A1 PROs

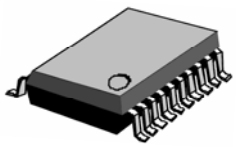
Ai1002

Vertical Clock Driver for Camera System

GENERAL DESCRIPTION

The ***Ai1002*** is a vertical driver for CCD image sensors. This IC is the successor of the Ai1001S with better features. 3.3V and 5V clock interface is acceptable while *Ai1001S* can accept only 5V clock interface.

20-pin SSOP



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FEATURES

- Only two power supplies are (+15V and -8.5V) needed.
- 3.3V and 5V clock interface is acceptable.
- 20-pin SSOP package

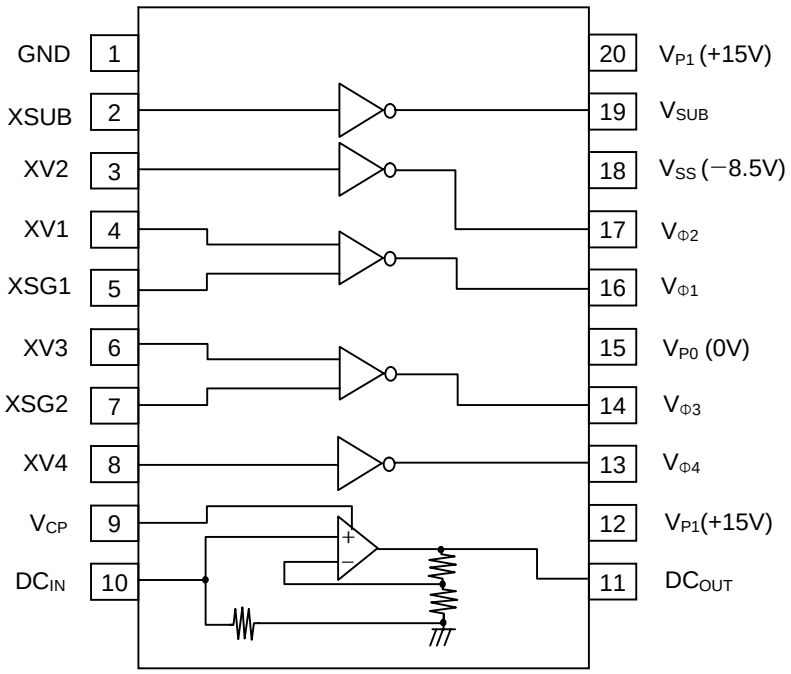
APPLICATIONS

CCD Cameras

PROCESS

High Voltage CMOS

BLOCK DIAGRAM



PIN DESCRIPTION

Pin	Symbol	I/O	Description
1	GND	-	Ground Control
2	XSUB	I	Output Control (V_{SUB})
3	XV2	I	Output Control ($V_{\Phi 2}$)
4	XV1	I	Output Control ($V_{\Phi 1}$)
5	XSG1	I	Output Control ($V_{\Phi 1}$)
6	XV3	I	Output Control ($V_{\Phi 3}$)
7	XSG2	I	Output Control ($V_{\Phi 3}$)
8	XV4	I	Output Control ($V_{\Phi 4}$)
9	V_{CP}	I	Power of Amp
10	DC_{IN}	I	OP-Amp Input (internal pull-down resistor)
11	DC_{OUT}	O	OP-Amp Output
12	V_{P1}	-	Power (15V)
13	$V_{\Phi 4}$	O	High Voltage Output (2 level : V_{P0}, V_{SS})
14	$V_{\Phi 3}$	O	High Voltage Output (3 level : V_{P0}, V_{SS}, V_{P1})
15	V_{P0}	-	Power (0V)
16	$V_{\Phi 1}$	O	High Voltage Output (3 level : V_{P0}, V_{SS}, V_{P1})
17	$V_{\Phi 2}$	O	High Voltage Output (2 level : V_{P0}, V_{SS})
18	V_{SS}	-	Power ($-$ 8.5V)
19	V_{SUB}	O	High Voltage Output (2 level : V_{SS}, V_{P1})
20	V_{P1}	-	Power (15V)

ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

Characteristics	Symbol	Value	Unit
Supply Voltage	V_{SS}	0 ~ −10	V
	V_{P1}	−0.3 ~ V_{SS} + 35	
	V_{P0}	V_{SS} − 0.3 ~ 3.0	
Input Voltage	V_I	− 0.3 ~ V_{P1} + 0.3	
	V_{CP}	− 0.3 ~ V_{SS} + 35	
Output Voltage	$V_{\Phi1}$, $V_{\Phi2}$, $V_{\Phi3}$, $V_{\Phi4}$, V_{SUB}	V_{SS} − 0.3 ~ V_{P1} + 0.3	
OP-Amp Output Current	I_{OUT}	± 5	mA
Operating Temperature	T_{OPR}	− 25 ~ + 85	°C
Storage Temperature	T_{STG}	− 45 ~ + 120	

LOGIC FUNCTION TABLE

INPUT				OUTPUT		
XV1,3	XSG1,2	XV2,4	XSUB	$V_{\Phi1,3}$	$V_{\Phi2,4}$	V_{SUB}
L	L	X	X	V_{P1}	X	X
H	L	X	X	Z	X	X
L	H	X	X	V_{P0}	X	X
H	H	X	X	V_{SS}	X	X
X	X	L	X	X	V_{P0}	X
X	X	H	X	X	V_{SS}	X
X	X	X	L	X	X	V_{P1}
X	X	X	H	X	X	V_{SS}

X : Don’t care
Z : High impedance

AC CHARACTERISTICS

(V_{P1} = 15V, V_{P0} = GND, V_{SS} = -8.5V ; Ta = 25°C)

Description	Symbol	Test Condition	Min	Typ	Max	Unit
Delay Time	T_{PLM}	No Load (*1)	10	40	70	ns
	T_{PMH}	No Load(*1)	10	30	70	
	T_{PLH}	No Load(*1)	10	40	100	
	T_{PML}	No Load(*1)	10	100	200	
	T_{PHM}	No Load(*1)	10	100	180	
	T_{PHL}	No Load(*1)	10	60	100	
Rising Time	T_{TLM}	$V_{SS} \rightarrow V_{P0}$ (*1)	400	700	930	
	T_{TMH}	$V_{P0} \rightarrow V_{P1}$ (*1)	400	650	930	
	T_{TLH}	$V_{SS} \rightarrow V_{P1}$ (*1)	10	50	100	
	T_{TML}	$V_{P0} \rightarrow V_{SS}$ (*1)	200	300	500	
	T_{THM}	$V_{P1} \rightarrow V_{P0}$ (*1)	400	600	820	
	T_{THL}	$V_{P1} \rightarrow V_{P0}$ (*1)	10	50	100	
Output Noise Voltage	V_{CLH}, V_{CLL} V_{CMH}, V_{CML}	(*2)	-	-	0.5	V

(*1) Refer the timing diagram of page 5.
(*2) Refer the noise diagram of page 5.

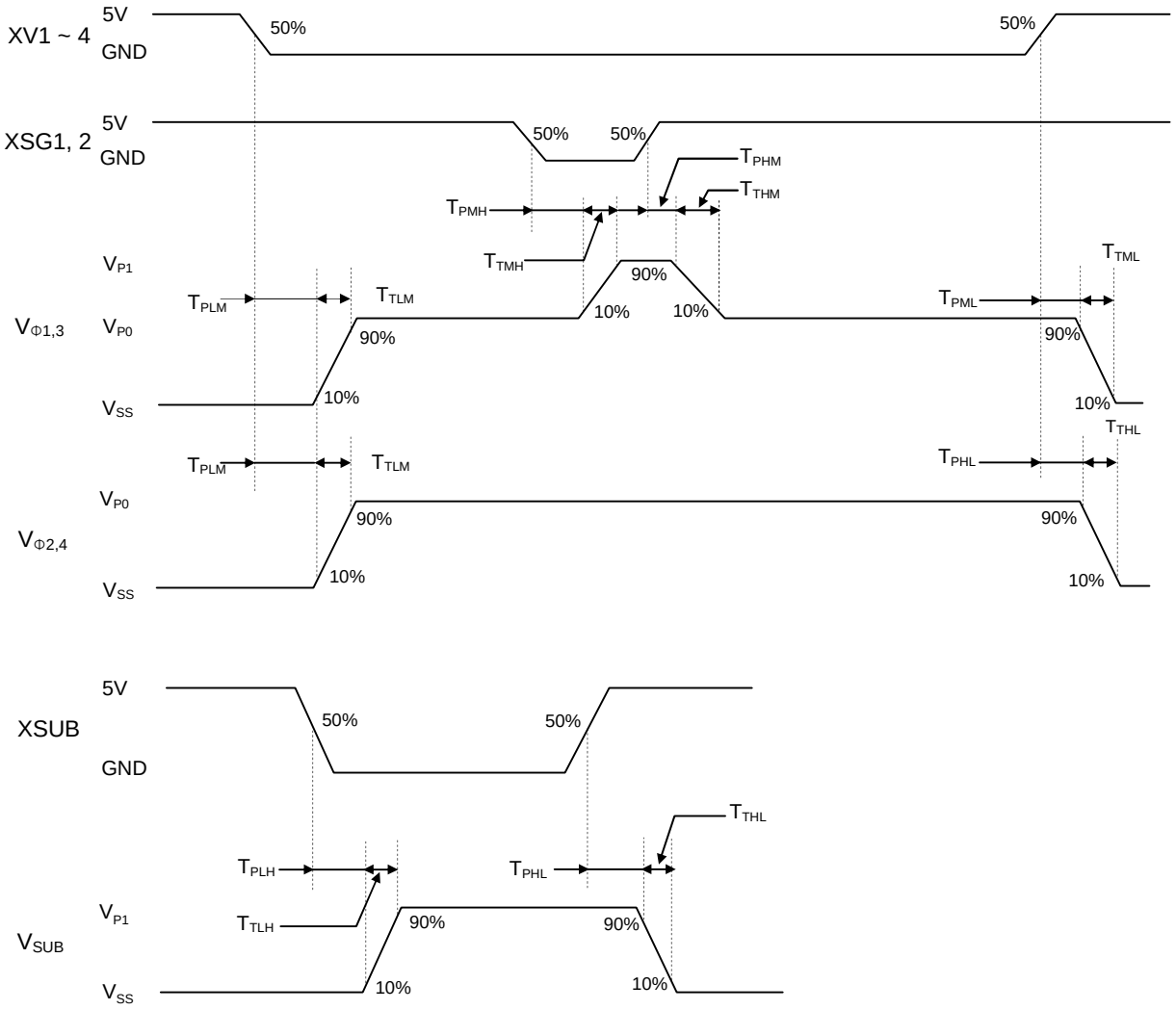
DC CHARACTERISTICS

(V_{P1} = 15V, V_{P0} = GND, V_{SS} = -8.5V, V_{CP} = 22V ; Ta = 25°C)

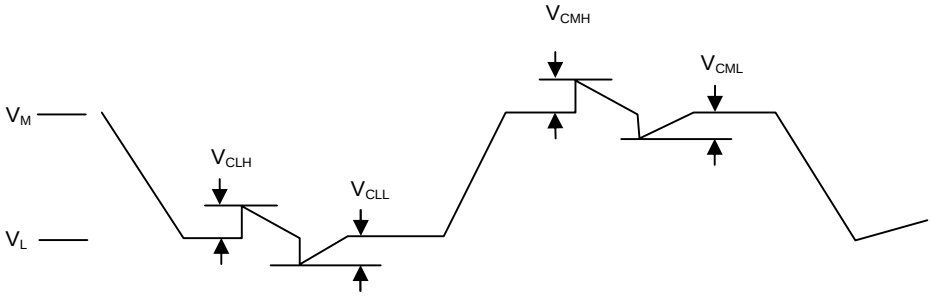
Description	Symbol	Test Condition	Min	Typ	Max	Unit
Supply Voltage	V_{P1}		14.5	15	15.5	V
	V_{SS}		− 9.5	− 8.5	− 7.5	
Input Voltage	V_{CP}	When V_{CP} is used	V_{P1}	22	23.5	
High Level Input Voltage	V_{IH}	(*3)	2.3	-	-	
Low Level Input Voltage	V_{IL}	(*3)	-	-	1.2	
Input Current	I_I	V_{IN} = 0 ~ 5V (*3)	− 1.0	0.0	1.0	μA
	IDC_{IN}	VDC_{IN} = 1.0V	80	100	140	
Operation Current	I_{P1}	(*1)	-	2.0	3.5	mA
	I_{P0}	(*1)	-	4.5	5.0	
	I_{SS}	(*1)	− 8.5	− 6.5	-	
Output Current	I_{OL}	$V_{\Phi 1\sim 4}$ = − 8.0V	25	37	-	
	I_{OM1}	$V_{\Phi 1\sim 4}$ = − 0.5V	-	− 15	− 10	
	I_{OM2}	$V_{\Phi 1,3}$ = 0.5V	9	13.5	-	
	I_{OH}	$V_{\Phi 1,3}$ = 14.5V	-	− 18	− 12	
	I_{OSL}	V_{SUB} = − 8.0V	12	18	-	
	I_{OSH}	V_{SUB} = 14.5V	-	− 10.5	− 7	
Op-Amp Gain	G	I_{OUT} = − 200μA	X 4.0	X 4.2	X 4.7	
Gain Variation	ΔG	Ta = − 20 ~ 75°C (*2), I_{OUT} = − 200mA VDC_{IN} = 1.0 ~ 4.5V	− 3	-	+ 3	%
Operation Current	IV_{CP}	VDC_{IN} = 1.0 ~ 4.5V I_{OUT} = 0mA	0.08	-	1.0	mA

(*1) : Refer the test circuit of page 7. Shutter speed : 1/100000 sec.
(*2) : Refer the characteristics of OP-AMP of page 7.
(*3) : XV1 ~ 4, XSG1, XSG2, XSUB pin

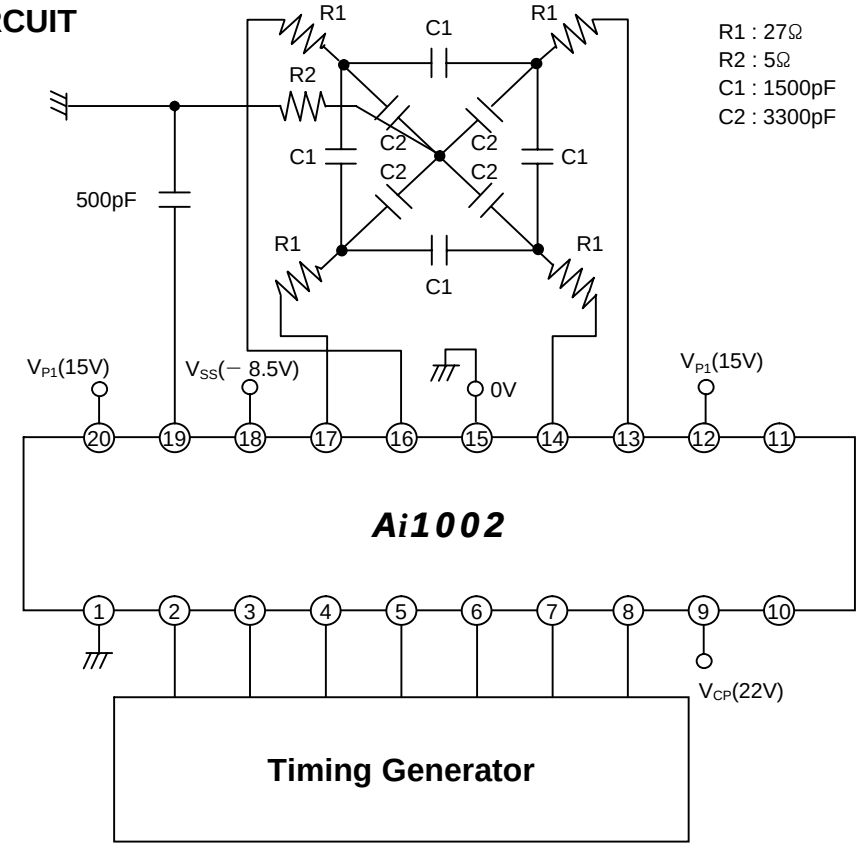
TIMING DIAGRAM



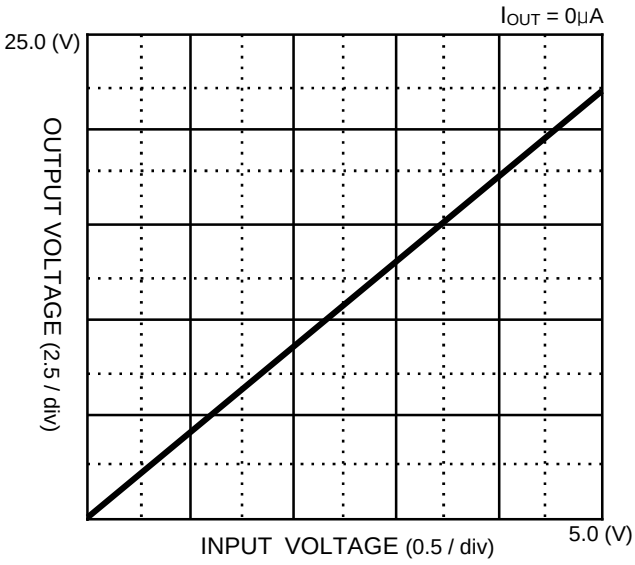
NOISE DIAGRAM



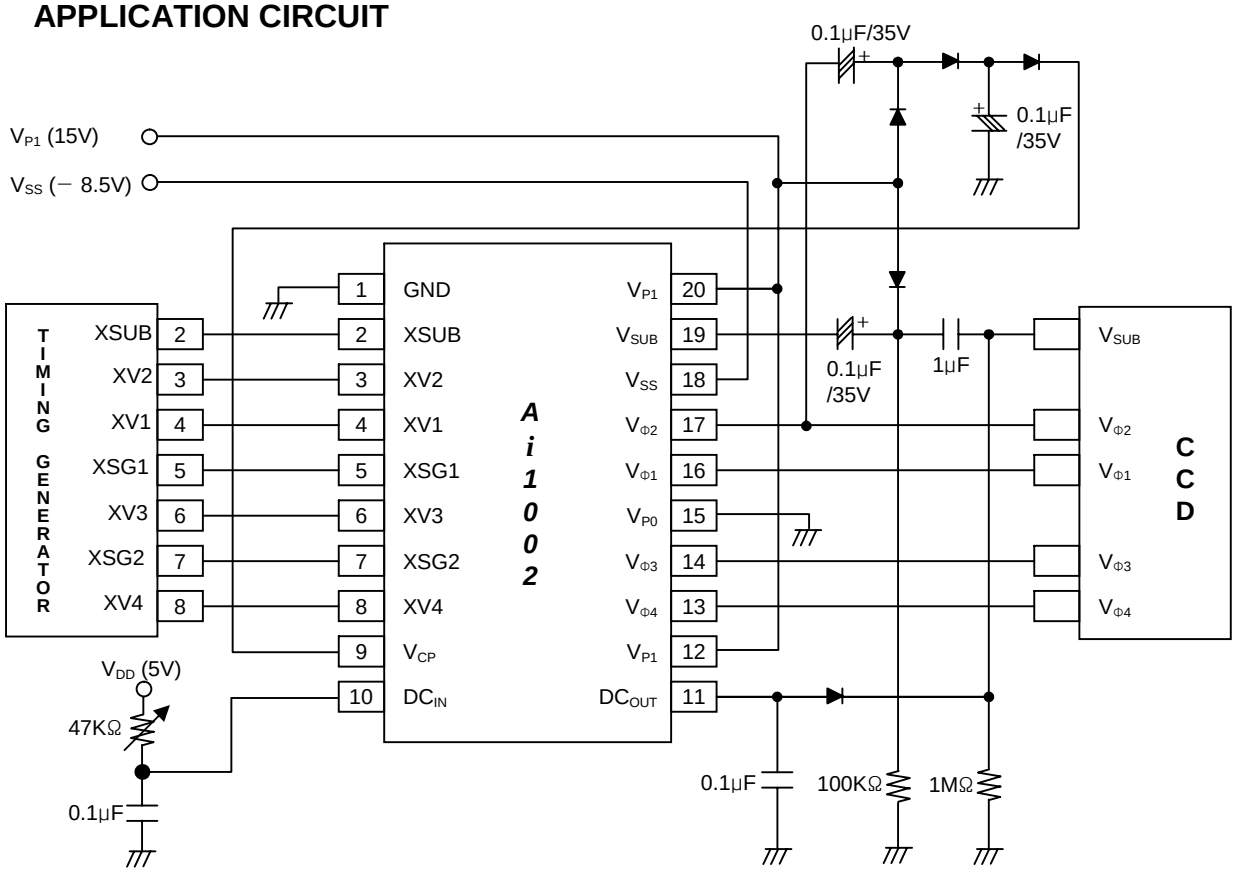
TEST CIRCUIT



OP-AMP GAIN CHARACTERISTICS (Ta = − 20 ~ 75°C)

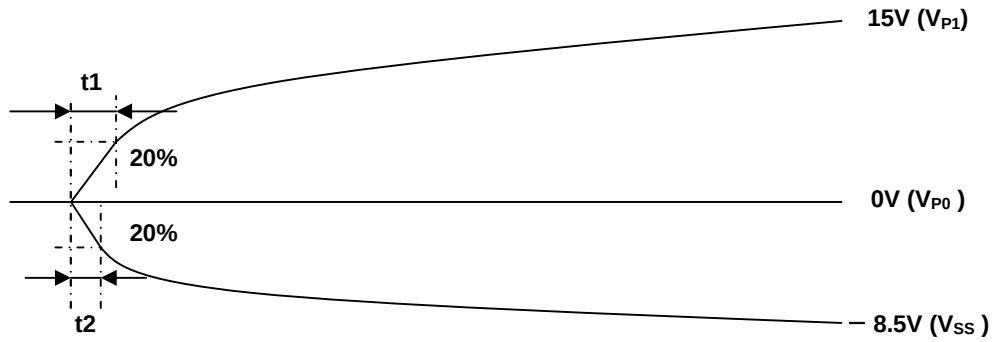


APPLICATION CIRCUIT



* In case of $DC_{OUT} \leq V_{P1} - 1.0V$, V_{CP} PIN connects with V_{P1}.

*** Warning** : When voltage is biased, You must keep this flow. If you don't keep this flow, Negative voltage is applied to CCD image sensor's SUB.



*** t1 ≥ t2 ≥ 10ms**

PACKAGE DIMENSION

20-pin SSOP

Unit : mm