



CUSTOMER APPROVAL SHEET

Company Name	
MODEL	A060SE02 V9
CUSTOMER APPROVED	

- APPROVAL FOR SPECIFICATIONS ONLY (Spec. Ver. 0.2)
- APPROVAL FOR SPECIFICATIONS AND ES SAMPLE (Spec. Ver. 0.2)
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- CUSTOMER REMARK :

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Product Specification

6" EPD MODULE

Model Name : **A060SE02 V9**

Planned Lifetime: From 2010/Aug. To 2011/ Aug.

Phase-out Control: From 2011/May. To 2011/ Aug.

EOL Schedule: 2011/ Aug.

< ◆ >Preliminary Specification

< >Final Specification

Note: The content of this specification is subject to change.

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A. General Information

This display is a active matrix electrophoretic display (EPD), which comprises a-si TFT substrate, electrophoretic front plane, protective anti-glare top-sheet, driver ICs, and FPC. It is designed for applications such as e-book or e-reader.

NO.	Item	Unit	Specification	Remark
1	Screen Size	inch	6 (Diagonal)	
2	Display Resolution	dot	800 (H)x 600 (V)	
3	Overall Dimension	mm	130.4 (H) × 104.6 (V) × 1.32 (T)	Note 1
4	Active Area	mm	122.4 (H)×90.6 (V)	
5	Dot Pitch	mm	0.153 (H)x 0.151 (V)	
6	Gray level	--	16	
7	Weight	G	(30.6)	
8	Surface Treatment		AG (7.5 ± 2%) Hard coating (3H)	Note 2

Note 1: Not include FPC. Refer next page to get further information.

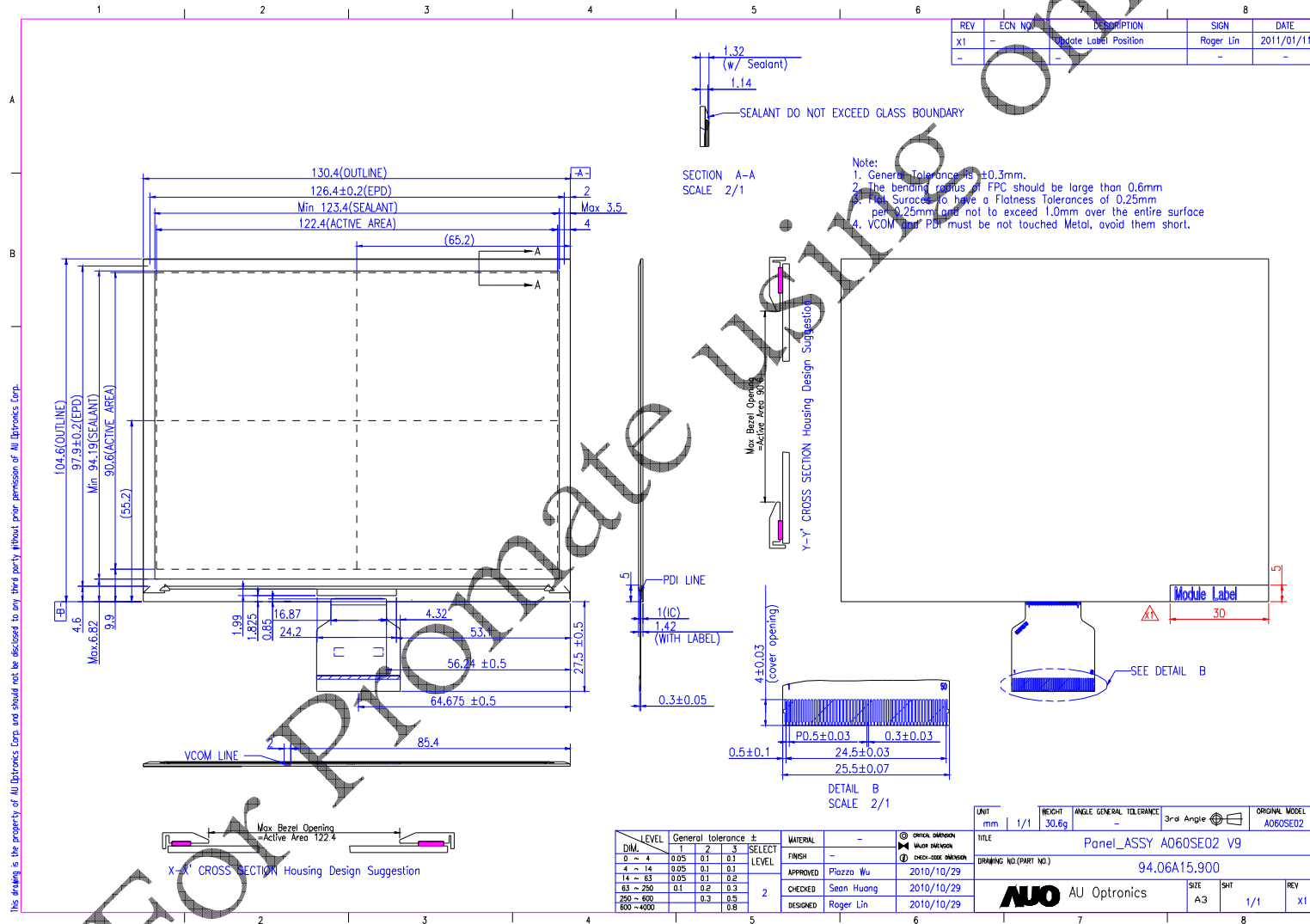
Note 2: 750 g load force on UNI/JPIA 3H pencil, speed is 3.5mm/s on the AG film and scratch length is 1cm and write 5 handwriting, Scratch no. ≤ 2 is OK



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B. Outline Dimension



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C. Electrical Specifications

1. Pin Assignment

Recommended connector : FH12-50S-0.5SH.

Pin No.	Symbol	I/O	I/O Structure	Description	Remark
1	Dummy	--	--	Dummy pin	
2	VCOM	O	--	VCOM polarity output signal	
3	VCOM_BOT	I	--	VCOM signal setting pin	
4	VCOMDC	P	Type2	External voltage for VCOMDC power.	
5	VCOMH	P	--	External voltage for VCOM high power.	
6	VCOML	P	--	External voltage for VCOM low power.	
7	RST_N	I	Type 3	Global reset pin. Low reset.	
8	SHD_N	I	Type 3	DC-DC converter shut down pin. "0" : Enable.(Panel shut down, Default) "1" : Disable.	
9	PWR_RDY	O	Type 1	Power ready output. When SHD_N from "1" to "0": PWR_RDY will become "0". When SHD_N from "0" to "1": after 100ms, PWR_RDY will become "1".	Note1
10	VCOMIN_0	I	Type 2	Logic Input for VCOM voltage generate.	
11	VCOMIN_1	I	Type 2	Logic Input for VCOM voltage generate.	
12	YOE	I	Type 3	Vertical output enable pin.	Note2
13	YCLK	I	Type 3	Vertical clock. input	Note2
14	UD	I	Type 3	Vertical (up/down) scan direction. U/D = "L": Shift up to down. Default U/D = "H": Shift down to up.	

15	YDIOD	I/O	Type 5	Vertical start pulse input/output. These pins are used to input and output shift data. These pins are switched as input or output by setting the UD pin as follow.										
16	YDIUO	I/O	Type 5	<table border="1"> <thead> <tr> <th>UD</th> <th>YDIUO</th> <th>YDIOD</th> </tr> </thead> <tbody> <tr> <td>L</td> <td>Output</td> <td>Input</td> </tr> <tr> <td>H</td> <td>Input</td> <td>Output</td> </tr> </tbody> </table>	UD	YDIUO	YDIOD	L	Output	Input	H	Input	Output	
UD	YDIUO	YDIOD												
L	Output	Input												
H	Input	Output												
17	XDIOL	I/O	Type 5	Horizontal start pulse input/output. These pins are used to input and output shift data. These pins are switched as input or output by setting the SHL pin as follow.										
18	XDIOR	I/O	Type 5	<table border="1"> <thead> <tr> <th>SHL</th> <th>XDIOL</th> <th>XDIOR</th> </tr> </thead> <tbody> <tr> <td>L</td> <td>Input</td> <td>Output</td> </tr> <tr> <td>H</td> <td>Output</td> <td>Input</td> </tr> </tbody> </table>	SHL	XDIOL	XDIOR	L	Input	Output	H	Output	Input	
SHL	XDIOL	XDIOR												
L	Input	Output												
H	Output	Input												
19	LD	I	Type 3	Latch data.										
20	D0	I	Type 3	Data input, First pixel LSB										
21	D1	I	Type 3	Data input, First pixel MSB										
22	D2	I	Type 3	Data input, Second pixel LSB										
23	D3	I	Type 3	Data input, Second pixel MSB										
24	D4	I	Type 3	Data input, Third pixel LSB										
25	D5	I	Type 3	Data input, Third pixel MSB										
26	D6	I	Type 3	Data input, Forth pixel LSB										
27	D7	I	Type 3	Data input, Forth pixel MSB										
28	SHL	I	Type 3	Horizontal (left/right) scan direction. SHL = "L": Shift right to left. SHL = "H": Shift left to right. Default										
29	XCLK	I	Type 3	Horizontal Clock input..	Note3									
30	VREF	C	--	For power setting capactor connected pin.										
31	VR	P	--	VCOMDC reference voltage										
32	AVDD	C	--	For power setting capactor connected pin.										
33	C1P	C	--	For charge pump capactor connected pin.										
34	C1N	C	--	For charge pump capactor connected pin.										
35	VSS	P	--	Digital ground										
36	VSSA	P	--	Analog ground.										
37	VDD	P	--	Analog power.										
38	VREF_POS	C	--	For power setting capactor connected pin.										
39	VREF_NEG	C	--	For power setting capactor connected pin.										

40	VDDX8	P	--	DCDC positive voltage	
41	NVDDX8	P	--	DCDC negative voltage	
42	VDD_DRV	P	--	DCDC power.	
43	ADRVU	O	Type 1	PWM output for DCDC converter.	
44	ADRVD	O	Type 1	PWM output for DCDC converter.	
45	VSS_DRV	P	--	DCDC ground.	
46	VDPS	P	--	External voltage for source positive power.	
47	VDNS	P	--	External voltage for source negative power.	
48	VDPG	C	--	For power setting capacitor connected pin.	
49	VDNG	C	--	For power setting capacitor connected pin.	
50	Dummy	D	--	Dummy pin	

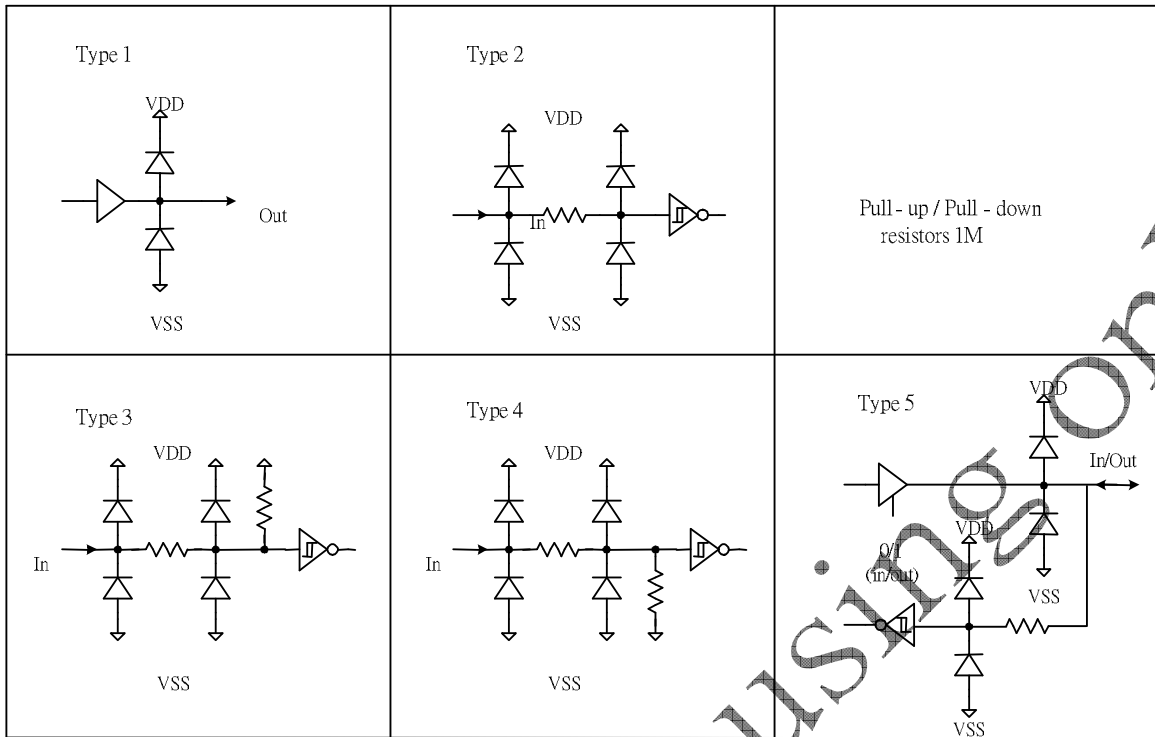
I: Input pin; O: output pin, I/O: Input / Output; P: Power pin; C: capacitor pin; D : Dummy

Note 1: Please reference chapter F

Note 2: Please reference chapter E

Note 3: Please reference chapter E

I/O Pin Structure:



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2. Absolute Maximum Ratings

Item	Symbol	Condition	Min.	Max.	Unit	Remark
Power voltage	VDD	VSSA=VSS=0	-0.3	+5.0	V	
Power voltage	VDD_DRV	VSS_DRV=0	-0.3	+5.0	V	
Source voltage	VDPS	VSSA=VSS=0		+20	V	
	VDNS	VSSA=VSS=0	-20		V	
Gate voltage	VDPG	VSSA=VSS=0	-0.3	VDNG+40	V	
	VDNG	VSSA=VSS=0	VDPG-40	+0.3	V	
VCOM voltage	VCOMH	VSSA=VSS=0	0	VNPG-1	V	
	VCOML	VSSA=VSS=0	VDNG+1	0	V	
Storage temperature	Tstg	-	-25	70	°C	
Operating	Topa	-	0	40	°C	

3. Operation Ratings

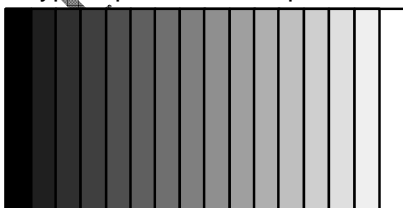
Item	Symbol	Min.	Typical	Max.	Unit	Remark
Power voltage	VDD=VCC	3.0	3.3	3.6	V	
Power voltage	VDD_DRV	3.0	3.3	3.6	V	
Source voltage	VDPS	14.5	15	15.5	V	
	VDNS	-15.5	-15	-14.5	V	
Gate voltage	VDPG	19	20	21	V	
	VDNG	-21	-20	-19	V	
VCOM voltage	VCOMH	10.5	11	11.5	V	
	VCOML	-19.5	-19	-18.5	V	

D. Electrical Characteristics

1. Panel Power Consumption

Item	Symbol	Condition	Min.	Typical	Max.	Unit
Supply Voltage	VDD	VSSA=VSS=VSS_DRV=0V	--	3.3	--	V
	VDD_DRV	VSSA=VSS=VSS_DRV=0V	--	3.3	--	
Low Level Input Voltage	Vil	Digital input pins	GND	-	0.3xVDD	V
High Level Input Voltage	Vih	Digital input pins	0.7xVDD	-	VDD	V
Operating temperature	T _{op}		-	25	-	°C
Operation Power Dissipation	P	VDD=VDD_DRV=3.3V	--	1.07	2	mA
		VDNS=-15V		0.82	1.5	mA
		VDPS=15V		0.86	1.5	mA
		VDPG=20V		1.23	2	mA
		VDNG=-20V		0.66	1.5	mA
		VCOMH=11V		0.36	1	mA
		VCOML=-19V		0.56	1	mA
Standby Power Dissipation	P	VDD=VDD_DRV=3.3V	--	0.06	0.15	mA
		VDNS=0V		0.02	0.1	mA
		VDPS=0V		0.02	0.1	mA
		VDPG=3.3V		0.02	0.1	mA
		VDNG=0V		0.02	0.1	mA
		VCOMH=0V		0.01	0.1	mA
		VCOML=0V		0.02	0.1	mA
Image Update Time		T=25°C	--	950	1010	ms
		T=10°C	--	2310	2450	ms
		T=0°C	--	2750	3150	ms

*: Typical power consumption measured by following pattern



E. Input timing AC Characteristics

1. Horizontal Input Timing

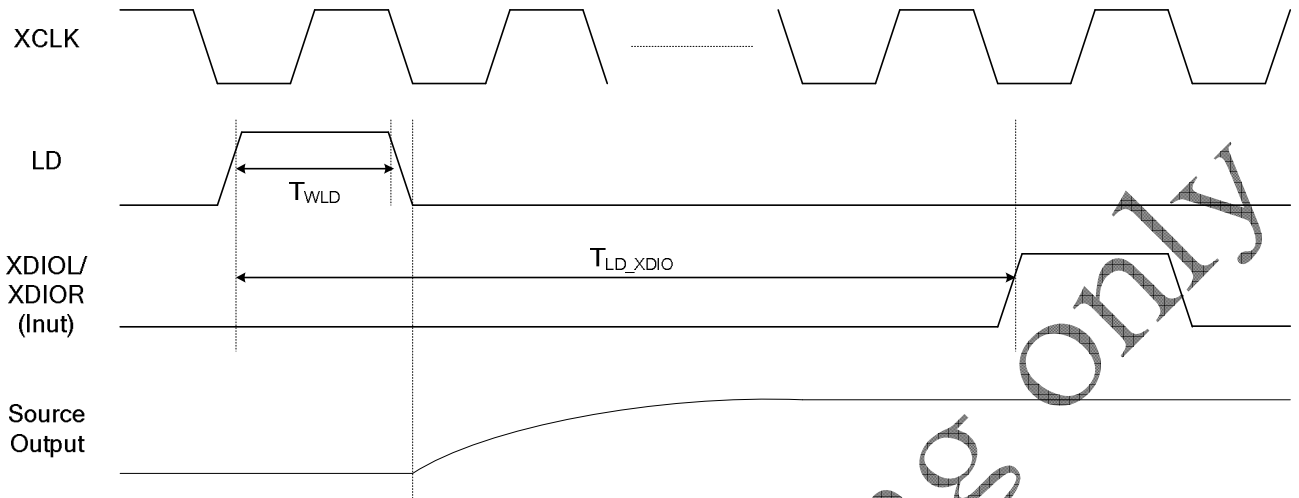
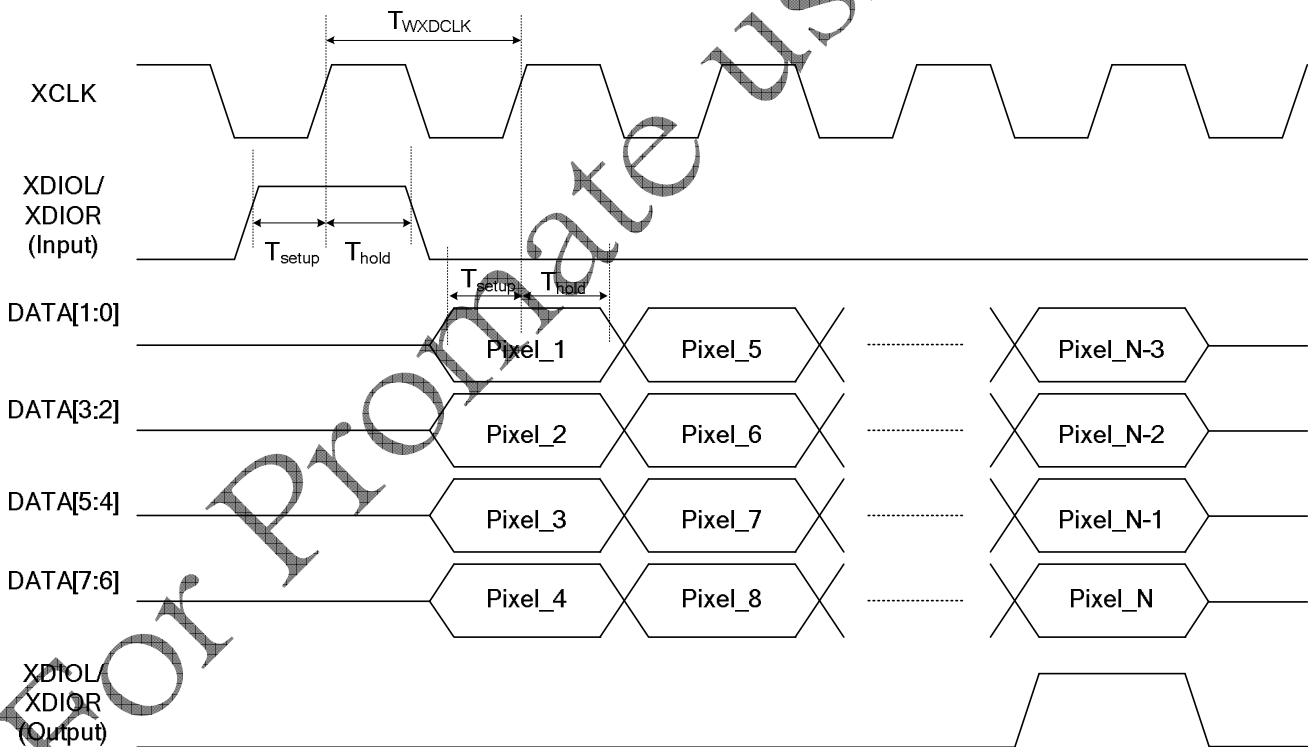


Figure 1: LD input timing



N=800

Figure 2: Horizontal data Input timing

(VDD=VDD_DRV=3.3V, VSSA=VSS=VSS_DRV=0V, TA=25°C)

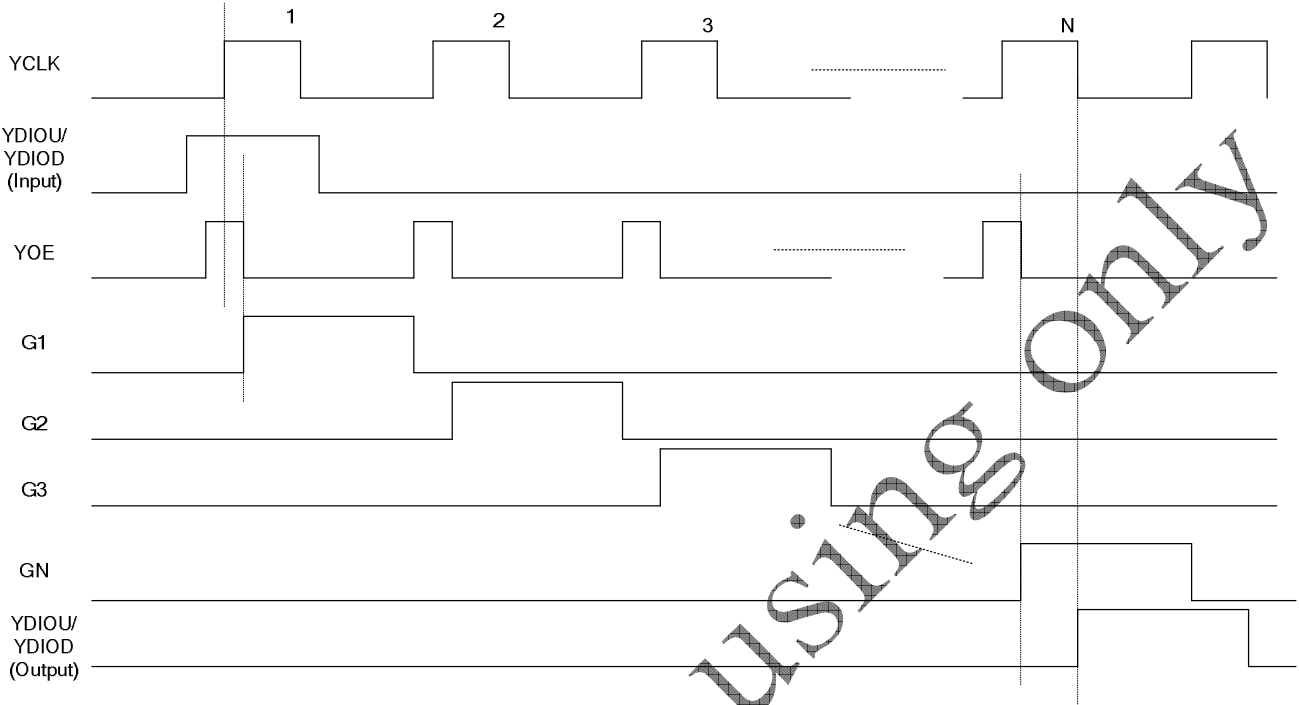
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
Clock pulse width	T _{WXDCLK}	13			ns
Data setup time	T _{setup}	2	-	-	ns
Data hold time	T _{hold}	2	-	-	ns
LD pulse width	T _{WLD}	1	-	-	XCLK
Time from LD to XDIOL/XDIOR	T _{LD_DIO}	5	-	-	XCLK

1.1 Relationship of Input Data and Source Output Voltage

The source driver output voltage will base on input 2 bits data, and the relationship is as below:

MSB	LSB	Function
0	0	Source output is 0V
0	1	Source output is VDPS(+15V)
1	0	Source output is VDNS(-15V)
1	1	Source output is floating

2. Vertical Input Timing



N=600

Figure 3: Vertical input timing

3. VCOM Voltage Definition

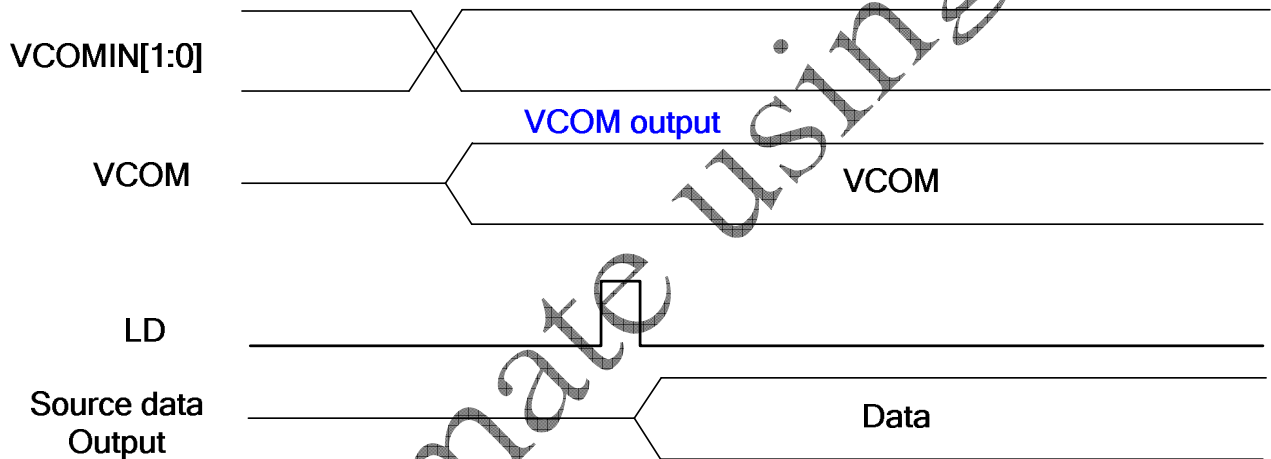
The VCOM output voltage will base on input pins VCOMIN[1:0], and the relationship is as below:

VCOMIN[1 :0]	Function
00	VCOM output is (-VDC) v
01	VCOM output is (VDPS-VDC) v
10	VCOM output is (VDNS-VDC) v
11	VCOM output is floating

4. VCOM Relationship

VCOM will change while VCOMIN change

Source output will change while LD signal falling edge.

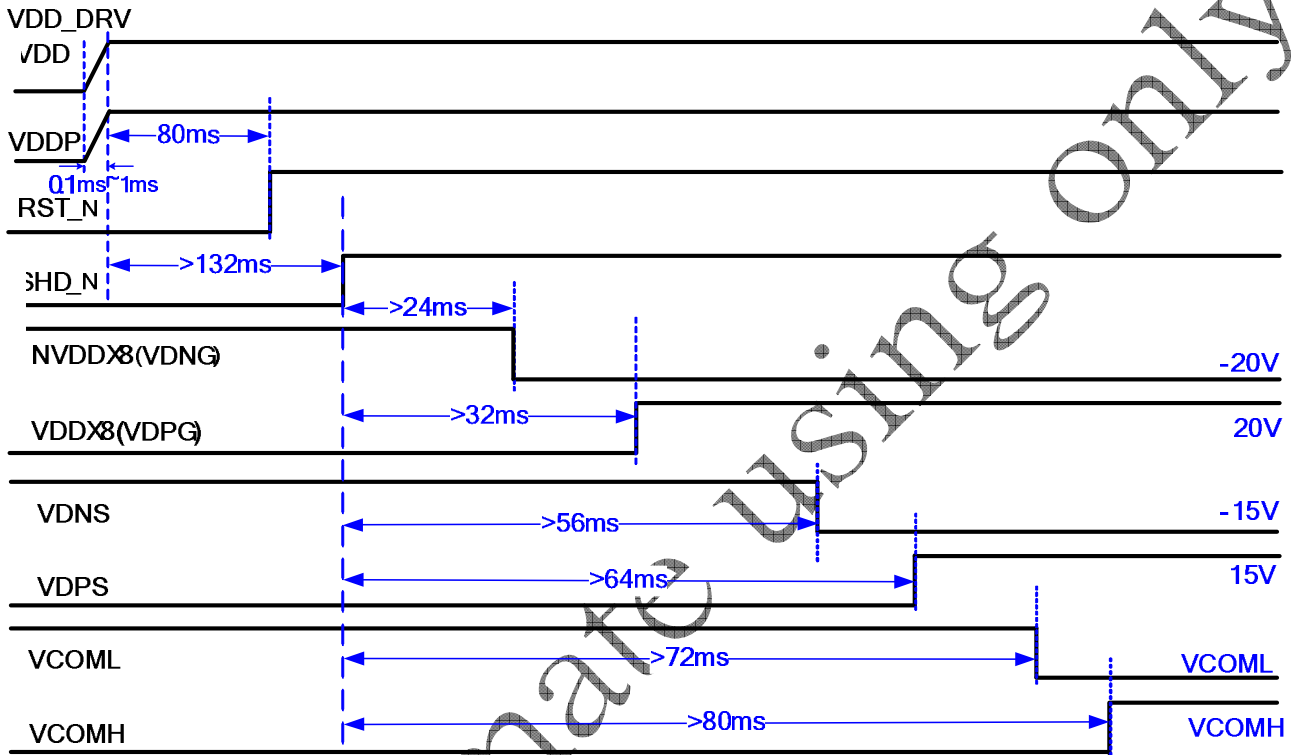


F. Power On/Off Characteristics

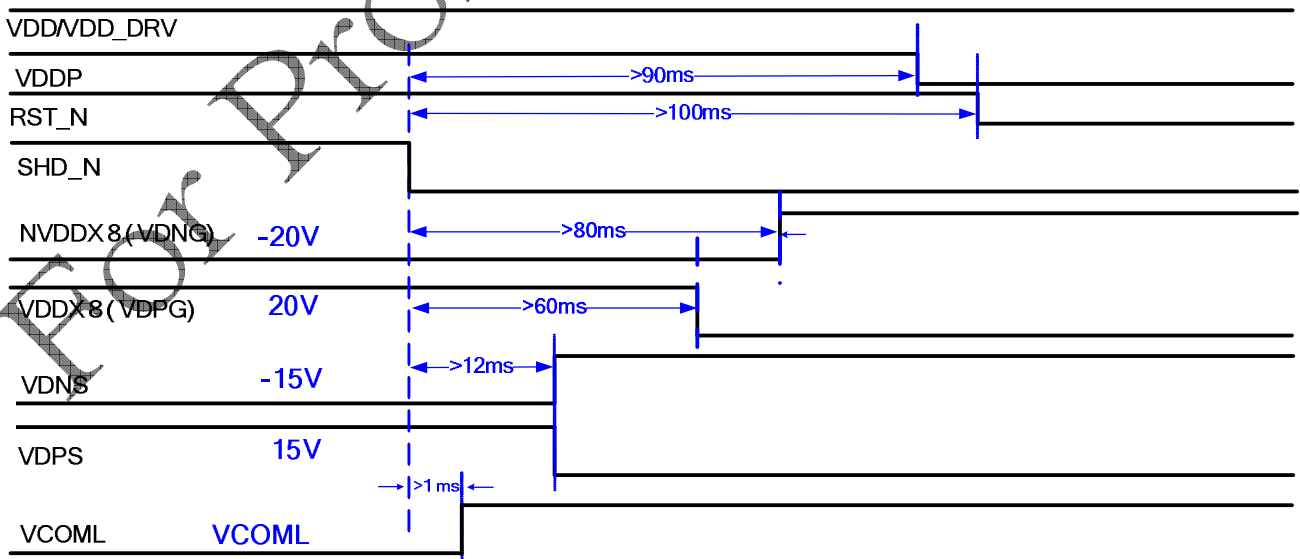
1. Recommended Power On/Off Sequence

The suggested power on/off sequence is below:

1.1 Power On Sequence:



1.2 Power Off Sequence:



G. Optical Specification

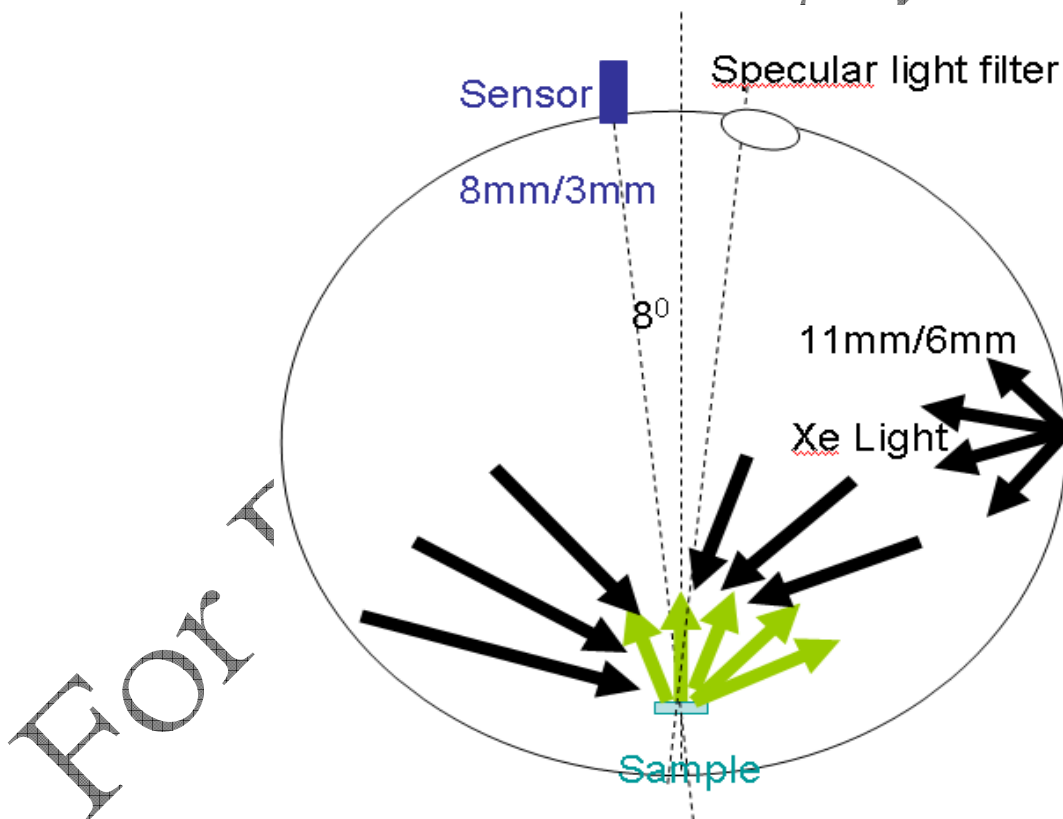
All optical specification is measured under typical condition (Note 1, 2)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Reflectance	R	white	28	30	--	%	Note1,2,3,4
Contrast Ratio	CR	At optimized viewing angle	5	6	--		Note1,2,3,5
Update Time	T	T=25°C T=10°C T=0°C	--	950 2310 2750	1010 2450 3150	ms	Note 3

Note 1. Ambient temperature =25°C

Note 2. Reflectance and contrast ratio are measured by KONICA MINOLTA spectrophotometer CM-2600d.

Note 3: The measurement shall be conducted under AUO specified driving condition, including LUT and TCON codes.



Note 4. Definition of Reflectance:

The Reflectance is expressed as:

$$R = \text{Reflectance Factor}_{\text{white board}} \times (L_{\text{center}} / L_{\text{white board}})$$

L_{center} is the luminance measured at center in a white area. $L_{\text{white board}}$ is the luminance of a standard white board.

Note 5. Definition of contrast ratio:

The contrast ratio (CR) is the ratio between the reflectance in a full white area (Rl) and reflectance in a dark area (Rd).

$$\text{Contrast ratio (CR)} = \frac{Rl}{Rd}$$

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H. Reliability Test Items

	Test	Condition	Condition	Remark
1	High-Temperature Operation	Tamb=+40°C, RH=30% for 240hrs	IEC 60068-2-2Bp	Update pattern four times per minute.
2	Low-Temperature Operation	Tamb=0°C for 240hrs	IEC 60068-2-2Ab	Update pattern four times per minute.
3	High-Temperature Storage	Tamb=+70°C, RH=23% for 240hrs	IEC 60068-2-2Bp	
4	Low-Temperature Storage	Tamb=-25°C for 240hrs	IEC 60068-2-2Ab	
5	High-Temperature, High-Humidity Operation	Tamb=+40°C, RH=90% for 168hrs	IEC 60068-2-3CA	Update pattern four times per minute.
6	High-Temperature, High-Humidity Storage	Tamb=+60°C, RH=80% for 240hrs	IEC 60068-2-3CA	
7	Temperature Cycle	1 Cycle : [-25° C 30min] → [+70° C 30min] : 100 cycles	IEC 60068-2-14	
8	UV Exposure Resistance	Condition: 1120W/m2, 40°C Test Duration: 3 cycles (Definition of 1 cycle: 8 hr at exposure state and 16 Hr at non-exposure state)	IEC 60068-2-5Sa	
9	Package Vibration	1.04G, Frequency : 10 ~ 500HZ Direction : X, Y, Z Duration : 1 hours in each direction		
10	Package Drop Impact	Drop from height of 100 cm on concrete surface. Drop sequence : 1 corner, 3 edges, 6 faces one drop for each.		
11	Electrostatic discharge	Air-mode : +/- 6kV Contact-mode : +/- 2kV	IEC 61000-4-2	
12	FPC Bonding Strength	Pull the FPC Stiffener part with a force of 500gf in the horizontal and vertical directions		

13	FPC bending Performance	Apply MIT method. Bending rate radius : 1.0mm Weight 500gf, Bending angle : ± 135° Bending cycle : 20 times		
14	Stylus Tapping	POLYACETAL Pen : Top R0.8mm Load : 300gf Speed : 3 times/sec Total 13,500 times		Pass criteria - no glass breakage or damage to micro-cups.

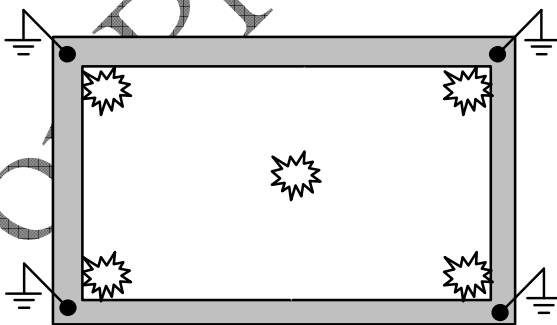
Note 1. In the above conditions, there is no display function NG issue occurred. All the cosmetic specification is judged before the reliability stress.

Note 2. The test modules will be kept at 25°C environment for 4 hours after finish the environmental test and make measurement after AUO specified TCON code and waveform re-driving. The judgement of above tests should satisfy minimum contrast ratio and minimum reflectance.

Note 3. For Item 8, in addition to satisfy minimum contrast ratio and minimum reflectance, the display shall be able to identify 8 gray levels, including Black and White when being driven under AUO specified driving condition at the end of test.

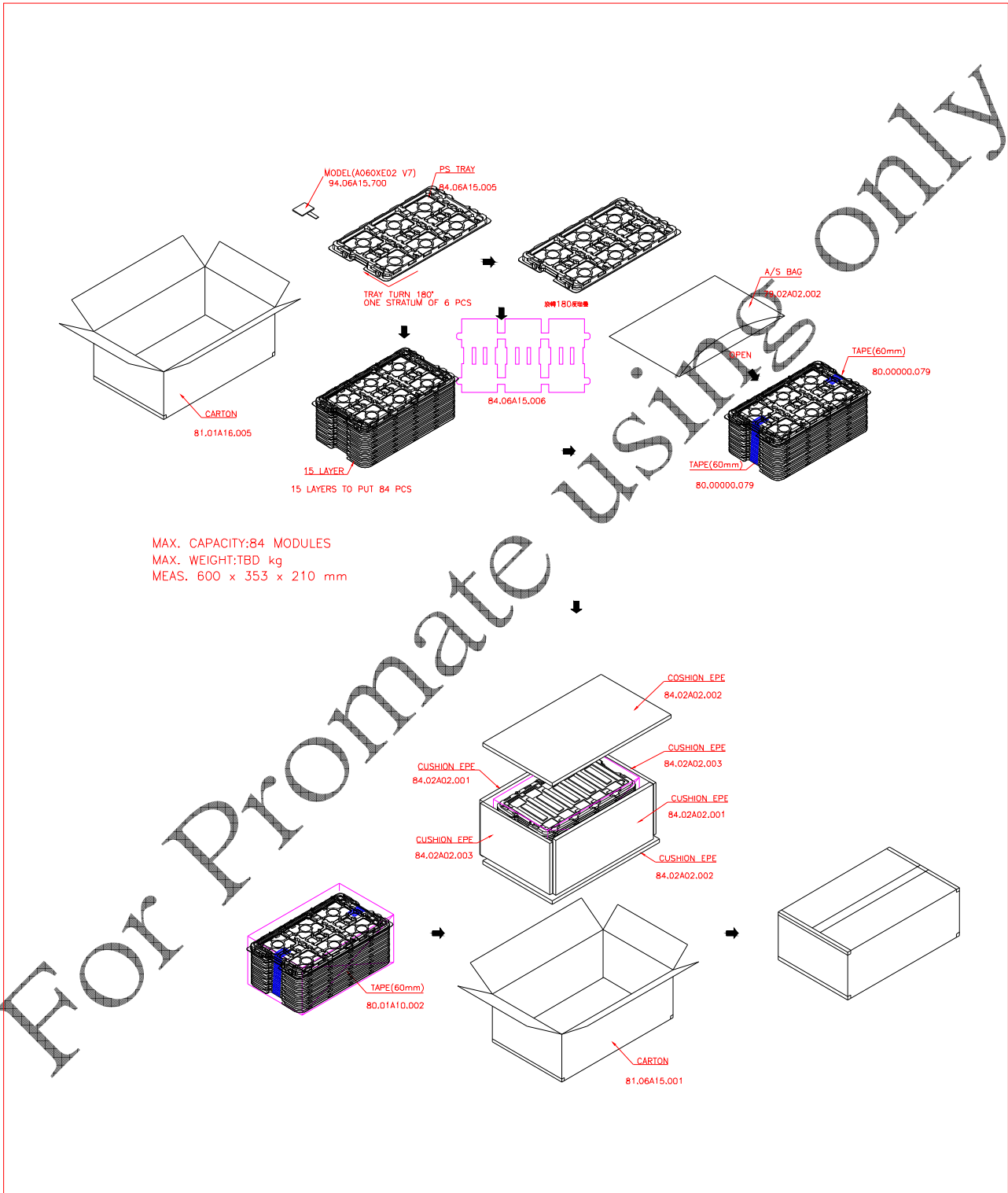
Note 4. ESD testing method.

1. Ambient: 24~26°C, 56~65%RH, atmospheric pressure : 940~960hPa
2. Instruments: Noiseken ESS-2000,
3. Operation System: AUO pattern generator
4. Test Mode: Non-operating mode, test pattern: chess
5. Test Method:
 - a. Contact Discharge: 150pF(330Ω) 1sec, 5 points, 10 times/point
 - b. Air Discharge: 150pF(330Ω) 1sec, 5 points, 10 times/point
6. Test point:



I. Packing and Marking

1. Packing Form



2. Module/Panel Label Information

The module/panel (collectively called as the "Product") will be attached with a label of Shipping Number which represents the identification of the Product at a specific location. Refer to the Product outline drawing for detailed location and size of the label. The label is composed of a 22-digit serial number and printed with code 39/128 with the following definition:

ABCDEFGHIJKLMNQRSTUV

- For internal system usage and production serial numbers.
- AUO Module or Panel factory code, represents the final production factory to complete the Product
- Product version code, ranging from 0~9 or A~Z (for Version after 9)
- Week Code, the production week when the product is finished at its production process

3. Carton Label Information

The packing carton will be attached with a carton label where packing Q'ty, AUO Model Name, AUO Part Number, Customer Part Number (Optional) and a series of Carton Number in 13 or 14 digits are printed. The Carton Number is appearing in the following format:

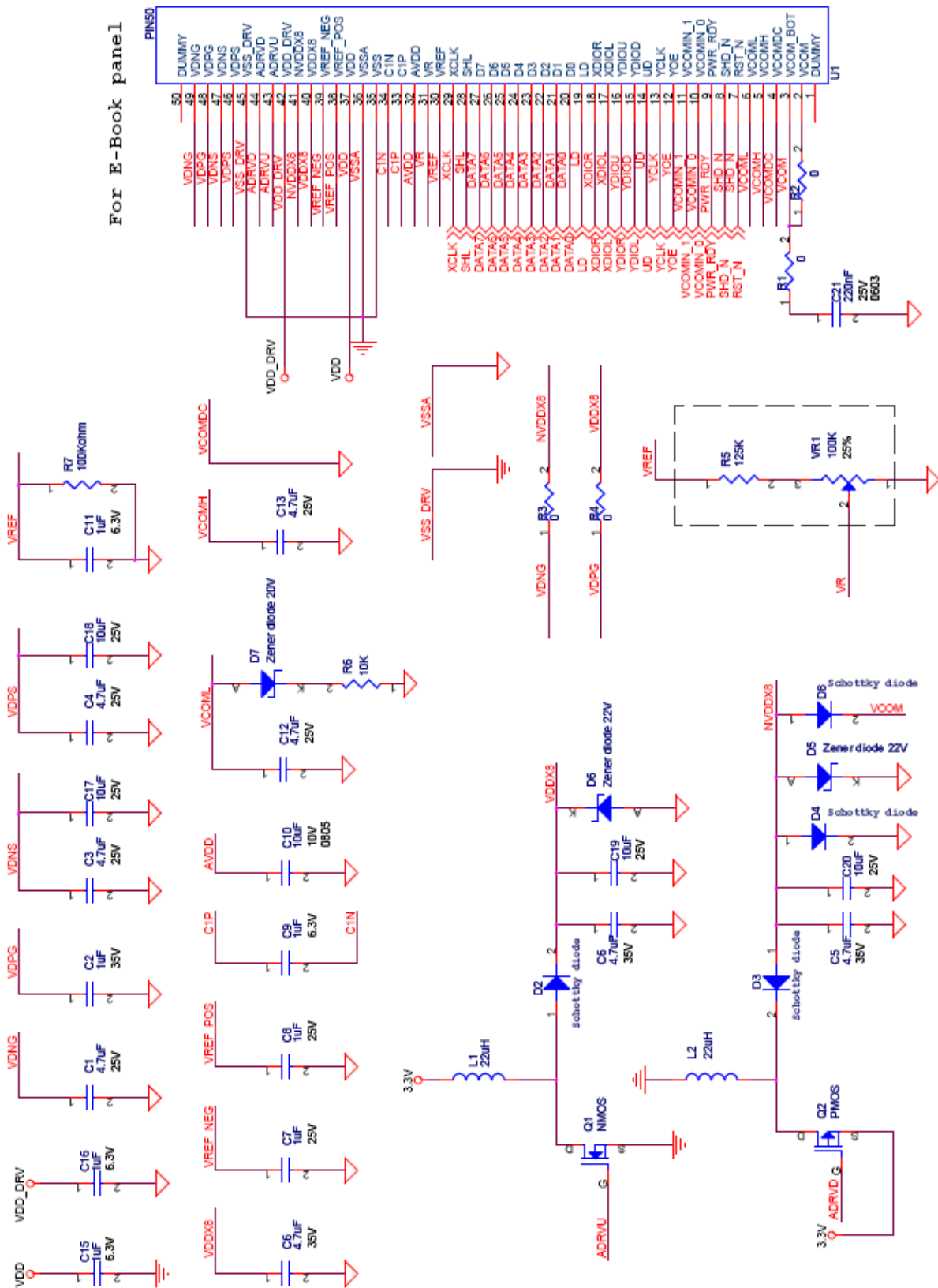
ABC-DEFG-HIJK-LMN

- DEFG appear after first "-" represents the packing date of the carton
- Date from 01 to 31
- Month, ranging from 1~9, A~C. A for Oct, B for Nov and C for Dec.
- A.D. year, ranging from 1~9 and 0. The single digit code represents the last number of the year

Refer to the drawing of packing format for the location and size of the carton label.

J. Application Note

1. Application Circuit



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K. Precautions

1. Do not twist or bend the module and prevent the unsuitable external force for display module during assembly.
2. Adopt measures for good heat radiation. Be sure to use the module within the specified temperature.
3. Avoid dust or oil mist during assembly.
4. Follow the correct power sequence while operating. Do not apply the invalid signal, otherwise, it will cause improper shut down and damage the module.
5. Less EMI: it will be more safety and less noise.
6. Please operate module in suitable temperature. The response time & brightness will drift by different temperature.
7. Be sure to turn off the power when connecting or disconnecting the circuit.
8. Display surface never likes dirt or stains.
9. A dewdrop may lead to destruction. Please wipe off any moisture before using module.
10. High temperature and humidity may degrade performance. Please do not expose the module to the direct sunlight and so on.
11. Acetic acid or chlorine compounds are not friends with display module.
12. Static electricity will damage the module, please do not touch the module without any grounded device.
13. Do not disassemble and reassemble the module by self.
14. Be careful do not touch the rear side directly.
15. No strong vibration or shock. It will cause module broken.
16. Storage the modules in suitable environment with regular packing.
17. Be careful of injury from a broken display module.
18. Please avoid the pressure adding to the surface (front or rear side) of modules, because it will cause the display non-uniformity or other function issue.
19. Application under direct sunlight is strongly not recommended as it would result in display performance degradation.
20. It is highly recommended that the display is exposed to an even lighting condition to ensure a good display uniformity.
21. Elimination of light exposure to the display by applying proper means, e.g. lighting shielding cover is suggested when the display is not being used to extend the life performance of the device.
22. Heat isolation or heat sink to control uniformity of panel temperature should be smaller than 3°C
23. Any performance degradation or display distortion which can be eliminated by display refreshing should not be regarded as a defect.