Product Specifications

LoRa® Mini-PCIe Dongle

LD-11 series

VER: 1.0

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Introduction

LD-11 series are low power-consuming, half-duplex dongle with mini PCIe interface. It can wirelessly transmit data to long-distance. It is built-in high speed and low power-consuming MCU and SX1276 modulation chipset. This chipset is applied with the forward error correction technique which greatly improves interference immunity and advances sensitivity. The coding can detect errors and automatically filter out errors and false data. It can work as the end-node devices in the LoRaWAN™ infrastructure or in GlobalSat proprietary M.O.S.T. mode.

LD-11 series are suitable for long-distance transmission or harsh environments.

Product Features

- LoRa Alliance™ certified module inside, support Class A/ Class C
- Compliant with LoRaWAN™ FW and proprietary M.O.S.T. FW
- Mini PCI Express Form Factor
- Micro USB Interface
- u.FL antennas to support EU 868, US 915 and AS 923MHz
- Range 10km (@ 980bps)
- Support Windows® 7/ 8/ 10
- Support x86 Linux® Ubuntu 12.04
- Support MacAir OS 10.7 (later)

Compatibility with

- . Raspberry Pi 2 and 3
- . Beaglebone Black and Green

Hardware Specifications	
LoRa® Module	GlobalSat LM-130H LoRaWAN™ module
LoRa® Antenna	IPEX connector for u.FL antennas
Frequency	863-870MHz (EU) 902-928MHz (US) 920-928MHz (ROA)
Interface	Micro USB/ Mini-PCIe
RF Output power	862-870MHz (EU) @ 14dBm 902-928MHz (US) @ 20dBm 920-928MHz (ROA) @ 20dBm
Current Consumption	Receiving: 90.8 mA (typical) Transmitting: 210 mA (typical) Sleeping：66.8 mA (typical)
Transmission Distance	LoRaWAN™: 1 ~10 KM @ 980 bps M.O.S.T.: 1 ~10 KM @ 0.81 Kbps
Receiving Sensitivity	LoRaWAN™: -130 dBm @ 980bps M.O.S.T.: -130 dBm @ 0.81Kbps
Temperature	Operating：-40 ~ 85°C Storage：-40 ~ 85°C
Humidity	5 ~ 95 % (Non-condensing)
Dimension	50 x 29 x 9 mm
Weight	40 ± 2 g

LoRaWAN™ Configuration

Activation of an end-device can be achieved in two ways, either via Over-The-Air Activation (OTAA) when an end-device is deployed or reset, or via Activation By Personalization (ABP) in which the two steps of end-device personalization and activation are done as one step.

■ Over-the-Air Activation

For over-the-air activation, end-devices must follow a join procedure prior to participating in data exchanges with the network server. An end-device has to go through a new join procedure every time it has lost the session context information. The join procedure requires the end-device to be personalized with the following information before its starts the join procedure: a globally unique end-device identifier (DevEUI), the application identifier (AppEUI), and an AES-128 key (AppKey).

■ Activation by Personalization

Under certain circumstances, end-devices can be activated by personalization. Activation by personalization directly ties an end-device to a specific network by-passing the join request join accept procedure.
Activating an end-device by personalization means that the DevAddr and the two session keys NwkSKey and AppSKey are directly stored into the end-device instead of the DevEUI, AppEUI and the AppKey. The end-device is equipped with the required information for participating in a specific LoRa® network when started. Each device should have a unique set of NwkSKey and AppSKey. Compromising the keys of one device shouldn‘t compromise the security of the communications of other devices.

Operation Mode

- Bi-directional end-devices (Class A)**:** End-devices of Class A allow for bi-directional communications whereby each end-device's uplink transmission is followed by two short downlink receive windows. The transmission slot scheduled by the end-device is based on its own communication needs with a small variation based on a random time basis (ALOHA-type of protocol). This Class A operation is the lowest power end-device system for applications that only require downlink communication from the server shortly after the end-device has sent an uplink

transmission. Downlink communications from the server at any other time will have to wait until the next scheduled uplink.

- Bi-directional end-devices with maximal receive slots (Class C): End-devices of Class C have nearly continuously open receive windows, only closed when transmitting.

M.O.S.T. Proprietary Mode

Operation Mode

There are four operating modes.

1. Normal mode 2.Wake-up mode 3.Power-saving mode 4.Setup mode

The four operation modes are switched by the signal level of P1 and P2.

Mode 1: Normal mode (P1=0, P2=0)

UART is opened. Wireless channel is opened. Penetrating transmission.

Mode 2: Wake-up mode (P1=0, P2=1)

UART is opened. Wireless channel is opened. The only difference from normal mode is that its preamble is longer than normal mode's, so that it can make sure the receiver could be waked in the power-saving mode.

Note. The receiver could be waked no matter it is in normal mode or wake-up mode or power-saving mode. The receiver would automatically add the RSSI at the end of the received data.

Mode 3: Power-saving mode (P1=1, P2=0)

UART is closed. The wireless channel is in power-saving mode. You can set up an interval from 0.5 to 5 seconds to wake up in power-saving mode to check if there is preamble. If the receiver receives preamble, it will open UART, and wake MCU to process the received data and return data. After that, it will return to the power-saving mode.

Mode 4: Setup mode (P1=1, P2=1)

UART is closed. Wireless channel is closed. It could only be configured.