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SPEC. NUMBER AM-1010021A	PRODUCT GROUP TFT- LCM	REV. V0	ISSUE DATE 2022-06-20	PAGE 1 OF 26
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FN1010D021A

Product Specification Rev.V0

BUYER	
SUPPLIER	FANNAL Electronics CO., LTD
FG-Code	FN1010D021A

ITEM	BUYER SIGNATURE	DATE
_____	_____	_____
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_____	_____	_____

ITEM	SUPPLIER SIGNATURE	DATE
Prepared	LAI	2022.06.20
Reviewed	Dong	2022.06.20
Approved	STEVEN	2022.06.20

PRODUCT GROUP	REV	ISSUE DATE	
TFT- LCM PRODUCT	V0	2022-06-20	

SPEC. NUMBER AM-1010021A	SPEC . TITLE FN1010D021A Product Specification	PAGE 2 OF 26
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REVISION HISTORY

REV.	ECN No.	DESCRIPTION OF CHANGES	DATE	PREPARED
V0		Initial Release	2022.06.20	LAI

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PRODUCT GROUP

REV

ISSUE DATE



TFT- LCM PRODUCT

V0

2022-06-20

SPEC. NUMBER

SPEC. TITLE

PAGE

AM-1010021A

FN1010D021A Product Specification

3 OF 26

Contents

No.	Items	Page
1.0	General Description	4
2.0	Mechanical Drawing	5
3.0	Absolute Maximum Ratings	7
4.0	Electrical Specifications	8
5.0	Interface Description	9
6.0	Optical Specifications	16
7.0	Reliability Test	18
8.0	Precautions	19
9.0	Packing Information	23
10.0	Visual Inspection Criteria For All Customers	24

PRODUCT GROUP

REV

ISSUE DATE



TFT- LCM PRODUCT

V0

2022-06-20

SPEC. NUMBER

SPEC. TITLE

PAGE

AM-1010021A

FN1010D021A Product Specification

4 OF 26

1.0 General Description /一般说明

1.1 Application /应用

- Industrial Instruments etc.

1.2 General Specification /通用技术条件

The followings are general specifications at the FN1010D021A.

Parameter	Specification	Unit
LCD size	10.1 inch(Diagonal)	
Resolution	1024(H)RGB×600(V)	pixel
Sub pixel size	0.0725 x 0.2088	mm
Pixel Arrangement	RGB Stripe	
Active Area	222.72(H) x 125.28 (V)	mm
Viewing Direction	FREE	o'clock
Display Mode	Normally black,Transmissive	
Module Size	235.0(W)×143.0(H)×5.25(D)	mm
Interface	LVDS	
Backlight Consumption	TBD	W
Luminance	500(Typ.)	cd/m ²
Driver IC	ILI6150&ILI5120	

PRODUCT GROUP

REV

ISSUE DATE



TFT- LCM PRODUCT

V0

2022-06-20

SPEC. NUMBER

SPEC. TITLE

PAGE

AM-1010021A

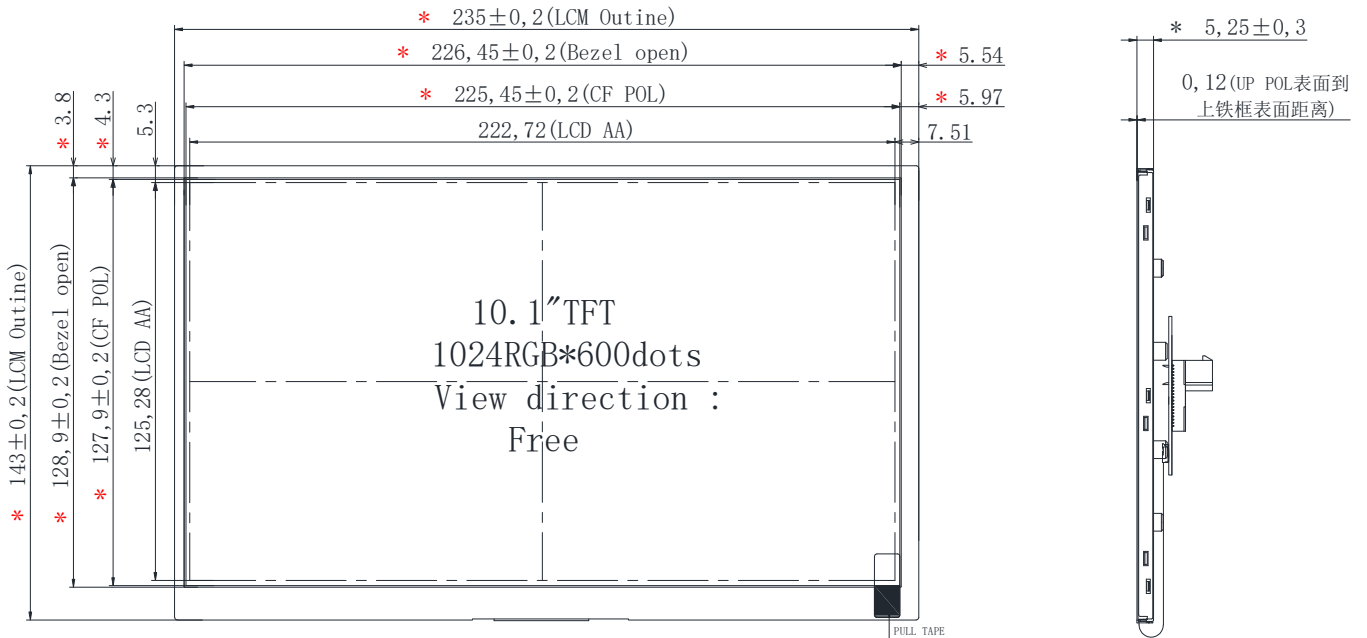
FN1010D021A Product Specification

5 OF 26

2.0 Mechanical Drawing /机械制图

LCM Drawing

Drawing Attachment: Front



PRODUCT GROUP

REV

ISSUE DATE



TFT- LCM PRODUCT

V0

2022-06-20

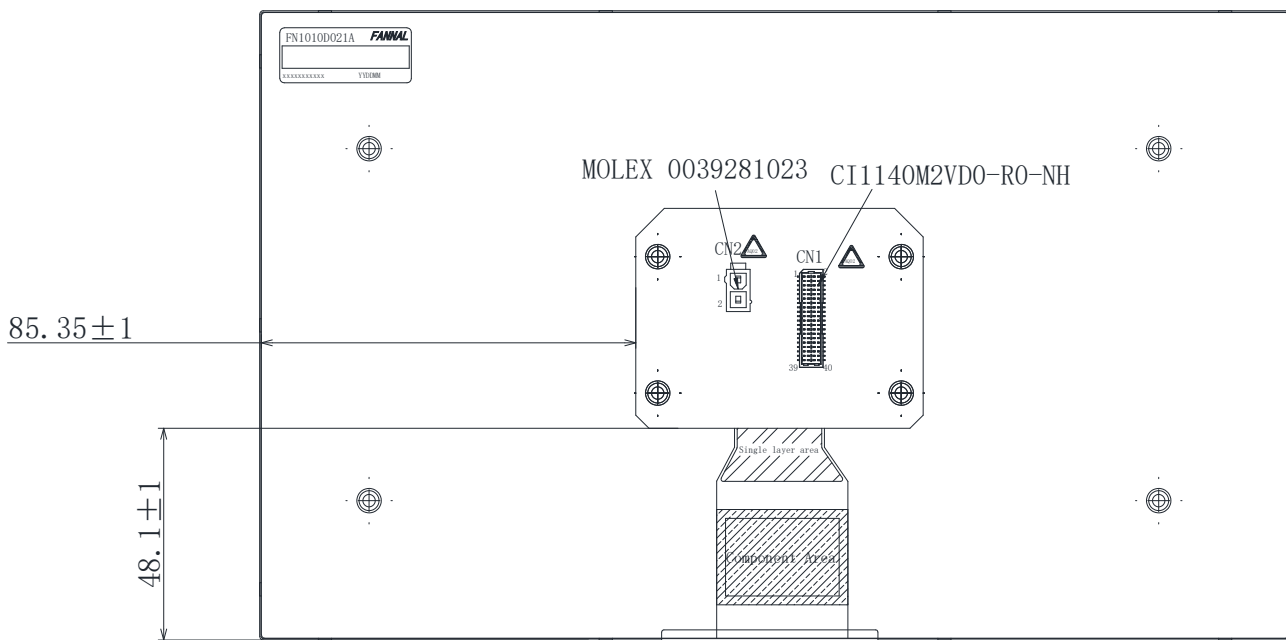
SPEC. NUMBER
AM-1010021A

SPEC. TITLE
FN1010D021A Product Specification

PAGE
6 OF 26

LCM Drawing

Drawing Attachment: Back



PRODUCT GROUP

REV

ISSUE DATE



TFT- LCM PRODUCT

V0

2022-06-20

SPEC. NUMBER

SPEC. TITLE

PAGE

AM-1010021A

FN1010D021A Product Specification

7 OF 26

3.0 ABSOLUTE MAXIMUM RATINGS /绝对最大额定值

The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit.

Parameter	Symbol	Min.	Max.	Unit
Power Supply Voltage	VDD	-0.5	5.0	V
Operating Temperature	T _{OP}	-20	70	°C
Storage Temperature	T _{ST}	-30	80	°C
Humidity	RH	--	90%(Max60 °C)	RH

PRODUCT GROUP

REV

ISSUE DATE



TFT- LCM PRODUCT

V0

2022-06-20

SPEC. NUMBER

SPEC. TITLE

PAGE

AM-1010021A

FN1010D021A Product Specification

8 OF 26

4.0 ELECTRICAL SPECIFICATIONS/电气规范**4.1 TFT LCM Module**

[Ta =25 ± 2 °C]

Parameter	Symbol	Values			Unit	Notes
		Min.	Typ.	Max.		
Power Supply Voltage	VDD	3.0	3.3	3.6	V	Note 2
Input logic high voltage	VIH	0.7VDD	-	VDD	V	Note 3
Input logic low voltage	VIL	0	-	0.3VDD	V	

4.2 Backlight Driving Conditions

[Ta =25 ± 2 °C]

Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
LED Life Time	--	20000	30000	--	Hrs

5.0 Interface Description/接口说明

FPC Connector is used for the module electronics interface. The recommended model is CI1140M2VD0-R0-NH(CN1)/MOLEX 0039281023 (CN2) manufactured by Hirose.

5.1 Pin assignment for LCM module /模组引脚分配

Pin No.	Symbol	Description
1	DDC_CLK	
2	NC	No Connection
3	GND	Ground
4	GND	Ground
5	NC	No Connection
6	NC	No Connection
7	RXIN0-	LVDS Negative data signal(-)
8	VDD	Power supply
9	RXIN0+	LVDS Negative data signal(+)
10	BKLT_EN_A	Enable of display backlight
11	GND	Ground
12	GND	Ground
13	RXIN1-	LVDS Negative data signal(-)
14	BKLT_PWM_A	PWM Signal to control backlight
15	RXIN1+	LVDS Negative data signal(+)
16	NC	No Connection
17	GND	Ground
18	GND	Ground
19	RXIN2-	LVDS Negative data signal(-)
20	NC	No Connection
21	RXIN2+	LVDS Negative data signal(+)
22	NC	No Connection
23	GND	Ground
24	GND	Ground
25	LCK-	LVDS Negative CLK signal(-)
26	NC	No Connection
27	LCK+	LVDS Positive CLK signal(+)
28	NC	No Connection

PRODUCT GROUP

REV

ISSUE DATE



TFT- LCM PRODUCT

V0

2022-06-20

SPEC. NUMBER

SPEC. TITLE

PAGE

AM-1010021A

FN1010D021A Product Specification

10 OF 26

Pin No.	Symbol	Description
29	GND	Ground
30	GND	Ground
31	RXIN3-	LVDS Negative data signal(-)
32	USB_N	USB DATA-
33	RXIN3+	LVDS Negative data signal(+)
34	USB_P	USB DATA+
35	VDS_DOC_OAT	
36	USB 5V	+5V USB Voltage
37	RXIN4-	LVDS Negative data signal(-)
38	NC	No Connection
39	RXIN4+	LVDS Negative data signal(+)
40	NC	No Connection

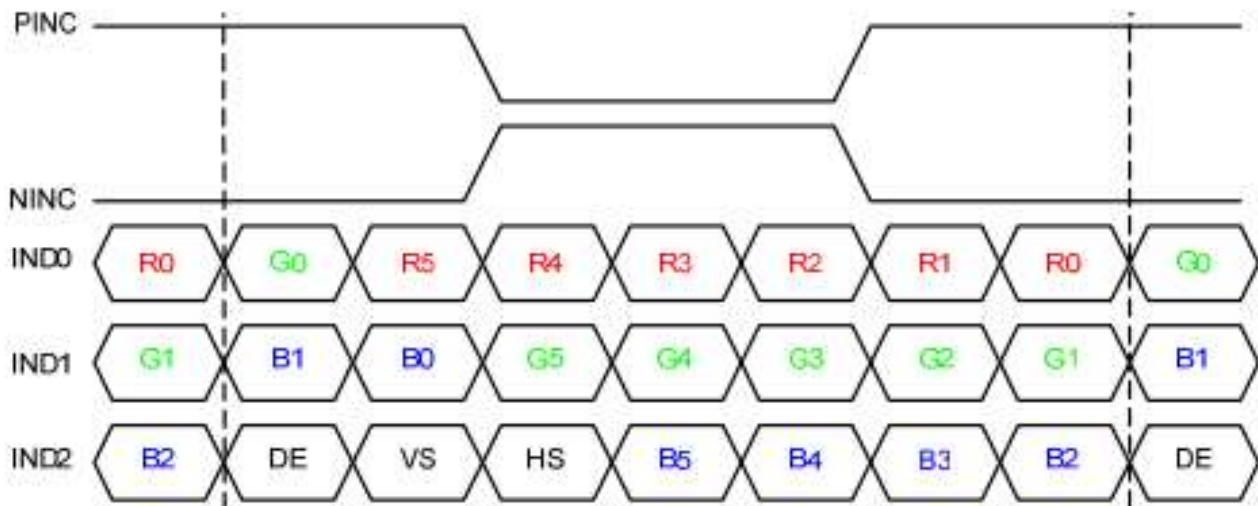
CN2

Pin No.	Symbol	Description
1	+24V	Power supply(24V)
2	GND	Ground

5.2 Interface timing Parameter /接口时序参数

5.2.1 Data Input Format for LVDS

6bit LVDS input



8bit LVDS input



5.2.2 Parallel RGB input timing table

DE Mode

Parameter	Symbol	Value			Unit
		Min	Typ.	Max	
DCLK frequency Frame rate = 60Hz	fclk	42.6	51.2	67.2	MHz
Horizontal display area	thd	1024			DCLK
HSYNC period time	th	1164	1344	1400	DCLK
HSYNC blanking	thb+thfp	140	320	376	DCLK
Vertical display area	tvd	600			H
VSYNC period time	tv	610	635	800	H
VSYNC blanking	tvb+tvfp	10	35	200	H

HV Mode

a. Horizontal input timing

Parameter		Symbol	Value			Unit
Horizontal display area		thd	1024			DCLK
DCLK frequency Frame rate = 60Hz		fclk	Min	Typ.	Max	MHz
			44.9	51.2	63	
1 Horizontal Line		th	1200	1344	1400	DCLK
HSYNC pulse width	Min	thpw	1			DCLK
	Typ.		-			
	Max		140			
HSYNC blanking		thb	160	160	160	
HSYNC front porch		thfp	16	160	216	

b. Vertical input timing

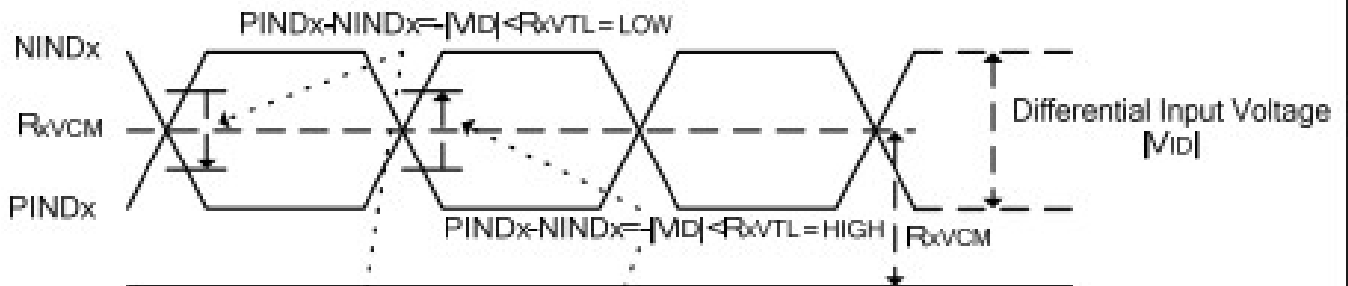
Parameter	Symbol	Value			Unit
		Min	Typ.	Max	
Vertical display area	tvd	600			H
VSYNC period time	tv	624	635	750	H
VSYNC pulse width	tvpw	1	-	20	H
VSYNC blanking	tvb	23	23	23	H
VSYNC front porch	tvfp	1	12	127	H

5.2.3 LVDS mode

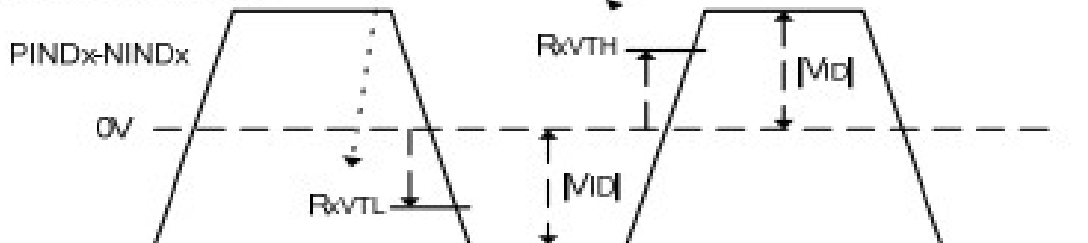
LVDS mode (Receiver Differential Input: PIND0-PIND3, NIND0-NIND3, PINC, NINC)

Parameter	Symbol	Min	Typ.	Max	Unit	Conditions
Differential input high threshold voltage	RxVTH	-	-	0.1	V	RxVCM=1.2V
Differential input low threshold voltage	RxVTL	-0.1	-	-	V	
Input voltage range (singled-end)	RxVIN	0	-	2.4	V	
Differential input common mode voltage	RxVCM	VID/2	-	2.1- VID /2	V	
Differential input voltage	VID	0.2	-	0.6	V	
Differential input leakage current	RxI _l	-10	-	+10	uA	
LVDS Digital Operating Current	I _{dd} lvds	-	T.B.D	T.B.D	mA	F _{clk} =65MHz, VDD=3.3V
LVDS Digital Standby Current	I _{st} lvds	-	T.B.D	T.B.D	uA	Clock & all Functions are stopped

Single end signals



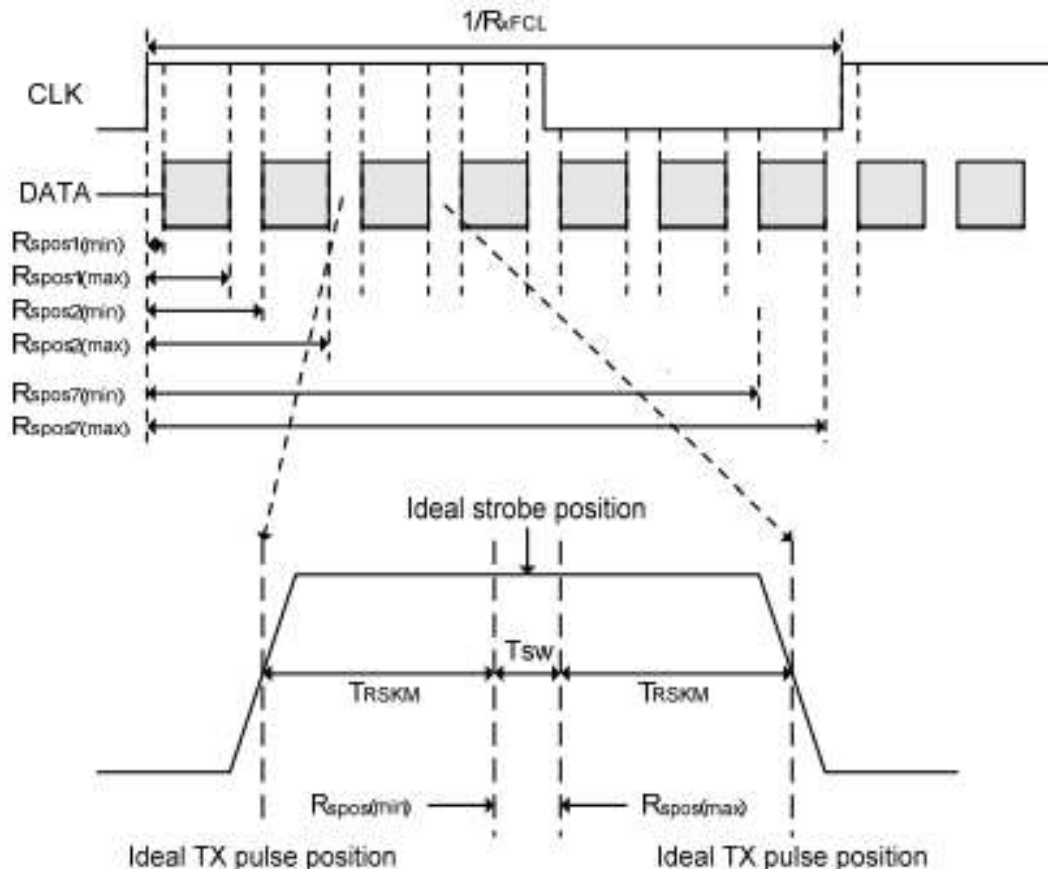
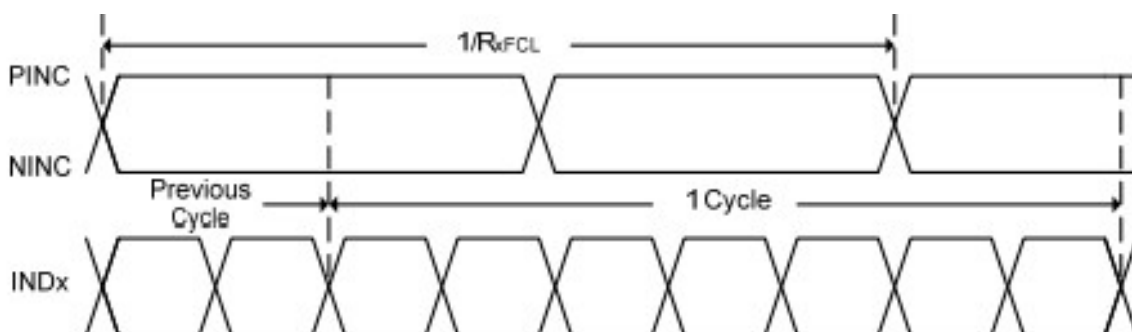
Differential signals



5.2.4 AC Electrical Characteristics

LVDS mode

Parameter	Symbol	Min	Typ.	Max	Unit	Conditions
Clock frequency	RxFCLK	26.2		71	MHz	
Input data skew margin	TRSKM	500			ps	VID =400mv RxVCM=1.2V RxFCLK=71MHz
Clock high time	TLVCH		4/(7x RxFCLK)		ns	
Clock low time	TLVCL		3/(7xRxFCLK)		ns	
VSD setup time	TenPLL			150	us	



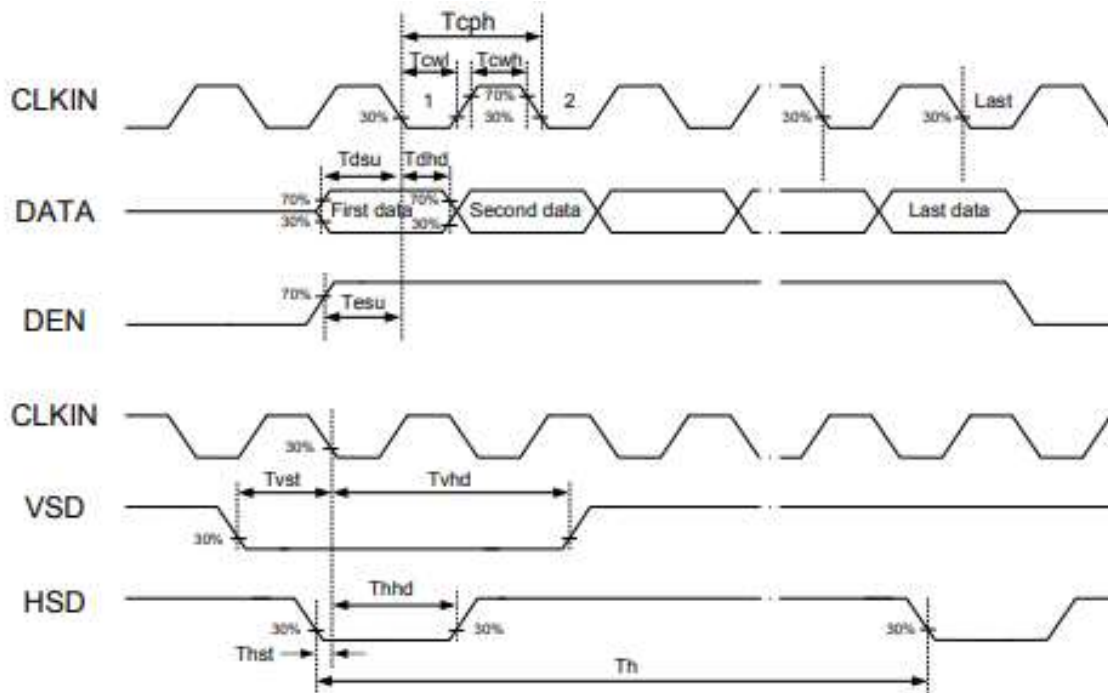
TRSKM: Receiver strobe margin
 RSPOS Receiver strobe position
 Tsw: Strobe width (internal data sampling window)

Output timing table

parameter	symbol	Min	Typ.	Max	Units	condition
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	Twid	-	10	-	DCLK	
CKV Pulse Width	Twckv	-	66	-	DCLK	
OEV Pulse Width	Twoev	-	74	-	DCLK	

5.2.5 Timing Diagram

Input Clock and Data Timing Diagram



5.3 POWER ON/OFF SEQUENCE / 上电时序

To prevent the device damage from latch up, the power On-Off sequence must be followed.

Power On: VDD,GNDAVDD,AGNDV1~V14Input Signals

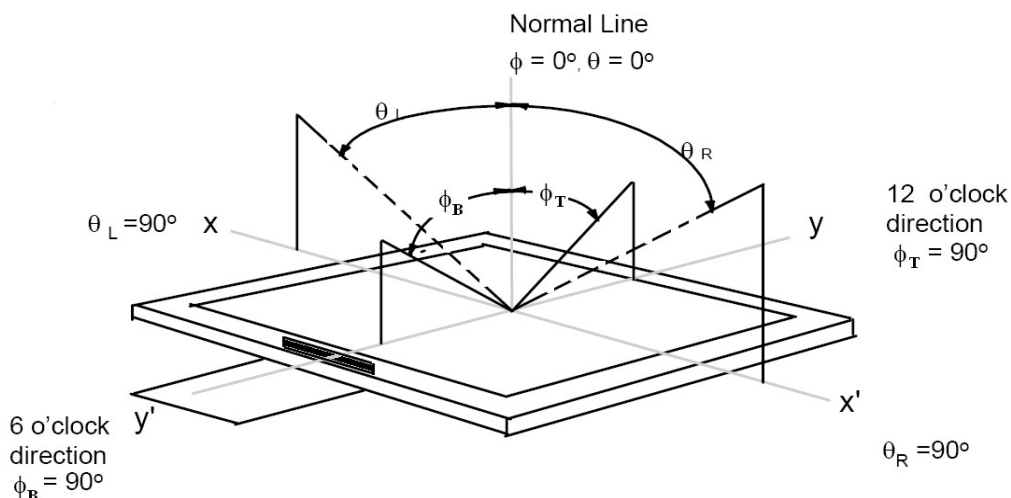
Power Off: Input SignalsV1~V14 AVDD,AGND VDD,GND

6.0 OPTICAL SPECIFICATIONS /光学规格

Item	Symbol	Condition	Min	Typ.	Max	Unit	Note
Viewing Angle	θ_L	$Cr \geq 10$	80	--	--	deg	Note 1
	θ_R		80	--	--		
	ψ_T		80	--	--		
	ψ_B		80	--	--		
Contrast Ratio	Cr	$\theta = 0^\circ$	800	1000		-	Note 2
Response Time	Tr+Tf	FF=0°	--	25	35	ms	Note 3
Color Coordinate of CIE1931	Wx	$\theta = 0^\circ$	TYP.- 0.05	TBD	TYP.+ 0.05	-	Note 4
	Wy			TBD			
Uniformity	U		75	80		%	Note 5
Luminance	L		400	500	-	cd/m ²	Note 6

Note 1: The definition of Viewing Angle

Refer to the graph below marked by θ and ϕ .



Note2:The definition of Contrast Ratio

$$\text{Contrast Ratio(CR)} = \frac{\text{Luminance When LCD is at "White" state}}{\text{Luminance When LCD is at "Black" state}}$$

(Contrast Ratio is measured in optimum common electrode voltage)

Note3: Definition of Response time.(Test LCD using RD80S or similar equipments):

The output sign also photo detector are measured when the input sign also are changed from "black" to " white "(Voltage falling time)and from " white " to " black " (Voltage rising time), respectively .The response time is defined as the time interval between the 10% and 90% of amplitudes . Refer to figures below.

Note 4: Color Coordinates of CIE 1931

The test condition is at ILED=20mA and measured on the surface of LCD module at 25°C. Measurement equipment: CS2000 or similar equipments
The Color Coordinate (CIE 1931) is the measurement of the center of the display shown in below figure.

Note 5:Definition of Luminance Uniformity

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

$$\text{Luminance Uniformity (U)} = \text{Lmin/ Lmax}$$

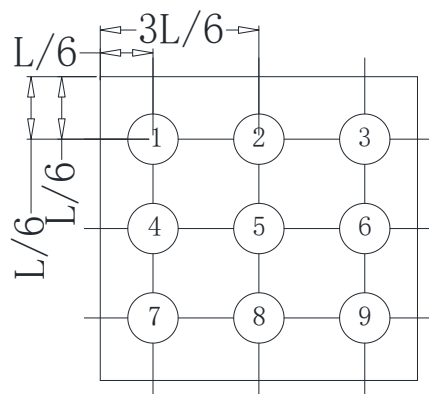
L-----Active area length W----- Active area width

Lmax: The measured Maximum luminance of all measurement position.

Lmin: The measured Minimum luminance of all measurement position.

Note 6: Definition of Luminance:

Measure the luminance of white state at center point.



PRODUCT GROUP

REV

ISSUE DATE



TFT- LCM PRODUCT

V0

2022-06-20

SPEC. NUMBER

SPEC. TITLE

PAGE

AM-1010021A


FN1010D021A Product Specification

18 OF 26

7.0 RELIABILITY TEST /可靠性测试

The Reliability test items and its conditions are shown in below.

No	Test Items	Conditions
1	High temperature storage test	85°C 240hr
2	Low temperature storage test	-30°C 240hr
3	Low temperature operation test	-20°C 240hr
4	High temperature operation test	70°C 240hr
5	High temperature & humidity (storage)	60°C 90%RH 240hr
6	Thermal Shock Test	-30°C~80°C 1hr/cycle 10cycle
7	Vibration Test	10Hz-55Hz 100m/s ² 120min
8	Mechanical shock	60G ±X, ±Y, ±Z, 3times for each direction
9	Package Drop	Height: 80 cm, 1 corner, 3 edges, 6 surfaces
10	ESD test	C=150pF, R=330 Ω, 5 points/panel Air:±8KV, 5 times; Contact: ±4KV, 5times


PRODUCT GROUP	REV	ISSUE DATE	
TFT- LCM PRODUCT	V0	2022-06-20	
SPEC. NUMBER AM-1010021A	SPEC. TITLE FN1010D021A Product Specification		PAGE 19 OF 26

- **8.0 Precautions /注意事项**

- Please pay attention to the followings when you use this TFT LCD Panel.

- **8.1 Mounting Precautions /安装注意事项**

- (1) Use fingerstalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (2) You must mount a module using specified mounting holes (Details refer to the drawings).
- (3) Please make sure to avoid external forces applied to the Source PCB or FPC and D-IC during the process of handling or assembling. If not, It causes panel damage or malfunction.
- (4) Note that polarizers are very fragile and could be easily damaged. Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment.
- (5) Do not pull or fold the source D-IC which connect the source PCB or FPC and the panel.
- Do not pull or fold the LED wire.
- (6) After removing the protective film, when the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with alcohol or purified water.
- Do not strong polar solvent because they cause chemical damage to the polarizer.
- (7) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
- (8) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.
- (9) Since the LCD is made of glass, do not apply strong mechanical impact or static load onto it. Handling with care since shock, vibration, and careless handling may seriously affect the product. If it falls from a high place or receives a strong shock, the glass may be broken.
- (10) Do not disassemble the module.
- (11) To determine the optimum mounting angle, refer to the viewing angle range in the specification for each model.
- (12) If the customer's set presses the main parts of the LCD, the LCD may show the abnormal display. But this phenomenon does not mean the malfunction of the LCD and should be pressed by the way of mutual agreement.
- (13) Do not drop water or any chemicals onto the LCD's surface.

PRODUCT GROUP	REV	ISSUE DATE	
TFT- LCM PRODUCT	V0	2022-06-20	
SPEC. NUMBER AM-1010021A	SPEC. TITLE FN1010D021A Product Specification		PAGE 20 OF 26

8.2 Operating Precautions /操作注意事项

- (1) Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
- (2) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimized the interference.
- (3) The electrochemical reaction caused by DC voltage will lead to LCD degradation, so DC drive should be avoided.
- (4) The LCD modules use C-MOS LSI drivers, so customers are recommended that any unused input terminal would be connected to Vdd or Vss, do not input any signals before power is turn on, and ground you body, work/assembly area, assembly equipments to protect against static electricity.
- (5) Do not exceed the absolute maximum rating value. (supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on) Otherwise the Module may be damaged.
- (6) Design the length of cable to connect between the connector for back-light and the converter as short as possible and the shorter cable shall be connected directly.
The longer cable between that of back-light and that of converter may cause the luminance of LED to lower and need a higher startup voltage(Vs).
- (7) Connectors are precise devices for connecting PCB and transmitting electrical signals. Operators should insert and unplug MDL in parallel when assembling MDL.
- (8) Do not connect or disconnect the cable to/ from the module at the "Power On" condition.
- (9) When the module is operating, do not lose CLK, ENAB signals. If any one these signals is lost, the LCD panel would be damaged.
- (10) Obey the supply voltage sequence. If wrong sequence is applied, the module would be damaged.
- (11) Do not re-adjust variable resistor or switch etc.
- (12) For the Q/Single/OC Product, If the LED designed side view, LED bar should be putted in the Long/short side ; Otherwise, its reliability and function may not be guaranteed.

注：
 ①(1)涉及到Pol相关条目适用于OC/MDL出货产品，
 ②(6)(7)涉及到connector相关适用于OC/MDL出货产品
 ③ (12) 涉及到客户进行BLU设计， LED Bar位置需要避开GOA位置；

8.3 Electrostatic Discharge Control /静电放电控制

- (1) Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc. And don't touch interface pin directly. Keep products as far away from static electricity as possible.
- (2) Avoid the use work clothing made of synthetic fibers. We recommend cotton clothing or other conductivity-treated fibers.

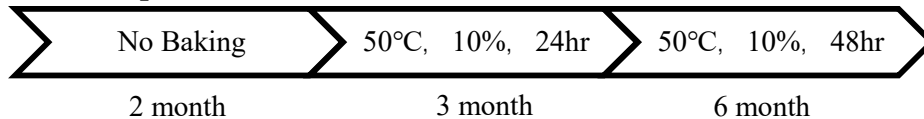
8.4 Precautions for Strong Light Exposure /强光照射注意事项

It is not allowed to store or run directly in strong light or in high temperature and humidity for a long time; Strong light exposure causes degradation of polarizer and color filter.

8.5 Storage Precautions /存储注意事项

When storing modules as spares for a long time, the following precautions are necessary.

- (1) The polarizer surface should not come in contact with any other object.
It is recommended that they be stored in the container in which they were shipped.
Temperature : 5 ~ 40 °C
- (2) Humidity : 35 ~ 75 %RH
- (3) Period : 6 months
- (4) Control of ventilation and temperature is necessary.
- (5) Please make sure to protect the product from strong light exposure, water or moisture.
Be careful for condensation.
- (6) Store in a polyethylene bag with sealed so as not to enter fresh air outside in it.
- (7) Do not store the LCD near organic solvents or corrosive gasses.
- (8) Please keep the Modules/OC/FOG at a circumstance shown below Fig.



8.6 Precautions for Protection Film /保护膜注意事项

- (1) Remove the protective film slowly, keeping the removing direction approximate 30-degree not vertical from panel surface, If possible, under ESD control device like ion blower, and the humidity of working room should be kept over 50%RH to reduce the risk of static charge.
- (2) In handling the LCD, wear non-charged material gloves. And the conducting wrist to the earth and the conducting shoes to the earth are necessary.


8.7 Appropriate Condition for Display /适当的显示条件

- (1) Normal operating condition
 - Temperature: 0 ~ 40°C
 - Operating Ambient Humidity : 10 ~ 90 %
 - Display pattern: dynamic pattern (Real display)
 - Suitable operating time: under 12 hours a day.

- (2) Special operating condition

If the product will be used in extreme conditions such as high temperature, humidity, display patterns or 7*24hrs operation time etc., It is strongly recommended to contact BOE for Application engineering advice. Otherwise, its reliability and function may not be guaranteed.

- (3) Black image or moving image is strongly recommended as a screen save.

PRODUCT GROUP	REV	ISSUE DATE	
TFT- LCM PRODUCT	V0	2022-06-20	
SPEC. NUMBER	SPEC. TITLE		PAGE
AM-1010021A	FN1010D021A Product Specification		22 OF 26

- (4) Lifetime in this spec. is guaranteed only when commercial display is used according to operating usages.
- (5) Please contact BOE in advance when you display the same pattern for a long time.
- (6) If the Module keeps displaying the same pattern for a long period of time, the image may be “sticked“ or “turn off” to the screen. To avoid image sticking, it is recommended to use a screen saver.
- (7) Do not exceed the absolute maximum rating value. (supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on) Otherwise the Module may be damaged.
- (8) Dew drop atmosphere should be avoided.
- (9) The storage room should be equipped with a good ventilation facility and avoid to expose to corrosive gas , which has a temperature controlling system.
- (10) The LCD should be avoided to expose to corrosive gas for long time, ,the LCD may be affected by the gas as SO₂ ,H₂S etc.
- (11) When expose to drastic fluctuation of temperature (hot to cold or cold to hot) ,the LCD may be affected; Specifically, drastic temperature fluctuation from cold to hot ,produces dew on the LCD's surface which may affect the operation of the polarizer and the LCD.
- (12) Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD may turn black at temperature above its operational range. However those phenomena do not mean malfunction or out of order with the LCD. The LCD will revert to normal operation once the temperature returns to the recommended temperature range for normal operation

8.8 Others /其他


A. LC Leak /液晶泄露

- If the liquid crystal material leaks from the panel, it is recommended to wash the LC with acetone or ethanol and then burn it.
- In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.
- If LC in mouth, mouth need to be washed, drink plenty of water to induce vomiting and follow medical advice.
- If LC touch eyes, eyes need to be washed with running water at least 15 minutes.

B. Rework /返工

- When returning the module for repair or etc., Please pack the module not to be broken. We recommend to use the original shipping packages.

- C.** In order to prevent potential problems, flicker should be adjusted by optimizing the Vcom value in customer LCM Line (适用于Q/Single/OC出货产品)

PRODUCT GROUP		REV	ISSUE DATE	
TFT- LCM PRODUCT		V0	2022-06-20	
SPEC. NUMBER	SPEC. TITLE			PAGE
AM-1010021A	FN1010D021A Product Specification			23 OF 26

9.0 PACKING INFORMATION(产品形态: LCM)

TBD

10.0 VISUAL INSPECTION CRITERIA FOR ALL CUSTOMERS /所有客户的目视检查标准

10.1 Sampling Method /抽样方法

Unless otherwise agreed upon in writing, the sampling inspection shall be applied to the Customers incoming inspection.

- 10.1.1 Lot size : 1 pallet per same model
- 10.1.2 Sampling type : Random sampling
- 10.1.3 Inspection level : II
- 10.1.4 Sampling table : MIL-STD-105E

10.2 Inspection Environment /检验环境

10.2.1 Ambient conditions

- a. Ambient Temperature: $25 \pm 3^{\circ}\text{C}$
- b. Relative Humidity: $65 \pm 20\% \text{RH}$
- c. Ambient Illumination: 300-700LUX (Normal: 500LUX)

10.2.2 Viewing Distance

The distance between the LCM and the inspector's eyes shall be at least 30cm-50cm

10.2.3 Viewing Angle

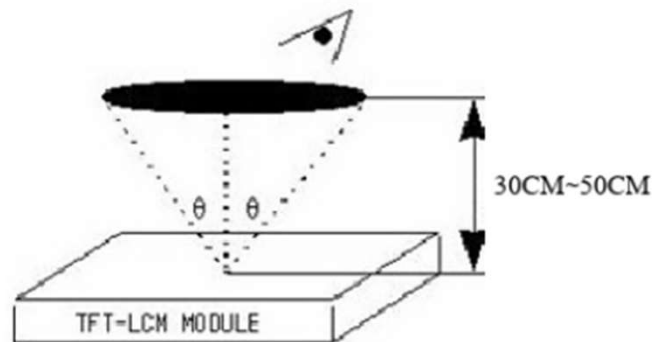
performing in front of the panel

[Vertical] : $\pm 25^{\circ}$

[Horizontal] : $\pm 40^{\circ}$

10.2.4 Inspection Area:

Display Area (Active Area)



10.3 Definitions /定义

10.3.1 Dark / Bright Spots

Points on display which appear dark/bright and usually result from the contamination.

These defects do not vary in size or intensity (contrast) when contrast is varied.

10.3.2 Dark / Bright Lines

Lines on display which appear dark/bright and usually result from the contamination.

10.3.3 Polarizer Scratch


Lines on display which are seen across a darker background and do not vary in size.

10.3.4 Polarizer Dent

White spots on display which appear against a darker background and do not vary in size.

10.3.5 Bright Dot Defects

Dots (sub-pixels) on display which appear bright in the display area and visible through the 5%ND filter at Black Pattern.

PRODUCT GROUP	REV	ISSUE DATE	
TFT- LCM PRODUCT	V0	2022-06-20	
SPEC. NUMBER AM-1010021A	SPEC. TITLE FN1010D021A Product Specification		PAGE 25 OF 26

10.3.6 Dark Dot Defects

Dots(sub-pixels)on display which appear dark in the display area at R.G.B Color Pattern.

10.3.7 Line Defects

All line defects on display which appear bright/dark such as vertical, horizontal, or cross lines.

10.3.8 Mura

Mura on display which appears darker/brighter against background brightness on parts of display area.

10.3.9 BM Defects

Bright(white)Points on display which are off BM(Black Matrix).

10.3.10 Visual Inspection

Inspection for LCM when the unit turns on.

10.3.11 Appearance Inspection

External inspection for LCM when the unit turns off.

10.3.12 Other

Defects which cannot be classified into the above defect definitions.

Note 1: Bright& Dark dots are not smaller than a sub-pixel(Dots smaller than a sub-pixel are not counted as defect dots)

10.4 Inspectin Criteria /检验标准

Refer to 《TFT LCM general inspection standard》

10.5 Verification /验证

The supplier can verify the defective LCMs to segregate the responsibilities at customer's facility or can request the Customer to ship the defective LCMs to assigned place for verification


This verificatin result shall be agreed mutually buy the Customer and Supplier. This result can be corrected/changed after detail failure analysis at Supplier's facilities.

10.6 Supplier Induced Defects /供应商引起的缺陷

All of the Supplier induced defective LCMs shall be returned to the Supplier for repair or replacement.

Bfore return the defective LCMs, the Customer needs Supplier's confirmatin with RMA Number.

All of the returned LCMs shall be returned to the Customer within agreed time period.

PRODUCT GROUP	REV	ISSUE DATE	
TFT- LCM PRODUCT	V0	2022-06-20	
SPEC. NUMBER AM-1010021A	SPEC. TITLE FN1010D021A Product Specification		PAGE 26 OF 26

10.7 Customer Induced Defects /顾客引起的缺陷

The Customer can return the customer induced defective LCMs to the Supplier for repair. The repair cost for Customer induced defective LCMs shall be agreed with both parties, Customer and Supplier.

10.8 Warranty Period /质量保证期

In-warranty period is Eighteen(18)Months from manufacturing month of LCM

Note :

- a. Eighteen months are composed of twelfth months in-warranty period and sixth months distribution period
- b. The manufacturing Month is on the LCMs as Supplier's serial No.

10.9 Repair Warranty /维修保证书

Repair warranty is Twelve(12)Months from repaired month for repaired LCMs

Note : a. The Label for repair will be added after repairing.

10.10 Warranty avoidance /避免担保

The warranty will be avoided in cases of below:

- a. When the warranty period is expired.
- b. The Customer induced defective LCMs.
- c. When the LCMs were repaired by 3rd party without Supplier's approval.
- d. When the LCMs were treated like Disassemble and Rework by the Customer and/or Customer's representatives without Supplier's approval.

10.11 Others /其他

If any problems arise with the LCMs supplied by supplier, the customer and supplier will cooperate and make efforts to solve it with mutual confidence and respect