



Product Specifications

LoRa® Wireless Programmable Module

LM-533PH

VER: 1.1



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Product Description

The GlobalSat LM-533PH is a programmable module that based on LoRa[®] technology. With 9 programmable I/O pins, LM-533PH can extend more multiple applications and enrich LoRa[®] scenarios. LM-533PH is also pin-to-pin and firmware compatible with LM-533 family, and comes with programmable SDK/ API and compact size, easy-to-use and makes design simple.

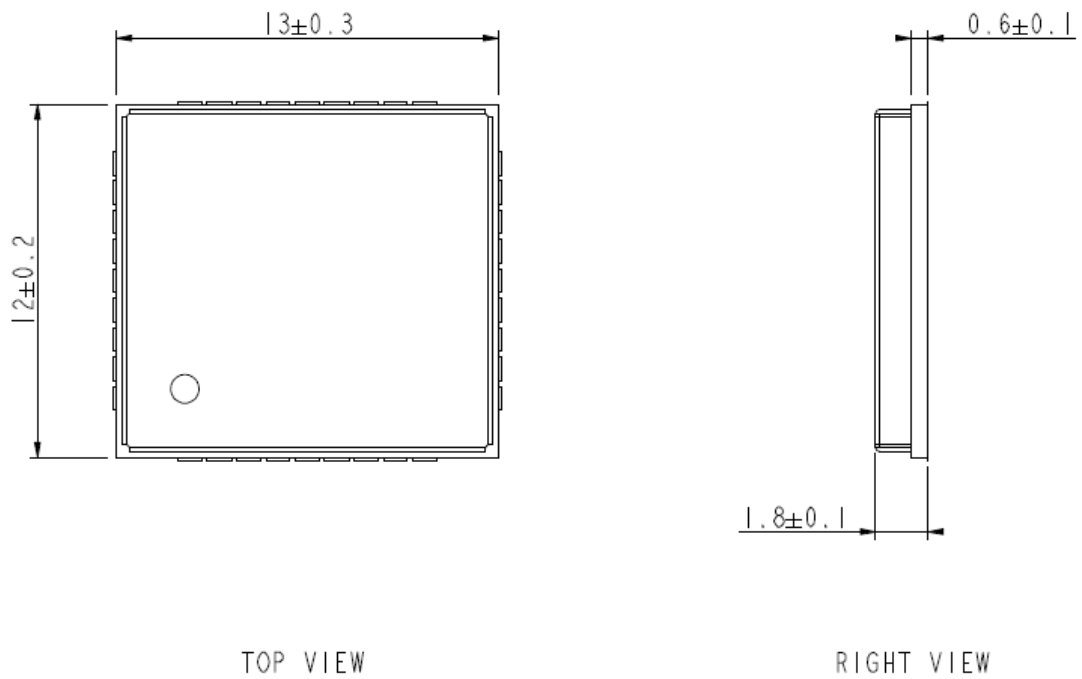
Product Feature

- Compact size, only 12 x 13 mm
- Ultra-high sensitive receiving ability by LoRa[®] spread spectrum modulation technology
- Long-distance transmission (1KM to 10KM)
- Instant wake up over the air
- Multiple I/O available for direct sensor access : 2 UART, 1 I2C, 1 ADC
- Programmable SDK/ API
- LoRa[®] / FSK/ GFSK/ OOK modulation, 2-way half –duplex communication, strong anti-interfere
- Maximal output power 100mW (20dBm), output power adjustable between 5-20dBm
- Easily use, auto exchange on communication & transceiver
- Tuning free
- Accord FCC, ETSI, TELEC standard

Hardware Specifications

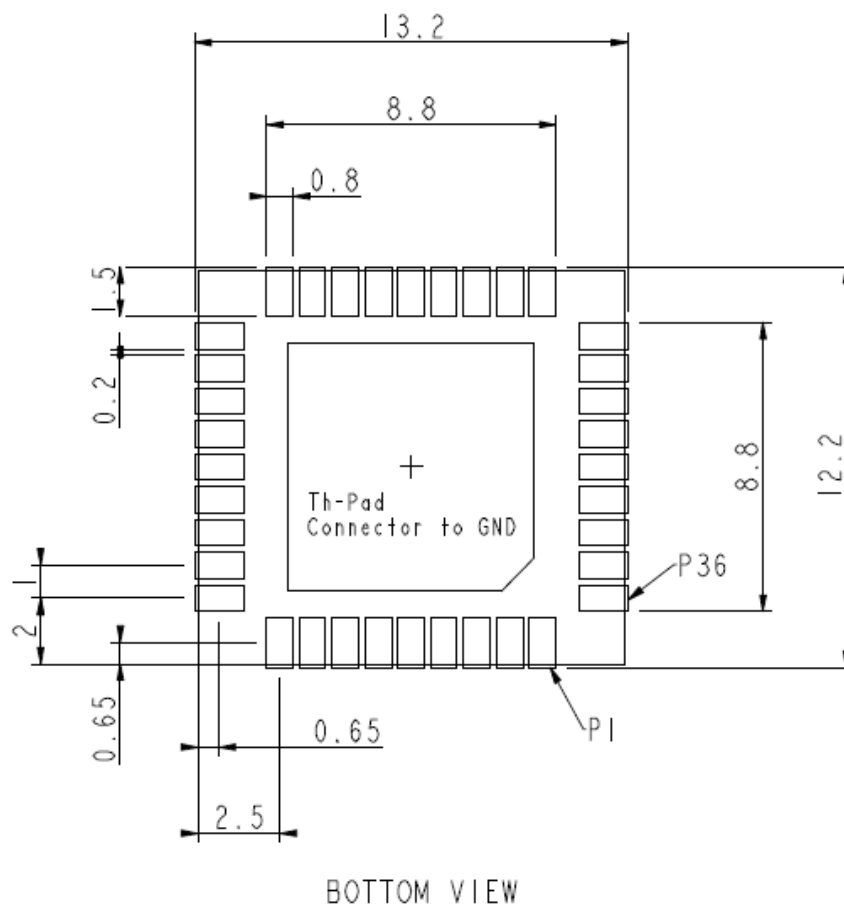
LoRa® Chipset	SX1276
MCU	STM32 Cortex M0
Available Memory for Development	Flash: 100 KB RAM: 7 KB
Frequency	863-870MHz (EU) 902-928MHz (US) 920-928MHz (ROA)
Transmission Power	862-870MHz (EU) @ 14dBm 902-928MHz (US) @ 20dBm 920-928MHz (ROA) @ 20dBm
Operation Voltage	2.4 ~ 3.6V
Current Consumption	Receiving: 20 mA (Typical) Transmitting: 120 mA (Typical) Sleeping: 1.5 uA (Typical)
Transmission Distance	LoRaWAN™: 1 ~ 10KM @ 980 bps MOST-Link: 1 ~ 10KM @ 0.81 Kbps
Receiving Sensitivity	LoRaWAN™: -132dBm @ 980 bps MOST-Link: -132dBm @ 0.81 Kbps
Operation Temperature	-40 ~ 85 °C
Humidity	5 ~ 95% (Non-condensing)
Dimension	12 x 13 x 1.8 ± 0.2mm
Development Language	C Programming Language

Product Size



UNITS
mm

Recommend Layout



UNITS
mm

Pin Definition

PIN NO.	Name	Type	Description
1, 3, 9, 17, 36	GND	P	GND
2	RF_IN	RF	RF Input/ Output
4	UART2_CK		
5	ADC	I	Analog-to-Digital Converter
6, 19, 20, 21, 22, 32, 33, 34, 35	GPIO	I/O	Programmable General-Purpose Inputs/ Outputs User can use this I/O pin for the special functions. (e.g. LED control)
7	nRST	I	Reset. Low active
8	USB_VDD	P	External power supply for USB transceiver If USB is not used, this pin must be tied to VDD.
10	USB_DM	I/O	USB DM. If USB is not used, just NC.
11	USB_DP	I/O	USB DP. If USB is not used, just NC.
12	OSC_IN		High-speed external user clock generated from an external source. If this is not used, just NC.
13	OSC_OUT		High-speed external user clock generated from an external source. If this is not used, just NC.
14	UART1_TX	O	This is the transmission channel for output. TTL level.
15	UART1_RX	I	This is the receiving channel for receiving software commands to LM-533PH. TTL level.
16	VREF+	P	Positive reference voltage
18	VCC	P	This is the main power supply. (3.1 Vdc to 3.5 Vdc)
23	SWDIO	I/O	Serial Wire Data Input/ Output for F/W debug
24	SWCLK	I	Serial Wire Clock for F/W debug.

PIN NO.	Name	Type	Description
25	UART2_TX	O	This is the main transmission channel for output. TTL level.
26	UART2_RX	I	This is the main receiving channel for receiving software commands to LM-533PH, TTL level.
27	BOOT0	I	BOOT mode selection
28	UART2_CTS		UART2 CTS. If this is not used, just NC.
29	UART2_RTS		UART2 RTS. If this is not used, just NC.
30	I2C_SDA		I2C Interface
31	I2C_SCL		

Electrical Characteristics

Absolute Maximum Ratings

Parameter	Min.	Typ.	Max.	Unit
Power Supply				
Main Power Supply Voltage	2.4	3.0	3.6	V
Main Power Supply Current	1	1.5	3	uA
Interface (VCC = 3 V , Operation Temp.= 25 °C)				
High Level Input Voltage	2.1		3.6	V
Low Level Input Voltage	-0.3		0.9	V
High Level Output Voltage	2.25			V
Low Level Output Voltage			0.75	V
RF Input				
Input Impedance		50		Ω

SDK Content

1. LoRa[®] engine (Library type)
2. Module Sample Code (Source code)
3. SDK User Guide

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 it 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 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 receiving 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.

MOST-Link Configuration

There are three operating modes in MOST-Link configuration state, as below;

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

The different operation modes are switched by AT-command.

■ **Mode 1: Normal mode**

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

■ **Mode 2: Wake-up mode**

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.

■ **Mode 3: Power-saving mode**

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.

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.

Federal Communication Commission Interference Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

FOR MOBILE DEVICE USAGE (>20cm/low power)

Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

This device is intended only for OEM integrators under the following conditions:

- 1) The antenna must be installed such that 20 cm is maintained between the antenna and users.
- 2) The transmitter module may not be co-located with any other transmitter or antenna.

As long as **2** conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed

IMPORTANT NOTE: In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID can not be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

End Product Labeling

FOR MOBILE DEVICE USAGE (>20cm/low power)

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: "Contains FCC ID:RID-LM533". The grantee's FCC ID can be used only when all FCC compliance requirements are met.

Manual Information To the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

The end user manual shall include all required regulatory information/warning as show in this manual.