

1-MSPS, ULTRA LOW POWER, 3.0 V – 4.5 V, 12-BIT SAR ANALOG-TO-DIGITAL CONVERTER

DESCRIPTION

The XC11665A is a 12-bit, high speed, low power, and small-sized Successive-Approximation-Register (SAR) ADC. The supply current drops at lower sampling rates because the device automatically power down after conversion.

The XC11665A version can operate from a single 3.0 V to 4.5 V supply with a 1-MSPS throughput.

The XC11665A is available in a 6-pin SOT-23 package and has an operating temperature range of -40°C to 85°C.

The XC11665A is a drop-in replacement for the MAX11665.



FEATURES

- Single 3.0 V to 4.5 V Supply Operation for XC11665A
- Fast Throughput Rate: 1 MSPS
- 12-Bit Resolution
- Low Power (XC11665A typical):
 - 2.30mW (3.3 V, 1 MSPS)
 - 9.80mW (4.5 V, 1 MSPS)
- $\pm 1\text{LSB INL}$, $\pm 1\text{LSB DNL}$
- No Data Latency
- SPI/QSPI/MICROWIRE™ Compatible Serial Interface
- Guaranteed Operation from -40°C to 85°C
- 6-Pin SOT-23 Package
- Second-Source for MAX11665

APPLICATIONS

- Data Acquisition
- Portable Data Logging
- Medical Instrumentation
- Battery-Operated Systems
- Communication Systems
- Automotive

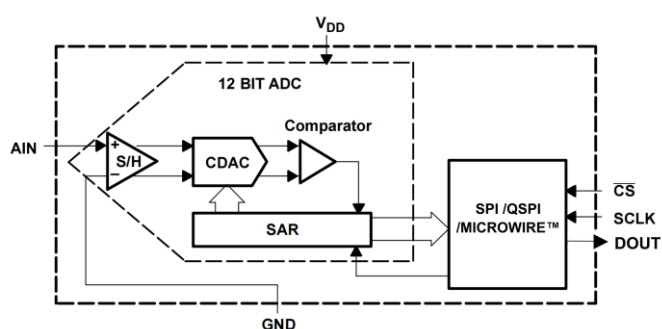


Figure 1. Functional Block Diagram

SPECIFICATIONS

At -40°C to 85°C, $f_{\text{SAMPLE}} = 1$ MSPS and $f_{\text{SCLK}} = 16.6$ MHz if $3.0 \text{ V} \leq V_{\text{DD}} \leq 4.5 \text{ V}$. (unless otherwise noted)

PARAMETER	TEST CONDITIONS	XC11661A	XC11663A	XC11665A	UNITS
		MIN TYP MAX	MIN TYP MAX	MIN TYP MAX	
SYSTEM PERFORMANCE					
Resolution		8	10	12	Bits
No missing codes		8	10	12	Bits
Integral linearity		0.5	0.5	1	LSB
Differential linearity		0.5	0.5	1	LSB
fSAMPLE Throughput rate	fSCLK = 16.6 MHz, 3.0 V ≤ VDD ≤ 4.5 V	1	1	1	MSPS
SNR	fIN = 100 kHz	49	61	72	dB
THD	fIN = 100 kHz	-66	-73.5	-83	dB

XC11665A

PARAMETER	TEST CONDITIONS		MIN	TYP	MAX	UNITS
I _{DD} Supply current, normal operation	Digital inputs = 0 V or V _{DD}	f _{SAMPLE} = 1000 KSPS, f _{SCLK} = 16.6 MHz, V _{DD} = 3.3 V	0.69		1.54	mA
		f _{SAMPLE} = 1000 KSPS, f _{SCLK} = 16.6 MHz, V _{DD} = 4.5 V	2.17		3.40	
		f _{SAMPLE} = 800 KSPS, f _{SCLK} = 16.6 MHz, V _{DD} = 3.3 V	0.60		1.28	
		f _{SAMPLE} = 800 KSPS, f _{SCLK} = 16.6 MHz, V _{DD} = 4.5 V	1.80		2.80	
POWER DISSIPATION, XC11665A						
Normal operation		f _{SAMPLE} = 1000 KSPS, f _{SCLK} = 16.6 MHz, V _{DD} = 3.3 V	2.30		5.10	mW
		f _{SAMPLE} = 1000 KSPS, f _{SCLK} = 16.6 MHz, V _{DD} = 4.5 V	9.80		15.3	mW

PIN CONFIGURATION AND FUNCTION DESCRIPTIONS

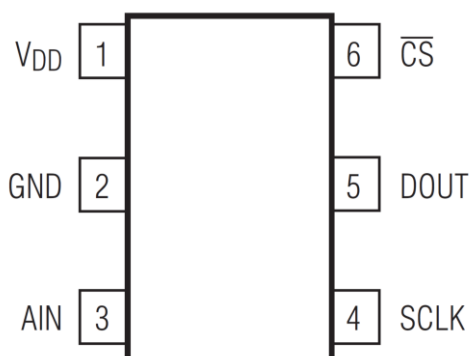


Figure 2. Pin Configuration

TERMINAL		DESCRIPTION
NAME	NO.	
V _{DD}	1	Power Supply Input.
GND	2	The ground return for the supply and signals.
AIN	3	Analog Input. This signal can range from 0 V to V _{DD} .
SCLK	4	Digital clock input. This clock directly controls the conversion and readout processes.
DOUT	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 XC11665A. The 3.3 V supply should come from a stable power supply such as an LDO. The supply to XC11665A should be decoupled to the ground. Two decoupling capacitors, one 1-μF and one 10-nF, are suggested to be inserted between the V_{DD} and GND pins of the converter. The capacitors should be placed as close as possible to the pins of the device. Always set the V_{DD} supply to be greater than or equal to the maximum input signal to avoid saturation of codes.

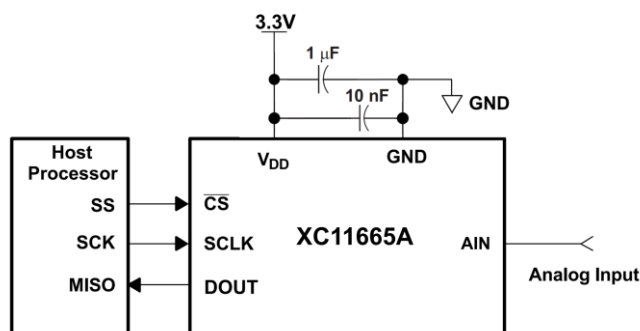


Figure 3. Typical Circuit Configuration

TIMING DIAGRAM

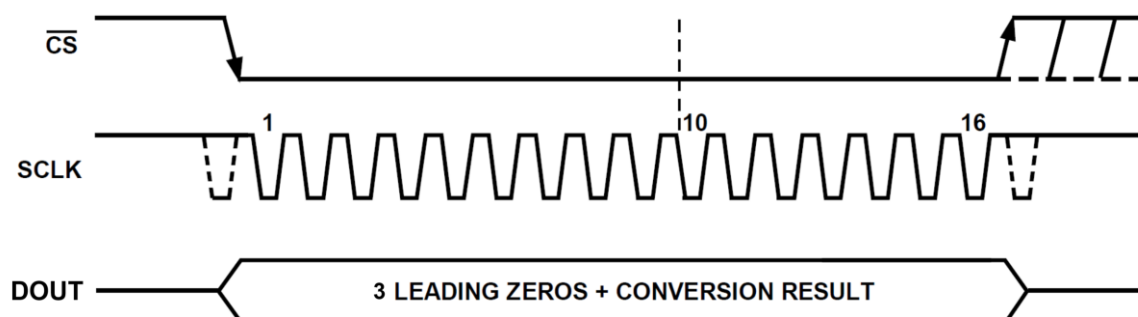


Figure 4. Timing Diagram

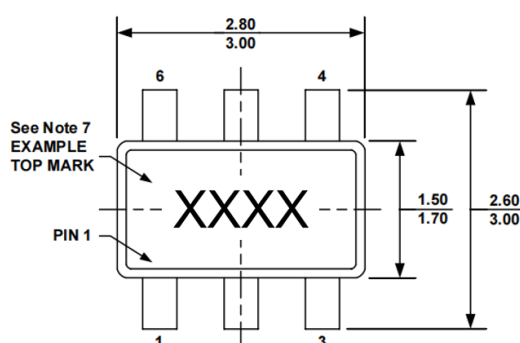
Unlike the MAX11665 series conversion, the MAX11665 will output the conversion result through DOUT after the second SCLK falling edge after the falling edge of $\overline{CS}$. However, the XC11665A series will output 3 leading zeros from DOUT following the 12-bit conversion result after the fourth SCLK falling edge after the $\overline{CS}$ falling edge, with the 8-bit result followed by four trailing zeros, and the 10-bit result followed by two trailing zeros. After that, DOUT enters a three-state and the transition cycle ends.

POWER-DOWN MODE

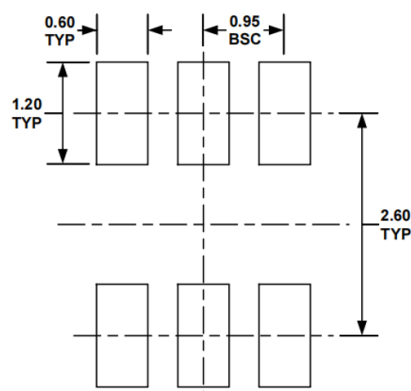
The XC11665A has an auto power-down feature. Besides powering down all circuitry, the converter consumes only a small amount of current in this mode. The device automatically wakes up when $\overline{CS}$ falls. However, not all of the functional blocks are fully powered until sometime before the third 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 XC11665A. The device enters power down mode if $\overline{CS}$ goes high before the 10th SCLK falling edge. Ongoing conversion stops and DOUT 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.

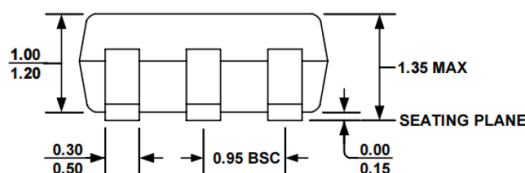
OUTLINE DIMENSIONS



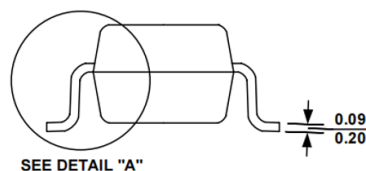
TOP VIEW



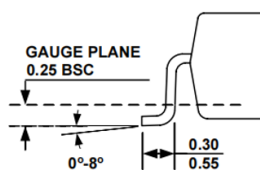
RECOMMENDED LAND PATTERN



FRONT VIEW



SIDE VIEW



DETAIL "A"

NOTE:

- 1) ALL DIMENSIONS ARE IN MILLIMETERS.
- 2) PACKAGE LENGTH DOES NOT INCLUDE MOLD FLASH, PROTRUSION OR GATE BURR.
- 3) PACKAGE WIDTH DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION.
- 4) LEAD COPLANARITY (BOTTOM OF LEADS AFTER FORMING) SHALL BE 0.10 MILLIMETERS MAX.
- 5) DRAWING CONFORMS TO JEDEC MO-178, VARIATION AB.
- 6) DRAWING IS NOT TO SCALE.
- 7) PIN 1 IS LOWER LEFT PIN WHEN READING TOP MARK FROM LEFT TO RIGHT, (SEE EXAMPLE TOP MARK)

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.