LoRa® Products

Long Range, Low Power Consumption
Secure Device to Cloud Solutions

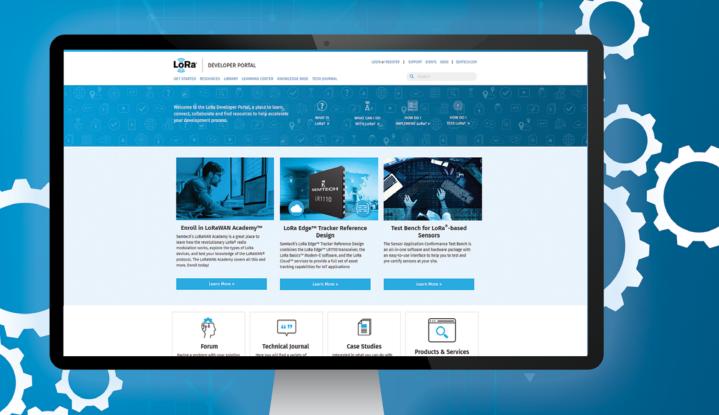**LoRa®**

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LoRa Portfolio of Products

LoRa Edge™
MULTI-TECHNOLOGY PLATFORM FOR IoT

Product Overview

Ultra-low power platform that integrates a long range LoRa® transceiver, multi-constellation scanner and passive Wi-Fi AP MAC address scanner targeting GNSS asset management applications.

The LoRa Edge LR1110 solution utilizes Semtech's LoRa Cloud™ geolocation capabilities to significantly reduce power consumption by determining asset location in a Cloud-based solver.

LoRa Edge Products	
Part number	LR1110
Description	Multi-technology indoor and outdoor asset management solution
Frequency band	150-960MHz

Key Features

Low Power High-Sensitivity LoRa/(G)FSK Half-Duplex RF Transceiver

- Worldwide ISM frequency bands support from 150-960MHz
- Low Noise Figure Rx front-end for enhanced LoRa/(G) FSK sensitivity
- +22dBm High Power Transmitter Output
- +15dBm High Efficiency Transmitter Output
- Integrated PA regulator supply selector to simplify dual power +15/+22dBm with one board implementation
- Adaptive Matching Network capable of supporting multi-regions with single BOM
- 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
- 150-2700MHz continuous frequency synthesizer range
- High bandwidth Rx ADC (up to 24MHz DSB)
- Digital baseband processing with DSP co-processor for power consumption optimization

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 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
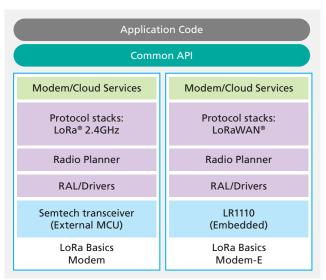
LoRa Basics™

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

Application Code	
Common API	
Modem/Cloud Services	Modem/Cloud Services
Protocol stacks: LoRa® 2.4GHz	Protocol stacks: LoRaWAN®
Radio Planner	Radio Planner
RAL/Drivers	RAL/Drivers
Semtech transceiver (External MCU)	LR1110 (Embedded)
LoRa Basics Modem	LoRa Basics Modem-E

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 LoRa 2.4GHz protocol.

LoRa Basics™ Modem-E

The LoRa Basics Modem-E is a fully integrated, LoRaWAN® Certified[CM] 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.

LoRa Basics Station

LoRa Basics Station is an implementation of a LoRa packet forwarder, and can be remotely managed by a configuration and update server to obtain configuration, system and firmware updates.

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

LoRa Basics Station

- Support for class A, B and C
- Centralized update and configuration management
- TLS and token-based authentication
- Easily portable to Linux-based gateways and embedded systems

Key Benefits

LoRa Basics Modem

- Enables a full functional 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[CM] solution
- Accelerates time to market, reduces design complexity and lowers development cost
- Reduces amount of resources needed on the external MCU

LoRa Basics Station

- Gateway operating the LoRaWAN protocol
- Enables remote management

LoRa Core™

LoRa SUB-GHZ TRANSCEIVER AND GATEWAY SOLUTION

Product Overview

LoRa Core portfolio consists of sub-GHZ transceiver chips, gateway chips and reference designs including SX126x series, SX127x series and LLCC68 transceiver chips, as well as the SX130x series gateway chips, legacy gateway reference designs and the LoRa® Corecell gateway reference designs. Together, they represent the essential capability of Semtech's LoRa 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
- Bi-directional communication link with adaptive data rates

- Low power sensors with extended battery lifetime of up to 20 years
    - 100nA sleep mode
    - 4.6mA active receive mode
- LoRaWAN®, IEEE 802.15.4g and WMBus 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 up to 20 years

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

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End-to-End Secured Payload

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LoRa Core™

CHIPS LISTINGS

LoRa Core Transceiver ICs

Part Number	Frequency Range (MHz)	Link Budget (dB)	Rx Current (mA)	Max Sensitivity (dBm)	Tx Power (dBm)	LoRa Data Rate (kbps)	Integrated DC-DC and LDO
SX1261	150–960	163	4.6	-148	+15	0.018–62.5	•
SX1262	150–960	170	4.6	-148	+22	0.018–62.5	•
SX1268	410–810	170	4.6	-148	+22	0.018–62.5	•
LLCC68	150–960	151	4.6	-129	+22	1.760–62.5	•
SX1272	862–1020	158	10	-138	+20	0.3–40	
SX1273	862–1020	150	10	-130	+20	1.7–40	
SX1276	137–1020	168	11	-148	+20	0.018–40	
SX1277	137–1020	158	11	-138	+20	1.7–40	
SX1278	137–525	168	11	-148	+20	0.018–40	
SX1279	137–960	168	11	-148	+20	0.018–40	

LoRa Core Gateway Digital Baseband ICs

Part Number	Main Front End	No. of Channels	No. of Demodulators (125KHz)	High Speed Demodulator (125/250/500KHz)	FSK Modem	Single Clock	Operating Temp. Range (°C)	Fine Timestamp	Package
SX1301	SX1255, SX1257	8	8	1	1		-40– 85		QFN64 (9mmx9mm)
SX1302	SX1250, SX1255, SX1257	8	16	1	1	•	-40– 85		QFN64 (7mmx7mm)
SX1303	SX1250, SX1255, SX1257	8	16	1	1	•	-40– 85	•	QFN64 (7mmx7mm)
SX1308	SX1255, SX1257	8	8	1	1		0–70		QFN64 (9mmx9mm)

LoRa Core Gateway RF Analog Front End ICs

Part Number	Tx/Rx	Band (MHz)	Tx Power
SX1250	Tx/Rx	150 - 960	22
SX1255	Tx/Rx	400–510	-20 to +8dBm
SX1257	Tx/Rx	860–1000	-20 to +8dBm
SX1258	Tx/Rx	779-787	-20 to +8dBm

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.

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

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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	Evaluation Kit
LLCC68	LLCC68 @868mhz Mbed Shield; +15dBm	LLCC68MB2BAS
	LLCC68 @915mhz Mbed Shield; +22dBm	LLCC68MB2CAS
	LLCC68 @490mhz Mbed Shield; +20dBm	LLCC68MB2GAS
LR1110	LR1110 Development Kit @915Mhz For North America	LR1110DVK1TCKS
	LR1110 Development Kit @868Mhz For Europe	LR1110DVK1TBKS
	LR1110 Development Kit @490Mhz For China/Asia	LR1110DVK1TGKS
SX1261	Development Kit, SX1261, 868MHz for Europe	SX1261DVK1BAS
	Development Kit, SX1261, 923MHz for Asia	SX1261DVK1CAS
	Development Kit, SX1261, 923MHz for Japan TELEC	SX1261DVK1CASTELEC
	Mbed Shield, SX1261, 868MHz for Europe	SX1261MB2BAS
SX1262	Development Kit, SX1262, 915MHz for North America	SX1262DVK1CAS
	Development Kit, SX1262, 866MHz for India	SX1262DVK1DAS
	Development Kit, SX1262, 915MHz for Australia and North America	SX1262DVK1PAS
	Development Kit, SX1262, 923MHz for Korea	SX1262DVK1CBS
	Mbed Shield, SX1262, 915MHz for North America	SX1262MB2CAS
SX1268	Development Kit, SX1268, 490MHz for China and Asia	SX1268DVK1GAS
	Development Kit, SX1268, 780MHz for China and Asia	SX1268DVK1NAS
SX1272	Development Kit, SX1272, 868MHz	SX1272DVK1BAS (868MHz)
	Development Kit, SX1272, 915MHz	SX1272DVK1CAS (915MHz)
	Mbed Shield, SX1272, 868 and 915MHz	SX1272MB2DAS

RF Evaluation Kits

APPLICATION-SPECIFIC

Tx/Rx Kits With LoRa® (Continued)		
Part Number	Description	Evaluation Kit
SX1276	Development Kit, SX1276, 169MHz (LF) or 868MHz (HF)	SX1276DVK1IAS (169MHz and 868MHz)
	Development Kit, SX1276, 433MHz (LF) or 868MHz (HF)	SX1276DVK1JAS (433MHz and 868MHz)
	Development Kit, SX1276, 470MHz (LF) or 915MHz (HF)	SX1276DVK1KAS (490MHz and 915MHz)
	Mbed Shield, SX1276, 433MHz (LF) or 915MHz (HF)	SX1276MB1LAS
	Mbed Shield, SX1276, 433MHz (LF) or 868MHz (HF)	SX1276MB1MAS
SX1278	Low Power RF Transceiver 138–510MHz with LoRa Modem	Use SX1276 kit (SX1276 is a superset)
SX1280	Development Kit, SX1280, 2.4GHz	SX1280DVK1ZHP
	SX1280 Development Kit for LoRa Basics™ Modem 2.4GHz	SX1280ED1ZHP
SX1281	Development Kit, SX1280, 2.4GHz	SX1280DVK1ZHP

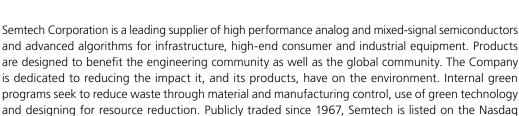| Gateway Kits With LoRa		
Part Number	Description	Evaluation Kit
SX1280	Reference Design for 2.4GHz Gateway Based on SX1280	SX1280ZXXXXGW1
SX1302	LoRa Corecell Reference Design for Gateway Applications Based on SX1302 and SX1250	SX1302CxxxGW1
	LoRa Corecell Reference Design for Full Duplex Gateway Applications Based on SX1302 and SX1255	SX1302CFDXXXGW
	LoRa Corecell Gateway Reference Design for Listen Before Talk (LBT) and Spectral Scan Based on SX1302 and SX1250	SX1302CSSXXXGW1
SX1303	LoRa Corecell Gateway Reference Design for Fine Timestamp Based on SX1303	SX1303CTSXXXGW1
SX1308	PicoCell Gateway, SX1308, 490 MHz	SX1308P490GW
	PicoCell Gateway, SX1308, 868 MHz	SX1308P868GW
	PicoCell Gateway, SX1308, 915 MHz	SX1308P915GW

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SEMTECH

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