



MODEL NO. : TM024HDH36

ISSUED DATE: 2010-8-2

VERSION : Ver 2.0

- Preliminary Specification
- Final Product Specification

Customer : \_\_\_\_\_

Approved by	Notes

SHANGHAI TIANMA Confirmed :

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This technical specification is subjected to change without notice



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## 1 General Specifications

	Feature	Spec
<b>Display Spec</b>	Size	2.4 inch
	Resolution	240(RGB) x 320
	Interface	CPU 8/9/16/18 bits
	Color Depth	262k
	Technology Type	a-Si
	Pixel Pitch (mm)	0.153x 0.153
	Pixel Configuration	R.G.B Vertical Stripe
	Display Mode	TM with Normally White
	Surface Treatment(Up Polarizer)	Clear Type (3H)
	Viewing Direction	6 o'clock
	Gray Scale Inversion Direction	12 o'clock
<b>Mechanical Characteristics</b>	LCM (W x H x D) (mm)	42.72x60.26x2.55
	Active Area(mm)	36.72 x 48.96
	With /Without TSP	Without TSP
	Weight (g)	11.84
	LED Numbers	4 LEDs
<b>Electronic</b>	Driver IC	HX8347G

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:  $\pm 5\%$



## 2 Input/Output Terminals

### 2.1 TFT LCD Panel

No	Symbol	I/O	Description	Comment
1	ID	O	LCD identify for reading a 0.5023 Volt Voltage when VCI is 2.8 Volt	
2	GND	P	Power Ground	
3	VCI	P	Power Supply of Analog	
4	VDD	P	Power Supply of Digital	
5	NCS	I	Chip select signal	
6	RS	I	Register select signal	
7	NWR	I	Write enables signal	
8	NRD	I	Read enables signal	
9	D1	I	Data Input	
10	D2	I	Data Input	
11	D3	I	Data Input	
12	D4	I	Data Input	
13	D5	I	Data Input	
14	D6	I	Data Input	
15	D7	I	Data Input	
16	D8	I	Data Input	
17	D10	I	Data Input	
18	D11	I	Data Input	
19	D12	I	Data Input	
20	D13	I	Data Input	
21	D14	I	Data Input	
22	D15	I	Data Input	
23	D16	I	Data input	
24	D17	I	Data input	
25	NRES	I	Reset signal	
26	IF0	I	Mode select	Note 2
27	IF1	I	Mode select	
28	YD	-	NC	
29	XL	-	NC	
30	YU	-	NC	
31	XR	-	NC	
32	LED3-	P	LED light cathode	
33	LED2-	P	LED light cathode	
34	LED1-	P	LED light cathode	
35	LED+	P	LED light anode	
36	LED4-	P	LED light cathode	
37	D9	I	Data input	
38	D0	I	Data input	
39	GND	P	Power Ground	



Note1: I/O definition: I----Input O---Output P----Power/ Ground NC--- Not Connected

Note2:

IF1	IF0	Interface	Data Bus Use	
			Register/Content	GRAM
0	0	8080 MCU 16bit parallel	D8~D1	D17~D10,D8~D1
0	1	8080 MCU 8bit parallel	D17~D10	D17~D10
1	0	8080 MCU 18bit parallel	D8~D1	D17~D0
1	1	8080 MCU 9bit parallel	D17~D10	D17~D9



### 3 Absolute Maximum Ratings

#### 3.1 Driving TFT LCD Panel

GND=0V, Ta=25°C

Item	Symbol	MIN	MAX	Unit	Remark
Logic Supply Voltage	VDD	-0.3	4.6	V	
Analog Supply Voltage	VCI	-0.3	4.6	V	
Input voltage	NCS/RS/NWR/NRD/D0~D17 NRES/IF0/IF1	-0.3	VDD+0.5	V	
Back Light Forward Current	I <sub>F</sub>	-	25	mA	ONE LED
Operating Temperature	Top	-20	70	°C	
Storage Temperature	Tst	-30	80	°C	



## 4 Electrical Characteristics

### 4.1 Driving TFT LCD Panel

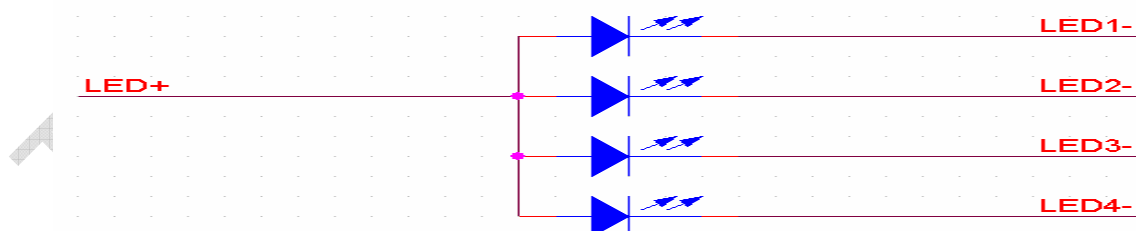
GND=0V, Ta=25°C

Item	Symbol	MIN	TYP	MAX	Unit	Remark	
Logic Supply Voltage	VDD	1.65	1.8/2.8	3.3	V		
Analog Supply Voltage	VCI	2.3	2.8	3.3	V		
Input Signal Voltage	High Level	V <sub>IH</sub>	0.7xVDD	-	VDD	V	NCS/RS/NWR/NRD/D0~D17 NRES/IF0/IF1
	Low Level	V <sub>IL</sub>	-	-	0.3xVDD		
Output Signal Voltage	High Level	V <sub>OH</sub>	0.8xVDD	-	-	V	
	Low Level	V <sub>OL</sub>	-	-	0.2xVDD	V	
(Panel+LSI) Power Consumption	Black Mode	-	21.636	-	-	mW	
	8 color Mode	-	5.897	-	-	mW	
	Sleeping Mode	-	0.095	-	-	mW	

### 4.2 Driving Backlight Ta=25°C

Item	Symbol	Min	Typ	Max	Unit	Remark
Forward Current	I <sub>F</sub>	-	60	-	mA	4 LEDs
Forward Voltage	V <sub>F</sub>	(2.9)	3.2	(3.4)	V	
Backlight Power Consumption	W <sub>BL</sub>	-	192	-	mW	
Operating Life Time	-	10000	(20000)	-	Hrs	For each LED

Note1: Figure below shows the connection of backlight LED.



Note 2: One LED:  $1/4 \times I_F = 15 \text{ mA}$ ,  $V_F = 3.2 \text{ V}$

Note 3: : I<sub>F</sub> is defined for one channel LED.

Optical performance should be evaluated at Ta=25°C only.

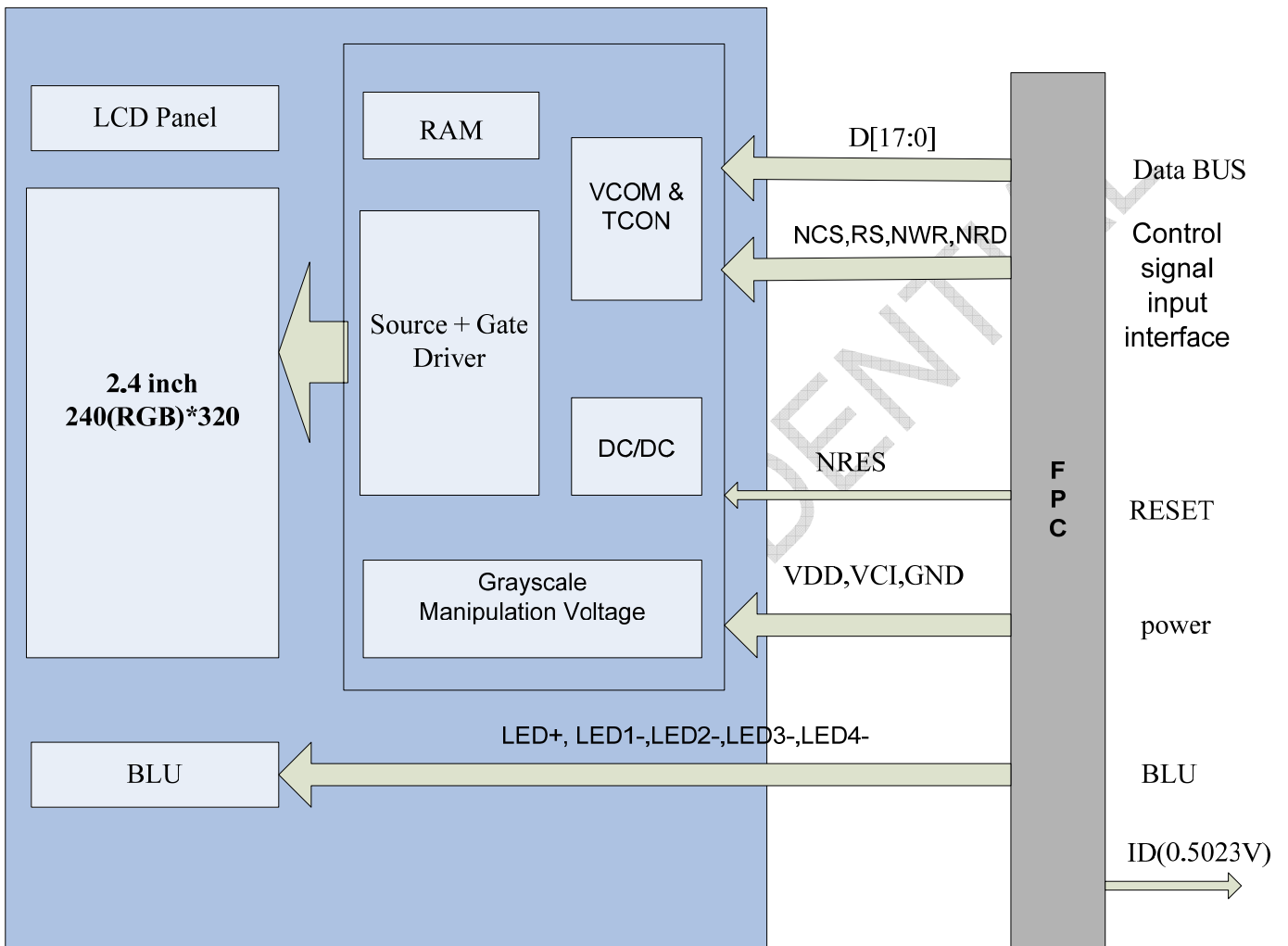
If LED is driven by high current, high ambient temperature & humidity condition. The life time of LED will be reduced. Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.

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### 4.3 Block Diagram



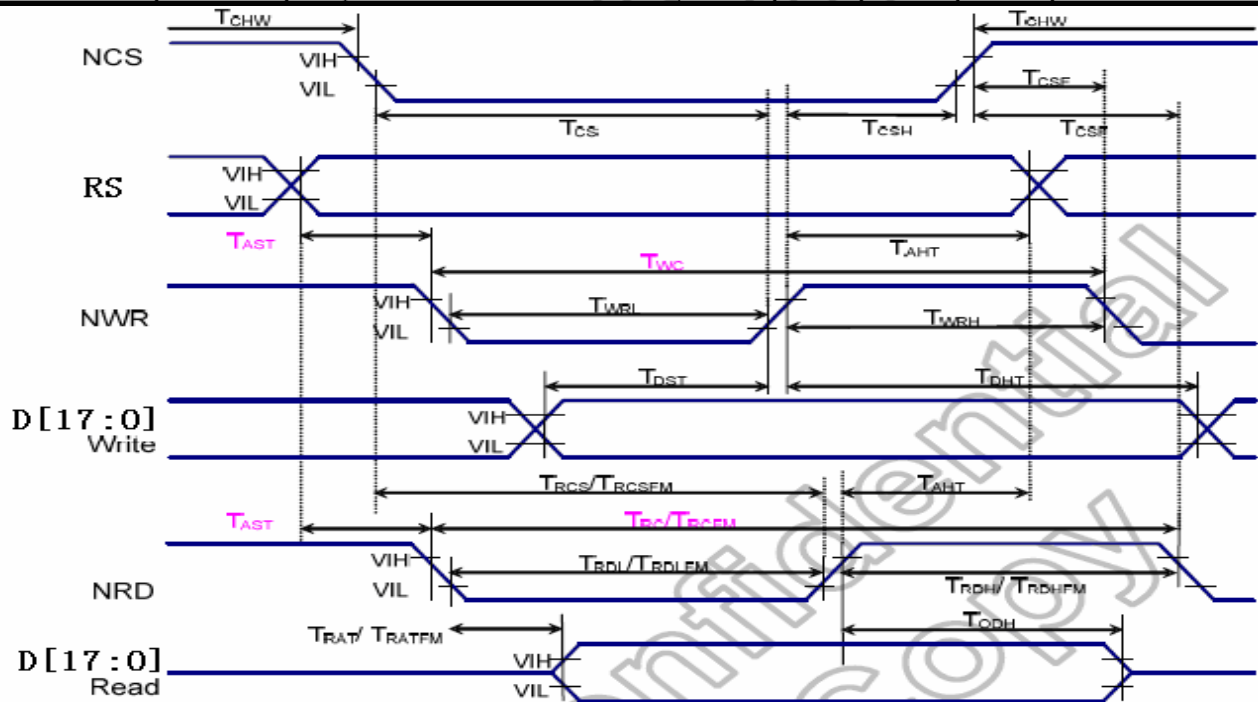


## 5 Timing Chart

### 5.1 Interface Characteristics

Ta=25°C

Signal	Symbol	Parameter	Spec.			Unit	Description
			Min.	Typ	Max.		
RS	tAST	Address setup time	10	-	-	ns	-
	tAHT	Address hold time (Write/Read)	10	-	-		
NCS	tCHW	Chip select "H" pulse width	0	-	-	ns	-
	tCS	Chip select setup time (Write)	15	-	-		
	tRCS	Chip select setup time (Read ID)	45	-	-		
	tRCSFM	Chip select setup time (Read FM)	355	-	-		
	tCSF	Chip select wait time (Write/Read)	10	-	-		
	tCSH	Chip select hold time	10	-	-		
NWR	tWC	Write cycle	66	-	-	ns	-
	tWRH	Control pulse "H" duration	15	-	-		
	tWRL	Control pulse "L" duration	15	-	-		
NRD(ID)	tRC	Read cycle (ID)	160	-	-	ns	When read ID data
	tRDH	Control pulse "H" duration (ID)	90	-	-		
	tRDL	Control pulse "L" duration (ID)	45	-	-		
NRD(FM)	tRCFM	Read cycle (FM)	450	-	-	ns	When read from frame memory
	tRDHFM	Control pulse "H" duration (FM)	90	-	-		
	tRDLFM	Control pulse "L" duration (FM)	355	-	-		
D[17:0]	tDST	Data setup time	10	-	-	ns	For maximum CL=30pF For minimum CL=8pF
	tDHT	Data hold time	10	-	-		
	tRAT	Read access time (ID)	-	-	100		
	tRATFM	Read access time (FM)	-	-	340		
	tODH	Output disable time	20	-	80		

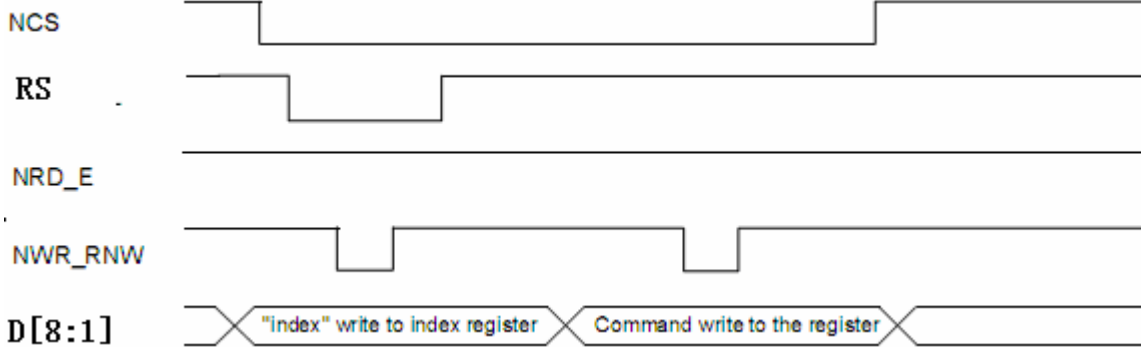


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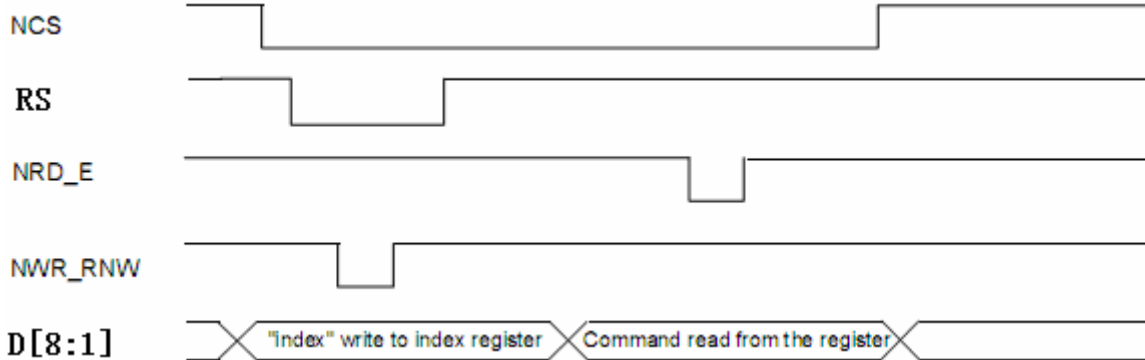
5.2 Registr Write/Read Timing Parameter(for CPU 18 BIT)

a. Write to register



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

b. Read to register



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

5.3 GRAM write timing in i80 series system

Register Command	DB17	DB16	DB15	DB14	DB13	DB12	DB11	DB10	DB9	DB8	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Command
17H	0	0	1	0	0	0	1	0	x	x	x	x	x	x	x	x	x	x	22H
03h	R3	R2	R1	R0	G3	G2	G1	G0	x	x	x	x	x	x	x	x	x	x	4K-Color (2-pixels/ 3-bytes)
	B3	B2	B1	B0	R3	R2	R1	R0	x	x	x	x	x	x	x	x	x	x	
	G3	G2	G1	G0	B3	B2	B1	B0	x	x	x	x	x	x	x	x	x	x	
05h	R4	R3	R2	R1	R0	G5	G4	G3	x	x	x	x	x	x	x	x	x	x	65K-Color (1-pixel/ 2-bytes)
	G2	G1	G0	B4	B3	B2	B1	B0	x	x	x	x	x	x	x	x	x	x	
06h	R5	R4	R3	R2	R1	R0	x	x	x	x	x	x	x	x	x	x	x	x	262K-Color (1-pixel/ 3bytes)
	G5	G4	G3	G2	G1	G0	x	x	x	x	x	x	x	x	x	x	x	x	
	B5	B4	B3	B2	B1	B0	x	x	x	x	x	x	x	x	x	x	x	x	

8 bit parallel interface GRAM write table



Register Command	DB17	DB16	DB15	DB14	DB13	DB12	DB11	DB10	DB9	DB8	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Command
17H									x	0	0	1	0	0	0	1	0	x	22H
03h	X	x	x	x	R3	R2	R1	R0	x	G3	G2	G1	G0	B3	B2	B1	B0	x	Color
05h									x	G2	G1	G0	B4	B3	B2	B1	B0	x	4K-Color
06h									x	G5	G4	G3	G2	G1	G0	x	x	x	65K-Color
									x	R5	R4	R3	R2	R1	R0	x	x	x	
07h									x	G5	G4	G3	G2	G1	G0	x	x	x	262K-Color
									x	B5	B4	B3	B2	B1	B0	x	x	x	

16bit parallel interface GRAM write table

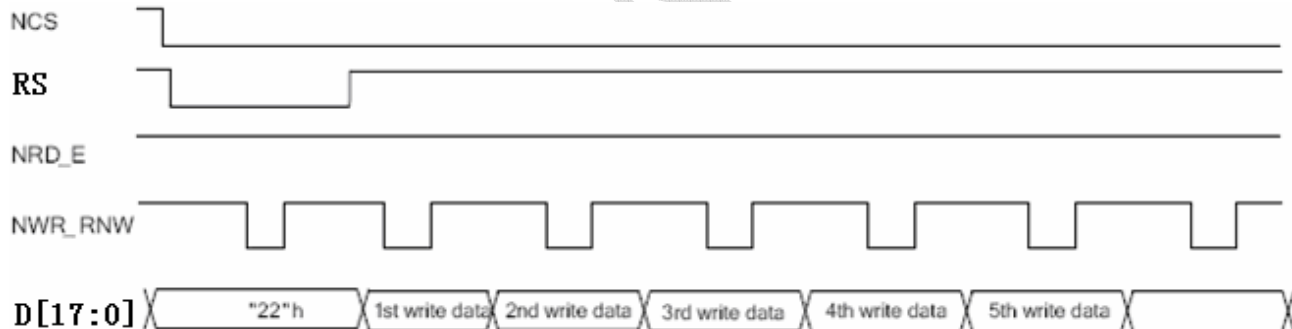
Register Command	D17	D16	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0	Register
17H	0	0	1	0	0	0	1	0	x	x	x	x	x	x	x	x	x	x	22H
06h																			Color
06h																			262K-Color (1-pixel/ 2bytes)

9 bit parallel interface GRAM write table

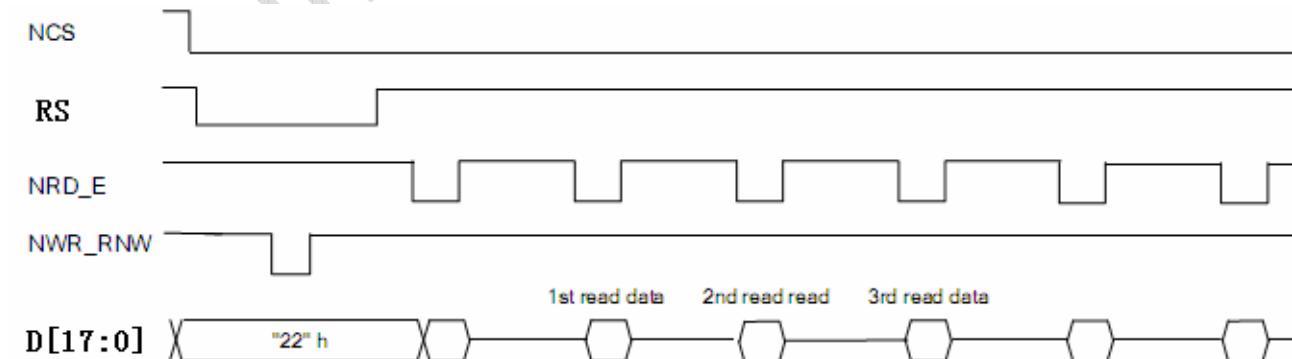
Register Command	DB17	DB16	DB15	DB14	DB13	DB12	DB11	DB10	DB9	DB8	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Register
17H	X	x	x	x	x	x	x	x	x	0	0	1	0	0	0	1	0	x	22H
06h																			Color
06h																			262K-Color

18 bit parallel interface GRAM write table

a. Write the GRAM



b. Read the GRAM

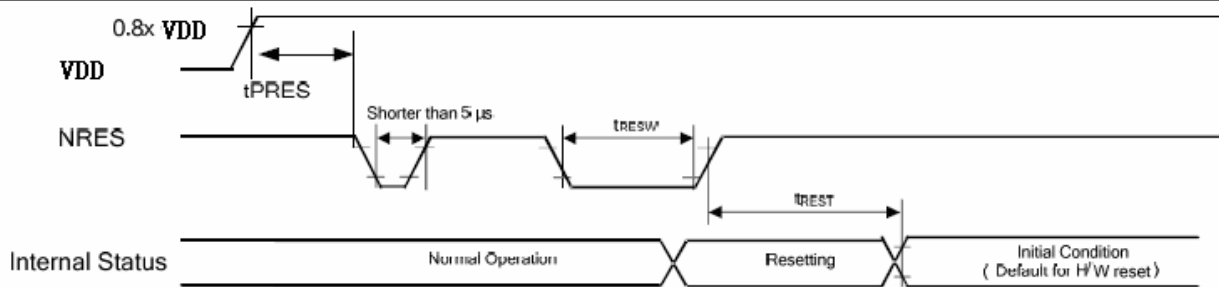




## 5.4 Reset Timing Characteristics

Item	Symbol	Unit	Min.	Typ.	Max.
RESET low pulse width	tRESW	us	10	-	-
Reset complete time (STB out mode)	tREST	ms	5	-	
Reset complete time (STB mode)		ms	120		
Reset goes high lever after power on time	tPRES	ms	1		

RESET Timing Parameter

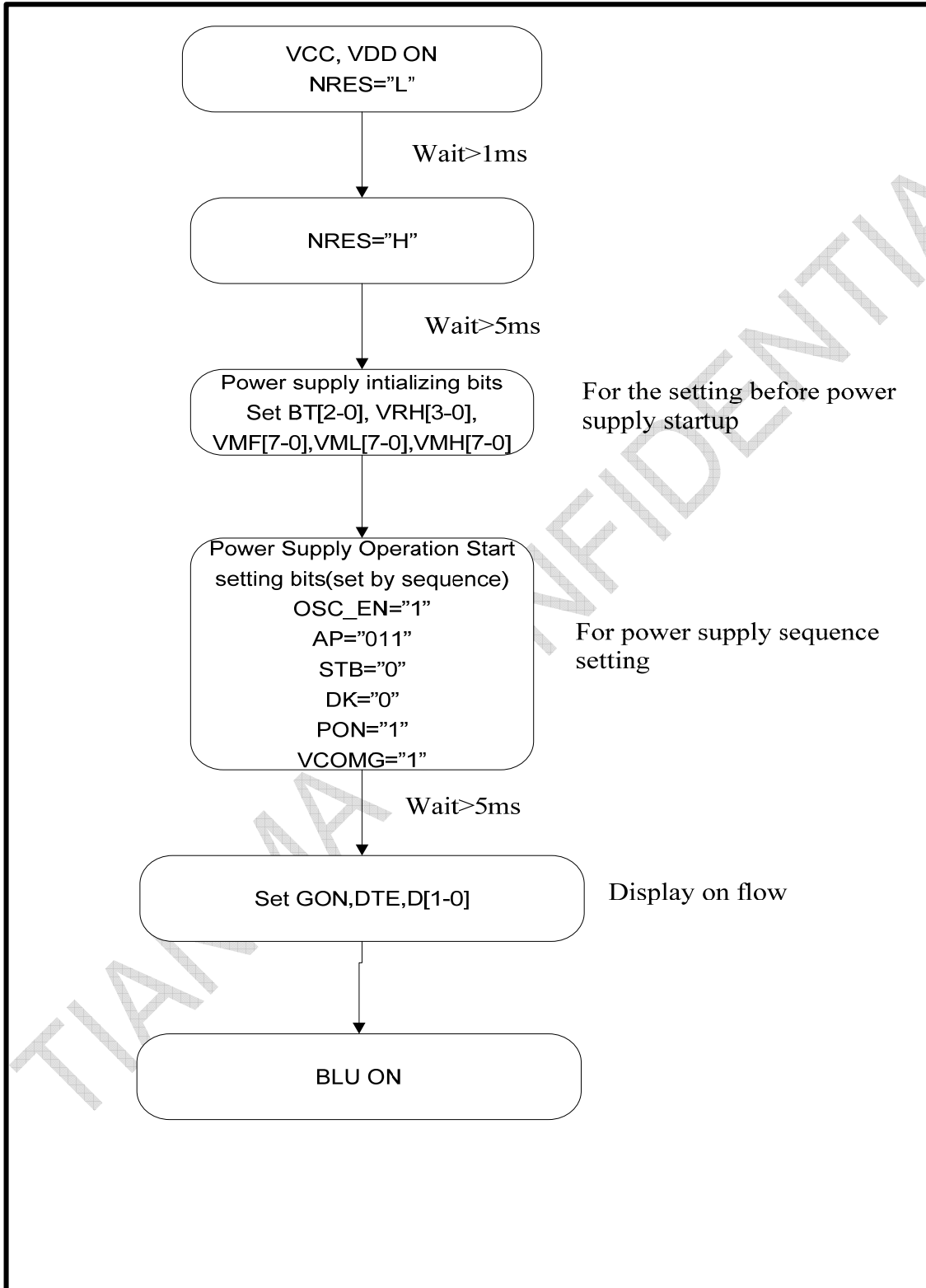


RESET Timing



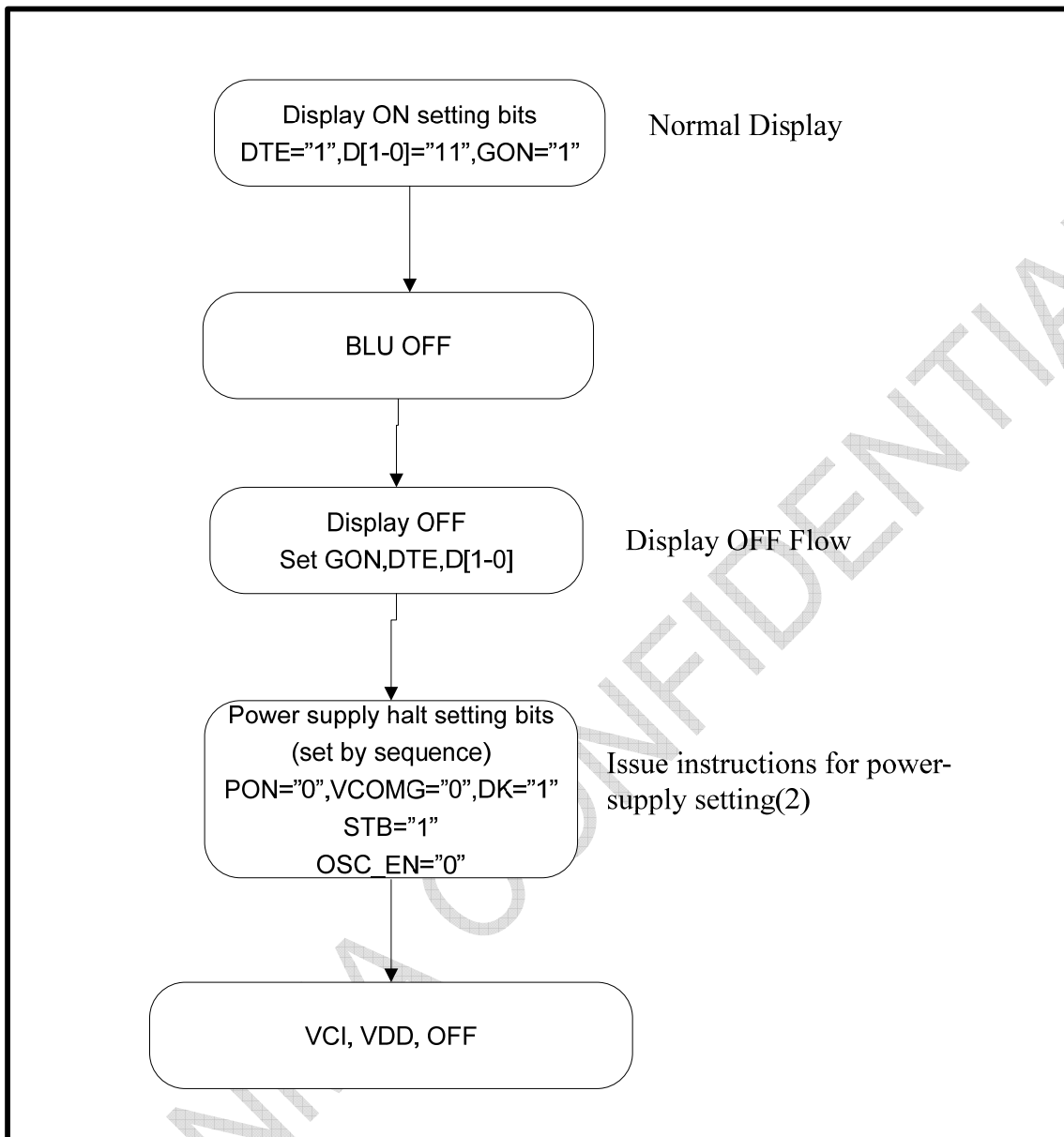
5.5 Power on/off Sequence

5.5.1 Power on sequence





5.5.2 Power off sequence





## 6 Optical Characteristics

Ta=25°C

Item	Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles	$\theta T$	$CR \geq 10$	60	70	-	Degree	Note 2
	$\theta B$		50	60	-		
	$\theta L$		60	70	-		
	$\theta R$		60	70	-		
Contrast Ratio	CR	$\theta=0^\circ$	400	500	-		Note1 Note3
Response Time	Ton	25°C	-	20	30	ms	Note1 Note4
	Toff						
Chromaticity	White	x	0.239	0.289	0.339	Backlight is on	Note5, Note1
		y	0.265	0.315	0.365		
	Red	x	0.538	0.588	0.638		
		y	0.294	0.344	0.394		
	Green	x	0.273	0.323	0.373		
		y	0.535	0.585	0.635		
	Blue	x	0.098	0.148	0.198		
		y	0.055	0.105	0.155		
Uniformity	U		-	80	-	%	Note1 Note6
NTSC			-	53	-	%	Note 5
Luminance	L		180	200	-	cd/m <sup>2</sup>	Note1 Note7

Test Conditions:

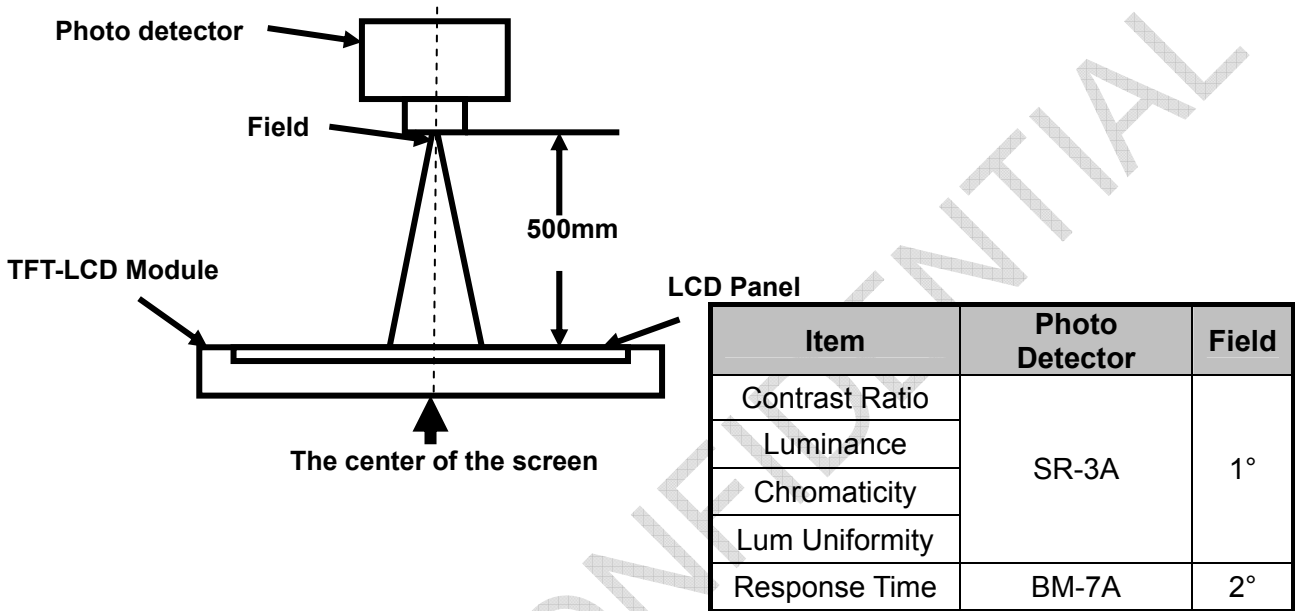
1. For one LED:  $V_F=3.2V$ ,  $1/4I_F=15mA$ , the ambient temperature is 25°C.
2. The test systems refer to Note 1 and Note 2.





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.



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).

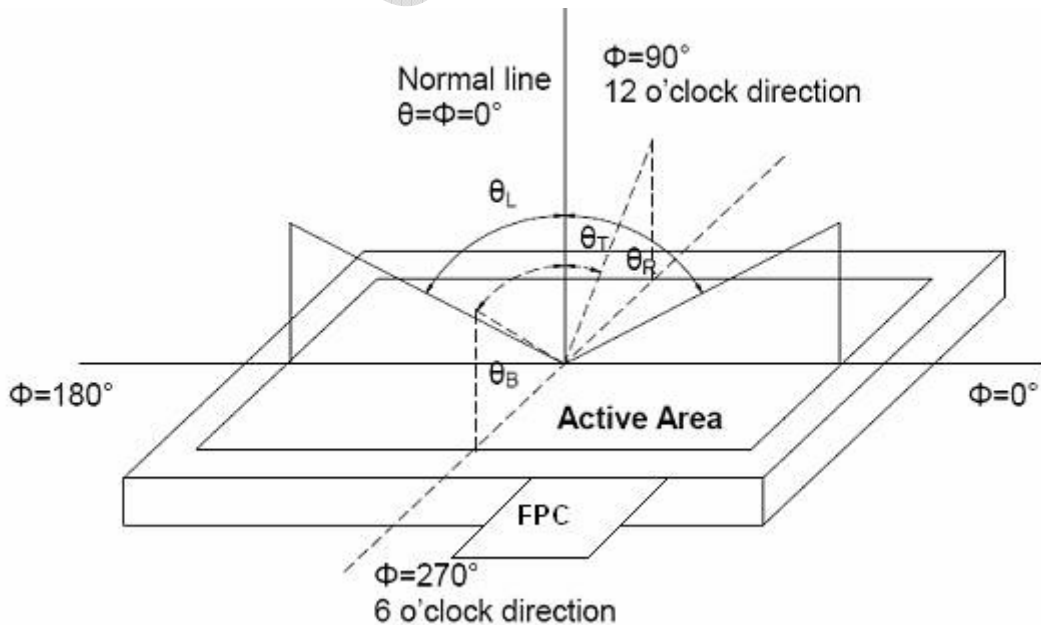


Fig. 1 Definition of viewing angle



Note 3: Definition of contrast ratio

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

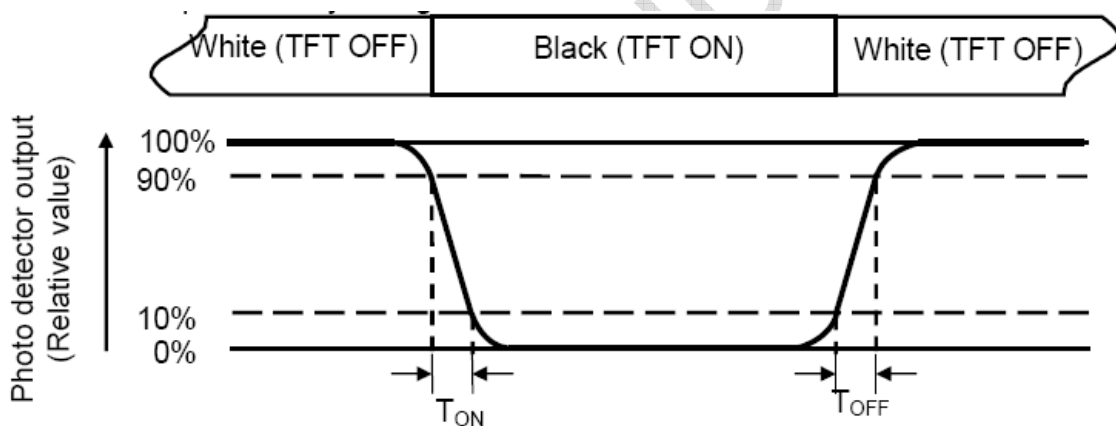
"White state": The state is that the LCD should be driven by  $V_{\text{white}}$ .

"Black state": The state is that the LCD should be driven by  $V_{\text{black}}$ .

$V_{\text{white}}$ : To be determined     $V_{\text{black}}$ : 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 ( $T_{\text{ON}}$ ) is the time between photo detector output intensity changed from 90% to 10%. And fall time ( $T_{\text{OFF}}$ ) 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

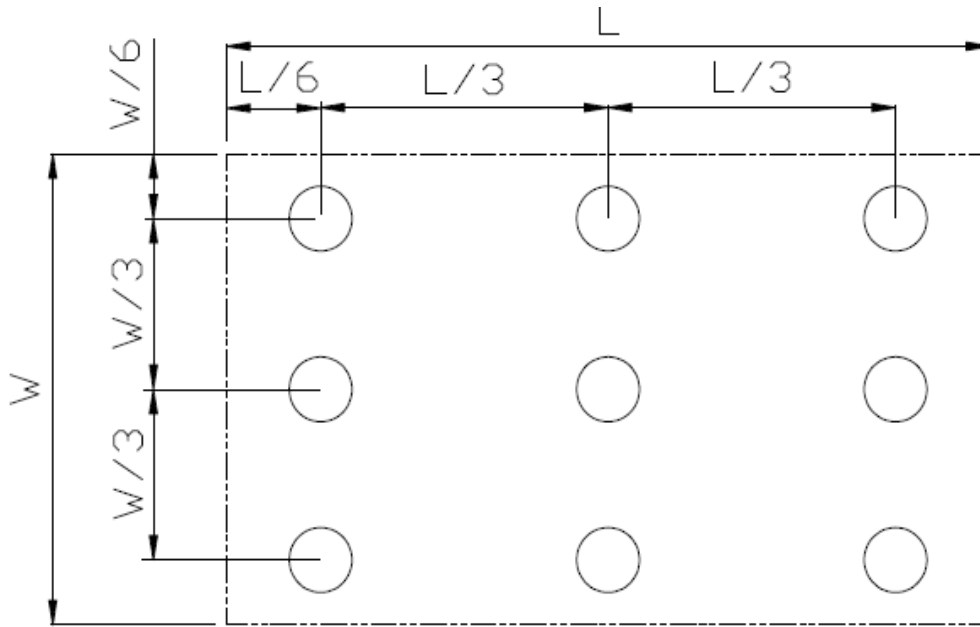


Fig. 2 Definition of uniformity

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 Tests

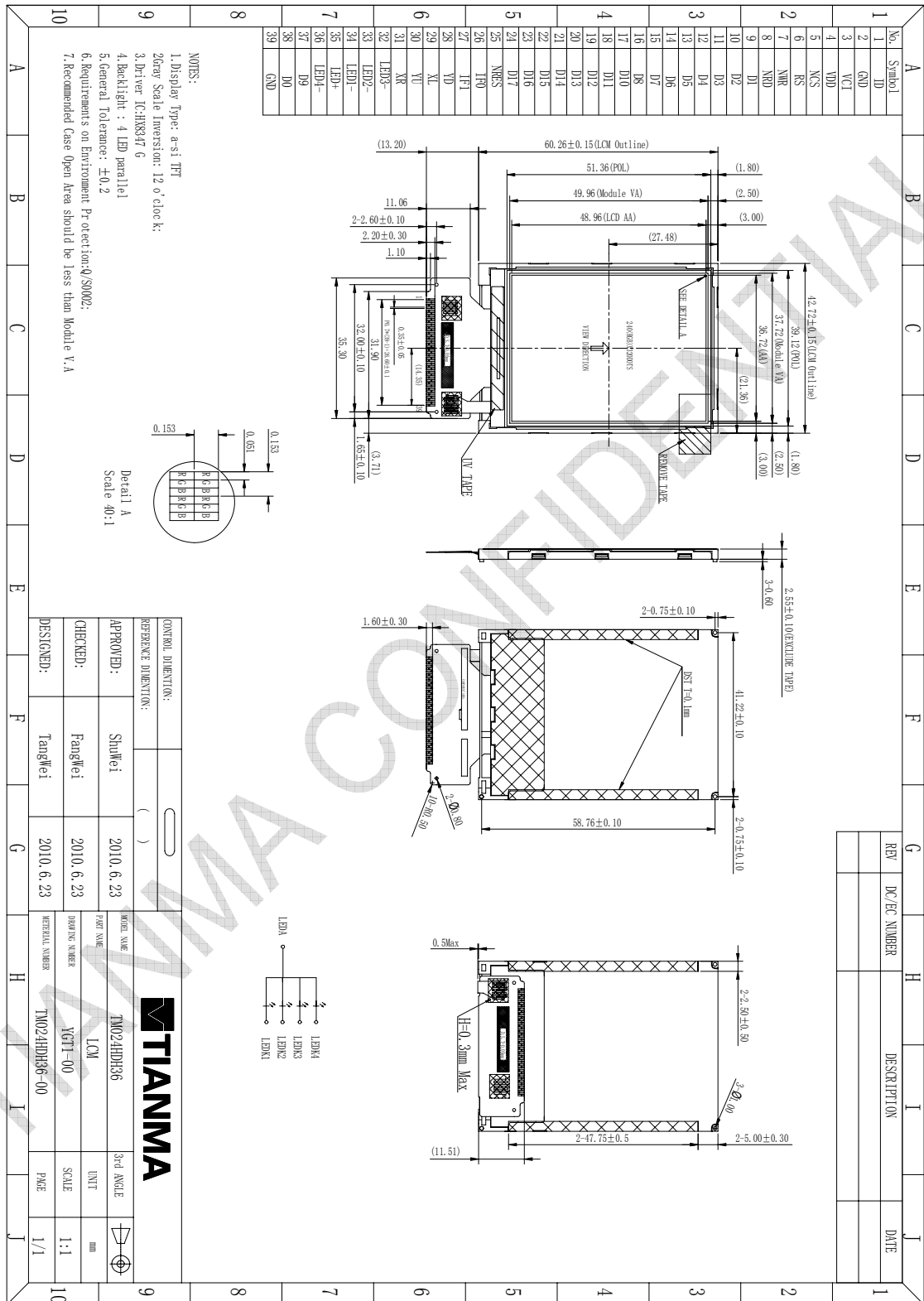
No	Test Item	Condition	Remarks
1	High Temperature Operation	Ts=+70°C, 240hrs	Note1 IEC60068-2-1:2007,GB2423.2-2008
2	Low Temperature Operation	Ta=-20°C, 240hrs	IEC60068-2-1:2007 GB2423.1-2008
3	High Temperature Storage	Ta=+80°C, 240hrs	IEC60068-2-1:2007 GB2423.2-2008
4	Low Temperature Storage	Ta=-30°C, 240hrs	IEC60068-2-1:2007 GB2423.1-2008
5	High Temperature & High Humidity Storage	Ta=+60°C, 90% RH 240 hours	Note2 IEC60068-2-78 :2001 GB/T2423.3—2006
6	Thermal Shock (Non-operation)	-30°C 30 min~+70°C 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°C~35°C, 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 hours for each direction of X.Y.Z. (6 hours for total) (Package condition)	2 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

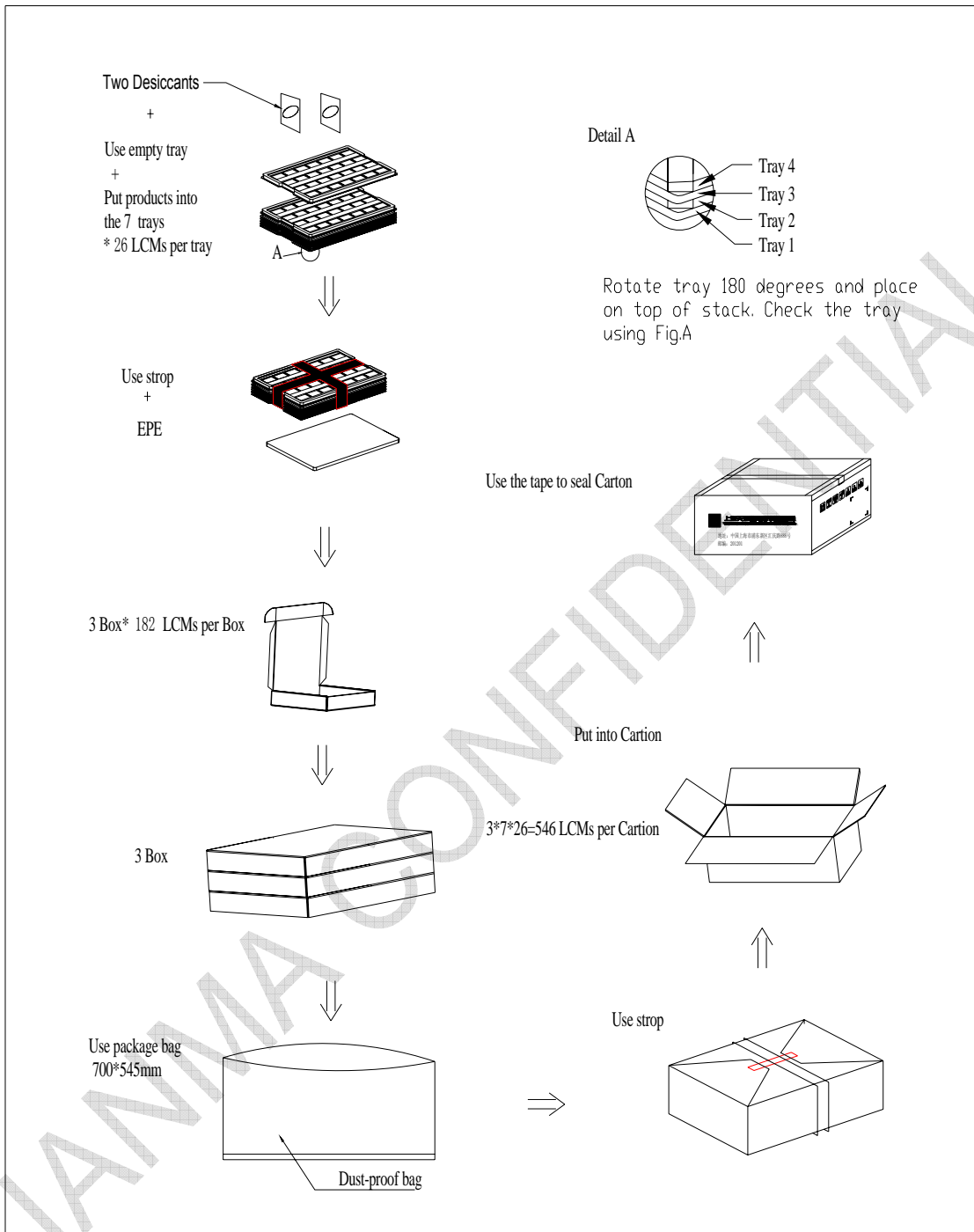


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## 9 Packing Drawing

No	Item	Model (Material)	Dimensions (mm)	Unit Weight(Kg)	Quantity	Remark
1	LCM module	TM024HDH36	42.72×60.26 ×2.55	0.01184	546	
2	Tray	PET (Transmit)	485×330×13.8	0.1746	24	Anti-static
3	DUST-PROOF BAG	PE	700X545	0.046	1	
4	EPE	EPE	485×330×5	0.0183	3	
5	BOX	CORRUGATED PAPER	520×345×74	0.3879	3	
6	Desiccant	Desiccant	45×35	0.002	6	
7	Carton	CORRUGATED PAPER	544×365×250	1.01	1	
8	Total weight			About 12.95 Kg		



## 10 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.
- 11.1.8.1 Be sure to ground the body when handling the LCD Modules.
- 11.1.8.2 Tools required for assembly, such as soldering irons, must be properly ground.
- 11.1.8.3 To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.
- 11.1.8.4 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:

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