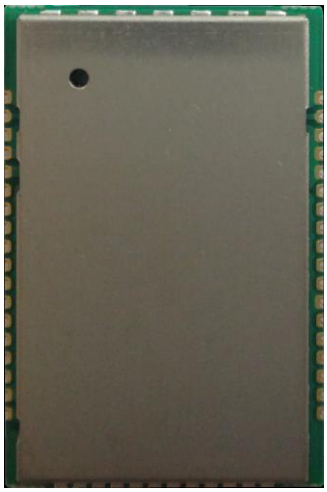
WISOL / LOM102A

DATA SHEET



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Aim of this Document

The aim of this document is to give a detailed product description including interfaces, features and performance of the radio module LOM102A.

Table of Contents

1 Introduction

This LOM102A is a highly-integrated, low power, bi-directional radio transceiver module optimized for use in the 915 MHz ISM and the 868 MHz ETSI frequency bands.

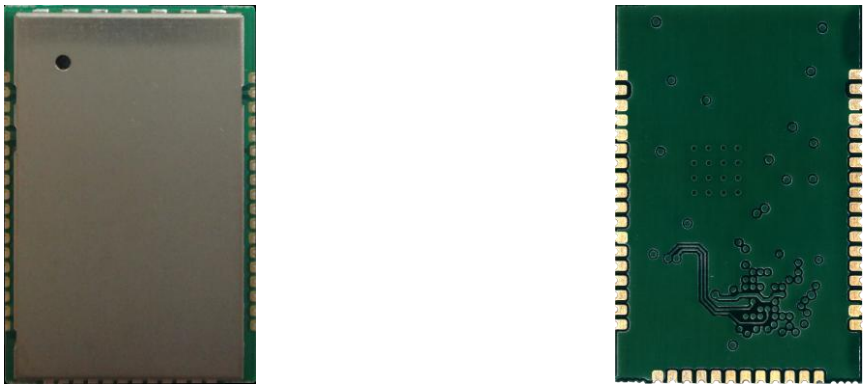

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Figure 1-1: Picture of LOM102A

1.1 Key Features

- Compact module 17.0 x 26.0 x 2.65mm. (Typ.)
- LoRa™ modulation technology.
- Sensitivity down to -136dBm.
- UART and SPI interface.
- Low-Power Long Range Transceiver operating in the 917 MHz ISM and the 868MHz ETSI frequency band.
- Supply voltage range from 3.0 to 3.6V.
- RF interface optimized to 50 Ω.
- Output Power Level up to +14dBm
- STM32L051R8H6.

1.2 Applications

- Automated Meter Reading.
- Wireless Networks.
- Home-, Building- and Industrial Automation.
- Industrial Monitoring and Control
- Wireless Sensors.
- Wireless Alarm and Security Systems.

2 Module Overview

The LOM102A is an ultra-long range, high-performance, pre-certified module for wireless communication. It includes all necessary passive components for wireless communication as depicted in the following figure.

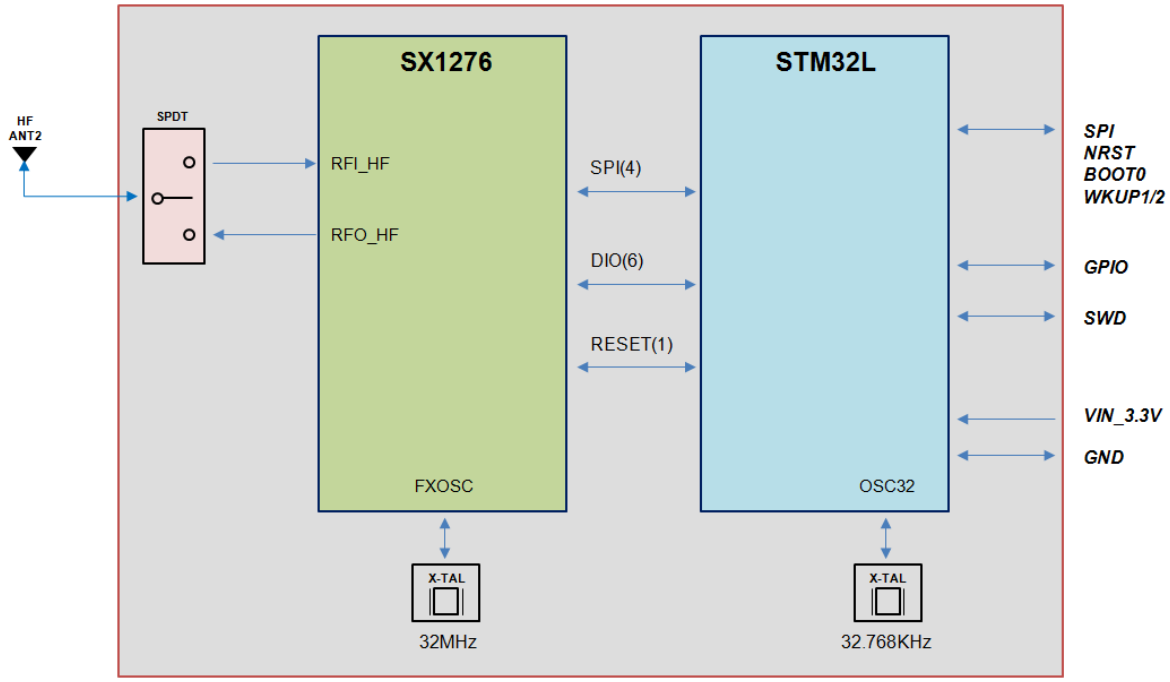

Figure 2-1: Block Diagram of Radio Module LOM102A

The LOM102A uses Semtech's patented LoRa modulation technique which combines spread spectrum modulation and forward error correction techniques to increase the range and robustness of radio communication links compared with traditional FSK or OOK based modulation. Typically examples of LOM102A receive performances are given in the following table.

SF	125kHz	250kHz	500kHz	Unit
SF6	*-118*	*-115*	*-111*	*dBm*
SF7	*-123*	*-120*	*-116*	*dBm*
SF8	*-126*	*-123*	*-119*	*dBm*
SF9	*-129*	*-125*	*-122*	*dBm*
SF10	*-132*	*-128*	*-125*	*dBm*
SF11	*-133*	*-130*	*-128*	*dBm*
SF12	*-136*	*-133*	*-130*	*dBm*

Table 2-1: Typically Radio Performance of LOM102A

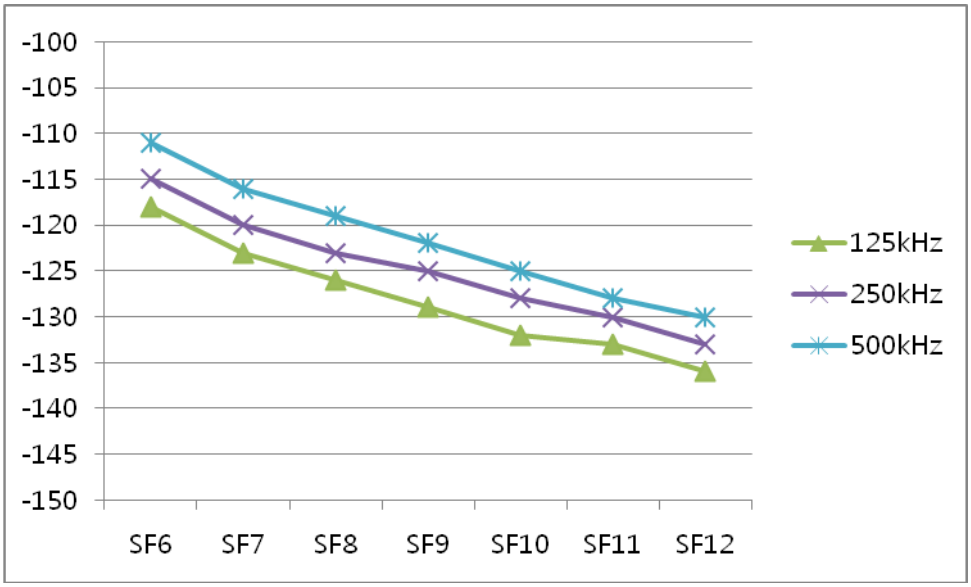

Figure 2-1: Typically Radio Performance Graph of LOM102A

The wide range of capabilities provided by the LOM102A can be tested by using the our EVB.

3 LoRa Modulation Technique

The LOM102A uses Semtech's LoRa proprietary spread spectrum modulation technique. This modulation, in contrast to conventional modulation techniques, permits an increase in link budget and increased immunity to in-band interference. It achieves sensitivities 8 dB better than FSK modulation.

LoRa also provides significant advantages in both blocking and selectivity, solving the traditional design compromise between range, interference immunity and energy consumption.

In LoRa mode the LOM102A offers three bandwidth options of 125 kHz, 250 kHz, and 500 kHz with spreading factors ranging from 7 to 12.

The spread spectrum LoRa modulation is performed by representing each bit of payload information by multiple chips of information. The rate at which the spread information is sent is referred to as the symbol rate (Rs), the ratio between the nominal symbol rate and chip rate is the spreading factor and represents the number of symbols sent per bit of information. The range of parameters which can be configured are given in the following tables.

Spreading Factor	Chips/Symbol	SNR/[dB]
7	128	-7.5
8	256	-10
9	512	-12.5
10	1024	-15
11	2048	-17.5
12	4096	-20

Table 3-1: Spreading Factors of Sx1272

Note that the spreading factor must be known in advance on both transmit and receive sides of the radio link as different spreading factors are orthogonal to each other. Note also the resulting signal to noise ratio (SNR) required at the receiver input. It is the capability to receive signals with negative SNR that increases the sensitivity, so link budget and range, of the LoRa receiver.

To further improve the robustness of the radio link LOM102A provides cyclic error coding with different coding rates. With using this coding scheme forward error detection and correction can be applied.

Coding Rate	Cyclic Coding Rate	Overhead Ratio
1	4/5	1.25
2	4/6	1.5
3	4/7	1.75
4	4/8	2

Table 3-2: Coding Rate of LOM102A

4 Electrical Characteristics

In the following different electrical characteristics of the LOM102A are listed. Furthermore details and other parameter ranges are available on request.

- Note**:** Stress exceeding of one or more of the limiting values listed under “Absolute Maximum Ratings” may cause permanent damage to the radio module

4.1 Absolute Maximum Ratings

Parameter	Condition	Min	Typ.	Max	Unit
Supply Voltage (VDD)		3.0	3.3	3.6	V
Storage Temperature			TBD		°C
Operating Temperature			TBD		°C
RF Input Power				+10	dBm
Notes: 1) Unless otherwise noted, all voltages are with respect to GND					

Table 4-1: Absolute Maximum Ratings

4.2 Global Electrical Characteristics

T = 25°C, VDD = 3.3 V (typ.) if nothing else stated

Parameter	Condition	Min	Typ.	Max	Unit
Supply Voltage (VDD)	Note 1	3.0	3.3	3.6	V
Current Consumption Low Power Mode	RTC off		TBD		nA
	RTC on		TBD		µA
Current Consumption System IDLE	TRX idle mode, µC idle mode		TBD		mA
Current Consumption RECEIVE LoRa	TRX receive mode µC sleep mode		TBD		mA
Current Consumption Transmit (NOTE 3)	TRX transmit mode µC sleep mode, all µC units off, max. RF power level		TBD		mA
Operation Clock frequency			32		MHz
			32.768		kHz
Notes: 1) Unless otherwise noted, all voltages are with respect to GND					

Table 4-2: General Characteristics

4.3 Module Interface Characteristics

T = 25°C, VDD = 3.3 V (typ.) if nothing else stated

Parameter	Condition	Min	Typ.	Max	Unit
Digital output voltage (high level)			TBD		V
Digital output voltage (low level)			TBD		V
Digital input voltage (high level)			TBD		V
Digital input voltage (low level)			TBD		V
UART baud rate			TBD		kbps

Notes:
1) Unless otherwise noted, all voltages are with respect to GND

Table 4-3: Module Interface Characteristics

4.4 RF Characteristics

- Note**:** National laws and regulations, as well as their interpretation can vary with the country. In case of uncertainty, it is recommended to contact either IMST's accredited Test Center or to consult the local authorities of the relevant countries.

4.4.1 Output Power vs. Power table

Power table	
Input Power / dBm	Output Power (Typ.) / dBm
0	-1.82
1	-0.68
2	0.31
3	1.38
4	2.45
5	3.52
6	4.66
7	5.77
8	6.85
9	8.10
10	9.38
11	10.56
12	11.72
13	12.68
14	13.62
15	14.38
Note: TX : CW mode, Frequency :917MHz	

Table 4-4: Output Power vs. Power table

4.4.2 Transmitter RF Characteristics

The LOM102A has an excellent transmitter performance as given by Table 4-5

* T = 25°C, VDD = 3.3 V (typ.), 917 MHz if nothing else stated

Parameter	Condition	Min	Typ.	Max	Unit
Frequency Range		902.3	-	927.5	MHz
RF Output Power	917 MHz Band		14		dBm
Modulation Techniques	LoRa™				
TX Frequency Tolerance	25°C	-	±20	-	Ppm

Table 4-5: Transmitter RF Characteristics

5 Module Package

In the following the LOM102A module package is described. This description includes the LOM102A pinout as well as the modules dimensions. Furthermore a recommendation for a suitable footprint is given, which should be used for further mounting on appropriate carrier boards.

5.1 Pinout Description

Figure 5-1 depicts a description of the LOM102A's pads on the bottom side. The figure shows the module with its pinout in top view (right figure). A detailed description of the individual pins can be found in Table 5-1: LOM102A Pinout Table.

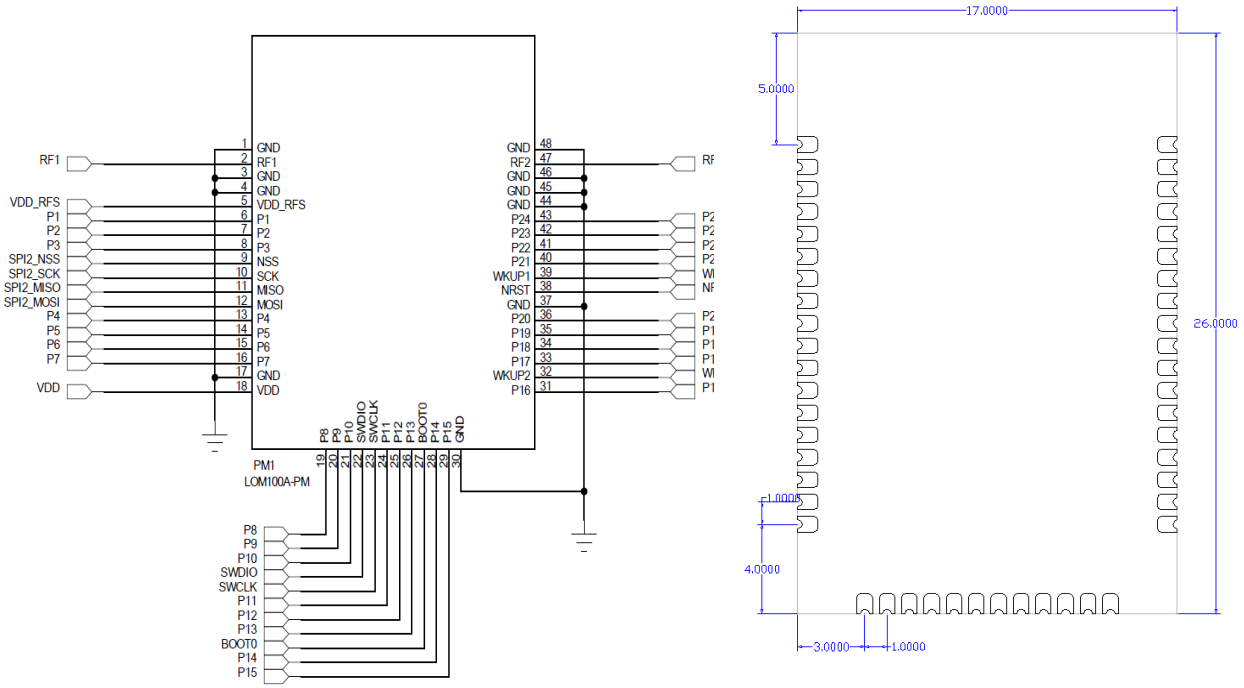

Figure 5-1: Description of LOM102A module pins and top view

PIN	PIN Name	PIN Type	MCU Pin (number)	Description
1	GND	Supply		Ground connection
2	RF1	A IN/OUT		External 50Ω port for mono static antenna connection.
3	GND	Supply		Ground connection
4	GND	Supply		Ground connection
5	VDD_RFS			Supply voltage
6	P1	D IN/OUT	PB2(G6)	VLCDRAIL1
7	P2	D IN/OUT	PB0(F5)	ADC_IN8/COMP1_INP /VREF_OUT/VLCDRAIL3
8	P3	D IN/OUT	PC6(F6)	TIM3_CH1/LCD_SEG24
9	NSS	D IN/OUT	PB12(H8)	SPI2_NSS
10	SCK	D IN/OUT	PB13(G8)	SPI2_SCK
11	MISO	D IN/OUT	PB14(F8)	SPI2_MISO
12	MOSI	D IN/OUT	PB15(F7)	SPI2_MOSI
13	P4	D IN/OUT	PC8(E8)	TIM3_CH3/LCD_SEG26
14	P5	D IN/OUT	PA8(D7)	USART1_CK/MCO /LCD_COM0
15	P6	D IN/OUT	PC9(D8)	TIM3_CH4/LCD_SEG27
16	P7	D IN/OUT	PA9(C7)	USART1_TX/LCD_COM1
17	GND	Supply		Ground connection
18	VDD	Supply		Supply voltage
19	P8	D IN/OUT	PA11(C8)	USB_DM
20	P9	D IN/OUT	PA12(B8)	USB_DP
21	P10	D IN/OUT	PC10(B7)	USART3_TX/LCD_SEG28/LCD_SEG40/LCD_COM4
22	SWDIO	D IN/OUT	PA13(A8)	JTMS-SWDIO
23	SWCLK	D IN/OUT	PA14(A7)	JTCK-SWCLK
24	P11	D IN/OUT	PA15(A6)	TIM2_CH1_ETR/PA15/SPI1_NSS/LCD_SEG17
25	P12	D IN/OUT	PC11(B6)	USART3_RX/LCD_SEG29/LCD_SEG41/LCD_COM5
26	P13	D IN/OUT	PB3(A5)	JTDO
27	BOOT0	D IN	BOOT0(B4)	Bootloader Pin 0, internally pulled-down by 47 kΩ
28	P14	D IN/OUT	PD2(B5)	TIM3_ETR/LCD_SEG31 /LCD_SEG43/LCD_COM7
29	P15	D IN/OUT	PB4(A4)	NJTRST
30	GND	Supply		Ground connection
31	P16	D IN/OUT	PB9(A3)	TIM4_CH4/I2C1_SDA /LCD_SEG16/TIM10_CH1
32	WKUP2	D IN/OUT	PC13(A2)	Digital IO / Wake Up2
33	P17	D IN/OUT	PB8(B3)	TIM4_CH3/I2C1_SCL /LCD_SEG16/TIM10_CH1
34	P18	D IN/OUT	PB7(C3)	I2C1_SDA/TIM4_CH2/USART1_RX, PVD_IN
35	P19	D IN/OUT	PA10(C6)	USART1_RX/LCD_COM2
36	P20	D IN/OUT	PC12(C5)	USART3_CK/LCD_SEG30/LCD_SEG42/LCD_COM6
37	GND	Supply		Ground connection

PIN	PIN Name	PIN Type	MCU Pin (number)	Description
38	NRST	D IN	NRST(E1)	NReset
39	WKUP1	D IN/OUT	PA0(G2)	Digital IO / Wake Up1
40	P21	D IN/OUT	PB6(D3)	I2C1_SCL/TIM4_CH1 /USART1_TX
41	P22	D IN/OUT	PB5(C4)	I2C1_SMBA/TIM3_CH2 /SPI1_MOSI/LCD_SEG9, COMP2_INP
42	P23	UART_TXD	PA2(F3)	ADC_IN2
43	P24	UART_RXD	PA3(G3)	ADC_IN3
44	GND	Supply		Ground connection
45	GND	Supply		Ground connection
46	GND	Supply		Ground connection
47	RF2	A IN/OUT		External 50Ω port for monostatic antenna connection.
48	GND	Supply		Ground connection

Table 5-1: LOM102A Pinout Table

5.2 Module Dimensions

The outer dimensions of the LOM102A are given by Figure 5-2.

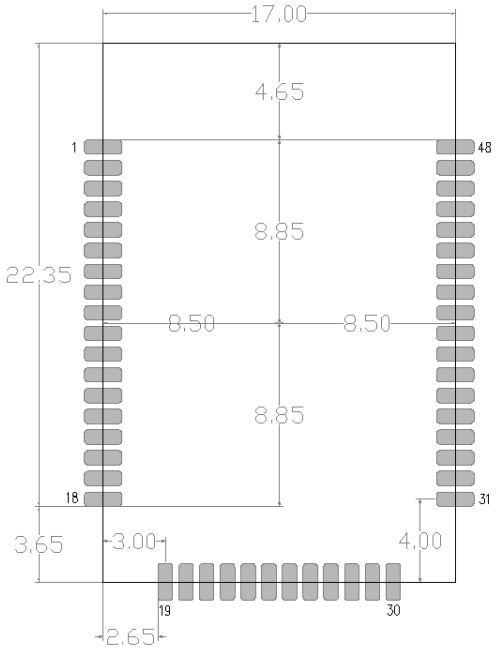

Figure 5-2: Outer Dimensions of the LOM102A (top view)

5.3 Recommended Footprint

According to Chapter 5.2, a recommendation for the footprint of the LOM102A is given by Figure 5-3.

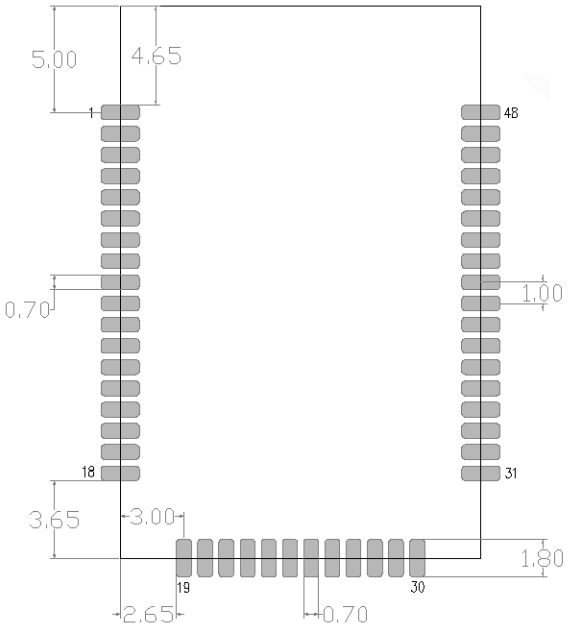

Figure 5-3: Recommended footprint of the LOM102A (top view)

6 Integration Guide

The LOM102A provides 48 connectors as described in Chapter 5. For integrating the LOM102A into an environment, a typically circuit as given in Chapter 6.1 can be used.

6.1 Typical Application Schematic

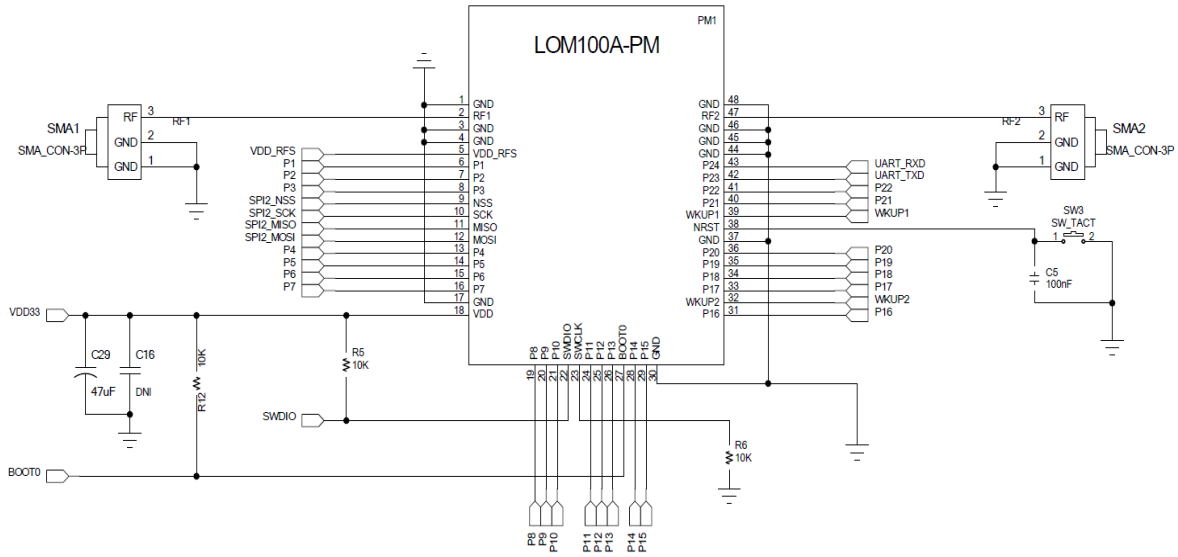

Figure 6-1: Typical Application Schematic for LOM102A

7 Packing

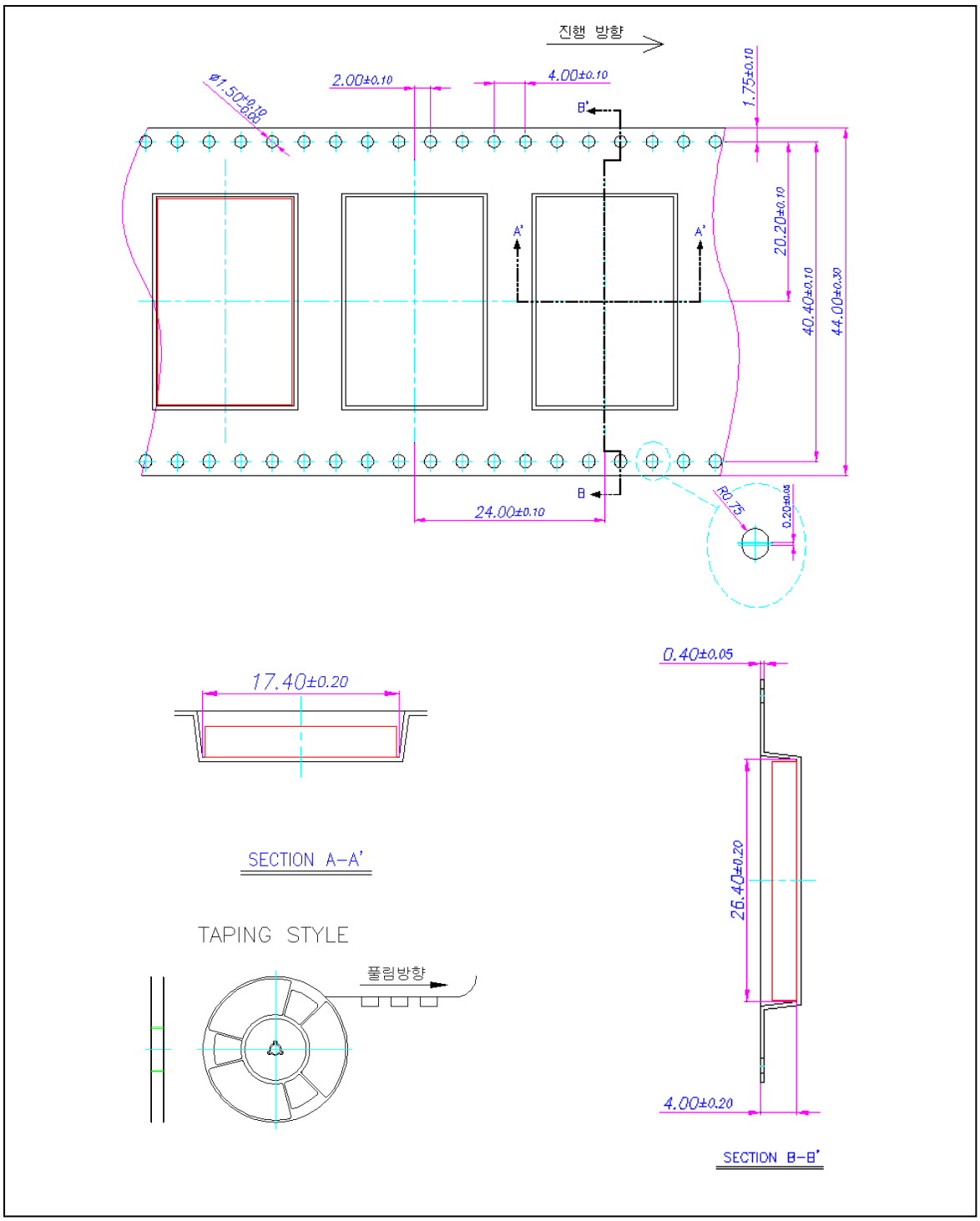

Figure 7: Reel packing of LOM102A

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