1. Record of Revision

| Revision	Description	Date
1.0	Initial Release	2015/10/28
1.1	Change Surface Luminance page 12/23	2016/7/15

2. General Description and Features

The 3.5 inch module named   MTF35381B   is a-Si TFT-LCD module. which is the type of transmissive. It is consisted of TFT-LCD Panel, one Driver IC, one FPC one cap touchpanel and one Back-Light unit. Features of this product are listed in the following table.

NO	Item	Contents	Unit
(1)	Module Outline	98.24(H)*59.74(V)*3.32(T)	mm
(2)	LCD Active area	74.88(H)*49.92(V)	mm
(3)	Dot Number	640*3(RGB)*960	/
(4)	Pixel Size	0.078(H)*0.078(V)	mm
(5)	LCD type	TFT Transmissive	/
(6)	Display Mode	IPS,Normally Black	/
(7)	Display Color	16.7M	/
(8)	Viewing direction	Free	O'clock
(9)	Backlight Type	6-chip LED	/
(10)	Power Supply	3.3(TYP)	V
(11)	Drive IC	HX8394-F	/
(12)	Interface(LCM)	FPC 0. 4mm_Pitch 30pin	/
(13)	Interface type(LCM)	MIPI interface	/
(14)	Interface(CTP)	FPC 0. 5mm_Pitch 10pin	/
(15)	Interface type(CTP)	IIC interface	/

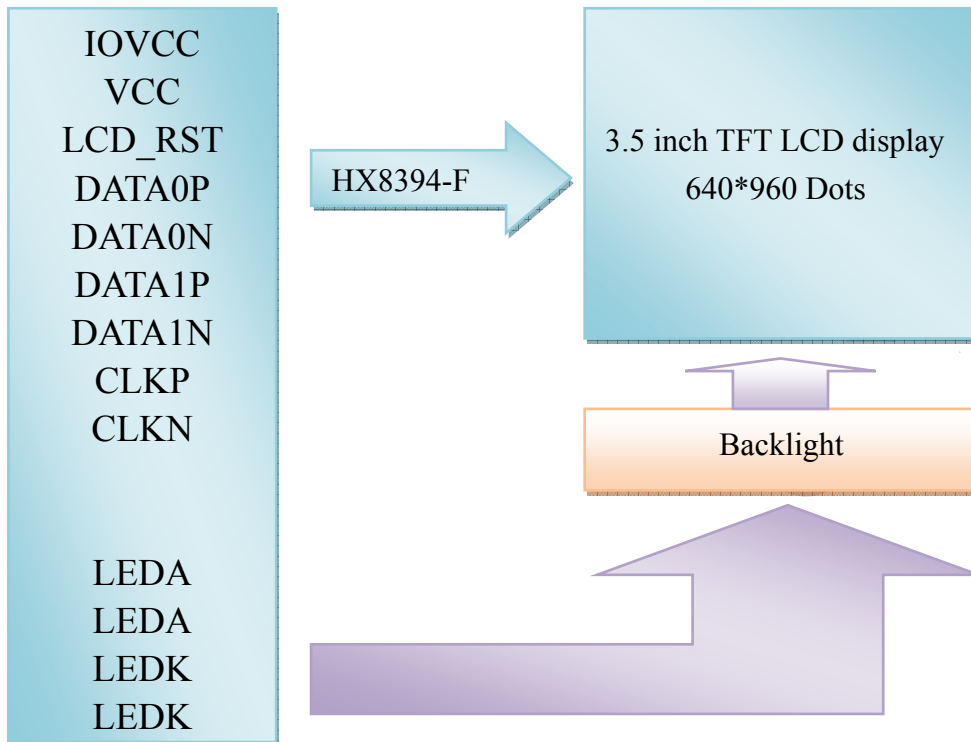# 3. Mechanical Dimension
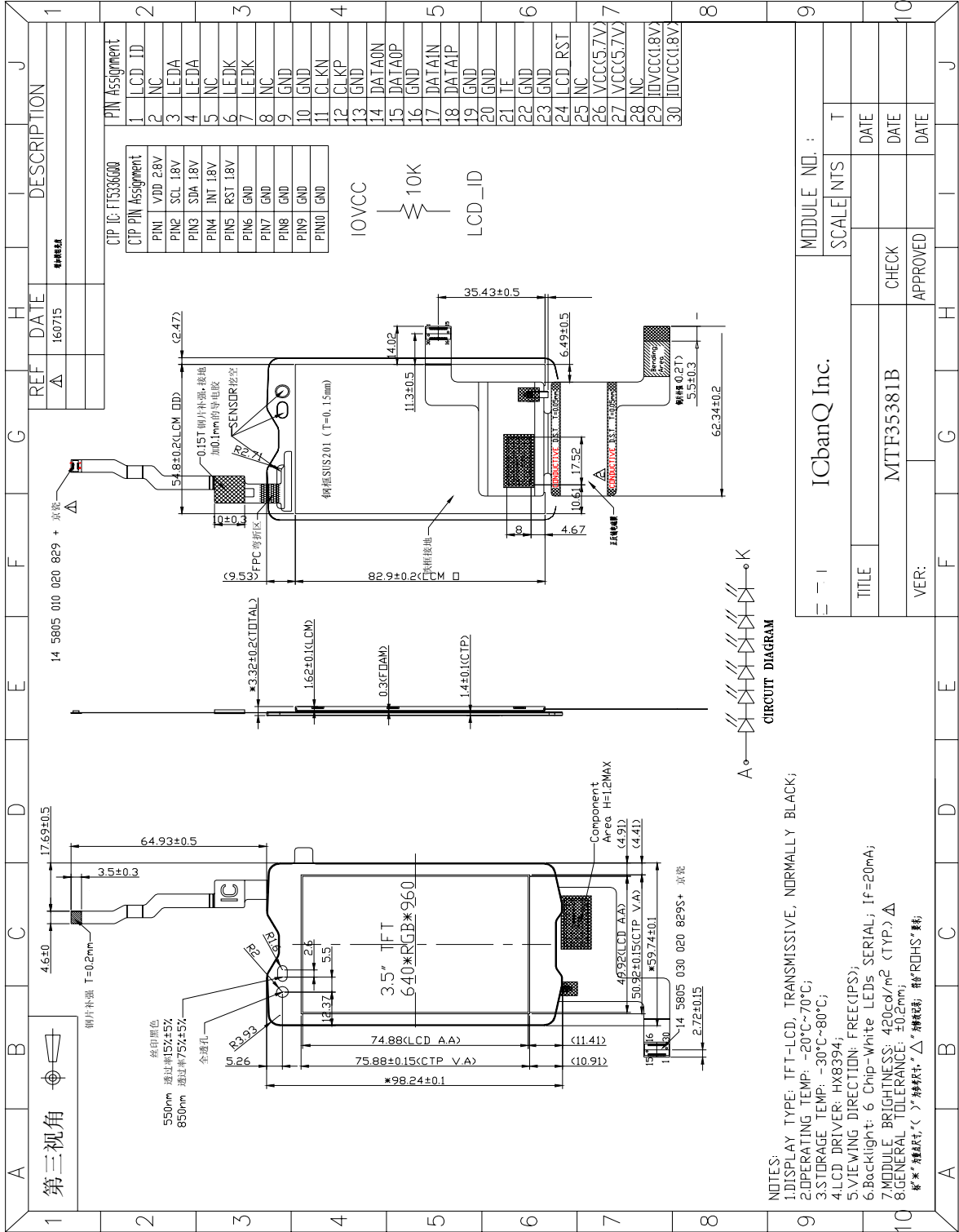
4. Interface Pin Connection

4.1 LCM interface pin

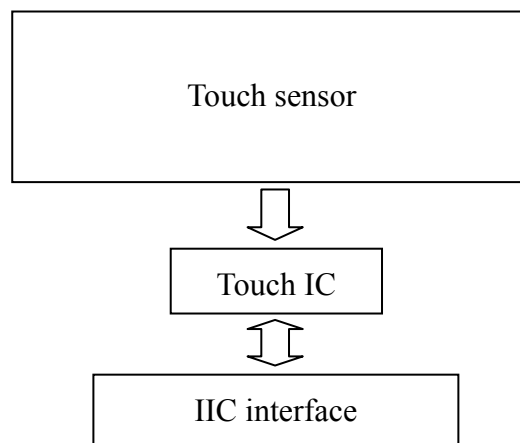| NO	Symbol	Level	Description
1	LCD_ID	I	Connected a 10K resistor to GND
2	NC	-	Not Connect
3	LEDA	P	Power supply for LEDA
4	LEDA	P	Power supply for LEDA
5	NC	-	Not Connect
6	LEDK	P	Power supply for LEDK
7	LEDK	P	Power supply for LEDK
8	NC	-	Not Connect
9	GND	P	Ground
10	GND	P	Ground
11	CLKN	I	DSI Host
12	CLKP	I	DSI Host
13	GND	P	Ground
14	DATA0N	I	DSI Host
15	DATA0P	I	DSI Host
16	GND	P	Ground
17	DATA1N	I	DSI Host
18	DATA1P	I	DSI Host
19	GND	P	Ground
20	GND	P	Ground
21	TE	I	Tearing Effect pin.
22	GND	P	Ground
23	GND	P	Ground
24	LCD_RST	I	Reset pin
25	NC	-	Not Connect
26	VCC(5.7V)	P	Input voltage(5.7V)
27	VCC(5.7V)	P	Input voltage(5.7V)
28	NC	-	Not Connect
29	IOVCC(1.8V)	P	Power supply for the logic power(1.8V)
30	IOVCC(1.8V)	P	Power supply for the logic power(1.8V)

4.2 CTP interface pin

NO	Symbol	Level	Description
1	VDD(2.8V)	P	CTP power supply
2	SCL	I/O	I2C:Clock input
3	SDA	I/O	I2C: Data input and output
4	INT	I/O	I2C: Interrupt pin
5	RST	I/O	I2C: Reset pin
6	GND	P	CTP Ground
7	GND	P	CTP Ground
8	GND	P	CTP Ground
9	GND	P	CTP Ground
10	GND	P	CTP Ground

5. Block Diagram

5.1 LCM

IOVCC		
VCC		
LCD_RST	HX8394-F →	3.5 inch TFT LCD display
DATA0P		640*960 Dots
DATA0N		
DATA1P		
DATA1N		
CLKP		
CLKN		Backlight
LEDA		
LEDA		
LEDK		
LEDK		

5.2 CTP

Touch sensor

⇩

Touch IC

⇕

IIC interface

6. Maximum Rating

Item	Symbol	Rating	Unit
Operating temperature	Top	-20 to 70	℃
Storage temperature	Tst	-30 to 80	℃
Power supply for LCM	VCC	4.3 ~ 6.5	V
Power supply for CTP	VDD	-0.3~4.2	V

NOTE:

If the module was used these absolute maximum ratings as above, it may be damaged permanently. Using the module within the following electrical characteristic conditions are also exceeded, the module will malfunction and cause poor reliability. VCC>GND must be maintained.

7. Electrical Characteristics

Parameter	Symbol	Spec. Min.	Spec. Typ.	Spec. Max.	Unit	Note
Power Supply Voltage 1	VDD1~ VSSD	-0.3	-	+3.6	V	Note[1],[2]
Power Supply Voltage 2	VDD3 ~ VSSA	-0.3	-	+3.6	V	Note[1] [4]
Power Supply Voltage 3	HS_VCC ~ HS_VSS	-0.3	-	+3.6	V	Note[1] [5]
Power Supply Voltage 4	VSP ~ VSSA	-0.3	-	+6.6	V	Note[6]
Power Supply Voltage 5	VSSA ~ VSN	-6.6	-	0	V	Note[7]
Power Supply Voltage 6	VGH ~ VSSA	-0.3	-	+19.6	V	Note[8]
Power Supply Voltage 7	VSSA ~ VGL	-16	-	0	V	Note[9]
Operating Temperature	Topr	-40	-	+85	°C	Note[10]
Storage Temperature	Tstg	-55	-	+110	°C	Note[11]
Input Voltage	V_{IN}	-0.3	-	VDD1+0.3	V	Note[12]
HS Input Voltage	V_{HSIN}	-0.3	-	+2	V	Note[13]

Note: (1) VDD1, VSSD must be maintained.
(2) To make sure VDD1 ≥ VSSD.
(4) To make sure VDD3≥ VSSA.
(5) To make sure HS_VCC ≥ HS_VSS.
(6) To make sure VSP ≥ VSSA.
(7) To make sure VSSA ≥ VSN
(8) To make sure VGH ≥ VSSA.
(9) To make sure VSSA ≥ VGL, VGH +|VGL| < 32V
(10) For die and wafer products, specified up to +85℃.
(11) This temperature specifications apply to the TCP package.
(12) This specifications include input signals but without following: CP, CN, D0P, D0N, D1P, D1N, D2P, D2N, D3P, D3N.
(13) This specifications include following signals: CP, CN, D0P, D0N, D1P, D1N, D2P, D2N, D3P, D3N.

8. Backlight Characteristics

Item	syb	Min	Typ	Max	Unit	Condition
Voltage	Vf	-	19.2	-	V	-
current	I_{BL}	-	20	-	mA	-
Power Consumption	PWF	-	384	-	mW	-
LED life-span	-	10000		-	Hrs	50% luminance from initial

9. Timing Characteristics
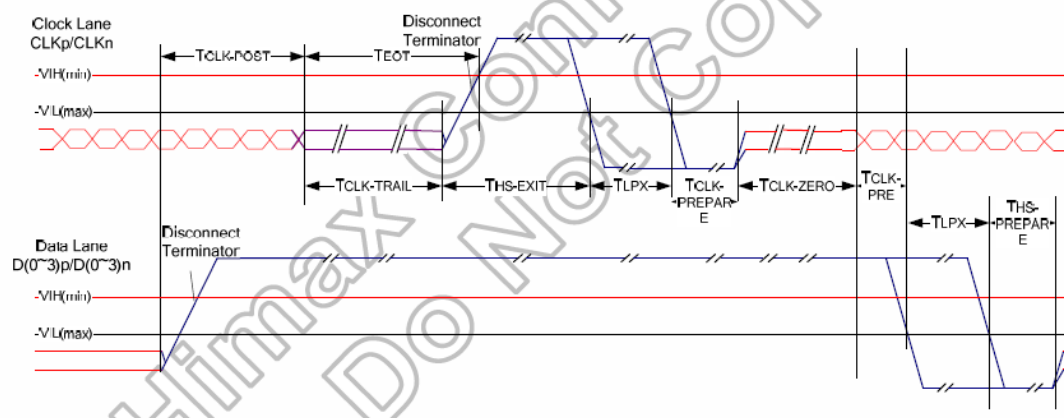
Global Operation Timing Parameters for Data Lane

Parameter	Description	Min.	Typ.	Max.	Unit
$T_{HS-PREPARE}$	Time that the transmitter drives the Data Lane LP-00 Line state immediately before the HS-0 Line state starting the HS transmission.	40+4*UI	-	85+6*UI	ns
$T_{HS-PREPARE}$+ $T_{HS-ZERO}$	THS-PREPARE + time that the transmitter drives the HS-0 state prior to transmitting the Sync sequence.	145+10*UI	-	-	ns
T_{EOT}	Transmitted time interval from the start of THS-TRAIL or TCLK-TRAIL, to the start of the LP-11 state following a HS burst.	-	-	105ns+12*UI	ns
$T_{HS-TRAIL}$	Time that the transmitter drives the flipped differential state after last payload data bit of a HS transmission burst.	60ns+4*UI	-	-	ns
$T_{HS-EXIT}$	Time that the transmitter drives LP-11 following a HS burst.	100	-	-	ns

Global Operation Timing Parameters for Clock Lane

Parameter	Description	Min.	Typ.	Max.	Unit
$T_{CLK-POST}$	Time that the transmitter continues to send HS clock after the last associated Data Lane has transitioned to LP Mode.	60+52*UI	-	-	ns
$T_{CLK-TRAIL}$	Time that the transmitter drives the flipped differential state after last payload data bit of a HS transmission burst.	60	-	-	ns
$T_{CLK-PREPARE}$	Time that the HS clock shall be driven by the transmitter prior to any associated Data Lane beginning the transition from LP to HS mode.	38	-	95	ns
$T_{CLK-PREPARE}$+ $T_{CLK-ZERO}$	TCLK-PREPARE + time that the transmitter drives the HS-0 state prior to starting the Clock.	300	-	-	ns
$T_{CLK-PRE}$	Time that the HS clock shall be driven by the transmitter prior to any associated Data Lane beginning the transition from LP to HS mode.	8*UI	-	-	ns

Power ON sequence

VDD1 on before VDD3 on

VDD1
HS_VCC

VDD3

>1ms   ≥10us

RESX

>1ms

Note: MIPI Data Lane and
CLK Lane must set LP11
before HW reset go high

MIPI Data & CLK lane

>50ms   >120ms   +- no limit

MIPI Video Packet

Host Command

Initial SLPOUT   Initial+DISPON

Note: SLPOUT CMD can before or after initial code, but after SLPOUT CMD must wait at least 120ms

VDD1
HS_VCC

+- no limit

VDD3

RESX

≥0us

MIPI Video Packet

≥0 frame

≥2 frame

Host Command

SLPIN

10. DC characteristics

(VDD3=2.5 ~ 3.6V, VDD1=1.65~3.6V, T$_A$=-40 ~ 85 ℃)

Parameter	Symbol	Test condition	Min.	Typ.	Max.	Unit	Note
Input high voltage	V$_{IH}$	VDD1= 1.65 ~ 3.6V	0.7 V$_{DD1}$	-	VDD1	V	-
Input low voltage	V$_{IL}$	VDD3= 2.5 ~ 3.6V	0	-	0.3 V$_{DD1}$	V	-
VPP	V$_{IH}$ / V$_{IL}$	VPP	8.0	8.25	8.5	V / V	(1)
Output high voltage (SDO, CABC_PWM_OUT)	V$_{OH1}$	I$_{OH}$ = -1.0 mA	0.8 V$_{DD1}$	-	VDD1	V	-
Output low voltage (SDO, CABC_PWM_OUT)	V$_{OL1}$	VDD1= 1.65 ~ 3.6V I$_{OL}$ = 1.0 mA	0	-	0.2 V$_{DD1}$	V	-
Logic High level input current	I$_{IH}$	VSYNC, HSYNC	-	-	1	uA	-
		RESX, DCX, CSX, SCL	-	-	1		-
	I$_{IHD}$	DB[23:0], SDI, DCX	-	-	1	uA	-
		DB[23:0]	-		1		
Logic Low level input current	I$_{IL}$	VSYNC, HSYNC	-1	-	-	uA	-
		RESX, DCX, CSX, SCL	-1	-	-		-
	I$_{ILD}$	DB[23:0], SDI, DCX	-1	-	-	uA	-
		DB[23:0]	-1	-	-		
Current consumption standby mode (VDD3-VSSA)	I$_{ST(VDD)}$		-	--	14	µA	-
Current consumption standby mode (VDD1– VSSD)	I$_{ST(VDD1)}$	VDD3/HS_VCC=2.8V, VDD1=1.8V T$_A$ =25℃ (DSI Ultra Low Power mode)	-	--	58	µA	-
Current consumption standby mode which include HS_VCC (HS_VCC-HS_VSS)	I$_{ST(VDD1)}$		-	--	50	µA	-
Oscillator tolerance	△OSC	T$_A$ =25℃	-5	-	5	%	-

Note: (1) The VPP pin is open on normal mode and in used while OTP programming condition.

11. Electro-Optical Characteristics

Item		Symbol	Condition	Min	Typ	Max	Unit	Note
Transmission　(with pol)		T		-	4.1	-	%	
Response time		Tr	θ =0°	-	15	-	ms	4
		Tf	$\varnothing$=0°	-	20	-	ms	
Uniformity （Five point）		δ WHITE	Ta=25℃	-	TBD	-	%	7
Contrast ratio		Cr		-	1200	-	-	3 ,5
Surface Luminance		Lv		-	420	-	-	3 ,7
Viewing angle range		θ	$\varnothing = 90°$	-	(85)	-	deg	6
			$\varnothing = 270°$	-	(85)	-	deg	
			$\varnothing = 0°$	-	(85)	-	deg	
			$\varnothing = 180°$	-	(85)	-	deg	
	White	X	$\theta = \phi =$	TBD	TBD	TBD	−	7

Color filter chromaticity (x, y)		Y	0°	TBD	TBD	TBD		
	Red	X	θ = φ =	TBD	TBD	TBD		
		Y	0°	TBD	TBD	TBD		
	Green	X	θ = φ =	TBD	TBD	TBD		
		Y	0°	TBD	TBD	TBD		
	Blue	X	θ = φ =	TBD	TBD	TBD		
		Y	0°	TBD	TBD	TBD		
NTSC		S	-	-	60	-	%	
Flick		-	-	-	-	TBD	−	8

Note 1: To be measured in the dark room with backlight unit.

Note 2: To be measured at the center area of panel with a viewing cone of 1 by Topcon luminance meter BM-7A, after 10 minutes operation (module).
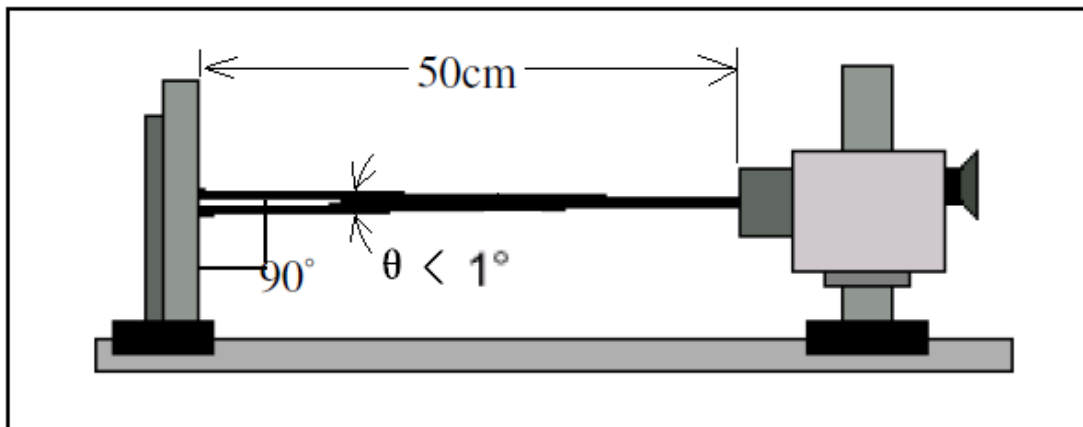
Note 3: Definition of response time:

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

Refer to figure as below.
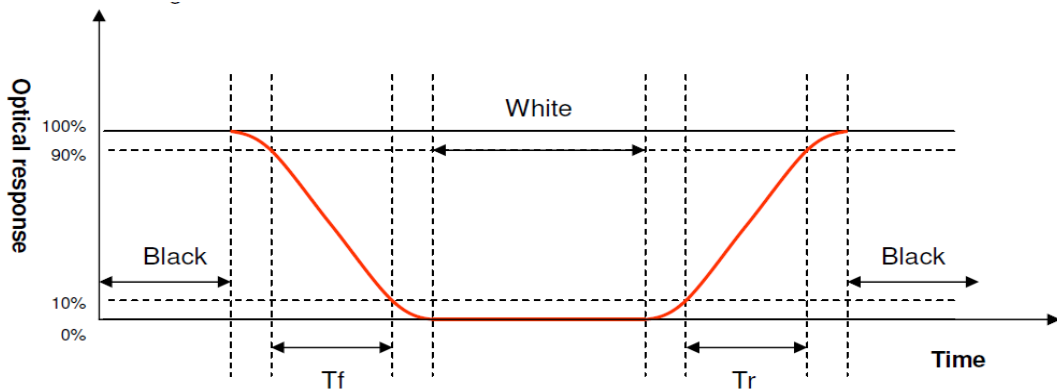
Note 4. Definition of contrast ratio:

  Contrast ratio is calculated with the following formula:

$$\text{Contrast ratio (CR)} = \frac{\text{Photo detector output when LCD is at "White" state}}{\text{Photo detector output when LCD is at "Black" state}}$$

Note 5. Definition of viewing angle

      Viewing angle is the angle at which the contrast ratio is greater than 2, for TFT module the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface.
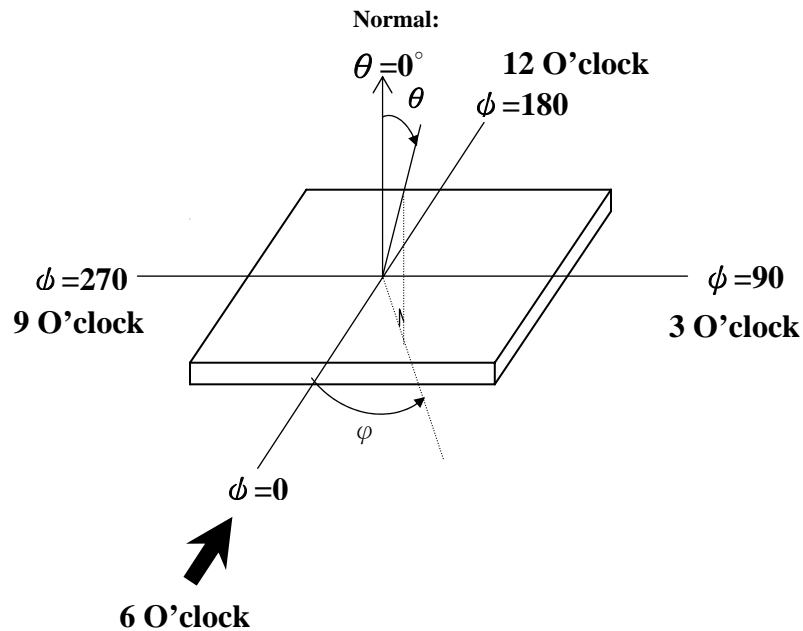
Note 6. Surface luminance is the LCD surface from the surface with all pixels displaying white. Refer to figure as below.

Measuring method for Contrast ratio, surface luminance, Luminance uniformity，CIE (x, y) chromaticity
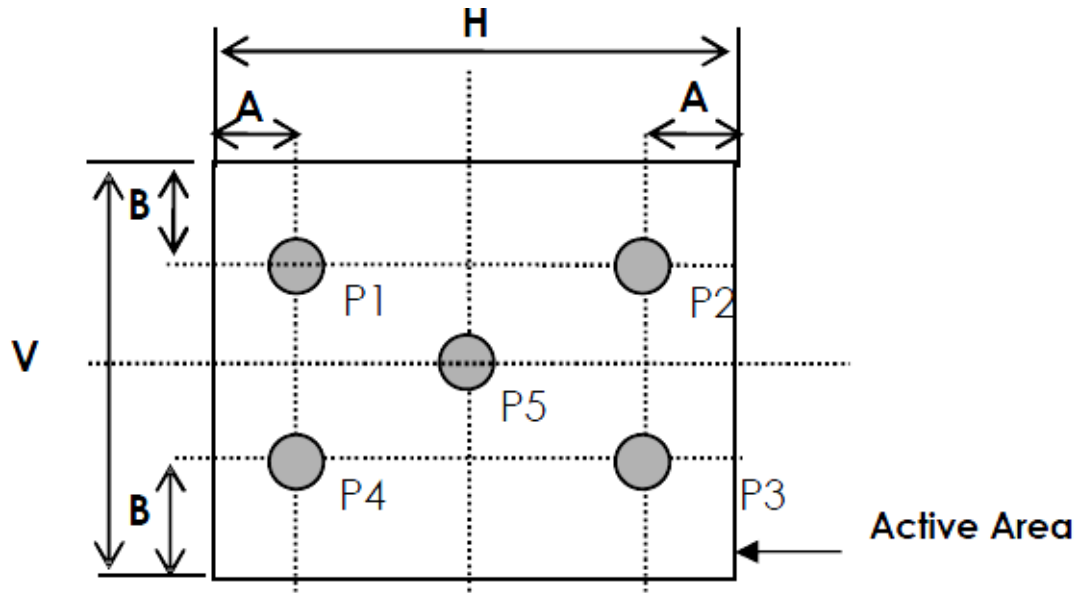
A : 5 mm   B : 5 mm   H,V : Active Area
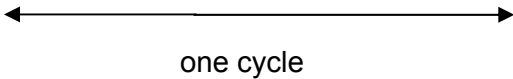
Light spot size Æ=7mm, 500mm distance from the LCD surface to detector lens

measurement instrument is TOPCON's luminance meter BM-7A

Uniformity definition= [min of 5point/max of 5points]x100%

Lv = Average Surface Luminance with all white pixels (P$_1$, P$_2$, P $_3$, P4, P$_5$)

12. Reliability Test

This standard reliability test is done only for the first lot of MP products. Customer and supplier must hold a discussion if other reliability test is requested by customer.

NO.	Test Item	Description	Test Condition
1	High temperature storage	Endurance test applying the high storage temperature for a long time	80℃，240hrs
2	Low temperature storage	Endurance test applying the low storage temperature for a long time	-30℃，240 hrs
3	High temperature operation	Endurance test applying the electric stress under high temperature for a long time	70℃，240 hrs
4	Low temperature operation	Endurance test applying the electric stress under low temperature for a long time	-20℃，240 hrs
5	High temperature /humidity storage	Endurance test applying the high temperature and high humidity storage for a long time	60℃ ,90%RH 240 hrs
7	Temperature Cycle/humidity storage	Endurance test applying the low and high temperature cycle -30℃← →25℃ ← →80℃ 30min←→5min←→30min <------------------------> one cycle	-30℃/80℃, 10 cyles
8	ESD Test /Non-operating	150pF,330ohm	Voltage: ± 8KV(contact discharge); ±15 KV(air discharge)

13. Quality Assurance

The customer should check and accept the products of XINLI within one month after reception. This standard for Quality Assurance should affirm the quality of LCD products to supply to purchaser by XINLI Company Limited.

1. Appearance Inspection

（1）Ambient illumination condition need 750lux for visual cosmetic inspection (300lux for Electrical characteristic functional inspection.)

（2）The distance from eyes to LCD must be 30cm.

（3）Viewing direction must be within 30 degrees to vertical line of LCD center.
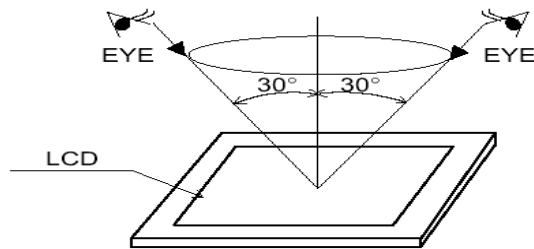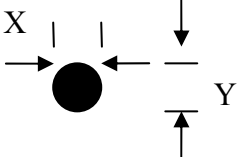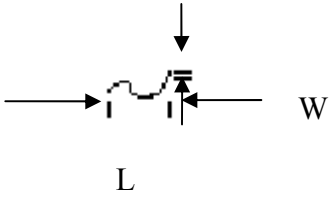
2. Definition of A zone, B zone and C zone
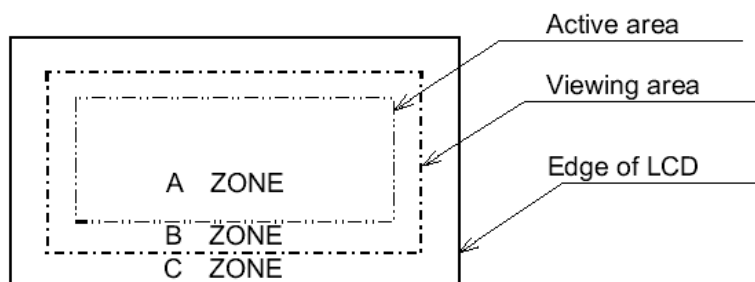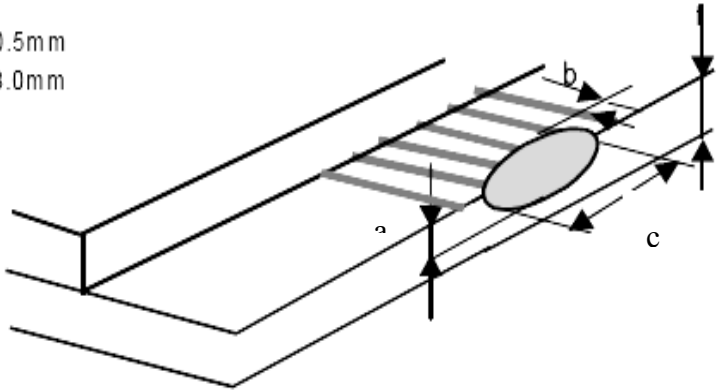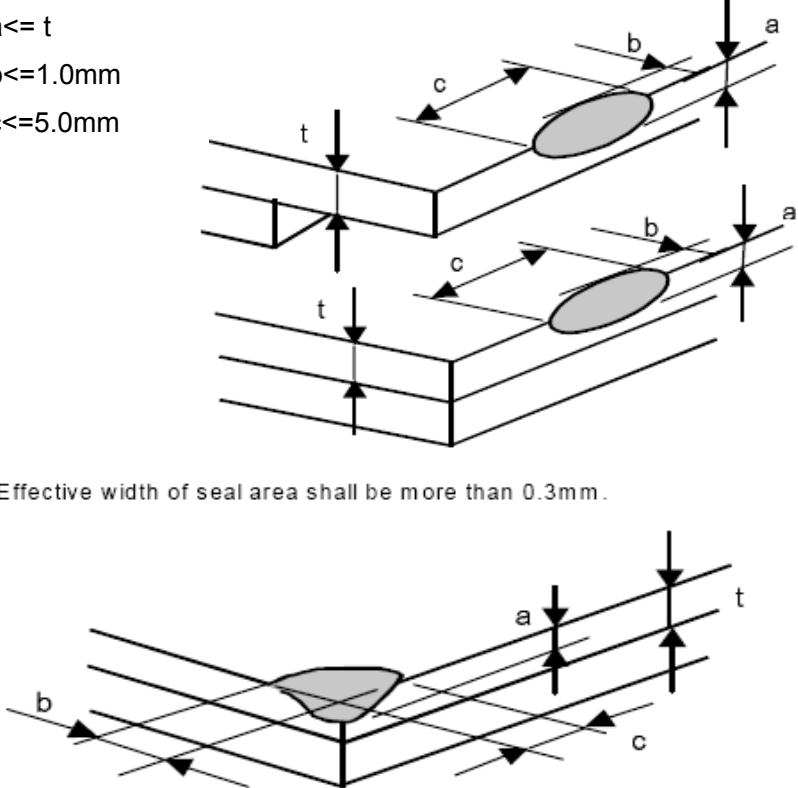
B ZONE: A ZONE and 1/2 BM

3. Appearance Criterion

Item	Criterion				Note
LCD black spots, white spots, color spots	Size	Acceptable QTY	Remark		.
	$\varphi \leqq 1/2$ Dot	Ignore	No more than two spots		
	1/2 Dot $<\varphi \leqq 1$ Dot	3			

	1 Dot <φ	0	ithin 5mm	

contamination , scratches (display/non-display)	1 Round type: As following drawing

φ=(x+y)/2

X Y

Size	Acceptable QTY		Remark
	A.A	V.A	
φ ≦ 0.20	Ignore	Ignore	No more than two spots within 5mm
0.20<φ ≦ 0.25	2	3	
0.25 ≦ φ ≦ 0.30	1	2	
0.30<φ	0	0	
Total	3	5	

2 Line Type: (As following drawing)

 W

L

Legth	Width	Acc ptab e QTY		Remark
		A.A	V.A	
---	W ≦ 0.03	Ignore	Ignore	
L ≦ 2.5	0.03< W ≦ 0.05	2	3	No more than

| | L ≦ 1.5 | 0.05< W ≦ 0.08 | | | two lines within 5mm | |
| | --- | 0.08< W | 0 | 0 | | |

| **Polarizer bubbles** | If bubbles are visible, judge using black spot specifications, not easy to find, must check in specify direction. |
| | |

Size	Acceptable QTY	
	A.A	V.A
φ ≦ 0.30	Ignore	Ignore
0.30<φ ≦ 0.60	2	3
Total	0	0

Chipped glass	Symbols:
	a: Chip length b: Chip width c: Chip thickness
	t: Glass thickness
	1 ITO electrode

a<=t
b<=0.5mm
c<=3.0mm

2 General ,corner portion

	a<= t b<=1.0mm c<=5.0mm *Effective width of seal area shall be more than 0.3mm.	
Cracked glass	The LCD with extensive crack is not acceptable.	
Backlight elements	1 Illumination source flickers when lit. 2 Spots or scratches that appear when lit must be judged using LCD spot, lines and contamination standards. 3 Backlight doesn't light or color is wrong	
Soldering	1 No unmelted solder paste may be present on the PCB. 2 No cold solder joints, missing solder connections, oxidation or icicle. 3 No residue or solder balls on PCB. 4 No short circuits in components on PCB.	
General appearance	1 No oxidation, contamination, curves or, bends on interface pin (OLB) of TCP.	

	2 No cracks on interface pin(OLB) of TCP	
	3 NO contamination, solder residue or solder balls on product.	
	4 The IC on the TCP may not be damaged, circuits.	
	5 The residual rosin or tin oil of soldering (component or chip component) is not burned into brown or black color.	
	6 Sealant on top of the ITO circuit has not hardened	
	7 Pin type must match type in specification sheet.	
	8 LCD pin loose or missing pins.	
	9 Product packaging must the same as specified on packaging specification sheet.	
	10 Product dimension and structure must conform to product specification sheet.	

14. Precautions for Operation and Storage

1. Precautions for Operation

(1)Since LCD panel made of glass,in order to prevent from glass broken or color tone change,please do not apply any mechanical shock or impact or excessive force to it when installing the LCD module.

(2)If LCD panel is broken and liquid crystal substance leaks out and contact your skin or clothes,please immediately wash it off by using soap and water.

(3)The polarizer on the LCD surface is soft and easily scratched.Please be careful when handling.

(4)If LCD surface becomes contaminated,please wipe it off gently by using mois ten soft cloth with normal hexane,do not use acetone,ketone,ethanol, alcohol or water.If there is saliva or water on the LCD surface,please wipe it off immediate ly.

(5)When handing LCD module,please be sure that the body and the tools are properly grounded.And do not touch I/F pins with bare hands or contaminate I/F pins.

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

(7)LCD module should be used under recommended operating conditions shown in chapter 6 and 7.

(8)Response time will be extremely slower at lower temperature than at specified temperature and LCD will show different color when at higher temperature.The phenomenon will disappear when returning to specified condition.

(9)Foggy dew,moisture condensation or water droplets deposited on surface and contact terminals will cause polarizer stain or damage,the deteriorated display quality and electrochemical reaction then leads to the shorter life time and permanent damage to the module probably.Please pay attention to the enviro nmental temperature and humidity.

1. Precautions for Storage

(1)Please store LCD module in a dark place,avoid exposure to sunlight,the light of fluorescent lamp or any ultraviolet ray.

(2)Keep the environment temperature at between $10℃$ and 35 $℃$ and at normal humidity.Avoid high temperature,high humidity or temperature below $0℃$.

(3)That keeps the LCD modules stored in the container shipped from supplier be fore using them is recommended.

(4)Do not leave any article on the LCD module surface for an extended period of
 time.

2. Warranty period

Warrants for a period of 12 Months from the shipping date when stored or used
under normal condition.

15. Package Specification

TBD