MODEL NO. : TM022HDH16

ISSUED DATE: 2009-11-19

VERSION : Ver 1.0

■**Preliminary Specification**
□**Final Product Specification**

Customer : Longcheer

Approved by	Notes

SHANGHAI TIANMA Confirmed :

Prepared by	Checked by	Approved by

This technical specification is subjected to change without notice.

Table of Contents

Record of Revision

Rev	Issue Date	Description	Editor
1.0	2009-11-19	Preliminary release.	Qiuping Yang

1   General Specifications

Feature		Spec
Display Spec	Size	2.2 inch
	Resolution	240(RGB) x 320
	Interface	CPU 16 bit
	Color Depth	262K
	Technology Type	a-Si
	Pixel Pitch (mm)	0.141 x 0.141
	Pixel Configuration	R.G.B. Vertical Stripe
	Display Mode	TM with Normally White
	Surface Treatment	Clear type (3H)
	Viewing Direction	6 o'clock
	Gray Scale Inversion Direction	12 o'clock
Mechanical Characteristics	LCM (W x H x D) (mm)	44.40×55.30×2.35
	Active Area(mm)	33.84×45.12
	With /Without TSP	Without TSP
	Weight (g)	TBD
	LED Numbers	4 LEDs
Electronic	Driver IC	S6D04H0

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: RoHS.

Note 3: LCM weight tolerance: +/- 5%.

2 Input/Output Terminals

2.1 TFT LCD Panel

No	Symbol	I/O	Description	Remark
1	X+	-	Dummy	
2	Y+	-	Dummy	
3	X-	-	Dummy	
4	Y-	-	Dummy	
5	GND	P	Power Ground	
6	/CS	I	Chip select	
7	RS	I	Register select	
8	/WR	I	Write strobe	
9	/RD	I	Read strobe	
10	DB00	-	NC	
11	DB01	I	Data bus	
12	DB02	I	Data bus	
13	DB03	I	Data bus	
14	DB04	I	Data bus	
15	DB05	I	Data bus	
16	DB06	I	Data bus	
17	DB07	I	Data bus	
18	DB08	I	Data bus	
19	DB09	-	NC	
20	DB10	I	Data bus	
21	DB11	I	Data bus	
22	DB12	I	Data bus	
23	DB13	I	Data bus	
24	DB14	I	Data bus	
25	DB15	I	Data bus	
26	DB16	I	Data bus	
27	DB17	I	Data bus	
28	RESET	I	Reset	
29	FLM	O	FMARK	
30	IM0	I	Mode select	
31	IM3	I	Mode select	
32	IOVCC	P	Logic supply Voltage	
33	VCC	P	Analog supply Voltage	
34	LEDA1+	P	LED anode	
35	LEDA2+	P	LED anode	
36	LEDA3+	P	LED anode	
37	LEDA4+	P	LED anode	
38	NC	-	NC	
39	LEDK-	P	LED cathode	

Note: I/O definition: I-----Input; O---Output; P----Power/Ground.

i80-parallel 16bit interface only:

IM3	IM0	Interface	DB pin
0	0	i80-parallel 16bit interface	DB[17~10],DB[08~01]

3 Absolute Maximum Ratings

3.1   Driving TFT LCD Panel

GND=0V, Ta=25°C

Item	Symbol	Min	Max	Unit	Remark
Logic Supply Voltage	IOVCC	-0.3	3.3	V	
Analog Supply Voltage	VCC	-0.3	5.0	V	
Input Signal Voltage	/CS,RS,/WR,/RD RESET,DB[17:00],IM0,IM3	-0.3	VCC +0.5	V	
Back Light Forward Current	I_{LED}	--	25.0	mA	For each LED
Operating Temperature	T_{OPR}	-20	70	℃	
Storage Temperature	T_{STG}	-30	80	℃	

4   Electrical Characteristics

4.1   Driving TFT LCD Panel

GND=0V, Ta=25℃

Item		Symbol	Min	Typ	Max	Unit	Remark
Logic Supply Voltage		IOVCC	1.65	2.8/1.8	3.3	V	
Analog Supply Voltage		VCC	2.5	2.8	3.3	V	
Input Signal Voltage	Low Level	V_{IL}	0	--	0.2xVCC	V	/CS,RS,/WR,/RD RESET,DB[17:00],IM0,IM3
	High Level	V_{IH}	0.8xVCC	--	VCC	V	
Output Signal Voltage	Low Level	V_{OL}	0	--	0.2xVCC	V	FLM
	High Level	V_{OH}	0.8xVCC	--	VCC	V	
(Panel+ LSI) Power Consumption	Black Mode	--	TBD	--	mW	Frame Rate:60Hz
	8 Color Mode	--	TBD	--	µW	
	Sleeping Mode	--	TBD	--	µW	

4.2   Driving Backlight

Ta=25℃

Item	Symbol	Min	Typ	Max	Unit	Remark
Forward Current	I_F	--	15	--	mA	For each LED
Forward Voltage	V_F	--	3.2	--	V	
Power Consumption	W_{BL}	--	192	--	mW	

Note 1: The figure below shows the connection of backlight LED.
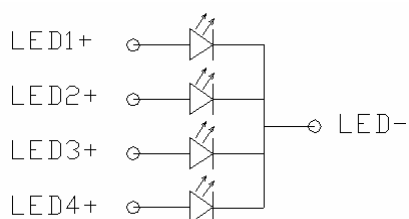
Note 2: One LED: I_F =15mA, V_F =3.2V.

Note 3: The life of LED: 20,000 hrs.
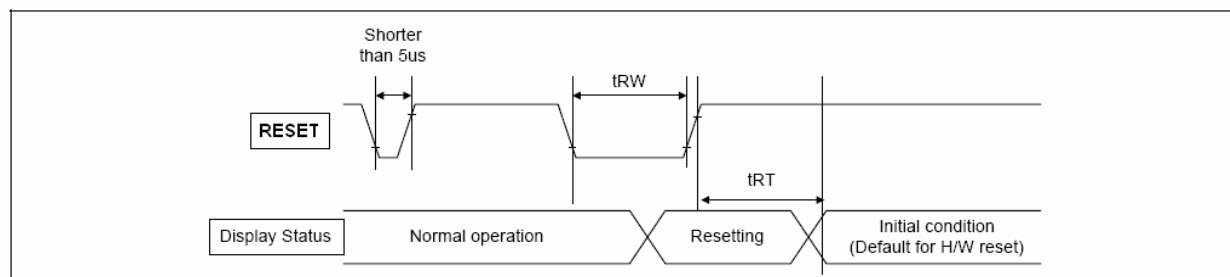
4.3 Block Diagram

5   Timing Chart

I80-parallel 16bit register write/read timing
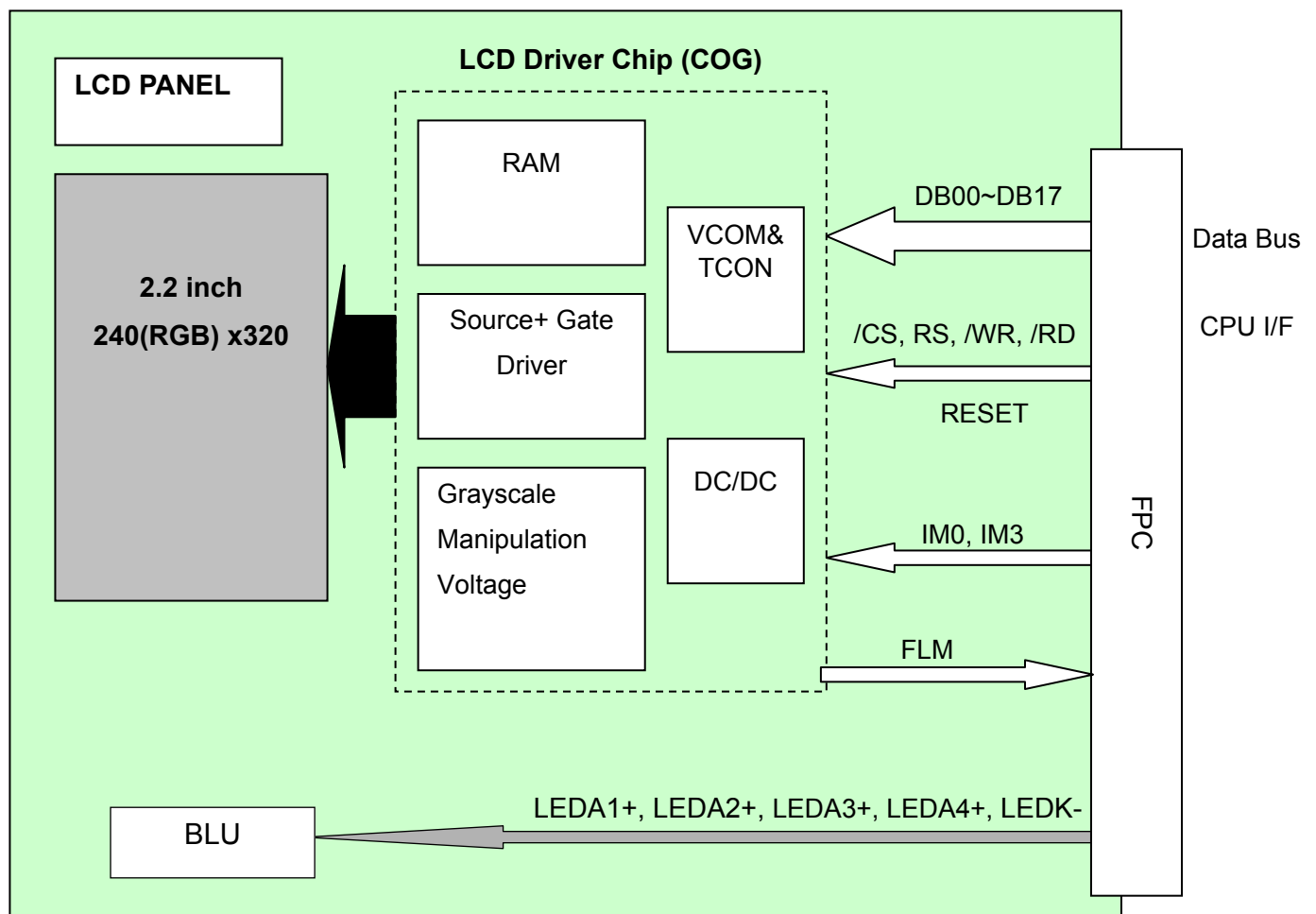
5.1 Timing Parameter   Normal Write Mode

Signal	Parameter	Symbol	Min	Max	Unit	Description
RS	RS setup time	tast80	0	–	ns	
	RS hold time	taht80	10	–	ns	
/CS	/CS "H" pulse width	tchw80	0	–	ns	
	Chip select setup time(write)	tcs80	15	–	ns	
	Chip select setup time (Read ID)	trcs80	45	–	ns	
	Chip select setup time (Read FM)	trcsfm80	355	–	ns	
	Chip select wait time(write/read)	tcsf80	10	–	ns	
/WR	Write cycle	twc80	66	–	ns	
	Control pulse H duration	twrh80	15	–	ns	
	Control pulse L duration	twrl80	15	–	ns	
/RD（ID）	Read cycle	trc80	160	–	ns	When read ID data
	Control pulse H duration	trdh80	90	–	ns	
	Control pulse L duration	trdl80	45	–	ns	
/RD（FM）	Read cycle	trcfm80	450	–	ns	When read from frame memory
	Control pulse H duration	trdhfm80	90	–	ns	
	Control pulse L duration	trdlfm80	355	–	ns	
DB[17：10] DB[8：1]	Write data setup time	tdst80	10	–	ns	For maximum CL = 30 pF For minimum CL = 8 pF
	Write data hold time	tdht80	10	–	ns	
	Read access time	trat80	–	40	ns	
	Read access time (FM)	tratfm80	–	340	ns	
	Read output disable time	todh80	20	80	ns	

Table 5.1 timing parameter

Reset Timing Characteristics

Signal	Symbol	Parameter	Min	Max	Unit
RESET	tRW	Reset pulse duration	10	–	us
	tRT	Reset cancel	–	5 (note 5)	ms
			–	120 (note 6, 7)	ms

5.2 Register write timing

The host starts to control DB[17:0] lines when there is a falling edge of /WR

The client read DB[17:0] lines when there is a Rising edge of the /WR

The host stops to control DB[17:0] lines

80-series MPU Parallel Interface Write Mode

The display starts to control DB[17:0] lines when there is a falling edge of the RDX

The host read DB[17:0] lines when there is a Rising edge of the RDX

The display stops to Control DB[17:0]

80-series MPU Parallel Interface Read Mode

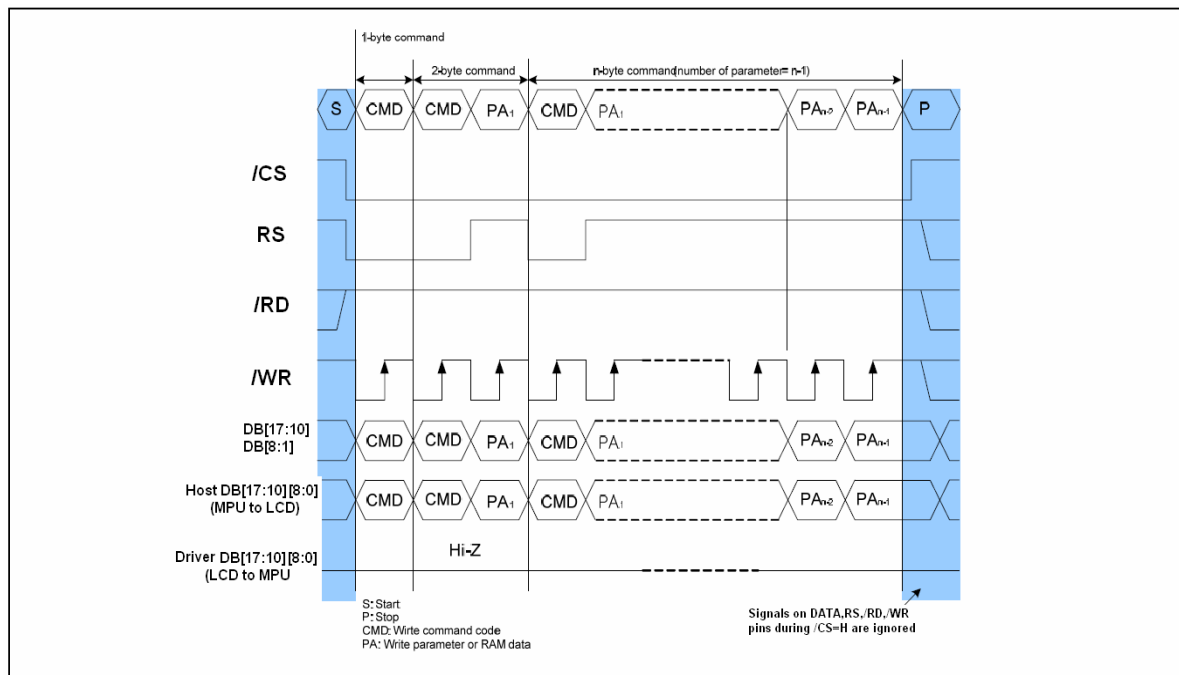### 5.2.1 16-bit System Bus Interface Register Write Timing

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

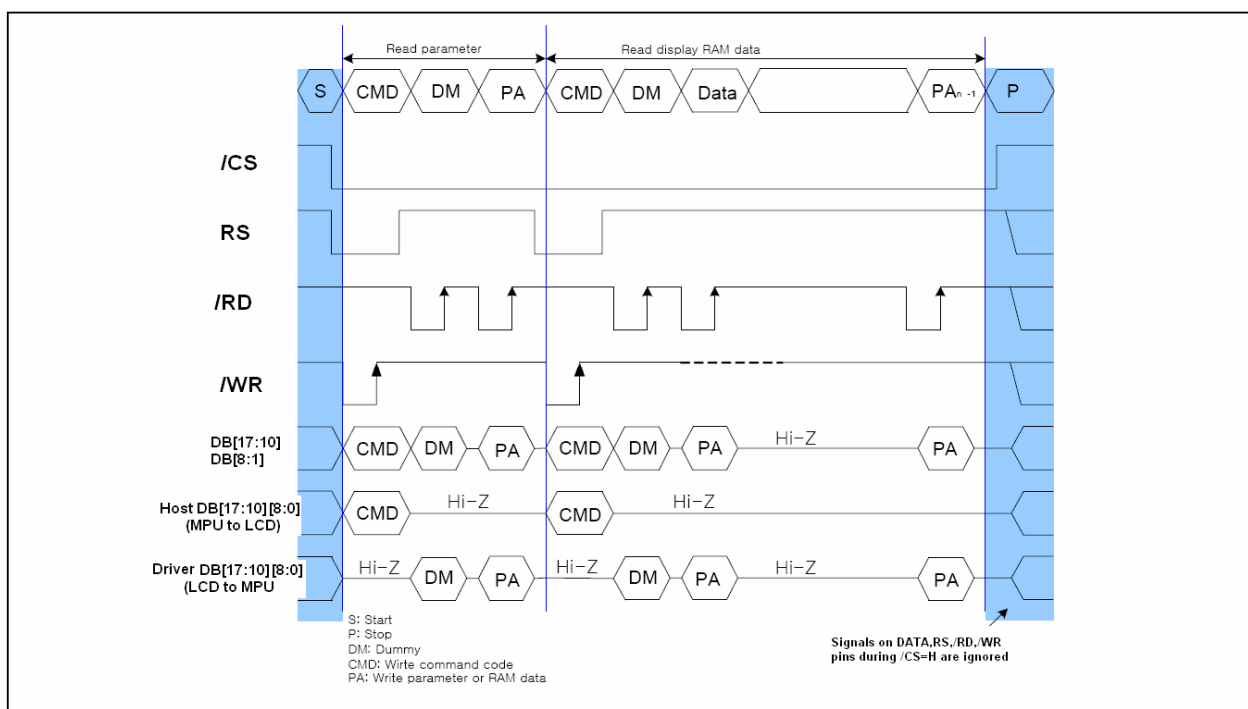### 5.2.2 16-bit System Bus Interface Register Read Timing

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

5.3   GRAM Write/Read Timing
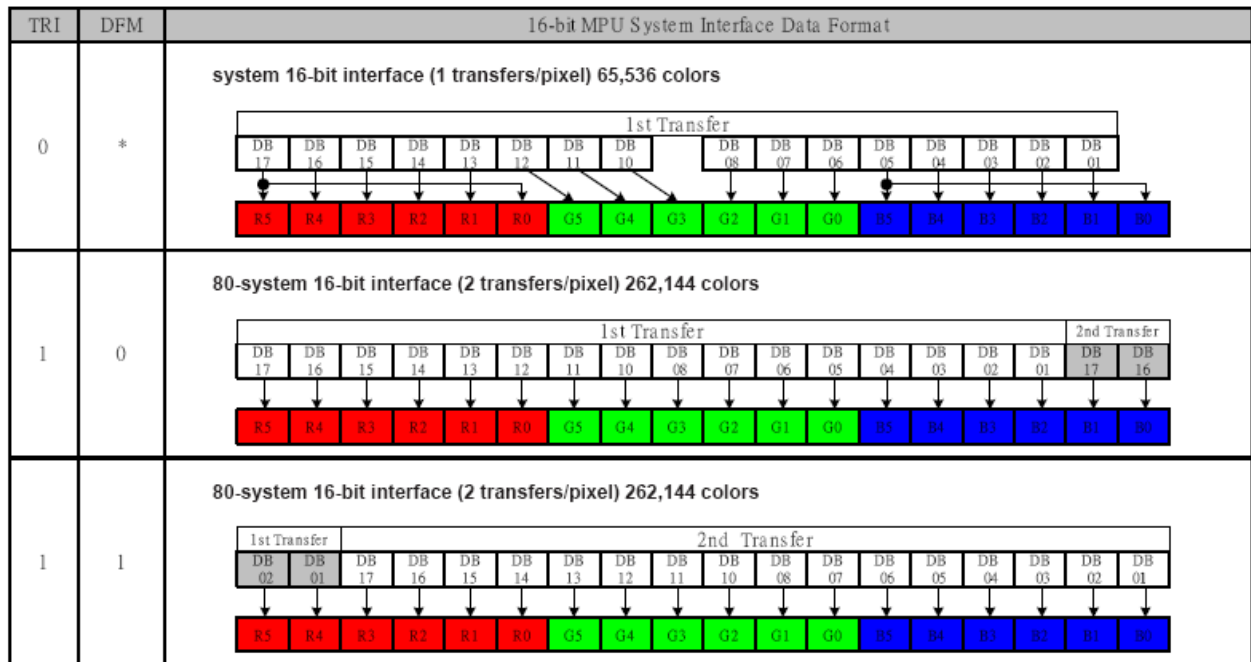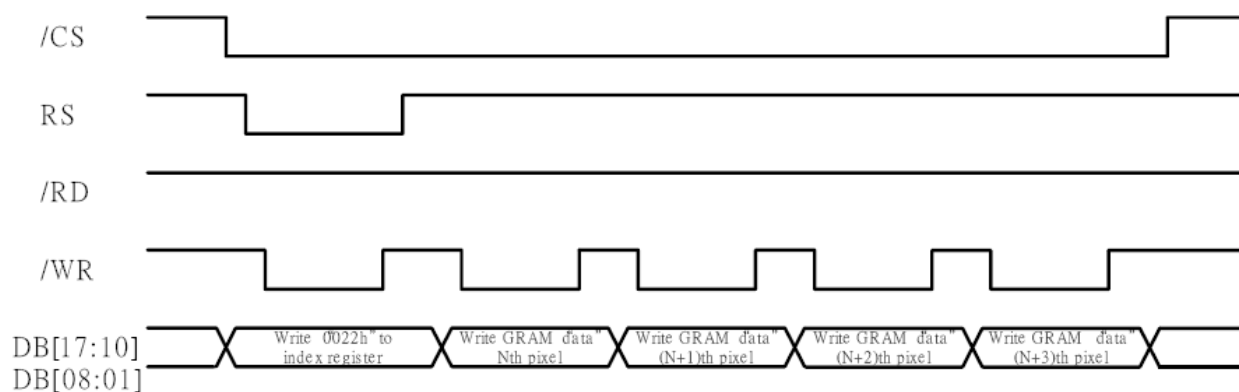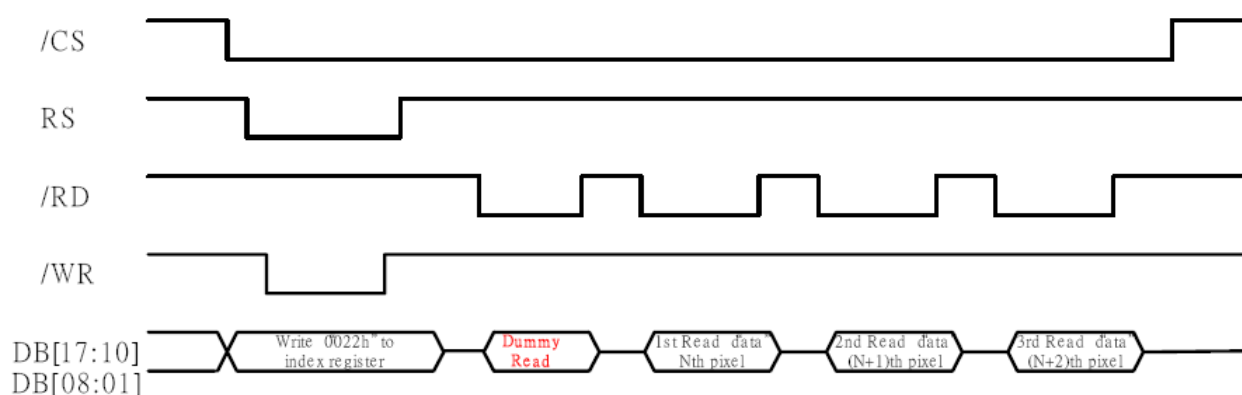
5.3.1 16-bit Read/Write GRAM Data format

Figure 5.3.1 16-bit Read/Write GRAM Data format
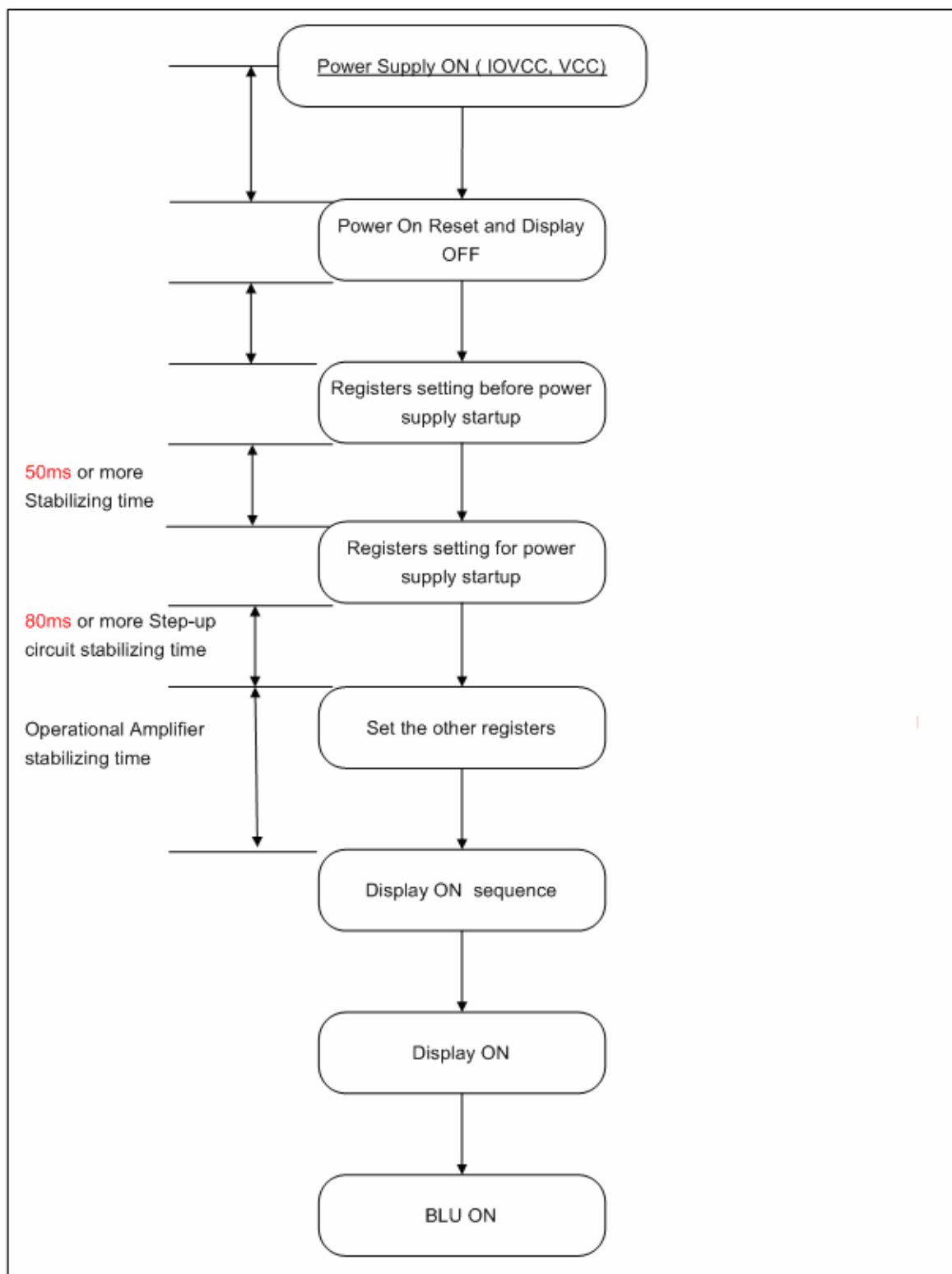
5.3.2 16-bit Data Bus GRAM Write Timing
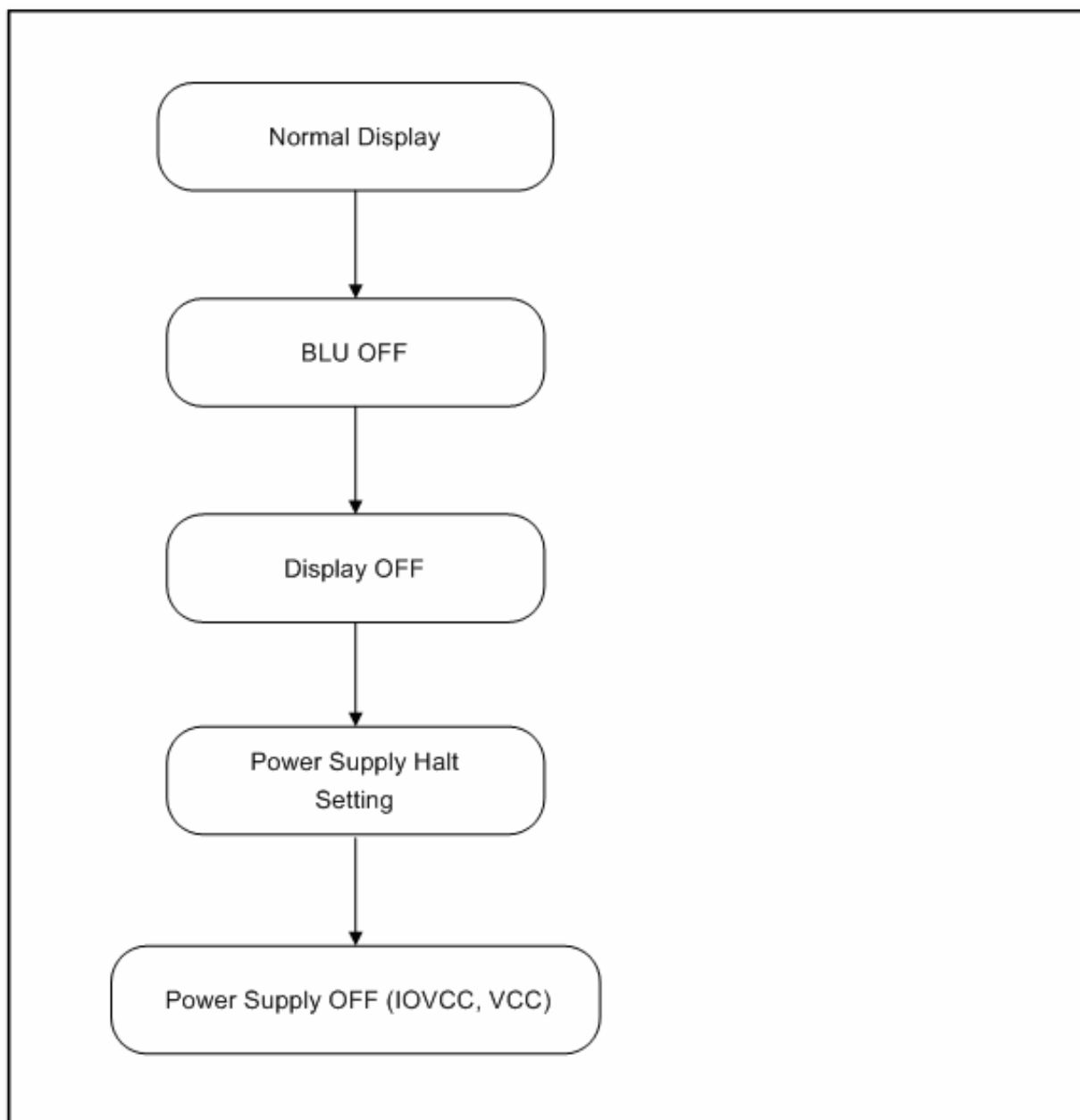

5.3.3 16-bit Data Bus GRAM Read Timing

5.4 Power ON/OFF Sequence

5.4.1 Power ON Sequence

5.4.2 Power OFF Sequence

```
┌──────────────────────────────┐
│                              │
│     ┌──────────────────┐     │
│     │  Normal Display  │     │
│     └──────────────────┘     │
│              │               │
│              ▼               │
│     ┌──────────────────┐     │
│     │     BLU OFF      │     │
│     └──────────────────┘     │
│              │               │
│              ▼               │
│     ┌──────────────────┐     │
│     │   Display OFF    │     │
│     └──────────────────┘     │
│              │               │
│              ▼               │
│     ┌──────────────────┐     │
│     │ Power Supply Halt│     │
│     │     Setting      │     │
│     └──────────────────┘     │
│              │               │
│              ▼               │
│ ┌──────────────────────────┐ │
│ │ Power Supply OFF         │ │
│ │      (IOVCC, VCC)        │ │
│ └──────────────────────────┘ │
│                              │
└──────────────────────────────┘
```

6 Optical Characteristics Optical Specification

Ta=25℃

Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angle		θT	CR≥10	60	65	--	Degree	Note 2
		θB		15	20	--		
		θL		35	40	--		
		θR		35	40	--		
Contrast Ratio		CR	θ=0°	250	350	--		Note1 Note3
Response Time		T_{ON}	25℃	--	20	30	ms	Note1 Note4
		T_{OFF}						
Chromaticity	White	x	Backlight is on	0.253	0.303	0.353		Note1 Note5
		y		0.278	0.328	0.378		
	Red	x		0.555	0.605	0.655		
		y		0.273	0.323	0.373		
	Green	x		0.300	0.350	0.400		
		y		0.490	0.540	0.590		
	Blue	x		0.098	0.148	0.198		
		y		0.054	0.104	0.154		
Uniformity（%）		U		--	--	--		Note1 Note6
NTSC（%）				--	50	--		Note5
Luminance		L		180	200	--		Note1 Note7

Test Conditions:

1. V_F =3.2V , I_F =15mA(LED current), the ambient temperature is 25℃.

2. The test systems refer to Note1 and Note2.

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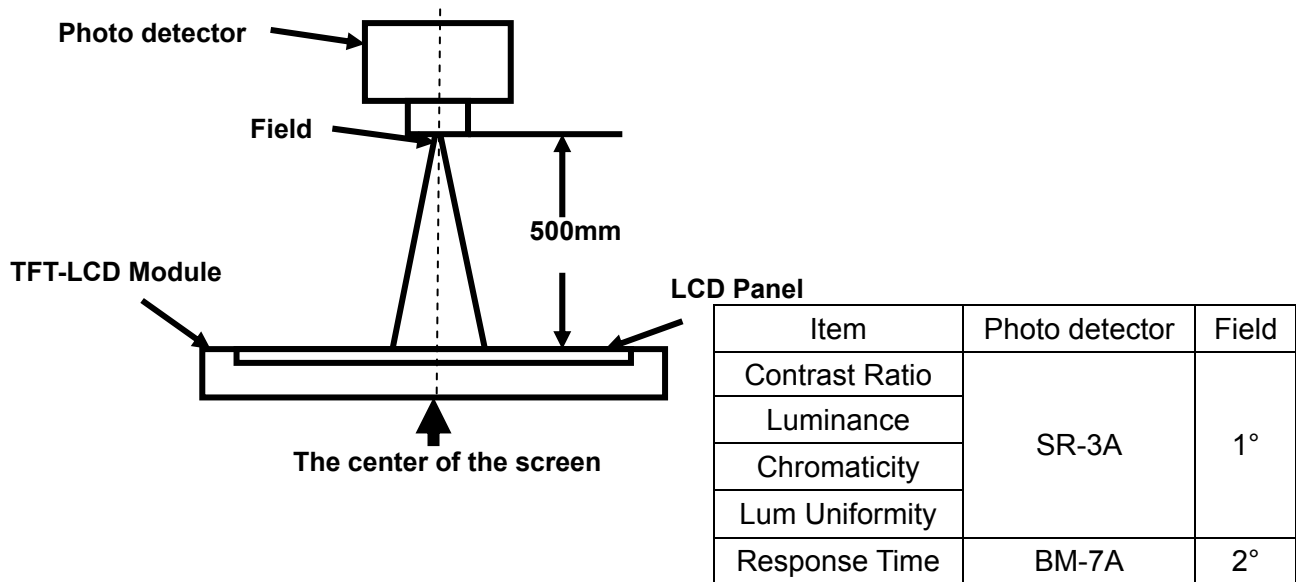
Note 2: Definition of viewing angle range and measurement system.

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

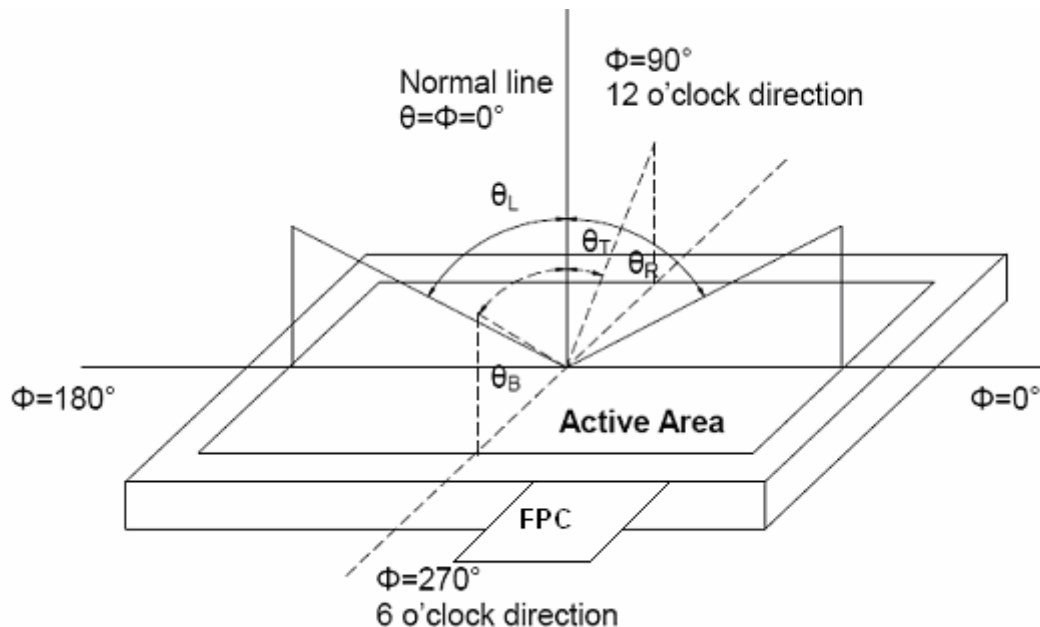
Fig. 1 Definition of viewing angle

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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 driven by Vwhite.

"Black state": The state is that the LCD should driven by Vblack.

V_{white}: To be determined V_{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_{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%.
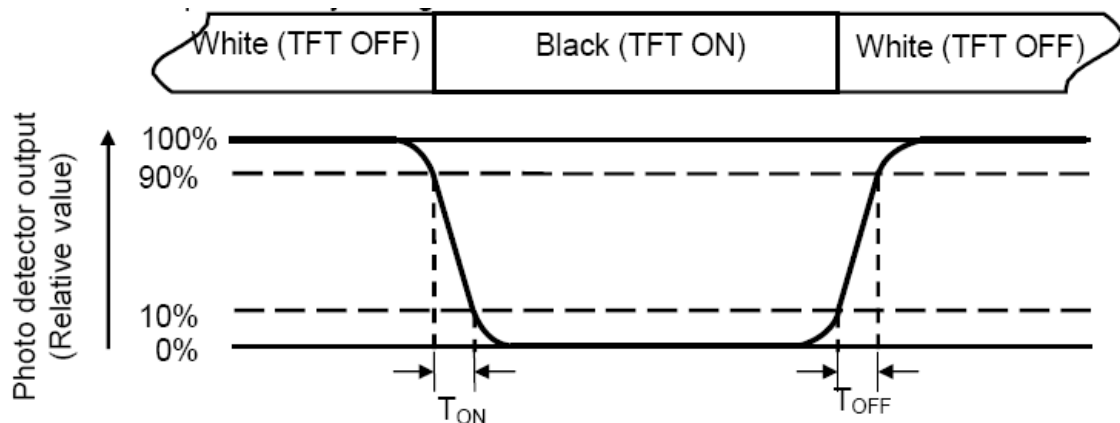
Note 5: Definition of color chromaticity (CIE1931)

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.

Luminance Uniformity(U) = Lmin/ Lmax
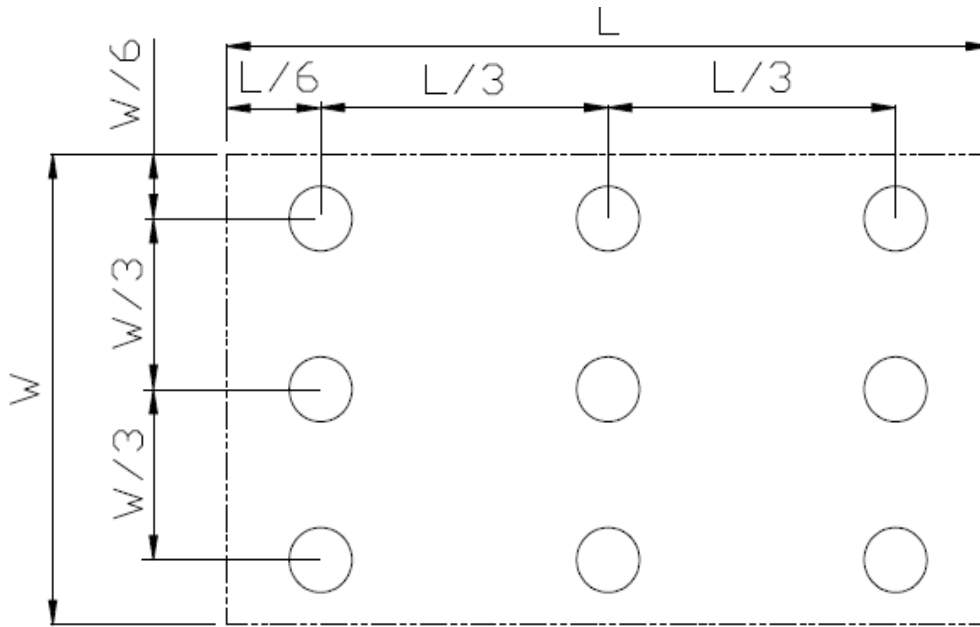
L-------Active area length W----- Active area width

Fig. 2 Definition of uniformity

Lmax: The measured maximum luminance of all measurement position.

Lmin: 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	Remark
1	High Temperature Operation	Ts=+70℃, 240hrs	Note1 IEC60068-2-2,GB2423.2—89
2	Low Temperature Operation	Ta=-20℃, 240hrs	IEC60068-2-1 GB2423.1—89
3	High Temperature Storage	Ta=+80℃, 240hrs	IEC60068-2-2, GB2423.2—89
4	Low Temperature Storage	Ta=-30℃, 240hrs	IEC60068-2-1 GB2423.1—89
5	High Temperature & High Humidity Storage	Ta=+60℃, 90% RH 240 hours	Note2 IEC60068-2-3, GB/T2423.3—2006
6	Thermal Shock (Non-operation)	-30℃ 30 min~+80℃ 30 min, Change time:5min, 20 Cycles	Start with cold temperature, End with high temperature, IEC60068-2-14,GB2423.22—87
7	Electro Static Discharge (Operation)	C=150pF, R=330Ω，5points/panel Air:±8KV, 5times; Contact:±4KV, 5 times; (Environment: 15℃~35℃, 30%~60%, 86Kpa~106Kpa).	IEC61000-4-2 GB/T17626.2—1998
8	Vibration (Non-operation)	Frequency range:10~55Hz, Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X.Y.Z. (6 hours for total)(Package condition)	IEC60068-2-6 GB/T2423.10—1995
9	Shock (Non-operation)	60G 6ms, ±X,±Y,±Z 3times, for each direction	IEC60068-2-27 GB/T2423.5—1995
10	Package Drop Test	Height:80 cm,1 corner, 3 edges, 6 surfaces	IEC60068-2-32 GB/T2423.8—1995

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

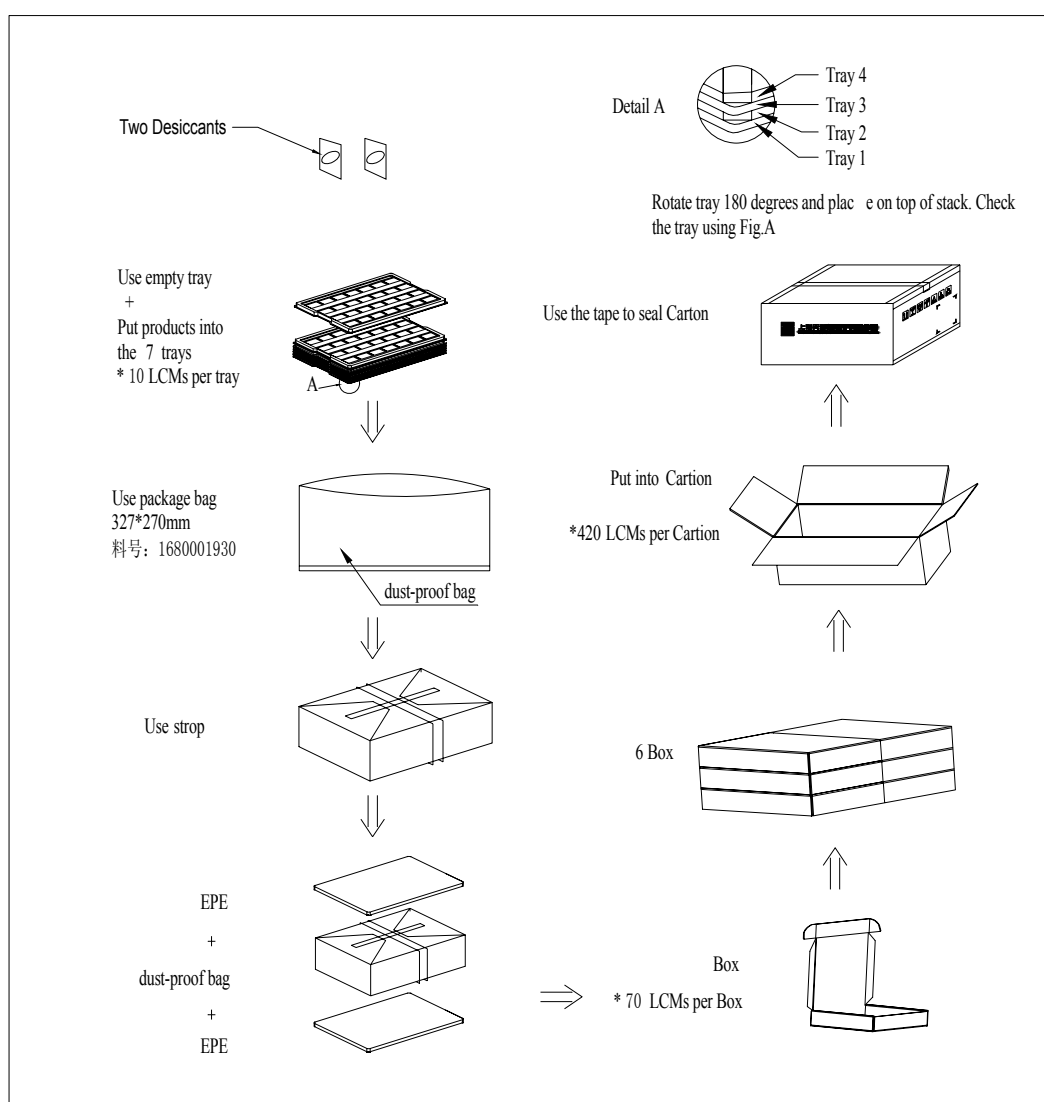Note2: Ta is the ambient temperature of sample.

8 Mechanical Drawing
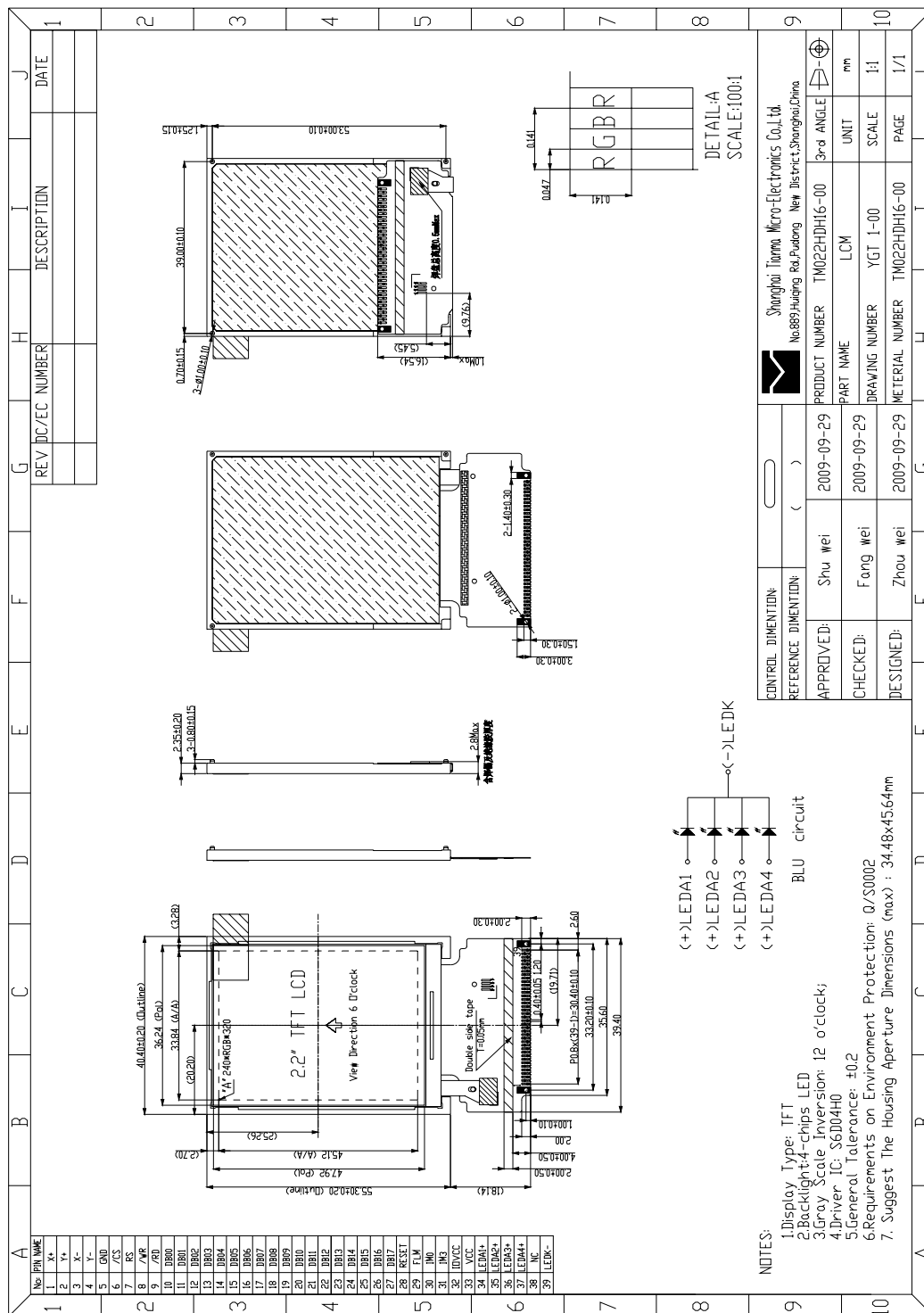
9 Packing Drawing

No	Item	Model (Material)	Dimensions(mm)	Unit Weight(Kg)	Quantity	Remark
1	LCM module	TM022HDH16	44.40×55.30×2.35	TBD		
2	Tray	PET(Transmit)	TBD	TBD		Anti-static
3	EPE	EPE	TBD	TBD		
4	Desiccant	Desiccant	TBD	TBD		
5	Anti-static bag	PE	TBD	TBD		
6	BOX	Corrugated paper	TBD	TBD		
7	Carton	Corrugated paper	TBD	TBD		
8	Total Weight(Kg)	TBD				

Two Desiccants

Detail A
Tray 4
Tray 3
Tray 2
Tray 1

Rotate tray 180 degrees and place on top of stack. Check the tray using Fig.A

Use empty tray
+
Put products into the 7 trays
* 10 LCMs per tray

A

Use the tape to seal Carton

Use package bag 327*270mm
料号：1680001930

dust-proof bag

Put into Cartion

*420 LCMs per Cartion

Use strop

6 Box

EPE
+
dust-proof bag
+
EPE

Box
* 70 LCMs per Box

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:

10.2.3   Temperature: 0℃~40℃ Relatively humidity: ≤80%

10.2.4   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.