

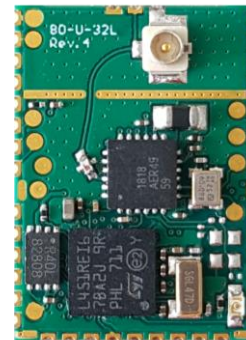
FMLR

STM SX1280



HIGH PERFORMANCE 2.4 GHZ LORA®
IOT MODUL

FMLR 2.4 GHz low power
wireless module with
STM32L0 or STM32L4 MCU
and time-of-flight ranging



FMLR STM SX1280 LoRa® and LoRaWAN® IoT modules enable devices and sensors to communicate at high data rates or over long-distance in the worldwide available 2.4 GHz ISM spectrum. The modules also support time-of-flight (ToF) distance measurement for indoor and outdoor localization. Power consumption can be optimized to run on a small-sized battery. The integrated microcontroller has sufficient resources available to run user applications.

The FMLR module supports additional modulation schemes such as high-bitrate long-range FLRC and Bluetooth Low Energy (BLE).

KEY BENEFITS

- Semtech SX1280/1 based long range 2.4 GHz IoT module
- Time-of-flight ranging
- Bitrate up to 1.3 mbps
- Receiver sensitivity down to -137 dBm
- Optional ext. flash, TCXO, U.FL connector
- Customer application on MCU
- Tiny FMLR footprint: 14 x 19.5 mm

APPLICATIONS

- Indoor and outdoor localization
- People and work safety
- Smart agriculture, farming and city

ABOUT

File name	FMLR STM SX1280 datasheet
Document type	Datasheet
Date	25.02.2021
Revision	1.83

REVISION HISTORY

Date	Release	Changes
25.02.2021	1.0	Initial revision

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Functional Description

The **FMLR STM SX1280** LoRa® and LoRaWAN® IoT module provides wireless connectivity to devices, systems, and sensors communicating with high data rates or over a long distance. The 2.4 GHz modules support long-range Time-of-Flight (ToF) distance measurement for indoor and outdoor localization down to an accuracy of 5 meters. Power consumption can be optimized to run from a small-sized battery. The integrated ARM Cortex-M0+ or M4 32-bit microcontroller runs entire RF stacks and has sufficient resources to run user applications.

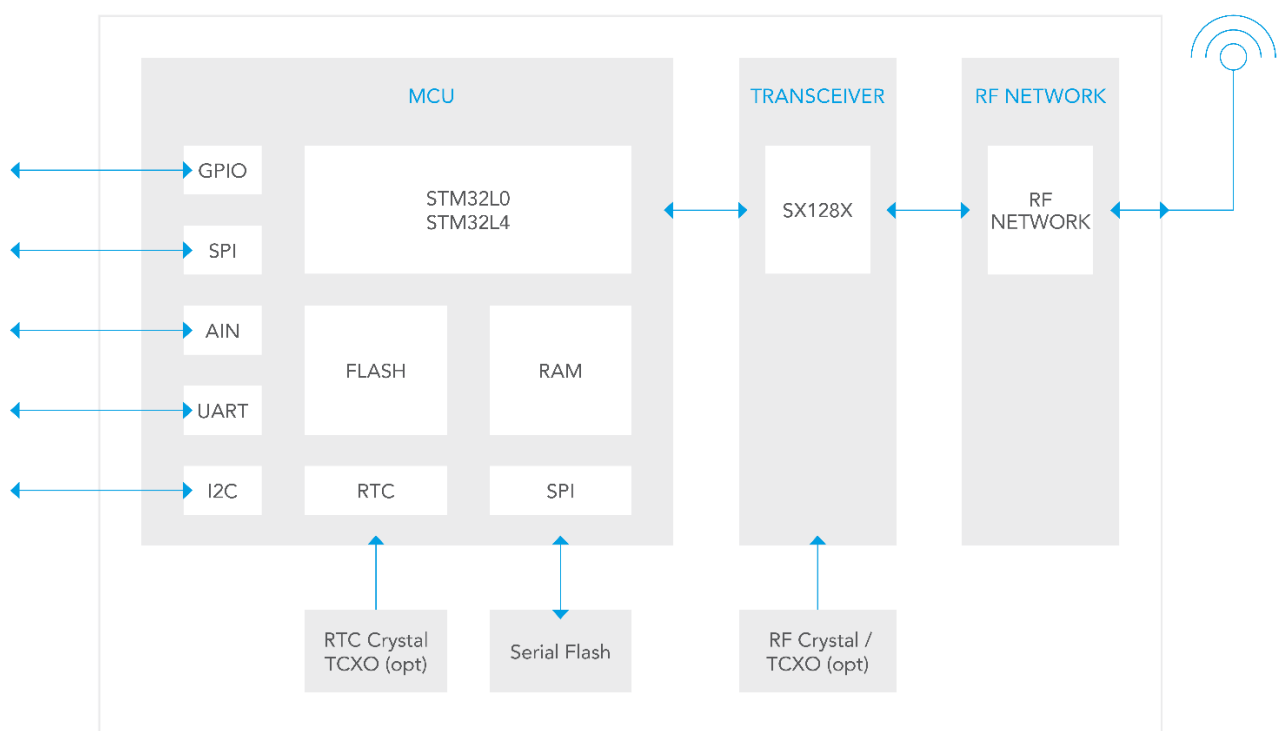


Figure 1: Block diagram FMLR STM SX1280

The modules are available with additional onboard flash memory to enable Over-the-Air (OTA) update and data storage. The FMLR family supports additional modulation schemes like the very efficient and robust high-bitrate and long-range FLRC and Bluetooth Low Energy (BLE). This enables communication with smartphones, tablets, gadgets, and more. Optional low-power high precision temperature compensated oscillators (TCXO) for both RTC and radio available.

The module's firmware, including the wireless stack, can be updated via SWD, UART-Bootloader or OTA, to support fast prototyping and development.

CORE COMPONENTS

LoRa® Transceiver	Semtech SX1280
Microcontroller	STM STM32L451REI6
Core	Cortex-M4 with FPU, 80 MHz
Flash Memory	512 kB
RAM	160 kB
Ext. Flash, optional (-4M)	Macronix MX25R4035FZUIL0, 512 kB

MECHANICAL SPECIFICATIONS

Weight	2 g
Dimensions	14 x 19 x 2 mm

OPERATING CONDITIONS

Temperature	-40 – 85 °C
Humidity	0 – 95% RH, non-condensing

ABSOLUTE MAXIMUM RATINGS

Parameter	Min	Max	Unit
Ext. supply voltage on all power pins (V_{DD})	-0.3	3.6	V
Input voltage on any pin	$V_{SS} - 0.3$	V_{DD}	V
DC current on any pin		15	mA
Storage temperature	-40	+85	°C

WARNING!

Stressing the device beyond the «Absolute Maximum Ratings» may cause permanent damage.

OPERATING CONDITIONS

Parameter	Min	Typ	Max	Unit
Standard operating voltage (V_{DD})	1.9		3.6	V
Digital IO pin input low voltage	V_{SS}		$0.4 \cdot V_{DD}$	V
Digital IO pin input high voltage	$0.4 \cdot V_{DD}$		V_{DD}	V
Digital IO pin output low voltage	0		0.4	V
Digital IO pin input high voltage	$V_{DD} - 0.4$		V_{DD}	V
Current consumption, TX mode (10dBm)		18.3		mA
Current consumption, RX mode	4.8		8.6	mA
Current consumption, sleep mode		1.5		μ A
Highest receiver sensitivity			-132	dBm
RF output power	-18		TBD	dBm

ON-BOARD LED

The on-board LED is connected to port PB8. Actively drive port to low (0V) to light up LED. Drive port high to disable LED.

Module Pinout

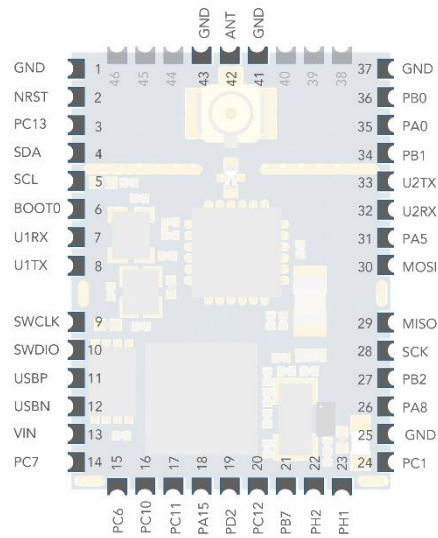


Figure 2: FMLR Pinout

#	Pad name	MCU pad	Description
1	GND		Ground (V_{SS})
2	NRST	NRST	MCU Reset
3	PC13	PC13	GPIO
4	SDA	PB9	I ² C1, GPIO
5	SCL	PB6	I ² C1, GPIO
6	BOOT0	BOOT0	MCU BOOT0
7	U1RX	PA10	UART1 RX
8	U1TX	PA9	UART1 TX
9	SWCLK	PA14	DBG Clock / GPIO
10	SWDIO	PA13	DBG Data / GPIO
11	USBP	PA12	USB P / GPIO
12	USBN	PA11	USB N / GPIO
13	VIN		Supply Voltage V_{DD}
14	PC7	PC7	GPIO
15	PC6	PC6	GPIO
16	PC10	PC10	GPIO
17	PC11	PC11	GPIO
18	PA15	PA15	GPIO
19	PD2	PD2	GPIO
20	PC12	PC12	GPIO

#	Pad name	MCU pad	Description
21	PB7	PB7	GPIO
22	PH2	PH2	GPIO
23	PH1	PH1	GPIO
24	PC1	PC1	GPIO
25	GND		Ground (V_{SS})
26	PA8	PA8	GPIO
27	PB2	PB2	GPIO
28	SCK ¹⁾	PB3	SPI SCK
29	MISO ¹⁾	PB4	SPI MISO
30	MOSI ¹⁾	PB5	SPI MOSI
31	PA5	PA5	GPIO
32	U2RX	PA3	UART2 RX
33	U2TX	PA2	UART2 TX
34	PB1	PB1	GPIO
35	PA0	PA0	GPIO
36	PB0	PB0	GPIO
37	GND		Ground (V_{SS})
41	GND		Ground (V_{SS})
42	ANT		RF Out (50 Ω)
43	GND		Ground (V_{SS})

¹⁾ If the module variant contains an external flash, these pins are connected internally and should not be used as GPIO pins!

FMLR Family Footprint

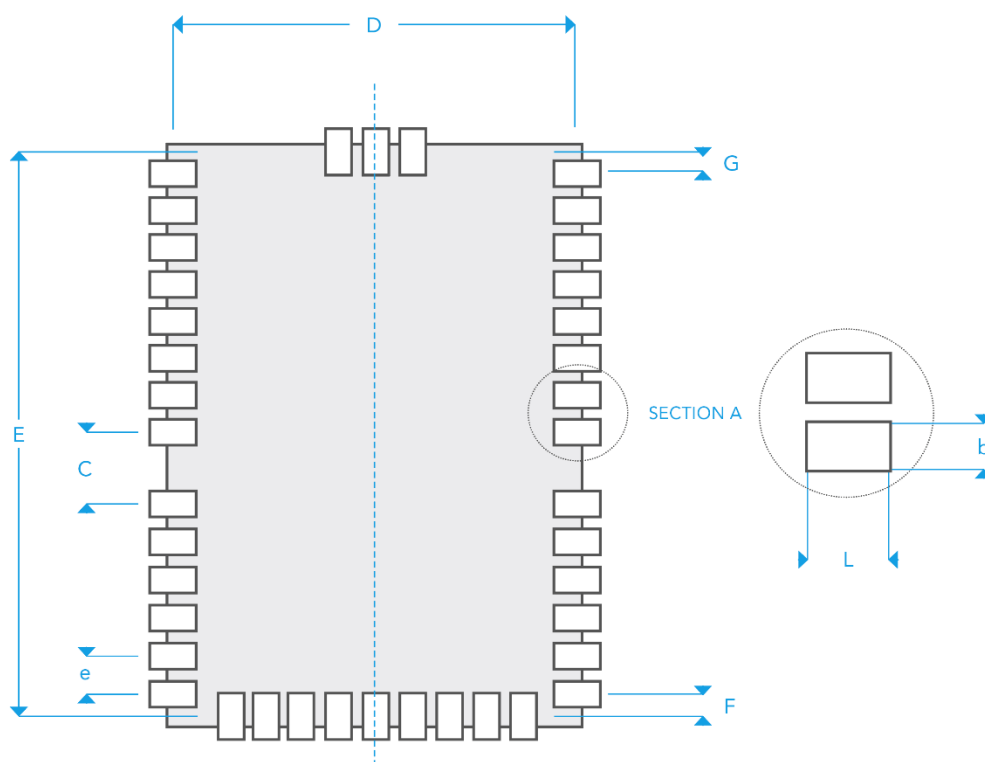


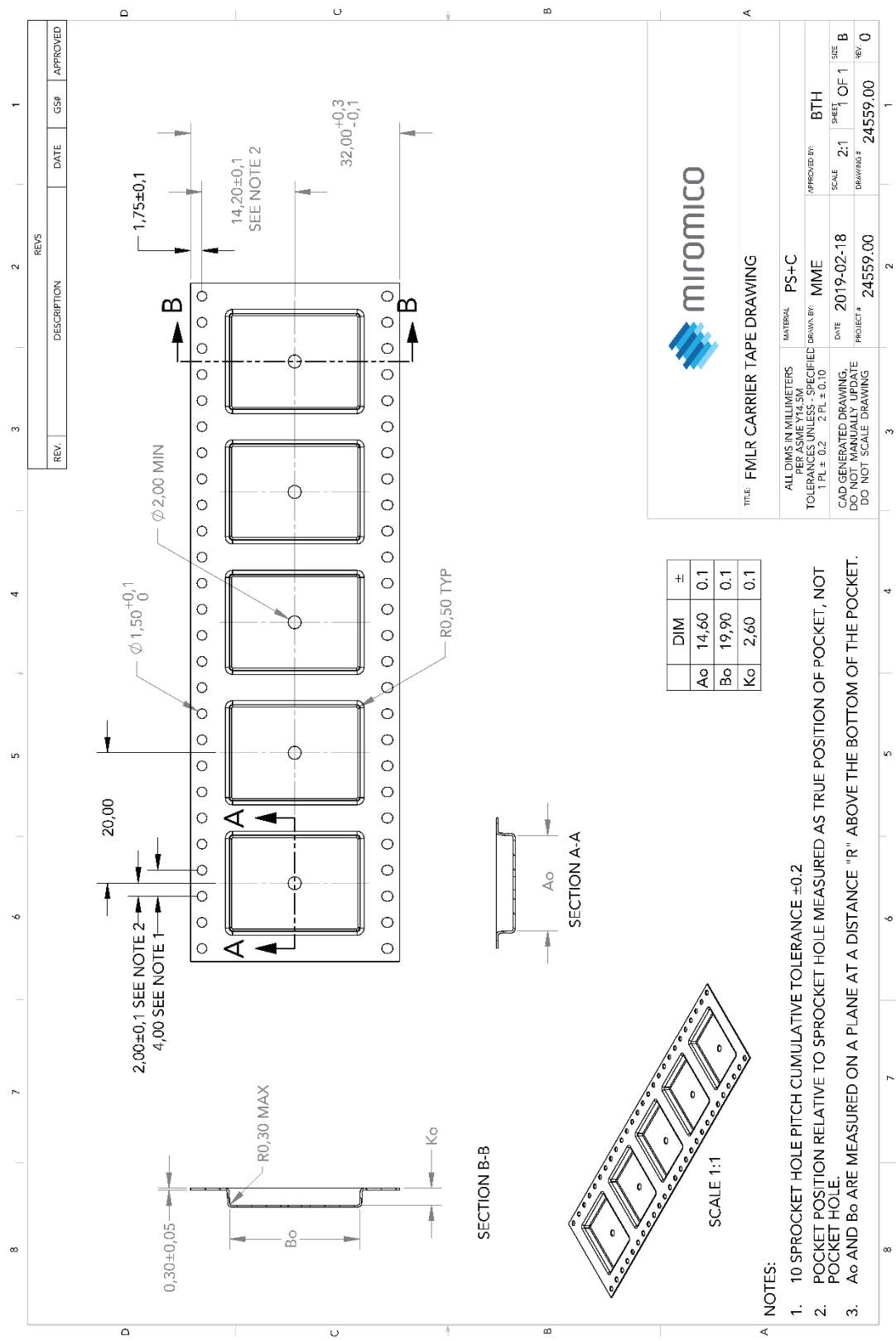
Figure 3: FMLR Footprint

FMLR FOOTPRINT DIMENSIONS

Dimension (see Figure 3: FMLR Footprint)	Min	Typ	Max
C		2.5	
D		13.7	
e		1.25	
b	0.85	0.9	0.95
L	1.45	1.5	1.55
F		1	
G		0.5	

All dimensions in mm

Tape Information



All dimensions in mm

Recommended Soldering Conditions

The following graph shows a typical temperature profile for the module soldering process. The exact values to be used in production are highly dependent on other parameters of the soldering process, such as soldering paste, PCB design, soldering process, etc.

Reflow process should be finished within 1 cycle.

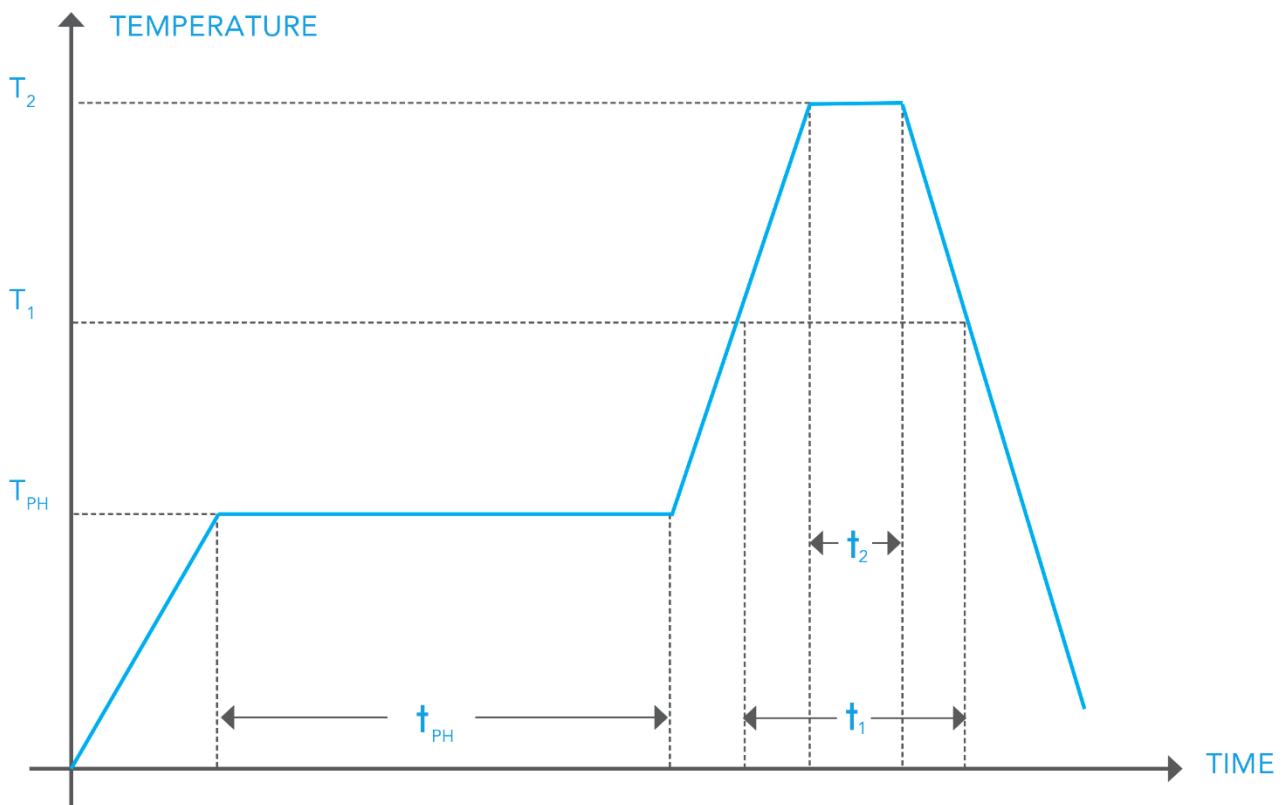


Figure 4: Soldering Profile

SOLDERING CONDITIONS

Step (see Figure 4: Soldering Profile)	Temperature	Time
Preheat (T_{PH} , t_{PH})	150 to 180 °C	120 s
Heating (T_1 , t_1)	220 °C	60 s
Reflow (T_2 , t_2)	255 °C	5 s

Device Options

PRODUCT ID	MCU OPTIONS						RF OPTIONS			
	Cortex-M0+	Cortex-M4	192KB flash	512KB flash	20KB RAM	160KB RAM	4Mbit Flash	ToF ranging	U.FL connect.	Antenna pad
FMLR-80-U-STL0Z	■		■		■			■	■	
FMLR-80-P-STL0Z	■		■		■			■		■
FMLR-80-U-STL0Z-4M	■		■		■		■	■	■	
FMLR-80-P-STL0Z-4M	■		■		■		■	■		■
FMLR-81-U-STL0Z	■		■		■				■	
FMLR-81-P-STL0Z	■		■		■					■
FMLR-81-U-STL0Z-4M	■		■		■		■		■	
FMLR-81-P-STL0Z-4M	■		■		■		■			■
FMLR-80-U-STL4E		■		■		■		■	■	
FMLR-80-P-STL4E		■		■		■		■		■
FMLR-80-U-STL4E-4M		■		■		■	■	■	■	
FMLR-80-P-STL4E-4M		■		■		■	■	■		■
FMLR-81-U-STL4E		■		■		■			■	
FMLR-81-P-STL4E		■		■		■				■
FMLR-81-U-STL4E-4M		■		■		■	■		■	
FMLR-81-P-STL4E-4M		■		■		■	■			■

Options for other STM32 variants (USB, Cortex-M0+/M4 with FPU, etc.) and external flash sizes are available on request.

Additional Documentation

ADDITIONAL RESSOURCES

Product Information Page	Product Website
Technical Documentation	Technical Documentation Website



Keep
in touch

Miromico AG

Gallusstrasse 4
CH-8006 Zürich
Switzerland

info@miromico.ch

www.miromico.ch

<https://forum.miromico.ch>

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