

# **Xilinx Standalone Library Documentation**

## ***XiRSA Library v1.5***

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## Overview

The XiIRSA library provides APIs to use RSA encryption and decryption algorithms and SHA algorithms for Zynq®-7000 SoC devices.

### Note

The RSA-2048 bit is used for RSA and the SHA-256 bit is used for hash.

For an example on usage of this library, refer to the RSA Authentication application and its documentation.

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## Source Files

The following is a list of source files shipped as a part of the XiIRSA library:

- `librsa.a`: Pre-compiled file which contains the implementation.
- `xilrsa.h`: This file contains the APIs for SHA2 and RSA-20148..

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## Usage of SHA-256 Functions

When all the data is available on which sha2 must be calculated, the [sha\\_256\(\)](#) function can be used with appropriate parameters, as described. When all the data is not available on which sha2 must be calculated, use the sha2 functions in the following order:

1. [sha2\\_update\(\)](#) can be called multiple times till input data is completed.
2. `sha2_context` is updated by the library only; do not change the values of the context.

## SHA2 API Example Usage

```
sha2_context ctx;  
sha2_starts(&ctx);  
sha2_update(&ctx, (unsigned char *)in, size);  
sha2_finish(&ctx, out);
```

Following is the source code of the `sha2_context` class.

```
typedef struct  
{  
    unsigned int state[8];  
    unsigned char buffer[SHA_BLKBYTES];  
    unsigned long long bytes;  
} sha2_context;
```

# XiIRSA APIs

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## Overview

This section provides detailed descriptions of the XiIRSA library APIs.

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## Functions

- void [rsa2048\\_exp](#) (const unsigned char \*base, const unsigned char \*modular, const unsigned char \*modular\_ext, const unsigned char \*exponent, unsigned char \*result)
- void [rsa2048\\_pubexp](#) (RSA\_NUMBER a, RSA\_NUMBER x, unsigned long e, RSA\_NUMBER m, RSA\_NUMBER rrm)
- void [sha\\_256](#) (const unsigned char \*in, const unsigned int size, unsigned char \*out)
- void [sha2\\_starts](#) (sha2\_context \*ctx)
- void [sha2\\_update](#) (sha2\_context \*ctx, unsigned char \*input, unsigned int ilen)
- void [sha2\\_finish](#) (sha2\_context \*ctx, unsigned char \*output)

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## Function Documentation

```
void rsa2048_exp ( const unsigned char * base, const unsigned char * modular, const unsigned char * modular_ext, const unsigned char * exponent, unsigned char * result )
```

This function is used to encrypt the data using 2048 bit private key.

### Parameters

<i>modular</i>	A char pointer which contains the key modulus
<i>modular_ext</i>	A char pointer which contains the key modulus extension
<i>exponent</i>	A char pointer which contains the private key exponent
<i>result</i>	A char pointer which contains the encrypted data

### Returns

None

**void rsa2048\_pubexp ( RSA\_NUMBER *a*, RSA\_NUMBER *x*, unsigned long *e*, RSA\_NUMBER *m*, RSA\_NUMBER *rrm* )**

This function is used to decrypt the data using 2048 bit public key.

### Parameters

<i>a</i>	RSA_NUMBER containing the decrypted data.
<i>x</i>	RSA_NUMBER containing the input data
<i>e</i>	Unsigned number containing the public key exponent
<i>m</i>	RSA_NUMBER containing the public key modulus
<i>rrm</i>	RSA_NUMBER containing the public key modulus extension.

### Returns

None

**void sha\_256 ( const unsigned char \* *in*, const unsigned int *size*, unsigned char \* *out* )**

This function calculates the hash for the input data using SHA-256 algorithm. This function internally calls the sha2\_init, updates and finishes functions and updates the result.

### Parameters

<i>In</i>	Char pointer which contains the input data.
<i>Size</i>	Length of the input data
<i>Out</i>	Pointer to location where resulting hash will be written.

### Returns

None

**void sha2\_starts ( sha2\_context \* *ctx* )**

This function initializes the SHA2 context.

### Parameters

<i>ctx</i>	Pointer to sha2_context structure that stores status and buffer.
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### Returns

None

**void sha2\_update ( sha2\_context \* ctx, unsigned char \* input, unsigned int ilen )**

This function adds the input data to SHA256 calculation.

### Parameters

<i>ctx</i>	Pointer to sha2_context structure that stores status and buffer.
<i>input</i>	Pointer to the data to add.
<i>Out</i>	Length of the input data.

### Returns

None

**void sha2\_finish ( sha2\_context \* ctx, unsigned char \* output )**

This function finishes the SHA calculation.

### Parameters

<i>ctx</i>	Pointer to sha2_context structure that stores status and buffer.
<i>output</i>	Pointer to the calculated hash data.

### Returns

None

# Additional Resources and Legal Notices

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## Xilinx Resources

For support resources such as Answers, Documentation, Downloads, and Forums, see [Xilinx Support](#) .

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## Solution Centers

See the [Xilinx Solution Centers](#) for support on devices, software tools, and intellectual property at all stages of the design cycle. Topics include design assistance, advisories, and troubleshooting tips.

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