

■ Preliminary Specification
□ Approval Specification

SPECIFICATION FOR LCD MODULE

Customer : _____
Product Model: AGO-070DS1-NN-N
Sample code : _____

Designed by	Checked by	Approved by

Final Approval by Customer

☐ LCM Machinery OK Checked By ☐ LCM Display OK Checked By	☐ LCM OK ☐ NG, Problem survey: 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.

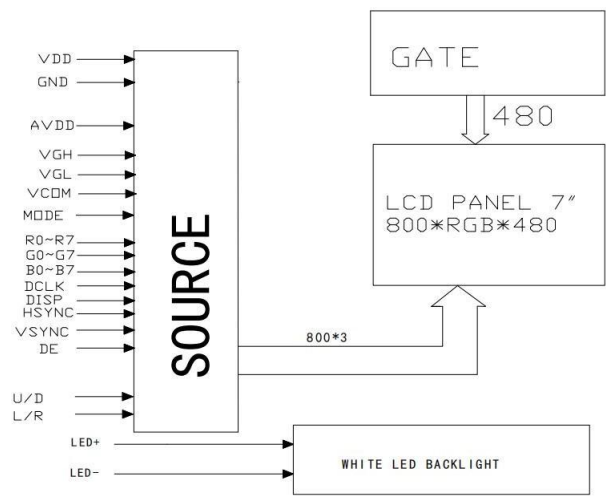
Revision History

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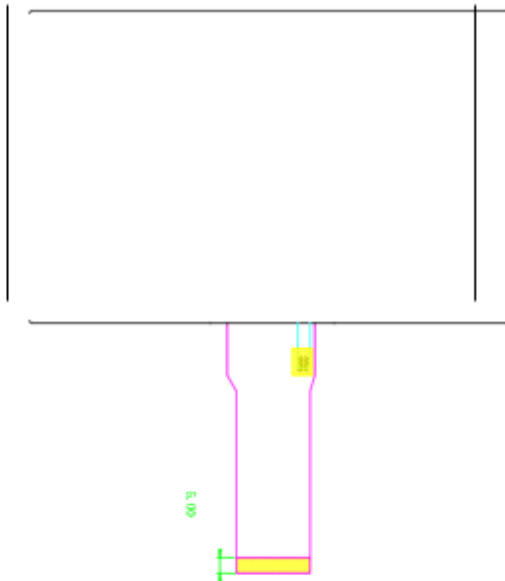
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1. Block Diagram



2. Technology Specifications

Item	Contents	Unit
LCD type	TFT TRANSMISSIVE	---
Viewing direction	6	o'clock
Module size (W×H×T)	164.9 x 100 x 5.7	mm ³
Active area(W×H)	153.84×85.63	mm ²
Number of dots(W×H)	800*RGB* × 480	dots
Pixel Pitch(W×H))	0.0632xRGB×0.1790	mm
Driver IC	EK9716	---
Colors	16.7M	---
Backlight Type	27 white leds 9.6V /180mA	---
Interface Type	RGB	---

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5.Interface Pin Assignment

Pin No.	Symbol	Functional
1	LED A	LED Anode
2	LED A	LED Anode
3	LED K	LED Cathode
4	LED K	LED Cathode
5	GND	Digital Ground
6	VCOM	For external VCOM DC input
7	DVDD	Digital Power
8	MODE	DE/SYNC mode select MODE=H: DE mode(normally pull high) MODE=L: HSD/VSD mode
9	DE	Data enable signal
10	VSYNC	Vertical sync input.Negative polarity
11	HSYNC	Horizontal sync input.Negative polarity
12~19	B7~B0	Blue data Input
20~27	G7~G0	Green data Input
28~35	R7~R0	Red data Input
36	GND	Digital Ground
37	DCLK	Clock input
38	GND	Digital Ground
39	L/R	Source right or left sequence control SHLR=H: right shift, Left → Right SHLR=L: left right, Right → Left
40	U/D	Gate up or down scan control UPDN=H: up shift, Down → Up UPDN=L: down shift, Up → Down
41	VGH	Positive Power for TFT
42	VGL	Negative Power for TFT
43	AVDD	Analog Power
44	RSTB	Global reset pin.Active low to enter reset state Suggest to connecting with an RC reset circuit for stability. Normally pull high. (RC circuit :R=10KΩ, C=1uF)
45	NC	Not connect
46	VCOM	For external VCOM DC input
47	DITHB	Dithering setting DITH="H" 6-bit resolution (last 2 bits of input data turncated) DITH="L" 8-bit resolution (default setting)
48	GND	Digital Ground
49	NC	Not connect
50	NC	Not connect

6 .Operation Specifications

6.1 Absolute Max. Rating

Parameter	Symbol	Min	Max	Unit
Power supply1	VDD	-0.6	+3.6	V
Power supply2	Avdd	-0.5	+13.5	V
Operating temperature	T _{OPR}	-20	70	°C
Storage temperature	T _{STG}	-30	80	°C

6.2 Typical operation conditions

parameter	Typ	Unit
VGH	18	V
VGL	-8	V
AVDD	10.2	V
* VCOM	3.8	V

Note: Please adjust Vcom to make the flicker level be minimum

6.3 LED Back Light Specification

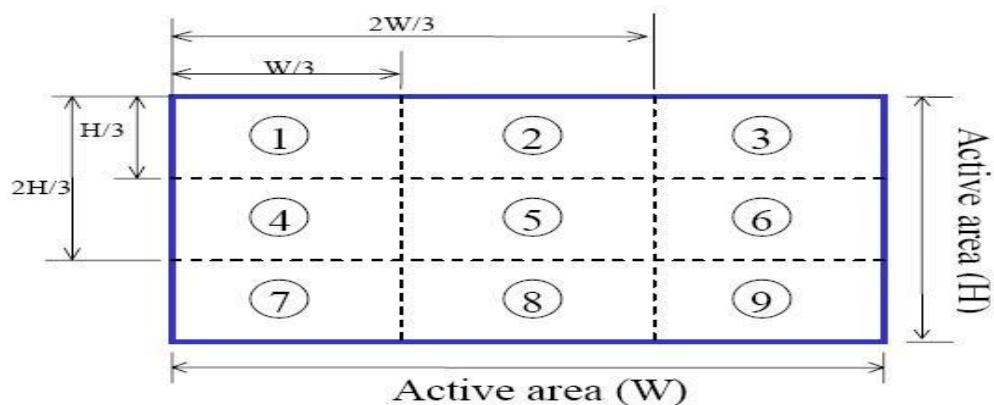
Item	Symbol	Min	Typical	Max	Unit
LED module Forward voltage	V _{LED}	9.0	9.3	9.6	V
LED module current	I _{LED}	--	180	--	mA
L/G Surface Luminance ★1	L _S	--	500	--	mcd
LCM Surface brightness uniform ★2	L _D	80	--	--	%

★ 1 Test condition is:

- (a) Center point on active area.
- (b) Best Contrast.

★2 Uniform measure condition:

- (1) Measure 9 point. Measure location show below;
- (2) Uniform=(Min. brightness /Max. brightness)*100%
- (3) Best Contrast.



7. Signal Timing Characteristics

7.1 RGB MODE AC ELECTRICAL CHARACTERISTICS

(Detail please refer IC data sheet)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
VDD Power On Slew rate	T_{POR}	From 0V to 90% VDD	-	-	20	ms
RSTB pulse width	T_{RST}	CLKIN = 50MHz	50	-	-	us
CLKIN cycle time	T_{cph}	-	20	-	-	ns
CLKIN pulse duty	T_{cwh}	-	40	50	60	%
VSD setup time	T_{vst}	-	8	-	-	ns
VSD hold time	T_{vhd}	-	8	-	-	ns
HSD setup time	T_{hst}	-	8	-	-	ns
HSD hold time	T_{hhd}	-	8	-	-	ns
Data set-up time	T_{dsu}	DR[7:0], DG[7:0], DB[7:0] to CLKIN	8	-	-	ns
Data hold time	T_{dhd}	DR[7:0], DG[7:0], DB[7:0] to CLKIN	8	-	-	ns
DEN setup time	T_{esu}	-	8	-	-	ns
DEN hold time	T_{ehd}	-	8	-	-	ns
Output stable time	T_{sst}	10% to 90% target voltage. CL=120pF, R=10K ohm	-	-	6	us

7.2 DC ELECTRICAL CHARACTERISTICS FOR RGB

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Low level input voltage	Vil	For the digital circuit	0	-	0.3×VDD	V
High level input voltage	Vih	For the digital circuit	0.7×VDD	-	VDD	V
Input leakage current	Ii	For the digital circuit	-	-	±1	μA
High level output voltage	Voh	Ioh= -400 μA	VDD-0.4	-	-	V
Low level output voltage	Vol	Iol= +400 μA	-	-	VSS+0.4	V
Pull low/high resistor	Ri	For the digital input pin @ VDD=3.3V	200K	250K	300K	ohm
Digital Operation current	Idd	Fclk=50 MHz, FLD=48KHz, VDD=3.3V	-	14	18	mA
Digital Stand-by current	Ist1	Clock and all functions are stopped	-	10	50	μA
Analog Operating Current	Idda	No load, Fclk=50MHz, FLD=48KHz @ VDDA=10V, V1=8V, V14=0.4V	-	7	12	mA
Analog Stand-by current	Ist2	No load, Clock and all functions are stopped	-	10	50	μA
Input level of V1 ~ V7	Vref1	Gamma correction voltage input(Cascade Mode)	0.4×VDDA	-	VDDA-1	V
Input level of V8 ~ V14	Vref2	Gamma correction voltage input(Cascade Mode)	VSSA+1	-	0.6×VDDA	V
Input level of V1 ~ V7	Vref3	Gamma correction voltage input(Dual Gate Mode)	0.4×VDDA	-	VDDA-0.1	V
Input level of V8 ~ V14	Vref4	Gamma correction voltage input(Dual Gate Mode)	VSSA+0.1	-	0.6×VDDA	V
Output Voltage deviation	Vod1	Vo = VSSA+0.1V ~ VSSA+0.5V and Vo = VDDA-0.5V ~ VDDA-0.1V	-	±20	±35	mV
Output Voltage deviation	Vod2	Vo = VSSA+0.5V ~ VDDA-0.5V	-	±15	±20	mV
Output Voltage Offset between Chips	Voc	Vo = VSSA+0.5V ~ VDDA-0.5V	-	-	±20	mV
Dynamic Range of Output	Vdr	SO1 ~ SO1200	0.1	-	VDDA-0.1	V
Sinking Current of Outputs	IOLy	SO1 ~ SO1200; Vo=0.1V v.s 1.0V , VDDA=13.5V	80	-	-	uA
Driving Current of Outputs	IOHy	SO1 ~ SO1200; Vo=13.4V v.s 12.5V , VDDA=13.5V	80	-	-	uA
Resistance of Gamma Table	Rg	Rn: Internal gamma resistor	0.7×Rn	1.0×Rn	1.3×Rn	ohm

7.3 Data input format for RGB

For 24-Bit RGB input

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
CLKIN Frequency	Fclk	VDD = 1.71V ~ 3.6V	-	40	50	MHz
CLKIN Cycle Time	Tclk	-	20	25	-	ns
CLKIN Pulse Duty	Tcwh	Tclk	40	50	60	%
Time from HSD to Source Output	Thso		-	46	-	CLKIN
Time from HSD to LD	Thld		-	46	-	CLKIN
Time from HSD to STV	Thstv	-	-	2	-	CLKIN
Time from HSD to CKV	Thckv	-	-	20	-	CLKIN
Time from HSD to OEV	Thoev	-	-	4	-	CLKIN
LD Pulse Width	Twld			10		CLKIN
CKV Pulse Width	Twckv	-	-	66	-	CLKIN
OEV Pulse Width	Twoev	-	-	74	-	CLKIN

Vertical input Timing

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Vertical display area	tvd		480		H	
VSD period time	tv	517	525	712	H	tvpw+tvb=32H Is fixed
VSD pulse width	tvpw	1	1	3	H	
VSD Back Porch (Blanking)	tvb	31	31	29	H	
VSD Front Porch	tvfp	5	13	200	H	

Horizontal input Timing

Parameter	Symbol	Value			Unit	Note
Horizontal display area	thd	800			DCLK	
DCLK frequency	fclk	Min. 20	Typ. 33.3	Max. 50	MHz	
1 Horizontal Line	th	908	928	1088	DCLK	thb+thpw=88 DCLK is fixed
HSD pulse width	thpw	1	48	87		
HSD Back Porch (Blanking)	thb	87	40	1		
HSD Front Porch	thfp	20	40	200		

8. Optical specifications

Item	Symbol	Condition	Values			Unit	Remark
			Min.	Typ.	Max.		
Viewing angle (CR $\geq$ 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)	50	60	-		
	θ_B	$\Phi=270^\circ$ (6 o'clock)	60	70	-		
Response time Rise+ Fall	T_{RT}	Normal $\theta=\Phi=0^\circ$	-	25	50	msec	Note 3
Contrast ratio	CR		350	500	-	-	Note 4
Color chromaticity	R_X		-	TBD	-		Note 2
	R_Y		-	TBD	-		Note 5 Note 6
Luminance	L		-	500	-	cd/m ²	Note 6

Note 1: Definition of viewing angle range

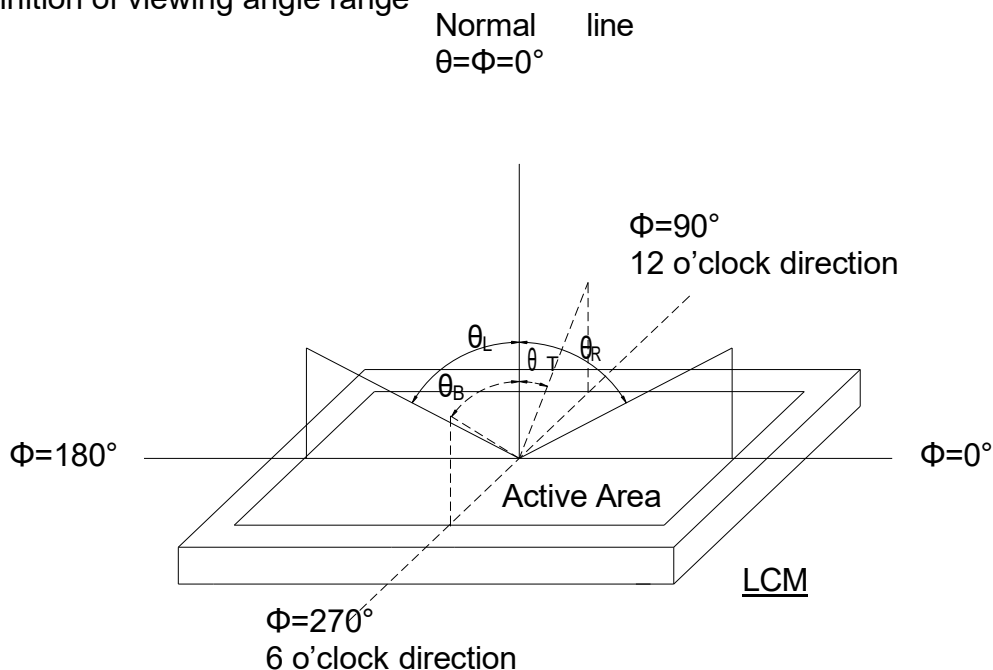
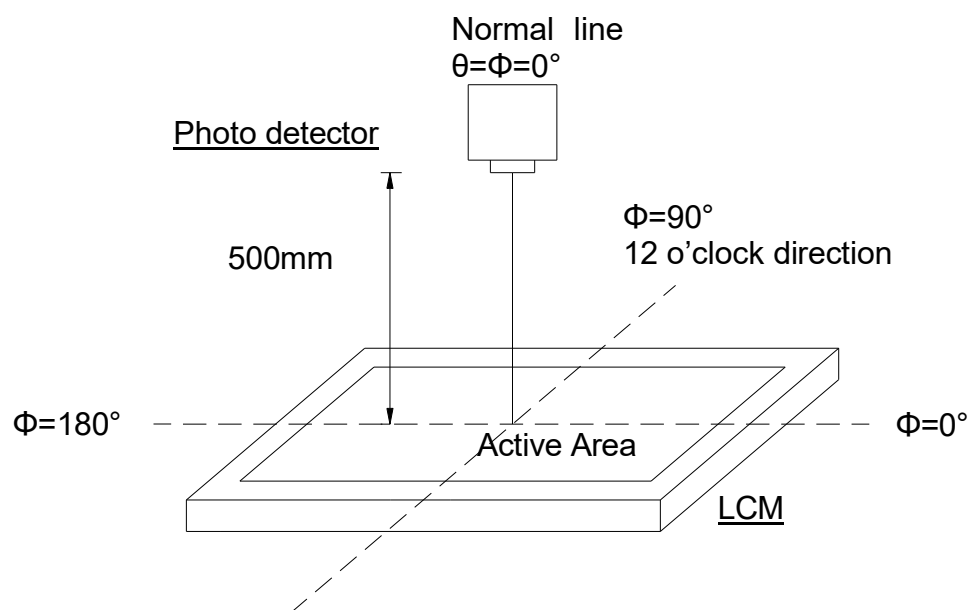


Fig. 4-1 Definition of viewing angle

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. (Viewing angle is measured by ELDIM-EZ contrast/Height :1.2mm ,Response time is measured by Photo detector TOPCON BM-5A, other items are measured by BM-7A/Field of view: 1° /Height: 500mm.)



$\Phi=270^\circ$
6 o'clock direction

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%.

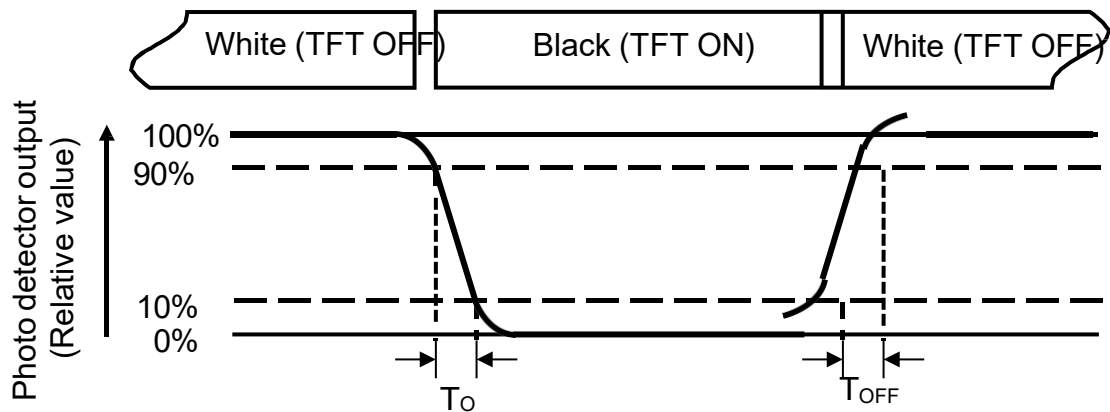


Fig. 4-3 Definition of response time

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.