MODEL NO. : TM023KDH18

ISSUED DATE: 2010-05-21

VERSION : 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

Record of Revision

Rev	Issued Date	Description	Editor
1.0	2010-05-21	Preliminary Release	Qiuping Yang

1. General Specifications

Feature		Spec
Display Spec	Size	2.3 inch
	Resolution	320(RGB) x 240
	Interface	CPU 16 bits
	Color Depth	65K/262K
	Technology Type	a-Si
	Pixel Pitch (mm)	0.1461x 0.1461
	Pixel Configuration	R.G.B Vertical Stripe
	Display Mode	TM with Normally White
	Surface Treatment(Up Polarizer)	Clear Type
	Viewing Direction	6 o'clock
	Gray Scale Inversion Direction	12 o'clock
Mechanical Characteristics	LCM (W x H x D) (mm)	50.90x45.80x2.25
	Active Area(mm)	46.75x35.06
	With /Without TSP	Without TSP
	Weight (g)	TBD
	LED Numbers	4 LED
Electronic	Driver IC	ILI9342

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 TFT LCD Panel

No	Symbol	I/O	Description	Remark
1	LEDK	P	LED Cathode	
2	LEDA4	P	LED Anode	
3	LEDA3	P	LED Anode	
4	LEDA2	P	LED Anode	
5	LEDA1	P	LED Anode	
6	GND	P	Power Ground	
7	RESET	I	A RESET signal	
8	DB15	I	Data input	
9	DB14	I	Data input	
10	DB13	I	Data input	
11	DB12	I	Data input	
12	DB11	I	Data input	
13	DB10	I	Data input	
14	DB9	I	Data input	
15	DB8	I	Data input	
16	DB7	I	Data input	
17	DB6	I	Data input	
18	DB5	I	Data input	
19	DB4	I	Data input	
20	DB3	I	Data input	
21	DB2	I	Data input	
22	DB1	I	Data input	
23	DB0	I	Data input	
24	NC	--	No connection	
25	RD	I	A read strobe signal and enables an operation to read out data when the signal is low.	
26	WR	I	A write strobe signal and enables an operation to write data when the signal is low.	
27	RS	I	A register select signal	
28	CS	I	A chip select signal	
29	IOVCC	P	Digital power supply	
30	VCC	P	Analog power supply	
31	VCI	P	Analog power supply	

No	Symbol	I/O	Description	Remark
32	GND	P	Power Ground	
33	NC	--	No connection	
34	NC	--	No connection	
35	NC	--	No connection	
36	NC	--	No connection	

Table 2.1 input terminal pin assignment

Note: 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
Logic Supply Voltage	IOVCC	-0.3	3.3	V	
Analog Supply Voltage	VCI/VCC	-0.3	4.8	V	
Input Signal Voltage	DB0~DB15, WR, RS, CS, RESET, RD	-0.3	IOVCC +0.3	V	
Back Light Forward Current	I_{LED}	--	25	mA	
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℃

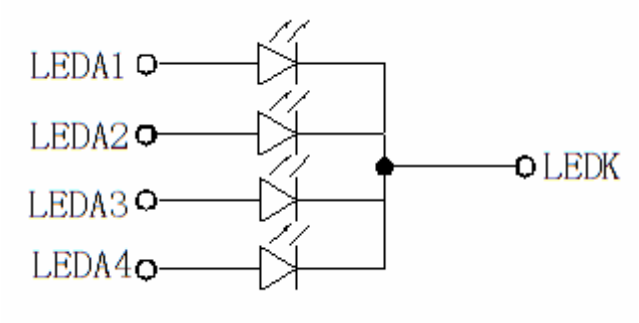
Item		Symbol	Min	Typ	Max	Unit	Remark
Logic Supply Voltage		IOVCC	1.65	2.8	3.3	V	
Analog Supply Voltage		VCI	2.3	2.8	4.8	V	
Input Signal Voltage	Low Level	V_{IL}	GND	--	0.2xIOVCC	V	DB0~DB15, WR, RS, CS, RESET, RD
	High Level	V_{IH}	0.8xIOVCC	--	IOVCC	V	
Output Signal Voltage	Low Level	V_{OL}	GND	--	0.2xIOVCC	V	
	High Level	V_{OH}	0.8xIOVCC	--	IOVCC	V	
(Panel+ LSI) Power Consumption		Black Mode (60Hz)	--	TBD	--	mW	
		Sleeping Mode	--	TBD	--	mW	

Note: We will provide the power consumption after we test the samples.

4.2 Driving Backlight Ta=25℃

Item	Symbol	Min	Typ	Max	Unit	Remark
Forward Current	I_F	--	15	25	mA	
Forward Voltage	V_F	--	3.2	--	V	4 LEDs in parallel
Power Consumption	W_{BL}	--	192	--	mW	

Note1: Figure below shows the connection of backlight LED.



Note 2: One LED: I_F =15 mA, V_F =3.2V

Note 3:

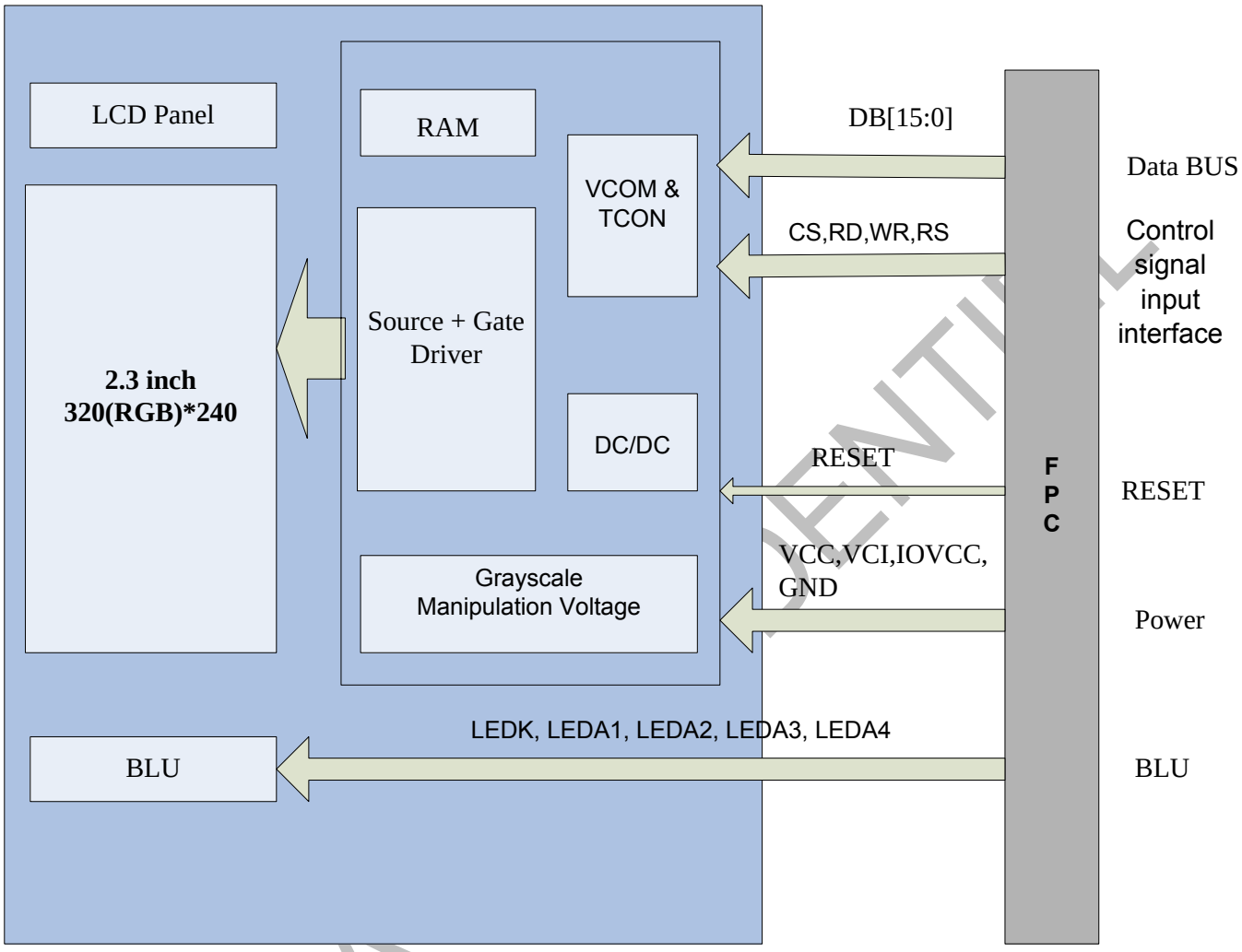
IF is defined for one channel LED.

Optical performance should be evaluated at Ta=25℃ only.

If LED is driven by high current, high ambient temperature & humidity condition. The life time of LED will be reduced.

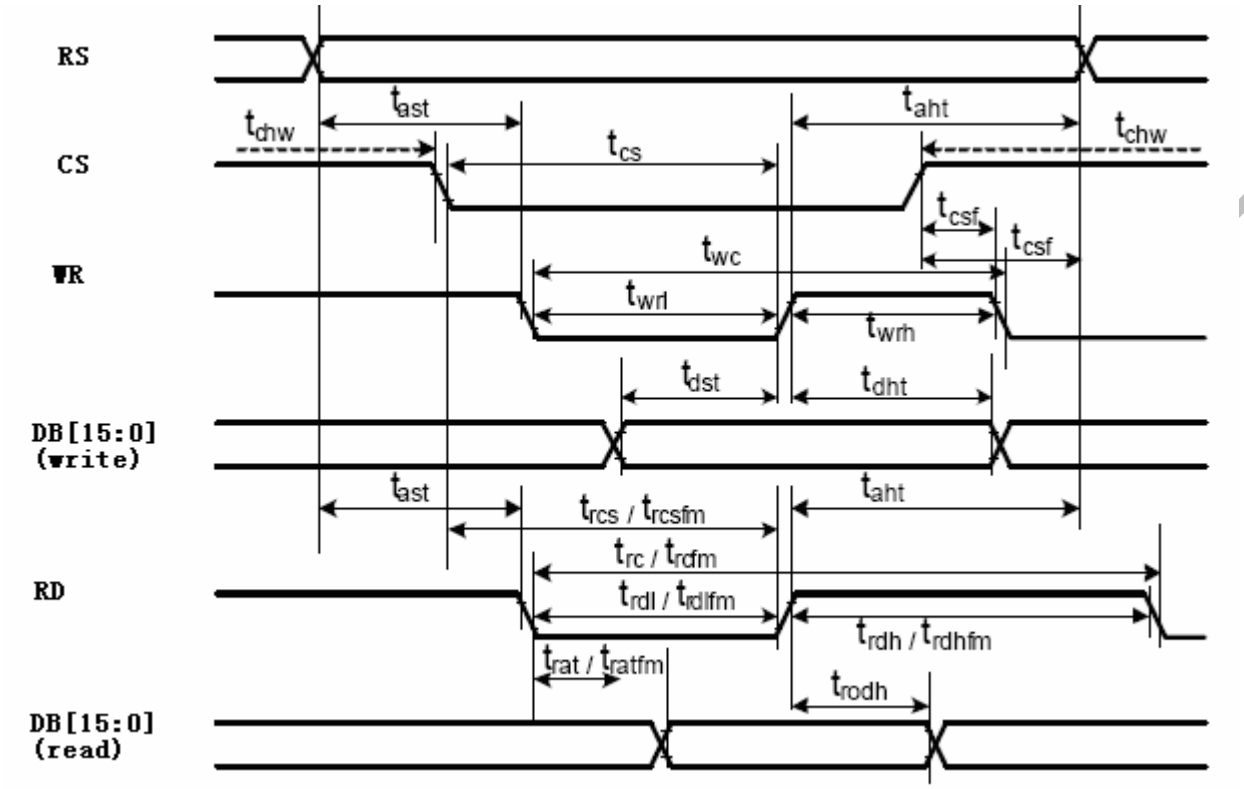
Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.

4.3 Block Diagram



5. Timing Chart

5.1 Interface Characteristics



5.2 Interface Timing Parameters

Normal Write Mode

Signal	Symbol	Parameter	Spec			Description
			Min	Max	Unit	
RS	t_{AST}	Address setup time	0	-	ns	-
	t_{AHT}	Address hold time(Write/Read)	10			
CS	t_{CHW}	Chip select “H” pulse width	0	-	ns	-
	t_{CS}	Chip select setup time (Write)	15			
	t_{RCS}	Chip select setup time (Read ID)	45			
	t_{RCSFM}	Chip select setup time (Read FM)	355			
	t_{CSF}	Chip select wait time(Write/Read)	10			
WR	t_{WC}	Write cycle	65	-	ns	-
	t_{WRH}	Control pulse “H” duration	15			
	t_{WRL}	Control pulse “L” duration	15			
RD（ID）	t_{RC}	Read cycle (ID)	160	-	ns	When read ID data
	t_{RDH}	Control pulse “H” duration (ID)	90			
	t_{RDL}	Control pulse “L” duration (ID)	45			
RD（FM）	t_{RCFM}	Read cycle (FM)	450	-	ns	When read from frame memory
	t_{RDHFM}	Control pulse “H” duration (FM)	90			
	t_{RDLFM}	Control pulse “L” duration (FM)	355			
DB[15:0],	t_{DST}	Data setup time	10	-	ns	For maximum C_L=30pF For minimum C_L=8pF
	t_{DHT}	Data hold time	10	-		
	t_{RAT}	Read access time (ID)	-	40		
	t_{RATFM}	Read access time (FM)	-	340		
	t_{ODH}	Output disable time	20	80		

Table 5.2 CPU Interface Timing Parameters

5.3 Interface Register write/read timing

5.3.1 System Bus Interface Register or GRAM Write Timing

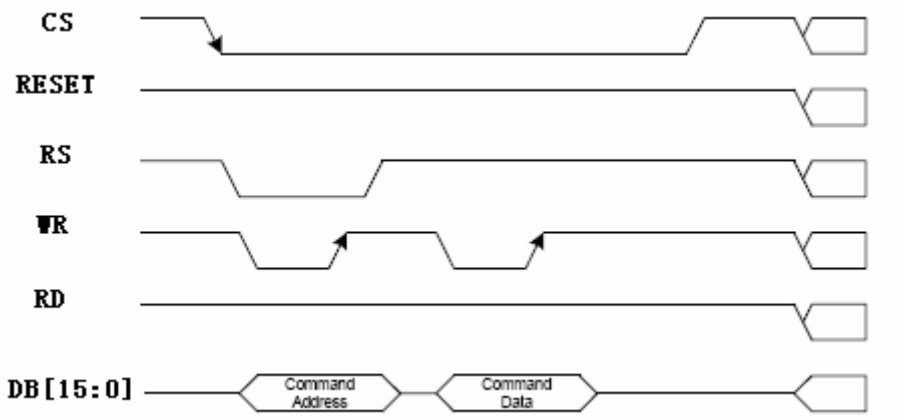


Figure 5.3.1 System Bus Interface Register or GRAM Write Timing

5.3.2 System Bus Interface Register or GRAM Read Timing

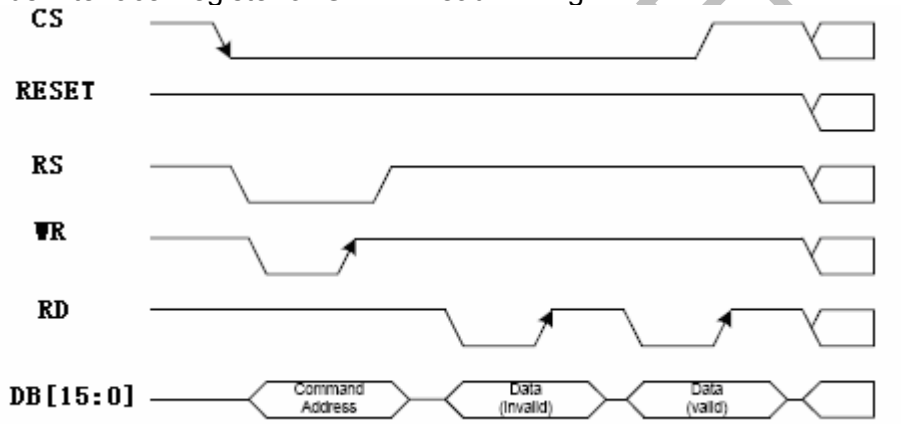


Figure 5.3.1 System Bus Interface Register or GRAM Read Timing

5.4 GRAM Write/Read Data Format

5.4.1 Write data for RGB 5-6-5 (65k colors) bits input in 8-bit parallel Interface

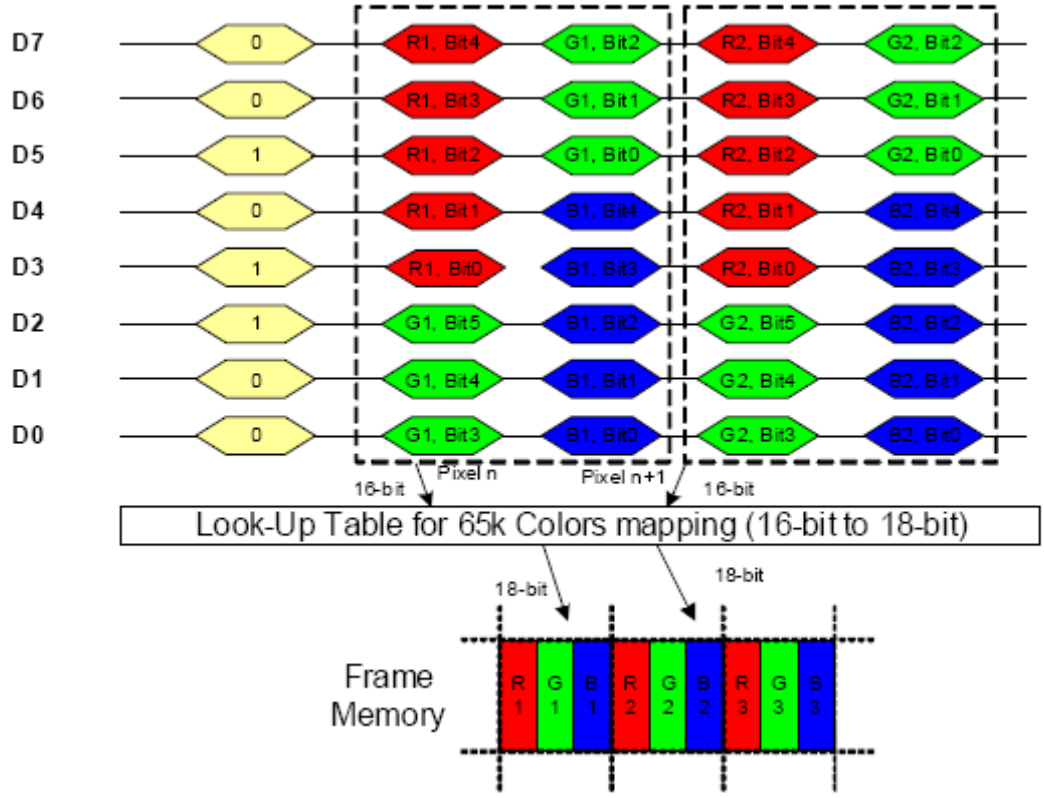


Figure 5.4.1 Write data for RGB 5-6-5 (65k colors) bits input in 8-bit parallel Interface

5.4.2 Write data for RGB 6-6-6 (262k colors) bits input in 8-bit parallel Interface

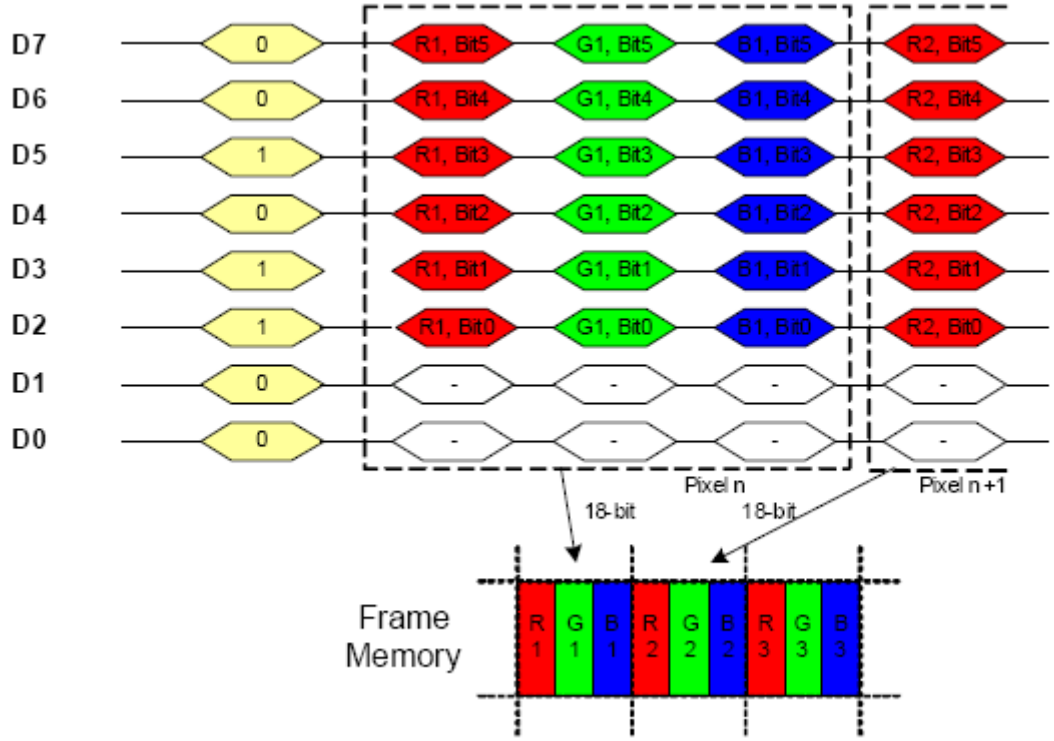


Figure 5.4.2 Write data for RGB 6-6-6 (262k colors) bits input in 8-bit parallel Interface

5.4.3 Write data for RGB 5-6-5 (65k colors) bits input in 16-bit parallel Interface

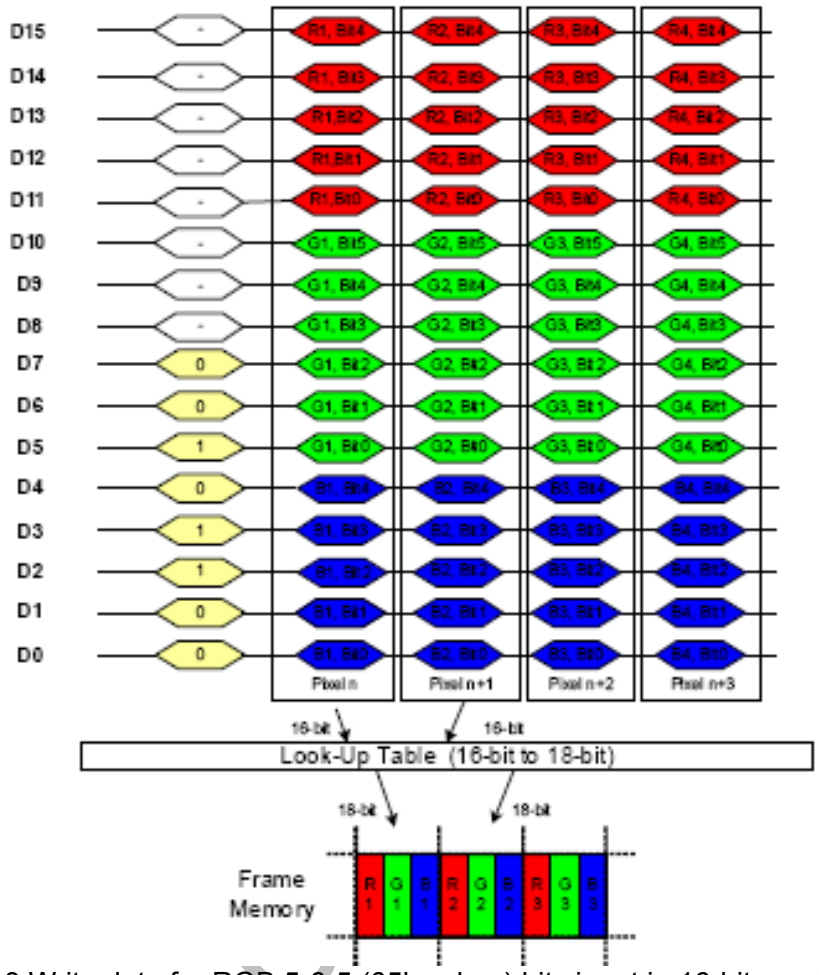


Figure 5.4.3 Write data for RGB 5-6-5 (65k colors) bits input in 16-bit parallel Interface

5.4.4 Write data for RGB 6-6-6 (262k colors) bits input in 16-bit parallel Interface

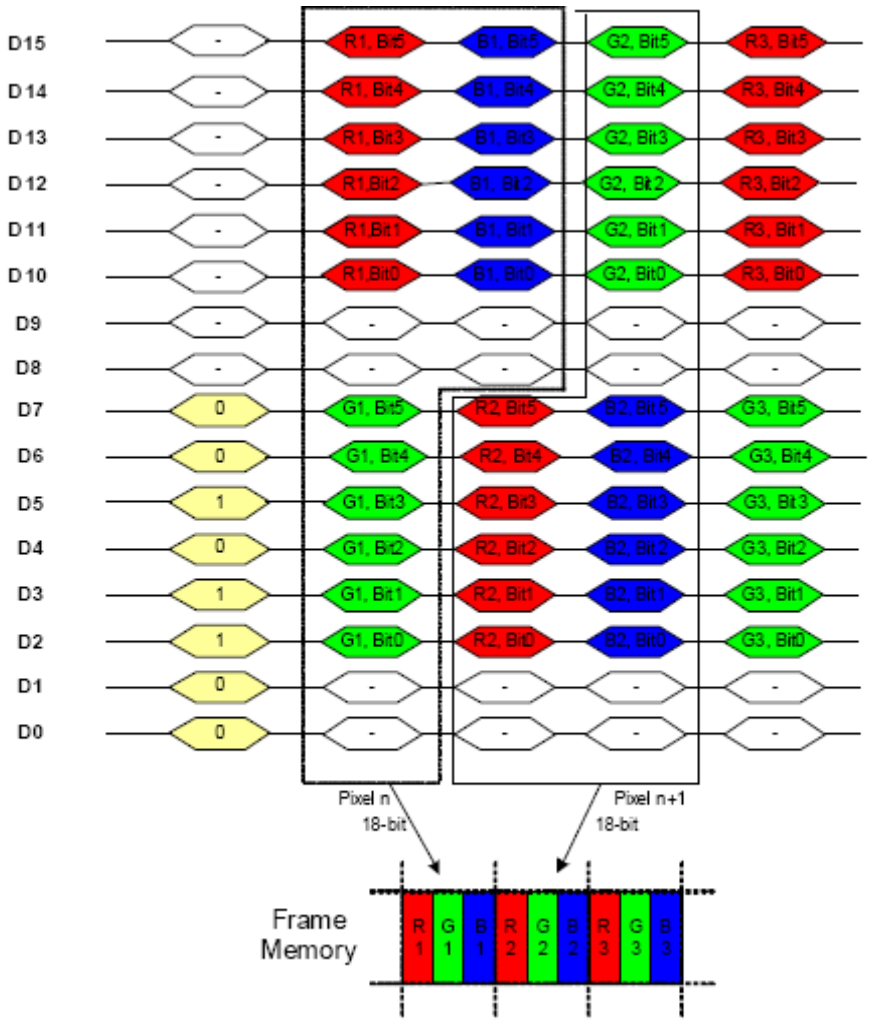


Figure 5.4.4 Write data for RGB 6-6-6 (262k colors) bits input in 16-bit parallel Interface

5.5 Reset Timing Characteristics

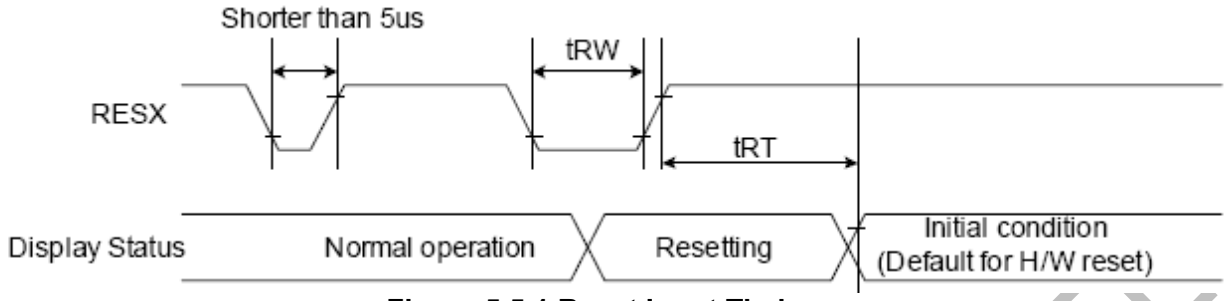


Figure 5.5.1 Reset Input Timing

Symbol	Parameter	Related Pins	Spec.			Note	Unit
			Min.	Typ.	Max.		
t_{RESW}	Reset low pulse width	RESET	10	-	-	-	us
t_{REST}	Reset complete time	-	-	-	5	When reset applied during “Sleep In mode”	ms
		-		-	120	When reset applied during “Sleep Out mode”	ms

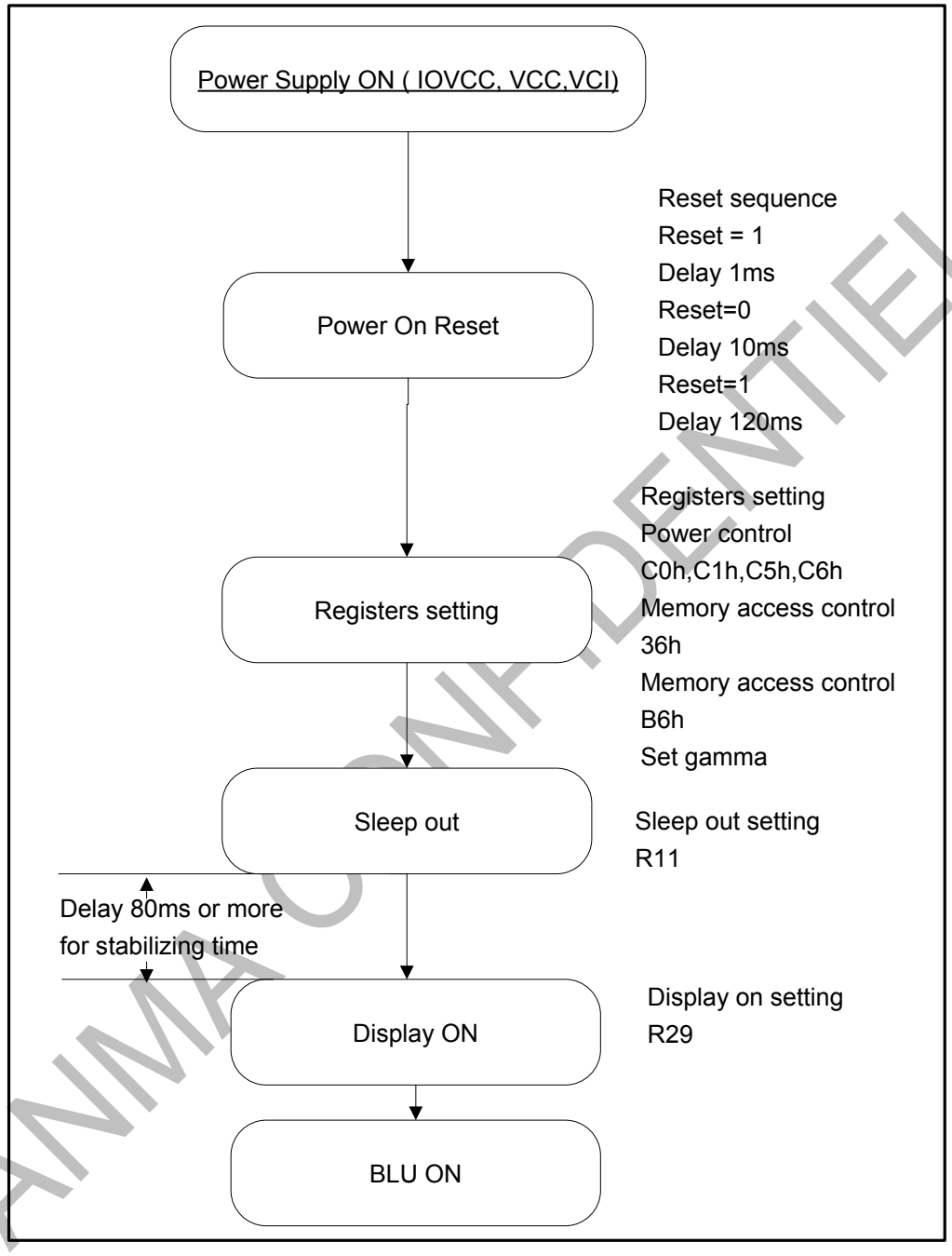
Table 5.5.1 Reset Timing Parameters

Note 1:

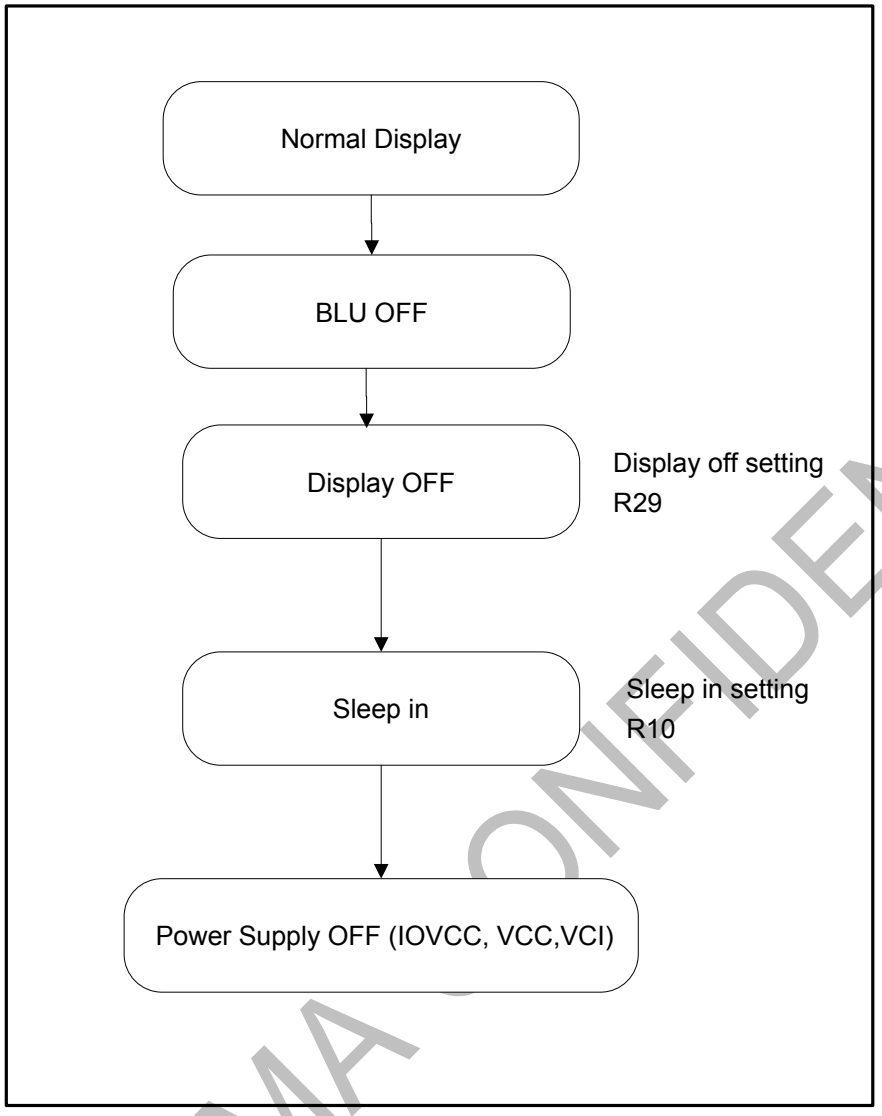
RESET Pulse	Action
Shorter than 5μs	Reset Rejected
Longer than 10μs	Reset
Between 5μs and 10μs	Reset Start

5.6 Power On/Off Sequence

5.6.1 Power on Sequence



5.6.2 Power Off Sequence



6. Optical Characteristics

Ta=25℃

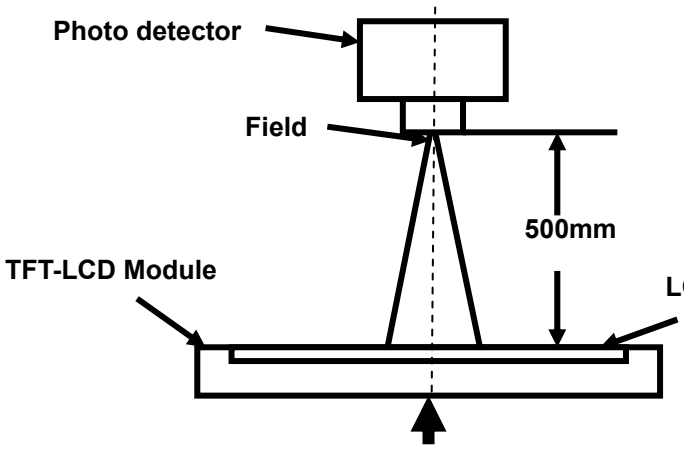
Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles		θT	CR≥10	60	70	-	Degree	Note 2
		θB		50	60	-		
		θL		60	70	-		
		θR		60	70	-		
Contrast Ratio		CR	θ=0°	400	500	-		Note1 Note3
Response Time		Ton	25℃	-	20	30	ms	Note1 Note4
		Toff						
Chromaticity	White	x	Backlight is on	0.247	0.297	0.347		Note5, Note1
		y		0.263	0.313	0.363		
	Red	x		0.536	0.586	0.636		
		y		0.292	0.342	0.392		
	Green	x		0.288	0.338	0.388		
		y		0.518	0.568	0.618		
	Blue	x		0.098	0.148	0.198		
		y		0.032	0.082	0.132		
Uniformity		U		-	80	-	%	Note1 Note6
NTSC				-	50	-	%	Note 5
Luminance		L		200	250	-	cd/m^2	Note1 Note7

Test Conditions:

1. V_F=3.2V, I_F=15mA, 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)。

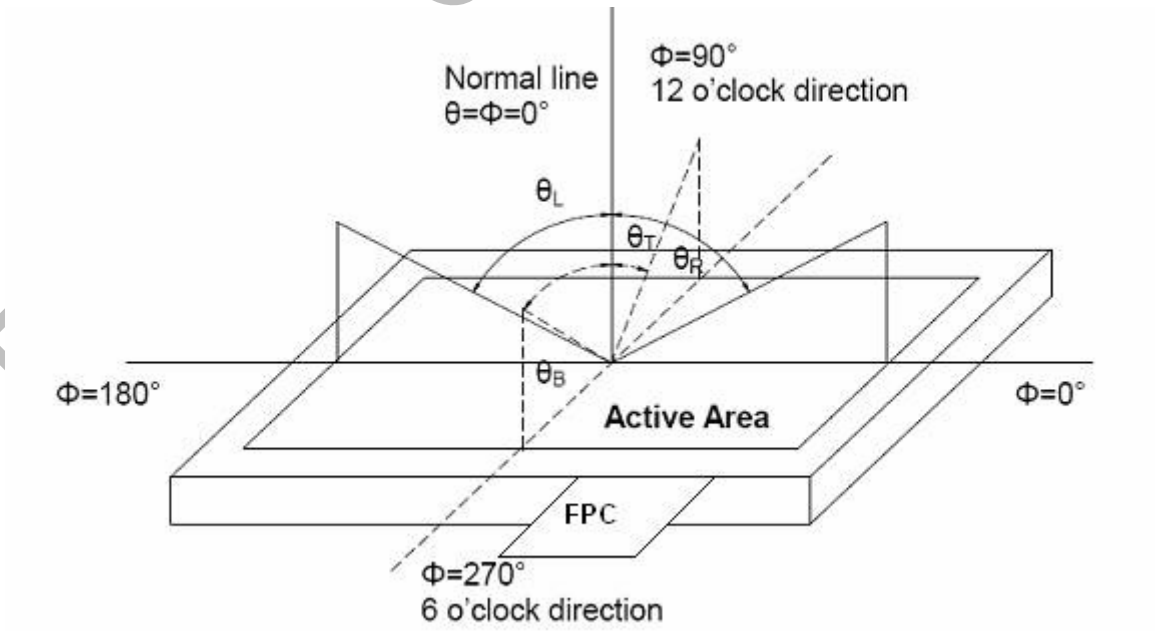


Fig. 1 Definition of viewing angle

Note 3: Definition of contrast ratio

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

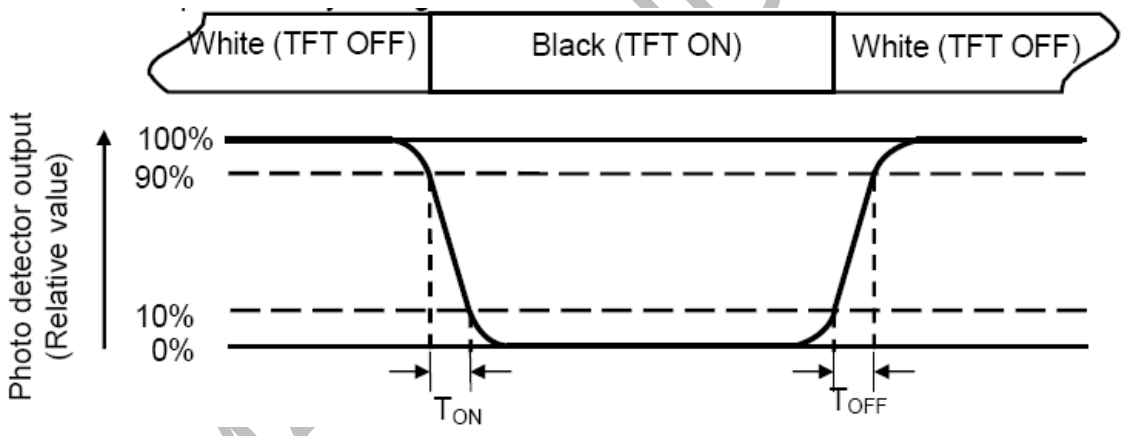
“White state “:The state is that the LCD should driven by Vwhite.

“Black state”: The state is that the LCD should 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 (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

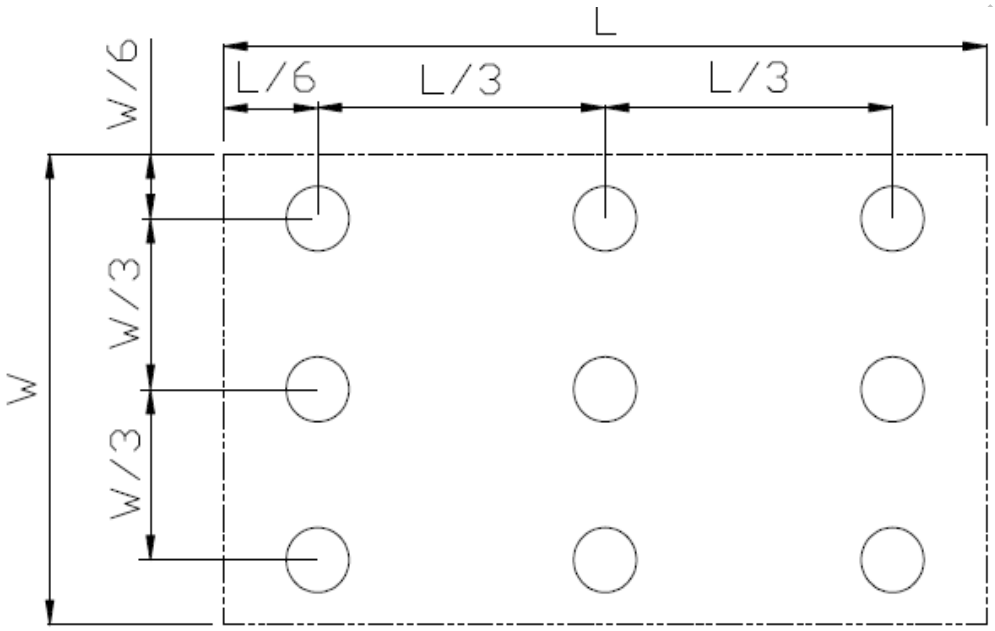


Fig. 2 Definition of uniformity

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.

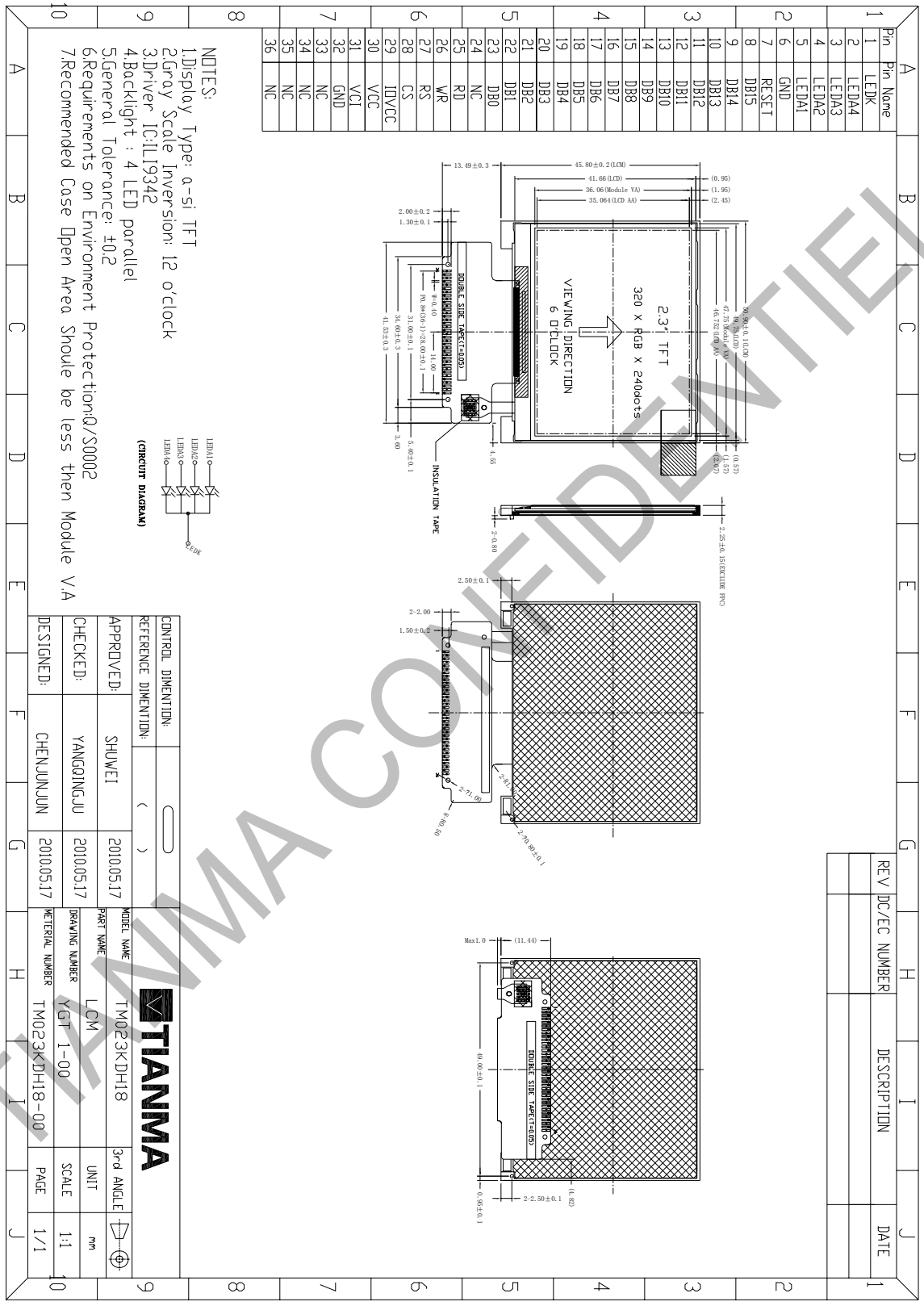
7. Environmental / Reliability Tests

No	Test Item	Condition	Remarks
1	High Temperature Operation	Ts=+70℃, 48hrs Restore4H at 25℃	Note1 IEC60068-2-1,GB2423.2
2	Low Temperature Operation	Ta=-20℃, 48hrs Restore4H at 25℃	IEC60068-2-1 GB2423.1
3	High Temperature Storage	Ta=+80℃, 96hrs Restore4H at 25℃	IEC60068-2-1 GB2423.2
4	Low Temperature Storage	Ta=-30℃, 96hrs Restore4H at 25℃	IEC60068-2-1 GB2423.1
5	High Temperature & High Humidity Storage	+40℃, 90% RH 48 hours	Note2 IEC60068-2-78 GB/T2423.3
6	Thermal Shock (Non-operation)	-30℃ 30 min~+80℃ 30 min, Change time:5min, After 10 cycle, Restore4H at 25℃	Start with cold temperature, End with high temperature, IEC60068-2-14,GB2423.22
7	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)	IEC61000-4-2 GB/T17626.2
8	Package Drop Test	Height:80 cm，1 corner, 3 edges, 6 surfaces	IEC60068-2-6 GB/T2423.10

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

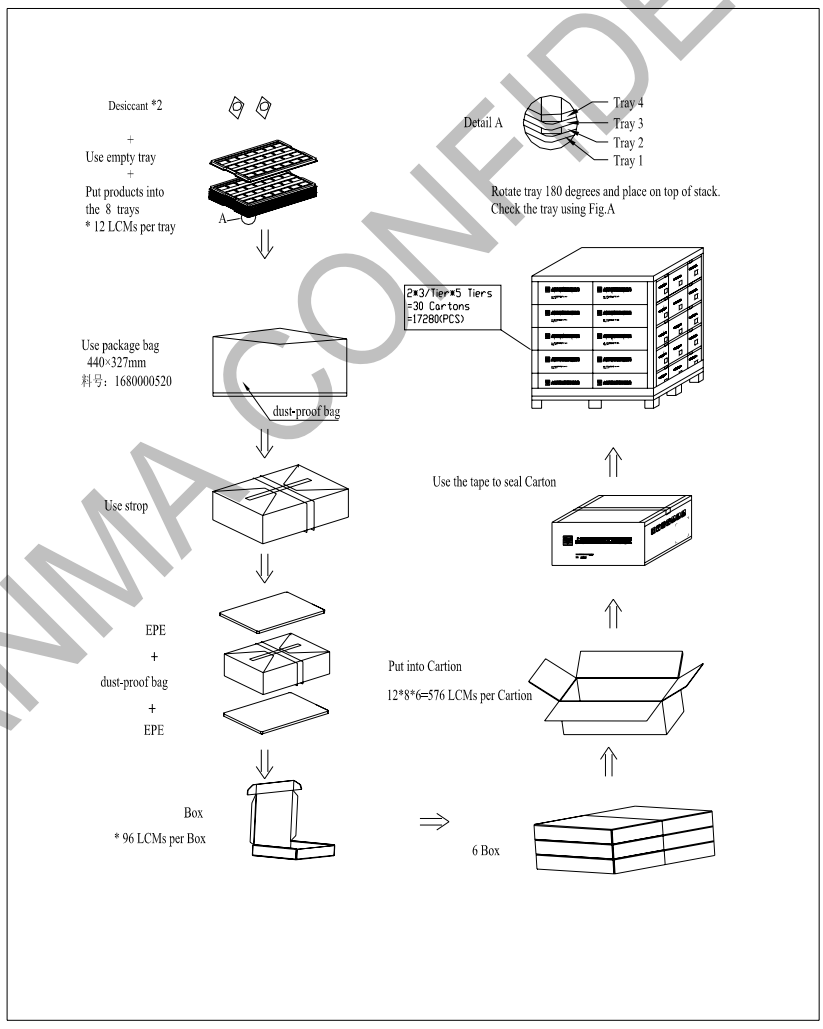
Note2: Ta is the ambient temperature of sample.

8. Mechanical Drawing



9. Packing Drawing

No	Item	Model(Material)	Dimensions(mm)	Unit Weight(Kg)	Quantity	Remark
1	LCM module	TM023KDH18	50.90x45.80x2.25	TBD	TBD	
2	Tray	PET（Transmit）	TBD	TBD	TBD	Anti-static
3	EPE	EPE	TBD	TBD	TBD	
4	Anti-Static Bag	PE	TBD	TBD	TBD	
5	BOX	Corrugated Paper	TBD	TBD	TBD	
6	Desiccant	Desiccant	TBD	TBD	TBD	
7	Carton	Corrugated Paper	TBD	TBD	TBD	
8	Total Weight(Kg)	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.

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

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

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

10.1.12 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.