Application Report
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Interfacing the DAC8814EVM to MSP430 Processors

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ABSTRACT

This application report presents a method for interfacing the DAC8814 – a four-channel, current output, 16-bit multiplying digital-to-analog converter — to the MSP430F449 processor using the HPA449 from SoftBaugh. The software developed creates a 256-point sine table, and then continuously writes values from the sine table to the DAC8814. In an effort to reduce development time, the source code for this application report can be found on the Texas Instruments Web site.

1 Introduction

The DAC8814 is a four-channel, 16-bit, multiplying digital-to-analog converter (DAC), offering 2-mA full-scale output, and a flexible 3-wire serial interface. The converter is able to interface gluelessly to the MSP430 series of microcontrollers. For development of this application report, the MSP430F449 and HPA449 Development Board along with the DAC8814EVM were used to implement a serial peripheral interface (SPI).

2 Hardware

The combination of the HPA449 and the DAC8814EVM is a convenient way of experimenting with the MSP430 series microcontroller and the DAC8814. The DAC8814EVM plugs onto the HPA449 Development platform for a direct serial interface to the MSP430F449.

2.1 HPA449

The HPA449 is a third-party tool used for evaluation of the MSP430F449. The tool is available through the Softbaugh Web site at www.softbaugh.com. This board provides convenient access to a variety of analog EVMs from Texas Instruments, including analog-to-digital converters and amplifier modules. A complete data acquisition system can be built using modular boards that plug directly onto the HPA449.

3 DAC8814EVM

The DAC8814 is one of the multiplying series of serial DACs available from Texas Instruments. The DAC8814EVM provides a platform to demonstrate the functionality of the DAC8814 device with various Texas Instruments DSPs and microcontrollers, while allowing easy access to all analog and digital signals for customized end-user applications. For more information on the DAC8814EVM, see the relevant TI user's guide (SLAU184).

3.1 Hardware Interface

The hardware interface is a simple 3-wire serial connection between the DAC and one of the SPI ports of the MSP430F449.

The hardware connections are shown in Figure 1 via the HPA449 Development Board. The SCLK, $\overline{CS}$, and Din pins from the DAC8814 are connected to SPISCLK, SPISTE, and SPIMOSI pins of the MSP430F449, respectively. The $\overline{LDAC}$ pin of the DAC8814 is connected to a GPIO to facilitate simultaneous updates of all four DAC outputs.

Embedded Workbench is a trademark of IAR Systems.

Although this application report specifically discusses the MSP430F449, any of the MSP430 family of microcontrollers containing at least one SPI peripheral could be used.

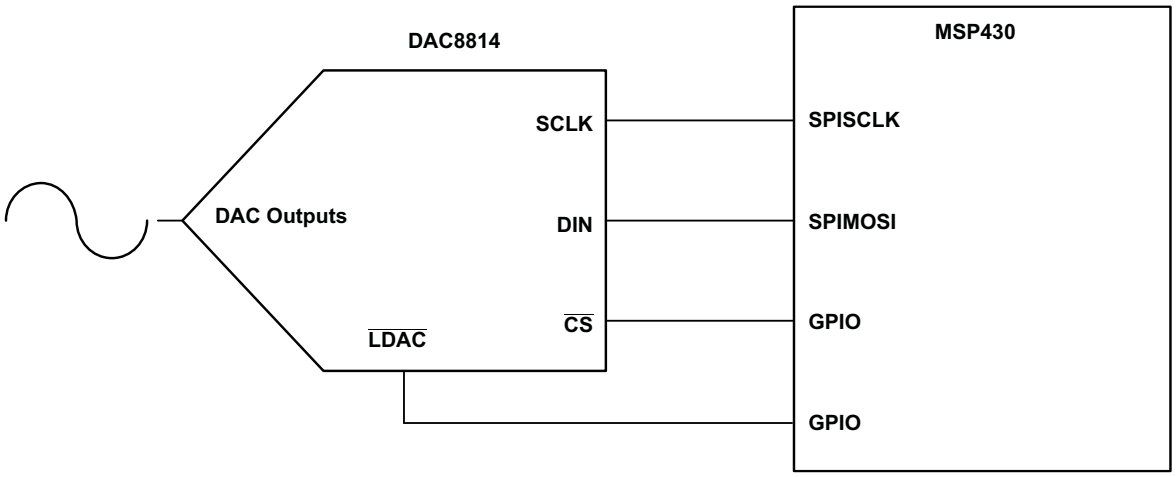

Figure 1. Basic Hardware Interface

4 Software Interface

The code archive associated with this application report (SLAA319.zip) contains a workspace and associated project for the MSP430 KickStart version of Embedded Workbench™ from IAR Systems. Extract the archive to any convenient folder of your Embedded Workbench™ installation and locate the DAC8814 folder. Open the associated workspace and project, debug, and run the code.

All of the software was written and compiled using IAR Embedded Workbench Kickstart for MSP430 development platform. This is the free 4K C-compiler version of the IDE available for download from the TI Web site. The most involved portion of writing the code for this simple interface is programming the serial peripheral interface (SPI).

4.1 SPI Settings

In the HPA449 sample code, the four channels of the DAC8814 are updated at a 19-kHz rate, with a serial clock of 3.8 MHz. The HPA449 SPI port is set for master mode operation with 8 characters per cycle. The clock polarity is set to zero so that the SPI clock dwells low. The clock phase is set to 1, so that transmitted data is received properly by the DAC8814.

A total of 24 clocks are transmitted with each DAC transfer. Three blocks of eight bits with channel information masked into the first two MSBs of the first byte are required for proper DAC operation.

4.2 Software Flow

The software presented in this application report creates a 256-point sine table. The software simply initializes the sine table with 16-bit values and then writes the values to the serial port. The main function simply initializes the sine values, enables the SPI port, and then enters an endless loop. The values from the sine table transmitted to the DAC, creating four sine wave outputs on J1 of the EVM. The main program provides #define statements that allow the user to select which serial site is used on the HPA449.

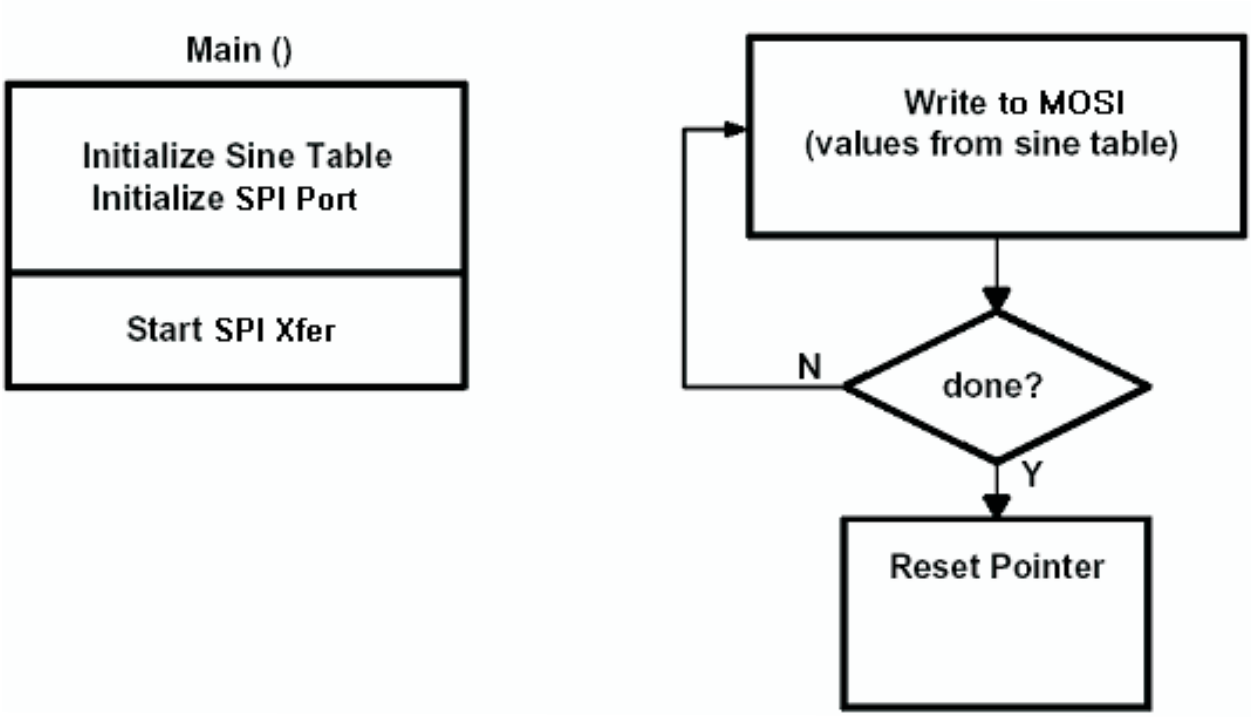

Figure 2. Software Flow Chart

5 References

1. *DAC8814, Quad, Serial Input 14-Bit Multiplying Digital-to-Analog Converter* data sheet (SBAS338)
2. *MSP430x4xx Family User's Guide* (SLAU056)
3. *DAC8803/14EVM Users Guide* (SLAU184)
4. *Designing Modular EVMs for Data Acquisition Products* application report (SLAA185)

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