MODEL NO. : TM032PDHV08

ISSUED DATE: 2011-09-29

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

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Record of Revision

Rev	Issued Date	Description	Editor
1.0	2011-09-29	Preliminary Specification Release	Que jifa

1. General Specifications

Feature		Spec
Display Spec.	Size	3.2 inch
	Resolution	320(RGB) x 480
	Interface	CPU 8/9/16 /18bit
	Color Depth	262K
	Technology Type	a-Si
	Pixel Pitch (mm)	0.1395 x 0.1395
	Pixel Configuration	R.G.B. Vertical Stripe
	Display Mode	VA
	Surface Treatment(Up Polarizer)	Clear Type (3H)
Mechanical Characteristics	LCM (W x H x D) (mm)	50.54 x 78.71 x 1.80
	Active Area(mm)	45.12 x 67.68
	With/Without TSP	Without TSP
	Weight (g)	TBD
	LED Numbers	5 LEDs (Parallel)
Electronic	Driver IC	HX8357C

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. PIN ASSIGNMENT

No	Symbol	I/O	Description	Comment
1	FMARK	O	Output a frame head pulse signal. If not used, please open this pin.	
2	IOVCC	P	Digital power	
3	VDD	P	Analog power	
4	CS	I	Chip select signal, signal is ″low″ enable	
5	RS	I	Data/command selection pin. RS=1,select data; RS=0,select command. If not used Connect to GND	
6	WR	I	A write strobe signal and enables an operation to write data when the signal is low.	
7	RD	I	A read strobe signal and enables an operation to read out data when the signal is low.	
8	GND	P	Power Ground	
9	RESET	I	reset signal	
10	DB00	I/O	Data input/output If not used Connect to GND	
11	DB01	I/O	Data input/output If not used Connect to GND	
12	DB02	I/O	Data input/output If not used Connect to GND	
13	DB03	I/O	Data input/output If not used Connect to GND	
14	DB04	I/O	Data input/output If not used Connect to GND	
15	DB05	I/O	Data input/output If not used Connect to GND	
16	DB06	I/O	Data input/output If not used Connect to GND	
17	DB07	I/O	Data input/output If not used Connect to GND	
18	DB08	I/O	Data input/output If not used Connect to GND	
19	DB09	I/O	Data input/output If not used Connect to GND	
20	DB10	I/O	Data input/output If not used Connect to GND	
21	DB11	I/O	Data input/output If not used Connect to GND	
22	DB12	I/O	Data input/output If not used Connect to GND	
23	DB13	I/O	Data input/output If not used Connect to GND	
24	DB14	I/O	Data input/output If not used Connect to GND	

25	DB15	I/O	Data input/output If not used Connect to GND	
26	DB16	I/O	Data input/output If not used Connect to GND	
27	DB17	I/O	Data input/output If not used Connect to GND	
28	GND	P	Power Ground	
29	IM3	I	System interface mode select (floating in LCM)	floating in LCM
30	IM2	I	System interface mode select	
31	IM1	I	System interface mode select	
32	IM0	I	System interface mode select	
33	GND	P	Power Ground	
34	LEDA	P	LED Anode	
35	LEDK1	P	LED Cathode	
36	LEDK2	P	LED Cathode	
37	LEDK3	P	LED Cathode	
38	LEDK4	P	LED Cathode	
39	LEDK5	P	LED Cathode	

Table 2.1 input terminal pin assignment

Note1: I/O definition: I-----Input O---Output P----Power/Ground

Note2:

IM2	IM1	IM0	MPU-Interface Mode	DB Pin in use	Colors
0	0	0	DBI Type B 18-bit	DB[17:0]	262K
0	0	1	DBI Type B 9-bit	DB[8:0]	262K
0	1	0	DBI Type B 16-bit	DB[15:0]	65K/262K
0	1	1	DBI Type B 8-bit	DB[7:0]	65K/262K

Table 2.2 System interface select

3. Absolute Maximum Ratings

GND=0V, Ta = 25℃

Item	Symbol	MIN	MAX	Unit	Remark
Logic Supply Voltage	IOVCC	-0.3	4.6	V	
Analog Supply Voltage	VDD	-0.3	4.6	V	
Logic Input voltage	CS,RS,WR,RD,IM0 RESET,DB[0:15]	-0.3	IOVCC +0.5	V	
Back Light Forward Current	ILED	-	25	mA	For each LED
Operating Temperature	TOPR	-20	70	℃	
Storage Temperature	TSTG	-30	80	℃	

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	1.65	1.8/2.8	3.3	V	
Analog Supply Voltage		VDD	2.5	2.8	3.3	V	
Input Signal Voltage	Low Level	V_{IL}	GND	-	0.3* IOVCC	V	DB[0:15],RS,WR, CS,RD,RESET,IM0
	High Level	V_{IH}	0.7* IOVCC	-	IOVCC	V	
Output Signal Voltage	Low Level	V_{OL}	-	-	0.2* IOVCC	V	
	High Level	V_{OH}	0.8* IOVCC		IOVCC	V	
(Panel+LSI) Power Consumption		Black Mode (60Hz)	-	TBD.	-	mW	
		Sleeping Mode	-	TBD.	-	mW	
		Standby Mode	-	TBD.	-	mW	

Table 4.1 LCD module electrical characteristics

4.2. Driving Backlight

Ta=25℃

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Forward Current	I_F	--	20	--	mA	For each LED
Forward Current Voltage	V_F	--	3.2	--	V	For each LED
Backlight Power Consumption	W_{BL}	--	320	--	mW	For 5 LEDs
Operating Life Time	-	10000	(20000)	-	Hrs	For each LED

Table 4.2 backlight unit electrical characteristics

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

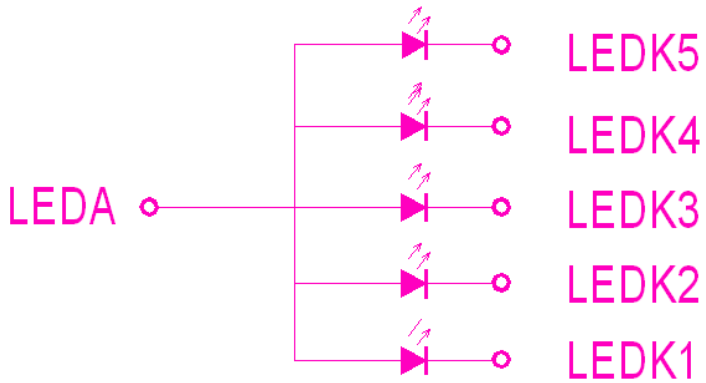
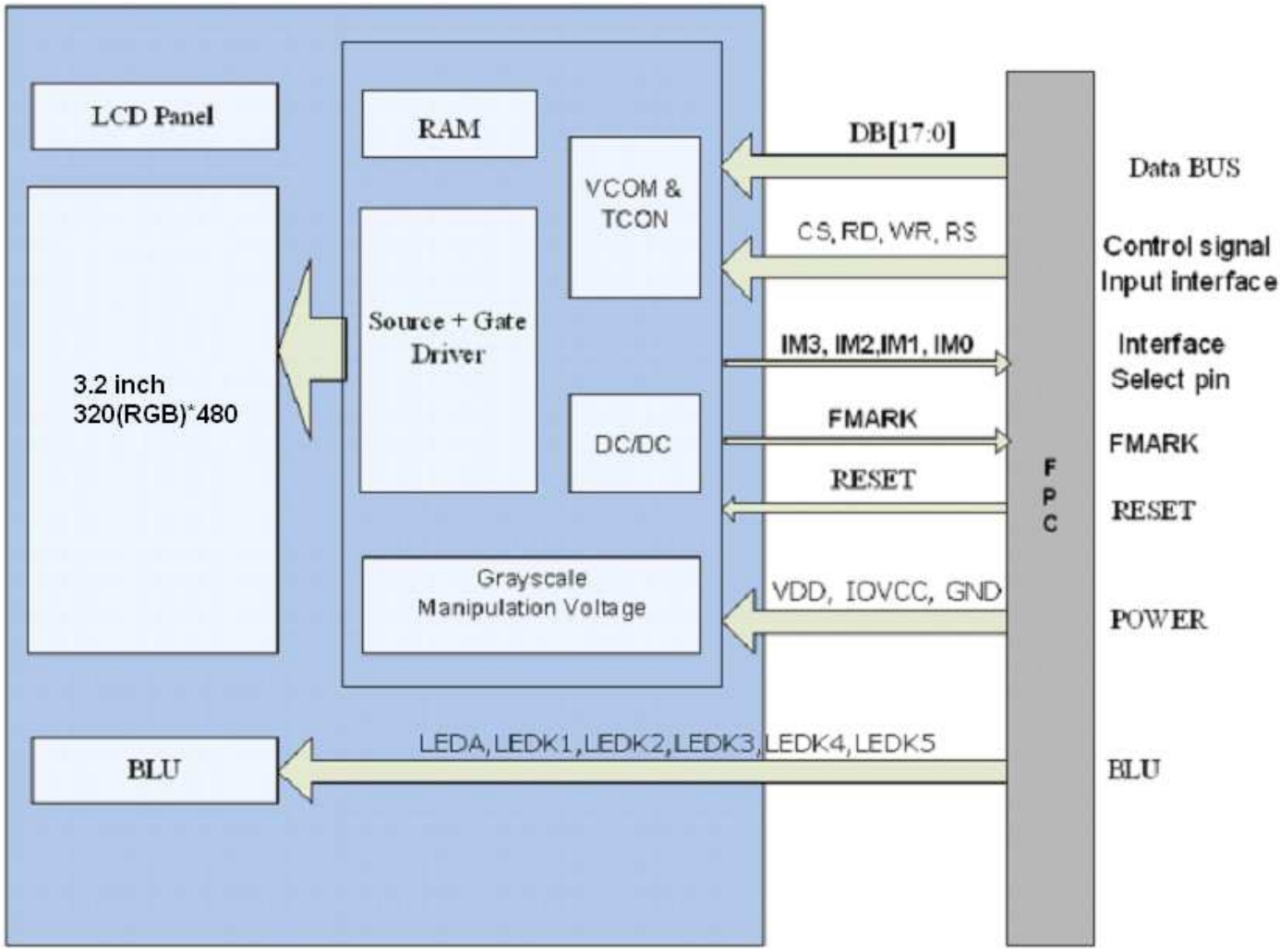


Figure 4.2.1 Backlight circuit

Note 2: One LED : I_F =20 mA, V_F =3.2V

Note 3: I_F 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. Interface Timing

5.1 DBI Type B Write/Read Cycle

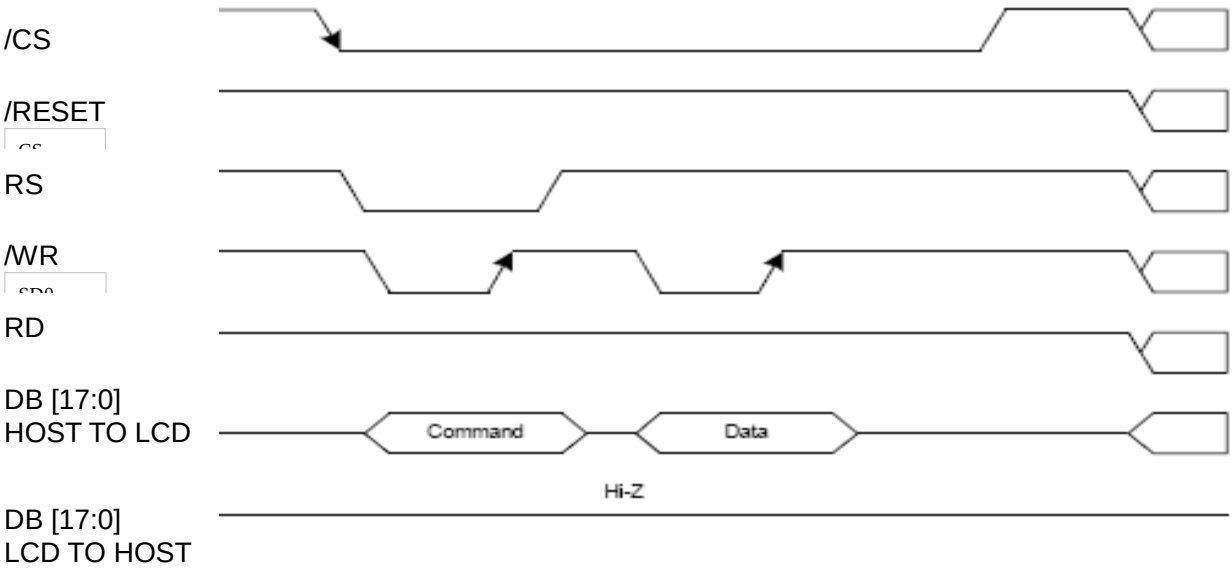


Figure 5.1.1 DBI Type B Write

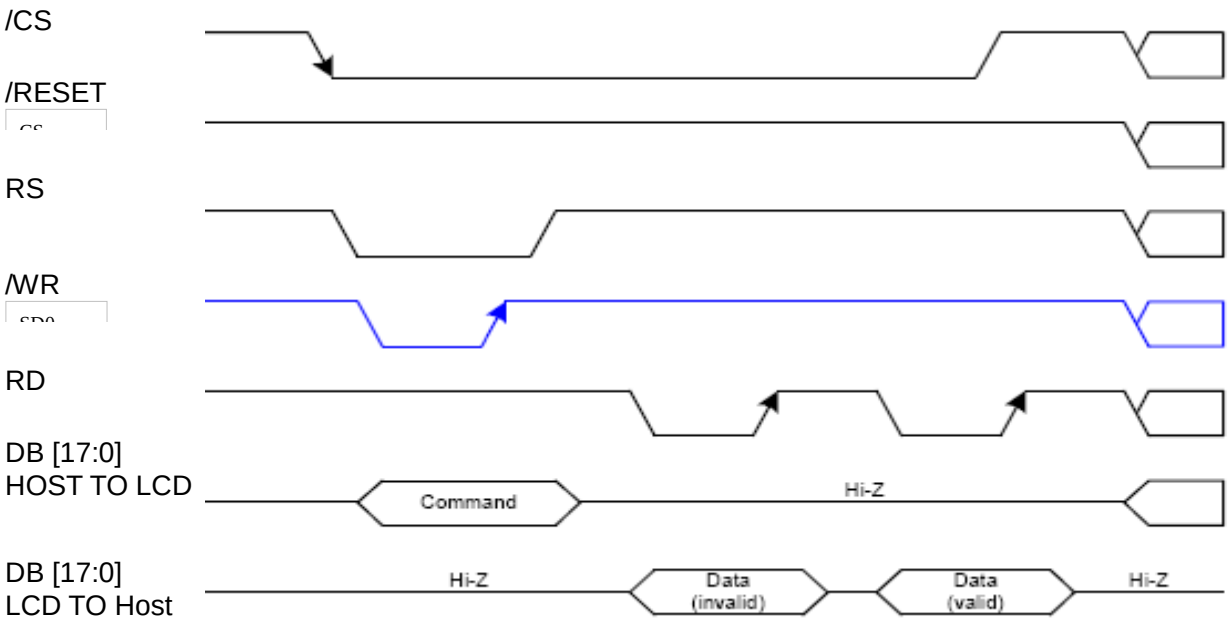
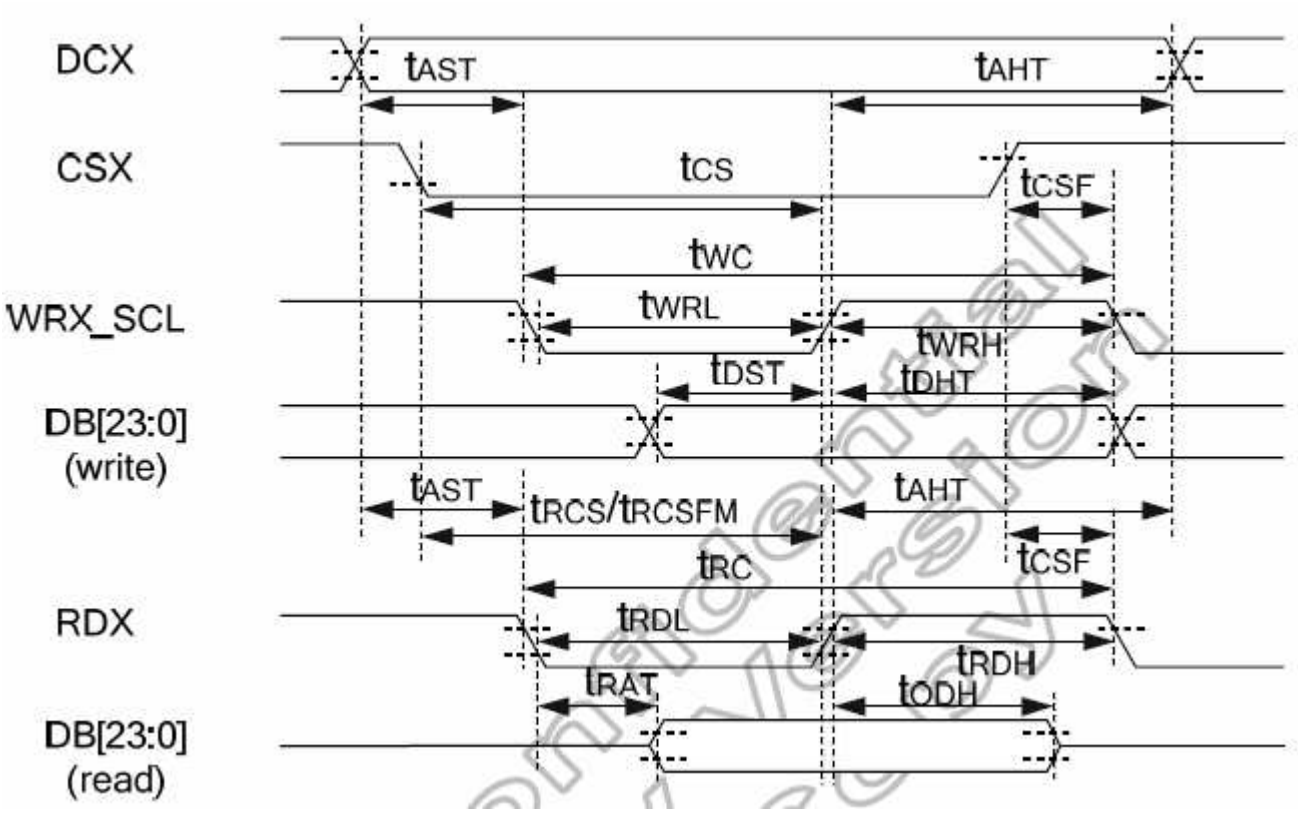


Figure 5.1.2 DBI Type B Read

5.2 DBI Type B（18/16/9/8 bit）Interface Timing Characteristics



(VSSA=0V, VDD1=1.8V, VDD3=2.8V, T_A=25℃)

Signal	Symbol	Parameter	Min.	Max.	Unit	Description
DCX	t_{AST}	Address setup time	0	-	ns	-
	t_{AHT}	Address hold time (Write/Read)	10	-		
CSX	t_{CS}	Chip select setup time (Write)	10	-	ns	-
	t_{RCS}	Chip select setup time (Read register)	45	-		
	t_{RCSFM}	Chip select setup time (GRAM)	355	-		
	t_{CSF}	Chip select wait time (Write/Read)	10	-		
WRX_SCL	t_{WC}	Write cycle (write register)	50	-	ns	-
	t_{WC}	Write cycle (write GRAM@SLPOUT)	47	-		
	t_{WC}	Write cycle (write GRAM@SLPIN)	100	-		
	t_{WRH}	Control pulse "H" duration	15	-		
	t_{WRL}	Control pulse "L" duration	15	-		
RDX	t_{RC}	Read cycle (read register)	160	-	ns	-
	t_{RC}	Read cycle (GRAM)	450	-		
	t_{RDH}	Control pulse "H" duration	90	-		
	t_{RDL}	Control pulse "L" duration(read register)	35	-		
	t_{RDL}	Control pulse "L" duration(GRAM)	345	-		
DB[23:0]	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(read register)	-	40		
	t_{RAT}	Read access time(GRAM)	-	340		
	t_{ODH}	Output disable time	20	80		

Note: The input signal rise time and fall time (tr, tf) is specified at 15 ns or less.
Logic high and low levels are specified as 30% and 70% of VDD1 for Input signals.

Figure 5.2.1 Timing Parameters

5.3 DBI Type B interface data bus

18-bit data bus DB[17:0] interface, IM[2:0] = 000

	Set_pixel_format	DFM	DB17	DB16	DB15	DB14	DB13	DB12	DB11	DB10	DB9	DB8	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Command/Parameter Write	*	*											D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]
Command/Parameter Read	*	*											D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]

	Set_pixel_format	DFM	DB17	DB16	DB15	DB14	DB13	DB12	DB11	DB10	DB9	DB8	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
18bpp Frame Memory Write	3'h6	*	R[5]	R[4]	R[3]	R[2]	R[1]	R[0]	G[5]	G[4]	G[3]	G[2]	G[1]	G[0]	B[5]	B[4]	B[3]	B[2]	B[1]	B[0]
Frame Memory Read	*	*	r[5]	r[4]	r[3]	r[2]	r[1]	r[0]	g[5]	g[4]	g[3]	g[2]	g[1]	g[0]	b[5]	b[4]	b[3]	b[2]	b[1]	b[0]

16-bit data bus DB[15:0] interface, IM[2:0] = 010

	Set_pixel_format	DFM	DB15	DB14	DB13	DB12	DB11	DB10	DB9	DB8	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Command/Parameter Write	*	*									D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]
Command/Parameter Read	*	*									D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]

	Set_pixel_format	DFM	DB15	DB14	DB13	DB12	DB11	DB10	DB9	DB8	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
16bpp Frame Memory Write	3'h5	*	R4]	R[3]	R[2]	R[1]	R[0]	G[5]	G[4]	G[3]	G[2]	G[1]	G[0]	B[4]	B[3]	B[2]	B[1]	B[0]
Frame Memory Read	*	*	r4]	r[3]	r[2]	r[1]	r[0]	g[5]	g[4]	g[3]	g[2]	g[1]	g[0]	b[4]	b[3]	b[2]	b[1]	b[0]

			First Transfer				Second Transfer				Third Transfer			
	Set_pixel_format	DFM	DB[15:10]	DB[9:8]	DB[7:2]	DB[1:0]	DB[15:10]	DB[9:8]	DB[7:2]	DB[1:0]	DB[15:10]	DB[9:8]	DB[7:2]	D
18bpp Frame Memory Write	3'h6	0	R1[5:0]		G1[5:0]		B1[5:0]		R2[5:0]		G2[5:0]		B2[5:0]	
		1			R1[5:0]		G1[5:0]		B1[5:0]				R2[5:0]	

			First Transfer				Second Transfer				Third Transfer			
	Set_pixel_format	DFM	DB[15:10]	DB[9:8]	DB[7:2]	DB[1:0]	DB[15:10]	DB[9:8]	DB[7:2]	DB[1:0]	DB[15:10]	DB[9:8]	DB[7:2]	D
Frame Memory Read	*	0	r1[5:0]		g1[5:0]		b1[5:0]		r2[5:0]		g2[5:0]		b2[5:0]	
		1			r1[5:0]		g1[5:0]		b1[5:0]				r2[5:0]	

9-bit data bus DB[8:0] interface, IM[2:0] = 001

	Set_pixel_format	DFM	DB8	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Command/Parameter Write	*	*		D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]
Command/Parameter Read	*	*		D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]

			First Transfer								Second Transfer								
	Set_pixel_format	DFM	DB8	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	DB8	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
18bpp Frame Memory Write	3'h6	*	R[5]	R[4]	R[3]	R[2]	R[1]	R[0]	G[5]	G[4]	G[3]	G[2]	G[1]	G[0]	B[5]	B[4]	B[3]	B[2]	B[1]	B[0]
Frame Memory Read	*	*	r[5]	r[4]	r[3]	r[2]	r[1]	r[0]	g[5]	g[4]	g[3]	g[2]	g[1]	g[0]	b[5]	b[4]	b[3]	b[2]	b[1]	b[0]

8-bit data bus DB[7:0] interface, IM[2:0] = 011

	Set_pixel_format	DFM	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Command/Parameter Write	*	*	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]
Command/Parameter Read	*	*	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]

			First Transfer								Second Transfer							
	Set_pixel_format	DFM	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
16bpp Frame Memory Write	3'h5	*	R[4]	R[3]	R[2]	R[1]	R[0]	G[5]	G[4]	G[3]	G[2]	G[1]	G[0]	B[4]	B[3]	B[2]	B[1]	B[0]
Frame Memory Read	*	*	r[4]	r[3]	r[2]	r[1]	r[0]	g[5]	g[4]	g[3]	g[2]	g[1]	g[0]	b[4]	b[3]	b[2]	b[1]	b[0]

			First Transfer								Second Transfer								Third Transfer							
	Set_pixel_format	DFM	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		DB6	DB5	DB4	DB3	DB2	DB1	DB0
18bpp Frame Memory Write	3'h6	*	R[5]	R[4]	R[3]	R[2]	R[1]	R[0]			G[5]	G[4]	G[3]	G[2]	G[1]	G[0]			B[5]	B[4]	B[3]	B[2]	B[1]	B[0]		
Frame Memory Read	*	*	r[5]	r[4]	r[3]	r[2]	r[1]	r[0]			g[5]	g[4]	g[3]	g[2]	g[1]	g[0]			b[5]	b[4]	b[3]	b[2]	b[1]	b[0]		

5.4 Reset Timing

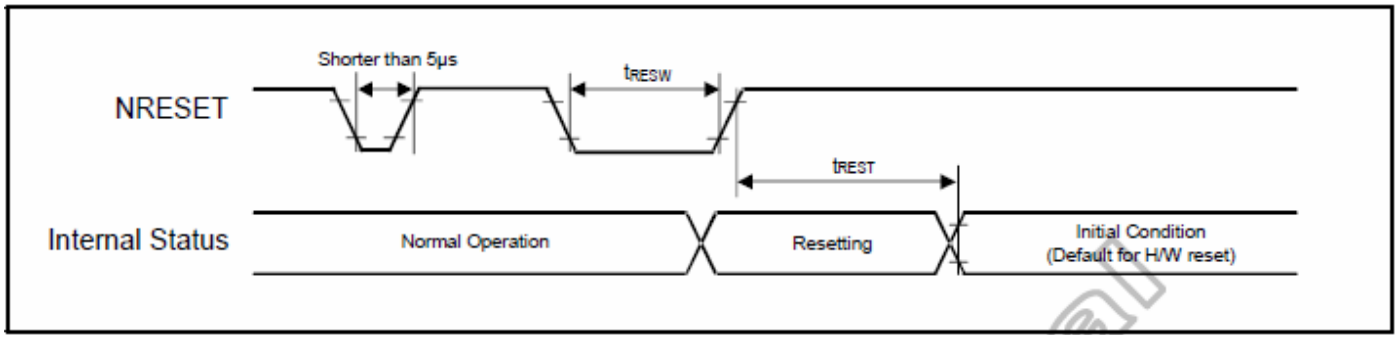


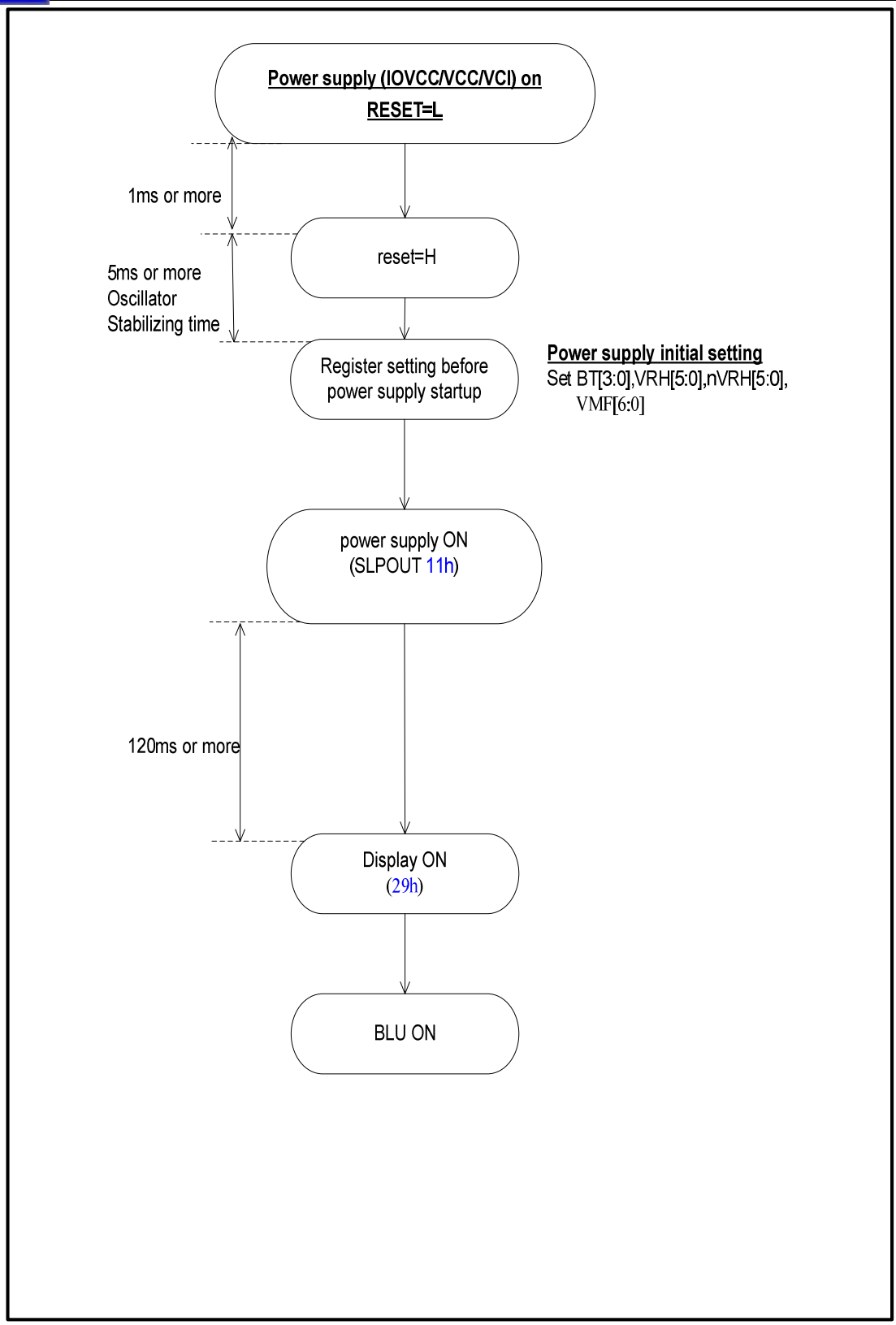
Figure 5.4.1 Reset Timing

Symbol	Parameter	Related Pins	Spec.			Note	Unit
			Min.	Typ.	Max.		
tRESW	Reset low pulse width(1)	NRESET	10	-	-	-	µs
tREST	Reset complete time(2)	-	5	-	-	When reset applied during SLPIN mode	ms
		-	120	-	-	When reset applied during SLPOUT mode	ms

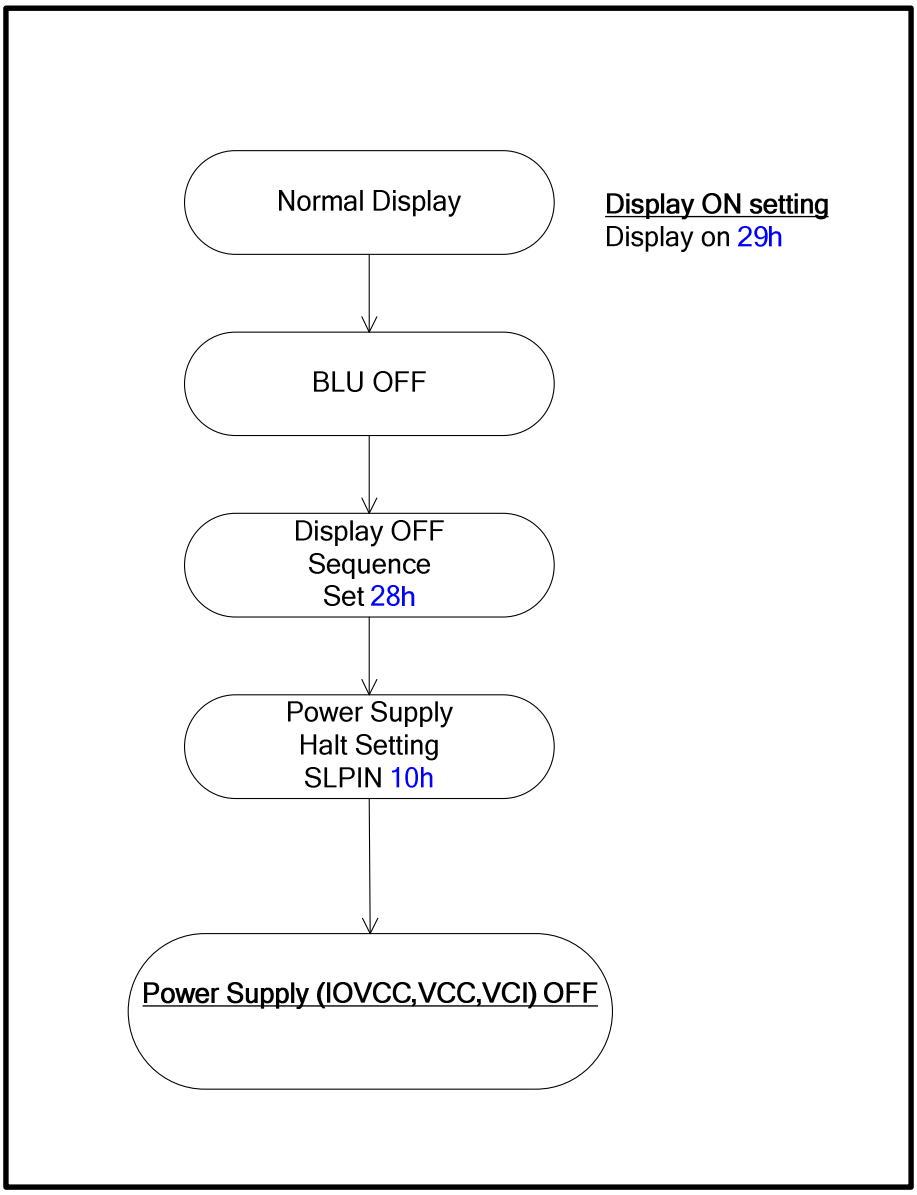
Table 5.4.2 Reset Timing Parameter

5.5 Power On/Off sequence

5.6.1 Power on Sequence



5.6.2 Power off Sequence



6. Optical Characteristics

Ta=25℃

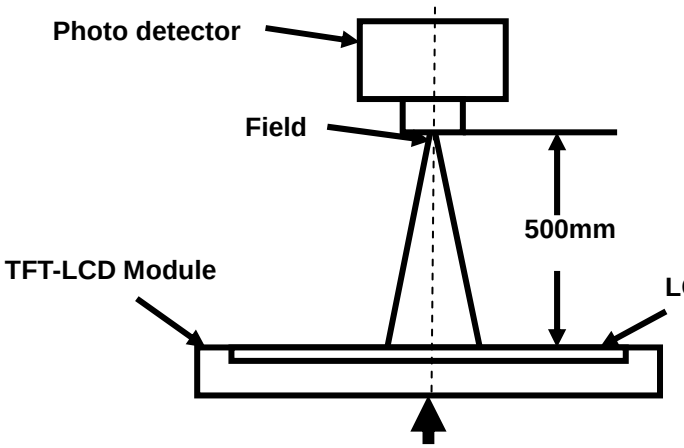
Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles		θT	CR≧10	--	80	-	Degree	Note 2
		θB		--	80	-		
		θL		--	80	-		
		θR		--	80	-		
Contrast Ratio		CR	θ=0°	--	TBD	-	-	Note1 Note3
Response Time		T_{ON}	25℃	-	TBD	TBD	ms	Note1 Note4
		T_{OFF}						
Chromaticity	White	x	Backlight is on	TBD	TBD	TBD	-	Note5 Note1
		y		TBD	TBD	TBD		
	Red	x		TBD	TBD	TBD		
		y		TBD	TBD	TBD		
	Green	x		TBD	TBD	TBD		
		y		TBD	TBD	TBD		
	Blue	x		TBD	TBD	TBD		
		y		TBD	TBD	TBD		
Uniformity		U	-	70	80	-	%	Note1 Note6
NTSC		-	-	-	65	-	%	Note 5
Luminance		L		280	300	-	cd/m^2	Note1 Note7

Test Conditions:

1. V_F=3.2V, I_F=20mA(One LED 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)。

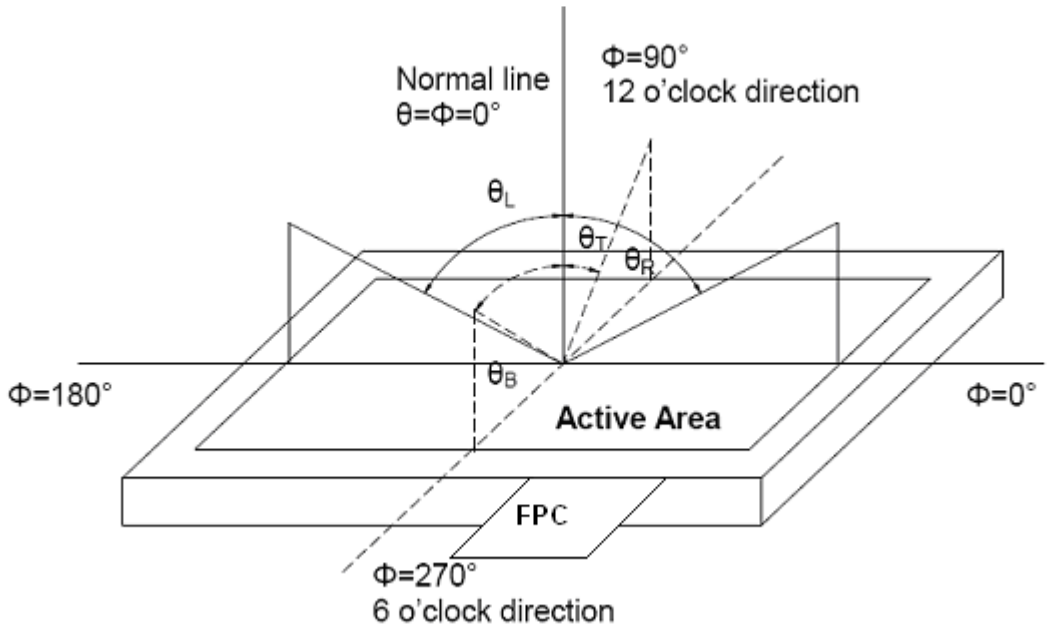


Fig. 7.1 Definition of viewing angle

Note 3: Definition of contrast ratio

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

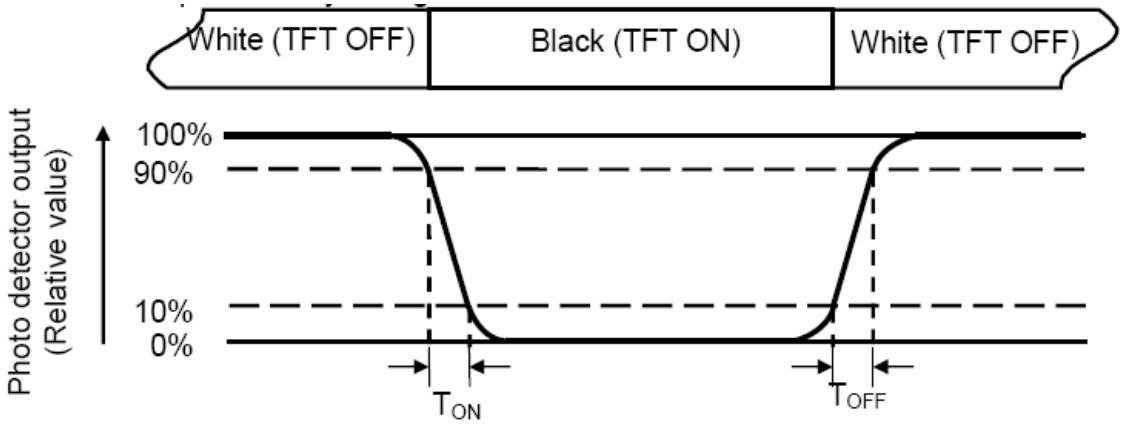
“White state “:The state is that the LCD should driven by Vwhite.

“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

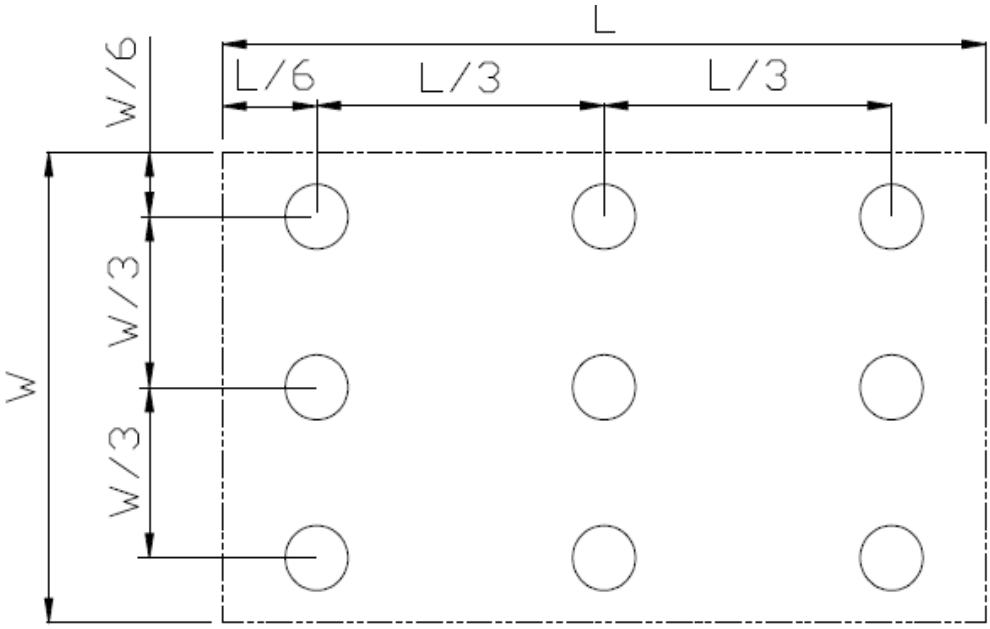


Fig. 2 Definition of uniformity

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.

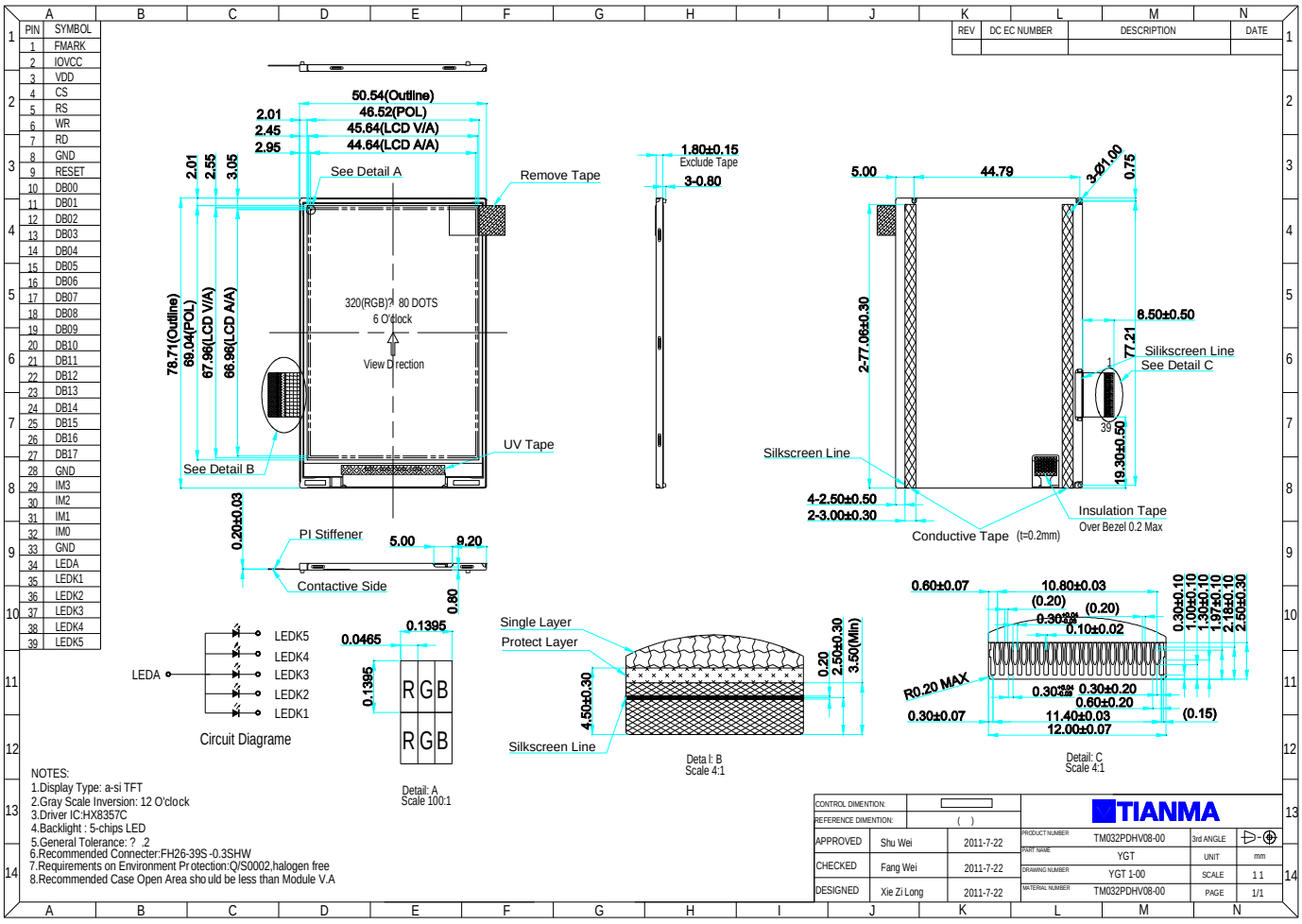
7. Environmental / Reliability Test

No	Test Item	Condition	Remark
1	High Temperature Operation	Ts=+70℃, 120hrs	Note1 IEC60068-2-1:2007,GB2423.2-2008
2	Low Temperature Operation	Ta=-20℃,120hrs	IEC60068-2-1:2007 GB2423.1-2008
3	High Temperature Storage	Ta=+80℃, 120hrs	IEC60068-2-1:2007 GB2423.2-2008
4	Low Temperature Storage	Ta=-30℃, 120hrs	IEC60068-2-1:2007 GB2423.1-2008
5	High Temperature & High Humidity Storage	Ta=+60℃, 90% RH 120 hours	Note2 IEC60068-2-78 :2001 GB/T2423.3—2006
6	Thermal Shock (Non-operation)	-30℃ 30 min~+70℃ 30 min, Change time:5min, 20 Cycles	Start with cold temperature, End with high temperature, IEC60068-2-14:1984,GB2423.22-2002
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）	IEC61000-4-2:2001 GB/T17626.2-2006
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)	IEC60068-2-6:1982 GB/T2423.10—1995
9	Shock (Non-operation)	60G 6ms, ± X,± Y,± Z 3times, for each direction	IEC60068-2-27:1987 GB/T2423.5—1995
10	Package Drop Test	Height:80 cm, 1 corner, 3 edges, 6 surfaces	IEC60068-2-32:1990 GB/T2423.8—1995

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

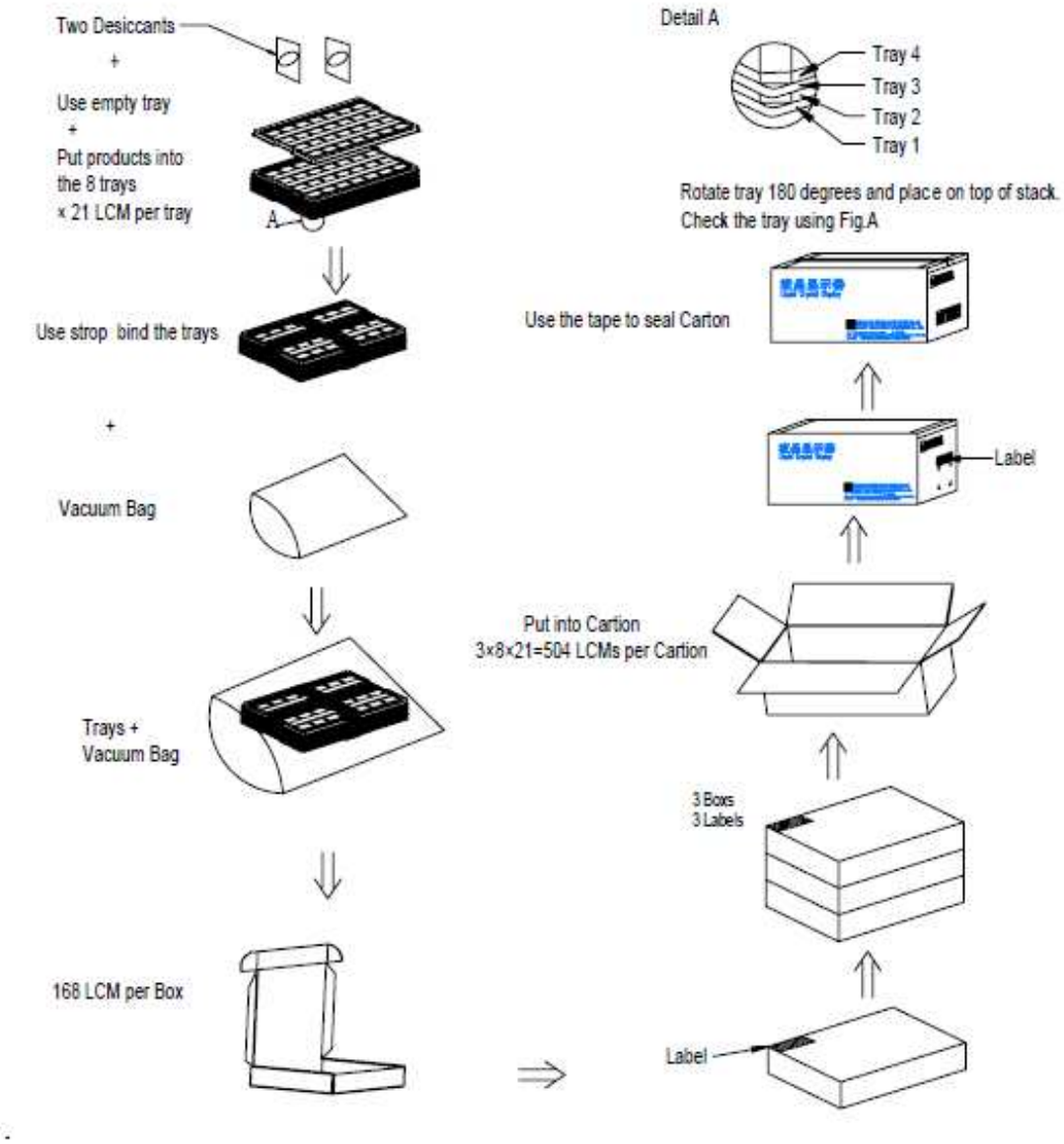
Note2: Ta is the ambient temperature of sample.

8. Mechanical Drawing



9. Packing Drawing

No	Item	Model (Material)	Dimensions(mm)	Unit Weight(Kg)	Quantity	Remark
1	LCM module	TM032PDHV08	50.54×78.71×1.8	TBD	504	
2	Tray	PET（Transmit）	485×330×13.8	0.160	27	Anti-static
3	Desiccant	Desiccant	45×35	0.002	6	
4	Vacuum bag	PE	600×500×0.08	0.047	1	
5	BOX	CORRUGATED PAPER	520×345×74	0.369	3	
6	Label	Paper	100×52	0.001	4	
7	Carton	CORRUGATED PAPER	544×365×250	0.76	1	
8	Total weight	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.