The AHB Compliant Nand Flash Controller provides access to Nand Flash memory. It accepts the Read / Write commands from AHB and converts it into Flash access. While doing this it combines AHB burst transactions and performs single/ multi page flash R/W transactions. It also supports 1-bit error correction and 2-bit error detection ECC module.

**DESCRIPTION**

NAND Flash Controller has a built-in AHB Slave Interface, handles all sorts of Nand Flash commands, address & data sequences. It allows the users to access the NAND flash memory simply by reading or writing into the Operational registers & the data buffer. It consists of four major blocks-

**AHB Slave I/F:** It consists of the AHB FSM & Operational registers.

**Synchronization Module (Sync):** This block has handshake logic to communicate with the AHB interface and with the flash interface. To increase the throughput a single page size buffer is used for the data transactions.

**Error Correcting Code (ECC):** This block generates & compares ECC (user programmable) for every page program & page read to/ from the Nand Flash respectively. It uses Hamming Code algorithm for single bit error correction and two or more bit error detection (SECDED). It calculates 28 bit ECC for every 512 word data.

**NAND Flash Interface:** This block handles all sorts of Nand Flash commands, address, data sequences, and manages all the hardware protocols & flash timing requirements.

**TECHNICAL DETAILS**

- **ASIC:** 90nm
- **FPGA:** Xilinx xc4vfx12-12sf363
- **Eq. Gate Count:** 16,160 Gates
- **Memory:** 2 RAMB16s (Xilinx Virtex4)

**KEY FEATURES**

**Flash Side Features**
- Supports up to 2Gb Nand Flash devices.
- Supports 3/4/5 address cycles.
- Supports 8/16 bits of Flash I/O bus sizes (user programmable data transfer mode).
- Programmable R/W pulse timings (RE#/ WE# pulse width)
- Configurable Flash timing (Twhr, Trr delays).
- Double protection for page program & block erase.
- Support multiple page program & Read operation.
- Same data can be programmed to successive pages without host having to supply data for each page.
- ECC protection by programming Configuration register (user programmable).
- 28 bit ECC for 512 word data.
- Hamming Code algorithm for Single bit error correction and two or more bit error detection (SECDED)
- Command, flash address and buffer address Error logging in Status register.
- Multi-page program/ read operation termination on detection of ECC error at intermediate page with generation of Interrupt & setting of Error in Status register
- Block address logging in Status register on detection of ECC or program/ erase Error.

**Host Side Features**
- AHB slave interface compliant to AMBA Specification (2.0)
- 32 bit input & output buses.
- Supports Byte, Half word and Word transactions.
- Supports all Incremental AHB Burst transactions (i.e. INC, INC4, INC8 and INC16)
- Supports OK, ERROR and RETRY responses.
- Random access to any location of internal page buffer by the host.
- Supports two modes of operation-boot & normal mode.
- Supports system booting from Nand Flash in boot mode.
DELIVERABLES

Verilog RTL/Synchronous Design
Test Plan, Test Bench, Test Cases & Test Results
ISE Synthesis Scripts

APPLICATIONS

- **Medical**: NAND Flash provides increasingly portable, convenient patient monitoring by enabling weeks or even months of detailed information storage in a very rugged, compact, battery-friendly system. Ex: Portable Equipment Monitors etc
- **Commercial/Industrial**: The low pin count, simple interface, and high density of NAND Flash provide a natural migration path for many existing NOR Flash industrial applications. And NAND’s rugged shock and vibration specifications make it a clear favorite over sensitive mechanical mass storage devices. Ex: Bar Code Scanners, Robotics Inspection Systems etc
- **Computing**: The rapidly increasing density and cost reductions of NAND Flash make it a promising supplement or even replacement for the hard disk drive in many portable computer platforms. NAND disks improve performance and reliability while stretching precious battery life. Ex: Solid-state disk etc

CONTACT DETAILS
ashok.madaan@hcl.in