



# **CV180X & CV181X Secure Boot User Guide**

Version: 1.2.5

Release date: 2023-02-06

Copyright © 2020 CVITEK Co., Ltd. All rights reserved.

No part of this document may be reproduced or transmitted in any form or by any means without prior written consent of CVITEK Co., Ltd.

# Contents

|          |                                    |          |
|----------|------------------------------------|----------|
| <b>1</b> | <b>Disclaimer</b>                  | <b>2</b> |
| <b>2</b> | <b>Secure Boot Introduction</b>    | <b>3</b> |
| 2.1      | Image Structure . . . . .          | 3        |
| 2.2      | Secure Startup Process . . . . .   | 4        |
| <b>3</b> | <b>Secure Image Generation</b>     | <b>5</b> |
| 3.1      | List of Keys . . . . .             | 5        |
| 3.2      | Generate Keys . . . . .            | 5        |
| 3.3      | Sign and Encrypt . . . . .         | 6        |
| 3.3.1    | Generate Image . . . . .           | 6        |
| 3.3.2    | Sign FIP.bin . . . . .             | 6        |
| 3.3.3    | Sign and encrypt FIP.bin . . . . . | 6        |
| <b>4</b> | <b>eFuse Burning</b>               | <b>8</b> |

**Revision History**

| Revision | Date       | Description                          |
|----------|------------|--------------------------------------|
| 0.1      | 2022/06/01 | First Draft                          |
| 0.2      | 2022/09/28 | Change processor name                |
| 0.3      | 2023/02/01 | Update the secure boot usage process |
| 0.4      | 2023/02/06 | CV181x/CV180x document fusion        |

# 1 Disclaimer

---



## Terms and Conditions

The document and all information contained herein remain the CVITEK Co., Ltd' s ( "CVITEK" ) confidential information, and should not disclose to any third party or use it in any way without CVITEK' s prior written consent. User shall be liable for any damage and loss caused by unauthority use and disclosure.

CVITEK reserves the right to make changes to information contained in this document at any time and without notice.

All information contained herein is provided in "AS IS" basis, without warranties of any kind, expressed or implied, including without limitation mercantability, non-infringement and fitness for a particular purpose. In no event shall CVITEK be liable for any third party' s software provided herein, User shall only seek remedy against such third party. CVITEK especially claims that CVITEK shall have no liable for CVITEK' s work result based on Customer' s specification or published shandard.

## Contact Us

**Address** Building 1, Yard 9, FengHao East Road, Haidian District, Beijing, 100094, China

Building T10, UpperCoast Park, Huizhanwan, Zhancheng Community, Fuhai Street, Baoan District, Shenzhen, 518100, China

**Phone** +86-10-57590723 +86-10-57590724

**Website** <https://www.sophgo.com/>

**Forum** <https://developer.sophgo.com/forum/index.html>

# 2 Secure Boot Introduction

---

## 2.1 Image Structure

Figure 2.1 shows the image structure of CV181x/CV180x. When using secure boot, FIP.bin image will be signed and encrypted (encryption function is optional), and the processor will check when boot.

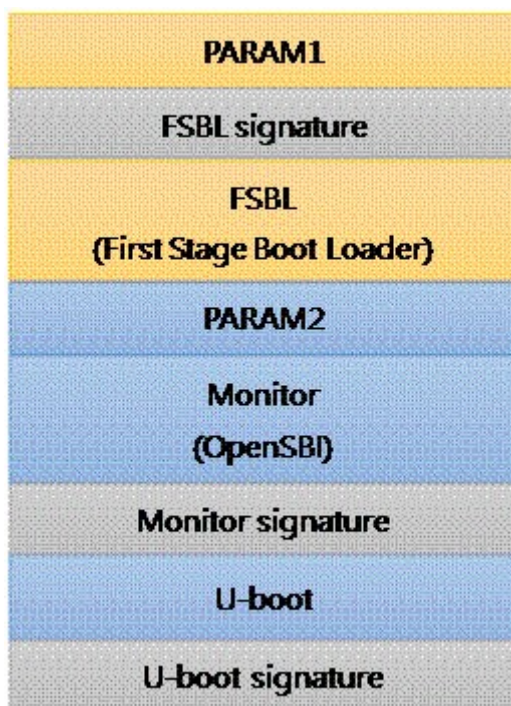
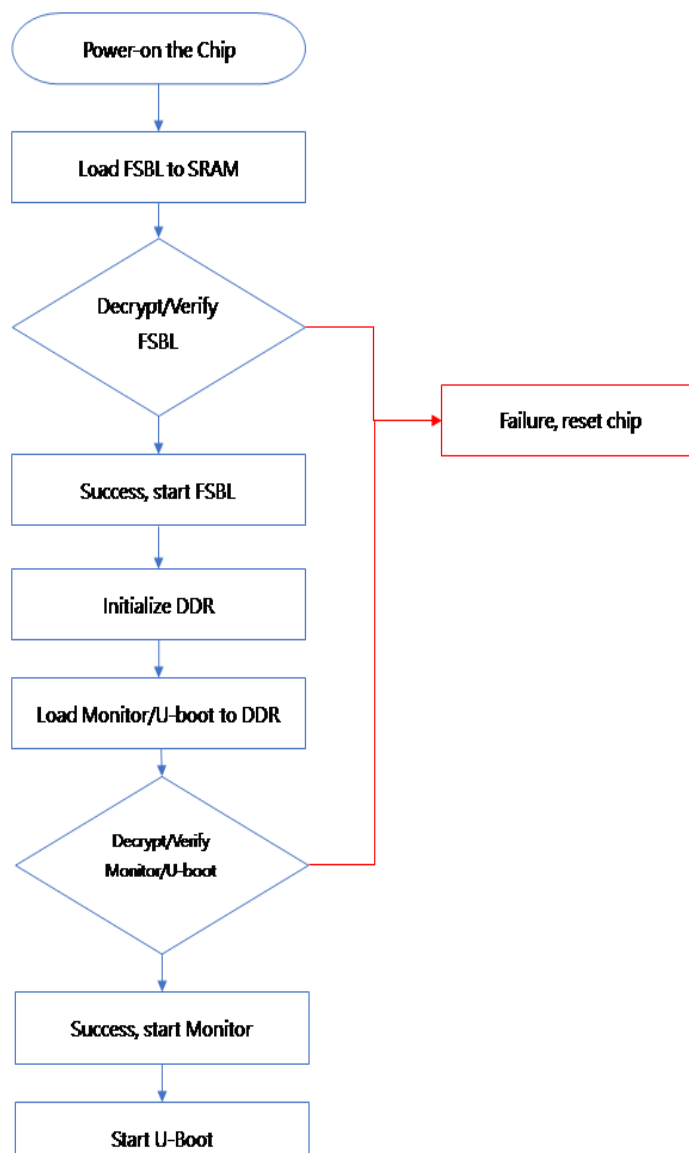


Fig. 2.1: Layout of FIP.bin

## 2.2 Secure Startup Process



---

**Note:** CV180x only supports signature/verification function, please do not use encryption/decryption function, it will cause IC not to start.

---

# 3 Secure Image Generation

---

## 3.1 List of Keys

|    |               |   |
|----|---------------|---|
| 1. | rsa_hash0.pem | RSA private key for sign FSBL           |
| 2. | loader_ek.key | AES key for encrypt FSBL                |
| 3. | bl_priv.pem   | RSA private key for sign Monitor/u-boot |
| 4. | bl_ek.key     | AES key for encrypt Monitor/u-boot      |

## 3.2 Generate Keys

1. Generate signature private keys rsa\_hash0.pem and bl\_priv.pem.

\* RSA keys use 2048 bits and the 4th fermat number.

```
host$ openssl genrsa -out rsa_hash0.pem -F4 2048
```

```
host$ openssl genrsa -out bl_priv.pem -F4 2048
```

2. Generate encryption/decryption keys loader\_ek.key and bl\_ek.key.

\* If signature only without encryption you do not need to generate these keys

\* The following uses random numbers to generate the keys

```
host$ head -c 16 /dev/random > loader_ek.key
```

```
host$ head -c 16 /dev/random > bl_ek.key
```

## 3.3 Sign and Encrypt

### 3.3.1 Generate Image

Please refer to <U-boot Porting Development Guide> to generate FIP.bin image.

### 3.3.2 Sign FIP.bin

---

**Note: Precautions**

In order to avoid the mass production key being stolen, it is suggested that the mass production key should be kept separately, and the signature tool should be used to sign and encrypt in a secure environment.

---

Execute the following command to sign the FIP image, fip.bin is the original image, fip\_sign.bin is the signed image.

```
cv_crypt$ ./fipsign.py sign \  
  
--root-priv= rsa_hash0.pem \  
  
--bl-priv=bl_priv.pem \  
  
fip.bin fip_sign.bin
```

Tool parameters:

```
cv_crypt$ ./fipsign.py sign  
  
usage: fipsign.py sign [-h] [--root-priv ROOT_PRIV] [--bl-priv BL_PRIV] SRC_  
↪FIP DEST_FIP
```

### 3.3.3 Sign and encrypt FIP.bin

Execute the following command to sign and encrypt the FIP image, fip.bin is the original image, fip\_enc.bin is the signed and encrypted image.

```
cv_crypt$ ./fipsign.py sign-enc \  
  
--root-priv= rsa_hash0.pem \  
  
--bl-priv=bl_priv.pem \  
  
--ldr-ek=loader_ek.key \  
  
fip.bin fip_enc.bin
```

(continues on next page)



(continued from previous page)

```
--bl-ek=bl_ek.key \  
fip.bin fip_enc.bin
```

Tool parameters:

```
cv_crypt$ ./fipsign.py sign-enc  
  
usage: fipsign.py sign-enc [-h] [--ldr-ek LDR_EK] [--bl-ek BL_EK] [--root-priv_  
↪ROOT_PRIV] [--bl-priv BL_PRIV] SRC_FIP DEST_FIP
```

---

**Note:** Encryption is optional, if encryption is required, the FIP.bin needs to be configured when compiling.

---

CONFIG\_FSBL\_SECURE\_BOOT\_SUPPORT = y, configuration method:

```
host$ source build/envsetup_soc.sh
```

```
host$ defconfig xxxxxx
```

```
host$ menuconfig -> FIP setting -> select [ ] Add secure boot support to FSBL
```

# 4 eFuse Burning

---

Please refer to <eFuse User Guide> to burn eFuse

---

**Note: Precautions**

eFuse burning is irreversible. Please make sure the image is signed before executing

---