

MODEL NO. : TM020GDH43ISSUED DATE: 2011-09-29VERSION : Ver 1.3

- Preliminary Specification  
 Final Product Specification

Customer : \_\_\_\_\_

Approved by	Notes

SHANGHAI TIANMA Confirmed :

Prepared by	Checked by	Approved by

This technical specification is subjected to change without notice

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### Record of Revision

Rev	Issued Date	Description	Editor
1.0	2011-09-09	Preliminary Specification Release	Adam Hu
1.1	2011-09-20	Update RA test condition Page 20	Adam Hu
1.2	2011-09-23	1. Update storage temperature from -20~70 to -30~20 Page5 2. Add ESD condition: no reset. Page 19	Adam Hu
1.3	2011-09-29	1. Update electronically and Package information.	Adam Hu

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# 1. General Specifications

Feature		Spec
<b>Display Spec</b>	Size	2.0 inch
	Resolution	176(RGB) x 220
	Interface	CPU 8/16 bits
	Color Depth	262k/65k
	Technology Type	a-Si
	Pixel Pitch (mm)	0.180x 0.180
	Pixel Configuration	R.G.B Vertical Stripe
	Display Mode	TM with Normally White
	Surface Treatment(Up Polarizer)	Clear Type (3H)
	Viewing Direction	6 o'clock
	Gray Scale Inversion Direction	12 o'clock
<b>Mechanical Characteristics</b>	LCM (W x H x D) (mm)	38.03x51.65x2.50
	Active Area(mm)	31.68 x 39.60
	With /Without TSP	Without TSP
	Weight (g)	8.1
	LED Numbers	3 LEDs
<b>Electronic</b>	Driver IC	HX8340-B

Note 1: Viewing direction for best image quality is different from TFT definition, there is a 180 degree shift.

Note 2 : Requirements on Environmental Protection: Q/S0002

Note 3: LCM weight tolerance:  $\pm 5\%$



## 2. Input/output Terminals

### 2.1 ABSOLUTE MAXIMUM RATINGS

Ta = 25°C

Item	Symbol	MIN	MAX	Unit	Remark
Logic Supply Voltage	IOVCC	-0.3	3.6	V	
Power Supply Voltage	VCC	-0.3	4.2	V	
Logic Input voltage	/CS,RS,/WR,/RD, /RESET,DB[0:15]	-0.3	IOVCC+0.5	V	
Back Light Forward Current	I <sub>LED</sub>		TBD	mA	
Operating Temperature	T <sub>OPR</sub>	-20	70	°C	
Storage Temperature	T <sub>STG</sub>	-30	80	°C	

Table 1.1 absolute maximum rating

## 3 ELECTRICAL CHARACTERISTICS

### 3.1 LCD module

V<sub>CC</sub>=2.5~3.3V ,GND=0V,Ta=25°C

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Logic Supply Voltage	IOVCC	1.65	1.8/2.8	3.3	V	
Power Supply Voltage	VCC	2.5	2.8	3.3	V	
Input Signal Voltage	Low Level V <sub>IL</sub>	GND		0.3* IOVCC	V	
	High Level V <sub>IH</sub>	0.7* IOVCC		IOVCC	V	
(Panel+LSI) Power Consumption	Black Mode		TBD.		mW	
	8 color Mode		TBD.		mW	
	Sleeping Mode		TBD.		mW	

Table 2.1 LCD module electrical characteristics



### 3.2 Backlight Unit

Ta=25°C

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Forward Current	$I_F$		15		mA	For each LED
Forward Current Voltage	$V_F$		3.2		V	For each LED
Backlight Power Consumption	$W_{BL}$		144		mW	Total LED

Table 2.2 backlight unit electrical characteristics

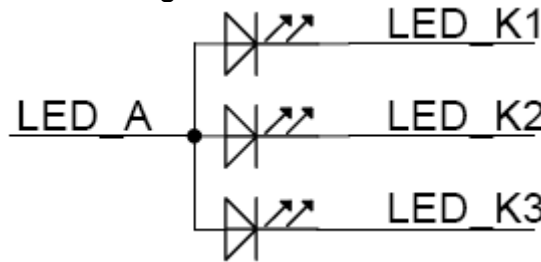
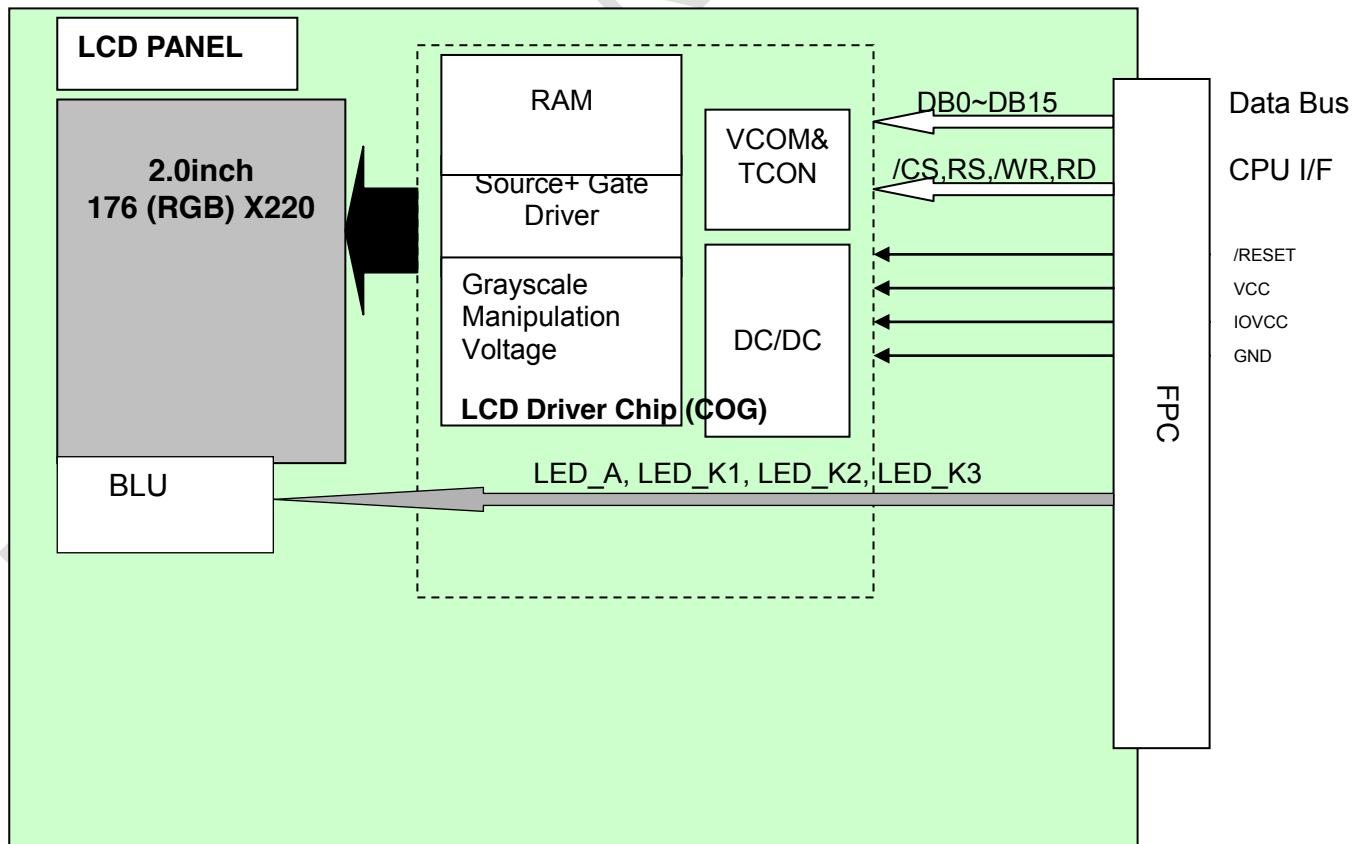


Figure 2.2 LED driver circuit

### 3.3 BLOCK DIAGRAM

LCD module diagram





### 3.4 INPUT TERMINALS PIN ASSIGNMENT

No	Symbol	I/O	Description	Comment
1	DB15	I/O	Data Bus	
2	DB14	I/O	Data Bus	
3	DB13	I/O	Data Bus	
4	DB12	I/O	Data Bus	
5	DB11	I/O	Data Bus	
6	DB10	I/O	Data Bus	
7	DB9	I/O	Data Bus	
8	DB8	I/O	Data Bus	
9	GND	P	Ground	
10	DB7	I/O	Data Bus	
11	DB6	I/O	Data Bus	
12	DB5	I/O	Data Bus	
13	DB4	I/O	Data Bus	
14	DB3	I/O	Data Bus	
15	DB2	I/O	Data Bus	
16	DB1	I/O	Data Bus	
17	DB0	I/O	Data Bus	
18	IOVCC	P	Logic IO power supply	
19	VCC	P	Driver power supply	
20	/RD	I	Read signal Active low	
21	/WR	I	Write signal Active low	
22	RS	I	Register select low: Index high: register	
23	/CS	I	Chip selection Active low	
24	/RESET	I	Reset signal Active low	
25	IM0	I	Mode select low :16bit high:8bit	
26	GND	P	Ground	
27	LED_A	I	Anode of LED	
28	LED_K1	I	Cathode of LED	
29	LED_K2	I	Cathode of LED	
30	LED_K3	I	Cathode of LED	
31	NC	—	No connection	
32	NC	—	No connection	
33	NC	—	No connection	
34	NC	—	No connection	
35	NC	—	No connection	
36	NC	—	No connection	

Table 4.1 input terminal pin assignment

IM0	Interface
0	8080 MCU 16-bits Parallel
1	8080 MCU 8-bits Parallel

Table 4.2 Module interface select

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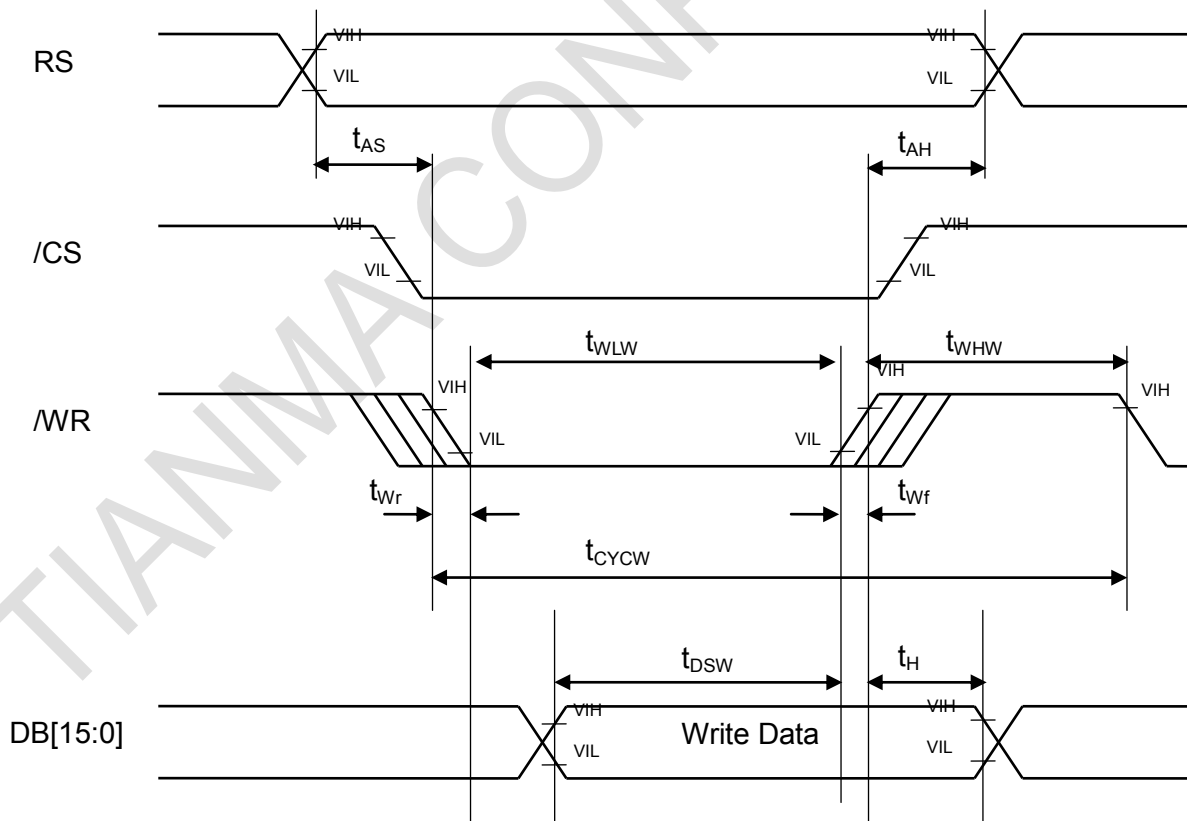


## 4. Interface Timing

### 4.1 Timing Parameter

Item	Symbol	Unit	Min	Type	Max
Bus cycle time   Write	$t_{CYCW}$	ns	66	—	—
Write low-level pulse width	$t_{WLW}$	ns	15	—	—
Write high-level pulse width	$t_{WHW}$	ns	15	—	—
Write rise/fall time	$t_{Wr,Wf}$	ns	—	—	15
Address setup time	$t_{AS}$	ns	0	—	—
Address hold time	$t_{AH}$	ns	10	—	—
Write data setup time	$t_{DSW}$	ns	10	—	—
Write data hold time	$t_H$	ns	10	—	—

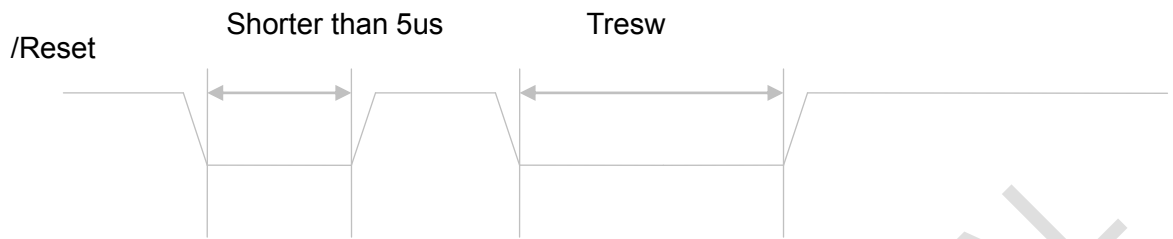
Table 5.1 timing parameter







Reset timing



Note: Tresw(at least 10us)

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## 4.2 Register write timing

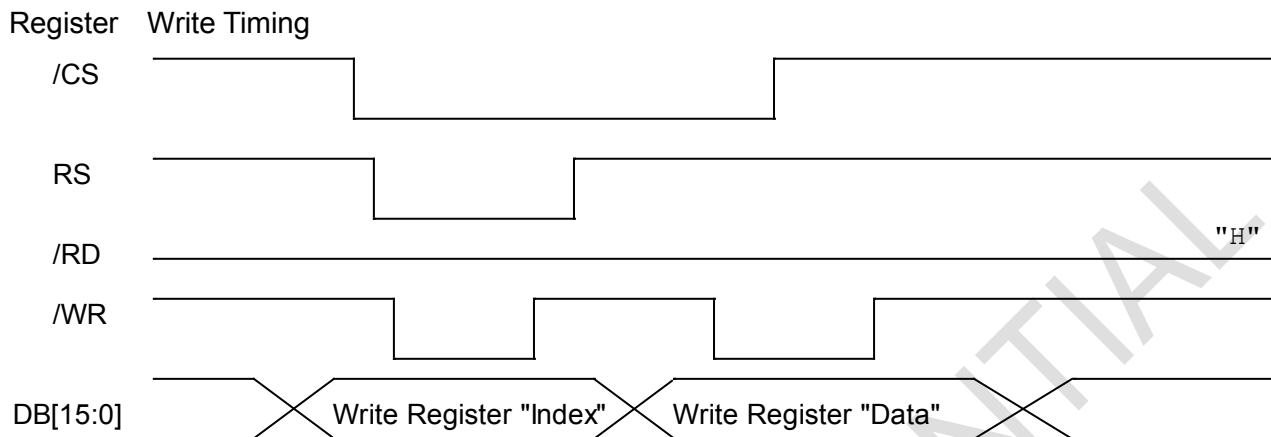


Figure 5.2.1 16-bit System Bus Interface Timing(Register Write Timing)

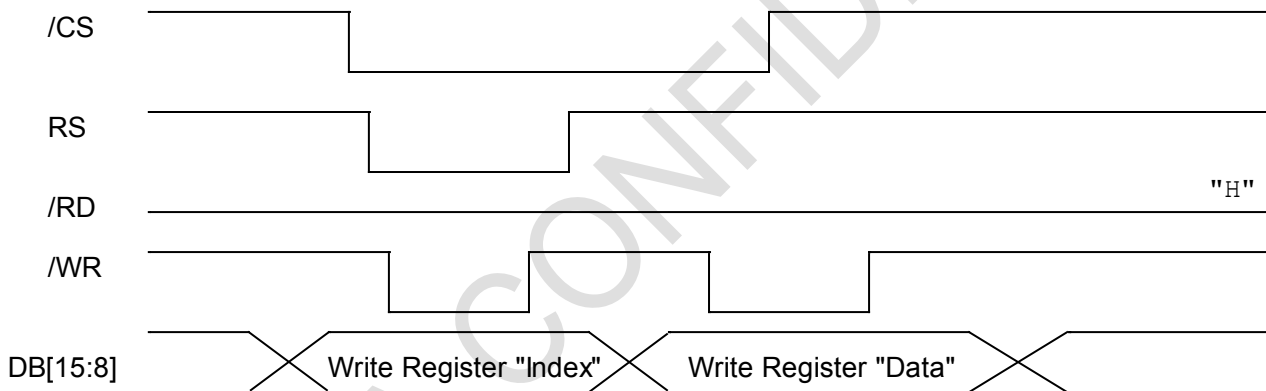


Figure 5.2.2 8-bit System Bus Interface Timing(Register Write Timing)



### 4.3 GRAM write/read timing

#### 4.3.1 GRAM Write Timing

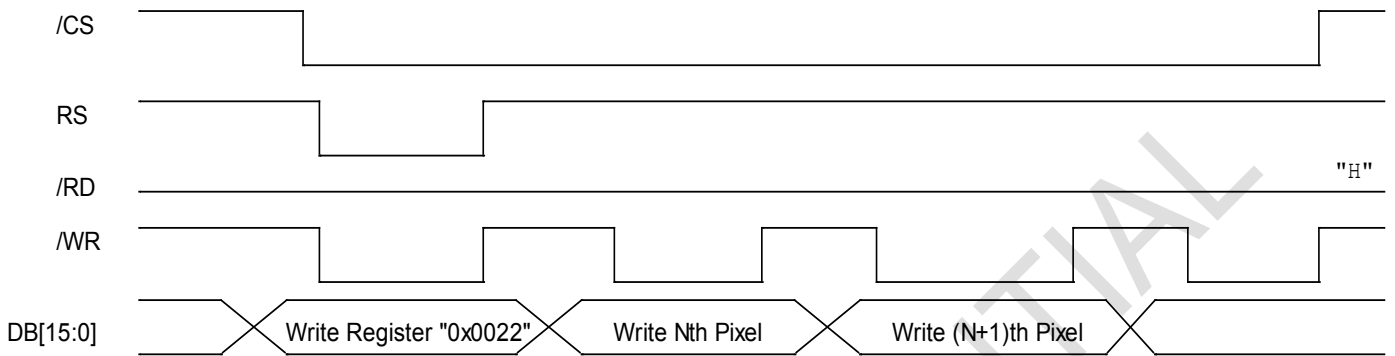


Figure 5.3.1 16-bit Write data for RGB 5-6-5-bits input (GRAM Write Timing)

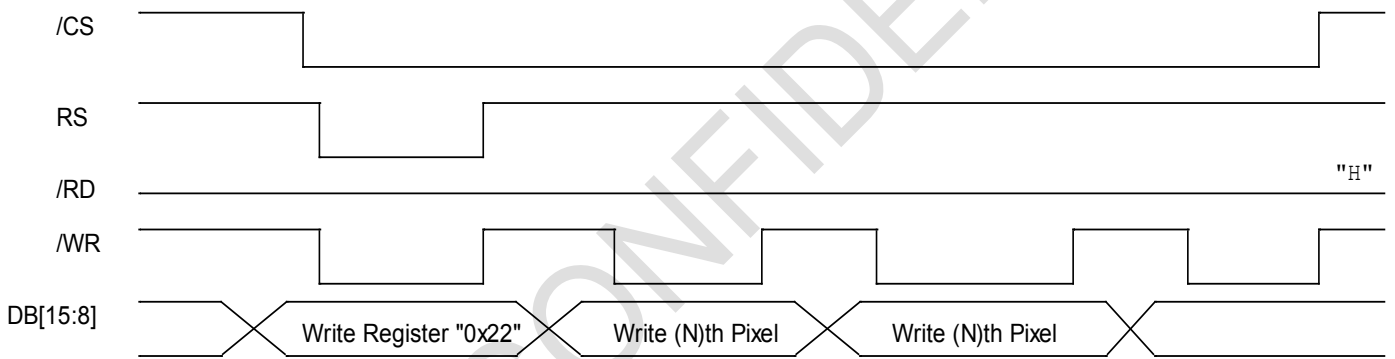


Figure 5.3.2 8-bit Write data for RGB 5-6-5-bits input (GRAM Write Timing)



4.3.2 Display mode

Register	DB15	DB14	DB13	DB12	DB11	DB10	DB9	DB8	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Command
Command	X	X	X	X	X	X	X	X	0	0	1	0	0	0	1	0	22H
17H	DB15	DB14	DB13	DB12	DB11	DB10	DB9	DB8	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Color
03h	X	X	X	X	R3	R2	R1	R0	G3	G2	G1	G0	B3	B2	B1	B0	4K-Color
05h	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B4	B3	B2	B1	B0	65K-Color
06h	R5	R4	R3	R2	R1	R0	X	X	G5	G4	G3	G2	G1	G0	X	X	262K-Color
	B5	B4	B3	B2	B1	B0	X	X	R5	R4	R3	R2	R1	R0	X	X	
	G5	G4	G3	G2	G1	G0	X	X	B5	B4	B3	B2	B1	B0	X	X	

Figure 5.3.3 16-bit Bus GRAM mode select

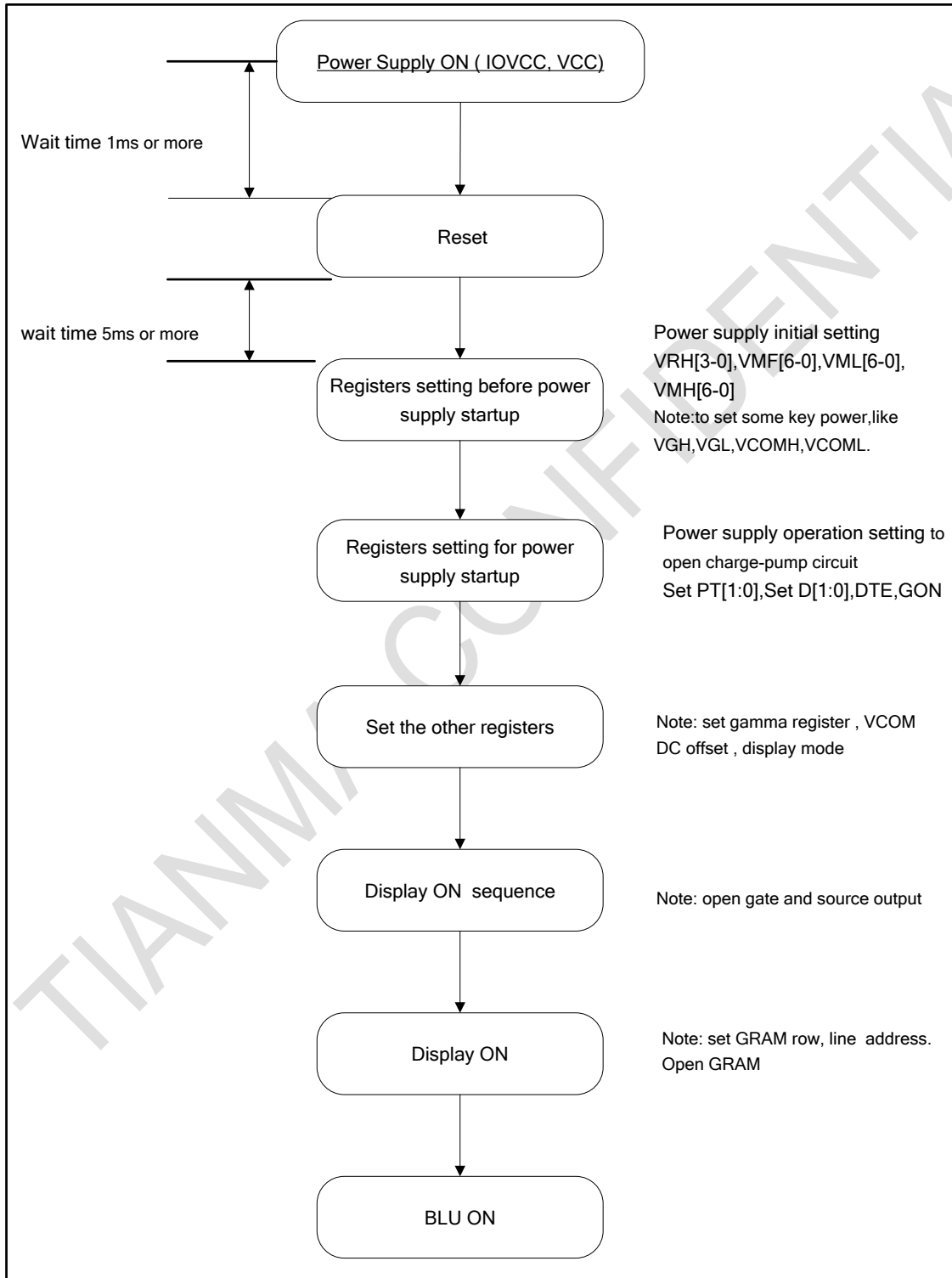
Register	DB15	DB14	DB13	DB12	DB11	DB10	DB9	DB8	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Command
Command	X	X	X	X	X	X	X	X	0	0	1	0	0	0	1	0	22H
17H	DB15	DB14	DB13	DB12	DB11	DB10	DB9	DB8	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Color
03h	R3	R2	R1	R0	G3	G2	G1	G0	X	X	X	X	X	X	X	X	4K-Color
	B3	B2	B1	B0	R3	R2	R1	R0									
	G3	G2	G1	G0	B3	B2	B1	B0									
05h	R4	R3	R2	R1	R0	G5	G4	G3	X	X	X	X	X	X	X	X	65K-Color
	G2	G1	G0	B4	B3	B2	B1	B0									
06h	R5	R4	R3	R2	R1	R0	X	X	X	X	X	X	X	X	X	X	262K-Color
	B5	B4	B3	B2	B1	B0	X	X	X	X	X	X	X	X	X	X	
	G5	G4	G3	G2	G1	G0	X	X	X	X	X	X	X	X	X	X	

Figure 5.3.4 8-bit Bus GRAM mode select



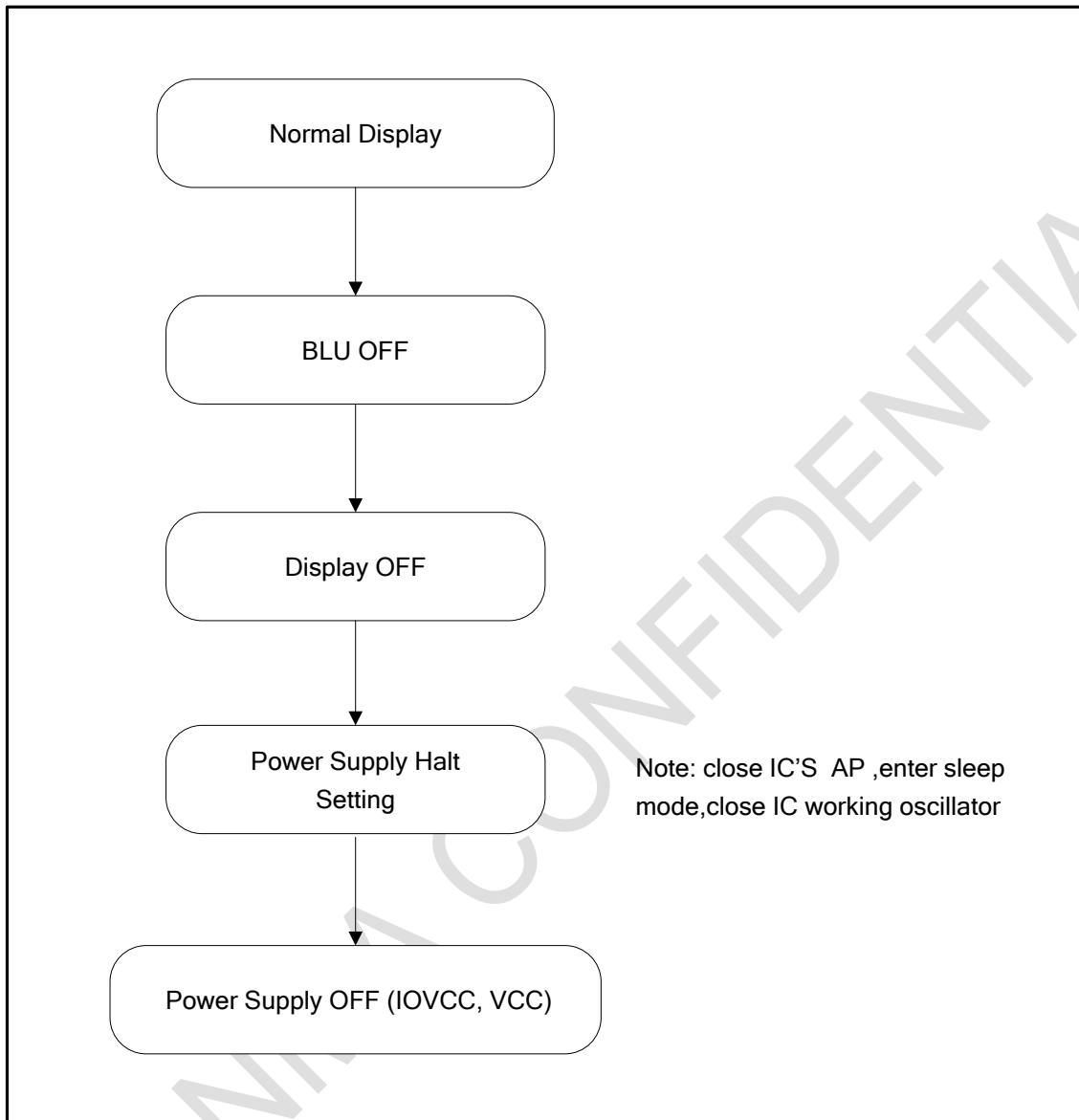
# 5. POWER ON/OFF SEQUENCE

## 5.1 Power on Sequence





## 5.2 Power off Sequence





## 6. Optical Characteristics

Ta=25°C

Item	Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles	$\theta T$	CR $\geq$ 10	60	70	-	Degree	Note 2
	$\theta B$		50	60	-		
	$\theta L$		60	70	-		
	$\theta R$		60	70	-		
Contrast Ratio	CR	$\theta=0^\circ$	400	500	-		Note1 Note3
Response Time	Ton	25°C	-	20	30	ms	Note1
	Toff		Note4				
Chromaticity	White	x	0.234	0.284	0.334	Backlight is on	Note5, Note1
		y	0.262	0.312	0.362		
	Red	x	0.561	0.611	0.661		
		y	0.288	0.338	0.388		
	Green	x	0.274	0.324	0.374		
		y	0.562	0.612	0.662		
	Blue	x	0.095	0.145	0.195		
		y	0.041	0.091	0.141		
Uniformity	U		75	80	-	%	Note1 Note6
NTSC			55	60	-	%	Note 5
Luminance(TSP)	L		200	220	-	cd/m <sup>2</sup>	Note1 Note7

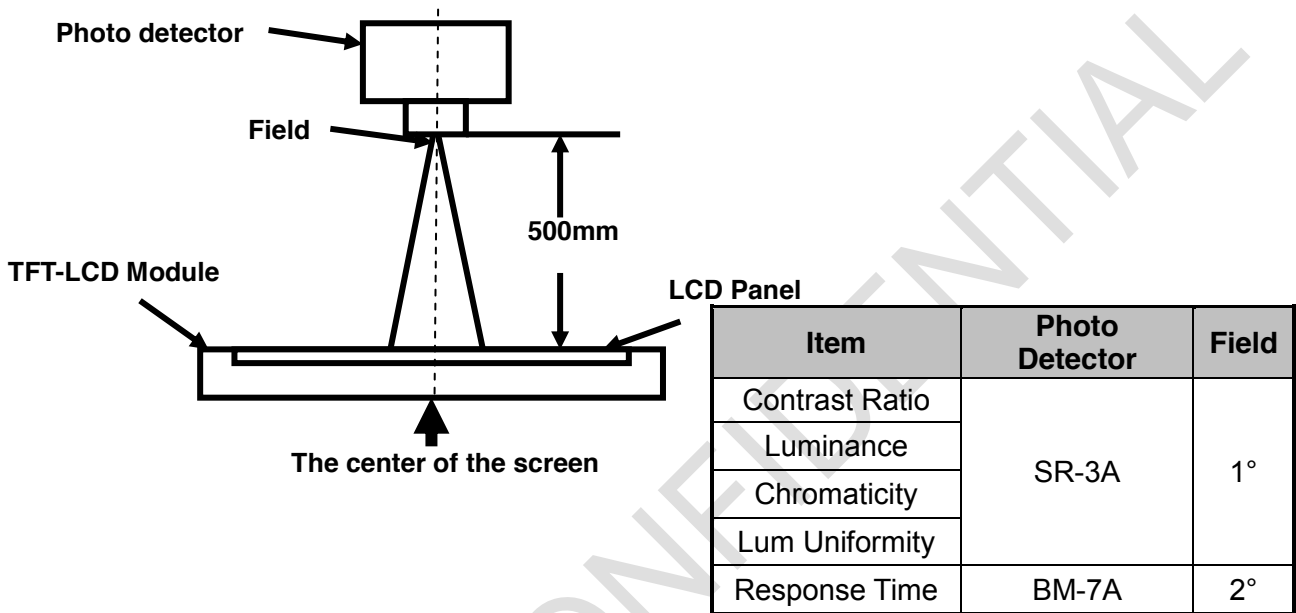
Test Conditions:

1. For one LED:  $V_F=3.2V$ ,  $I_F=15mA$ , the ambient temperature is 25°C.
2. The test systems refer to Note 1 and Note 2.



Note 1: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 5 minutes operation, the optical properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.



Note 2: Definition of viewing angle range and measurement system.

viewing angle is measured at the center point of the LCD by CONOSCOPE(ergo-80).

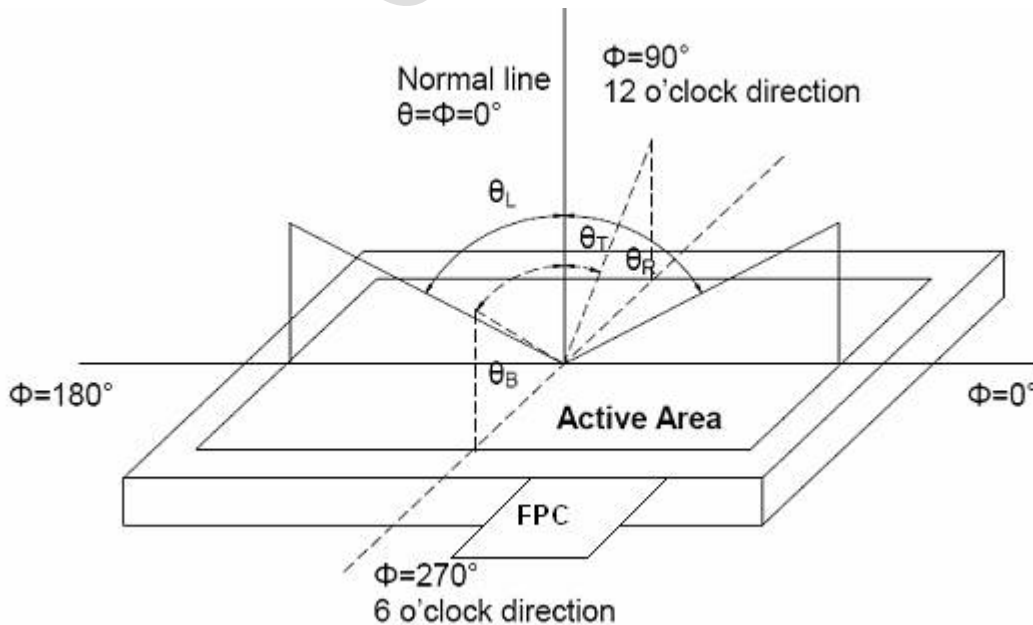


Fig. 1 Definition of viewing angle





Note 3: Definition of contrast ratio

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

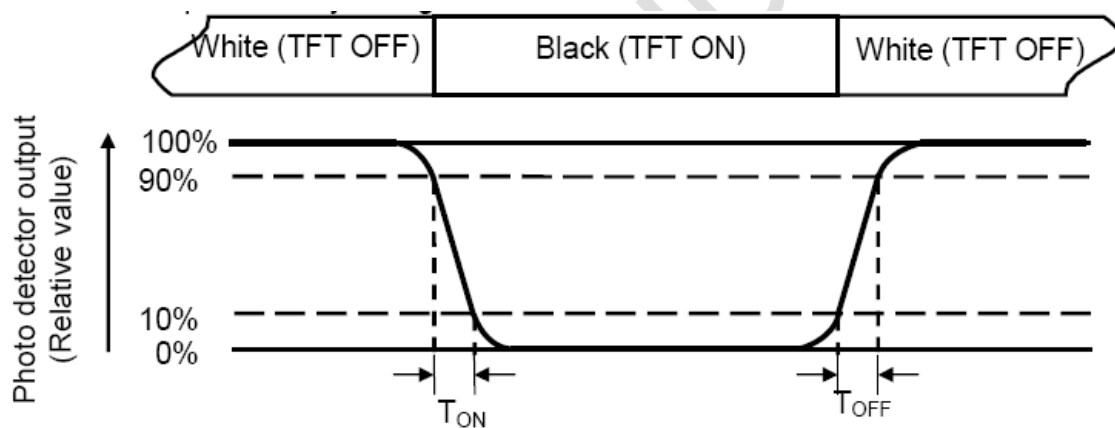
"White state": The state is that the LCD should be driven by  $V_{\text{white}}$ .

"Black state": The state is that the LCD should be driven by  $V_{\text{black}}$ .

$V_{\text{white}}$ : To be determined     $V_{\text{black}}$ : To be determined.

Note 4: Definition of Response time

The response time is defined as the LCD optical switching time interval between "White" state and "Black" state. Rise time ( $T_{\text{ON}}$ ) is the time between photo detector output intensity changed from 90% to 10%. And fall time ( $T_{\text{OFF}}$ ) is the time between photo detector output intensity changed from 10% to 90%.



Note 5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.



Note 6: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer Fig. 2). Every measuring point is placed at the center of each measuring area.

$$\text{Luminance Uniformity}(U) = L_{\min} / L_{\max}$$

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

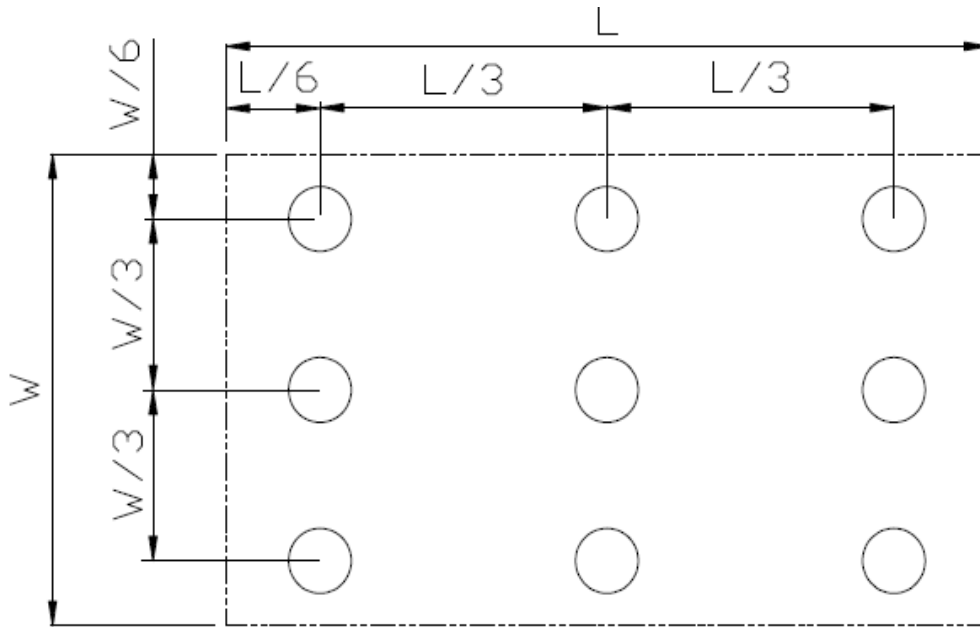


Fig. 2 Definition of uniformity

$L_{\max}$ : The measured maximum luminance of all measurement position.

$L_{\min}$ : The measured minimum luminance of all measurement position.

Note 7: Definition of Luminance:

Measure the luminance of white state at center point.



## 7. Environmental / Reliability Tests

No	Test Item	Condition	Remarks
1	High Temperature Operation	Ts = +70°C, 240 hours	Follow Cisco's First Level Qualification for Display Modules
2	Low Temperature Operation	Ta = -20°C, 240 hours	Follow Cisco's First Level Qualification for Display Modules
3	High Temperature Storage	Ta = +80°C, 240 hours	Follow Cisco's First Level Qualification for Display Modules
4	Low Temperature Storage	Ta = -30°C, 240 hours	Follow Cisco's First Level Qualification for Display Modules
5	Operation at High Temperature and Humidity	Ta = +60°C, 90% RH, 240 hours	Follow Cisco's First Level Qualification for Display Modules
6	Temperature Cycle	-30±2 deg C. for 30 minutes followed by 80±2 deg C. for 30 minutes A total of 50 cycles	Follow Cisco's First Level Qualification for Display Modules
7	ESD	LCM level Air discharge 6 times at: Voltage: 4 kV Contact discharge 6 times at: Voltage: 2.5 kV Resistance 330 Ohms, Capacitance 150 pF Phone level Air discharge 6 times at: Voltage: 4 kV Resistance 330 Ohms, Capacitance 150 pF	Follow Cisco's First Level Qualification for Display Modules Without any reset
8	Vibration Test	0.015G*G/Hz from 5~200Hz, -6dB/Octave from 200~500Hz, 2 hours for each direction of X, Y, Z (6 hours for total)	Follow Cisco's First Level Qualification for Display Modules
9	Mechanical Shock (Non Op)	Half Sine Wave 60G 6ms, ±X, ±Y, ±Z 3 times for each direction	IEC60068-2-27 GB/T2423.5
10	Drop Test	Height 750 mm Drop test must be done 10 times at concrete floor, 1 corner, 3 edges, 6 sides	Follow Cisco's First Level Qualification for Display Modules

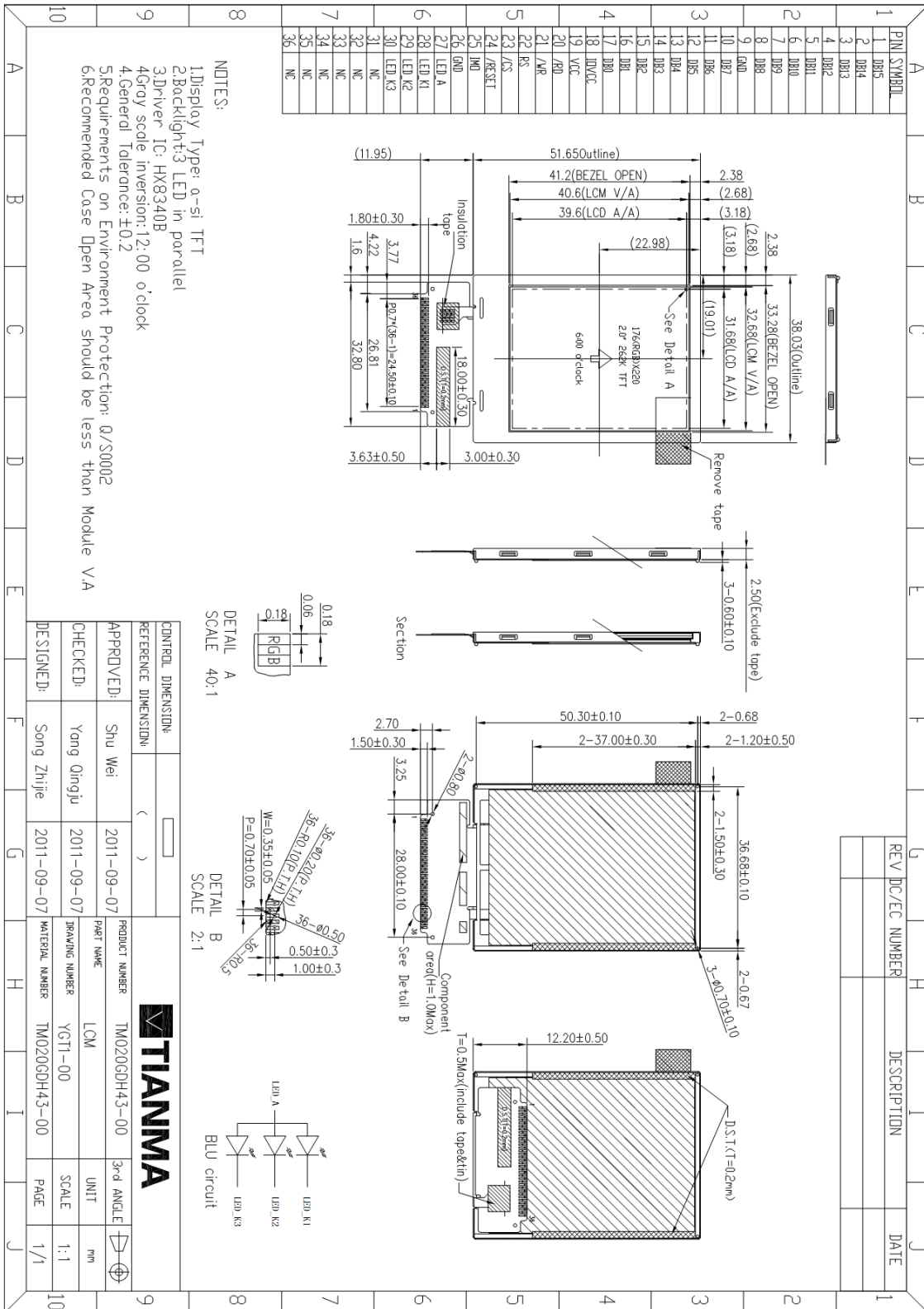
Note1: Ts is the temperature of panel's surface.

Note2: Ta is the ambient temperature of sample.

**MTBF: 50000Hrs sample NO. 10Pcs 504Hrs Operating, 60°C 90%RH**



# 8. Mechanical Drawing

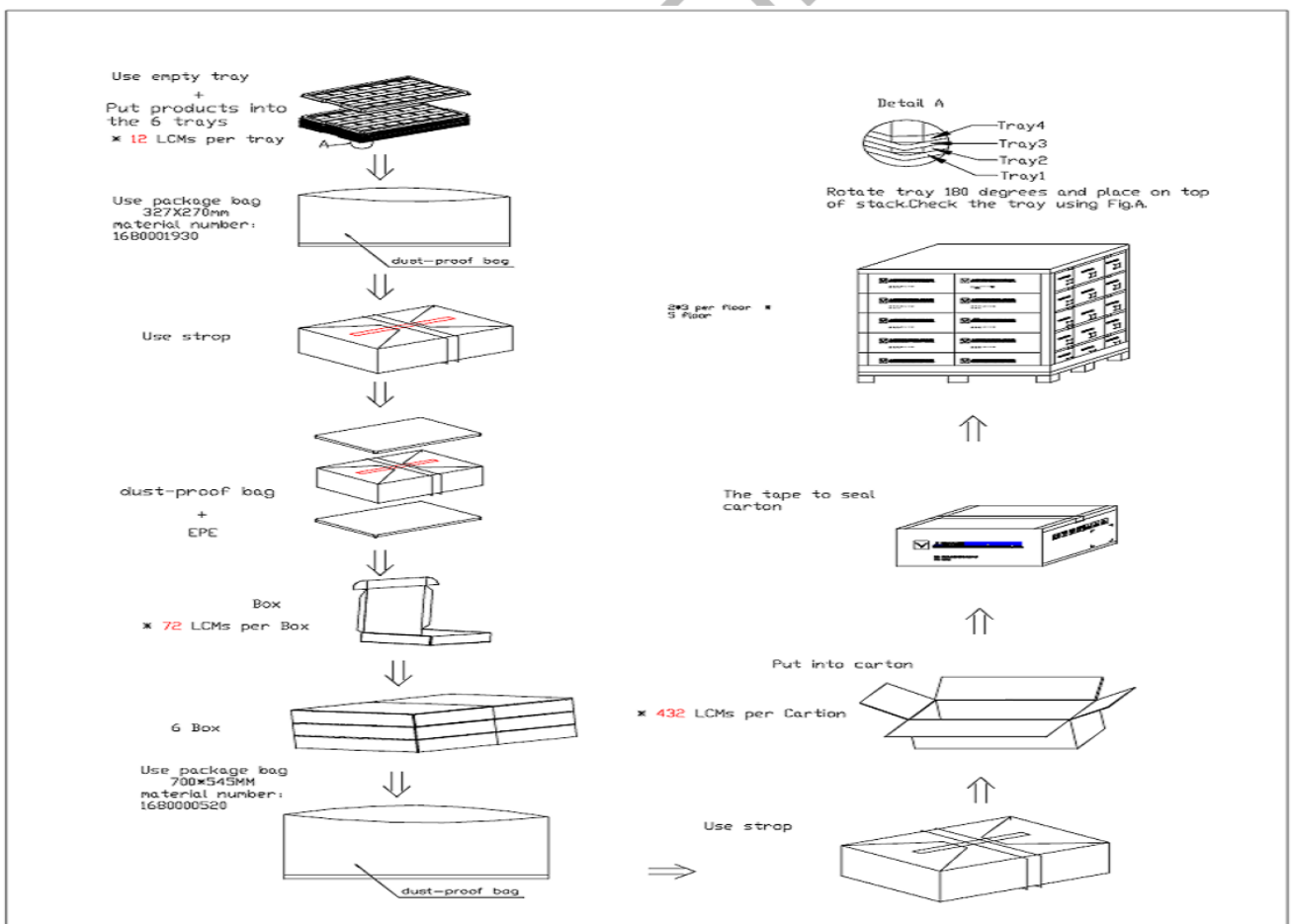


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# 9. Packing Drawing

No	Item	Model (Material)	Dimensions(mm)	Unit Weight(Kg)	Quantity	Remark
1	LCM module	TM020GDH43	38.03×51.65×2.5	0.008	432	
2	Tray	PET (Transmit)	315×247×11	0.086	42	Anti-static
3	EPE	EPE	315×247×5	0.08	12	
4	DUST-PROOF BAG	PE	700×545	0.05	1	
5	Anti-Static Bag	PE	327X270	0.01	6	
6	BOX	CORRUGATED PAPER	345X260X70	0.44	6	
7	Carton	CORRUGATED PAPER	544×365×250	1.01	1	
8	Total weight	(11.8±0.6) Kg				



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## 10. Precautions for Use of LCD Modules

### 10.1 Handling Precautions

- 10.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.
- 10.1.2 If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.
- 10.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
- 10.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.
- 10.1.5 If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:
- Isopropyl alcohol.
  - Ethyl alcohol
- Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:
- Water
  - Ketone
  - Aromatic solvents
- 10.1.6 Do not attempt to disassemble the LCD Module.
- 10.1.7 If the logic circuit power is off, do not apply the input signals.
- 10.1.8 To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
- 10.1.8.1 Be sure to ground the body when handling the LCD Modules.
- 10.1.8.2 Tools required for assembly, such as soldering irons, must be properly ground.
- 10.1.8.3 To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.
- 10.1.8.4 The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.

### 10.2 Storage precautions

- 10.2.1 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.
- 10.2.2 The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:
- Temperature : 0℃ ~ 40℃    Relatively humidity: ≤80%
- 10.2.3 The LCD modules should be stored in the room without acid, alkali and harmful gas.

### 10.3 Transportation Precautions:

The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.