

**MODEL NO :** TM020GDH43**MODEL VERSION:** 00**SPEC VERSION :** 2.1**ISSUED DATE:** 2016-2-23

- Preliminary Specification  
 Final Product Specification

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

Approved by	Notes

**TIANMA Confirmed :**

Prepared by	Checked by	Approved by
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This technical specification is subjected to change without notice

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## 1 General Specifications

	Feature	Spec
<b>Display Spec.</b>	Size	2.0 inch
	Resolution	176(RGB) x 220
	Technology Type	a-Si
	Pixel Configuration	R.G.B Vertical Stripe
	Pixel pitch(mm)	0.180x 0.180
	Display Mode	TM with Normally White
	Surface Treatment	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
	Matching Connection Type	Weld pin
	LED Numbers	3 LEDs
	Weight (g)	8.1
<b>Electrical Characteristics</b>	Interface	CPU 8/16 bits
	Color Depth	262k/65k
	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

Matching Connection Type:weld pin

Pin No.	Symbol	I/O	Function	Remark
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	

Note1: Please add the FPC connector type and matched one if necessary .

<b>IM0</b>	<b>Interface</b>
0	8080 MCU 16-bits Parallel
1	8080 MCU 8-bits Parallel

### 3 Absolute Maximum Ratings

GND=0V

Item	Symbol	MIN	MAX	Unit	Remark
Power Voltage	VCC	-0.3	4.2	V	Note1
Input voltage	V <sub>IN</sub>	-0.3	4.2	V	
Operating Temperature	Top	-20	70	°C	
Storage Temperature	Tst	-30	80	°C	
Relative Humidity Note2	RH	--	≤95	%	Ta≤40°C
		--	≤85	%	40°C < Ta≤50°C
		--	≤55	%	50°C < Ta≤60°C
		--	≤36	%	60°C < Ta≤70°C
		--	≤24	%	70°C < Ta≤80°C
Absolute Humidity	AH	--	≤70	g/m <sup>3</sup>	Ta>70°C

Table 3.1 Absolute Maximum Ratings

Note1: Input voltage include R0~R5, G0~G5, B0~B5, Dotclk, Hsync, Vsync, Enable, R/L, U/D

Note2: Ta means the ambient temperature.

It is necessary to limit the relative humidity to the specified temperature range.  
Condensation on the module is not allowed.

## 4 Electrical Characteristics

### 4.1 LCD module

$V_{CC}=2.5\sim 3.3V$ ,  $GND=0V$ ,  $T_a=25^\circ C$

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	$V_{IL}$	GND	0.3* IOVCC	V	
	High Level	$V_{IH}$	0.7* IOVCC	IOVCC	V	
(Panel+LSI) Power Consumption	Black Mode (60HZ)		7.85	13.5	mW	
	Sleeping Mode		10	26	uW	

Table 4.1.1 LCD module electrical characteristics

### 4.2 Backlight Unit

$T_a=25^\circ C$

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
Lifetime	T	-	20000	-	Hr	One LED

Table 4.2.1 backlight unit electrical characteristics

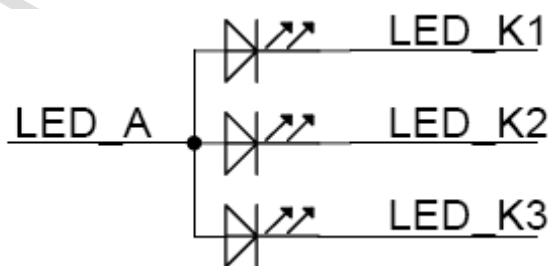
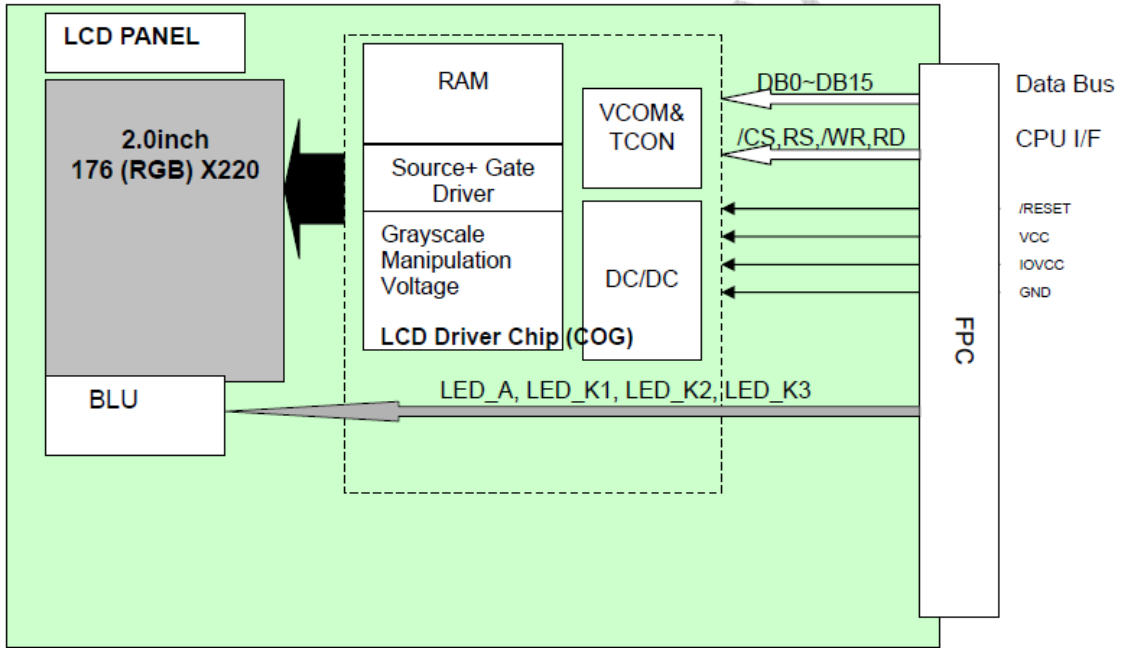


Figure 4.2.2 LED driver circuit

### 4.3 Block Diagram

#### LCD module diagram





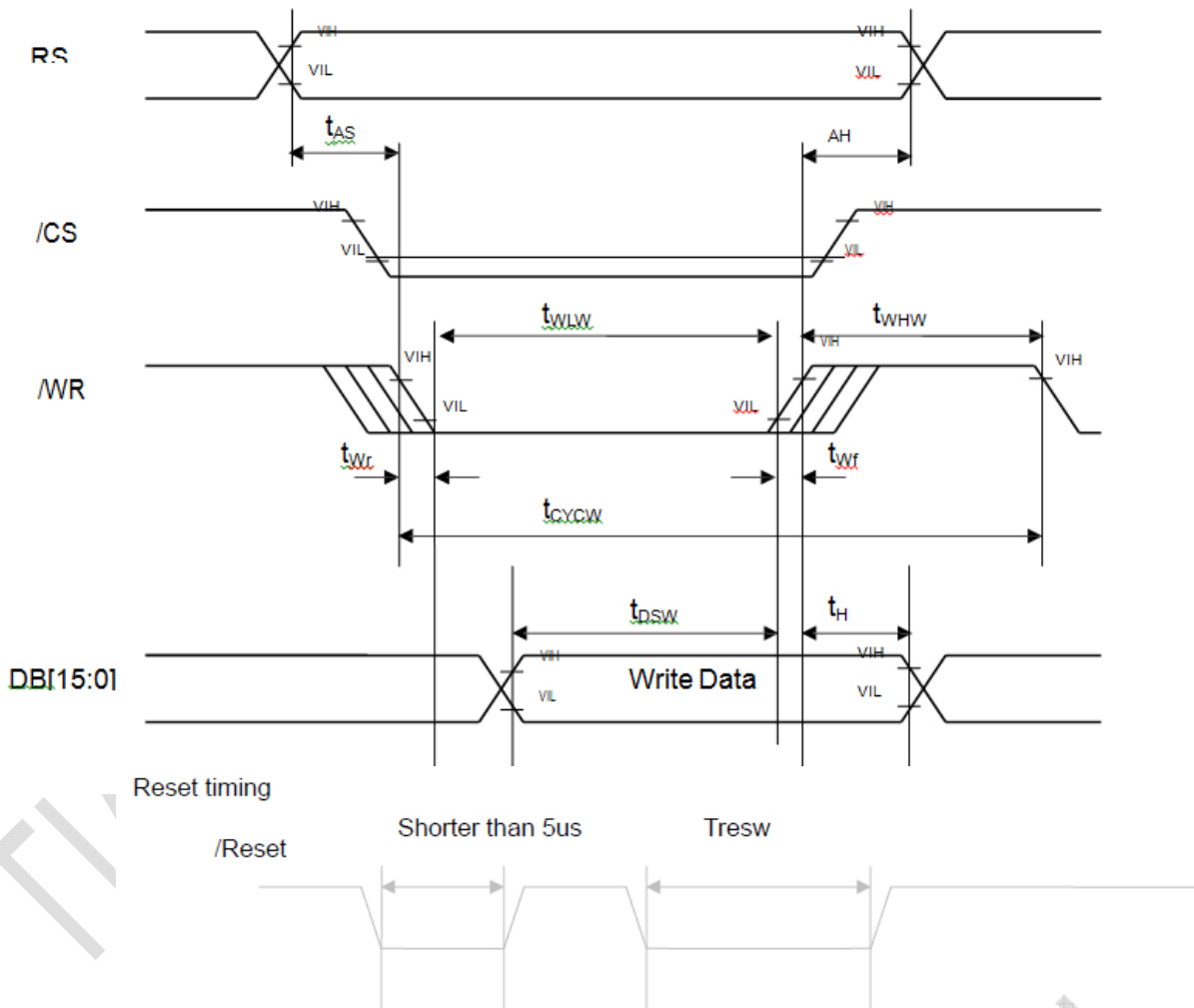
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## 5 Timing Chart

### 5.1 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 5.1.1 timing parameter



Note:  $Tresw$ (at least 10us)

## 5.2 Register Write Timing

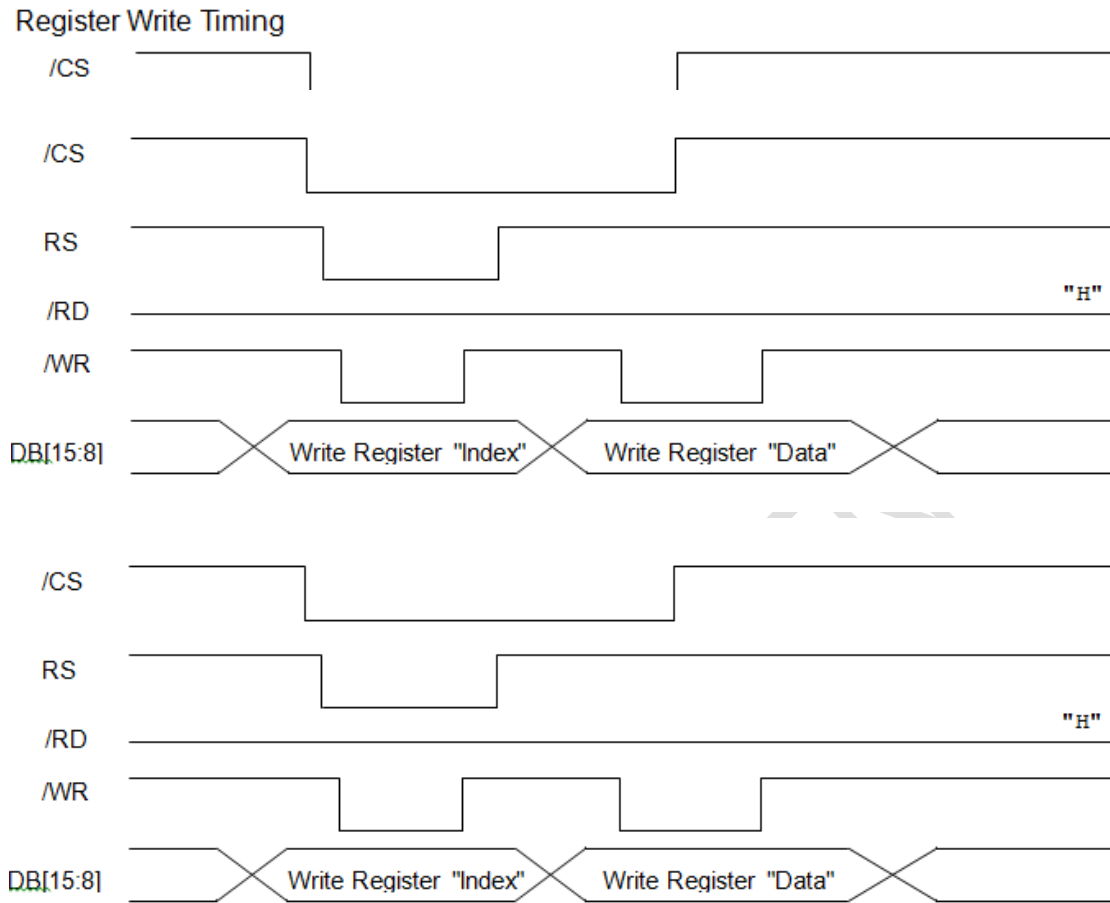


Figure 5.2.2 16-bit System Bus Interface Timing (Register Write Timing)

## 5.3 GRAM Write/Read Timing

### 5.3.1 GRAM Write Timing

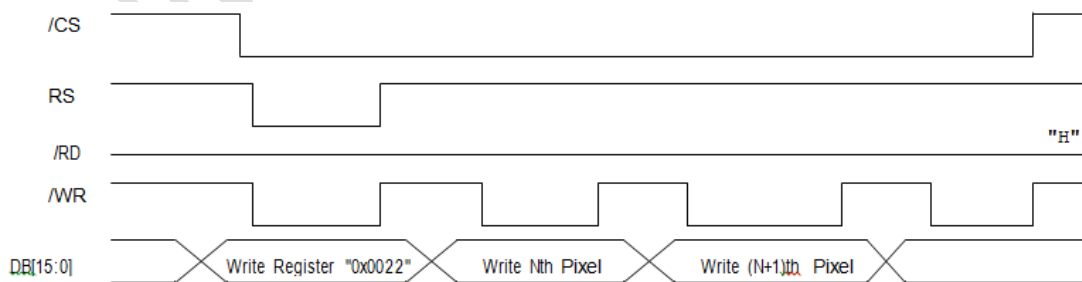


Figure 5.3.1.1 16 bit Write data

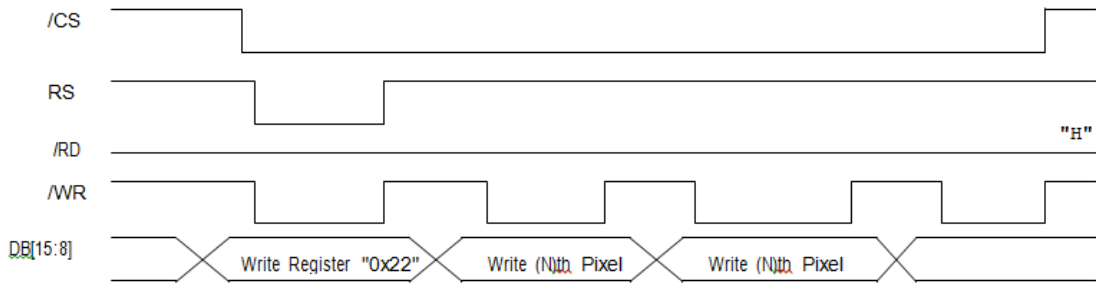


Figure 5.3.1.2 8 bit Write data

### 5.3.2 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	

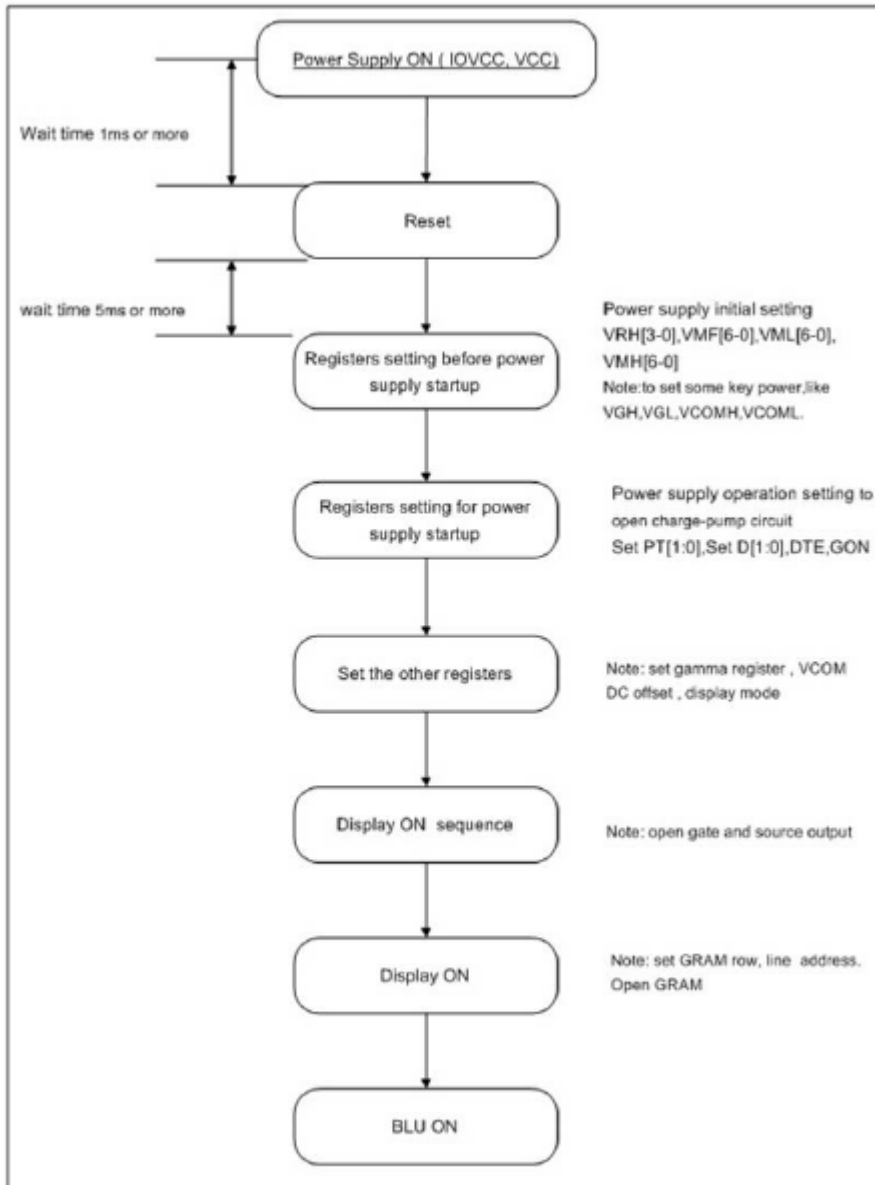
Figure 5.3.2.1 16-bit Bus GRAM mode select

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		
	G5	G4	G3	G2	G1	G0	X	X	X	X	X	X	X	X	X		

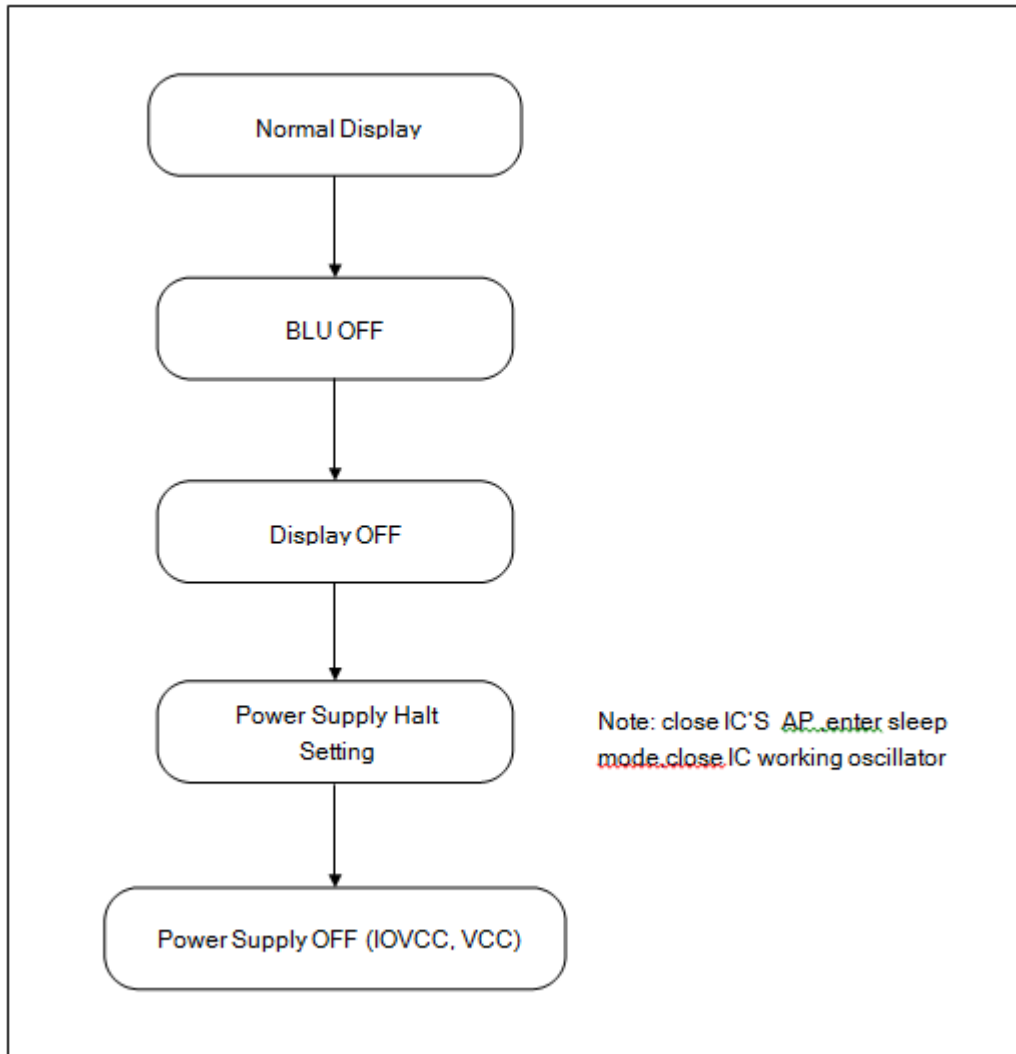
Figure 5.3.2.2 8-bit Bus GRAM mode select

## 5.4 Power on/off Sequence

### 5.4.1 Power on Sequence



### 5.4.2 Power off Sequence



## 6 Optical Characteristics

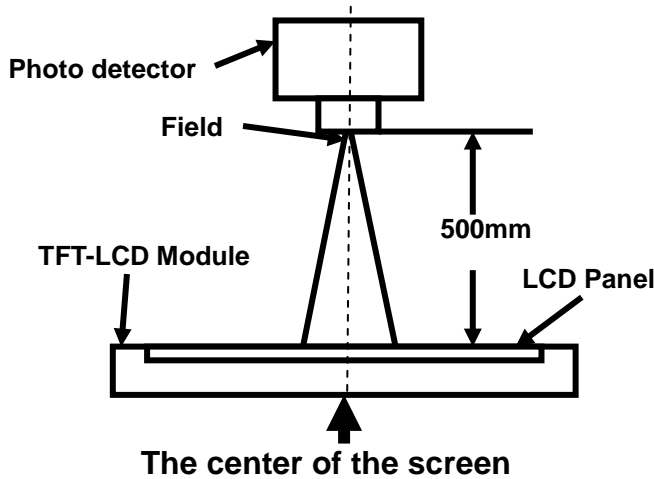
Item	Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles	$\theta T$	CR $\geq$	60	70		Degree	Note2,3
	$\theta B$		50	60			
	$\theta L$		60	70			
	$\theta R$		60	70			
Contrast Ratio	CR	$\theta=0^\circ$	400	500			Note 3
Response Time	$T_{ON}$	25°C		20	30	ms	Note 4
	$T_{OFF}$						
Chromaticity	White	Backlight is on	x	0.234	0.284	0.334	Note 1,5
			y	0.262	0.312	0.362	
	Red		x	0.561	0.611	0.661	Note 1,5
			y	0.288	0.338	0.388	
	Green		x	0.274	0.324	0.374	Note 1,5
			y	0.562	0.612	0.662	
	Blue		x	0.095	0.145	0.195	Note 1,5
			y	0.041	0.091	0.141	
Uniformity	U		75	80		%	Note 6
NTSC			55	60		%	Note 5
Luminance	L		200	220		cd/m <sup>2</sup>	Note 7

Test Conditions:

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

Note 1: Definition of optical measurement system.

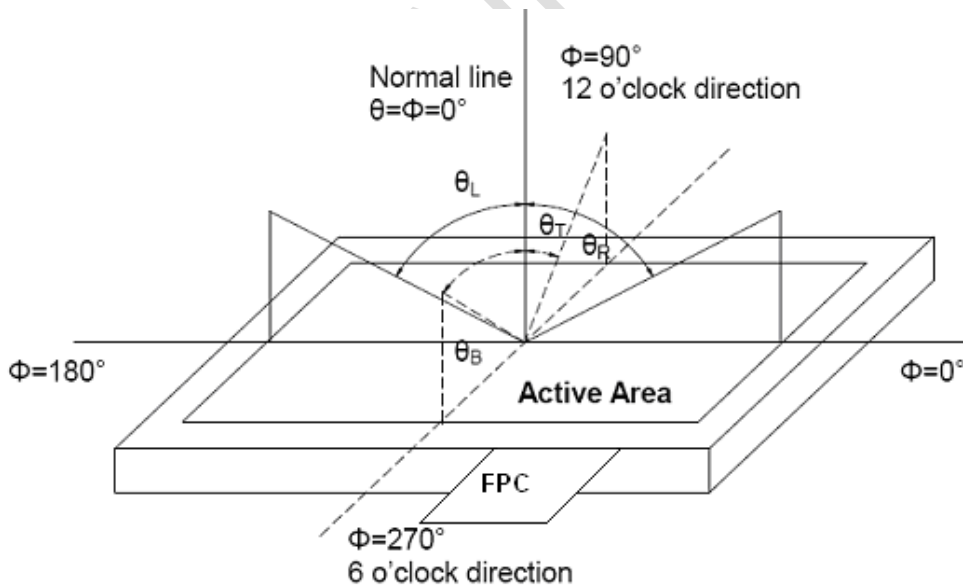
The optical characteristics should be measured in dark room. After 5 Minutes operation, the optical properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.



Item	Photo detector	Field
Contrast Ratio	SR-3A	1°
Luminance		
Chromaticity		
Lum Uniformity		
Response Time	BM-7A	2°

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).



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 drive by V<sub>white</sub>.

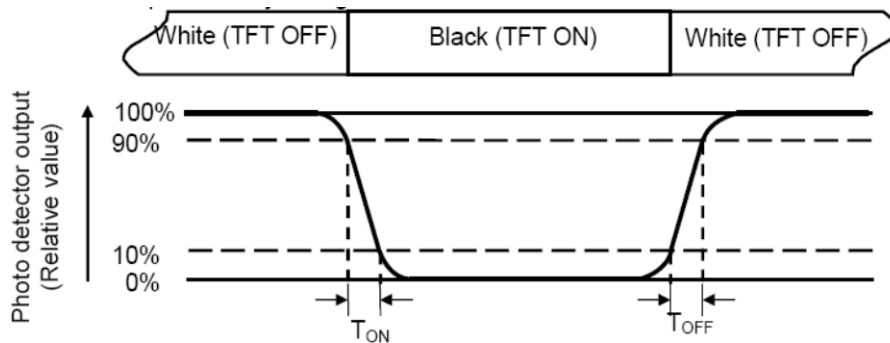
“Black state”: The state is that the LCD should drive by V<sub>black</sub>.



Vwhite: To be determined Vblack: 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 ( $T_{ON}$ ) is the time between photo detector output intensity changed from 90% to 10%. And fall time ( $T_{OFF}$ ) is the time between photo detector output intensity changed from 10% to 90%.



Note 5: Definition of color chromaticity (CIE1931)

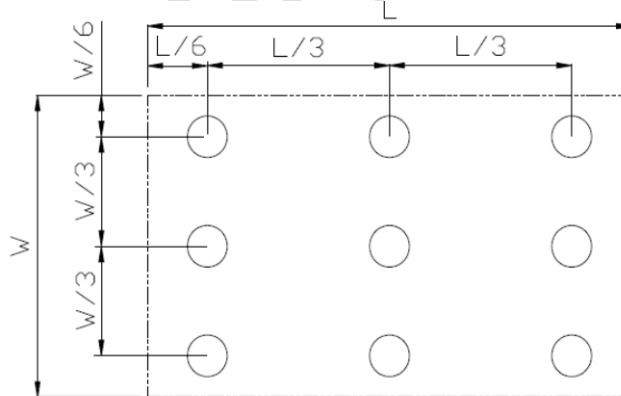
Color coordinates measured at center point of LCD.

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



$L_{\max}$ : 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 Test

No	Test Item	Condition	Remarks
1	High Temperature Operation	Ts = +70°C, 240 hours	IEC60068-2-1:2007 GB2423.2-2008
2	Low Temperature Operation	Ta = -20°C, 240 hours	IEC60068-2-1:2007 GB2423.1-2008
3	High Temperature Storage	Ta = +80°C, 240 hours	IEC60068-2-1:2007 GB2423.2-2008
4	Low Temperature Storage	Ta = -30°C, 240 hours	IEC60068-2-1:2007 GB2423.1-2008
5	Operation at High Temperature and Humidity	Ta = +60°C, 90% RH, 240hours	IEC60068-2-78 :2001 GB/T2423.3—2006
6	Thermal Shock (non-operation)	-30±2 deg C. for 30 minutes followed by 80±2 deg C. for 30 minutes A total of 50 cycles	Start with cold temperature, End with high temperature, IEC60068-2-14:1984,G B2423.22-2002
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: 8 kV Resistance 330 Ohms, Capacitance 150 pF	IEC61000-4-2:2001 GB/T17626.2-2006
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)	IEC60068-2-6:1982 GB/T2423.10—1995
9	Mechanical Shock (Non OP)	Half Sine Wave 60G 6ms, ±X,±Y,±Z 3times for each direction	IEC60068-2-27:1987 GB/T2423.5—1995
10	Package Drop Test	Height 750 mm Drop test must be done 10 times at concrete floor, 1 corner, 3 edges, 6 sides	IEC60068-2-32:1990 GB/T2423.8—1995

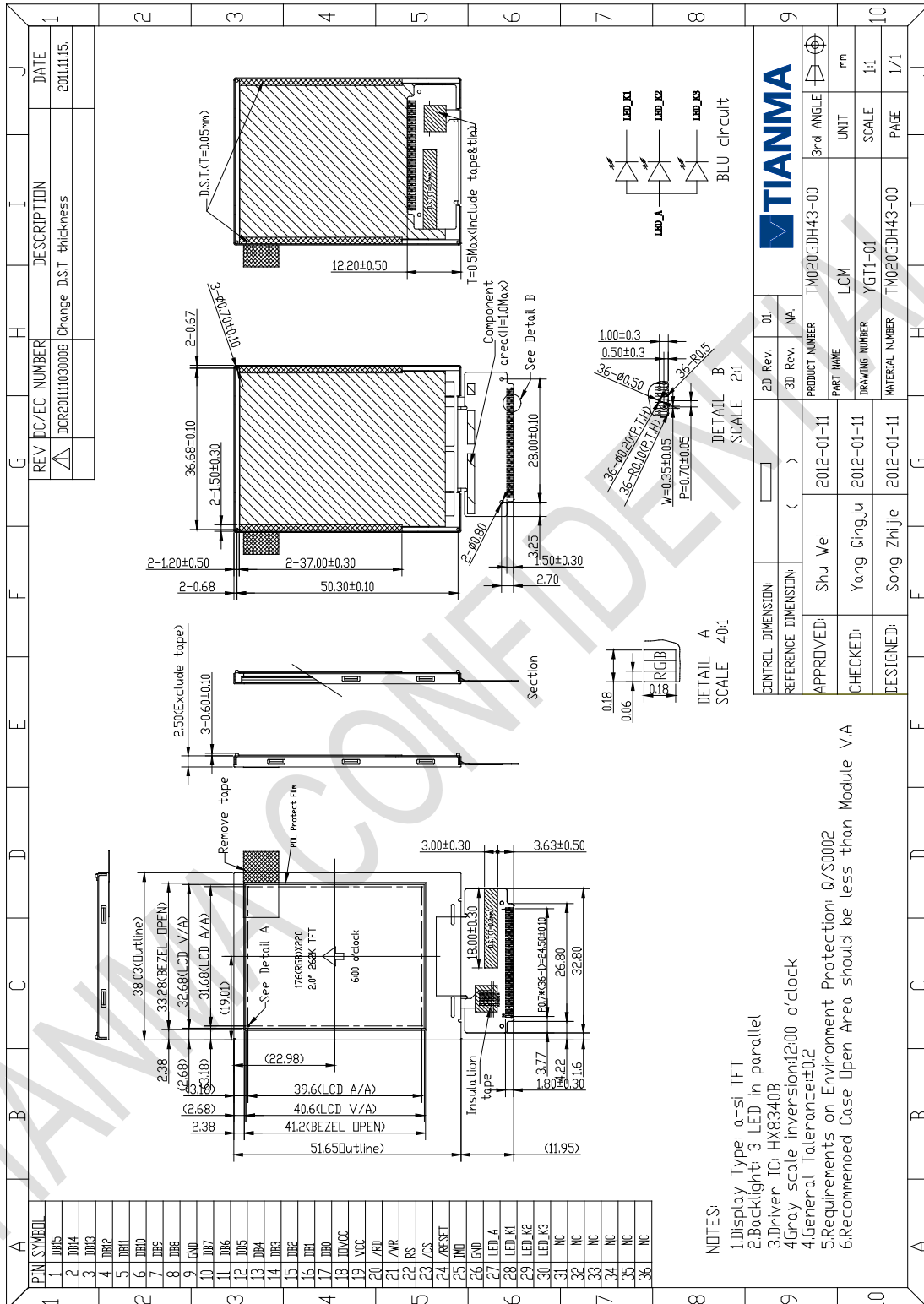
Note1: Ts is the temperature of panel's surface.

Note2: Ta is the ambient temperature of sample.

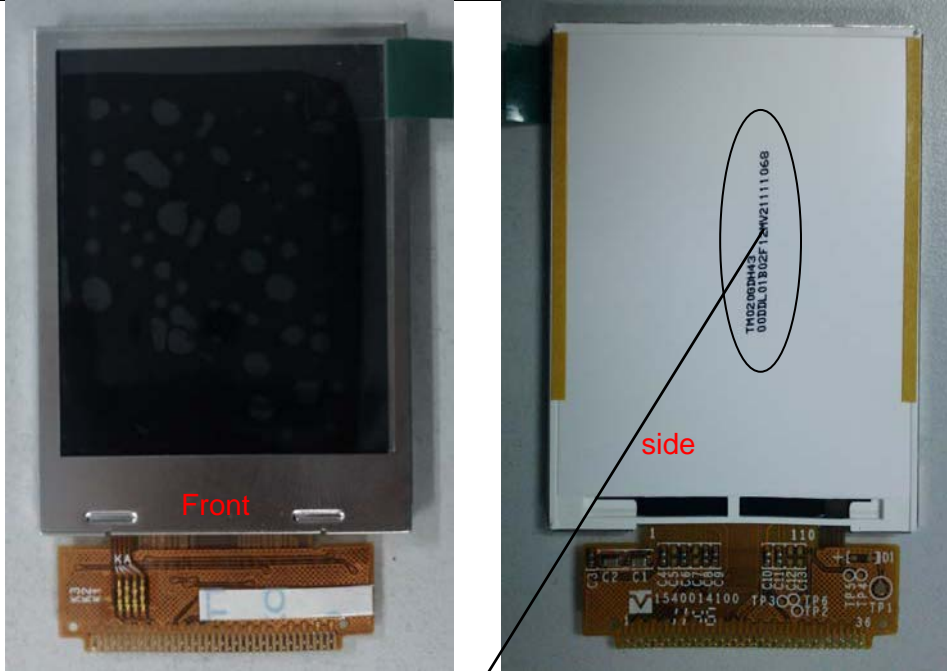
Note3: Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.

Note 4: In the standard condition, there shall be no practical problem that may affect the display function. After the reliability test, the product only guarantees operation, but don't guarantee all of the cosmetic specification.

# 8 Mechanical Drawing



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**TM020GDH43  
00DDL01B02F12MV2111068**

TM020GDH43

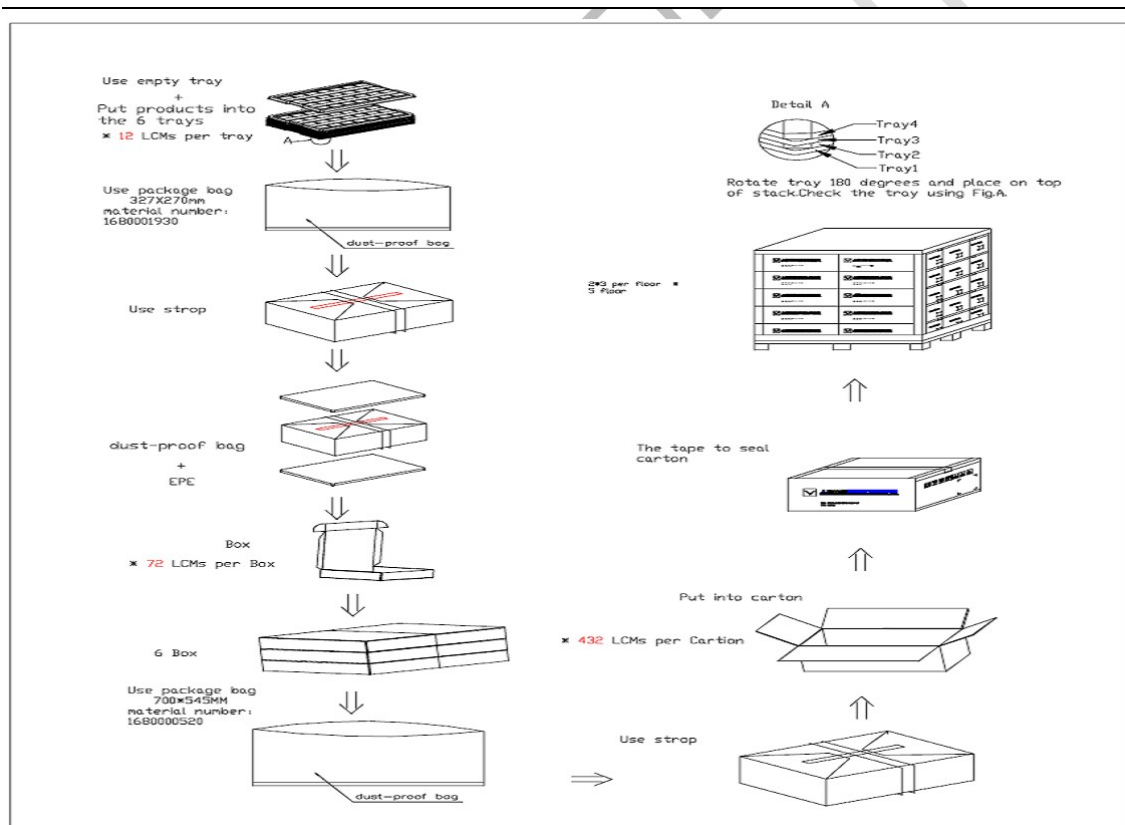
- 43:No.1 of the series
- HFAE Location in Shanghai
- Deliver type : Array+CF+LC +Pol+Driver IC +FPC+BL
- Resolution
- 020:2.0inch
- TM: Tianma

00DDL01B02F12MV2111068

- Work ordernumber
- 02:Module Line02
- A or B shift
- 01-3 IDATE
- Month of Production:
- 1-12 month equal to A-L
- Year of Production:
- A:2008,B:2009,C:2010,etc
- Production area: Wuhan
- Serial No.2 Model Revision

## 9 Packing Drawing

No	Ite	Model (Material)	Dimensions(m)	Unit	Quantit	Remar
1	LCM module	TM020GDH43	38.03x51.65x2	0.008	432	
2	Tr	PET (Transmit)	315x247x11	0.086	42	Anti-stat
3	EP	E	315x247x5	0.	12	
4	DUST-PROOF	P	700x545	0.	1	
5	Anti-Static Bag	P	327X270	0.	6	
6	BO	CORRUGATED	345X260X70	0.	6	
7	Carton	CORRUGATED	544x365x250	1.	1	
8	Total weight		(11.8+			



## **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 °C ~ 40°C 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**

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