

## Features

- Integrates All Required Components for Complete ATAPI DVD/CD Writer Solution
  - Data Channel
  - Servo Control Processor
  - DVD ECC ENDEC
  - CD CIRC C3 ENDEC
  - Buffer Management
  - EFM EFM+ 1.7 PP ENDEC
  - ATAPI Interface
- Formats Supported
  - DVD-ROM
  - DVD-R
  - DVD-RW
  - DVD+R
  - DVD+RW
  - Blue Laser DVD
  - CD-ROM Mode 1
  - CD-ROM Mode 2
  - CD-ROM XA Mode 2 Form 1
  - CD-ROM XA Mode 2 Form 2
  - CD-DA
  - CD-R
  - CD-RW
- Read/Write Speeds Supported
  - DVD-ROM           16x
  - DVD+R            16x
  - DVD+RW           8x
  - DVD-R             16x
  - DVD-RW           8x
  - Blue Laser DVD   8x
  - CD-R              52x
  - CD-RW             48x
  - CD-ROM            52x
- Pick-up Head Interface
  - Auto Laser Power Control (ALPC) Circuit
  - Supports Alpha (ROPC) Loop and OPC
  - Programmable Serial Interface to OPU for Write Strategy Control
  - Supports OPU Current Type and Voltage Type
  - TWI interface to Access the EEPROM Serial Number
- Host Interface
  - ATAPI Compatible ATA-6 Host Mode
  - Ultra DMA Support (100 MB/s)
  - Direct Interface to ATAPI Bus
- Processor
  - ARM946E-S™ RISC Processor
  - Internal SRAM for Data
  - Parallel External 16-bit Width Flash for Code, 512 Kbyte (max)



## DVD PRML Channel and System Controller SoC

AT78C4050

## Summary

3507BS-NETST-6/05



Note: This is a summary document. A complete document is available under NDA. For more information, please contact your local Atmel sales office.

- **Error Correction**
  - Real Time DVD ECC Encoder and Decoder for 32 Kbyte Block
  - Real Time DVD ECC Encoder and Decoder for Blue Laser DVD
  - DVD EDC Error Detection
  - Error Correction for Pre-pit, ATIP, ADIP, ID, Wobble Data for Blue Laser DVD
  - Real Time CD CIRC Encoder and Decoder
  - Real Time CD C3 ECC Encoder and Decoder
  - CD EDC Error Detection
  - CD Sub-code Error Correction
- **Data Format**
  - EFM and EFM+ Modulation and Demodulation
  - 1.7 PP Modulation and Demodulation for Blue Laser DVD
  - Target ID Detection
  - Support DVD-R/RW 2K and 32K Linking Loss
  - Support CD-R/RW Link Sector Read
  - Support CD-R/RW Address Mode 1 and Mode 2
  - ATIP, ADIP, Pre-pit, Blue Laser DVD Wobble Information Decoder
- **Buffer Manager**
  - Supports SDRAM Up to 16 Mbytes (8M x 16)
  - Support Buffer Underrun Prevention
  - Support Variable Buffer Segmentation
  - Circular Buffer Control with Access Priority
  - Programmable Timing Control for SDRAM
- **Servo**
  - Servo Processing Unit Using ARM946E-S  
Maximum Processing Power with 200 MHz System Clock
  - Internal RAM for Code and Data (24 KB)
  - Digital Servo Adapted to Various OPU
  - Digital DPD for Tracking Error
  - 1 and 3 Beams Push/Pull Tracking Detection
  - Digital Detector for Blank Detect, Media Recognition and Defect Detect
  - Wobble PLL, Pre-pit Detector, Frequency Demodulator, BPSK Demodulator and MSK STW Demodulator
- **Read Channel**
  - PRML Read Channel to Support High Speed Transfer Rates
  - RF Data Channel
    - Wide Bandwidth Automatic Gain Control Analog Front-end
    - Programmable 7<sup>th</sup> Order Continuous Filter
    - 7-bit ADC for Sampling the PRML Read Signal
    - 15 Tap Adaptive Digital FIR Equalizers
    - Digital Viterbi Detector
  - Clock Recovery and Synthesizer Functions
    - Wide Frequency Range of Clock Extraction
    - Frequency Synthesizer with M/N Dividers
    - Supporting CLV, CAV, PCAV and ZCLV
    - Supports Write Clock Synthesis with a Low Jitter PLL
  - Integrated Servo Algebra and ALPC Functions
    - Supports Sampled Signals for Differential Phase Detection (DPD), and Push/Pull Tracking Detection
    - Wobble Detection of DVD+R and DVD+RW

- **Pre-pit Detection of DVD-R/W**
- **ADIP/ATIP Detection**
- **ALPC Closed Loop Capability to Support OPC/ROPC**
- **Integrated Servo Pre-drivers for Focus, Track and Spindle Motor**
- **Integrated On-chip Calibrator to Remove Circuit Offsets**
- **Integrated Audio Drivers**
- **On-chip Sequencer to Internally Generate Control Signals for RF AGC, Timing Recovery, Calibration and Various Servo Algebra Loops**

## 1. Description

The AT78C4050 is ATMEL's high-integration, high performance single chip solution for DVD-ROM, DVD-R/RW, DVD+R/RW, CD-ROM, CD-R/RW and Blue Laser formats. It integrates all required components for a DVD and CD rewritable drive as well as for a DVD recorder. The AT78C4050 includes data channel, DVD ECC, CD CIRC C3, buffer management, DVD CD 1.7PP, EFM+, EFM Endec and ATAPI interface logic.

The AT78C4050 is programmed by an external flash, and needs an external SDRAM, and a power driver to create a complete DVD/CD rewritable solution. This chip can be connected to an MPEG Endec to build a DVD recorder for consumer electronics applications.

DVD disk read and write speeds of up to 16x, CD-ROM disc reading and writing speeds of up to 54x, Blue Laser DVD speeds of up to 8x can be implemented.

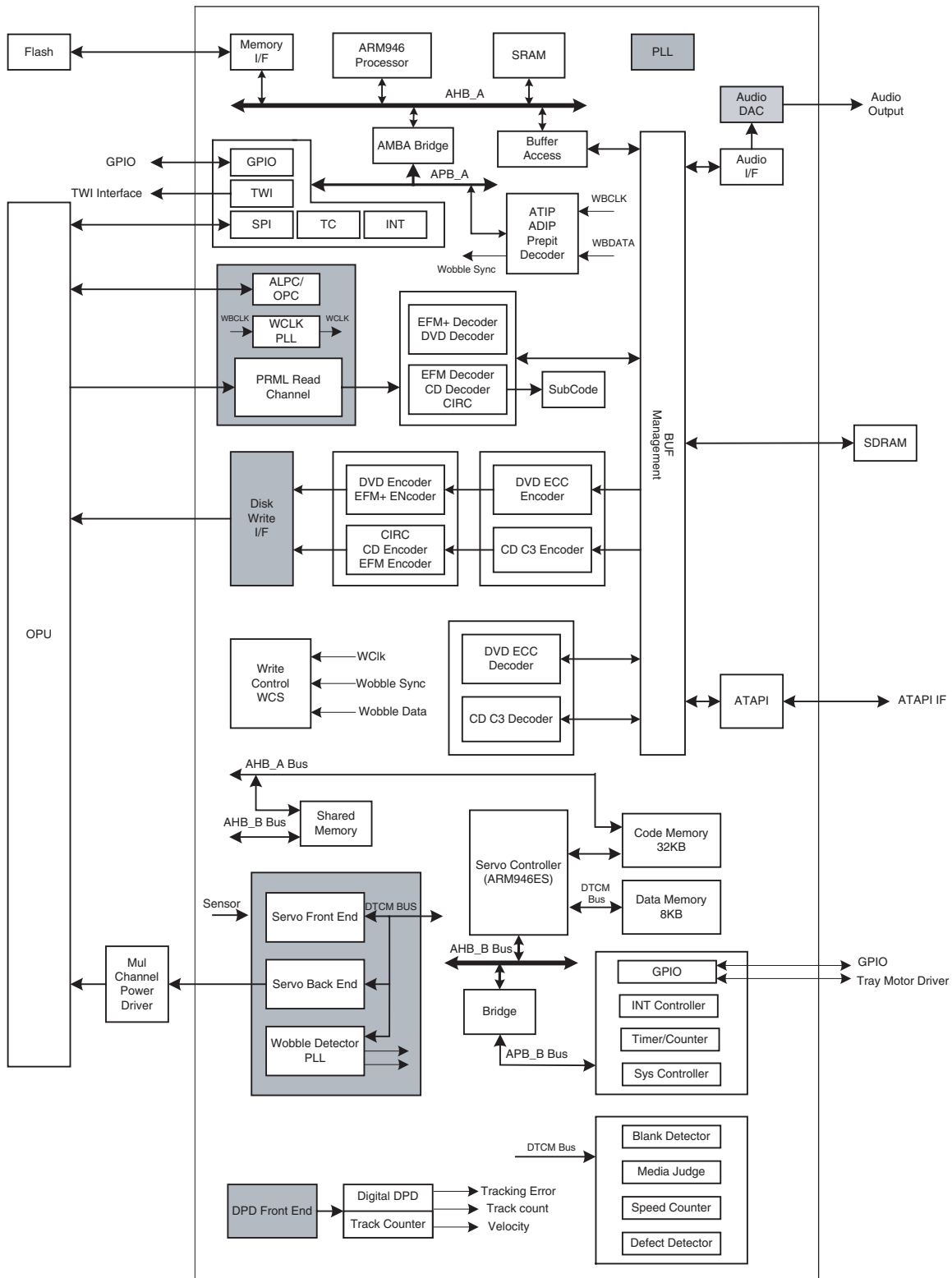
The AT78C4050 supports various types of OPUs. Either a current output OPU or voltage output OPU can be connected to AT78C4050. ALPC, ROPC and OPC manage operation of the laser diode driver IC and control the writing process. On-chip features and programming options improve performance in high-speed systems.

Digital Servo control provides flexibility that enables the AT78C4050 to support various PDIC output. The calibration control is implemented by firmware. The Servo processor implements the focus, track, tilt, seek and spindle control loop, which off loads the master processor burden. Push-pull tracking error, DPD tracking error and Astigmatic Focus error detection are available. The chip provides all CLV, CAV, ZCLV and PCAV spin modes.

The AT78C4050 offers buffer underrun prevention for all types of discs. The data buffer size is up to 16 Mbytes with circular buffer method. The SDRAM controller supports various SDRAM chips. AT78C4050 supports Audio buffer playback. The buffer management provides pre-reading and cache to increase the data throughput.

The ATAPI host interface is designed in compliance with the ATAPI specification, which supports UltraDMA 100 Mbyte/s transfer rate. This device is fabricated in 0.13  $\mu\text{m}$  CMOS technology.

Figure 1-1. Block Diagram





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