DOCUMENT TITLE:

SPECIFICATION

OF

LCD MODULE TYPE

CUSTOMER	
MODEL NUMBER	MACHJ029HXNN0101N REV A
CUSTOMER PART NAME	
SAMPLE LOT NO.	
CUSTOMER APPROVAL	
DATE	

DEPARTMENT	NAME	SIGNATURE	DATE
PREPARED BY	Zhou Tianxiao	周天霄	221.10.30
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☒ **PRELIMINARY SPECIFICATION**
☑ **FINAL SPECIFICATION AND SAMPLE**

DOCUMENT REVISION HISTORY:

DOCUMENT REVISION FROM TO	DATE	DESCRIPTION	CHANGED BY
A	2021.10.29	First Release.	Zhou Tianxiao

CONTENTS

Specification of LCD Module Type
Item No.: MACHJ029HXNN0101

1 General Description

This technical specification applies to 2.9"color TFT-LCD module. This module follows RoHS.
High Resolution: 376 RGB x 960.   This TFT - LCD is a transmissive type color active matrix liquid crystal display (LCD), which uses amorphous thin film transistor (TFT) as switching devices. This product is composed of a TFT LCD panel,driver ICs, FPC and a backlight unit.

2 Mechanical Specifications

The mechanical detail is shown in Fig. 1 and summarized in Table 1 below.

Table 1

Parameter		Specifications	Unit
Screen size		2.9	inch
Display Format		376 RGB x 960	Dot
Active area		67.68(H) x 26.508(V)	mm
Pixel Configuration		RGB Vertical Stripe	
Outline dimension		31.2(W) x 76.603(H) x 2.11(D)	mm
Display Mode		Normally Black	
Input Interface		2-lane Mipi	
Weight		8.5	g
View Angle direction		Free	
Temperature Range	Operation	-20~70	℃
	Storage	-30~80	℃

Display Type	2.86"Inch NORMALLY BLACK / TRANSMISSIVE
Display Resolution	376*(RGB)*960
Viewing Direction	Free
LCD Controller/Driver	ST7701S
Logic Voltage	3.3V
Operation Temperature	-20°C TO 70°C
Storage Temperature	-30°C TO 80°C
Backlight Speciality	LED SIDE (WHITE),4PCS VF=3.1V±0.3V,IF=80mA(constant) Luminance of module is 200cd/m2(Typ.)
Reliability test	Normal
Remark	

MARELCOM

Backlight LED Circuit

FPC ASSIGNMENT:

NO.	NAME	NO.	NAME	NO.	NAME
1	LEDA	21	R3		
2	LEDK	22	R4		
3	VCC(3.3V)	23	G0		
4	GND	24	G1		
5	D0N	25	G2		
6	D0P	26	G3		
7	GND	27	G4		
8	CLKN	28	G5		
9	CLKP	29	B0		
10	GND	30	B1		
11	DIN	31	B2		
12	D1P	32	B3		
13	GND	33	B4		
14	VS	34	RESET		
15	HS	35	CS		
16	CLK	36	SCL		
17	DEN	37	SDI		
18	R0	38	IM0		
19	R1	39	IM1		
20	R2	40	IM2		

ISSUE	MODIFY DESCRIPTION	DATE
T01	First Issue	2020.08.04

TITLE:		Module Speciality	
ITEM NO:		M7196	
PROJECT NO:		MACHJ029HXNN0101N	
		THIRD ANGLE PROJECTION	
	NAME	SIGN	DATE
DRAWN	Liao Mao liang		2020.08.04
CHECKED	Weng Guang da		
CHECKED	Lan Li juan		
APPROVED	Yu Hao		
REV: T01	UNIT:mm	SCALE:1/1	SHEET: 1 OF 2

▲: Special characteristic ▽ : Critical dimension
+: Safety characteristic (...): Reference dimension
Tolerance unless:x.x±0.3 Otherwise specified:x.xx±0.2

Kind suggestion: VA of customer's application should be 0.5mm smaller than LCD VA in each side.

Figure 1a: Module Specification

3 Interface signals

Table 2

Pin	Symbol	I/O	Function	Remark
1	LEDA	I	Anode of Backlight.	
2	LEDK	I	Cathode of Backlight.	
3	VCC(3.3V)	Power	Power Supply.	
4	GND	Ground	Ground.	
5	D0N	I	Mipi DSI differential data pair	
6	D0P	I		
7	GND	Ground	Ground.	
8	CLKN	I	Mipi DSI differential clock pair.	
9	CLKP	I		
10	GND	Ground	Ground.	
11	D1N	I	Mipi DSI differential data pair	
12	D1P	I		
13	GND	Ground	Ground.	
14	VS	I	Vertical synchronizing for RGB interface	
15	HS	I	Horizontal synchronizing for RGB interface	
16	CLK	I	Dot clock for RGB interface	
17	DEN	I	Data Enable signal for RGB interface	
18	R0	I		
19	R1	I		
20	R2	I		
21	R3	I		
22	R4	I		
23	G0	I		
24	G1	I		
25	G2	I	Parallel data bus for RGB interface.	
26	G3	I		
27	G4	I		
28	G5	I		
29	B0	I		
30	B1	I		
31	B2	I		
32	B3	I		
33	B4	I		
34	RESET	I	Extern Reset. Low:Enable High:Disable	
35	CS	I	Chip Select. Low:Enable High:Disable	
36	SCL	I	Serial clock input for SPI interface.	
37	SDI	I	Serial data input/output bidirectional pin for SPI interface.	
38	IM0	I		
39	IM1	I	The system interface mode set.	
40	IM2	I		

4. Absolute Maximum Ratings

4.1 Electrical Maximum Ratings (Ta = 25 ºC)

Table 3

Item	Symbol	Condition	Min.	Max.	Unit	Remark
Power Voltage	VCC	GND=0	-0.3	4.6	V	
Input Signal Voltage	Vin	GND=0	-0.3	VCC+0.3	V	
Logic Output Voltage	VOUT	GND=0	-0.3	VCC+0.3	V	

Note: If one of the above items is exceeded its maximum limitation momentarily, the quality of the product may be degraded.

Absolute maximum limitation, therefore, specify the values exceeding which the product may be physically damaged. Be sure to use the product within the recommend range.

4.2 Environmental Condition

Table 4

Item	Operating Temperature (Topr)		Storage Temperature (Tstg)	
	Min.	Max.	Min.	Max.
Ambient Temperature	-20 C	+70 C	-30 C	+80 C

5 Electrical Specifications and Timing

5.1 LED driving conditions

Table5

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
LED current		-	80	-	mA	
LED voltage	Vf	2.8	3.1	3.4	V	
Luminance	Lv	6000	-	-	cd/m^2	
LED Life Time	-	-	30000	-	Hr	Note 1

Note 1 : Ta = 25℃

5.2 DC Characteristics

Table 6

Parameter	Symbol	Rating			Unit	Condition
		Min.	Typ.	Max.		
System Voltage	VCC	3.0	3.3	3.6	V	
Low level input voltage	VIL	0	-	0.3VCC	V	
Hight level input voltage	VIH	0.7 VCC	-	VCC	V	

5.3Timing

5.3.1Reset Timing:
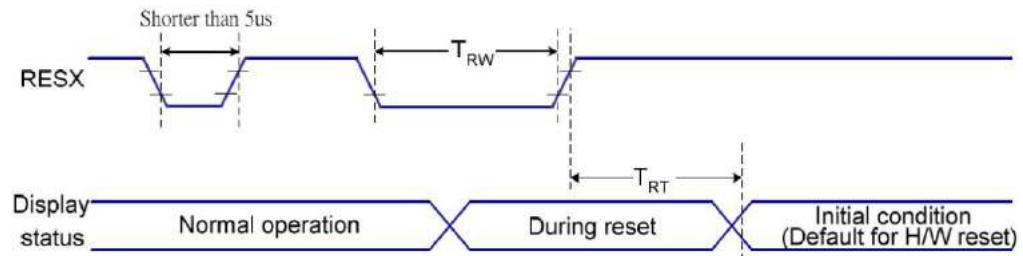
Figure 2:Reset Timing
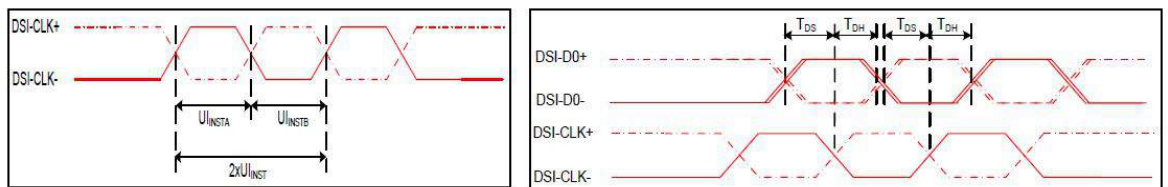
5.3.2Mipi Timing

5.3.2.1High Speed Mode

Figure3: DSI High Speed Timing

Table 7 Mipi High Speed Timing Characteristics

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
DSI-CLK+/-	$2xUI_{INSTA}$	Double UI instantaneous	4	25	ns	
DSI-CLK+/-	UI_{INSTA} UI_{INSTB}	UI instantaneous halfs	2	12.5	ns	$UI = UI_{INSTA} = UI_{INSTB}$
DSI-Dn+/-	tDS	Data to clock setup time	0.15	-	UI	
DSI-Dn+/-	tDH	Data to clock hold time	0.15	-	UI	

5.3.2.2Low Power Mode
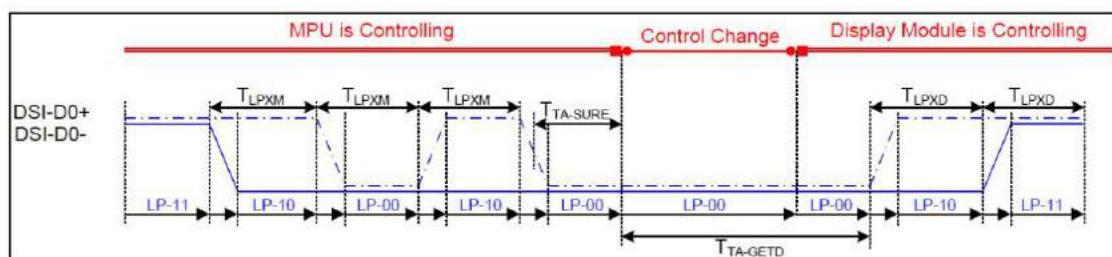
Figure4: Bus Turnaround (BTA) from display module to MPU Timing
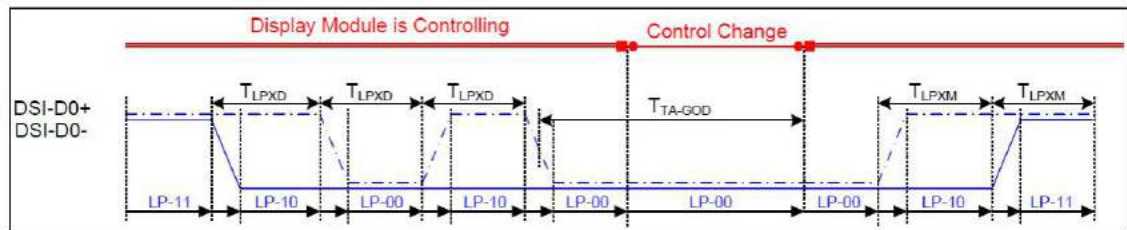
Figure5: Bus Turnaround (BTA) from MPU to display module Timing

Table 8 Mipi Low Power Timing Characteristics

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
DSI-D0+/-	TLPXM	Length of LP-00,LP-01, LP-10 or LP-11 periods MPU→Display Module	50	75	ns	Input
DSI-D0+/-	TLPXD	Length of LP-00,LP-01, LP-10 or LP-11 periods MPU→Display Module	50	75	ns	Output
DSI-D0+/-	TTA-SURED	Time-out before the MPU start driving	T_{LPXD}	$2 \times T_{LPXD}$	ns	Output
DSI-D0+/-	TTA-GETD	Time to drive LP-00 by display module	$5 \times T_{LPXD}$		ns	Input
DSI-D0+/-	TTA-GOD	Time to drive LP-00 after turnaround request-MPU	$4 \times T_{LPXD}$		ns	Output

5.3.3 RGB Timing
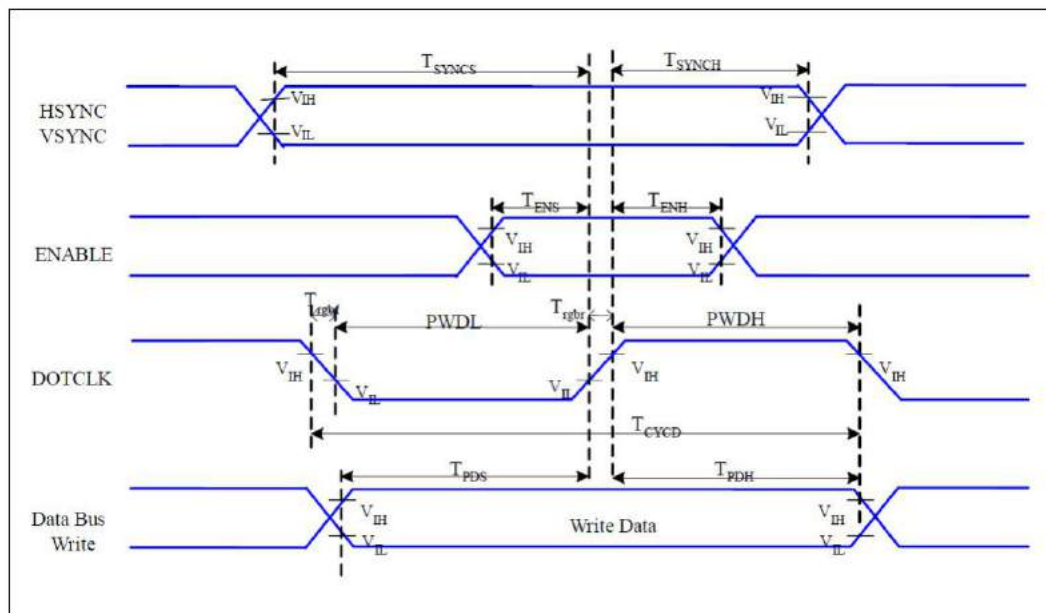
Figure6: RGB Interface Timing

Table 9 18/16 Bits RGB Timing Characteristics

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
HSYNC, VSYNC	T_{SYNCS}	VSYNC, HSYNC Setup Time	5	-	ns	
ENABLE	T_{ENS}	Enable Setup Time	5	-	ns	
	T_{ENH}	Enable Hold Time	5	-	ns	
DOTCLK	PWDH	DOTCLK High-level Pulse Width	15	-	ns	
	PWDL	DOTCLK Low-level Pulse Width	15	-	ns	
	T_{CYCD}	DOTCLK Cycle Time	33	-	ns	
	Trghr, Trghf	DOTCLK Rise/Fall time	-	15	ns	
DB	T_{PDS}	PD Data Setup Time	5	-	ns	
	T_{PDH}	PD Data Hold Time	5	-	ns	

5.3.4 3-Line Serial Interface Timing
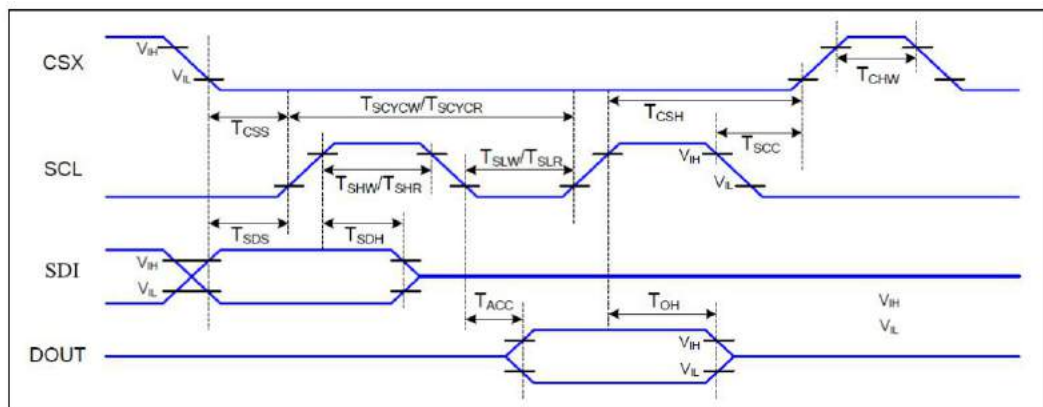
Figure7: 3-Line Serial Interface Timing

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)	60		ns	
	T_{CHW}	Chip select "H" pulse width	40		ns	
SCL	T_{SCYCW}	Serial clock cycle (Write)	66		ns	
	T_{SHW}	SCL "H" pulse width (Write)	15		ns	
	T_{SLW}	SCL "L" pulse width (Write)	15		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	
SDI (DIN)	T_{SDS}	Data setup time	10		ns	
	T_{SDH}	Data hold time	10		ns	

Table 10 3-Line Serial Timing Characteristics

6. Command Table

Table 11

Instruction	Address		R/W/ C	PNUM	D7	D6	D5	D4	D3	D2	D1	D0	Function
	MIPI	SPI-16											
NOP	00h	0000h	C	0	0	0	0	0	0	0	0	0	No operation
SWRESET	01h	0100h	C	0	0	0	0	0	0	0	0	1	Software reset
RDDID	04h	0400h	R	3	ID1[7:0]								ID1 read
		0401h			ID2[7:0]								ID2 read
		0402h			ID3[7:0]								ID3 read
RDNUMED	05h	0500h	R	1	ErrOver	Err[6:0]							Read No. of the Errors on DSI only
RDRED	06h	0600h	R	1	R_1st[7:0]								Read the first pixel of Color R
RDGREEN	07h	0700h	R	1	G_1st[7:0]								Read the first pixel of Color G
RDBLUE	08h	0800h	R	1	B_1st[7:0]								Read the first pixel of Color B
RDDPM	0Ah	0A00h	R	1	BSTON	0	0	SLPOUT	1	DISON	--	--	Read Display Power Mode
RDDMADCTL	0Bh	0B00h	R	1	--	--	--	ML	BGR	--	--	--	Read Display MADCTR
RDDCOLMOD	0Ch	0C00h	R	1	--	VIPF[2:0]		--	--	--	--	--	Read Display Pixel Format
RDDIM	0Dh	0D00h	R	1	--	--	INVON	ALPXLON	ALPXLOFF	GCS[2:0]			Read Display Image Mode
RDDSM	0Eh	0E00h	R	1	TEON	TELMD	--	--	--	--	--	--	Read Display Signal Mode
RDDSDR	0Fh	0F00h	R	1	RLD	FUND	0	0	--	--	--	--	Read Display Self-diagnostic result
SLPIN	10h	1000h	C	0	0	0	0	0	0	0	1	0	Sleep in
SLPOUT	11h	1100h	C	0	0	0	0	1	0	0	0	1	Sleep out
PTLON	12h	1200h	C	0	0	0	0	1	0	0	1	0	Partial mode on
NORON	13h	1300h	C	0	0	0	0	1	0	0	1	1	Normal display mode on
INVOFF	20h	2000h	C	0	0	0	1	0	0	0	0	0	Display inversion off (normal)
INVON	21h	2100h	C	0	0	0	1	0	0	0	0	1	Display inversion on
ALLPOFF	22h	2200h	C	0	0	0	1	0	0	0	1	0	All pixel off (black)
ALLPON	23h	2300h	C	0	0	0	1	0	0	0	1	1	All pixel on (white)
GAMSET	26h	2600h	W	1	--	--	--	--	GC[3:0]				Gamma curve select
DISPOFF	28h	2800h	C	0	0	0	1	0	1	0	0	0	Display off
DISPON	29h	2900h	C	0	0	0	1	0	1	0	0	1	Display on

Instruction	Address MIPI	Address SPI-16	R/W/C	PNUM	D7	D6	D5	D4	D3	D2	D1	D0	Function
TEOFF	34h	3400h	C	0	0	0	1	1	0	1	0	0	Tearing effect line off
TEON	35h	3500h	W	0	0	0	1	1	0	1	0	1	Tearing effect line on
MADCTL	36h	3600h	W	1	--	--	--	ML	BGR	--	--	--	Display data access control
IDMOFF	38h	3800h	C	0	--	--	--	--	--	--	--	--	Idle mode off
IDMON	39h	3900h	C	0	--	--	--	--	--	--	--	--	Idle mode on
COLMOD	3Ah	3A00h	W	0	--	VIPF[2:0]			--	--	--	--	Interface Pixel Format
GSL	45h	4500h	R	2	TESL[15:8]								Read Tear line
		4501h			TESL[7:0]								
WRDIBV	51h	5100h	W	1	DBV[7:0]								Write display brightness
RDDISBV	52h	5200h	R	1	DBV[7:0]								Read display brightness value
WRCTRLD	53h	5300h	W	1	--	--	BCTRL	--	DD	BL	--	--	Write control display
RRCTRLD	54h	5400h	R	1	--	--	BCTRL	--	DD	BL	--	--	Read control display value
WRCABC	55h	5500h	W	1	CE_ON	--	CE_MD[1:0]		--	--	CABC_MD[1:0]		Write CABC mode
RRCABC	56h	5600h	R	1	CE_ON	--	CE_MD[1:0]		--	--	CABC_MD[1:0]		Read CABC mode
WRCABCMB	5Eh	5E00h	W	1	CMB[7:0]								Write CABC minimum brightness
RRCABCMB	5Fh	5F00h	R	1	CMB[7:0]								Read CABC minimum brightness
RDABCSD	68h	6800h	R	1	RLD	FUND	--	--	--	--	--	--	Read Automatic Brightness Control Self-Diagnostic Result
RDBWLB	70h	7000h	R	1	BKx1	BKx0	BKy1	BKy0	Wx1	Wx0	Wy1	Wy0	Read Black/White Low Bits
RDBKx	71h	7100h	R	1	BKx9	BKx8	BKx7	BKx6	BKx5	BKx4	BKx3	BKx2	Read BKx
RDBKy	72h	7200h	R	1	BKy9	BKy8	BKy7	BKy6	BKy5	BKy4	BKy3	BKy2	Read Bky
RDWx	73h	7300h	R	1	Wx9	Wx8	Wx7	Wx6	Wx5	Wx4	Wx3	Wx2	Read Wx
RDWy	74h	7400h	R	1	Wy9	Wy8	Wy7	Wy6	Wy5	Wy4	Wy3	Wy2	Read Wy
RDRGLB	75h	7500h	R	1	Rx1	Rx0	Ry1	Ry0	Gx1	Gx0	Gy1	Gy0	Read Red/Green Low bits
RDRx	76h	7600h	R	1	Rx9	Rx8	Rx7	Rx6	Rx5	Rx4	Rx3	Rx2	Read Rx
RDRy	77h	7700h	R	1	Ry9	Ry8	Ry7	Ry6	Ry5	Ry4	Ry3	Ry2	Read Ry
RDGx	78h	7800h	R	1	Gx9	Gx8	Gx7	Gx6	Gx5	Gx4	Gx3	Gx2	Read Gx
RDGy	79h	7900h	R	1	Gy9	Gy8	Gy7	Gy6	Gy5	Gy4	Gy3	Gy2	Read Gy
RDBALB	7Ah	7A00h	R	1	Bx1	Bx0	By1	By0	Ax1	Ax0	Ay1	Ay0	Blue/AColour Low Bits
RDBx	7Bh	7B00h	R	1	Bx9	Bx8	Bx7	Bx6	Bx5	Bx4	Bx3	Bx2	Read Bx
RDBy	7Ch	7C00h	R	1	By9	By8	By7	By6	By5	By4	By3	By2	Read By
RDAx	7Dh	7D00h	R	1	Ax9	Ax8	Ax7	Ax6	Ax5	Ax4	Ax3	Ax2	Read Ax
RDAy	7Eh	7E00h	R	1	Ay9	Ay8	Ay7	Ay6	Ay5	Ay4	At3	Ay2	Read Ay

| Instruction | Address | | R/W/C | PNUM | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Function |
	MIPI	SPI-16											
RDDDBS/ CHKSUM	A1h	A100h	R	5	0x88									Read the DDB from the provided location
		A101h			0x02									
		A102h			MID[15:8]									
		A103h			MID[7:0]									
		A104h			8'hff									
RDDDBC	A8h	A800h	R	5	SID[15:8]									Continue reading the DDB from the last read location
		A801h			SID[7:0]									
		A802h			MID[15:8]									
		A803h			MID[7:0]									
		A804h			8'hff									
RDFCS	AAh	AA00h	R	1	FCS[7:0]									Read First Checksum
RDCCS	AFh	AF00h	R	1	CCS[7:0]									Read Continue Checksum
RDID1	DAh	DA00h	R	1	ID1[7:0]									Read ID1
RDID2	DBh	DB00h	R	1	ID2[7:0]									Read ID2
RDID3	DCh	DC00h	R	1	ID3[7:0]									Read ID3

7. Optical Characteristic

7.1 Optical Specification

Table 12

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle Range	Horizontal	Θ_3	CR > 10	75	85	-	Deg.	Note 4.1
		Θ_9		75	85		Deg.	
	Vertical	Θ_{12}		75	85	-	Deg.	
		Θ_6		75	85	-	Deg.	
Contrast Ratio		CR	$\Theta = 0°$	1000	1500	-		Without APF Note 4.2/4.3
Cell Transmittance		Tr		3.0	3.5	-	%	
Reproduction of color		Rx	$\Theta = 0°$	0.589	0.619	0.649	-	@C Light Note 4.4
		Ry		0.302	0.332	0.362	-	
		Gx		0.273	0.303	0.333	-	
		Gy		0.533	0.563	0.593	-	
		Bx		0.105	0.135	0.165	-	
		By		0.104	0.134	0.164	-	
		Wx		0.288	0.318	0.348	-	
		Wy		0.310	0.340	0.370	-	
Color Gamut			$\Theta = 0°$	50	55.1	-	%	
Response Time		Tr	Ta= 25°C $\Theta = 0°$	-	-	-	ms	Note 4.5
		Tf		-	-	-	ms	
		Tr+Tf		-	30	35	ms	

Ta=25±2℃, IF=80mA

Note 4.1: Definition of viewing angle range
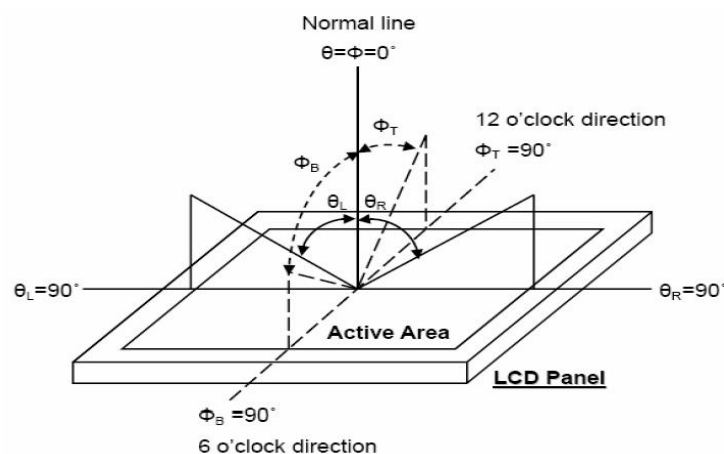
Fig. 8: Definition of viewing angle

Note 4.2: Definition of contrast ratio:

The contrast ratio is defined as the following expression.

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

Note 4.3: Transmittance is the Value with Polarizer.

Note 4.4: The color chromaticity coordinates specified shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel.

Note 4.5: Definition of Response time:

The response time is defined as the LCD optical switching time interval between "White" state and "Black" state. Rise time, Tr, is the time between photo detector output intensity changed from 90% to 10%. And fall time, Tf, is the time between photo detector output intensity changed from 10% to 90%.
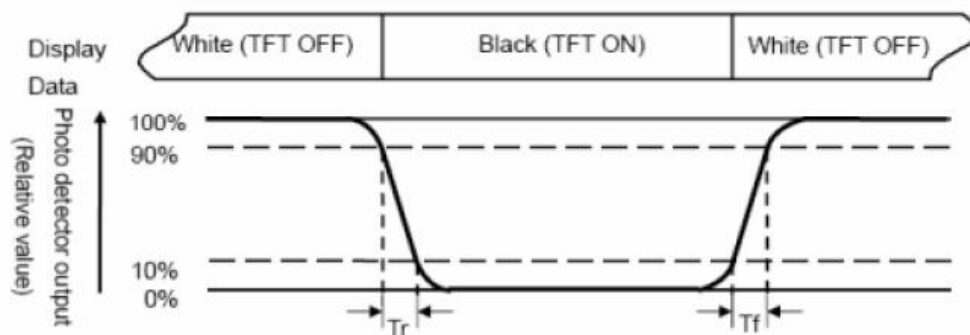
Fig.9:Definition of response time

8. Quality Assurance

Table 13

No.	Test Items	Test Condition	REMARK
1	High Temperature Storage Test	Ta=80℃ 240h	
2	Low Temperature Storage Test	Ta=-30℃ 240h	
3	High Temperature Operation Test	Ta=70℃ 240h	
4	Low Temperature Operation Test	Ta=-20℃ 240h	
5	High Temperature and High Humidity Operation Test	Ta=60℃/90±3%RH/240h	
6	Electro Static Discharge Test (no-operation)	C=150pF,R=330Ω,5point/panel Air: ±12KV,5times; Contact: ±8KV,5times (Environment:15℃~35℃, 30%RH~60% RH.86Kpa~106Kpa)	1.Total current consumption should be below double of initial value. 2.Cosmetic defects should not be happened.
7	Vibration (Package state)	10Hz~500Hz Sweep: 5g, 0.5Hrs for X,Y,Z direction.	
8	Thermal Shock Test	-30℃→+80℃ 30min→30min 100cycle	
9	Falling test (Packaged state)	<table><tr><td>Package Weight（kg）</td><td>Drop Height（cm）</td></tr><tr><td>≤10</td><td>80</td></tr><tr><td>11−30</td><td>60</td></tr><tr><td>≥31kg</td><td>40</td></tr></table> 6 faces, 3 edges, a pair corner	

***** Ta= Ambient Temperature

Note:

1. The test samples have recovery time for 2 hours at room temperature before the function check. In the standard conditions, there is no display function NG issue occurred.

2. All the cosmetic specifications are judged before the reliability stress.

9 Precautions

Please pay attention to the following when you use this TFT LCD module.

9.1 Mounting Precautions

(1) You must mount a module using arranged in four corners or four sides.

(2) You should consider the mounting structure so that uneven force (ex. Twisted stress) is not applied to the module. And the case on which a module is mounted should have sufficient strength so that external

force is not transmitted directly to the module.

(3) Please attach a transparent protective plate to the surface in order to protect the polarizer. Transparent protective plate should have sufficient strength in order to the resist external force.

(4) You should adopt radiation structure to satisfy the temperature specification.

(5) Acetic acid type and chlorine type materials for the cover case are not describe because the former generates corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.

(6) 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. Do not touch the surface of polarizer for bare hand or greasy cloth. (Some cosmetics are determined to the polarizer)

(7) When the surface becomes dusty, please wipe gently with adsorbent cotton or other soft materials like chamois soaks with petroleum benzene. Normal-hexane is recommended for cleaning the adhesives used to attach front / rear polarizers. Do not use acetone, toluene and alcohol because they cause chemical damage to the polarizer.

(8) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.

(9) Do not open the case because inside circuits do not have sufficient strength.

9.2 Operating Precautions

(1) The spike noise causes the mis-operation of circuits. It should be lower than following voltage：
V=±200mV(Over and under shoot voltage)

(2) Response time depends on the temperature. (In lower temperature, it becomes longer.)

(3) Brightness depends on the temperature. (In lower temperature, it becomes lower) And in lower temperature, response time (required time that brightness is stable after turned on) becomes longer.

(4) 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.

(5) When fixed patterns are displayed for a long time, remnant image is likely to occur.

(6) 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 minimize the interference.

9.3 Electrostatic Discharge Control

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 wristband etc. And don't touch interface pin directly.

9.4 Precautions For Strong Light Exposure

Strong light exposure causes degradation of polarizer and color filter.

9.5 Storage

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

(1) Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5℃ and 35℃ at normal humidity.

(2) 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.

9.6 Handling Precautions For Protection Film

(1) When the protection film is peeled off, static electricity is generated between the film and polarizer. This should be peeled off slowly and carefully by people who are electrically grounded and with well ion-blown equipment or in such a condition, etc.

(2) The protection film is attached to the polarizer with a small amount of glue. Is apt to remain on the polarizer.Please carefully peel off the protection film without rubbing it against the polarizer.

(3) When the module with protection film attached is stored for a long time, sometimes there remains a very small amount of glue still on the polarizer after the protection film is peeled off.

(4) You can remove the glue easily. When the glue remains on the polarizer surface or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal-hexane.

10 Quality Units

1.Inspection method

An appearance inspection should be conducted at 30 cm or more distance/height from the inspector's eye sight to the LCD module surface under fluorescent light. The distance between LCD and fluorescent lamps should be 100 cm or more. Viewing angle for inspection is 45° from vertical against LCD.
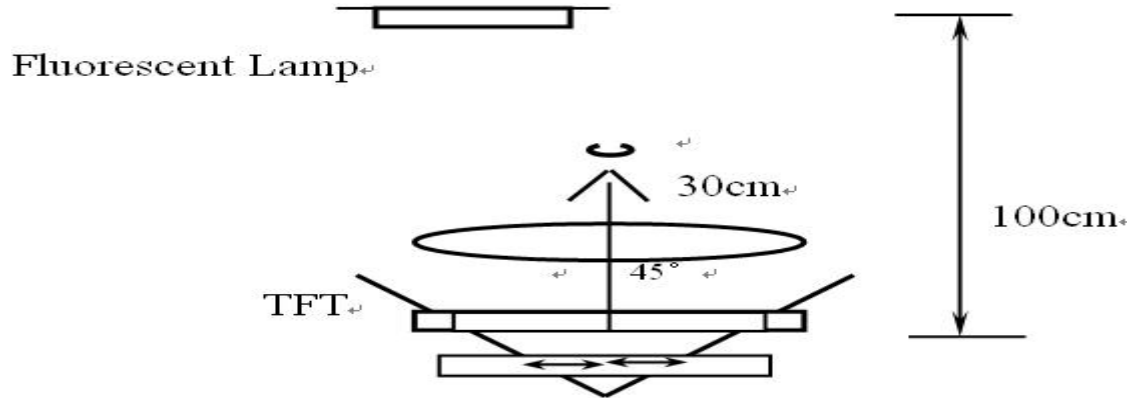
2. Quality Level

The AQL for major and minor defects is defined as follows:

Partition	Definition	AQL
Major defect	Functional defective in product.	0.65
Minor defect	Meet all functions of product but have some cosmetic defective	1.0

3．Definition

3.1The environmental condition of inspection

1）Ambient temperature ：22℃±5℃，65±20%RH

2）Function inspection：less than 300Lux

3）Visual inspection：750±150Lux

3.2 Definition of dot defect

The size of a defective dot full of a whole dot，and all bright dot or dark dot defect must be visible through ND 5% filter.

3.2.1 Bright dot

Dots appear bright and unchanged in size in which TFT is displaying.

single dot

two adjacent dots

three adjacent dots
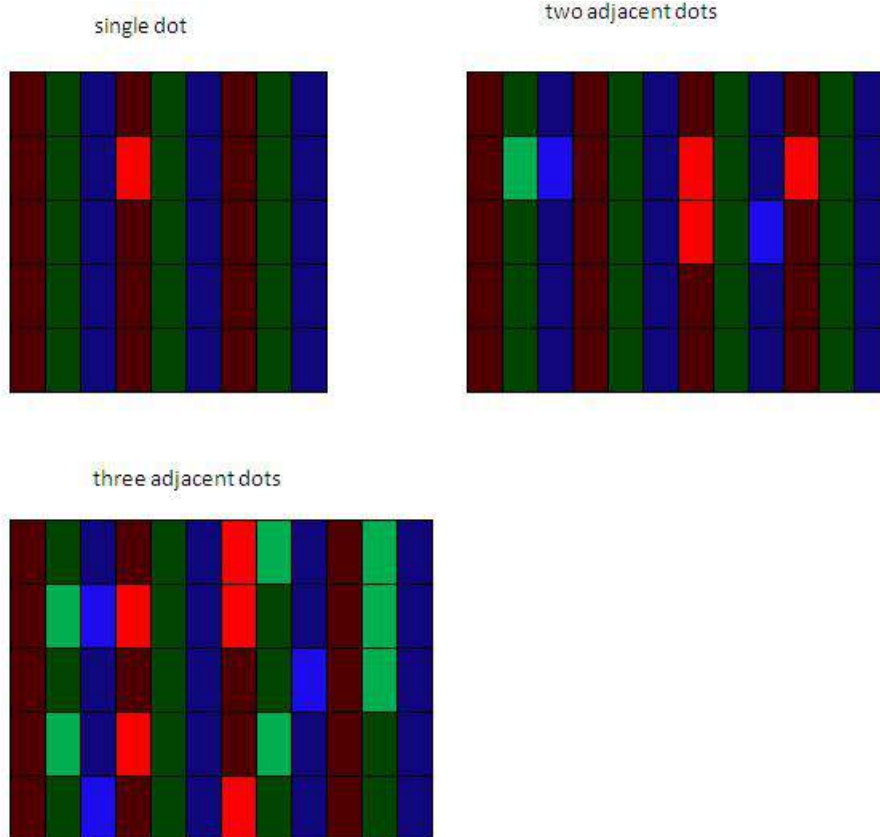
3.2.2 Dark dot

The same definition of bright dot, but always display dark

3.2.3 The usage of ND 5%

Use the ND 5% to cover bright dot within 2s,it should be judged OK if it's invisible.

4. Visual Inspection Standard

Defect	Inspection	Criteria
1 Corner Broken （Minor）	CF Glass / TFT Glass / T / A / C / B	1.A≤2.0 mm , B≤2.0 mm ,C≤T Ignore (No effect on function) 2. A > 2.0 mm ,or B > 2.0 mm, Not allowed
2 Corner Broken （Minor）	T / CF Glass / TFT Glass / A / C / B	1. A≤1.5 mm , B≤1.5 mm , C≤T Ignore (No effect on function) 2. A > 1.5 mm, or B > 1.5 mm Not allowed 3. To be applied to both CF and TFT glass

3 Corner Broken (**Minor**)		1. A≤1.5 mm , B≤1.5 mm , C≤T Ignore (No effect on function) 2. A > 1.5 mm, or B > 1.5 mm Not allowed 3. To be applied to both CF and TFT glass
4 Pad Broken (**Minor**)		1. A≤0.8 mm, C≤T Ignore B Length Ignore (No effect on function) 2. A > 0.8 mm, Not allowed
5 Side Broken (**Minor**)		1. A≤0.8 mm, C≤T Ignore B Length Ignore (No effect on function) 2. A > 0.8 mm, Not allowed
6 Glass crack (**Major**)		Not allowed
7 Spot defect: (**Minor**)	Foreign/Black/White/Bright Spot/POL dent or bubble Φ= a+	<table><tr><td>Dimensions</td><td>Acceptable Numbers</td></tr><tr><td>Φ≤0.1mm</td><td>Ignore</td></tr><tr><td>0.1mm < Φ≤0.20mm</td><td>2</td></tr><tr><td>0.2mm < Φ≤0.30mm</td><td>1</td></tr><tr><td>Φ > 0.30mm</td><td>0</td></tr></table> Note: *1:defect that beyond AA area Ignored

No.	Item	Criteria
8 Line defect （Minor）	Scratch; Fiber	**Scratch** : | Dimensions	Acceptable Numbers
---	---
W≤0.03mm	Ignore
L≤5 mm 0.03mm < W≤0.05mm	2
L≤5 mm 0.05mm < W≤0.1mm	1
Beyond Above, Not Allowed	| **Fiber:** | Size	Acceptable Numbers
---	---
W≤0.03mm	Ignore
L≤3 mm 0.03 < W≤0.05mm	2
Beyond Above, Not Allowed		 Note: *1：defect that beyond AA area Ignored
9 （Major）	FPC	1. the line broken off　　　　reject 2. gold-fingers oxidation/broken/fold-injury in acute angle / distortion on golden fingers reject 3. deflection over the drawing request reject 4. Burr /Scratch/Surface Dirty or mark that doesn't affect assembling & display Ignored 5.Cover film broken that didn't reveal line Ignored 6. gold-fingers scratch/ particle/ just color difference(non-oxidation) that didn't affect display Ignored
10 （Minor）	Backlight	1.The size don't match with the drawing . reject 2. Surface Dirty or mark that can not wipe out　　　　　　Ignored 3. Scald　　　　　　reject 4.Uneven or Scratch on surface that doesn't affect display Ignored
11.Bezel （Minor）	1.Out of shape/Scratch /Dent or salient point on surface that does not affect assembling or can not see after assembling	1. Ignored
12 （Minor）	protect film	Neglect any defect on protect film, such as: scratches/bubbles/particles

5. Electronic Inspection Standard:

Defect	Inspection	Criteria

1 **Spot defect** **（Minor）**	Foreign particle/Black/ White spot/Bubble .etc.	**Dimensions** / **Acceptable Numbers**: Φ≤0.1mm → Ignore 0.1mm < Φ≤0.20mm → 2 0.2mm < Φ≤0.30mm → 1 Φ > 0.30mm → 0		Note: *1: defect that beyond AA area Ignored

Dimensions / Acceptable Numbers

Dimensions	Acceptable Numbers
Φ≤0.1mm	Ignore
0.1mm < Φ≤0.20mm	2
0.2mm < Φ≤0.30mm	1
Φ > 0.30mm	0

Note:
*1: defect that beyond AA area Ignored

2
Line defect （Minor） — Scratched, Fiber

Scratch:

Dimensions	Acceptable Numbers
W≤0.03mm	Ignore
L≤5 mm 0.03mm < W≤0.05mm	2, *1
L≥5 mm or W≥0.05 mm	0

Fiber:

Size	Acceptable Numbers
W≤0.03mm	Ignore, *1
L≤3 mm 0.03 < W≤0.05mm	2
Beyond Above, Not Allowed	

Note:
*1:defect that beyond AA area Ignored

3
（Minor） — Bright/dark dot By sub-pixel

Dimensions	Acceptable Numbers
Single bright dot	N ≤1
Two adjacent bright dots	reject
Three adjacent bright dots	reject
Single dark dot	≤2
Two adjacent dark dots	≤0
Three adjacent dark dots	reject

1:Total dot≤2

4
（Minor） — Tiny Bright dot

Invisible by ND5% Filter, Ignore;
If visible , Φ≤0.1mm, Ignore ;
0.1mm < < Φ≤0.30mm,N≤2

5
（Major） — Display

1.Missing segment, missing word   reject
2.no display.   reject
3. Viewing angle not right.   reject
4. Display abnormal   reject

6
（Major） — Mura/ hot spot/ Light leak (apply to all patterns)

judge by ND5% filter or limit sample

7
（Major） — flicker

judge by ND 5% filter in grey pattern or limit sample

8
（Major） — Electricity parameter

Over the production SPEC   reject

	(VoP/Current)	
9 **(Major)**	Backlight	1、 LED died off reject 2、 Display on uniformity Invisible by ND5% filter 3、 Brightness does not match the SPEC reject 4、 light leak Invisible by ND5% filter
10 **(Major)**	Cross talk	Limit sample

6.0 Quality Assurance

6.1 when customer receive our product，if there is any broken on package or other quality problem，please contact US in time;

6.2 Manufacturer will only replace or repair any of its LCD which is found defective electrically or visually when inspected in accordance with the LCM specification, for a period of one year from the date of shipment. Confirmation of such date shall be based on freight documents.

No warranty can be granted if any of the precautions stated in handing LCD and LCD Modules above have been disregarded.

6.3 In returning the LCD and LCD Modules, they must be properly packaged and there should be detailed description of the failures or defects. Broken glass, scratches on polarizers, mechanical damages as well as defects that are caused by accelerated environmental tests are excluded from warranty.

6.4 Don't apply excessive force on the display surface;

6.5 LC is harmful material,when it leaks out， please do not touch it directly;

6.6 Store in dark places and do not expose to sunlight or fluorescent light. Keep the temperature between 0℃ and 40℃ and the humidity lower than 60%RH. Please consult display manufacturer for other storage requirements；

6.7 please do not scratch or make POL dirty

6.8 To avoid ESD, please keep product Storing in anti-static electricity container.

6.9 Quality assurance period is 1 Year

- END -