



## Product Specifications

# Dual-mode Compact LoRa<sup>®</sup> Module

**LM-533H**

**VER: 1.1**



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## **Product Description**

The GlobalSat LM-533H is a RF module that based on LoRa<sup>®</sup> technology which provides long-range, low data rate IoT connectivity to sensors, electronic meter reading, geolocation devices, industrial monitoring and control, home and building automation, long range irrigation systems, and all kinds of IoT/ M2M equipments. It can works as the end-node devices in the LoRaWAN<sup>™</sup> infrastructure or in GlobalSat proprietary ecosystem (MOST-Link).

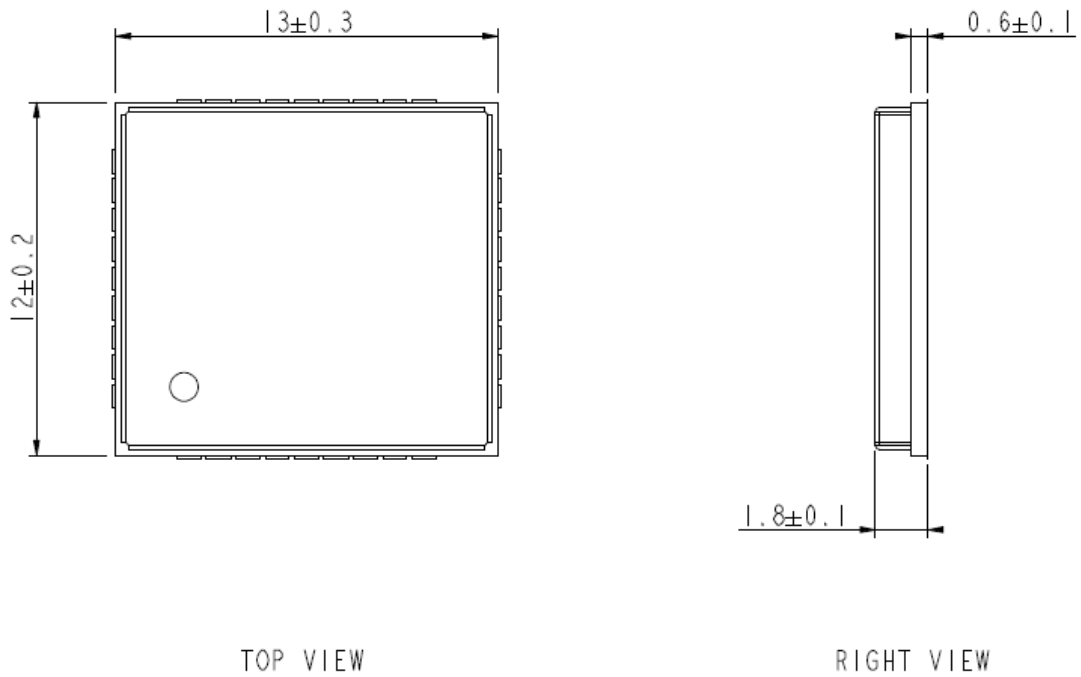
## **Product Feature**

- Built-in standard LoRaWAN<sup>™</sup> FW and proprietary MOST-Link FW in the same module
- Share same PCB/ device design for both LoRaWAN<sup>™</sup> and private RF data communication
- Compact size, only 12x13 mm
- Ultra-high sensitive receiving ability by LoRa<sup>®</sup> spread spectrum modulation technology
- Long-distance transmission (1KM to 10KM)
- Instant wake up over the air
- LoRa<sup>®</sup> / 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

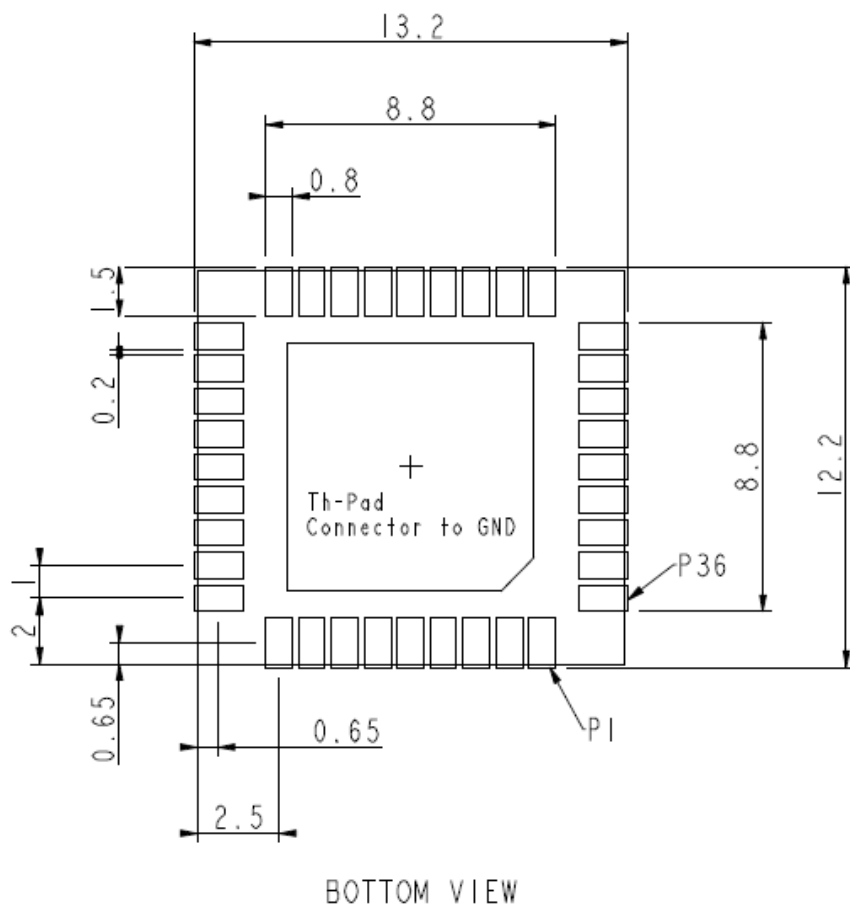
LoRa® Chipset	SX1276
MCU	STM32 (192KB Flash)
Frequency	<b>LM-533H:</b> 863-870MHz (EU) 902-928MHz (US) 920-928MHz (ROA)
Transmission Power	<b>LM-533H:</b> 862-870MHz (EU) @ 14dBm 902-928MHz (US) @ 20dBm 920-928MHz (ROA) @ 20dBm
Transmission Media	UART
UART	Baud Rate : 57600 bps Parity: 8N1
Operation Voltage	2.4V ~ 3.6V
Current Consumption	Receiving: 20 mA (Typical) Transmitting: 120 mA (Typical) Sleeping: 1.5 uA (Typical)
Transmission Distance	LoRaWAN™: 1KM~10KM @ 980bps MOST-Link: 1KM~10KM @ 0.81Kbps
Receiving Sensitivity	LoRaWAN™: -132dBm @ 980bps MOST-Link: -132dBm @ 0.81Kbps
Operation Temperature	-40°C~ 85°C
Humidity	5%~95% (Non-condensing)
Dimension	12 x 13 x 1.8 ± 0.2mm

**Product Size**



UNITS  
mm

**Recommend Layout**



UNITS  
mm

## LM-533H Pin Definition

No.	Pin	Definition	Description
1	GND	GND	GND
2	RF_IO	I / O	RF Input / Output
3	GND	GND	GND
4	PA4	Reserved	ADC4/ DAC1/ UART2_CK
5	PA5	Reserved	ADC5/ DAC2
6	PA8	Reserved	MCO
7	nRST	Input	Reset, Low active
8	USB_VDD	Input	Power for USB
9	GND	GND	GND
10	PA11	Reserved	USB_BM
11	PA12	Reserved	USB_DP
12	PH0	Reserved	OSC_IN (OUT_XTAL)/ USB_CRS_SYNC
13	PH1	Reserved	OSC_OUT (OUT_XTAL)
14	PA9	Reserved	UART1_TX
15	PA10	Reserved	UART1_RX
16	VREF+	Input	VREF+
17	GND	GND	GND
18	VCC	Input	VCC
19	PB12	Reserved	SPI2_NSS
20	PB13	Reserved	SPI2_CLK
21	PB14	Reserved	SPI2_MISO
22	PB15	Reserved	SPI2_MOS1
23	PA13	Reserved	SWDIO
24	PA14	Reserved	SWCLK
25	PA2	Reserved	ADC2/ UART2_TX

No.	Pin	Definition	Description
26	PA3	Reserved	ADC3/ UART2_RX
27	BOOT0	Input	BOOT0
28	PA0	Reserved	WKUP1/ UART2_CTS
29	PA1	Reserved	UART2_RTS
30	PB8	Reserved	I2C1_SDA
31	PB9	Reserved	I2C1_SCL
32	PB2	Reserved	LPTIM_OUT
33	PB5	Reserved	LPTIM_IN1
34	PB6	Reserved	LPTIM_ETR
35	PB7	Reserved	LPTIM_IN2
36	GND	GND	GND

## **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 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.

## **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.