



Product Specification

Part Name: 10.1 inch TFT DISPLAY MODULE

Customer Part ID:

Topovision Part ID: TVT1010L10-CP

Ver: A

Customer:
Approved by

From: Topovision Technology Co., Ltd.
Approved by

Notes:

1. Please contact Topovision Technology Co., Ltd. before assigning your product based on this module specification
2. The information contained herein is presented merely to indicate the characteristics and performance of our products. No responsibility is assumed by Topovision Technology Co., Ltd. for any intellectual property claims or other problems that may result from application based on the module described herein.

Revision History

Rev.	Date	Contents	Written	Approved
A	2021/07/14	Preliminary Specification	ZHENG	YUAN

Special Notes

Note1.	

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1. General Specifications

No.	Item	Specification	Remark
1	LCD size	10.1 inch	
2	Driver element	a-Si TFT active matrix	
3	Resolution	800(W) RGB x1280(H)	
4	Display mode	Normally Black, Transmissive	
5	Dot pitch	0.1692(W) x 0.1692(H)mm	
6	Active area	135.36(W) x 216.58(H) mm	
7	Module size	163.74(W) x 244.96(H) x4.625(D) mm	Note 1
9	View direction	ALL	O 'clock
10	Surface treatment	Hard Coating	
11	Color arrangement	RGB-stripe	
12	Interface	MIPI	
13	Lcm power consumption	2.5W	
14	Drive IC	ILI9881C	

Note 1: Refer to Mechanical drawing.

2. Pin Assignment

FPC Connector is used for the module electronics interface. The recommended model is FH12-40S-0.5SH manufactured by Hirose.

Pin No	Symbol	I/O	Function	Remark
1	NC	-	Open	
2	VDD	P	Power supply 2.8V/3.3V	
3	VDD	P	Power supply 2.8V/3.3V	
4	GND	P	Ground	
5	RESET	I	The external reset pin 1.8V	
6	NC	-	Open	
7	GND	P	Ground	
8	D2-	I	DSI data2 Negative signal	
9	D2+	I	DSI data2 Positive signal	
10	GND	P	Ground	
11	D1-	I	DSI data1 Negative signal	
12	D1+	I	DSI data1 Positive signal	
13	GND	P	Ground	
14	CLK-	I	DSI clock Negative signal	
15	CLK+	I	DSI clock Positive signal	
16	GND	P	Ground	
17	D0-	I	DSI data0 Negative signal	
18	D0+	I	DSI data0 Positive signal	
19	GND	P	Ground	
20	D3-	I	DSI data3 Negative signal	
21	D3+	I	DSI data3 Positive signal	
22	GND	P	Ground	
23	NC	-	Open	
24	NC	-	Open	
25	GND	P	Ground	
26	NC	-	Open	
27	NC	-	Open	
28	NC	-	Open	
29	NC	-	Open	
30	GND	P	Ground	
31	LEDK	P	Power Supply For LED Backlight Cathode Input	

32	LEDK	P	Power Supply For LED Backlight Cathode Input	
33	NC	-	Open	
34	NC	-	Open	
35	NC	-	Open	
36	NC	-	Open	
37	NC	-	Open	
38	NC	-	Open	
39	LEDA	P	Power Supply For LED Backlight Anode Input	
40	LEDA	P	Power Supply For LED Backlight Anode Input	

Note I: input; O: output; P: Power or Ground(0V).

2.1 TP Pin Assignment

FPC Connector is used for the module electronics interface. The recommended model is 126106RT manufactured by GTK.

Pin No	Symbol	I/O	Function	Remark
1	VCC (3.3V)	P	Power for TP	
2	RST (1.8V)	I	TP Reset pin	
3	SCL (1.8V)	I	TP High speed interface CLOCK differential signal input pins.	
4	SDA (1.8V)	I	TP serial data input/output bi-direction pin	
5	INT (1.8V)	O	TP Interrupt	
6	GND	P	Ground	

Note I: input; O: output; P: Power or Ground(0V).

3. Operation Specifications

3.1. Absolute Maximum Ratings

Test condition: GND=0V, T_A=25 °C

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
	V _{DD}	2.725	2.8	3.3	V	
Input logic high voltage	V _{IH}	0.7 V _{DD}	-	V _{DD}	V	
Input logic low voltage	V _{IL}	-0.3	-	0.2 V _{DD}	V	
Operation Temperature	T _{OP}	-10	-	50	°C	
Storage Temperature	T _{ST}	-20	-	60	°C	

3.2. Current for LED Driver

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Voltage for LED Backlight	V_L	19.4	21	23.1	V	Note 1
Current for LED Backlight	I_L	-	100	-	mA	
LED life time	-	20,000	-	-	Hr	Note 2

Note1: $V_L=21V$, $I_L=100mA$ (Backlight circuit: 7 series connection, 4 parallel connection), the ambient temperature is 25°C.

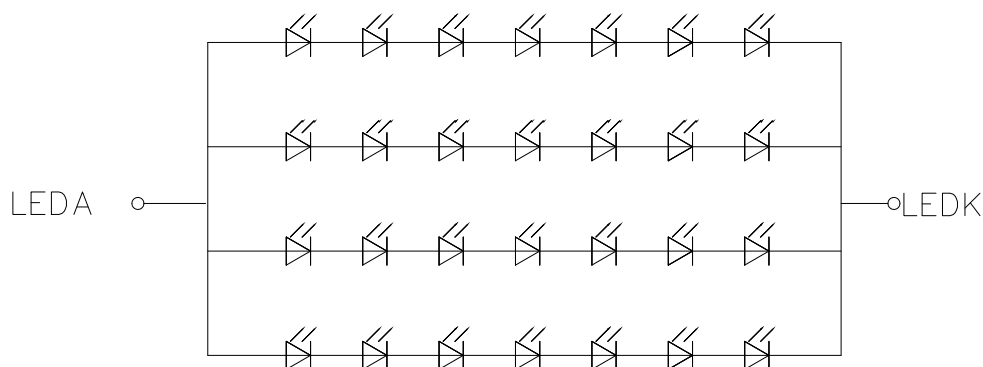
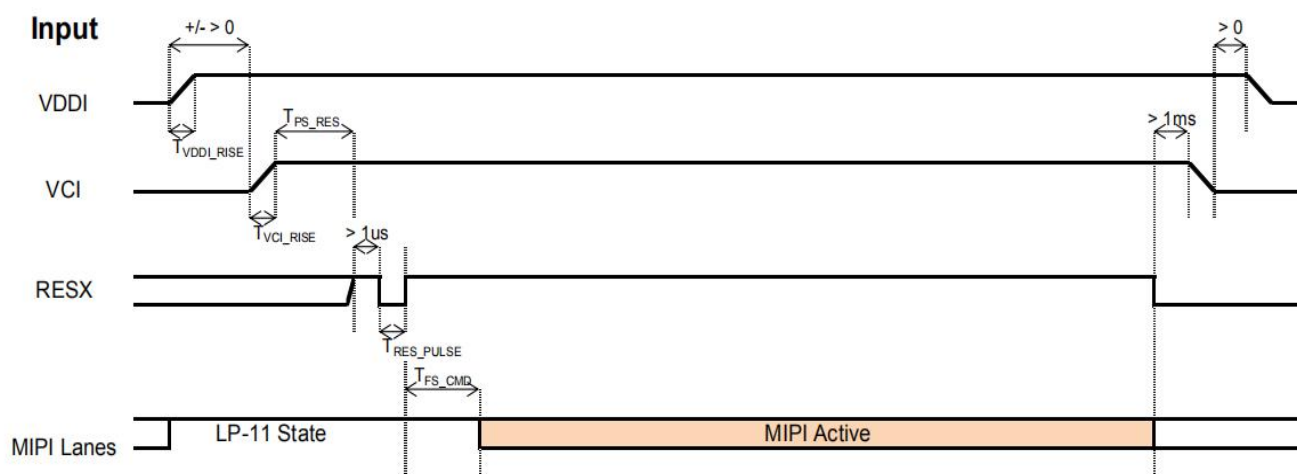


Fig. 3-1 LED test circuit diagram

Note 2: The “LED life time” is defined as the module brightness decrease to 50% original brightness at $T_a=25^{\circ}C$ and 1/2 rated current . The LED lifetime could be decreased if operating I_L is larger than 100 mA.

3.3. Power Sequence



Symbol	Characteristics	Min.	Typ.	Max.	Units
T_{VDDI_RISE}	VDDI Rise time	200	-	-	us
T_{VCI_RISE}	VCI Rise time	200	-	-	us
T_{PS_RES}	VDDI/VCI on to Reset high	5	-	-	ms
T_{RES_PULSE}	Reset low pulse time	10	-	-	us
T_{FS_CMD}	Reset to first command	10	-	-	ms

Figure 106: Power on/off sequence with Power Mode 3

3.4. Reset input timings

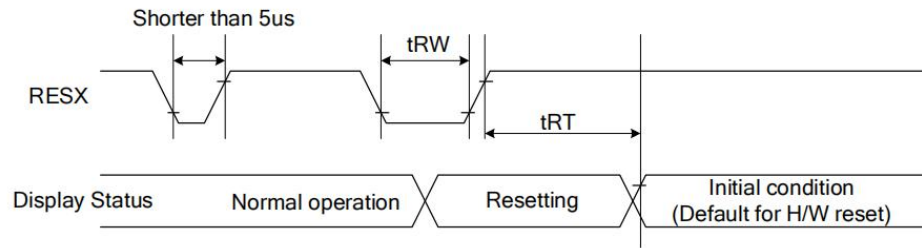


Figure 126: Reset Timing

Table 47: Reset Timing

Signal	Symbol	Parameter	Min	Max	Unit
RESX	tRW	Reset pulse duration	10		uS
	tRT	Reset cancel		5 (note 1,5) 120 (note 1,6,7)	mS

Notes:

1. The reset cancel also includes required time for loading ID bytes, VCOM setting and other settings from EEPROM to registers. This loading is done every time when there is H/W reset cancel time (tRT) within 5 ms after a rising edge of RESX.
2. Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the Table 48.

Table 48: Reset Descript

RESX Pulse	Action
Shorter than 5us	Reset Rejected
Longer than 10us	Reset
Between 5us and 10us	Reset starts

3. During the Resetting period, the display will be blanked (The display enters the blanking sequence, which maximum time is 120 ms, when Reset Starts in the Sleep Out mode. The display remains the blank state in the Sleep In mode.) and then return to Default condition for Hardware Reset.
4. Spike Rejection can also be applied during a valid reset pulse, as shown below:

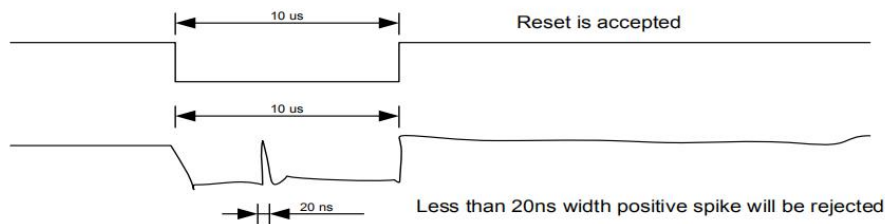


Figure 127: Positive Noise Pulse during Reset Low

5. When Reset applied during Sleep In Mode.
6. When Reset 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.

3.5. High speed mode-rising and falling timing

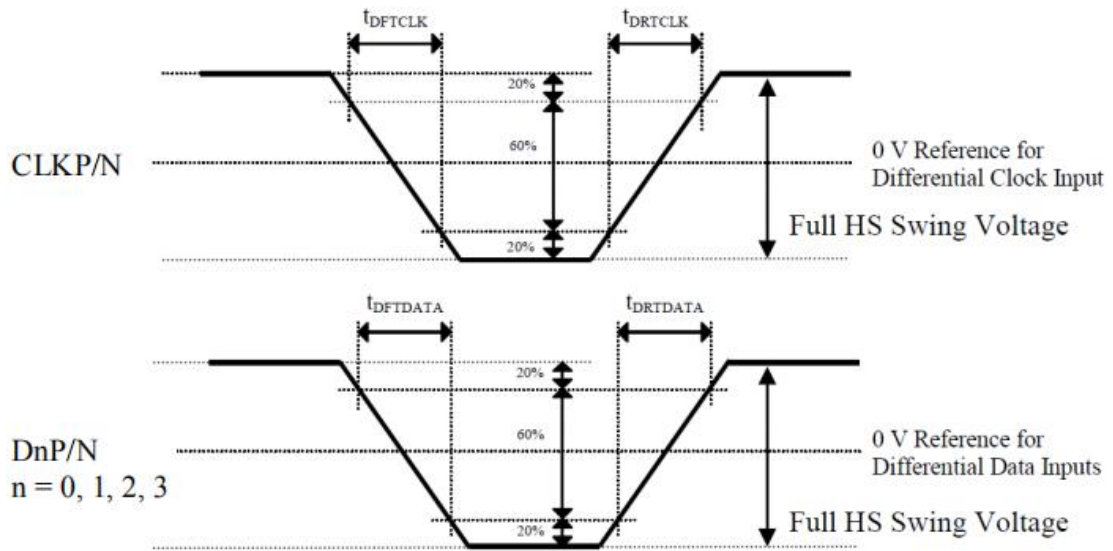


Figure 120: Rising and Falling Timings on Clock and Data Channels

Table 41: Rise and Fall Timings on Clock and Data Channels

Parameter	Symbol	Condition	Specification		
			Min	Typ	Max
Differential Rise Time for Clock	t_{DRTCLK}	CLKP/N	150 ps	-	0.3UI (Note)
Differential Rise Time for Data	$t_{DRTDATA}$	DnP/N n=0 and 1	150 ps	-	0.3UI (Note)
Differential Fall Time for Clock	t_{DFTCLK}	CLKP/N	150 ps	-	0.3UI (Note)
Differential Fall Time for Data	$t_{DFTDATA}$	DnP/N n=0 and 1	150 ps	-	0.3UI (Note)

Note: The display module has to meet timing requirements, which are defined for the transmitter (MCU) on MIPI D-Phy standard.

4. Optical Specifications

Item	Symbol	Condition	Values			Unit	Remark
			Min.	Typ.	Max.		
Viewing angle (CR≥ 10)	θ_L	$\Phi=180^\circ$ (9 o'clock)	-	80	-	degree	Note 1
	θ_R	$\Phi=0^\circ$ (3 o'clock)	-	80	-		
	θ_T	$\Phi=90^\circ$ (12 o'clock)	-	80	-		
	θ_B	$\Phi=270^\circ$ (6 o'clock)	-	80	-		
Response time	T_{ON+} T_{OFF}	Normal $\theta=\Phi=0^\circ$	-	30	40	msec	Note 3
Contrast ratio	CR		1200	1500	-	-	Note 4
Cross talk	%		-	-	4		Note 8
Color chromaticity	W_X		0.26	0.31	0.36	-	Note 2 Note 5 Note 6
	W_Y		0.30	0.35	0.40	-	
Luminance	L		200	250	-	cd/m ²	Note 6
Luminance uniformity	Y_U		70	75	-	%	Note 7
Color Gamut	NTSC		-	60	-	%	

The test systems refer to Note 2.

Note 1: Definition of viewing angle range

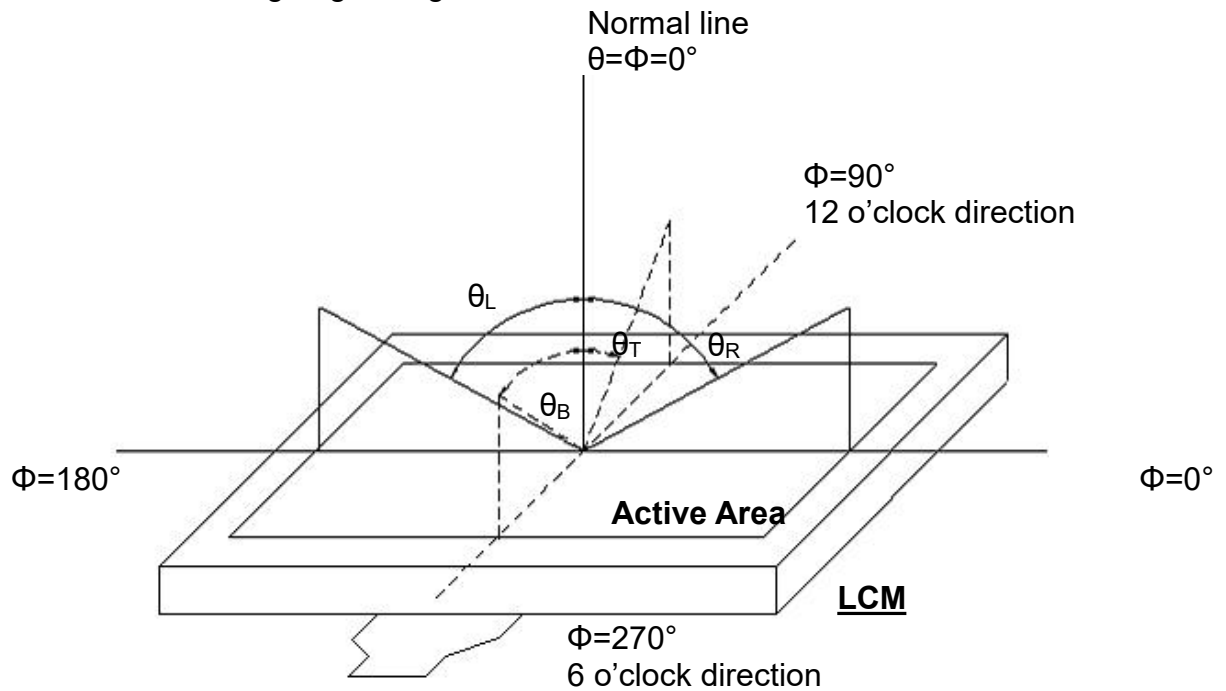


Fig. 4-1 Definition of viewing angle

Note 2: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 30 minutes operation, the optical properties are measured at the center point of the LCD screen. (Viewing angle is measured by ELDIM-EZ contrast/Height :1.2mm, Response time is measured by Photo detector TOPCON BM-7, other items are measured by BM-5A/ Field of view: 1° /Height: 500mm.) or CA-210.

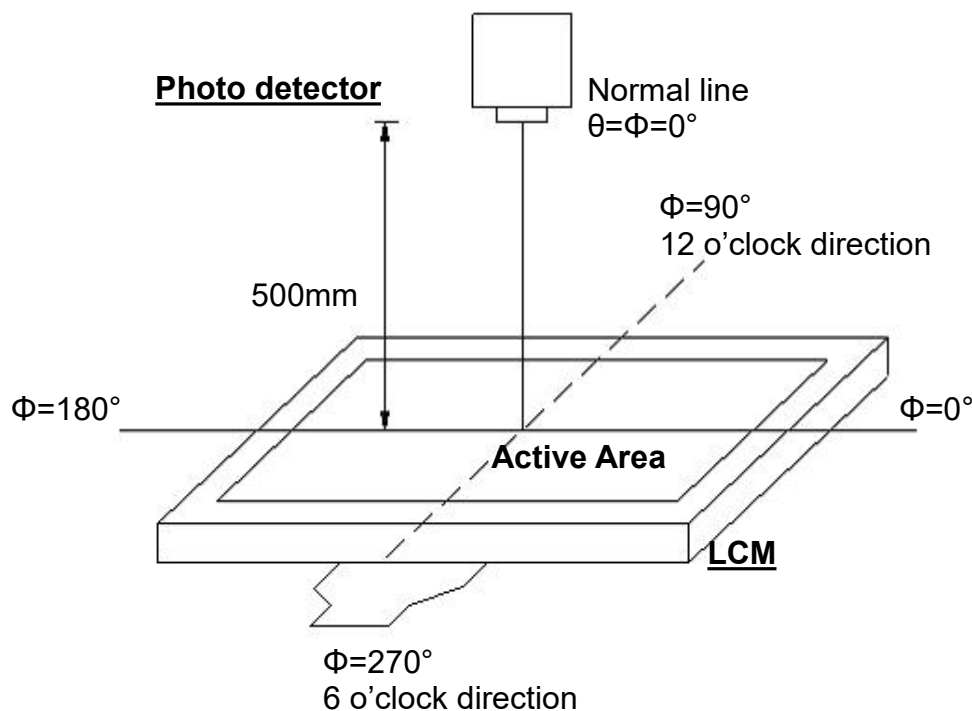


Fig. 4-2 Optical measurement system setup

Note 3: 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%.

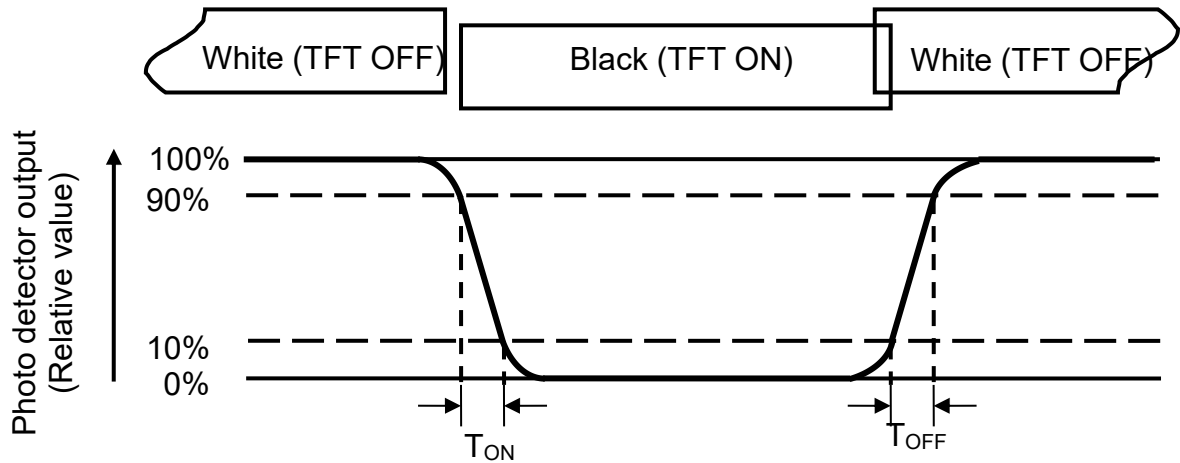


Fig. 4-3 Definition of response time

Note 4: Definition of contrast ratio

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

Note 5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

Note 6: All input terminals LCD panel must be ground while measuring the center area of the panel. The LED driving condition is $I_L=100\text{mA}$.

Note 7: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas(Refer to Fig. 4-4).

Every measuring point is placed at the center of each measuring area.

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

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

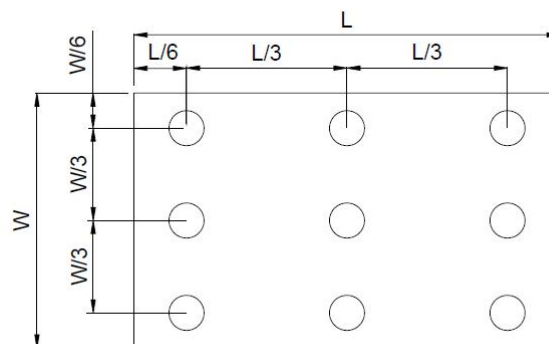
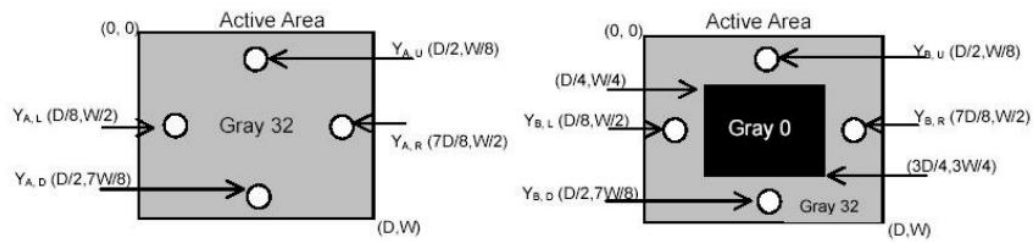


Fig. 4-4 Definition of measuring points

B_{MAX} : The measured maximum luminance of all measurement position.

B_{MIN} : The measured minimum luminance of all measurement position.

YB = Luminance of measured location with gray level 0 pattern (cd/m²)



Note 9: 16.7M color by 24bit R.G.B. signal input.

5. Reliability Test

Item	Test Conditions	Criterion
High Temperature Storage	Ta = 60℃ 240hrs	Note 1, Note3, Note 4 ,Note5
Low Temperature Storage	Ta = -20℃ 240hrs	Note 1, Note3, Note 4
High Temperature Operation	Ts = 50℃ 240hrs	Note 2, Note3, Note 4 , Note5
Low Temperature Operation	Ta =-10℃ 240hrs	Note 1, Note3, Note 4
Operate at High Temperature and Humidity	+50℃, 90%RH 240hrs	Note3, Note 4 Note5
Thermal Shock(non operation)	-10℃/30 min ~ +50℃/30 min for a total 27cycles, Start with cold temperature and end with high temperature.	Note3, Note 4 Note5
Vibration Test	Sweep:10Hz~55Hz~10Hz 2G 2 hours for each direction of X. Y. Z. (6 hours for total)	
Package Vibration Test	Random Vibration : 0.015G*G/Hz from 5-200HZ, -6dB/Octave from 200-500HZ 2 hours for each direction of X. Y. Z. (6 hours for total)	
Package Drop Test	Height:60 cm 1 corner, 3 edges, 6 surfaces	
Electro Static Discharge	Contact=+/-4KV, Air=+/-8KV,(R=330R,C=150pF), 1 sec,9point,10times/point;	

※Criterion:

Note 1: T_a is the ambient temperature of samples.

Note 2: T_s is the temperature of panel's surface.

Note 3: 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.

Note 4: Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.

Note 5: A certain level of Mura (non-uniformity) of dark / black image will happen several days after high temperature testing (H.T.T.). There is a slowly part recovery over a long time (several months). Such a long exposure time like in H.T.T. will normally not happen in a real application. Therefore the test H.T.T. was introduced to simulate cycles with normal conditions in-between but with the same total exposure time what show a significant reduced Mura.

The root cause is related to tension generated due to different amount of shrinking in the stack of layers in the polarizer sheet. The effect is more significant on larger displays like this size. An investigation into alternative polarizer material showed that there is no better alternative currently available.

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7. Package Drawing

TBD

8. Inspection Standards for LCD Modules

8.1. Acceptable Criteria

Unless there is other agreement, the sampling plan for incoming inspection shall follow GB2828.1-2012

- (1) Lot size: Quantity per shipment as one lot (different model as different lot).
- (2) Sampling type: Normal inspection, single sampling.
- (3) Sampling level: Level II.
- (4) AQL: Acceptable Quality Level

Major defect: AQL=0.65

Minor defect: AQL=1.0

8.2. Classification of defects

Defects are classified two types, major defect and minor defect according to the defect. And, the definition of defects is classified as below.

- (1) Major defect

Any defect may result in functional failure, or reduce the usability of product for its purpose. For example, electrical failure, deformation and etc..

- (2) Minor defect

A defect that is not to reduce the usability of product for its intended purpose and un-uniformity, dot defect and etc..

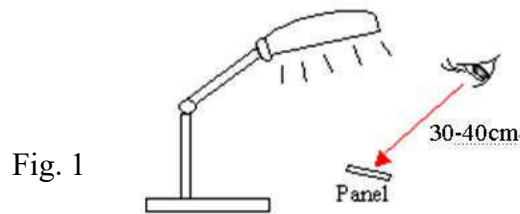
The criteria on major or minor judgment will be according with the classification of defects.

8.3. The environmental condition of inspection

The environmental condition and visual inspection shall be conducted as below.

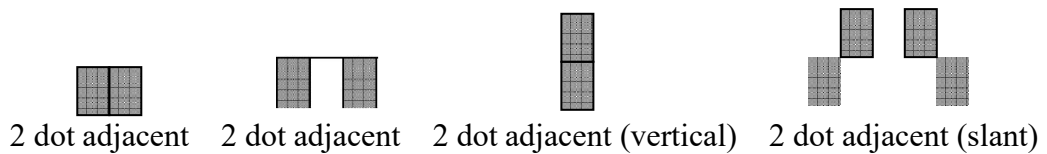
- (1) Ambient temperature: 25 ± 5 °C
- (2) Humidity: 25~75 % RH
- (3) Panel visual inspection on the operation condition for cosmetic shall be conducted at the distance 30~40cm or more between the LCD module and eyes of inspector.
Ambient Illumination: 500~600Lux for external appearance inspection
Ambient Illumination: 200~500 Lux for light on inspection
- (4) The viewing angle:
 - a) ± 45 degree to the front surface of display panel in vertical direction.
 - b) ± 45 degree to the front surface of display panel in horizontal direction.

- (5) Display panel shall be conducted at the distance 35~40cm between the LCD module and eyes of inspector (Fig. 1)



8.4. Inspection Criteria Safety

- (1) Definition of dot defect induced from the panel inside
- a) Bright dot: Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.
 - b) Dark dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue picture.
 - c) 2 dot adjacent = 1 pair = 2 dots
- Picture:



(2)Display Inspection

Items		Acceptable count
Bright dot	Random	$N \leq 1$
	2 dots adjacent	$N \leq 0$
	3 dots adjacent	$N \leq 0$
Distance	Minimum Distance Between Bright dots	5mm
Dark dot	Random	$N \leq 2$
	2 dots adjacent	$N \leq 0$
	3 dots adjacent	$N \leq 0$
Total bright and dark dot		$N \leq 2$
Distance	Minimum Distance Between dark dots Minimum Distance Between dark and bright dot.	5mm
Tiny bright dot		visible through 5% ND filter $D \leq 0.15\text{mm}$, Ignore $0.15\text{mm} < D \leq 0.3\text{mm}$, $N \leq 3$ Distance $\geq 5\text{mm}$
Display failure (V-line/H-line/Cross line etc.)		Not allowable
Mura/ Waving/ Hot spot	Not visible through 5% ND filter	

***Note: Defect which is on the Black Matrix(outside of Active Area) are not considered as a defect.**

(3)Appearance & Display inspection

Item	Standards
Foreign Black/White/Bright Spot (Display & Appearance)	$D \leq 0.15\text{mm}$, Ignore $0.15\text{mm} < D \leq 0.4\text{mm}$, $N \leq 2$ Distance $\geq 5\text{mm}$ It is shown in Fig. 2.
Foreign Black/White/Bright Line (Display & Appearance)	$W \leq 0.05\text{ mm}$, Ignore $0.05 < W \leq 0.1\text{ mm}$ $L \leq 3.0\text{ mm}$, $N \leq 2$ It is shown in Fig. 3.
Polarizer Dent/Air Bubble	$D \leq 0.15\text{mm}$, Ignore $0.15\text{mm} < D \leq 0.4\text{mm}$, $N \leq 2$ Distance $\geq 5\text{mm}$
Polarizer Scratches	$W \leq 0.05\text{ mm}$, Ignore $0.05 < W \leq 0.1\text{ mm}$ $L \leq 3.0\text{ mm}$, $N \leq 2$

Notes: If any specific defect is not included in the above defect table, this defect should be judged by Topovision and customer discussion.

1. W: Width
2. L: Length
3. D: Average Diameter
4. N: Count

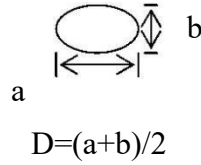


Fig. 2



W: width, L: length

Fig. 3

8.5. External Appearance Inspection Criteria

Item	Contents	
FPC cable	Cable not continuous、Break-off Connector Burn-off /Break-off are not permitted.	
Metal frame (Bezel)	Scratch	*Noticeable scratch and exfoliation coating are not permitted. *The oxidized metal is not permitted.
	Incomplete assembly is not permitted.	
Backlight	Scratch	The scratch which may causes a problem in practical use is not permitted.
	Break-off	Breaking off is not permitted.
	Crack	The crack is not permitted.
Stain on Polarizer	The stain, which can't be wiped off, is not permitted.	
Tape/Label	Incorrect position, missed label is not permitted.	
Connector	Assembly NG or Function fail caused by deformation is not permitted	
Outline size	Spec. out is not permitted.	

9. General Precautions

9.1. Safety

Liquid crystal is poisonous. Do not put it in your mouth. If liquid crystal touches your skin or clothes, wash it off immediately by using soap and water.

9.2. Handling

1. The LCD panel is plate glass. Do not subject the panel to mechanical shock or to excessive force on its surface.

2. The polarizer attached to the display is easily damaged. Please handle it carefully to avoid scratch or other damages.

3. To avoid contamination on the display surface, do not touch the module surface with bare hands.

4. Keep a space so that the LCD panels do not touch other components.

5. Put cover board such as acrylic board on the surface of LCD panel to protect panel from damages.

6. Transparent electrodes may be disconnected if you use the LCD panel under environmental conditions where the condensation of dew occurs.

7. Do not leave module in direct sunlight to avoid malfunction of the ICs.

9.3. Static Electricity

1. Be sure to ground module before turning on power or operating module.

2. Do not apply voltage which exceeds the absolute maximum rating value.

9.4. Storage

1. Store the module in a dark room where must keep at $25\pm 10^{\circ}\text{C}$ and 65%RH or less.

2. Do not store the module in surroundings containing organic solvent or corrosive gas.

3. Store the module in an anti-electrostatic container or bag.

9.5. Cleaning

1. Do not wipe the polarizer with dry cloth. It might cause scratch.

2. Only use a soft cloth with IPA to wipe the polarizer, other chemicals might permanent damage to the polarizer.