

A DSP/BIOS PCM3002 Codec Device Driver for the TMS320C5416 DSK

Software Development Systems

ABSTRACT

This document describes the implementation of a DSP/BIOS device driver for the PCM3002 codec on the TMS320C5416 DSK. This device driver is written in conformance to the DSP/BIOS™ IOM device driver model and APIs. The main functionality of this device driver is to set up the codec. The generic C5416_DMA_MCBSP driver performs the actual data samples transformation. This device driver is an interface for the core generic C5416_DMA_MCBSP driver.

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1 Usage

The device driver described here is actually part of an IOM mini-driver. That is, it is implemented as the lower layer of a 2-layer device driver model. The upper layer is the class driver, and can be the DSP/BIOS GIO, SIO/DIO, or PIP/PIO modules, or even some other class driver. The upper layer provides an independent and generic set of APIs and services for a wide variety of mini-drivers and allows the application to use a common interface for I/O requests. Figure 1 shows the overall DSP/BIOS device driver architecture. For more information about the IOM device driver model as well as the GIO, SIO/DIO, and PIP/PIO modules, see the References section.

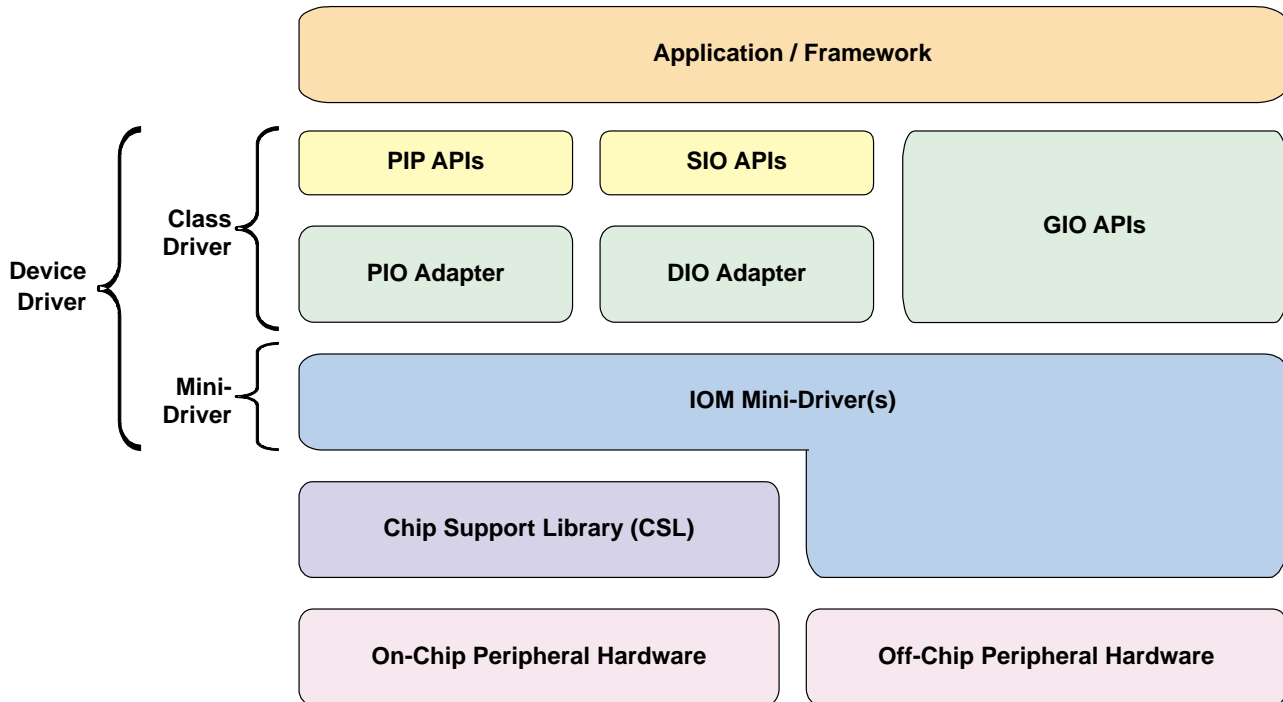


Figure 1. DSP/BIOS IOM Device Driver Model

As shown in Figure 2, mini-drivers are often split into a generic part and a codec-specific part in order to maximize code reusability. This application note only describes the codec-specific part of the mini-driver, which uses the generic C5416_DMA_MCBSP part to transfer data to and from the serial ports. This codec-specific part also uses some functions such as DSK5416_PCM3002_openCodec and DSK5416_PCM3002_closeCodec from the C5416 DSK Board Support Library (BSL), which comes with the DSK, to set up the codec. Because this device driver is dependent on both the generic C5416_DMA_MCBSP part and the BSL, an application must link all the libraries necessary in order for it to function correctly: one from this codec-specific part, one from the generic C5416_DMA_MCBSP part, and one from the BSL. These three libraries are called dsk5416_dma_pcm3002.lib, c5416_dma_mcbsp.lib, and dsk5416.lib, respectively.

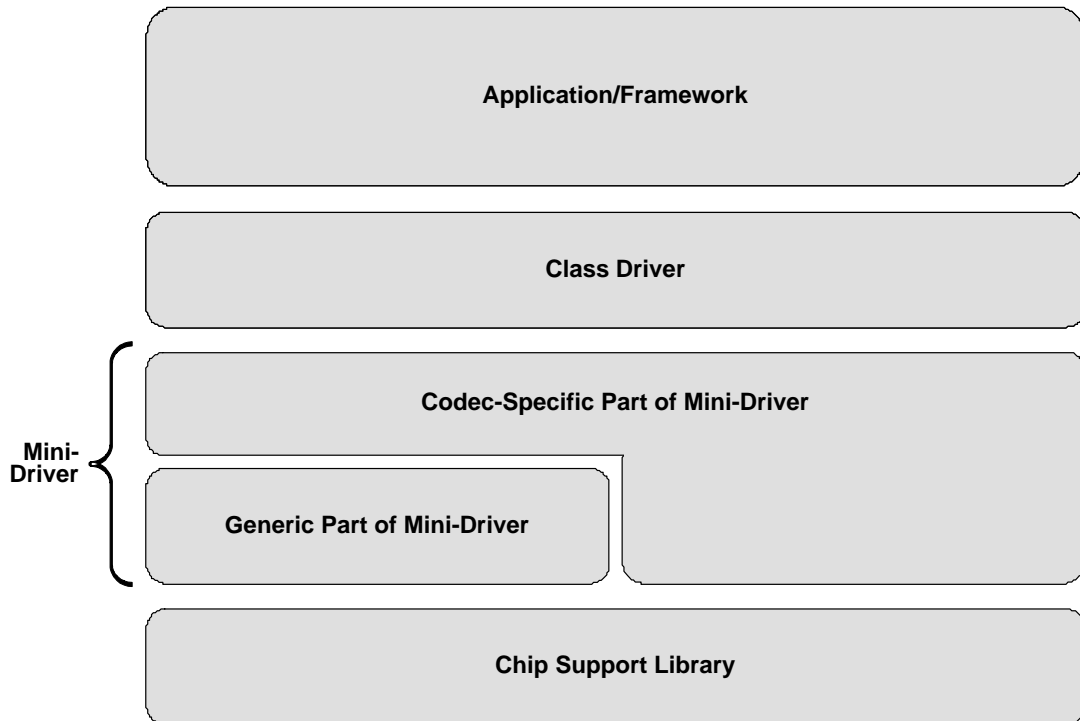


Figure 2. Codec Device Driver Partitioning

1.1 Configuration

To use this device driver, a device entry has to be added and configured in the DSP/BIOS configuration tool. Refer to the DSP/BIOS Device Driver Developer's Guide (SPRU616) for more information on how to use the DSP/BIOS configuration tool to configure device drivers. This device driver will set up the generic C5416_DMA_MCBSP driver to meet its needs. The following are the device configuration settings required to use this driver:

- **Init function:** `_DSK5416_DMA_PCM3002_init`.
- **Function table ptr:** `_DSK5416_DMA_PCM3002_Fxns`.
- **Function table type:** `IOM_Fxns`.
- **Device id:** This property is ignored by this device driver since there is only one PCM3002 codec on the TMS320C5416 DSK and it is hard-coded within the driver.
- **Device params ptr:** An optional pointer to an object of type `DSK5416_DMA_PCM3002_DevParams` as defined in the header file `dsk5416_dma_pcm3002.h`. This pointer will point to a device parameter structure. Set this pointer to `NULL` to use the default parameters. The parameter structure and defaults are described below.
- **Device global data ptr:** N/A, not used by this driver.

1.2 Device Parameters

```
typedef struct DSK5416_DMA_PCM3002_DevParams {
    Int versionId;
    Uns rxDmaId;
    Uns txDmaId;
    DSK5416_PCM3002_Config pcm3002;
    Uns rxIntrMask;
    Uns txIntrMask;
} DSK5416_DMA_PCM3002_DevParams;
```

- **versionId:** Version number of the driver.
- **rxDmaId:** Receive DMA channel.
- **txDmaId:** Transmit DMA channel.
- **pcm3002:** The codec registers setup. If the device parameters pointer is NULL, the default parameters are used. Here are the default setups for the registers.
 - **Register 0:** Left channel DAC attenuation. The default value is 0x01FF.
 - **Register 1:** Right channel DAC attenuation. The default value is 0x01FF.
 - **Register 2:** Various controls such as power down mode. Default value is 0x0000.
 - **Register 3:** Setup codec format. Default value is 0x0000.
- **rxIntrMask:** Receive interrupt mask, set in the ISR.
- **txIntrMask:** Transmit interrupt mask, set in the ISR.

1.3 Channel Parameters

This device driver does not have any channel parameters. Any values that are passed as channel parameters will be ignored. Specifying NULL is suggested.

1.4 Control commands

This device driver has no run-time control commands.

2 Architecture

This codec-specific portion of the mini-driver is a layer to the generic C5416_DMA_MCBSP part that transfers the data samples, opens the channels, and so on. The codec-specific part uses two basic functions, mdBindDev() and mdCreateChan(), to bind with the functions from the generic part. The mdBindDev() function uses openCodec and closeCodec functions from the BSL to open and configure the codec through the McBSP port 2. The McBSP port 2 is then passed to the generic C5416_DMA_MCBSP mdBindDev() function to handle data control. The mdCreateChan() function specifies the mode of the channel (i.e., input or output) to be opened and then calls the generic C5416_DMA_MCBSP mdCreateChan() function to carry out the work of creating the channel.

It is important to note that every sample sent to the codec that has the LSB set will be interpreted as a command. This device driver does not strip the LSB when sending the samples to the codec, so the application layer has to strip the LSB from every sample it sent to the codec device driver.

3 Constraints

- Inherits the constraints of the generic C5416_DMA_MCBSP part of the mini-driver.
- Application must strip the least significant bit (LSB) from the data.

4 References

All these documents are available at the TI Developer's Village.

1. *TMS320C54x Chip Support Library API User's Guide* (SPRU420).
2. *TMS320C5000 DSP/BIOS Application Programming Interface (API) Reference Guide* (SPRU404C).
3. *DSP/BIOS Device Driver Developer's Guide* (SPRU616).
4. *A DSP/BIOS Generic DMA McBSP Device Driver for TMS320C5000 DSPs* (SPRA858).
5. *16-/20-Bit Single-Ended Analog Input/Output Stereo Audio Codecs Data Sheet*, SBAS-079

Appendix A Device Driver Data Sheet

A.1 Device Driver Library Name

dsk5416_dma_pcm3002.l54

c5416_dma_mcbbsp.l54 and dsk5416.l54 are required for building application.

A.2 DSP/BIOS Modules Used

Refer to the generic C5416_DMA_MCBSP documentation.

A.3 DSP/BIOS Objects Used

Refer to the generic C5416_DMA_MCBSP documentation.

A.4 CSL Modules Used

Refer to the generic C5416_DMA_MCBSP documentation.

A.5 CPU Interrupts Used

Refer to the generic C5416_DMA_MCBSP documentation.

A.6 Peripherals Used

MCBSP port 2 is used for data control.

A.7 Interrupt Disable Time

Maximum time that hardware interrupts can be disabled by the driver: refer to the generic C5416_DMA_MCBSP documentation. This measurement is taken using the compiler option `-O3`.

A.8 Memory Usage

Table A–1. Device Driver Memory Usage

	Uninitialized memory	Initialized memory
CODE	—	266 (16-bit words)
DATA	56 (16-bit words)	59 (16-bit words)

NOTE: This data was gathered using the `sectti` command utility.
 Uninitialized data: `.bss`
 Initialized data: `.cinit + .const`
 Initialized code: `.text + .text:init`

The sizes in this table were measured on the driver library built for near model on the C5416 DSK platform.

Note that to calculate the total driver overhead, you must include the sizes of the generic C5416_DMA_MCBSP part of the mini-driver as well. These size overheads are listed in the generic part's application note, which is listed in the References section.

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