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-800600RTMQW-00H
APPROVED BY	
DATE	

☐ Approved For Specifications
☐ Approved For Specifications & Sample

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RECORD OF REVISION

Revision Date	Page	Contents	Editor
2011/7/18	--	New Release	Rober

1. INSTRUCTION

Ampire 12.1" module is composed of the amorphous silicon thin film transistor liquid crystal display (a-Si TFT LCD) panel structure with driver LSIs for driving the TFT (Thin Film Transistor) array and a acklight. The a-Si TFT LCD panel structure is injected liquid crystal material into a narrow gap between the TFT array glass substrate and a color-filter glass substrate.
Color (Red, Green, Blue) data signals from a host system (e.g. PC, signal generator, etc.) are modulated into best form for active matrix system by a signal processing board, and sent to the driver LSIs which drive the individual TFT arrays. The TFT array as an electro-optical switch regulates the amount of transmitted light from the backlight assembly, when it is controlled by data signals. Color images are created by regulating the amount of transmitted light through the TFT array of red, green and blue dots.

1.1 Features

- LVDS interface
- R.G.B input 8bit, 16.2 millions colors
- Resolution SVGA (800× 600 pixels)
- Wide viewing angle 80°/80° (L/R); 65°/75° (U/D)
- Contrast ratio 700 :1
- Module size 279.0 (H) ×209.0 (V) ×9.0 (D) mm
- Fast response time (Ton+ Toff= 35 ms）
- Color gamut (55%)
- Edge light type backlight (White-LED)
- RoHS compliance

2. PHYSICAL SPECIFICATIONS

Item	Specifications	unit
Display resolution(dot)	800RGB (W) x 600(H)	dots
Active area	246 (W) x 184.5(H)	mm
Pixel pitch	0.375 (W) x 0.375 (H)	mm
Color configuration	R.G.B -stripe	
Overall dimension	279.0(W) x 209.0(H) x 9.0(D)	mm
Weight	TBD	g
Backlight unit	LED	
Display color	16.2M(default)	colors

3. ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Min.	Max.	Unit	Note
Supply voltage range	VCC	-0.3	6	V	(1)
Voltage range at any terminal	VI	-0.3	3.3	V	
Operating Temperature	Top	-20	70	℃	
Storage Temperature	Tstg	-30	80	℃	

Note : All voltage values are with respect to the GND terminals unless otherwise noted.

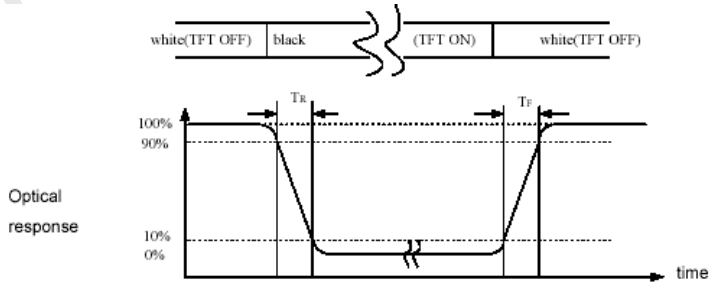
4. OPTICAL CHARACTERISTICS

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Response Time		$T_r + T_f$	Θ=Φ=0°	-	10	-	ms	(1)
Contrast ratio		CR		-	700	-	-	(2)(3)
Viewing Angle	Horizontal	ΘL	CR≧10	-	80	-	Deg.	(5)
		ΘR		-	80	-		
	Vertical	ΘU		-	65	-		
		ΘD		-	75	-		
Luminance (Center)		L	Θ=Φ=0°	-	450	--	cd/m^2	(3)(4) IL=52mA Ta=25℃
Luminance Uniformity		ΔL		-	1.25	-	%	(3)(4)
Color chromaticity	White	Wx		-	0.313	-		
		Wy		-	0.329	-		

NOTE :

- These items are measured by BM-5A(TOPCON) or CA-1000(MINOLTA) in the dark room (no ambient light)

(1) Definition of Response Time (White-Black)



(2) Definition of Contrast Ratio

Measure contrast ratio on the below 5 points(refer to figurel,#1~#5point) and take the average value

Contrast ratio is calculated with the following formula :

Contrast Ratio(CR)=(White)Luminance of ON ÷ (Black)Luminance of OFF

(3) Definition of Luminance :

Measure white luminance on the center point (point 5) and take the value.

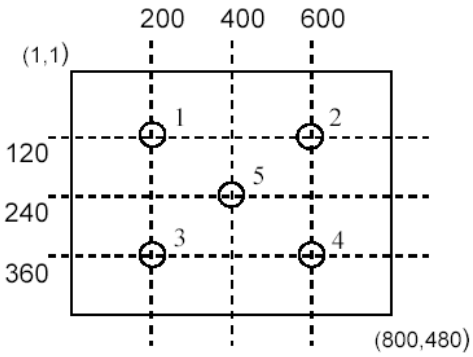


Fig.1 Measuring point

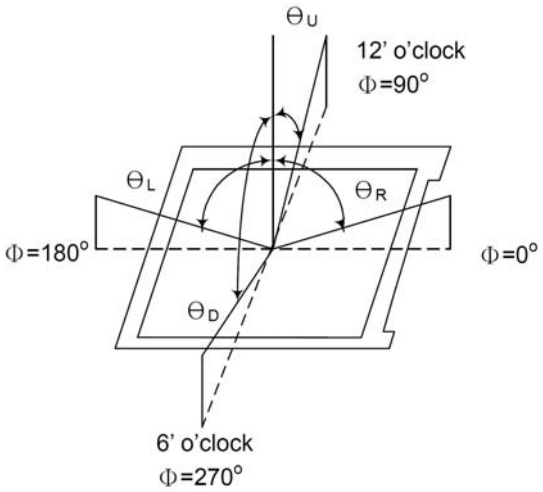
(4)Definition of Luminance Uniformity :

Measured Maximum luminance[L(MAX)] and Minimum luminance[L(MIN)] on the 5 points

Luminance Uniformity is calculated with the following formula :

ΔL =[L(MIN) / L (MAX)] X 100%

(5)Definition of Viewing Angle



5. ELECTRICAL CHARACTERISTICS

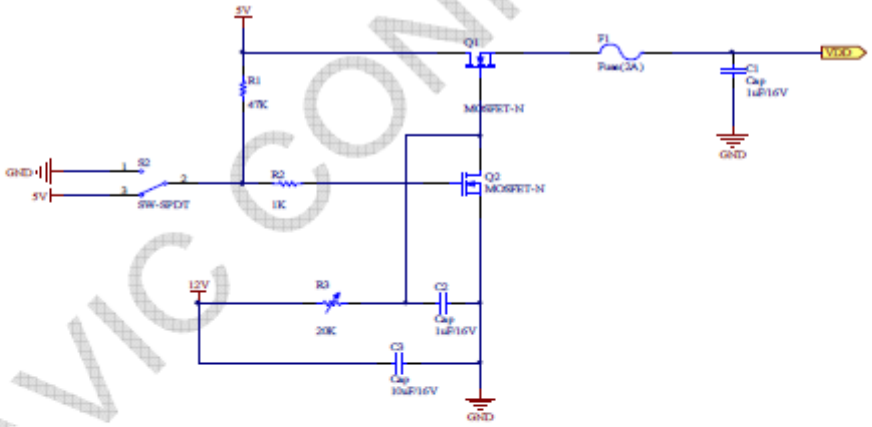
5.1 DRIVING FOR LCD

Parameter		Symbol	min.	typ.	max.	Unit	Remarks
Power supply voltage		VDD	3.0	3.3	3.6	V	-
Power supply current		IDD	-	-	325 Note 1	mA	at VDD = 3.3V
Permissible ripple voltage		VRP	-	-	100	mV	VDD
Differential input voltage		| Vid |	250		450	mV	
Differential input threshold voltage for LVDS receiver	Low	VTL	-100	-	-	mV	VCM = 1.25V Note2
	High	VTH	-	-	100	mV	
Input voltage width for LVDS receiver		Vi	0	-	2.4	V	-
Terminating resistor		RT	-	100	-	Ω	-
Rush current		I_{rush}	-	-	1.5	A	Note3

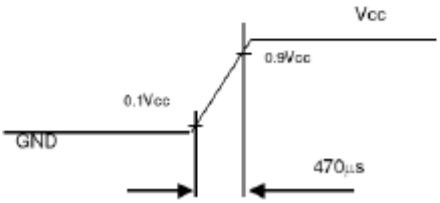
Note 1: All black pattern

Note 2: Common mode voltage for LVDS receiver

Note 3: Measurement Conditions:



Vcc rising time is 470μs



5.2 DRIVING FOR BACKLIGHT

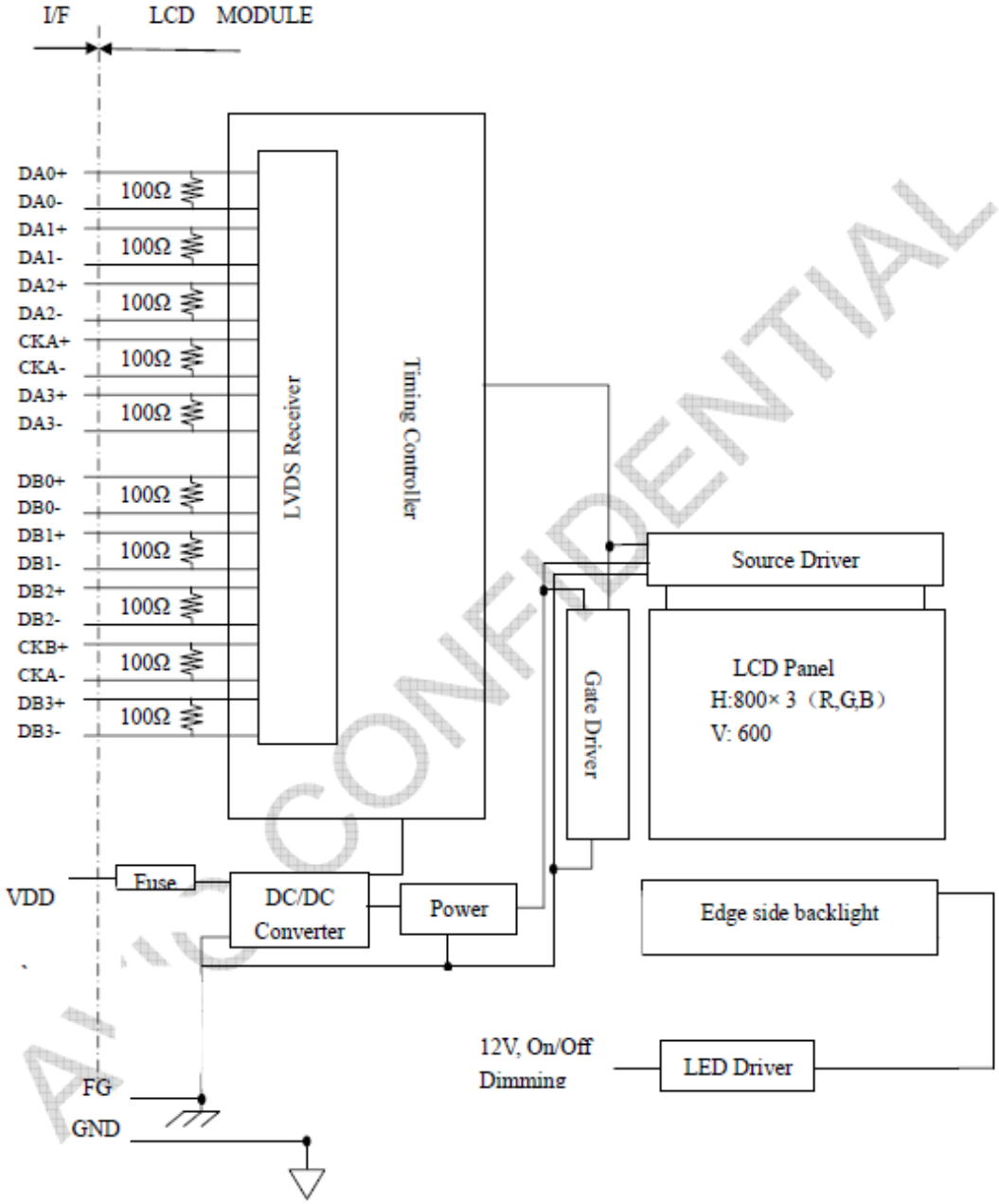
Parameter	Symbol	min.	typ.	max.	Unit	Remarks
Light bar operation voltage (for reference)	V_{LED}	25	-	33	Vrms	Operating with fixed driving current
Light bar operation current (pin)	I_{LED}	-	80	-	mArms	Note1
Light bar operating lifetime	Hr	50000	-	-	Hour	I_{LED}=80mA,Note3

Note1: The backlight of this product is made up of 1 light bar, LED to be 3020, 20pieces, 10 serials and 2 parallels.

Note2: The light bar can work normally if the PWM dimming ratio range is from 0% to 100% and the operation current is 80mA.

Note3: The operating lifetime is mean time to half-luminance. In case the product works under room temperature environment.

6. BLOCK DIAGRAM



Note: System ground (GND), FG (Frame ground) in the product should be connected together in customer equipment.

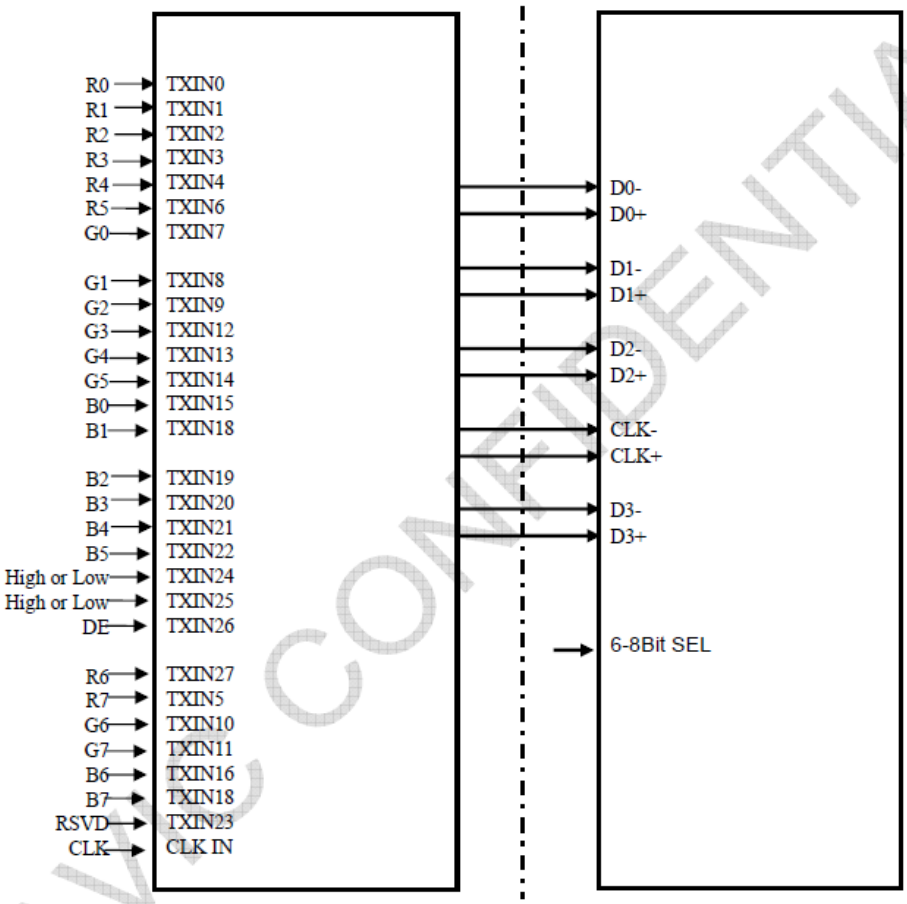
7. INTERFACE

CN1: MSB240420HE (Produced by STM) or equivalent.

Pin	Name	Description
1	VCC	3.3V Power Supply
2	VCC	3.3V Power Supply
3	GND	Ground
4	6-8Bit SEL	Select 6 or 8 Bits LVDS Input (VCC:8Bits ; GND/NC: 6Bits)
5	RIN0-	Negative(-) LVDS differential data input
6	RIN0+	Positive(+) LVDS differential data input
7	GND	Ground
8	RIN1-	Negative(-) LVDS differential data input
9	RIN1+	Positive(+) LVDS differential data input
10	GND	Ground
11	RIN2-	Negative(-) LVDS differential data input
12	RIN2+	Positive(+) LVDS differential data input
13	GND	Ground
14	CLKIN-	Clock Signal(-)
15	CLKIN+	Clock Signal(+)
16	GND	Ground
17	RIN3-	Negative(-) LVDS differential data input (Used for 8Bits LVDS Input; NC for 6Bits)
18	RIN3+	Positive(+) LVDS differential data input (Used for 8Bits LVDS Input; NC for 6Bits)
19	REVERSE	Display Reversed Function (VCC: Display Reverse; GND/NC: Normal Display)
20	NC/GND	Test Function Pin(Do not set this pin to High)

CN2: MSB24038P5 (Produced by STM) or equivalent.

Pin	Symbol	Signal Name
1	Vcc	12V
2	GND	GND
3	Enable	5V-On / 0V-Off
4	Dimming	PWM Dimming or Analog Dimming
5	NC	NC



Note1: The lowest bit (RA0, GA0, BA0, RB0, GB0, BB0), the most upper bit (RA7, GA7, BA7, RB7, GB7, BB7)

Note2:Connecting cable between LCD panel's connector and transmitter should use 100Ω twisted line.

Note3: If only Hsync and Vsync, the product don't work. Make sure DE signal has been input.

8. DISPLAY COLORS AND INPUT DATA SIGNALS

This product can display in equivalent to 16.2M colors in 256 scales. Also the relation between display colors and input data signals is as the following table.

Display colors		Data signal （0:Low level，1:High Level）																							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Color	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Red grayscale	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dark	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑				:								:									:			
	↓				:								:									:			
	Bright	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Green grayscale	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	↑				:								:									:			
	↓				:								:									:			
	Bright	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Blue grayscale	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	↑				:								:									:			
	↓				:								:									:			
	Bright	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

9. AC Timing characteristic

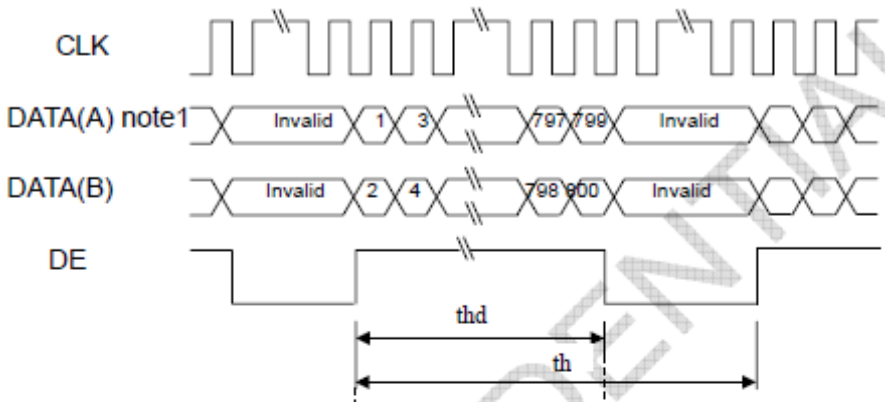
9.1 AC Timing characteristic

Parameter		Symbol	min.	typ.	max.	Unit	Remarks
Clock	Frequency	1/tc	33.16	39.80	49.74	MHz	LVDS transmitter input
		tc	30.16	25.13	20.10	ns	
	Rise time, Fall time	-	Refer to the timing characteristics of LVDS transmitter			ns	Note 1
	Duty	-				-	
Horizontal signals	Cycle	th	14.8	18.0	26.5	μs	55.5kHz(typ.)
			920	1056	1240	CLK	
	Display period	thd	800			CLK	-
Vertical signals	Cycle	tv	13.3	16.67	20	ms	60.0Hz(typ.)
			608	628	650	H	
	Display period	tvd	600			H	-
DE/Data	Setup time	-	Refer to the timing characteristics of LVDS transmitter			ns	Note 1
	Hold time	-				ns	
	Rise time, Fall time	-				ns	

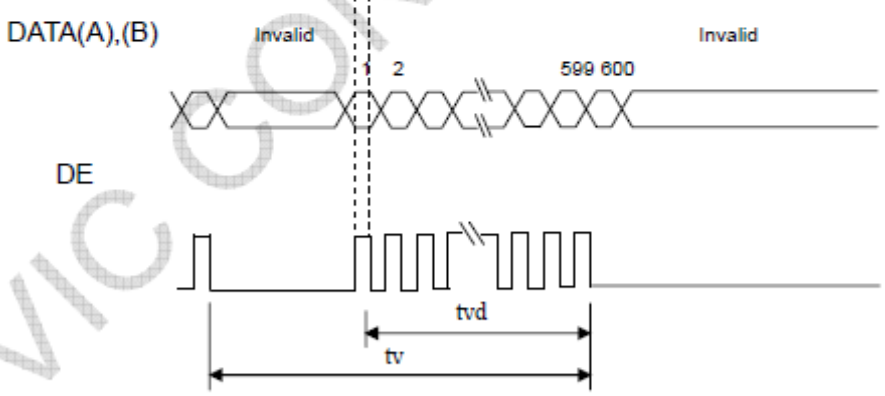
Note1: See the data sheet of LVDS transmitter.

9.2 INPUT SIGNAL TIMING CHART

Horizontal timing



Vertical timing



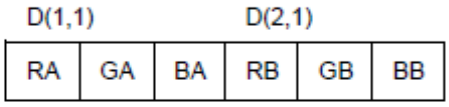
Note 1:

DATA(A)=RA0-RA7,GA0-GA7,BA0-BA7
DATA(B)=RB0-RB7,GB0-GB7,BB0-BB7

9.3 PIXEL DATA ALIGNMENT OF DISPLAY IMAGE

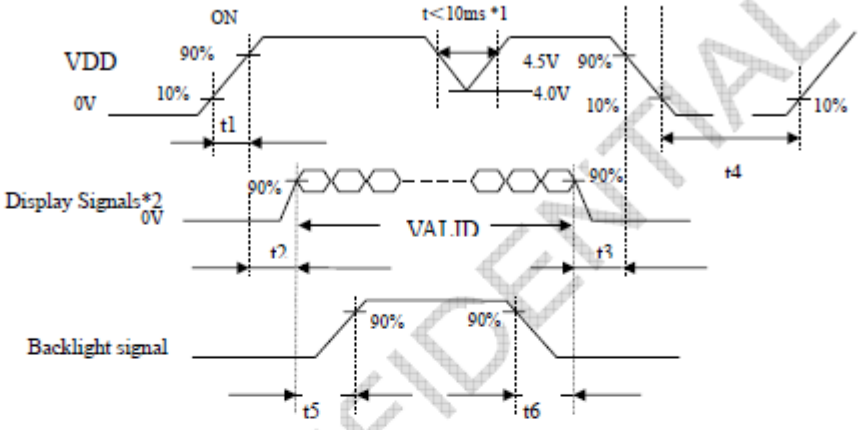
The following chart is the coordinates of per pixel

Odd Pixel: RA= R DATA Even Pixel : RB=R DATA
GA= G DATA GB=G DATA
BA= B DATA BB=B DATA



D(1,1)	D(2,1)	D(3,1)	•••	D(800,1)
D(1,2)	D(2,2)	D(3,2)	•••	D(800,2)
D(1,3)	D(2,3)	D(3,3)	•••	D(800,3)
•	•	•	•••	•
•	•	•	•••	•
•	•	•	•••	•
D(1,600)	D(2,600)	D(2,600)	•••	D(800,600)

9.4 PIXEL DATA ALIGNMENT OF DISPLAY IMAGE



Timing Specifications:

t1 :0.47ms<t1 <10ms;
t2 :0.5 ms<t2 <50ms;
t3 :0ms<t3 <50ms;
t4 :t4 >1000ms;
t5 :t5 >200ms;
t6 :t6 >200ms;

*1. When VDD is on, but the value is lower than 4.5V, a protection circuit may work, then the module ma not display.

*2 The signal line is not connected with the module, at the end of cable the terminal resistor of 100 should be added.

Note1: Display signals (D0+/-, D1+/-, D2+/-, D3+/- and CK+/-) must be "0" voltage, exclude the VALI period (See above sequence diagram). If these signals are higher than 0.3 V, the internal circuit is damaged. If some of display signals of this product are cut while this product is working, even if the signa input to it once again, it might not work normally. If customer stops the display signals, the should cut VDD.

Note2: When VDD is on, it should be set above 4.0V.

When the power supply is designed, the next form can give the reference. If the voltage ripple is over the value in next form, the noise should be seen in display area.

Ripple (Measured at input terminal of power supply)

	VDD (3.3V to drive the panel)
Ripple voltage	≤200mVP-P（Including spike noise）

Parameter	Fuse		Rating	Fusing current	Remarks
	Type	Supplier			
VDD	FCC16152ABTP	KAMAYA	1.5A 32V	-	

Note1: There are different power supply systems from the power input terminal. The power supply capacity should be less than the fusing current. If the power supply capacity is above the fusing current, the fuse may blow in a short time, and then nasty smell, smoking and so on may occur.

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

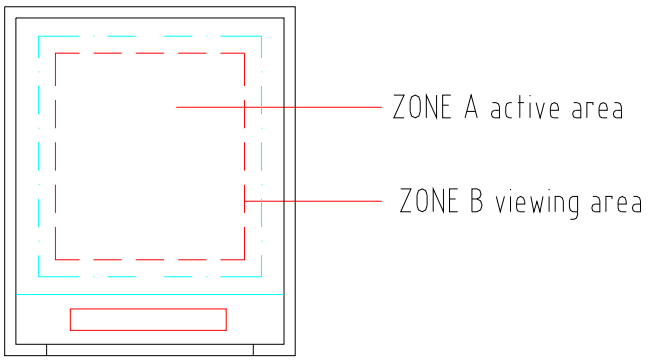
Sampling method shall be in accordance with MIL-STD-105E , level II, normal single sampling plan .

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 INCOMING INSPECTION STANDARD FOR TFT-LCD PANEL

10.5.1. Scope

Specifications contain

10.5.1.1 Display Quality Evaluation

10.51.2 Mechanics Specification

10.5.2. Sampling Plan

Unless there is other agreement, the sampling plan for incoming inspection shall follow MIL-STD-105E LEVEL II.

10.5.2.1 Lot size: Quantity per shipment as one lot (different model as different lot).

10.5.2.2 Sampling type: Normal inspection, single sampling.

10.5.2.3 Sampling level: Level II.

10.5.2.4 AQL: Acceptable Quality Level

Major defect: AQL=0.65

Minor defect: AQL=1.0

10.5.3. Panel Inspection Condition

10.5.3.1 Environment:

Room Temperature: 25±5°C.

Humidity: 65±5% RH.

Illumination: 300 ~ 700 Lux.

10.5.3.2 Inspection Distance:

35-40 cm

10.5.3.3 Inspection Angle:

The vision of inspector should be perpendicular to the surface of the Module.

10.5.3.4 Inspection time ：

Perceptibility Test Time: 20 seconds max.

10.5.4. Display Quality

10.5.4.1 Function Related:

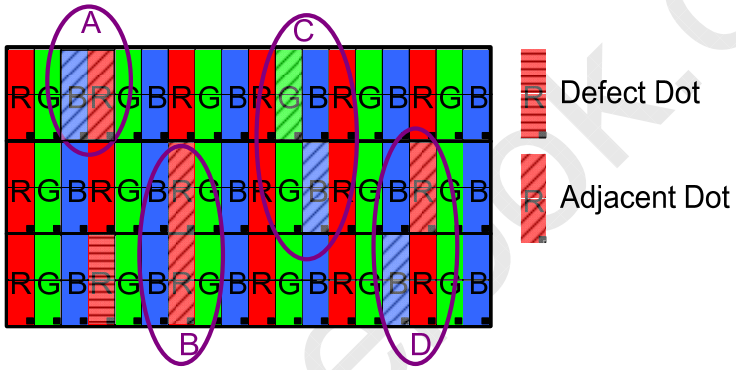
The function defects of line defect, abnormal display, and no display are considered Major defects.

10.5.4.2 Bright/Dark Dots:

Defect Type / Specification	G0 Grade	A Grade
Bright Dots	0	N≤ 3
Dark Dots	0	N≤ 4
Total Bright and Dark Dots	0	N≤ 6

[Note 1]

Judge defect dot and adjacent dot as following.



(1) One pixel consists of 3 sub-pixels, including R,G, and B dot.(Sub-pixel = Dot)

(2) The definition of dot: The size of a defective dot over 1/2 of whole dot is regarded as one defective dot.

(3) Allow above (as A, B, C and D status) adjacent defect dots, including bright and dart adjacent dot. And they will be counted 2 defect dots in total quantity.

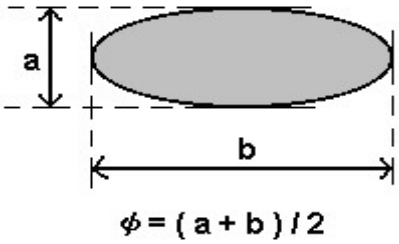
(4) Defects on the Black Matrix, out of Display area, are not considered as a defect or counted.

(5) There should be no distinct non-uniformity visible through 3% ND Filter within 2 sec inspection times.

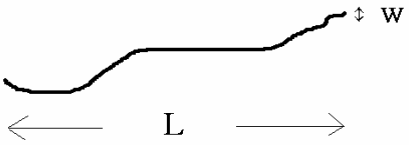
10.5.4.3 Visual Inspection specifications:

Defect Type	Specification	Count(N)
Dot Shape (Particle、Scratch and Bubbles in display area)	D≤0.25mm	Ignored
	0.25mm < D≤ 0.5mm	N≤ 3
	D > 0.5mm	N=0
Line Shape (Particles、Scratch、Lint and Bubbles in display area)	W≤ 0.07mm	Ignored
	0.07mm<W≤ 0.1mm ，L≤ 5mm	N≤ 3
	W > 0.1mm ， L > 5mm	N=0

[Note 2] W : Width[mm], L : Length[mm], N : Number, φ : Average Diameter

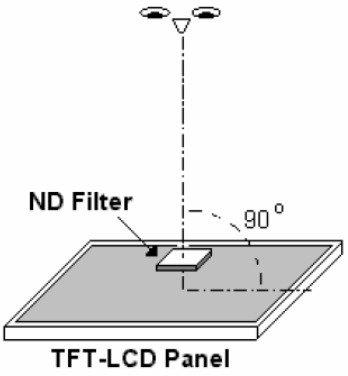


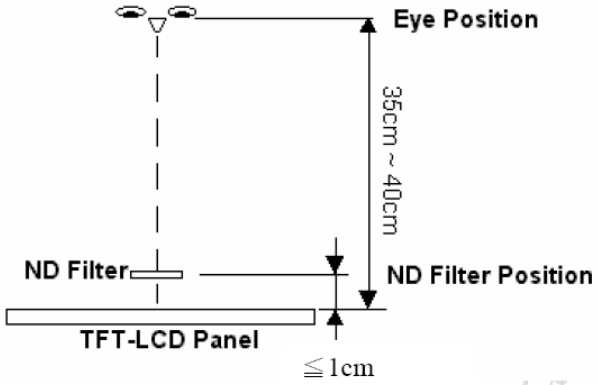
1. (White, black) Spot
2. Polarizer Bubble



1. fiber

[Note 3] Bright dot is defined through 3% transmission ND Filter as following.





10.6 Reliability Test

Test Item	Test Conditions	Note
High Temperature Operation	70±3°C , t=96 hrs	
Low Temperature Operation	-20±3°C , t=96 hrs	
High Temperature Storage	80±3°C , t=96 hrs	1,2
Low Temperature Storage	-30±3°C , t=96 hrs	1,2
Thermal Shock Test	-20°C ~ 25°C ~ 70°C 30 m in. 5 min. 30 min. (1 cycle) Total 5 cycle	1,2
Humidity Test	60 °C, Humidity 90%, 96 hrs	1,2
Vibration Test (Packing)	Sweep frequency : 10 ~ 55 ~ 10 Hz/1min Amplitude : 0.75mm Test direction : X.Y.Z/3 axis Duration : 30min/each axis	2

Note 1 : Condensation of water is not permitted on the module.

Note 2 : The module should be inspected after 1 hour storage in normal conditions

(15-35°C , 45-65%RH).

Definitions of life end point :

- Current drain should be smaller than the specific value.
- Function of the module should be maintained.
- Appearance and display quality should not have degraded noticeably.
- Contrast ratio should be greater than 50% of the initial value.

11. USE PRECAUTIONS

11.1 Handling precautions

1) The polarizing plate may break easily so be careful when handling it. Do not touch, press or rub it with a hard-material tool like tweezers.
2) Do not touch the polarizing plate surface with bare hands so as not to make it dirty. If the surface or other related part of the polarizing plate is dirty, soak a soft cotton cloth or chamois leather in benzine and wipe off with it. Do not use chemical liquids such as acetone, toluene and isopropyl alcohol. Failure to do so may bring chemical reaction phenomena and deteriorations.
3) Remove any spit or water immediately. If it is left for hours, the suffered part may deform or decolorize.
4) If the LCD element breaks and any LC stuff leaks, do not suck or lick it. Also if LC stuff is stuck on your skin or clothing, wash thoroughly with soap and water immediately.

11.2 Installing precautions

1) The PCB has many ICs that may be damaged easily by static electricity. To prevent breaking by static electricity from the human body and clothing, earth the human body properly using the high resistance and discharge static electricity during the operation. In this case, however, the resistance value should be approx. 1MΩ and the resistance should be placed near the human body rather than the ground surface. When the indoor space is dry, static electricity may occur easily so be careful. We recommend the indoor space should be kept with humidity of 60% or more. When a soldering iron or other similar tool is used for assembly, be sure to earth it.
2) When installing the module and ICs, do not bend or twist them. Failure to do so may crack LC element and cause circuit failure.
3) To protect LC element, especially polarizing plate, use a transparent protective plate (e.g., acrylic plate, glass etc) for the product case.
4) Do not use an adhesive like a both-side adhesive tape to make LCD surface (polarizing plate) and product case stick together. Failure to do so may cause the polarizing plate to peel off.

11.3 Storage precautions

1) Avoid a high temperature and humidity area. Keep the temperature between 0°C and 35°C and also the humidity under 60%.
2) Choose the dark spaces where the product is not exposed to direct sunlight or fluorescent light.
3) Store the products as they are put in the boxes provided from us or in the same conditions as we recommend.

11.4 Operating precautions

1) Do not boost the applied drive voltage abnormally. Failure to do so may break ICs. When applying power voltage, check the electrical features beforehand and be careful. Always turn off the power to the LC module controller before removing or inserting the LC module input connector. If the input connector is removed or inserted while the power is turned on, the LC module internal circuit may break.
2) The display response may be late if the operating temperature is under the normal standard, and the display may be out of order if it is above the normal standard. But this is not a failure; this will be restored if it is within the normal standard.
3) The LCD contrast varies depending on the visual angle, ambient temperature, power voltage etc. Obtain the optimum contrast by adjusting the LC dive voltage.
4) When carrying out the test, do not take the module out of the low-temperature space suddenly. Failure to do so will cause the module condensing, leading to malfunctions.
5) Make certain that each signal noise level is within the standard (L level: 0.2Vdd or less and H level: 0.8Vdd or more) even if the module has functioned properly. If it is beyond the standard, the module may often malfunction. In addition, always connect the module when making noise level measurements.
6) The CMOS ICs are incorporated in the module and the pull-up and pull-down function is not adopted for the input so avoid putting the input signal open while the power is ON.
7) The characteristic of the semiconductor element changes when it is exposed to light emissions, therefore ICs on the LCD may malfunction if they receive light emissions. To prevent these malfunctions, design and assemble ICs so that they are shielded from light emissions.
8) Crosstalk occurs because of characteristics of the LCD. In general, crosstalk occurs when the regularized display is maintained. Also, crosstalk is affected by the LC drive voltage. Design the contents of the display, considering crosstalk.

11.5 Other

1) Do not disassemble or take the LC module into pieces. The LC modules once disassembled or taken into pieces are not the guarantee articles.
2) The residual image may exist if the same display pattern is shown for hours. This residual image, however, disappears when another display pattern is shown or the drive is interrupted and left for a while. But this is not a problem on reliability.
3) AMIPRE will provide one year warranty for all products and three months warrantee for all repairing products.

12. OUTLINE DIMENSION