ORIENT DISPLAY

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SPECIFICATION
FOR
LCD MODULE

MODULE NO: AFQ480234SWN-7.0-9355
REVISION NO: 02

Customer's Approval:

	SIGNATURE	DATE
PREPARED BY (RD ENGINEER)		
CHECKED BY		
APPROVED BY		

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REVISION RECORD

REV	REVISION ITEM	DATE
Preliminary	First release	2010-10-28
A		
B		
C		
D		
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1.GENERAL DESCRIPTION

1.1 Introduction

AMQ480234SWN-7.0-9355 is a color active matrix thin filmtransistor (TFT) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. This model is composed of a TFT LCD panel, a driving circuit. This TFT LCD has a 7.0 (16:9) inch diagonally measured active display area with WQVGA (480 horizontal by 234 vertical pixel) resolution.

1.2 Features

7.0 (16:9 diagonal) inch configuration
6-bits+FRC driver with 1 channel TTL interface
RoHS and Halogen-Free compliance

1.3 Applications

Personal Navigation Device
Multimedia applications and Others OD system

1.4 General information

Item	STANDARD Value	Unit
Dot arrangement	480RGB(H)*234(V)	Dot
Module size	165.00(W)*100.0(H)*5.70(T)	mm
Active area	154.08(W)*86.58(H)	mm
Pixel size	321(H)* 370 (V)	um
Diagonal length	7.0	inch
Viewing direction	6 O'clock	-
Backlight	LED(white 15*LED)	-
Top & Tst	-20˚C - +70˚C & -30˚C - +80˚C	˚C
LCM: All of LCM of material and process measure up to ROHS Europe		

2. Absolute Maximum Ratings

2.1 Electrical Absolute Rating

2.1.1 TFT LCD Module

Item	Symbol	Min.	Max.	Unit	Note
Power supply voltage	DV_{DD}	-0.3	6.0	V	GND=0
	AV_{DD}	-0.3	6.0	V	AGND=0
Analog Signal Input Level V_R, V_G, V_B		-0.2	AV_{DD}+0.2	V	
Logic Signal Input Level V_I		-0.3	DV_{DD} +0.3	V	

Note: (1) Stresses above those listed under "Absolute Maximum Rating" may cause permanent damage to the device. These are stress ratings only. Functional operation of this device at indicated in the operational sections(6.1) of this specification.

2.1.2 Back-Light Unit

Item	Symbol	Typ.	Max.	Unit	Note
LED current	I_L	100	—	mA	(1) (2)(3)
LED voltage	V_L	10.5	—	V	(1) (2)(3)

Note: (1) Permanent damage may occur to the LCD module if beyond this specification. Functional operation should be restricted to the conditions described under normal operating conditions.

(2) Ta =25±2℃

(3) Test Condition: LED current 100 mA. The LED lifetime could be decreased if operating IL is larger than 100mA.

2.2 Environment Absolute Rating

Item	Symbol	Min.	Max.	Unit	Note
Operating Temperature	T_{opa}	-20	70	℃	
Storage Temperature	T_{stg}	-30	80	℃	

3.OPTICAL CHARACTERISTICS

3.1 Optical specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast		CR	Θ=0 Normal Viewing Angle	400	500	—		(1)(2)
Response time	Rising	T_R		—	5	7	msec	(1)(3)
	Falling	T_F		—	20	28		
White luminance (Center)		Y_L		160	200	—	cd/m^2	(1)(4) (I_L=100mA)
Color chromaticity (CIE1931)	White	W_x		0.260	0.310	0.360		
		W_y		0.280	0.330	0.380		
Viewing angle	Hor.	Θ_L	CR>10	60	70	—		(1)(4)
		Θ_R		60	70	—		
	Ver.	Θ_U		55	65	—		
		Θ_D		55	65	—		
Brightness uniformity		B_{UNI}	Θ=0	70	75	—	%	(5)
Optima View Direction		6 O' clock						(6)

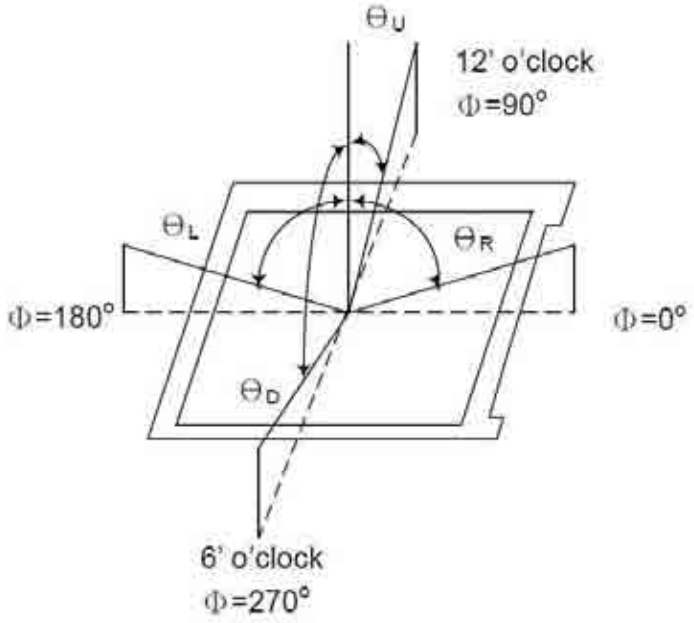
3.2 Measuring Condition

- Measuring surrounding: dark room
- LED current I_L : 100mA
- Ambient temperature: 25±2°C
- 15min. warm-up time.

3.3 Measuring Equipment

- FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.
- Measuring spot size: 20 ~ 21 mm

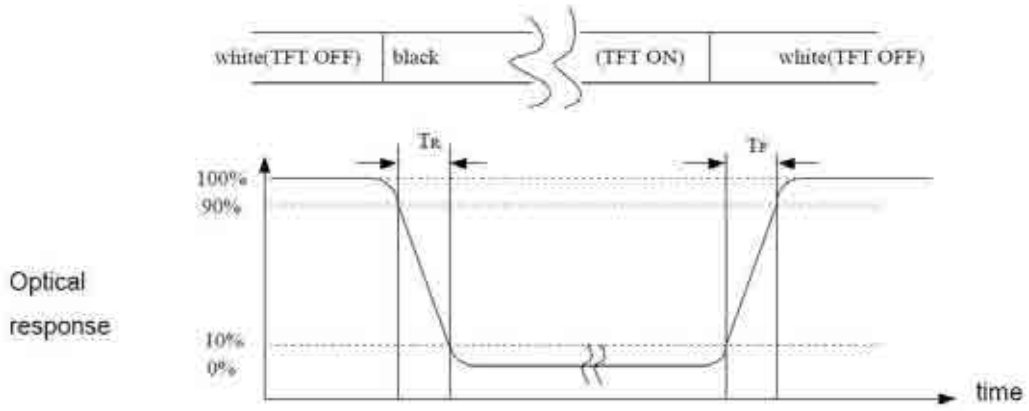
Note (1) Definition of Viewing Angle:



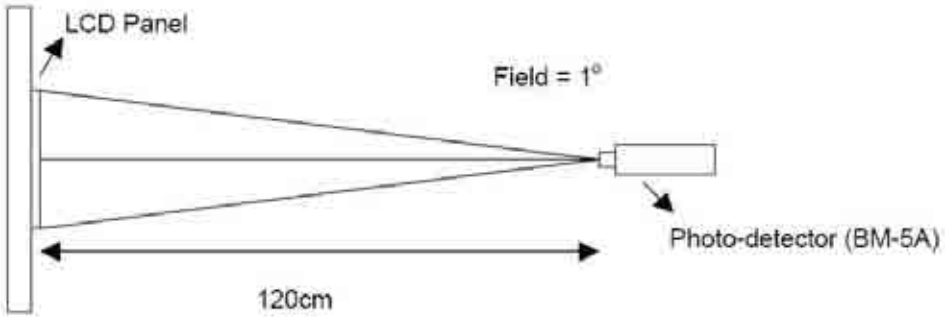
Note (2) Definition of Contrast Ratio (CR):
Measured at the center point of panel

$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

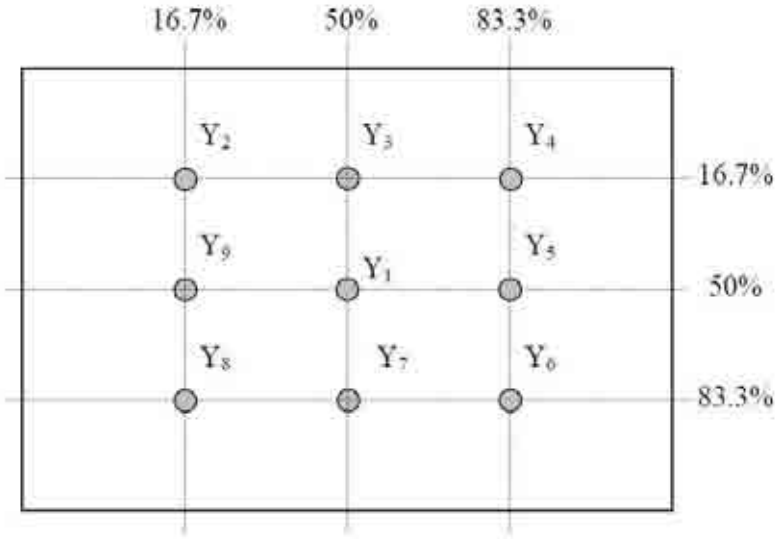
Note (3) Definition of Response Time: Sum of T_R and T_F



Note (4) Definition of optical measurement setup



Note (5) Definition of brightness uniformity

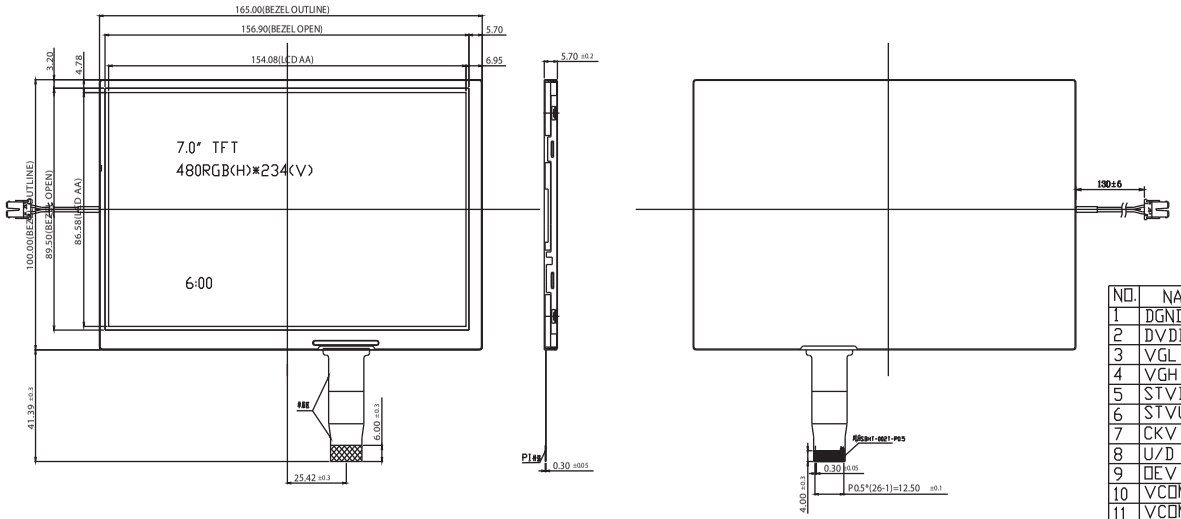


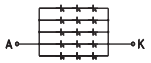
$$\text{Luminance uniformity} = \frac{\text{(Min Luminance of 9 points)}}{\text{(Max Luminance of 9 points)}} \times 100\%$$

Note (6) Rubbing Direction (The different Rubbing Direction will cause the different optima view direction.

Note (7) Measured at the brightness of the panel when all terminals of LCD panel are electrically open.

NO.		CONTENT	DATE
AMEND	A	NEW	20100814
	B	LCD AA	20101029
	C		
	D		





NO.	NAME	DESC.
1	DGND	GROUND OF LOGIC CIRCUIT
2	DVDD	SUPPLY VOLTAGE OF LOGIC CONTROL CIRCUIT FOR SCAN(GATE)DRIVER
3	VGL	NEGATIVE POWER FOR SCAN(GATE)DRIVER
4	VGH	POSITIVE POWER FOR SCAN(GATE)DRIVER
5	STVD	VERTICAL START PULSE
6	STVU	VERTICAL START PULSE
7	CKV	SHIFT CLOCK INPUT FOR SCAN (GATE)DRIVER
8	U/D	UP/DOWN SCAN CONTROL INPUT
9	OEV	OUTPUT ENABLE INPUT FOR DATA(SOURCE)DRIVER
10	VCOM	COMMON ELECTRODE DRIVING SIGNAL
11	VCOM	COMMON ELECTRODE DRIVING SIGNAL
12	L/R	LEFT/RIGHT SCAN CONTROL INPUT
13	MOD	SEQUENTIAL SAMPLING AND SIMULTANEOUS SAMPLING SETTING
14	OEH	OUTPUT ENABLE INPUT FOR DATA(SOURCE)DRIVER
15	STHL	START PULSE FOR HORIZONTAL SCAN(GATE)LINE
16	STHR	START PULSE FOR HORIZONTAL SCAN(GATE)LINE
17	CPH3	SAMPLING AND SHIFTING CLOCK PULSE FOR DATA(SOURCE)DRIVER
18	CPH2	SAMPLING AND SHIFTING CLOCK PULSE FOR DATA(SOURCE)DRIVER
19	CPH1	SAMPLING AND SHIFTING CLOCK PULSE FOR DATA(SOURCE)DRIVER
20	DVDD	SUPPLY VOLTAGE OF LOGIC CONTROL CIRCUIT FOR SCAN(GATE)DRIVER
21	DGND	GROUND OF LOGIC CIRCUIT
22	VR	ALTERNATED VIDEO SIGNAL INPUT(RED)
23	VG	ALTERNATED VIDEO SIGNAL INPUT(green)
24	VB	ALTERNATED VIDEO SIGNAL INPUT(blue)
25	AVDD	SUPPLY VOLTAGE OF ANALOG CIRCUIT
26	AGND	GROUND OF ANALOG CIRCUIT

NOTES:

1. DISPLAY TYPE: 7.0" TFT
   (TRANSMISSIVE/NORMAL WHITE)
2. LCD VIEW DIRECTION: 6 O'CLOCK
3. LCD DRIVER IC: -----
4. BACK LIGHT: 15 CHIP-WHITE LEDS;
5. STORAGE TEMP : -30°C~80°C
6. OPERATING TEMP: -20°C~70°C
7. GENERAL TOLERANCE: ±0.2
8. The fram VA is the recommanded size and position. It is suggested to not exceed the frame VA in its position and size. The suggested frame position ans size shall not exceed (frame VA) more than 0.5mm

CUSTOMER APPROVE	TOLERANCE DECIMAL	ORIENT DISPLAY				
	.X ±.30 .XX ±.20 ∠ ±1/4°	Model No.	AFQ480234SWN-7.0-9355	Part No.	AFQ480234SWN-7.0-9355	
		Drawing No.	AFQ480234SWN-7.0-9355	Drawn		Rev B
		Drawing Title	LCM Characteristics	Checked		Unit MM
		Scale 1:1		Approve		Page 1/1

5.BACKLIGHT SPECIFICATION

COLOR : WHITE

Item	Symbol	Min.	Typ..	Max..	Unit.
Forward voltage	Vf	9	10	10.9	V
Backlight current	I_{led}	-	100	-	MA
Luminance	Lv	3500	3800	4000	cd/m^2
Backlight uniformity	No less than eighty percent				-
Number of LED	-	15			Piece
Connection mode	S/P	In SERIAL & In parallel			-

★1 Test condition is :

(a) Center point on active area

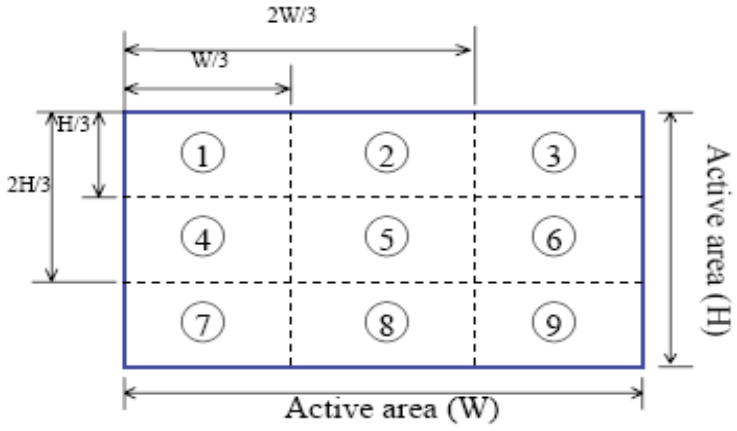
(b) Best Contrast

★2 Uniform measure condition :

(1)Measure 9 point. Measure location is show below :

(2)Uniform = (Min. brightness / Max. brightness)×100%

(3)Best Contrast.



6.ELECTRICAL CHARACTERISTICS

6.0 ELECTRICAL CHARACTERISTICS

6.1 TFT LCD Module (Operation Rating)

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Supply Voltage	DV_{DD}	2.7	3.3	5.5	V	
	V_{GH}	14.3	15	15.7	V	
	V_{GL}	-10.5	-10	-9.5	V	
	AV_{DD}	3	-	5.5	V	
Video signal amplitude (VR,VG,VB)	V_{IA}	0.4	-	AV_{DD}-0.4	V	
	V_{IAC}	-	4	-	V	AC component,
	V_{IDC}	-	$AV_{DD}/2$	-	V	DC component
VCOM	V_{CAC}		5.5		Vp-p	AC component
	V_{CDC}	1.6	1.8	2.0	V	DC component, (1)
Input signal voltage	V_{IH}	$0.7DV_{DD}$	-	DV_{DD}	V	(2)
	V_{IL}	0	-	$0.3DV_{DD}$	V	(2)
Current of power supply	I_{DD}	-	4.2	-	mA	DV_{DD} =3.3V
	I_{ADD}	-	3.7	-	mA	AV_{DD}=5V(Black)
	I_{GH}	-	60	-	uA	V_{GH}=15V
	I_{GL}	-	400	-	uA	V_{GL}=-10V

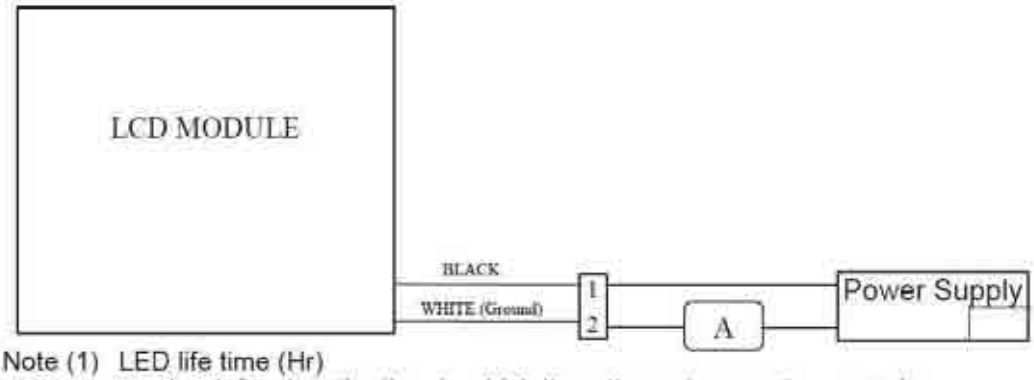
Note (1): The brightness of LCD panel could be changed by adjusting the AC component of V_{COM}.

Note (2): STHL, STHR, OEH, L/R, CPH1~CPH3, STVD, STVU, OEV, CKV, U/D

6.2 Back-Light Unit

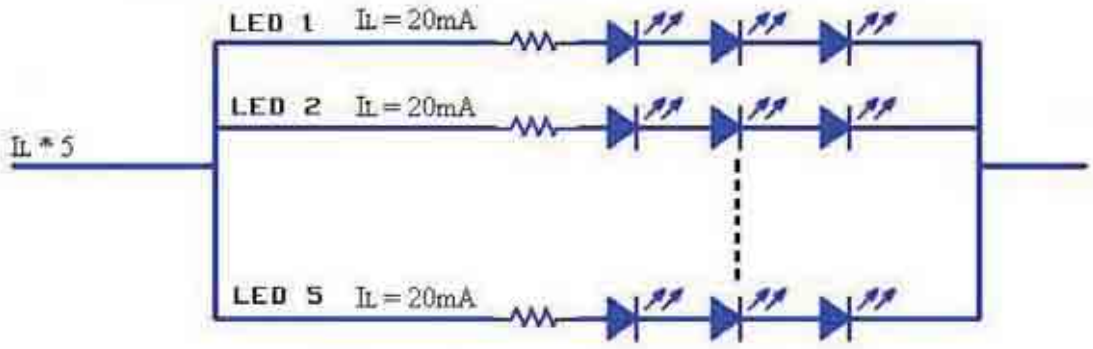
The back-light system is an edge-lighting type with 15 LED.
The characteristic of the LED is shown in the following tables.

Item	Symbol	Min.	Typ.	Max.	Unit	Note
LED current	IL	-	100	—	mA	(2)
LED voltage	VL	-	10.5	—	V	
Operating LED life time	Hr	20,000	-	—	Hour	(1)(2)



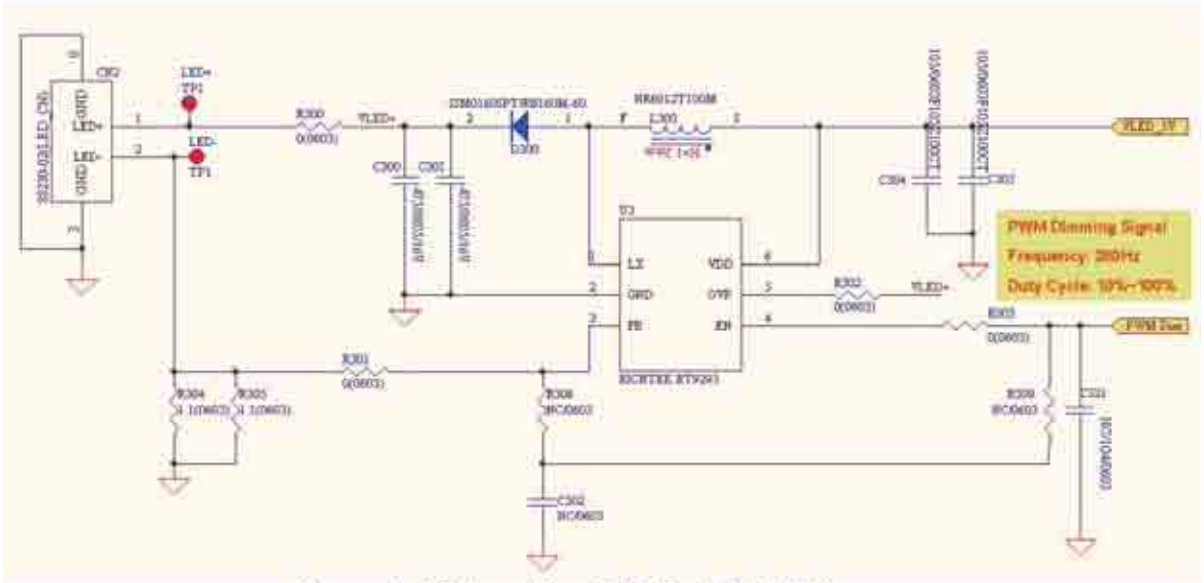
Note (1) LED life time (Hr)
can be defined as the time in which it continues to operate under the condition: Ta=25±3°C, typical IL value indicated in the above table until the brightness becomes less than 50%.

Note (2) The "LED life time" is defined as the module brightness decrease to 50% original brightness at Ta=25℃ and IL=100mA. The LED lifetime could be decreased if operating IL is larger than 100mA. The constant current driving method is suggested.



LED Light Bar Circuit

Note (3) Suggested Schematic of LED Back-Light Driver



Suggested Schematic of LED Back-Light Driver

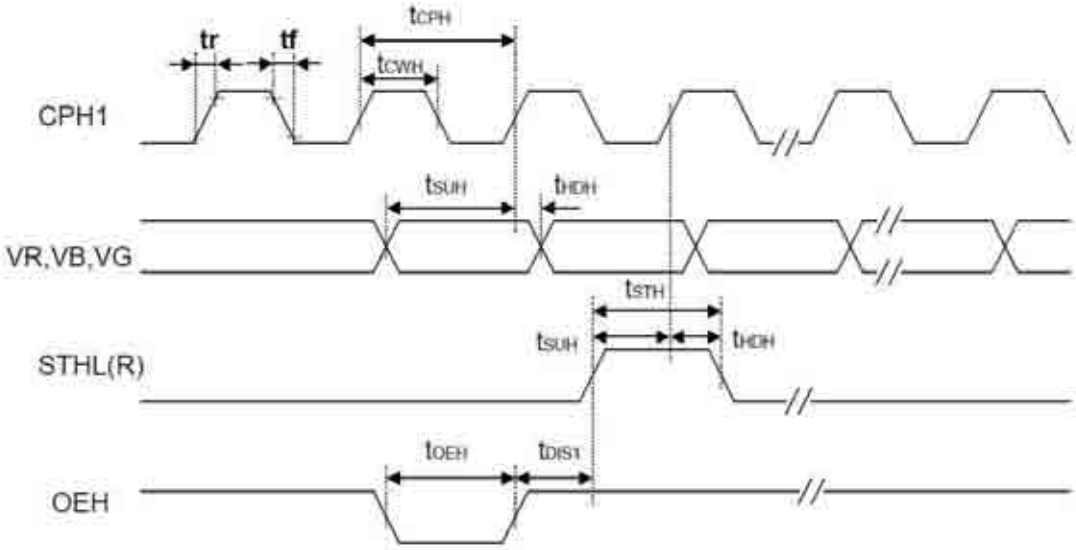
6.3 AC Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Rising time	t_r	-	-	10	ns	(1)
Falling time	t_f	-	-	10	ns	(1)
High and low level pulse duty	t_{CPH}	100	103	-	ns	CPH1~CPH3
CPH pulse duty	t_{CWH}	40	50	60	%	CPH1~CPH3
STH setup time	t_{SUH}	20	-	-	ns	STHR,STHL
STH hold time	t_{HDH}	10	-	-	ns	STHR,STHL
STH pulse width	t_{STH}	-	1	-	t_{CPH}	STHR,STHL
STH period	t_H	61.5	63.5	65.5	µs	STHR,STHL
OEH pulse width	t_{OEH}	-	1.23	-	µs	OEH
Sample and hold disable time	t_{DIS1}	-	8.19	-	µs	
OEV pulse width	t_{OEV}	-	4.77	-	µs	OEV
CKV pulse width	t_{CKV}	-	3.91	-	µs	CKV
Clean enable time	t_{DIS2}	-	3.90	-	µs	
Horizontal display timing range	t_{DH}	-	1440	-	t_{CPH}/3	
STV setup time	t_{SUV}	200	-	-	ns	STVD,STVU
STV hold time	t_{HDV}	300	-	-	ns	STVD,STVU
STV pulse width	t_{STV}	-	1	-	t_H	STVD,STVU
Horizontal line per field	t_V	256	262	268	t_H	(2)
Vertical display start	t_{SV}		3	-	t_H	
Vertical display timing range	t_{DV}		234	-	t_H	
VCOM Rising time	t_{rCOM}		-	5	µs	
VCOM Falling time	t_{fCOM}		-	5	µs	
VCOM delay time	t_{DCOM}		-	3	µs	
RGB delay time	t_{DRGB}		*	1	µs	

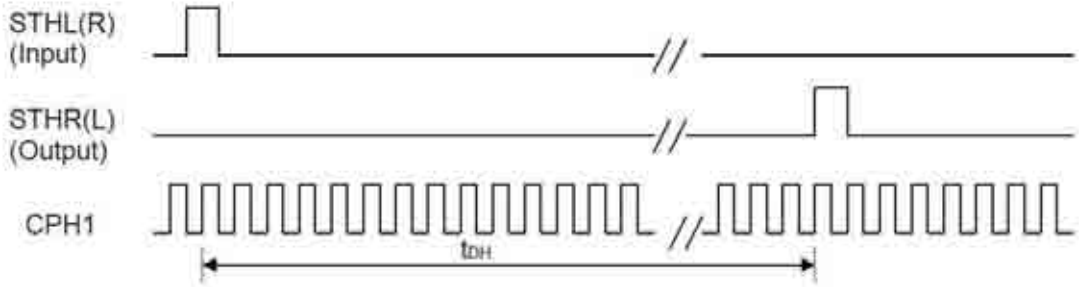
Note (1): For all of the logic signals.

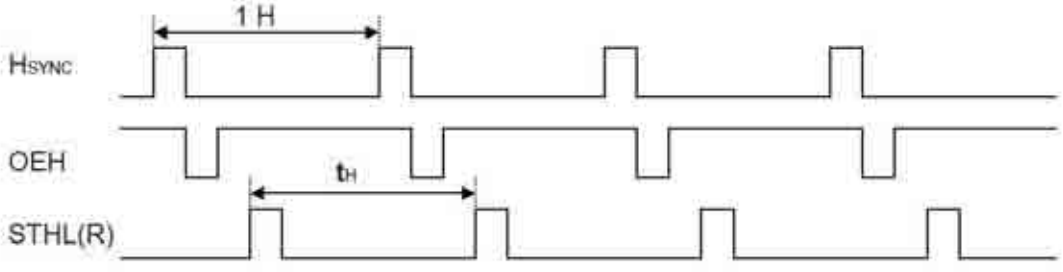
Note (2): Please don't use odd horizontal lines to drive LCD panel for both odd and even filed simultaneously.

6.4 Timing Diagram of Interface Signal

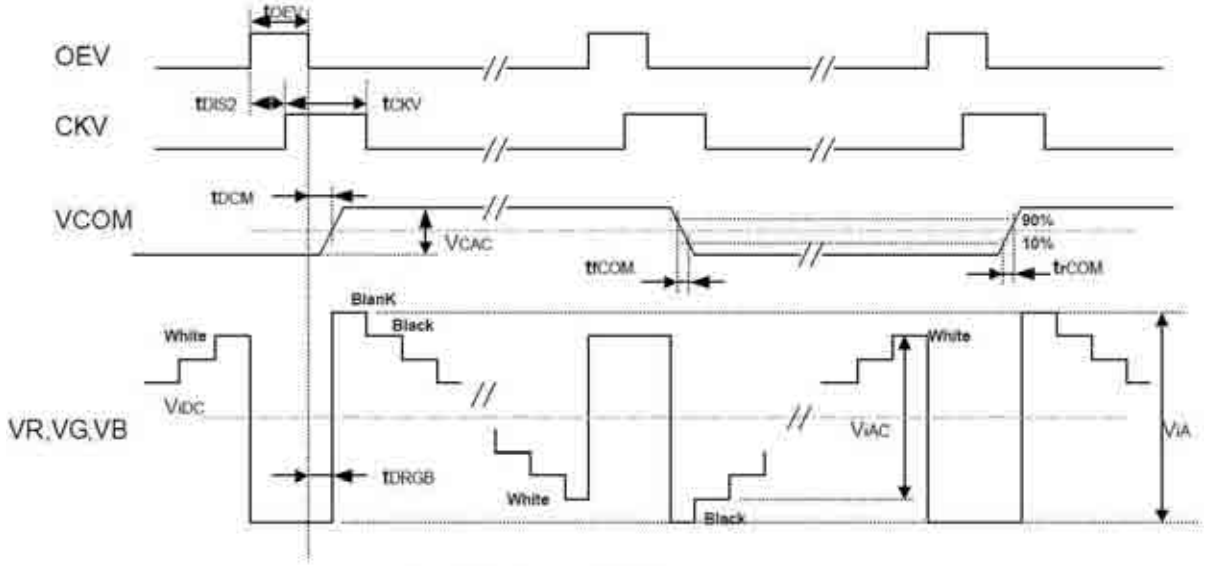


Sampling clock timing

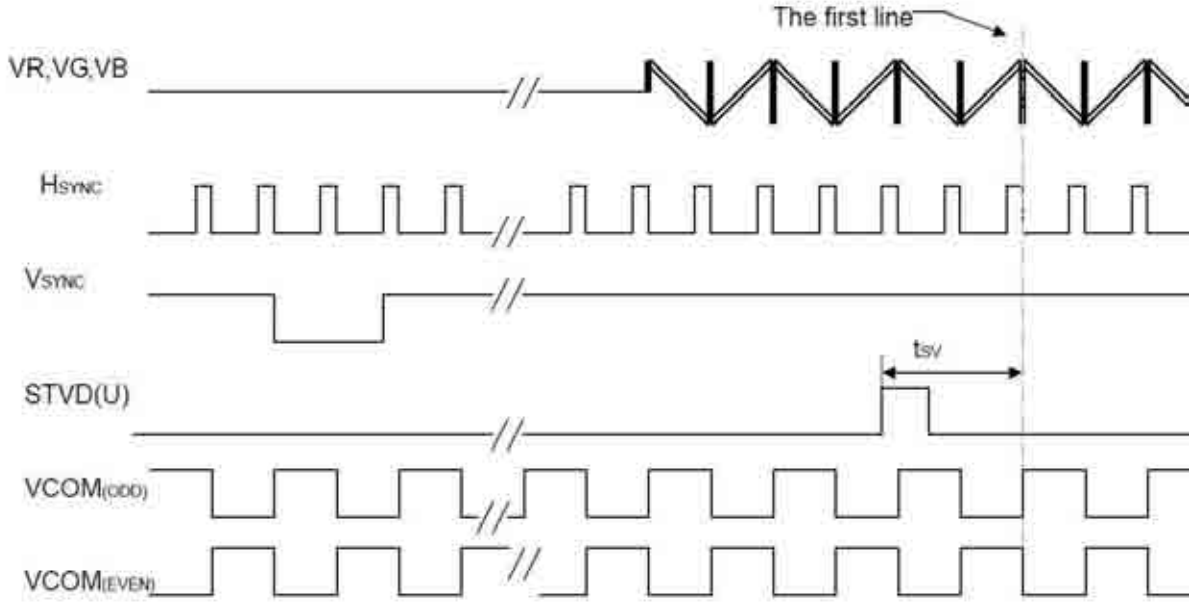




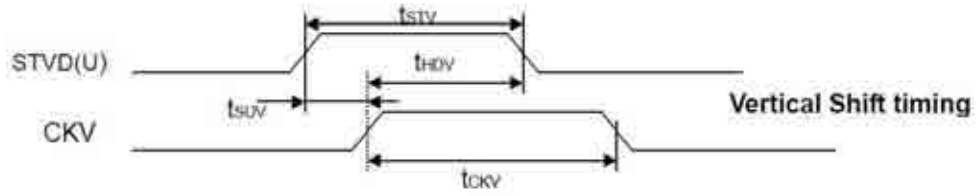
Horizontal display timing range



Detail Horizontal timing

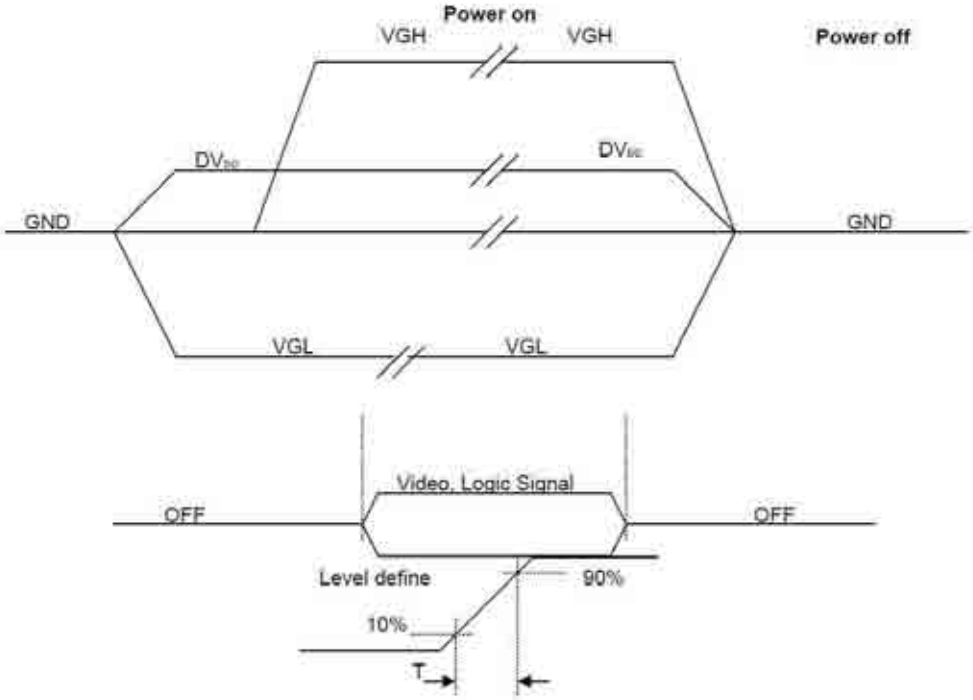


Vertical timing



Vertical Shift timing

6.5 Power Sequence



Power Sequence: DV_{DD} -> VGL -> VGH

Note: Apply the LED volatge within the LCD operation range. When the back-light turns on before the LCD operation or the LCD truns off before the back-light turns off. the display may momentarily become white.

7. INTERFACE DESCRIPTION

CN2 (Input signal): FPC Down Connector, 26 pins, pitch: 0.5mm

Terminal no.	Symbol	I/O	Function	Note
1	DGND	-	Ground for logic circuit	
2	DV_{DD}	I	Supply voltage of logic control circuit for scan (Gate) driver	
3	V_{GL}	I	Negative power for scan (Gate) driver	
4	V_{GH}	I	Positive power for scan (Gate) driver	
5	STVD	I/O	Vertical start pulse	(1)
6	STVU	I/O	Vertical start pulse	(1)
7	CKV	I	Shift clock input for scan (Gate) driver	
8	U/D	I	UP/DOWN scan control input	(1)
9	OEV	I	Output enable input for scan(Gate) driver	
10	V_{COM}	I	Common electrode driving signal	
11	V_{COM}	I	Common electrode driving signal	
12	L/R	I	LEFT/RIGHT scan control input	(1)
13	MOD	I	Sequential sampling and simultaneous sampling setting	(2)
14	OEH	I	Output enable input for data (Source) driver	
15	STHL	I/O	Start pulse for horizontal scan (Gate) line	(1)
16	STHR	I/O	Start pulse for horizontal scan (Gate) line	(1)
17	CPH3	I	Sampling and shifting clock pulse for data (Source) driver	(2)
18	CPH2	I	Sampling and shifting clock pulse for data (Source) driver	(2)
19	CPH1	I	Sampling and shifting clock pulse for data (Source) driver	
20	DV_{DD}	I	Supply voltage of logic control circuit for data(Source) driver	
21	DGND	-	Ground for logic circuit	
22	V_R	I	Alternated video signal input(Red)	
23	V_G	I	Alternated video signal input(Green)	
24	V_B	I	Alternated video signal input(blue)	
25	AV_{DD}	I	Supply voltage for analog circuit	
26	AGND	-	Ground for analog circuit	

Note (1) Selection of scanning mode (please refer to the following table)

Setting of scan control input		IN/OUT state for start pulse				Scanning direction
U/D	L/R	STVD	STVU	STHR	STHL	
GND	DV_{DD}	Output	Input	Output	Input	up to down, and from left to right.
DV_{DD}	GND	Input	Output	Input	Output	down to up, and from right to left.
GND	GND	Output	Input	Input	Output	up to down, and from right to left.
DV_{DD}	DV_{DD}	Input	Output	Output	Input	down to up, and from left to right.

Note (2) MOD=H: Simultaneous sampling.(Please check CPH2 and CPH3 to GND when MOD=H)
MOD=L: Sequential sampling.

8. FINAL REMARKS

1. The above specifications are the binding criteria for Orient Display outgoing quality inspection.
2. The customer is kindly requested to inform OD as soon as possible on any questions, remarks, and disagreements regarding these specifications.
3. OD is not responsible for damage to its products due to neglect of the precautions as described in the previous chapter.
4. About the limited warranty unless special agreement between OD and customer OD will replace or repair any of its products that are found to be functionally defective when inspected in accordance with OD acceptance standards for a period of one year from data of shipments.