

# FMLR 72-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-72-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 860 MHz to 1020 MHz, it supports all major sub-GHz ISM bands around the world. In addition to the LoRa® modulation scheme, the module supports ASK, OOK, (G)FSK and (G)MSK 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 SX1272 based
- ▶ LoRaWAN® IoT module
- ▶ Line-of-sight range of up to 100 km
- ▶ ARM Cortex®-M0+ MCU
- ▶ Optional ext. flash, 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-FLMR-72-STM	Datasheet	2023/04/11	2.0

### Revision History

Date	Release	Changes
2021/02/25	1.0	Initial revision
2021/05/26	1.1	Changed solder profile
2021/07/17	1.2	Added FCC information
2022/03/21	1.3	New design
2023/04/11	2.0	Fully revised

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## Functional Description

The **FMLR-72-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 860 MHz up to 1020 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.

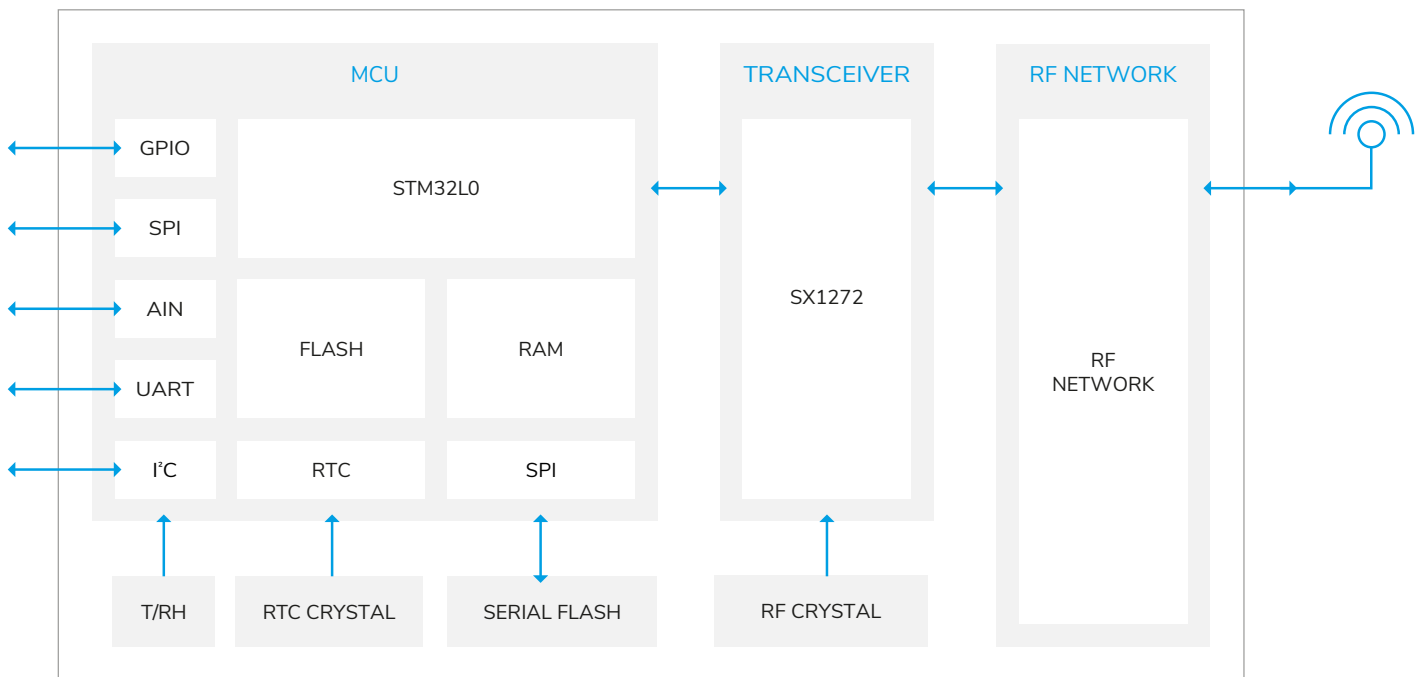


Figure 1: Block diagram FMLR-72-STM

The module is available with additional on-board flash memory to support Over-the-Air (OTA) update and additional data storage. The **FMLR-72-STM** supports many different modulation schemes such as LoRa®, (G)FSK, (G)MSK, ASK, and OOK. This enables communication with standards like Wireless M-Bus and IEEE802.15.4g. The module also allows the emulation of proprietary systems such as Nordic NRF905 or NRF9E5 with enhanced range coverage and additional flexibility.

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 SX1272
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
Humidity/temperature sensor, optional	Sensirion SHTC3

### 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 (+7dBm) <sup>1</sup>		18		mA
Current consumption, TX mode (+13dBm) <sup>1</sup>		28		mA
Current consumption, TX mode (+20dBm) <sup>1</sup>		125		mA
Current consumption, RX mode, LoRa® 125 kHz <sup>1</sup>		10.5		mA
Current consumption, sleep mode		1.5		µA
Highest receiver sensitivity <sup>1</sup>			-137	dBm
RF output power ( $V_{DD} < 2.4$ V) <sup>1</sup>			17	dBm
RF output power ( $V_{DD} \geq 2.4$ V) <sup>1</sup>			19.5	dBm

<sup>1</sup>See transceiver datasheet for detailed specifications

## Certifications

CE

UKCA

LoRaWAN® certification

EU863-870

FCC

FCC ID: 2AUQE14DJC

### ⚠ FCC Caution:

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference, and
- (2) this device must accept any interference received, including interference that may cause unde-sired operation.

The module is FCC compliant by using antenna ANT-868-PW-QW-UFL from Linx Technologies Inc.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

## 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.

## Module Pinout

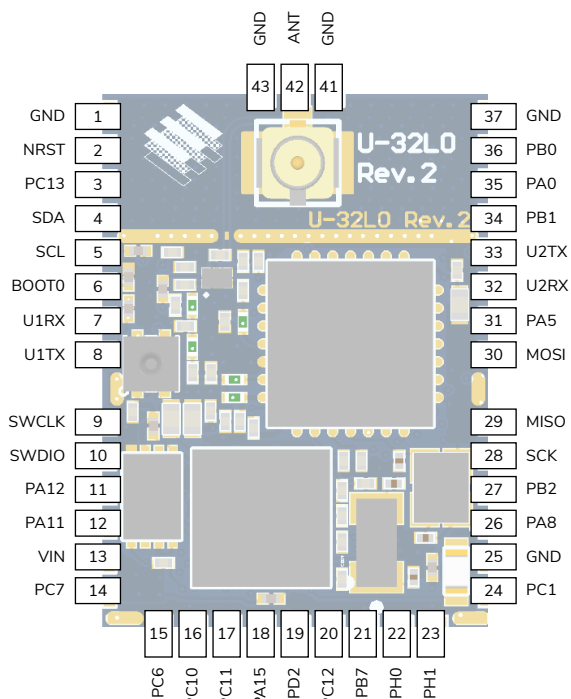


Figure 2: Module Pinout

#	Pad name	MCU pad	Description
1	GND		Ground ( $V_{SS}$ )
2	NRST	NRST	MCU Reset
3	PC13	PC13	GPIO
4	SDA	PB9	I <sup>2</sup> C1, GPIO
5	SCL	PB6	I <sup>2</sup> 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	PA12	PA12	USB P <sup>2</sup> / GPIO
12	PA11	PA11	USB N <sup>2</sup> / 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	PH0	PH0	GPIO
23	PH1	PH1	GPIO
24	PC1	PC1	GPIO
25	GND		Ground ( $V_{SS}$ )
26	PA8	PA8	GPIO
27	PB2	PB2	GPIO
28	SCK <sup>1</sup>	PB3	SPI SCK
29	MISO <sup>1</sup>	PB4	SPI MISO
30	MOSI <sup>1</sup>	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 (50 $\Omega$ )
43	GND		Ground ( $V_{SS}$ )

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

<sup>2</sup> USB not available on all variants

## FMLR Family Footprint

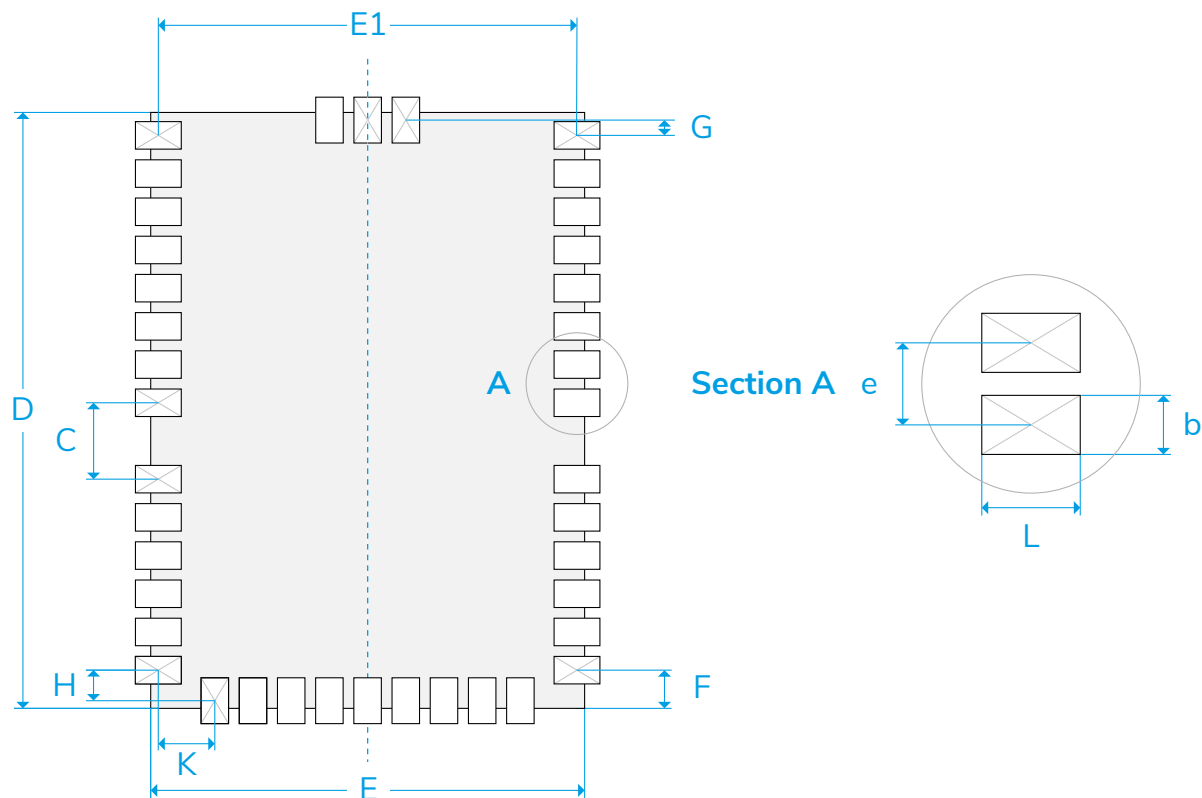


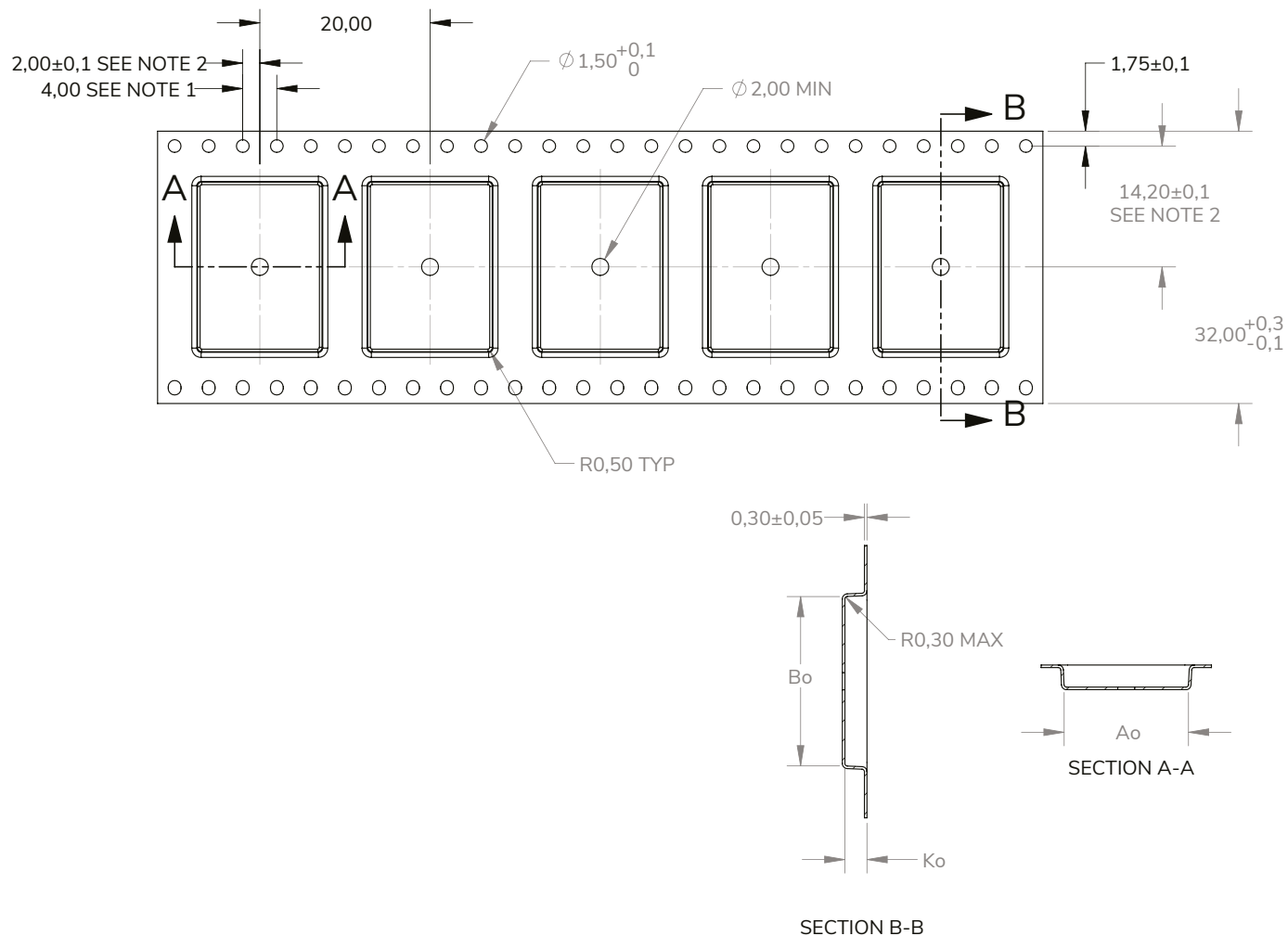
Figure 3: FMLR Module Footprint

### 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 <sup>3</sup>	14,60	0.1
Bo <sup>3</sup>	19,90	0.1
Ko	2,60	0.1

<sup>1</sup> 10 Sprocket Hole Pitch Cumulative Tolerance  $\pm 0.2$ 
<sup>2</sup> Pocket Position Relative To Sprocket Hole Measured As True Position Of Pocket, Not Pocket Hole

<sup>3</sup> 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  $\pm 0.2$ 

2 PL  $\pm 0.10$



## 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.

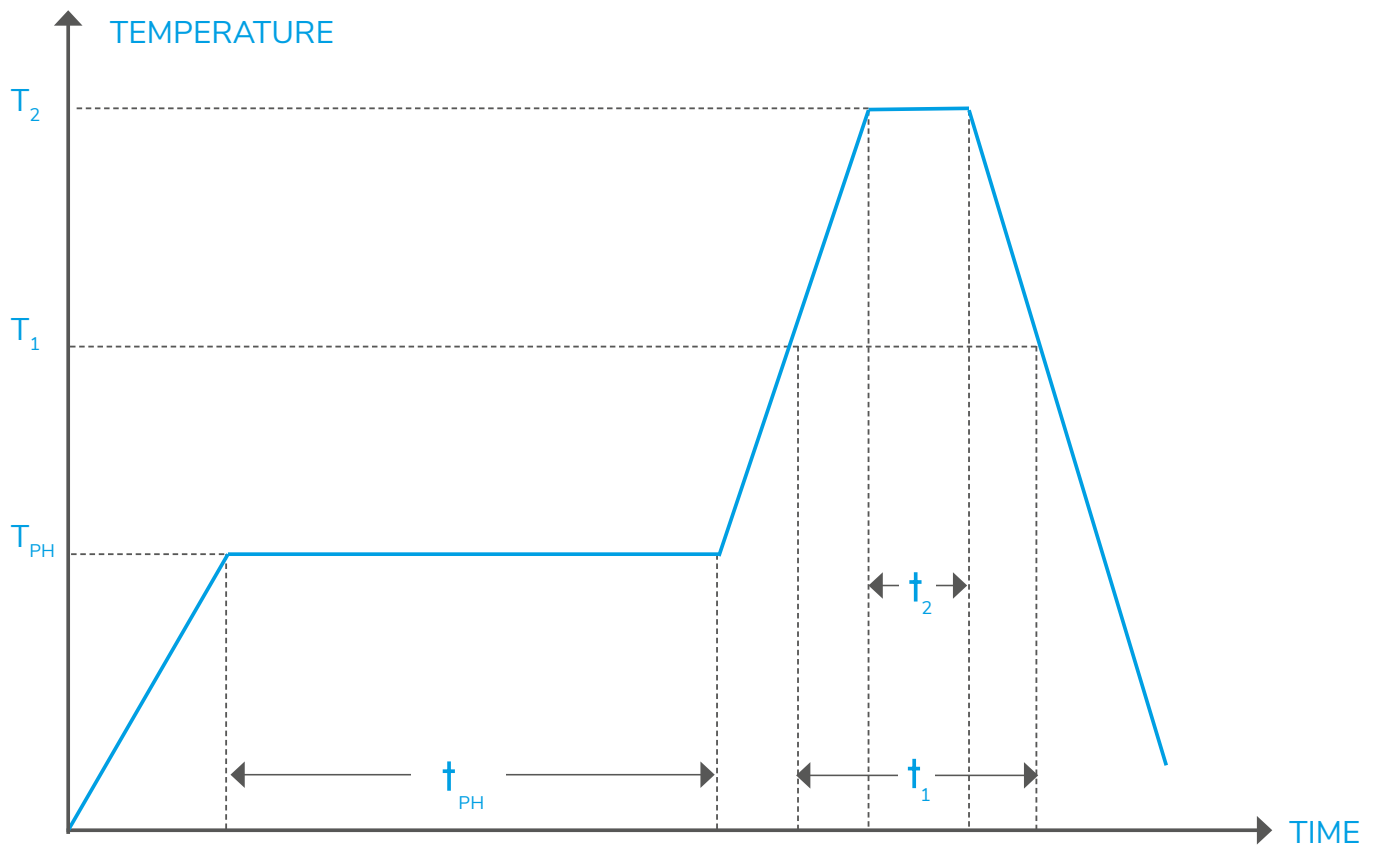


Figure 4: Soldering Profile

### 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	<a href="https://miromico.ch/fmlr-72-stm">https://miromico.ch/fmlr-72-stm</a>
Technical documentation	<a href="https://docs.miromico.ch/modules/">https://docs.miromico.ch/modules/</a>

## Device Options

Product ID	MCU options				RF	
	Cortex®-M0+	192KB flash	20KB RAM	4Mbit Flash	U.FL conect.	Antenna pad
FMLR-72-U-STL0Z	✓	✓	✓		✓	
FMLR-72-P-STL0Z	✓	✓	✓			✓
FMLR-72-U-STL0Z-4M	✓	✓	✓	✓	✓	
FMLR-72-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

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