



深圳市拓普微科技开发有限公司

SHENZHEN TOPWAY TECHNOLOGY CO., LTD.

LMT070DNCFWU

LCD Module User Manual

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Rev.	Descriptions	Release Date
0.1	Preliminary release	2012-08-07
0.2	Update section 4.1 and 4.3 parameter	2016-09-13

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1. General Specification

Signal Interface :	Digital 24-bits RGB
Display Technology :	a-Si TFT active matrix
Display Mode :	TN Type Full Color / Transmissive / Normal White
Screen Size(Diagonal) :	7.0"
Outline Dimension :	164.9 x 100.0 x 5.7 (mm) (see attached drawing for details)
Active Area :	154.08 x 85.92 (mm)
Number of dots :	800 x 3 (RGB) x 480
Pixel Pitch :	0.1926 x 0.179 (mm)
Pixel Configuration :	RGB Stripe
Backlight :	LED
Surface Treatment :	Anti-Glare
Viewing Direction :	6 o'clock
Operating Temperature :	-20 ~ +70°C
Storage Temperature :	-30 ~ +80°C

2. Terminal Function (Input Terminal)

Pin No.	Pin Name	I/O	Descriptions
1	AGND	Power	Power GND (0V)
2	AVDD	Power	Analog power
3	VCC	Power	Digital power supply
4	R0	Input	8bit Data for Red
:	:		
11	R7		
12	G0	Input	8bit Data for Green
:	:		
19	G7		
20	B0	Input	8bit Data for Blue
:	:		
27	B7		
28	DCLK	Input	Clock input
29	DE	Input	Data input enable. Active high to enable data
30	HSD	Input	Horizontal Sync Input. negative polarity
31	VSD	Input	Vertical Sync Input. negative polarity
32	MODE	Input	DE/SYNC mode select H: DE mode ,L:SYNC mode
33	RSTB	Input	Reset pin
34	STBYB	Input	Standby mode select H:normal operation, L:standby mode
35	SHLR	Input	right or left scanning Direction
36	VCC	Power	Digital power
37	UPDN	Input	up or down scanning Direction
38	GND	Power	Power GND (0V)
39	AGND	Power	Power GND (0V)
40	AVDD	Power	Analog power
41	VCOM	Input	Common voltage input
42	DITH	Input	Dithering setting. H:6bit resolution, L:8bit resolution
43	NC	-	No connect
44	NC	-	No connect
45	V10	Input	Gamma voltage 10
:	:	:	:
54	V1	Input	Gamma voltage 1
55	NC	-	No connect
56	VGH	Power	Positive power for TFT
57	VCC	Power	Digital power
58	VGL	Power	Negative power for TFT
59	GND	Power	Power GND (0V)
60	NC	-	No connect

2.1 K2 (Backlight connector)

Pin No.	Pin Name	IO	Descriptions	Wire Color
1	BLA	Power	LED driving anode (high voltage)	Red
2	BLK	Power	LED driving cathode (low voltage)	White

2.2 U/D R/L Function Description

Scan Control Input		Scanning direction
U/D	L/R	
GND	VCC	Up to down, left to right
VCC	GND	Down to up, right to left
GND	GND	Up to down, right to left
VCC	VCC	Down to up, left to right

3. Absolute Maximum Ratings

Items	Symbol	Min.	Max.	Unit	Condition
Power voltage	VCC	-0.5	5.0	V	
	AVDD	-0.5	15.0	V	
	VGH	-0.3	42.0	V	
	VGL	VGH-42.0	0.3	V	
	VGH-VGL	-0.3	40.0	V	
Backlight Forward Current	I _{LED}	-	25.0	mA	For each LED
Operating Temperature	T _{OP}	-20	+70	°C	No Condensation
Storage Temperature	T _{ST}	-30	+80	°C	No Condensation

Note:

- *1. This rating applies to all parts of the module. And should not be exceeded.
- *2. The operating temperature only guarantees operation of the circuit. The contrast, response speed, and the other specification related to electro-optical display quality is determined at the room temperature, T_{OP}=25.
- *3. Ambient temperature when the backlight is lit (reference value)
- *4. Any Stresses exceeding the Absolute Maximum Ratings may cause substantial damage to the device. Functional operation of this device at other conditions beyond those listed in the specification is not implied and prolonged exposure to extreme conditions may affect device reliability.

4. Electrical Characteristics

4.1 DC Characteristics

AGND=GND=0V, Ta = 25°C

Items	Symbol	Min.	Typ.	Max.	Unit	Remark
Digital supply Voltage	VCC	3.0	3.3	3.6	V	
Analog supply Voltage	AVDD	9.87	10.4	10.93	V	
Gate on voltage	V _{GH}	14.4	16.0	17.6	V	
Gate off voltage	V _{GL}	-7.7	-7.0	-6.3	V	
Input signal voltage	V _{COM}	-	3.94	-	V	*1
Input level of Gamma Voltage	V1~V5	0.4AVDD	-	AVDD-0.4	V	
	V6~V10	0.1	-	0.6AVDD	V	
Input logic high voltage	V _{IH}	0.7VCC	-	VCC	V	R0~R7,G0~G7, B0~B7,DE,DCLK,HSD ,VSD,MODE, RSTB,STBYB, SHLR,UPDN, DITH
Input logic low voltage	V _{IL}	0	-	0.3VCC	V	
Current of digital supply voltage	I _{VCC}	-	-	10	mA	
Current of analog supply voltage	I _{AVDD}	-	-	40	mA	
Current of Gate on voltage	I _{VGH}	-	-	0.3	mA	
Current of Gate off voltage	I _{VGL}	-	-	0.3	mA	

Note:

- *1. Typical Vcom is only a reference value .It must be optimized according to each LCM. Please use VR for Vcom circuit.

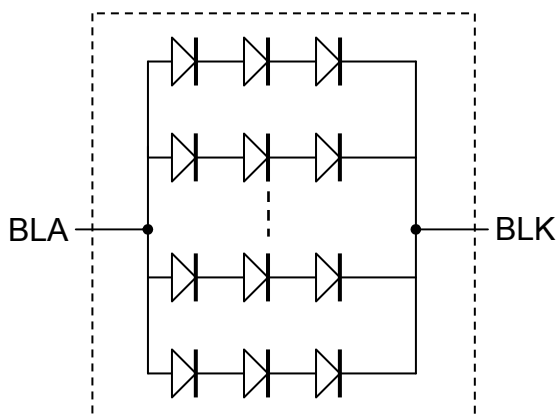
4.2 LED Backlight Circuit Characteristics

Top=25°C

Items	Symbol	MIN.	TYP.	MAX.	Unit	Note
Forward Voltage	V_F	-	9.6	11.4	V	
Forward Current	I_F	-	140.0	-	mA	
Operating Life Time	--	10000	20000	-	hrs	

Note 1: The LED driving condition is defined for total backlight consumption, and which depend on Forward Current setting.

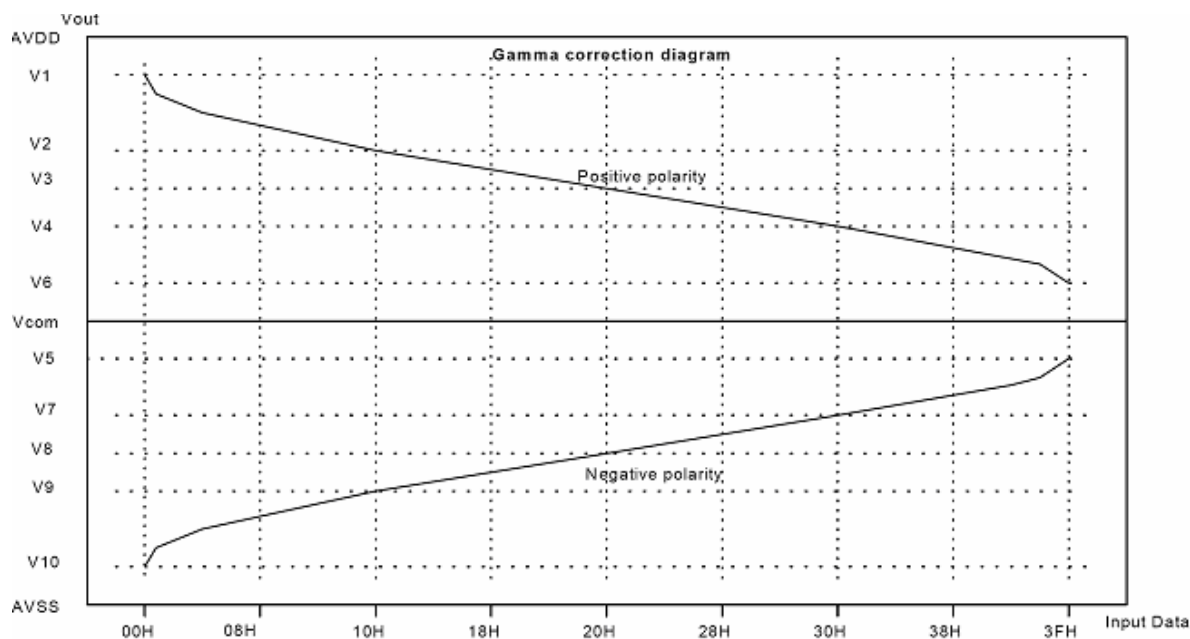
Note 2: Forward Voltage is just for reference for one serial.



No. of LED = 7x3=21 pcs

4.3 Gamma Correction Reference Voltage Setting

Gamma Correction Curve



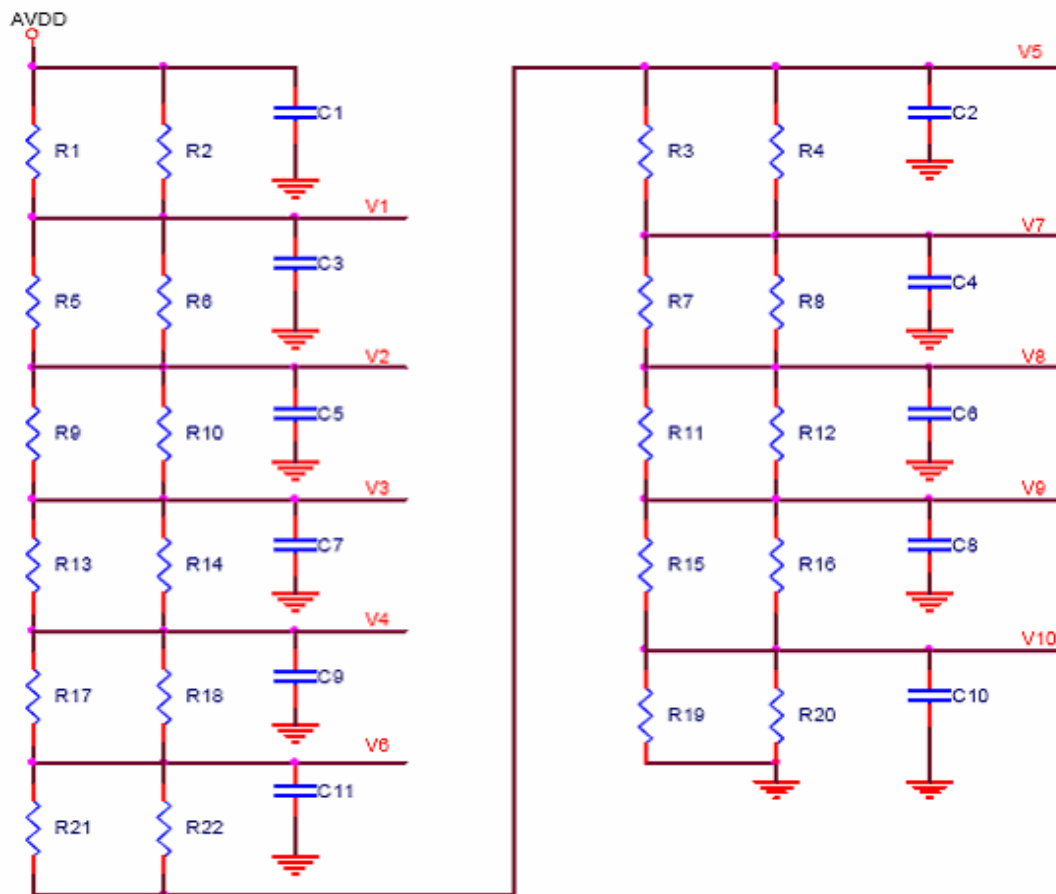
Gamma Correction Reference Voltage Setting

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Gamma correction reference voltage V1~V10	V1	-	9.80	AVDD-0.4	V	
	V2	-	8.13	-	V	
	V3	-	7.55	-	V	
	V4	-	6.97	-	V	
	V5	-	5.21	-	V	
	V6	-	5.01	-	V	
	V7	--	3.02	-	V	
	V8	-	2.66	-	V	
	V9	-	2.07	-	V	
	V10	AGND+0.1	0.4	-	V	

Note: the value is for design stage only;

AVDD-0.4> V1 > V2> V3 > V4 > V6 > V5 > V7>V8 > V9 > V10 > AGND+0.1V

Gamma Correction Reference Circuit



Gamma Correction Resistance Value

Symbol	Unit	Resistance	Symbol	Unit	Resistance
R1// R2	Ω	47//NC	R3// R4	Ω	240//620
R5// R6	Ω	240//1000	R7// R8	Ω	62//220
R9// R10	Ω	91//180	R11// R12	Ω	91//180
R13// R14	Ω	62//220	R15// R16	Ω	240//1000
R17// R18	Ω	240//620	R19// R20	Ω	47//NC
R21// R22	Ω	47//300	C1~C10	uF	1.0 (16V)

Note: Setting the resistance only when AVDD=10.60V, AGND=GND=0V

5. AC Characteristics

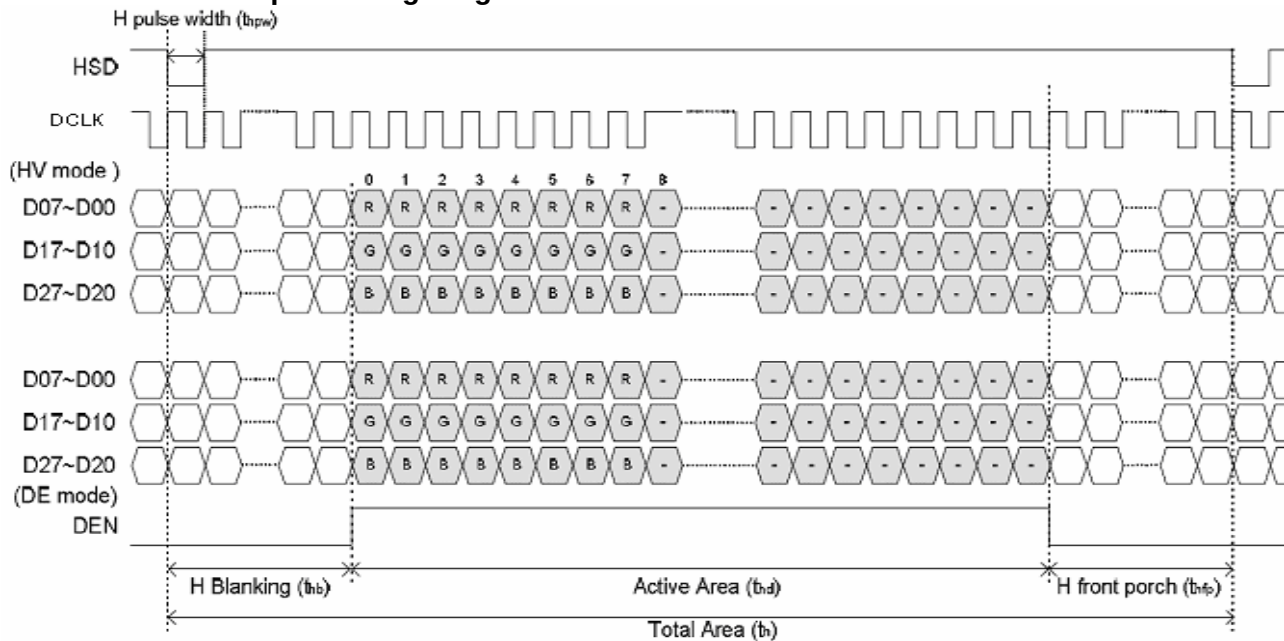
5.1 TFT-LCD Input Timing

VCC=3.3V, AGND=GND=0V, Ta=25°C

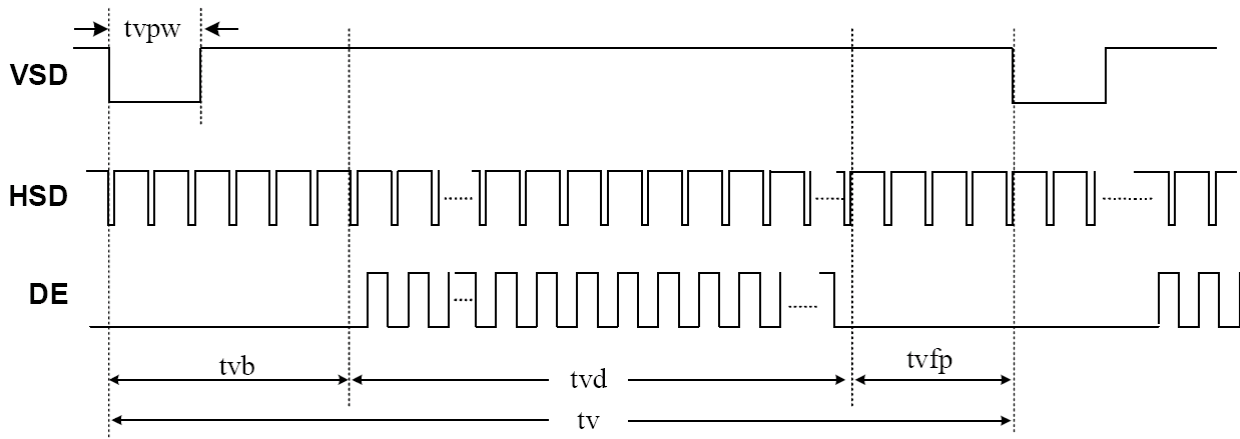
Parameter	Symbol	Min	Typ	Max	Unit	Remark
DCLK	Fclk	-	30	40	MHZ	
	tclk	-	33.3	25.0	ns	
HSD	th	928	928	928	tclk	
	thd	800	800	800	tclk	
	thpw	1	48	-	tclk	
	thb	88	88	88	tclk	
	thfp	1	40	-	tclk	
VSD	tv	513	525	-	th	
	tvd	480	480	480	th	
	tvpw	3	3	-	th	
	tvb	32	32	32	th	
	tvfp	1	13	-	th	

Note: DE timing refer to HSD, VSD input timing.

TCON Horizontal Input Timing Diagram



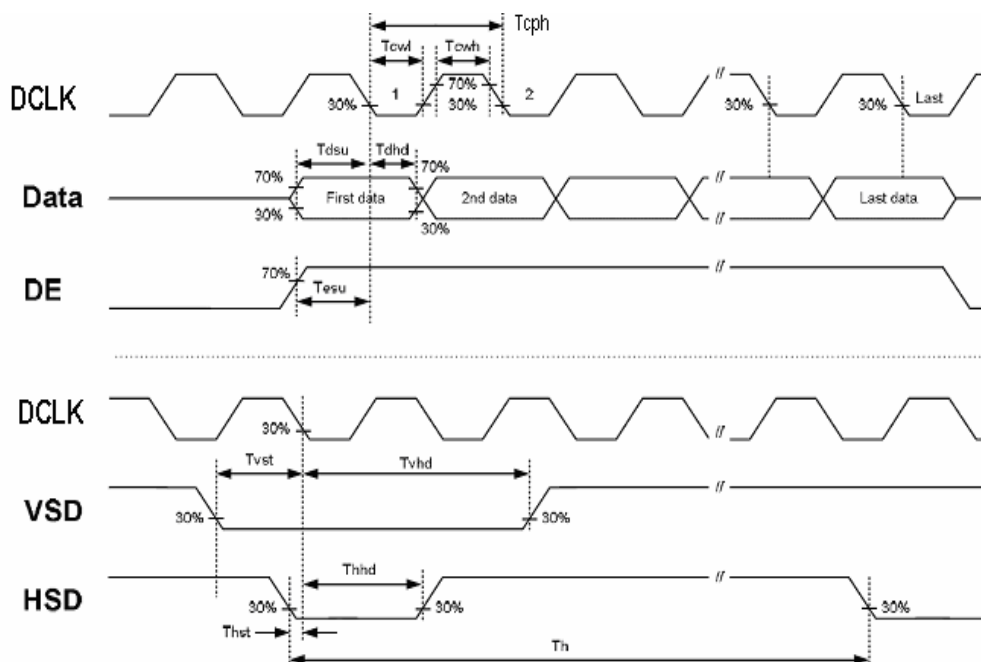
TCON Vertical Input Timing Diagram HV



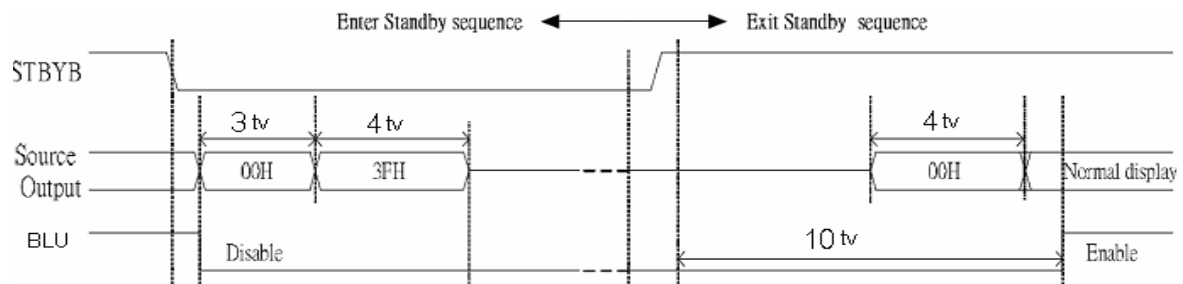
5.2 Input timing Characteristics of Interface

VCC=3.3V, AVSS=GND=0V, Ta=25°C

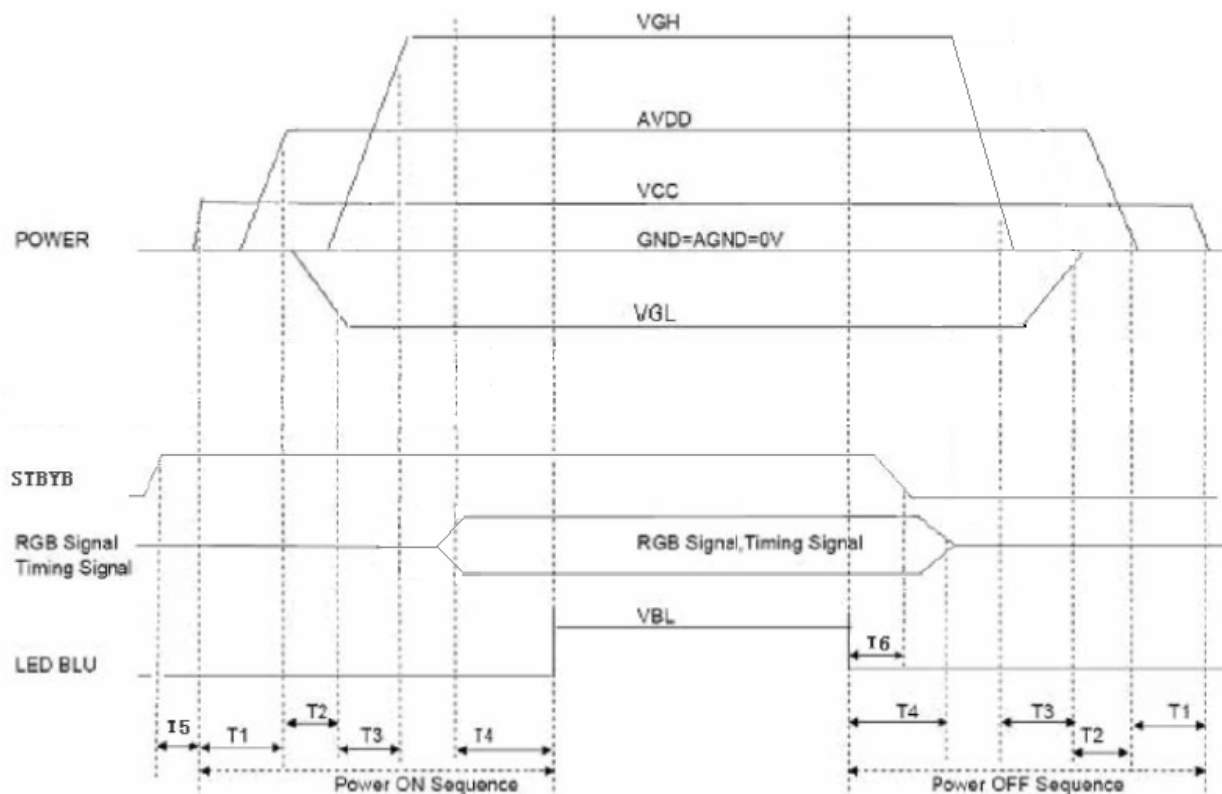
Parameter	Symbol	MIN.	TYP.	MAX.	Unit	Remark
DCLK frequency	Fclk	-	30.0	40.0	MHz	
DCLK cycle time	Tcph	-	33.3	25	ns	
DCLK pulse width	Tcw	40%	50%	60%	Tcph	
VSD setup time	Tvst	8	-	-	ns	
VSD hold time	Tvhd	8	-	-	ns	
HSD setup time	Thst	8	-	-	ns	
HSD hold time	Thhd	8	-	-	ns	
Data setup time	Tdsu	8	-	-	ns	
Data hold time	Tdhd	8	-	-	ns	
DE setup time	Tesu	8	-	-	ns	
DE hold time	Tehd	8	-	-	ns	



5.3 Enter and Exit Standby Mode Sequence



5.4 POWER ON/OFF SEQUENCE



Note: $T1 \geq 20\text{ms}$, $T2 \geq 20\text{ms}$, $T3 \geq 5\text{ms}$, $T4 \geq 100\text{ms}$, $T5 \geq 5\text{ms}$, $T6 \geq 5\text{ms}$.

6. Optical Characteristics

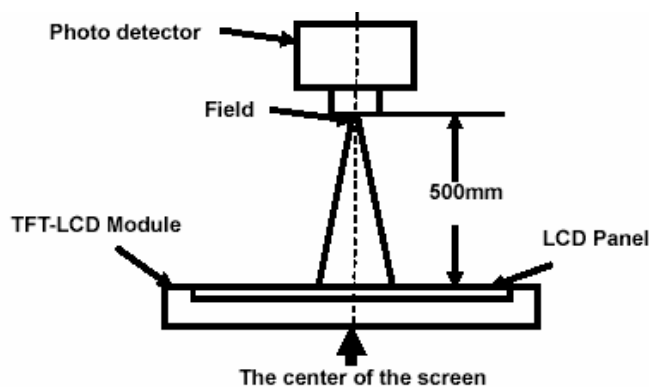
Item	Symbol	Condition	MIN.	TYP.	MAX.	UNIT	Note.
Viewing angle	θ_T	(CR $\geq$ 10)	50	60	-	degree	Note 2
	θ_B		60	70	-		
	θ_L		60	70	-		
	θ_R		60	70	-		
Contrast ratio	CR	$\theta=0^\circ$	400	500	-	-	Note 1,3
Response Time	T _{on}	25°C	-	20	30	msec	Note 1,4
	T _{off}					msec	
Chromaticity	White	X	Backlight is on	0.274	0.324	0.374	Note 1,5
		Y		0.295	0.345	0.395	
	Red	X		0.544	0.594	0.644	
		Y		0.301	0.351	0.401	
	Green	X		0.299	0.349	0.399	
		Y		0.531	0.581	0.631	
	Blue	X		0.102	0.152	0.202	
		Y		0.053	0.103	0.153	
Luminance	L		280	350	-	cd/m ²	Note 1,6
NTSC			-	50		%	Note 5
Luminance uniformity	U		75	80	-	%	Note 1,7

Test Conditions:

1. IF= 160 mA, VF=9.6V, and the ambient temperature is 25. °C
2. The test systems refer to Note 1 and Note 2.

Note 1: Definition of optical measurement system.

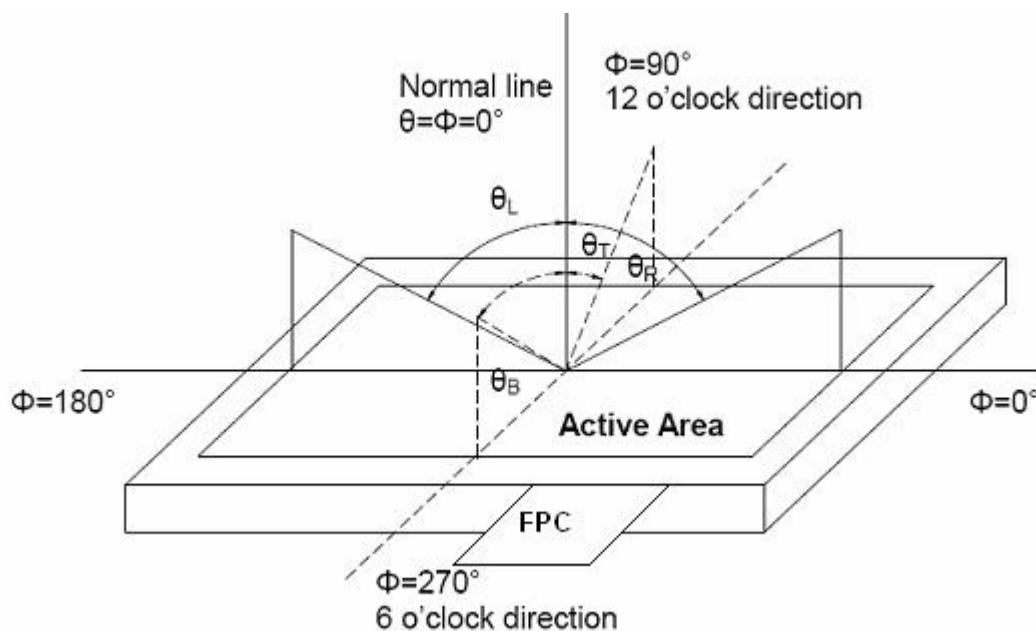
The optical characteristics should be measured in dark room. After 5 minutes operation, the optical properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.



Item	Photo detecto	Field
Contrast Ratio	SR-3A	1°
Luminance		
Chromaticity		
Lum Uniformity		
Response Time	BM-7A	2°

Note 2: Definition of viewing angle range and measurement system

viewing angle is measured at the center point of the LCD by CONOSCOPE(ergo-80).

**Note 3: Definition of contrast ratio**

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

White state “: The state is that the LCD should driven by V_{white} .

“Black state”: The state is that the LCD should driven by V_{black} .

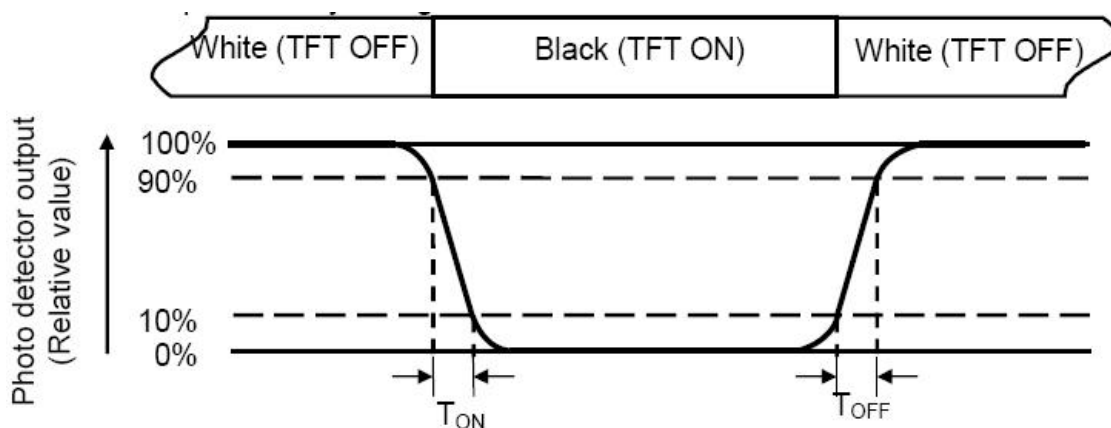
V_{white} : To be determined V_{black} : To be determined.

Note 4: 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%.



Note 5: Definition of color chromaticity (CIE1931)

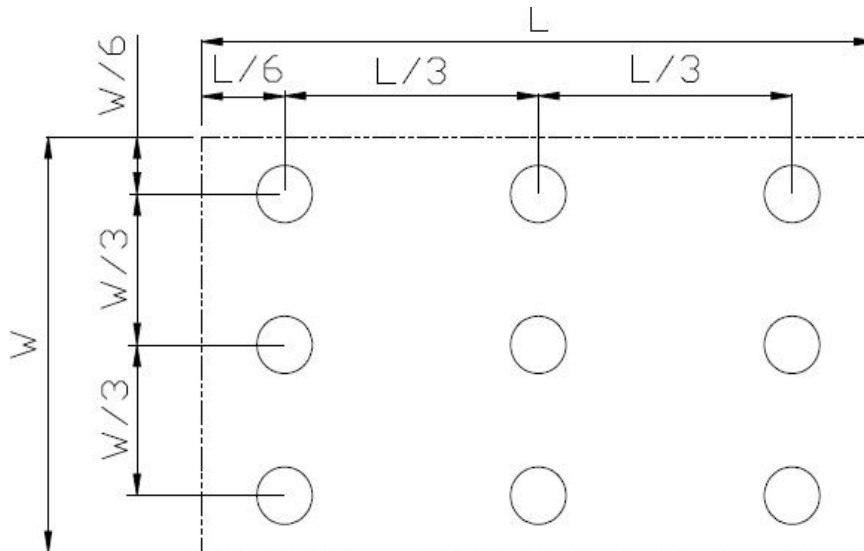
Color coordinates measured at center point of LCD.

Note 6: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer Fig. 2). Every measuring point is placed at the center of each measuring area.

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

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



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 center point.

7. 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.

8. Appendix <Inspection items and criteria for appearance defect>

8.1 Bright/Dark Dots:

Defect Type	Specification	Major	Minor
Bright Dots	$N \leq 2$		•
Dark Dots	$N \leq 3$		•
Total Bright and Dark Dots	$N \leq 4$		•

Note: 1. **The definition of dot:** The size of a defective dot over 1/2 of whole dot is regarded as one defective dot.

2. **Bright dot:** Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.
3. **Dark dot:** Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue pattern.