



## GENERAL DESCRIPTION

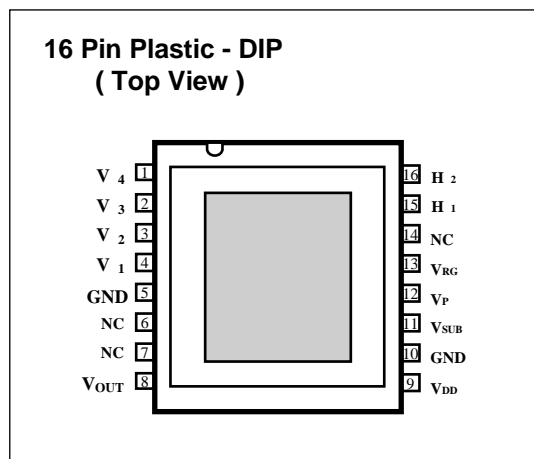
The **Ai329CA** is a 290K pixels' CCD area sensor for PAL 1/3 inch video cameras. Buried photodiodes and micro lenses are adopted for low noise, low smear and high sensitivity. A chrominance signal is achieved by the adoption of Yellow, Magenta, Cyan and Green complementary color mosaic filters. This product also has the features of strong anti-blooming and electronic shutter with variable charge-storage time.

## FEATURES

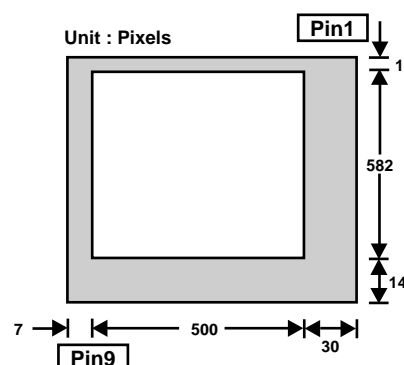
- Micro lens arrays for high sensitivity
- Ye, Mg, Cy and G complementary color mosaic filters
- Excellent blooming suppression
- TTL level(5V) operation on HCCD & RG electrodes
- 16 pin plastic DIP type package
- Variable electronic shutter of 1/50 to 1/100,000 sec
- High sensitivity and low smear
- Low image lag

## STRUCTURE

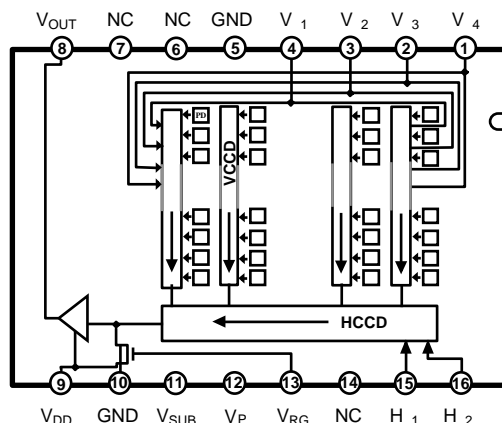
- Architecture : IT - CCD
- Optical size : 1/3 inch format
- Chip size : 6.0(H) x 5.2(V) mm<sup>2</sup>
- Number of effective pixels :  
500 (H) x 582 (V) about 290K pixels
- Number of total pixels :  
537 (H) x 597 (V) about 320K pixels
- Pixel size : 9.8 (H) x 6.3 (V) μm<sup>2</sup>
- Optical black area  
Horizontal direction : Front 7 pixels Rear 30 pixels  
Vertical direction : Front 14 pixels Rear 1 pixels
- Number of dummy bits  
Horizontal : 16  
Vertical : 1 ( Even field only )



**Optical black position( Top View )**



**BLOCK DIAGRAM**



**PIN DESCRIPTION**

Pin	Symbol	Description	Pin	Symbol	Description
1	V <sub>4</sub>	Vertical register transfer clock 4	9	V <sub>DD</sub>	Output amplifier drain bias
2	V <sub>3</sub>	Vertical register transfer clock 3	10	GND	Ground
3	V <sub>2</sub>	Vertical register transfer clock 2	11	V <sub>SUB</sub>	Substrate (Overflow drain) bias
4	V <sub>1</sub>	Vertical register transfer clock 1	12	V <sub>P</sub>	Protection bias
5	GND	Ground	13	V <sub>RG</sub>	Reset gate clock
6	NC	No connection	14	NC	No connection
7	NC	No connection	15	H <sub>1</sub>	Horizontal register transfer clock 1
8	V <sub>OUT</sub>	CCD output signal	16	H <sub>2</sub>	Horizontal register transfer clock 2

**ABSOLUTE MAXIMUM RATINGS**

Parameter	Symbol	Value	Unit
Substrate voltage	V <sub>SUB</sub> – GND	–0.3 to +55	V
Supply voltage	V <sub>DD</sub> , V <sub>OUT</sub> – GND	–0.3 to +18	V
	V <sub>DD</sub> , V <sub>OUT</sub> – V <sub>SUB</sub>	–55 to +10	V
Vertical clock input voltage	V <sub>1,2,3,4</sub> – GND	–10 to +20	V
	V <sub>1,2,3,4</sub> – V <sub>P</sub>	–0.3 to +27	V
	V <sub>1,2,3,4</sub> – V <sub>SUB</sub>	–55 to +10	V
Horizontal clock input voltage	H <sub>1, H2</sub> – GND	–10 to +15	V
Between vertical clock input pins	V <sub>X</sub> – V <sub>Y</sub>	–10 to +15	V
Between horizontal clock and vertical clock input pins	H <sub>1, H2</sub> – V <sub>4</sub>	–17 to +17	V
Output pin voltage	RG – GND	–10 to +15	V
	RG – V <sub>SUB</sub>	–55 to +10	V
Protective circuit voltage	V <sub>P</sub> – V <sub>SUB</sub>	–65 to 0.3	V
Storage temperature	T <sub>STG</sub>	–30 to 80	°C
Operation temperature	T <sub>OPR</sub>	–10 to 60	°C

\* Protective circuit voltage(V<sub>P</sub>) is induced to the image sensor before V<sub>DD</sub> supplied power voltage.

**BIAS CONDITION**

Parameter	Symbol	Min	Typ	Max	Unit	Remark
Output amplifier drain voltage	$V_{DD}$	14.5	15.0	15.5	V	
Substrate voltage adjustment range	$V_{SUB}$	5		15	V	
Fluctuation range after substrate voltage adjustment	$V_{SUB}$	-1		1	V	
Reset gate clock voltage adjustment range	$V_{RG}$	0		4	V	*
Fluctuation range after reset gate voltage adjustment	$V_{RG}$	-3		3	%	
Protection bias	$V_P$	Set to low level of vertical transfer clock				

\* No adjustment of reset gate clock voltage is necessary when reset gate clock is driven as indicated below.

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Reset gate clock voltage	$V_{RGL}$	-0.2	0.0	0.2	V	
	$V_{RG}$	8.5	9.0	9.5	V	

**DC CHARACTERISTICS**

Parameter	Symbol	Min	Typ	Max	Unit
Output amplifier drain current	$I_{DD}$	-	3	-	mA

**DRIVING CONDITION**

Parameter	Symbol	Min	Typ	Max	Unit
Vertical clock high voltage	$V_{H1}, V_{H3}$	14.5	15.0	15.5	V
Vertical clock middle voltage	$V_{M1, 2, 3, 4}$	-0.2	0.0	0.2	V
Vertical clock low voltage	$V_{L1, 2, 3, 4}$	-9.0	-8.5	-8.0	V
Horizontal clock high voltage	$H_{H1, 2}$	4.5	5.0	5.5	V
Horizontal clock low voltage	$H_{L1, 2}$	-0.5	0.0	0.5	V
RG clock voltage difference	$RG_{HL}$	4.7	5.0	5.3	V
Substrate clock voltage	$V_{SUB}$	23	24	25	V

**ELECTRO-OPTICAL PERFORMANCE ( Ta = 25°C )**

Item	Symbol	Min	Typ	Max	Unit	Measurement Method	Remark
Sensitivity	SENS	65	80		mV/Lux	1	
Saturation signal	V <sub>SAT</sub>	900			mV	2	Temp=60 °C
Smear	S <sub>MR</sub>			0.015	%	3	
Blooming	BL			1	%	4	
Video signal shading	OSNU			25	%	7	
Uniformity between video signal channels	Sr			10	%	9	
	Sb			10	%	9	
Dark signal level	V <sub>DARK</sub>			2	mV	6	Temp=60 °C
Dark signal shading	DSNU			2	mV	8	Temp=60 °C
Flicker Y	F <sub>Y</sub>			2	%	5	
Flicker B-Y, R-Y	F <sub>Cr</sub> , F <sub>Cb</sub>			5	%	10	
Line crawl R, G, B, W	L <sub>Cr</sub> , L <sub>Cb</sub> , L <sub>Cg</sub> , L <sub>Cw</sub>			20	%	11	
Image lagging	Lag			0.5	%	12	

**MESUREMENT METHOD****1. Sensitivity**

Set to SILC ( Standard Illumination Conditions\* )  
Measure the average value of signal output (  $V_{OUT}$  )  
Calculate the efficiency of  $V_{OUT}$  to light intensity

**2.  $V_{SAT}$** 

Adjust light intensity to 200 times of SILC  
Measure the average value of signal output

**3. Smear**

Adjust light intensity to 200 times of SILC & readout clock  
Measure the signal output at horizontal optical black (  $V_{HOPB}$  )  
Measure the signal output at vertical blanking dummy (  $V_{VBD}$  )  
Smear =  $\{ (V_{VBD} - V_{HOPB}) / V_{SAT} \} \times 100$  ( % )

**4. Blooming**

Adjust light intensity to 200 times of SILC & readout clock  
Measure the signal output at horizontal optical black (  $V_{HOPB}$  )  
Measure the signal output at blooming dummy area (  $V_{BD}$  )  
Blooming =  $\{ (V_{BD} - V_{HOPB}) / V_{SAT} \} \times 100$  ( % )

**5. OSNU**

Set to SILC  
Measure the average value of signal output (  $V_{OUT}$  )  
Measure the maximum value and the minimum value of signal output  
OSNU =  $(V_{MAX} - V_{MIN}) / V_{OUT} \times 100$  ( % )

**6.  $S_r$ ,  $S_b$** 

Set to SILC  
Measure the average value of signal output (  $V_{OUT}$  )  
Measure the maximum value and minimum value of chroma output  
 $S_r = (C_{rMAX} - C_{rMIN}) / V_{OUT} \times 100$  ( % )  
 $S_b = (C_{bMAX} - C_{bMIN}) / V_{OUT} \times 100$  ( % )

**7.  $V_{DARK}$** 

Measure the average value of signal output at dark condition

**8. DSNU**

Measure the voltage difference between minimum and maximum of dark signal

**9. F<sub>γ</sub>**

Set to SILC

Measure the average value of signal output ( V<sub>OUT</sub> )

Measure the difference of signal output between even field and odd field

$$FLK = ( V_{OUT} / V_{OUT} ) \times 100 (\%)$$

**10. F<sub>Cr</sub>, F<sub>Cb</sub>**

Set to SILC using the R,B optical filter respectively

Measure the average value of chroma signal output

Measure the difference of chroma signal output between even field and odd field

$$F_{Ci} = ( V_{CiOUT} / V_{CiOUT} ) \times 100 (\%) \quad ( i = r, b )$$

**11. L<sub>Cr</sub>, L<sub>Cb</sub>, L<sub>Cg</sub>, L<sub>Cw</sub>**

Set to SILC using the W,R,B,G optical filter respectively

Measure the average value of signal output

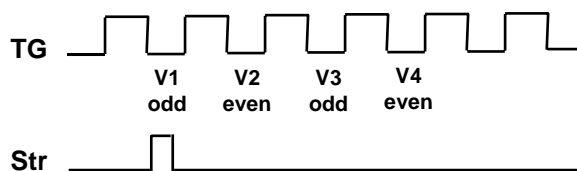
Measure the difference of signal output between signal lines of the same field

( V<sub>lw</sub>, V<sub>lr</sub>, V<sub>lg</sub>, V<sub>lb</sub>)

$$L_{Ci} = ( V_{liOUT} / V_{iOUT} ) \times 100 (\%) \quad ( i = w, r, g, b )$$

**12. Lag**

Light a strobe lamp as follow



$$Lag = \{ V2(out) + V3(out) + V4(out) \} / V1(out)$$

**\* Standard Illumination Conditions**

Measure the average value of output of linear region

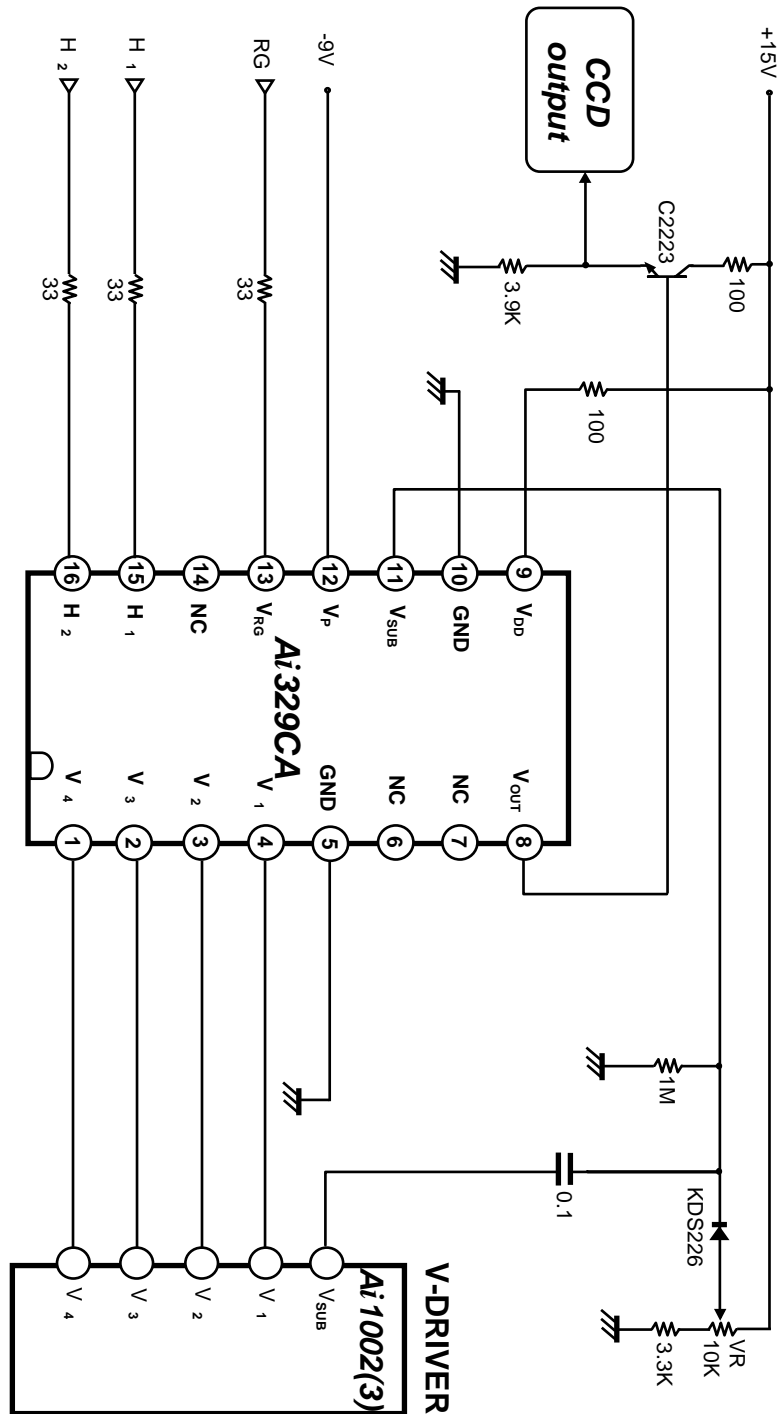
At this time, measure the light intensity of illumination at CCD face plate

Define SILC with above

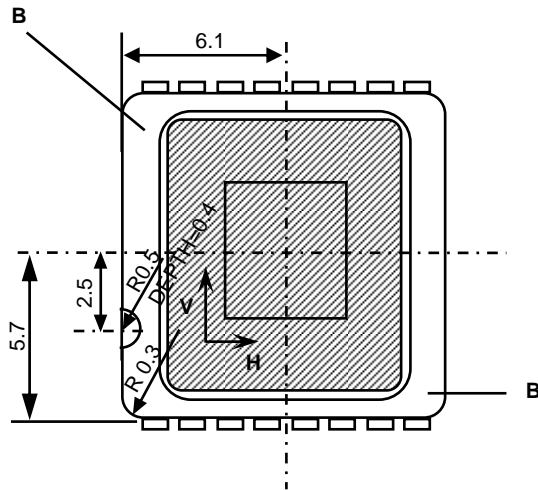
Light source: Tungsten lamp(3100K)

Use a standard test lens at F8

**APPLICATION CIRCUIT**



**PACKAGE DIMENSION (16 PIN PLASTIC-DIP)**



UNIT = mm

1. The center of the effective image area relative to " B " and " B' " is  $(H, V) = (6.1, 5.7) \pm 0.15\text{mm}$ .

2. The rotation angle of the effective image area relative to H and V is  $\pm 1.5^\circ$ .

 : GLASS LID

