MODEL NO. :   **TM022HDH06-00**

ISSUED DATE: **2008-11-13**

VERSION   :   **Ver 1.0**

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

Customer :_____

Approved by	Notes

SHANGHAI TIANMA Confirmed :

Prepared by	Checked by	Approved by
康新华 2008.11.13	杨梅 2008.11.13	王旻 08 11/17

This technical specification is subjected to change without notice

Table of Contents

Record of Revision

Rev	Issued Date	Description	Editor
1.0	2008-11-13	Preliminary Specification Release	Xinhua Kang

1 General Specifications

Feature		Spec
Display Spec.	Size	2.2 inch
	Resolution	240(RGB) x 320
	Interface	CPU 16 bits
	Color Depth	262K
	Technology Type	a-Si
	Pixel Pitch (mm)	0.1395X0.1395
	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
Mechanical Characteristics	LCM (W x H x D) (mm)	40.10x55.20x2.35
	Active Area(mm)	33.48x44.64
	With /Without TSP	Without TSP
	Weight (g)	TBD
	LED Numbers	4 LEDs
Electronic	Driver IC	ILI9325

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	DB0	I	Data bus	
2	DB1	I	Data bus	
3	DB2	I	Data bus	
4	DB3	I	Data bus	
5	GND	P	Power	
6	VCC	P	Power	
7	/CS	I	Chip select	
8	RS	I	Register select	
9	/WR	I	Write	
10	/RD	I	Read	
11	IM0	I	Mode select	
12	NC	--	No connection	
13	NC	--	No connection	
14	NC	--	No connection	
15	NC	--	No connection	
16	LED_A	P	LED power	
17	LED_K1	P	LED power	
18	LED_K2	P	LED power	
19	LED_K3	P	LED power	
20	LED_K4	P	LED power	
21	NC	--	No connection	
22	DB4	I	Data bus	
23	DB8	I	Data bus	
24	DB9	I	Data bus	
25	DB10	I	Data bus	
26	DB11	I	Data bus	
27	DB12	I	Data bus	
28	DB13	I	Data bus	
29	DB14	I	Data bus	
30	DB15	I	Data bus	
31	/RESET	I	Reset	
32	VCI	P	Power	
33	VCC	P	Power	
34	GND	P	Power	
35	DB5	I	Data bus	
36	DB6	I	Data bus	
37	DB7	I	Data bus	

Note 1: I/O definition：

I-----Input   O---Output   P----Power(Ground)   NC---No connection

3   Absolute Maximum Ratings

3.1   Driving TFT LCD Panel

Ta = 25°C

Item	Symbol	Min.	Max.	Unit	Remark
Supply Voltage	VCI/ VCC	-0.3	4.6	V	
Input Signal Voltage	DB0~DB15,/CS,RS,/WR,/RD, IM0,/RESET	-0.3	VCC +0.3	V	
Back Light Forward Current	I_{LED}	--	25	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		VCC	1.65	2.8/1.8	3.3	V	
Analog supply voltage		VCI	2.5	2.8	3.3	V	
Input Signal Voltage	Low Level	V_{IL}	0	--	0.2xVCC	V	DB0~DB15,/CS,RS, /WR,/RD, IM0,/RESET
	High Level	V_{IH}	0.8xVCC	--	VCC	V	
Output Signal Voltage	Low Level	V_{OL}	-0.3	--	0.3xVCC	V	
	High Level	V_{OH}	0.7xVCC	--	VCC	V	
(Panel+ LSI) Power Consumption	Black Mode (60Hz)	--	TBD	--	mW	Frame rate 60Hz, VCC=2.8V, VCI=2.8V	
	8 Color Mode	--	TBD	--	uW		
	Sleeping Mode	--	TBD	--	uW		

4.2 Driving Backlight

Ta=25℃

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Forward Current	I_F	--	72	100	mA	4 LEDs (in parallel)
Forward Voltage	V_F	--	3.2	3.5	V	
Power Consumption	W_{BL}	--	230	350	mW	

Note1: Figure below shows the connection of backlight LED.
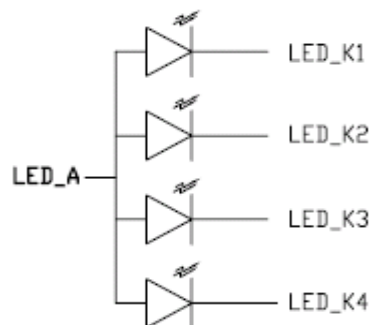
Note 2: One LED : I_F =18 mA, V_F =3.2V
Note 3: The life of LED : 20,000 hours

4.3 Block Diagram
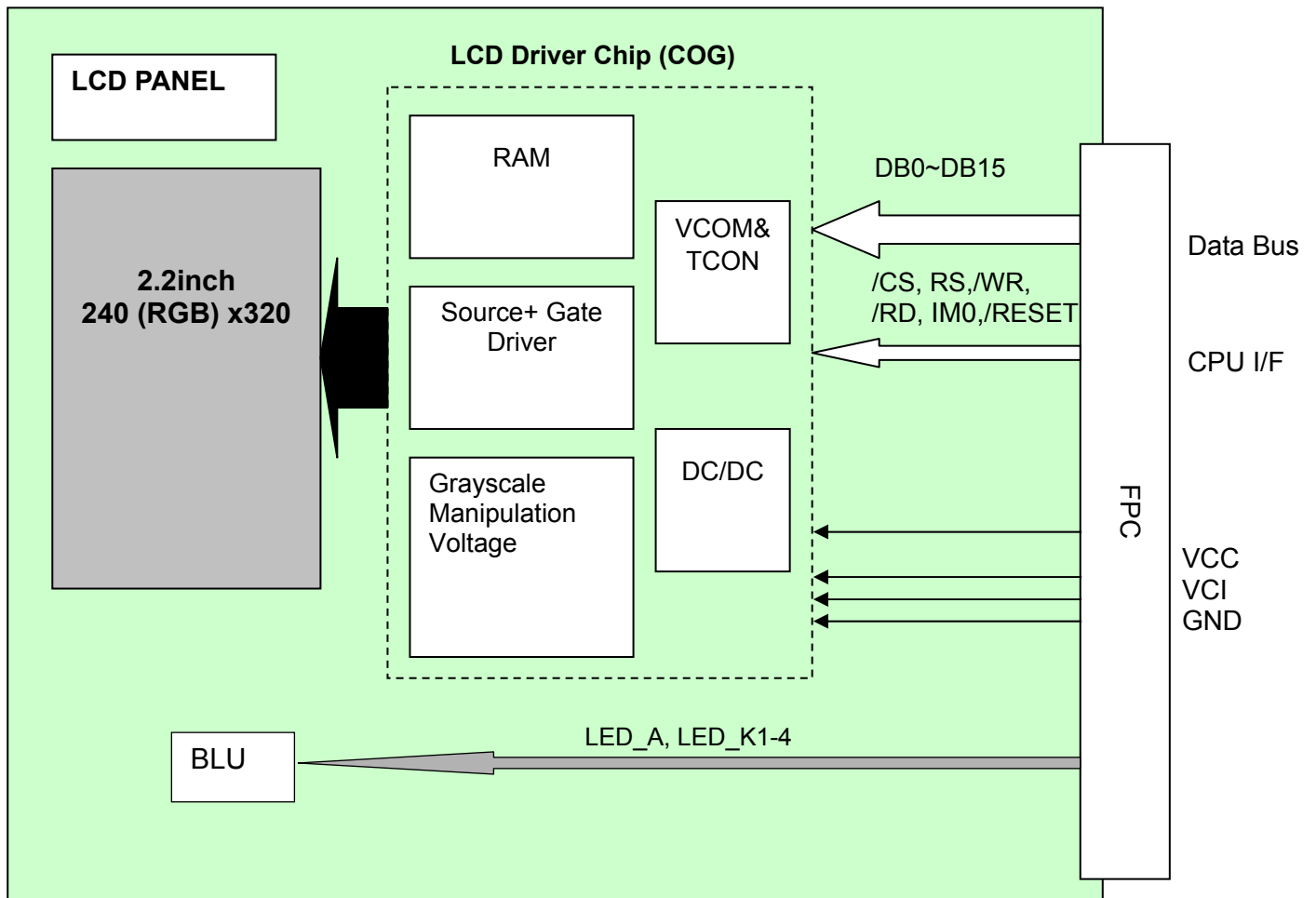
5 Timing Chart

5.1 I80 System Timing Parameter

Normal Write Mode (VCC=2.5~3.3V)

Item		Symbol	Unit	Min.	Typ.	Max.	Test Condition
Bus cycle time	Write	t_{CYCW}	ns	100	-	-	
	Read	t_{CYCR}	ns	300	-	-	
Write low-level pulse width		PW_{LW}	ns	50	-	500	
Write high-level pulse width		PW_{HW}	ns	50	-	-	
Read low-level pulse width		PW_{LR}	ns	150	-	-	
Read high-level pulse width		PW_{HR}	ns	150	-	-	
Write / Read rise / fall time		t_{WRr}/t_{WRf}	ns	-	-	25	
Setup time	Write (RS to /CS, E/WR)	t_{AS}	ns	10	-	-	
	Read (RS to /CS, RW/RD)			5	-	-	
Address hold time		t_{AH}	ns	5	-	-	
Write data set up time		t_{DSW}	ns	10	-	-	
Write data hold time		t_{H}	ns	15	-	-	
Read data delay time		t_{DDR}	ns	-	-	100	
Read data hold time		t_{DHR}	ns	5	-	-	

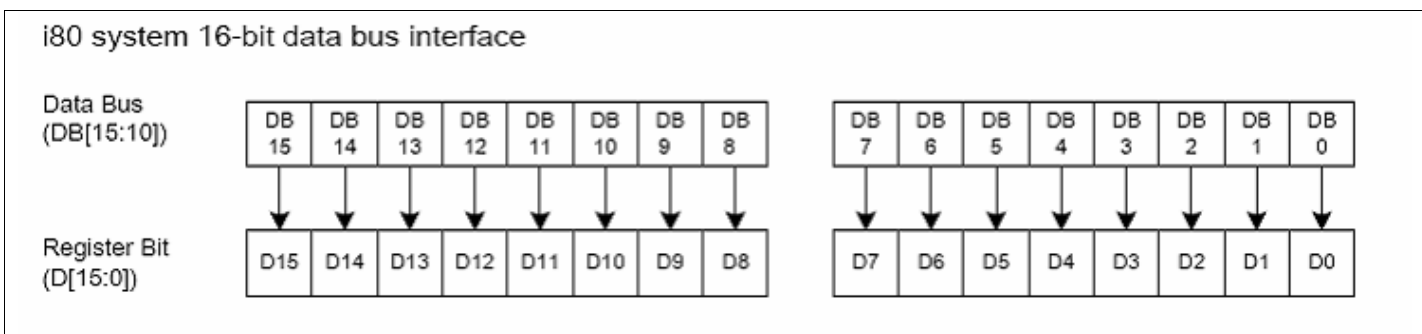### 5.1.1 I80 System Bus Timing
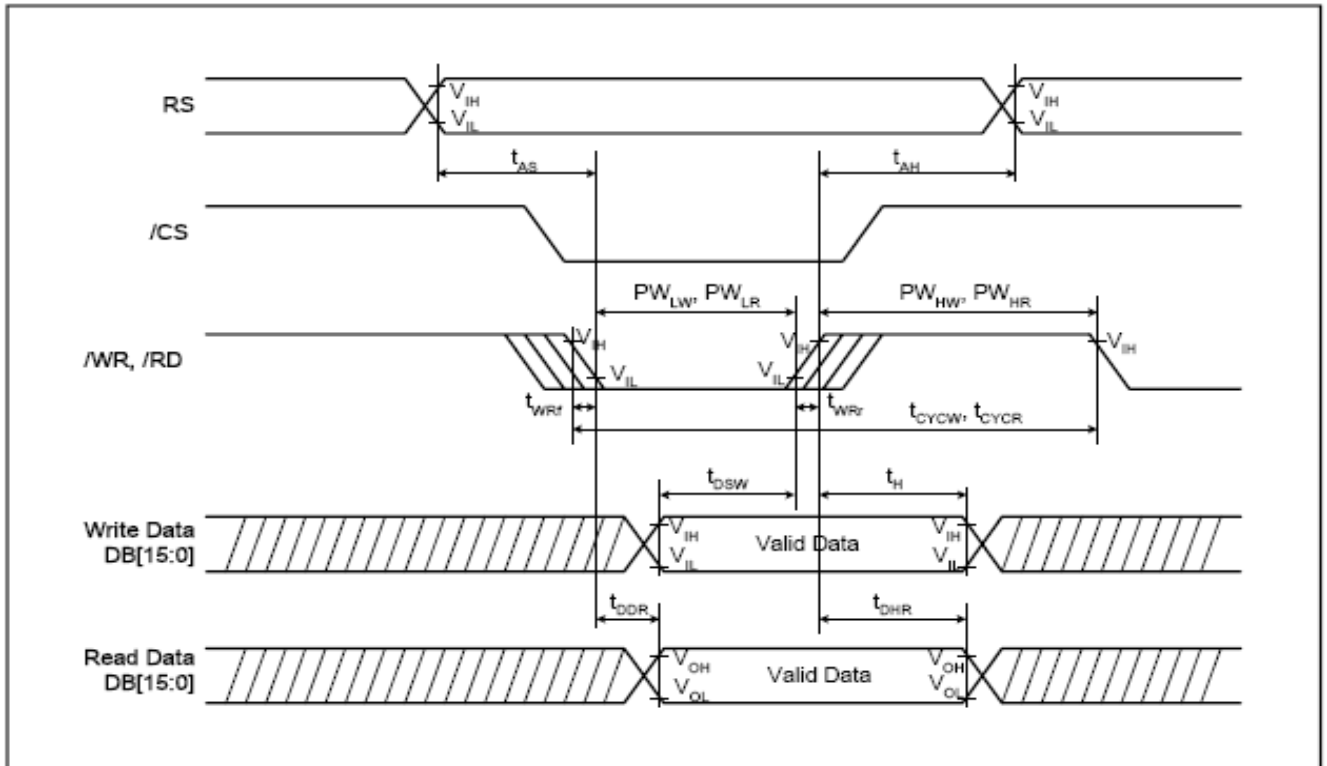
5.1.2 Register write /read timing in I80 series system

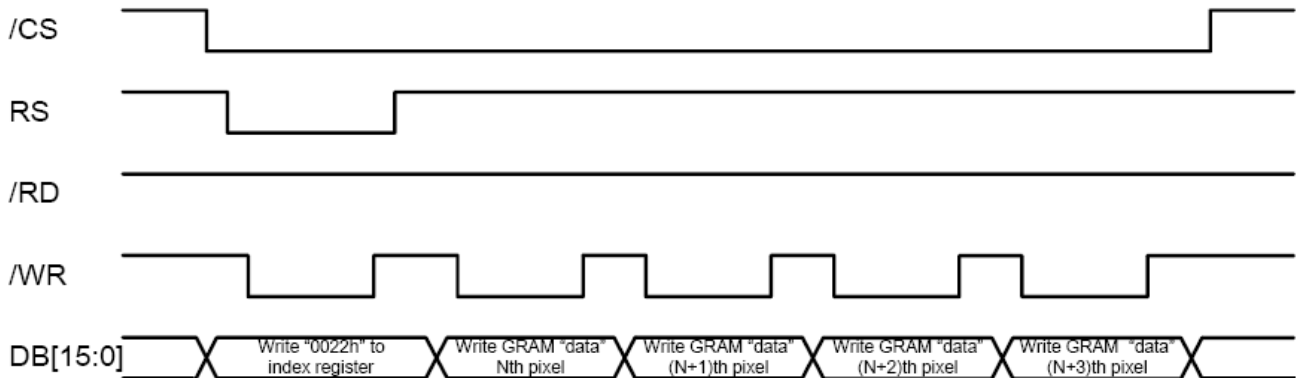**16-bit System Bus Interface Timing(Register Write Timing)**

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

5.1.3 **GRAM write/read timing in I80 series system**

16-bit Data Bus GRAM Write Timing

16-bit Data Bus GRAM Read Timing

5.1.4 Reset Timing Characteristics

Item	Symbol	Unit	Min.	Typ.	Max.
Reset low-level width	t_{RES}	ms	1	-	-
Reset rise time	t_{rRES}	µs	-	-	10
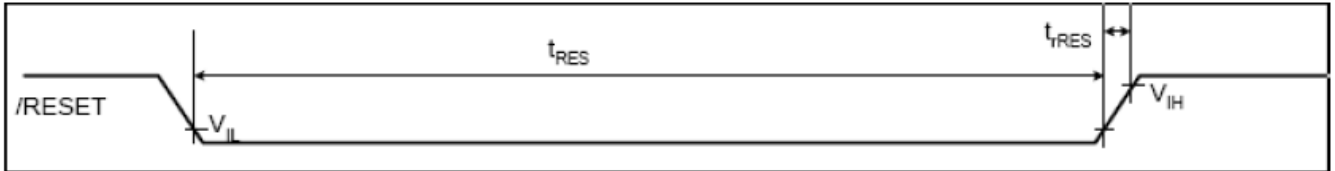
5.1.5 IM0 16-bit Selection Pin Characteristics

IM0	Interface	DB Pin
1	i80-parallel 8bit interface	DB[15~8]
0	i80-parallel 16bit interface	DB[15~0]

I80-parallel 8bit register write/read timing
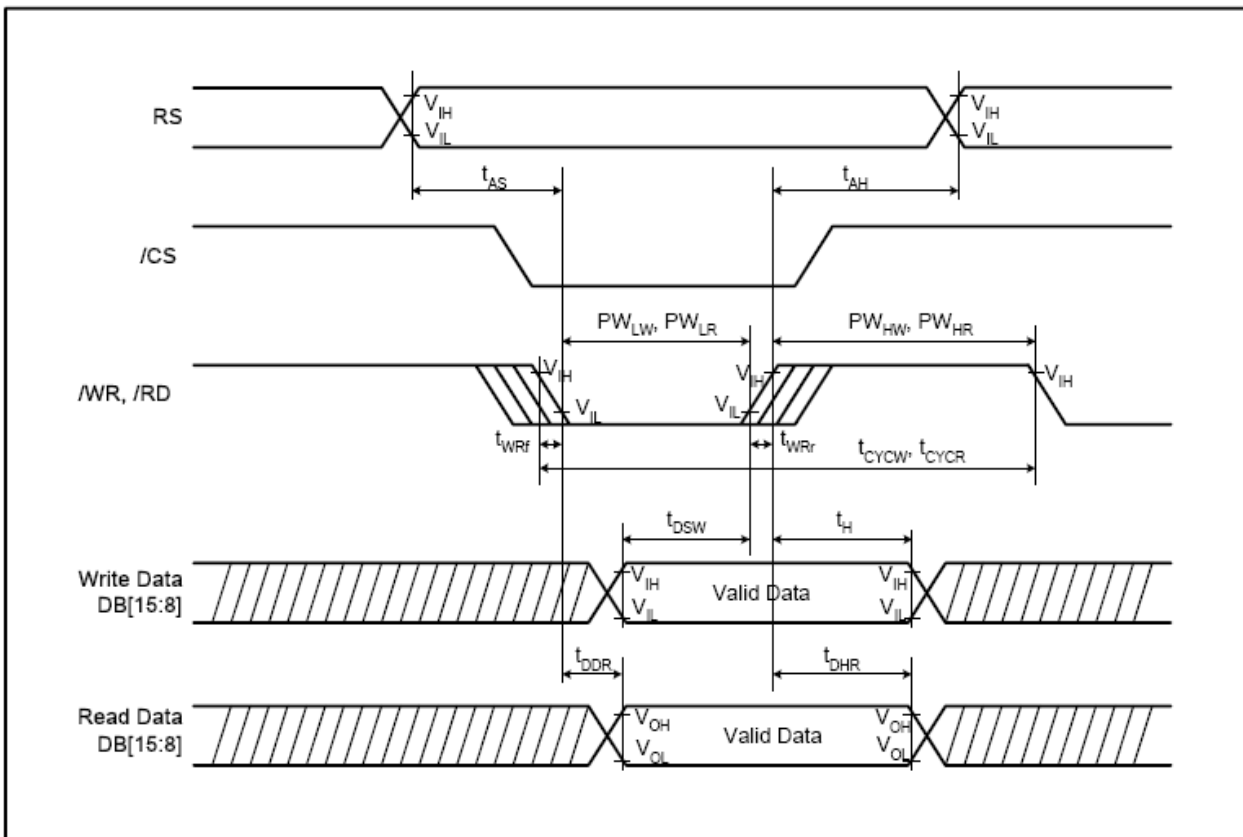
5.1.5.1 Register write/read timing in I80 8-bit system

8-bit System Bus Interface Timing(Register Write Timing)
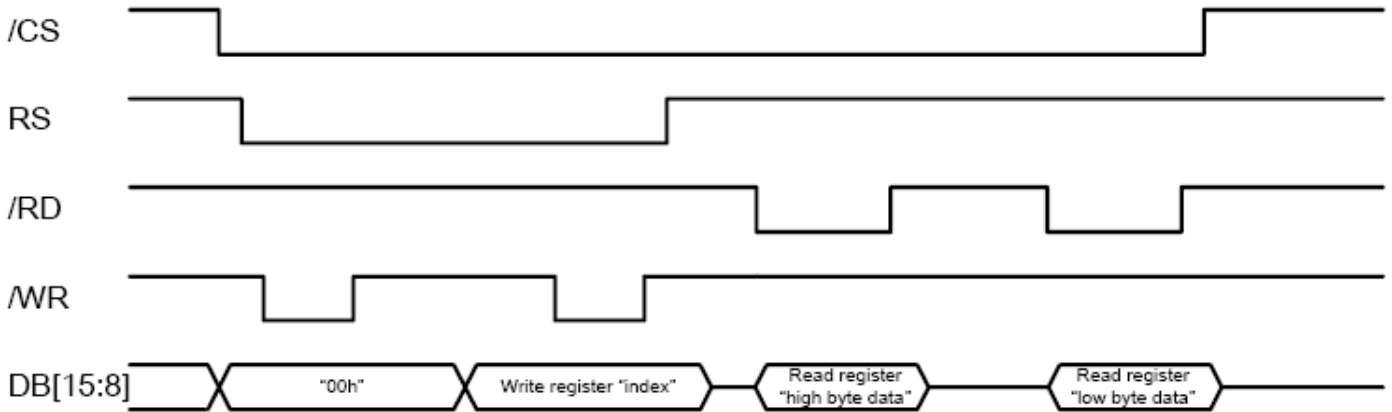
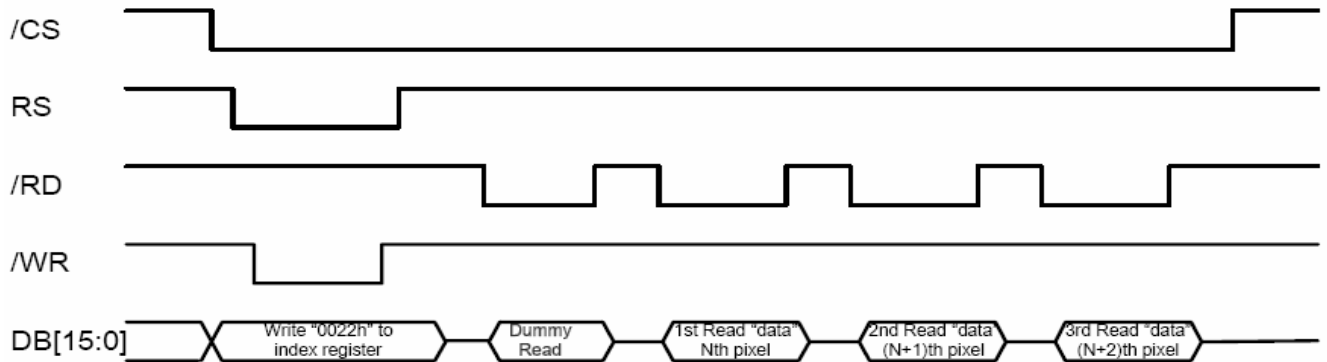**8-bit System Bus Interface Timing(Register Read Timing)**
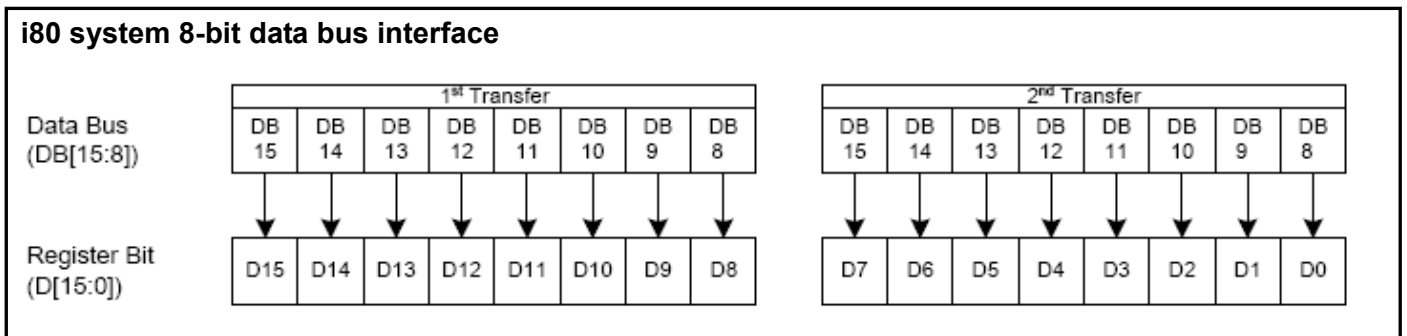
5.1.5.2 GRAM write/read timing in I80 8-bit system
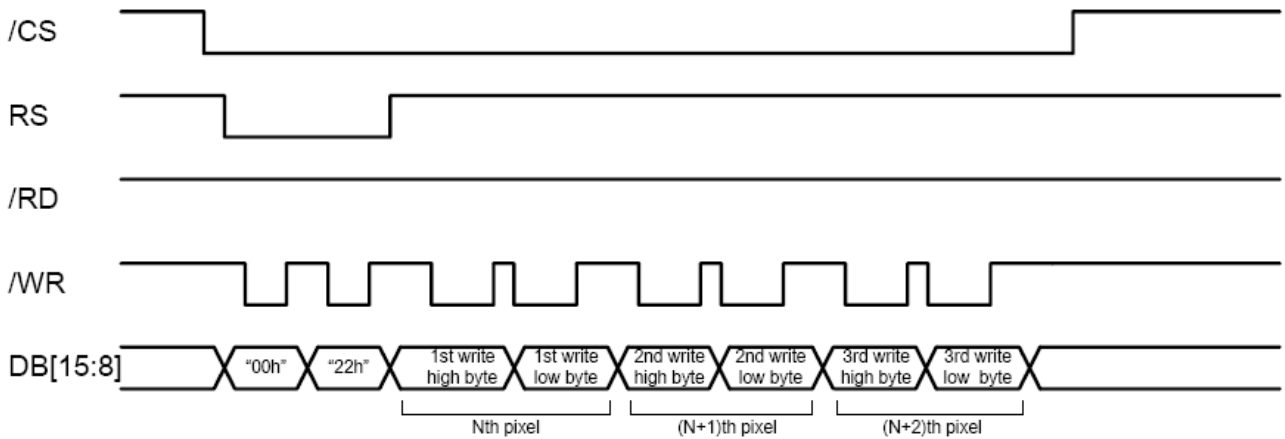
**8-bit Data Bus GRAM Write Timing**

8-bit Data Bus GRAM Read Timing

5.2   Power On/Off sequence

5.2.1 Power on Sequence

```
                    ┌─────────────────────────────┐
                    │  Power supply (VCC,VCI) on   │
                    └─────────────────────────────┘
                                  │
         1ms or more              ▼                    Display OFF setting
                    ┌─────────────────────────────┐    DTE=0
                    │    Power on reset and       │    D[1:0]=00
                    │    Display off              │    GON=0
                    └─────────────────────────────┘    PON=0
    10ms or more                  │
    Oscillator                    │
    Stabilizing time              ▼                    Power supply initial setting
    LCD power           ┌─────────────────────────┐    Set VC[2:0], VRH[3:0], VCM[4:0],
    supply on           │  Register setting before │    VDV[4:0], PON=0
    sequence            │  power supply startup    │
                        └─────────────────────────┘
                                  │
                                  ▼                    Power supply operation setting (1)
                        ┌─────────────────────────┐    BT[2:0]=000
                        │  Register setting before │    Set dc1[2:0], DC0[2:0]
                        │  power supply startup    │    PON=1
                        │          (1)             │    Set AP[2:0]
                        └─────────────────────────┘
    40ms or more                  │
    Step-up circuit               │
    Stabilizing time              ▼                    Power supply operation setting (2)
                        ┌─────────────────────────┐    Set BT[2:0]
                        │  Register setting before │
    Operational         │  power supply startup    │
    Amplifier           │          (2)             │
    stabilizing time    └─────────────────────────┘
                                  │
                                  ▼
                        ┌─────────────────────────┐
                        │   Set the other registers│
                        └─────────────────────────┘
                                  │
                                  ▼                    Set SAP[2:0]
                        ┌─────────────────────────┐
                        │   Display ON sequence    │
                        └─────────────────────────┘
                                  │
                                  ▼                    DTE=1
                        ┌─────────────────────────┐    D[1:0]=11
                        │       Display ON         │    GON=1
                        └─────────────────────────┘
                                  │
                                  ▼
                        ┌─────────────────────────┐
                        │         BLU ON           │
                        └─────────────────────────┘
```
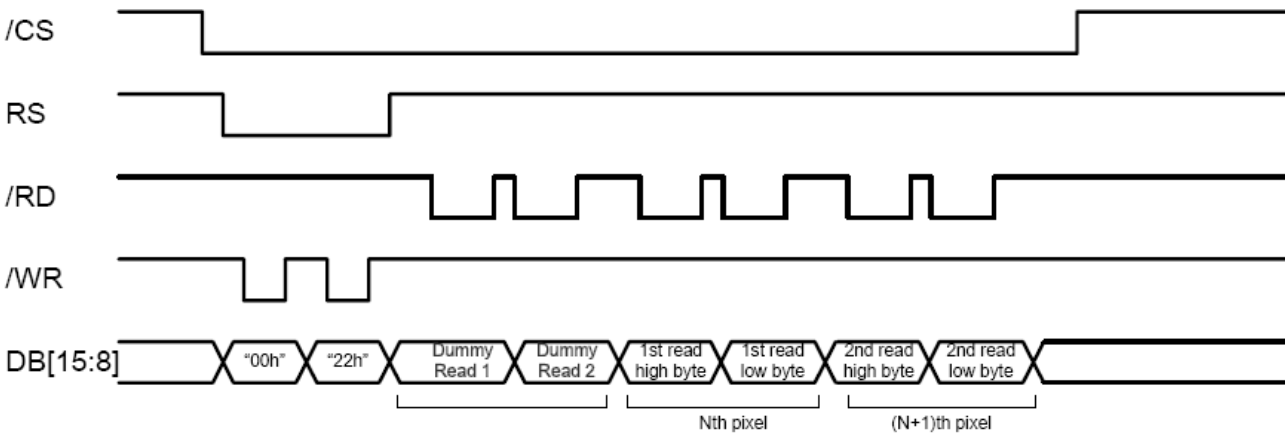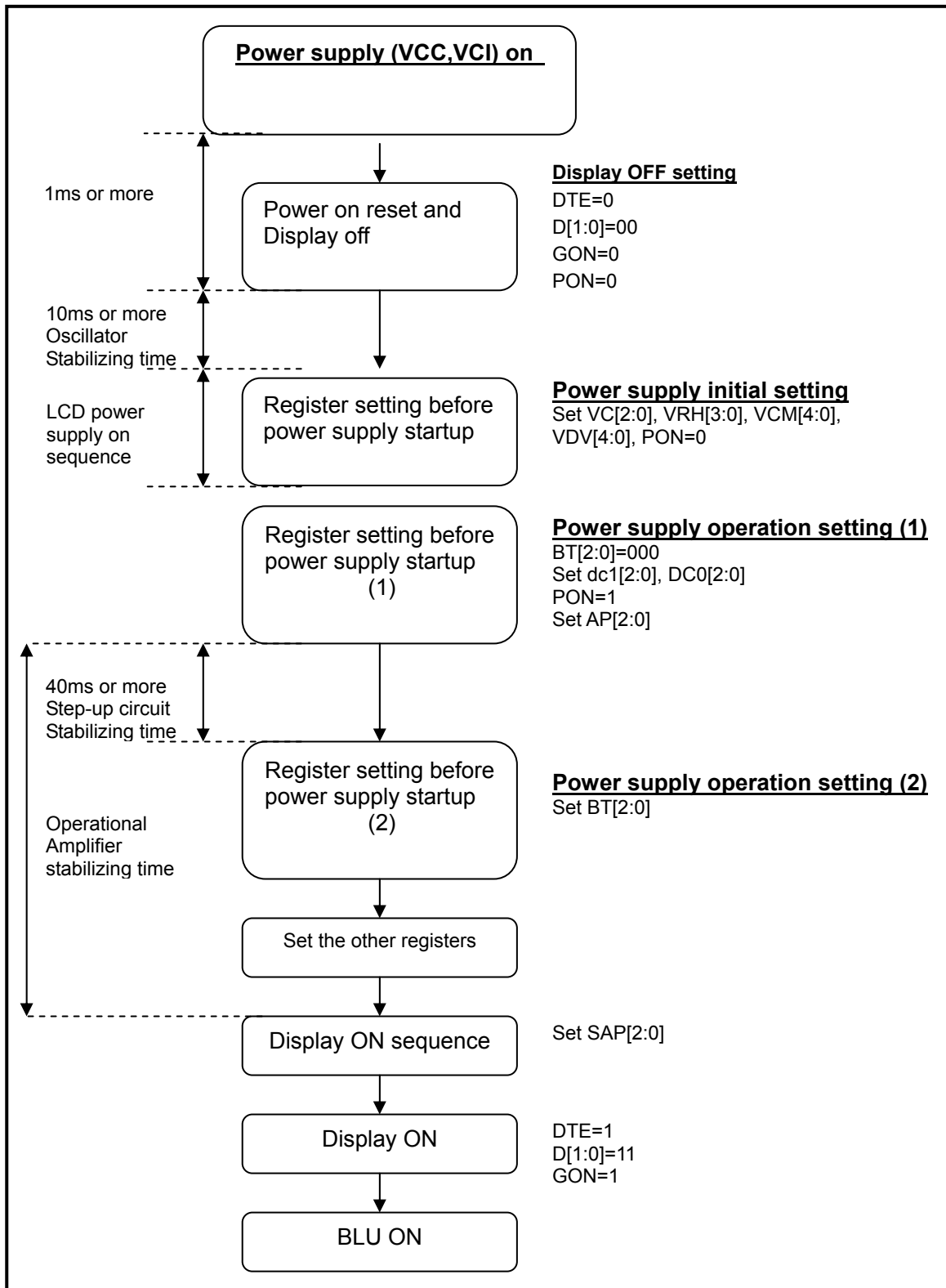
5.2.2 Power off Sequence

```
                    ┌──────────────────┐      Display ON setting
                    │  Normal Display  │      DTE=1
                    └──────────────────┘      D[1:0]=11
                             │                GON=1
                             ▼
                    ┌──────────────────┐
                    │     BLU OFF      │
                    └──────────────────┘
                             │
                             ▼
                    ┌──────────────────┐
                    │   Display OFF    │
                    │    Sequence      │
                    └──────────────────┘
                             │
                             ▼
                    ┌──────────────────┐
                    │   Display OFF    │
                    └──────────────────┘
                             │
                             ▼
                    ┌──────────────────┐      SAP[2:0]=000
                    │  Power Supply    │      AP[2:0]=000
                    │  Halt Setting    │      PON=0
                    └──────────────────┘
                             │
                             ▼
                    ┌──────────────────────┐
                    │ Power Supply (VCC,   │
                    │        VCI) OFF      │
                    │                      │
                    └──────────────────────┘
```

6 Optical Characteristics

6.1 Optical Specification

Ta=25℃

| Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
View Angles		θT	CR≧10	50	60	-	Degree	Note 2
		θB		30	40	-		
		θL		50	60	-		
		θR		50	60	-		
Contrast Ratio		CR	θ=0°	200	350	-		Note1 Note3
Response Time		T_{ON}	25℃	-	25	40	ms	Note1 Note4
		T_{OFF}						
Chromaticity	White	x	Backlight is on	-	TBD	-		Note5, Note1
		y		-	TBD	-		
	Red	x		-	TBD	-		
		y		-	TBD	-		
	Green	x		-	TBD	-		
		y		-	TBD	-		
	Blue	x		-	TBD	-		
		y		-	TBD	-		
Uniformity		U		75	80	-	%	Note1 Note6
NTSC				-	62	-	%	Note 5
Luminance		L		170	220	-	cd/m^2	Note1 Note7

Test Conditions:

1. V_F =3.2V, I_F=72mA(Backlight current), the ambient temperature is 25℃.

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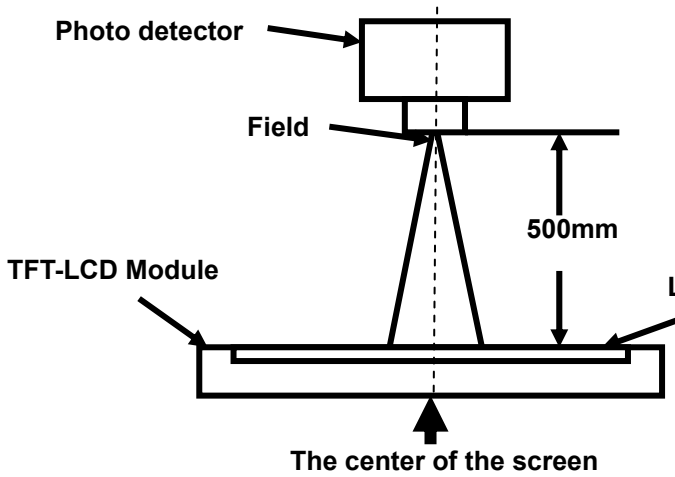
Item	Photo detector	Field
Contrast Ratio	SR-3A	1°
Luminance		
Chromaticity		
Lum Uniformity		
Response Time	BM-7A	2°

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

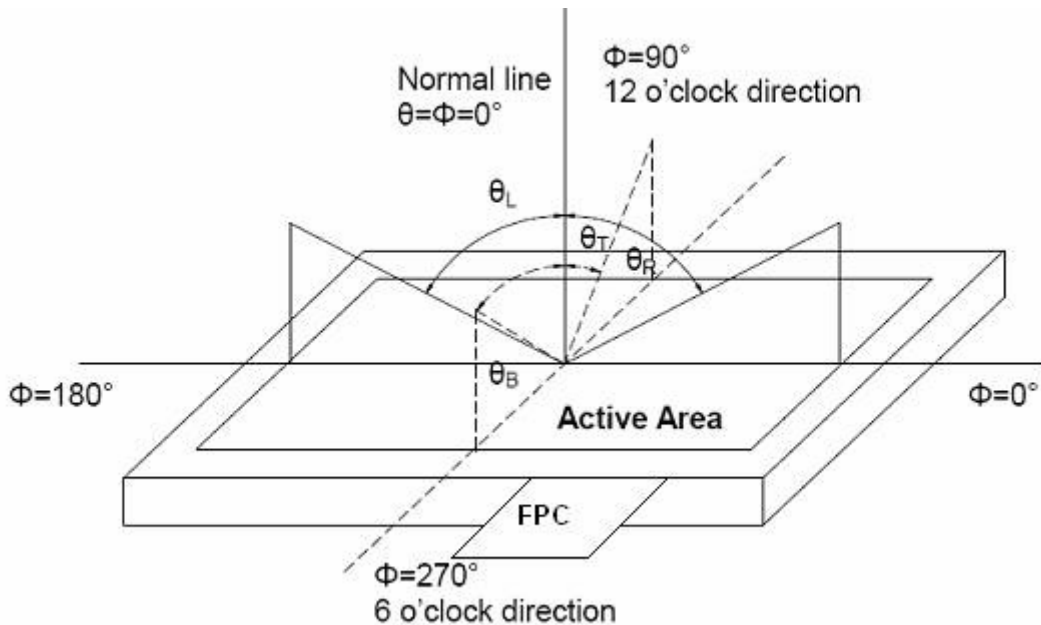viewing angle is measured at the center point of the LCD by CONOSCOPE(ergo-80)。

Fig. 1 Definition of viewing angle

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 Vwhite.

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

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%.
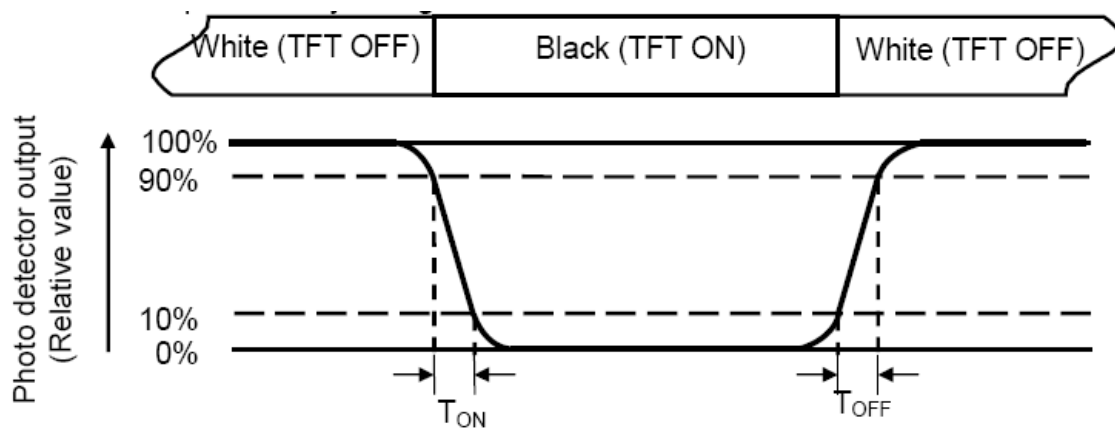
Note 5: Definition of color chromaticity (CIE1931)

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.

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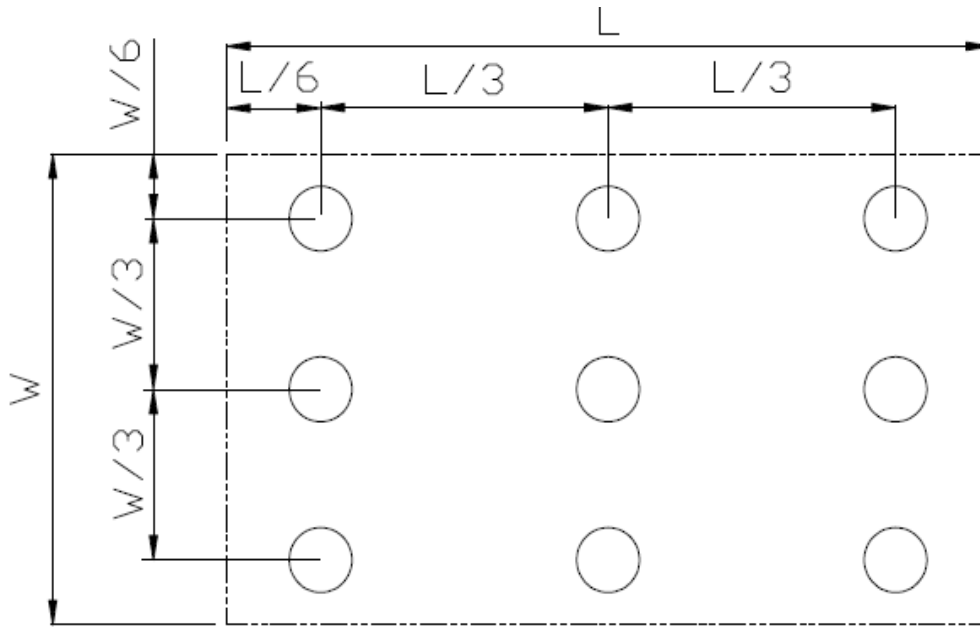
L-------Active area length W----- Active area width

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.
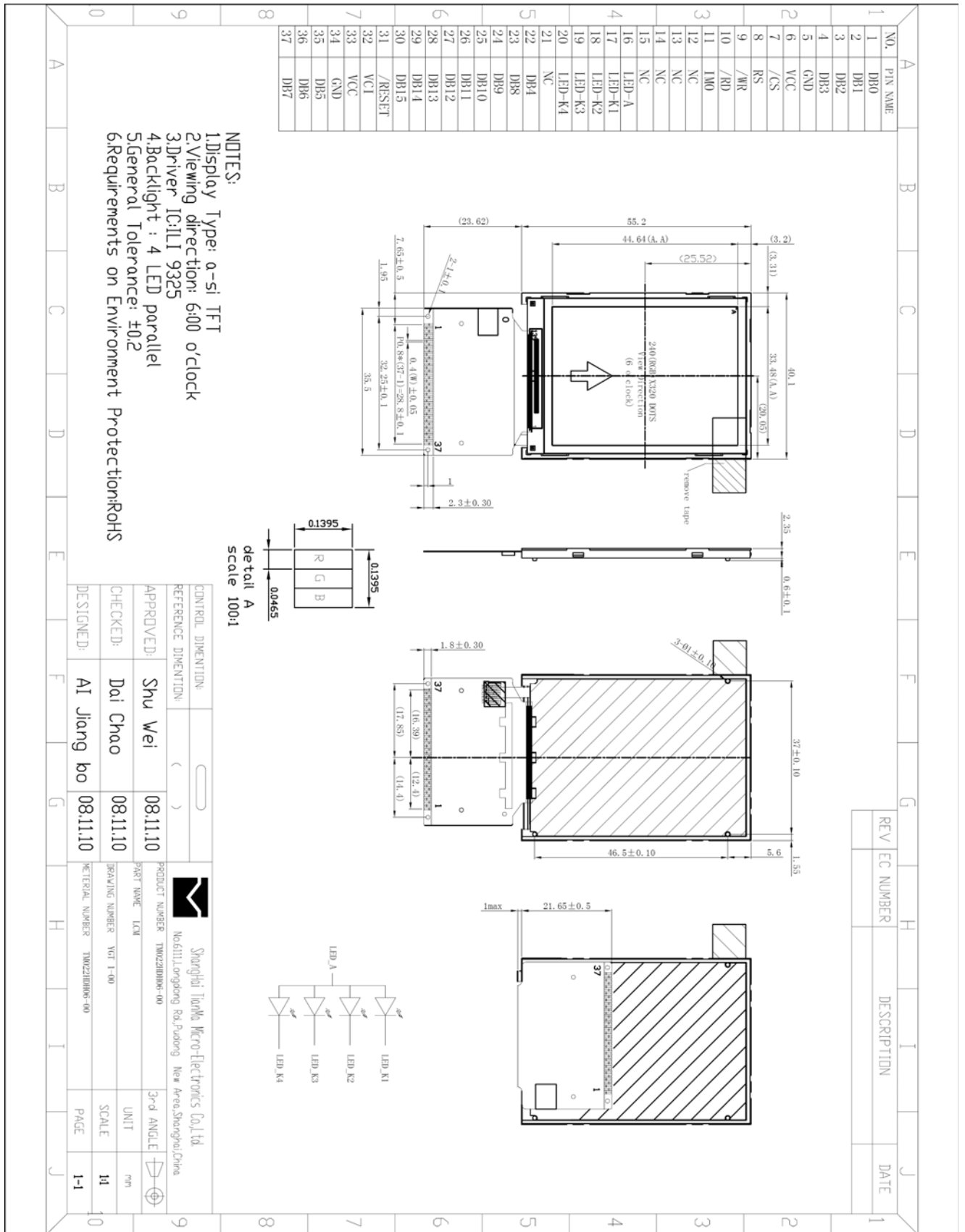
7 Environmental / Reliability Tests

No	Test Item	Condition	Remarks
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

NOTES:
1. Display Type: a-si TFT
2. Viewing direction: 6:00 o'clock
3. Driver IC: ILI 9325
4. Backlight : 4 LED parallel
5. General Tolerance: ±0.2
6. Requirements on Environment Protection:RoHS

NO.	PIN NAME
1	DB0
2	DB1
3	DB2
4	DB3
5	GND
6	VCC
7	/CS
8	RS
9	/WR
10	/RD
11	IM0
12	NC
13	NC
14	NC
15	NC
16	LED-A
17	LED-K1
18	LED-K2
19	LED-K3
20	LED-K4
21	NC
22	DB4
23	DB8
24	DB9
25	DB10
26	DB11
27	DB12
28	DB13
29	DB14
30	DB15
31	/RESET
32	VC1
33	VCC
34	GND
35	DB5
36	DB6
37	DB7

9 Packing Drawing

TBD

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.