Si4010 DEVELOPMENT KIT QUICK-START GUIDE

1. Purpose

Thank you for your interest in Silicon Laboratories Si4010 RF SoC transmitter development kit. This development kit contains everything you need to develop your software with the Si4010 embedded Si8051 MCU. The kit has three versions: one for the 434 MHz band (P/N 4010-KFOBDEV-434), one for the 868 MHz band (P/N 4010-KFOBDEV-868) and one for the 915 MHz band (P/N 4010-KFOBDEV-915). The key features of the development platform are as follows:

- The key fob development board has five push buttons and one LED.
- The key fob development board has a battery to enable disconnect from the programming interface board and SMA antenna output to allow wired measurements.
- Uses Silicon Laboratories Integrated Development Environment (IDE) for software debugging and can also use Keil C compiler, assembler, and linker.
- Interfaces with Silicon Laboratories USB Debug Adapter or Toolstick.
- Contains a socketed key fob development board for burning the OTP NVM memory. Contains Si4355 receiver board for link testing.
- Contains three blank NVM Si4010 chips and key fob demo boards without IC for burning and testing user code on an actual key fob PCB.

2. Kit Content

Table 1 lists the items contained in the kits.

Table 1. Kit Content

Qty	Part Number	Description
	4010-KFOBDEV-434	**Si4010 Key Fob Development Kit 434MHz**
2	4010-KFOB-434-NF	Si4010 key fob demo board 434 MHz w/o IC
1	MSC-DKPE1	SOIC/MSOP socketed development board
3	Si4010-C2-GS	Si4010-C2-GS transmitter IC, SOIC Package
1	4010-DKPB434-BM	Si4010 MSOP key fob development board 434 MHz, SMA
1	4355-LED-434-SRX	Si4355 RFStick 434 MHz receiver board
1	MSC-PLPB_1	Key Fob Plastic Case (translucent grey)
1	MSC-BA5	Programming interface board
1	MSC-BA4	Burning adapter board
1	EC3	USB Debug Adapter
1	Toolstick_BA	Toolstick Base Adapter
1	MSC-DKCS5	USB Cable
1		USB extender cable (USBA-USBA)
2	AAA	AAA battery
2	CRD2032	CR2032 3 V coin battery

Table 1. Kit Content (Continued)

	4010- KFOBDEV-868	Si4010 Key Fob Development Kit 868MHz
2	4010-KFOB-868-NF	Si4010 key fob demo board 868 MHz w/o IC
1	MSC-DKPE1	SOIC/MSOP socketed development board
3	Si4010-C2-GS	Si4010-C2-GS transmitter IC, SOIC Package
1	4010-DKPB868-BM	Si4010 MSOP key fob development board 868 MHz, SMA
1	4355-LED-868-SRX	Si4355 RFStick 868 MHz receiver board
1	MSC-PLPB_1	Key Fob Plastic Case (translucent grey)
1	MSC-BA5	Programming interface board
1	MSC-BA4	Burning adapter board
1	EC3	USB Debug Adapter
1	Toolstick_BA	Toolstick Base Adapter
1	MSC-DKCS5	USB Cable
1		USB extender cable (USBA-USBA)
2	AAA	AAA battery
2	CRD2032	CR2032 3 V coin battery
	4010- KFOBDEV-915	Si4010 Key Fob Development Kit 915MHz
2	4010-KFOB-915-NF	Si4010 key fob demo board 915 MHz w/o IC
1	MSC-DKPE1	SOIC/MSOP socketed development board
3	Si4010-C2-GS	Si4010-C2-GS transmitter IC, SOIC Package
1	4010-DKPB915-BM	Si4010 MSOP key fob development board 915 MHz, SMA
1	4355-LED-915-SRX	Si4355 RFStick 915 MHz receiver board
1	MSC-PLPB_1	Key Fob Plastic Case (translucent grey)
1	MSC-BA5	Programming interface board
1	MSC-BA4	Burning adapter board
1	EC3	USB Debug Adapter
1	Toolstick_BA	Toolstick Base Adapter
1	MSC-DKCS5	USB Cable
1		USB extender cable (USBA-USBA)
2	AAA	AAA battery
2	CRD2032	CR2032 3 V coin battery

SILICON LABS

**Figure 1. Burning Adapter Board (P/N MSC-BA4)**
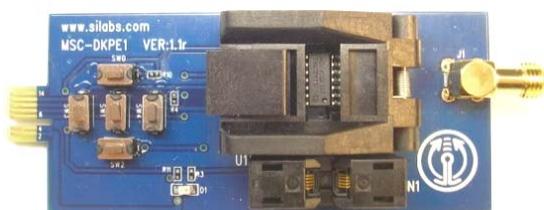
**Figure 2. Si4010 Socketed Key Fob Development Board (P/N MSC-DKPE1)**
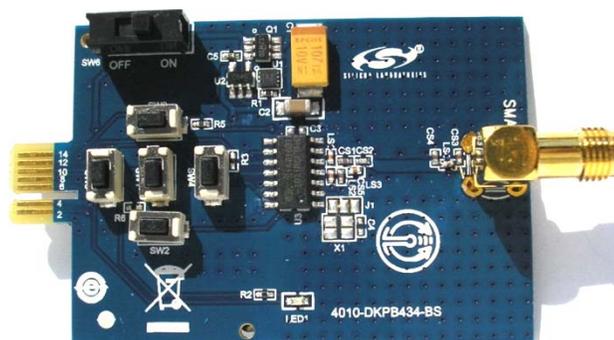
Figure 3. Si4010 MSOP Key Fob Development Board 434 MHz, SMA (P/N 4010-DKPB434-BM)

Note: Instead of this board, the 434 MHz development kits may contain the pcb antenna version of this board called the Si4010 key fob development board 434 MHz (P/N 4010-DKPB_434).
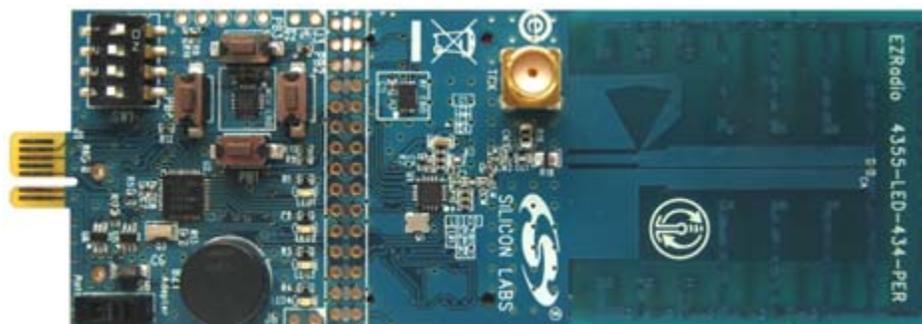
Figure 4. Si4355 RFStick 434 MHz Receiver Board (P/N 4355-LED-434-SRX)

Figure 5. 4010 Key Fob Demo Board 434 MHz w/o IC (P/N 4010-KFOB-434-NF)

Figure 6. Key Fob Plastic Case (Translucent Grey) (P/N MSC-PLPB_1)

Figure 7. EC3 Debug Adapter (P/N EC3)

Figure 8. Toolstick Base Adapter (P/N Toolstick_BA)

3. Software Installation

The software and documentation pack for the development kit is available as a zip file on the Silicon Labs website at http://www.silabs.com/products/wireless/EZRadio/Pages/Si4010.aspx on the Tools tab. The provided software pack contains all the documentation and files needed to develop a user application. It also contains example applications using API functions and the key fob demo application.

The directory structure of the software examples is as follows:

```
+--Si4010_projects
|  +--aes_demo
|  |  +--bin              .. Keil uVision and SiLabs IDE files
|  |  +--out              .. output directory for Keil toolchain
|  |  +--src              .. aes_demo source code
|  +--common
|  |  +--lib              .. Si4010 additional API functions library
|  |  +--src              .. Si4010 required files
|  +--fcast_demo          .. frequency casting (tuning) demo
|  |  +--bin
|  |  +--out
|  |  +--src
|  +--fstep_demo          .. frequency two step tuning demo
|  |  +--bin
|  |  +--out
|  |  +--src
|  +--tone_demo           .. continuous wave (tone) demo
|  |  +--bin
|  |  +--out
|  |  +--src
|  +--keyfob_demo         .. simple keyfob demo
|  |  +--bin
|  |  +--out
|  |  +--src
|  +--rke_demo            .. advanced keyfob demo with AES
|  |  +--bin
|  |  +--out
|  |  +--src
```

Copy the directory structure in a directory of your choice. It is recommended to keep the structure of the Si4010_projects folder to allow the compiler to find the Si4010 common files. Each project has a *.wsp project file in the bin folder that contains all the settings of the IDE for the project, including the relative path of the common files.

AN690

4. Silicon Labs IDE Run

Download the Silicon Labs IDE (Integrated Development Environment) from the following URL: http://www.silabs.com/products/mcu/Pages/SiliconLaboratoriesIDE.aspx and install it on your computer. To run the Silicon Labs IDE, open an *.wsp project file.

5. Hardware Setup using a USB Debug Adapter

A detailed description about the IDE and debug adapters can be found in the Si4010 Development Kit User's Guide.

The target board is connected to a PC running the Silicon Laboratories IDE via the USB Debug Adapter as shown in Figure 9.

Figure 9. Target Board and Debug Adapter

Perform the following steps to set up the debug adapter:

1. Connect the EC3 Debug Adapter to the J2 connector on the Burning Adapter board with the 10-pin ribbon cable.

2. Connect one end of the USB cable to the USB connector on the USB Debug Adapter.

3. Connect the other end of the USB cable to a USB Port on the PC.

4. Reset the firmware of the Debug adapter by running the following application:
   \Silabs_IDE\usb_debug_adapter_firmware_reset.exe
   (This operation needs to be done only once per USB Debug Adapter before a new version of the IDE can be used.)

5. Run Silabs_IDE\ide.exe
   The first time the IDE program is run, it will automatically update the correct firmware for the adapter.

Note: Remove power from the target board and the USB Debug Adapter before connecting or disconnecting the ribbon cable from the target board. Connecting or disconnecting the cable when the devices have power can damage the device and/or the USB Debug Adapter.

SILICON LABS

6. Keil Toolchain Integration

The project files in examples assume that the Keil toolchain is installed to: C:\Keil directory. The location of the Keil toolchain can be easily changed in the Silabs IDE in the Project—Tool Chain Integration menu. An evaluation version of the Keil toolchain can be downloaded from the Keil web site, http://www.keil.com/. This free version has 2 kB code limitation and starts the code at 0x0800 address. The Keil free evaluation version can be unlocked to become a 4k version with no code placement limitation by following the directions given in application note "AN104: Integrating Keil 8051 Tools into the Silicon Labs IDE", which covers Keil toolchain integration and license management. The unlock code can be found in the documentation pack mentioned in "3. Software Installation" on page 5 of this document. You can find the unlock code in the root folder in the Keil_license_number.txt file. Contact your Silicon Laboratories sales representative or distributor for application assistance.

7. Known Issues

There is an issue related to the LED driver, which demonstrates itself only under the following circumstances when all three conditions are satisfied:

1. The device programming level is Factory or User. For those levels, the C2 debugging interface is enabled after the boot by a boot routine.
2. The device has been disconnected from the Silicon Labs IDE. "Disconnected" is meant in the software sense (not physically) using the Connect/Disconnect buttons on IDE, or the device is running the User code automatically after the boot without ever being connected to the IDE.
3. The device is running a code that turns the LED on and off.

If all the conditions are satisfied, after the first LED blink when the LED is turned off, the GPIO4 stops working and is no longer visible to the application.

If the device programming level is Run or the C2 debugging interface is internally disabled, there is no issue. The LED can be turned on and off without affecting the device GPIO4 functionality.

The issue can be summarized as follows: Whenever the C2 debugging interface is enabled and the device is not connected to the IDE and the LED is turned on and off, then the GPIO4 will stop functioning. Since, in Run mode, the C2 is disabled after the boot process finishes, the GPIO4 is not affected.

Therefore, this issue only affects the software development process and inconveniences the developer. After the application is finalized and the chip is programmed as Run, there is no issue.

There are several possible software workarounds; see details in the Si4010 key fob development kit user guide.

CONTACT INFORMATION

Silicon Laboratories Inc.

Silicon Laboratories Inc.
400 West Cesar Chavez
Austin, TX 78701
Please visit the Silicon Labs Technical Support web page:
https://www.silabs.com/support/pages/contacttechnicalsupport.aspx
and register to submit a technical support request.

SILICON LABS