MODEL NO. : TM035NDH04

ISSUED DATE: 2012-8-20

VERSION : Ver 2.1

□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	2010-12-22	Preliminary Specification release	Lu Bai
2.0	2011-6-1	Final Product Specification release	Lu Bai
2.1	2012-8-20	Add LED lifetime as page7	Beibei Sun

1. General Specifications

Feature		Spec
Display Spec.	Size	3.5 inch
	Resolution	272(RGB) x 480
	Interface	CPU8/9/16/18bit
	Color Depth	65K/262K
	Technology Type	a-si TFT
	Pixel Pitch (mm)	0.16125×0.16125
	Pixel Configuration	R.G.B. Vertical Stripe
	Display Mode	TM with Normally White
	Surface Treatment(Up Polarizer)	Anti-Glare
	Viewing Direction	9 o'clock
	Gray Scale Inversion Direction	3 o'clock
	LCM (W x H x D) (mm)	50.86x 87.98x2.50
Mechanical Characteristics	Active Area(mm)	43.86×77.40
	With /Without TSP	Without TSP
	Weight (g)	21.371
	LED Numbers	6 LEDs(parallel)

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

No	Symbol	I/O	Description	Remarks
1	YU	-	No Connection	
2	XR	-	No Connection	
3	YD	-	No Connection	
4	XL	-	No Connection	
5	IM0	I	Select the MPU interface mode	Note 3
6	IM1	I	Select the MPU interface mode	Note 3
7	IM2	I	Select the MPU interface mode	Note 3
8	RESET	I	A reset signal	
9	DB17	I/O	Data input/output	
10	DB16	I/O	Data input/output	
11	DB15	I/O	Data input/output	
12	DB14	I/O	Data input/output	
13	DB13	I/O	Data input/output	
14	DB12	I/O	Data input/output	
15	DB11	I/O	Data input/output	
16	DB10	I/O	Data input/output	
17	DB9	I/O	Data input/output	
18	DB8	I/O	Data input/output	
19	DB7	I/O	Data input/output	
20	DB6	I/O	Data input/output	
21	DB5	I/O	Data input/output	
22	DB4	I/O	Data input/output	
23	DB3	I/O	Data input/output	
24	DB2	I/O	Data input/output	
25	DB1	I/O	Data input/output	
26	DB0	I/O	Data input/output	
27	/RD	I	A read strobe signal and enables an operation to read out data when the signal is low.	
28	/WR	I	A write strobe signal and enables an operation to write data when the signal is low.	
29	D/C	I	A register select signal, D/C=0,select command, D/C=1,select data	
30	/CS	I	A chip select signal	
31	IOVCC	P	Digital power supply	
32	VCC	P	Analog power supply	
33	GND	P	Power Ground	
34	LEDA	P	LED Anode	
35	LED1-	P	LED Cathode	
36	LED2-	P	LED Cathode	
37	LED3-	P	LED Cathode	
38	LED4-	P	LED Cathode	
39	LED5-	P	LED Cathode	
40	LED6-	P	LED Cathode	
41	TE	O	Tearing effect output. If not used, please open this pin.	

Table 2.1 input terminal pin assignment

Note:

(1) I/O-----Input/Output, I-------Input, P------Power/Ground, NC----No Connection

(2) Unused I/O pin should be fixed to GND level.

(3) Select the MPU system interface mode

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
1	0	0	Setting prohibited	-	-
1	0	1	DBI Type C 9-bit	DIN, DOUT	8/262K
1	1	0	Setting prohibited	-	-
1	1	1	DBI Type C 8-bit	DIN, DOUT	8/262K

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	VCC	-0.3	4.6	V	
Input Voltage	/CS,/RD,/WR,D/C,RESET, IM0,IM1,IM2,DB[0~17]	-0.3	IOVCC+0.3	V	
Back Light Forward Current	I_{LED}		25	mA	For each LED
Operating Temperature	T_{OPR}	-20	60	℃	
Storage Temperature	T_{STG}	-30	70	℃	

Table 3.1 absolute maximum rating

4 Electrical Characteristics

4.1 LCD module

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		VCC	2.5	2.8	3.3	V	
Input Signal Voltage	Low Level	V_{IL}	0.0	-	0.3* IOVCC	V	/CS,/RD,/WR,D/C, RESET,IM0, IM1,IM2,DB[0~17]
	High Level	V_{IH}	0.7* IOVCC	-	IOVCC	V	
Output Signal Voltage	Low Level	V_{OL}	0.0	-	0.2* IOVCC	V	TE
	High Level	V_{OH}	0.8* IOVCC	-	IOVCC	V	
(Panel+LSI) Power Consumption		Black Mode (60Hz)	-	--	-	mW	
		Sleeping Mode	-	--	-	mW	
		Standby Mode	-	--	-	uW	

Table 4.1 LCD module electrical characteristics

4.2 Backlight Unit

Ta=25℃

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Forward Current	I_F	--	20	--	mA	For each LED
Forward Voltage	V_F	--	3.2	--	V	For each LED
Backlight Power Consumption	W_{BL}	--	384	--	mW	For 6 LEDs
LED lifetime	-	--	20,000	-	Hrs	Note1

Table 4.2 backlight unit electrical characteristics

Note1: 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.

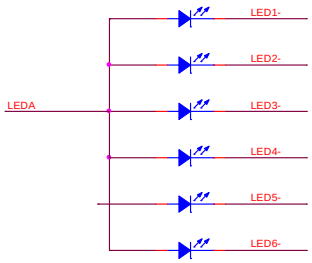


Figure 4.2 LED driver circuit

4.3 Block Diagram

LCD module diagram

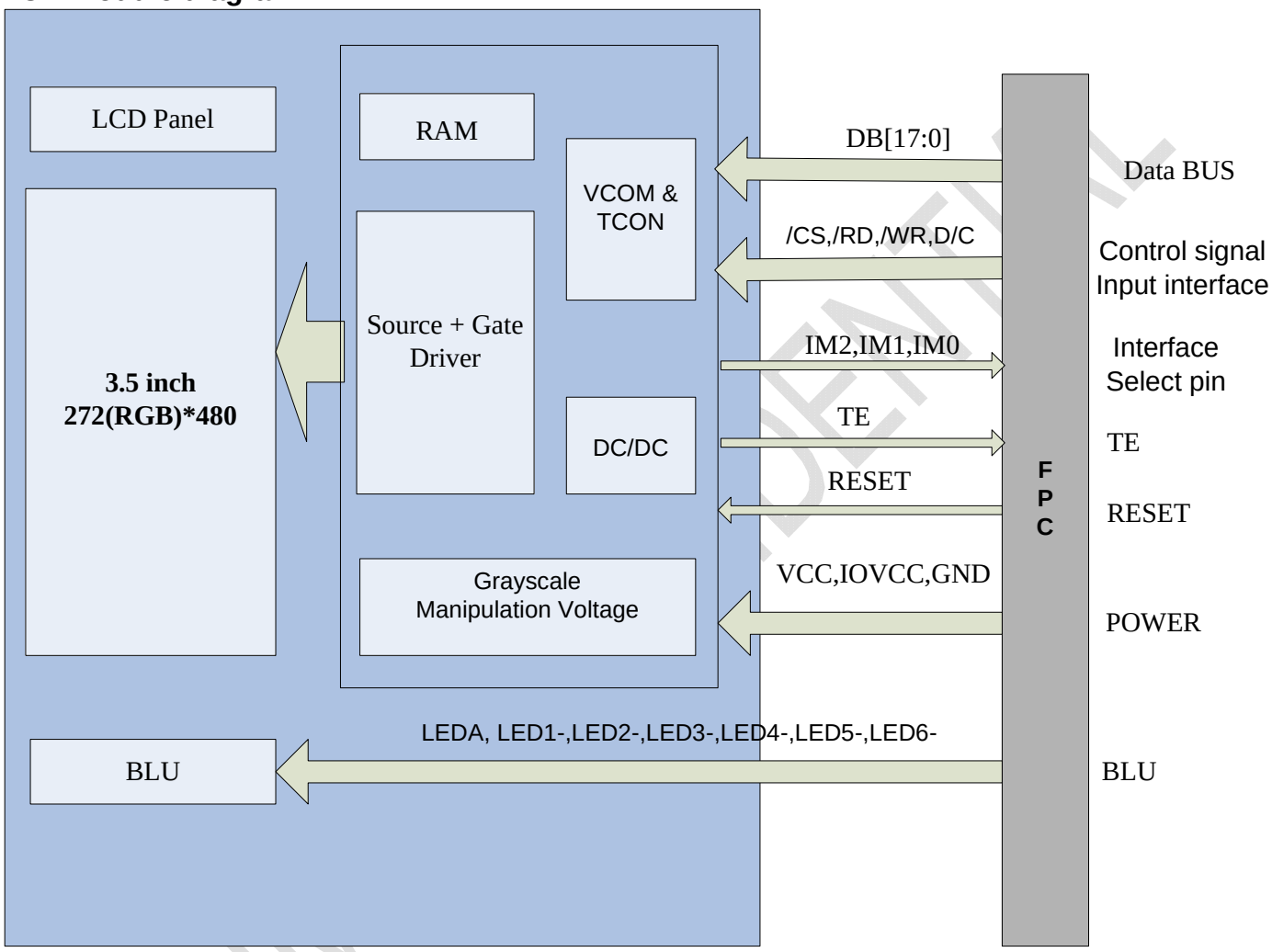
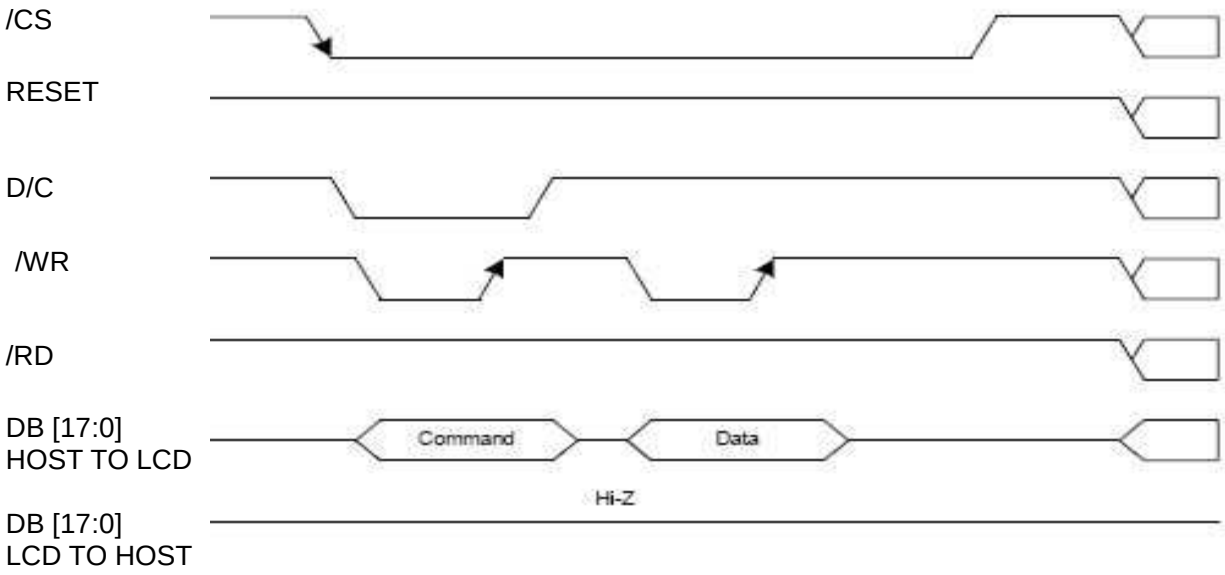


Figure 4.3 LCD module diagram

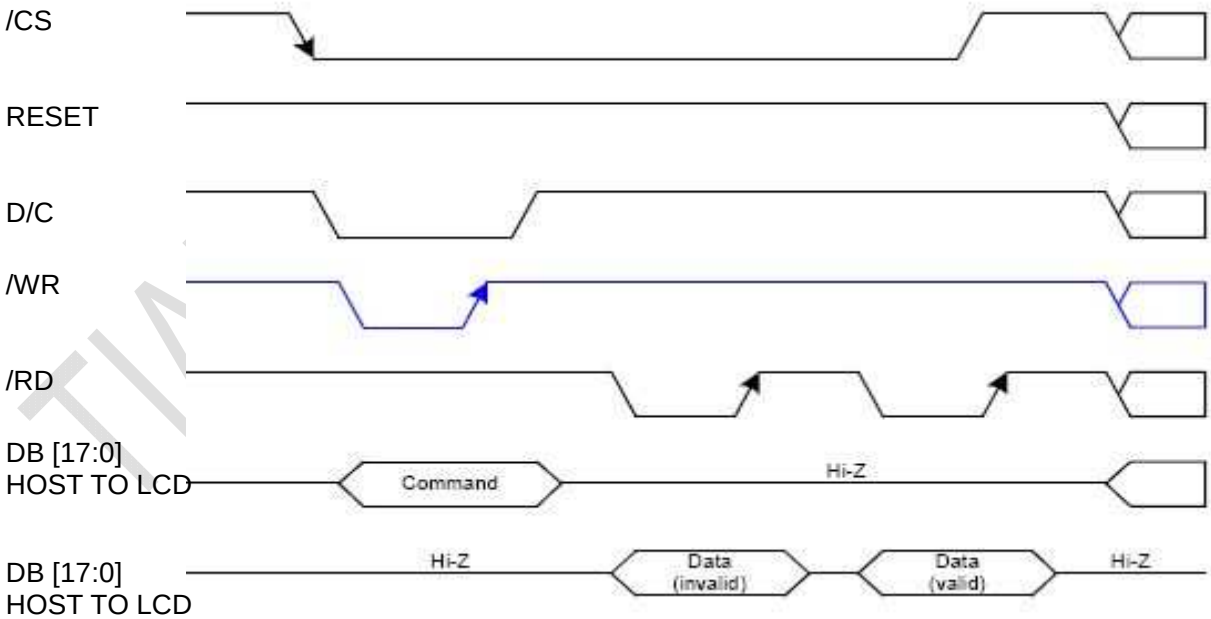
5. Data input timing

5.1 DBI Type B

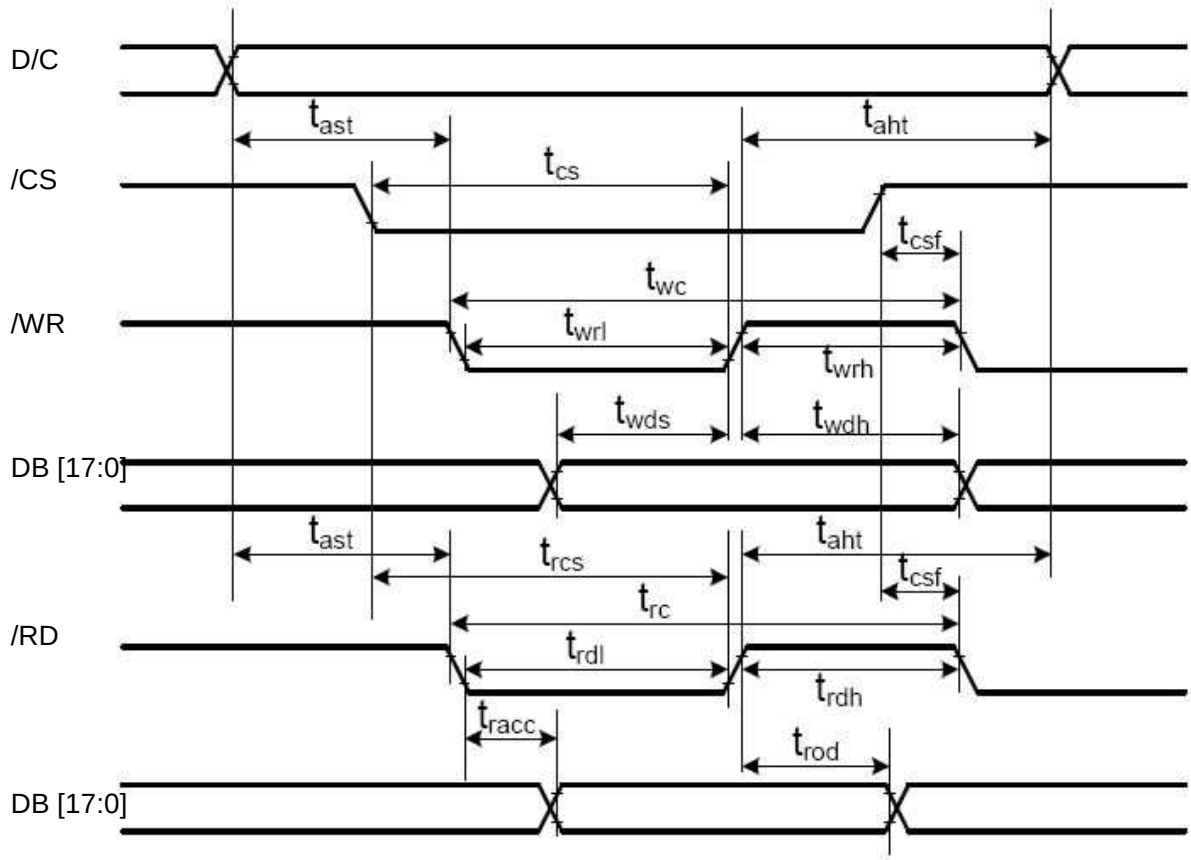
5.1.1 DBI Type B Write Cycle



5.1.2 DBI Type B Read Cycle



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



5.1.4 Interface Timing Parameters

Normal Write Mode

Signal	Symbol	Parameter	Spec.			Description
			Min.	Max.	Unit	
D/C	t_{AST} t_{AHT}	Address setup time Address hold time(Write/Read)	10 10	-	ns	-
/CS	t_{CS} t_{RCS} t_{CSF}	Chip select setup time (Write) Chip select setup time (Read) Chip select wait time(Write/Read)	20 20 20	-	ns	-
/WR	t_{WC} t_{WRH} t_{WRL}	Write cycle Control pulse “H” duration Control pulse “L” duration	100 30 25	-	ns	-
/RD	t_{RC} t_{RDH} t_{RDL}	Read cycle Control pulse “H” duration Control pulse “L” duration	450 250 170	-	ns	
DB[17:0] DB[15:0] DB[8:0] DB[7:0]	T_{WDS} T_{WDH} t_{RACC} t_{ROD}	Data setup time Data hold time Read access time Output disable time	15 20 10 10	- - 340	ns	For maximum C_L=30pF For minimum C_L=8pF

5.1.5 DBI Type B interface

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[5]	B[4]	B[3]	B[2]	B[1]
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[5]	b[4]	b[3]	b[2]	b[1]

			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]	DI
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]	DI
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[5]	B[4]	B[3]	B[2]	B[1]
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[5]	b[4]	b[3]	b[2]	b[1]

			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]		

16-bit data extend to 18-bit

		Frame Memory Data (18bpp)																	
Set_pixel_format	EPF[1:0]	DB17	DB16	DB15	DB14	DB13	DB12	DB11	DB10	DB9	DB8	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
18bpp	*	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]
16bpp	2'h0	R[4]	R[3]	R[2]	R[1]	R[0]	0	G[5]	G[4]	G[3]	G[2]	G[1]	G[0]	B[4]	B[3]	B[2]	B[1]	B[0]	0
	2'h1	R[4]	R[3]	R[2]	R[1]	R[0]	1	G[5]	G[4]	G[3]	G[2]	G[1]	G[0]	B[4]	B[3]	B[2]	B[1]	B[0]	1
	2'h2	R[4]	R[3]	R[2]	R[1]	R[0]	R4	G[5]	G[4]	G[3]	G[2]	G[1]	G[0]	B[4]	B[3]	B[2]	B[1]	B[0]	B[4]

5.2 Reset Timing Characteristics

Ta=25℃

Item	Symbol	Unit	Min.	Typ.	Max.
RESET low-level width	t_{RES}	ms	1	-	-
RESET rise time	t_{rRES}	μs	-	-	10
Reset high-level width	t_{RES_H}	ms	50		

Table 5.2 RESET Timing Parameter

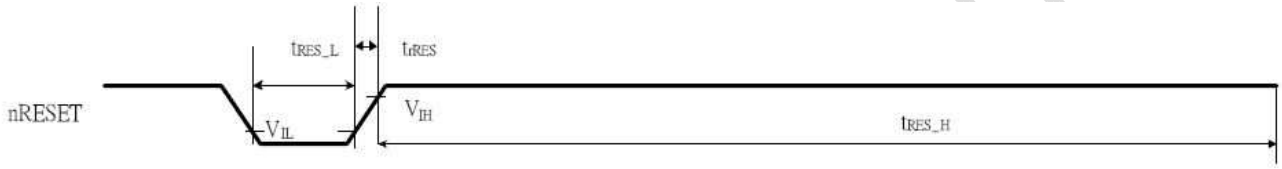
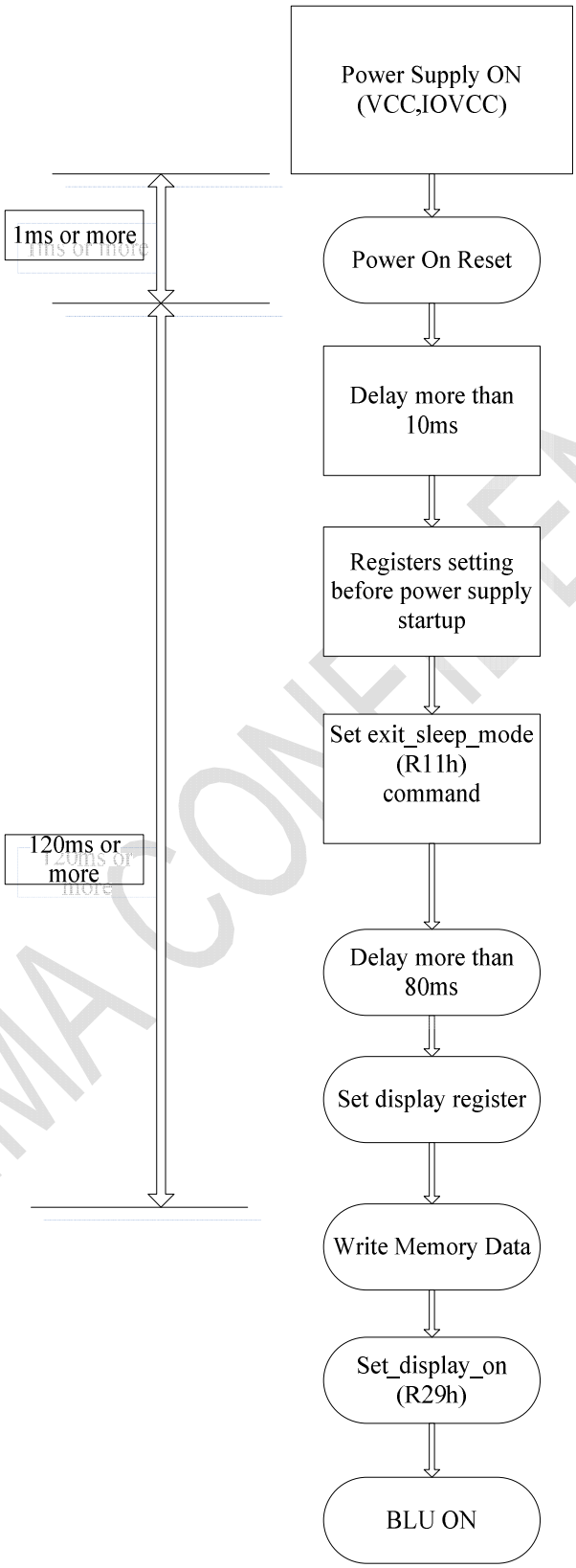


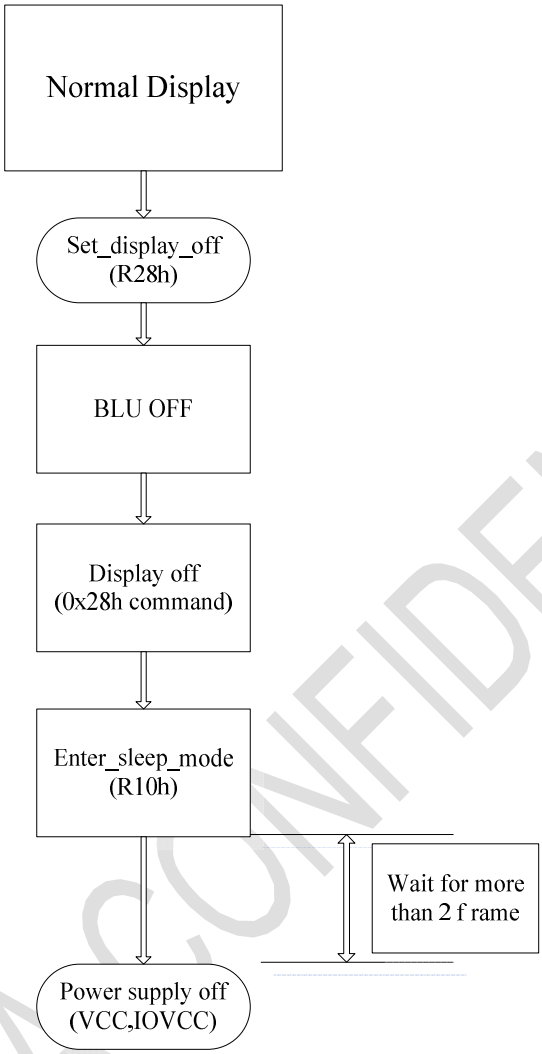
Figure 5.2 RESET Timing

5.3 Power ON/OFF Sequence

5.3.1 Power ON Sequence



5.3.2 Power OFF Sequence



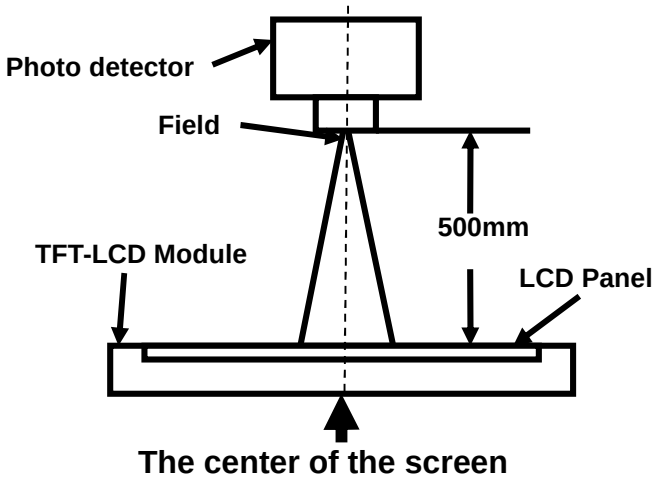
6. Optical Characteristics

Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles		θT	CR≧10	60	70	--	Degree	Note 2
		θB		60	70	--		
		θL		50	60	--		
		θR		60	70	--		
Contrast Ratio		CR	θ=0°	400	500	--		Note1、Note3
Response Time		T_{ON}	25℃	--	20	30	ms	Note1 Note4
		T_{OFF}						
Chromaticity	White	x	Backlight is on	0.250	0.300	0.350		Note5 Note1
		y		0.270	0.320	0.370		
	Red	x		0.515	0.565	0.615		
		y		0.290	0.340	0.390		
	Green	x		0.290	0.340	0.390		
		y		0.530	0.580	0.630		
	Blue	x		0.095	0.145	0.195		
		y		0.045	0.095	0.145		
Uniformity		U		--	80	--	%	Note1、Note6
NTSC				--	50	--	%	Note 5
Luminance		L		250	300	--	cd/m^2	Note1、Note7

Test Conditions:

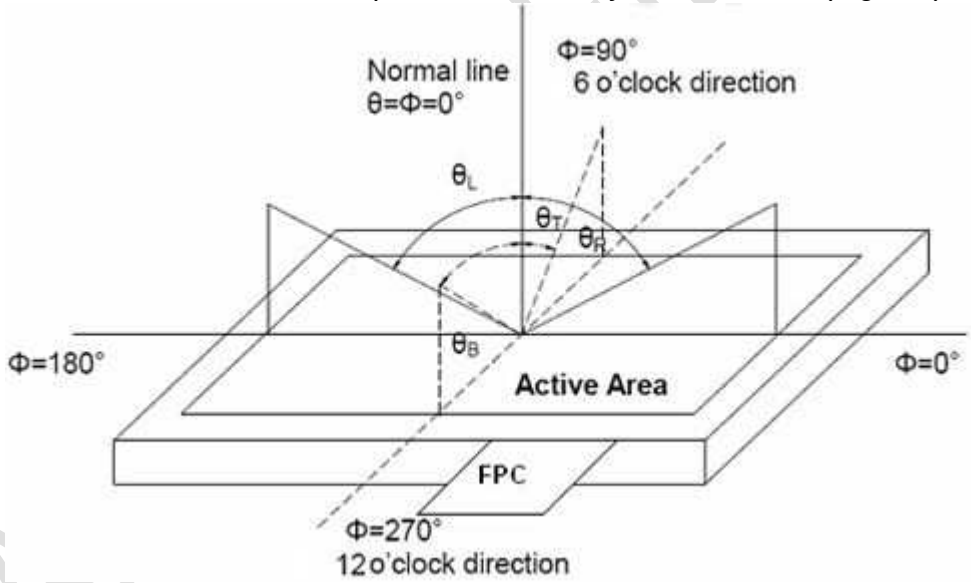
1. I_F= 20mA(one channel), the ambient temperature is 25℃.
2. The test systems refer to Note 1 and Note 2.

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°

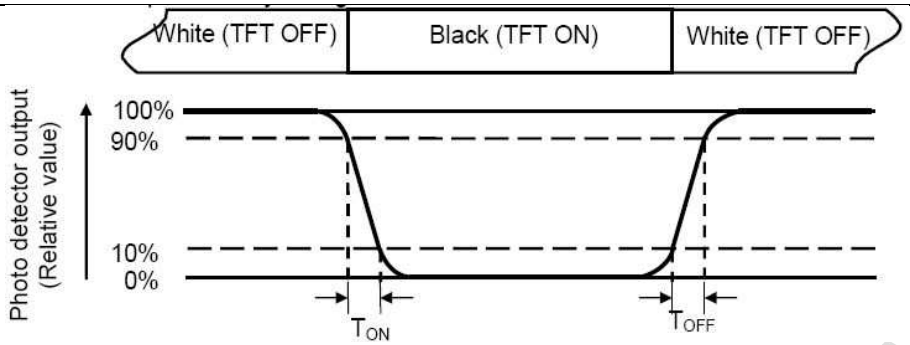
Note 2: Definition of viewing angle range and measurement system.
viewing angle is measured at the center point of the LCD by CONOSCOPE(ergo-80)。



Note 3: Definition of contrast ratio

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

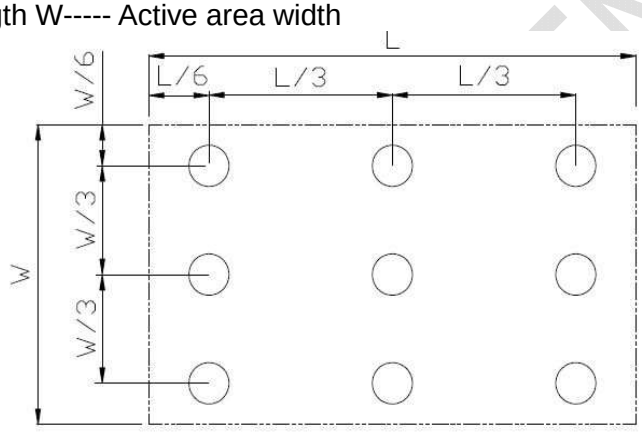
“White state “: The state is that the LCD should drive by Vwhite.
“Black state”: The state is that the LCD should drive by Vblack.
Vwhite: To be determined Vblack: To be determined.
Note 4: Definition of Response time
The response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time (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



Lmax: The measured Maximum luminance of all measurement position.

Lmin: The measured Minimum luminance of all measurement position.

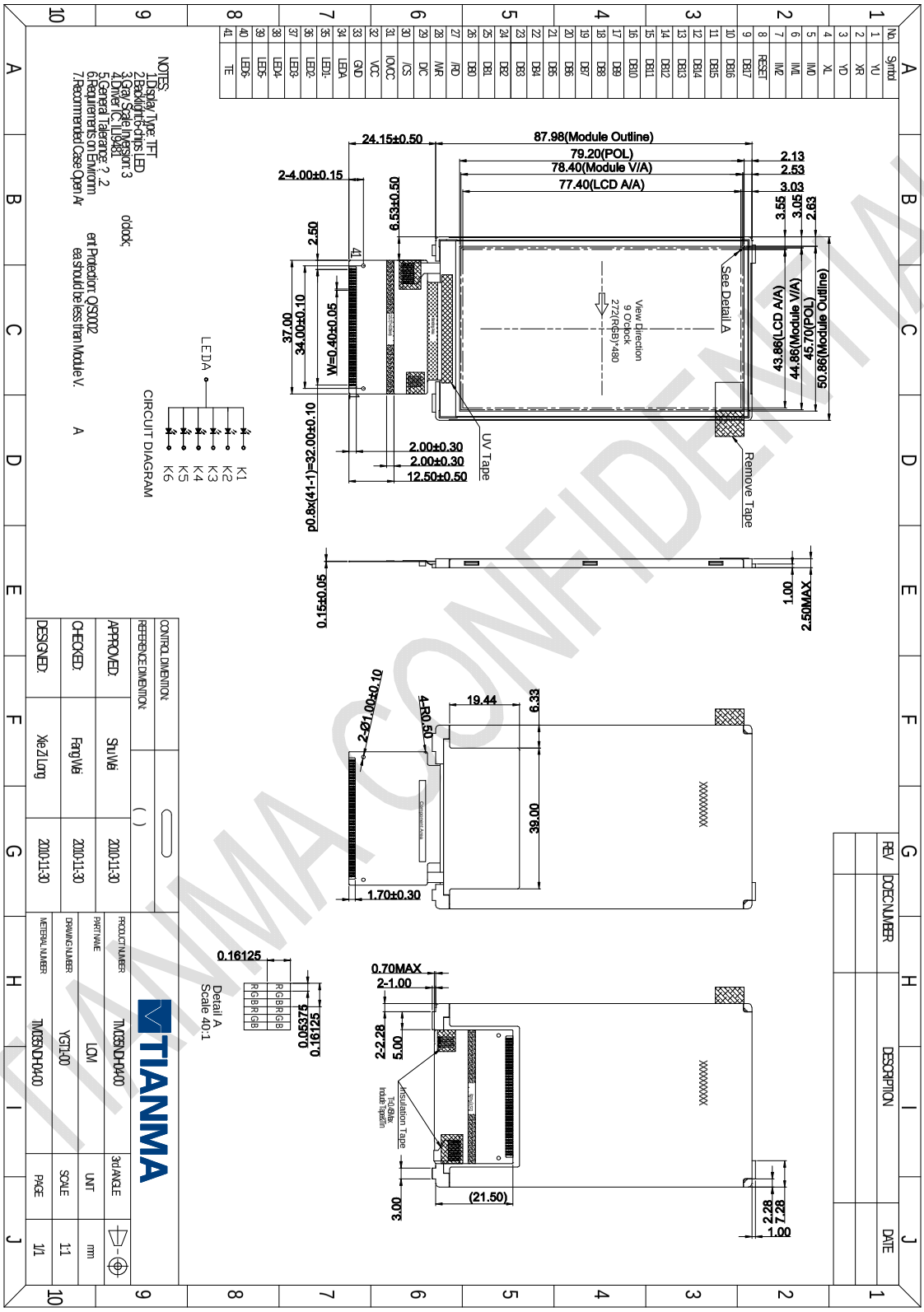
Note 7: Definition of Luminance:
Measure the luminance of white state at center point.

7. Environmental / Reliability Test

No	Test Item	Condition	Remarks
1	High Temperature Operation	Ts = +60℃, 240 hours	Note1 IEC60068-2-1,GB2423.2
2	Low Temperature Operation	Ta = -20℃, 240 hours	IEC60068-2-1 GB2423.1
3	High Temperature Storage	Ta = +70℃, 240 hours	IEC60068-2-1 GB2423.2
4	Low Temperature Storage	Ta = -30℃, 240 hours	IEC60068-2-1 GB2423.1
5	Storage at High Temperature and Humidity	Ta = +60℃, 90% RH max,240hours	Note2 IEC60068-2-78 GB/T2423.3
6	Thermal Shock (non-operation)	-30℃ 30 min~+70℃ 30 min, Change time:5min,30 Cycle.	Start with cold temperature, End with high temperature, IEC60068-2-14,GB2423.22
7	ESD	C=150pF,R=330Ω,5point/panel Air:±8Kv,5times; Contact:±4Kv,5times (Environment:15℃~35℃, 30%~60%.86Kpa~106Kpa)	IEC61000-4-2 GB/T17626.2
8	Vibration Test	Frequency range:10~55Hz,Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X.Y.Z.(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:60cm, 1corner,3edges,6surfaces	IEC60068-2-32 GB/T2423.8

Note1: Ts is the temperature of panel's surface.
Note2: Ta is the ambient temperature of samples.

8. Mechanical Drawing



9. Packing Drawing

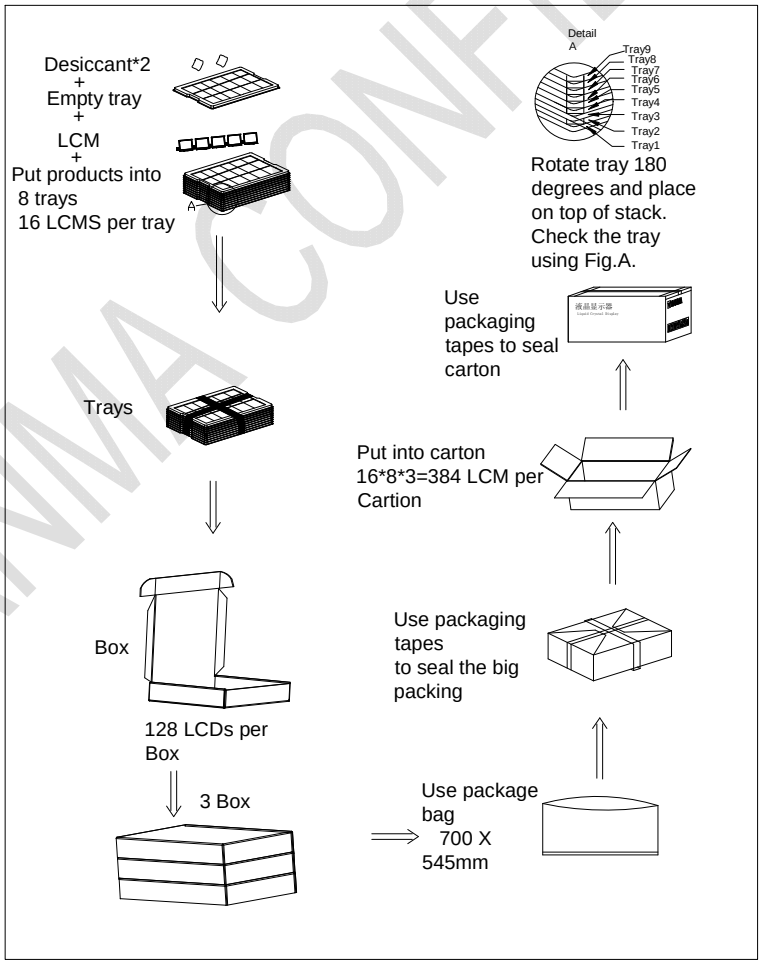
9.1 Packaging Material

No	Item	Model(Material)	Dimensions (mm)	Unit Weigt (Kg)	Quantity	Remark
1	LCM module	TM035NDH04	50.86x 87.98x2.50	0.021	384	
2	Desicant	Desicant	45x35	0.002	6	
3	Tray	PET（Transmit）	485x330x12.1	0.165	27	Anti-static
4	Dust-Proof Bag	PE	700x545	0.021	1	
5	Box	Corrugated paper	520x345x74	0.227	3	
6	Carton	Corrugated paper	544x365x250	1.01	1	
7	Total weight	14.243±5%				

Note: Packaging Specification and Quantity

1. LCD quantity per tray:6 row x 2column+4=16
2. Module quantity in a carton: NO. of PS trays 24x quantity per tray 16=384pcs

9.2 Packing Instruaction



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

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