Kodak Display AM550L
Active Matrix OLED
Panel Data Sheet

Preliminary
rvs110402 rev1.11-2

Overview:

The Kodak Display AM550L is a 5.48-cm (2.16-inch) diagonal, full-color active matrix organic light emitting diode (OLED) display. Optimal applications include digital video cameras and digital cameras, portable entertainment (games, DVD/video players, TV,) and other products in the consumer electronics, industrial, medical, and automotive industries.

Features and Benefits:

High brightness and contrast, full color, crisp motion, and extremely wide viewing angle deliver sharper brighter images.

Thin, lightweight screens; no backlight required.

Low power consumption, achieved by eliminating the power for backlight and by taking advantage of the normal (off) state of the pixels.

Simple, rugged, and easy to integrate.

- 113,578 (521x218) light emitting dots
- Delta color arrangement
- Up/down and right/left inverse function
- Narrow frame
- Anti-reflection (AR) coated polarizer
- High response time
- Full-color(16.7 million colors/ 24 bit) with Kodak's Controller device (KDP01100)

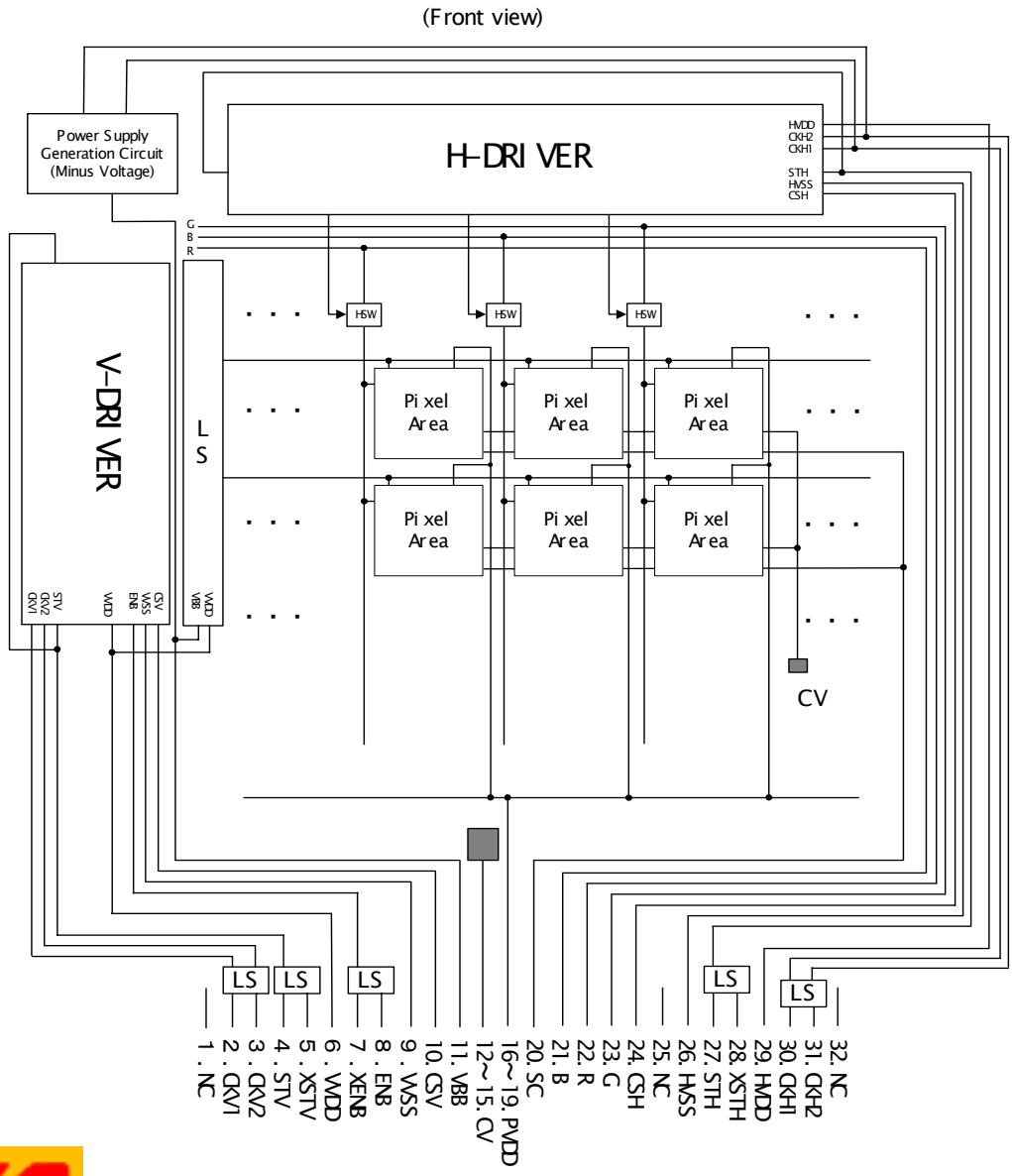
1.Mechanical Specifications

Parameter	Specification	Unit
Number of light emitting dots (H) x (V)=(Total)	521 x 218 = 113,578	dot
Effective viewing area (W) x (H)	43.81 x 32.92	mm
Display size (diagonal)	5.48 (2.16-inch type)	cm
Dot pitch (H) x (V)	0.084 x 0.151	mm
Color arrangement	RGB delta	-
Dimensions (W) x (H) x (D) *1	52.0 x 45.4 x 1.72	mm
Weight	8.0	g
FPC projection length	33.0	mm

*1 The protrusions (FPC) are not included.

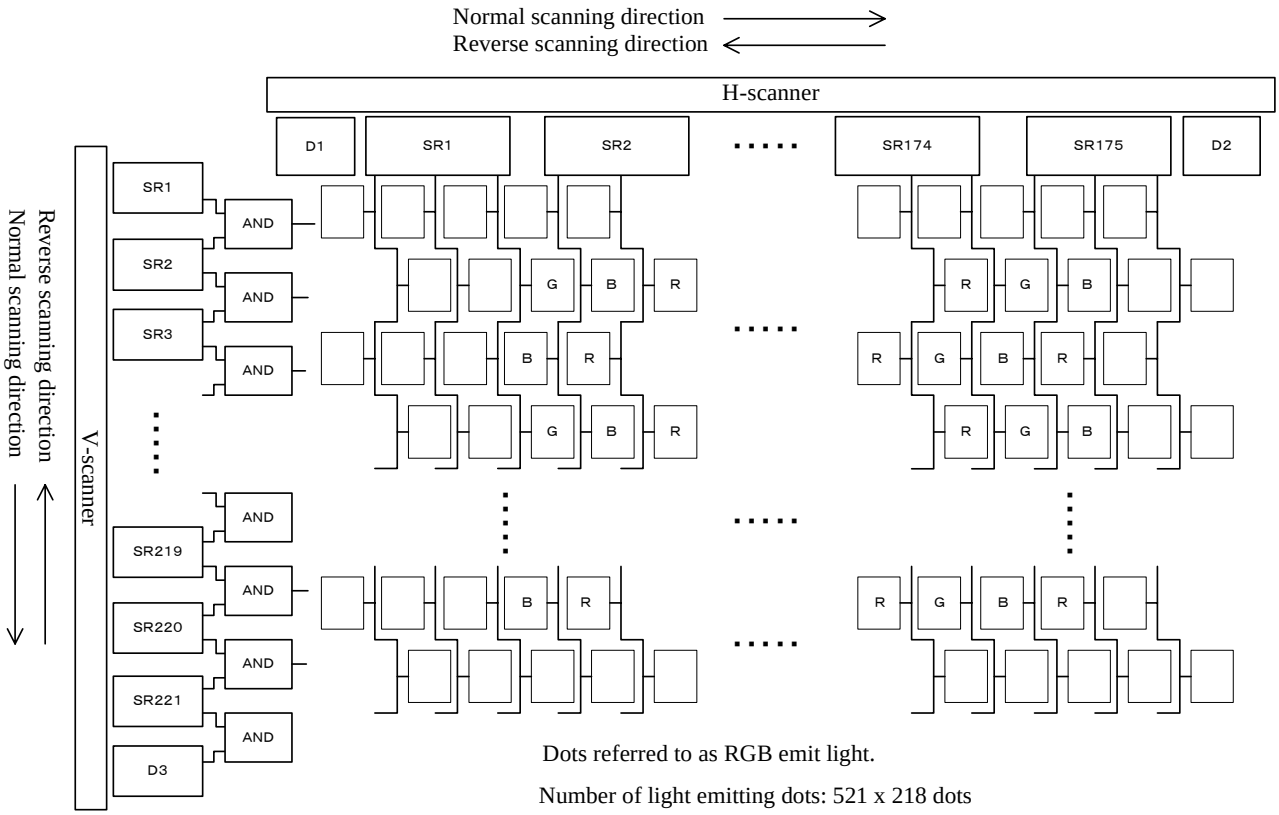
2.Block Diagram

Block diagram of the OLED display is shown below.



3. Dot Arrangement

(Front view)



Dots referred to as RGB emit light.

Number of light emitting dots: 521 x 218 dots

Total number of dots: 525 x 220 dots

D1, D2, and D3 are dummy shift resisters.

7.Absolute Maximum Ratings (HVSS, VVSS=0V, Ta=25ºC)

Parameter	Symbol	Rating	Unit	Remarks
H driver power supply voltage	HVDD	-1.0 ~ +10.0	V	
V driver power supply voltage	VVDD	-1.0 ~ +10.0	V	
V driver power supply voltage (negative)	VBB	-6.0 ~ -1.0	V	
Input voltage for storage capacitance	SC	HVDD+0.5	V	
Power supply voltage for OLED 1	PVDD	0 ~+10.0	V	*2
Power supply voltage for OLED 2	CV	-10.0 ~ 0	V	*2
H driver input voltage	STH,XSTH,CKH1, CKH2,CSH	-1.0 ~ +10.0	V	
V driver input voltage	STV,XSTV,CKV1, CKV2,ENB, XENB, CSV	-1.0 ~ +10.0	V	
Video signal input voltage	R,G,B	-1.0 ~ +8.0	V	
Operating temperature (on the panel surface)	Topr	-10 ~ +75	C	*3
Storage temperature	Tstg	-30 ~ +75	C	*3

*2 However, potential difference (PVDD-CV) shall be within 16V.

*3 Maximum wet bulb temperature is 39ºC or below; no condensing.

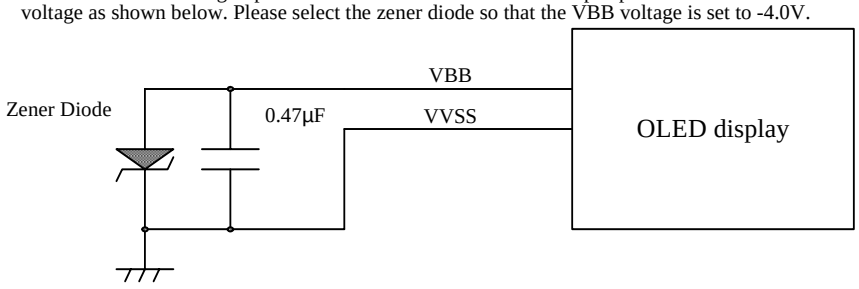
4.Operating Conditions

(1) Power Supply and Input Signal Voltage (VVSS=HVSS=0V,SC=PVDD,Ta=25C)

Parameter		Symbol	MIN	TYP	MAX	Unit
Power supply voltage		HVDD	8.2	8.5	8.8	V
		VVDD	8.2	8.5	8.8	
VBB output voltage		VBB	-	-4.0	-	V
H driver input voltage	Low	VHIL	-0.3	0	0.3	V
	High	VHIH	2.5	3.0	4.0	
V driver input voltage	Low	VVIL	-0.3	0	0.3	V
	High	VVIH	2.5	3.0	4.0	
CSH	Low	VCSHL	HVSS			V
	High	VCSHH			HVDD	
CSV	Low	VCSVL	VVSS			V
	High	VCSVH			VVDD	
Video signal input voltage		Vsig max	PVDD -2.8	-	PVDD -0.7	V
		Vsig p-p	1.0	-	3.4	
Power supply voltage for OLED 1		PVDD	6.7	7.0	7.3	V
Power supply voltage for OLED 2		CV	-7.3	-7.0	-6.7	V

Power Supply Voltage Generation Circuit (Negative Voltage)

Connect the smoothing capacitor and zener diode to VBB output pin for stabilization of voltage as shown below. Please select the zener diode so that the VBB voltage is set to -4.0V.



5. Pin Function

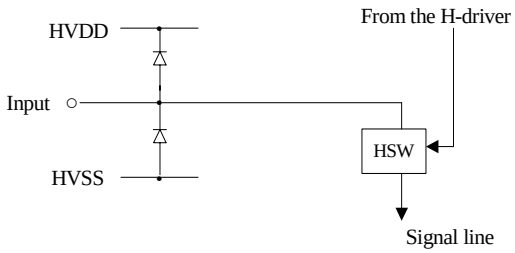
No.	Name	Description
1	N.C.	(Leave this pin open)
2	CKV1	V clock 1
3	CKV2	V clock 2
4	STV	V SR start signal
5	XSTV	Inverted signal of STV
6	VVDD	VDD for V drive
7	XENB	Inverted signal of ENB
8	ENB	Enable signal
9	VVSS	VSS for V drive
10	CSV	Up/down inverse control signal
11	VBB	VBB output pin
12	CV	Power supply voltage for OLED 2 (cathode)
13	CV	Power supply voltage for OLED 2 (cathode)
14	CV	Power supply voltage for OLED 2 (cathode)
15	CV	Power supply voltage for OLED 2 (cathode)
16	PVDD	Power supply voltage for OLED 1 (anode)
17	PVDD	Power supply voltage for OLED 1 (anode)
18	PVDD	Power supply voltage for OLED 1 (anode)
19	PVDD	Power supply voltage for OLED 1 (anode)
20	SC	Input voltage for storage capacitance (connected with PVDD)
21	B	Video signal (B)
22	R	Video signal (R)
23	G	Video signal (G)
24	CSH	Right/left inverse control signal
25	N.C.	(Leave this pin open)
26	HVSS	VSS for H drive
27	STH	H SR start signal
28	XSTH	Inverted signal of STH
29	HVDD	VDD for H drive
30	CKH1	H clock 1
31	CKH2	H clock 2
32	N.C.	(Leave this pin open)

6. Equivalent Circuit

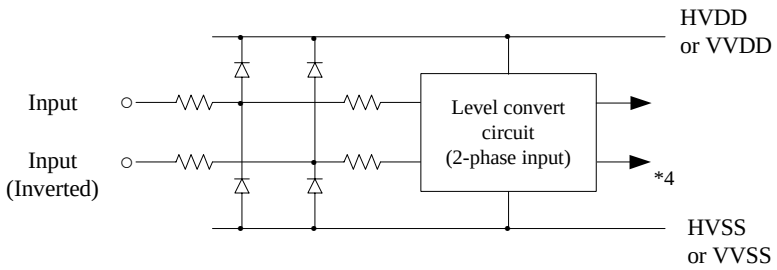
Every terminal, except for those in the power supply circuit, is provided with a protective diode against electrostatic charge.

The following is the equivalent circuit for each input terminal.

(1) R, G, B

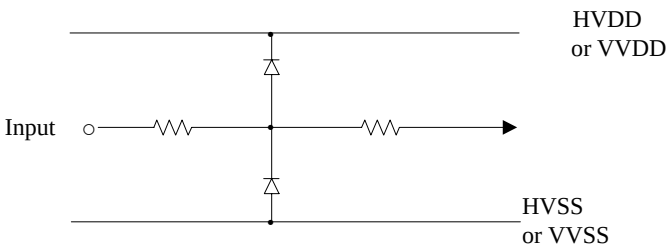


(2) STV, XSTV, CKV1, CKV2, ENB, XENB (VVDD-VVSS) and STH, XSTH, CKH1, CKH2 (HVDD-HVSS)



*4 STH, STV and ENB have one output port each.

(3)SC, CSH (HVDD-HVSS), CSV(VVDD-VVSS)



(4) HVDD, VVDD, HVSS, VVSS, VBB, PVDD, CV

7. Timing

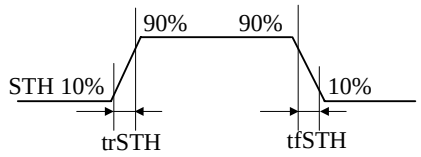
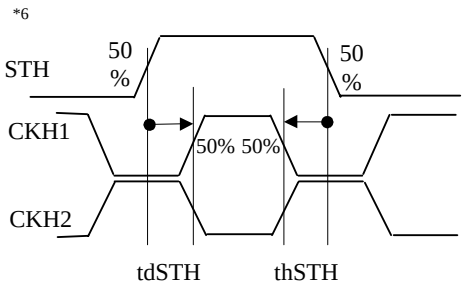
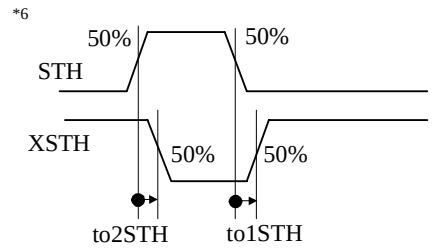
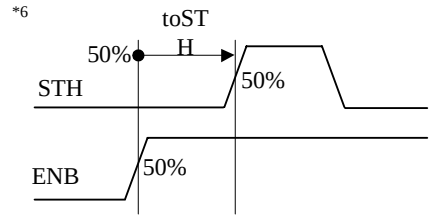
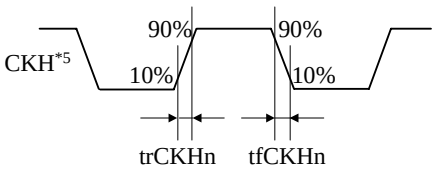
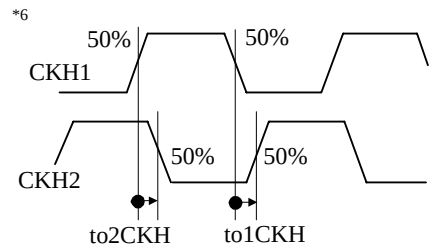
Clock Timing Conditions (Ta=25ºC, HVDD=VVDD=8.5V)

Parameter		Symbol	MIN	TYP	MAX	Unit
STH	STH rise time	trSTH	-	-	30	ns
	STH fall time	tfSTH	-	-	30	ns
	STH data setup time	tdSTH	70	181	201	ns
	STH data hold time	thSTH	70	90	201	ns
	STH fall→XSTH rise time	to1STH	-15	0	15	ns
	STH rise→XSTH fall time	to2STH	-15	0	15	ns
	ENB rise→STH fall time	toSTH	900	1100	1300	ns
CKHn	CKHn*5 rise time	trCKHn	-	-	100	ns
	CKHn*5 fall time	tfCKHn	-	-	100	ns
	CKH1 fall→CKH2 rise time	to1CKH	-15	0	10	ns
	CKH1 rise→CKH2 fall time	to2CKH	-15	0	10	ns
STV	STV rise time	trSTV	-	-	60	ns
	STV fall time	tfSTV	-	-	60	ns
	STV data setup time	tdSTV	4	6	10	us
	STV data hold time	thSTV	53	57	59	us
	STV fall→XSTV rise time	to1STV	-20	0	20	ns
	STV rise→XSTV fall time	to2STV	-20	0	20	ns
CKVn	CKVn*5 rise time	trCKVn	-	-	60	ns
	CKVn*5 fall time	tfCKVn	-	-	60	ns
	CKV1 fall→CKV2 rise time	to1CKV	-20	0	20	ns
	CKV1rise→CKV2 fall time	to2CKV	-20	0	20	ns
ENB	ENB rise time	trENB	-	-	60	ns
	ENB fall time	tfENB	-	-	60	ns
	CKV rise/fall→ENB rise time	tdENB	400	2200	5000	ns
	ENB pulse width	twENB	7000	7300	7600	ns
	ENB rise→XENB fall time	to1ENB	-20	0	20	ns
	ENB fall→XENB rise time	to2ENB	-20	0	20	ns

*5 CKHn, CKVN indicate CKH1, CKH2, and CKV1, CKV2 respectively.
(fCKHn=1.84MHz; fCKVn=7.87kHz)

8. Drive Waveforms

(1)H driver

Parameter		Symbol	Waveform	Condition
STH	STH rise time	trSTH		○ CKHn*5 Duty 50% to1CKH=0ns to2CKH=0ns
	STH fall time	tfSTH		
	STH data setup time	tdSTH		
	STH data hold time	thSTH		
	STH fall → XSTH rise time	to1STH		○ CKHn*5 Duty 50% to1CKH=0ns to2CKH=0ns tdSTH=181ns thSTH=90ns
	STH rise → XSTH fall time	to2STH		
	ENB rise → STH fall time	toSTH		
CKH	CKHn*5 rise time	trCKHn		○ CKHn*5 Duty 50% to1CKH=0ns to2CKH=0ns tdSTH=181ns thSTH=90 ns
	CKHn*5 fall time	tfCKHn		
	CKH1 fall → CKH2 rise time	to1CKH		○ tdSTH=181ns thSTH=90 ns
	CKH1 rise → CKH2 fall time	to2CKH		

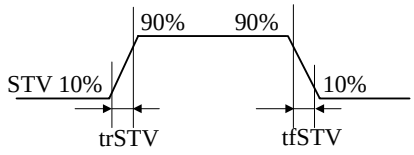
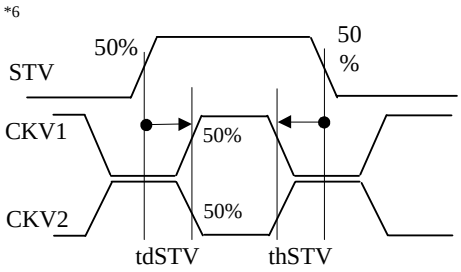
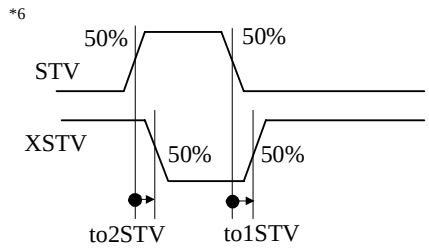
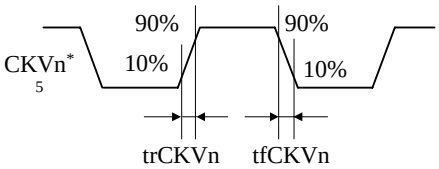
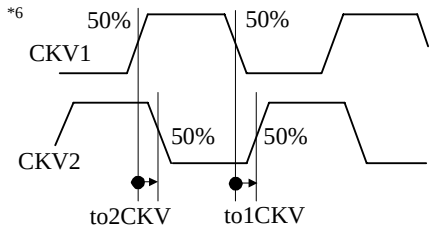
*6 Time Measurement Definition

In wave form: Rightarrow defined as "+"

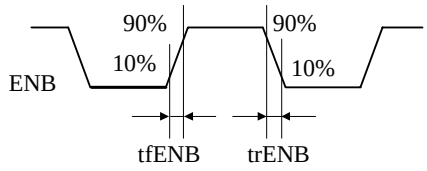
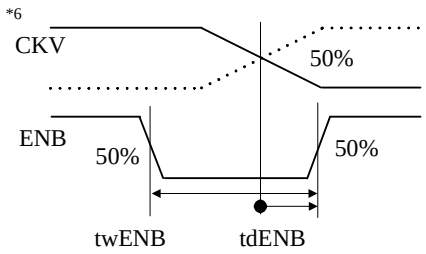
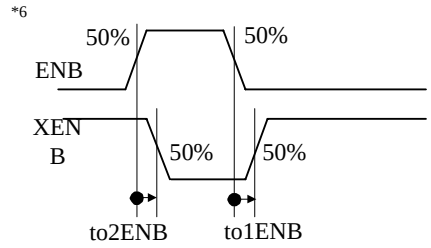
Leftarrow defined as "-"

The black round mark shows the benchmark.

(2)**V driver**

Parameter		Symbol	Waveform	Condition
STV	STV rise time	trSTV		○ CKVn*5 Duty 50% to1CKV=0ns to2CKV=0ns
	STV fall time	tfSTV		
	STV data setup time	tdSTV		
	STV data hold time	thSTV		
	STV fall →XSTV rise time	to1STV		○ CKHn*5 Duty 50% to1CKV=0ns to2CKV=0ns tdSTV=6us thSTV=57us
	STV rise →XSTV fall time	to2STV		
CKV	CKVn*5 rise time	trCKVn		○ CKHn*5 Duty 50% to1CKV=0ns to2CKV=0ns tdSTV=6us thSTV=57us
	CKVn*5 fall time	tfCKVn		
	CKV1 fall →CKV2 rise time	to1CKV		○ tdSTV=6us thSTV=57us
	CKV1 rise →CKV2 fall time	to2CKV		

(2)**V driver** (continued from the previous page)

ENB	ENB rise time	trENB		○ CKHn*5 Duty 50% to1CKV=0ns to2CKV=0ns
	ENB fall time	tfENB		
	CKV rise/fall →ENB rise time	tdENB	*6 	○ CKHn*5 Duty 50% to1CKV=0ns to2CKV=0ns
	ENB pulse width	twENB		
	ENB rise →XENB fall time	to1ENB	*6 	○ CKHn*5 Duty 50% to1CKV=0ns to2CKV=0ns tdSTV=6us thSTV=57us
	ENB fall →XENB rise time	to2ENB		

9. Electrical Characteristics

9.1 H driver

Parameter	Symbol	MIN	TYP	MAX	Unit	Condition
CKHn input terminal capacity	CCKHn	-	T.B.D.	T.B.D.	pF	
STH input terminal capacity	CSTH	-	T.B.D.	T.B.D.	pF	
Video signal input terminal capacity	CR,CG,CB	-	T.B.D.	T.B.D.	pF	
Input terminal current CKH1	ICKH1	-150	-50	-	uA	CKH1=GND,CKH2=High
Input terminal current CKH2	ICHK2	-150	-50	-	uA	CKH2=GND,CKH1=High
Input terminal current STH	ISTH	-150	-50	-	uA	STH=GND,XSTH=High
Input terminal current XSTH	IXSTH	-150	-50	-	uA	XSTH=GND,STH=High
Electric current consumption	IH	-	1.6	2.3	mA	

CKHn: CKH1, CKH2

9.2 V driver

Parameter	Symbol	MIN	TYP	MAX	Unit	Condition
CKVn input terminal capacity	CCKVn	-	T.B.D.	T.B.D.	pF	
STV input terminal capacity	CSTV	-	T.B.D.	T.B.D.	pF	
ENB input terminal capacity	CENB	-	T.B.D.	T.B.D.	pF	
Input terminal current CKV1	ICKV1	-280	-50	-	uA	CKV1=GND,CKV2=High
Input terminal current CKV2	ICHV2	-360	-50	-	uA	CKV2=GND,CKV1=High
Input terminal current STV	ISTV	-280	-50	-	uA	STV=GND,XSTV=High
Input terminal current XSTV	IXSTV	-360	-50	-	uA	XSTV=GND,STV=High
Input terminal current ENB	IENB	-280	-50	-	uA	ENB=GND,XENB=High
Input terminal current XENB	IXENB	-360	-50	-	uA	XENB=GND,ENB=High
Electric current consumption	IV	-	0.2	0.6	mA	

CKVn: CKV1, CKV2

9.3 Power Consumption by OLED Display

Parameter	Symbol	MIN	TYP	MAX	Unit
OLED display power consumption	PWR	-	-	2.2	W

Conditions: White color in whole area (120cd/m^2, 6000K), PVDD=+7V, CV=-7V, 60Hz driving,ambient lighting 1000[lx] at room temperature

10. Electro-Optical Specification

10.1 Electro-Optical Characteristics

Items measured		Symbol	Method	MIN	TYP	MAX	Unit
Contrast ratio (Ambient lighting 500 [lx])		CR	(1)	100	-	-	-
Response time	ON time	ton	(2)	-	5	-	us
	OFF time	toff		-	5	-	
Red chromaticity (display surface)		RCIEx	(3)	T.B.D.	T.B.D.	T.B.D.	-
		RCIEy		T.B.D.	T.B.D.	T.B.D.	
Green chromaticity (display surface)		GCIEx	(3)	T.B.D.	T.B.D.	T.B.D.	-
		GCIEy		T.B.D.	T.B.D.	T.B.D.	
Blue chromaticity (display surface)		BCIEx	(3)	T.B.D.	T.B.D.	T.B.D.	-
		BCIEy		T.B.D.	T.B.D.	T.B.D.	
Display surface maximum white luminance			(3)	120	-	-	cd/ m²
Evenness			(4)	T.B.D.	-	T.B.D.	%

10.2 Electro-Optical Characteristics Measuring Method

<Basic measuring condition>

a) Drive voltage

HVDD = VVDD = 8.5V, VVSS=HVSS=0V,VBB=-4V

PVDD=SC=7V, CV=-7V

b) Measuring temperature

25ºC unless otherwise specified

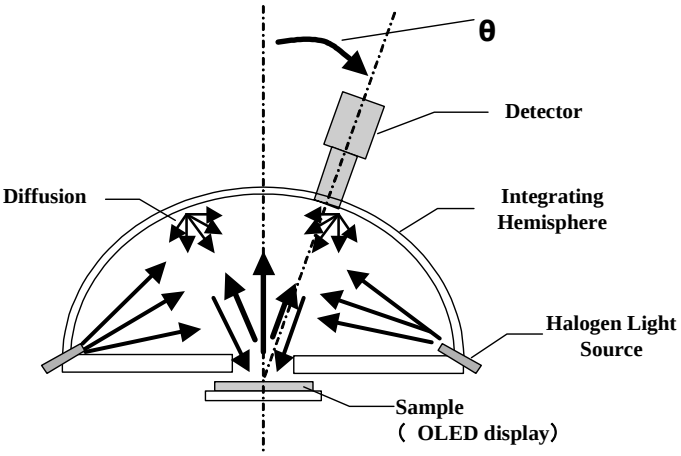
c) Measuring point

One point in the center of the screen unless otherwise specified; measuring points on the normal line (è line)

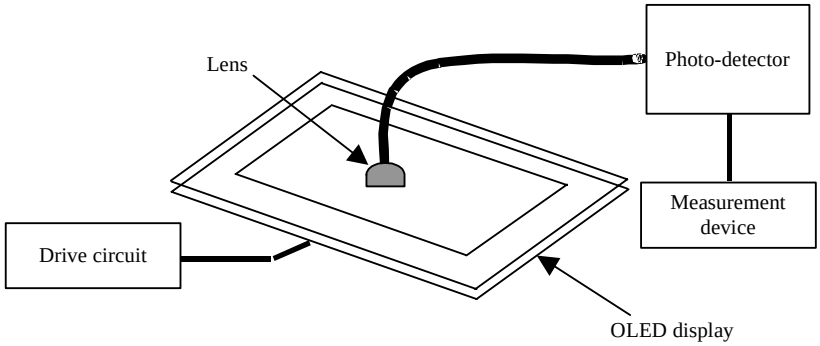
d) Measuring system

The following three systems are used as measuring systems.

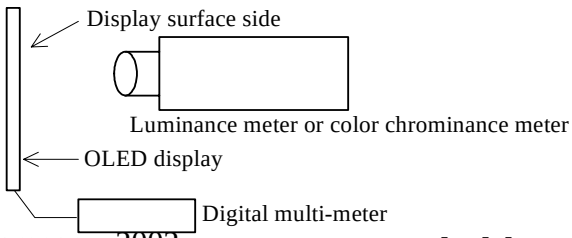
Measuring system I (Contrast measuring system)



Measuring system II (Response time measuring system)



Measuring system III (Luminance uniformity)



(1) Contrast ratio

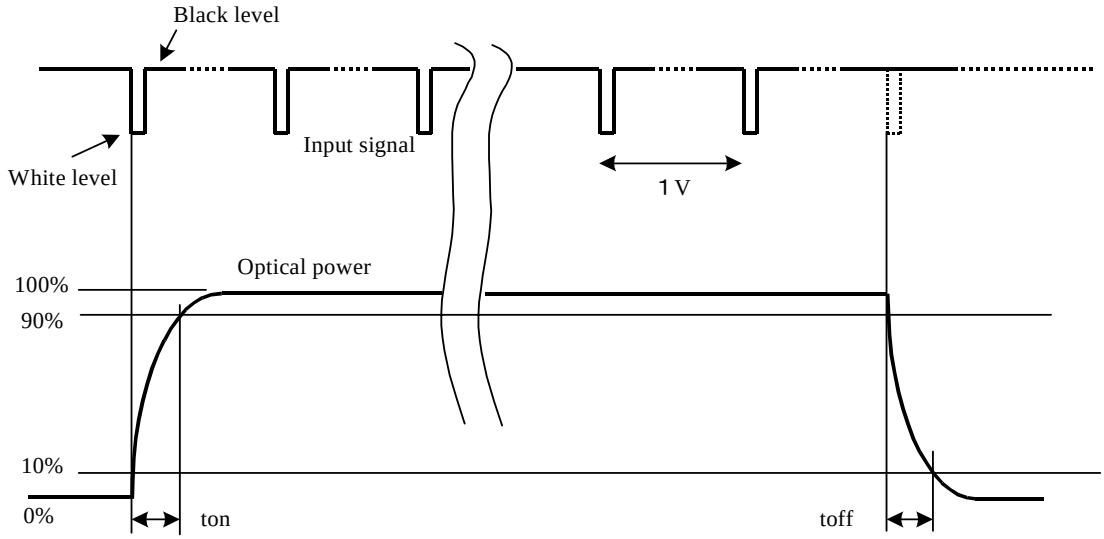
In the Measuring System I (f Æ = 0, halogen light source = 1000 [lx]), measure the display surface luminance Lw (white) under the condition of the display luminance being 120[cd/m^2], 6500K and the display surface luminance Lb (black) under the condition of the luminance being 0[cd/m^2]. Define the maximum value of the display surface ratio calculated by the following formula as contrast ratio CR.

$$CR = \frac{Lw(White)}{Lb(Black)}$$

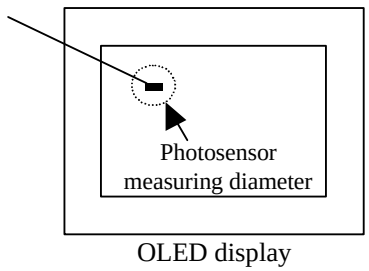
(2) Response speed

In the Measuring System II, response speed is measured by the following method:

Item	Conditions
Ambient lighting	10[lx] or below in the darkroom
Ambient temperature	25±3℃
Measuring instrument	Photosensor: Made by Hamamatsu Photonics Photodiode S3071 Photoamp: Made by Hamamatsu Photonics C8366
Measuring diameter	ϕ 5 ㎜
Measuring position	At 9 points selected voluntary within the effective display area
Measuring signal	As shown below



White signal display
Display white signals for 3 dots written all at once



(3) Display surface luminance, chromaticity

In the Measuring System III, luminance and chromaticity are measured under the following conditions:

Parameter	Condition
Ambient lighting	10[lx] and below in the darkroom
Ambient temperature	25± 3℃
Measuring instrument	Color luminance meter (CA-210: Minolta)
Measuring diameter	ϕ 27 mm
Measuring position	Center point of the display screen
Video signal input	Vsig = 0.6V (T. B. D.) and above
Color temperature	6500K

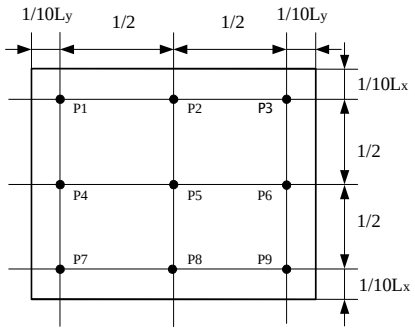
(4) Measuring Conditions of Luminance uniformity

In the Measuring System III, luminance uniformity is measured by the following conditions:

Parameter	Parameter
Ambient lighting	10[lx] and below in the darkroom
Ambient temperature	25±3℃
Measuring instrument	T.B.D.
Measuring diameter	ϕ 5mm
Measuring point	At 9 points within the display area (see the figure below)
Calculation method of luminance uniformity	Measure luminance at 9 points and calculate the value by the formula stated below
Screen display	White color in the whole area (120cd/m^2, 6500K)
Measuring time	Within 3 minutes fromturning on the power

Calculation method of luminance uniformity:

MAX (| (MAX(P1`P4, P6`P9)-P5)/P5 | , | P5-MIN(P1`P4, P6`P9)) / P5 |) X 100



11. Operation

11.1 Description of the OLED display operation

-V driver, consisting of V shift resister, enable gate and buffer, outputs a selective pulse one by one sequentially to each of the 218 row electrodes in every horizontal period.

-The selective pulse is output when enable terminal is at the high-level.

-H driver, consisting of H shift resister, gate circuit and CMOS sample holder, outputs a selective pulse one by one sequentially to each of the 521 signal electrodes in every horizontal period. The video signals sampled by the pulse are sent to the row signal lines.

-The scanning direction of the H driver can be changed by the CSH terminal. When the CSH terminal is at the high level, the panel is scanned from left to right (normal scan) as seen from the front; at the low level, from right to left (reverse scan).
Also, the scanning direction of the V driver can be changed by the CSV terminal. When the CSV terminal is at the high level, the panel is scanned from top to bottom (normal scan) as seen from the front; at the low level, from bottom to top (reverse scan).

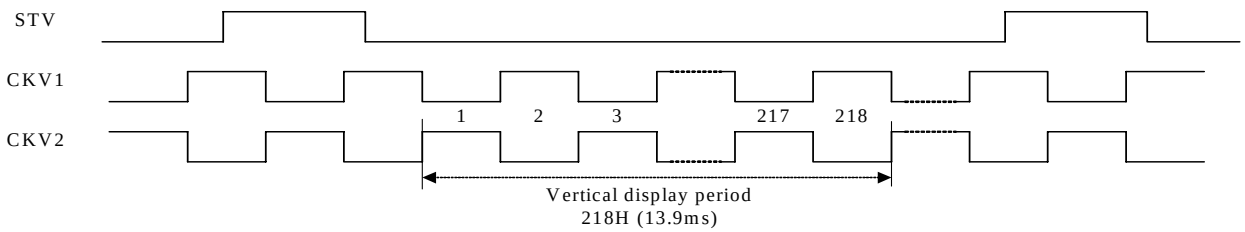
-The V and H drivers mentioned above and TFTs (Thin Film Transistor) provided for each dot write display signals sequentially into each dot of 521 x 218 dots in every vertical period.

-Dots are arranged to form RGB delta (delta arrangement) with shifting each sequence of R, G, and B dots by 1.5 dots per horizontal line. In order to input video signal to each dot correctly, H driver output pulse needs to be shifted by 1.5 dots against the horizontal sync signal per horizontal line.

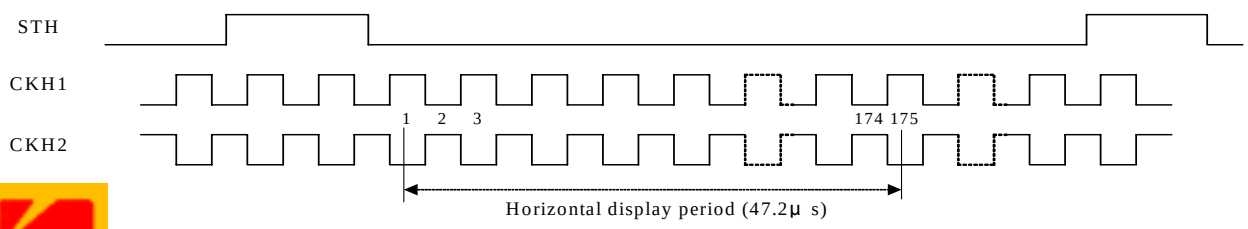
-When you input video signals, please input them as negative signals.

-Relationship between V driver start pulse (STV) and the vertical direction display period and the one between H driver start pulse (STH) and the horizontal direction display period are shown in the figures below.
In case of displaying the vertical direction by reverse scanning, the phases of CKV1 and CKV2 get reversed.

(1) Display period in the vertical direction(CSV at the High level)



(2) Display period in the horizontal direction(CSH at the High level)



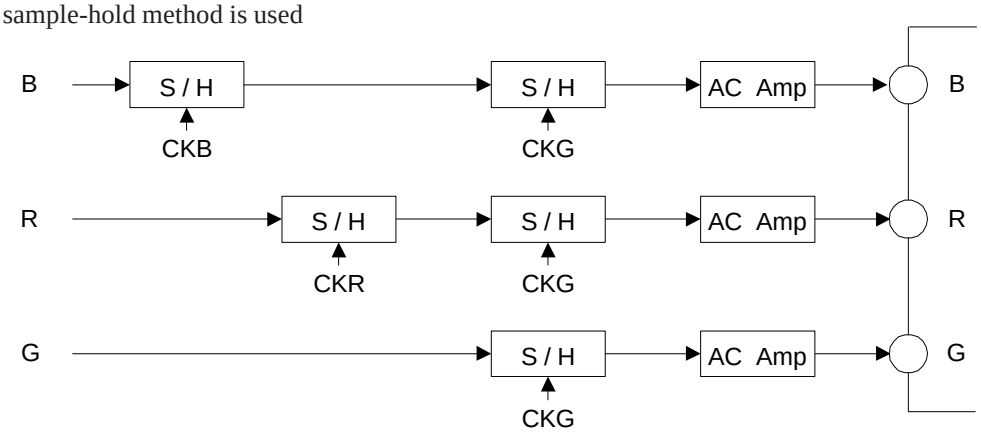
11.2 **RGB Simultaneous Sampling**

Video signals of R, G and B are simultaneously sampled by H driver. Consequently, prior to inputting the signals to the panel, it is necessary that the video signal are adequately delay processed and the phase for each signal agrees with each other to prevent the horizontal resolution from degrading.

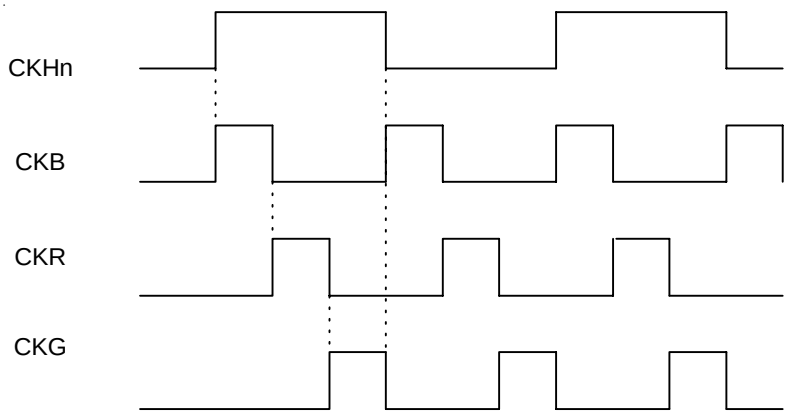
There are two methods in delay processing: one is the sample-hold method, and the other is the delay circuit method. The block diagrams of such methods are shown below.

This model is provided with the right/left inverting function. The following figures show the phase setting for normal scanning (CSH=high level). For the reverse scanning, replace the phase setting of B with G for usage.

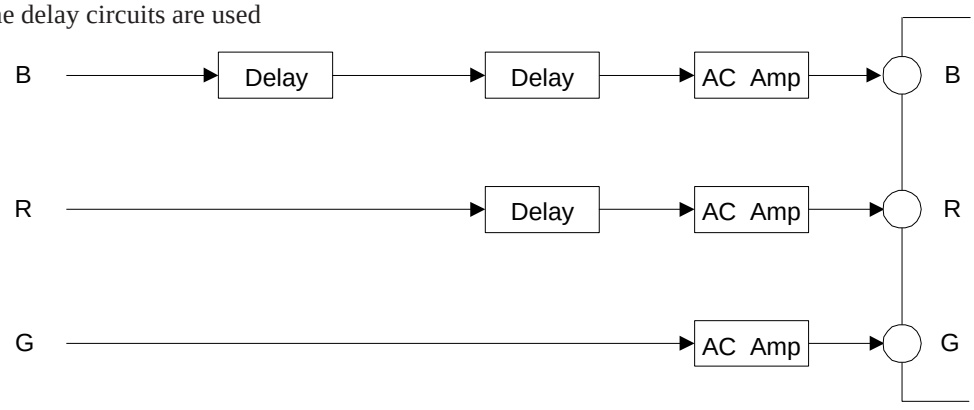
(1) When the sample-hold method is used



<Explanatory diagrams for delay sample-hold pulse phases>



(2) When the delay circuits are used

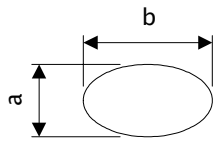


12. Appearance and Display Standard

Category		Items	Criteria
Appearance	Panel surface	Flaw	Shall not be appreciable when being lights on
		Foreign matters	Shall be 200μm or smaller in mean diameter *7
		Dent	
		Dirt	Shall not be appreciable when being lights on
	Outer frame	Flaw, burr, dirt, flexure	Shall not be readily appreciable
	FPC	Break, flaw	Shall not be readily appreciable
		Dirt	Dirt on the terminal part shall not be readily appreciable by the naked eyes

*7 Definition of Mean Diameter

Mean diameter = (a + b) / 2



*8 Definition of bright dots

- Visible through the 5% ND filter
- Count the number of bright dots when displaying black raster

*9 Definition of unlit dots

- Count the number of dots which do not emit light when displaying RGB raster.

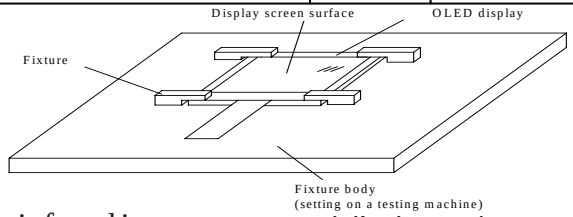
Inspection Method

Parameter	Appearance visual inspection	Display inspection (line/surface/dot)
Ambient lighting	500~1000[lx] under the white fluorescent light	100~300 [lx] under the white fluorescent light
Inspection distance	To be inspected 35 cm away from the display surface	To be inspected 35 cm away from the display surface, from the front (normal line)
Ambient temperature	25± 5℃	

13. **Reliability Testing**

13.1 Reliability Testing Conditions

Item	Condition		Grounds for judgment
High-temperature operation *10	Display surface temperature 60C	240 hrs	See “13.2 Evaluation Method” below
High-temperature/ high-humidity operation *10	Ta = 40C , RH = 95%, no condensing	240 hrs	See “13.2 Evaluation Method” below
Low-temperature operation *10	Ta = 0C	240 hrs	See “13.2 Evaluation Method” below
High-temperature storage *10	Ta = 71C	240 hrs	See “13.2 Evaluation Method” below
Low-temperature storage *10	Ta = -32C	240 hrs	See “13.2 Evaluation Method” below
Heat cycle *10	-30C (8H.) ? ? 71C (8H) (non-operation)	3 cycles	See “13.2 Evaluation Method” below
Resistance to static electricity	C = 200pF, R = 0ƒ¶: Discharge 3 times for each between power supply terminal and other terminals (non-operation)	(TBD) V	No breakdown
Surface discharge	C = 150pF, R = 330ƒ¶: Impress positive and negative voltages on the display surface 5 times each (non-operation) with the outer frame being grounded.	(TBD) V	No breakdown
Terminal strength (FPC)	Pull FPC up at 90 ‹ and down at 90 ‹ from front surface (non-operation)	5N or above	No error in functions and display
Atmospheric Pressure	507 hPa (non-operation)	2 hrs	No error in functions and display
Vibration (non-assembled)	10 ~ 55 Hz, total amplitude 1.5mm, 10~55~10Hz, period 5 min., 2 hours in each of X, Y, and Z direction (non-operation). (See the figure below for the fixing method.)		No error in functions and display
Impact (non-assembled)	980m/s^2, t=6ms, 3 times each in ±X, ±Y, and ±Z direction, half-sine wave (non-operation) (See the figure below for the fixing method.)		No error in functions and display
Vibration (packaged)	10~55Hz (logarithm sweeping), acceleration 9.8m/s^2 constant, 2 hours each (one way 1 hour) in X, Y, and Z direction		No error in functions and display
Dropping (packaged)	For all 6 sides- from the height of 1m; for 4 edges - from the height of 60cm; for two corners - from the height of 60cm (according to SANYO Standard Drop Test Specification)		No error in functions and display



13.2 Evaluation Method

-As a result of test, no significant change is found in appearance and display performance that may cause the problems in practical use (for items with *10, after letting a panel stand for 2 hours at a normal temperature).

-When doing operation test, the images displayed on the screen shall be white-bar images with scrolling.

13.3 Luminance degradation time

Luminance degradation time shall be the shortest time from the results of the operation test for each of white,R,G,and B by using two types of luminance with the limited area of display on (window displaying) in white or R,G,B at room temperature.

(1)Time that the luminance reaches 50% of the initial luminance when conducting the operation test at 120cd/m2 and 6500K.

(2)Time that the luminance reaches 70% of the initial luminance when conducing the operation test at 30cd/m2 and 6500K.

When displaying the limited area (window displaying) in RGB,calculate the luminance for each color equivalent to 6500K.

Luminance degradation time: T.B.D hours(Typ.)

14. **Cautionary Instructions in Handling**

(1)Protection against static electricity

Since OLED displays are vulnerable to be damaged by static electricity, please handle the displays with sufficient protection against such electricity. We recommend you to take the following protections:

a)Wear antistatic gloves and an earth band when handling. (Do not touch electrodes.)

b)Wear antistatic clothes and conductive shoes.

c)Cover the floor and working table with conductive mats and keep any electrical-charged article away.

d)When handling OLED displays, eliminate electricity from them by using a discharge blower.

-Also, ground the outer frame when incorporating the display into your product.

(2)Protection against dusts and dirt

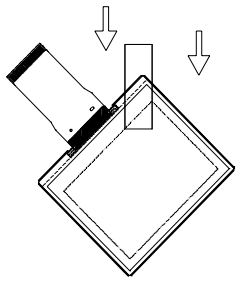
a)Keep the workplace clean.

b)When delivered, the display screen of an OLED panel is covered with a protection sheet. Peel the protection sheet off only after doing anti-static treatment for avoidance of making scratches on the panel surface.

<Recommended working method>

-Use a discharge blower with the distance from an OLED display and blowing direction adjusted to the optimum value for the blower.

Blowing Direction



-Press a piece of cellophane tape onto the corner of the protection sheet close to the discharge blower (and FPC) for avoidance of making scratches on the display surface.

-Pull the cellophane tape slowly toward you along the panel surface to peel the protection sheet off. When you pull the tape, do it slowly enough to take 2 seconds or longer to finish peeling.

c)Do not touch the display surface because it is very vulnerable to damages. In an unavoidable case of removing dirt, please wipe it gently with cellulose wiper or lint free clean gauze.

d)In case that any dusts are attached to the display surface, blow them off by air blower (We recommend you to use a discharge blower to eliminate dusts attached by static electricity.)

14. Cautionary Instructions in Handling (continued)

(3) Others

a) Do not hold, twist or bend FPC (Flexible Printed Cable) because the connecting part of FPC is very vulnerable to twisting.

b) Do not drop, or give any mechanical impact (e.g. hitting with a hammer or a tool) to, OLED displays; do not twist or bend the outer frame of the display.

c) Keep OLED displays away from heaters, such as the soldering iron, or water or any solvents.

d) Do not use the display under the condition of condensing or with water droplets attached to it because such conditions may cause the electrodes to be corroded when operating the display.

e) OLED display is delivered packaged in the sealed aluminum bag. Use the display as soon as possible after opening the package because the appearance and characteristics of the display are subject to be changed by the ambient conditions. Avoid using or storing displays at high temperature or under high humidity since the appearance and characteristics are especially vulnerable under such conditions. In case of storage, please store the display as being packaged and sealed in the aluminum bag.

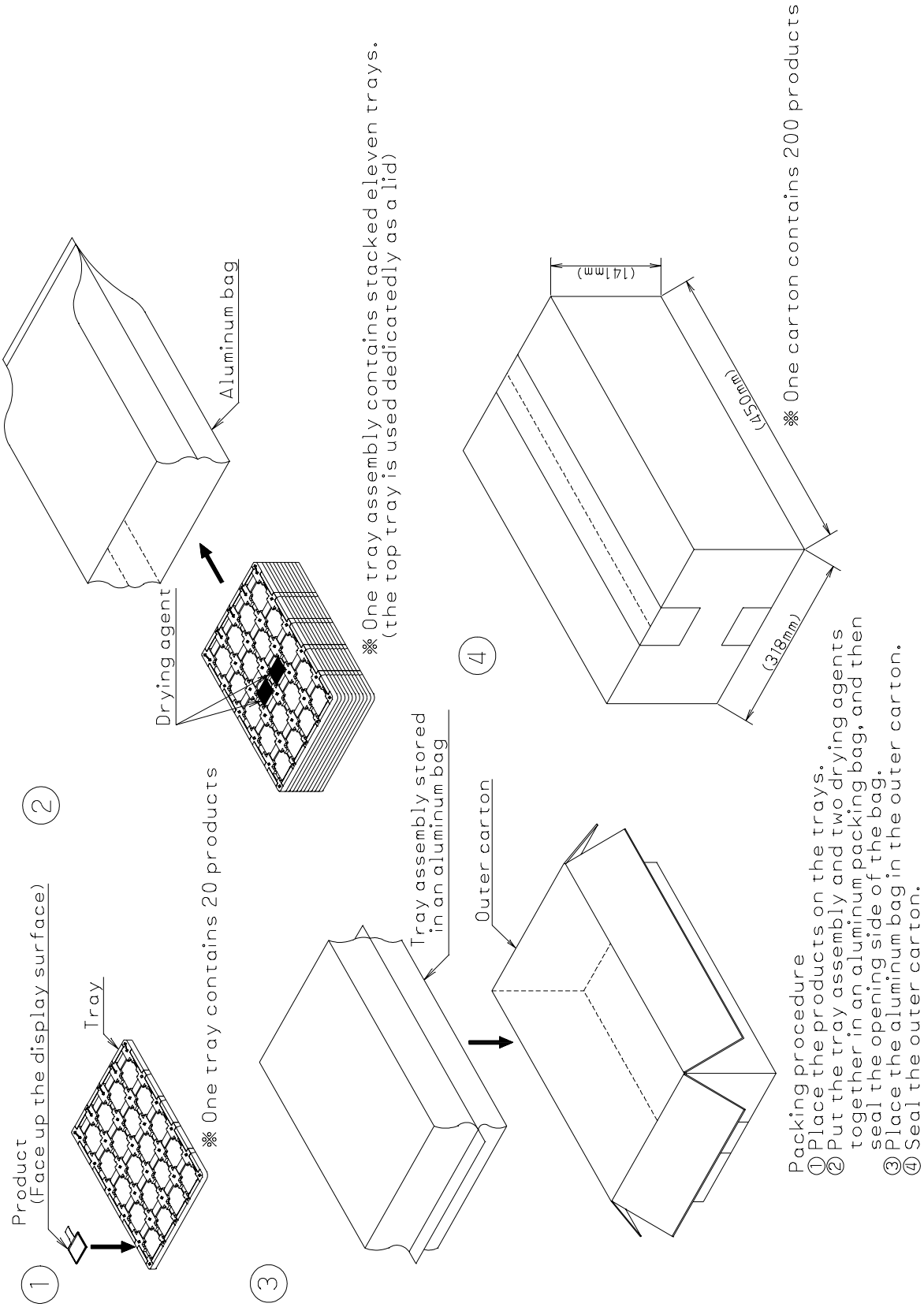
f) Just in case of breaking an OLED display, do not put the OLED materials contained in the display into your mouth. When the organic materials are attached to the clothes, wash them off immediately with soap. Also please be careful for handling the broken glasses and edges of the outer frame.

g) In case of disassembling an OLED display, operational performance and display quality will not be guaranteed.

h) When incorporating an OLED display into your product, please avoid putting too much stress on it.

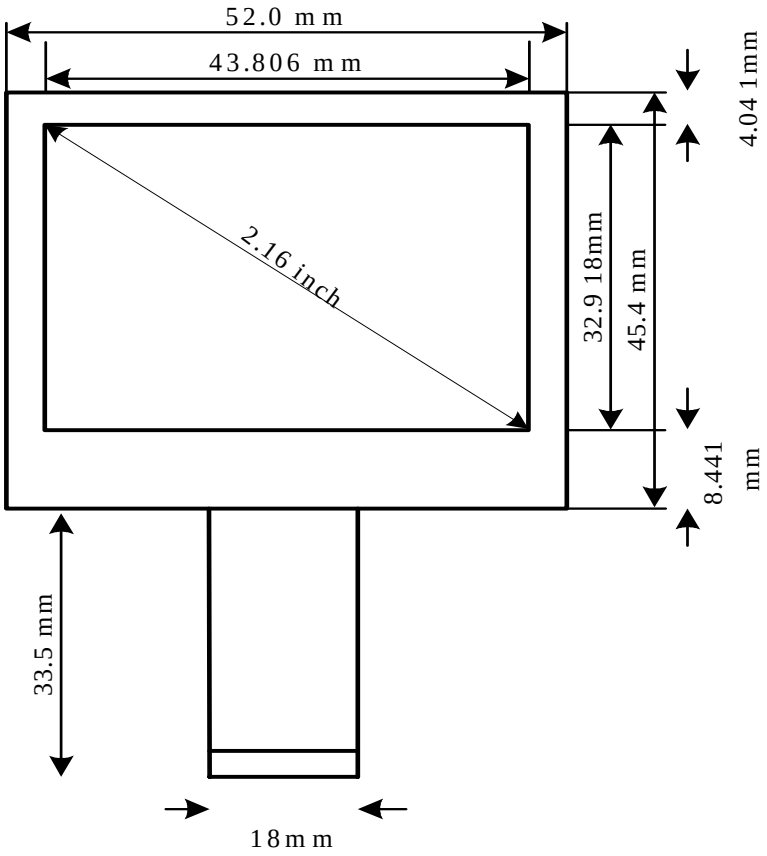
i) Since the display surface is very vulnerable to scratches, please install a protection (e.g. acrylic case) on the surface in your product. When designing the product, please design the protection, such as an acrylic case, to avoid contacting with the module surface. (Secure the space of 0.5mm or larger in consideration of acrylic case being twisted by high temperature.)

15. Packaging Specification T.B.D.



16. Dimensions

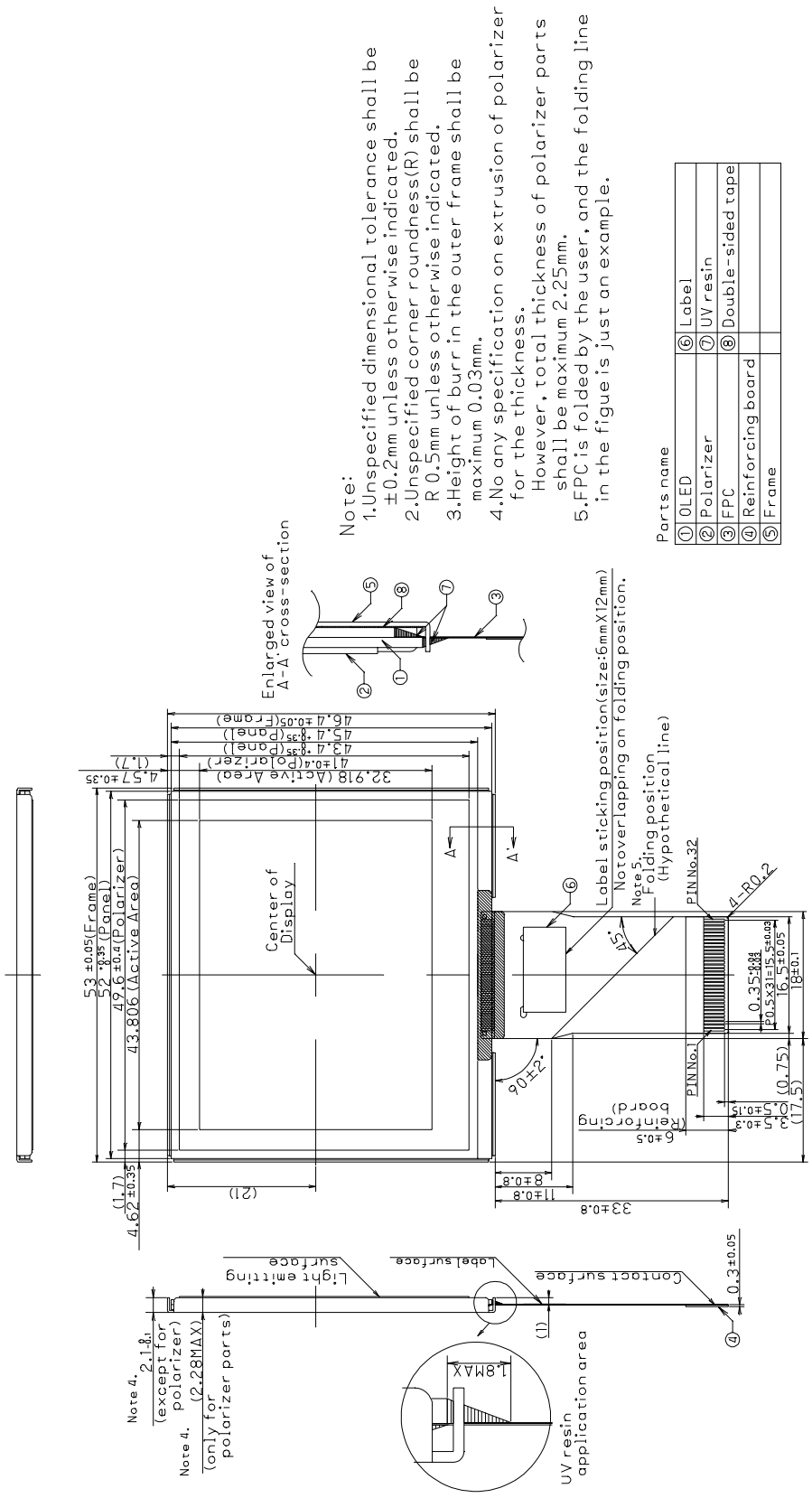
Weight: 8g



32pin

17. Dimensions with Metal Case (example)

Weight : 14 g



Revision History

Date	Version	Revision
1/23/03	1.11-1	Line/Dot/Surface
2/05/03	1.11-2	Drawing, title number 13.2