PRODUCT SPECIFICATION FOR LCD MODULE

Revision: 00

Model No: ATK70048

Module Type: COG+FPC+B/L+ST

APPROVED SIGNATURE

□ Approved Product Specification only
■ Approved Product Specification and Samples

Prepared By	Checked By	Approved By

Contents

1. General Description

ATK70048 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 7.0 inch and the resolution is 1024(RGB)*600, the panel can display up to 16M colors. The LCM can be easily accessed by micro-controller via parallel interface.

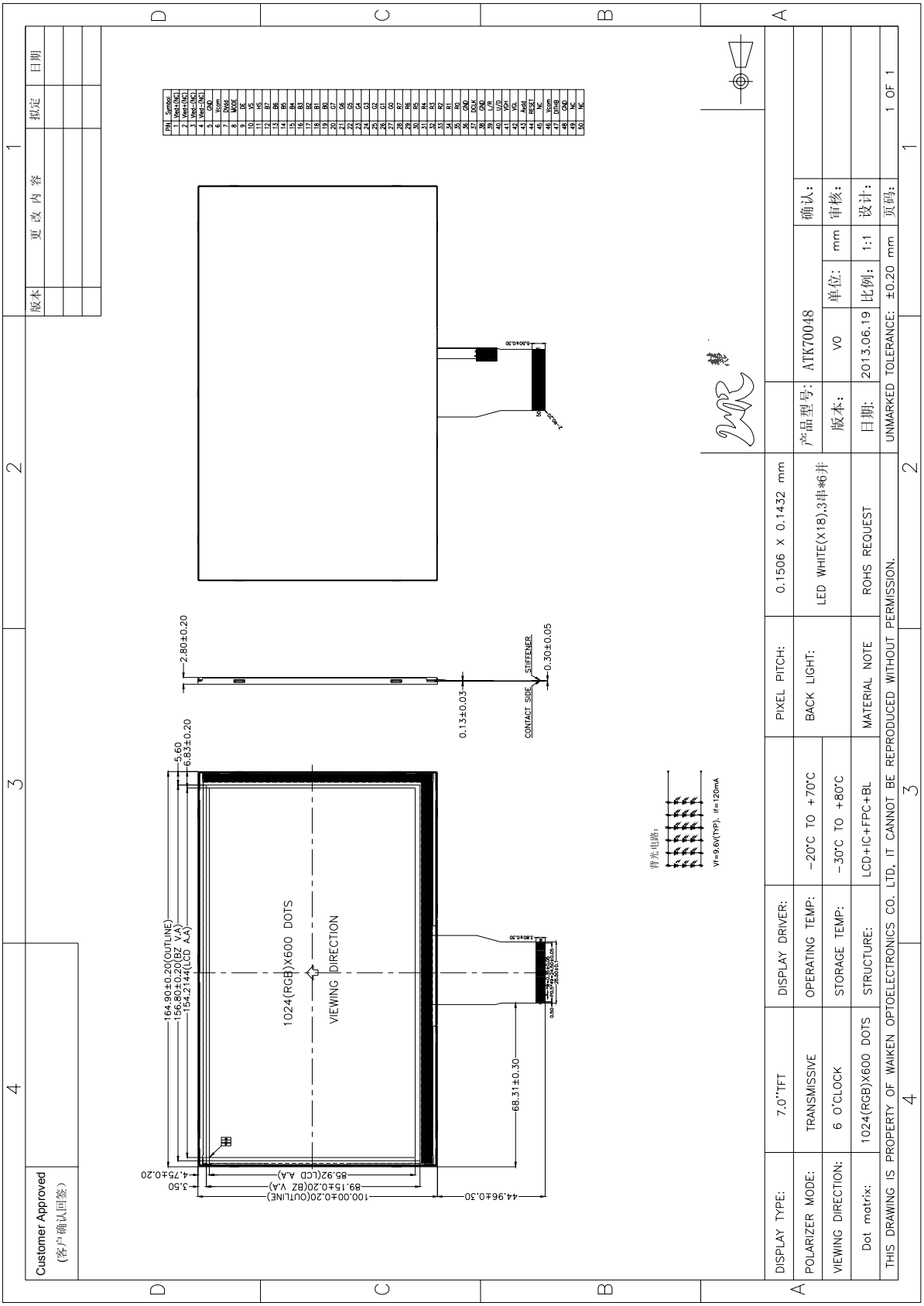
2. Physical Features

Display Mode	TFT-LCD Module
	Active matrix TFT, Transmissive type
Display Format	Graphic 1024×RGB×600 Dot-matrix
Input Data	24 bit RGB interface
Viewing Direction	6 O'clock

3. Mechanical Specification

Item	Contents	Unit
Module size (W×H×T)	164.90 × 100.00× 2.80	mm
Number of dots	1024(RGB) × 600	---
Active area (W×H)	154.2144×85.92	mm

4. Outline Dimension



5. Absolute Maximum Ratings

Item	Symbol	Min	Max	Unit	Remark
Digital Supply Voltage	DVDD	-0.3	3.96	V	Note1
Analog Supply Voltage	AVDD	-0.5	14.85	V	
Gate On Voltage	VGH	-0.3	40	V	
Gate Off Voltage	VGL	-20	0.3	V	
Gate On-Gate Off Voltage	VGH-VGL	12	40	V	
Operating temperature	TOPR	-20	70	℃	
Storage temperature	TSTR	-30	80	℃	
Humidity	---	---	90	%RH	---

Remark:

Note1：If users use the product out off the environmemtal operation range（temperature and humidity,it will have visual quality concerns）.

6. Electrical Characteristics

6.1 Typical Operation Conditions

Item		Symbol	Rating			Unit	Remark
			Min	Typ	Max		
Digital Power Supply Voltage	Logic	VCC	3.0	3.3	3.6	V	Note1
Analog Power Supply Voltage	Analog	AVDD	9.4	9.6	9.8		
Gate On Power Supply Voltage		VGH	17	18	19		
Gate Off Power Supply Voltage		VGL	-6.6	-6	-5.4		
Common Power Supply Voltage		VCOM	3.7	3.9	4.1		
Input Voltage	L level	VIL	GND	---	0.3*DVDD	V	VCC= 3.0 ~ 3.6V
	H level	VIH	0.7* DVDD	---	DVDD	V	
LCD Drive Power current		ILCD	---	---	45	mA	VCC= 3.3V

Remark:

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

6.2 TFT-LCD Current Consumption

ITEM	SYMBOL	CONDITION	MIN	TYPE	MAX	UNIT	NOTE
Gate On Power Current	IVGH	VGH =18V	- -	0.5	1	mA	Note1
Gate Off Power Current	IVGL	VGL= -6V	- -	0.5	1	mA	Note1
Digital Power Current	IDVDD	DVDD = 3.3V	- -	30	45	mA	Note1
Analog Power Current	IAVDD	AVDD = 9.6V	- -	35	45	mA	Note1
Total Power Consumption	PC		- -	447	604	mW	Note1

Note1: Typ. specification：Gray-level test Pattern
Max. specification：Black test Pattern

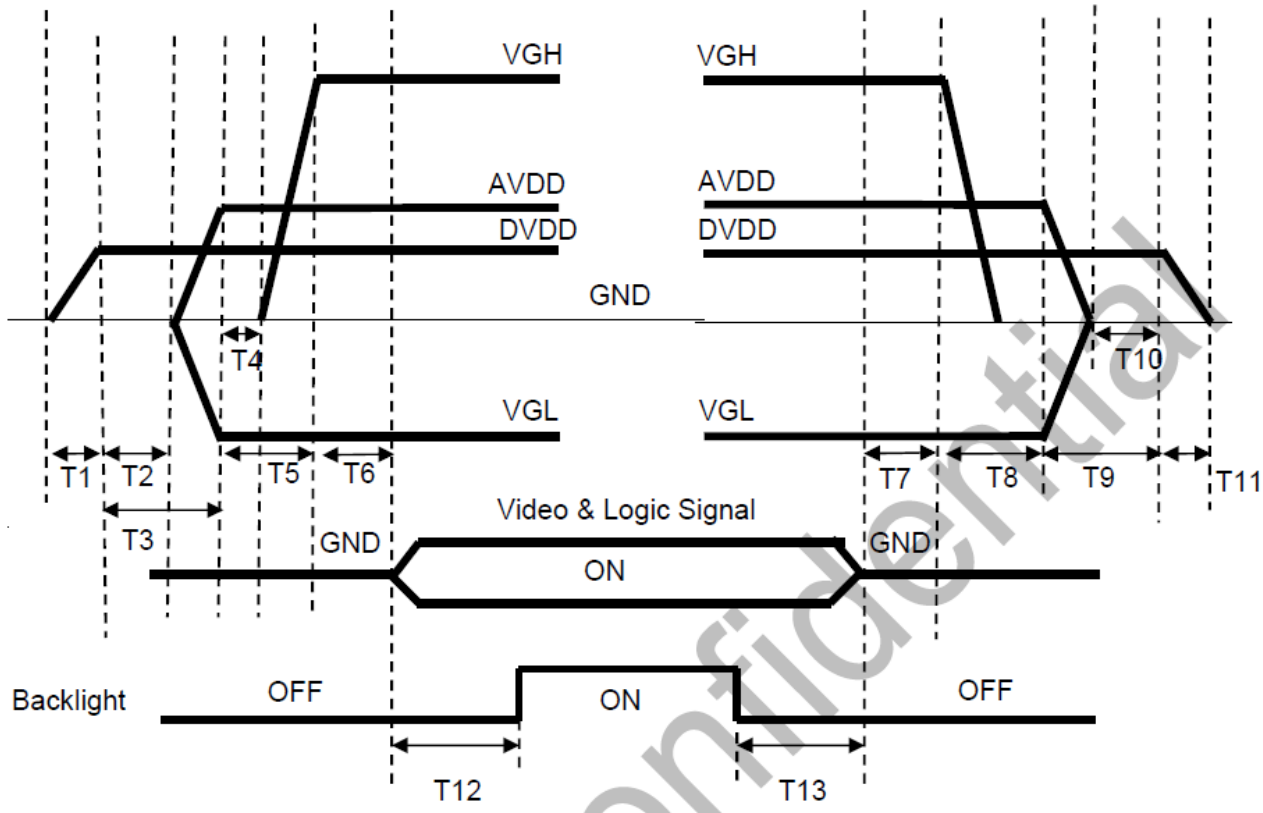
256 gray pattern

Black Pattern

6.3 Power、Signal Sequence

Power On：DVDD→AVDD/VGL →VGH →Video &Logic Signal→Backlight

Power Off：Backlight→Video &Logic Signal→ VGH→AVDD/VGL→DVDD

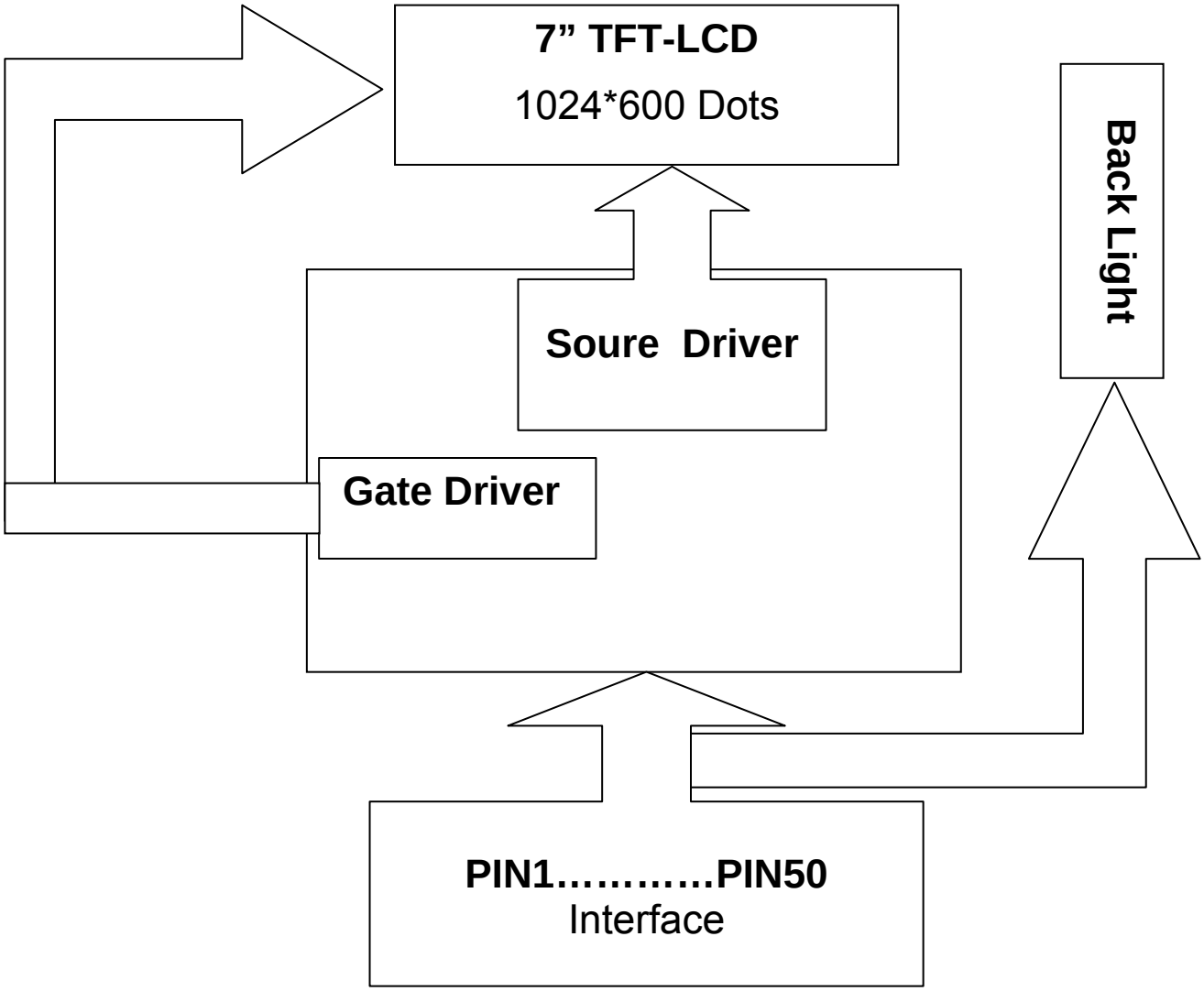


0<T1≦10ms
T2>0ms
T3>20ms
T4>0ms
T5>10ms
0<T6≦10ms
T12≧200ms

T7>0ms
T8>0ms
T9>0ms
T10>0ms
0<T11≦10ms
T13≧200ms

7. Module Function Description

7-1. Block Diagram Of LCM



7-2. Pin Description

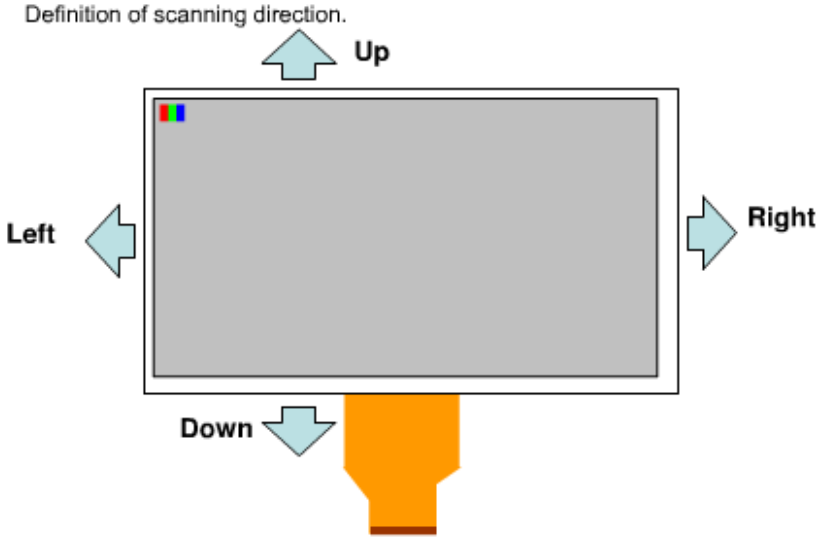
PIN NO.	Symbol	I/O	Description
1-2	LED-A	P	Power for LED backlight anode
3-4	LED-K	P	Power for LED backlight cathode
5	GND	P	Power ground
6	VCOM	O	Common voltage
7	DVDD	P	Power supply for digital
8	MODE	I	DE/SYNC Mode Select. Normally Pull High H: DE mode. L: HSD/VSD mode

9	DE	I	Input data enable control.
10	VSD	I	Vertical sync signal
11	HSD	I	Horizontal sync signal
12-19	B7~B0	I	Blue data
20-27	G7~G0	I	Green data
28-35	R7~R0	I	Red data
36	GND	P	Power ground
37	DCLK	I	Clock for input data
38	GND	P	Power ground
39	SHLR	I	Source shift direction control.
40	UPDN	I	Gate scan direction control
41	VGH	p	Positive Power for TFT
42	VGL	p	Negative Power for TFT
43	AVDD	p	Analog Power
44	RSTB	I	Global reset pin. Active low to enter reset state. Suggest to connecting with an RC reset circuit for stability. Normally pull high. (R=10KΩ，C=1μF)
45	NC	--	NC
46	VCOM	O	Common Voltage
47	DITH	I	Dithering setting DITH="H" 6bit resolution(last 2 bit of input data truncated) DITH="L" 8bit resolution(default setting)
48	GND	P	Power ground
49-50	NC	--	NC

【Note1】SHLR：left or right setting
UPDN：up or down setting

SHLR	UPDN	Data shifting
DVDD	GND	Left→Right，Up→Down(default)
GND	GND	Right→Left，Up→Down
DVDD	DVDD	Left→Right，Down→Up
GND	DVDD	Right→Left，Down→Up

Definition of scanning direction.



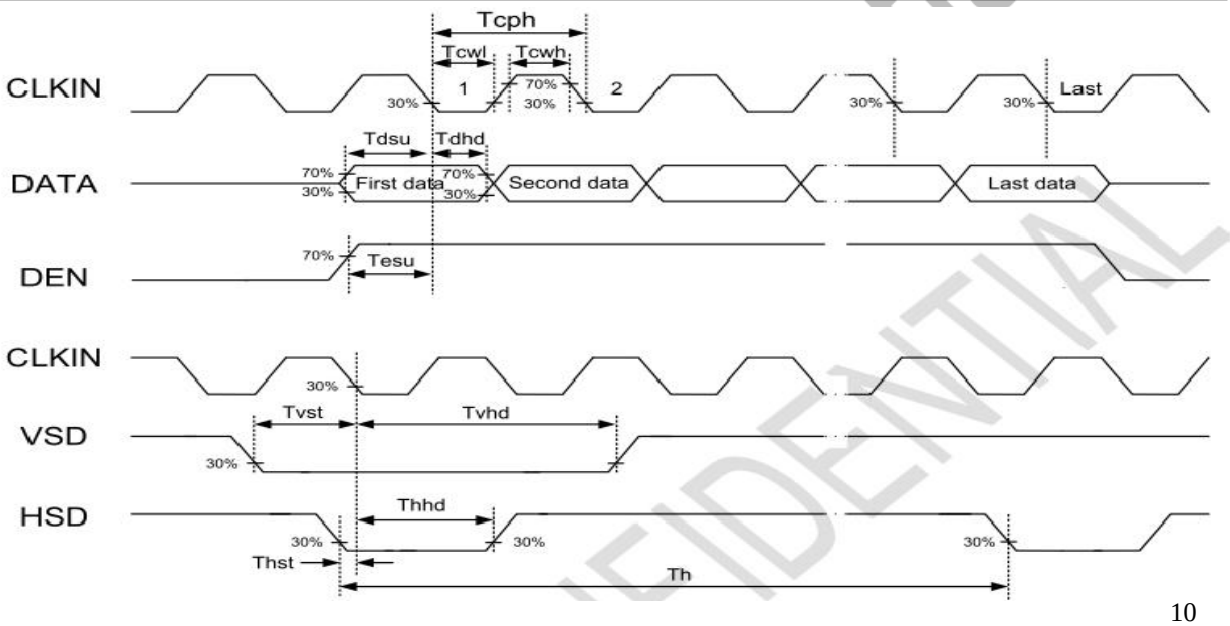
7-3. Timing Characteristics

7.3.1 Input Timing Table

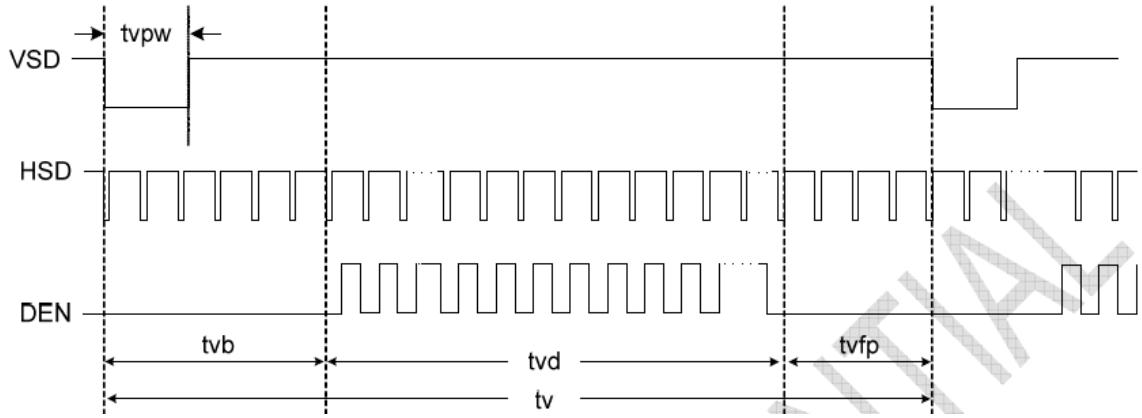
	ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	Note
DE MODE	Dot Clock	1/tCLK	45	51.2	57	MHz	
	DCLK Pulse Duty	Tcwh	40	50	60	%	
	Horizontal Total Time	tH	1324	1344	1364	tCLK	
	Horizontal Effective Time	tHA		1024		tCLK	
	Horizontal Blank Time	tHB	300	320	340	tCLK	
	Vertical Total Time	tV	625	635	645	tH	
	Vertical Effective Time	tVA		600		tH	
	Vertical Blank Time	tVB	25	35	45	tH	
SYNC MODE	Horizontal Total Time	TH	1324	1344	1364	tCLK	
	Horizontal Pulse Width	Thpw		20	-	tCLK	thb + thpw =160DCLK is fixed
	Horizontal Back Porch	Thb		140	-	tCLK	
	Horizontal Front Porch	Thfp	140	160	180	tCLK	
	Horizontal Effective Time	THA		1024		tCLK	
	Vertical Total Time	TV	625	635	645	tH	
	Vertical Pulse Width	Tvpw		3	-	th	tvpw + tvb =23th is fixed
	Vertical Back Porch	Tvb	-	20	-	th	
	Vertical Front Porch	Tvfp	2	12	22	th	
	Vertical Valid	Tvd		600		th	

7.3.2 Input Clock and Data Timing Diagram

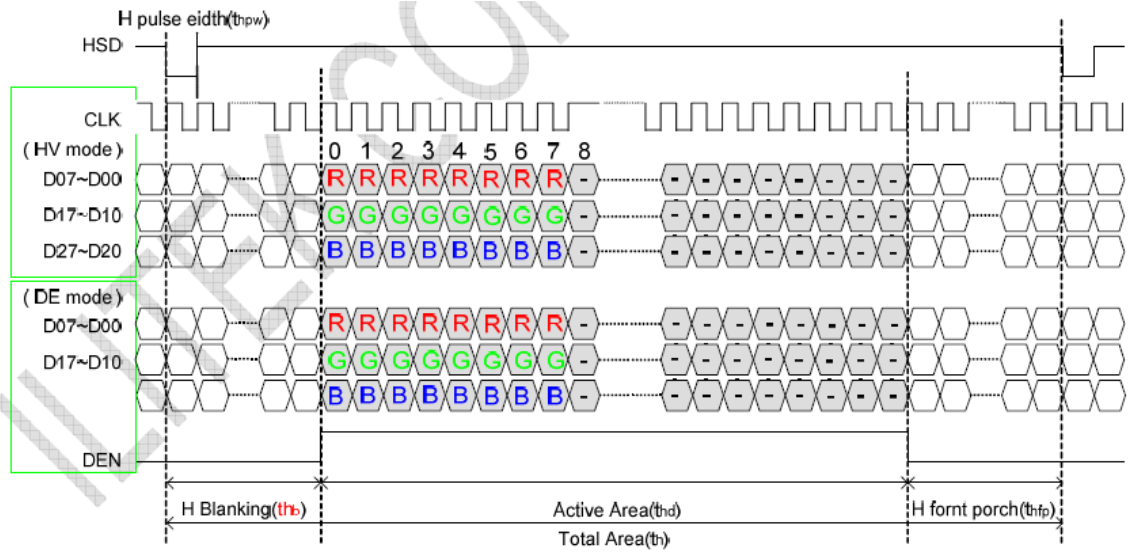
Parameter	Symbol	Spec.			Unit	Condition
		Min.	Typ.	Max.		
DVDD Power On Slew Rate	TPOR	-	-	20	ms	From 0V to 90% DVDD
RSTB Pulse Width	TRst	50	-	-	us	DCLK=65MHz
DCLK Cycle Time	Tcph	14	-	-	ns	
DCLK Pulse Duty	Tcwh	40	50	60	%	
VSD Setup Time	Tvst	5	-	-	ns	
VSD Hold Time	Tvhd	5	-	-	ns	
HSD Setup Time	Thst	5	-	-	ns	
HSD Hold Time	Thhd	5	-	-	ns	
Data Setup Time	Tdsu	5	-	-	ns	D0[7:0],D1[7:0],D2[7:0] to DCLK
Data Hold Time	Tdhd	5	-	-	ns	D0[7:0],D1[7:0],D2[7:0] to DCLK
DEN Setup Time	Tesu	5	-	-	ns	
DEN Hold Time	Tehd	5	-	-	ns	



Vertical input timing



Horizontal input timing



DE Mode

Parameter	Symbol	Value			Unit
		Min	Typ.	Max	
DCLK frequency Frame rate = 60Hz	fclk	40.8	51.2	67.2	MHz
Horizontal display area	thd		1024		DCLK
HSYNC period time	th	1114	1344	1400	DCLK
HSYNC blanking	thb+thfp	90	320	376	DCLK
Vertical display area	tvd		600		H
VSYNC period time	tv	610	635	800	H
VSYNC blanking	tvb+tvfp	10	35	200	H

HV Mode

a. Horizontal input timing

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

b. Vertical input timing

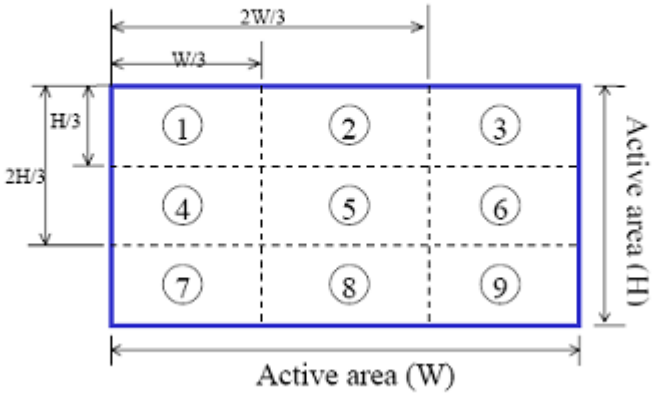
Parameter	Symbol	Value			Unit
		Min	Typ.	Max	
Vertical display area	tvd		600		H
VSYNC period time	tv	624	635	750	H
VSYNC pulse width	tvpw	1	-	20	H
VSYNC blanking	tvb	23	23	23	H
VSYNC front porch	tvfp	1	12	127	H

8. Backlight Characteristics

Item	Symbol	Min	Typ	Max	Unit	Remark
Forward voltage	V_{BL}	-	9.6	-	V	-
Current	I_{BL}	90	120	150	mA	-
ICE	X	0.26	-	0.31	-	-
	Y	0.26	-	0.31	-	
Brightness	-	-	200	-	cd/m²	★1
Uniformity	-	80	-	-	%	★1

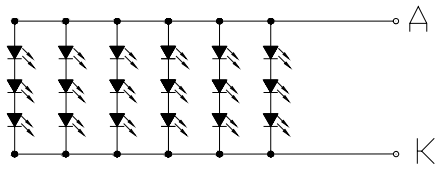
★1 Uniform measure condition:

(1)Measure 9 point. Measure location is show below :
(2)Uniform = (Min. brightness / Max. brightness)×100%
(3)Best Contrast.



★2 Backlight circuit:

背光电路：



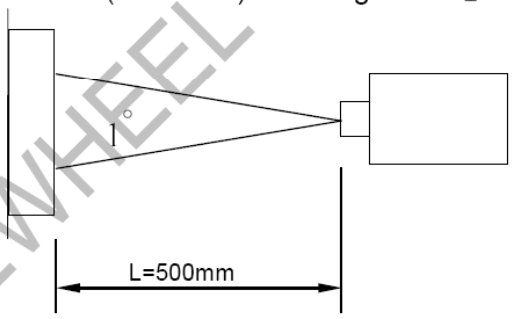
Vf=9.6V(TYP). If=120mA

9. Electro-Optical Characteristics

ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	REMARK
Transmittance		T		4.8	5.1	-	%	
Contrast Ratio		CR	*1)	320	400	-	--	Note 3
Response Time		Tr+ Tf	*3)	-	25	40	ms	Note 4
Viewing Angle	Vertical	θ	CR≧10	120	140	-	°	Note 5
	Horizontal	ψ		100	120	-	°	
Color Filter Chromacicity	White	x	θ=ϕ= 0°	0.282	0.302	0.322		Note 6
		y		0.318	0.338	0.358		
		Y		31.3	34.3	37.3		
	Red	x	θ=ϕ= 0°	0.586	0.606	0.626		
		y		0.305	0.325	0.345		
		Y		18.8	21.8	24.8		
	Green	x	θ=ϕ= 0°	0.283	0.303	0.323		
		y		0.547	0.567	0.587		
		Y		55.7	59.7	63.7		
	Blue	x	θ=ϕ= 0°	0.127	0.147	0.167		
		y		0.141	0.161	0.181		
		Y		18.3	21.3	24.3		
	NTSC			45	50	-	%	

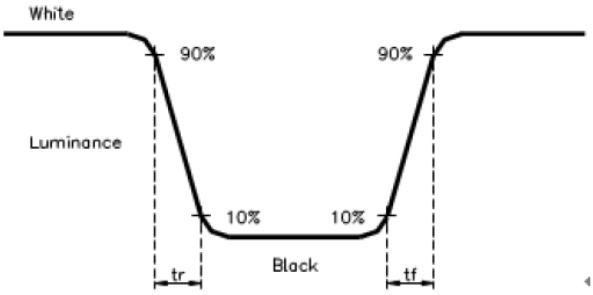
Note 1.Ambient condition：25℃±2℃，60±10%RH，under 10 Lunx in the darkroom。

Note 2.Measure device：BM-5A (TOPCON)，viewing cone= 1°，I_L=20mA。

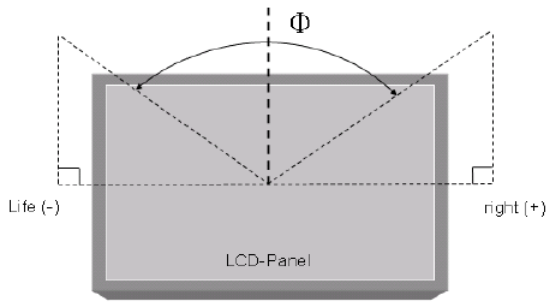


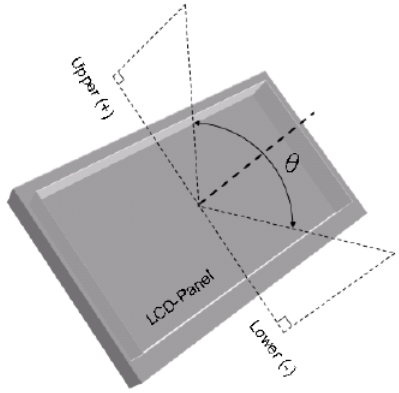
Note 3. Definition of Contrast Ratio：
CR = White Luminance (ON) / Black Luminance (OFF)

Note 4. Definition of response time：The response time is defined as the time interval between the 10% and 90% amplitudes.



Note 5. Definition of view angle(θ，ϕ)：





Note 6 Light source: C light.

10. 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

ITEM	CONDITIONS	CRITERION
OPERATING TEMPERATURE	HIGH TEMPERTURE +70℃ 48HRS	NO DEFECT IN DISPLAYING AND OPERATIONAL FUNCTION
	LOW TEMPERTURE -20℃ 48HRS	
STORAGE TEMPERATURE	HIGH TEMPERTURE +80℃ 48HRS	NO DEFECT IN DISPLAYING AND OPERATIONAL FUNCTION
	LOW TEMPERTURE -30℃ 48HRS	
HUMIDITY	60℃ 90%RH 48HRS	NO DEFECT IN DISPLAYING AND OPERATIONAL FUNCTION

11. Inspection Standards

1. AQL(Acceptable Quality Level)

AQL of major and minor defect

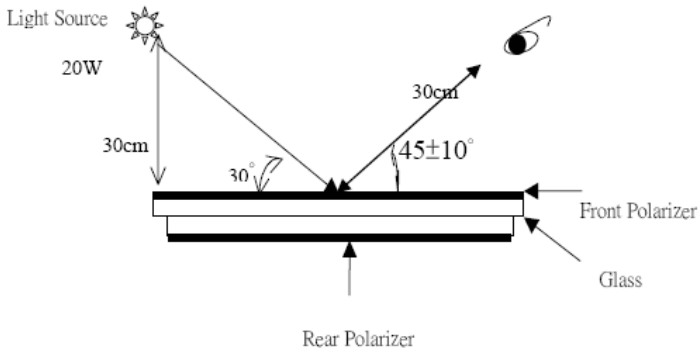
	MAJOR DEFECT	MINOR DEFECT	MAJOR+MINOR
APPEARANCE	0.40%	1.0%	1.0%
ELECTRIC-OPTICAL	0.15%	0.15%	0.15%

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)

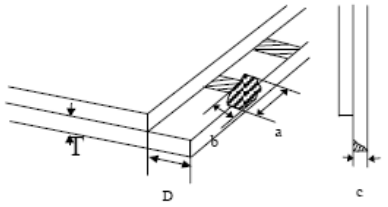
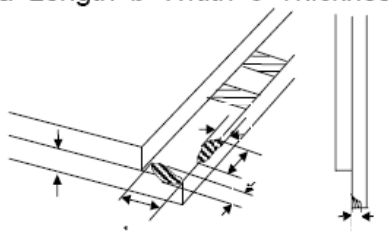


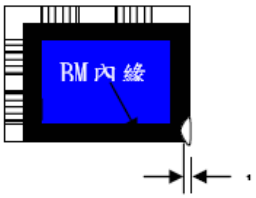
3. Inspection item and criteria

3.1 Visual inspection criterion in immobility

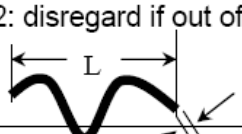
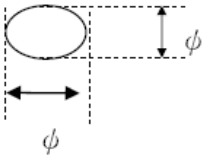
3.1.1 Glass defect

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

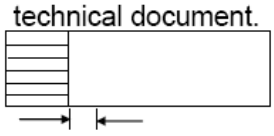
No	Defect item	Criteria		Remark
1	Copper screen peel (Major defect)	Copper screen peel 【Reject】		
2	No release tape or peel (Major defect)	No release tape or peel 【Reject】		
3	Dirty dot and impurity of FPC for customer using side (minor defect)	Specification	Allowable	note1: Cannot have stride ITO impurities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

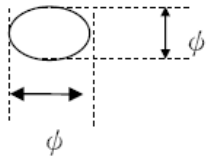
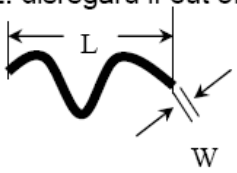
3.1.5 Silicon and Tuffy glue

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	

12. 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.

13. Records Of Version

Version	Revise Date	Page	Content
00	2013-7-5	All	New released