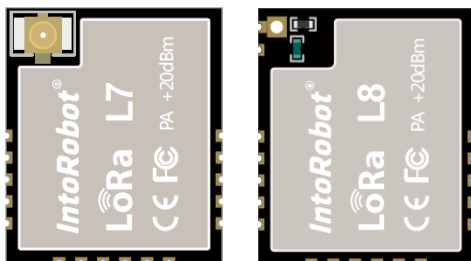


# ***IntoRobot***

## **L7/L8 LoRa™ Datasheet**



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## 1 Overview

### 1.1 Product Description

IntoRobot-L7/IntoRobot-L8 (L7/L8, for short), designed by Shenzhen MOLMC Technology co., Ltd., is a kind of LoRa™ communication module, with the advantages of long distance, compact package and low power consumption. The module operates at the frequency range of Sub-1GHz, including 433MHz and 470MHz. The only difference between L7 and L8 is the RF interface.

L7/L8 integrates the chip SX1276/1278 from Semtech, and its LoRa™ modulation mode is backward compatible with FSK and OOK. The LoRa™ spread spectrum modulation technology exhibits extremely high receive sensitivity and anti-jamming ability; the communication distance as well as the receive sensitivity is much larger than those of FSK and GFSK modulation modes. The power consumption is lower than 1.5uA when standby. L7/L8 can reduce the product development cycle time greatly.

### 1.2 Key Specification

- Transmission distance up to 6000m in open space;
- Radio frequency: 433/470 MHz;
- LoRa™ Modulation mode backward compatible with FSK and OOK;
- Receive sensitivity as low as -148dBm;
- RF output power: max 100mW (+20dBm)
- Power supply: 1.8~3.7V;
- Operating temperature: -40~+85°C;

### 1.3 Product Applications

- Smart agriculture, forestry, animal husbandry and fishery;
- Smart logistics, e.g., cargo tracking, cold chain logistics, important assets monitoring;
- Smart city, e.g., smart metering, parking, street lighting, and fire alarms;
- Environment monitor, e.g., air quality monitoring (PM2.5, CO2, CO, and formaldehyde), forest fire monitoring, and water quality monitoring;
- Smart home and building, e.g., access control systems, security systems, and smoke alarms;
- Smart industry, e.g., industrial automation;
- Robotics and UAVs.

## 2 Hardware Specification

**2.1 Specification Table**

Chart 1: Specification Table

Product	IntoRobot L7	IntoRobot L8
Communication	SPI	
Power Supply	1.8 ~ 3.7 V, typical 3.3V	
Current	Transmission: Maximum current 120mA (20dBm)	
	Receive: Maximum current 12mA	
	Standby current 1.5uA	
Radio Frequency	433MHz/470MHz	
Modulation Mode	LoRa/FSK/OOK	
Emission Power	2-20dBm	
Receive Sensitivity	> -148dBm	
Peripheral Interface	6 GPIO	
	1 SPI	
	1 Reset	
	Power in pin 1.8 ~ 3.7 V	
	Antenna interface	
Antenna Type	IPX/IPEX U.FL-R-SMT Antenna	
		Stamp Hole
Temperature	Operating Temperature -40°C - 85°C	
	Storage Temperature -40°C - 125°C	
	Humidity 10% - 90% Non-condensing	
Panel Connection	Stamp Hole	
Shield	Shield	
Size	14.98mm(Width), 17.7mm(Length), 2.5mm(Height)	

**2.2 Pin Description**

Chart 2: L7 Pin Block Diagram (Front View)

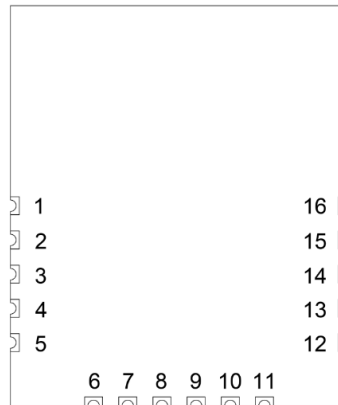


Chart 3: L8 Pin Block Diagram (Front View)

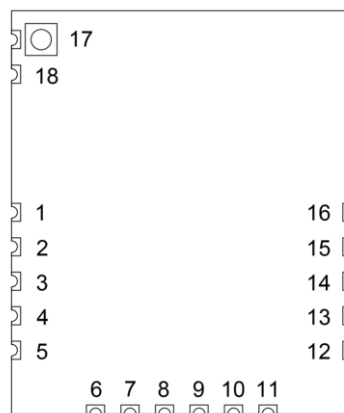


Chart 4: Pin Definition and Description

Pin	Name	Description
1	GND	Ground
2	GND	Ground
3	VDD	External Power Supply, range: +1.8V - +3.7V
4	VDD	External Power Supply, range: +1.8V - +3.7V
5	RXTX	SX1278 T-R control pin: High-Receive, Low-Transmit
6	SX_RST	Module Reset Pin, Active Low
7	DIO0	Digital I/O, Refer to DIOx map for multiplexed functions
8	DIO1	Digital I/O, Refer to DIOx map for multiplexed functions
9	DIO2	Digital I/O, Refer to DIOx map for multiplexed functions
10	DIO3	Digital I/O, Refer to DIOx map for multiplexed functions
11	DIO4	Digital I/O, Refer to DIOx map for multiplexed functions
12	DIO5	Digital I/O, Refer to DIOx map for multiplexed functions

13	SX_CLK	SPI Clock in
14	SX_MISO	SPI Data out
15	SX_MOSI	SPI Data in
16	SX_CS	SPI Chip Select
17	RF	Radio Frequency Pin , Ground ,Only for L8
18	GND	Ground ,Only for L8

Chart 5: Interface Description

Name	Pin	Description
SPI	SPI_MOSI, SPI_MISO, SPI_SCK, SPI_NSS	Peripheral MCU interface for receiving and transmitting data packets, and managing SX1278
DIOx	DIO0, DIO1, DIO2, DIO3, DIO4, DIO5,	Peripheral MCU interface for interrupting the reception and transmission.

Chart 6: DIOx Map

DIOx	DIO5	DIO4	DIO3	DIO2	DIO1	DIO0
00	Mode Ready	Cad Detected	Cad Done	FhssChange Channel	Rx Timeout	Rx Done
01	Clk Out	PIILock	Valid Header	FhssChange Channel	FhssChange Channel	Tx Done
10	Clk Out	PIILock	Payload CRC Error	FhssChange Channel	Cad Detected	Cad Done
11	-	-	-	-	-	-

**2.3 Electrical characteristics**

**2.3.1 Operating Environment**

Chart 7: Recommended Operating Environment



Item	Label	Min	Typical	Max	Unit
Operating Temperature	-	-40	20	85	°C
Storage Temperature	-	-40	20	125	°C
Power Supply	VDD	1.8	3.3	3.7	V
Operating Humidity	-	10%	-	90%	-

Test condition: IPC/JEDEC J-STD-020.

### 2.3.2 Digital Port Characteristics

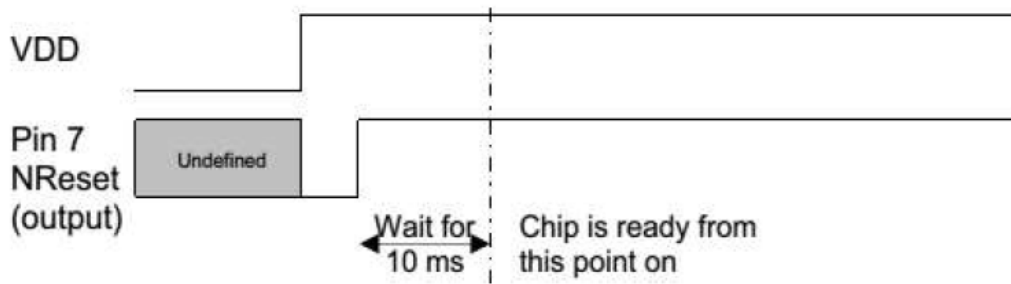
Chart 8: Digital Port Characteristics

Label	Description	Condition	Min	Typical	Max	Unit
V <sub>IL</sub>	Input Level Logic Low	-	-	-	0.2VDD	V
V <sub>IH</sub>	Input Level Logic High	-	0.8VDD	-	-	V
V <sub>OL</sub>	Output Level Logic Low	I <sub>max</sub> =1mA	-	-	0.1VDD	V
V <sub>OH</sub>	Output Level Logic High	I <sub>max</sub> =1mA	0.9VDD	-	-	V
F <sub>sck</sub>	SCK Frequency	-	-	-	10	MHz
T <sub>ch</sub>	SCK High Level Duration	-	50	-	-	ns
T <sub>cl</sub>	SCK Low Level Duration	-	50	-	-	ns
T <sub>rise</sub>	SCK Rise Time	-	-	5	-	ns
T <sub>fall</sub>	SCK Fall Time	-	-	5	-	ns
T <sub>setup</sub>	MOSI Setup Time	-	30	-	-	ns
T <sub>hold</sub>	MOSI Stay Time	-	20	-	-	ns
T <sub>nsetup</sub>	NSS Setup Time	-	30	-	-	ns
T <sub>nhold</sub>	NSS Stay Time	-	100	-	-	ns
T <sub>nhigh</sub>	NSS High Level Duration in SPI Access Interval	-	20	-	-	ns

### 2.3.3 Reset

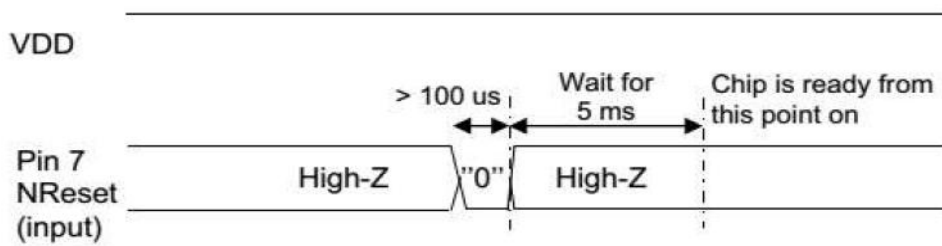
The power module will trigger POR (power-on reset). After POR, wait 10ms before starting SPI communication.

Chart 9: Power-on Reset Timing



For manual reset, the pin SX\_RST should be pulled low for more than 100us and then released. The users need to wait at least 5ms to use the module again.

Chart 10: Manual Reset Timing



2.4 Power Consumption

2.4.1 Operating Power Consumption

Chart 11: Operating Power Consumption

Modes	Min	Typical	Max	Unit
Sleep mode		1.5		uA
Normal		5.8		mA
Receive		12		mA
Transmission (5dBm)		50		mA
Wake up(20dBm)		120		mA

Remark: T=25°C, VDD=3.3V.

2.5 RF Characteristics

2.5.1 RF Characteristics

Chart 12: RF Characteristics

Parameters	Min	Max	Unit
Sensitivity@433MHz	-148	—	dBm

Power Consumption@433MHz	2	20	dBm
Sensitivity@470MHz	-148	—	dBm
Power Consumption@470MHz	2	20	dBm

### 3 Mechanical Specification

#### 3.1 Recommended SMT Temperature

Chart 13: Recommended RF Temperature

Temperature increases from TS to TL	Maximum value 3°C/s
Warm-up	150°C
Minimum temperature (TS Min.)	175°C
Typical temperature (TS Typ.)	200°C
Maximum temperature (TS Max.)	60~180 seconds
Time(TS)	
Temperature increases from TL to TP	Maximum value 3°C/s
Temperature(TL)/Duration period	217°C/60~150 seconds
Peak temperature (TP)	Maximum value 260°C, duration period 10"
Target temperature	260°C+0/-5°C
Real peak temperature (TP) 5°C duration period	20~40 "
Temperature decreases	Maximum value 6°C/s
The time that Temperature increases from 25°C to peak value(t)	8 minutes at most

#### 3.2 Module Weight

Chart 14: Module Weight

Module	Weight
IntoRobot-L7/ IntoRobot-L8	1.3 g

#### 3.3 Module Size

Chart 15: Module Size (Front View) Unit mm

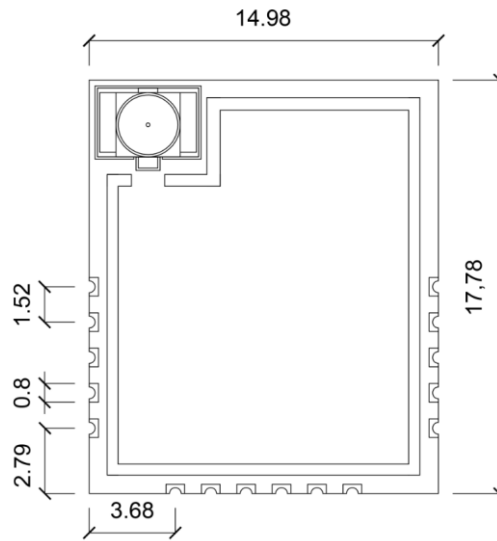


Chart 16: L7 Module Size (Front View) Unit mm

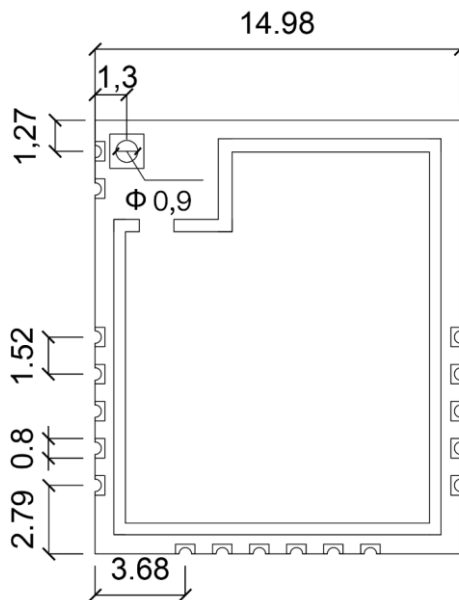


Chart 17: L8 Module Size (Side View) Unit mm



**3.4 Recommended PCB package**

Chart 18: L7 Recommended PCB Package (Front View) Unit mm

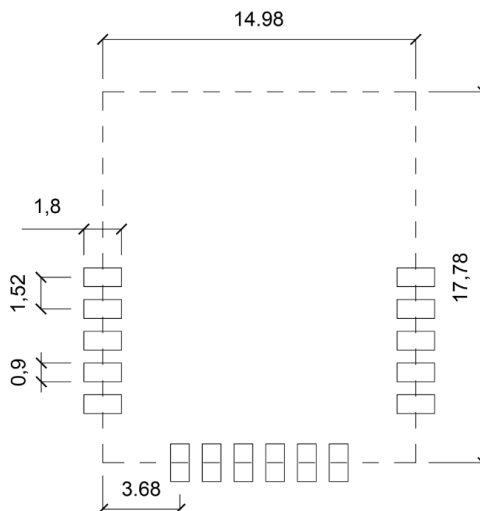
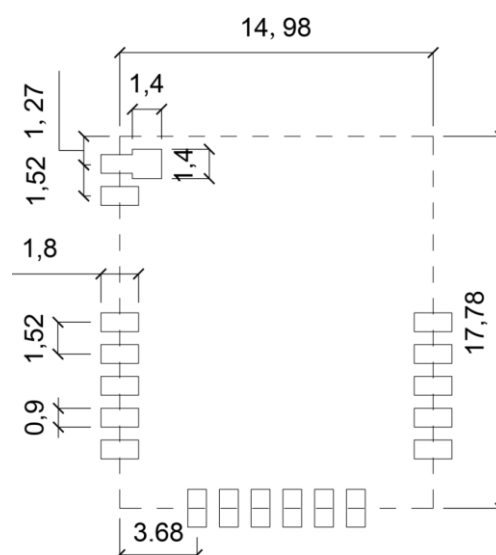


Chart 19: L8 Recommended PCB Package (Front View) Unit mm



## 4 Application Example

### 4.1 Schematic

L7/L8 has no internal MCU, and please select IntoRobot-L6 when a MCU is needed. L7/L8 is designed with characteristics of low power consumption and wide-voltage power supply. If L7/L8 is powered by a battery, it is recommended to select low-power MCUs like STM32L0 or L1 series. The following is a schematic example based on STM32L151XX MCU.

Chart 20: A schematic example for L7/L8 application

