LoRa® Products

Long Range, Low Power Consumption
Secure Device to Cloud Solutions

semtech.com/LoRa

LoRa Portfolio of Products

LoRa Connect™ 3

The LoRa Connect portfolio consists of sub-GHz, 2.4GHz and dual-band transceiver chips and reference designs.

LoRa Edge™ 5

An ultra-low power, multi-technology platform that integrates a long-range LoRa transceiver, multi-constellation GNSS scanner and passive Wi-Fi AP MAC address scanner targeting location-aware applications.

LoRa Core™ 6

The LoRa Core portfolio consists of gateway chips and reference designs including the SX130x series gateway chips, legacy gateway reference designs and the latest LoRa Corecell and LoRa 2.4GHz gateway reference designs.

LoRa Basics™ 8

LoRa Basics consists of a suite of software tools for end node and gateways that simplifies and accelerates IoT solutions development based on LoRa modulation and LoRaWAN® networks.

LoRa Cloud™ 9

LoRa Cloud delivers value-added services that enable simple solutions for common tasks related to LoRaWAN networks and LoRa-based devices.

Evaluation Kits 10

Semtech offers a wide range of evaluation kits to enable solutions development based on Semtech's LoRa devices.

LoRa Connect™

WE NEED SOMETHING HERE

Product Overview

The LoRa Connect portfolio consists of sub-GHz transceiver chips, 2.4GHz chips, dual-band chips, and reference designs including SX126x series, SX127x series, SX128x series, LLCC68 transceiver chips, and LR1121. Together, they represent the essential capability of Semtech's LoRa Connect devices including long range, low power, and cost-effective end-to-end communication.

Key Features

- Long range of up to 30 miles outdoor line of sight
- Deep indoor coverage for hard-to-reach areas
- Bidirectional communication link with adaptive data rates
- Low power sensors with extended battery lifetime of up to 10 years
- Large and growing online developer community for products that use LoRa®
- Public, semi-private and private networks available worldwide

Key Benefits

Long Range: Penetrates in dense urban and deep indoor environments, connecting to sensors up to 30 miles away in rural areas.

Scalability: Easy and quick to adapt the network capacity to the business needs

Low Power: Designed specifically for low power consumption extending battery lifetime up to 10 years

Standardized: LoRaWAN® specification ensures global interoperability among applications, IoT solution providers and telecom operators

Secure: Embedded end-to-end AES-128 encryption of data for optimal privacy and protection

Low Cost: Reduces costs three ways: infrastructure investment, operating expenses and end-node sensors

Additional features supported by the SX128x include ranging engine, time-of-flight capability, BLE PHY layer compatibility and includes LoRa, FLRC and (G)FSK modulations.

LoRa Connect Kits

Part Number	LoRa IP Generation	Frequency Range (MHz)	Link Budget (dB)	Rx Current (mA)	Max Sensitivity (dBm)	Tx Power (dBm)	SF	LoRa BW (kHz)
SX1261	2	150–960	163	4.6	-148	+15	5-12	7.8-500
SX1262	2	150–960	170	4.6	-148	+22	5-12	7.8-500
SX1268	2	410–810	170	4.6	-148	+22	5-12	7.8-500
SX1272	1	862–1020	158	10	-138	+20	6-12	125-500
SX1276	1	137–1020	168	11	-148	+20	6-12	7.8-500
SX1278	1	137–525	168	11	-148	+20	6-12	7.8-500
SX1280	2	2400	145	5.5	-132	+12.5	5-12	
SX1281	2	2400	145	5.5	-132	+12.5	5-12	
LLCC68	2	150–960	151	4.6	-129	+22	5-11	125-500
LR1121	3	150 - 960MHz 1900 MHz S-Band 2.4GHz	166	5.4	-144	+22 (sub-GHz) +11.5 (2.4GHz)	5-12	62.5-500 125-500 203-812

LoRa Connect™

WE NEED SOMETHING HERE

LoRa® 2.4GHz

LONG RANGE GLOBAL INTEROPERABILITY

Product Overview

LoRa 2.4 GHz offers ultra-long communication in the 2.4 GHz band with low power use and high reliability connectivity. This feature can be found on LoRa Connect Transceivers such as the LR1120, LR1121, SX1280, and SX128.

Key Features

Long Range Radio in the Worldwide ISM 2.4GHz Band

- High sensitivity to -132dBm
- 12.5dBm output power with high efficiency PA
- 144.5dB maximum link budget (up to 3km LoS)

Open Source Proprietary Protocol Stack

- Pre-integrated with Semtech's LoRa Cloud™ services
- RTOS and MCU agnostic

Low System Cost

- Minimal external BOM/matching
- Package low foot print, 24-pin 4x4

Multi Radio

- LoRa – 476bps up to 250kbps
- FLRC – 260kbps up to 1.3Mbps
- (G)FSK/MSK – up to 2Mbps
- BLE PHY layer compatibility

Ranging Engine for Proximity Detection

- Time-of-flight functionality
- +/- 3m accuracy

Low Power

- <5mA Rx current consumption
- 24mA Tx @ +12.5dBm
- 215nA sleep mode

Key Benefits

- LoRa capabilities (i.e., long range, low power, robustness to interferers) at 2.4GHz address IoT markets where single SKU, worldwide interoperability, high data rate and no duty cycle limitations are required
- Indoor/outdoor connectivity and low power proximity detection with low bill of materials
- Fully documented pre-certification for FCC and ETSI gateway reference design reduces development time

LoRa Edge™

MULTI-TECHNOLOGY LOCATION-AWARE PLATFORM FOR IoT

Product Overview

LoRa Edge is an ultra-low power platform that integrates a LoRa® transceiver, multi constellation GNSS scanning and passive WiFi AP MAC addressing scanning on a single chip.

LoRa Edge chip versions can support standard LoRa modulation and Long Range Frequency Hopping Spread Spectrum (LR-FHSS) modulation in the global ISM band(s), the 2.4GHz band and the S-band for satellite communication. When paired with LoRa Cloud services, power consumption can be reduced by up to 10x as compared to conventional GPS technologies.

Key Features

Low Power High-Sensitivity LoRa/(G)FSK, LR-FHSS/Sigfox Half-Duplex RF Transceiver

- Worldwide ISM frequency band support from 150-960MHz
- 2.4GHz ISM and Licensed S-Band support for Global connectivity (LR1120 Exclusively)
- Low Noise Figure Rx front-end for enhanced LoRa/(G)FSK sensitivity
- +22dBm High Power Sub-GHz Transmitter Output
- +15dBm High Efficiency Sub-GHz Transmitter Output
- Fully LoRaWAN® standard compliant as defined by the LoRa Alliance®

Multi-Technology RF Front-End for Geolocation Purposes

- GNSS (GPS/ BeiDou) low power scanning
- 802.11b/g/n Wi-Fi ultra-low power passive scanning
- Bluetooth® Low Energy beaconing compatibility*
- Round-Trip-Time-of-Flight (RTToF) Engine for Sub-GHz Ranging applications

Cryptographic Engine

- Hardware support for AES-128 encryption/decryption based algorithms
- Handling device parameters such as DevEUI and JoinEUI, as defined by the LoRa Alliance
- Protects confidential information such as encryption keys against unauthorized access
- Stores NwkKey and AppKey as defined in the LoRaWAN standard

Key Benefits

- Enables companies to develop affordable asset management solutions with outstanding battery life and end-to-end robust security
- Provides a single platform solution to develop asset management, localization and recovery applications for indoor and outdoor uses
- Enables customer to balance performance, location, accuracy and low power use which significantly reduces battery costs
- Reduces the bill of materials (BOM) by integrating GNSS, Wi-Fi and a LoRa transceiver into a single chip solution, enabling indoor and outdoor applications
- Enables customers to develop solutiuons that use roughly 10x less power than previous applications
- LoRa Edge is pre-provisioned with security keys using a highly secure hardware module, substantially reducing security cost

LoRa Connect Kits

Part Number	LoRa IP Generation	Frequency Range (MHz)	Link Budget (dB)	Rx Current (mA)	Max Sensitivity (dBm)	Tx Power (dBm)	SF	LoRa BW (kHz)
LR1110	3	150-2700	166	5.4	-144	+22	5-12	62.5-500
LR1120	3	150 - 960MHz 1900 MHz S-Band 2.4GHz	166	5.4	-144	+22 (sub-GHz) +11.5 (2.4GHz)	5-12	62.5-500 125-500 203-812

For complete listing of all IC attributes, please see the **LoRa Developer Portal**

* Semtech's products are designed to be used in connection with qualified Bluetooth products and applications but are not certified or qualified Bluetooth products.

LoRa Core™

LoRa GATEWAY SOLUTIONS

Product Overview

Latest LoRa Core portfolio consists of gateway reference designs including the SX130x series gateway chips, legacy gateway reference designs and latest LoRa® Corecell and LoRa 2.4GHz gateway reference designs. Together, they represent the essential capability of Semtech's LoRa devices in gateway designs.

Key Features

- Long range of up to 30 miles outdoor line of sight
- Deep indoor coverage for hard to reach areas
- Bi-directional communication link with adaptive data rates
- LoRaWAN® and LoRa 2.4GHz compliant
- Scalable, multi-channel, high-capacity gateways powered by SX1301, SX1302, SX1303 and SX1308
- Available for any operating environment
- Supported by the LoRa Alliance®, an open IoT Alliance for Low Power Wide Area Network (LPWAN) applications
- Large and growing online developer community for products that use LoRa
- Public, semi-private and private networks available worldwide

Key Benefits

Long Range: Penetrates in dense urban and deep indoor environments, connecting to sensors up to 30 miles away in rural areas

Scalability: Easy and quick to adapt the network capacity to business needs

Low Power: Designed specifically for low power consumption, extending battery lifetime of sensors up to 20years

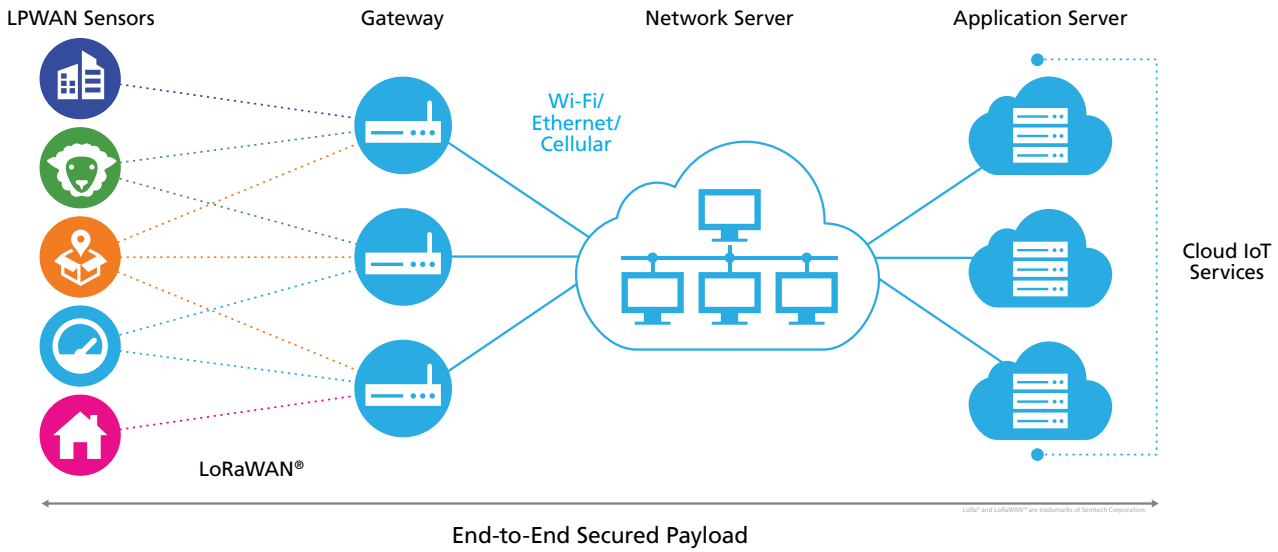
High Capacity: Supports millions of messages per base station

Geolocation: Enables GPS free, low power tracking applications

Standardized: LoRaWAN specification ensures global interoperability among applications, IoT solution providers and telecom operators

Secure: Embedded end-to-end AES-128 encryption of data for optimal privacy and protection

Low Cost: Reduces costs three ways: infrastructure investment, operating expenses and end-node sensors



LoRa Core™

CHIPS AND GATEWAY REFERENCE DESIGN LISTINGS

LoRa Core – RF Front End Devices

Part Number	Frequency Range (MHz)	Tx/Rx	Tx Power (dBm)	Digital Baseband Compatibility	Feature
SX1250	150 - 960	Tx/Rx	22	SX1302, SX1303	Half-duplex
SX1255	400–510	Tx/Rx	-20 to +8	SX1301, SX1302, SX1303, SX1308	Full-duplex
SX1257	860–1000	Tx/Rx	-20 to +8	SX1301, SX1302, SX1303, SX1308	Full-duplex

LoRa Core – Digital Base Band for LoRa Gateway

Part Number	No. of Channels	No. of Demodulators (125KHz)	High Speed Demodulator (125/250/500KHz)	FSK Modem	Fine Timestamp	Power Consumption
SX1301	8	8	1	1		1.5W
SX1302	8	16	1	1		110mW
SX1303	8	16	1	1	•	110mW
SX1308	8	8	1	1		1.5W

Gateway Kits With LoRa

Reference Design	Description
SX1280ZXXXXGW1	3 channel reference Design for LoRa(R) 2.4GHz gateway based on SX1280
SX1302CSSXXXGW1	LoRa Corecell gateway reference design with Listen Before Talk (LBT) and Spectral Scan (SS) feature
SX1303CTSXXXGW1	LoRa Corecell gateway reference design with Fine Timestamp feature for TDOA geolocation
SX1302CFDXXXGW1	LoRa Corecell gateway reference design with Full Duplex feature for China 490MHz band operation
SX1302CFD915GW1-H	LoRa Corecell gateway reference design with Full Duplex feature for US 915MHz band operation

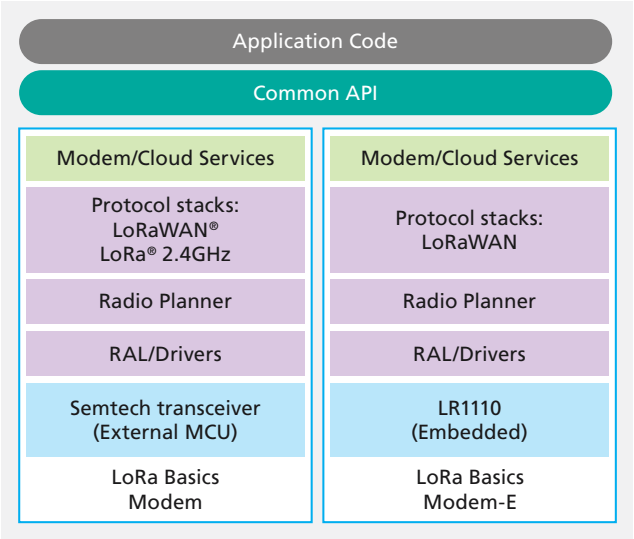
LoRa Basics™

BASIC SOFTWARE BUILDING BLOCKS

Product Overview

LoRa Basics is a set of basic software building blocks that enables solution developers to bring new innovative IoT products to market quickly, easily, reliably and cost effectively.

LoRa Basics



LoRa Basics Modem

The LoRa Basics Modem is an open source software library that runs on an external MCU to enable communication between Internet of Things devices that use LoRa and Semtech's LoRa Cloud™ services. The LoRa Basics Modem supports the LoRaWAN® and LoRa 2.4GHz protocol.

LoRa Basics™ Modem-E

The LoRa Basics Modem-E is a fully integrated, LoRaWAN® Certified℠ soft-modem designed to run inside the LoRa Edge™ LR1110 and allow IoT sensors to securely connect to any gateway operating the LoRaWAN protocol. Device-side APIs allow native access to LoRa Cloud Geolocation and Devices & Application Services.

Key Features

LoRa Basics Modem

- Software API your firmware can use for modem configuration, wireless communication and Cloud services
- MCU hardware abstraction layer allows simple adaptation of the modem to an MCU

LoRa Basics Modem-E

- Downlink and uplink messaging
- Remote reset and re-keying
- Wi-Fi passive scanning and GNSS passive scanning
- Over the air GNSS almanac updates
- LoRa Cloud™ large file upload service, application-layer clock synchronization and reliable octet stream encoding streaming service

Key Benefits

LoRa Basics Modem

- Enables a full functional LoRaWAN and LoRa 2.4GHz production stack
- Enables seamless connective with LoRa Cloud services
- Flexible open source running on MCU

LoRa Basics Modem-E

- A LoRaWAN Certified℠ solution
- Accelerates time to market, reduces design complexity and lowers development cost
- Reduces amount of resources needed on the external MCU

LoRa Cloud™

ADDED VALUE SERVICES

Product Overview

LoRa Cloud provides value-added services that enable simple solutions for common tasks related to LoRaWAN® networks and devices that use LoRa®.

LoRa Cloud Geolocation for Gateways or Transceiver-based Devices

LoRa Cloud Geolocation is a simple cloud API that can be easily integrated with a LoRaWAN network or application server to enable location estimation via any device that uses LoRa.

Key Features

- Calculate location device based on metadata such as received signal strength, signal-to-noise ratio and time of arrival
- Devices in transceiver mode, such as LoRa Edge™ LR1110 can calculate location based on GNSS or Wi-Fi data

LoRa Cloud Device and Application Services With Geolocation for Modem-based Devices

- Device telemetry
- Device and application configuration
- Clock synchronization
- Advanced data transport services with configurable robustness against packet loss and transparent data fragmentation
- Location solver for LoRa Edge LR1110 GNSS and Wi-Fi while using LoRa Basics™ Modem or LoRa Basics Modem-E

LoRa Cloud Device Join

- The standard LoRaWAN join server backend interface connects with compliant LoRaWAN network servers to provide fully secure end device onboarding and network joining
- The secret security keys are embedded in the device using a highly secure module based provisioning system
- The join server is connected to a hardware secure module, which processes Device Join requests without ever exposing device keys
- LoRa Cloud Device & Application Services enables join server device migration via key extraction and end device re-keying

Key Benefits

- Simplified managed endpoint solutions development via easy to use Cloud APIs
- Geolocation services tightly coupled with LR1110 reduce power consumption by 10x compared to conventional GPS technologies
- LoRa Cloud Device Join service enhances security and avoids network server lock-in

RF Evaluation Kits

APPLICATION-SPECIFIC

Tx/Rx Kits With LoRa®	
Part Number	Description
LLCC68	A sub-GHz LoRa® RF Transceiver for medium range indoor and indoor to outdoor wireless applications.
LR1110	Ultra-low power platform that integrates a LoRa transceiver, long range FHSS modulator, multi-constellation scanner, and passive Wi-Fi AP MAC address scanner targeting asset management applications.
LR1120	An ultra-low power device targeting global geolocation applications. It provides multi band LoRa and Long Range - Frequency Hopping Spread Spectrum (LR-FHSS) communication over sub-GHz and 2.4GHz Industrial, Scientific and Medical (ISM) bands as well as licensed S-Band for satellites.
LR1121	Semtech's third generation ultra-low power LoRa transceiver. It provides multi-band LoRa and Long Range - Frequency Hopping Spread Spectrum (LR-FHSS) communication over sub-GHz and 2.4GHz ISM bands as well as satellite S-Band connectivity.
SX1261 SX1262 SX1268	SX1261, SX1262 and SX1268 sub-GHz radio transceivers are ideal for long range wireless applications. The three devices are designed for long battery life with just 4.2 mA of active receive current consumption. The SX1261 can transmit up to +15dBm and the SX1262 and SX1268 can transmit up to +22dBm with highly efficient integrated power amplifiers.
SX1272	Long Range, Low Power RF Transceiver 860-1000MHz with LoRa Technology Features the LoRa long range modem that provides ultra-long range spread spectrum communication and high interference immunity whilst minimizing current consumption.
SX1276 SX1278	LoRa Connect™ 137MHz to 1020MHz Long Range Low Power Transceiver The SX1276/78 transceivers features the LoRa long range modem that provides ultra-long range spread spectrum communication and high interference immunity whilst minimizing current consumption.
SX1280 SX1281	The SX1280/81 transceivers provides ultra-long range communication in the 2.4GHz band with the linearity to withstand heavy interference. This makes them the ideal solution for robust and reliable wireless solutions.

RF Evaluation Kits

APPLICATION-SPECIFIC

Gateway Kits With LoRa	
Part Number	Description
SX1280	The SX1280 transceivers provides ultra-long range communication in the 2.4GHz band with the linearity to withstand heavy interference. This makes them the ideal solution for robust and reliable wireless solutions.
SX1302	The SX1302 is a new generation of baseband LoRa chip for gateways. It excels in reducing current consumption, simplifies the thermal design of gateways, and reduces the bill of materials costs, yet it is capable of handling a higher amount of traffic than preceding devices.
SX1303	In addition to supporting all the features of SX1302, SX1303 introduces a new Fine Timestamp capability that enables Time Difference of Arrival (TDOA) network-based geolocation.
SX1308	The SX1308 digital baseband chip is a massive digital signal processing engine specifically designed to offer breakthrough gateway capabilities in the ISM bands worldwide. It integrates the LoRa concentrator IP.

For a detailed list of sales representatives
in your area please visit **semtech.com/sales**

SEMTECH®

Semtech Corporation is a leading supplier of high performance analog and mixed-signal semiconductors and advanced algorithms for infrastructure, high-end consumer and industrial equipment. Products are designed to benefit the engineering community as well as the global community. The Company is dedicated to reducing the impact it, and its products, have on the environment. Internal green programs seek to reduce waste through material and manufacturing control, use of green technology and designing for resource reduction. Publicly traded since 1967, Semtech is listed on the Nasdaq Global Select Market under the symbol SMTC.

200 Flynn Road, Camarillo, California 93012 | 805-498-2111

semtech.com | Find us, like us, follow us

Semtech, the Semtech logo and LoRa are registered trademarks or service marks, LoRa Basics, LoRa Cloud, LoRa Core, LoRa Edge and LoRa Region are trademarks of Semtech Corporation or its subsidiaries. All other product and company names, logos, and brands are property of their respective owners. Semtech reserves the right to make changes to, or discontinue any products described in this document without further notice. Semtech makes no warranty, representation or guarantee, express or implied, regarding the suitability of its products for any particular purpose. ©2023 Semtech Corporation. All rights reserved. LoRa_PG_2023