# The new D.Module2 Family

| Available D.Module2 Boards | |
|---|---|
| D.Module2.DM642 | 720MHz TMS320DM642 fixed-point DSP board |
| D.Module2.C6747 | 300MHz TMS320C6747 floating-point DSP board |
| D.Module2.TS203 | 500MHz ADSP-TS203 TigerSHARC® floating-point board |
| D.Module2.ADDA8M12 | 2-channel, 8 MSPS, 12-bit AD/DA converter daughter card |

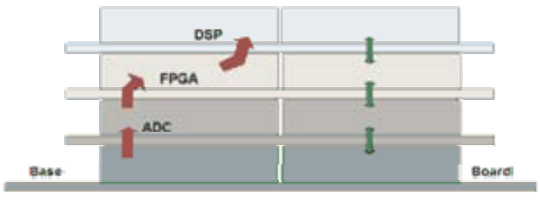
## Motivation

**B**ased on more than 8 years experience with the D.Module family of modular DSP systems, the development of the new D.Module2 family was motivated by the continually increasing speed and complexity of DSP systems. Todays DSPs now include more and more specialized built-in peripherals and communication interfaces. New algorithms and applications are hungry for I/O and memory bandwidth and often require DSP-FPGA co-operation.

The D.Module2 DSP board generation addresses these needs with a significantly increased pin count to make the additional DSP peripherals and I/O channels accessible. The bus interface now supports asynchronous and synchronous operation with 500 Mbyte/s bandwidth, ideally suited to exchange data with FPGAs. Additional high-speed communication peripherals are available on the D.Module2: a 3 Mbit/s dual-channel UART and a USB 2.0 peripheral controller.

## Mechanics

**T**he D.Module2 family maintains the same form factor and self-stacking design as the D.Module boards. Two modules or module stacks can be mounted side-by-side on a Eurocard base board (160 x 100 mm), leaving ample space for connectors and control elements. Connectors are the widely available industry standard IEEE1386 connectors, which are also used on PMC mezzanine boards. The module spacing in a stack is 10mm.




Receptacles and connectors on the top and bottom side of the module are normally interconnected 1:1 to route busses and signals through a module stack. On the other hand it is possible to break this interconnection to insert devices in external busses and interfaces. This is done on D.Module2 FPGA boards: The FPGA module can be inserted between the data acquisition board(s) and the DSP board. Data is acquired and pre-processed by the FPGA, and then presented to the DSP. It is also possible to redefine unused signals to implement additional I/O interfaces in the FPGA.

Note: the DSP module must always be mounted on top of the stack for thermal reasons, DSP boards therefore are not equipped with receptacles on the module top side.

## Electrical Interface

**D.**Module2 boards use a controlled impedance PCB to guarantee signal integrity and minimize radiation of the high-speed busses and interfaces. The external bus interface is configurable to asynchronous and synchronous mode, and is fully buffered with (registered) bus drivers to make the system more robust against external capacitive loads, excessive signal trace lengths, and missing line termination.

The four connectors carry the following signal groups:

- COM: power supply, UART, USB, I²C, 16 pin-programmable IO signals, optional Ethernet
- EXT: DSP-specific extensions, e.g. Video Ports of a DM642
- BUS1: 16 bit parallel high-speed bus interface
- BUS2: 32-bit extension for BUS1, synchronous serial ports

## Module Configuration

**T**he jumperless design simplifies production and system integration. All programmable I/Os, DSP configuration options and clocks are initialized at power up with the settings read from the Module Configuration File. This file is a simple ASCII text file, which can also store application specific data like communication or network settings, making installation of a D.Module2 in various environments straightforward.

## Enhanced Module BIOS

**T**he BIOS is a set of resident API functions for the on-board peripherals. It covers initialization and configuration of the DSP, UART, USB controller and bus interface. Data transfer functions are available for UART and USB, and the Flash Memory support functions cover read, write, erase, and upload of bootloadable Intel-Hex files. All Flash-related functions provide extra security by checking a user-defined protected range before starting any erase or programming cycles. The vital parts of the Flash content (BIOS and hardware configuration) are kept in hardware write-protected sectors.

Typically more than 60 API functions are available and relieve software developers from struggling with low-level, hardware-related problems.

## Setup Utility

**T**he resident Setup-Utility is used for field-maintenance and provides an interface to update program, logic, data, and module configuration files. Setup communicates via RS232 or USB, allowing field updates without any special emulation hardware, even without direct access to the board itself.

## Why is no FPGA included on-board?

**F**PGAs are excellent companions to a DSP to perform initial data filtering, scaling, and data reduction. The complex parts of the algorithm, especially if higher precision is required, are calculated on the DSP. FPGAs are also ideally suited to implement complex I/O interfaces.

Unfortunately there is no "universal" FPGA device suitable for all conceivable implementations, applications, and economic restrictions. FPGA designers often made significant investments in tools, training, IP cores, and are bound to a specific manufacturer or device family.

For cost and space reasons most available DSP-FPGA boards use parts of the FPGA for the board logic too. This is a potential reliability problem, since device utilization and fitting will have an impact on the DSP hardware. Additional validation cycles are required to verify the system under all operating conditions. Remote reprogramming of the FPGA in such a system might be limited or unsupported.

We therefore decided not to include a specific FPGA on the D.Module2 boards, but instead provide the technical prerequisites for successful co-operation with FPGAs: a bus interface supporting high-speed data transfers and matching FPGA design needs. Users are free to select a suitable D.Module2.FPGA board (coming soon), design their own daughter card with their favored FPGA, or implement it on a custom base board. This concept improves reliability by encapsulating the DSP hardware from the FPGA

implementation. During product evolution either the DSP or the FPGA board can be replaced independently to accommodate new features and enhancements.

The ability to insert an FPGA into the D.Module2 busses provides more usable FPGA signals without increasing pin count. Any DSP signal which no longer required in the module stack or on the base board can be replaced with a specific FPGA signal.

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