Introduction

The ATWINC15x0/ATWINC3400 features an on-chip microcontroller and integrated SPI Flash memory for the system firmware. The serial Flash memory also stores the root certificate required for the TLS/SSL connection and the power gain values used by the transceiver. This application note details the download procedure of firmware, TLS/SSL root certificates, and TX power gain values into WINC serial Flash through different supported serial interfaces like SPI/UART. This document also covers some useful troubleshooting tips for download failures.

Note: This Flash memory download procedure is applicable for both the ATWINC15x0 and ATWINC3400 boards. The ATWINC15x0 is used for demonstrating the download procedure.

Features

- Firmware download procedure
- Root certificate download procedure
- Gain values download procedure
- Modified provisioning webpage download
- Troubleshooting tips
- Common download procedure for ATWINC15x0 and WINC3400
# Table of Contents

Introduction ...................................................................................................................... 1

Features .......................................................................................................................... 1

1. Firmware Update Project ........................................................................................... 4  
   1.1. Import Firmware Update Project .............................................................................. 4  
   1.2. Project Overview ........................................................................................................ 4  
   1.3. Firmware Version Mismatch Indication ...................................................................... 5  
   1.4. Downloading Interfaces ............................................................................................ 6  

2. Serial Flash Download via Serial Bridge ................................................................. 7  
   2.1. Serial Flash Download Using SAM Xplained Pro Board ............................................. 7  
   2.2. Serial Flash Download Using Custom Host MCU ..................................................... 9  

3. Serial Flash Download via Built-in UART ................................................................ 12  
   3.1. Hardware Setup ......................................................................................................... 12  
   3.2. Batch Script ............................................................................................................. 13  

4. Download Failure Troubleshooting ......................................................................... 15  
   4.1. Failed To Find Any COM Port .................................................................................. 15  
   4.2. Found More Than One Matching Tool ....................................................................... 16  
   4.3. Listing More Than One COM Port .............................................................................. 16  
   4.4. Failed To Initialize Programmer: Invalid Chip ID ..................................................... 17  
   4.5. Failed To Initialize Programmer: Waiting For Chip Permission ............................... 18  

5. Customized Provisioning Webpage Download ......................................................... 19  
   5.1. Batch Script ............................................................................................................. 20  

6. TLS/SSL Certificates Download .............................................................................. 21  
   6.1. Batch Script ............................................................................................................. 21  

7. Gain Values Download .............................................................................................. 22  
   7.1. Modify Gain Values ................................................................................................. 22  
   7.2. Batch Script ............................................................................................................. 22  

8. Document Revision History ....................................................................................... 23  

The Microchip Web Site ................................................................................................ 24  

Customer Change Notification Service ........................................................................ 24  

Customer Support ........................................................................................................ 24  

Microchip Devices Code Protection Feature .................................................................. 24  

Legal Notice .................................................................................................................. 25
1. **Firmware Update Project**

The WINC1500 or WINC3400 Firmware Update Project is retrieved through the Atmel Software Framework (ASF). The latest Firmware Update Project contains the new firmware images as well as the batch script files used to download the firmware, TLS/SSL root certificate, provisioning webpage, and TX power gain values into the Wi-Fi Network Controller (WINC) through SPI/UART.

1.1 **Import Firmware Update Project**

**Prerequisites:** Install Atmel Studio. The latest version is available on the Atmel Gallery or found on the Atmel Studio Extensions manager.

1. Search for "Firmware Update Project" from the "New Example Project" of ASF menu in Atmel Studio.

![Figure 1-1. Firmware Update Project in ASF](image)

2. Select the appropriate "WINC Firmware Update Project (vxx.x.x)" corresponding to the intended host MCU Xplained Pro board and then press the OK button to import firmware update project and related documentation.

1.2 **Project Overview**

The Firmware Update Project appears as a regular project in Atmel Studio.
Figure 1-2. Firmware Update Project Overview

The `/src/firmware` folder contains the new WINC firmware as well as:

- The `download_all.bat` script - To download the WINC firmware, TLS/SSL root certificate, and TX power gain values.
- The `modify_provisioning_webpage.bat` - To update the WINC firmware image with a custom modified HTTP provisioning webpage.

The `/src` folder contains update scripts to download the WINC firmware, TLS/SSL root certificate, and TX power gain values at one go using a serial bridge through host MCU Xplained Pro boards.

1.3 Firmware Version Mismatch Indication

When there is an update for the WINC, it usually combines the Wi-Fi software API for the host MCU and a binary firmware for the WINC. To ensure the compatibility between the Wi-Fi software API on the host MCU and the WINC, a major/minor version number is used and verified at the Wi-Fi driver init.

When a version mismatch is detected at start-up, the Wi-Fi driver initialization fails and the `m2m_wifi_init()` function returns the firmware version mismatch error code. The required baud rate configuration on terminal window is 115200 8-N-1-N.

Figure 1-3. Firmware Version Mismatch Error Code

Setting the `CONF_WIFI_DEBUG` to '1' in the `conf_winc.h` configuration file of the host application project provides more information about the version mismatch error.
In this scenario, a firmware update with the appropriate firmware version number is expected. Each ASF release is tied to one particular WINC driver/firmware release.

1.4 Downloading Interfaces

The WINC serial Flash download (WINC firmware, TLS/SSL root certificate, and TX power gain values) is done by connecting a Windows computer to:

- Host MCU UART (typically the EDBG COM port when using an Xplained Pro board) – The host MCU is connected to the WINC via SPI, thus, host MCU UART acts as a serial bridge between a Windows computer and a WINC device.
- WINC built-in UART
2. **Serial Flash Download via Serial Bridge**

As the WINC device is connected to host MCU through SPI interface, upgrading the WINC serial Flash via the host MCU is an easier solution. Since the WINC provides transparent access to host MCU, the WINC serial Flash can be read/written from host MCU. The host MCU can program the serial (SPI) Flash without the need for operational firmware in the WINC. The host MCU running the serial bridge firmware is connected between a Windows computer and a WINC SPI to download the firmware to a WINC serial Flash.

2.1 **Serial Flash Download Using SAM Xplained Pro Board**

The `/src/firmware/Tools/serial_bridge` contains the serial bridge binary images for a few of SAM-based host MCUs. This serial bridge firmware uses UART interface available on SAM Xplained Pro boards.

The batch script files available in `/src` folder contains the scripts to program the platform specific serial bridge binary image on the host MCU before it starts the WINC serial Flash download. EDBG on SAM Xplained Pro board is used for programming serial bridge image. The script uses the Atmel Studio atprogram.exe commands for programming the host MCU via EDBG of SAM Xplained Pro boards.

2.1.1 **Hardware Setup**

The download procedure requires that the WINC module is attached on EXT1 of the SAM Xplained Pro kit. Plug a Micro-USB cable from a Windows computer to the debug USB port of the Xplained Pro kit.

**Figure 2-1. USB Connection With Xplained Pro Kit**

2.1.2 **Batch Script**

A list of batch (.bat) script files in the `/src` folder of "WINCXXXX_Firmware_Update_Project (vxx.x.x)" is used to trigger a WINC serial Flash download.

1. Ensure that the SAM Xplained Pro board is connected to a PC via a debug USB port. The virtual EDBG COM port of the board is now listed in the device manager.
2. Run the `sam_xplained_pro_firmware_update.bat` script that corresponds to the connected SAM Xplained Pro board.

3. The batch script programs a serial bridge binary on the host MCU to redirect firmware data from the computer (EDBG virtual COM port) to the WINC chip (via SPI). The serial bridge application also performs the WINC power-up sequence, thus ensuring that the WINC bootloader is in the appropriate state to start a download.

   **Figure 2-2. Serial Bridge Firmware Programming : Success**

4. During the download process the batch script provides information about the output the firmware version being programmed onto the WINC, as well as the previously installed firmware version.

   **Figure 2-3. Displaying Firmware Version**

5. After several seconds, the following message appears in order to indicate that the WINC download procedure is successfully completed.
Figure 2-4. WINC Serial Flash Download : Success

The WINC chip firmware, TLS/SSL root certificates, and TX power gain values are successfully updated. Refer to Download Failure Troubleshooting in case of failure.

Note: The serial Flash download using EDBG virtual COM of SAM Xplained Pro on Virtual OS is presently unsupported.

2.2 Serial Flash Download Using Custom Host MCU

The serial bridge example application is available in ASF for a few of the SAM-based host MCUs.

Prerequisites: Install latest version of the Atmel Studio.

1. Search for "Serial Bridge Example" from the "New Example Project" of ASF menu in Atmel Studio. The search result lists the available Serial Bridge example projects for supported host MCU Xplained Pro board of the WINC device.

Note: WINC3400 Serial bridge application is not available at present.
2. Select the appropriate “WINC Serial Bridge Example” project corresponding to the intended host MCU Xplained Pro board and then press the OK button to import the project and related documentation.

Note: This project can be considered as a base for implementing serial bridge for custom-specific host MCUs. Porting of serial bridge firmware to custom host MCU is not within the scope of this document.

2.2.1 Batch Script

The `download_all.bat` is located in the `src/firmware` folder of the “WINCXXXX_Firmware_Update_Project”, which triggers the serial Flash download.

1. Program the host MCU with the custom implemented serial bridge firmware.
2. Ensure that the WINC device connected to the host MCU is powered up and that the host UART is connected to a PC.
3. In a Windows shell, execute the following to start the download:
   1. For ATWINC1500 (before firmware version 19.5.3), `download_all.bat UART`.
   2. For ATWINC1500 (from firmware version 19.5.3), `download_all.bat UART <MCU> <TargetChip> <AARDVARKSN> <Port number>.Example - download_all.bat UART SAMD21 3A0 0 0.`
   3. For ATWINC3400, `download_all.bat UART <MCU> <TGTCHIP> <AARDVARKSN> <PORTNUM> dev <KEYCERTS>.Example - download_all.bat UART SAMD21 3400 0 0 dev none none none`.
4. During the download process the batch script provides information about the output firmware version being programmed onto the WINC, as well as the previously installed firmware version.
5. After several seconds, the following message appears in order to indicate that the WINC download procedure is successfully completed.

**Figure 2-7. WINC Serial Flash Download : Success**

The WINC chip firmware, TLS/SSL root certificates, and TX power gain values are successfully updated. Refer to **Download Failure Troubleshooting** in case of failure.
3. Serial Flash Download via Built-in UART

The serial Flash download is done using the built-in UART of the WINC device. Prior to running any update script, setup the hardware as required.

Note: WINC3400 does not support download through built-in UART at present.

3.1 Hardware Setup

3.1.1 Power-On Sequence

To perform a serial Flash download using the WINC built-in UART, it is mandatory that the WINC chip is in the right bootloader state. To do so, the host MCU must power-up the WINC chip and then perform the Reset sequence as defined in the IEEE 802.11 b/g/n SmartConnect IoT Module Datasheet (DS70005304A). This is done very easily from the host MCU by calling the `m2m_bsp_init()` function.

```c
int main(void)
{
    /* Initialize the board. */
    system_init();

    /* Initialize the BSP. */
    nm_bsp_init();

    /* Reset the BSP. */
    nm_bsp_reset();

    while(1) {
    }
}
```

3.1.2 UART Pin assignment

The pin assignment of WINC1500 module UART are described in the following table. On ATWINC1500 Xplained Pro, TX, and RX are available on through holes labeled as “DEBUG_UART” for easy identification.

<table>
<thead>
<tr>
<th>ATWINC1500 Module Pin Name</th>
<th>ATWINC1500 Xplained Pro Pin Name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>J14</td>
<td>UART_TX</td>
<td>TXD</td>
</tr>
<tr>
<td>J19</td>
<td>UART_RXD</td>
<td>RXD</td>
</tr>
</tbody>
</table>

3.1.3 Hardware Connection

Depending on the WINC-Xpro board version, it may feature a Micro-USB plug, which is connected to the WINC built-in UART via an FTDI module. In this case, the PC must have the latest FTDI driver installed to see the corresponding virtual serial COM port.
Figure 3-1. USB Connection With WINC Built-In UART

When a Micro-USB plug is not present on the WINC-Xpro board, the RX, TX, and GND UART signals (see Table 3-1) that are available on the board can be connected to a PC using a third-party serial-to-USB converter.

### 3.2 Batch Script

The `download_all.bat` batch script is located in the `src/firmware` folder of the "WINCXXXX_Firmware_Update_Project" that triggers the download through built-in UART.

1. Ensure that the host MCU is powered up and that the WINC built-in UART is connected to a PC via a serial-to-USB converter.
2. In a Windows shell, execute the following to start the download:
   1. For ATWINC1500 (before firmware version 19.5.3), `download_all.bat UART`
   2. For ATWINC1500 (from firmware version 19.5.3), `download_all.bat UART <MCU> <TargetChip> <AARDVARKSN> <Port number>`. Example - `download_all.bat UART SAMD21 3A0 0 0`.
3. During the download process the batch script provides information about the output firmware version being programmed onto the WINC, as well as the previously installed firmware version.
4. After several seconds, the following message appears in order to indicate that the WINC download procedure is successfully completed.

**Figure 3-3. WINC Serial Flash Download : Success**

```
>Start erasing...
Done
#Erase time = 0.032000 sec
>Writing the certificate to SPI flash...
>Start programming...
Done
#Programming time = 0.219000 sec

> This task finished after 2.23 sec
OK.
```

**Result:** The WINC chip firmware, TLS/SSL root certificate, and TX power gain values are successfully updated. Refer to **Download Failure Troubleshooting** in case of failure.
4. Download Failure Troubleshooting

This section provides the troubleshooting tips for a specific error while downloading using batch script.

4.1 Failed To Find Any COM Port

Figure 4-1. Error : Failed To Find Any COM Port

The image downloader tool used to perform a serial bridge or a built-in UART download tries to look for available COM ports using Windows API. It attempts to match each COM port name with “EDBG” string or a port number “COM” string. If one of the two conditions is true, the program attempts to send a 0x12 character on the UART line. The host device is then expected to answer 0x5A for a built-in UART update or 0x5B for a serial bridge update.

The Failed to find any COM port error is expected when there are no response for the command.

How to fix it:

- Ensure the WINC COM port is listed in the device manager.
- Ensure the WINC COM port is not opened by any other application. For verification, try to open and close the COM port with a terminal application.
- Low quality USB cable or serial-to-USB converter (built-in UART) can introduce garbage on the UART line, thus, fail to detect the WINC COM port. Use another cable.
- When performing a built-in UART download, it is expected that the WINC bootloader is in a particular state that is only achievable after doing a clean power-up and Reset sequence. Therefore, before downloading, it is recommended to ensure a clean power-up and Reset sequence.
- Ensure that no other extension board is connected to the Xplained Pro board while performing the download.
- Ensure the project path is not exceeding the Windows maximum path length of 260 characters.
4.2 Found More Than One Matching Tool

Figure 4-2. Error: Found More Than One Matching Tool

The Found more than one matching tool error is observed when downloading using Xplained Pro board serial bridge with `sam_xplained_pro_firmware_update.bat` batch script. The image downloader tool tries to look for available COM ports and attempts to match each COM port name with “EDBG” string to program the serial bridge binary image on the host MCU.

How to fix it:
- All the Xplained Pro boards are enumerated with “EDBG Virtual COM Port”. Ensure to connect one Xplained Pro board at a time on a PC.

4.3 Listing More Than One COM Port

Figure 4-3. Listing More Than One COM Port

The More than one COM port is listed using `download_all.bat` when downloading, where the host MCU contains the serial bridge firmware or download through built-in UART. The image downloader tool used to perform a serial bridge or a built-in UART download tries to look for available COM ports and attempts to match each COM port name with “EDBG” string or a port number “COM” string. If one of the two conditions is true, the program attempts to send a 0x12 character on each UART line. The host
device is then expected to answer 0x5A for a built-in UART update or 0x5B for a serial bridge update. If the expected response is received on all UART lines, the script lists all the detected COM ports.

**How to fix it:**

- Input COM port number of the intended device to be downloaded when Please enter COM port number to program: displays as shown in the preceding figure.

**Note:** For each download of WINC chip firmware, TLS/SSL root certificates, and TX power gain values, it is required to provide a COM port number. To avoid this, it is possible to force the image downloader tool to use a specific COM port number from the start. For example:

- To use COM56, run the script such as this: download_all.bat UART 56.
- For 19.5.3 firmware, download_all.bat UART <MCU> <TargetChip> <AARDVARKSN> <Port number>. Example - download_all.bat UART SAMD21 3A0 0 0.

### 4.4 Failed To Initialize Programmer: Invalid Chip ID

**Figure 4-4. Error : Failed To Initialize Programmer - Invalid Chip ID**

The **Failed to initialize programmer with Invalid chip ID** error typically happens when there is garbage or noise on the UART line preventing from reading the correct chip ID value.

**How to fix it:**

- Try connecting the PC and the WINC with a different cable. A clean power-up and Reset sequence of the WINC is necessary to start over with the WINC bootloader in the appropriate state.
4.5 Failed To Initialize Programmer: Waiting For Chip Permission

Figure 4-5. Error: Failed To Initialize Programmer - Waiting For Chip Permission

After printing the correct chip ID of the WINC, the image downloader tool programs a small binary (programmer firmware) to assist with WINC Flash programming. At this stage the image downloader changes the UART baud rate from 115200 to 500000 to speed up the actual transfer of the firmware image. Once the baud rate change is made, the chip permission is verified to ensure the UART connection is reliable. Failing at this stage means that the current setup does not support such a high baud rate.

How to fix it:

- It is recommended to try connecting a PC and the WINC with a different cable. Also, a clean power-up and Reset sequence of the WINC is necessary to start over with the WINC bootloader in the appropriate state.
5. Customized Provisioning Webpage Download

The WINC device features a Provisioning Webpage mode that can be used to enter user credentials to connect the WINC device to the desired Access Point. The HTTP server and the actual HTML provisioning webpage is embedded in the WINC firmware, therefore, it cannot be modified from the host MCU. The firmware update project includes the HTML code used by the WINC for HTTP provisioning and also the necessary scripts to generate a new WINC firmware image with the modified provisioning webpage.

Figure 5-1. Provisioning Webpage Folder Structure

The /src/firmware – Contains the script to generate an updated WINC firmware image:
- The `modify_provisioning_webpage.bat` script to generate a new WINC firmware image that includes the HTML code provided in the /provisioning_webpage folder.
- The `modify_provisioning_webpage_ota.bat` script to generate a new WINC firmware OTA image that includes the HTML code provided in the /provisioning_webpage folder.

The /src/firmware/provisioning_webpage – Contains the WINC HTML code:
- `logo.png` - Logo image displayed at the top of the provisioning page.
- `favicon.ico` - Icon that appears inside the browser tab displaying the WINC provisioning page.
- `default.html` - The default HTML file that appears in the browser when the user requests the WINC Home Page.
• **style.css** - Cascading Style Sheet (CSS) used for describing the look and formatting of the default.html contents.

### 5.1 Batch Script

The `modify_provisioning_webpage.bat` batch script is located in `src/firmware` folder of the "WINCXXXX_Firmware_Update_Project". This script triggers the generation of new WINC firmware image that includes the HTML code provided in the `src/firmware/provisioning_webpage` folder.

1. Modify WINC HTML code in `/src/firmware/provisioning_webpage` folder as required.
2. Run the `modify_provisioning_webpage.bat` script.
3. The generated new firmware image overwrites the default firmware image located in the `src/firmware` folder. The following message appears to indicate that the new WINC firmware is successfully generated.

#### Figure 5-2. WINC Firmware Generated with Modified Provisioning Webpage

![Provisioning webpage has been successfully updated in firmware image](image)

4. Follow the steps mentioned in **Serial Flash Download via Serial Bridge** or **Serial Flash Download via Built-in UART** for specific interface to download the modified Provisioning Webpage.
6. **TLS/SSL Certificates Download**

The WINC saves the TLS/SSL certificates inside the serial Flash in 4K sector (the maximum size of all certificates in Flash must be less than 4K). The serial Flash download process as explained in **Serial Flash Download via Built-in UART** also downloads the TLS/SSL certificates. However, it is also possible to download only the certificates without downloading the WINC chip firmware. For generating the certificate, refer to the *Wi-Fi Network Controller Software Design Guide Application Note (DS00002389A)*. The following procedure explains how to download the TLS/SSL certificates.

### 6.1 Batch Script

The `RootCertDownload.bat` batch script is located in `src/firmware/Tools/root_certificate_downloader/debug_uart` folder of the "WINCXXX_Firmware_Update_Project". This script triggers the certificate to download into WINC device.

1. Ensure that the host MCU is powered up as mentioned in the Power-On sequence and that the WINC built-in UART is connected to a PC via a serial-to-USB converter. If the host MCU is running the serial bridge firmware, then it is also possible to download the certificates through host MCU.
2. Paste the certificates in the `/src/firmware/Tools/root_certificate_downloader/crt` folder.
3. Run the `RootCertDownload.bat` to start the download.
4. After a few seconds, the following message appears to indicate that the root certificates are successfully downloaded.

**Figure 6-1. Root Certificates Download : Success**

![Image of certificate download message](image)

Result: TLS/SSL root certificates are successfully downloaded.
7. **Gain Values Download**

Gain setting values are used by the RF with different rates to configure the transmission power.

7.1 **Modify Gain Values**

The `.csv` file in the `src/firmware/Tools/gain_builder/gain_sheets` folder holds the gain values. The following figure shows the template of the `.csv` file. The `.csv` file must be sorted based on the gain rates (Row) and for all the channels (Column).

**Figure 7-1. Gain Sheet Template**

<table>
<thead>
<tr>
<th>ch</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7.2 **Batch Script**

The gain values are downloaded as part of the complete download process explained in the previous sections. It is impossible to download the gain values alone. The modified gain values can be downloaded as follows:

1. The `.csv` file in the `src/firmware/Tools/gain_builder/gain_sheets` folder holds the gain values. The values can be changed in the default `.csv` file.

2. If the new gain values are available in a different file, but with a different path, then open the `download_all.bat` from the `src/firmware` and update it with the new path and file such as:

   `GAIN_FILE=-hp ../gain_sheets/samd21_gain_setting_hp.csv → GAIN_FILE=c:/gain_values.csv`

3. After modifying the gain values using either of the steps above, follow the steps mentioned in the [Serial Flash Download via Serial Bridge](#) or [Serial Flash Download via Built-in UART](#) to download the new gain values.
8. Document Revision History

**Rev. B - 11/2017**

<table>
<thead>
<tr>
<th>Section</th>
<th>Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>Editorial updates.</td>
</tr>
<tr>
<td>Features</td>
<td>Editorial updates.</td>
</tr>
<tr>
<td>Batch Script</td>
<td>Revised the command in Serial Flash Download Using Custom Host MCU procedure.</td>
</tr>
<tr>
<td>Batch Script</td>
<td>Revised the command in Serial Flash Download via Built-in UART procedure.</td>
</tr>
</tbody>
</table>

**Rev. A - 3/2017**

<table>
<thead>
<tr>
<th>Section</th>
<th>Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Document</td>
<td>• Updated from Atmel to Microchip template.</td>
</tr>
<tr>
<td></td>
<td>• Assigned a new Microchip document number. Previous version is Atmel 42809 revision A.</td>
</tr>
<tr>
<td></td>
<td>• ISBN number added.</td>
</tr>
</tbody>
</table>
The Microchip Web Site

Microchip provides online support via our web site at http://www.microchip.com/. This web site is used as a means to make files and information easily available to customers. Accessible by using your favorite Internet browser, the web site contains the following information:

- **Product Support** – Data sheets and errata, application notes and sample programs, design resources, user’s guides and hardware support documents, latest software releases and archived software
- **General Technical Support** – Frequently Asked Questions (FAQ), technical support requests, online discussion groups, Microchip consultant program member listing
- **Business of Microchip** – Product selector and ordering guides, latest Microchip press releases, listing of seminars and events, listings of Microchip sales offices, distributors and factory representatives

Customer Change Notification Service

Microchip’s customer notification service helps keep customers current on Microchip products. Subscribers will receive e-mail notification whenever there are changes, updates, revisions or errata related to a specified product family or development tool of interest.


Customer Support

Users of Microchip products can receive assistance through several channels:

- Distributor or Representative
- Local Sales Office
- Field Application Engineer (FAE)
- Technical Support

Customers should contact their distributor, representative or Field Application Engineer (FAE) for support. Local sales offices are also available to help customers. A listing of sales offices and locations is included in the back of this document.

Technical support is available through the web site at: http://www.microchip.com/support

Microchip Devices Code Protection Feature

Note the following details of the code protection feature on Microchip devices:

- Microchip products meet the specification contained in their particular Microchip Data Sheet.
- Microchip believes that its family of products is one of the most secure families of its kind on the market today, when used in the intended manner and under normal conditions.
- There are dishonest and possibly illegal methods used to breach the code protection feature. All of these methods, to our knowledge, require using the Microchip products in a manner outside the operating specifications contained in Microchip’s Data Sheets. Most likely, the person doing so is engaged in theft of intellectual property.
- Microchip is willing to work with the customer who is concerned about the integrity of their code.
Neither Microchip nor any other semiconductor manufacturer can guarantee the security of their code. Code protection does not mean that we are guaranteeing the product as “unbreakable.”

Code protection is constantly evolving. We at Microchip are committed to continuously improving the code protection features of our products. Attempts to break Microchip’s code protection feature may be a violation of the Digital Millennium Copyright Act. If such acts allow unauthorized access to your software or other copyrighted work, you may have a right to sue for relief under that Act.

Legal Notice

Information contained in this publication regarding device applications and the like is provided only for your convenience and may be superseded by updates. It is your responsibility to ensure that your application meets with your specifications. MICROCHIP MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND WHETHER EXPRESS OR IMPLIED, WRITTEN OR ORAL, STATUTORY OR OTHERWISE, RELATED TO THE INFORMATION, INCLUDING BUT NOT LIMITED TO ITS CONDITION, QUALITY, PERFORMANCE, MERCHANTABILITY OR FITNESS FOR PURPOSE. Microchip disclaims all liability arising from this information and its use. Use of Microchip devices in life support and/or safety applications is entirely at the buyer’s risk, and the buyer agrees to defend, indemnify and hold harmless Microchip from any and all damages, claims, suits, or expenses resulting from such use. No licenses are conveyed, implicitly or otherwise, under any Microchip intellectual property rights unless otherwise stated.

Trademarks

The Microchip name and logo, the Microchip logo, AnyRate, AVR, AVR logo, AVR Freaks, BeaconThings, BitCloud, CryptoMemory, CryptoRF, dsPIC, FlashFlex, flexPWR, Heldo, JukeBlox, KeeLoq, KeeLoq logo, Kleer, LANCheck, LINK MD, maXStylus, maXTouch, MediaLB, megaAVR, MOST, MOST logo, MPLAB, OptoLyzer, PIC, picoPower, PICSTART, PIC32 logo, Prochip Designer, QTouch, RightTouch, SAM-BA, SpyNIC, SST, SST Logo, SuperFlash, tinyAVR, UNI/O, and XMEGA are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

ClockWorks, The Embedded Control Solutions Company, EtherSynch, Hyper Speed Control, HyperLight Load, IntelliMOS, mTouch, Precision Edge, and Quiet-Wire are registered trademarks of Microchip Technology Incorporated in the U.S.A.


SQT P is a service mark of Microchip Technology Incorporated in the U.S.A.

Silicon Storage Technology is a registered trademark of Microchip Technology Inc. in other countries.

GestIC is a registered trademark of Microchip Technology Germany II GmbH & Co. KG, a subsidiary of Microchip Technology Inc., in other countries.

All other trademarks mentioned herein are property of their respective companies.
Quality Management System Certified by DNV

ISO/TS 16949
Microchip received ISO/TS-16949:2009 certification for its worldwide headquarters, design and wafer fabrication facilities in Chandler and Tempe, Arizona; Gresham, Oregon and design centers in California and India. The Company’s quality system processes and procedures are for its PIC® MCUs and dsPIC® DSCs, KEELQ® code hopping devices, Serial EEPROMs, microperipherals, nonvolatile memory and analog products. In addition, Microchip’s quality system for the design and manufacture of development systems is ISO 9001:2000 certified.
## AMERICAS

**Corporate Office**  
2355 West Chandler Blvd.  
Chandler, AZ 85224-6199  
Tel: 480-792-7200  
Fax: 480-792-7277  
Technical Support:  
http://www.microchip.com/support  
Web Address:  
www.microchip.com

**Atlanta**  
Duluth, GA  
Tel: 678-957-9614  
Fax: 678-957-1455

**Austin, TX**  
Tel: 512-257-3370  
Fax: 512-257-3380

**Chicago**  
Itasca, IL  
Tel: 630-285-0071  
Fax: 630-285-0075

**Dallas**  
Addison, TX  
Tel: 972-818-7423  
Fax: 972-818-2924

**Detroit**  
Novi, MI  
Tel: 248-848-4000

**Houston, TX**  
Tel: 281-894-5983

**Indianapolis**  
Noblesville, IN  
Tel: 317-773-8323  
Fax: 317-773-5453  
Tel: 317-536-2380

**Los Angeles**  
Mission Viejo, CA  
Tel: 949-462-9523  
Fax: 949-462-9608  
Tel: 951-273-7800

**Raleigh, NC**  
Tel: 919-844-7510

**New York, NY**  
Tel: 631-435-6000

**San Jose, CA**  
Tel: 408-735-9110  
Tel: 408-436-4270

**Canada - Toronto**  
Tel: 905-695-1980  
Fax: 905-695-2078

## ASIA/PACIFIC

**Australia - Sydney**  
Tel: 61-2-9868-6733

**China - Beijing**  
Tel: 86-10-8569-7000

**China - Chengdu**  
Tel: 86-28-8665-5511

**China - Chongqing**  
Tel: 86-23-8980-9588

**China - Dongguan**  
Tel: 86-769-8702-9880

**China - Guangzhou**  
Tel: 86-20-8755-8029

**China - Hangzhou**  
Tel: 86-571-8792-8115

**China - Hong Kong SAR**  
Tel: 852-2943-5100

**China - Nanjing**  
Tel: 86-25-8473-2460

**China - Qingdao**  
Tel: 86-632-8502-7355

**China - Shanghai**  
Tel: 86-21-3326-8000

**China - Shenzhen**  
Tel: 86-755-8864-2200

**China - Suzhou**  
Tel: 86-188-6233-1526

**China - Wuhan**  
Tel: 86-27-5980-5300

**China - Xian**  
Tel: 86-29-8833-2752

**China - Xiamen**  
Tel: 86-592-2388138

**China - Zhuhai**  
Tel: 86-756-3210040

**India - Bangalore**  
Tel: 91-80-3090-4444

**India - New Delhi**  
Tel: 91-11-4160-8631

**India - Pune**  
Tel: 91-20-4121-0141

**Japan - Osaka**  
Tel: 81-6-6152-7160

**Japan - Tokyo**  
Tel: 81-3-6880-3770

**Korea - Daegu**  
Tel: 82-53-744-4301

**Korea - Seoul**  
Tel: 82-2-554-7200

**Malaysia - Kuala Lumpur**  
Tel: 60-3-7651-7906

**Malaysia - Penang**  
Tel: 60-4-227-8870

**Philippines - Manila**  
Tel: 63-2-634-9065

**Singapore**  
Tel: 65-6334-8870

**Taiwan - Hsin Chu**  
Tel: 886-3-577-8366

**Taiwan - Kaohsiung**  
Tel: 886-7-213-7830

**Taiwan - Taipei**  
Tel: 886-2-2508-8600

**Thailand - Bangkok**  
Tel: 66-2-694-1351

**Vietnam - Ho Chi Minh**  
Tel: 84-29-5449-2100

## EUROPE

**Austria - Wels**  
Tel: 43-7242-2244-39  
Fax: 43-7242-2244-393

**Denmark - Copenhagen**  
Tel: 45-4450-2828  
Fax: 45-4485-2829

**Finland - Espoo**  
Tel: 358-9-4520-820  
Fax: 358-9-4520-821

**France - Paris**  
Tel: 33-1-69-53-63-20  
Fax: 33-1-69-30-90-79

**Germany - Garching**  
Tel: 49-8931-9700

**Germany - Haan**  
Tel: 49-2129-376400  
Fax: 49-2129-376400

**Germany - Heilbronn**  
Tel: 49-7131-67-3636

**Germany - Karlsruhe**  
Tel: 49-721-625370

**Germany - Munich**  
Tel: 49-89-627-144-0  
Fax: 49-89-627-144-44

**Germany - Rosenheim**  
Tel: 49-8031-354-560

**Israel - Ra’anana**  
Tel: 972-9-744-7705

**Italy - Milan**  
Tel: 39-0331-742611  
Fax: 39-0331-466781

**Italy - Padova**  
Tel: 39-049-7625286

**Netherlands - Drunen**  
Tel: 31-416-690399  
Fax: 31-416-690340

**Norway - Trondheim**  
Tel: 47-7289-7561

**Poland - Warsaw**  
Tel: 48-22-3325737

**Romania - Bucharest**  
Tel: 40-21-407-67-60

**Spain - Madrid**  
Tel: 34-91-708-08-90  
Fax: 34-91-708-08-91

**Sweden - Gothenberg**  
Tel: 46-31-704-60-40

**Sweden - Stockholm**  
Tel: 46-8-5090-4654

**UK - Wokingham**  
Tel: 44-118-921-5800  
Fax: 44-118-921-5820