



# Arm® Corstone™-300 Reference Package

Revision: r0p0

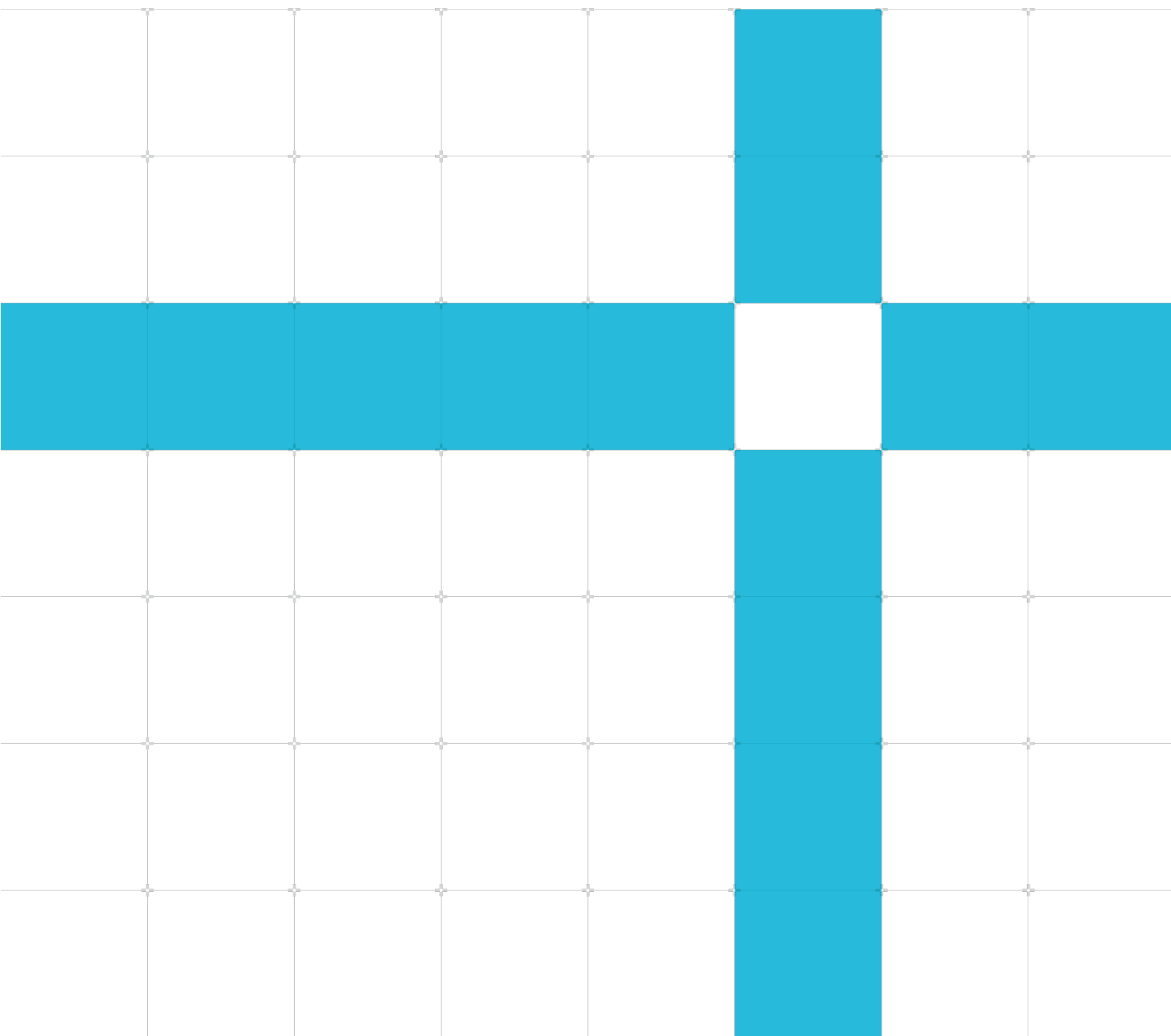
## Technical Overview

Non-Confidential

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**Issue 02**

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# Arm® Corstone™-300 Reference Package

## Technical Overview

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### Release information

#### Document history

Issue	Date	Confidentiality	Change
01	08-May-2020	Non-Confidential	First release for r0p0 EAC
02	07-Dec-2022	Non-Confidential	Second release for r0p0 EAC

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## Product Status

The information in this document is Final, that is for a developed product.

## Feedback

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# 1. Introduction

This Technical Overview is for the Arm® Corstone™-300 Reference Package. It describes Arm® Corstone™-300 Reference Package and gives a summary of the included products.

## 1.1. Product revision status

The rpxy identifier indicates the revision status of the product described in this book, for example, r1p2, where:

- rx** identifies the major revision of the product, for example, r1.
- py** identifies the minor revision or modification status of the product, for example, p2.

## 1.2. Intended audience

This book is written for hardware or software engineers who want an overview of the components and functionality in Arm® Corstone™-300 Reference Package.

## 1.3. Conventions

The following subsections describe conventions used in Arm documents.







### Glossary

The Arm Glossary is a list of terms used in Arm documentation, together with definitions for those terms. The Arm Glossary does not contain terms that are industry standard unless the Arm meaning differs from the generally accepted meaning.

See the Arm Glossary for more information: <https://developer.arm.com/glossary>.

### Typographical conventions

Convention	Use
<i>italic</i>	Citations.
<b>bold</b>	Interface elements, such as menu names. Terms in descriptive lists, where appropriate.
<code>monospace</code>	Text that you can enter at the keyboard, such as commands, file and program names, and source code.
<code>monospace <b>bold</b></code>	Language keywords when used outside example code.
<code>monospace <u>underline</u></code>	A permitted abbreviation for a command or option. You can enter the underlined text instead of the full command or option name.

Convention	Use
<and>	Encloses replaceable terms for assembler syntax where they appear in code or code fragments. For example: <code>MRC p15, 0, &lt;Rd&gt;, &lt;CRn&gt;, &lt;CRm&gt;, &lt;Opcode_2&gt;</code>
SMALL CAPITALS	Terms that have specific technical meanings as defined in the Arm® Glossary. For example, IMPLEMENTATION DEFINED, IMPLEMENTATION SPECIFIC, UNKNOWN, and UNPREDICTABLE.
 Caution	Recommendations. Not following these recommendations might lead to system failure or damage.
 Warning	Requirements for the system. Not following these requirements might result in system failure or damage.
 Danger	Requirements for the system. Not following these requirements will result in system failure or damage.
 Note	An important piece of information that needs your attention.
 Tip	A useful tip that might make it easier, better, or faster to perform a task.
 Remember	A reminder of something important that relates to the information you are reading.

## 1.4. Useful resources

This document contains information that is specific to this product. See the following resources for other relevant information.

- Arm Non-Confidential documents are available on [developer.arm.com/documentation](https://developer.arm.com/documentation). Each document link in the tables below provides direct access to the online version of the document.
- Arm Confidential documents are available to licensees only through the product package.

Arm products	Document ID	Confidentiality
Arm® CoreLink™ ADB-400 AMBA® Domain Bridge User Guide	DUI 0615	Confidential
Arm® CoreLink™ CG092 AHB Flash Cache Configuration and Integration Manual	DIT 0065	Confidential
<a href="#">Arm® CoreLink™ CG092 AHB Flash Cache Technical Reference Manual</a>	DDI 0569	Non-Confidential
Arm® CoreLink™ GFC-100 Generic Flash Controller Configuration and Integration Manual	101060	Confidential
<a href="#">Arm® CoreLink™ GFC-100 Generic Flash Controller Technical Reference Manual</a>	101059	Non-Confidential
Arm® CoreLink™ GFC-200 Generic Flash Controller Configuration and Integration Manual	101485	Confidential
<a href="#">Arm® CoreLink™ GFC-200 Generic Flash Controller Technical Reference Manual</a>	101484	Non-Confidential
Arm® CoreLink™ NIC-400-Lite Network Interconnect Integration Manual	100825	Confidential
Arm® CoreLink™ NIC-400-Lite Network Interconnect Technical Reference Manual	100824	Non-Confidential
Arm® CoreLink™ PCK-600 Power Control Kit Configuration and Integration Manual	101151	Confidential
<a href="#">Arm® CoreLink™ PCK-600 Power Control Kit Technical Reference Manual</a>	101150	Non-Confidential
Arm® CoreLink™ SIE-200 System IP for Embedded Configuration and Integration Manual	DIT 0067	Confidential
<a href="#">Arm® CoreLink™ SIE-200 System IP for Embedded Technical Reference Manual</a>	DDI 0571	Non-Confidential
Arm® CoreLink™ SIE-300 AXI5 System IP Configuration and Integration Manual	101527	Confidential
<a href="#">Arm® CoreLink™ SIE-300 AXI5 System IP for Embedded Technical Reference Manual</a>	101526	Non-Confidential
Arm® CoreLink™ XHB-500 Bridge Configuration and Integration Manual	101376	Confidential
<a href="#">Arm® CoreLink™ XHB-500 Bridge Technical Reference Manual</a>	101375	Non-Confidential
Arm® Corstone™ SSE-300 Example Subsystem Configuration and Integration Manual	101774	Confidential
<a href="#">Arm® Corstone™ SSE-300 Example Subsystem Technical Reference Manual</a>	101773	Non-Confidential
Arm® Corstone™-300 Reference Package Release Note	107795	Confidential
Arm® Cortex®-M System Design Kit Example System Guide	DUI 0594	Confidential
<a href="#">Arm® Cortex®-M System Design Kit Technical Reference Manual</a>	DDI 0479	Non-Confidential
Arm® Cortex®-M0 and Cortex®-M0+ System Design Kit Example System Guide	DUI 0559	Confidential
<a href="#">Arm® Cortex®-M3 Processor Technical Reference Manual</a>	100165	Non-Confidential
<a href="#">Arm® Cortex®-M55 Processor Technical Reference Manual</a>	101051	Non-Confidential
<a href="#">Arm® PrimeCell Real Time Clock (PL031) Technical Reference Manual</a>	DDI 0224	Non-Confidential
<a href="#">Arm® PrimeCell DMA Controller (PL230) Technical Reference Manual</a>	DDI 0417	Non-Confidential



Arm architecture and specifications	Document ID	Confidentiality
<a href="#">Arm® v8-M Architecture Reference Manual</a>	DDI 0553	Non-Confidential

See [www.arm.com/cmsis](http://www.arm.com/cmsis) for embedded software development resources including the Cortex® Microcontroller Software Interface Standard (CMSIS).

See Arm Mbed™ platform, [www.mbed.com](http://www.mbed.com) for information on the Mbed tools including Mbed OS and online tools.



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Adobe PDF reader products can be downloaded at <http://www.adobe.com>.

## 2. About Arm® Corstone™-300 Reference Package

Arm® Corstone™-300 Reference Package (Corstone™-300) makes an ideal starting point for creating Internet of Things (IoT) System on Chip (SoC) designs based on the Cortex®-M55 processor cores.

Corstone™-300 example subsystems are configurable, modifiable, and pre-integrate cores. Corstone™ SSE-300 Example Subsystem pre-integrates security IP with the most relevant Arm CoreLink™ and Arm CoreSight™ components.

### 2.1. Corstone™-300 components

Corstone-300 grants licenses to the following subsystems, security IP and system IP:

- **Subsystems**
  - ◆ Arm® Corstone™ SSE-300 Example Subsystem  
The SSE-300 is a collection of pre-assembled elements to use as the basis of an IoT SoC. SSE-300 provides a high-performance and low-power computing subsystem for Cortex-M55 processor cores. You can use it as the foundation of a Secure system because of system-level support for TrustZone® technology.
  - ◆ Arm® Cortex®-M System Design Kit  
The CMSDK provides example systems for the Cortex-M0, Cortex-M0+, Cortex-M3, and Cortex-M4 cores, with reusable AMBA® components for system-level development.
- **Security and System IP**
  - ◆ Arm® CoreLink™ SIE-200 System IP for Embedded  
SIE-200 is a collection of interconnect, peripheral, and TrustZone components for use with a processor that complies with the Armv8-M architecture.
  - ◆ Arm® CoreLink™ SIE-300 AXI5 System IP for Embedded  
SIE-300 provides a set of configurable AXI5 security-aware components that comply with the TrustZone for Armv8-M processor architecture in addition to an SRAM controller, clock synchronizing bridges and an access control gate.
  - ◆ Arm® CoreLink™ PCK-600 Power Control Kit  
PCK-600 provides a set of configurable RTL components that provide a power control methodology. The components use the Arm Q-Channel and P-Channel low-power interfaces.

- ◆ Arm® CoreLink™ XHB-500 Bridge  
XHB-500 Bridge consists of an AMBA® AXI5 to AHB5 bridge and an AHB5 to AXI5 bridge. The AXI5 to AHB5 bridge translates AXI5 transactions into the corresponding AHB5 burst transfers. The bridge has an AXI5 slave interface and an AHB5 master interface. The AHB5 to AXI5 bridge translates AHB5 transfers into the corresponding AXI5 transactions. The bridge has an AHB5 slave interface and an AXI5 master interface.
- ◆ Arm® CoreLink™ NIC-400-Lite Network Interconnect  
NIC-400-Lite enables to create a complete high performance, optimized, and AMBA®-compliant network infrastructure.
- ◆ Arm® CoreLink™ ADB-400 AMBA® Domain Bridge  
ADB-400 is an asynchronous bridge between two components or systems that can be in different power, clock, or voltage domains. The bridge supports being put into clock or power isolation states to enable low-power system design.
- ◆ Arm® CoreLink™ GFC-200 Generic Flash Controller  
GFC-200 comprises the generic part of a Flash controller in a SoC, so you can easily integrate an embedded Flash macro into your system. The GFC-200 supports accesses from two masters that can operate in separate domains, such as a Non-secure domain and a Secure domain.
- ◆ Arm® CoreLink™ GFC-100 Generic Flash Controller  
GFC-100 comprises the generic part of a Flash controller in a SoC. GFC-100 enables an embedded Flash macro to be integrated easily into your system.
- ◆ Arm® CoreLink™ CG092 AHB Flash Cache  
CG092 is an instruction cache that is instantiated between the bus interconnect and the embedded Flash (eFlash) controller.
- ◆ Arm® PrimeCell™ Real Time Clock  
The Real Time Clock (RTC) is an AMBA® slave module that connects to the Advanced Peripheral Bus (APB). The RTC can be used to provide a basic alarm function or long-time base counter. This is achieved by generating an interrupt signal after counting for a programmed number of cycles of a real-time clock input.
- ◆ Arm® Socrates™  
The Socrates IP Tooling platform is an environment for the configuration of Arm IP.

## Separately licensed IP

To provide optimum flexibility, all Cortex cores must be licensed separately. See the individual release notes for instructions on downloading and installing the components that you require.

## 2.2. Using the Corstone components

The Corstone components form only part of the finished SoC. You must extend and customize the subsystems for your specific application requirements.

The following examples show you some of the ways you can use the components that are licensed by Corstone-300:

- Use the SSE-300 Example Subsystem as a foundation for your own IoT solution that is based around the Cortex-M55 core.  
Use the security and system IP components to add bus and controller IP to create Secure TrustZone system.
- Use the Cortex-M System Design Kit (CMSDK) and the example systems as a starting point for your own IoT solution that is based around the Cortex-M0, Cortex-M0+, Cortex-M3, or Cortex-M4 cores.
- Use the system IP provided with Corstone-300 and your own IP to create a custom solution. You can use the example systems and software libraries as a reference for your system solution.

A complete system typically contains the following components:

### Compute subsystem

A compute subsystem consisting of Cortex-M core and associated bus, debug, controller, peripherals, and interface logic supplied by Arm.

### System memory and peripherals

SRAM is part of some of the subsystems, but a SoC requires extra memory, control, and peripheral components beyond the minimum subsystem components. Flash memory, for example, is not provided with the SSE-300.

### Communication interface

The endpoint must have some way of communicating with other nodes or masters in the system. This interface could be Wi-Fi, Bluetooth, or a wired connection.

### Sensors and actuators

The reference design is typically extended by adding sensors or actuator logic such as temperature input or motor control output.

### Software development environment

Arm provides a complete software development environment, which includes the Arm Mbed operating system, Arm or GNU (GCC) compilers and debuggers, and firmware. Custom peripherals typically require corresponding third-party firmware that can be integrated into the software stack.

For information on how to use the components that are licensed by Arm® Corstone™-300 Reference Package, see the relevant component IP product documentation, starting with each IP product's Technical Reference Manual.

## 2.3. Product deliverables

The Corstone™-300 product package (BP313) does not have hardware or software deliverables. Its subsystems and IP component products include these deliverables.

The hardware deliverables must be downloaded separately for the following IP products that are included in the Corstone-300 license:

**Table 2-1: Corstone™-300 deliverables**

Component IP	Product code
Corstone™ SSE-300 Example Subsystem (NTBSS)	CG067
Cortex®-M System Design Kit (NTBSS)	BP210
Cortex®-M0_M0+ System Design Kit (NTBSS)	BP200
CoreLink™ SIE-200 System IP	BP300
CoreLink™ SIE-300	BP301
CoreLink™ XHB-500	PL417
CoreLink™ GFC-200 Flash Controller (NTBSS)	CG094
CoreLink™ GFC-100 Flash Controller	CG090
CoreLink™ AHB Flash Cache	CG092
CoreLink™ PCK-600	PL608
CoreLink™ NIC-400-Lite	PL410
CoreLink™ ADB-400 Domain Bridge	PL405
PrimeCell Real Time Clock	PL031
Socrates™ main product	SYSOC

For component versions, see the *Arm® Corstone™-300 Reference Package Release Note*.

## 2.4. Compliance

See the component Technical Reference Manuals for more details about compliance with, or implementation of, the following specifications:

- Arm architecture
- CoreSight Debug
- Advanced Microcontroller Bus Architecture

## 2.5. Documentation

The following documents are supplied with the Corstone-300 product package:

### Technical Overview

The Technical Overview (TO) describes the functionality of Corstone-300.

### Release Note

The Release Note describes download and installation instructions for the IP products included in Corstone-300.



- The separately downloaded product packages also contain documentation such as Technical Reference Manuals or Configuration and Integration Manuals.
  - See the individual product packages for details of what documentation is provided for that IP package.
-

## 3. Corstone™-300 component IP overview

This chapter describes the IP products included in the Arm® Corstone™-300 Reference Package license.

### 3.1. Corstone™ SSE-300 Example Subsystem

This section is an extract from the [Arm® Corstone™ SSE-300 Example Subsystem Technical Reference Manual](#). It gives an overview of the product and its features.

For more information, see the SSE-300 Example Subsystem documentation set:

- [Arm® Corstone™ SSE-300 Example Subsystem Technical Reference Manual](#)
- *Arm® Corstone™ SSE-300 Example Subsystem Configuration and Integration Manual*

#### 3.1.1. About SSE-300 Example Subsystem

SSE-300 is a subsystem that integrates key components available from Arm that can be integrated into a larger system. SSE-300 integrates the following:

- Cortex-M CPU cores with optional MVE, FPU, DSP extensions, Caches, TCMs, and ETM. Arm® Corstone™-300 Reference Package supports only one Cortex M-55 processor.
- Multiple banks of System Volatile Memory, for example SRAMs. Arm® Corstone™-300 Reference Package supports two Volatile Memory bank.
- Memory Protection Controllers (MPC)
- Exclusive Access Monitor (EAM)
- System interconnect
- Implementation Defined Attribution Unit (IDAU)
- CMSDK Timers and Watchdog timers
- Timestamp-based System Timers and Watchdog timers
- Subsystem Controllers for security and general system control
- Power Policy Units, Clock Controller, and Low Power Interface interconnect components (PCK-600)

### 3.1.2. System block diagram

For a representative system block diagram of a Corstone™ SSE-300 Example Subsystem based IoT Subsystem, see the System Block Diagram section in the [Arm® Corstone™ SSE-300 Example Subsystem Technical Reference Manual](#).

### 3.1.3. Hardware components

Arm® Corstone™ SSE-300 Example Subsystem contains the following components:

- One Arm® Cortex-M55 processor with M-Profile Vector Extension (MVE):
  - ◆ Optional Floating-Point Unit (FPU) (configurable)
  - ◆ Optional Embedded Trace Macrocell (ETM) (configurable)
  - ◆ 32kB Instruction Cache
  - ◆ 32kB Data Cache

For more information, see the [Arm® Cortex®-M55 Processor Technical Reference Manual](#).

- Tightly Coupled Memories (TCM):
  - ◆ 256kB ITCM
  - ◆ 256kB DTCM
- Secure AMBA® AXI interconnect:
  - ◆ AXI4 NIC-400 Lite interconnect
  - ◆ AXI5 TrustZone® Memory Protection Controller (MPC)
  - ◆ AXI5 Access Control Gates (ACG)
  - ◆ AXI5 SRAM Controller (SMC) including Exclusive Access Monitor (EAM)
  - ◆ AXI5 to AHB5 bridge (XHB)
  - ◆ One Expansion AXI5 slave bus
  - ◆ Three AXI5 Expansion master buses
- Secure AMBA® AHB5 interconnect:
  - ◆ Advanced High-Performance Bus (AHB5) Bus Matrix
  - ◆ AMBA® AHB5 TrustZone® Peripheral Protection Controller (PPC)
  - ◆ AMBA® AHB5 Access Control Gates (ACG)
  - ◆ AMBA® AHB5 to Advanced Peripheral Bus (APB) Bridges
  - ◆ AMBA® APB TrustZone® Peripheral Protection Controller (PPC)
  - ◆ Expansion AHB5 master and slave buses (two each)



- Memory system:
  - ◆ AXI5 slave bus to access ITCM and DTCM memories
  - ◆ AXI5 master bus to external code memory
  - ◆ AXI5 master bus to external static memory
  - ◆ AXI5 Static memory controllers
  - ◆ Two banks of SRAM – 256kB each
- Security components:
  - ◆ Implementation Defined Attribution Unit (IDAU)
  - ◆ Secure expansion ports
  - ◆ System Security Controller
  - ◆ System Controller
- APB peripherals with security support:
  - ◆ One always-on Secure Watchdog in the SLOWCLK domain
  - ◆ One always-on general-purpose timer with configurable security in the SLOWCLK domain
  - ◆ One always-on Timestamp-based Secure Watchdog in the CNTCLK domain
  - ◆ One always-on Timestamp-based Non-secure Watchdog in the CNTCLK domain
  - ◆ Four Timestamp-based timers with configurable security in the CNTCLK domain
- Power control components:
  - ◆ Power Dependency Control Matrix (PDCM)
  - ◆ PCK-600 components:
    - Power Policy Units (PPU)
    - Low Power P-channel distributors (LPD\_P)
    - Low Power Q-channel distributors (LPD\_Q) and combiners (LPC\_Q)
    - P-channel to Q-channel converters (P2Q)
    - Clock Controllers (CLK-CTRL)
  - ◆ Cortex-M55 External Wake-up Interrupt Controller (EWIC)
- Example expansion integration:
  - ◆ AMBA® AHB5 to AXI5 bridge (HXB)
  - ◆ AMBA® AHB5 to AHB5 and APB asynchronous bridge
  - ◆ AMBA® AHB5 to APB synchronous bridge
  - ◆ System Timestamp generator (generic counter)
  - ◆ PCK-600 components
  - ◆ CoreSight™ DAP-Lite 2

- ◆ Cortex-M55 Trace Port Interface Unit (TPIU)
- ◆ Cortex-M55 MCU ROM table
- ◆ Debug Timestamp generator

### 3.1.4. Configuration options

The Corstone™ SSE-300 Example Subsystem is configurable, thus a system based on this specification can scale across the performance, power, and area requirement of the market.

## 3.2. Cortex-M System Design Kit

This section is an extract from the CMSDK technical reference manual. It gives an overview of the product and its features.

For more information, see the CMSDK documentation set:

- [Arm® Cortex®-M System Design Kit Technical Reference Manual](#)
- *Arm® Cortex®-M System Design Kit Example System Guide*

### 3.2.1. About Cortex-M System Design Kit

The Cortex-M System Design Kit helps you design products using Arm Cortex-M3 and Cortex-M4 processors.

The design kit contains the following:

- A selection of AHB-Lite and APB components, including several peripherals such as GPIO, timers, watchdog, and UART. These components are used in the CMSDK example system, but you can also use the components to create your own custom system.
- An example system for supported processor products
- Example synthesis scripts for the example system
- Example compilation and simulation scripts for the Verilog environment that supports ModelSim, VCS, and NC Verilog
- Example code for software drivers
- Example test code to demonstrate various operations of the systems
- Example compilation scripts and example software project files that support:
  - ◆ Arm Development Studio 5 (DS-5)
  - ◆ Arm RealView Development Suite
  - ◆ Keil® Microcontroller Development Kit (MDK)
  - ◆ GNU tools for Arm embedded processors (Arm GCC)
- Documentation including:

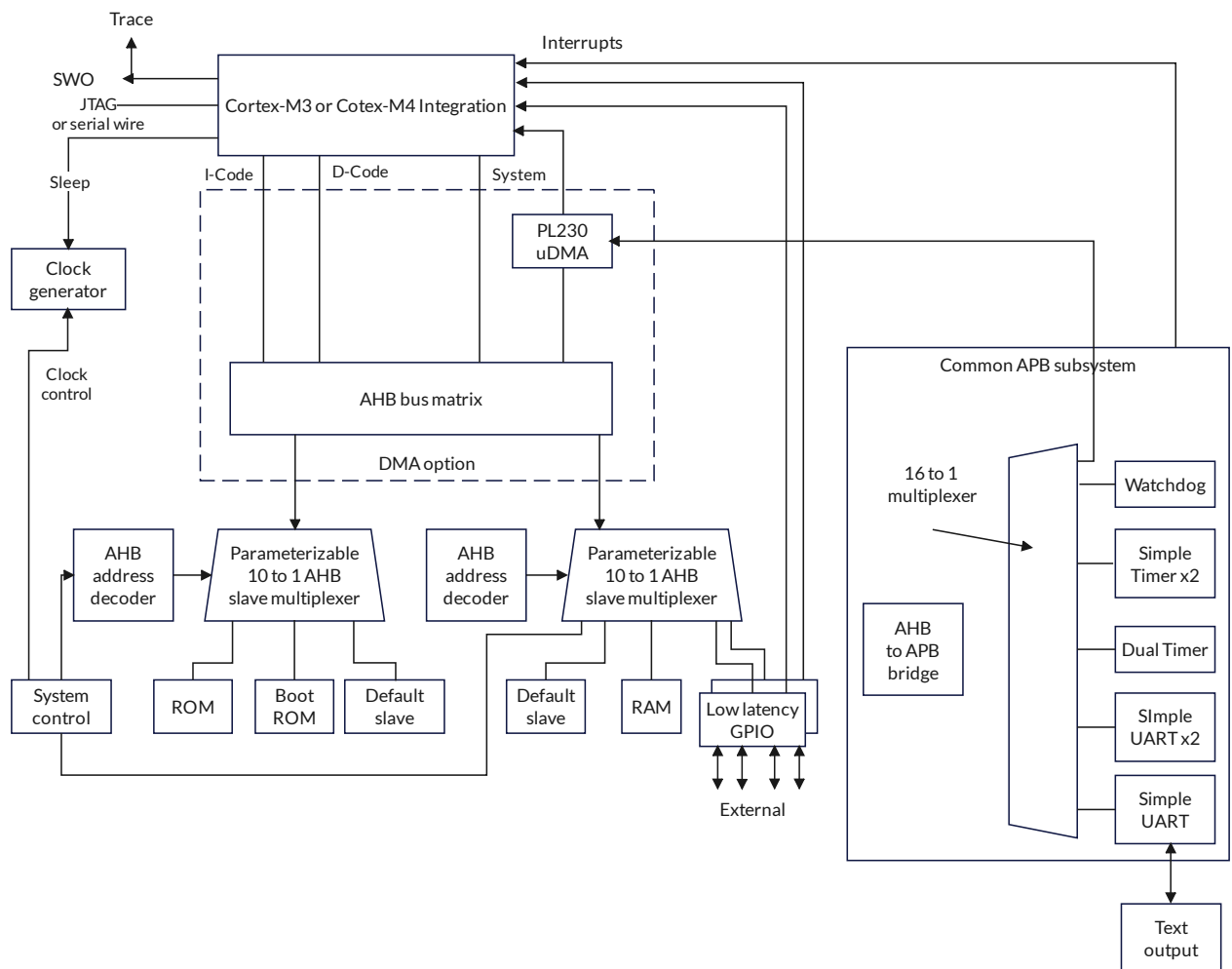
- ♦ [Arm® Cortex®-M System Design Kit Technical Reference Manual](#)
- ♦ *Arm® Cortex® -M0 and Cortex® -M0+ System Design Kit Example System Guide*
- ♦ *Arm® Cortex® -M System Design Kit Example System Guide*

For details of the CMSDK components, see the [Arm® Cortex®-M System Design Kit Technical Reference Manual](#).

### 3.2.1.1. Example system

The following figure shows the block diagram of the CMSDK example system:

Figure 3-1: CMSDK example system



The  $\mu$ DMA Controller (PL230) is not included in the Arm® Corstone™-300 Reference Package license and, if instantiated, must be licensed separately. See the [Arm® PrimeCell DMA Controller \(PL230\) Technical Reference Manual](#) for more information.

### 3.2.1.2. Components

The CMSDK example system consists of the following components and models:

- Basic AHB-Lite components
- APB components
- Advanced AHB-Lite components
- Behavioral memory models

### 3.2.1.3. Cortex-M Software Design Kit software

The Cortex-M System Design Kit includes the following software:

- CMSIS-compliant drivers
- Device-specific header files, startup code, and example drivers including retargeting code for the `printf()` and `puts()` functions
- Platform hardware adaptation layer code that is required in addition to the open-source code and generic Cortex-M processor header files
- Mbed OS driver support  
Extra Cortex-M code is available on the Mbed website
- Shell scripts to sync, build, and run the software

## 3.3. Cortex-M0 and M0+ System Design Kit

This section is an extract from the CMSDK technical reference manual. It gives an overview of the product and its features.

For more information, see the CMSDK documentation set:

- [Arm® Cortex®-M System Design Kit Technical Reference Manual](#)
- *Arm® Cortex®-M System Design Kit Example System Guide*
- *Arm® Cortex®-M0 and Cortex®-M0+ System Design Kit Example System Guide*

### 3.3.1. About Cortex-M0 and M0+ System Design Kit

The Cortex-M0 and Cortex-M0+ System Design Kit provides:

- An example system-level design for the Arm Cortex-M0 and Cortex-M0+ processors
- Reusable AMBA components for system-level development from the CMSDK

For information on the AMBA components that the design kit uses, see the [Arm® Cortex®-M System Design Kit Technical Reference Manual](#).

### 3.3.1.1. About the example system

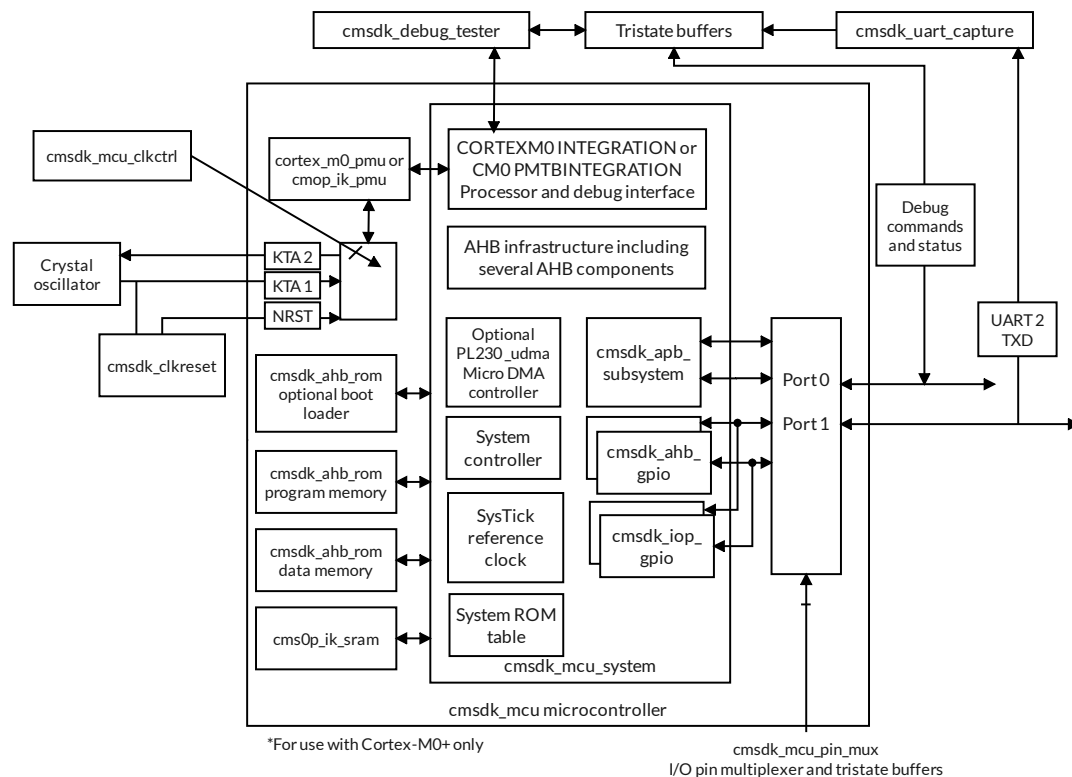
The Arm Cortex-M0 and M0+ System Design Kit Example System Guide describes an example system for the Cortex-M0 and Cortex-M0+ processors.

**Figure 3-1: CMSDK example system** shows the example system block diagram. The following figure shows the testbench of the example system.

The example system is a simple microcontroller design that contains the following:

- A single Cortex-M0 or Cortex-M0+ processor
- Internal program memory
- SRAM data memory
- Boot loader
- The following peripherals:
  - ♦ Several timers
  - ♦ General-Purpose input/output (GPIO)
  - ♦ Universal Asynchronous Receiver Transmitter (UART)
  - ♦ Watchdog timer
- Debug connection

**Figure 3-2: CMSDK example system testbench**





The optional  $\mu$ DMA Controller (PL230) is not included in the Arm® Corstone™-300 Reference Package license and, if instantiated, must be licensed separately. See the [Arm® PrimeCell DMA Controller \(PL230\) Technical Reference Manual](#) for more information.

### 3.3.1.2. Cortex-M0 and Cortex-M0+ software

The Cortex-M0 and M0+ System Design Kit products include the following software:

- CMSIS-compliant drivers
- Device-specific header files, startup code, and example drivers including retargeting code for the `printf()` and `puts()` functions
- Platform hardware adaptation layer code that is required in addition to the open-source code and generic Cortex-M processor header files
- Mbed OS driver support.  
Extra Cortex-M0 and Cortex-M0+ code is available on the Mbed website
- Shell scripts to sync, build, and run the software

## 3.4. CoreLink SIE-200 System IP

This section is an extract from the SIE-200 technical reference manual. It gives an overview of the product and its features.

For more information, see the SIE-200 documentation set:

- [Arm® CoreLink™ SIE-200 System IP for Embedded Technical Reference Manual](#)
- *Arm® CoreLink™ SIE-200 System IP for Embedded Configuration and Integration Manual*

### 3.4.1. About CoreLink SIE-200 System IP

The CoreLink SIE-200 System IP for Embedded product is a collection of interconnect, peripheral, and TrustZone controller components for use with a processor that complies with the Armv8-M processor architecture and the AMBA 5 AHB5 protocol.

The SIE-200 components are used in the SSE-300 product, but you can also use the SIE-200 components to create your own custom system.

The CoreLink SIE-200 System IP for Embedded consists of the following components and models that support the AHB5 standard:

- AHB5 system components
- AHB5 bridge components
- TrustZone protection controllers
- Verification components

## 3.5. CoreLink SIE-300 AXI5 System IP

This section is an extract from the SIE-300 technical reference manual. It gives an overview of the product and its features.

For more information, see the SIE-300 documentation set:

- [Arm® CoreLink™ SIE-300 AXI5 System IP for Embedded Technical Reference Manual](#)
- [Arm® CoreLink™ SIE-300 AXI5 System IP for Embedded Configuration and Integration Manual](#)

### 3.5.1. About CoreLink SIE-300 AXI5 System IP

The SIE-300 AXI5 System IP for Embedded provides a set of configurable AXI5 security-aware components. The components comply with the TrustZone for Armv8-M processor architecture and can protect peripherals and memories that are unaware of security, so that a peripheral or memory is only accessible to trusted software. The SIE-300 also provides an AXI5 SRAM controller, clock synchronizing bridges and an access control gate.

The SIE-300 consists of the following components:

#### Master Security Controller (MSC)

The MSC acts as security gate for AXI transactions, and it can transform the security attribute.

#### Memory Protection Controller (MPC)

The MPC acts as security gate for AXI transactions that target a memory interface. The security checks operate on block or page level and are programmable by using the APB slave interface.

#### Peripheral Protection Controller (PPC)

The PPC gates AXI5 transactions to, and responses from, peripherals when a security violation occurs.

#### Access Control Gate (ACG)

The ACG component can be placed on a clock or power domain boundary to pass or block AXI5 transactions whenever the downstream component cannot accept the transaction or is explicitly asked not to do so. The transaction is latched internally and the ACG generates automatic responses when necessary.

#### Sync-Down Bridge (SDB)

The SDB synchronizes AXI5 interfaces where the upstream side is faster than the downstream side and the clocks are synchronous, in phase and have an N:1 frequency ratio.

#### Sync-Up Bridge (SUB)

The SUB synchronizes AXI5 interfaces where the upstream side is slower than the downstream side and the clocks are synchronous, in phase, and have a 1:N frequency ratio.

#### SRAM Memory Controller (SMC)

The SMC enables on-chip synchronous RAM blocks to attach to an AXI5 interface. The SMC supports 32, 64, 128, or 256-bit SRAM with byte writes.

## 3.6. CoreLink PCK-600 Power Control Kit

This section is an extract from the PCK-600 technical reference manual. It gives an overview of the product and its features.

For more information, see the PCK-600 documentation set:

- [Arm® CoreLink™ PCK-600 Power Control Kit Technical Reference Manual](#)
- *Arm® CoreLink™ PCK-600 Power Control Kit Configuration and Integration Manual*

### 3.6.1. About the Power Control Kit

The PCK-600 provides a set of configurable RTL components for the creation of SoC clock and power control infrastructure. The components use the Arm Q-Channel and P-Channel low power interfaces.

The PCK-600 consists of the following components:

#### Low Power Distributor Q-Channel (LPD-Q)

The LPD-Q component distributes a Q-Channel from one Q-Channel controller to up to 32 QChannel devices.

#### Low Power Distributor P-Channel (LPD-P)

The LPD-P component distributes a P-Channel from one P-Channel controller to up to 8 PChannel devices.

#### Low Power Combiner Q-Channel (LPC-Q)

The LPC-Q component combines the Q-Channels from multiple Q-Channel controllers to multiple Q-Channel devices with common control requirements.

#### P-Channel to Q-Channel Converter (P2Q)

The P2Q component converts a P-Channel to a Q-Channel.

#### Clock Controller (CLK-CTRL)

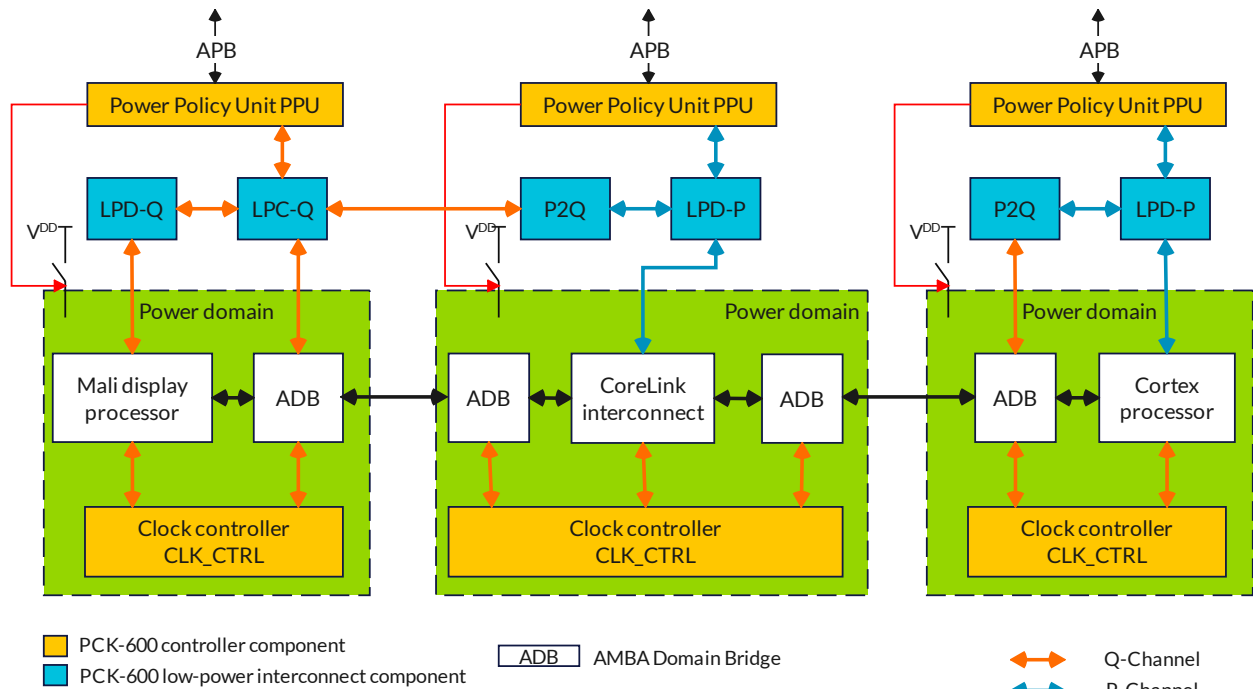
The CLK-CTRL component provides High-level Clock Gating (HCG) for a single clock domain. Power Policy Unit.

#### Power Policy Unit (PPU)

The PPU component is a configurable and programmable P-Channel and Q-Channel power domain controller.

The following figure shows an example system that uses the components to manage three power domains. The components are shown in red and blue.



**Figure 3-3: Example system that contains PCK-600**

## 3.7. CoreLink XHB-500 Bridge

This section is an extract from the XHB-500 technical reference manual. It gives an overview of the product and its features.

For more information, see the XHB-500 documentation set:

- [Arm® CoreLink™ XHB-500 Bridge Technical Reference Manual](#)
- *Arm CoreLink XHB-500 Configuration and Integration Manual*

### 3.7.1. About CoreLink XHB-500 Bridge

The product provides an AMBA® AXI5 to AHB5 bridge and an AHB5 to AXI5 bridge.

The AXI5 to AHB5 bridge translates AXI5 transactions into the corresponding AHB transfers. The bridge has an AXI5 slave interface and an AHB5 master interface.

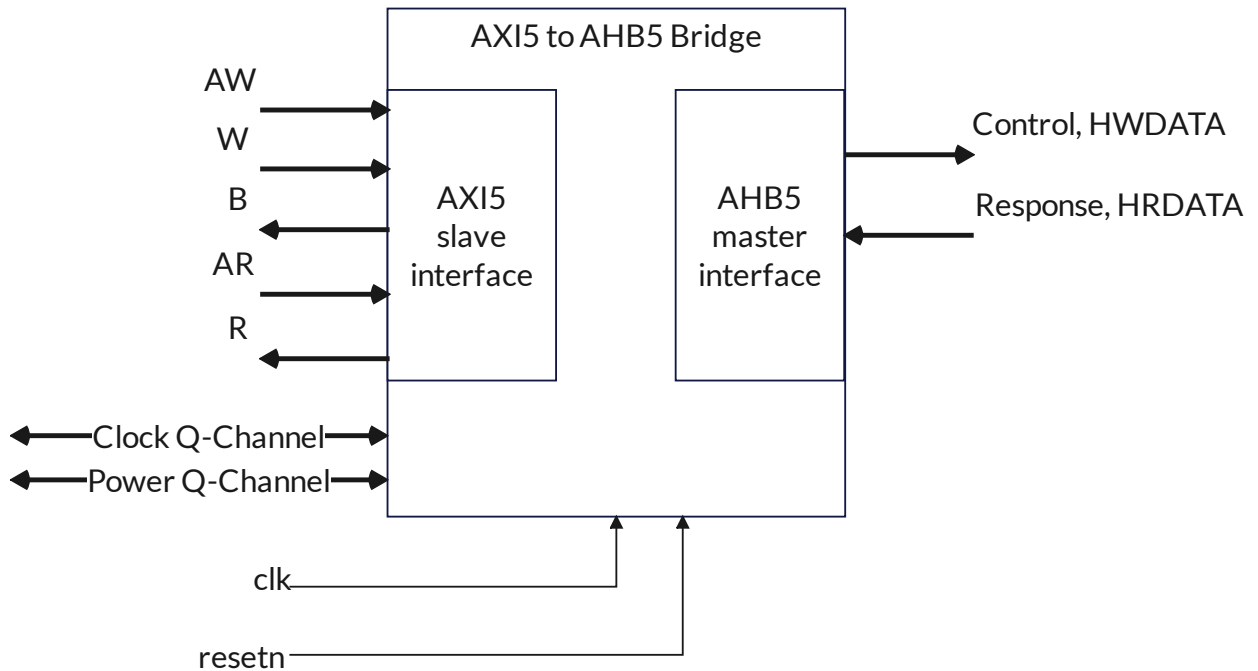
The AHB5 to AXI5 translates AHB5 transfers into the corresponding AXI transactions. The bridge has an AHB5 slave interface and an AXI5 master interface.

### 3.7.1.1. AXI5 to AHB5 bridge overview

The AXI5 to AHB5 is a low-latency bridge that performs no transaction buffering.

The following figure shows the interfaces of the AXI5 to AHB5 bridge.

**Figure 3-4: AXI5 to AHB5 bridge interfaces**



The main features are:

- Single power domain
- Single clock domain
- Configurable data width
- AXI5 slave interface features:
  - ◆ AXI5 protocol support
  - ◆ AXI4 protocol support
  - ◆ Fixed address width
  - ◆ Registered or unregistered interface
  - ◆ Single Exclusive accesses. Exclusive bursts are not supported
  - ◆ Unaligned accesses
  - ◆ Conversion of sparse write transactions, when the HWSTRB\_ENABLE configuration parameter is set to OFF
  - ◆ Supports all burst types

- AHB5 master interface features:
  - ♦ AHB5 support
  - ♦ AHB-Lite support, which requires several signals to be tied off
  - ♦ Fixed address width
  - ♦ Registered or unregistered interface
  - ♦ Exclusive accesses. For AHB-Lite, extra glue logic is required
  - ♦ Write strobe support using the hwstrb signal, when the HWSTRB\_ENABLE configuration parameter is set to ON. The hwstrb signal is not present in the *Arm® AMBA® 5 AHB Protocol Specification*.
- Q-Channel interface for clock control
- Q-Channel interface for power control

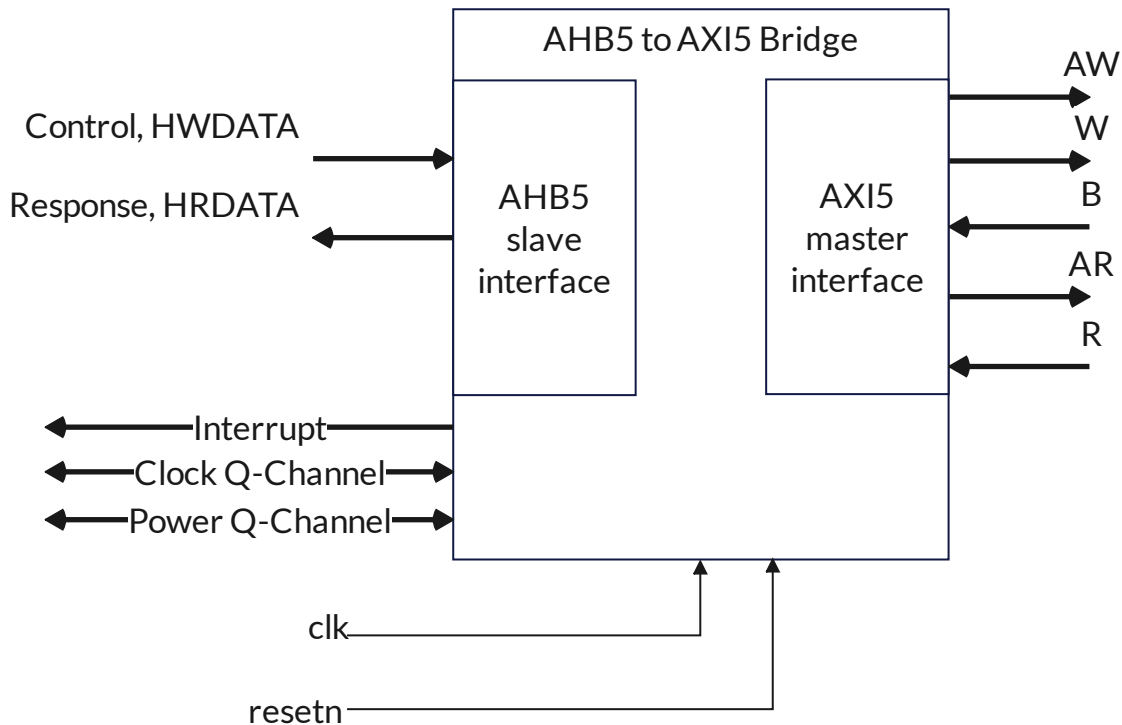
The bridge does not support endian conversion.

### 3.7.1.2. AHB5 to AXI5 bridge overview

The AHB5 to AXI5 bridge is a low-latency bridge that performs no transaction buffering.

The following figure shows the interfaces of the AHB5 to AXI5 bridge.

**Figure 3-5: AHB5 to AXI5 bridge interfaces**



The main features are:

- Single power domain
- Single clock domain
- Configurable data width
- AHB5 slave interface features:
  - ♦ AHB5 protocol support
  - ♦ Fixed address width
  - ♦ Registered or unregistered interface
  - ♦ Support for early write response
  - ♦ Supports all burst types
- AXI5 master interface features:
  - ♦ AXI5 support.
  - ♦ Fixed address width
  - ♦ Registered or unregistered interface
  - ♦ RAW hazard checking for early write response
- Buffered write error interrupt
- Q-Channel interface for clock control
- Q-Channel interface for power control

The bridge does not support endian conversion.

## 3.8. CoreLink NIC-400-Lite Network Interconnect

This section is an extract from the NIC-400 Lite technical reference manual. It gives an overview of the product and its features.

For more information, see the NIC-400 Lite documentation set:

- *Arm® CoreLink™ NIC-400-Lite Network Interconnect Technical Reference Manual*
- *Arm® CoreLink™ NIC-400-Lite Network Interconnect Integration Manual*

### 3.8.1. About CoreLink NIC-400 Lite Network Interconnect

The CoreLink NIC-400 Lite Network Interconnect is highly configurable and enables you to create a complete high performance, optimized, and AMBA-compliant network infrastructure.

There are many possible configurations for the CoreLink NIC-400 Lite Network Interconnect. They allow for any topology of up to 6 slave interfaces and 12 master interfaces. Bridges are not counted against the limits of 6 slave interfaces and 12 master interfaces.

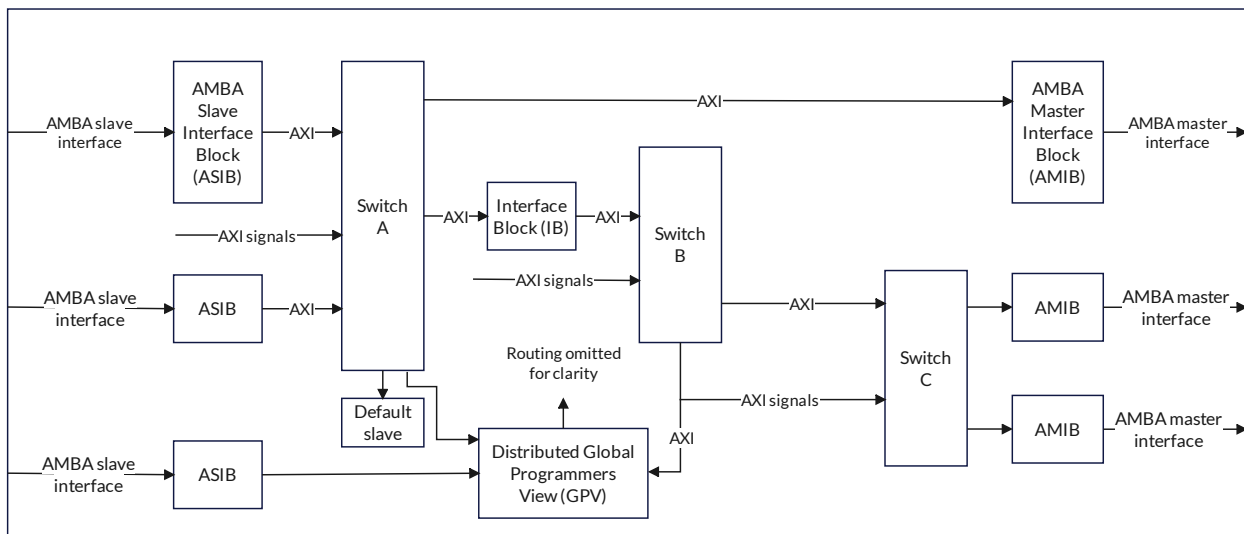


For configurations containing multiple bridges, the total number of interfaces cannot be more than 64 slave interfaces and 128 master interfaces.

The NIC-400 Lite configuration can consist of many switches and topology options. The following figure shows a top-level block diagram of the NIC-400 Lite that contains:

- Multiple switches
- Multiple AMBA Slave Interface Blocks (ASIBs)
- Multiple AMBA Master Interface Blocks (AMIBs)

**Figure 3-6: NIC-400 Lite block diagram**



The NIC-400-Lite is designed for applications ranging from simple single-core systems based on Cortex-M55 or Cortex®-M7 processors to more complex multi-core systems. For an enhanced feature set, upgrade to the NIC-400 license.

## 3.9. CoreLink ADB-400 AMBA Domain Bridge

This section is an extract from the ADB-400 user guide. It gives an overview of the product and its features.

For more information, see the ADB-400 documentation set:

- *Arm® CoreLink™ ADB-400 AMBA® Domain Bridge User Guide*

### 3.9.1. About CoreLink ADB-400 AMBA Domain Bridge

The CoreLink ADB-400 AMBA Domain Bridge is an asynchronous bridge between two components or systems that can be in a different power, clock, or voltage domains.

The ADB-400 supports:

- An optional configurable destination register for the payload of each channel
- Simple reset requirements
- A power management interface
- *Dynamic Voltage and Frequency Scaling* (DVFS)
- *Quality of Service* (QoS) *Virtual Network* (QVN)
- Clock status indication

The ADB-400 consists of a slave domain and a master domain. The slave domain received transfers from the AMBA® master and the master domain transmits transfers to an AMBA® slave.



The ADB-400 does not perform protocol translation.

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## 3.10. CoreLink GFC-100 Generic Flash Controller

This section is an extract from the GFC-100 technical reference manual. It gives an overview of the product and its features.

For more information, see the GFC-100 documentation set:

- [Arm® CoreLink™ GFC-100 Generic Flash Controller Technical Reference Manual](#)
- *Arm® CoreLink™ GFC-100 Generic Flash Controller Configuration and Integration Manual*

### 3.10.1. About GFC-100

The GFC-100 comprises the generic part of a Flash controller in a System-on-Chip (SoC). GFC-100 enables an embedded Flash (eFlash) macro to be integrated easily into any system.

An eFlash macro enables a Flash controller to access eFlash memory. The eFlash macros produced by different foundries and processes can have different interfaces, timings, signal names, protocols and features that are determined by the foundry processes that produced the eFlash memory.

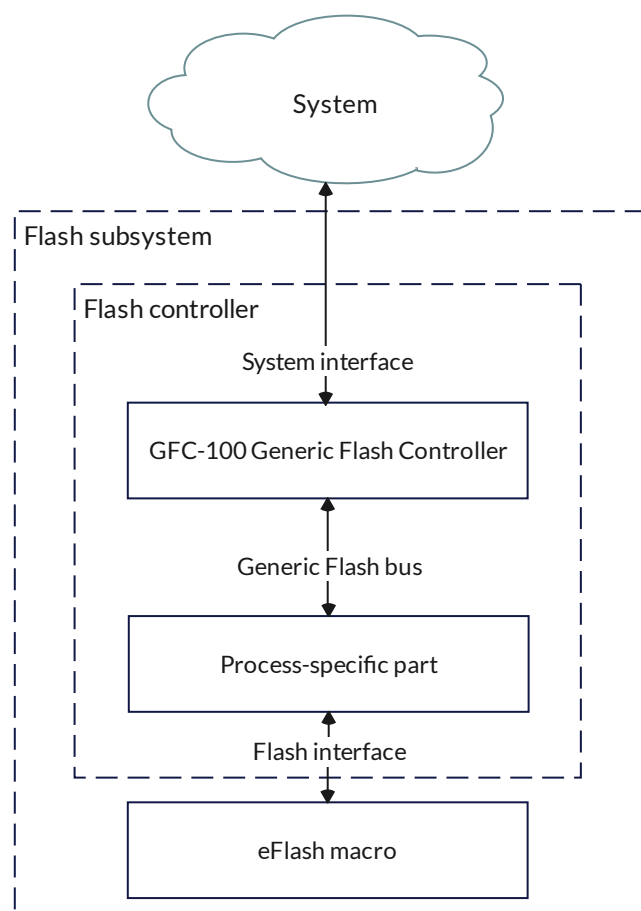
GFC-100 provides the functions that relate only to services for the system side of the Flash controller. GFC-100 cannot communicate directly with the eFlash macro. Therefore, GFC-100 must be integrated with a process-specific part that connects to, and communicates with, the eFlash macro.

The process-specific part of the Flash controller is part of the Flash subsystem in your SoC. It communicates directly with the eFlash macro through a Flash interface.

Communication between the system and eFlash memory is through a Generic Flash Bus (GFB) supplied with GFC-100.

The following figure shows how GFC-100 is used in a Flash controller implementation.

**Figure 3-7: GFC-100 in a Flash controller implementation**



### 3.10.2. Features

GFC-100 provides several interfaces and test features.

#### Advanced High-performance Bus (AHB-Lite) interface

- Read access to the main and extended areas of embedded Flash
- Burst support
- Low latency

#### Advanced Peripheral Bus (APB) slave interface

- Write and erase access to the main and extended areas of embedded Flash
- Debug read access to the main and extended areas of embedded Flash
- Control port for GFC-100 and the eFlash macro
- Interrupt capability for long running commands
- Access to internal and external registers

#### APB register master interface

- Control port for attached process-specific registers

#### Q-Channel interface

- Control port for system power
- Control port for the system clock

#### P-Channel controller interface

- Control port for power to the attached process-specific part

#### Generic Flash Bus (GFB)

- Enables GFC-100 accesses to embedded Flash
- Simple command-based protocol
- Synchronous with the AHB clock
- Simplifies communication between GFC-100 and the attached process-specific part

## 3.11. CoreLink GFC-200 Generic Flash Controller

This section is an extract from the GFC-200 technical reference manual.

It gives an overview of the product and its features. For more information, see the GFC-200 documentation set:

- [Arm® CoreLink™ GFC-200 Generic Flash Controller Technical Reference Manual](#)
- [Arm® CoreLink™ GFC-200 Generic Flash Controller Configuration and Integration Manual](#)



### 3.11.1. About the GFC-200

The GFC-200 comprises the generic part of a Flash controller in a System-on-Chip (SoC). The GFC-200 enables an embedded Flash macro to be integrated easily into any system.

An eFlash macro enables a Flash controller to access eFlash memory. The eFlash macros produced by different foundries and processes can have different interfaces, timings, signal names, protocols, and features that are determined by the foundry processes that produced the eFlash memory.

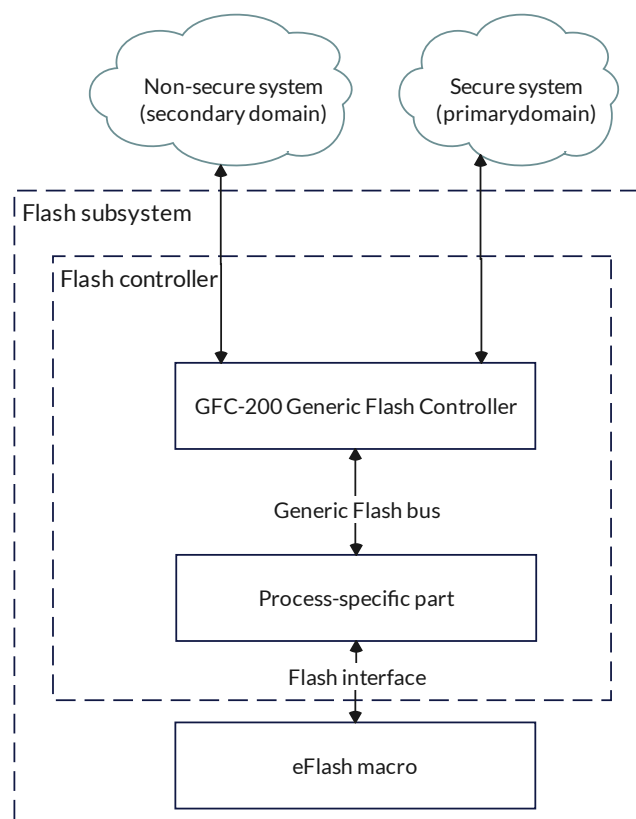
The GFC-200 provides functions that relate only to services for the system side of the Flash controller. The GFC-200 cannot communicate directly with the eFlash macro. Therefore, the GFC-200 must be integrated with a process-specific part that connects to, and communicates with, the eFlash macro.

The process-specific part of the Flash controller is part of the Flash subsystem in your SoC. It communicates directly with the eFlash macro through a Flash interface.

The GFC-200 supports accesses from two masters that can operate in separate domains such as a Non-secure domain and a Secure domain. Communication between the system and eFlash memory is through a Generic Flash Bus (GFB) supplied with GFC-200.

The following figure shows how the GFC-200 is used in a Flash controller implementation.

**Figure 3-8: GFC-200 in a Flash controller implementation**



### 3.11.2. Features

The GFC-200 provides several interfaces and features.

#### Flash memory partitioning

- Ability to divide the available Flash memory space into several partitions and perform access control on a per partition basis
- Dynamically configurable access rights to partitions
- A configuration parameter controls the size of the partitions

#### AMBA AHB-Lite interface

- Read-only access to the embedded Flash
- Configurable data width
- Burst support
- Low latency

#### Primary APB slave interface

- Write and erase access to the embedded Flash
- Debug read access to the embedded Flash
- Control port for GFC-200 and the eFlash macro
- Interrupt capability for long running commands
- Access to internal registers and the control registers in the process-specific part

#### Secondary APB slave interface

- Write and erase access to the embedded Flash
- Debug read access to the embedded Flash
- Control port for GFC-200
- Interrupt capability for long running commands
- Access to internal registers

#### APB register master interface

Enables access to the registers in the process-specific part

#### Q-Channel interface

- Control port for system power
- Control port for the system clock

#### P-Channel controller interface

- Control port for power to the attached process-specific part

#### Generic Flash Bus (GFB)

- Enables GFC-200 accesses to embedded Flash
- Simple command-based protocol
- Synchronous with the AHB clock
- Simplifies communication between GFC-200 and the attached process-specific part

## 3.12. CoreLink CG092 AHB Flash Cache

This section is an extract from the CG092 technical reference manual. It gives an overview of the product and its features.

For more information, see the CG092 documentation set:

- [Arm® CoreLink™ CG092 AHB Flash Cache Technical Reference Manual](#)
- [Arm® CoreLink™ CG092 AHB Flash Cache Configuration and Integration Manual](#)

### 3.12.1. About CG092

The CG092 AHB Flash Cache is an instruction cache that is instantiated between the bus interconnect and the eFlash controller.

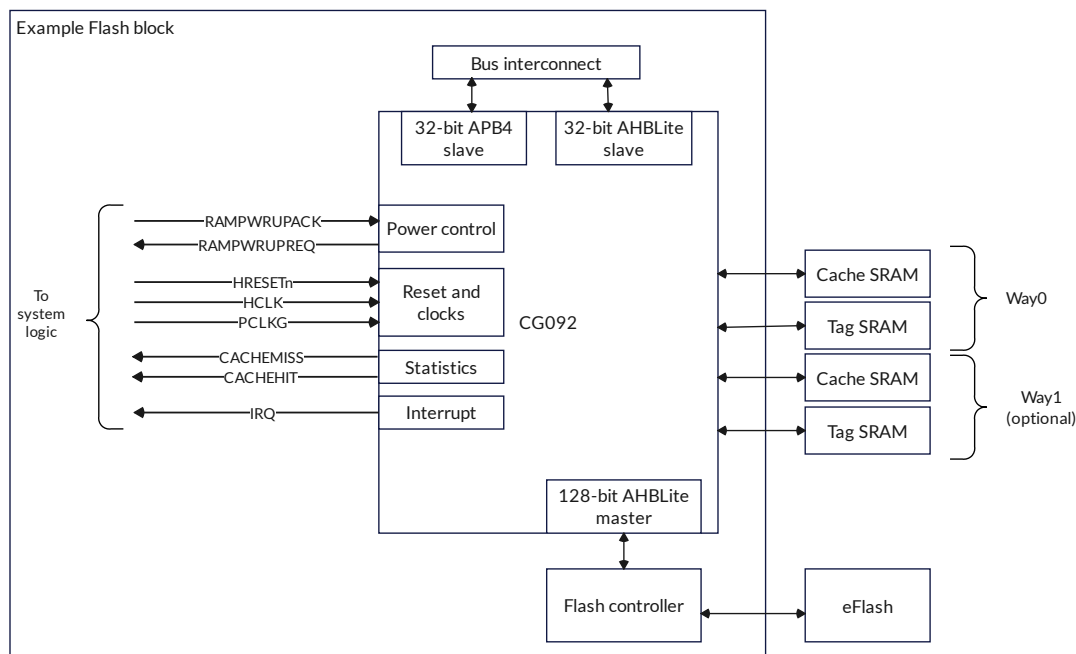
The CG092 is a simple cache for on-chip embedded Flash (eFlash). The CG092 design is optimized for fetching Cortex-M3 or Cortex-M4 instructions directly from an eFlash. The main benefit of the CG092 is improved power efficiency, but there are also improvements in code fetching performance.



The AHB Flash Cache can also be used with external eFlash if the Flash controller is modified accordingly.

The following figure shows the connections in a typical Flash subsystem.

**Figure 3-9: Example eFlash implementation**



### 3.12.2. Features of CG092

The CG092 is an instruction cache designed to be instantiated between the bus interconnect and the eFlash controller.

The CG092 has the following features:

- Configurable cache size (minimum 256 bytes/way)
- Four words per cacheline
- Supports 2-way set associative cache, or 1-way fully associative cache
- Configurable address bus size (based on flash memory size) so that tag memory size can be minimized
- SRAM power-control handshaking to an external power management unit.  
Supports automatic and manual SRAM power up and power down (with simple handshaking).  
If valid data is in the powered-down cache because the cache is in a low-power state, the cache contents should not be invalidated on wake up. The software can therefore save energy by avoiding invalidating the cache RAMs on wake up.
- Supports automatic or manual cache invalidate in the enabling sequence. This behavior can be overridden.
- 32-bit AHB slave interface to the AHB master in the system processor
- 32-bit APB slave interface to the memory-mapped registers of the CG092
- 128-bit AHB master interface to the eFlash
- Interrupt request generated on SRAM power or manual invalidation errors.  
Optional run-time support for prefetch to improve performance when executing a sequence of code that has not been read before.  
The prefetching performance impact is application dependent and might have a negative impact on eFlash power consumption.
- Optional compile-time support configurable performance counters that measure cache hits and misses

Exported cache hit and cache miss status signals can be used by performance measurement logic implemented at SoC level.



Note

An eFlash controller is not part of the CG092 component.

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## 3.13. PrimeCell Real Time Clock

This section is an extract from the Real Time Clock (RTC) technical reference manual. It gives an overview of the product and its features.

For more information, see the RTC documentation set:

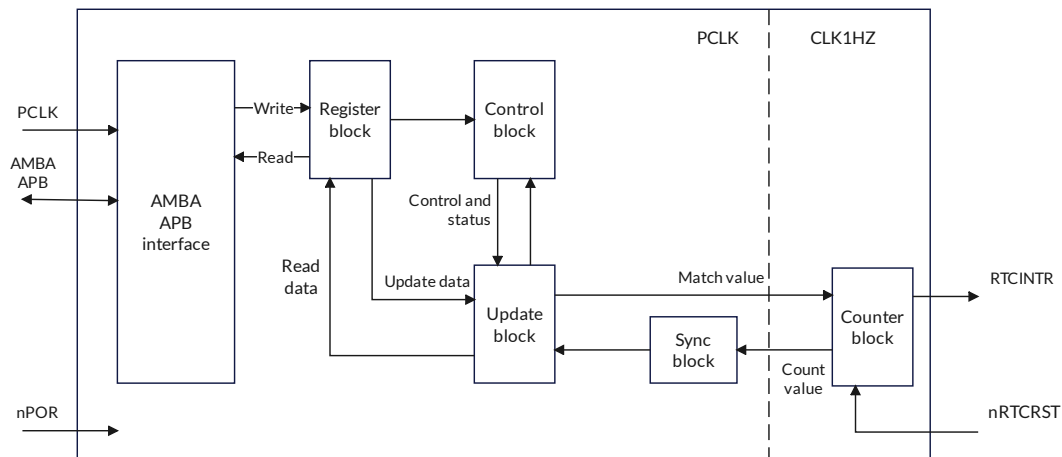
- [Arm® PrimeCell Real Time Clock \(PL031\) Technical Reference Manual](#)

### 3.13.1. About Real Time Clock

The RTC is an AMBA slave module that connects to the Advanced Peripheral Bus (APB).

The following figure shows the RTC block diagram.

**Figure 3-10: RTC block diagram**



The RTC can be used to provide a basic alarm function or long-time base counter. This is achieved by generating an interrupt signal after counting for a programmed number of cycles of a real-time clock input. Counting in one-second intervals requires a 1Hz clock input to the RTC.

### 3.13.2. Features of the RTC

The features of the RTC are:

- Compliance to the Arm AMBA Specification (Rev 2.0) onwards for easy integration into SoC implementation
- 32-bit up counter (free-running counter)
- Programmable 32-bit match compare register
- Software maskable interrupt when counter and compare registers are identical

Additional test registers and modes are implemented for functional verification and manufacturing test.

# Appendix A. Revisions

This appendix describes the technical changes between released issues of this document.

**Table A-1: Issue 01**

Change	Location
First release for EAC.	-

**Table A-2: Differences between issue 01 and issue 02**

Change	Location
Removed Arm True Random Number Generator (TRNG)	Entire document