

# AN8133FHP (Under development)

High Speed Low Power Consumption Bi-CMOS 10-Bit A/D Converter

## Overview

The AN8133FHP is a 10-bit A/D converter for image processing which employs the Bi-CMOS process to realize the low power consumption.

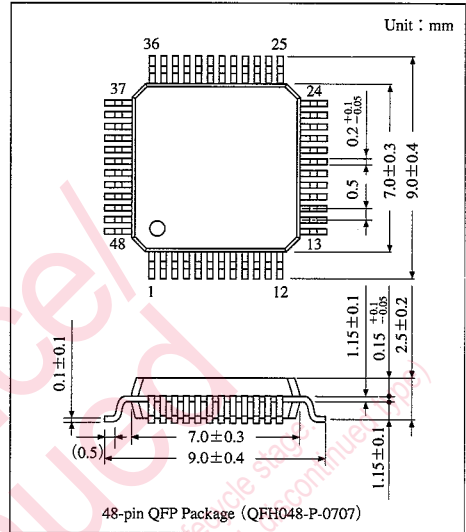
## Features

- 10-bit resolution
- Maximum conversion rate : 40 MSPS (min.)
- Low power consumption : 200 mW (typ.)
- Operation on single power supply of 5 V
- S/H circuit not required
- Input/Output form : TTL level compatible

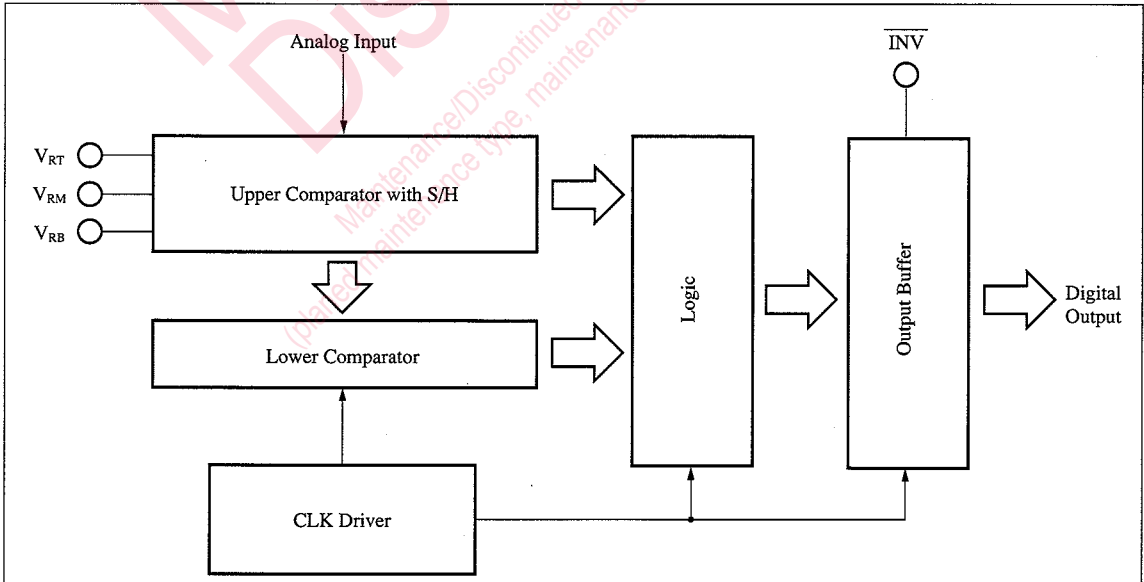
## Application Field

- Digital video broadcasting such as D-STB
- Image equipment such as HDTV
- OA equipment such as image scanner
- Medical equipment such as ultrasonic diagnosis device

Note) Since the AN8133FHP is under development, the description here may be modified without any prior notice. When the final design is reviewed, refer to the up-to-date product standards.



## Block Diagram



A/D  
and D/A  
Converters

### ■ Absolute Maximum Rating (Ta=25°C)

Parameter	Symbol	Rating	Unit
Supply voltage	V <sub>CC</sub>	-0.5 to +6.0	V
Analogue input voltage	V <sub>IN</sub>	0 to V <sub>CC</sub> +0.3	V
Digital input voltage	V <sub>CLK</sub>	-0.5 to V <sub>CC</sub> +0.5	V
Digital output current	I <sub>OVF</sub> /I <sub>DO</sub> to I <sub>D9</sub>	-15	mA
Reference voltage	V <sub>RT</sub> /V <sub>RB</sub>	0 to V <sub>CC</sub> +0.5	V
Power dissipation	P <sub>D</sub>	700 (Ta=75°C)	mW
Operating ambient temperature	T <sub>opr</sub>	0 to 75	°C
Storage temperature	T <sub>stg</sub>	-55 to +150	°C

### ■ Recommended Operating Conditions (Ta=25°C)

Parameter	Symbol	Condition	min	typ	max	Unit
Supply voltage	V <sub>CC</sub>		4.75	5.0	5.25	V
Reference voltage	V <sub>RT</sub>		—	4.25	—	V
	V <sub>RB</sub>		—	2.25	—	V
Analogue input voltage	V <sub>IN</sub>		V <sub>RB</sub>	—	V <sub>RT</sub>	V
Digital input voltage	V <sub>IH</sub>		2	—	4	V
	V <sub>IL</sub>		—	—	0.8	V
Digital output current	I <sub>OH</sub>	V <sub>OH</sub> =2.7V	—	-0.4	—	mA
	I <sub>OL</sub>	V <sub>OL</sub> =0.4V	—	1.6	—	mA
Clock input pulse width			—	50	—	%

### ■ Electrical Characteristics (V<sub>CC</sub>=5V, Ta=25°C)

Parameter	Symbol	Condition	min	typ	max	Unit
Supply current	I <sub>CC</sub>		—	40	—	mA
Reference resistive current	I <sub>RT</sub>	V <sub>RT</sub> =4.25V	—	2.4	—	mA
	I <sub>RB</sub>	V <sub>RB</sub> =2.25V	—	-2.4	—	mA
Input bias current	I <sub>IN</sub>	V <sub>IN</sub> =3.2V	—	—	150	μA
Clock input current	I <sub>IH</sub>	V <sub>CLK</sub> =2.7V	—	1	—	μA
	I <sub>IL</sub>	V <sub>CLK</sub> =0.4V	—	1	—	μA
Digital output voltage	V <sub>OH</sub>	I <sub>OH</sub> =-400μA	2.7	3.4	—	V
	V <sub>OL</sub>	I <sub>OL</sub> =1.6mA	—	—	0.4	V
Linearity error	E <sub>L</sub>	V <sub>IN</sub> =2V <sub>P-P</sub>	—	±1	—	LSB
Differential linearity error	E <sub>D</sub>	V <sub>IN</sub> =2V <sub>P-P</sub>	—	—	1.0	LSB
Maximum conversion rate	F <sub>C</sub>	V <sub>IN</sub> =2V <sub>P-P</sub>	40	—	—	MSPS
Quantization noise	S/N	f <sub>CLK</sub> =40MHz, f <sub>IN</sub> =1MHz	—	55	—	dB
		f <sub>CLK</sub> =40MHz, f <sub>IN</sub> =15MHz	—	50	—	dB
Difference gain	DG	IRE standard 15Kz Sawtooth 40% subcarrier	—	0.5	1.0	%
Differential phase	DP	f <sub>CLK</sub> =20MHz, Nolock	—	0.5	1.0	°
Input band	BW	V <sub>IN</sub> =2V <sub>P-P</sub> , -3dB	50	—	—	MHz
Digital output delay	τ <sub>d</sub>	f <sub>CLK</sub> =40MHz	—	20	—	ns
Input capacitance	C <sub>IN</sub>	V <sub>IN</sub> =3.25V	—	10	—	pF

### Pin Description

Pin No.	Symbol	Pin name	Standard waveform	Voltage level	Description
42	$\overline{\text{INV}}$	Digital output invert pin		TTL	Setting $\overline{\text{INV}}$ pin to "L" level inverts all the data outputs (D0-D9) but not the overflow output. This pin is set to "L" level with no connection and operates a synchronously with clock.
24,30 39,40 43,47	DVCC	Digital power supply pin		5V	It is a power supply pin for digital circuit block. Connect tantalum capacitor of several $\mu\text{F}$ and ceramic capacitor of $0.1 \mu\text{F}$ as near as possible to this pin between this pin and DGND.
21,23 31,38 41,46	DGND	Digital ground		0V	Connect AGND and DGND with the possible lowest impedance at one point as near as possible to the chip.
37	OVF	Overflow pin		TTL	When overflow occurs, it becomes "H." This pin is not affected by $\overline{\text{INV}}$ pin.
25 26 27 28 29 32 33 34 35 36	D0 D1 D2 D3 D4 D5 D6 D7 D8 D9	Digital output (LSB) Digital output Digital output Digital output Digital output Digital output Digital output Digital output Digital output (MSB)	Refer to the timing chart.	TTL	It is an output pin of TTL Level. In order to prevent the digital noise to entering the analogue circuit, suppress the ringing as far as possible.
3,6 8,10 13,15 18,45 48	AGND	Analogue ground		0V	Connect the AGND and DGND with the possible lowest impedance at one point as near as the chip.
11 12 14 16 17	$V_{\text{RT}}$ $V_{\text{RTS}}$ $V_{\text{RM}}$ $V_{\text{RBS}}$ $V_{\text{RB}}$	Reference voltage high level, Reference voltage middle point level, Reference voltage low level		4.25V 3.25V 2.25V	It is used to set the reference voltage for comparator. Normally, $V_{\text{RT}}$ is given 4.25V and $V_{\text{RB}}$ is given 2.25V. Connect tantalum capacitor of several $\mu\text{F}$ and ceramic capacitor of $0.1 \mu\text{F}$ in parallel between each pin and analogue ground. $V_{\text{RM}}$ is provided for linearity compensation, which gives middle point potential between $V_{\text{RT}}$ and $V_{\text{RB}}$ . However, it is normally opened. $V_{\text{RTS}}$ and $V_{\text{RBS}}$ are sense pin of $V_{\text{RT}}$ or $V_{\text{RB}}$ respectively.
9	$V_{\text{IN}}$	Analogue input pin		2.25V~4.25V	It is an input pin of analogue signal for A/D conversion circuit.
1,2 7,19 44	AVCC	Analogue power supply pin		5.0V	It is a power supply pin for analogue circuit block. Connect tantalum capacitor of several $\mu\text{F}$ and ceramic capacitor of $0.1 \mu\text{F}$ as near as possible to this pin between this pin and AGND.
22	CLK	Clock input	Refer to the timing chart.	TTL	It is a clock for sampling. For their timing, refer to the timing chart.

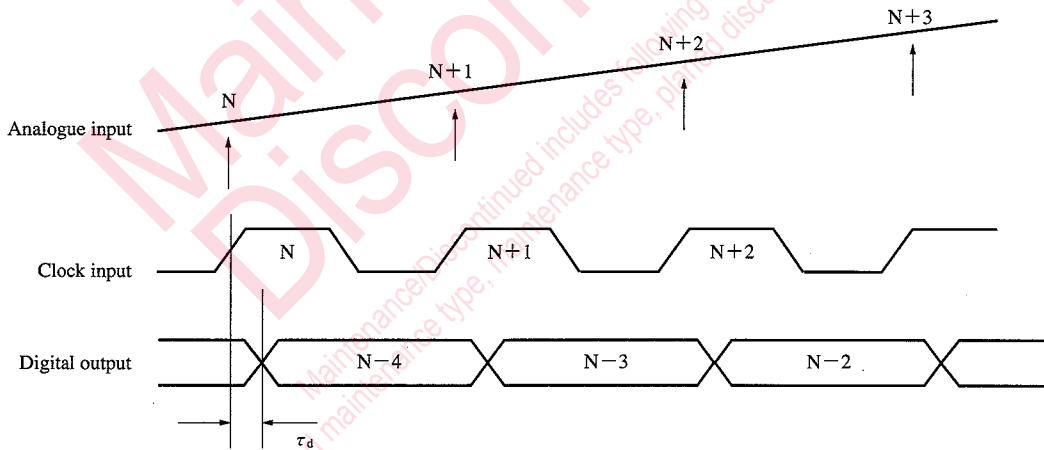
Pin No.4, 5, 20 : NC

A/D and D/A Converters
------------------------------

■ Output Code

Step	Input signal			Digital output			
	2.000VFS	1.953mV	STEP	$\overline{INV}=H$		$\overline{INV}=L$	
				M	L	M	L
				OVF9876543210		OVF9876543210	
000	4.250000			0	0000000000	0	1111111111
001	4.248047			0	0000000001	0	1111111110
.	.			.	.	.	.
.	.			.	.	.	.
.	.			.	.	.	.
511	3.251953			0	0111111111	0	1000000000
512	3.250000			0	1000000000	0	0111111111
513	3.248047			0	1000000001	0	0111111110
.	.			.	.	.	.
.	.			.	.	.	.
.	.			.	.	.	.
1023	2.251953			0	1111111111	0	0000000000
1024	2.250000			1	1111111111	1	0000000000

■ Timing Chart



## Request for your special attention and precautions in using the technical information and semiconductors described in this book

- (1) If any of the products or technical information described in this book is to be exported or provided to non-residents, the laws and regulations of the exporting country, especially, those with regard to security export control, must be observed.
- (2) The technical information described in this book is intended only to show the main characteristics and application circuit examples of the products. No license is granted in and to any intellectual property right or other right owned by Panasonic Corporation or any other company. Therefore, no responsibility is assumed by our company as to the infringement upon any such right owned by any other company which may arise as a result of the use of technical information described in this book.
- (3) The products described in this book are intended to be used for standard applications or general electronic equipment (such as office equipment, communications equipment, measuring instruments and household appliances).  
Consult our sales staff in advance for information on the following applications:
  - Special applications (such as for airplanes, aerospace, automobiles, traffic control equipment, combustion equipment, life support systems and safety devices) in which exceptional quality and reliability are required, or if the failure or malfunction of the products may directly jeopardize life or harm the human body.
  - Any applications other than the standard applications intended.
- (4) The products and product specifications described in this book are subject to change without notice for modification and/or improvement. At the final stage of your design, purchasing, or use of the products, therefore, ask for the most up-to-date Product Standards in advance to make sure that the latest specifications satisfy your requirements.
- (5) When designing your equipment, comply with the range of absolute maximum rating and the guaranteed operating conditions (operating power supply voltage and operating environment etc.). Especially, please be careful not to exceed the range of absolute maximum rating on the transient state, such as power-on, power-off and mode-switching. Otherwise, we will not be liable for any defect which may arise later in your equipment.
  - Even when the products are used within the guaranteed values, take into the consideration of incidence of break down and failure mode, possible to occur to semiconductor products. Measures on the systems such as redundant design, arresting the spread of fire or preventing glitch are recommended in order to prevent physical injury, fire, social damages, for example, by using the products.
- (6) Comply with the instructions for use in order to prevent breakdown and characteristics change due to external factors (ESD, EOS, thermal stress and mechanical stress) at the time of handling, mounting or at customer's process. When using products for which damp-proof packing is required, satisfy the conditions, such as shelf life and the elapsed time since first opening the packages.
- (7) This book may be not reprinted or reproduced whether wholly or partially, without the prior written permission of our company.