

ARM[®] Cortex[®]-A72 MPCore Processor Cryptography Extension

Revision: r0p3

Technical Reference Manual

ARM[®]

ARM® Cortex®-A72 MPCore Processor Cryptography Extension

Technical Reference Manual

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Release Information

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Product Status

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Preface

This preface introduces the *ARM® Cortex®-A72 MPCore Processor Cryptography Extension Technical Reference Manual*.

It contains the following:

- [About this book on page 6.](#)
- [Feedback on page 8.](#)

About this book

This document describes the instructions for the processor Cryptography extensions.

Product revision status

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

rm Identifies the major revision of the product, for example, *r1*.

pn Identifies the minor revision or modification status of the product, for example, *p2*.

Intended audience

This book is written for system designers, system integrators, and programmers who are designing or programming a System-on-Chip (SoC) that uses the processor with the optional Cryptography Extension.

Using this book

This book is organized into the following chapters:

Chapter 1 Introduction

This chapter introduces the Cryptography Extensions instructions for the Cortex-A72 processor and its features.

Chapter 2 Programmers Model

This chapter describes the registers of the Cryptography engine and provides information for programming the engine.

Appendix A Revisions

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

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.

Typographic conventions

italic

Introduces special terminology, denotes cross-references, and citations.

bold

Highlights interface elements, such as menu names. Denotes signal names. Also used for terms in descriptive lists, where appropriate.

monospace

Denotes text that you can enter at the keyboard, such as commands, file and program names, and source code.

monospace

Denotes a permitted abbreviation for a command or option. You can enter the underlined text instead of the full command or option name.

monospace italic

Denotes arguments to monospace text where the argument is to be replaced by a specific value.

monospace bold

Denotes language keywords when used outside example code.

<and>

Encloses replaceable terms for assembler syntax where they appear in code or code fragments.
For example:

```
MRC p15, 0, <Rd>, <CRn>, <CRm>, <Opcode_2>
```

SMALL CAPITALS

Used in body text for a few terms that have specific technical meanings, that are defined in the *ARM glossary*. For example, IMPLEMENTATION DEFINED, IMPLEMENTATION SPECIFIC, UNKNOWN, and UNPREDICTABLE.

Feedback

Feedback on this product

If you have any comments or suggestions about this product, contact your supplier and give:

- The product name.
- The product revision or version.
- An explanation with as much information as you can provide. Include symptoms and diagnostic procedures if appropriate.

Feedback on content

If you have comments on content then send an e-mail to errata@arm.com. Give:

- The title *ARM® Cortex®-A72 MPCore Processor Cryptography Extension Technical Reference Manual*.
- The number ARM 100097_0003_05_en.
- If applicable, the page number(s) to which your comments refer.
- A concise explanation of your comments.

ARM also welcomes general suggestions for additions and improvements.

————— **Note** —————

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Chapter 1

Introduction

This chapter introduces the Cryptography Extensions instructions for the Cortex-A72 processor and its features.

It contains the following sections:

- [1.1 About the Cortex-A72 processor Cryptography engine on page 1-10.](#)
- [1.2 Product revisions on page 1-11.](#)

1.1 About the Cortex-A72 processor Cryptography engine

The Cortex-A72 processor Cryptography engine supports the ARMv8 Cryptography Extensions. The Cryptography Extensions add new instructions that the Advanced SIMD can use to accelerate the execution of AES, SHA1, and SHA2-256 algorithms.

The following table lists the instructions for AES. See the *ARM® Architecture Reference Manual, ARMv8, for ARMv8-A architecture profile* for more information.

Table 1-1 AES instructions

Mnemonic	Instruction
AESD	AES single round decryption
AESE	AES single round encryption
AESIMC	AES inverse mix columns
AESMC	AES mix columns
VMULL ^a	Polynomial multiply long

The following table lists the instructions for SHA1 or SHA2-256. See the *ARM Architecture Reference Manual, ARMv8, for ARMv8-A architecture profile* for more information.

Table 1-2 SHA1 and SHA2-256 instructions

Mnemonic	Instruction
SHA1C	SHA1 hash update accelerator, choose
SHA1H	SHA1 fixed rotate
SHA1M	SHA1 hash update accelerator, majority
SHA1P	SHA1 hash update accelerator, parity
SHA1SU0	SHA1 schedule update accelerator, first part
SHA1SU1	SHA1 schedule update accelerator, second part
SHA256H	SHA256 hash update accelerator
SHA256H2	SHA256 hash update accelerator, upper part
SHA256SU0	SHA256 schedule update accelerator, first part
SHA256SU1	SHA256 schedule update accelerator, second part

^a Polynomial 64-bit instruction.

1.2 Product revisions

This section describes the differences in functionality between product revisions.

- r0p0** First release.
- r0p1** No technical changes for cryptography extension.
- r0p2** No technical changes for cryptography extension.
- r0p3** No technical changes for cryptography extension.

Chapter 2

Programmers Model

This chapter describes the registers of the Cryptography engine and provides information for programming the engine.

It contains the following sections:

- [2.1 About the programmers model on page 2-13.](#)

2.1 About the programmers model

The Cortex-A72 processor Cryptography engine implements the Cryptography Extensions described in the ARMv8 architecture.

This section contains the following subsections:

- [2.1.1 Identifying the cryptography instructions implemented on page 2-13.](#)
- [2.1.2 Disabling the Cryptography engine on page 2-13.](#)

2.1.1 Identifying the cryptography instructions implemented

Software can read a register to identify the cryptography instructions that are implemented.

The register to read depends on the Execution state, as follows:

AArch32

To access the ID_ISAR5 in AArch32 state, read the register with:

```
MRC p15, 0, <Rt>, c0, c2, 5 ; Read AArch32 Instruction Set Attribute Register 5
```

AArch64

To access the ID_ISAR5_EL1 in AArch64 state, read the register with:

```
MRS <Rd>, ID_ISAR5_EL1 ; Read AArch32 Instruction Set Attribute Register 5
```

To access the ID_AA64ISAR0_EL1 in AArch64 state, read the register with:

```
MRS <Xt>, ID_AA64ISAR0_EL1 ; Read AArch64 Instruction Set Attribute Register 0
```

The following table lists the instruction identification registers for the Cryptography engine. See the *ARM® Cortex®-A72 MPCore Processor Technical Reference Manual* for more information about the registers.

Table 2-1 Cryptography engine register summary

Name	Execution state	Description
ID_ISAR5	AArch32	AArch32 Instruction Set Attribute Register 5
ID_ISAR5_EL1		
ID_AA64ISAR0_EL1	AArch64	AArch64 Instruction Set Attribute Register 0

2.1.2 Disabling the Cryptography engine

The **CRYPTODISABLE[N:0]** input controls whether the Cryptography engine is disabled for processor *N*. The processor only samples this signal during reset.

When **CRYPTODISABLE** is HIGH, executing a cryptography instruction results in an Undefined Instruction exception.

Appendix A

Revisions

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

It contains the following sections:

- [A.1 Revisions on page Appx-A-15.](#)

A.1 Revisions

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

Table A-1 Issue 01

Change	Location	Affects
First release	-	-

Table A-2 Differences between issue 01 and issue 02

Change	Location	Affects
No technical changes.	-	-

Table A-3 Differences between issue 02 and issue 03

Change	Location	Affects
No technical changes.	-	-

Table A-4 Differences between issue 03 and issue 04

Change	Location	Affects
No technical changes.	-	-

Table A-5 Differences between issue 04 and issue 05

Change	Location	Affects
No technical changes.	-	-