

# SHIMMER 3

How to program the device



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# 1. REQUIRED SOFTWARE

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## 1.1. Code composer

Code Composer Studio from Texas Instruments is the IDE used to compile the programs targeted the embedded controller (TI MSP430) of the Shimmer3 device. It can be downloaded here:

[http://processors.wiki.ti.com/index.php/Download\\_CCS](http://processors.wiki.ti.com/index.php/Download_CCS)

To be able to download, you'll need to create a My TI account. When creating this, use your institutional email (for example <name>@post.au.dk), because Texas Instruments doesn't accept emails that are not from an institution.

When installing CCS, select only to install the MSP430 compilers, as depicted in Figure 1-1. The same applies to the add-ons, as depicted in Figure 1-2.

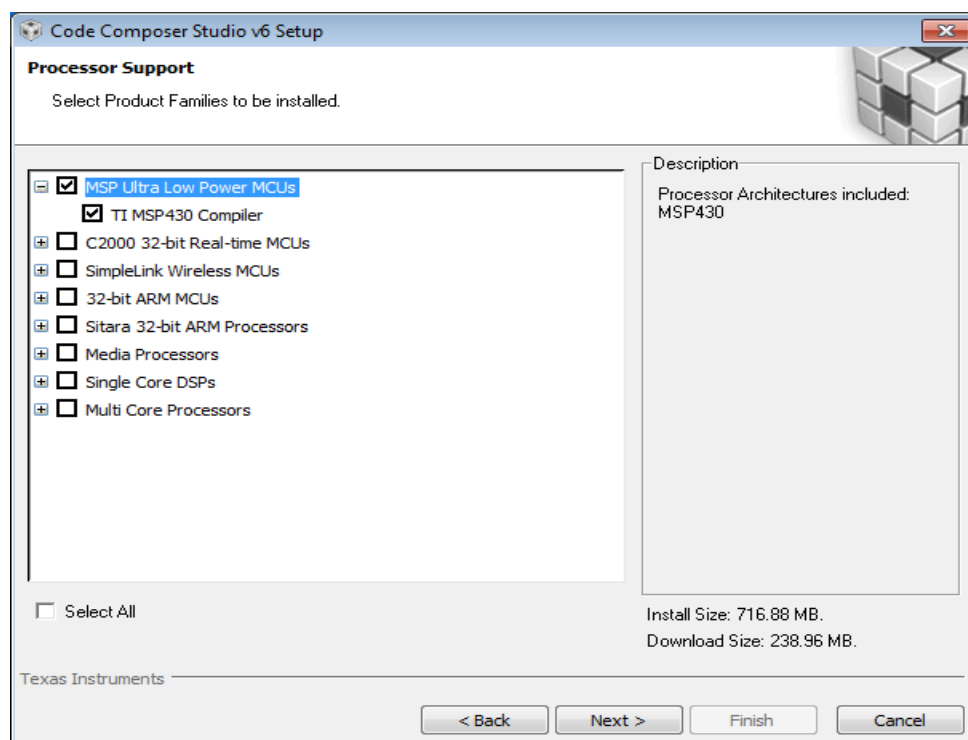


Figure 1-1 - MSP430's compiler selected to be installed.



Figure 1-2 - MSP430's add-ons selected to be installed.

**IMPORTANT:** notice that TI has made a restriction in the free version of CCS so that the code size cannot exceed 16KB. As explained in section 2.3, the BtStream firmware is larger than this limit and therefore it can't be compiled with the free version of CCS.

## 1.2. Shimmer3 Bootstrap Loader (BSL)

It is not possible to download a program onto the Shimmer3 device directly from Code Composer Studio. Therefore the Shimmer3 Bootstrap Loader (BSL) is needed in order to transfer the generated Hex file from Code Composer to the controller of the Shimmer3 device. The program is located in the folder "Resources/Bootstrap Loader". No installation is required here. It can be run directly from the .exe file.

## 1.3. Sample programs

Shimmer has made various sample programs that use the different functionalities of the Shimmer3 device. These programs are a great starting point when developing custom applications. The sample programs are included in the Bootstrap Loader but only as Hex files so that it is impossible to inspect the structure of the code behind. However the sample programs are maintained at a Github repository where the actual code can be downloaded and modified:

<https://github.com/ShimmerResearch/shimmer3/tree/015b696fd36076cbf6c45e70ac3c4e345dd10c06/apps>

All sample programs are located in the folder “Resources/Sample firmware”.

## 1.4. Shimmer Connect

Shimmer Connect is a PC application, which reads data from the Shimmer3 device and displays it graphically. This program along with the source code is located in the folder “Resources/Shimmer Connect v0.7”

## 2. PROGRAMMING THE DEVICE

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This section describes the procedure to download one of the sample programs to the Shimmer3 device.

### 2.1. Programming - step by step

1. In Code Composer press File->Import
2. Choose Code Composer Studio->Import CCS Projects
3. Choose "Select search-directory and the "Browse"
4. Locate the sample program "Shimmer3\_Blink" and press "OK"
5. *OPTIONAL: Choose "Copy projects into workspace" if you want the project to be located in the workspace directory of Code Composer. Otherwise the project explorer will refer to the current location of the project.*
6. Press "Finish" (The project should afterwards be displayed in the Project Explorer)
7. To compile the project press Run->Debug. An error message will be displayed saying:

Error initializing emulator:  
No USB FET was found

This is because there no emulator attached. Just press Cancel

8. Locate the generated .txt file either in the workspace of Code Composer or the current directory on your computer depending on the choice in step 5. The file will be named "Shimmer3\_Blink" and is located in the Debug folder. The first lines of the file will be something like this:

```
@5c00
31 40 00 5C B0 13 04 5F 0C 93 02 24 B0 13 D2 5D
0C 43 B0 13 C2 5E B0 13 0E 5F 4F 14 B2 92 EE 03
```

9. Copy this file and paste it into the folder "Resources/Bootstrap Loader/Bootstraps/User Bootstraps".
10. Connect the dock with the shimmer device attached to the computer and wait for the drivers to be installed. **Make sure that device is turned on (The green LED on the dock should be ON)**
11. Open the bootstrap loader. The correct COM port should already be chosen. Otherwise choose the COM port where the shimmer dock is attached.
12. Select the tab "User Bootstraps" and the select "Shimmer3\_Blink.txt"

13. Press “Program” and wait for the program to finish. Then press “OK”  
IMPORTANT: Make sure the Shimmer is turned on.
14. Now both LEDs on the shimmer3 device should toggle with approximately 1 second.

## 2.2. Sample programs

This package includes various sample programs as explained in the following.

### **Shimmer3\_Blink**

This is a very basic application that uses a timer on MSP430 to toggle the LEDs on the Shimmer.

### **Shimmer3\_Bluetooth**

This application is able to transmit dummy data on button press over Bluetooth. To indicate button press the application toggles the red LED. The skeleton for handling received data is included in an event handler which currently only toggles the red LED to indicate the communication is working properly.

### **BtStream**

This is a general-purpose configurable application to be used with Shimmer3 and any add-on daughter-cards supplied by Shimmer. It allows monitoring and capturing the different sensors of the Shimmer3 device via Bluetooth. These data can be visualized on the PC application Shimmer Connect. The newest version of the program is version 0.5 and the .txt file of this is located in the user bootstraps of the bootstrap loader.

By default this application samples the 3-axis analog accelerometer, MPU9150 gyroscope, LSM303DLHC magnetometer and battery voltage at 50Hz and sends the data over the Bluetooth radio at 51.2Hz, using a data buffer size of 1 (the buffer size is not currently configurable).

### **LogAndStream**

The application facilitates logging of data from a Shimmer3 to the on board SD card while also providing the ability to simultaneously stream data via wireless connection to a Bluetooth-enabled PC.

### **SDLog**

SD Log Firmware is an application that allows logging of data from a Shimmer to the on-board SD card. The firmware allows full user configuration of the Shimmer via a configuration file, stored on the SD card. Many useful features, such as time synchronization among multiple Shimmer units, start/stop logging on one or more devices by a single button press, and user-defined naming of devices, are enabled by this firmware image.

## 2.3. Final remarks

The BtStream program uses the different sensors of the Shimmer3 device and transmits the data via Bluetooth. These data can be interpreted by the PC application Shimmer Connect. The newest version of the program is version 0.5 and the .txt file of this is located in the user bootstraps of the bootstrap loader.

The first step in this process is to add the shimmer3 device to the computer so that a COM port is assigned to the Bluetooth communication.

When this is done and the BtStream program is loaded onto the device you can connect to it using the PC application and see the data graphically.

Unfortunately the size of version 0.5.0 of this program exceeds the 16 KB which is the limit for the free version of Code Composer. Therefore this version cannot be compiled. Earlier versions (0.1.0 – Initial) of this program can be downloaded from the Github repository which is below the limit however this might lead to issues due to missing bug fix implementations. Therefore it would be beneficial to have a paid version of Code Composer so that the newest version of BtStream can be modified and compiled.