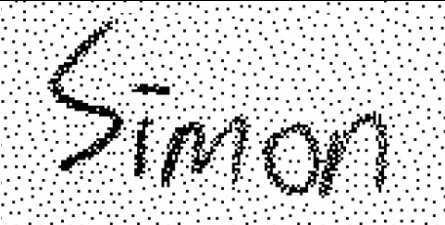
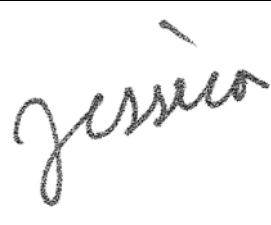


Specifications for LCD module

Customer	
Customer part no.	
Ampire part no.	AM-19201080MTZQW-00
Approved by	
Date	

☐ Approved For Specifications

☐ Approved For Specifications & Sample

Approved by	Checked by	Organized by
		

RECORD OF REVISION

Revision Date	Page	Contents	Editor
2018/7/20	--	New Release	Jessica

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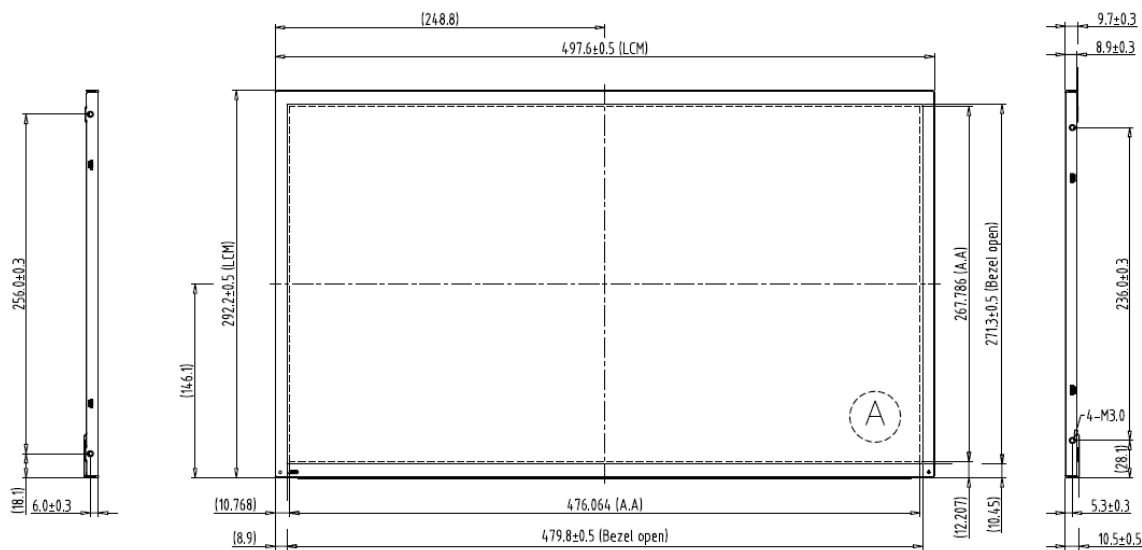
1.0 General Descriptions

1.1 Introduction

The LCM is a color active matrix TFT LCD module using amorphous silicon TFT's (Thin Film Transistors) as an active switching device. This module has a **21.5 inch** diagonally measured active area with FHD resolutions (1920 horizontal by 1080 vertical pixel array). Each pixel is divided into red, green, blue dots which are arranged in vertical Stripe and this module can display 16.7M colors.

1.2 Product Summary

Items	Specifications	Unit
Screen Diagonal	21.5	Inch
Pixel Format	1920 (H) X RGB X 1080 (V)	-
Pixel Pitch	247.95 (H) X 247.95 (V)	um
Pixel Arrangement	R.G.B. Vertical Stripe	-
Display Mode	AHVA mode, Normally Black	-
White Luminance	350 (Typ.)	cd /m2
Contrast Ratio	1000 (Typ.)	-
Nominal Input Voltage VDD	5	V
Support Color	16.7M	-



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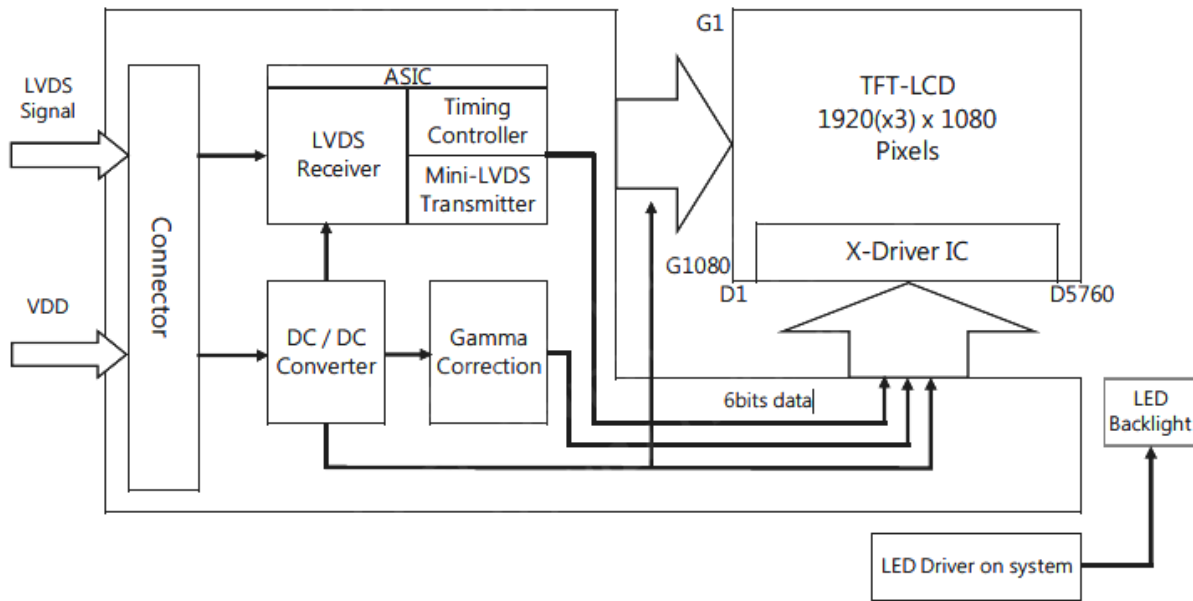
2.0 Absolute Maximum Ratings

Item	Symbol	Values		Unit	Remark
		Min.	Max.		
Logic Signal Input Level	VDD	-0.3	+5.5	V	
Operation Temperature	TOP	0	50	°C	
Storage Temperature	TST	-20	60	°C	

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

Note(2) $T_a = 25 \pm 2^\circ\text{C}$

3.0 LCD Functional Block Diagram



4.0 Electrical Specifications

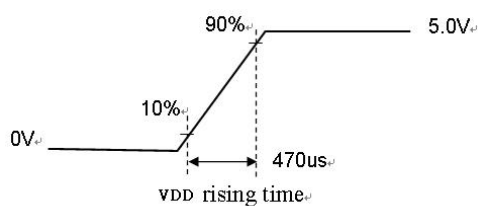
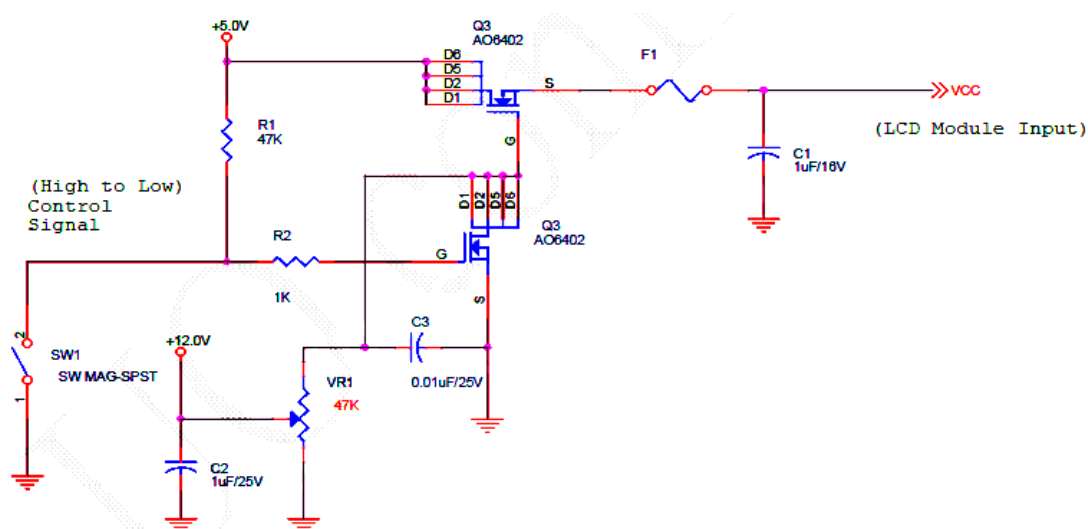
4.1 TFT LCD module

4.1.1 Power Specification

Symbol	Parameter	Min.	Typ.	Max.	Unit	Conditions
VDD	Logic/LCD Drive Voltage	4.5	5.0	5.5	V	+/-10%
IDD	Input Current	--	0.46	0.55	A	VDD= 5.0V, All White Pattern At 60Hz
PDD	VDD Power	--	2.3	2.75	Watt	VDD= 5.0V, All White Pattern At 60Hz
IRush	Inrush Current	--	--	3.0	A	Note(1)
VDDrp	Allowable Logic/LCD Drive Ripple Voltage	--	--	500	mVp-p	VDD= 5.0V, All White Pattern At 60Hz

Note(1) Measurement conditions:

The duration of rising time of power input is 470us.



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4.1.2 Signal Electrical Characteristics

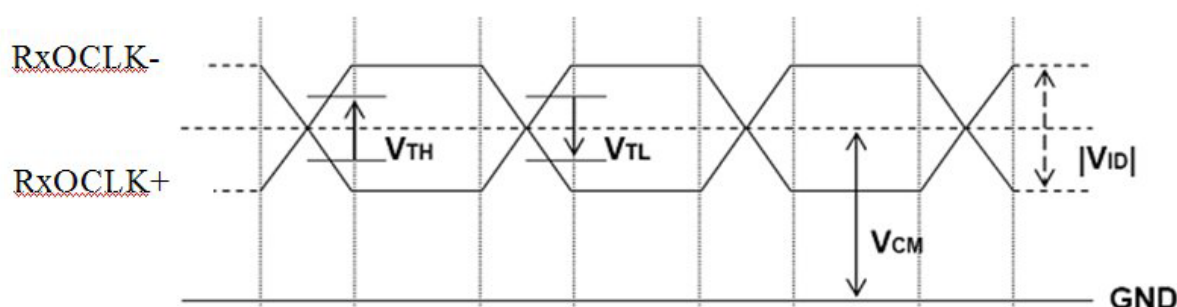
Characteristics of each signal are as follows:

Symbol	Parameter	Min.	Typ.	Max.	Units	Condition
V _{TH}	Differential Input High Threshold	100	--	--	mV	V _{ICM} = 1.2V Note(1)
V _{TL}	Differential Input Low Threshold	--	--	-100	mV	V _{ICM} = 1.2V Note(1)
V _{ID}	Input Differential Voltage	100	400	600	mV	Note(1)
V _{ICM}	Differential Input Common Mode Voltage	1.0	1.2	1.5	V	V _{TH} -V _{TL} = 200mV (max) Note(1)

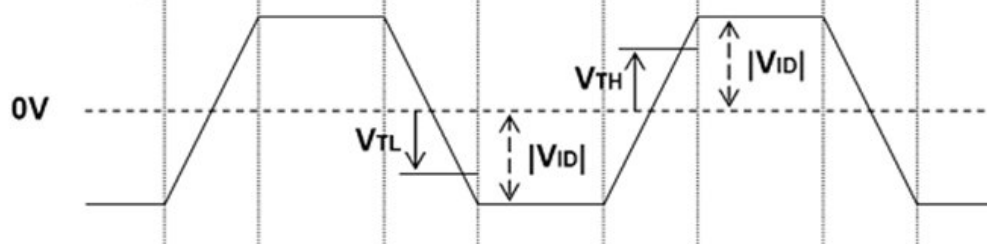
Note(1) LVDS Signal Waveform

Use RxOCLK- & RxOCLK+ as example

Single-End



Differential Signal



5.0 Interface Timings

5.1 Timing Characteristics

Signal	Item	Symbol	Min	Typ	Max	Unit
V-section	Period	Tv	1094	1130	1836	Th
	Active	Tdisp(v)	1080	1080	1080	Th
	Blanking	Tbp(v)+Tfp(v)+PWvs	14	50	756	Th
H-section	Period	Th	1000	1050	1678	Tclk
	Active	Tdisp(h)	960	960	960	Tclk
	Blanking	Tbp(h)+Tfp(h)+PWhs	40	90	718	Tclk
Clock	Period	Tclk	11.2	14	18.6	ns
	Frequency	Freq.	53.7	71.2	90	MHz
Frame Rate	Frame Rate	1/Tv	49	60	76	Hz

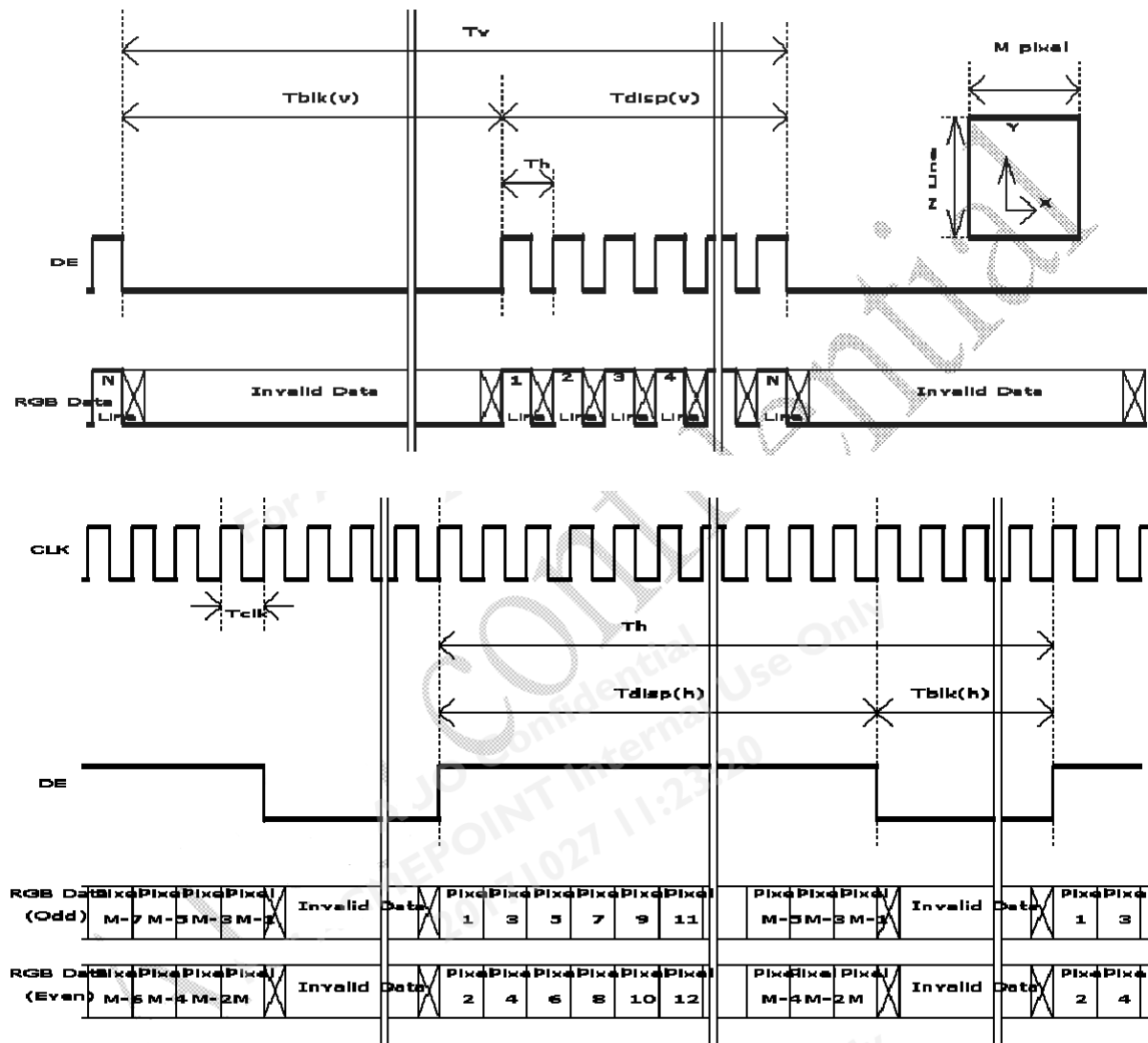
Note(1) Only DE mode operation.

The input of Hsync & Vsync signal does not have an effect upon the LCD normal operation.

Note(2) The performance of the electro-optical characteristics may be influenced by variance of the vertical refresh rates.

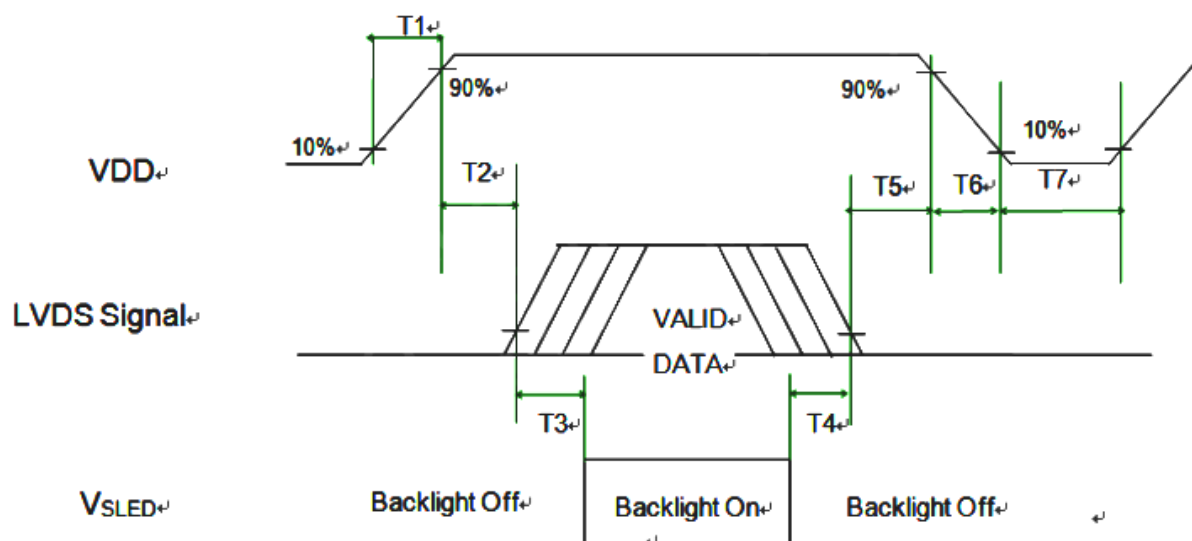
Note(3) Horizontal period should be even.

5.2 Timing diagram



5.3 Power Sequence

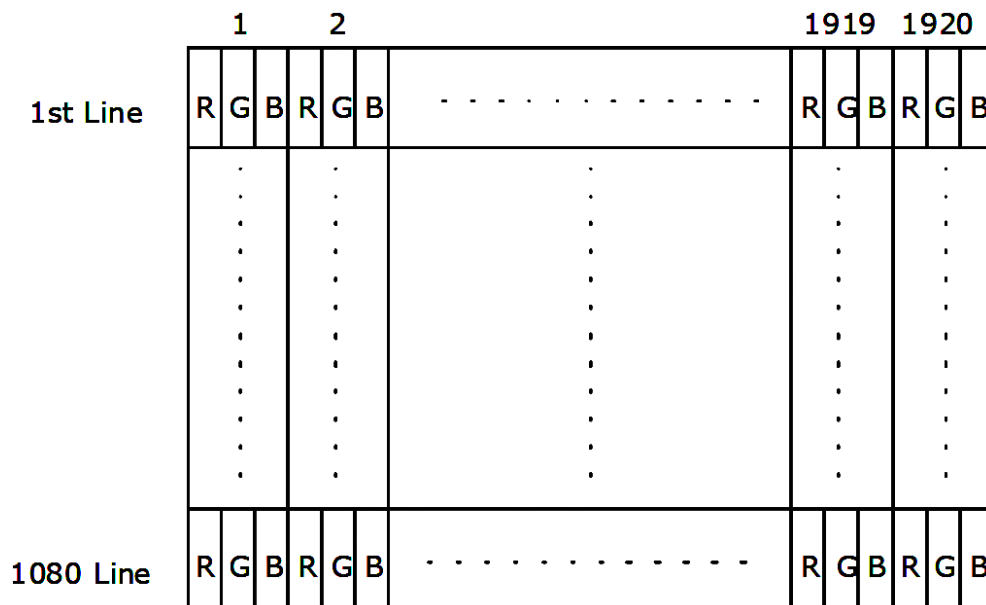
VDD power and LED on/off sequence are as follows. Interface signals are also shown in the chart.



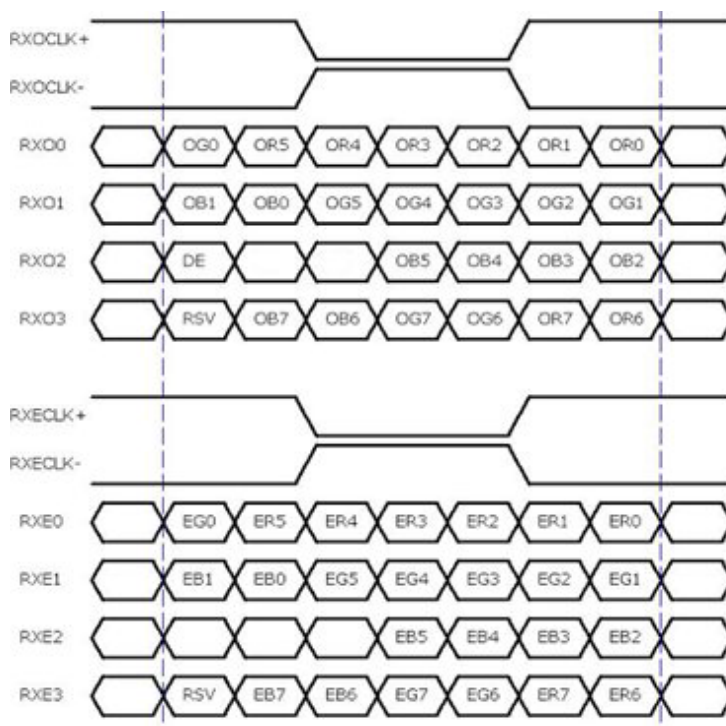
Parameter	Value			Units
	Min.	Typ.	Max.	
T1	0.5	-	10	[ms]
T2	0	-	50	[ms]
T3	500	-	-	[ms]
T4	100	-	-	[ms]
T5	0	-	50	[ms]
T6	0	-	200	[ms]
T7	1000	-	-	[ms]

5.4 Pixel Format Image

Following figure shows the relationship of the input signals and LCD pixel format.



5.5 The input data format



8 Bit Color Bit Order			
MSB	R7	G7	B7
	R6	G6	B6
	R5	G5	B5
	R4	G4	B4
	R3	G3	B3
	R2	G2	B2
	R1	G1	B1
LSB	R0	G0	B0

Note(1) Normally DE mode only. VS and HS on EVEN channel are not used.

Note(2) Please follow VESA.

Note(3) 8-bits signal input.

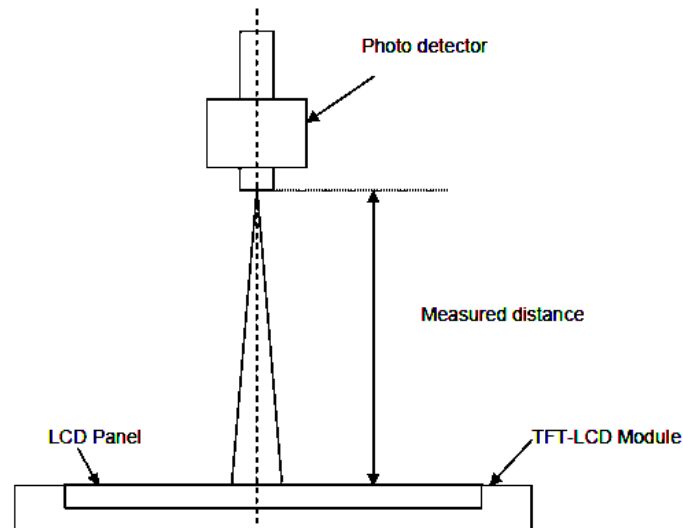
6.0 Optical Specifications

The optical characteristics are measured under stable conditions as following notes

Item	Conditions		Min.	Typ.	Max.	Unit	Note
Viewing Angle (CR>10)	Horizontal	θ_L	--	89	--	degree	Note(2)
		θ_R	--	89	--		
	Vertical	θ_T	--	89	--		
		θ_B	--	89	--		
Contrast Ratio	Center		800	1000	--	--	Note(3)
Response Time	Rising + Falling		--	22	42	ms	Note(4)
Color Chromaticity (CIE1931)	Red	x	Typ. -0.05	TBD	Typ. +0.05	--	Note(5)
	Red	y		TBD		--	
	Green	x		TBD		--	
	Green	y		TBD		--	
	Blue	x		TBD		--	
	Blue	y		TBD		--	
	White	x		0.313		--	
	White	y		0.329		--	
White Luminance	Center		280	350	--	cd/m ²	Note(6)
Luminance Uniformity	9Points		75	80	--	%	Note(7)
Color Gamut	--		--	72	--	%	--

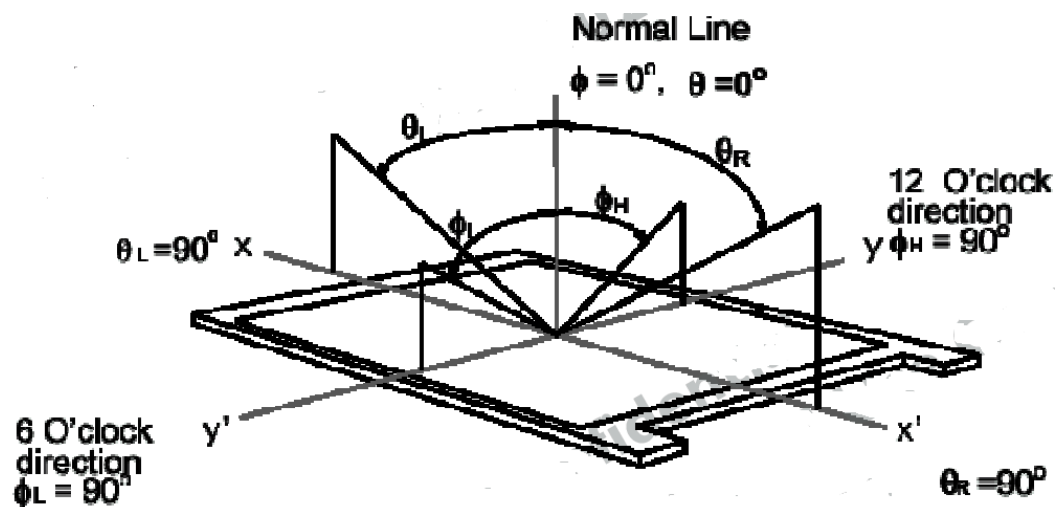
Note(1) Measurement method

The LCD module should be stabilized at given temperature for 30 minutes to avoid abrupt temperature change during measuring (at surface 35°C). In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 30 minutes in a stable, windless and dark room.



Note(2) Definition of viewing angle

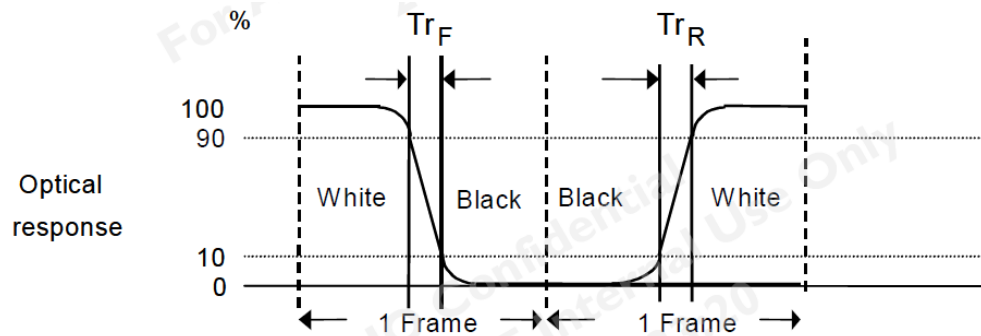
Viewing angle is the measurement of contrast ratio ≥ 10 , at the screen center, over a 180° horizontal and 180° vertical range (off-normal viewing angles). The 180° viewing angle range is broken down as follows; 90° (θ) horizontal left and right and 90° (Φ) vertical, high (up) and low (down). The measurement direction is typically perpendicular to the display surface with the screen rotated about its center to develop the desired measurement viewing angle.



Note(3) Contrast ratio is measured.

Note(4) Definition of Response time

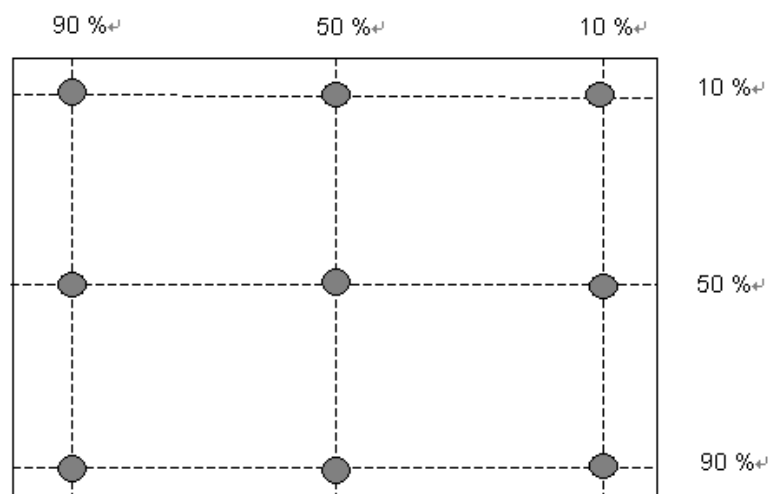
The output signals of photo detector are measured when the input signals are changed from “Full Black” to “Full White” (rising time, Tr_R), and from “Full White” to “Full Black” (falling time, Tr_F), respectively. The response time is interval between the 10% and 90% (1 frame at 60 Hz) of amplitudes. $Tr_R + Tr_F = 5 \text{ msec (typ.)}$.



Note(5) Color chromaticity and coordinates (CIE) is measured.

Note(6) Central luminance is measured.

Note(7) Luminance uniformity of these 9 points is defined as below and measured.



$$\text{Uniformity} = \frac{\text{Minimum Luminance in 9 points (1-9)}}{\text{Maximum Luminance in 9 Points (1-9)}}$$

7.0 Interface Connections

7.1 LCD interface

Pin	Signal Name	Description
1	RxO0-	Negative LVDS differential data input (Odd data)
2	RxO0+	Positive LVDS differential data input (Odd data)
3	RxO1-	Negative LVDS differential data input (Odd data)
4	RxO1+	Positive LVDS differential data input (Odd data)
5	RxO2-	Negative LVDS differential data input (Odd data)
6	RxO2+	Positive LVDS differential data input (Odd data)
7	GND	Ground
8	RxOCLK-	Negative LVDS differential clock input (Odd clock)
9	RxOCLK+	Positive LVDS differential clock input (Odd clock)
10	RxO3-	Negative LVDS differential data input (Odd data)
11	RxO3+	Positive LVDS differential data input (Odd data)
12	RxE0-	Negative LVDS differential data input (Even data)
13	RxE0+	Positive LVDS differential data input (Even data)
14	GND	Ground
15	RxE1-	Negative LVDS differential data input (Even data)
16	RxE1+	Positive LVDS differential data input (Even data)
17	GND	Ground
18	RxE2-	Negative LVDS differential data input (Even data)
19	RxE2+	Positive LVDS differential data input (Even data)
20	RxECLK-	Negative LVDS differential clock input (Even clock)
21	RxECLK+	Positive LVDS differential clock input (Even clock)
22	RxE3-	Negative LVDS differential data input (Even data)
23	RxE3+	Positive LVDS differential data input (Even data)
24	GND	Ground
25	NC	No connection
26	NC	No connection
27	NC	No connection
28	VDD	Power Supply Input Voltage
29	VDD	Power Supply Input Voltage
30	VDD	Power Supply Input Voltage

Connector Name / Designation	Interface Connector / Interface card
Manufacturer	STM
Type Part Number	MSBKT2407P30HB
Mating Housing Part Number	FI-X30HL or FI-X30C2L-NPB

7.2 Backlight interface

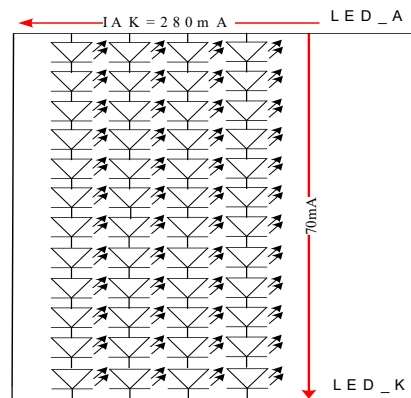
Pin	Signal Name	Description
1	CH1	LED Current Feedback Terminal (Channel 1)
2	CH2	LED Current Feedback Terminal (Channel 2)
3	VSLED	LED Power Supply Voltage Input Terminal
4	VSLED	LED Power Supply Voltage Input Terminal
5	CH3	LED Current Feedback Terminal (Channel 3)
6	CH4	LED Current Feedback Terminal (Channel 4)

Connector Name / Designation	LED Connector
Manufacturer	ENTERY
Connector Model Number	3707K-S06N-21R
Mating Connector Model Number	H112K-P06N-00B (Non-Locking type) H112K-P06N-13B (Locking type)

8.0 LED Driving Conditions

Item	Symbol	Values			Unit	Note
		Min.	Typ.	Max.		
LED voltage	VAK	32.4	33.5	34.6	V	IAK =280mA Ta=25°C
LED current	IAK	--	280	320	mA	Ta=25°C
LED Life Time	-	--	50K	--	Hour	Note (2)

Note(1) The constant current source is needed for white LED back-light driving.

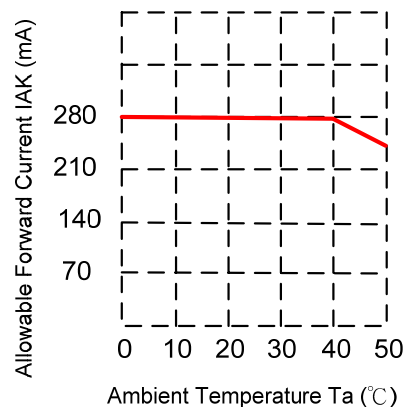


Note(2) Condition: Ta=25°C , continuous lighting

Life time is estimated data. Definitions of failure:

1. LCM brightness becomes half of the minimum value.
2. LED doesn't light normally.

When LCM is operated over 40°C ambient temperature, the IAK should follow :



9.0 Reliability Test

The reliability test items and its conditions are shown below.

Test Item	Test Conditions	Note
High Temperature Operation	50±3°C , t=240 hrs	
Low Temperature Operation	0±3°C , t=240 hrs	
High Temperature Storage	60±3°C , t=240 hrs	1,2
Low Temperature Storage	-20±3°C , t=240 hrs	1,2
Storage at High Temperature and Humidity	40°C, 90% RH , 240 hrss	1,2
Thermal Shock Test	-30°C (30min) ~ 60°C (30min) , 27 cycles	1,2
Vibration Test (Packing)	Sweep frequency : 10~55~10 Hz/1min Amplitude : 0.75mm Test direction : X.Y.Z/3 axes Duration : 30 min/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).

Note(3) The module shouldn't be tested over one condition, and all the tests are independent.

Note(4) All reliability tests should be done without the protective film. Current drain should be smaller than the specific value.

Note(5) Function of the module should be maintained.

Definitions of life end point:

-
- Appearance and display quality should not have degraded noticeably.
- Contrast ratio should be greater than 50% of the initial value.

10. General Precaution

10.1 Use Restriction

- (1) 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.

10.2 Disassembling or Modification

- (1) 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.

10.3 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.
Handle carefully with chips of glass that may cause injury, when the glass is broken.

10.4 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.

10.5 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.

10.6 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 cause deformation or color fading.
- (5) When cleaning the adhesives, please use absorbent cotton wetted with a little petroleum benzene or other adequate solvent.

10.7 Mechanism

- (1) Please mount LCD module by using mounting holes arranged in four corners tightly.

10.8 Static Electricity

- (1) Protection film must remove very slowly from the surface of LCD module to prevent from electrostatic occurrence.
- (2) Because LCD modules 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.

10.9 Strong Light Exposure

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

10.10 Disposal

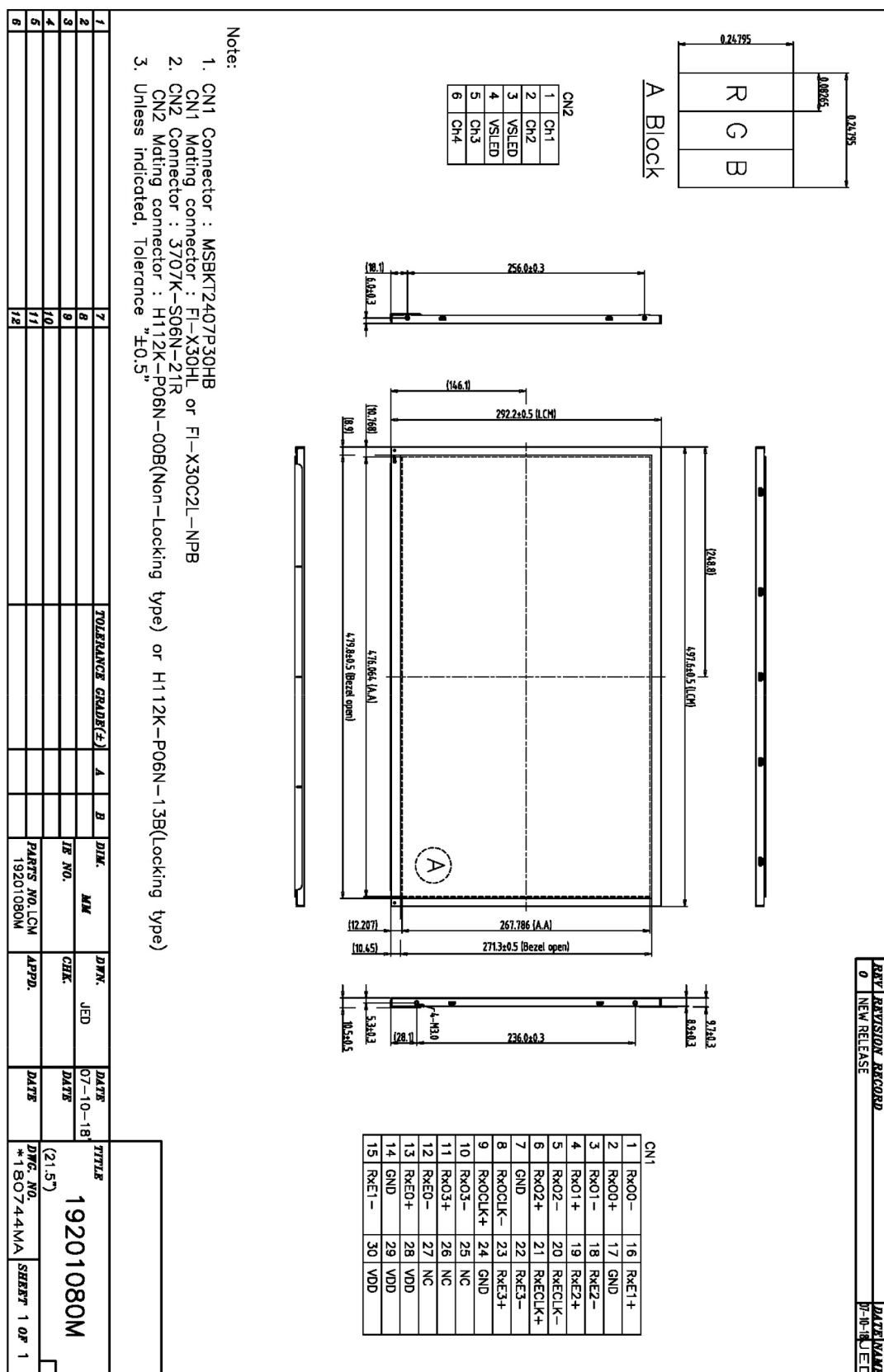
- (1) When disposing LCD module, obey the local environmental regulations.

10.11 Others

- (1) AMIPRE will provide one year warrantee for all products and three months warrantee for all repairing products.
- (2) Do not keep the LCD at the same display pattern continually. The residual image will happen and it will damage the LCD. Please use screen saver.

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11.0 Outline Dimension



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