iSense Core Module 3 Datasheet
CM30I, CM30U, CM30HP

Coalesenses GmbH Maria-Goeppert-Str. 1 23562 Lübeck Germany www.coalesenses.com sales@coalesenses.com

Document history

Version	*Date*	*Changes*
1.0	22.09.2011	Initial version
1.1	08.03.2012	Added block diagram
1.2	02.04.2012	Corrected V_usb+ to +U_usb and +U_coin to +U_direct in section 4.1 and 4.2
1.3	28.08.2012	Corrected the description of availability of pins for the CM30HP below the table in section 3.3

Contents

List of Figures

1. Overview

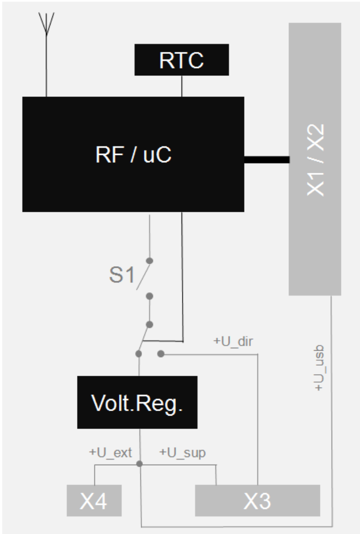

Figure 1: Block Diagram of the CM30x.

The iSense Core Module is based on a Jennic JN5148 wireless microcontroller [2], a chip that combines the controller and the wireless communication transceiver in a single housing.

The controller provides 32 bit RISC computation and runs at a software-scalable frequency between 4 and 32 MHz. It comprises 128kbytes of memory that are shared by program code and data. The advantage of this choice is that memory consumption of program code and data can be traded. Opposite to other controllers where the user is limited to a certain amount of data and code memory, free choices that are only bounded by the sum of both become possible here.

The radio part complies with the IEEE 802.15.4 standard [1]. It achieves a data rate of 250kBit/s, provides hardware AES encryption and is ZigBee-ready. As the world's first IEEE 802.15.4 radio, it supports distance measurements to neighboring devices using time of flight ranging. Besides IEEE 802.15.4 standard compliant operation, the radio transceiver provides two additional modes of operation, offering increased data rates of 500kBit/s and 667kBit/s.

Apart from the CM30U version that is equipped with a µFl antenna connector, the CM30I with an integrated PCB antenna for especially compact systems is available. Both provide a receive sensitivity of -95dBm (at 250kBit/s) and a transmit power tunable between -60dBm and +2.5dBm.

In addition, a Core Module version (CM30HP) with a power amplification stage for transmitting and receiving is available. It is equipped with a µFl antenna connector, reaches a receive sensitivity of -98dBm (at 250kBit/s) and a transmit power of up to 10dBm.

A common quandary in design is whether or not to use a voltage regulator. It has the advantage that operation with voltages lower than the required one is possible, but the regulator inherently wastes energy. This is especially bad as it also wastes current if the voltage would be high enough and the regulator would not be required. To resolve this problem, we decided to combine the measurement of the supply voltage with the possibility to bypass the regulator by a software switch. Like this, the regulator usage can be omitted when not required but is available when the supply voltage drops.

To enable long, but still synchronous sleep and wakeup cycles, the module is equipped with a high precision clock (error < 3ppm). The Core Module also features a software-switchable LED for debugging purposes.

There is a 34 pin connector (X1, X2) on both sides of the module where other modules can be attached to the Core Module. It can supply up to 500mA to other modules.

The controller can be programmed in various ways. While over-the-air programming (OTAP) is possible and considered to be the standard procedure, the program can also be transferred via the gateway module, or using a special programming adapter that mates with corresponding pads on the module.

The module can be powered by a wall mount adapter or a standard battery holder, by one of the power modules or via the USB interface of the gateway module.

2. Mechanical Information

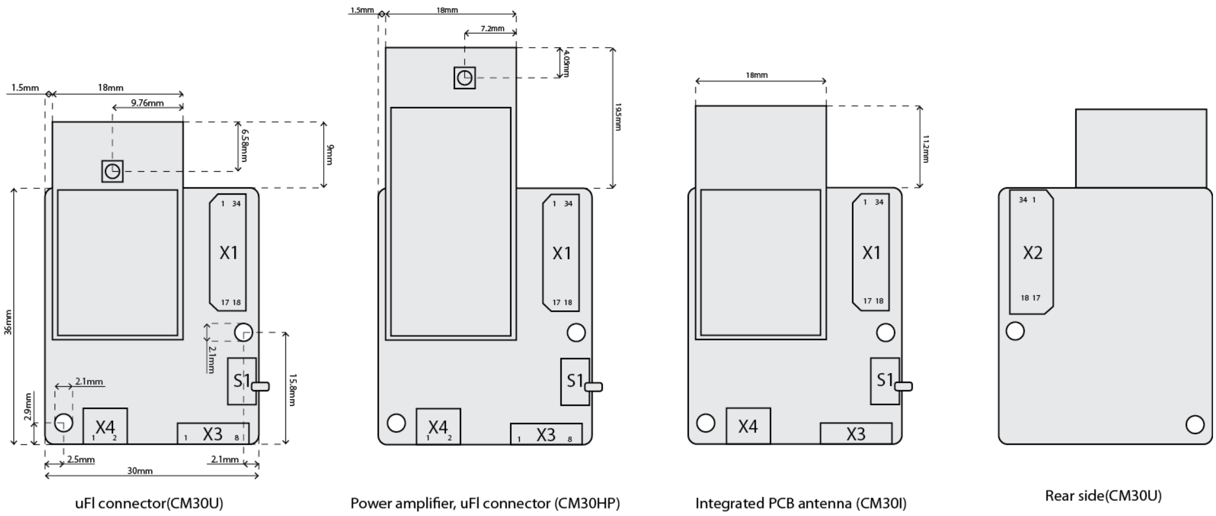

Figure 2: Mechanical information.

3. Interfaces

3.1. Programming Pads

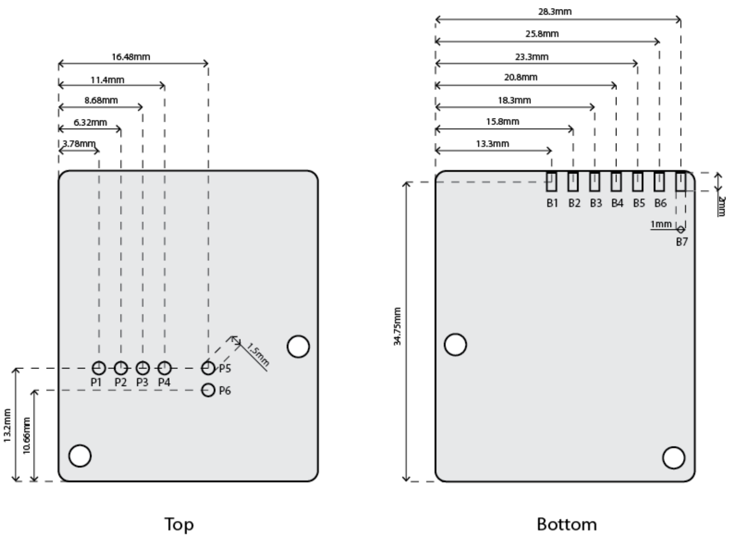

Figure 3: Programming pad positions.

The Core Module features six PCB pads that can be used for programming the flash IC. The table below states the pad functions.

Pad No.	Function
P1	UART 0 TX
P2	UART 0 RX
P3	SPI MISO
P4	VCC (3.3V)
P5	Reset
P6	GND

Pad No.	Function
B1	Reset
B2	VCC (3.3V)
B3	GND
B4	UART 0 TX
B5	UART 0 RX
B6	SPI MISO
B7	Do not connect

3.2. Switch S1

S1 is the main power switch of the Core Module. It is switched on towards X3 and switched off towards X1.

3.3. Connectors X1 and X2

The connectors X1 and X2 on both sides of the Core Module is intended for connecting it to other modules such as sensor modules, a gateway module, or an I/O module. X1 is of type Panasonic AXN334130S, X2 of type Panasonic AXN434530S [3]. The table below states the pin configuration of X1/X2.

pin no.	GPIO pin no	alternative function	used in iSense as
1	n/a	ADC3	
2	n/a	ADC2	
3	n/a	ADC1	
4	n/a	GND	
5	5	RTS0	Voltage measurement switch
6	6	TXD0	
7	7	RXD0	
8	20	RXD1	
9	19	TXD1	
10	n/a	SPI MOSI	
11	n/a	SPI CLK	
12	n/a	SPI MISO	
13	18	RTS1	S2_INT
14	0	SPISEL1	
15	16	-	MM_ON
16	15	SDA	
17	14	SCL	
18	n/a	-	+U_USB (voltage supply from USB port on gateway module)
19	n/a	-	+U_USB (voltage supply from USB port on gateway module)
20	n/a	GND	
21	n/a	VCC	
22	n/a	VCC	
23	n/a	GND	

24	2	SPISEL3	
25	3	SPISEL4	
26	11	TIM1GT	EM_ON
27	10	TIM0_OUT	CAM_ON
28	9	TIM0_CAP	PIR_ON
29	8	TM0GT	S1_INT
30	4	CTS0	I2C_IO_EXP_INT
31	n/a	GND	
32	n/a	RESET	
33	n/a	DAC2	
34	n/a	DAC1	

Note that pins 24 (GPIO 2, SPISEL 3) and 25 (GPIO 3, SPISEL 4) cannot be used on CM30HP, as these pins are reserved for internal power stage control here.

3.4. Connector X3

Connector X3 is the power supply connector. Here, energy modules are to be connected. X3 is of type JST BM08B-SRSS-TB [5]. The table below states the pin configuration of X3.

pin no.	pin function / used in iSense as
1	GND
2	GND
3	+U_sup / supply voltage, connected to the voltage regulator input
4	+U_direct / supply voltage, by-passes the voltage regulator
5	+U_ext / Core Module output of external voltage from wall mount adapter (X4) or USB power supply via X1/X2, e.g. for charging the iSense LiIon Module
6	
7	BAT_SCL / clock line for I2C interface of battery monitor on energy modules
8	BAT_SDA / data line for I2C interface of battery monitor on energy modules

3.5. Connector X4

Connector X4 is the wall mount adapter connector. Here, voltages between 1.8V and 5.5V can be supplied to the module e.g. by a wall mount adapter. This voltage is also fed to the +U_ext pins of X3 to e.g. charge the iSense LiIon Module. The supply voltage of X4 is fed into the voltage regulator input.

X4 is of type JST S2B-ZR-SM3A-TF [4]. The table below states the pin configuration of X4.

pin no.	pin function / used in iSense as
1	+U_ext
2	GND

4. Specifications

4.1. Maximum Ratings

Parameter	Unit	Min	Max
Voltage to pins +U_ext, +U_sup, +U_usb	V	-0.3	5.5
Voltage to all other pins	V	0	3.3
Storage Temperature	° C	-50	+125

4.2. Operation

Parameter	Unit	Min	Typ	Max
Operating voltage, regulator enabled (pins U_ext, U_sup, +U_usb)	V	2.0		5.5
Operating voltage, regulator disabled (pin +U_direct)	V	2.0		3.3
Operation temperature	° C	-20.0		+70.0

4.3. Current consumption

The following table gives an overview of the Core Module’s current consumption. All values are specified at an input voltage of 3.3V, temperature of 25°C, with the voltage regulator bypassed.

Parameter	Unit	Min	Typ	Max
Current consumption controller	mA		1.6+0.28/MHz	
Current consumption radio RX	mA		15.9	
Current consumption radio TX	mA		13.4	
Current consumption radio RX with power amplifier	mA		21.4	
Current consumption radio TX with power amplifier	mA		108.4	
Current consumption sleep mode, regulator disabled	µA		3.75	

For more detailed information on current consumption, please refer to the figures below.

5. RoHS compliance

This device meets the requirements of Directive 2002/95/EC of the European Parliament and of the Council on the Restriction of Hazardous Substance (RoHS).

6. Status information

This data sheet shows the specification of a product in development.

The functionality and electrical performance specifications are target values and may be used as a guide to the final specification. Coalesenses reserves the right to make changes to the product specification at anytime without notice.

7. Ordering information

Order code	Product
CM30I	Core Module 3 with integrated PCB antenna
CM30U	Core Module 3 with µFl connector
CM30HP	Core Module 3 with power amplifier, µFl connector

8. References

[1] IEEE Computer Society, IEEE Standard for Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements, Part 15.4: Wireless Medium Access Control (MAC) and Physical Layer (PHY) Specifications for Low-Rate Wireless Personal Area Networks (LR-WPANs), http://standards.ieee.org/getieee802/download/802.15.4-2003.pdf

[2] Preliminary Data Sheet – JN5148, online available at http://www.jennic.com/support/datasheets/jn5148_wireless_microcontroller_datasheet

[3] NARROW-PITCH CONNECTORS FOR PC BOARDS NARROW-PITCH (0.8mm) CONNECTORS — P8 SERIES — AXN(1/3/4) , online available at http://pewa.panasonic.com/pcsd/product/conn/pdf_cat/p8conn.pdf

[4] JST 1.5mm (0.059”) pitch ZH connector, SMT type shrouded header, online available at http://www.jst-mfg.com/product/eng/eZH.pdf

[5] JST 1.0mm pitch SR connector, online available at http://www.jst-mfg.com/product/pdf/eng/eSR.pdf

coalesenses GmbH
Maria-Goeppert-Str. 1a
23562 Lübeck
Germany

www.coalesenses.com
sales@coalesenses.com