ICmic
IC MICROSYSTEMS

APPLICATION NOTES
AN004

SMART PROCESS-INSTRUMENT TRANSMITTER USING ICmic DUAL DAC (ICM7373)

Shahab A. Najmi,
M. Nizam

ICM7373 is a 12-bit dual adjustable output gain, high precision digital to analog converter. This application note describes the usage of this device to implement a complete smart process-instrument transmitter.

An analog transmitter is a device that senses a remote physical parameter like pressure or temperature and generates a current proportional to the standard range 4mA to 20mA. This particular arrangement has many practical advantages, some of which are,

- Transmitters are interchangeable since they all follow the same basic standard.
- The output is relatively insensitive to noise and changes in the loop resistance.
- The transmitters can be powered from an external, remote power supply.
- Signals can easily be transmitted over thousands of feet.

The first generation transmitters had a sensor and a current manipulating transmitter that used a remote power supply. However as the need for the precision and flexibility increased in many applications, smart transmitters were developed which includes a microcontroller to provide computing power as well as remote memory.

The major advantage of using a smart transmitter is that the microcontroller can be used to condition the signal before it is transmitted. This way any known non-linearities in sensors can be compensated for by the microprocessor by conditioning the signal in the algorithm. Using this type of transmitter allows for much simpler processing at the receiver side which can be a big advantage if the main controller has to process many such signals.

Smart transmitter using ICM7373

ICM7373 is an adjustable gain 12-bit precision digital to analog converter. Its low power consumption as well as the high precision makes it ideal for applications like the one discussed here.

The block diagram of the circuit to implement the transmitter is shown in figure 1.

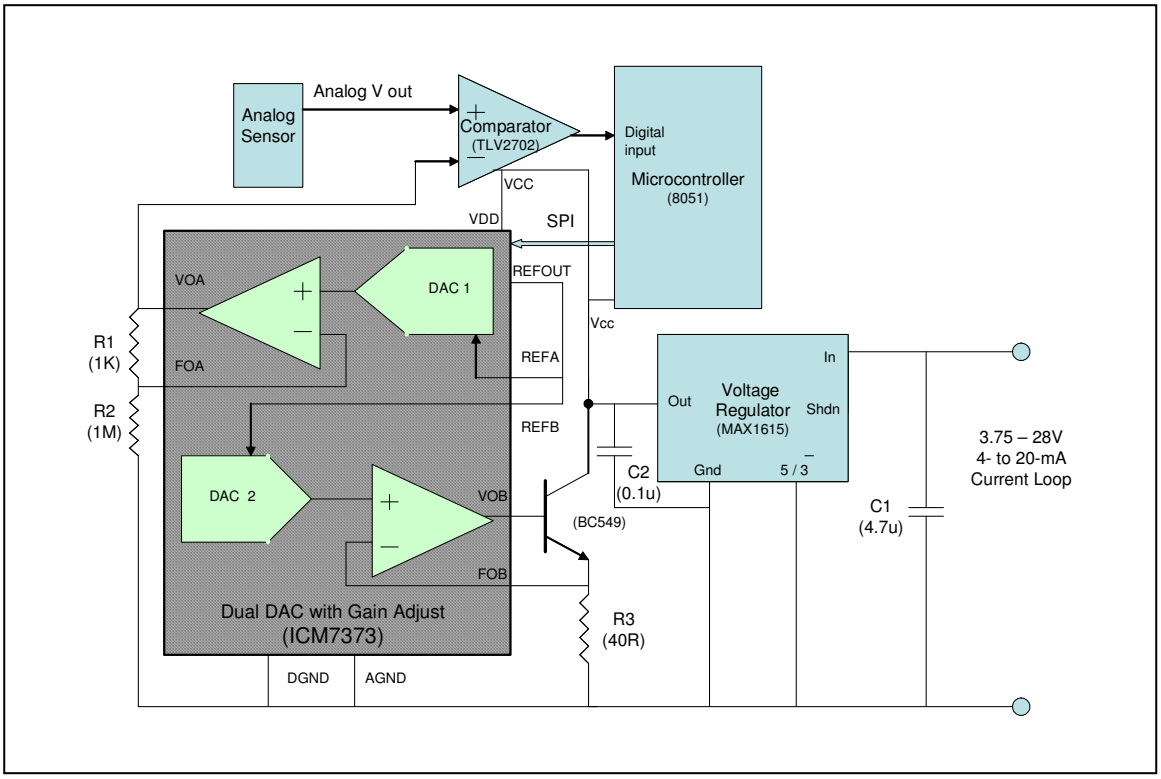

Figure 1: Smart Process-Instrument Transmitter

Using DAC for Analog sensing

In this figure, a DAC1 (digital to analog converter) is used with a comparator to perform the function of analog sensing. This is used rather than Analog to Digital converter typically used in such applications. There are many advantages of using such a configuration some of which are discussed in detail in the application note AN003 titled 'Temperature Sensing Application using ICmic DAC (ICM7363/7343/7323)'. Please refer to AN003 for the algorithm of Analog sensing (binary search) as well as its implementation in more detail.

Smart process-instrument transmitter

Once the digitized value of the analog output of the sensor is found using the binary search method [1], it is processed in the microcontroller. This is done to linearize some of the known non-idealities in the sensor. This can also be used for correcting output from pre-calibrated sensor.

After the corrections by the microcontroller, the value of the output is sent to the digital to analog converter which gives a precise analog output representation of the digital signal to be transmitted. This is then converted into current using the BJT transistor circuit.

The main advantage of using this topology is that the entire transmitter can be powered using the current loop with no extra battery requirements. Another advantage is the reduced component and Bill of Material (BOM) cost since no separate analog to digital converter is required for this implementation.

References

[1] IC Microsystems Sdn. Bhd. Malaysia, AN003 – Temperature Sensing Application Using ICmic DAC (ICM7363/7343/7323), 2004.
[2] Analog Devices. Analog Dialogue *Build a Smart Analog Process-Instrument Transmitter with Low-Power Converters and a Microcontroller*, USA.
[4] Jerry Steele, *4- To 20-mA Loop Powers Temperature Sensor, Electronic* Design, May 2001.
[3] IC Microsystems Snd. Bhd. Malaysia, *ICM7373/7353/7333 Quad 12/10/8-Bit Voltage Output DACs - Serial Interface with Adjustable Output Gain,* Malaysia*,* 2003.

Contact Information

For any other questions / queries please feel free to contact us at support@icmic.com or contact us at the following address.

IC MICROSYSTEMS Sdn. Bhd.
Suite S06, 2320 Century Square,
63000 Cyberjaya, Selangor D.E.,
Malaysia
Tel: (603) 8319 1919
Fax: (603) 8319 1918

Disclaimer