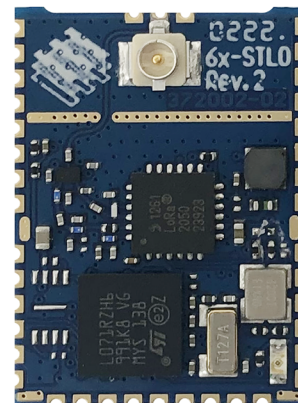


FMLR 61-STM

High performance sub-GHz
LoRaWAN® IoT module

FMLR sub-GHz low power wireless
LoRa® / LoRaWAN® module with
STM32L0 and optional flash memory



Description

FMLR-61-STM is a LoRa® and LoRaWAN® IoT module that provides wireless connectivity to devices and sensors in the sub-GHz spectrum. With a frequency coverage from 150 MHz to 960 MHz, it supports all major sub-GHz ISM bands around the world. In addition to the LoRa® modulation scheme, the module supports (G)FSK modulation.

Due to its low power consumption, the module is ideal for applications with small-sized batteries. The integrated low power 32-bit ARM Cortex®-M0+ microcontroller featuring 192 kB flash and 20 kB RAM offers sufficient resources to run advanced user applications.

Features

- ▶ Semtech SX1261 based
- ▶ LoRaWAN® IoT module
- ▶ Line-of-sight range of up to 100 km
- ▶ ARM Cortex®-M0+ MCU
- ▶ Optional ext. flash, TCXO, U.FL connector
- ▶ STM32L0 MCU for stack and user application
- ▶ Tiny FMLR footprint: 14 × 19.5 mm

Applications

- ▶ Asset tracking
- ▶ Health care
- ▶ Industry 4.0
- ▶ Smart agriculture
- ▶ Smart building
- ▶ Smart city
- ▶ Smart metering
- ▶ Smart retail
- ▶ Supply chain and logistics

Document Information

About

File name	Document type	Date	Revision
DS-FMLR-61-STM	Datasheet	2023/05/10	2.0

Revision History

Date	Release	Changes
2021/03/21	1.0	Initial revision
2023/04/11	2.0	Fully revised
2023/05/10	2.1	Added difference L0/L4 variants

Table of Content

Document Information	2
Functional Description	3
Technical Specifications	4
Module Pinout	6
FMLR Family Footprint	7
Tape Information	8
Recommended Soldering Conditions	9
Additional Documentation	10
Device Options	10
Keep in Touch	11

Functional Description

The **FMLR-61-STM** LoRa® and LoRaWAN® IoT module provides wireless connectivity to devices, systems and sensors communicating with low data rates over a long distance. The module supports a frequency range from 150 MHz to 960 MHz. Due to its low power consumption, the module is ideal for devices running on small-sized batteries. The integrated ARM Cortex®-M0+ 32-bit microcontroller is capable of running entire RF stacks and has sufficient resources to run user applications.

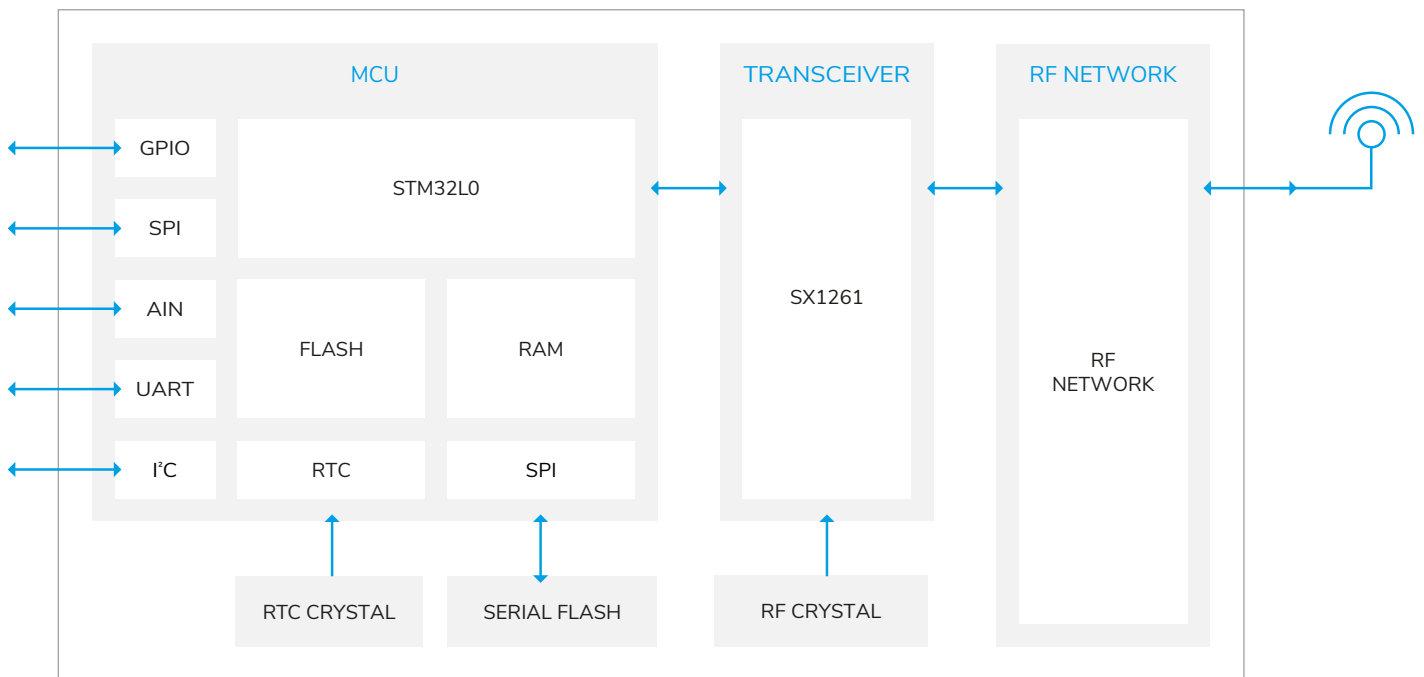


Figure 1: Block diagram FMLR-61-STM

The module is available with additional on-board flash memory to support Over-the-Air (OTA) update and additional data storage. In addition to the LoRa® modulation scheme, the module supports (G)FSK modulation, thus enabling communication with standards like Wireless M-Bus and IEEE802.15.4g.

To support fast prototyping and development, the firmware, including the wireless stack, can be updated via SWD or UART bootloader.

Technical Specifications

Core Components

LoRa® transceiver	Semtech SX1261
Microcontroller	STM STM32L071RZH6
Core	Cortex®-M0+, 32 MHz
Flash memory	192 kB
RAM	20 kB
EEPROM	6 kB
Ext. flash, optional (-4M)	Macronix MX25R4035FZUIL0, 512 kB

Mechanical Specifications

Weight	2 g
Dimensions	14 × 19.5 × 2 mm

Operating Conditions

Temperature	-20 – 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})	1.8		3.5	V
Digital IO pin input low voltage	V_{SS}		$0.3 \cdot V_{DD}$	V
Digital IO pin input high voltage	$0.7 \cdot V_{DD}$		V_{DD}	V
Digital IO pin output low voltage	0		0.4	V
Digital IO pin output high voltage	$V_{DD} - 0.4$		V_{DD}	V
Current consumption, TX mode (+10dBm), 3.3V ¹		18		mA
Current consumption, TX mode (+14dBm), 3.3V ¹		25.5		mA
Current consumption, RX mode, LoRa® 125 kHz ¹		10.1		mA
Current consumption, sleep mode		1.2		µA
Highest receiver sensitivity ¹			-148	dBm
RF output power ¹			14	dBm

¹See transceiver datasheet for detailed specifications

Certifications

CE	
UKCA	
LoRaWAN® certification	pending
FCC	pending

On-Board LED

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

Differences between L0 and L4 variants

Due to differences in STM32 MCU pin out, on modules using STM32L4 devcies, port PC3 is connected to VDD. Port PC3 should always be kept in its default configuration (input with no pull up or pull down). Other pin configuration might lead to device damage or excessive current consumption!

On modules using STM32L0 port PC3 is not available as an external pin of the MCU package and pin configuration has no effect. It's recommended to keep pin in default configuration.

Module Pinout

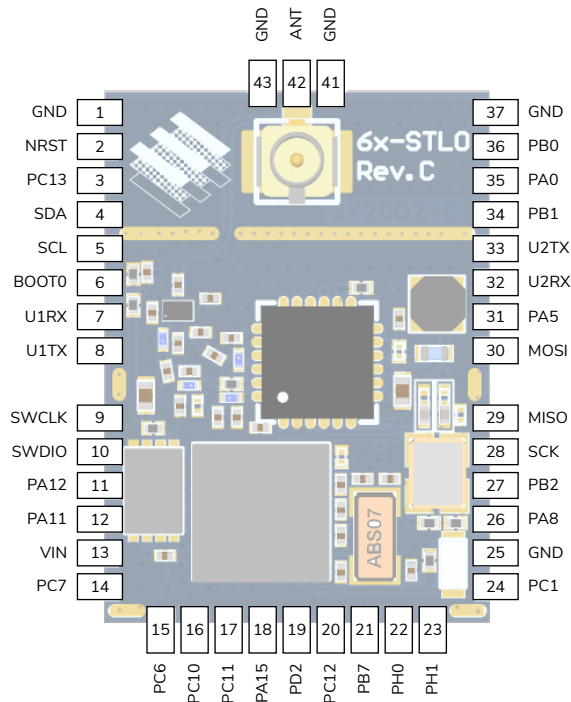


Figure 2: Module Pinout

#	Pad name	MCU pad	Description	#	Pad name	MCU pad	Description
1	GND		Ground (V_{SS})	21	PB7	PB7	GPIO
2	NRST	NRST	MCU Reset	22	PH0	PH0	GPIO
3	PC13	PC13	GPIO	23	PH1	PH1	GPIO
4	SDA	PB9	I ² C1, GPIO	24	PC1	PC1	GPIO
5	SCL	PB6	I ² C1, GPIO	25	GND		Ground (V_{SS})
6	BOOT0	BOOT0	MCU BOOT0	26	PA8	PA8	GPIO
7	U1RX	PA10	UART1 RX	27	PB2	PB2	GPIO
8	U1TX	PA9	UART1 TX	28	SCK ¹	PB3	SPI SCK
9	SWCLK	PA14	DBG Clock / GPIO	29	MISO ¹	PB4	SPI MISO
10	SWDIO	PA13	DBG Data / GPIO	30	MOSI ¹	PB5	SPI MOSI
11	PA12	PA12	USB P ² / GPIO	31	PA5	PA5	GPIO
12	PA11	PA11	USB N ² / GPIO	32	U2RX	PA3	UART2 RX
13	VIN		Supply Voltage V_{DD}	33	U2TX	PA2	UART2 TX
14	PC7	PC7	GPIO	34	PB1	PB1	GPIO
15	PC6	PC6	GPIO	35	PA0	PA0	GPIO
16	PC10	PC10	GPIO	36	PB0	PB0	GPIO
17	PC11	PC11	GPIO	37	GND		Ground (V_{SS})
18	PA15	PA15	GPIO	41	GND		Ground (V_{SS})
19	PD2	PD2	GPIO	42	ANT		RF (50 Ω)
20	PC12	PC12	GPIO	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!

² USB not available on all variants

FMLR Family Footprint

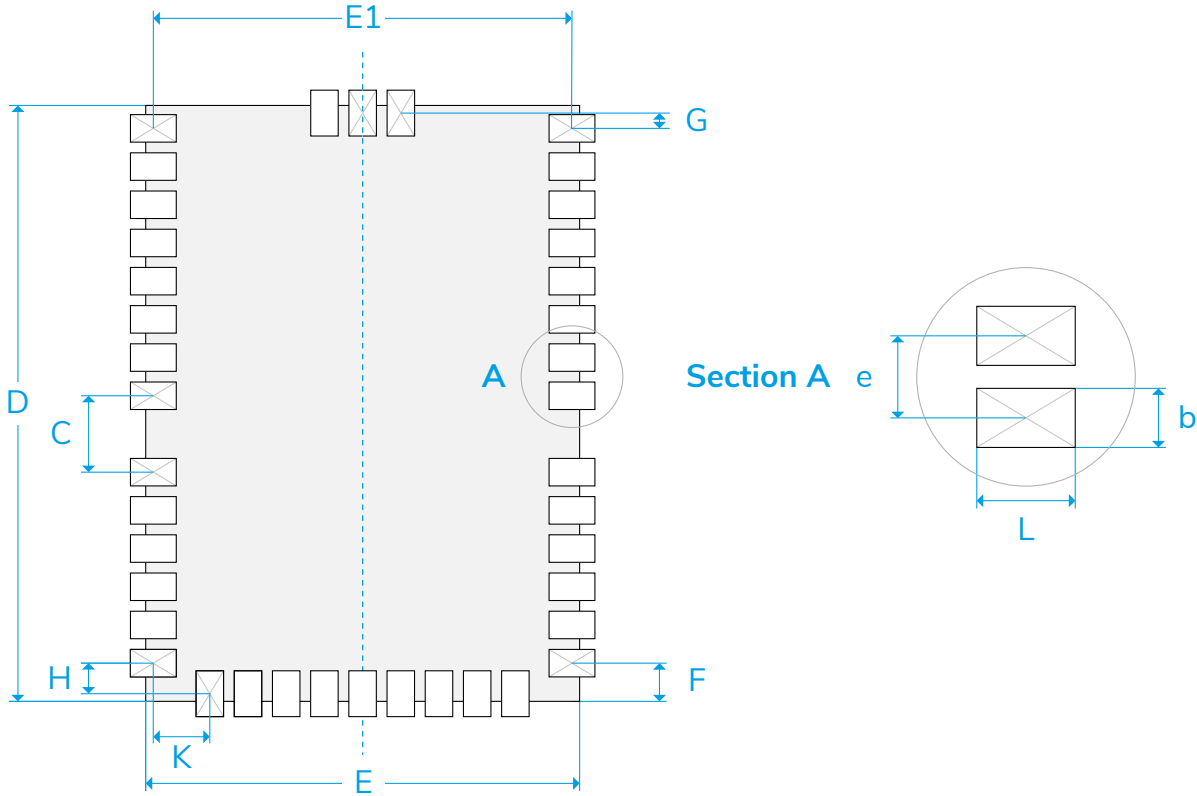


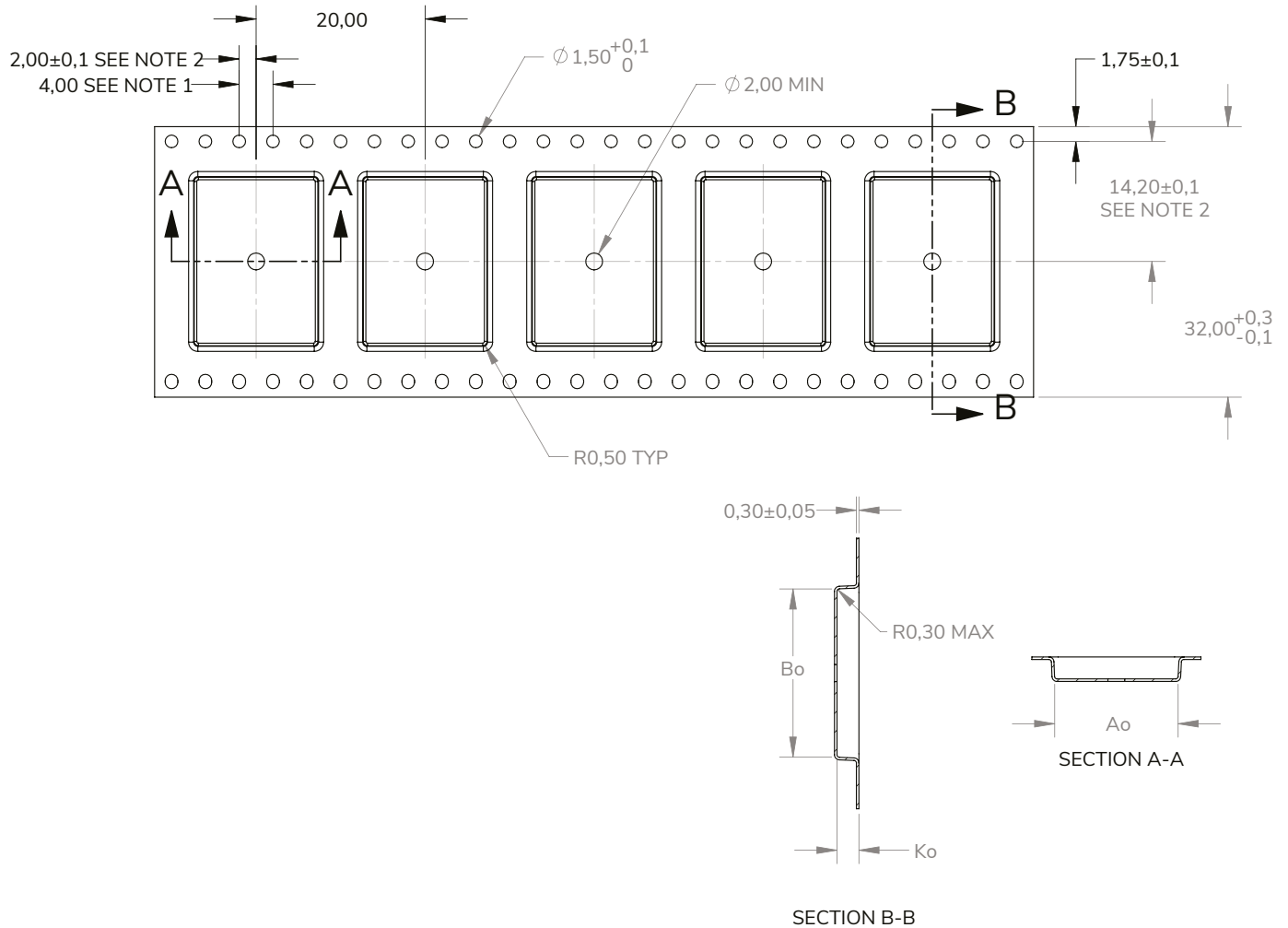
Figure 3: FMLR Module Footprint

FMLR Footprint Dimensions*

Dimension (see Figure 3: FMLR Module Footprint)	Min	Typ	Max
b	0.85	0.9	0.95
C		2.5	
D		19.5	
E		14.2	
E1		13.7	
e		1.25	
F		1.25	
G		0.5	
H		1	
K		1.85	
L	1.45	1.5	1.55

*All dimensions in mm

Tape Information



	DIM	±
Ao^3	14,60	0.1
Bo^3	19,90	0.1
Ko	2,60	0.1

¹ 10 Sprocket Hole Pitch Cumulative Tolerance ± 0.2

² Pocket Position Relative To Sprocket Hole Measured As True Position Of Pocket, Not Pocket Hole

³ Ao And Bo Are Measured On A Plane At A Distance „R“ Above The Bottom Of The Pocket.

All dimensions in mm

Tolerances unless – specified

1 PL ± 0.2

2 PL ± 0.10

Recommended Soldering Conditions

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

Reflow process should be finished within 2 cycles.

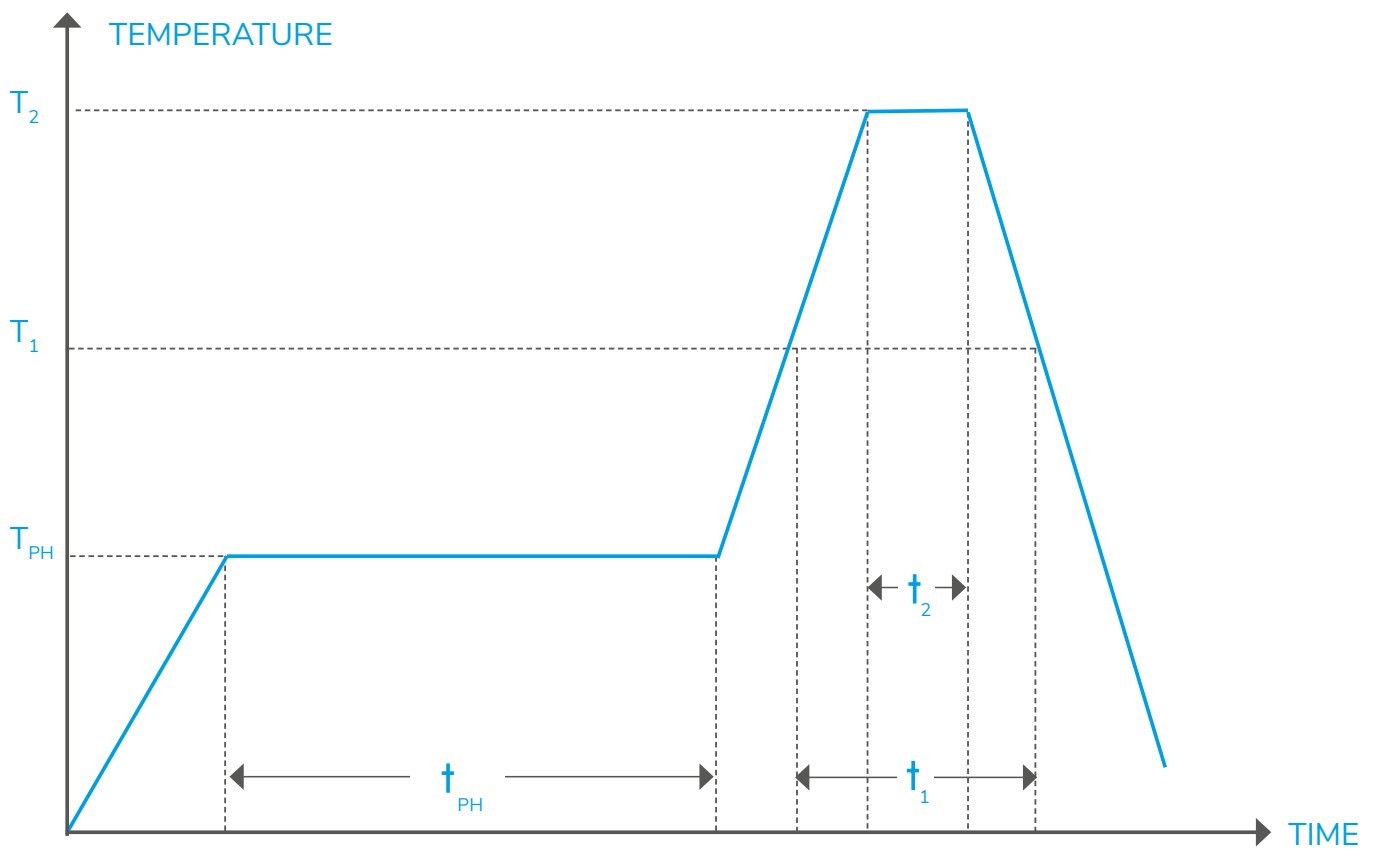


Figure 4: Soldering Profile

Soldering Conditions

Step (see Figure: 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

Additional Documentation

Additional Resources

Product information page	https://miromico.ch/fmlr-61-stm
Technical documentation	https://docs.miromico.ch/modules/

Device Options

Product ID	MCU options				RF	
	Cortex®-M0+	192KB flash	20KB RAM	4Mbit Flash	U.FL connect.	Antenna pad
FMLR-61-U-STL0Z	✓	✓	✓		✓	
FMLR-61-P-STL0Z	✓	✓	✓			✓
FMLR-61-U-STL0Z-4M	✓	✓	✓	✓	✓	
FMLR-61-P-STL0Z-4M	✓	✓	✓	✓		✓

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

Keep in Touch

Miromico AG
Gallusstrasse 4
CH-8006 Zürich
Switzerland

info@miromico.ch
www.miromico.ch

DISCLAIMER

We reserve the right to make technical changes, which serve to improve the product, without prior notification.

LoRa®, Semtech®, the Semtech logo, LoRa®, and LoRaWAN® are registered trademarks or service marks of Semtech Corporation, the LoRaAlliance® or its affiliates.

SAFETY-CRITICAL, MILITARY, AND AUTOMOTIVE APPLICATIONS DISCLAIMER: Miromico products are not designed for and will not be used in connection with any applications where the failure of such products would reasonably be expected to result in significant personal injury or death ("Safety-Critical Applications") without an Miromico officer's specific written consent. Safety-Critical applications include, without limitation, life support devices and systems, equipment, or systems for the operation of nuclear facilities and weapons systems. Miromico products are not designed nor intended for use in military or aerospace applications or environments. Miromico products are not designed nor intended for use in automotive applications unless specifically designated by Miromico as automotive grade.

© 2022 Miromico AG. All rights reserved.