



PRODUCT SPECIFICATION **FOR LCD MODULE**

Revision: 01

Model No: JT0TFT7040001A

Module Type: LCM

APPROVED SIGNATURE

- ☐ Approved Product Specification only
- ☒ Approved Product Specification and Samples

<u>Prepared By</u>	<u>Checked By</u>	<u>Approved By</u>

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1. General Description

JT13001T70-01 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 800(RGB)*480, 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 800×RGB×480 Dot-matrix
Input Data	24 bit RGB interface
Viewing Direction	12 O'clock

3. Mechanical Specification

Item	Contents	Unit
Module size (W×H×T)	164.90 ×100.0 × 6.80	mm
Number of dots	800(RGB) × 480	---
Active area (W×H)	154.08×85.92	mm
Backlight power consumption	0.864	W
Panel power consumption	0.226	W
Weight	TBD	g

5. Absolute Maximum Ratings

Item	Symbol	Values		Unit	Remark
		Min.	Max.		
Power voltage	DV _{DD}	-0.3	5.0	V	
	AV _{DD}	6.5	13.5	V	
	V _{GH}	-0.3	40.0	V	
	V _{GL}	-20.0	0.3	V	
	V _{GH} -V _{GL}	-	40.0	V	
Operation Temperature	T _{OP}	-20	+70	°C	
Storage Temperature	T _{ST}	-30	+80	°C	
LED Reverse Voltage	V _R	-	1.2	V	Each LED Note 2
LED Forward Current	I _F	-	25	mA	Each LED

Note 1: The absolute maximum rating values of this product are not allowed to be exceeded at any times. Should a module be used with any of the absolute maximum ratings exceeded, the characteristics of the module may not be recovered, or in an extreme case, the module may be permanently destroyed.

Note 2: V_R Conditions: Zener Diode 20mA

6. Electrical Characteristics

6-1 Typical Operation Conditions

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Power voltage	DV _{DD}	3.0	3.3	3.6	V	Note 2
	AV _{DD}	10.2	10.4	10.6	V	
	V _{GH}	15.3	16.0	16.7	V	
	V _{GL}	-7.7	-7.0	-6.3	V	
Input signal voltage	V _{COM}	3.8	4.0	4.2	V	
Input logic high voltage	V _{IH}	0.7 DV _{DD}	-	DV _{DD}	V	Note 3
Input logic low voltage	V _{IL}	0	-	0.3 DV _{DD}	V	

Note 1: Be sure to apply DV_{DD} and V_{GL} to the LCD first, and then apply V_{GH}.

Note 2: DV_{DD} setting should match the signals output voltage (refer to Note 3) of customer's system board.

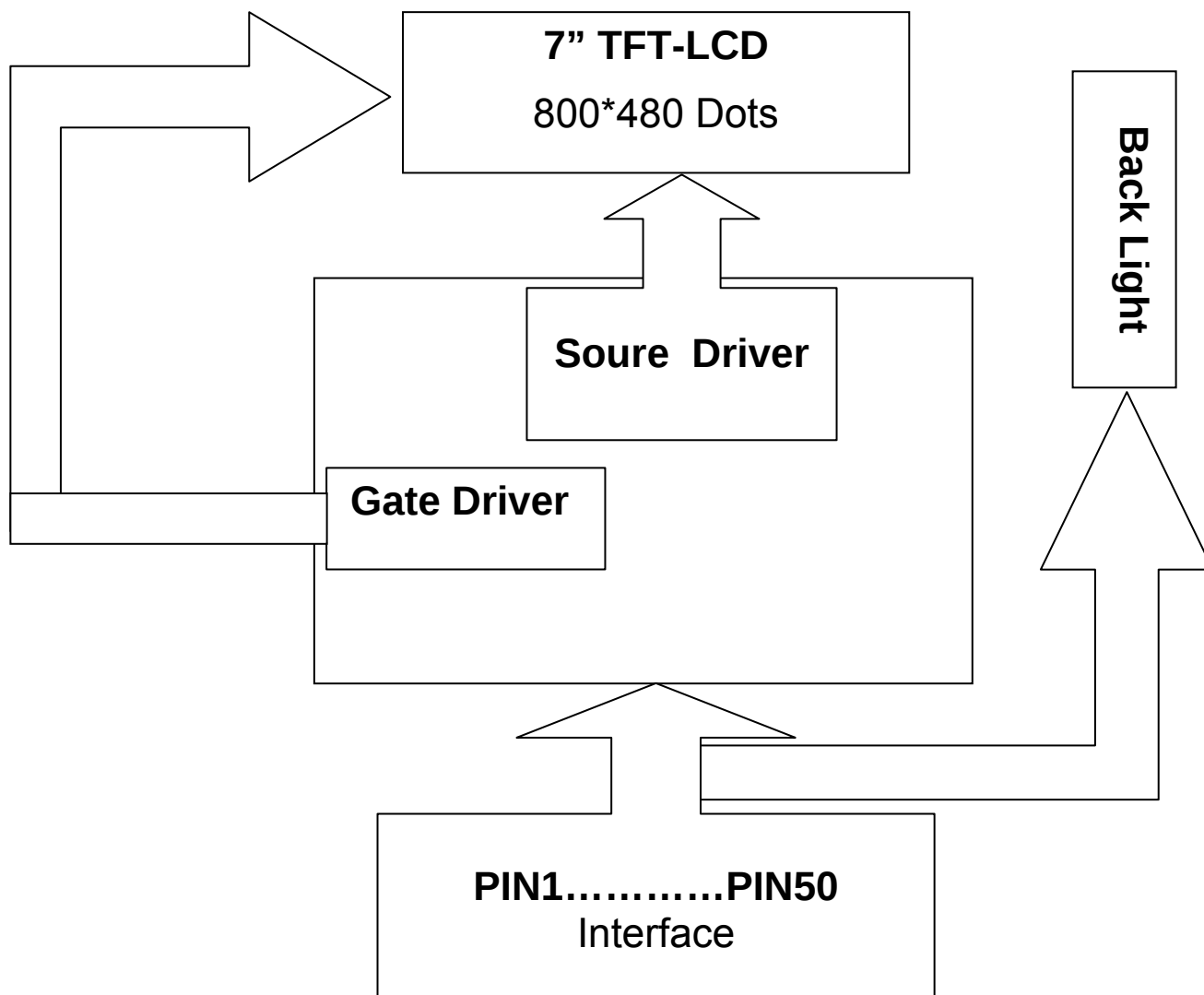
Note 3: DCLK, HS, VS, RESET, U/D, L/R, DE, R0~R7, G0~G7, B0~B7, MODE, DITHB.

6-2 Current Consumption

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Current for Driver	I _{GH}	-	0.2	1.0	mA	V _{GH} = 16.0V
	I _{GL}	-	0.2	1.0	mA	V _{GL} = -7.0V
	IDV _{DD}	-	4.0	10	mA	DV _{DD} = 3.3V
	IAV _{DD}	-	20	50	mA	AV _{DD} = 10.4V

7. Module Function Description

7-1. Block Diagram Of LCM



7-2. Pin Description

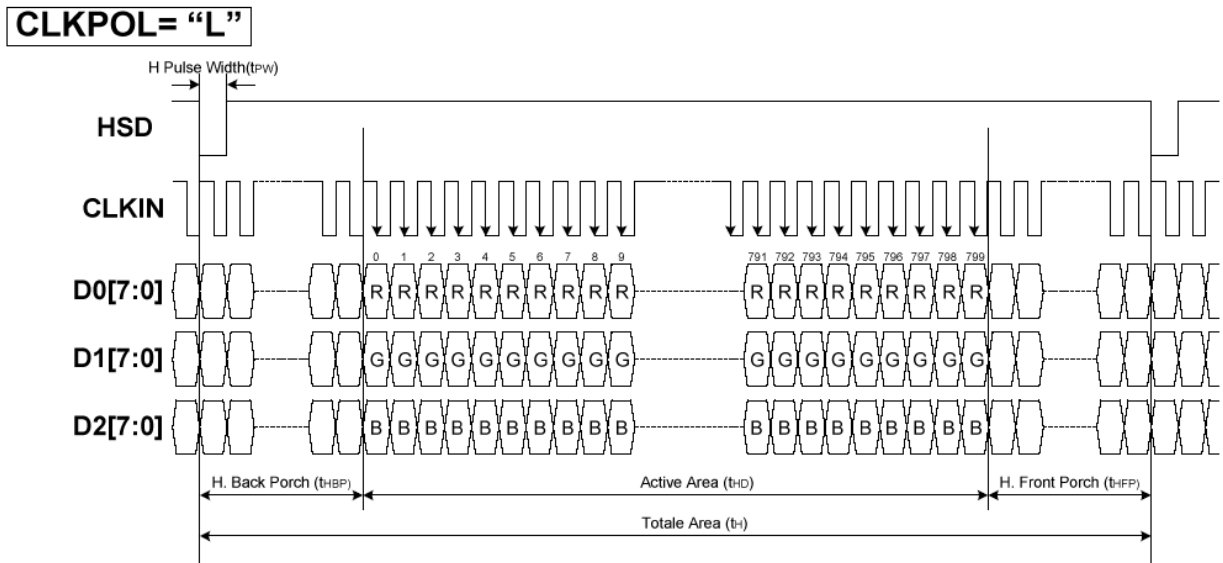
PIN NO.	Symbol	I/O	Description
1-2	LED-A	P	Power for LED backlight anode
3-4	LED-K	P	Power for LED backlight cathode
5	GND	P	Power ground
6	VCOM	O	VCOM output
7	DVDD	P	Power supply for digital block.
8	MODE	I	DE / SYNC mode select.
9	DE	I	Input data enable control.
10	VSD	I	Vertical sync signal
11	HSD	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	VDDG	p	Power supply for gate drive output high
42	VEEG	p	Power supply for gate drive output low
43	AVDD	p	Power supply for analog block. Global reset.
44	RSTB	I	Hardware global reset. Low active.
45	NC	--	NC
46	VCOM	O	VCOM output
47	DITH	I	Dithering function enable control.
48	GND	P	Power ground
49-50	NC	--	NC

7-3. Timing Characteristics

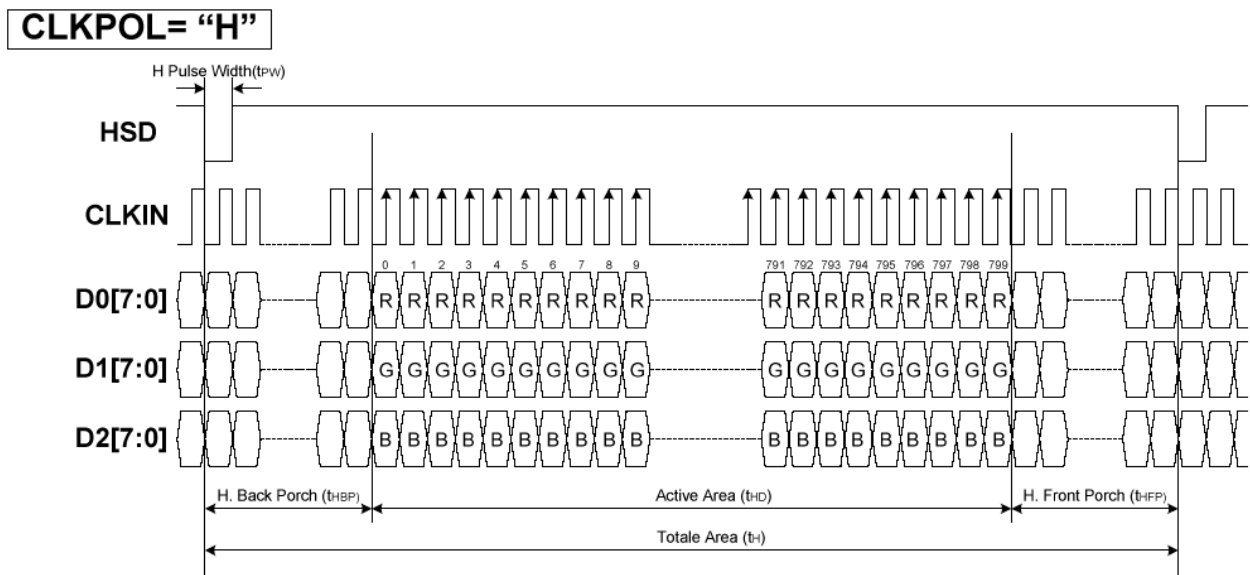
7.3.1 SYNC MODE(MODE=L)

ILI6122 will enter SYNC mode while MODE pin is fixed at "L" level. Every HSD period is consists of Horizontal Back Porch, Active Area and Horizontal Front Porch time. The first active display data is transmitted at the first falling/rising edge of CLKIN after Horizontal Back Porch period and the last display data is transmitted at the last falling/rising edge of CLKIN before Horizontal Front Porch period.

ILI6122 will latch the display data on Dx[7:0] bus at falling edge of CLKIN when CLKPOL is set to "L", the input data timing is illustrated as below:

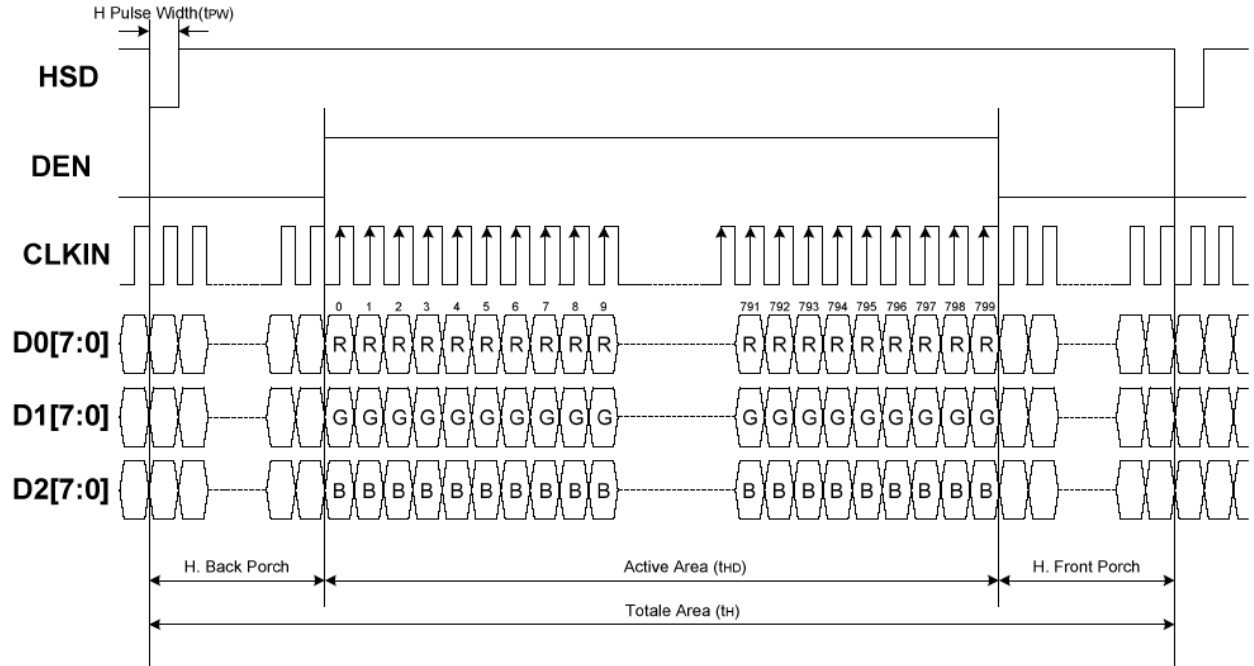


ILI6122 will latch the display data on Dx[7:0] bus at rising edge of CLKIN when CLKPOL is set to "H", the input data timing is illustrated as below:

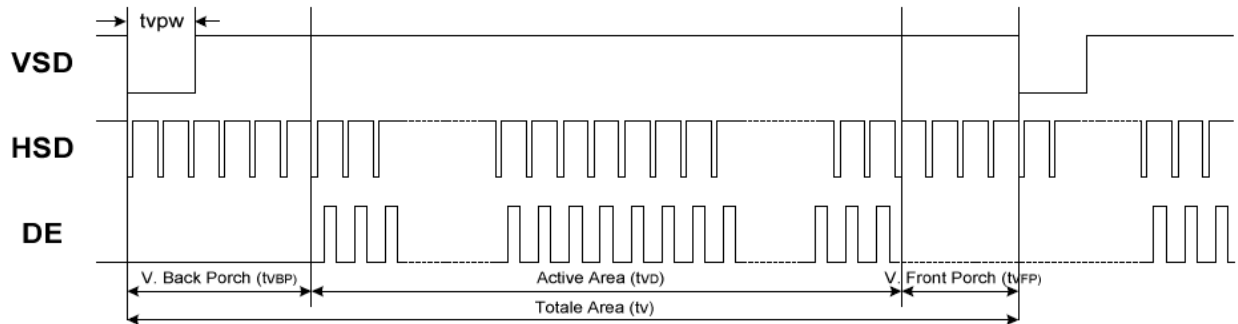


7.3.2 DE MODE(MODE=H)

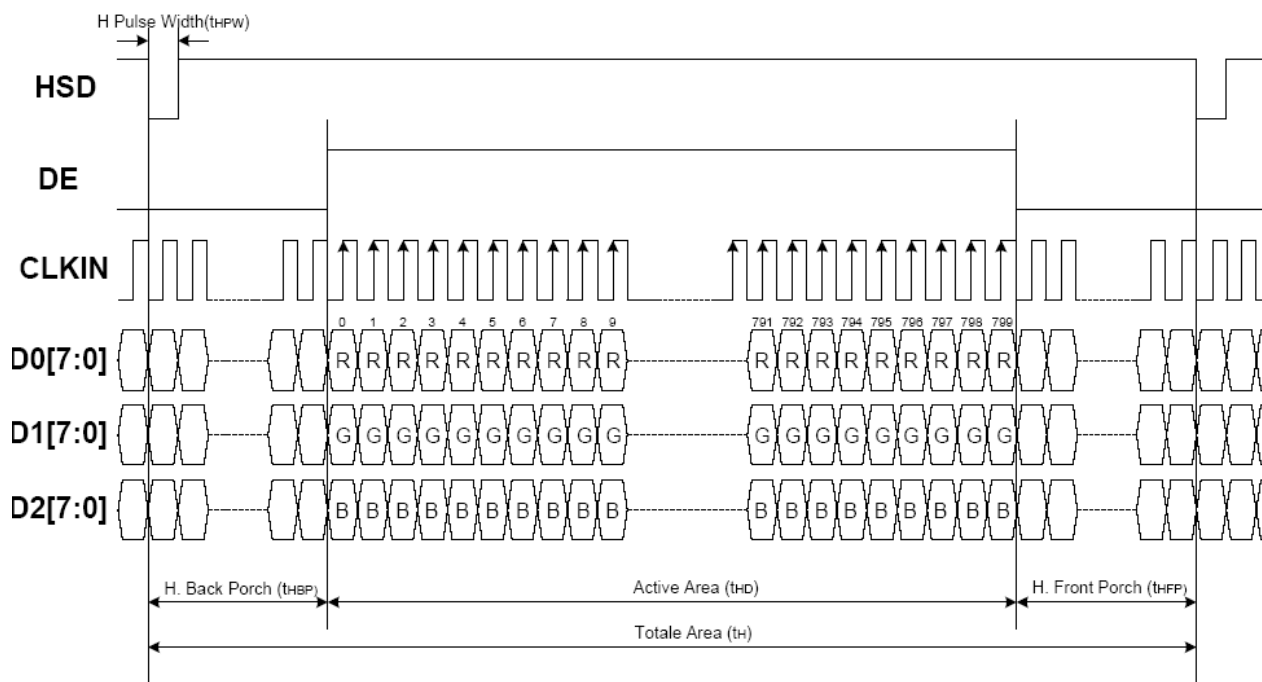
ILI6122 will enter DE mode while MODE pin is fixed at “H” level. ILI6122 will treat the data on Dx[7:0] bus as active display data while DEN is at “H” level and ignore the data on Dx[7:0] bus while DEN is at “L” level.



7.3.3 Display Timing characteristics

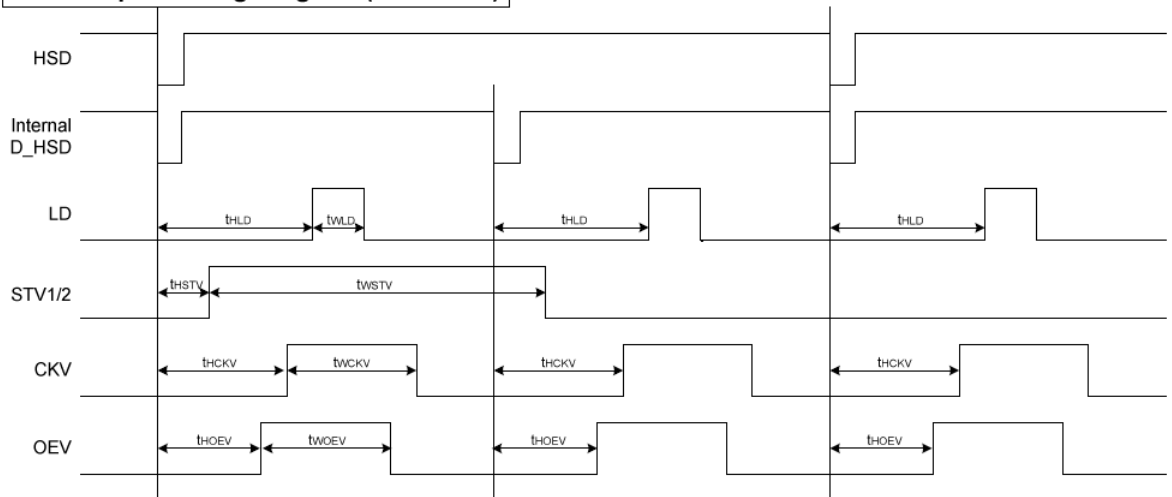


Vertical Input Timing					
Parameter	Symbol	Min.	Value		Unit
			Typ.	Max.	
Vertical display area	t _{VD}	--	480	--	HSD
VSD period time	t _V	510	525	650	HSD
VSD pulse width	t _{VPW}	1	--	20	HSD
VSD back porch	t _{VBP}	23	23	23	HSD
VSD front porch	t _{VFP}	7	22	147	HSD



Horizontal Input Timing						
Parameter		Symbol	Value			Unit
			Min.	Typ.	Max.	
Horizontal display area		t _{HD}	--	800	--	CLKIN
CLKIN frequency		f _{CLK}	--	33.3	50	MHz
1 Horizontal line period		t _H	862	1056	1200	CLKIN
HSD pulse width	Min.	t _{HPW}	--	1	--	CLKIN
	Typ.		--	--	--	CLKIN
	Max.		--	40	--	CLKIN
HSD back porch	SYNC	t _{HBP}	46	46	46	CLKIN
HSD front porch	SYNC	t _{HFP}	16	210	354	CLKIN

Gate Output Timing Diagram (Dual Gate)

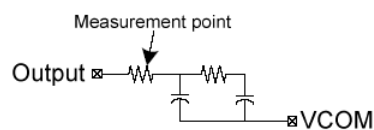


Parameter	Symbol	Spec			Unit	Conditions
		Min.	Typ.	Max.		
VDD Power ON slew rate	t_{POR}	--	--	20	ms	0V ~ 0.9VDD
RSTB pulse width	t_{RST}	10	--	--	us	CLKIN=50MHz
CLKIN cycle time	t_{CPH}	20	--	--	ns	
CLKIN pulse duty	t_{CWH}	40	50	60	%	
VSD setup time	t_{VST}	8	--	--	ns	
VSD hold time	t_{VHD}	8	--	--	ns	
HSD setup time	t_{HST}	8	--	--	ns	
HSD hold time	t_{HHD}	8	--	--	ns	
Data setup time	t_{DST}	8	--	--	ns	D0[7:0], D1[7:0], D2[7:0] to CLKIN
Data hold time	t_{DHD}	8	--	--	ns	D0[7:0], D1[7:0], D2[7:0] to CLKIN
DE setup time	t_{EST}	8	--	--	ns	
DE hold time	t_{EHD}	8	--	--	ns	
Output stable time	t_{SST}	--	--	6	us	10% to 90% target voltage. CL=120pF, R=10K Ω
CLKIN frequency	f_{CLK}	--	40	50	MHz	VDD=3.0 ~ 3.6V
CLKIN cycle time	t_{CLK}	20	25	--	ns	
CLKIN pulse duty	t_{CWH}	40	50	60	%	T_{CLK}
Time from HSD to Source output	t_{HSO}	--	20	--	CLKIN	
Time from HSD to LD	t_{HLD}	--	20	--	CLKIN	Note (2)
Time from HSD to STV	t_{HSTV}	--	2	--	CLKIN	
Time from HSD to CKV	t_{HCKV}	--	20	--	CLKIN	
Time from HSD to OEV	t_{HOEV}	--	4	--	CLKIN	
LD pulse width	t_{WLD}	--	10	--	CLKIN	Note (2)
CKV pulse width	t_{WCKV}	--	66	--	CLKIN	
OEV pulse width	t_{WOEV}	--	74	--	CLKIN	

Note: (1) VDD=3.0 ~ 3.6V, VDDA=6.5~13.5V, DGND=AGND=0V, Ta=-20~+85℃

(2) The contents of the data register are transferred to the latch circuit at the rising edge of LD. Then the gray scale voltage is output from the device at the falling edge of LD.

(3) Output loading condition :



8. Backlight Characteristics

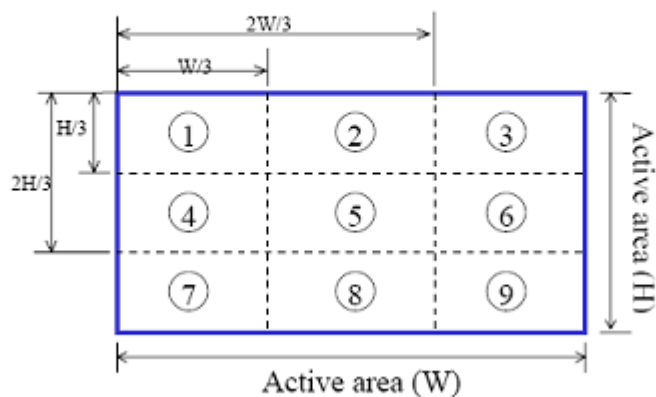
Item	Symbol	Min	Typ	Max	Unit	Remark
Forward voltage	V_{BL}	-	9.6	-	V	-
Current	I_{BL}	90	135	180	mA	-
LED life time		20000	-	-	Hr	
ICE	X	0.26	-	0.31	-	-
	Y	0.26	-	0.31	-	
Uniformity	-	80	-	-	%	★1

★1 Uniform measure condition:

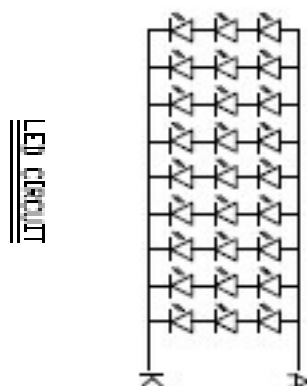
(1) Measure 9 point. Measure location is show below :

(2) $\text{Uniform} = (\text{Min. brightness} / \text{Max. brightness}) \times 100\%$

(3) Best Contrast.



★2 Backlight circuit:

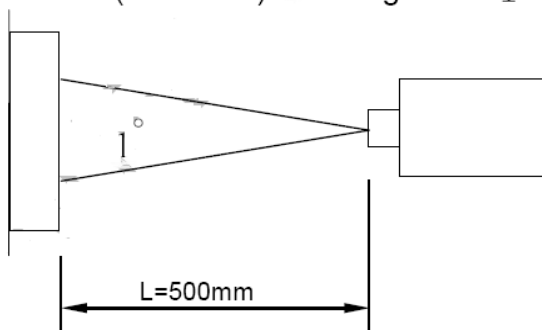


9. Electro-Optical Characteristics

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 Chromaticity	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	-	%	
Luminance	L		300	330		cd/m²	WITH TP	

Note 1. Ambient condition : 25°C $\pm$ 2°C , 60 $\pm$ 10%RH , under 10 Lunx in the darkroom .

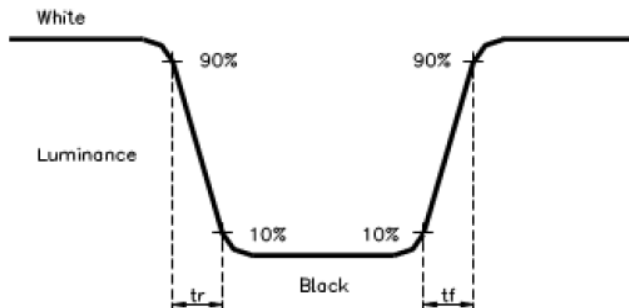
Note 2. Measure device : BM-5A (TOPCON) , viewing cone= 1° , I_L=20mA .



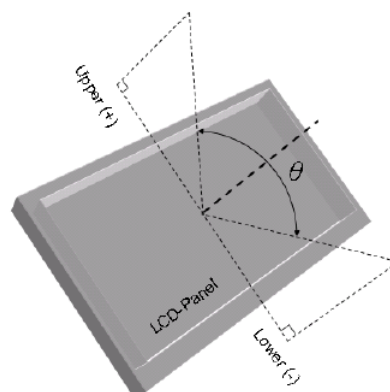
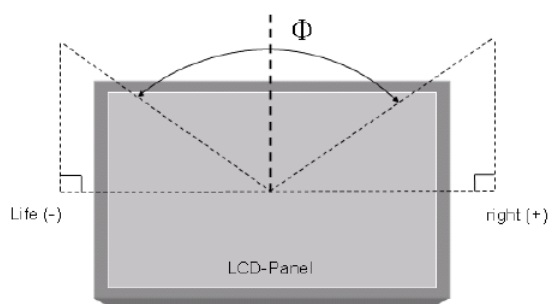
Note 3. Definition of Contrast Ratio :

$$CR = \text{White Luminance (ON)} / \text{Black Luminance (OFF)}$$

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°C 240HRS	NO DEFECT IN DISPLAYING AND OPERATIONAL FUNCTION
	LOW TEMPERTURE -20°C 240HRS	
STORAGE TEMPERATURE	HIGH TEMPERTURE +80°C 240HRS	NO DEFECT IN DISPLAYING AND OPERATIONAL FUNCTION
	LOW TEMPERTURE -30°C 240HRS	
HUMIDITY	+60°C 90%RH 240HRS	NO DEFECT IN DISPLAYING AND OPERATIONAL FUNCTION
Thermal Shock	-30°C/30 min ~ +80°C/30 min for a total 100 cycles, Start with cold temperature and end with high temperature.	NO DEFECT IN DISPLAYING AND OPERATIONAL FUNCTION

ITEM	CONDITIONS	CRITERION
Vibration Test	Frequency range:10~55Hz Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X. Y. Z. (6 hours for total)	NO DEFECT IN DISPLAYING AND OPERATIONAL FUNCTION
Package Vibration	Random Vibration : 0.015G*G/Hz from 5-200HZ, - 6dB/Octave from 200-500HZ 2 hours for each direction of X. Y. Z. (6 hours for total)	NO DEFECT IN DISPLAYING AND OPERATIONAL FUNCTION
Mechanical Shock	100G 6ms,±X, ±Y, ±Z 3 times for each direction	NO DEFECT IN DISPLAYING AND OPERATIONAL FUNCTION
Package Drop	Height:60 cm 1 corner, 3 edges, 6 surfaces	NO DEFECT IN DISPLAYING AND OPERATIONAL FUNCTION
Electro Static Discharge	± 2KV, Human Body Mode, 100pF/1500Ω	NO DEFECT IN DISPLAYING AND OPERATIONAL FUNCTION

11. Inspection Standards

1. AQL(Acceptable Quality Level)

AQL of major and minor defect

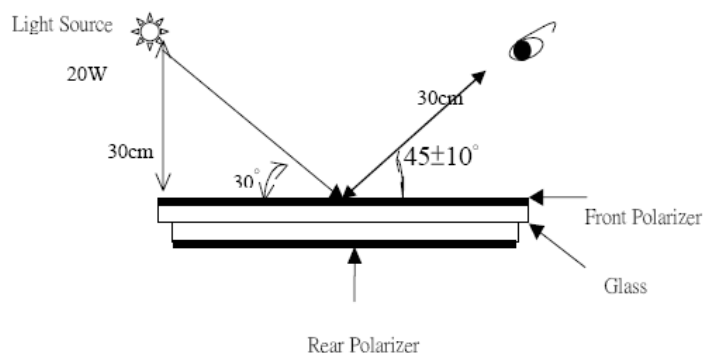
	MAJOR DEFECT	MINOR DEFECT	MAJOR+MINOR
APPEARANCE	0.40%	1.0%	1.0%
ELECTRIC-OPTICAL	0.15%	0.15%	0.15%

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)

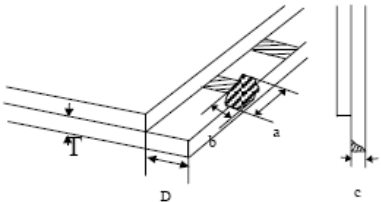
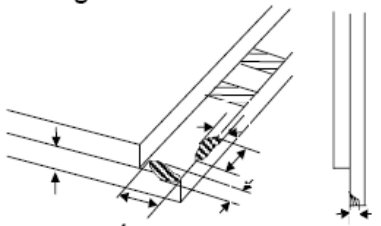


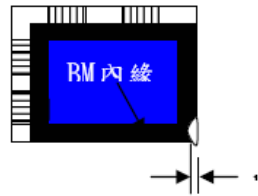
3. Inspection item and criteria

3.1 Visual inspection criterion in immobility

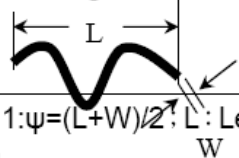
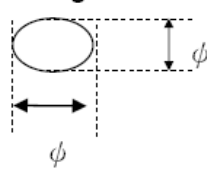
3.1.1 Glass defect

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) $b \leq 1/3$ Pin width(non bonding area) 【Accept】 2) bonding area $\leq 0.5\text{mm}$ 【Accept】	a:Length, b:Width
4	Pin-side , conductive area damaged (minor defect)	(a c : disregards) $b \leq 1/3$ 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 (Inclueing contraposition mark,except scribing mark) 【Accept】 2) $c < T$ $b \leq BM \ 1/3$ 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 : Thickness b: width of damage 
		$c = T$ b not touch the seal glue 【Reject】	

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 
		$0.05\text{mm} < W \leq 0.1\text{mm};$ $L \leq 3.0\text{mm}$	1	
		$W > 0.1\text{mm}; L > 3.0\text{mm}$	0	
2	Polarizer bubble 、 concave and convex (minor defect)	$\psi \leq 0.2\text{mm}$	disregard	note 1: $\psi = (L+W)/2$; L : Length , W : Width note2: disregard if out of AA 
		$0.2\text{mm} < \psi \leq 0.3\text{mm}$	2	
		$0.3\text{mm} < \psi \leq 0.5\text{mm}$	1	
		$0.5\text{mm} < \psi$	0	
3	Black dots 、dirty dots 、 impurities 、eyewinker (Major defect)	$\psi \leq 0.15\text{mm}$	disregard	note2: disregard if out of AA
		$0.15\text{mm} < \psi \leq 0.25\text{mm}$	2	
		$0.25\text{mm} < \psi \leq 0.3\text{mm}$	1	
		$0.3\text{mm} < \psi$	0	
4	Polarizer prick (Major defect)	$\psi \leq 0.1\text{mm}$	disregard	note1: $\psi = (L+W)/2$; L= Length , W=Width note2: the distance between two dots > 5mm
		$0.1\text{mm} < \psi \leq 0.25\text{mm}$	3	
		$\psi > 0.25\text{mm}$	0	

3.1.3 .FPC

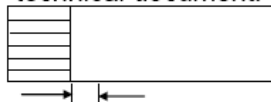
No	Defect item	Criteria		Remark
1	Copper screen peel (Major defect)	Copper screen peel 【 Reject】		
2	No release tape or peel (Major defect)	No release tape or peel 【 Reject】		
3	Dirty dot and impurity of FPC for customer using side (minor defect)	Specification	Allowable	note1: Cannot have stride ITO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

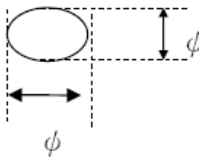
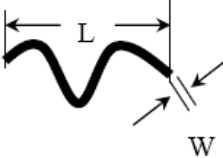
3.1.5 Silicon and Tuffy glue

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 
		$\psi \leq 0.15\text{mm}$	disregard	
		$0.15\text{mm} < \psi \leq 0.25\text{mm}$	2	
		$0.25\text{mm} < \psi \leq 0.3\text{mm}$	1	
		$0.3\text{mm} < \psi$	0	
12	Fiber 、 glass cratch 、 polarizer scratch/folded (minor defect)	$W \leq 0.03\text{mm}$	disregard	note1: L : Length 、 W : Width note2: disregard if out of AA 
		$0.03\text{mm} < W \leq 0.05\text{mm} ;$ $L \leq 3.0\text{mm}$	2	
		$0.05\text{mm} < W \leq 0.1\text{mm} ;$ $L \leq 3.0\text{mm}$	1	
		$W > 0.1\text{mm} ; L > 3.0\text{mm}$	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
01	2013-9-16	All	New released