MT793X IoT SDK for ECC User Guide

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Version History

Version	Date	Description
1.0	2021-07-29	Official release

Table of Contents

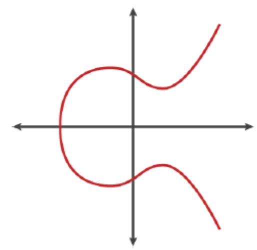
1 Getting Started

This chapter introduces the MT7933 ECC project and gives you an idea of what you need to prepare to get started.

1.1 Overview

The Elliptic Curve Cryptography (ECC) driver is designed to process signature and verification based on the Elliptic curve Digital Signature Algorithm (ECDSA). The ECC module supports 192/224/256/384/521 curve based on National Institute of Standards and Technology(NIST).

Curve Name	Curve Function
NIST P-192	$y^2 = x^3 - 3x + b \pmod{p}$
NIST P-224	
NIST P-256	
NIST P-384	
NIST P-521	



1.2 Code Layout

driver\chip\mt7933\src\hal_ecc_api.c
driver\chip\inc\hal_ecc.h

1.3 ECC APIs

The ECC module provides 2 APIs for signature and verification.

hal_ecc_ecdsa_sign

```
/** @brief Elliptic curve digital signature algorithm sign function.
* Calculate an ECDSA signature using elliptic curve digital signature
 * algorithm with the specified curve, private key, random number, and data.
*
* @param curve[in]  An elliptic curve of choice. See hal_ecc_curve_t for more information.
 * @param d[in]       The private key.
 * @param k[in]       The random data.
 * @param e[in]       The data which has already been hashed to create a signature.
 * @param r[out]      The first part of the signature result.
 * @param s[out]      The second part of the signature result.
*
* @return       #HAL_ECC_STATUS_OK is returned if signature is generated
 *              using the specified curve. Otherwise, see descriptions in hal_ecc_status_t.
*/
hal_ecc_status_t hal_ecc_ecdsa_sign(
            const  hal_ecc_curve_t    curve,
            const  uint32_t         *d,
            const  uint32_t         *k,
            const  uint32_t         *e,
```

```
                    uint32_t        *r,
                    uint32_t        *s);
```

hal_ecc_ecdsa_verify

```
/**@brief Elliptic curve digital signature algorithm verify function.
 * Verify an ECDSA signature using elliptic curve digital signature
 * algorithm with the specified curve, public key, signature, and data.
 *
 * @param curve      An elliptic curve of choice. See hal_ecc_curve_t for more information.
 * @param r[in]      The first part of a signature result.
 * @param s[in]      The second part of a signature result.
 * @param Qx[in]     The first part of a public key.
 * @param Qy[in]     The second part of a public key.
 * @param e[in]      The data which has already been hashed to verify a signature.
 * @param v[out]     The output of verification.
 *
 * @return      #HAL_ECC_STATUS_OK is returned if signature is generated
 *              using the specified curve. Otherwise, see descriptions in hal_ecc_status_t.
 */
hal_ecc_status_t hal_ecc_ecdsa_verify(
            const  hal_ecc_curve_t    curve,
            const  uint32_t        *r,
            const  uint32_t        *s,
            const  uint32_t        *Qx,
            const  uint32_t        *Qy,
            const  uint32_t        *e,
                   uint32_t        *v);
```

2 ECC Sample Use Case

```
/* - Trigger ECC to do signature and verification.
 *  - Step1: Call hal_ecc_init() to initialize the ECC clock.
 *  - Step2: Call hal_ecc_ecdsa_sign() to generate the ECDSA signarure or hal_ecc_ecdsa_verify() to verify the ECDSA signarure.
 *  - Step3: Call hal_ecc_deinit() to de-initialize the ECC clock.
 *  - Sample code:
 *  @code
 *     // ECC needs 32 bytes(32 * 8 bits) length when using NIST P-256 curve. Little endian format.
 *     // You can test sign/verify funtion by using the following golden data.
 *     // e: {0x0377BCC0, 0x26681592, 0x5F3CDF14, 0xC64E5D61, 0xC535C273, 0x637536F7, 0x19F5BF25, 0x1FDA2156}.
 *     // d: {0xA112ED54, 0xFDAF4EE1, 0x4DC4192F, 0x7C7A9947, 0xF013D563, 0x84335DD3, 0x3B51E0FC, 0xACEC122D}.
 *     // k: {0xFD11A53D, 0x0AEBFE6D, 0x3694C98E, 0xA3CE7B21, 0x8566A7E8, 0x2DEA7054, 0x1958A428, 0xC8BDD79F}.
 *     // r: {0xF345B5B5, 0x8926F457, 0xFDAB95A9, 0xBD362686, 0x253EB72A, 0xD33E3511, 0xB21737AE, 0x2F350F06}.
 *     // s: {0x5313B579, 0x814492C3, 0x135D7EF3, 0xA686FD6E, 0xCED6F8A5, 0x0749A6B2, 0x151E00C0, 0x338AE2FA}.
 *     // Qx:{0xC3E79B79, 0x8F335540, 0x684E285C, 0xAAAA74F1, 0x6AE6900E, 0x65455B8E, 0xE75F70CD, 0x5AF2E9D1}.
 *     // Qy:{0x3016AC86, 0x50FDF6D9, 0xB69BA98B, 0xC5EC1D8B, 0x9A296177, 0x32F97CCB, 0xD8565D9D, 0xEC52712F}.
 *
 *     uint32_t  e[8]; // input data
 *     uint32_t  d[8]; // input data
 *     uint32_t  k[8]; // input data
 *     uint32_t  r[8]; // output data for signature, input data for verification
 *     uint32_t  s[8]; // output data for signature, input data for verification
 *     uint32_t  v[8]; // output data
 *     uint32_t  Qx[8]; // input data
 *     uint32_t  Qy[8]; // input data
 *
 *     // Initializes the ECC clock.
 *     if(HAL_ECC_STATUS_OK != hal_ecc_init()) {
 *         //error handle
 *     }
 *     // Generate the ECDSA signarure based on NIST P-256 curve.
 *     if(HAL_ECC_STATUS_OK != hal_ecc_ecdsa_sign(HAL_ECC_CURVE_NIST_P_256, d, k, e, r, s)) {
 *         //error handle
 *     }
 *     // Verify the ECDSA signarure based on NIST P-256 curve.
 *     if(HAL_ECC_STATUS_OK != hal_ecc_ecdsa_verify(HAL_ECC_CURVE_NIST_P_256, r, s, e, Qx, Qy, v)) {
 *         //error handle
 *     }
 *     if(memcmp(v, r, 4 * 8)) {
 *         //error handle
 *     }
 *     // De-initialize the ECC clock.
 *     hal_ecc_deinit();
*/
```

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