

# Wireless Protocol Modules MiP Series

## 32001505BEU

Stand Alone LoRaWAN™ Module

## Data Sheet



### Overview

The 32001505BEU is a transceiver operating in the 868 MHz SRD Band optimized for very long range, low power applications, suitable for LPWA networks. Based on LoRa® RF Technology and LoRaWAN™ protocol, it provides ultra-long range spread spectrum communication and high interference immunity.

Thanks to its small LGA form factor (11.3 x 8.9 mm only) and its low current consumption, this module allows the implementation of highly integrated low power (battery operated) solutions for Internet of Things (IoT) applications, security systems, sensor networks, metering, smart buildings, agriculture, supply chain.

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## I. Product Features

### Mechanical highlights:

- ✓ Extremely compact dimensions (1 cm<sup>2</sup>)
- ✓ LGA pattern

### Low power characteristics:

- ✓ power down current consumption 1.5  $\mu$ A
- ✓ 11 mA in RX mode

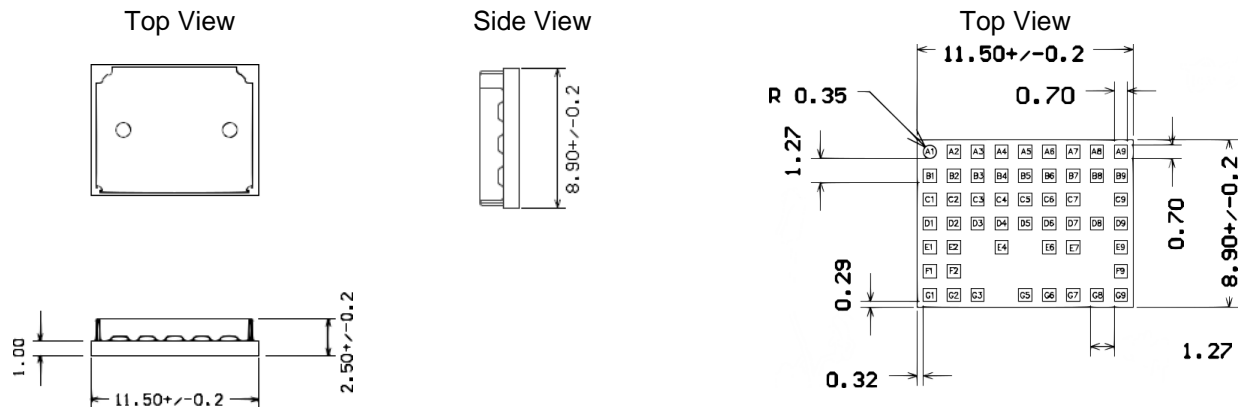
### RF performances:

- ✓ -135 dBm sensitivity @LoRa®
- ✓ +14 dBm Output power

### Protocol and interfaces:

- ✓ LoRaWAN™ version 1.1
- ✓ Smart peripheral interfaces selector (UART, LPUART, SPI, I<sup>2</sup>C)

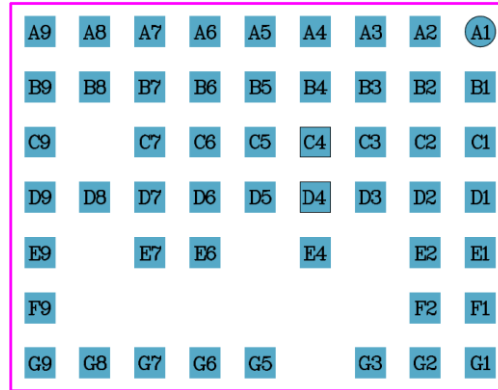
## 2. Mechanical Dimensions



**Note:** all dimensions are in millimetres (mm)

### 3. Pin Definition

Bottom View



Pin	Name	Type	Pin	Name	Type
A1	SPI1_MISO	I/O	D1	GND	S
A2	SPI1_SCK	I/O	D2	TIM2_CH3	I/O
A3	SPI1_NSS	I/O	D3	TIM2_CH4	I/O
A4	LPUART1_TX	I/O	D4	GND	S
A5	LPUART1_RX	I/O	D5	ADC_IN1	I/O
A6	SPI1_MOSI	I/O	D6	DAC_OUT1	I/O
A7	I2C1_SCL	I/O	D7	VBAT	S
A8	I2C1_SDA	I/O	D8	ADC_IN0	I/O
A9	VDD	S	D9	SPI2_MISO	I/O
B1	GPIO0-NWAKE	I/O	E1	GND	S
B2	GPIO1	I/O	E2	GND	S
B3	USART2_TX	I/O	E4	LPTIM2_IN1	I/O
B4	USART2_RX	I/O	E6	COMP2_INM	I/O
B5	USART1_TX	I/O	E7	ADC_IN8	I/O
B6	USART1_RX	I/O	E9	SPI2_MOSI	I/O
B7	COMP2_INP	I/O	F1	ANT	RF I/O
B8	VDDA	S	F2	GND	S
B9	VDD	S	F9	SPI2_NSS	I/O
C1	BOOT0	I/O	G1	GND	S
C2	LPTIM2_OUT	I/O	G2	GND	S
C3	TIM2_CH2	I/O	G3	GND	S
C4	GND	S	G5	T_NRST	I/O
C5	TIM2_CH1	I/O	G6	T_SWDIO	I/O
C6	COMP1_INP	I/O	G7	T_SWCLK	I/O
C7	VREF+	S	G8	T_SWO	I/O
C9	GND	S	G9	SPI2_SCK	I/O

## 4. Electrical characteristics

### 4.1 Absolute Maximum Ratings

Parameter	Max.	Unit
Supply voltage, +Vdd, pin A9, B9:	3.9	V
Radio Frequency Input Level, pin FI:	0	dBm
Voltage Standing Wave Ratio (VSWR) at RF Input, ANT, pin FI:	10:1	
Max pins voltage with respect to GND	Vdd+0.3	V
Storage Temperature:	-40 ÷ 100	°C
Operating Temperature:	-40 ÷ 85	°C

### 4.2 Operating Condition

#### GENERAL ELECTRICAL CHARACTERISTICS @ 25 °C

Parameter	Min.	Typ.	Max.	Unit	Notes
Supply Voltage (VDD)	1.9	3.0	3.6	V	
VDDA	0	-	3.6	V	
VBAT	1.55		3.6	V	
VIN	-0.3		VDD+0.3	V	
Start-up time	-	-	TBD	ms	See note 8
Settling time	-	-	TBD	ms	See note 9

#### RECEIVER ELECTRICAL CHARACTERISTICS @ 25 °C

Parameter	Min.	Typ.	Max.	Unit	Notes
DC Current drain	-	-	11	mA	See note 6
Power Down DC Current	-	1.5	-	µA	
Operating Frequency	868.0	-	868.6	MHz	
Channel Frequency Precision	-	±15	-	kHz	
Sensitivity, 2-FSK	-	-115	-	dBm	See notes 2,3,5
Sensitivity, LoRa®	-	-135	-	dBm	See notes 2,4,5

-3 dB RF Bandwidth	7.8	-	500	kHz	
Image Frequency Rejection	-	54	-	dB	See note 7
Spurious radiated level	-	-	-57	dBm	
Data Rate	0.3	-	300	kbit/s	
Output Logic low	GND	-	0.05	V	
Output Logic high	VDD-0.2	-	VDD	V	

## TRANSMITTER ELECTRICAL CHARACTERISTICS @ 25 °C

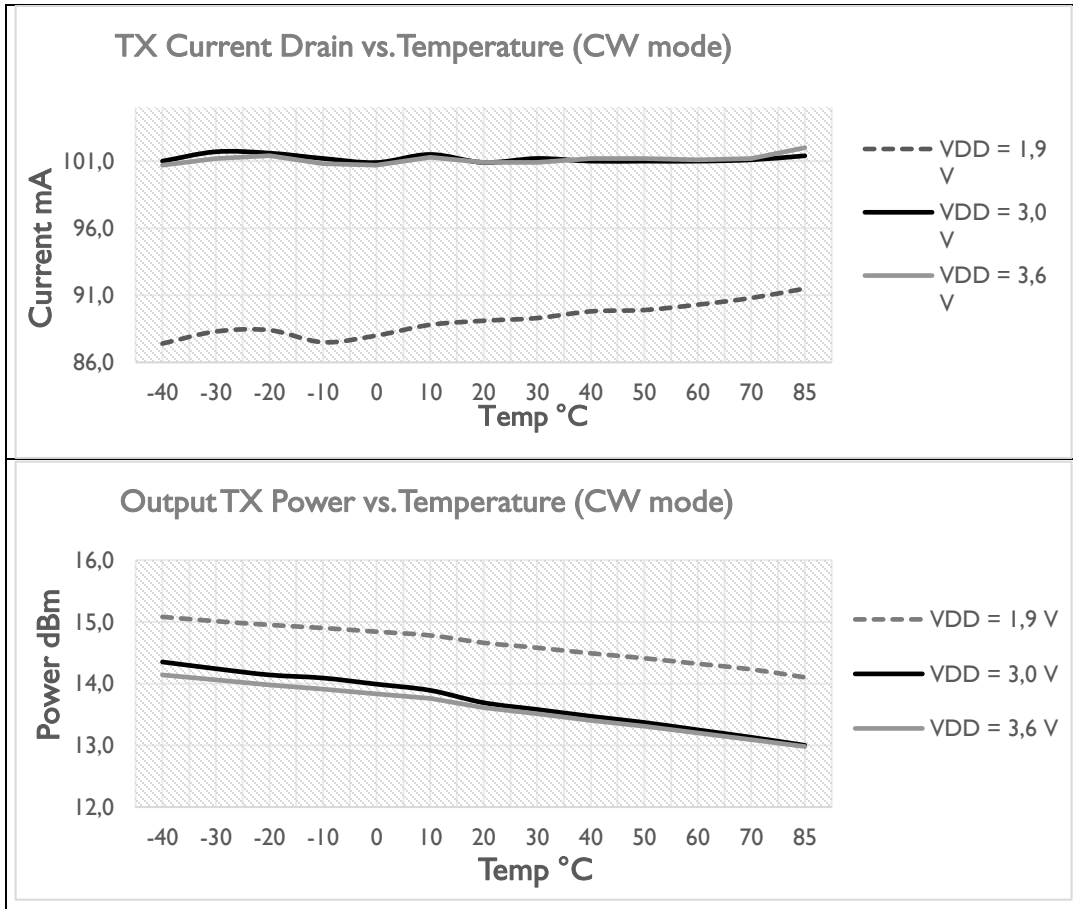
Parameter	Min.	Typ.	Max.	Unit	Notes
Current Drain	-	103	-	mA	1,2
Stand-by current	-	1.5	-	μA	
Operating frequency	868.0	-	868.6	MHz	
Occupied Bandwidth	-	125	-	kHz	
Operating Channel Width	-	200	-	kHz	
Output power (on 50 Ω load)	-	14	-	dBm	See notes 1,2,10
Output Impedance	-	50	-	Ω	
Data Rate	0.3	-	300	kbit/s	
Input Logic low	GND	-	0.05	V	
Input Logic high	VDD-0.2	-	VDD	V	

#### 4.2.1 Notes:

- Note 1:** VDD = 3.6 V.
- Note 2:** All RF parameters measured with input (pin FI, ANT) connected to 50  $\Omega$  impedance signal source or load.
- Note 3:** Pseudo random code NRZ, 2-FSK BER (bit error rate) = 0.1 % or better, 2-level FSK modulation without pre-filtering, Bit Rate = 4.8 Kbit/s, frequency deviation = 5 kHz, filter bandwidth = 20 kHz
- Note 4:** LoRa® PER (packet error rate) = 1 %, packet of 64 bytes, preamble of 8 bytes, error correction code CR = 4/5, CRC on payload enabled, no reduced encoding, no implicit header
- Note 5:** Sensitivities given using highest LNA gain step
- Note 6:** Power consumption measured with -140 dBm signal and AGC ON
- Note 7:** Blocking immunity, ACR and co-channel rejection, given for a single tone interferer and referenced to sensitivity +6 dB, blocking tests performed with unmodulated signal measured as per ETSI 300 220-1
- Note 8:** Time by power-on to valid data reception.
- Note 9:** Time by test signal at RF input to valid data reception.
- Note 10:** In order to not exceed the maximum power permitted by the ETSI EN 300 220 regulation, choose an appropriate antenna system and power supply.

### 4.3 Temperature Range Curves

**Note:** All RF parameters measured with input (pin 3) connected to a 50 Ω impedance signal source or load.





## 5. Application Notes

Title	Description	Doc
Command Reference Manual	Description of all commands	32001505BEU_Com_Ref
Manufacturing Process Information for LGA MiP Series Modules	Packaging information, Tape& Reel Specification, Reflow soldering information	AN_MNF002

## 6. Ordering Information

Part Number	Description	Region
32001505BEU	MiP-Lw-1C128N-EU	Europe

## 7. Regulatory Approvals

Doc	Title	Description
DoC	...	...
CE Approval	...	...

## 8. Revision History

Revision	Date	Description
0.0	18.01.2021	Draft
0.9	28.02.2021	Preliminary
0.10	28.04.2021	<ul style="list-style-type: none"> <li>- Pin C4 is GND</li> <li>- Pin C3 is TIM2_CH2</li> <li>- Added pin D4 (GND)</li> <li>- Bottom view of the pinout</li> <li>- Added TX OBW and TX OCW</li> </ul>