Xingyue technology co., ltd

No.	M121-500D
DATE	06-Aug-2023

TECHNICAL LITERATURE

FOR

TFT- LCD module

These parts have corresponded with the RoHS directive.

MODEL No. M121VGXN20C-500D

The technical literature is subject to change without notice. So, please contact CYD or its representative before designing your product based on this literature.

RECORDS OF REVISION

Model No. : M121VGXN20C-500D

SPEC No.	DATE	REVISED No	PAGE	SUMMARY	NOTE
P0	2023/8/6			-	

- Contents -

1. Application

This Technical Literature applies to the color TFT-LCD module M121VGXN20C-500D .

The device listed in this specification was designed and manufactured for use in general electronic equipment.

In case of using the device for applications such as control and safety equipment for transportation (controls of aircraft, trains, automobiles, etc.), rescue and security equipment and various safety related equipment which require higher reliability and safety, take into consideration that appropriate measures such as fail-safe functions and redundant system design should be taken.

Do not use the device for equipment that requires an extreme level of reliability, such as aerospace applications, telecommunication equipment (trunk lines), nuclear power control equipment and medical or other equipment
for life support.

CYD assumes no responsibility for any damage resulting from the use of the device which does not comply with the instructions and the precautions specified in this specification.

Contact and consult with a CYD sales representative for any questions about this device.

2. Overview

This module is a color active matrix LCD module incorporating amorphous silicon TFT (Thin Film Transistor). It is composed of a color TFT-LCD panel, driver ICs, control circuit, power supply circuit and a White-LED Backlight unit. Graphics and texts can be displayed on a 800×RGB×600dots panel with about 262144colorscolors by using LVDS (Low Voltage Differential Signaling) and supplying +3.3V DC supply voltages for TFT-LCD panel driving and +12.0V DC supply voltage for backlight.

The TFT-LCD panel used for this module is a high-brightness and high contrast

image. The maximum viewing angle is in the 6o'clockdirection.

The 12o'clock direction is difficult to reverse the grayscale.

The LED driver circuit is built into the module.

3.Mechanical technicalliteratures

Parameter	technical literatures	Unit
Display size	31(12.1inch)Diagonal	cm
Active area	246.0(H)×184.5(V)	mm
Pixel format	800(H)×600(V) (1pixel=R+G+B dot)	pixel
Aspect ratio	4:3	
Pixel pitch	0.3075(H)×0.3075(V)	mm
Pixel configuration	R,G,B vertical stripe	
Display mode	Normally white	
Unit outline dimensions (*1)	276.0(W)×209.0(H)×9.1(D)	mm
Mass(MAX)	750	g
Surface treatment	Anti-glare and hard-coating 3H	

△1

(*1) excluding the area of the connector cover.

Outline dimensions are shown in Fig.1-1 and

Fig.1-2.

4. Input Terminals

4.1. TFT-LCD panel driving

CN1 (Interface signals and +3.3V power supply)

Using connectors: FI-SEB20P (Japan Aviation Electronics industry Co., Ltd.) or Similar type Corresponding connectors: FI-SE20M or FI-S20S (Japan Aviation Electronics industry Co., Ltd.) Using LVDS receiver: Building into cotroll IC (THC63LVDF84B (Thine electronics) or Compatible product)

Corresponding LVDS transmitter: THC63LVDM83R (Thine electronics) or Compatible product

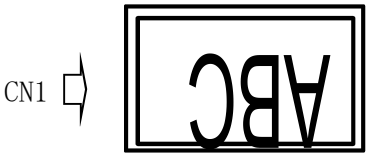
CN1

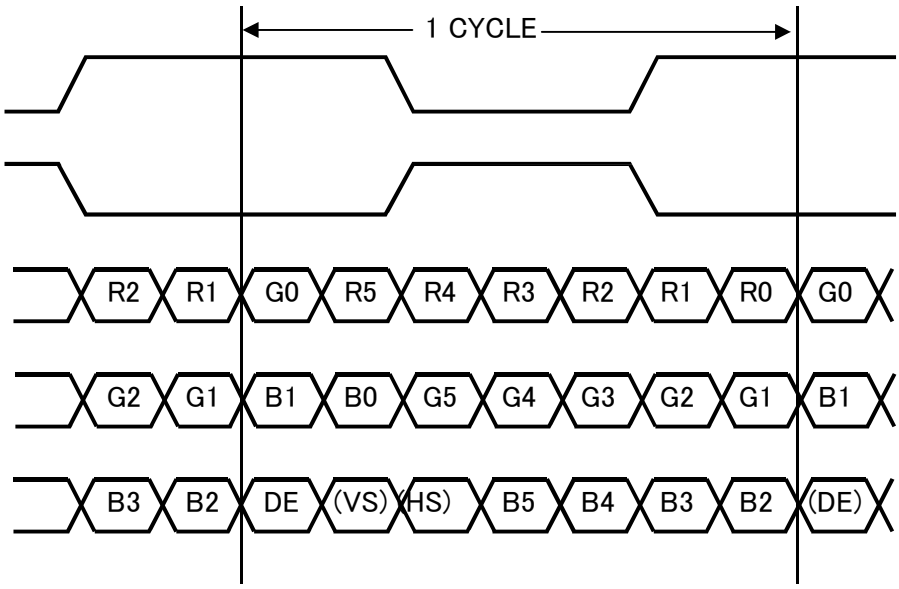
< Pin Assignment for LCD Module Connector >

Pin No.	Symbol	Description	I/O
1	VCC	Power supply	P
2	VCC	Power supply	P
3	GND	Ground	-
4	SEL	VCC:8Bits; GND/NC:6Bits	I
5	RIN0-	LVDS signal input	I
6	RIN0+	LVDS signal input	I
7	GND	Ground	-
8	RIN1-	LVDS signal input	I
9	RIN1+	LVDS signal input	I
10	GND	Ground	-
11	RIN2-	LVDS signal input	I
12	RIN2+	LVDS signal input	I
13	GND	Ground	-
14	CLKIN-	LVDS clock input	I
15	CLKIN+	LVDS clock input	I
16	GND	Ground	-
17	RIN3-	LVDS signal input	I
18	RIN3+	LVDS signal input	I
19	NC	SDA,For BOE Use	-
20	NC	SCL, For BOE Use	-

【*1】 RL/UD= LOW

RL/UD = HIGH





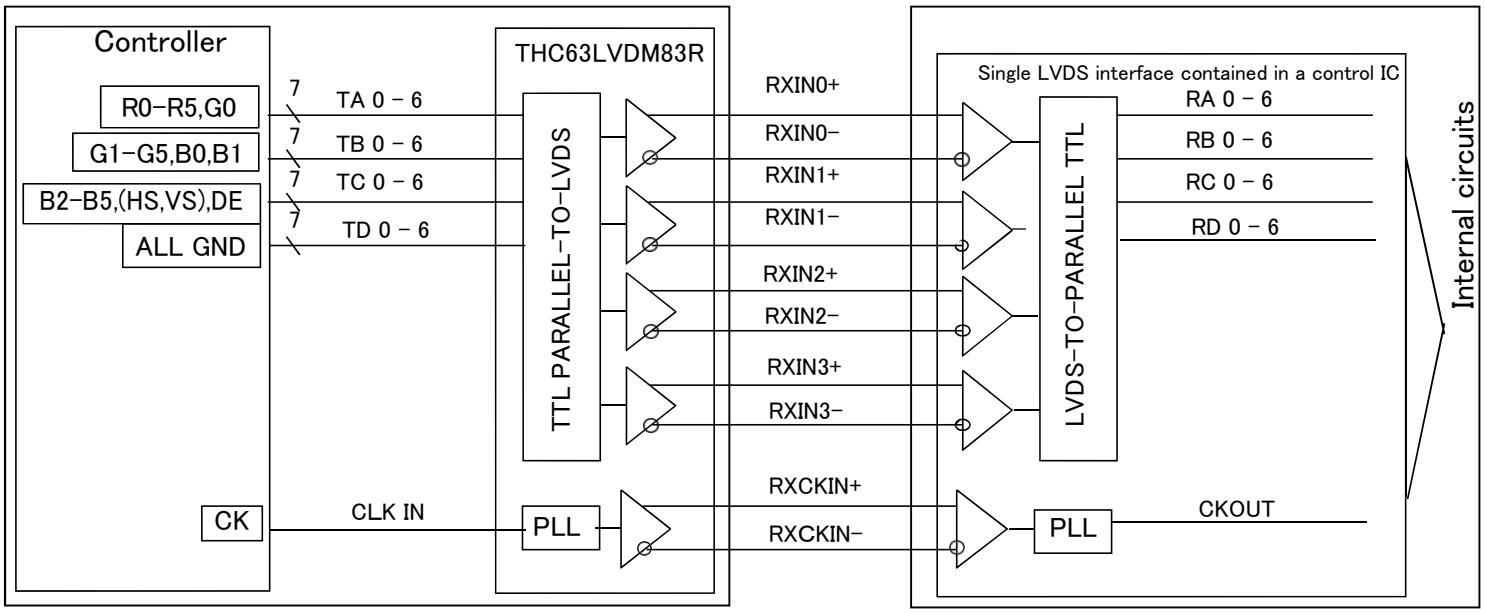
DE: DATA ENABLE

(HS: Hsync)

(VS: Vsync)

4.2. Interface block diagram

(Computer Side) (TFT-LCD side)



4.3. LED backlight

LED backlight connector CN2 Using connectors: KB916-05RSRG3A or Similar type

Connector No.	Pin No.	symbol	function
CN2	1	NC	/
	2	PWM	luminance
	3	EN	3.3v-on/0v-off
	4	GND	GND
	5	VLED	power supply 12v

5.Absolute MaximumRatings

Parameter	Symbol	Condition	Pin	Ratings	Unit	Remark
Supply voltage	Vcc	Ta=25℃	VCC	-0.3 ～ +4.0	V	【*1,2】
	V_{DD}	Ta=25℃	VDD	-0.3 ～ +15.0	V	【*1,2】
Input voltage	V_{I1}	Ta=25℃	RxINi-/+ CKIN-/+	-0.3～Vcc+0.3	V	i=0,1,2
	V_{I2}	Ta=25℃	RL/UD,SELLVDS	-0.3～Vcc+0.3	V	
	V_{I4}	Ta=25℃	XSTABY, VBR	-0.3～+VDD	V	
Storage temperature	T_{STG}	—	-	-30 ～ +70	℃	【*1】
Operating temperature	T_{OPA}	—	-	-20 ～ +60	℃	【*1,3,4】

【*1】 Humidity: 95%RH Max.(Ta≦40℃) Note static electricity.

Maximum wet-bulb temperature at 39℃ or less. (Ta>40℃)No condensation.

【*2】 The VCC power supply capacity must use the one of 2A or more.

The VDD power supply capacity must use the one of 3Aor more. △1

【*3】 There is a possibility of causing deterioration in the irregularity and others of the screen and the display fineness though the liquid crystal module doesn't arrive at destruction when using it at65～70℃.

There is a possibility of causing the fineness deterioration by the prolonged use in the (high temperature) humidity environment (60 % ormore).

【*4】 In the operating temperature item, the low temperature side is the ambient temperature regulations.

The high temperature side is the panel surface temperature regulations.

6. ElectricalCharacteristics

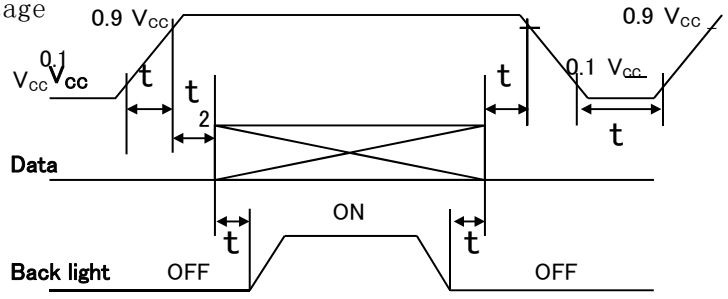
6-1. TFT-LCDpaneldriving

T_a＝+25℃

Parameter		Symbo	Condition	Min.	Typ.	Max.	Unit	Remark
Supply voltage		V_{CC}		3.0	3.3	3.6	V	【*1】
Current dissipation		I_{CC}	Vcc=3.3V	—	(250)	(350)	mA	【*2】
InputvoltagewidthforLVDSreceiver		V_L		0	—	2.4	V	
Permissive input ripple voltage		V_{RP}		—	—	200	mV_{P-P}	Vcc=3.3V
Differential input Threshold voltage	High	V_{TH}		—	—	V_{CM} +100	mV	V_{CM} =+1.2V
	Low	V_{TL}		V_{CM} -100	—	—	mV	【*3】
Input voltage		V_{IH}		2.1	—	—	V	【*4】
		V_{IL}		—	—	0.8	V	
Input reak current		I_{OH}		—	—	400	μA	V_{I2} =+3.3V【*4】
		I_{OL}		-10	—	+10	μA	V_{I2} =0V【*4】
Terminal resistor		R_T		—	100	—	Ω	Differential input

△1

【*1】 On-off conditions for supply voltage



$20\mu s < t_1 \leqq 10ms$

$20ms < t_2 \leqq 200ms$

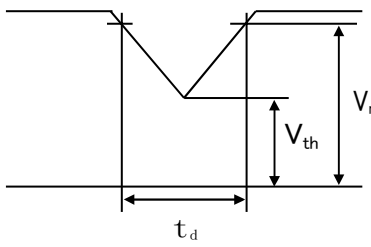
$0 < t_3 \leqq 1s$

$1s \leqq t_4$

$500ms \leqq t_5$

$200ms \leqq t_6$

Vcc-dip conditions



V_{th} =2.5V

V_{min} = 3V

1. $Vth < V_{CC} \leqq Vmin$

   $t_d \leqq 10ms$

2. $V_{CC} < V_{th}$

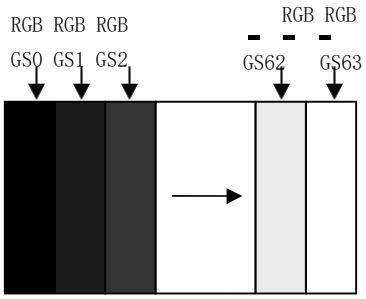
Vcc-dip conditions should also follow the On-off conditions for supply voltage

- Hsync/Vsync need not be input so that this model may drive only by the ENABsignal. Even if Hsync/Vsync is input, it doesn't become a malfunction.
- Therelationbetweenthedatainputandthebacklightlightingwillrecommendtheabove-mentionedinputsequence. When the backlight is turned on before the panel operates, there is a possibility of abnormally displaying. The liquid crystal module is not damaged.

【*2】 Current dissipation

Typical current situation : 64-gray-bar pattern

(Vcc=+3.3V、fck = 40MHz、Ta=25° C)



【*3】 V_{CM} : LVDS common mode voltage

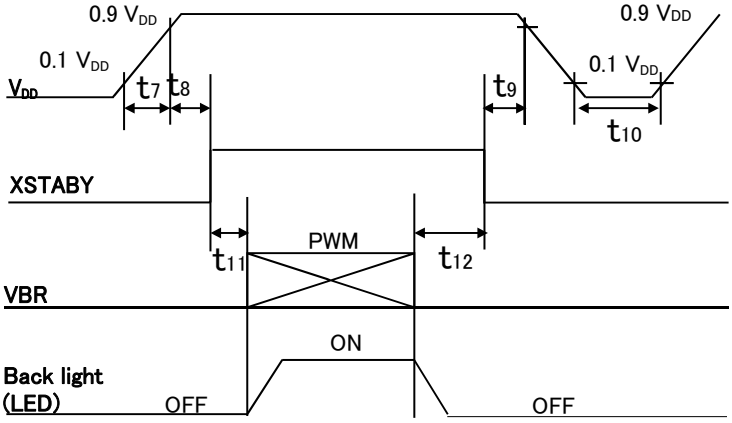
【*4】 RL/UD

6-2. LED backlight

Ta＝+25℃

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark	
Supply voltage		V_{DD}	10.2	12.0	13.8	V	【*1】	
Current dissipation		I_{DD1}	–	(550)	(700)	mA	【*2】	△1
		I_{DD2}	–	–	(12)	mA		△1
Permissive input ripple voltage		V_{RP_BL}	–	–	200	mV_{P-P}	VDD=+12.0V	
XSTABY	Highvoltage	V_{IH_BL1}	2.4	–	VDD	V	【*3】	
	Low voltage	V_{IL_BL1}	–	–	0.2	V	【*3】	
VBR	Highvoltage	V_{IH_BL2}	2.1	–	VDD	V	【*4】	
	Low voltage	V_{IL_BL2}	–	–	0.8	V	【*4】	
PWM frequency		f_{PWM}	200	–	1K	Hz	【*4,5】	
PWM duty		D_{PWM}	10	–	100	%	【*4,5】	
Life time		L	–	(50,000) (Module)	–	h	【Reference】 【*6】	

【*1】 On-off conditions for supply voltage



20 μs ≦ t_7 ≦ 200ms

0ms ≦ t_8

0ms ≦ t_9

200ms ≦ t_{10}

10ms ≦ t_{11}

0ms ≦ t_{12}

【*2】 Current dissipation

Typ. value: V_{DD}=+12.0V、Duty=100 %

Max. value: V_{DD}=+10.2V、Duty=100 %

【*3】 Backlight ON/OFF signal (connected by the pull-down resistor of 10kΩ)

【*4】 PWM signal (connected by the pull-down resistor of 10kΩ)

【*5】 PWM

f_{PWM} = $1/t_{14}$

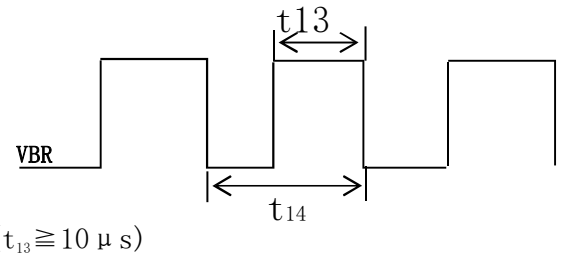
Duty10%:Min.Luminance(0 %: LED OFF)

Duty

100 %: Max. Luminance

Luminance changes in proportion to the duty ratio.

When the frequency slows, the display fineness might decrease.



(t_{13}≧10 μs)

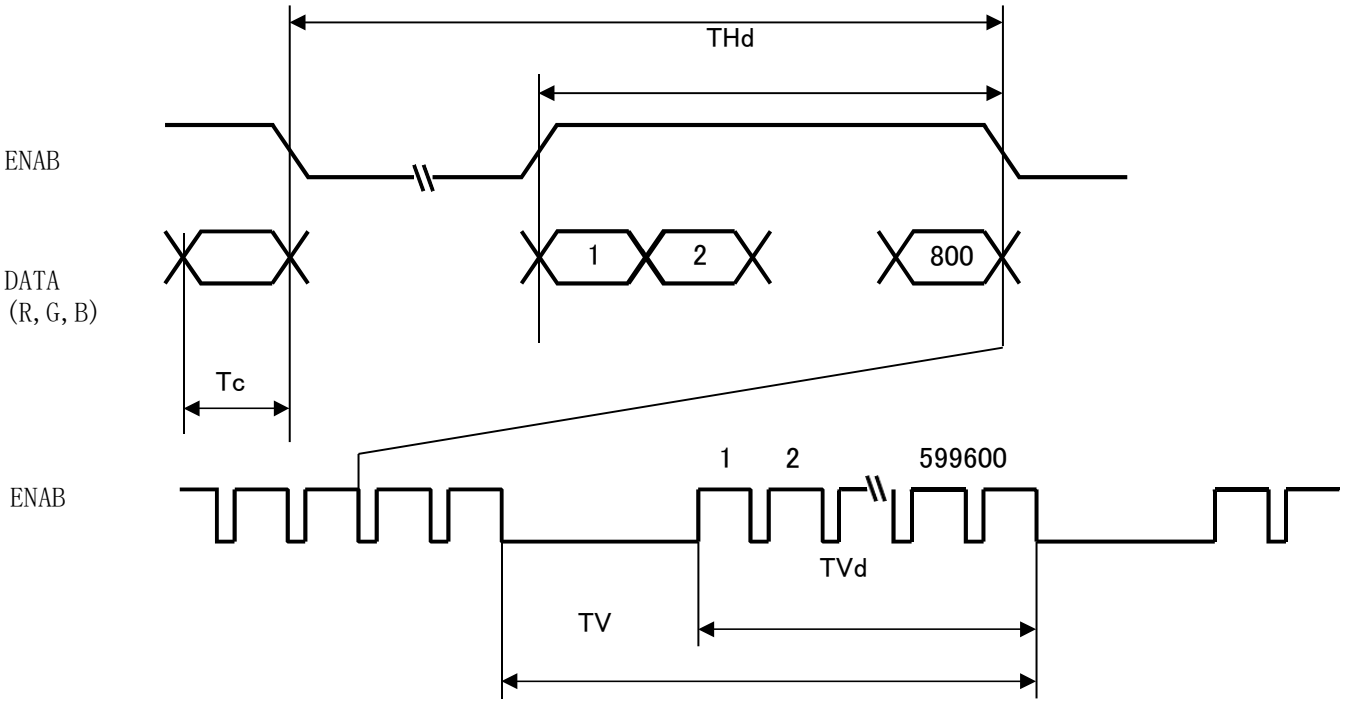
【*6】Luminancebecomes 50% of aninitialvalue. (Ta＝25℃, PWM=100%)

7. Timing characteristics of inputsignals

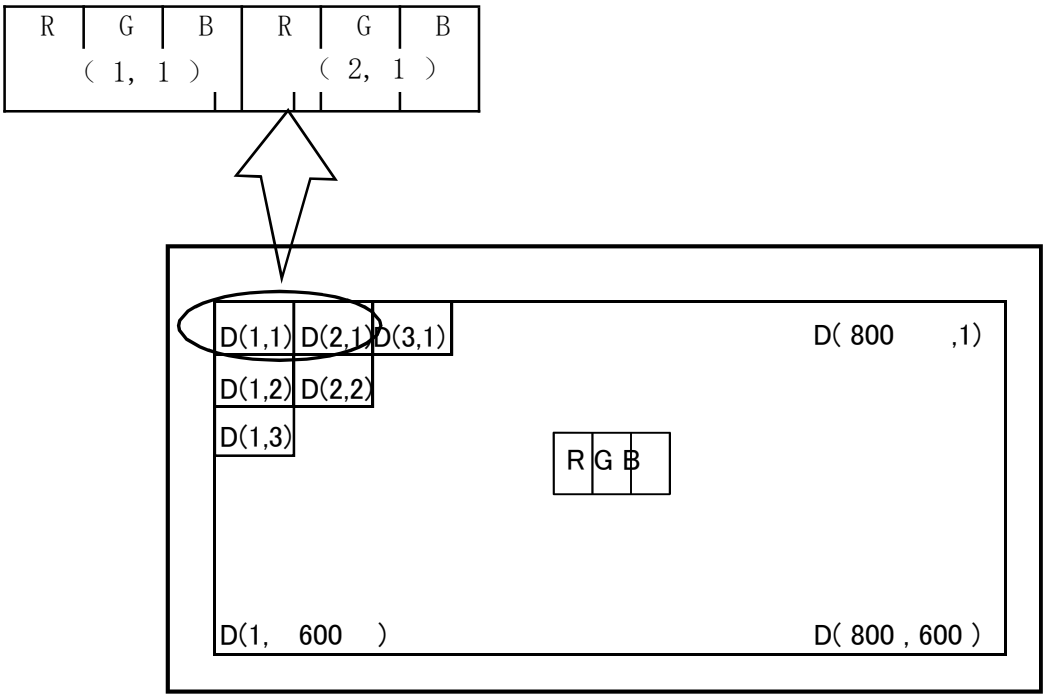
7-1. Timing characteristics

Parameter		Symbol	min	typ	max	unit	remark
Clock	Frequency	1/Tc	35	40	42	MHz	
ENAB	Horizontal period	TH	940	1056	1395	clock	
			23.5	26.4	39.9	μ s	
	Horizontal period (High)	THd	800	800	800	clock	
	VerticalFrequency	TV	628	666	798	line	【*1】
			-	16.7	-	ms	
	Vertical period (High)	TVd	600	600	600	line	

【*1】 In case of using the long vertical period, the deterioration of display quality, flicker etc. may occur.



7-2. Input Data Signals and Display Position on the screen



8. Input Signals, Basic Display Colors and Gray Scale of EachColor

	Colors & Gray scale	Data signal																	
		GrayScale	R0	R1	R2	R3	R4	R5	G0	G1	G2	G3	G4	G5	B0	B1	B2	B3	B4	B5
Basic Color	Black	–	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	1	1	1	1	1	1
	Green	–	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Cyan	–	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Red	–	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta	–	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	–	1	1	1	1	1	1	1	1	1	1	1	1	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
Gray Scale of Red	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑	GS1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	GS2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑	↓				↓						↓						↓		
	↓	↓				↓						↓						↓		
	Brighter	GS61	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	↓	GS62	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red	GS63	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale of Green	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑	GS1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	Darker	GS2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	↑	↓				↓						↓						↓		
	↓	↓				↓						↓						↓		
	Brighter	GS61	0	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0	0	0
	↓	GS62	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0
	Green	GS63	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Gray Scale of Blue	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑	GS1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
	Darker	GS2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
	↑	↓				↓						↓						↓		
	↓	↓				↓						↓						↓		
	Brighter	GS61	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1
	↓	GS62	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
	Blue	GS63	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

Each basic color can be displayed in 64 gray scales from 6 bit data signals. According to the combination of total 18 bit data signals, the 262,144-color display can be achieved on the screen.

9. OpticalCharacteristiCS

Ta=+25℃, Vcc=＋3.3V

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing angle range	Horizontal	θ21, θ22	CR>10	70	80	-	Deg.	*1, 2, 4
	Vertical	θ11		50	60	-	Deg.	
		θ12		70	80	-	Deg.	
Contrast ratio		CR	optimizedangle	500	800	-		*2
Response Time	White Black	τr + τd	θ=0°	-	30	-	ms	*3, 4
Chromaticity of White		Wx		0.250	0.300	0.350		*4 △1
		Wy		0.265	0.315	0.365		
Chromaticity of Red		Rx		-	0.570	-		
		Ry		-	0.330	-		
Chromaticity of Green		Gx		-	0.330	-		
		Gy		-	0.600	-		
Chromaticity of Blue		Bx		-	0.150	-		
		By		-	0.100	-		
Luminance of white		Y_{L1}		300	350	-	cd/m^2	*4
White Uniformity				75	-	-	%	*5

※The measurement shall be executed 30 minutes after lighting at rating.

Theopticalcharacteristicsshallbemeasuredinadarkroomorequivalentstatewiththemethodshow n in Fig.2below.

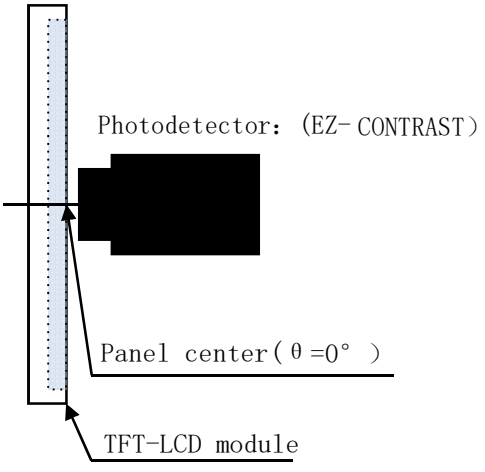


fig.2-1 Measuring method of Viewing anglerange.

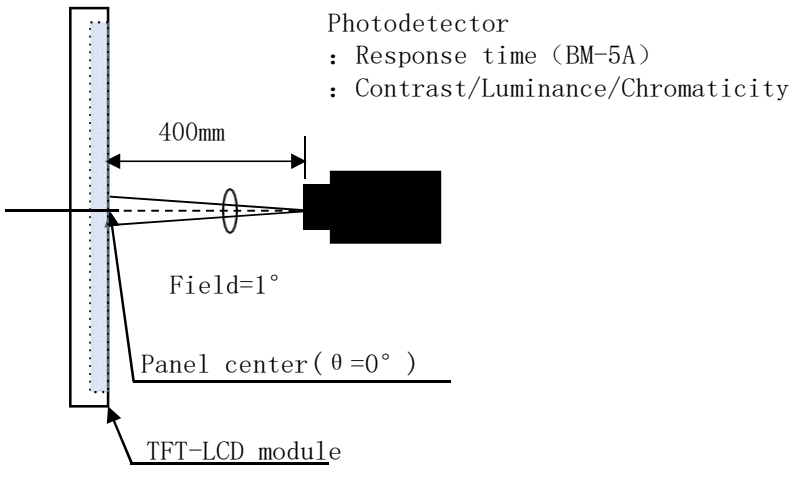
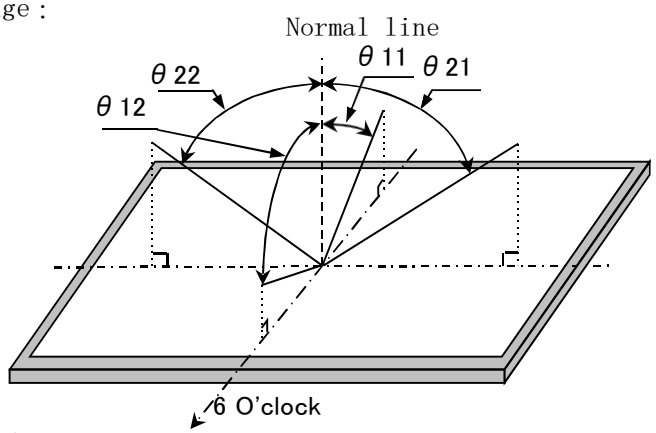


fig.2-2 Measuring method of contrast, luminance, response time, and Chromaticity.

Fig.2 Optical characteristics measurement method

【*1】

Definitions of viewing angle range：



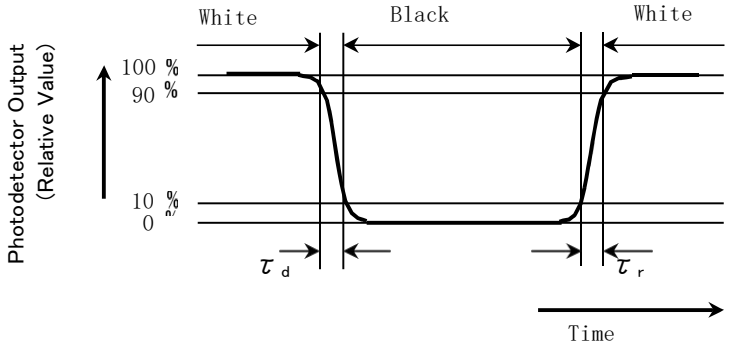
【*2】Definition of contrast ratio:

The contrast ratio is defined as the The following.

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

【*3】Definition of response time:

The response time is defined as the following figure and shall bemeasured by switching the input signal for "black"and"white".

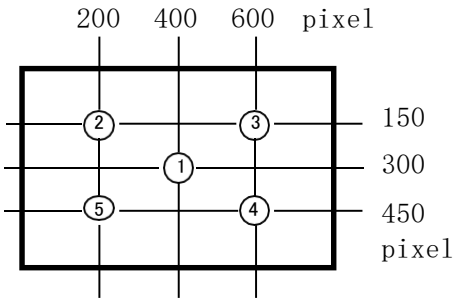


【*4】This shall be measured at center of thescreen.

【*5】Definition of white uniformity:

White uniformity is defined as the following with five measurements. (①～⑤)

$$\text{Luminance uniformity} = \frac{\text{Minimumluminanceof5points(①～⑤).}}{\text{Maximum luminance of 5 points(①～⑤).}} \times 100\ \%$$



10. HandlingPrecautions

a) Be sure to turn off the power supply when inserting or disconnecting the cable. b) Since the front polarizer is easily damaged, pay attention not to scratchit.

c) Wipe off water drop immediately. Long contact with water may cause discoloration or spots. d) When the panel surface is soiled, wipe it with absorbent cotton or other softcloth.

e) Since the panel is made of glass, it may break or crack if dropped or bumped on hardsurface. Handle with care.

f) Since CMOS LSI is used in this module, take care of static electricity and injure the human earth when handling. Observe all other precautionary requirements in handling components.

g) Since there is a circuit board in the module back, stress is not added at the time of a design assembly.

Please make it like. If stress is added, there is a possibility that circuit parts may be damaged.

h) It causes an irregular display and the defective indication, etc., when always put constant pressure on the back of the module.

Please do not make the structure to press the back of the module.

i) Do not expose the LCD panel to direct sunlight. Lightproof shade etc. should be attached when LCD panel is used under such environment.

j) Connect GND to stabilize against EMI and externalnoise.

k) When handling LCD modules and assembling them into cabinets, please avoid that long-terms storage in the environment of oxidization or deoxidization gas and the use of such materials as reagent,solvent,

adhesive, resin, etc. which generate these gasses, may cause corrosion and discoloration of the modules. Do not use the LCD module under such environment.

l) When the module is installed, please take care not to pull and to hangLED_FFC.

m) Liquid crystal contained in the panel may leak if the LCD is broken. Rinse it as soon as possible if it gets inside your eye or mouth by mistake.

n) Be careful when using it for long time with fixed pattern display as it may cause accidential image. o) Adjusting volume have been set optimally before shipment, so do not change any adjustedvalue.

If adjusted value is changed, the specification may not be satisfied.

p) If a minute particle enters in the module and adheres to an optical material, it may cause display non-uniformity issue, etc. Therefore, fine-pitch filters have to be installed to cooling and inhalation hole if you intend to install a fan.

q) An abnormal display by changing in quality of the polarizing plate might occur regardless of contact or no contact to the polarizing plate, because of epoxy resin (amine system curing agent)

that comes out from the material and the packaging material used for the set side, the silicon adhesive (dealcoholization system and oxime system), and the tray blowing agents (azo-compound), etc.
Please confirm adaptability with your employed material.

r) The polarizer surface on the panel is treated with Anti-Glare for low reflection. In case of attaching protective board over the LCD, be careful about the optical interface fringe etc. which degrades display quality.

s) Notice : Never take to pieces the module , because it will cause failure. Please do not peel off the Black tape pasted to theproduct.

t) When install LCD modules in the cabinet, please tighten with“torque=0.294±0.02N·m(3.0±0.2kgf·cm)

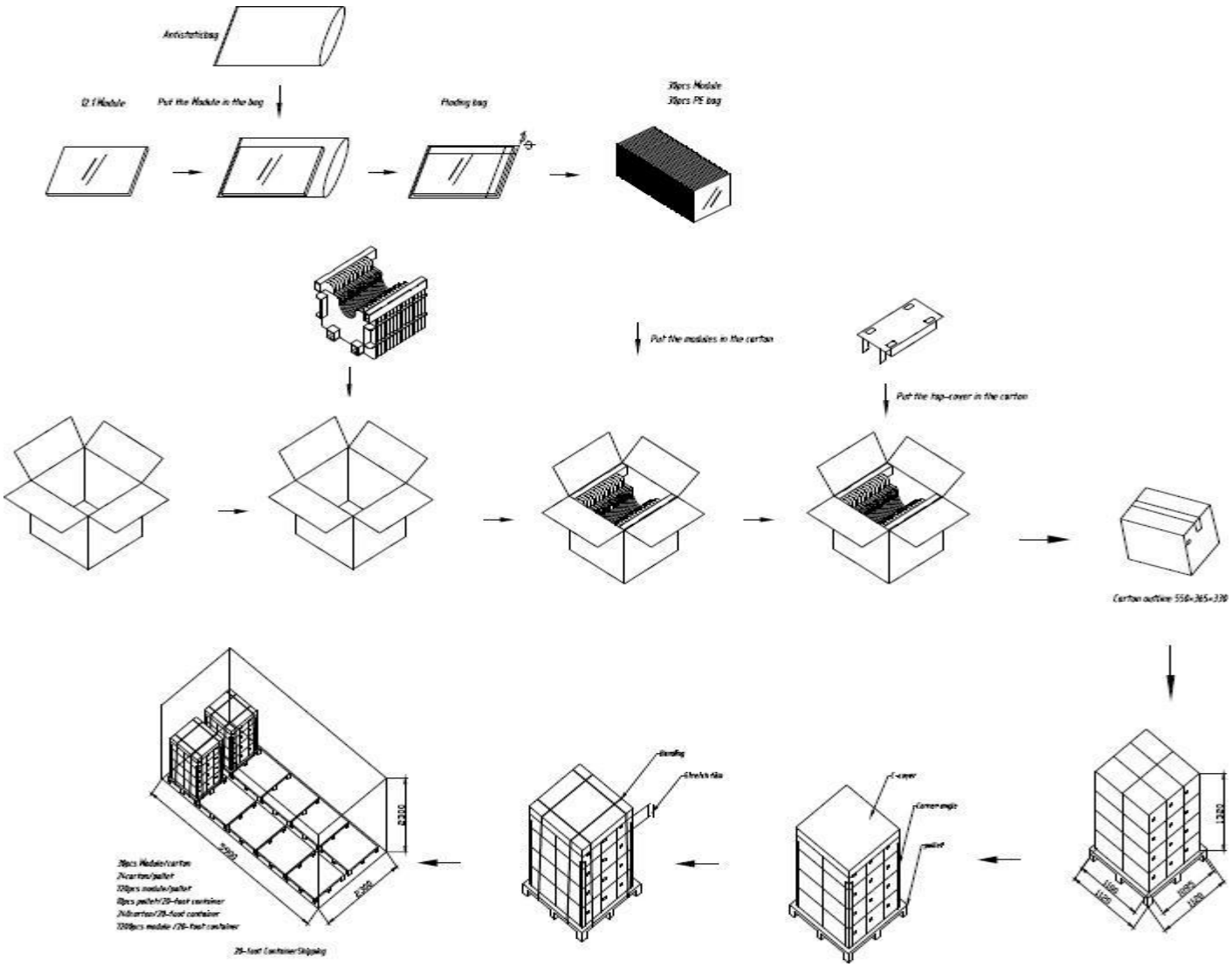
11. Packing form △1

a) Piling number of cartons ： MAX. 4

b) Package quantity in one carton： 30pcs

c) Carton size(TYP)： 520mm(W) × 370mm(D)×315mm(H)

d) Total mass of one carton filled with full modules(30pcs)： MAX 26kg



12. Reliability testitems

No.	Test item	Conditions	Remark
1	High temperature storage test	Ambient temperature 80℃ 240H	【Note1】
2	Low temperature strage test	Ambient temperature -30℃ 240H	【Note1】
3	High temperature & high humidity operation test	Ambient temperature40℃、Humidity95% RH 240H (No condensation.)	【Note1】
4	High temperature operation test	Panel surface 70℃240H	【Note1】
5	Low temperature operation test	Ambient temperature -20℃ 240H	【Note1】
6	Vibration test (non-operating)	＜Sin wave＞ Frequency : 10～57Hz / Vibration width (one side) : 0.076mm : 57～500Hz / Gravity: 9.8m/s2 Sweep time: 11minutes Test period : 3H (X, Y, Z direction1H)	【Note1】
7	Shock test (non-operating)	Max. gravity: 490m/s2 Pulse width: 11ms Direction: ±X,±Y,±Z Test period: 1time / 1direction	【Note1】
8	Thermal shocktest	-30℃[0.5h]～80℃[0.5h] / 50cycles	【Note1】

【 Note1 】 Under the display quality test conditions with normal operation state, these shall be no change which may affect practical display function. (normal operation state: Temperature:15～35℃, Humidity:45～75%, Atmospheric pressure:86～106kpa)

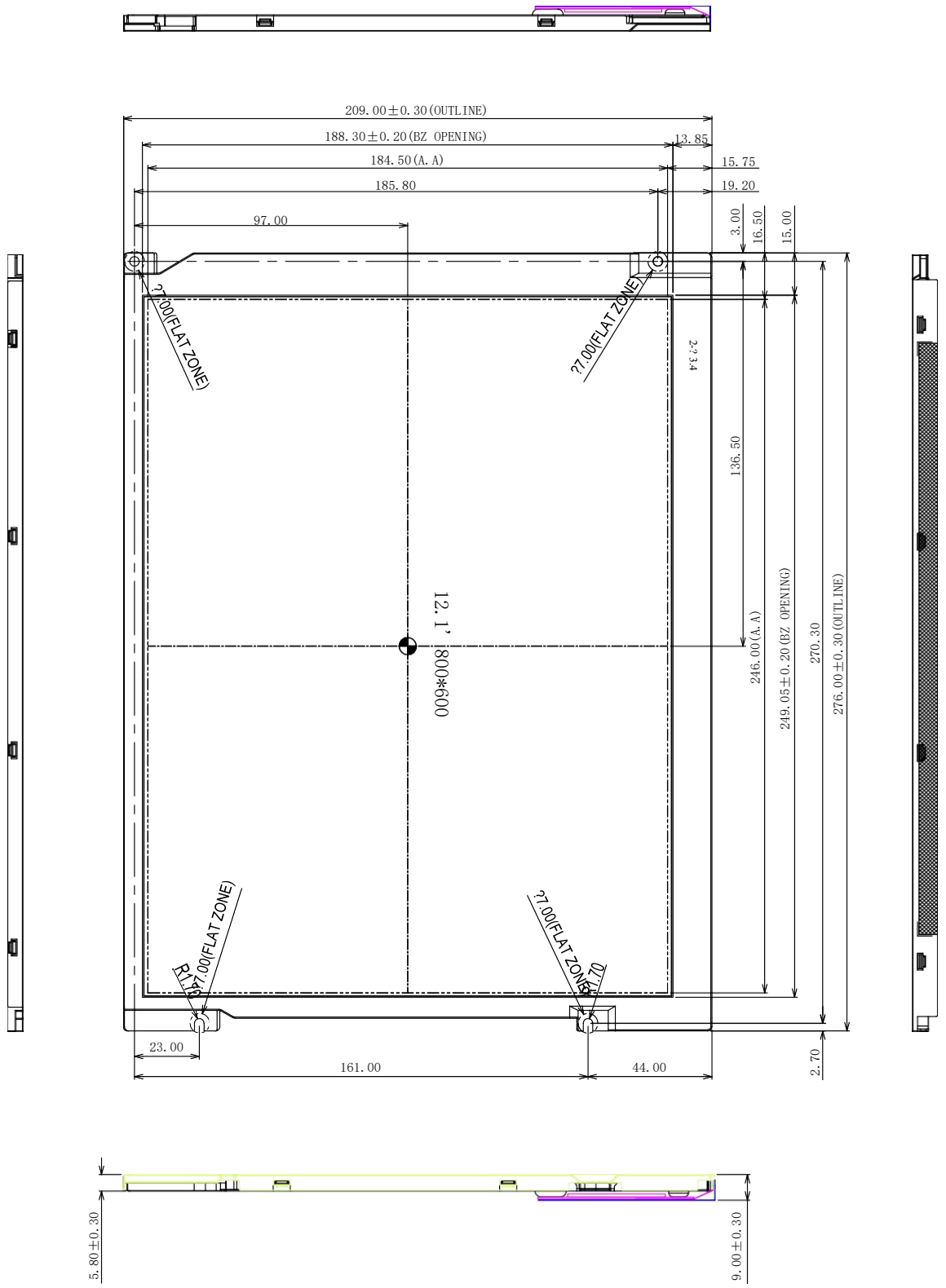


Fig .1-1 ： M121VGXN20C-500D Outline Drawing （Front Side)

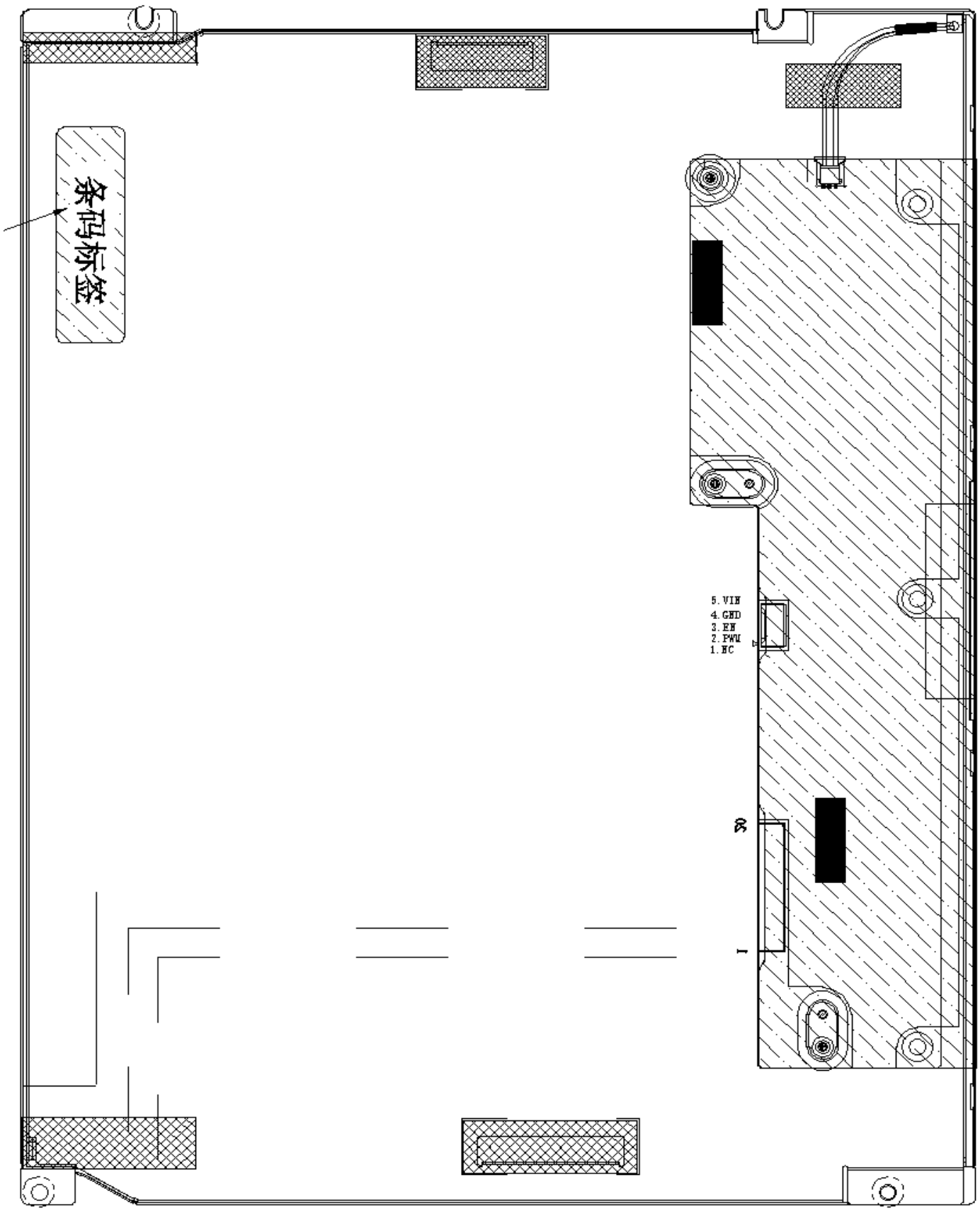


Fig .1-2 ： M121VGXN20C-500D Outline Drawing （Back Side)