

密码算法库使用指南

术语及缩略语

缩写	全拼
AES	Advance Encryption Standard
DES	Data Encryption standard
TDES	Triple Data Encryption standard
RNG	Random Number Generator
SHA	Secure Hashing Algorithm are required for digital signature applications

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1. 概述

本文档适用于 N32H47X、N32H48X 系列芯片，主要说明该类芯片中算法接口和使用方法。

对于 U32 数据类型参数，若采用 U8 强制转换 U32 形式，则需要确保 U8 地址按字对齐。

1.1. 支持的算法

- ☐ DES: 加密/解密
- ☐ TDES: 加密/解密
- ☐ AES: 加密/解密 (AES-128/192/256)
- ☐ SM4: 加密/解密
- ☐ HASH: 获取摘要，支持 (SHA-1/SHA-224/SHA-256/MD5/SM3)
- ☐ RNG: 随机数生成

1.2. 基本数据类型

<i>typedef unsigned char</i>	<i>bool;</i>
<i>typedef unsigned char</i>	<i>u8;</i>
<i>typedef signed char</i>	<i>s8;</i>
<i>typedef unsigned short</i>	<i>u16;</i>
<i>typedef signed short</i>	<i>s16;</i>
<i>typedef unsigned int</i>	<i>u32;</i>
<i>typedef signed int</i>	<i>s32;</i>
<i>typedef unsigned long long</i>	<i>u64;</i>
<i>typedef signed long long</i>	<i>s64;</i>

2. DES/TDES算法API说明

2.1. 算法库使用方法

算法库使用方法如下：

1. 将 n32h47x_48x_des.h、n32h47x_48x_Type.h、n32h47x_48x_algo_common.h 文件夹中；将 n32h47x_48x_algo_common.lib、n32h47x_48x_des.lib 添加到工程中；
2. 按 2.3 节函数说明调用函数，例程见附录一、附录二提供的 demo。

2.2. 数据类型定义

```
#define DES_ECB (0x11111111)
#define DES_CBC (0x22222222)
#define DES_ENC (0x33333333)
#define DES_DEC (0x44444444)
#define DES_KEY (0x55555555)
#define TDES_2KEY (0x66666666)
#define TDES_3KEY (0x77777777)

enum DES
{
    DES_Crypto_OK = 0x0,      //DES/TDES operation success
    DES_Init_OK      = 0x0,    //DES/TDES Init operation success
    DES_Crypto_ModeError = 0x5a5a5a5a,    //Working mode error(Neither ECB nor CBC)
    DES_Crypto_EnOrDeError,    //En&De error(Neither encryption nor decryption)
    DES_Crypto_ParaNull,      // the part of input(output/iv) Null
    DES_Crypto_LengthError,    //the length of input message must be 2 times and cannot be zero
    DES_Crypto_KeyError,    //keyMode error(Neither DES_KEY nor TDES_2KEY nor TDES_3KEY)
    DES_Crypto_UnInitError,    //DES/TDES uninitialized
};
```

```
typedef struct
```

```
{
    u32 *in;    // the part of input to be encrypted or decrypted
    u32 *iv;    // the part of initial vector
    u32 *out;   // the part of out
    u32 *key;   // the part of key
    u32 inWordLen; // the length(by word) of plaintext or cipher
    u32 En_De; // 0x33333333- encrypt, 0x44444444 - decrypt
    u32 Mode; // 0x11111111 - ECB, 0x22222222 - CBC
    u32 keyMode; //TDES key mode: 0x55555555-key,0x66666666-2key, 0x77777777-3key
}DES_PARM;
```

2.3. 函数接口说明

DES 算法库包含的函数列表如下：

表 2-1 DES/TDES 算法库函数表

函数	描述
u32 DES_Init(DES_PARM *parm);	DES/TDES 初始化函数
u32 DES_Crypto(DES_PARM *parm)	DES/TDES 加解密
void DES_Close(void)	DES/TDES 关闭
void DES_Version(u8 *type, u8 *customer, u8 date[3], u8 *version)	DES 版本获取函数

2.3.1.DES/TDES算法初始化

DES_Init

DES/TDES 算法初始化

函数原型

u32 DES_Init(DES_PARM *parm)

参数说明

parm 输入，指向 DES_PARM 结构体的指针

返回值

DES_Init_OK：初始化成功 其他：初始化错误

注意事项

1. 若是 ECB 模式，则参数 iv 可直接用 NULL 替换。

2.3.2.DES/TDES算法加解密

DES_Crypto	DES/TDES 算法初始化，加解密
函数原型	u32 DES_Crypto(DES_PARM *parm)
参数说明	parm 输入，指向 DES_PARM 结构体的指针
返回值	DES_Crypto_OK: 运算正确 其他: 运算错误
注意事项	在调用本函数前，若还未初始化或已切换到其他算法，先调用 DES_Init 函数； 1. 若是 ECB 模式，则参数 iv 可直接用 NULL 替换。 2. 大量数据作为一整体但分多块进行 CBC 加密时，需注意： 第 X 块数据（X>1）调用本函数进行加密，使用的初始向量 IV（IV = iv）一定要更新为第 X-1 块数据调用本函数进行加密得到的密文的最后一个分组（8 字节）。 3. 大量数据作为一整体但分多块进行 CBC 解密时，需注意： 第 X 块数据（X>1）调用本函数进行解密，使用的初始向量 IV（IV = iv）一定要更新为第 X-1 块数据的最后一个分组（8 字节）。 4.调用方式请参考附录一和附录二。

2.3.3.DES/TDES关闭

DES_Close	关闭 DES/TDES 算法时钟和系统时钟
函数原型	void DES_Close(void)
参数说明	
返回值	

2.3.4. 获取DES/TDES库版本信息

DES_Version	获取 DES/TDES 库版本信息								
函数原型	<code>void DES_Version(u8 *type, u8 *customer, u8 date[3], u8 *version)</code>								
参数说明	<table><tr><td><code>type</code></td><td>商业或快速版本</td></tr><tr><td><code>customer</code></td><td>标准或定制版本</td></tr><tr><td><code>date</code></td><td>年, 月, 日</td></tr><tr><td><code>Version</code></td><td>版本 x.x</td></tr></table>	<code>type</code>	商业或快速版本	<code>customer</code>	标准或定制版本	<code>date</code>	年, 月, 日	<code>Version</code>	版本 x.x
<code>type</code>	商业或快速版本								
<code>customer</code>	标准或定制版本								
<code>date</code>	年, 月, 日								
<code>Version</code>	版本 x.x								
返回值									
注意事项	<pre>*type = 0x05; // 商业和快速版 *customer = 0x00; // 标准版本 date[0] = 18; //Year date[1] = 12; //Month date[2] = 28; //Day *version = 0x10; //表示版本 1.0</pre>								

3. AES算法API说明

3.1. 算法库使用方法

算法库使用方法如下：

1. 将 n32h47x_48x_aes.h 、 n32h47x_48x_Type.h 、 n32h47x_48x_algo_common.h 中； 将 n32h47x_48x_algo_common.lib、 n32h47x_48x_aes.lib 程中；
2. 按 3.3 节函数说明调用函数，例程见附录三提供的 demo

3.2. 数据类型定义

```
#define AES_ECB (0x11111111)
#define AES_CBC (0x22222222)
#define AES_CTR (0x33333333)
#define AES_ENC (0x44444444)
#define AES_DEC (0x55555555)

enum
{
    AES_Crypto_OK = 0x0,    //AES opreation success
    AES_Init_OK = 0x0,    //AES Init opreation success
    AES_Crypto_ModeError = 0x5a5a5a5a,    //Working mode error(Neither ECB nor CBC nor CTR)
    AES_Crypto_EnOrDeError,    //En&De error(Neither encryption nor decryption)
    AES_Crypto_ParaNull,    // the part of input(output/iv) Null
    AES_Crypto_LengthError,    // if Working mode is ECB or CBC,the length of input message must
    be 4 times and cannot be zero;
                                //if Working mode is CTR,the length of input message cannot be
    zero; others: return AES_Crypto_LengthError

    AES_Crypto_KeyLengthError, //the keyWordLen must be 4 or 6 or 8; others:return
```

```

AES_Crypto_UnInitError, //AES uninitialized
};

typedef struct
{
    uint32_t *in;    // the part of input to be encrypted or decrypted
    uint32_t *iv;    // the part of initial vector
    uint32_t *out;   // the part of out
    uint32_t *key;   // the part of key
    uint32_t keyWordLen; // the length(by word) of key
    uint32_t inWordLen; // the length(by word) of plaintext or cipher
    uint32_t En_De; // 0x44444444 - encrypt, 0x55555555 - decrypt
    uint32_t Mode; // 0x11111111 - ECB, 0x22222222 - CBC, 0x33333333 - CTR
}AES_PARM;

```

3.3. 函数接口说明

AES 算法库包含的函数列表如下：

表 3-1 AES 算法库函数表

函数	描述
u32 AES_Init(AES_PARM *parm)	AES 初始化
u32 AES_Crypto(AES_PARM *parm)	AES 加解密函数
void AES_Close(void)	AES 关闭函数
void AES_Version(u8 *type, u8 *customer, u8 date[3], u8 *version)	AES 版本获取函数

3.3.1. AES算法初始化

AES_Init

AES 算法初始化

函数原型 u32 AES_Init(AES_PARM *parm)

参数说明	parm	输入，指向 AES_PARM 结构体的指针
返回值	AES_Init_OK: 运算正确	其他: 运算错误
注意事项	1.调用方式请参考附录三。	

3.3.2.AES算法加解密

AES_Crypto	AES 算法加解密	
函数原型	u32 AES_Crypto(AES_PARM *parm)	
参数说明	parm	输入，指向 AES_PARM 结构体的指针
返回值	AES_Crypto_OK: 运算正确	其他: 运算错误
注意事项	在调用本函数前，若还未初始化或已切换到其他算法，先调用 AES_Init 函数； 1.调用方式请参考附录三。	

3.3.3.关闭AES

AES_Close	关闭 AES 算法时钟和系统时钟	
函数原型	void AES_Close(void)	
参数说明		
返回值		

3.3.4 获取AES库版本信息

AES_Version	获取 AES 库版本信息	
函数原型	void AES_Version(u8 *type, u8 *customer, u8 date[3], u8 *version)	
参数说明	type	商业或快速版本
	customer	标准或定制版本

date 年, 月, 日
version 版本 x.x

返回值

注意事项

```
*type = 0x05; // 商业和快速版  
*customer = 0x00; // 标准版本  
date[0] = 18; //Year  
date[1] = 12; //Month  
date[2] = 28; //Day  
*version = 0x10; //表示版本 1.0
```

4. HASH算法API说明

包括 SHA1/SHA224/SHA256/MD5/SM3 算法库。

4.1. 算法库使用方法

数据输入及输出均采用字节大端顺序。算法库使用方法如下：

1. 将 n32h47x_48x_Type.h、n32h47x_48x_hash.h、n32h47x_48x_algo_common.h 加入头文件夹中，将 n32h47x_48x_algo_common.lib、n32h47x_48x_hash.lib 添加到工程中；
2. 按 4.3 节函数说明调用函数，例程见附录四提供的 demo

4.2. 数据类型定义

enum

```
{  
  
    HASH_SEQUENCE_TRUE = 0x0105A5A5, //save IV  
    HASH_SEQUENCE_FALSE = 0x010A5A5A, //not save IV  
  
    HASH_Init_OK = 0, //hash init success  
    HASH_Start_OK = 0, //hash update success  
    HASH_Update_OK = 0, //hash update success  
    HASH_Complete_OK = 0, //hash complete success  
    HASH_Close_OK = 0, //hash close success  
    HASH_ByteLenPlus_OK = 0, //byte length plus success  
    HASH_PadMsg_OK = 0, //message padding success  
    HASH_ProcMsgBuf_OK = 0, //message processing success  
  
    SHA1_Hash_OK = 0, //sha1 operation success  
    SM3_Hash_OK = 0, //sm3 operation success  
    SHA224_Hash_OK = 0, //sha224 operation success  
    SHA256_Hash_OK = 0, //sha256 operation success
```

MD5_Hash_OK = 0, //MD5 operation success

HASH_Init_ERROR = 0x01044400, //hash init error

HASH_Start_ERROR, //hash start error

HASH_Update_ERROR, //hash update error

HASH_ByteLenPlus_ERROR, //hash byte plus error

};

typedef struct _HASH_CTX HASH_CTX;

typedef struct

```
{  
  
    const uint16_t HashAlgID; //choice hash algorithm  
  
    const uint32_t * const K, KLen; //K and word length of K  
  
    const uint32_t * const IV, IVLen; //IV and word length of IV  
  
    const uint32_t HASH_SACCR, HASH_HASHCTRL; //relate registers  
  
    const uint32_t BlockByteLen, BlockWordLen; //byte length of block, word length of block  
  
    const uint32_t DigestByteLen, DigestWordLen; //byte length of digest, word length of digest  
  
    const uint32_t Cycle; //iteration times  
  
    uint32_t (* const ByteLenPlus)(uint32_t *, uint32_t); //function pointer  
  
    uint32_t (* const PadMsg)(HASH_CTX *); //function pointer  
  
}HASH_ALG;
```

typedef struct _HASH_CTX_

```
{  
  
    const HASH_ALG    *hashAlg; //pointer to HASH_ALG  
  
    uint32_t    sequence;    // TRUE if the IV should be saved  
  
    uint32_t    IV[16];  
  
    uint32_t    msgByteLen[4];
```

```
uint8_t      msgBuf[128+4];

uint32_t      msgIdx;

}HASH_CTX;
```

4.3. 函数接口说明

HASH 算法库包含的函数列表如下：

表 4-1 HASH 算法库函数表

函数	描述
u32 HASH_Init(HASH_CTX *ctx)	HASH 初始化函数
u32 HASH_Start(HASH_CTX *ctx)	HASH 分步杂凑开始运算函数
u32 HASH_Update(HASH_CTX *ctx, u8 *in, u32 byteLen)	HASH 分步杂凑处理函数
u32 HASH_Complete(HASH_CTX *ctx, u8 *out)	HASH 分步杂凑完成函数
u32 HASH_Close(void)	关闭 HASH 函数
void HASH_Version(u8 *type, u8 *customer, u8 date[3], u8 *version)	获取 HASH 算法库版本

4.3.1. HASH初始化

HASH_Init	<u>HASH 初始化</u>
函数原型	u32 HASH_Init(HASH_CTX *ctx)
参数说明	ctx 输入，指向 HASH_CTX 结构体的指针
返回值	HASH_Init_OK：运算正确 其他值：运算错误
注意事项	1. ctx 必须指向 RAM 区，且指向的内容不可更改(为杂凑计算的中间状态和临时内容存储)，下同 2. 分步计算一段消息的杂凑值时，必须先调用本函数

4.3.2. HASH启动运算

HASH_Start	<u>HASH 启动运算</u>
-------------------	------------------

函数原型	u32 HASH_Start(HASH_CTX *ctx)
参数说明	ctx 输入，指向 HASH_CTX 结构体的指针
返回值	HASH_Start_OK: 运算正确 其他值: 运算错误
注意事项	1. 若需要 HASH 运算过程中支持中断，将 ctx->sequence 置为 HASH_SEQUENCE_TRUE，在中断结束后需要重新调用 HASH_Init 函数，然后 再调用 HASH_Update 函数；否则，置为 HASH_SEQUENCE_FALSE。 2.调用方式请参考附录四。

4.3.3.HASH分步处理数据

HASH_Update	HASH 分步处理数据
函数原型	u32 HASH_Update(HASH_CTX *ctx, u8 *in, u32 byteLen)
参数说明	ctx 输入，指向 HASH_CTX 结构体的指针 in 输入，指要杂凑的信息 byteLen 输入，指杂凑信息的字节长度
返回值	HASH_Update_OK: 运算正确 其他值: 运算错误
注意事项	在调用本函数前，若还未初始化或已切换到其他算法，先调用 HASH_Init 和 HASH_Start 函数； 1. 调用此函数前必须先调用初始化函数 HASH_Init 和 HASH_Start 2. ctx 必须指向 RAM 区，且指向的内容不可更改(为杂凑计算的中间状态和临时内容存储)。 3. in 内容可指向 RAM 或 Flash 区，in 可以是 NULL，计算结果为 NULL 的摘要值。 4. byteLen 可以是 0 或者 NULL，计算结果为 NULL 的摘要值 5. 初始化后，对一整块消息可任意分割成多小块，对每一小块消息可依次调用此函数，最后调用 HASH_Complete 函数，即可得到这一整块消息的杂凑结果。

- 6.若需要级联应用，需要将 `ctx->sequence = HASH_SEQUENCE_TRUE`，把外部的 IV 拷贝到 `ctx->IV`，并且把已 Update 的数据长度 `len` 用 `ctx->hashAlg->ByteLenPlus(ctx->msgByteLen,len)`加到 `ctx->msgByteLen`，然后调用 `HASH_Update` 函数，才能级联成功。
7. 调用方式请参考附录四。

4.3.4.HASH完成并取结果

HASH_Complete	HASH 完成并取结果
函数原型	u32 HASH_Complete(HASH_CTX *ctx, u8 *out)
参数说明	ctx 输入，指向 HASH_CTX 结构体的指针 out 输出，指向 HASH 结果的指针
返回值	HASH_Complete_OK: 运算正确 其他值: 运算错误
注意事项	在调用本函数前，若还未初始化或已切换到其他算法，先调用 <code>HASH_Init</code> 和 <code>HASH_Start</code> 函数； 1. 消息输入完毕，调用此函数才能获得最终结果， 2. ctx 必须指向 RAM 区，且指向的内容不可更改(为杂凑计算的中间状态和临时内容存储)。 3.调用方式请参考附录四。

4.3.5.HASH运算关闭

HASH_Close	HASH 运算关闭
函数原型	u32 HASH_Close(void)
参数说明	
返回值	HASH_Close_OK: 运算正确
注意事项	

4.3.6. 获取HASH库版本信息

HASH_Version

获取 HASH 库版本信息

函数原型

void HASH_Version(u8 *type, u8 *customer, u8 date[3], u8 *version)

参数说明

type 商业或快速版本
customer 标准或定制版本
date 年，月，日
version 版本 x.x

返回值

注意事项

*type = 0x05; // 商业和快速版
*customer = 0x00; // 标准版本
date[0] = 18; //Year()
date[1] = 12; //Month()
date[2] = 28; //Day ()
*version = 0x10; //表示版本 1.0

5. SM4算法API说明

5.1. 算法库使用方法

算法库使用方法如下：

1. 将 n32h47x_48x_sm4.h、n32h47x_48x_Type.h、n32h47x_48x_algo_common.h 加入头文件夹中，将 n32h47x_48x_algo_common.lib、n32h47x_48x_sm4.lib 添加到工程中；
2. 按 5.3 节函数说明调用函数，例程见附录五提供的 demo

5.2. 数据类型定义

```
#define SM4_ECB (0x11111111)
#define SM4_CBC (0x22222222)
#define SM4_ENC (0x33333333)
#define SM4_DEC (0x44444444)
enum{
    SM4_Crypto_OK=0, //SM4 operation success
    SM4_Init_OK=0, //SM4 Init operation success
    SM4_ADRNULL =0x27A90E35, //the address is NULL
    SM4_ModeErr, //working mode error(Neither ECB nor CBC)
    SM4_EnDeErr, // En&De error(Neither encryption nor decryption)
    SM4_LengthErr, //the word length of input error(the word length is 0 or is not as times as 4)
    SM4_UnInitError, //SM4 uninitialized
};

typedef struct{
    uint32_t *in; // the first part of input to be encrypted or decrypted
    uint32_t *iv; // the first part of initial vector
    uint32_t *out; // the first part of out
```

```
uint32_t *key; // the first part of key

uint32_t inWordLen; //the word length of input or output

uint32_t EnDeMode; //encrypt/decrypt

uint32_t workingMode; // ECB/CBC

}SM4_PARM;
```

5.3. 函数接口说明

SM4 算法库包含的函数列表如下：

表 6-1 SM4 算法库函数表

函数	描述
u32 SM4_Init(SM4_PARM *parm)	SM4 算法初始化函数
u32 SM4_Crypto(SM4_PARM *parm)	SM4 算法加密/解密
void SM4_Close(void)	SM4 算法关闭
void SM4_Version(u8 *type, u8 *customer, u8 date[3], u8 *version)	获取 SM4 库版本信息

5.3.1. SM4模块初始化

SM4_Init	初始化 SM4 模块
函数原型	u32 SM4_Init(SM4_PARM *parm)
参数说明	parm 输入，指向 SM4_PARM 结构体的指针
返回值	SM4_Init_OK：运算正确 其他值：计算错误，详见枚举类型值定义
注意事项	

5.3.2. SM4算法加解密

SM4_Crypto	SM4 模块算法加解密
函数原型	u32 SM4_Crypto(SM4_PARM *parm)
参数说明	parm 输入，指向 SM4_PARM 结构体的指针

返回值	SM4_Crypto_OK: 运算正确 其他值: 计算错误, 详见枚举类型值定义
注意事项	在调用本函数前, 若还未初始化或已切换到其他算法, 先调用 SM4_Init 函数; 1. 结构体 SM4_PARM 参考 6.2 节 <i>SM4_PARM 的定义</i>。 2. 若是 ECB 模式, 则参数 iv1 可直接用 NULL 替换 3. 大量数据作为一整体但分多块进行 CBC 加密时, 需注意: 第 X 块数据 (X>1) 调用本函数进行加密, 使用的初始向量 IV (IV = iv1) 一定要更新为第 X-1 块数据调用本函数进行加密得到的密文的最后一个分组 (16 字节)。 4. 大量数据作为一整体但分多块进行 CBC 解密时, 需注意: 第 X 块数据 (X>1) 调用本函数进行解密, 使用的初始向量 IV (IV = iv1) 一定要更新为第 X-1 块数据的最后一个分组 (16 字节)

5.3.3. SM4关闭

SM4_Close	关闭 SM4 算法时钟和系统时钟
函数原型	void SM4_Close(void)
参数说明	
返回值	
注意事项	

5.3.4. 获取SM4库版本信息

SM4_Version	获取 SM4 库版本信息								
函数原型	void SM4_Version(u8 *type, u8 *customer, u8 date[3], u8 *version)								
参数说明	<table><tr><td>type</td><td>商业或快速版本</td></tr><tr><td>customer</td><td>标准或定制版本</td></tr><tr><td>date</td><td>年, 月, 日</td></tr><tr><td>version</td><td>版本 x.x</td></tr></table>	type	商业或快速版本	customer	标准或定制版本	date	年, 月, 日	version	版本 x.x
type	商业或快速版本								
customer	标准或定制版本								
date	年, 月, 日								
version	版本 x.x								
返回值									

注意事项

```
*type = 0x05; // 商业和快速版  
*customer = 0x00; // 标准版本  
date[0] = 18; //Year  
date[1] = 12; //Month  
date[2] = 28; //Day  
*version = 0x10; //表示版本 1.0
```

6. RNG算法API说明

6.1. 算法库使用方法

算法库使用方法如下：

- 1、将 n32h47x_48x_Type.h、n32h47x_48x_rng.h、n32h47x_48x_algo_common_1B.h 加入头文件夹中，将 n32h47x_48x_algo_common.lib 、n32h47x_48x_rng.lib 添加到工程中；
- 2、按 6.3 节函数说明调用函数。

6.2. 数据类型定义

```
enum{
    RNG_OK = 0x5a5a5a5a,
    LENError = 0x311ECF50,    //RNG generation of key length error
    ADDRNULL = 0x7A9DB86C,    // This address is empty
};
```

6.3. 函数接口说明

RNG 算法库包含的函数列表如下：

表 7-1 RNG 算法库函数表

函数	描述
u32 GetPseudoRand_U32(u32 *rand, u32 wordLen,u32 seed[2])	伪随机数按 word 生成函数
u32 GetTrueRand_U32(u32 *rand, u32 wordLen)	真随机数按字生成函数
void RNG_Version(u8 *type, u8 *customer, u8 date[3], u8 *version)	获取 RNG 库版本信息

6.3.1. 伪随机生成函数

GetPseudoRand_U32	伪随机数按 word 生成函数
--------------------------	-----------------

函数原型	u32 GetPseudoRand_U32(u32 *rand, u32 wordLen, u32 seed[2])
参数说明	rand 指针，指向生成的随机数 wordlen: 拟获取伪随机数word长 seed[2] 输入，伪随机种子变量数组
返回值	RNG_OK 成功；其他 生成伪随机数出错
说明	按word生成伪随机数
注意事项	1. 用户可输入种子数组，如果用户输入seed为NULL，则内部自动生成种子；

6.3.2. 随机数生成函数

GetTrueRand_U32真随机数生成函数

函数原型	u32 GetTrueRand_U32(u32 *rand, u32 wordLen)
参数说明	rand: 指针，指向生成的随机数某内存地址 wordLen: 拟获取真随机数的字长度
返回值	RNG_OK 成功；其他：生成真随机数出错，详见枚举类型值定义
注意事项	

6.3.3. 获取RNG库版本信息

RNG_Version 获取 RNG 库版本信息

函数原型	void RNG_Version(u8 *type, u8 *customer, u8 date[3], u8 *version)
参数说明	type 商业或快速版本 customer 标准或定制版本 date 年，月，日 version 版本 x.x
返回值	
注意事项	*type = 0x05; // 商业和快速版 *customer = 0x00; // 标准版本

```
date[0] = 18; //Year  
date[1] = 12; //Month  
date[2] = 28; //Day  
*version = 0x10; //表示版本 1.0
```

7. 历史版本

版本	日期	备注
V1.0.0	2024.12.04	新建文档

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i. 附录一 DES 算法库函数调用例程

```
u32 DES_test()
{
    u32 i,flag1,flag2,flag3,flag4;
    u32 ret;
    DES_PARM DES_Parm={0};

    /*若需要修改测试实例，当参数的真实值为“0x0102030405060708”时，由于 u32 数据是字节小
    端序存储，在对以上参数进行初始化赋值时，请输入“0x04030201,0x08070605”.若无特殊说明，本
    例程参数都以这种方式设置*/

    u32 in1 [16]={
        0x5FE2D4C0,0xAEAE3F30,0x692930A8,0x1DA69A51,0xDD34B34B,0xAF8D237A,0x2114F489,
        0xE461FF17,0x47C795FD,0x8FF62B49,0x62E9BD63,0x1AF52817,0xECB9DFD4,0xE04421C9,
        0x87B4B22E,0x9FF98759
    };

    u32 key1 [2]={0x946AB06B,0x2276E632};

    u32 iv1 [2]={0x482A8C66,0xC324FC78};

    u32 out[16];

    u32 DES_ECB_EN[16]={0x2FD8D31F,0xC3E2E705,0x4B6D1C4C,0x31EB4154,0xDA273EEC,
        0x8EED57DA,0x26FDE038,0x15B0D57D,0xBCE7464F,0x78D7997A,
        0x4F9917D7,0xAE9C1DA9,0x749FEAEE,0xDFE6A911,0x34D556D5,
        0xA32FA0A2};

    /*DES_ECB_EN=0x1FD3D82F05E7E2C34C1C6D4B5441EB31EC3E27DADA57ED8E38E0FD26
    7DD5B0154F46E7BC7A99D778D717994FA91D9CAEEEEA9F7411A9E6DFD556D534A2A02FA3*/
```

```
u32 DES_ECB_DE[16]={0xBD77D94A,0xCF5698BB,0xF113743F,0x0FCFC898,0x7DD21DA8,  
0x3908A674,0x65303E6C,0x56CB0E02,0xF0B14651,0x3BBB36AB,  
0x8C129CC3,0xC42D5DD0,0x74549F20,0x5A7E5029,0xE5334FE2,  
0xD5ED9CA8};
```

```
/*DES_ECB_DE=0x4AD977BDBB9856CF3F7413F198C8CF0FA81DD27D74A608396C3E30650  
20ECB565146B1F0AB36BB3BC39C128CD05D2DC4209F547429507E5AE24F33E5A89CEDD5*/
```

```
u32 DES_CBC_EN[16]={0x236813B0,0x14D3A0CA,0xDB57CA2F,0x073FADB0,0x83577985,  
0x7DEBA1CB,0xD5410854,0x2C0E74D8,0x8B8019BB,0xBAB789EF,  
0xF93DEC2E,0xD1BFE8F4,0xE061C81D,0x2F620219,0x662759FF,  
0x77CABBF6};
```

```
/*DES_CBC_EN=0xB0136823CAA0D3142FCA57DBB0AD3F0785795783CBA1EB7D540841D5  
D8740E2CBB19808BEF89B7BA2EEC3DF9F4E8BFD11DC861E01902622FFF592766F6BBCA77*/
```

```
u32 DES_CBC_DE[16]={0xF55D552C,0x0C7264C3,0xAEF1A0FF,0xA161F7A8,0x14FB2D00,  
0x24AE3C25,0xB8048D27,0xF9462D78,0xD1A5B2D8,0xDFDAC9BC,  
0xCBD5093E,0x4BDB7699,0x16BD2243,0x408B783E,0x098A9036,  
0x35A9BD61};
```

```
/*DES_CBC_DE=0x2C555DF5C364720CFFA0F1AEA8F761A1002DFB14253CAE24278D04B87  
82D46F9D8B2A5D1BCC9DADF3E09D5CB9976DB4B4322BD163E788B4036908A0961BDA935*/
```

```
Cpy_U32(out, in1,16);
```

```
DES_Parm.in = out;
```

```
DES_Parm.key = key1;
```

```
DES_Parm.out = out;
```

```
DES_Parm.inWordLen = 16;
```

```
DES_Parm.keyMode = DES_KEY;
```

```
DES_Parm.Mode = DES_ECB;
```

```
DES_Parm.En_De = DES_ENC;
```

```
ret = DES_Init(&DES_Parm);
ret = DES_Crypto(&DES_Parm);
DES_Close();
if (ret!= DES_Crypto_OK)
{
    flag1=0x5A5A5A5A;
}
else
{
    if(Cmp_U32(DES_ECB_EN,16, out,16))
    {
        flag1=0x5A5A5A5A;
    }
    else
    {
        flag1=0;
    }
}
Cpy_U32(out, in1,16);
DES_Parm.En_De = DES_DEC;
ret = DES_Init(&DES_Parm);
ret=(DES_Crypto(&DES_Parm));
DES_Close();
if (ret!= DES_Crypto_OK)
{
    flag2=0x5A5A5A5A;
}
else
{
```

```
    if(Cmp_U32(DES_ECB_DE,16, out,16))
    {
        flag2=0x5A5A5A5A;
    }
    else
    {
        flag2=0;
    }
}
Cpy_U32(out, in1,16);
DES_Parm.iv = iv1;
DES_Parm.Mode = DES_CBC;
DES_Parm.En_De = DES_ENC;
ret = DES_Init(&DES_Parm);
ret=(DES_Crypto(&DES_Parm));
DES_Close();
if (ret!= DES_Crypto_OK)
{
    flag3=0x5A5A5A5A;
}
else
{
    if(Cmp_U32(DES_CBC_EN,16, out,16))
    {
        flag3=0x5A5A5A5A;
    }
    else
    {
        flag3=0;
    }
}
```

```
    }  
}  
  
Cpy_U32(out, in1,16);  
  
DES_Parm.iv = iv1;  
  
DES_Parm.En_De = DES_DEC;  
ret = DES_Init(&DES_Parm);  
  
ret=(DES_Crypto(&DES_Parm));  
  
DES_Close();  
  
if (ret!= DES_Crypto_OK)  
{  
    flag4=0x5A5A5A5A;  
}  
else  
{  
    if(Cmp_U32(DES_CBC_DE,16, out,16))  
    {  
        flag4=0x5A5A5A5A;  
    }  
    else  
    {  
        flag4=0;  
    }  
}  
  
if (flag1|flag2|flag3|flag4)  
{  
    return 0x5A5A5A5A;  
}  
else
```

```
{  
    return 0;  
}  
}
```

ii.附录二 TDES算法库函数调用例程

```
u32 TDES_2Key_test()
```

```
{
```

```
    u32 i,flag1,flag2,flag3,flag4;
```

```
    u32 ret;
```

```
    DES_PARM TDES_Parm={0};
```

/*若需要修改测试实例，当参数的真实值为“0x0102030405060708”时，由于 u32 数据是字节小端序存储，在对以上参数进行初始化赋值时，请输入“0x04030201,0x08070605”.若无特殊说明，本例程参数都以这种方式设置*/

```
    u32 in1[16]={
```

```
        0x3C7EB08D,0xAFD2FDE9,0x22245D10,0x148AE53D,0xC70F11D1,0x0813FEDF,
```

```
        0xED8A71D7,0xA66B2FAA,0x137DAC5A,0x9A7850D6,0xFDE9C4AB,0xC1C6856E,
```

```
        0x05CDB663,0xF7D812E4,0x86341DEB,0xBA52B237
```

```
    };
```

```
    u32 key1[4]={0x81F08C18,0x5C6BE38C,0x4D6A6563,0xFF220031};
```

```
    u32 iv1[2]={0xB5CC3A62,0xC96EF050};
```

```
    u32 out[16];
```

```
    u32 TDES_ECB_EN[16]={0x42976179,0x3A15FDA5,0x278639E4,0x3F4D2DDD,0x987EAF74,
```

```
    0x17376CD5,0x9BE1CAB1,0x5501A0BA,0xD18D511B,0x11054F45,
```

```
    0x7EAC1828,0x375B9DAD,0x3823A312,0x8EE802FF,0xF2F00328,
```

```
    0x3F81CF19};
```

```
    /*TDES_ECB_EN=0x79619742A5FD153AE4398627DD2D4D3F74AF7E98D56C3717B1CAE19B  
    BAA001551B518DD1454F05112818AC7EAD9D5B3712A32338FF02E88E2803F0F219CF813F*/
```

```
u32 TDES_ECB_DE[16]={0x58AD407C,0x76B43ED7,0x23B44DDA,0x22EC376C,0x50311263,  
0xECC57D42,0x2FA5ADAA,0xE7A099A0,0x287DBD9B,0x3951FD62,  
0x530A3728,0x9AAFA2D3,0x0C41708F,0x5BFE1BCC,0x3B21EE97,  
0xE29E749A};
```

```
/*TDES_ECB_DE=0x7C40AD58D73EB476DA4DB4236C37EC2263123150427DC5ECAAADA5  
2FA099A0E79BBD7D2862FD513928370A53D3A2AF9A8F70410CCC1BFE5B97EE213B9A749EE2*/
```

```
u32 TDES_CBC_EN[16]={0x3723A485,0x3E2EEB10,0x9E5434C4,0x2692C8FD,0x978D5743,  
0x10CBCFD7,0x873A396C,0xD9CF6AEB,0x5C8953FC,0xD62F3744,  
0xDE2D0B60,0x1DA22B35,0x00793D6F,0x543CD424,0x833BE660,  
0x05703F52};
```

```
/*TDES_CBC_EN=0x85A4233710EB2E3EC434549EFDC8922643578D97D7CFCB106C393A87E  
B6ACFD9FC53895C44372FD6600B2DDE352BA21D6F3D790024D43C5460E63B83523F7005*/
```

```
u32 TDES_CBC_DE[16]={0xED617A1E,0xBFDAACE87,0x1FCAFD57,0x8D3ECA85,0x72154F73,  
0xF84F987F,0xE8AABC7B,0xEFB3677F,0xC5F7CC4C,0x9F3AD2C8,  
0x40779B72,0x00D7F205,0xF1A8B424,0x9A389EA2,0x3EEC58F4,  
0x1546667E};
```

```
/*TDES_CBC_DE=0x1E7A61ED87CEDABF57FDCA1F85CA3E8D734F15727F984FF87BBCAA  
E87F67B3EF4CCCF7C5C8D23A9F729B774005F2D70024B4A8F1A29E389AF458EC3E7E664615*/
```

```
TDES_Parm.in = in1;
```

```
TDES_Parm.key = key1;
```

```
TDES_Parm.out = out;
```

```
TDES_Parm.inWordLen = 16;
```

```
TDES_Parm.keyMode = TDES_2KEY;
```

```
TDES_Parm.Mode = DES_ECB;
```

```
TDES_Parm.En_De = DES_ENC;
```

```
ret = DES_Init(&TDES_Parm);
ret=(DES_Crypto(&TDES_Parm));
DES_Close();
if (ret!= DES_Crypto_OK)
{
    flag1=0x5A5A5A5A;
}
else
{

if(Cmp_U32(TDES_ECB_EN,16, out,16))
{
    flag1=0x5A5A5A5A;
}
else
{
    flag1=0;
}
}
```

```
TDES_Parm.En_De = DES_DEC;
ret = DES_Init(&TDES_Parm);
ret=(DES_Crypto(&TDES_Parm));
DES_Close();
if (ret!= DES_Crypto_OK)
{
    flag2=0x5A5A5A5A;
}
else
```

```
{

    if(Cmp_U32(TDES_ECB_DE,16, out,16))
    {
        flag2=0x5A5A5A5A;
    }
    else
    {
        flag2=0;
    }
}

TDES_Parm.iv = iv1;
TDES_Parm.Mode = DES_CBC;
TDES_Parm.En_De = DES_ENC;
ret = DES_Init(&TDES_Parm);
ret=(DES_Crypto(&TDES_Parm));
DES_Close();
if (ret!= DES_Crypto_OK)
{
    flag3=0x5A5A5A5A;
}
else
{

    if(Cmp_U32(TDES_CBC_EN,16, out,16))
    {
        flag3=0x5A5A5A5A;
    }
}
```

```
        else
        {
            flag3=0;
        }
    }

    TDES_Parm.iv = iv1;
    TDES_Parm.En_De = DES_DEC;
    ret = DES_Init(&TDES_Parm);
    ret=(DES_Crypto(&TDES_Parm));
    DES_Close();
    if (ret!= DES_Crypto_OK)
    {
        flag4=0x5A5A5A5A;
    }
    else
    {

        if(Cmp_U32(TDES_CBC_DE,16, out,16))
        {
            flag4=0x5A5A5A5A;
        }
        else
        {
            flag4=0;
        }
    }

    if (flag1|flag2|flag3|flag4)
```

```
{  
    return 0x5A5A5A5A;  
}  
else  
{  
    return 0;  
}  
}
```

u32 TDES_3Key_test()

```
{  
    u32 i,flag1,flag2,flag3,flag4,ret=0;  
    DES_PARM TDES_Parm={0};  
    u32 in1[16]= {  
  
        0x3C7EB08D,0xAFD2FDE9,0x22245D10,0x148AE53D,0xC70F11D1,0x0813FEDF,0xED8A71D7,  
        0xA66B2FAA,  
  
        0x137DAC5A,0x9A7850D6,0xFDE9C4AB,0xC1C6856E,0x05CDB663,0xF7D812E4,0x86341DEB  
        ,0xBA52B237  
    };  
    u32 key1[6]={0x675BE5D2,0x1641A6AD,0x14531A6B,0xEBFA006E,0x90DFD0CD,0x2D029B93};  
  
    u32 iv1[2]={0xB5CC3A62,0xC96EF050};  
  
    u32 out[16];
```

u32

TDES_ECB_EN[16]={0x5D6C633C,0x8EDFC4C7,0x3D02A02C,0x97431789,0x83EF4C36,0xFF591C
67,0xE869DB08,0xAB82D05B,

0x11771439,0xDC6F79BB,0x5B46D128,0xF52114F5,0x2C758CB4,0x1A4D1A6A,0x0DC3FBCA,0x82
222BB2};

u32

TDES_ECB_DE[16]={0x6780A75A,0x62EC1AC8,0xD0341FF5,0x2260C44E,0xF2720589,0xB0EBBB
E0,0xBFE0991D,0x1EA78C1C,

0xBAB53D00,0xE3FA25D6,0x9430DEF4,0xC465511C,0xEE9D2DFB,0x9796AADC,0x4FFFEF58,0x1
72D00A2};

u32

TDES_CBC_EN[16]={0x048BD8AD,0xF98F2C51,0x5F6FD563,0xA26A1038,0x8017FC81,0xBBD5A
F4C,0x0A7AEFF,0xB7D428A1,

0x316E31F7,0xD8F283E1,0xDDD4395F,0x8076C2D0,0x0434D1E9,0xD1A94D4D,0xFF3E3B5E,0x77
C93116};

u32

TDES_CBC_DE[16]={0xD24C9D38,0xAB82EA98,0xEC4AAF78,0x8DB239A7,0xD0565899,0xA4615
EDD,0x78EF88CC,0x16B472C3,

0x573F4CD7,0x45910A7C,0x874D72AE,0x5E1D01CA,0x1374E950,0x56502FB2,0x4A32593B,0xE0F
51246};

TDES_Parm.in = in1;

TDES_Parm.key = key1;

TDES_Parm.out = out;

TDES_Parm.inWordLen = 16;

```
TDES_Parm.keyMode = TDES_3KEY;

TDES_Parm.Mode = DES_ECB;

TDES_Parm.En_De = DES_ENC;

ret = DES_Init(&TDES_Parm);

DES_Crypto(&TDES_Parm);

DES_Close();


if(Cmp_U32(TDES_ECB_EN,16, out,16))
{
    flag1=0x5A5A5A5A;
}
else
{
    flag1=0;
}


TDES_Parm.En_De = DES_DEC;

ret = DES_Init(&TDES_Parm);

DES_Crypto(&TDES_Parm);

DES_Close();


if(Cmp_U32(TDES_ECB_DE,16, out,16))
{
    flag2=0x5A5A5A5A;
}
else
{
    flag2=0;
}
```

```
TDES_Parm.iv = iv1;

TDES_Parm.Mode = DES_CBC;
TDES_Parm.En_De = DES_ENC;
ret = DES_Init(&TDES_Parm);
DES_Crypto(&TDES_Parm);
DES_Close();

if(Cmp_U32(TDES_CBC_EN,16, out,16))
{
    flag3=0x5A5A5A5A;
}
else
{
    flag3=0;
}

TDES_Parm.iv = iv1;
TDES_Parm.En_De = DES_DEC;
ret = DES_Init(&TDES_Parm);
DES_Crypto(&TDES_Parm);
DES_Close();

if(Cmp_U32(TDES_CBC_DE,16, out,16))
{
    flag4=0x5A5A5A5A;
}
else
```

```
{  
    flag4=0;  
}  
  
if (flag1|flag2|flag3|flag4)  
{  
    return 0x5A5A5A5A;  
}  
  
else  
{  
    return 0;  
}  
}
```

iii.附录三 AES算法库函数调用例程

```
u32 AES_128_test()
```

```
{
```

```
    u32 flag1,flag2,flag3,flag4,flag5,flag6;
```

```
    u32 ret;
```

```
    AES_PARM AES_Parm={0};
```

/*若需要修改测试实例，当参数的真实值为“0x0102030405060708”时，由于 u32 数据是字节小端序存储，在对以上参数进行初始化赋值时，请输入“0x04030201,0x08070605”.若无特殊说明，本例程参数都以这种方式设置*/

```
    u32 in[32]={0x4A8770A5,0x73C2DA98,0xF52D52D1,0x5F884A46,0x8DCF72D5,0x2A0F207D,
0x7479F5CE,0x3FB5BE9E,0x3D7998FE,0x7C59586D,0x30E1294B,0xB3E17790,
0xCA080CBD,0x2AB47913,0x3B09B803,0x1B410FE7,0xE64237EF,0x3576BE5E,
0xE4D7AAAF6,0x19495FB0,0x812DC3B1,0xDD339F7A,0xBE6F495F,0x8CB0803A,
0xCD0D9760,0xA4C0D6D4,0x98381DBB,0x9769CA10,0x3B67DD99,0x4C335A1A,
0x85D4EFC8,0x9BAAD700};
```

```
    /*in=0xA570874A98DAC273D1522DF5464A885FD572CF8D7D200F2ACEF579749EBEB53FFE9
8793D6D58597C4B29E1309077E1B3BD0C08CA1379B42A03B8093BE70F411BEF3742E65EBE7635
F6AAD7E4B05F4919B1C32D817A9F33DD5F496FBE3A80B08C60970DCDD4D6C0A4BB1D389810
CA699799DD673B1A5A334CC8EFD48500D7AA9B*/
```

```
    u32 key[4]={0x7FDDA35D,0x7D5C725B,0x1960F327,0x4FD9DDA2};
```

```
    /*key=0x5DA3DD7F5B725C7D27F36019A2DDD94F*/
```

```
    u32 iv[4]={0x7B00FE39,0xD3E06638,0xD52BC983,0x38E98017};
```

```
    /*iv=0x39FE007B3866E0D383C92BD51780E938*/
```

```
    u32 out[32];
```

```
u32 AES_ECB_EN[32]={0xB24E5438,0x0145A303,0xC450A27F,0x2ADEEE70,0x906F314E,  
0xB24229AD,0x1312360E,0x949C8B22,0xE2C1BC02,0x1960239E,  
0xCAD2D5E5,0x8DC57DE2,0x13429CE1,0xE8FC0876,0xCA4581DB,  
0x08019050,0x4B2942F8,0xD6073C62,0x113FB648,0x1967CC27,  
0x250B9989,0x861180E0,0x1A450E0C,0x81D727AF,0xB679608E,  
0x53D31669,0x1D071E99,0x42CEB6DB,0x44094205,0xD0331668,  
0x2704B798,0x6E347E9C};
```

```
/*AES_ECB_EN=0x38544EB203A345017FA250C470EEDE2A4E316F90AD2942B20E361213228  
B9C9402BCC1E29E236019E5D5D2CAE27DC58DE19C42137608FCE8DB8145CA50900108F842294  
B623C07D648B63F1127CC671989990B25E08011860C0E451AAF27D7818E6079B66916D353991E07  
1DDBB6CE4205420944681633D098B704279C7E346E*/
```

```
u32 AES_ECB_DE[32]={0x818D1AFD,0xEC4B4F8E,0x69D9F9FF,0x5567B549,0x42DD5C4B,  
0x3BCA1DD3,0xF318E616,0x89297FEC,0x2A3E0A06,0xFDA90D61,  
0x93DCAE5D,0xCF1AFEAE,0x3CF5A889,0x4CFFFEFE3,0xB2C42607,  
0x37D43F8A,0x9C1CD1D8,0x2FE878E8,0x22D941C3,0x239B9D2D,  
0xD9FEB719,0xA4F9E01C,0xC9C39FE8,0x336B01FA,0xFD12E415,  
0x2B6A0006,0x4A35AFBC,0xA7942FAB,0x09DF0A3A,0x9545521B,  
0x7E009336,0x030A5DA5};
```

```
/*AES_ECB_DE=0xFD1A8D818E4F4BECFFF9D96949B567554B5CDD42D31DCA3B16E618F3  
EC7F2989060A3E2A610DA9FD5DAEDC93AEFE1ACF89A8F53CE3EFFF4C0726C4B28A3FD437D  
8D11C9CE878E82FC341D9222D9D9B2319B7FED91CE0F9A4E89FC3C9FA016B3315E412FD06006  
A2BBCAF354AAB2F94A73A0ADF091B5245953693007EA55D0A03*/
```

```
u32 AES_CBC_EN[32]={0x8A83E006,0xAC3AB610,0x0CD2C4CB,0x21F22AA9,0x61963E3C,  
0x992FDE54,0x7E408523,0x749261FF,0xE159802D,0xBC807E3C,  
0x1C16AF67,0xE7574629,0x73573225,0xEE88600D,0x324FE0BB,  
0x7426A48C,0x8EA9E470,0x4DB1BE0F,0x9DC49C2E,0xAD41A05B,  
0x9E7C9143,0x15F55BF2,0xF4E7195D,0x2D9E1E46,0xB78E9809,
```

```
0xF8F831D0,0x12F1890A,0x0CABFF9C,0x49E6FCE6,0x6156CDA5,  
0xFFE38EF7,0x4962AF1D};
```

```
/*AES_CBC_EN=0x06E0838A10B63AACCBC4D20CA92AF2213C3E966154DE2F992385407EF  
F6192742D8059E13C7E80BC67AF161C294657E7253257730D6088EEBBE04F328CA4267470E4A98  
E0FBEB14D2E9CC49D5BA041AD43917C9EF25BF5155D19E7F4461E9E2D09988EB7D031F8F80A  
89F1129CFFAB0CE6FCE649A5CD5661F78EE3FF1DAF6249*/
```

```
u32 AES_CBC_DE[32]={0xFA8DE4C4,0x3FAB29B6,0xBCF2307C,0x6D8E355E,0x085A2CEE,  
0x4808C74B,0x0635B4C7,0xD6A135AA,0xA7F178D3,0xD7A62D1C,  
0xE7A55B93,0xF0AF4030,0x018C3077,0x30A6B78E,0x82250F4C,  
0x8435481A,0x5614DD65,0x055C01FB,0x19D0F9C0,0x38DA92CA,  
0x3FBC80F6,0x918F5E42,0x2D14351E,0x2A225E4A,0x7C3F27A4,  
0xF6599F7C,0xF45AE6E3,0x2B24AF91,0xC4D29D5A,0x318584CF,  
0xE6388E8D,0x946397B5};
```

```
u32 AES_CTR_EN[32]={0xF14C3DA0,0xA74E1089,0x81480939,0x5C8D4E8D,0x655E20AB,  
0x6D797028,0x1E355F48,0x58184929,0x52B1495A,0xC15EB91D,0xFBD499AB,  
0xF59B39FE,0x96DAE1C3,0x6ECC9CDA,0xDA1FB535,0xAA1C74B2,0xA3F19C5E,  
0x9944E1A6,0xDAA05E9A,0xB96278E3,0x1E4915FC,0xB77FBBD2,0x92BA80B9,  
0xCA97857E,0x509D0365,0x78A6FD99,0xB56F5B3C,0xFBEFF5B2,0xF9E928C6,  
0xBC28AE3A,0xD8B82D7A,0xA99BF98D};
```

u32

```
AES_CTR_DE[32]={0x4A8770A5,0x73C2DA98,0xF52D52D1,0x5F884A46,0x8DCF72D5,0x2A0F207  
D,
```

```
0x7479F5CE,0x3FB5BE9E,0x3D7998FE,0x7C59586D,0x30E1294B,0xB3E17790,  
0xCA080CBD,0x2AB47913,0x3B09B803,0x1B410FE7,0xE64237EF,0x3576BE5E,  
0xE4D7AAAF6,0x19495FB0,0x812DC3B1,0xDD339F7A,0xBE6F495F,0x8CB0803A,  
0xCD0D9760,0xA4C0D6D4,0x98381DBB,0x9769CA10,0x3B67DD99,0x4C335A1A,  
0x85D4EFC8,0x9BAAD700};
```

```
/*AES_CBC_DE=0xC4E48DFAB629AB3F7C30F2BC5E358E6DEE2C5A084BC70848C7B43506  
AA35A1D6D378F1A71C2DA6D7935BA5E73040AFF077308C018EB7A6304C0F25821A48358465D  
D1456FB015C05C0F9D019CA92DA38F680BC3F425E8F911E35142D4A5E222AA4273F7C7C9F59F  
6E3E65AF491AF242B5A9DD2C4CF8485318D8E38E6B5976394*/
```

```
Cpy_U32(out, in,32);
```

```
AES_Parm.in = out;
```

```
AES_Parm.key = key;
```

```
AES_Parm.iv = iv;
```

```
AES_Parm.out = out;
```

```
AES_Parm.keyWordLen = 4;
```

```
AES_Parm.inWordLen = 32;
```

```
AES_Parm.Mode = AES_ECB;
```

```
AES_Parm.En_De = AES_ENC;
```

```
ret =AES_Init(&AES_Parm);
```

```
ret = AES_Crypto(&AES_Parm);
```

```
AES_Close();
```

```
if(ret!= AES_Crypto_OK)
```

```
{
```

```
    flag1=0x5A5A5A5A;
```

```
}
```

```
else
```

```
{
```

```
    if(Cmp_U32(AES_ECB_EN, 32, out, 32))
```

```
    {
```

```
        flag1=0x5A5A5A5A;
```

```
    }
    else
    {
        flag1=0;
    }
}
Cpy_U32(out, in,32);
AES_Parm.En_De = AES_DEC;
ret =AES_Init(&AES_Parm);
ret = AES_Crypto(&AES_Parm);
AES_Close();
if(ret!= AES_Crypto_OK)
{
    flag2=0x5A5A5A5A;
}
else
{

    if(Cmp_U32(AES_ECB_DE, 32, out, 32))
    {
        flag2=0x5A5A5A5A;
    }
    else
    {
        flag2=0;
    }
}

//CBC
Cpy_U32(out, in,32);
```

```
AES_Parm.Mode = AES_CBC;
AES_Parm.En_De = AES_ENC;
ret =AES_Init(&AES_Parm);
ret = AES_Crypto(&AES_Parm);
AES_Close();
if(ret!= AES_Crypto_OK)
{
    flag3=0x5A5A5A5A;
}
else
{
    if(Cmp_U32(AES_CBC_EN, 32, out, 32))
    {
        flag3=0x5A5A5A5A;
    }
    else
    {
        flag3=0;
    }
}
Cpy_U32(out, in,32);
AES_Parm.En_De = AES_DEC;
ret =AES_Init(&AES_Parm);
ret = AES_Crypto(&AES_Parm);
AES_Close();
if(ret!= AES_Crypto_OK)
{
    flag4=0x5A5A5A5A;
}
```

```
else
{
    if(Cmp_U32(AES_CBC_DE, 32, out, 32))
    {
        flag4=0x5A5A5A5A;
    }
    else
    {
        flag4=0;
    }
}

//CTR
Cpy_U32(out, in,32);
AES_Parm.Mode = AES_CTR;
AES_Parm.En_De = AES_ENC;
ret =AES_Init(&AES_Parm);
ret = AES_Crypto(&AES_Parm);
AES_Close();
if(ret!= AES_Crypto_OK)
{
    flag5=0x5A5A5A5A;
}
else
{
    if(Cmp_U32(AES_CTR_EN, 32, out, 32))
    {
        flag5=0x5A5A5A5A;
    }
    else
```

```
        {
            flag5=0;
        }
    }
Cpy_U32(out, AES_CTR_EN,32);
    AES_Parm.En_De = AES_DEC;
    ret =AES_Init(&AES_Parm);
    ret = AES_Crypto(&AES_Parm);
    AES_Close();
    if(ret!= AES_Crypto_OK)
    {
        flag6=0x5A5A5A5A;
    }
    else
    {
        if(Cmp_U32(AES_CTR_DE, 32, out, 32))
        {
            flag6=0x5A5A5A5A;
        }
        else
        {
            flag6=0;
        }
    }

    if (flag1|flag2|flag3|flag4|flag5|flag6)
    {
        return 0x5A5A5A5A;
    }
```

```
else
{
    return 0;
}

}

u32 AES_192_test()
{
    u32 flag1,flag2,flag3,flag4,flag5,flag6,ret=0;
    AES_PARM AES_Parm={0};

    u32
in[32]={0x5A42C72C,0x09F16329,0xE9BD742B,0xB403E0FF,0xBA43D804,0xDE77B9E1,0xE1A330
77,0xE3AEA215,

    0x2670CBEB,0x160CA5C2,0x86808BEA,0x3D7A9E73,0xB16E68A0,0x12E5BF98,0x8A18EC5F,
0xC4BD0D05,

    0xAB21B81D,0x7477E171,0xDE6FFE4,0xB80B68F8,0xA4AF05A1,0x1C77249A,0xB2CCA806,
0x9C3A69BA,

    0x6F7CD7A9,0x2BD9E19F,0x78B41533,0x2F5E08F7,0x1C2EF8F1,0x03D4B04F,0xE0EAAAC56,0
x73CC7E9C};

    u32
key[6]={0xA1148977,0xCFA42A1F,0x9D983F36,0x521C1313,0xDAD2CB6F,0xC6254819};

    u32 iv[4]={0xFCAA7077,0x44DB6BB5,0xDC74178D,0xA91A44D6};
```

u32 out[32];

u32

AES_ECB_EN[32]={0x9FCB396D,0xF9A6B55C,0x4CCE7669,0x917CAF2F,0x71F8907D,0xC689393
6,0x5ABA1DFB,0xA933FF81,

0xBD33847F,0x0F1B2F6C,0x1B4AACA7,0xE555E2EE,0x0CBD4683,0x76ECD138,0x7BFE81E8,
0xE05FE788,

0xAF688124,0xED29ACF2,0xCE424458,0x8E304A1C,0xE5A21E6C,0x3C7D433A,0x32DC028D,
0x697F9624,

0xB451070E,0xF82A4488,0x33D99F4C,0x7FBBCC3E,0x8BB01E57,0x0C1EE01B,0x6D96FF7F,0
xDEC84BD8};

u32

AES_ECB_DE[32]={0x41F29D18,0x13C52105,0xB24DBDDD,0x46B6BAB9,0x95F63F1A,0x28B24F
73,0xAA774293,0xA086E548,

0xD446667D,0xF8D67CCE,0x7AC5BD02,0xE43EE791,0x25B857B4,0x30A3D7FB,0x8DB4C416,
0xAE6B0B0C,

0x0F7E89E1,0xBA900B96,0x516EC69B,0xBED1D082,0x3590FD32,0x878C5EE5,0x91B71430,0x
6A005A7F,

0x0627EF04,0x28D96A77,0xF8DCDCFC,0x790D0304,0x02149E37,0xDC8E518D,0x80D75D77,0
x80670408};

u32

AES_CBC_EN[32]={0xE5682F2E,0x07A087E9,0x37D60ED6,0x41262C81,0xD69A23B5,0x1800A3F
D,0xAC50301D,0xB12F3C5E,

0x568A1F62,0xC1057524,0x7E7D09BC,0x26F42541,0x5C2FB09B,0x12C68EFC,0xE03B2AF8,0x
6E2C9934,

0xD805445F,0x3876A6E4,0xCA85688F,0xD1116501,0x2DE18902,0xCBFE9B2,0x57911796,0x0
719A673,

0x3915B680,0x3B760C23,0x23F715DE,0x6D3425B9,0x9C339EF5,0x6C91D7B0,0x050E91DA,0x
286AB477};

u32

AES_CBC_DE[32]={0xBD58ED6F,0x571E4AB0,0x6E39AA50,0xEFACFE6F,0xCFB4F836,0x21432C
5A,0x43CA36B8,0x148505B7,

0x6E05BE79,0x26A1C52F,0x9B668D75,0x07904584,0x03C89C5F,0x26AF7239,0x0B344FFC,0x9
311957F,

0xBE10E141,0xA875B40E,0xDB762AC4,0x7A6CDD87,0x9EB1452F,0xF3FBBF94,0x4FD8EAC4
,0xD20B3287,

0xA288EAA5,0x34AE4EED,0x4A1074FA,0xE5376ABE,0x6D68499E,0xF757B012,0xF8634844,0
xAF390CFF};

u32

AES_CTR_EN[32]={0xF4EB3E15,0xCEC90E4B,0x1708E770,0x6A1297BB,0x045A69FD,0x7FC870A
7,0x56BE6A22,0x5A912CEA,

0xC22E6811,0x37177967,0x68D08A6A,0xCECA04AE,0x30EA7217,0x16992F79,0xF0DD4DAD,0x47
10126B,0xCC06BD7F,

0x03093EE5,0x596D2B9B,0xD9844F7C,0x130D4E24,0xD6C87ABF,0xE1745614,0xEF260225,0x0F90
C354,0x7557E159,

0x4CBC3789,0xDB0552F8,0x28F27315,0x046363A6,0xAF1F0089,0x29AC2CC1};

u32

AES_CTR_DE[32]={0x5A42C72C,0x09F16329,0xE9BD742B,0xB403E0FF,0xBA43D804,0xDE77B9
E1,0xE1A33077,0xE3AEA215,

0x2670CBEB,0x160CA5C2,0x86808BEA,0x3D7A9E73,0xB16E68A0,0x12E5BF98,0x8A18EC5F,
0xC4BD0D05,

0xAB21B81D,0x7477E171,0xDE6FFE4,0xB80B68F8,0xA4AF05A1,0x1C77249A,0xB2CCA806,
0x9C3A69BA,

0x6F7CD7A9,0x2BD9E19F,0x78B41533,0x2F5E08F7,0x1C2EF8F1,0x03D4B04F,0xE0EAAAC56,0
x73CC7E9C};

AES_Parm.in = in;

AES_Parm.key = key;

AES_Parm.iv = iv;

AES_Parm.out = out;

AES_Parm.keyWordLen = 6;

AES_Parm.inWordLen = 32;

```
AES_Parm.Mode = AES_ECB;
AES_Parm.En_De = AES_ENC;
ret =AES_Init(&AES_Parm);
ret =AES_Crypto(&AES_Parm);
AES_Close();

if(Cmp_U32(AES_ECB_EN, 32, out, 32))
{
    flag1=0x5A5A5A5A;
}
else
{
    flag1=0;
}

AES_Parm.En_De = AES_DEC;
ret =AES_Init(&AES_Parm);
ret =AES_Crypto(&AES_Parm);
AES_Close();

if(Cmp_U32(AES_ECB_DE, 32, out, 32))
{
    flag2=0x5A5A5A5A;
}
else
{
    flag2=0;
```

```
    }  
  
    //cbc  
  
    AES_Parm.Mode = AES_CBC;  
  
    AES_Parm.En_De = AES_ENC;  
  
    ret =AES_Init(&AES_Parm);  
    ret =AES_Crypto(&AES_Parm);  
    AES_Close();  
  
    if(Cmp_U32(AES_CBC_EN, 32, out, 32))  
    {  
        flag3=0x5A5A5A5A;  
    }  
    else  
    {  
        flag3=0;  
    }  
    AES_Parm.En_De = AES_DEC;  
    ret =AES_Init(&AES_Parm);  
    ret =AES_Crypto(&AES_Parm);  
    AES_Close();  
  
    if(Cmp_U32(AES_CBC_DE, 32, out, 32))  
    {  
        flag4=0x5A5A5A5A;  
    }  
    else  
    {  
        flag4=0;  
    }  
}
```

```
//ctr

AES_Parm.Mode = AES_CTR;

AES_Parm.En_De = AES_ENC;

ret =AES_Init(&AES_Parm);

ret =AES_Crypto(&AES_Parm);

AES_Close();


if(Cmp_U32(AES_CTR_EN, 32, out, 32))
{
    flag5=0x5A5A5A5A;
}
else
{
    flag5=0;
}

AES_Parm.in = AES_CTR_EN;

AES_Parm.En_De = AES_DEC;

ret =AES_Init(&AES_Parm);

ret =AES_Crypto(&AES_Parm);

AES_Close();


if(Cmp_U32(AES_CTR_DE, 32, out, 32))
{
    flag6=0x5A5A5A5A;
}
else
{
    flag6=0;
```

```
}
```

```
if (flag1|flag2|flag3|flag4|flag5|flag6)
{
    return 0x5A5A5A5A;
}
else
{
    return 0;
}
}
```

```
u32 AES_256_test()
```

```
{
    u32 flag1,flag2,flag3,flag4,flag5,flag6,ret=0;
    AES_PARM AES_Parm={0};

    u32
in[32]={0x86DF711D,0xB9C4122D,0x13368B2D,0x53A5CF4F,0xBDFFAA2C,0xB4D4B3C0,0x8BB9
7CB6,0x99EA0BE6,

    0x8B338E1D,0xFE104A1C,0x4E13D5E3,0xA886852F,0x67522841,0x9D1FF5E1,0xEFBD3A3,0
xA7C27969,

    0x0475C629,0xD4EB12F0,0x4570B427,0xF9296516,0x58F7F4A6,0x2A9D3C6B,0x652654E1,0x4
38105F6,
```

0x986F81C9,0x639F51B2,0xA3169082,0x6CD5570C,0x39B678E4,0x84986F66,0x94BB95FA,0x976D9797};

u32

key[8]={0xB2591B82,0xD25676DB,0x2546F076,0xC8D01753,0xB4A620E7,0x4AADD91D,0x2E5EDF9B,0x596C1146};

u32 iv[4]={0xF0E72786,0xD272F169,0x0ECED17B,0x29D34319};

u32 out[32];

u32

AES_ECB_EN[32]={0x5766DACC,0x50DBB1F9,0x58720E73,0x2182AA3E,0x7D5A6D4D,0xA07EF43D,0x5A533E1E,0x34816CF3,

0xBA23F9CD,0x99A7BD14,0x6789D933,0xD14B2F0D,0xAF53E19E,0xB88DA31F,0xEFBE0472,0x03F077B1,

0x4489E477,0x97161707,0x6C24CB62,0x0FF361DC,0x60BBD2CF,0xEB7AB0C1,0xFA3421E5,0x2F5DB80E,

0x2D61A7CD,0x22988E98,0x51B195AF,0x22C8A4C0,0x7F8E90C3,0x6690789A,0x48AF0FAF,0xAC16F7A6};

u32

AES_ECB_DE[32]={0x0ADBDA93,0x93C512ED,0x6A99A60B,0x0A1841B5,0x135E685D,0xB9ADC987,0x6262573F,0x9090A7D3,

0x2B7DDAA3,0x7370FB9D,0xE7E739C6,0xCA013CA6,0x3509E08F,0x74A21641,0x3D2C9527,0xF8DF90F0,

0xED8209E9,0x9DD57975,0x0A506603,0x7C2EFD3B,0x0937237E,0x2828BAAF,0x245E9D40,0x
F3BB882A,

0x66E82B24,0xF3E778E7,0x386802D1,0xD74C7057,0xEF8525C8,0x1EB7AA48,0x362EACDD,0
x8AA0F286};

u32

AES_CBC_EN[32]={0x39AD6F3A,0xF8E3E1DD,0x2209A14B,0x241642CC,0x83FA4820,0xD82816
B3,0xEF66B17A,0xB5B49FCC,

0xA7540FD7,0xCC11801C,0xC6126D93,0x8E6C259A,0x626135EB,0x3FEA411B,0x45FF91A3,0
x1B91B51A,

0x9169DD4C,0x2F42A1E6,0x4299E687,0xEB9FBAA4,0x3B667902,0xDCB4117A,0x45B78A05,0
x5FECBFA7,

0x54C54A81,0xBDF538B1,0xF2D5804D,0x568910A8,0x41655B32,0xD47D533B,0x5A82D212,0x
63C07B46};

u32

AES_CBC_DE[32]={0xFA3CFD15,0x41B7E384,0x64577770,0x23CB02AC,0x95811940,0x0069DBA
A,0x7154DC12,0xC335689C,

0x9682708F,0xC7A4485D,0x6C5E4570,0x53EB3740,0xBE3A6E92,0x8AB25C5D,0x733F40C4,0x
505915DF,

0x8AD021A8,0x00CA8C94,0xE5EDA5A0,0xDBEC8452,0x0D42E557,0xFCC3A85F,0x612E2967,
0x0A92ED3C,

0x3E1FDF82,0xD97A448C,0x5D4E5630,0x94CD75A1,0x77EAA401,0x7D28FBFA,0x95383C5F,0
xE675A58A};

u32

AES_CTR_EN[32]={0x85F1DD33,0xAE808F2F,0x26A40960,0xB2020DF8,0xB6C2006E,0xA22A35F
6,0x33BB584A,0xBFEA7F68,

0x73E54E78,0xF3EB0368,0x80816676,0x6109DE39,0xE0001920,0x8D2B18B8,0x0E46A012,0xE4
3F1DD1,0x3CA4BC36,

0xD5101452,0x83020170,0x4B752F62,0x3D27A004,0x3C18B5DB,0x99DA9032,0xEA59B340,0x
79BBD087,0x2EF8CB3D,

0xDC32D3CA,0x30F577EA,0x56774C66,0xC33DA1F8,0x0288B1D6,0x091C9666};

u32

AES_CTR_DE[32]={0x86DF711D,0xB9C4122D,0x13368B2D,0x53A5CF4F,0xBDFFAA2C,0xB4D4B
3C0,0x8BB97CB6,0x99EA0BE6,

0x8B338E1D,0xFE104A1C,0x4E13D5E3,0xA886852F,0x67522841,0x9D1FF5E1,0xEFBDC3A3,0
xA7C27969,

0x0475C629,0xD4EB12F0,0x4570B427,0xF9296516,0x58F7F4A6,0x2A9D3C6B,0x652654E1,0x4
38105F6,

0x986F81C9,0x639F51B2,0xA3169082,0x6CD5570C,0x39B678E4,0x84986F66,0x94BB95FA,0x9
76D9797};

AES_Parm.in = in;

```
AES_Parm.key = key;
```

```
AES_Parm.iv = iv;
```

```
AES_Parm.out = out;
```

```
AES_Parm.keyWordLen = 8;
```

```
AES_Parm.inWordLen = 32;
```

```
AES_Parm.Mode = AES_ECB;
```

```
AES_Parm.En_De = AES_ENC;
```

```
ret =AES_Init(&AES_Parm);
```

```
ret =AES_Crypto(&AES_Parm);
```

```
AES_Close();
```

```
if(Cmp_U32(AES_ECB_EN, 32, out, 32))
```

```
{
```

```
    flag1=0x5A5A5A5A;
```

```
}
```

```
else
```

```
{
```

```
    flag1=0;
```

```
}
```

```
AES_Parm.En_De = AES_DEC;
```

```
ret =AES_Init(&AES_Parm);
```

```
ret =AES_Crypto(&AES_Parm);
```

```
AES_Close();
```

```
if(Cmp_U32(AES_ECB_DE, 32, out, 32))
```

```
{
    flag2=0x5A5A5A5A;
}
else
{
    flag2=0;
}
//CBC
AES_Parm.Mode = AES_CBC;
AES_Parm.En_De = AES_ENC;
ret =AES_Init(&AES_Parm);
ret =AES_Crypto(&AES_Parm);
AES_Close();

if(Cmp_U32(AES_CBC_EN, 32, out, 32))
{
    flag3=0x5A5A5A5A;
}
else
{
    flag3=0;
}

AES_Parm.En_De = AES_DEC;
ret =AES_Init(&AES_Parm);
ret =AES_Crypto(&AES_Parm);
AES_Close();

if(Cmp_U32(AES_CBC_DE, 32, out, 32))
```

```
{
    flag4=0x5A5A5A5A;
}
else
{
    flag4=0;
}

//CTR

AES_Parm.Mode = AES_CTR;
AES_Parm.En_De = AES_ENC;
ret =AES_Init(&AES_Parm);
ret =AES_Crypto(&AES_Parm);
AES_Close();

if(Cmp_U32(AES_CTR_EN, 32, out, 32))
{
    flag5=0x5A5A5A5A;
}
else
{
    flag5=0;
}

AES_Parm.in = AES_CTR_EN;
AES_Parm.En_De = AES_DEC;
ret =AES_Init(&AES_Parm);
ret =AES_Crypto(&AES_Parm);
AES_Close();

if(Cmp_U32(AES_CTR_DE, 32, out, 32))
```

```
{  
    flag6=0x5A5A5A5A;  
}  
else  
{  
    flag6=0;  
}  
  
if (flag1|flag2|flag3|flag4|flag5|flag6)  
{  
    return 0x5A5A5A5A;  
}  
else  
{  
    return 0;  
}  
}
```

iv.附录四 HASH算法库函数调用例程

```
u32 MD5_fixed_steps_test(void)
{
    u8 out[16];
    char in[] = "ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz0123456789";
    u8 MD5_fixout[16]=
    {
        0xd1,0x74,0xab,0x98,0xd2,0x77,0xd9,0xf5,0xa5,0x61,0x1c,0x2c,0x9f,0x41,0x9d,0x9f
    };
    HASH_CTX ctx[1];
    ctx->hashAlg = HASH_ALG_MD5;
    ctx->sequence = HASH_SEQUENCE_TRUE;

    HASH_Init(ctx);

    HASH_Start(ctx);
    HASH_Update(ctx, (u8*)in, 28);
    HASH_Update(ctx, ((u8*)in)+ 28, 28);
    HASH_Update(ctx, ((u8*)in)+ 56, 6);
    HASH_Complete(ctx, out);
    HASH_Close();
    if(memcmp(out,MD5_fixout,16))
    {

        //printf("MD5-FIX-Test fail\r\n");

        return 0x5a5a5a5a;
    }
}
```

```
else
{
    //printf("MD5-FIX-Test success\r\n");
    return 0;
}
//return 0;
}

// SM3 固定分步测试用例
u32 SM3_test(void)
{
    u8 out[32];
    //SM3 固定分步哈希
    //分步消息
    u8 SM3_fixin[48*3]=
    {
        0x02,0x89,0x00,0xD4,0x66,0x14,0xF9,0xA2,0x9E,0xC9,
        0xBC,0x05,0x5B,0xBE,0x10,0x33,0x0F,0x41,0x1B,0xDF,
        0x9A,0x20,0x44,0x2C,0xB1,0x51,0xBD,0xCA,0x8D,0xDB,
        0xAD,0x86,0x46,0x48,0xA3,0xC6,0x34,0x27,0xEB,0x8B,
        0x05,0x57,0x40,0x90,0x52,0xE9,0x92,0xA3,0x79,0xBB,
        0x2D,0x3D,0x48,0xEC,0xC2,0x9A,0x91,0xBE,0x47,0xD0,
        0x7C,0x6E,0x6B,0x4E,0xEF,0x68,0x46,0x03,0x72,0x44,
        0xD5,0xCA,0x96,0x17,0xE3,0xFB,0x92,0x3E,0x41,0x27,
        0x55,0x16,0x77,0x9F,0x93,0x1A,0x60,0x78,0x83,0x13,
        0xDF,0x76,0x09,0xC0,0xC1,0xBF,0x6F,0x0F,0xEB,0x11,
        0x6D,0x6A,0x0B,0x8C,0x0A,0x43,0x38,0xE6,0x05,0x8E,
        0xCD,0x84,0xE7,0xA3,0x9B,0x9D,0x6B,0x75,0x91,0xEB,
        0xA5,0x28,0xCF,0xEF,0x4F,0xED,0x61,0x35,0x43,0x2D,
        0x33,0xE2,0x25,0x99,0x14,0xB1,0x05,0xA8,0xFF,0x04,
```

```
        0x9C,0xC2,0x29,0x05

    };

//正确的消息摘要
u8 SM3_fixout[32]=

    {

        0xC7,0x8B,0xF5,0x97,0x52,0xCD,0xFE,0x9F,0x70,0x21,

        0x4F,0x5D,0x88,0x92,0x2E,0x60,0x35,0x22,0x3B,0x66,

        0x94,0xFD,0x08,0x96,0x5E,0x26,0x44,0xF9,0x72,0xFE,

        0xE2,0xB2

    };

u8 i,byteLen=48;
HASH_CTX ctx[1];
//设置为 SM3 运算
// ctx->hashAlg 可以选择不同 HASH 运算,
//如 HASH_ALG_SHA1、
    //HASH_ALG_SHA224、
    //HASH_ALG_SHA256、
    //HASH_ALG_SM3
ctx->hashAlg = HASH_ALG_SM3;
ctx->sequence = HASH_SEQUENCE_TRUE;
HASH_Init(ctx);
HASH_Start(ctx);
for(i=0;i<3;i++)
{
    HASH_Update(ctx,SM3_fixin+i*byteLen,byteLen);
}

HASH_Complete(ctx, out);
HASH_Close();
if (memcmp(out,SM3_fixout,32))
```

```
{
    //分步 SM3 测试失败
    printf("SM3-FIX-Test fail\r\n");
    return HASH_ATTACK;
}
else
{
    //分步 SM3 测试成功
    printf("SM3-FIX-Test success\r\n");
}
return SM3_Hash_OK;
}

//此函数例程分别对哈希 sha1/224/256 进行了单步哈希运算
u32 HASH_test(void)
{
    u32 TEST_BUF[200];
    u8 in[48]=
    {

        0x1C,0xBB,0x9F,0x4A,0x43,0x6A,0xAD,0x81,0xFE,0x4F,0x52,0x4A,0x0A,0x76,0x22,0xC8,0
        x4F,0x90,0x18,0x30,0xA4,0xD2,0x8C,0x6A,0xC3,0x40,0xA0,0xBD,0x0A,0x6A,0x37,0x18,0x
        8D,0x19,0x9D,0xE5,0xCB,0x84,0xA3,0xFC,0x39,0xDE,0x8C,0xD6,0xFC,0x2F,0xC8,0x88

    };
    u8 in2[10] = {0x1C,0x61,0xAD,0x6C,0x05,0xF3,0x98,0xA4,0x4C,0xFD};
    u8 out[64];
    u8 sha1_out[20]=
    {

        0x0E,0xEC,0x49,0xC5,0x36,0xBB,0xD7,0x87,0xD2,0xE2,0x0C,0x97,0xC4,0xF8,0x65,0x7C,0x
        CC,0x74,0x8D,0x1E

    }
```

```
};  
u8 sha224_out[28]=  
{  
  
    0xC1,0x44,0x4F,0xD0,0xB8,0xA9,0xA3,0xD9,0xE8,0x04,0xA0,0xD1,0x9E,0x38,0xF3,0x5E,  
    0x85,0xB4,0x0F,0x10,0x5A,0x1C,0x48,0xC4,0xF2,0x40,0x10,0x48  
};  
u8 sha256_out[32]=  
{  
  
    0xE2,0xE4,0x2C,0x8A,0x01,0x1A,0xE7,0x98,0x67,0x74,0x93,0xAF,0x9D,0x65,0x99,0xB3,0  
    xA1,0x68,0x8B,0x5A,0xF1,0x32,0x3D,0x5B,0xFF,0xFB,0x12,0x30,0x94,0xE4,0x81,0xDD  
};  
  
u8 SM3_out[32]=  
{  
  
    0xBD,0x77,0x63,0x33,0x0A,0x71,0x19,0x5C,0x5D,0x26,0xE7,0x99,0x7B,0x41,0x22,0xB0,0  
    xBC,0xB0,0xBE,0x52,0x3E,0xDA,0x0F,0xBE,0xE6,0xA4,0x33,0x96,0xB8,0x83,0x76,0xD4  
};  
u32 ret=0x5123;
```

```
#if 1
```

```
    HASH_CTX *ctx;  
    ctx = (HASH_CTX*)(TEST_BUF);  
    ctx->hashAlg = HASH_ALG_SHA1;  
    ctx->sequence = HASH_SEQUENCE_FALSE;  
    HASH_Init(ctx);  
    HASH_Start(ctx);
```

```
HASH_Update(ctx, in, 48);
ret=HASH_Complete(ctx, out);
HASH_Close();
if (memcmp(out,sha1_out,20))
{
    return 0x5a5a5a5a;
}
else
{
    printf("SHA1-Test success\r\n");
}

ctx->hashAlg = HASH_ALG_SHA224;
ctx->sequence = HASH_SEQUENCE_FALSE;
HASH_Init(ctx);
HASH_Start(ctx);
HASH_Update(ctx, in, 48);
//HASH_Update(ctx, in2, 10);
ret=HASH_Complete(ctx, out);
HASH_Close();
if (memcmp(out,sha224_out,28))
{
    return 0x5a5a5a5a;
}
else
{
    printf("SHA224-Test success\r\n");
}

ctx->hashAlg = HASH_ALG_SHA256;
```

```
ctx->sequence = HASH_SEQUENCE_FALSE;
HASH_Init(ctx);
HASH_Start(ctx);
HASH_Update(ctx, in, 48);
ret=HASH_Complete(ctx, out);
HASH_Close();
if(memcmp(out,sha256_out,32))
{
    return 0x5a5a5a5a;
}
else
{
    printf("SHA256-Test success\r\n");
}
#endif
return 0;
}
```

v.附录五 SM4算法库函数调用例程

```
u32 SM4_test(void)
```

```
{
```

```
    u32 flag1,flag2,flag3,flag4;
```

```
    u32 ret;
```

```
    SM4_PARM SM4_Parm={0};
```

/*若需要修改测试实例，当参数的真实值为“0x0102030405060708”时，由于 u32 数据是字节小端序存储，在对以上参数进行初始化赋值时，请输入“0x04030201,0x08070605”.若无特殊说明，本例程参数都以这种方式设置*/

```
    u32 in1[32]={
```

```
        0x4B551C70,0xD54DA600,0xBAA2CA7F,0x0ABA6CD8,0x97BC9D7D,0xAD650748,
```

```
        0x0590F143,0x7288FD0F,0x9EDF1005,0xB7D4A607,0x8ED480C9,0x34FD4C59,
```

```
        0x97C9286E,0xD0A23857,0x1ABE2026,0x6163578A,0xF5FBAFB4,0x72DB71B7,
```

```
        0x21217431,0xF8BE4ECA,0xB73D1018,0xACD37812,0x3FF19EE7,0x4C9575BE,
```

```
        0xF1FB289E,0x33694113,0x8EC5BB10,0x3B1DFF5F,0xA9D6A5A5,0xB98D90C8,
```

```
        0x91AB4E89,0x804343FD
```

```
    };
```

```
    u32 key1[4]={0x84853E30,0xB3D3154D,0x9A887F49,0xDC65910A};
```

```
    u32 iv1[4]={0x2FA6B65A,0x1D0EC205,0xB90B8620,0x42E74F58};
```

```
    u32 out[32];
```

```
    u32 SM4_ECB_EN[32]={0xD61A389C,0xE136A0AD,0xBD626B7E,0x4277F173,0xAF3E5E82,
```

```
    0x876D84DF,0x7A065B7B,0x1CBBFFA8,0xC57C31DC,0x5BD86AFC,
```

```
    0x0825EAEF,0x600162A4,0x3E4787AC,0x58B32579,0x3A9135BF,
```

```
    0xB806A17C,0x9854F4C4,0x065CD28F,0x68FDF21F,0x9CA62C4C,
```

```
0x5B2FA76E,0xEC693A2B,0xF028ADF6,0xFAA2ED18,0x6395B4B1,  
0x7A9B0069,0x9D55E04C,0xA5CDC23F,0x7FC56C92,0x89F199A1,  
0xF228D9E1,0xD705050A};
```

```
/*SM4_ECB_EN=0x9C381AD6ADA036E17E6B62BD73F17742825E3EAFDF846D877B5B067A  
A8FFBB1CDC317CC5FC6AD85BEFEA2508A4620160AC87473E7925B358BF35913A7CA106B8C4F  
454988FD25C061FF2FD684C2CA69C6EA72F5B2B3A69ECF6AD28F018EDA2FAB1B4956369009B  
7A4CE0559D3FC2CDA5926CC57FA199F189E1D928F20A0505D7*/
```

```
u32 SM4_ECB_DE[32]={0x3107DFA0,0xC1EE3D0A,0x9025F9D5,0x90ACC081,0x7A72F90A,  
0x6481F1CE,0x76DF5450,0xCD262ACF,0xCE8E3C3B,0x208B7390,  
0xC9F8F526,0x1A73FFCC,0x0AB6E26F,0xA02B544A,0x760CD602,  
0x6D250CA4,0x2477FF67,0x44CBC39E,0x84ECF5CC,0x7DF30644,  
0x8746D41C,0xCB42B9EC,0xE975598C,0x28756C41,0x64C3C870,  
0x9EA8CBB3,0xBA2FA98E,0x1B10BA7B,0x1C50E8A0,0x1EE697FD,  
0xA4E2DDD5,0xBB29D912};
```

```
/*SM4_ECB_DE=0xA0DF07310A3DEEC1D5F9259081C0AC900AF9727ACEF181645054DF76C  
F2A26CD3B3C8ECE90738B2026F5F8C9CCFF731A6FE2B60A4A542BA002D60C76A40C256D67FF  
77249EC3CB44CCF5EC844406F37D1CD44687ECB942CB8C5975E9416C752870C8C364B3CBA89E  
8EA92FBA7BBA101BA0E8501CFD97E61ED5DDE2A412D929BB*/
```

```
u32 SM4_CBC_EN[32]={0x304E1C3C,0x10DA649D,0x5EBCB5BE,0x2964AD84,0x18599756,  
0x2106AAD2,0x84364B24,0x57A9E62D,0xD160B03B,0x58293A74,  
0xEE57389F,0x398E69C2,0x63FD0959,0x5B4584FD,0x4DA6E8BE,  
0x578E4501,0x74B0159B,0x570E8604,0x38E2DB49,0xE028387E,  
0xCDDE4984,0x6B717E9F,0xE516D698,0x6520025E,0xC8D187A7,  
0x6E08373F,0xC3472666,0x654A0D41,0x7F363B95,0xAD8EB5D2,  
0x01F0F12A,0x8169D65A};
```

```
/*SM4_CBC_EN=0x3C1C4E309D64DA10BEB5BC5E84AD642956975918D2AA0621244B36842  
DE6A9573BB060D1743A29589F3857EEC2698E395909FD63FD84455BBEE8A64D01458E579B15B0
```

7404860E5749DBE2387E3828E08449DECD9F7E716B98D616E55E022065A787D1C83F37086E6626
47C3410D4A65953B367FD2B58EAD2AF1F0015AD66981*/

```
u32 SM4_CBC_DE[32]={0x1EA169FA,0xDCE0FF0F,0x292E7FF5,0xD24B8FD9,0x3127E57A,  
0xB1CC57CE,0xCC7D9E2F,0xC79C4617,0x5932A146,0x8DEE74D8,  
0xCC680465,0x68FB02C3,0x9469F26A,0x17FFF24D,0xF8D856CB,  
0x59D840FD,0xB3BED709,0x9469FBC9,0x9E52D5EA,0x1C9051CE,  
0x72BD7BA8,0xB999C85B,0xC8542DBD,0xD0CB228B,0xD3FED868,  
0x327BB3A1,0x85DE3769,0x5785CFC5,0xEDABC03E,0x2D8FD6EE,  
0x2A2766C5,0x8034264D};
```

/*SM4_CBC_DE=0xFA69A11E0FFFE0DCF57F2E29D98F4BD27AE52731CE57CCB12F9E7DCC
17469CC746A13259D874EE8D650468CCC302FB686AF269944DF2FF17CB56D8F8FD40D85909D7
BEB3C9FB6994EAD5529ECE51901CA87BBD725BC899B9BD2D54C88B22CBD068D8FED3A1B37
B326937DE85C5CF85573EC0ABEDEED68F2DC566272A4D263480*/

```
Cpy_U32(out, in1, 32);  
SM4_Parm.in = out;  
SM4_Parm.key = key1;  
SM4_Parm.out = out;  
SM4_Parm.inWordLen = 32;  
SM4_Parm.workingMode = SM4_ECB;  
SM4_Parm.EnDeMode = SM4_ENC;  
ret=SM4_Init(&SM4_Parm);  
ret=(SM4_Crypto(&SM4_Parm));  
SM4_Close();  
if(ret!=SM4_Crypto_OK)  
{  
    flag1=0x5A5A5A5A;  
}  
else
```

```
{

    if(Cmp_U32(SM4_ECB_EN,32, out,32))
    {
        flag1=0x5A5A5A5A;
    }
    else
    {
        flag1=0;
    }
}

Cpy_U32(out, in1,32);
SM4_Parm.EnDeMode = SM4_DEC;
ret=SM4_Init(&SM4_Parm);
ret=(SM4_Crypto(&SM4_Parm));
SM4_Close();
if(ret!=SM4_Crypto_OK)
{
    flag2=0x5A5A5A5A;
}
else
{

    if(Cmp_U32(SM4_ECB_DE,32, out,32))
    {
        flag2=0x5A5A5A5A;
    }
    else
    {
```

```
        flag2=0;
    }
}

Cpy_U32(out, in1,32);
SM4_Parm.iv = iv1;
SM4_Parm.workingMode = SM4_CBC;
SM4_Parm.EnDeMode = SM4_ENC;
ret=SM4_Init(&SM4_Parm);
ret=(SM4_Crypto(&SM4_Parm));
SM4_Close();
if(ret!=SM4_Crypto_OK)
{
    flag3=0x5A5A5A5A;
}
else
{

    if(Cmp_U32(SM4_CBC_EN,32, out,32))
    {
        flag3=0x5A5A5A5A;
    }
    else
    {
        flag3=0;
    }
}

Cpy_U32(out, in1,32);
SM4_Parm.iv= iv1;
SM4_Parm.EnDeMode = SM4_DEC;
```

```
ret=SM4_Init(&SM4_Parm);
ret=(SM4_Crypto(&SM4_Parm));
SM4_Close();
if(ret!=SM4_Crypto_OK)
{
    flag4=0x5A5A5A5A;
}
else
{
    if(Cmp_U32(SM4_CBC_DE,32, out,32))
    {
        flag4=0x5A5A5A5A;
    }
    else
    {
        flag4=0;
    }
}

if (flag1|flag2|flag3|flag4)
{
    return 0x5A5A5A5A;
}
else
{
    return 0;
}
}
```

vi.附录六 RNG算法库调用例程

```
#define POKER_RAND_BYTE 40 //320bit

u32 TrueRand_Poker_Test(void)
{
    u16 count[16] = {0};
    u32 sum = 0;
    u8  rand[POKER_RAND_BYTE];
    u8 i, j, k, tmp;

    GetTrueRand_U32((u32*)rand, POKER_RAND_BYTE>>2);
    //GetTrueRand_U8(rand, POKER_RAND_BYTE);
    //GetPseudoRand_U32((u32*)rand,POKER_RAND_BYTE>>2);
    for(j = 0; j < POKER_RAND_BYTE; j++)
    {
        for(k = 0; k < 2; k++)
        {
            (k == 1) ? tmp = (rand[j] >> 4) : (tmp = (rand[j] & 0x0F));
            for(i = 0; i < 16; i++)
            {
                if(tmp==i) count[i]++;
            }
        }
    }
    for(i = 0; i < 16; i++)
    {
        sum += ((u32)count[i]) * count[i];
    }
}
```

```
if(405 < sum && sum < 687)
    return 0;
else
    return 1;
}

u32 PseudoRand_Poker_Test(void)
{
    u16 count[16] = {0};
    u32 sum = 0;
    u8  rand[POKER_RAND_BYTE];
    u8 i, j, k, tmp;

    //GetTrueRand_U32((u32*)rand, POKER_RAND_BYTE>>2);
    //GetTrueRand_U8(rand, POKER_RAND_BYTE);
    GetPseudoRand_U32((u32*)rand,POKER_RAND_BYTE>>2,NULL);
    for(j = 0; j < POKER_RAND_BYTE; j++)
    {
        for(k = 0; k < 2; k++)
        {
            (k == 1) ? tmp = (rand[j] >> 4) : (tmp = (rand[j] & 0x0F));
            for(i = 0; i < 16; i++)
            {
                if(tmp==i) count[i]++;
            }
        }
    }

    for(i = 0; i < 16; i++)
    {
```

```
        sum += ((u32)count[i]) * count[i];
    }

    if(405 < sum && sum < 687)
        return 0;
    else
        return 1;
}
```