MODEL NO. : TM024HDH64
ISSUED DATE: 2014-02-12
VERSION : Ver 1.5

□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	2012-01-29	Pre-spec release	Jin Zhao
1.1	2012-02-21	Update mechanical drawing	Jin Zhao
1.2	2012-5-10	Update mechanical drawing, packing	Jin Zhao
1.3	2012-6-12	Update the drawing	Jin Zhao
1.4	2013-4-3	Update the gray scale inversion direction	Jin Zhao
1.5	2014-2-12	Update mechanical drawing	Jin Zhao

1 General Specifications

Feature		Spec
Display Spec.	Size	2.4”
	Resolution	240(RGB)x320
	Interface	RGB 18 bits
	Driving IC	ILI9341
	Technology type	a-si TFT
	Pixel pitch (mm)	0.153 x 0.153
	Display colors	262K
	Pixel Configuration	RGB Vertical Stripe
	Display Mode	TM,NW
	Surface Treatment	Clear Type
	Gray Scale Inversion Direction	12 o’clock
	Viewing Direction	6 o’clock
Mechanical Characteristics	LCM (W x H x D) (mm)	42.72x60.26x2.15
	Active Area(mm)	36.72x48.96
	With /Without TSP	Without TP
	Weight (g)	11.25
	LED Numbers	4 Parallel

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 TERMINALS PIN ASSIGNMENT

No	Symbol	I/O	Description	Comment
1	GND	P	Ground	
2	VCI	P	Analog power supply	
3	VDDI	P	Digital power supply	
4	GND	P	Ground	
5	DB17	I	Data input	
6	DB16	I	Data input	
7	DB15	I	Data input	
8	DB14	I	Data input	
9	DB13	I	Data input	
10	DB12	I	Data input	
11	DB11	I	Data input	
12	DB10	I	Data input	
13	DB09	I	Data input	
14	DB08	I	Data input	
15	DB07	I	Data input	
16	DB06	I	Data input	
17	DB05	I	Data input	
18	DB04	I	Data input	
19	DB03	I	Data input	
20	DB02	I	Data input	
21	DB01	I	Data input	
22	DB00	I	Data input	
23	SDA	I/O	Serial data input/output signal	
24	DOTCLK	I	Dot clock signal for RGB interface operation	
25	DE	I	Data enable signal for RGB interface operation	
26	VSYNC	I	Frame synchronizing signal for RGB interface operation	
27	HSYNC	I	Line synchronizing signal for RGB interface operation	
28	SCL	I	Serial clock input signal The data is applied on the rising edge of the SCL signal	
29	CSX	I	Chip Select Signal	

30	RESX	I	Reset signal; Must be reset after power is supplied	
31	GND	P	Ground	
32	LEDA	P	Back light anode LEDA	
33	LED K1	P	Back light cathode LEDK1	
34	LED K2	P	Back light cathode LEDK2	
35	LED K3	P	Back light cathode LEDK3	
36	LED K4	P	Back light cathode LEDK4	

Table 2.1 Input terminal pin assignment

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

3 ABSOLUTE MAXIMUM RATINGS

Ta = 25℃

Item	Symbol	MIN	MAX	Unit	Remark
Supply Voltage	VCI	-0.3	4.6	V	
Supply Voltage	VDDI	-0.3	4.6	V	
Input voltage	DB[17:0],SDA,DOTCLK,DE,VSYNC, HSYNC,SCL,CSX,RESX	-0.3	VDDI+0.3	V	
Back Light Forward Current	I_F	-	25	mA	ONE LED
Operating Tempera-ture	Top	-20	70	℃	
Storage Temperature	Tst	-30	80	℃	

Table 3.1 Absolute maximum rating

4 ELECTRICAL CHARACTERISTICS

4.1 LCD Module

GND=0V,Ta=25℃

Item		Symbol	MIN	TYP	MAX	Unit	Remark
Supply Voltage		VCI	2.5	2.8	3.3	V	
Supply Voltage		VDDI	1.65	2.8	3.3	V	
Input Signal Voltage	High Level	VIH	0.7 VDDI	-	VDDI	V	
	Low Level	VIL	0	-	0.3 VDDI	V	
Output Signal Voltage	High Level	VOH	0.8 VDDI	-	VDDI	V	
	Low Level	VOL	0	-	0.2 VDDI	V	
(Panel+LSI) Power Consumption		Black Mode	-	-	11.7	mA	VCI=2.8V
		Sleeping Mode	-	-	40.5	uA	VCI=2.8V

Table 4.1 LCD module electrical characteristics

4.2 Backlight Unit

Ta=25℃

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Forward Current	I_F	-	20	-	mA	One LED
Forward Voltage	V_F	(2.9)	3.2	(3.4)	V	One LED
Backlight Power Consumption	W_{BL}	-	256	-	mW	4 LEDs

Table 4.2.1 backlight unit electrical characteristics

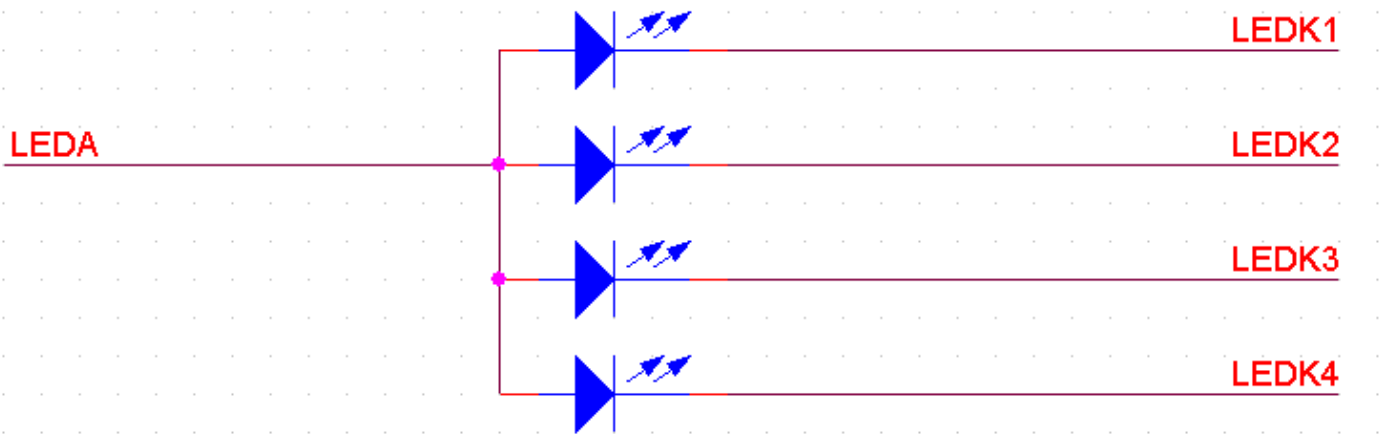


Figure 4.2.1 LED backlight circuit

4.3 Block Diagram

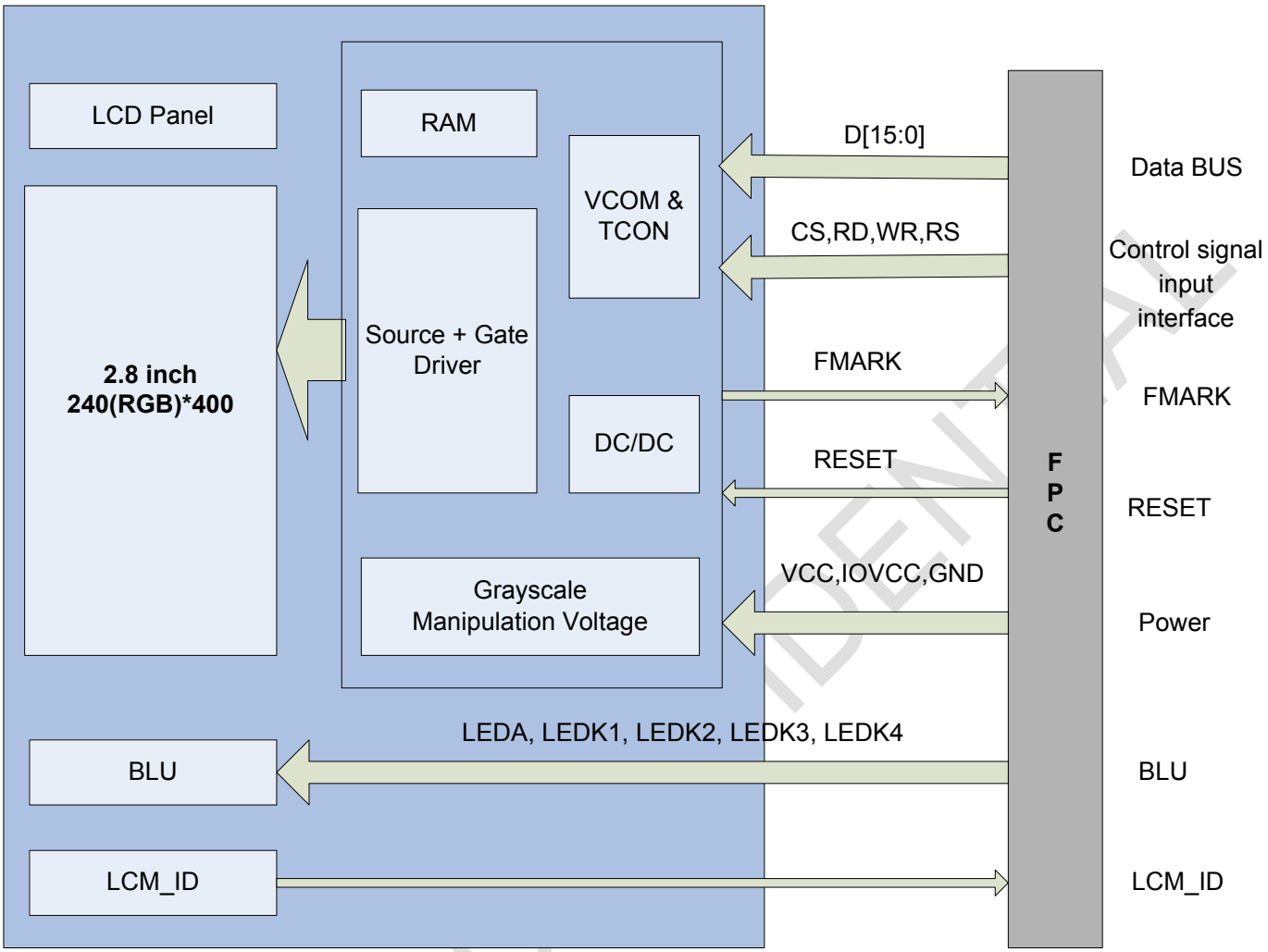
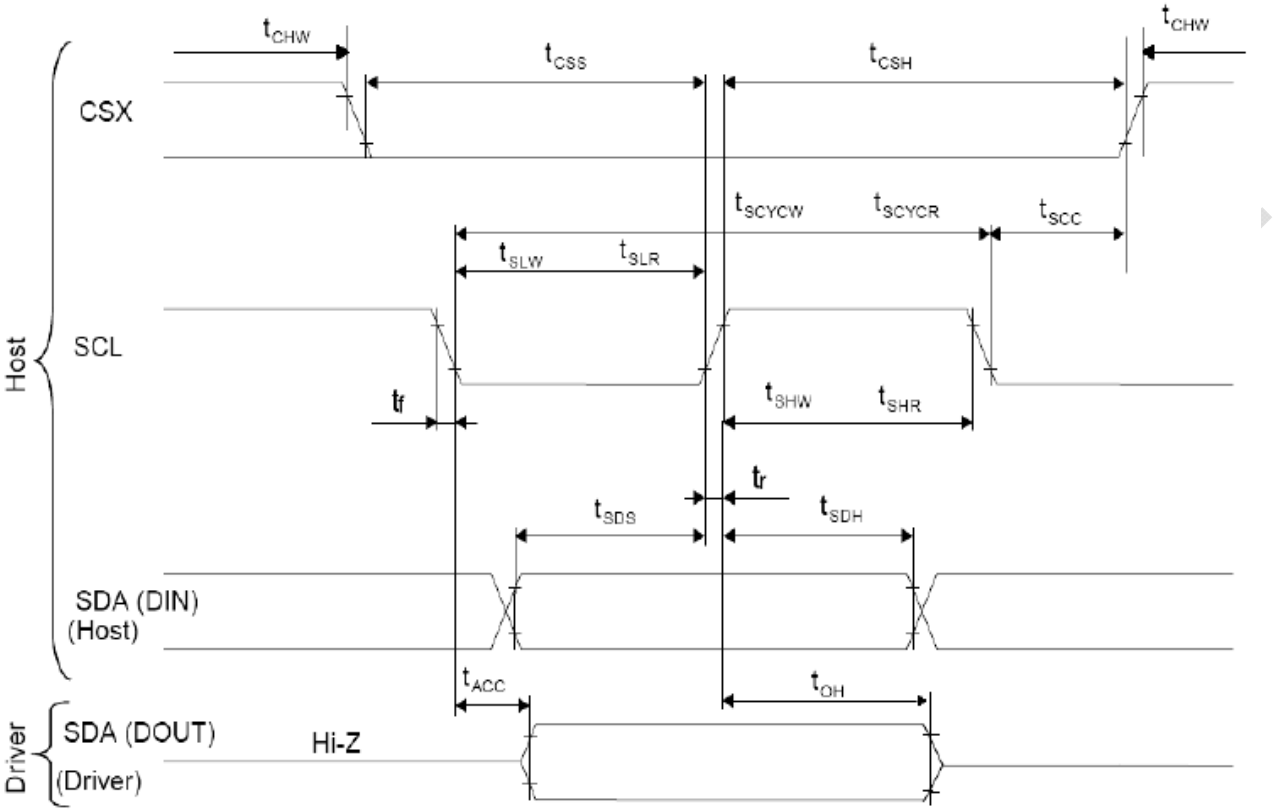


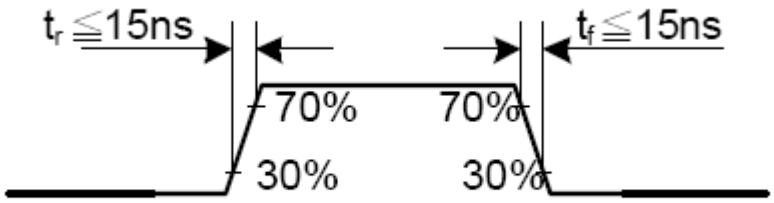
Figure 4.3 LCD module diagram

5 INTERFACE TIMING

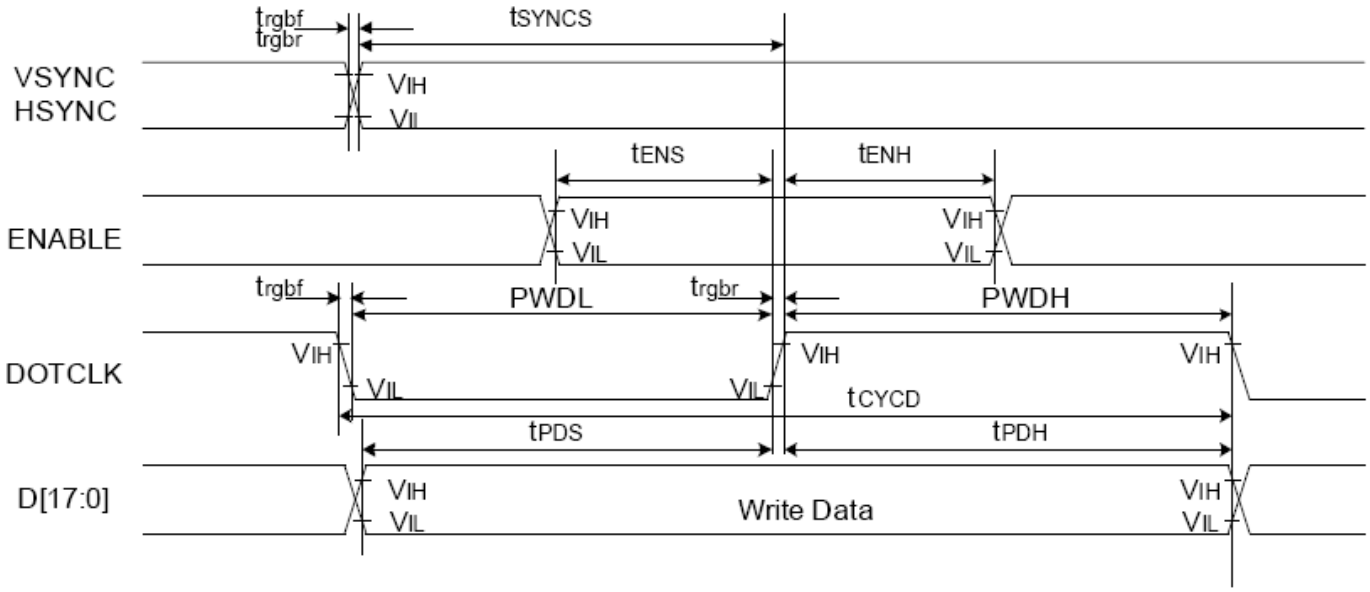
5.1Display Serial Interface Timing Characteristics (3-line SPI system)



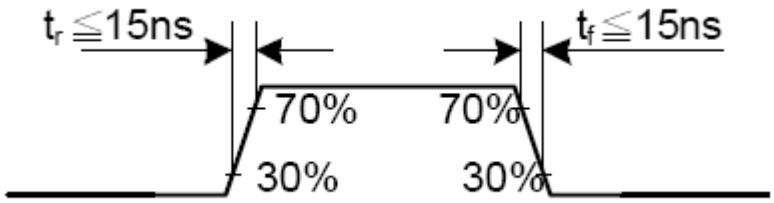
Signal	Symbol	Parameter	Min	max	unit	description
SCL	tscycw	Serial Clock Cycle (Write)	100	-	ns	
	tshw	SCL “H” Pulse Width (Write)	40	-	ns	
	tslw	SCL “L” Pulse Width (Write)	40	-	ns	
	tscycr	Serial Clock Cycle (Read)	150	-	ns	
	tshr	SCL “H” Pulse Width (Read)	60	-	ns	
	tslr	SCL “L” Pulse Width (Read)	60	-	ns	
SDA(INPUT)	tsds	Data setup time (Write)	30	-	ns	
	tsdh	Data hold time (Write)	30	-	ns	
SDA(Output)	tacc	Access time (Read)	10	-	ns	
	toh	Output disable time (Read)	10	50	ns	
CSX	tscc	SCL-CSX	20	-	ns	
	tchw	CSX “H” Pulse Width	40	-	ns	
	tcss	CSX-SCL Time	60	-	ns	
	tcsh		65	-	ns	



5.2Parallel 18bit RGB Interface Timing Characteristics

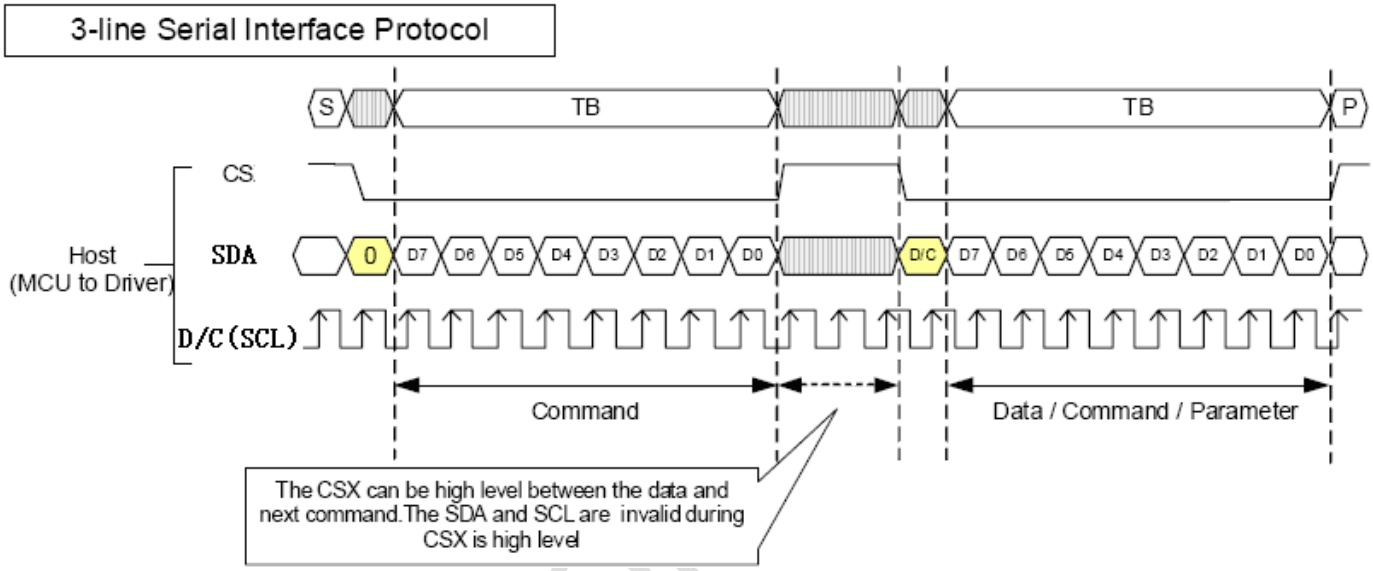


SIGNAL	SYMBOL	PARAMETER	min	max	Unit	Description
VSYNC/HSYNC	tSYNCS	VSYNC/HSYNC setup time	15	-	ns	18 bit bus RGB interface mode
	tSYNCH	VSYNC/HSYNC hold time	15	-	ns	
DE(ENABLE)	tENS	DE setup time	15	-	ns	
	tENH	DE hold time	15	-	ns	
DB[17:0]	tPDS	Data setup time	15	-	ns	
	tPDH	Data hold time	15	-	ns	
DOTCLK	PWDH	DOTCLK high-level period	15	-	ns	
	PWDL	DOTCLK low-level period	15	-	ns	
	tCYCD	DOTCLK cycle time	100	-	ns	
	trgbr,trgbf	DOTCLK,HSYNC,VSYNC rise/fall time	-	15	ns	

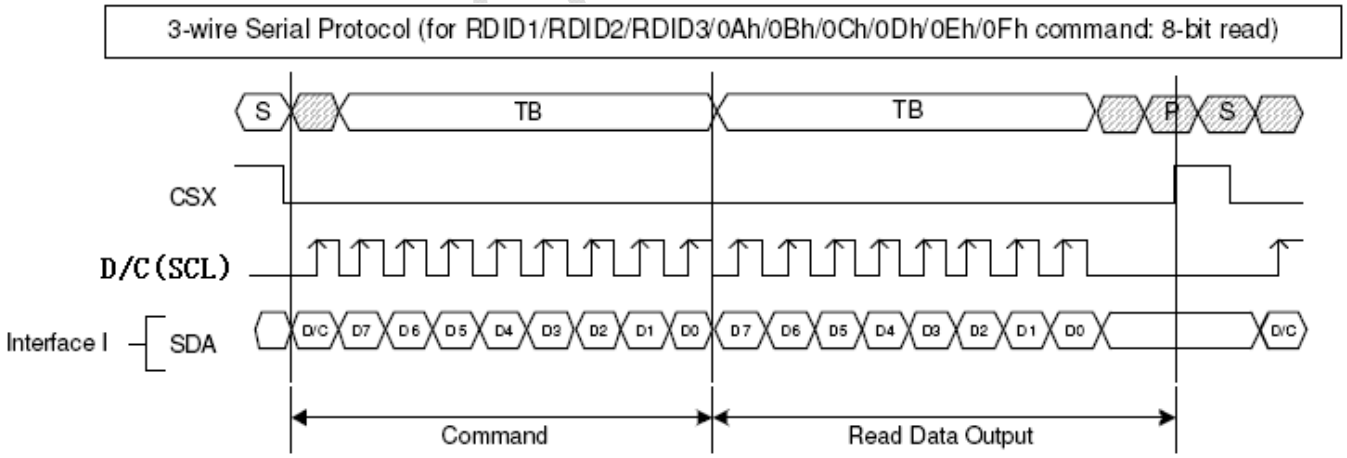


5.3 Interface Register Write/Read Timing

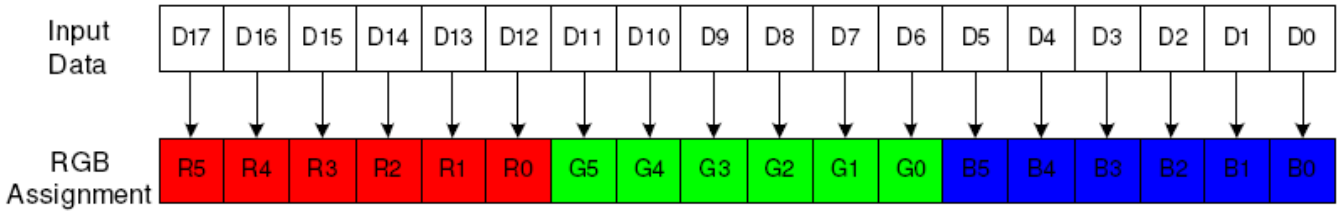
5.3.1 System Bus Interface Register Write Timing



5.3.2 System Bus Interface Register Read Timing



5.4 18-BIT RGB Interface for transfer RGB Data



5.5Reset Timing Characteristics

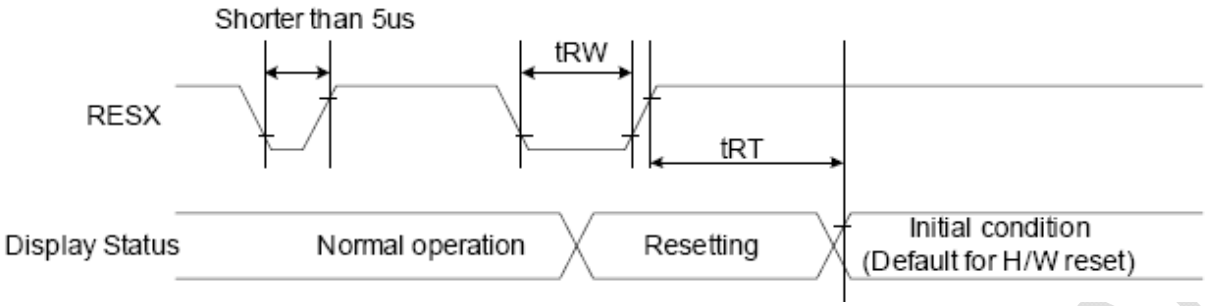


Figure 5.6.1 Reset Input Timing

Signal	Symbol	Parameter	Min	Max	Unit
RESX	tRW	Reset pulse duration	10		uS
	tRT	Reset cancel		5(note1,5)	mS
				120(nte1,6,7)	mS

Table 5.6.1 Reset Timing Parameters

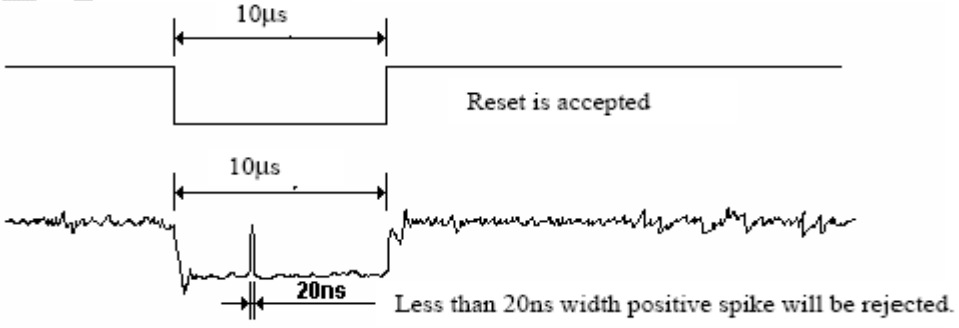
Note 1: The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from NV memory to registers. This loading is done every time when there is HW reset cancel time (tRT) within 5 ms after a rising edge of RESX.

Note 2: Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the table below:

RESX	Action
Shorter than 5us	Reset Rejected
Longer than 10us	Reset
Between 5us and 10us	Reset starts

Note 3: During the Resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120 ms, when Reset Starts in Sleep Out –mode. The display remains the blankstate in Sleep In -mode.) And then return to Default condition for Hardware Reset.

Note 4: Spike Rejection also applies during a valid reset pulse as shown below:

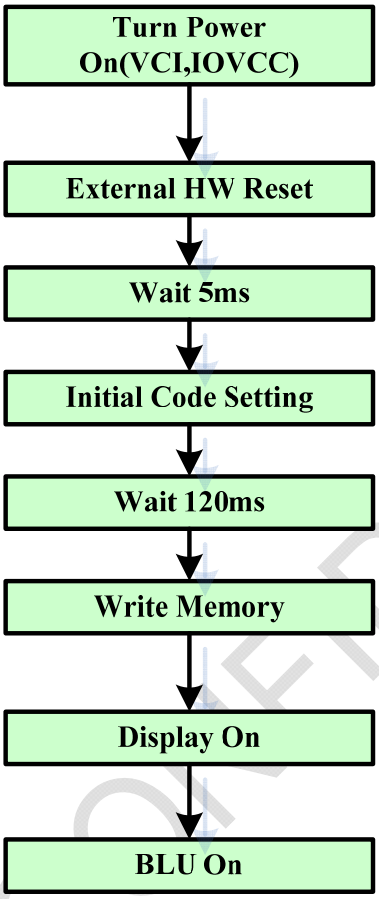


Note 5: When Reset applied during Sleep In Mode.

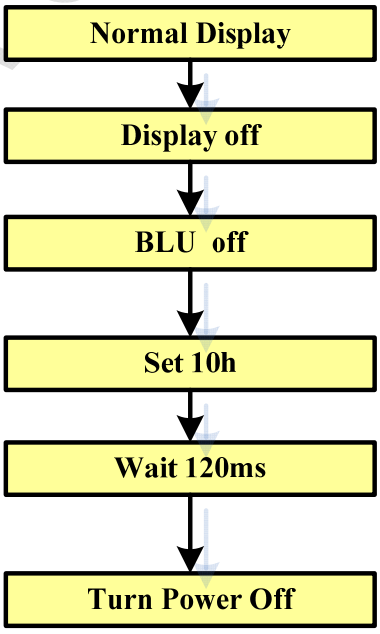
Note 6: When Reset applied during Sleep Out Mode.

Note 7: It is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120msec.

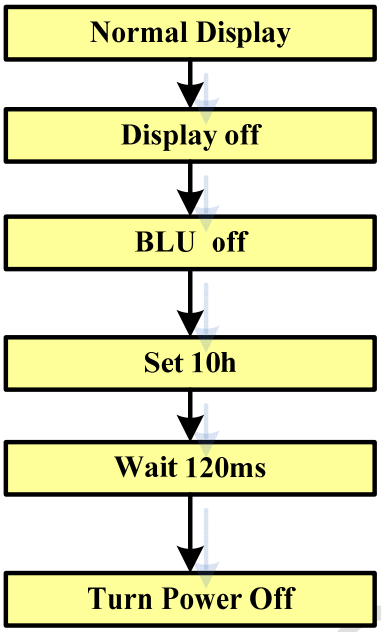
5.4 Power on Sequence



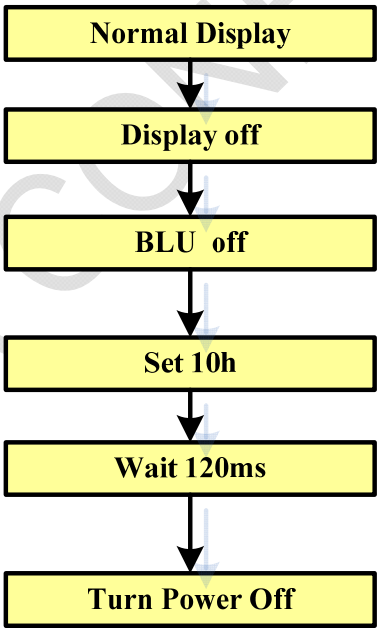
5.5 Power off Sequence



5.6 Enter SleepIn Mode Sequence



5.7 Exit SleepIn Mode Sequence



6 Optical Characteristics

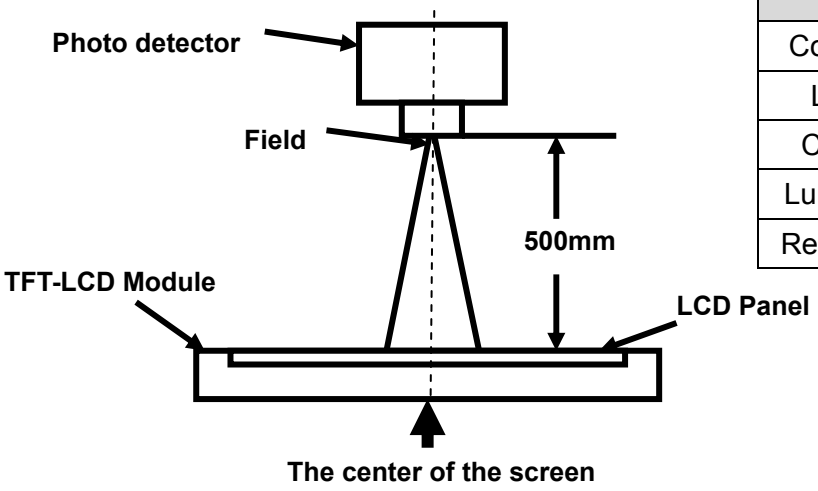
Item		Symbol	Condition	Min	Typ.	Max.	Unit	Remark
View Angles		θT	CR≧10	60	70	-	Degree	Note 2
		θB		50	60	-		
		θL		60	70	-		
		θR		60	70	-		
Contrast Ratio		CR	θ=0°	400	500	-	-	Note1,3
Response Time		Ton	25℃	-	20	30	ms	Note1,4
		Toff						
Chromaticity	White	x	-	0.255	0.305	0.355	-	Note1,5
		y		0.285	0.335	0.385		
	RED	x		0.542	0.592	0.642		
		y		0.279	0.329	0.379		
	GREEN	x		0.299	0.349	0.399		
		y		0.535	0.585	0.635		
	BLUE	x		0.103	0.153	0.203		
		y		0.056	0.106	0.156		
Uniformity		U	-	-	80%	-	%	Note1,6
NTSC		-	-	-	50%	-	%	Note 5
Luminance		L	-	180	220	-	cd/m2	Note1,7

Test Conditions:

1. VDD=3.3V, I_L=20mA(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)。

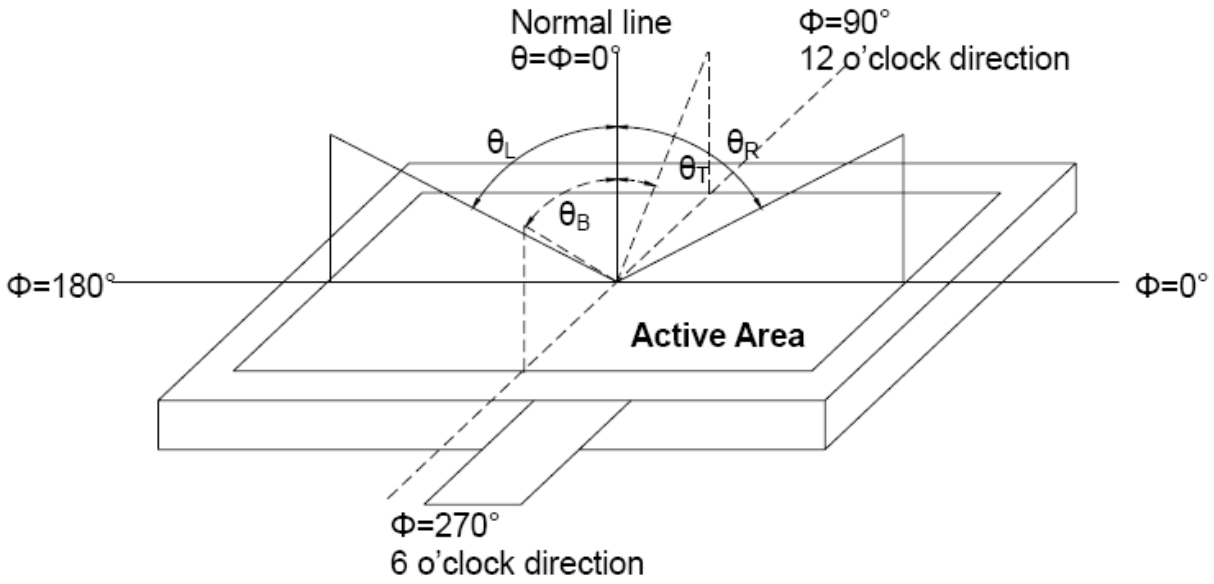


Fig. 1 Definition of viewing angle

Note 3: Definition of contrast ratio

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

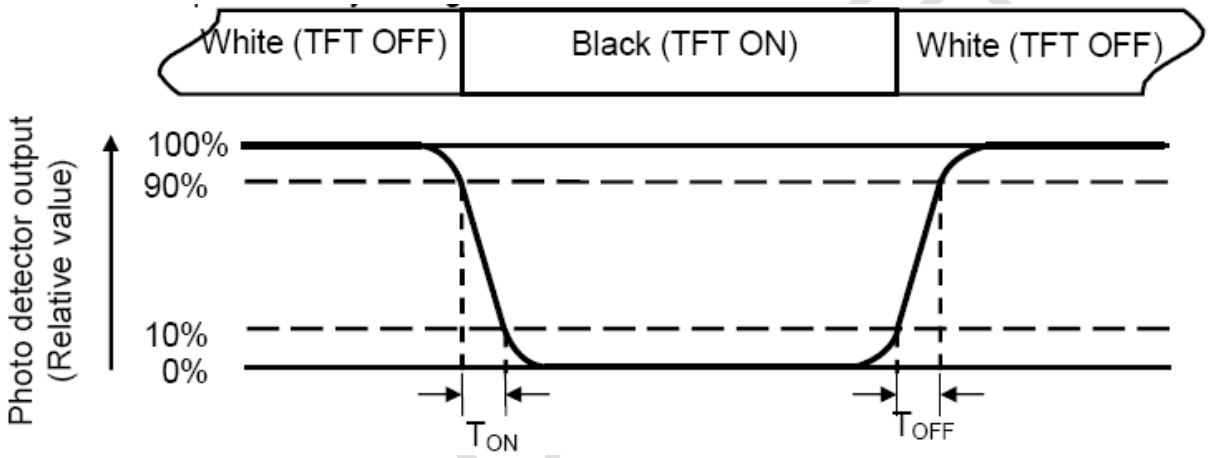
"White state ":The state is that the LCD is driven by $\mathbf{V}_{white}$.

"Black state": The state is that the LCD is driven by $\mathbf{V}_{black}$.

$\mathbf{V}_{white}$: To be determined $\mathbf{V}_{black}$: 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 (TON) is the time between photo detector output intensity changed from 90% to 10%. And fall time (TOFF) 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

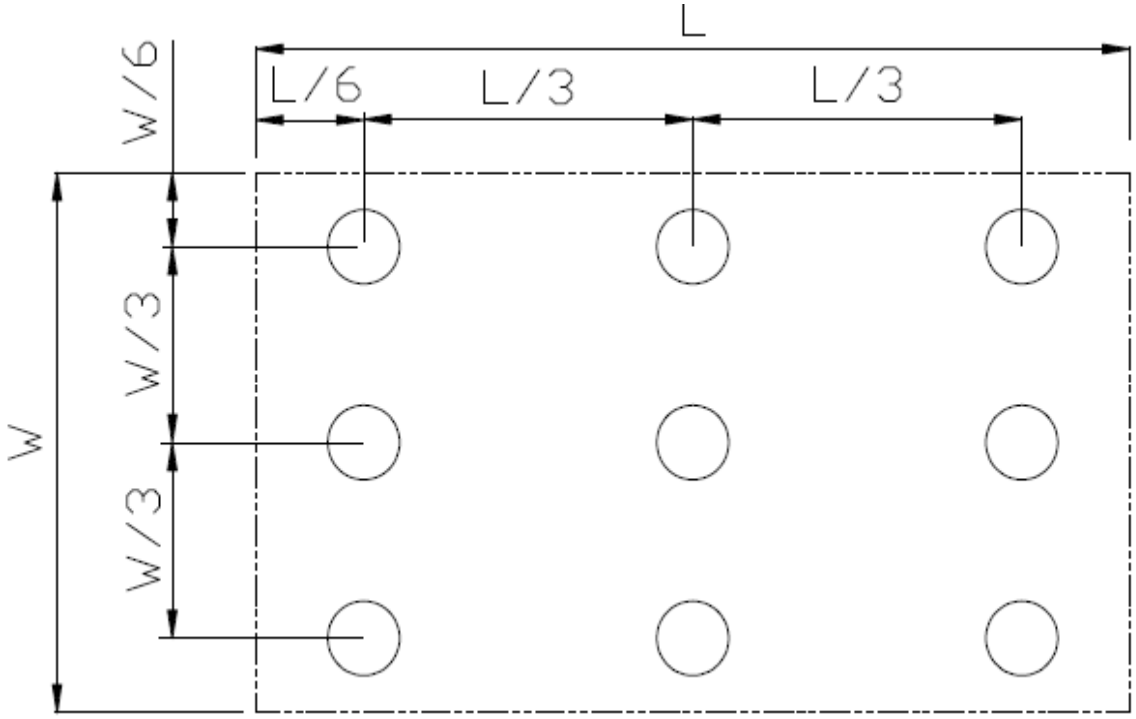


Fig. 2 Definition of uniformity

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

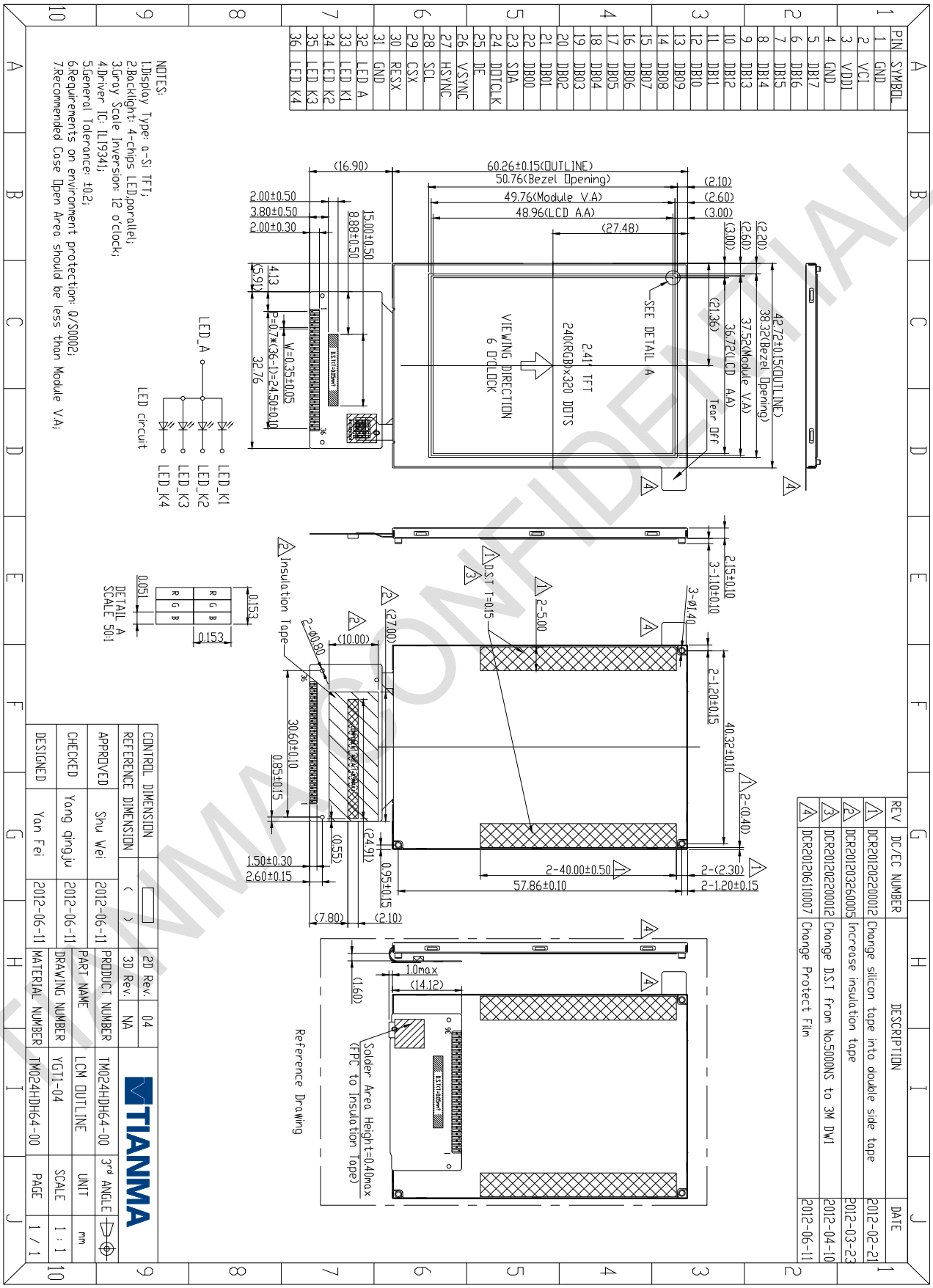
7 Environmental / Reliability Tests

No	Test Item	Condition	Remarks
1	High Temperature Operation	Ts=+70℃, 240hrs	Note1 IEC60068-2-1,GB2423.2
2	Low Temperature Operation	Ta=-20℃, 240hrs	IEC60068-2-1 GB2423.1
3	High Temperature Storage	Ta=+80℃, 240hrs	IEC60068-2-1 GB2423.2
4	Low Temperature Storage	Ta=-30℃, 240hrs	IEC60068-2-1 GB2423.1
5	High Temperature & High Humidity Storage	Ta=+60℃, 90% RH 240 hours	Note2 IEC60068-2-78 GB/T2423.3
6	Thermal Shock (Non-operation)	-30℃ 30 min~+70℃ 30 min, Change time:5min, 20 Cycles	Start with cold temperature, End with high temperature, IEC60068-2-14,GB2423.22
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
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
9	Shock (Non-operation)	60G 6ms, ±X,±Y,±Z 3times, for each direction	IEC60068-2-27 GB/T2423.5
10	Package Drop Test	Height:80 cm, 1 corner, 3 edges, 6 surfaces	IEC60068-2-32 GB/T2423.8

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

Note2: Ta is the ambient temperature of sample.

8 Mechanical Drawing

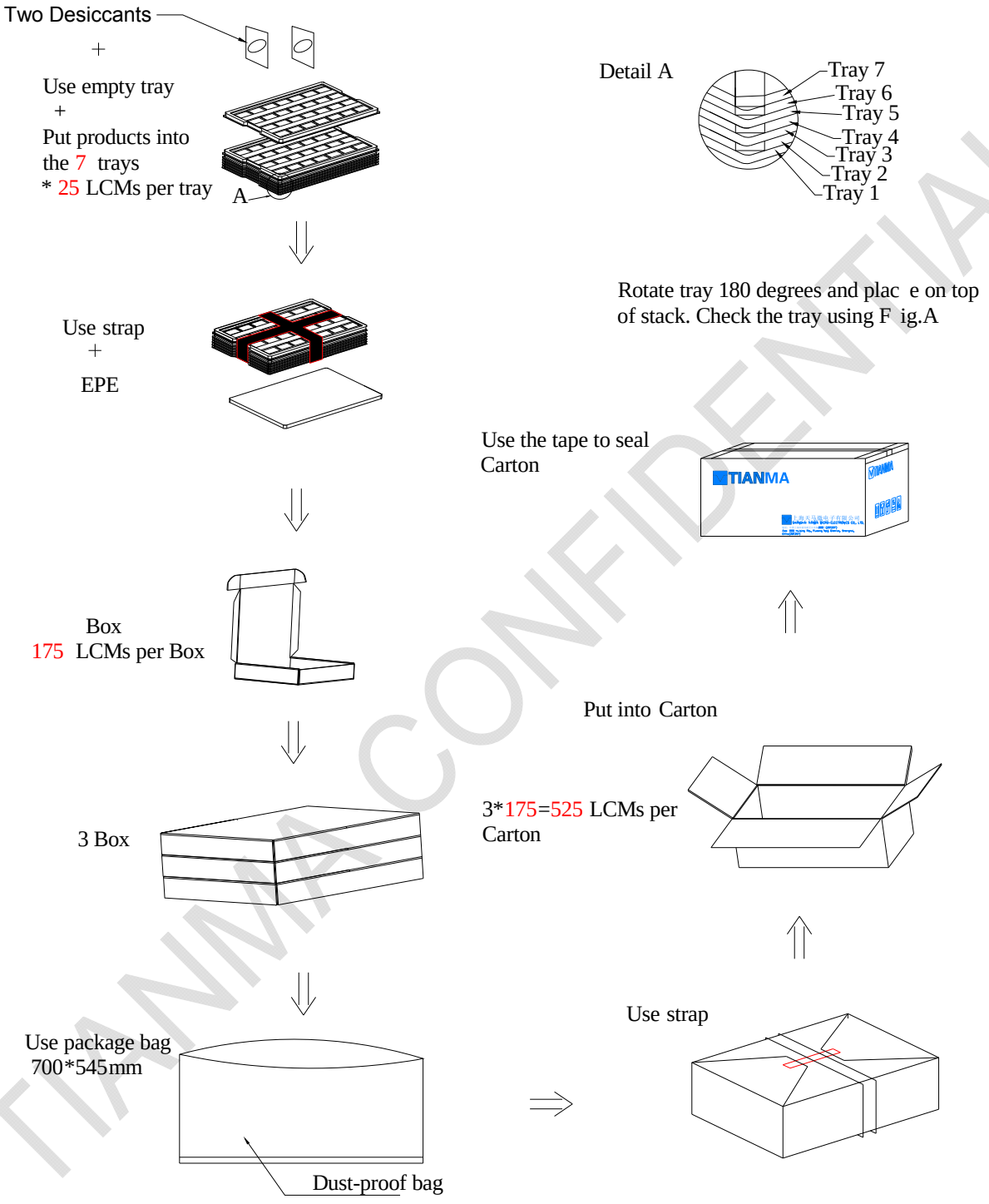


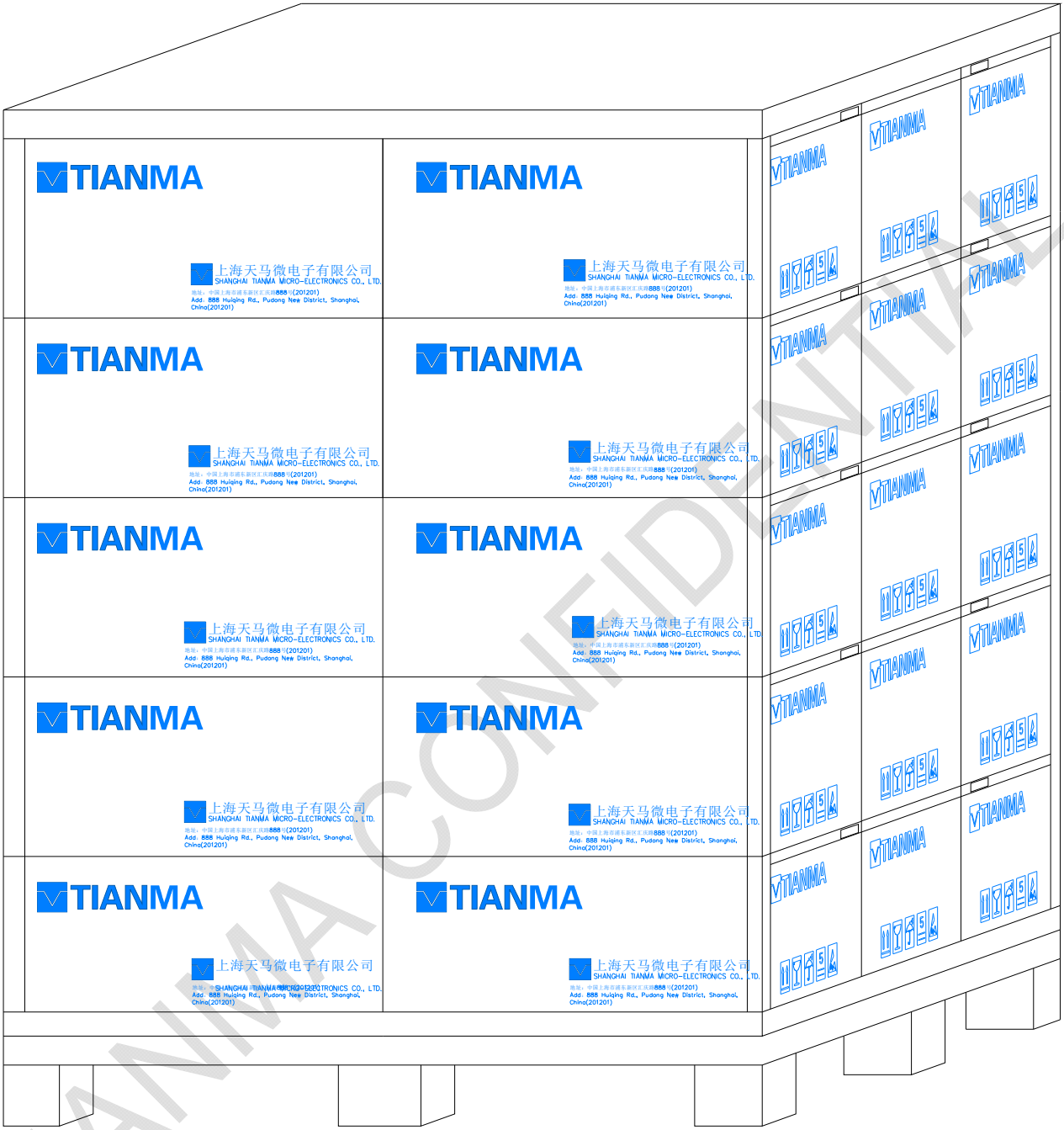
9 Packaging Drawing

9.1 Packaging flow

No	Item	Model (Material)	Dimen-sions(mm)	Unit Weight(Kg)	Quantity	Remark
1	LCM module	TM024HDH64	42.72x60.26x2.15	0.01125	525	
2	Tray	PET（Transmit）	485x330x13.8	0.17	24	Anti-static
3	Dust-proof bag	PE	700x545	0.05	1	
4	BOX	Corrugated Paper	520x345x74	0.44	3	
5	Desiccant	Desiccant	45x35	0.002	6	
6	Carton	Corrugated Paper	544x365x250	1.01	1	
7	EPE	EPE	485x330x5	0.0183	3	
8	Total weight（Kg）	12.43Kg+/-5%				

9.2 Packaging flow





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.

a. Be sure to ground the body when handling the LCD Modules.

b. Tools required for assembly, such as soldering irons, must be properly ground.

c. To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

d. 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.