Product Bulletin

DSP/BIOS™ Driver Development Kit (DDK)

Easy Development of Device Drivers for DSP Peripherals

Key Features
- Full driver source code enables easy debugging and customization
- Robust set of DSP device drivers eliminates need to develop most drivers
- Reusable device driver modules reduce new driver development time
- Full application programming interface (API) and driver model documentation yields immediate developer production

The DSP/BIOS Driver Development Kit (DDK) is designed to simplify development of device drivers for a broad spectrum of DSP applications, ranging from consumer electronics to telecommunications infrastructure.

The DDK includes drivers for peripherals present on TI's TMS320™ family of DSPs and their associated evaluation boards. To achieve this goal, the DDK provides:

- Fully functional device drivers for numerous TMS320 DSP peripherals
- Documented driver model that standardizes the methodology for developing drivers
- Reusable driver modules that eliminate development of all driver code from scratch

The DDK complements the Chip Support Library (CSL), which is provided for each TMS320 DSP. The CSL provides low-level hardware abstractions of DSP peripheral registers, initialization functions and resource management.

The DDK drivers use the CSL for peripheral initialization and control. For relatively simple peripherals such as timers, real-time clocks and cache, the CSL also provides higher-level programming interfaces. The DDK provides drivers for sophisticated peripherals that perform real-time data movement.

DDK Driver Support for the TMS320 DSP Platforms

Driver	Description
McBSP	McBSP-DMA driver for use with codecs, TDM and data converters. Supports multiple McBSPs. The McBSP driver is highly versatile and applicable to applications ranging from MP3 decode to codecs in VOIP switches.
McASP	McASP-DMA driver for use with audio codecs. Highly configurable with support for 1-N serializers and TDM modes. The McASP driver is especially appropriate for use in professional audio applications that need to process multiple channels of high-quality audio using I²S.
Video Port	Video Port-DMA driver for use with video encoders, decoders and RAMDACs. The driver addresses the needs of applications such as video servers and security cameras that must process multiple video streams.
UART	Common UART driver code with low-level hardware interface. Supports 16550 UART out of the box. UART drivers may be used for client-side telephony communications or provide general purpose I/O, such as a command console.
Software UART	Simulates the same UART functionality described above using a DSP's on-chip McBSP and DMA peripherals.
PCI	DSP-side PCI driver that allows bus mastering with support for multiple channels and high/low-priority queuing. The PCI driver can be used in applications such as wireless basestations that require the DSP to communicate with a microprocessor or custom ASIC.
USB	DSP-side USB client driver that supports up to eight endpoints. The USB driver enables consumer electronics devices such as a digital camera to easily connect to a Windows® PC to upload pictures.
Multimedia Card	MMC driver that is compatible with file system module. The multimedia card and file system are especially useful in digital camera or portable music players where pictures or songs need to be stored for subsequent retrieval.

Figure 1. Many drivers supported through the DDK are available now.

Device Driver Availability Across the TMS320™ DSP Platforms

Device Driver	TMS320C64x™	TMS320C67x™	TMS320C55x™	TMS320C54x™
McBSP Codec	Yes	Yes	Yes	Yes
Software UART	Yes	Yes	Yes	Yes
McASP	Yes	Yes	–	–
Video Port	Yes	–	–	–
UART	–	–	Yes	Yes
PCI	Yes	–	–	–
HPI	Yes	Yes	Yes	Yes
USB	–	–	Yes	–
Multimedia Card	–	–	Yes	–
Ethernet MAC	Yes	–	–	–

Black signifies available today, and red indicates planned or in development. Please contact TI for updated availability.

Figure 2. Wide variety of device drivers available for TI's most popular DSPs.

Functional Device Drivers

The DDK offers several complete device drivers in both binary and source code form for peripherals such as codecs, UARTs, PCI controllers and serial ports. Extensive documentation is provided for each driver, including memory requirements and a design overview that explains exactly how the driver works.

DDK drivers are targeted specifically at on-chip DSP peripherals or external peripherals on DSP evaluation boards such as codecs. Each driver is thoroughly tested on a specific board to validate correct real-time behavior. These drivers enable developers to immediately begin using a supported peripheral without any driver development effort. The availability of source code makes it simple to port the driver to custom board configurations using similar peripherals.

The DDK also offers drivers for specific codecs, including the AIC23, PCM3002, AD50 and AD535 used on DSP evaluation boards.

Documented Driver Model

The DDK defines a standard driver model and set of APIs for developing drivers. To simplify driver development, the driver model breaks a driver into two components. The upper layer, the class driver, is device-independent and performs functions such as buffer management and application synchronization. The lower layer or Input/Output Module (IOM) mini-driver handles the device-specific control and initialization. All IOM mini-drivers conform to a standard interface called the IOM mini-driver interface applicable to a wide range of devices including serial ports, video ports, flash cards, UARTs, PCI controllers and Ethernet MACs. As a result, driver developers only need to learn a single API to implement drivers for a full-range of DSP peripherals. In addition, the standard IOM mini-driver API enables multiple class drivers to work with a single IOM mini-driver.

The driver model offers several benefits. With one or more of the pre-existing class drivers able to provide a complete driver, developers working on a new driver only need to use a new IOM mini-driver. The IOM mini-driver is simpler to implement than a full driver since the class driver handles all the buffer management and synchronization. An IOM
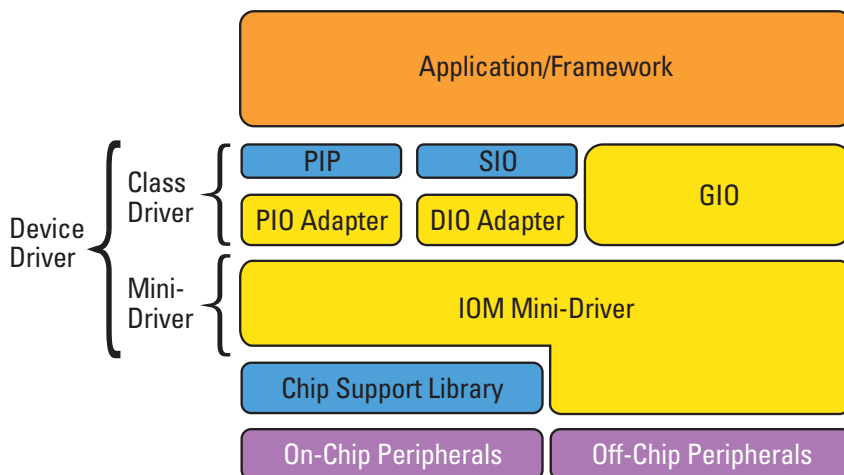
DSP/BIOS™ Driver Model

Figure 3: The DDK defines a two-level driver model and additional application-level APIs that simplify development of device drivers.
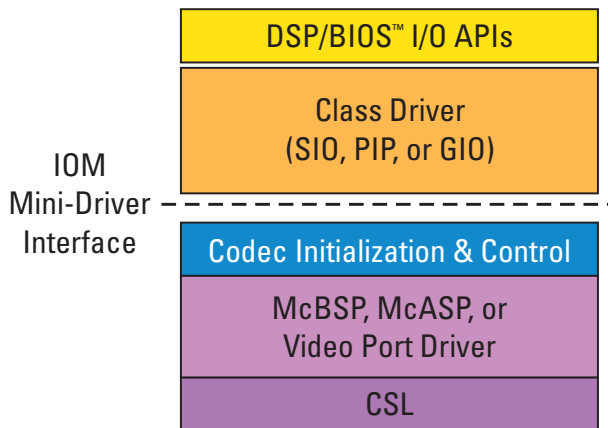
CODEC Driver Architecture

Figure 4: The IOM mini-drivers for McASP, McBSP and Video Port define a further interface that isolates the specifics of the codec or video encoder. This minimizes the code required to develop a driver for a different codec.

mini-driver developed for a codec can be used with any of the pre-defined DSP/BIOS™ Input/Output (I/O) modules such as Streaming Input/ Output (SIO) or PIP. Therefore, it is not necessary to rewrite a driver when a different I/O interface is desired. In addition, a developer can apply an alternative set of I/O interfaces to those provided by DSP/BIOS by executing a new class driver or extending the General Input/ Output class driver. These will work with all pre-existing IOM mini-drivers.

Reusable Driver Modules

The DDK provides several reusable modules that eliminate the need to develop a complete driver from scratch. These modules include the following three class drivers in source code and binary form:

- **DIO Module:** Enables the DSP/BIOS SIO module to be used with an IOM mini-driver

- **PIO Module:** Enables the DSP/BIOS PIP module to be used with an IOM mini-driver
- **GIO Module:** Implements a new set of I/O APIs that may be used with DSP/BIOS and is designed to support easy extension of I/O APIs. For example, asynchronous (call-back-based) I/O APIs are provided in the DDK and specialist APIs, such as frame video APIs, easily can be created. The GIO class driver works with IOM mini-drivers.

In addition to the class drivers, a selection of IOM mini-drivers is provided that clearly illustrates how to develop the device-specific code for a variety of peripherals. The existing IOM mini-drivers can act as an initial template for developing new peripheral support.

On-chip peripherals such as the McBSP, McASP or video port typically operate in conjunction with an external peripheral, such as a

codec, data converter or video encoder or decoder. The generic IOM mini-drivers provided for these peripherals define additional APIs to isolate the specifics of the external peripheral. As a result, development of a new IOM mini-driver for a codec-type device requires only a small amount of initialization and control code. The generic McBSP, McASP or Video Port driver handles the details of setting up and using the direct memory access and on-chip communications ports.

Support for Debug and Analysis Tool Communication

Applications such as telecommunications infrastructure products have to undergo rigorous real-world testing in laboratories or on actual customer premises. During these periods, it often is no longer practical to obtain debug and analysis information using a JTAG-emulator connection. To upload RTDX™ or real-time analysis-based instrumentation to the development host, a non-JTAG RTDX porting kit is available. This kit includes a class driver that enables non-JTAG RTDX to operate over appropriate DDK drivers.

For More Information

The DSP/BIOS DDK can be downloaded for free at www.ti.com/driverdevkit

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