



# Proprietary Flex SDK 3.2.9.0 GA

## Gecko SDK Suite 3.2

### October 25, 2023

The Proprietary Flex SDK is a complete software development suite for proprietary wireless applications. Per its namesake, Flex offers two implementation options.

The first uses Silicon Labs RAIL (Radio Abstraction Interface Layer), an intuitive and easily-customizable radio interface layer designed to support both proprietary and standards-based wireless protocols.

The second uses Silicon Labs Connect, an IEEE 802.15.4-based networking stack designed for customizable broad-based proprietary wireless networking solutions that require low power consumption and operates in either the sub-GHz or 2.4 GHz frequency bands. The solution is targeted towards simple network topologies.

The Flex SDK is supplied with extensive documentation and sample applications. All examples are provided in source code within the Flex SDK sample applications.

These release notes cover SDK version(s):

- 3.2.9.0 released October 25, 2023 (support for EFR32xG22, Revision D)
- 3.2.8.0 released September 5, 2023 (underlying platform changes only)
- 3.2.7.0 released July 13, 2023 (RAIL: support for EFR32xG21, Revision C and later)
- 3.2.5.0 released March 29, 2023 (RAIL: early access part support)
- 3.2.4.0 released January 11, 2023 (underlying platform changes only)
- 3.2.3.0 released October 13, 2021
- 3.2.2.0 released September 8, 2021
- 3.2.1.0 released July 21, 2021
- 3.2.0.0 released June 16, 2021



#### CONNECT APPS AND STACK KEY FEATURES

- EFR32xG23 GA support
- EFR32xG21 and MGMx CONNECT GA support
- FreeRTOS Support for CONNECT
- Long Range PHY Support for CONNECT
- New example: ECDH key exchange
- Example ported from Flex 2.7: DMP Light/Switch
- Support for the RAIL-embedded IEEE 802.15.4 PHY

#### RAIL APPS AND LIBRARY KEY FEATURES

- Wi-SUN Profile and Certified PHYs in Radio Configurator
- New example: SimpleTRX Standards for demonstrating 15.4/BLE usage

## Compatibility and Use Notices

For information about security updates and notices, see the Security chapter of the Gecko Platform Release notes installed with this SDK or on the [Silicon Labs Release Notes page](#). Silicon Labs also strongly recommends that you subscribe to Security Advisories for up-to-date information. For instructions, or if you are new to the Silicon Labs Flex SDK, see [Using This Release](#).

### Compatible Compilers:

IAR Embedded Workbench for ARM (IAR-EWARM) version 8.50.91

- Using wine to build with the IarBuild.exe command line utility or IAR Embedded Workbench GUI on macOS or Linux could result in incorrect files being used due to collisions in wine's hashing algorithm for generating short file names.
- Customers on macOS or Linux are advised not to build with IAR outside of Simplicity Studio. Customers who do should carefully verify that the correct files are being used.

GCC (The GNU Compiler Collection) version 10.2.0, provided with Simplicity Studio.

**Contents**

- 1 Connect Applications .....1
  - 1.1 New Items.....1
  - 1.2 Improvements .....1
  - 1.3 Fixed Issues.....1
  - 1.4 Known Issues in the Current Release .....1
  - 1.5 Deprecated Items.....1
  - 1.6 Removed Items.....1
- 2 Connect Stack .....2
  - 2.1 New Items.....2
  - 2.2 Improvements .....2
  - 2.3 Fixed Issues.....2
  - 2.4 Known Issues in the Current Release .....2
  - 2.5 Deprecated Items.....2
  - 2.6 Removed Items.....2
- 3 RAIL Applications .....3
  - 3.1 New Items.....3
  - 3.2 Improvements .....3
  - 3.3 Fixed Issues.....3
  - 3.4 Known Issues in the Current Release .....3
  - 3.5 Deprecated Items.....3
  - 3.6 Removed Items.....3
- 4 RAIL Library .....4
  - 4.1 New Items.....4
  - 4.2 Improvements .....4
  - 4.3 Fixed Issues.....5
  - 4.4 Known Issues in the Current Release .....6
  - 4.5 Deprecated Items.....7
  - 4.6 Removed Items.....7
- 5 Using This Release .....8
  - 5.1 Installation and Use.....8
  - 5.2 Security Information .....8
  - 5.3 Support.....9

# 1 Connect Applications

## 1.1 New Items

### Added in release 3.2.2.0

EFR32xG23 support

## 1.2 Improvements

### Changed in release 3.2.0.0

BRD4183C support (EFR32MG22)

## 1.3 Fixed Issues

None

## 1.4 Known Issues in the Current Release

Issues in bold were added since the previous release. If you have missed a release, recent release notes are available on <https://www.silabs.com/products/software>.

| ID #   | Description   | Workaround |
|--------|---|------------|
| 652925 | EFR32XG21 is not supported for "Flex (Connect) - SoC Light Example DMP" and "Flex (Connect) - SoC Switch Example" |            |

## 1.5 Deprecated Items

Connect NCP-Host applications are not supported.

## 1.6 Removed Items

None

## 2 Connect Stack

### 2.1 New Items

#### **Added in release 3.2.2.0**

EFR32xG23 support

### 2.2 Improvements

None

### 2.3 Fixed Issues

| ID #   | Description  |
|--------|--|
| 708489 | Fixed an issue causing EFR32MG1 to fail to join any network. |

### 2.4 Known Issues in the Current Release

Issues in bold were added since the previous release. If you have missed a release, recent release notes are available on <https://www.silabs.com/products/software>.

| ID #   | Description   | Workaround  |
|--------|---|---|
| 501561 | In the Legacy HAL component, the PA configuration is hard-coded regardless of the user or board settings. | Until this is changed to properly pull from the configuration header, the file ember-phy.c in the user's project will need to be modified by hand to reflect the desired PA mode, voltage, and ramp time. |
| 711804 | Connecting multiple devices simultaneously may fail with a timeout error.                                 |   |

### 2.5 Deprecated Items

None

### 2.6 Removed Items

None

## 3 RAIL Applications

### 3.1 New Items

#### Added in release 3.2.0.0

- New Applications
- Os support (FreeRTOS / Micrium) for each application except:
  - Flex (RAIL) – RAILtest
  - Flex (RAIL) – Light
  - Flex (RAIL) – Switch
  - Flex (RAIL) – Light Standards

### 3.2 Improvements

#### Changed in release 3.2.0.0

- BRD4183C support (EFR32MG22)

### 3.3 Fixed Issues

None

### 3.4 Known Issues in the Current Release

Issues in bold were added since the previous release. If you have missed a release, recent release notes are available on <https://www.silabs.com/products/software>.

| ID #   | Description  | Workaround |
|--------|--|------------|
| 732659 | <b>On EFR32xG23:</b> <ul style="list-style-type: none"> <li>• <b>Wi-SUN FSK mode 1a exhibits a PER floor with frequency offsets around <math>\pm 8</math> to 10 KHz</b></li> <li>• <b>Wi-SUN FSK mode 1b exhibits a PER floor with frequency offsets around <math>\pm 18</math> to 20 KHz</b></li> </ul> |            |

### 3.5 Deprecated Items

None

### 3.6 Removed Items

None

## 4 RAIL Library

### 4.1 New Items

#### **Added in release 3.2.2.0**

- Added support for the EFR32xG23 series of chips.
- Added a new RAIL\_ConfigDirectMode() API for configuring direct mode settings on all chips. This can set whether the data stream is synchronous or asynchronous and which GPIOs are used for the feature.
- Added PA curves for EFR32xG23 for HP, MP, LP and LLP modes for both 14dBm and 20dBm variants.
- Added a new RAIL\_RxDataSource\_t to capture direct mode data on supported devices.

#### **Added in release 3.2.1.0**

- Added the new RAIL\_STREAM\_CARRIER\_WAVE\_PHASENOISE RAIL\_StreamMode\_t for phase noise measurement.
- Added RAIL\_PA\_BAND\_COUNT to count RAIL\_PaBand\_t.

#### **Added in release 3.2.0.0**

- Added RAIL\_StartScheduledCcaCsmaTx and RAIL\_StartScheduledCcaLbtTx APIs to allow applications to schedule a CSMA/LBT transmit.
- Added support for a new RAIL\_EVENT\_ZWAVE\_LR\_ACK\_REQUEST\_COMMAND, triggered on the reception of a Z-Wave Long range packet with acknowledgement request bit set, following which the application must call RAIL\_ZWAVE\_SetLrAckData to populate the fields of the Z-Wave Long range acknowledgement packet.
- Added RAIL\_TX\_OPTION\_RESEND to allow re-transmitting the packet most recently loaded into the Transmit FIFO. This can be used in combination with RAIL\_SetNextTxRepeat() on supported platforms to repeatedly transmit the same packet.
- Added new RAIL\_SetNextTxRepeat() API and RAIL\_TxRepeatConfig\_t to allow configuration of repeated transmits triggered by an initial transmit.
- Added ability to configure TxToTx state transition time via RAIL\_StateTiming\_t::txToTx and RAIL\_SetStateTiming(). This time is generally used between an autoACK transmit and a user transmit that was pending. It is also used during repeated transmits by default, but can be overridden by the RAIL\_TxRepeatConfig\_t::delayOrHop or RAIL\_BLE\_TxRepeatConfig\_t::delayOrHop configuration.
- Added ability to hop channels during repeated transmits in RAIL\_TxRepeatConfig\_t using RAIL\_TX\_REPEAT\_OPTION\_HOP.
- Added BLE-specific hooks for repeated transmits with channel hopping in RAIL\_BLE\_SetNextTxRepeat() and RAIL\_BLE\_TxRepeatConfig\_t.
- The “RAIL Utility, Callbacks” component can now be configured to not provide the RAILCb\_AssertFailed() function for situations where the application wants to provide its own implementation.

### 4.2 Improvements

#### **Changed in release 3.2.2.0**

- Now when using a RAIL\_RxDataSource\_t other than RX\_PACKET\_DATA the receiver will be disabled and must be manually restarted any time a RAIL\_EVENT\_RX\_FIFO\_OVERFLOW occurs. If the RAIL\_EVENT\_RX\_FIFO\_OVERFLOW event is not enabled, then the receiver will continue to run and lose some amount of data until the buffer is processed that matches the old behavior.

#### **Changed in release 3.2.0.0**

- Added support for the RAIL\_TX\_POWER\_MODE\_\*\_HIGHEST options in the RAIL\_GetTxPowerCurve() function.
- Changed when RAIL\_EVENT\_IEEE802154\_DATA\_REQUEST\_COMMAND event is issued to better facilitate support for 802.15.4E-2012 Enhanced ACKing and reduce time spent in the event handler. The event is now issued \*after\* receiving the Auxiliary Security Header (if present) in the MAC Header of the incoming frame, and for MAC Command frames, after receiving the MAC Command byte (which may be encrypted). This change is \*not\* backwards-compatible with prior releases for Enhanced ACK requesting frames, but is for Immediate ACK requesting frames. Use of RAIL\_IEEE802154\_EnableEarlyFramePending() is no longer required to support Enhanced ACKing; the notion of early frame pending notification has also shifted to after the Auxiliary Security Header for Enhanced ACK requesting frames.
- Changed RAIL Timer Synchronization over sleep on the EFR32xG21 to use the RTCC instead of the PRORTC to reduce current consumption in EM2.

- The posting of RAIL\_EVENT\_TX\_ABORTED now occurs before the PA ramps down, at the same time other transmit completion events get posted.
- Allow RAIL\_ZWAVE\_ReceiveBeam to be run on US LR regions instead of always returning an error.

## 4.3 Fixed Issues

### Fixed in release 3.2.3.0

| ID #   | Description  |
|--------|--|
| 737292 | Fixed an issue on the EFR32xG21 that was causing some Bluetooth LE coded PHY packets to be sent with a corrupted sync word and payload, breaking the connection.                           |
| 738158 | Fixed the RX_DIRECT_MODE_DATA RAIL_RxDataSource_t data source on the EFR32xG23.  |
| 741120 | Fixed an issue where the IQ data captured during Bluetooth LE's CTE could be all zeros on the 2Mbps PHY.   |
| 743258 | Fixed an issue that could cause the antenna switching pattern in Bluetooth LE AoX applications to sometimes repeat a previous sequence instead of following the expected antenna sequence. |

### Fixed in release 3.2.2.0

| ID #   | Description  |
|--------|--|
| 671651 | Fixed timing problems with certain State_Transitions or Rx_Channel_Hopping delay values on the EFR32xG22 and newer parts.  |
| 714271 | Fixed an issue where RAIL_IEEE802154_Config2p4GHzRadio*() and RAIL_IEEE802154_ConfigGB*Radio() functions were improperly clearing or were setting certain RAIL_IEEE802154_EOptions_t. Also documented that these functions still implicitly clear or set certain RAIL_IEEE802154_GOptions_t suitable for that configuration. |
| 716369 | Fixed an issue where incorrect radio transition times were being applied at higher temperatures when using the high power PA on EFR32xG22 parts.   |

### Fixed in release 3.2.1.0

| ID #   | Description   |
|--------|---|
| 646980 | An attempt to use an unsupported built-in radio channel configuration, e.g. on a module that does not support that protocol or configuration, will now trip RAIL_ASSERT_FAILED_INVALID_CHANNEL_CONFIG rather than returning success and ignoring the configuration.   |
| 675252 | Fixed an antenna diversity regression where a transmitted auto-ACK would incorrectly go out the currently configured TX antenna rather than the antenna used to receive the packet being acknowledged.  |
| 676896 | Fixed an issue in OOK PHYs where dynamic adjustments made to receive a packet with a high RSSI could persist after the packet and decrease the ability to receive packets with a lower RSSI.  |
| 696198 | Fixed an issue on PHYs that do not support dual sync words. If RAIL_RX_OPTION_ENABLE_DUALSYNC is called when one of these PHYs is loaded the RAIL_ConfigRxOptions function will now return RAIL_STATUS_INVALID_PARAMETER.   |
| 697097 | Fixed a rare situation where a premature RAIL_EVENT_TX_BLOCKED event might occur when auto-ACK is enabled and a scheduled transmit using RAIL_SCHEDULED_TX_DURING_RX_ABORT_TX is pending when an erroneous packet is received.  |
| 700439 | Fixed an issue where configuring a Selective RF Sense Wakeup packet by calling RAIL_ConfigRfSenseSelectiveOokWakeupPhy followed by RAIL_SetRfSenseSelectiveOokWakeupPayload would put RAIL in fixed length mode and leave it there even after a new PHY was loaded. We will now revert the fixed length settings to their default when loading a new PHY after the Selective RF Sense Wakeup PHY was loaded so that the incoming PHY's settings are used. |
| 710273 | Fixed an issue using RAIL_TX_REPEAT_OPTION_HOP with RAIL_SetNextTxRepeat() or RAIL_BLE_SetNextTxRepeat() when they return an error found in the channel-hopping configuration, yet would still attempt to repeat the next transmit.   |

**Fixed in release 3.2.0.0**

| ID #   | Description   |
|--------|---|
| 456701 | Fixed an issue on EFR32xG1x parts where calling RAIL_Init() with the MSC->CTRL.CLKDISFAULTEN bit set would cause a bus fault.   |
| 654600 | On EFR32XG21, a watchdog has been added to terminate an RSSI averaging operation in case the RAIL_EVENT_RSSI_AVERAGE_DONE event does not occur.   |
| 655541 | Fixed an issue on EFR32XG22 and later where packet filtering might be incomplete in FEC-enabled radio configurations causing good packets to be improperly dropped. Note that if packet filtering fails close to the end of an otherwise successfully received packet, the packet may be flagged RAIL_RX_PACKET_READY_CRC_ERROR rather than RAIL_RX_PACKET_ABORT_FILTERED. Note this issue is still present on earlier chips. |
| 665705 | Fixed an issue where a transmit with RAIL_TX_OPTION_SYNC_WORD_ID 1 to use SYNC2 would improperly indicate SYNC1 was used in the packet trace appended information.  |
| 666275 | Fixed potential delays when using RAIL's channel hopping or duty cycling features in EM1P mode on the EFR32xG22 and newer parts.  |
| 667103 | Fixed RAIL_ReadRxFifo() to behave as documented when passed NULL dataPtr: the data is thrown away rather than copied out.   |
| 671817 | Fixed an issue when switching between certain radio configurations (for example, Z-Wave) where use of RAIL_TX_OPTION_REMOVE_CRC can become permanently stuck.   |
| 673333 | Fixed an issue with RAIL_TX_OPTION_WAIT_FOR_ACK transmits where an RX overflow during the ACK wait period would silently abort the ACK timer resulting in no RAIL_EVENT_RX_ACK_TIMEOUT being generated.   |
| 682032 | Fixed an issue where setting RAIL_SCHEDULED_TX_DURING_RX_ABORT_TX for a scheduled transmit could cause subsequent non-scheduled transmits to be blocked.  |
| 696665 | Fixed an issue in RAIL_ConvertRawToDbm for PAs that use piecewise-linear line segment fit, where the minimum raw power level was incorrectly compared to the minimum deci-dBm value.  |
| 697097 | Fixed a rare situation where a premature RAIL_EVENT_TX_BLOCKED event might occur when auto-ACK is enabled and a scheduled transmit using RAIL_SCHEDULED_TX_DURING_RX_ABORT_TX is pending when an erroneous packet is received.  |
| 699890 | Fixed missing C++ compatibility in the "RAIL Utility, Init" component's generated header file.  |
| 701604 | Fixed an issue where using Rx_Channel_Hopping with channels in different frequency bands would cause RAIL to assert.  |
| 703788 | Fixed an issue on EFR32xG2x devices where RAIL would not allow you to initialize the radio with voltage scaling enabled even though this is supported on these devices.   |
| 705595 | Fixed an issue where custom PA curves provided through the PA Module were not respected when building Silicon Labs Zigbee applications.   |
| 708511 | Fixed possible RAIL_ASSERT_FAILED_UNEXPECTED_STATE_TX_FIFO when RAIL_SetTxFifo() is called after the transmit FIFO had been filled enough to cause its write offset to wrap.  |

**4.4 Known Issues in the Current Release**

Issues in bold were added since the previous release. If you have missed a release, recent release notes are available on <https://www.silabs.com/products/software>.



| ID #   | Description   | Workaround |
|--------|---|------------|
|        | Using direct mode (or IQ) functionality on EFR32xG23 requires a specifically set radio configuration that is not yet supported by the radio configurator. For these requirements, reach out to technical support who could provide that configuration based on your specification |            |
| 641705 | Infinite receive operations where the frame's fixed length is set to 0 are not working correctly on the EFR32xG23 series chips.   |            |

#### 4.5 Deprecated Items

None

#### 4.6 Removed Items

None

## 5 Using This Release

This release contains the following

- Radio Abstraction Interface Layer (RAIL) stack library
- Connect Stack Library
- RAIL and Connect Sample Applications
- RAIL and Connect Components and Application Framework

This SDK depends on Gecko Platform. The Gecko Platform code provides functionality that supports protocol plugins and APIs in the form of drivers and other lower layer features that interact directly with Silicon Labs chips and modules. Gecko Platform components include EMLIB, EMDRV, RAIL Library, NVM3, and mbedTLS. Gecko Platform release notes are available through Simplicity Studio's Documentation tab.

For more information about the Flex SDK v3.x see [UG103.13: RAIL Fundamentals](#) and [UG103.12: Silicon Labs Connect Fundamentals](#). If you are a first time user, see [QSG168: Proprietary Flex SDK v3.x Quick Start Guide](#).

### 5.1 Installation and Use

Stack installation instructions are covered in the [Simplicity Studio 5 online User's Guide](#).

Use the Flex SDK v3.x with the Silicon Labs Simplicity Studio 5 development platform. Simplicity Studio ensures that most software and tool compatibilities are managed correctly. Install software and board firmware updates promptly when you are notified.

Documentation specific to the SDK version is installed with the SDK. Additional information can often be found in the [knowledge base articles \(KBAs\)](#). API references and other information about this and earlier releases is available on <https://docs.silabs.com/>.

### 5.2 Security Information

#### Secure Vault Integration

This version of the stack does not integrate Secure Vault Key Management.

## Security Advisories

To subscribe to Security Advisories, log in to the Silicon Labs customer portal, then select **Account Home**. Click **HOME** to go to the portal home page and then click the **Manage Notifications** tile. Make sure that 'Software/Security Advisory Notices & Product Change Notices (PCNs)' is checked, and that you are subscribed at minimum for your platform and protocol. Click **Save** to save any changes.

**SILICON LABS** Search Within the Support Portal for Cases, etc... SEARCH CATHERIN...

HOME CASES SOFTWARE RELEASES

### Update Preference

WHAT EMAILS WOULD YOU LIKE TO RECEIVE?

Newsletters

- Community Monthly Newsletter
- Sales Newsletter
- Micrium Newsletter

Product Specific Notifications

- Product Information and Newsletter
- Software/Security Advisory Notices & Product Change Notices (PCNs)
- Technical Document Updates (Release Notes, Data Sheets, etc.)

SELECT THE PRODUCTS TO RECEIVE UPDATES FOR

Select/Unselect All

|  |  |
|--|--|
| <input type="checkbox"/> Audio and Radio   | <input type="checkbox"/> Power over Ethernet   |
| <input type="checkbox"/> Interface   | <input type="checkbox"/> Sensors   |
| <input type="checkbox"/> Isolation   | <input type="checkbox"/> TV and Video  |
| <input type="checkbox"/> Modems and DAAs   | <input type="checkbox"/> Voice   |
| <input type="checkbox"/> Microcontrollers  | <input type="checkbox"/> Wireless  |
| <input type="checkbox"/> 8-bit MCUs<br><input checked="" type="checkbox"/> 32-bit MCUs | <input type="checkbox"/> Bluetooth Classic<br><input type="checkbox"/> Bluetooth Low Energy<br><input checked="" type="checkbox"/> Proprietary |
| <input type="checkbox"/> Timing  | <input type="checkbox"/> Wi-Fi   |
| <input type="checkbox"/> Clocks  | <input type="checkbox"/> ZigBee and Thread   |
| <input type="checkbox"/> Buffers   | <input type="checkbox"/> Z-Wave  |
| <input type="checkbox"/> Oscillators   |  |
| <input type="checkbox"/> CDR and PHY   |  |

## 5.3 Support

Development Kit customers are eligible for training and technical support. Use the [Silicon Labs Flex web page](#) to obtain information about all Silicon Labs Thread products and services, and to sign up for product support.

You can contact Silicon Laboratories support at <http://www.silabs.com/support>.

# Simplicity Studio

One-click access to MCU and wireless tools, documentation, software, source code libraries & more. Available for Windows, Mac and Linux!



**IoT Portfolio**  
[www.silabs.com/IoT](http://www.silabs.com/IoT)



**SW/HW**  
[www.silabs.com/simplicity](http://www.silabs.com/simplicity)



**Quality**  
[www.silabs.com/quality](http://www.silabs.com/quality)



**Support & Community**  
[www.silabs.com/community](http://www.silabs.com/community)

## Disclaimer

Silicon Labs intends to provide customers with the latest, accurate, and in-depth documentation of all peripherals and modules available for system and software implementers using or intending to use the Silicon Labs products. Characterization data, available modules and peripherals, memory sizes and memory addresses refer to each specific device, and "Typical" parameters provided can and do vary in different applications. Application examples described herein are for illustrative purposes only. Silicon Labs reserves the right to make changes without further notice to the product information, specifications, and descriptions herein, and does not give warranties as to the accuracy or completeness of the included information. Without prior notification, Silicon Labs may update product firmware during the manufacturing process for security or reliability reasons. Such changes will not alter the specifications or the performance of the product. Silicon Labs shall have no liability for the consequences of use of the information supplied in this document. This document does not imply or expressly grant any license to design or fabricate any integrated circuits. The products are not designed or authorized to be used within any FDA Class III devices, applications for which FDA premarket approval is required or Life Support Systems without the specific written consent of Silicon Labs. A "Life Support System" is any product or system intended to support or sustain life and/or health, which, if it fails, can be reasonably expected to result in significant personal injury or death. Silicon Labs products are not designed or authorized for military applications. Silicon Labs products shall under no circumstances be used in weapons of mass destruction including (but not limited to) nuclear, biological or chemical weapons, or missiles capable of delivering such weapons. Silicon Labs disclaims all express and implied warranties and shall not be responsible or liable for any injuries or damages related to use of a Silicon Labs product in such unauthorized applications.

**Note: This content may contain offensive terminology that is now obsolete. Silicon Labs is replacing these terms with inclusive language wherever possible. For more information, visit [www.silabs.com/about-us/inclusive-lexicon-project](http://www.silabs.com/about-us/inclusive-lexicon-project)**

## Trademark Information

Silicon Laboratories Inc.<sup>®</sup>, Silicon Laboratories<sup>®</sup>, Silicon Labs<sup>®</sup>, SiLabs<sup>®</sup> and the Silicon Labs logo<sup>®</sup>, Bluegiga<sup>®</sup>, Bluegiga Logo<sup>®</sup>, EFM<sup>®</sup>, EFM32<sup>®</sup>, EFR, Ember<sup>®</sup>, Energy Micro, Energy Micro logo and combinations thereof, "the world's most energy friendly microcontrollers", Redpine Signals<sup>®</sup>, WiSeConnect, n-Link, ThreadArch<sup>®</sup>, EZLink<sup>®</sup>, EZRadio<sup>®</sup>, EZRadioPRO<sup>®</sup>, Gecko<sup>®</sup>, Gecko OS, Gecko OS Studio, Precision32<sup>®</sup>, Simplicity Studio<sup>®</sup>, Telegesis, the Telegesis Logo<sup>®</sup>, USBXpress<sup>®</sup>, Zentri, the Zentri logo and Zentri DMS, Z-Wave<sup>®</sup>, and others are trademarks or registered trademarks of Silicon Labs. ARM, CORTEX, Cortex-M3 and THUMB are trademarks or registered trademarks of ARM Holdings. Keil is a registered trademark of ARM Limited. Wi-Fi is a registered trademark of the Wi-Fi Alliance. All other products or brand names mentioned herein are trademarks of their respective holders.



Silicon Laboratories Inc.  
400 West Cesar Chavez  
Austin, TX 78701  
USA

[www.silabs.com](http://www.silabs.com)