晶采光電科技股份有限公司
AMPIRE CO., LTD.

SPECIFICATIONS FOR LCD MODULE

CUSTOMER	
CUSTOMER PART NO.	
AMPIRE PART NO.	AM-480272MTMQW-T00H
APPROVED BY	
DATE	

☐ Approved For Specifications
☐ Approved For Specifications & Sample

AMPIRE CO., LTD.
2F., No.88, Sec. 1, Sintai 5th Rd., Sijhih City, Taipei County 221, Taiwan (R.O.C.)台北縣汐止市新台五路一段88號2樓(東方科學園區D棟)
TEL:886-2-26967269 , FAX:886-2-26967196 or 26967270

APPROVED BY	CHECKED BY	ORGANIZED BY

RECORD OF REVISION

Revision Date	Page	Contents	Editor
2010/1/14	--	New Release	Eric
2010/2/24		Modify Brightness data	Kokai

1. FEATURES

(1) Construction : amorphous silicon TFT-LCD with driving system, Bezel and White LED Backlight and **touch panel.**

(2) LCD type : Transmissive , Normally White.

(3) Interface : 24bit RGB interface.

(4) Power Supply Voltage : 3.3V power input for TFT, built-in power supply circuit.

(5) RoHS Compliance.

2. PHYSICAL SPECIFICATIONS

Item	Specifications	unit
Display size (diagonal)	4.3	inch
Resolution	480 RGB(H) x 272(V)	Dot
Display area	95.04 (H) x 53.856 (V)	mm
Pixel pitch	0.198 (H) x 0.198 (V)	mm
Overall dimension	105.5 x 67.2 x 4.05 (Typ.)	mm
Color configuration	R.G.B Vertical stripe	
Surface treatment	Antiglare, Hard-Coating (3H)	
View Direction (Gray Inversion)	6 o'clock	
Brightness	**400** (typ.)	cd/m^2
Backlight unit	LED	

3. ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Power Supply Voltage	VDD	-0.3	--	5	V	GND=0
Logic Signal Input Level	V_I	-0.3	--	5	V	
LED Current	I_L	--	40	--	mA	(1)(2)(3)
LED voltage	V_L	--	19.8	--	V	(1)(2)(3)
Operating Temperature	Tops	-20	--	70	℃	
Storage Temperature	Tstg	-30	--	80	℃	

Note :

(1) Permanent damage may occur to the LCD module if beyond this specification. Functional operation should be restricted to the conditions described under normal operating conditions.

(2) Ta =25±2℃

(3) Test Condition: LED current 40 mA. The LED lifetime could be decreased if operating IL is larger than 40mA.

4. OPTICAL CHARACTERISTICS

4.1 Optical specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Viewing Angle	Left	Θ_L	CR≧10	65	75	--	deg.	(1)(4)
	Right	Θ_R		65	75	--		
	Up	Θ_U		50	60	--		
	Down	Θ_D		60	70	--		
Contrast ratio		CR	Θ=0 Normal viewing angle	480	600	--	--	(1)(2)
Response Time	Rising	T_R		--	3	6	msec	(1)(3)
	Falling	T_F		--	7	14	msec	
Color chromaticity (CIE1931)	White	Wx		0.26	0.31	0.36	--	(1)(4)
		Wy		0.28	0.33	0.38		
White Luminance (Center)		Y_L		**320**	**400**	--	cd/m²	(1)(4)(7) (IL=40mA)
Brightness Uniformity		B_{UNI}		70	--	--	%	(5)(7)
Optima View Direction		6 o'clock						(6)

4.2 Measuring Condition

(1) Measuring surrounding : dark room

(2) LED current I_L : 40mA

(3) Ambient temperature : 25±2℃

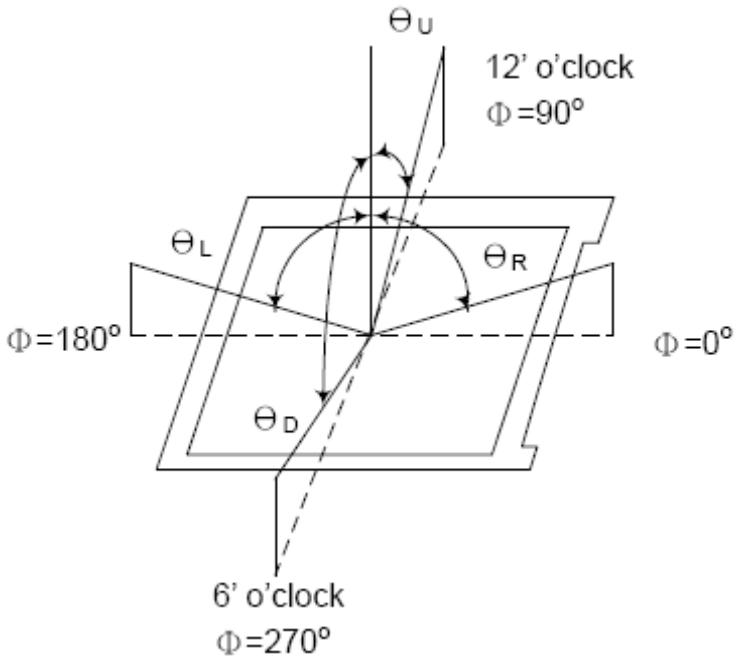
(4) 15min. warm-up time.

4.3 Measuring Equipment

(1) FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.

(2) Measuring spot size : 20 ~ 21 m

Note (1) Definition of Viewing Angle :

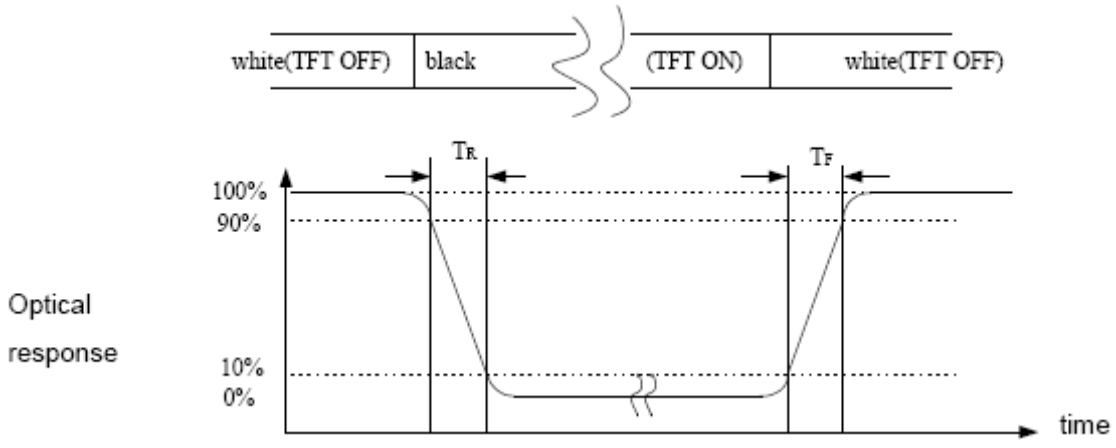


Note (2) Definition of Contrast Ratio (CR) :

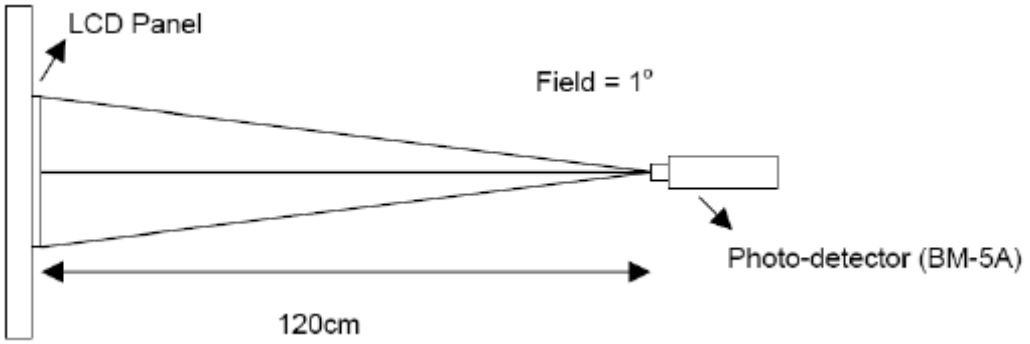
measured at the center point of panel

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

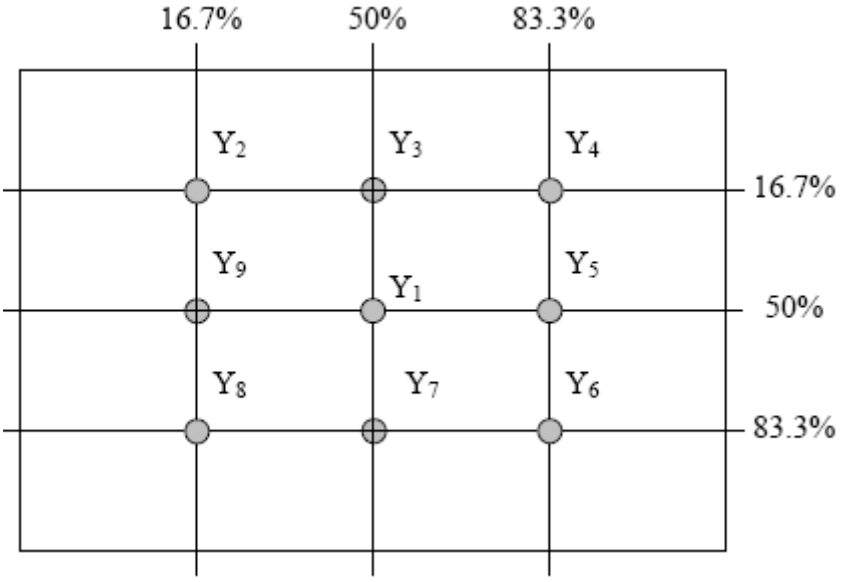
Note (3) Definition of Response Time : Sun of T_R and T_F



Note (4) Definition of optical measurement setup



Note (5) Definition of brightness uniformity



$$\text{Luminance uniformity} = \frac{\text{(Min Luminance of 9 points)}}{\text{(Max Luminance of 9 points)}} \times 100\%$$

Note (6) Rubbing Direction (The different Rubbing Direction will cause the different optima view direction.)

Note (7) Measured at the brightness of the panel when all terminals of LCD panel ate electrically open.

5. ELECTRICAL CHARACTERISTICS

5.1 TFT LCD Module

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Supply Voltage	V_{DD}	3.0	3.3	3.6	V	
Input signal voltage	V_{IH}	$0.7V_{DD}$	--	V_{DD}	V	Note(1)
	V_{IL}	0	--	$0.3V_{DD}$	V	
Current of power supply	I_{CC}	--	--	24.12	mA	V_{DD}=3.3V

Note (1) : HSYNC , VSYNC , DE , R/G/B Date

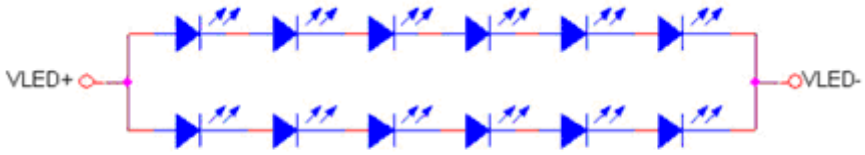
Note (2) : GND = 0V

5.2 Back-Light Unit

The back-light system is an edge-lighting type with 12 LED.

The characteristics of the LED are shown in the following tables.

Item	Symbol	Min.	Typ.	Max.	Unit	Note
LED current	IL	--	40	--	mA	(2)
LED voltage	VL	--	19.8	--	V	
Operating LED life time	Hr	10K	--	--	Hours	(1)(2)

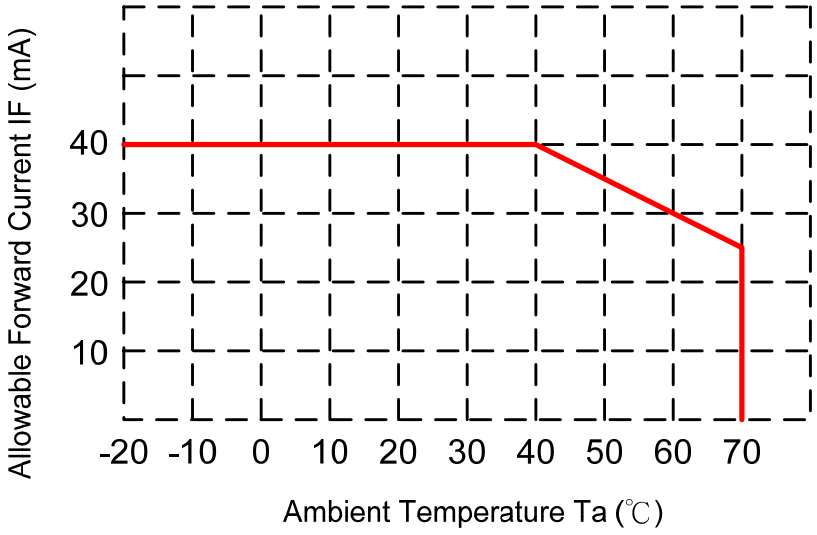


LED Light Bar Circuit

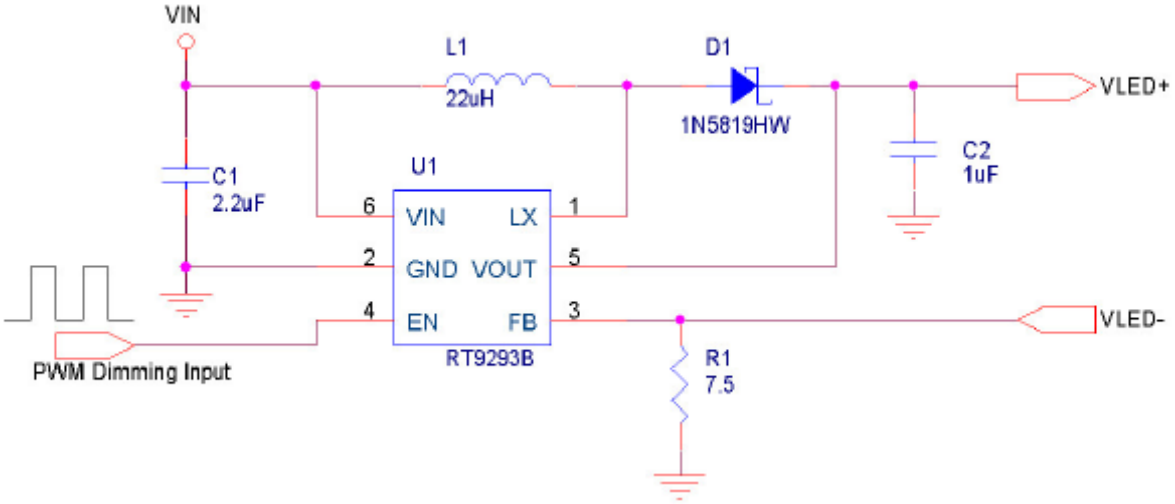
Note (1) LED life time (Hr) can be defined as the time in which it continues to operate under the condition: Ta=25±3℃, typical IL value indicated in the above table until the brightness becomes less than 50%.

Note (2) The “LED life time” is defined as the module brightness decrease to 50% original brightness at Ta=25℃ and IL=40mA. The LED lifetime could be decreased if operating IL is larger than 40mA. The constant current driving method is suggested.

The constant current source is needed for white LED back-light driving. When LCM is operated over 60℃ ambient temperature, the I_L of the LED back-light should be adjusted to 30mA max.

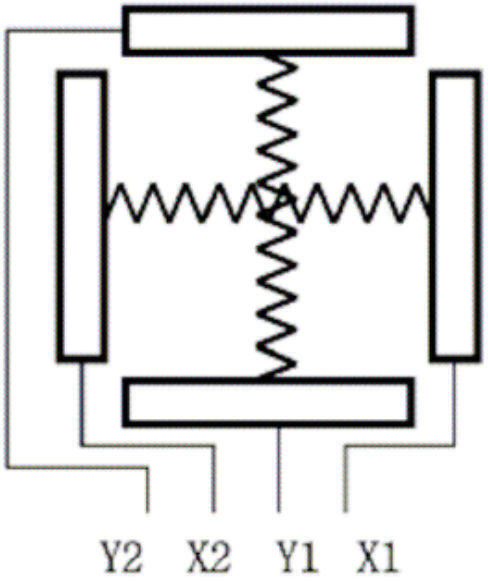


Note (3) Suggested Schematic of LED Back-Light Driver



6. Touch Screen Panel Specification

6.1 Touch panel Unit



Top View

X : Upper electrode
Y : Lower electrode

Pin No.	Symbol	I/O	Function
1	X1	Right	Right electrode - differential analog
2	Y1	Bottom	Bottom electrode - differential analog
3	X2	Left	Left electrode - differential analog
4	Y2	Top	Top electrode - differential analog

6.2 Touch panel electrical characteristics

Item	Min.	Typ.	Max.	Unit	Note
Terminal resistance	100	-	900	Ω	X (Film Side)
	100	-	900	Ω	Y (Glass Side)
Line Linearity	-	-	1.5	%	X Direction
	-	-	1.5	%	Y Direction
Insulation resistance	20	-	-	MΩ	DC 25V
Input voltage	-	5	7	V	
Chattering	-	-	10	ms	100KΩ pull-up
Transparency	-	80	-	%	JISK7105

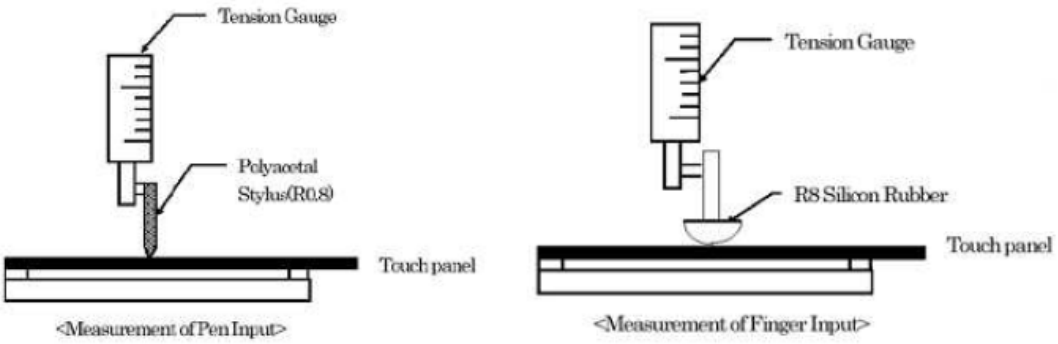
Note: Avoid operating with hard or sharp material such as a ballpoint pen or a mechanical pencil except a polyacetal pen (tip R0.8mm or less) or a finger.

6.3 Touch panel mechanical & reliability characteristics

Item	Min.	Typ.	Max.	Unit	Note
Activation force	80	-	-	gf	(1)
Durability -surface scratching	Write 100,000	-	-	Characters	(2)
Durability -surface pitting	1,000,000	-	-	touches	(3)
Surface hardness	3	-	-	H	JIS K5400

Note (1) Activation Force Test Condition

1. Input DC 5V on X direction, drop off polyacetal stylus (R0.8), until output voltage stabilized.
2. R0.8mm silicon rubber for finger activation force test.
3. Test points: 9 points.



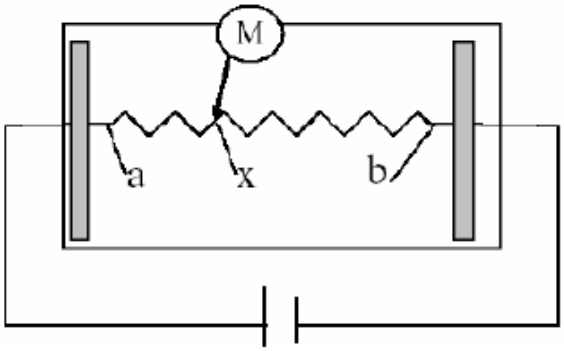
Note (2) Measurement for surface area (Scratching)

1. Scratch 100,000 times straight line on the film with a stylus change every 20,000 times.
2. Force: 250 gf.
3. Speed: 60 mm/sec.
4. Stylus: R0.8 polyacetal tip.

Note (3) Measurement for surface area (Pitting)

1. Pit 1,000,000 times on the film with a R8 silicon rubber.
2. Force: 250 gf.
3. Speed: 2 times/sec.

6.3 Linearity definition



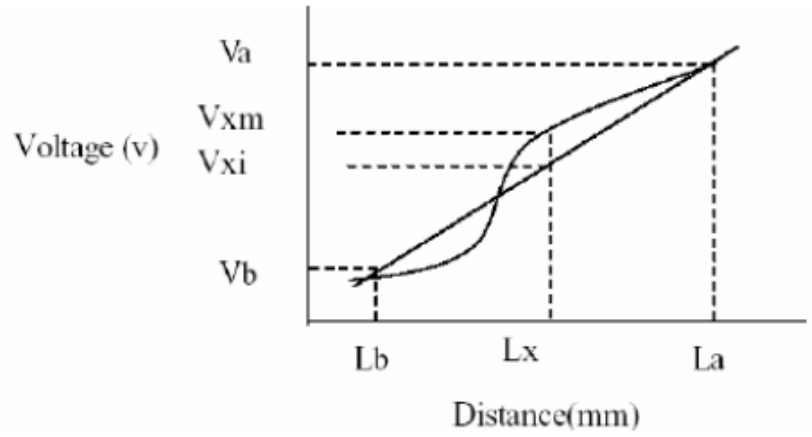
Va: maximum voltage in the active area of touch panel

Vb: minimum voltage in the active area of touch panel

X: random measuring point

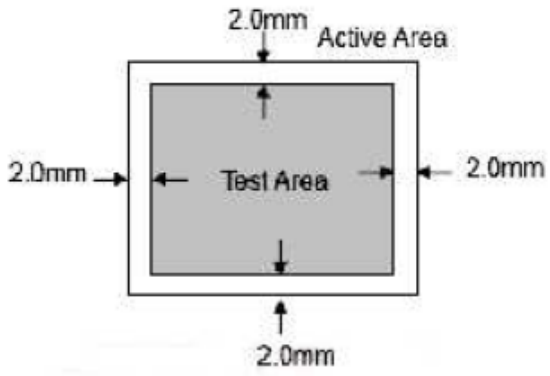
Vxm: actual voltage of Lx point

Vxi: theoretical voltage of Lx point



Linearity= [|Vxi-Vxm|/(Va-Vb)]*100%

Note: Test area is as follows and operation force is 100gf.

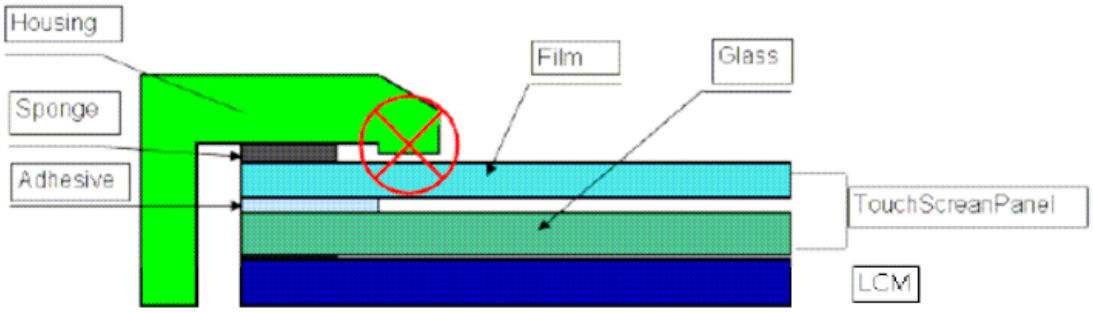


6.4 Housing design guide

Housing design follow as below

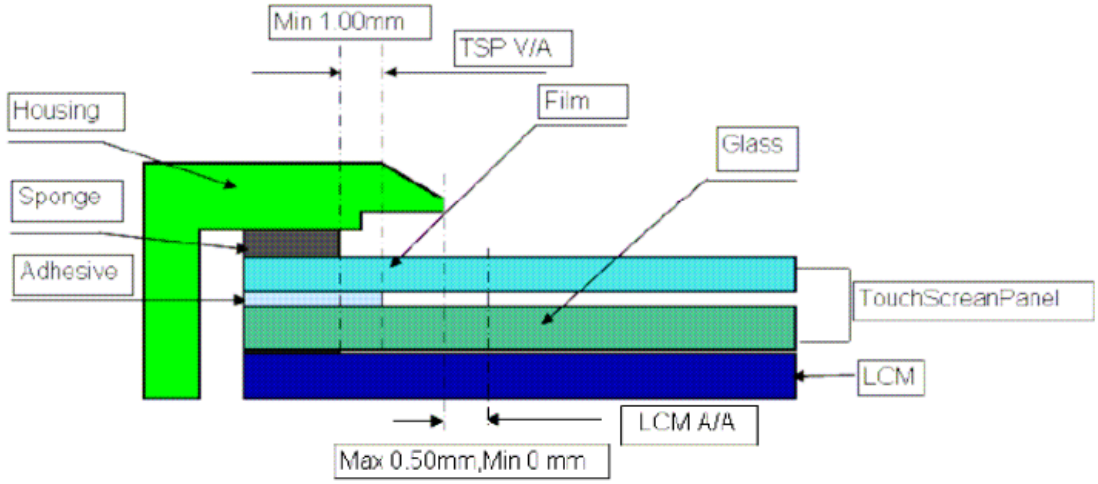
(1) Avoid the design that housing overlap and press on the active area of the LCM.

(2) Give enough gap (over 0.5mm at compressed) between the housing and TSP to protect wrong operating.



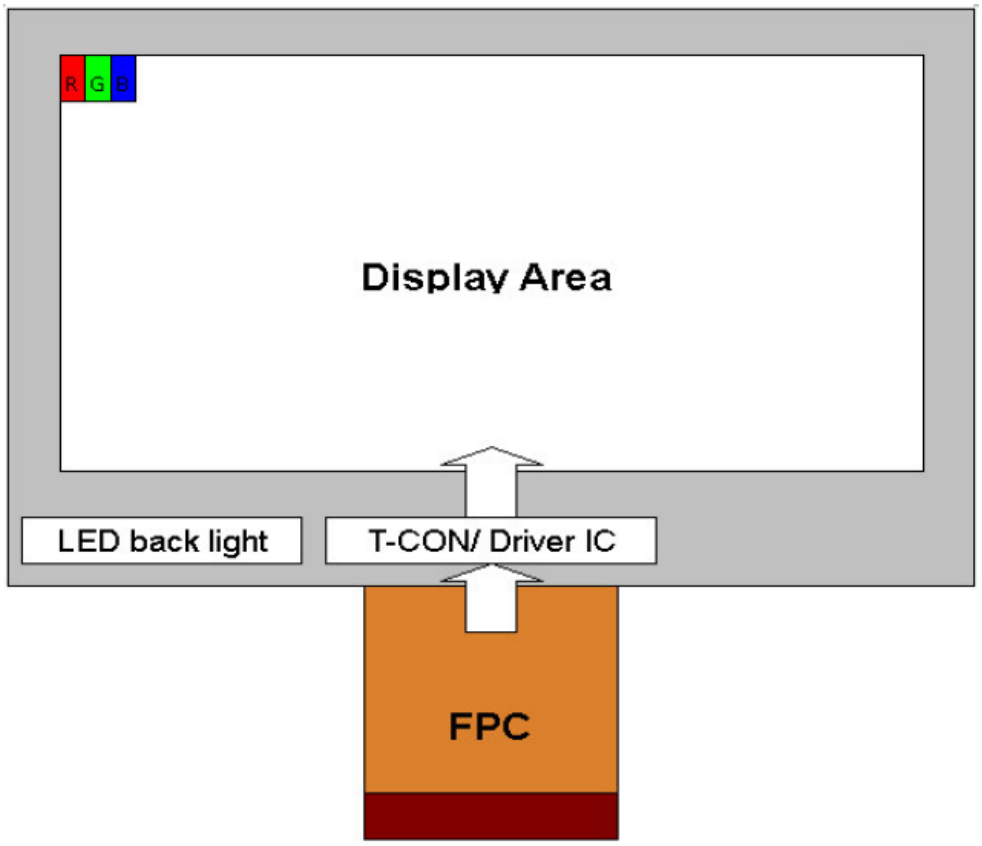
(3) Use a buffer material (gasket) between the TSP and housing to protect damage and wrong operating.

(4) Avoid the design that buffer material overlap and press on the inside of TSP view area.

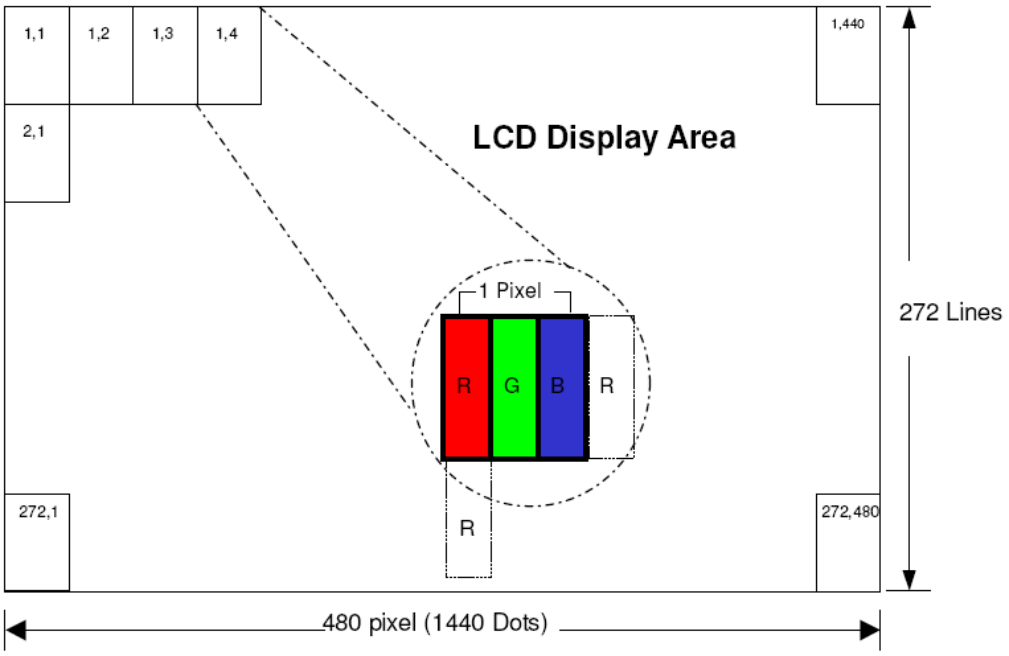


7. BLOCK DIAGRAM

7.1 TFT LCD Module



7.2 Pixel Format



8. INTERFACE PIN ASSIGNMENT

FPC connector is used for electronics interface. The recommended model is FH19SC-40S-0.5SH (05) manufactured by HIROSE

Pin no	Symbol	I/O	Function	Note
1	VLED-	P	Power for LED Backlight Cathode	
2	VLED+	P	Power for LED Backlight Anode	
3	GND	P	Power Ground	
4	VDD	P	Power Voltage	
5	R0	I	Red Data (LSB)	
6	R1	I	Red Data	
7	R2	I	Red Data	
8	R3	I	Red Data	
9	R4	I	Red Data	
10	R5	I	Red Data	
11	R6	I	Red Data	
12	R7	I	Red Data (MSB)	
13	G0	I	Green Data (LSB)	
14	G1	I	Green Data	
15	G2	I	Green Data	
16	G3	I	Green Data	
17	G4	I	Green Data	
18	G5	I	Green Data	
19	G6	I	Green Data	
20	G7	I	Green Data (MSB)	
21	B0	I	Blue Data (LSB)	
22	B1	I	Blue Data	
23	B2	I	Blue Data	
24	B3	I	Blue Data	
25	B4	I	Blue Data	
26	B5	I	Blue Data	
27	B6	I	Blue Data	

28	B7	I	Blue Data (MSB)	
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	DE	I	Data Enable	
35	NC	--	No connect	
36	GND	P	Power Ground	
37	X1	I/O	Right Electrode- Differential Analog	
38	Y1	I/O	Bottom Electrode- Differential Analog	
39	X2	I/O	Left Electrode- Differential Analog	
40	Y2	I/O	Top Electrode- Differential Analog	

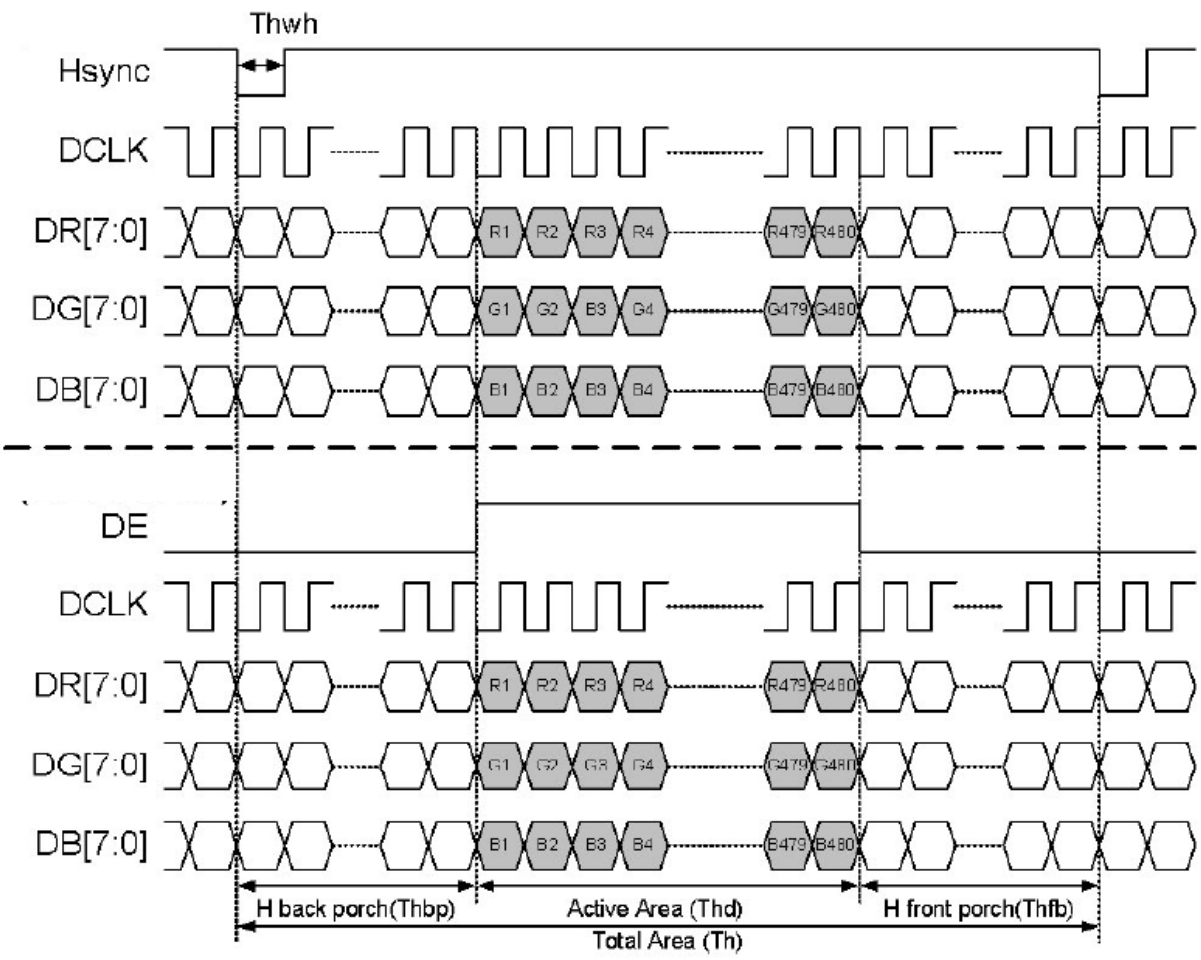
I/O : I: input, O: output, P: power

9. INTERFACE TIMING

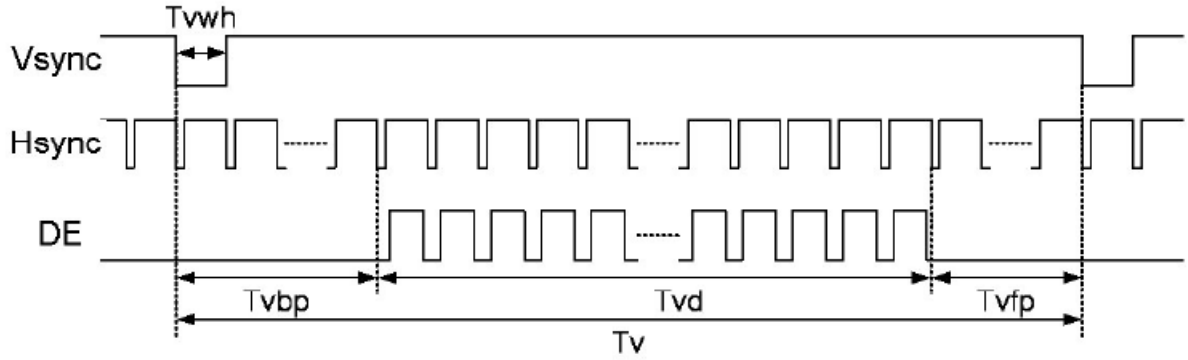
9.1 Parallel 24*bit RGB Input Timing Table

Item	Symbol	Min.	Typ.	Max.	Unit	Note
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	

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



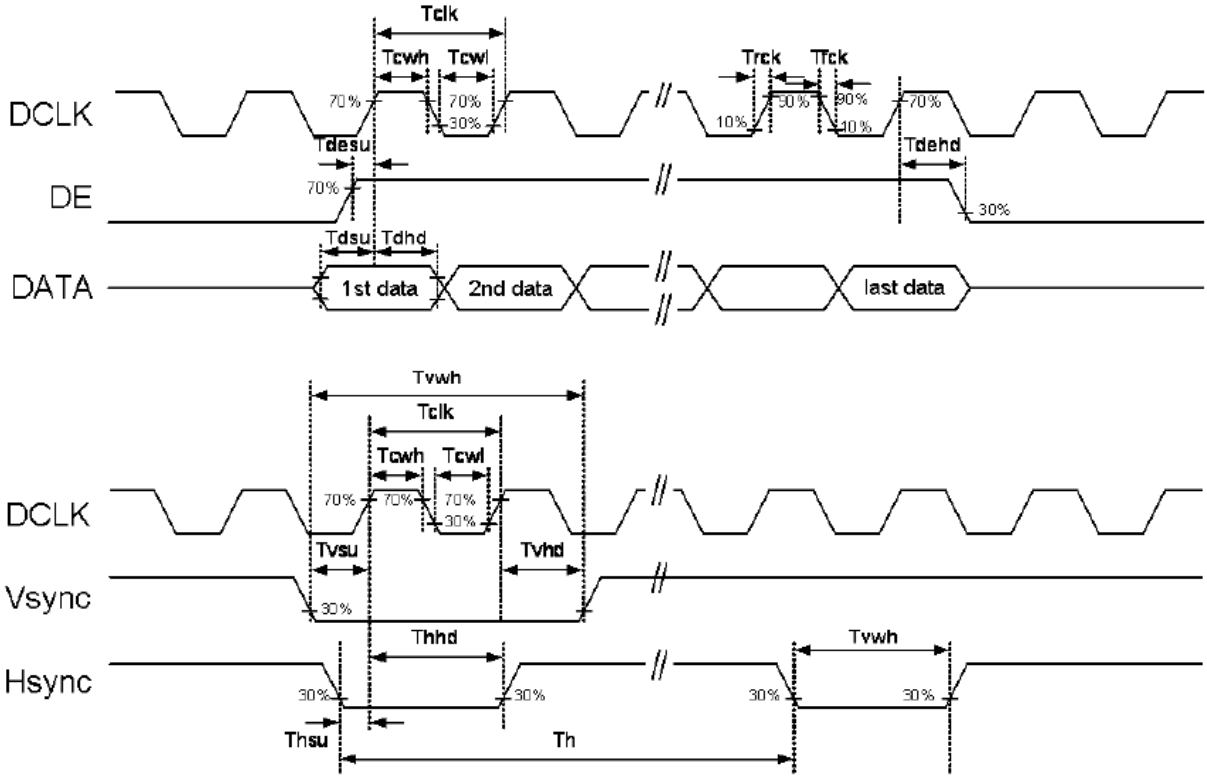
Vertical Input Timing



9.2 AC Electrical Characteristics

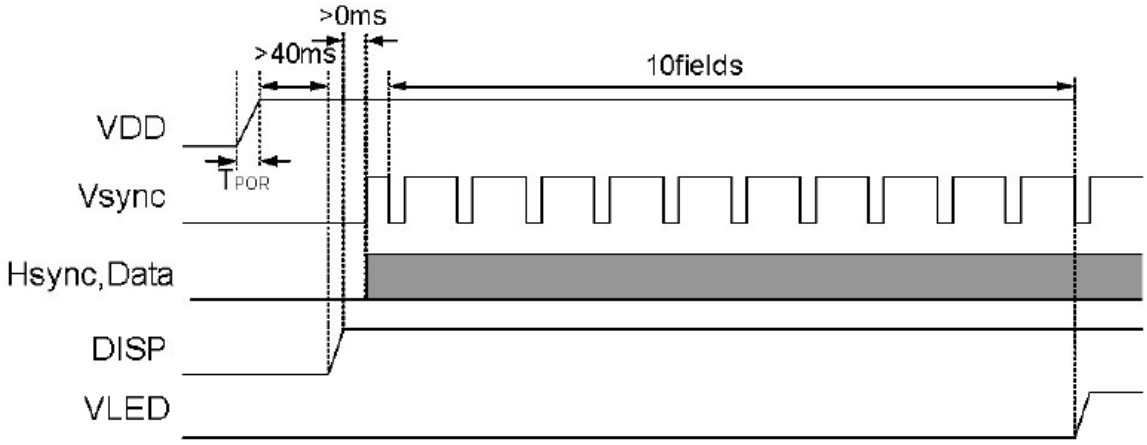
Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK period time	Tclk	83.3	111.1	200	ns	
DCLK rising time	Trck	--	--	9	ns	
DCLK falling time	Tfck	--	--	9	ns	
DCLK pulse duty	Tcwh	40	50	60	%	
DE setup time	Tdesu	12	--	--	ns	
DE hold time	Tdehd	12	--	--	ns	
HSYNC pulse width	Thwh	1	--	--	DCLK	
HSYNC setup time	Thsu	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

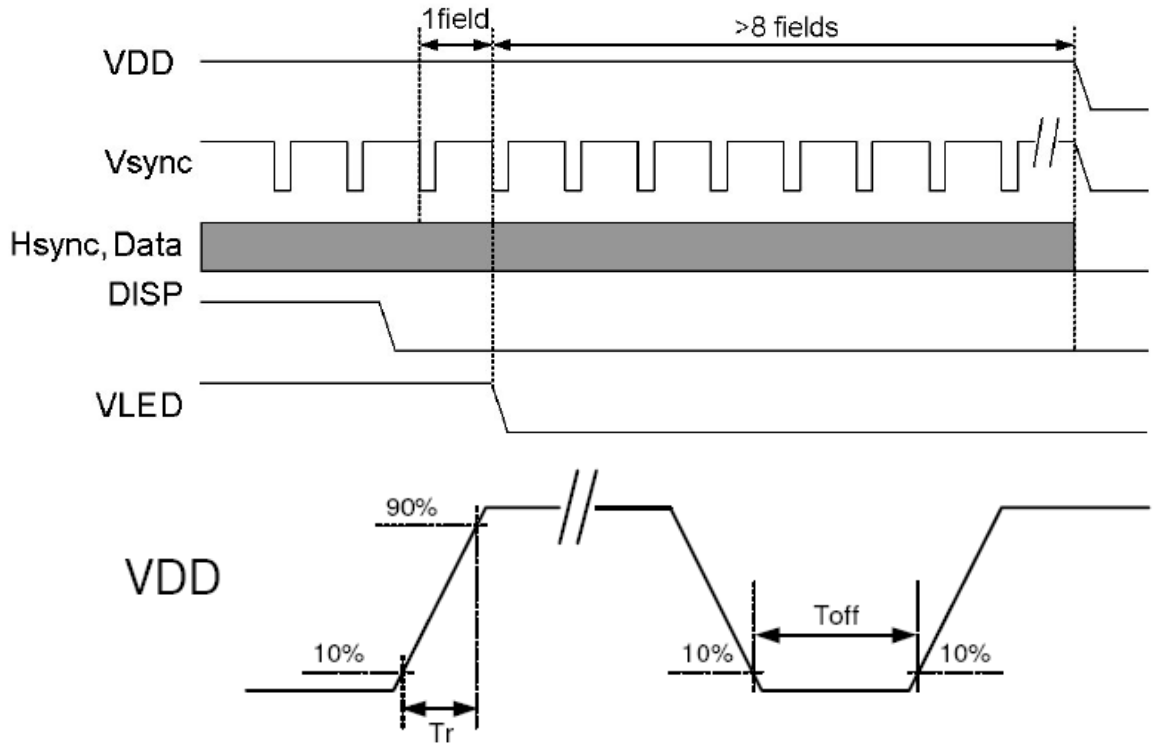


9.3 Power Sequence

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

10. QUALITY AND RELIABILITY

10.1 TEST CONDITIONS

Tests should be conducted under the following conditions :

Ambient temperature : 25 ± 5°C

Humidity : 60 ± 25% RH.

10.2 SAMPLING PLAN

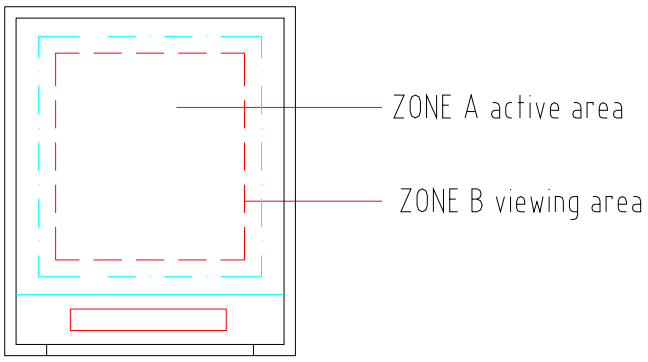
Sampling method shall be in accordance with MIL-STD-105E , level II, normal single sampling plan .

10.3 ACCEPTABLE QUALITY LEVEL

A major defect is defined as one that could cause failure to or materially reduce the usability of the unit for its intended purpose. A minor defect is one that does not materially reduce the usability of the unit for its intended purpose or is an infringement from established standards and has no significant bearing on its effective use or operation.

10.4 APPEARANCE

An appearance test should be conducted by human sight at approximately 30 cm distance from the LCD module under florescent light. The inspection area of LCD panel shall be within the range of following limits.



10.5 RELIABILITY TEST CONDITIONS

Test Item	Test Conditions	Note
High Temperature Operation	Ta=70°C, 240 hrs	
Low Temperature Operation	Ta=-20°C, 240 hrs	
High Temperature Storage	Ta=80°C, 240 hrs	
Low Temperature Storage	Ta=-30°C, 240 hrs	
High Temperature and High Humidity (Operation)	Ta=+60°C, 90%RH, 240 hrs	
Thermal Cycling Test (non operation)	-30°C(30min)→+80°C(30min), 200 cycles	
Electrostatic Discharge	±200V, 200pF(0Ω) 1 time/each terminal	
Vibration	1. Random: 1.04Grms, 5~500Hz, X/Y/Z, 30min/each direction 2. Sine: Ferq. Range : 8~33.3Hz Stoke : 1.3mm Sweep:2.9G, 33.3~400Hz X/Z : 2hr, Y: 4hr, cyc: 15min	
Shock	100G, 6ms, ±X, ±Y, ±Z 3 time for each direction	JIS C7021, A-10 (Condition A)
Vibration (with carton)	Random: 0.015G^2/Hr, 5~20Hz -6dB/Octave, 200~400Hz XYZ each direction:2hr	
Drop (with carton)	Height : 60cm 1 corner, 3 edges, 6 surfaces	JIS Z0202

Note : There is no display function NG issue occurred, all the cosmetic specification is judged before the reliability stress.

10.6 VISUAL INSPECTION CRITERIA

10.6.1 Inspection condition is as followings

- Viewing distance is approximately 30 cm
- Viewing angle is referred to the CAS .
- Ambient temperature is in the room temperature
- Ambient illumination is 300_50 Lux.

Defect type			Criteria	
Electrical defect	Area (Note 2)		I	O
	Bright Dots (Note 3)		N ≦ 0	N ≦ 1
	Dark Dots (Note 4)		N ≦ 2	N ≦ 2
	Bright Dot- 2 Adjacent (Note 5)		N ≦ 0	
	Dark Dots- 2 Adjacent (Note 6)		N ≦ 0	
	Dark or Bright Dots- 3 and More Adjacent (Note 7)		N ≦ 0	
	Total Bright and Dark Dots		N ≦ 3	
	Minimum Distance Between Bright Dots		---	
	Minimum Distance Between Dark Dots		5 mm	
	Minimum Distance Between Dark And Bright Dots		---	
Visual defect	Foreign Material	Circular Foreign Material : Dark/ Bright Spot	Visible under ND5%: 1.D≦0.15mm : No count 2.0.15mm＜D≦0.5mm, N≦4 3.D＞0.5mm : Not allowable	
		Linear Foreign Material : Bright or Dark Line	Invisible under ND5%: 0.1mm＜W≦0.5mm, 0.3mm＜L≦1.5 mm,N≦2	
			Visible under ND5%: 0.05mm≦W≦0.1mm, 0.3mm≦L≦0.7mm,N≦1	
	Polarizer	Linear Scratch	1. BM : No count 2. Pixel area: 0.05mm≦W≦0.2mm, 1.0mm≦L≦5.0mm,N≦2	
		Bubble/ Peeling	1. BM: No count 2. Pixel area: 0.15mm≦D＜0.5mm,N≦4	
	Mura & Leak		ND5%	

D: diameter , N: number , W: horizontal width , L: vertical height

10.6.2 Others

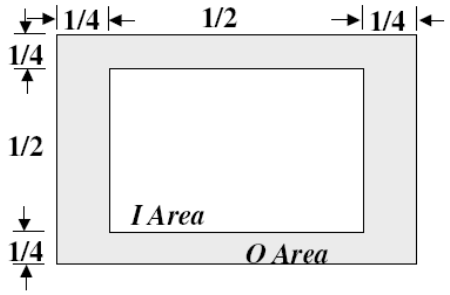
Note(1) a. Every dot herein means sub-pixel(Each Red, Green, Blue Color).

b. Damaged less than half size of sub-pixel is not counted as defect.

c. Extraneous substances which can be wiped out are not considered as defect.

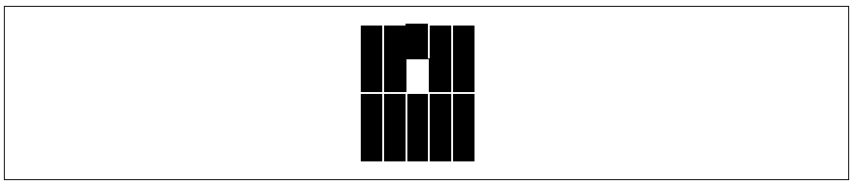
d. Defects which is on the Black Matrix(Outside of Active Area) are not considered as defect.

Note (2) Definition of Area



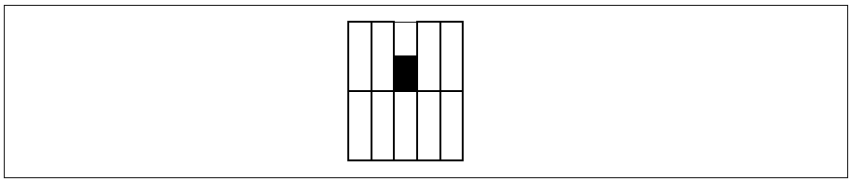
Note (3) Bright dot defect definition

-bright area is more than 50% of one dot .All bright dot defect must be visible through 5% ND filter.



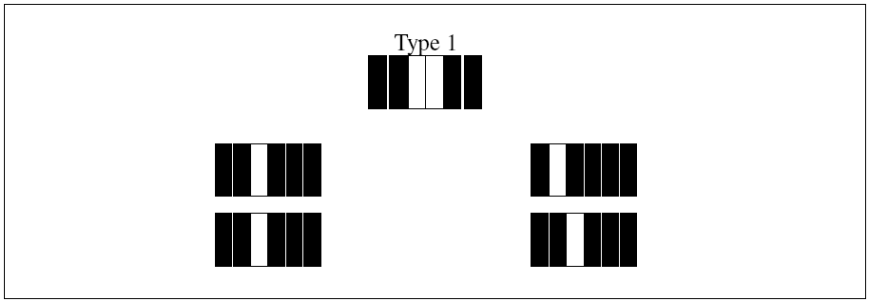
Note (4) Dark dot defect definition

-Dark area is more than 50% of one dot . All bright dot defect must be visible through 5% ND filter.



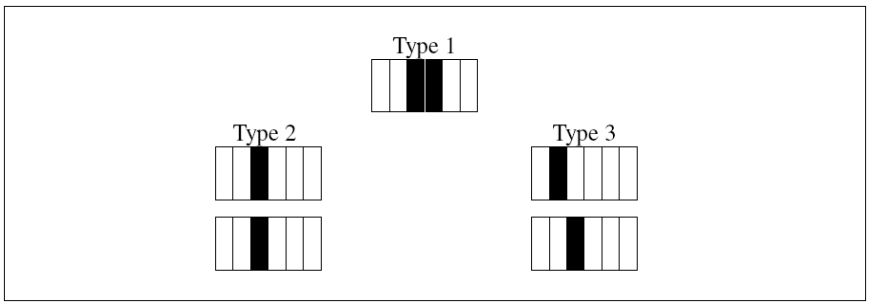
Note (5) Bright dot defect description

- Two adjacent



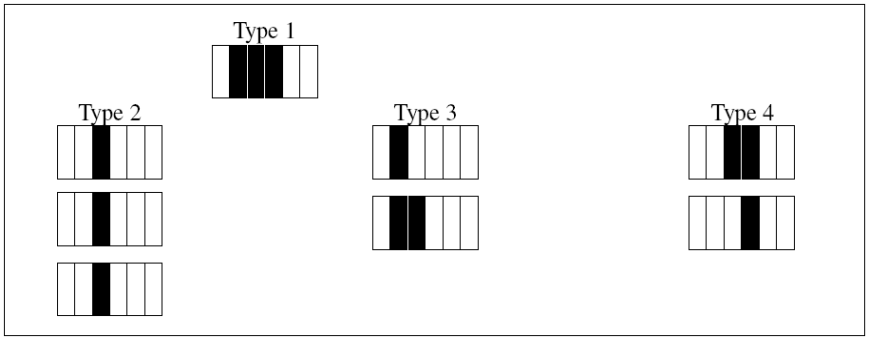
Note (6) Dark dot defect description

- Two adjacent



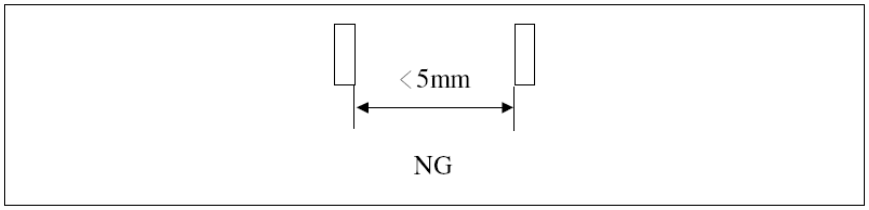
Note (7) Dark dot defect description

- Three adjacent

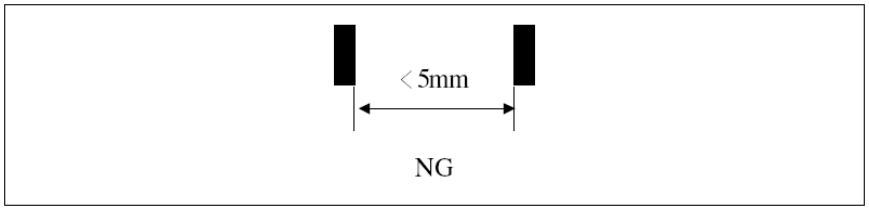


Note (8) Minimum distance between dot defects

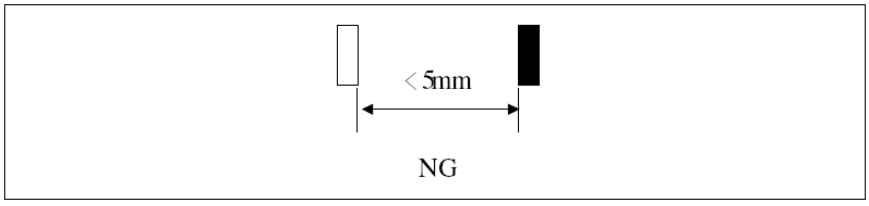
Bright dot to bright dot



Dark dot to dark dot

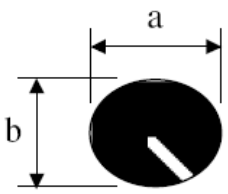


Bright dot to dark dot



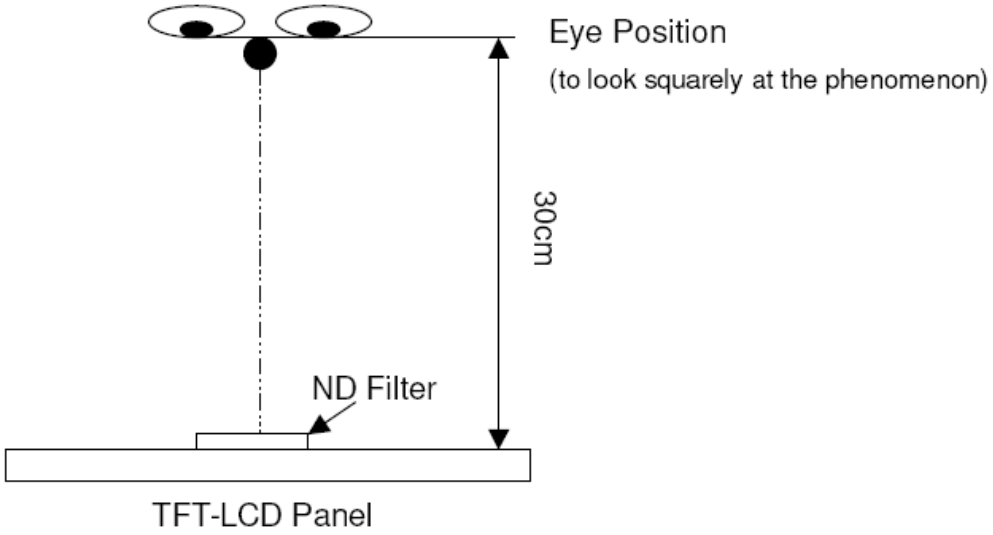
Note (9) “Average Diameter” description

Average Diameter = (a+b)/2



The defect that are not defined above and considered to be problem shall be reviewed and discussed by both parties.

Note (10) Bright dot, mura and leak are defined through transmission ND Filter as following.



11. GENERAL PRECAUTION

11-1 Use Restriction

This product is not authorized for use in life supporting systems, aircraft navigation control systems, military systems and any other application where performance failure could be life-threatening or otherwise catastrophic.

11-2 Disassembling or Modification

Do not disassemble or modify the module. It may damage sensitive parts inside LCD module, and may cause scratches or dust on the display. Ampire does not warrant the module, if customers disassemble or modify the module.

11-3 Breakage of LCD Panel

(1) If LCD panel is broken and liquid crystal spills out, do not ingest or inhale liquid crystal, and do not contact liquid crystal with skin.
(2) If liquid crystal contacts mouth or eyes, rinse out with water immediately.
(3) If liquid crystal contacts skin or cloths, wash it off immediately with alcohol and rinse thoroughly with water.
(4) Handle carefully with chips of glass that may cause injury, when the glass is broken.

11-4 Electric Shock

(1) Disconnect power supply before handling LCD module.
(2) Do not pull or fold the LED cable.
(3) Do not touch the parts inside LCD modules and the fluorescent LED's connector or cables in order to prevent electric shock.

11-5 Absolute Maximum Ratings and Power Protection Circuit

(1) Do not exceed the absolute maximum rating values, such as the supply voltage variation, input voltage variation, variation in parts' parameters, environmental temperature, etc., otherwise LCD module may be damaged.
(2) Please do not leave LCD module in the environment of high humidity and high temperature for a long time.
(3) It's recommended to employ protection circuit for power supply.

11-6 Operation

(1) Do not touch, push or rub the polarizer with anything harder than HB pencil lead.
(2) Use fingerstalls of soft gloves in order to keep clean display quality, when persons handle the LCD module for incoming inspection or assembly.
(3) When the surface is dusty, please wipe gently with absorbent cotton or other soft material.
(4) Wipe off saliva or water drops as soon as possible. If saliva or water drops contact with polarizer for a long time, they may causes deformation or color fading.
(5) When cleaning the adhesives, please use absorbent cotton wetted with a little petroleum benzine or other adequate solvent.

11-7 Mechanism

Please mount LCD module by using mounting holes arranged in four corners tightly.

11-8 Static Electricity

(1) Protection film must remove very slowly from the surface of LCD module to prevent from electrostatic occurrence.
(2) Because LCD module use CMOS-IC on circuit board and TFT-LCD panel, it is very weak to electrostatic discharge. Please be careful with electrostatic discharge. Persons who handle the module should be grounded through adequate methods.

11-9 Strong Light Exposure

The module shall not be exposed under strong light such as direct sunlight. Otherwise, display characteristics may be changed.

11-10 Disposal

When disposing LCD module, obey the local environmental regulations.

11-11 Others

AMIPRE will provide one year warrantee for all products and three months warrantee for all repairing products.

12. OUTLINE DIMENSION