Rocktech Displays Limited

LCD Module Specification

Module P/N: RK121BI05E-CT

Version: 1.0

Description : 12.1 inch TFT 1280*800 Pixels with LED backlight, All viewing angle, 800 nits brightness and Capacitive touch panel with USB interface

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Revision History

Date	Rev.	Page	Description
2024-05-15	1.0	All	First issue

CONTENTS

1. General Features

Item	Spec	Remark
Display Mode	Normally Black transmissive	
Viewing Direction	Free	IPS
Input Signals	LVDS	
Outside Dimensions	277.70(W) x180.60(H) x8.55(D)	With CTP
Active Area	261.12mm(W)×163.20mm(H)	
Number of Pixels	1280(RGB)×800	
Dot Pitch	0.204mm(W) ×0.204mm(H)	
Pixel Arrangement	RGB Vertical stripes	
CTP Driver IC	ILI2511	

2. Absolute Maximum Ratings

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

ITEM	Sym.	Min.	Max.	Unit	Remark
Supply Voltage	VDD	-0.3	5.0	V	
Operation Temperature	Top	-20	70	℃	
Storage Temperature	Tst	-30	80	℃	

Note 1: The absolute maximum rating values of this product are not allowed to be exceeded at any times. Should a module be used with any of the absolute maximum ratings exceeded, the characteristics of the module may not be recovered, or in an extreme case, the module may be permanently destroyed.

3. Electrical Specification

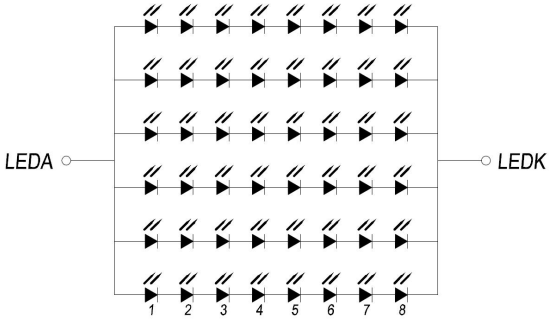
3.1 Driving TFT LCD Panel

ITEM	Sym.	Min.	Typ	Max.	Unit	Remark
Supply Voltage	VDD	2.6	3.3	3.6	V	
Input Voltage “H” Level	VIH	0.7VDD	-	VDD	V	
Input Voltage “L” Level	VIL	0	-	0.3VDD	V	

3.2 Backlight Driving Conditions

Item	Sym.	Min	Typ.	Max	Unit	Note
Backlight driving voltage	V_F	-	24.0	-	V	
Backlight driving current	I_F	330	360	390	mA	
Backlight Power Consumption	W_{BL}	-	8640	-	mW	
Life Time	-	-	50,000	-		

Note 1: Each LED, If=60mA,Vf=3.0+/-0.2V.
Note 2: Optical performance should be evaluated at Ta=25℃ only.
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.



LED Diagram Circuit

3.3 Driving CTP

Item	Value
Working Voltage	DC 2.8-3.3V(I2C) DC 5.0V(USB)
Interface	I2C and USB
Support Touch	10 points
Surface Hardness	≥6H

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	1000	1200	-		FIG.1
2)Module Luminance	L	700	800	-	cd/m^2	After CTP
3)Response time	Tr+Tf	-	30	34	ms	FIG.2
4)Viewing Angle	θ_T	80	85	-	Degree	FIG.3
	θ_B	80	85	-		
	θ_L	80	85	-		
	θ_R	80	85	-		
5)Chromaticity	Wx	0.27	0.31	0.35		
	Wy	0.29	0.33	0.37		
	Rx	-	-	-		
	Ry	-	-	-		
	Gx	-	-	-		
	Gy	-	-	-		
	Bx	-	-	-		
	By	-	-	-		

◆ Measurement System

Notes:

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

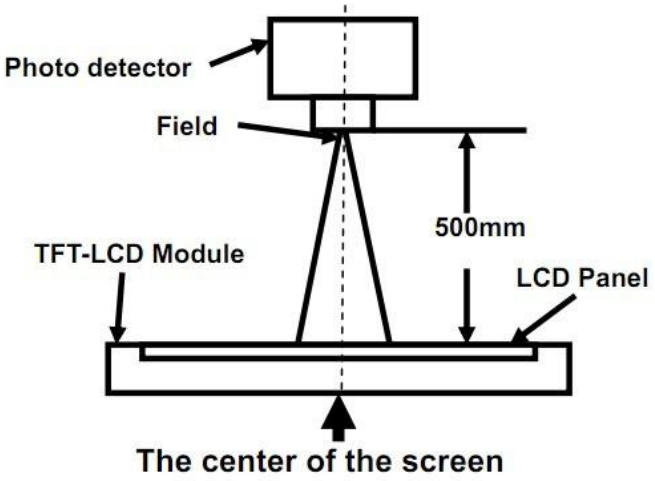
$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

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.

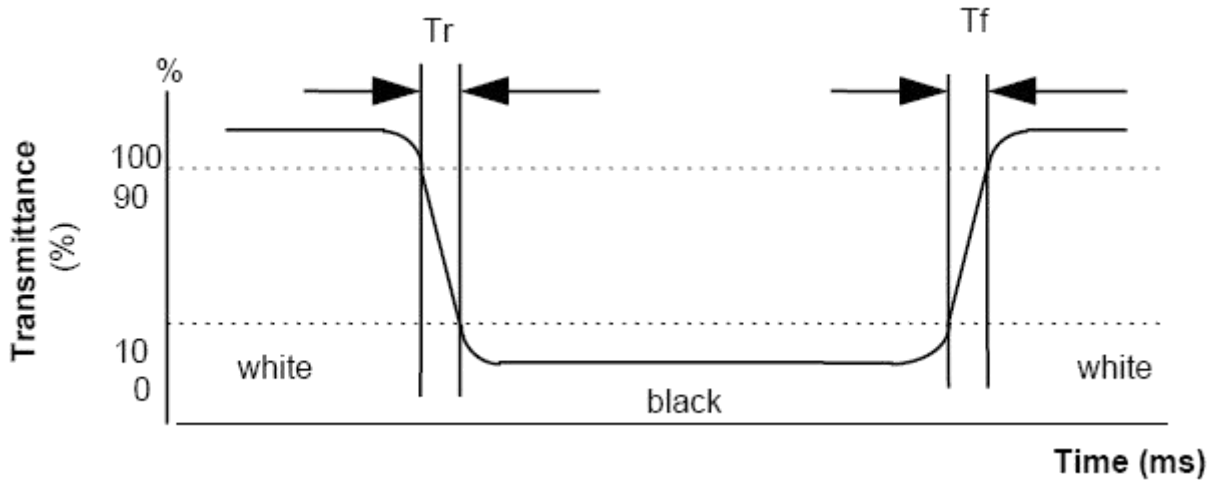
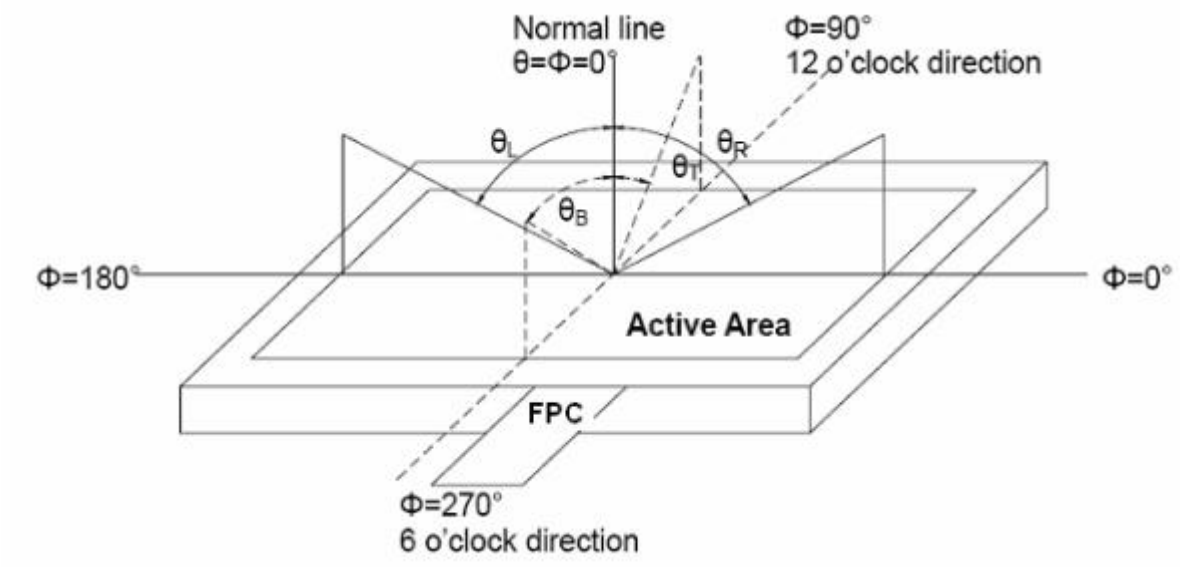
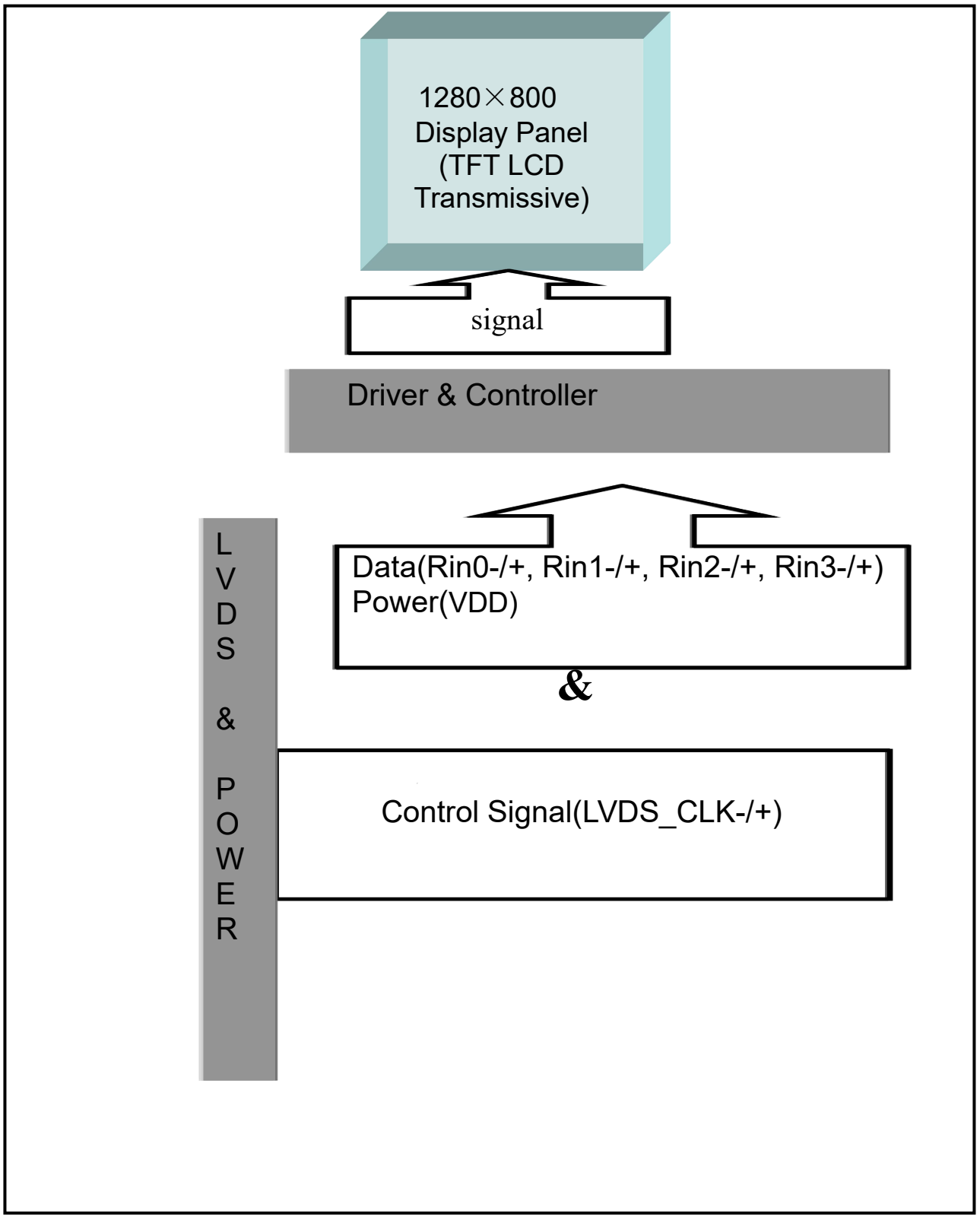


FIG. 3 The definition of Viewing Angle

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 LCD Pin interface

Item	Terminal	Functions	
1	NC	No Connection	
2-4	VDD	Power Supply,3.3V	
5	NC	No Connection	
6,7	GND	Ground	
8	Rin0-	-LVDS Differential Data Input	
9	Rin0+	+LVDS Differential Data Input	
10	GND	Ground	
11	Rin1-	-LVDS Differential Data Input	
12	Rin1+	+LVDS Differential Data Input	
13	GND	Ground	
14	Rin2-	-LVDS Differential Data Input	
15	Rin2+	+LVDS Differential Data Input	
16	GND	Ground	
17	LVDS_CLK-	LVDS Clock Differential Signal Input Pins	
18	LVDS_CLK+	LVDS Clock Differential Signal Input Pins	
19	GND	Ground	
20	Rin3-	-LVDS Differential Data Input	
21	Rin3+	+LVDS Differential Data Input	
22	GND	Ground	
23,24	NC	No Connection	
25	GND	Ground	
26,27	NC	No Connection	
28	GND	Ground	
29,30	NC	No Connection	
31-33	GND	Ground	
34-40	NC	No Connection	

6.2 Backlight Pin Interface

Item	Terminal	Functions
1	LEDA	Power for backlight(Anode PIN)
2	LEDK	Power for backlight(Cathode PIN)

6.3 CTP Pin Interface

Item	Terminal	Functions
1	USB_GND	Ground
2	USB_VDD_5.0V	Working Voltage 5.0V when using USB interface
3	USB_D-	USB Data- signal
4	USB_D+	USB Data+ signal
5	I2C_GND	Ground
6	I2C_VDD_3.3V	Working Voltage 3.3V when using I2C interface
7	I2C_RST	I2C reset signal
8	I2C_SCL	I2C clock signal
9	I2C_INT	I2C interrupt signal
10	I2C_SDA	I2C data signal

7.Timing Characteristics

7.1 Timing Table

Parameter		Symbol	Value			Unit
			Min.	Typ.	Max.	
DCLK frequency @Frame rate=60Hz (LVDS)		F_{DCLK}	66.3	72.4	78.9	MHz
HSYNC period time		T_H	1380	1440	1500	DCLK
Horizontal display area		T_{HD}		1280		DCLK
HSYNC pulse width	Min.	T_{HPW}		2		
	Typ.			-		
	Max.			40		
HSYNC back porch(with pulse width)		T_{HBP}	88	88	88	DCLK
HSYNC front porch		T_{HFP}	12	72	132	DCLK
VSYNC period time		T_V	824	838	872	H
Vertical display area		T_{VD}		800		H
VSYNC pulse width	Min.	T_{VPW}		2		H
	Typ.			-		
	Max.			20		
VSYNC back porch(with pulse width)		T_{VBP}	23	23	23	H
VSYNC front porch		T_{VFP}	1	15	49	H

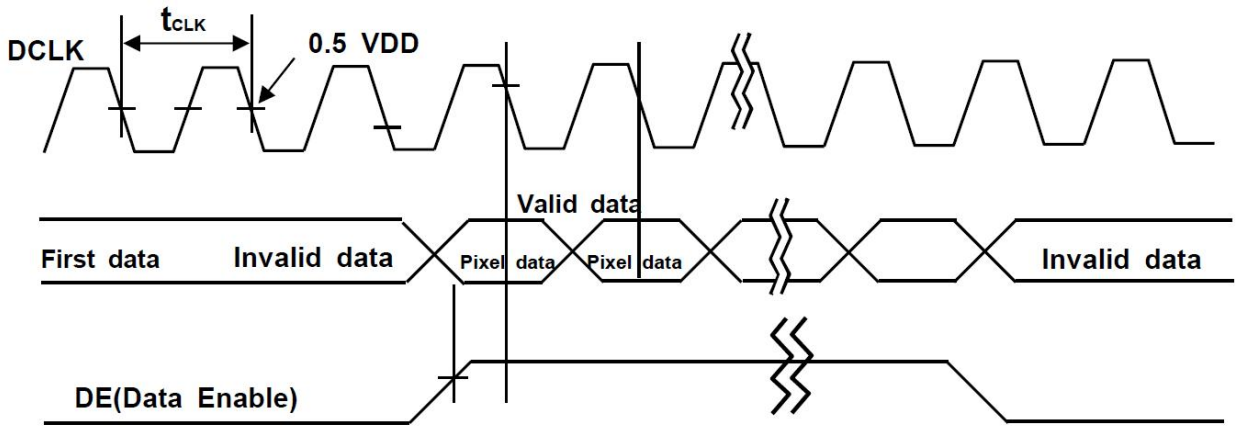
For 1280RGBx800 DE mode

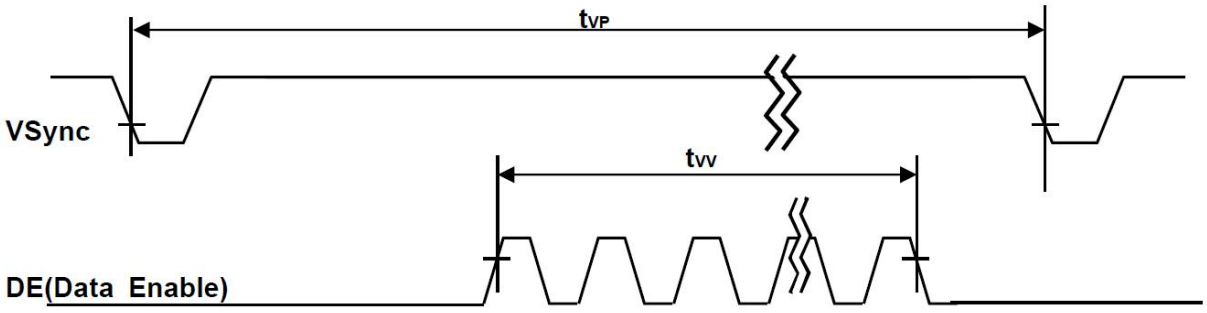
Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
DCLK frequency @Frame rate=60Hz (LVDS)	F_{DCLK}	69.7	75	80.9	MHz
Horizontal display area	T_{HD}		1280		DCLK
HSYNC period time	T_H	1380	1440	1500	DCLK
HSYNC blanking	$T_{HBP}+T_{HFP}$	100	160	220	DCLK
Vertical display area	T_{VD}		800		H
VSYNC period time	T_V	842	838	872	H
VSYNC blanking	$T_{VBP}+T_{VFP}$	24	38	72	H

Note

1. DE Only Mode, While operation, DE signal should be have the same cycle. The input of HSYNC & VSYNC signal does not have an effect on normal operation.
2. Best operation clock frequency is 75Mhz.
3. Frequency] = [H Total] * [V Total] * [vertical Frame rate]
   H Total, V Total and Frame rate]should operate within the range between Frequency_Min and Frequency_Max
4. Except Best operation clock frequency, FOS(Flicker & Brightness & Crosstalk, Etc.) are not guaranteed.
5. Main frequency Max is 80.9Mhz MHz without spread spectrum

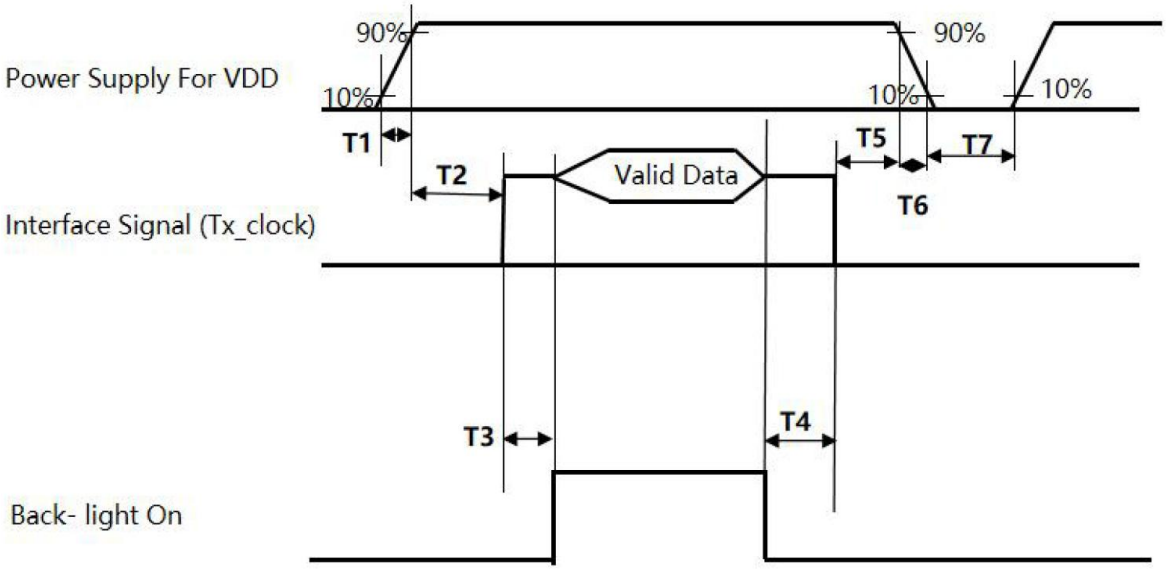
7.2 Timing Waveform





7.3 Power ON/OFF Sequence

To prevent a latch-up or DC operation of the Open Cell, the power on/off sequence shall b e as shown in below

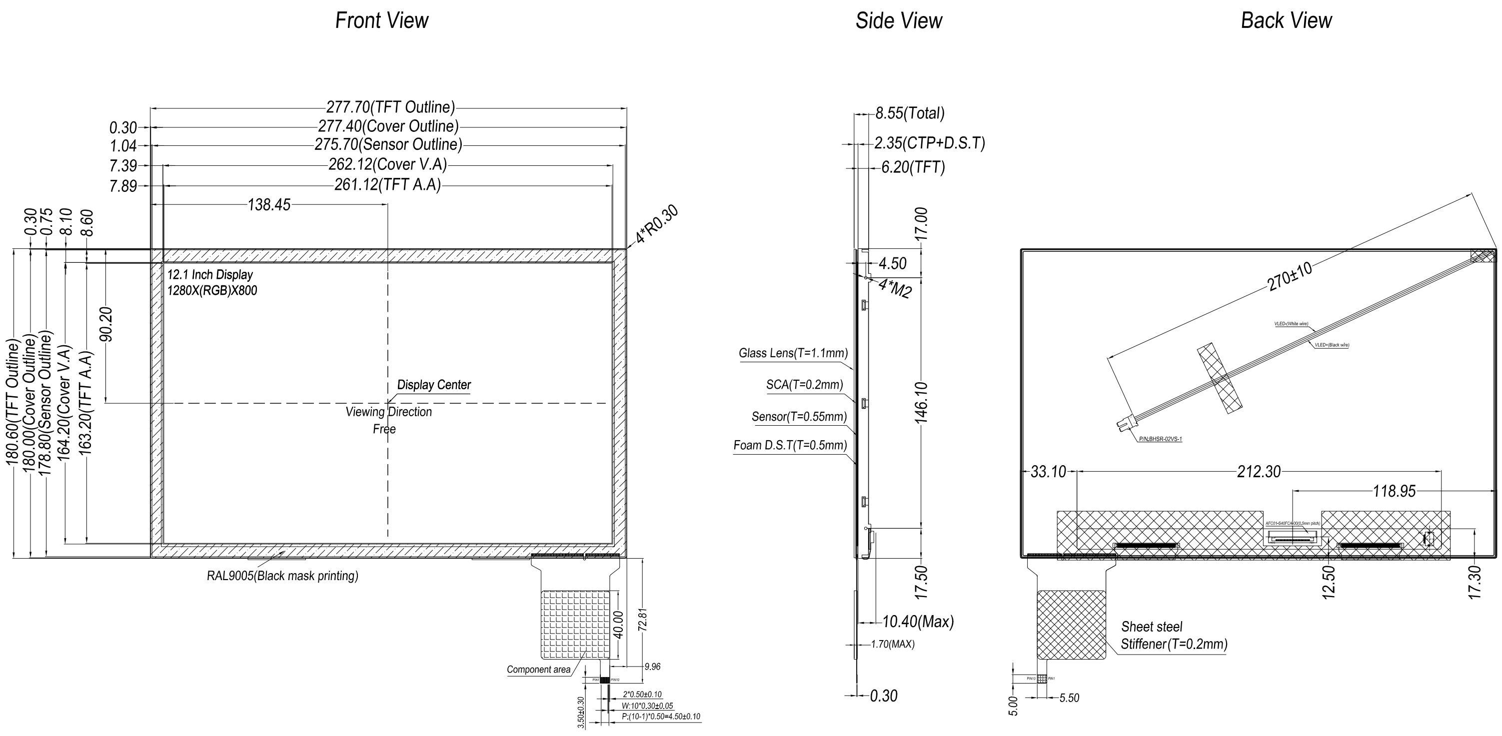


Parameter	Values			Units
	Min	Typ	Max	
T1	0.1	-	10	ms
T2	0.1	-	50	ms
T3	300	-	-	ms
T4	200	-	-	ms
T5	0.1	-	50	s
T6	0.1	-	10	ms
T7	500	-	-	ms

Note 1: Even though T1 is over the specified value, there is no problem if the rush current is within Spec.
Note 2: When the power supply VDD is 0V, keep the level of input signals on the low or high impedance;
※ Please avoid floating state of interface signal at invalid period.
※ When the power supply for LCD (VDD) is off, be sure to pull down the valid and invalid data to 0V.
Note 3: The T3 / T4 is recommended value, the case when failed to meet a minimum specification, abnormal display would be shown. There is no reliability problem.
Note 4: T6: Voltage of VDD must decay smoothly after power-off , there should be none re-bounding voltage. (customer system decide this value)
Note 5: T7 should be measured after the Module has been fully discharged between power off and on period

8. Outline Dimension

ISSUE	MODIFY DESCRIPTION	DATE
1.0	First Issue	2024.05.15



TFT ASSIGNMENT:

PIN	SYMBLE
1	NC
2	VDD
3	VDD
4	VDD
5	NC
6	GND
7	GND
8	Rin0-
9	Rin0+
10	GND
11	Rin1-
12	Rin1+
13	GND
14	Rin2-
15	Rin2+
16	GND
17	LVDS_CLK-
18	LVDS_CLK+
19	GND
20	Rin3-
21	Rin3+
22	GND
23	NC
24	NC
25	GND
26	NC
27	NC
28	GND
29	NC
30	NC
31	GND
32	GND
33	GND
34	NC
35	NC
36	NC
37	NC
38	NC
39	NC
40	NC

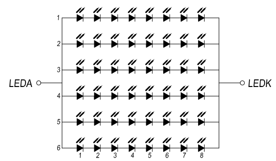
CTP ASSIGNMENT:

PIN	SYMBLE
1	USB_GND
2	USB_VDD_5.0V
3	USB_D-
4	USB_D+
5	I2C_GND
6	I2C_VDD_3.3V
7	I2C_RST
8	I2C_SCL
9	I2C_INT
10	I2C_SDA

B/L ASSIGNMENT:

PIN	SYMBLE
1	LEDA
2	LEDK

Display Type	Transmissive,Normally Black
Display Resolution	1280(RGB)X800
Viewing Angle	FREE
Controller/Driver	ILI2511(CTP)
Driving Voltage	3.3V(TFT)+3.3V(CTP_I2C)+5.0V(CTP_USB)
Operation Temperature	-20°C TO 70°C
Storage Temperature	-30°C TO 80°C
Backlight Speciality	48PCS LEDS,Vf=24V(TYP.),If=360mA
Remark	Surface hardness:≥6H; Structure type: G+G; CTP support I²C and USB interface; Use air bonding between TFT and CTP; Luminance: 800cd/m² All materials in the drawing comply with the ROHS



LED Diagram Circuit

TITLE:	LCM Outline		
PROJECT NO:	RK121BI05E-CT		
DESCRIPTION:	12.1 Inch TFT with high brightness+CTP		
GENERAL TOLERANCE: ±0.3			
Rocktech Displays Limited			
THIRD ANGLE PROJECTION			
	NAME	SIGN	DATE
DRAWN	Marvin Zhou		2024.05.15
CHECKED	Marvin Zhou		2024.05.15
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.