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Product Specification

2.7″ COLOR TFT-LCD MODULE

MODEL NAME: A027CW00 V2

(RoHS Compliance)

< ◆ > Preliminary Specification

< > Final Specification

Note: The content of this specification is subject to change without prior notice.

Record of Revision

Version	Revise Date	Page	Content
0.0	January/30/2007		First draft

Contents:

A. Physical specifications

NO.	Item	Specification	Remark
1	Display resolution (dot)	480(W)×234(H)	
2	Active area (mm)	58.56 (W) × 33.228 (H)	
3	Screen size (inch)	2.65 (Diagonal)	
4	Dot pitch (mm)	0.122 (W) × 0.142 (H)	
5	Color configuration	R. G. B. delta	
6	Overall dimension (mm)	63.10 (W) × 42 (H) × 1.65 (D)	Note 1
7	Weight (g)	TBD	
8	Panel surface treatment	Low reflection, Hard coating	

Note 1: Refer to Fig. 2

B. Electrical specifications

1.Pin assignment:

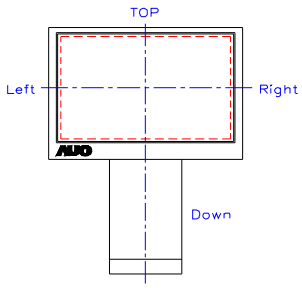
Pin no	Symbol	I/O	Description	Remark
1	DRV	VO	Power transistor gate signal for the boost converter	
2	FB	VI	Main boost regulator feedback input	
3	ADJ0	I	PLL adjustment Pin0	
4	ADJ1	I	PLL adjustment Pin1	
5	PVDD	P	Power supply for PLL circuits (3.3v)	
6	PGND	P	Ground pin for PLL circuits	
7	VA	I	Video R input signal	
8	VB	I	Video G input signal	
9	VC	I	Video B input signal	
10	SCL	I	Serial communication clock input	
11	SDA	I	Serial communication data input	
12	CSB	I	Serial communication chip select	
13	GRB	I	Global reset pin	
14	VSYNC	I	Vertical sync input. Negative polarity	
15	HSYNC	I	Horizontal sync input. Negative polarity	
16	DFRP	O	Digital Frame polarity output signal	
17	AGND	C	Ground pin for source driver	
18	VCI_OUT	C	Power supply for source driver	
19	VCC	P	System power (3.3v)	
20	GND	P	System ground	
21	C1+	C	Power setting capacitor connect pin	
22	C1-	C		
23	C12+	C		
24	C12-	C		
25	C8+	C		
26	C8-	C		
27	V3	C		
28	C31+	C		
29	C31-	C		
30	APOL	O	Frame polarity output signal for panel VCOM	
31	VCAC	C	APOL level supply	
32	VGH	C	VGH turn on voltage	
33	VGL	C	Power setting capacitor connect pin	

Pin no	Symbol	I/O	Description	Remark
34	Vgoff_L	C	VGL turn off voltage	
35	Vgoff_H	C	VGL+VCOM	
36	VCOMR	I	Adjust VCOM DC voltage	

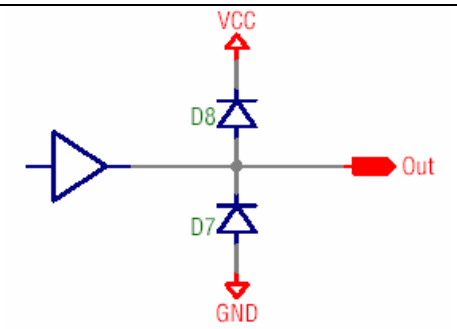
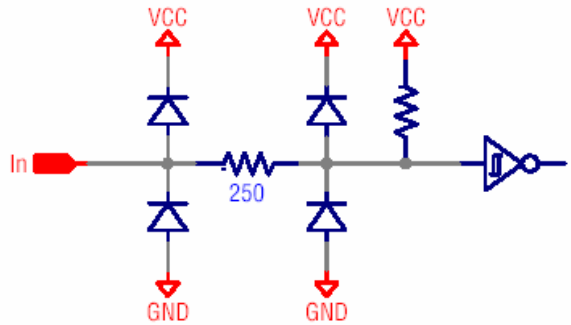
Illustration of I/O symbol

I: Input. O: Output. VI: voltage input. VO: voltage output. P: Power. C: Capacitor pin.

Note 1: Please refer to figure below for the definition of scanning direction.



2. Equivalent circuit of I/O

Pin no & Pin name	Schematics
1.DRV	
13.GRB	

3. Absolute maximum ratings

Item	Symbol	Condition	Min.	Max.	Unit	Remark
Power voltage	V_{CC}	GND=0	-0.5	5.	V	
	AV_{DD}	AV_{SS}=0	-0.5	5.5	V	
Input signal voltage	VCOM		-2.9	5.2	V	
Operating temperature	Topa		0	70	℃	Ambient temperature
Storage temperature	Tstg		-25	80	℃	Ambient temperature

4. Electrical characteristics

a. Typical operating conditions (GND=PGND=0V)

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Power supply	VCC	2.8	3.3	3.6	V	
	PVDD	2.8	3.3	3.6	V	
	VGH	11.5	14	15	V	Note1.
	VGL	-13,5	-12	-11.5	V	Note1.
	Vgoff_L	-13.5	-12	-11.5	V	Note1.
	Vgoff_H	-9.1	-6.4	-5.7	V	Note1.
	VCI_OUT	4.8	5	5.5	V	Note1.

Video signal Amplitude (VR,VG,VB)		ViA	0.2		5.0		
		ViAC		3			AC Component
		ViDC		2.5			DC Component
		VI_high			4.8		Note 2.
Output Signal voltage	H Level	V_{OH}	Vcc-0.4				
	L Level	V_{OL}	GND		GND+0.4		
Input Signal voltage	H Level	V_{IH}	$0.7V_{CC}$	-	V_{CC}	V	
	L Level	V_{IL}	GND	-	$0.3V_{CC}$	V	
Output current	H Level	IOH		10		uA	
	L Level	IOL		-10		uA	
Analog stand by current		Ist			200	uA	DCLK is stopped
VCOM		V_{CAC}	4.6	5.6	6.0	Vp-p	AC component
		V_{CDC}		1.13		V	DC component

Note 1. These voltages (VGH, VGL, Vgoff_H, Vgoff_L, VCI_OUT) are related to input voltage VCC.

Note 2. The R,G,B maximum input voltage can not higher than 4.8 volt.

b. Current consumption (GND=AVss=0V)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
	I_{CC}	V_{CC}=3.3V	-	2	2.5	mA	
	I_{DD}	AV_{DD}=3.3V	-	1.5	2.0	mA	

5. AC Timing

a. NTSC:

Parameter	Symbol	Min.	Typ.	Max.	Unit.	Remark
Clock period time	t_{OSC}	94	104.6	114	ns	
Hsync period time	T_{Hs}	61.5	63.5	65.5	us	
Vsync pulse width	Twvs	1	-	260	Hs	
Vsync to Hsync timing	Tvshs	0			ns	Note1
Hsync to Vsync timing	Thsvs	0			ns	
Vsync to STV input time	Tvs	7	19	26	Hs	ref to Fig. 6
Horizontal lines per field		256	262.5	268	line	Note 2

b. PAL:

Parameter	Symbol	Min.	Typ.	Max.	Unit.	Remark
Clock period time	t_{OSC}	94	104.6	114	ns	
Hsync period time	T_{Hs}	62	64	66	us	
Vsync pulse width	Twvs	1	-	260	Hs	
Vsync to Hsync timing	Tvshs	0			ns	Note1
Hsync to Vsync timing	Thsvs	0			ns	
Vsync to STV input time	Tvs	12	24	31	Hs	ref to Fig. 6
Horizontal lines per field		306	312.5	318	line	Note 2

Note 1: Vsync and Hsync both support rising edge or falling edge timing

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

c. Horizontal Timing:

Parameter	Symbol	Min.	Typ.	Max.	Unit.	Remark
Hsync frequency	Fhs	-	15.75k	-	Hz	
Hsync pulse width time	Twhs	5	44	600	Tclk	
Hsync to DFRP change time	Thsdfrp	-	40	-	Tclk	
Hsync to APOL change time	Thsapol	-	40	-	Tclk	

Refer to Figure 3.

d. 3-wire serial communication AC timing

Parameter	Symbol	Min.	Typ.	Max.	Unit
Serial clock	Tsck	300	1000		ns
SCL pulse duty	Tscw	40	50	60	%
CSB hold time	Tcst	120			ns
Serial data setup time	Tist	120			ns
Serial data hold time	Tiht	120			ns
Serial clock high/low	Tssw	120			ns
Chip select distinguish	Tcd	1			us
CSB to Vsync Time	Tcv	1			us

Refer to Figure 5.

6. The configuration of serial data at SDA terminal is at below

MSB LSB

	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0		
	Address			X	DATA													
No.	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0	Description	Default
R0	0	0	0	X	X	X	X	X	X	X	X	0	0	0	0	0	Select relationship between the inputs VA, VB, VC and outputs R, G, B.	V
				X	X	X	X	X	X	X	X	0	0	0	0	1		
				X	X	X	X	X	X	X	X	0	0	0	1	0		
				X	X	X	X	X	X	X	X	0	0	1	0	0		
				X	X	X	X	X	X	X	X	0	1	0	0	0	Frame advance or delay selection	
				X	X	X	X	X	X	X	X	1	0	0	0	0		
R1	0	0	1	X	X	X	X	X	X	X	X	X	0	0	0	0	Up to down	V
				X	X	X	X	X	X	X	X	X	0	0	0	1	Down to up	
				X	X	X	X	X	X	X	X	X	0	0	0	0	Right to left	
				X	X	X	X	X	X	X	X	X	0	0	1	0	Left to right	V
				X	X	X	X	X	X	X	X	X	0	0	0	0	In reset state	
				X	X	X	X	X	X	X	X	X	0	1	0	0	Normal	V
				X	X	X	X	X	X	X	X	X	0	0	0	0	In standby mode	
				X	X	X	X	X	X	X	X	X	1	0	0	0	Normal	V
R2	0	1	0	X	X	X	X	X	X	X	1	0	0	0	0	0	Set horizontal position	V
				X	X	X	X	X	X	X	0	0	0	0	0	1		
				X	X	X	X	X	X	X	0	0	0	0	1	0		
				X	X	X	X	X	X	X	0	0	0	1	0	0		
				X	X	X	X	X	X	X	0	0	1	0	0	0		
				X	X	X	X	X	X	X	0	1	0	0	0	0		
R3	0	1	1	X	X	X	X	X	X	X	X	0	0	0	0	0	Set vertical position	V
				X	X	X	X	X	X	X	X	0	0	0	0	1		
				X	X	X	X	X	X	X	X	0	0	0	1	0		
				X	X	X	X	X	X	X	X	0	0	1	0	0		
				X	X	X	X	X	X	X	X	0	1	0	0	0		
				X	X	X	X	X	X	X	X	1	0	0	0	0		
R4	1	0	0	X	X	X	X	X	X	X	X	X	0	1	0	1	Adjust the VCOM AC level	V
				X	X	X	X	X	X	X	X	X	0	0	0	1		
				X	X	X	X	X	X	X	X	X	0	0	1	0		
				X	X	X	X	X	X	X	X	X	0	1	0	0		
				X	X	X	X	X	X	X	X	X	0	0	0	0	The APOL polarity, the same as DFRP.	V
				X	X	X	X	X	X	X	X	X	1	0	0	0	The APOL polarity will be inverted.	

No.	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0	Description	Default
	Address			X	DATA													
R5	1	0	1	X	X	X	X	X	X	X	X	0	0	0	0	0	Data format selected by D1.	
				X	X	X	X	X	X	X	X	0	0	0	0	1	Data format auto selection.	V
				X	X	X	X	X	X	X	X	0	0	0	0	0	NTSC	V
				X	X	X	X	X	X	X	X	0	0	0	1	0	PAL	
				X	X	X	X	X	X	X	X	0	0	0	0	0	Normally display	V
				X	X	X	X	X	X	X	X	0	0	1	0	0	16:9 wide display	
				X	X	X	X	X	X	X	X	0	0	0	0	0	Hsync and Vsync input Positive polarity	V
				X	X	X	X	X	X	X	X	0	1	0	0	0	Hsync and Vsync input Negative polarity	
				X	X	X	X	X	X	X	X	0	0	0	0	0	Normal display	V
				X	X	X	X	X	X	X	X	1	0	0	0	0	4:3 narrow display	
R6	1	1	0	X	X	X	X	X	X	0	0	0	0	0	0	0	PWM control circuit is shut down.	V
				X	X	X	X	X	X	0	0	0	0	0	0	1	PWM circuit is working.	
				X	X	X	X	X	X	0	0	0	0	0	0	0	PLL is working.	V
				X	X	X	X	X	X	0	0	0	0	0	1	0	PLL is disabled.	
				X	X	X	X	X	X	1	0	0	0	0	0	0	PLL frequency Selection	V
				X	X	X	X	X	X	0	0	0	0	1	0	0		
				X	X	X	X	X	X	0	0	0	1	0	0	0		
				X	X	X	X	X	X	0	0	1	0	0	0	0		
				X	X	X	X	X	X	0	1	0	0	0	0	0		

"X" => don't care

Register detail description

Register **R0**:

Control and switch the relationship between the inputs VA, VB, VC and outputs R, G, B. This function is used to match different types of color filters.

D2	D1	D0	Output (n=1 to 160)			
			R	G	B	
0	0	0	R	G	B	Odd Line
			G	B	R	Even Line
0	0	1	G	B	R	Odd Line
			B	R	G	Even Line
0	1	X	B	R	G	Odd Line
			R	G	B	Even Line
1	0	0	R	G	B	Odd Line
			B	R	G	Even Line
1	0	1	G	B	R	Odd Line
			R	G	B	Even Line
1	1	X	B	R	G	Odd Line
			G	B	R	Even Line

"X" => Regardless

Frame advance or delay selection

D4	D3	Advance Frame	Unit	Notes
0	0	Default	H	Odd frame: Vsync and Hsync falling edge are synchronize Even frame: Vsync and Hsync falling edge are not synchronize Refer to Fig.7
0	1	Odd frame	H	
1	0	Even frame	H	
1	1	X	H	

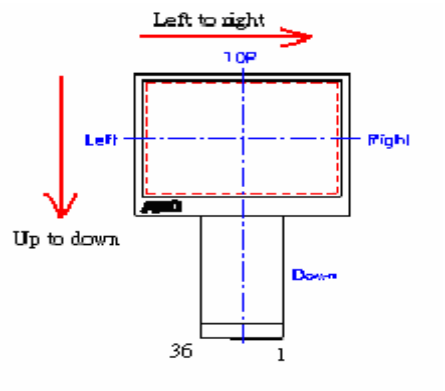
"X" => Regardless

Register **R1**:

Set the scan direction, reset, and standby mode.

Bit	Function
D0	Up/down scan direction. "1"=> Down to up. "0"=> Up to down (Default).
D1	Left/Right scan direction. "1"=> Left to right. (Default) "0"=>Right to left.
D2	Global reset pin, it should be connected to VCC in normal operation. IF connected to GND, the controller is in reset state, normally pulled high.
D3	Standby mode, active low. Normally pulled high.

Default scan direction is below:



Register **R2**:

Set the horizontal position adjustment timing.

D5	D4	D3	D2	D1	D0	NO.	Unit
0	0	0	0	0	0	-32	
0	0	0	0	0	1	-31	
0	0	0	0	1	0	-30	
0	0	0	0	1	1	-29	
0	0	0	1	0	0	-28	
:	:	:	:	:	:	:	
:	:	:	:	:	:	:	
0	1	1	1	0	1	-3	
0	1	1	1	1	0	-2	
0	1	1	1	1	1	-1	
1	0	0	0	0	0	Default	
1	0	0	0	0	1	+1	
1	0	0	0	1	0	+2	DCLK
1	0	0	0	1	1	+3	
:	:	:	:	:	:	:	
:	:	:	:	:	:	:	
1	1	0	1	1	1	+23	
1	1	1	0	0	0	+24	
1	1	1	0	0	1	+25	
1	1	1	0	1	0	+26	
1	1	1	0	1	1	+27	
1	1	1	1	0	0	+28	
1	1	1	1	0	1	+28	
1	1	1	1	1	0	+28	
1	1	1	1	1	1	+28	

Remark: D[5:0]= 111011~111111 will be keep +28 position shift.

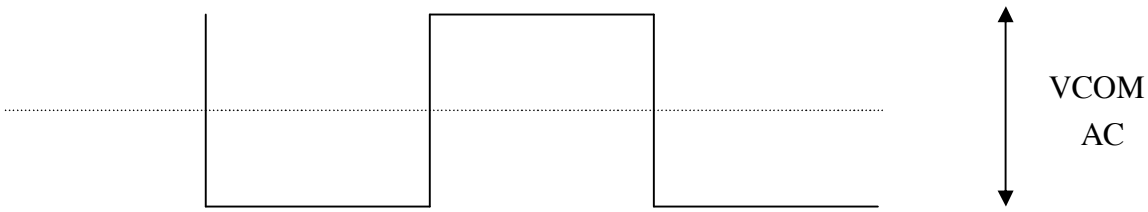
Register **R3**:

Set the vertical position adjustment timing.

D4	D3	D2	D1	D0	NO.	Unit
0	0	0	0	0	Default	H
0	0	0	0	1	+1	
0	0	0	1	0	+2	
0	0	0	1	1	+3	
0	0	1	0	0	+4	
0	0	1	0	1	+5	
0	0	1	1	0	+6	
0	0	1	1	1	+7	
0	1	0	0	0	X	
0	1	0	0	1	X	
0	1	0	1	0	X	
0	1	0	1	1	X	
0	1	1	0	0	X	
0	1	1	0	1	X	
0	1	1	1	0	X	
0	1	1	1	1	X	
1	0	0	0	0	X	
1	0	0	0	1	X	
1	0	0	1	0	X	
1	0	0	1	1	X	
1	0	1	0	0	-12	
1	0	1	0	1	-11	
1	0	1	1	0	-10	
1	0	1	1	1	-9	
1	1	0	0	0	-8	
1	1	0	0	1	-7	
1	1	0	1	0	-6	
1	1	0	1	1	-5	
1	1	1	0	0	-4	
1	1	1	0	1	-3	
1	1	1	1	0	-2	
1	1	1	1	1	-1	

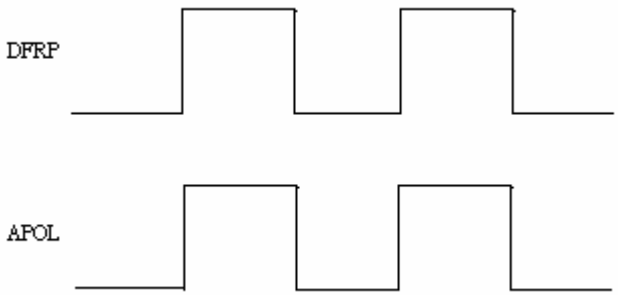
Register **R4**:

D0~D2: Adjust the VCOM AC level.

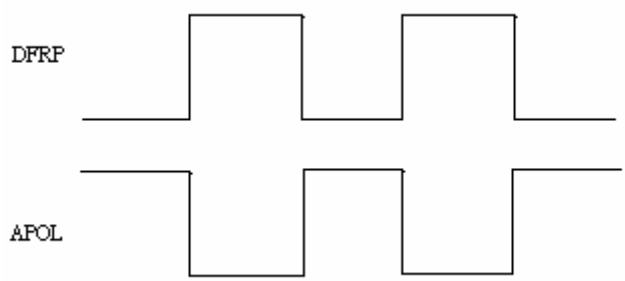


VCAC level setting (Unit: V)			
D2	D1	D0	Level
0	0	0	4.6
0	0	1	4.8
0	1	0	5.0
0	1	1	5.2
1	0	0	5.4
1	0	1	5.6(Default)
1	1	0	5.8
1	1	1	6.0

D3: Set the polarity of APOL. If D3=0, then the polarity of APOL is the same as the polarity of DFRP. As below:



If D3=1, then the polarity of APOL is inverted. As below:



D3	Control APOL are inverted or not, normally pulled low. '0'=>The APOL polarity, the same as DFRP, is negative at the first line. '1'=>The APOL polarity will be inverted.

Register **R5**:

In this register, the input format of NTSC/PAL is setting here. It would be set by AUTO-selection of external setting. Apart from this 4:3 mode to 16:9 mode is also setting be D2 bit. And the sync polarity could be set by positive and negative.

Bit	Function
D0	Data format auto selection pin, normally pulled high. '1'=>Data format is auto selection. '0'=>Data format is decided by D1.
D1	Data format selection pin, normally pulled low. '1'=>PAL. '0'=>NTSC.
D2	Wide display format selection pin, normally pulled low. '1'=>16:9 wide display. '0'=>Normally display.
D3	Horizontal and vertical sync edge selection, normally pulled low. '0'=>Horizontal and vertical sync input. Positive polarity. '1'=> Horizontal and vertical sync input. Negative polarity.
D4	Narrow display mode selection bit, normally pulled low. '0'=>Normally display. '1'=>4:3 narrow display function enable. S1~S60 and S421~S480 are in black display.

Note: Display mode is normal display when D2='1' and D4='1'.

Register **R6**

In this register, PLL clock is generated by internal synchronize signal. And the PLL frequency can be set to adjust 4:3 circle ratio.

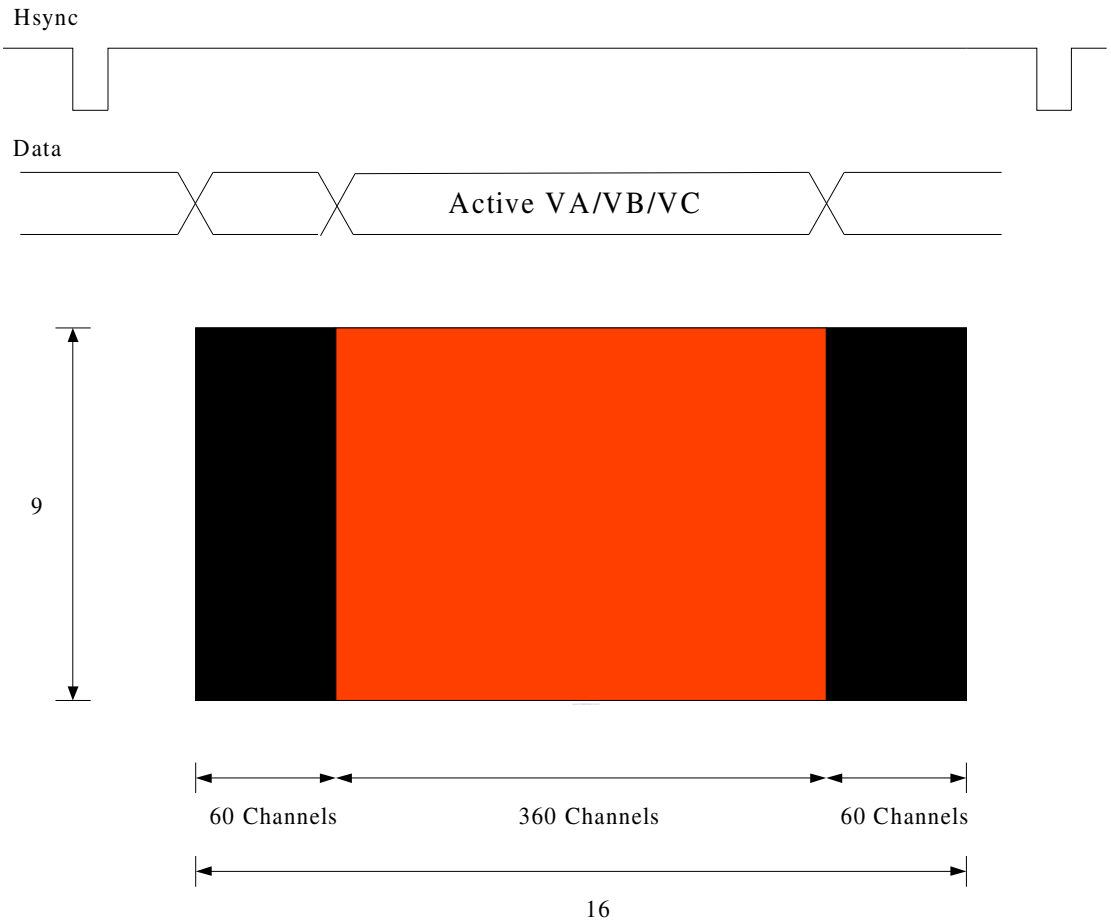
<table>
<tr><th>Bit</th><th>Function</th></tr>
<tr><td>D0</td><td>Shut down pin for PWM control circuit, normally pulled low.
‘1’=>PWM control circuit is working normally..
‘0’=>PWM control circuit is shut down..</td></tr>
<tr><td>D1</td><td>Disable PLL pin, normally pulled low.
‘1’=>PLL is disabled and CLK must be input externally.
‘0’=>CLK is generated by PLL.</td></tr>
<tr><td>D2~ D6</td><td>PLL frequency selection. Note3.
<table>
<tr><th rowspan="3">D6</th><th rowspan="3">D5</th><th rowspan="3">D4</th><th rowspan="3">D3</th><th rowspan="3">D2</th><th colspan="4">Clks no. in Hs</th><th rowspan="3">Condition</th></tr>
<tr><th colspan="2">Normally display</th><th colspan="2">Narrow display</th></tr>
<tr><th>NTSC</th><th>PAL</th><th>NTSC</th><th>PAL</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>575</td><td>593</td><td>423</td><td>437</td><td rowspan="18">Hsync frequency=15750Hz</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>577</td><td>595</td><td>425</td><td>439</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>579</td><td>597</td><td>427</td><td>441</td></tr>
<tr><td>:</td><td>:</td><td>:</td><td>:</td><td>:</td><td>:</td><td>:</td><td>:</td><td>:</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td><td>605</td><td>623</td><td>453</td><td>467</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>607</td><td>625</td><td>455</td><td>469</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>609</td><td>627</td><td>457</td><td>471</td></tr>
<tr><td>:</td><td>:</td><td>:</td><td>:</td><td>:</td><td>:</td><td>:</td><td>:</td><td>:</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>615</td><td>633</td><td>463</td><td>477</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>617</td><td>635</td><td>465</td><td>479</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>1</td><td>0</td><td>619</td><td>637</td><td>467</td><td>481</td></tr>
<tr><td>:</td><td>:</td><td>:</td><td>:</td><td>:</td><td>:</td><td>:</td><td>:</td><td>:</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>0</td><td>1</td><td>633</td><td>651</td><td>481</td><td>495</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>635</td><td>653</td><td>483</td><td>497</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>637</td><td>655</td><td>485</td><td>499</td></tr>
</table>
</td></tr>
</table>

Note 3. NTSC suggested setting is 617.

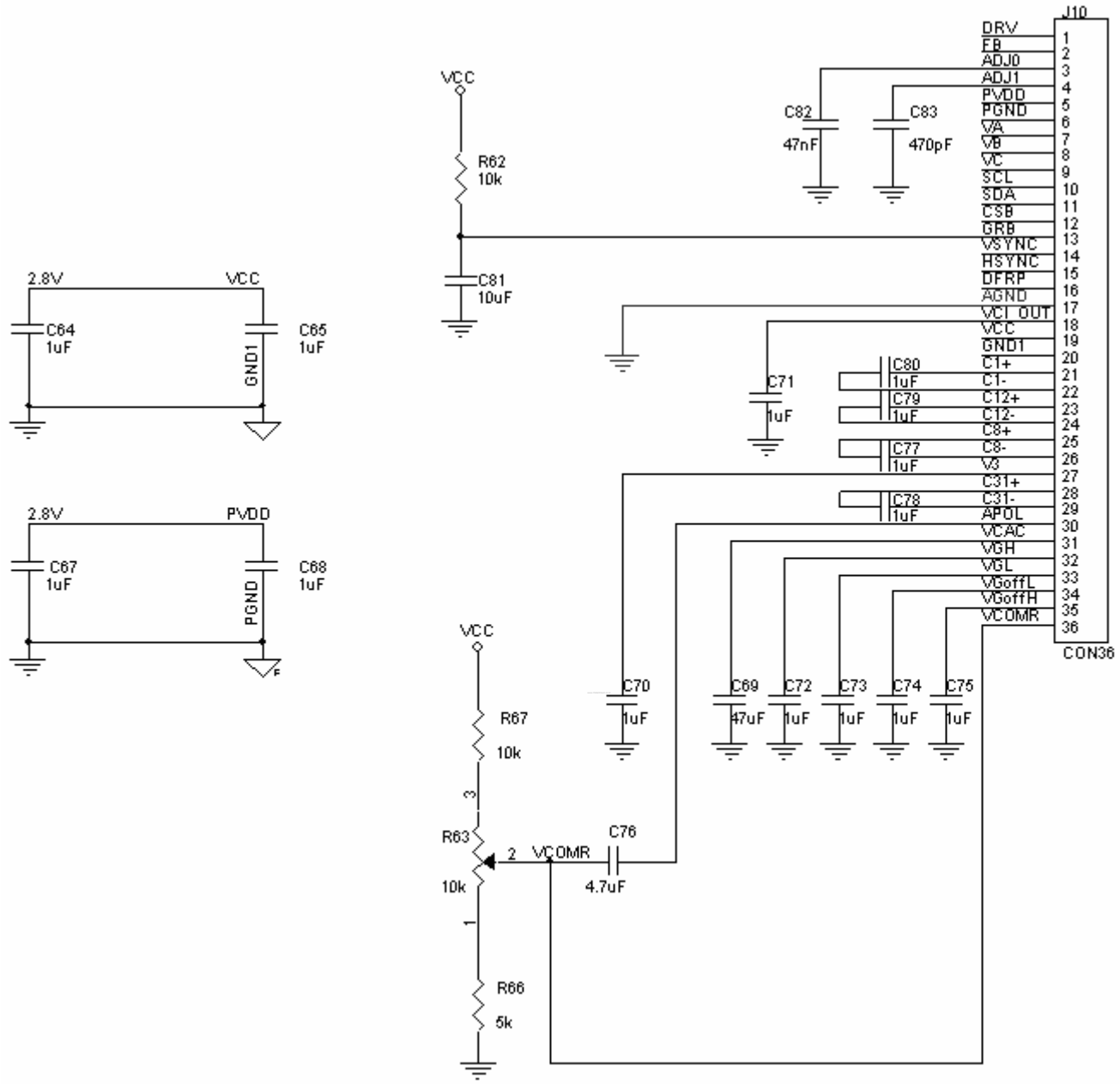
PAL suggested setting is 635.

7. 4:3 Narrow display

In order to display the 4:3 format in 16:9 panel,front 60 channels and last 60 channels must be in black display.Active region will display in center 360 channels.



8. Reference Circuit



C. Optical specification (Note 1,Note 2, Note 3)

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Response time	Rise	Tr	θ =0°	-	20	30	ms	Note 4, 6
	Fall	Tf		-	30	40	ms	
Contrast ratio		CR	At optimized viewing angle	100	150	-		Note 5, 6
Viewing angle	Top		CR≧10	10	-	-	deg.	Note 6, 7
	Bottom			30	-	-		
	Left			40	-	-		
	Right			40	-	-		
Transmittance		Y_L	θ =0°	-	7.3	-	%	Note 8

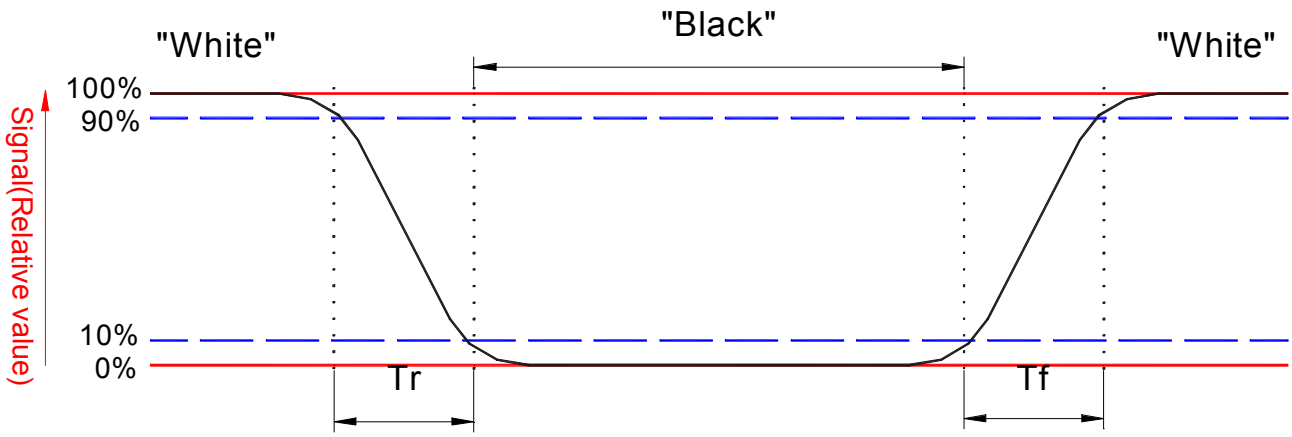
Note 1. Ambient temperature =25℃.

Note 2. To be measured in the dark room.

Note 3.To be measured on the center area of panel with a field angle of 1°by Topcon luminance meter BM-7, after 10 minutes operation.

Note 4. Definition of response time:

The output signals of photo detector are measured when the input signals are changed from “black” to “white”(falling time) and from “white” to “black”(rising time), respectively. The response time is defined as the time interval between the 10% and 90% of amplitudes. Refer to figure as below.



Note 5. Definition of contrast ratio:

Contrast ratio is calculated with the following formula.

$$\text{Contrast ratio (CR)} = \frac{\text{Photo detector output when LCD is at “White” state}}{\text{Photo detector output when LCD is at “Black” state}}$$

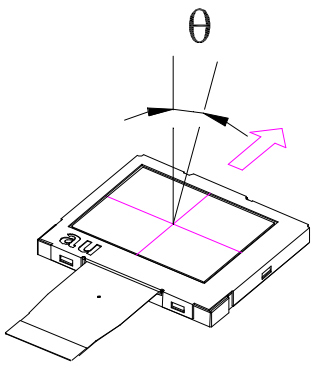
Note 6. White $Vi=V_{i50} \mp 1.5V$

Black $Vi=V_{i50} \pm 2.0V$

“±” Means that the analog input signal swings in phase with COM signal.

"$\pm$" Means that the analog input signal swings out of phase with COM signal.
V_{i50} : The analog input voltage when transmission is 50%
The 100% transmission is defined as the transmission of LCD panel when all the input terminals of module are electrically opened.

Note 7. Definition of viewing angle:
Refer to figure as below.



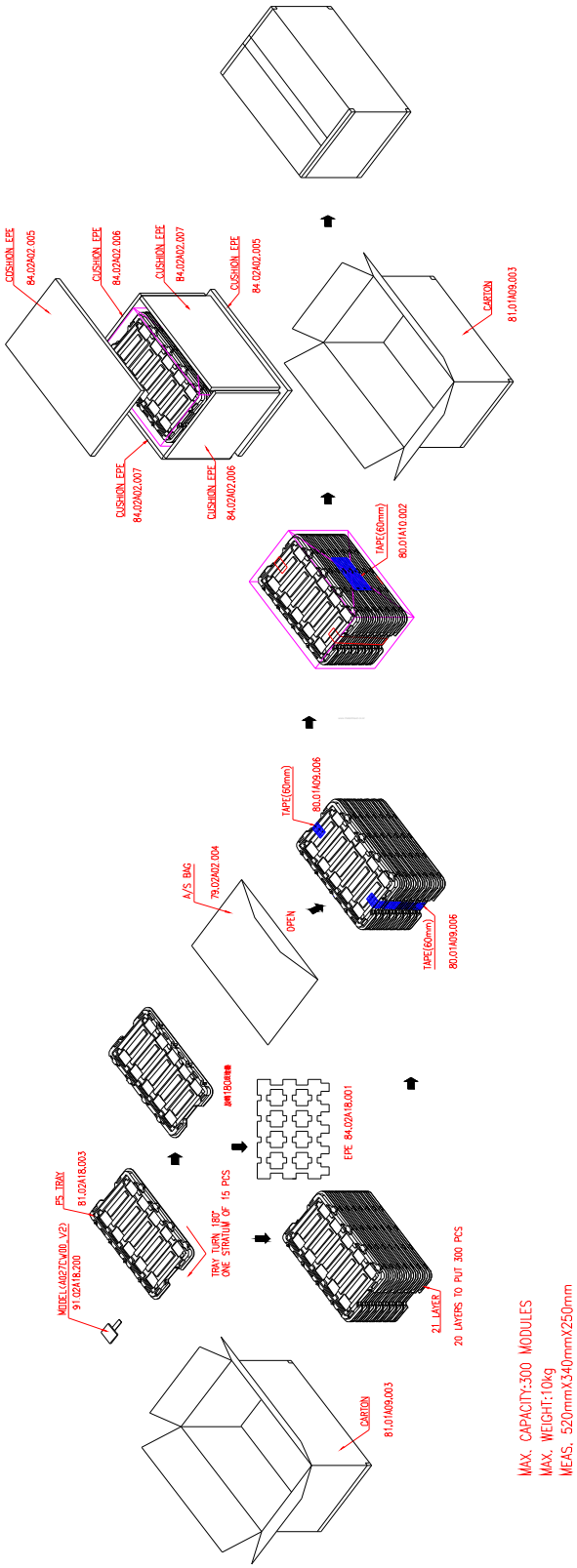
Note 8. Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

D. Reliability test items:

No.	Test items	Conditions	Remark
1	High temperature storage	Ta= 70℃ 240Hrs	
2	Low temperature storage	Ta= -25℃ 240Hrs	
3	High temperature operation	Ta= 60℃ 240Hrs	
4	Low temperature operation	Ta= 0℃ 240Hrs	
5	High temperature and high humidity	Ta= 60℃. 90% RH 240Hrs	Operation
6	Heat shock	-25℃~80℃/50 cycle @ 2hrs/cycle	Non-operation
7	Electrostatic discharge	±200V,200pF(0Ω), once for each terminal	Non-operation
8	Vibration (with carton)	Random vibration: 0.015G^2/Hz from 5~200Hz –6dB/Octave from 200~500Hz	IEC 68-34
9	Drop (with carton)	Height: 60cm 1 corner, 3 edges, 6 surfaces	

Note: Ta: Ambient temperature.

E. Packing form



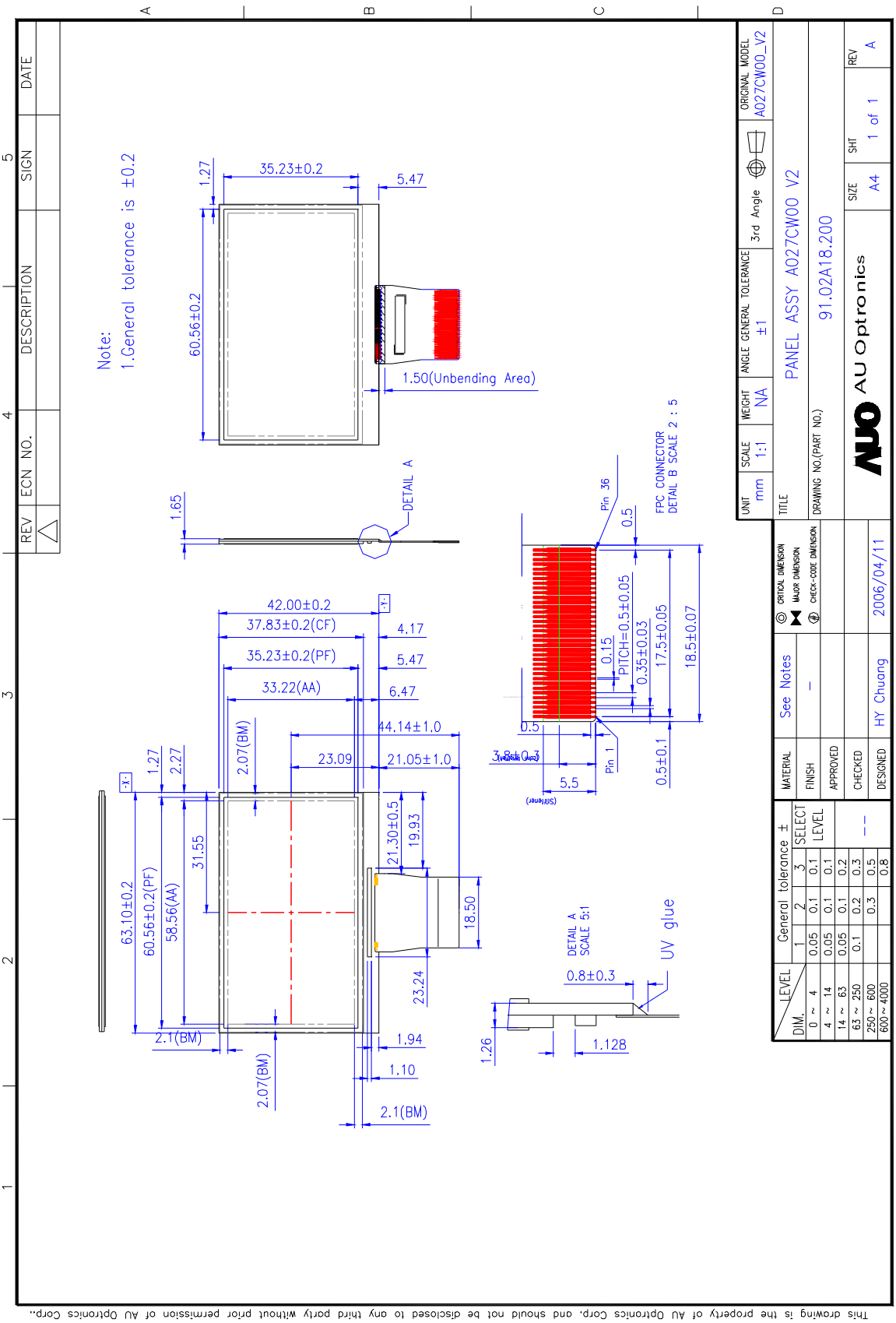


Fig.2 Outline dimension of TFT-LCD module

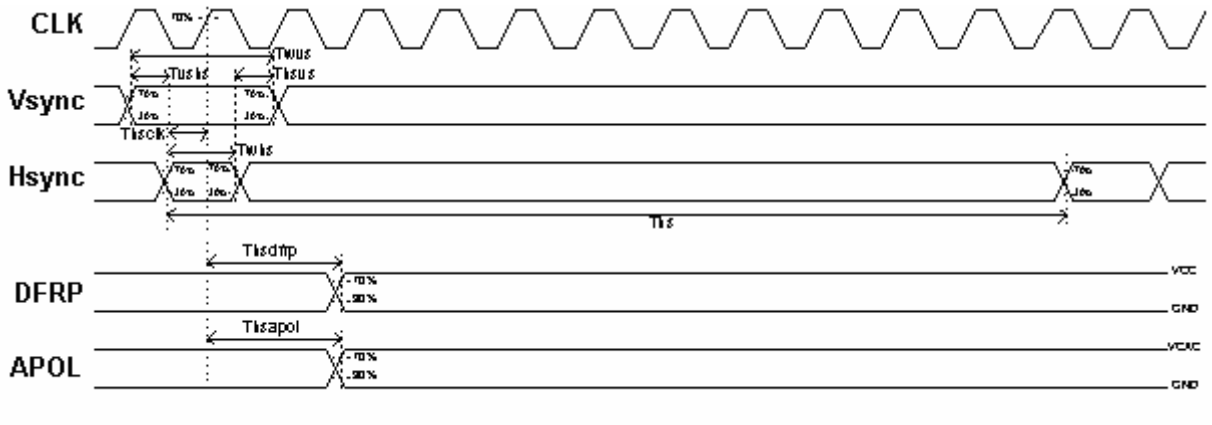


Fig .3 Horizontal Timing Diagram

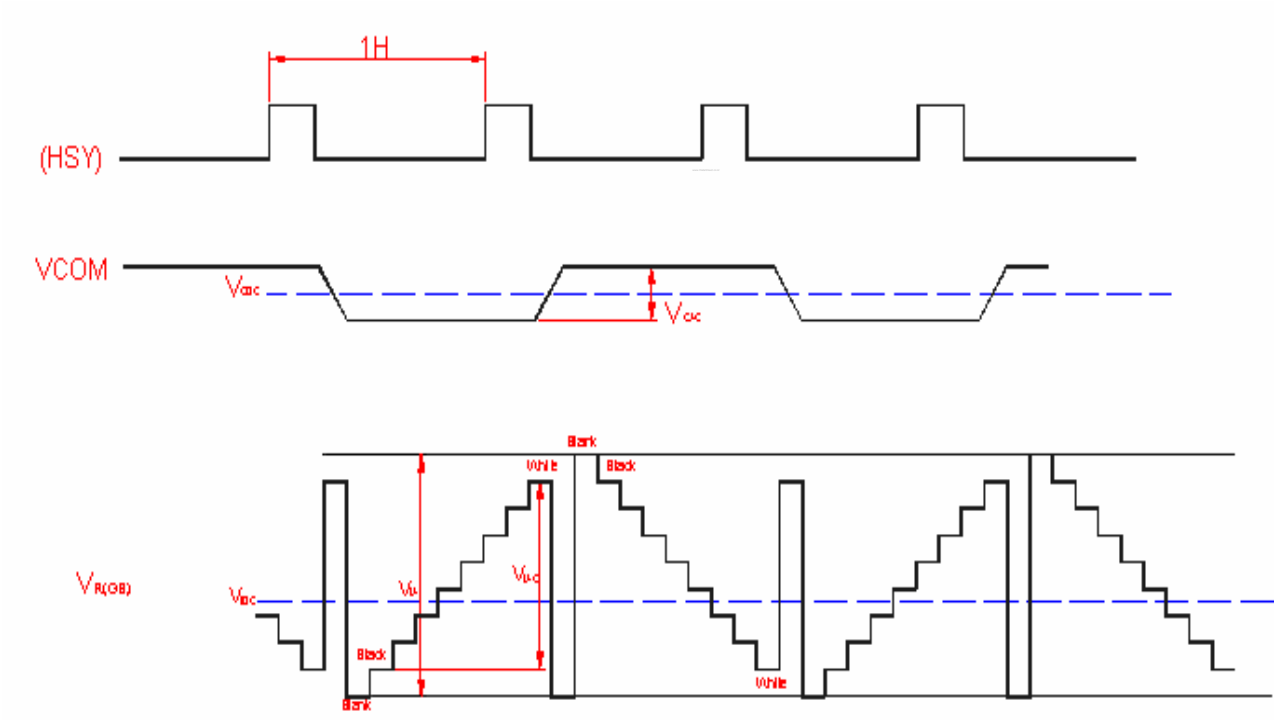


Fig. 4 Input Video signal

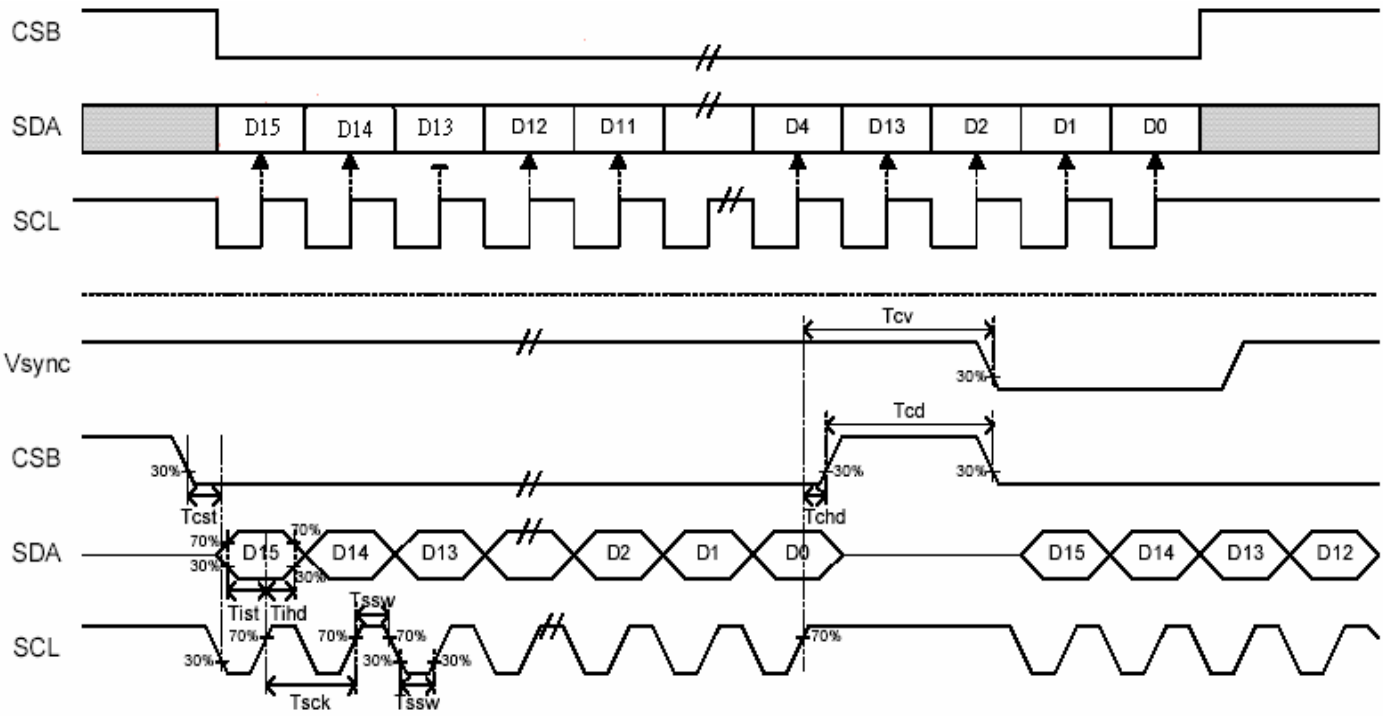


Fig. 5 3-wire programming function Timing

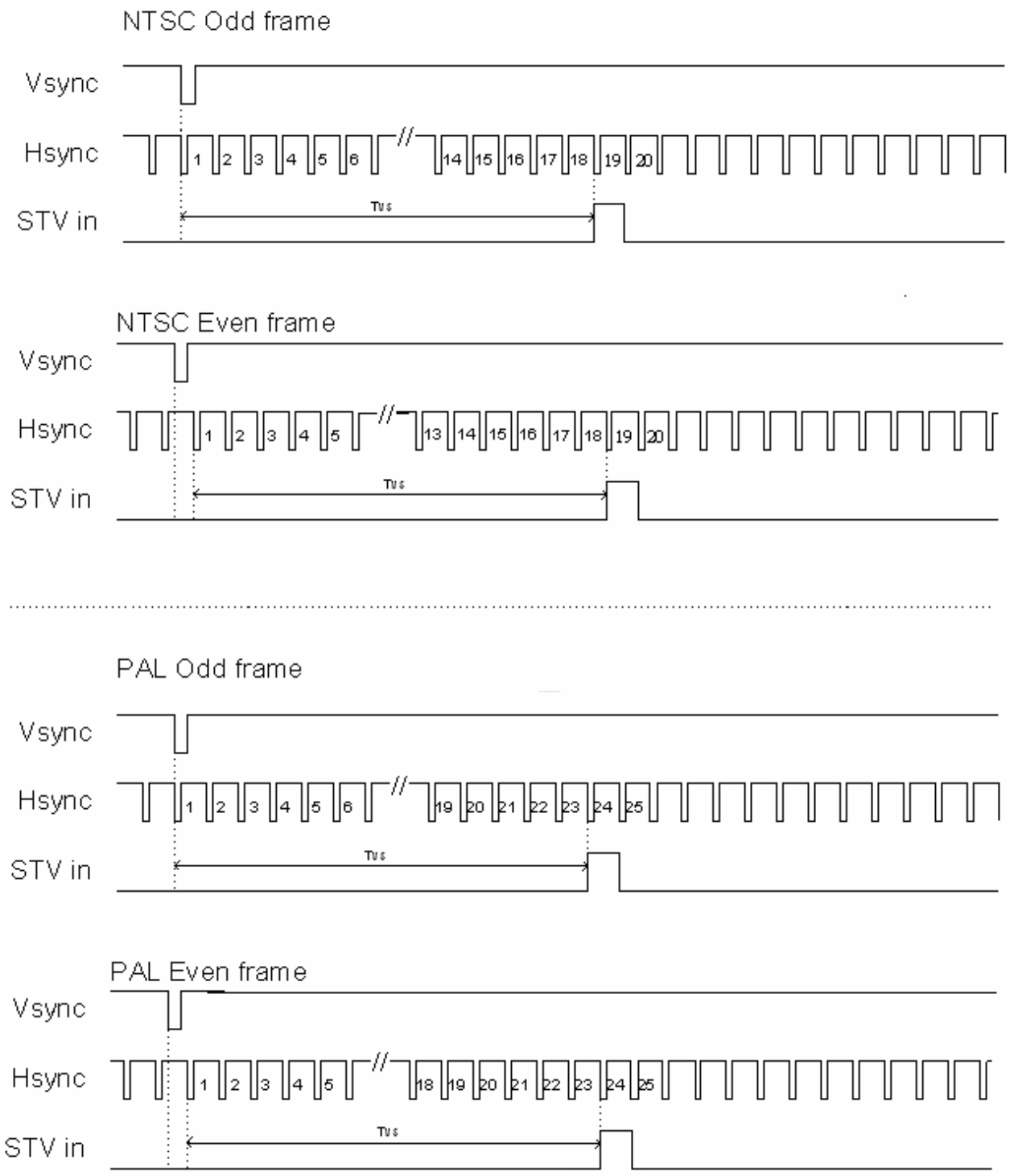


Fig. 6 Vertical Timing Diagram

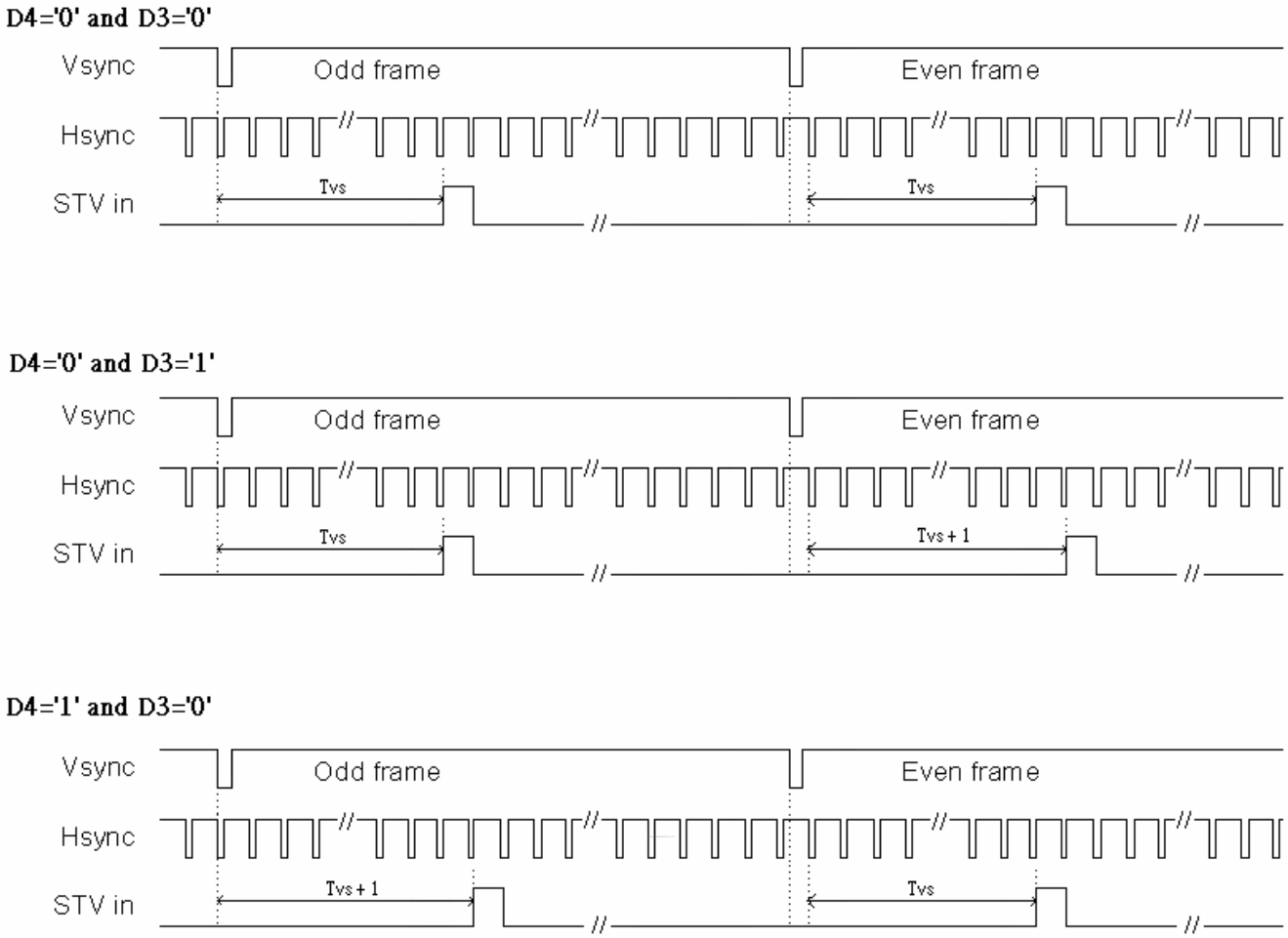


Fig. 7 Frame advance Timing Diagram