SPECIFICATION FOR LCD MODULE

Part No.:	MLT043R40-CT30
Customer No.:	
Spec Version:	03
Issued Date:	2018.11.30
Customer approval:	

Designed 设计者	Checked 审核者	Approved 核准者

※Please pay more attention for the “inspection standard”, we assume you already agree this standard when place an order with us.

※The specification of “TBD” should refer to the measured value of sample .

2. Revision Record

Date	Rev.No.	Page	Revision Items	Prepared
2018-11-30	01		The first release	GZH
2019-02-21	02		Updated the drawing	JOHN
2019-02-23	03		Add inspection criteria	JOHN

3. General Specifications

MLT043R40-CT30 is a TFT-LCD module. It is composed of a TFT-LCD panel, driver IC, FPC, a back light and CTP unit. The 4.3″ display area contains 480 x 272 pixels and can display up to 16.7M colors. This product accords with RoHS environmental criterion.

3.1 LCD parameter

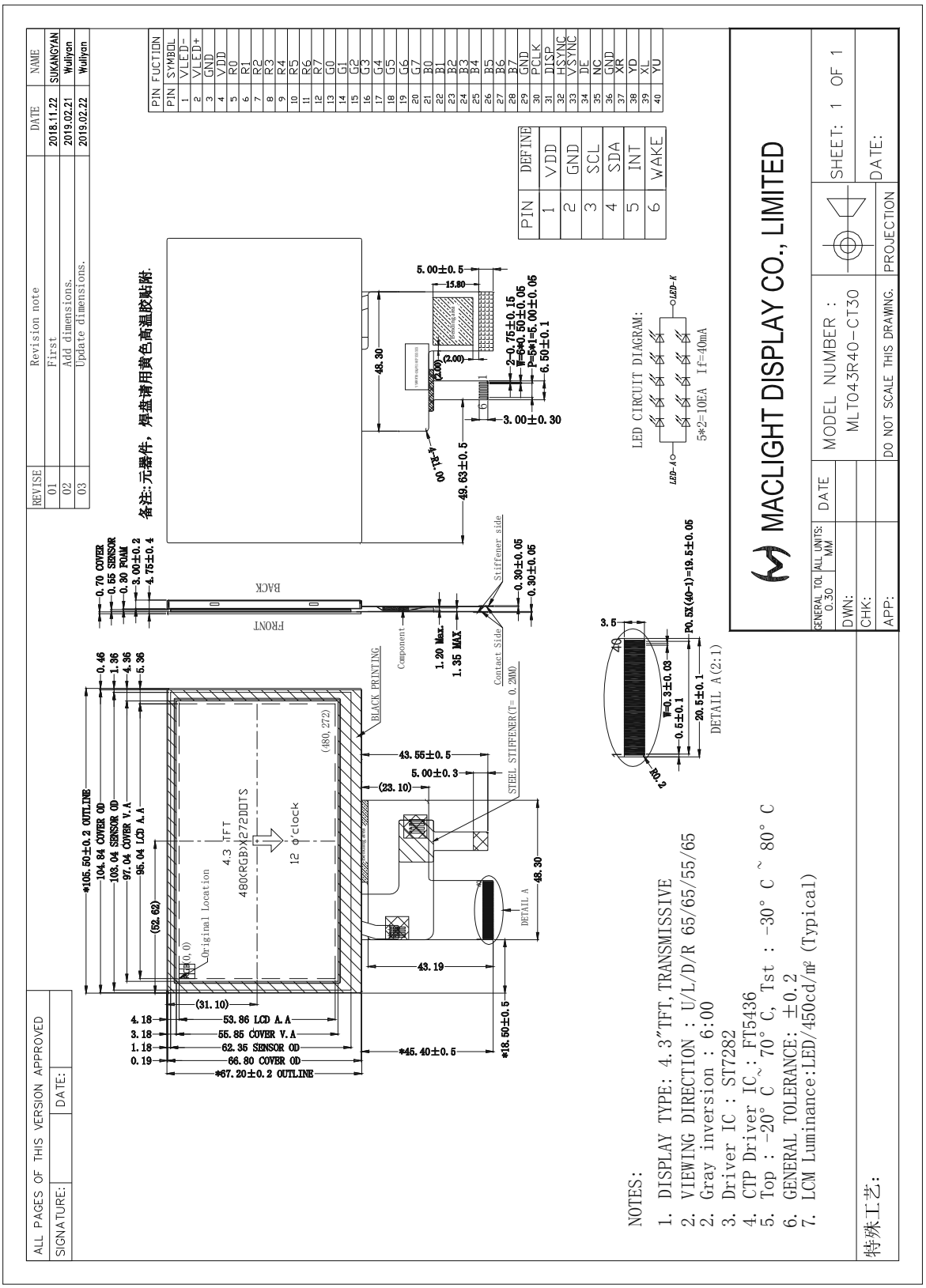
Item	Contents	Unit	Note
LCD Type	TFT	-	
Display color	16.7M		
Viewing Direction	12	O'Clock	
Gray scale inversion	6	O'Clock	
Operating temperature	-20~+70	℃	
Storage temperature	-30~+80	℃	
Module size	Refer to outline drawing	mm	
Active Area(W×H)	95.04X53.86	mm	
Number of Dots	480×272	dots	
Controller	ST7282	-	
Power Supply Voltage	3.3	V	
Outline Dimensions	Refer to outline drawing	-	
Backlight	5*2-LEDs (white)	pcs	
Weight	---	g	
Interface	RGB888	-	

3.2 CTP parameter

Item	Contents	Unit	Note
Outline Size	104.84(H)X66.8(V)X1.45(T)	mm	
Cover View Area	97.04(H)X55.85(V)	mm	
CTP Resolution	480×272	-	
Interface Mode	IIC	-	
Touch Mode	5 Human fingers multi touch		
Controller	FT5436	-	
IIC Address	0x70	-	
Optical Characteristics	Transparency>=86%	-	
Surface Hadness	>=6H	-	

4.Drawing

4.1 LCM



5. Absolute Maximum Ratings(Ta=25℃)

5.1 Electrical Absolute Maximum Ratings.(Vss=0V ,Ta=25℃)

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	V_{DD}	-0.3	3.6	V	1，2

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. V_{DD} >V_{SS} must be maintained.

3. Please be sure users are grounded when handing LCD Module.

5.2 Environmental Absolute Maximum Ratings.

Item	Storage		Operating		Note
	MIN.	MAX.	MIN.	MAX.	
Ambient Temperature	-30℃	80℃	-20℃	70℃	1,2
Humidity	-	-	-	-	3

1. The response time will become lower when operated at low temperature.

2. Background color changes slightly depending on ambient temperature.

The phenomenon is reversible.

3. Ta<=40 ℃:85%RH MAX.

Ta>=40 ℃:Absolute humidity must be lower than the humidity of 85%RH at 40 ℃.

6. Electrical Specifications and Instruction Code

6.1.1 LCM Electrical characteristics(Vss=0V ,Ta=25℃)

Parameter		Symbol	Condition	Min	Typ	Max	Unit	Note
Power supply		VDD	Ta=25℃	3.0	3.3	3.6	V	
Input voltage	'H'	V_{IH}	V_{DD}=3.3V	0.8V_{DD}	-	V_{DD}	V	
	'L'	V_{IL}	V_{DD}=3.3V	0	-	0.2V_{DD}	V	

Note: 1: Tested in 1×1 chessboard pattern.

6.1.2 CTP Characteristics

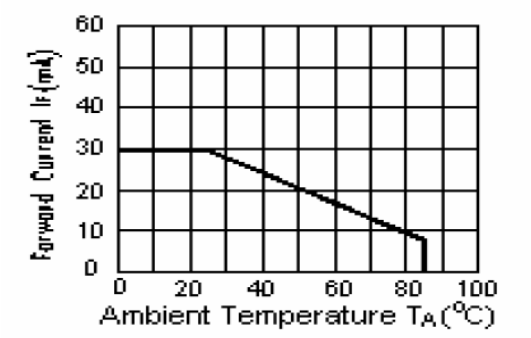
Parameter		Symbol	MIN	TYP	MAX	Unit	Remark
Supply Voltage		VDD_CTP	2.8	-	3.6	V	
Input Signal Voltage	Low Level	VIL	-0.3	-	0.3* VDD_CTP	V	
	High Level	VIH	0.7* VDD_CTP	-	VDD_CTP	V	
Output Signal Voltage	Low Level	VOL	-	-	0.3* VDD_CTP	V	
	High Level	VOH	0.7* VDD_CTP	-	-	V	

6.2 LED backlight specification(VSS=0V ,Ta=25℃)

Item	Symbol	Condition	Min	Typ	Max	Unit	Note
Supply voltage	V_f	If=2*20mA	-	15	-	V	
Uniformity	∆Bp	If=2*20mA	75	-	-	%	

Note:

LED power consumption is around 0.06W.



ILED VS TEMP

6.3 Interface signals

Pin No.	Symbol	I/O	Function
1	VLED-	P	LED back light(Cathode)
2	VLED+	P	LED back light(Anode)
3	GND	P	Ground.
4	VDD	P	Power supply
5-12	R0~R7	I	Red data bus
13-20	G0~G7	I	Green data bus
21-28	B0~B7	I	Blue data bus
29	GND	P	Ground.
30	PCLK	I	Data clock
31	DISP	I	Standby mode select pin
32	HSYNC	I	Line sync signal
33	VSYNC	I	Frame sync signal
34	DE	I	Data enable pin
35	NC	-	No connection.
36	GND	P	Ground.
37	XR	O	Touch panel
38	YD	O	
39	XL	O	
40	YU	O	

CTP PIN:

Pin No.	Symbol	I/O	Function
1	VDD	P	CTP power supply
2	GND	P	CTP Ground.
3	SCL	I	CTP serial clock signal
4	SDA	I	CTP serial Input/output data bus
5	INT	I	external Interrupt to the IC of CTP
6	WAKE	I	CTP reset

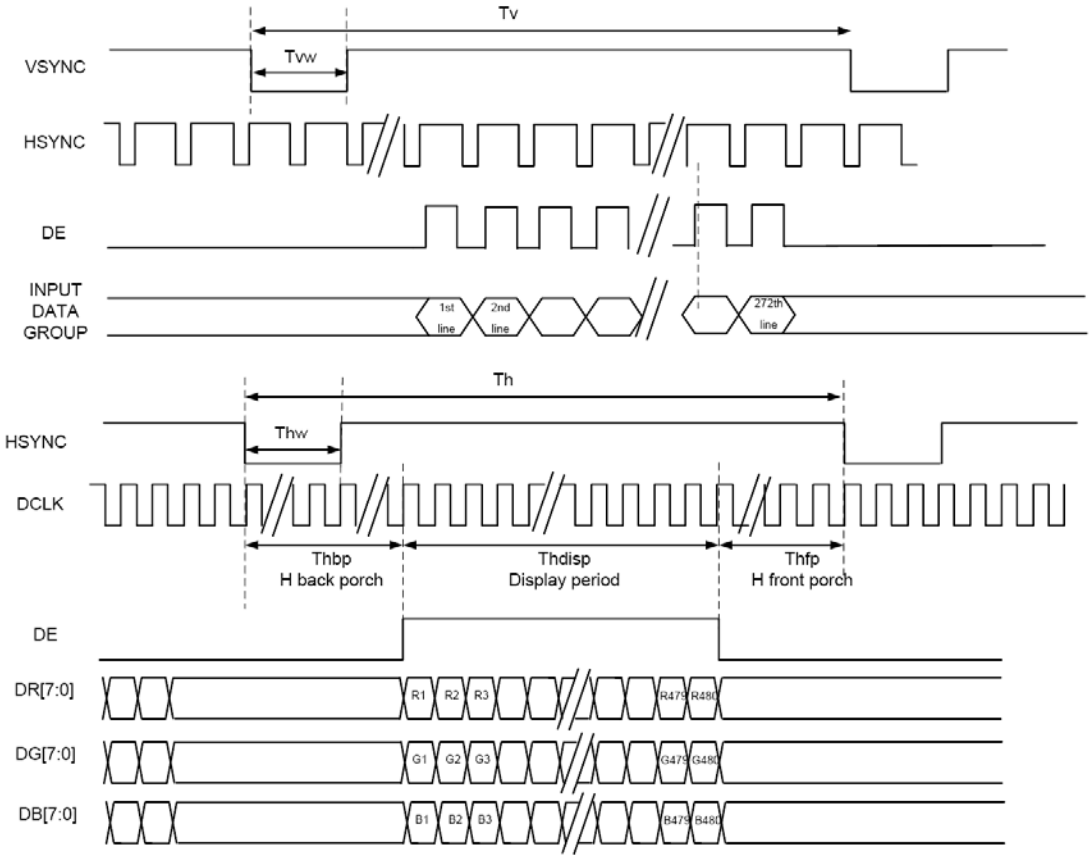
6.4 AC Characteristics

6.4.1 Parallel 24-bit RGB Timing Table

Item		Symbol	Min.	Typ.	Max.	Unit	Remark
DCLK Frequency		Fclk	8	9	12	MHz	
DCLK Period		Tclk	83	111	125	ns	
HSYNC	Period Time	Th	485	531	598	DCLK	
	Display Period	Thdisp		480		DCLK	
	Back Porch	Thbp	3	43	43	DCLK	By H_Blanking setting
	Front Porch	Thfp	2	8	75	DCLK	
	Pulse Width	Thw	2	4	75	DCLK	
VSYNC	Period Time	Tv	276	292	321	H	
	Display Period	Tvdisp		272		H	
	Back Porch	Tvbp	2	12	12	H	By V_Blanking setting
	Front Porch	Tvfp	2	8	37	H	
	Pulse Width	Tvw	2	4	37	H	

Note: It is necessary to keep Tvbp =12 and Thbp =43 in sync mode. DE mode is unnecessary to keep it.

6.4.2 SYNC-DE Mode Timing Diagram



7. *Optical Characteristics*

Item	Symbol		Condition	Min.	Typ.	Max.	Unit	Note
Brightness	Bp		θ=0° Φ=0°	350	450	-	Cd/m²	1
Uniformity	⊿Bp			75	-	-	%	1,2
Viewing Angle	3:00		Cr≥10	55	65	-	Deg	3
	6:00			45	55	-		
	9:00			55	65	-		
	12:00			55	65	-		
Contrast Ratio	Cr		θ=0° Φ=0°	300	500	-	-	4
Response Time	T_r+T_f			-	25	35	ms	5
							ms	
Color of CIE Coordinate	W	x	θ=0° Φ=0°	-0.05	0.313	+0.05	-	1,6
		y			0.323		-	
	R	x			0.618		-	

		y			0.306		-	
	G	x			0.306		-	
		y			0.527		-	
	B	x			0.139		-	
		y			0.098		-	
NTSC Ratio	S				52	-	%	

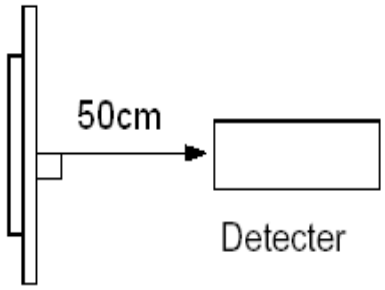
Note：The parameter is slightly changed by temperature, driving voltage and materiel

*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 equipm*ent BM-7 (Φ5mm)

Measuring condition:

- *Measuring surroundings: Dark room.*
- *Measuring temperature: Ta=25 ℃.*
- *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.

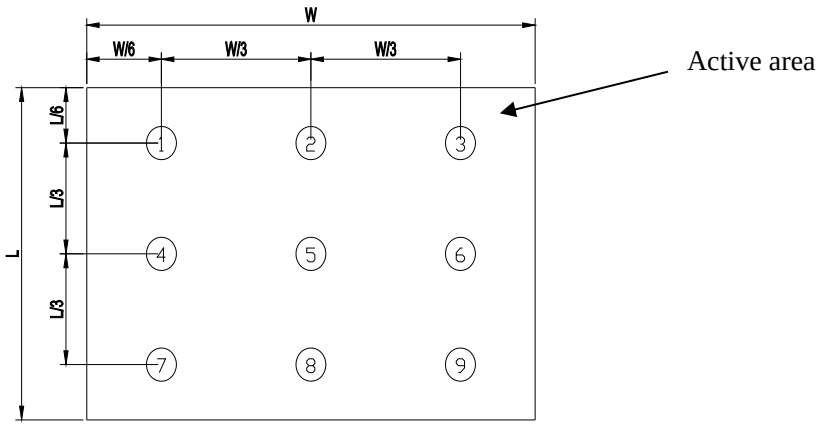


Note 2: The luminance uniformity is calculated by using following formula.

⊿Bp = Bp (Min.) / Bp (Max.)×100 (%)

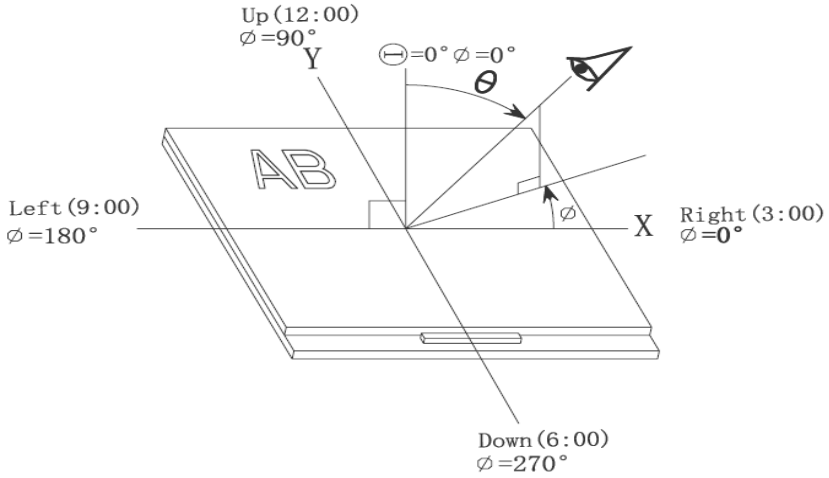
Bp (Max.) = Maximum brightness in 9 measured spots

Bp (Min.) = Minimum brightness in 9 measured spots.

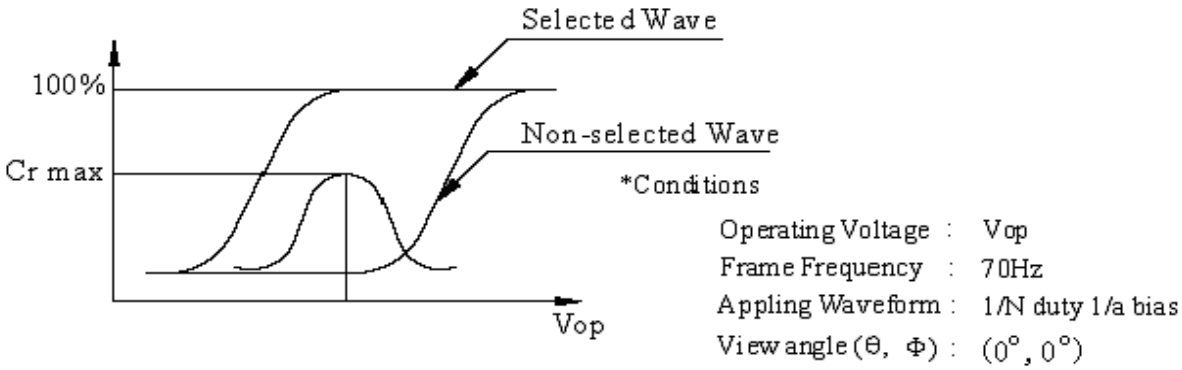


Note 3: The definition of viewing angle:

Refer to the graph below marked by ϑ and Φ



Note 4: Definition of contrast ratio.(Test LCD using DMS501)

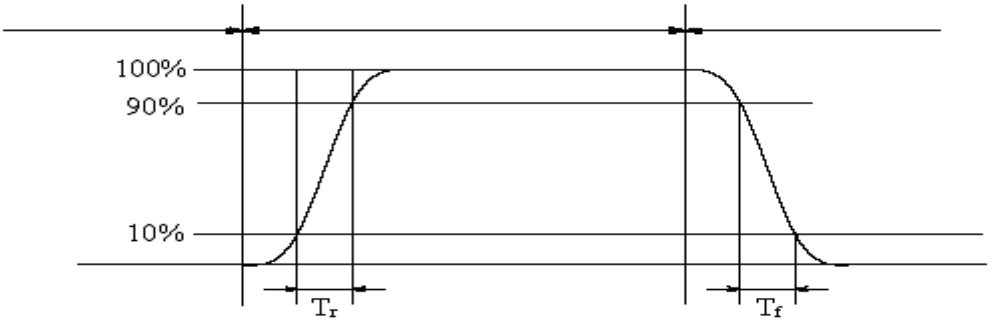


$$Contrast\ ratio(Cr) = \frac{Brightness\ of\ selected\ dots}{Brightness\ of\ non-selected\ dots}$$

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

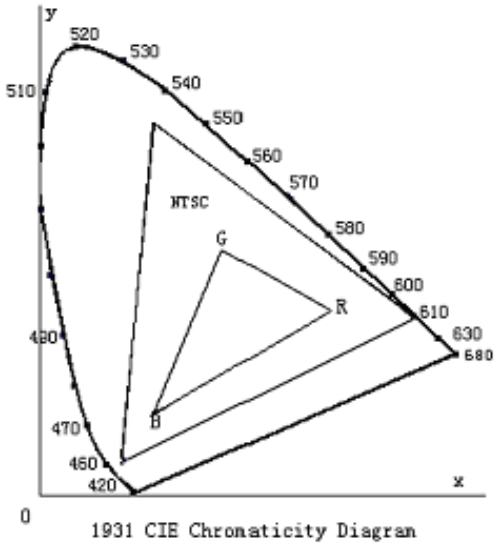
The output signals of photo detector are measured when the input signals are changed from "black" to "white"(falling time) and from "white" to "black"(rising time), respectively. The response time is defined as the time interval between the 10% and 90% of amplitudes.Refer to figure as

below.



The definition of response time

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

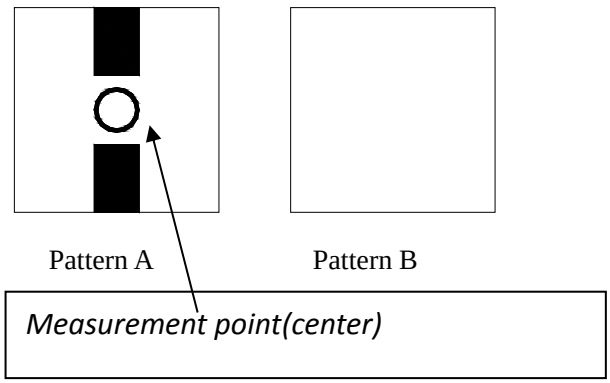


Color gamut:

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

Note 7: Definition of cross talk.

*Cross talk ratio(%)=|pattern A Brightness-pattern B Brightness|/pattern A Brightness*100*



Electric volume value=3F+/-3Hex

8. Reliability Test Items and Criteria

No	Test Item	Test condition	Criterion
1	High Temperature Storage	80℃±2℃ 96H Restore 2H at 25℃ Power off	*Note 1* *Note 2* *Note 3* *Note 4*
2	Low Temperature Storage	-30℃±2℃ 96H Restore 2H at 25℃ Power off	
3	High Temperature Operation	70℃±2℃ 96H Restore 2H at 25℃ Power on	
4	Low Temperature Operation	-20℃±2℃ 96H Restore 4H at 25℃ Power on	
5	High Temperature/Humidity Operation	60℃±2℃ 90%RH 96H Power on	
6	Temperature Cycle	-30℃←————→80℃ 30min 5min 30min after 5 cycle, Restore 2H at 25℃ Power off	

Note: Operation: Supply 3.3V for logic system.

The inspection terms after reliability test, as below

ITEM	Inspection
Contrast	CR>50%
IDD	IDD<200%
Brightness	Brightness>60%
Color Tone	Color Tone+/-0,05

Note 1:Ta is the ambient temperature of samples.

Note 2:Ts is the temperature of panel's surface.

Note 3:In the standard condition,there shall be no practical problem that may after the display function.After the reliability test,the product only guarantees operation,but don't guarantee all of the cosmetic specification.

Note4:Before cosmetic and function test,the product must have enough recovery time,at least 2 hours at room temperature.

9. Precautions for Use of LCD Modules

9.1 Handling Precautions

9.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

9.1.2 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.

9.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

9.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

9.1.5 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 alcohol

Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:

— Water — Ketone — Aromatic solvents

9.1.6 Do not attempt to disassemble the LCD Module.

9.1.7 If the logic circuit power is off, do not apply the input signals.

9.1.8 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.

9.2 Storage precautions

9.2.1 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

9.2.2 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℃ ～ 40℃

Relatively humidity: ≤80%

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

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

10. INSPECTION CRITERION

10.1 Definition

10.1.1 Major defect：

a.Functional defects affect normal operation
b.Performance, parameters (size, brightness, etc.) exceed acceptance criteria.
c.Missing parts, wrong materials, multiple extraneous signs

10.1.2 Minor defect：

Minor defects beside main defects.

10.1.3 Display area

a.V/A：View Area Generally refers to the area that the customer can see after the machine is installed

b.A/A：Ative Area Generally refers to the area can display graphics

c.A/A was included in V/A

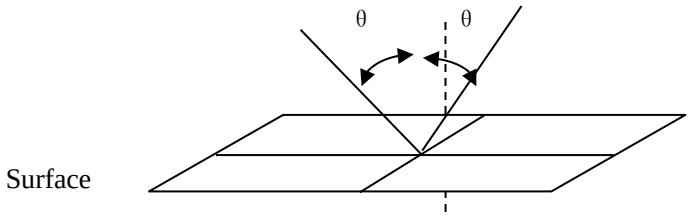
10.2 Inspection condition

10.2.1 Temperature and humidity according to the regulations of the environment management of the "dust free room”

10.2.2 Inspection illuminance according to 500~1000（LUX) for visual inspection and ≦200（LUX）for electrical measurement

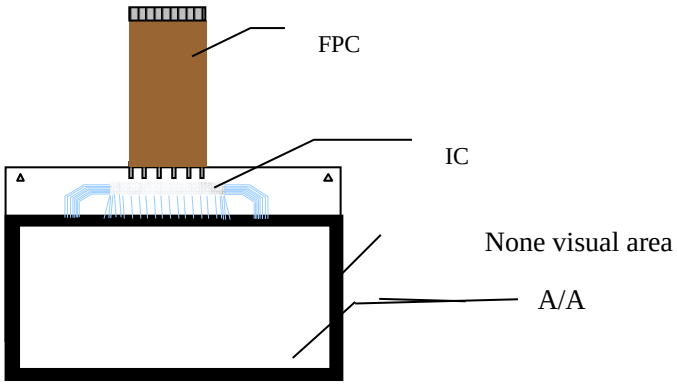
10.3 Inspection mode

10.3.1 Inspection sight distance：30±5cm；The inspection angle is 45 degrees from the perspective of the drawing requirement as θ in the picture



Perspective diagram

10.3.2 Definition of V/A



10.3.3 Attention

10.3.3.1 Wear electrostatic rings and finger sleeves for inspection

10.3.3.2 The inspector performs visual inspection or comparison with the film card and the magnifier

10.3.3.3 The inspector strictly operates according to the inspection specification. If the sample is bad, the sample should be judged according to the limited sample

10.3.3.4 If there is bad judgement, feedback the quality leader in time.

10.3.3.5 The A+ standard is only applicable to designated customers ，The general standard is A standard，A- standards are applied to customers with low standards at home

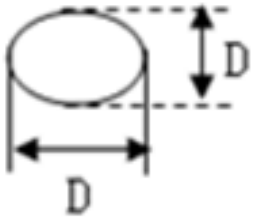
10.3.3.6 Factory purchase original FOG, LCM, please refer to original factory shipment standard

10.4 Standard（The unit size is mm if not specified）

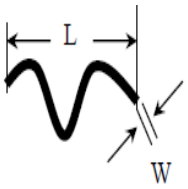
10.4.1 Inspection standard

10.4.1.1 Inspection standard for dot

Size	Standard	A+	A	A-	Remark
≤3.5”	D≤0.10	Ignore	Ignore	Ignore	

	0.10<D≤0.20	1	2	2	Line calculation method：  Dot density＞10mm
	0.20<D≤0.25	0	0	1	
3.5”~5”	D≤0.10	Ignore	Ignore	Ignore	
	0.10<D≤0.25	1	2	2	
	0.25<D≤0.30	0	0	1	
	D＞0.30	0	0	0	
5”~7”	D≤0.15	Ignore	Ignore	Ignore	
	0.15<D≤0.3	3	3	3	
	0.30<D≤0.40	1	2	2	
	0.40<D≤0.50	0	0	1	
7”~10.4”	D≤0.2	Ignore	Ignore	Ignore	
	0.20<D≤0.50	1	2	2	

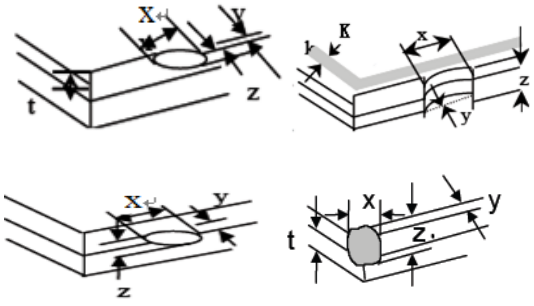
10.4.1.2 Inspection standard for line

Size	Standard	A+	A	A-	Remark
≤3.5”	W<0.03	Ignore	Ignore	Ignore	Dot calculation method：  Line density ＞10mm
	0.03≤W≤0.05 L≤3.0	1	1	2	
	W＞0.05 L＞3	0	0	0	
3.5”~5”	W<0.03	Ignore	Ignore	Ignore	
	0.03≤W≤0.05 L≤3.0	1	1	2	
	W＞0.05 L＞3	0	0	0	
5”~10.4”	W<0.05	Ignore	Ignore	Ignore	
	0.05<W≤0.1 L≤5.0	1	2	3	
	W＞0.1 L＞5.0	0	0	0	

10.4.1.3 Inspection standard for poor function

Item	Description	Standard	Defect category
No display	Can’t display picture	NG	Major defect
Abnormal/inverted display	It is not consistent with the normal display screen when it is lit	Not allowed	Major defect
Lighter display	Bright and dark differences appear on the light or the display is lighter when display Red,green,blue	NG	Major defect
Image retention	The image of the last picture in the next picture	It≤3S	Major defect
Splash screen	A flash of light, flutter, or flutter or waves	NG or refer to limited sample	Major defect
Missing segment	One or more bright lines are missing when lighting.	NG	Major defect
Dark segment	One or more gray lines are missing when lighting	NG	Major defect
Flicker	Bright spot bright spot	NG	Major defect
（MURA）	Black screen appear irregular white blocks / black blocks when lit	5% ND filter NG	Major defect
Over current	Test current exceeds SPEC	NG	Major defect

10.4.1.4 Normal bad appearance

Item	Description	Standard	
Chip and crack	 x：Crack length y：Crack width z：Crack thickness K：Glue width t：Glass thickness	z ≤1/2t；y≤1/3 K；x≤3mm；not affect ITO line and mark，the function test is ok 1/2t < z ≤2t； y not affect glue；x≤2mm；not affect ITO line and mark,the function test is okay	Minor defect
Scratch	LCD surface scratch	According to dot/line	Minor defect
Poor pol	Air bubble	No access overlap area between 1/2 POL and BM	Minor defect
	Dent	NG or refer to limited sample	Minor defect
	Bubble and all poor dot and line	According to dot/line	Minor defect
Attaching skew	Over polarizer distance ±0.3 on FOG	NG	Minor defect
Poor protective film	Dirty	NG or refer to limited sample	Minor defect
	Scratch(Affect POL)	NG	Minor defect
	Scratch(Don’t affect POL)	Hard scratch≤5 bar is OK	Minor defect
Poor glue	Glue doesn’t cover the ITO completely	NG	Major defect
	Glue is thicker than glass or cover the glass	NG	Minor

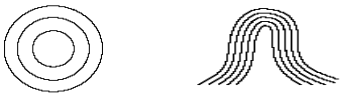
			defect
Poor gleam	Cover TFT surface/Glue width0.8mm/ Doesn't FPC root	NG	Minor defect
Poor cutting	Doesn't affect product assembly	OK	Minor defect
Missing glue	Glue at wrong spot	NG	Major defect
Poor mark	Wrong /Unclear/Broken mark	NG	Minor defect
Mixed material	Mixed with other product or use wrong material at one part	NG	Major defect

10.4.1.5 Poor FPA

Item	Description	Standard	
Less/more/wrong component	---	NG	Major defect
Solder beading	Solder beading cause component short circuit、diameter>0.1mm	NG	Major defect
Gold finger tin	---	NG	Minor defect
Gold finger dirty	---	According to dot/line	Minor defect
Gold finger fracture	Fracture doesn't affect circuit and function	OK	Minor defect
Gold finger bubble	Bubble cover the single pin	NG	Minor defect
FPC scratch/strain	Doesn't affect circuit	OK	Minor defect
Biased welding	Welding offset is more than 1⁄3pin	NG	Major defect
Poor welding	Welded joint,insufficient solder,solder bridge,solder icicle	NG	Major defect

10.4.1.6 Poor RTP/CTP

Item	Description	Standard	
Camera hole/ IR hole	Poor dot/line	According to dot/line	Minor defect
Ink color difference	Difference ink color compared with sample	Refer to limited sample	Minor defect
Adhesive residue,oil	Appear at ink printing area	According to dot/line standard	Minor defect
Poor silk screen	Ink splash、pinhole、light leak	According to dot/line standard	Minor defect
	Broken ink printing	Less than 1⁄2 ling is OK	Minor defect
	Wrong/unclear/broken printing	NG	Minor defect
Ink printing sawtooth	Type/LOGO/Key	Sawtooth width≤0.2 OK	Minor defect
	CTP 、V/A margin	Sawtooth width≤0.3 OK	Minor defect
Different color point at ink area	Type/LOGO/Key/Panel area	According to dot/line standard	Minor defect
Dirty TP	Glass or TP inside	NG or refer to limited sample	Minor defect
	Cover Len or ITO film surface is washable	Within totally 3%	Minor defect
TPscratch/Impurity	---	According to dot/line standard	Minor defect
TP adhesive migration /sawtooth	adhesive migration or sawtooth at silver pulp printing	NG or refer to limited sample	Minor defect
TP assembly skew	Cover the BZ and affect display and final assembly	NG	Major defect
Touch shift	Shift is less than 1.5 格	OK	Major defect
TP without touch	No reaction when tested	NG	Major defect
TP assembly curl	Curl within 0.2mm and doesn’t affect thickness	OK	Minor defect

TP Newton ring	Regular Irregular 	Area is less than1/6 TP function is ok	Minor defect

10.4.1.7 Blacklight standard:

Item	Description	Standard	
Black screen	Backlight doesn't light when the power on	NG	Minor defect
Scratch、Impurity、Black and white dot	---	According to dot/line	Minor defect
Light leakage	The crack between Black and white glue and glue frame leak light	Less than 1/2 single side is OK	Minor defect
	V/A light leakage(bright side、white line)	NG	
Blank pressing	When the whole black frame is tested, the frame is blocked	NG	Minor defect
Shift	In the full white test screen, there is a clear sense of hierarchy on the edge of the membrane.	NG	Minor defect
Mura/Color difference	Different color compared with sample when lighted	NG	Minor defect
	One part is darker or lighter when lighted	NG or refer to limited sample	Minor defect
TP water mark/white print	Water mark/white print appear when lighted	NG	Minor defect
Interference pattern	Interference pattern appear when lighted	NG	Minor defect
B/L film wrinkle	The film isn't smooth and the light is uneven when lighted	NG or refer to limited sample	Minor defect
Poor BZ	Discoloration/dent/oil/rust/oxidation/deformation/gap	**NG**	Minor defect
	1. Hard scratch is not allowed		Minor

	2. Soft scratch within 30mm is allowed，30-50mm should less than 2 bar， more than 50mm is not allowed		defect
	Deformation/loosening without falling risk, doesn't affect final assembly	OK	Minor defect
Poor glue frame	Glue frame is deformed or broken	NG	Minor defect
Poor mark	Missing/unclear/wrong mark	NG	Minor defect
Backlight light eye	The led beam shot out when lighted	NG or refer to limited sample	Minor defect