

Date : 2023/08/18

Customer:
Model Name: AT056TN53 V.1
Date: 2024/02/20
Version: 02

☐ **Preliminary Specification**
☒ **Final Specification**

For Customer's Acceptance

Approved by	Comment

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Record of Revision

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1. General Specifications

No.	Item	Specification	Remark
1	LCD size	5.6 inch(Diagonal)	
2	Driver element	a-Si TFT active matrix	
3	Resolution	640 × (RGB) × 480	
4	Display mode	Normally White, Transmissive	
5	Dot pitch	0.0588(W) × 0.1764(H) mm	
6	Active area	112.896 (W) × 84.672(H) mm	
7	Module size	126.5(W) × 100(H) × 5.7(D) mm	Note 1
8	Surface treatment	Anti-Glare	
9	Color arrangement	RGB-stripe	
10	Interface	Digital	
11	Backlight Power consumption	1.90W(Typ.)	Note 2
12	Panel Power consumption	0.66 W(Typ.)	Note 3
13	Weight	83.1g(Typ.)	

Note 1: Refer to Mechanical Drawing.

Note 2: Including LED Driver power consumption.

Note 3: Including T-con Board power consumption @ black pattern.

2.Pin Assignment

TFT LCD Panel Driving Section

FPC connector is used for the module electronics interface. The recommended model is FH19-40S -0.5SH manufactured by HiRose.

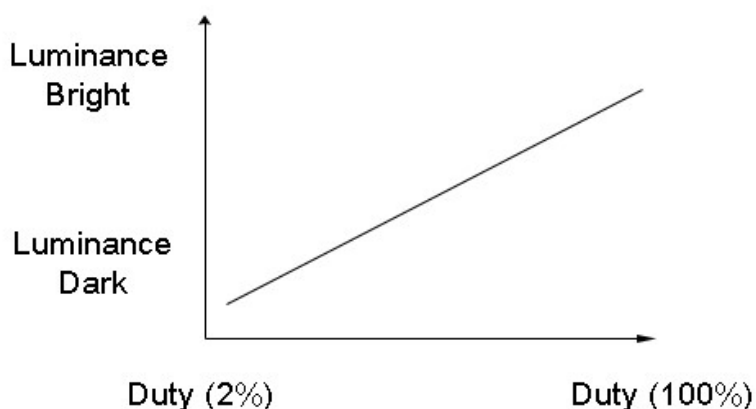
Pin No.	Symbol	I/O	Function	Remark
1	V _{LED}	P	Power Voltage for LED circuit	
2	V _{LED}	P	Power Voltage for LED circuit	
3	ADJ	I	Adjust the LED brightness with PWM Pulse	Note1,2
4	G _{LED}	P	Ground for LED circuit	
5	G _{LED}	P	Ground for LED circuit	
6	V _{CC}	P	Power Voltage for digital circuit	
7	V _{CC}	P	Power Voltage for digital circuit	
8	MODE	I	DE or HV mode control	Note 3
9	DE	I	Data enable	
10	VS	I	Vsync signal input	
11	HS	I	Hsync signal input	
12	GND	P	Power ground	
13	B5	I	Blue data input (MSB)	
14	B4	I	Blue data input	
15	B3	I	Blue data input	
16	GND	P	Power ground	
17	B2	I	Blue data input	
18	B1	I	Blue data input	
19	B0	I	Blue data input(LSB)	
20	GND	P	Power ground	
21	G5	I	Green data input(MSB)	
22	G4	I	Green data input	
23	G3	I	Green data input	
24	GND	P	Power ground	

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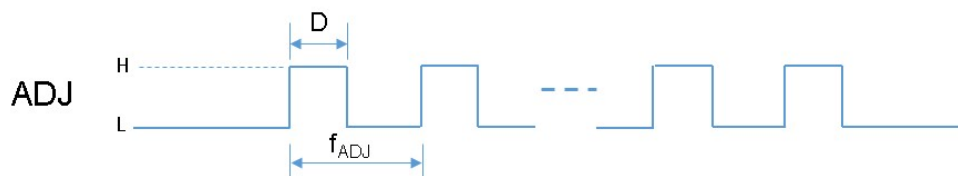
25	G2	I	Green data input	
26	G1	I	Green data input	
27	G0	I	Green data input(LSB)	
28	GND	P	Power ground	
29	R5	I	Red data input(MSB)	
30	R4	I	Red data input	
31	R3	I	Red data input	
32	GND	P	Power ground	
33	R2	I	Red data input	
34	R1	I	Red data input	
35	R0	I	Red data input(LSB)	
36	GND	P	Power ground	
37	DCLK	I	Dot clock	
38	GND	P	Power ground	
39	L/R	I	Select left to right scanning direction	Note4,5
40	U/D	I	Select up or down scanning direction	Note4,5

Note: I: input, O: output, P: Power

Note1: [ADJ](#) is used to adjust brightness.



Note 2: Following figure is ADJ signal setting



ADJ signal: L: 0~0.8V; H: 2~5V;

D(duty) : 2%~100%;

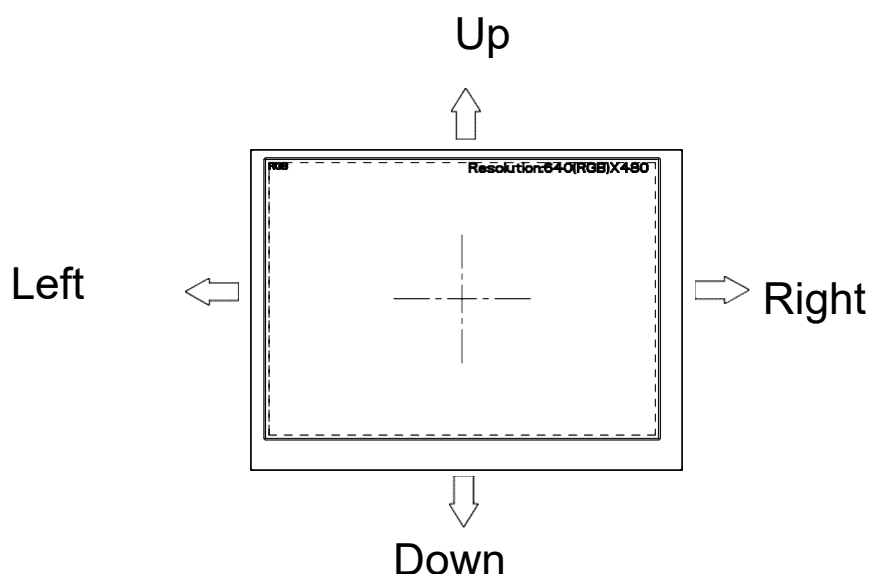
f_{ADJ}: 100Hz ~20KHz.

Note 3: DE Mode, Mode="H",HS floating and VS floating
HV Mode, Mode="L" and DE floating

Note 4: Selection of scanning mode

Setting of scan control input		Scanning direction
U/D	L/R	
GND	V _{CC}	Up to down, left to right
V _{CC}	GND	Down to up, right to left
GND	GND	Up to down, right to left
V _{CC}	V _{CC}	Down to up, left to right

Note 5: Definition of scanning direction.
Refer to the figure as below:



3. Operation Specifications

3.1. Absolute Maximum Ratings

(Note 1)

Item	Symbol	Values		Unit	Remark
		Min.	Max.		
Power voltage	V_{CC}	-0.3	4	V	
	V_{LED}	-0.3	6.5	V	
Operation temperature	T_{OP}	-20	70	°C	
Storage temperature	T_{ST}	-30	80	°C	

Note 1: The absolute maximum rating values of the module should not be exceeded. Once exceeded absolute maximum rating values, the characteristics of the module may not be recovered. Even in an extreme condition, may result in module permanently destroyed.

3.2. Typical Operation Conditions

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Power voltage	V_{CC}	3.1	3.3	3.5	V	Note 1
	V_{LED}	4.8	5.0	5.2	V	Note 2
Current Consumption	I_{VCC}	-	200	250	mA	@ black pattern
	I_{VLED}	-	380	450	mA	Note 3
Input logic high voltage	V_{IH}	$0.7V_{CC}$	-	$1V_{CC}$	V	Note 4
Input logic low voltage	V_{IL}	0	-	$0.3V_{CC}$	V	
LED life time	-	20,000	-	-	Hr	Note 5

Note 1: V_{CC} setting should match the signals output voltage (refer to Note 4) of customer's system board.

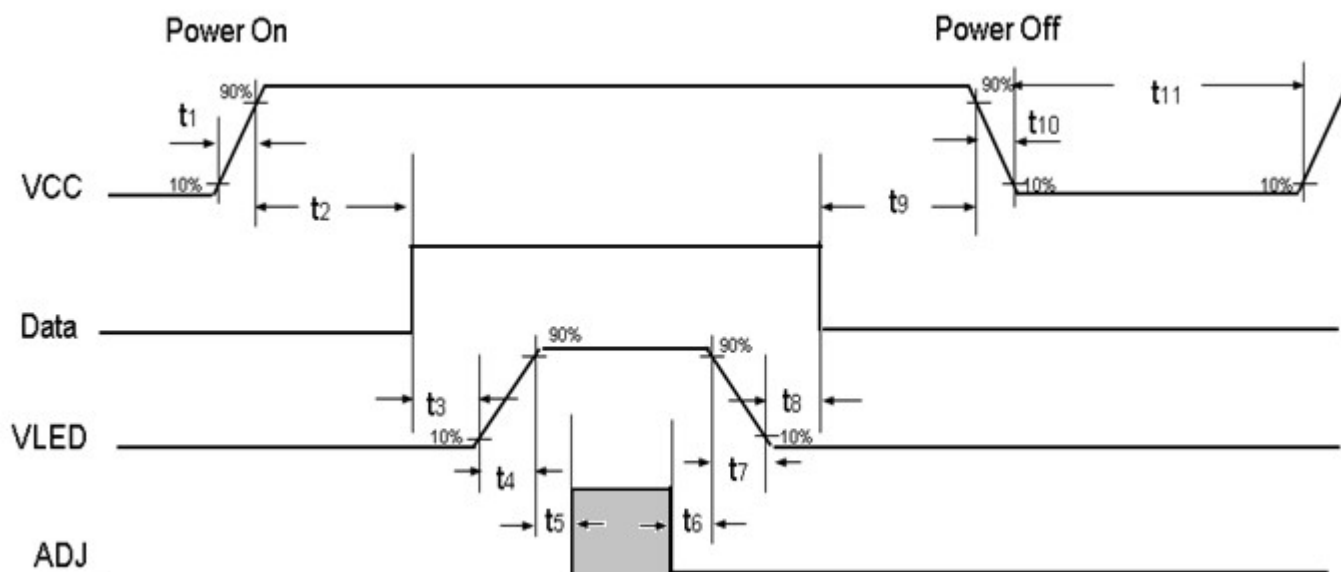
Note 2: LED driving voltage.

Note 3: LED driving current.

Note 4: DCLK, DE, HS, VS, R0~ R5, G0~ G5, B0~ B5.

Note 5: The "LED life time" is defined as the module brightness decrease to 50% original brightness at $T_a=25^{\circ}\text{C}$ and $V_{LED}=5.0\text{V}$. The LED lifetime could be decreased if operating V_{LED} is larger than 5.0V.

3.3.Power Sequence



Note:Data includes DE, VS ,HS, R0~ R5,G0~ G5,B0~ B5,DCLK.

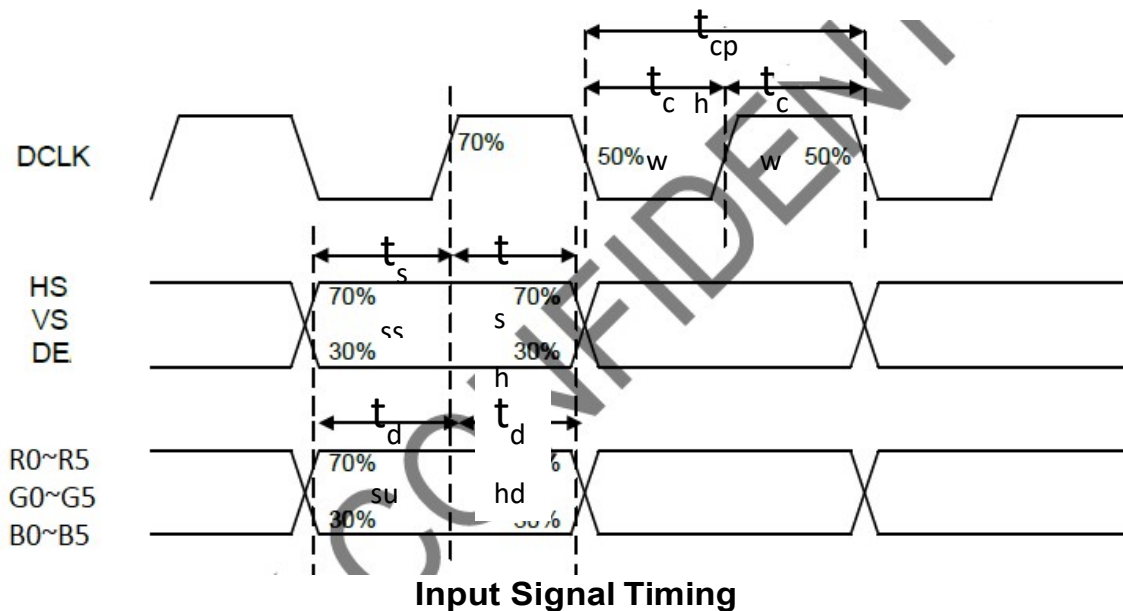
ADJ is a PWM signal, refer to page7 Note2 for detail setting.

Timing spec as below table

Item	Min	Typ	Max	Unit
t ₁	1	-	10	ms
t ₂	50	-	-	ms
t ₃	200	-	-	ms
t ₄	1	-	10	ms
t ₅	0	-	-	ms
t ₆	0	-	-	ms
t ₇	0	-	10	ms
t ₈	200	-	-	ms
t ₉	200	-	-	ms
t ₁₀	0	-	10	ms
t ₁₁	500	-	-	ms

3.4. Timing Characteristics

3.4.1. TTL mode AC electrical characteristics

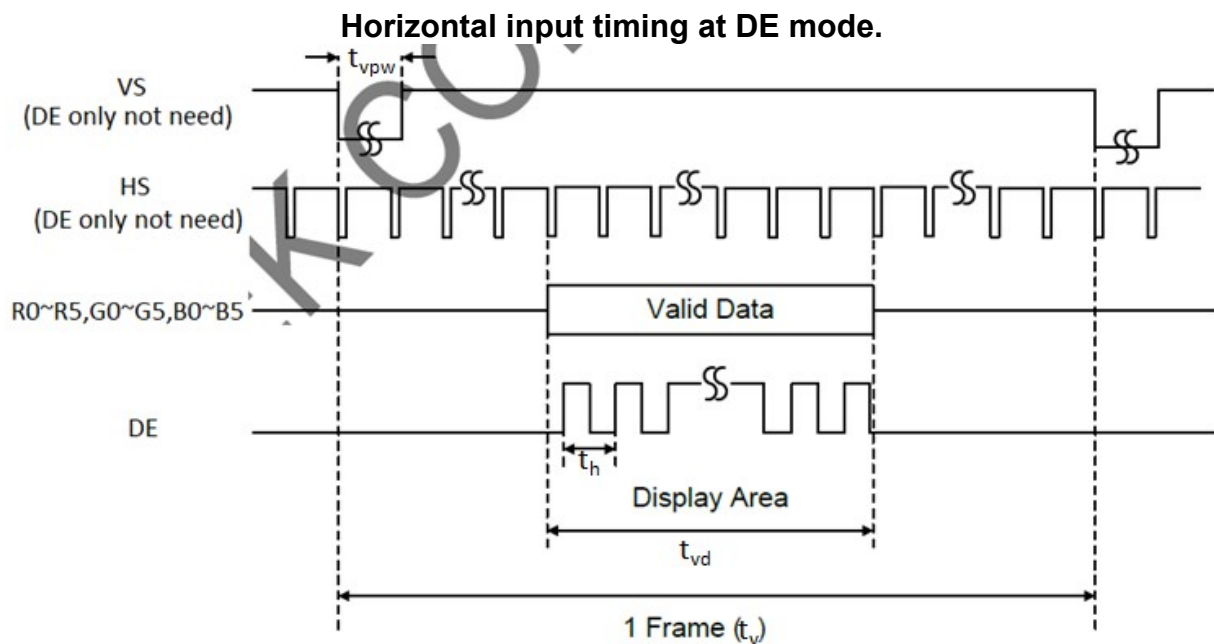
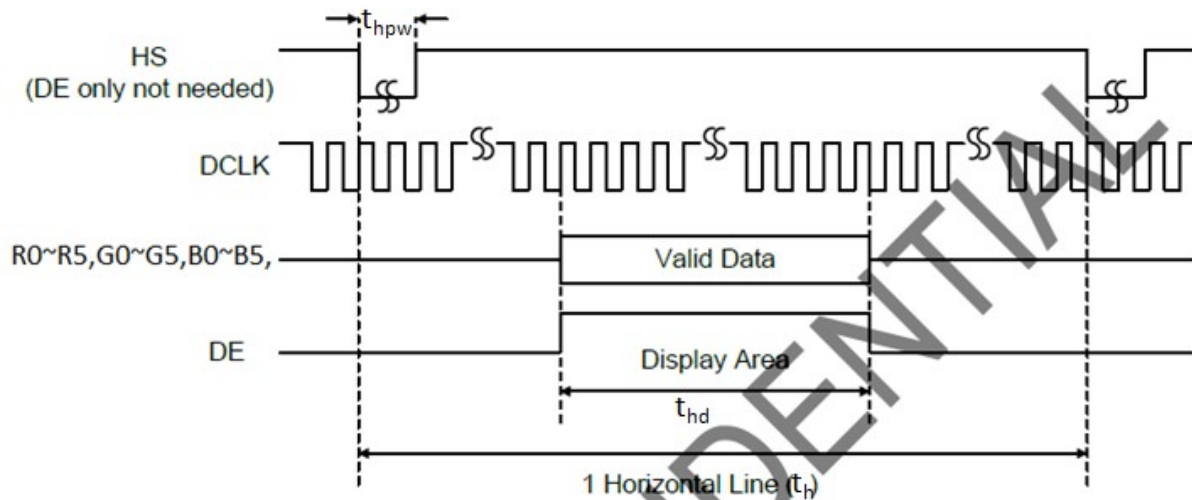


Input data/Sync. Parameters

Parameter	Symbol	Min.	Typ.	Max.	Unit
DCLK period	T_{cph}	16.7	-	-	ns
DCLK duty ratio	T_{CW}	40	50	60	%
Data setup time	T_{dsu}	5	-	-	ns
Data hold time	T_{dhd}	5	-	-	ns
VS/POL setup time	T_{ss}	5	-	-	ns
VS/POL hold time	T_{sh}	5	-	-	ns
HS/DIO setup time	T_{ss}	5	-	-	ns
HS/DIO hold time	T_{sh}	5	-	-	ns
DE/LD setup time	T_{ss}	5	-	-	ns
DE/LD hold time	T_{sh}	5	-	-	ns

3.4.2. TTL mode DC electrical characteristics

3.4.2.1 Parallel RGB at DE only mode

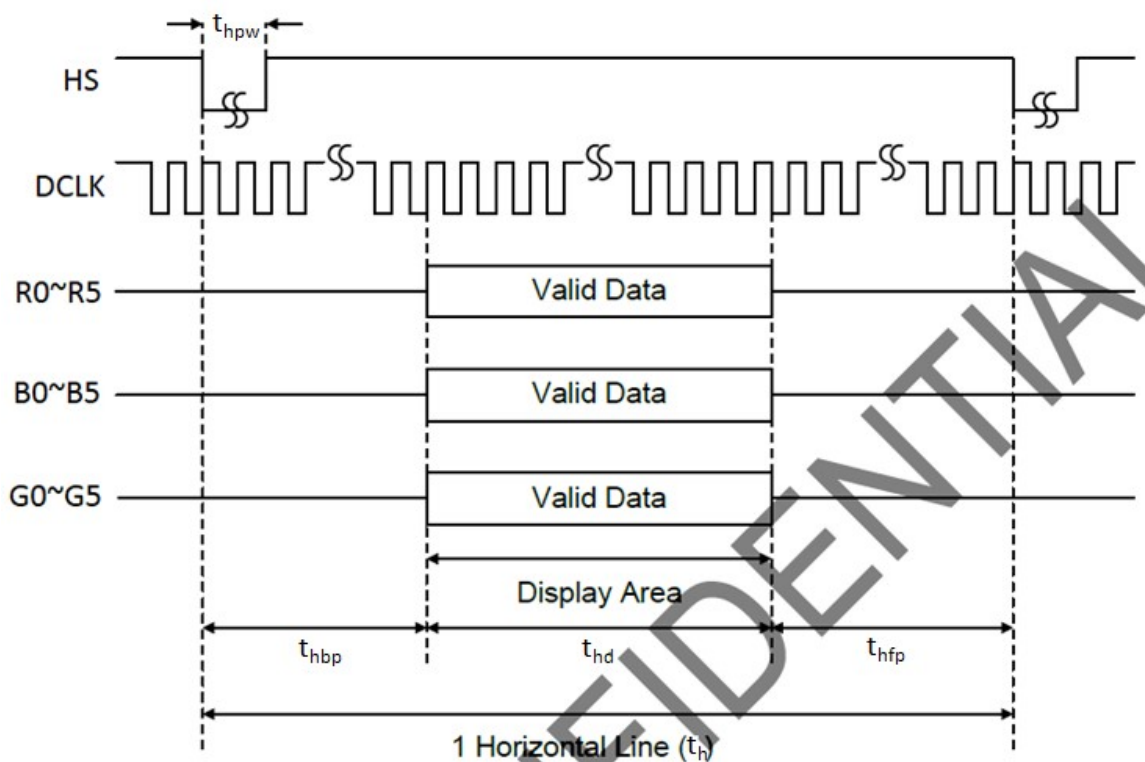


DE mode timing

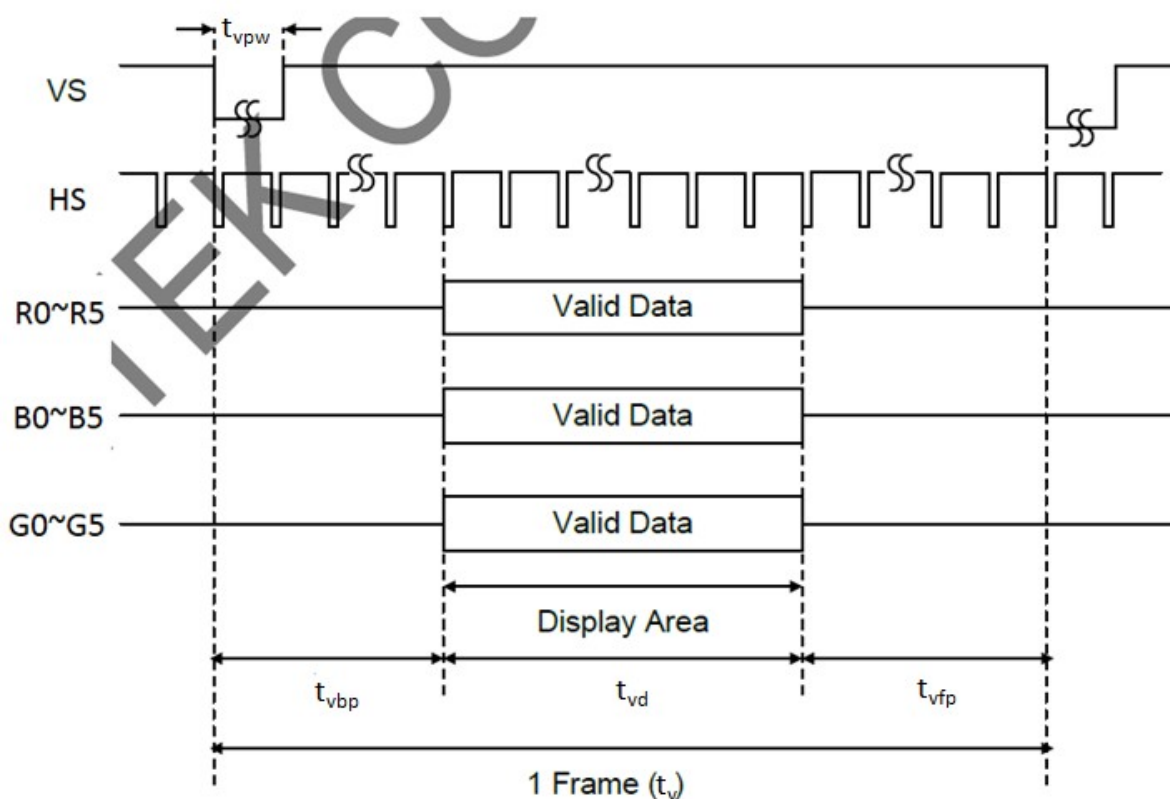
DE only mode 640xRGBx480

Parameter	Symbol	Panel Resolution			Unit
		1 port 640xRGBx480			
		Min.	Typ.	Max.	
DCLK frequency	F _{DCLK}	20.0	23.0	31.2	MHz
Horizontal display area	t _{hd}	640	640	640	DCLK
1 horizontal line	t _h	669	776	832	DCLK
Vertical display area	t _{vd}	480	480	480	H
1 vertical field	t _v	487	493	624	H
Frame rate	FR	-	60	-	Hz

3.4.2.2 Parallel RGB at Sync mode (HV mode)



Horizontal input timing at sync mode.



Vertical input timing at sync mode.

HV mode timing

Sync mode 640xRGBx480

Parameter	Symbol	Panel Resolution			Unit
		1 port 640xRGBx480			
		Min.	Typ.	Max.	
DCLK frequency	F _{DCLK}	20.0	23.0	31.2	MHz
Horizontal display area	t _{hd}	640	640	640	DCLK
Hsync pulse Width	t _{h_{pw}}	10	12	255	DCLK
Hsync back porch	t _{h_{bp}}	5	16	255	DCLK
Hsync front porch	t _{h_{fp}}	24	120	260	DCLK
1 horizontal line	t _h	669	776	832	DCLK
Vertical display area	t _{vd}	480	480	480	H
Vsync pulse width	t _{vpw}	1	3	20	H
Vsync back porch	t _{v_{bp}}	2	5	255	H
Vsync front porch	t _{v_{fp}}	5	8	260	H
1 vertical field	t _v	487	493	624	H
Frame rate	FR	-	60	-	Hz

4. Optical Specifications

Item	Symbol	Condition	Values			Unit	Remark
			Min.	Typ.	Max.		
Viewing angle (CR≥10)	θ_L	$\Phi=180^\circ$ (9 o'clock)	60	70	-	degree	Note 1
	θ_R	$\Phi=0^\circ$ (3 o'clock)	60	70	-		
	θ_T	$\Phi=90^\circ$ (12 o'clock)	40	50	-		
	θ_B	$\Phi=270^\circ$ (6 o'clock)	60	70	-		
Response time	T_{ON}	Normal $\theta=\Phi=0^\circ$	-	10	20	msec	Note 3
	T_{OFF}		-	15	30	msec	Note 3
Contrast ratio	CR		500	800	-	-	Note 4
Color chromaticity	W_X		0.26	0.31	0.36	-	Note 2
	W_Y		0.28	0.33	0.38	-	Note 5 Note 6
Luminance	L_1		400	500	-	cd/m ²	Note 6
Luminance uniformity	Y_U		70	75	-	%	Note 6,7

Test Conditions:

1. $V_{CC}=3.3V$, $V_{LED}=5.0V$, the ambient temperature is $25^\circ C$.
2. The test systems refer to Note 2.

Note 1: Definition of viewing angle range

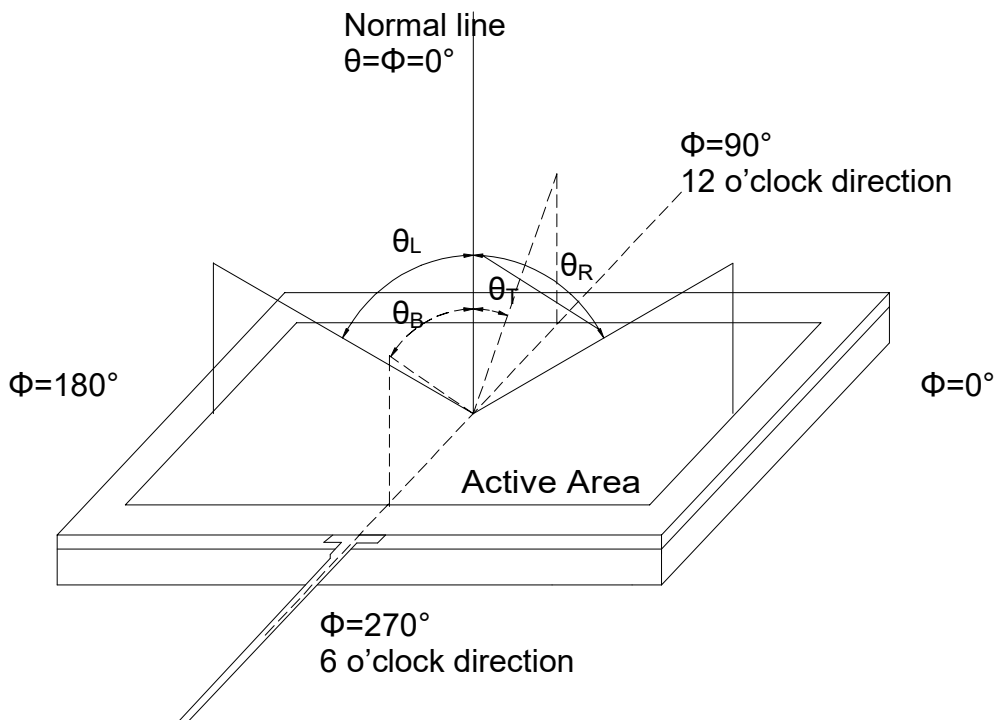


Fig. 4-1 Definition of viewing angle

Note 2: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 30 minutes operation, the optical properties are measured at the center point of the LCD screen. (Response time is measured by Photo detector TOPCON BM-7, other items are measured by BM-5A/Field of view: 1° /Height: 500mm.)

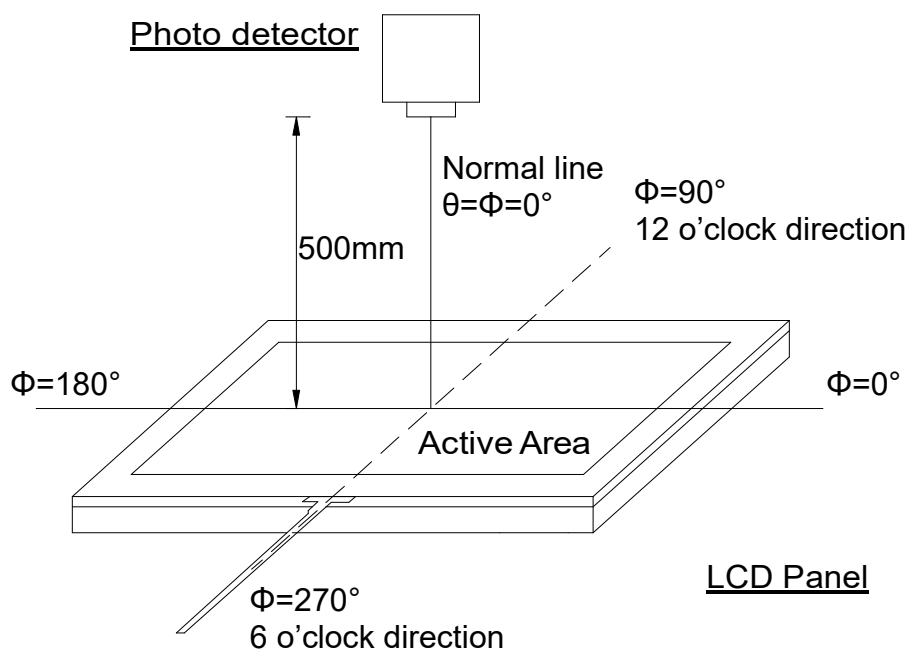


Fig. 4-2 Optical measurement system setup

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Note 3: Definition of Response time

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 90% to 10%. And fall time (T_{OFF}) is the time between photo detector output intensity changed from 10% to 90%.

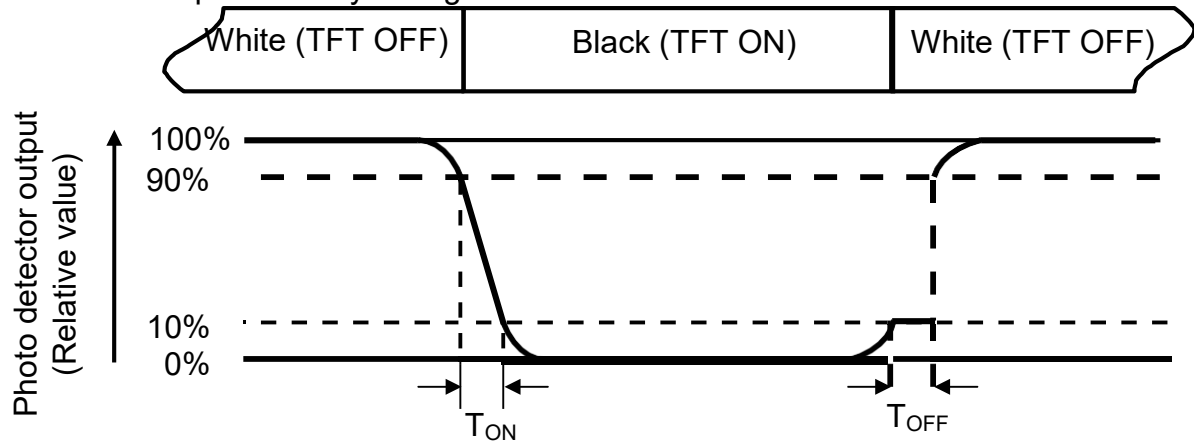


Fig. 4-3 Definition of response time

Note 4: Definition of contrast ratio

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

Note 5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

Note 6: All input terminals LCD panel must be ground while measuring the center area of the panel. The LED driving condition is $V_{LED}=5.0V$

Note 7: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer to Fig. 4-4).Every measuring point is placed at the center of each measuring area.

$$\text{Luminance Uniformity (Yu)} = \frac{B_{min}}{B_{max}}$$

L-----Active area length W -----Active area width

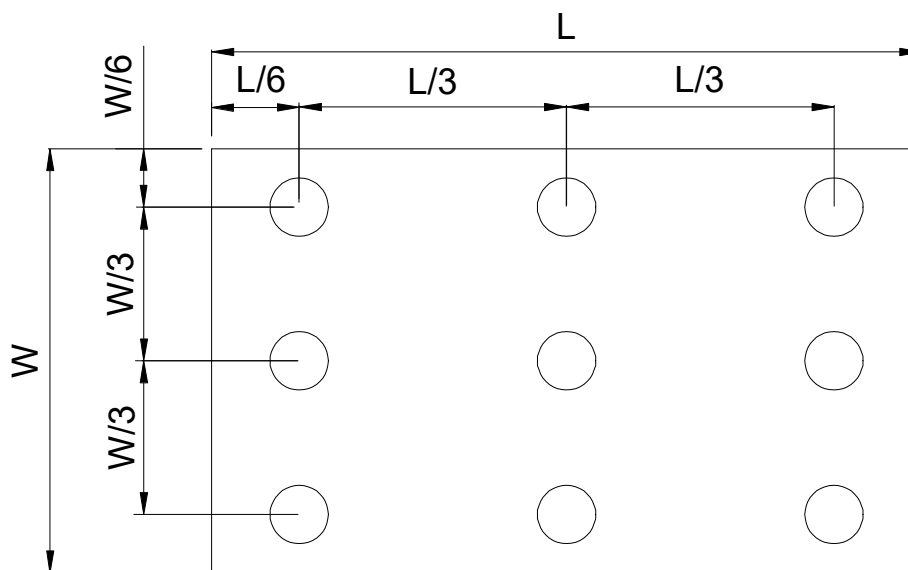


Fig. 4-4 Definition of measuring points

B_{max} : The measured maximum luminance of all measurement position.

B_{min} : The measured minimum luminance of all measurement position.

5. Reliability Test

Item	Test Conditions		Remark
High Temperature Storage	80°C	240 hrs	Note 1, 2
Low Temperature Storage	-30°C	240hrs	Note 1, 2
High Temperature Operation	70°C	240hrs	Note 1, 2
Low Temperature Operation	-20°C	240hrs	Note 1, 2
Operate at High Temperature and Humidity	+40°C, 90%RH	240 hrs	Note 1, 2
Thermal Shock	-30°C/30 min ~ +80°C/30 min for a total 100 cycles, Start with cold temperature and end with high temperature		Note 1, 2
Vibration Test	Frequency: 1.5G / 10-500Hz, 30min/cycle, 1cycle for each X, Y, Z		Note 2
Mechanical Shock	100G 6ms, ±X, ±Y, ±Z 1 times for each direction		Note 2
Package Vibration Test	1.14Grms Random frequency 1~200Hz 30min/Bottom, 15min/Right-Left, 15min/Front-Back		Note 2
Package Drop Test	Height:60 cm 1 corner, 3 edges, 6 surfaces		Note 2
Electro Static Discharge	± 2KV, Human Body Mode, 100pF/1500Ω		Note 2

Note 1: The test samples have recovery time need more than 2 hours at room temperature before the function check. In the standard conditions, there is no abnormal display function occurred.

Note 2: After the reliability test, the product only guarantees operational function, but don't guarantee all of the cosmetic specification.

6. General Precautions

6.1. Safety

Liquid crystal is poisonous. Do not put it in your mouth. If liquid crystal touches your skin or clothes, wash it off immediately by using soap and water.

6.2. Handling

6.2.1. The LCD panel is plate glass. Do not subject the panel to mechanical shock or to excessive force on its surface.

6.2.2. The polarizer attached to the display is easily damaged. Please handle it carefully to avoid scratch or other damages.

6.2.3. To avoid contamination on the display surface, do not touch the module surface with bare hands.

6.2.4. Keep a space so that the LCD panels do not touch other components.

6.2.5. Put cover board such as acrylic board on the surface of LCD panel to protect panel from damages.

6.2.6. Transparent electrodes may be disconnected if you use the LCD panel under environmental conditions where the condensation of dew occurs.

6.2.7. Do not leave module in direct sunlight to avoid malfunction of the ICs.

6.3. Static Electricity

6.3.1. Be sure to ground module before turning on power or operating module.

6.3.2. Do not apply voltage which exceeds the absolute maximum rating value.

6.4. Storage

6.4.1. Store the module in a dark room where must keep at $+25\pm 10^{\circ}\text{C}$ and 65%RH or less.

6.4.2. Do not store the module in surroundings containing organic solvent or corrosive gas.

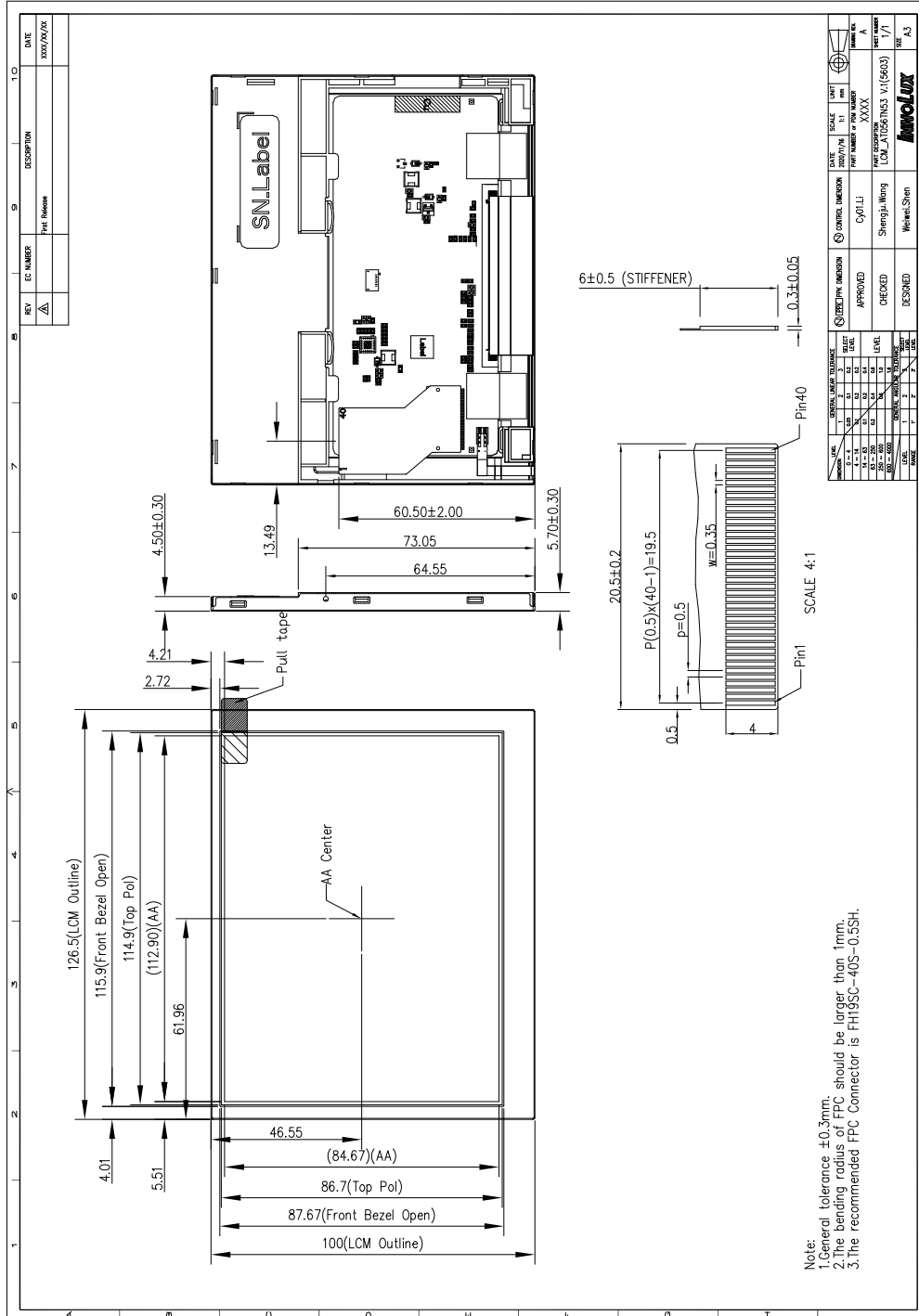
6.4.3. Store the module in an anti-electrostatic container or bag.

6.5. Cleaning

6.5.1. Do not wipe the polarizer with dry cloth. It might cause scratch.

6.5.2. Only use a soft cloth with IPA to wipe the polarizer, other chemicals might permanent damage to the polarizer.

7.Mechanical Drawing



8.Package Drawing

