5.0" WVGA

High brightness color TFT-LCD module

Model: VM05B1 V3

Date: Mar. 17th, 2021

Note: This specification is subject to change without notice

Customer：_____

Date：_____

Approved	Prepared
Date:	Date:

Contents

RECORD OF REVISION

Version and Date	Page	Old description	New description	Remark
0.1　2014/08/28	All	First Edition for customer		
0.2　2021/03/17	6	Total power：3.783W	Total power：2.743W	
		LED power：3.56W	LED power：2.52W	
	12	LED voltage：19.8V	LED voltage：18V	
		LED current：180mA	LED current：140mA	

1. Handling Precautions

1) Since front polarizer is easily damaged, pay attention not to scratch it.

2) Be sure to turn off power supply when inserting or disconnecting from input connector.

3) Wipe off water drop immediately. Long contact with water may cause discoloration or spots.

4) When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.

5) Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface.

6) Since CMOS LSI is used in this module, take care of static electricity and insure human earth when handling.

7) Do not open or modify the Module Assembly.

8) Do not press the reflector sheet at the back of the module to any directions.

9) At the insertion or removal of the Signal Interface Connector, be sure not to rotate nor tilt the Interface Connector of the TFT Module.

10) After installation of the TFT Module into an enclosure, do not twist nor bend the TFT Module even momentary. At designing the enclosure, it should be taken into consideration that no bending/twisting forces are applied to the TFT Module from outside. Otherwise the TFT Module may be damaged.

2. General Description

2.1 Overview

This specification applies to the Color Active Matrix Liquid Crystal Display composed of a TFT-LCD display a LED backlight system. The screen format is intended to support WVGA (800(H) x480(V)) screen and 16.7M colors.

2.2 Features

- High brightness display, 1500nits by LED backlight.
- Long operation lifetime BLU design
- RoHS Compliance
- Wide operation temperature

2.3 Application

Industrial applications.

2.4 Display specifications

| Items	Unit	Specification
Screen Diagonal	inch	5.0"
Active Area	mm	108.0 (H) X 64.8 (V)
Pixels H x V	pixels	800 x3(RGB) x 480
Pixels Pitch	um	135 (per one triad) x 135
Pixel Arrangement		RGB Vertical stripe
Display mode		Normally white
White luminance (center)	Cd/m^2	1500 (Typ)
Contrast ratio		500:1 (Typ.)
Optical Response Time	msec	25 ms (Typ. On/off)
Normal Input Voltage VDD	Volt	3.3 / 10.4 / 16 / -6
Power Consumption (Vcc Line + LED backlight)	Watt	2.743 W (VDD line=0.223 W; LED lines= 2.52 W)
Weight	Grams	TBD
Physical size	mm	120.7 (W)×76.3 (H)×3.1 (D)
Electrical Interface		Digital
Support colors		16.7M colors
Surface Treatment		Anti-glare and hard-coating 3H
Temperature range		
Operating	^{0}C	-20 ~ 70
Storage	^{0}C	-30 ~ 80
RoHS Compliance		RoHS Compliance

2.5 Optical characteristics

The following optical characteristics are measured under stable condition at 25 ^{0}C

Items	Unit	Conditions	Min.	Typ.	Max.	Note
Viewing angle	Deg.	Horizontal (Right)	60	70		2
		CR=10 (Left)	60	70		
		Vertical (Up)	40	50		
		CR=10 (Down)	60	70		
Contrast Ratio		Normal Direction	400	500		3
Response Time	msec	Raising + Falling		25	50	4
Color coordinates (CIE) White		White x	-0.05	0.31	+0.05	5
		White y		0.33		
Center Luminance	Cd/m^2		1200	1500		6
Luminance Uniformity	%		70	75		7
Crosstalk (in 60 Hz)	%				1.5	
Flicker	dB				-20	

Note 1: Measurement method

The LCD module should be stabilized at given temperature for 0.5 hour to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 1 hour in a windless room.
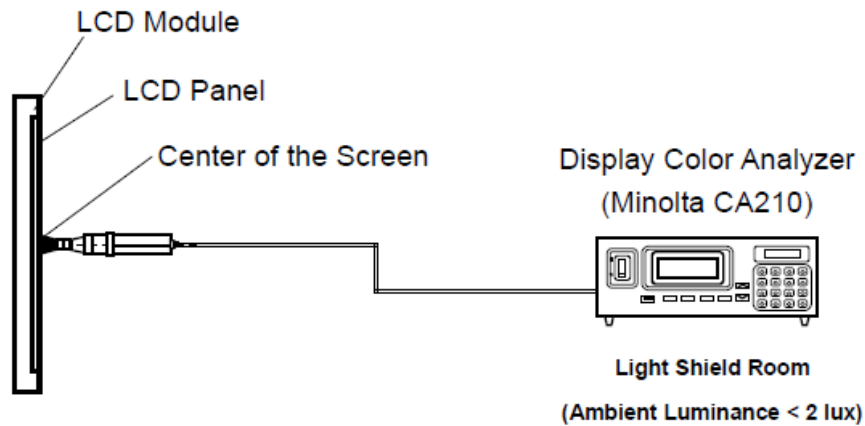

Note 2: Definition of viewing angle
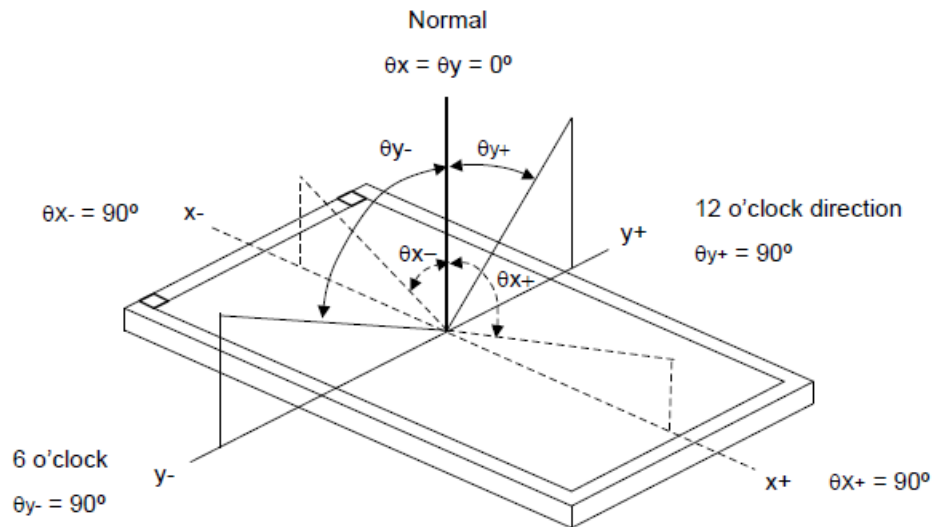
Note 3: Contrast ratio is measured by Minolta CA210

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), and from "Full White" to "Full Black" (falling time), respectively. The response time is interval between the 10% and 90% of amplitudes. Please refer to the figure as below.
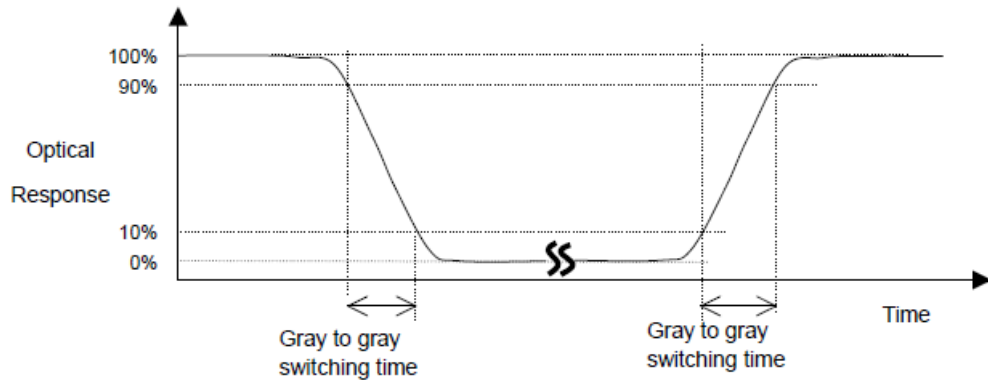
Note 5: Color chromaticity and coordinates (CIE) is measured by Minolta CA210

Note 6: Center luminance is measured by Minolta CA210

Note 7: Luminance uniformity of these 5 points is defined as below and measured by Minolta CA210

Uniformity = (Min. Luminance of 5 points) / (Max. Luminance of 5 points)

3. Absolute Maximum Ratings

Absolute maximum ratings of the module are as following:

3.1 TFT LCD module

Items	Symbol	Min	Max	Unit	Conditions
Power supply voltage	DV_{DD}	-0.3	5.0	V	Note 1, 2
	AV_{DD}	-0.5	13.5	V	
	V_{GH}	-0.3	42	V	
	V_{GL}	-20	0.3	V	
	$V_{GH}-V_{GL}$	0	40	V	

3.2 Backlight unit

Items	Symbol	Min	Max	Unit	Conditions
LED bar input current			360	mA	

3.3 Environment

Items	Symbol	Values Min.	Values Typ.	Values Max.	Unit	Conditions
Operation temperature	T_{OS}	-20	-	70	^0C	Note 3
Operation Humidity	H_{OP}	10		85	%	
Storage temperature	T_{ST}	-30		80	^0C	
Storage Humidity	H_{ST}	5		90	%	

Note 1: With in Ta= 25℃

Note 2: Permanent damage to the device may occur if exceed maximum values

Note 3: For quality performance, please refer to IIS (Incoming Inspection Standard).

## 4. Electrical characteristics

4.1 LCD electronics specification

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Power voltage	DV_{DD}	3.0	3.3	3.6	V	Note 2
	AV_{DD}	10.2	10.4	10.6	V	
	V_{GH}	15.3	16.0	16.7	V	
	V_{GL}	-6.7	-6.0	-5.3	V	
Input signal voltage	V_{COM}	3.09	4.09	5.09	V	Note 4
Input logic high voltage	V_{IH}	$0.7\ DV_{DD}$	-	DV_{DD}	V	Note 3
Input logic low voltage	V_{IL}	0	-	$0.3\ DV_{DD}$	V	

Note 1: Be sure to apply DV_{DD} and V_{GL} to the LCD first, and then apply V_{GH}.
Note 2: DV_{DD} setting should match the signals output voltage (refer to Note 3) of customer's system board.
Note 3: DCLK,HS,VS,RESET,U/D, L/R,DE,R0~R7,G0~G7,B0~B7,MODE,DITHB.
Note 4: Typical V_{COM} is only a reference value. It must be optimized according to each LCM. Please use VR and base on below application circuit.
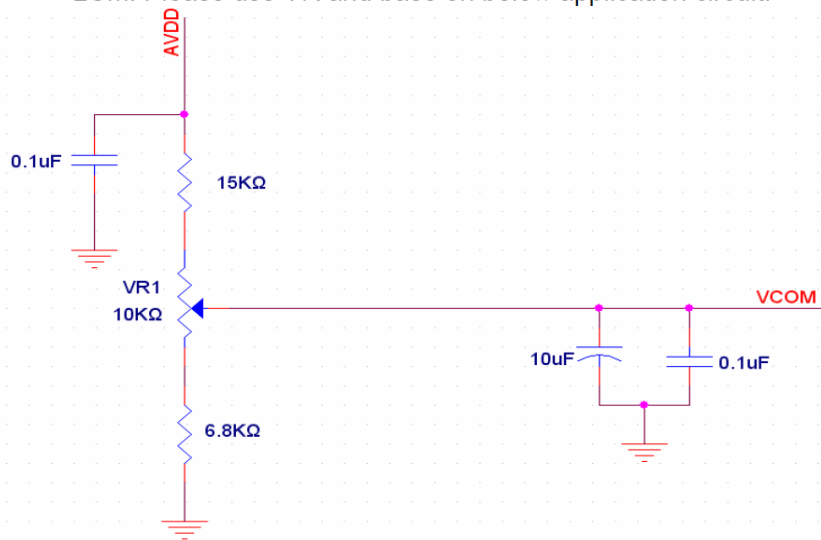
Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Current for Driver	I_{GH}	-	(0.50)	1	mA	V_{GH} =16.0V
	I_{GL}	-	(0.54)	1	mA	V_{GL} = -6.0V
	IDV_{DD}	-	(4.2)	10	mA	DV_{DD} =3.3V
	IAV_{DD}	-	(19)	50	mA	AV_{DD} =10.4V

4.2 Backlight unit

Parameter	Min	Typ	Max	Unit	Note
LED voltage (VL)		18		[V]	2
LED current (IL)		140		[mA]	2
LED power (PL)		2.52		[W]	
LED lite time (MTBF)		100,000		[Hour]	1

Note 1: The "LED lift time" is defined as the module brightness decrease to 50% original brightness that the ambient

temperature is 25℃ and typical LED Current at 140mA

Note 2: The variance of LED Light Bar power consumption is ±10%. Calculator value for reference (IL × VL = PLED)

4.3 Interface connector

    4.3.1   TFT connector(CN1)

FPC Connector is used for the module electronics interface. The recommended model is FH12A-50S-0.5SH manufactured by Hirose.

Pin No.	Symbol	I/O	Function	Remark
1	NC	-	No connection	
2	NC	-	No connection	
3	NC	-	No connection	
4	NC	-	No connection	
5	GND	P	Power ground	
6	V_{COM}	P	Common voltage	
7	DV_{DD}	P	Power for Digital Circuit	
8	MODE	I	DE/SYNC mode select	Note 1
9	DE	I	Data Input Enable	
10	VS	I	Vertical Sync Input	
11	HS	I	Horizontal Sync Input	
12	B7	I	Blue data(MSB)	
13	B6	I	Blue data	
14	B5	I	Blue data	
15	B4	I	Blue data	
16	B3	I	Blue data	
17	B2	I	Blue data	
18	B1	I	Blue data	Note 2
19	B0	I	Blue data(LSB)	Note 2
20	G7	I	Green data(MSB)	
21	G6	I	Green data	
22	G5	I	Green data	
23	G4	I	Green data	
24	G3	I	Green data	
25	G2	I	Green data	
26	G1	I	Green data	Note 2
27	G0	I	Green data(LSB)	Note 2

28	R7	I	Red data(MSB)	
29	R6	I	Red data	
30	R5	I	Red data	
31	R4	I	Red data	
32	R3	I	Red data	
33	R2	I	Red data	
34	R1	I	Red data	Note 2
35	R0	I	Red data(LSB)	Note 2
36	GND	P	Power Ground	
37	DCLK	I	Sample clock	Note 3
38	GND	P	Power Ground	
39	L/R	I	Left / right selection	Note 4,5
40	U/D	I	Up/down selection	Note 4,5
41	V_{GH}	P	Gate ON Voltage	
42	V_{GL}	P	Gate OFF Voltage	
43	AV_{DD}	P	Power for Analog Circuit	
44	RESET	I	Global reset pin.	Note 6
45	NC	-	No connection	
46	V_{COM}	P	Common Voltage	
47	DITHB	I	Dithering function	Note 7
48	GND	P	Power Ground	
49	NC	-	No connection	
50	NC	-	No connection	

I: input, O: output, P: Power

Note 1: DE/SYNC mode select. Normally pull high.
When select DE mode, MODE="1", VS and HS must pull high.
When select SYNC mode, MODE= "0", DE must be grounded.
Note 2: When input 18 bits RGB data, the two low bits of R,G and B data must be grounded.
Note 3: Data shall be latched at the falling edge of DCLK.

Note 4: Selection of scanning mode

Setting of scan control input		Scanning direction
U/D	L/R	
GND	DV_{DD}	Up to down, left to right
DV_{DD}	GND	Down to up, right to left
GND	GND	Up to down, right to left
DV_{DD}	DV_{DD}	Down to up, left to right

Note 5: Definition of scanning direction.
Refer to the figure as below:
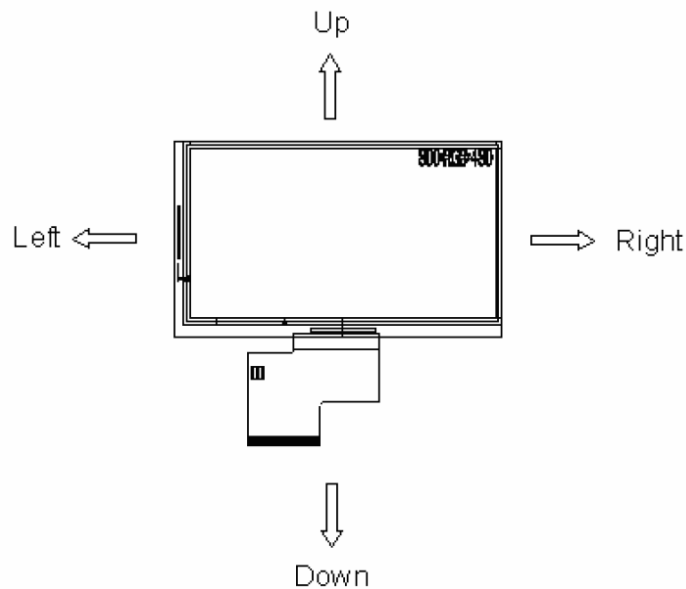
Note 6: Global reset pin. Active low to enter reset state. Suggest to connect with an RC
reset circuit for stability. Normally pull high.

Note 7: Dithering function enable control, normally pull high.
When DITHB="1",Disable internal dithering function,
When DITHB="0",Enable internal dithering function,

4.3.2 Backlight connector (CN2)

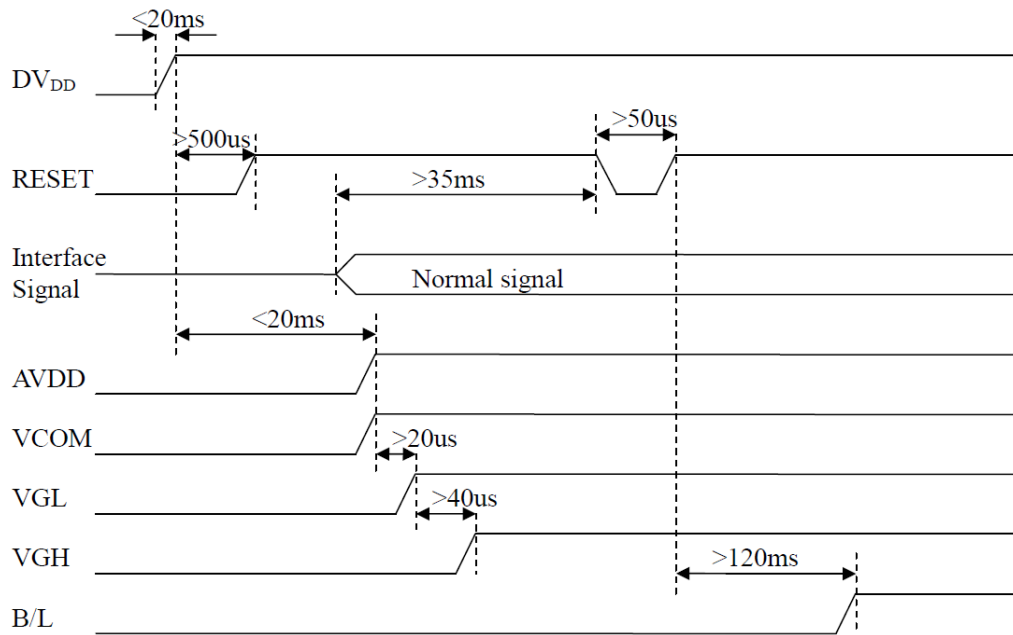Recommended connector : JOIN TEK JT1025-1021 (BHSR-02VS-1 manufactured by JST

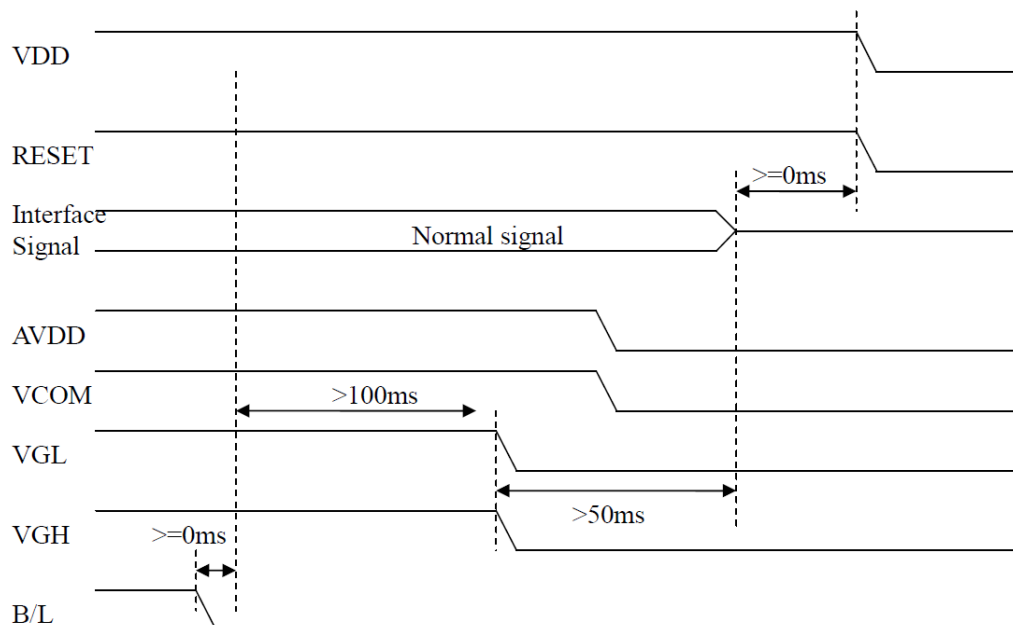| Pin no	Symbol	Description	Note
1	V_{LED+}	Backlight LED anode	Red
2	V_{LED-}	Backlight LED cathode	Black

5. Signal characteristics

5.1 Power sequence

To prevent a latch-up or DC operation of the LCD module, the power on/off sequence should be as the diagram below.

a. Power on sequence:

b. Power off sequence:

5.2 Timing characteristics

5.2.1 Timing conditions

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
HS setup time	T_{hst}	8	-	-	ns	
HS hold time	T_{hhd}	8	-	-	ns	
VS setup time	T_{vst}	8	-	-	ns	
VS hold time	T_{vhd}	8	-	-	ns	
Data setup time	T_{dsu}	8	-	-	ns	
Data hole time	T_{dhd}	8	-	-	ns	
DE setup time	T_{esu}	8	-	-	ns	
DE hole time	T_{ehd}	8	-	-	ns	
DV_{DD} Power On Slew rate	T_{POR}	-	-	20	ms	From 0 to 90% DV_{DD}
RESET pulse width	T_{Rst}	1	-	-	ms	
DCLK cycle time	T_{coh}	20	-	-	ns	
DCLK pulse duty	T_{cwh}	40	50	60	%	

5.2.2 Timing diagram
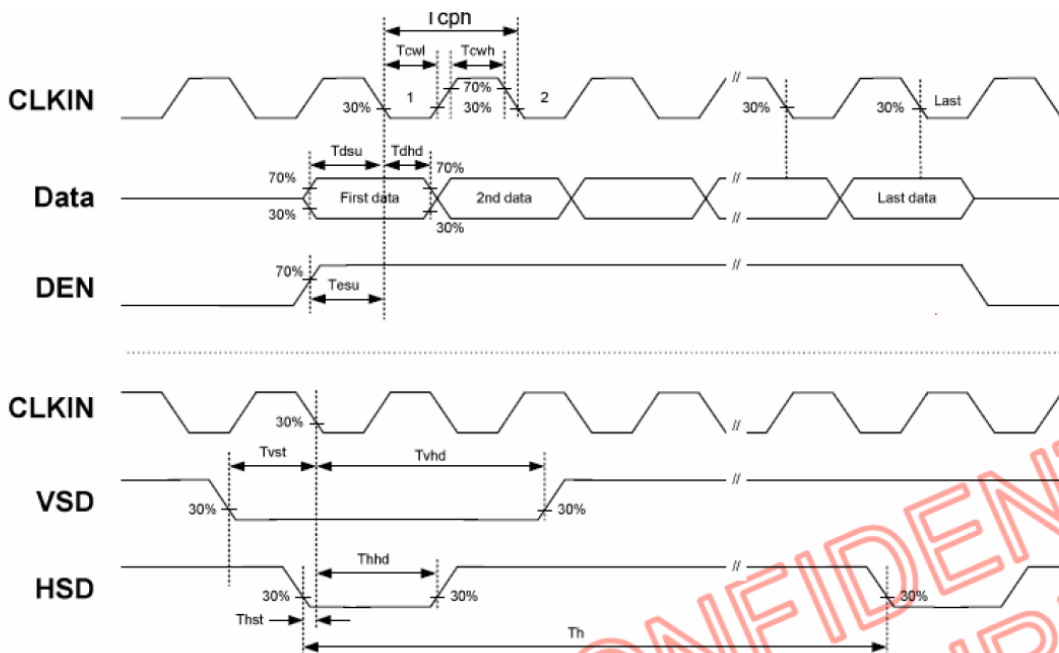
5.2.3 Timing

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Horizontal Display Area	thd	-	800	-	DCLK	
DCLK Frequency	fclk	26.4	33.3	46.8	MHz	
One Horizontal Line	th	862	1056	1200	DCLK	
HS pulse width	thpw	1	-	40	DCLK	
HS Blanking	thb	46	46	46	DCLK	
HS Front Porch	thfp	16	210	354	DCLK	

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Vertical Display Area	tvd	-	480	-	TH	
VS period time	tv	510	525	650	TH	
VS pulse width	tvpw	1	-	20	TH	
VS Blanking	tvb	23	23	23	TH	
VS Front Porch	tvfp	7	22	147	TH	

5.2.4 Data input format

Figure 3. 1 Horizontal input timing diagram.
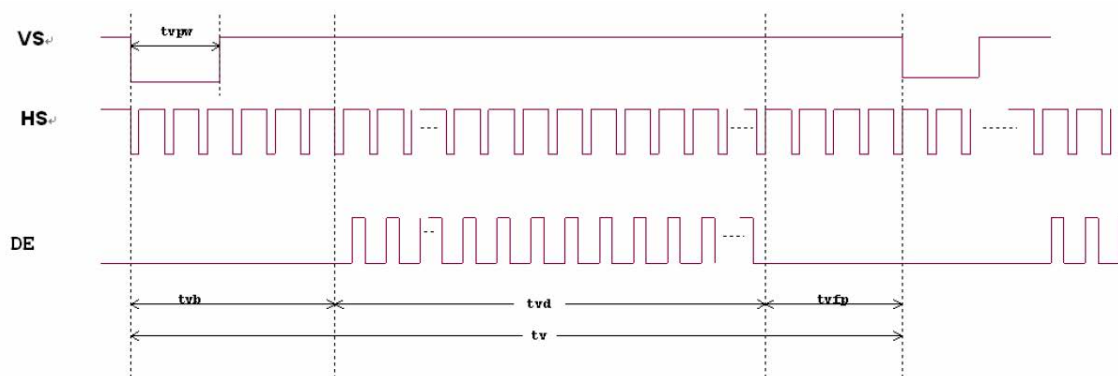
6. Reliability Test

Environment test conditions are listed as following table.

Items	Required Condition	Note
Temperature Humidity Bias (THB)	Ta=40℃, 80%RH, 240hours	
High Temperature Operation (HTO)	Ts= 70℃, 240hours	3
Low Temperature Operation (LTO)	Ta= -20℃, 240hours	
High Temperature Storage (HTS)	Ta= 80℃, 240hours	
Low Temperature Storage (LTS)	Ta= -30℃, 240hours	
Thermal Shock Test (TST)	-20℃/30min, 60℃/30min, 100 cycles	
On/Off Test	On/10sec, Off/10sec, 30,000 cycles	
ESD (ElectroStatic Discharge)	Contact Discharge: ± 8KV, 150pF(330Ω) 1sec, 9 points, 25 times/ point.	
	Air Discharge: ± 15KV, 150pF(330Ω) 1sec 9 points, 25 times/ point.	

Note 1: The TFT-LCD module will not sustain damage after being subjected to 100 cycles of rapid temperature change. A cycle of rapid temperature change consists of varying the temperature from -10℃ to 50℃, and back again. Power is not applied during the test. After temperature cycling, the unit is placed in normal room ambient for at least 4 hours before power on.
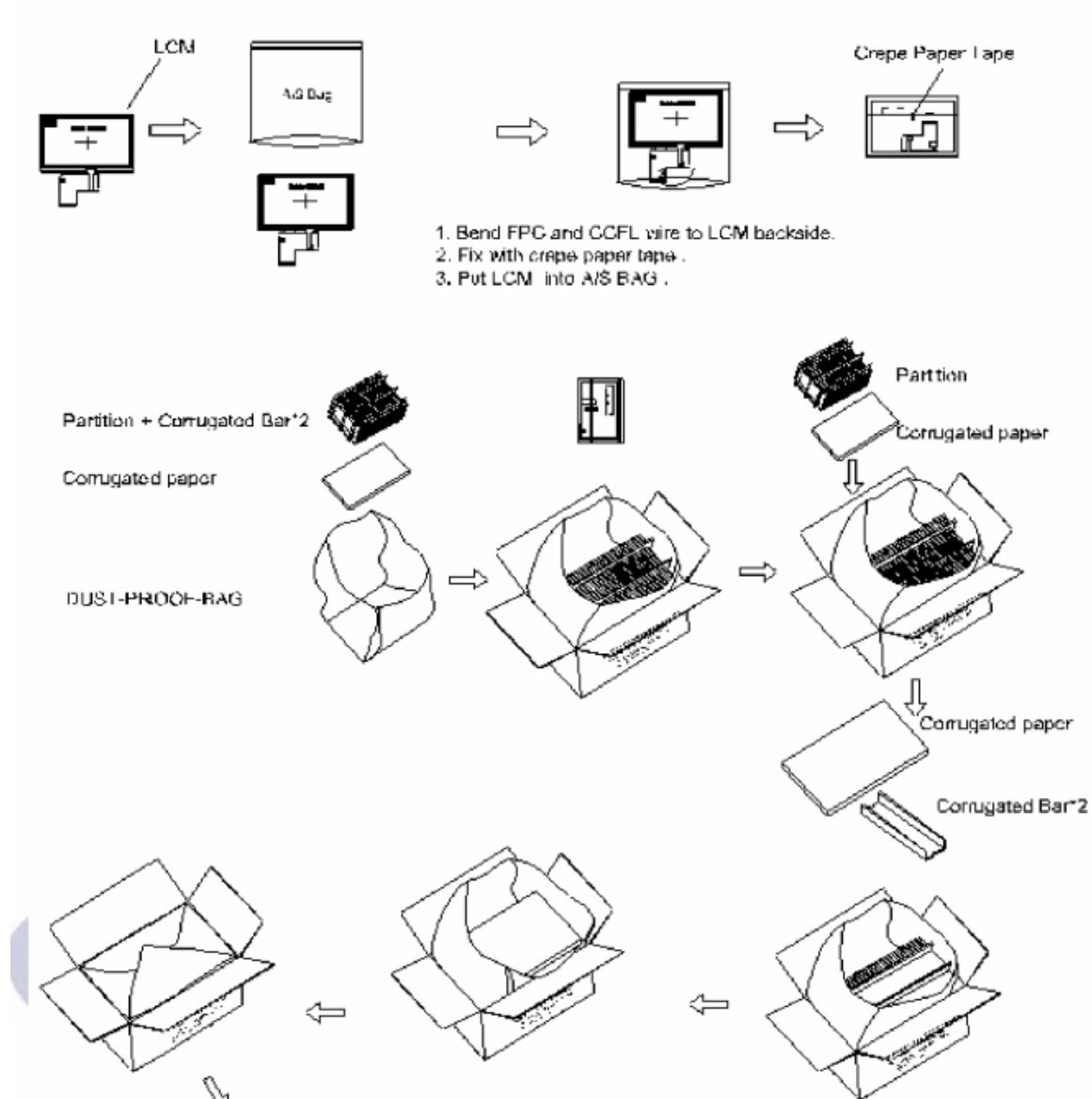
Note 2: According to EN61000-4-2 , ESD class B: Some performance degradation allowed. No data lost. Self-recoverable. No hardware failures.
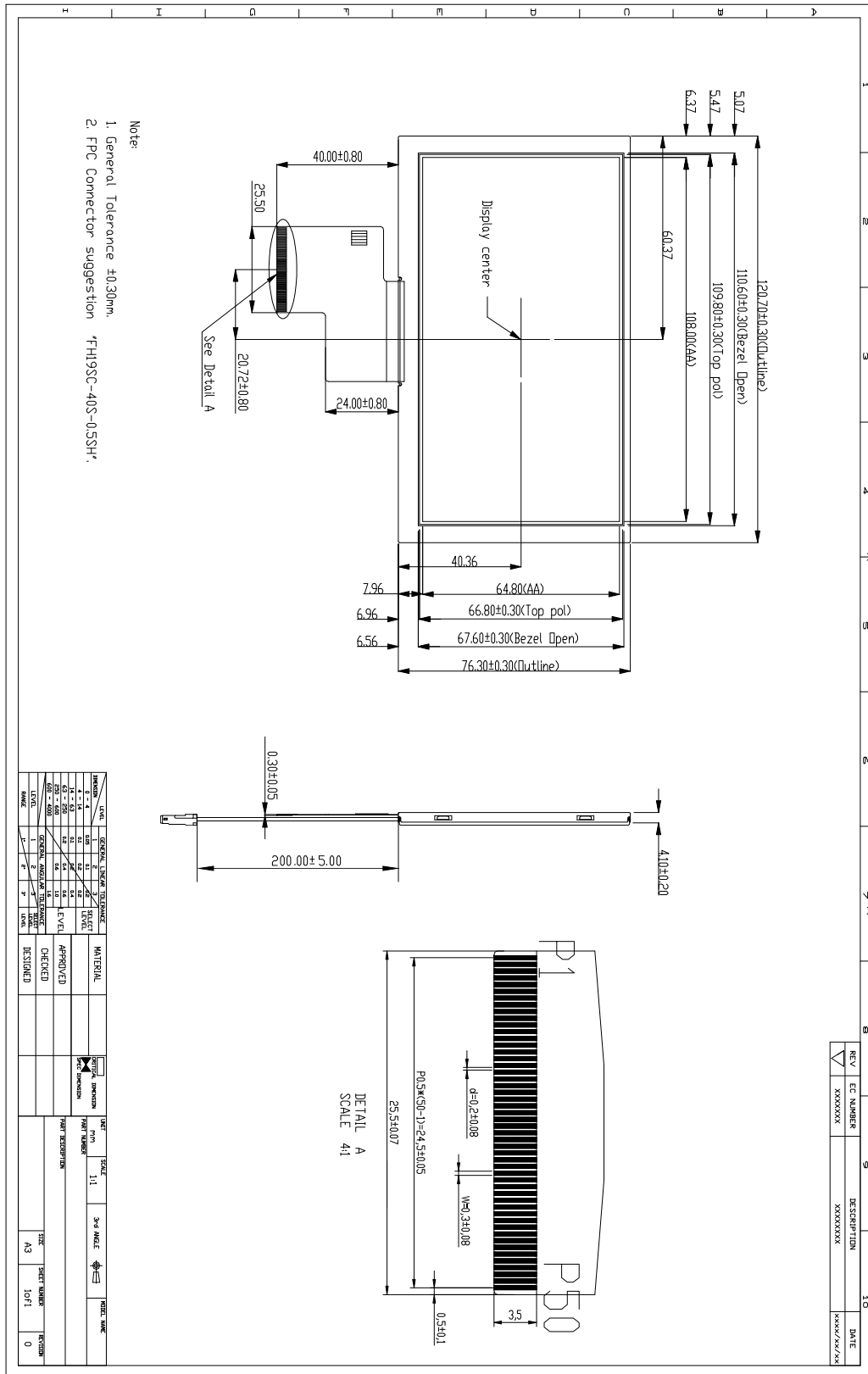
Note 3: TFT surface.

7. Shipping package (TBD)

No	Item	Model (Material)	Dimensions(mm)	Unit Weight (Kg)	Quantity (pcs)	Remark
1	LCM module	VM05B1	120.7× 76.3 × 3.1	TBD	100	
2	Corrugated Bar	B Corrugated Paper	510 × 178	0.047	4	
3	Corrugated Board	B Corrugated Paper	512 × 349	0.074	3	
4	Partition	BC Corrugated Paper	512 × 349 × 112	0.073	2	
5	Dust-Proof Bag	PE	700 × 530	0.060	1	
6	A/S Bag	PE	145 ×145	0.001	100	
7	Carton	Corrugated Paper	530 × 355 × 255	1.100	1	
8	Total weight	TBD± 5%KG				

(1) LCM quantity per Partition:	2 row x 25 pcs = 50pcs	
(2) Total LCM quantity in Carton:	2 layer x 50 pcs/Partition = 100 pcs	

LCM

AG Bag

Crepe Paper Tape

1. Bend FPC and CCFL wire to LCM backside.
2. Fix with crepe paper tape .
3. Put LCM into A/S BAG .

Partition + Corrugated Bar*2

Corrugated paper

DUST-PROOF-BAG

Partition

Corrugated paper

Corrugated paper

Corrugated Bar*2

8. Mechanical Characteristics