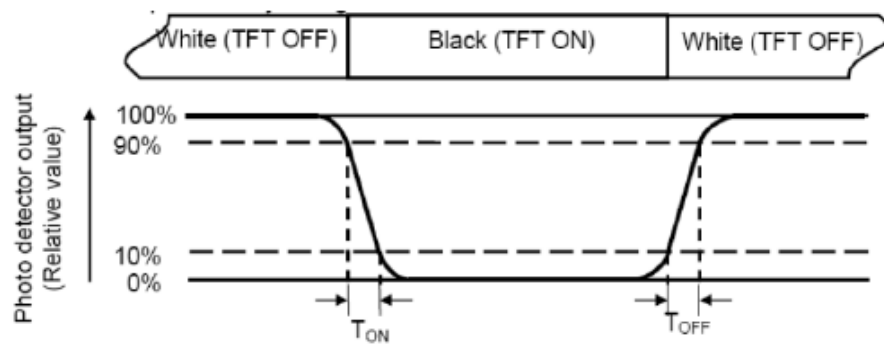
Note5: Definition of color chromaticity（CIE1931）
      Color coordinates measured at center point of LCD.

Note6: 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
      L-Active area length   W-Active area width
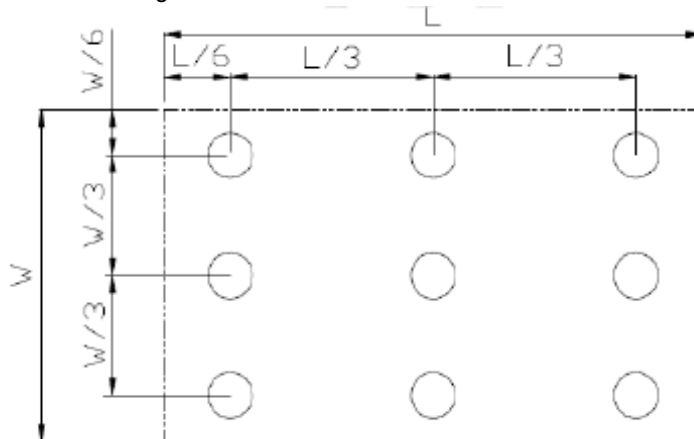
      L max: The measured Maximum luminance of all measurement position.
      L min: The measured Minimum luminance of all measurement position.

Note7: Definition of luminance: Measure the luminance of white state at center point.
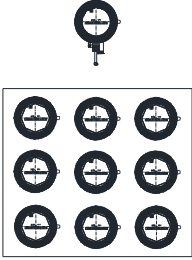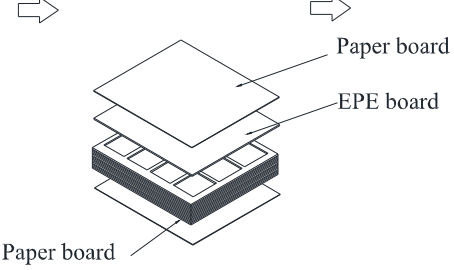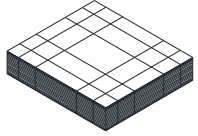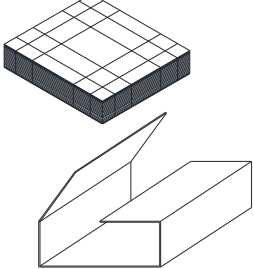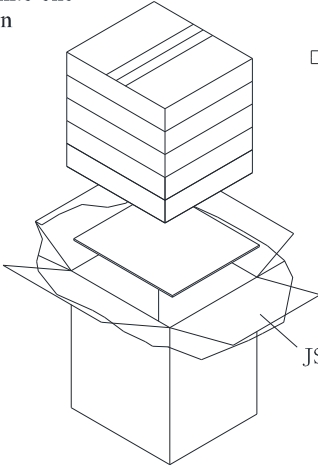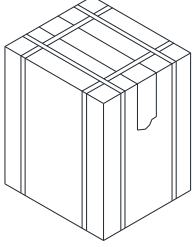
8. Environmental/Reliability Test

No.	Test Item	Test Condition	Inspection after test
1	High Temperature Storage	80±2℃/240 hours	Inspection after 2~4hours storage at room temperature, the sample shall be free from defects: 1.Air bubble in the LCD; 2.Sealleak; 3.Non-display; 4.Missing segments; 5.Glass crack; 6.Current Idd is twice higher than initial value.
2	Low Temperature Storage	-30±2℃/240 hours	
3	High Temperature Operating	70±2℃/240 hours	
4	Low Temperature Operating	-20±2℃/240 hours	
5	Temperature Cycle	-30℃~ 25℃~ 80℃ × 10cycles (30min.) (5min.) (30min.)	
6	Damp Proof Test	40℃±5℃×90%RH/240 hours	
7	Vibration Test	Frequency：10Hz~55Hz~10Hz Amplitude：1.5mm, X，Y，Z direction for total 3hours (Packing condition)	
8	Dropping test	Drop to the ground from 1m height, one time, every side of carton. (Packing condition)	
9	ESD test	Voltage:±8KV R: 330Ω C: 150pF Air discharge, 10time	
		Voltage:±6KV R: 330Ω C: 150pF Contact discharge, 10time	

Remark:
1. The test samples should be applied to only one test item.
2. Sample size for each test item is 5~10pcs.
3. For Damp Proof Test, Pure water(Resistance＞10MΩ) 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 judge as a good part.
5. Failure Judgment Criterion: Basic Specification, Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.
6. Please use automatic switch menu(or roll menu) testing mode when test operating mode.

9. Packing Drawing

CUSTOMER'S APPROVED:		DATE:2021.06.25	PAGE: 1/1

PRODUCT PART NO.: YTC210HLAB-03-100C-V1

PACKING TYPE: BY EPE TRAY(T210HLAB-03-100B)

PACKLING ORDER:

1) Putting 9 pcs Modules on each EPE tray.

2) Putting 7 pcs EPE trays together with EPE paper on the top of EPE tray.

3) Assembling the boards and the tray together with adhesive tape

Paper board

EPE board

Paper board

4) Putting in the inner small carton (TYPE:H82)

5) Putting 5 small cartons into one outcarton

6) Packing   finished

JSC plastic bag

Note: 9 pcs in a tray, 7 trays in a inner carton,5 inner cartons in a out carton, so 9x7x5=315pcs/Outcarton

Dimension (Small carton): 385*325*87㎜   Dimension (Out carton): 394*344*470㎜

NO. YTC210HLAB-03-100C-V1 Ver.1	Drw:		Chk:		Apv:	

ANSHAN   YES   OPTOELECTRONICES   DISPLAY   CO.,   LTD

10. Standard Specifications For Product Quality

10.1. Manner of test:

10.1.1 The test must be under 40W fluorescent light, and the distance of view must be at 35±5cm

10.1.2 Room temperature 25±5℃   Humidity: (65±5)%RH.

10.1.3 If the product is uneven and bright spot, use 2%ND filter to check and confirm. Not visible, OK.

10.1.4 Inspection Angle:
        The vision of inspector should be perpendicular to the surface of the Module.

10.1.5 Inspection time：
        Perceptibility Test Time: 20 seconds max.

10.2. Quality specification

It shall be based on GB2828, inspection level II.

	IETM	CHECK LEVEL	AQL
MAJOR (MA)	1.Liquid crystal leakage 2.Wrong polarizer 3.Outside dimension 4. Bright dot,Dark dot 5. Display abnormal 6. Glass crack	II	0.65
MINOR (MI)	1. Spot Defect (Including black spot,white spot,pinhole,foreign particle,bubbles,hurt） 2. fragment 3. Line Defect (Including black line,white line,scratch) 4. Incision defect 5. Newton's ring 6. Other visual defects	II	1.0

10.3 Definition of area

10.3.1 Ⅰ area: viewing area
        Ⅱ area: outside viewing area
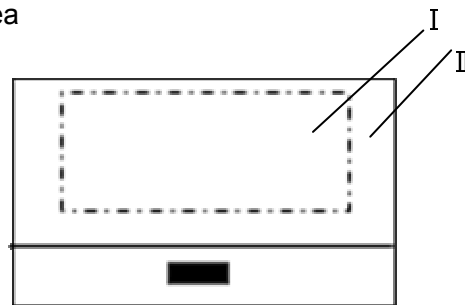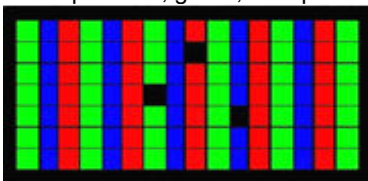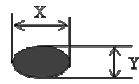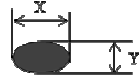
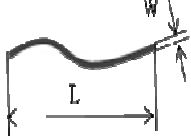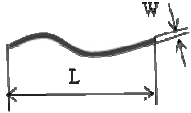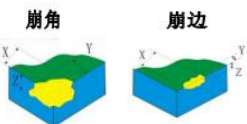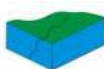## 10.4. Standard of appearance test for Ⅰ area: (unit: mm)

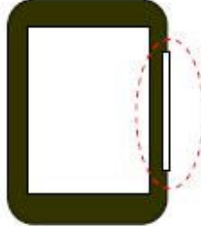NOTE：Defect ignore for Ⅱ area.

10.4.1 Bright/Dark Dots explain

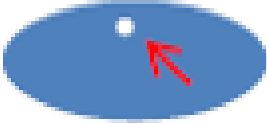| Name	Explain	Definition
Bright dot	Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern 	The definition of dot: The size of a defective dot over 1/2 of single pixel dot is regarded as one defective dot . Note:One pixel consists of 3 sub-pixels, including R,G, and B dot.(Sub-pixel = Dot)
Dark dot	Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue pattern. 	
Adjacent Dot	Adjacent two sub-pixel are defect（define two dot defect）	

10.4.2 Inspection standard

No	Items	Criterion				Checking manner	Defect classes
1	Bright/dark dot	LCD≤4.3"	4.3"＜LCD＜7"	7"≤LCD≤12"	LCD＞12"	Checking with eyes	MAJ
		Bright dot：N≤2 Dark dot：N≤3 Total：N≤4	Bright dot：N≤3 Dark dot：N≤4 Total：N≤6	Bright dot：N≤4 Dark dot：N≤5 Total：N≤8	Bright dot：N≤5 Dark dot：N≤6 Total：N≤10		
		The distance between the two defect dots shall be greater than 5mm The distance between two defect dots above 7 inches shall be more than 10 mm					
		Note: Adjacent dot defect N≤0					
2	Spot defects (black and white spot, pinhole, foreign matter, dent, backlight foreign matter) D=(X+Y)/2	D≤0.15 Ignore 0.15＜D≤0.3 N≤3 0.3＜D　N=0	D≤0.2 Ignore 0.2＜D≤0.5 N≤4 0.5＜D　N=0	D≤0.2 Ignore 0.2＜D≤0.5 N≤5 0.5＜D　N=0	D≤0.2 Ignore 0.2＜D≤0.5 N≤6 0.5＜D　N=0	Checking with eyes	MIN
3	Bubble D=(X+Y)/2	D≤0.2 Ignore 0.2＜D≤0.5 N≤3 0.5＜D　N=0	D≤0.2 Ignore 0.2＜D≤0.5 N≤4 0.5＜D　N=0	D≤0.2 Ignore 0.2＜D≤0.5 N≤5 0.5＜D　N=0	D≤0.2 Ignore 0.2＜D≤0.5 N≤6 0.5＜D　N=0		

No	Items	Criterion				Checking manner	Defect classes
		LCD≤4.3"	4.3"＜LCD＜7"	7"≤LCD≤12"	LCD＞12"		
4	Line defects(black and white line, backlight foreign matter etc.)	W≤0.03 Ignore 0.03＜W≤0.06 L≤5 N≤3 W＞0.06 L＞5 N=0	W≤0.03 Ignore 0.03＜W≤0.1 L≤5 N≤4 W＞0.1 L＞5 N=0	W≤0.03 Ignore 0.03＜W≤0.1 L≤5 N≤5 W＞0.1 L＞5 N=0	W≤0.03 Ignore 0.03＜W≤0.1 L≤5 N≤6 W＞0.1 L＞5 N=0	Checking with eyes	MIN
5	Scratch	W≤0.03 Ignore 0.03＜W≤0.2 1.0＜L≤ 5.0 N≤3 W＞0.2 L＞5 N=0	W≤0.03 Ignore 0.03＜W≤0.2 1.0＜L≤ 5.0 N≤4 W＞0.2 L＞5 N=0	W≤0.03 Ignore 0.03＜W≤0.2 1.0＜L≤ 5.0 N≤5 W＞0.2 L＞5 N=0	W≤0.03 Ignore 0.03＜W≤0.2 1.0＜L≤ 5.0 N≤6 W＞0.2 L＞5 N=0	Checking with eyes	MIN
6	Display abnormal	Not allowed				Checking with eyes	MAJ
7	Outside dimension	Accord with drawing				Calipers	MAJ
8	Glass crack	Not allowed				Checking with eyes	MAJ
9	Leak	Not allowed				Checking with eyes	MAJ
10	Comer and side fragment	崩角 崩边	**1.** Comer fragment： X ， Y≤1mm Z≤T/2 allowed 2. Side fragment： X≤2.0mm Y≤1mm Z≤T/2 allowed			Calipers& Eyes	MIN
11	Crack		NG			Eyes	MAJ
12	Newton's ring （CTP or Cover board）		Newton's ring＜1/9 area ,after lightened ,no influence on words and lines			Checking with eyes	MIN

TP 标准

No	Items	Phenomenon/picture	Criterion	Checking manner	Defect class
1	Outside dimension		Accord with drawing	Calipers& Eyes	MIN
2	Color deviation	Difference of ink color	Obvious deviation compared with samples	Eyes	MIN
3	Ink pinhole	油墨针孔	No any holes near VA side 3mm Out of VA：D≤0.15mm N≤1 ,no present in reflection condition.	Eyes Film	MIN
4	Ink saw tooth	印刷锯齿	W≤0.15mm N=1	Eyes Film	MIN
5	Ink light leakage	油墨漏光	1、width of light leakage at the edge area ≤0.15mm OK 2、width of light leakage at the edge area >0.15mm NG	Eyes Film	MIN
6	Cover glass profile		No ink, adhesive, oil stain, etc.	Eyes	MIN
7	IR(LED)dot/black-white dot		φ≤0.2、N≤1 0.15 < φ、not allowed	Eyes& Film	MIN
8	IR(LED)dot black-white dot/different color		no present when use all viewing angle to determine at 35cm ,allowed	Eyes	MIN
9	Shooting hole		φ≤0.2、N≤1 0.15 < φ、not allowed	Eyes& Film	MIN

10	LOGO/ICON black-white dot		Diagram clear φ≤0.2、N≤1	Eyes& Film	MIN
11	FPC warped	FPC翘曲	OK	Eyes	MIN
12	FPC broken, stained, oxidation	FPC折伤	NG	Eyes	MAJ
13	Stain		No evident finger print，oil print，gelatinoids，etc.	Eyes	MIN
14	Sponge		Presented in AA area. NG	Eyes	MIN
15	Protection foil	Finished Protection foil	1、Protection foil stain：In normal inspection condition ,finger print，pen print and gelatinoids are presented. NG 2、Bubble≤5.0mm ,or according to client's limited sample 3、Protection foil worn and warped。NG 4、Scratch：W≤0.10mm，ignore length；0.10mm＜W≤0.20mm，L≤30mm，and N≤4,d＞15mm；OK;L＞30mm or W＞0.20mm;NG	Eyes& Film	MIN

11. Precautions for Use of LCD Modules

11.1 Handing Precautions

(1) The display panel is made of glass and polarizer. As glass is fragile. It tends to become or chipped during handling especially on the edges. Please avoid dropping or jarring. Do not subject it to a mechanical shock by dropping it or impact.

(2) If the display panel is damaged and the liquid crystal substance leaks out, be sure not to get any in your mouth. If the substance contacts your skin or clothes, wash it off using soap and water.

(3) Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary. Do not touch the display with bare hands. This will stain the display area and degraded insulation between terminals (some cosmetics are determined to the polarizer).

(4) The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully. Do not touch, push or rub the exposed polarizer with anything harder than an HB pencil lead (glass, tweezers, etc.). Do not put or attach anything on the display area to avoid leaving marks on. Condensation on the surface and contact with terminals due to cold will damage, stain or dirty the polarizer. After products are tested at low temperature they must be warmed up in a container before coming is contacting with room temperature air.

(5) If the display surface becomes contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, moisten cloth with one of the following solvents
- Isopropyl alcohol
- Ethyl alcohol
- Do not scrub hard to avoid damaging the display surface.

(6) Solvents other than those above-mentioned may damage the polarizer. Especially, do not use the following.
- Water
- Ketone
- Aromatic solvents
Wipe off saliva or water drops immediately, contact with water over a long period of time may cause deformation or color fading. Avoid contacting oil and fats.

(7) Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.

(8) Install the LCD Module by using the mounting holes. When mounting the LCD module make sure it is free of twisting, warping and distortion. In particular, do not forcibly pull or bend the I O cable or the backlight cable.

(9) Do not attempt to disassemble or process the LCD module.

(10) NC terminal should be open. Do not connect anything.

(11) If the logic circuit power is off, do not apply the input signals.

(12) Electro-Static Discharge Control, Since this module uses a CMOS LSI, the same careful attention should be paid to electrostatic discharge as for an ordinary CMOS IC. To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
- Before remove LCM from its packing case or incorporating it into a set, be sure the module and your body have the same electric potential. Be sure to ground the body when handling the LCD modules.
- Tools required for assembling, such as soldering irons, must be properly grounded.   make certain the AC power source for the soldering iron does not leak. When using an electric screwdriver to attach LCM, the screwdriver should be of ground potentiality to minimize as much as possible any transmission of electromagnetic waves produced sparks coming from the commutator of the motor.
- To reduce the amount of static electricity generated, do not conduct assembling and other work under dry conditions. To reduce the generation of static electricity be careful that the air in the work is not too dried. A relative humidity of 50%-60% is recommended. As far as possible make the electric potential of your work clothes and that of the work bench the ground potential.
The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.

(13) Since LCM has been assembled and adjusted with a high degree of precision, avoid applying excessive shocks to the module or making any alterations or modifications to it.
- Do not alter, modify or change the shape of the tab on the metal frame.
- Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.
- Do not damage or modify the pattern writing on the printed circuit board.
- Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector.
- Except for soldering the interface, do not make any alterations or modifications with a soldering iron.
- Do not drop, bend or twist LCM.

11.2 Storage Precautions

When storing the LCD modules, the following precaution is necessary.
(1) Store them in a sealed polyethylene bag. If properly sealed, there is no need for the dessicant.
(2) Store them in a dark place. Do not expose to sunlight or fluorescent light, keep the temperature between 0℃ and 35℃.
(3) The polarizer surface should not come in contact with any other objects. (We advise you to store them in the container in which they were shipped).

11.3 Others

(1) Liquid crystals solidify under low temperature (below the storage temperature range) leading to defective orientation or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subject to a low temperature.
(2) If the LCD modules have been operating for a long time showing the same display patterns, the display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear.A normal operating status can be regained by suspending use for some time. It should be noted that this phenomenon does not adversely affect performance reliability.
(3) To minimize the performance degradation of the LCD modules resulting from destruction caused by static electricity etc., exercise care to avoid holding the following sections when handling the modules.
- Exposed area of the printed circuit board.
-Terminal electrode sections.

11.4 USING LCD MODULES

Installing LCD Modules

The hole in the printed circuit board is used to fix LCM as shown in the picture below. Attend to the following items when installing the LCM.
(1) Cover the surface with a transparent protective plate to protect the polarizer and LC cell.
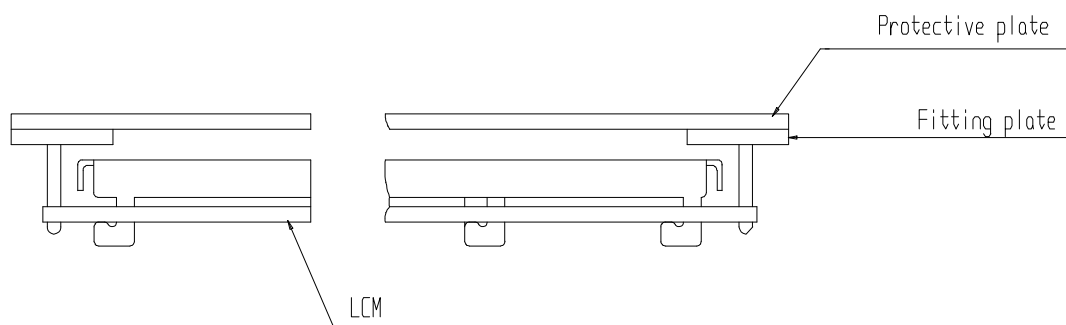
(2) When assembling the LCM into other equipment, the spacer to the bit between the LCM and the fitting plate should have enough height to avoid causing stress to the module surface, refer to the individual specifications for

measurements. The measurement tolerance should be 0.1mm.

Precaution for assemble the module with BTB connector:

Please note the position of the male and female connector position, don't assemble or assemble like the method which the following picture shows
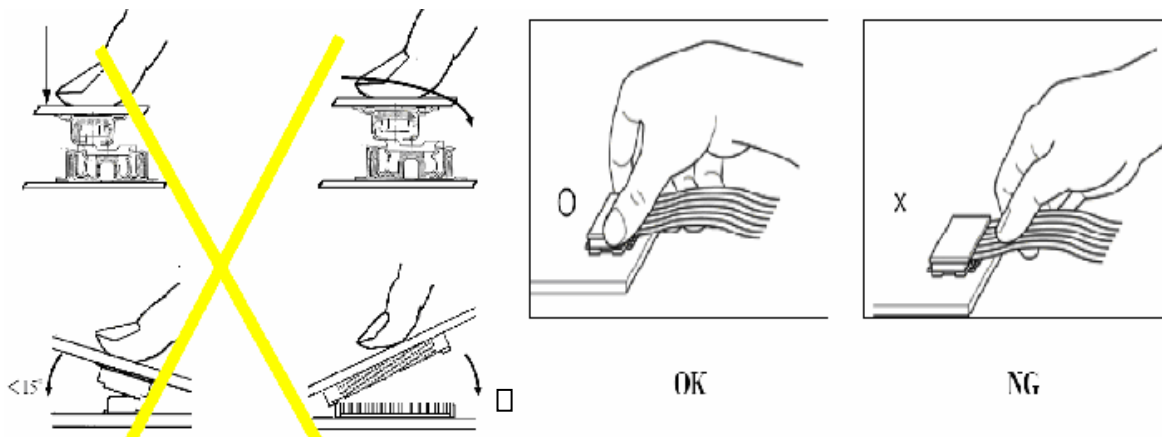
Precaution for soldering to the LCM

	Hand soldering	Machine drag soldering	Machine press soldering
No ROHS Product	290 C~350 C. Time :3-5S.	330 C ~350 C. Speed : 4-8mm/s.	300 C~330C. Time : 3-6S. Press: 0.8~1.2Mpa
ROHS Product	340 C~370 C. Time:3-5S.	350 C ~370 C. Time : 4-8 mm/s.	330 C~360C. Time : 3-6S. Press: 0.8~1.2Mpa

(1)   If soldering flux is used, be sure to remove any remaining flux after finishing to soldering operation. (This does not apply in the case of a non-halogen type of flux.) It is recommended that you protect the LCD surface with a cover during soldering to prevent any damage due to flux spatters.

(2)   When soldering the electroluminescent panel and PC board, the panel and board should not be detached more than three times. This maximum number is determined by the temperature and time conditions mentioned above, though there may be some variance depending on the temperature of the soldering iron.

(3)   When remove the electroluminescent panel from the PC board, be sure the solder has completely melted, the soldered pad on the PC board could be damaged.

Precautions for Operation

(1)   It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage then the limit cause the shorter LCD life. An electrochemical reaction due to direct current causes LCD's undesirable deterioration, so that the use of direct current drive should be avoided.

(2)   Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD's show dark color in them. However those phenomena do not mean malfunction or out of order with LCD's, which will come back in the specified operating temperature.

(3)   If the display area is pushed hard during operation, the display will become abnormal. However, it will return to normal if it is turned off and then back on.

(4)   A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit. Usage under the maximum operating temperature,50%RH or less is required.

(5)   Input each signal after the positive/negative voltage becomes stable.

(6)   Please keep the temperature within specified range for use and storage. Polarization degradation, bubble generation or polarizer peel-off may occur with high temperature and high humidity.

Safety

(1) It is recommended to crush damaged or unnecessary LCDs into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned.

(2) If any liquid leaks out of a damaged glass cell and comes in contact with the hands, wash off thoroughly with soap and water.

11.5The disposal of waste

For waste disposal, our recommendations are as follows, please refer to your company, and the relevant provisions of the state laws and regulations of the act accordingly

1. Packing materials disposal for our packaging (carton/PS tray/EPE tray/PET tray)

   1) Our company used to recycle and reuse materials, packing materials can be you just need to transfer to material recycling companies

2. Our scrap module can't be recycled for reuse, so please dispose of:

   1) Our scrap module can't be recycled for reuse, products and components are "served" can lead to accidents

   2) Our scrap can be transfer to material recycling companies, dismantling, to ensure that scrap in relatively advanced technology products, environmental protection measures of relatively perfect environment for processing.

3. WEEE order must be executed in product scrap.

12. Prior Consult Matter

1. (1) For YES standard products, we keep the right to change material, process…for improving the product property without notice on our customer.

  (2) For OEM products, if any change needed which may affect the product property, we will consult with our customer in advance.

2. If you have special requirement about reliability condition, please let us know before you start the test on our samples.

13. Factory

FACTORY NAME: YES OPTOELECTRONICS DISPLAY CO.,LTD
FACTORY ADDRESS: No.288 Yueling Road Anshan, Liaoning, P.R.CHINA
FACTORY PHONE: 86-412-5211859   FAX: 86-412-5211729