SPECIFICATION

[◉] Preliminary Specification
[ ] Final Specification

Description **4.17” 720xRGBx720 TFT-LCD Module**

Part Number **A0417RKF1MA00**

Customer			Tianma Microelectronics Co., Ltd.	
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* This cover page is for your Comments and Signatures back to TIANMA.

REVISION HISTORY

Rev	Date	Page	Revision Items	Editor
1.0	2022/11/15	/	Preliminary spec	Mingxu_xiao
2.0	2023/06/13	Page8 Page 15 Page 18	1.page8: update LED forward current , voltage , power consumption , LED strings is 4 LED /string 2. Page15: update Wx, Wy 3. Page 18： module drawing update	Mingxu_xiao
3.0	2023/07/24	Page 19	Update package specifation	Mingxu_xiao

CONTENTS

1. Summary

1.1 General Description

This is a 4.17 inch a-Si TFT-LCD module with Normal- Black technology. It is composed of a TFT-LCD panel, a driver circuit, FPC, and a LED backlight unit.

1.2 Features

- Ultra-wide viewing angle (Super Fine TFT)
- High luminance
- Wide temperature range
- Sunglass visible
- Interface: RGB
- Compliant with the European RoHS Directive (2011/65/EU) and Delegated Directive (2015/863/EU, Amending Annex II of 2011/65/EU)

2. General Specifications

Feature		Spec	Unit
Display Spec	Size	4.17	inches
	Resolution	720(RGB)x720	
	Pixel Pitch	0.147*0.147	mm
	Pixel Configuration	RGB stripe	
	TFT Active Area	105.84x105.84	mm
	Pixel Configuration	R.G.B Vertical Stripe	
	Panel mode, technology and configuration	a-Si ,SFT, Normally Black	
	Surface Treatment	AG	
	Viewing Direction	ALL	
Mechanical Characteristics	LCM (W x H x D)	114.85x118.37x6.46(screw boss are not counted)	mm
	Weight	TBD	g
Optical Characteristics	Luminance	1300 type	cd/m^2
	Contrast Ratio	1000 type	
	NTSC	65% type	%
	Viewing Angle	85/85/85/85	degree
	Interface	RGB 24 bits	
	Color Depth	16.7 Million	colors
	Power Consumption	TBD	mW

Table 2.1 General TFT Specifications

3. Input / Output Terminals

3.1 CN1 Pin assignment (LCD Interface)

matching connector type:FH28D-50S-0.5SH(05)

PIN #	Symbol	P/I/O	Description	Remark
1	LEDA1	P	LED anode	--
2	LEDA2	P	LED anode	--
3	NTC+	O	Connect NTC	--
4	NTC-	O	Connect NTC	--
5	LEDK1	P	LED cathode	--
6	LEDK2	P	LED cathode	--
7	GND	P	Power Ground	--
8	RESETB	I	Reset Pin. Low active. Initialization is executed when this pin is set to Low	--
9	STBYB	I	Standby mode: 'H': Normal operation (Default) 'L': TCON, SD, power circuit and temp sensor will be turned off	--
10	GND	P	Power Ground	--
11	MODE	I	DE or SYNC mode select: 'H': SYNC mode 'L': DE mode	--
12	DE	I	Input pin for data enable	
13	HS	I	Input pin for horizontal synchronization signal	--
14	VS	I	Input pin for vertical synchronization signal	--
15	GND	P	Power Ground	--
16	DCLK	I	Input pin for pixel clock, （Rising Latch）	--
17	GND	P	Power Ground	--
18	R7	I	Red data(MSB)	--
19	R6	I	Red data	--
20	R5	I	Red data	--
21	R4	I	Red data	--
22	R3	I	Red data	--
23	R2	I	Red data	--
24	R1	I	Red data	--
25	R0	I	Red data(LSB)	--
26	G7	I	Green data(MSB)	--
27	G6	I	Green data	--
28	G5	I	Green data	--

PIN #	Symbol	P/I/O	Description	Remark
29	G4	I	Green data	--
30	G3	I	Green data	--
31	G2	I	Green data	--
32	G1	I	Green data	--
33	G0	I	Green data(LSB)	--
34	B7	I	Blue data(MSB)	--
35	B6	I	Blue data	--
36	B5	I	Blue data	--
37	B4	I	Blue data	--
38	B3	I	Blue data	--
39	B2	I	Blue data	--
40	B1	I	Blue data	--
41	B0	I	Blue data(LSB)	--
42	GND	P	Power Ground	--
43	VCC	P	Power supply 3.3V	--
44	VCC	P	Power supply 3.3V	--
45	GND	P	Power Ground	--
46	SPI_CSB	I	Chip select signal for SPI interface, Only Tianma used, customer must be floating(no connection)	--
47	SPI_SCL	I	Clock signal for SPI interface, Only Tianma used, customer must be floating(no connection)	--
48	SPI_SDI	I	Serial data input for SPI interface, Only Tianma used, customer must be floating(no connection)	--
49	SPI_SDO	O	Serial data output for SPI interface, Only Tianma used, customer must be floating(no connection)	--
50	VOTP	P	OTP Power, Only Tianma used, customer must be floating(no connection)	--

I/O definition: I---Input, O---Output, P---Power/Ground, N---No connection

Table 3.1.1 Pin Assignment for LCD Interface

Note1: All of the GND pins should be connected to the system ground.

Note2: Pin definition will be fine-tuned after layout

4. Absolute Maximum Ratings

GND=0V, Ta = 25℃

Item	Symbol	Min	Max	Unit	Remark
Logic supply voltage	VCC	-0.3	6	V	
Input Voltage	VIN	-0.3	VCC	V	Note1

Table 4.1 Absolute Maximum Rating

Note1: Input voltage include: R0~R7, G0~G7, B0~B7, STBYB, RESETB, DCLK, HS,VS，DE

5. Electrical Characteristics

5.1 DC Characteristics for Panel Driving

GND=0V, Ta = 25℃

Item		Symbol	Min	Typ	Max	Unit	Remark
Logic supply voltage		VCC	3.2	3.3	3.4	V	
VCC Current		Ivcc		TBD		mA	Note1
Input Signal Voltage	High Level	VIH	0.8xVCC	-	VCC	V	Note2
	Low Level	VIL	0	-	0.2xVCC	V	
(Panel +LSI) Power Consumption		White Mode		TBD		mW	Note1

Table 5.1.1 Operating Voltages

Note1: Indicated the subsequent version may be updated.

Note2: Input voltage include: R0~R7, G0~G7, B0~B7, STBYB, RESETB, DCLK, HS,VS,DE

5.2 DC Characteristics for Backlight Driving

Item	Symbol	Min	Typ	Max	Unit	Remark
Forward Current	I_F		140(70*2)		mA	Note1
Forward Voltage	V_{BL}	11.2	12	12.8	V	Note2
Backlight Power Consumption	W_{BL}		1.68		W	Note2
Lifetime	-		50000		Hrs	Note3

Table 5.2.1 LED Backlight Characteristics

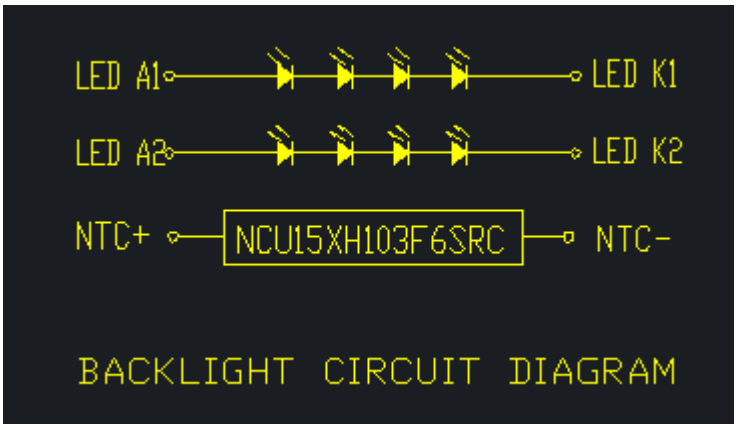


Figure 5.2.2 LED Connection of Backlight

Note1: I_F is defined for two channel LEDs. There are total of 2 LED channels in the backlight unit. While the LCM is operating, a stable forward current should be supplied. The forward current max value is only for inrush current.
Note2: Under LCM operating, the stable forward current should be inputted.
Note3: IF is defined for two 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.
Note4: An NTC thermistor is included in the LED circuit. It is used to measure the LED temperature and is located in the LED circuit on the backlight FPC.

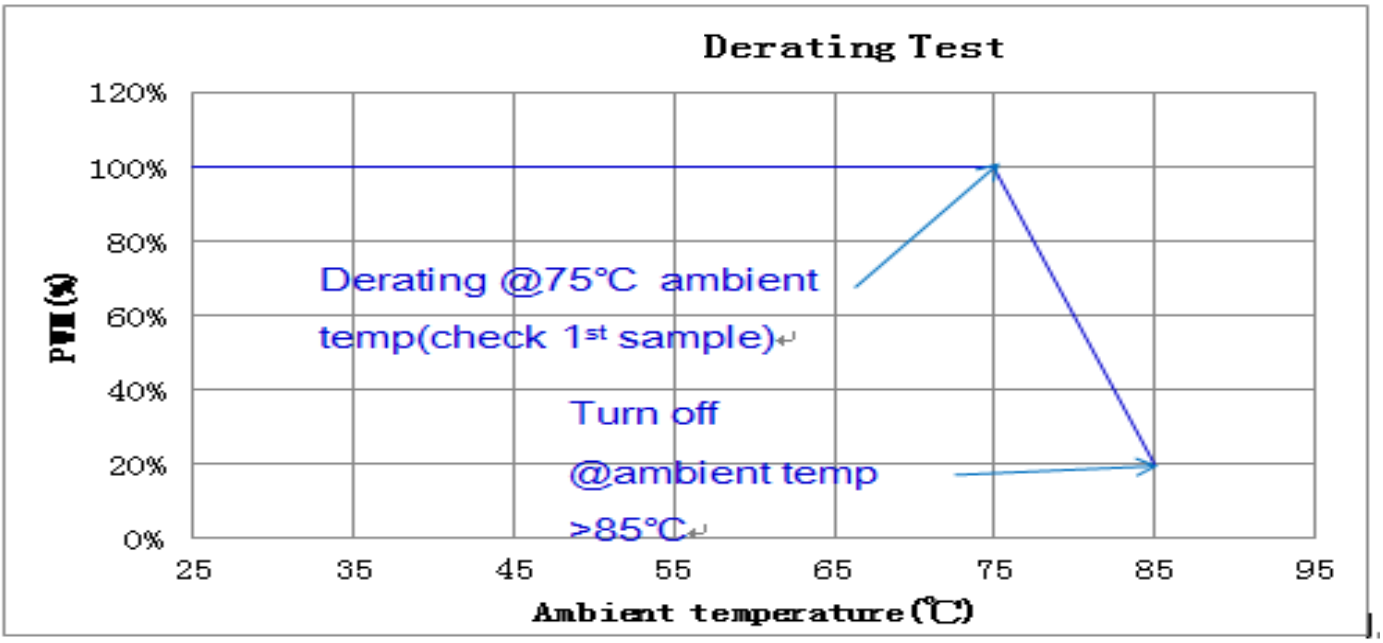
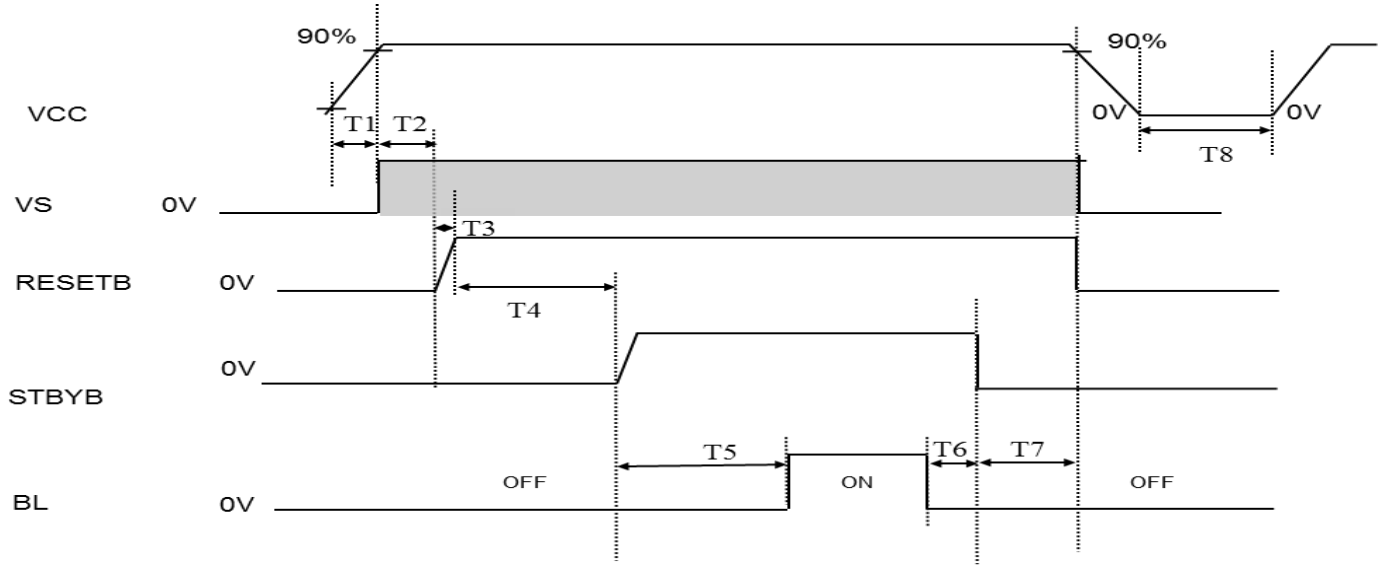


Figure 5.2.3 PWM vs. Ambient Temperature (Update based on actual measurement)

Note5: To reduce the influence of NTC self-heating and improve the measurement accuracy, suggest the operating current of NTC is 0.1mA Max

5.3 Recommended Power ON/OFF Sequence

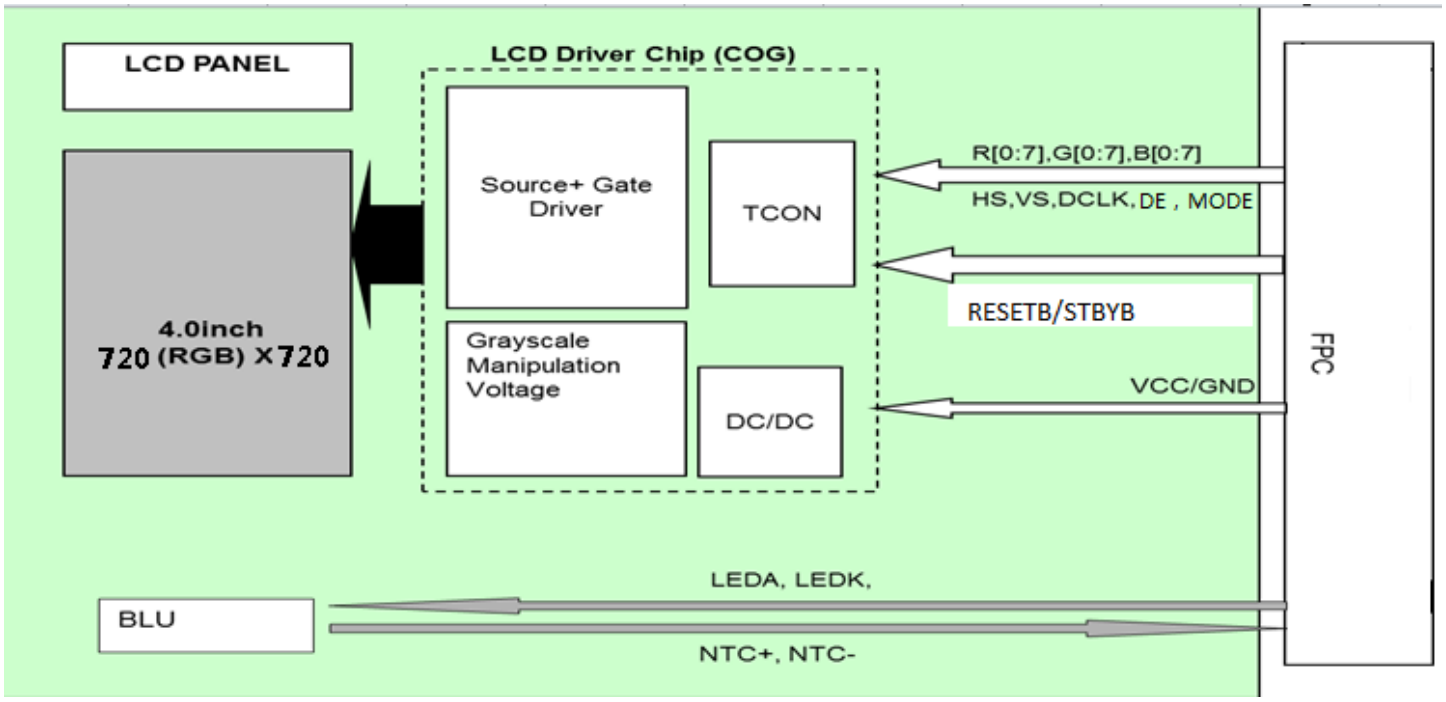


Description	Parameter	Min	Typ	Max	Unit
Rise time 0.1*VCC to 0.9*VCC	T1	1	-	3	ms
0.9VCC to RESETB start(low)	T2	1	-	-	ms
0.1*RESETB to 0.9*RESETB	T3	-	-	1	us
RESETB high to STBYB low	T4	50	-	-	ms
STBYB high to BL on	T5	200	-	-	ms
BL off to STBYB low	T6	50	-	-	ms
STBYB low to failing time 0.9*VCC	T7	150	-	-	ms
VCC power down（GND） to VCC power up again	T8	2000	-	-	ms

Table 5.3.1 Power ON/OFF Sequence

Note1: The low level of these signals and analog powers are GND level.
Note2: All of the power and signals should be kept at GND level before power on. If there are residual voltages on them, the LCD might not work properly.
Note3: The power on/off sequence is the first version. It will be updated when the design is fixed.
Note4: BL is the voltage applied to backlight. Keep it turned off until the display has stabilized.

5.4 LCD Module Block Diagram



5.5 Interface Timing Characteristics

5.5.1 RGB Interface Timing Characteristics

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
CLK frequency	tCLK	34.66	34.66	40	Mhz	
Horizontal blanking time	tHBT	40	40	112	tCLK	tHBP + tHFP
Horizontal back porch	tHBP	20	20	56	tCLK	Include tHPW
Horizontal display area	tHD		720		tCLK	
Horizontal front porch	tHFP	20	20	56	tCLK	
Horizontal period	tH	760	760	832	tCLK	
Horizontal pulse width	tHPW	2	2	2	tCLK	
Vertical blanking time	tVBT	40	40	80	tH	tVBP + tVFP
Vertical back porch	tVBP	20	20	40	tH	Include tVPW
Vertical display area	tVD		720		tH	
Vertical front porch	tVFP	20	20	40	tH	
Vertical period	tV	760	760	800	tH	
Vertical pulse width	tVPW	2	2	2	tH	

Table 5.1.1 Input Timing

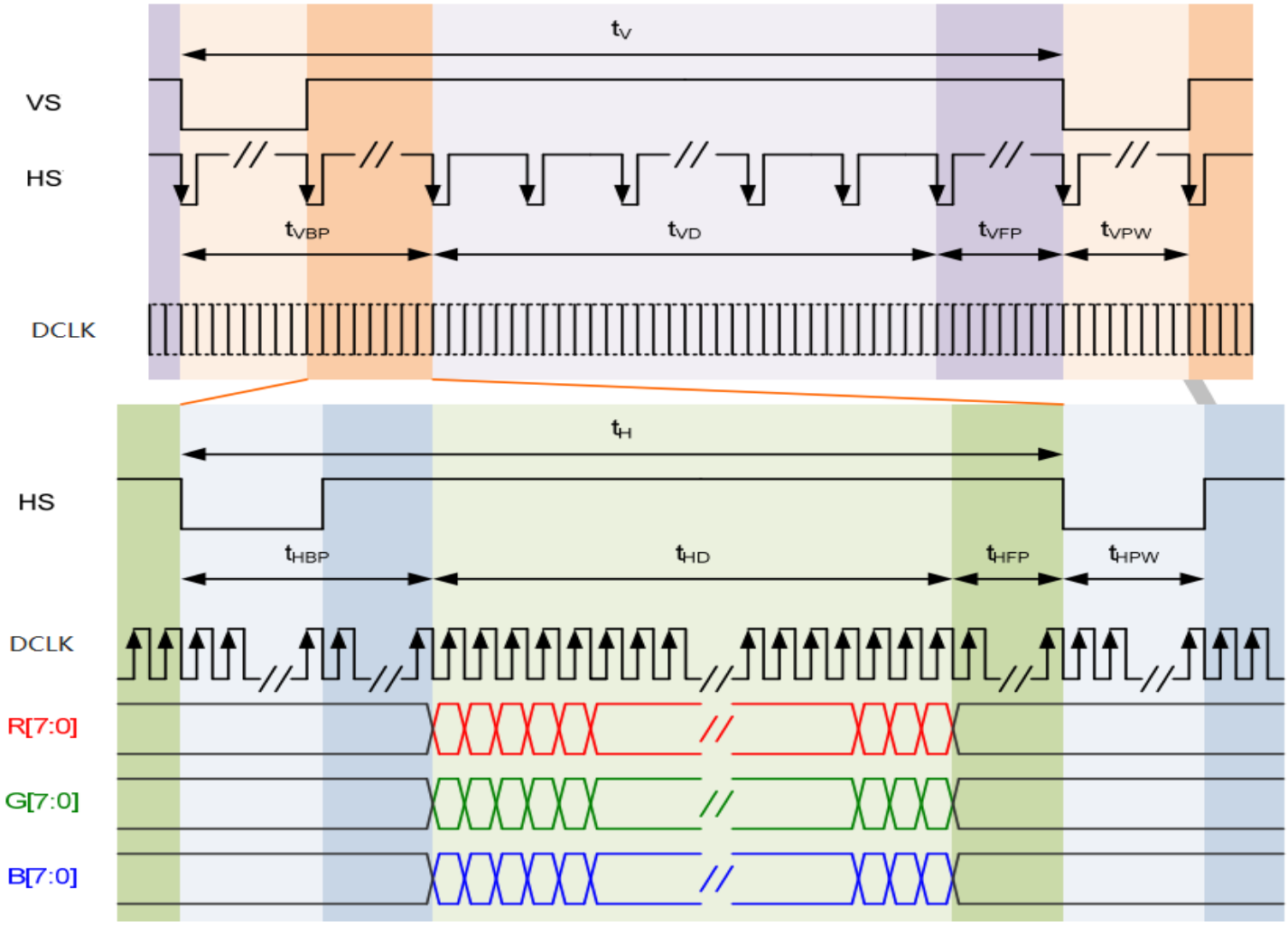


Figure 5.1.2 SYNC mode Input Timing

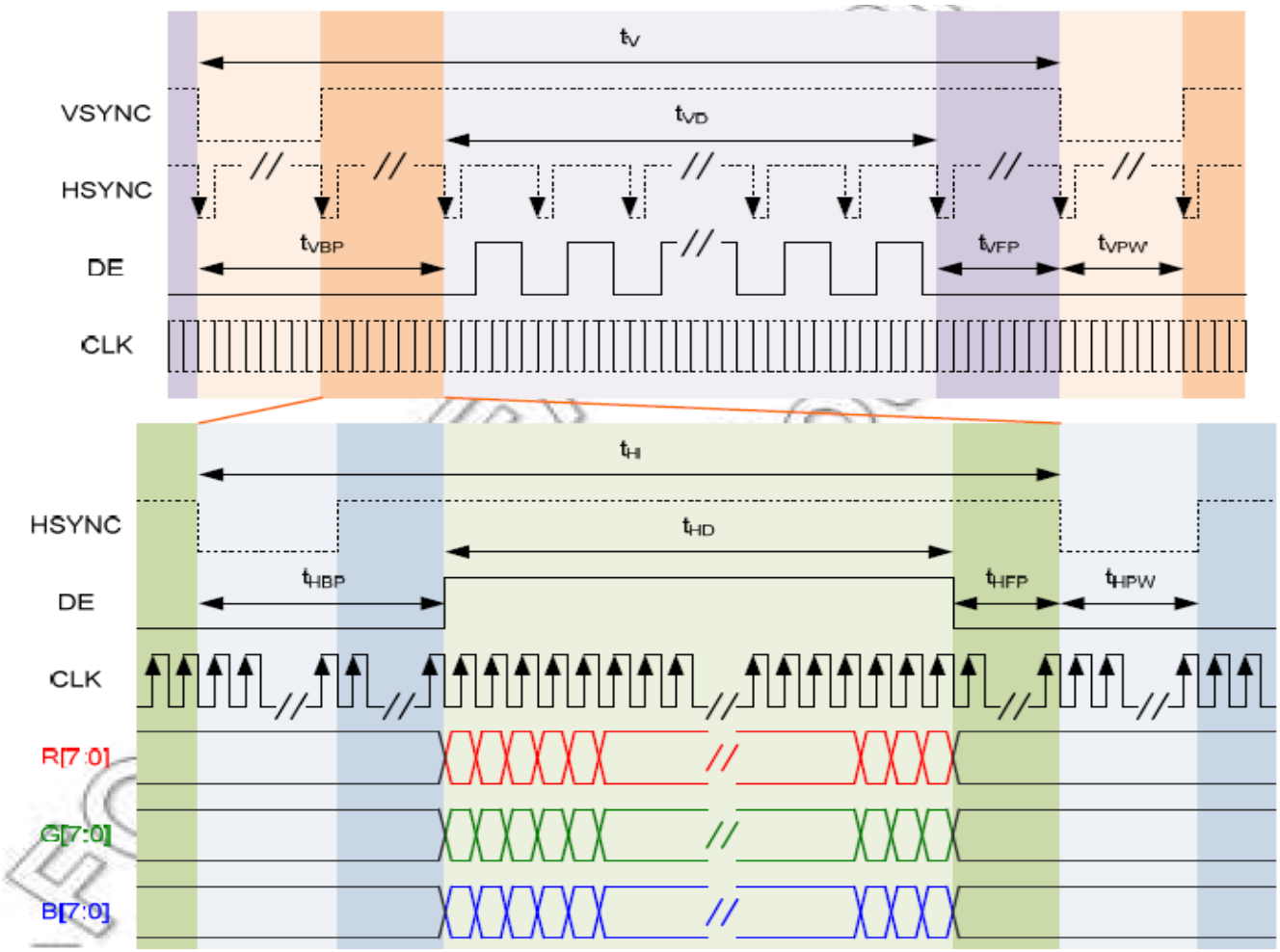
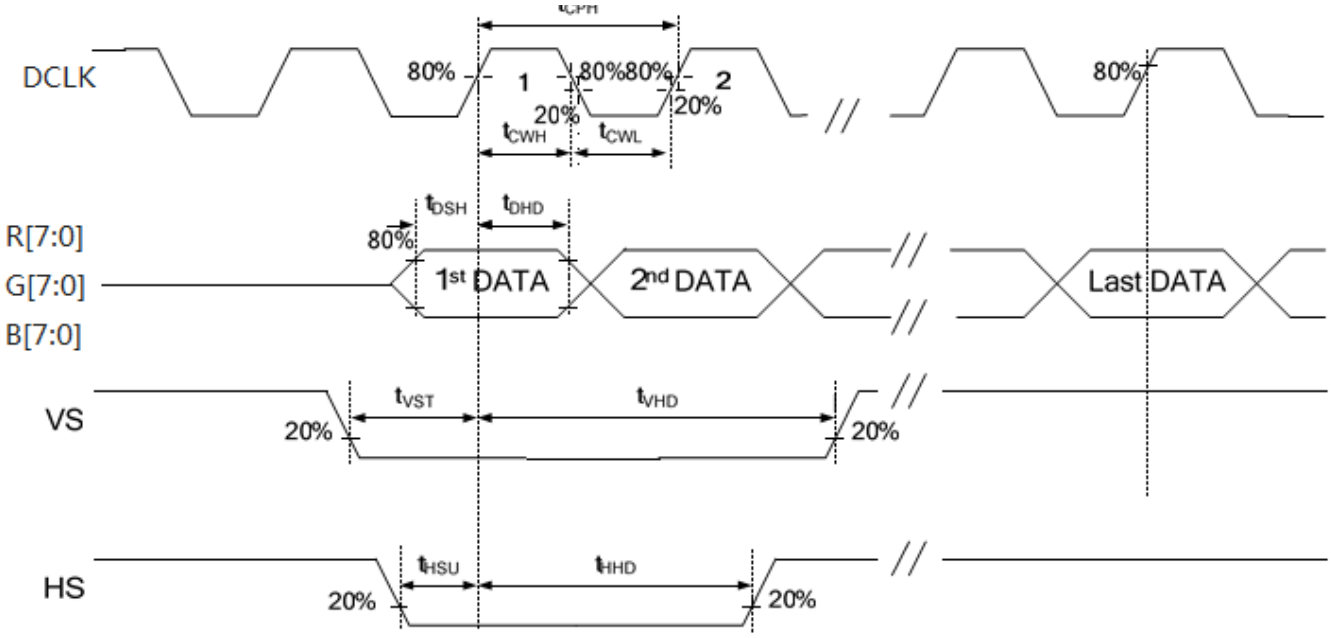


Figure 5.1.3 DE mode Input Timing

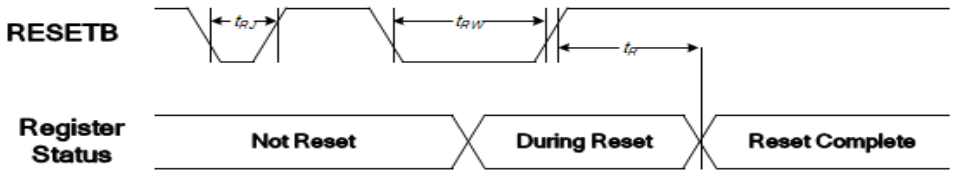
Note1：Above of all these parameters is just for reference，the final parameters should be based on the test result of module

5.5.2 AC Timing



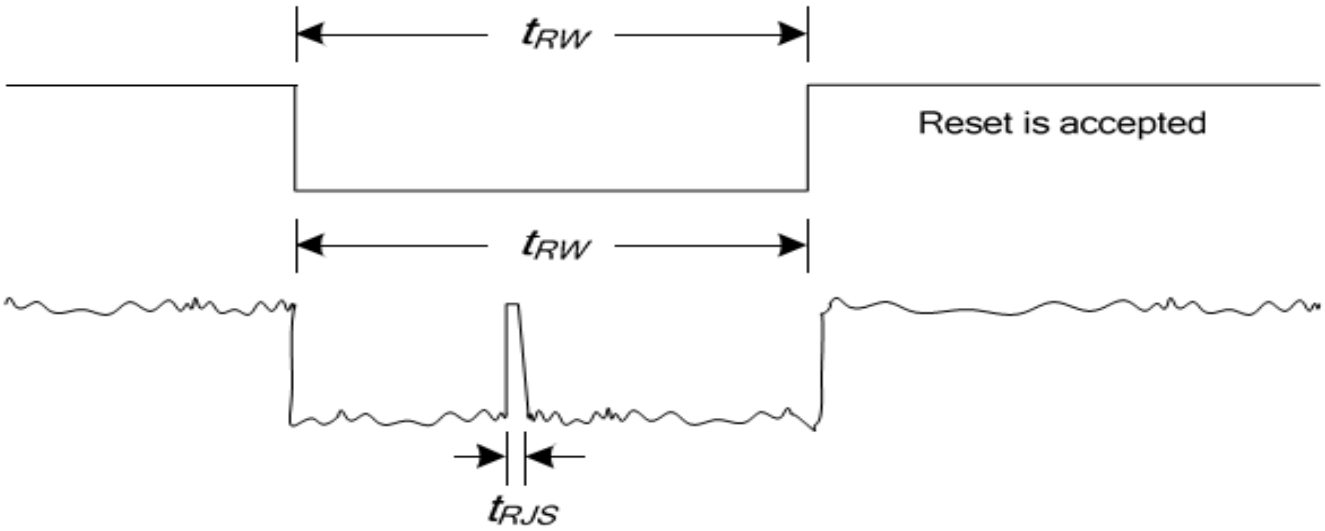
Item	Signal	Symbol	Condition	Rating		Unit
				Min.	Max.	
CLK cycle time	CLK	t_{CPH}		25	200	ns
CLK pulse high duty		t_{CWH}		40	60	%
CLK pulse low duty		t_{CWL}		40	60	
VS setup time	VS	t_{VST}		4	-	ns
VS hold time		t_{VHD}		2	-	
HS setup time	HS	t_{HST}		4	-	
HS hold time		t_{HHD}		2	-	
Data setup time	R/G/B[7:0]	t_{DSH}		4	-	
Date hold time		t_{DHD}		2	-	

5.5.3 RESETB Timing



GND= 0V, VCC = 3.3V, Ta = -30 ~ 85°C

Item	Signal	Symbol	Condition	Rating		Unit
				Min.	Max.	
RESETB time	RESETB	t_R		—	5	us
RESETB "L" pulse width		t_{RW}		15	—	
RESETB rejection		t_{RJ}		—	5	
RESETB rejection (for noise spike)		t_{RJS}		—	10	ns



NOTE:

1. When the system issues a RESETB low pulse, the reset procedure of IC will start if the low pulse is longer than tRW specified above. If the low pulse is less than tRJ specified above, the reset procedure of IC will not start. If the low pulse is longer than tRJ and less than tRW, the reset procedure of IC is not guaranteed.

6. Optical Characteristics

Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
Viewing Angle		θU	CR≧10	75	85		°	Note 1&2&3
		θD		75	85			
		θL		75	85			
		θR		75	85			
Contrast Ratio		CR(25℃)	Vertical	800	1000		--	Note 1&2&3
Response Time		Tr+Tf	25℃		20	30	ms	Note4
Chromaticity	White	X	CIE1931-XYZ	0.242	0.292	0.342	--	Note 1&5
		Y		0.274	0.324	0.374		
	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		
Luminance		Vertical	25℃	1000	1300		cd/m^2	Note 1.6
Uniformity		White	25℃,9points	70	75		%	Note 7
NTSC			25℃	60	65		%	

Table 7.1 Optical Parameters

Test Conditions:

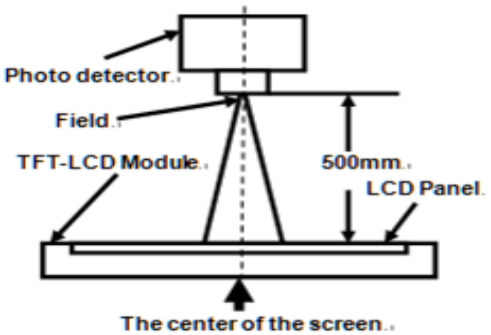
1. IF= 140mA (two channel), the ambient temperature is 25℃.
2. The test systems refer to Note 1 and Note 2.

Note1: Definition of optical measurement system

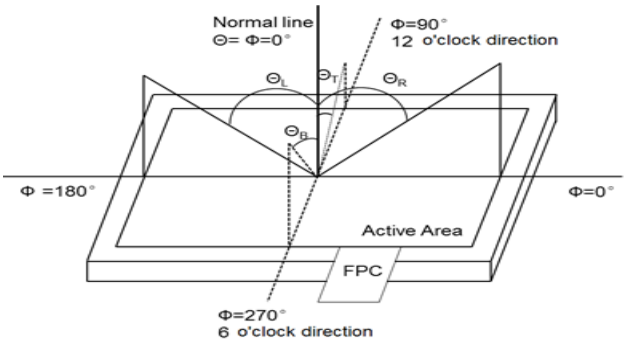
Measured at the center of the panel

Measuring condition:

- Measuring surroundings: Dark room.
- Measuring temperature: Ta=+25℃.
- Adjust operating voltage to get optimum contrast at the center of the display.



Note2: Definition of viewing angle range and measurement system



Note3: Definition of contrast ratio:

$$\text{Contrast Ratio(CR)} = \frac{\text{Luminance When LCD is White}}{\text{Luminance When LCD is Black}}$$

Contrast Ratio is measured in the optimum common electrode voltage

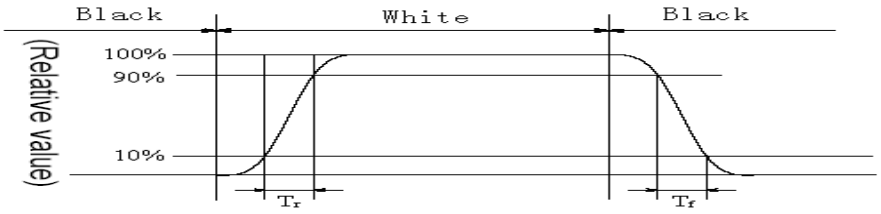
Note4: Definition of response time:

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 10% to 90%.

And fall time (T_{OFF}) is the time between photo detector output intensity changed from 90% to 10%.

Please see the illustration below. The test temperature is the ambient temperature.



Note5: Definition of color chromaticity (CIE1931)

Color coordinates measured at the center point of the LCD.The criteria of color coordinate is just for reference , after the BLU sample out ,need to measure the sample to confirm the final spec.

Note6: Definition of Luminance

Measure the luminance at white state at the center point.

Note7: Definition of Luminance Uniformity

The luminance uniformity is calculated by using the following formula.

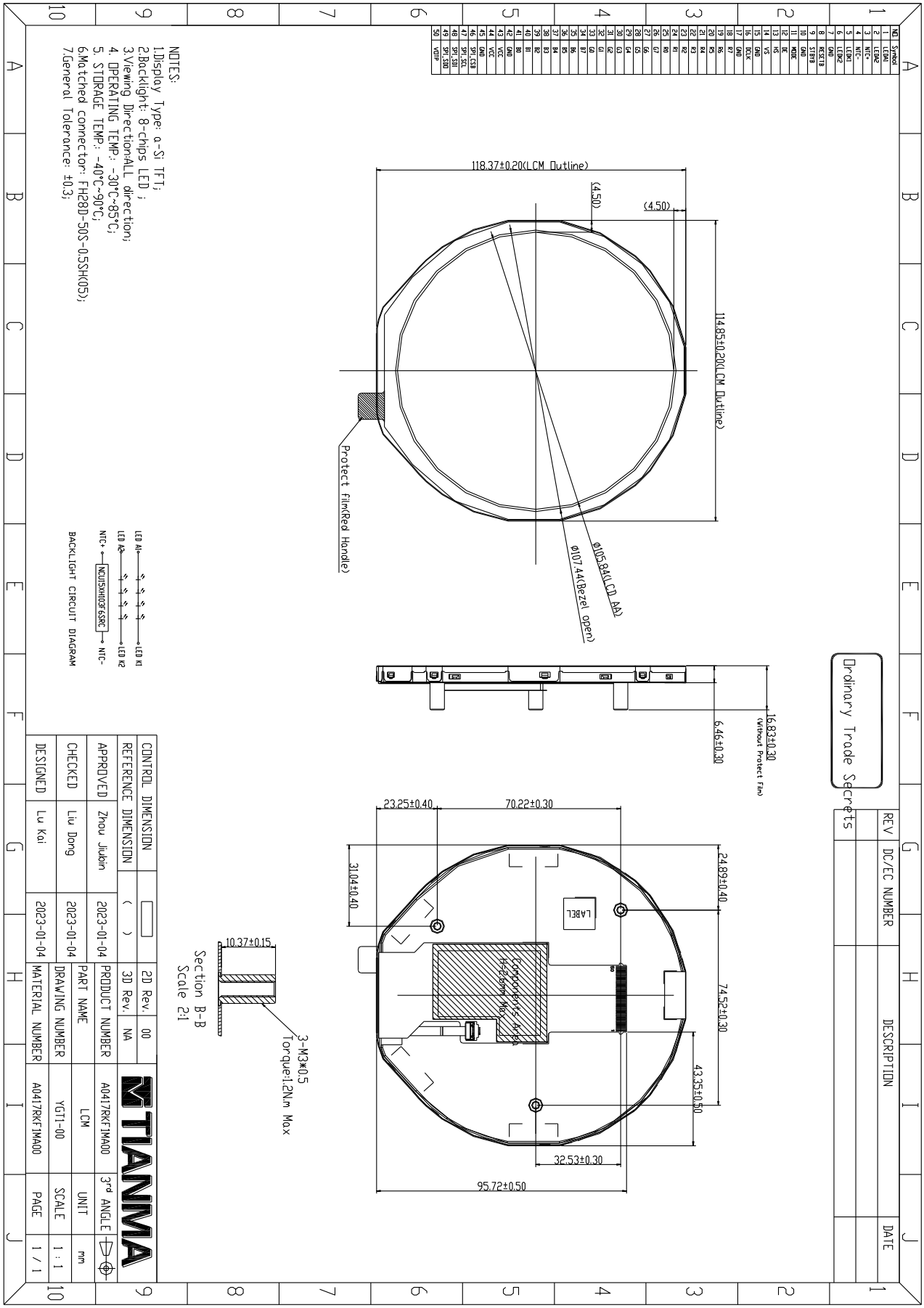
$$\text{Luminance uniformity (Lu)} = \frac{\text{Minimum luminance from (1) to (9)}}{\text{Maximum luminance from (1) to (9)}}$$

7. Reliability Test

No	Test Item	Test condition	Criterion
1	High Temperature Storage	Ta= 90^{0}C+/-2°C ,500hrs Recover time 2H at 25℃	Note1, Note4 IEC60068-2-2,GB2423.2
2	Low Temperature Storage	Ta= -40^{0}C+/-2°C ,500hrs Recover time 2H at 25℃	Note1, Note4 IEC60068-2-1,GB2423.1
3	High Temperature Operation	Ta= 85^{0}C+/-2°C ,500hrs Recover time 2H at 25℃	Note1, Note4 IEC60068-2-2,GB2423.2
4	Low Temperature Operation	Ta= -30^{0}C+/-2°C ,500hrs Recover time 2H at 25℃	Note1, Note4 IEC60068-2-1,GB2423.1
5	High Temperature & Humidity Operation (operational)	Ta= 60°C, 90 %RH , 500Hrs Recover time 2H at 25℃	Note1, Note4 IEC60068-2-78,GB2423.3
6	Thermal Shock (non-operational)	Ta= -30°C (0.5h) / +85°C (0.5h), 240h cycles Recover time 2H at 25℃	Note1, Note4 Start with cold temperature End with high temperature, IEC60068-2-14,GB2423.22
7	Vibration Test (non-operational)	Accelebration: 5g; Frequency: 30~500HZ; Sweep time: 2h in each axis（For X\Y\Z）	IEC60068-2-6,GB2423.10
9	Shock Test (non-operational)	Half sign wave 50G, 6ms, ±X,±Y,±Z ten times each Axis	IEC 60068-2-27, GB 2423.5
10	ESD (operational)	C=150pF, R=330Ω，5points/panel. Air:±8KV, 5times; Contact:±4KV, 5 times; （Environment: 15℃～35℃, 30%～60%, 86Kpa～106Kpa）	IEC61000-4-2,GB17626.2
11	Package Vibration	Frequency:5~20-200Hz,PSD:0.01-0.01-0.001 Total:0.781g2/Hz, time：X/Y/Z each direction 30min	IEC60068-2-27:1987,GB2423.5
12	Package Drop	Height: X cm,1 corner, 3edges, 6 surfaces	IEC60068-2-27:1987,GB2423.5

Note1: Ta is the ambient temperature of sample.
Note2: Use sample for only one reliability test.
Note3: For duration test in the chamber
a. Keep a small distance between each sample and don't place the samples close to the wall or the wick. Don't open the chamber unless absolutely necessary.
b. During the test, avoid moisture condensation on the polarizer.
c. Perform de-rating during high temp.

8. Mechanical Drawing



9. Packing Instruction

1.包装材料规格表(Packaging Material)

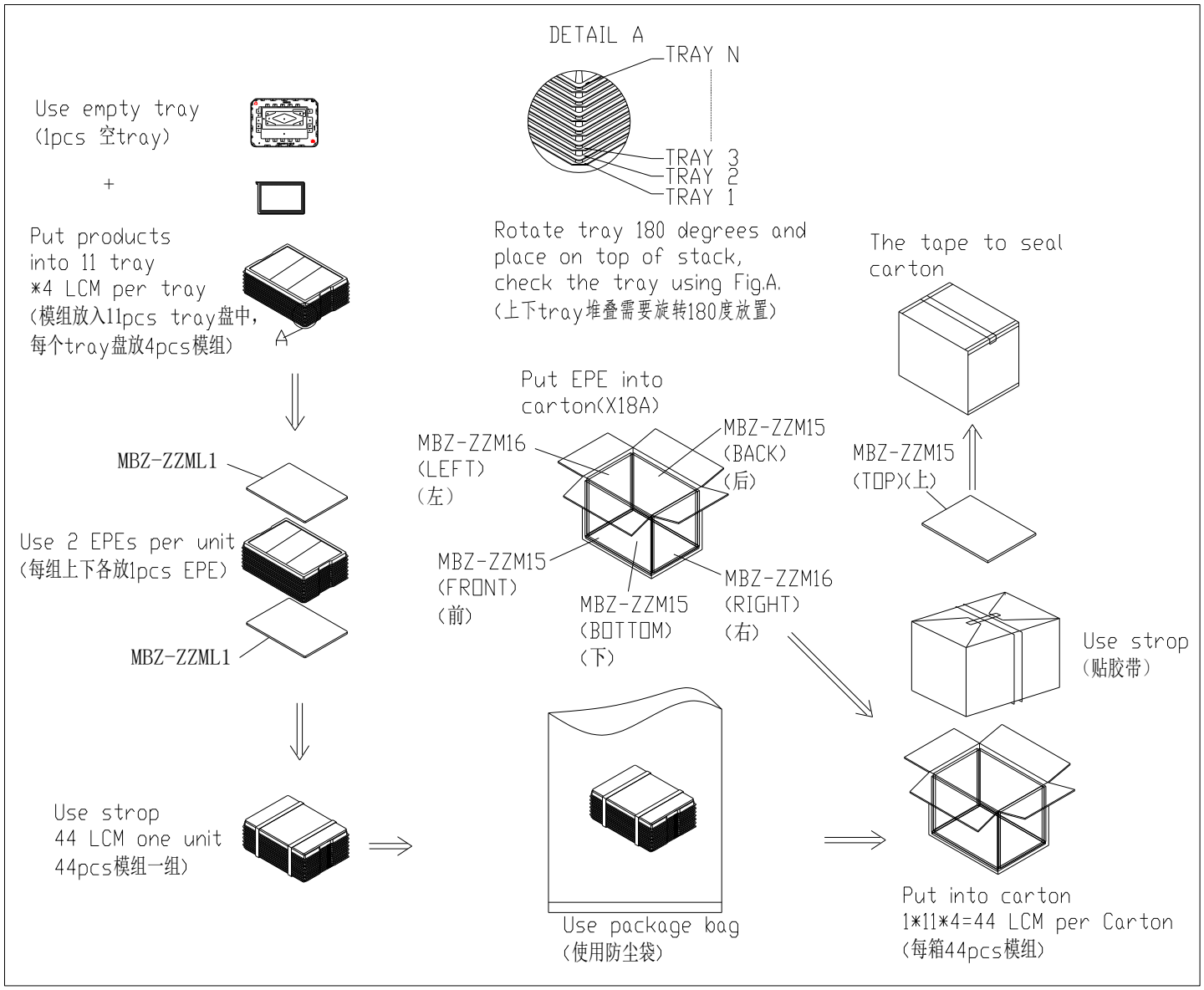
Per Carton

No	Item 内容	Model (Materiel) 类型（材质）	Dimensions(mm) 尺寸描述（毫米）	Unit Weight(Kg) 单位重量（千克）	Quantity 数量	Remark 备注
1	LCM 模组	A0417RKF1MA00	114.85*187.37*16.83	TBD	44	A0417RKF1MA00
2	Tray(吸塑盘)	PET	356*256*26.5	0.150	12	1150373040
3	EPE（珍珠棉1）	MBZ-ZZML1	336*246*6	0.01	2	1680104800
4	EPE（珍珠棉2）	MBZ-ZZM15	375*275*10	0.014	4	1680267110
5	EPE（珍珠棉3）	MBZ-ZZM16	250*280*12	0.015	2	1680267120
6	Carton(纸箱)	X18A	395*290*315	0.58	1	1680104850
7	Package bag （包装袋）	PE	680*520	0.042	1	1680341570
8	Total Weight 总重量	TBD				

2.包装数量规格(Packaging Specification and Quantity)

(1) LCM quantity per tray:4 每个tray中的模组数量：4
(2) Total LCM quantity per group:44 (11 trays*4LCMs per tray=44, and 1 empty tray) 每捆中的模组数量:44（装产品的tray数11*每个tray的模组数量4=44，另外还有1个空tray）
(2) Total LCM quantity in Carton:44(11trays*4LCMs per tray=44 and 1 empty tray) 每个纸箱中的模组数量：44（装产品tray数11*每个tray模组数量4=44，另外还有1个空tray）
Note: Please refer to the data from “estimated report about the dimension and stack of Carton ”about stacking carton

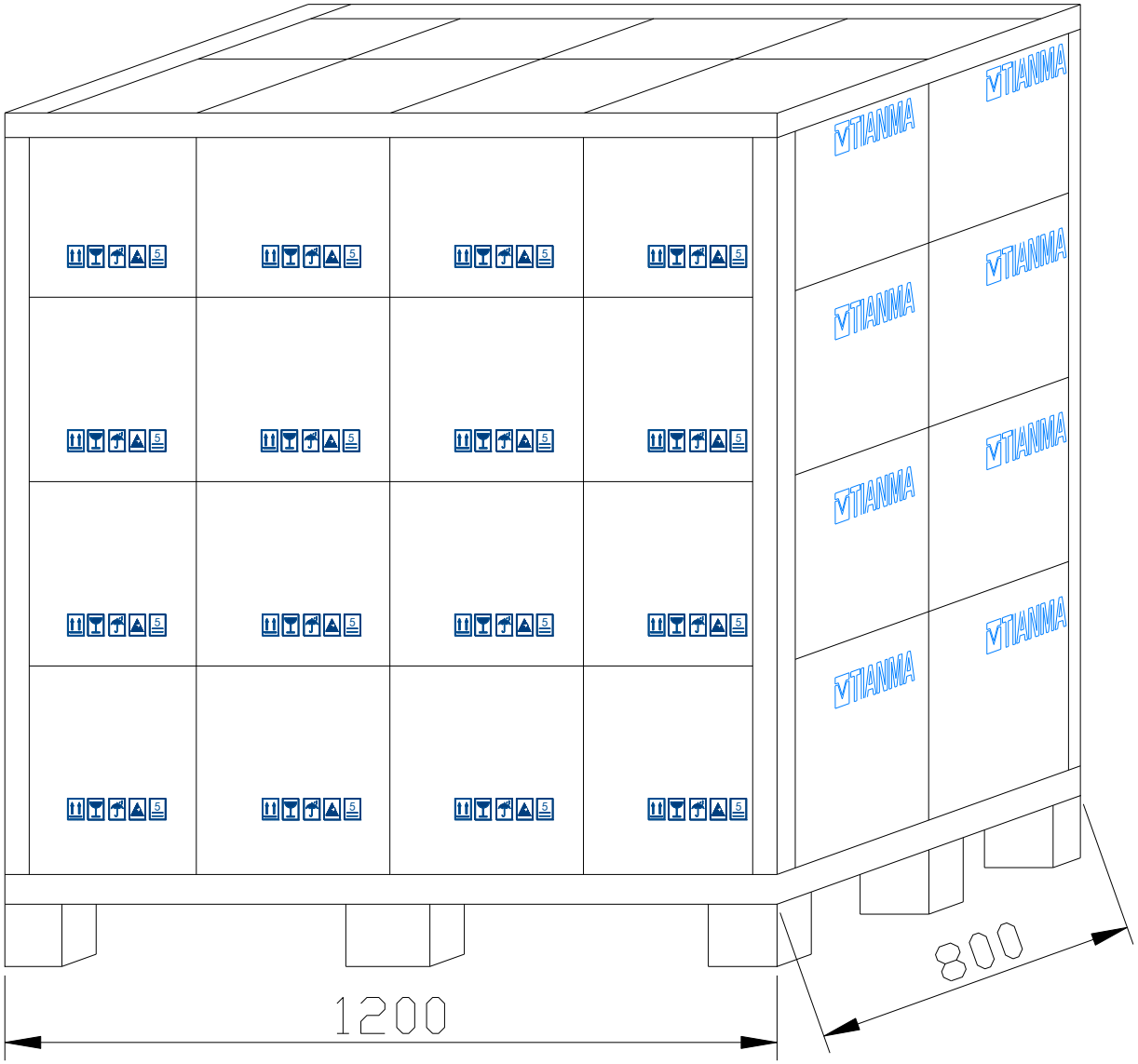
3.包装说明图示（Packaging instruction diagram）



注：模组显示面朝上放置（Note: The module is placed facing upwards）

4.堆栈放置（Stack placement）

纸箱堆叠数按2×4/每层×共4层（Number of stacked cardboard boxes by 2 × 4/Each layer × 4 layers in total）
栈板尺寸1200mm×800mm（Pallet size 1200mm × 800mm）
栈板代码：PL021（Pallet code: PL021）



10. Precautions for Use of LCD Modules

10.1. Handling Precautions

(1) The display panel is made of glass. Do not subject it to mechanical shock by dropping it, etc.
(2) If the display panel is damaged and the liquid crystal fluid inside it leaks out be sure not to get any in your mouth. If the fluid comes into contact with your skin or clothes promptly wash it off using soap and water.
(3) Do not apply excessive force to the display surface or the bezel since this may cause the color tone to vary.
(4) The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle the polarizer carefully.
(5) If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is still not completely clear use a moist cloth with one of the following solvents:
  - Isopropyl alcohol
  - Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer. Specifically, do not use the following:

  - Water
  - Ketone
  - Aromatic solvents

(6) Do not disassemble the LCD Module.
(7) If powered off, do not apply the input signals.
(8) To prevent destruction of the module by static electricity, be careful to maintain an optimum work environment.
(9) Be sure to ground your body when handling the LCD Modules.
(10) Tools used for assembly, must be properly grounded.
(11) To reduce the amount of static electricity generated, do not conduct assembly or other work under very low humidity conditions.
(12) The LCD Module is covered with a film to protect the display surface, remove film slowly under the ionizer.

10.2. Storage precautions

(1) When storing the LCD modules avoid exposure to direct sunlight or to the light of fluorescent lamps.
(2) The LCD modules should be stored within the rated storage temperature range. The recommend condition is: Temperature: 0 ~ 35 ℃ at normal humidity.
(3) The LCD modules should be stored in a room without acid, alkali or other harmful gas.

10.3. Transportation Precautions

The LCD modules should not be dropped or subject to violent mechanical shock during transportation. Also they should avoid excessive pressure, water, high humidity and direct sunlight.

10.4. Screen saver Precautions

Not display the fixed pattern for a long time. Use a screen saver, if the fixed pattern is displayed on the screen

10.5. Safety Precautions

(1) When you waste damaged or unnecessary LCDs, it is recommended to crush LCDs into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned
(2) Be sure to turn off the power supply when inserting or disconnecting the LED backlight cable.
(3) LED driver should be designed carefully to limit or stop its function when over current is detected on the L ED.