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Overview

The BridgeCo DM860 Networked Media Processor is a triple core processor that combines benefits of a 240MHz ARM926EJ as system controller, a dedicated highly Secure Co-processor for unequalled security of DRM encrypted content, and an Audio Engine to handle computationally intensive real-time signal processing, providing a computational power of over 600 MIPS at very low incremental cost.

The DM860 is identical to the DM870 except that the Wi-Fi baseband and MAC are not integrated. The DM860 is intended for those systems not requiring Wi-Fi capability or using external wireless connectivity components. See the Chip Family Comparison below for more details.

Combined with the broad set of networking functions and BridgeCo's complete embedded software stack and SDK, the DM860 delivers a true system-on-a-chip for next-generation Networked Music Stations. This platform enables all-new streaming music experiences at an attractive system cost, a fast time to market, and design flexibility for the OEM.

The software packages will be available as complete products and as SDKs for easy customisation. Reference designs are available for the example applications below.

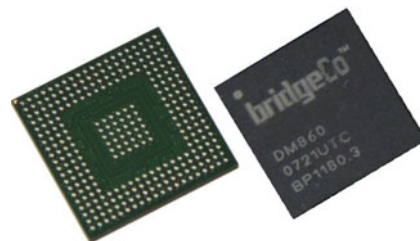
Features

Secure high-performance audio/video Networked Media Processor

- CE Appliance optimized multi-core processor
- Audio and video ports: Stereo PWM output/H-bridge output, I²S, I⁸S, SPDIF, CCIR 656
- Network I/O interfaces and controller: Ethernet, USB 2.0 OTG
- PCMCIA/Compact Flash interface to connect IDE HDD, IDE CDROM etc.
- Control Ports: Two UARTs, SPI, GPIO
- Secure Co-processor
- Integrated TFT/STN/DSTN LCD controller
- SD/SDIO/MMC Card Interface
- Dedicated hardware High Performance Audio Engine
- On-chip Real Time Clock
- Industry-standard ARM926EJ embedded RISC controller
- Native NAND flash interface

Comprehensive Media Networked System Software

- Linux operating system and kernel
- UPNP & DLNA compliant Middleware
- Audio encoding/decoding and processing such as MP3, WMA (incl Lossless), AAC, Real Audio, etc.
- Digital Rights Management
- Premium Music Services (Pandora, Rhapsody, etc.)
- Color graphic User Interface on LCD or Video output



292 ball mBGA, 20x20 array, 0.8mm pitch, 17x17mm

Example Applications

Internet Radio & Alarm Clock, iPod Docks

Wired or wireless (requires external Wi-Fi solution) Internet Radio with optional FM/AM tuner, Alarm functions, and iPod docking support bringing radio stations and music services from around the world into any room in the house, along with playback of digital media content from networked PCs.

Networked Music Stations

Innovative Music Stations that bring Music Services which were previously only available on the PC into the living room and stand-alone devices improving the user experience and eliminating the need for a PC.

Consumer Electronic Products

Integrated wired or wireless network capability for consumer electronics such as AV Receivers, mini-hifi systems, and boom-boxes.

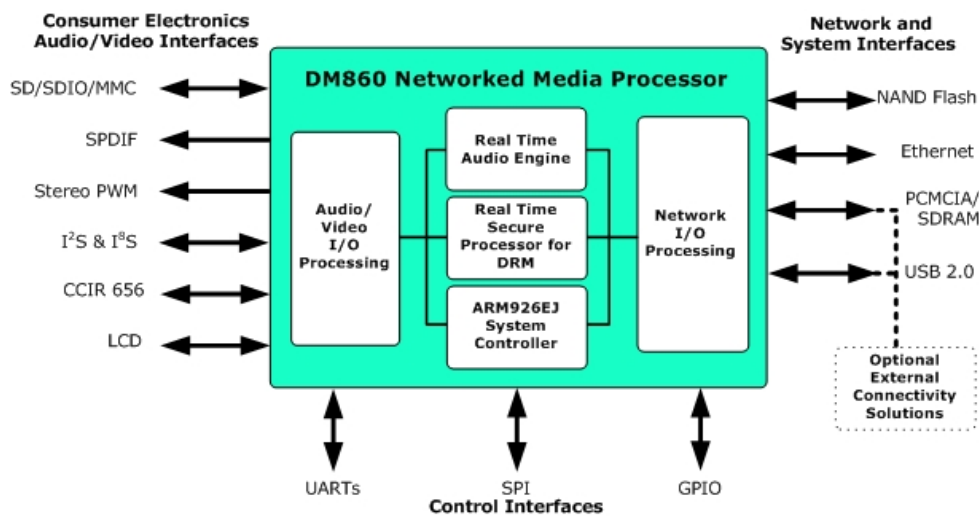


Figure 1
The DM860 enables networked media applications.

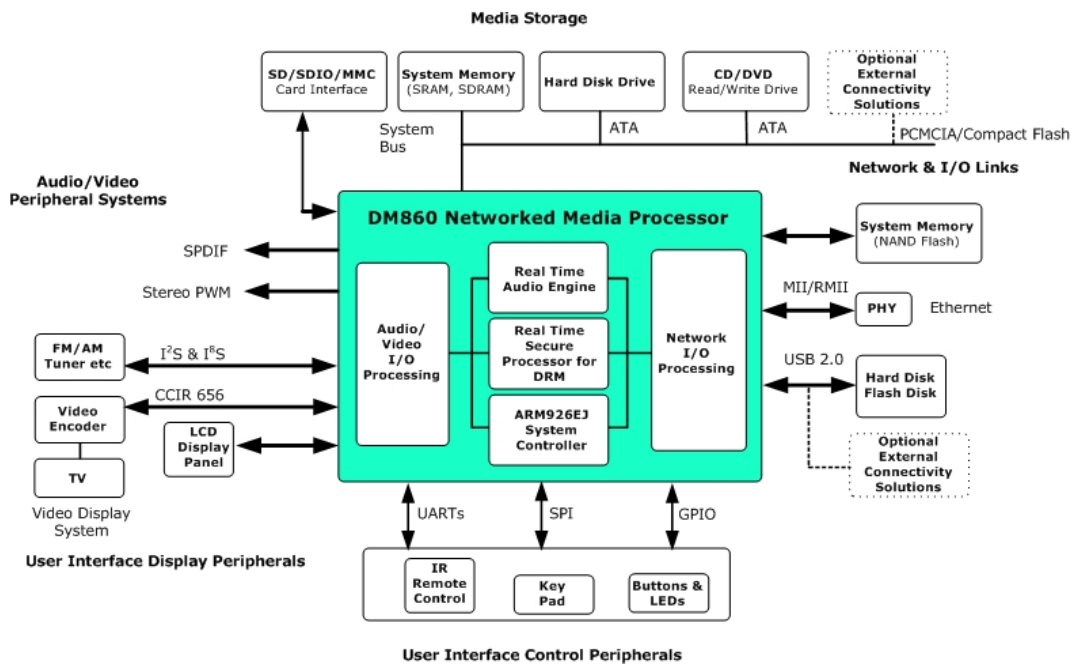


Figure 2
Composite view of network and consumer electronic devices that can be linked to DM860 applications

Networked Music Stations

The term Networked Music Stations is used to describe a wide range of devices that stream and process media content.

Figure 2 is a composite representation of the diversity of connection and configuration options that can occur in a Networked Music Station, and how these configurations are supported by the DM860. The diagram also shows that the DM860 supports the five functional processing areas essential to the implementation of a Networked Music Station. Table 1 gives an overview of the associated software functionality.

Network I/O Processing

As the division between the computer domain and the consumer domain narrows, there is an increasing need for devices to support a wider range of interfaces. USB is the dominant approach for interfacing PC peripherals. Ethernet is the de facto standard for data networking. But the wireless standard 802.11 is becoming increasingly important to all classes of products. The DM860 allows for flexibility and connectivity through the USB port and System bus.

Real Time Media Digital Signal Processing

As most of the media stream's timing, formatting and de/multiplexing is performed by the I/O hardware and its software drivers, the remaining media processing falls into the broad categories of compression/expansion (encode/decode), or the conversion of some functions on data blocks or frames. In the DM860, these processes are shared between the embedded RISC microcontroller and the real-time Audio Engine, where array and DSP-intensive multiply-accumulate operations dominate. An example of this use is the real-time decoding of WMA-Lossless.

Digital Rights Management Processing

It is becoming increasingly common to stream media content digitally between devices, so it is important to consider the protection of the property rights of the content providers through appropriate Digital Rights Management (DRM) schemes. The different algorithms used often need computationally intensive encryption and authentication routines. A dedicated, secure, powerful processing engine in the DM860 is designed to support these algorithms, many of which are already available in the associated software platform.

Audio/Video I/O Processing

Digital audio applications require a range of interfaces, including SPDIF, I²S and I⁸S. All these interfaces are supported in the DM860 hardware. The combination of the media processor and supporting software facilitates operations such as switching and mixing. Support for video is provided in the form of CCIR 656, MPEG, or DV through a digital DVB-SPI interface. LCD panels are supported through the integrated LCD controller.

Real-Time Control Processing

In addition to its core media streaming functions, a Networked Music Station must support a range of interfaces such as LCDs, LEDs, push buttons, rotary encoders and remote controls. There is also a need to provide the general control program requirements with support for advanced services, such as an embedded web server to allow control through web browsers. In order to minimize overall system costs, it is important that this range of functions can be supported without additional components.

The software support provided with the DM860 leverages the processing power of the ARM926EJ controller. This allows general purpose control functions to be elegantly implemented alongside media processing algorithms. This avoids the need for ancillary control processors. General purpose outputs, coupled with industry standard SPI and UART ports, complete this support in hardware. An extensive library of software also exists for these functions.

Table 1

Functional Process	Functional Software Support
Network Input/Output	A/V Streaming & Clock Regeneration
	Reference Time Distribution
	Packet Synchronisation
	TCP/IP Stack
	USB Communication Stack
Audio Support	Audio Decoding (MP3, WMA, WMA-lossless, AAC, Real Audio, etc)
	Sample Rate Conversions
	Audio mixing, equalisation, limiting, fading, etc.
Picture Support	JPEG image decoding
	Video 656 framing
Video Support	Video transport (eg MPEG, DV, etc)
Digital Rights Management Processing	Encryption/Decryption including DES, 3DES, AES, IDEA & DTCP (5C)
	Authentication including RSA, Diffie/Hellman & Elliptic Curves
	Support for Proprietary Content schemes
Control Protocols	UPnP Stack, DLNA Stack
User Interface	IR Remote Control support
	Graphical Color LCD support

Hardware Description

The DM860 major functional blocks are shown below.

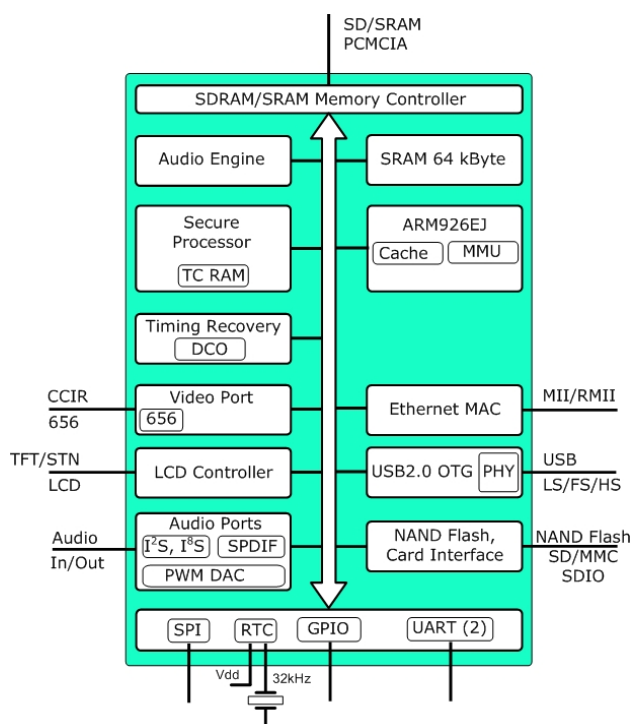


Figure 3
DM860 Hardware Block Diagram

Network Input/Output

Network I/O is provided by four distinct interfaces.

- The on-chip Ethernet MAC supports 10/100 Mbps half or full duplex modes with IEEE802.1d/q VLAN, and priority. It connects to an external PHY through the MII and RMII interface. A dedicated output provides a 25 MHz clock to the PHY, making an additional crystal unnecessary.
- The integrated USB 2.0 On-The-Go (OTG) Controller (Dual-Role) supports Full Speed (12 Mbps) rates, High Speed (480 Mbps) and Low Speed (1.5 Mbps) rates, with full hub support. A total of 8 endpoints providing INT, BULK and ISOCH transaction capabilities are supported.

LCD Controller

The DM860 has an integrated LCD controller for TFT, STN, and DSTN LCD panels. The outputs are up to 18bit RGB data, with support for panels up to 1024x768 panels, depending on data rate and refresh rate.

Audio/Video Input/Output

There are up to four Audio I/O ports, two ports with four I²S/I⁸S interfaces operating at up to 192 kHz in both I²S and I⁸S modes; one port with two I²S/I⁸S interfaces; and two ports with support for two SPDIF ports each.

There are up to four SPDIF interfaces operating at up to 192 kHz.

An on-chip stereo PWM-DAC provides 3-level differential PWM output, intended for subwoofer or headphone signals. The DAC can be operated either in digital-to-analog convertor mode, where only an external low-pass filter is required, or in digital amplifier mode where an external H-bridge may be attached for higher output power.

Video I/O is 8 bit input or output, compliant with EN50083-9 (DVB-SPI). It provides a glueless connection to MPEG, DV, and PAL/NTSC video encoders/decoders.

Low-jitter digital clock recovery, using an on-chip DCO, eliminates the need for an external VCO.

Control & System Input/Output

Two UARTs provide data rates up to 20 Mbps. Auxiliary interfaces include SPI (master and slave) and GPIOs supporting IR receivers and transceivers, LCD displays, etc.

ARM Microcontroller

The ARM926EJ RISC CPU operates at up to 240MHz, and is optimized for performance under Linux. It has a 16 kByte instruction and a 16 kByte data cache.

The ARM926EJ offers additional performance by incorporating DSP enhancements, and a multichannel DMA controller.

Real Time Audio Engine

The DM860 is completed by a powerful patent-pending Audio Engine, a circuitry dedicated to complex audio processing like audio enhancement algorithms, MP3 encoding for streaming purposes, native real time WMA lossless decoding, and similar tasks. The Audio Engine is an efficient implementation of SIMD techniques (Single Instruction, Multiple Data); it is composed by a 160MHz 32-bit RISC processor joined to a programmable & proprietary filter bank, enabling the simultaneous execution of four instruction sets in parallel giving a total computational power of over 60 MIPS at very low incremental cost.

Secure Processor

Running at 160 MHz, this dedicated processor provides:

- Secure processing capabilities to prevent spoofing of data and code
- Signal processing including audio decode, sample rate conversions and still image decoding
- Support for Copy Protection and Digital Rights Management schemes.

Memory Controller

An SDRAM/SRAM memory controller, with a 16 bit data path, provides connectivity

- to SDRAM at up to 160 MHz
- to SRAM and NOR Flash
- to PCMCIA, Compact Flash, or ATA compliant devices.

It features four Chip-Select signals. These CS signals have 64MB address range and a CS for SDRAM with 256 MB address range. It provides an IOREADY signal to prolong access cycles as well as 64 kByte internal SRAM.

Software

A comprehensive set of software modules and complete reference applications for an audio Networked Music Station will be available for the DM860. The application software is based on Linux 2.6.

The Linux kernel is made available under GPL and supports the DM860 specific hardware interfaces.

On top of Linux, a comprehensive set of object-oriented software libraries is offered. This Networked Music Station software framework supports typical interface functions, e.g. buttons, switches, rotaries, LEDs, LCD drivers, and control and transport protocols (including UPnP, TCP/IP and HTTP), and direct interfaces to popular online music services.

DSP functions include MP3 and WMA decoders, AAC-HE, etc. Additional DSP functions offered are picture decoding and OSD.

Software will be available as a finished product with defined feature set, and as licensed SDK of the Middleware to allow customizations and additions.

The UI is offered including source codes, to enable for a custom look and feel.

For a complete list of software modules and supported applications, please contact our Sales Representatives.

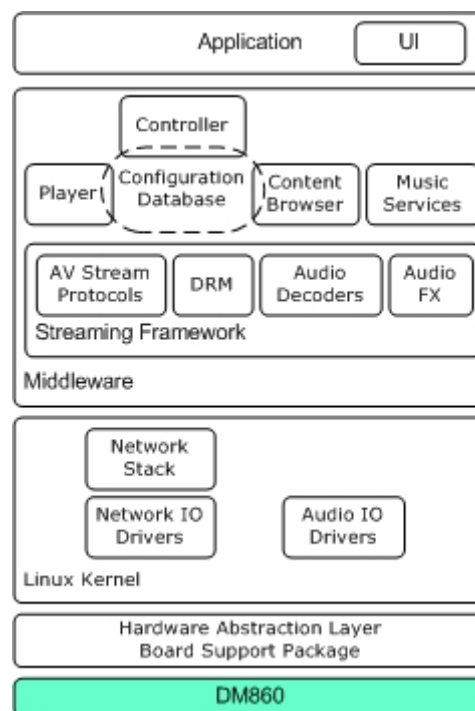


Figure 4
DM860 Software Stack

Product Development and Reference Designs

Given the increasing complexities of the target products and the competitive nature of the market, system designers must consider important criteria when choosing an application platform solution. BridgeCo solutions deliver strong advantages:

1. Proven and mature hardware and software platforms
2. Broadest industry features and compatibility
3. Comprehensive system design platforms minimize design cost and risk
4. Advanced customization tools bring compelling products to market quickly

BridgeCo delivers all of these advantages with the DM860. The DM860 Evaluation

Board provides a working physical design that can be used for familiarisation with the software.

BridgeCo also supplies complete turnkey application software which operates on companion reference boards:

- CE Family: Embedded AVR networking
- Internet Radio & Alarm Clock
- Music Station

Please see the relevant Product Information brochures for more details. The most up to date information is available from your local Sales Representative. This list is constantly extended.

Software Development Kit

The DM860 Software Development Kit (SDK) includes a development license, together with software, documentation and a reference design evaluation board.

The DM860 software consists of the Linux Operating System, together with the application framework. Tools and function libraries are provided to enable the generation of custom application software.

Simple APIs make the kit easy to use and the documentation is straightforward and easy to understand.

The SDK comes with sample applications that run on BridgeCo Evaluation Boards or Reference Boards, and can serve as models for final product designs.

The BridgeCo SDK reduces development risk and enables rapid progress from prototype design to a shipping product.

Contact BridgeCo Sales for availability.

DM860 Core Module

To enable fastest time to market BridgeCo has designed the DM860 Core Module which contains all necessary and critical system components, while leaving the designer the flexibility to define and optimize the external interfaces. By placing the fast digital system interfaces on the module, the designer can focus on the overall system design and integration of the module.

The module is designed and tested for the required RF and EMI/EMC compliance, and is available as reference design from BridgeCo and as tested module from BridgeCo manufacturing partners.

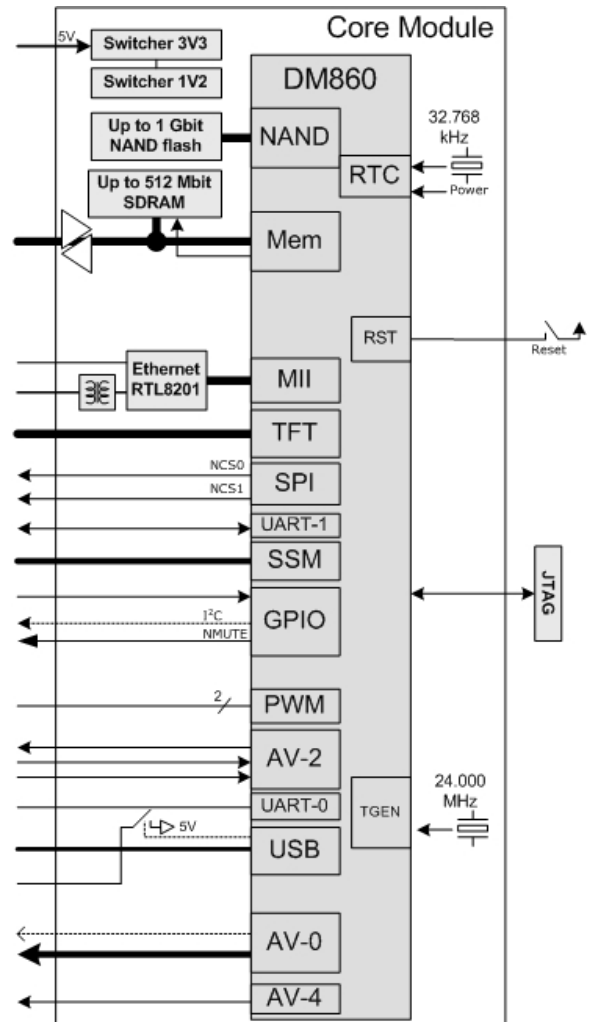


Figure 5
DM860 Core Module

Chip Family Comparison

Feature	DM870	DM865	DM860
Max Clock Speed	240 MHz	150 MHz	240 MHz
Max SDRAM Speed	160 MHz	133 MHz	160 MHz
Audio Engine	Yes	No	Yes
Security Engine	Yes	Yes	Yes
TFT LCD driver	Yes	No	Yes
Audio I/O Ports	4	1	4
Wi-Fi MAC & BB	Yes	Yes	No
TV UI Output	Yes	No	Yes
SPDIF Out	Yes	No	Yes
Ethernet MAC	Yes	No	Yes

Ordering Information

The following order codes should be used to specify DM860 products when ordering from BridgeCo:

Product Description	Ordering Code
DM860 Networked Media Processor IC	DM860
Package	mBGA (lead free package)
Temperature Range	Commercial
Evaluation Kit including reference board	Contact BridgeCo Sales – www.bridgeco.com
Development Kit including reference board	Contact BridgeCo Sales – www.bridgeco.com
Application software packages and software modules	Contact BridgeCo Sales – www.bridgeco.com

For information on additional software modules, integrated software application packages, or pricing and order enquiries, please contact BridgeCo directly:

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Please refer to the website for further contact information.

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