

MODEL NO. : TM020HDH01ISSUED DATE: 2009-06-11VERSION : Ver 1.0

- 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



Table of Contents

Coversheet.....	1
Table of Contents.....	2
Record of Revision.....	3
1 General Specifications	4
2 Input/Output Terminals	5
3 Absolute Maximum Ratings	6
4 Electrical Characteristics.....	6
5 Timing Chart.....	9
6 Optical Characteristics	15
7 Environmental / Reliability Test	19
8 Mechanical Drawing.....	20
9 Packing Drawing	21
10 Precautions For Use of LCD Modules.....	22



1 General Specifications

	Feature	Spec
Display Spec.	Size	2.0 inch
	Resolution	240(RGB) x 320
	Interface	CPU 16bits
	Color Depth	65/262K
	Technology Type	a-Si
	Pixel Pitch (mm)	0.126x0.126
	Pixel Configuration	R.G.B. Vertical Stripe
	Display Mode	TM with Normally White
	Surface Treatment(Up Polarizer)	Clear Type(3H)
	Viewing Direction	3 o'clock
	Gray Scale Inversion Direction	9 o'clock
Mechanical Characteristics	LCM (W x H x D) (mm)	38.03x51.65x2.35
	Active Area(mm)	30.24x40.32
	With/Without TSP	Without TSP
	Weight (g)	TBD
	LED Numbers	3 LEDs
Electronic	Driver IC	ILI9335

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	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	Power Supply of I/O Interface	
19	VCC	P	Power Supply of Analog Circuit	
20	/RD	I	Read Signal	
21	/WR	I	Write Signal	
22	RS	I	Register Select	
23	/CS	I	Chip Select	
24	/RESET	I	Reset Signal	
25	IM0	I	Mode Select	Note 4-1
26	GND	P	Ground	
27	LED_A	P	LED Anode	
28	LED_K1	P	LED Cathode	
29	LED_K2	P	LED Cathode	
30	LED_K3	P	LED Cathode	
31	NC	-	Not Connected	
32	NC	-	Not Connected	
33	NC	-	Not Connected	
34	NC	-	Not Connected	
35	NC	-	Not Connected	
36	NC	-	Not Connected	

Note2-1: I/O definition:

I----Input O---Output P----Power/Ground



3 Absolute Maximum Ratings

3.1 Driving TFT LCD Panel

Ta = 25°C

Item	Symbol	Min	Max	Unit	Remark
Logic Supply Voltage	IOVCC	-0.3	4.6	V	
Analog Supply Voltage	VCC	-0.3	4.6	V	
Input voltage	/CS,/RD,/WR,RS,/RESET,IM0, DB0~15	-0.3	IOVCC+0.3	V	
Back Light Forward Current	I _{LED}		25	mA	For each LED
Operating Temperature	T _{OPR}	-20	60	°C	
Storage Temperature	T _{STG}	-30	70	°C	

4 Electrical Characteristics

4.1 Driving TFT LCD Panel

Ta=25°C

Item	Symbol	MIN	TYP	MAX	Unit	Remark	
Logic Supply Voltage	IOVCC	2.5	2.8	3.3	V		
Analog Supply Voltage	VCC	2.5	2.8	3.3	V		
Input Signal Voltage	Low Level	V _{IL}	-0.3	-	0.2* IOVCC	V	/CS,/RD,/WR,RS,/RESET,IM0, DB0~15
	High Level	V _{IH}	0.8* IOVCC	-	IOVCC	V	
Output Signal Voltage	Low Level	V _{OL}	-	-	0.2* IOVCC	V	
	High Level	V _{OH}	0.8* IOVCC	-	-	V	
(Panel+LSI) Power Consumption	Black Mode (60Hz)	-	--	-	mW		
	Sleeping Mode	-	--	-	mW		
	Standby Mode	-	--	-	uW		

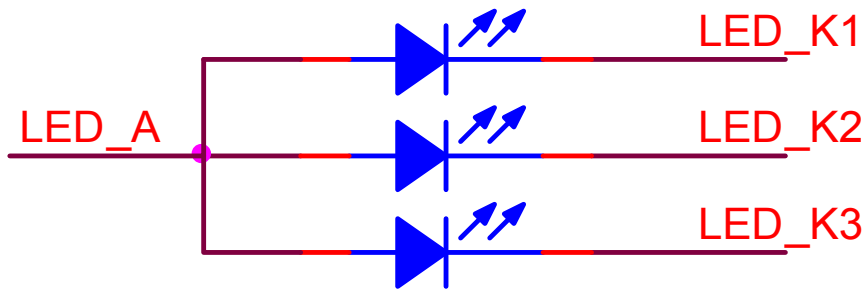


4.2 Driving Backlight

Ta=25°C

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

Note 1: The figure below shows the connection of backlight LED.

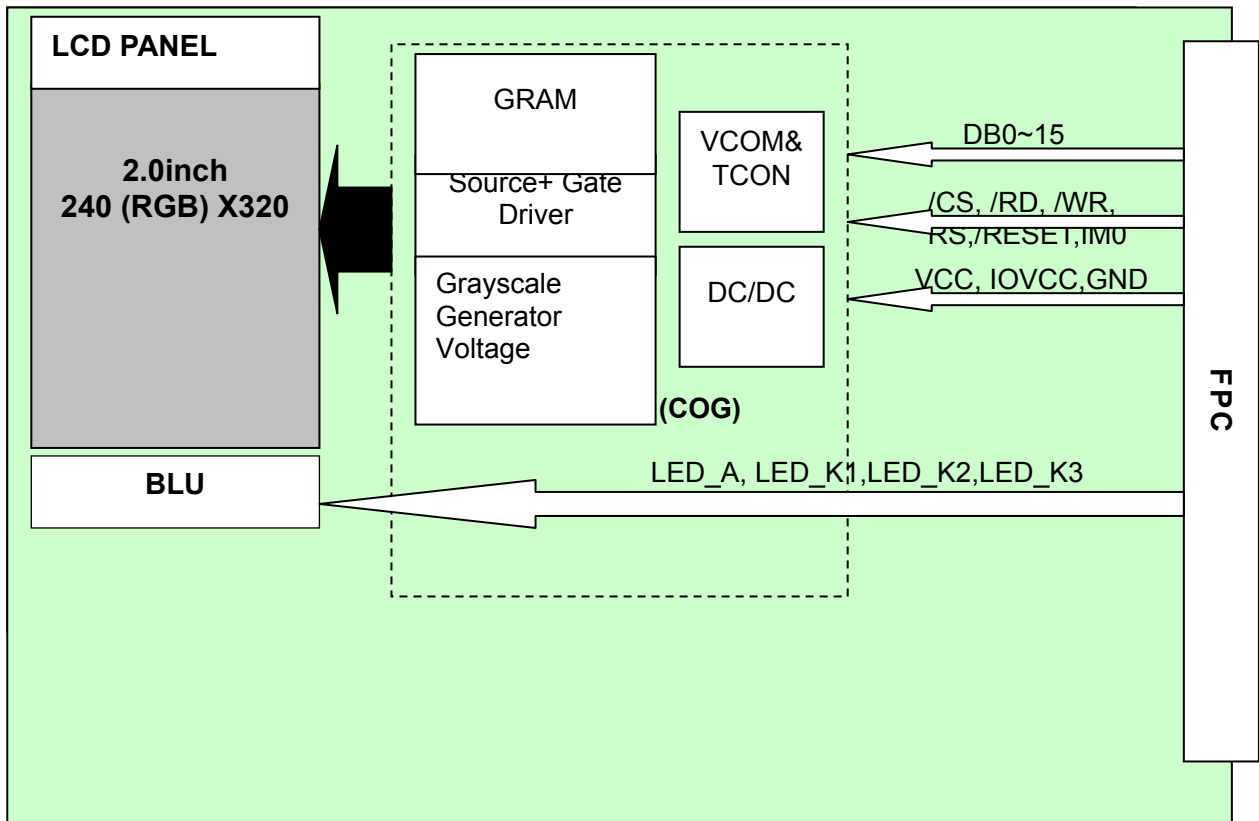


Note 2: One LED : $I_F = 15 \text{ mA}$, $V_F = 3.2 \text{ V}$

Note 3: The Life of LED : 20,000 hours



4.3 Block Diagram LCD module diagram





5 Timing Chart

5.1 Timing Parameter

Item		Symbol	Unit	Min	Typ	Max
Bus cycle time	Write	t_{CYCW}	ns	(75)	-	-
	Read	t_{CYCR}	ns	300	-	-
Write low-level pulse width		PW_{LW}	ns	(40)	-	500
Write high-level pulse width		PW_{HW}	ns	(30)	-	-
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, /WR)	t_{AS}	ns	10	-	-
	Read (RS to /CS, /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	-	-

Table 5.1 timing parameter

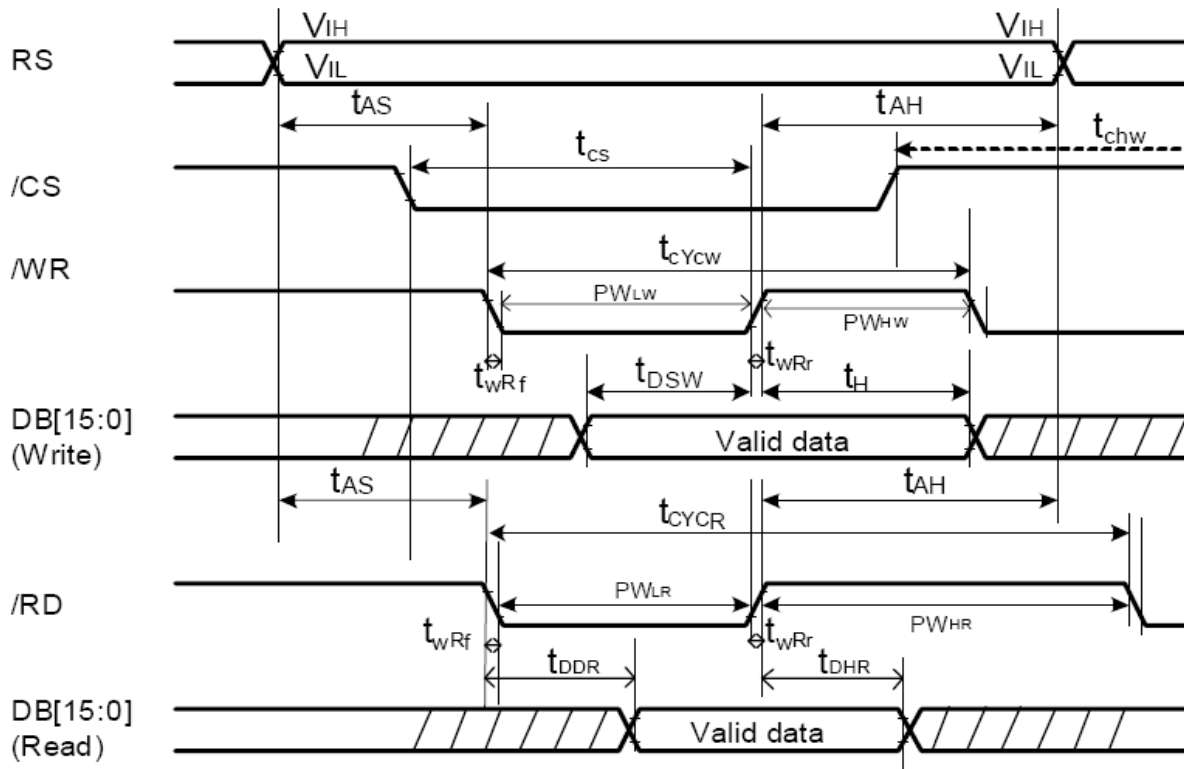


Figure 5.1 i80 System Bus Timing



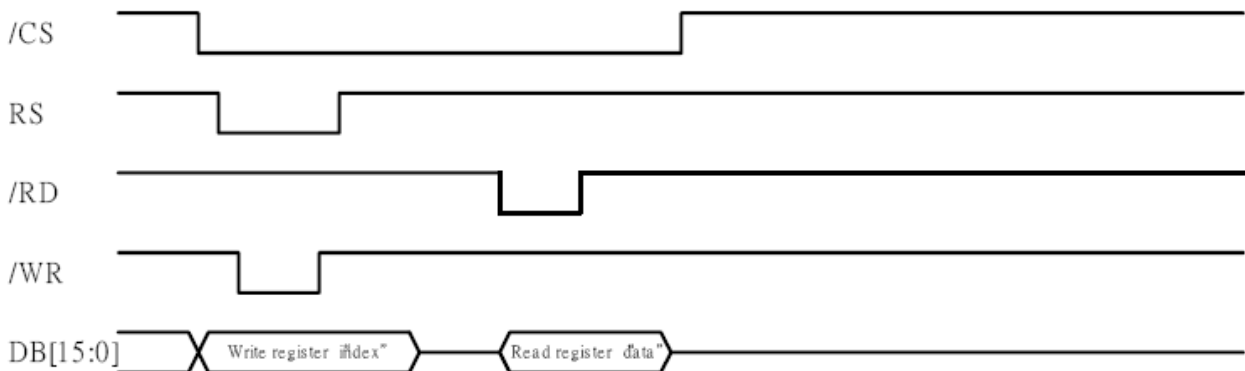
5.2 Register write/read timing in i80 8/16bit system

5.2.1 i80 16-bit System Bus Interface Timing

a, Write to register

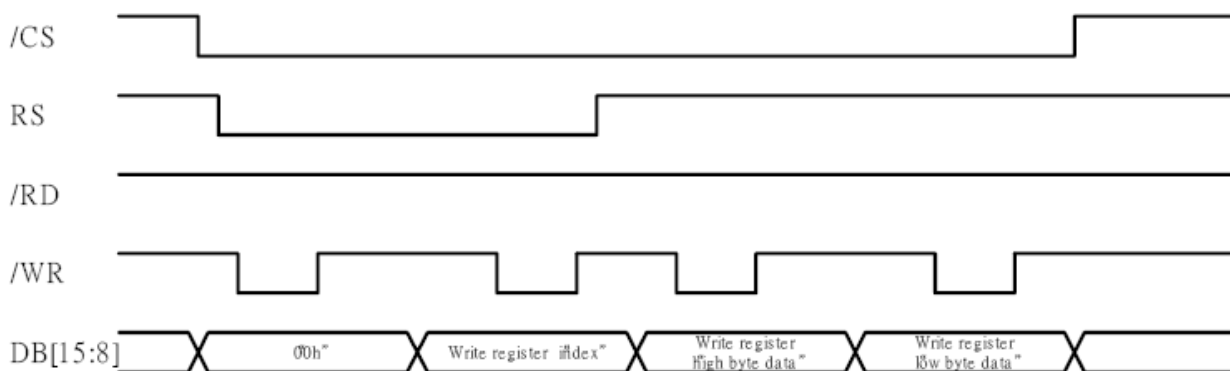


b. Read from register



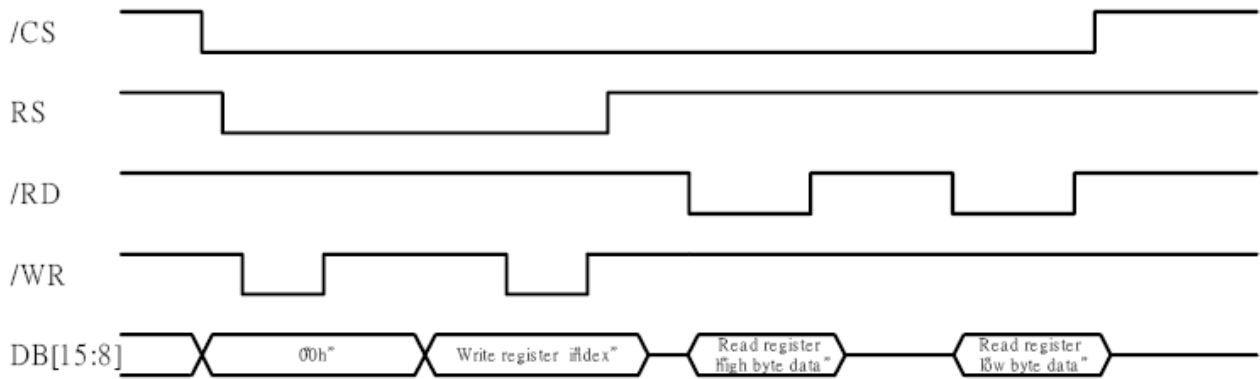
5.2.2 i80 8-bit System Bus Interface Timing

a. Write to register





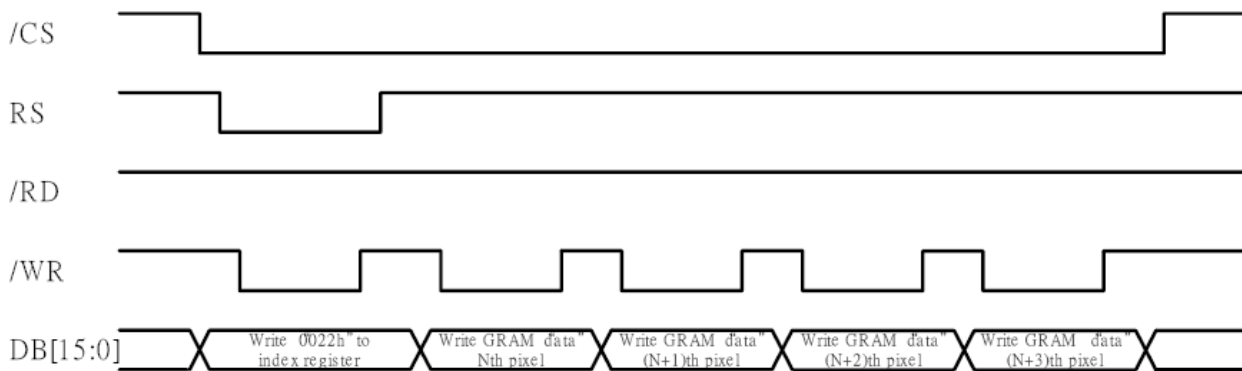
b. Read from register



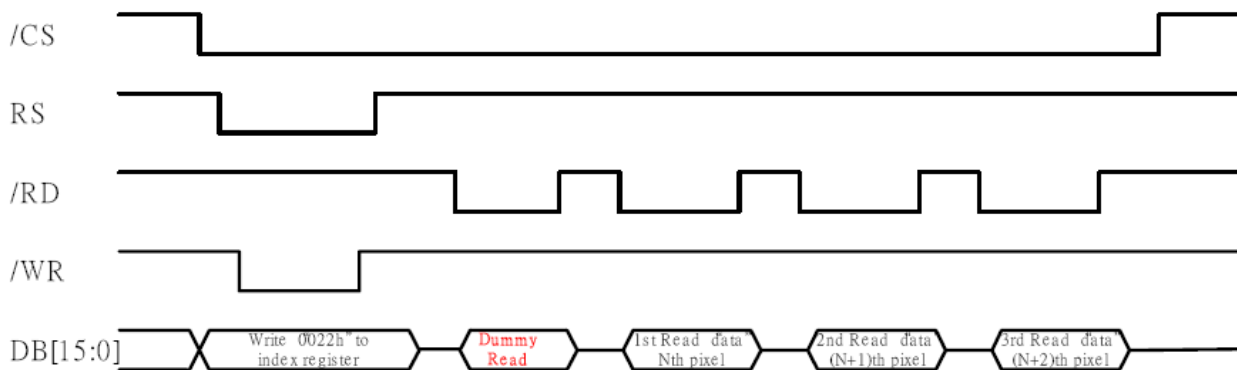
5.3 GRAM write timing in i80 8/16bit system

5.3.1 i80 16-bit System Bus Interface Timing

a. Write to GRAM



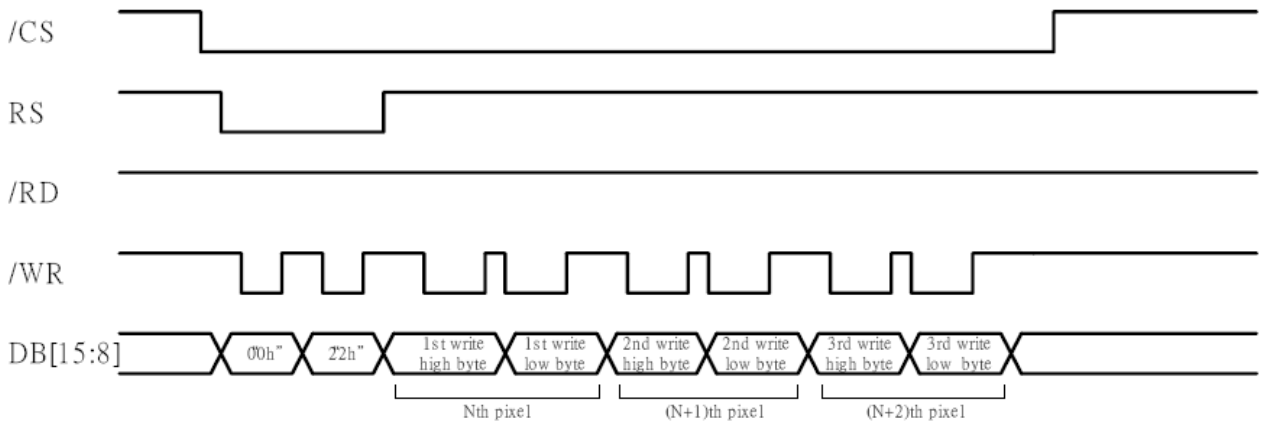
b. Read from GRAM



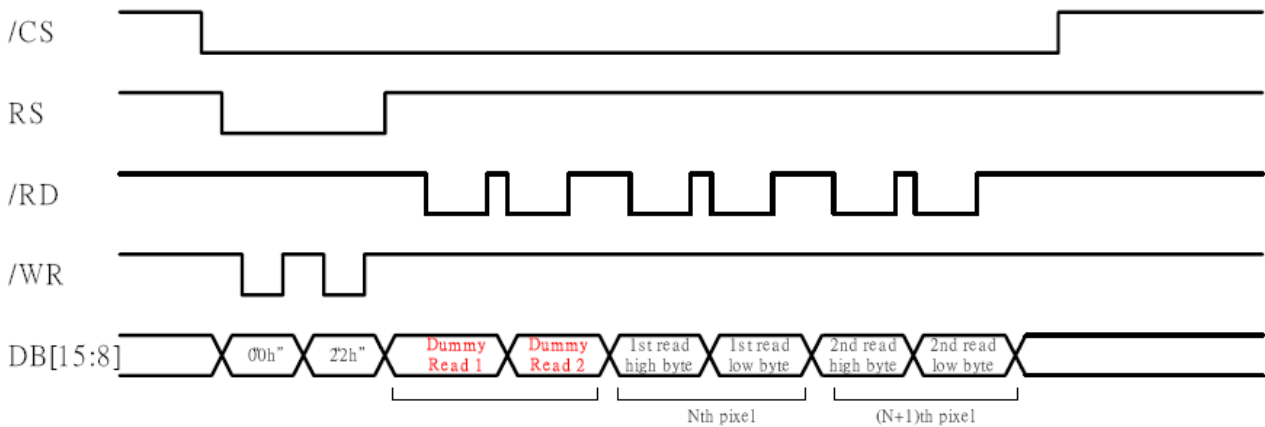


5.3.2 i80 8-bit System Bus Interface Timing

a. Write to GRAM



b. Read from GRAM

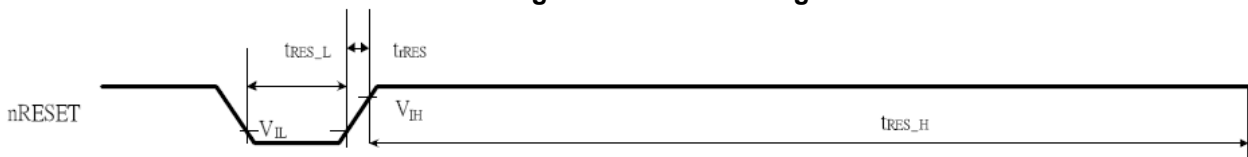


5.4 Reset Timing Characteristics

Ta=25°C

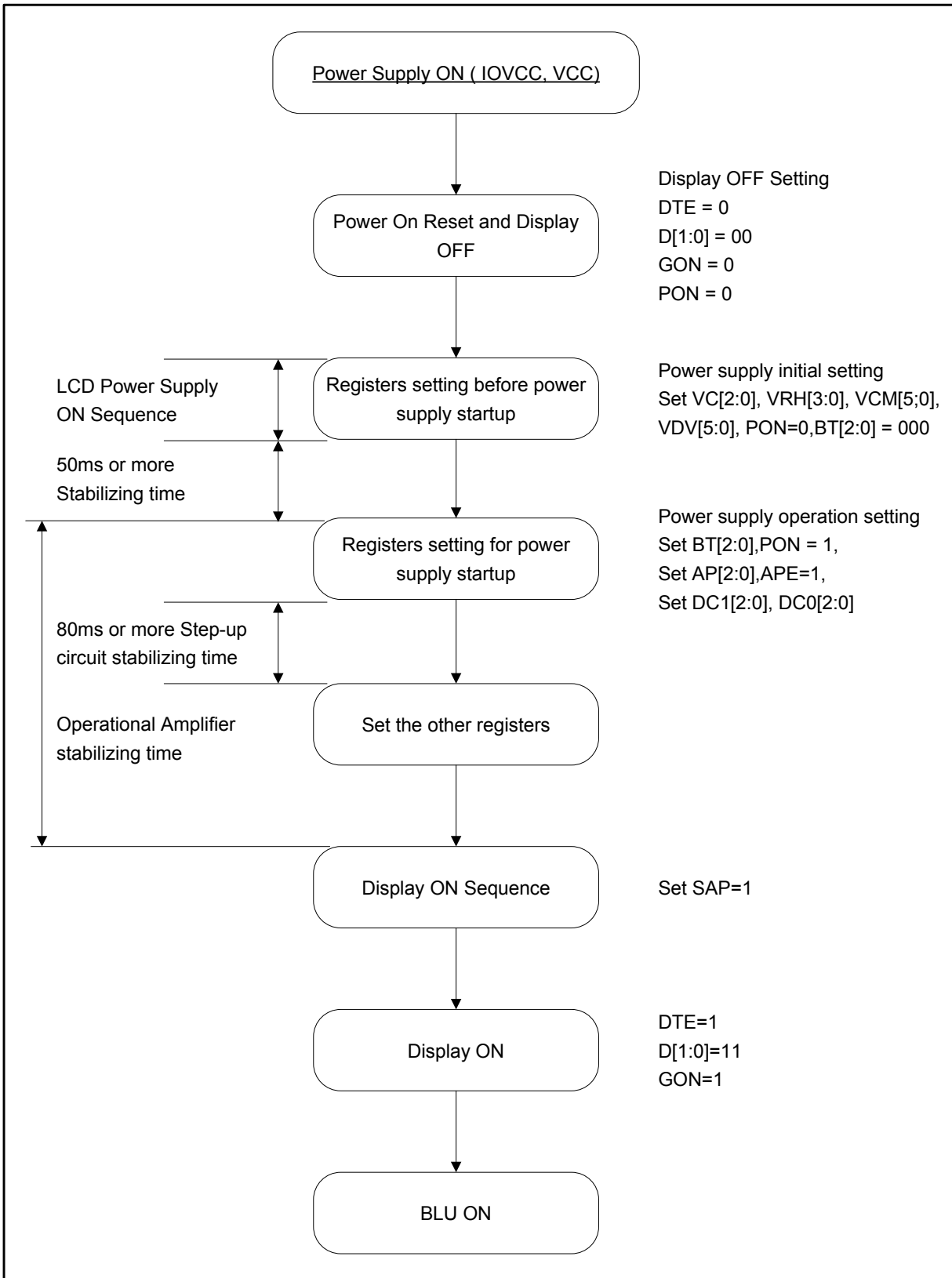
Item	Symbol	Unit	Min.	Typ.	Max.
RESET low-level width	t _{RES_L}	ms	1	-	-
RESET rise time	t _{rRES}	µs	-	-	10
Reset high-level width	t _{RES_H}	ms	50		

Figure 5.4 NRES Timing



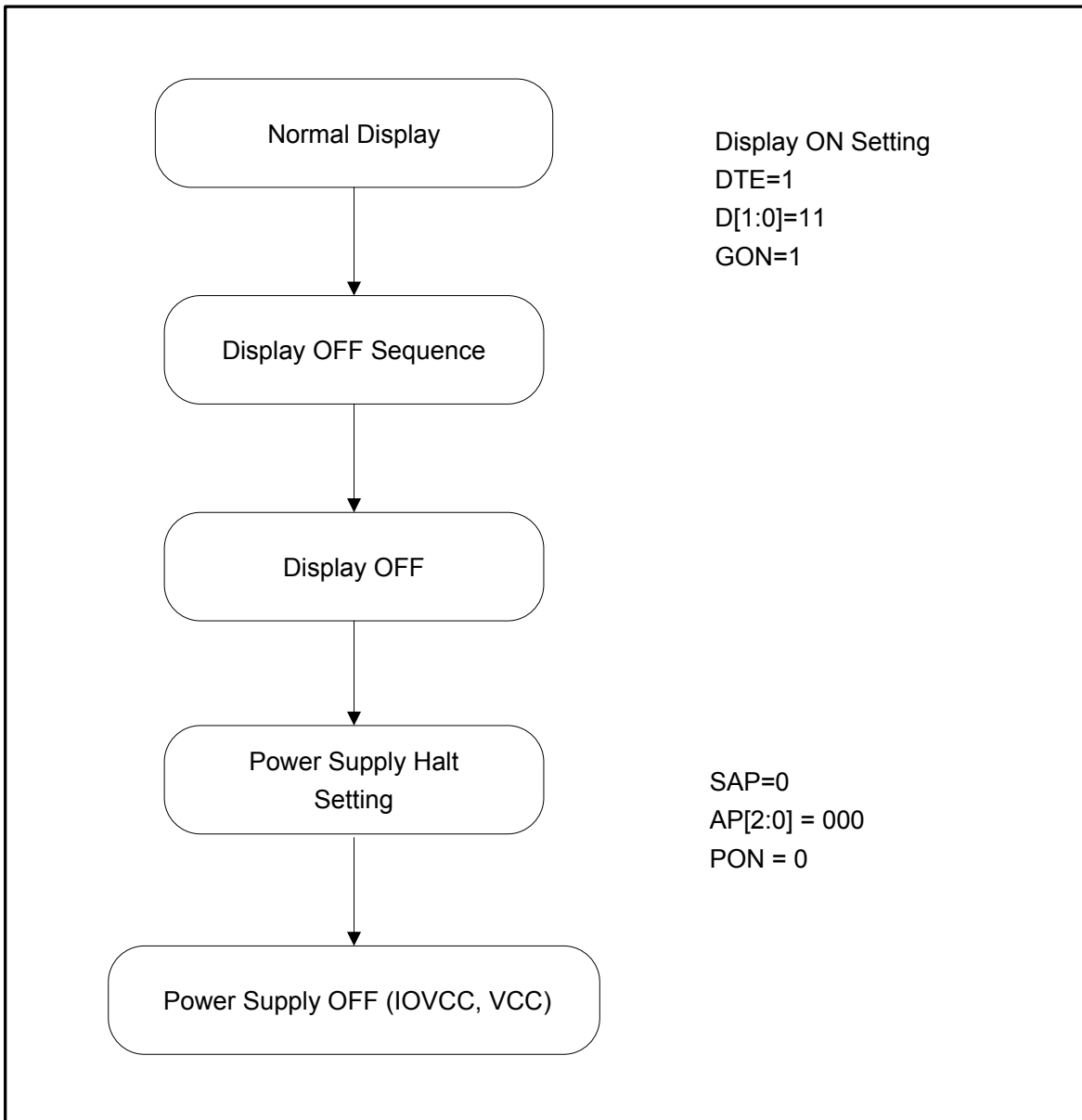


6. Power On/Off sequence
6.1 Power on Sequence





6.2 Power off Sequence





7 Optical Characteristics

Ta=25°C

Item	Symbol	Condition	Min	Typ	Max	Unit	Remark	
View Angles	θT	$CR \geq 10$	55	60	-	Degree	Note 2	
	θB		55	60	-			
	θL		50	55	-			
	θR		55	60	-			
Contrast Ratio	CR	$\theta=0^\circ$	300	350	-	-	Note1 Note3	
Response Time	T_{ON}	25°C	-	25	40	ms	Note1 Note4	
	T_{OFF}							
Chromaticity	White	Backlight is on	x	0.265	0.305	0.345	-	Note5 Note1
			y	0.277	0.317	0.357		
	Red		x	0.548	0.588	0.628		
			y	0.299	0.339	0.379		
	Green		x	0.299	0.339	0.379		
			y	0.533	0.573	0.613		
	Blue		x	0.126	0.166	0.206		
			y	0.048	0.088	0.128		
Uniformity	U	-		80	-	%	Note1 Note6	
NTSC	-	-	-	50	-	%	Note 5	
Luminance	L			220	-	cd/m ²	Note1 Note7	

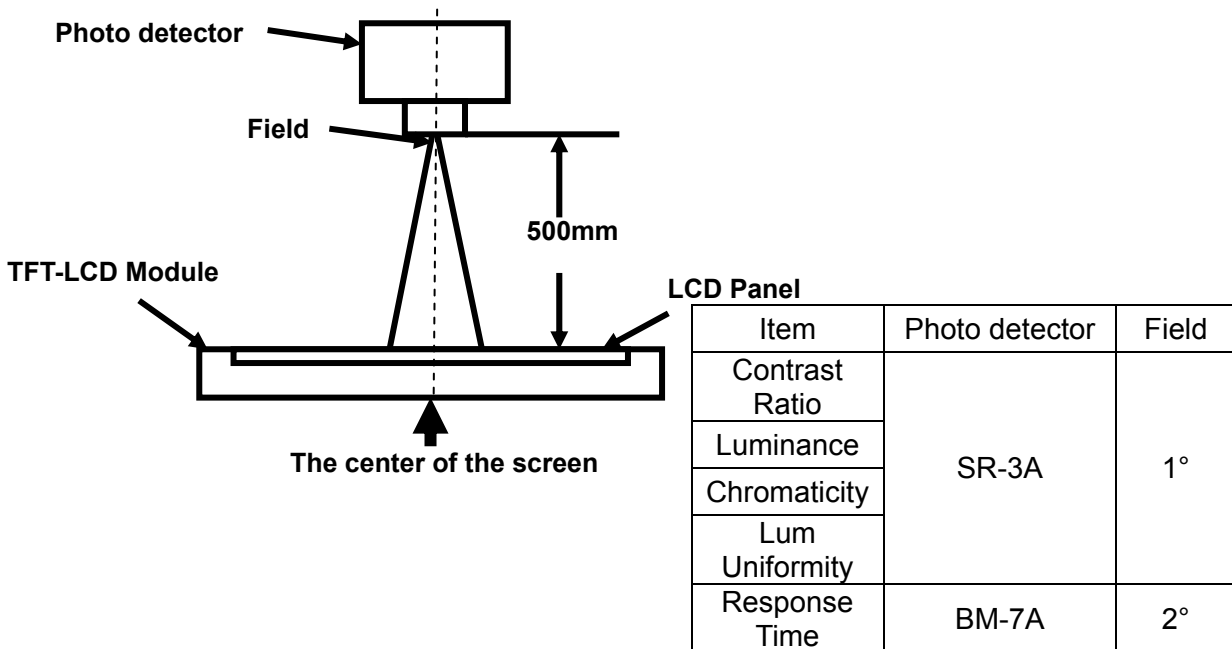
Test Conditions:

1. $V_F=3.2V$, $I_F=15mA$ (One LED current), 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).

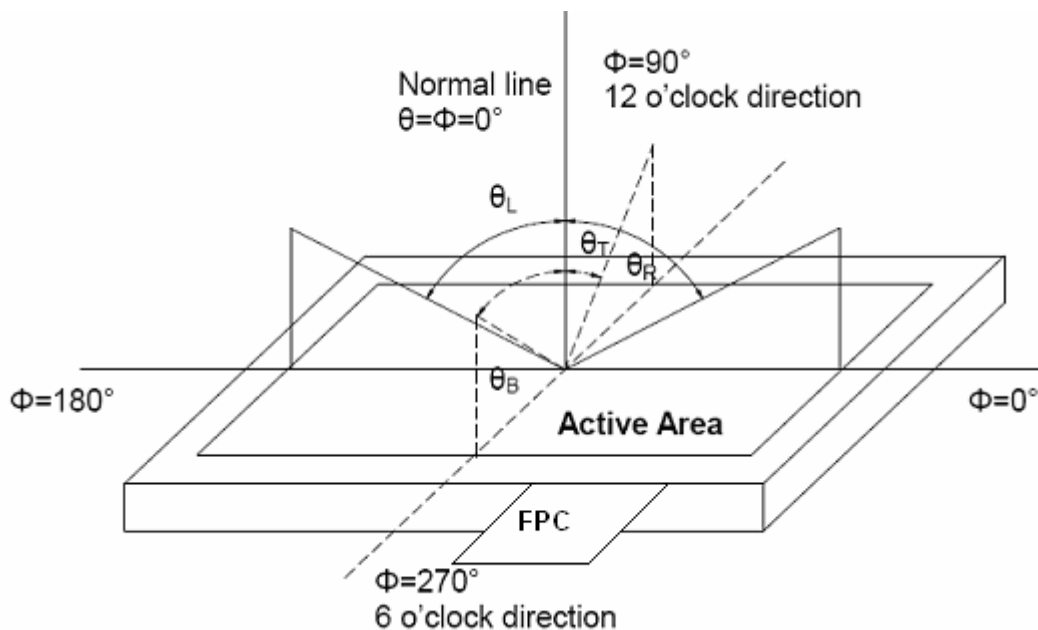


Fig. 1 Definition of viewing angle

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Note 3: Definition of contrast ratio

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

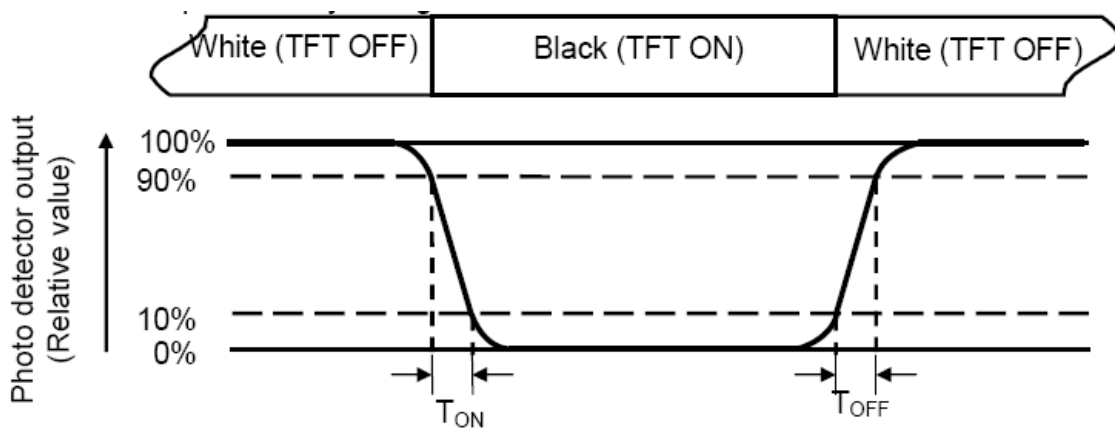
“White state “:The state is that the LCD should driven by V_{white} .

“Black state”: The state is that the LCD should driven by V_{black} .

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.

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

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

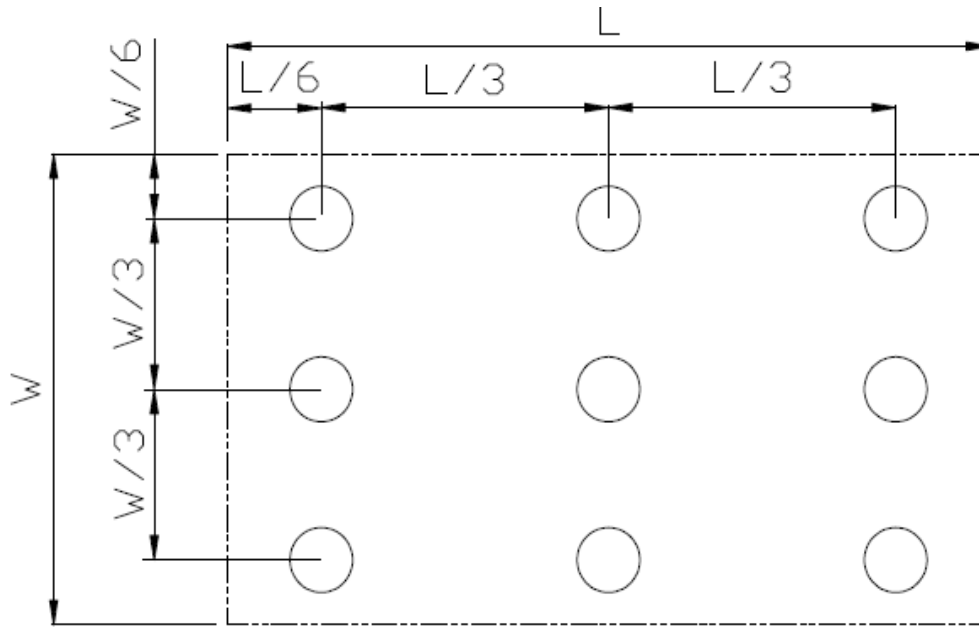


Fig. 2 Definition of uniformity

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.



8 Environmental / Reliability Test

No	Test Item	Condition	Remark
1	High Temperature Operation	T _s =+60°C, 48hrs	Note1 IEC60068-2-2,GB2423.2—89
2	Low Temperature Operation	T _a =-20°C, 48hrs	IEC60068-2-1 GB2423.1—89
3	High Temperature Storage	T _a =+70°C, 96hrs	IEC60068-2-2, GB2423.2—89
4	Low Temperature Storage	T _a =-30°C, 96hrs	IEC60068-2-1 GB2423.1—89
5	High Temperature & High Humidity Storage	T _a =+60°C, 90% RH 48 hours	Note2 IEC60068-2-3, GB/T2423.3—2006
6	Thermal Shock (Non-operation)	-30°C 30 min~+70°C 30 min, Change time:5min, 10 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°C ~ 35°C, 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 1 hours for each direction of X.Y.Z. (3 hours for total)(Package condition)	IEC60068-2-6 GB/T2423.10—1995
9	Package Drop Test	Height:80 cm, 1 corner, 3 edges, 6 surfaces	IEC60068-2-32 GB/T2423.8—1995

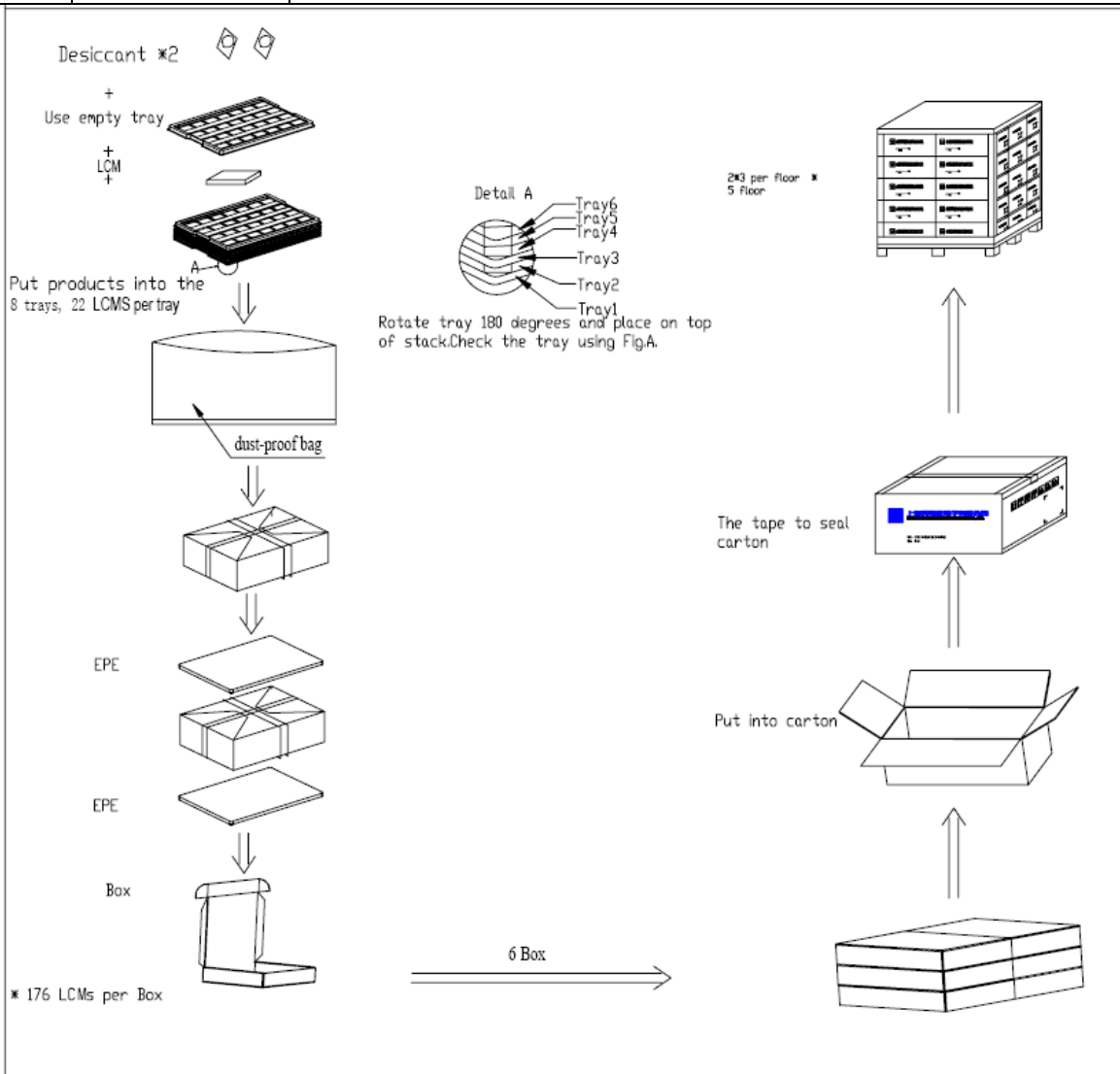
Note1: T_s is the temperature of panel's surface.

Note2: T_a is the ambient temperature of sample.



10 Packing Drawing

No	Item	Model (Material)	Dimensions(mm)	Unit Weight(Kg)	Quantity	Remark
1	LCM module	TM020HDH01-00	38.03×51.58×2.35	TBD	672	
2	Tray	PET (Transmit)	315×247×10.3	TBD	48	Anti-static
3	EPE	EPE	315×247×5	0.009	12	
4	Anti-static bag	PE	327×440	0.021	6	
5	BOX	CORRUGATED PAPER	345×260×70	0.227	6	
6	Desiccant	Desiccant	45×50	0.0035	12	
7	Carton	CORRUGATED PAPER	544×365×250	1.01	1	
8	Total weight	TBD Kg				



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11 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

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