Interfacing the DAC8806 and DAC8820 to MSP430 Microcontrollers

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ABSTRACT
This application report presents a method for interfacing the DAC8806 and DAC8820 — single-channel, current-output, 14-/16-bit multiplying digital-to-analog converters — to the MSP430F449 processor using the SoftBaugh HPA449 evaluation system. The associated software creates a 256-point sine table, and then continuously writes values from the sine table to the DAC8806/20EVM, which outputs a ±10V sine wave. In an effort to reduce development time, the source code for this application report can be found on the Texas Instruments Web site at http://www.ti.com. Search for document number SLAA345 from the home page and follow the links to this application report. Project collateral discussed in this application report can be downloaded from the following URL: www.ti.com/lit/zip/SLAA345.

1 Introduction
The DAC8806 and DAC8820 are single-channel, 14- and 16-bit multiplying digital-to-analog converters (DAC), offering 1.66-mA full-scale and a parallel input interface. These converters operate from +2.7 V to +5.5 V and can interface directly to the MSP430 series of microcontrollers. For development of this application report, the MSP430F449 and HPA449 Development Board along with the DAC8806/20EVM were used to implement a 16-bit parallel interface using port 3 and port 6.

2 Hardware
The combination of the HPA449 and the DAC8806/20EVM is a convenient way of experimenting with the MSP430 series microcontroller using the DAC8806 and DAC8820. The DAC8806/20EVM plugs onto the HPA449 development platform for a parallel interface to the MSP430F449 via ports 3 and 6. The DAC8806/20EVM also contains an SN74LVC138A address decoder which implements the write (WR), reset (RST), and load DAC (LDAC) functions. The address decoder allows for the possibility to stack up to three DAC8806/20EVMs together using a common data bus.
2.1 **HPA449**

The HPA449 Evaluation System is a third-party tool that was used for evaluating the DAC8806 and DAC8820 with the MSP430F449. The tool is available through the vendor's Web site at [www.softbaugh.com](http://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 **DAC8806/20EVM**

The DAC8806 and DAC8820 are two of the multiplying series of parallel DACs available from Texas Instruments. The DAC8806/20EVM provides a platform to demonstrate the functionality of the DAC8806 and DAC8820 devices 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 EVM, search for document number SLAU190 from the main page of the Texas Instruments Web site at [http://www.ti.com](http://www.ti.com).

3.1 **Hardware Interface**

The RST, WR, and LDAC control functions are realized with a simple 3-wire general purpose output connection between the DAC and port 2 of the MSP430F449. These signals are fed into the SN74LVC138A found on the DAC8806/20EVM. A 16-bit parallel data bus is realized through the use of port 3 and port 6 of the MSP430.

The hardware connections are shown in Figure 1 via the HPA449 Development Board. The LDAC, WR, and RST pins from the DAC8806 and DAC8820 could be connected directly to any GPIO pin on the MSP430. The MSP430F449 is used in this example, but any MSP430 with at least 19 GPIO pins could be connected to the DAC8820. For the 14-bit DAC8806, 17 GPIO pins would be required.

![Figure 1. Basic Hardware Interface](image)

4 **Software Interface**

The code archive associated with this application report (**slaa345.zip**) contains a workspace and associated project for the MSP430 KickStart version of the IAR Embedded Workbench™. Extract the archive to any convenient folder of your Embedded Workbench installation and locate the SLAA345 folder. Open the associated workspace and project, and then 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, [http://www.ti.com](http://www.ti.com).
4.1 Creating a 16-Bit Parallel Data Bus

In the sample code associated with this application note, ports 3 and 6 of the MSP430F449 are used to implement a 16-bit parallel databus which is fed to the HPA449 board at J1, pins 1-31. The data bus of DAC8806/20EVM is connected to the HPA449 by means of J7 on the EVM. The sample code creates a 16-bit sine value which is split into two bytes. The least significant byte is sent to port three and the most significant byte is sent to port 6. Once the two bytes are written to their respective ports, the LDAC signal is toggled and the DAC outputs are updated.

A total of 256 sine values are created in the sample code, which are written to the DAC8806/20EVM at an 89kHz rate. Using the default configuration of the EVM, this provides a +/-10V sine wave output at 347.6 Hz.

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 port 3 and port 6. The main function simply initializes the sine values, enables the GPIO control and port write functions, and then enters an endless loop. The values from the sine table are transferred to the DAC, creating a sine wave output on J2 of the EVM.

Main()

Initialize Sine Table
Initialize GPIO
Setup for Port Writes

Write to Ports 3 and 6
(Sine Table Values)

Done?

N

Y

Reset Pointer and Restart

Figure 2. Software Flow Chart

5 References

1. DAC8806, 14-Bit, Parallel Input Multiplying Digital-to-Analog Converter data sheet (SBAS385)
2. DAC8820, 16-Bit, Parallel Input Multiplying Digital-to-Analog Converter data sheet (SBAS358)
3. MSP430x4xx Family User’s Guide (SLAU056)
4. Designing Modular EVMs for Data Acquisition Products application report (SLAA185)
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