

# LISA-C2 series

## CDMA 1xRTT Module

### Data Sheet

#### Abstract

Technical data sheet describing the LISA-C2 series CDMA 2000 1xRTT cellular modules.

These modules are a complete and cost efficient 3G solution offering 153 kb/s single-band 450 MHz or dual-band 800/1900 MHz data transmission technology in a popular compact form factor.



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**Document status explanation**

Objective Specification	Document contains target values. Revised and supplementary data will be published later.
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**This document applies to the following products:**

Name	Type number	Firmware version	PCN / IN
LISA-C200	LISA-C200-02S-01	E0.S.05.00.04R	UBX-TN-12077
LISA-C200	LISA-C200-22S-01	E0.V.05.00.03R	UBX-TN-12077
LISA-C200	LISA-C200-03S-00	E0.S.06.00.07R	UBX-13005454
LISA-C200	LISA-C200-23S-00	E0.V.06.00.06R	UBX-13005454
LISA-C200	LISA-C200-04S-00	E0.S.07.00.07R	UBX-14042040
LISA-C200	LISA-C200-24S-00	E0.V.07.00.07R	UBX-14042040

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# 1 Functional description

## 1.1 Overview

The LISA-C2 series CDMA2000 1xRTT modules provide dual-band 800/1900 MHz (LISA-C200) voice and data transmission in a compact form factor. The modules feature low power consumption and packet data transmission, and combine baseband, RF transceiver, power management unit, and power amplifier in a single, easy-to-integrate solution.

The LISA-C2 series modules are complete, fully qualified and certified solutions, which reduces cost and enables short time to market. Either module is ideally suited to M2M and automotive applications such as: mobile Internet terminals and applications, car infotainment and telematics, Automatic Meter Reading (AMR), Remote Monitoring Automation and Control (RMAC), surveillance and security, road pricing, asset tracking, fleet management, anti theft systems, and Point of Sales (PoS) terminals.

The LISA-C2 series modules support full access to u-blox GNSS receivers via a serial port. Thus CDMA and GNSS can be controlled through a single serial port from any host processor.

The compact LISA form factor and SMT pads allow fully automated assembly with standard pick & place and reflow soldering equipment for cost-efficient, high-volume production.

## 1.2 Product features

Module	Technology		Bands		Interface				Audio	Functions													
	Rx [kb/s]	Tx [kb/s]	CDMA [MHz]	CDMA [MHz]	UART	SPI	USB	GPIO	DDC for u-blox GNSS	Analog Audio	Digital Audio	Network indication	Antenna Supervisor	Jamming Detection	Embedded TCP/UDP	Embedded FTP, HTTP	Embedded SSL	Embedded AssistNow	CellLocate	FW update over the air (FOTA)	FW update via serial	Rx Diversity	GNSS via modem
<b>LISA-C200</b>	153	153	800	1900	1		1	5	•	•	•	b	•	•	•	•	a	b	c	•	•		•

a = Available from versions 03S/23S onwards; b = Available from versions 04S/24S onwards; c = Sprint

Table 1: LISA-C2 series main features summary

### 1.3 Block diagram

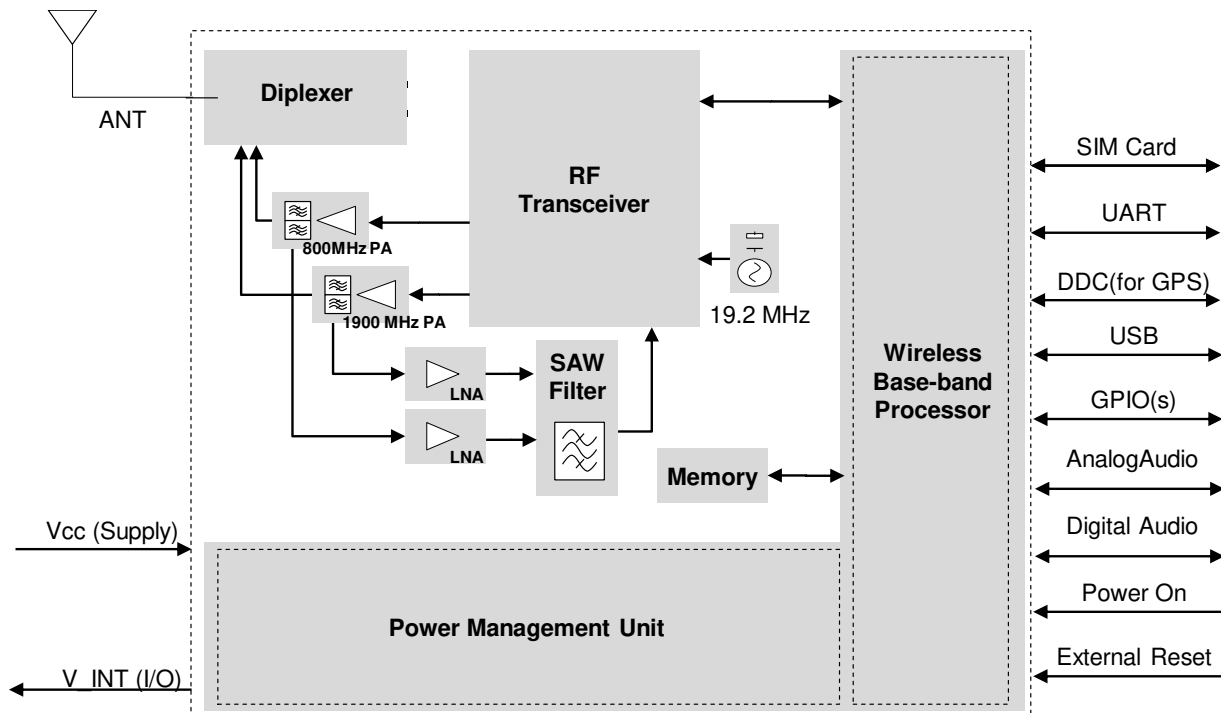


Figure 1: LISA-C200 series block diagram

### 1.4 Product description

LISA-C2 series cellular modules integrate full-feature 1xRTT CDMA data and voice communication. These modules are form factor compatible with the popular u-blox LISA-U W-CDMA module families. The LISA-C200 module is intended for operation on CDMA networks, such as Sprint, Verizon and Aeris in North America.

#### 3G CDMA 2000 1x Characteristics

Dual Band Mobile Station

Dual-band support:

- Band Class 0 ; 800 MHz
- Band Class 1 ; 1900 MHz

Rx Sensitivity

- Band Class 0 ; -108 dBm
- Band Class 1 ; -108 dBm

Tx Power conducted

- Band Class 0 ; +24 dBm
- Band Class 1 ; +24 dBm

CDMA 2000 1x packet data up to 153 kb/s DL/UL

Table 2: LISA-C200 CDMA 2000 1x characteristics

### 1.5 AT Command support

The modules support enhanced AT command sets: IS-707.3 [1], GSM 07.05 [4], GSM 07.07 [3], ITU-T v.24 [7] (as applicable) and the u-blox AT command extension.



For the complete list of the supported AT commands and their syntax see the u-blox C-200 AT Commands Manual [6].

## 1.6 Supported features

### 1.6.1 Antenna Detection

Antenna presence detection capability is provided, by evaluating the resistance from the **ANT** pin to GND by means of an internal antenna detection circuit. For further details, refer to the u-blox C-200 System Integration Manual [9].

The antenna detection feature can be enabled through the +UANTR AT command.

For more details about AT commands, see the u-blox AT Commands Manual [8].

### 1.6.2 Embedded TCP/IP and UDP/IP

LISA-C2 series modules include embedded TCP/IP and UDP/IP stack. For more details about AT commands, see the u-blox AT Commands Manual [8].

Direct Link mode for TCP and UDP sockets is supported. Sockets can be set in Direct Link mode to establish a transparent end to end communication with an already connected TCP or UDP socket via serial interface.



TCP direct link mode for LISA-C200 is not supported in 01S and 21S versions

### 1.6.3 FTP

File Transfer Protocol functionality is supported via AT commands. Files are read and stored in the local file system of the module. Alternatively Direct Link mode is supported, where files are sent to the serial interface from an external application processor is forwarded to the network and vice-versa. For more details about AT commands see u-blox AT Commands Manual [8].



FTP direct link mode for LISA-C200 is supported by versions 04S/24S and successive versions

### 1.6.4 HTTP

HTTP protocol is supported. HEAD, GET, POST, DELETE and PUT operations are available. The file size to be uploaded or downloaded depends on the free space available in the local file system (FFS) at the moment of the operation.

For more details about AT commands see the u-blox AT Commands Manual [8].

### 1.6.5 GNSS (via modem)

Full access to u-blox positioning chips and modules is available through a dedicated DDC (I<sup>2</sup>C) interface. This means that from any host processor a single serial port can control the cellular module and the positioning chip or module. For more details see the GPS Implementation Application Note [11].



GNSS integration for LISA-C200 is supported by versions 03S/23S and successive versions

### 1.6.6 Embedded AssistNow Software

Embedded AssistNow Online and AssistNow Offline clients provide better GNSS performance and faster Time-to-First-Fix. An AT command can enable / disable the clients.



Embedded AssistNow software for LISA-C200 is supported by versions 03S /23S and successive versions

### 1.6.7 CellLocate™

CellLocate™ enables the estimation of device position based on the parameters of the mobile network cells visible to the specific device based on the CellLocate™ database. It is implemented using a set of AT commands for CellLocate™ service configuration and position request. For more details about AT commands see the u-blox AT Commands Manual [8].



CellLocate™ for LISA-C200 is supported by versions 04S/24S and successive versions

### 1.6.8 Hybrid Positioning

The module current position is provided using a u-blox positioning chip or module or the estimated position from CellLocate™ depending by which positioning method provides the best and fastest solution according to the user configuration

Hybrid positioning is implemented through a set of AT commands that allow the configuration and the position request. For more details about AT commands see the u-blox AT Commands Manual [8].



Hybrid positioning for LISA-C200 is supported by versions 04S/24S and successive versions

### 1.6.9 Network Indication

Selected GPIO can be configured to indicate the network status: registered home network, registered roaming, voice or data call session, no service.

The feature can be enabled through the +UGPIOC AT command. For more details about AT commands see the u-blox AT Commands Manual [8].



Network indication status for LISA-C200 is supported by versions 04S/24S and successive versions

### 1.6.10 Audio Playback

Audio files in AMR format can be uploaded in the LISA-C200 local file system (FFS) and played back through the audio interface using the +UPLAYFILE AT command. For more details about AT commands see the u-blox AT Commands Manual [8].



Audio playback for LISA-C200 is supported by versions 04S/24S and successive versions



## 2 Interfaces


### 2.1 Power Management

#### 2.1.1 Module supply (VCC)

LISA-C2 series modules must be supplied through the **VCC** pin by a DC power supply. Voltages must be stable: during operation, the current drawn from **VCC** can vary significantly, based on the power consumption profile of the CDMA system (described in the u-blox C-200 System Integration Manual [9]).

#### 2.1.2 Digital I/O interfaces supply

The LISA-C2 series module provides an internally generated supply rail output for digital interfaces (**V\_INT**). This can be used in place of an external discrete regulator to supply pull-up resistors on the DDC interface. This optimizes the bill of material for various applications, e.g. with u-blox GNSS receivers operating at 1.8 V.

 **This source is shared with internal base band processing and memory devices. Prohibit external devices from sourcing current into this pin. Unexpected behavior of LISA-C2 series modules can result.**

### 2.2 RF antenna interface

The **ANT** pad has an impedance of 50  $\Omega$  and provides the RF antenna interface.

### 2.3 System functions

#### 2.3.1 Module power-on (PWR\_ON)

By pulling the **PWR\_ON** pin low the falling edge will begin power on sequence. This line must be held low (150 msec) and should be driven by open drain or open collector. **PWR\_ON** pin has an internal pull-up resistor.

#### 2.3.2 External reset (RESET\_N)

By pulling the **Reset\_N** pin low the falling edge will begin the reset sequence. This line must be held low for 300 msec and should be driven by open drain or open collector. The modem has an internal pull-up resistor.

### 2.4 Serial communication

LISA-C2 series modules provide the following serial communication interfaces where AT command interface and Packet-Switched Data communication are concurrently available:

- One asynchronous serial interface (UART)
- One full-speed USB 2.0 compliant interface

Only one interface is active. The default is USB, and if no USB is detected then it is assumed that the UART interface is desired.

The USB interface, using all the provided lines (**VUSB\_DET**, **USB\_D+** and **USB\_D-**), can be used for the upgrade of the module firmware.

### 2.4.1 Asynchronous serial interface (UART)

The UART interface is a 5-wire unbalanced asynchronous serial interface provided for all communications with LISA-C2 series modules.

UART features are:

- Serial port with RS-232 functionality conforming to the ITU-T V.24 Recommendation [6], with CMOS compatible signal levels (0 V for low data bit or ON state and 1.8 V for high data bit or OFF state)
- Data lines (**TxD** as input, **RxD** as output), hardware flow control lines (**RTS** as input, **CTS** as output), and Ring Indicator (RI)

### 2.4.2 Universal Serial Bus (USB)

The LISA-C2 series modules include a full-speed USB 2.0 compliant interface with maximum throughput of 12 Mb/s. The module itself acts as a USB device and can be connected to any USB host.

The USB is the main interface for transferring high speed data between the LISA-C2 module and a host processor.

Signals **USB\_D+/USB\_D-** carry the USB serial data and signaling. The USB interface is automatically enabled by a valid USB VBUS supply voltage (5.0 V typical) on **VUSB\_DET** pin.

### 2.4.3 Mux protocol

The LISA-C2 series modules have a software layer with MUX functionality, 3GPP TS 27.010 Multiplexer Protocol [2], available on the UART.



The USB interface does not support the multiplexer protocol TS 27.010.

This is a data link protocol (layer 2 of OSI model) that uses HDLC-like framing and operates between the module (DCE) and the application processor (DTE) and allows simultaneous sessions over the used physical link (UART): the user can concurrently use the AT command interface on one MUX channel and Packet-Switched / Data communication on another MUX channel. Each session consists of a stream of bytes transferring various kinds of data such as SMS, CBS, PSD, AT commands in general.

The following channels are defined:

- Channel 0: control channel
- Channel 1- 2 : AT commands / data connection

This permits, for example, an SMS to be transferred to the DTE when a data connection is in progress.

## 2.5 DDC (I<sup>2</sup>C) bus interface

LISA-C200 modules, from version 03S/23S onwards, include an I2C compatible DDC interface that can communicate with a u-blox GNSS receiver. The LISA-C2 series module acts as an I2C master, which can communicate with two I2C slaves in accordance with the I<sup>2</sup>C bus specifications [6].

## 2.6 Audio

Audio signal routing can be controlled by the dedicated AT command +USPM (refer to u-blox C200 AT Commands Manual [8]). This command allows setting the audio path mode, composed by the uplink audio path and the downlink audio path. The LISA-C2 series modules provide one analog and one digital audio interface:

- Analog audio interface: a differential analog microphone input (**MIC\_P/MIC\_N**) and a differential analog output (**SPK\_P/SPK\_N**) shared for all downlink analog path modes. The uplink or downlink analog path profiles use the same physical input or output but have different sets of audio parameters (for more details, refer to u-blox C200 AT Commands Manual [8])
- Digital audio interface: a 4-wire digital audio interface, including **PCM\_CLK**, **PCM\_DI**, **PCM\_DO**, **PCM\_SYNC**. This audio path is selected using parameters <main\_uplink> and <main\_downlink > in AT+USPM command (for more details, refer to u-blox C200 AT Commands Manual [8])

For further details about the hardware integration of the audio interface in an application design, refer to the u-blox C200 System Integration Manual [9].

For further details about the possible settings of the audio interface, as well as the allowed input/output audio path combinations and as the default values related to the uplink/downlink path, refer to u-blox C200 AT Commands Manual [8].

## 2.7 GPIO

The LISA-C2 series modules provide 5 pins (**GPIO1**, **GPIO2**, **GPIO3**, **GPIO4** and **GPIO5**) that can be configured for general purpose input or output, or can be configured to provide special functions via u-blox AT commands (for further details, refer to the u-blox C200 System Integration Manual [9] and to the u-blox C200 AT Commands Manual [8]).

Function	Description	Module	Default GPIO	Configurable GPIOs
GPS supply enable	Enable/disable the supply of u-blox GNSS receiver connected to cellular module	LISA-C2 series	GPIO2	--
GPS data ready	Sense when u-blox GNSS receiver connected to cellular module is ready for sending data by the DDC (I <sup>2</sup> C)	LISA-C2 series	GPIO3	--
GPS RTC sharing	RTC (Real Time Clock) synchronization signal to u-blox GNSS receiver connected to cellular module	Future firmware release	GPIO4	--
General purpose input	Input to sense high or low digital level	LISA-C2 series	--	All
General purpose output	Output to set the high or the low digital level	LISA-C2 series	--	All
Network Indication status	Indicates network status: registered home network, registered roaming, voice or data call session, no service.	LISA-C2 series	--	All
Pad disabled	Tri-state with an internal active pull-down enabled	LISA-C2 series	--	All

**Table 3: GPIO functions**



Network indication status for LISA-C200 is supported by versions 04S/24S and successive versions

### 3 Pin Definition

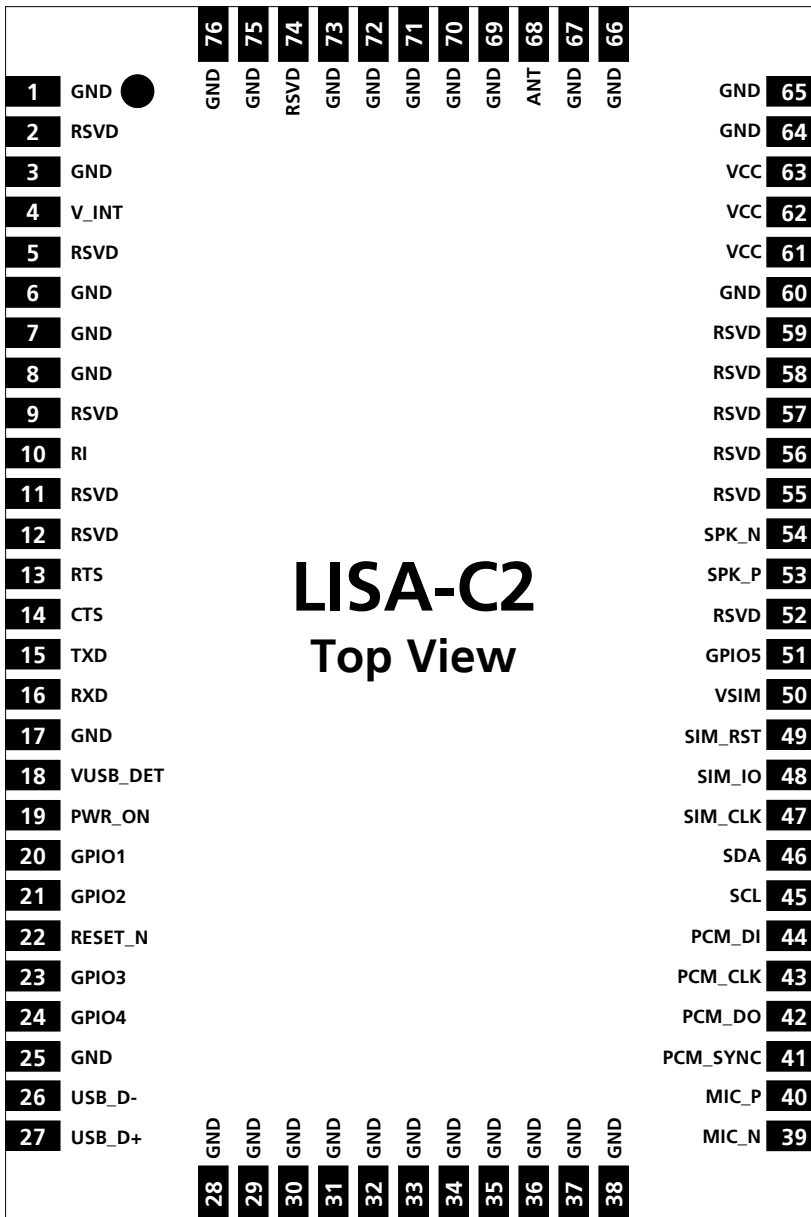


Figure 2: LISA-C2 series pin assignment

No	Name	Power domain	I/O	Description	Remarks
1	GND	-	N/A	Ground	All GND pads must be connected to ground.
2	RSVD	-	N/A	RESERVED pin	Leave unconnected.
3	GND	-	N/A	Ground	All GND pads must be connected to ground.
4	V_INT	-	O	Digital I/O Interfaces supply output	V_INT = 1.8V (typical) generated by the module when it is switched-on and the RESET_N (external reset input pin) is not forced to the low level.
5	RSVD	-	N/A	RESERVED pin	This pin has special function: it must be connected to GND to allow module to work properly.
6	GND	-	N/A	Ground	All GND pads must be connected to ground.
7	GND	-	N/A	Ground	All GND pads must be connected to ground.
8	GND	-	N/A	Ground	All GND pads must be connected to ground.
9	RSVD	-	N/A	RESERVED pin	Leave unconnected.
10	RI	GDI	O	UART ring indicator	4 Circuit 125 (RI) in ITU-T V.24. Output driver class B. PU/PD class a. Value at internal reset: T/PU. See section 5.2.8 for detailed electrical specs.
11	RSVD	-	N/A	RESERVED pin	Leave unconnected.
12	RSVD	-	N/A	RESERVED pin	Leave unconnected.
13	RTS	GDI	I	UART ready to send	Circuit 105 (RTS) in ITU-T V.24. Internal active pull-up to V_INT enabled. See section 5.2.8 for detailed electrical specs.
14	CTS	GDI	O	UART clear to send	Circuit 106 (CTS) in ITU-T V.24. Output driver class A. See section 5.2.8 for detailed electrical specs.
15	TXD	GDI	I	UART transmitted data	Circuit 103 (TxD) in ITU-T V.24. Internal active pull-up to V_INT enabled. See section 5.2.8 for detailed electrical specs.
16	RXD	GDI	O	UART received data	Circuit 104 (RxD) in ITU-T V.24. Output driver class A. See section 5.2.8 for detailed electrical specs.
17	GND	-	N/A	Ground	All GND pads must be connected to ground.
18	VUSB_DET	USB	I	USB detect input	Input for VBUS (5 V typical) USB supply sense. See section 9.1.1 for detailed electrical specs.
19	PWR_ON	POS	I	Power-on input	The PWR_ON pin has Internal pull-up resistor. See section 5.2.5 for detailed electrical specs.
20	GPIO1	GDI	I/O	GPIO	Value at internal reset: T/PD. See section 5.2.8 for detailed electrical specs.
21	GPIO2	GDI	I/O	GPIO	Value at internal reset: T/PD. See section 5.2.8 for detailed electrical specs.
22	RESET_N	ERS	I	External reset input	The RESET_N has Internal pull-up resistor See section 4.2.6 for detailed electrical specs.
23	GPIO3	GDI	I/O	GPIO	Value at internal reset: T/PD. See section 5.2.8 for detailed electrical specs.
24	GPIO4	GDI	I/O	GPIO	Value at internal reset: T/PD. See section 5.2.8 for detailed electrical specs.
25	GND	-	N/A	Ground	All GND pads must be connected to ground.
26	USB_D-	USB	I/O	USB Data Line D-	90 $\Omega$ nominal differential impedance Pull-up or pull-down resistors and external series resistors as required by the USB 2.0 high-speed specification [5] are part of the USB pad driver and need not be provided externally. See section 9.1.1 for detailed electrical specs.

No	Name	Power domain	I/O	Description	Remarks
27	USB_D+	USB	I/O	USB Data Line D+	90 Ω nominal differential impedance Pull-up or pull-down resistors and external series resistors as required by the USB 2.0 high-speed specification [5] are part of the USB pad driver and need not be provided externally. See section 9.1.1 for detailed electrical specs.
28	GND	-	N/A	Ground	All GND pads must be connected to ground.
29	GND	-	N/A	Ground	All GND pads must be connected to ground.
30	GND	-	N/A	Ground	All GND pads must be connected to ground.
31	GND	-	N/A	Ground	All GND pads must be connected to ground.
32	GND	-	N/A	Ground	All GND pads must be connected to ground.
33	GND	-	N/A	Ground	All GND pads must be connected to ground.
34	GND	-	N/A	Ground	All GND pads must be connected to ground.
35	GND	-	N/A	Ground	All GND pads must be connected to ground.
36	GND	-	N/A	Ground	All GND pads must be connected to ground.
37	GND	-	N/A	Ground	All GND pads must be connected to ground.
38	GND	-	N/A	Ground	All GND pads must be connected to ground.
39	MIC_N	AUDIO	I	Differential analog audio input (negative)	Differential analog microphone input Internal DC blocking 0.1 uF capacitor.
40	MIC_P	AUDIO	I	Differential analog audio input (positive)	Differential analog microphone input Internal DC blocking 0.1 uF capacitor.
41	PCM_SYNC	GDI	O	Digital Sync	Digital Audio Sync pulse. See section 4.2.8 for detailed electrical specs.
42	PCM_DO	GDI	O	Data Output	Digital Audio Output. See section 4.2.8 for detailed electrical specs.
43	PCM_CLK	GDI	O	Clock Output	Digital Audio Clock Output. See section 4.2.8 for detailed electrical specs.
44	PCM_DI	GDI	I	Data Input	Digital Audio Input. See section 4.2.8 for detailed electrical specs.
45	SCL	DDC	O	I <sup>2</sup> C bus clock line	Fixed open drain. No internal pull-up. Value at internal reset: T. See section 4.2.10 for detailed electrical specs.
46	SDA	DDC	I/O	I <sup>2</sup> C bus clock line	Fixed open drain. No internal pull-up. Value at internal reset: T. See section 9.1.2 for detailed electrical specs.
47	SIM_CLK	SIM	O	SIM clock	Value at internal reset: L. See section 4.2.7 for detailed electrical specs.
48	SIM_IO	SIM	I/O	SIM data	Internal 10 kΩ pull-up resistor to VSIM. Value at internal reset: L/DP. See section 4.2.7 for detailed electrical specs.
49	SIM_RST	SIM	O	SIM reset	Value at internal reset: L. See section 4.2.7 for detailed electrical specs.
50	VSIM	-	O	SIM supply output	VSIM = 1.80 V typical or 2.85 V typical generated by the module according to the SIM card type. See section 4.2.7 for detailed electrical specs.
51	GPIO5	GDI	I/O	GPIO	Value at internal reset: T/DP. See section 5.2.8 for detailed electrical specs.
52	RSVD	-	N/A	RESERVED pin	Leave unconnected.
53	SPK_P	AUDIO	O	Differential analog audio output (positive)	Differential analog audio output shared for all path modes: earpiece, headset and loudspeaker mode. See section 9.1.2 for detailed electrical specs.
54	SPK_N	AUDIO	O	Differential analog audio output (negative)	Differential analog audio output shared for all path modes: earpiece, headset and loudspeaker mode. See section 9.1.2 for detailed electrical specs.
55	RSVD	RSVD	-	N/A	RESERVED pin
56	RSVD	RSVD	-	N/A	RESERVED pin

No	Name	Power domain	I/O	Description	Remarks
57	RSVD	RSVD	-	N/A	RESERVED pin
58	RSVD	RSVD	-	N/A	RESERVED pin
59	RSVD	RSVD	-	N/A	RESERVED pin
60	GND	GND	-	N/A	Ground
61	VCC	VCC	-	I	Module supply input
62	VCC	VCC	-	I	Module supply input
63	VCC	VCC	-	I	Module supply input
64	GND	GND	-	N/A	Ground
65	GND	GND	-	N/A	Ground
66	GND	GND	-	N/A	Ground
67	GND	GND	-	N/A	Ground
68	ANT	ANT	-	I/O	RF antenna
69	GND	GND	-	N/A	Ground
70	GND	GND	-	N/A	Ground
71	GND	GND	-	N/A	Ground
72	GND	GND	-	N/A	Ground
73	GND	GND	-	N/A	Ground
74	RSVD	RSVD	-	N/A	RESERVED pin
75	GND	GND	-	N/A	Ground
76	GND	GND	-	N/A	Ground

**Table 4: LISA-C200 Pinout**


Pins designated “RESERVED” should be left open.



For more information about the pinout, see u-blox C-200 System Integration Manual [9].



See Appendix A for an explanation of abbreviations and terms used.

## 5 Electrical specifications

**Stressing the device above one or more of the ratings listed in the Absolute Maximum Rating section may cause permanent damage. These are stress ratings only. Operating the module at these or at any conditions other than those specified in the Operating Conditions sections (chapter 5.2) of the specification should be avoided. Exposure to Absolute Maximum Rating conditions for extended periods may affect device reliability.**

Operating condition ranges define those limits within which the functionality of the device is guaranteed.

Where application information is given, it is advisory only and does not form part of the specification.

### 5.1 Absolute maximum rating

Limiting values given below are in accordance with the Absolute Maximum Rating System (IEC 134).

Symbol	Description	Condition	Min.	Max.	Unit
VCC	Module supply voltage	Input DC voltage at VCC pin	-0.30	5.00	V
ICC	Module supply current	Input DC current at VCC pin		0.80	A
VUSB_DET	USB detection pin	Input DC voltage at VUSB_DET	-0.30	5.35	V
USB	USB D+/D- pins	Input DC voltage at USB_D+ and USB_D-	-1.00	5.35	V
GDI	Generic digital interfaces	Input DC voltage at Generic digital interfaces pins	-0.30	2.10	V
ERS	External reset signal	Input DC voltage at External reset signal pin	-0.30	2.50	V
POS	Power-on input	Input DC voltage at Power-on signal pin	-0.30	4.70	V
ANT	Antenna power	Input RF power at ANT pin		10	dBm
Rho_ANT	Antenna ruggedness	Output RF load mismatch ruggedness at ANT pin		10:1	VSWR
Tstg	Storage Temperature		-40	90	°C

Table 5: Absolute maximum ratings

**The product is not protected against overvoltage or reversed voltages. If necessary, voltage spikes exceeding the power supply voltage specification, given in table above, must be limited to values within the specified boundaries by using appropriate protection devices.**

### 5.2 Operating conditions

Unless otherwise indicated, all operating condition specifications are at an ambient temperature of 25°C.

**Operation beyond the operating conditions is not recommended and extended exposure beyond them may affect device reliability.**

#### 5.2.1 Operating temperature range

Parameter	Min.	Typ.	Max.	Unit	Remarks
Normal operating temperature	-20		+65	°C	Normal operating temperature range (fully CDMA Specification Compliant).
Extended operating temperature	-30		+85	°C	Extended operating temperature range (not fully CDMA Specification Compliant).

Table 6: LISA-C2 series environmental conditions



## 5.2.2 Supply/Power pins

Symbol	Parameter	Min.	Typ.	Max.	Unit
VCC	Module supply input voltage	3.40	3.80	4.20	V
ICC	Module supply peak current consumption: peak of current consumption through the VCC pad during Tx Max Pout, at VCC = 3.6 V, conducted 50 ohm impedance.		0.60	0.80	A

**Table 7: Input characteristics of Supply/Power pins**

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_INT	Digital I/O Interfaces supply output voltage	1.76	1.80	1.84	V
I_INT	Digital I/O Interfaces supply output current capability			50	mA

**Table 8: Output characteristics of Supply/Power pins**

## 5.2.3 Power consumption

Table 9 reports power consumption of LISA-C200 module.

Mode	Power Consumption
Power Off	<20 $\mu$ A
Idle Mode (UART and USB)	< 2 mA
Active Mode (UART and USB)	<17 mA
Active Mode - RX enabled (UART and USB)	<70 mA
Connected mode Maximum Tx power (24.5 dBm typ.)	<750 mA

**Table 9: LISA-C200 Power consumption**

## 5.2.4 RF Performance

Parameter	Module		Min.	Max.	Unit	Remarks
Frequency range CDMA 800	LISA-C200	Uplink	824	849	MHz	Module transmit
	LISA-C200	Downlink	869	894	MHz	Module receive
Frequency range CDMA 1900	LISA-C200	Uplink	1850	1910	MHz	Module transmit
	LISA-C200	Downlink	1930	1990	MHz	Module receive

**Table 10: Operating RF frequency bands**

Parameter	Module	Min.	Typ.	Max.	Unit	Remarks
Receiver input sensitivity CDMA 800 MHz	LISA-C200	-106	-107		dBm	Forward link RF level @ FER < 0.5 %
Receiver input sensitivity CDMA 1900 MHz	LISA-C200	-106	-107		dBm	Forward link RF level @ FER < 0.5 %

Condition: 50  $\Omega$  source

**Table 11: Receiver sensitivity performance**

Parameter	Module	Min.	Typ.	Max.	Unit	Remarks
Maximum output power CDMA 800/1900 MHz, ver. 0xS	LISA-C200	24.0	24.5	-	dBm	
Maximum output power CDMA 800/1900 MHz, ver. 2xS	LISA-C200	23.0	23.5	-	dBm	

Condition: 50  $\Omega$  output load

**Table 12: Transmitter maximum output power**

### 5.2.5 PWR\_ON pin

Pin Name	Parameter	Min.	Typ.	Max.	Unit	Remarks
PWR_ON	Internal supply for Power-On Input Signal		1.8		V	
	L-level input	-0.30		0.30	V	180 k $\Omega$ internal pull up resistor
	H-level input	2.00		4.70	V	180 k $\Omega$ internal pull up resistor
	L-level input current		-10		$\mu$ A	
	Minimal low time	300			ms	required to perform a proper PWR_ON

**Table 13: PWR\_ON pin characteristics**

### 5.2.6 RESET\_N pin

Pin Name	Parameter	Min.	Typ.	Max.	Unit	Remarks
RESET_N	Internal supply for External Reset Input Signal		1.80		V	
	L-level input	-0.30		0.63	V	550 $\Omega$ internal pull up resistor
	H-level input			2.10	V	550 $\Omega$ internal pull up resistor
	L-level input current		-3.3		mA	At 0 V
	Minimal low time	300			ms	required to perform a proper reset

**Table 14: RESET\_N pin characteristics (ERS domain)**

### 5.2.7 SIM pins

The SIM pins are a dedicated interface to the SIM chip card/IC. The electrical characteristics fulfill regulatory specification requirements. The values in Table 15 are for information only.

Parameter	Min.	Typ.	Max.	Unit	Remarks
Low-level input	0.00		0.63	V	VSIM = 1.80 V
	0.00		1.0	V	VSIM = 2.85 V
High-level input	1.17		2.10	V	VSIM = 1.80 V
	1.85		3.15	V	VSIM = 2.85 V
Low-level output		0.00	0.45	V	VSIM = 1.80 V, Max value at $I_{OL} = +10$ mA
		0.00	0.20	V	VSIM = 2.85 V, Max value at $I_{OL} = +10$ mA
High-level output	1.35	1.80	2.10	V	VSIM = 1.80 V, Min value at $I_{OH} = -10$ mA
	2.40	2.85	3.15	V	VSIM = 2.85 V, Min value at $I_{OH} = -10$ mA
Input/Output leakage current			0.7	$\mu$ A	$0.2$ V < $V_{IN}$ < 3.3 V
Internal pull-up resistor on SIM_IO to VSIM		10		k $\Omega$	
Clock frequency on SIM_CLK				MHz	UART CLOCK or UART CLOCK divide by 2

**Table 15: SIM pins characteristics (SIM domain)**

## 5.2.8 Generic Digital Interfaces pins

Parameter	Min.	Typ.	Max.	Unit	Remarks
Internal supply for GDI domain	1.77	1.80	1.83	V	
Input characteristic: L-level input	-0.20		0.63	V	
Input characteristic: H-level input	1.17		1.97	V	
Output characteristics: L-level output	0.00	0.00	0.45	V	6 I = 4 mA; Class A 7 I = 6 mA; Class B
Output characteristics: H-level output	1.35	1.80	1.83	V	8 I = -4 mA; Class A 9 I = 6 mA; Class B
				V	
Input/Output leakage current			0.7	μA	
Pull-up input current	-30		-3	μA	
Pull-down input current	3		30	μA	

**Table 16: Generic Digital Interfaces pins characteristics (GDI domain)**

### 9.1.1 USB pins

USB data lines (**USB\_D+** and **USB\_D-**) are compliant to the USB 2.0 high-speed specification. Refer to the Universal Serial Bus Revision 2.0 specification [10] for detailed electrical characteristics.

Parameter	Min.	Typ.	Max.	Unit	Remarks
USB detection voltage on pin VUSB_DET	4.40	5.00	5.25	V	
Current sink at VUSB_DET		150		μA	
High-speed squelch detection threshold (input differential signal amplitude)	100		150	mV	
High speed disconnect detection threshold (input differential signal amplitude)	525		625	mV	
High-speed data signaling input common mode voltage range	-50		500	mV	
High-speed idle output level	-10		10	mV	
High-speed data signaling output high level	360		440	mV	
High-speed data signaling output low level	-10		10	mV	
Chirp J level (output differential voltage)	700		1100	mV	
Chirp K level (output differential voltage)	-900		-500	mV	

**Table 17: USB pins characteristics**

### 9.1.2 DDC (I<sup>2</sup>C) pins

DDC (I<sup>2</sup>C) lines (**SCL** and **SDA**) are compliant to the I<sup>2</sup>C-bus standard mode specification. Refer to the I<sup>2</sup>C-Bus Specification Version 2.1 [6] for detailed electrical characteristics.

Parameter	Min.	Typ.	Max.	Unit	Remarks
Internal supply for DDC domain	1.73	1.80	1.87	V	Digital I/O Interfaces supply (V_INT)
L-level input	-0.20		0.35	V	
H-level input	1.31		1.93	V	
L-level output		0.00	0.35	V	Max value at I <sub>OL</sub> = +1.0 mA
Input/Output leakage current			0.7	μA	0.2 V < V <sub>IN</sub> < 1.93 V
Clock frequency on SCL		100		kHz	

**Table 18: DDC (I<sup>2</sup>C) pins characteristics (DDC domain)**



DDC interface is exclusively used to control an external u-blox GNSS receiver.



The LISA-C200 supports the DDC interface in versions 03S/23S and successive versions.

### 9.1.3 Audio pins

Pin Name	Parameter	Min.	Typ.	Max.	Unit	Remarks
MIC_P/MIC_N	Differential input voltage	0.89	1.00	1.12	Vrms	Full scale differential voltage, Gain stage = 0dB
	Differential input resistance	16	20	24	kΩ	
	Input coupling capacitance		100		nF	Internal DC blocking capacitor at MIC_P and MIC_N pins
	Signal to noise	73			dB	Gain stage = 0 dB, Codec Gain = 0 dB, Fs=8 and 16 KHz, A-weighted
	THD+N ratio, 24 dB gain, high level output			0.3	%	24 dB analog gain, 0 dB codec Tx gain, f= 200-(0.45* Fs/2) Hz, Fs = 8 or 16 kHz, output = -1 dBFS
	Power supply rejection	65			dB	0<f<20 kHz

If not specified otherwise, all parameters are measured with a bandwidth of 20 Hz,..., 20 kHz.

**Table 19: Differential audio transmit path (MIC\_P, MIC\_N) input characteristics**

Pin Name	Parameter	Min.	Typ.	Max.	Unit	Remarks
SPK_P/SPK_N	Maximum Power		35		mW	Full scale +3 dBm0 sine wave Load = 32 Ω
	Common mode output voltage		1.25		V	
	Output load resistance		32		Ω	
	Single-ended output load capacitance			250	pF	
	Signal to noise	79			dB	Load = 32 Ω, Ratio of full-scale output to output noise level, Min = 20 log (1.11/120 micro Vrms)
	THD+N ratio			4	%	Load = 32 Ω, f= 498 Hz, 0 dBFS, 22 to 20 kHz measurement BW

If not specified otherwise, all parameters are measured with a bandwidth of 20 Hz,..., 20 kHz.

**Table 20: Differential audio receive path (SPK\_P, SPK\_N) output characteristics**

### 9.1.4 Primary PCM interface (2.048 MHz PCM clock speed)

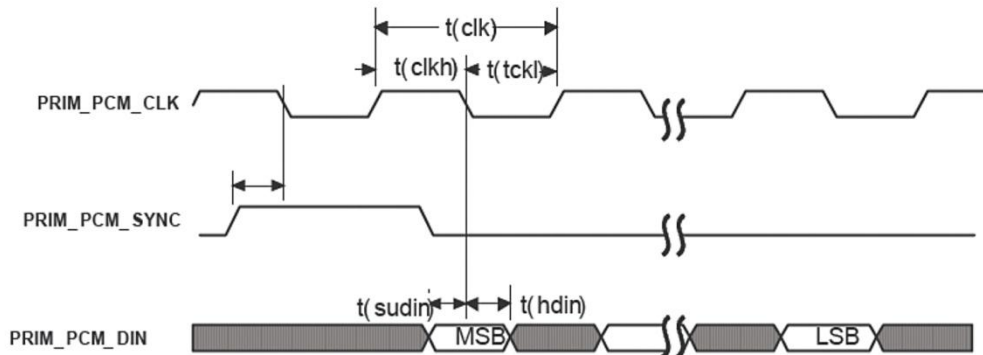


Figure 3: PRIM\_PCM\_CODEEC timing (input)

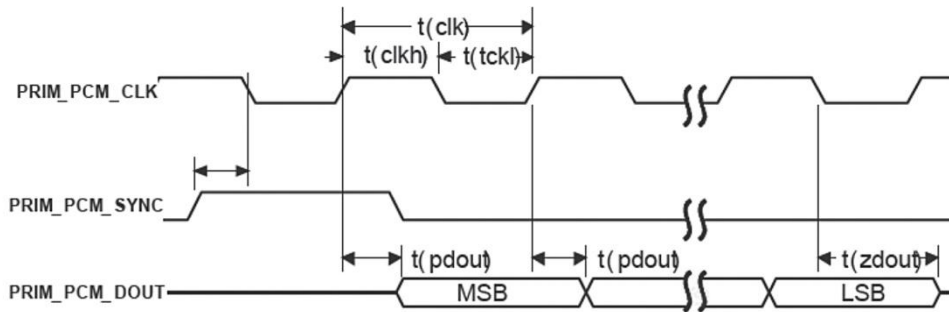


Figure 4: PRIM\_PCM\_CODEEC timing (output)

Parameter	Description	Min	Typical	Max	Units
t(sync)	PCM_SYNC cycle time		125		µs
t(synca)	PCM_SYNC asserted time	400	500		ns
t(syncd)	PCM_SYNC de-asserted time		124.5		µs
t(clk)	PCM_CLK cycle time		488		ns
t(clkh)	PCM_CLK high time		244		ns
t(clkl)	PCM_CLK low time		244		ns
t(susync)	PCM_SYNC setup time high before falling edge of PCM_CLK	60			ns
t(hsync)	PCM_SYNC hold time after falling edge of PCM_CLK	60			ns
t(sudin)	PCM_DIN setup time before falling edge of PCM_CLK	50			ns
t(hdin)	PCM_DIN hold time after falling edge of PCM_CLK	10			ns
t(pdout)	Delay from PCM_CLK rising to PCM_DOUT valid			350	ns
t(zdout)	Delay from PCM_CLK falling to PCM_DOUT HIGH-Z		160		ns

Table 21: PRIM\_PCM\_CODEEC timing parameters

### 9.1.5 Aux PCM interface (128 KHz PCM clock speed)

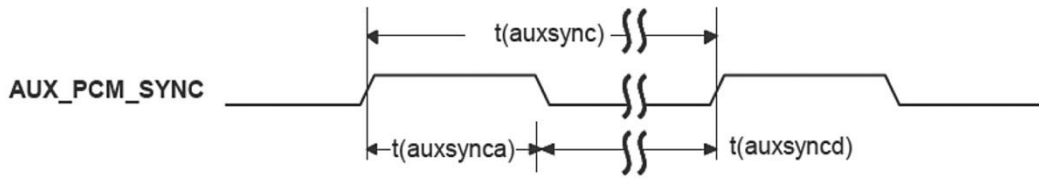


Figure 5: AUX\_PCM\_SYNC timing

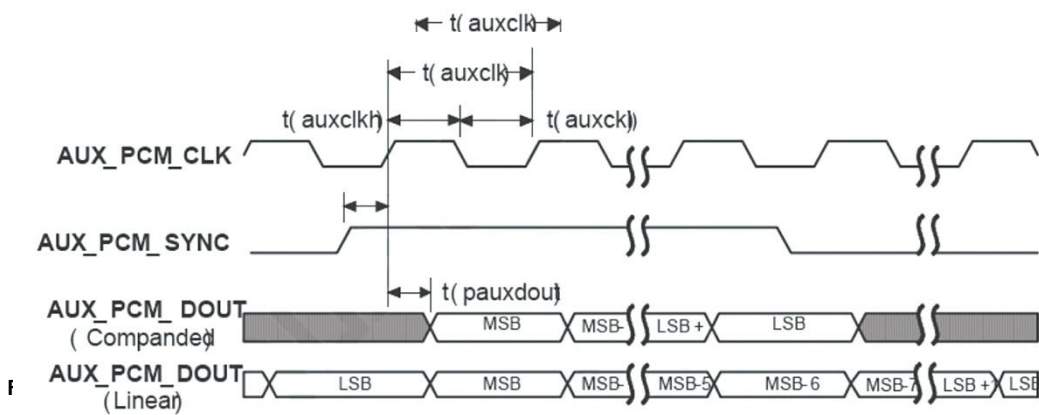
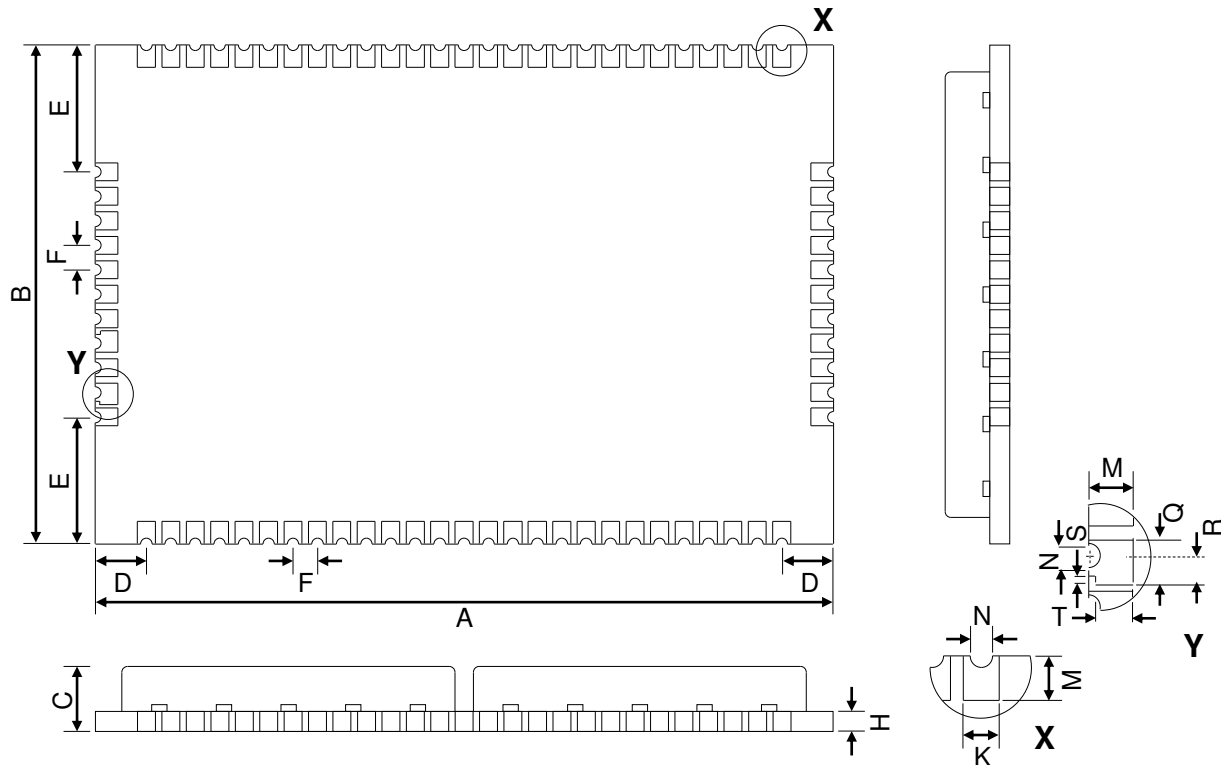


Figure 7: AUX\_PCM\_CODEEC timing (output)

Parameter	Description	Min	Typical	Max	Units
t(auxsync)	9.1.5.1.1.1 AUX_PCM_SYNC cycle time		125		μs
t(auxsynca)	AUX_PCM_SYNC asserted time	62.4	62.5		μs
t(auxsyncd)	AUX_PCM_SYNC de-asserted time	62.4	62.5		μs
t(auxclk)	AUX_PCM_CLK cycle time		7.8		μs
t(auxclkh)	AUX_PCM_CLK high time	3.8	3.9		μs
t(auxckl)	AUX_PCM_CLK low time	3.8	3.9		μs
t(auxsusync)	AUX_PCM_SYNC setup time high before AUX_PCM_CLK falling edge	1.95			μs
t(auxhsync)	AUX_PCM_SYNC hold time after AUX_PCM_CLK falling edge	1.95			μs
t(auxsudin)	AUX_PCM_DIN setup time before AUX_PCM_CLK falling edge	70			ns
t(auxhdin)	AUX_PCM_DIN hold time after AUX_PCM_CLK falling edge	20			ns
t(auxpdout)	Delay from AUX_PCM_CLK rising to AUX_PCM_DOUT valid			50	ns

**Table 22: AUX\_CODEC timing parameters**

# 10 Mechanical specifications



Note: There are two asymmetric GND pads that have the same dimensions but are mirror patterns of each other. One of these pads is shown in depiction Y.

**Figure 8: Dimensions (LISA-C2 series bottom and sides views)**

Param.	Description	Min.		Typ.		Max.	
A	Height (mm)	32.9	[1295 mil]	33.2	[1307 mil]	33.5	[1317 mil]
B	Width (mm)	22.1	[870 mil]	22.4	[882 mil]	22.5	[886 mil]
C	Total Thickness (mm)	-	-	2.70	[106 mil]	2.80	[110 mil]
D	Horizontal Edge to Pin Pitch (mm)	2.20	[86.6 mil]	2.30	[90.6 mil]	2.40	[94.5 mil]
E	Vertical Edge to Pin Pitch (mm)	5.60	[221 mil]	5.70	[224 mil]	5.80	[228 mil]
F	Pin to Pin Pitch (mm)	1.05	[39.4 mil]	1.10	[43.3 mil]	1.15	[45.3 mil]
K	Pad width (mm)	0.65	[25.6 mil]	0.80	[31.4 mil]	0.95	[37.4 mil]
M	Pad height (mm)	0.75	[39.5 mil]	1.00	[39.3 mil]	1.25	[49.2 mil]
N	Pad half-moon diameter (mm)	0.40	[15.7 mil]	0.50	[19.6 mil]	0.60	[23.6 mil]
Q	Asymmetric GND pad width(mm)	0.85	[33.5 mil]	1.00	[39.3 mil]	1.15	[45.3 mil]
R	Asymmetric GND pad edge with corner cut to half-moon center(mm)	0.50	[19.7 mil]	0.60	[23.6 mil]	0.70	[27.6 mil]
S	Asymmetric GND pad corner cut segment (mm)	0.15	[5.91 mil]	0.20	[7.87 mil]	0.25	[9.84 mil]
T	Asymmetric GND pad edge length without corner cut segment	0.65	[25.6 mil]	0.80	[31.4 mil]	0.95	[37.4 mil]
Weight	(g)						< 8

**Note:** values in mil in square brackets were calculated from the measure in mm. Approximation to first decimal value has been applied.

**Table 23: Dimensions**



# 11 Approvals

## 11.1 Approvals



Products marked with this lead-free symbol on the product label comply with the "Directive 2002/95/EC of the European Parliament and the Council on the Restriction of Use of certain Hazardous Substances in Electrical and Electronic Equipment" (RoHS).

LISA-C2 series modules are RoHS compliant.

No natural rubbers, hygroscopic materials, or materials containing asbestos are employed.

LISA-C2 series modules are approved under the schemes reported in Table 24.

Country	Scope	ID
US	FCC	R5Q-LISAC200A
Canada	Industry Canada (IC)	8595B-LISAC200A
US	Verizon operator approval	
US	Sprint operator approval	
US	Aeris operator approval	
US	US Cellular operator approval	

**Table 24: LISA-C2 series certification approvals**

For more details on all country certification and network operators, refer to our website [www.u-blox.com](http://www.u-blox.com).

## 12 Product handling & soldering

### 12.1 Packaging

LISA-C2 series modules are delivered as hermetically sealed, reeled tapes to enable efficient production, production lot set-up and tear-down.



Figure 9: Reeled LISA-C2 series modules

#### 12.1.1 Reels

LISA-C2 series modules are deliverable in quantities of 250 pieces per reel. The reel dimensions are shown in Figure 10.

series



Quantities of less than 250 pieces are also available. Contact u-blox for more information.



Figure 10: Dimension of reel for 250 pieces (dimensions in mm)

### 12.1.2 Tapes

Figure 11 shows the position and orientation of LISA-C2 series modules as they are delivered on tape. The dimensions of the tapes are specified in Figure 12.

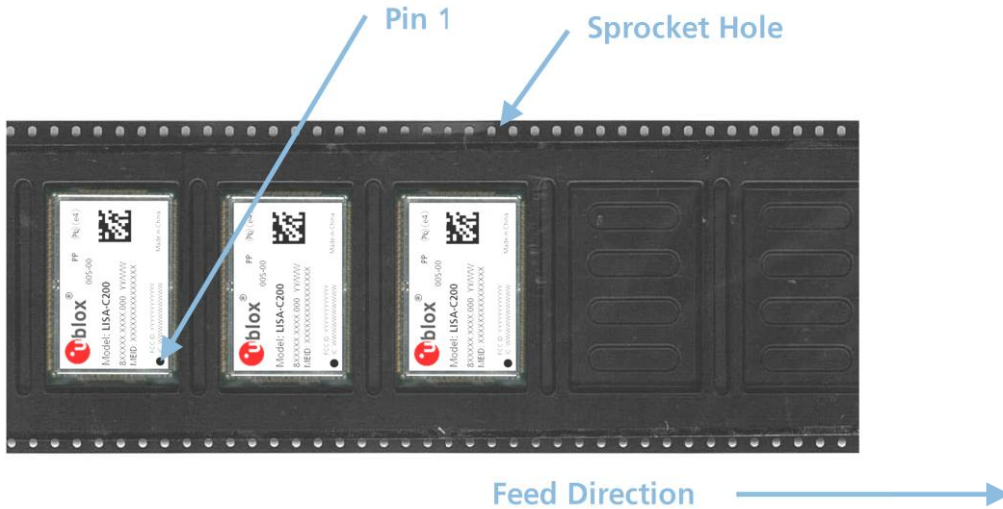


Figure 11: Orientation for LISA-C2 series modules on tape. (LISA-C200 shown)

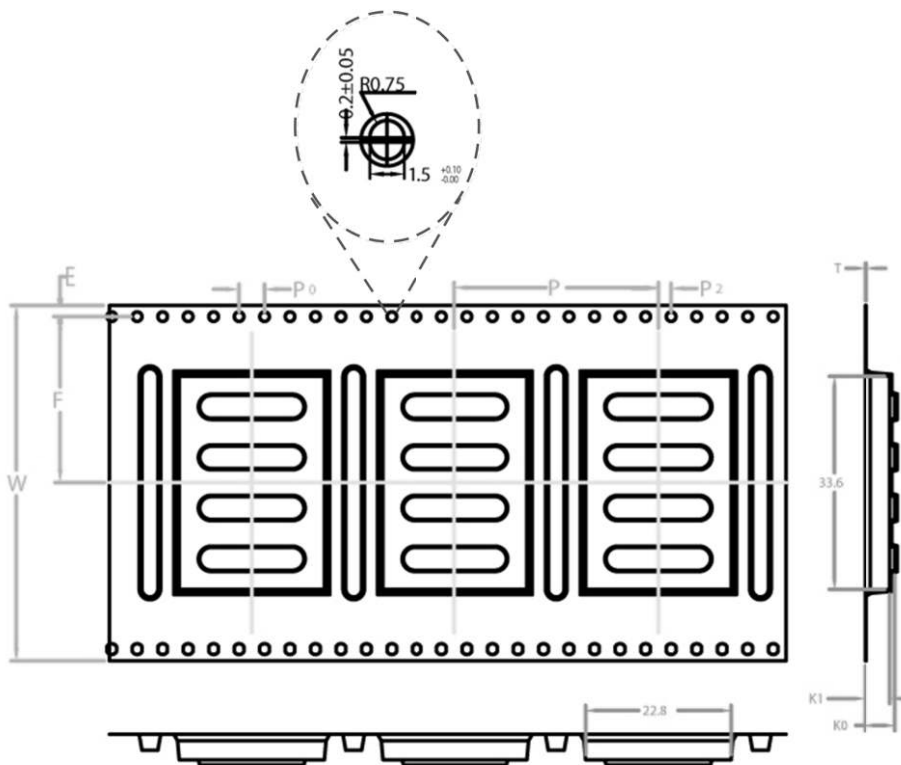


Figure 12: LISA-C2 series modules tape. Dimensions in mm (See also Table 25)


Parameter	Specification (mm)
E	1.75 ± 0.10
F	26.2 ± 0.15
K0	4.80 ± 0.10
K1	4.00 ± 0.10
P	32.0 ± 0.10
P0	4.00 ± 0.10
P2	2.00 ± 0.15
W	56.0 ± 0.30

**Table 25: LISA-C2 series tape dimensions (mm)**

## 12.2 Moisture Sensitivity Levels

 **LISA-C2 series modules are Moisture Sensitive Devices (MSD) in accordance to the IPC/JEDEC specification.**

The Moisture Sensitivity Level (MSL) relates to the packaging and handling precautions required. LISA-C2 series modules are rated at MSL level 4. For more information regarding moisture sensitivity levels, labeling, storage and drying see the u-blox Package Information Guide [10].

 For MSL standard see IPC/JEDEC J-STD-020 (can be downloaded from [www.jedec.org](http://www.jedec.org)).

## 12.3 Reflow soldering

Reflow profiles are to be selected according to u-blox recommendations (see u-blox C-200 System Integration Manual [9]).

 **Failure to observe these recommendations can result in severe damage to the device!**


## 12.4 ESD precautions

LISA-C2 series modules are Electrostatic Sensitive Devices (ESD) and require special ESD precautions typically applied to ESD sensitive components.

Proper ESD handling and packaging procedures must be applied throughout the processing, handling and operation of any application that incorporates LISA-C2 series module.

ESD precautions should be implemented on the application board where the module is mounted, as described in the u-blox C-200 System Integration Manual [9].

 **Failure to observe these precautions can result in severe damage to the device!**

 Refer to the u-blox C-200 AT Commands Manual [6] and to the u-blox C-200 System Integration Manual [9] for information about further settings.

# 13 Labeling and ordering information

## 13.1 Product labeling

The label on u-blox modules includes important product information. The location of the product type number is shown in Figure 13.



Figure 13: Location of product type number on LISA-C2 series module label

## 13.2 Explanation of codes

Three different product code formats are used. The **Product Name** is used in documentation such as this data sheet and identifies all u-blox products, independent of packaging and quality grade. The **Ordering Code** includes options and quality, while the **Type Number** includes the hardware and firmware versions. Table 26 shows the structure of these three different formats.

Format	Structure
Product Name	LISA-CDVG
Ordering Code	LISA-CDVG-TTQ
Type Number	LISA-CDVG-TTQ-XX

Table 26: Product Code Formats

The parts of the product code are explained in Table 27.

Code	Meaning	Example
C	Cellular standard (i.e. G: GSM; E: EDGE; W: WEDGE; H: HSDPA; U: HSUPA, P:HSPA+; L: LTE; C: CDMA 1xRTT, D: EV-DO)	C: CDMA 1xRTT
D	Generation, e.g. chip or function set; range[0...9]	2
V	Variant based on the same cellular chip range: [0...9]	
G	GNSS generation (if GNSS functionality available)	6 = u-blox 6, 0: no GNSS functionality
TT	Major product version	0
Q	Quality grade/production site <ul style="list-style-type: none"> <li>• S = standard</li> <li>• A = automotive</li> </ul>	S
XX	Minor product version (not relevant for certification)	Default value is 00

**Table 27: Part identification code**

### 13.3 Ordering information

Ordering No.	Product
LISA-C200-02S	1xRTT module, 800/1900 MHz, voice + data, Sprint / Aeris feature set
LISA-C200-22S	1xRTT module, 800/1900 MHz, voice + data, Verizon feature set
LISA-C200-03S	1xRTT module, 800/1900 MHz, voice + data, Sprint / Aeris feature set
LISA-C200-23S	1xRTT module, 800/1900 MHz, voice + data, Verizon feature set
LISA-C200-03S	1xRTT module, 800/1900 MHz, voice + data, Sprint / Aeris feature set
LISA-C200-24S	1xRTT module, 800/1900 MHz, voice + data, Verizon / US Cellular feature set
LISA-C200-04S	1xRTT module, 800/1900 MHz, voice + data, Sprint / Aeris feature set

**Table 28: Product ordering codes**

# Appendix

## A Glossary

Name	Definition
AUDIO	Audio Pins (power domain)
DDC	DDC (Display Data Channel) Interface (power domain)
Driver Class	Output Driver Class: see Table 16 for definition
HSS	Hardware Shutdown Signal (power domain)
ESD	Electrostatic Discharge
GDI	Generic Digital Interfaces (power domain)
H	High
HBM	Human Body Model
I	Input (means that this is an input port for LISA-C200)
FFS	Local File System
L	Low
LCC	Leadless Chip Carrier
N/A	Not Applicable (used in the I/O field of pinout)
NC	Do not connect
O	Output (means that this is an output port of LISA-C200)
PD	Pull-Down
POS	Power-On Input (power domain)
PU	Pull-Up
PU/PD Class	Pull Class: see Table 16 for definition
SIM	SIM Interface (power domain)
T	Tristate
TBF	Temporary Block Flow
USB	Universal Serial Bus (power domain)

**Table 29: Explanation of abbreviations and terms used**

## Related documents

- [1] IS-707.3 - Data Service Option for Wideband Spread Spectrum Systems
- [2] 3GPP TS 27.010 V3.4.0 - Terminal Equipment to User Equipment (TE-UE) multiplexer protocol (Release 1999)
- [3] 3GPP TS 27.007 V3.13.0 - AT command set for User Equipment (UE) (Release 1999)
- [4] 3GPP TS 27.005 V3.2.0 (2002-06) - Use of Data Terminal Equipment - Data Circuit terminating; Equipment (DTE - DCE) interface for Short Message Service (SMS) and Cell Broadcast Service (CBS) (Release 1999)
- [5] Universal Serial Bus Revision 2.0 specification, <http://www.usb.org/developers/docs/>
- [6] I2C-Bus Specification Version 2.1 Philips Semiconductors (January 2000), [http://www.nxp.com/acrobat\\_download/literature/9398/39340011\\_21.pdf](http://www.nxp.com/acrobat_download/literature/9398/39340011_21.pdf)
- [7] ITU-T Recommendation V24, 02-2000. List of definitions for interchange circuits between Data Terminal Equipment (DTE) and Data Connection Equipment (DCE)
- [8] u-blox C200 AT Commands Manual, Docu. No UBX-13000621
- [9] u-blox C200 System Integration Manual, Docu. No UBX-13000620
- [10] u-blox Package Information Guide, Docu. No UBX-14001652
- [11] GPS Implementation Application Note, Docu No GSM.G1-CS-09007



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## Revision history

Revision	Date	Name	Status / Comments
-	13-Jan-2012	rcam	Initial release
1	07-Mar-2012	smoi	Minor corrections
2	23-May-2012	smoi	Updated product naming
3	09-Jul-2012	rcam	Updated SIM nomenclature & document status
4	06-Aug-2012	smoi	Electrical specification updated; Software features section added; Tape & reel information updated; Update to Early Production Information status
5	20-Feb-2013	rcam	New sections about PCM interfaces; Output RF level section (clause 4.2.4) updated to reflect the Sprint and Verizon RF power requirements Last revision with old document number CDMA-2X-11001.
6	11-Jun-2013	rcam	GNSS subject matter. DDC interface. Applicability to 02S-01/22S-01 and successive versions. Updated formatting to follow u-blox standards.
R08	31-Jan-2014	rcam	Updated Vcc Input values.
R09	25-Feb-2014	clee	Updated PWR_ON pin "Minimal low time" from 150 ms to 300 ms in section 5.2.5
R10	09-Apr-2014	pafe	Update to Production Information document status
R11	02-Oct-2014	clee	Updated info for 04S / 24S: Network indication status, CellLocate™ and Hybrid positioning, Audio Playback, US Cellular profile. Last revision with old document number CDMA-2X-11001.
R12	09-Jan-2015	clee	Added LISA-C210. Document status changed to Objective Specification.
R13	11-May-2016	pafe	Added LISA-C200-05S. Document status changed to Early Production Information.
R14	04-Nov-2016	clee	Updated 05S FW ver to E0.S.08.00.02R; Added LISA-C200-25S. Updated Mechanical Specifications to include asymmetric GND pads.
R15	16-Aug-2017	smoi	Removed LISA-C210 and LISA-C200 versions 05S and 25S

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