Nexperia PNX7850

High-speed DVD+R/RW and CD-R/RW processor for PC-hosted recorders

The Philips Nexperia PNX7850 is a highly integrated, multi-functional processor for high-speed DVD/CD recorders. As part of the Philips DVD+RW chipset, the PNX7850 brings industry-leading speed and accuracy to computing applications.

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The Nexperia PNX7850 processor handles all of the encoding and decoding functions required for industry-leading write and read performance in DVD/CD recorders. In addition to a 32-bit MIPS RISC core, it integrates channel and data-block codecs, a servo DSP, a buffer manager, and an audio processor. On its own, the PNX7850 can support write speeds of 8x DVD and 48x CD (early versions support 4x DVD), and read speeds of 16x DVD and 56x CD. When configured with the Philips DVD+RW chipset, the PNX7850 contributes to write performance of 8x DVD+R, 4x DVD+RW, 32x CD-R, and 12x CD-RW, and read performance of 16x DVD-ROM and 48x CD. Exceptional write speeds are due in part to a technology, developed in partnership with Intersil, that moves the write-strategy function off-chip onto the optical pickup unit (OPU).

Designed in accordance with the DVD+RW standard, the PNX7850 is compatible with other DVD and CD formats, including DVD-R/RW and DVD-ROM, as well as CD-ROM and CD-DA. It is manufactured using an advanced 0.18-µm CMOS process that reduces core voltage and power consumption. For portable applications, the PNX7850 offers clock gating and enhanced power-down features.

Key features

> Delivers industry-leading performance as part of the Philips DVD+RW chipset:
  - Writes 8x DVD+R, 4x DVD+RW, 32x CD-R, and 12x CD-RW
  - Reads 16x DVD-ROM, DVD+R, DVD+RW, DVD-R, DVD-RW; and 48x CD-ROM, CD-DA, CD-R, CD-RW
> Integrated functions for lower cost, higher performance
  - Channel and data-block codecs
  - Buffer manager with ATAPI host interface
  - Audio processor for digital audio data
  - 32-bit MIPS processor with embedded memory
  - Servo DSP with acceleration modules
  - Analog front-end
> Power management features for portable applications
> 240-pin PGBA package
> Complete reference design with modular software available

Target applications

The PNX7850 is designed for use in desktop, notebook, and laptop PCs that integrate a DVD recorder. It can also be used in desktop or portable PC peripherals. Wide interoperability with other standards makes it especially suited to double-writer and combination applications.

Functional overview

The PNX7850 is a highly integrated device that includes channel and data-block codecs, a buffer manager, an audio processor, a 32-bit MIPS processor, and a servo DSP.

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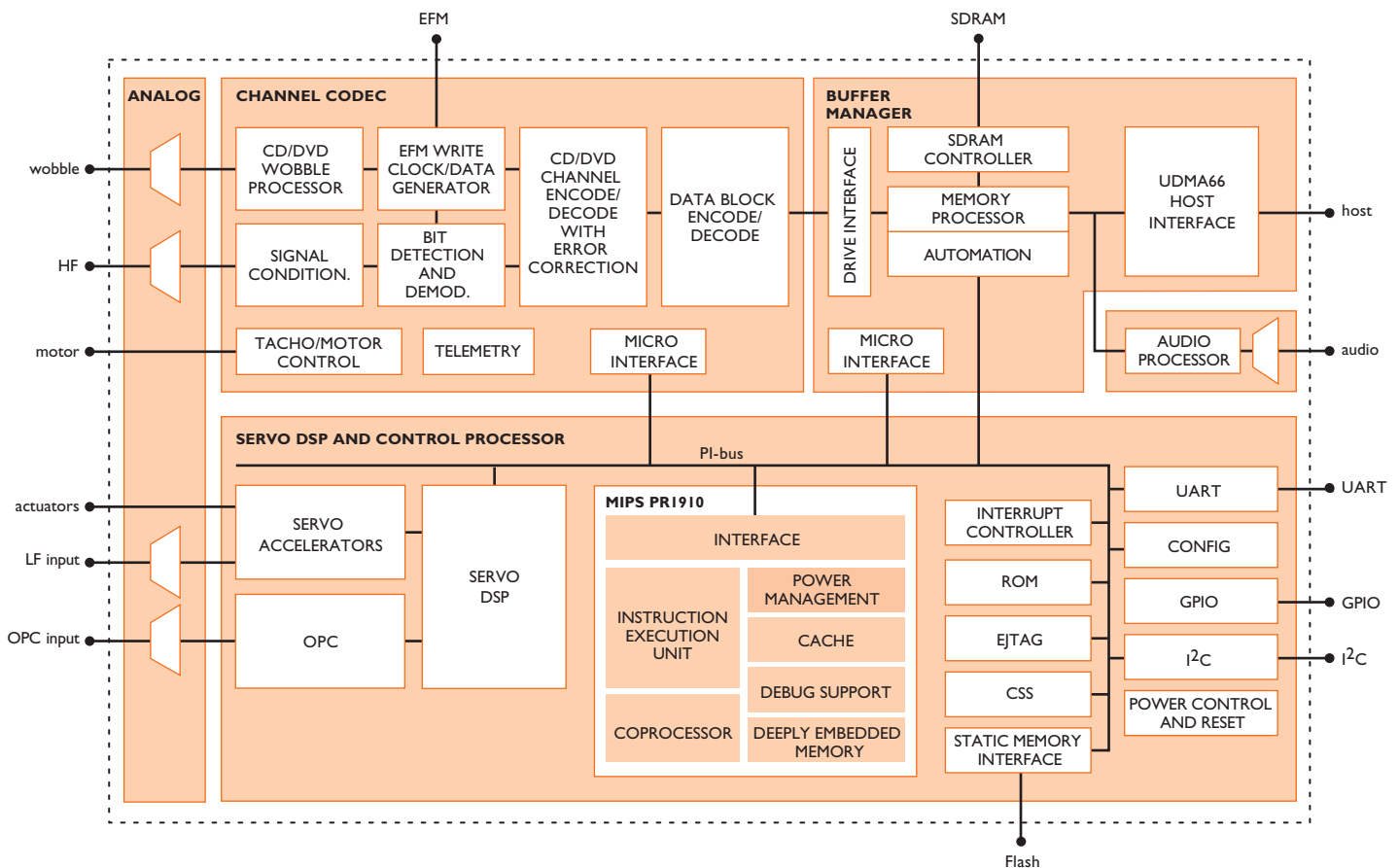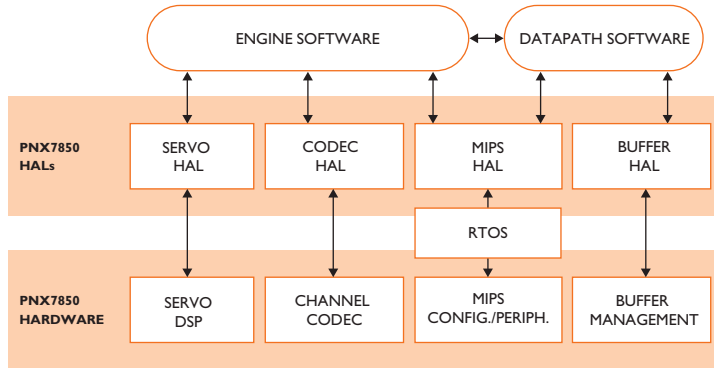
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Channel and block codecs

The PNX7850 includes a DVD/CD channel encoder/decoder and a block encoder/decoder. In encode mode, the codecs generate the write signal. In decode mode, they perform signal conditioning, demodulation, and error correction of the EFM stream. Telemetry and error correction statistics are accessible to the processor via registers and are output directly on a dedicated serial debug channel.

Buffer manager

The buffer manager includes a memory processor, hardware automation, an SDRAM controller, a UDMA66 ATAPI host interface, plus interfaces to the codecs and microprocessor blocks. In encode mode, data from the host PC is temporarily stored in external SDRAM before being fed to the data block codec. In decode mode, data from the data block codec is stored in external SDRAM, so it can be provided to the host PC on request. Digital audio data is handled separately, passing through an internal audio processor before reaching the PC.

Nexperia PNX7850 conceptual block diagram

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ENGINE SOFTWARE  ⟷  DATAPATH SOFTWARE

PNX7850        SERVO    CODEC    MIPS     BUFFER
HALs           HAL      HAL      HAL      HAL

                        RTOS

PNX7850        SERVO    CHANNEL  MIPS           BUFFER
HARDWARE       DSP      CODEC    CONFIG./PERIPH. MANAGEMENT
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The PNX7850's layered software architecture simplifies development and makes it easy to fine-tune performance.

Software tools

The PNX7850 is supported by an extensive suite of software tools that help designers optimize performance. The tools are built around a modular architecture, so the software is highly reusable. Adding next-generation hardware requires only minimal software changes. The tools employ hardware abstraction layers (HALs) to reduce complexity and offer automation features to minimize tight timing constraints.

Real-time operating system
The PNX7850 uses a proven, scalable RTOS for embedded applications. The RTOS is portable, takes up very little space, and delivers high performance. It provides POSIX-compliant threads, semaphores, messages, and more.

Editor, compiler, simulator, and debugger
The PNX7850 toolset includes the full-featured CodeWright® text editor, the High C/C++™ optimizing compiler, and an RTOS-aware debugger for MIPS applications. For non-intrusive, real-time tracing and debugging, even in a ROM-only system, the debugger can be used via the PNX7850 serial port or EJTAG interface. The toolset runs on Microsoft Windows® and Sun Solaris™ host systems and includes a PNX7850 CPU simulator.

Datapath software
The datapath manages the datastreams exchanged between the host PC and the PNX7850 processor. It ensures correct data handling and supervises error recovery, disc concepts, and operations of the host interface. The datapath software enables clean, object-oriented design. It is component-based for easy maintenance, reuse, and extensability, and offers a HAL that masks the lower-level details of the PNX7850 processor. It also includes control, media standards, dispatch/sequence, and stream layers.

Engine software
The engine decodes data read from the disc and forms a continuous datastream. In encode mode, it receives a datastream from the datapath, encodes the data, and aligns to the ATIP/ADIP information while generating the write signals for the laser driver. In both encode and decode modes the engine controls the servo and actuator functions. The engine software uses callbacks instead of complex state machines for faster execution. For consistency within the datapath, it handles all types of data, including TOC and

Audio processor
The on-chip audio processor provides digital volume control, attenuation, de-emphasis, and single-sample interpolation. Data can be output using I2S or IEC958 interfaces. A digital audio DAC is also included, supplying analog audio for line-out or headphones.

32-bit MIPS RISC processor
A 32-bit MIPS RISC processor, supported by cache and on-chip SRAM, controls operation of the PNX7850. It features a MIPS R4000 architecture and uses the MIPS 16 and MIPS II instruction sets. Embedded instruction and data cache reduce the impact of latency and bandwidth restrictions. Deeply embedded SRAM offers single-cycle access times. The processor includes various general-purpose peripherals as well as several application-specific modules, such as a global configuration module, a CSS module, and an on-chip boot ROM.

Servo DSP
Digital servo control in the PNX7850 uses a programmable DSP processor supported by hardware-accelerated modules for specific functions. The accelerators include focus and radial loops, tilt control, trackloss-less servo functionality, and track-crossing velocity measurement. The servo DSP also performs the OPC function for CD-R/RW and DVD+R/RW, based on information provided by the channel codec.

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ATIP, as a stream. It also allows the datapath to determine system-level strategies for recovery. The engine software supports local and remote datapaths (including S2B functionality), and includes an engine API and sequence, utility, servo, and HAL layers.

DSP software
DSP software, provided as a pre-compiled object downloaded by the MIPS processor into the DSP RAM, speeds implementation of the servo DSP. The engine software also provides coefficients to customize and tune servo behavior. The engine software communicates with the servo DSP through a defined API.

Philips DVD+RW chipset

The PNX7850 is available as part of a Philips DVD+RW chipset that includes the TZA1047 analog processor and the TZA1042 laser power controller. The chipset brings industry-leading speed and accuracy to computer and consumer applications such as recording home video, creating photo albums on DVD, PC data backup, and data archiving.

Philips Nexperia ATAPI DVD+RW Recording Engine reference design

For speeding time-to-market, the Nexperia ATAPI DVD+RW Recording Engine reference design is a comprehensive solution that offers high-performance hardware and easy-to-use software. Based on the Philips DVD+RW chipset, the reference design includes a working DVD mechanism with an OPU manufactured by Philips. Industry-standard development tools complete the package. Optional software for telemetry and tuning is also available.

Systems based on the reference design are able to create 4.7-GB video or data DVDs in fewer than eight minutes for 8x DVD+R recording - twice the speed of existing DVD recorders. These same systems are able to store the equivalent of up to seven data CDs on a single disc, making it easy to transfer multi-gigabyte files between PCs. A firmware upgrade increases these systems to 24x CD-RW and makes them compatible with the Dual-layer DVD+R standard.

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