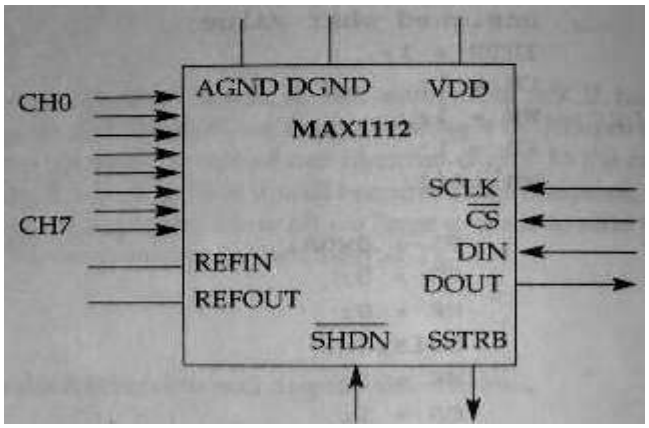
Serial ADC MAX 1112

The D0-D7 data pins of the ADC0848/0804 provide an 8-bit parallel data path between the ADC chip and the CPU. In the case of the 16-bit parallel ADC chip, we need 16 pins for the data path. In recent years, for many applications where space is a critical issue, using such a large number of pins for data is not feasible. For this reason, serial devices such as the serial ADC are becoming widely used. We examine the MAX1112 serial ADC chip from Maxim Corporation and show how to interface it with the microcontroller.

MAX1112 ADC

The MAX1112 is an 8-bit serial ADC chip with 8 channels of analog input. It has a single D_{OUT} pin to bring out the digital data after it has been converted. It is compatible with a popular SPI and Microwire serial standard. The following are descriptions of the MAX1112 pins. (See below figure)



CHO-CH7

CH0-CH7 are 8 channels of the analog inputs. In the single-ended mode, each of the channels can be used for an analog input where the COM pin is used as a ground reference for all the channels. In single-ended mode, 8 channels of input allow us to read 8 different analog inputs. We select the input channel by sending in the control byte via the DIN pin. In differential mode, we have 4 sets of 2-channel differentials. CH0 and CH1 go together, and CH2-CH3, and so on.

COM: Ground reference for the analog input in single-ended mode.

CS: Chip select is an active low input used to select the MAX1112 chip. To send in the control byte via the D_{IN} pin, CS must be low. When CS is high the D_{OUT} is high impedance.

SCLK: Serial clock input. SCLK is used to bring data out and send in the control byte, one bit at a time.

D_{OUT}: Serial data out. The digital data is clocked out one bit at a time on the H-to-L edge (falling edge) of SCLK.

D_{IN} : Serial data in the control byte is clocked in one bit at a time on the L-to-H edge (rising edge) of SCLK.

SSTRB: Serial strobe output. In internal clock mode this indicates end-of-conversion. It goes high when the conversion is complete.

V_{DD} : V_{DD} is the +5 volt power supply.

AGND, DGND (analog ground and digital ground)

Both are input pins providing ground for both the analog and the digital signals.

SHDN: Shutdown in an input and is normally not connected (or is connected to V_{DD}). If low, the ADC is shut down to save power. This is shut down by hardware. The control byte causes shutdown by software.

REFIN : Reference voltage input. This voltage dictates the step size.

REFOUT: Internal Reference Generator output. A 1 μF bypass capacitor is placed between this pin and AGND.

MAX1112 control byte

The MAX1112 chip has 8 channels of analog inputs that are selected using a control byte. The control byte is fed into the MAX1112 serially one bit at a time via the D_{IN} pin with the help of SCLK. The control byte must be sent in with the MSB of the control byte is high to indicate the start of the control byte.

REFIN voltage and step size

The step size for the MAX1112 depends on the voltage connected to the REFIN pin. In unipolar mode, with V_{DD}=5V, we get 4.096 V for full-scale in the REFIN pin is connected to the ADND with a 1-μF capacitor. That gives us a 16-mV step size since 4.096 V/256=16mV. To get a 10-mV step size, we need to connect the REFIN pin to a 2.56 V external voltage

Selecting a channel

We select the analog input channel using the control byte. Notice that the MSB (D7) of the control byte must be high.

The control byte is fed into the DIN pin one bit at a time using SCLK. The DIN pin clocks in the control byte on the rising edge of SCLK .

Start conversion and end of conversion for MAX1112

When the last bit of the control byte, PD0, is sent in, the conversion starts, and SSTRB goes low. The end-of-conversion state is indicated by SSTRB going high, which happens 55 μs, or monitor SSTRB before we get the digital out of the ADC chip. Next we show how to get digital data out of the MAX1112.

Reading out digital data

The 8-bit converted digital data is brought out of the MAX1112 via the D_{OUT} pin using SCLK. As we apply a negative-edge pulse to the SCLK pin, the 8-bit digital data is read out one bit at a time with the MSB (D7) coming out first. The SSTRB goes high to indicate that the

conversion is finished. According to the MAX1112 data sheet, "after SSTRB goes high, the second falling edge of SCLK produces the MSB" of converted data at the D_{OUT} pin. In other words, we need 9 pulses to get data out. To bring data out, CS must be low.

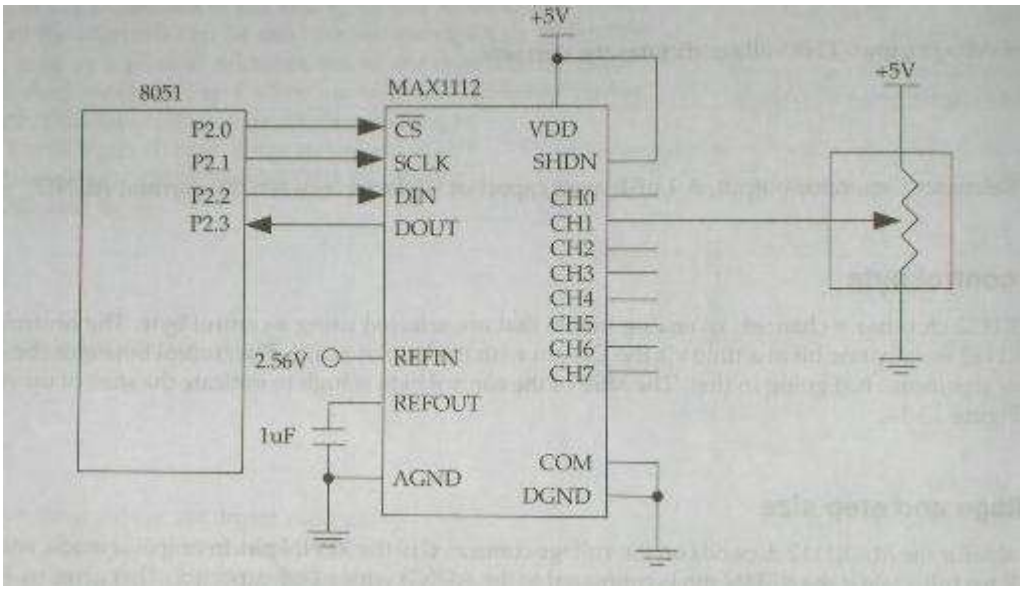


Fig: Interfacing MAX1112 with 8051