Rocktech Displays Limited

LCD Module Specification

Module P/N: RK123BY02E

Version: 1.0

Description : 12.3 inch TFT 1920*720 Pixels with LED backlight, All viewing angle, 1000 nits brightness

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Revision History

Date	Rev.	Page	Description
2023-10-18	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	304.50(W) x122.50(H) x6.60(D)	Without PCBA
Active Area	292.03mm(W)×109.51mm(H)	
Number of Pixels	1920(RGB)×720	
Dot Pitch	0.1521mm(W)×0.1521mm(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	-	3.9	V	
Backlight Forward Current	I_{LED}	-	-	25	mA	For each LED
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

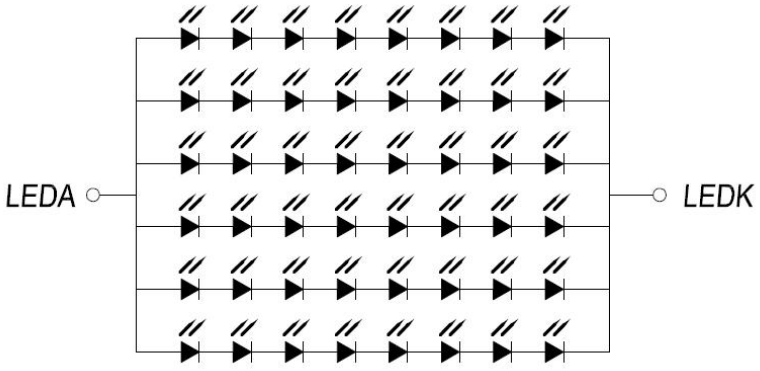
ITEM	Sym.	Min.	Typ	Max.	Unit	Remark
Supply Voltage	VDD	3.0	3.3	3.6	V	
Current of VDD	I_{VDD}	-	350	550	mA	

Notes :
1: AVDD should be set to satisfy the characteristic of LC .
2: VGH should be set to satisfy charging ratio of TFT pixel.
3 : VCOM should be adjusted to make the flicker level be minimum and optimize display quality.
4: Frame rate=60HZ

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

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	-		FIG.1
2)Module Luminance	L	900	1000	-	cd/m^2	FIG.1
3)Response time	Tr+Tf	-	30	34	ms	FIG.2
4)Viewing Angle	θ_T	80	88	-	Degree	FIG.3
	θ_B	80	88	-		
	θ_L	80	88	-		
	θ_R	80	88	-		
5)Chromaticity	Wx	0.256	0.296	0.336		
	Wy	0.294	0.334	0.374		
	Rx	-	-	-		
	Ry	-	-	-		
	Gx	-	-	-		
	Gy	-	-	-		
	Bx	-	-	-		
	By	-	-	-		

◆ Measurement System

Notes:

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

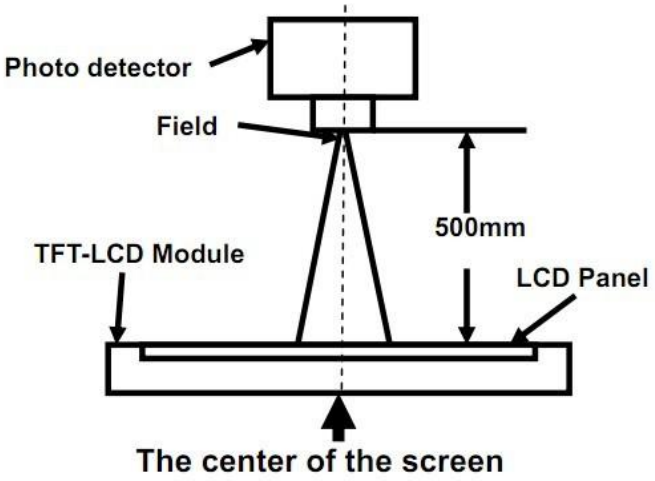
$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

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.

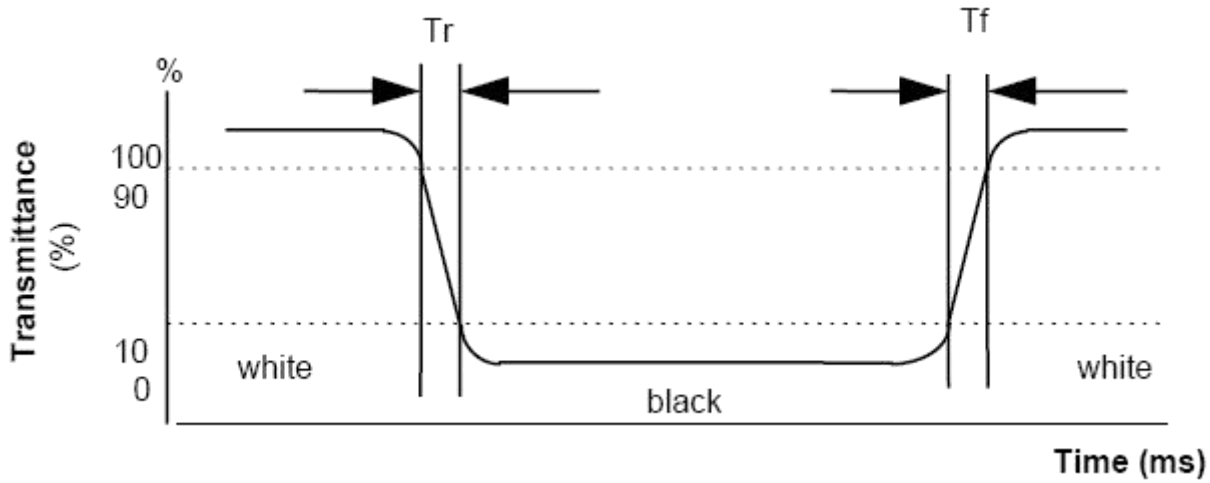
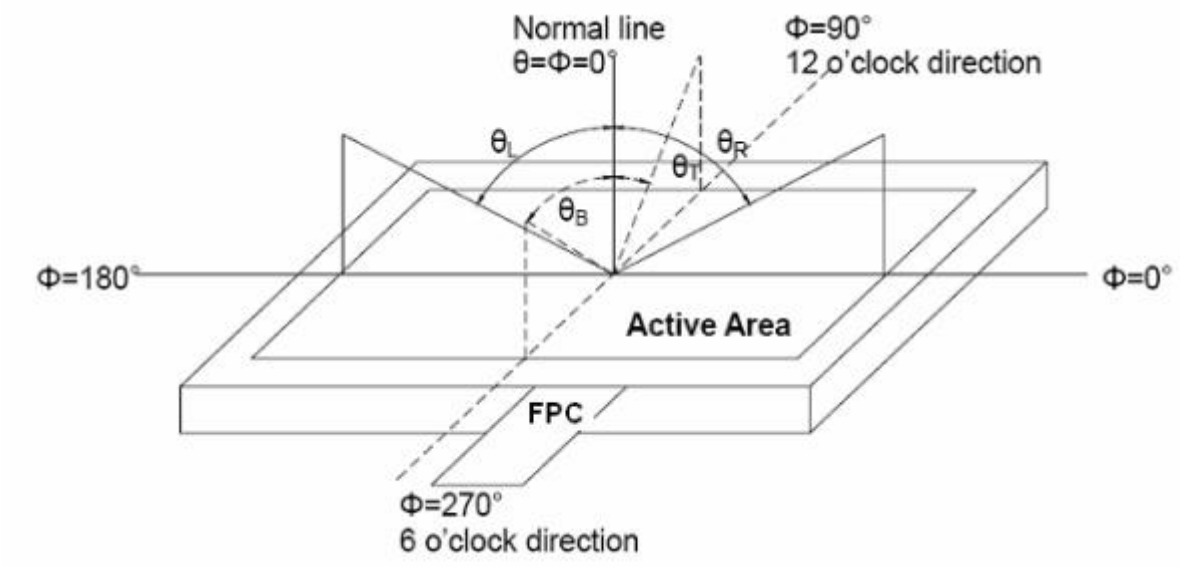
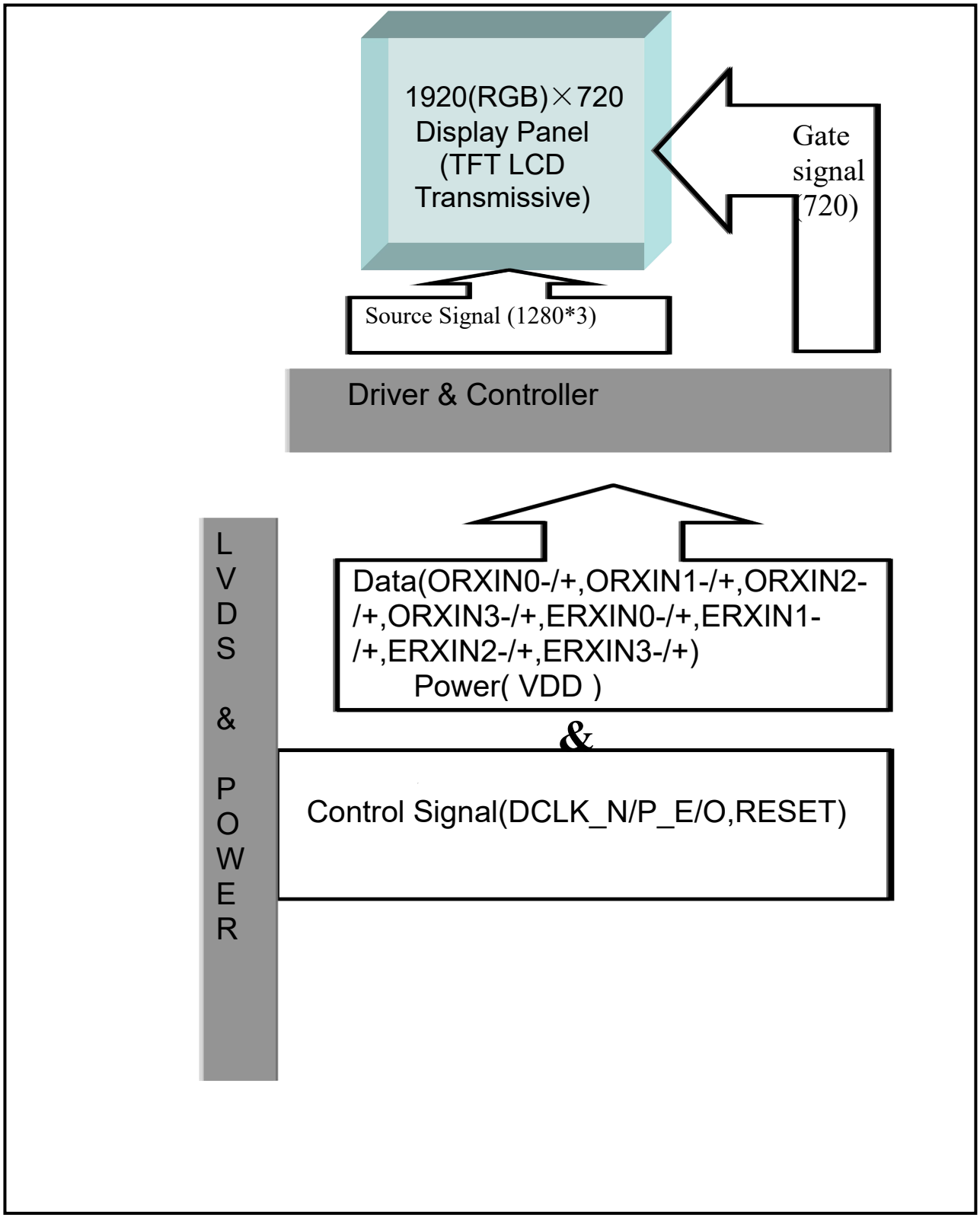


FIG. 3 The definition of Viewing Angle

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(LCD Connector P/N is 101049-205050)

PIN	SYMBOL	Description	Remark
1	**NC**	NO CONNECTION	BOE for VDDOTP
2	**GND**	Ground	
3	**GND**	Ground	
4	**GND**	Ground	
5	NC	NO CONNECTION	
6	VDD	Power Supply	
7	VDD	Power Supply	
8	VDD	Power Supply	
9	NC	NO CONNECTION	
10	NC	NO CONNECTION	BOE for ATREN
11	GND	Ground	
12	GND	Ground	
13	**ORXIN0-**	LVDS Receiver Signal(-)	
14	**ORXIN0+**	LVDS Receiver Signal(+)	
15	**GND**	Ground	
16	**ORXIN1-**	LVDS Receiver Signal(-)	
17	**ORXIN1+**	LVDS Receiver Signal(+)	
18	**GND**	Ground	
19	**ORXIN2-**	LVDS Receiver Signal(-)	
20	**ORXIN2+**	LVDS Receiver Signal(+)	
21	**GND**	Ground	
22	**ORXCLKIN-**	LVDS Receiver Signal(-)	
23	**ORXCLKIN+**	LVDS Receiver Signal(+)	
24	**GND**	Ground	

PIN	SYMBOL	Description	Remark
25	ORXIN3-	LVDS Receiver Signal(-)	
26	ORXIN3+	LVDS Receiver Signal(+)	
27	GND	Ground	
28	ERXIN0-	LVDS Receiver Signal(-)	
29	ERXIN0+	LVDS Receiver Signal(+)	
30	GND	Ground	
31	ERXIN1-	LVDS Receiver Signal(-)	
32	ERXIN1+	LVDS Receiver Signal(+)	
33	GND	Ground	
34	ERXIN2-	LVDS Receiver Signal(-)	
35	ERXIN2+	LVDS Receiver Signal(+)	
36	GND	Ground	
37	ERXCLKIN-	LVDS Receiver Signal(-)	
38	ERXCLKIN+	LVDS Receiver Signal(+)	
39	GND	Ground	
40	ERXIN3-	LVDS Receiver Signal(-)	
41	ERXIN3+	LVDS Receiver Signal(+)	
42	GND	Ground	
43	STBYB	STBYB Signal	L:Standby H:Normal
44	RESET	RESET Signal	L:Reset H:Normal
45	CSB	SPI Signal	
46	NC	NO CONNECTION	
47	SCL	SPI Signal	
48	SDA	SPI Signal	
49	NC	NO CONNECTION	
50	GND	Ground	

6.2 Backlight Pin Interface

Item	Terminal	Functions
1	LEDA	Power for backlight(Anode PIN)
2	LEDA	Power for backlight(Anode PIN)
3	LEDA	Power for backlight(Anode PIN)
4	NC	No Connection
5	NTC1	Thermistor
6	NTC2	Thermistor
7	NC	No Connection
8	LEDK	Power for backlight(Cathode PIN)
9	LEDK	Power for backlight(Cathode PIN)
10	LEDK	Power for backlight(Cathode PIN)

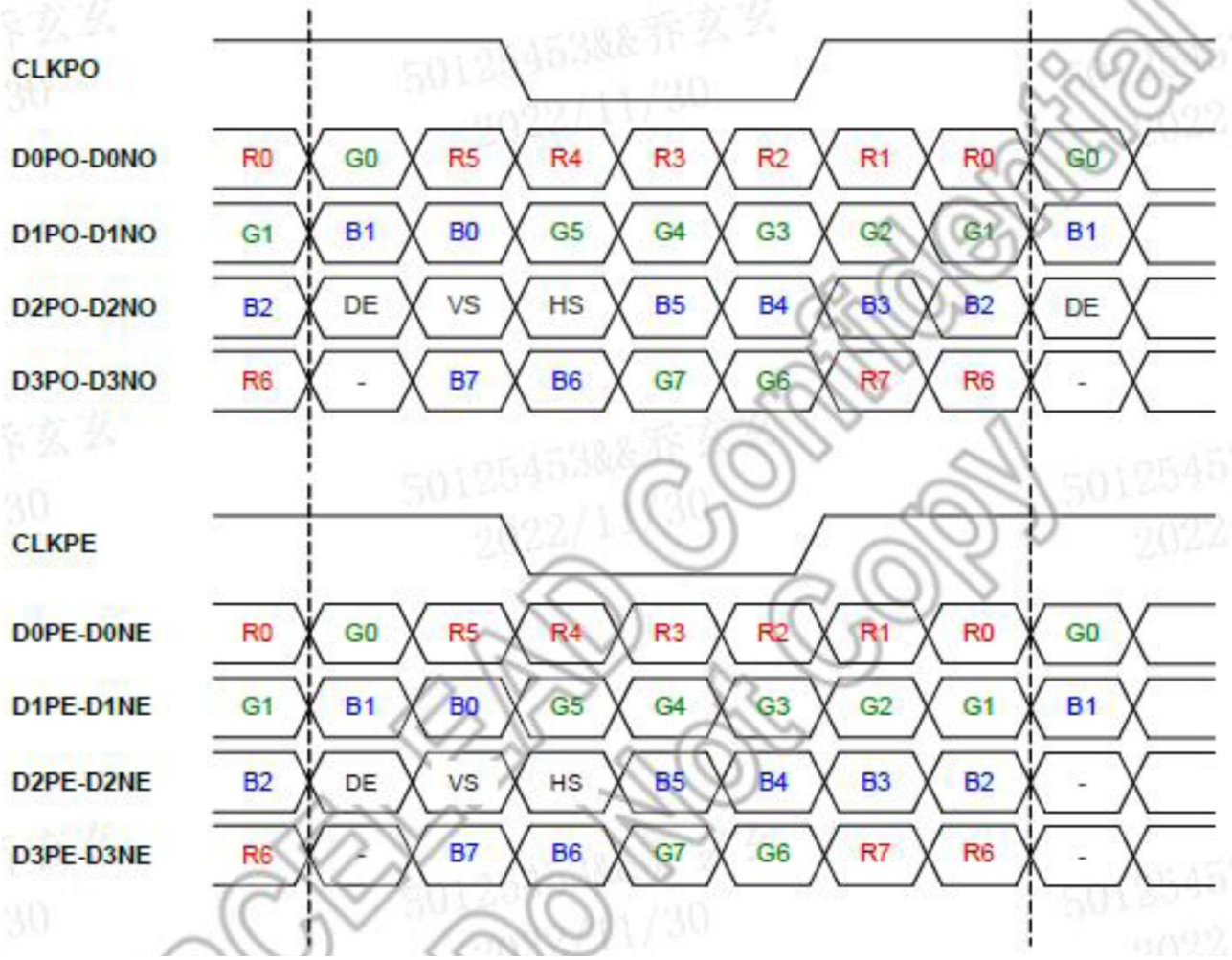
7.Timing Characteristics

7.1 Interface Characteristics and Timing Table(DE Mode)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Clock frequency	RxFCLK	43.1	45.7	70.1	MHz	Note1
Horizontal Display Area	thd		960		DCLK	
HS Period	th	989	1002	1248	DCLK	
HS Blanking	Thb+thfp		42		DCLK	
Vertical Display Area	tvd		720		TH	
VS Period	tv	727	760	936	TH	
VS Blanking	Tvbp+tvfp		40		TH	
Frame Rate	FR	60	60	60	Hz	
Clock period	TLVCYC	14.28			ns	
Clock high time	TLVCH		4		UI	
Clock low time	TLVCL		3		UI	
LVDS wake-up time	T_{ENLVDS}			150	us	

Note 1: Advise the customer to use the Typ. value

7.2 Data Input Format(2-Port LVDS Signals, VESA Format, 8-bit Mode)



Note:

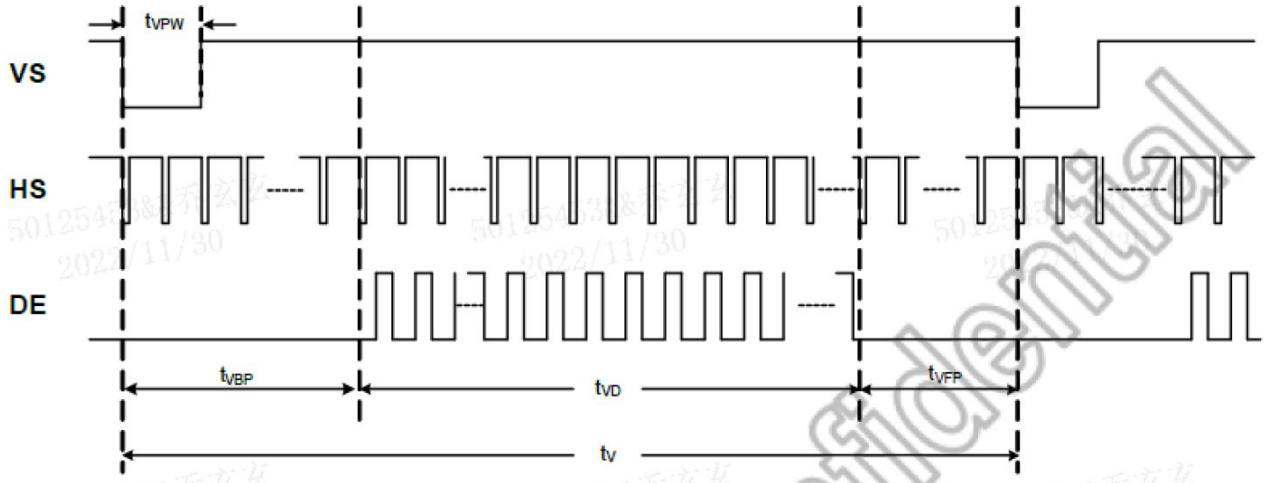
1, For 6 bit mode, MSB are R/G/B(5) and LSB are R/G/B(0)

2, For 8 bit mode, MSB are R/G/B(7) and LSB are R/G/B(0)

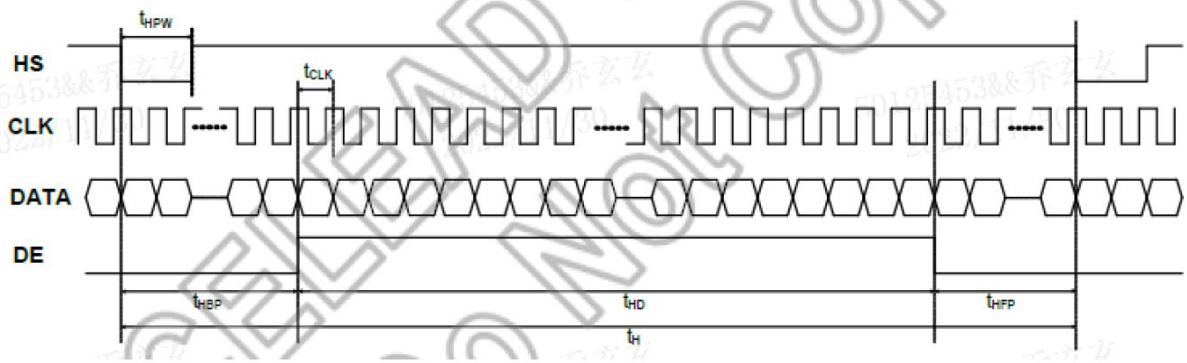
3, For single port LVDS only ODD port(CLKXO and DXXO) are used

7.3 Input Timing

Vertical input timing

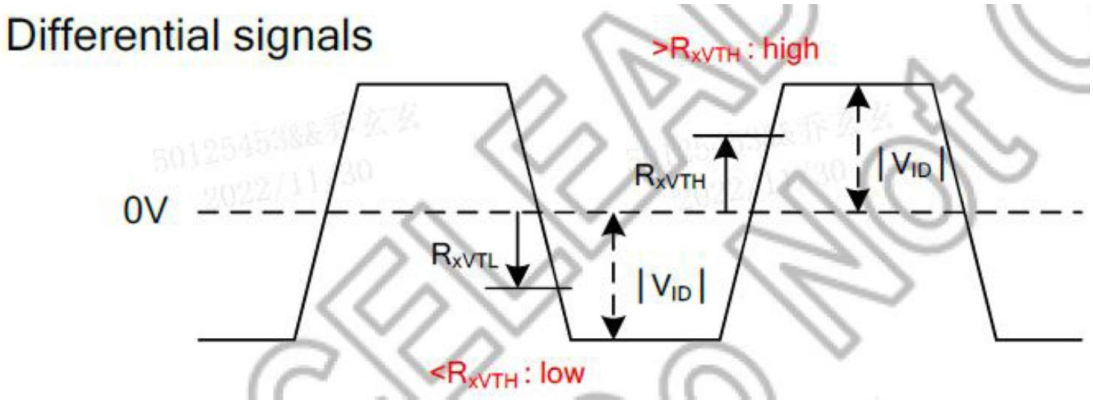


Horizontal input timing

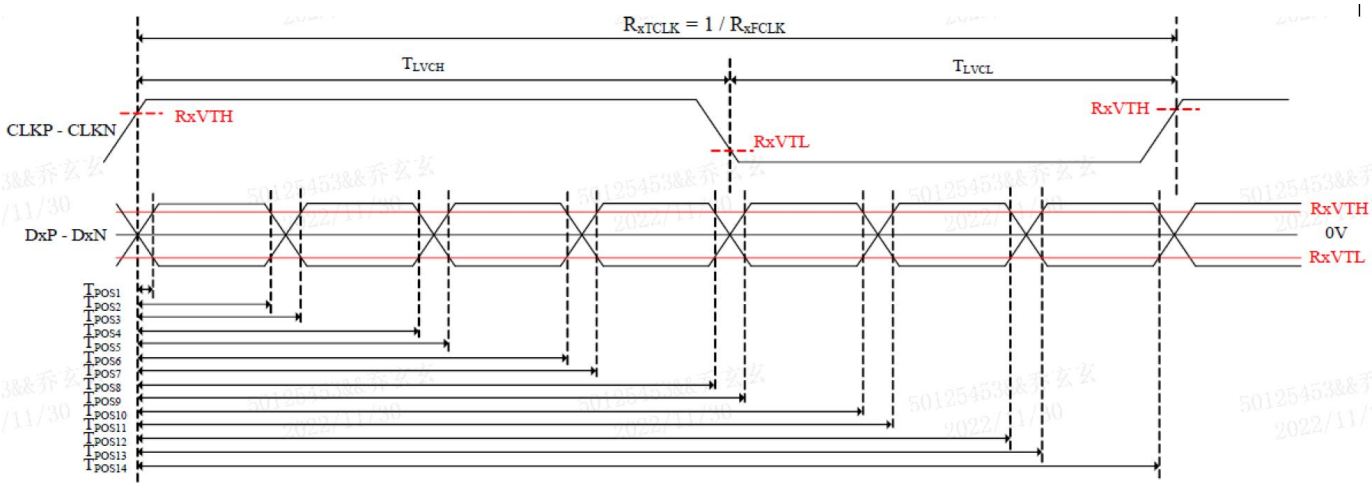


7.4 LVDS DC Characteristics

Parameter	Symbol	Min	Typ.	Max.	Unit	Conditions
Differential input high threshold voltage	R_{xVTH}			0.1	V	RxVCM = 1.2V
Differential input low threshold voltage	R_{xVTL}	-0.1			V	
Input voltage range (singled-end)	R_{xVIN}	0		VDD-1.2	V	
Differential input common mode voltage	R_{xVCM}	0.8	1.2	1.4	V	
Differential input voltage	$\|V_{ID}\|$	0.2	0.4	0.6	V	
Differential input leakage current	RV_{xliz}	-10		10	uA	

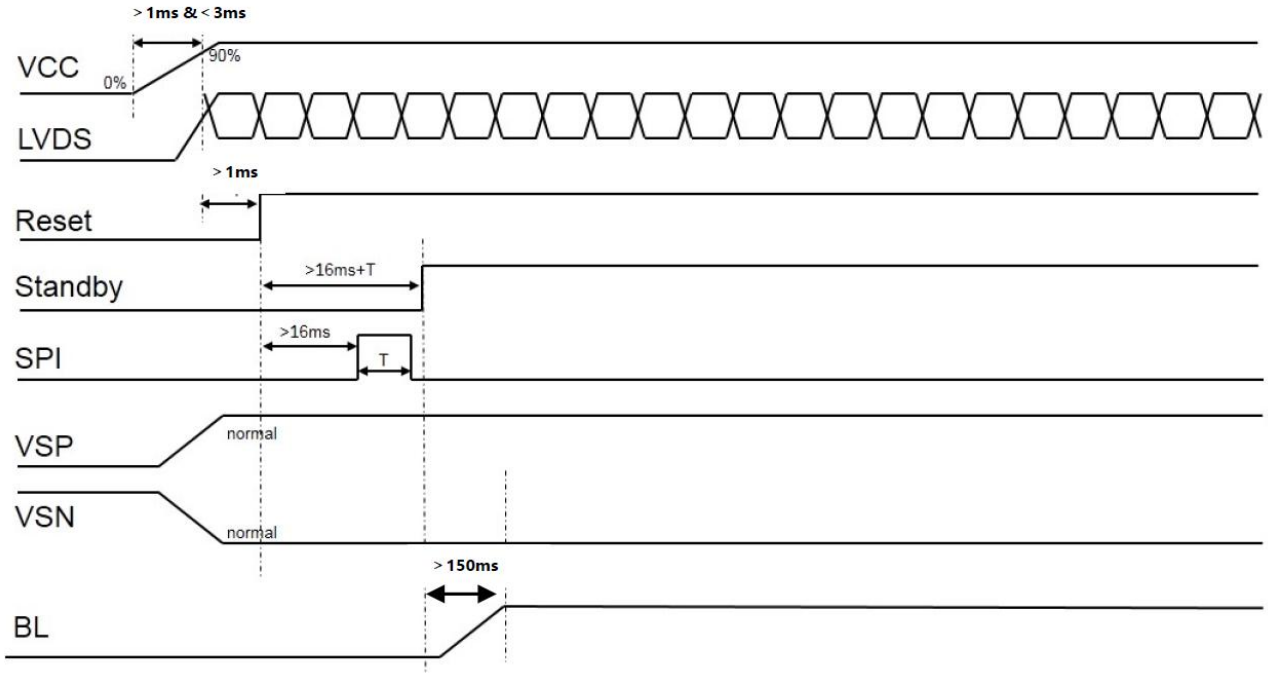


7.5 LVDS AC Characteristics

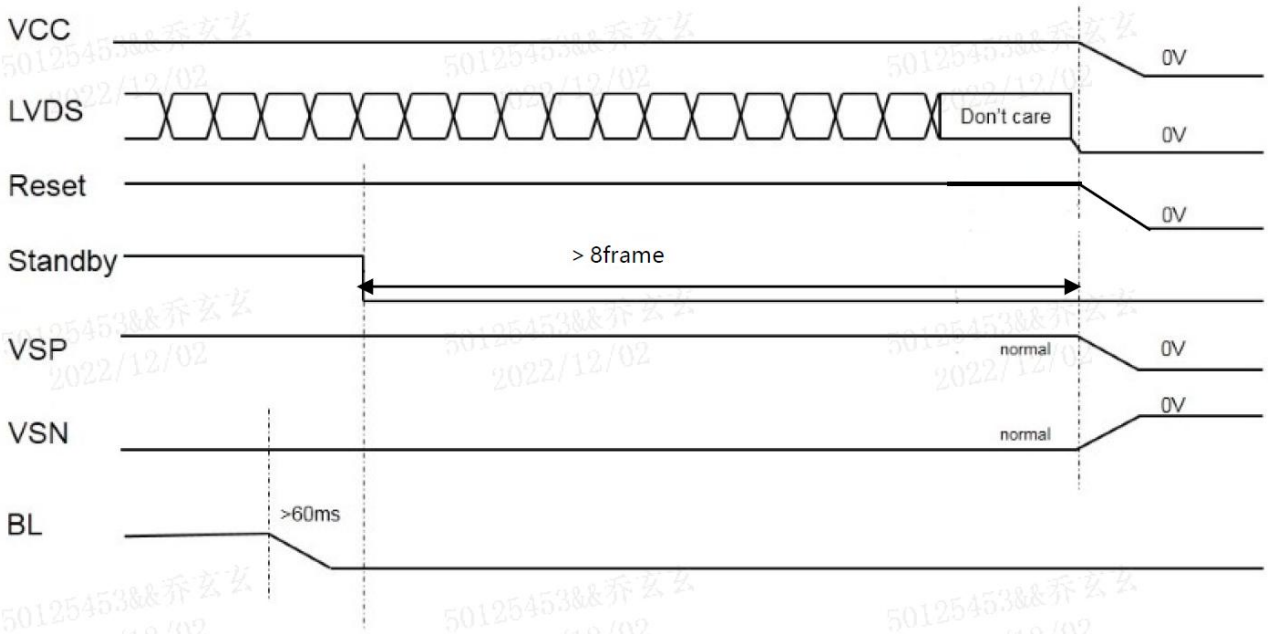


Parameter	Symbol	Min	Typ.	Max.	Unit
Clock Frequency	R_{xFCLK}	20		90	MHz
Clock Period	R_{xTCLK}	11.1		50	ns
1 data bit time	UI	-	1/7	-	R_{xTCLK}
Clock high time	T_{LVCH}		4		UI
Clock low time	T_{LVCL}		3		UI
Position 1	T_{POS1}	-0.25	0	0.25	UI
Position 2	T_{POS2}	0.75	-	1.25	UI
Position 3	T_{POS3}	0.75	1	1.25	UI
Position 4	T_{POS4}	1.75	-	2.25	UI
Position 5	T_{POS5}	1.75	2	2.25	UI
Position 6	T_{POS6}	2.75	-	3.25	UI
Position 7	T_{POS7}	2.75	3	3.25	UI
Position 8	T_{POS8}	3.75	-	4.25	UI
Position 9	T_{POS9}	3.75	4	4.25	UI
Position 10	T_{POS10}	4.75	-	5.25	UI
Position 11	T_{POS11}	4.75	5	5.25	UI
Position 12	T_{POS12}	5.75	-	6.25	UI
Position 13	T_{POS13}	5.75	6	6.25	UI
Position 14	T_{POS14}	6.75	-	7.25	UI
Input eye width	T_{EYEW}	0.5	-	-	UI
Input eye border	T_{EX}	-	-	0.25	UI
PLL wake-up time	TenPLL			150	us

7.3 Power ON/OFF Sequence

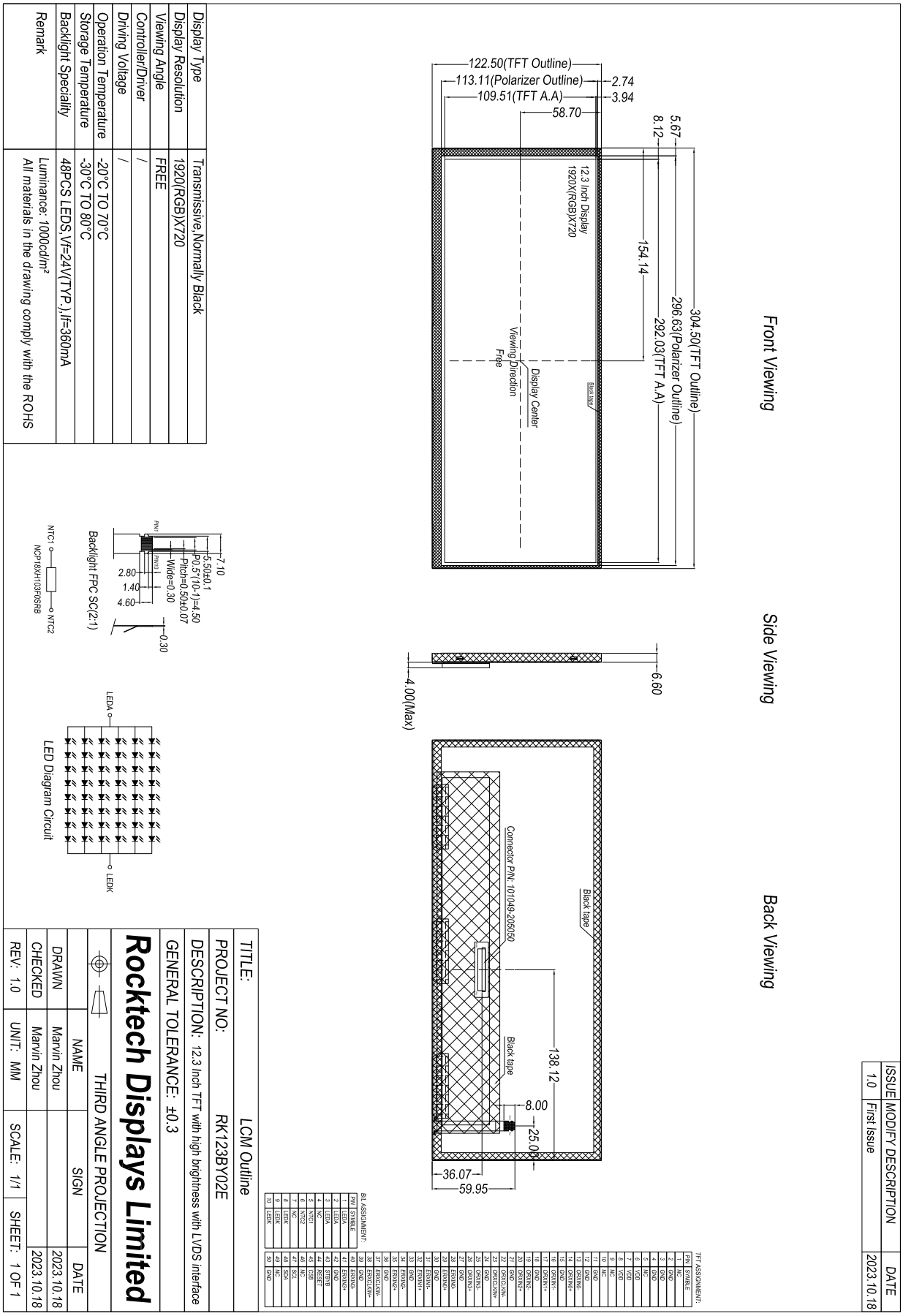


POWER ON SEQUENCE



POWER OFF SEQUENCE

8.Outline Dimension



Display Type	Transmissive,Normally Black
Display Resolution	1920(RGB)X720
Viewing Angle	FREE
Controller/Driver	/
Driving Voltage	/
Operation Temperature	-20°C TO 70°C
Storage Temperature	-30°C TO 80°C
Backlight Speciality	48PCS LEDS,Vf=24V(TYP.),If=360mA
Remark	Luminance: 1000cd/m² All materials in the drawing comply with the ROHS

ISSUE	MODIFY DESCRIPTION	DATE
1.0	First Issue	2023.10.18

TFT ASSIGNMENT:

PIN	SYMBLE
1	NC
2	GND
3	GND
4	GND
5	NC
6	VDD
7	VDD
8	VDD
9	NC
10	NC
11	GND
12	GND
13	DRXN0-
14	DRXN0+
15	GND
16	DRXN1-
17	DRXN1+
18	DRXN2-
19	DRXN2+
20	GND
21	GND
22	DRXCLKN-
23	DRXCLKN+
24	GND
25	DRXN3-
26	DRXN3+
27	GND
28	DRXN4-
29	DRXN4+
30	GND
31	ERXN1-
32	ERXN1+
33	GND
34	ERXN2-
35	ERXN2+
36	GND
37	ERXCLKN-
38	ERXCLKN+
39	GND
40	ERXN3-
41	ERXN3+
42	GND
43	STBYB
44	RESET
45	NTC1
46	NC
47	SCL
48	SDA
49	NC
50	GND

BL ASSIGNMENT:

PIN	SYMBLE
1	LEDA
2	LEDA
3	LEDA
4	NC
5	NTC2
6	NC
7	NC
8	LEDK
9	LEDK
10	LEDK

TITLE:	LCM Outline
PROJECT NO:	RK123BY02E
DESCRIPTION:	12.3 Inch TFT with high brightness with LVDS interface
GENERAL TOLERANCE:	±0.3

Rocktech Displays Limited

THIRD ANGLE PROJECTION

	NAME	SIGN	DATE
DRAWN	Marvin Zhou		2023.10.18
CHECKED	Marvin Zhou		2023.10.18
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.