+12.5dBm LoRa 2.4GHz Transceiver

Features

- Long Range 2.4GHz RF Module
- Integrated LoRa™ Transceiver **Semtech SX1280**
- Highly Efficient Integral Impedance Matching Network
- Provides Full Functionality of the RFIC:
- High sensitivity: down to -132 dBm
- Transmit power +12.5 dBm at 118mA constant RF output vs. V supply
- +14 dBm high efficiency PA
- 170 dB maximum link budget
- Built in RF switch
- Bullet-proof front end: IIP3 = -12.5 dBm
- 89 dB blocking immunity
- Small Form Factor: 23mm x 20mm
- Programmable bit rate up to 300 kbps
- Low RX current of 4.6 mA, (Lora Operating Mode)
- LoRa,FSK,GFSK,MSK,GMSK,OOK modulation
- Built-in bit synchronizer for clock recovery
- Preamble detection
- 127 dB Dynamic Range RSSI
- Automatic RF Sense and CAD with ultra-fast AFC
- Packet engine up to 256 bytes with CRC
- Built-in temperature sensor and low battery indicator
- 868MHz CE Compliant
- 915MHz "Modular" FCC Certification Pending

Applications

- RF Alarms
- Sensor networks
- Long Range Telemetry
- Meter Reading
- Environmental Sensors
- Building Control & Automation
- Agricultural Applications

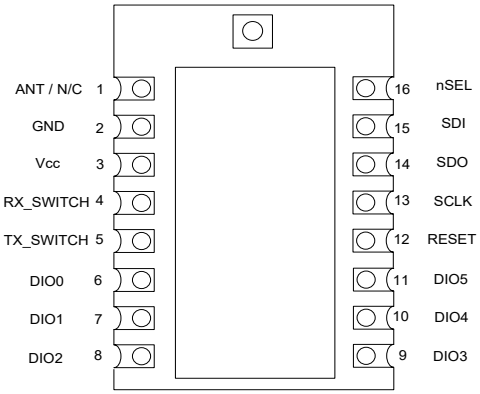
Description

The LAMBDA80 RF module is an extremely high performance, cost effective radio module featuring the Semtech SX1280 LoRa™ long range providing ultra-long range, spread spectrum communication and high interference immunity within minimal current consumption operating at the only world wide acceptable 2.4GHz band.

This module including crystal, RF Changeover switch, impedance matching network and track layout provide a simple digital interface and direct antenna connection. This enables a plug in RF solution with maximum efficiency. Programming of the module is via SPI interface.

The LAMBDA80 Module is CE compliant. Providing that certain procedures are followed. (please refer to application schematic later in this datasheet).

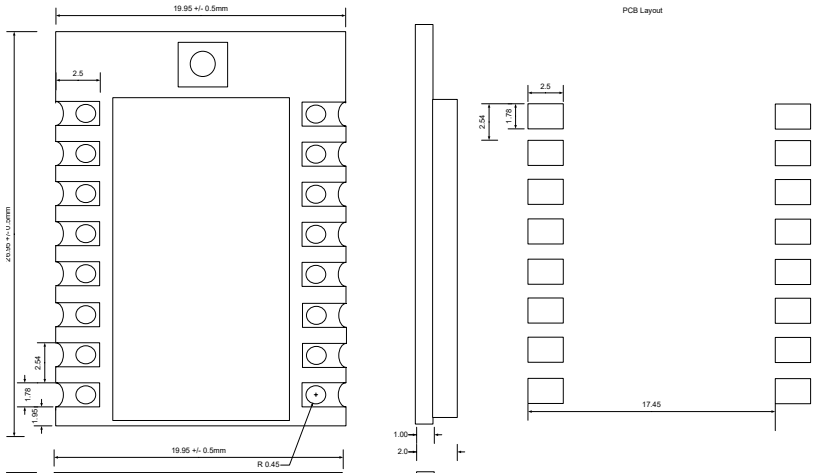
Pin Description



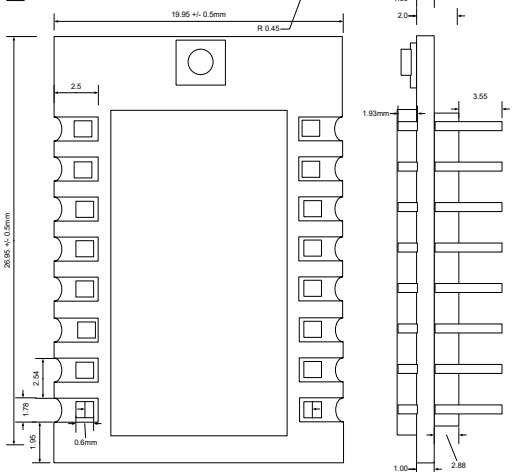
Mechanical Dimensions

Suggested Layout

SMT Version



DIP Version



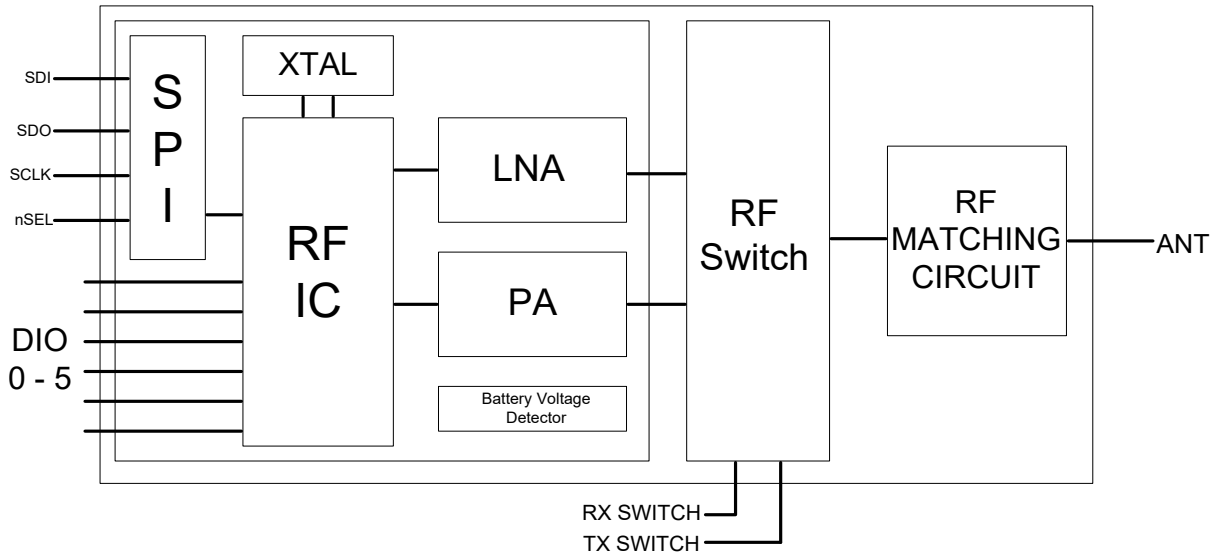
Part Numbers

Part Number	Description	Package
LAMBDA80-24S	Transceiver Module, 868MHz Open Module	SMT
LAMBDA80-24D	Transceiver Module, Open Module	DIP
LAMBDA80C-24S	Transceiver Module, Module with Screen Can	SMT
LAMBDA80C-24D	Transceiver Module, with Screen Can	DIP

Pin Description

<table>
<tr><th>Pin</th><th>Definition</th><th>Direction</th><th>Function</th></tr>
<tr><td>1</td><td>Antenna</td><td>In/Out</td><td>868MHz Versions: Antenna connection
915MHz Versions: No Connect</td></tr>
<tr><td>2</td><td>GND</td><td>-</td><td>Ground connection</td></tr>
<tr><td>3</td><td>Vcc</td><td>In</td><td>Power connection</td></tr>
<tr><td>4</td><td>RX_SWITCH</td><td>In</td><td>Enable RX RF Path Active High
<table><tr><td></td><td>TX PIN5</td><td>RX PIN4</td></tr><tr><td>RX Mode</td><td>0</td><td>1</td></tr></table></td></tr>
<tr><td>5</td><td>TX_SWITCH</td><td>In</td><td>Enable TX RF Path Active High
<table><tr><td></td><td>TX PIN5</td><td>RX PIN4</td></tr><tr><td>TX Mode</td><td>1</td><td>0</td></tr></table></td></tr>
<tr><td>6</td><td>DIO0</td><td>In/Out</td><td>Digital I/O software configured</td></tr>
<tr><td>7</td><td>DIO1</td><td>In/Out</td><td>Digital I/O software configured</td></tr>
<tr><td>8</td><td>DIO2</td><td>In/Out</td><td>Digital I/O software configured</td></tr>
<tr><td>9</td><td>DIO3</td><td>In/Out</td><td>Digital I/O Software configured</td></tr>
<tr><td>10</td><td>DIO4</td><td>In/Out</td><td>Digital I/O software configured</td></tr>
<tr><td>11</td><td>DIO5</td><td>In/Out</td><td>Digital I/O software configured</td></tr>
<tr><td>12</td><td>RESET</td><td>In</td><td>Reset Trigger Input</td></tr>
<tr><td>13</td><td>Serial Clock</td><td>In</td><td>SPI Serial Clock Input</td></tr>
<tr><td>14</td><td>Serial Data Out</td><td>Out</td><td>SPI Serial Data Output</td></tr>
<tr><td>15</td><td>Serial Data In</td><td>In</td><td>SPI Serial Data Input</td></tr>
<tr><td>16</td><td>nSEL</td><td>In</td><td>Device Select Active Low</td></tr>
</table>

Block Diagram



Application Resources

The LAMBDA80 is a ready to use application of the Semtech SX1280.
Access to the programming and configuration of Semtech 1280 Transceiver are via the modules interface SPI line.
The LAMBDA80 has been developed with Semtech to provide a low cost platform application of the 1280 transceiver. This offers optimal design realisation and easy integration within the end application.
The most important aspect of any RF Module is to maximise the performance of the transceiver at the external module pads.
In particular the impedance matching network which is the most sensitive section of the RF module design.
In order to maximise signal propagation to the external pad of the module, a specific layout is required which is not (usually) the smallest physical size (beware of small RF modules!).
Many RF Module manufacturers simply reproduce the IC manufacturers data characteristics where in practice the Module RF performance is considerably lower.
We have measured the conducted power transmitted from the LAMBDA80 ufl connector at +12.4dBm, which demonstrates the efficiency of the LAMBDA80 module.

To ensure that the latest details in programming this device are offered, we have not included the 1280's programming information in this document.

You can find the datasheet at the link below:

https://www.rfsolutions.co.uk/downloads/1537522490DS_SX1280-1_V2.2_SEMTECH.pdf

Programming, configuration and further resource data including;

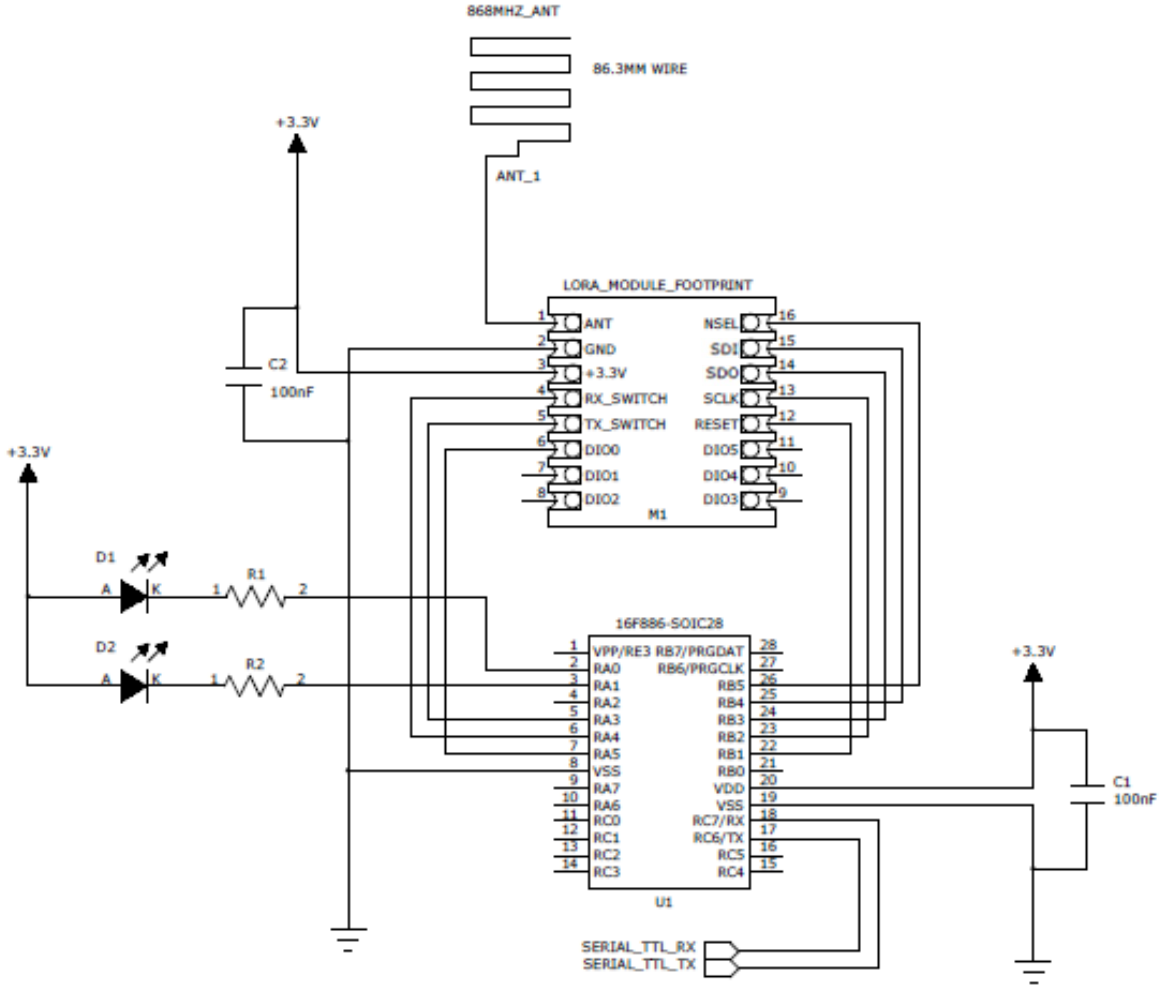
LoRa Calculator: fast evaluation of link budget, time on air and energy consumption.

Packet Error Rate Firmware User Guide.

LoRa Modem Designer's Guide.

is available from Semtech at the below links
Semtec Website

Application schematic Interfacing a PIC™ Micro Controller



The above schematic shows an easy interface to a PIC Microcontroller

This is the same application circuit that we used for range testing (please see our range test information later in the document).

We also have application source code available for download on our website. This configures the RF LoRa Module for maximum range.

Walk Test application
Also available is the source code used to carry out a simple range test.
In order to use this two application boards are required, one acts as a beacon transmitter, the other as the beacon receiver. The TX board will illuminate the GREEN LED when transmitting and the Receiver will illuminate the RED LED when RECEIVING
The Transmitter board transmits an RF beacon every second (Green LED flashes to indicate transmission).
This enables a one man range test, by placing either board in a fixed location and monitoring the beacon signals.

Electrical Specifications

Absolute Maximums

Symbol	Parameter	Minimum	Maximum	Unit
V_{dd}	Positive power supply	-0.5	+3.9	V
V_{in}	Voltage on Digital Inputs	-0.3	Vdd+0.3	V
RX	Max Rx input power		+10	dBm
T_{op}	Operating temperature	-40	+85	°C
T_{st}	Storage temperature	-55	115	°C

Recommended Operating Conditions

Symbol	Parameter	Minimum	Maximum	Unit
V_{dd}	Positive power supply	1.8	3.7	V
T_{op}	Working temperature	-40	85	°C

DC Characteristics

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Supply Voltage Range	V_{DD}		1.8	3.3	3.7	V
Power Saving Modes	I_{DDSL}	Data Ram not Retained Data Buffer Retained Instruction RAM flushed.	—	0.25	1	uA
		Sleep Mode Data Ram Retained Data Buffer Flushed Instruction RAM flushed.	—	0.25	1	uA
		Sleep Mode Data Ram Retained Data Ram Retained Data Buffer Retained Instruction RAM Retained	—	1.2	1.8	mA

General Electrical Specifications

Symbol	Description	Min	Typ	Max	Unit
IDDSTDBYRNC	Supply Current in STDBY_RC Mode		700		uA
IDDSTDBYXOSC	Supply Current in STDBY_XOSC Mode		1		uA
IDDFS	Supply Current in FS Mode		2.8		uA
FR	Synthesizer Frequency Range	2400		2500	MHz
FSTEP	Synthesizer Frequency Step (52MHz Ref)		198		Hz
PHN	Phase Noise at 2.45GHz 1MHz Offset 10MHz Offset		 -115 -135		 dBc/ Hz
FXOSC	Crystal Oscillator Frequency		52		MHz
TS_FS	Freq Synt wakeup time (XOSC Enabled)		54		uS
TS_HOP	Freq Synth Hop Time within 10KHz of target Freq 1MHz 10MHz 100MHz		 20 30 50		 uS
TX_OS	XTAL Osc wakeup time from STDBY_RC		40		uS

Receiver Specifications

Symbol	Description	Typ	Max	Unit
IP3	3rd Order Input intercept for max Low Power Gain Setting In Band Interferer <6MHz In Band Interferer @ 6MHz In Band Interferer @ 10MHz In Band Interferer @ 20MHz		 -25 -12 0 0	dBm
IMR	Image Rejection (CW Tone 1% PER)		30	dB

Transmitter Electrical Specifications

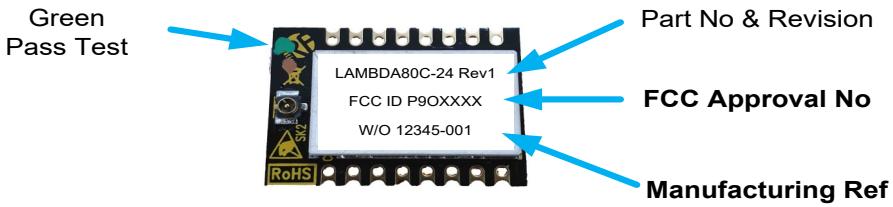
Symbol	Description	Min	Typ	Max	Unit
IDD_T13	12.5dBm		24		mA
IDD_T10	10dBm		18		mA
IDD_T0	0dBm		10		mA
RFOPMIN	Min RF Output power		-18		dBm
RFOPMAX	Max RF Output power		12.5		dBm
FDA	Programmable FSK Frequency Deviation	62.5		1000	KHz

LAMBDA80 Device Marking

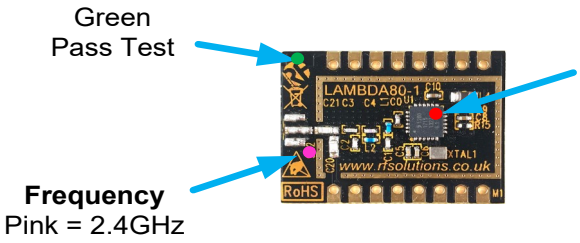
The LAMBDA80 module is available in two versions.
LAMBDA module is CE Compliant and at the time of writing is being submitted for modular FCC part 15 certification

Note:
915MHz include a screening can shield and ufl antenna connector, (requirement for FCC modular apprlval)
868MHz versions antenna connection is via pin 1 of the module

Module with Screen Can Fitted

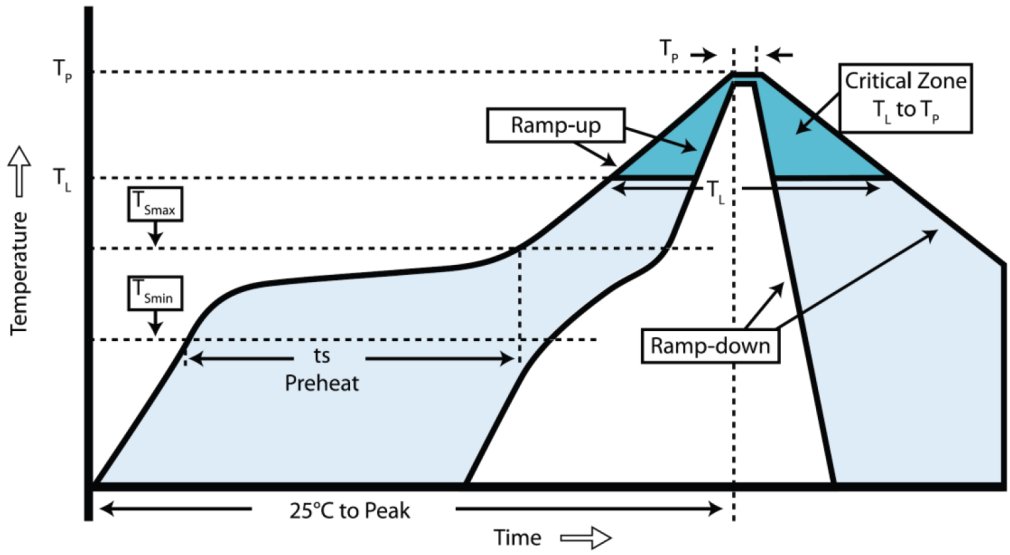


Open Module Version



Module versions Uses std Colour Coding	
Colour Dot	Rev
Brown	1
Red	2
Orange	3
Yellow	4
Green	5
Blue	6
Violet	7
Grey	8
White	9

Module re-flow guide



Profile feature	Value (lead free)
Ramp up rate	3°C /s
Pre-heat Temperature **- Temperature Min (T_{Smin})** **- Temperature Max (T_{smax})** **- Pre-heat time**	 150°C 200°C 60-100s
Peak Temperature (T_P)	240°C
Time at T_P	10-20sec
Ramp down rate	6°C/s
Time from 25°C to peak	8 mins max.

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