Interfacing the DAC8534EVM to TMS320C5x Processors

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ABSTRACT

The DAC8534 is a quad-channel, low-power, 16-bit, serial digital-to-analog converter. This application report describes a method for interfacing the DAC8534 to the TMS320C5x-series DSKs using McBSP1 and the 5-6K Interface Board. The software developed for this application creates a 256-point sine table, then continuously writes values from the sine table to the DAC8534. To reduce development time, the source code for this application report is posted on the Texas Instruments Web site at http://www.ti.com. Search for the appropriate device data sheet from the home page and follow the links to this application report.

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1 Introduction

The DAC8534 is a quad channel, 16-bit Digital-to-Analog Converter (DAC), offering low-power operation and a flexible 3-wire serial interface with triple buffering. The converter directly interfaces to the TMS320C5x digital signal processors. For development of this application report, the TMS320C5416 and TMS320C5510 DSP starter kits (DSK) along with the DAC8534EVM were used in conjunction with the 5-6K Interface Board.

2 Hardware

The combination of the TMS320C5x DSK and the 5-6K Interface Board is a convenient tool for evaluation and development with the TMS320C5x series DSPs and the DAC8534. The DAC8534EVM plugs onto the 5-6K Interface Board, which then plugs directly into the DSK through mating connectors compatible with the TMS320 cross-platform daughtercard interface connectors (described in document number SPRA711) on the DSK platform.

2.1 TMS320C5x DSKs

The TMS320C5x DSP starter kits (DSKs) provide an introduction to C5000 DSP-platform technology and are powerful enough for rapid development of networking, communications, and other power-sensitive applications like data acquisition. See the TI Web site for more information on the TMS320C5x-series DSKs.

2.2 DAC8534EVM

The DAC8534 is one of many resistor-string architecture serial DACs available from Texas Instruments. The DAC8534EVM provides a platform to demonstrate the functionality of the DAC8534 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 EVM, search for document number SLAU107 from the home page of the Texas Instruments Web site.

2.3 Hardware Interface

The DAC8534 EVM interfaces seamlessly to the C5x DSKs. The 5-6K Interface Board provides direct access to the C5416 and C5510 DSK McBSPs zero and one.

The hardware connections via the 5-6K Interface Board are shown in Figure 1. The SCLK, /SYNC, and D_{IN} pins from the DAC8534 are connected to CLKX, FSX, and DX pins of McBSP1, respectively. The EN, LDAC, A0 and A1 pins are grounded via jumpers on the DAC8534 EVM. The LDAC is grounded to configure the DAC-update function for software control.

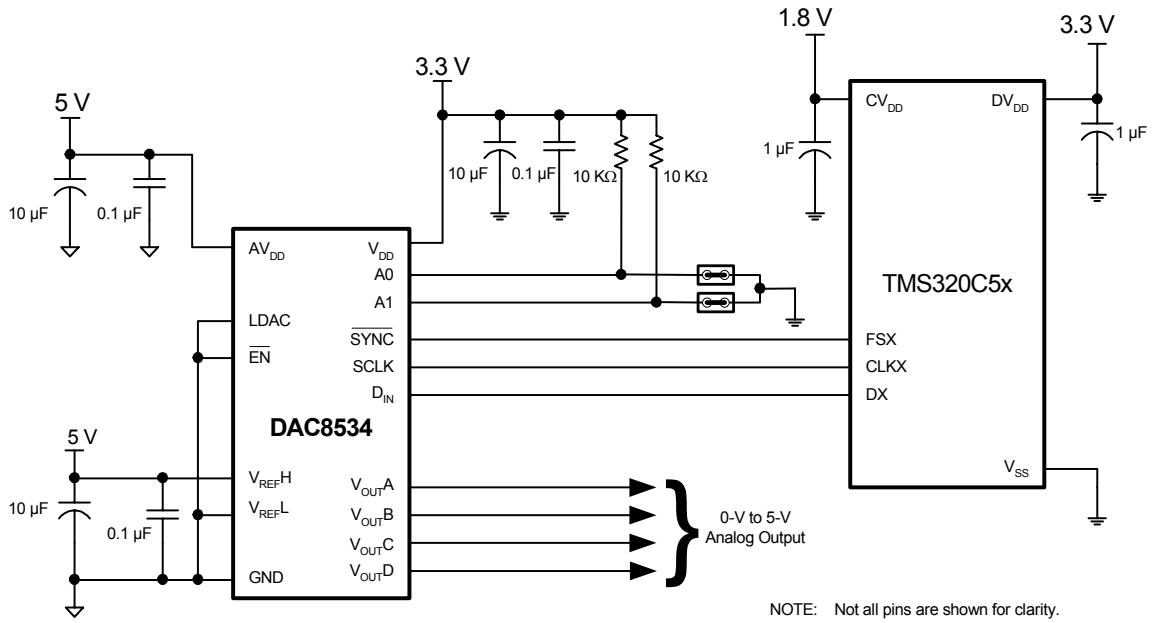

Figure 1. Basic Hardware Interface Schematic

3 Software Interface

The code archive associated with this application report (SLAA191.ZIP) contains two folders and two separate Code Composer Studio (CCS) projects. The two project folders identify the associated processor. Extract the archive to the *myprojects* folder of your CCS installation and locate the DAC8534_xxxx folder for your installed DSK (replace xxxx with 5510 or 5416).

The software was written and compiled using CCS version 2.20. The most involved portion of writing the code for this simple interface is programming the McBSP. If an earlier version of CCS is used, the DSP configuration file (DAC8534.cbd) associated with the project must be re-created.

3.1 Board Support Libraries

The C5510 DSK assigns the McBSP signals to the 5-6K Interface Card via the Board Support Library files (*.bsl). The library files must be included in the projects in order for the code examples to work properly. A copy of the appropriate .bsl file is located in the software example archive.

3.2 McBSP Configuration

The user interface of the configuration tool makes it easy to write programs and configure the McBSP. To set up the McBSP registers, double click on the *.cdb* file (in the code example provided, choose *DAC8534.CDB* from the DSP/BIOS *Config* tab) from within the project window. Browse through the CDB tree to find the McBSP configuration manager under CSL. Right click on *mcbspCfgx* and select *properties*. This is where the McBSP registers are available as tabs, with individual bit-field settings provided as pulldown options. Once all options are selected, click *OK*, then choose *Rebuild All* from the *Project* pulldown menu. Register options can be confirmed by opening the file DAC8534cfc_c.c under the *Generated Files* branch in the project-manager window. The generated code for C5416 DSK project example used in this application is shown in the following box.

```
MCBSP_Config mcbspCfg1 = {
    0x0000,        /*  Serial Port Control Register 1     */
    0x0020,        /*  Serial Port Control Register 2     */
    0x0000,        /*  Receive Control Register 1         */
    0x0000,        /*  Receive Control Register 2         */
    0x0080,        /*  Transmit Control Register 1        */
    0x0001,        /*  Transmit Control Register 2        */
    0x0005,        /*  Sample Rate Generator Register 1   */
    0x3018,        /*  Sample Rate Generator Register 2   */
    0x0000,        /*  Multichannel Control Register 1    */
    0x0000,        /*  Multichannel Control Register 2    */
    0x0a00,        /*  Pin Control Register               */
    /* multi-channel settings removed for clarity         */
};
```

McBSP1 of the C5416 DSK is programmed as a serial port in nonstop clock mode (or DSP mode). Frame sync and serial-clock transmit signals are output pins. The transmitter is set for 24-bit transfers with a one-bit delay on. The frame sync (FSX1) is generated by the sample-rate generator and is used to strobe the /SYNC signal on the DAC8534 via J2-7 on the EVM.

In the C5416 DSK sample code, the DAC8534 is updated at a 1.06-MHz rate with a 26.7-MHz serial clock. The C5416 DSK clocks the DAC8534 via the sample-rate generator settings. The sample-rate generator clock source is the CPU-clock frequency, or 160 MHz. The 26.7-MHz clock on CLKX was derived by setting the CLKGDV bit field in the sample-rate generator register to 6. The formula for calculating the serial clock is given below as Equation 1.

$$SCLK = (CPUCLOCK)/(CLKDIV) \qquad (1)$$

By equation 1, each clock cycle is approximately 37.5 ns, triggering a frame-sync pulse every 25 serial-clock cycles to give an update rate of 1.067 MHz. The 25-cycle period is set in the frame-period (FPER) field in the sample-rate generator register.

3.3 DAC Commands

Header file DAC8534CMD.h is included in the project directories of the software archive associated with this application report. This header file defines the command instructions that are sent to the DAC8534. For the purposes of this application report, the DAC8534 is set to broadcast mode. All DAC outputs are updated each time the /SYNC (via FSx) pin is toggled.

3.4 Software Flow

The software described in this application report creates a 256-point sine table. The software simply initializes the sine table, then writes the values to the serial port. All register and peripheral programming is done during initialization using the options selected with the configuration tool. The main function simply initializes the sine values, enables McBSP1, and then enters an endless loop. The values from the sine table, along with the DAC command byte defined in DAC8534CMD.h, are transmitted to the DAC, creating a sine-wave output on all four DAC channels.

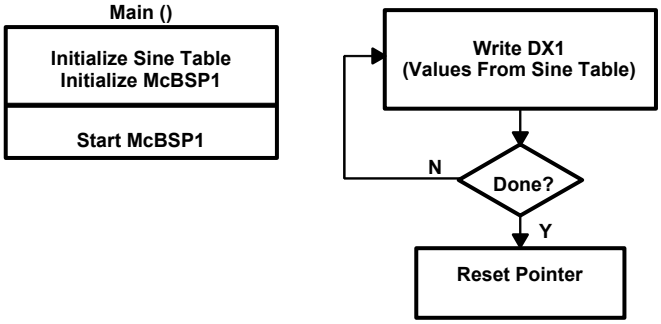

Figure 2. Software Flow Chart

4 References

1. DAC8534 data sheet (SBAS254A)
2. *TMS320C5000 DSP/BIOS User's Guide* (SPRU326)
3. *TMS320 Cross-Platform Daughtercard Specification* Revision 1.0 (SPRA711)
4. *5-6K Interface Board User's Guide* (SLAU104)
5. *DAC8534 Evaluation Module User's Guide* (SLAU107)
6. *Designing Modular EVMs for Data Acquisition Products* (SLAA185)

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