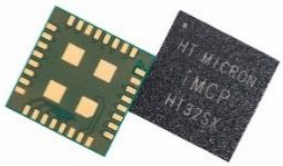
HT32SX iMCP SiP Sigfox

Datasheet

Sigfox® Monarch RF Transceiver System in Package

Overview

iMCP – HT32SX is a Multicomponent Integrated Circuit (MCO) designed to provide a ready-to-use connectivity solution for Internet of Things (IoT) applications. It provides both uplink (transmit) and downlink (receive) communications, and it is the first HT Micron product in a new family of non-memory component. Its small dimensions, high performance and low power consumption targets the best experience for IoT developers. The system combines an ARM Cortex M0+ 32bit (STM32L052x8) and the ST Microelectronics S2-LP low power transceiver combining all the advantages, integration and convenience of advanced semiconductor packaging technology into a single chip.



Features

- Key features
  - Enables operations in the SIGFOX™
  - Multizone worldwide operation – MONARCH feature
  - Integrated 50 MHz crystal
  - 32-bit ARM Cortex M0+
  - 64 KB flash - Other options will be available on demand
  - 8 KB RAM
  - TX output power up to +22 dBm
  - RX sensitivity: - 128 dBm
- Power consumption
  - 17.7 mA RX
  - 166.5 mA TX @ 20 dBm, 902.2MHz
- RF
  - S2-LP Transceiver STMicroelectronics
  - SKY66420-11 Front-End Module
  - Frequency bands:
  - 413-479 MHz
  - 452-527 MHz
  - 826-958 MHz
  - 904-1055 MHz
  - Modulation schemes:
  - DBPSK, 2(G)FSK, OOK, ASK
  - Data Rate:
  - Up to region: 100bps or 600bps
- Interface
  - Up 21 General-Purpose Input/Output (GPIO) pins, with configurable pull-up/pull-down resistors
  - 12-bit ADC
  - 12-bit 1 channel DAC
  - 2 USART, LPUART, USB 2.0, I^2C
- Single power supply: 2.7 V to 3.6 V
- Operating temperature range: -20°C to +75°C
- External antenna
- 13x13x1.35mm LGA – 32 pads package
- Part number: HT32SX

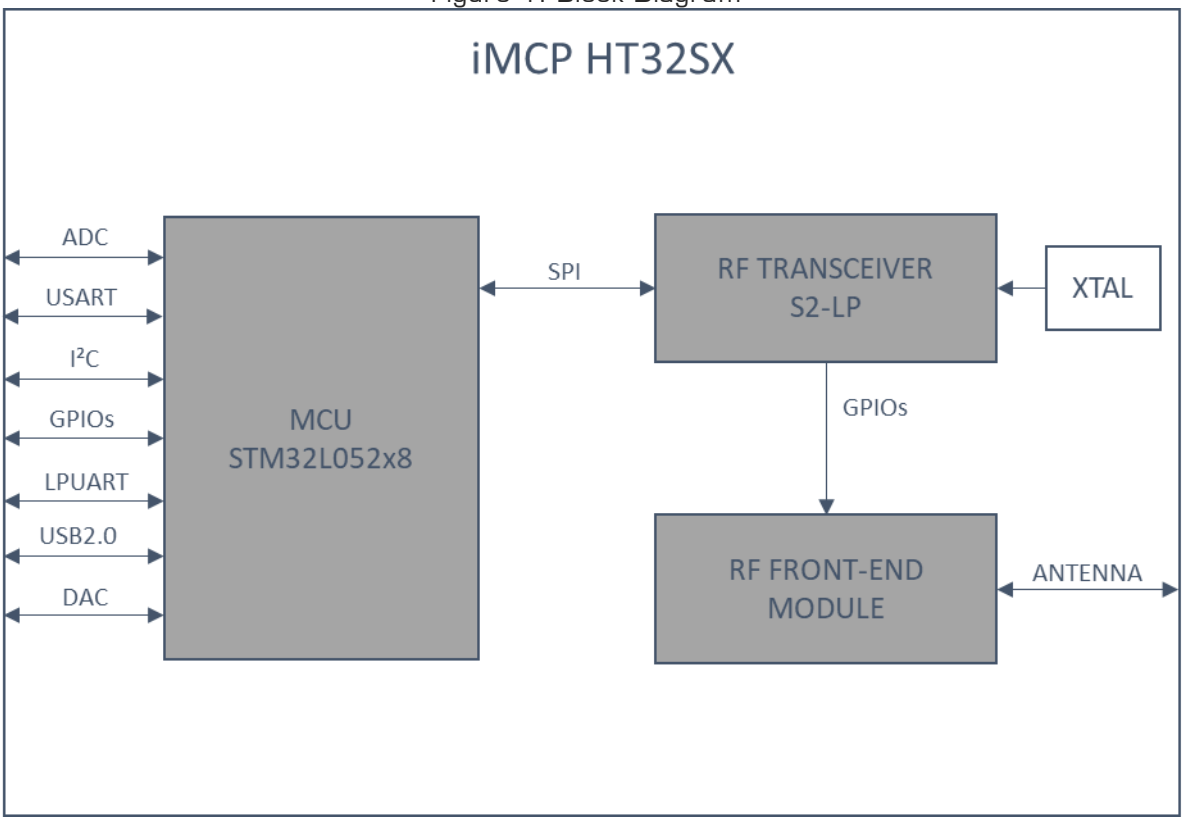
Applications

- Smart home
- Wireless alarm systems
- Manufacturing
- Agriculture
- Building automation
- Smart metering
- Smart lighting systems

SUMMARY

1 BLOCK DIAGRAM

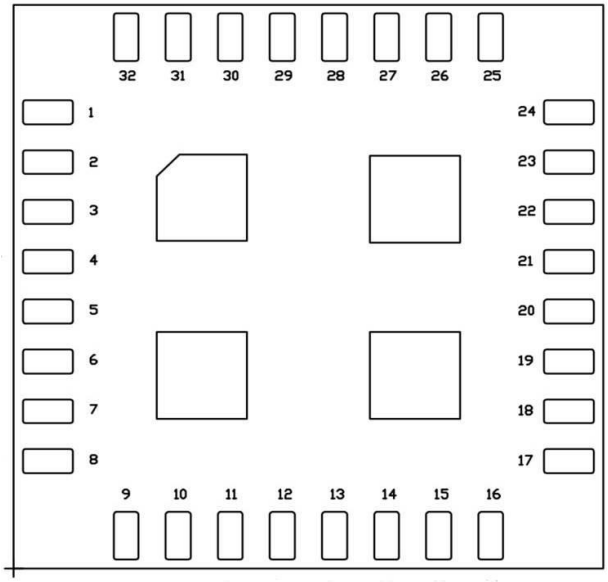
Figure 1: Block Diagram



2 PINNING INFORMATION

2.1 Pin Diagram

Figure 2: Pin Diagram



2.2 Pin description

Table 1: Pin Description

Number	Symbol	Pin name	Pin Type	Description
1	GND	GND	Ground	Exposed pad connected to the ground of the application board
2	VDD_3.3V	VDD_3.3V	Power	3.3 V power supply
3	GND	GND	Ground	Exposed pad connected to the ground of the application board
4	MCU-PA2	USART2_TX	Digital I/O	USART interface
		ADC_IN2	Analog I	ADC external input 2
		TIM21_CH3	Digital I/O	General-purpose timer
		TIM2_CH3	Digital I/O	General-purpose timer
5	MCU-PB0	ADC_IN0	Analog I	ADC external input 2
		VREF_OUT	Analog I/O	Output reference voltage
6	MCU-PB5	I2C1_SMBA	Digital I/O	I2C interface
		LPTIM1_IN1	Digital I/O	Low-power timer
		TIM22_CH2	Digital I/O	General-purpose timer
7	MCU-PB6	USART1_TX	Digital I/O	USART interface
		I2C1_SCL	Digital I/O	I2C interface
		LPTIM1_ETR	Digital I/O	Low-power timer
8	MCU-PB7	USART1_RX	Digital I/O	USART interface
		I2C1_SDA	Digital I/O	I2C interface
		LPTIM1_IN2	Digital I/O	Low-power timer
9	OSC32OUT	OSC32OUT		External clock source pins
10	OSC32IN	OSC32IN		

11	GND	GND	Ground	Exposed pad connected to the ground of the application board
12	NRESET	NRESET	I/O	Bidirectional reset pin with embedded weak pull-up resistor
13	MCU-PA14	SWCLK	Digital O	Serial wire clock output
		USART2_TX	Digital I/O	USART interface
14	MCU-PA13	SWDIO	Digital I/O	Serial wire
		USB_NOE	Digital I/O	USB
15	MCU-PA9	USART1_RX	Digital I/O	Serial wire
16	MCU-PA10	USART1_TX	Digital I/O	
17	MCU-PA12	USART1_RTS_DE	Digital I/O	USART interface
		USB_DP	Digital I/O	USB
		EVENT_OUT	Digital I/O	
18	MCU-PB1	LPUART1_RTS_DE	Digital I/O	Low-power USART interface
		ADC_IN9	Analog I	ADC external input 9
		VREF_OUT	Analog O	1.2 V VCO-LDO band-gap reference voltage decoupling
19	GND	GND	Ground	Exposed pad connected to the ground of the application board
20	MCU-PA11	USART1_CTS	Digital I/O	USART interface
		USB_DM	Digital I/O	USB
		COMP1_OUT	Analog O	Comparator output
		EVENT_OUT	Digital I/O	
21	MCU-PB11	LPUART1_RX	Digital I/O	Low-power USART interface
		TIM2_CH4	Digital I/O	General-purpose timer
		EVENTOUT	Digital I/O	
22	MCU-PA8	USART1_CK	Digital I/O	USART interface
		USB_CSR_SYNC	Digital I/O	
		EVENT_OUT	Digital I/O	
23	MCU-PB10	LPUART1_TX	Digital I/O	USART interface
		TIM2_CH3	Digital I/O	General-purpose timer
24	GND	GND	Ground	Exposed pad connected to the ground of the application board
25	ANTENNA	ANTENNA	RF I/O	RF input and output signal
26	GND	GND	Ground	Exposed pad connected to the ground of the application board
27	MCU-PB2	LPTM1_OUT	Digital I/O	Low-power timer
28	MCU-PA6	LPUART1_CTS	Digital I/O	USART interface
		ADC_IN6	Analog I	ADC external input 6
		TIM22_CH1	Digital I/O	General-purpose timer
		COMP1_OUT	Analog O	Comparator output
		EVENT_OUT	Digital I/O	
29	MCU-PA4	USART2_CK	Digital I/O	USART interface
		ADC_IN4	Analog I	ADC external input 4
		DAC_OUT	Analog O	DAC analog output
		TIM22_ETR	Digital I/O	General-purpose timer
		COMP1_INM4	Analog I	Comparator input
30	MCU-PA5	ADC_IN5	Analog I	ADC external input 5
		ADC_IN3	Analog I	ADC external input 3
		TIM2_CH1	Digital I/O	General-purpose timer

		TIM2_ETR	Digital I/O	General-purpose timer
31	MCU-PA3	USART2_RX	Digital I/O	USART interface
		ADC_IN3	Analog I	ADC external input 3
		TIM2_CH4	Digital I/O	General-purpose timer
		TIM21_CH2	Digital I/O	General-purpose timer
32	MCU-PA1	USART2_RTS_DE	Digital I/O	USART interface
		ADC_IN1	Analog I	ADC external input 1
		COMP1_IMP	Analog I	Comparator input
		TIM21_ETR	Digital I/O	General-purpose timer
		EVENT_OUT	Digital I/O	
Central pins	GND	GND	Ground	Exposed pad connected to the ground of the application board

3 STATIC CHARACTERISTICS

3.1 General operating range

Table 2: General Operating Range

Parameter	Conditions	Min	Typ.	Max	Unit
Internal XTAL frequency	-	-	-	50	MHz
Supply voltage	-	2.6	3.3	3.6	V
Operating temperature	-	-20	-	75	°C
Storage temperature	-	-	25	-	°C

3.2 Power consumption

Characteristics measured over recommended operating conditions unless otherwise specified. Typical values are referred to 25 °C temperature, VDD = 3.3 V.

Table 3: Static characteristics: Low-power state power consumption TA = 25 °C, VDD = 3.3 V, 50 MHz crystal oscillator.

Parameter	Conditions	Min	Typ.	Max	Unit
Supply current	Shutdown	-	-	-	nA
	Standby	-	57.6	-	mA
	Sleep	-	43.1	-	uA
	Deep sleep	-	-	8	uA

Table 4: Static characteristics: Power consumption in reception TA = 25 °C, VDD = 3.3 V, fc = 905 MHz

Parameter	Conditions	Min	Typ.	Max	Unit
Supply current	RX @ -102 sensitivity level	-	17.7	-	mA

Table 5: Static characteristics: Power consumption in transmission TA = 25 °C, VDD = 3.3 V, fc = 902.2 MHz

Parameter	Conditions	Min	Typ.	Max	Unit
Supply current	TX CW @ 22 dBm	-	175.1	-	mA
	TX CW @ 10 dBm	-	75.5	-	

Table 6: Static characteristics: Power consumption in transmission TA = 25 °C, VDD = 3.3 V, fc = 865.2MHz

Parameter	Conditions	Min	Typ.	Max	Unit
Supply current	TX CW @ 16 dBm	-	104.8	-	mA
	TX CW @ 8 dBm	-	71	-	

3.3 Clock source

Table 7: 50 MHz Internal XTAL clock source characteristics

Parameter	Conditions	Min	Typ.	Max	Unit
Nominal frequency	-	-	50	-	MHz
Frequency tolerance	-20°C to 75 °C	-10	-	+10	ppm
Load capacitance	-	-	6	-	pF
Motional resistance (ESR)	-	-	-	60	Ω

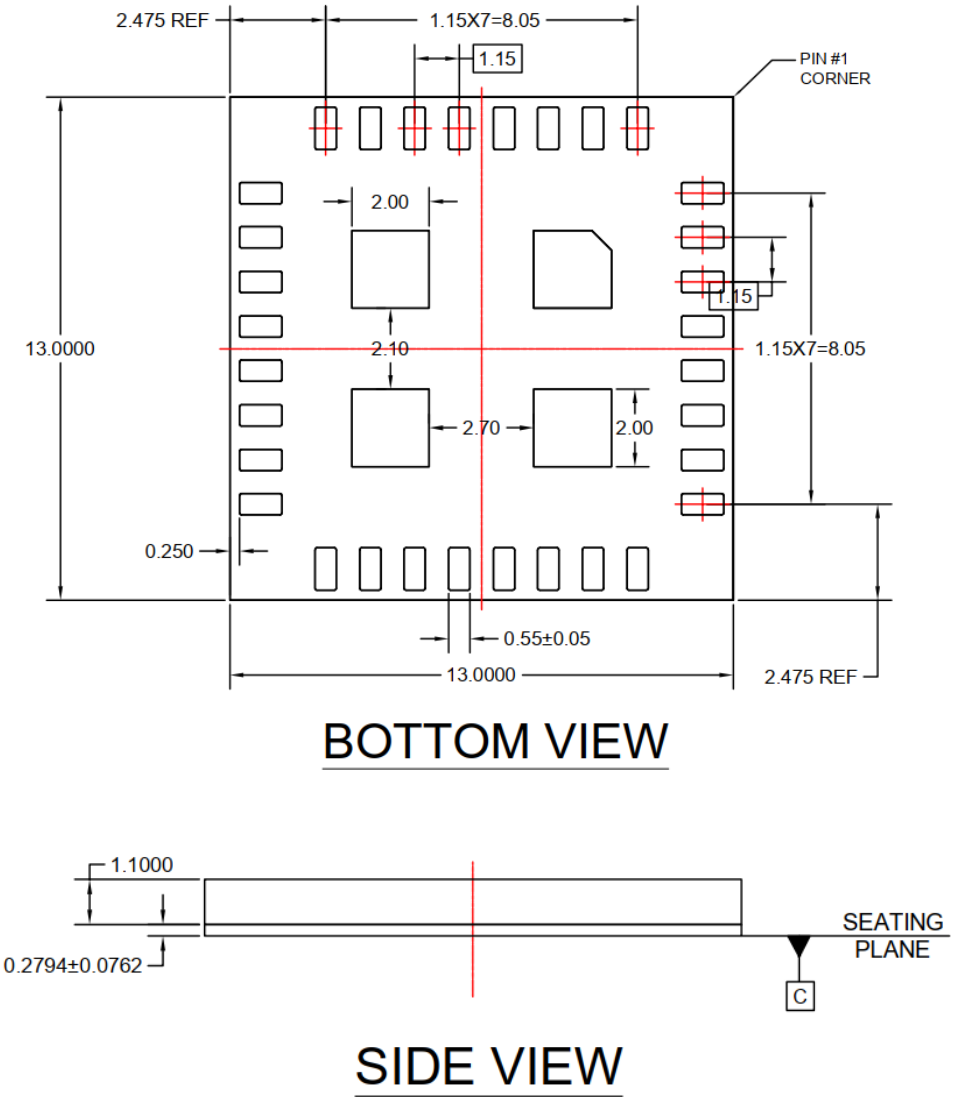
4 RF CHARACTERISTICS

Table 8: Transceiver and Receiver characteristics. TA = 25°C based on characterization; not tested in production. VDD = 3.3V; All RX measurements made at the antenna connector, to a bit error rate (BER) limit of 1%.

Parameter		Min	Typ.	Max	Unit
RF Characteristics					
RF Frequency	TX	865	-	924	MHz
	RX	869	-	923	MHz
Tx max. output power		22	-	-	dBm
Tx power variation vs. temperature	-40°C to +85°C	-	-	-	dB
Emission 2nd Harmonics (conducted)		-	-33	-	dBc
Emission 3rd Harmonics (conducted)		-	-41	-	
Emission 4th harmonic			-58		
Data Rate (for Sigfox Regions)	TX (RC1, RC3, RC5, RC6)	-	100	-	bps
	TX (RC2, RC4)	-	600	-	bps
	RX (All RCZ)	-	600	-	bps
Antenna Load Impedance			50		Ohm
Rx Sensitivity (@600bps, GFSK)			-128		dBm
Rx Spurious Emission (30MHZ~12.75GHZ)		-	-	-	dBm
Rx Blocking at 10MHz offset		-	-	-	dB
RSSI Resolution		-	1	-	dB

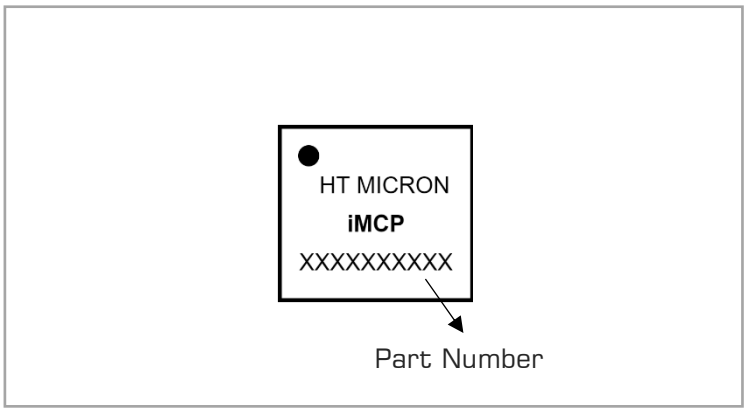
5 PACKAGE OUTLINE

Figure 3: Package Outline



6 MARKING

Figure 4: Package Marking Example



7 ORDERING INFORMATION

Table 9: Ordering information

Type number	Package		
	Name	Description	Version
	iMCP HT32SX	SIP module in LGA package; body 13mm x 13mm	

ABBREVIATIONS

Table 10: Abbreviations

Acronym	Description
ADC	Analog to Digital Converter
AES	Advanced Encryption Standard
API	Application Program Interface
CLK	Clock
EEPROM	Electrically-Erasable Programmable Read Only Memory
FIFO	First In First Out
GPIO	General Purpose Input Output
ID	Identification
IF	Intermediate frequency
IO	Input Output
MSL	Moisture sensitivity level
PCB	Printed-Circuit Board
PHY	Physical
SPI-bus	Serial Peripheral Interface -bus
PWM	Pulse Width Modulation
RAM	Random Access Memory
RC	Remote Control
RF	Radio Frequency
RoHS	Restriction of Hazardous Substances
RSSI	Receive Signal Strength Indication
RX	Receiver
SCL	Serial Clock
SDA	Serial Data
TX	Transmitter

LIST OF FIGURES

LIST OF TABLES

REVISION HISTORY

Version	Changes	Date
00	Initial release	19/Nov/2019