Revision: 0.0

Model No: T43P12

Module Type: COG+FPC+B/L

APPROVED SIGNATURE

□ Approved Product Specification only
■ Approved Product Specification and Samples

Prepared By	Checked By	Approved By

Contents

1. General Description

T43P12 is a transmissive type a-Si TFT-LCD (amorphous silicon thin film transistor liquid crystal display) module, which is composed of a TFT-LCD panel, a driver circuit and a backlight unit. The panel size is 4.3 inch and the resolution is 480(RGB)*272, the panel can display up to 16M colors. The LCM can be easily accessed by micro-controller via parallel interface.

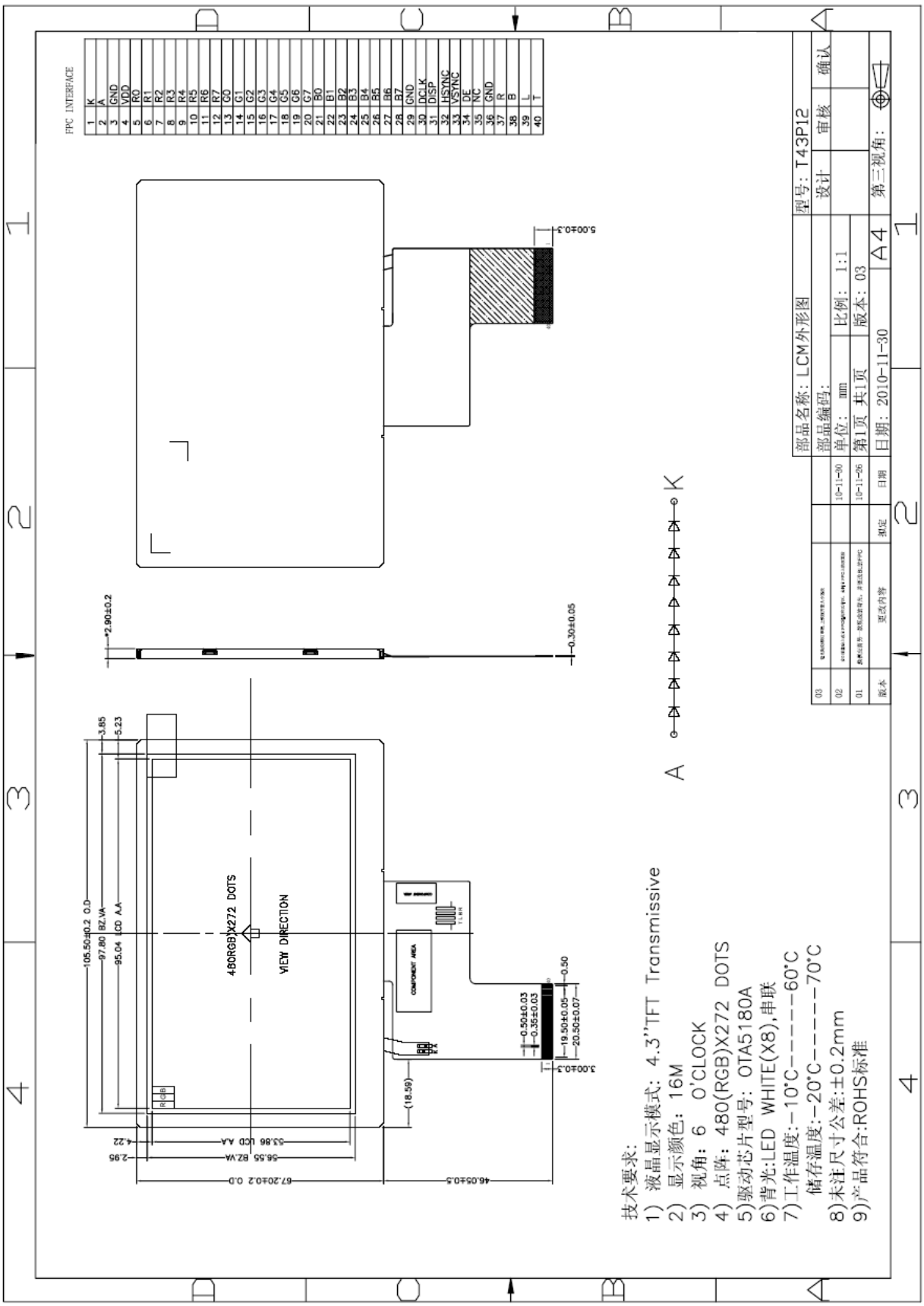
2. Physical Features

Display Mode	TFT-LCD Module
	Active matrix TFT, Transmissive type
Display Format	Graphic 480×RGB×272 Dot-matrix
Input Data	24 bit RGB interface
Viewing Direction	6 O'clock

3. Mechanical Specification

Item	Contents	Unit
Module size (W×H×T)	105.50 × 67.20× 2.90	mm
Number of dots	480(RGB) × 272	---
Active area (W×H)	95.04×53.86	mm

4. Outline Dimension



5. Absolute Maximum Ratings

Item	Symbol	Min	Max	Unit	Remark
Power Voltage	VCC	0.3	5.0	V	Note1、Note2
Input Voltage	VIN	-0.3	5.0	V	
Operating temperature	TOPR	-20	70	℃	
Storage temperature	TSTR	-30	80	℃	
Humidity	---	---	90	%RH	---

Remark:

Note 1) The driver IC may be permanently damaged if it is used under the condition exceeding the above absolute maximum values. It is also recommended to use the driver IC within the limit of its electric characteristics during normal operation. Exceeding the conditions may lead to malfunction of it and affect its credibility.

Note 2) The voltage from VSS.

6. Electrical Characteristics

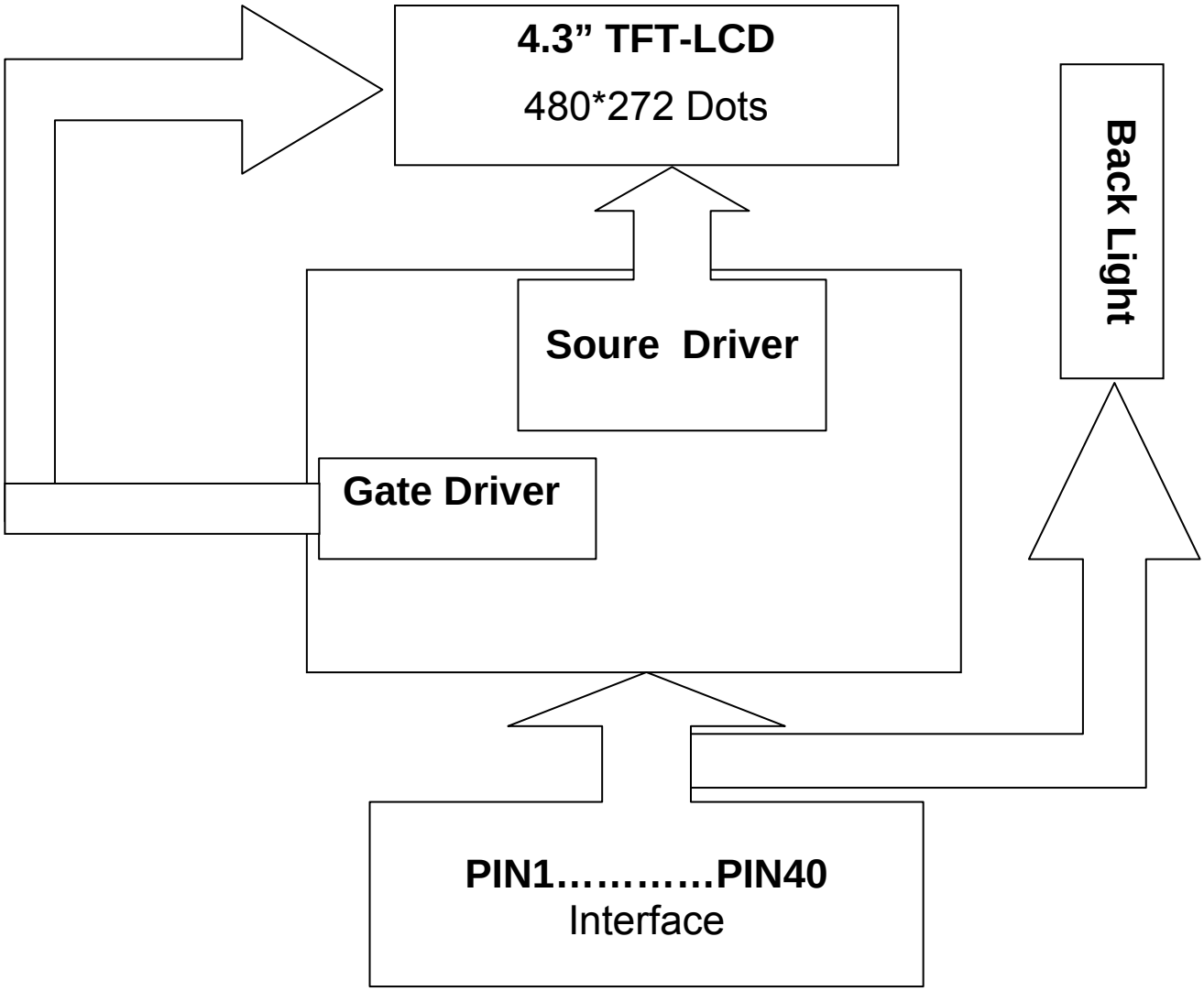
Item		Symbol	Rating			Unit	Remark
			Min	Typ	Max		
Power Voltage	Logic	VCC	3.0	3.3	3.6	V	Note1
Input Voltage	L level	VIL	GND	---	0.3*VCC	V	VCC=3.0 ~ 3.6V
	H level	VIH	0.7* VCC	---	VCC	V	
LCD Drive Power current		ILCD	---	7	---	mA	VCC=3.3V

Remark:

Note1:Vcom must be adjusted to optimize display quality: Cross-talk, Contrast Ratio and etc.

7. Module Function Description

7-1. Block Diagram Of LCM



7-2. Pin Description

PIN NO.	Symbol	I/O	Description
1	LED-	P	Power for LED backlight cathode
2	LED+	P	Power for LED backlight anode
3	GND	P	Power ground
4	VDD	P	Power voltage
5~12	R0~R7	I	Red data
13~20	G0~G7	I	Green data
21~28	B0~B7	I	Blue data
29	GND	P	Power ground
30	DCLK	I	Pixel clock
31	DISP	I	Display on/off
32	HSYNC	I	Horizontal sync signal
33	VSYNC	I	Vertical sync signal
34	DEN	I	Data enable
35	NC	--	No connect
36	GND	P	Power ground
37	XR	--	Touch Panel
38	YD	--	Touch Panel
39	XL	--	Touch Panel
40	YU	--	Touch Panel

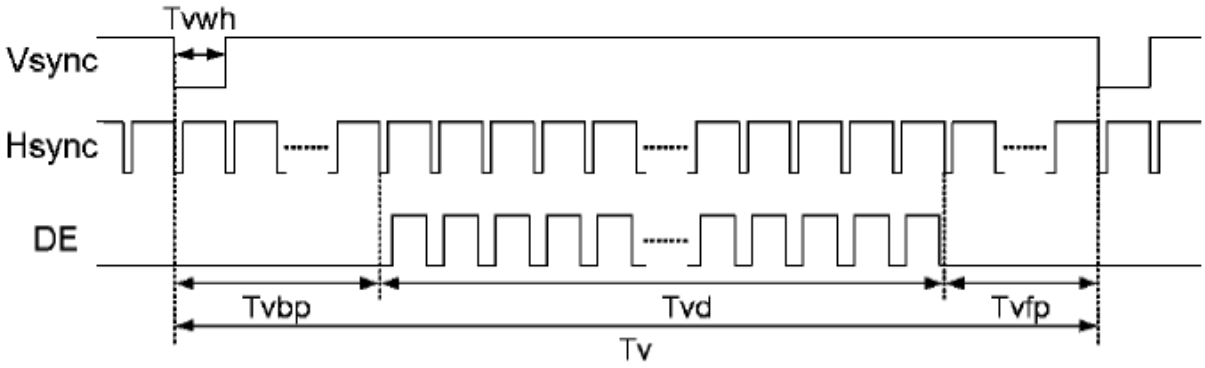
7-3. Timing Characteristics

7.3.1 Data Input Format

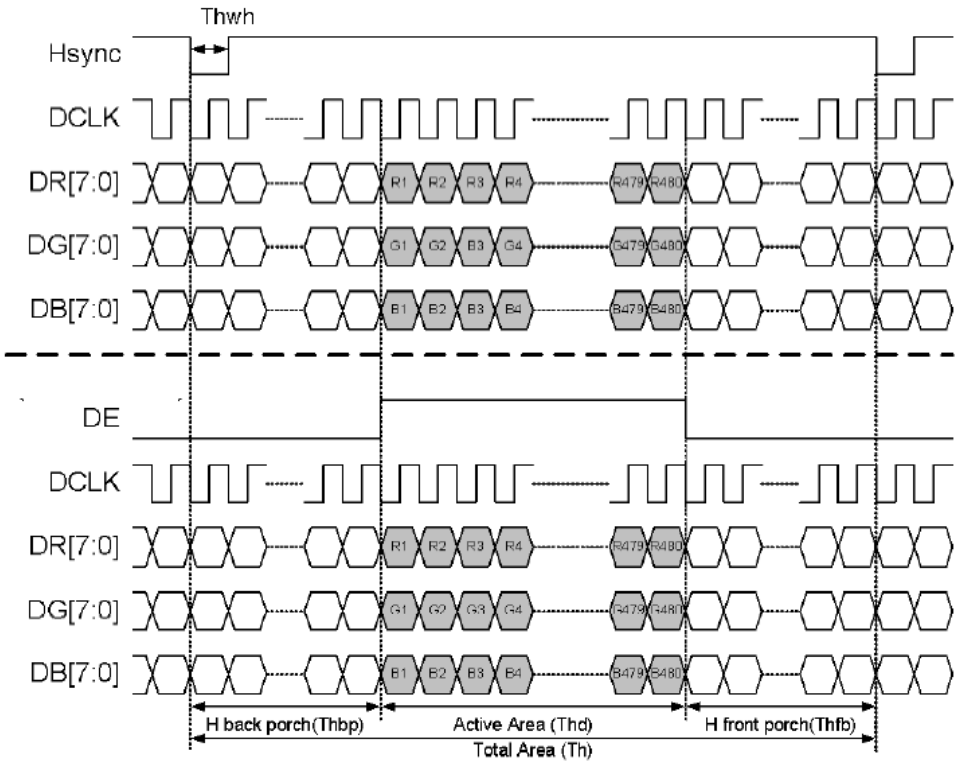
Parallel 24-bit RGB Input Timing Table

Parameters	Symbol	Min.	Typ.	Max.	Unit	Conditions
DCLK frequency	fclk	5	9	12	MHz	
VSYNC period time	Tv	277	288	400	Th	
VSYNC display area	Tvd		272		Th	
VSYNC back porch	Tvbp	3	8	31	Th	
VSYNC front porch	Tvfp	2	8	93	Th	
HSYNC period time	Th	520	525	800	DCLK	
HSYNC display area	Thd		480		DCLK	
HSYNC back porch	Thbp	36	40	255	DCLK	
HSYNC front porch	Thfp	4	5	65	DCLK	

Vertical Input Timing



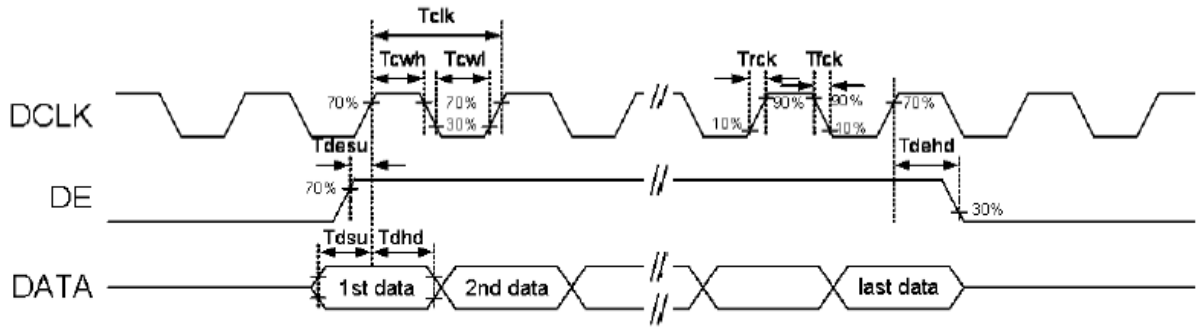
Parallel 24-bit RGB Mode Data Format (DE Mode)

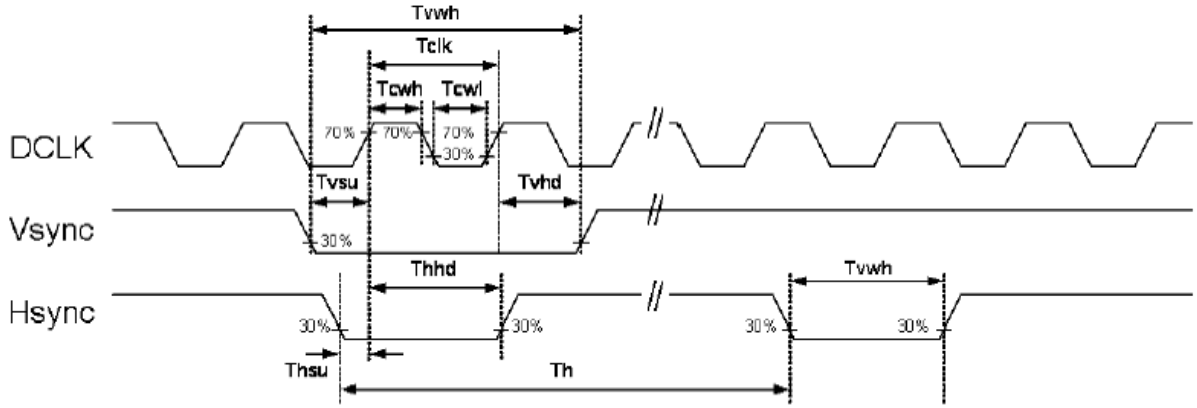


7.3.2 AC Electrical Characteristics

Parameters	Symbol	Min.	Typ.	Max.	Unit	Conditions
DCLK period time	Tclk	83.3	111.1	200	ns	Parallel 24-bit RGB mode
		33.3	37.0	41.7	ns	Serial 8-bit RGB mode
DCLK rising time	Trck	-	-	9	ns	
DCLK falling time	Tfck	-	-	9	ns	
DCLK pulse duty	Tcwh	40	50	60	%	
DE setup time	Tdesu	12	-	-	ns	
DE hold time	Tdehd	12	-	-	ns	
HSYNC pulse width	Thwh	1	-	-	DCLK	
HSYNC setup time	Thsu	12	-	-	ns	
HSYNC hold time	Thhd	12	-	-	ns	
VSYNC pulse width	Tvwh	1	-	-	Th	
VSYNC setup time	Tvsu	12	-	-	ns	
VSYNC hold time	Tvhd	12	-	-	ns	
Data setup time	Tdsu	12	-	-	ns	
Data hold time	Tdhd	12	-	-	ns	

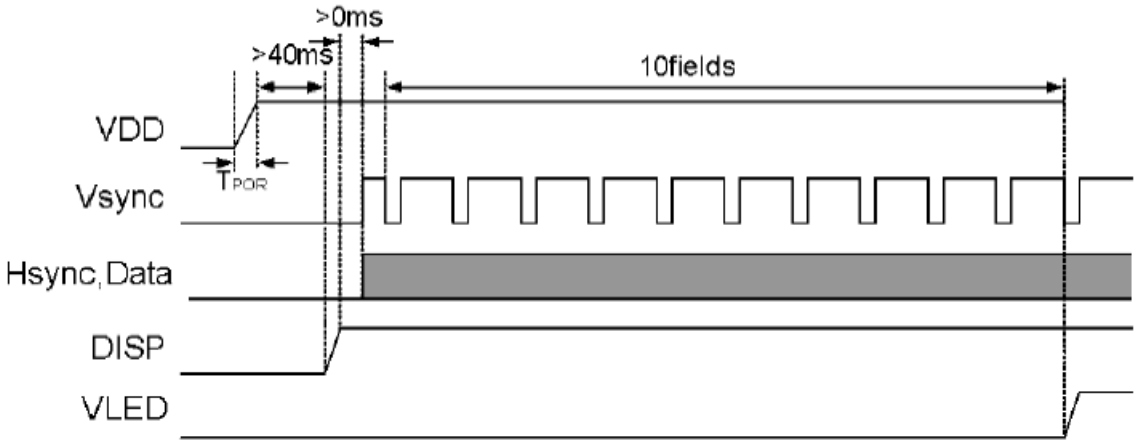
Clock and Data Input Timing Diagram



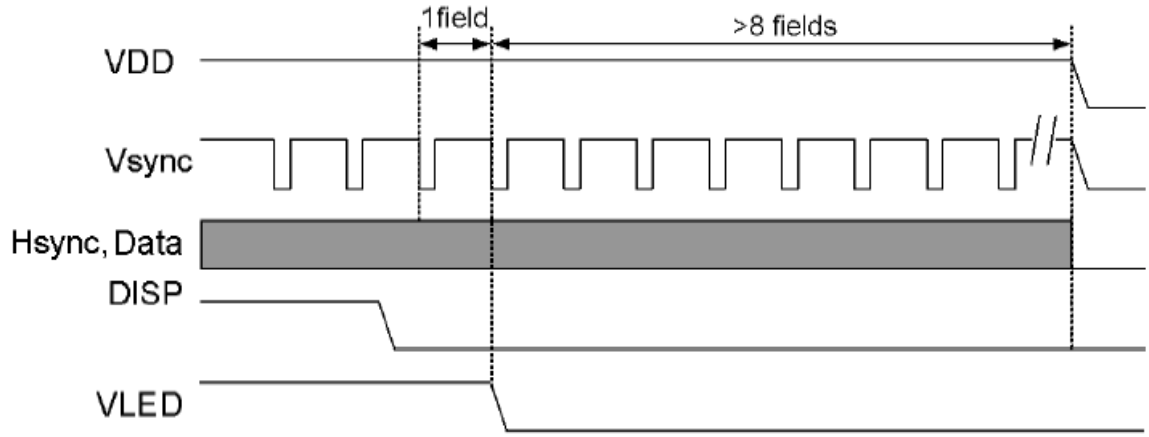


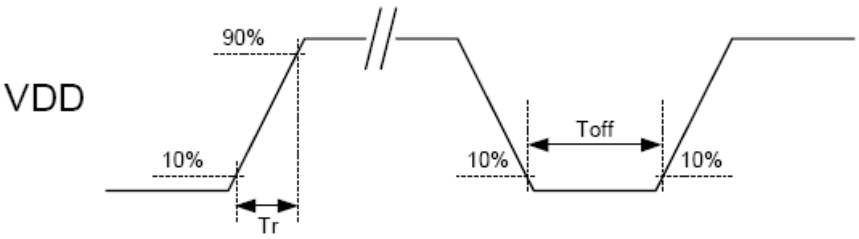
7.3.3 Power on/off Sequence

Power On Sequence



Power Off Sequence





VDD power input timing

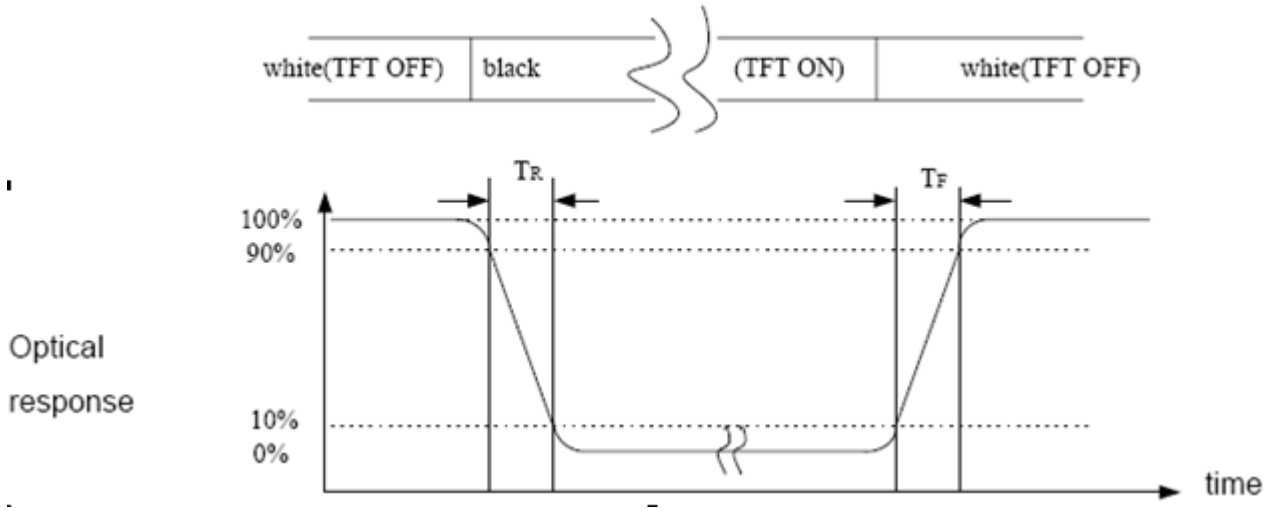
Notes:

Data include R0~R7, G0~G7, B0~B7, HSD, VSD, DCLK, DE
Power on sequence: VDD → DISP → Data → V_{LED}
Power off sequence: DISP → V_{LED} → Data → VDD
VDD power input timing: 0.5ms < Tr < 10ms; Toff > 500ms

8. Electro-Optical Characteristics

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Response time		Tr +Tf	θx = θy =0	---	30	45	ms	Note 1
Contrast Ratio		CR		250	350	---	---	Note 2
Transmittance		T%		6.0	6.4	---	%	
Color chromaticity	white	Wx		0.287	0.307	0.327	-	Reference Only
		Wy		0.325	0.345	0.365		
	Red	Rx		0.589	0.609	0.629		
		Ry		0.297	0.317	0.337		
	Green	Gx		0.297	0.317	0.337		
		Gy		0.523	0.543	0.563		
	Blue	Bx		0.117	0.137	0.157		
		By		0.141	0.161	0.181		
Viewing angle	Hor.	θ_L	CR ≥ 10	--	65	---	Deg.	Note 3
		θ_R		--	65	---		
	Ver.	θ_U		--	55	---		
		θ_D		--	55	---		
Luminance ($I_F = 20mA$)		L		---	200	---	cd/m2	Note4

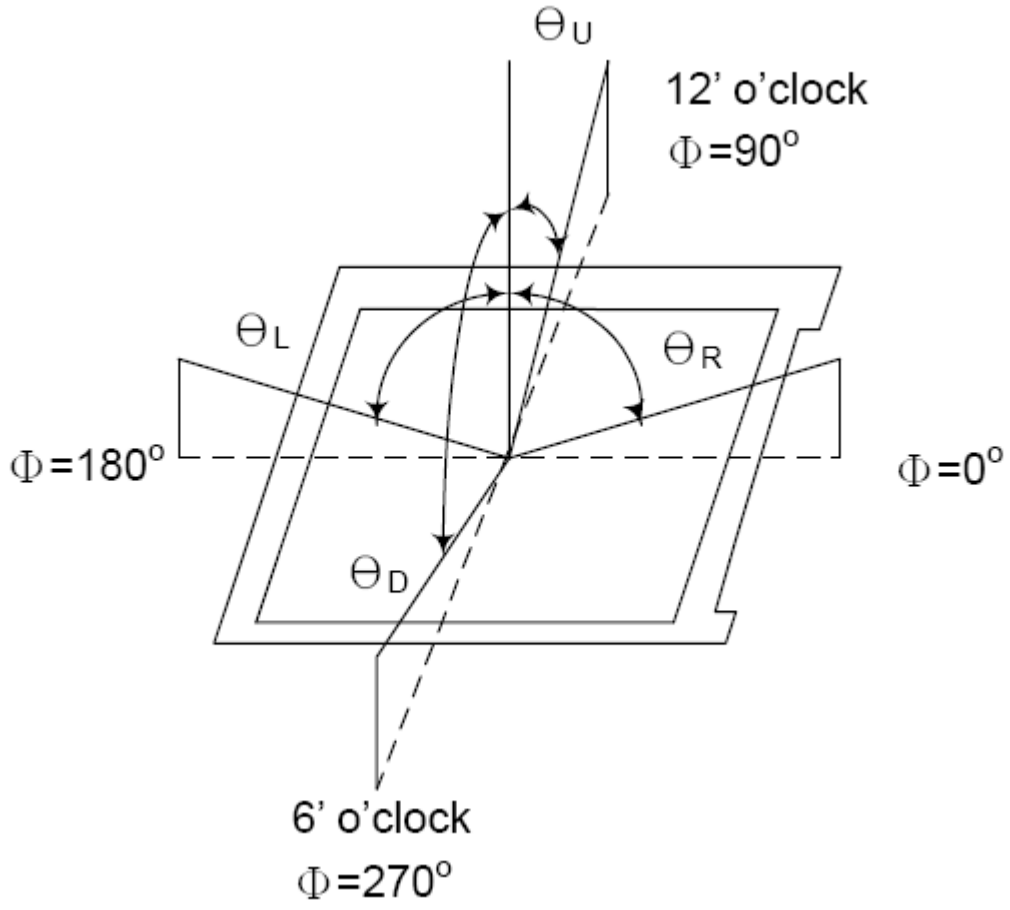
Note(1) Definition of Response Time:Sum of T_R and T_F



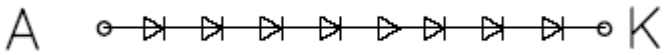
Note (2) Definition of Contrast Ratio(CR):measureed at the center point of panel

$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

Note (3) Definition of Viewing Angle x and y:



Note(4) Backlight circuit



9. Reliability

10. 1. MTBF

The LCD module shall be designed to meet a minimum MTBF value of 50000 hours with normal. (25°C in the room without sunlight)

10. 2. Test condition

NO.	ITEM	CONDITION	CRITERION
1	High Temperature Non-Operating Test	80℃ * 240Hrs	◦ No Defect Of Operational Function In Room Temperature Are Allowable. ◦ IDD of LCM in Pre-and Post-Test Should Follow Specification
2	Low Temperature Non-Operating Test	-30℃ * 240Hrs	
3	High Temperature/Humidity Non-Operating Test	50℃ * 90%RH * 240 Hrs	
4	High Temperature Operating Test	70℃ * 240Hrs	
5	Low Temperature Operating Test	-20℃ * 240Hrs	
6	Thermal Shock Test	-30℃(30Min)↔ 80(30Min)* 10 Cycles	

Notes:
1. Judgments should be made after exposure in room temperature for two hours.
2. The distill water is used for the high temperature / humidity test.
3. The sample above is individually for every reliability tests condition.

10. Inspection Standards

1. AQL(Acceptable Quality Level)

AQL of major and minor defect

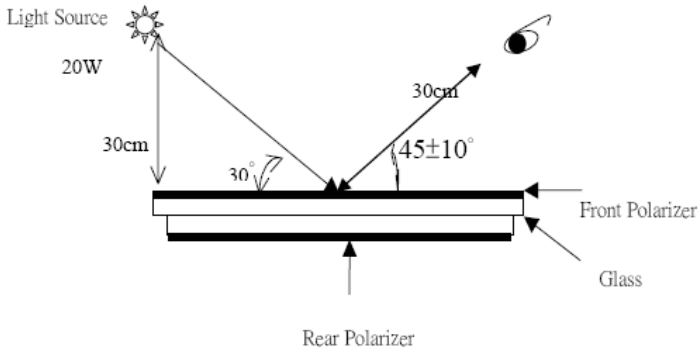
	MAJOR DEFECT	MINOR DEFECT	MAJOR+MINOR
APPEARANCE	0.40%	1.0%	1.0%
ELECTRIC-OPTICAL	0.15%	0.15%	0.15%

2. Basic conditions for inspection

The LCM face to us, in normal environment, the lux is 1000±200.(Darkroom's lux:100±50),

About an angle of incidence 30, a distance of 30cm with normal eye,with an angle of 45 degree to check the products without uncovering the film!

(As shown below)

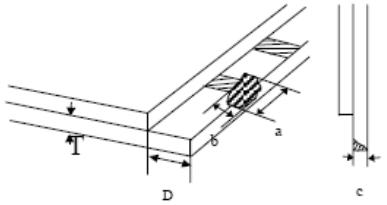
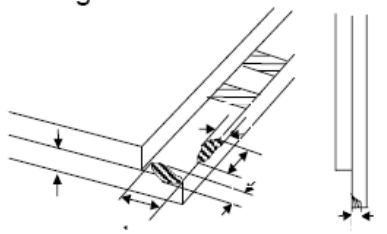


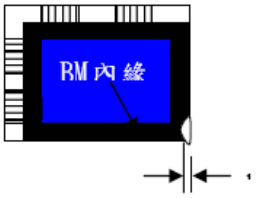
3. Inspection item and criteria

3.1 Visual inspection criterion in immobility

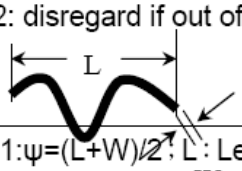
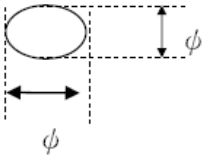
3.1.1 Glass defect

No	Defect item	Criteria	Remark
1	Dimension Unconformity (Major defect)	By Engineering Drawing	

No	Defect item	Criteria	Remark
2	Cracks (Major defect)	1.Linear cracks on panel 【Reject】 2. Nonlinear crack contrast by limited sample	
3	Glass extrude the conductive area (minor defect)	a: disregards and no influence assemblage 1) b≦1/3Pin width(non bonding area) 【Accept】 2) bonding area≦0.5mm 【Accept】	a:Length, b:Width
4	Pin-side，conductive area damaged (minor defect)	(a c：disregards) b≦ 1/3 of effective length for bonding electrode 【Accept】	a:Length，b:Width，c:Thickness 
5	Pin-side，non-conductive area damaged (minor defect)	1) Damage area don't touch the ITO (Inclueling contraposition mark,except scribing mark) 【Accept】 2) c<T b≦BM 1/3 of width 【Accept】 3) c=T b not touch the seal glue 【Accept】 4) a disregards	a:Length，b:Width，c:Thickness 

No	Defect item	Criteria	Remark
6	Non-pin-side damage (minor defect)	c<T 1) b exceeds 1/3 BM 【Reject】 c=T b not touch the seal glue 【Reject】	c : Thickness b: width of damage 

3.1.2 LCD appearance defect (View area)

No	Defect item	Criteria		Remark
1	Fiber、glass cratch、polarizer scratch/folded (minor defect)	Specification	Allowable	note1: L：Length，W：Width note2: disregard if out of AA 
		0.05mm<W≦0.1mm; L≦3.0mm	1	
		W>0.1mm ; L>3.0mm	0	
2	Polarizer bubble、concave and convex (minor defect)	ψ≦0.2mm	disregard	note 1:ψ=(L+W)/2；L：Length，W：Width  note2: disregard if out of AA
		0.2mm<ψ ≦ 0.3mm	2	
		0.3mm<ψ ≦ 0.5mm	1	
		0.5mm<ψ	0	
3	Black dots、dirty dots、impurities、eyewinker (Major defect)	ψ≦0.15mm	disregard	note2: disregard if out of AA 
		0.15mm<ψ ≦ 0.25mm	2	
		0.25mm<ψ ≦ 0.3mm	1	
		0.3mm<ψ	0	
4	Polarizer prick (Major defect)	ψ≦0.1mm	disregard	note1:ψ=(L+W)/2 ；L= Length，W=Width note2: the distance between two dots ＞5mm
		0.1mm<ψ≦0.25mm	3	
		ψ＞0.25mm	0	

3.1.3 .FPC

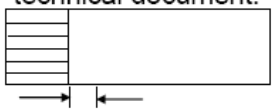
No	Defect item	Criteria		Remark
1	Copper screen peel (Major defect)	Copper screen peel 【Reject】		
2	No release tape or peel (Major defect)	No release tape or peel 【Reject】		
3	Dirty dot and impurity of FPC for customer using side (minor defect)	Specification	Allowable	note1: Cannot have stride ITO impurities
		ψ≦0.25mm	2	
		ψ>0.25	0	

3.1.4 Black tape & Mara tape

1	FPC or H/S black tape shift (minor defect)	1.shift spec: 1)glue to the polarize 【Reject】 2) IC bare 【Reject】 2. left-and-right spec: 1) exceed of FPC edge or H-S edge 【Reject】 2)IC bare 【Reject】	
2	No black tape (Major defect)	No black tape 【Reject】	
3	Tape position mistake (minor defect)	Not by engineering drawing 【Reject】	
4	Mara tape defect (minor defect)	Peel before pulling the protecting film. 【Reject】	

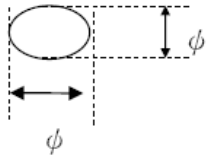
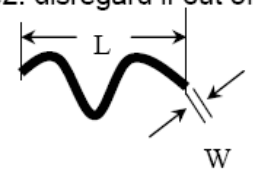
3.1.5 Silicon and Tuffy glue

No	Defect item	Criteria	Remark
1	Quantity of silicon (minor defect)	Uncover the ITO and circuit area. 【Reject】	note: compared by engineering drawing.

No	Defect item	Criteria	Remark
2	Tuffy glue (minor defect)	1. Uncover the reveal copper area 【Reject】 2. Cover layer 0.3mm(Min) ~ 3.0mm(Max) 【accept】	note:if customer has special requirement , refer to the technical document. 
3	Depth of glue covering (minor defect)	Depth of glue covering overtop front Polarizer 【Reject】	Except of the special requirement。

3.2 Electrical criteria

No	Defect item	Criteria	Remark
1	No display (Major defect)	No display 【Reject】	
2	Missing line (Major defect)	Missing line 【Reject】	
3	Seg-com light and dark (Major defect)	Seg-com light and dark 【Reject】	ND filter 2% test
4	No display in immobility (Major defect)	No display in immobility 【Reject】	
5	Flicker of Pattern (Major defect)	Flicker of Pattern 【Reject】	
6	Mura (Major defect)	ND filter 2% test	
7	Over current (Major defect)	Over current 【Reject】	
8	Voltage out of specification (Major defect)	Voltage out of specification 【Reject】	
9	Pattern blur ,error code (Major defect)	Pattern blur ,error code 【Reject】	
10	Dark light, Flicker (Major defect)	Dark light, Flicker 【Reject】	

No	Defect item	Criteria	Remark	
11	Black/White dots、Dirty dots、eyewinker (Major defect)	Specification	Allowable	Note1: disregard if out of AA 
		ψ≦0.15mm	disregard	
		0.15mm<ψ ≦ 0.25mm	2	
		0.25mm<ψ ≦ 0.3mm	1	
		0.3mm<ψ	0	
12	Fiber、glass cratch、polarizer scratch/folded (minor defect)	W≦0.03mm	disregard	note1: L : Length、W : Width note2: disregard if out of AA 
		0.03mm<W≦0.05mm ; L≦3.0mm	2	
		0.05mm<W≦0.1mm; L≦3.0mm	1	
		W>0.1mm ; L>3.0mm	0	

11. Precautions For Using LCD Modules

Please pay attentions to the followings as using the LCD module.

12.1 Handling

(a) Do not apply strong mechanical stress like drop, shock or any force to LCD module. It may cause improper operation, even damage.

(b) Because the ITO film very fragile and easy to be damaged, do not hit, press or rub the display surface with hard materials.

(c) Do not put heavy or hard material on the display surface, and do not stack LCD modules.

(d) If the display surface is dirty, please wipe the surface softly with cotton swab or clean cloth.

(e) Wipe off water droplets or oil immediately.

(f) Protect the LCD module from ESD. It will damage the LSI and the electronic circuit.

(g) Do not touch the output pins directly with bare hands.

(h) Do not disassemble the LCD module.

12.2 Storage

(a) Do not leave the LCD modules in high temperature, especially in high humidity for a long time.

(b) Do not expose the LCD modules to sunlight directly.

(c) The liquid crystal is deteriorated by ultraviolet. Do not leave it in strong ultraviolet ray for a long time.

(d) Avoid condensation of water. It may cause improper operation.

(e) Please stack only up to the number stated on carton box for storage and transportation. Excessive weight will cause deformation and damage of carton box.

12.3 Operation

(a) When mounting or dismounting the LCD modules, turn the power off.

(b) Protect the LCD modules from electric shock.

(c) The Driver IC control algorithms stated above should always obeyed to avoid damaging the LSI and electronic circuit.

(d) Be careful to avoid mixing up the polarity of power supply for backlight.

(e) Absolute maximum rating specified above has to be always kept in any case. Exceeding it may cause non-recoverable damage of electronic components or, nevertheless, burning.

(f) When a static image is displayed for a long time, remnant image is likely to occur.

(g) Be sure to avoid bending the FPC to an acute shape, it might break FPC.

12.4 Others

(a) If the liquid crystal leaks from the panel, it should be kept away from the eyes or mouth.

(b) It is recommended to peel off the protection film on the ITO film slowly so that the electrostatic charge can be minimized.

(c) It is recommended to peel off the protection film on the polarizer slowly so that the electrostatic charge can be minimized.

12. Records Of Version

Version	Revise Date	Page	Content
0.0	2010-12-8	All	New released