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Optical Bonding



SPECIFICATION FOR LCM Module

MODULE No:	ET050WV20-K
CUSTOMER:	

YOURITECH	INITIAL	DATE
PREPARED BY		
CHECKED BY		
APPROVED BY		

CUSTOMER	INITIAL	DATE
APPROVED BY		



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* Description

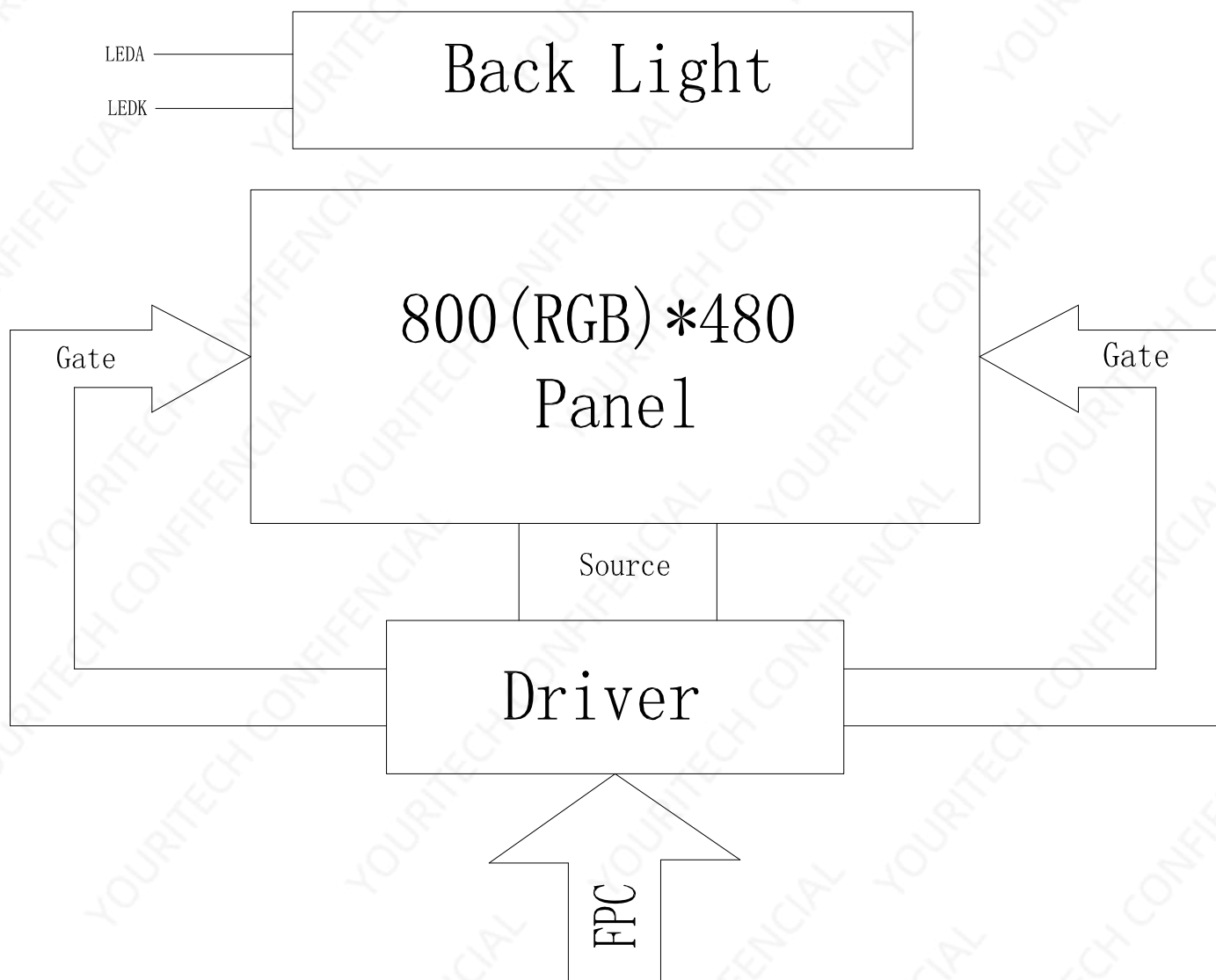
This is a color active matrix TFT (Thin Film Transistor) LCD (liquid crystal display) that uses amorphous silicon TFT as a switching device. This module is composed of a Transmissive type TFT-LCD Panel, driver circuit, back-light unit. The resolution of a 5.0 " TFT-LCD contains 800x480 pixels, and can display up to 16.7M colors.

General Information Items	Specification	Unit	Note
	Main Panel		
Display area(AA)	108.0(H)*64.80(V) (5.0inch)	mm	
Driver element	TFT active matrix	-	
Display colors	16.7M	colors	
Number of pixels	800(RGB)*480	dots	
Pixel arrangement	RGB vertical stripe	-	
Pixel pitch	0.135(H)*0.135(V)	mm	
Viewing angle	ALL	o'clock	
Controller IC	ST7262	-	
Display mode	Transmissive /Normally Black	-	
LCM Interface	16/18/24 BIT RGB	-	
Operating temperature	-30~+85	°C	
Storage temperature	-30~+85	°C	

Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal(H)	-	120.70	-	mm	
	Vertical(V)	-	75.90	-	mm	
	Depth(D)	-	2.95	-	mm	
Weight		-	50	-	g	



1. Block Diagram





3. Input terminal Pin Assignment

NO.	SYMBOL	DISCRIPTION	I/O						
1	VLED-	Cathode pin of backlight.	P						
2	VLED+	Anode pin of backlight.	P						
3	GND	Ground	P						
4	VDD	Power supply for digital circuits	P						
5-12	R0-R7	8 bit data bus display red data.	I						
13-20	G0-G7	8 bit data bus display green data.	I						
21-28	B0-B7	8 bit data bus display blue data.	I						
29	GND	Ground	P						
30	PCLK	Pixel clock input pin.	I						
31	DISP	DISP sets the display mode. <table><tr><th>DISP</th><th>Function Description</th></tr><tr><td>L</td><td>Standby mode</td></tr><tr><td>H</td><td>Normal display mode</td></tr></table>	DISP	Function Description	L	Standby mode	H	Normal display mode	I
DISP	Function Description								
L	Standby mode								
H	Normal display mode								
32	HSYNC	Horizontal sync signal input PIN.	I						
33	VSYNC	Vertical sync signal input PIN.	I						
34	DE	Data input enable applied to the RGB interface. Display access is enabled when DE is “H”.	I						
35	NC	-	-						
36	GND	Ground	P						
37	XR(NC)	Touch panel Right Glass Terminal	--						
38	YD(NC)	Touch panel Bottom Film Terminal	--						
39	XL(NC)	Touch panel Left Glass Terminal	--						
40	YU(NC)	Touch panel Top Film Terminal	--						



4. LCD Optical Characteristics

4.1 Optical specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit.	Note
Contrast Ratio		CR	$\Theta=0$ Normal viewing angle	800	1000	--		*(1)(2)
Response time	Rising	T_{R+T_F}		--	30	40	msec	*(1)(3)
	Falling			--				
Uniformity		S(%)		45	50	--	%	*
Color Filter Chromaticity	White	W_X		0.2731	0.3131	0.3531		CA-310 Test
		W_Y		0.3059	0.3459	0.3859		
	Red	R_X		0.5478	0.5878	0.6278		
		R_Y		0.3154	0.3554	0.3954		
	Green	G_X		0.3162	0.3562	0.3962		
		G_Y		0.5194	0.5594	0.5994		
	Blue	B_X		0.1121	0.1521	0.1921		
		B_Y		0.0705	0.1105	0.1505		
Viewing angle	Hor.	Θ_L	CR>10	75	80	--		
		Θ_R		75	80	--		
	Ver.	Θ_U		75	80	--		
		Θ_D		75	80	--		
Option View Direction		ALL						

*The data comes from the LCD specification.

4.2 Measuring Condition

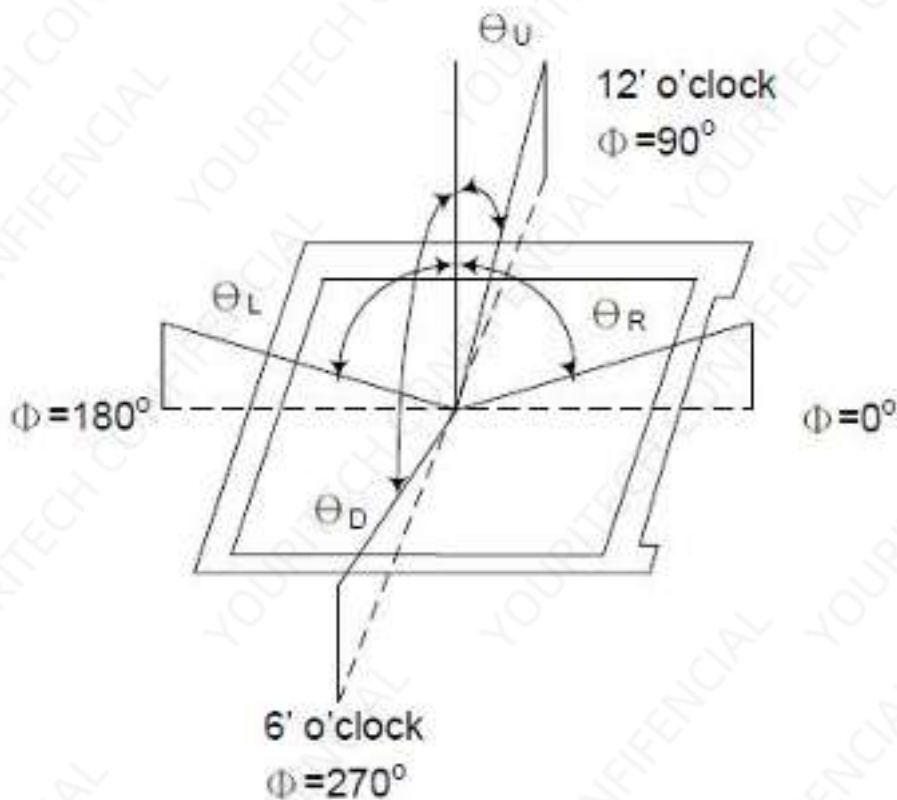
- Measuring surrounding: dark room
- Ambient temperature: $25 \pm 2^\circ\text{C}$
- 15min. warm-up time.



4.3 Measuring Equipment

FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.

Note (1) Definition of Viewing Angle:

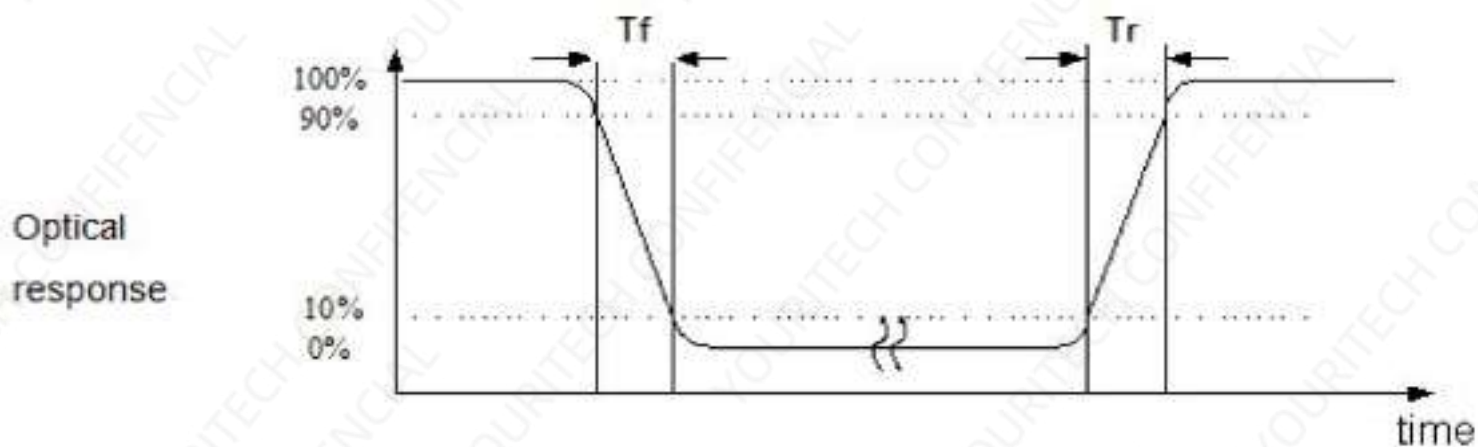


Note (2) Definition of Contrast Ratio (CR):
measured at the center point of panel

$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$



Note (3) Definition of Response Time : Sum of T_R and T_F



5. Electrical Characteristics

5.1 Absolute Maximum Rating

Characteristics	Symbol	Min.	Max.	Unit	Note
Digital Supply Voltage	VDD	-0.3	4.0	V	Note1
Operating temperature	T _{OP}	-30	+85	°C	
Storage temperature	T _{ST}	-30	+85	°C	

NOTE1: If the absolute maximum rating of even is one of the above parameters is exceeded even momentarily, the quality of the product may be degraded. Absolute maximum ratings, therefore, specify the values exceeding which the product may be physically damaged. Be sure to use the product within the range of the absolute maximum ratings.

5.2 DC Electrical Characteristics

Characteristics	Symbol	Min.	Typ.	Max.	Unit	Note
Digital Supply Voltage	VDD	3.3	--	3.6	V	
Normal mode Current consumption	IDD	--	80	--	mA	
Level input voltage	V _{IH}	0.7VDD		VDD	V	
	V _{IL}	GND		0.3 VDD	V	
Level output voltage	V _{OH}	VDD-0.4		--	V	
	V _{OL}	GND		GND+0.4	V	



5.3 LED Backlight Characteristics

The back-light system is edge-lighting type with 16 chips LED

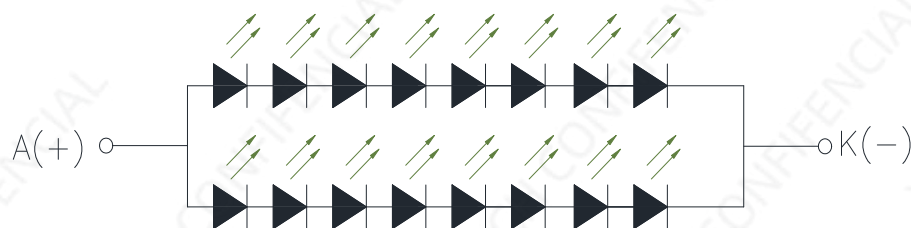
Item	Symbol	Min.	Typ.	Max.	Unit	Note
Forward Current	I_F	30	40	--	mA	
Forward Voltage	V_F	--	25.6	--	V	
LCM Luminance	LV	750	800	--	cd/m2	Note3
LED life time	Hr	--	50000	--	Hour	Note1,2
Uniformity	Avg	80	--	--	%	Note3

Note1: LED life time (Hr) can be defined as the time in which it continues to operate under the condition:

$T_a = 25 \pm 3^\circ \text{C}$, typical IL value indicated in the above table until the brightness becomes less than 50%.

Note 2: The “LED life time” is defined as the module brightness decrease to 50% original brightness at

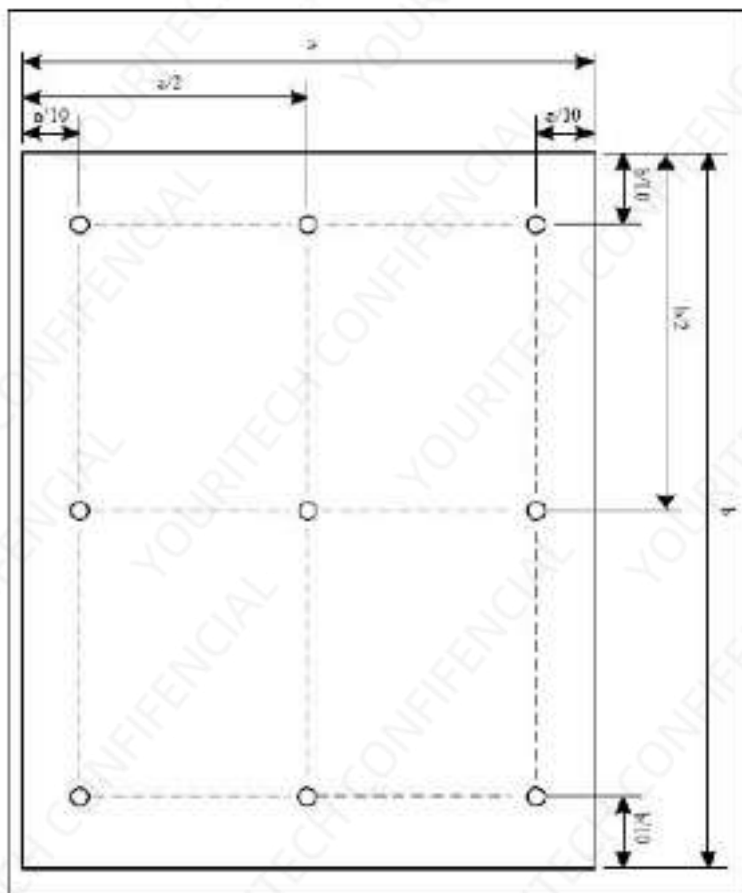
$T_a = 25^\circ \text{C}$ and $I_L = 40 \text{mA}$. The LED lifetime could be decreased if operating I_L is larger than 40mA. The constant current driving method is suggested.



B/L Circuit



Note (3) Luminance Uniformity of these 9 points is defined as below:



$$\text{Uniformity} = \frac{\text{minimum luminance in 9 points (1-9)}}{\text{maximum luminance in 9 points (1-9)}}$$

$$\text{Luminance} = \frac{\text{Total Luminance of 9 points}}{9}$$

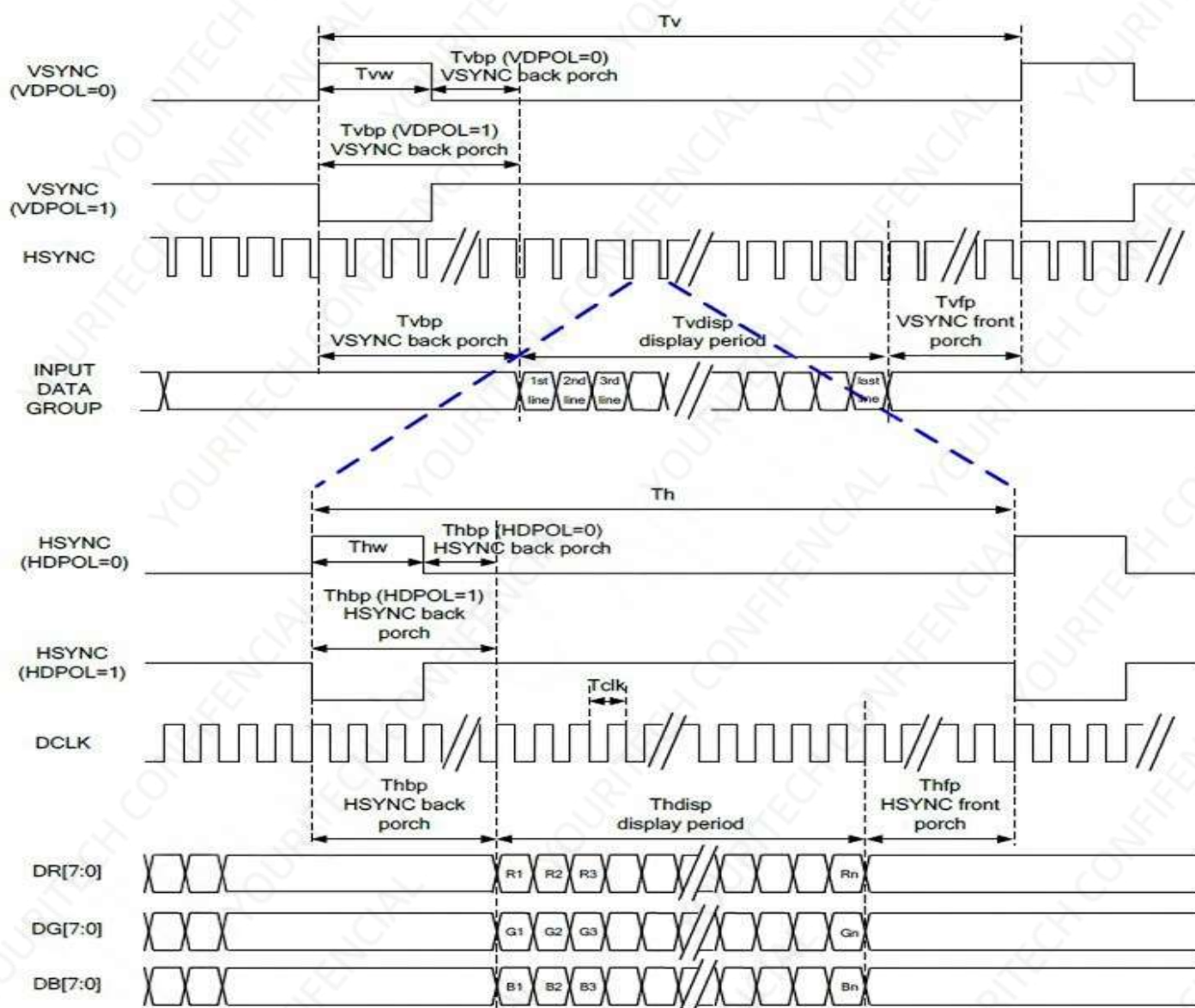


6. RGB Interface Characteristics

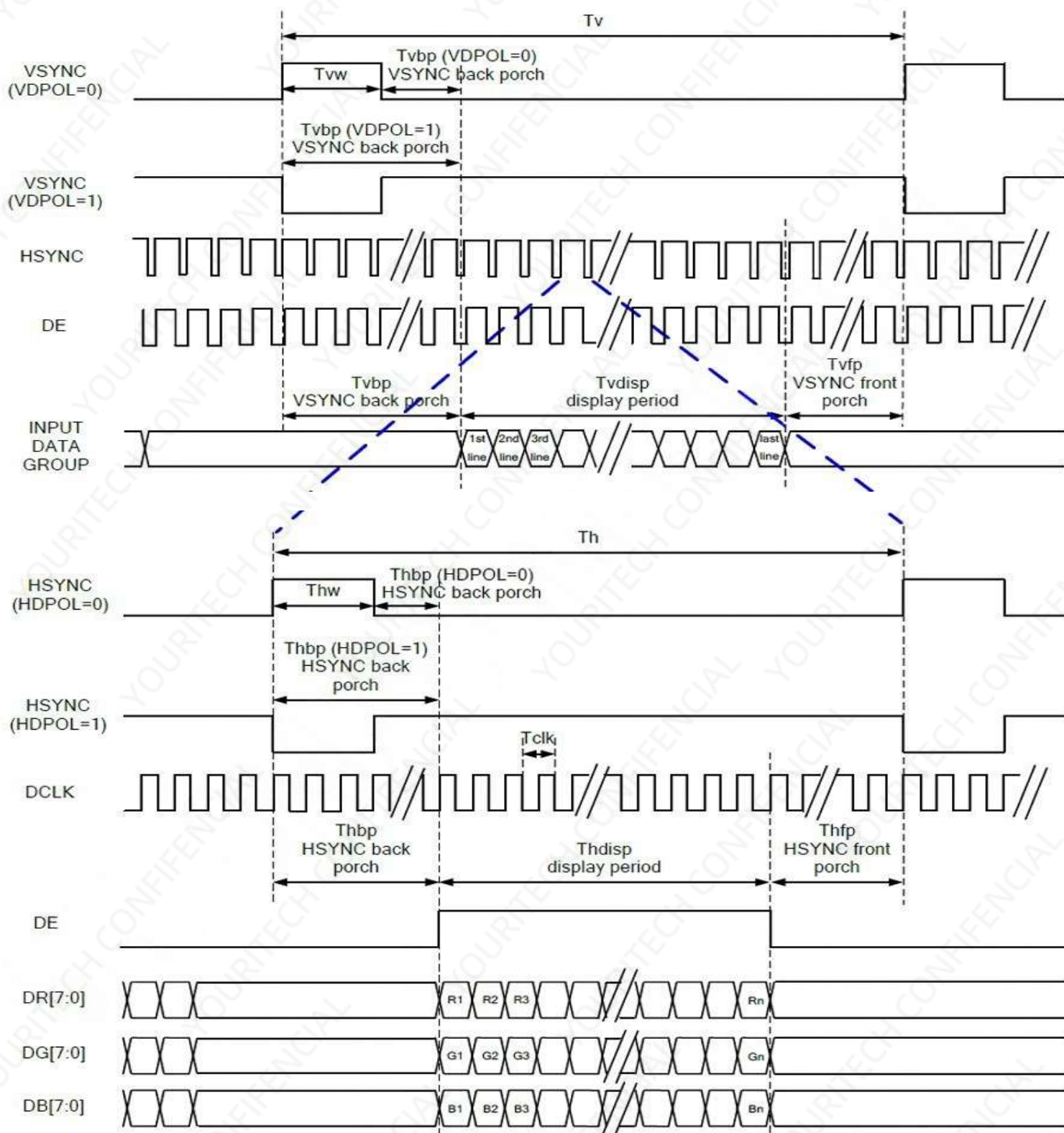
RGB Mode Selection Table	DCLK	HSYNC	VSYNC	DE
SYNC - DE Mode	Input	Input	Input	Input
SYNC Mode	Input	Input	Input	GND
DE Mode	Input	GND	GND	Input

Note: "Input" means these signals are driven by host side

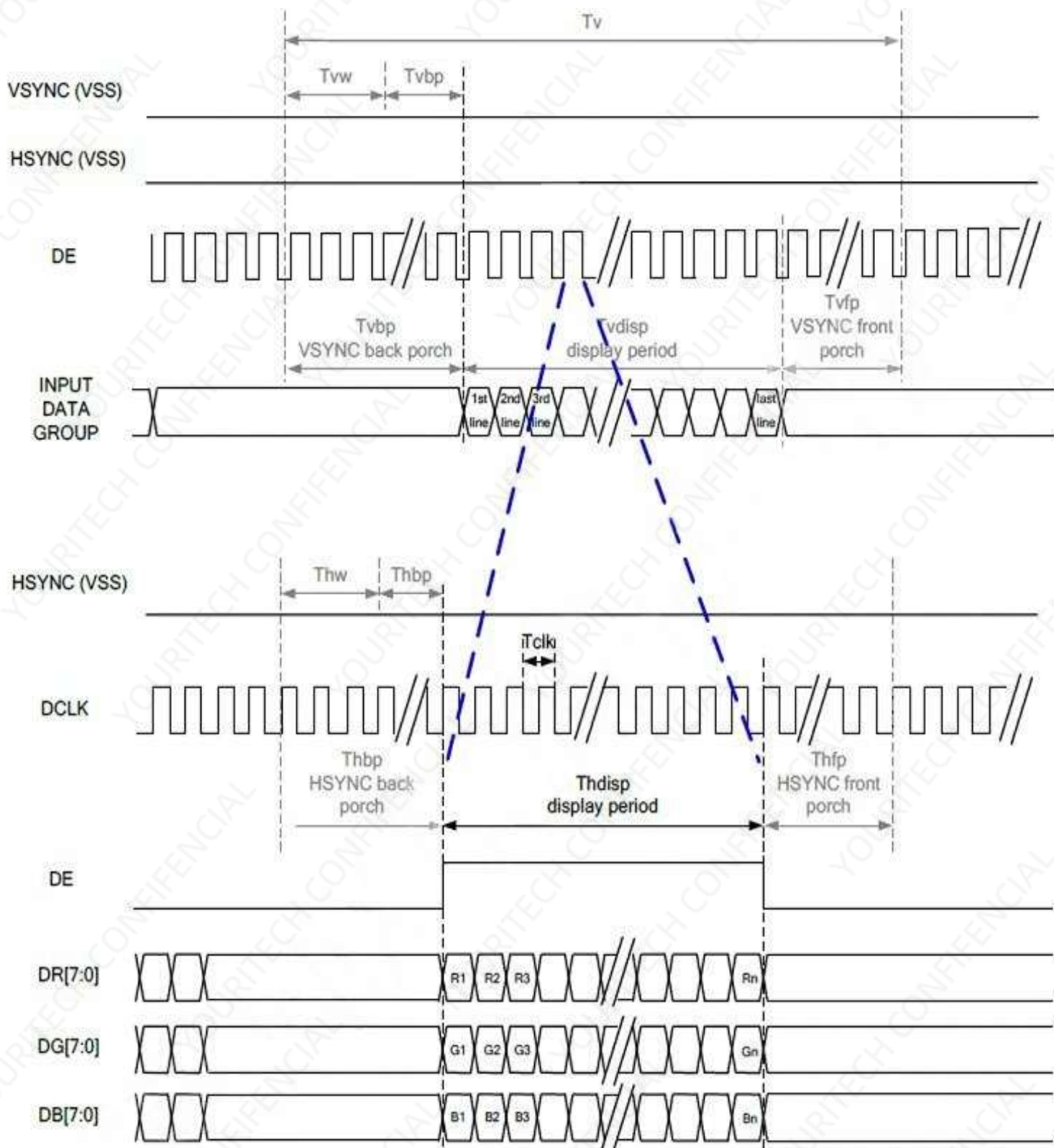
6.1 SYNC Mode



6.2 SYNC-DE Mode



6.3 DE Mode



6.4 Parallel 24-bit RGB Input Timing Table

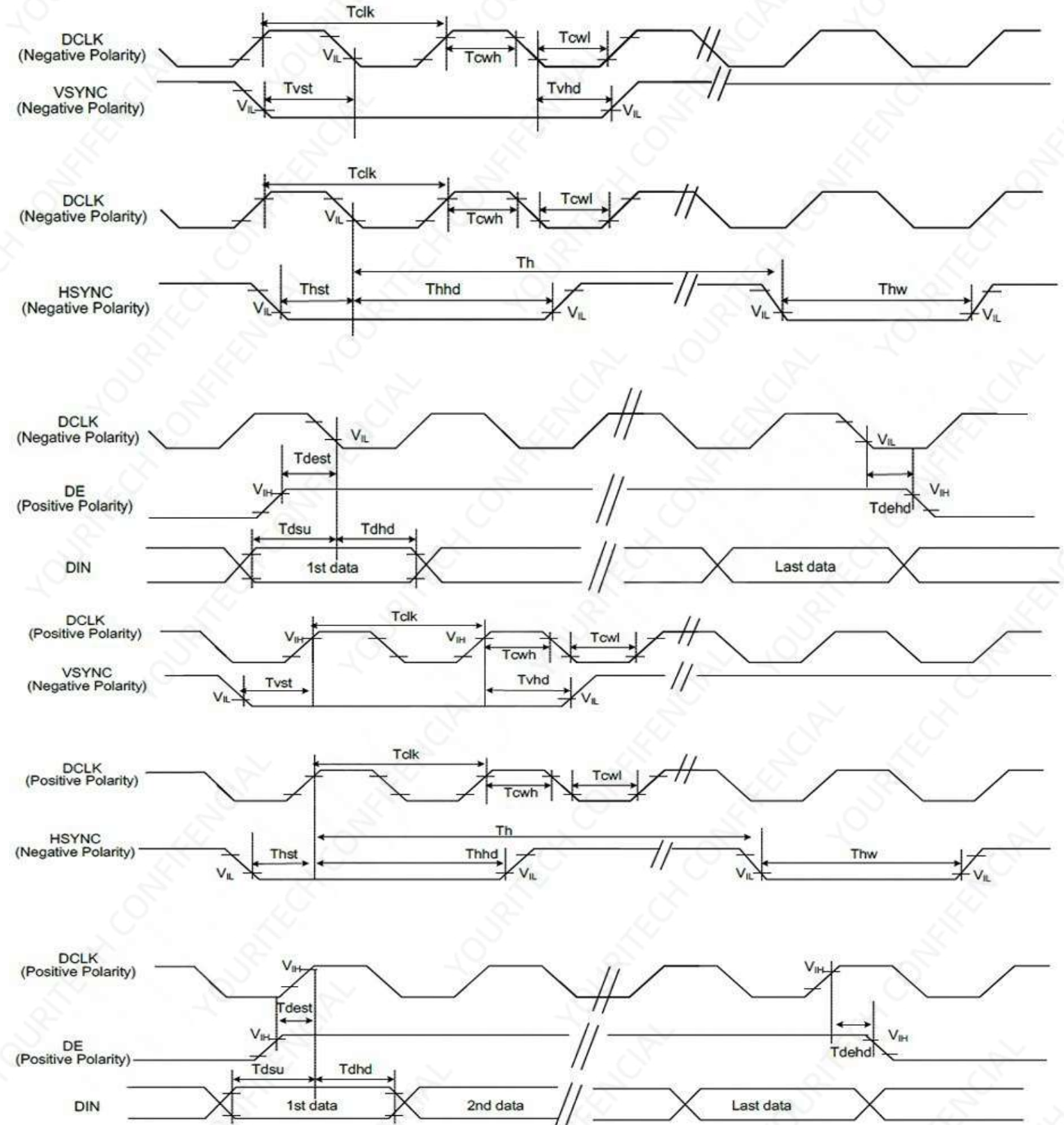
Parallel 24-bit RGB Input Timing (PVDD=PVDD1=VDD=VDDI= 3.3V, AGND= 0V, TA=25°C)

Parallel 24-bit RGB Interface Timing Table						
Item		Symbol	Min.	Typ.	Max.	Unit
DCLK Frequency		Fclk	23	25	27	MHz
HSYNC	Period Time	Th	808	816	896	DCLK
	Display Period	Thdisp	800			DCLK
	Back Porch	Thbp	4	8	48	DCLK
	Front Porch	Thfp	4	8	48	DCLK
	Pulse Width	Thw	2	4	8	DCLK
VSYNC	Period Time	Tv	488	496	504	HSYNC
	Display Period	Tvdisp	480			HSYNC
	Back Porch	Tvbp	4	8	12	HSYNC
	Front Porch	Tvfp	4	8	12	HSYNC
	Pulse Width	Tvw	2	4	8	HSYNC



7. AC Electrical Characteristics

7.1 System Bus Timing for RGB Interface

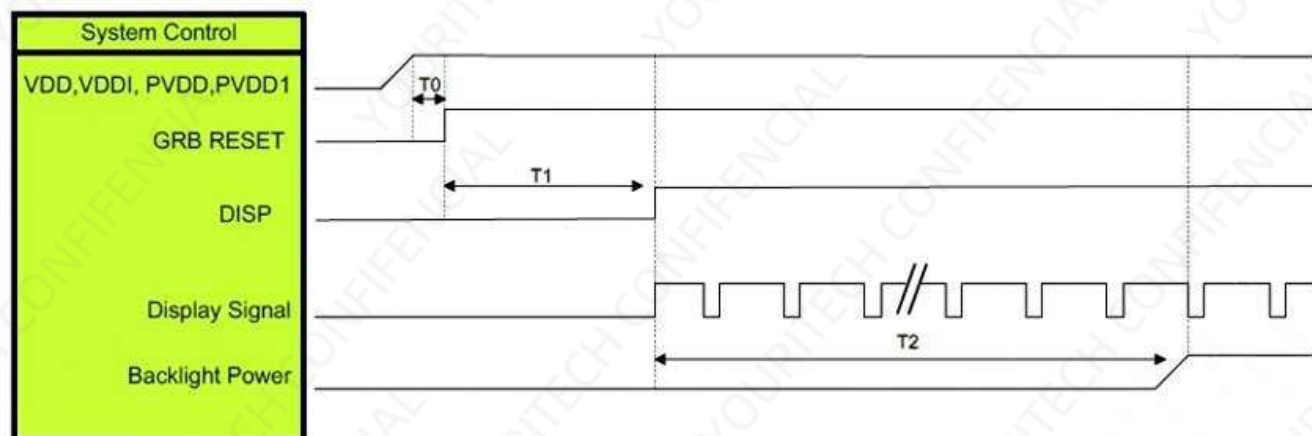


Item	Symbol	Min.	Typ.	Max.	Unit	Conditions
CLK Pulse Duty	T _{cw}	40	50	60	%	
HSYNC Width	T _{hw}	2	-	-	DCLK	
HSYNC Period	T _h	55	60	65	us	
VSYNC Setup Time	T _{vst}	12	-	-	ns	
VSYNC Hold Time	T _{vhd}	12	-	-	ns	
HSYNC Setup Time	T _{hst}	12	-	-	ns	
HSYNC Hold Time	T _{hhd}	12	-	-	ns	
Data Setup Time	T _{dsu}	12	-	-	ns	
Data Hold Time	T _{dhd}	12	-	-	ns	
DE Setup Time	T _{dest}	12	-	-	ns	
DE Hold Time	T _{dehd}	12	-	-	ns	



8. POWER ON/OFF SEQUENCE

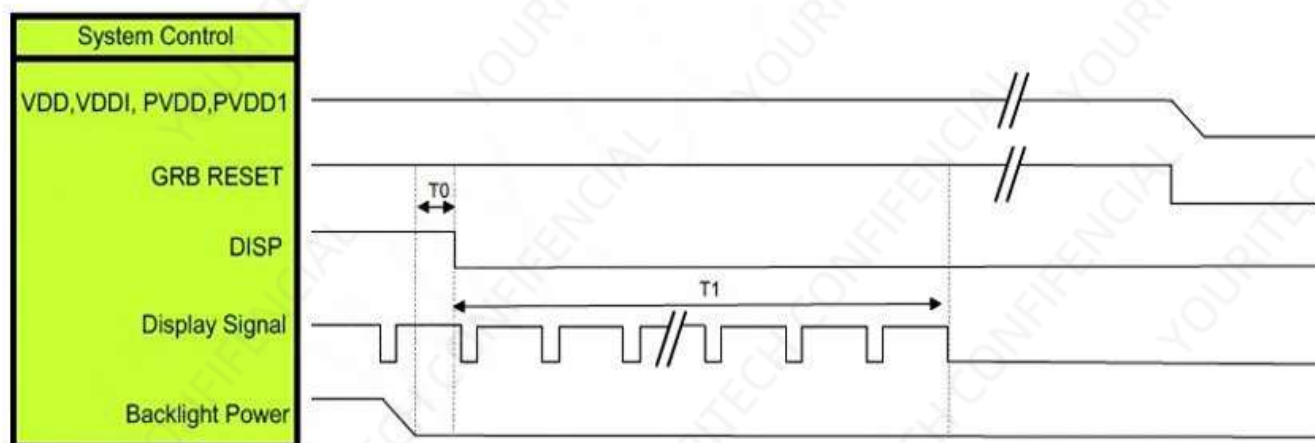
8.1 Power On Sequence



Symbol	Description	Min. Time	Unit
T0	System power stability to GRB RESET signal	0	ms
T1	GRB RESET= "High" to DISP="High"	10	ms
T2	Display Signal output to Backlight Power on	250	ms

Note: RGB interface Display signal: DCLK; VSYNC; HSYNC; DE; DR[7:0]; DG[7:0]; DB[7:0]

8.2 Power Off Sequence



Symbol	Description	Min. Time	Unit
T0	Backlight Power off to DISP="Low"	5	ms
T1	DISP="Low" to IC internal voltage discharge complete	100	ms

Note: RGB interface Display signal: DCLK; VSYNC; HSYNC; DE; DR[7:0]; DG[7:0]; DB[7:0]



9. LCD Module Out-Going Quality Level

9.1 VISUAL & FUNCTION INSPECTION STANDARD

9.1.1 Inspection conditions

Inspection performed under the following conditions is recommended.

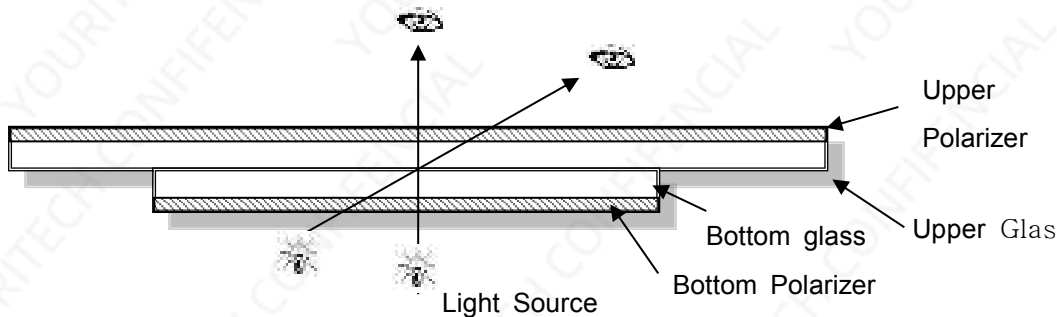
Temperature : $25\pm 5^{\circ}\text{C}$

Humidity : $65\%\pm 10\%\text{RH}$

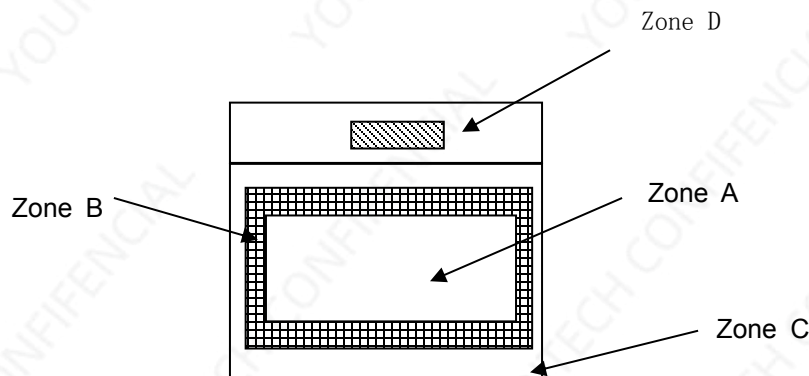
Viewing Angle : Normal viewing Angle.

Illumination: Single fluorescent lamp (300 to 700Lux)

Viewing distance:30-50cm



9.1.2 Definition



Zone A : Effective Viewing Area(Character or Digit can be seen)

Zone B : Viewing Area except Zone A

Zone C : Outside (Zone A+Zone B) which can not be seen after assembly by customer .)

Zone D : IC Bonding Area

Note:As a general rule ,visual defects in Zone C can be ignored when it doesn't effect product function or appearance after assembly by customer



9.1.3 Sampling Plan

According to GB/T 2828-2003 ; , normal inspection, Class II

AQL:

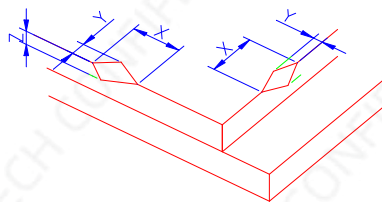
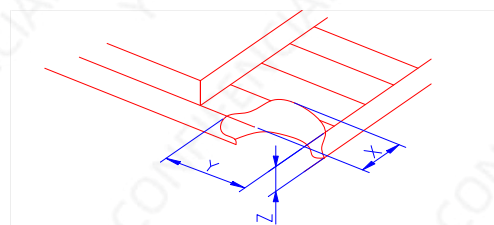
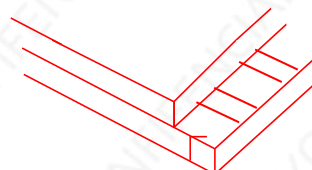
Major defect	Minor defect
0.65	1.5

LCD: Liquid Crystal Display , TP: Touch Panel , LCM: Liquid Crystal Module

No	Items to be inspected	Criteria	Classification of defects
1	Functional defects	1) No display, Open or miss line 2) Display abnormally, Short 3) Backlight no lighting, abnormal lighting. 4) TP no function	Major
2	Missing	Missing component	
3	Outline dimension	Overall outline dimension beyond the drawing is not allowed	
4	Color tone	Color unevenness, refer to limited sample	Minor
5	Spot Line defect	Light dot, Dim spot, Polarizer Bubble ; Polarizer accidented spot.	
6	Soldering appearance	Good soldering , Peeling off is not allowed.	
7	LCD/Polarizer/TP	Black/White spot/line, scratch, crack, etc.	



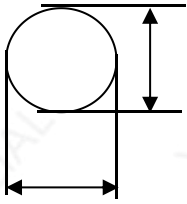
9.1.4 Criteria (Visual)

Number	Items	Criteria(mm)						
1.0 LCD Crack/Broken NOTE: X: Length Y: Width Z: Height L: Length of IT O, T: Height of LCD	(1) The edge of LCD broken	 <table><tr><td>X</td><td>Y</td><td>Z</td></tr><tr><td>≤3.0mm</td><td><Inner border line of the seal</td><td>≤T</td></tr></table>	X	Y	Z	≤3.0mm	<Inner border line of the seal	≤T
	X	Y	Z					
	≤3.0mm	<Inner border line of the seal	≤T					
(2)LCD corner broken	 <table><tr><td>X</td><td>Y</td><td>Z</td></tr><tr><td>≤3.0mm</td><td>≤L</td><td>≤T</td></tr></table>	X	Y	Z	≤3.0mm	≤L	≤T	
X	Y	Z						
≤3.0mm	≤L	≤T						
(3) LCD crack	 Crack Not allowed							



2.0

Spot defect



$\Phi=(X+Y)/2$

① light dot (LCD/TP/Polarizer black/white spot , light dot, pinhole, dent, stain)

Zone Size (mm)	Acceptable Qty		
	A	B	C
$\Phi\leq0.10$	Ignore		
$0.10<\Phi\leq0.25$	4(distance $\geq 10\text{mm}$)		
$0.25<\Phi\leq0.35$	3		
$\Phi>0.4$	0		

②Dim spot (LCD/TP/Polarizer dim dot, light leakage、dark spot)

Zone Size (mm)	Acceptable Qty		
	A	B	C
$\Phi\leq0.1$	Ignore		
$0.10<\Phi\leq0.25$	4(distance $\geq 10\text{mm}$)		
$0.25<\Phi\leq0.35$	3		
$\Phi>0.4$	0		

③ Polarizer accidented spot

Zone Size (mm)	Acceptable Qty		
	A	B	C
$\Phi\leq0.2$	Ignore		
$0.3<\Phi\leq0.5$	3(distance $\geq 10\text{mm}$)		
$\Phi>0.5$	0		

④Pixel bad points (light dot, Dim dot, color dot)

Zone Size (mm)	Acceptable Qty		
	A	B	C
$\Phi\leq0.15$	Ignore		Ignore
$0.2<\Phi\leq0.3$	2(distance $\geq 10\text{mm}$)		
$\Phi>0.4$	0		

⑤ Polarizer Bubble

Zone Size (mm)	Acceptable Qty		
	A	B	C
$\Phi\leq0.2$	Ignore		
$0.3<\Phi\leq0.4$	4(distance $\geq 10\text{mm}$)		
$0.4<\Phi\leq0.5$	3		
$\Phi>0.5$	0		



3.0	Line defect (LCD/TP /Polarizer backlight black/white line, scratch, stain)	Width(mm)	Length(m m)	Acceptable Qty		
				A	B	C
		$\Phi\leq0.05$	Ignore	Ignore		Ignore
		$0.05<W\leq0.06$	$L\leq5.0$	$N\leq3$		
		$0.07<W\leq0.08$	$L\leq4.0$	$N\leq2$		
$0.08<W$	Define as spot defect					
4.0	Electronic Components SMT	Not allow missing parts, solderless connection, cold solder joint, mismatch, The positive and negative polarity opposite				
5.0	Display color& Brightness	1. Color: Measuring the color coordinates, The measurement standard according to the datasheet or samples. 2. Brightness: Measuring the brightness of White screen, The measurement standard according to the datasheet or Samples.				
6.0	LCD Mura	By 5% ND filter invisible.				

Criteria (functional items)

Number	Items	Criteria (mm)
1	No display	Not allowed
2	Missing segment	Not allowed
3	Short	Not allowed
4	Backlight no lighting	Not allowed
5	TP no function	Not allowed



10. Reliability Test Result

Item	Condition	Inspection after test
High Temperature Operating	85°C,96HR	Inspection after 2~4hours storage at room temperature, the sample shall be free from defects: 1.Air bubble in the LCD; 2.Non-display; 3.Missing segments/line; 4.Glass crack; 5.Current IDD is twice higher than initial value.
Low Temperature Operating	-30°C, 96HR	
High Temperature Storage	85°C, 96HR	
Low Temperature Storage	-30°C, 96HR	
High Temperature & High Humidity Operating	+60°C, 90% RH ,96 hours.	
Thermal Shock (Non-operation)	-30°C,30 min ↔ 85°C,30 min, Change time:5min 20CYC.	
ESD test	C=150pF, R=330,5points/panel Air:±8KV, 5times; Contact:±6KV, 5 times; (Environment: 15°C~35°C, 30%~60%).	
Vibration (Non-operation)	Frequency range:10~55Hz, Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X.Y.Z. (6 hours for total) (Package condition).	
Box Drop Test	1 Corner 3 Edges 6 faces,80cm(MEDIUM BOX)	

Remark:

- 1.The test samples should be applied to only one test item.
- 2.Sample size for each test item is 5~10pcs.
- 3.For Damp Proof Test, Pure water(Resistance > 10MΩ) should be used.
- 4.In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judged as a good part.
- 5.Failure Judgment Criterion: Basic Specification, Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.



11. Cautions and Handling Precautions

11.1 Handling and Operating the Module

- (1) When the module is assembled, it should be attached to the system firmly.
Do not warp or twist the module during assembly work.
- (2) Protect the module from physical shock or any force. In addition to damage, this may cause improper operation or damage to the module and back-light unit.
- (3) Note that polarizer is very fragile and could be easily damaged. Do not press or scratch the surface.
- (4) Do not allow drops of water or chemicals to remain on the display surface.
If you have the droplets for a long time, staining and discoloration may occur.
- (5) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.
- (6) The desirable cleaners are water, IPA (Isopropyl Alcohol) or Hexane.
Do not use ketene type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.
- (7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs, or clothes, it must be washed away thoroughly with soap.
- (8) Protect the module from static; it may cause damage to the CMOS ICs.
- (9) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (10) Do not disassemble the module.
- (11) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.
- (12) Pins of I/F connector shall not be touched directly with bare hands.
- (13) Do not connect, disconnect the module in the "Power ON" condition.
- (14) Power supply should always be turned on/off by the item 6.1 Power On Sequence & 6.2 Power Off Sequence

11.2 Storage and Transportation.

- (1) Do not leave the panel in high temperature, and high humidity for a long time.
It is highly recommended to store the module with temperature from 0 to 35 °C and relative humidity of less than 70%
- (2) Do not store the TFT-LCD module in direct sunlight.
- (3) The module shall be stored in a dark place. When storing the modules for a long time, be sure to adopt effective measures for protecting the modules from strong ultraviolet radiation, sunlight, or fluorescent light.
- (4) It is recommended that the modules should be stored under a condition where no condensation is allowed. Formation of dewdrops may cause an abnormal operation or a failure of the module.
In particular, the greatest possible care should be taken to prevent any module from being operated where condensation has occurred inside.
- (5) This panel has its circuitry FPC on the bottom side and should be handled carefully in order not to be stressed.

