SN10-12 SIGFOX Module
User Guide and Product Specification

Model Name	SN10-12
Project code	
Description	SIGFOX module
Version	1.0
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Approved by	Reviewed by	Issued by
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Revision History

Revision	Released Date	Comments/Remark	Author
0.1	2017/03/14	Initial release	Iestyn Chen
0.2	2017/03/17	Update with RX performance spec.	Iestyn Chen
0.3	2017/03/24	Add module layout guide and appendix section	Iestyn Chen
0.4	2017/03/29	Update RX value, reflow profile, and section 5.3 typo	Iestyn Chen
0.5	2017/06/05	Update reference circuit	Iestyn Chen
0.6	2017/07/11	Update RCZ4 related information and add module photo	Iestyn Chen
0.7	2017/08/04	Add standby current information, update block diagram, reference circuit and pin description	Iestyn Chen
0.8	2017/08/08	Add pin assignment, type approval and packing specification information, update reference circuit and pin name	Iestyn Chen
0.9	2017/08/18	Update pin type and description	Iestyn Chen
1.0	2017/09/12	Update FCC statement, and ME drawing	Iestyn Chen

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1. Introduction

The SN10-12 is a SIGFOX verified and FCC, ACMA approved transceiver module which complies with SIGFOX network specifications. It is based on NXP OL2385 chip which is a Sub-GHz wireless SoC transceiver.

1.1. Key Features

- High performance low power RISC micro-controller
- Memory
  - 32kB EROM
  - 7kB RAM
- Ultra Narrow Band Radio
  - Frequency Band
    RCZ2: 902.1375-904.6625MHz
    RCZ4: 920.1375MHz-922.6625MHz
  - Output Power
    22 dBm
- Excellent Receiving Sensitivity: -125dBm @600bps 2GFSK
- Excellent Image Rejection: 60 dB
- Excellent Blocking Performance: 58 dB
- SIGFOX™ certified module
- FCC compliant (FCC ID: YAISN10-12T)
- ACMA compliant
- Brazil Anatel compliant
- RoHS compliant

2. PIN Map and Signal Description

Pin #	Pin Name	Type	Description
1	GND	GND	Ground
2	VDD	Power	Power Supply input
3	GND	GND	Ground
4	GND	GND	Ground
5	GND	GND	Ground
6	GND	GND	Ground
7	GND	GND	Ground
8	GND	GND	Ground
9	SPI_SDI	Digital I	SPI_MOSI
10	SPI_CS	Digital I/O	SPI_CS
11	GND	GND	Ground
12	GND	GND	Ground
13	SPI_SCLK	Digital I/O	SPI_SCLK
14	SPI_SDO	Digital O	SPI_MISO
15	Reserved	Digital I/O	N.C.
16	Reserved	Digital I/O	N.C.
17	Reserved	Digital I/O	N.C.
18	RST_N	Digital I/O	RESET, active Low, with internal pull–up
19	Reserved	Digital I/O	N.C.
20	Reserved	Digital I/O	N.C.
21	GND	GND	Ground
22	SPI_AK	Digital I/O	SPI_AK
23	Reserved	Digital I/O	N.C.
24	Reserved	Digital I/O	N.C.
25	Reserved	Digital I/O	N.C.
26	Reserved	Digital I/O	N.C.
27	GND	GND	Ground
28	Reserved	Digital I/O	N.C.
29	Reserved	Digital I/O	N.C.
30	GND	GND	Ground
31	ANT	RF	RF Antenna Interface Impedance=50 Ω
32	GND	GND	Ground

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3. ELECTRICAL CHARACTERISTICS

3.1 Absolute Maximum Rating

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
Storage temperature range		–55		150	°C
Supply voltage	VDD	-0.3		3.6	V
Maximum RX input level without damage				10	dBm

3.2 Recommended Operating Range

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
Operating temperature range		–40	25	85	°C
Operating supply voltage		3.3		3.6	V

3.3 Power Consumption

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
TX supply current at maximum output power	@22dBm, 3.3V		260		mA
RX			17.5		mA
Standby	3.3V		4.4		uA

3.4 Characterization information

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
Voltage at I/O pins		-0.3		VDD + 0.3	V

4. RF Characteristics

PARAMETER	Model	Frequency Band	UNIT	Note
Center Frequency	SN10-12	RCZ2: 902.1375-904.6625MHz RCZ4: 920.1375MHz-922.6625MHz	MHz	RCZ2 RCZ4

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT	Note
Antenna port impedance			50		Ω	

TX Characteristics

Following characteristics are valid for conditions as follows (unless otherwise specified)
Tamb = -40 °C to 85 °C, VDD = 3.3 V to 3.6 V, TCXO = 27.6 MHz

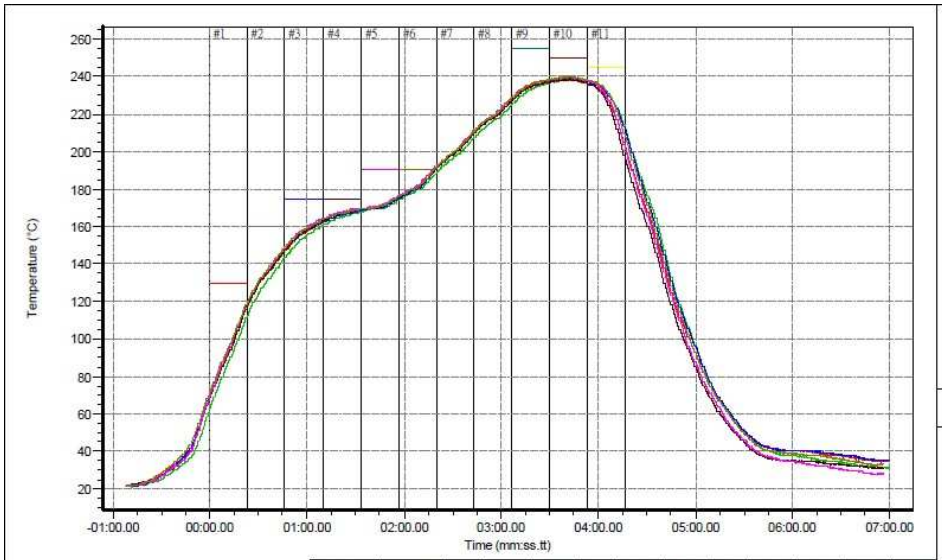
PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT	Note
Maximum output power, CW mode	SN10-12		22		dBm	

RX Characteristics

Following characteristics are valid for conditions as follows (unless otherwise specified)
2GFSK modulation, h = 2.67, BT = 1.0, NRZ, data-rate = 0.6 kChips/s, Channel spacing = 10 kHz, Channel filter bandwidth = 10 kHz, Frame Error Rate (FER) = 20%, payload length = 228 byte, TCXO = 27.6 MHz
Tamb = 25 °C, VDD = 3.3 V to 3.6 V, fC = 905 MHz

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT	Note
Sensitivity	-40 °C to 85 °C		-125		dBm	PER at 10% on 1000 frames sent.
Co-channel rejection	2GFSK jammer		2	5	dB	
Adjacent channel rejection	Channel filter BW = 10 kHz, Channel: 10 kHz, 20 kHz, 150 kHz	50	55		dB	
		55	60		dB	
		60	65		dB	

5. SMT Solder Reflow Recommendation



Line Speed:	Zone:	Zone #1	Zone #2	Zone #3	Zone #4	Zone #5	Zone #6	Zone #7	Zone #8	Zone #9	Zone #10	Zone #11
90.00 cm/min	Length (cm):	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0
	Upper (°C):	130.0	160.0	175.0	175.0	190.0	190.0	220.0	240.0	255.0	250.0	245.0
	Lower (°C):	130.0	160.0	175.0	175.0	190.0	190.0	220.0	240.0	255.0	250.0	245.0

Probe Map:

Probe	Reflow Results									Maximum / Minimum								Slopes	
	Positive Slope (°C/sec)	Positive Slope Time (mm:ss.tt)	Rise Time (150.0 - 200.0°C) (mm:ss.tt)	Rise Time 50.0°C to Peak (mm:ss.tt)	Mean Slope to Peak (°C/sec)	Time Above Liquidus (220.0°C) (mm:ss.tt)	Peak Temperature (°C)	Delta T (°C)	Negative Slope (°C/sec)	Maximum (°C)	Max. Reached (mm:ss.tt)	Mean (°C)	Deviation From 0.0°C	Standard Deviation	Minimum (°C)	Min. Reached (mm:ss.tt)	Delta T (°C)	Positive Slope (°C/sec)	Mean Slope (°C/sec)
#1 (°C) U2-1	2.61	-00:04.90	01:41.60	03:45.30	0.83	01:12.40	238.5	1.5	-3.07	238.5	03:37.90	129.7	+238.5	74.2	21.5	-00:48.00	1.5	2.61	-0.09
#2 (°C) U2-15	2.54	-00:01.90	01:41.50	03:42.20	0.84	01:13.20	238.5		-3.34	238.5	03:37.80	128.7	+238.5	75.4	21.0	-00:48.00		2.54	-0.08
#3 (°C) U2-29	2.59	-00:04.30	01:42.30	03:46.00	0.83	01:15.50	239.0		-3.09	239.0	03:38.40	130.7	+239.0	74.5	20.5	-00:48.00		2.59	-0.09
#4 (°C) U2-4	2.53	-00:06.20	01:42.80	03:44.30	0.84	01:11.20	238.5		-3.11	238.5	03:37.10	127.5	+238.5	75.6	22.0	-00:51.20		2.53	-0.09
#5 (°C) U2-18	2.63	-00:06.00	01:42.40	03:48.80	0.83	01:14.40	240.0		-2.98	240.0	03:41.70	128.6	+240.0	76.6	21.5	-00:51.20		2.63	-0.09
#6 (°C) U2-32	2.45	-00:04.90	01:41.60	03:47.60	0.83	01:16.10	240.0		-3.03	240.0	03:38.90	130.4	+240.0	75.3	21.0	-00:51.50		2.45	-0.08

Note: Allowable reflow soldering times: 2 times base on recommended reflow profile.

6. SW information and User Guide

SW information

The SIGFOX software driver supports MCUs. These MCUs are a subset of the MCUs supported by the Kinetis Software Development Kit (KSDK) layer.
This SW driver is built on the Analog Middleware Layer (AML), which creates an API abstraction layer for the desired Software Development Kit (SDK).
The current implementation includes abstractions for KSDK 2.0 and S32 SDK. This allows support to be added for additional layers, such as the KSDK, without having to change the SIGFOX Software Driver itself.

The detail Commend and SPI please read the web link as below.

SigFox Software driver user guide
http://cache.nxp.com/assets/documents/data/en/user-guides/OL2385SWUG.pdf?fsrch=1&sr=9&pageNum=1:

Hardware Setting

1) SN10-1x EVB
2) FRDM_KL25Z host board
3) Sigfox Network Emulator Kit (SNEK)
4) USB cable

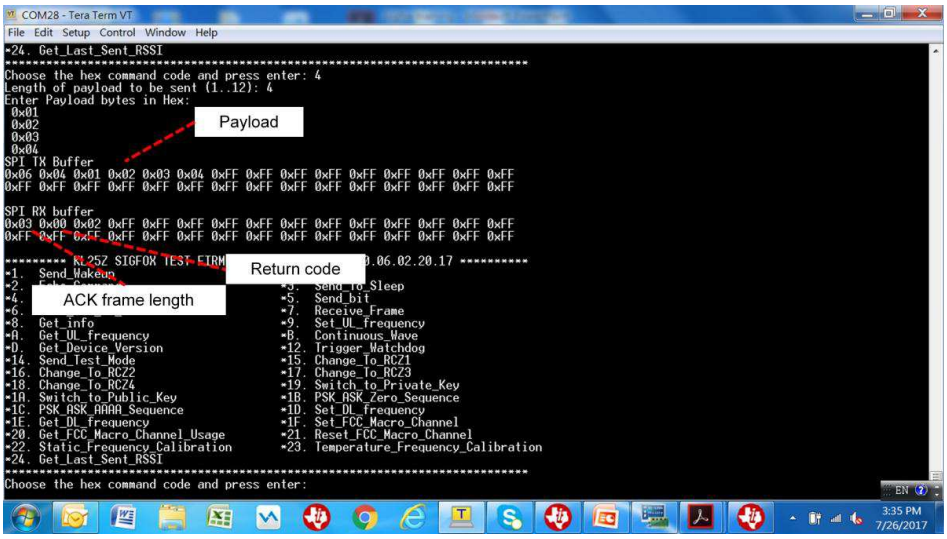
Setting up the command line interface

Figure 1

1) Stack the SN10-1x EVB on top of the KL25Z host boards to connect the SPI interface,
2) Connect the host board Open SDA to the PC with an USB cable,
3) KL25Z will pop up as a mass storage device. Open the folder and copy spi_sigfox_demo.srec to the folder. (ask innocomm for spi_sigfox_demo.srec),
4) Start a terminal emulator (e.g. tera term) from the PC,
5) Configure the terminal settings to 115200 baud, 8 data bit, 1 stop bit, no parity and no flow control,
6) Press the reset button on the host board. The host board will show the list of SIGFOX commands on the terminal emulator,
7) Enter the command code and follow the prompt to send the SIGFOX commands.
Description of the command codes, the data frames and the ACK frames, and the SPI protocol are available **SigFox Software driver user guide** , **http://cache.nxp.com/assets/documents/data/en/user-guides/OL2385SWUG.pdf?fsrch=1&sr=9&pageNum=1**
.

The command list screen shot

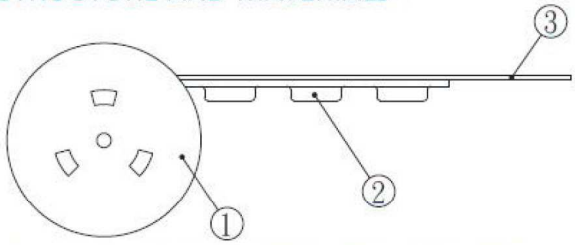
Send payload screen shot



7. Packing Specification

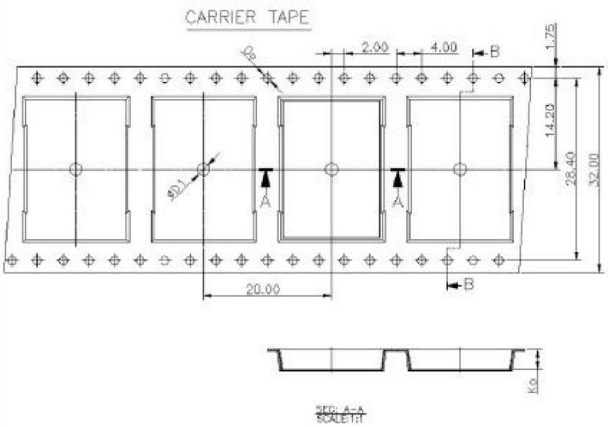
THE PACKING SPECIFICATIONS	RoHS Compliant

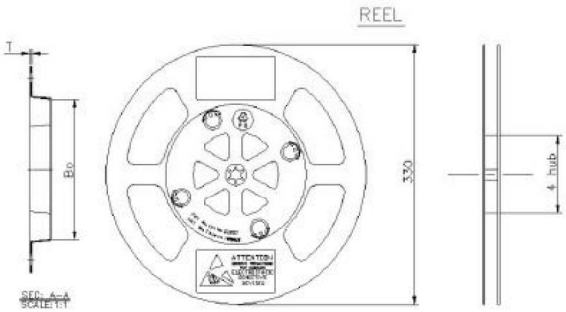
1.STRUCTURE AND MATERIALS



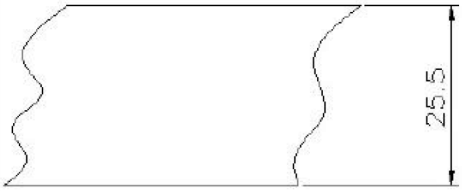
NO.	PARTS NAME	MATERIALS
③	COVER TAPE	POLYESTER
②	CARRIER TAPE	POLYSTYRENE
①	REEL	POLYSTYRENE

2. PACKAGING QUANTITY :900 PCS/REEL
3. MORE THAN 10 EMPTY POCKETS SHOULD BE REMAINED AT BOTH ENDS OF THE CARRIER TAPE FOR EACH REEL
4. STRIPPING STRENGTH OF COVER TAPE IS BETWEEN 30 gf TO 80 gf AND STRIPPING ANGLE SHOULD BE WITHIN 165° ~ 180°.
5. THE PRODUCT IN THE POCKET OF CARRIER TAPE SHOULD BE PLACED IN A SPECIFIED CORRECT POSITION
6. TAPE AND REEL PER EIA-481
7. DIMENSIONS :





COVER TAPE



Feeding Direction

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Federal Communication Commission Interference Statement

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 undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

This device is intended only for OEM integrators under the following conditions:

1) The antenna must be installed such that 20 cm is maintained between the antenna and users, and
2) The transmitter module may not be co-located with any other transmitter or antenna.
3) Module approval valid only when the module is installed in the tested host or compatible series of host which have similar RF exposure characteristic with equal or larger antenna separation distance.

As long as **3** conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed

IMPORTANT NOTE: In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID can not be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

End Product Labeling

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following:
"Contains FCC ID:YAISN10-12T". The grantee's FCC ID can be used only when all FCC compliance requirements are met.

Manual Information To the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.
The end user manual shall include all required regulatory information/warning as show in this manual.