



深圳市拓普微科技开发有限公司

SHENZHEN TOPWAY TECHNOLOGY CO., LTD.

LMT056DIDFWD-NNA

LCD Module User Manual

Prepared by: HT LIU Date: 2016-4-5	Checked by: Date:	Approved by: Date:
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Rev.	Descriptions	Release Date
0.1	Preliminary	2012-03-09
0.2	Typing correction	2016-4-5

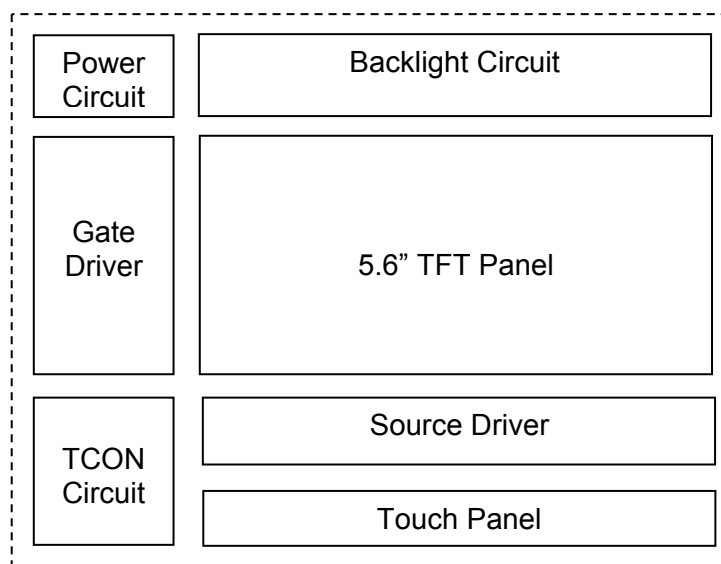
Table of Content

1. General Specification	3
2. Block Diagram.....	3
3. Input/Output Terminals	4
3.1 TFT LCD Panel	4
3.2 Touch Panel FPC.....	5
4. Absolute Maximum Ratings.....	6
5. Electrical Characteristics	6
5.1 DC Characteristics	6
5.2 Current Consumption	6
5.3 Backlight Driving Conditions	6
5.4 Power Sequence.....	7
5.5 Touch Panel Characteristics	7
6. AC Characteristics.....	8
6.1 Timing Conditions	8
6.2 Timing Diagram.....	9
7. Optical Characteristics.....	11
7.1 Optical characteristic of the LCD.....	11
8. Precautions of using LCD Modules	13

1. General Specification

Screen Size(Diagonal) :	5.6 inch
Number of dots :	640x 3 (RGB) x 480
Active Area :	112.896x86.672(mm)
Outline Dimension :	126.5x100.0x5.7 (mm) exclude Cable (See attached drawing details)
Display Mode :	Normal White mode / Transmissive
Pixel Arrangement :	R.G.B. Vertical Stripe
Dot pitch :	0.0588x0.1764 (mm)
Color Depth:	262k color
Backlight Type	LED Sidelight
Viewing Direction :	6 o'clock
Touch Panel Surface Treatment:	Anti-Glare
Touch Panel type:	4 wire Resistive
Input Interface:	24bit Parallel(R:G:B=8:8:8)
Operating Temperature :	-20 ~ +70°C
Storage Temperature :	-30 ~ +80°C

2. Block Diagram



3. Input/Output Terminals

3.1 TFT LCD Panel

Pin No.	Pin Name	IO	Descriptions	Note
1	VLED+	Power	Power for LED backlight anode	
2	VLED+			
3	VLED-	Power	Power for LED backlight cathode	
4	VLED-			
5	GND	Power	Power ground	
6	VCOM	Input	VCOM input	
7	VCC	Power	Digital power supply(+3.3V)	
8	MODE	Input	DE or HV mode control	Note 1
9	DE	Input	Data enable	
10	VS	Input	Vsync signal input	
11	HS	Input	Hsync signal input	
12	B7	Power	Blue data input	
:	:	Input	:	
19	B0	Input	Blue data input	
20	G7	Input	Green data input	
:	:	Input	:	
27	G0	Input	Green data input	
28	R7	Input	Red data input	
:	:	Input	:	
35	R0	Input	Red data input	
36	GND	Power	Power ground	
37	DCLK	Input	Sample clock	
38	GND	Power	Power ground	
39	L/R	Input	Select left to right scanning direction	Note 2,3
40	U/D	Input	Select up or down scanning direction	Note 2,3
41	VGH	Input	Positive power for scan driver	
42	VGL	Input	Negative power for scan driver	
43	AVDD	Power	Power supply for analog circuit	
44	RESET	Power	Reset	
45	POL	Output	Polarity select for the line inversion control signal	
46	VCOM	Input	VCOM input	
47	NC	-	No Connector	
48	NC	-		
49	NC	-		
50	NC	-		

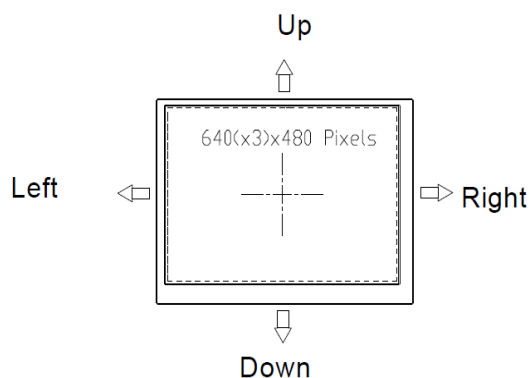
Note 1: DE Mode, Mode=" H" ,HS floating and VS floating
HV Mode, Mode=" L" and DE floating

Note 2: 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 3: Definition of scanning direction.

Refer to the figure as below:



3.2 Touch Panel FPC

No.	Symbol	IO	Descriptions	Note
1	XR	Passive	Touch Panel Right Terminal	
2	YU	Passive	Touch Panel Upper Terminal	
3	XL	Passive	Touch Panel Left Terminal	
4	YD	Passive	Touch Panel Down Terminal	

4. Absolute Maximum Ratings

GND=0V, T_{OP}=25°C

Items	Symbol	Min.	Max.	Unit	Condition
Power Voltage	V _{CC}	-0.3	+6.5	V	
Backlight Supply	V _{LED}	-0.3	+6.5	V	
Operating Temperature	T _{OP}	-20	+70	°C	*1
Storage Temperature	T _{ST}	-30	+80	°C	*1

* 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.

5. Electrical Characteristics

5.1 DC Characteristics

GND=0V, T_{OP}=25°C

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Power voltage	V _{CC}	3.0	3.3	3.6	V	Note 1
	AV _{DD}	4.8	5.0	5.2	V	
	V _{GH}	14.3	15.0	15.7	V	
	V _{GL}	-10.5	-10.0	-9.5	V	
Current Consumption	V _{CAC}	-	5.50	-	V	
	V _{CDC}	0.72	0.92	1.12	V	
Input logic high voltage	V _{IH}	0.7V _{CC}	-	V _{CC}	V	Note 2
Input logic low voltage	V _{IL}	0	-	0.3V _{CC}	V	

Note 1: VCC setting should match the signals output voltage (refer to Note 2) of customer's system board.

Note 2: DCLK, DE, HS, VS, R0~ R7, G0~ G7, B0~ B7.

5.2 Current Consumption

GND=0V, T_{OP}=25°C

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Current for Driver	I _{GH}	-	120	240	uA	V _{GH} =+15V
	I _{GL}	-	130	260	uA	V _{GL} =-10V
	I _{CC}	-	10	15	mA	V _{CC} =3.3V
	I _{DD}	-	16	24	mA	AV _{DD} =5V

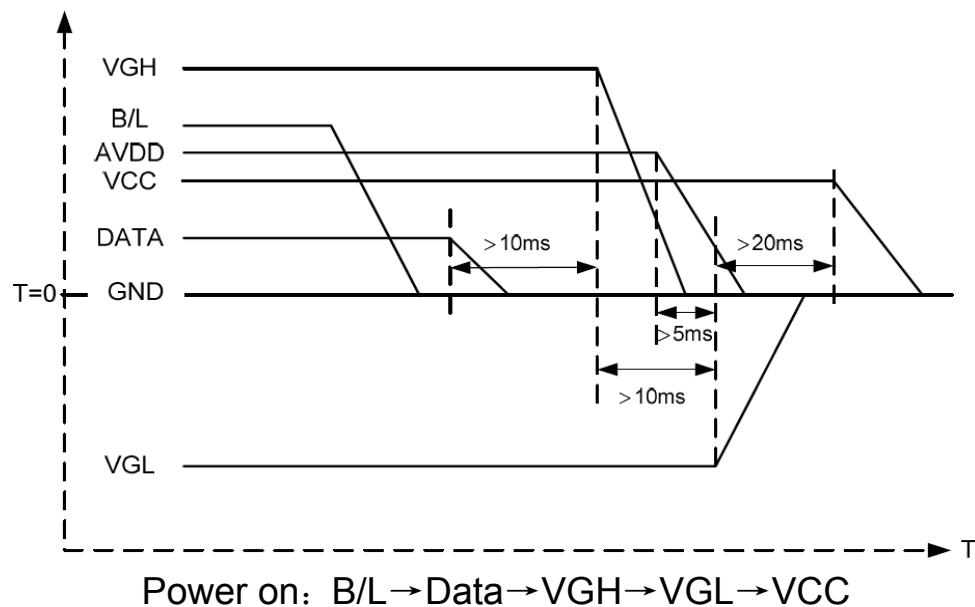
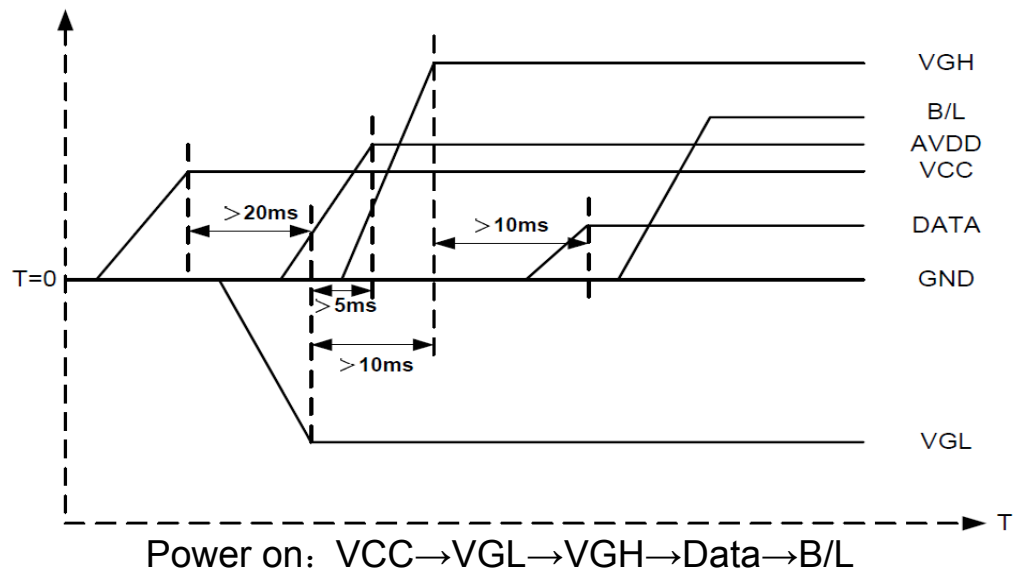
5.3 Backlight Driving Conditions

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Voltage for LED	VL	8.4	9.3	10.5	V	Note 1
Current for LED	IL	90	100	110	mA	
LED life time	-	20,000	-	-	Hr	Note 2

Note 1: The Voltage for LED Backlight is defined at Ta=25°C and IL =100mA.

Note 2: The “LED life time” is defined as the module brightness decrease to 50% original brightness that the ambient temperature is 25°C and IL =100mA. The LED lifetime could be decreased if operating IL is larger than 100 mA.

5.4 Power Sequence



Note: Data includes DE, VS, HS, B0~B7, G0~G7, R0~R7, DCLK.

5.5 Touch Panel Characteristics

Items	Min.	Typ.	Max.	Unit	Note
Linearity	-1.5	-	+1.5	%	Analog X and Y directions
Terminal resistance	300	-	900	Ω	X (Film side)
	100	-	600	Ω	Y (Glass side)
Transmittance	80	-	-	%	
Voltage	-	5.0	-	V	DC
Activation force	60	-	100	g	
Hitting Test	1,000,000	-	-	times	

6. AC Characteristics

6.1 Timing Conditions

Input/Output Timing

Items	Symbol	Min.	Typ.	Max.	Unit	Note
PXLCLK clock time	Tclk	33.3	39.7	-	ns	
PXLCLK pulse duty	Tcwh	40	50	60	%	Tclk
DATA set-up time	Tdsu	12	-	-	ns	DATA to PXLCLK
DATA hold time	Tdhd	12	-	-	ns	DATA to PXLCLK
DE setup time	Tesu	12	-	-	ns	DE to PXLCLK
VSYNC setup time	Tvst	12	-	-	ns	
VSYNC hold time	Tvhd	12	-	-	ns	
HSYNC setup time	Thst	12	-	-	ns	
HSYNC hold time	Thhd	12	-	-	ns	
HSYNC period time	Th	22.91	31.76	-	us	
HSYNC width	Thwh	1	-	-	Tclk	
VSYNC width	Tvwh	1	-	-	Th	
HSYNC to CLKIN	Thc	-	-	1	Tclk	

DE Mode input Timing Limitation

Items	Min.	Typ.	Max.	Unit	Note
THC	48	160	765	tclk	
THD	640	640	640	tclk	
TH	688	800	1405	tclk	1TH=1line
TVC	6	45	255	line	
TVD	480	480	480	line	
TV	486	525	735	line	1TV=1field

HV Mode input Timing Limitation

Items	Min.	Typ.	Max.	Unit	Note
Thwh	-	10	-	tclk	
Thbp	-	134	-	tclk	
Thfp	-	16	-	tclk	
THD	-	640	-	tclk	
TH	-	800	-	tclk	1TH=1 line
Tvwh	-	2	-	line	
Tvbp	-	11	-	line	
Tvfp	-	32	-	line	
TVD	-	480	-	line	
TV	-	525	-	line	1TV=1 field

6.2 Timing Diagram

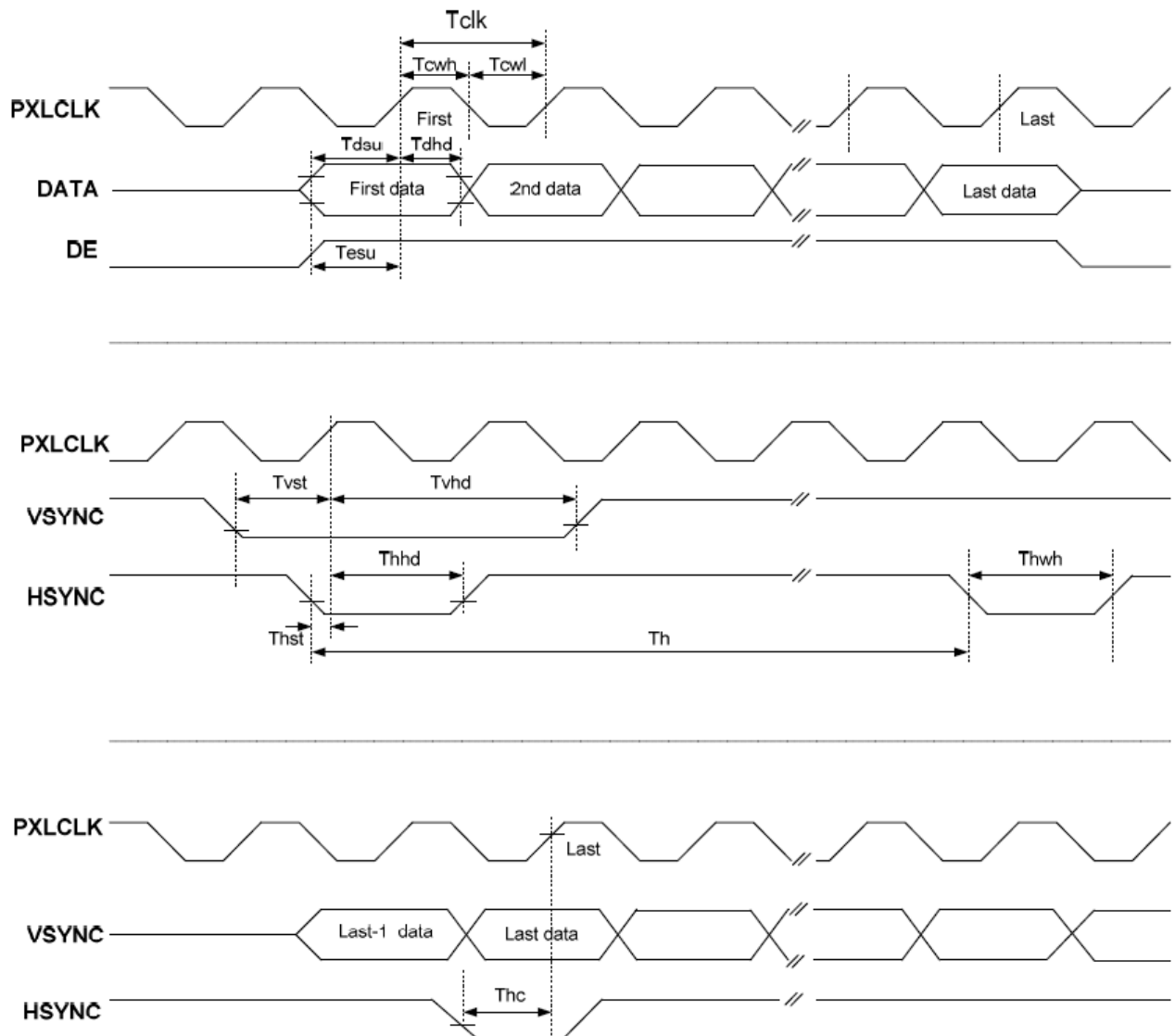


Fig.3-1 Clock and Data Input Timing Diagram

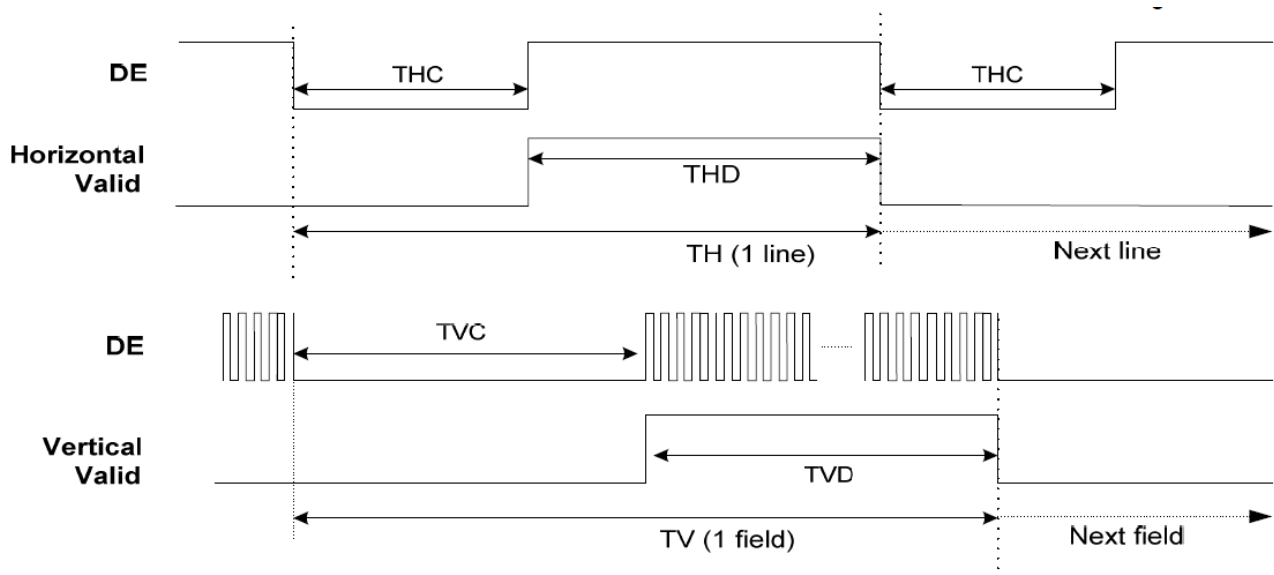


Fig.3-2 DE Mode Input Timing

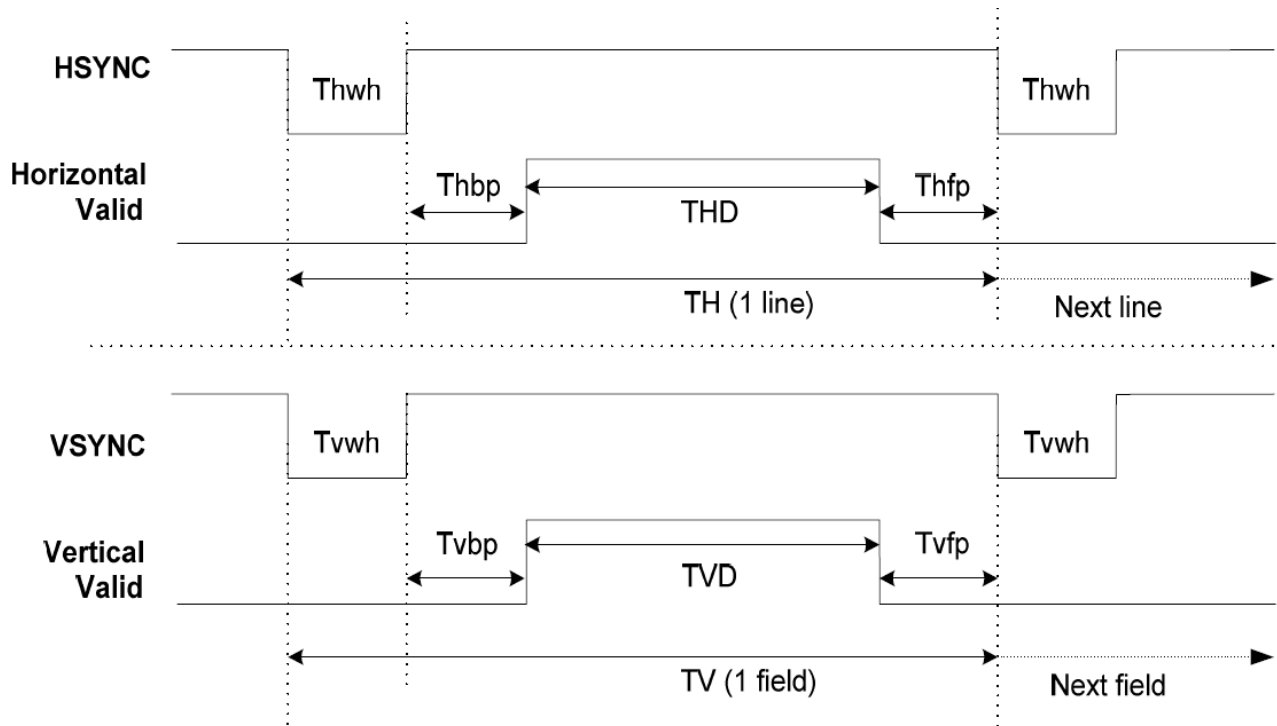


Fig.3-3 HV Mode Input Timing

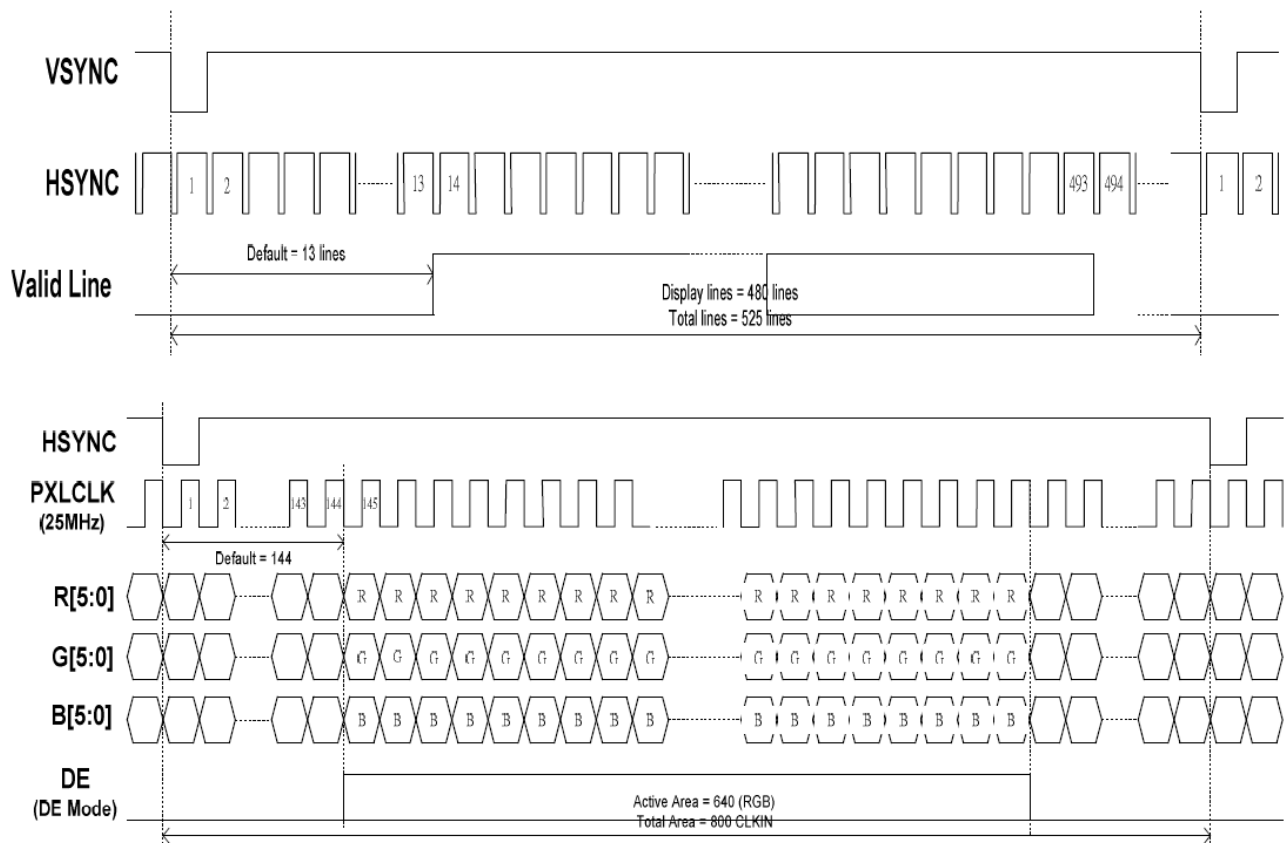


Fig. 3-4 18 bit RGB mode for 640 x (RGB) x 480

7. Optical Characteristics

7.1 Optical characteristic of the LCD

Test Conditions:

1. VCC=3.3V, IL=100mA, the ambient temperature is 25°C.
2. The test systems refer to Note 2.
3. Exclude Touch Panel.

Top=25°C

Items	Symbol	Min.	Typ.	Max.	Unit	Condition	Note
Viewing angle (CR≥10)	θ_L	60	70	-	degree	$\Phi=180^\circ$ (9 o'clock)	Note 1
	θ_R	60	70	-		$\Phi=0^\circ$ (3 o'clock)	
	θ_T	40	50	-		$\Phi=90^\circ$ (12 o'clock)	
	θ_B	60	70	-		$\Phi=270^\circ$ (6 o'clock)	
Response time	T_{ON}	-	10	20	msec	Normal $\theta=\Phi=0^\circ$	Note 3
	T_{OFF}	-	15	30	msec		Note 3
Contrast ratio	C_R	400	500	-	-		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	-	200	-	cd/m ²		Note 6
Luminance uniformity	Y_U	70	75	-	%		Note 6,7

Note 1: Definition of viewing angle

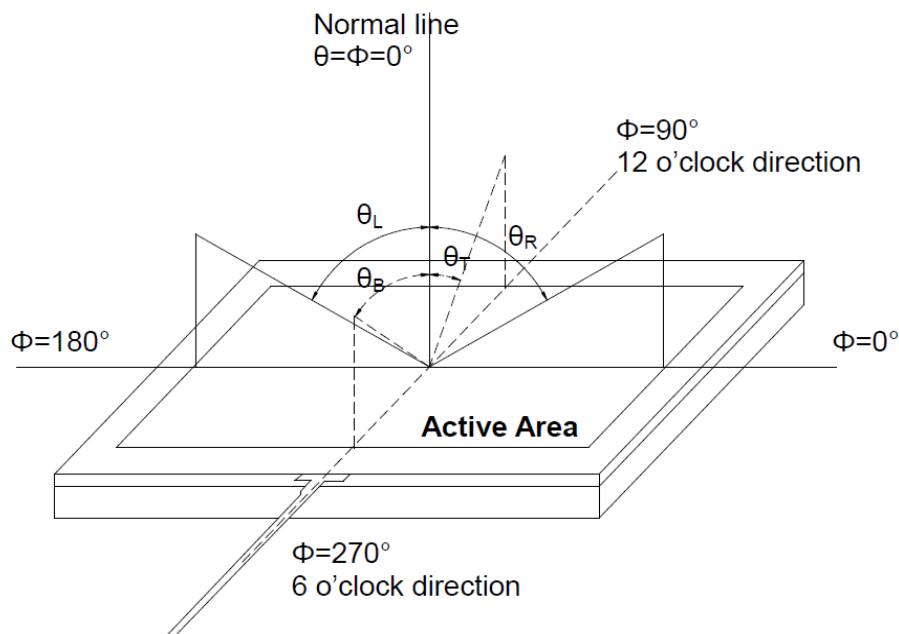


Fig. 4-1 Definition of viewing angle

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.)

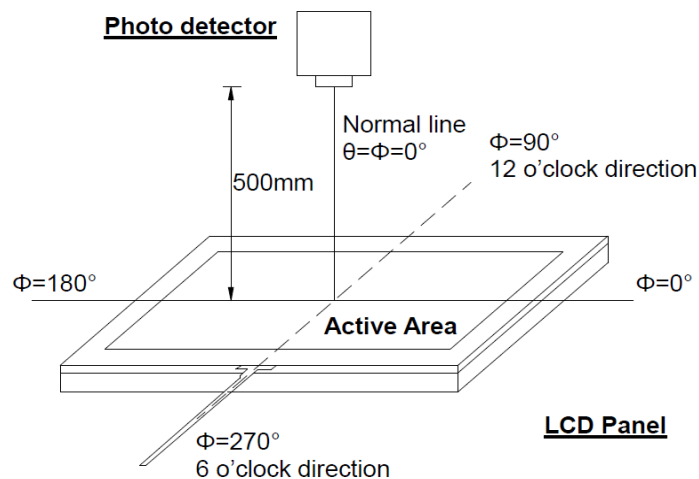


Fig. 4-2 Optical measurement system setup

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%.

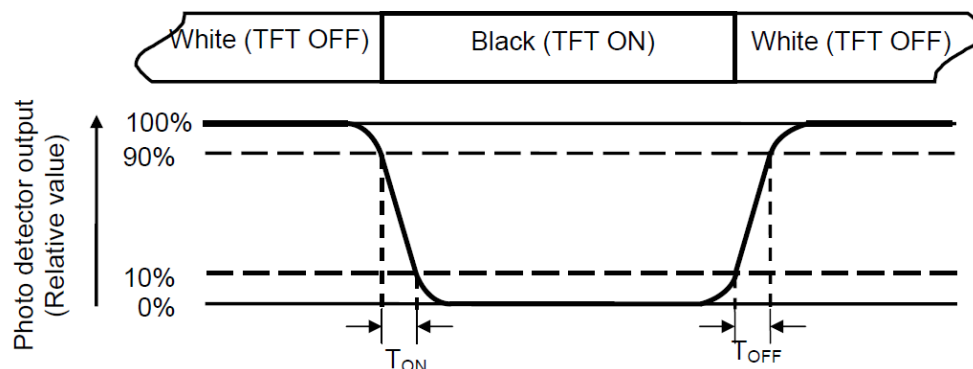


Fig. 4-3 Definition of response time

Note 4: Definition of contrast ratio:

Luminance measured when LCD is at “white state”

$$\text{Contrast Ratio (CR)} = \frac{\text{Luminance measured when LCD is at “white state”}}{\text{Luminance measured when LCD is at “black state”}}$$

Luminance measured when LCD is at “black state”

Note 5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

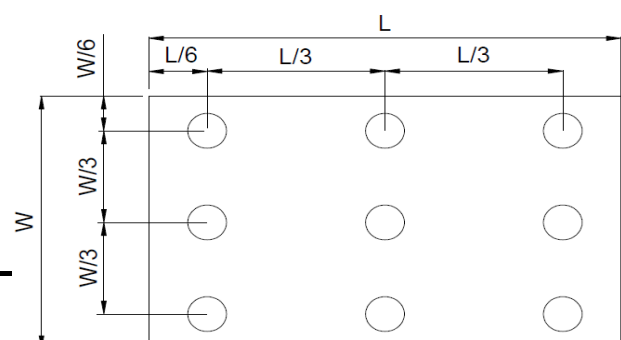
Note 6: All input terminals LCD panel must be ground while measuring the center area of the panel. The LED driving condition is $V_{LED}=5.0V$.

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.

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

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



Bmin: The measured minimum luminance of all measurement position.

8. Precautions of using LCD Modules

Mounting

- Mounting must use holes arranged in four corners or four sides.
- The mounting structure so provide even force on to LCD module. Uneven force (ex. Twisted stress) should not applied to the module. And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.
- It is suggested to attach a transparent protective plate to the surface in order to protect the polarizer. It should have sufficient strength in order to the resist external force.
- The housing should adopt radiation structure to satisfy the temperature specification.
- Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.
- Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. Never rub with dust clothes with chemical treatment. Do not touch the surface of polarizer for bare hand or greasy cloth.(Some cosmetics deteriorate the polarizer.)
- When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with petroleum benzine. Normal-hexane is recommended for cleaning the adhesives used to attach front / rear polarizers. Do not use acetone, toluene and alcohol because they cause chemical damage to the polarizer.
- Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer

Operating

- The spike noise causes the mis-operation of circuits. It should be within the $\pm 200\text{mV}$ level (Over and under shoot voltage)
- Response time depends on the temperature.(In lower temperature, it becomes longer.)
- Brightness depends on the temperature. (In lower temperature, it becomes lower.) And in lower temperature, response time(required time that brightness is stable after turned on) becomes longer.
- Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
- When fixed patterns are displayed for a long time, remnant image is likely to occur.
- Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimized the interference

Electrostatic Discharge Control

Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc. And don't touch interface pin directly.

Strong Light Exposure

Strong light exposure causes degradation of polarizer and color filter.

Storage

When storing modules as spares for a long time, the following precautions are necessary.

- Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5°C and 35°C at normal humidity.
- The polarizer surface should not come in contact with any other object. It is recommended that they be stored in the container in which they were shipped.

Protection Film

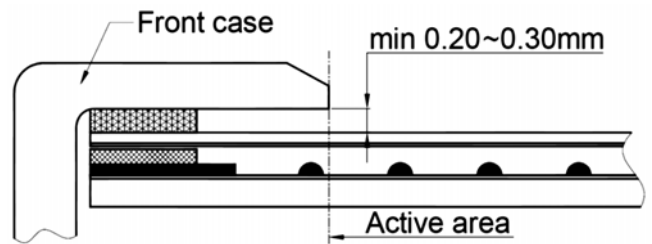
- When the protection film is peeled off, static electricity is generated between the film and polarizer. This should be peeled off slowly and carefully by people who are electrically grounded and with well ion-blown equipment or in such a condition, etc.
- The protection film is attached to the polarizer with a small amount of glue. If some stress is applied to rub the protection film against the polarizer during the time you peel off the film, the glue is apt tore main on the polarizer. Please carefully peel off the protection film without rubbing it against the polarizer.
- When the module with protection film attached is stored for a long time, sometimes there remains a very small amount of glue still on the polarizer after the protection film is peeled off.
- You can remove the glue easily. When the glue remains on the polarizer surface or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal-hexane.

Transportation

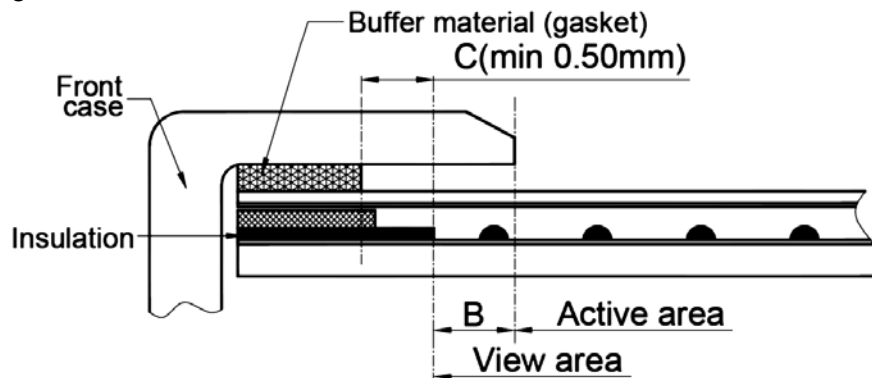
The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.

附录: Touch panel Design Precautions

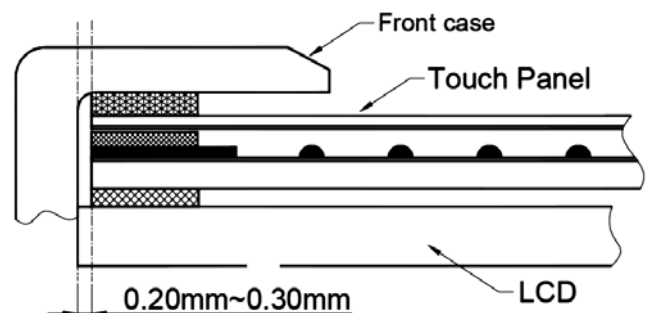
1. It should prevent front case touching the touch panel Active Area (A.A.) to prevent abnormal touch.
It should left gab (e.g. 0.2~0.3mm) in between.



2. Outer case design should take care about the area outside the A.A.
Those areas contain circuit wires which is having different thickness. Touching those areas could deform the ITO film. As a result case the ITO cold be damaged and shorten its lifetime.
It is suggested to protect those areas with gasket (between the front case and the touch panel).
The suggested figures are $B \geq 0.50\text{mm}$; $C \geq 0.50\text{mm}$.



3. The front case side wall should keep space (e.g. 0.2 ~ 0.3mm) from the touch panel.



4. In general design,
touch panel V.A. should be bigger than the LCD V.A.
and touch panel A.A. should be bigger than the LCD A.A.

