

Preliminary Technical Data for AMBA Navigator™

AMBA On-Chip Bus Analyzer for AHB Bus Systems

The AMBA Navigator™ is used to monitor signal activity on the AMBA Advanced High-performance Bus (AHB) in System-on-Chip designs. It allows the user to capture bus activity along with related signals in real-time and display critical information for analysis on a host PC.

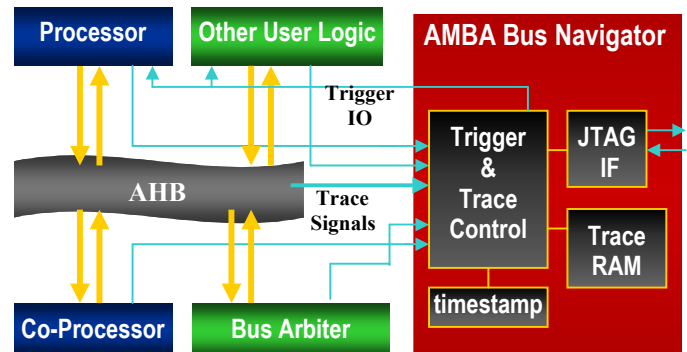
The system consists of an On-chip Instrumentation (OCI®) synthesizable logic block, a JTAG hardware probe, and PC based software for controlling probing and analysis. The OCI passively captures bus activity and buffers it using on-chip RAM and transfers the collected data through an on-chip JTAG port to the JTAG probe. The host PC controls the collection process and provides captured bus history to the user with an easy-to-use graphical interface. The system runs on a Windows® 98/NT/2000/XP PC over an IEEE-1284 EPP/ECP high-speed parallel port. It provides a comprehensive debug tool for AMBA based systems at a competitive price.

Bus Connection Overview

The OCI block is synthesized into the SoC design and can be used with either FPGA or Structured ASIC designs. It can support single-master (AHB-Lite) and multiple-master systems. The OCI block monitors 92 (for 32 bit data) or 124 (for 64 bit data) AHB signals sampled with the AHB clock. Signals include 32 bits of address, 32 or 64 bits of data combined from the read and write data buses, and all critical control and status signals. A user defined number of additional signals running over a common clock domain with the AMBA bus, can be hooked up to any nodes in the SoC such as interrupt requests, additional AHB status, peripheral status, and CPU control signals. The additional signals can also be used to recognize specific on-chip activity outside the AHB bus and transmitted to the probe for triggering purposes. (Continued on page 2)

Features Overview

- Captures bus activity in real-time
- Captures 92-124 AHB bus signals and up to 120 additional user-defined inputs attached to other nodes in the SoC
- Bus clock mode trace stores AMBA signals on every clock
- Bus transfer mode filter aligns bus transfers and response phases for single event triggering using combinations of address, data, and control
- Filtering of wait and idle state cycles in bus transfer mode
- Trace storage qualifiers; single cycle, start or stop trace on any trigger, counter, and state sequencer condition
- Configurable for user defined number of AHB Masters
- Trace buffer stores bus cycles or bus transfers based on RAM memory size
- Up to 16 user defined triggers recognize combinations of 1, 0, X, signal values
- Sequential event monitoring using cascadable trigger states (2 to 16 states)
- Two 32-bit event counter/timers
- Trigger conditions include bus and user defined signals, Event counter/timer value and Trigger state
- Actions include Trigger, Trace control (start, stop, single), Trig Out control (pulse, assert, negate), Counter control (increment, start, stop, clear), and Goto state
- Trigger position variable in 1/512 increments of trace depth
- User definable timestamp records duration of each trace frame from trace start, displayable as absolute or delta times
- Automatic trace clock frequency measurement allows displaying frame durations in either nanoseconds or clocks
- Multiple external trigger in/out with configurable logic levels
- Easy-to-use graphical software interface with state views and waveform views of data
- Symbolic lookup and signal value naming for ease of bus signal viewing and analysis
- Optional VCD format export for simulation tools integration



Trace Features

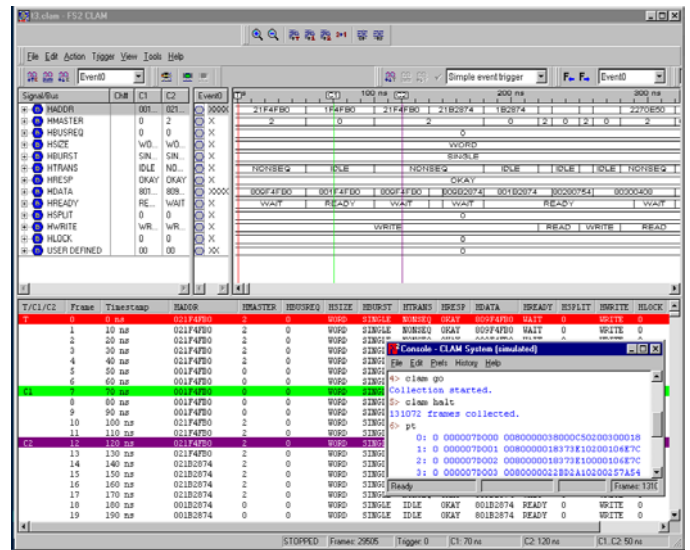
Bus trace is captured in **Bus Cycle Mode** where address, control, and data signals are captured on clock by clock basis. Each trace frame records 92/124 bits of AHB signals and additional user-selectable signals, and timestamp of user defined width. Trace depth is defined by available on chip RAM and can range from 4 to 32K frames deep. AMBA trace can be filtered real time into a **Bus Transfer Mode**, where trace of transfer and resulting response, occurring on different clock cycles, are aligned onto the same clock cycle. This provides a more intuitive, software oriented view of bus operations and allows combinatorial data-address-control triggering. In Bus Transfer Mode, trace can be filtered to remove AHB IDLE, BUSY, and not-Ready cycles where no data is being transferred, to improve RAM utilization and ease of use. Operation can be dynamically switched between Bus Cycle and Bus Transfer mode on a per trace basis. Trigger position can be set to user defined fraction of trace depth, to be able to look at both pre and post trigger events.

Triggering Features

AMBA Navigator allows, during synthesis, selection of a configurable number (between 2 to 16) of triggers with configurable (between 2 - 16) numbers of states per trigger. Trigger conditions are AND combinations of three components, each are optional:

- Unfiltered or aligned bus comparator recognizing a high or low level or any edge on each signal,
- 32-bit counter matching a preprogrammed value,
- Trigger state

When a trigger condition is satisfied, one or more actions that affect the OCI or other parts of the SoC can be taken. These can include mark the trigger frame, turn trace on/off, record a single frame, turn the counter on/off, increment or clear counter, or assert the trigger interfaces or change trigger state. Trigger actions can in turn initiate some logic or control in the bus or at the core level. This wide variety of conditions and actions provides system flexibility and visibility into AMBA bus operations for monitoring and tuning System-on-Chip performance based on a range of bus level parameters.



Host software

Windows based host software displays trace in waveform or state table formats. Bus signals can be viewed numerically or symbolically. The user interface supports template based windows for set up of events, triggers, and trigger actions. Buses can define symbolic ranges and display a symbol + offset when a bus value matches the symbol. Predefined symbols for AHB control signals such as HTRANS, HRESP, HSIZE, HBURST, HMASTER, and other fields allow either numerical or symbolic display.

FS2 Command line interface

The AMBA Navigator also includes a command line interface (CLI). The CLI is based on the Tcl/tk command language, and allows batch scripts. Writing post-analysis programs, provides command recall, and activity transcripts.

Host Requirements

Pentium class PC with minimum 32 Mbytes of memory, IEEE-1284 (EPP/ECP) parallel or USB port and Windows® 98/NT/2000/XP operating system are required.

Product Codes

NAV-AMBA/INT AMBA On Chip bus analyzer with internal trace capture



4000 SW Kruse Way Place
Bldg 3, Suite 210
Lake Oswego, OR 97035
(503) 489-0311
Email: info@fs2.com
Web: www.fs2.com