

# Rocktech Displays Limited



Module P/N: RK040HF08

Version: 1.0

Description : 4.0 inch TFT 480\*480 pixels with  
LED Backlight, ,All viewing angle,  
350 nits brightness

TEL: 0086-755-26065260

Fax: 0086-755-26065261

E-mail: [Sales@rocktech.com.hk](mailto:Sales@rocktech.com.hk)

Web: [www.rocktech.com.hk](http://www.rocktech.com.hk)

**Revision History**

<b>Date</b>	<b>Rev.</b>	<b>Page</b>	<b>Description</b>
<b>2020-11-15</b>	<b>1.0</b>	<b>All</b>	<b>First issue</b>

# CONTENTS

- GENERAL FEATURES
- ABSOLUTE MAXIMUM RATINGS
- ELECTRICAL SPECIFICATIONS
- OPTICAL SPECIFICATIONS
- BLOCK DIAGRAM
- PIN DESCRIPTION
- TIMING CHARACTERISTICS
- OUTLINE DIMENSION
- RELIABILITY AND INSPECTION STANDARD
- PRECAUTIONS

**1. General Features**

<b>Item</b>	<b>Spec</b>	<b>Remark</b>
Display Mode	Normally Black transmissive	
Viewing Direction	Free	IPS
Input Signals	RGB 24bit	
Outside Dimensions	77.66(W) x78.97(H) x2.30(D)	
Active Area	71.86mm(W)×70.18mm(H)	
Number of Pixels	480 (RGB)×480	
Dot Pitch	0.1497(W)×0.1462(H)	
Pixel Arrangement	RGB Vertical stripes	
Drive IC	ST7701S-G5	

## 2. Absolute Maximum Ratings

The following are maximum values which, if exceeded may cause operation or damage to the unit.

ITEM	Sym.	Min.	Typ.	Max.	Unit	Remark
Power for Circuit Driving	VDD	-0.5	-	5.0	V	
Storage Humidity	H <sub>ST</sub>	10	-		%RH	At 25±5°C
Storage Temperature	T <sub>ST</sub>	-30	-	80	°C	
Operating Ambient Humidity	H <sub>OP</sub>	10	-		%RH	
Operating Ambient temperature	T <sub>OP</sub>	-20	-	70	°C	

### 3. Electrical Specification

#### 3.1 Driving TFT LCD Panel

Item	Sym.	Min	Typ.	Max	Unit	Note	
Power for Circuit Driving	VDD	3.0	3.3	3.6	V		
Logic Input Voltage	Low Voltage	V <sub>IL</sub>	GND	-	0.3VDD	V	
	High Voltage	V <sub>IH</sub>	0.7VDD	-	VDD	V	
Logic Output Voltage	Low Voltage	V <sub>OL</sub>	GND	-	VDD+0.4	V	
	High Voltage	V <sub>OH</sub>	VDD-0.4	-	VDD	V	

#### 3.2 Driving Backlight

Item	Sym.	Min	Typ.	Max	Unit	Note
Backlight driving voltage	V <sub>F</sub>	-	15.0	-	V	
Backlight driving current	I <sub>F</sub>	30	40	50	mA	
Backlight Power Consumption	W <sub>BL</sub>	-	600	-	mW	
Life Time	-	-	50,000	-		Note 3

Note 1: (Unless specified, the ambient temperature Ta=25°C)

Note 2: The recommended operating conditions refer to a range in which operation of this product is guaranteed. Should this range is exceeded, the operation cannot be guaranteed even if the values may be without the absolute maximum ratings.

Note 3: 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.

## 4. Optical Specifications

Optical characteristics are determined after the unit has been 'ON' and stable for approximately 30 minutes in a dark environment at 25 °C. The values specified are at an approximate distance 500mm from the LCD surface at a viewing angle of  $\Phi$  and  $\theta$  equal to 0°.

Item	Sym.	Values			Unit	Note
		Min.	Typ.	Max.		
1) Contrast Ratio	C/R	500	700	-		FIG.1
2) Module Luminance	L	300	350	-	cd/m <sup>2</sup>	
3) Response time	Tr+Tf	-	25	35	ms	FIG.2
4) Viewing Angle	$\theta_T$	70	80	-	Degree	FIG.3
	$\theta_B$	70	80	-		
	$\theta_L$	70	80	-		
	$\theta_R$	70	80	-		
5) Chromaticity	Wx	0.2611	0.3011	0.3411		
	Wy	0.2626	0.3026	0.3426		
	Rx	-	-	-		
	Ry	-	-	-		
	Gx	-	-	-		
	Gy	-	-	-		
	Bx	-	-	-		
	By	-	-	-		

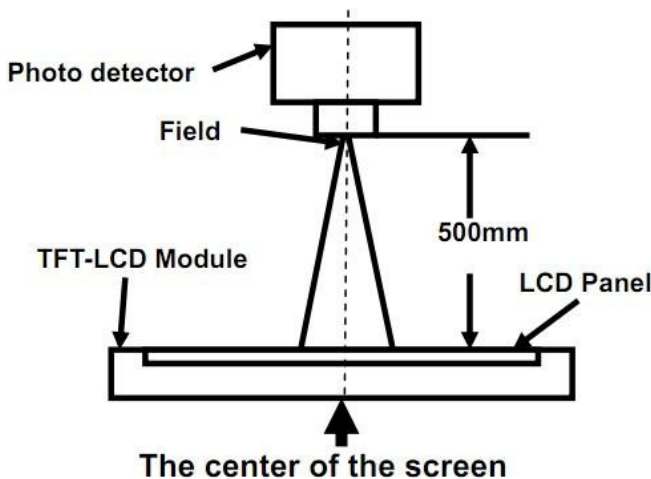
## ◆ Measurement System

Notes:

1. Contrast Ratio(CR) is defined mathematically as :  

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$
2. Surface luminance is the center point across the LCD surface 500mm from the surface with all pixels displaying white. For more information see FIG 1.
3. Response time is the time required for the display to transition from white to black (Rising Time, Tr) and from black to white (Falling Time, Tf). For additional information see FIG 2.
4. Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information see FIG 3.

**FIG. 1 Optical Characteristic Measurement Equipment and Method**



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

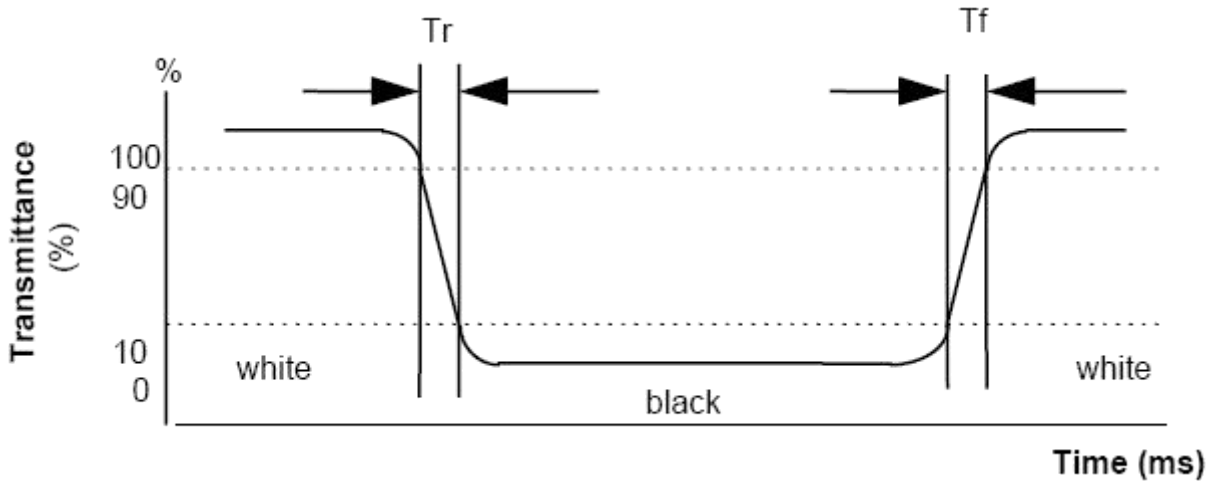


**FIG. 2 The definition of Response Time**

The response time is defined as the following figure and shall be measured by switching the input signal for “black” and “white”.

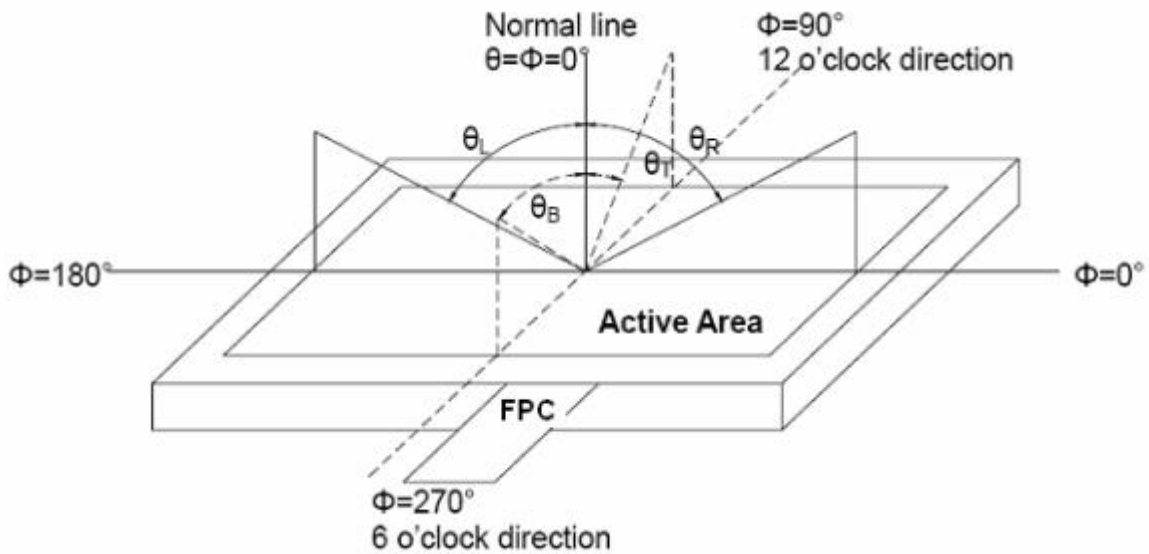
$$\text{Response Time} = \text{Rising Time}(Tr) + \text{Falling Time}(Tf)$$

- Rising Time( $T_r$ ) : Full White 90%  $\rightarrow$  Full White 10% Transmittance.
- Falling Time( $T_f$ ) : Full White 10%  $\rightarrow$  Full White 90% Transmittance.

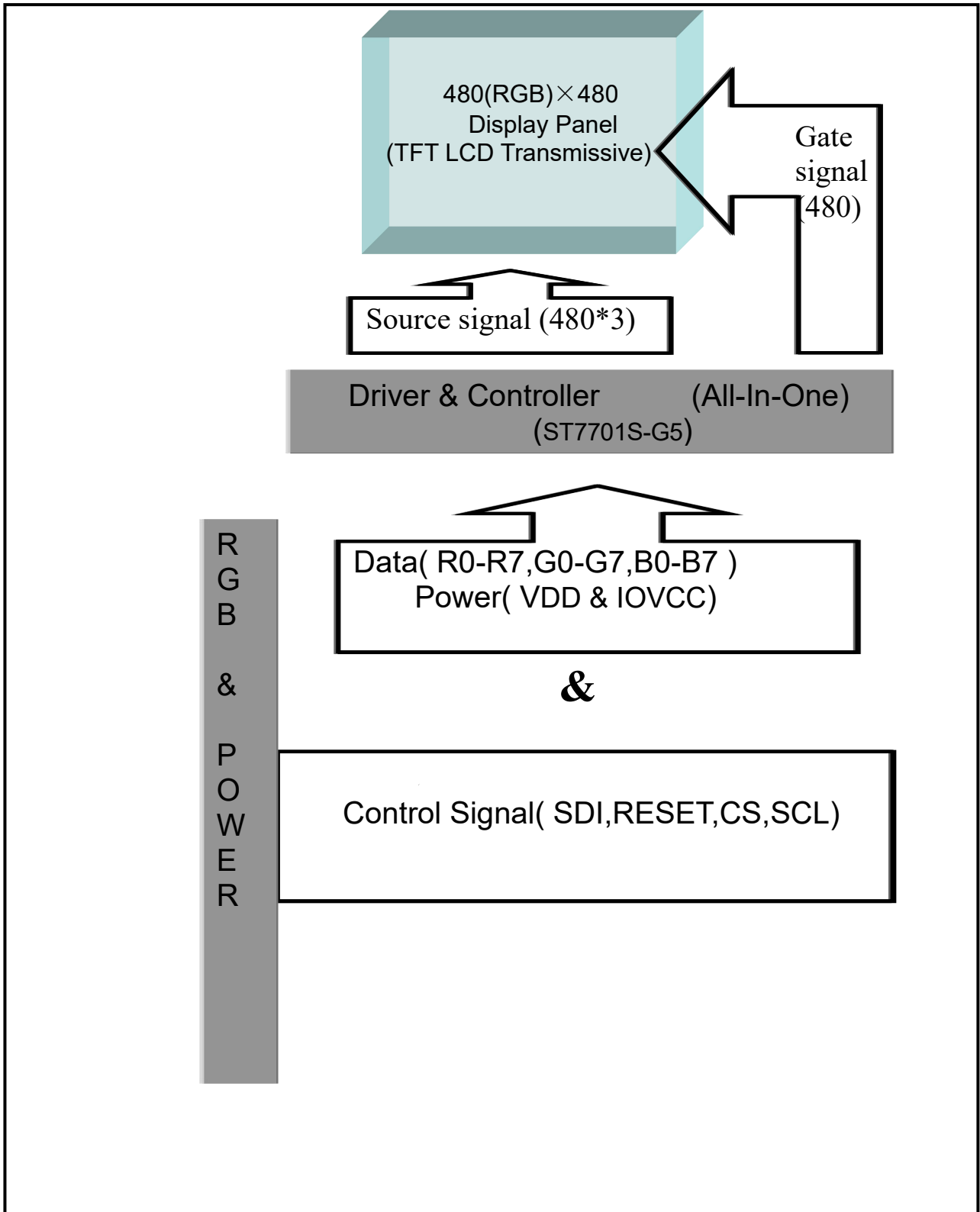


**FIG. 3 The definition of Viewing Angle**

Use Fig. 1 (Test Procedure) under Measurement System to measure the contrast from the measuring direction specified by the conditions as the following figure.



## 5. Block Diagram



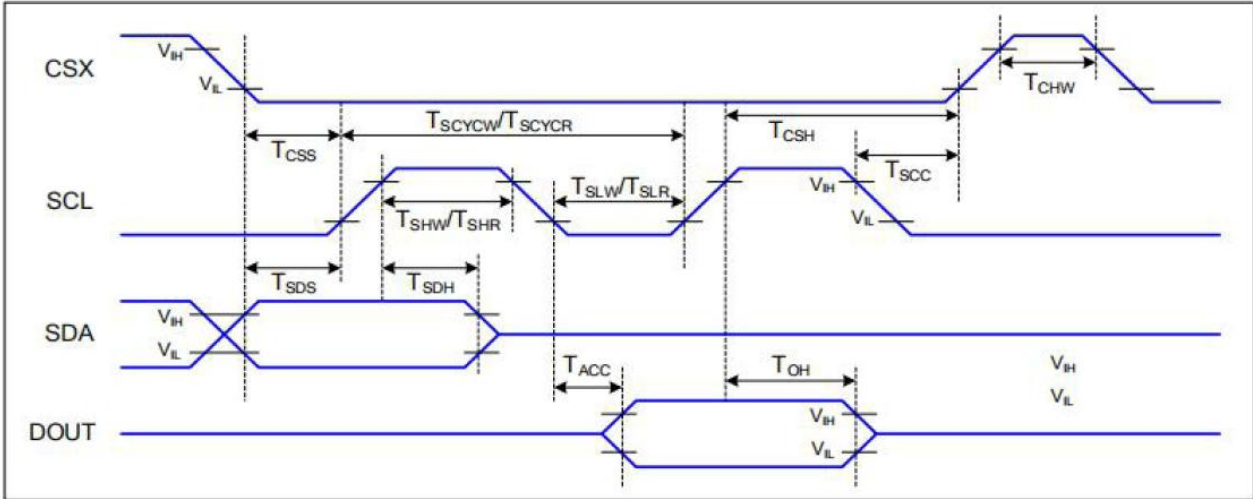
## 6.Pin Description

### TFT interface

Item	Terminal	Functions
1	GND	Ground
2	VLED+	B/L Power input PIN anode
3	VLED-	B/L Power input PIN negative
4	VDD	Power supply 3.3V
5	IOVCC	Power supply 1.8V
6	SDO	Serial output signal
7	SDI	Serial data input
8	GND	Ground
9	SCL	Serial Clock
10	CS	Chip select pin
11	NC	No connect
12	RESET	Reset signal pin
13-20	R0--R7	Display for R dot
21-28	G0--G7	Display for G dot
29-36	B0--B7	Display for B dot
37	DE	Data input enable
38	GND	Ground
39	DCLK	Clock for input data
40	GND	Ground
41	HSYNC	Horizontal synchronizing signal
42	VSYNC	Vertical synchronizing signal
43	NC	No connect
44	LED-PWM	The PWM frequency output for LCD driver control.
45	GND	Ground

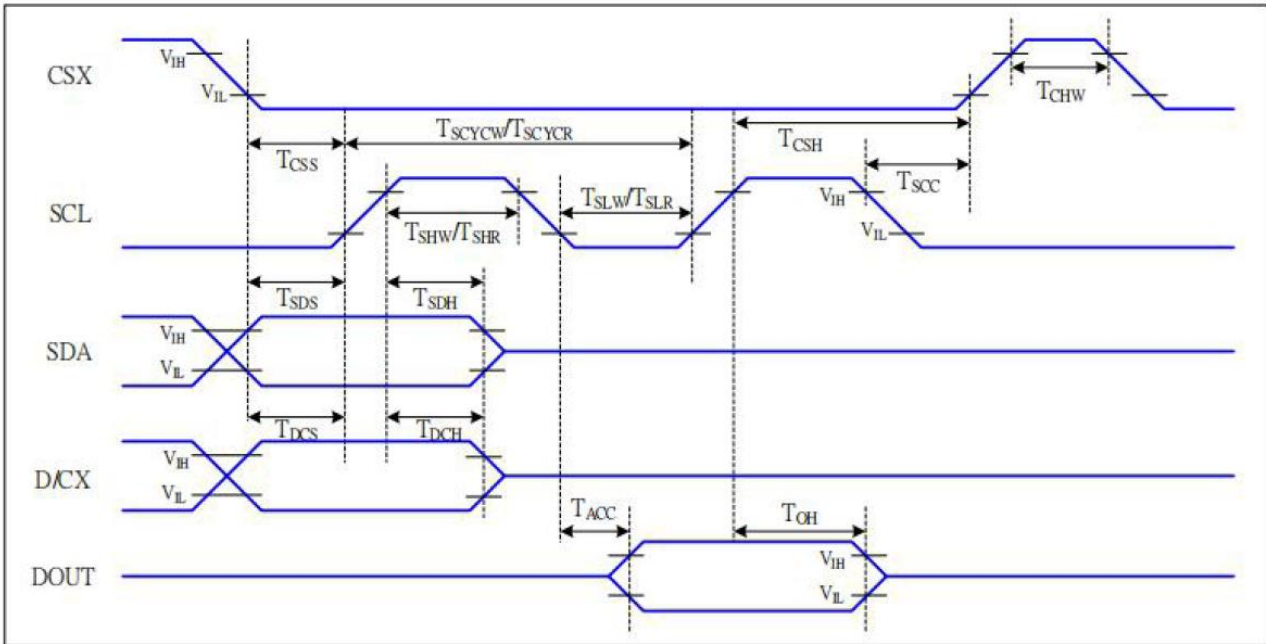
## 7. Timing Characteristics (details refer to spec of ST7701S)

### 7.1 3-line Serial Interface Timing Characteristics



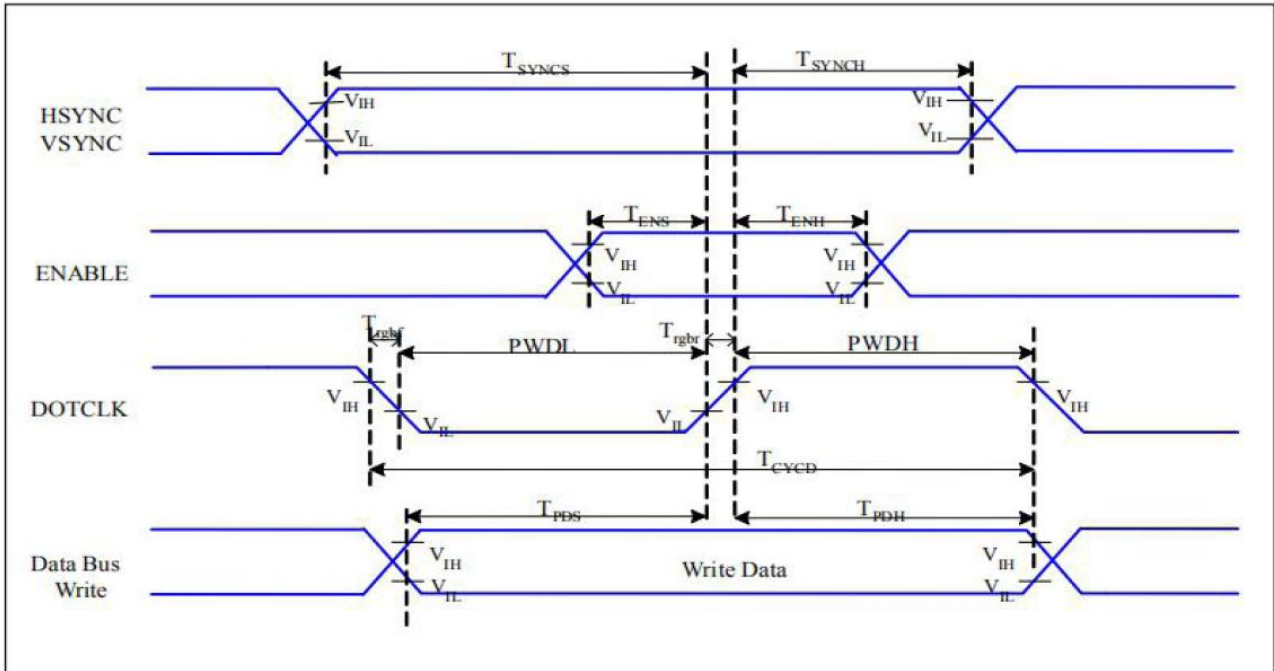
Signal	Symbol	Parameter	Min	Max	Unit	Description
CSX	$T_{CSS}$	Chip select setup time (write)	15		ns	
	$T_{CSH}$	Chip select hold time (write)	15		ns	
	$T_{CSS}$	Chip select setup time (read)	60		ns	
	$T_{SCC}$	Chip select hold time (read)	60		ns	
	$T_{CHW}$	Chip select "H" pulse width	40		ns	
SCL	$T_{SCYCW}$	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	

## 7.2 4-line Serial Interface Timing Characteristics



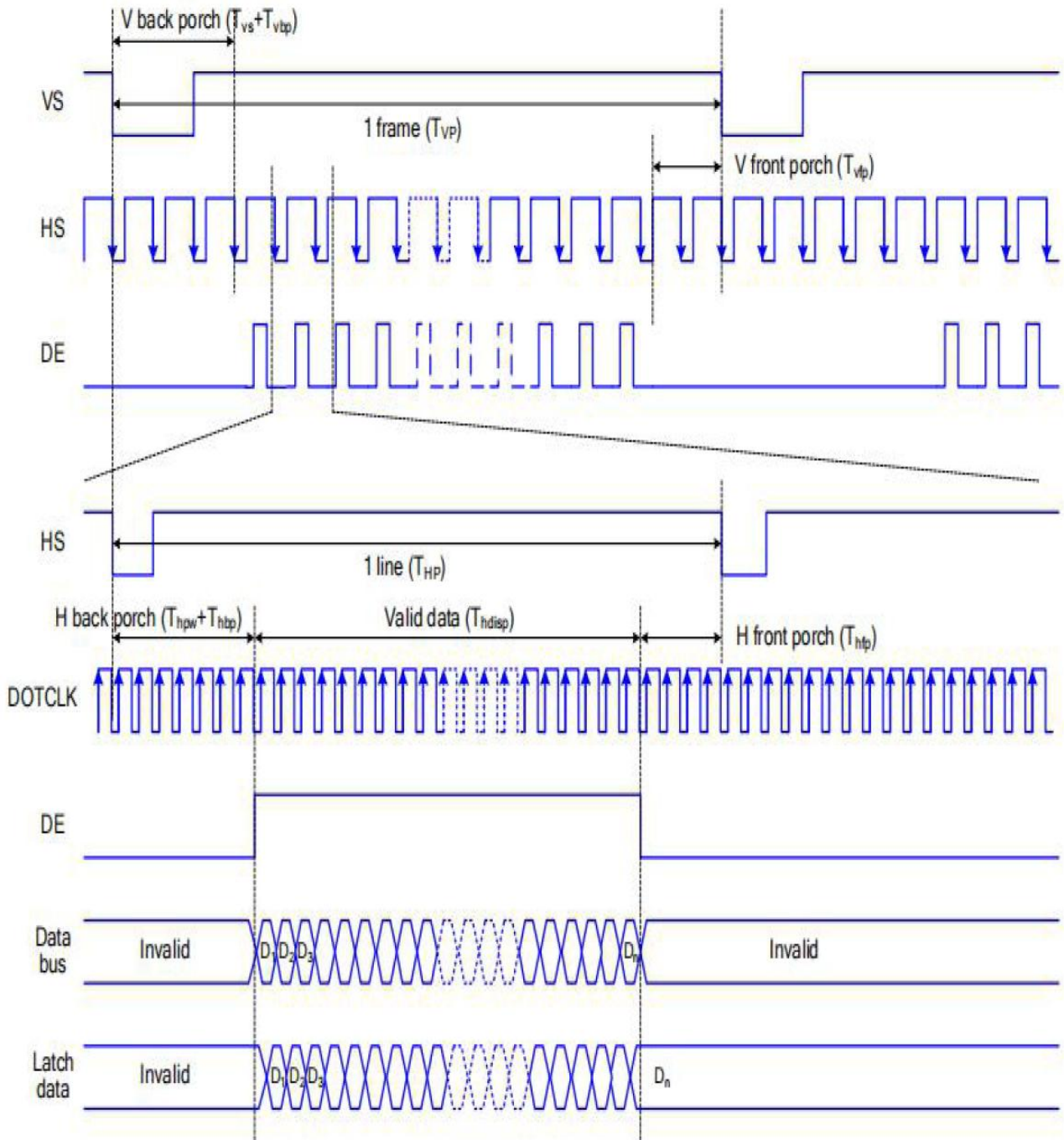
Signal	Symbol	Parameter	MIN	MAX	Unit	Description
CSX	T <sub>CSS</sub>	Chip select setup time (write)	15		ns	
	T <sub>CSH</sub>	Chip select hold time (write)	15		ns	
	T <sub>CSS</sub>	Chip select setup time (read)	60		ns	
	T <sub>SCC</sub>	Chip select hold time (read)	65		ns	
	T <sub>CHW</sub>	Chip select "H" pulse width	40		ns	
SCL	T <sub>SCYCW</sub>	Serial clock cycle (Write)	66		ns	-write command & data ram
	T <sub>SHW</sub>	SCL "H" pulse width (Write)	15		ns	
	T <sub>SLW</sub>	SCL "L" pulse width (Write)	15		ns	
	T <sub>SCYCR</sub>	Serial clock cycle (Read)	150		ns	-read command & data ram
	T <sub>SHR</sub>	SCL "H" pulse width (Read)	60		ns	
	T <sub>SLR</sub>	SCL "L" pulse width (Read)	60		ns	
D/CX	T <sub>DCS</sub>	D/CX setup time	10		ns	
	T <sub>DCH</sub>	D/CX hold time	10		ns	
SDA (DIN)	T <sub>SDS</sub>	Data setup time	10		ns	
	T <sub>SDH</sub>	Data hold time	10		ns	

## 7.3 RGB Interface Timing Characteristics

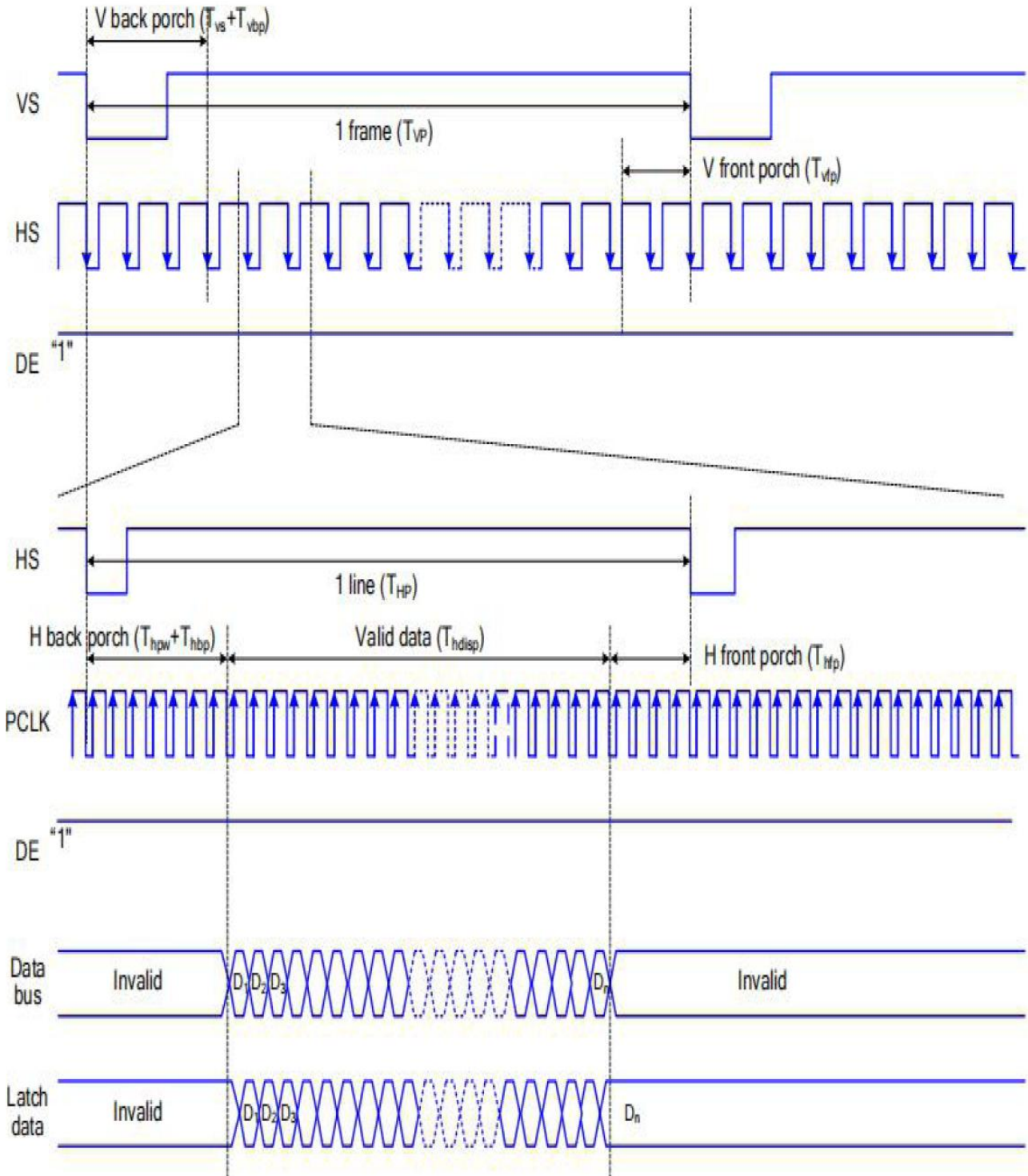


Signal	Symbol	Parameter	MIN	MAX	Unit	Description
HSYNC, VSYNC	$T_{SYNCS}$	VSYNC, HSYNC Setup Time	5	-	ns	
ENABLE	$T_{ENS}$	Enable Setup Time	5	-	ns	
	$T_{ENH}$	Enable Hold Time	5	-	ns	
DOTCLK	$PWDH$	DOTCLK High-level Pulse Width	15	-	ns	
	$PWDL$	DOTCLK Low-level Pulse Width	15	-	ns	
	$T_{CYCD}$	DOTCLK Cycle Time	33	-	ns	
	$T_{rghr}, T_{rghf}$	DOTCLK Rise/Fall time	-	15	ns	
DB	$T_{PDS}$	PD Data Setup Time	5	-	ns	
	$T_{PDH}$	PD Data Hold Time	5	-	ns	

## 7.4 The Timing chart of RGB interface DE mode



## 7.5 The Timing chart of RGB interface HV mode





## 8. Outline Dimension

Display Type	Transmissive Normally Black
Display Resolution	480(RGB)X480
Viewing Angle	FREE
Controller/Driver	ST7701S-G5
Driving Voltage	1.8V(TFT)+2.8V(TFT)
Operation Temperature	-20°C TO 70°C
Storage Temperature	-30°C TO 80°C
Backlight Speciality	10PCS LEDs, V <sub>f</sub> =1.5V, I <sub>f</sub> =40mA
Remark	Luminance: 350cd/m <sup>2</sup> All materials in the drawing comply with the ROHS

PNL SYMBOL	TFT ASSIGNMENT:
1 GND	1 GND
2 VDD+	2 VDD+
3 VDD-	3 VDD-
4 VCC	4 VCC
5 IOWC	5 IOWC
6 SDO	6 SDO
7 SDI	7 SDI
8 GND	8 GND
9 SCL	9 SCL
10 CS	10 CS
11 NC	11 NC
12 RESET	12 RESET
13 R0	13 R0
14 R1	14 R1
15 R2	15 R2
16 R3	16 R3
17 R4	17 R4
18 R5	18 R5
19 R6	19 R6
20 R7	20 R7
21 R8	21 R8
22 G2	22 G2
23 G1	23 G1
24 G3	24 G3
25 G4	25 G4
26 G5	26 G5
27 G6	27 G6
28 G7	28 G7
29 B0	29 B0
30 B1	30 B1
31 B2	31 B2
32 B3	32 B3
33 B4	33 B4
34 B5	34 B5
35 B6	35 B6
36 B7	36 B7
37 DE	37 DE
38 GND	38 GND
39 DCLK	39 DCLK
40 SDO	40 SDO
41 SCL	41 SCL
42 NC	42 NC
43 NC	43 NC
44 LED_PWM	44 LED_PWM
45 GND	45 GND

TITLE:	LCM Outline
PROJECT NO.:	RK040HF08
DESCRIPTION:	3.95 Inch TFT
GENERAL TOLERANCE:	±0.3

THIRD ANGLE PROJECTION

### Rocktech Displays Limited

NAME	SIGN	DATE
DRAWN: Marvin Zhou		2020.11.01
CHECKED: Marvin Zhou		2020.11.01
REV: 1.0	UNIT: MM	SCALE: 1/1
		SHEET: 1 OF 1

## 9. Reliability and Inspection Standard

No.	Test Item		Test Conditions	Remark
1	High Temperature	Storage	80°C, 120Hr	Note
		Operation	70°C, 120Hr	Note
2	Low Temperature	Storage	-30°C, 120Hr	Note
		Operation	-20°C, 120Hr	
3	High Temperature and High Humidity		40°C, 90%RH, 120Hr	Note
4	Thermal Cycling Test(No operation)		-20°C for 30min, 70°C for 30 min. 100 cycles. Then test at room temperature after 1 hour	Note
5	Vibration Test(No operation)		Frequency :10~55 HZ; Stroke :1.5 mm;Sweep:10HZ~55HZ~10HZ; 2hours for each direction of X, Y, Z(6 hours for total)	
6	Package Drop Test		Height:60 cm,1 corner, 3 edges, 6 surfaces	
7	Electro Static Discharge		±2KV,Human Body Mode, 100pF/1500Ω	

Note:

- 1) Sample quantity for each test item is 5~10pcs.
- 2) Note 4: Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.

## 10. PRECAUTIONS FOR USING LCD MODULES

### Handling Precautions

- (1) The display panel is made of glass and polarizer. As glass is fragile, it tends to become or chipped during handling especially on the edges. Please avoid dropping or jarring. Do not subject it to a mechanical shock by dropping it or impact.
- (2) If the display panel is damaged and the liquid crystal substance leaks out, be sure not to get any in your mouth. If the substance contacts your skin or clothes, wash it off using soap and water.
- (3) Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary. Do not touch the display with bare hands. This will stain the display area and degraded insulation between terminals (some cosmetics are determined to the polarizer).
- (4) The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully. Do not touch, push or rub the exposed polarizers with anything harder than an HB pencil lead (glass, tweezers, etc.). Do not put or attach anything on the display area to avoid leaving marks on. Condensation on the surface and contact with terminals due to cold will damage, stain or dirty the polarizer. After products are tested at low temperature they must be warmed up in a container before coming in contact with room temperature air.
- (5) If the display surface becomes contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, moisten cloth with one of the following solvents
  - Isopropyl alcohol
  - Ethyl alcoholDo not scrub hard to avoid damaging the display surface.
- (6) Solvents other than those above-mentioned may damage the polarizer. Especially, do not use the following.
  - Water
  - Ketone
  - Aromatic solventsWipe off saliva or water drops immediately, contact with water over a long period of time may cause deformation or color fading. Avoid contacting oil and fats.
- (7) Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.
- (8) Install the LCD Module by using the mounting holes. When mounting the LCD module make sure it is free of twisting, warping and distortion. In particular, do not forcibly pull or bend the I/O cable or the backlight cable.
- (9) Do not attempt to disassemble or process the LCD module.
- (10) NC terminal should be open. Do not connect anything.
- (11) If the logic circuit power is off, do not apply the input signals.
- (12) Since LCM has been assembled and adjusted with a high degree of precision, avoid applying excessive shocks to the module or making any alterations or modifications to it.
  - Do not alter, modify or change the shape of the tab on the metal frame.
  - Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.
  - Do not damage or modify the pattern writing on the printed circuit board.
  - Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal

connector.

- Except for soldering the interface, do not make any alterations or modifications with a soldering iron.
- Do not drop, bend or twist LCM.

## Storage Precautions

When storing the LCD modules, the following precaution is necessary.

- (1) Store them in a sealed polyethylene bag. If properly sealed, there is no need for the dessicant.
- (2) Store them in a dark place. Do not expose to sunlight or fluorescent light, keep the temperature between 0°C and 35°C.
- (3) The polarizer surface should not come in contact with any other objects. (We advise you to store them in the container in which they were shipped).

## Others

Liquid crystals solidify under low temperature (below the storage temperature range) leading to defective orientation or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subject to a low temperature.

If the LCD modules have been operating for a long time showing the same display patterns, the display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. A normal operating status can be regained by suspending use for some time. It should be noted that this phenomenon does not adversely affect performance reliability.

To minimize the performance degradation of the LCD modules resulting from destruction caused by static electricity etc., exercise care to avoid holding the following sections when handling the modules.

- Exposed area of the printed circuit board.
- Terminal electrode sections.