

LINEAR IMAGE SENSOR IC FOR CIS

S-8632AWI

The S-8632AWI is a suitable linear image sensor IC for a multichip-type contact image sensor with a resolution of 300 dots per inch. This IC integrates a 96dots photo-diode array and a CMOS scanning circuit. Picture signals are output one after another in analog signals, synchronized with a clock signal.

■ Features

- Resolution : 300 dpi
- High frequency : fclk=4MHz
- Good linearity : $\gamma \cong 1$
- Low image lag : $\leq 1\%$
 - ... Color picture reappears finely using RGB LEDs.
- 2-input signal : SI,CLK
 - ... Only these two input signals, start and clock, make the scanning easily.
- Adjustable scanning length for various sizes of paper : 8.128mm
 - ... Various sizes of paper can be read by simply changing the number of chips aligned in a line.
- Low current consumption : 5V single power supply and CMOS scanning circuit.

■ Terminal functions

Table-1

Terminal no.	Symbol	Name	Functions
1	SI	Start input terminal	Input data for shift register
2	CLK	Clock input terminal	Input clock for shift register
3	VDD	Power supply terminal	Connect to +5V
4	GND	Ground terminal	Connect to 0V
5	N.C.	—	—
6	RS	Reference signal output terminal	Output analog reference signal
7	SIG	Video signal output terminal	Output analog video signal
8	SO	Start output terminal	Output data for shift register

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■ Block diagram

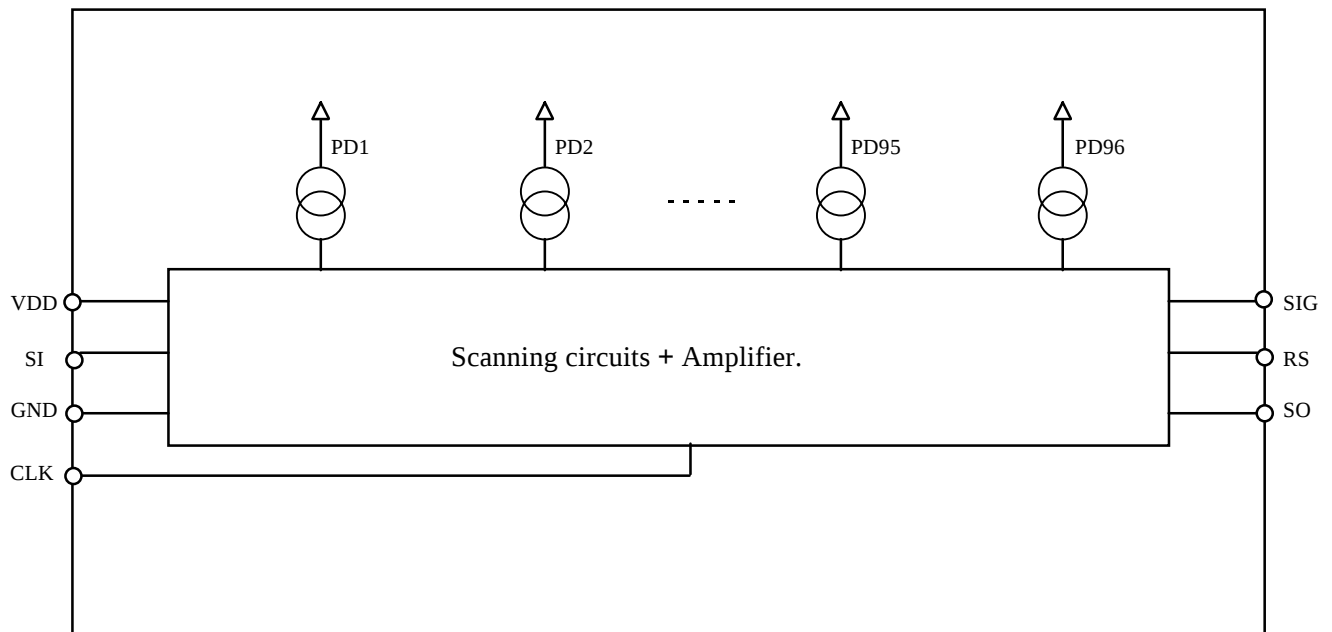


Fig.1

■ Timing chart

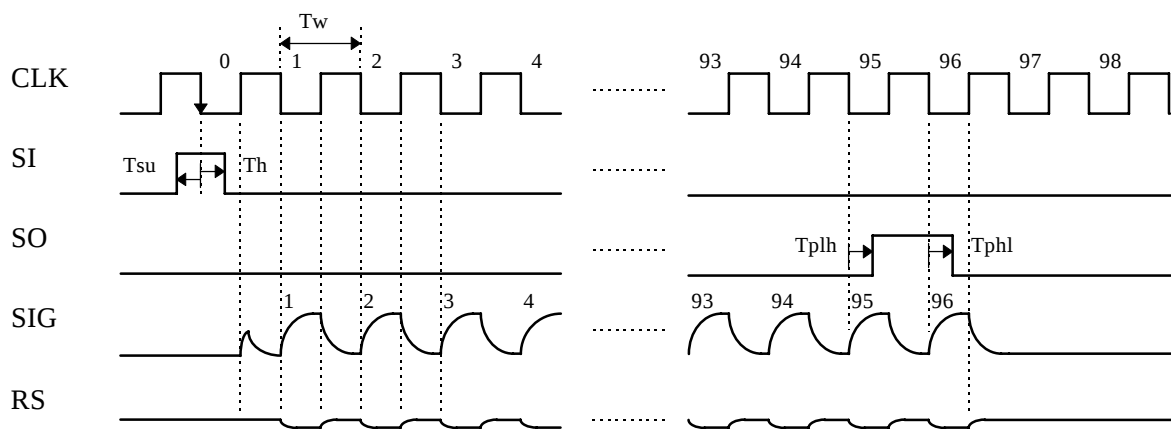


Fig.2

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■ Absolute maximum rating

Table-2

Parameter	Symbol	Condition	Rating	Unit
Power supply voltage	V _{DD}	V _{DD} -GND	- 0.4 ~ +7.0	V
Input voltage	V _{IN}	SI1,SI2,CLK	- 0.4 ~ V _{DD} +0.4	V
Output voltage	V _{OUT}	SIG,SO	- 0.4 ~ V _{DD} +0.4	V
Operating temperature	T _{OPR}	—	- 5 ~ +85	°C
Storage temperature	T _{STR}	—	- 40 ~ +125	°C

■ Electric characteristics

1) DC characteristics

Table-3

V_{DD}=5V±10%,T_{OPR}=typ.55°C

Parameter	Symbol	Condition	Rating			Unit
			min.	typ.	max.	
Input voltage	V _{IH}	SI,CLK	2.4	—	—	V
	V _{IL}		—	—	0.8	
Input current	I _{IH}	CLK	—	—	0.5	μA
		SI	—	—	40.0	
	I _{IL}	CLK	-0.5	—	—	
		SI	-0.5	—	—	
Output voltage	V _{OH}	SO,I _{OH} = -100μA	3.8	—	—	V
	V _{OL}	SO,I _{OL} = 100μA	—	—	0.4	
Current consumption 1	I _{DD1}	f _{ck} = 3.0MHz Not amp operating	—	0.6	2.0	mA
Current consumption 2	I _{DD2}	V _{DD} -GND Amp operating	—	23.0	40.0	mA
Leak current	I _S	V _{DD} -GND Not amp operating	—	0.10	0.30	mA

2) Switching characteristics

Table-4

V_{DD}=5V±10%,T_{OPR}=typ.55°C

Parameter	Symbol	Condition	Rating			Unit
			min.	typ.	max.	
Clock pulse width	T _w	Duty=50%	250	—	—	nsec
Data set up time	T _{su}	SI	100	—	—	nsec
Data hold time	T _h	SI	0	—	—	nsec
Clock frequency	f _{ck}	Duty=50% SIG,SO	0.5	—	4.0	MHz
CLK-SO L-H delay time	T _{plh}	f _{ck} = 4.0MHz CL = 10 pF	—	—	160	nsec
CLK-SO H-L delay time	T _{phl}	f _{ck} = 4.0MHz CL = 10 pF	—	—	160	nsec

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3) Photoelectric conversion characteristics

Condition : $V_{DD}=5V$, $T_{OPR}=55^{\circ}C$, $f_{ck}=500kHz$ (duty=50%)
 Read period $R_T=5msec$,
 Load capacitor $C_L=100pF$, Load resistor $R_L=100k\Omega$
 Light source LED($\lambda=570nm$, Half value width $\Delta\lambda\approx 30nm$,
 Illuminance 12 lx)
 Connecting a capacitor $4.7\mu F$ between V_{DD} and GND ,
 V_p is tested using the measurement circuit of Fig. 3.

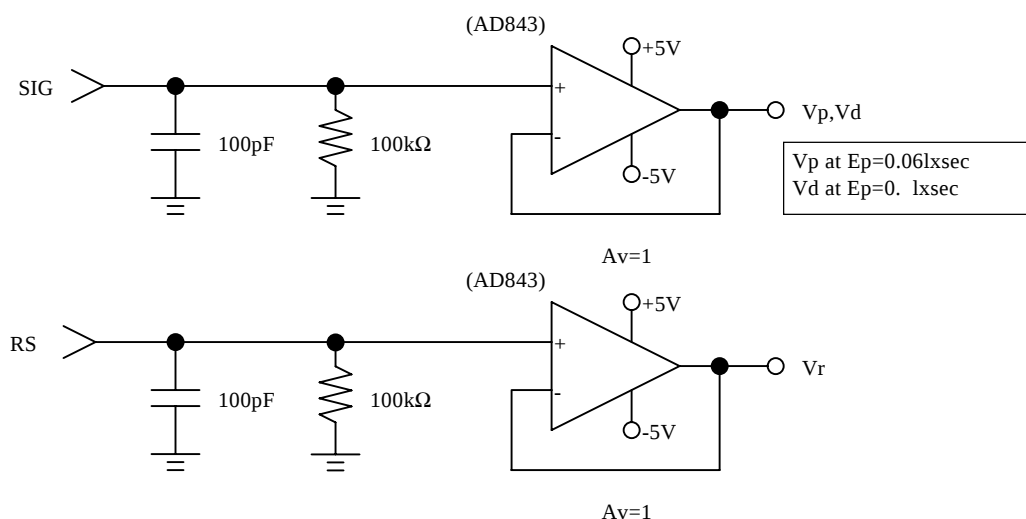


Fig. 3 Measurement circuit

Table- 5

Parameter	Symbol	Condition	Rating			Unit	Note
			min.	typ.	max.		
Bright signal	V_{pave}	Exposure value $E_p = 0.06 \text{ lx} \cdot \text{sec}$	280	400	550	mV	$V_{pe(i)}$
Bright signal deviation (*1)	$dV3$	Read period $R_T = 5msec$	0	+3	+15	%	$V_{pe(i)}$ 3)-1
	$dV4$	" , $i = 2 \sim 94$	0	+2	+10	%	
		" , $i = 1, 95$	0	+3	+15	%	
Dark signal	V_d	$R_T = 5msec$ $f_{ck} = 500kHz$	1170	1320	1470	mV	$V_{d(i)}$
Dark signal deviation	ΔV_d	$R_T = 5msec$ $f_{ck} = 500kHz$	—	20	35	mV	$V_{d(max)}$ - $V_{d(min)}$
Reference signal	V_r	$R_T = 5msec$ $f_{ck} = 500kHz$	1150	1300	1450	mV	
Reference signal deviation	ΔV_r	$R_T = 5msec$ $f_{ck} = 500kHz$	—	7	15	mV	$V_{r(max)}$ - $V_{r(min)}$
Dark Difference	$V_d - V_r$	" , $i = 1 \sim 96$	-10	18	45	mV	$V_{d(i)} - V_{r(i)}$
Linearity	R_γ	V_{pave}	0.30	0.32	0.34		3)-2
Image lag	R_{IL}	V_{pave}	-1	0	+1	%	3)-1
Light response	R_{IR}	V_{pave}	98	99	101	%	3)-1

(*1 : Including measurement error 1%.)

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3)-1 Definitions

The definitions of parameters are as follows.

- $Vp(i)$: Bright signal of i-th pixel.
- $Vd(i)$: Dark signal of i-th pixel.
- $Vpe(i) = Vp(i) - Vd(i)$: Effective bright signal of i-th pixel.
- $Vpave$: Average of all $Vpe(i)$
- $Vp\ max$: Maximum $Vpe(i) \dots i=2\sim95$
- $Vp\ min$: Minimum $Vpe(i) \dots i=2\sim95$
- $dV3 = \frac{Vp\ max - Vp\ min}{Vpave} \times 100$
- $dV4 = \left| \frac{Vpe(i) - Vpe(i+1)}{Vpave} \right| \times 100$
- RIL : Average of all pixel image lag ratio . (cf. Fig.4)
- RIR : Average of all pixel light response ratio . (cf. Fig.4)

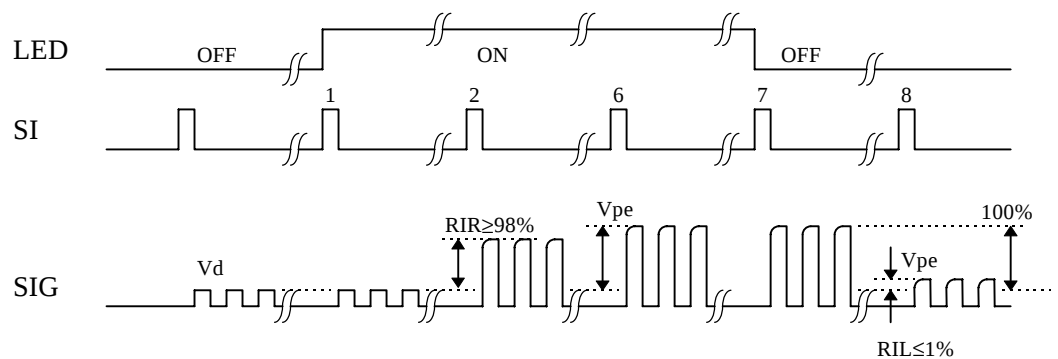


Fig. 4

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3)-2 Linearity

$R\gamma$ is tested by the following equation.

Vd : The average of the dark signal $Vd(i)$ at R.T.=5.0msec.

$Vp5$: The average of the bright signal $Vp(i)$ at R.T.=0.5msec.

$Vp15$: The average of the bright signal $Vp(i)$ at R.T.=1.5msec.

i : 1~96

$$R\gamma = \frac{Vp5 - Vd}{Vp15 - Vd}$$

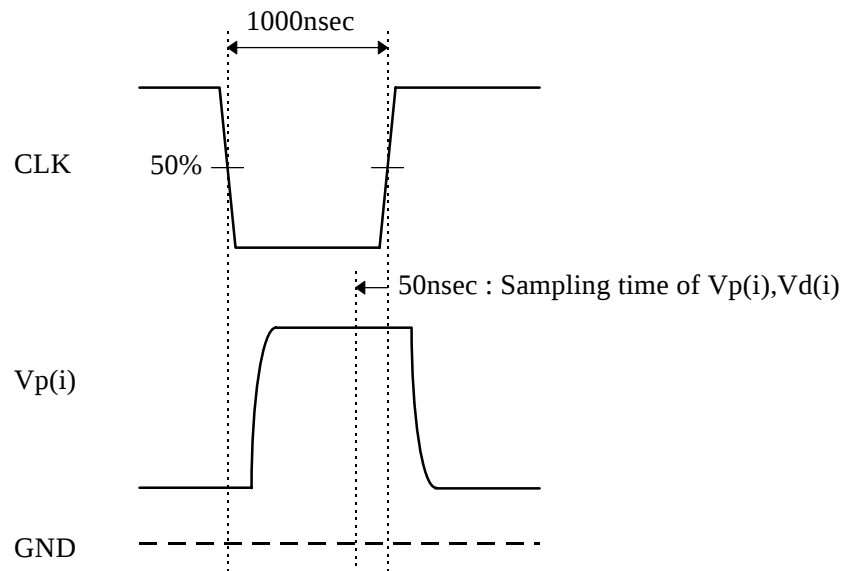


Fig. 5

- Pad configuration

Unit : μm

PAD No.	Name	Coordinate		PAD No.	Name	Coordinate	
		X	Y			X	Y
1	SI	-2974	-103	5	N.C.	-276	-103
2	CLK	-2676	-103	6	RS	+947	-103
3	VDD	-1533	-103	7	SIG	+1522	-103
4	GND	-1152	-103	8	SO	+2108	-103

The coordinate origin is the center of IC, and the coordinate value is the center of the pad.

Chip size: 8140 μm $\times$ 410 μm (Before scribing)
 Shaded area: Photo detecting window($X=53.5$, $Y=60.5$)

(Scribe line center)

96.5

1 2 3 4

P2 P1 P1

($P1=84.5$)
 ($P2=81.7$)

47 48 49 50

P1

93 94 95 96

P1 P2

8140

Unit : μm

Fig.7

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■ Wafer form

Note: The arrangement of IC is subject to change without notes.

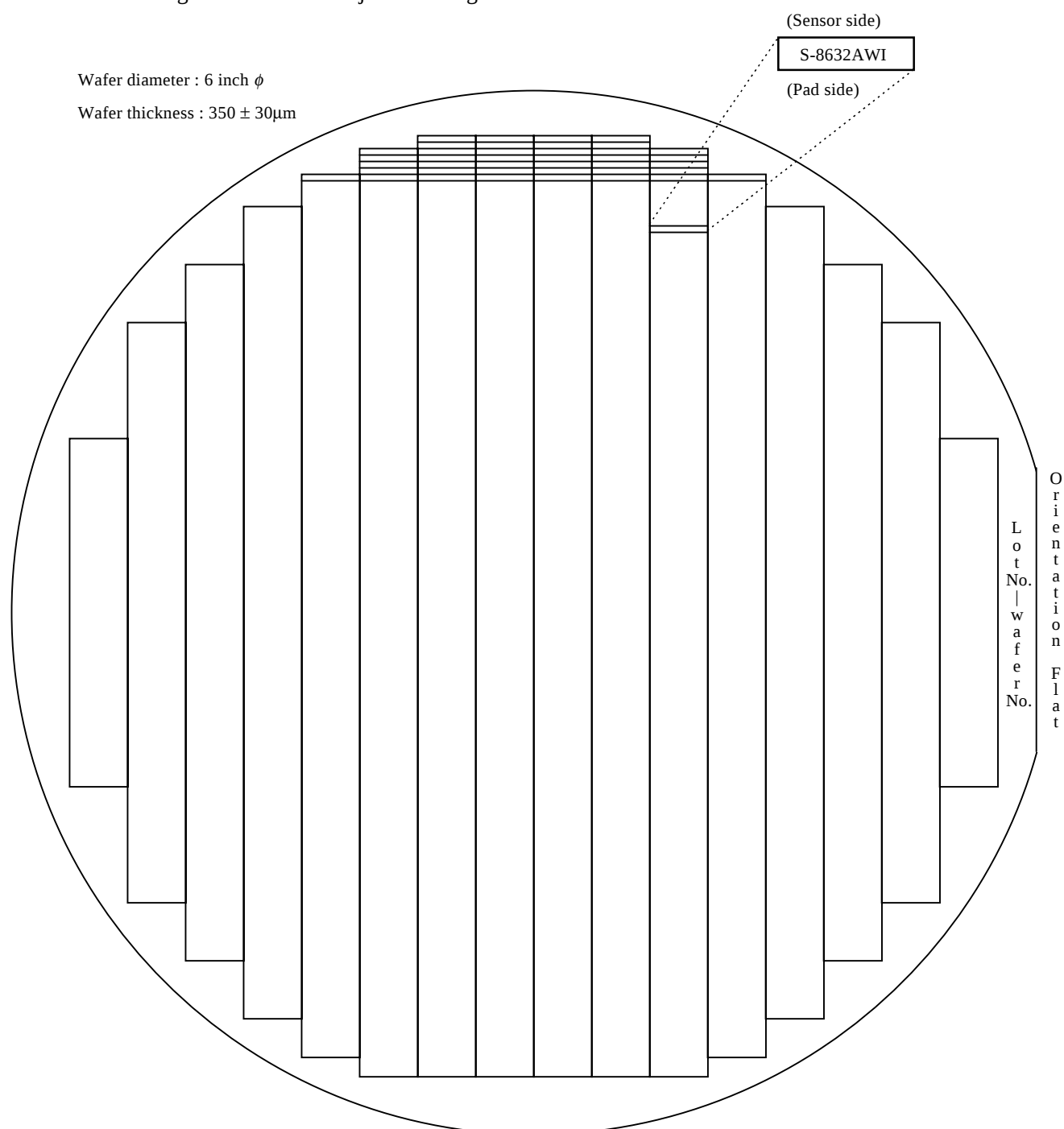


Fig. 8

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■ Scribe line

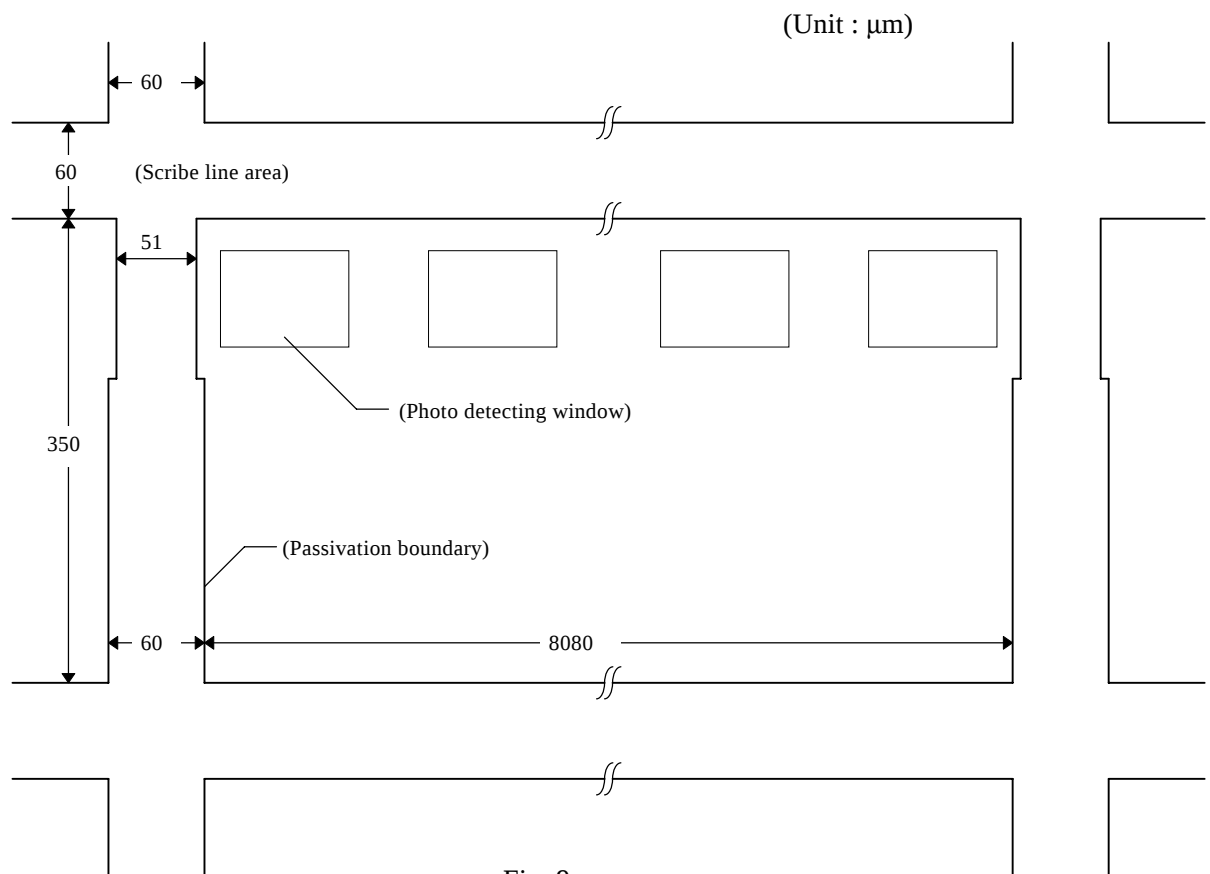


Fig. 9