FORTEC GROUP

Datasheet

Tianma

P1850FHF1MB01

TI-01-030

APOLLO DISPLAY TECHNOLOGIES

FORTEC INTEGRATED

FORTEC UNITED KINGDOM

SPECIFICATION

[ ] Preliminary Specification
[◉] Final Specification

Description **18.5” 1920xRGBx1080 TFT-LCD Module**

Part Number **P1850FHF1MB01**

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* This cover page is for your Comments and Signatures back to TIANMA.

REVISION HISTORY

Rev	Date	Page	Revision Items	Editor
1.0	2021/11/30	-	Final spec	Tianyao.Zhang
1.0	2022/05/31	15	Revised RA specification.	Tianyao Zhang
2.0	2022/10/31	4	DF19L-14P-1H(54) is EOL, I change it to DF19L-14P-1H(52). They are fully compatible.	Tianyao Zhang
2.0	2022/10/31	15	Change ESD 10KV –> 15KV	Tianyao Zhang
2.1	2023/05/15	1	Add UL certification.	Tianyao Zhang
2.2	2023/05/31	-	This module only supports DE mode. The SYNC and SYNC-DE contents have been removed.	Tianyao_Zhang
2.3	2023/07/05	3, 4	Remove “or equivalent” from the descriptions of CN1 and CN2.	Tianyao_Zhang

CONTENTS

1. Summary

1.1 General Description

This is a 18.5 inch a-Si TFT-LCD module with Normal- Black technology. It is composed of a TFT-LCD panel, a driver circuit, PCB, and a LED backlight unit.

1.2 Features

- Ultra-wide viewing angle
- High resolution
- Interface: LVDS

- Acquisition product for UL62368-1/CSA C22.2 No.62368-1-03 (File number: E250878)
- Compliant with the European RoHS Directive (2011/65/EU) and Delegated Directive (2015/863/EU, Amending Annex II of 2011/65/EU)

2. General Specifications

Feature		Spec	Unit
Display Spec	Size	18.5 inches	
	Resolution	1920(RGB)x1080	
	Pixel Pitch	0.213x0.213	mm
	TFT Active Area	408.96 x 230.04	mm
	Technology Type	a-Si	
	Pixel Configuration	R.G.B Vertical Stripe	
	Display Mode	SFT, Normally Black	
	Surface Treatment	Anti-Glare	
	Viewing Direction	-	
	Gray Scale Inversion Direction	-	
Mechanical Characteristics	LCM (W x H x D)	430.4 x 254.6 x13.5	mm
	Weight	1550	g
Optical Characteristics	Luminance	400	cd/m^2
	Contrast Ratio	1000:1	
	NTSC	72	%
	Viewing Angle	88/88/88/88	degree
Electrical Characteristics	Interface	LVDS 2port 8 bits	
	Color Depth	16.7 Million	color
	Power Consumption	LCD:2000; Backlinght:13200	mW
Touch Spec	Type	With out	
	Lamination Type	-	
	Interface	-	

Table 2.1 General TFT Specifications

3. Input / Output Terminals

3.1 CN1 Pin assignment (LCD Interface)

Connector Information	
LCD Module connector	MDF76KBW-30S-1H(55) (HIROSE)
Matching connector	MDF76-30P-1C (HIROSE)

Table 3.1.1 Connector information

No	Symbol	I/O	Description	Comment
1	DA0-	I	Odd pixel data 0	
2	DA0+	I		
3	DA1-	I	Odd pixel data 1	
4	DA1+	I		
5	DA2-	I	Odd pixel data 2	
6	DA2+	I		
7	GND	P	Ground	
8	CLKA-	I	Odd pixel clock	
9	CLKA+	I		
10	DA3-	I	Odd pixel data 3	
11	DA3+	I		
12	DB0-	I	Even pixel data 0	
13	DB0+	I		
14	GND	P	Ground	
15	DB1-	I	Even pixel data 1	
16	DB1+	I		
17	GND	P	Ground	
18	DB2-	I	Even pixel data 2	
19	DB2+	I		
20	CLKB-	I	Even pixel clock	
21	CLKB+	I		
22	DB3-	I	Even pixel data 3	
23	DB3+	I		
24	GND	P	Ground	
25	GND	P	Ground	
26	GND	P	Ground	
27	GND	P	Ground	
28	VCC	P	Power supply	
29		P		
30		P		

Table 3.1.2 Pin Assignment for LCD Interface

Note1: I/O definition: I---Input, O---Output, P---Power/Ground, N---No connection
Note2: All of the GND pins should be connected to the system ground.
Note3: This LCD module supports DE mode.

3.2 CN2 Pin assignment (Back Light)

Connector Information	
LCD Module connector	DF19L-14P-1H(52) (HIROSE)
Matching connector	DF19-14S-1C (HIROSE)

Table 3.2.1 Connector information

No	Symbol	I/O	Description	Description
1	VDD	P	Power supply	Note3
2	VDD	P		
3	VDD	P		
4	VDD	P		
5	VDD	P		
6	GND	P	LED driver ground	Note3
7	GND	P		
8	GND	P		
9	GND	P		
10	GND	P		
11	RSVD	N	Keep this pin open.	-
12	BRTC	I	Backlight ON/OFF control	High or Open:
13	PWM	I	Luminance control	PWM dimming
14	GND	P	LED driver ground	Note1

Table 3.2.2 Pin Assignment for Back Light Interface

Note1: I/O definition: I---Input, O---Output, P---Power/Ground, N---No connection
Note2: All of the GND pins should be connected to the system ground.
Note3: All VDD and GND terminals should be used without any non-connected lines.

4. Absolute Maximum Ratings

GND=0V

Parameter			Symbol	Rating	Unit	Remarks
Power supply voltage	LCD panel signal processing board		VCC	-0.3to +6.5	V	Ta= 25°C
	LED driver		VDD	-0.3to +15		
Input voltage for signals	Display signals Note1		VD	-0.3to +3.2	V	
	Function signal for LED driver		PWM	-0.3to +5.5	V	
			BRTC	-0.3to +5.5	V	
Storage temperature			Tst	-30 to +80	°C	-
Operating temperature		Front surface	TopF	-20 to +70	°C	Note2
		Rear surface	TopR	-20 to +70	°C	Note3
Relative humidity Note4			RH	≤ 95	%	Ta ≤ 40°C
				≤ 85	%	40°C < Ta ≤ 50°C
				≤ 55	%	50°C < Ta ≤ 60°C
				≤ 36	%	60°C < Ta ≤ 70°C
Absolute humidity Note4			AH	≤ 70 Note5	g/m^3	Ta = 70°C

Table 4.1 Absolute Maximum Ratings

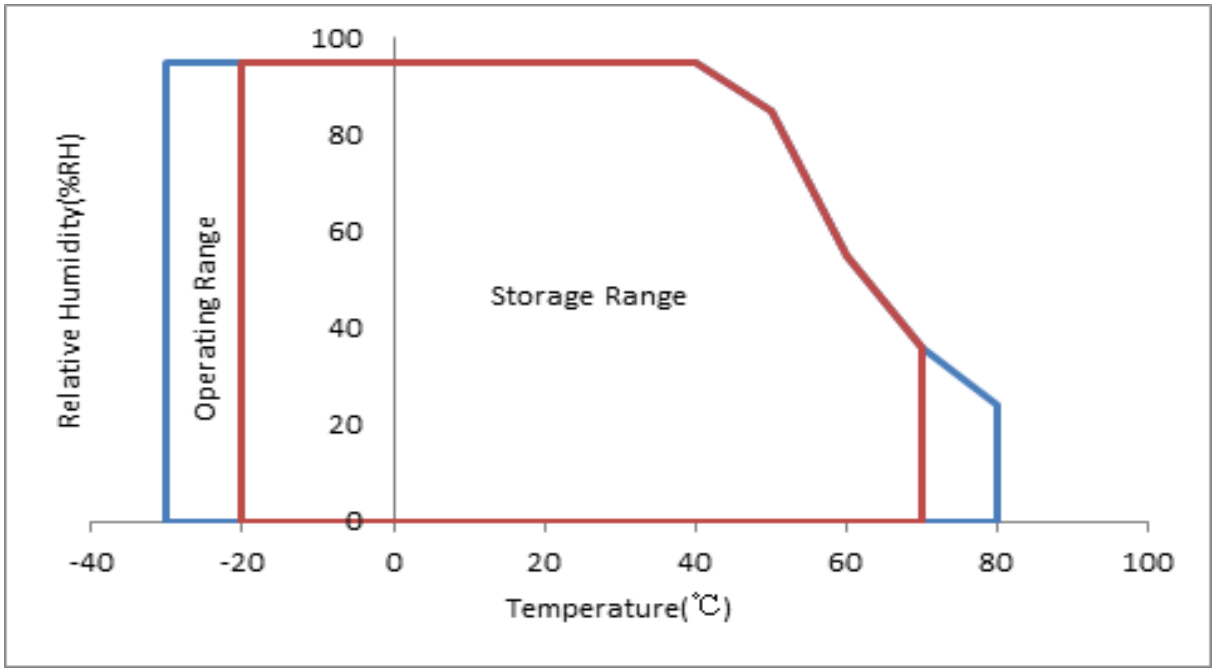


Table 4.2 Absolute Maximum Ratings chart

Note1: DA0+/-, DA1+/-, DA2+/-, DA3+/- ,CLKA+/-, DB0+/-, DB1+/-, DB2+/-, DB3+/-, CLKB+/-
Note2: Measured at LCD panel surface (including self-heat)
Note3: Measured at LCD module's rear shield surface (including self-heat)
Note4: No condensation
Note5: Water amount at Ta= 70°C and RH= 36%

5. Electrical Characteristics

5.1 DC Characteristics for Panel Driving

(Ta= 25°C)

Parameter		Symbol	min.	typ.	max.	Unit	Remarks
Power supply voltage		VCC	4.5	5.0	5.5	V	-
Power supply current		ICC	-	400 Note1	680 Note2	mA	at VCC= 5V
Permissible ripple voltage		VRPC	-	-	100	mVp-p	for VCC
Differential input threshold voltage	High	VTH	-	-	+100	mV	at VCM= 1.2V
	Low	VTL	-100	-	-	mV	
Input Differential Voltage		|VID|	100	400	600	mV	-
Differential Input Common Mode Voltage		VCM	0.7	1.2	1.6	V	-
Terminating resistance		RT	-	100	-	Ω	-

Table 5.1.1 Operating Voltages

Note1: Indicated the subsequent version may be updated.

5.2 DC Characteristics for Backlight Driving

Parameter		Symbol	min.	typ.	max.	Unit	Remarks
Power supply voltage		VDD	(10.8)	(12.0)	(13.2)	V	Note1
Power supply current		IDD	-	(1,100)	(1,350) Note2	mA	at VDD= 12.0V Note3
Permissible ripple voltage		VRPD	-	-	200	mVp-p	for VDD Note3, Note4, Note5
Input voltage for PWM signal	High	VDFH1	2.0	-	5.0	V	-
	Low	VDFL1	0	-	0.4		
Input voltage for BRTC signal	High	VDFH2	2.0	-	5.0		
	Low	VDFL2	0	-	0.8		
Input current for PWM signal	High	IBCH1	-	-	+300	μA	-
	Low	IBCL1	-300	-	-		
Input current for BRTC signal	High	IBCH2	-	-	+300		
	Low	IBCL2	-300	-	-		
PWM frequency		f_{PWM}	200	-	1k	Hz	Note6, Note8
PWM duty ratio		DR_{PWM}	1	-	100	%	Note7, Note9, Note10
PWM pulse width		tPWH	5	-	-	μs	Note9, Note10
LED life time		Hr	-	50000	-	Hour	Note 11
LED supply voltage		VF	2.7	3.1	3.5	V	
LED supply current		IF		70		mA/ch	6ch*9pcs

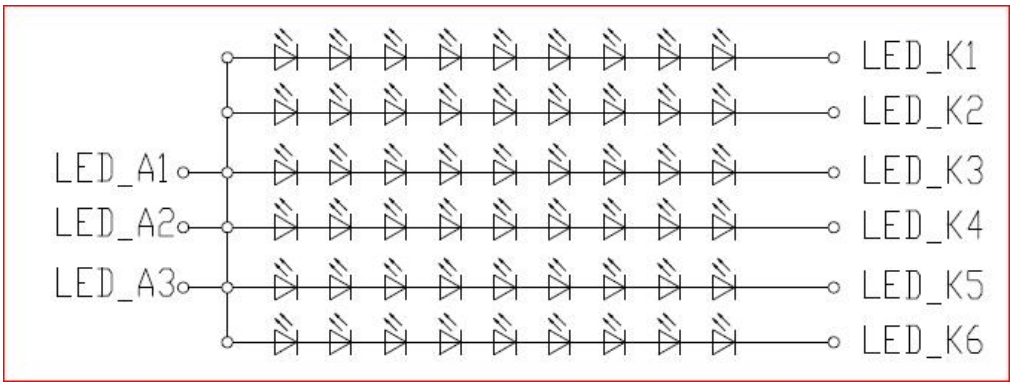


Table 5.2.1 LED Backlight Characteristics

Note1: I_F is defined for each channel.

Note2: Optical performance should be evaluated at Ta=25℃ only.

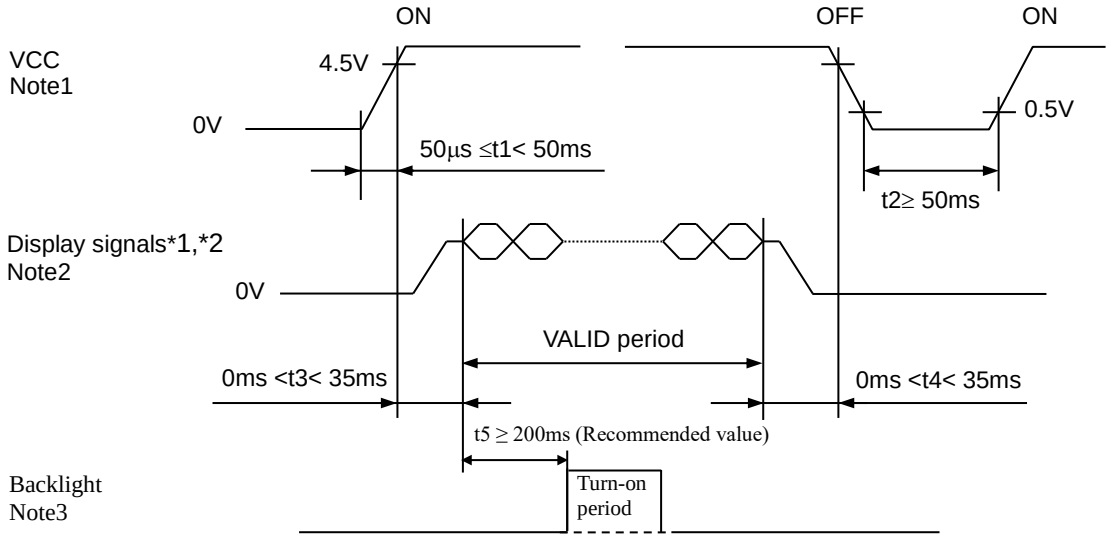
Note3: If LED is driven by high current, high ambient temperature & humidity condition,The life time of LED will be reduced.

Note4: Operating life means brightness goes down to 50% of initial brightness. Typical operating life time is estimated data.

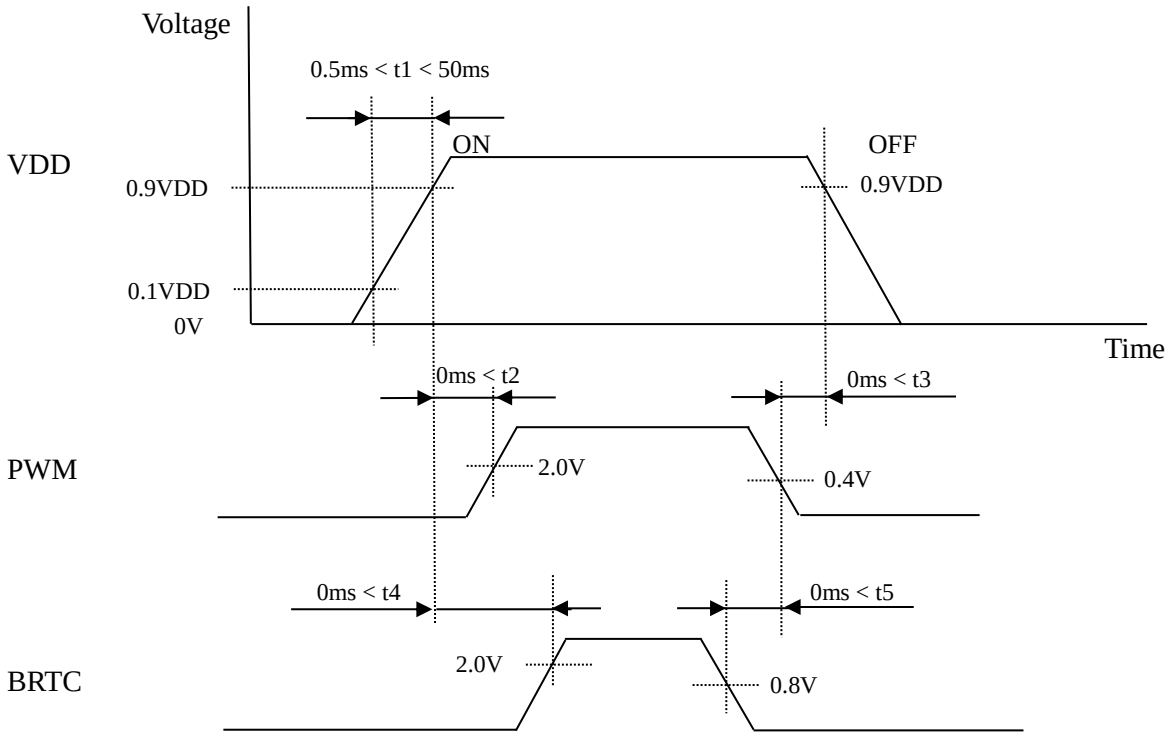
5.3 Recommended Power ON/OFF Sequence

Power ON Sequence

Item	Symbol	Min	Typ	Max	Unit	Remark
VCC on to VCC stable	t1	0.05	-	50	ms	
VCC off to next VCC on	t2	50	-	-	ms	
VCC stable to Signal stable	t3	0	-	35	ms	
Signal off to VCC off	t4	0	-	35	ms	
Signal stable to BL on	t5	200	-	-	ms	

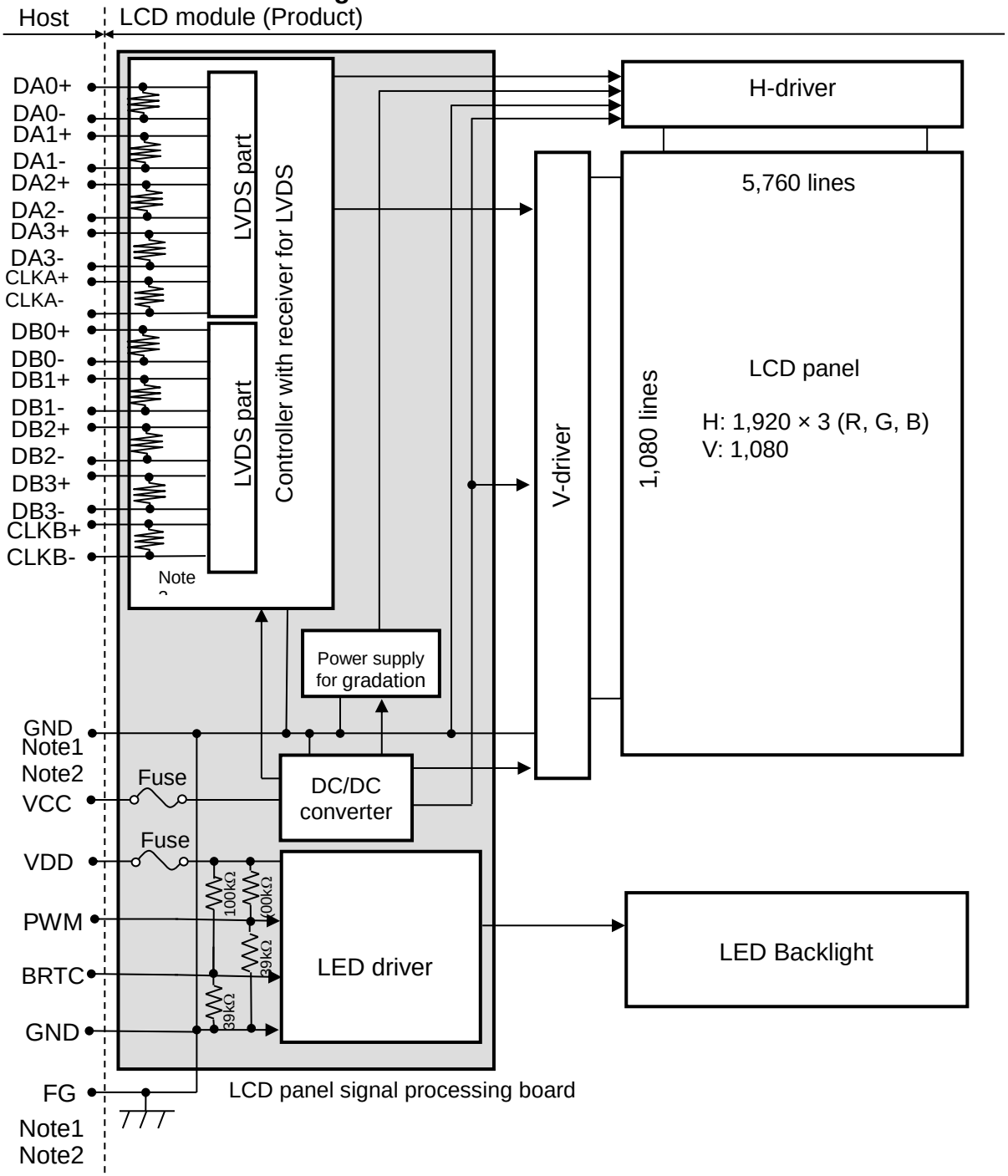


LED driver



Note1: T1< T2.
Note2: The low level of these signals and analog powers are GND level.
Note3: All of the power and signals should be kept at GND level before power on. If there are residual voltages on them, the LCD might not work properly.
Note4: The power on/off sequence is the first version. It will be updated when the design is fixed.
Note5: BL is the voltage applied to backlight. Keep it turned off until the display has stabilized.

5.4 LCD Module Block Diagram



Note1: Relation between GND (Signal ground and LED driver ground) and FG (Frame ground) in the LCD module is as follows.

GND- FG	Connected

Note2: GND and FG must be connected to customer equipment's ground, and it is recommended that these grounds to be connected together in customer equipment.

Note3: Each pair of the LVDS signal has a 100Ω terminating resistance.

Figure 5.5.1 LCD Module Block Diagram

6. Interface Timing Characteristics

6.1 Data Input Timing Parameter Setting

Parameter			Symbol	min.	typ.	max.	Unit	Remarks
CLK	Frequency		1/tc	65.0	74.175	81.5	MHz	13.48ns (typ.)
	Duty ratio		-	-			-	-
	Rise time, Fall time		-				ns	
DE	Horizontal	Cycle	th	13.19	14.83	16.53	μs	67.43kHz (typ.)
				1,075	1,100	-	CLK	
		Display period	thd	960			CLK	-
	Vertical (One frame)	Cycle	tv	15.39	16.68	18.18	ms	59.94Hz (typ.)
				1,100	1,125	-	H	
		Display period	tvd	1,080			H	-
	CLK-DE	Setup time	-	-			ns	-
		Hold time	-				ns	
	Rise time, Fall time		-				ns	

Table 6.1.1 Data Input Timing Parameters

6.2 DE Mode Timing Diagram

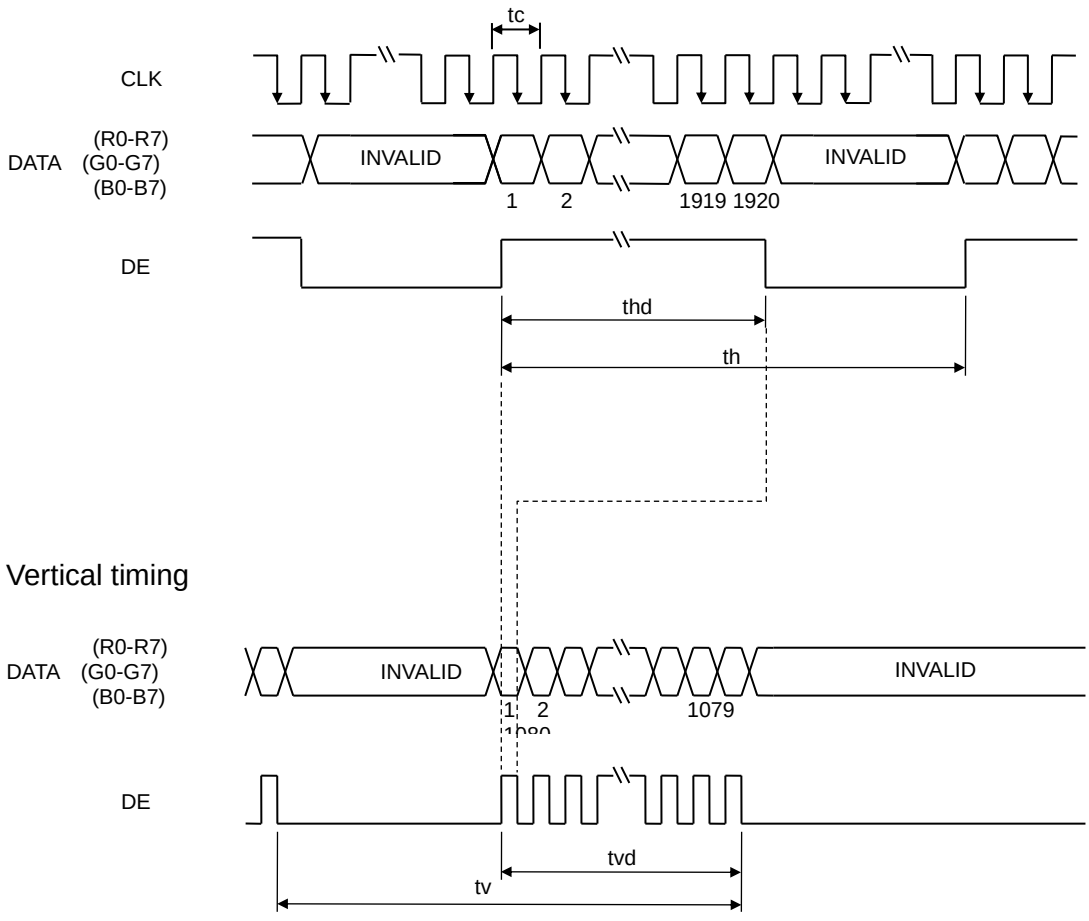


Figure 6.2.1 Data Input Timing Diagram Under DE Mode

7. Optical Characteristics

Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles		θT	CR≧10	70	88		degree	Note2,3
		θB		70	88			
		θL		70	88			
		θR		70	88			
Contrast Ratio		CR	θ=0°	600	1000			Note 3
Response Time		T_{ON}	25℃	-	25	40	ms	Note 4
		T_{OFF}						
Chromaticity	**White**	x	Backlight is on	(0.254)	(0.304)	(0.354)		Note 1,5
		y		(0.291)	(0.341)	(0.391)		
	Red	x		(0.592)	(0.642)	(0.692)		Note 1,5
		y		(0.290)	(0.340)	(0.390)		
	Green	x		(0.236)	(0.286)	(0.336)		Note 1,5
		y		(0.586)	(0.636)	(0.686)		
	Blue	x		(0.099)	(0.149)	(0.199)		Note 1,5
		y		(0.024)	(0.074)	(0.124)		
Uniformity		U	-	72	80	-	%	Note 6
NTSC		-	-	65	72	-	%	Note 5
Luminance		L		280	400	-	cd/m^2	Note 7

Table 7.1 Optical Parameters

Test Conditions:

1. I_F= **70** mA, and the ambient temperature is 25℃.
2. The test systems refer to Note1 and Note2.

Note1: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 5 Minutes operation, the optical characteristics are measured at the center point of the LCD screen.

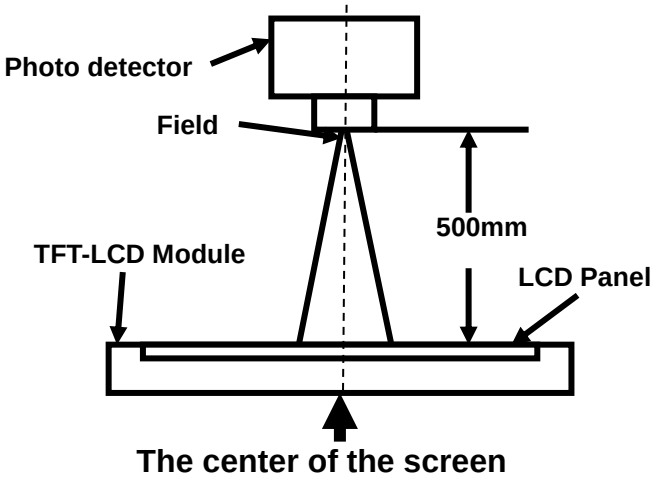


Fig1.Measurement Set Up

Note2: Definition of viewing angle range and measurement system. Viewing angle is measured at the center point of the LCD 。

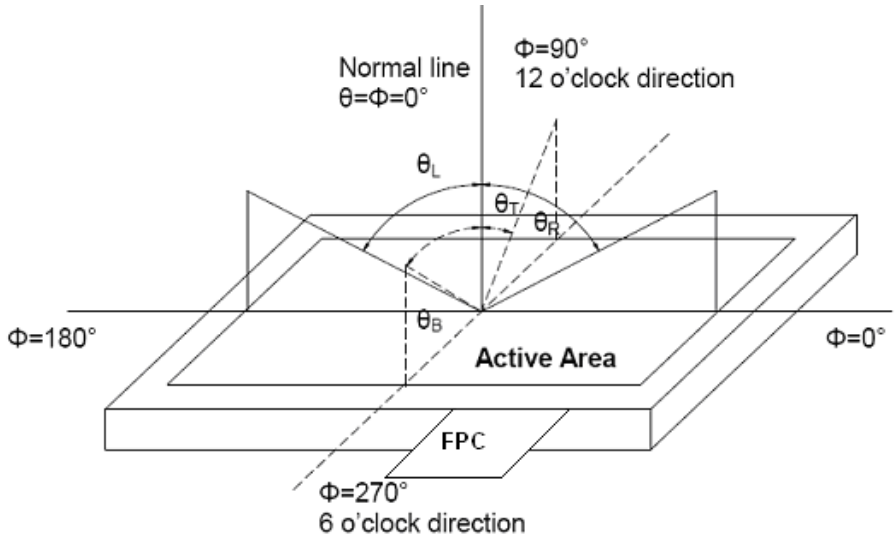


Fig2. Measurement viewing angle

Note3: Definition of contrast ratio

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD is on the "White" state}}{\text{Luminance measured when LCD is on the "Black" state}}$$

Note4: Definition of Response time

For TN LCM,the response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time (T_r) is the time between photo detector output intensity changed from 90% to 10%. And fall time (T_f) is the time between photo detector output intensity changed from 10% to 90%.

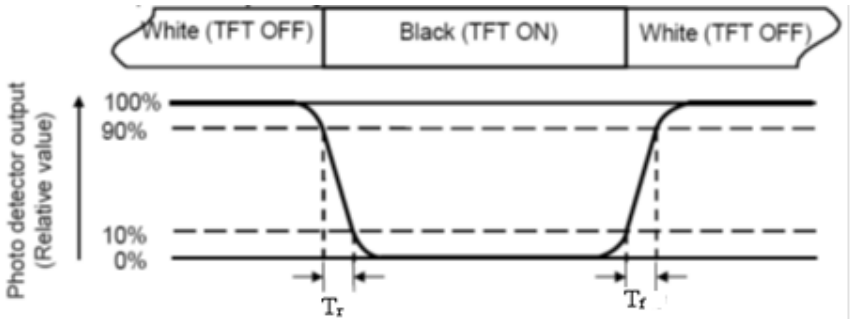


Fig3. Response Time Testing(TN)

For SFT LCM, the response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time (T_r) is the time between photo detector output intensity changed from 10% to 90%. And fall time (T_f) is the time between photo detector output intensity changed from 90% to 10%.

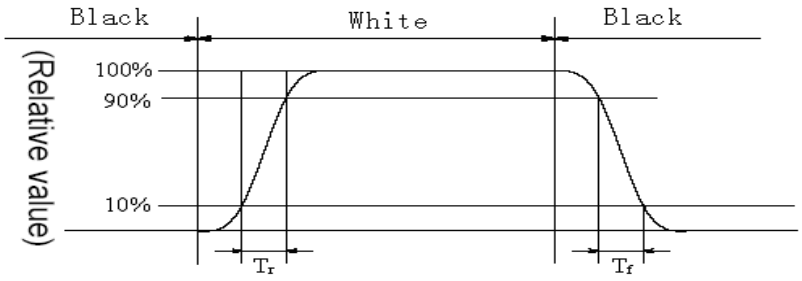


Fig4.Response Time Testing(SFT)

Note5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

Note6: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer Fig.5). Every measuring point is placed at the center of each measuring area.

Luminance Uniformity (U) = Lmin/ Lmax

Lmax: The measured Maximum luminance of all measurement position.

Lmin: The measured Minimum luminance of all measurement position.

L-------Active area length; W----- Active area width

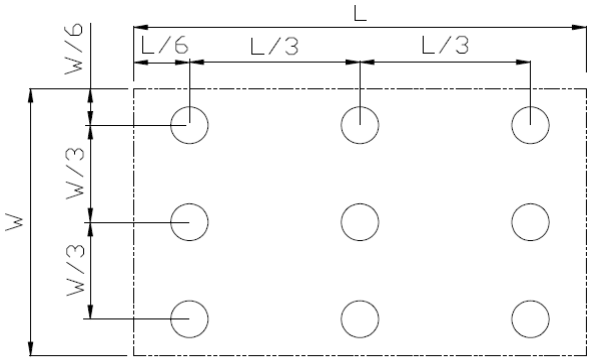


Fig5. Luminance Uniformity Measurement Locations(9 points)

Note7: Definition of Luminance:

Measure the luminance of white state at center point.

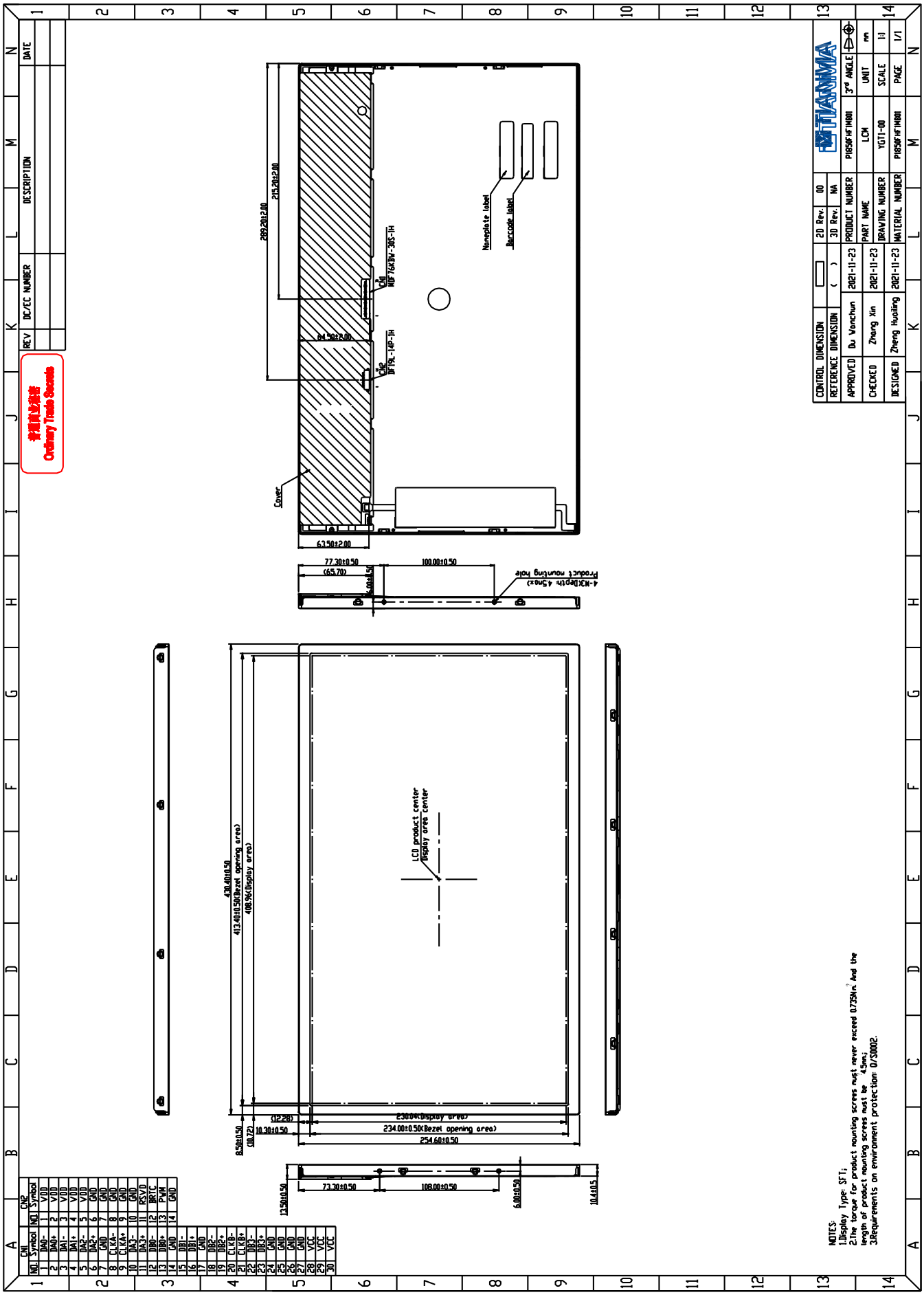
8. Reliability Test

No	Test Item	Condition	Judgment Note1
1	High Temperature Operation	① +70±3℃, 240hours Note2 ② Display data is white.	No display malfunctions
2	High Temperature & High Humidity Operation	① +60±2℃, RH= 90%, 240hours ② Display data is white.	
3	Thermal Shock (non-operation)	① -30 ± 3°C…30minutes +80 ± 3°C…30minutes ② 100cycles, 1hour/cycle ③ Temperature transition time is within 5 minutes.	
4	Heat Cycle (Operation)	①-20±3℃…1hour 70±3℃…1hour ②50cycles, 4hours/cycle ③Display data is White.	
5	ESD(Operation)	① 150pF, R=150Ω,15kV ② 9 places on a panel surface Note3 ③ 10 times each point at 1 sec interval	
6	Vibration (Non-operation)	① 5 to 100Hz, 11.76m/s2 ② 1 minute/cycle ③ X, Y, Z directions ④ 50 times each direction	No display malfunctions No physical damages
7	Shock (Non-operation)	① 294m/ s2, 11ms ② ±X, ±Y, ±Z directions ② 3 times each direction	
8	Image retention (Room temperature)	① Room temperation(25±3℃) ② Display pattern is H/20 x H/20 checker-flag ③ Burning time:24 hours	Check pattern 51/256 Check time: after 5mins

Table 8.1 RA test condition

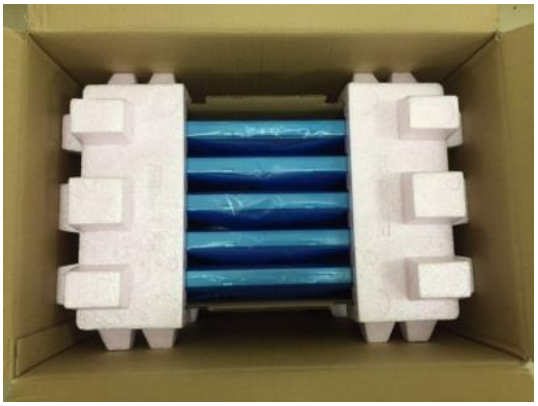
Note1: Temperature is the ambient temperature of sample
Note2: Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.
Note3: In the standard condition, there shall be no practical problem that may affect the display function. After the reliability test, the product's function only be guaranted, but not for all of the cosmetic specification.

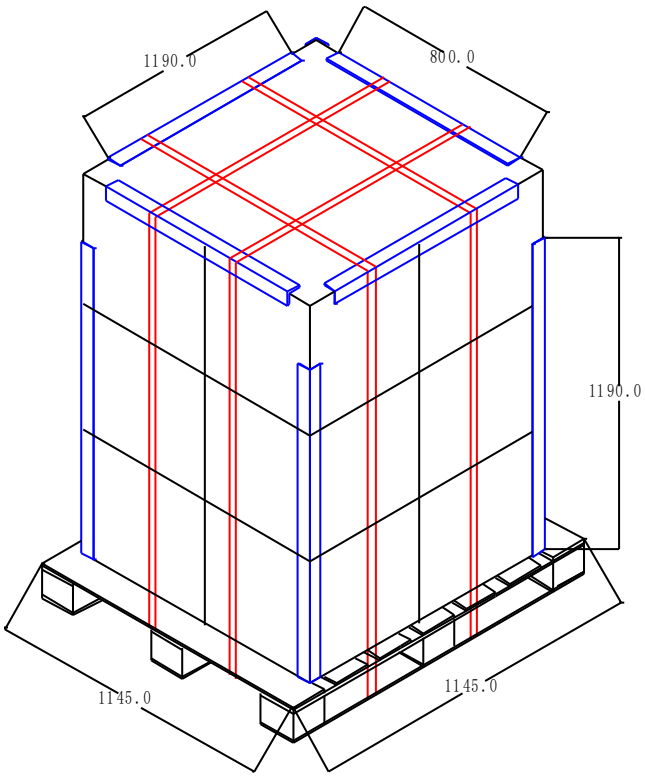
9. Mechanical Drawing



10. Packing Instruction

No	Item	Model (Material)	Dimensions(mm)	Unit Weight(Kg)	Q'ty	Remark
1	LCM module	P1850FHF1MB01	430.4x254.6x13.5	1.557	5	
2	Partition board	Corrugated paper	491×255×5	0.05	2	
3	Anti-static Bag	LD-PE	600x420mm	0.022	5	
4	EPP-Bottom	EPP	532.4×433.5×170	0.476	1	
5	EPP-Top	EPP	433.5×188.3×90	0.055	2	
6	Carton	Corrugated paper	536×437×370	1.238	1	
7	Barcode Label	Paper	76x104	0.001	1	
8	Total weight	9.82 ±10% kg				
8	Total weight	9.82 ±10% kg				





11. Precautions for Use of LCD Modules

11.1 Handling Precautions

(1) The display panel is made of glass. Do not subject it to mechanical shock by dropping it, etc.
(2) If the display panel is damaged and the liquid crystal fluid inside it leaks out be sure not to get any in your mouth. If the fluid comes into contact with your skin or clothes promptly wash it off using soap and water.
(3) Do not apply excessive force to the display surface or the bezel since this may cause the color tone to vary.
(4) The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle the polarizer carefully.
(5) If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is still not completely clear use a moist cloth with one of the following solvents:
  - Isopropyl alcohol
  - Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer. Specifically, do not use the following:
  - Water
  - Ketone
  - Aromatic solvents

(6) Do not disassemble the LCD Module.
(7) If powered off, do not apply the input signals.
(8) To prevent destruction of the module by static electricity, be careful to maintain an optimum work environment.
(9) Be sure to ground your body when handling the LCD Modules.
(10) Tools used for assembly, must be properly grounded.
(11) To reduce the amount of static electricity generated, do not conduct assembly or other work under very low humidity conditions.
(12) The LCD Module is covered with a film to protect the display surface, remove film slowly under the ionizer.

11.2 Storage precautions

(1) When storing the LCD modules avoid exposure to direct sunlight or to the light of fluorescent lamps.
(2) The LCD modules should be stored within the rated storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is: Temperature: 0 ~ 35 ℃ at normal humidity.
(3) The LCD modules should be stored in a room without acid, alkali or other harmful gas.

11.3 Transportation Precautions

The LCD modules should not be dropped or subject to violent mechanical shock during transportation. Also they should avoid excessive pressure, water, high humidity and direct sunlight.

11.4 Screen saver Precautions

Not display the fixed pattern for a long time. Use a screen saver, if the fixed pattern is displayed on the screen

11.5 Safety Precautions

(1) When you waste damaged or unnecessary LCDs, it is recommended to crush LCDs into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned
(2) Be sure to turn off the power supply when inserting or disconnecting the LED backlight cable.
(3) LED driver should be designed carefully to limit or stop its function when over current is detected on the L ED.

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