



SPECIFICATION FOR LCD MODULE

Customer : \_\_\_\_\_

Product Model: \_\_\_\_\_ NDS043TN01-40NM01 \_\_\_\_\_

Sample code: \_\_\_\_\_

Designed by	Checked by	Approved by

Final Approval by Customer

<input type="checkbox"/> <b>LCM Machinery OK</b> Checked By _____  <input type="checkbox"/> <b>LCM Display OK</b> Checked By _____	<input type="checkbox"/> <b>LCM OK</b>  <input type="checkbox"/> <b>NG Problem survey:</b>  Approved By _____
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※The specification of "TBD" should refer to the measured value of sample . If there is difference between the design specification and measured value, we naturally shall negotiate and agree to solution with customer.



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# 1. General Specifications

No.	Item	Specification	Remark
1	LCD size	4.3 inch(Diagonal)	
2	Driver element	a-Si TFT active matrix	
3	Resolution	480 3(RGB) 272	
4	Display mode	Normally White, Transmissive	
5	Dot pitch	198(W) ×198(H) um	
6	Active area	95.04(W) ×53.856 (H) mm	
7	Module size	105.5(W) ×67.2(H) ×2.9(D) mm	Note 1
8	Surface treatment	Anti-Glare	
9	Color arrangement	RGB-stripe	
10	Interface	Digital	
11	Backlight power consumption	TBD	
12	Panel power consumption	TBD	
13	Weight	TBD	

Note 1: Refer to Mechanical Drawing.

## 2. Pin Assignment

1	<b>GLED</b>	<b>GND for LED</b>
2	<b>VLED</b>	<b>Power for LED</b>
3	<b>GND</b>	<b>Ground</b>
4	<b>VDD</b>	<b>Digital power supply(+3.3V)</b>
5	<b>R0</b>	<b>Red data(LSB)</b>
6	<b>R1</b>	<b>Red data</b>
7	<b>R2</b>	<b>Red data</b>
8	<b>R3</b>	<b>Red data</b>
9	<b>R4</b>	<b>Red data</b>
10	<b>R5</b>	<b>Red data</b>
11	<b>R6</b>	<b>Red data</b>
12	<b>R7</b>	<b>Red data(MSB)</b>
13	<b>G0</b>	<b>Green data(LSB)</b>
14	<b>G1</b>	<b>Green data</b>
15	<b>G2</b>	<b>Green data</b>
16	<b>G3</b>	<b>Green data</b>
17	<b>G4</b>	<b>Green data</b>
18	<b>G5</b>	<b>Green data</b>
19	<b>G6</b>	<b>Green data</b>
20	<b>G7</b>	<b>Green data(MSB)</b>
21	<b>B0</b>	<b>Blue data(LSB)</b>
22	<b>B1</b>	<b>Blue data</b>
23	<b>B2</b>	<b>Blue data</b>
24	<b>B3</b>	<b>Blue data</b>
25	<b>B4</b>	<b>Blue data</b>
26	<b>B5</b>	<b>Blue data</b>
27	<b>B6</b>	<b>Blue data</b>
28	<b>B7</b>	<b>Blue data(MSB)</b>

<b>29</b>	<b>GND</b>	<b>Ground</b>
<b>30</b>	<b>DCLK</b>	<b>Data clk</b>
<b>31</b>	<b>DISP</b>	<b>Display ON/OFF control. Internally pulled high</b>
<b>32</b>	<b>HS</b>	<b>Horizontal sync input in RGB mode</b>
<b>33</b>	<b>VS</b>	<b>Vertical sync input in RGB mode</b>
<b>34</b>	<b>DE</b>	<b>Data Enable</b>
<b>35</b>	<b>NC</b>	<b>No connection</b>
<b>36</b>	<b>GND</b>	<b>Ground</b>
<b>37</b>	<b>XR</b>	<b>T/p X-Right(No connection)</b>
<b>38</b>	<b>YD</b>	<b>T/p Y-Bottom(No connection)</b>
<b>39</b>	<b>XL</b>	<b>T/p X-Left(No connection)</b>
<b>40</b>	<b>YU</b>	<b>T/p Y-Up(No connection)</b>

## 3. Operation Specifications

### 3.1. Absolute Maximum Ratings

(Note 1)

Item	Symbol	Values		Unit	Remark
		Min.	Max.		
Supply voltage	$V_{DD}$	-0.3	4.5	V	
Operation Temperature	$T_{OP}$	-20	60	°C	
Storage Temperature	$T_{ST}$	-30	70	°C	
LED Reverse Voltage	$V_R$	-	5	V	Each LED Note 2
LED Forward Current	$I_F$	-	25	mA	Each LED

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.

Note 2:  $V_R$  Conditions: Zener Diode 20mA

#### 3.1.1. Typical Operation Conditions

Item	Symbol	Values			Unit	Remark
		Min.	Typ	Max.		
Power voltage	$V_{DD}$	3.0	3.3	3.6	V	Note 2
Current for Driver	$I_{V_{DD}}$	-	17	25	mA	
Input logic high voltage	$V_{IH}$	$0.8 V_{DD}$	-	$V_{DD}$	V	Note 3
Input logic low voltage	$V_{IL}$	0	-	$0.2 V_{DD}$	V	

### 3.1.2. Backlight Driving Conditions

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Voltage for LED backlight	$V_L$	20.2	22.9	24.5	V	Note 1
Current for LED backlight	$I_L$	18	20	22	mA	
LED life time	-	-	20,000	-	Hr	Note 2

Note 1: The LED Supply Voltage is defined by the number of LED at  $T_a=25^{\circ}\text{C}$  and  $I_L=20\text{mA}$ .

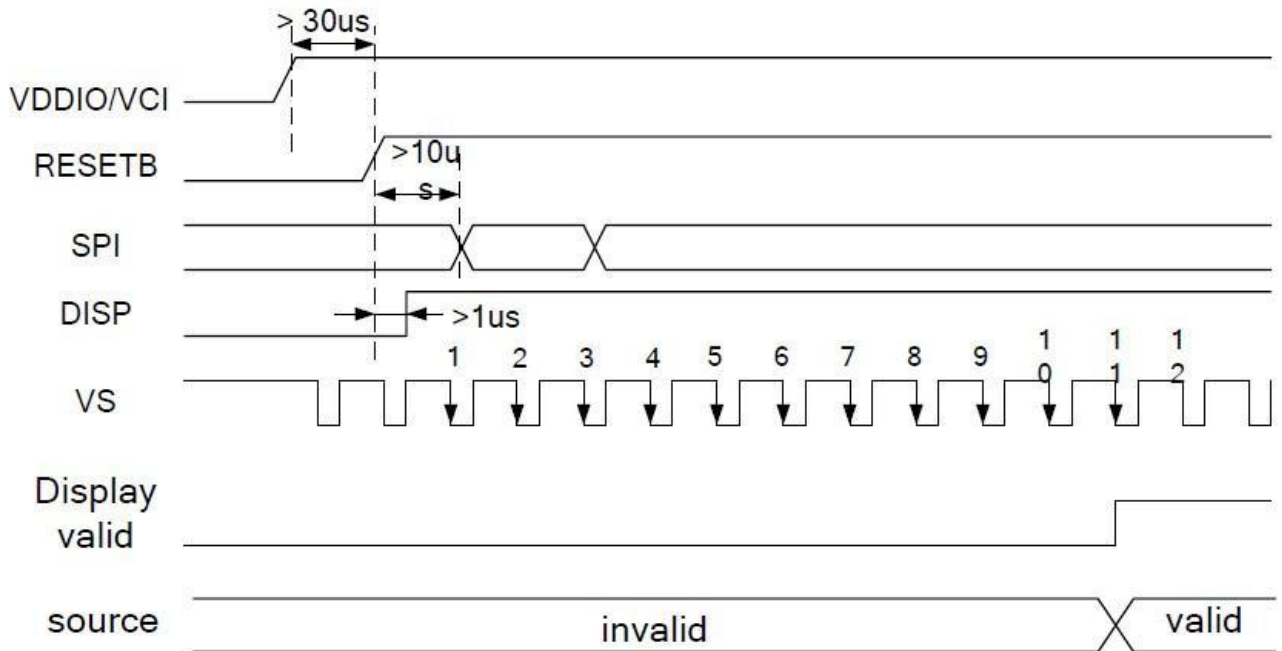
Note 2: The "LED life time" is defined as the module brightness decrease to 50% original brightness at  $T_a=25^{\circ}\text{C}$  and  $I_L=20\text{mA}$ . The LED lifetime could be decreased if operating  $I_L$  is larger than 20mA.

### LED CIRCUIT

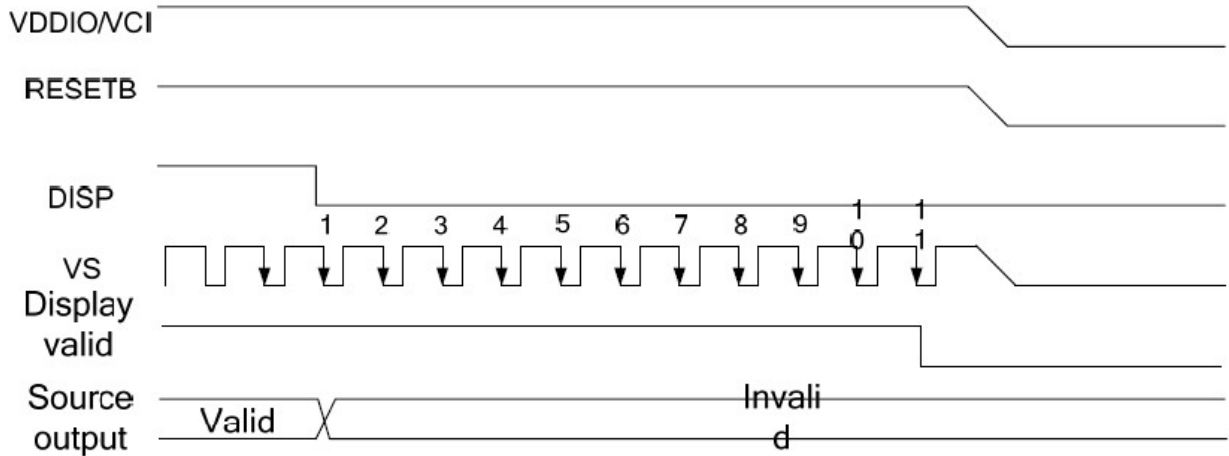




### 3.2. Power Sequence

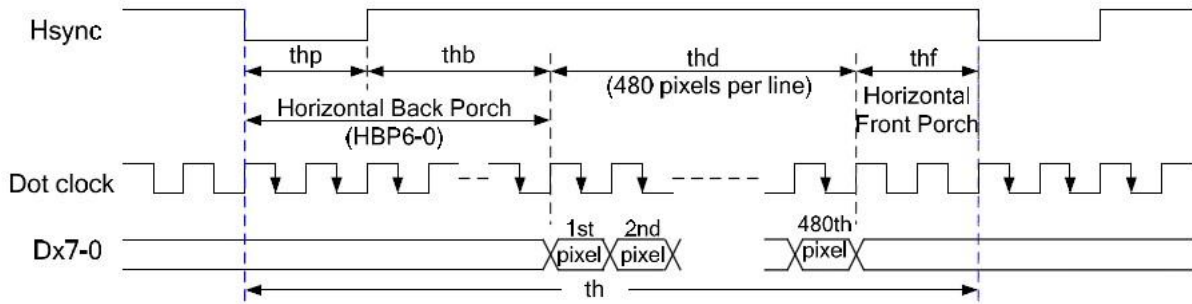
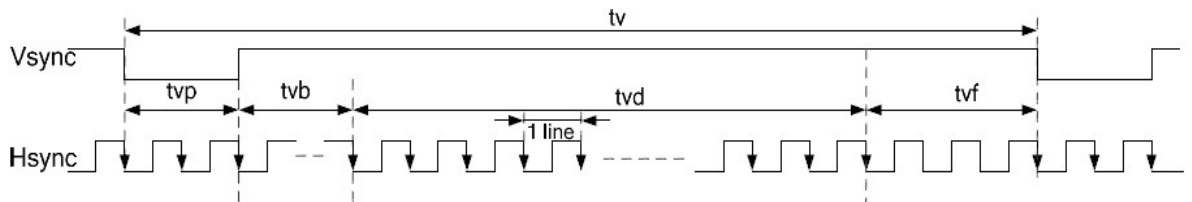


#### Power off sequence



### 3.3. Timing Characteristics

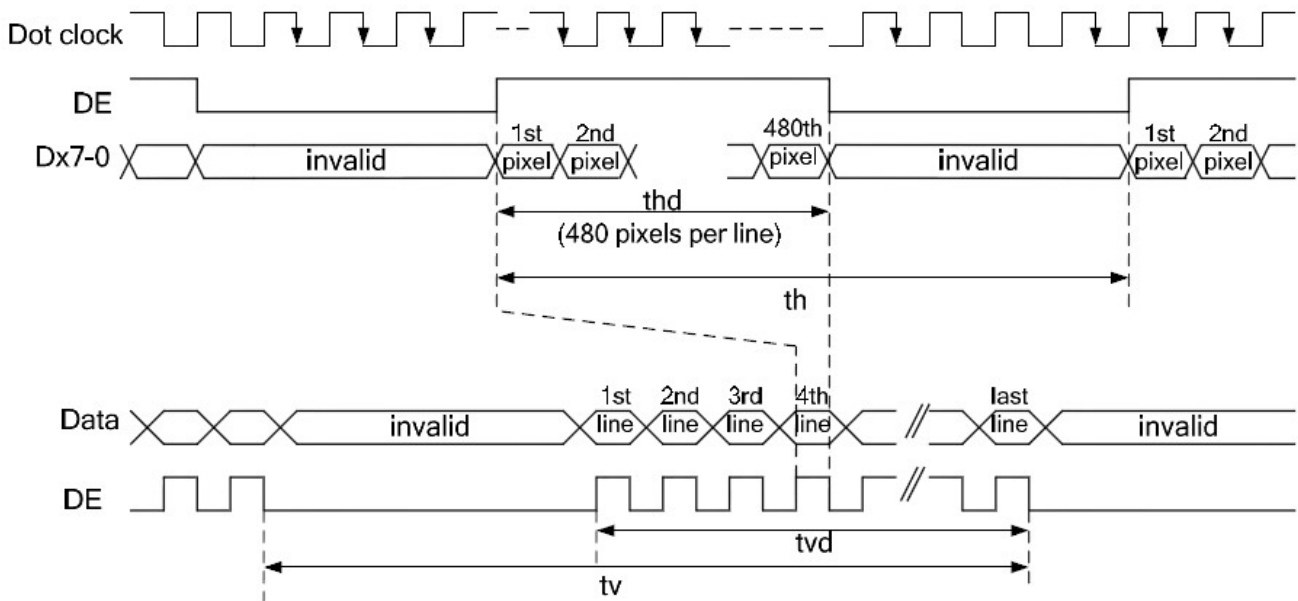
#### 3.3.1. Sync Mode

**Horizontal timing****Vertical timing****Timing Table**

Parameter	Symbol	Min	Typ.	Max	Unit
Clock frequency	$1/t_{CLK}$	-	9	15	MHz
Hsync frequency	$1/th$	-	17.14	-	KHz
Vsync frequency	$1/tv$	-	59.94	-	Hz
<b>Horizontal timing</b>					
Horizontal cycle	th	525	525	605	CLK
Horizontal display period	thd	480	480	480	CLK
Horizontal front porch	thf	2	2	82	CLK
Horizontal pulse width	thp <sup>(1)</sup>	2	41	41	CLK
Horizontal back porch	thb <sup>(1)</sup>	2	2	41	CLK
<b>Vertical timing</b>					
Vertical cycle	tv	285	286	511	H
Vertical display period	tvd	272	272	272	H
Vertical front porch	tvf	1	2	227	H
Vertical pulse width	tvp <sup>(1)</sup>	1	10	11	H
Vertical back porch	tvb <sup>(1)</sup>	1	2	11	H

**Note (1)** it is necessary to keep  $tvp + tvb = 12$  and  $thp + thb = 43$ .

### 3.3.2. De Mode



**Timing Table**

Parameter	Symbol	Min	Typ.	Max	Unit
Clock frequency	$1/t_{CLK}$	-	9	15	MHz
Hsync frequency <sup>(3)</sup>	$1/th$	-	17.14	-	KHz
Vsync frequency <sup>(3)</sup>	$1/tv$	-	59.94	-	Hz
<b>Horizontal timing</b>					
Horizontal cycle	th	525	525	605	CLK
Horizontal display period	thd	480	480	480	CLK
<b>Vertical timing</b>					
Vertical cycle	tv	285	286	511	H <sup>(4)</sup>
Vertical display period	tvd	272	272	272	H <sup>(4)</sup>

**Note (3)** HSYNC is not necessary in DE mode. VSYNC is not necessary in DE mode when DEO=0.

**Note (4)** 1 H=1 th.

### 3.3.3. Input Setup Timing Requirement

Parameter	Symbol	Spec.			Unit
		Min	Typ.	Max	
DISP setup time	tdiss	10	-	-	ns
DISP hold time	tdish	10	-	-	ns
Clock period	PW <sub>CLK</sub>	66.7	-	-	ns
Clock pulse high period	PWH	26.7	-	-	ns
Clock pulse low period	PWL	26.7	-	-	ns
Hsync setup time	ths	10	-	-	ns
Hsync hold time	thh	10	-	-	ns
Data setup time	tds	10	-	-	ns
Data hold time	tdh	10	-	-	ns
DE setup time	tdes	10	-	-	ns
DE hold time	tdeh	10	-	-	ns
Vsync setup time	tvhs	10	-	-	ns
Vsync hold time	tvhh	10	-	-	ns

## 4. Optical Specifications

Item	Symbol	Condition	Values			Unit	Remark
			Min.	Typ.	Max.		
Viewing angle (CR≥ 10)	$\theta_L$	$\Phi=180^\circ$ (9 o'clock)	-	70	-	degree	Note 1
	$\theta_R$	$\Phi=0^\circ$ (3 o'clock)	-	70	-		
	$\theta_T$	$\Phi=90^\circ$ (12 o'clock)	-	50	-		
	$\theta_B$	$\Phi=270^\circ$ (6 o'clock)	-	70	-		
Response time	$T_{ON}$	Normal $\theta=\Phi=0^\circ$	-	10	20	msec	Note 3
	$T_{OFF}$		-	10	20	msec	Note 3
Contrast ratio	CR		500	700	-	-	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		250	300	-	cd/m <sup>2</sup>	Note 6
Luminance uniformity	$Y_U$		70	75	-	%	Note 7

Test Conditions:

1.  $V_{DD}=3.3V$ ,  $I_L=20mA$  (Backlight current), the ambient temperature is  $25^\circ C$ .
2. The test systems refer to Note 2.

Note 1: Definition of viewing angle range

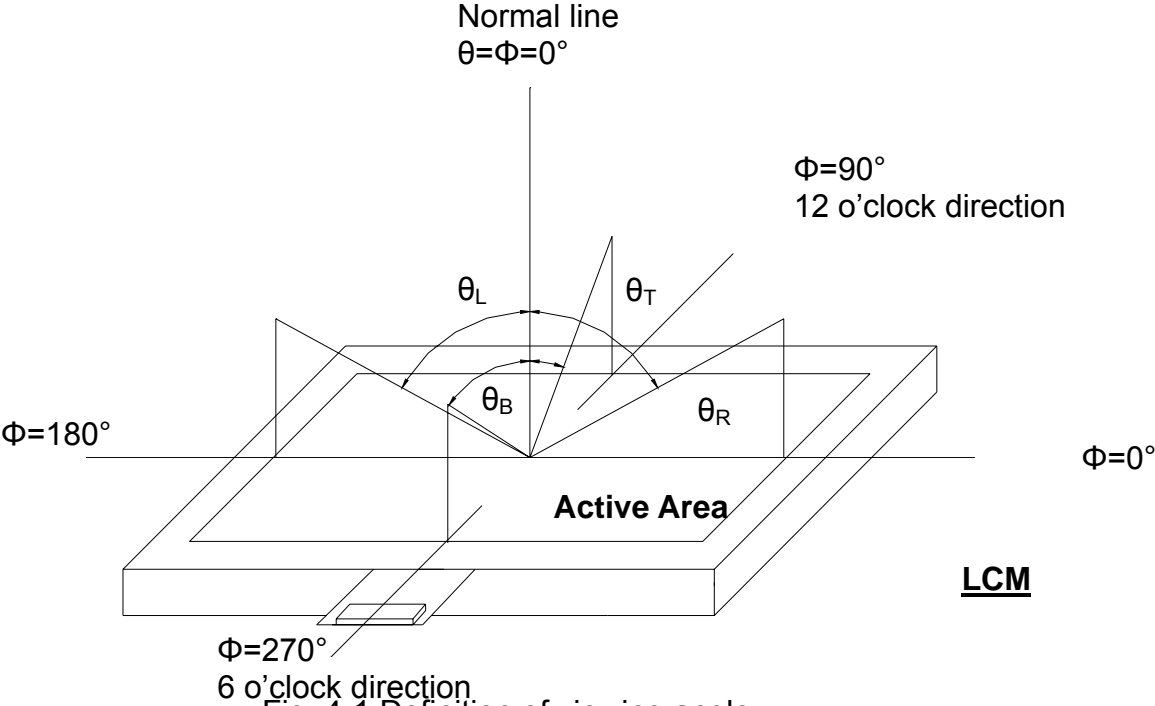


Fig. 4-1 Definition of viewing angle

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.)

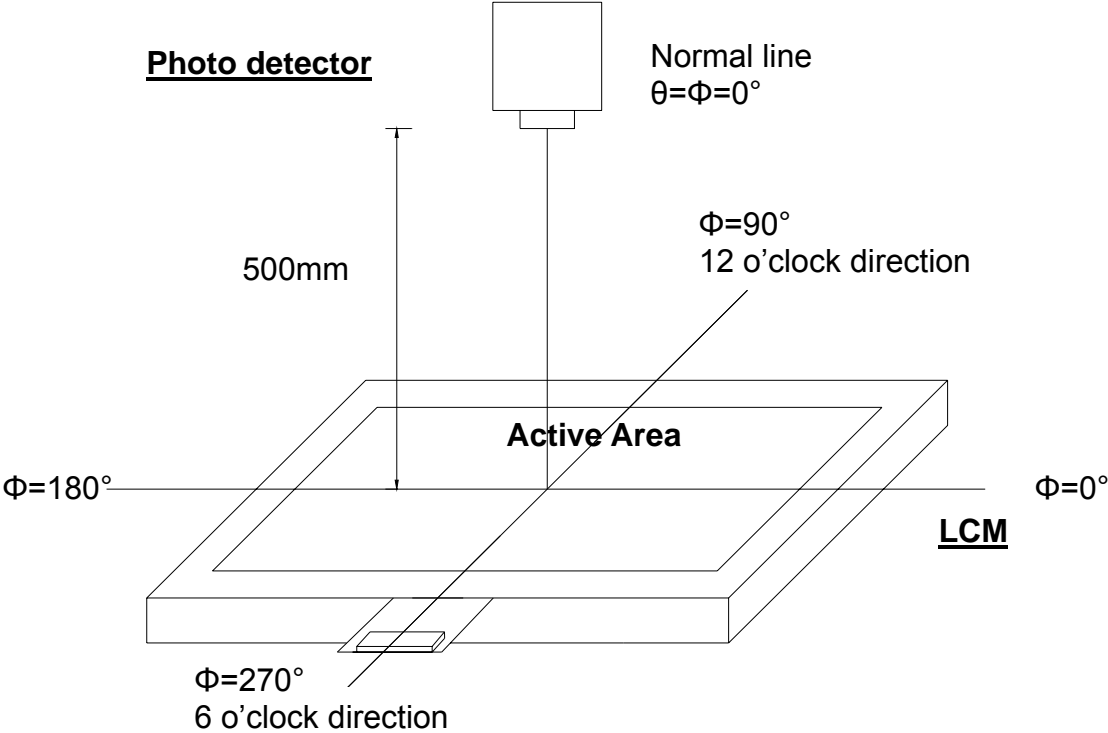


Fig. 4-2 Optical measurement system setup

## 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%.

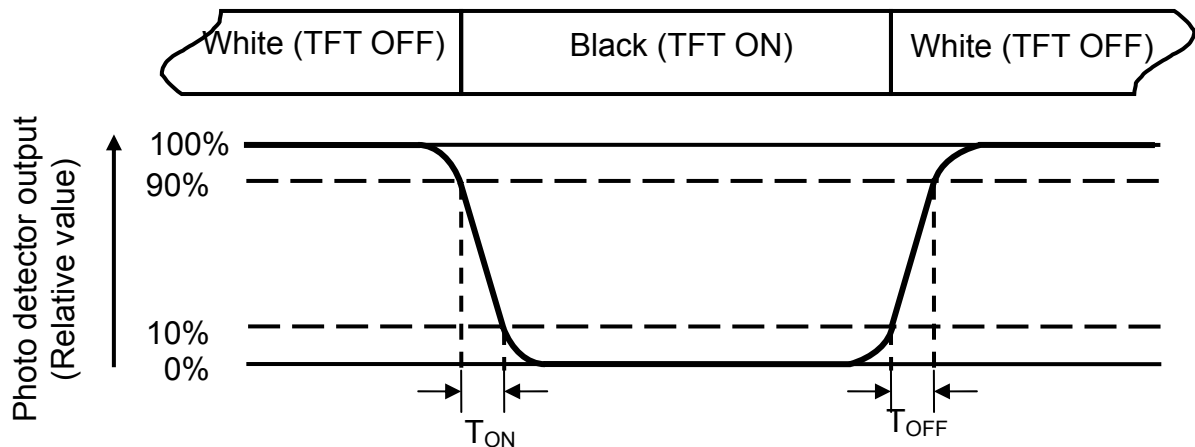


Fig. 4-3 Definition of response time

## Note 4: Definition of contrast ratio

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

## 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  $I_L=20\text{mA}$ .

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

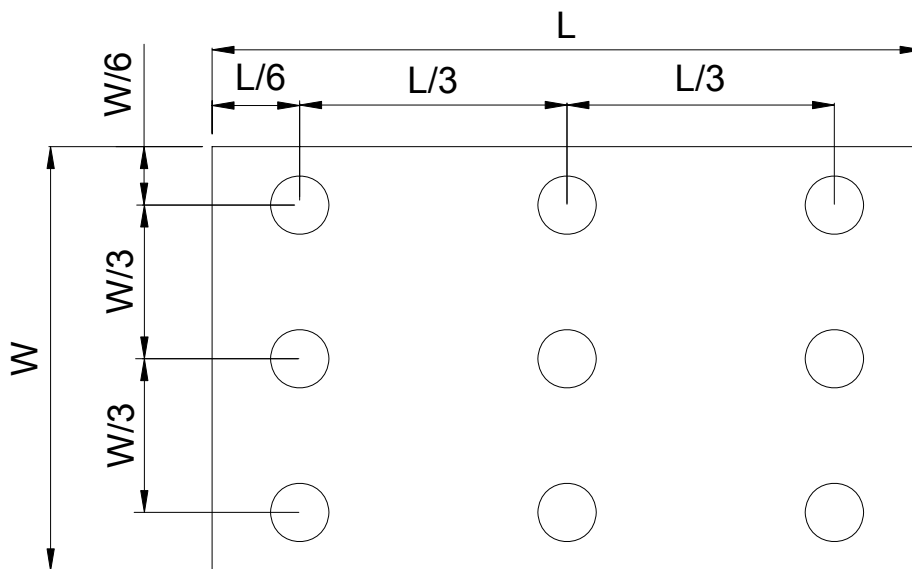


Fig. 4-4 Definition of measuring points

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

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





## 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

1. The LCD panel is plate glass. Do not subject the panel to mechanical shock or to excessive force on its surface.
2. The polarizer attached to the display is easily damaged. Please handle it carefully to avoid scratch or other damages.
3. To avoid contamination on the display surface, do not touch the module surface with bare hands.
4. Keep a space so that the LCD panels do not touch other components.
5. Put cover board such as acrylic board on the surface of LCD panel to protect panel from damages.
6. Transparent electrodes may be disconnected if you use the LCD panel under environmental conditions where the condensation of dew occurs.
7. Do not leave module in direct sunlight to avoid malfunction of the ICs.

### 6.3. Static Electricity

1. Be sure to ground module before turning on power or operating module.
2. Do not apply voltage which exceeds the absolute maximum rating value.

### 6.4. Storage

1. Store the module in a dark room where must keep at  $25\pm 10^{\circ}\text{C}$  and 65%RH or less.
2. Do not store the module in surroundings containing organic solvent or corrosive gas.
3. Store the module in an anti-electrostatic container or bag.

### 6.5. Cleaning

1. Do not wipe the polarizer with dry cloth. It might cause scratch.
2. Only use a soft sloth with IPA to wipe the polarizer, other chemicals might permanent damage to the polarizer.

# 7. Mechanical Drawing

