

**Preliminary**

# DAE - 5™

High quality surround sound decoder subsystem

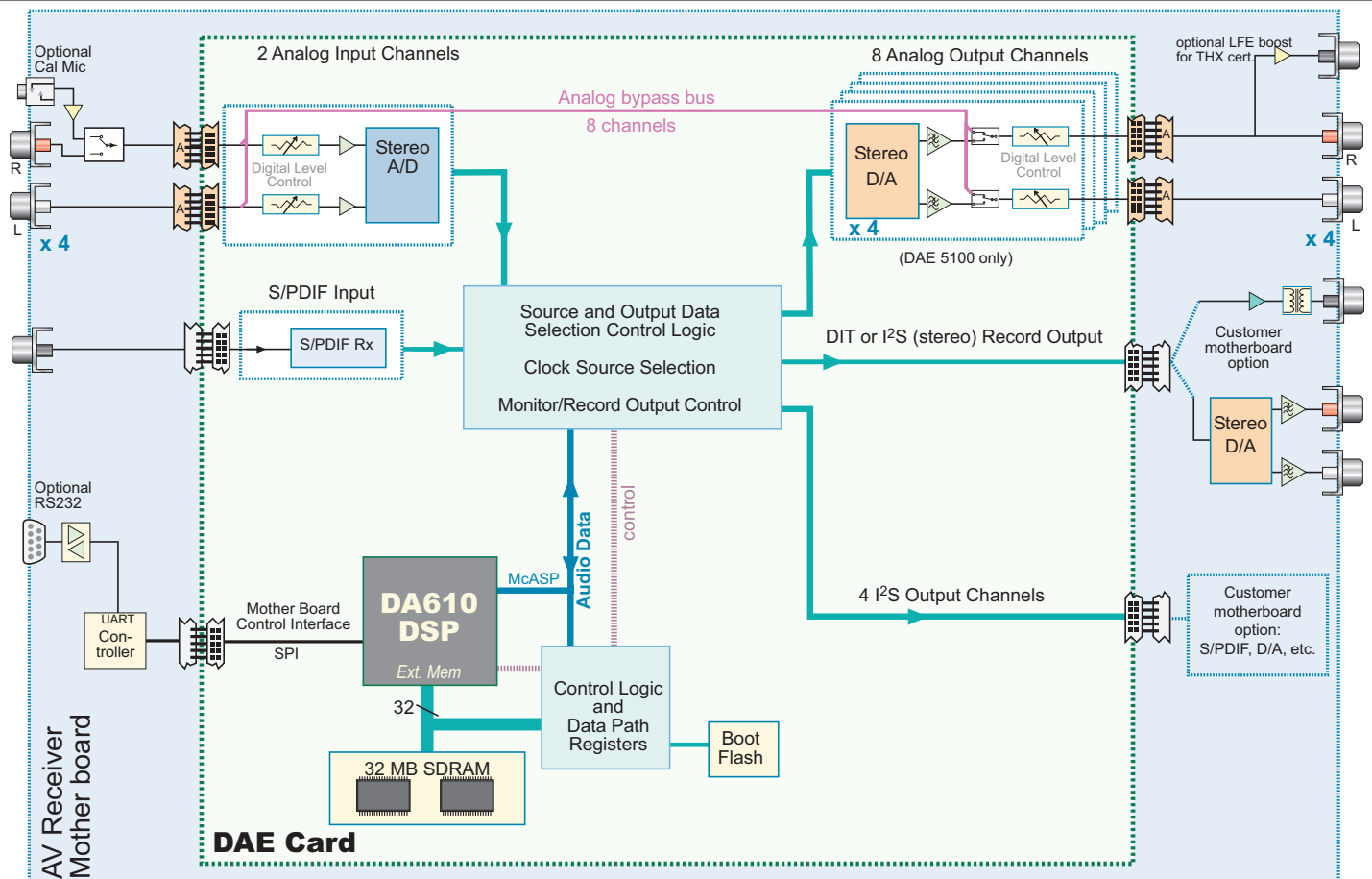
TEXAS INSTRUMENTS DA610 DSP based OEM Audio Module for high quality audio/video systems

### Hardware Features

- Native 32 bit floating point DSP (140 dB equiv. resolution) with 64 bit floating point for use in critical calculations
- S/PDIF in, 2 analog in, 8 analog out (DAE-5100 only)
- 4 I<sup>2</sup>S outputs for external DACs or S/PDIF transmitters
- Record out - S/PDIF or I<sup>2</sup>S + analog (motherboard option)
- Multichannel Analog bypass mode with audio-quality relays eliminates extra motherboard hardware
- Input gain adjustment for optimum source level matching optimizes dynamic range without extra motherboard hardware
- Level controls allow DAE-5 to function as system volume controller
- Flash (firmware) upgrades via SPI (RS232) or S/PDIF (future upgrade)
- SPI motherboard control interface
- 192 kHz 24 bit D/A converters
- High quality converters, op-amps, and passives throughout the analog chain. Typical performance; output >113 dB dynamic range and < -97 dB THD+N, input >107 dB dynamic range and < -104 dB THD+N

### Software Features

- Decoders
  - DTS-96/24, DTS-ES Discrete
  - Dolby Digital
  - PCM-96/24
- Matrix Processing
  - Pro Logic II, Dolby Digital EX
  - DTS-ES Matrix, DTS Neo:6 2-channel
- Standard Post Processing
  - Comprehensive Bass Management
  - Tone Controls, 7-Channel Stereo/Mono
  - Double Bass Mode, Loudness control
- Premium Post Processing
  - THX Ultra 2, Virtualization, Dolby Headphone
  - Parametric EQ, Graphic EQ
  - Multiple subwoofers, Reverberation.
- Auto Calibration of levels and delays (future upgrade)
- Custom code can be written in C and integrated into the Performance Audio Framework
- Supported via Texas Instrument's Code Composer Studio IDE



## DAE-5 : High quality surround sound decoder subsystem

Momentum Data Systems newest Digital Audio Engine builds on the sonic excellence and versatile decoder capability of the DAE™ product series. The DAE-5™ offers support for all of the latest decoders and sound field processing algorithms from Dolby™, DTS™, and THX™.

Using the DAE-5, equipment designers can save man-years of development time and instead focus on features for product differentiation.

The DAE-5 uses the Texas Instruments 225 MHz DA610 VLIW processor, which is based on the TMS320C6713 core. Executing multiple instructions per clock cycle, the DA610 provides the computational power (1800 MIPS) to perform all I/O and decoder operations with enough CPU bandwidth left over for sophisticated sound field processing.

The use of floating point arithmetic throughout overcomes the inherent dynamic range limitations of fixed point (integer) processors. The DA610 has 4 floating point ALUs and 2 floating point multipliers, so there is no performance penalty associated with preferred floating point operations.

This extra dynamic range would be of little value if the digital to analog conversion stages did not offer corresponding capability. The DAE-5 design offers 24 bit D/As that support sample rates up to 192 kHz.

Unlike fixed decoder devices, the software architecture of the DAE-5 is based on the Performance Audio Framework. This open and extensible framework allows for software customization (e.g. to add specific audio processing), as well as in-the-field software upgrades to support new decoder standards.

The system's device drivers automatically recognize the type of source encoding and automatically switch operation to the correct decoder with no artifacts in the output audio stream. The stream manager architecture simplifies development of post processing/effects such as room equalization, dynamic range compression, and surround modes.

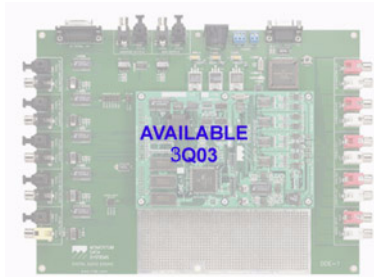
The DAE-5 is designed as a module that plugs into manufacturer provided connectors on the Receiver motherboard. These connectors provide:

- Power
- Control: via SPI interface and interrupt line
- Analog I/O
- S/PDIF input
- I<sup>2</sup>S for Digital (S/PDIF) output
- I<sup>2</sup>S or S/PDIF for record output

### DAE-3 pin compatible

The DAE-5 is pin compatible with MDS' prior generation of Digital Audio Engines, removing the need for a hardware redesign to take advantage of all of the features offered by the DAE-5. Note that due to the huge increase in functionality the software API is different, but the fundamental architecture used to command and control the DAE-5 is similar to that used with the DAE-3.

### DAE development platform



The DAE-5 is available with the DAE Development Environment (DDE). This board provides access to all DAE-5 signals for testing and evaluation prior to integration into an A/V Receiver system.

Access to the DAE-5 control port allows interfacing with a PC or an emulator board running the A/V Receiver system software.

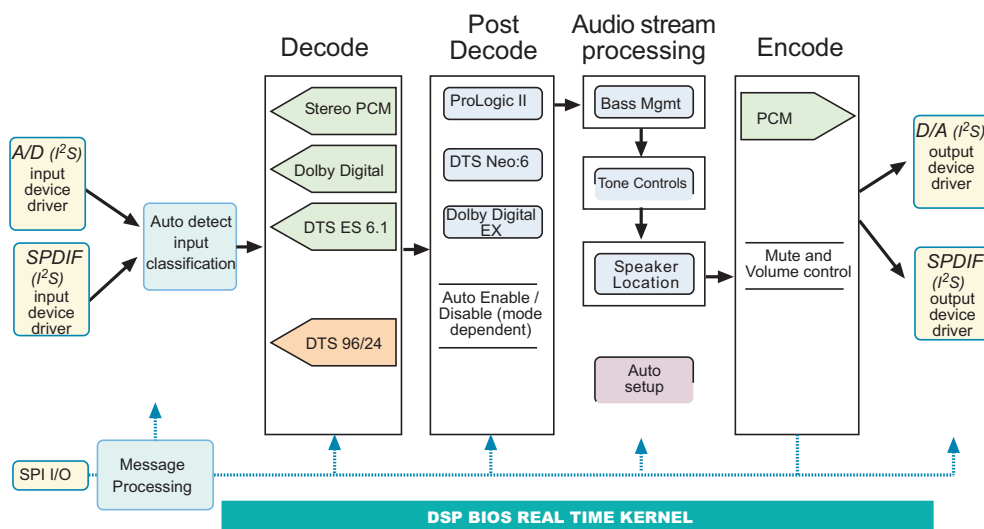
Using the DDE developers can fully test out system operation prior to availability of their A/V Receiver hardware.

**Preliminary**



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# DAE-5 : High quality surround sound decoder subsystem



The DAE software is based on the Open Audio System using the Performance Audio Framework (PA/F). This framework, pictured at left, creates a modular software environment that simplifies product customization. Processing can be inserted into the chain without disrupting the environment.

## Hardware Specifications

**Preliminary, performance specifications subject to change**

### Analog input stage

- 10 k $\Omega$  input impedance
- Approximately  $\pm 23.5$ mV to  $\pm 2.5$ V for FS A/D output
- AC Coupled, Fc 3 Hz
- Digitally controlled analog volume control
- A/D: 24 bit delta-sigma A/D
- Sample clock:
  - internal osc: 48, 96, 192 kHz
- minimum performance
  - Fs = 48 kHz, 997 Hz, -1dBFS input, 22 Hz - 22k kHz, A-weighting: < -102 dB THD+N, > 106 dB dynamic range (AES-17 method)
  - input crosstalk: 1kHz FS input to any other input > 100 dB
- 2 channels

### Analog bypass

- 8 channels fed to output level controls
- relay switched using high quality small signal relays

### S/PDIF coax input

- 75 $\Omega$  input impedance
- 44.1 kHz to 192 kHz sample clock recovery

### Analog output stage

- 50  $\Omega$  output impedance
- 2V RMS for FS D/A output at max level
- Digitally controlled analog volume control
- DC Coupled output
- Anti-Imaging filter: 2nd order, Fc = 70 kHz
- Sample clock: slaves to input source, 2x, or 4x input up to 192 kHz
- minimum performance
  - Fs = 44.1 kHz, 997 Hz, -1dBFS output, 22 Hz - 22k kHz, A-weighting: < -95 dB THD+N, > 110 dB dynamic range (AES-17)
  - output crosstalk: 1kHz FS output to any other output > 100 dB

### Record monitor output

- Can operate as DIT (S/PDIF) signal
  - requires buffer and (optional) transformer on motherboard
- I<sup>2</sup>S format
  - use DIT xmit chip on motherboard for S/PDIF out
  - use D/A on motherboard for analog output
- Note: copyright control not part of DAE-5.

### External devices needed on motherboard

- microphone amp and select switch
- Subwoofer amp for +/- 10V THX certification
- Controller with SPI interface, UART, and interrupt pin

### S/PDIF coax output

- Motherboard generated from I<sup>2</sup>S signals

### Processor

- 225 MHz DA610 DSP with ROM based Performance Audio Framework with built in decoders
- 32 MB SDRAM
- 4 MByte program flash

### Motherboard connectors

- 3 digital (3.3V, 5V compliant inputs), 2 analog
- .1" IDC header style

### Power

- +3.3, +5VD, +5VA, -5VA, +12VA, -12VA
- approximately 15 W

### Mechanical

- 5" x 6"

# DAE-5 : High quality surround sound decoder subsystem

## Ordering information (order code is in *Italics*)

Shipment of any of these products requires appropriate license information from Dolby Labs, Digital Theater Systems, or THX, as needed.

Modules orders are subject to minimum quantities, please contact MDS sales department for a quotation

*DAE-5100*: DAE-5 unit with 225 MHz DA610 processor.

- Basic DAE module, 2 analog in, 1 S/PDIF in, 8 analog bypass in
- 8 analog out, 4 stereo I<sup>2</sup>S out, 1 DIT (for S/PDIF) or I<sup>2</sup>S out (record monitor), Standard Post Processing

*DAE-5110*: DAE-5 digital out only unit with 225 MHz DA610 processor.

- I<sup>2</sup>S output DAE module, 2 analog in, 1 S/PDIF in
- 8 stereo I<sup>2</sup>S out, 1 DIT (for S/PDIF) or I<sup>2</sup>S S/PDIF out (record monitor)
- Standard Post Processing

*DAE-ASP-#*: DAE-5 premium post processing item

- Premium post-processing items can be added to the DAE-5 on an individual basis for additional cost.

*DDE-DK-EVAL*: DAE with eval board

- DDE MotherBoard
- DAE-5100 or DAE-5110 module
- PC based control software for DDE
- 90 Day DDE Getting Started support

*DDE-DK-FULL*: DAE Development Environment

- DDE MotherBoard
  - DAE-5100 or DAE-5110 module
  - Open Audio System Tool Kit
  - Source code to example applications and device drivers used by the DSP
  - PC based control software for DDE
  - 90 Day DDE Getting Started support
- Please check with MDS for the currently available software options prior to ordering.

*DAE-TRAIN-1*: 2 Day DAE integration course

- One on one training to learn how to integrate DAE
- Covers both software and hardware
- Cost of course credited towards first production DAE-5 order
- 180 days of extended support

*DAE-TRAIN-2*: 3 Day DAE training course: Custom software

- Prerequisite: Texas Instruments TMS320C6000/CCS course
- Covers writing and integrating the following:
  - Interface control/mode setups
  - Hardware interfacing
  - post decode sound field processing selection
  - custom post decode processing
- 270 days of extended support

Consulting services are also available from Momentum Data Systems.

*DDE-STD* 90 Day Startup Support (inc. with DDE-DK)

- Help with installation of hardware/software.
- Problems in installation.
- How to use/run hardware or software that comes with the DVE. This excludes example programs because they are provided as-is, without support.
- General questions on background information (standards, etc.)

*DDE-EXT\_#* DAE Extended Support

- (TBD/In development).

Please see the MDS website for a copy of the DAE Support data sheet, which has full details.

## Related items

Please visit <http://www.mds.com> for more information on these and other products to speed your design to market.



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DTS is a trademark of Digital Theater Systems, Inc.

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DAE-5 Data Sheet rev 1n aug 2003 PRELIMINARY

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