

Diagonal 6mm (Type 1/3) CCD Image Sensor for PAL Color Video Cameras

Description

The ICX409AKB is an interline CCD solid-state image sensor suitable for NTSC color video cameras with a diagonal 6mm (Type 1/3) system. Compared with the current product ICX059AKB, basic characteristics such as sensitivity, smear, dynamic range and S/N are improved drastically.

This chip features a field period readout system and an electronic shutter with variable charge-storage time. Also, this outline is miniaturized by using original package.

This chip is suitable for applications such as surveillance cameras, automotive cameras, etc.

Features

- High sensitivity (+6dB compared with the ICX059AKB)
- Low smear (-15dB compared with the ICX059AKB)
- High D range (+5dB compared with the ICX059AKB)
- High S/N
- High resolution and low dark current
- Excellent antiblooming characteristics
- Ye, Cy, Mg, and G complementary color mosaic filters on chip
- Continuous variable-speed shutter
- No voltage adjustment
(Reset gate and substrate bias are not adjusted.)
- Horizontal register: 5V drive
- Reset gate pulse: 5V drive

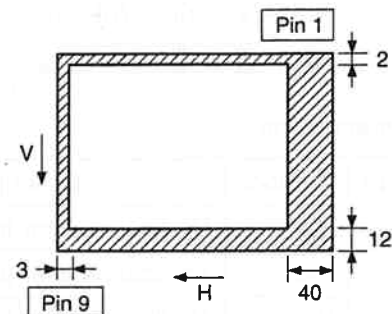
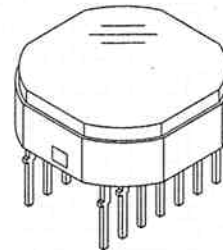
Device Structure

- Interline CCD image sensor
- Optical size: Diagonal 6mm (Type 1/3)
- Number of effective pixels: 752 (H) × 582 (V) approx. 440K pixels
- Total number of pixels: 795 (H) × 596 (V) approx. 470K pixels
- Chip size: 5.59mm (H) × 4.68mm (V)
- Unit cell size: 6.50μm (H) × 6.25μm (V)
- Optical black: Horizontal (H) direction: Front 3 pixels, rear 40 pixels
Vertical (V) direction: Front 12 pixels, rear 2 pixels
- Number of dummy bits: Horizontal 22
Vertical 1 (even fields only)
- Substrate material: Silicon

Super HAD CCD™

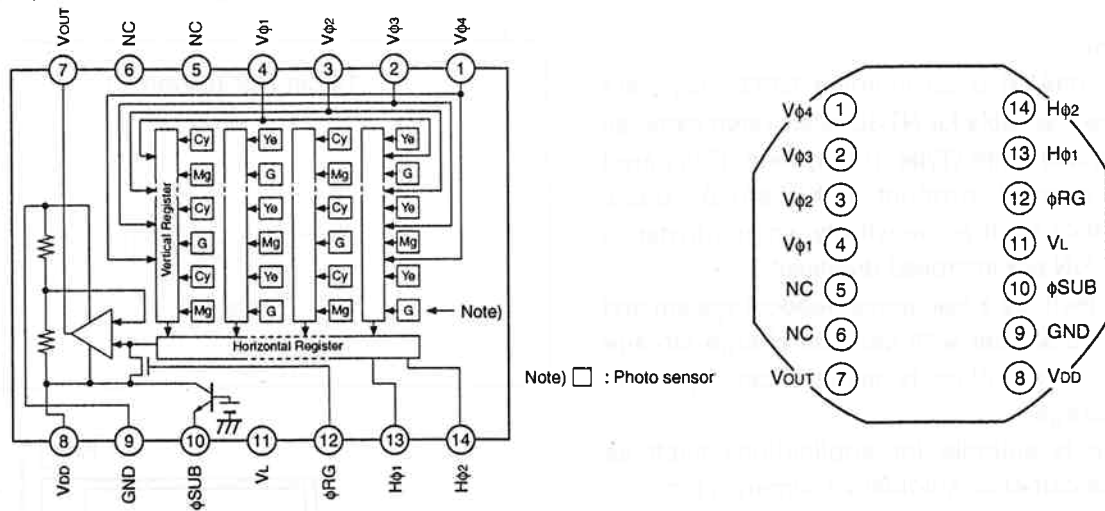
* Super HAD CCD is a trademark of Sony Corporation. The Super HAD CCD is a version of Sony's high performance CCD HAD (Hole-Accumulation Diode) sensor with sharply improved sensitivity by the incorporation of a new semiconductor technology developed by Sony Corporation.

14 pin DIP (Ceramic)

**Optical black position
(Top View)**

Block Diagram and Pin Configuration

(Top View)



Pin Description

Pin No.	Symbol	Description	Pin No.	Symbol	Description
1	Vφ4	Vertical register transfer clock	8	VDD	Supply voltage
2	Vφ3	Vertical register transfer clock	9	GND	GND
3	Vφ2	Vertical register transfer clock	10	φSUB	Substrate clock
4	Vφ1	Vertical register transfer clock	11	VL	Protective transistor bias
5	NC		12	φRG	Reset gate clock
6	NC		13	Hφ1	Horizontal register transfer clock
7	VOUT	Signal output	14	Hφ2	Horizontal register transfer clock

Absolute Maximum Ratings

Item		Ratings	Unit	Remarks
Against φSUB	VDD, VOUT, RG - φSUB	-40 to +8	V	
	Vφ1, Vφ3 - φSUB	-50 to +15	V	
	Vφ2, Vφ4, VL - φSUB	-50 to +0.3	V	
	Hφ1, Hφ2, GNG - φSUB	-40 to +0.3	V	
Against GND	VDD, VOUT, RG - GND	-0.3 to +20	V	
	Vφ1, Vφ2, Vφ3, Vφ4 - GND	-10 to +18	V	
	Hφ1, Hφ2 - GND	-10 to +6	V	
Against VL	Vφ1, Vφ3 - VL	-0.3 to +28	V	
	Vφ2, Vφ4, Hφ1, Hφ2, GND - VL	-0.3 to +15	V	
Between input clock pins	Voltage difference between horizontal clock input pins	to +15	V	*1
	Hφ1 - Hφ2	-6 to +6	V	
	Hφ1, Hφ2 - Vφ4	-14 to +14	V	
Storage temperature		-30 to +80	°C	
Operating temperature		-10 to +60	°C	

*1 +24V (Max.) when clock width < 10μs, clock duty factor < 0.1%.

Bias Conditions

Item	Symbol	Min.	Typ.	Max.	Unit	Remarks
Supply voltage	V _{DD}	14.55	15.0	15.45	V	
Protective transistor bias	V _L		*1			
Substrate clock	φ _{SUB}		*2			

*1 V_L setting is the V_{VL} voltage of the vertical transfer clock waveform, or the same supply voltage as the V_L power supply for the V driver should be used.

*2 Do not apply a DC bias to the substrate clock pin, because a DC bias is generated within the CCD.

DC Characteristics

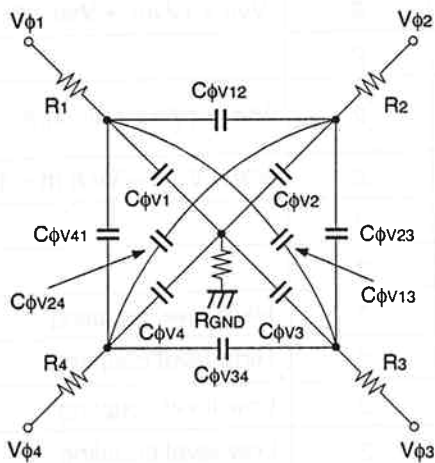
Item	Symbol	Min.	Typ.	Max.	Unit	Remarks
Supply current	I _{DD}		4	6	mA	

Clock Voltage Conditions

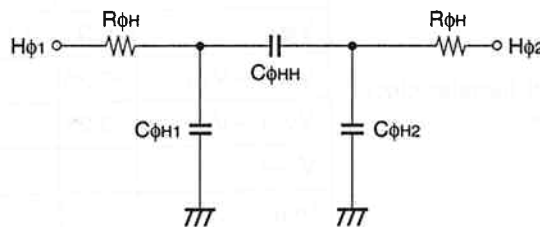
Item	Symbol	Min.	Typ.	Max.	Unit	Waveform diagram	Remarks
Readout clock voltage	V _{VT}	14.55	15.0	15.45	V	1	
Vertical transfer clock voltage	V _{VH1} , V _{VH2}	-0.05	0	0.05	V	2	$V_{VH} = (V_{VH1} + V_{VH2})/2$
	V _{VH3} , V _{VH4}	-0.2	0	0.05	V	2	
	V _{VL1} , V _{VL2} , V _{VL3} , V _{VL4}	-8.0	-7.0	-6.5	V	2	$V_{VL} = (V_{VL3} + V_{VL4})/2$
	V _{φV}	6.3	7.0	8.05	V	2	$V_{φV} = V_{VHn} - V_{VLn} (n = 1 \text{ to } 4)$
	V _{VH3} - V _{VH}	-0.25		0.1	V	2	
	V _{VH4} - V _{VH}	-0.25		0.1	V	2	
	V _{VHH}			0.3	V	2	High-level coupling
	V _{VHL}			0.3	V	2	High-level coupling
	V _{VLH}			0.3	V	2	Low-level coupling
	V _{VLL}			0.3	V	2	Low-level coupling
Horizontal transfer clock voltage	V _{φH}	4.75	5.0	5.25	V	3	
	V _{HL}	-0.05	0	0.05	V	3	
Reset gate clock voltage	V _{φRG}	4.5	5.0	5.5	V	4	Input through 0.1μF capacitance
	V _{RGLH} - V _{RGLL}			0.4	V	4	Low-level coupling
	V _{RGL} - V _{RGLm}		5.0	0.5	V	4	Low-level coupling
	V _{RGH}	V _{DD} +0.3	V _{DD} +0.6	V _{DD} +0.9	V	4	
Substrate clock voltage	V _{φSUB}	21.0	22.0	23.5	V	5	

Clock Equivalent Circuit Constant

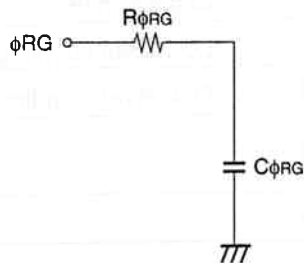
Item	Symbol	Min.	Typ.	Max.	Unit	Remarks
Capacitance between vertical transfer clock and GND	$C_{\phi V1}, C_{\phi V3}$		1500		pF	
	$C_{\phi V2}, C_{\phi V4}$		1000		pF	
Capacitance between vertical transfer clocks	$C_{\phi V12}, C_{\phi V34}$		820		pF	
	$C_{\phi V23}, C_{\phi V41}$		330		pF	
	$C_{\phi \zeta 13}$		120		pF	
	$C_{\phi \zeta 24}$		100		pF	
Capacitance between horizontal transfer clock and GND	$C_{\phi H1}, C_{\phi H2}$		75		pF	
Capacitance between horizontal transfer clocks	$C_{\phi HH}$		22		pF	
Capacitance between reset gate clock and GND	$C_{\phi RG}$		5		pF	
Capacitance between substrate clock and GND	$C_{\phi SUB}$		270		pF	
Vertical transfer clock series resistor	R_1, R_3		100		Ω	
	R_2, R_4		150		Ω	
Vertical transfer clock ground resistor	R_{GND}		68		Ω	
Horizontal transfer clock series resistor	$R_{\phi H}$		15		Ω	
Reset gate clock series resistor	$R_{\phi RG}$		50		Ω	



Vertical transfer clock equivalent circuit



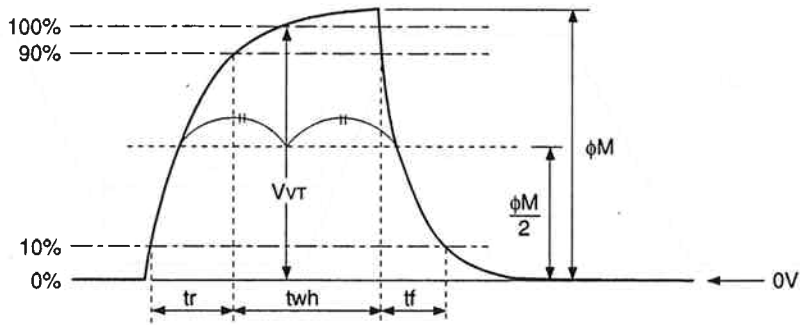
Horizontal transfer clock equivalent circuit



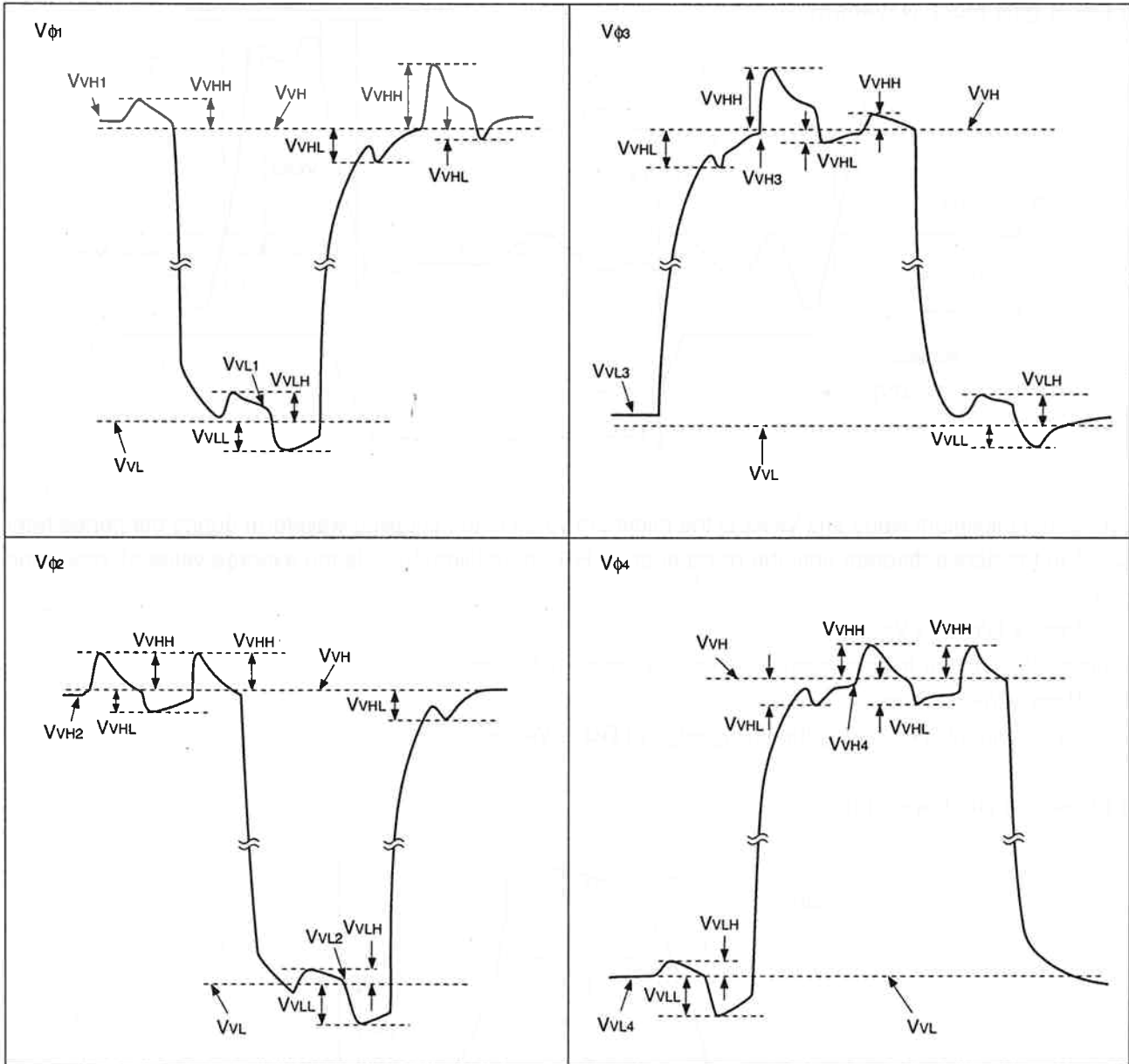
Reset gate clock equivalent circuit

Drive Clock Waveform Conditions

(1) Readout clock waveform



(2) Vertical transfer clock waveform

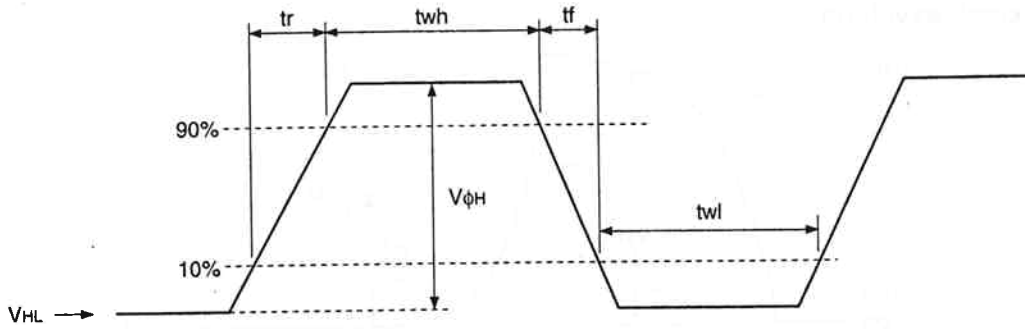


$$V_{VH} = (V_{VH1} + V_{VH2})/2$$

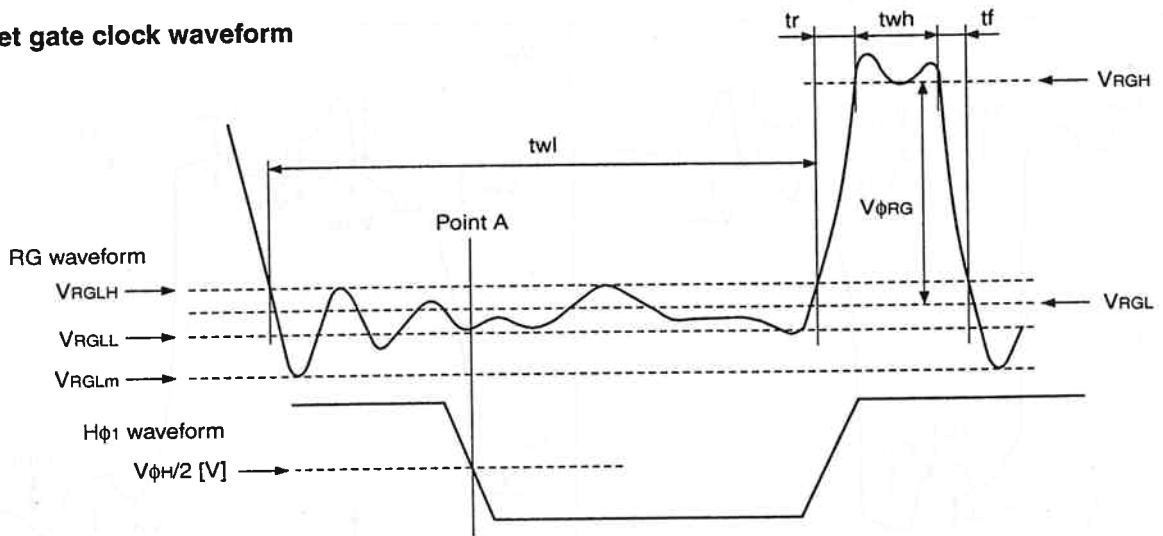
$$V_{VL} = (V_{VL3} + V_{VL4})/2$$

$$V_{\phi} = V_{VHn} - V_{VLn} \quad (n = 1 \text{ to } 4)$$

(3) Horizontal transfer clock waveform



(4) Reset gate clock waveform



V_{RGLH} is the maximum value and V_{RGLL} is the minimum value of the coupling waveform during the period from Point A in the above diagram until the rising edge of RG. In addition, V_{RGL} is the average value of V_{RGLH} and V_{RGLL} .

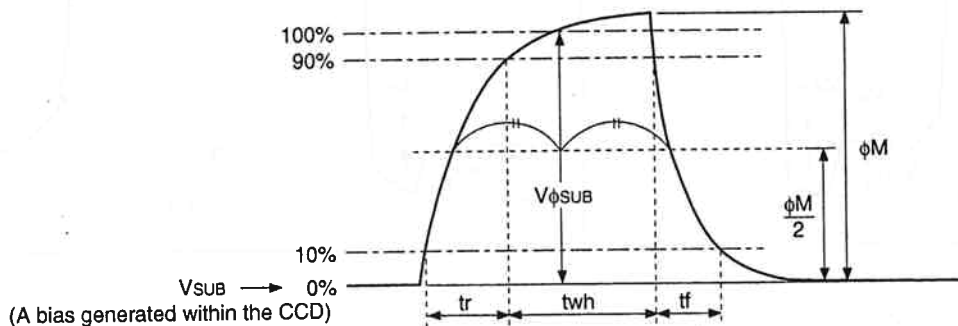
$$V_{RGL} = (V_{RGLH} + V_{RGLL})/2$$

Assuming V_{RGH} is the minimum value during the period t_{wh} , then:

$$V_{\phi RG} = V_{RGH} - V_{RGL}$$

Negative overshoot level during the falling edge of RG is V_{RGLm} .

(5) Substrate clock waveform



Clock Switching Characteristics

Item	Symbol	twh			twl			tr			tf			Unit	Remarks
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.		
Readout clock	V _T	2.3	2.5						0.5			0.5		μs	During readout
Vertical transfer clock	V _{φ1} , V _{φ2} , V _{φ3} , V _{φ4}										15		250	ns	*1
Horizontal transfer clock	During imaging	H _{φ1}	26	28.5		26	28.5		6.5	9.5		6.5	9.5	ns	*2
		H _{φ2}	26	28.5		26	28.5		6.5	9.5		6.5	9.5		
	During parallel-serial conversion	H _{φ1}		5.38					0.01			0.01		μs	
		H _{φ2}					5.38		0.01			0.01			
Reset gate clock	φ _{RG}	11	13			51		3			3		ns		
Substrate clock	φ _{SUB}	1.5	1.8							0.5			0.5	μs	During drain charge

*1 When vertical transfer clock driver CXD1267AN is used.

*2 $t_f \geq t_r - 2ns$, and the cross-point voltage (V_{CR}) for the H_{φ1} rising side of the H_{φ1} and H_{φ2} waveforms must be at least V_{φH}/2 [V].

Item	Symbol	two			Unit	Remarks
		Min.	Typ.	Max.		
Horizontal transfer clock	H _{φ1} , H _{φ2}	22	26		ns	*3

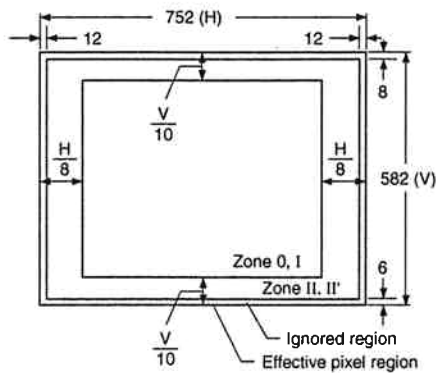
*3 The overlap period for twh and twl of horizontal transfer clocks H_{φ1} and H_{φ2} is two.

Image Sensor Characteristics

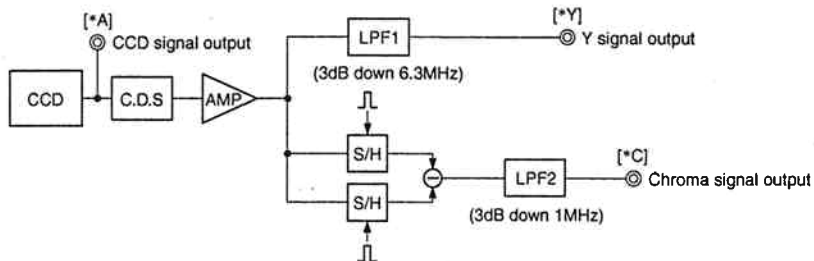
(Ta = 25°C)

Item	Symbol	Min.	Typ.	Max.	Unit	Measurement method	Remarks
Sensitivity	S	760	950		mV	1	
Sensitivity ratio	R _{MgG}	0.93		1.35		2	
	R _{YeCy}	1.15		1.48		2	
Saturation signal	Y _{sat}	1000			mV	3	Ta = 60°C
Smear	Sm		-110	-93	dB	4	
Video signal shading	SHy			20	%	5	Zone 0 and I
				25	%	5	Zone 0 to II'
Uniformity between video signal channels	ΔSr			10	%	6	
	ΔSb			10	%	6	
Dark signal	Y _{dt}			2	mV	7	Ta = 60°C
Dark signal shading	ΔY _{dt}			1	mV	8	Ta = 60°C
Flicker Y	Fy			2	%	9	
Flicker R-Y	Fcr			5	%	9	
Flicker B-Y	Fcb			5	%	9	
Line crawl R	Lcr			3	%	10	
Line crawl G	Lcg			3	%	10	
Line crawl B	Lcb			3	%	10	
Line crawl W	Lcw			3	%	10	
Lag	Lag			0.5	%	11	

Zone Definition of Video Signal Shading



Measurement System



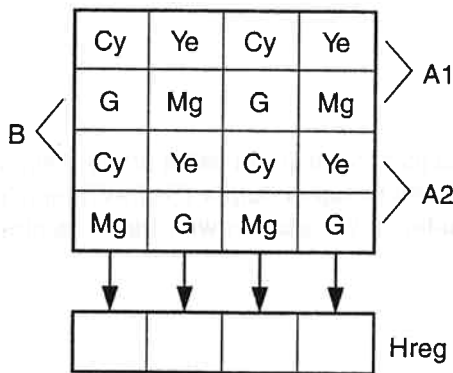
Note) Adjust the amplifier gain so that the gain between [*A] and [*Y], and between [*A] and [*C] equals 1.

Image Sensor Characteristics Measurement Method

◎ **Measurement conditions**

- 1) In the following measurements, the device drive conditions are at the typical values of the bias and clock voltage conditions.
- 2) In the following measurements, spot blemishes are excluded and, unless otherwise specified, the optical black level (OB) is used as the reference for the signal output, which is taken as the value of Y signal output or chroma signal output of the measurement system.

◎ **Color coding of this image sensor & Composition of luminance (Y) and chroma (color difference) signals**



Color Coding Diagram

As shown in the left figure, fields are read out. The charge is mixed by pairs such as A1 and A2 in the A field. (pairs such as B in the B field)

As a result, the sequence of charges output as signals from the horizontal shift register (Hreg) is, for line A1, (G + Cy), (Mg + Ye), (G + Cy), and (Mg + Ye).

These signals are processed to form the Y signal and chroma (color difference) signal. The Y signal is formed by adding adjacent signals, and the chroma signal is formed by subtracting adjacent signals. In other words, the approximation:

$$Y = \{(G + Cy) + (Mg + Ye)\} \times 1/2$$

$$= 1/2 \{2B + 3G + 2R\}$$

is used for the Y signal, and the approximation:

$$R - Y = \{(Mg + Ye) - (G + Cy)\}$$

$$= \{2R - G\}$$

is used for the chroma (color difference) signal. For line A2, the signals output from Hreg in sequence are (Mg + Cy), (G + Ye), (Mg + Cy), (G + Ye).

The Y signal is formed from these signals as follows:

$$Y = \{(G + Ye) + (Mg + Cy)\} \times 1/2$$

$$= 1/2 \{2B + 3G + 2R\}$$

This is balanced since it is formed in the same way as for line A1.

In a like manner, the chroma (color difference) signal is approximated as follows:

$$-(B - Y) = \{(G + Ye) - (Mg + Cy)\}$$

$$= -\{2B - G\}$$

In other words, the chroma signal can be retrieved according to the sequence of lines from R - Y and -(B - Y) in alternation. This is also true for the B field.

© Definition of standard imaging conditions

1) Standard imaging condition I:

Use a pattern box (luminance 706cd/m², color temperature of 3200K halogen source) as a subject. (Pattern for evaluation is not applicable.) Use a testing standard lens with CM500S (t = 1.0mm) as an IR cut filter and image at F5.6. The luminous intensity to the sensor receiving surface at this point is defined as the standard sensitivity testing luminous intensity.

2) Standard imaging condition II:

Image a light source (color temperature of 3200K) with a uniformity of brightness within 2% at all angles. Use a testing standard lens with CM500S (t = 1.0mm) as an IR cut filter. The luminous intensity is adjusted to the value indicated in each testing item by the lens diaphragm.

1. Sensitivity

Set to standard imaging condition I. After selecting the electronic shutter mode with a shutter speed of 1/250s, measure the Y signal (Y_s) at the center of the screen and substitute the value into the following formula.

$$S = Y_s \times \frac{250}{50} \text{ [mV]}$$

2. Sensitivity ratio

Set to standard imaging condition II. Adjust the luminous intensity so that the average value of the Y signal output is 200mV, and then measure the Mg signal output (S_{Mg} [mV]) and G signal output (S_G [mV]), and Ye signal output (S_{Ye} [mV]) and Cy signal output (S_{Cy} [mV]) at the center of the screen with frame readout method. Substitute the values into the following formula.

$$R_{MgG} = S_{Mg}/S_G$$

$$R_{YeCy} = S_{Ye}/S_{Cy}$$

3. Saturation signal

Set to standard imaging condition II. After adjusting the luminous intensity to 10 times the intensity with average value of the Y signal output, 200mV, measure the minimum value of the Y signal.

4. Smear

Set to standard imaging condition II. With the lens diaphragm at F5.6 to F8, adjust the luminous intensity to 500 times the intensity with average value of the Y signal output, 200mV. When the readout clock is stopped and the charge drain is executed by the electronic shutter at the respective H blankings, measure the maximum value Y_{Sm} [mV] of the Y signal output and substitute the value into the following formula.

$$S_m = 20 \times \log \left(\frac{Y_{Sm}}{200} \times \frac{1}{500} \times \frac{1}{10} \right) \text{ [dB]} \quad (1/10V \text{ method conversion value})$$

5. Video signal shading

Set to standard imaging condition II. With the lens diaphragm at F5.6 to F8, adjust the luminous intensity so that the average value of the Y signal output is 200mV. Then measure the maximum (Y_{max} [mV]) and minimum (Y_{min} [mV]) values of the Y signal and substitute the values into the following formula.

$$SH_y = (Y_{max} - Y_{min})/200 \times 100 \text{ [%]}$$

6. Uniformity between video signal channels

Set to standard imaging condition II. Adjust the luminous intensity so that the average value of the Y signal output is 200mV, and then measure the maximum (C_{rmax}, C_{bmax} [mV]) and minimum (C_{rmin}, C_{bmin} [mV]) values of the R - Y and B - Y channels of the chroma signal and substitute the values into the following formula.

$$\Delta S_r = | (C_{rmax} - C_{rmin})/200 | \times 100 \text{ [%]}$$

$$\Delta S_b = | (C_{bmax} - C_{bmin})/200 | \times 100 \text{ [%]}$$

7. Dark signal

Measure the average value of the Y signal output (Y_{dt} [mV]) with the device ambient temperature 60°C and the device in the light-obstructed state, using the horizontal idle transfer level as a reference.

8. Dark signal shading

After measuring 7, measure the maximum (Y_{dmax} [mV]) and minimum (Y_{dmin} [mV]) values of the dark signal output and substitute the values into the following formula.

$$\Delta Y_{dt} = Y_{dmax} - Y_{dmin} \text{ [mV]}$$

9. Flicker

1) F_y

Set to standard imaging condition II. Adjust the luminous intensity so that the average value of the Y signal output is 200mV, and then measure the difference in the signal level between fields (ΔY_f [mV]). Then substitute the value into the following formula.

$$F_y = (\Delta Y_f / 200) \times 100 \text{ [%]}$$

2) F_{cr} , F_{cb}

Set to standard imaging condition II. Adjust the luminous intensity so that the average value of the Y signal output is 200mV, insert an R or B filter, and then measure both the difference in the signal level between fields of the chroma signal (ΔC_r , ΔC_b) as well as the average value of the chroma signal output (C_{Ar} , C_{Ab}). Substitute the values into the following formula.

$$F_{ci} = (\Delta C_i / C_{Ai}) \times 100 \text{ [%]} \quad (i = r, b)$$

10. Line crawls

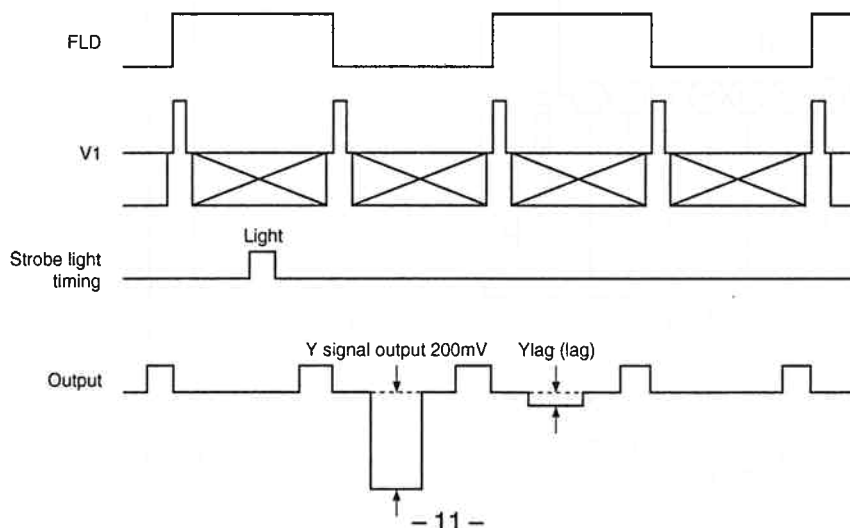
Set to standard imaging condition II. Adjust the luminous intensity so that the average value of the Y signal output is 200mV, and then insert a white subject and R, G, and B filters and measure the difference between Y signal lines for the same field (ΔY_{lw} , ΔY_{lr} , ΔY_{lg} , ΔY_{lb} [mV]). Substitute the values into the following formula.

$$L_{ci} = (\Delta Y_{li} / 200) \times 100 \text{ [%]} \quad (i = w, r, g, b)$$

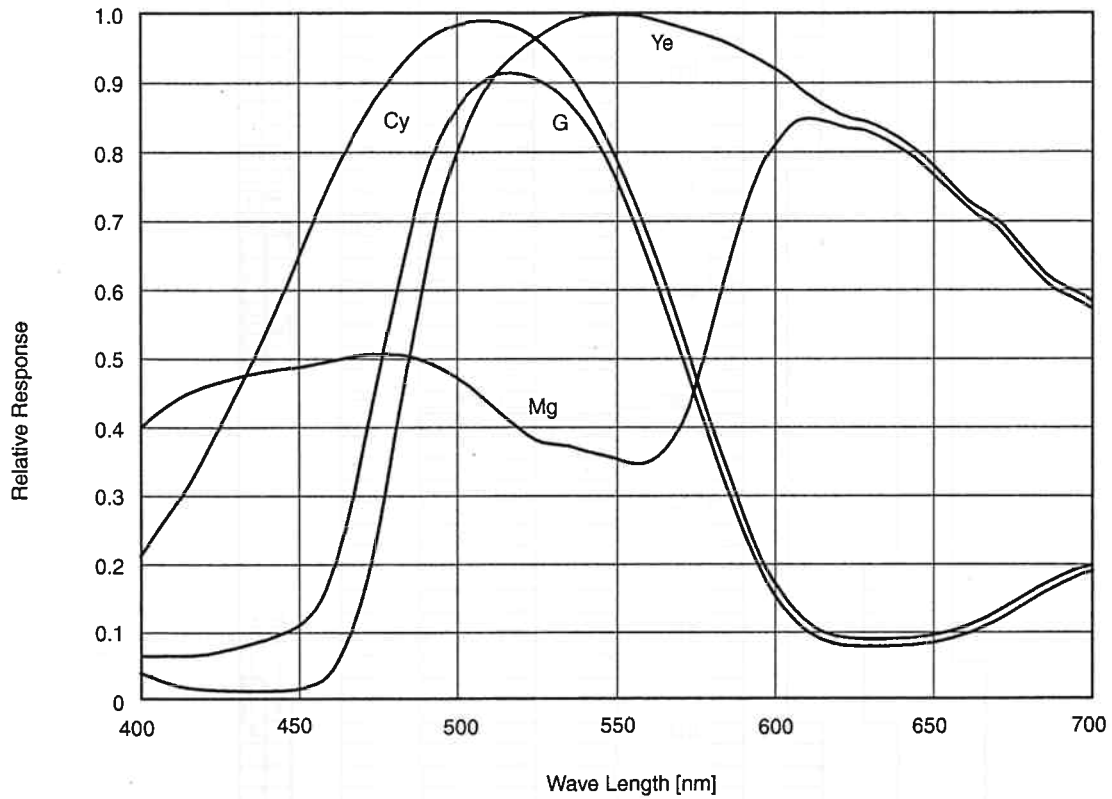
11. Lag

Adjust the Y signal output value generated by strobe light to 200mV. After setting the strobe light so that it strobes with the following timing, measure the residual signal (Y_{lag}). Substitute the value into the following formula.

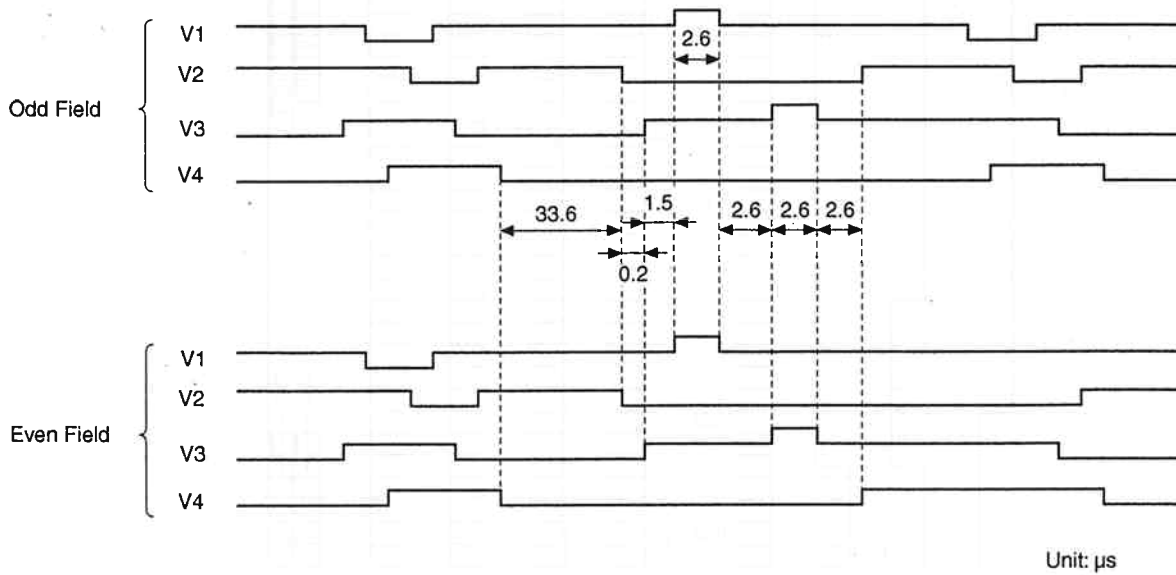
$$Lag = (Y_{lag} / 200) \times 100 \text{ [%]}$$



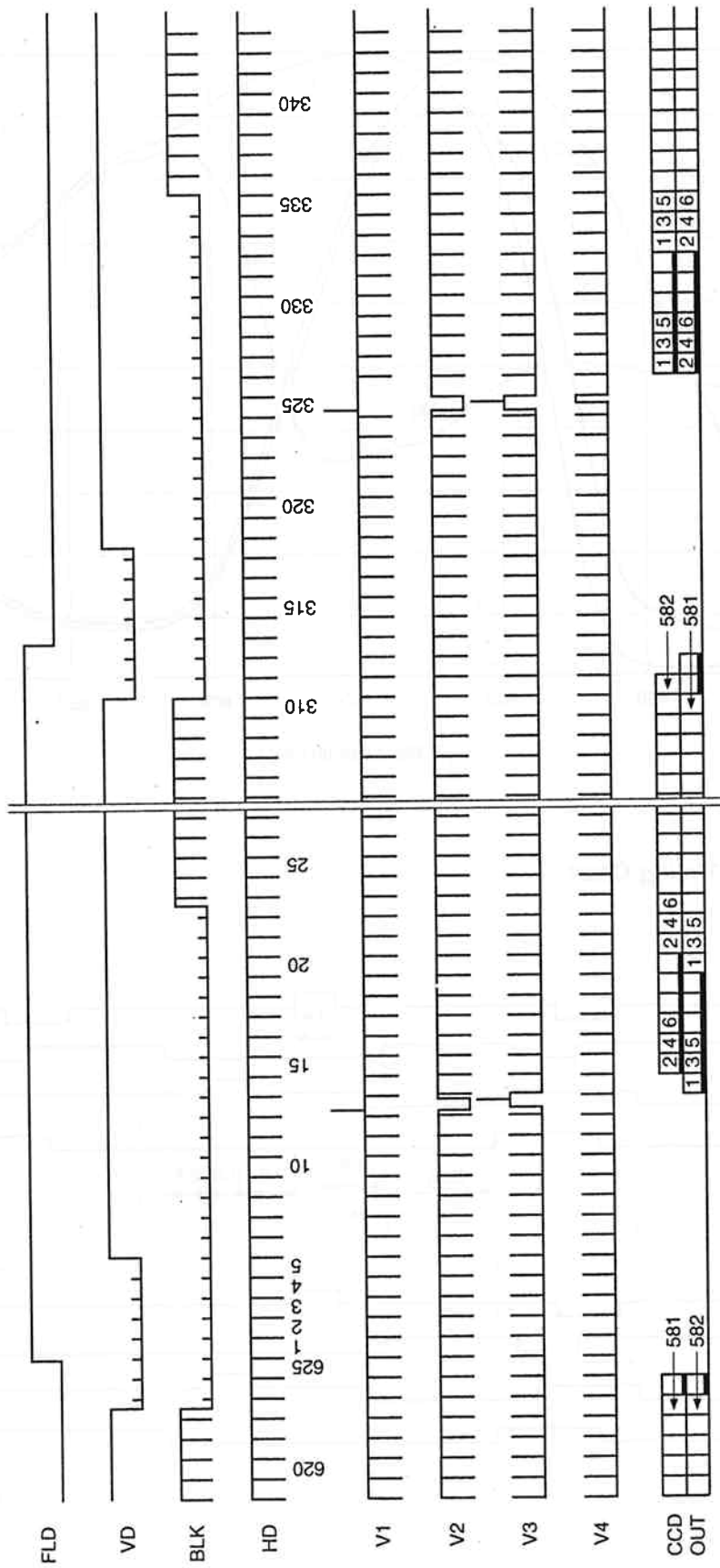
Spectral Sensitivity Characteristics (Excludes lens characteristics and light source characteristics)



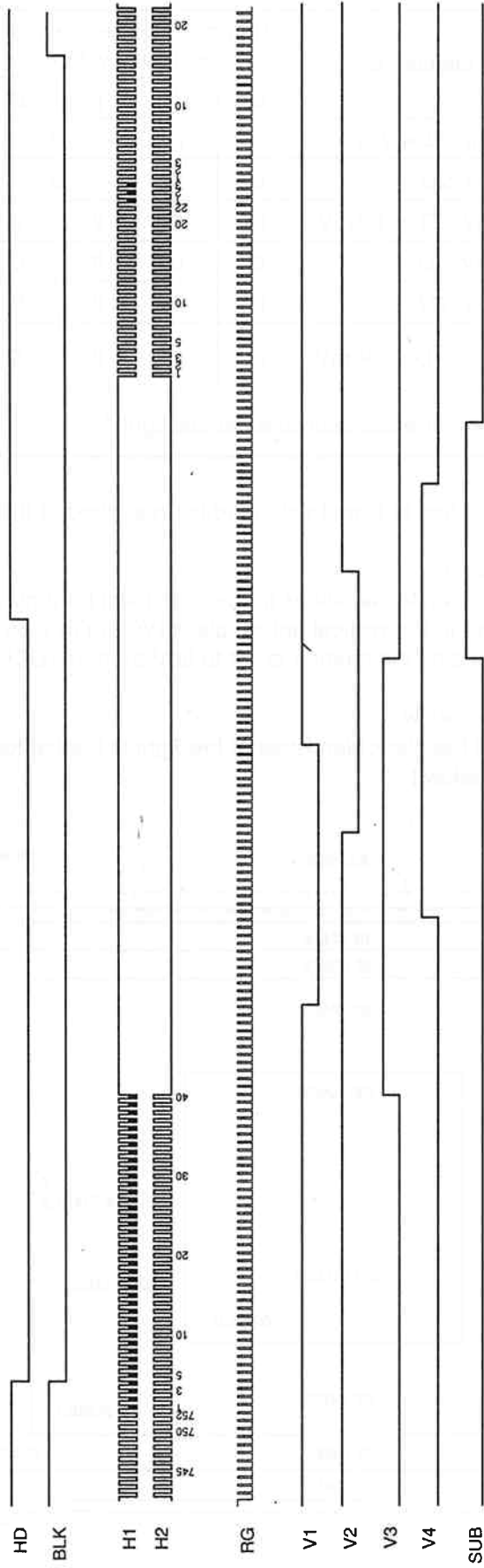
Sensor Readout Clock Timing Chart



Drive Timing Chart (Vertical Sync)



Drive Timing Chart (Horizontal Sync)



Spot Blemish Specifications

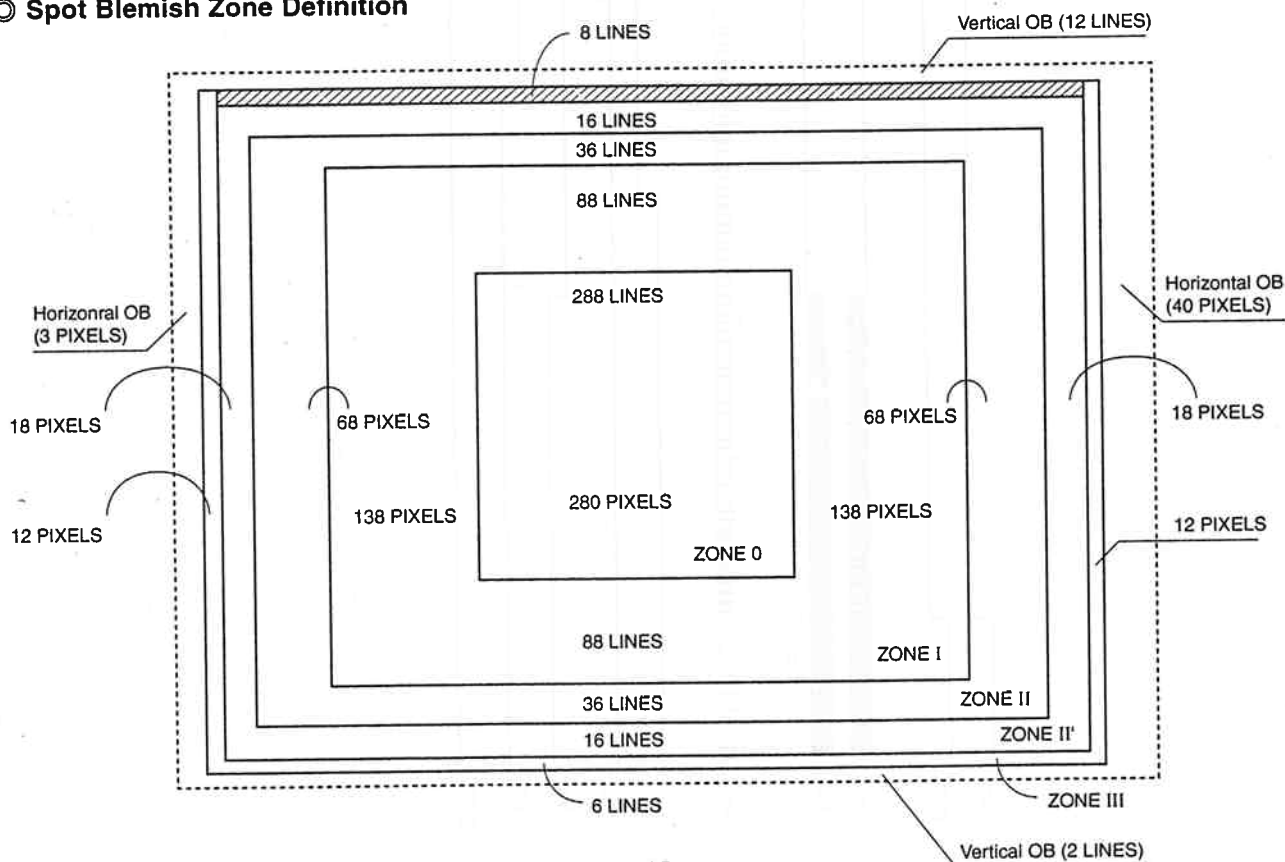
(Y signal, Ta = 25°C)

Spot blemish	Spot blemish level	Number of allowable spot blemishes by zone				Measurement method	Remarks
		0	I	II	II'		
Black or white blemishes at high light	$5\% \leq D < 7\%$	0	2	3		1	
	$7\% \leq D$	0	0	0			
Black blemishes at low light	$1.0\text{mV} \leq D < 1.2\text{mV}$	0	0	2	2	2	
	$1.2\text{mV} \leq D$	0	0	0	0		
White blemishes in the dark	$1.4\text{mV} \leq D$	0	0	0	0	3	Ta = 60°C
Black blemishes at signal saturated	$D \leq 850\text{mV}$	0	0	0	0	4	
Black or white blemishes at electronic shutter operation	Same as for black blemishes at low light.					5	

Notes

- 1) D ... Spot blemish level. Black blemishes at signal saturated is prescribed at the Y signal output in blemish part.
- 2) Zone III - no evaluation criteria applied.
- 3) In the optical black (OB), the level of white blemishes in the dark must be 3mV or less in the horizontal optical black (HOB) and 9mV or less in the vertical optical black (VOB) (Ta = 60°C).
- 4) The distance between spot blemishes on the monitor is set to 50V or more (CCIR frame line number conversion).
- 5) Zone definition is illustrated in figure below.
- 6) The Zone II' specification applies to the black blemishes at low light in the halftone area of Zone III on the monitor. (See the figure shown below.)

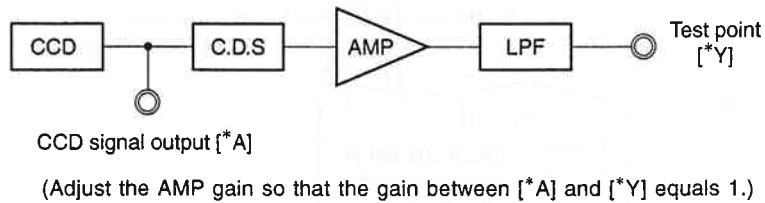
© Spot Blemish Zone Definition



◎ Measurement Method for Spot Blemishes

After setting to standard imaging condition II, and the device driver should be set to meet bias and clock voltage conditions.

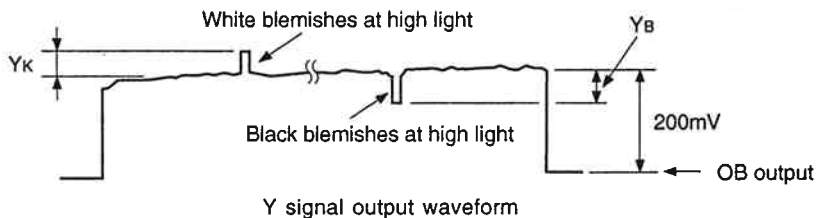
Configure the driver circuit according to the example below and measure at the test point shown.



1. Black or white blemishes at high light

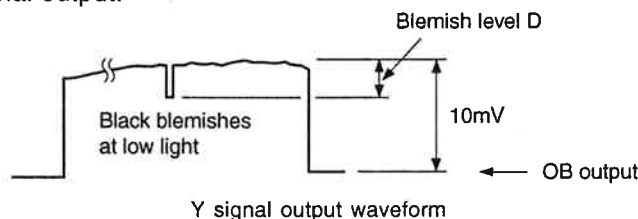
After adjusting the luminous intensity so that the average value of the Y signal output is 200mV, measure the local dip point (black blemishes at high light, Y_B) and peak point (white blemishes at high light, Y_K) in the signal output, and then substitute the value into the following formula.

$$\text{Blemish level D} = \frac{Y_K \text{ (or) } Y_B}{200} \times 100 [\%]$$



2. Black blemishes at low light

After adjusting the luminous intensity so that the average value of the Y signal output is 10mV, measure the local dip point in the signal output.

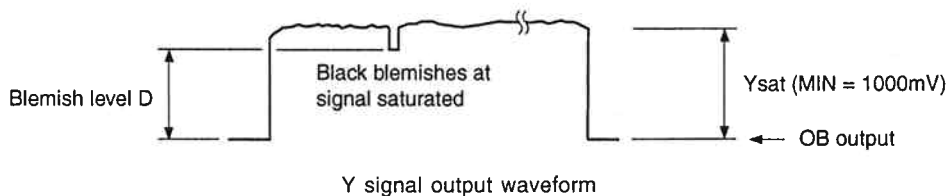


3. White blemishes in the dark

Set the device to a dark setting and measure the local peak point of the Y signal output waveform, using the average value of the dark signal output as a reference.

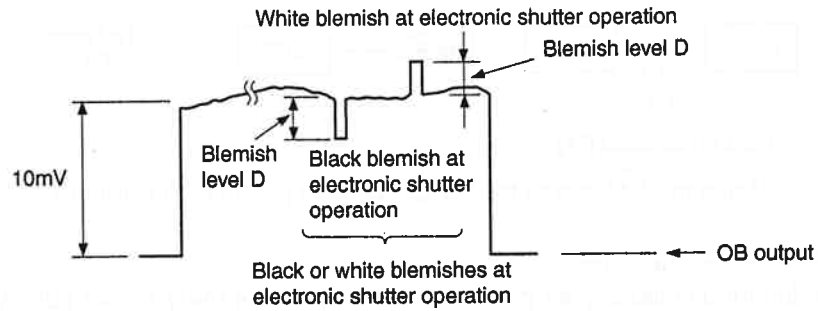
4. Black blemishes at signal saturated

Set the device to operate in saturation and measure the local dip point, using the OB output as a reference.



5. Black or white blemishes at electronic shutter operation

Set to electronic shutter operation, adjust the luminous intensity so that the average value of the Y signal output is 10mV, and measure the local dip point (black blemishes at electronic shutter operation) and peak point (white blemishes at electronic shutter operation).



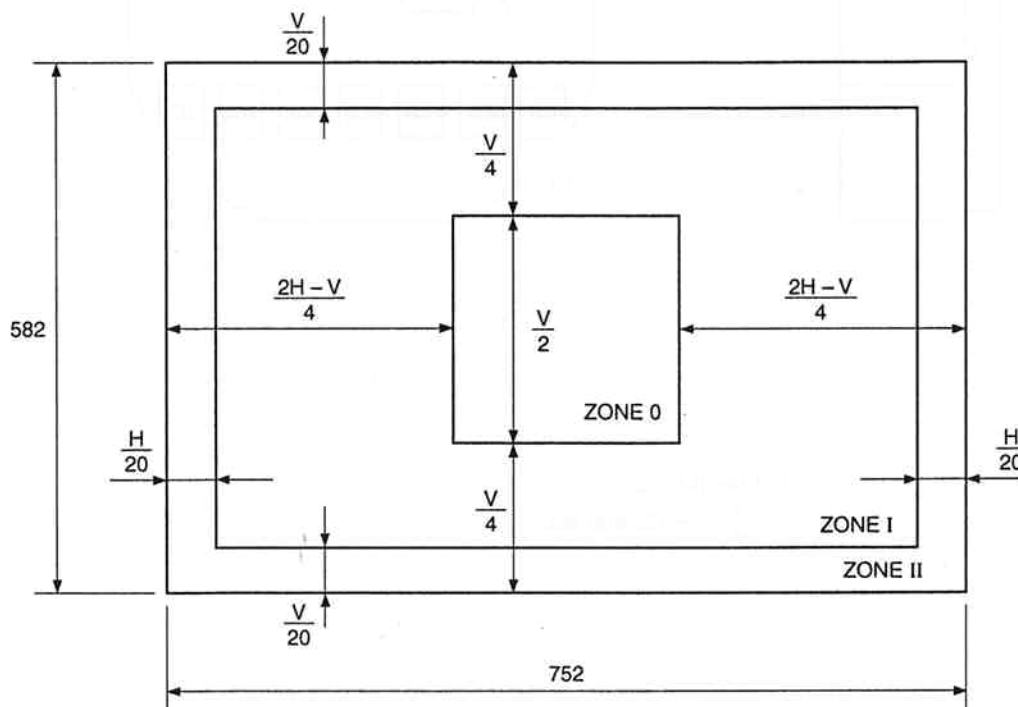
Y signal output waveform

Stain Specifications

Zone	Allowable blemishes	Total allowable blemishes	Size	Level	Interval
0	1	3	$3 \leq L \leq 10$ lines	$4 \leq R \leq 8\%$	≥ 200 lines
I	2				
II	3		$4 \leq L \leq 20$ lines	$4 \leq R \leq 8\%$	Overlap permitted

For instances of two or more zones, the surface area of the largest zone is used.

© **Stain Zone Definition**

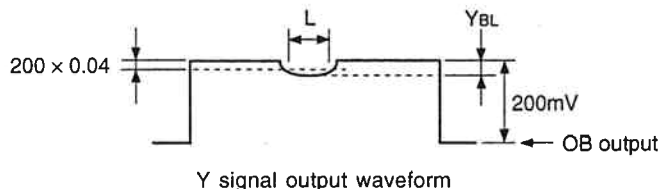


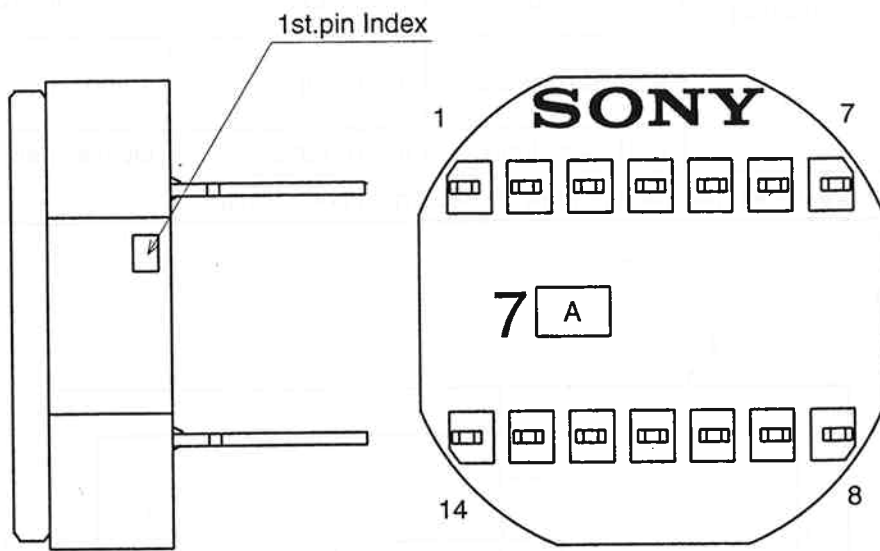
© **Stain Measurement Method**

In the following measurements, set to standard imaging condition II, set the lens iris to F16, and adjust the luminous intensity so that the average value of the Y signal output is 200mV. Measure the local dip in the average value of the Y signal output (Y_{BL}) and then calculate the stain level (R) as the ratio of Y_{BL} to the average value of the Y signal output.

$$R = \frac{Y_{BL}}{200} \times 100 [\%]$$

At the same time, the size (L) of the area where the stain level is 4% or more is determined by CCIR frame line number conversion. The distance from one center of a stain to another is the stain interval, and is also determined in the same fashion by CCIR frame line number conversion.





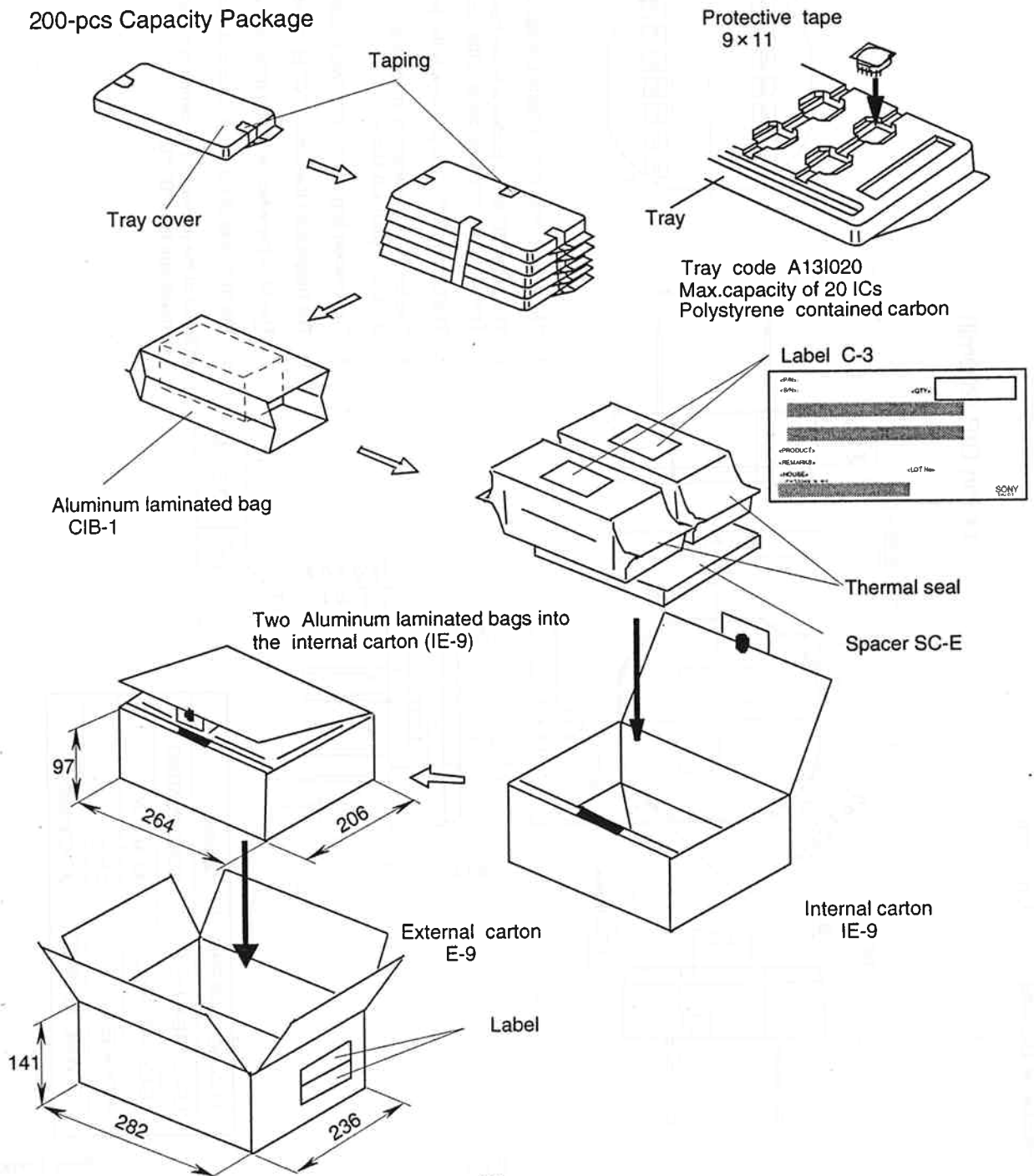
A : Lot No. (Max.2)

□□ — Control No.

CCD Image Sensor Package Specification KB-14

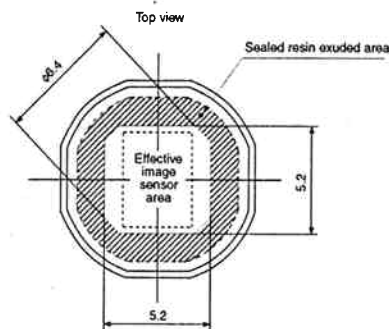
Packing code	Package code	Quantity (pcs)			Packing form	
		Tray	Internal carton	External carton	Internal carton	External carton
KB-14	AS-C3 AS-C10	20	200	200	2 Aluminum laminated bags Dimensions : mm W × D × H 264 × 206 × 97	1 Internal carton Dimensions : mm W × D × H 282 × 236 × 141

200-pcs Capacity Package



Notes on Handling

- 1) Static charge prevention
 CCD image sensors are easily damaged by static discharge. Before handling be sure to take the following protective measures.
 - a) Either handle bare handed or use non-chargeable gloves, clothes or material.
 Also use conductive shoes.
 - b) When handling directly use an earth band.
 - c) Install a conductive mat on the floor or working table to prevent the generation of static electricity.
 - d) Ionized air is recommended for discharge when handling CCD image sensor.
 - e) For the shipment of mounted substrates, use boxes treated for the prevention of static charges.
- 2) Soldering
 - a) Make sure the package temperature does not exceed 80°C.
 - b) Solder dipping in a mounting furnace causes damage to the glass and other defects. Use a 30W soldering iron with a ground wire and solder each pin in less than 2 seconds. For repairs and remount, cool sufficiently.
 - c) To dismount an image sensor, do not use a solder suction equipment. When using an electric desoldering tool, use a thermal controller of the zero cross On/Off type and connect it to ground.
- 3) Dust and dirt protection
 Image sensors are packed and delivered by taking care of protecting its glass plates from harmful dust and dirt. Clean glass plates with the following operation as required, and use them.
 - a) Operate in clean environments (around class 1000 is appropriate).
 - b) Do not either touch glass plates by hand or have any object come in contact with glass surfaces. Should dirt stick to a glass surface, blow it off with an air blower. (For dirt stuck through static electricity ionized air is recommended.)
 - c) Clean with a cotton bud and ethyl alcohol if the grease stained. Be careful not to scratch the glass.
 - d) Keep in a case to protect from dust and dirt. To prevent dew condensation, preheat or precool when moving to a room with great temperature differences.
 - e) When a protective tape is applied before shipping, just before use remove the tape applied for electrostatic protection. Do not reuse the tape.
- 4) Do not expose to strong light (sun rays) for long periods, as color filters will be discolored. When high luminous objects are imaged with the exposure level control by the electronic-iris, the luminance of the image-plane may become excessive and discolor of the color filter will possibly be accelerated. In such a case, it is advisable that taking-lens with the automatic-iris and closing of the shutter during the power-off mode should be properly arranged. For continuous using under cruel condition exceeding the normal using condition, consult our company.
- 5) Exposure to high temperature or humidity will affect the characteristics. Accordingly avoid storage or usage in such conditions.
- 6) CCD image sensors are precise optical equipment that should not be subject to too much mechanical shocks.
- 7) Eclipse (to get dark around the four corners of the picture) may occur when some object lenses are in the open iris state.



Additional Information

There is some possibility that CCD Image Sensing devices could be damaged during transportation and/or stocking after the dispatch from the manufacturing sites, and then it may happen at random and/or suddenly. By way of a realistic measures to this phenomenon, we highly recommend that "Defect Compensation" circuit should be adopted within the camera system. Should you require further assistance on this issue, please send us an inquiry.