Rocktech Displays Limited

LCD Module Specification

Module P/N: RK070HB93

Version: 1.0

Description : 7.0 inch TFT 280*1424pixels with LED backlight ,All viewing angle,MIPI interface, 550 nits brightness

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Revision History

Date	Rev.	Page	Description
2024-08-25	1.0	All	First Issue

CONTENTS

1. General Features

Item	Spec	Remark
Display Mode	Normally Black transmissive	
Viewing Direction	Free	
Input Signals	MIPI	
Outside Dimensions(mm)	38.20 (W) x186.62(H) x3.50 (D)	
Active Area(mm)	33.60(W)×170.88(H)	
Number of Pixels	280(RGB)×1424	
Dot Pitch(mm)	0.12 (W) x 0.12 (H)	
Pixel Arrangement	RGB Vertical stripes	

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	-0.3	-	+5.0	V	
Storage Humidity	H_{ST}	10	-		%RH	At 25±5℃
Storage Temperature	T_{ST}	-30	-	80	℃	
Operating Ambient Humidity	H_{OP}	10	-		%RH	
Operating Ambient temperature	T_{OP}	-20	-	70	℃	

3. Electrical Specification

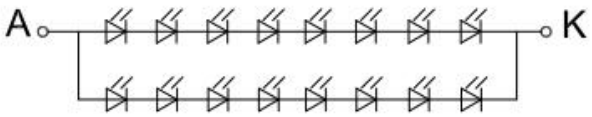
3.1 Driving TFT LCD Panel

Item		Sym.	Min	Typ.	Max	Unit	Note
Power Voltage		VDD	3.0	3.3	3.6	V	
Logic Input Voltage	Low Voltage	VIL	0.	-	0.3VDD	V	
	High Voltage	VIH	0.7VDD	-	VDD	V	

3.2 Driving LED Backlight

Item	Sym.	Min	Typ.	Max	Unit	Note
Backlight driving voltage	VF	-	24	-	V	
Backlight driving current	IF	30	40	50	mA	
Backlight Power Consumption	WBL	-	960	-	mW	
Life Time	-	-	50,000	-		Note 1

Note 1: 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.



If=40mA，V=21.6~27.2V

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 ℃. The values specified are at an approximate distance 500mm from the LCD surface at a viewing angle of Φ and θ equal to 0°.

Item	Sym.	Values			Unit	Note
		Min.	Typ.	Max.		
1)Contrast Ratio	C/R	800	1000	-		FIG.1
2)Module Luminance	L	450	550	-	cd/m^2	
3)Response time	Tr+Tf	-	30	40	ms	FIG.2
4)Viewing Angle	θ_T	75	80	-	Degree	FIG.3
	θ_B	75	80	-		
	θ_L	75	80	-		
	θ_R	75	80	-		
5)Chromaticity	Wx	TBD	TBD	TBD		
	Wy	TBD	TBD	TBD		
	Rx	-	-	-		
	Ry	-	-	-		
	Gx	-	-	-		
	Gy	-	-	-		
	Bx	-	-	-		
	By	-	-	-		

◆ Measurement System

Notes:

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

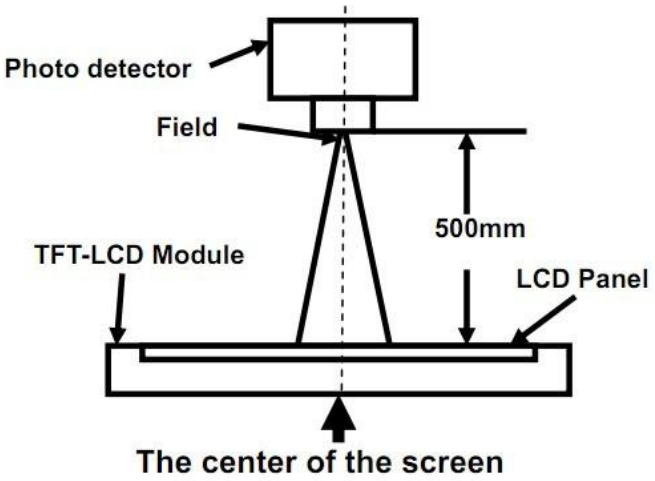
$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

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		
Response Time	BM-7A	2°

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”.

Response Time = Rising Time(Tr) + Falling Time(Tf)

- Rising Time(Tr) : Full White 90% → Full White 10% Transmittance.
- Falling Time(Tf) : Full White 10% → Full White 90% Transmittance.

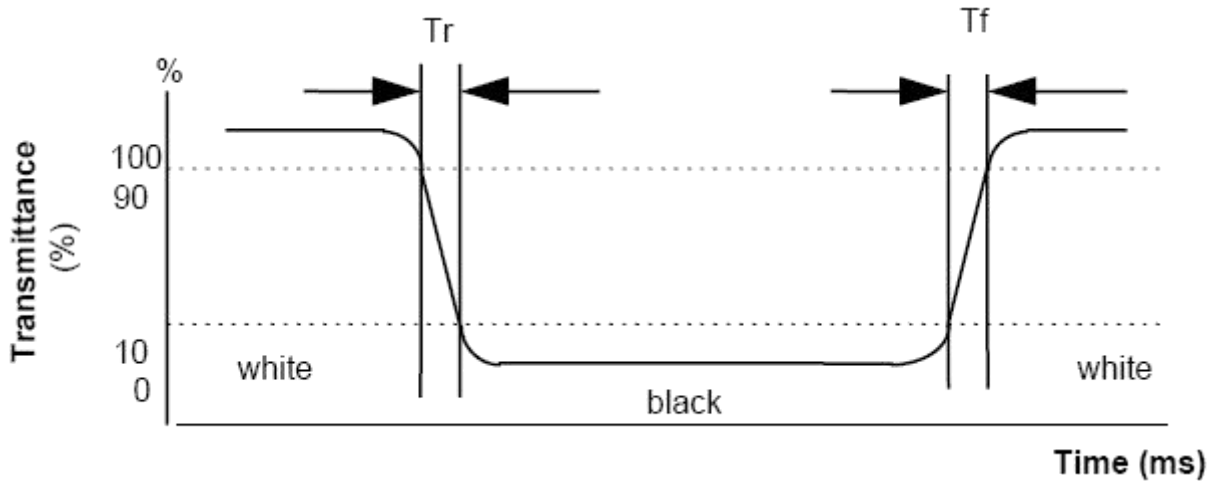
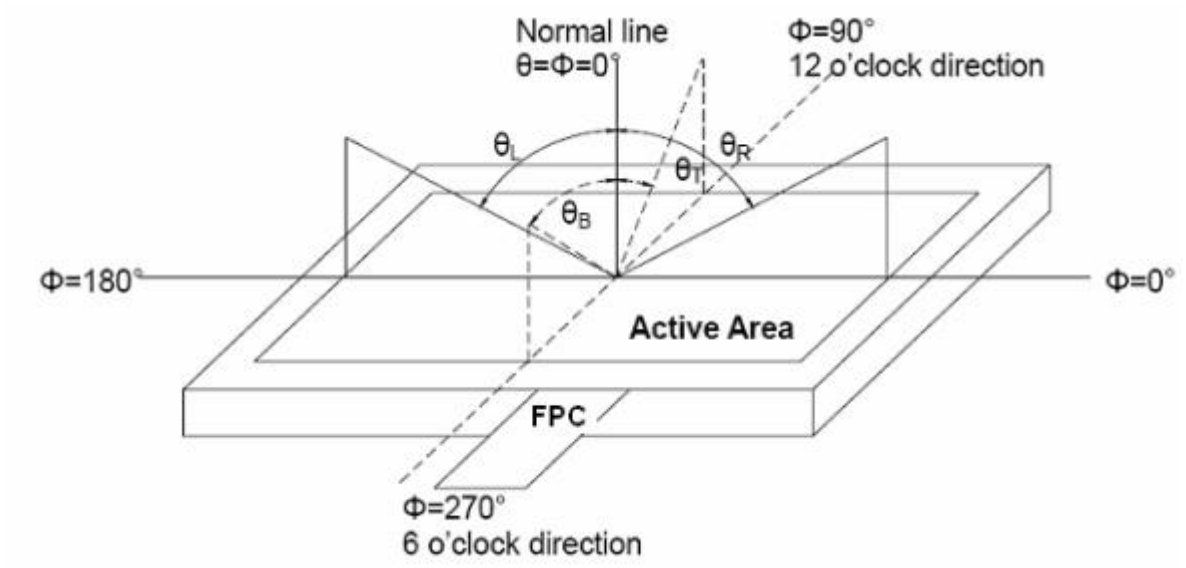
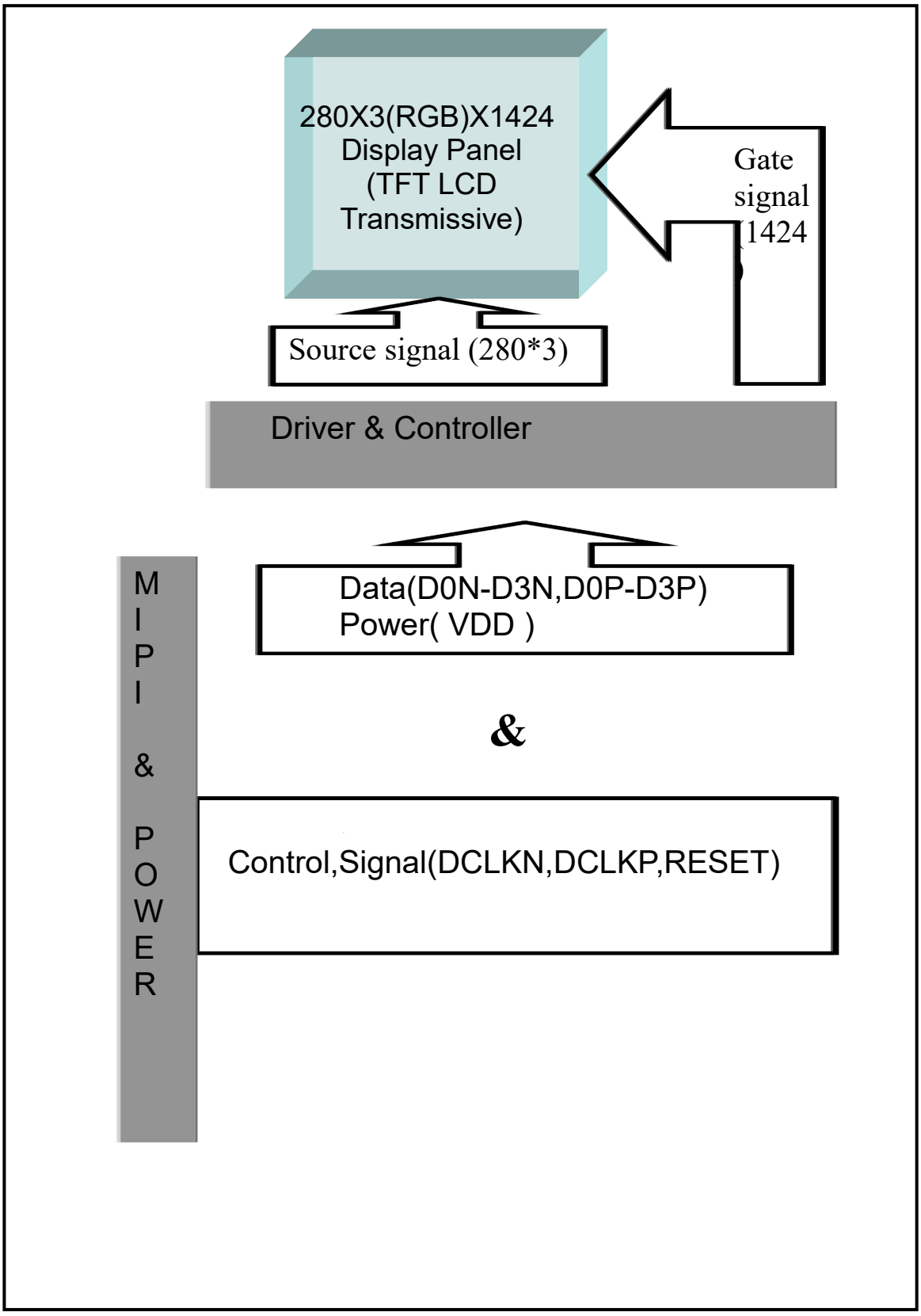


FIG. 3 The definition of Viewing Angle

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

6.1 TFT LCD Panel

PIN No.	Symbol	I/O	Function	Remark
1	GND	P	Ground	
2	D3N	I/O	Negative MIPI differential data input	
3	D3P	I/O	Positive MIPI differential data input	
4	GND	P	Ground	
5	D2N	I/O	Negative MIPI differential data input	
6	D2P	I/O	Positive MIPI differential data input	
7	GND	P	Ground	
8	DCLKN	I/O	Negative MIPI differential clock input	
9	DCLKP	I/O	Positive MIPI differential clock input	
10	GND	P	Ground	
11	D1N	I/O	Negative MIPI differential data input	
12	D1P	I/O	Positive MIPI differential data input	
13	GND	P	Ground	
14	D0N	I/O	Negative MIPI differential data input	
15	D0P	I/O	Positive MIPI differential data input	
16	GND	P	Ground	
17	GND	P	Ground	
18	TE	I	Sync signal for touch panel	
19	RESET	I	Global reset pin. Active low to enter reset state.	
20	GND	P	Ground	
21	VDD	P	Power Supply 3.3V	
22	VDD	P	Power Supply 3.3V	
23	VDD	P	Power Supply 3.3V	
24	GND	P	Ground	
25	NC	-	No connection	
26	NC	-	No connection	
27	LEDK	P	LED Cathode	
28	LEDK	P	LED Cathode	
29	LEDA	P	LED Anode	
30	LEDA	P	LED Anode	

7.Timing Characteristics

7.1 MIPI DC Characteristics

HS Receiver DC Specification

Parameter	Symbol	Rating			Unit	Note
		Min	Typ	Max		
Operation Voltage	VDD	1.5-10%	1.5	1.5+10%	mV	
Differential Input Voltage	|VID|	70	200	260	mV	
Common Mode Voltage	$V_{CMRX(DC)}$	70	-	330	mV	
Differential Input High Threshold Voltage	VTH	-	-	70	mV	
Differential Input Low Threshold Voltage	VTL	-70	-	-	mV	
Singled-ended input high voltage	V_{IHHS}	-	-	460	mV	
Singled-ended input low voltage	V_{ILHS}	-40	-	-	mV	
Singled-ended threshold for HS termination enable	$V_{TERM-EN}$	-	-	450	mV	
Differential input impedance	Z_{ID}	80	100	125	ohm	
Pin leakage current	I_{LEAK}	-10	-	10	uA	
Common-mode interference beyond 450MHz	$\Delta V_{CMRX(HF)}$	-	-	100	mV	
Common-mode interference 50MHz - 450MHz	$\Delta V_{CMRX(LF)}$	-50	-	50	mV	
Common-mode termination	C_{CM}	-	-	60	pF	
Embedded Termination	R_T	90	100	110	ohm	2bits RT_SEL[1: 0] for termination resistor selection 00 → 200ohm 10 , 01→ 150ohm 11 → 100ohm (default) 1bit ERMR_EN for termination resistor enable TERMR_EN=0, termr disable R=(OPEN) TERMR_EN=1, termr enable

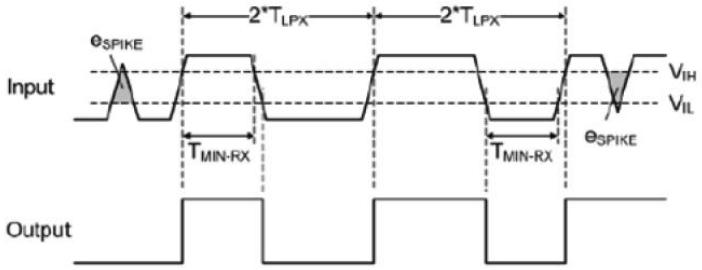
Note:

(1) Excluding possible additional RF interference of 100mV peak sine wave beyond 450MHz.

(2) This table value includes a ground difference of 50mV between the transmitter and the receiver, the static common-mode level tolerance and variations below 450MHz.

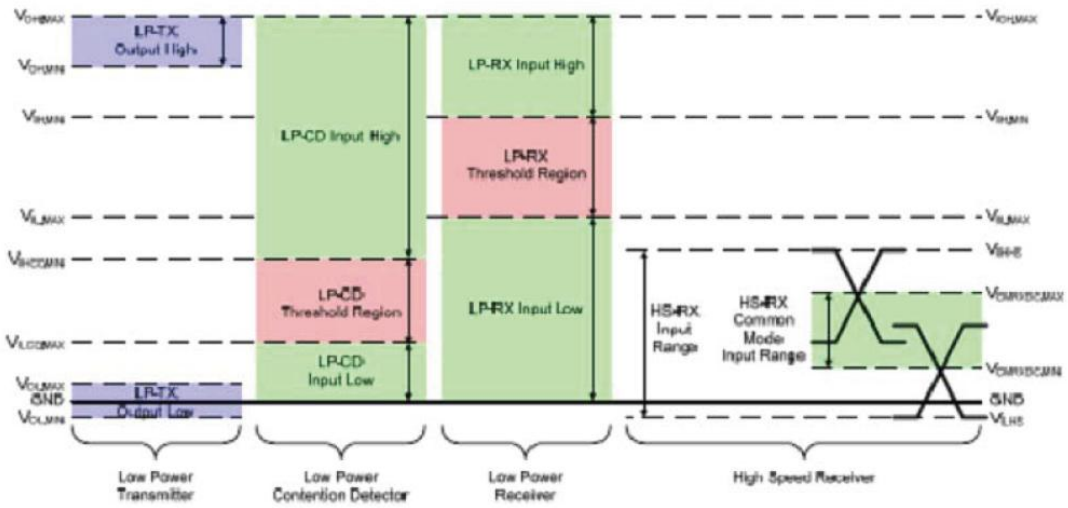
LP Receiver DC Specification

Parameter	Symbol	Rating			Unit	Note
		Min	Typ	Max		
Logic 1 input voltage	V_{IH}	880	-	-	mV	
Logic 0 input voltage, not in ULP State	V_{IL}	-	-	550	mV	
Input hysteresis	V_{HYST}	25	-	-	mV	



Line Contention Detection

Parameter	Symbol	Rating			Unit	Note
		Min	Typ	Max		
Logic 1 contention threshold	V_{IHCD}	450	-	-	mV	
Logic 0 contention threshold	VILCD	-	-	200	mV	



7.2 MIPI AC Chrematistics

HS Receiver AC Timing Characteristics

Parameter	Symbol	Rating			Unit	Note
		Min	Typ	Max		
Bandwidth per lane	-	-	-	1000	Mbps	Bandwidth selected by register 'speedup' Speedup=0 → Max=550Mbps Speedup=1→ Max=1000Mbps
Operation frequency	-	-	-	500	MHz	
UI instantaneous	UI_{INST}	1	-	12.5	ns	1
Data to Clock Skew	Tskew	-0.15	-	0.15	UI_{INST}	
Inter-lane static skew	Tskew-lane	-	-	UI_{INST}/50	UI_{INST}	
Data to Clock Setup Time	T_{SETUP}	0.25	-	-	UI_{INST}	2
Data to Clock Hold Time	T_{HOLD}	0.25	-	-	UI_{INST}	
Common-mode interference beyond 450MHz	$\Delta V_{CMRX(HF)}$	-	-	100	mV	4
Common-mode interference 50MHz- 450MHz	$\Delta V_{CMRX(LF)}$	-50	-	50	mV	3,6
Common-mode termination	C_{CM}	-	-	60	pF	5

Note:

(1) Total silicon and package delay budget of 0.3*UINST

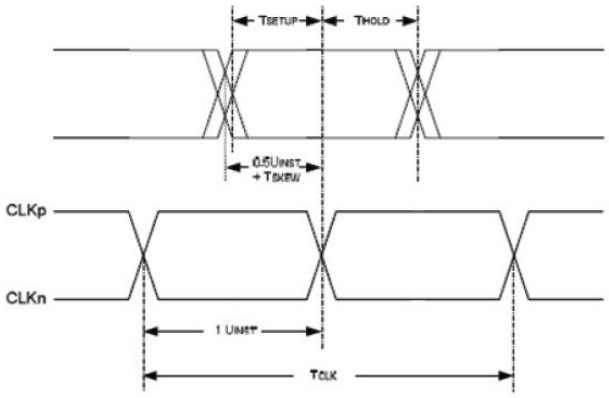
(2) Total setup and hold window for receiver of 0.3*UINST

(3) Excluding 'static' ground shift of 50mV

(4) =VCMRX (HF) is the peak amplitude of a sine wave superimposed on the receiver input

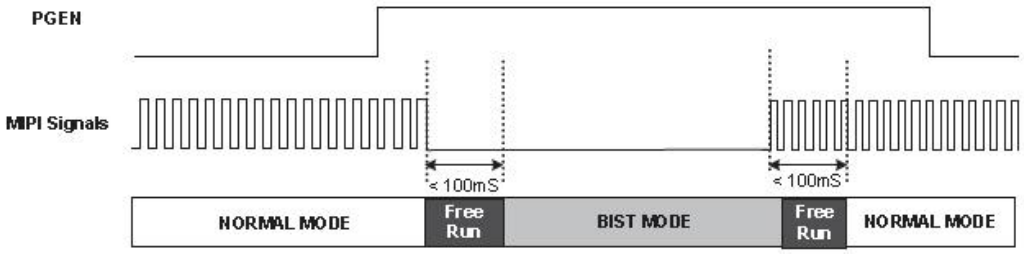
(5) For higher bit rates a 14pF capacitor will be needed to meet the common-mode return loss specification.

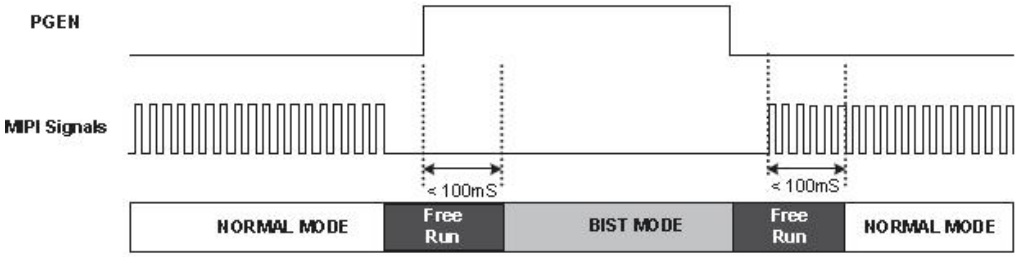
(6) Voltage difference compared to the DC average common-mode potential.



7.3 Reset Timing Characteristic

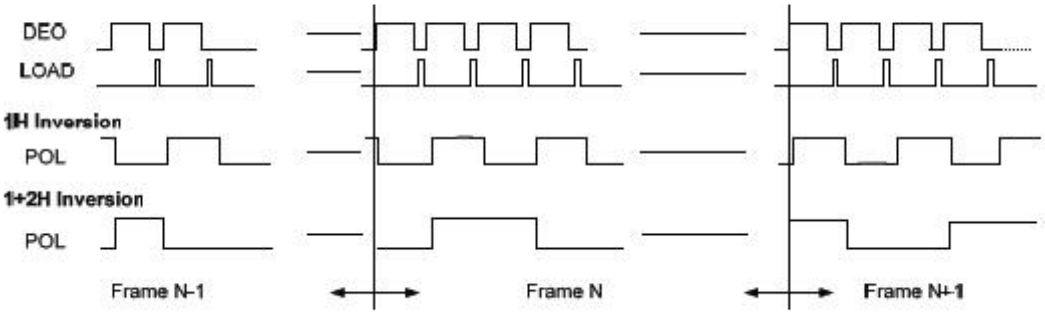
BIST Timing



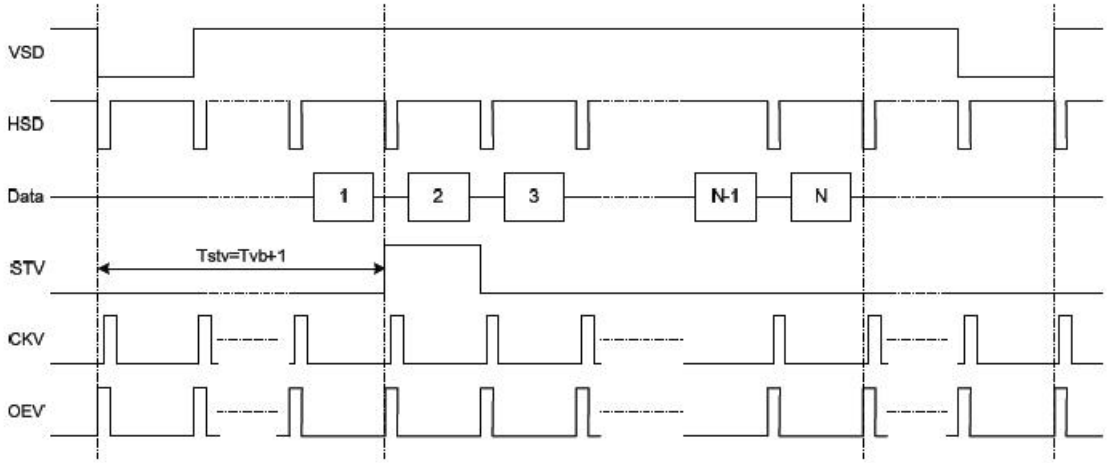


TCON Timing

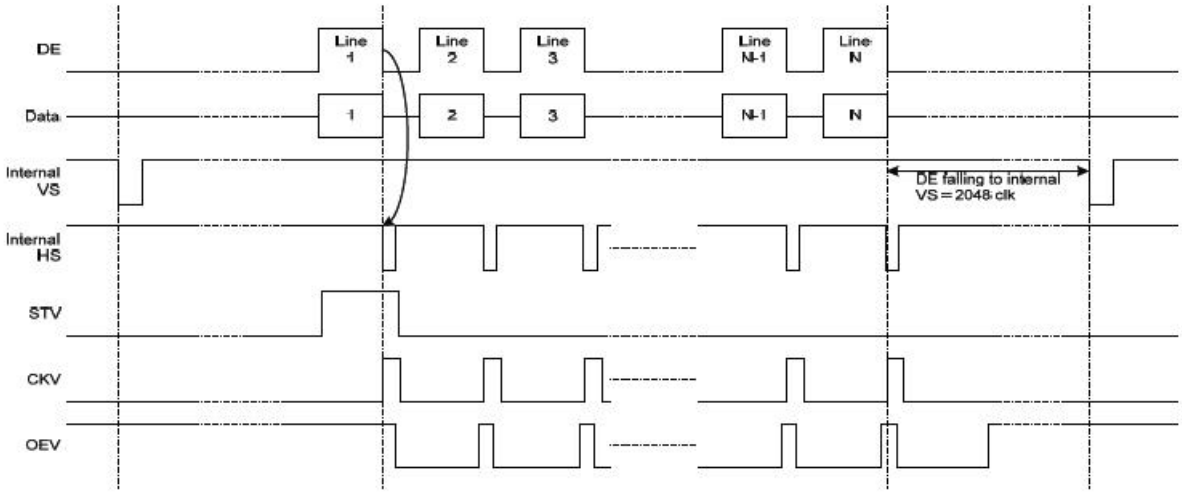
Polarity Control



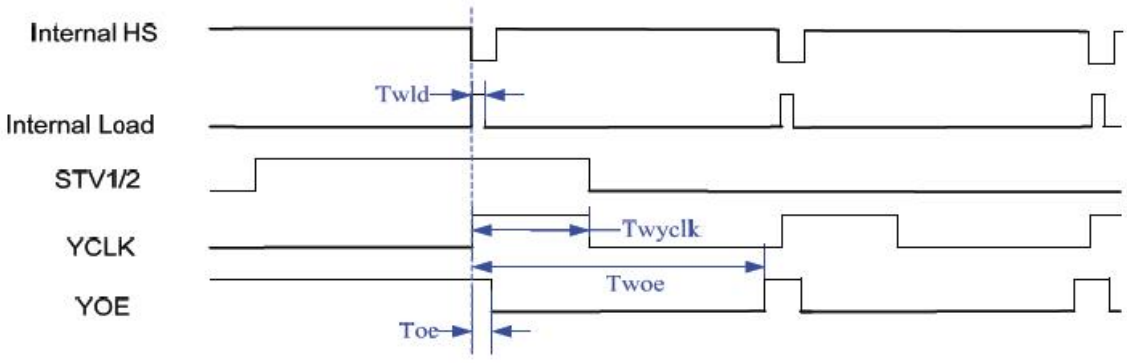
Vertical Timing Diagram HV (Cascade)



Vertical Timing Diagram DE (Cascade)

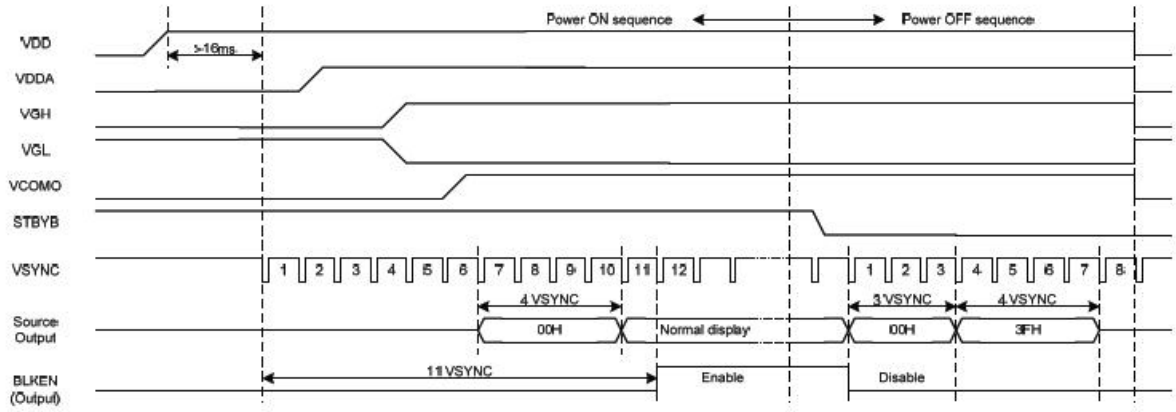


Gate output timing diagram (Cascade)

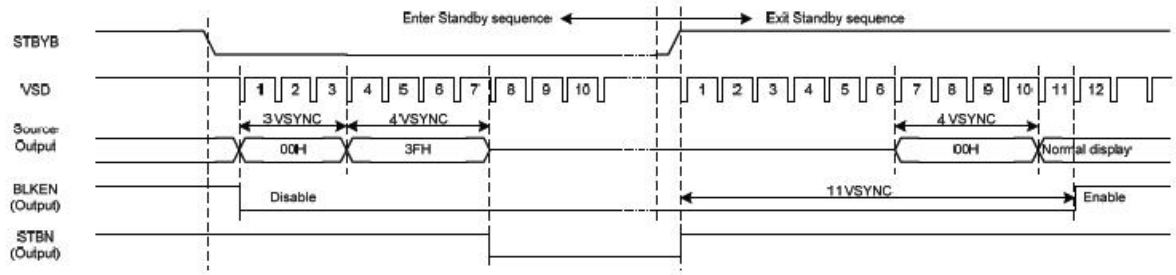


7.4 Power On/Off Sequence

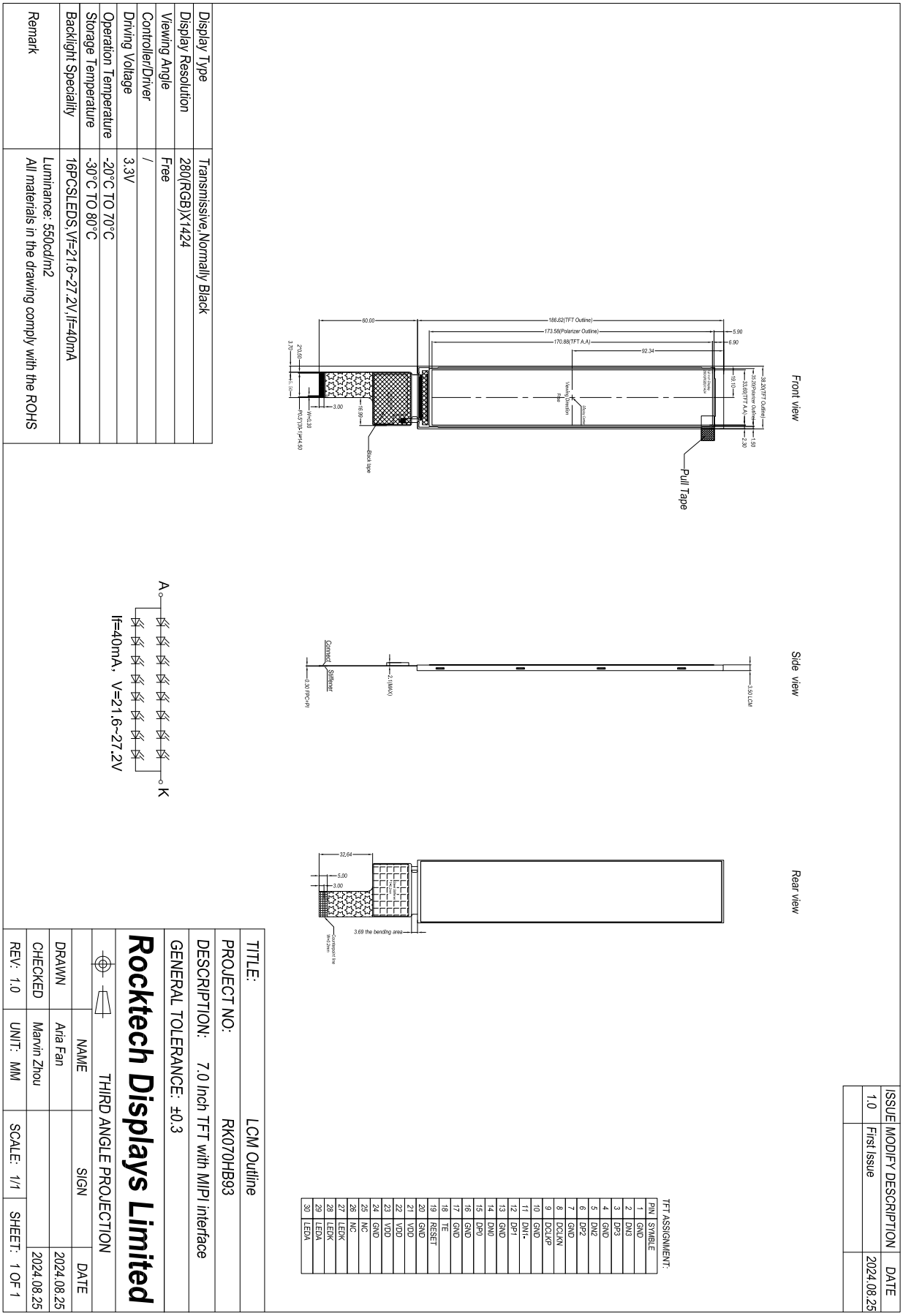
Power-On/Off Timing Sequence:



Enter and Exit Standby Mode Sequence:



8. Outline Dimension



Display Type	Transmissive,Normally Black
Display Resolution	280(RGB)X1424
Viewing Angle	Free
Controller/Driver	/
Driving Voltage	3.3V
Operation Temperature	-20°C TO 70°C
Storage Temperature	-30°C TO 80°C
Backlight Speciality	16PCSLEDS,Vf=21.6~27.2V,If=40mA
Remark	Luminance: 550cd/m2 All materials in the drawing comply with the ROHS

TFT ASSIGNMENT:

PIN	SYMBLE	PIN	SYMBLE
1	GND	16	GND
2	DN3	17	GND
3	DP3	18	TE
4	GND	19	RESET
5	DN2	20	GND
6	DP2	21	VDD
7	GND	22	VDD
8	DCLKN	23	VDD
9	DCLKP	24	GND
10	GND	25	NC
11	DN1	26	NC
12	DP1	27	LEDK
13	GND	28	LEDK
14	DN0	29	LEDA
15	DP0	30	LEDA

ISSUE	MODIFY DESCRIPTION	DATE
1.0	First Issue	2024.08.25

TITLE:	LCM Outline		
PROJECT NO:	RK070HB93		
DESCRIPTION:	7.0 Inch TFT with MIPI interface		
GENERAL TOLERANCE: ±0.3			
Rocktech Displays Limited			
THIRD ANGLE PROJECTION			
	NAME	SIGN	DATE
DRAWN	Aria Fan		2024.08.25
CHECKED	Marvin Zhou		2024.08.25
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℃, 120Hr	Note
		Operation	70℃, 120Hr	Note
2	Low Temperature	Storage	-30℃, 120Hr	Note
		Operation	-20℃, 120Hr	
3	High Temperature and High Humidity		40℃, 90%RH, 120Hr	Note
4	Thermal Cycling Test(No operation)		-20℃ for 30min, 70℃ 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

Handing 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 is contacting 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 alcohol
Do 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 solvents
Wipe 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.