HARRIS SEMICONDUCTOR

HI2300

8-Bit, 18 MSPS, Video A/D Converter with 3.3V Power Supply Operation

August 1997

Features

- Resolution ..... 8-Bit $\pm 1/2$ LSB (DL)
- Maximum Sampling Frequency ..... 18 MSPS
- Low Power Consumption at 18 MSPS (Typ) (Reference Current Excluded) 18mW
- Synchronizing Clamp Function
- Clamp ON/OFF Function
- Reference Voltage Self-Bias Circuit
- Input CMOS Compatible
- Three-State TTL Compatible Output
- Power Supply ..... 3.3V Single
- Low Input Capacitance 8pF
- Reference Impedance ..... 330Ω (Typ)
- Direct Replacement for Sony CXD2300

Applications

- Portable Equipment
- Hand-Held Instruments

Description

The HI2300 is an 8-bit, CMOS A/D converter for video with synchronizing clamp function and can operate on 3.3V power supply. The adoption of 2 step-parallel method achieves ultra-low power consumption and a maximum conversion speed of 18 MSPS.

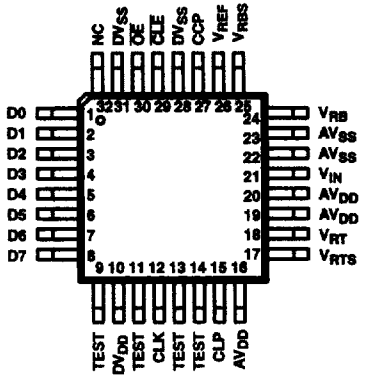
Ordering Information

PART NUMBER	TEMP. RANGE (°C)	PACKAGE	PKG. NO.
HI2300JCQ	-40 to 85	32 Ld MQFP	Q32.7x7-S

4 A/D CONVERTERS HIGH SPEED

Pinout

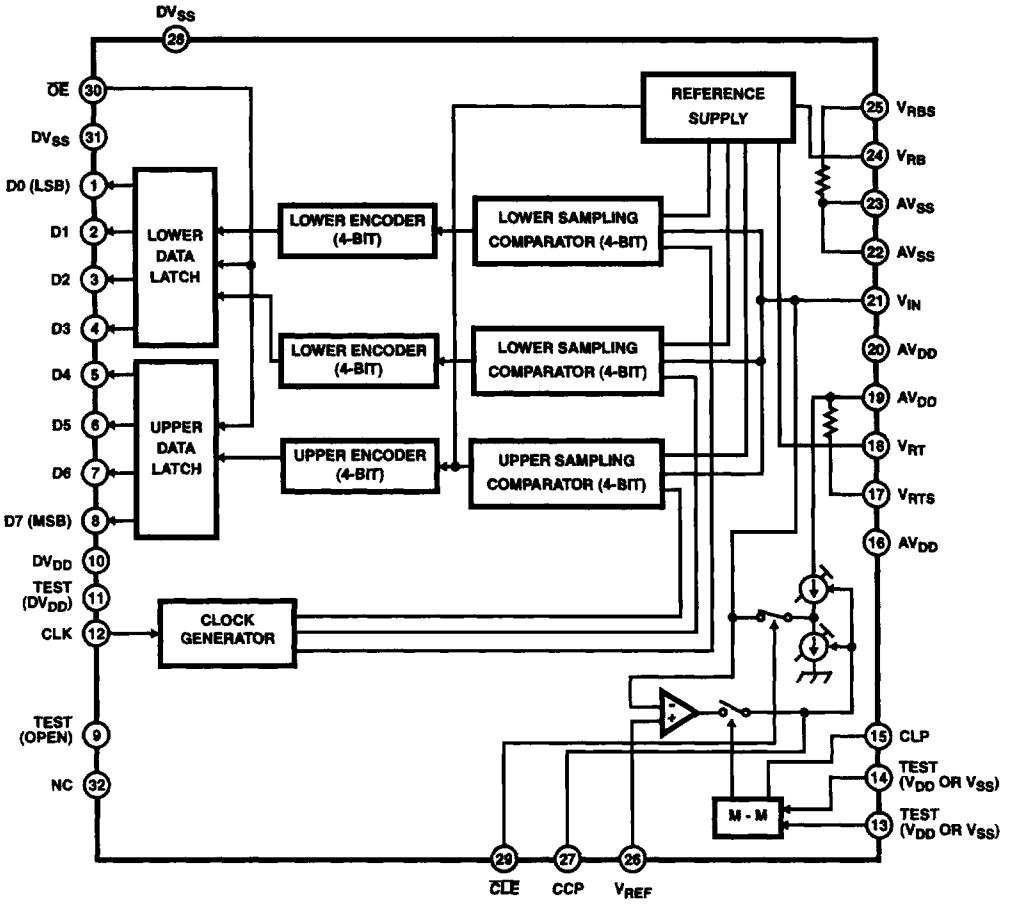
HI2300
(MQFP)
TOP VIEW



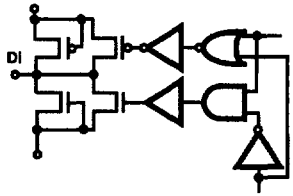
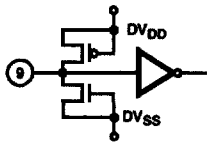
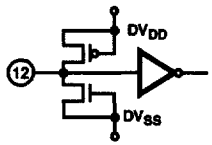
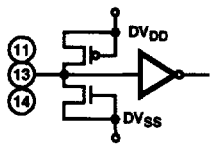
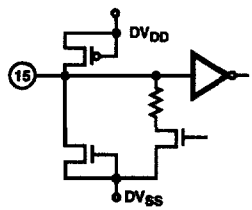
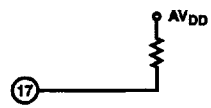
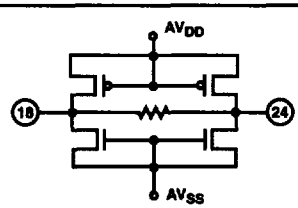
CAUTION: These devices are sensitive to electrostatic discharge. Users should follow proper IC Handling Procedures.

File Number 4103.1

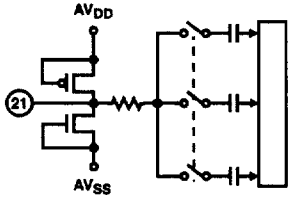
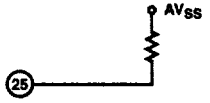
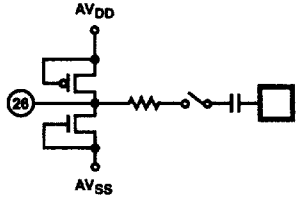
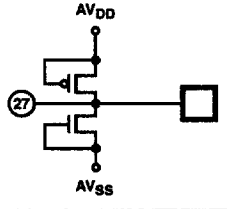
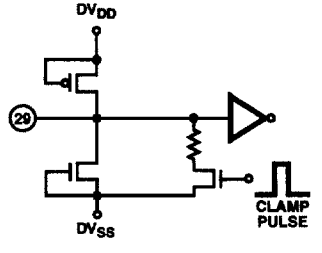
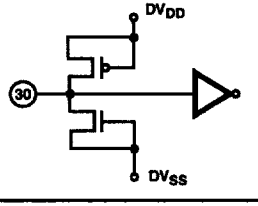
Functional Block Diagram



Pin Descriptions

PIN NUMBER	SYMBOL	EQUIVALENT CIRCUIT	DESCRIPTION
1 to 8	D0 to D7		D0 (LSB) to D7 (MSB) Output.
9	TEST		Leave open during normal usage.
10	DV_{DD}		Digital +3.3V.
12	CLK		Clock Input.
11, 13, 14	TEST		Fix Pin 11 to V_{DD}, Pins 13 and 14 to V_{DD} or V_{SS} during normal usage.
15	CLP		Inputs Clamp Pulse to Pin 15 (CLP). Clamps the signal voltage during Low interval.
16, 19, 20	AV_{DD}		Analog +3.3V
17	V_{RTS}		Generates approximately +1.8V when shorted with V_{RT}.
18	V_{RT}		Reference Voltage (Top).
24	V_{RB}		Reference Voltage (Bottom).

Pin Descriptions (Continued)

PIN NUMBER	SYMBOL	EQUIVALENT CIRCUIT	DESCRIPTION
21	V_{IN}		Analog Input.
25	V_{BRS}		Generates approximately +0.4V when shorted with V_{RB}.
26	V_{REF}		Clamp Reference Voltage Input. Clamps so that the reference voltage and the input signal during clamp interval are equal.
27	CCP		Integrates the clamp control voltage. The relationship between the changes in CCP voltage and in V_{IN} voltage is positive phase.
28, 31	DV_{SS}		Digital Ground.
29	$\overline{CLE}$		The clamp function is enabled when $\overline{CLE}$ = Low. The clamp function is set to off and the converter functions as a normal A/D converter when $\overline{CLE}$ = High. The clamp pulse can be measured by connecting $\overline{CLE}$ to DV_{DD} through a several-hundred-ohm resistor.
30	$\overline{OE}$		Data is output when $\overline{OE}$ = Low. Pins D0 to D7 are at high impedance when $\overline{OE}$ = High.
32	NC		No Connect pin.

Absolute Maximum Ratings $T_A = 25^oC$

Supply Voltage (V_{DD}) 7V
Reference Voltage (V_{RT}, V_{RB}) ..... V_{DD} +0.5V to V_{SS} - 0.5V
Input Voltage, Analog (V_{IN}) ..... V_{DD} +0.5V to V_{SS} - 0.5V
Input Voltage, Digital (V_{IH}, V_{IL}) ..... V_{DD} +0.5V to V_{SS} - 0.5V
Output Voltage, Digital (V_{OH}, V_{OL}) ..... V_{DD} +0.5V to V_{SS} - 0.5V

Thermal Information

Thermal Resistance (Typical, Note 1) θ_{JA} ($^oC/W$)
MQFP Package 122
Maximum Junction Temperature (Plastic Package) ..... 150^oC
Maximum Storage Temperature Range ..... -65^oC to 150^oC
Maximum Lead Temperature (Soldering 10s) ..... 300^oC
(MQFP - Lead Tips Only)

Recommended Operating Conditions

Temperature Range (t_{OPR}) ..... -40^oC to 85^oC
Supply Voltage ($|DV_{SS} - AV_{SS}|$) ..... 0 to 100mV
Power Supply (DV_{DD}, DV_{SS})(AV_{DD}, AV_{SS}) ..... 3.14V to 4.0V
Reference Input Voltage (V_{RB}) 0.4V
(V_{RT}) 1.8V
Analog Input (ADIN) ..... V_{RT} to V_{RB}
Clock Pulse width (t_{PW1}) ..... 27ns (Min)
(t_{PW0}) ..... 27ns (Min)

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

NOTE:
1. θ_{JA} is measured with the component mounted on an evaluation PC board in free air.

Electrical Specifications

When using a single power supply; $f_C = 18$ MSPS, $V_{DD} = 3.3V$, $V_{RB} = 0V$, $V_{RT} = 1.5V$, $T_A = 25^oC$

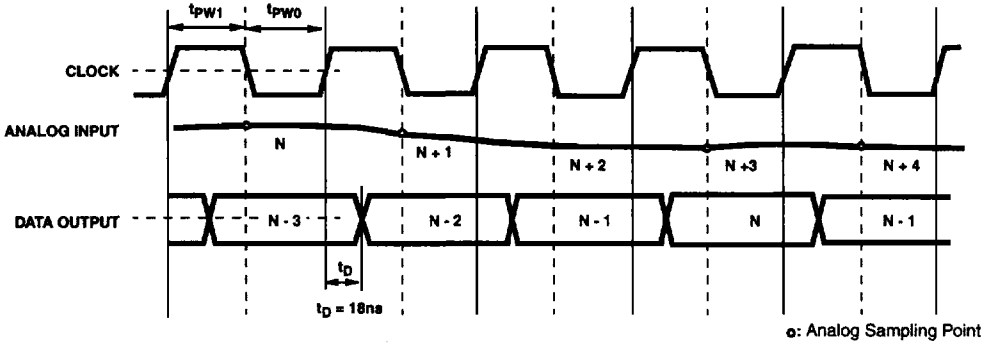
PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNITS
Maximum Conversion Rate	f_C Max	V_{IN} = 0 to 1.5V		18	32	-	MSPS
Minimum Conversion Rate	f_C Min	f_{IN} = 1kHz Ramp		-	32	0.5	MSPS
Supply Current	I_{DD}	f_C = 18 MSPS, NTSC Ramp Wave Input		-	5.5	10	mA
Reference Pin Current	I_{REF}			3.3	4.6	6.6	mA
Analog Input Band Width	BW	V_{IN} = 1.4V_{P-P}, 17.9MHz		-	-.9	-	dB
Analog Input Capacitance	C_{IN}	V_{IN} = 0.75V + 0.07 V_{RMS}		-	8	-	pF
Reference Resistance (V_{RT} to V_{RB})	R_{REF}			230	330	440	Ω
Self Bias I	V_{RB1}	Shorts V_{RB} and V_{RBS}		0.33	0.36	0.39	V
	V_{RT1} - V_{RB1}	Shorts V_{RT} and V_{RTS}		1.30	1.39	1.48	V
Offset Voltage	E_{OT}			-45	-25	-5	mV
	E_{OB}			40	60	80	mV
Digital Input Voltage	V_{IH}			2.5	-	-	V
	V_{IL}			-	-	0.5	V
Digital Input Current	I_{IH}	V_{DD} = Max	$V_{IH} = V_{DD}$	-	-	5	µA
	I_{IL}		V_{IL} = 0V	-	-	-	µA
Digital Output Current	I_{OH}	$\overline{OE} = V_{SS}$, V_{DD} = Min	$V_{OH} = V_{DD}$ - 0.5V	-1.0	-	-	mA
	I_{OL}		V_{OL} = 0.4V	3.3	-	-	mA
Digital Output Current	I_{OZH}	$\overline{OE} = V_{DD}$, V_{DD} = Max	$V_{OH} = V_{DD}$	-	-	16	µA
	I_{OZL}		V_{OL} = 0V	-	-	16	µA
Output Data Delay	t_{DL}	With TTL 1 Gate and 10pF Load		8	18	30	ns
Three-State Output Enable Time	t_{PZH}	R_L = 1kΩ, C_L = 20pF, $\overline{OE}$ = 3V→0V					
	t_{PZL}						
Three-State Output Disable Time	t_{PHZ}	R_L = 1kΩ, C_L = 20pF, $\overline{OE}$ = 0V→3V					
	t_{PLZ}						
Integral Nonlinearity Error	E_L	f_C = 18 MSPS, V_{IN} = 0 to 1.5V		-	+0.5	±1.3	LSB
Differential Nonlinearity Error	E_D	f_C = 18 MSPS, V_{IN} = 0 to 1.5V		-	±0.3	±0.5	LSB
Aperture Jitter	t_{AJ}			-	30	-	ps
Sampling Delay	t_{SD}			-	4	-	ns
Clamp Offset Voltage	E_{OC}	V_{IN} = DC, PWS = 3µs	V_{REF} = 0.5V	-20	0	+20	mV
			V_{REF} = 1.5V	-30	-10	+10	mV
Clamp Pulse Delay	t_{CPD}			-	25	-	ns

Digital Output

The following table shows the relationship between analog input voltage and digital output code.

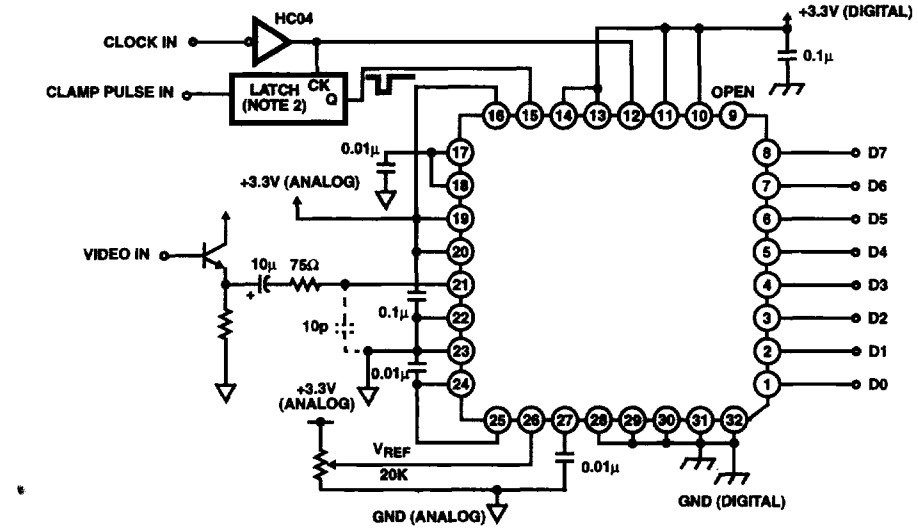
INPUT SIGNAL VOLTAGE	STEP	DIGITAL OUTPUT CODE MSB							LSG
V_{RT}	0	1	1	1	1	1	1	1	1
•	•				•				
•	•				•				
•	•				•				
•	127	1	0	0	0	0	0	0	0
•	128	0	1	1	1	1	1	1	1
•	•				•				
•	•				•				
•	•				•				
V_{RB}	255	0	0	0	0	0	0	0	0

Timing Chart



o: Analog Sampling Point

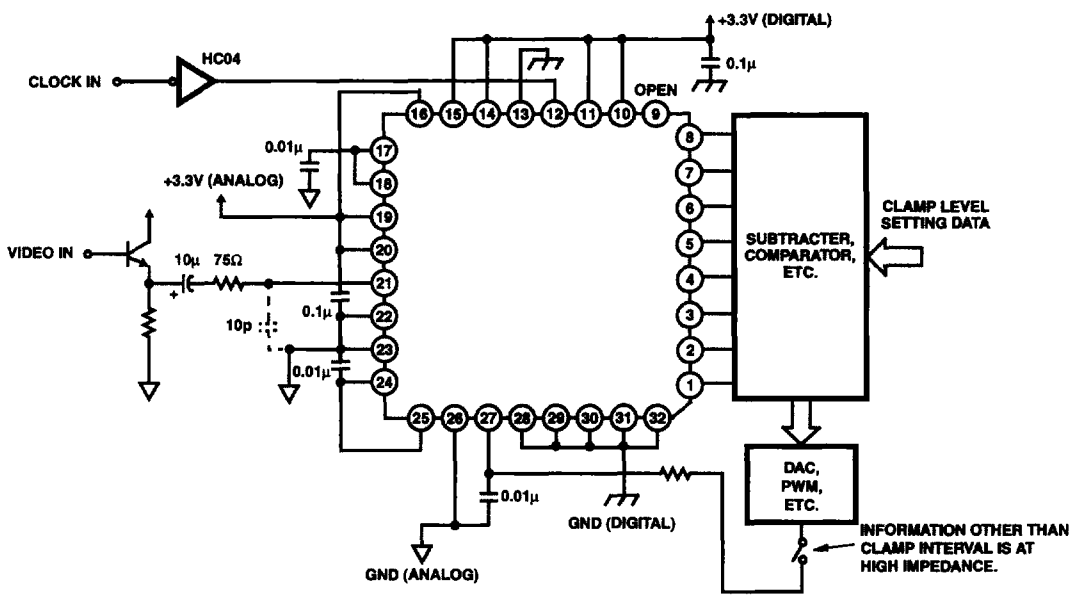
Typical Application Circuits



NOTE:

1. The clamp pulse is latched by the sampling clock of ADC, but that is not necessary for basic clamp operaiotn. However, slight small beat may be generated as Vertical sag according to the relationship between the sampling frequency and the clamp pulse frequency. At such time, the latch circuit is efective in this case.

FIGURE 1. WHEN CLAMP IS USED (SELF BIAS)



NOTES:

2. The relationship between the changes in CCP voltage (Pin 27) and in V_{IN} voltage is positive phase.
3. $\Delta V_{IN}/\Delta V_{CCP}$ = 3.0 (f_S = 20 MSPS).

FIGURE 2. DIGITAL CLAMP (SELF BIAS)

Typical Application Circuits (Continued)

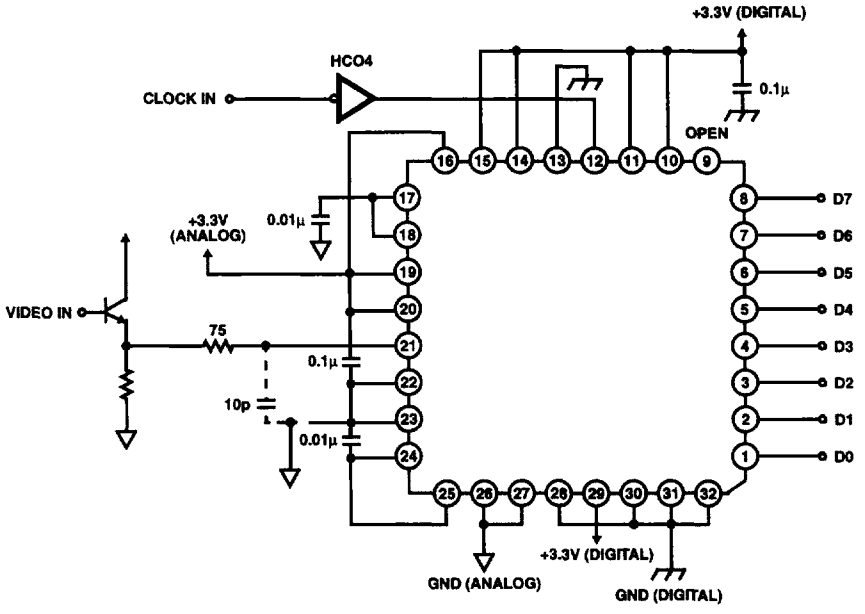


FIGURE 3. WHEN CLAMP IS NOT USED (SELF BIAS)