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Specification

RFQ Number: YX-TFTRFQ-ZX-20200416005

Tianma Part Number: TM070RDSP15-00

Description: 7 inch WVGA

	Department	Name	Signature
Tianma	Integral Project Manager	Zhixian Li	
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Customer			

REVISION RECORD

Version	Page	Revision Items	Name	Date
V1.0		Initial release	Zhixian Li	2020.06.19

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1. Features

This is a 7.0 inch Amorphous-TFT-LCD (Thin Film Transistor Liquid Crystal Display) Normally Black technology module, which is composed of a TFT-LCD panel, LCD Driver IC with T-con integrated, FPC and a LED backlight unit. It is designed for Automotive and other high reliability electronic products and complies with the RoHS environmental protection directive.

2. General Specifications

Feature		Spec
Display Spec.	Size	7.0 inch
	Resolution	800(RGB) x 480
	Interface	RGB 3*8bits TTL
	Aspect Ratio	15:9
	Color Depth	16.7M
	Technology Type	a-Si
	Pixel Pitch (mm)	0.1905x0.1905
	Pixel Configuration	RGB vertical Square pixel
	Display Mode	Normally black
	Surface Treatment(Up Polarizer)	Anti-Glare(3H)
	Gray Scale Inversion Direction	Free
	LCM (W x H x D) (mm)	165.1x108.44x 7.2
	Mechanical Characteristics	Active Area(mm)
With /Without touch panel		Without touch panel
Weight (g)		TBD
LED Numbers		16 LEDs

Note 1: The height dimension does not include the length of FPC.

Note 2: Dimension is for reference, not including fixing features.

Note 3: LCM weight tolerance:±5%.

3. Input/output Terminals

3.1 CN1 pin assignment

Recommended connector: FH28-40S-0.5SH(HIROSE)

No	Symbol	I/O	Description	Remark
1	GND	P	Tianma used,customer connect to GND	
2	B7	I	Blue data(MSB)	
3	B6	I	Blue data	
4	B5	I	Blue data	
5	B4	I	Blue data	
6	B3	I	Blue data	
7	B2	I	Blue data	
8	B1	I	Blue data;(connect to GND for 6 bit)	
9	B0	I	Blue data(LSB) ;(connect to GND for 6 bit)	
10	GND	P	Ground	
11	G7	I	Green data(MSB)	
12	G6	I	Green data	
13	G5	I	Green data	
14	G4	I	Green data	
15	G3	I	Green data	
16	G2	I	Green data	
17	G1	I	Green data;(connect to GND for 6 bit)	
18	G0	I	Green data(LSB) ;(connect to GND for 6 bit)	
19	GND	P	Ground	
20	R7	I	Red data(MSB)	
21	R6	I	Red data	
22	R5	I	Red data	
23	R4	I	Red data	
24	R3	I	Red data	
25	R2	I	Red data	
26	R1	I	Red data;(connect to GND for 6 bit)	
27	R0	I	Red data(LSB) ;(connect to GND for 6 bit)	
28	GND	P	Ground	
29	DCLK	I	Data clock, latch the data at falling edge.	
30	GND	P	Ground	
31	DE	I	Data enable	
32	GND	P	Ground	
33	NC	N	Tianma used, please don't connect	

34	STBYB	I	L (active) standby mode	
35	UDLR	I	Left , right,up,down scan direction control H: left→right, up→down L: right→ left; Down→up	Note3
36	DINT	I	6bit/8bit control : H:8bit L:6bit	
37	NC	N	Tianma used, please don't connect	
38	GND	P	Tianma used,customer connect to GND	
39	VCC	P	Power Supply	
40	VCC	P	Power Supply	

Table 3.1.1 Pin assignment for TFT interface

Note1: All of GND pins should be connected to system ground.

Note2: I/O definition.

I---Input, O---Output, P--- Power/Ground, N--- No connection, T---Test

Note3: Scan Direction Control Description

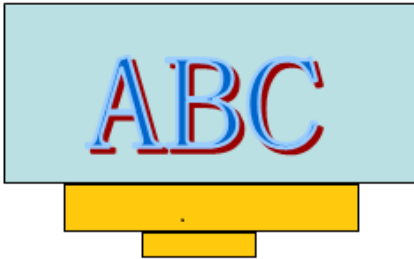

UDLR	Source output sequence and data order	Remark
H		Internal pull high resistor 175KΩ typ
L		

Figure 3.1.1 Scan direction Description

3.2 Pin assignment for backlight interface

Recommended Connector type: FH28-10S-0.5SH

No	Symbol	I/O	Description	Comment
1	A1	P	LED Anode	
2	NC	N	No connect	
3	A2	P	LED Anode	
4	NC	N	No connect	
5	NTC+	I/O	Thermistor +	
6	NTC -	I/O	Thermistor -	
7	NC	N	No connect	
8	C2	P	LED Cathode	
9	NC	N	No connect	
10	C1	P	LED Cathode	

Table 3.2.1 Pin assignment for backlight interface

I/O definition: P--- Power/Ground, N--- No connection, I---Input, O---Output

Note1: thermistor type: NCU18XH103F6SRB

Note2: All of GND pins should be connected to system ground.

4. Absolute Maximum Ratings

GND=0V, Ta = 25°C

Item	Symbol	Min	Max	Unit	Remark
Logic supply voltage	VCC	-0.3	+3.96	V	
Operating Temperature	Top	-30	+85	°C	Note1
Storage Temperature	Tst	-40	+95	°C	Note2
Digital I/O input signals	VI/O	-0.3	VCC+0.3	V	

Table 4.1.1 absolute maximum rating

Note1: The temperature is the surface temperature of module.

Note 2: If the voltage exceeds its absolute maximum ratings, the LCM may be damaged. If the LCM is operated with the absolute maximum ratings for a long time, its reliability may drop. During -40~-30C(ambient) , the operating performance is not guaranteed except no functional damage occur.

5. Electrical Characteristics

5.1 Driving TFT LCD Panel

GND=0V, Ta = 25°C

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Logic supply voltage	VCC	3.2	3.3	3.4	V	
Power consumption	P	--	440	660	mW	VCC=3.3V, Fclk=33.3Mhz, In white pattern
System Ground	GND	--	0	--	V	
Input High Voltage	VIH	0.7*VCC	--	VCC	V	
Input Low Voltage	VIL	0	--	0.3*VCC	V	
Output High level	VOH	VCC-0.4	--	--	V	
Output Low level	VOL	GND	--	GND+0.4	V	VSS=GND
Internal Pull low/high resistor(DINT)	R _{DINT}	200	350	850	K Ω	
Internal Pull low/high resistor(UDLR)	R _{UDLR}	100	175	425	K Ω	

Table 5.1.1 Operating voltage

5.2 Driving Backlight

Item	Symbol	Min	Typ	Max	Unit	Remark
Forward Current for each LED	I _F	--	100	110	mA	Note1
Forward Voltage	V _{BL}	24	24.8	25.6	V	I _F =100mA
Backlight Power Consumption	W _{BL}	4.32	4.96	5.12	W	I _F =100mA
Life Time	--	10,000	--	--	Hrs	Note 2 Note 3

Table 5.2.1 LED backlight characteristics

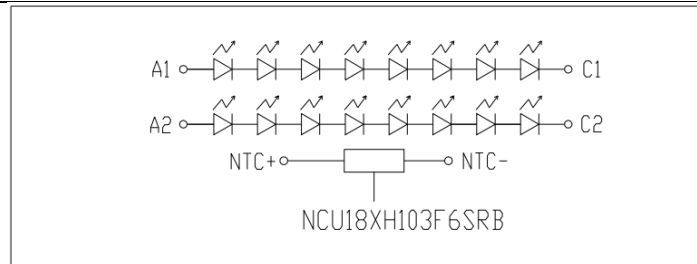


Figure 5.2.1 LED connection of backlight

Item	Value	Remarks
Part Number	NCU18XH103F6SRB	Murata
Resistance / Tolerance	10kΩ±1%	Ta=25°C
Permissible Operating Max. Current	0.31mA	Ta=25°C Note5

Table 5.2.2 Thermistor Description

Note1: IF is defined for one channel LEDs. There are a total of two LED channels in the backlight unit. While the LCM is operating, a stable forward current should be supplied. The Forward Current Max. value is only for inrush current.

Note2: IF =100mA.

Note3: Optical performance should be evaluated at Ta=25°C only. If the LEDs are driven at high current or at high ambient temperature & in high humidity environment, the lifetime of the LEDs will be reduced. Operating lifetime means the brightness will decrease to 50% of the original brightness.

Note4: An NTC thermistor is included in the LED circuit. It is used to measure the LED temperature and is located in the LED circuit on the backlight FPC.

Note5: To reduce the influence of NTC self-heating and improve the measurement accuracy, suggest the operating current of NTC is 0.031mA.

Note6: When operating at high temperature, NTC resistance should not be below 1.170kohm

TM070RDHP10-03 Derating Test

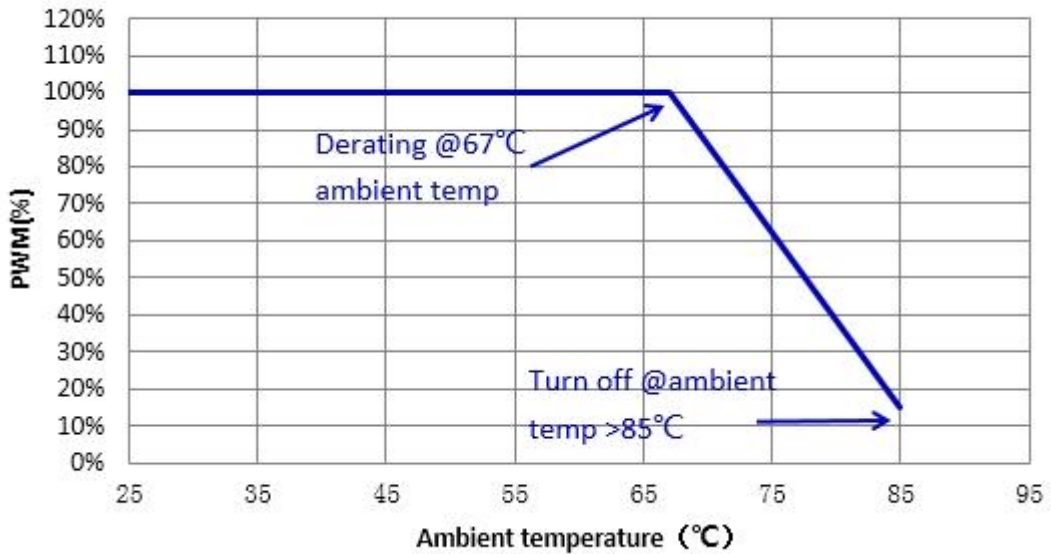


Figure 5.2.2 PWM vs. Ambient Temperature(for reference only)

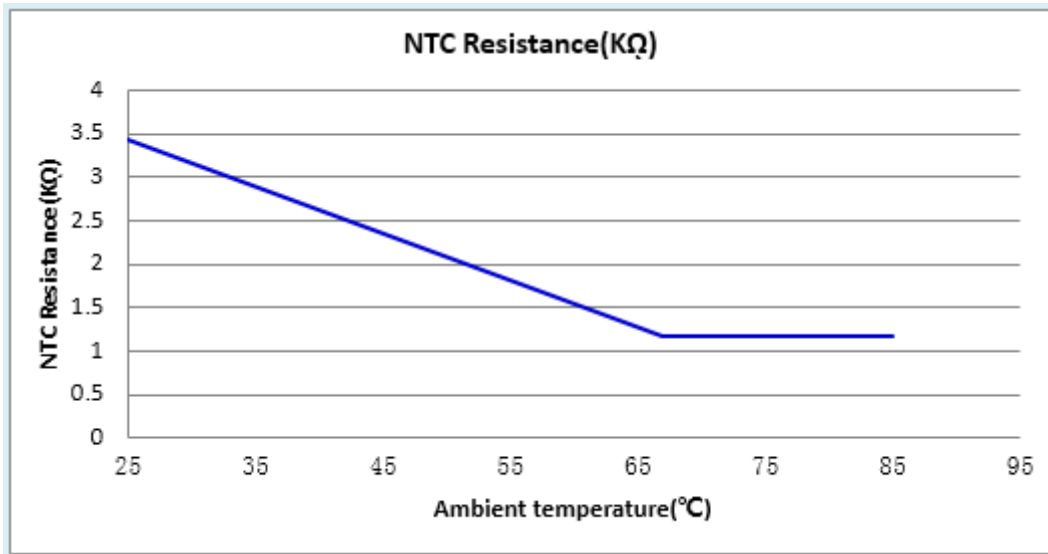


Figure 5.2.3 NTC vs. Ambient Temperature(for reference only)

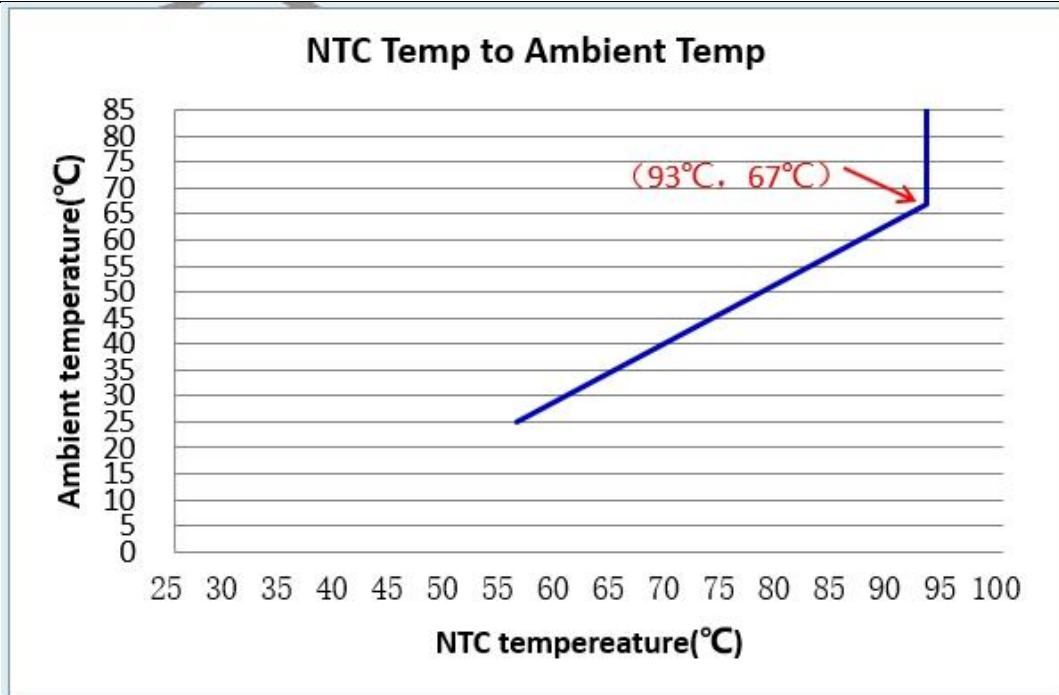


Figure 5.2.4 NTC Temperature vs. Ambient Temperature(for reference only)

5.3 Recommended Power ON/OFF Sequence

(1) Power on Sequence

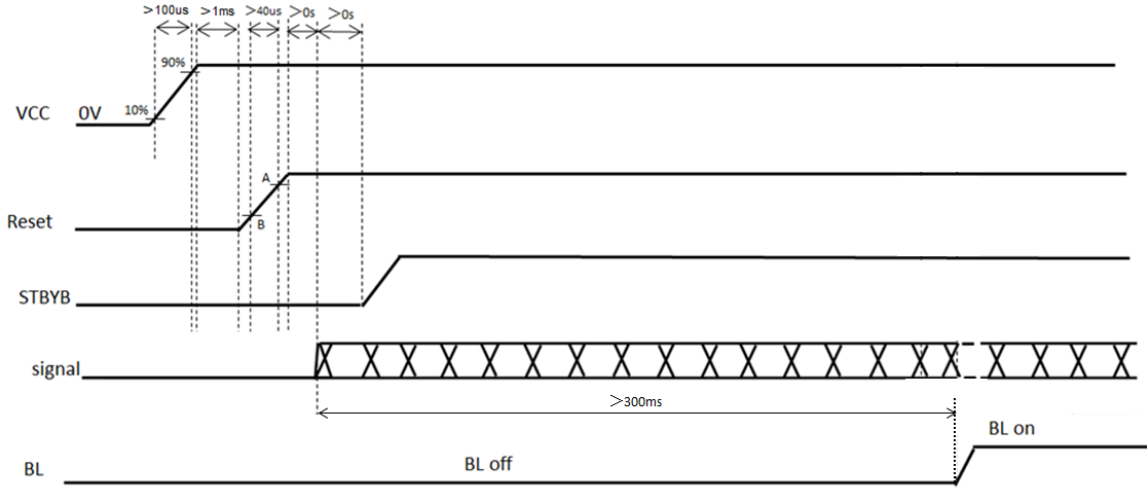


Figure 5.3.1 Power on Sequence

(2) Power off Sequence

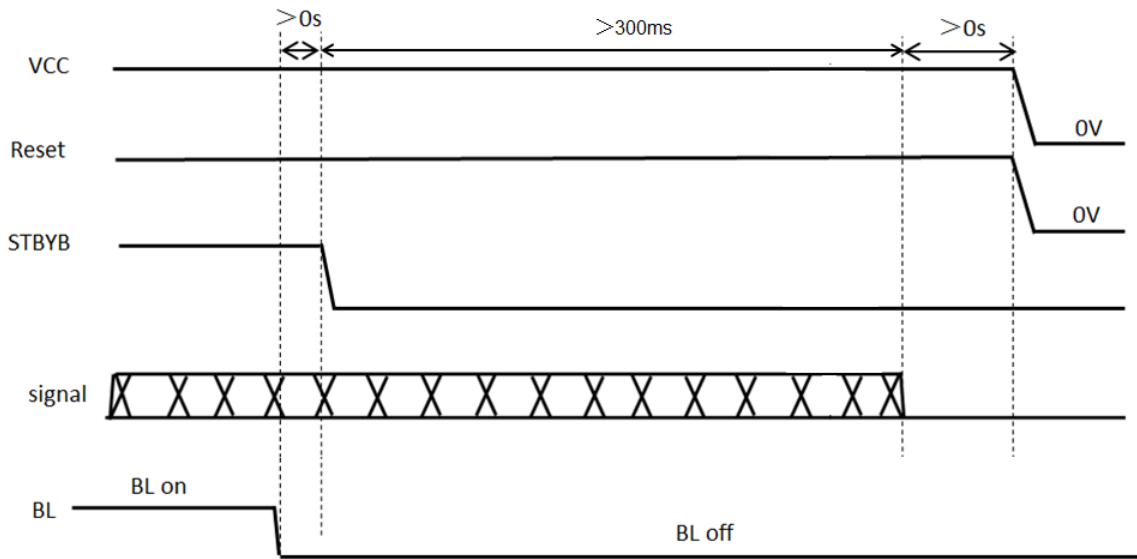


Figure 5.3.2 Power off Sequence

(3) Power off to power on Sequence

After power off, the next power on must be >300ms

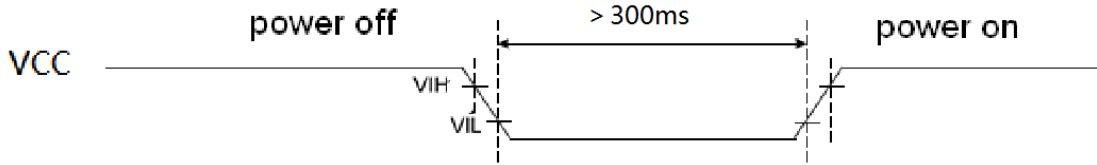


Figure 5.3.3 Power off to power on Sequence

Note1: The low level of these signals and analog powers are GND level.

Note2: All of the power and signals should be kept at GND level before power on.

If there are residual voltages on them, the LCD might not work properly.

5.4 LCD Module Block Diagram

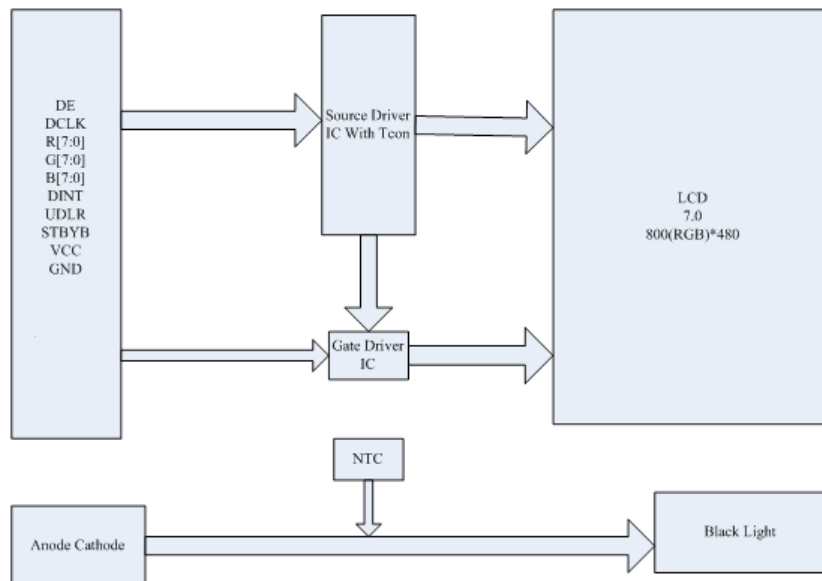


Figure 5.4.1 LCD Module Block Diagram

6. Timing Characteristics

6.1 RGB 24bits Interface Timing Characteristics

- Vertical

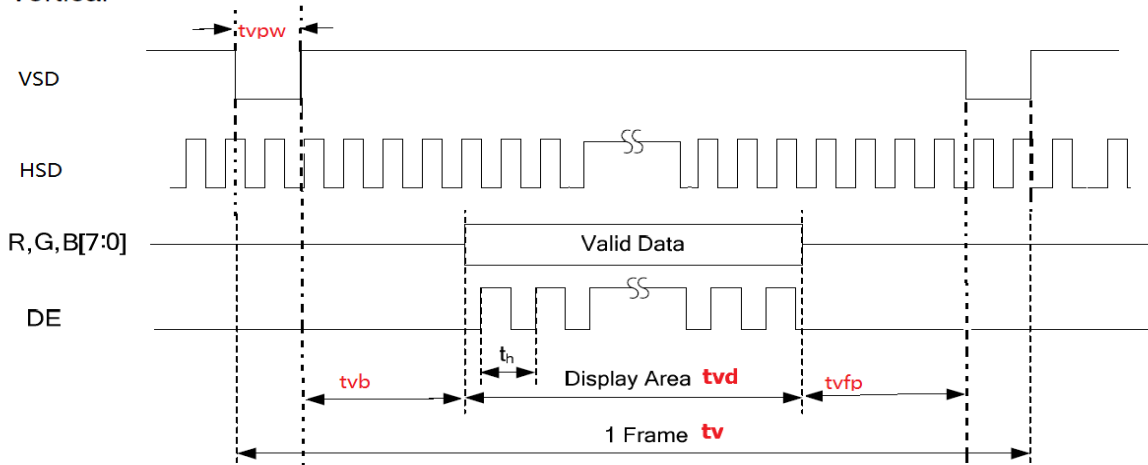


Figure 6.1.1 Vertical input timing at DE mode

- Horizontal

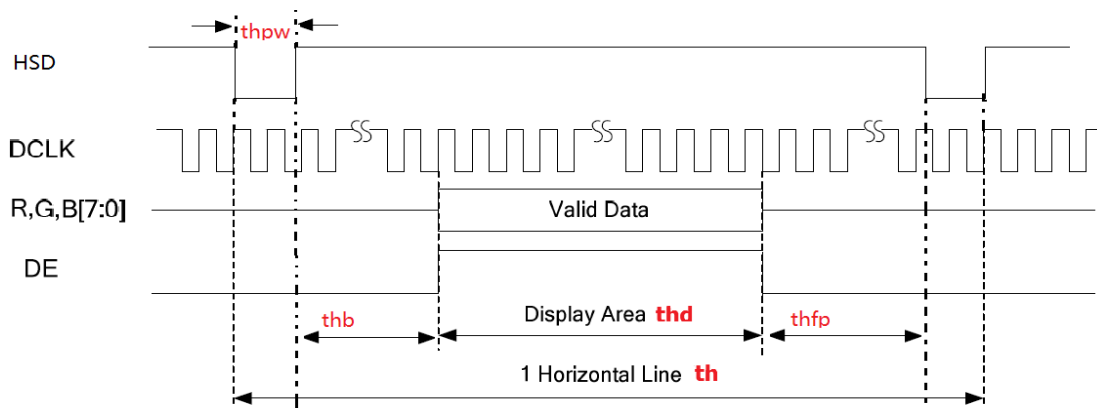


Figure 6.1.2 Horizontal input timing at DE mode

Parameter	Symbol	Min.	Typ.	Max.	Unit	REMARKS
Clock Frequency	fdck	20	27.2	50	MHz	
Horizontal valid data	Thd	--	800	--	clocks	
1 horizontal line	Th	--	908	1178	clocks	
HSD pulse width	Thpw	--	1	87	clocks	
HSD Back Porch	Thb	--	30	39	clocks	
HSD Front Porch	Thfp	--	77	252	clocks	
Vertical valid data	Tvd	--	480	--	Th	
1 vertical field	Tv	-	501	606	Th	
VSD Pulse width	Tvpw	--	1	3	Th	
VSD Back Porch	Tvb	--	12	29	Th	
VSD Front Porch	Tvfp	--	8	94	Th	
V Frequency	fv	48	60	--	Hz	Note

Table 6.1.1 RGB 24bits interface timing

Note: The minimum value of V frequency setting is 48Hz, and the optimal value is 60Hz.

6.2 AC electrical characteristics

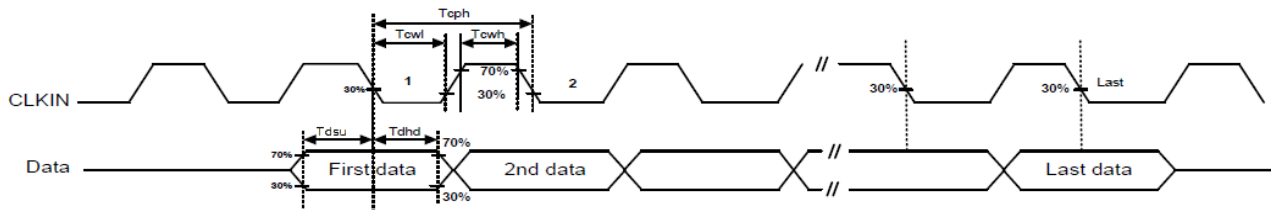


Figure 6.2.1 AC electrical characteristics

Parameter	Symbol	Min	Typ	Max	Unit
CLK pulse width	Tcw	40%		60%	Tchp
Data set-up time	Tdsu	8			ns
Data hold time	Tdhd	8			ns

Table 6.2.1 AC electrical characteristics

7. Optical Characteristics

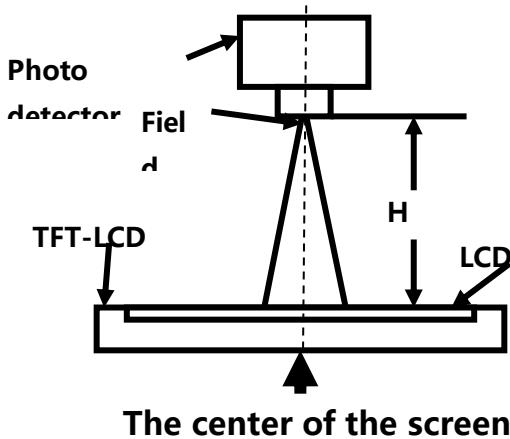
Item	Symbol	Condition	Min	Typ	Max	Unit	Remark	
View Angles	θT	CR≥10	80	88	--	Degree		
	θB		80	88	--			
	θL		80	88	--			
	θR		80	88	--			
Contrast Ratio	CR	25°C Perpendicular	800	1000	--	--	Note3 Note8	
		-30~85°C Perpendicular	50% value of 25°C	--	--			
Response Time	T _{ON+} T _{OFF}	25°C	--	--	25	ms	Note4	
	T _{ON+} T _{OFF}	-20°C	--	--	200			
	T _{ON+} T _{OFF}	-30°C	--	--	350			
Chromaticity	White	Backlight is on (25°C) perpendicular	x	0.259	0.299	0.339		Note5
			y	0.276	0.316	0.356		
	Red		x	0.581	0.621	0.661		
			y	0.292	0.332	0.372		
	Green		x	0.277	0.317	0.357		
			y	0.589	0.629	0.669		
	Blue		x	0.113	0.153	0.193		
			y	0.022	0.062	0.102		
Uniformity	White	25°C perpendicular	70	80	--	--	Note6	
NTSC		25°C perpendicular	65	70	--	%	Note5	
Reflection	SCI	25°C	--	--	6.5	%	ASTM E1164	
Gamma	γ	VESA standard Perpendicular	2	2.2	2.4	--		
Luminance	L	perpendicular	800	1000	--	cd/m ²	Note7	
Flicker		50% gray pattern					JEITA Method	

Test Conditions:

1. I_{BL}=100mA*2=200mA, the ambient temperature is 25°C.
2. The test systems refer to Note 1 and Note 2.

Note 1: Definition of optical measurement system.

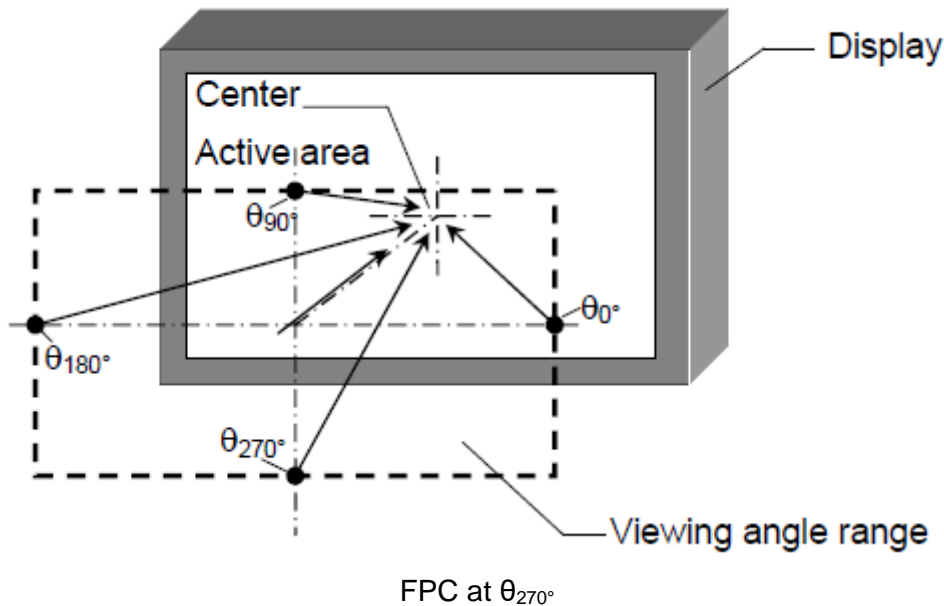
The optical characteristics should be measure in dark room. After 5 Minutes operation, the optical properties are measure at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.



Item	Photo detector	Field	High
Contrast Ratio	SR-3	1°	H=500m m
Luminance			
Chromaticity			
Lum Uniformity			
Response Time	LCD-5200/DM S	3mm	H=200m m
Reflectivity	CM2600/CM-3 600	--	--

Note 2: Definition of viewing angle range and measurement system.

Viewing angle is measure at the center point of the LCD by EZ-Contrast or similar device.



Note 3: Definition of the contrast ratio

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD is on the "White" state}}{\text{Luminance measured when LCD is on the "Black" state}}$$

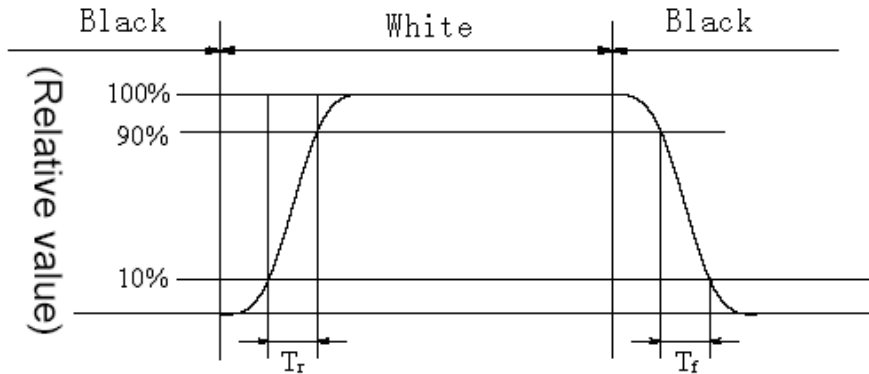
“White state “: The state is that the LCD display 100% white pattern.

“Black state”: The state is that the LCD display 0% white pattern.

Note 4: Definition of Response time

The temperature condition is ambient temperature.

The response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time (T_{ON}) is the time between photo detector output intensity changed from 10% to 90%. And fall time (T_{OFF}) is the time between photo detector output intensity changed from 90% to 10%. Refer to below



Note 5: Definition of color chromaticity(CIE1931)

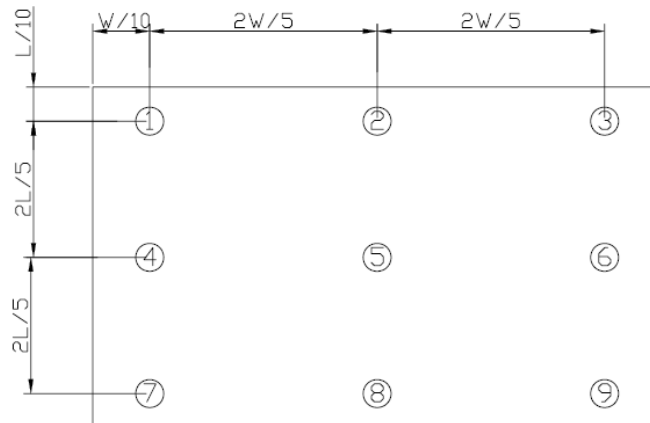
Color coordinates measured at center point of LCD.

Note 6: Definition of Luminance Uniformity

Luminance Uniformity (U) = L_{min} / L_{max}

L_{max} : The measured Maximum luminance of all measurement position.

L_{min} : The measured Minimum luminance of all measurement position.



Note 7: Definition of Luminance

Measure the luminance of white state at the center point.

Note 8: Contrast ratio against temperature ,CR defines the allowed contrast reduction at the defined temperature based on the CR at room temperature.

For example: $CR = (CR@25^{\circ}C - CR@-30^{\circ}C) / CR@25^{\circ}C \times 100\%$

8. Reliability Test

No	Test Item	Condition	Remarks
1	High Temperature Storage	95°C 500H RH≤45% Restore 2H at 25°C non-operation	Note1, Note2, Note4
2	Low Temperature Storage	-40°C±3°C 500H Restore 2H at 25°C non-operation	Note1, Note2, Note4
3	High Temperature Operation	85°C±3°C 500H Restore 2H at 25°C Operation	Note1, Note2, Note4
4	Low Temperature Operation	-30°C±3°C 500H Restore 2H at 25°C Operation	Note1, Note2, Note4
5	High Temperature & Humidity Operation	60°C±3°C, 90±2%RH 500H Restore 2H at 25°C Operation	Note1, Note2, Note4
6	Thermal Shock	<-30°C(30min)>→ change(30s)<→+<85°C(30min)> 200cycle non-operation	Note1, Note2, Note4
7	ESD	330pF/330Ω, Direct discharge: Contact discharge: ±4 Kv,class A Air discharge: ±8 Kv,class B ±15 Kv,class C Indirection discharge: Contact discharge:±8 Kv,class B ±15 Kv, class C	Note1, Note2, Note3, Note5
8	Mechanical Shock Test	100 x 9.8m/s ² ,t=6ms,XYZ directions, Half sin curve, [non-operating],each directions 3 times	Note1
9	Vibration Test	Frequency: 8 - 33.3 Hz, Total amplitude: 1.3mm Frequency: 33.3 - 400 Hz, Acceleration: 29.4 m/s ² sweep time: 15 minutes 2 hours each for X and Z directions, 4 hours for Y direction (total 8 hours) non-operation	Note1

10	Image Sticking	1. Power the unit with chess board pattern (10x6) for 1 hr at +65°C 2. Entire screen is then switched to an all grey 50% pattern 3. observation time: 5min; 4. Viewing Angle: H : 0°±20° and V: 0°±10° 5. Criteria : visible by a closer look, invisible by 60cm distance and viewing angle	
11	Vibration (with carton)	2~12~100~300Hz 0.0002~0.01~0.01~0.00001g2/Hz 3 axes (x/y/z) 30minutes/axis	Note1
12	Drop (with carton)	Height: 60cm 1 corner, 3 edges, 6 surfaces	Note1

Note1: After completion of the test, the sample shall be free from the following defects:

- 1) Air bubble in the LCD
- 2) Seal leak
- 3) Non-display
- 4) Missing segments
- 5) Glass crack

Note2: Use sample for only one reliability test.


Note3: In case of an abnormal display caused by discharge, if it can recover to normal state after reset, it is considered "PASS". The use of an ionizer (antistatic blower) is recommended during this test. When removing the protection film from LCM panel, do it at a slow speed (preferably more than one second) and blow with ionizer toward the peeling face to minimize ESD which may damage the electrical circuit.

Note4: For duration test in the chamber

- a. Keep a small distance between each sample and don't place the samples close to the wall or the wick. Don't open the chamber unless absolutely necessary.
- b. During the test, avoid moisture condensation on the polarizer.
- c. After taking the samples out of the chamber and returning to room temperature and humidity, wait at least two hours before inspecting and measuring data.
- d. Perform de-rating during high temp. operation test.

Note5: ESD Class Define:

- Class A: All functions perform as designed during and after exposure to interference
- Class B: Temporary degradation or less of performance which is self-recoverable
- Class C: Display abnormally after reset. Degradation or less of performance which requires system reset to recover
- Class D: Degradation or less of function which is not recoverable


	<input checked="" type="checkbox"/> Preliminary Specification <input type="checkbox"/> Product Specification	
	Confidential	Part Number: TM070RDSP15-00 Version: 1.0

10.1 Handling Precautions

- 13.1.1 The display panel is made of glass. Do not subject it to mechanical shock by dropping it, etc.
- 13.1.2 If the display panel is damaged and the liquid crystal fluid inside it leaks out be sure not to get any in your mouth. If the fluid comes into contact with your skin or clothes promptly wash it off using soap and water.
- 13.1.3 Do not apply excessive force to the display surface or the bezel since this may cause the color tone to vary.
- 13.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle the polarizer carefully.
- 13.1.5 If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is still not completely clear use a moist cloth with one of the following solvents:
- Isopropyl alcohol
 - Ethyl alcohol
- Solvents other than those mentioned above may damage the polarizer. Specifically, do not use the following:
- Water
 - Ketone
 - Aromatic solvents
- 13.1.6 Do not attempt to disassemble the LCD Module.
- 13.1.7 If the logic circuitry is powered off, do not apply the input signals.
- 13.1.8 To prevent destruction of the module by static electricity, be careful to maintain an optimum work environment.
- 13.1.8.1 Be sure to ground your body when handling the LCD Modules.
- 13.1.8.2 Tools used for assembly, such as soldering irons, must be properly grounded.
- 13.1.8.3 To reduce the amount of static electricity generated, do not conduct assembly or other work under very low humidity conditions.
- 13.1.8.4 The LCD Module is covered with a film to protect the display surface. Be careful when peeling off this protective film since static electricity may be generated.

10.2 Storage precautions

- 13.1.9 When storing the LCD modules avoid exposure to direct sunlight or to the light of fluorescent lamps.
- 13.1.10 The LCD modules should be stored within the rated storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:
 Temperature: 15 ~ 35 degree C (or at least Temp. 10 ~ 40 degree C / Humidity 25% ~ 75%), for National Std. recommendation
 The LCD modules should be stored in a room without acid, alkali or other harmful gases.

	<input checked="" type="checkbox"/> Preliminary Specification <input type="checkbox"/> Product Specification	
	Confidential	Part Number: TM070RDSP15-00 Version: 1.0

10.3 Transportation Precautions

The LCD modules should not be dropped or subject to violent mechanical shock during transportation. Also they should avoid excessive pressure, water, high humidity and direct sunlight.