

## APM - 89L™

Dual DSP module with integrated Linux  
host controller

Momentum Data Systems APM modules are a superset of MDS' DAE modules, adding an integral ARM based processor running Linux to create a standalone subsystem compared to the DSP only DAE modules.

This module offers a transition between DSP only modules such as the DAE-82 and DAE-89 and new modules to be based on multicore SoCs offering twice the performance of current parts.

The APM-89L module offers up to 20 I<sup>2</sup>S ports, allowing the mixed signal portions to be selected to meet the exact system requirements. The APM-89L is based on Texas Instruments (TI) DA830 and DA810, which are functionally similar to TI's OMAP L137 and C674x floating point DSP devices.

The module can also be used with MDS HDMI switcher/repeater products, which range from a 1:1 repeater with OSD through a 8:2 switch.

By using MDS' audio and HDMI modules system designers can quickly implement the common functions needed of all AV Receivers and focus on the unique aspects of their products.

For OEMs and integrators needing assistance with analog, system or software design, MDS' Audio Services Group can provide design services ranging from consulting through complete product design.

### AVR decoder firmware

The modules includes DSP firmware that enables certain specific processing features that are common to AV Receivers (AVRs, which for these products also includes Pre-Processor or Pre-Pro applications).

This firmware is the same configuration used on the DAE-89 modules; please see that datasheet for full details of the DSP configuration.

When an APM-89L is ordered, it is assigned a 4 digit order code that both defines the hardware and the firmware configuration (i.e. the decoder, ASPs and their topology) that go with it. Unless noted otherwise, the descriptions in this datasheet refers to the firmware in a generic sense and not a specific combination of features.

### Linux host interface

The APM-89L includes an integrated ARM processor running Linux. An example console application is included that illustrates the major features of an AVR system. Customers can replace this example with a Linux based control application of their own design that interfaces to their system

Texas  
Instruments  
DA830 and  
DA810 Linux/  
DSP based  
OEM Audio  
Module for  
ATMOS & UHD  
decoder  
systems



host processor over I<sup>2</sup>C or serial  
communications.



### APM-89L module details

The details of the DSP features can be found on the DAE-89 datasheet.

#### Common Features - connector

All DAE-8 / APM-8 series modules use the same 140 pin connector for digital signals and power, a Hirose FX8C-140S-SV5 receptacle. This allows mating heights of 10 to 16mm to allow circuitry to be placed under the board if desired; do not place any analog circuitry under the DAE module.

The APM-89L uses 3.3 and 5V power from the digital connector. Peak 3.3V power is 3A. About 100 mA is used on the 5V supply.

#### Booting

The modules boots from a local SPI serial flash. While the host can write to this flash directly for field updates it is generally suggested to implement field updates in the Linux system as less overall storage is typically needed that way.

#### Development

To support application development your system board will need to provide access to the UART and USB ports from the DA830. The UART is used for a console connection, and the USB is used for a USB ethernet adapter to support NFS during development.

JTAG is available for use with CCS compatible emulators, but a Tag-Connect adapter is needed. Please contact MDS for more information.

The standard development environment is TI CCS running in Windows and Ubuntu running as a VM in Windows.

#### Common Features - control

The board is controlled through an I<sup>2</sup>C port on the DA830 device. The serial console UART could also be used but isn't suggested due to the complications of sharing the port during development.

#### Common Features - I<sup>2</sup>S ports

With the exception of a few I<sup>2</sup>S data lines, the three McASP ports on the DA8xx devices are brought out to the connector. From the raw hardware perspective this provides up to 20 I<sup>2</sup>S data lines in three clock domains.

# APM-89L Linux based audio module for ATMOS and UHD systems

However the AVR firmware makes specific use of certain ports. 4 data lines of McASP0 are used for audio input. McASP 1 is always used for the primary output. McASP2 is always used for secondary (downmix) output and an optional stereo input mix.

## HDMI input/output

MDS offers a number of different HDMI repeater/switching solutions to provide access to the audio carried by HDMI interconnects.

Typically the downstream HDMI device will be a TV or similar display device which does not decode audio. In that case the APM-89L is configured to provide the stereo downmix as 2 channel PCM for the HDMI output of the AVR.

## Evaluation systems

For those wishing to better understand how to use the APM-89L module MDS offers an evaluation system for purchase.

Customers combining MDS' APM-89L with one of MDS' HDMI repeater/switcher/audio extractor systems should contact MDS for guidance on the evaluation system choices.

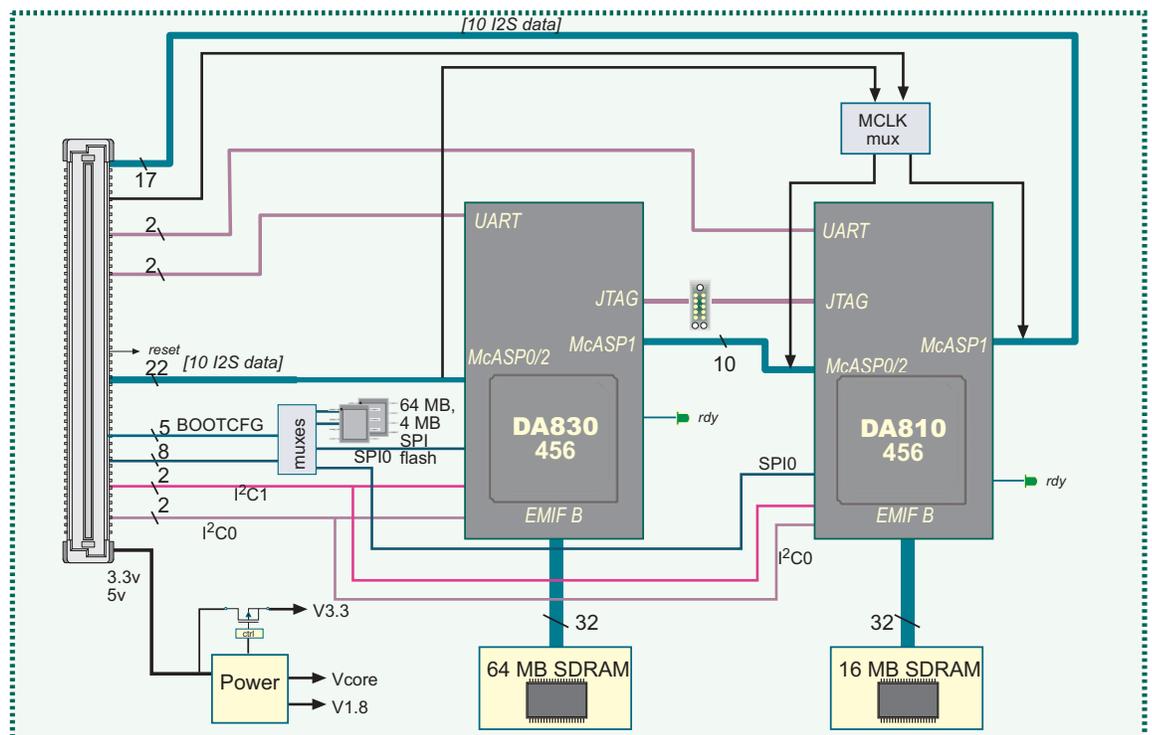
Included with the system is a host side API source code library on the ARM 9 of the DA30 that is used to control the DSP functions.

MDS provides a layer on top of the lower level driver to provide a simple and robust interface for the common functions of an AVR. Access to the lower level interface is available to allow complete customization of the system's functions.

The EVM board provides volume control on input and output since these are features of a typical AVR and the EVM software provides an example of how to integrate that with the APM-89L.



**EVM board.**



**APM-89L block diagram.**

# APM-89L Linux based audio module for ATMOS and UHD systems

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

Shipment of APM-89L products with decoder capability requires appropriate license information from Dolby Labs and Digital Theater Systems.

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

Ordering codes consist of the hardware model followed by 2 or more alpha-numeric code that indicates a specific combination of firmware modules (standard and optional).

Some features may incur additional charges for porting or per unit license fees.

*EVM-APM-89xx*: APM-89 development system.

- EVM MotherBoard (includes 13.3 analog out) for APM-89L
- APM-89xx module
- Power supply
- HSR-41 HDMI repeater module

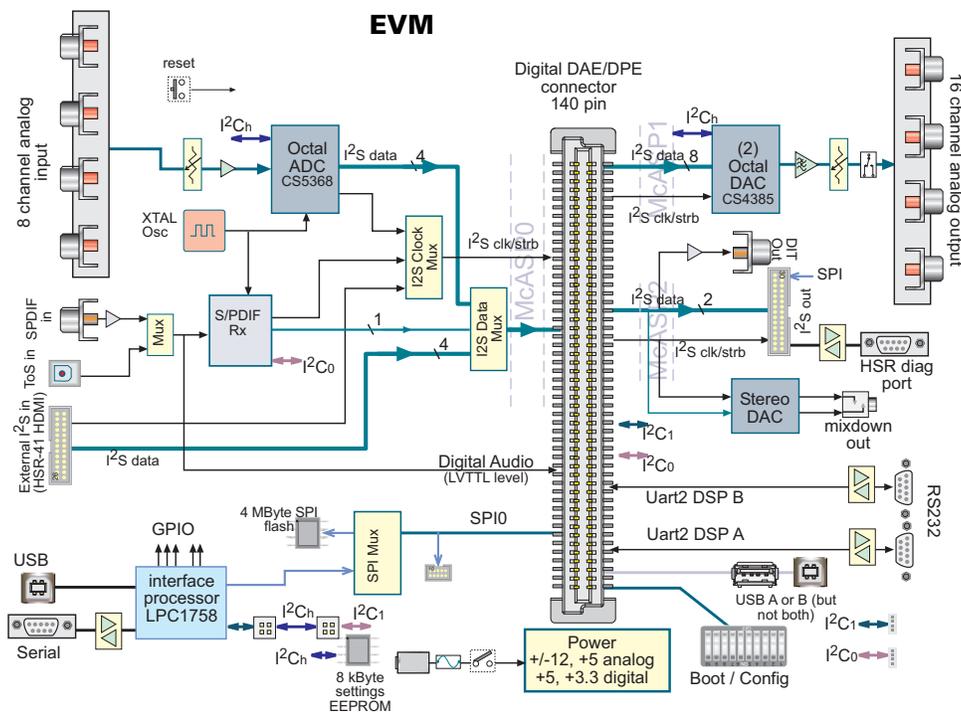
*Some options require MDS to create a customer specific firmware release and incur a porting charge. These charges do not include the license fee from the algorithm vendor. Adding additional processing options will reduce CPU availability for other features.*

## Supported ADC/DACs/Volume controls

Different parts have different control requirements. While in most cases the host processor can take responsibility, there are some direct hardware level interactions that the APM board needs to be involved with (for example the MUTE signals). Please contact MDS to discuss hardware choices and to determine if specific hardware might require modification to the DAE's drivers.

## 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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