MODEL NO.   :   TM035NDH01

ISSUED DATE: 2010-07-27

VERSION   :   Ver 1.1

■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

Record of Revision

Rev	Issued Date	Description	Editor
1.0	2010-3-15	Preliminary release.	Haitao Chen
1. 1	2010-7-27	Change Luminance value min from 250 to 300, typical from 300 to 350	Hongming Chen

1. General Specifications

Feature		Spec
Display Spec.	Size	3.5 inch
	Resolution	272(RGB) x 480
	Interface	1. CPU 18/16/9/8 bit 2. SPI 9/8-bit 3. SPI+RGB 18/16 bit
	Color Depth	262K
	Technology Type	a-Si
	Pixel Pitch (mm)	0.161x0.161
	Pixel Configuration	R.G.B. Vertical Stripe
	Display Mode	TM with Normally White
	Surface Treatment(Up Polarizer)	clear
	Viewing Direction	9 o'clock
	Gray Scale Inversion Direction	3 o'clock
	LCM (W x H x D) (mm)	51.76x 89.50x2.70
Mechanical Characteristics	Active Area(mm)	43.86 x 77.40
	With /Without TSP	Without TSP
	Weight (g)	TBD
	LED Numbers	6 LEDs

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: ± 5%

2. Input/Output Terminals

2.1 CN1 pin assignment of FPC

Connector type: FH12-40S-0.5S (HRS)

No	Symbol	I/O	Description	Comment
1	IM0	I	Select the MPU interface mode	Note 1
2	IM1	I	Select the MPU interface mode	Note 1
3	IM2	I	Select the MPU interface mode	Note 1
4	DB17	I/O	Data Bus	Note 2
5	DB16	I/O	Data Bus	Note 2
6	DB15	I/O	Data Bus	Note 2
7	DB14	I/O	Data Bus	Note 2
8	DB13	I/O	Data Bus	Note 2
9	DB12	I/O	Data Bus	Note 2
10	DB11	I/O	Data Bus	Note 2
11	DB10	I/O	Data Bus	Note 2
12	DB9	I/O	Data Bus	Note 2
13	DB8	I/O	Data Bus	Note 2
14	GND	I/O	Ground	Note 2
15	DB7	I/O	Data Bus	Note 2
16	DB6	I/O	Data Bus	Note 2
17	DB5	I/O	Data Bus	Note 2
18	DB4	I/O	Data Bus	Note 2
19	DB3	I/O	Data Bus	Note 2
20	DB2	I/O	Data Bus	Note 2
21	DB1	I/O	Data Bus	Note 2
22	DB0	I/O	Data Bus	Note 2
23	GND	P	Ground	
24	RD	I	Read control pin for the CPU interface	Note 2
25	WR	I	Write control pin for the CPU interface or SPI clock	Note 2
26	RS	I	Display data or Command selection	Note 2
27	CS	I	Chip select	Note 2
28	IOVCC	P	Power supply for interface pins	
29	VCI	P	Power supply for analog circuit	
30	GND	P	Ground	
31	RESET	I	IC reset	
32	DCLK	I	Dot clock signal for RGB interface operation	
33	GND	P	Ground	
34	DE	I	Data enable signal	
35	HSYNC	I	Horizontal synchronizing signal	
36	VSYNC	I	Vertical synchronizing signal	
37	DIN	I	Serial data input	Note 2
38	DOUT	O	Serial data output	Note 2
39	LED+	P	LED anode	
40	LED-	P	LED cathode	

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

Note1:

IM2	IM1	IM0	MPU Interface Mode	DB Pin in use
0	0	0	18-bit	DB[17:0]
0	0	1	9-bit	DB[8:0]
0	1	0	16-bit	DB[15:0]
0	1	1	8-bit	DB[7:0]
1	0	0	Setting prohibited	-
1	0	1	SPI 9-bit	DIN,DOUT
1	1	0	Setting prohibited	-
1	1	1	SPI 8-bit	DIN,DOUT

Note2:

Symbol	CPU		SPI	SPI+RGB	
RD	read control pin		fixed to IOVCC	fixed to IOVCC	
WR	write control pin		SPI clock pin	SPI clock pin	
RS	data/command selection pin		fixed to ground	fixed to ground	
CS	chip select input pin		chip select input pin	chip select input pin	
DIN	fixed to ground		SPI data input	SPI data input	
DOUT	-		SPI data output	-	
DB[17:0]	18-bit	DB[17:0]	-	18-bit	DB[17:0]
	9-bit	DB[8:0]	-		
	16-bit	DB[15:0]	-	16-bit	DB[15:0]
	8-bit	DB[7:0]	-		

---

3 Absolute Maximum Ratings

3.1 Driving TFT LCD Panel

GND=0V,Ta=25℃

Item	Symbol	Min	Max	Unit	Remark
Power Voltage	VCI	-0.3	4.6	V	Note 1
	IOVCC	-0.3	4.6	V	Note 1
	DDVDH-GND	-0.3	6.5	V	Note 1
	GND-VCL	-0.3	4.6	V	Note 1
	DDVDH-VCL	-0.3	9.0	V	Note 1
	VGH-GND	-0.3	18.5	V	Note 1
	GND-VGL	-0.3	18.5	V	Note 1
	VGH-VGL	-0.3	32.0	V	Note 1
	Vt	-0.3	IOVCC+0.3	V	Note 1
Operating Temperature	Top	-20	75	℃	Note 1
Storage Temperature	Tst	-30	80	℃	Note 1

Note1: The parameter is for driver IC (gate driver, source driver) only.

Table 3.1 absolute maximum rating

4   Electrical Characteristics

4.1 Driving TFT LCD Panel   GND=0V, Ta=25℃

Item		Symbol	Min	Typ	Max	Unit	Remark
Logic supply Voltage		IOVCC	2.6	2.8	3.0	V	
Analog supply Voltage		VCI	2.6	2.8	3.0	V	
Input Signal Voltage	Low Level	VIL	0	-	0.3xIOVCC	V	
	High Level	VIH	0.7xIOVCC	-	IOVCC	V	
Output Signal Voltage	Low Level	VOL	0.0	-	0.2xIOVCC	V	
	High Level	VOH	0.8xIOVCC	-	IOVCC	V	

Note1: For different LCM, the value may have a bit of difference.
Note2: To test the current dissipation, use "all Black Pattern".

Table 4.1 LCD module electrical characteristics

4.2 Driving Backlight

Item	Symbol	Min	Typ	Max	Unit	Remark
Forward Current	I_F	-	20	-	mA	Note1
Backlight Power Consumption	W_{BL}	-	384	-	mW	
Life Time	-	10,000	（20,000）		Hrs	Note 3

Note 1: There are total 6 LED serial in back light unit
Note 2: Optical performance should be evaluated at Ta=25℃ only.
Note 3: If LED is driven by high current, high ambient temperature & humidity condition. The life time of LED will be reduced.Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.
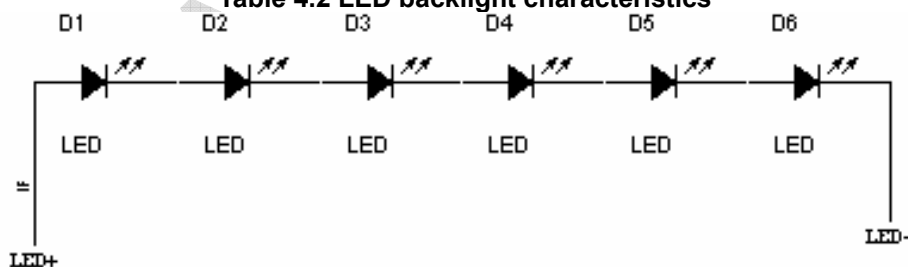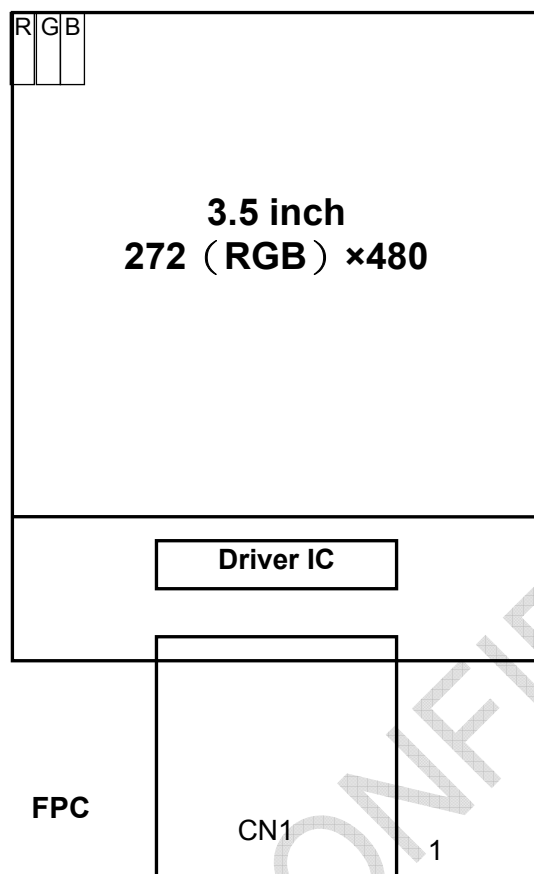
Table 4.2 LED backlight characteristics

Figure 4.2 LED connection of backlight

4.3 Block Diagram

| R | G | B |

3.5 inch
272（RGB）×480

| Driver IC |

FPC

CN1

1

5. Data input timing

5.1 CPU Interface Timing

(VCI=2.6V~3.0V, IOVCC=2.6V~3.0V,GND=0V, Ta=25℃)

Signal	Symbol	Parameter	Min	Max	Unit
RS	tast	Address setup time	10	-	ns
	taht	Address hold time(Write/Read)	10	-	ns
CS	tcs	Chip Select setup time(Write)	20	-	ns
	trcs	Chip Select setup time(Read)	20	-	ns
	tcsf	Chip Select Wait time(Write/Read)	20	-	ns
WR	twc	Write cycle	100	-	ns
	twrh	Write Control pulse H duration	30	-	ns
	twrl	Write Control pulse L duration	25	-	ns
RD	trc	Read cycle	450	-	ns
	trdh	Read Control pulse H duration	250	-	ns
	trdl	Read Control pulse L duration	170	-	ns
DB[17:0] DB[15:0] DB[8:0] DB[7:0]	twds	Write data setup time	15	-	ns
	twdh	Write data hold time	25	-	ns
	tracc	Read access time	10	340	ns
	trod	Read output disable time	10	-	ns

Table 5.1 CPU Interface Timing
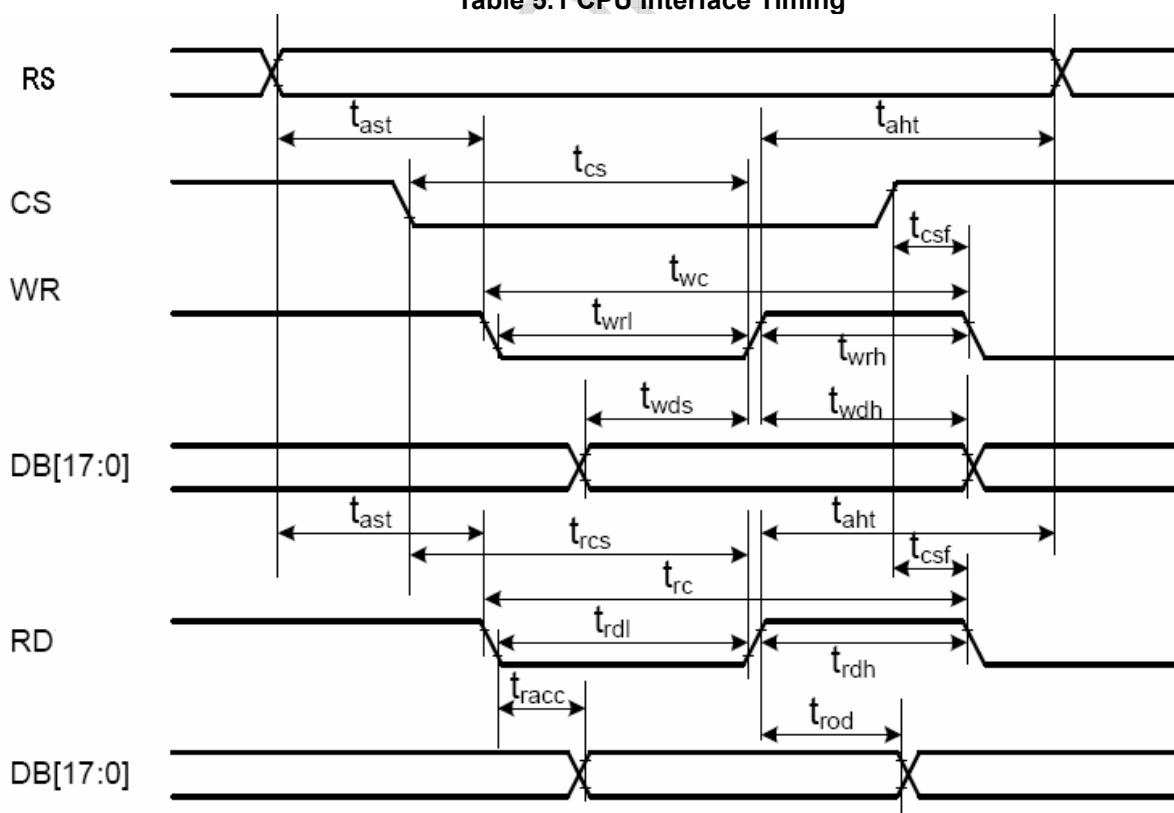
Figure 5.1 PI Interface Timing

5.2 SPI Interface Timing

(VCI=2.6V~3.0V, IOVCC=2.6V~3.0V,GND=0V, Ta=25℃)

Signal	Symbol	Parameter	Min	Max	Unit
CS	tcss	Chip Select setup time(Write)	40	-	ns
	tcsh	Chip Select hold time(Write)	40	-	ns
RS	tas	Address setup time	10		ns
	tah	Address hold time(Write/Read)	10		ns
WR (Write)	twc	Write cycle	100		ns
	twrh	SCL High duration(Write)	40		ns
	twrl	SCL Low duration(Write)	40		ns
WR (Read)	trc	Read cycle	300		ns
	trdh	SCL High duration(Read)	120		ns
	trdl	SCL Low duration(Read)	120		ns
DIN (Driver IC)	tds	Data setup time	30		ns
	tdh	Data hold time	30		ns
DOUT (Driver IC)	tacc	Access time	-	110	ns
	tod	Output disable time	10		ns

Table 5.2 SPI Interface Timing
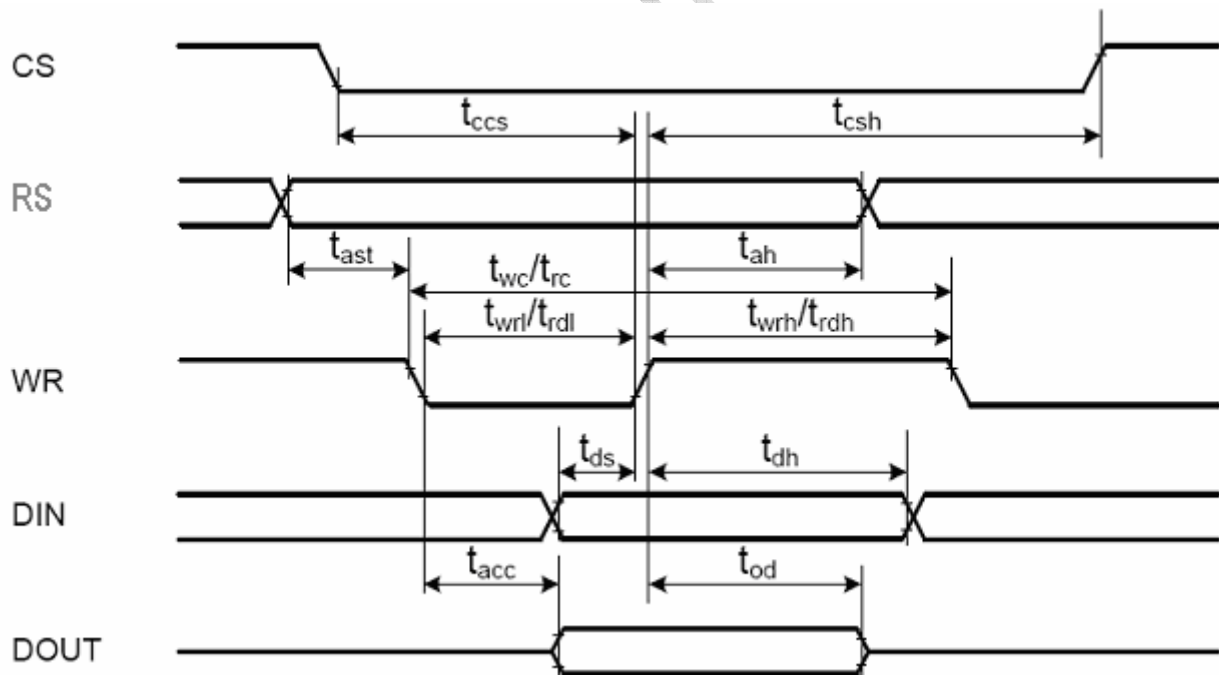
Figure 5.2 SPI Interface Timing

5.3 RGB Interface Timing

(VCI=2.6V~3.0V, IOVCC=2.6V~3.0V,GND=0V, Ta=25℃)

Signal	Symbol	Parameter	Min	Max	Unit
VSYNC/ HSYNC	t_{SYNCS}	VSYNC/HSYNC setup time	15	-	ns
	t_{SYNCH}	VSYNC/HSYNC hold time	15	-	ns
DE	t_{ENS}	ENABLE setup time	15	-	ns
	t_{ENH}	ENABLE hold time	15	-	ns
DB[17:0]	t_{POS}	Data setup time	15	-	us
	t_{PDH}	Data hold time	15	-	ns
DCLK	PWDH	DOTCLK high-level period	52	-	ns
	PWDL	DOTCLK low-level period	52	-	ns
	t_{CYCD}	DOTCLK cycle time	104	-	ns
	t_{rgbr} t_{rgbf}	DOTCLK,HSYNC,VSYNC rise/fall time	-	15	ns

Table 5.3 RGB Interface Timing
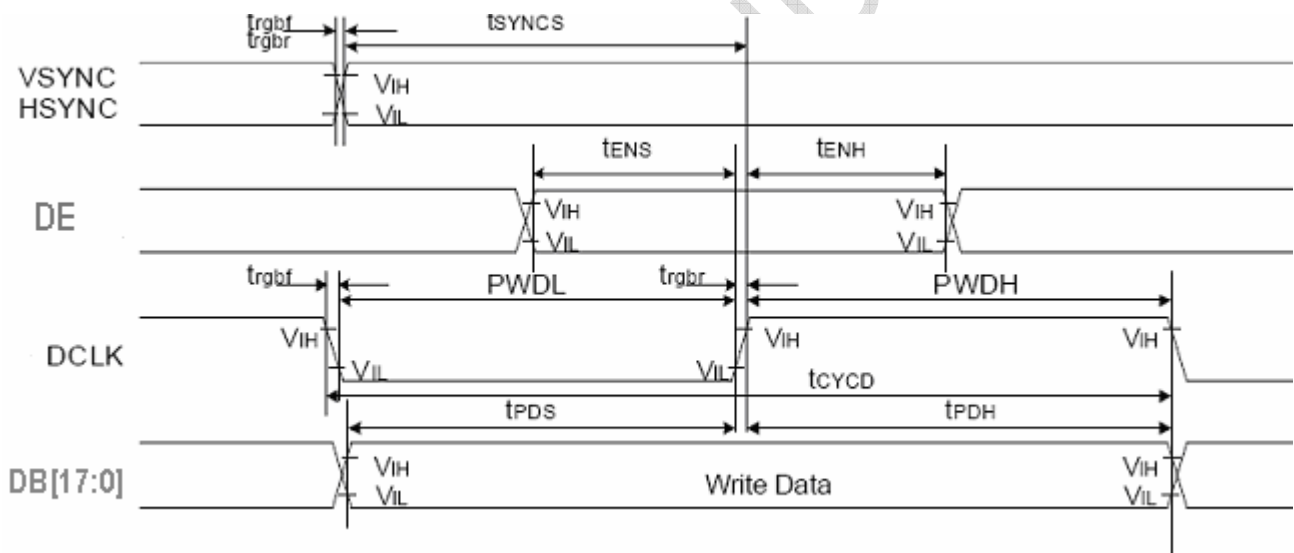
Figure 5.3 RGB Interface Timing

5.4 Power ON/OFF Sequence

5.4.1 Power ON Sequence

5.4.2 Power OFF Sequence

```
                    ┌─────────────────────┐
                    │   Normal Display    │
                    └─────────────────────┘
                               │
                               ▼
                    ┌─────────────────────┐
                    │   Set_display_off   │
                    │       (R28h)        │
                    └─────────────────────┘
                               │
                               ▼
                    ┌─────────────────────┐
                    │  Enter_sleep_mode   │
                    │       (R10h)        │
                    └─────────────────────┘
```

Wait for more than 2 frame

Power Supply OFF (VCI,IOVCC)

IOVCC   VCI

GND

IOVCC → VCI
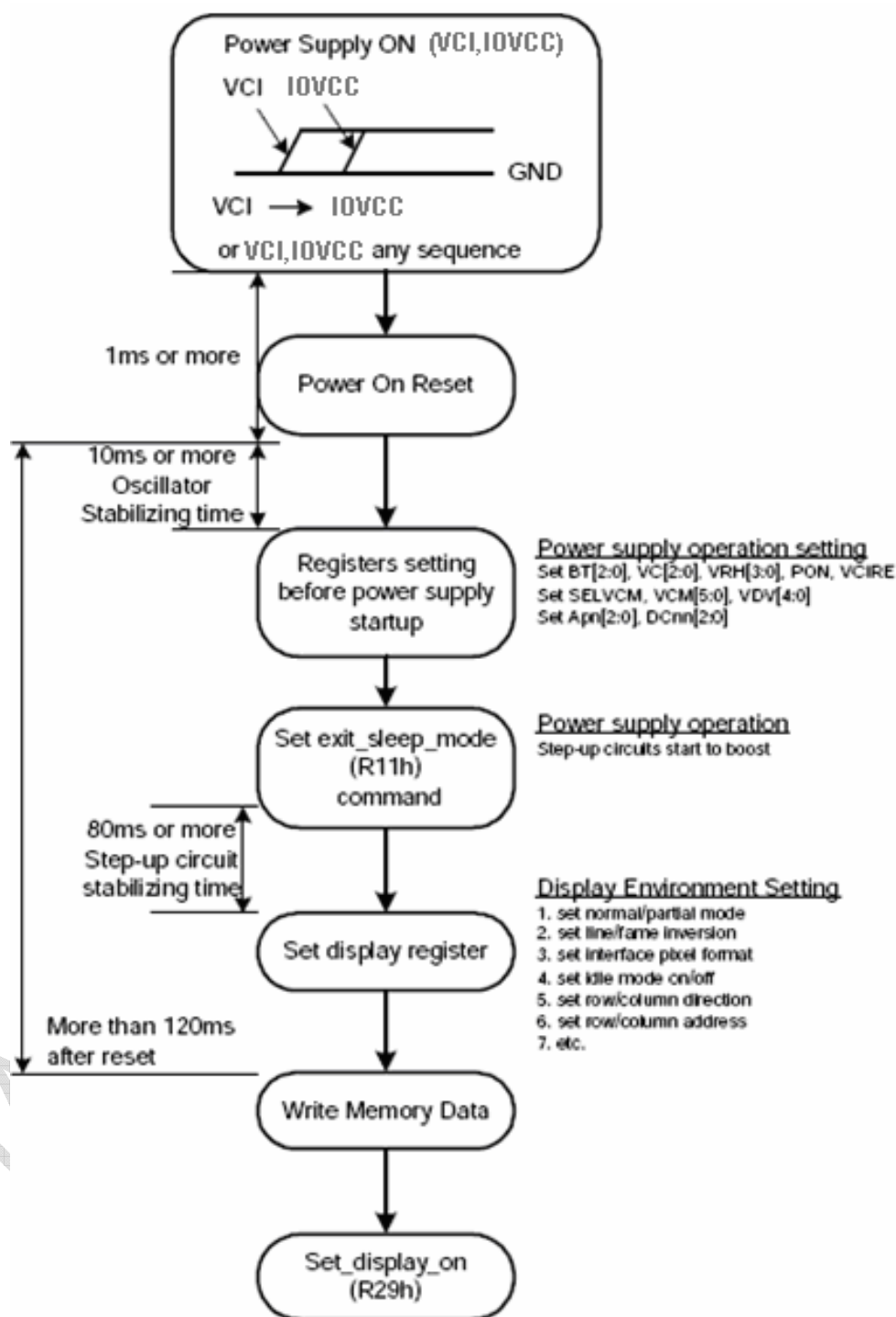
Or IOVCC,VCI any sequence
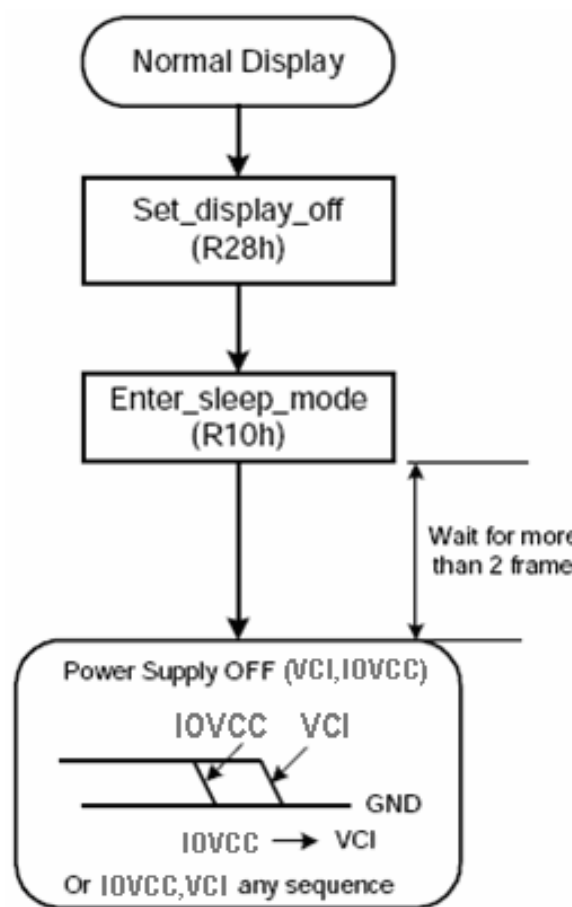
6. Optical Characteristics

| Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles		θT	CR ≧ 10	60	70	--	Degree	Note 2
		θB		60	70	--		
		θL		50	60	--		
		θR		60	70	--		
Contrast Ratio		CR	θ=0°	400	500	--		Note1、Note3
Response Time		T_{ON}	25℃	--	20	30	ms	Note1 Note4
		T_{OFF}						
Chromaticity	White	x	Backlight is on	0.250	0.300	0.350		Note5 Note1
		y		0.270	0.320	0.370		
	Red	x		0.520	0.570	0.620		
		y		0.295	0.345	0.395		
	Green	x		0.290	0.340	0.390		
		y		0.520	0.570	0.620		
	Blue	x		0.095	0.145	0.195		
		y		0.045	0.095	0.145		
Uniformity		U		75	80	--	%	Note1、Note6
NTSC				--	48	--	%	Note 5
Luminance		L		300	350	--	cd/m^2	Note1、Note7

Test Conditions:
1. I_F= 20mA(one channel), the ambient temperature is 25℃.
2. The test systems refer to Note 1 and Note 2.

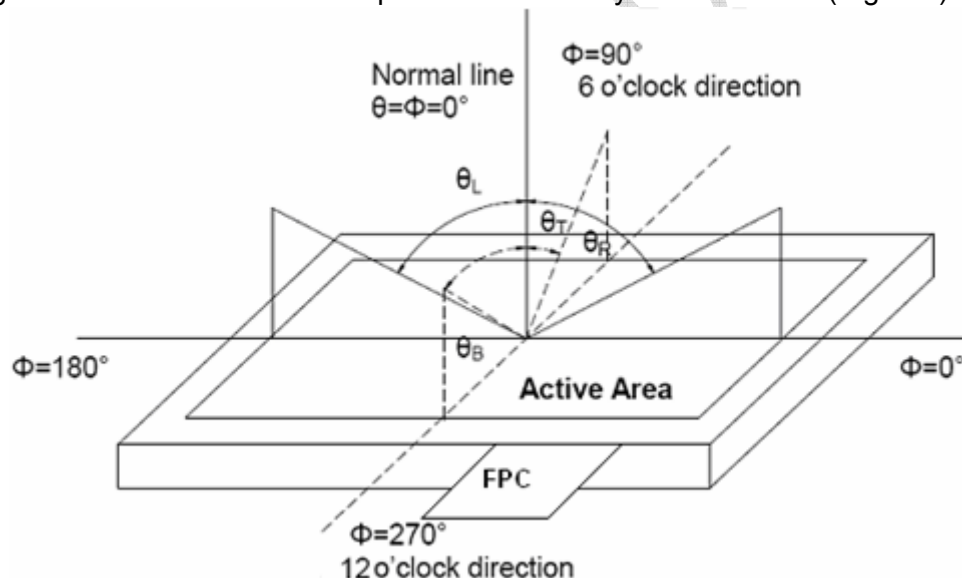Note 1: Definition of optical measurement system.

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.

Photo detector

Field

500mm

TFT-LCD Module

LCD Panel

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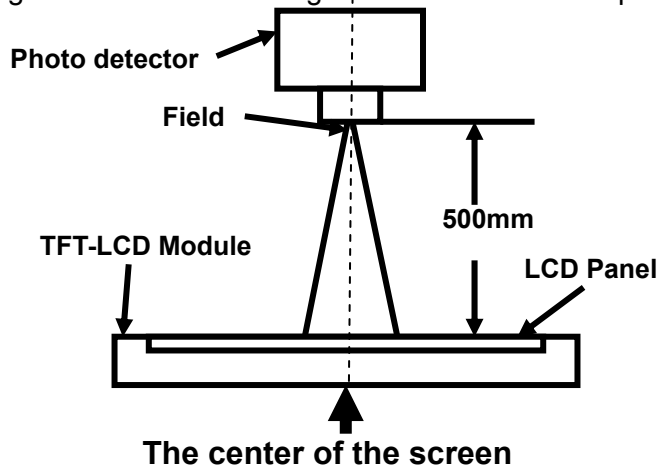
Item	Photo detector	Field
Contrast Ratio	SR-3A	1°
Luminance		
Chromaticity		
Lum Uniformity		
Response Time	BM-7A	2°

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)。

Normal line
θ=Φ=0°

Φ=90°
6 o'clock direction

θ_L

θ_T θ_R

Φ=180°

Φ=0°

θ_B

Active Area

FPC

Φ=270°
12 o'clock direction

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 Vwhite.

"Black state": The state is that the LCD should drive 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%.
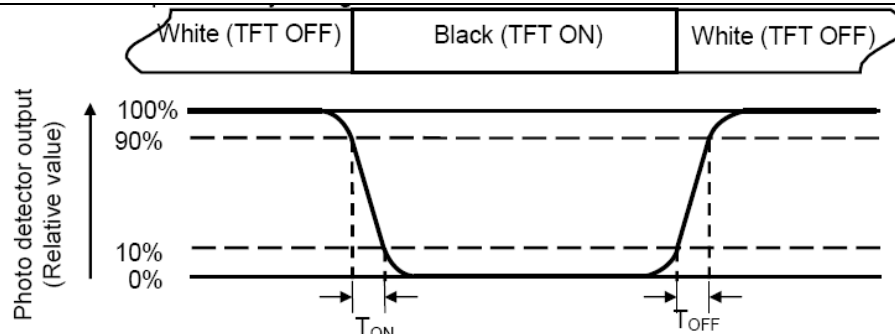
Note 5: Definition of color chromaticity (CIE1931)
Color coordinates measured at center point of LCD.
Note 6: Definition of Luminance Uniformity
Active area is divided into 9 measuring areas (Refer Fig. 2). Every measuring point is placed at the center of each measuring area.

　　Luminance Uniformity (U) = Lmin/ Lmax
　　L-------Active area length W----- Active area width
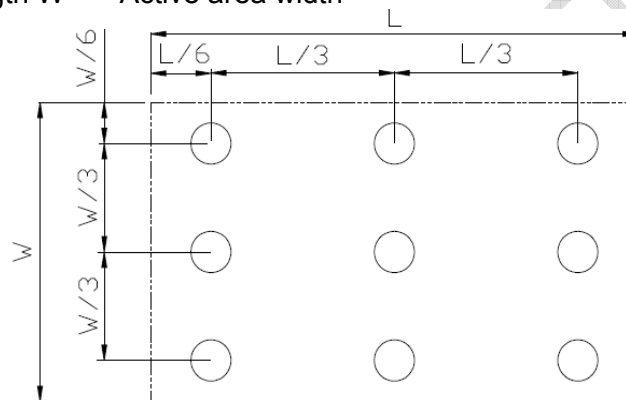
　　Lmax: The measured Maximum luminance of all measurement position.
　　Lmin: The measured Minimum luminance of all measurement position.
Note 7: Definition of Luminance:
Measure the luminance of white state at center point.

7. Environmental / Reliability Test

No	Test Item	Condition	Remarks
1	High Temperature Operation	Ts = +75℃, 240 hours	Note1 IEC60068-2-1,GB2423.2
2	Low Temperature Operation	Ta = -20℃, 240 hours	IEC60068-2-1 GB2423.1
3	High Temperature Storage	Ta = +80℃, 240 hours	IEC60068-2-1 GB2423.2
4	Low Temperature Storage	Ta = -30℃, 240 hours	IEC60068-2-1 GB2423.1
5	Storage at High Temperature and Humidity	Ta = +60℃, 90% RH max,240hours	Note2 IEC60068-2-78 GB/T2423.3
6	Thermal Shock (non-operation)	-30℃ 30 min~+70℃ 30 min, Change time:5min,30 Cycle.	Start with cold temperature, End with high temperature, IEC60068-2-14,GB2423.22
7	ESD	C=150pF,R=330Ω,5point/panel Air:±8Kv,5times; Contact:±4Kv,5times (Environment:15℃~35℃, 30%~60%.86Kpa~106Kpa)	IEC61000-4-2 GB/T17626.2
8	Vibration Test	Frequency range:10~55Hz,Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X.Y.Z.(package condition)	IEC60068-2-6 GB/T2423.10
9	Shock (Non-operation)	60G 6ms, ± X,± Y,± Z 3times for each direction	IEC60068-2-27 GB/T2423.5
10	Package Drop Test	Height:60cm, 1corner,3edges,6surfaces	IEC60068-2-32 GB/T2423.8

Note1:　Ts is the temperature of panel's surface.
Note2:　Ta is the ambient temperature of samples.

8. Mechanical Drawing

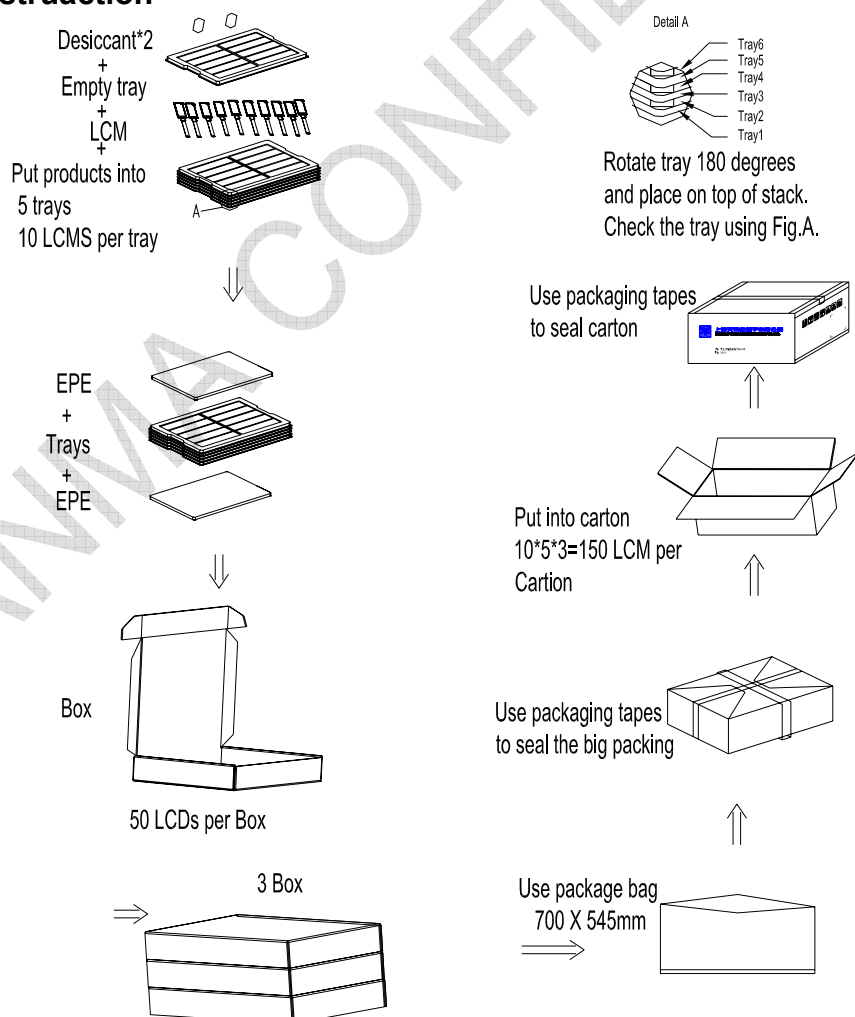| CH1		
1	IM0	
2	IM1	
3	IM2	
4	DB17	
5	DB16	
6	DB15	
7	DB14	
8	DB13	
9	DB12	
10	DB11	
11	DB10	
12	DB9	
13	DB8	
14	GND	
15	DB7	
16	DB6	
17	DB5	
18	DB4	
19	DB3	
20	DB2	
21	DB1	
22	DB0	
23	GND	
24	RD	
25	WR	
26	RS	
27	CS	
28	IOVCC	
29	VC1	
30	GND	
31	RESET	
32	DCLK	
33	GND	
34	DE	
35	HSYNC	
36	VSYNC	
37	DIN	
38	DOUT	
39	LED+	
40	LED-	

Notes:
1.General tolerance to be +/-0.3;
2.Operation Temperature:-20°C~75°C;
3.Storage Temperature:-30°C~80°C;
4.FPC recommended connector type:FH12-40S-0.5SH;
5.Gray scale inversion:3 o'clock;
6.Requirement on Environment Protection: Q/S0002.

51.76±0.3(LCM Outline)
46.56±0.3(Bezel Opening)
43.86±0.3(Active Area)
2.70±0.20
(42.85)
RGB
Resolution 480x272RGB
AA Center
3 O'clock
89.50±0.3(LCM Outline)
80.10±0.3(Bezel Opening)
77.40±0.3(Active Area)
115.00
0.30±0.05
7.00

insulated Tape covered upon the Soldering Area
See Detail A

DETAIL A
4:1
w=0.35
d=0.15
4.00
0.50
P0.50*(40-1)=19.50
20.50

LED CIRCUIT DIAGRAM
LED+o-
reference: IF=20mA & VF=19.8V
-o LED1-

CONTROL DIMENTION:
REFERENCE DIMENTION:
APPROVED: Wei Shu 2010/03/10
CHECKED: Wei Shu 2010/03/10
DESIGNED: Wallace Jiang 2010/03/10

Shanghai TianMa Micro-Electronics Co.,Ltd.
No.889 Huidong Rd.,Pudong New Area,Shanghai,China

MODEL NAME: TM035NDH01
PART NAME: LCM
DRAWING NUMBER: YGT1-00
METERIAL NUMBER: TM035NDH01-00

REV | DC/EC NUMBER | DESCRIPTION | DATE

3rd ANGLE
UNIT: mm
SCALE: 1:1
PAGE: 1/1

9.   Packing Drawing
9.1 Packaging Material

No	Item	Model(Material)	Dimensions (mm)	Unit Weigt (Kg)	Quantity	Remark
1	LCM module	TM035NDH01	89.50x51.76x2.70	TBD	150	
2	Desicant	Desicant	35x45	0.002	6	
3	Tray	PET（Transmit）	485x330x14	TBD	18	Anti-static
4	EPE	EPE	485x330x5	0.015	6	
5	Dust-Proof Bag	PE	700x545	0.03	1	
6	Box	Corrugated paper	520x345x74	0.350	3	
7	Carton	Corrugated paper	544x365x250	1.01	1	
8	Total weight	TBD				

Note: Packaging Specification and Quantity
1. LCD quantity per tray:2 row x 5column=10
2. Module quantity in a carton:15 traysx quantity per tray 10=150pcs

9.2 Packing Instruaction

Desiccant*2
+
Empty tray
+
LCM
+
Put products into
5 trays
10 LCMS per tray

Detail A

Tray6
Tray5
Tray4
Tray3
Tray2
Tray1

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

Use packaging tapes
to seal carton

EPE
+
Trays
+
EPE

Put into carton
10*5*3=150 LCM per
Cartion

Box

50 LCDs per Box

Use packaging tapes
to seal the big packing

3 Box

Use package bag
700 X 545mm

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

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.