

MAX32663 Secure Bootloader In-Application Programming with Python® User Guide

Abstract

This guide describes how to securely update application firmware via the MAX32663 Secure Bootloader and a Python host. The protocol details for the MAX32663 Secure Bootloader can be found in the MAX32663 Secure Bootloader User's Guide.

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Introduction

The MAX32663 Secure Bootloader provides an I²C interface that facilitates the transfer of a keyed and encrypted firmware image from an I²C host to the internal flash. This document describes one method of using this interface to securely program a firmware image using the MAX32630FTHR and Python-based software running on a Windows PC Host.



MAX32630FTHR

The I²C bootloader interface on the MAX32663 can be mastered by any host I²C-capable micro and user firmware. The bootloader protocol is detailed in the MAX32663 Secure Bootloader User's Guide. However, for development and production, it is desirable that the preprogrammed MAX32630FTHR is included in the MAX30003WING2# evaluation kit.

The MAX32630FTHR contained in the MAX30003WING2# evaluation kit is used to program the MAX32663 on the kit's main PCB. The MAX32630FTHR can be removed from the main PCB and wired directly to the user's product. Note that the MAX32630FTHR is referenced to $V_{DD} = 3.3V$. Targets referenced differently require voltage translation.

MAX32630FTHR I²C Pin Connections

The MAX32630FTHR is connected to the target system as follows:



MAX32630FTHR PIN	SIGNAL NAME	MAX32663 PIN
J3.11	SCL	24
J3.12	SDA	23
J2.16	GND	7 and 10

The target system must supply the power and not the MAX32630FTHR.

Host Software

The host software uses Python. Several software prerequisites are required to run the Python script on Windows

Use the following steps to download and install Microsoft Visual C++ Runtime:

1. Visit the download link here. Click Download.

Microsoft	Download Center Windows	Office Web browsers	Developer tools Xt	oox Windows Phone	All Microsoft - Search O Cart 🕁 Sign in (2	
N The	ew Surface Lap erfect everyday laptop is now even faster HOP NOW >	ptop 3				
	Visual C++ Redistribu	utable Packages fo	or Visual Studio	2013		



2. Select vcredist_x86.exe. Select Next.

Choose the download you want

File Name	Size	
vcredist_arm.exe	1.4 MB	Download Summary: KBMBGB
vcredist_x64.exe	6.9 MB	1. vcredist_x86.exe
vcredist_x86.exe	6.2 MB	
		Total Size: 6.2 MB

- 3. Download and run the setup file.
- 4. Read and click to agree to the terms. Select Install.

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5. Close the installation application.



Installing the OpenSSL Library

Use the following steps to download and install the OpenSSL Library:

- 1. Visit the OpenSSL downloads page here.
- 2. Select Win32 OpenSSL v1.1.10L Light.

Download Win32/Win64 OpenSSL today using the links below!

File	Туре	Description
Win64 OpenSSL v1.1.1f Light EXE MSI (experimental)	3MB Installer	Installs the most commonly used build of OpenSSL and is subject t
Win64 OpenSSL v1.1.1f EXE MSI (experimental)	63MB Installer	Installs Win64 OpenSSL v1.1.1f (subject to local and state laws. M
Win32 OpenSSL v1.1.1f Light EXE MSI (experimental)	3MB Installer	Installs the most commonly used state laws. More information can
Win32 OpenSSL v1.1.1f EXE MSI (experimental)	54MB Installer	Installs Win32 OpenSSL v1.1.1f (found in the legal agreement of th
Win64 OpenSSL v1.1.0L Light	3MB Installer	Installs the most commonly used build of OpenSSL and is subject t
Win64 OpenSSL v1.1.0L	37MB Installer	Installs Win64 OpenSSL v1.1.0L subject to local and state laws. M
Win32 OpenSSL v1.1.0L Light	3MB Installer	Installs the most commonly used state laws. More information can
Win32 OpenSSL v1.1.0L	30MB Installer	Installs Win32 OpenSSL v1.1.0L laws. More information can be for
Win64 OpenSSL v1.0.2u Light	3MB Installer	Installs the most commonly used build of OpenSSL and is subject t
Win64 OpenSSL v1.0.2u	23MB Installer	Installs Win64 OpenSSL v1.0.2u subject to local and state laws. M
Win32 OpenSSL v1.0.2u Light	2MB Installer	Installs the most commonly used state laws. More information can
Win32 OpenSSL v1.0.2u	20MB Installer	Installs Win32 OpenSSL v1.0.2u laws. More information can be fou

- 3. Download and run the installer.
- 4. Read and click to agree to the terms. Select Next.

👸 Setup -	OpenSSL	1.1.0L Light	(32-bit)
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License Agreement

Please read the following important information before continuing.



Please read the following License Agreement. You must accept the terms of this agreement before continuing with the installation.

DONATIONS NEEDED! If you are a bus donations. If you are a generous indiv people simply take and run - leaving me businesses even drop their customers of customer (ahem, PayPal). That's just of time donation of \$10, at least drop a lin effort out into this project (and, option	iness you should be contributing regular idual, consider regular donations. Most to foot the bill. That's not nice. Some onto me to provide direct support to the evil. Even if you can't afford a small, one he saying how much you appreciate the ally, what you use OpenSSL for). Lots of
complaints and few compliments is disc	puraging.
LEGAL NOTICE: This product includes :	oftware developed by the OpenSSL
 I accept the agreement 	

5. Leave the destination location default. Click Next.

🛃 Setup - OpenSSL 1.1.0L Light (32-bit)	_		×
Select Destination Location Where should OpenSSL Light (32-bit) be installed?		(
Setup will install OpenSSL Light (32-bit) into the following fi	older.		
To continue, click Next. If you would like to select a different folder, C:\OpenSSL-Win32	, click Br	rowse. Browse	
At least 6.7 MB of free disk space is required.			
< Back Nex	(t >	Car	ncel

6. Leave The Windows system directory. Click Next.

🔂 Setup - OpenSSL 1.1.0L Light (32-bit)		_		×
Select Additional Tasks Which additional tasks should be performed	d?		(
Select the additional tasks you would like S Light (32-bit), then click Next.	etup to perform	while installing Op	DenSSL	
Copy OpenSSL DLLs to:				
The Windows system directory				
O The OpenSSL binaries (/bin) directory				
	< Back	Next >	Can	cel

7. Click Install.

😽 Setup - OpenSSL 1.1.0L Light (32-bit)		-		\times
Ready to Install Setup is now ready to begin installing Open	SSL Light (32-bi	t) on your comp	uter.	
Click Install to continue with the installation change any settings.	, or click Back if	you want to rev	view or	
Destination location: C:\OpenSSL-Win32				^
Start Menu folder: OpenSSL				
Additional tasks: Copy OpenSSL DLLs to: The Windows system directory				
<			>	~
	< Back	Install	Ca	ancel

8. Click **Finish** when the installation is complete.

🛃 Setup - OpenSSL 1.1.0L Lig	ht (32-bit)	_		\times
	Completing the Open (32-bit) Setup Wizar Setup has finished installing OpenSSL computer. The application may be lau installed shortcuts. Click Finish to exit Setup. One-time \$10 donation to Win32 Larger one-time donation to Win32 Recurring \$5 donation to Win32 Recurring \$10 donation to Win33	nSSL L rd . Light (32-b .nched by s ? OpenSSL 32 OpenSSL 2 OpenSSL 2 OpenSSL 2 OpenSSL	ight it) on you electing th	ır ne
		Finish		

Installing Python

Use the following steps to download and install Python:

- 1. Download and install Python 2.7.13 here.
- 2. Install **pip** and add **python** to the path during installation.

🛃 Python 2.7.13 Setup	×
	Customize Python 2.7.13 Select the way you want features to be installed. Click on the icons in the tree below to change the way features will be installed.
2	 Register Extensions Tcl/Tk Documentation Utility Scripts pip Test suite Add python.exe to Path
python windows	Prepend C:\Python27\ to the system Path variable. This allows you to type 'python' into a command prompt without needing the full path. This feature requires OKB on your hard drive.
Disk Usage Advanc	ed < Back Next > Cancel

3. Type DOS in the Windows search box and select the Command Prompt.



4. Add the Python components by typing the following in the DOS prompt:

- a. pip install PySerial>=2.7
- b. pip install colorama>=0.3.3
- c. pip install enum34>=1.1.6

In-Application Programming with Python

The bootloader requires a specific firmware image, which is provided and signed by the algorithm vendor. The signed firmware images have an **msbl** file extension. The msbl file is found along with other supporting software, including the download_fw_over_host.py python script, on the MAX32663 product page on the Design Resources tab.

Use the following steps to flash the application to the MAX32663:

Enter the following commands in the command prompt or in the PowerShell window, replacing COMxx with the COM port of the connected MAX32630FTHR. Replace FIRMWARE with the name of the encrypted firmware file provided by the algorithm vendor.

python ./download_fw_over_host.py -f "FIRMWARE.msbl" -p "COMxx" -d 2

The COM port of the MAX32630FTHR is found by examining the **Ports (COM & LPT)** while hot plugging the MAX32630FTHR's USB connection to the host Windows PC. For example, the **USB Serial Device (COM4)** in the following image disappears when the MAX32630FTHR is disconnected from the PC and reappears when it is reconnected. The COM port number, four in this case, is likely to be different on each machine.



C:\test\max32660_demo>python .\download_fw_over_host.py -f Hello_World.msbl -p COM7 -c i2c				
MAXIM FIRMWARE DOWNLOADER 0.34				
>>> Parameters <<< Mass Flash: False Reset Target: False EBL mode: 0 Delay Factor: 1 Port: COMP MSBL/Blarry Input file: Hello_World.msbl Comm Interface: 12c COM7 is open				
Initializing bl downloader Input file name: Hello_Morld.msbl ### Press dowble Crtl + C to stop msbl file name: Hello_Morld.msbl magic: msbl formatVersion: 0 target: MAX32660 enc_type: numPages: 6 pageSize: 8192 crcSize: 4 size of header: 76 resv0: 0 nonce : 00 00 00 00 00 00 00 00 00 00 00 nonce : 00 00 00 00 00 00 00 00 00 00 nonce : 00 00 00 00 00 00 00 00 00 00 nonce : 00 00 00 00 00 00 00 00 00 00 nonce : 00 00 00 00 00 00 00 00 00 00 nonce : 00 00 00 00 00 00 00 00 00 00 nonce : 00 00 00 00 00 00 00 00 00 nonce : 00 00 00 00 00 00 00 00 00 nonce : 00 00 00 00 00 00 00 00 00 nonce : 00 00 00 00 00 00 00 00 00 nonce : 00 00 00 00 00 00 00 00 00 nonce : 00 00 00 00 00 00 00 00 00 nonce : 00 00 00 00 00 00 00 00 00 nonce : 00 00 00 00 00 00 00 00 00 nonce : 00 00 00 00 00 00 00 00 00 nonce : 00 00 00 00 00 00 00 00 00 nonce : 00 00 00 00 00 00 00 00 00 nonce : 00 00 00 00 00 00 00 00 00 nonce : 00 00 00 00 00 00 00 00 00 nonce : 00 00 00 00 00 00 00 00 00 nonce : 00 00 00 00 00 00 00 00 00 nonce : 00 00 00 00 00 00 00 00 00 nonce : 00 00 00 00 00 00 00 00 00 00 nonce : 00 00 00 00 00 00 00 00 00 00 nonce : 00 00 00 00 00 00 00 00 00 00 nonce : 00 00 00 00 00 00 00 00 00 nonce : 00 00 00 00 00 00 00 00 00 00 nonce : 00 00 00 00 00 00 00 00 00 00 nonce : 00 00 00 00 00 00 00 00 00 00 nonce : 00 00 00 00 00 00 00 00 00 nonce : 00 00 00 00 00 00 00 00 00 nonce : 00 00 00 00 00 00 00 00 00 00 nonce : 00 00 00 00 00 00 00 00 00 00 00 nonce : 00 00 00 00 00 00 00 00 00 00 00 nonce : 00 00 00 00 00 00 00 00 00 00 00 00 nonce : 00 00 00 00 00 00 00 00 00 00 00 nonce : 00 00 00 00 00 00 00 00 00 00 00 nonce : 00 00 00 00 00 00 00 00 00 00 00 00 0				
Bootloader communication interface as i2c Command: set_cfg comm i2c				
Set comm interface to i2c In silent mode, ret: 0				
Set timeout mode to enter bootloader Command: set_cfg host ebl 0				
Set ebl_mode to 0				
Set delay factor in host Set bl comm delay factor to 1				
Downloading msbl file				
Enable image on RAM: False CMD :image_on_nam 0				
In image_on_ram Hode. platform Bootloader_MAX32664 sensors err 0				
firmware_ver HSP2_3_2.3 hub_firm_ver 3.4.1				
Get page size Target page size: 8192				
Get USN USN = 0400134b0e801241ffffffacfffff7800000000000045d0				
set number of pages to download Set page size(6) successfully.				
Set IV set_iv 0000000000000000000				
Set IV bytes succeed.				
Set Auth set_auth 000000000000000000000000000000000000				
Set Auth bytes succeed.				
Erase App Erasing App flash succeed.				
Enter flashing mode Flash command succeed. Flashing 1/6 page[DONE] Flashing 2/6 page[DONE] Flashing 4/6 page[DONE] Flashing 6/6 page[DONE] Flashing 6/6 page[DONE] Flashing NSBL file succeed				
Junny to main application Dumping to main application. ret: 0 SUCCED				
Closing				

Trademarks List

Microsoft is a registered trademark and registered service mark of Microsoft Corporation.

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Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	10/20	Initial release	

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