

SPECIFICATION FOR CTP LCM

MODEL NO:	TM050RVHG01
CUSTOMER:	
CUSTOMER P/N.	
VERSION	V1.0
CUSTOMER APPROVED	

- ☐ Preliminary Specification
- ☒ Final Specification

PREPARED	CHECKED	VERIFIED BY QA DEPT	VERIFIED BY R&D DEPT

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CONTENTS

	Page
1. General Specifications.....	1
2. Outline Drawing.....	2
3. Circuit Block Diagram.....	3
4. Interface.....	4
4.1 The FPC Connection of LCM.....	4
4.2 The FPC Connection of CTP.....	5
5. Electrical characteristics(GND=0V ,Ta=25℃).....	6
5.1 Absolute Maximum Ratings.....	6
5.2 DC Characteristics.....	7
5.2.1 DC Characteristics of LCM.....	7
5.2.2 DC Characteristics of CTP.....	8
5.3 LED backlight specification(GND=0V ,Ta=25℃).....	8
6. Timing Characteristics.....	9
6.1 Timing Characteristics of LCM.....	9
6.2 Timing Characteristics of CTP.....	13
7. Optical Characteristics.....	15
8. Environmental / Reliability Tests.....	23
9. Specification of Quality Assurance.....	21
9.1 Quality level of LCM.....	21
9.2 Appearance defects inspection item and limit criteria of TP.....	30
10. Precautions for Use of CTP Modules.....	33
10.1 Handling Precautions.....	33
10.2 Storage precautions.....	33
10.3 notes.....	31

1 General Specifications

TM050RVHG01 is a color active matrix LCD module incorporating amorphous silicon TFT (Thin Film Transistor). It is composed of a color TFT-LCD panel, driver IC with CABC function, FPC, a back light unit and CTP (Capacitive Touch Panel) with Multi-Touch function. The 5.0" display area contains 800RGB x 480 pixels and can display up to 16.7M colors. This product accords with RoHS environmental criterion.

Item	Contents	Unit	Note
LCD Type	α -Si TFT	-	
Display Color	16.7M		1
Viewing Direction	12:00	O'Clock	
Touch Panel Size	5.0"		
LCM+CTP (W×H×D)	120.70 ×75.80×4.65(max)	mm	
Active Area(W×H)	108.00×64.80	mm	
Number of Dots	800(RGB)×480	mm	
Dot Pitch(W×H)	0.135×0.135	mm	
Backlight	14LEDs (white)		
Interface	Digital 24-bits RGB		
Polarizer Mode	Transmissive/Positive		
Weight	82+/-3	g	
LCM Driver IC	HX8264-D+HX8664-B		
CTP Controller	NT11002QG-48/A		
Touch panel resolution	Depend on design		
Cover lens material	Strengthen glass		

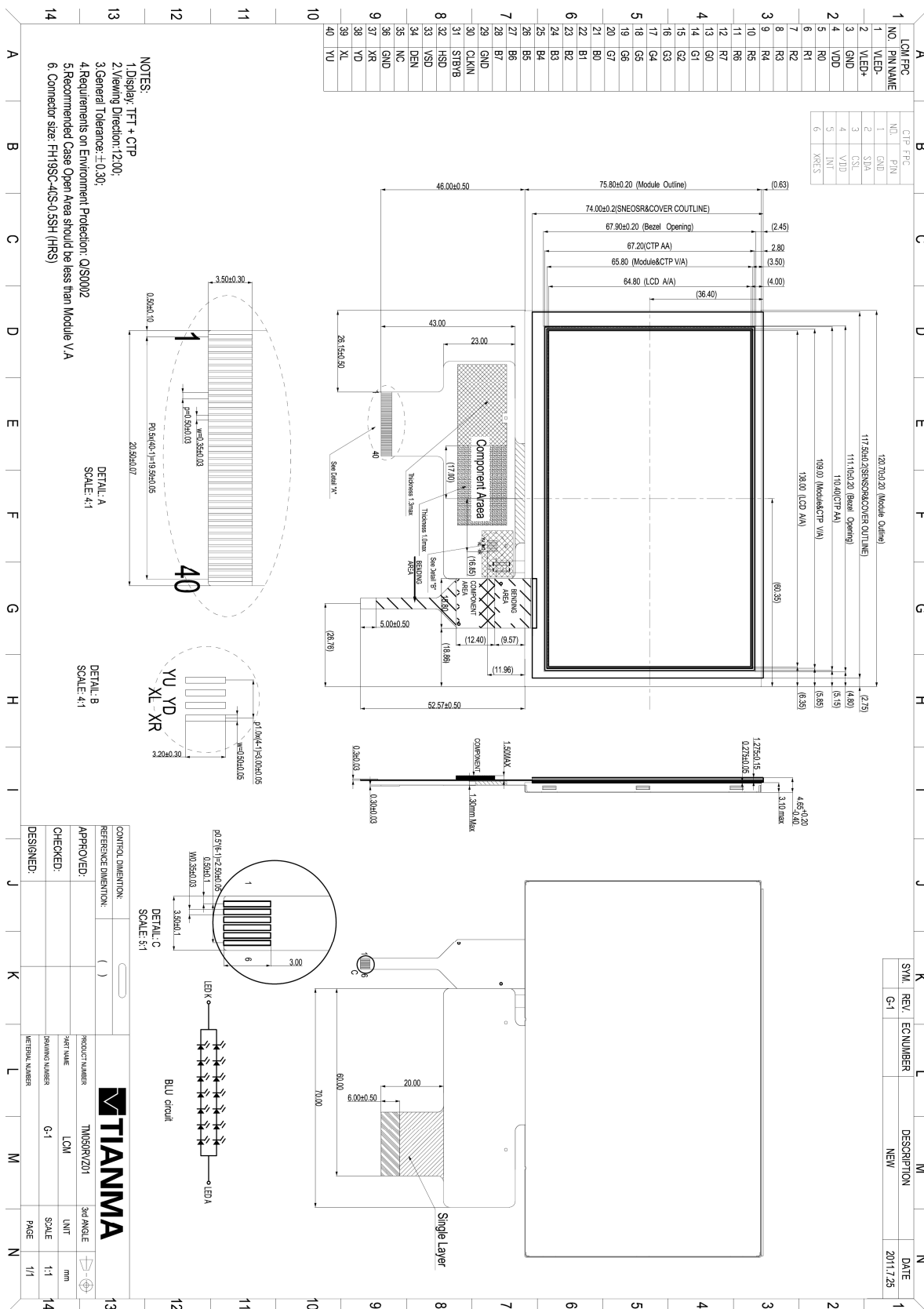
Note 1: Color tune is slightly changed by temperature and driving voltage.

Note 2: Requirements on Environmental Protection:RoHS

Note 3: Customer should do assembly according to our FPC bending sketch in the outline drawing.

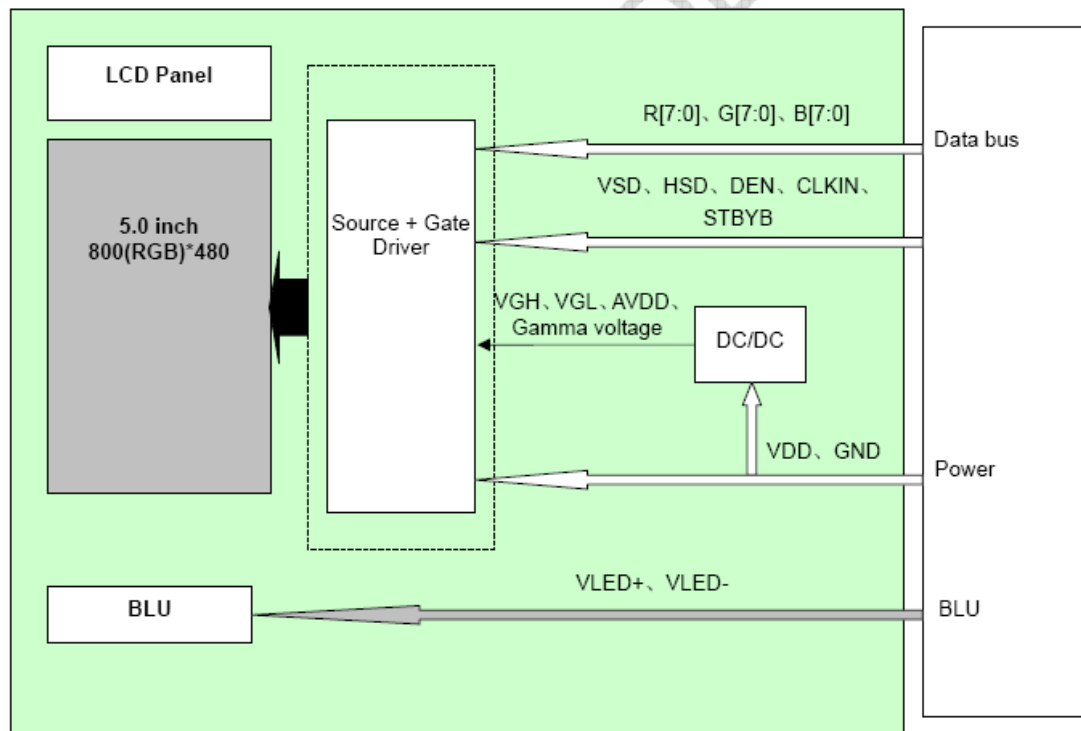
Note 4: Please approve our spec before placing mass production order. Otherwise we will regard customer has approved the spec when we receive the first 2Kpcs or above order fromcustomer.

2. Outline Drawing

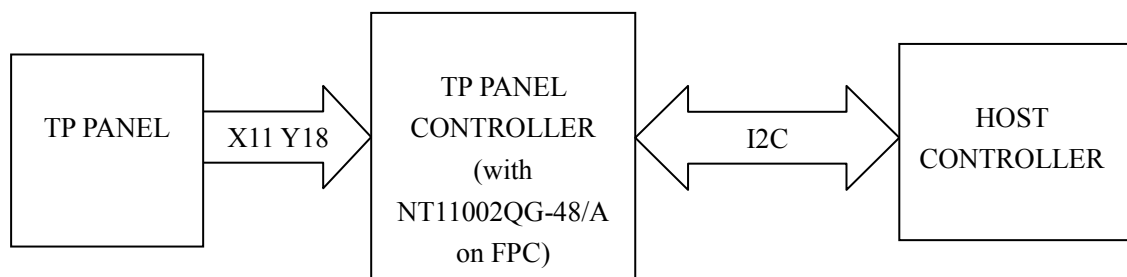


3. Circuit Block Diagram

3.1 LCM Block Diagram



3.2 CTP Block Diagram



4 Interface

4.1 The FPC Connection of LCM

Pin No.	Symbol	I/O	Function
1	VLED-	P	Back light cathode
2	VLED+	P	Back light anode
3	GND	P	Ground
4	VDD	P	Power supply
5	R0	I	Data input
6	R1	I	Data input
7	R2	I	Data input
8	R3	I	Data input
9	R4	I	Data input
10	R5	I	Data input
11	R6	I	Data input
12	R7	I	Data input
13	G0	I	Data input
14	G1	I	Data input
15	G2	I	Data input
16	G3	I	Data input
17	G4	I	Data input
18	G5	I	Data input
19	G6	I	Data input
20	G7	I	Data input
21	B0	I	Data input
22	B1	I	Data input
23	B2	I	Data input
24	B3	I	Data input
25	B4	I	Data input
26	B5	I	Data input
27	B6	I	Data input
28	B7	I	Data input

29	GND	I	Ground
30	CLKIN	I	Clock for input data. Data latched at rising edge of this signal.
31	STBYB	I	Standby mode. STBYB="1": Normally operation. STBYB="0": Standby mode .Timing controller, source driver will turn off, all output are High-Z.
32	HSD	I	Horizontal sync input.
33	VSD	I	Vertical sync input
34	DEN	I	Data input enable. Active high to enable the data input bus under "DE Mode ".
35	NC	-	No connection
36	GND	P	Ground
37	XR	-	XR
38	YD	-	YD
39	XL	-	XL
40	YU	-	YU

4.2 The FPC Connection of CTP

Pin No.	Symbol	I/O	Description	Remark
1	GND	P	Ground	
2	RESET	I/O	Active Low	
3	VDD	P	Power	
4	INT	P	Active Low	
5	SCL	I/O	CLOCK	
6	SDA	I/O	Data I/O	
7	TP_SYNC	I/O	GPIO from LCD	
8	NC	-	No connection	
9	NC	-	No connection	
10	NC	-	No connection	

Note :

1.Please contacts to product supplier for detail define information.

5 Electrical characteristics(GND=0V ,Ta=25°C)

5.1 Absolute Maximum Ratings

(Ta=25°C)

Item		Symbol	MIN	TYP	MAX	Unit	Remark
TFT Supply Voltage	Power supply for LCD	VDD	-0.5		5.0	V	1, 2
CTP Supply Voltage		VDD	2.7		3.6	V	
Operating Temperature		TOPR	-20		70	°C	
Storage Temperature		TSTG	-30		80	°C	

Notes:

1. If the module is above these absolute maximum ratings. It may become permanently damaged.
Using the module within the following electrical characteristic conditions are also exceeded, the module will malfunction and cause poor reliability.
2. VDD >GND must be maintained.

5.2 DC Characteristics

5.2.1 DC Characteristics of LCM

Parameter		Symbol	Condition	Min	Typ	Max	Unit	Note
Supply Voltage		VDD	-	3.0	3.3	3.6	V	
Input voltage	‘H’	VIH	VDD=3.3V	0.7 VDD		VDD	V	
	‘L’	VIL	VDD=3.3V	0	-	0.3VDD	V	
Output Voltage	‘H’	VOH	VDD=3.3V	0.7VDD	-	VDD	V	
	‘L’	VOL	VDD=3.3V	-	-	GND+0.4	V	
Current		ICC1	Normal mode	-	100	150	mA	
Consumption		ICC2	Standby mode	-	30	-	mA	

Note1: For different LCM, the value may have a bit of difference.

Note2: To test the current dissipation, use “all Black Pattern”.

5.2.2 DC Characteristics of CTP

Item	Min	Typ	Max	Unit	Note
power supply voltage	2.7		3.6	V	
Power supply current		---	4.0	mA	One finger on sensor

Note1: All current measurement is average current.

5.3 LED backlight specification(GND=0V ,Ta=25°C)

Item	Symbol	Min	Typ	Max	Unit	Remark
Forward Current	I_F	–	20	25	mA	Note 1
Forward Current Voltage	V_F	–	23.1	–	V	Note 1
Backlight Power Consumption	WBL	–	0.924	–	W	
Life Time	-	10,000	20,000	–	Hrs	Note 3

LED backlight characteristics

Note 1: I_F is defined for one channel LED. There are total two LED channels in back light unit

Note 2: Optical performance should be evaluated at Ta=25°C only.

Note 3: If LED is driven by high current, high ambient temperature & humidity condition. The life time of LED will be reduced. Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.



LED connection of backlight

6 Timing Characteristics

6.1 Timing Characteristics of LCM

6.1.1 Input Clock and Data Timing Diagram

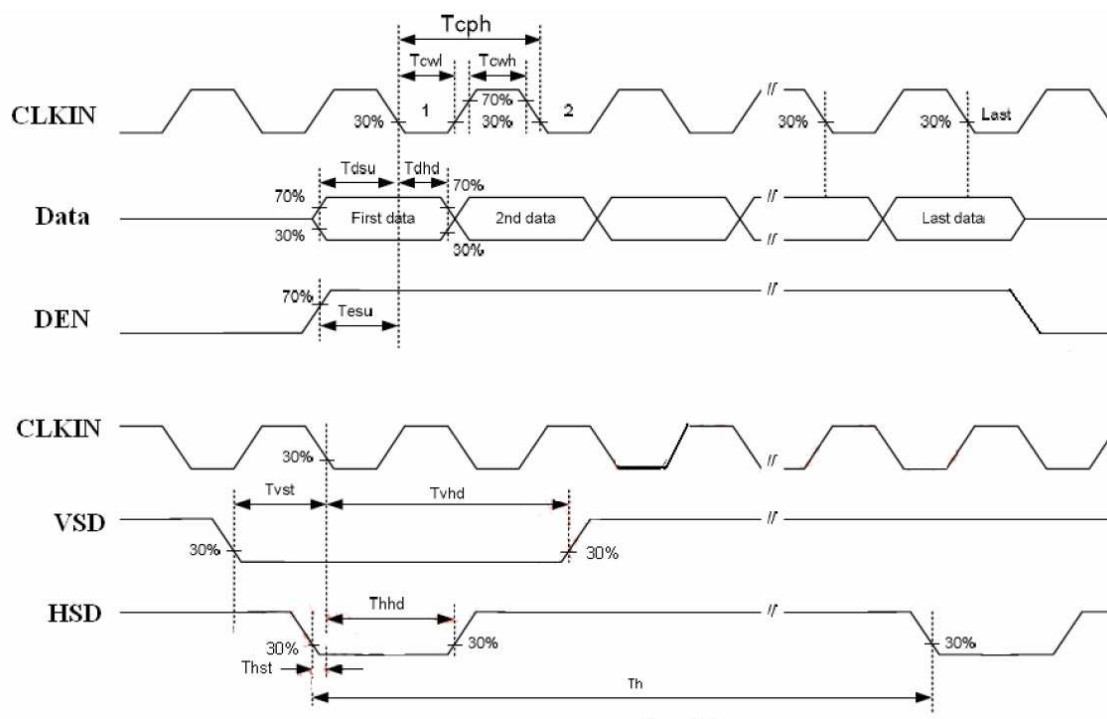


Figure 6.1 Input Clock and Data Timing Diagram

6.1.2 Timing Parameters

Normal Write Mode

VDD=3.3V Ta=25°C

Parameter	Symbol	Min	Typ	Max	Unit	Remark
HSD Setup Time	T_{hst}	8			ns	
HSD Hold Time	T_{hhd}	8	-	-	ns	
VSD Setup Time	T_{vst}	8			ns	
VSD Hold Time	T_{vhd}	8	-	-	ns	
Data Setup Time	T_{dsu}	8			ns	
Data Hold Time	T_{dhd}	8	-	-	ns	
DE Setup Time	T_{esu}	8			ns	
DE Hold Time	T_{ehd}	8	-	-	ns	
CLKIN Cycle Time	T_{cph}	20	-	-	ns	
CLKIN Pulse Width	T_{cwh}	40	50	60	%	
Output stable time	T_{sst}	-	-	6	us	
VDD Power ON Slew rate	T_{por}			20	ms	
RSTB pulse width	T_{rst}	10	-	-	us	

Table 6.1 Timing Parameters

6.1.3 Data Input format

6.1.3.1 Horizontal Input Timing Diagram

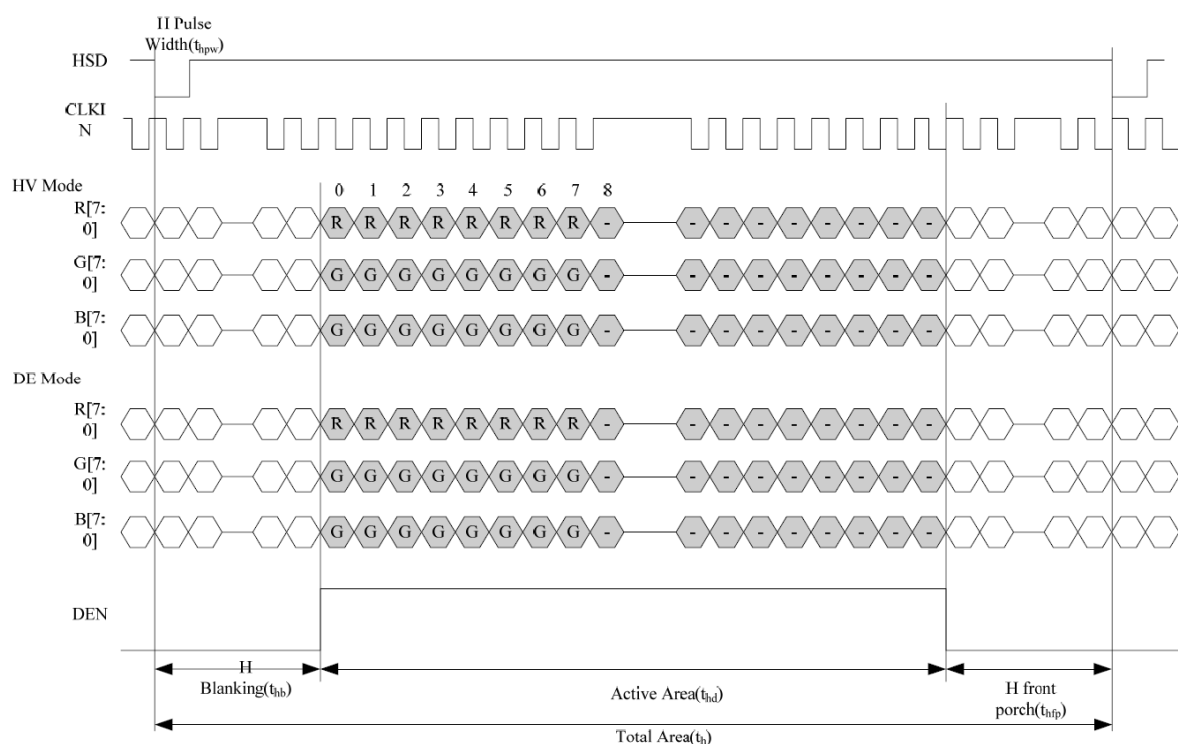


Figure 6.2 Horizontal Input Timing Diagram

6.1.3.2 Vertical Input Timing Diagram

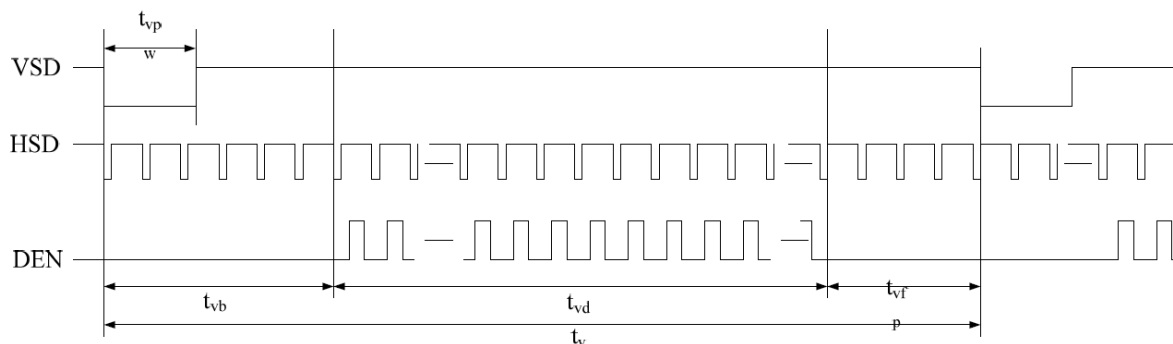


Figure 6.3 Vertical Input Timing Diagram

6.1.3.3 Parameter Setting Of Timing

Parameter	Symbol	Min	Typ	Max	Unit	Remak
Horizontal display area	t_{hd}	800			CLKIN	
CLKIN frequency (60Hz)	Fclk	-	30.0	50.0	MHZ	
HSYNC	t_h	889	928	1143	Tclk	
	t_{hd}	800	800	800	Tclk	
	t_{hpw}	1	48	255	Tclk	
	t_{hb}	88	88	88	Tclk	
	t_{hfp}	1	40	255	Tclk	
VSYNC	t_v	513	525	767	th	
	t_{vd}	480	480	480	th	
	t_{vpw}	3	3	255	th	
	t_{vb}	32	32	32	th	
	t_{vfp}	1	13	255	th	

Note:Base on Driver IC HX8264-D

Table 6.2 Parameter Setting Of Timing

6.1.4 Power ON/OFF Sequence

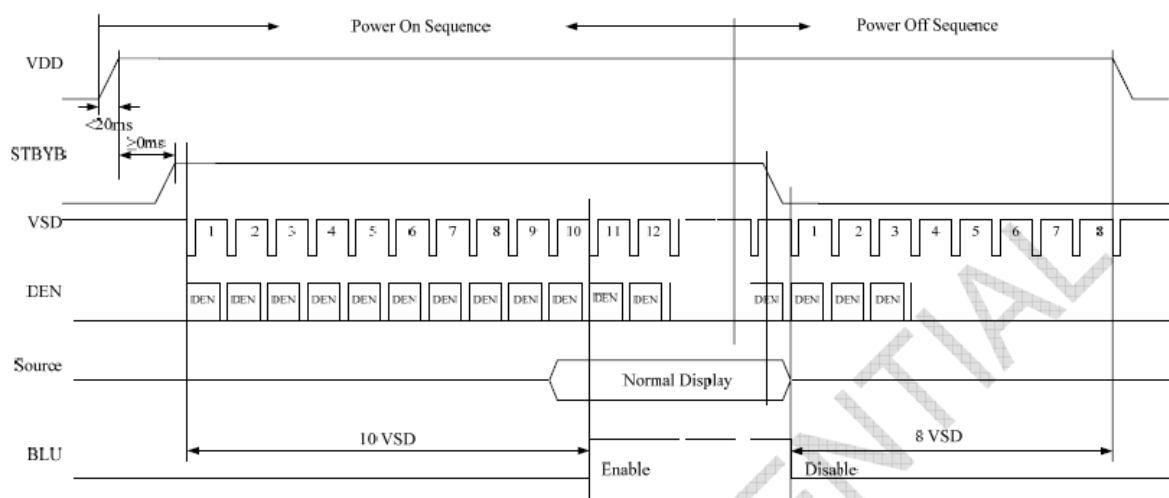


Figure 6.4 Power on/off sequence

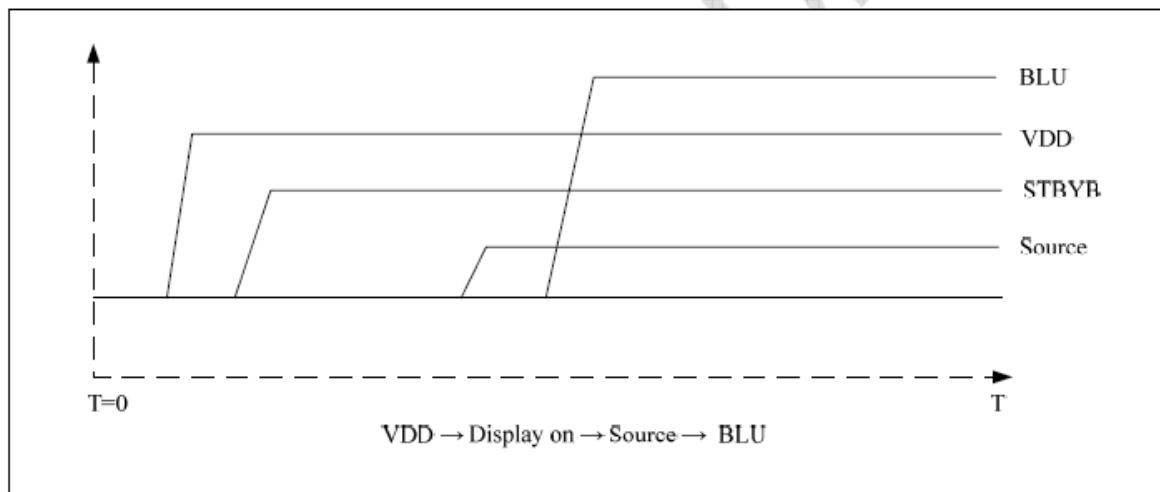


Figure 6.5 Power on sequence

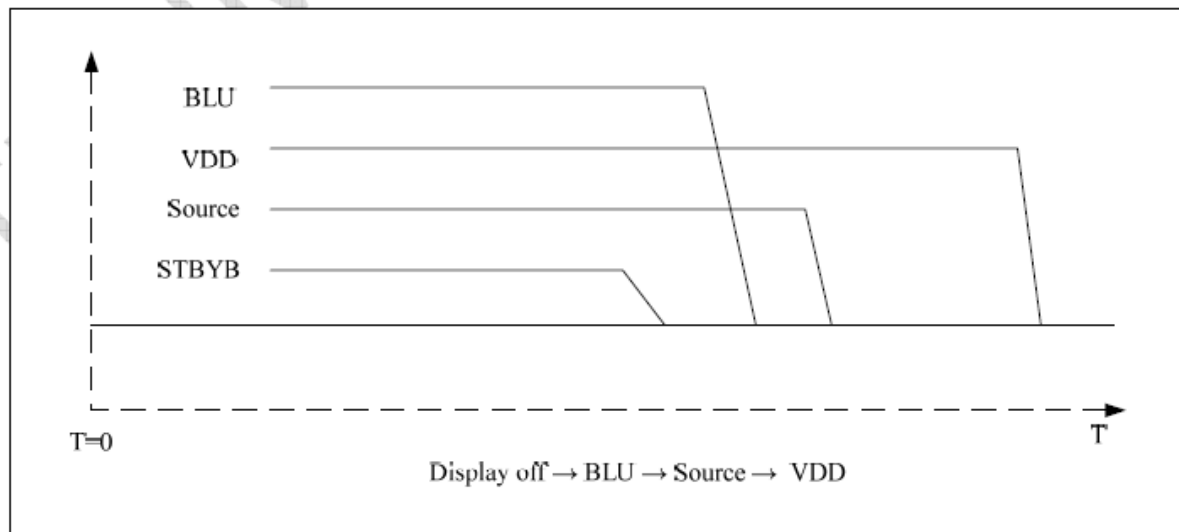


Figure 6.6 Power off sequence

6.2 Timing Characteristics of CTP

6.2.1 IIC Timing

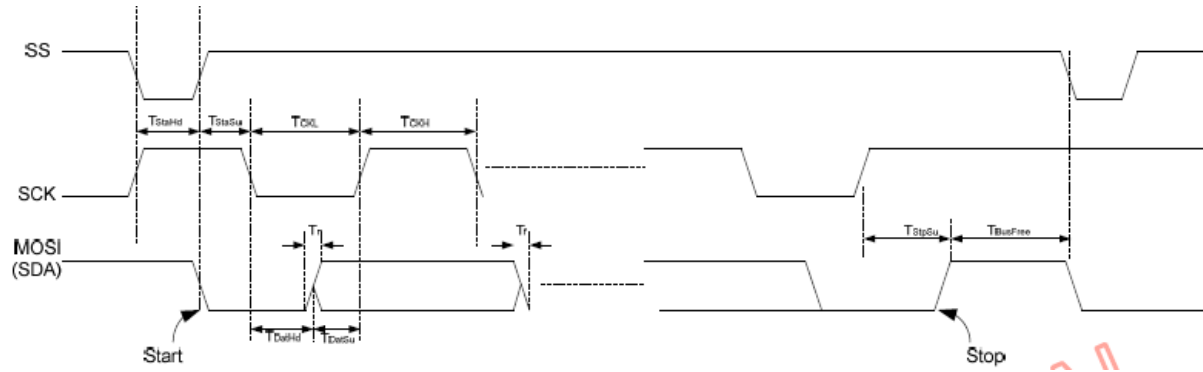


Fig4: IIC Timing

The IIC Timing Table as follows.

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Working Frequency	Fclk	0		400	KHz	
I2C Clock Low	TCKL	1250			ns	VDD =3.3V, TA=25 .
I2C Clock High	TCKH	1250			ns	VDD =3.3V, TA=25 .
I2C Data Rising Time	Tr			300	ns	VDD =3.3V, TA=25 .
I2C Data Falling Time	Tf			300	ns	VDD =3.3V, TA=25 .
I2C Data Hold Time	TDatHd	0			ns	VDD = 3.3V, TA=25 .
I2C Data Setup Time	TDatSu	100			ns	VDD = 3.3V, TA=25 .
I2C Start Condition Hold Time	TStaHd	600			ns	VDD = 3.3V, TA=25 . VDD =3.3V, TA=25°C.
I2C Start Condition Setup Time	TStaSu	600			ns	VDD = 3.3V, TA=25 .
I2C Stop Condition Setup Time	TStpSu	600			ns	VDD = 3.3V, TA=25 .
I2C Bus Free Time	TBusFree	1300			ns	VDD = 3.3V, TA=25 .

6.2.2

Register Definition

We reserve 42 bytes I2C buffer for recording gesture information and 4 bytes system control register for system designer to control touch panel appropriate for your requirement.

Address	I2C Buffer Definition							
00H	GID 1	GID 2	P1_D1	P1_D2	P1_D3	P1_D4	P2_D1	P2_D2
08H	P2_ D3	P2_D4	P3_D1	P3_D2	P3_D3	P3_D4	P4_D1	P4_D2
10H	P4_ D3	P4_D4	P5_D1	P5_D2	P5_D3	P5_D4	P6_D1	P6_D2
18H	P6_ D3	P6_D4	P7_D1	P7_D2	P7_D3	P7_D4	P8_D1	P8_D2
20H	P8_ D3	P8D4	P9_D1	P9_D2	P9_D3	P9_D4	P10_D1	P10_D2
28H	P10_ D3	P10_D4	F/W Ver.	Pwr_Ct l_1	Pwr_Ct l_2	Read_P nt	Reserv e	Reserv e

7 Optical Characteristics

7.1 LCM Optical Characteristics

Item	Symbol		Condition	Min.	Typ.	Max.	Unit	Note
Brightness	Bp		$\theta=0^{\circ}$ $\Phi=0^{\circ}$	200	250	-	Cd/m ²	1
Uniformity	\triangle Bp			75%	80%	-		1,2
Viewing Angle	$\theta 1$ ($\Phi=90^{\circ}$ or 270°)		Cr \geq 10	-60 \sim +45			Deg	3
	$\theta 2$ ($\Phi=0^{\circ}$ or 180 $^{\circ}$)			-60 \sim +60				
Contrast Ratio	Cr		$\theta=0^{\circ}$ $\Phi=0^{\circ}$	400	450		-	4
Response Time	T _r			-	20	30	ms	5
	T _f			-	20	30	ms	
Color of CIE Coordinate	W	x	$\theta=0^{\circ}$ $\Phi=0^{\circ}$	0.260	0.310	0.360	-	1,6
		y		0.280	0.330	0.370	-	
	R	x		0.540	0.590	0.630	-	
		y		0.300	0.350	0.390	-	
	G	x		0.298	0.348	0.388	-	
		y		0.520	0.570	0.610	-	
	B	x		0.095	0.145	0.185	-	
		y		0.060	0.110	0.150	-	
NTSC Ratio	S		-	50		%		

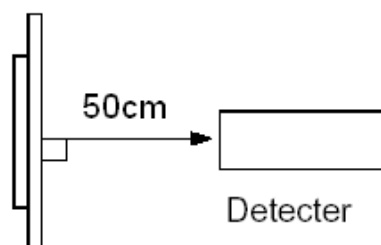
Note: The parameter is slightly changed by temperature, driving voltage and materiel.

Note 1: The data are measured after LEDs are turned on for 5 minutes. LCM displays full white. The brightness is the average value of 9 measured spots. Measurement equipment PR-705 (Φ8mm)

Measuring condition:

- Measuring surroundings: Dark room.
- Measuring temperature: $T_a=25^{\circ}\text{C}$.
- Adjust operating voltage to get optimum contrast at the center of the display.

Measured value at the center point of LCD panel after more than 5 minutes while backlight turning on.

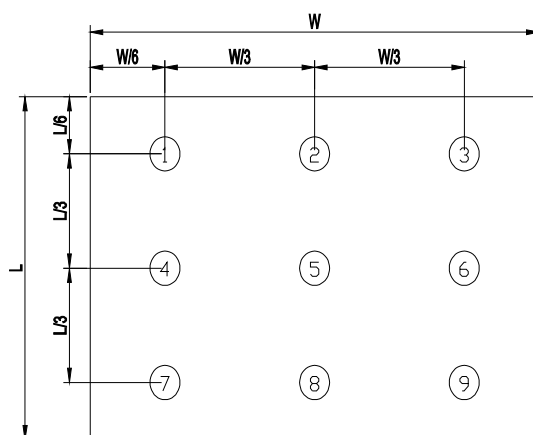


Note 2: The luminance uniformity is calculated by using following formula.

$$\Delta B_p = B_p (\text{Min.}) / B_p (\text{Max.}) \times 100 (\%)$$

$B_p (\text{Max.})$ = Maximum brightness in 9 measured spots

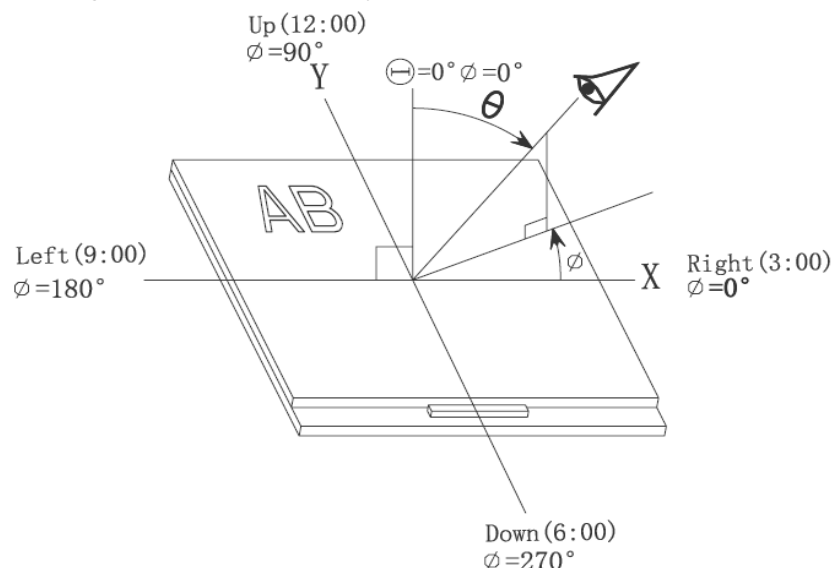
$B_p (\text{Min.})$ = Minimum brightness in 9 measured spots.



Measurement equipment PR-705 (Φ8mm)

Note 3: The definition of viewing angle:

Refer to the graph below marked by θ and ϕ



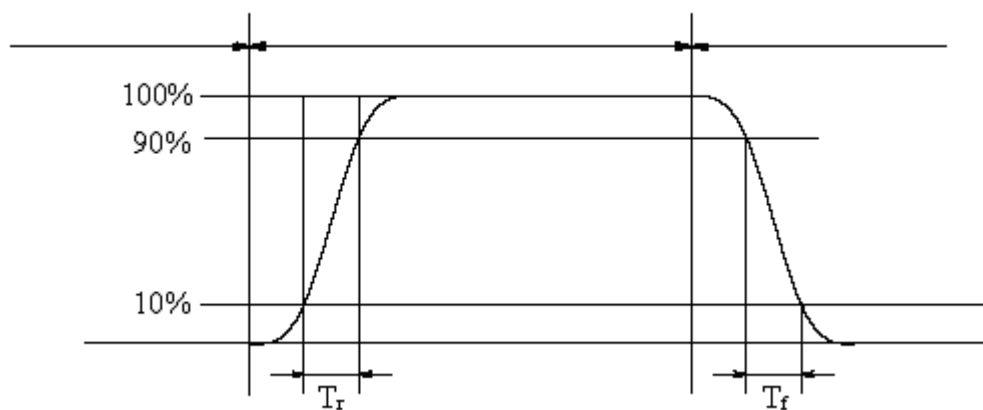
Note 4: The definition of contrast ratio (Test LCM using PR-705):

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

(Contrast Ratio is measured in optimum common electrode voltage)

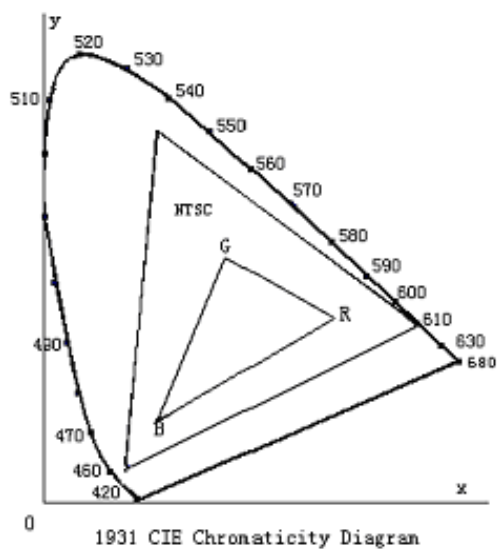
Note 5: Definition of Response time. (Test LCD using DMS501):

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



The definition of response time

Note 6: Definition of Color of CIE Coordinate and NTSC Ratio.



Color gamut:

$$S = \frac{\text{area of RGB triangle}}{\text{area of NTSC triangle}} \times 100\%$$

7.2 CTP Optical test

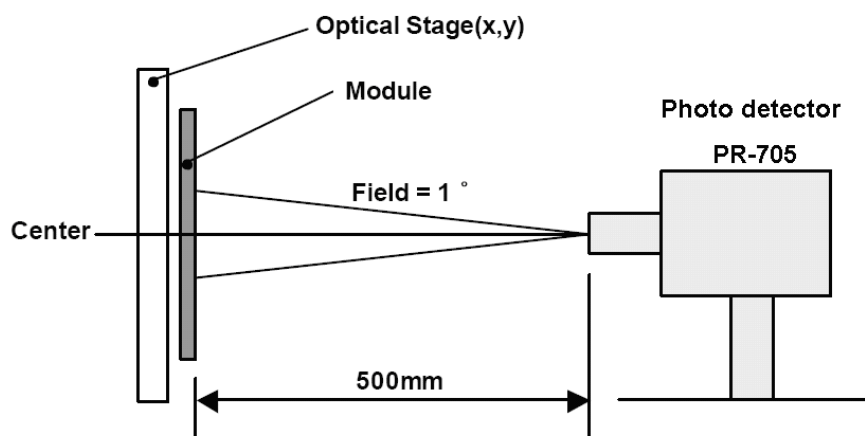
(Ta = 25 °C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Transmission	%	550nm	86	88	90	%	Note 1

Note 1: Measuring equipments: DMS-501, PR-705. @550nm

Measuring condition:

- After stabilizing and leaving the panel alone at a given temperature for 30 min, the measurement should be executed,
- Measuring surroundings: a stable, windless and dark room,
- Measuring temperature: Ta=25°C,
- 30 min after lighting the back-light.



8 Environmental / Reliability Tests

No	Test Item	Test condition	Criterion
1	High Temperature Storage	80℃±2℃ 240H Restore 2H at 25℃ Power off	After testing, cosmetic and electrical defects should not happen.
2	Low Temperature Storage	-30℃±2℃ 240H Restore 2H at 25℃ Power off	
3	High Temperature Operation	70℃±2℃(panel's surface) 240H Restore 2H at 25℃ Power on	
4	Low Temperature Operation	-20℃±2℃ 240H Restore 4H at 25℃ Power on	
5	High Temperature & Humidity Storage	60℃±2℃ 90%RH 240H Power off	
6	Temperature Cycle	-20℃→25℃→60℃ 30min 5min 30min after 100cycle, Restore 2H at 25℃ Power off	
7	Vibration Test	10Hz~150Hz, 100m/s ² , 120min	
8	Shock Test	Half-sine wave, 300m/s ² , 11ms	
9	ESD	C=150pF, R=330Ω, 5point/panel Air: ±8Kv, 5times; Contact: ±4Kv, 5times (Environment: 15℃~35℃, 30%~60%.86Kpa~106Kpa) Power on	

10	Drop Test(package state)	800mm, concrete floor, 1 corner, 3 edges, 6 sides each time	1.After testing, cosmetic and electrical defects should not happen. 2.the product should remain at initial place 3.Product uncovered or package broken is not permitted.
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Note:Additional test Item proposed by customer shall be determined by mutual agreement between customer and Tianma

For consumer production uses, we recommended the temperature operation range of 0~60 degree, beyond this temperature range can still be used, but the performance may be decrease, the difference with the production will be different.

9 Specification of Quality Assurance

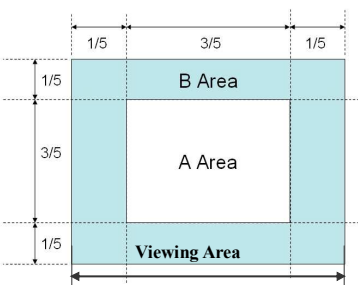
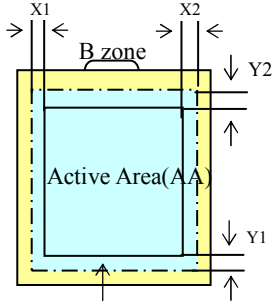
9.1 Quality level of LCM

9.1.1 Classification of defects

Major defects (MA): A major defect refers to a defect that may substantially degrade usability for product applications, including all functional defects(such as no display, abnormal display, open or missing segment, short circuit, missing component), outline dimension beyond the drawing, progressive defects and those affecting reliability.

Minor defects (MI): A minor defect refers to a defect which is not considered to be able to substantially degrade the product application or a defect that deviates from existing standards almost unrelated to the effective use of the product or its operation, such as black spot, white spot, bright spot, pinhole, black line, white line, contrast variation, glass defect, polarizer defect, etc.

9.1.2 Definition of inspection range

<p>For dot defect of TFT LCD which is not smaller than 3 inches, dividing three areas to make a judgment (according to figure 1).</p> <p>A area : center of viewing area</p> <p>B area : periphery of viewing area</p> <p>C area : Outside viewing area</p> <p>For other defects, dividing two areas to make a judgment (according figure 2).</p> <p>A zone : Inside Viewing area</p> <p>B zone : Outside Viewing area</p> <p>X1(A.A~V.A): 0mm X2(A.A~V.A): 0mm</p> <p>Y1(A.A~V.A): 0mm Y2(A.A~V.A): 0mm</p>	 <p>Figure 1</p>  <p>Figure 2</p>
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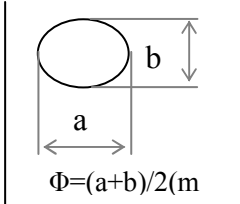
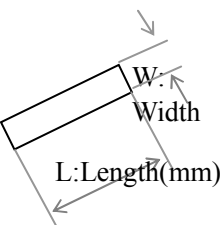
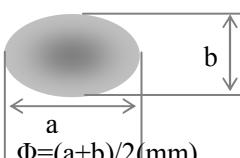
9.1.3 Inspection items and general notes

General notes	<p>①Should any defects which are not specified in this standard happen, additional standard shall be determined by mutual agreement between customer and TIANMA.</p> <p>②Viewing area should be the area which TIANMA guarantees.</p> <p>③Limit sample should be prior to this Inspection standard.</p> <p>④Viewing judgment should be under static pattern.</p> <p>⑤Inspection conditions</p> <p>Inspection distance: 250 mm (from the sample) Temperature : 25±5 °C</p> <p>Inspection angle : 45 degrees in 12 o'clock direction (all defects in viewing area should be inspected from this direction)</p>	
Inspection items	Pinhole, Bright spot, Black spot, White spot, Black line, White Line, Foreign particle, Bubble	The color of a small area is different from the remainder. The phenomenon doesn't change with voltage
	Contrast variation	The color of a small area is different from the remainder. The phenomenon changes with voltage
	Polarizer defect	Scratch, Dirt, Particle, Bubble on polarizer or between polarizer and glass
	Dot defect (TFT LCD)	The pixel appears bright or dark abnormally when display
	Functional defect	No display, Abnormal display, Open or missing segment, Short circuit, False viewing direction
	Glass defect	Glass crack, Shaved corner of glass, Surplus glass
	PCB defect	Components assembly defect

9.1.4 Outgoing Inspection level

Outgoing Inspection standard	Inspection conditions	Inspection				
		Min.	Max.	Unit	IL	AQL
Major Defects	See 8.3 general notes	See 8.5			II	0.65
Minor Defects	See 8.3 general notes	See 8.5			II	1.5
Note: Sampling standard conforms to GB2828						

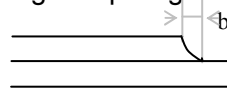
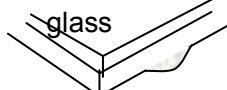
9.1.5 Inspection Items and Criteria

Inspection items			Judgment standard			
			Category		Acceptable number	
					A zone	B zone
1	Black spot, White spot, Bright Spot, Pinhole, Foreign Particle, Particle in or on glass, Scratch on glass		A	$\Phi \leq 0.10$	Neglected	Neglected
			B	$0.10 < \Phi \leq 0.15$	2	
			C	$0.15 < \Phi \leq 0.20$	1	
			D	$0.20 < \Phi$	0	
			Total defective point(B,C)		3	
2	Black line, White line, and Particle Between Polarizer and glass, Scratch on glass		A	$W \leq 0.01$	Neglected	Neglected
			B	$0.01 < W \leq 0.03$ $L \leq 3.0$	2	
			C	$0.03 < W \leq 0.05$ $L \leq 3.0$	1	
			D	$0.05 < W$	0	
			Total defective point(B,C)		3	
3	Contrast variation		A	$\Phi \leq 0.2$	Neglected	Neglected
			B	$0.2 < \Phi \leq 0.3$	2	
			C	$0.3 < \Phi \leq 0.4$	1	
			D	$0.4 < \Phi$	0	
			Total defective point(B,C)		3	

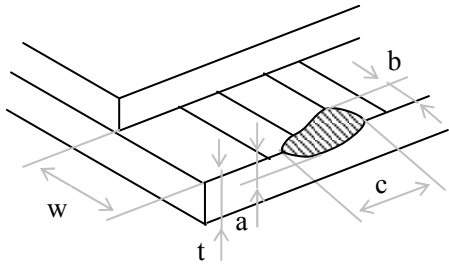
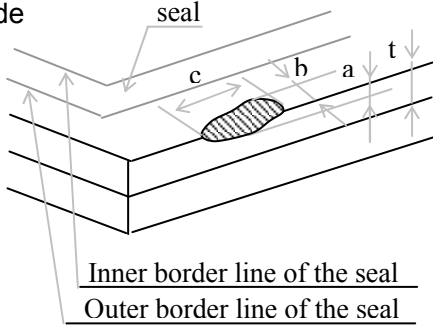
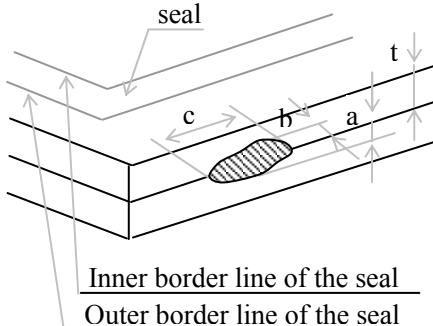
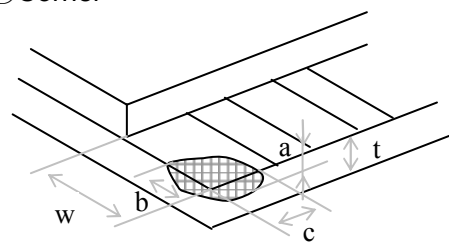
4	Dot defect (if TFT LCD is used)	TFT LCD is smaller than 3 inches	LCD Class	Defect	A area		B area
			A	Bright dot	1		Neglected
				Dark dot	2		
				Total	2		
			B	Bright dot	2		
				Dark dot	3		
		Total		4			
		TFT LCD between 3~10.4 inches	LCD Class	Defect	A area	B area	C area
			A	Bright dot	1	1	Neglected
				Dark dot	1	2	
				Total	4		
			B	Bright dot	2	2	
Dark dot	2			3			
Total	6						
Notes: Bright dot: in R、G、B or dark display figure, the pixel appears bright. Dark dot: in R、G、B or white display figure, the pixel appears dark. Defect area must be less than an half size of the dot.							

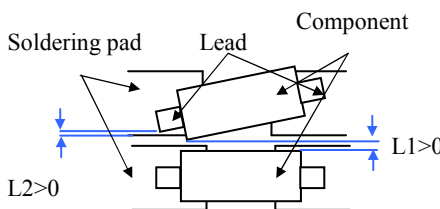
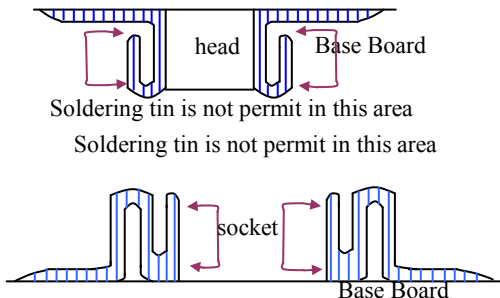
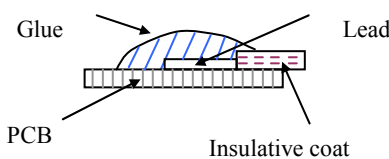
5	Bubble inside cell		any size		none		none
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6	Polarizer defect (if Polarizer is used)	Scratch ,damage on polarizer, Particle on polarizer or between polarizer and glass.	Refer to item 1 and item 2.				
		Bubble, dent and convex	A	$\Phi \leq 0.3$	Neglected		Neglected
			B	$0.3 < \Phi \leq 0.7$	2		
			C	$0.7 < \Phi$	0		

7	Surplus glass	Stage surplus glass 	$b \leq 0.3\text{mm}$				
		Surrounding surplus glass 	Should not influence outline dimension and assembling.				

8	Open segment or open common		Not permitted				
9	Short circuit		Not permitted				
10	False viewing direction		Not permitted				
11	Contrast ratio uneven		According to the limit specimen				
12	Crosstalk		According to the limit specimen				
13	Black /White spot(display)		Refer to item 1				
14	Black /White line(display)		Refer to item 2				

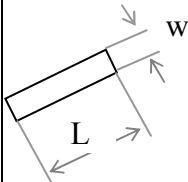
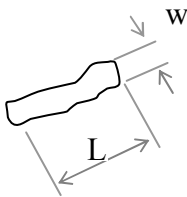
15	Glass defect crack	①The front of lead terminals	A	$a \leq t, \quad b \leq 1/5W, \quad c \leq 3\text{mm}$	Max.3 defects allowed	
			B	Crack at two sides of lead terminals should not cover patterns and alignment mark		
		②Surrounding crack—non-contact side	 $b < \text{Inner borderline of the seal}$			
		③ Surrounding crack— contact side	 $b < \text{Outer borderline of the seal}$			
		④Corner	A	$a \leq t, \quad b \leq 3.0, \quad c \leq 3.0$		
			B	Glass crack should not cover patterns u and alignment mark and patterns.		

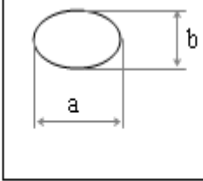
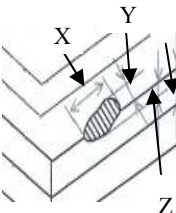
16	PCB defect	<p>Component soldering:</p> <p>No cold soldering、short、open circuit、burr、tin ball</p> <p>The flat encapsulation component position deviation must be less than 1/3 width of the pin (Pic.1);</p> <p>the sheet component deviation:</p> <p>Pin deviates from the pad and contact with the near components is not permitted (Pic.2)</p>	
		<p>lead defect:</p> <p>The lead lack must be less than 1/3 of its width;</p> <p>The lead burr must be less than 1/3 of the seam;</p> <p>Impurities connect with the near leads is not permitted</p>	
		<p>Connector soldering:</p> <p>Soldering tin is at contact position of the plug and socket is not permitted</p> <p>No foundation is scald</p> <p>Serious cave distortion on plug and socket contact pin is not permitted</p>	
		<p>Glue on root of the speaker receiver and motor lead:</p> <p>The insulative coat of the lead must join into the PCB; the protected glue must envelop to the insulative coat.</p>	

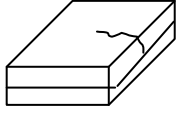
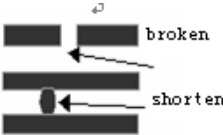
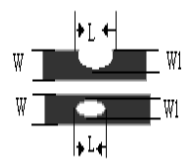
9.1.6 Display defects inspection item and limit criteria

About display defects inspection item and limit criteria ,please refer to the content of 《LCM-TFT liquid display module》(Q/DDG199-2007) and 《liquid display module display defects inspection standard》(Q/DDG439-1999)。

9.2 Appearance defects inspection item and limit criteria of TP

Inspection item	Detail content	criteria			remark	
Outline dimension	Length, Width, Thickness	Outline should meet the drawing			Vernier caliper ruler	
LOGO inclined, color, icon, grounding		LOGO inclined :not allowed			Eyeballing	
Surface scratch		(1) $W \leq 0.03 \text{ mm}$, allowed (2) $0.03 \text{ mm} < W \leq 0.05$, $L \leq 3 \text{ mm}$, defects space 20mm at least, 2 defects are allowed; $L > 3 \text{ mm}$, not allowed (3) $W > 0.05 \text{ mm}$, not allowed			Eyeballing	
Linear foreign matter		TP product under 3.5"	A	$W \leq 0.02 \text{ mm}$, $L \leq 3 \text{ mm}$	Neglected	Eyeballing
			B	$0.02 \text{ mm} < W \leq 0.05 \text{ mm}$, $L \leq 3 \text{ mm}$,	2	
			C	$L > 3 \text{ mm}$ or $W > 0.05 \text{ mm}$	0	
			Total defects (B)		2	
			Distance: $D \geq 10 \text{ mm}$, out of V,A is neglected			
		TP product between 3.5" and 4.3"	A	$W \leq 0.02 \text{ mm}$, $L \leq 3 \text{ mm}$	Neglected	
			B	$0.02 \text{ mm} < W \leq 0.03 \text{ mm}$, $L \leq 3 \text{ mm}$,	3	
			C	$0.03 \text{ mm} < W \leq 0.05 \text{ mm}$, $L \leq 3 \text{ mm}$,	2	
			D	$L > 3 \text{ mm}$ or $W > 0.05 \text{ mm}$	0	
			Total defects(B,C)		2	
			Distance: $D \geq 15 \text{ mm}$, out of V,A is neglected			
		TP product over 4.3"	A	$W \leq 0.02 \text{ mm}$, $L \leq 3 \text{ mm}$	Neglected	
			B	$0.02 \text{ mm} < W \leq 0.03 \text{ mm}$, $L \leq 3 \text{ mm}$,	3	
			C	$0.03 \text{ mm} < W \leq 0.05 \text{ mm}$, $L \leq 3 \text{ mm}$,	2	
			D	$L > 3 \text{ mm}$ or $W > 0.05 \text{ mm}$	0	
			Total defects(B,C)		3	
			Distance: $D \geq 20 \text{ mm}$, out of V,A is neglected			

Inspection item	Detail content	criteria				remark
Bright spot, Black spot, White spot, Pinhole, Black line, White Line, Foreign matter, air bubble	 $\Phi = (a+b)/2$	TP product under 3.5"	A	$\Phi \leq 0.15$	Neglected	Eyeballing
			B	$0.15 < \Phi \leq 0.20$	2	
			C	$0.20 < \Phi \leq 0.25$	1	
			D	$\Phi > 0.25$	0	
			Total defects(B,C)		2	
			distance	$D \geq 10\text{mm}$	Out of V,A is neglected	
		TP product between 3.5" and 4.3"	A	$\Phi \leq 0.15$	Neglected	
			B	$0.15 < \Phi \leq 0.35$	2	
			C	$0.35 < \Phi \leq 0.40$	1	
			D	$\Phi > 0.40$	0	
			Total defects(B,C)		2	
			distance	$D \geq 15\text{mm}$	Out of V,A is neglected	
		TP product over 4.3"	A	$\Phi \leq 0.15$	Neglected	
			B	$0.15 < \Phi \leq 0.35$	3	
			C	$0.35 < \Phi \leq 0.50$	1	
			D	$\Phi > 0.50$	0	
			Total defects(B,C)		3	
			distance	$D \geq 20\text{mm}$	Out of V,A is neglected	
Glass chip and crack		Side: $x(\text{length}) \geq 2\text{mm}$ $z(\text{deepness}) = T$: not allowed $y(\text{width}) \geq 2\text{mm}$ $z(\text{deepness}) = T$: not allowed Corner: $x, y \geq 2\text{mm}$ or $z = T$: not allowed (T: glass thickness)				Eyeballing
Newton ring		Film+ glass: Newton ring area(S) $\leq 1/2$ (T/P area) Film+ Film: Newton ring area (S) $\leq 1/3$ (T/P area)				Eyeballing with the lamplight
rainbow		Check in the range of viewing angle or press the TP LOGO by the finger, the rainbow is not allowed.				Eyeballing

Inspection item	Detail content	criteria	remark
TP white border		The insulation tape meet the LOGO is not allowed	Eyeballing
Glass crack		Not allowed	Eyeballing
TP surface dirty matter		Cleaned before shipment	Eyeballing
TP pressing mark	The mark between the TP and LCD	in the V,A(see limited sample):not allowed	Eyeballing
FPC brim teared, shorten, broken, trace mended		Not allowed	Eyeballing with the lamplight
FPC damage		(1) $W1 < 1/3$ trace width W , 2 lines are allowed (2) $W1 \geq 1/3$ routing line width W , the damage length $L \geq W$, not allowed	Eyeballing with the lamplight
FPC pressing mark /folding mark		(1)hot pressing side and connecting side: not allowed(make the limited sample if necessary) (2)around the hole: not allowed (3)routing line: mark width $\leq 1/3$ trace width, The mark length $\leq 1\text{mm}$ is allowed (4)big ground area: neglected (5)no see base material because of the mark.	Eyeballing with the lamplight
FPC trace reveal copper, Electrode oxidated, scratch		Revealing copper is not allowed; Palm oxidation is allowed; black oxidation is allowed; protect cover is forbad scratched and damaged	Eyeballing with the lamplight
TP inclined		Obvious incline is not allowed. No affect the machine assembly first.	eyeballing
Bezel defect		Scratch: length $\leq 10\text{mm}$, width $\leq 0.4\text{mm}$ and 3 defects at most; rust and distortion is not allowed	eyeballing
Spray Code defect		According to the content specified by the customer font illegible and wrong position is not allowed	eyeballing
Note: other appearance inspection standards which not mentioned in it ,please refer to 《LCM raw material inspection standard》（Q/DDG212-2005）			

10. Precautions for Use of CTP Modules

10.1 Handling Precautions

- 1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.
- 2 If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly 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.
- 4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.
- 5 If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:
 - Isopropyl alcohol
 - Ethyl alcoholSolvents other than those mentioned above may damage the polarizer. Especially, do not use the following:
 - Water
 - Ketone
 - Aromatic solvents
- 6 Do not attempt to disassemble the CTP Module.
- 7 If the logic circuit power is off, do not apply the input signals.
- 8 To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
 - a. Be sure to ground the body when handling the LCD Modules.
 - b. Tools required for assembly, such as soldering irons, must be properly ground.
 - c. To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.
 - d. The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.

10.2 Storage precautions

- 10.2.1 When storing the LCD modules, avoid exposure to direct sunlight or to the

light of fluorescent lamps.

10.2.2 The LCD modules should be stored under the storage temperature range.

If the LCD modules will be stored for a long time, the recommend condition is:

Temperature : $0^{\circ}\text{C} \sim 40^{\circ}\text{C}$

Relatively humidity: $\leq 80\%$

10.2.3 The LCD modules should be stored in the room without acid, alkali and harmful gas.

10.3 notes

The CTP modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.