



## **LN32240T028SA3598-TC**

2.8 inch, 240×320, TN screen with normal viewing angle, air bonding CTP

DWIN Technology Technical Document

Disclaimer: The product design is subject to alternation and improvement without prior notice.

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# 1 General Feature

## 1.1 LCD Parameters

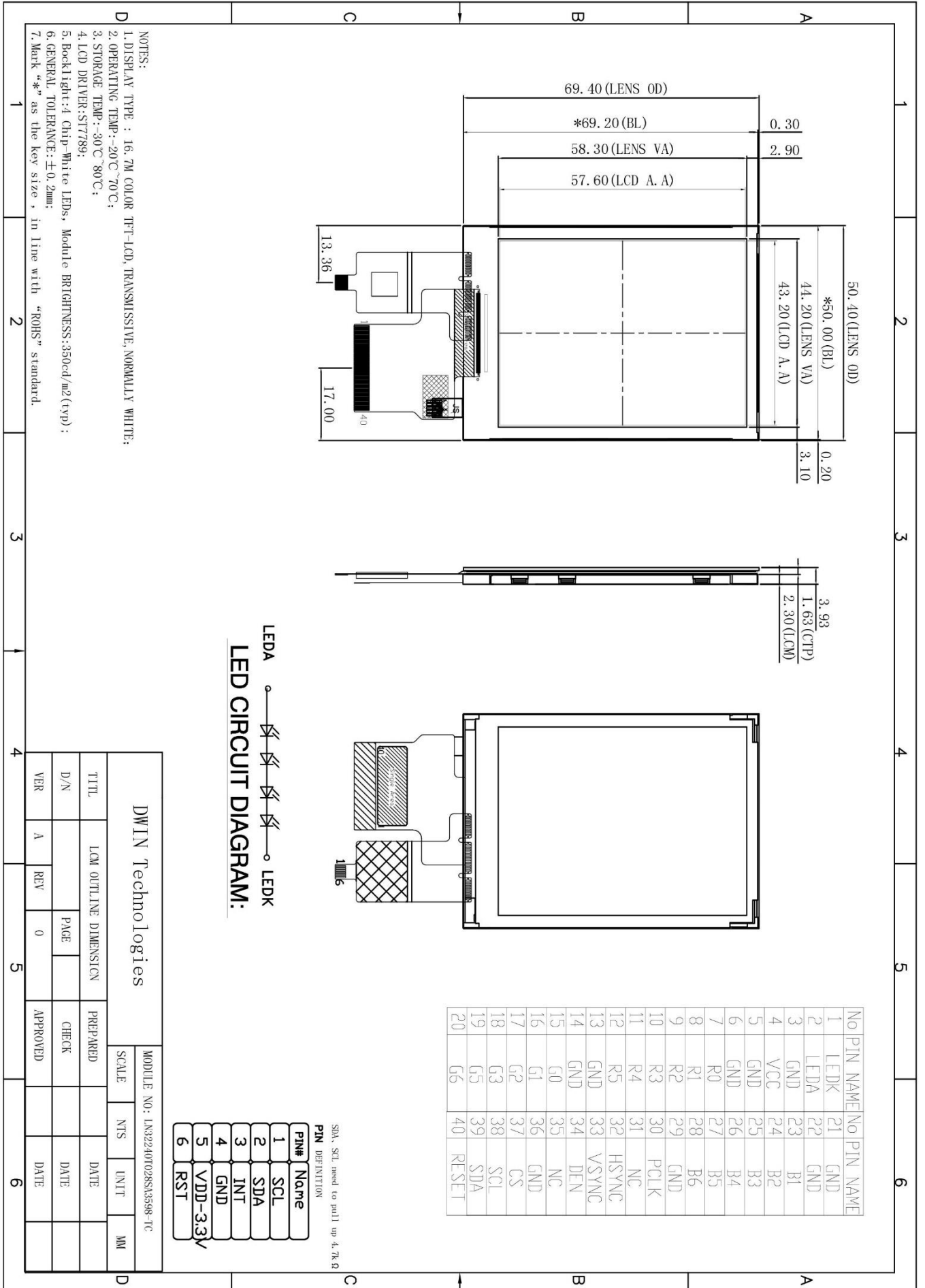
Feature		Description	Unit
Display Spec.	Size	2.8	inch
	Resolution	240(H)*320(V)	pixels
	Pixel Configuration	RGB stripe	-
	Pixel Pitch	0.06(H)*RGB*0.18(V)	mm
	Viewing Direction	6 o'clock	-
Mechanical Characteristics	Outside Dimension	50(W)*69.2(H)*2.3(D)	mm
	Active Area	43.2(W)*57.6(H)	mm
	Luminance	250	cd/m <sup>2</sup>
	LED Numbers	4 LEDS	-
	Pin Order	From left to right 40PIN_0.5mm	-
Electrical Characteristics	Interface	RGB_18bit	-
	Color Depth	262K	colors
	Driver Condition	2.8(Type)	V
	LCM Driver IC	ST7789	-
Temperature Range	Operating Temp.	-20~70	°C
	Storage Temp.	-30~80	°C

## 1.2 Touch Parameters

Feature	Description
Type	CTP (Capacitive touch panel)
Structure	G+G
Outline Size(mm)	50.40(L)*69.40(W)*1.45(T)
View Area(mm)	44.20(L)*58.30W)
Control Type	GT911
Surface Hardness	6H
Light Transmittance	≥85%
Operating Temperature	-20~70℃
Storage Temperature	-20~70℃

**Note: Requirements on Environmental Protection: RoHS**

## 2 Mechanical Drawing



### 3 Input/Output Terminals

#### 3.1 LCD Input/Output Terminals

Pin NO.	Symbol	Function	Remark
1	LEDK	Back light cathode	
2	LEDA	Back light anode	
3	GND	Ground	
4	VCC	Power supply	
5-6	GND	Ground	
7-12	R0-R5	Data bus	
13-14	GND	Ground	
15-20	G0-G5	Data bus	
21-22	GND	Ground	
23-28	B0-B5	Data bus	
29	GND	Ground	
30	PCLK	Clock signal	
31	NC	Not connect	
32	HSYNC	Line synchronizing signal	
33	VSYNC	Frame synchronizing signal	
34	DEN	Data ENABLE signal	
35	NC	Not connect	
36	GND	Ground	
37	CS	A Chip Select signal	
38	SCL	Serial clock input for SPI interface	
39	SDA	Serial data input/output bidirectional pin for SPI interface	
40	RESET	Reset Signal pin	

#### 3.2 TP Input/Output Terminals

Pin NO.	Logic	Remark
1	SCL	
2	SDA	
3	INT	
4	GND	
5	VDD-3.3V	
6	RST	

## 4 Electrical Characteristics

### 4.1 Driving TFT LCD Panel

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Analog Voltage	VCC	2.6	2.8	3.3	V	
Input Logic High Voltage	VIH	0.7VCC	-	VCC	V	
Input Logic Low Voltage	VIL	GND	-	0.3VCC	V	
Output Logic High Voltage	VOH	0.8VCC	-	VCC	V	
Output Logic Low Voltage	VOL	GND	-	0.2VCC	V	

### 4.2 LED Backlight Specification

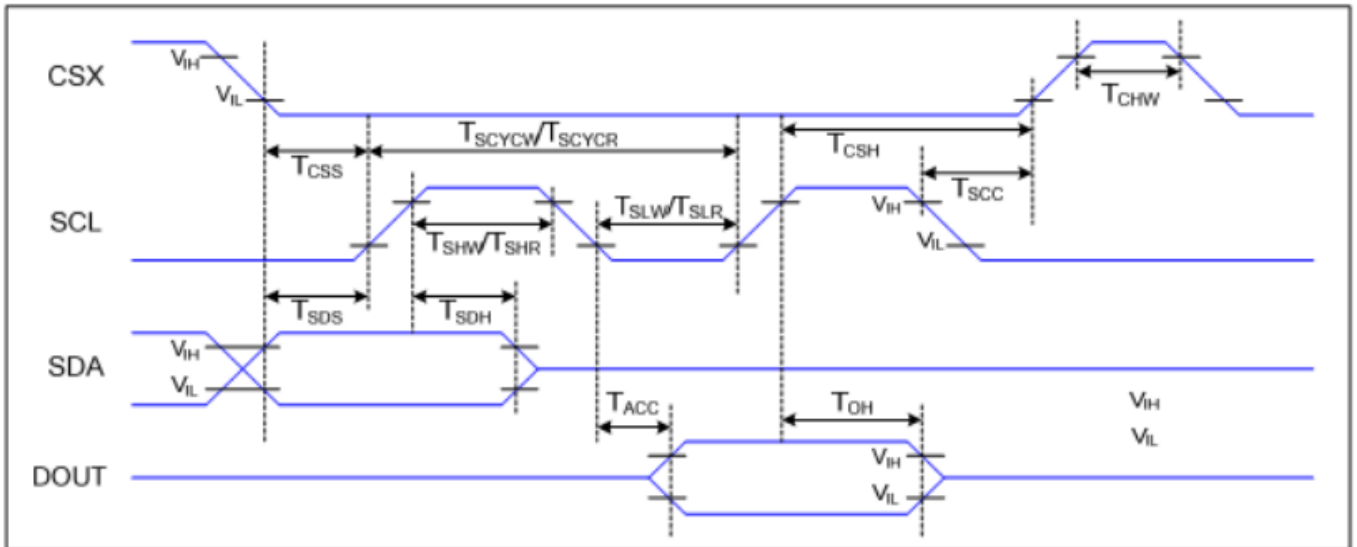
Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Forward Voltage	VF	11.2	12.8	13.2	V	
Forward Current	IF	-	20	-	mA	
Uniformity(with L/G)	Avg	75	80	-	%	
Luminance(with LCD)	Lv	-	250	-	cd/m <sup>2</sup>	
LED Life Time	Hr	-	30000	-	Hour	

Note: 4 LEDs



## 5 Timing Characteristics

### 5.1 Serial Interface Characteristics (3-line Serial)

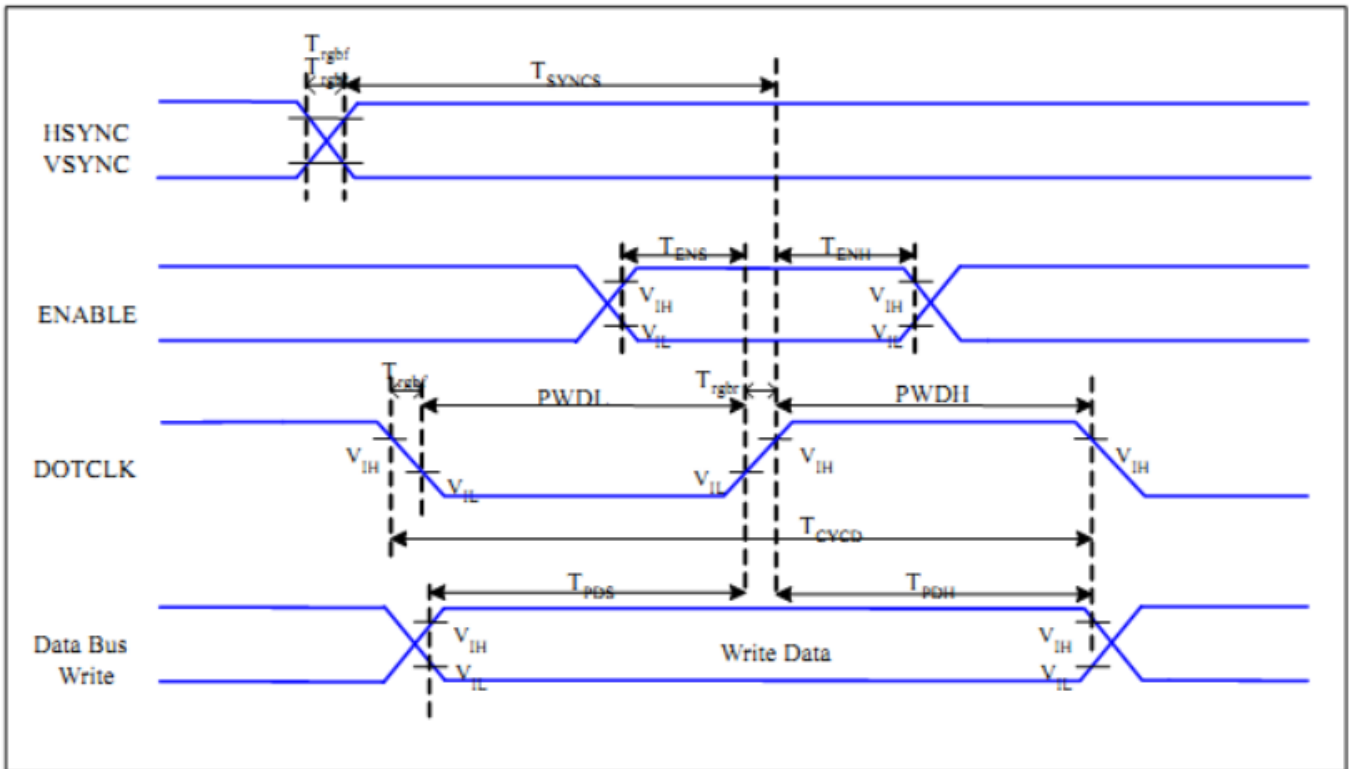


$V_{DD1}=1.65$  to  $3.3V$ ,  $V_{DD}=2.4$  to  $3.3V$ ,  $AGND=DGND=0V$ ,  $T_a=-30$  to  $70$  °C

Signal	Symbol	Parameter	Min	Max	Unit	Description
CSX	$T_{CSS}$	Chip select setup time (write)	15		ns	
	$T_{CSH}$	Chip select hold time (write)	15		ns	
	$T_{CSS}$	Chip select setup time (read)	60		ns	
	$T_{SCC}$	Chip select hold time (read)	65		ns	
	$T_{CHW}$	Chip select "H" pulse width	40		ns	
SCL	$T_{SCYCW}$	Serial clock cycle (Write)	66		ns	
	$T_{SHW}$	SCL "H" pulse width (Write)	15		ns	
	$T_{SLW}$	SCL "L" pulse width (Write)	15		ns	
	$T_{SCYCR}$	Serial clock cycle (Read)	150		ns	
	$T_{SHR}$	SCL "H" pulse width (Read)	60		ns	
	$T_{SLR}$	SCL "L" pulse width (Read)	60		ns	
SDA (DIN)	$T_{SDS}$	Data setup time	10		ns	
	$T_{SDH}$	Data hold time	10		ns	
DOUT	$T_{ACC}$	Access time	10	50	ns	For maximum $CL=30pF$
	$T_{OH}$	Output disable time	15	50	ns	For minimum $CL=8pF$

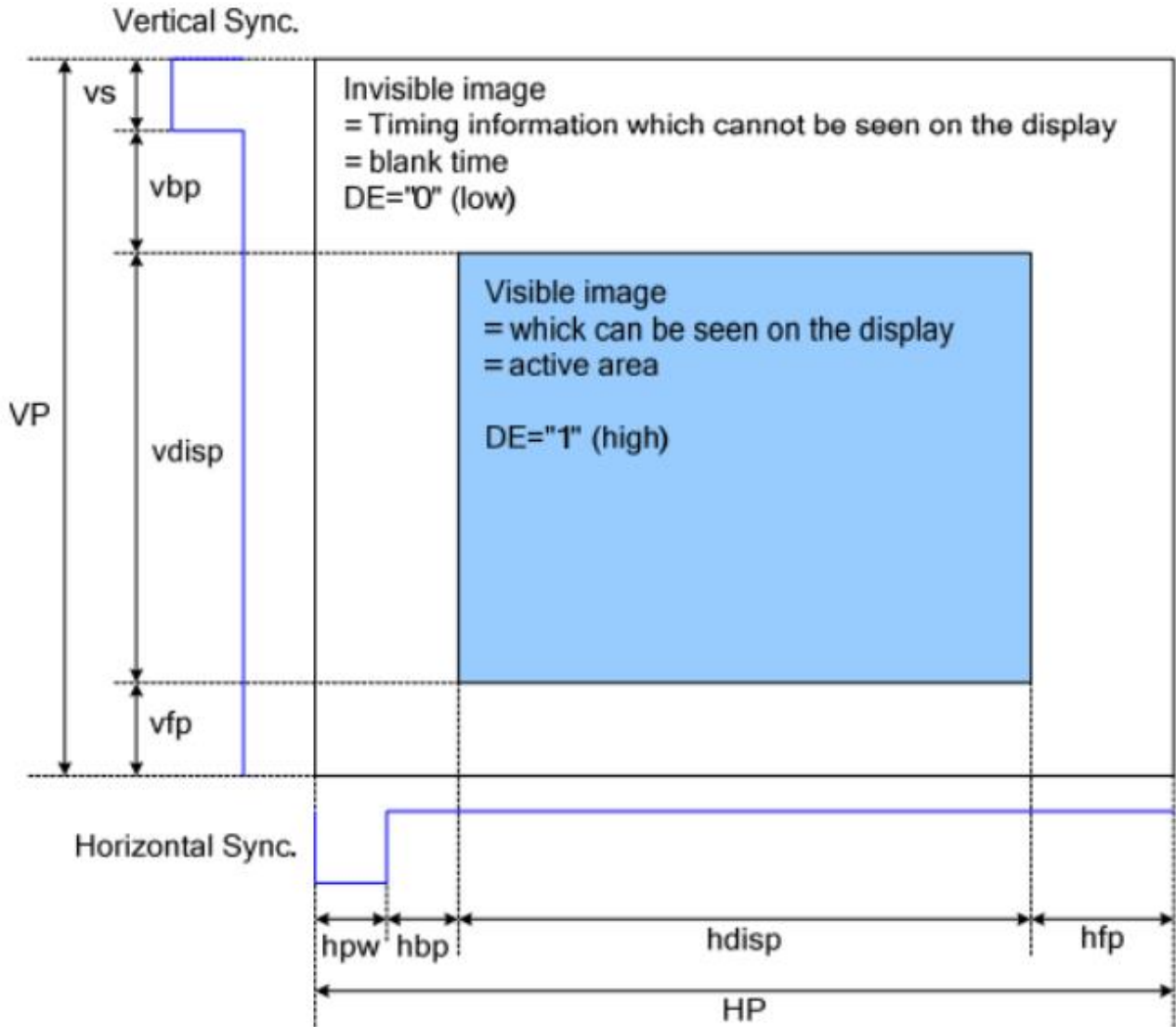


## 5.2 RGB Interface Characteristics



Signal	Symbol	Parameter	MIN	MAX	Unit	Description
HSYNC, VSYNC	$T_{SYNCS}$	VSYSNC, HSYNCS Setup Time	30	-	ns	
ENABLE	$T_{ENS}$	Enable Setup Time	25	-	ns	
	$T_{ENH}$	Enable Hold Time	25	-	ns	
DOTCLK	PWDH	DOTCLK High-level Pulse Width	60	-	ns	
	PWDL	DOTCLK Low-level Pulse Width	60	-	ns	
	$T_{CYCD}$	DOTCLK Cycle Time	120	-	ns	
	$T_{rghr}$ , $T_{rghf}$	DOTCLK Rise/Fall time	-	20	ns	
DB	$T_{PDS}$	PD Data Setup Time	50	-	ns	
	$T_{PDH}$	PD Data Hold Time	50	-	ns	

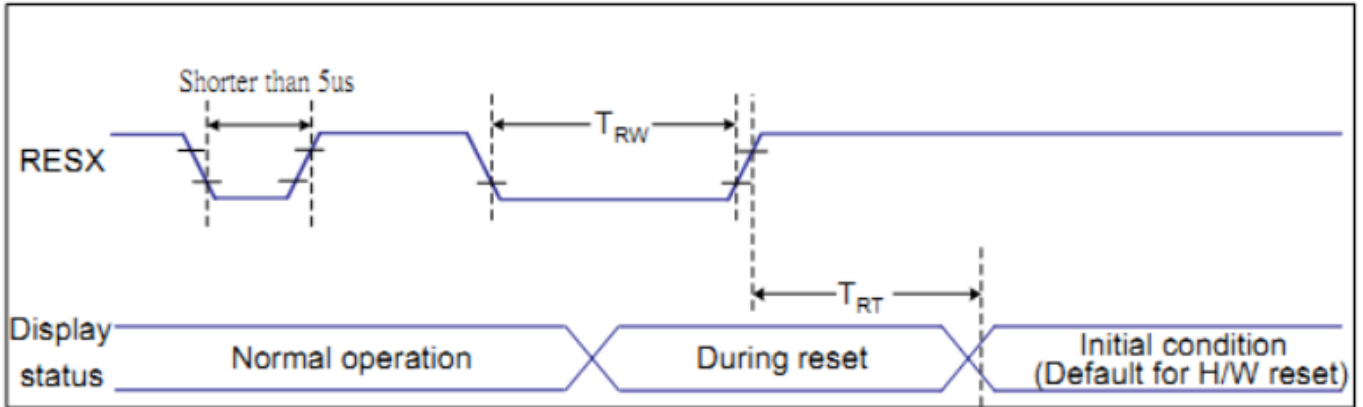
## 5.3 RGB Interface Definition



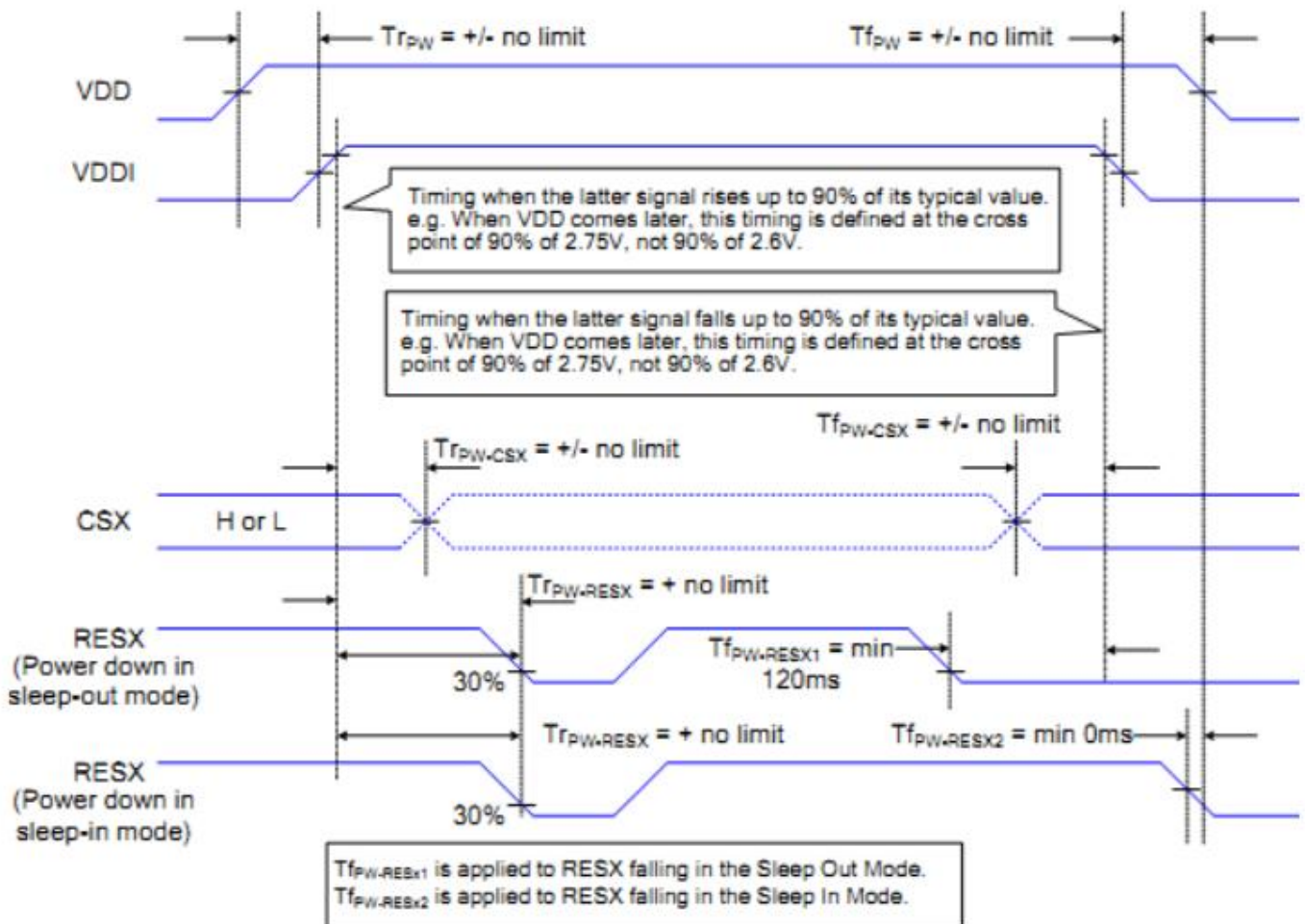
Parameter	Symbol	Min.	Typ.	Max.	Unit
Horizontal Sync. Width	hpw	2	10	hpw+hbp=31	Clock
Horizontal Sync. Back Porch	hbp	4	10		Clock
Horizontal Sync. Front Porch	hfp	2	38	-	Clock
Vertical Sync. Width	vs	1	4	vs+vbp=127	Line
Vertical Sync. Back Porch	vbp	1	4		Line
Vertical Sync. Front Porch	vfp	1	8	-	Line

## 5.4 Reset Timing

Related Pins	Symbol	Parameter	MIN	MAX	Unit
RESX	TRW	Reset pulse duration	10	-	us
	TRT	Reset cancel	-	5	ms
				120	ms



## 5.5 Power On/Off Sequence



## 6 Optical Characteristics

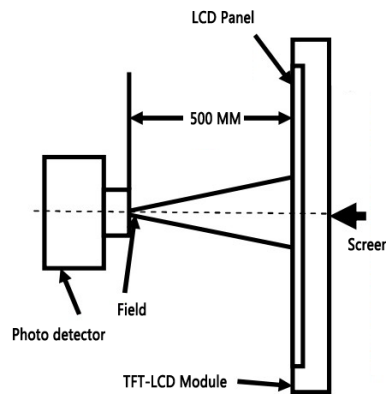
Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle	Top	$CR \geq 10$	-	20	-	Deg.	Note 2
	Bottom		-	50	-		
	Left		-	70	-		
	Right		-	70	-		
Contrast Ratio	CR	$\theta=0^\circ$	-	500	-		
Response Time	$T_r+T_f$	$\theta=0^\circ$	-	16	-	ms	
Color Chromaticity (CIE1931)	Wx	$\theta=0^\circ$	0.281	0.301	0.321		
	Wy		0.317	0.337	0.357		
	Rx		0.601	0.621	0.641		
	Ry		0.312	0.332	0.352		
	Gx		0.274	0.294	0.314		
	Gy		0.557	0.577	0.597		
	Bx		0.121	0.141	0.161		
	By		0.137	0.157	0.177		
Transmittance	Tr	-	-	6.4	-	%	

Test conditions:

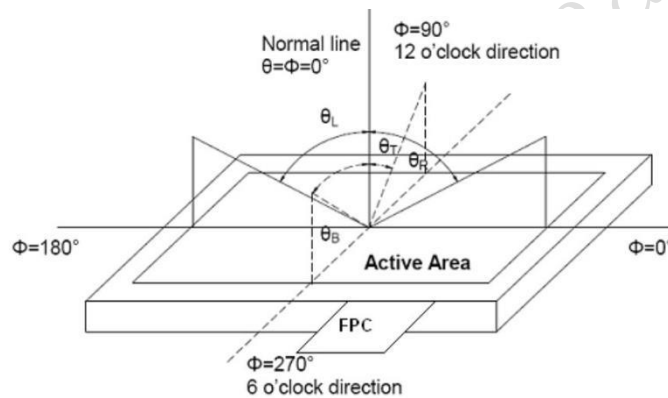
IF= 20 mA, and the ambient temperature is 25°C.

**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 LCD.


**Note 2: Definition of viewing angle range and measurement system.**

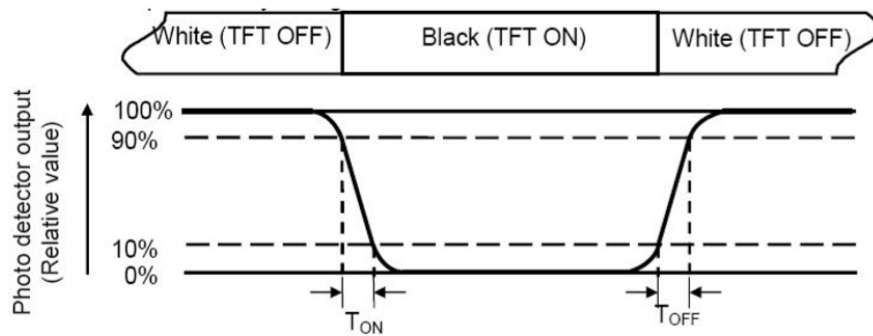
The viewing angle is measured at the center point of the LCD by BM-7A.


**Note 3: Definition of color temperature.**

When the radiation of the light source is exactly the same in the visible region and the absolute blackbody, the temperature of the blackbody is called the color temperature of the light source. Color temperature is an index to measure the degree of light source color (cold color, warm color). Warm color < 3300K, intermediate color 3300 ~ 5000K, cold color > 5000K.

**Note 4: Definition of response time.**

The response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Time ON (TON) is the time between photo detector output intensity changed from 90% to 10%. And time off (TOFF) 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.**

Measure the luminance of white state at center point.

## 7 Environmental Reliability Test

NO	Test Item	Condition	Remarks
1	High Temperature Operation	Ta=+70°C,48hours	IEC60068-2-1:2007 GB2423.2-2008
2	Low Temperature Operation	Ta=-20°C,48hours	IEC60068-2-1:2007 GB2423.1-2008
3	High Temperature Storage	Ta=+80°C,48hours	IEC60068-2-1:2007 GB2423.2-2008
4	Low Temperature Storage	Ta=-30°C,48hours	IEC60068-2-1:2007 GB2423.1-2008
5	Storage at High Temperature and Humidity	Ta=+45°C,90% RH max,48hours	IEC60068-2-78 :2001 GB/T2423.3-2006
6	Thermal Shock (non-operation)	-20°C 30 min~+70°C 30 min,10 Cycle	Start with cold temperature, End with high temperature, IEC60068-2-14:1984, GB 2423.22-2002
7	ESD(non-operation)	150pF, 330Ω, Contact: ±4KV, Air: ±8KV	IEC61000-4-2:2001 GB/T 17626.2-2006
8	Vibration Test	Frequency range:10~55Hz Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X.Y.Z. (6 hours for total)	IEC60068-2-6:1982 GB/T 2423.10-1995
9	Mechanical Shock (non-operation)	Half Sine Wave 100G 6ms, ±X, ±Y, ±Z 3times for each direction	IEC60068-2-27:1987 GB/T 2423.5-1995
10	Package Drop Test	Height: 60cm,1corner,3 edges,6 surfaces	IEC60068-2-32:1990 GB/T 2423.8-1995

## 8 Packing Capacity & Dimension

Dimension			
Dimension(mm)	50.40(W)*69.40(H)*3.93(D)		
Net Weight	-		
Packing Capacity			
Size	LCD Size and Resolution	Layer	Quantity (Pcs)
220mm(L)x160mm(W)470mm(H)	2.8 inch 240*320	1	1
600mm(L)x450mm(W)x300mm(H)	2.8 inch 240*320	2	240

Packing instruction:

The LCD+TP is placed in the grid, covered with a PE static bag and compactly assembled, the upper and the lower layers of the grid are protected by buffer spaces.

The LCD covered with a PE static bag and compactly assembled



placed in the grid



The upper and the lower layers of the grid are protected by buffer spaces



Packed





## 9 Appearance Inspection

### 9.1 General rules for inspection

9.1.1 Anti-static wearables (anti-static wristbands, gloves) must be worn during the inspection.

9.1.2 Do not use bare hands to touch the position of the device, golden fingers, and the surface of the screen to prevent the sweat from human hands from causing oxidation and affecting the appearance.

9.1.3 It is forbidden to stack products out of specification and handle them with care to avoid damage to components.

9.1.4 The repaired products need to be inspected to prevent rosin and tin slag from exceeding the specifications.

9.1.5 When technical documents and process documents have specific requirements for products, the technical documents and process documents shall be the main requirements.

### 9.2 Inspection conditions

9.2.1 The conditions of display function check

Angle:  $\pm 5^\circ$ ;

Inspection method: visual inspection. The inspection object is 30-40cm away from the light source, and the eye is 30-40cm away from the inspection object;

Illumination: 300-500Lux;

Inspection time: 5-10S.

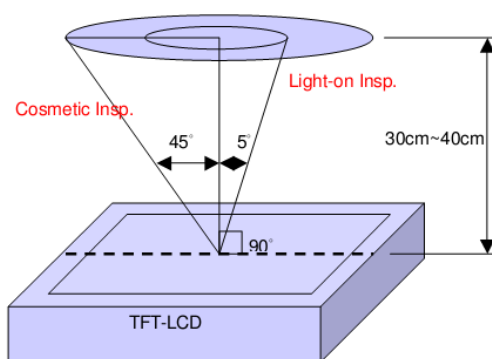
9.2.2 Visual inspection conditions

Angle:  $\pm 45^\circ$ ;

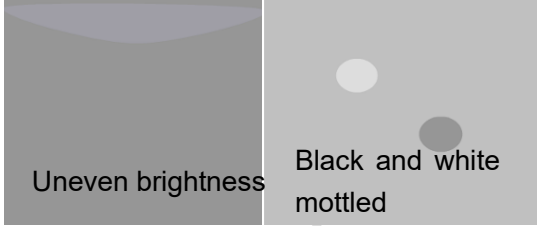
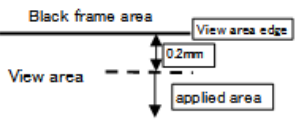
Inspection method: visual inspection. The inspection object is 30-40cm away from the light source, and the eye is 30-40cm away from the inspection object;


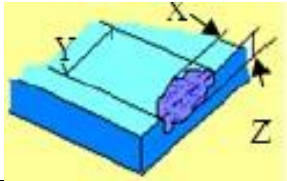
Illumination: 800-1500Lux;

Inspection time: 5-10S.



## 9.3 Inspection standard

Type	Test Items	Judgement Standard	Defect Category
Display state	Dead pixels	No dead pixels	
	mura	From different angles, the brightness is required to be uniform. Under the 64-level grayscale or pure black interface, there should be no uneven display brightness within the viewing angle range of 45° through 6% ND FILTER. Y series (TV film) LCD screen does not have specific requirements, and the picture inspection does not affect the display as qualified.	Slight defect
			
	Light leakage	Under the 64-level grayscale or pure black interface, there should be no obvious light leakage within the viewing angle range of 45° by visual inspection or through 6% ND FILTER. Y series (TV LCD screen) series can be without obvious visual defects.	Slight defect
	Linear foreign bodies	1. $W \leq 0.05$ , $L \leq 2\text{mm}$ , negligible; 2. $0.05\text{mm} < W \leq 0.1\text{mm}$ , $L \leq 2\text{mm}$ , $N \leq 3$ ; 3. $W > 0.1\text{mm}$ , $L > 2\text{mm}$ , not allowed.	Slight defect
	Bubble in OCA	1. $D < 0.20\text{mm}$ , negligible; 2. $0.20\text{mm} < D \leq 0.30\text{mm}$ , $N \leq 4$ and, $DS > 10\text{mm}$ ; 3. $0.30\text{mm} < D \leq 0.35\text{mm}$ , $N \leq 3$ and, $DS > 10\text{mm}$ ; 4. $0.35\text{mm} < D$ , fault. (Guarantee area: within 0.2mm outside VA)	
Screen surface	Within the effective area	Spotted: 1. $D \leq 0.2\text{mm}$ and it is not a piece, it is not counted; 2. $0.2\text{mm} < D \leq 0.5\text{mm}$ , $N \leq 3$ ; 3. $D > 0.5\text{mm}$ , $L > 0.5\text{mm}$ , $W > 0.5\text{mm}$ are not allowed; (The spotted foreign objects shall not exceed the point-line gauge $D=0.5$ , and the black dot coverage shall be checked, and the spotted foreign objects shall be judged within the range of $D=0.5$ )	Slight defect
		Linear: 1. $W \leq 0.05$ , $L \leq 2\text{mm}$ , ignored; 2. $0.05 < W \leq 0.1\text{mm}$ , $L \leq 2\text{mm}$ , $N \leq 3$ ; 3. $W > 0.1\text{mm}$ , $L > 2\text{mm}$ , not allowed.	
	Outside the effective area Foreign objects Scratches Air bubbles	Foreign objects are not checked, and bubbles are not allowed to $D > 1\text{mm}$ ; Non-inductive scratches of no more than $0.1 \times 8\text{mm}$ are allowed.	Slight defect

	Crack	Not allowed.		Slight defect
	Notch	1. Does not affect the appearance from the front; 2. Does not affect the relevant alignment; 3. $X \leq 1\text{mm}$ , $Y \leq 1\text{mm}$ , $N \leq 2$ .		Slight defect
	Glass side Foreign objects Dirty	1. The foreign body on the side is not controlled; 2. The paint pen marks on the side are not controlled; 3. Side oily note printing is not allowed.		Slight defect
FPC	Cracks Goldfinger crease	Not allowed.		Heavy deficit
	Crease	Slight creases are not controlled; The crease is whitish and has lines, which is not allowed.		Heavy deficit
	Top wound, stab wound	No damage to the line, $D \leq 0.2\text{mm}$ ; Damage to the line is not allowed.		Heavy deficit
	Scratch	Slight scratches on the surface are not controlled; Damage to the line is not allowed.		Heavy deficit
	Goldfinger scratch	$W \leq 0.05\text{mm}$ , no control; $W > 0.05\text{mm}$ , not allowed; Test probe tip marks are not controlled.		Heavy deficit
	Component	Under-soldering, over-soldering and false soldering are not allowed.		Heavy deficit

## 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, Can only use LCD dedicated cleaner, the following organic solvent can not be used:

- Isopropyl alcohol
- Ethyl alcohol
- 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

10.1.9 optimum work environment.

10.1.9.1 Be sure to ground the body when handling the LCD Modules.

10.1.9.2 Tools required for assembly, such as soldering irons, must be properly ground.

10.1.9.3 To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

10.1.9.4 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°C ~ 40°C 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.

## 11 Laminated Screen Introduction

### 11.1 Laminated screen classification

The laminated screen is mainly composed of cover glass, TP and LCD. The lamination methods can be either frame lamination or full lamination. The frame lamination process fixes TP with the four sides of LCD by 3M adhesive, which is one of the most common lamination methods. Full lamination is to seamlessly bond LCD and TP by optical adhesive. Compared to frame lamination, full lamination features by moisture-proof, dust-proof, high stability, high quality display, and can achieve the visible display under strong light.

### 11.2 ODM service

DWIN technology has built the Huan DWIN Science Park with a construction area of 250000 square meters (In addition, another 148000 square meters are under construction), integrating industrial chain of LCM, SMT, CTP, RTP, mold injection, and Sheet metal punching. DWIN can guarantee the production of LCM, CTP and RTP with first-class technology, highly automated and intelligent manufacturing equipment.

The production capacity of LCM lines is 2.5 million. The LCM lines support the production of LCM with high luminance(1200 nit), wide operating temperature(-40~85°C), anti-electromagnetic interference, sunlight readability and HDMI interface .

The production capacity of RTP lines is 5 hundred thousand. The RTP lines support the production of customized 4-wire RTP and 5-wire RTP, anti-UV material and AG material.

The production capacity of CTP lines is 1 million. The CTP lines support the production of customized CTP, including 1.3~21.5 inches (unconventional size), circular CTP, the shape, color and logo of cover plate, anti-UV, anti- fingerprint and AG material. They can also support the customization of various kinds of technologies, such as OCA lamination, ultrathin GFF, optical bonding, 2.5D and sunlight readability.

SMT lines



CTP lines

LCM lines



RTP lines

IQC lines



Final inspection lines



Laboratories

## Record of Revision

Rev	Date	Description	Editor
00	2022-12-22	First Release	Chen
01	2023-05-15	Update Terminals	Chen
02	2023-06-05	Update Luminance	Chen

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Thank you all for continuous support of DWIN, and your approval is the driving force of our progress!