

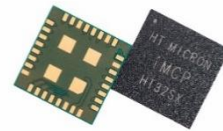
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# iMCP HT32SX



Sigfox System in Package

Code: iMCPHT32SX-001 – V2.2

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	iMCP HT32SX		iMCPHT32SX-001 – V2.2
	Datasheet	13/04/2020	V.00

## SUMMARY

<b>SUMMARY .....</b>	<b>1</b>
<b>DOCUMENT INFO .....</b>	<b>2</b>
<b>REVISION.....</b>	<b>2</b>
<b>1. GENERAL DESCRIPTION .....</b>	<b>3</b>
<b>2. FEATURES AND BENEFITS .....</b>	<b>3</b>
<b>3. APPLICATIONS.....</b>	<b>4</b>
<b>4. ORDERING INFORMATION .....</b>	<b>4</b>
<b>5. MARKING .....</b>	<b>4</b>
<b>6. BLOCK DIAGRAM.....</b>	<b>5</b>
<b>7. PINNING INFORMATION .....</b>	<b>6</b>
7.1.....	6
7.2    PIN DIAGRAM.....	6
7.3    PIN DESCRIPTION.....	6
<b>8. STATIC CHARACTERISTICS.....</b>	<b>8</b>
8.1 GENERAL OPERATING RANGE .....	8
8.2    POWER CONSUMPTION.....	8
8.3    CLOCK SOURCE .....	9
<b>9    RF CHARACTERISTICS .....</b>	<b>10</b>
<b>10    PACKAGE OUTLINE.....</b>	<b>11</b>
<b>11    SUGGESTED PCB FOOTPRINT .....</b>	<b>12</b>
<b>12    ABBREVIATIONS.....</b>	<b>13</b>

	<b>iMCP HT32SX</b>		<b>iMCPHT32SX-001 – V2.2</b>
	Datasheet	13/04/2020	V.00

## DOCUMENT INFO

This document supplies information about the iMCP SiP.

## REVISION

<b>Version</b>	<b>History</b>	<b>Date</b>	<b>Authors</b>
00	- Initial draft	13/04/2020	Maurício Carlotto

	iMCP HT32SX		iMCPHT32SX-001 – V2.2
	Datasheet	13/04/2020	V.00


## 1. GENERAL DESCRIPTION

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.

## 2. FEATURES AND BENEFITS

- 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 +xx dBm
  - RX sensitivity: - xxx dBm
- Power consumption
  - xxx mA RX
  - xxx mA TX @ xx dBm, 902.2MHz
- RF
  - S2-LP Transceiver STMicroelectronics
  - RF Front-End Module (for high efficiency in all frequency bands)
  - Frequency bands:
 

- RC1:	Europe, Middle East and Africa	868.034 ~ 868.226 MHz
- RC2:	North America and Brazil	902.104 ~ 902.296 MHz
- RC3:	Japan	923.104 ~ 923.296 MHz
- RC4:	Latin America and Asia Pacific	920.704 ~ 920.896 MHz
- RC5:	South Korea	923.204 ~ 923.396 MHz
- RC6:	India	865.104 ~ 865.296 MHz
- RC7:	Russia	868.704 ~ 868.896 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<sup>2</sup>C
- Single power supply: 2.7 V to 3.6 V
- Operating temperature range: -xx°C to +xx°C

	<b>iMCP HT32SX</b>		<b>iMCPHT32SX-001 – V2.2</b>
	Datasheet	13/04/2020	V.00

- External antenna
- 13x13x1.35mm LGA – 32 pads package
- Part number: HT32SX

### 3. APPLICATIONS

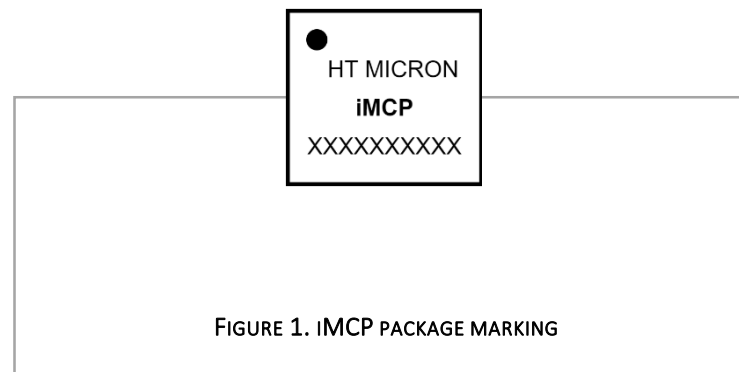
- Smart home
- Wireless alarm systems
- Manufacturing
- Agriculture
- Building automation
- Smart metering
- Smart lighting systems


### 4. ORDERING INFORMATION

TABLE 1. ORDERING INFORMATION

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

### 5. MARKING



	iMCP HT32SX		iMCPHT32SX-001 – V2.2
	Datasheet	13/04/2020	V.00

## 6. BLOCK DIAGRAM

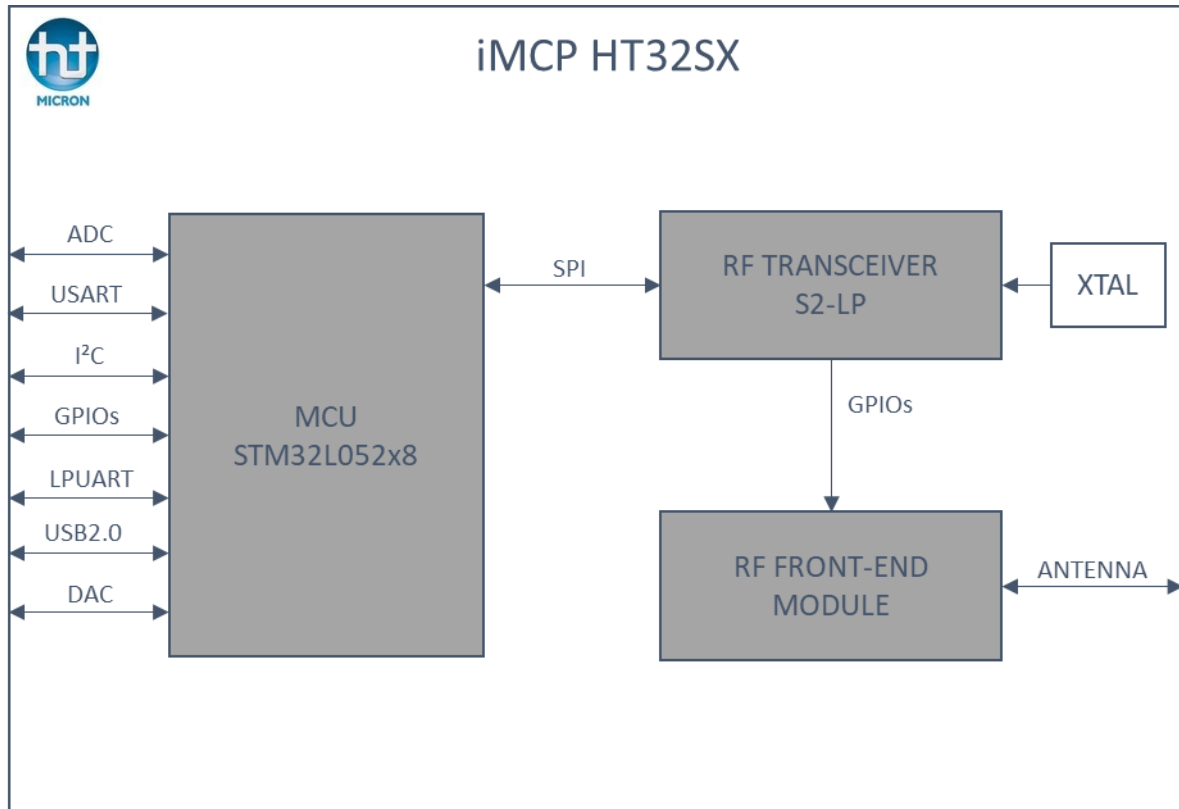

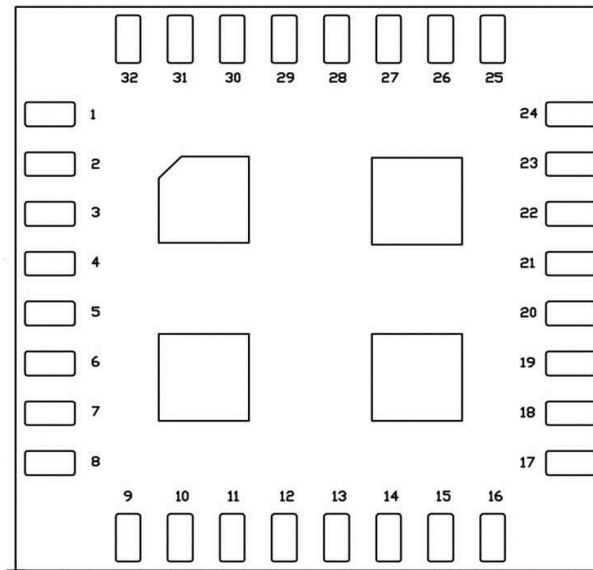


FIGURE 2. SIMPLIFIED BLOCK DIAGRAM

	<b>iMCP HT32SX</b>		<b>iMCPHT32SX-001 – V2.2</b>
	Datasheet	13/04/2020	V.00


## 7. PINNING INFORMATION

### 7.2 Pin Diagram



### 7.3 Pin description

Number	Symbol	Pin name	Pin Type	Description
<b>1</b>	ANTENNA	ANTENNA	RF I/O	RF input and output signal
<b>2</b>	GND	GND	Ground	Exposed pad connected to the ground of the application board
<b>3</b>	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	
<b>4</b>	MCU-PA9	USART1_TX	Digital I/O	Serial wire
<b>5</b>	MCU-PA10	USART1_RX	Digital I/O	
<b>6</b>	MCU-PB11	LPUART1_RX	Digital I/O	Low-power USART interface
		TIM2_CH4	Digital I/O	General-purpose timer
		EVENTOUT	Digital I/O	
<b>7</b>	MCU-PB0	ADC_IN0	Analog I	ADC external input 0
		VREF_OUT	Analog I/O	Output reference voltage
<b>8</b>	VDD_3.3V	VDD_3.3V	Power	3.3 V power supply
<b>9</b>	MCU-PA8	USART1_CK	Digital I/O	USART interface
		USB_CSR_SYNC	Digital I/O	USB
		EVENT_OUT	Digital I/O	
<b>10</b>	MCU-PA5	ADC_IN5	Analog I	ADC external input 5
		TIM2_CH1	Digital I/O	General-purpose timer
		TIM2_ETR	Digital I/O	General-purpose timer
		COMP1_INM5	Analog I	Comparator input
<b>11</b>	MCU-PA3	USART2_RX	Digital I/O	USART interface

	<b>iMCP HT32SX</b>		<b>iMCPHT32SX-001 – V2.2</b>
	Datasheet	13/04/2020	V.00

		ADC_IN3	Analog I	ADC external input 3
		TIM2_CH4	Digital I/O	General-purpose timer
		TIM21_CH2	Digital I/O	General-purpose timer
<b>12</b>	MCU-PA1	USART2_RTS_DE	Digital I/O	USART interface
		ADC_IN1	Analog I	ADC external input 1
		COMP1_INP	Analog I	Comparator input
		TIM21_ETR	Digital I/O	General-purpose timer
		EVENT_OUT	Digital I/O	
<b>13</b>	MCU-PB10	LPUART1_TX	Digital I/O	USART interface
		TIM2_CH3	Digital I/O	General-purpose timer
<b>14</b>	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
<b>15</b>	MCU-PA4	EVENT_OUT	Digital I/O	
		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
<b>16</b>	GND	COMP1_INM4	Analog I	Comparator input
		GND	Ground	Exposed pad connected to the ground of the application board
<b>17</b>	MCU-PA2	USART2_TX	Digital I/O	USART interface
		ADC_IN2	Analog I	ADC external input 2
		TIM21_CH1	Digital I/O	General-purpose timer
		TIM2_CH3	Digital I/O	General-purpose timer
<b>18</b>	MCU-PA0	WKUP1	Digital I	MCU external wakeup input
		ADC_IN0	Analog I	ADC external input 0
		USART2_CTS	Digital I/O	USART interface
		TIM2_CH1	Digital I/O	General-purpose timer
<b>19</b>	MCU-BOOT0	BOOT0	Digital I	Boot selection
<b>20</b>	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
<b>21</b>	GND	GND	Ground	Exposed pad connected to the ground of the application board
<b>22</b>	NRESET	NRESET	I/O	Bidirectional reset pin with embedded weak pull-up resistor
<b>23</b>	MCU-PA14	SWCLK	Digital O	Serial wire clock output
		USART2_TX	Digital I/O	USART interface
<b>24</b>	MCU-PA13	SWDIO	Digital I/O	Serial wire
		USB_NOE	Digital I/O	USB
<b>25</b>	OSC32OUT	OSC32OUT		External clock source pins
<b>26</b>	OSC32IN	OSC32IN		
<b>27</b>	GND	GND	Ground	Exposed pad connected to the ground of the application board
<b>28</b>	MCU-PB1	LPUART1_RTS_DE	Digital I/O	Low-power USART interface
		ADC_IN9	Analog I	ADC external input 9



	<b>iMCP HT32SX</b>		<b>iMCPHT32SX-001 – V2.2</b>
	Datasheet	13/04/2020	V.00

		VREF_OUT	Analog O	1.2 V VCO-LDO band-gap reference voltage decoupling
<b>29</b>	MCU-PB7	USART1_RX	Digital I/O	USART interface
		I2C1_SDA	Digital I/O	I2C interface
		LPTIM1_IN2	Digital I/O	Low-power timer
<b>30</b>	MCU-PB6	USART1_TX	Digital I/O	USART interface
		I2C1_SCL	Digital I/O	I2C interface
		LPTIM1_ETR	Digital I/O	Low-power timer
<b>31</b>	MCU-PA12	USART1_RTS_DE	Digital I/O	USART interface
		USB_DP	Digital I/O	USB
		EVENT_OUT	Digital I/O	
<b>32</b>	GND	GND	Ground	Exposed pad connected to the ground of the application board
<b>Central pins</b>	GND	GND	Ground	Exposed pad connected to the ground of the application board

## 8. STATIC CHARACTERISTICS

### 8.1 General operating range

TABLE 2. GENERAL OPERATING CONDITIONS

Parameter	Conditions	Min	Typ.	Max	Unit
<b>Internal XTAL frequency</b>	-	-	-	50	MHz
<b>Supply voltage</b>	-	2.6	3.3	3.6	V
<b>Operating temperature</b>	-	-xx	-	xx	°C
<b>Storage temperature</b>	-	-	25	-	°C

### 8.2 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
<b>Supply current</b>	Shutdown	-	-	-	nA
	Standby	-	xxx	-	mA
	Sleep	-	xxx	-	uA
	Deep sleep	-	-	xxx	uA

	<b>iMCP HT32SX</b>		iMCPHT32SX-001 – V2.2
	Datasheet	13/04/2020	V.00

TABLE 4. STATIC CHARACTERISTICS: POWER CONSUMPTION IN RECEPTION TA = 25 °C, VDD = 3.3 V, FC = 905 MHz

Parameter	Conditions	Min	Typ.	Max	Unit
<b>Supply current</b>	RX @ -102 sensitivity level	-	xxx	-	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
<b>Supply current</b>	TX CW @ 22 dBm	-	xxx	-	mA
	TX CW @ 10 dBm	-	xxx	-	


TABLE 6. STATIC CHARACTERISTICS: POWER CONSUMPTION IN TRANSMISSION TA = 25 °C, VDD = 3.3 V, FC = 865.2MHz

Parameter	Conditions	Min	Typ.	Max	Unit
<b>Supply current</b>	TX CW @ 16 dBm	-	xxx	-	mA
	TX CW @ 8 dBm	-	xxx	-	

### 8.3 Clock source

TABLE 7. 50 MHz INTERNAL XTAL CLOCK SOURCE CHARACTERISTICS

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


	<b>iMCP HT32SX</b>		iMCPHT32SX-001 – V2.2
	Datasheet	13/04/2020	V.00

## 9 RF CHARACTERISTICS

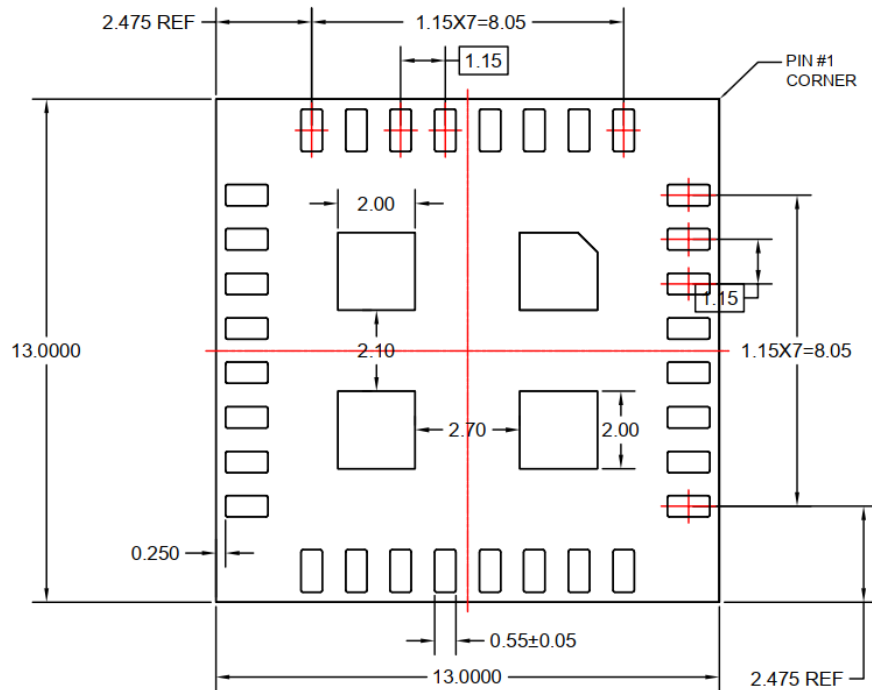
**TABLE 8. TRANSCEIVER AND RECEIVER CHARACTERISTICS**

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%.

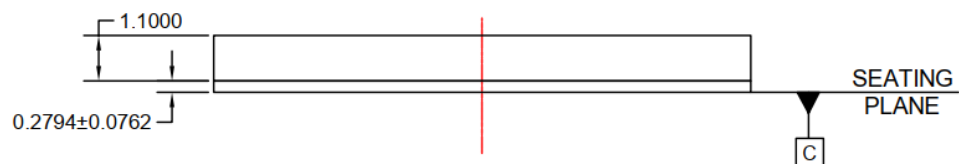
Parameter		Min	Typ.	Max	Unit
<b>RF Characteristics</b>					
<b>RF Frequency</b>	TX	865	902.2	924	MHz
	RX	869	905.2	923	MHz
<b>Tx max. output power</b>		xx	-	xx	dBm
<b>Tx power variation vs. temperature</b>	-40°C to +85°C	-	-	-	dB
<b>Emission 2<sup>nd</sup> Harmonics (conducted)</b>		-	xxx	-	dBc
<b>Emission 3<sup>rd</sup> Harmonics (conducted)</b>		-	xxx	-	
<b>Emission 4<sup>th</sup> harmonic</b>			xxx		
<b>Data Rate</b>	TX (RC1, RC3, RC5, RC6)	-	100	-	bps
	TX (RC2, RC4)	-	600	-	bps
	RX (All RCZ)	-	600	-	bps
<b>Load Impedance</b>			50		Ohm
<b>Rx Sensitivity(@600bps, GFSK)</b>			xxx		dBm
<b>Rx Spurious Emission (30MHZ~12.75GHZ)</b>		-	-	-	dBm
<b>Rx Blocking at 10MHz offset</b>		-	-	-	dB
<b>RSSI Resolution</b>		-	1	-	dB

	iMCP HT32SX		iMCPHT32SX-001 – V2.2
	Datasheet	13/04/2020	V.00


## 10 PACKAGE OUTLINE



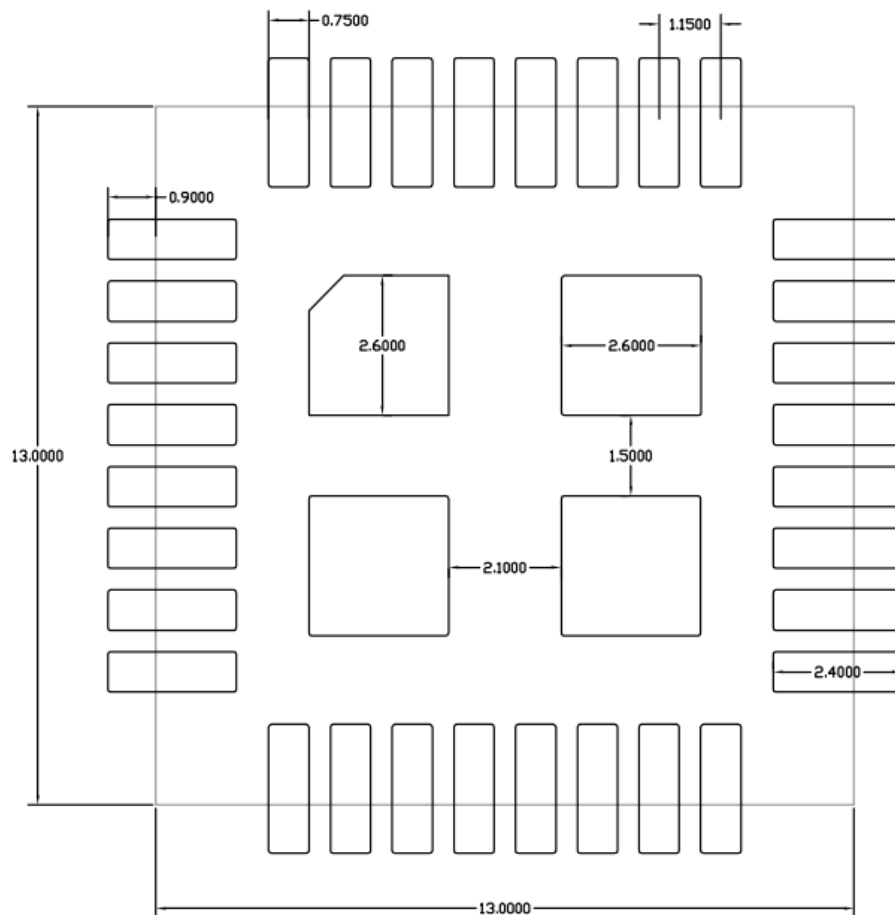
**BOTTOM VIEW**




**SIDE VIEW**

	iMCP HT32SX		iMCPHT32SX-001 – V2.2
	Datasheet	13/04/2020	V.00

## 11 RECOMMENDED PCB FOOTPRINT



	<b>iMCP HT32SX</b>		<b>iMCPHT32SX-001 – V2.2</b>
	Datasheet	13/04/2020	V.00

## 12 ABBREVIATIONS

TABLE 9. ABBREVIATIONS

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