10BIT 30MSPS ADC ADC1280X

GENERAL DESCRIPTION

The ADC1280X is a CMOS 10-bit low-voltage and high-speed A/D converter (ADC) for video and other applications. It has a four-step pipelined architecture, which consists of sample & hold amplifier, multiplying D/A converters (DACs), and subranging flash ADCs.
The maximum conversion rate of ADC1280X is 30MSPS and supply voltage is 1.8V single.

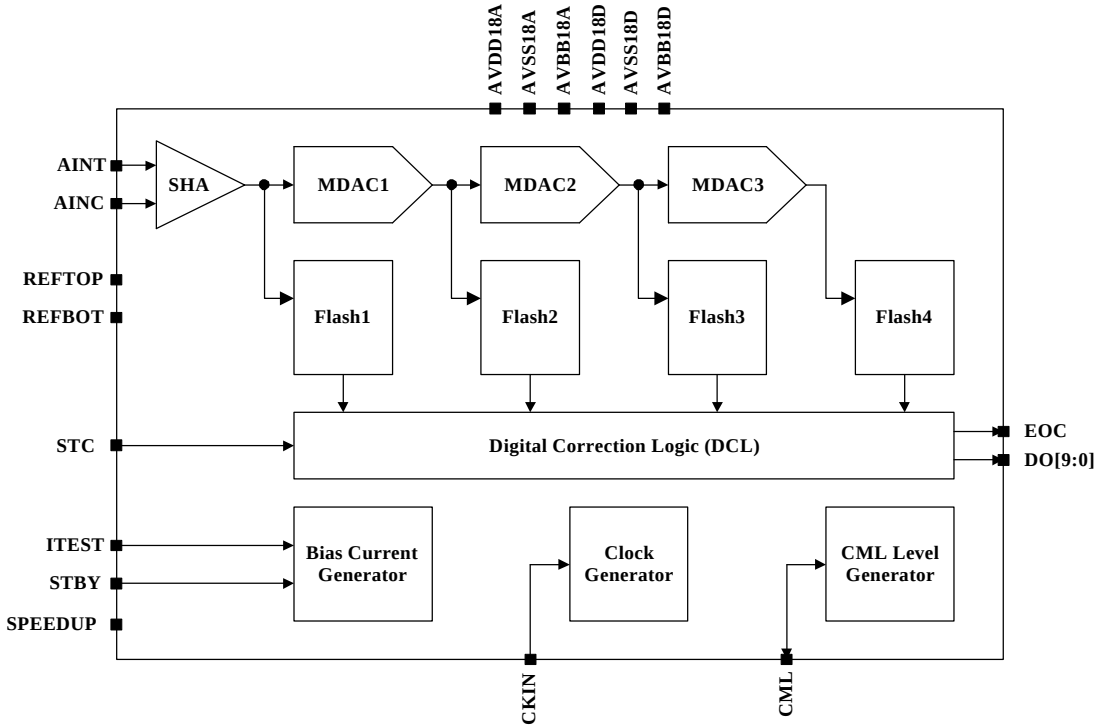
FEATURES

- **Resolution : 10Bit**
- **Differential Linearity Error : ±1.0 LSB**
- **Integral Linearity Error : ±2.0 LSB**
- **Maximum Conversion Rate : 30MSPS**
- **Sample & Hold Function Implemented**
- **Low Power Consumption : 21.6mW(Typ)**
- **Power Supply : 1.8V Single**
- **Operating Temperature Range : -40~85° C**

TYPICAL APPLICATIONS

- CCD imaging processors
  Camcorders, scanners, and security cameras.
- Read channel LSI
  HDD, DVD, and CD-ROM drives
- IF and baseband signal digitizers
- Portable equipments for low-power applications

FUNCTIONAL BLOCK DIAGRAM



Ver 2.2 (May 2002)

CORE PIN DESCRIPTION

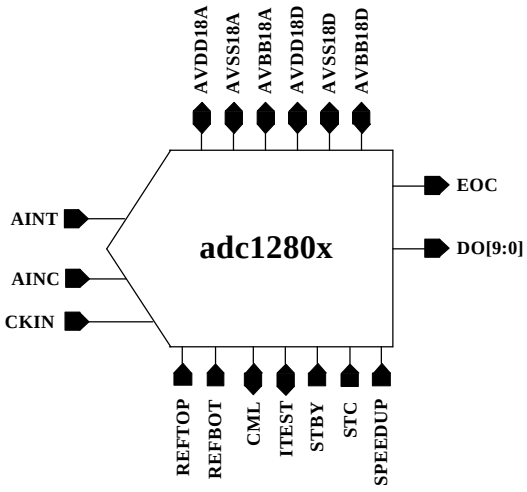
NAME	I/O TYPE	I/O PAD	PIN DESCRIPTION
AINT	AI	piar50_abb	Analog Input + (0.5V ~ 1.3V)
AINC	AI	piar50_abb	Analog Input - (1.3V ~ 0.5V)
REFTOP	AI	pia_abb	Reference Top (1.3V)
REFBOT	AI	pia_abb	Reference Bottom (0.5V)
AVDD18A	AP	vdd1t_abb	Analog Power (1.8V)
AVSS18A	AG	vss1t_abb	Analog Ground
AVBB18A	AG	vbb1_abb	Analog Sub Bias
ITEST	AB	pia_abb	Test pin (normally, open)
STBY	DI	picc_abb	Standby mode (normally, gnd)
STC	DI	picc_abb	Start of conversion signal (normally, high)
SPEEDUP	DI	picc_abb	Speed test pin (normally, gnd)
CKIN	DI	picc_abb	Sampling Clock Input
CML	AB	pia_abb	Test Pin (normally, open)
DO[9:0]	DO	poa_abb	Digital Output
EOC	DO	poa_abb	End of conversion signal
AVBB18D	DG	vbb1_abb	Digital Sub Bias
AVSS18D	DG	vss1t_abb	Digital Ground
AVDD18D	DP	vdd1t_abb	Digital Power

I/O TYPE ABBR.

- AI : Analog Input
- DI : Digital Input
- AO : Analog Output
- DO : Digital Output
- AB : Analog Bidirectional
- DB : Digital Bidirectional

- AP : Analog Power
- DP : Digital Power
- AG : Analog Ground
- DG : Digital Ground

CORE CONFIGURATION



ABSOLUTE MAXIMUM RATINGS

Characteristic	Symbol	Value	Unit
Supply Voltage	VDD	2.5	V
Analog Input Voltage	AIN	VSS to VDD	V
Digital Input Voltage	CLK	VSS to VDD	V
Digital Output Voltage	V_{OH}, V_{OL}	VSS to VDD	V
Storage Temperature Range	Tstg	-45 to 125	°C

NOTES

1. ABSOLUTE MAXIMUM RATING specifies the values beyond which the device may be damaged permanently. Exposure to ABSOLUTE MAXIMUM RATING conditions for extended periods may affect reliability. Each condition value is applied with the other values kept within the following operating conditions and function operation under any of these conditions is not implied.
2. All voltages are measured with respect to VSS unless otherwise specified.
3. 100pF capacitor is discharged through a 1.5KΩ resistor (Human body model).

RECOMMENDED OPERATING CONDITIONS

Characteristics	Symbol	Min	Typ	Max	Unit
Supply Voltage	AVDD18A - AVSS18A AVDD18D - AVSS18D	1.7	1.8	1.9	V
Supply Voltage Difference	AVDD18A - AVDD18D	-0.1	0.0	0.1	V
Reference Input Voltage(Externally)	REFTOP REFBOT	- -	1.3 0.5	- -	V
Analog Input Voltage (+)	AINT	0.5	-	1.3	V
Analog Input Voltage (-)	AINC	1.3	-	0.5	V
Operating Temperature	Topr	-40	-	85	°C

NOTES

1. It is strongly recommended that all the supply pins (AVDD18A, AVDD18D) be powered from the same source to avoid power latch-up.

DC ELECTRICAL CHARACTERISTICS

Characteristics	Symbol	Min	Typ	Max	Unit	Conditions
Resolution	-	-	10	-	Bits	
Reference Current	IREF	-	2	3	mA	
Differential Linearity Error	DLE	-	-	±1.0	LSB	
Integral Linearity Error	ILE	-	-	±2.0	LSB	
Bottom Offset Voltage Error	EOB	-	-	20	LSB	
Top Offset Voltage Error	EOT	-	-	20	LSB	

NOTES
1. Converter Specifications (unless otherwise specified)
   AVDD18A=1.8V AVDD18D=1.8V
   AVSS18A=GND AVSS18D=GND
   Ta=25° C
2. TBD : To Be Determined

AC ELECTRICAL CHARACTERISTICS

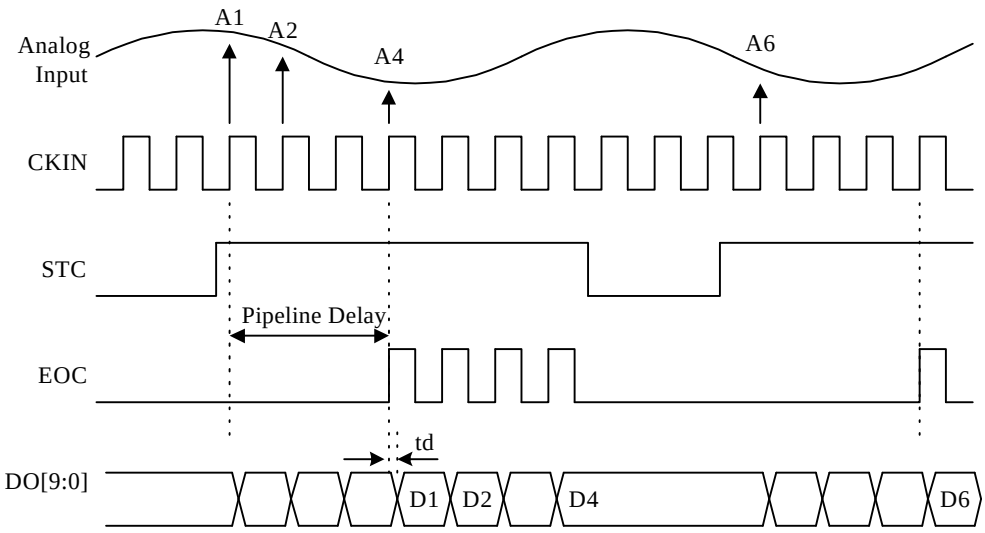
Characteristics	Symbol	Min	Typ	Max	Unit	Conditions
Maximum Conversion Rate	fc	-	-	30	MSPS	
Dynamic Supply Current	Ivdd	-	-	12	mA	fc=30MHz (without system load)
Digital Output Data Delay	td	-	2.1	-	ns	See "TIMING DIAGRAM"
Signal - to - Noise Ratio	SNR	48	52	-	dB	AINT = 1MHz fc = 30MHz

I/O CHART

Index	AINT Input (V)	AINC Input (V)	Digital Output	
0	0.50000 ~ 0.50078	1.29922 ~ 1.30000	0000000000	
1	0.50078 ~ 0.50156	1.29844 ~ 1.29922	0000000001	
2	0.50156 ~ 0.50234	1.29766 ~ 1.29844	0000000010	
•••	•••	•••	•••	1LSB=1.5625mV for differential input
511	0.89922 ~ 0.90000	0.90078 ~ 0.90156	0111111111	
512	0.90000 ~ 0.90078	0.90000 ~ 0.90078	1000000000	
513	0.90078 ~ 0.90156	0.89922 ~ 0.90000	1000000001	REFTOP=1.3V REFBOT=0.5V
•••	•••	•••	•••	
1021	1.29766 ~ 1.29844	0.50156 ~ 0.50234	1111111101	
1022	1.29844 ~ 1.29922	0.50078 ~ 0.50156	1111111110	
1023	1.29922 ~ 1.30000	0.50000 ~ 0.50078	1111111111	

TIMING DIAGRAM

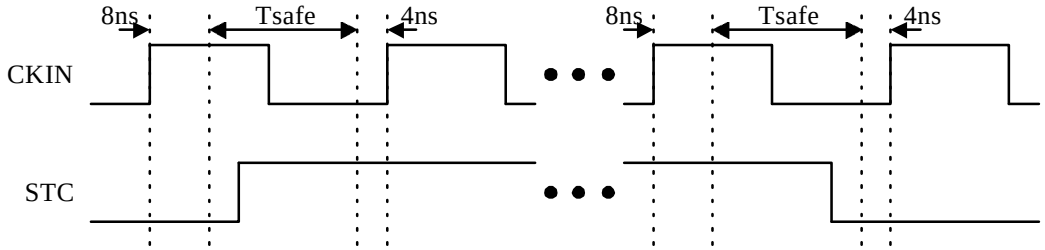
1. Main Waveform



Output code of DO[9:0] is generated during STC (Start of Conversion) signal is just "HIGH". Otherwise, it keeps the current states.

After STC goes "HIGH", the A/D converter requires the pipeline delay of 3 clock period to generate EOC signal and DO[9:0].

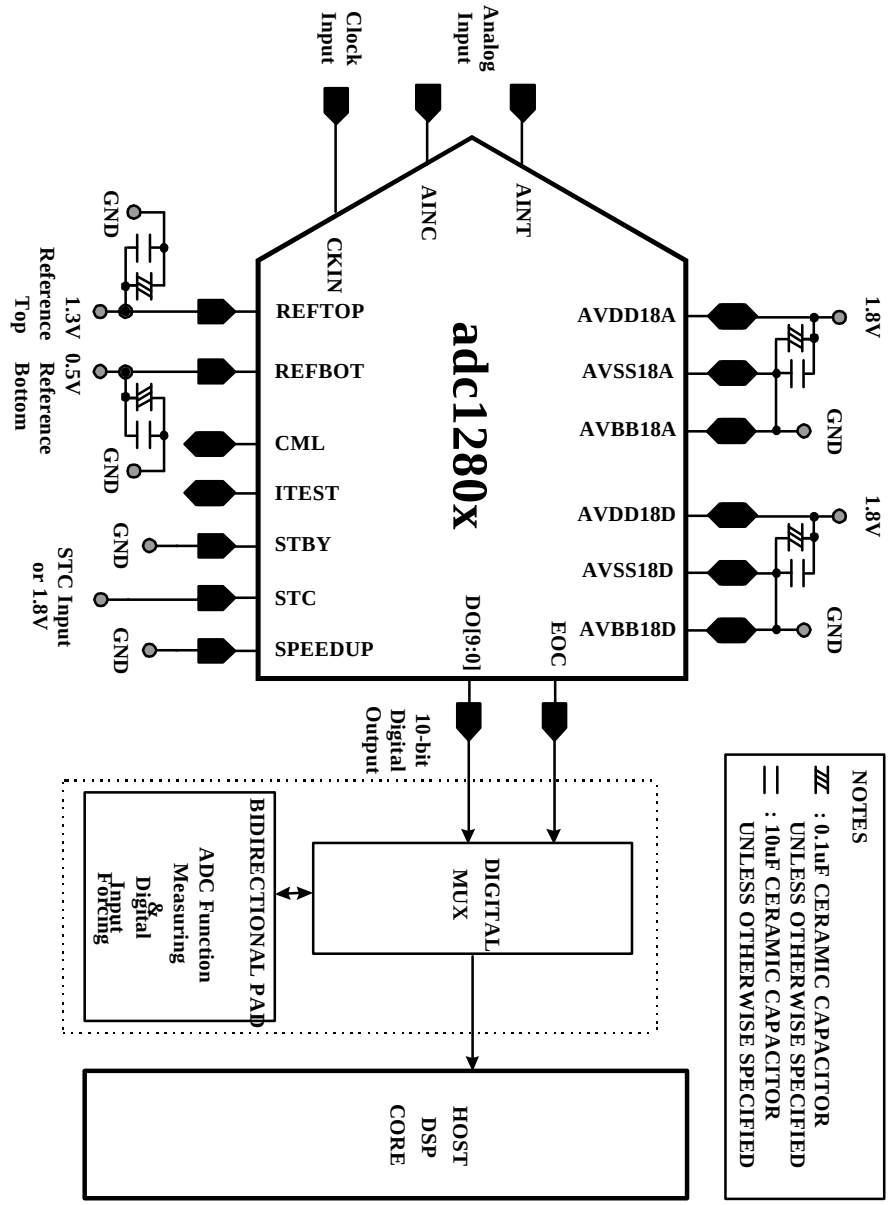
2. STC and CKIN



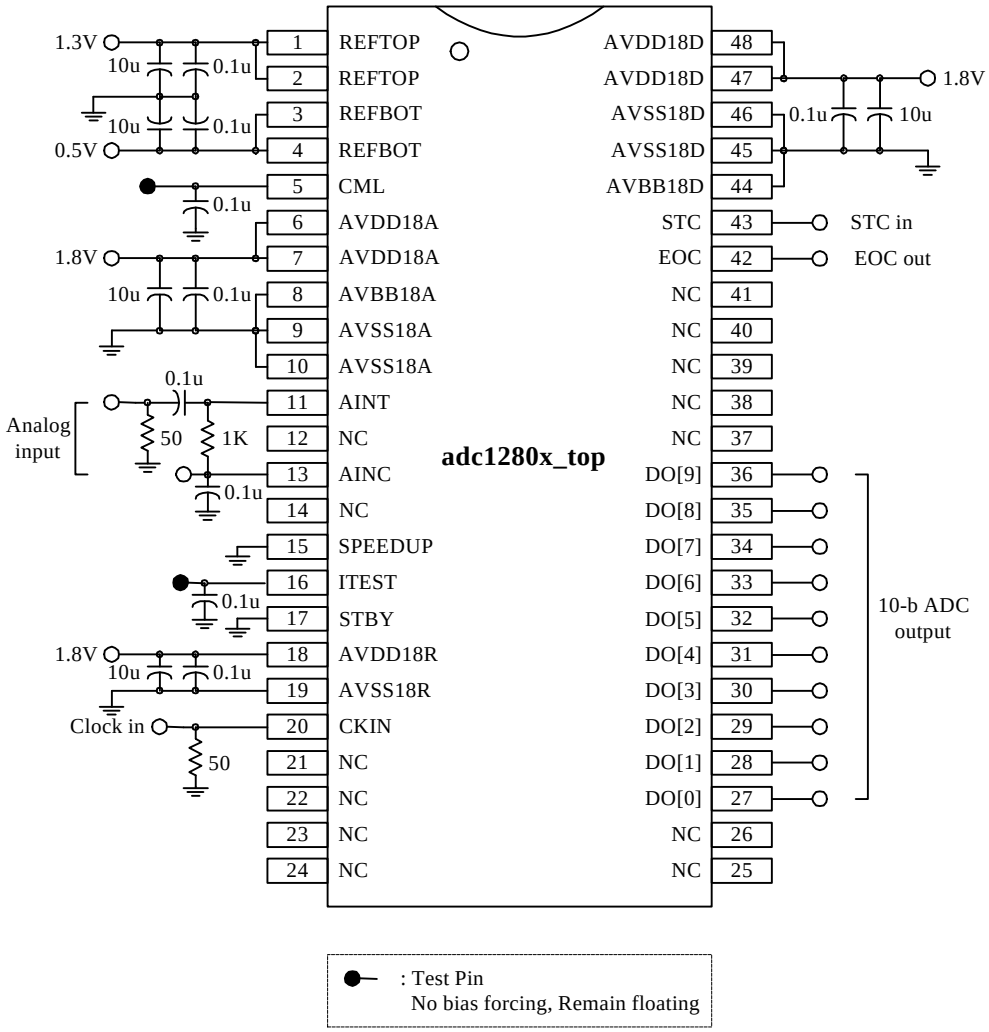
The STC signal is rising-edge triggered, and it should be changed during "Tsafe" region on CKIN .

CORE EVALUATION GUIDE

1. ADC function is evaluated by external check on the bidirectional pads connected to input nodes of HOST DSP back-end circuit.
2. The reference voltages may be biased internally through resistor devider.



PACKAGE CONFIGURATION



NOTES

1. This information is for testing the provided test-chips of ADC1280X.

PACKAGE PIN DESCRIPTION

NAME	PIN NO.	I/O TYPE	PIN DESCRIPTION
REFTOP	1,2	AI	External Reference Top Bias (1.3V)
REFBOT	3,4	AI	External Reference Bottom Bias (0.5V)
CML	5	AB	Internal Bias Point (Test Pin)
AVDD18A	6,7	AP	Analog Power (1.8V)
AVBB18A	8	AG	Analog Sub Bias
AVSS18A	9,10	AG	Analog Ground
AINT	11	AI	Analog Input + (Input Range : 0.5~1.3V Differential)
AINC	13	AI	Analog Input. - (Input Range : 1.3~0.5V Differential)
SPEEDUP	15	DI	Speed test pin. Tie to analog gnd
ITEST	16	AB	open=use internal bias point
STBY	17	DI	Power saving standby mode (normally gnd)
AVDD18R	18	PP	Ouput Driver Power (1.8V)
AVSS18R	19	PG	Output Driver Ground
CKIN	20	DI	Sampling Clock Input
DO[9:0]	27~36	DO	10bit Digitized Output
EOC	42	DO	End of conversion signal
STC	43	DI	Start of conversion signal
AVBB18D	44	DG	Digital Substrate Bias
AVSS18D	45,46	DG	Digital Ground
AVDD18D	47,48	DP	Digital Power (1.8V)

NOTES

1. This information is for testing the provided test-chips of ADC1280X.
2.. I/O TYPE PP and PG denote PAD Power and PAD Ground respectively.

USER GUIDE

1. Input signal range

The ADC was designed to use both single and differential mode input, but the differential mode is recommended to guarantee the operating margin in the low voltage condition.

- Differential mode input condition

Pin	Input range	Conditions
AINT	0.5V~1.3V	
AINC	1.3V~0.5V	180^{o} phase shifted input with the same DC level with AINT

- Single mode input condition

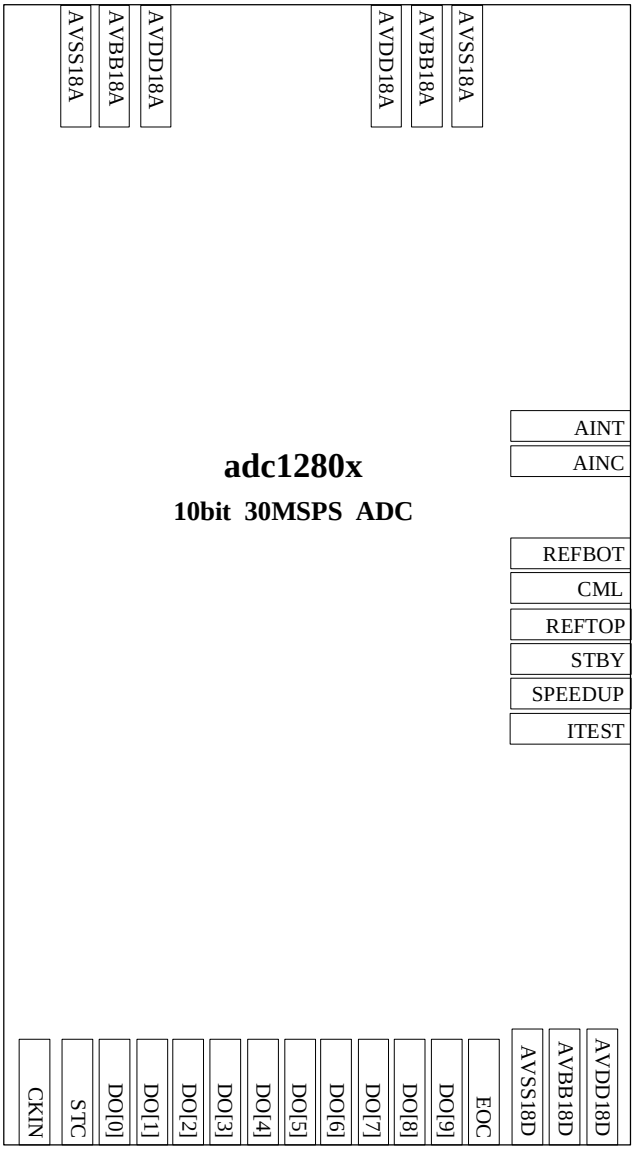
Pin	Input range	Conditions
AINT	0.2V~1.6V	
AINC	0.9V	forced from the clean DC source or CML pin of adc1280x

2. Input signal speed

Normal speed range of adc1280x is 1~6MHz input quantized by 30MHz clock, which is fixed by a normal video signal format. To use the input of adc1280x on near or over nyquist ranges such as the direct IF processing, consult about the additional performance issues with SEC.

PHANTOM CELL INFORMATION

- Pins of the core can be assigned externally (Package pins) or internally (internal ports) depending on design methods.
  The term "External" implies that the pins should be assigned externally like power pins.
  The term "External/internal" implies that the applications of these pins depend on the user.



Pin Name	Pin Usage	Pin Layout Guide
AVDD18A	External	- Maintain the large width of lines as far as the pads. - place the port positions to minimize the length of power lines. - Do not merge the analog powers with anoter power from other blocks. - Use good power and ground source on board.
AVSS18A	External	
AVBB18A	External	
AVDD18A	External	
AVSS18D	External	
AVBB18D	External	
AINT	External/Internal	- Do not overlap with digtal lines.
AINC	External/Internal	- Maintain the shotest path to pads.
CKIN	External/Internal	- Separate from all other analog signals
REFTOP	External/Internal	- Maintain the larger width and the shorter length as far as the pads.
REFBOT	External/Internal	
CML	External/Internal	- Separate from all other digital lines.
ITEST	External/Internal	
STBY	External/Internal	
STC	External/Internal	
SPEEDUP	External/Internal	
EOC	External/Internal	- Separated from the analog clean signals if possible. - Do not exceed the length by 1,000um.
DO[9]	External/Internal	
DO[8]	External/Internal	
DO[7]	External/Internal	
DO[6]	External/Internal	
DO[5]	External/Internal	
DO[4]	External/Internal	
DO[3]	External/Internal	
DO[2]	External/Internal	
DO[1]	External/Internal	
DO[0]	External/Internal	

FEEDBACK REQUEST

It should be quite helpful to our ADC core development if you specify your system requirements on ADC in the following characteristic checking table and fill out the additional questions.

We appreciate your interest in our products. Thank you very much.

Characteristic	Min	Typ	Max	Unit	Remarks
Analog Power Supply Voltage				V	
Digital Power Supply Voltage				V	
Bit Resolution				Bit	
Reference Input Voltage				V	
Analog Input Voltage				Vpp	
Operating Temperature				°C	
Integral Non-linearity Error				LSB	
Differential Non-linearity Error				LSB	
Bottom Offset Voltage Error				mV	
Top Offset Voltage Error				mV	
Maximum Conversion Rate				MSPS	
Dynamic Supply Current				mA	
Power Dissipation				mW	
Signal-to-noise Ratio				dB	
Pipeline Delay				CLK	
Digital Output Format (Provide detailed description & timing diagram)					

1. Between single input-output and differential input-output configurations, which one is suitable for your system and why?

2. Please comment on the internal/external pin configurations you want our ADC to have, if you have any reason to prefer some type of configuration.

3. Freely list those functions you want to be implemented in our ADC, if you have any.

HISTORY CARD

Version	Date	Modified Items	Comments
ver 1.0	00.7.4	Original version published (preliminary)	
ver 1.1	01.3.10	Change the reference range from "0.6V~1.2V" to "0.5V~1.3V"	
ver 2.0	01.7.2	Release the formal datasheet	
ver 2.1	01.8.1	Add "td" spec	
ver 2.2	02.5.1	Change the Operating Temperature Range from 0~70º C to -40~85º C	