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Date	2006/11/15

Product Specification

6.5" COLOR TFT-LCD MODULE

MODEL NAME: A065VL01 V2

< □ > Preliminary Specification

< > Final Specification

Note: The content of this specification is subject to change

Record of Revision

Version	Revise Date	Page	Content
0.0	2006/08/09		First draft.
0.1	2006/10/04	10	Revise typ. value of AVDD and VGH
		18	Revise optical specifications
		24	Revise application circuit (pin#5, 6, 7 of AVDD, R34, C21, C22)
		28	Add recommended register setting
0.2	2006/10/26	22	Update outline drawing
0.3	2006/11/15	10	Revise AVDD value
		29	Add important note for customer system design

Contents

1. Summary

A065VL01 V2 is a LTPS (Low Temperature Poly-Silicon) type TFT (Thin Film Transistor) LCD (Liquid crystal Display) with touch panel. This model is composed of TFT-LCD, drive IC, FPC (flexible printed circuit), backlight unit and touch panel.

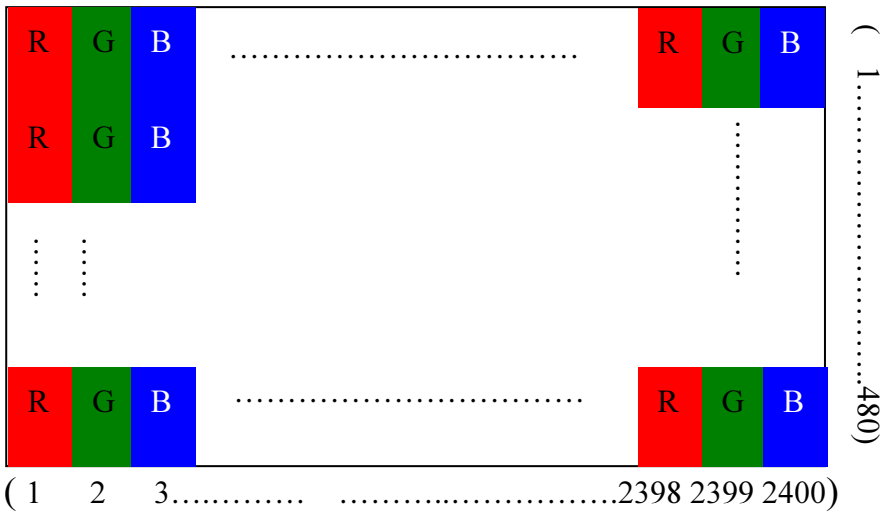
2. Features

- 6.5” display size in 16:9 aspect ratio
- 800RGBx480(WVGA) resolution for wide view format
- 250nits high brightness with high power LED backlight
- 250:1 high contrast
- Wide viewing angle technology
- Power supply: 3.3V for LCD panel and 13.2V for LED
- Parallel RGB I/F of 6-bit color depth
- Green design

3. Physical Specifications

NO.	Item	Specification	Remark
1	Display resolution(dot)	800 (W)×RGBx480 (H)	
2	Active area(mm)	143.4W)×79.2(H)	
3	Screen size(inch)	6.5”(Diagonal)	
4	Display Mode	Normally White	
5	Pixel pitch(mm)	0.0597(W)xRGB×0.165 (H)	
6	Color configuration	R. G. B. stripe	Note 1
7	Color Depth	262K Colors	Note 2
8	Overall dimension(mm)	157.2(W)×89.2(H)×6.4(D)	Note 3
9	Weight(g)	145±5%	
10	Surface treatment	AG(8% haze) & with SWV film	
11	Backlight unit	High power LEDs	

Note 1: Below figure shows the dot stripe arrangement.



Note 2: The 262K color display depends on 6-bit data signal input.

Note 3: Not including the backlight cable and screw height. Refer to next page for further information.

4. Electrical Specifications

a. Pin Assignment

Connector type: FH16-80S-0.3SH(05) or compatible

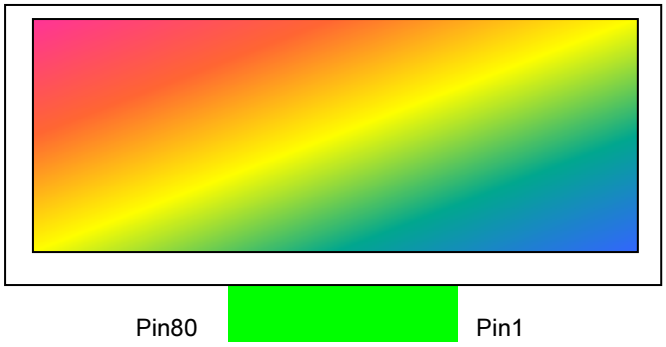
Pin no	Symbol	I/O	Description	Remark
1	VGH	P	Power for LCD	
2	DIO2	I/O	Start pulse signal	
3	AVDD	P	Analog power for source driver	
4	CHNSL1	I	Control signal, please set to ‘1’	
5	CHNSL0	I	Control signal, please set to ‘1’	
6	VCC	P	Digital power for source driver	
7	POL	I	Output data polarity control signal	
8	REV	I	Data inversion control signal output for source driver	
9	LINV	I	Polarity control signal	
10	MUX2	I	Source driver control signal	
11	MUX1	I	Source driver control signal	
12	MUX0	I	Source driver control signal	
13	GAMA	I	Source driver control signal ,please set to ‘1’	
14	LD2	I	Source driver control signal	
15	LD1	I	Source driver control signal	
16	OP1	I	Output buffer driving capacity control signal	
17	OP0	I	Output buffer driving capacity control signal	
18	MODE	I	Control signal , please set to ‘1’	
19	GND	P	Digital ground	
20	B5	I	Blue data	
21	B4	I	Blue data	
22	B3	I	Blue data	
23	B2	I	Blue data	
24	B1	I	Blue data	
25	B0	I	Blue data	
26	GND	P	Digital ground	
27	AGND	P	Analog ground	
28	V14	P	Gamma reference voltage	
29	V13	P	Gamma reference voltage	
30	V12	P	Gamma reference voltage	

31	V11	P	Gamma reference voltage	
32	V10	P	Gamma reference voltage	
33	V9	P	Gamma reference voltage	
34	V8	P	Gamma reference voltage	
35	V7	P	Gamma reference voltage	
36	V6	P	Gamma reference voltage	
37	V5	P	Gamma reference voltage	
38	V4	P	Gamma reference voltage	
39	V3	P	Gamma reference voltage	
40	V2	P	Gamma reference voltage	
41	V1	P	Gamma reference voltage	
42	AVDD	P	Analog power for source driver	
43	GND	P	Digital ground	
44	G5	I	Green data	
45	G4	I	Green data	
46	G3	I	Green data	
47	G2	I	Green data	
48	G1	I	Green data	
49	G0	I	Green data	
50	GND	P	Digital ground	
51	R5	I	Red data	
52	R4	I	Red data	
53	R3	I	Red data	
54	R2	I	Red data	
55	R1	I	Red data	
56	R0	I	Red data	
57	GND	P	Digital ground	
58	PRSEL1	I	Source driver control signal , please set to ‘0’	
59	PRSEL0	I	Source driver control signal , please set to ‘1’	
60	SHL	I	Source driver horizontal shift direction control	
61	CLK	I	Output data clock for source driver	
62	EDGSL	I	Source driver control signal	
63	RSTB	I	Reset pin, low active	
64	VCC	P	Digital power for source driver	
65	AGND	P	Analog ground	

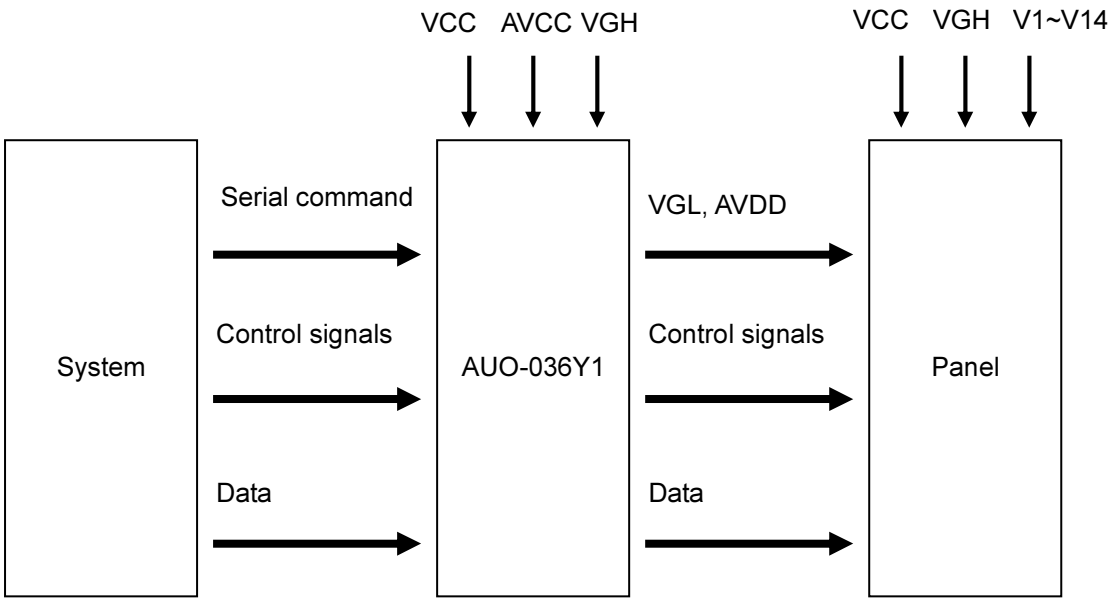
66	DIO1	I/O	Start pulse signal	
67	SW6	I	Control signal	
68	SW5	I	Control signal	
69	SW4	I	Control signal	
70	SW3	I	Control signal	
71	SW2	I	Control signal	
72	SW1	I	Control signal	
73	VGL	P	Power for LCD	
74	VGH	P	Power for LCD	
75	CK	I	Control signal	
76	XCK	I	Control signal	
77	VST	I	Control signal	
78	NC		not connected	
79	NC		not connected	
80	VCOM	I	Common electrode voltage	

I: Input, O: Output, P: Power

Note1: For pin sequence arrangement, please refer to the figure as below:



b. Block Diagram



c. Backlight Driving Section

Connector type: JST PHR-2

No.	Symbol	I/O	Description	Remark
1	GND	-	Ground for backlight unit	--
2	HI	I	Power supply for backlight unit (High voltage)	--

5. Absolute Maximum Ratings

Items	Symbol	Product Specification			Unit
		Min.	Typ.	Max.	
Power Voltage	Vcc	-0.3		4	V
	AVDD	-0.5		13.5	V
	VGH	-0.5		17	V
	VGL	-17		0.5	V
	VGH-VGL	-0.5		26.5	V
Input Signal Voltage	Vin	-0.3		VCC+0.3	V
Operating Temperature	Topa	0		60	□
Storage Temperature	Tstg	-25		80	□

6. Electrical Characteristics

a. Typical Operation Condition

Items	Symbol	Product Specification			Unit
		Min.	Typ.	Max.	
Power Voltage	VCC	3.0	3.3	3.6	VCC
	AVDD	8	10.5	12	AVDD
	VGH	10	13.5	15	VGH
	VGL	-5	-7	-9	VGL
	VCOM	0.35*AVDD	0.5*AVDD	0.65*AVDD	VCOM
Input H/L levelVoltage	VIH	0.7*VCC	—	VCC	VIH
	VIL	0	—	0.3*VCC	VIL

(All value should be measured under the condition of GND=AVss=0V)

b. Current Consumption

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Current For Driver	IGH	VGH=12V		96.82		uA
	IGL	VGL=-7V		48.52		uA
	ICC	VCC=3.3V		2.54		mA
	IDD	AVDD=10V		24.43		mA

c. Backlight Driving Condition

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Voltage	Vf	Note1		13.2	15.2	Vrms
Current	If	Note1		200		mA
LED life time		Note 1,2	10000	-		Hrs

Note 1: Panel surface temperature should be kept less than content of “D.2. Absolute maximum ratings"

Note 2: The ”LEd life time” is defined as the module brightness decrease to 50% original brightness at Ta=25□, I_L=200mA

d. Timing Condition

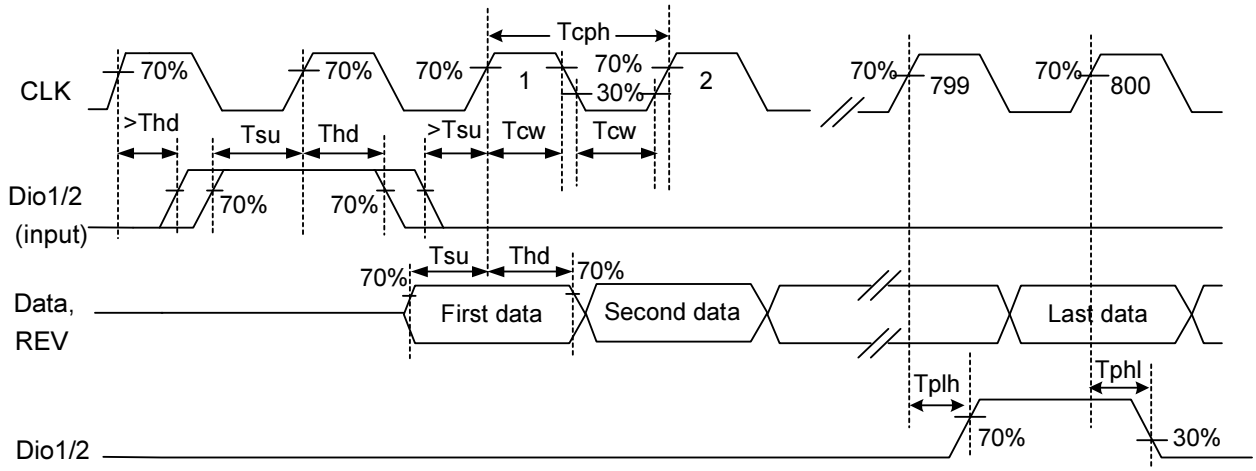
AC Electrical Characteristics (VCC =3V, AVDD=10V, AVSS=GND=0V, TA= 25 °C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
CLK frequency	Fclk=1/Tclk	-	-	45	MHz	As EDGSL="0"
CLK frequency	Fclk=1/Tclk	-	-	22.5	MHz	As EDGSL="1"
CLK pulse width	Tcw	6	-	-	ns	
Data set-up time	Tsu	4	-	-	ns	X1 ~ X5, REV and DIO1/2 to CLK
Data hold time	Thd	2	-	-	ns	
Propagation delay of DIO1/2 high to low level	Tphl	6	10	15	ns	CL=25pF
Propagation delay of DIO1/2 low to high level	Tplh	6	10	15	ns	CL=25pF
Time that the last data to LD1	Tld1	1	-	-	Tclk	
LD1 pulse width	Twld1	2	-	-	Tclk	
Time that LD1 to DIO1/2	Tlds	5	-	-	Tclk	
Time that LD1 to LD2	Tld2	2	-	-	Tclk	
LD2 pulse width	Twld2	1	-	-	Tclk	
MUX/LINV/POL setup time	Tsu2	6	-	-	ns	
MUX/LINV/POL hold time	Thd2	6	-	-	ns	
Output stable time	Tst	-	-	-	us	Refer to LD2 timing chart

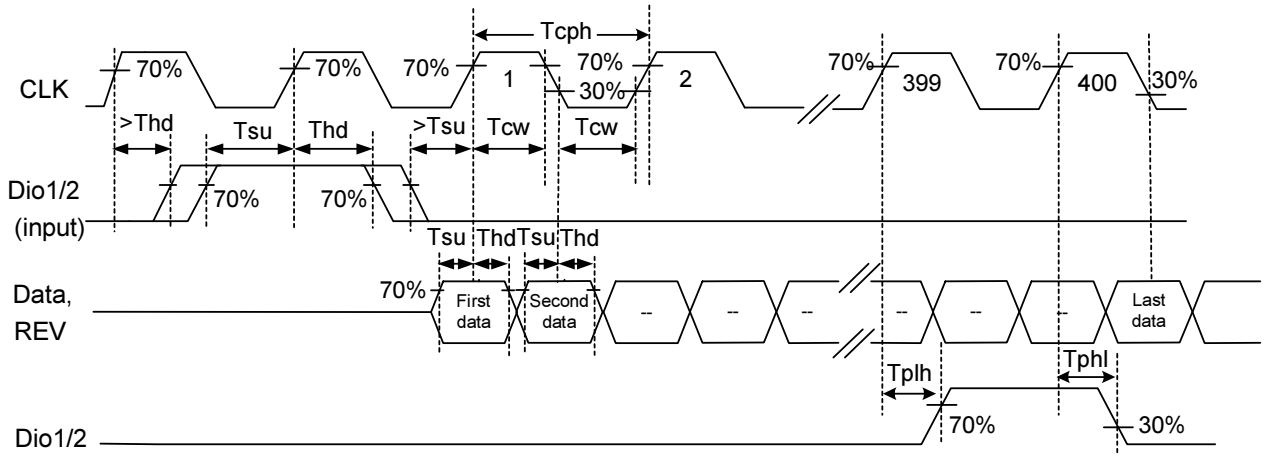
Timing Waveforms

Timing Diagram 1 (CHNSL="1", others setting = Default)

<< EDGSL= "0", Default >>

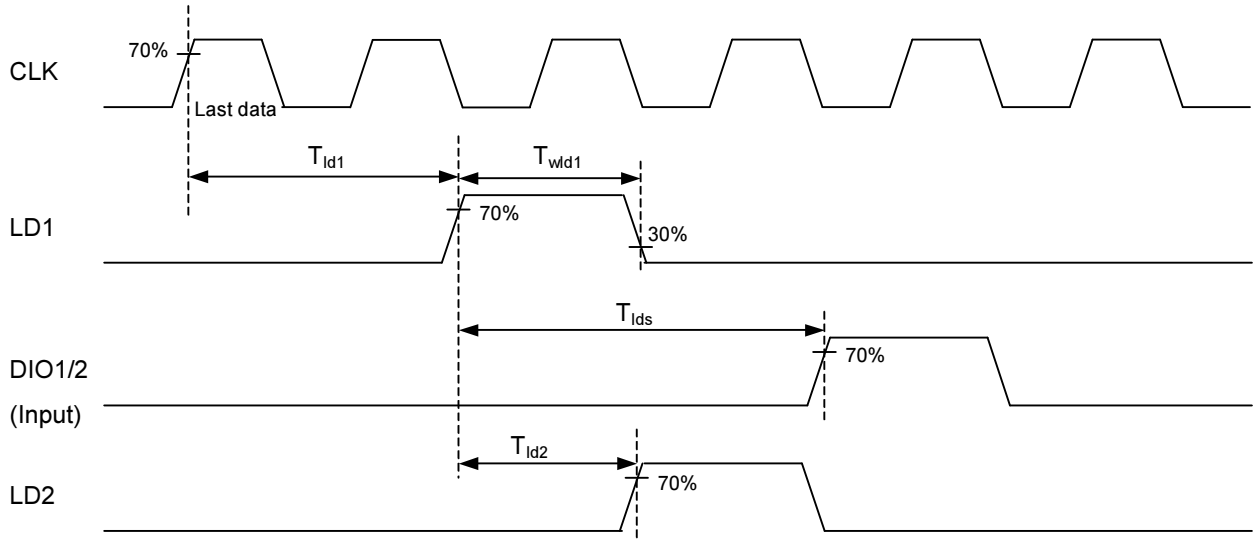


<< EDGSL= "1">>



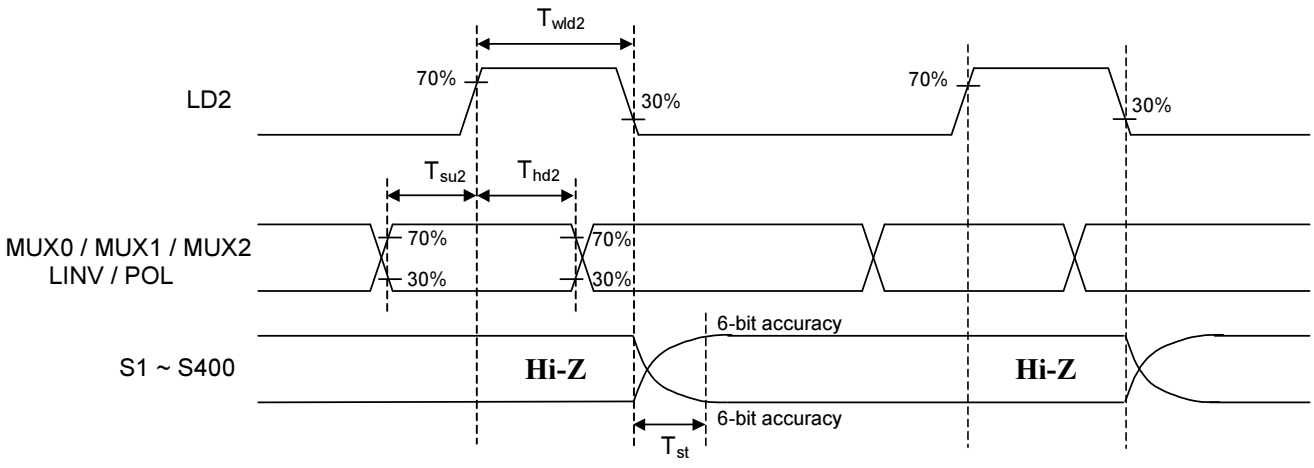
Timing Diagram 2

LD1 Timing Chart



Remark: During source output pre-charging are no relationship(Tld2) of the LD1 and LD2.

LD2 Timing Chart



7. Touch Panel Specifications

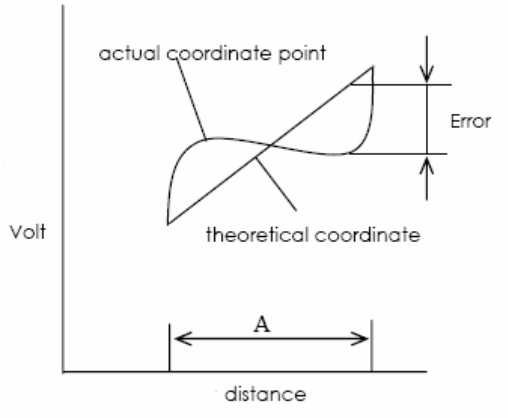
a. FPC Pin Assignment

Pin No.	Symbol	I/O
1	Right	O
2	Down	O
3	Left	O
4	Up	O

b. Electrical Characteristics

Item		Min.	Max.	Unit	Remark
Operating Voltage / DC		--	7	V	Standard 5V
Contact Current		--	1	mA	
Operating Current	Film	--	20	mA	
	Glass	--	20	mA	
Terminal Resistance	X –axis	200	1200	Ω	At connector
	Y –axis	200	900		
Linearity		-1.5%	1.5%	--	Note 1
Insulation Resistance		20M	--	Ω	DC 25V
Response Time		--	10	ms	

Note 1: Measurement condition of Linearity: difference between actual voltage & theoretical voltage is an error at any points. Linearity is the value max. error voltage divided by voltage difference on active area.



c. Mechanical Characteristics

Item	Min.	Max.	Unit	Remark
Hardness of Surface	3	--	H	JIS K-5600
Operation Force (Pen or Finger)	--	100	gf	Note 1

Note 1: Within ”guaranteed active area”, but not on the edge and dot-spacer.

d. Durability Test

Item	Min.	Max.	Unit	Remark
Touch Test	1000K		Times	Note 1
Handwriting Friction Test	100K		Times	Note 2, 3

Note 1: By using Φ12mm/R8.0mm silicon rubber, under the loading of 250g to impact the surface of touch panel under the speed of 2 time/second, after repeat knocking 1000k times, goods must fulfill:
Terminal Resistance: as defined in 7.b
Linearity Error: as defined in 7.b
Insulation Resistance: as defined in 7.b

Note 2: By using Φ3.0mm/R0.8mm/POM pen with 2.45N (250g) loading under 70mm/sec moving speed, within the touch panel 35mm linear contact range and repeat 100K times(one direction moving as test one time), goods must fulfil:
Terminal Resistance: as defined in 7.b
Linearity Error: as defined in 7.b
Insulation Resistance: as defined in 7.b

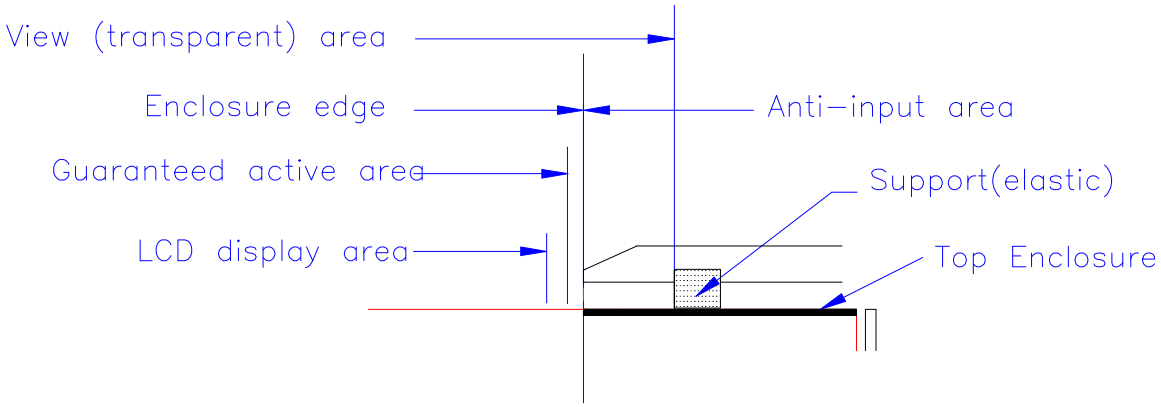
Note 3: Test area - Along the diagonals of active area of the touch panel, and the friction center is the same as the center of active area. It means that the distance is 17.5mm extended both at the friction center two sides along the diagonals of active area of the touch panel and proceeding handwriting friction test.

e. Attention

Please pay attention for below matters at mounting design of touch panel of LCD module.

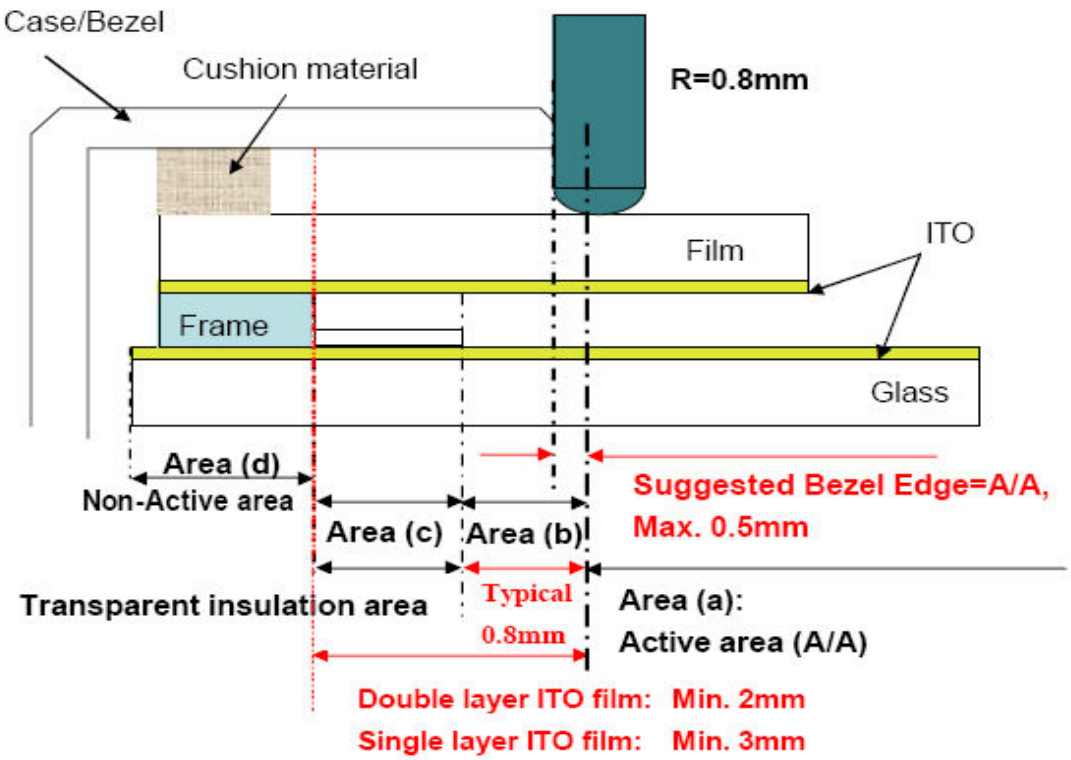
1) Do not design enclosure pressing the view area to prevent from miss input.
2) Enclosure support must not touch with view area.
3) Do not put a heavy force along the edge of the active area.
4) Use elastic or non-conductive material to enclosure touch panel.
5) Do not bond film of touch panel with enclosure.

6) The touch panel edge is conductive. Do not touch it with any conductive part after mounting.
If user wants to cleaning touch panel by air gun, pressure 2kg/cm^2 below is suggested. Not to blow glass from FPC site to prevent FPC peeled off



7) Do not put a heavy shock or stress on touch panel and film surface. Ex. Don't lift the panel by film face with vacuum.
8) Do not lift LCD module by FPC.
9) Please use dry cloth or soft cloth with neutral detergent (after wring dry) or one with ethanol at cleaning. Do not use any organic solvent, acid or alkali liquor.
10) Do not pile touch panel. Do not put heavy goods on touch panel.
11) Structure/area definition: The structure and the performance guaranteed area of this touch panel are defined below:

Below figure illustrates the recommended bezel and cushion design. In order to prevent unusual performance degradation and malfunction of the touch panel, please carry out the set case designing and a touch panel assembling method after surely considering the definition of each area illustrated in below figure.



Area (a): Active area

The active area is guaranteed the position data detectable precision, operation force and other operations. It's strongly recommended to place the operation button or menu keys within the active area. Due to structure, the active area is less durable at the edge or close to the edge.

Area (b): Operating non-guaranteed area

The area doesn't guarantee a touch panel operation and its function. When this area is pressed, touch panel shows degradation of its performance and durability such as a pen sliding durability becomes about one-tenth compared with the active area (Area(a) as guaranteed area) and its operation force requires about double. About 0.5mm outside from a boundary of the active area corresponds to this area.

Area (c): Pressing prohibition area

The area which forbids pressing, because an excessive load is applied to a transparent electrode (ITO) and a serious damage is given to a touch panel function by pressing.

Area (d): Non-active area

The area doesn't activate even if pressed.

8. Optical Specifications

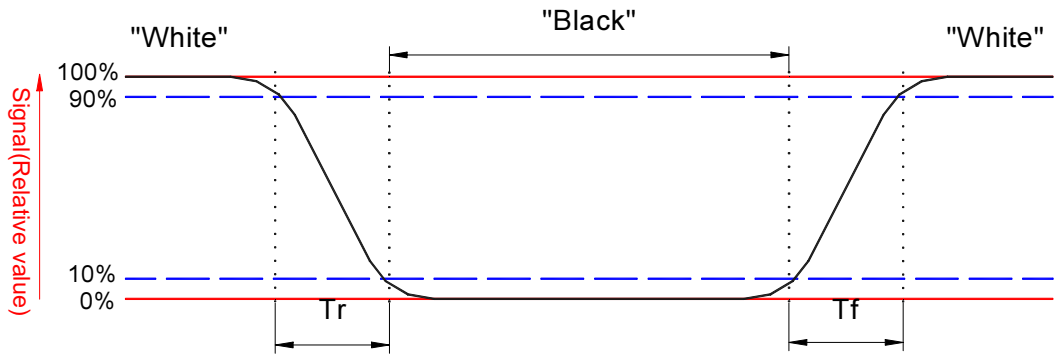
Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Response time	Rise Fall	Tr Tf	θ=0°	- -	12 18		ms ms	Note 3,5
Contrast ratio		CR	At optimized Viewing angle	150	250	-		Note 4, 5
Viewing angle	Top Bottom Left Right		CR≧10	35 50 45 45	45 60 55 55	- - - -	deg.	Note 5
Brightness		Y_L	I_L=200mA, 25□	200	250	-	nits	Note 1,2,6
White chromaticity		x	θ=0°	0.27	0.32	0.37		Note 6
		y	θ=0°	0.30	0.35	0.40		

Note 1 : Ambient temperature =25□, and LED current If= 200 mA. To be measured in the dark room.

Note 2 :To be measured on the center area of panel with a viewing cone of 1°by Topcon luminance meter BM-7, after 10 minutes operation.

Note 3. Definition of response time:

The response time is defined as the time interval between the 10% and 90% of amplitudes. 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).



Note 4. 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 5. White Vi = $V_{i50} \pm 1.5V$

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

“±” means that the analog input signal swings in phase with V_{COM} signal.

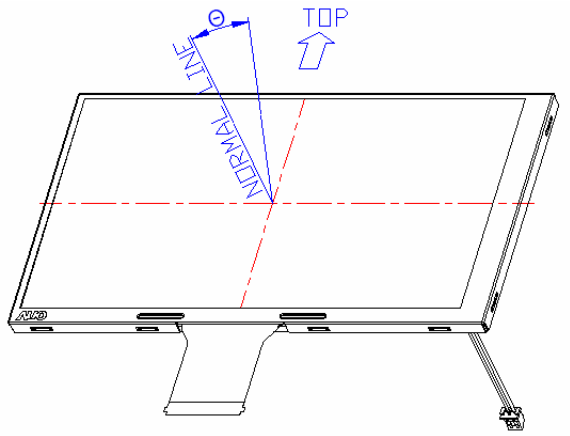
“$\mp$” means that the analog input signal swings out of phase with V_{COM} signal.

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 6. Measured at the center area of the panel when all the input terminals of LCD panel 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.

9. Reliability Test Items

No.	Test items	Conditions		Remark
1	High temperature storage	Ta= 80□	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	Ta= 60□, 90% RH	240Hrs	Operation
6	Heat shock	-20□- -70□/100 cycles 1Hrs/cycle		Non-operation
7	Electrostatic discharge	±200V,200pF(0Ω), once for each terminal		Non-operation
8	Vibration	Frequency	: 10~55Hz	JIS C7021 A-10 condition A
		Stoke	: 1.5mm	
		Sweep	: 10 ~ 55 ~ 10Hz	
		2 hours for each direction of X,Y,Z		
		(6 hours for total)		
9	Mechanical shock	100G, 6ms, ±X,±Y,±Z 3 times for each direction		JIS C7021, A-7 condition C
10	Vibration (with carton)	Random vibration: 0.015G^2/Hz from 5~200Hz –6dB/octave from 200~500Hz		IEC 68-34
11	Drop (with carton)	Height: 60cm 1 corner, 3 edges, 6 surfaces		JIS Z0202

Note 1: Ta: Ambient temperature.

Note 2: In the standard conditions, there is not display function failure issue occurred. All the cosmetic specification is judged before the reliability stress.

10. Handling Precautions

a Since the touch panel is easily damaged, pay attention not to scratch it.

b Be sure to turn off power supply when inserting or disconnecting from input connector.

c Wipe off water drop immediately. Long contact with water may cause discoloration or spots.

d When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.

e Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface.

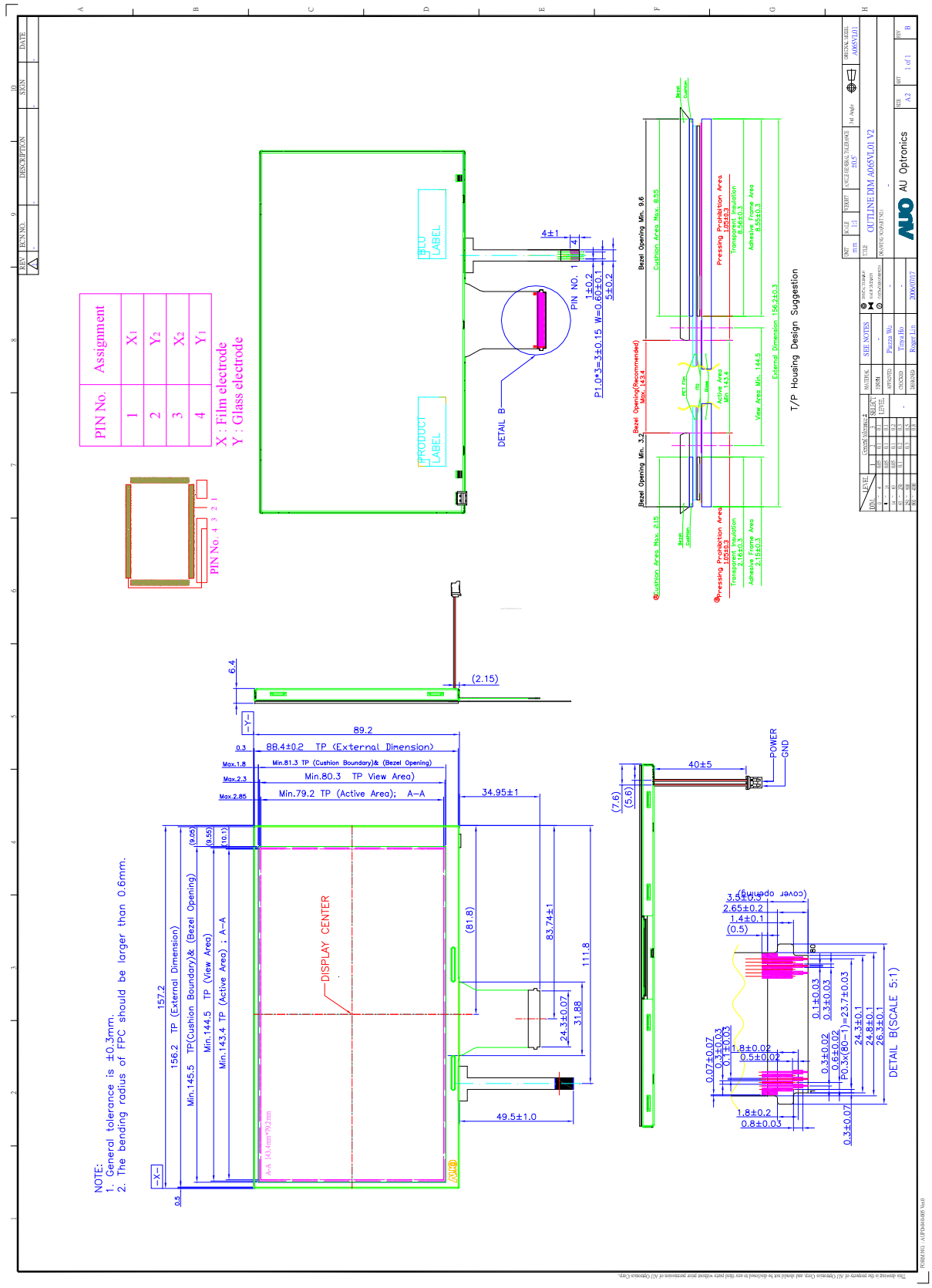
f Do not open nor modify the Module Assembly.

g Do not press the reflector sheet at the back of the module to any directions.

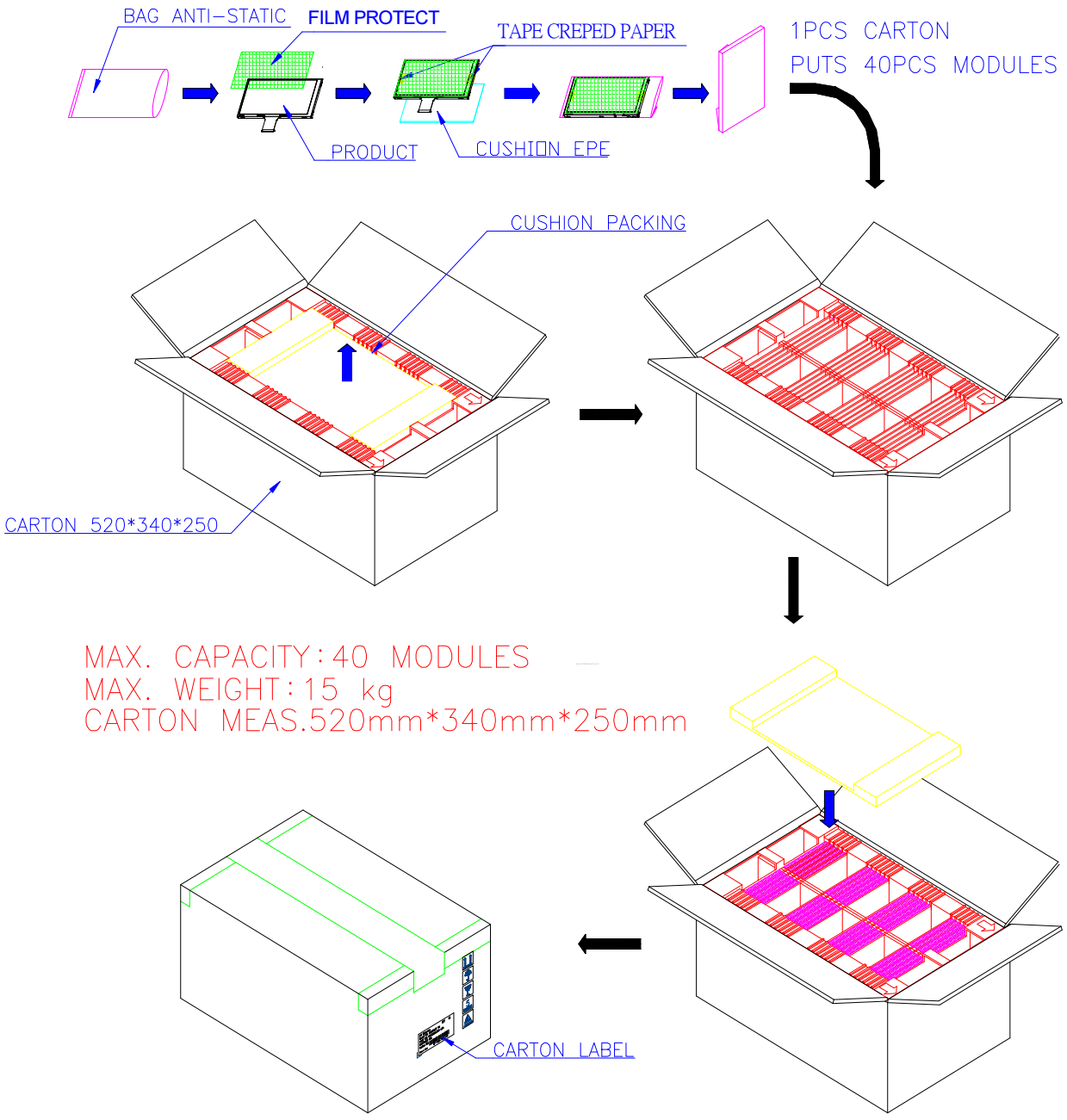
h At the insertion or removal of the Signal Interface Connector, be sure not to rotate nor tilt the Interface Connector of the TFT Module.

i After installation of the TFT Module into a system enclosure, do not twist nor bend the TFT Module even momentary. At designing the enclosure, it should be taken into consideration that no bending/twisting forces are applied to the TFT Module from outside. Otherwise the TFT Module may be damaged.

11. Outline Dimension

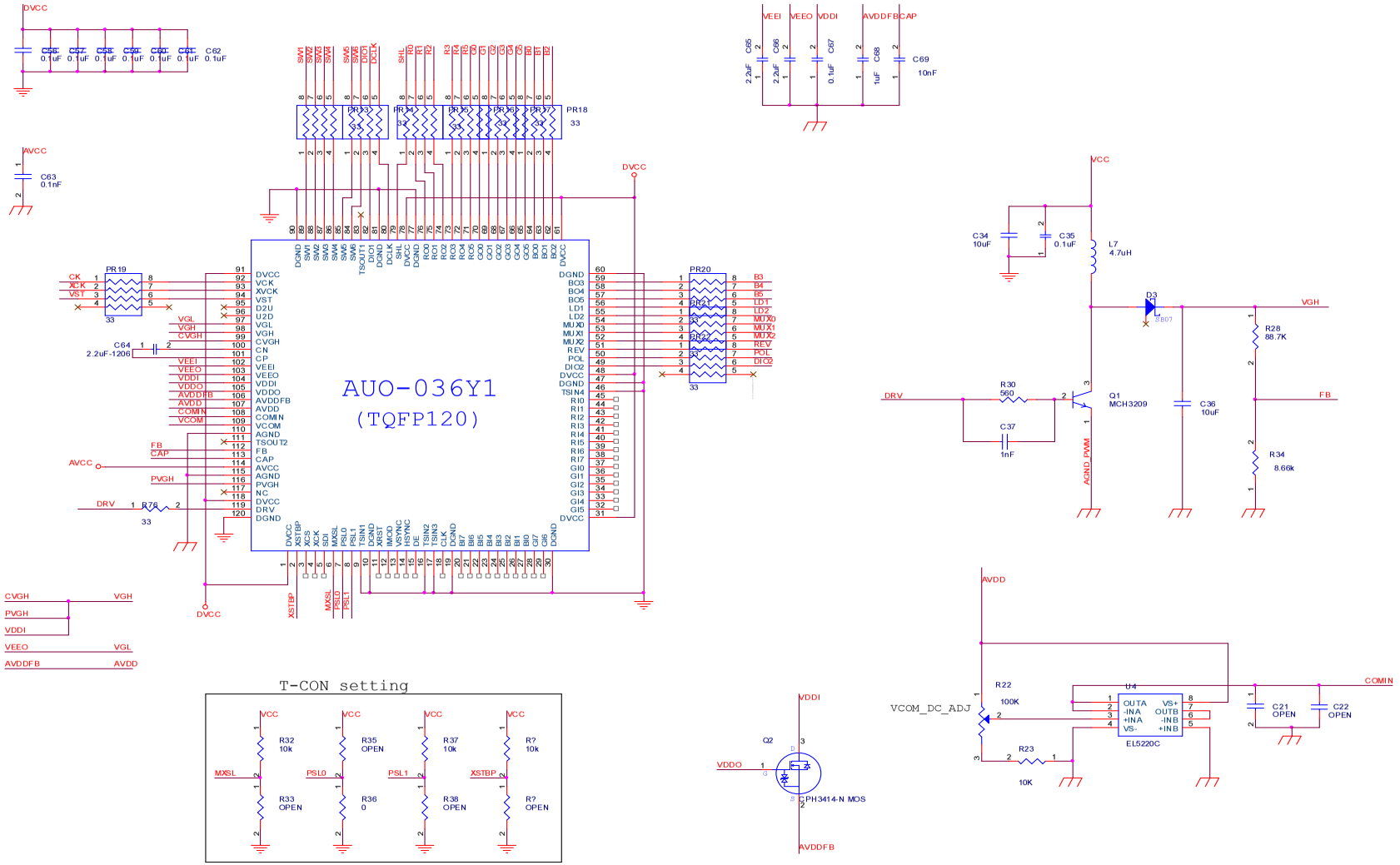


12. Packing Form

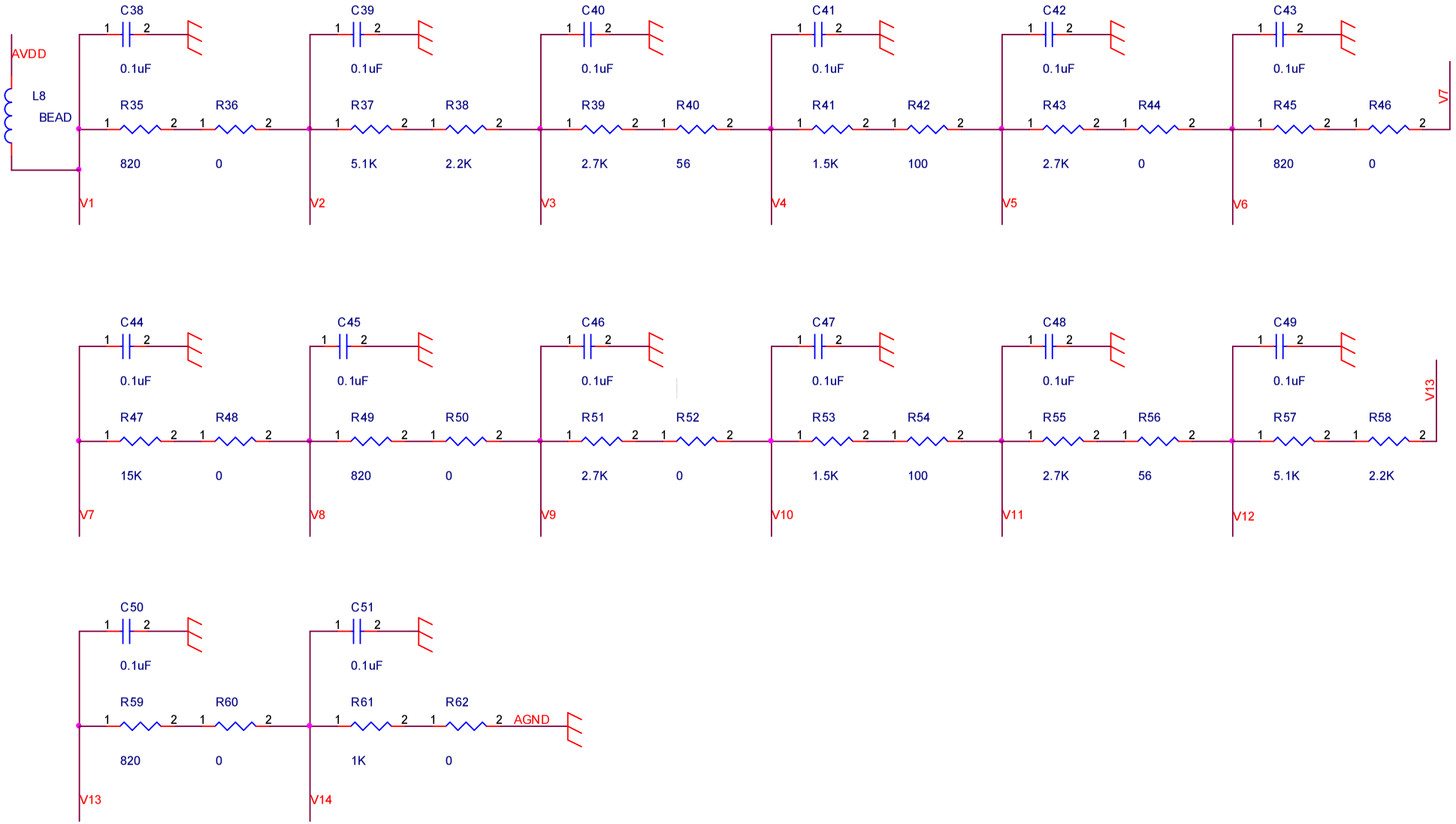


Appendix:

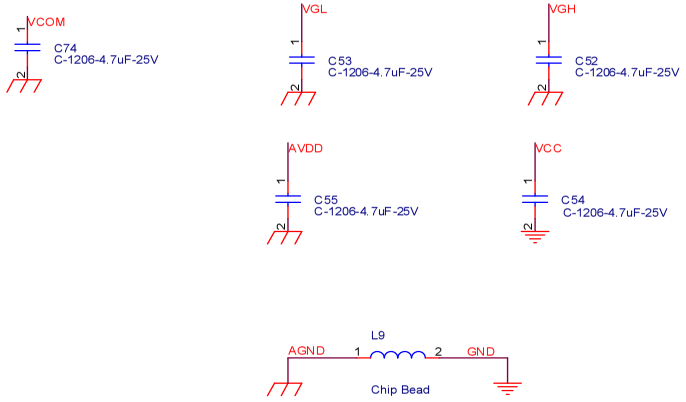
1.Typical Application Circuit

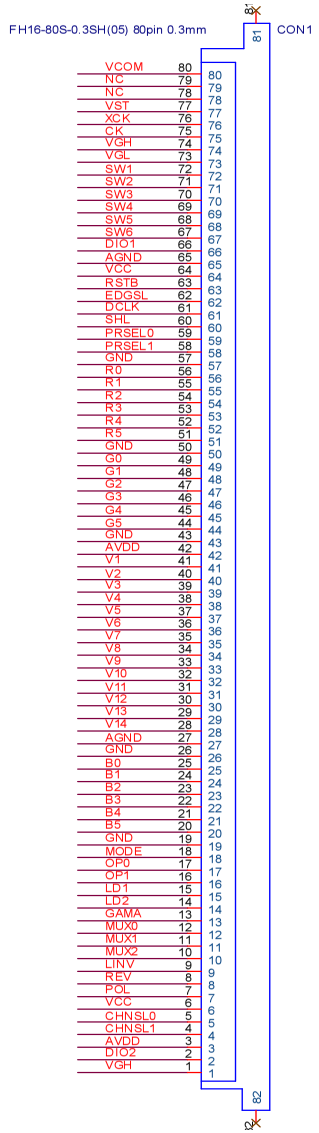


AUO-036 Circuit design

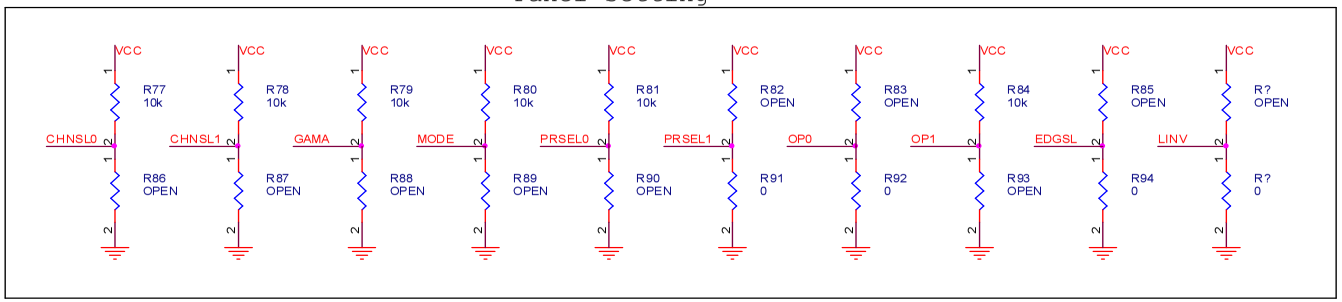


Gamma Circuit



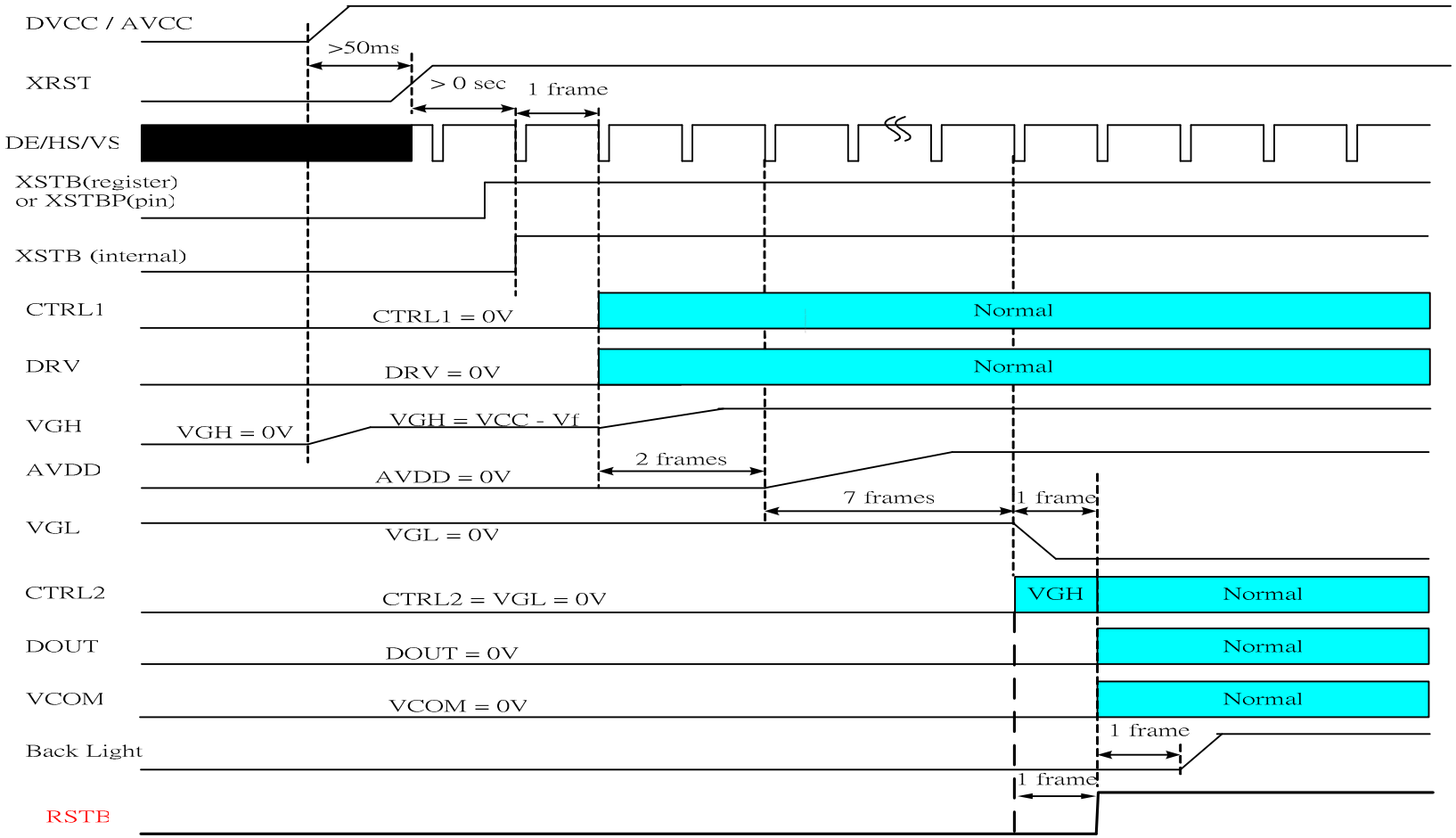


Panel setting



2. Power On/Off Sequence

Panel Setting



Power ON sequence

Note1: The using of standby mode signal XSTBP, please refer to AUO-036Y1 spec. P28.

Note2: Panel reset signal RSTB, please follow the power on sequence.

Note3: Input mode selection signal IMOD

IMOD="Low" : DE mode, please set VSYNC and HSYNC to "high".

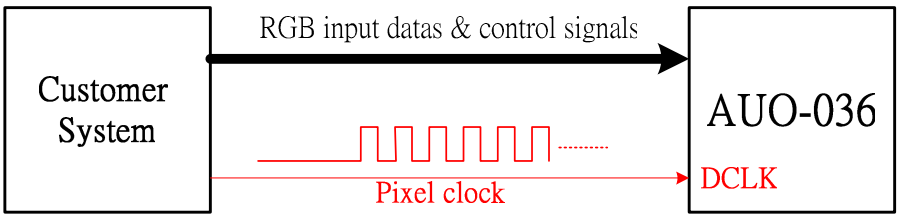
IMOD="high" : HSYNC/VSYNC mode, please set DE to "low".

Recommended register setting

		Register Data								Note
Reg NO.	**Reg Name**	**D7**	**D6**	**D5**	**D4**	**D3**	**D2**	**D1**	**D0**	
0	VDD_ADJ	X	X	X	0	1	1	1	1	VDD=11v
1	VEE_ADJ	X	X	X	X	0	1	0	0	(Default)
2	COMDC	1	0	0	0	0	0	0	0	(Default)
3	VPOSITION	0	0	1	0	0	0	0	0	(Default)
4	HPOSITION	1	0	1	0	0	0	0	0	
5	PANEL	X	1	1	0	0	0	0	1	
6	FUNCTION	X	X	X	1	1	1	0	1	
128	BLANK(1)	0	1	1	1	0	0	0	0	(Default)
129	PREC(1)	0	0	0	0	1	0	0	0	(Default)
130	SWITCH(1)	0	0	0	1	1	1	1	1	(Default)
131	INT(1)	0	0	0	1	1	0	0	0	(Default)
132	BLANK(2)	1	0	0	0	0	1	0	0	(Default)
133	PREC(2)	0	0	0	0	1	1	0	0	(Default)
134	SWITCH(2)	0	0	1	0	0	1	0	1	(Default)
135	INT(2)	0	0	0	1	1	1	0	0	(Default)
136	BLANK(3)	1	0	0	1	0	1	1	0	(Default)
137	PREC(3)	0	0	0	1	1	0	0	1	(Default)
138	SWITCH(3)	0	0	1	0	1	0	0	0	(Default)
139	INT(3)	0	0	0	1	1	1	1	0	(Default)

Important Note

1. In customer system, the initial state of the pixel clock output (DCLK pin of AUO-036) must be set to **Low**.



2. Please do not cut off the pixel clock during system operation.