

MODEL NO. : TM014EDHG10

ISSUED DATE: 2014-7-14

VERSION : V1.5

- Preliminary Specification
- Final Product Specification

Customer : _____

Approved by	Notes

TIANMA Confirmed :

Prepared by	Checked by	Approved by

This technical specification is subjected to change without notice

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1 Features

1.44 inch Amorphous-TFT-LCD (Thin Film Transistor Liquid Crystal Display) module. This module is composed of a 1.44 inch TFT-LCD panel, a driver circuit, FPC and a backlight unit.

This 1.44" TFT-LCD module is designed handheld device, home remote and other electronic products which require high quality flat panel displays.

This module follows RoHS.

2 General Specifications

	Feature	Spec
Display Spec.	Size	1.44
	Resolution	128×128
	Technology Type	a-Si TFT
	Pixel Configuration	RGB Vertical Stripe
	Display Mode	TM, NW
	Surface Treatment	Clear Type
	Viewing Direction	6:00
	Gray Scale Inversion Direction	12:00
Mechanical Characteristics	LCM (W x H x D) (mm)	32.36×38×2.75(MAX)
	Active Area(mm)	25.4976×26.4960
	With /Without TSP	Without
	LED Numbers	1
	Weight (g)	4.25g
Electrical Characteristics	Interface	SPI 4W
	Color Depth	65K/262K
	Driver IC	ST7735S

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

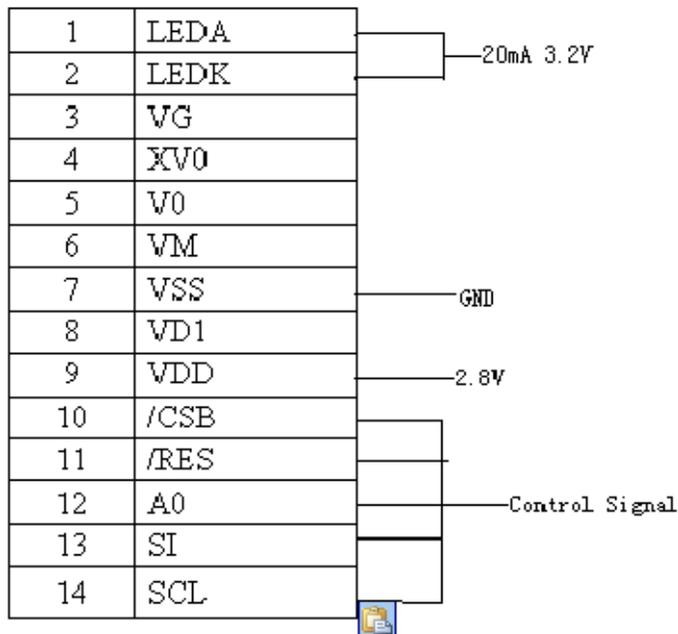
Note 3: LCM weight tolerance: ± 5%

3 Input/Output Terminals

No.	Symbol	I/O	Pin Function Description	Remark
1	LEDA	P	Power for backlight	Note
2	LEDK	P	Supply ground for backlight	
3	VG	-	No Connection	
4	XV0	-	No Connection	
5	V0	-	No Connection	
6	VM	-	No Connection	
7	VSS	P	Supply ground	
8	VD1	-	No Connection	
9	VDD	P	Power supply	
10	/CSB	I	Chip select: Low active	
11	/RES	I	Reset pin: Low active	
12	A0	I	Data / Instruction select input pin	
13	SI	I/O	serial input data/output data	
14	SCL	I	Serial clock input	

Note 1: I/O definition:

I----Input O---Output P----Power(Ground) NC---No connection



4 Absolute Maximum Ratings

Ta = 25°C

Item	Symbol	MIN	MAX	Unit	Condition	Remark
Power For Analogue Circuit	VCI	-0.3	4.8	V	Ta = 25°C	
Supply Voltage	IOVCC	-0.3	4.6	V		
Input Voltage	SCL, DC, /SDA, /CS, /RESET	-0.3	IOVCC+0.3	V		
Back Light Forward Current	I _{LED}	-	25	mA		For each LED
Storage Temperature	T _{STG}	-30	80	°C		
Operating Temperature	T _{OPR}	-20	70	°C		

5 Electrical Characteristics

GND=0V, Ta=25°C

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Supply Voltage	VCI	2.5	2.75	4.8	V	
Supply Voltage	IOVCC	1.65	1.8	3.7	V	
High-level Input Voltage	VIH	0.7* IOVCC	-	IOVCC	V	
Low-level Input Voltage	VIL	0	-	0.3* IOVCC	V	
High-level Output Voltage	VOH	0.8* IOVCC	-	IOVCC	V	
Low-level Output Voltage	VOL	0	-	0.2* IOVCC	V	
Supply Current for LED	IF	-	20	25	mA	Each LED
Supply Current for Logic	-	-	1.54	2.4	mA	
Sleep Current	-	-	0.010	0.015	mA	
Frame Frequency	-	-	60	90	HZ	

* Test Condition: Full Black

Table 5.1 LCD module electrical characteristics

5.2 Backlight Unit

Ta=25°C

Item	Symbol	MIN	TYP	MAX	Unit	Remark
LED Current	IF	--	20	--	mA	For each LED
LED Voltage	VF	--	3.2	--	V	For each LED
LED Consumption	W _{BL}	--	64	--	mW	

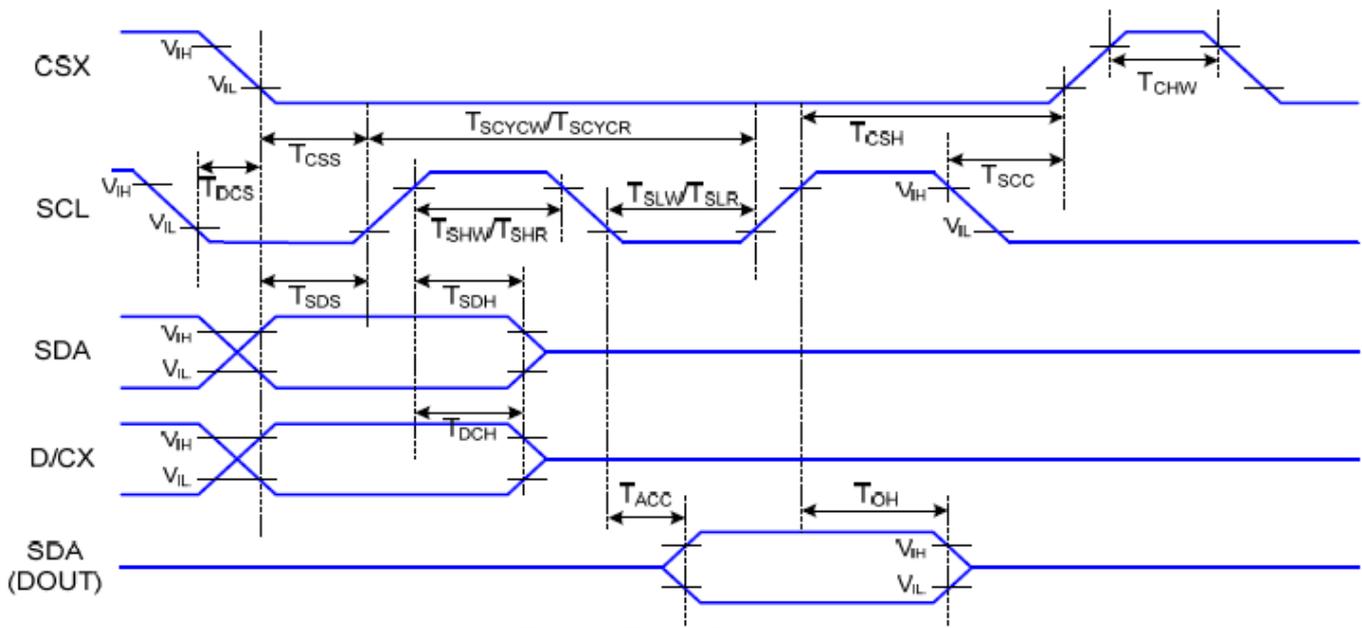
Table 5.2 Backlight Unit Electrical Characteristics



Figure 5.2.1 LED driver circuit

6 Timing Chart

6.1 4-Wire SPI Interface Timing Characteristics



Interface Characteristics

6.2 4-Wire SPI Interface Timing Parameters

Normal Write Mode (IOVCC=1.65 to 3.3V, VCC=2.5 to 4.8V)

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
CSX	TCSS	Chip Select Setup Time (Write)	45		ns	
	TCSH	Chip Select Hold Time (Write)	45		ns	
	TCSS	Chip Select Setup Time (Read)	60		ns	
	TSCC	Chip Select Hold Time (Read)	65		ns	
	TCHW	Chip Select "H" Pulse Width	40		ns	
SCL	TSCYCW	Serial Clock Cycle (Write)	66		ns	-Write Command & Data Ram
	TSHW	SCL "H" Pulse Width (Write)	15		ns	
	TSLW	SCL "L" Pulse Width (Write)	15		ns	
	TSCYCR	Serial Clock Cycle (Read)	150		ns	-Read Command & Data Ram
	TSHR	SCL "H" Pulse Width (Read)	60		ns	
	TSLR	SCL "L" Pulse Width (Read)	60		ns	
D/CX	TDCS	D/CX Setup Time	10		ns	
	TDCH	D/CX Hold Time	10		ns	
SDA (DIN) (DOUT)	TSDS	Data Setup Time	10		ns	For Maximum CL=30pF
	TSDH	Data Hold Time	10		ns	
	TACC	Access Time	10	50	ns	For Minimum CL=8pF
	TOH	Output Disable Time	15	50	ns	

Interface Timing Parameters

6.3 4-wire SPI Interface Register Write/Read timing

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6.3.1 System Bus Interface Register Write Timing

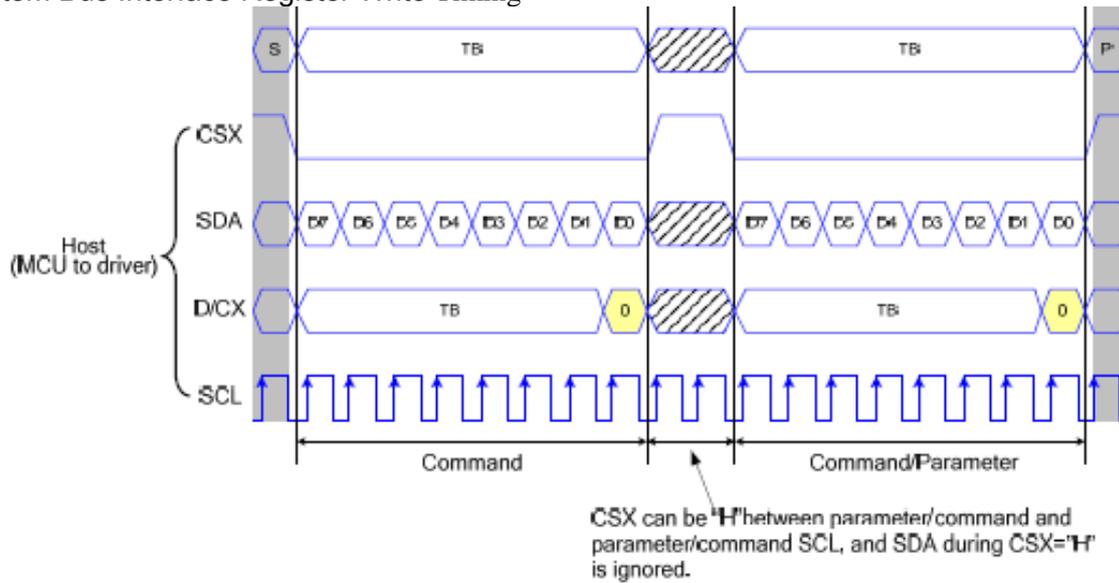
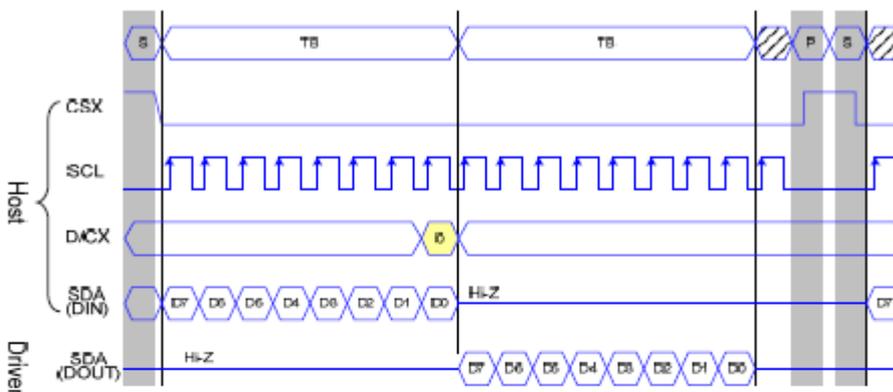


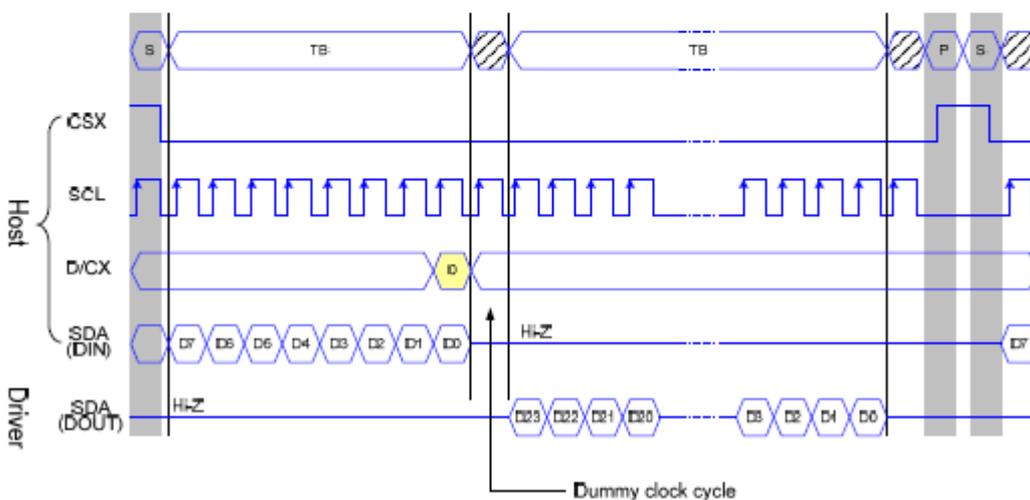
Figure 6.3.1 System Bus Interface Register Write Timing

6.3.2 System Bus Interface Register Read Timing

4-line Serial Protocol (for RDID1/RDID2/RDID3/0Ah/0Bh/0Ch/0Dh/0Eh/0Fh Command: 8-bit Read):



4-line Serial Protocol (for RDDID Command: 24-bit Read)



4-line Serial Protocol (for RDDST Command: 32-bit Read)

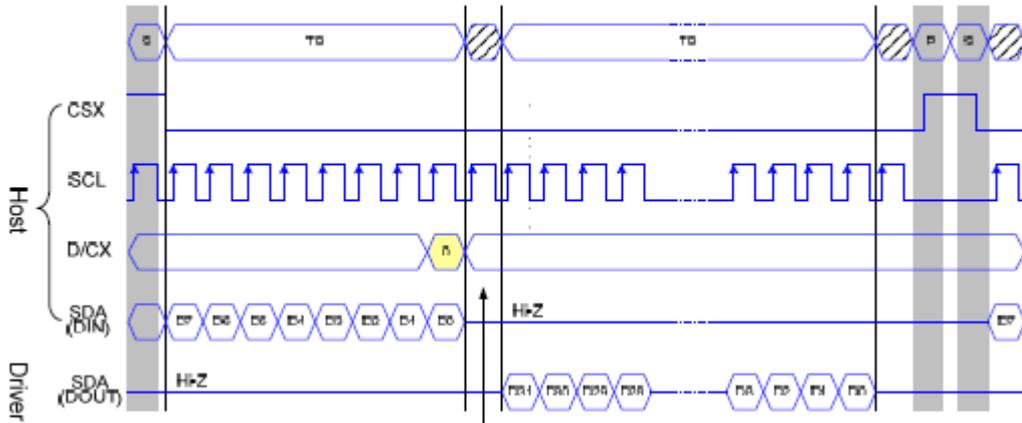


Figure 6.3.2 System Bus Interface Read Register Timing

6.4 GRAM Write/Read Data Format

6.4.1 Write Data For 16-bit/pixel (RGB 5-6-5 bit input)

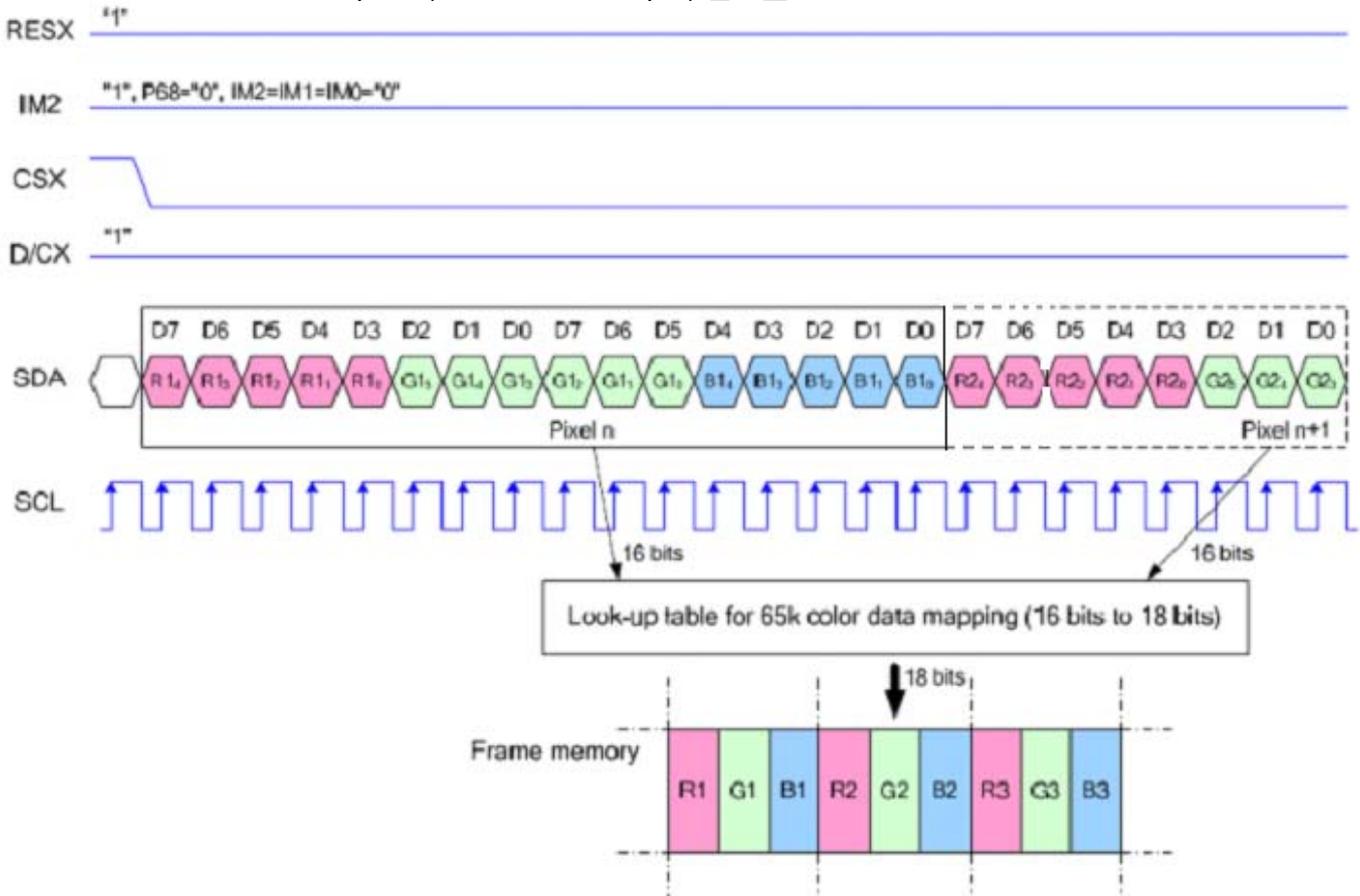


Figure 6.4.1 8-bit Data Bus GRAM Write/Read Data Format (16bit,65k)

6.4.2 Write Data For 18-bit/pixel (RGB 6-6-6 bit input)

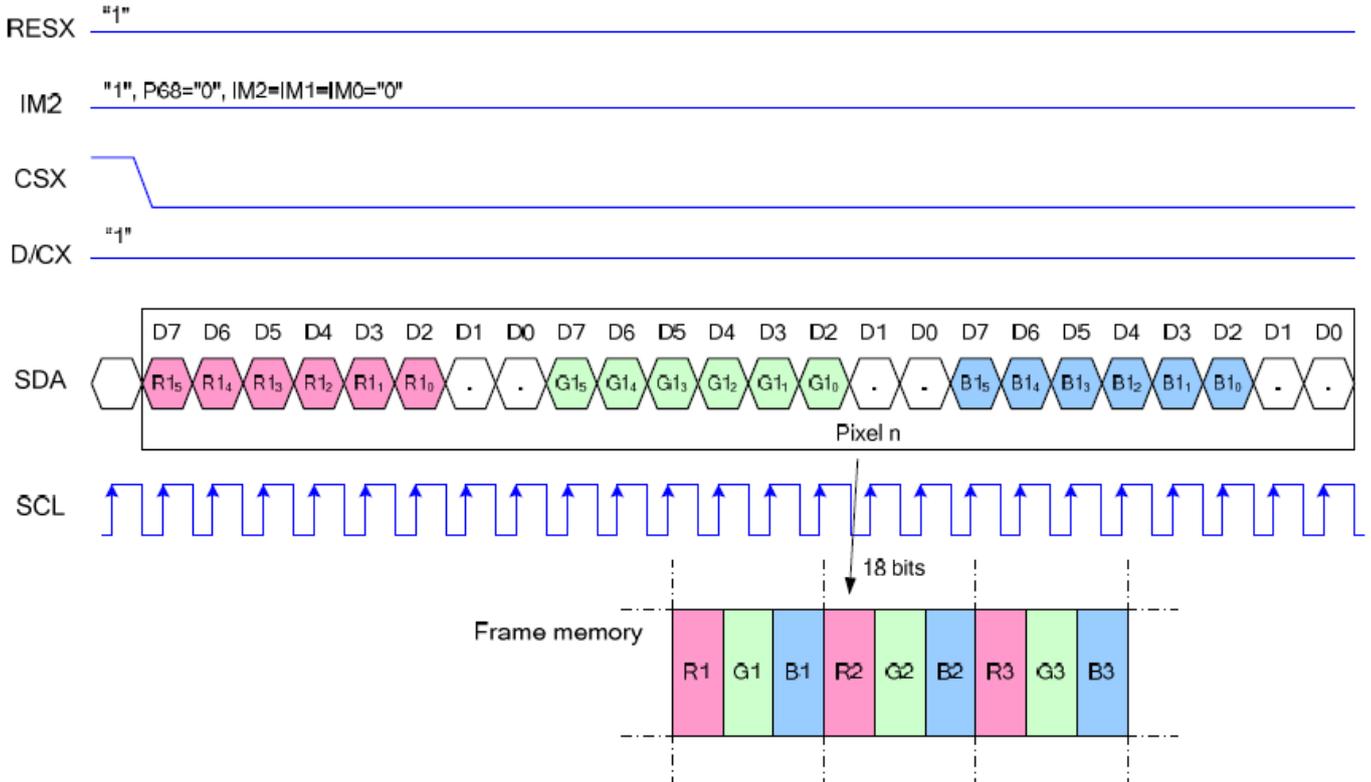
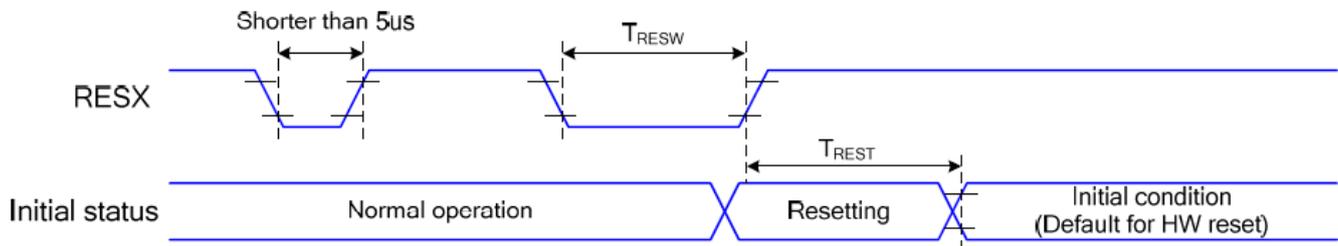


Figure 6.4.2 8-bit Data Bus GRAM Write/Read Data Format (18bit,262k)

6.5 Reset Timing Characteristics

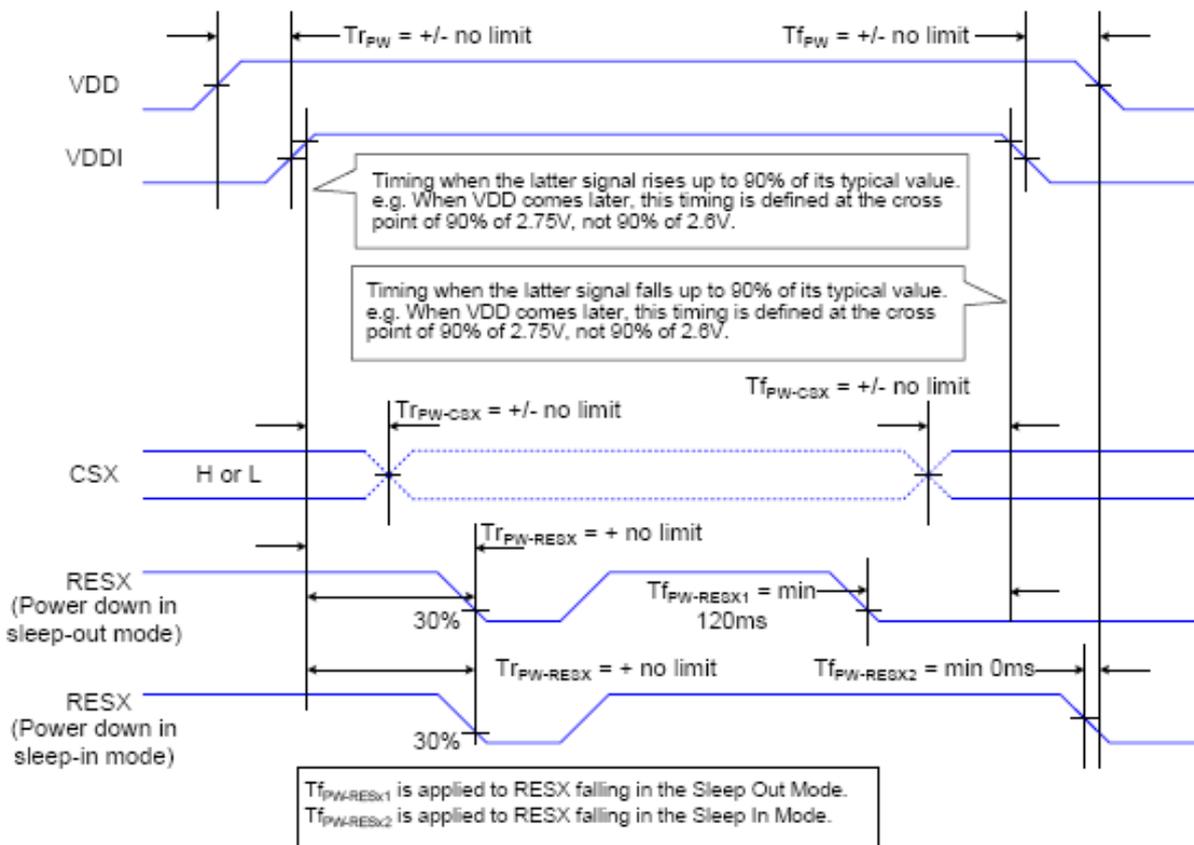
VDDIO=1.65 to 3.7V, VDD=2.5 to 4.8



Related Pins	Symbol	Parameter	MIN	MAX	Unit
RESX	tRESW	Reset Pulse Duration	10	-	us
	tREST	Reset Cancel	-	5	ms
				120	ms

Figure 6.5 Reset Input Timing

6.6 Power on/off Sequence



7 Optical Characteristics

Ta=25°C

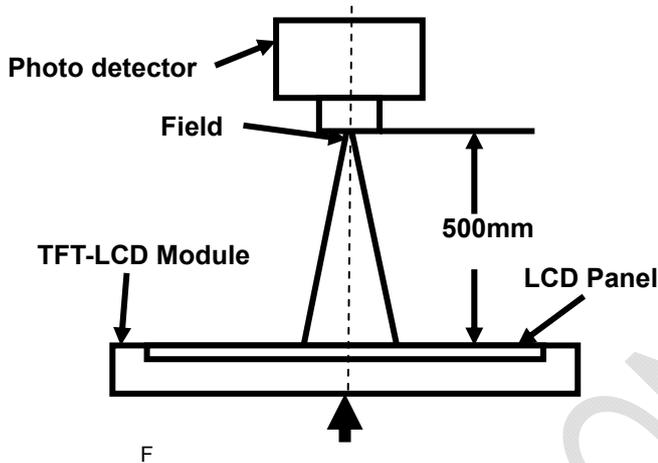
Item	Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles	θT	CR ≥ 10	60	70	-	Degree	Note2,3
	θB		50	60	-		
	θL		60	70	-		
	θR		60	70	-		
Contrast Ratio	CR	θ=0°	400	500	-		Note 3
Response Time	T _{ON}	25°C	-	20	30	ms	Note 4
	T _{OFF}						
Chromaticity	White	Backlight is on	x	0.244	0.294	0.344	Note 1,5
			y	0.275	0.325	0.375	
	Red		x	0.538	0.588	0.638	Note 1,5
			y	0.277	0.327	0.377	
	Green		x	0.292	0.342	0.392	Note 1,5
			y	0.531	0.581	0.631	
	Blue		x	0.101	0.151	0.201	Note 1,5
			y	0.054	0.104	0.154	
Uniformity	U		70	80	-	%	Note 6
NTSC				50		%	Note 5
Luminance	L		130	150		cd/m ²	Note 7

Test Conditions:

1. I_F= 20 mA, and the ambient temperature is 25°C.
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.

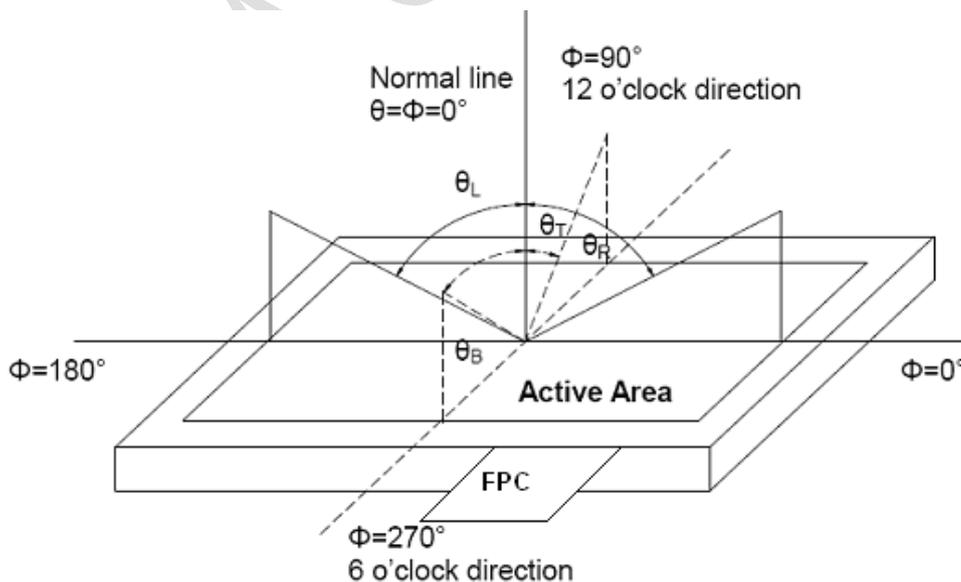


Item	Photo detector	Field
Contrast Ratio	SR-3A	1°
Luminance		
Chromaticity		
Lum Uniformity	BM-7A	2°
Response Time		

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).



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 drive by V_{white} .

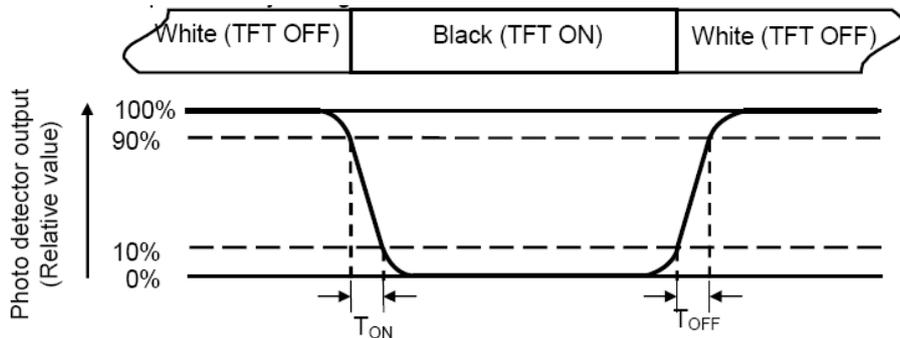
“Black state”: The state is that the LCD should drive by V_{black} .

V_{white} : To be determined V_{black} : To be determined.

Note 4: Definition of Response time

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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)

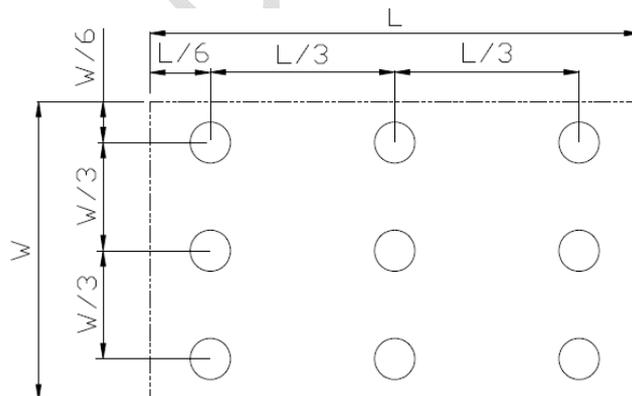
Color coordinates measured at center point of LCD.

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.

$$\text{Luminance Uniformity (U)} = L_{\min} / L_{\max}$$

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



L_{\max} : The measured Maximum luminance of all measurement position.

L_{\min} : The measured Minimum luminance of all measurement position.

Note 7: Definition of Luminance:

Measure the luminance of white state at center point.

8 Environmental / Reliability Test specifications

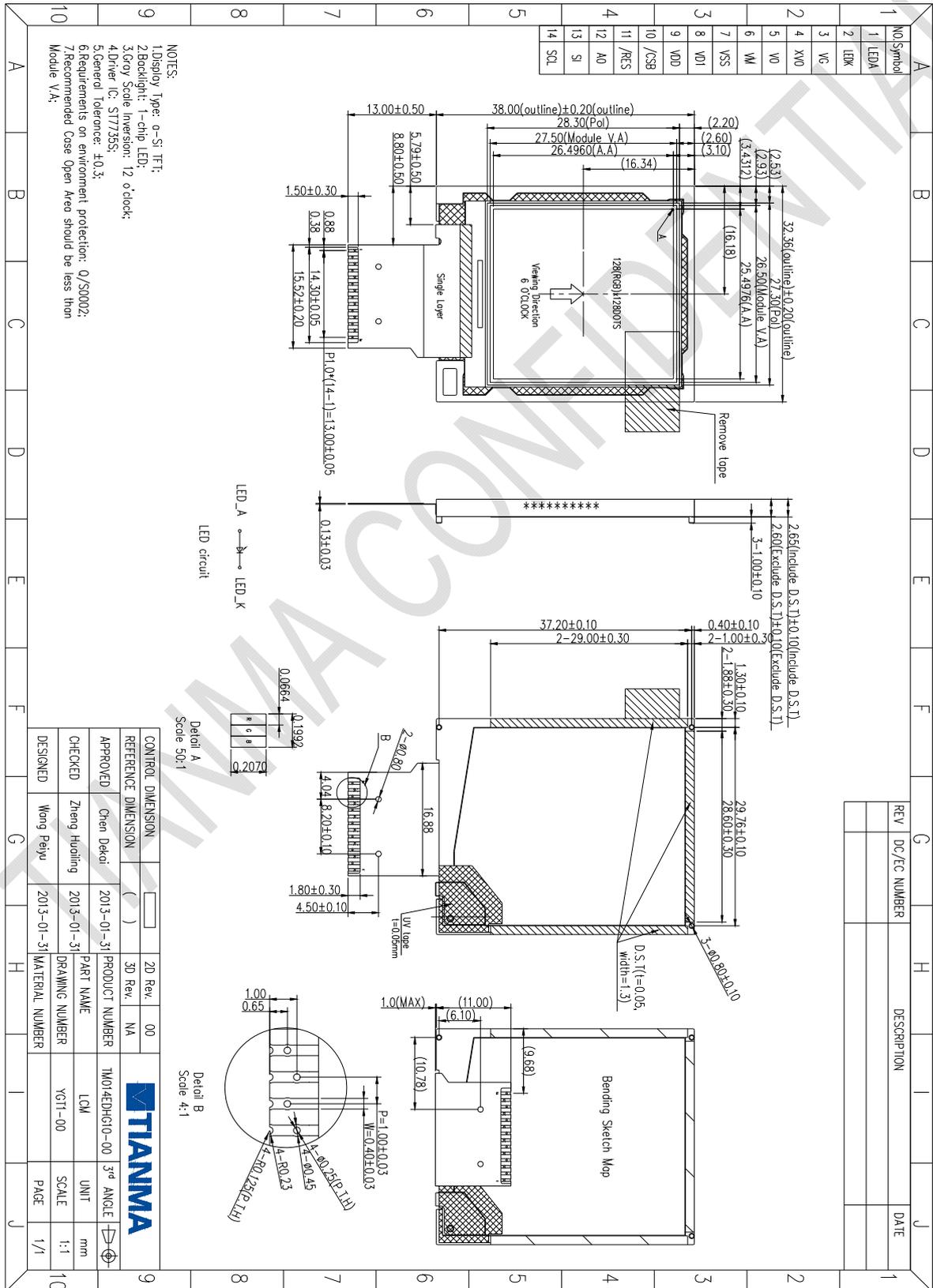
No	Test Item	Condition	Remark
1	High Temperature Operation	70°C , 240 Hr	
2	Low Temperature Operation	-20°C, 240 Hr	
3	High Temperature & High Humidity Operation	60°C, 90% RH, 240 Hr	
4	High Temperature Storage	80°C, 240Hr	
5	Low Temperature Storage	-30°C, 240Hr	
6	Thermal Shock	--30°C ↔ 25°C ↔ 80°C after 10cycle, Restore 2H at 25°C Power off	
7	Part Vibration Test	10Hz~150Hz, 100m/s ² , 120min	Part state
8	ESD Electrostatic Withstanding Voltage	C=150pF,R=330Ω · 5times/panal Air:±3KV,5times; Contact:±3KV,5times; (Environment :15°C ~35°C,30%~60%,86KPA~106KPA)	Test Jig
9	Shock	Half- sine wave,300m/s ² ,11ms	
10	Drop Test(package state)	76cm / concrete floor,1corner, 3edges, 6 sides each time	

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

Note2: Ta is the ambient temperature of sample.

Note3: Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.

9 Mechanical Drawing

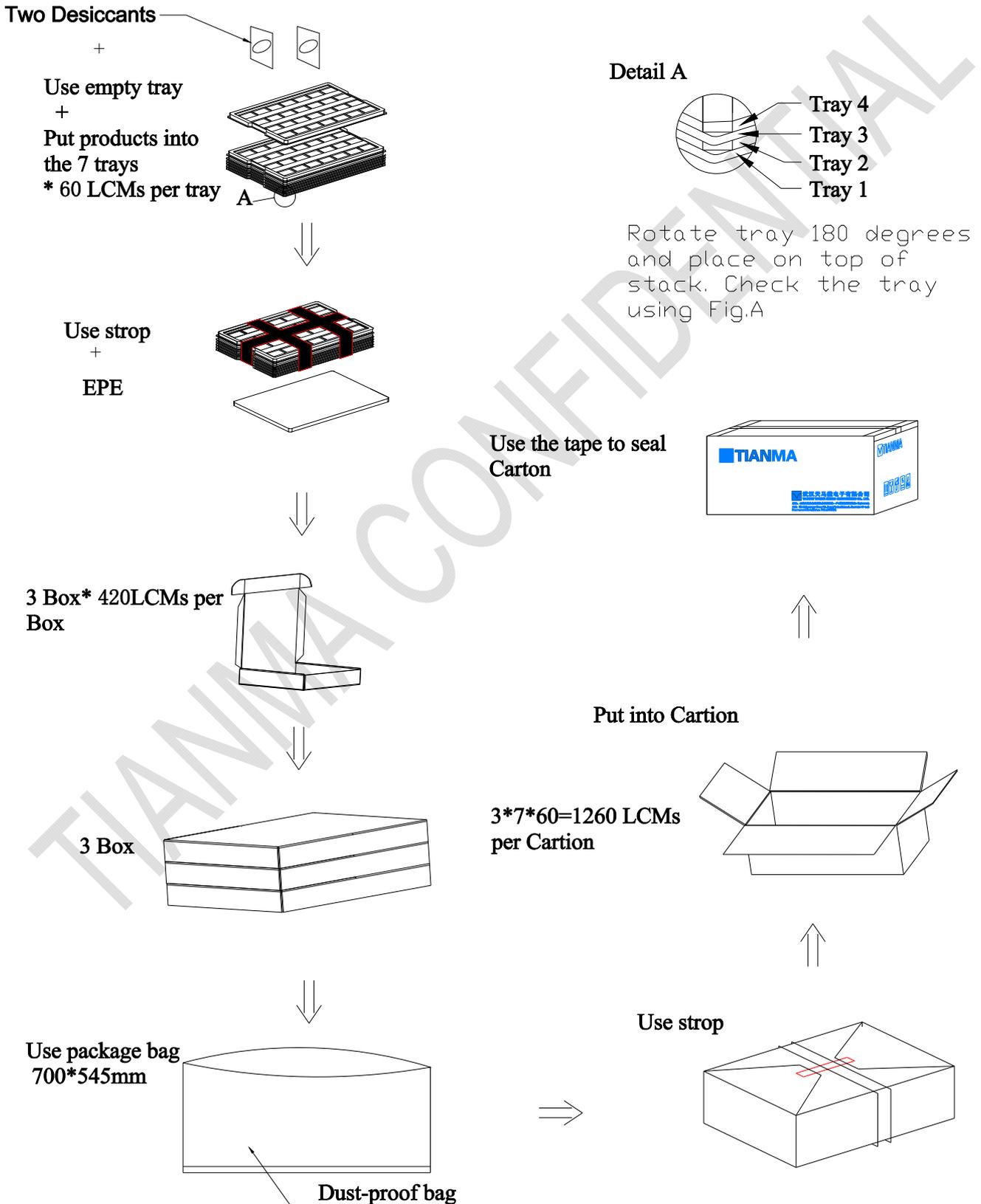


REV	DC/EC NUMBER	DESCRIPTION	DATE

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10 Packing Drawing

No	Item	Model (Material)	Dimensions(mm)	Unit Weight(Kg)	Quantity	Remark
1	LCM module	TM014EDHG10-00	32.36×38.00×2.6	0.00425kg	1260	
2	Tray	PET(Transmit)	485×330×13.8	0.17kg	24	Anti-static
3	EPE	EPE	485×335×5	0.0183kg	3	
4	Dust-proof bag	PE	700×545	0.047kg	1	
5	BOX	CORRUGATED PAPER	520×345×74	0.387kg	3	
6	Desiccant	DESICCANT	45×35	0.002kg	6	
7	Carton	CORRUGATED PAPER	544×365×250	0.76kg	1	
8	Total weight	11.5 Kg+/-5%				



11 Precautions for Use of LCD Modules

11.1 Handling Precautions

11.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

11.1.2 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.

11.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

11.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

11.1.5 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

11.1.6 Do not attempt to disassemble the LCD Module.

11.1.7 If the logic circuit power is off, do not apply the input signals.

11.1.8 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.

11.2 Storage precautions

11.2.1 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

11.2.2 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°C ~ 40°C Relatively humidity: ≤80%

11.2.3 The LCD modules should be stored in the room without acid, alkali and harmful gas.

11.3 Transportation Precautions

11.3.1 The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.