

200 to 500 KSPS, ULTRA LOW POWER, 12-BIT SAR ANALOG-TO-DIGITAL CONVERTER

FEATURES

- Single Power Supply Range: 3.3V to 5.25V
- Specified Over a Range of Sample Rates
- Throughput Rate: 200 - 500 KSPS
- $\pm 1\text{LSB INL}$, $\pm 1\text{LSB DNL}$
- Zero Latency
- SPI/DSP/MICROWIRE™/QSPI™ Compatible Serial Interface
- Variable Power Management
- Low Power (XC121S051 typical):
 - 1.72mW (3.3V, 500KSPS)
 - 4.25mW (5V, 500KSPS)
- Second-Source for ADC121S051
- 6-Pin SOT-23 Package

APPLICATIONS

- Battery Powered Systems
- Instrumentation and Control Systems
- Remote Data Acquisition
- Portable Systems

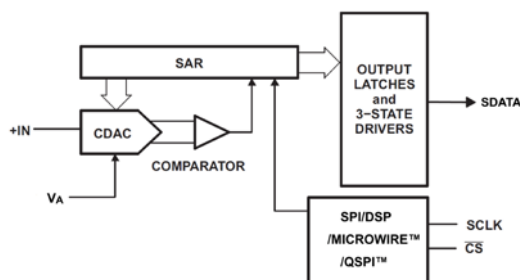


Figure 1. Functional Block Diagram

DESCRIPTION

The XC121S051 is an ultra-low power, small size, single-channel 12-bit analog-to-digital converter with a high speed serial interface. Unlike the conventional practice of specifying performance at a single sample rate only, the XC121S051 is fully specified over a sample rate range of 200 KSPS to 500 KSPS. The converter is based upon a successive-approximation register architecture with an internal track-and-hold circuit.

The XC121S051 is available in a 6-pin SOT-23 package and has an operating temperature range of -40°C to 85°C.

The XC121S051 is a drop-in replacement for the ADC121S051 and consumes only half dynamic power of their counterpart.

Pin-Compatible Alternatives by Resolution and Speed

Resolution	Specified for Sample Rate Range of:			
	50 to 200 KSPS	200 to 500 KSPS	500 to 800 KSPS	800 to 1000 KSPS
12-bit	XC121S021	XC121S051	XC121S101	XC121S101E
10-bit	XC101S021	XC101S051	XC101S101	XC101S101E
8-bit	XC081S021	XC081S051	XC081S101	XC081S101E

SPECIFICATIONS

At -40°C to 85°C, $f_{\text{SAMPLE}} = 500$ KSPS and $f_{\text{SCLK}} = 10$ MHz if $3.3 \text{ V} \leq V_{\text{DD}} \leq 5.25 \text{ V}$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS	XC121S051			XC101S051			XC081S051			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
SYSTEM PERFORMANCE											
Resolution		12			10			8			Bits
No missing codes		12			10			8			Bits
Integral linearity		-1 1			-1 1			-0.5 0.5			LSB
Differential linearity		-1 1			-0.75 0.75			-0.5 0.5			LSB
fSAMPLE Throughput rate	fSCLK = 10 MHz, 3.3 V ≤ VDD ≤ 5.25 V	200 500			200 500			200 500			KSPS
SNR	fIN = 100 kHz, 3.3 V ≤ VDD ≤ 5.25 V	72.5			61.4			49.4			dB
THD	fIN = 100 kHz, 3.3 V ≤ VDD ≤ 5.25 V	-83.5			-75			-67			dB

XC121S051

PARAMETER	TEST CONDITIONS		MIN	TYP	MAX	UNITS
I _{DD} Supply current, normal operation	Digital inputs = 0 V or V _{DD}	f _{SAMPLE} = 500 KSPS, f _{SCLK} = 10 MHz, V _{DD} = 3.3 V	0.52		0.55	mA
		f _{SAMPLE} = 500 KSPS, f _{SCLK} = 10 MHz, V _{DD} = 5 V	0.85		0.92	
		f _{SAMPLE} = 250 KSPS, f _{SCLK} = 5 MHz, V _{DD} = 3.3 V	0.35		0.38	
		f _{SAMPLE} = 250 KSPS, f _{SCLK} = 5 MHz, V _{DD} = 5 V	0.55		0.65	
POWER DISSIPATION, XC121S051						
Normal operation		f _{SAMPLE} = 500 KSPS, f _{SCLK} = 10 MHz, V _{DD} = 3.3 V	1.72		1.81	mW
		f _{SAMPLE} = 500 KSPS, f _{SCLK} = 10 MHz, V _{DD} = 5 V	4.25		4.60	mW

PIN CONFIGURATION AND FUNCTION DESCRIPTIONS

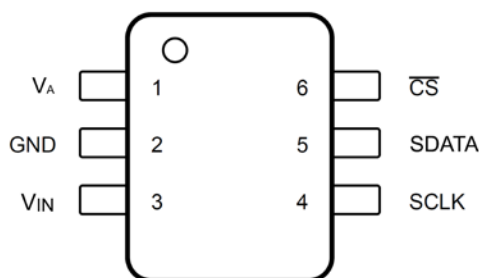


Figure 2. Pin Configuration

TERMINAL		DESCRIPTION
NAME	NO.	
V_A	1	Power supply input. The V_A range is from 3.3 V to 5.25 V.
GND	2	Ground for power supply, all analog and digital signals are referred with respect to this pin.
V_{IN}	3	Analog input. This signal can range from 0 V to V_A .
SCLK	4	Digital clock input. This clock directly controls the conversion and readout processes.
SDATA	5	Digital data output. The output samples are clocked out of this pin on falling edges of the SCLK pin.
$\overline{CS}$	6	Chip Select. On the falling edge of $\overline{CS}$, a conversion process begins.

TYPICAL CONNECTION

Figure 3 shows a typical connection diagram for the XC121S051. The 5 V supply should come from a stable power supply such as an LDO. The supply to XC121S051 should be decoupled to the ground. A 1- μ F and a 10-nF decoupling capacitor are required between the V_A and GND pins of the converter. This capacitor should be placed as close as possible to the pins of the device. Always set the V_A supply to be greater than or equal to the maximum input signal to avoid saturation of codes.

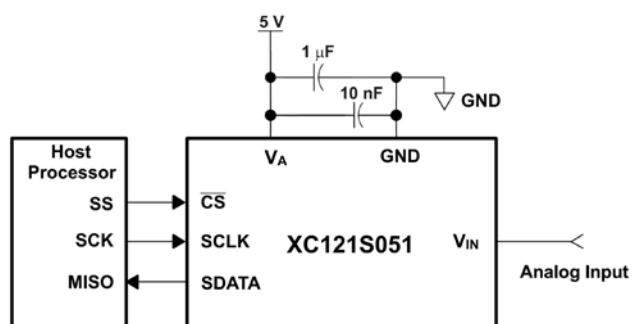


Figure 3. Typical Circuit Configuration

TIMING DIAGRAM

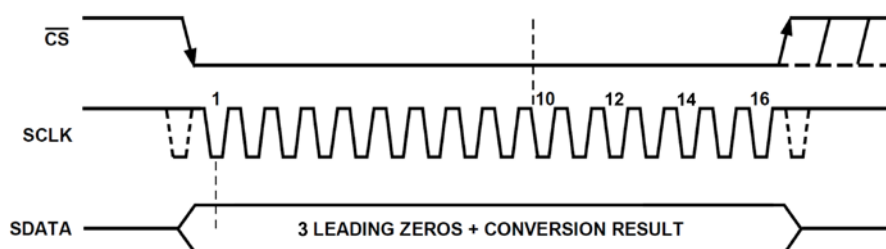


Figure 4. Timing Diagram

The conversion is initiated on the falling edge of $\overline{CS}$. The device outputs data while the conversion is in progress, and it requires 16 serial clock cycles to complete the conversion and access the full results. The XC121S051 data word contains 3 leading zeros, followed by 12-bit data in MSB first format.

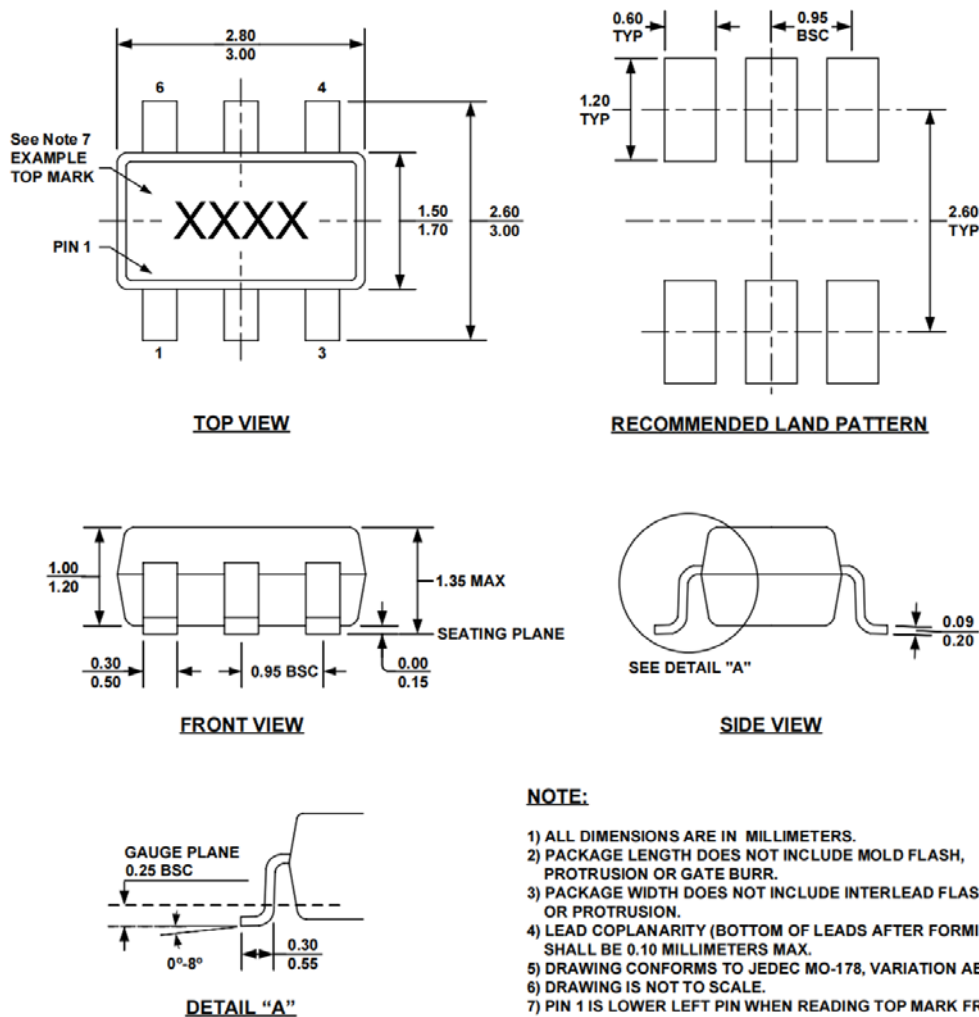
Once a data transfer is complete, SDATA will return to the tri-state mode, and another conversion can be initiated after the quiet time has elapsed by again bringing $\overline{CS}$ low.

POWER-DOWN MODE

The XC121S051 has an auto power-down feature. Besides powering down all circuitry, the converter consumes only a small amount of current in this mode. The device automatically wakes up when $\overline{CS}$ falls. However, not all of the functional blocks are fully powered until sometime before the third falling edge of SCLK. The device powers down once it reaches the end of conversion which is the 16th falling edge of SCLK for the XC121S051. The device enters power down mode if $\overline{CS}$ goes high before the 10th SCLK falling edge. Ongoing conversion stops and SDATA goes to three-state under this power down condition.

These converters achieve lower power dissipation for a fixed throughput rate by using higher SCLK frequencies. Higher SCLK frequencies reduce the acquisition time and conversion time. This means the converters spend more time in auto power-down mode per conversion cycle. For a particular SCLK frequency, the acquisition time and conversion time are fixed. Therefore, a lower throughput increases the proportion of the time the converters are in power down, thereby reducing power consumption.

OUTLINE DIMENSIONS



NOTES

1. Unpacked ICs, tube-mounted ICs, etc. must be stored in a drying cabinet, and the humidity in the drying cabinet < 20% R.H.
2. After access, the components are stored in an electrostatic packaging protective bag.
3. Anti-static damage: the device is an electrostatic sensitive device, and sufficient anti-static measures should be taken during transmission, assembly and testing.
4. The user should conduct a visual inspection before use, and the bottom, side and surrounding of the circuit can be welded only if it is bright. If oxidation occurs, the circuit can be processed by means of oxidation, and the circuit must be soldered within 12 hours after processing.