AHB SYSTEM VERIFICATION IP

The AHB SYSTEM verification IP comprises behavioral Verilog models of AHB Arbiter, AHB Master and AHB Slave connected together as shown in **Figure 1**. A Monitor VIP is provided to catch protocol violations. The AHB SYSTEM VIP supports verification with, up to 15 Masters and up to 15 Slaves (excluding in-built dummy Master and default Slave). The actual number of Masters and Slaves plugged-in for verification must be selected parametrically.

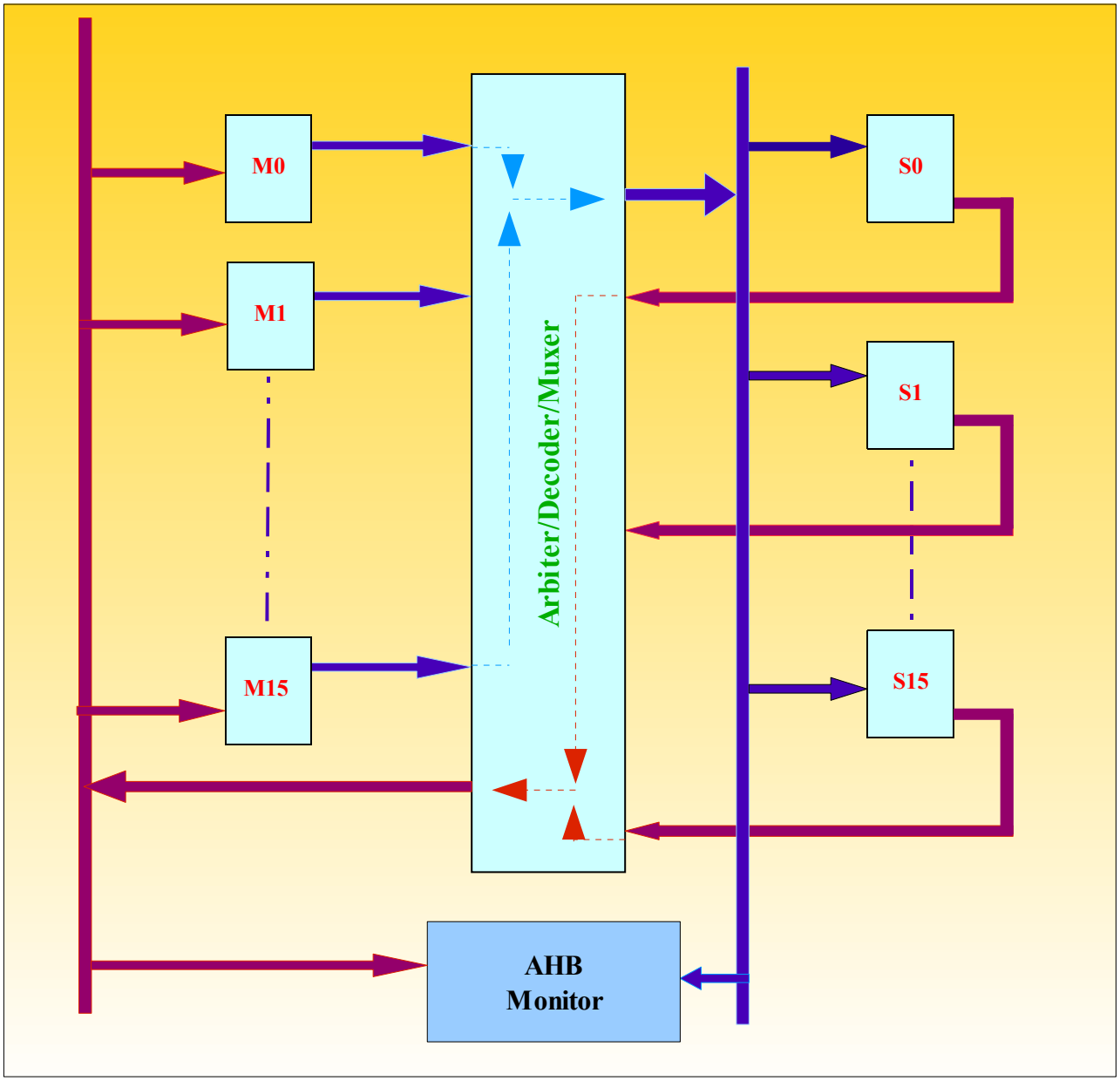

Figure-1

AHB Master VIP

Features supported by the Master:

- The AHB master initiates AHB transactions to any slave devices on the AMBA AHB Bus.
- All four types of slave responses (OK, ERROR, RETRY, SPLIT) and slave wait states are handled by the AMBA AHB bus master.
- In the event of RETRY and SPLIT, the bus master automatically re-issues the transaction until all data are transferred.
- In the event of ERROR response -
    - If the master has been configured to continue on error response, the bus master automatically rebuilds the transaction until all data are transferred.
    - Else the transaction is terminated
- Supports all possible AHB Burst transactions
- Supports Byte, Halfword and Fullword size transactions
- Supports Locked transfers
- Supports Little and Big Endian
- All the commands tasks are executed back to back.
- Supports burst transfer of 4KBytes maximum. The master automatically splits the transaction when there is a one Kilo Byte boundary cross over and an IDLE is inserted at the boundary.
- Bus master configurable to insert busy cycles in burst transfers

AHB Slave VIP

The slave model is a behavioral model coded in Verilog. This is implemented as a memory model of size 64k with address-wrap on the page. It has a task interface that the test writer may use to configure the slave to generate various responses and thus create any possible AHB transaction scenarios. It supports locked transfers and early-burst termination.

- Supports configurable Split generation
- Supports configurable Retry generation
- Supports configurable Wait generation
- Supports configurable Error generation
- Supports Early burst termination
- Supports Idle and Busy command
- Supports all possible AHB Burst transactions
- Supports Byte, Halfword and Fullword size transactions
- Supports Endianess

AHB ARBITER VIP

The AHB arbiter VIP comprises 3 sections:

1. The arbiter controller which does the actual arbitration of requests from all the masters on the AHB bus and issues a grant to the selected master.
2. The decoder that generates the hsel signal for each of the slave on the bus
3. The Multiplexer block that selectively interconnects the master busses to the slave busses

Features Supported:

- Supports up to 15 Masters and up to 15 Slaves
- Supports round-robin arbitration when enabled. If round-robin is not enabled, a fixed priority scheme is utilized
- Supports SPLIT response from slave. The master that is split goes out of arbitration until the slave that split it, comes back and unsplits it. Only the slave that has split a master can unsplit it.
- Supports RETRY response: During the RETRY response, request from lower priority masters are ignored.
- Supports Locked transactions: If a master initiates a locked transaction, all other masters are locked out of arbitration until that master completes the transaction
- Supports a dummy master: If all masters are split, or if a locked master is split, then the arbiter gives the bus to an in-built dummy master, which performs IDLE transfers until one of the real masters gets back the bus
- Supports a default slave: If a master selects an address of a non-existent slave, then the arbiter selects an in-built default slave to respond to the master. The default slave responds with ERROR for NONSEQ or SEQ type transfers. The slave responds with OKAY for IDLE or BUSY transfers.

AHB MONITOR VIP

The AHB monitor VIP catches and reports AHB bus protocol related violations.

Violations monitored and reported

The following is a list of AHB bus protocol related violations that the monitor shall check for and report. These may be selectively turned on/off. Since the AHB protocol specification is unclear on several points leaving them open to interpretation, the monitor has been designed to be configurable for some of these points and where such flexibility could not be built-in, the behavior has been clearly described to avoid any ambiguity in its usage by the end-user:

- Multiple grant violation
- Address misalignment.
- Address increment violation for bursts
- 1-k Boundary crossing for bursts
- WRAP burst violation
- Address decoding violation (Multiple HSEL)
- Command-bus violation for bursts (HSIZE, HBURST, HWRITE)
- Burst sequence violation on HTRANS
- 2-cycle response violation
- BUSY insertion violation for bursts
- HREADY violation
- Bus Grant to split-master violation
- Split/unsplit timing violations
- Splitting the correct master on a split response
- Unsplitting by inappropriate slave