

AMBA (Advanced Microcontroller Bus Architecture)

What is AMBA?

AMBA is a **standardized bus architecture** developed by **ARM** to facilitate communication between the **processor, memory, and peripherals** in **System-on-Chip (SoC)** designs.

Goal: Ensure high performance, modularity, and easy IP (Intellectual Property) integration across ARM-based systems.

AMBA Bus Types (Versions)

Bus	Purpose
ASB (Advanced System Bus)	Older synchronous bus
AHB (Advanced High-performance Bus)	High-speed, burst transfer, pipelined bus
APB (Advanced Peripheral Bus)	Low-speed, simple for peripherals
AXI (Advanced eXtensible Interface)	High-performance, for modern SoCs
ACE (AXI Coherency Extensions)	For cache-coherent multiprocessor systems

AHB (Advanced High-performance Bus)

What is AHB?

AHB is a **high-speed, pipelined** bus protocol under the AMBA specification, typically used for **high-performance peripherals and memory** communication.

It was introduced in **AMBA 2.0**.

Key Features of AHB:

- **Single Clock Edge Operation**
- **Pipelined Architecture** → High throughput
- **Burst Transfers** → Sequential transfers in one request
- **Single Master, Multiple Slave** (standard)
- **Split/Retry Response** → Improves bus efficiency
- Supports 32-bit, 64-bit, and 128-bit data buses

AHB Bus Signals (Basic):

Signal	Description
HADDR	Address bus
HWDATA	Write data bus
HRDATA	Read data bus

Signal	Description
HWRITE	Write control signal
HTRANS	Transfer type
HREADY	Transfer completion
HRESP	Transfer response

AHB vs APB

Feature	AHB	APB
Speed	High	Low
Complexity	Complex	Simple
Use	Memory, DMA, high-speed devices	UART, GPIO, Timer
Burst Support	Yes	No
Pipelining	Yes	No