MODEL NO. : TM032PDHV02

ISSUED DATE: 2010-12-5

VERSION : Ver 2.0

□**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	Issue Date	Description	Editor
1.0	2010-07-24	Preliminary release.	Guo Qiang
2.0	2010-11-20	Add Weight and Final Spec release	Hongming Chen

1 General Specifications

Feature		Spec
Display Spec	Size	3.2 inch
	Resolution	320(RGB) x 480
	Interface	CPU 8/9/16/18 bit
	Color Depth	262K
	Technology Type	a-Si
	Pixel Pitch (mm)	0.1395 x 0.1395
	Pixel Configuration	R.G.B. Vertical Stripe
	Display Mode	TM with Normally Black
	Surface Treatment	Clear type (3H)
	Viewing Direction	--
	Gray Scale Inversion Direction	--
Mechanical Characteristics	LCM (W x H x D) (mm)	50.74×78.35×2.2
	Active Area(mm)	44.64×66.96
	With /Without TSP	Without TSP
	Weight (g)	15.84
	LED Numbers	6 LEDs
Electronic	Driver IC	R61581

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	LED_K	P	LED light cathode	
2	LED_K	P	LED light cathode	
3	LED_K	P	LED light cathode	
4	LED_K	P	LED light cathode	
5	LED_K	P	LED light cathode	
6	LED_K	P	LED light cathode	
7	LED_A	P	LED light anode	
8	GND	P	Power Ground	
9	VCC	P	Power supply for analog	
10	VCC	P	Power supply for analog	
11	IOVCC	P	Power supply for digital	
12	GND	P	Power Ground	
13	TE	O	Tearing effect output signal	
14	CSX	I	Chip select signal	
15	D/CX	I	Register select signal	
16	WRX/SCL	I	Write enables signal in DBI type B operation, Synchronous clock signal in DBI type C operation	
17	RDX	I	Read enables signal	
18	DIN/SDA	I	Serial data input pin in DBI type C operation to input data on the rising edge of SCL signal	
19	DOUT	O	Serial data output pin in DBI type C operation to input data on the falling edge of SCL signal	
20	GND	P	Power Ground	
21	DB0	I	Data Input	
22	DB1	I	Data Input	
23	DB2	I	Data input	
24	DB3	I	Data input	
25	DB4	I	Data input	
26	DB5	I	Data input	
27	DB6	I	Data input	
28	DB7	I	Data input	
29	DB8	I	Data input	
30	DB9	I	Data input	
31	DB10	I	Data input	
32	DB11	I	Data input	
33	DB12	I	Data input	
34	GND	P	Power Ground	
35	DB13	I	Data input	
36	DB14	I	Data input	
37	DB15	I	Data input	
38	DB16	I	Data input	
39	DB17	I	Data input	
40	DE	I	Data enable signal in DPI operation Low: Select; High: Not Select	

41	PCLK	I	Pixel clock signal. The data input timing is set on the Rising edge.	
42	HSYNC	I	Line synchronous signal, low active	
43	VSYNC	I	Frame synchronous signal, low active	
44	RESET	I	Reset signal	
45	IM2	I	Mode select	
46	IM1	I	Mode select	
47	IM0	I	Mode select	NOTE1
48	SD	-	Floating	
49	GND	P	Power Ground	
50	LEDPWM	O	Control signal for brightness of LED backlight.	
51	GND	P	Power Ground	

Note 1: I/O definition: I-----Input; O---Output; P----Power/Ground.

Note 2:

IM2	IM1	IM0	Interface	Data Bus Use	
				Register/Content	GRAM
0	0	0	DBI type B 18_bit	D17~D0	D7~D0
0	0	1	DBI type B 9_bit	D8~D0	D7~D0
0	1	0	DBI type B 16_bit	D15~D0	D7~D0
0	1	1	DBI type B 8_bit	D7~D0	D7~D0
1	0	1	DBI type C 3_wire 9_bit	-	-
1	1	1	DBI type C 4_wire 8_bit	-	-

3 Absolute Maximum Ratings

3.1 Driving TFT LCD Panel

GND=0V, 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	CSX,D/CX,WRX/SCL,RDX, DB0~DB17,DIN/SDA,RESET, HSYNC,VSYNC,PCLK,DE	-0.3	IOVCC+0.5	V	
Back Light Forward Current	I_F	-	20	mA	ONE LED
Operating Temperature	Top	-20	60	℃	
Storage Temperature	Tst	-30	80	℃	

4 Electrical Characteristics

4.1 Driving TFT LCD Panel

GND=0V, Ta=25℃

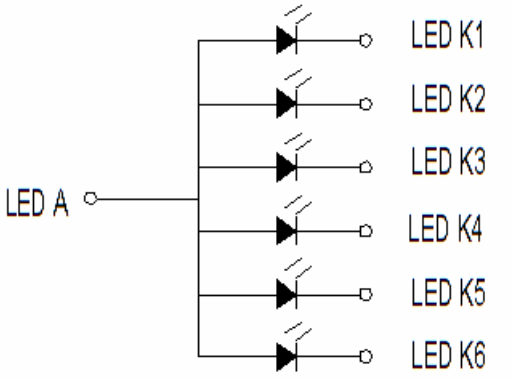
Item		Symbol	MIN	TYP	MAX	Unit	Remark
Logic Supply Voltage		IOVCC	1.65	1.8/2.8	3.3	V	
Analog Supply Voltage		VCC	2.3	2.8	3.3	V	
Input Signal Voltage	High Level	VIH	0.7 IOVCC	-	IOVCC	V	
	Low Level	VIL	-	-	0.3 IOVCC	V	
Output Signal Voltage	High Level	VOH	0.8 IOVCC	-	-	V	
	Low Level	VOL	-	-	0.2 IOVCC	V	
(Panel+LSI) Power Consumption		White Mode	-	44.136	-	mW	
		8 color Mode	-	24.08	-	mW	
		Sleeping Mode	-	0.014	-	mW	

4.2 Driving Backlight

Ta=25℃

Item	Symbol	Min	Typ	Max	Unit	Remark
Forward Current	I_F	--	15	--	mA	For each LED
Forward Voltage	V_F	--	3.2	--	V	
Power Consumption	W_{BL}	--	288	--	mW	
Operating Life Time	--	10000	(20000)	--	Hrs	

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



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

Note 3:

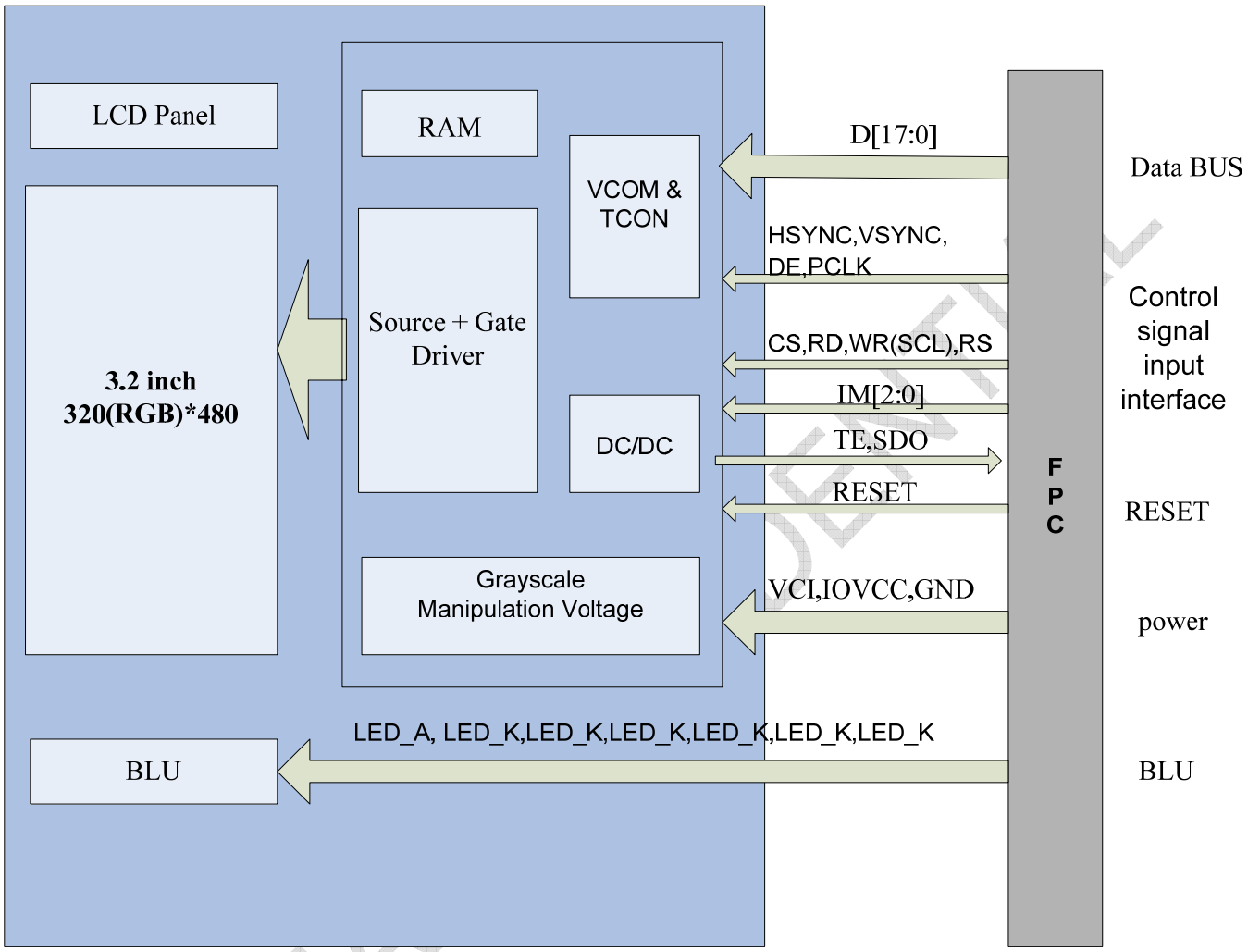
I_F is defined for one channel LED.

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 Timing Chart

5.1 Timing Parameters

Ta=25℃

Item		Symbol		Unit	Test Condition	Min.	Max.
Address setup time		DCX	tast	ns		0	-
Address hold time (Write/Read)			taht	ns		10	-
Chip select setup time (Write)		CSX	tcs	ns		30	-
Chip select setup time (Read)			trcs	ns		170	-
Chip select wait time (Write)			tcsfw	ns		20	-
Chip select wait time (Read)			tcsfr	ns		20	
1 transfer	Write cycle time	WRX	twc1	ns		60	-
	Write control pulse "High" period		twrh1	ns		30	-
	Write control pulse "Low" period		twrl1	ns		30	-
Read cycle time		RDX	trc	ns		450	-
Read control pulse "High" period			trdh	ns		250	-
Read control pulse "Low" period			trdl	ns		170	-
Write data setup time		DB[17:0]	twds	ns	CL Max.30pF Min.8pF	15	-
Write data hold time			twdh	ns		20	-
Read access time			tracc	ns		10	150
Output disable time			trod	ns		10	-

Table 5.1 Timing Parameters

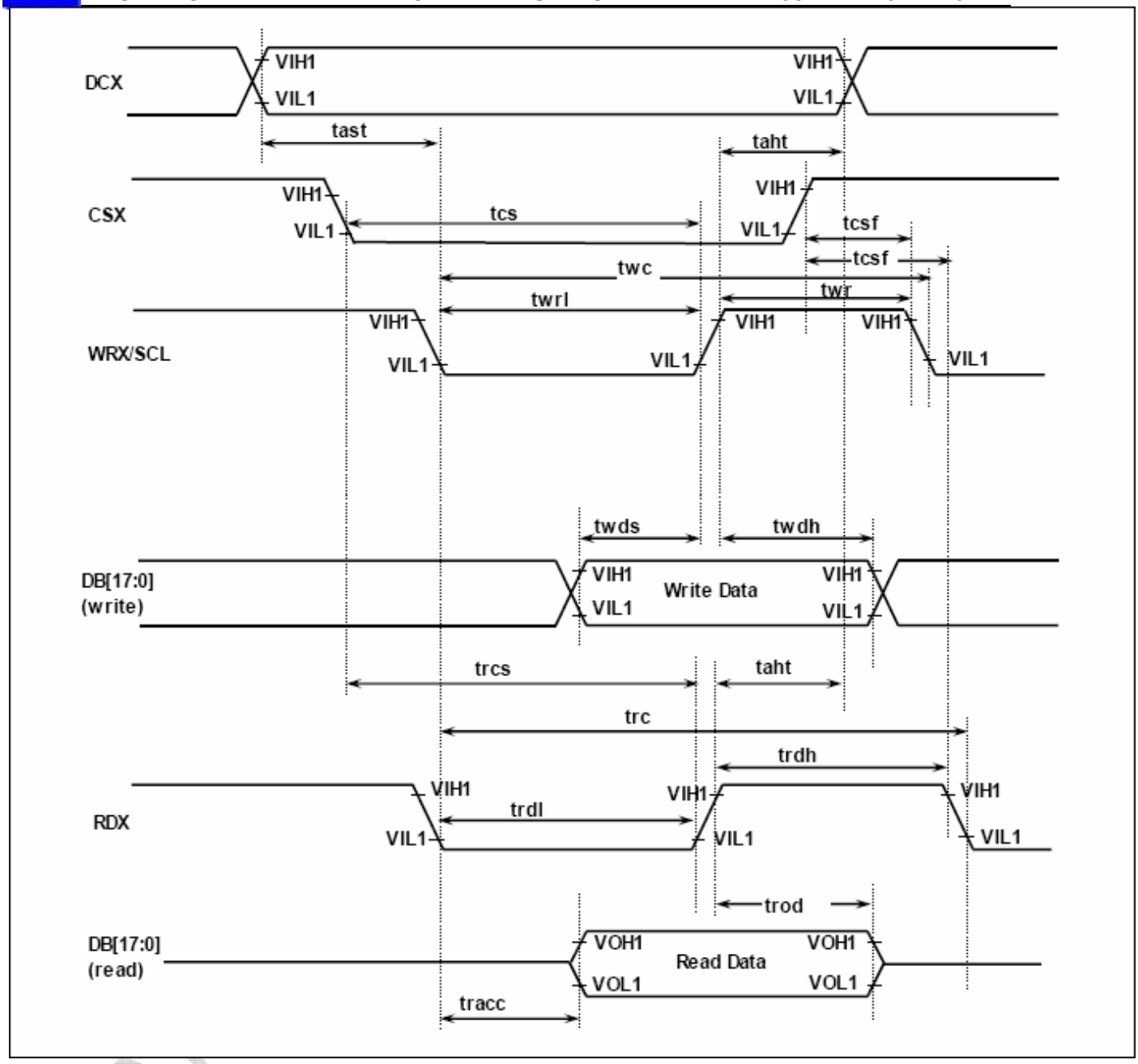


Figure 5.1 Parallel interface characteristics

5.2 Interface Register write/read timing

5.2.1 Write to register

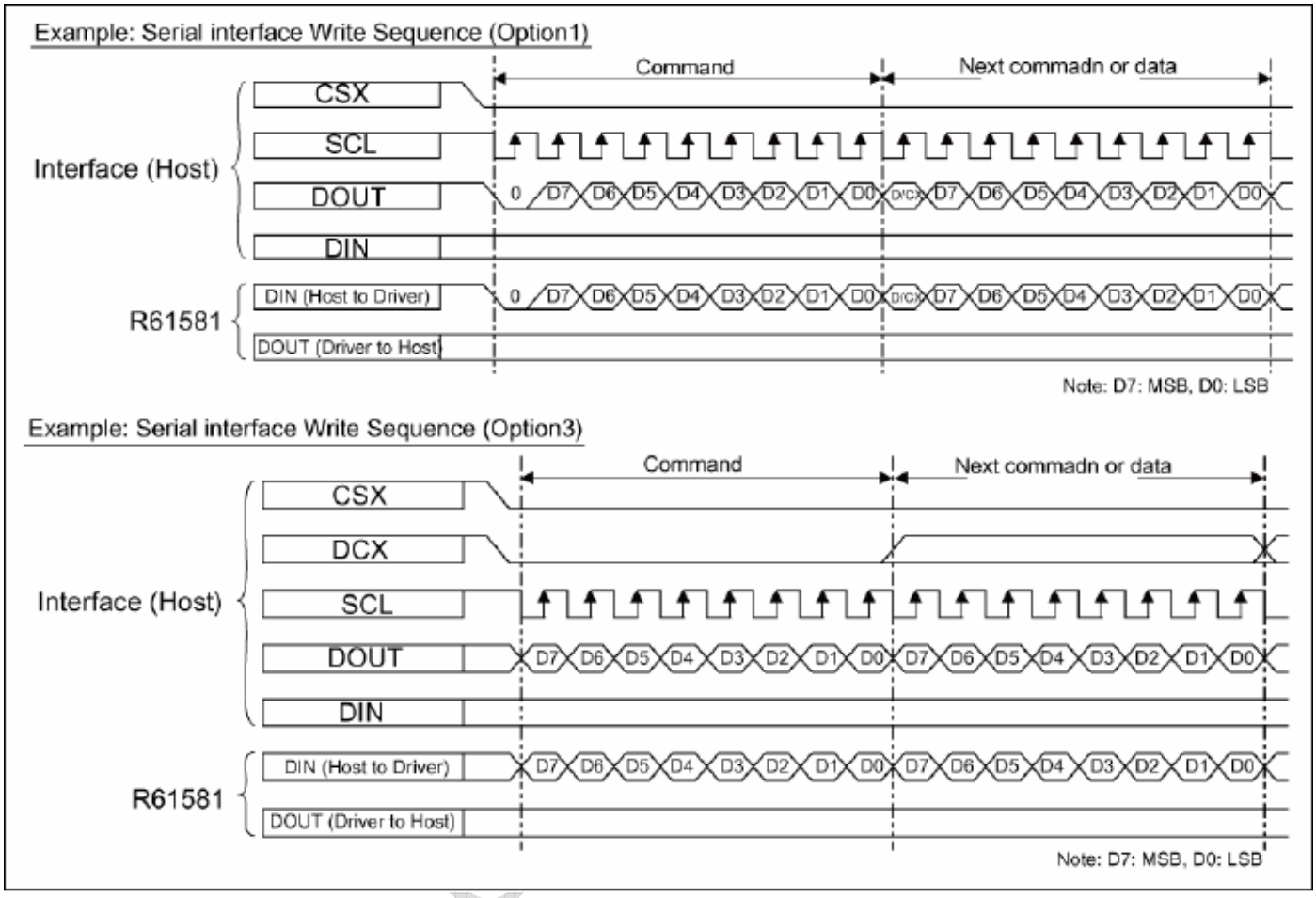


Figure 5.2.1 Register write timing in parallel bus system interface (for I80 series MPU)

5.2.2 Read from register

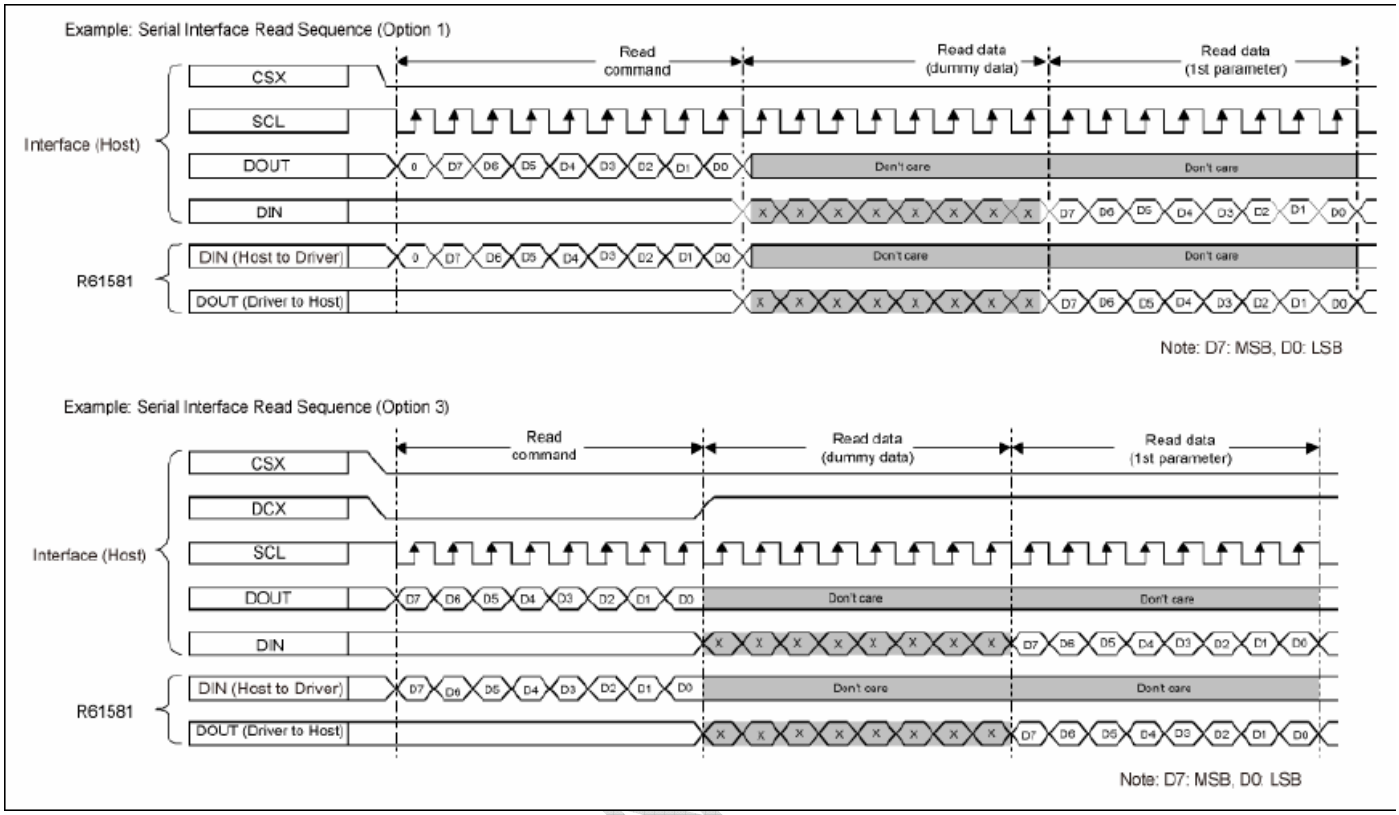


Figure 5.2.2 Register read timing in parallel bus system interface (for I80 series MPU)

5.3 DPI Data Format

● Pin Connection for 18-Bit Interface (DB[17:0] is used. set_pixel_format D[6:4]=3'h6. 18bpp)

Configuration 1

		D[23:0]																							
Host pin		[23]	[22]	[21]	[20]	[19]	[18]	[17]	[16]	[15]	[14]	[13]	[12]	[11]	[10]	[9]	[8]	[7]	[6]	[5]	[4]	[3]	[2]	[1]	[0]
								R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
		↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
LCD driver pin		DB[17:0]																							
		[17]	[16]	[15]	[14]	[13]	[12]	[11]	[10]	[9]	[8]	[7]	[6]	[5]	[4]	[3]	[2]	[1]	[0]						
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0						

Configuration 2

		D[23:0]																							
Host pin		[23]	[22]	[21]	[20]	[19]	[18]	[17]	[16]	[15]	[14]	[13]	[12]	[11]	[10]	[9]	[8]	[7]	[6]	[5]	[4]	[3]	[2]	[1]	[0]
				R5	R4	R3	R2	R1	R0			G5	G4	G3	G2	G1	G0			B5	B4	B3	B2	B1	B0
				↓	↓	↓	↓	↓	↓			↓	↓	↓	↓	↓	↓			↓	↓	↓	↓	↓	↓
LCD driver pin		DB[17:0]																							
				[17]	[16]	[15]	[14]	[13]	[12]			[11]	[10]	[9]	[8]	[7]	[6]			[5]	[4]	[3]	[2]	[1]	[0]
				R5	R4	R3	R2	R1	R0			G5	G4	G3	G2	G1	G0			B5	B4	B3	B2	B1	B0

5.4 Reset Timing Characteristics

Ta=25℃

Item	Symbol	Unit	Test Condition	Min.	Max.
Reset "Low" level width 1	tRW1	ms	Power On	1	–
Reset "Low" level width 2	tRW2	us	Operation	10	–
Reset time	tRT	ms		–	5

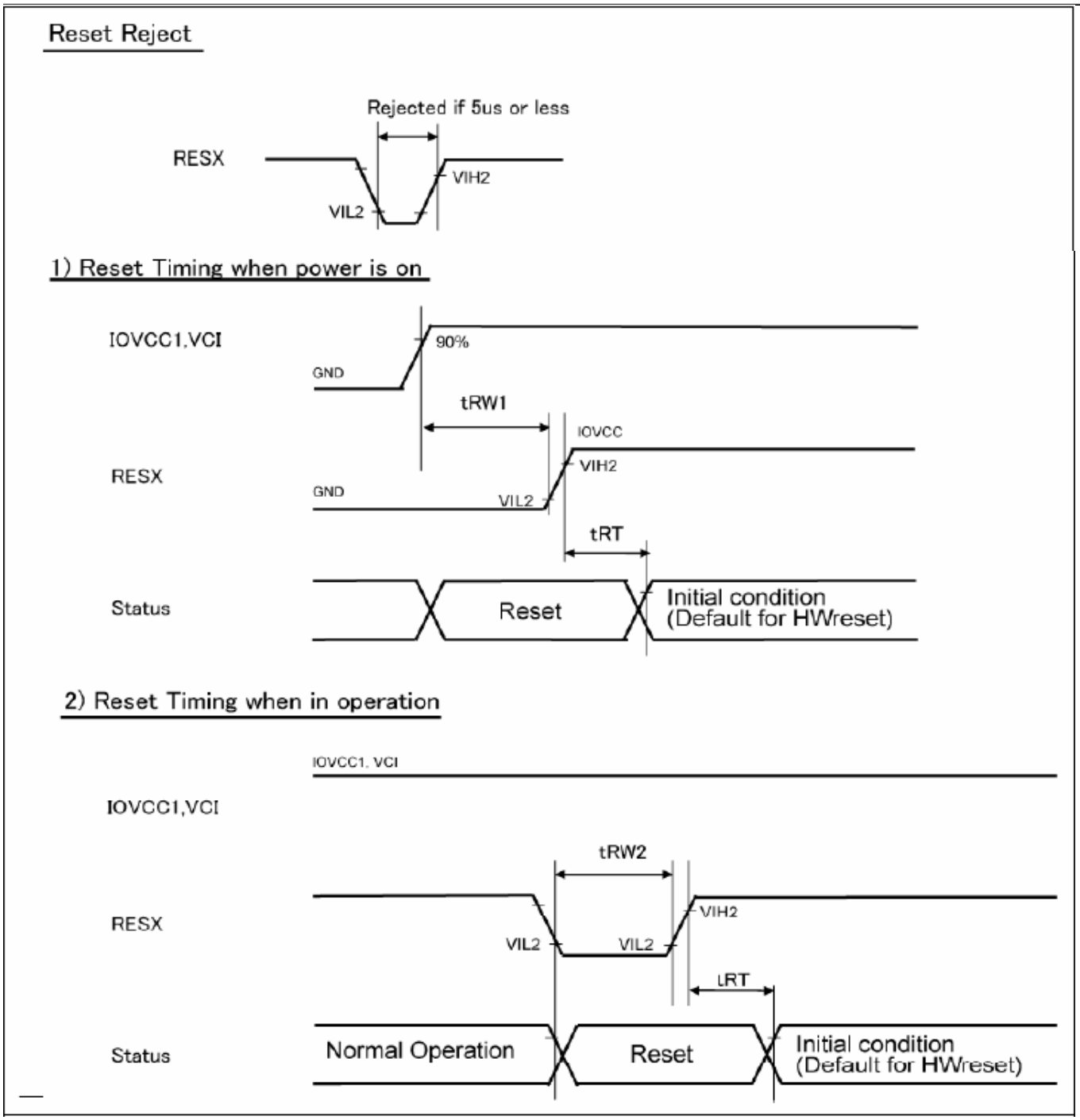
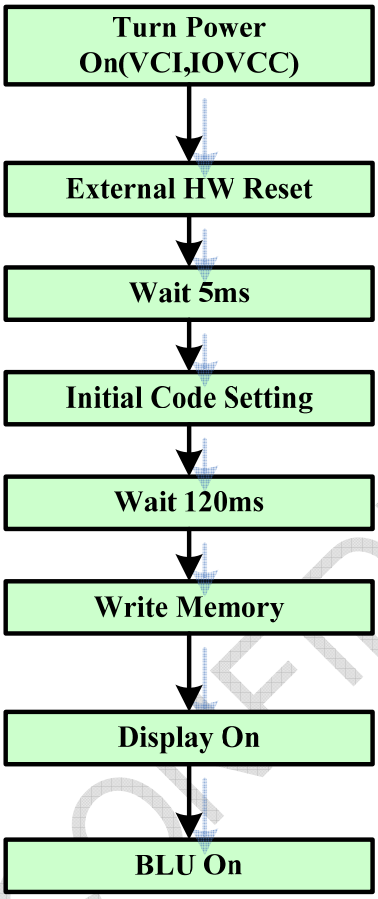


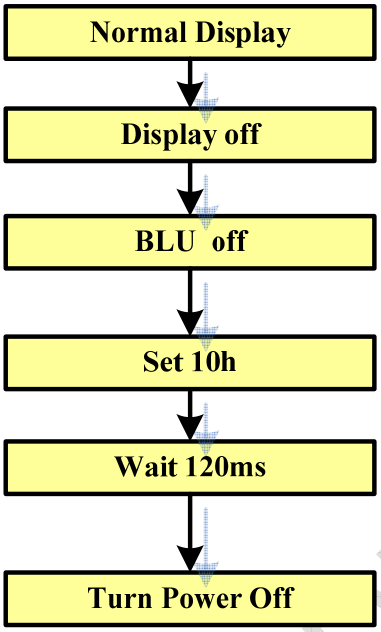
Figure 5.4 RESET Timing

Power ON/OFF Sequence

5.4.1 Power ON Sequence



5.4.2 Power OFF Sequence



6 Optical Characteristics Optical Specification

Ta=25℃

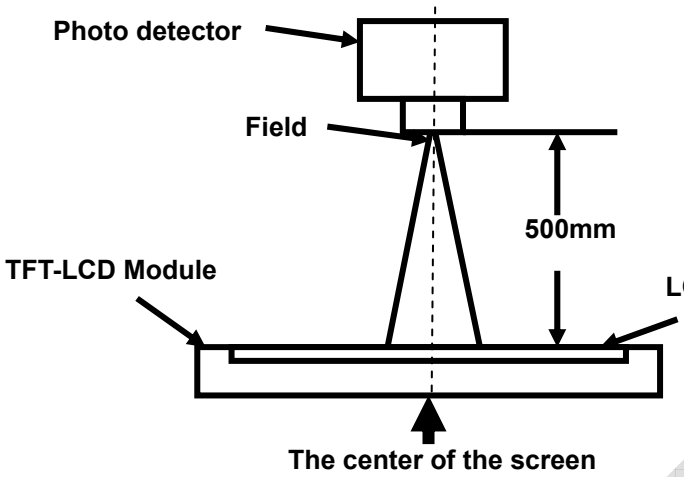
Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angle		θT	CR≥10	70	80	--	Degree	Note 2
		θB		70	80	--		
		θL		70	80	--		
		θR		70	80	--		
Contrast Ratio		CR	θ=0°	500	600	--		Note1 Note3
Response Time		T_{ON}	25℃	--	35	45	ms	Note1 Note4
		T_{OFF}						
Chromaticity	White	x	Backlight is on	0.249	0.299	0.349		Note1 Note5
		y		0.269	0.319	0.369		
	Red	x		0.527	0.577	0.627		
		y		0.271	0.321	0.371		
	Green	x		0.282	0.332	0.382		
		y		0.543	0.593	0.643		
	Blue	x		0.105	0.155	0.205		
		y		0.038	0.088	0.138		
Uniformity		U		75	80	--	%	Note1 Note6
NTSC				50	55	--	%	Note5
Luminance		L		300	350	--	nits	Note1 Note7

Test Conditions:

1. V_F =3.2V ,I_F =15mA(LED current), the ambient temperature is 25℃.
2. The test systems refer to Note1 and Note2.

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)。

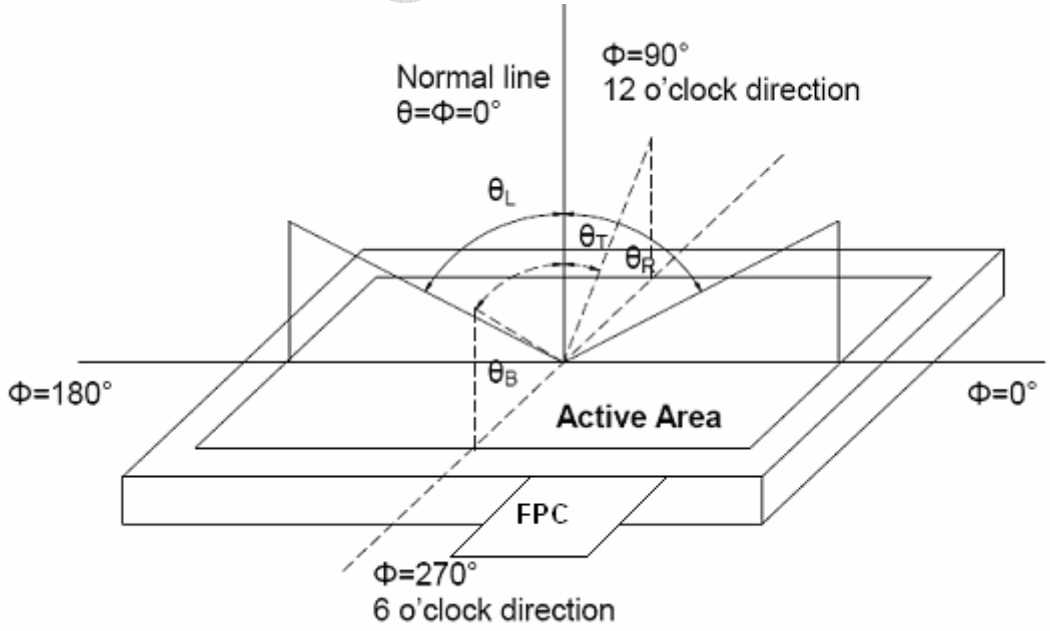


Fig. 1 Definition of viewing angle

Note 3: Definition of contrast ratio

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

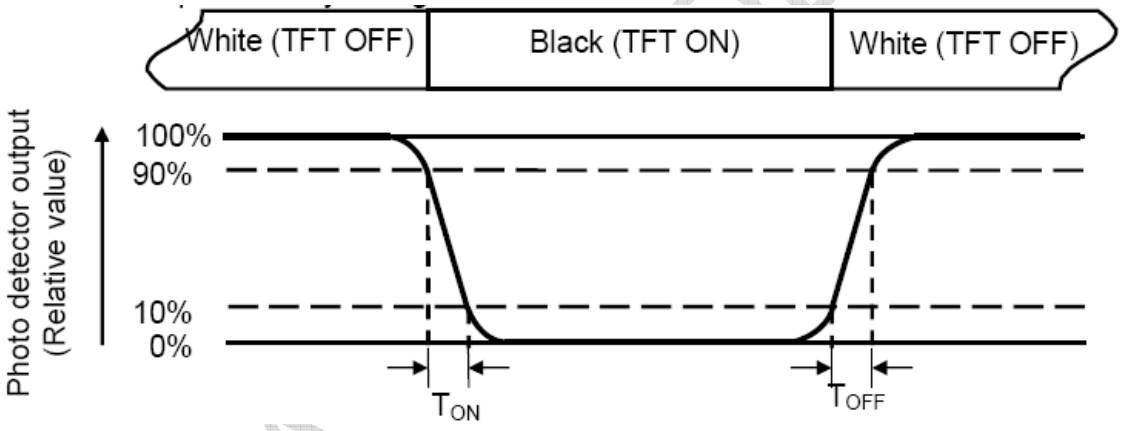
“White state “:The state is that the LCD should driven by Vwhite.

“Black state”: The state is that the LCD should driven by Vblack.

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.

Luminance Uniformity(U) = Lmin/ Lmax

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

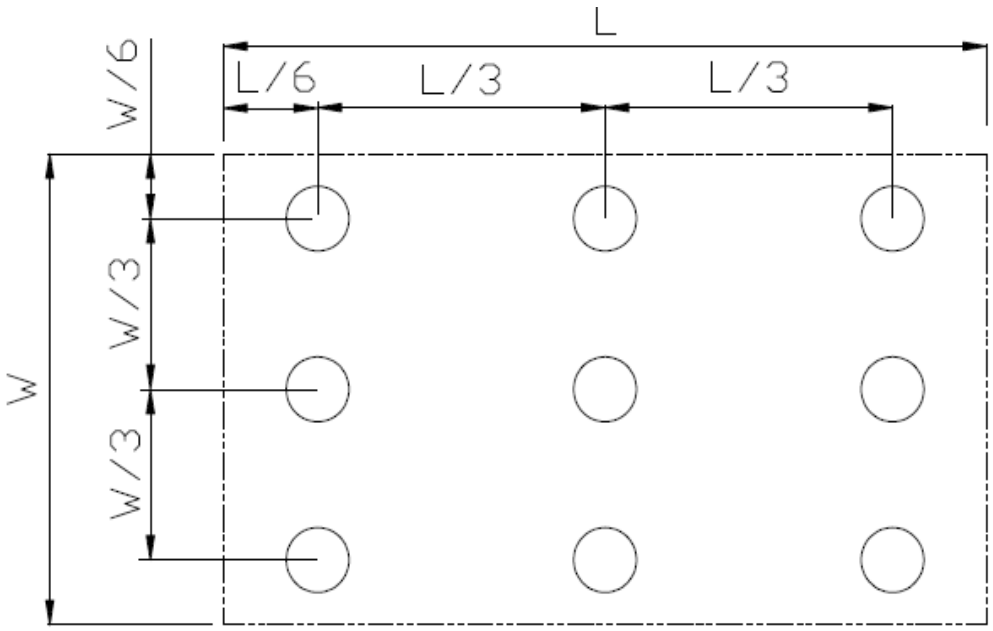


Fig. 2 Definition of uniformity

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.

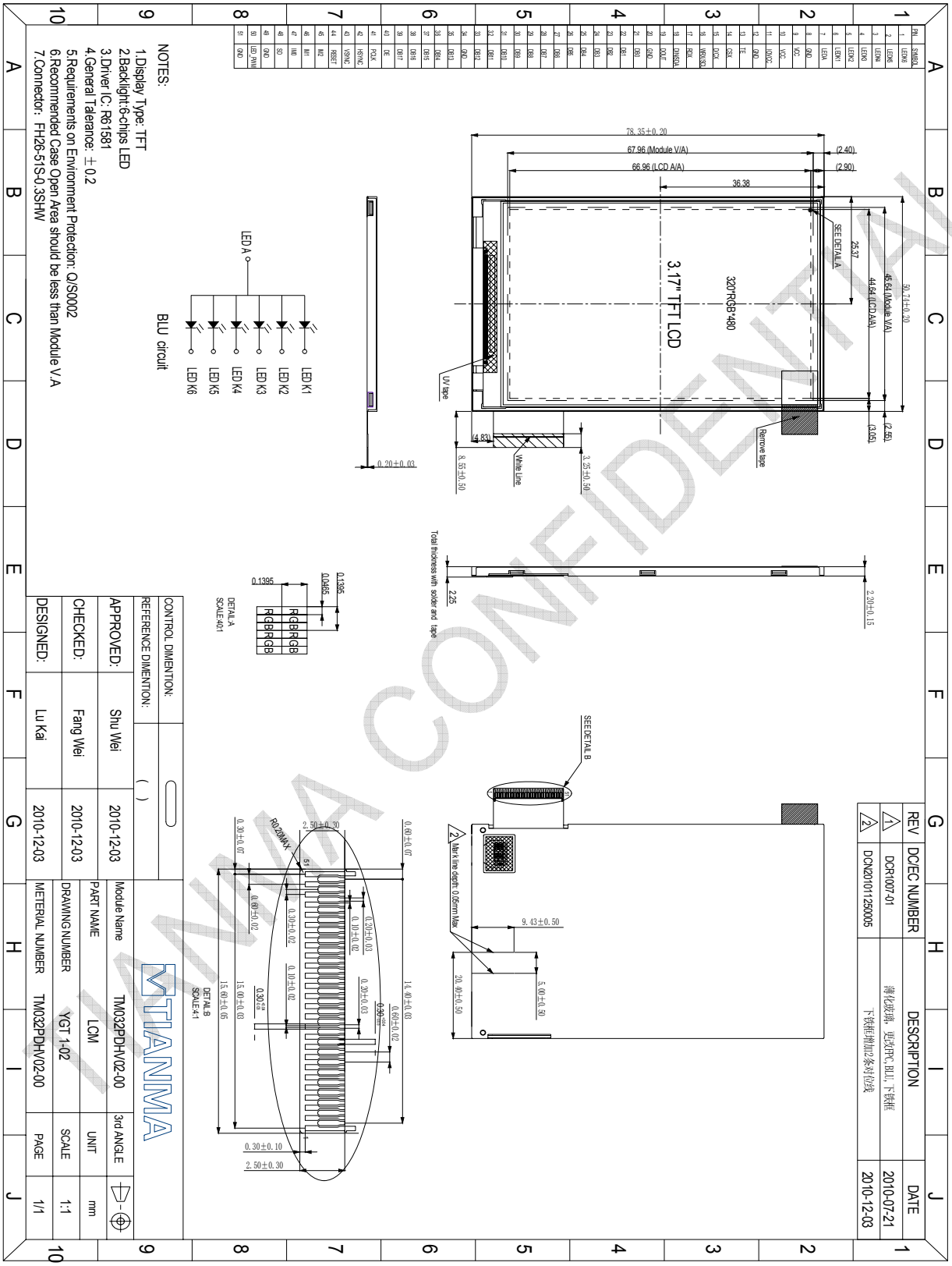
7 Environmental / Reliability Test

No	Test Item	Condition	Remark
1	High Temperature Operation	Ts=+70℃, 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~+80℃ 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
11	Package Vibration Test	Random Vibration: 0.015GxG/Hz for 5-200Hz, -6dB/Octave from 200-500Hz 2 hours for each direction of X,Y,Z (6 hours for total)	IEC60068-2-34 GB/T2423.11

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

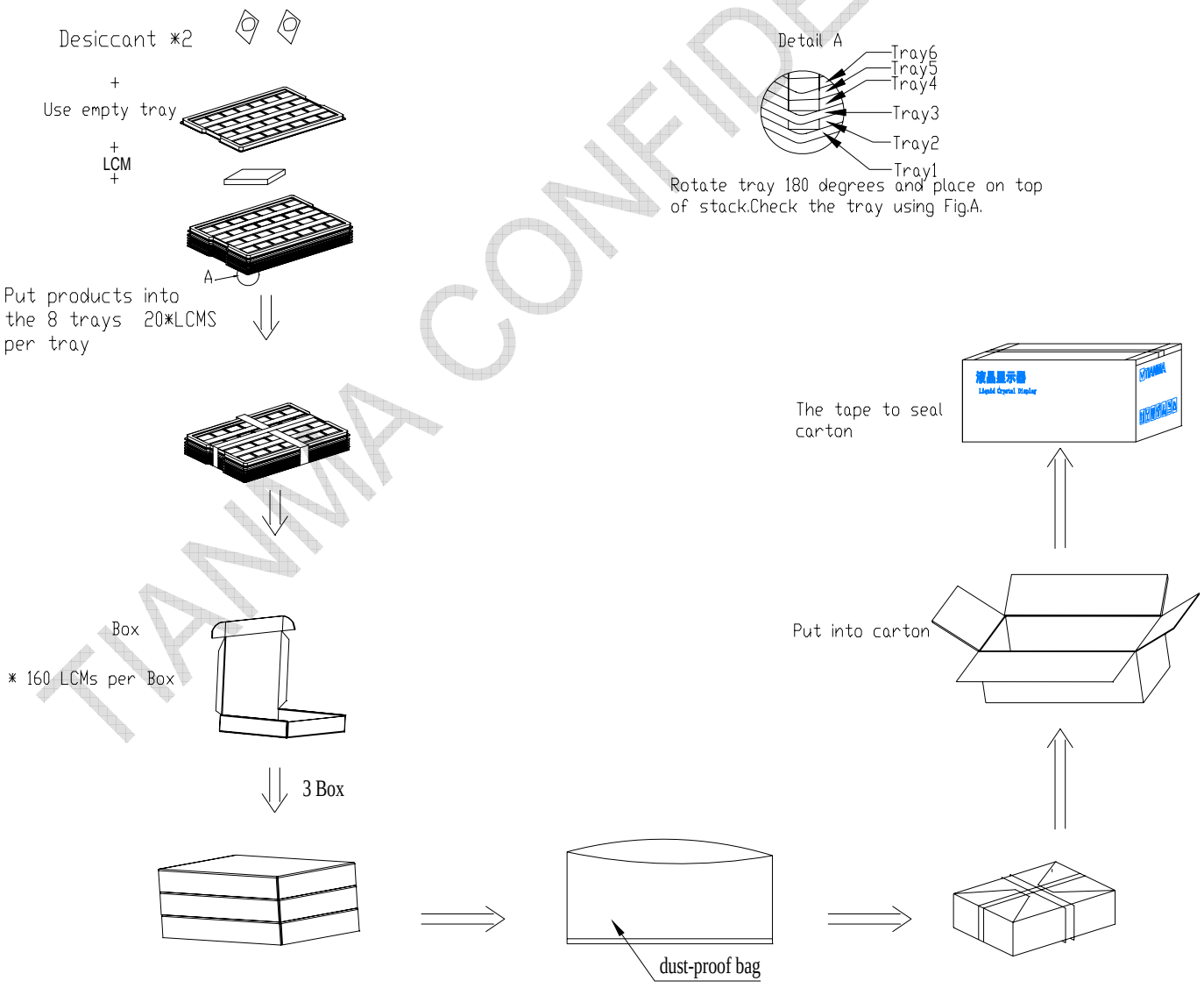
Note2: Ta is the ambient temperature of sample.

8 Mechanical Drawing



9 Packing Drawing

No	Item	Model (Material)	Dimensions(mm)	Unit Weight(Kg)	Quantity	Remark
1	LCM module	TM032PDHV02-00	50.74×78.35×2.2	0.01584	480	
2	Tray	PET（Transmit）	485×330×13.8	0.1758	27	Anti-static
3	Anti-static bag	PE	700×545	0.046	1	
4	BOX	CORRUGATED PAPER	520×345×70	0.3879	3	
5	Desiccant	Desiccant	45×35	0.002	6	
6	Carton	CORRUGATED PAPER	530×351×226	1.01	1	
7	Total Weight(Kg)	14.58 Kg				



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:

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.