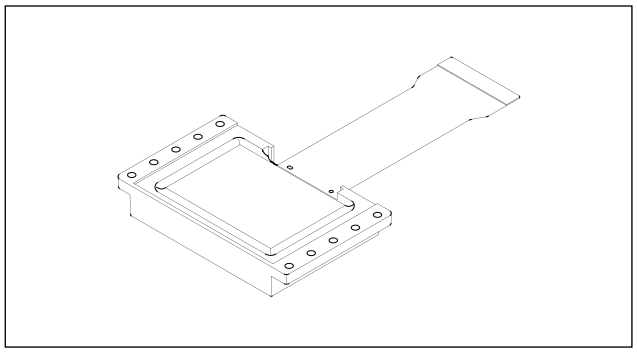
SONY

LCX011AM

3.6cm (1.43-inch) LCD Panel (with microlens)



Description

The LCX011AM is a 3.6cm diagonal active matrix TFT-LCD panel addressed by polycrystalline silicon super thin film transistors with built-in peripheral driving circuit. This panel allows full-color representation without color filters through the use of a microlens.

This panel provides a wide aspect ratio of 16:9, such as those represented in HD. The built-in side-black function also allows an aspect ratio of 4:3 in the NTSC/PAL mode.

This panel has a polysilicon TFT high-speed scanner and built-in function to display images up/down and/or right/left inverse. The built-in 5V interface circuit leads to lower voltage of timing and control signals.

Features

- The number of active dots: 768,000 (1.43-inch; 3.6cm in diagonal)
- Horizontal resolution: 600TV lines
- Effective aperture ratio: 70% (reference value)
- High contrast ratio with normally white mode: 200 (typ.)
- Built-in H and V drivers (built-in input level conversion circuit, 5V driving possible)
- NTSC/NTSC-WIDE/HD (band: 20MHz) mode selectable
  (PAL/PAL-WIDE mode also available through conversion of scanned dot numbers by an external IC)
- Up/down and/or right/left inverse display function
- Side-black function
- 16:9 and 4:3 aspect-ratio switching function

Element Structure

- Dots
  16:9 display: 1599.5 (H) × 480 (V) = 767,760
  4:3 display: 1199.5 (H) × 480 (V) = 575,760

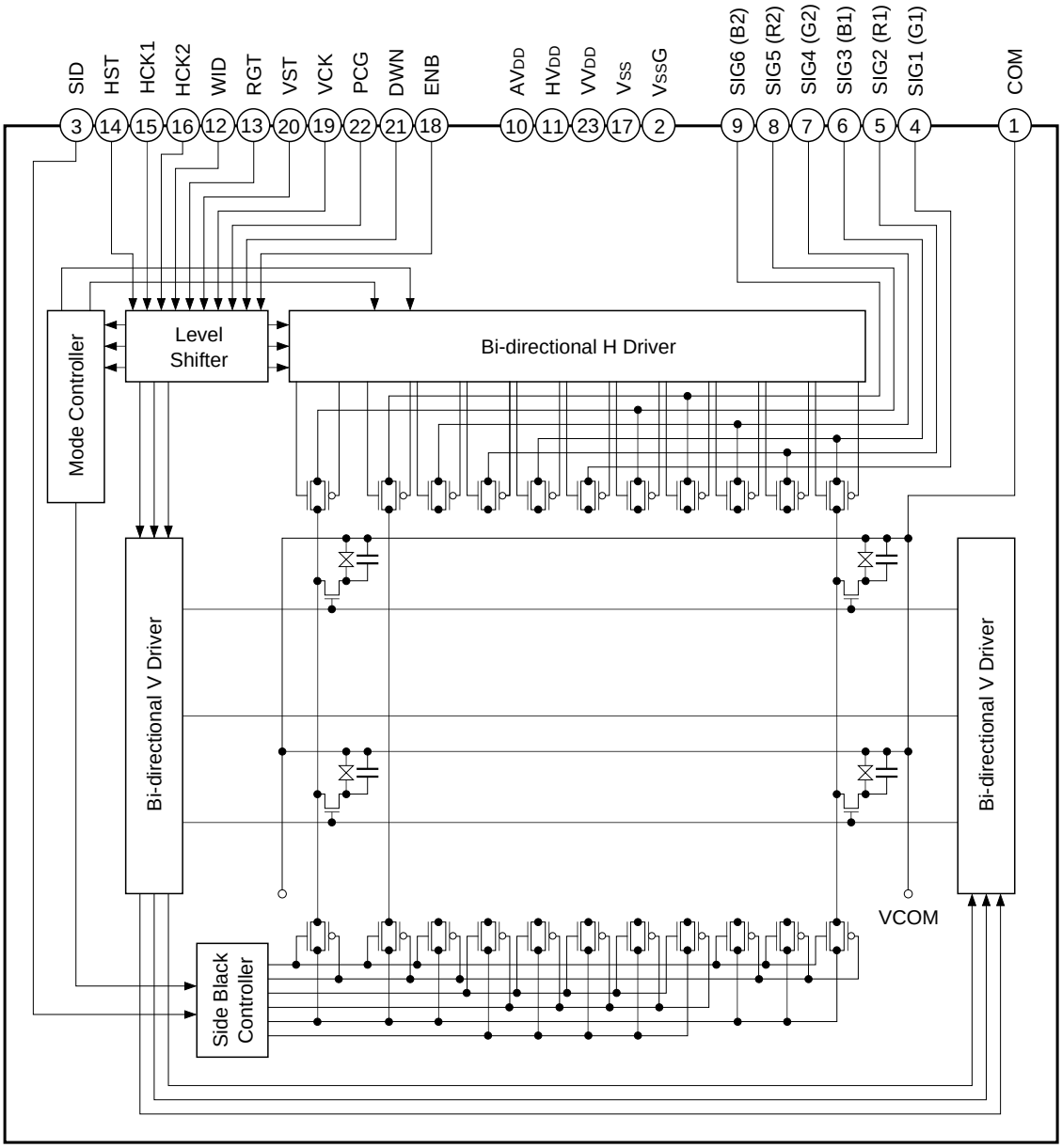
- Built-in peripheral driver using polycrystalline silicon super thin film transistors.

Applications

Liquid crystal projectors, etc.

E96919-PS

Block Diagram



Absolute Maximum Ratings (V_{SS} = 0 V)

• H driver supply voltage	HV_{DD}	–1.0 to +20	V
• V driver supply voltage	VV_{DD}	–1.0 to +20	V
• Analog block drive supply voltage	AV_{DD}	–1.0 to +20	V
• Common pad voltage	COM	–1.0 to +17	V
• H shift register input pin voltage	HST, HCK1, HCK2 RGT, WID	–1.0 to +17	V
• V shift register input pin voltage	VST, VCK, PCG ENB, DWN	–1.0 to +17	V
• Video signal input pin voltage	SIG1, SIG2, SIG3, SIG4 SIG5, SIG6, SID	–1.0 to +15	V
• Operating temperature	Topr	–10 to +70	°C
• Storage temperature	Tstg	–30 to +85	°C

Operating Conditions (V_{SS} = 0V)

• Supply voltage

HV_{DD}	13.5 ± 0.3	V
VV_{DD}	13.5 ± 0.3	V
AV_{DD}	15.5 ± 0.3	V

• Input pulse voltage (Vp-p of all input pins except video signal and side black signal input pins)

Vin	5.0 ± 0.5	V

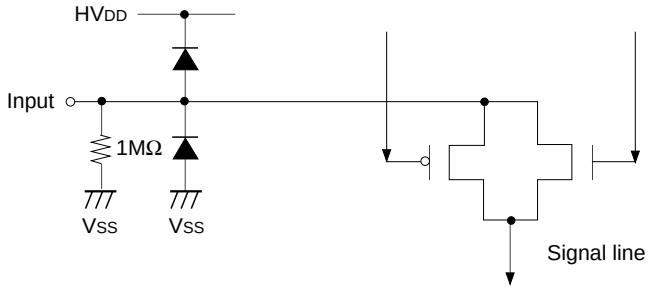
Pin Description

Pin No.	Symbol	Description	Pin No.	Symbol	Description
1	COM	Common voltage of panel	13	RGT	Drive direction pulse for H shift register (H: normal, L: reverse)
2	$V_{SS}G$	Analog block GND	14	HST	Start pulse for H shift register drive
3	SID	Side black signal for 4:3 display	15	HCK1	Clock pulse for H shift register drive
4	SIG1 (G1)	Video signal 1 (G) to panel	16	HCK2	Clock pulse for H shift register drive
5	SIG2 (R1)	Video signal 2 (R) to panel	17	V_{SS}	GND (H, V drivers)
6	SIG3 (B1)	Video signal 3 (B) to panel	18	ENB	Enable pulse for gate selection
7	SIG4 (G2)	Video signal 4 (G) to panel	19	VCK	Clock pulse for V shift register drive
8	SIG5 (R2)	Video signal 5 (R) to panel	20	VST	Start pulse for V shift register drive
9	SIG6 (B2)	Video signal 6 (B) to panel	21	DWN	Drive direction pulse for V shift register (H: normal, L: reverse)
10	AV_{DD}	Analog block power supply	22	PCG	Improvement pulse (2) for uniformity
11	HV_{DD}	Power supply for H driver	23	VV_{DD}	Power supply for V driver
12	WID	Aspect-ratio switching (H: 16:9, L: 4:3)	24	TEST	Test; Open

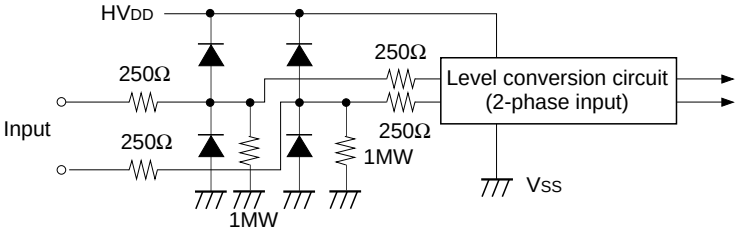
Input Equivalent Circuit

To prevent static charges, protective diodes are provided for each pin except the power supply. In addition, protective resistors are added to all pins except video signal input. All pins are connected to V_{SS} with a high resistance of 1MΩ (typ.). The equivalent circuit of each input pin is shown below: (The resistor value: typ.)

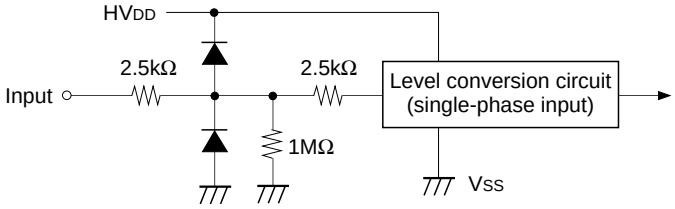
(1) SIG1, SIG2, SIG3, SIG4, SIG5, SIG6, SID



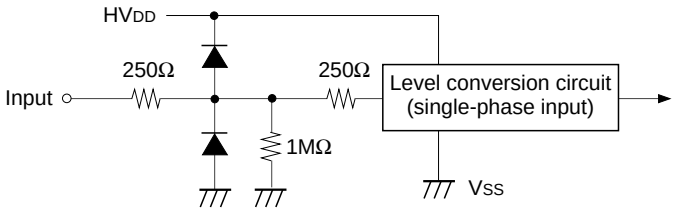
(2) HCK1, HCK2



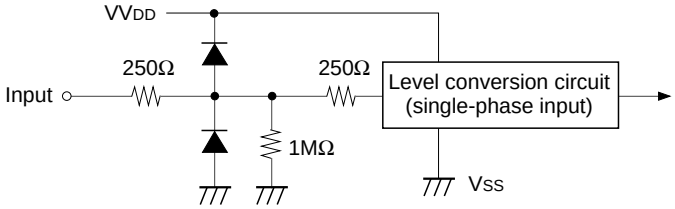
(3) RGT, WID



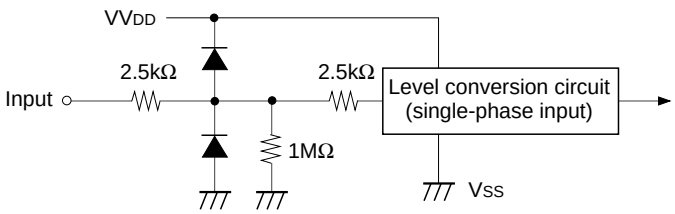
(4) HST



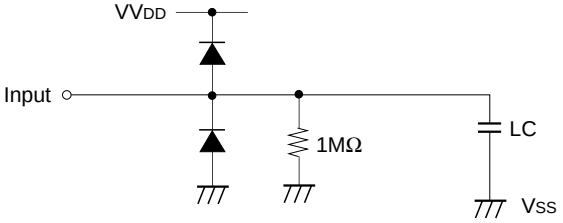
(5) PCG, VCK



(6) VST, ENB, DWN



(7) COM



Input Signals

1. Input signal voltage conditions

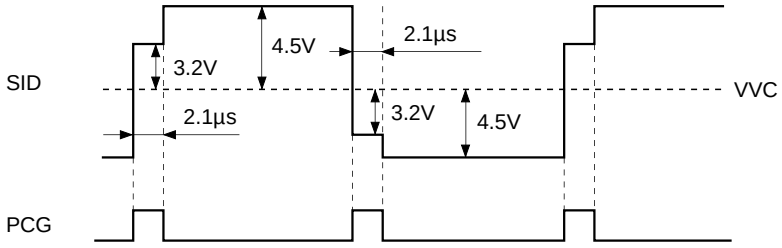
(Vss = 0V)

Item		Symbol	Min.	Typ.	Max.	Unit
H driver input voltage WID, RGT, HST, HCK1, HCK2	(Low)	VHIL	–0.5	0.0	0.3	V
	(High)	VHIH	4.5	5.0	5.5	V
V driver input voltage ENB, VCK, PCG, VST, DWN	(Low)	VVIL	–0.5	0.0	0.3	V
	(High)	VVIH	4.5	5.0	5.5	V
Video signal center voltage		VVC	6.8	7.0	7.2	V
Video signal input range*1 (SIG1 to 6)		Vsig	VVC – 4.5	—	VVC + 4.5	V
Common voltage of panel*2		Vcom	VVC – 0.3	VVC – 0.2	VVC – 0.1	V
Side black signal for 4:3 display*3 (SID) input voltage		Vsid	VVC ± 4.4 (VVC ± 3.1)	VVC ± 4.5 (VVC ± 3.2)	VVC ± 4.6 (VVC ± 3.3)	V

*1 Video input signal shall be symmetrical to VVC.

*2 Common voltage of the panel shall be adjusted to VVC – 0.2V.

*3 The side black signal for 4:3 display shall be input at the timing shown in the figure below. Also, the interval between the SID rise and fall shall be kept to 800ns or less.



Level Conversion Circuit

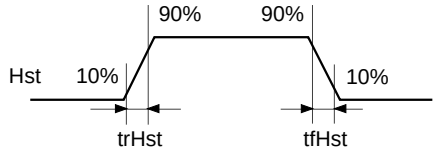
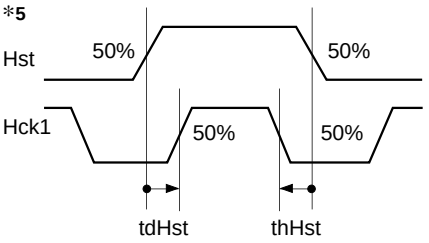
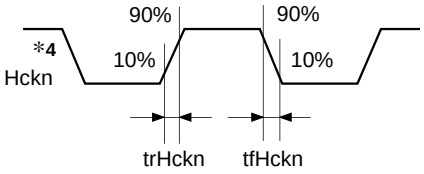
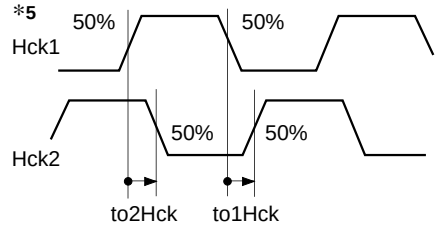
The LCX011AM has a built-in level conversion circuit in the clock input unit on the panel. The input signal level increases to HV_{DD} or VV_{DD}. The V_{CC} of external ICs are applicable to 5 ± 0.5V.

2. Clock timing conditions (16:9 display mode) (Ta = 25°C) (fHCKn = 5.6MHz, fVCK = 15.7kHz)

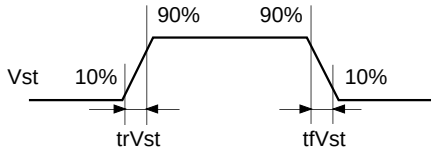
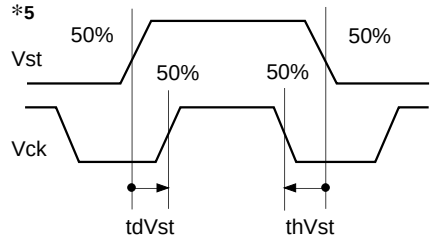
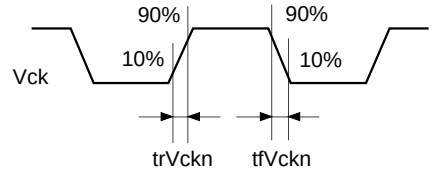
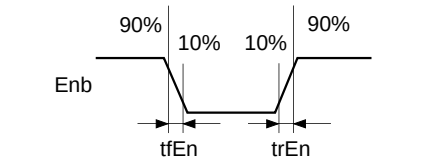
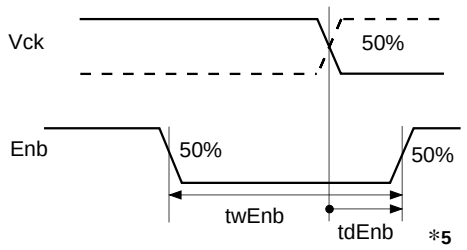
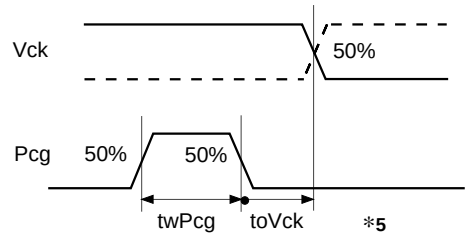
	Item	Symbol	Min.	Typ.	Max.	Unit
HST	Hst rise time	trHst	—	—	30	ns
	Hst fall time	tfHst	—	—	30	
	Hst data set-up time	tdHst	74	89	104	
	Hst data hold time	thHst	–15	0	15	
HCK	Hckn*4 rise time	trHckn	—	—	30	
	Hckn*4 fall time	tfHckn	—	—	30	
	Hck1 fall to Hck2 rise time	to1Hck	–15	0	15	
	Hck1 rise to Hck2 fall time	to2Hck	–15	0	15	
VST	Vst rise time	trVst	—	—	100	
	Vst fall time	tfVst	—	—	100	
	Vst data set-up time	tdVst	5	15	25	µs
	Vst data hold time	thVst	5	15	25	
VCK	Vck rise time	trVck	—	—	100	ns
	Vck fall time	tfVck	—	—	100	
ENB	Enb rise time	trEnb	—	—	100	
	Enb fall time	tfEnb	—	—	100	
	Vck rise/fall to Enb rise time	tdEnb	350	400	450	
	Enb pulse width	twEnb	3450	3500	3550	
PCG	Pcg rise time	trPcg	—	—	20	
	Pcg fall time	tfPcg	—	—	20	
	Pcg fall to Vck rise/fall time	toVck	–50	0	50	
	Pcg pulse width	twPcg	2050	2100	2150	

*4 Hckn means Hck1 and Hck2.

<Horizontal Shift Register Driving Waveform>

Item		Symbol	Waveform	Conditions
HST	Hst rise time	trHst		• Hckn*4 duty cycle 50% to1Hck = 0ns to2Hck = 0ns
	Hst fall time	tfHst		
	Hst data set-up time	tdHst		• Hckn*4 duty cycle 50% to1Hck = 0ns to2Hck = 0ns
	Hst data hold time	thHst		
HCK	Hckn*4 rise time	trHckn		• Hckn*4 duty cycle 50% to1Hck = 0ns to2Hck = 0ns
	Hckn*4 fall time	tfHckn		
	Hck1 fall to Hck2 rise time	to1Hck		
	Hck1 rise to Hck2 fall time	to2Hck		

<Vertical Shift Register Driving Waveform>

Item		Symbol	Waveform	Conditions
VST	Vst rise time	trVst		
	Vst fall time	tfVst		
	Vst data set-up time	tdVst		
	Vst data hold time	thVst		
VCK	Vck rise time	trVck		
	Vck fall time	tfVck		
ENB	End rise time	trEnb		
	End fall time	tfEnb		
	Vck rise/fall to Enb rise time	tdEnb		
	Enb pulse width	twEnb		
PCG	Pcg rise time	trPcg		
	Pcg fall time	tfPcg		
	Pcg fall to Vck rise/fall time	toVck		
	Pcg pulse width	twPcg		

*5 Definitions: The right-pointing arrow (•→) means +.
The left-pointing arrow (←•) means –.
The black dot at an arrow (•) indicates the start of measurement.

Electrical Characteristics (Ta = 25°C, HV_{DD} = 13.5V, VV_{DD} = 13.5V, AV_{DD} = 15.5V)

1. Horizontal drivers

Item	Symbol	Min.	Typ.	Max.	Unit	Conditions
Input pin capacitance HCKn	CHckn	—	12	17	pF	
HST	CHst	—	12	17	pF	
Input pin current HCK1		–500	–100	—	µA	HCK1 = GND
HCK2		–1000	–350	—	µA	HCK2 = GND
HST		–500	–150	—	µA	HST = GND
WID, RGT		–150	–30	—	µA	WID, RGT = GND
Video signal input pin capacitance	Csig	—	250	—	pF	
Current consumption	IH	—	5.5	10	mA	HCKn: HCK1, HCK2 (5.6MHz)

2. Vertical drivers

Item	Symbol	Min.	Typ.	Max.	Unit	Conditions
Input pin capacitance VCK	CVck	—	12	17	pF	
VST	CVst	—	12	17	pF	
Input pin current VCK		–500	–150	—	µA	VCK = GND
PCG, VST, ENB, DWN		–150	–30	—	µA	PCG, VST, EN, DWN = GND
Current consumption	IV	—	1.1	4	mA	VCK: (15.7kHz)

3. Analog block

Item	Symbol	Min.	Typ.	Max.	Unit	Conditions
Current consumption	IA	—	2	4	mA	HCKn, HCK1, HCK2 (5.6MHz) VCK (15.7kHz)

4. Total power consumption of the panel

Item	Symbol	Min.	Typ.	Max.	Unit
Total power consumption of the panel (NTSC)	PWR	—	120	250	mW

5. Pin input resistance

Item	Symbol	Min.	Typ.	Max.	Unit
Pin-V_{SS} input resistance	Rpin	0.4	1	—	MΩ

6. Side signal input pin capacitance

Item	Symbol	Min.	Typ.	Max.	Unit
Side signal input pin capacitance	CSIDon	—	13	16	nF

Electro-optical Characteristics (Ta = 25°C, NTSC mode)

Item			Symbol	Measure-ment method	Min.	Typ.	Max.	Unit
Contrast ratio		60°C	CR60	1	130	200	—	—
Effective aperture ratio		60°C	Teff	2	60	70	—	%
V-T characteristics	V_{90}	25°C	RV_{90-25}	3	1.0	1.3	1.7	V
			GV_{90-25}		1.0	1.4	1.8	
			BV_{90-25}		1.1	1.5	1.9	
		60°C	RV_{90-60}		1.0	1.3	1.7	
			GV_{90-60}		1.0	1.4	1.8	
			BV_{90-60}		1.1	1.5	1.9	
	V_{50}	25°C	RV_{50-25}		1.3	1.6	1.9	
			GV_{50-25}		1.4	1.7	2.0	
			BV_{50-25}		1.5	1.8	2.1	
		60°C	RV_{50-60}		1.4	1.7	2.1	
			GV_{50-60}		1.4	1.7	2.1	
			BV_{50-60}		1.5	1.8	2.2	
	V_{10}	25°C	RV_{10-25}		1.7	2.1	2.6	
			GV_{10-25}		1.7	2.1	2.6	
			BV_{10-25}		1.8	2.2	2.7	
		60°C	RV_{10-60}		1.7	2.1	2.6	
			GV_{10-60}		1.8	2.2	2.7	
			BV_{10-60}		1.8	2.2	2.7	
Response time	ON time	0°C	ton0	4	—	30	80	ms
		25°C	ton25		—	12	40	
	OFF time	0°C	toff0		—	100	200	
		25°C	toff25		—	30	70	
Flicker		60°C	F	5	—	–65	–40	dB
Image retention time		25°C	YT60	6	—	—	0	s
Cross talk		25°C	CTK	7	—	—	5	%

<Electro-optical Characteristics Measurement>

Basic measurement conditions

(1) Driving voltage

HV_{DD} = 13.5V, VV_{DD} = 13.5V, AV_{DD} = 15.5V

VVC = 7.0V, Vcom = 6.8V

(2) Measurement temperature

25˚C unless otherwise specified.

(3) Measurement point

One point in the center of screen unless otherwise specified.

(4) Measurement systems

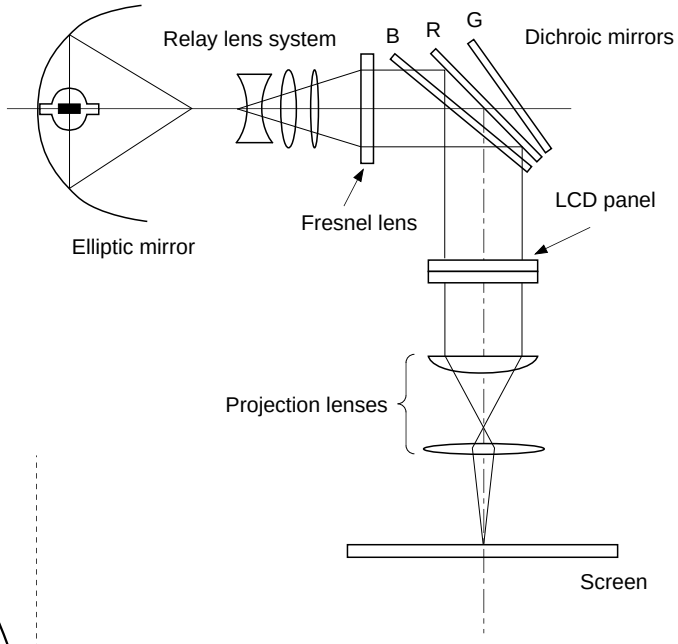
Two types of measurement system are used as shown below.

(5) Video input signal voltage (Vsig)

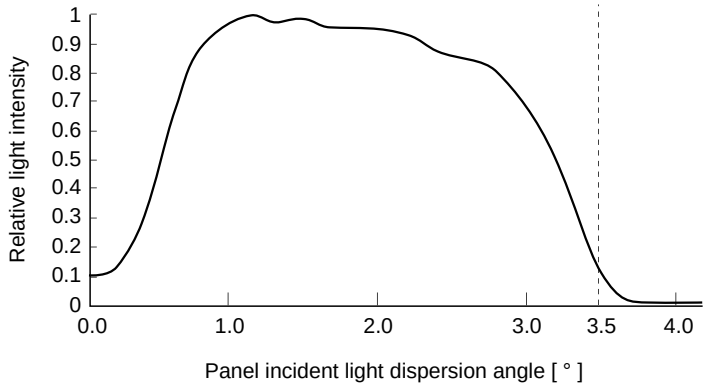
Vsig = 7.0 ± V_{AC} [V] (V_{AC}: signal amplitude)

(6) Optical measurement systems

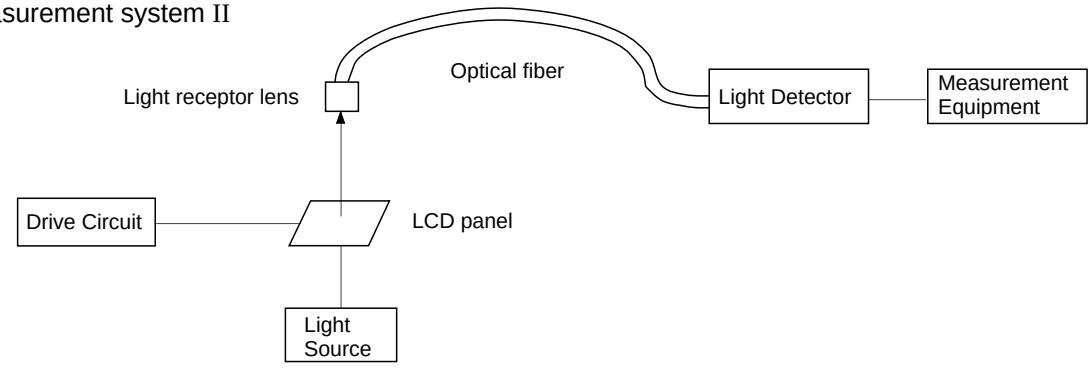
• Measurement system I



100W lamp angle distribution



• Measurement system II



1. Contrast ratio

Contrast Ratio (CR) is given by the following formula (1).

$$CR = \frac{L\ (White)}{L\ (Black)} \quad \text{..... (1)}$$

L (White): Surface luminance of the TFT-LCD panel at the input signal amplitude V_{AC} = 0.5V.

L (Black): Surface luminance of the panel at V_{AC} = 4.5V.

Both luminosities are measured by System I.

2. Effective aperture ratio

Measure the luminances below on the screen in System I, and calculate the effective aperture ratio using the following formula (2).

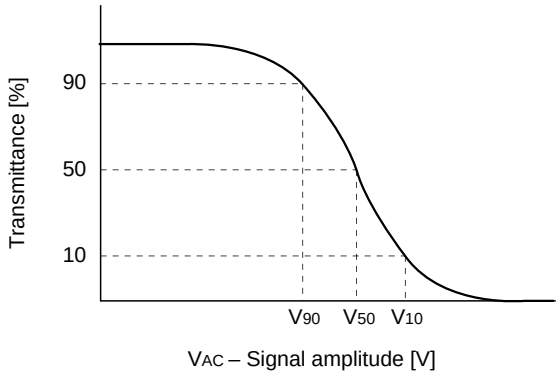
$$\frac{\text{Luminance for panel with microlens}}{\text{Luminance for panel without microlens}} \times (\text{TFT aperture ratio}) \times 100\ [\%] \ldots\ldots (2)$$

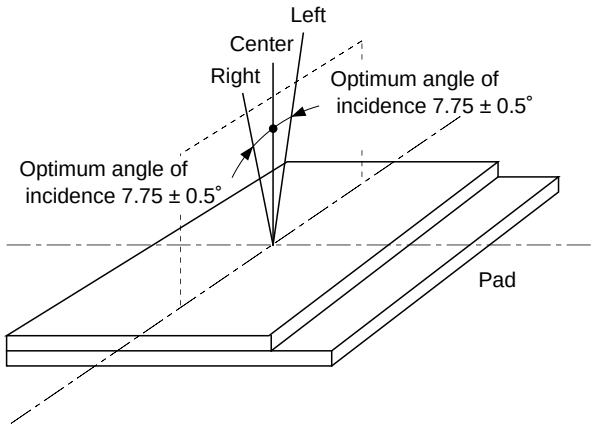
3. V-T characteristics

V-T characteristics, the relationship between signal amplitude and the transmittance of the panels, are measured by System II. V_{90}, V_{50} and V_{10} correspond to the each voltage which defines 90%, 50% and 10% of transmittance respectively.

The angles of incidence for R, G and B are as shown in the diagram below.

Red: Center: Vertical
Green: Left: 7.75 ± 0.5°
Blue: Right: 7.75 ± 0.5°





Input signal voltage (waveform applied to the measured pixels)

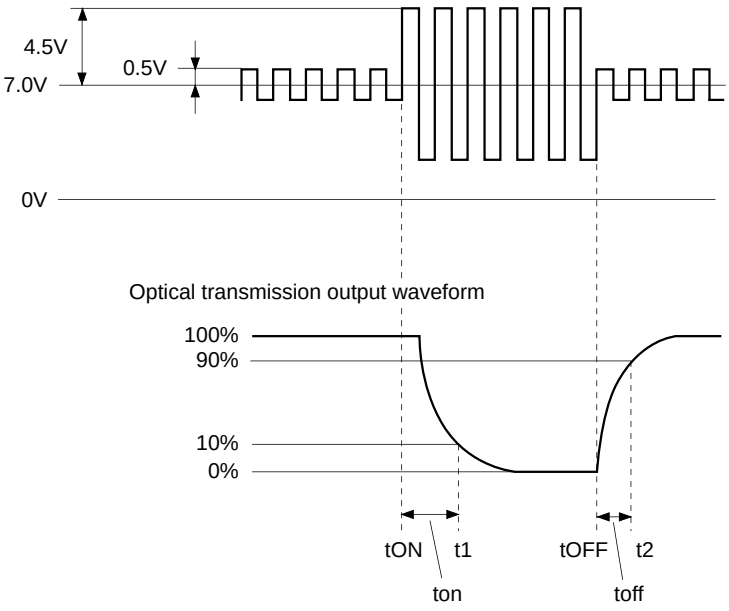
4. Response time

Response time ton and toff are defined by the formulas (3) and (4) respectively.

ton = t1 – tON ..... (3)
toff = t2 – tOFF ..... (4)

t1: time which gives 10% transmittance of the panel.
t2: time which gives 90% transmittance of the panel.

The relationships between t1, t2, tON and tOFF are shown in the right figure.



5. Flicker

Flicker (F) is given by the formula (5). DC and AC (NTSC: 30Hz, rms, PAL: 25Hz, rms) components of the panel output signal for gray raster* mode are measured by a DC voltmeter and a spectrum analyzer in System II.

$$F\ [dB] = 20 \log \left\{ \frac{\text{AC component}}{\text{DC component}} \right\} \quad \text{..... (5)}$$

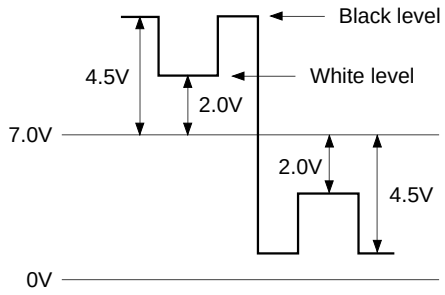
* Each input signal condition for gray raster mode is given by Vsig = 7.0 ± V_{50} [V]
where: V_{50} is the signal amplitude which gives 50% of transmittance in V-T characteristics.

6. Image retention time

Image retention time is given by following procedures.

Apply the monoscope signal to the LCD panel for 60 minutes and then change this signal to the gray scale of Vsig = 7.0 ± V_{AC} (V_{AC}: 3 to 4V). Hold V_{AC} that maximizes image retention judging by sight. Measure the time till the residual image becomes indistinct.

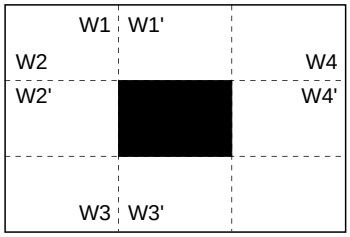
* Monoscope signal conditions:
Vsig = 7.0 ± 4.5 or ± 2.0 [V]
(shown in the right figure)
Vcom = 6.8V



Vsig waveform

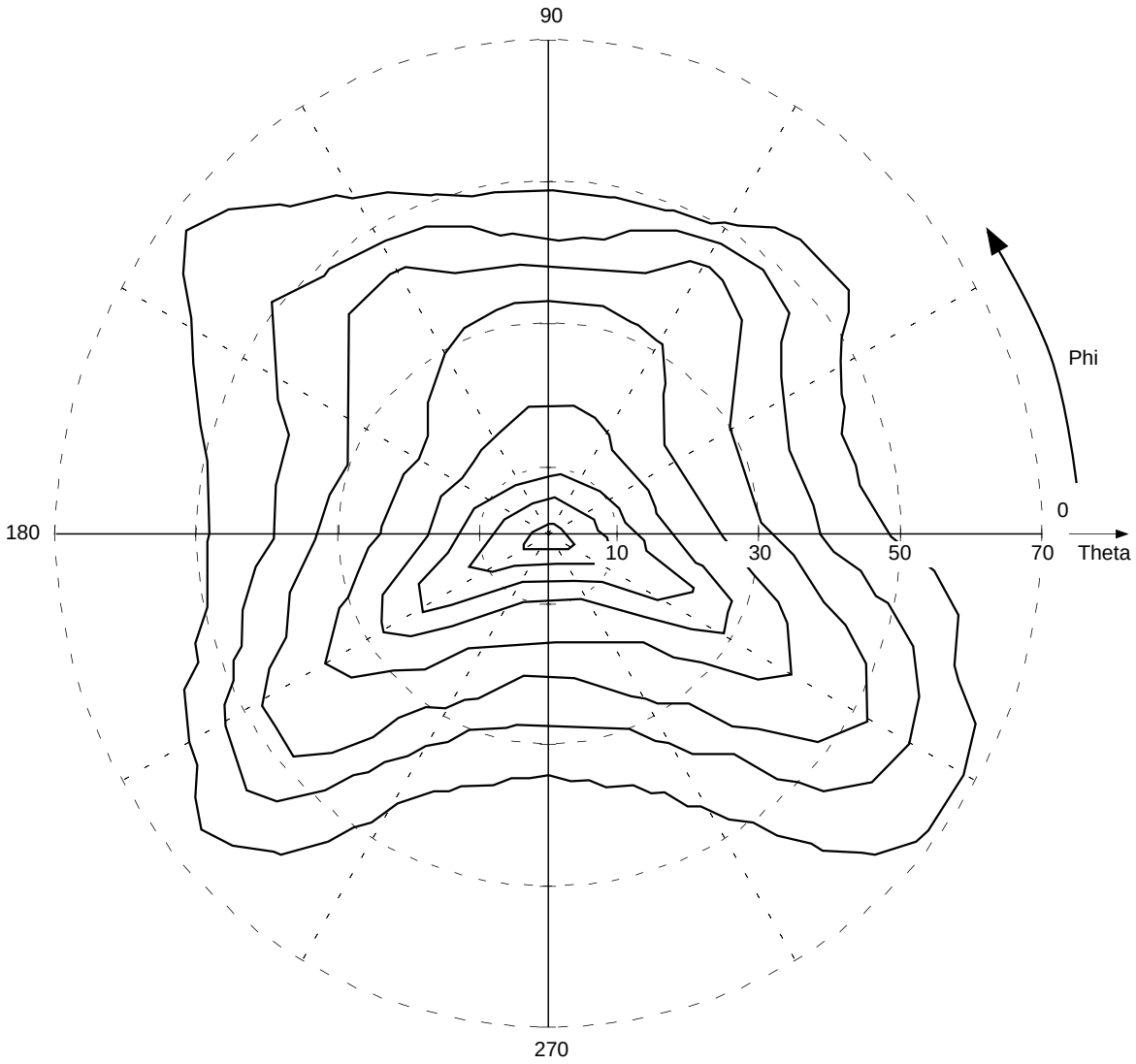
7. Cross talk

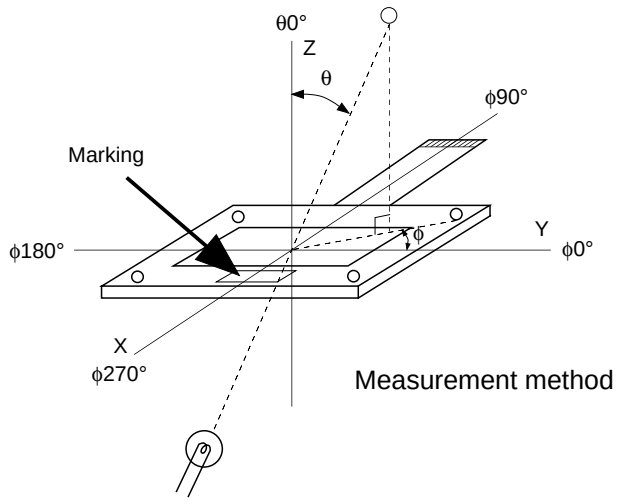
Cross talk is determined by the luminance differences between adjacent areas represented Wi' and Wi (i = 1 to 4) around black window (Vsig = 4.5V/1V).



$$\text{Cross talk CTK} = \left| \frac{Wi' - Wi}{Wi} \right| \times 100\ [\%]$$

Viewing Angle Characteristics (Typical Value)



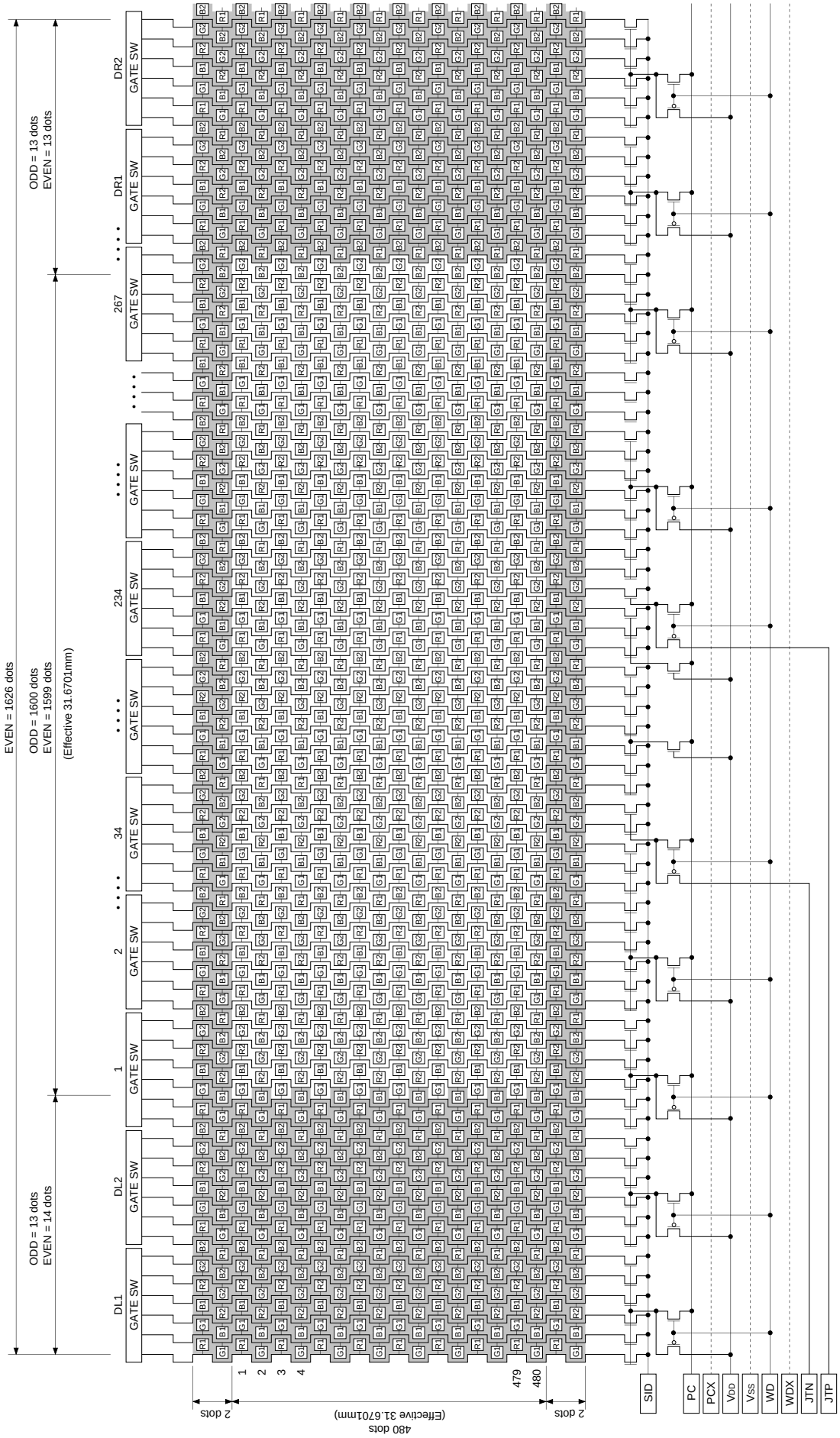


Note) This measurement is performed using an LCD panel without a microlens.

Description of Operation

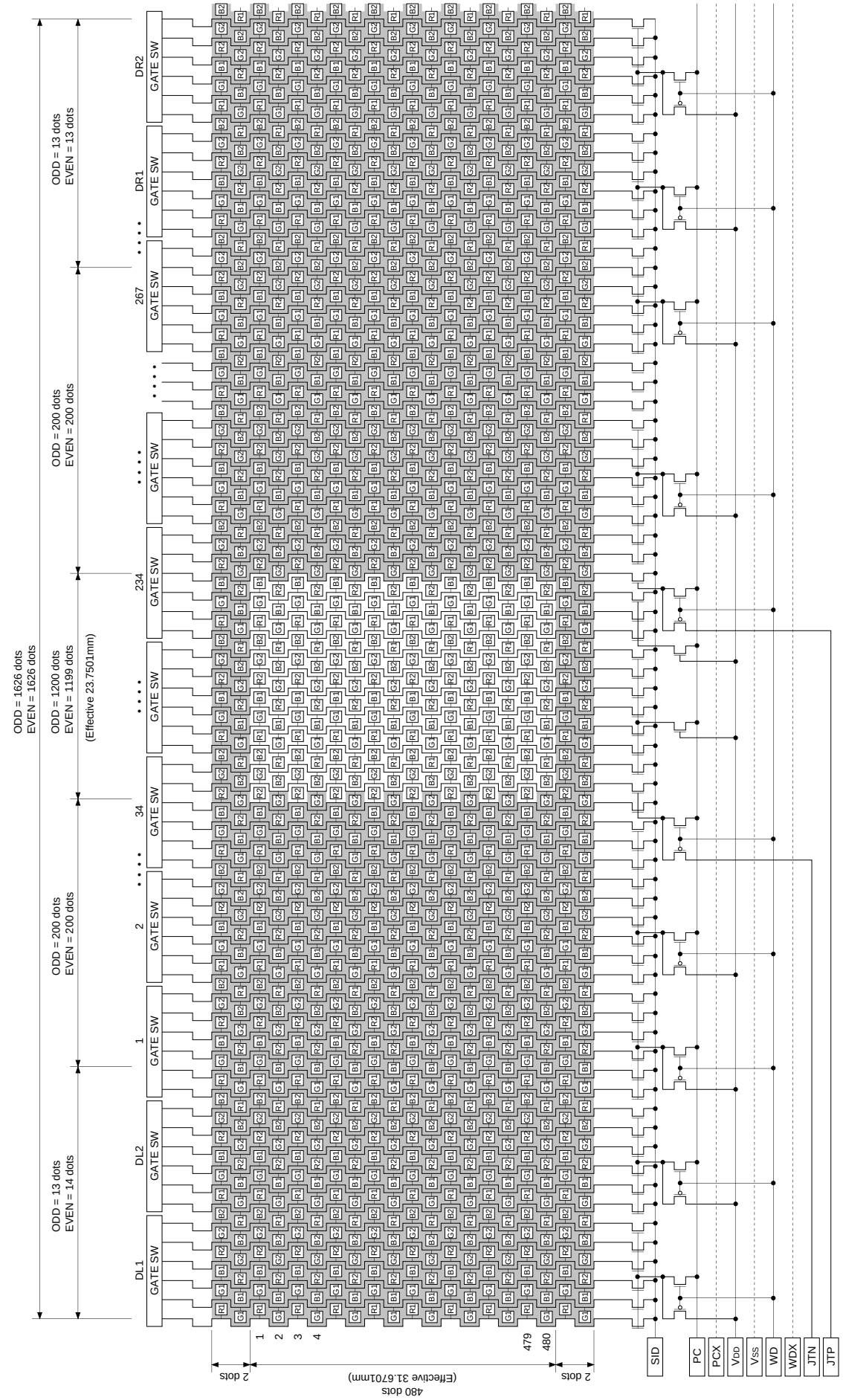
1. Dot arrangement (1) (16:9 display)

The dots are arranged in a delta pattern. The shaded area is used for the dark border around the display.
R1 corresponds to SIG2, G1 to SIG1, B1 to SIG3, R2 to SIG5, G2 to SIG4, and B2 to SIG6, respectively.



Dot arrangement (2) (4:3 display)

The dots are arranged in a delta pattern. The shaded area is used for the dark border around the display.
R1 corresponds to SIG2, G1 to SIG1, B1 to SIG3, R2 to SIG5, G2 to SIG4, and B2 to SIG6, respectively.



2. LCD panel operations

[Description of basic operations]

The basic operations of the LCD panel are shown below based on the wide-display mode.

- A vertical driver, which consists of vertical shift registers, enable-gates and buffers, applies a selected pulse to every 480 gate lines sequentially in every horizontal scanning period.

- A horizontal driver, which consists of horizontal shift registers, gates and CMOS sample-and-hold circuits, applies selected pulses to every 1599.5 signal electrodes sequentially in a single horizontal scanning period.

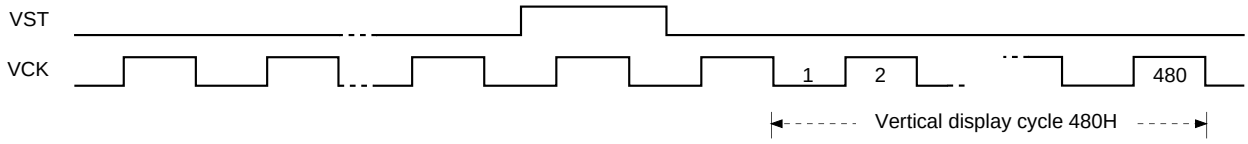
- Vertical and horizontal shift registers address one pixel, and then turn on Thin Film Transistors (TFTs; two TFTs) to apply a video signal to the dot. The same procedures lead to the entire 480 × 1599.5 dots to display a picture in a single vertical scanning period.

- The LCD pixel dots are arranged in a delta pattern, where the dots connected to the identical signal line is positioned with 1.5-dot offset against an adjacent horizontal line. Horizontal Start Pulse (HST) is generated with 1.5-bit offset between the horizontal lines to regulate the above offset. HCK and sample-and-hold (S/H) pulses follow the same 1.5-bit offset scheme.

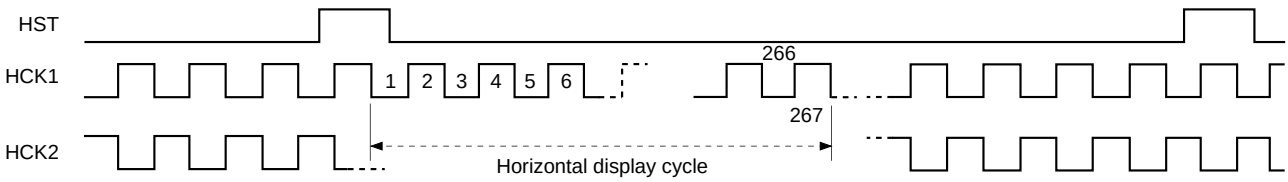
- The video signal shall be input with polarity-inverted system in every horizontal cycle.

- Timing diagrams of the vertical and the horizontal display cycle are shown below:

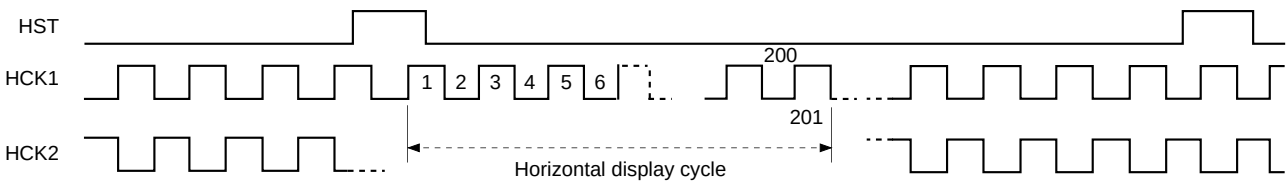
(1) Vertival display cycle



(2) Horizontal display cycle (16:9)



(3) Horizontal display cycle (4:3)



[Description of operating mode]

The LCD panel has the following functions to easily apply to various uses, as well as various broadcasting systems.

- Right/left inverse mode
- Up/down inverse mode
- 4:3 display mode with side-black display

These modes are controlled by three signals (RGT, DWN, and WID). The setting mode is shown below:

WID	RGT	Mode
H	H	16:9 right scan
H	L	16:9 left scan
L	H	4:3 right scan
L	L	4:3 left scan

DWN	Mode
H	Down scan
L	Up scan

The direction of the right/left and/or up/down mean when Pin 1 marking is located at right side with the pin block upside.

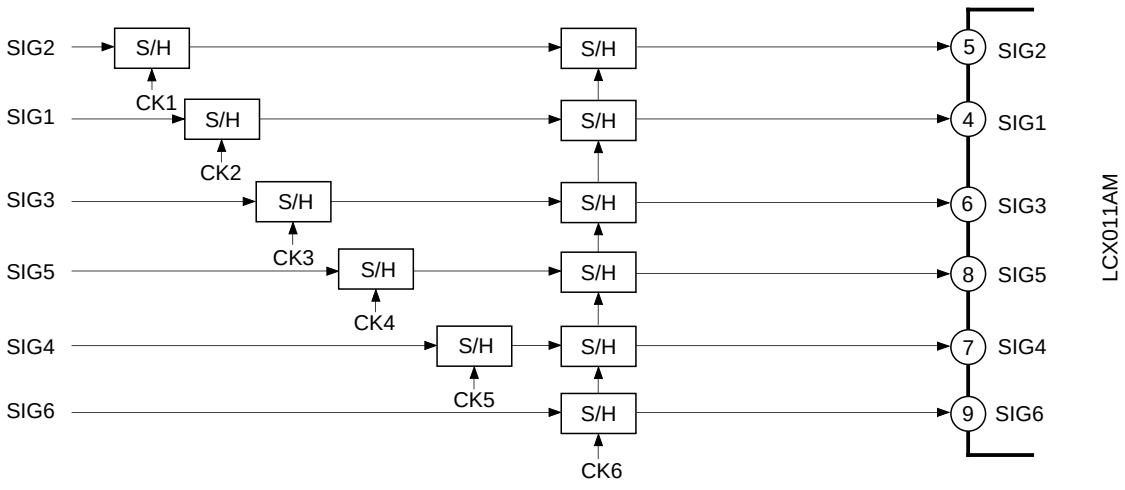
- The analog signal (SID) to display side-black shall be input by 1H inversion synchronized with the video signal.

3. 6-dot simultaneous sampling

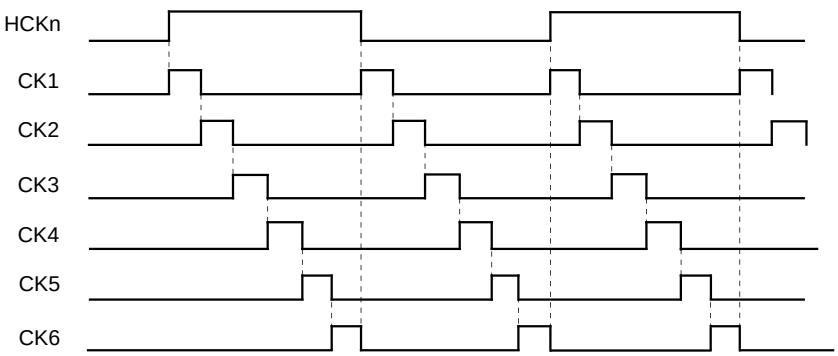
Horizontal driver samples SIG1 to SIG6 signals simultaneously, which requires the phase matching between signals to prevent horizontal resolution from deteriorating. Thus phase matching between each signal is required using an external signal delaying circuit before applying video signal to the LCD panel.

The block diagram of the delaying procedure using sample-and-hold method is as follows.

The LCX011AM has the right/left inverse function. The following phase relationship diagram indicates the phase setting for the right scan (RGT = High level). For the left scan (RGT = Low level), the phase setting shall be inverted in the order of the SIG6, SIG4, SIG5, SIG3, SIG1 and SIG2 signals.

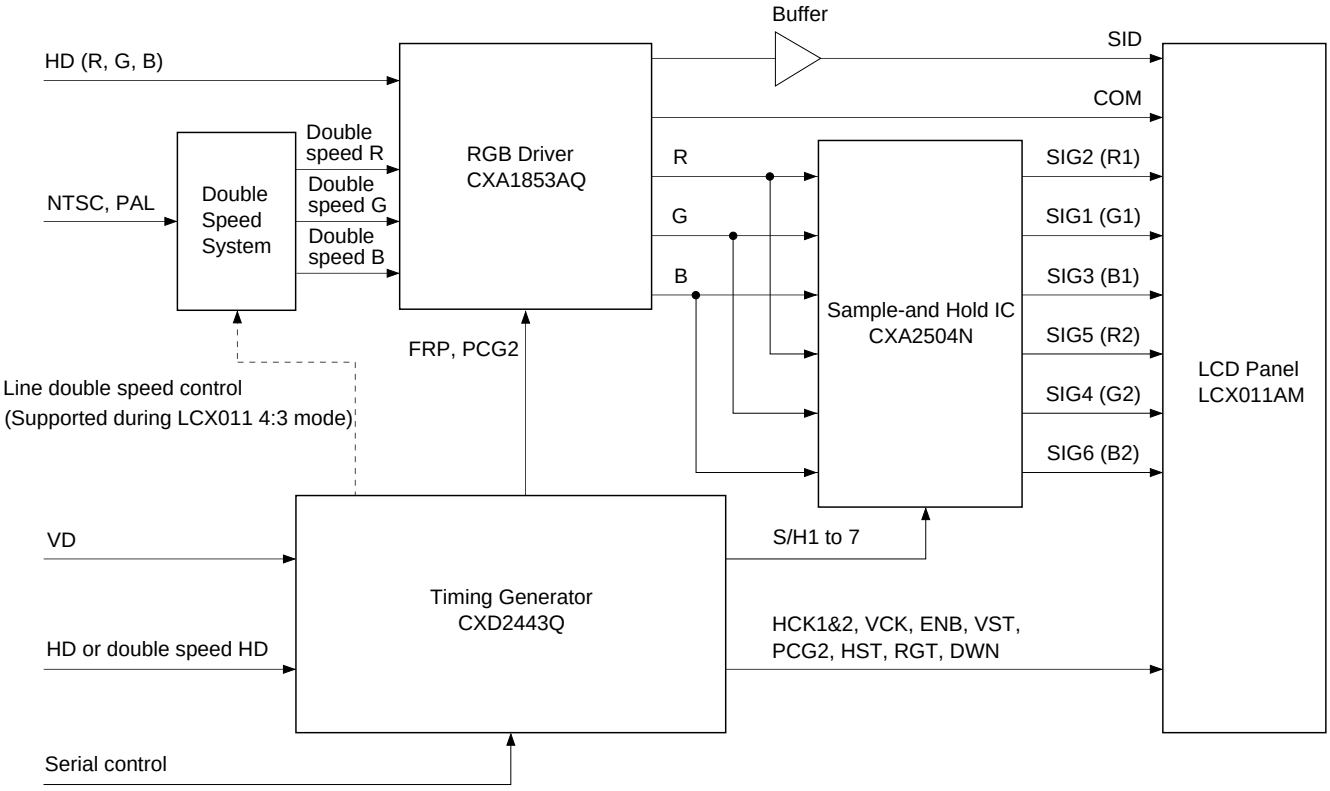


<Phase relationship of delaying sample-and-hold pulses> (right scan)



Display System Block Diagram

An example of display system is shown below.



Optical Characteristics

1. Microlens outline

The LCX011AM has a single built-in microlens on the substrate side facing the TFT for the three TFT panel picture elements. This microlens serves the following purposes.

(1) The microlens converges the incident light striking the LCD panel to the dot aperture in order to improve the effective aperture ratio and increase the display luminance.

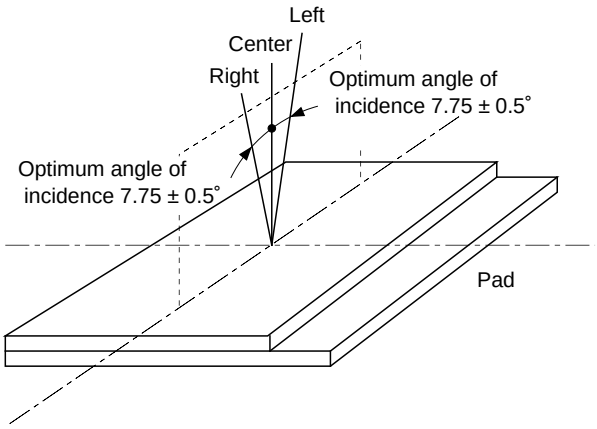
(2) The microlens provides a color representation by distributing the light flux for each of the three primary colors R, G and B which strike the panel at different angles to the dot apertures corresponding to each color.

This allows the light utilization efficiency to be improved by eliminating the light absorption by the color filter, which had been unavoidable with conventional single panel projectors.

2. Recommended lighting conditions

In order to bring out the full light converging effects of the microlens and provide a color representation with high color purity, the following lighting is recommended.

(1) The incident light angle of the three primary colors should be as shown in the figure below. The center light should strike the panel from the panel normal direction, and the left and right light from angles inclined to the right and left of the panel normal direction. The design optimal angle of incidence is the range of 7.75 ± 0.5°. However, the optimal angle of incidence may be altered slightly depending on the panel. Be sure to allow adjustment of the mutual angles of the dichroic mirrors so that the angle of incidence can be varied within the range of 7.75 ± 0.5°.



(2) Effective light: The normal direction (center light), left light and right light noted above should strike the panel at an angle of ±3.5° or less. Light with a dispersion angle greater than this value will strike adjoining dot apertures and cause the color purity to worsen. (See the incident angle distribution for System I.)

3. Recommended projection optical system

The maximum egress light angle for light passing through the LCD is approximately ±20°. Therefore, setting the F stop of the projection lens to about 1.5 is recommended in order to maximize the light converging effects of the microlens and provide a representation with excellent color balance. If the projection lens F stop is larger than this value, the right and left light are kicked accordingly by the projection lens, thereby reducing the egress light flux to the screen and the same time shifting the white balance.

Notes on Operation

(1) Lighting spectrum and intensity

Use only visible light with a wavelength λ = 415 to 780nm as a light source. Light with a wavelength λ > 780nm (infrared light) will produce unwanted temperature rises. Light with a wavelength λ < 415nm (ultraviolet light) will produce irreversible changes in the display characteristics. To prevent this, be sure to mount UV/IR cut filters between the LCX011AM and the light source as necessary depending on the light source.

The lighting intensity should be 1 million lux or less, and the panel surface temperature should not exceed 55°C.

(2) Lighting optical system

Care should be taken for the following points concerning the optical system mounted on the LCX011AM.

1) Light reflected from the optical system to the panel should be 20,000 lux or less.
2) Particular care should be taken for the panel incident angle distribution when designing optical systems for use with the LCX011AM.
3) The panel surface temperature distribution should not exceed 10°C.
4) Light should shine only on the effective display area within the LCD panel and not on other unnecessary locations. Leakage light may produce unwanted temperature rises.

Notes on Handling

(1) Static charge prevention

Be sure to take following protective measures. TFT-LCD panels are easily damaged by static charge.

a) Use non-chargeable gloves, or simply use bare hands.
b) Use an earth-band when handling.
c) Do not touch any electrodes of a panel.
d) Wear non-chargeable clothes and conductive shoes.
e) Install conductive mat on the working floor and working table.
f) Keep panels away from any charged materials.
g) Use ionized air to discharge the panels.

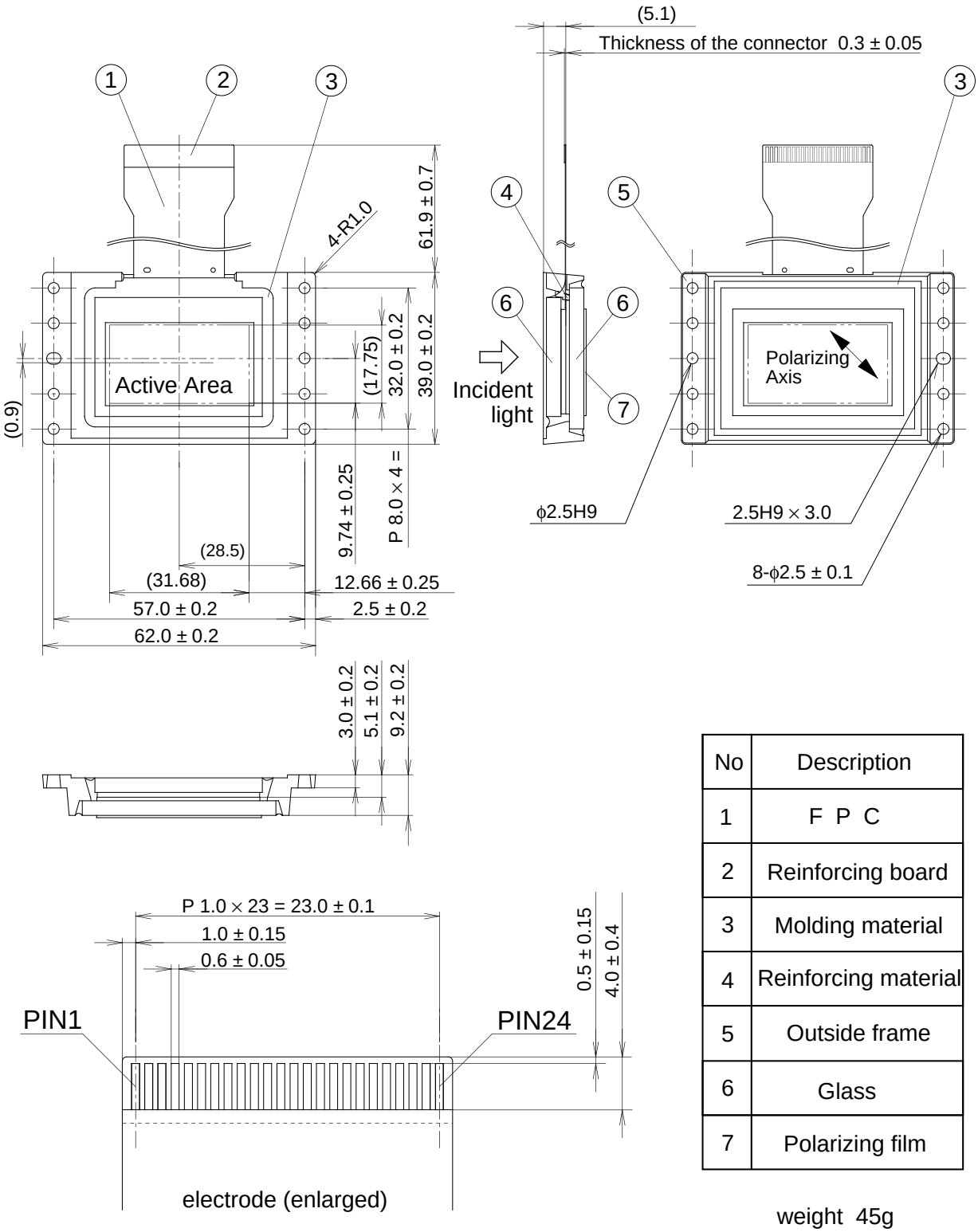
(2) Protection from dust and dirt

a) Operate in clean environment.
b) When delivered, a surface of a panel (Polarizer) is covered by a protective sheet.
Peel off the protective sheet carefully not to damage the panel.
c) Do not touch the surface of a panel. The surface is easily scratched. When cleaning, use a clean-room wiper with isopropyl alcohol. Be careful not to leave stain on the surface.
d) Use ionized air to blow off dust at a panel.

(3) Other handling precautions

a) Do not twist or bend the flexible PC board especially at the connecting region because the board is easily deformed.
b) Do not drop a panel.
c) Do not twist or bend a panel or a panel frame.
d) Keep a panel away from heat source.
e) Do not dampen a panel with water or other solvents.
f) Avoid to store or to use a panel in a high temperature or in a high humidity, which may result in panel damages.
g) Minimum radius of bending curvature for a flexible substrate must be 1mm.
h) Torque required to tighten screws on a panel must be 3kg · cm or less.

Package Outline Unit: mm



No	Description
1	F P C
2	Reinforcing board
3	Molding material
4	Reinforcing material
5	Outside frame
6	Glass
7	Polarizing film

weight 45g

The rotation angle of the active area relative to H and V is ± 1°.