SARA-U2 series

HSPA modules with 2G fallback
Data sheet

Abstract

Technical data sheet describing the SARA-U2 series HSPA cellular modules. These modules are a complete and cost-efficient 3.75G solution offering up to five-band high-speed HSPA and up to quad-band GSM/EGPRS voice and/or data transmission technology in a compact form factor.

Document information

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Functional sample	Draft	For functional testing. Revised and supplementary data will be published later.
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Engineering sample	Advance information	Data based on early testing. Revised and supplementary data will be published later.
Initial production	Early production information	Data from product verification. Revised and supplementary data may be published later.
Mass production / End of life	Production information	Document contains the final product specification.

This document applies to the following products:

Product name	Type number	Modem version	Application version	PCN reference	Product status
SARA-U201	SARA-U201-03B-00	23.60	A01.01	UBX-20009160	Mass production
	SARA-U201-63B-00	23.62	A01.01	UBX-17053345	Obsolete
	SARA-U201-63B-01	23.63	A01.02	UBX-18005738	Obsolete
	SARA-U201-63B-02	23.63	A01.03	UBX-20009160	Mass production
	SARA-U201-04B-00	23.60	A01.06	UBX-20009160	Mass production
SARA-U201 ATEX	SARA-U201-03X-00	23.60	A01.01	UBX-20009160	Mass production
	SARA-U201-04X-00	23.60	A01.06	UBX-20009160	Mass production
SARA-U260	SARA-U260-00S-01	23.20	A01.01	UBX-15013844	Obsolete
	SARA-U260-00S-02	23.20	A01.02	UBX-17061316	End of life
	SARA-U260-03S-00	23.41	A01.01	UBX-15020745	Obsolete
	SARA-U260-03S-01	23.41	A01.02	UBX-17061316	End of life
SARA-U270	SARA-U270-00S-01	23.20	A01.01	UBX-16006754	Obsolete
	SARA-U270-00S-02	23.20	A01.02	UBX-17061316	End of life
	SARA-U270-03S-00	23.41	A01.01	UBX-15020745	Obsolete
	SARA-U270-03S-01	23.41	A01.02	UBX-17061316	End of life
	SARA-U270-04B-00	23.41	A01.03	UBX-19000858	End of life
	SARA-U270-73S-00	23.41	A01.02	UBX-16028821	Obsolete
	SARA-U270-73S-01	23.41	A01.03	UBX-17061316	End of life
	SARA-U270-53S-00	23.41	A01.03	UBX-16008757	Obsolete
	SARA-U270-53S-01	23.41	A01.04	UBX-17011151	Obsolete
	SARA-U270-53S-02	23.41	A01.05	UBX-17061316	End of life
SARA-U270 ATEX	SARA-U270-00X-00	23.20	A01.00	UBX-14015739	Obsolete
	SARA-U270-00X-01	23.20	A01.02	UBX-17061316	End of life
SARA-U280	SARA-U280-00S-00	23.28	A01.00	UBX-15013708	Obsolete
	SARA-U280-00S-01	23.28	A01.01	UBX-17061316	End of life
	SARA-U280-03S-00	23.41	A01.01	UBX-15020745	Obsolete
	SARA-U280-03S-01	23.41	A01.02	UBX-17061316	End of life

Contents

1 Functional description

1.1 Overview

The SARA-U2 series modules are a 3.75G UMTS/HSPA solution with GSM/(E)GPRS fall-back in the miniature (26.0 x 16.0 mm, 96-pin) SARA LGA form factor that allows seamless drop-in migration from / to other u-blox cellular modules families. SARA-U2 modules feature HSPA data-rates of 7.2 Mbit/s (downlink) and 5.76 Mbit/s (uplink). The modules offer data and voice communication over an extended operating temperature range of -40 °C to +85 °C, with low power consumption and a rich feature set including dual-stack IPv4 / IPv6.

The SARA-U2 series includes variants supporting band combinations for worldwide operation, for operation in North America, Europe, Asia and other countries. A cost-saving UMTS-only variant is also available.

SARA-U2 modules are complete, fully qualified and certified solutions, which reduce costs and enable short time to market. They are ideally suited to M2M applications such as: mobile internet terminals, 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. SARA-U2 modules support full access to u-blox GNSS receivers via serial port. Thus any host processor connected to the cellular module through a single serial port can control both the cellular module and the positioning chip/module. The compact SARA 26.0 x 16.0 mm form factor with LGA pads (functionally referred to as "pins") allows fully automated assembly with standard pick & place and reflow soldering equipment for cost-efficient, high-volume production.

1.2 Product features

Model	HSUPA [Mbit/s]	HSDPA [Mbit/s]	UMTS / HSPA [MHz]	GSM / (E)GPRS [MHz]	UART	USB 2.0	DDC (I2C)	GPIO	Analog audio	Digital audio	Network indication	Antenna supervisor	Jamming detection	Embedded TCP/UDP	Embedded HTTP, FTP	Embedded SSL / TLS	GNSS via modem	AssistNow Software	CellLocate®	FW update via serial	FOTA	eCall / ERA-GLONASS	ODIS	Dual stack IPv4 / IPv6	Standard	Professional	Automotive
	UMTS		**Bands**		**Interfaces**				**Audio**		**Features**														**Grade**		
SARA-U201	5.76	7.2	800/850/900 1900/2100	850/900 1800/1900	2[1]	1	1	9	1		•	•	•	•	•	•	•	•	•	•	•[1]	•	•	•	•		
SARA-U201 ATEX	5.76	7.2	800/850/900 1900/2100	850/900 1800/1900	2[1]	1	1	9	1		•	•	•	•	•	•	•	•	•	•	•[1]	•	•	•	•		
SARA-U260	5.76	7.2	850/1900	850/1900	1	1	1	9	1		•	•	•	•	•	•	•	•	•	•				•	•		
SARA-U270	5.76	7.2	900/2100	900/1800[2]	2[3]	1	1	9	1		•	•	•	•	•	•	•	•	•	•	•[3]	•		•	•		
SARA-U270 ATEX	5.76	7.2	900/2100	900/1800	1	1	1	9	1		•	•	•	•	•	•	•	•	•	•		•		•	•		
SARA-U280	5.76	7.2	850/1900		1	1	1	9	1		•	•	•	•	•	•	•	•	•	•				•	•		

Table 1: SARA-U2 series main features summary[4]

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[1] Second UART interface, FOTA not supported by "03" and "63" product versions

[2] 2G radio access technology not supported by SARA-U270-73S and SARA-U270-53S module product versions

[3] Second UART interface, FOTA not supported by SARA-U270 "00", "03", "53", "73" product versions

[4] The SARA-U201 ATEX and SARA-U270 ATEX modules, unless otherwise specified, provide the same feature set as the SARA-U201 and SARA-U270 modules respectively, with the additional certification for use in potentially explosive atmospheres. Unless otherwise specified, SARA-U201 refers to all SARA-U201 ATEX and SARA-U201 modules, and in the same way SARA-U270 refers to both SARA-U270 ATEX and SARA-U270 modules.
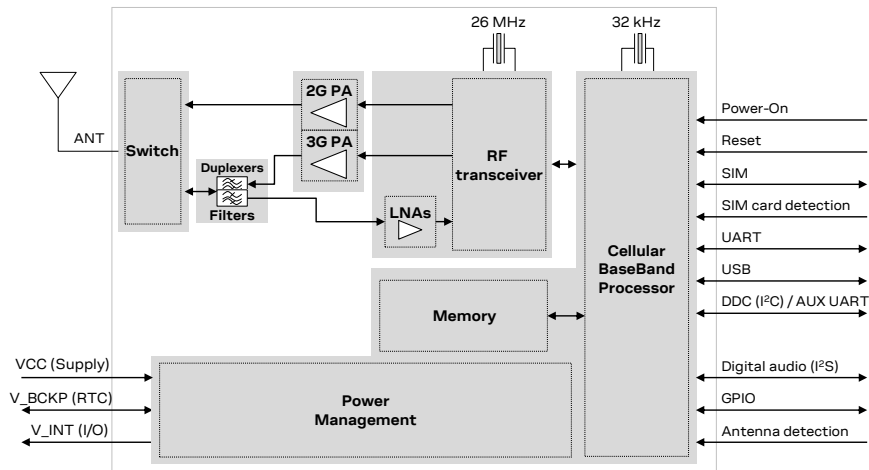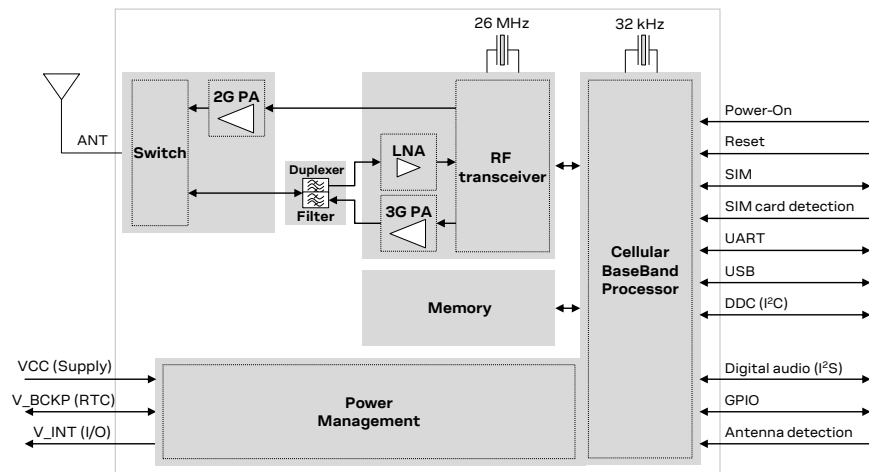
1.3 Block diagram

Figure 1: SARA-U201 block diagram

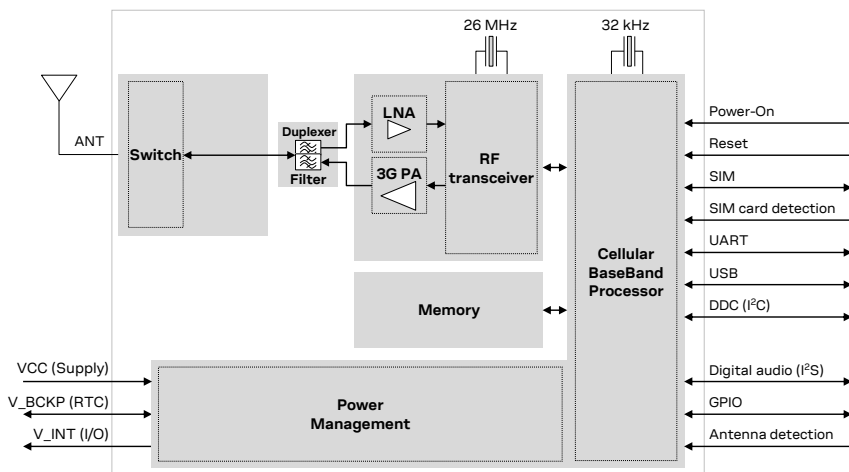**Figure 2: SARA-U260 and SARA-U270 block diagram**

Figure 3: SARA-U280 block diagram

1.4 Product description

SARA-U2 series modules provide variants to support different band combinations for specific regions:

- SARA-U201 modules are designed for worldwide operation
- SARA-U260 and SARA-U280 modules are mainly designed for operation in America
- SARA-U270 modules are mainly designed for operation in Europe, Asia and other countries

3G UMTS/HSDPA/HSUPA characteristics	2G GSM/GPRS/EDGE characteristics[5]
Class A User Equipment [6]	Class B Mobile Station [7]
3GPP Release 7 High Speed Packet Access (HSPA) UMTS Terrestrial Radio Access (UTRA) Frequency Division Duplex (FDD)	3GPP Release 7 Enhanced Data rate GSM Evolution (EDGE) GSM EGPRS Radio Access (GERA) Time Division Multiple Access (TDMA)

Band support:
- SARA-U201:
  Band 19 (800 MHz)
  Band 5 (850 MHz)
  Band 8 (900 MHz)
  Band 2 (1900 MHz)
  Band 1 (2100 MHz)
- SARA-U260 and SARA-U280:
  Band 5 (850 MHz)
  Band 2 (1900 MHz)
- SARA-U270:
  Band 8 (900 MHz)
  Band 1 (2100 MHz)
	Band support:
	- SARA-U201:
	  GSM 850 MHz
	  E-GSM 900 MHz
	  DCS 1800 MHz
	  PCS 1900 MHz
	
	- SARA-U260:
	  GSM 850 MHz
	  PCS 1900 MHz
	- SARA-U270:
	  E-GSM 900 MHz
	  DCS 1800 MHz

WCDMA/HSDPA/HSUPA Power Class - Power Class 3 (24 dBm) for WCDMA/HSDPA/HSUPA mode	GSM/GPRS Power Class - Power Class 4 (33 dBm) for GSM/E-GSM bands - Power Class 1 (30 dBm) for DCS/PCS bands EDGE Power Class[8] - Power Class E2 (27 dBm) for GSM/E-GSM bands - Power Class E2 (26 dBm) for DCS/PCS bands
PS (Packet Switched) data rate - HSUPA category 6, up to 5.76 Mbit/s UL - HSDPA category 8, up to 7.2 Mbit/s DL - WCDMA PS data, up to 384 kbit/s DL/UL	PS (Packet Switched) data rate[9] - GPRS multi-slot class 12[10], CS1-CS4 up to 85.6 kbit/s DL/UL - EDGE multi-slot class 12[11], MCS1-MCS9[12] up to 236.8 kbit/s DL/UL
CS (Circuit Switched) data rate - WCDMA CS data, up to 64 kbit/s DL/UL	CS (Circuit Switched) data rate - GSM CS data, up to 9.6 kbit/s DL/UL supported in transparent/non transparent mode

Table 2: SARA-U2 series 3G and 2G characteristics

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[5] 2G radio access technology not supported by SARA-U270-53S, SARA-U270-73S and SARA-U280 modules
[6] Device can work simultaneously in Packet Switch and Circuit Switch mode: voice calls are possible while the data connection is active without any interruption in service.
[7] Device can be attached to both GPRS and GSM services (i.e. Packet Switch and Circuit Switch mode) using one service at a time. If for example during data transmission an incoming call occurs, the data connection is suspended to allow the voice communication. Once the voice call has terminated, the data service is resumed.
[8] SARA-U260 and SARA-U270 modules do not support 8-PSK modulation in uplink; the EDGE Power Class corresponds to the GSM/GPRS Power Class
[9] GPRS / EDGE multi-slot class determines the number of timeslots available for upload and download and thus the speed at which data can be transmitted and received, with higher classes typically allowing faster data transfer rates.
[10] GPRS multi-slot class 12 implies a maximum of 4 slots in DL (reception) and 4 slots in UL (transmission) with 5 slots in total.
[11] EDGE multi-slot class 12 implies a maximum of 4 slots in DL (reception) and 4 slots in UL (transmission) with 5 slots in total.
[12] SARA-U260, SARA-U270 modules support EDGE multi-slot class 12, MCS1-MCS9 up to 236.8 kbit/s DL, MCS1-MCS4 up to 70.4 kbit/s UL

Operation modes I to III are supported on GSM/GPRS networks, with user-defined preferred service selectable from GSM to GPRS. Paging messages for GSM calls can be optionally monitored during GPRS data transfer in not-coordinating NOM II-III. Direct Link mode is supported for TCP and UDP sockets.

Basic features	Supplementary services	Short Message Service (SMS)
Display of Called Number	Call Hold/Resume (HOLD)	Text and PDU mode supported
Indication of Call Progress Signals	Call Waiting (CW)	Mobile-Originating SMS (MO SMS)
Country/PLMN Indication	Multi-Party (MTPY)	Mobile-Terminating SMS (MT SMS)
Country/PLMN Selection	Call Forwarding (CFU, CFB, CFNRy, CFNRc)	SMS indication and acknowledgement
International Access Function	Call Deflection (CD)	SMS Cell Broadcast (CBS)
Service Indicator	Explicit Call Transfer (ECT)	SMS during circuit-switched calls
Emergency Calls Capabilities	Call Barring (BAOC, BOIC, BOIC-exHC, BAIC, BIC_Roam)	SMS over CSD
Dual Tone Multi Frequency (DTMF)	Advice of Charge Charging (AoCC, AoCI)	SMS over PSD
Subscription Identity Management	Calling Line Identification Presentation (CLIP)	SMS storage on SIM
Service Provider Indication	Calling Line Identification Restriction (CLIR)	SMS storage on module memory
Abbreviated Dialing	Connected Line Identification Presentation (CoLP)	Concatenated SMS
Fixed Number Dialing	Connected Line Identification Restriction (CoLR)	
Barring of Dialed Numbers	Unstructured Supplementary Services Data (USSD)	
SIM Application Toolkit	Network Identify and Time Zone (NITZ)	
ME-SIM lock	Calling Name Presentation (CNAP)	
SIM Access Profile		

Table 3: SARA-U2 series mobile stations: basic features, supplementary services and SMS service summary[13]

1.5   AT command support

SARA-U2 series modules support AT commands according to the 3GPP Technical Specifications 27.007 [1], 27.005 [2], 27.010 [3], and the u-blox AT command extension.

☞   For the complete list of supported AT commands and their syntax, see the u-blox AT commands manual [4].

RIL (Radio Interface Layer) software for Android and Embedded Windows is available for SARA-U2 series modules free of charge; see the Android RIL source code application note [5] for more information.

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[13] All these functionalities are supported via AT commands (for more details, see u-blox AT commands manual [4]).

1.6 Supported features

Table 4 lists the main features supported by SARA-U2 modules. For more details, see the SARA-G3 and SARA-U2 series system integration manual [6] and the u-blox AT commands manual [4].

Feature	Description
Network indication	GPIO configured to indicate the network status: registered home network, registered roaming, voice or data call enabled, no service. The feature can be enabled through the +UGPIOC AT command.
Antenna detection	The **ANT_DET** pin provides antenna presence detection capability, evaluating the resistance from the **ANT** pin to GND by means of an external antenna detection circuit implemented on the application board. The antenna detection feature can be enabled through the +UANTR AT command.
Jamming detection	Detects some "artificial" interference that obscures the operator's carriers entitled to give access to the GSM/UMTS service and reports the start and stop of such conditions to the application processor (AP). The AP can react appropriately by e.g. switching off the radio transceiver to reduce power consumption and monitoring the environment at constant periods. The feature can be enabled and configured through the +UCD AT command.
Embedded TCP and UDP stack	Embedded TCP/IP and UDP/IP stack including direct link mode for TCP and UDP sockets. 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.
FTP, FTPS	File Transfer Protocol as well as Secure File Transfer Protocol (SSL encryption of FTP control channel) functionalities are supported via AT commands.
HTTP, HTTPS	Hyper-Text Transfer Protocol as well as Secure Hyper-Text Transfer Protocol (SSL encryption) functionalities is supported via AT commands. HEAD, GET, POST, DELETE and PUT operations are available. Up to four client contexts can be simultaneously used.
Embedded TLS 1.2 [15]	With the support of X.509 certificates, Embedded TLS 1.2 provides server and client authentication, data encryption, data signature and enables TCP/IP applications like HTTPS and FTPS to communicate over a secured and trusted connection. The feature can be configured and enabled by +USECMNG and +USECPRF AT commands.
IPv4/IPv6 dual-stack	Capability to move between IPv4 and dual stack network infrastructures using external context. IPv4 and IPv6 addresses can be used.
GNSS via modem	Full access to u-blox positioning chips and modules is available through a dedicated DDC (I2C) 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 GNSS implementation application note [7].
Embedded AssistNow Software	Embedded AssistNow Online and AssistNow Offline clients to provide better GNSS performance and faster Time-to-First-Fix. An AT command can enable / disable the clients.
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: • Normal scan: only the parameters of the visible home network cells are sent • Deep scan: the parameters of all surrounding cells of all mobile operators are sent CellLocate® is implemented using a set of AT commands that allow configuration and position request.
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 configuration and position request.
Control Plan Aiding / LCS [15]	Assisted GPS Location Services feature, which is based on the Radio Resources Location Protocol (RRLP), according to 3GPP TS 44.031 [9], and Radio Resource Control (RRC), according to 3GPP TS 25.331 [17]. With the Assisted GPS feature, a location server provides the module with the GPS system information that otherwise must be downloaded from satellites. The feature allows faster position fixes, increases sensitivity and reduces module power consumption. The feature is invoked by the module through LCS Supplementary Services or by the Network during emergency calls.
Firmware update Over AT commands (FOAT)	Firmware module upgrade over UART and USB interface using AT command. The firmware upgrade can be executed through the +UFWUPD AT command.

Feature	Description
Smart temperature supervisor	Constant monitoring of the module board temperature: • Warning notification when the temperature approaches an upper or lower predefined threshold • Shutdown notified and forced when the temperature value is outside the specified range (shutdown suspended in case of an emergency call in progress) The feature can be enabled or disabled through the +USTS AT command. ☞ The sensor measures the board temperature, which can differ from the ambient temperature.
SIM Access Profile (SAP)	Allows access and use of a remote (U)SIM card instead of the local SIM card directly connected to the module (U)SIM interface. The module acts as an SAP Client establishing a connection and performing data exchange to a SAP Server directly connected to the remote SIM. The modules provide a dedicated USB SAP channel and a dedicated multiplexer SAP channel over UART for communication with the remote (U)SIM card. The feature can be configured and enabled by +USAPMODE and + USAPIND AT commands.
BIP [15]	Bearer Independent Protocol for Over-the-Air SIM provisioning. The data transfer to/from the SIM uses either an already active PDP context or a new PDP context established with the APN provided by the SIM card.
In-Band Modem [14]	In-Band modem solution for eCall and ERA-GLONASS emergency call applications over cellular networks implemented according to the 3GPP TS 26.267 specification [8]. When activated, the in-vehicle eCall / ERA-GLONASS system (IVS) creates an emergency call carrying both voice and data (including vehicle position data) directly to the nearest Public Safety Answering Point (PSAP) to determine whether rescue services should be dispatched to the known position.
DTMF decoder	During a voice call, the Dual-Tone Multi-Frequency detector analyses the RX speech (coming from the remote party). The detected DTMF symbols can be output via the related URC. For more details, see the +UDTMFD AT command.
Power saving	The power saving configuration is disabled by default, but it can be configured using an AT command. When power saving is enabled, the module automatically enters the low power idle-mode whenever possible, reducing current consumption. During idle-mode, the module processor core runs with the RTC 32 kHz reference clock. The feature can be enabled through the +UPSV AT command.
Automatic selection of authentication type [15]	Automatic selection of authentication type during PDP context activation. The module will sequentially try different authentication protocols (none/CHAP/PAP) until the authentication succeeds. The feature can be enabled through the +UPSD and +UAUTHREQ AT commands.
Signal quality report for packet switched calls [15]	The quality of the GPRS UL and/or DL connection is returned by the AT+CSQ command.
eMLPP [15]	Multi-Level Precedence and Pre-emption Service (eMLPP) permits to handle the call priority. The maximum priority associated to a user is set in the SIM: within this threshold, the user can assign different priorities to the calls. This results in a differentiated treatment of the calls by the network in case of abnormal events such as handovers to congested cells. The feature can be enabled through the +CAEMLPP, +CPPS, +CAAP AT commands.
Network Friendly Mode [15]	When the Network Friendly Mode is enabled, the module reacts to service request denials by using time-spaced, randomized or delayed retry schemes according to GSMA IoT Device Connection Efficiency Guidelines [18]. The feature can be enabled through the +UNFM, +UNFMCONF and +URPM AT commands.
Ethernet (CDC-ECM) over USB interface [15]	Ethernet (CDC-ECM) interface allowing networking from a HOST by means of the IP address received from the cellular network (bridge mode). The HOST configuration is performed via the DHCP protocol (a DHCP server is implemented). It operates as a not exclusive alternative to PPP dial-up. The feature can be configured by +UUSBCONF and enabled by +UCEDATA AT commands.
ODIS [16]	OMA-DM IMEI Sync (ODIS) is an AT&T functionality required at the cellular module level and used to identify the end device operating inside the network.
Last gasp [17]	In case of power supply outage (i.e. main supply interruption, battery removal, battery voltage below a certain threshold) the cellular module can be configured to send an alarm notification to a remote entity. The feature can be enabled and configured through the +ULGASP AT command.

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[14] Not supported by SARA-U260 and SARA-U280 modules
[15] Not supported by "00" product version
[16] Not supported on SARA-U260, SARA-U270 and SARA-U280 modules
[17] Not supported by "00","03","53","63","73" product versions

Feature	Description
Firmware update Over The Air (FOTA) [17]	Embedded FOTA client to enable the Firmware module update over the cellular air interface. The feature can be enabled and configured through the +UFWINSTALL AT command.
Smart radio Coverage Manager (SCM) [17]	Smart radio coverage manager is a feature that aims to reduce the power consumption in those cellular scenarios where the radio coverage or the network conditions would cause an inefficient usage of power supply. The feature can be enabled and configured through the +UDCONF=57 AT command.

Table 4: Main supported features of the SARA-U2 series

☞ u-blox is extremely mindful of user privacy. When a position is sent to the CellLocate® server, u-blox is unable to track the SIM or the specific device that sent the position.

2 Interfaces

2.1 Power management

2.1.1 Module supply (VCC)

SARA-U2 modules must be supplied through the **VCC** pins by a DC power supply. Voltages must be stable: during operation, the current drawn from **VCC** can vary by some order of magnitude, especially due to the surging consumption profile of the GSM system (described in the SARA-G3 and SARA-U2 series system integration manual [6]). It is important that the system power supply circuit is able to support peak power.

2.1.2 RTC supply (V_BCKP)

V_BCKP is the Real Time Clock (RTC) supply of SARA-U2 modules. When **VCC** voltage is within the valid operating range, the internal Power Management Unit (PMU) supplies the RTC and the same supply voltage is available on **V_BCKP** pin. If the **VCC** voltage is under the minimum operating limit (e.g. during not powered mode), the **V_BCKP** pin can externally supply the RTC.

2.1.3 Generic digital interfaces supply (V_INT)

SARA-U2 modules provide a 1.8 V supply rail output on the **V_INT** pin, which is internally generated when the module is switched on. The same voltage domain is used internally to supply the generic digital interfaces of the modules. The **V_INT** supply output can be used in place of an external discrete regulator optimizing the bill of material for various applications, e.g. with u-blox GNSS receivers operating at 1.8 V.

2.2 Antenna

2.2.1 Antenna RF interface (ANT)

The **ANT** pin has an impedance of 50 Ω and provides the RF antenna interface of SARA-U2 modules.

2.2.2 Antenna detection (ANT_DET)

The **ANT_DET** pin is an Analog to Digital Converter (ADC) input used to sense the antenna presence (as optional feature), evaluating the resistance from the **ANT** pin to GND by means of an external antenna detection circuit implemented on the application board (for more details, see SARA-G3 and SARA-U2 series system integration manual [6] and u-blox AT commands manual [4], +UANTR).

2.3 System functions

2.3.1 Module power-on

SARA-U2 modules can be switched on in one of the following ways:

- Rising edge on **VCC** pins to a valid voltage for module supply, i.e. applying module supply
- Low pulse on **PWR_ON** pin, i.e. forcing the pin to a low level for a valid time period (see section 4.2.6), when the applied **VCC** voltage is within the valid operating range: **PWR_ON** pin requires an external pull-up resistor to set its value to normally logic high and may not be left floating
- Rising edge on **RESET_N** pin, i.e. releasing the pin from the low level, normally high due to internal pull-up, when the applied **VCC** voltage is within the valid operating range
- RTC alarm, i.e. pre-programmed scheduled time by AT+CALA command, when the applied **VCC** voltage is within the valid operating range

2.3.2 Module power-off

SARA-U2 modules can be properly switched off, with storage of current parameter settings and network detach, in one of these ways:

- AT+CPWROFF command
- Low pulse on the **PWR_ON** pin for at least 1 second

An abrupt under-voltage shutdown occurs on SARA-U2 modules when the **VCC** supply drops below the extended operating range minimum limit, but in this case it is not possible to perform the storing of the current parameter settings in the module's non-volatile memory as well as the proper network detach.

An over-temperature or an under-temperature shutdown occurs on SARA-U2 modules when the temperature measured within the cellular module reaches the dangerous area, if the optional Smart Temperature Supervisor feature is enabled and configured by the dedicated AT command. For more details, see the SARA-G3 and the SARA-U2 series system integration manual [6] and the u-blox AT commands manual [4], +USTS AT command.

2.3.3 Module reset

SARA-U2 modules can be properly reset (rebooted), with storage of current parameter settings and network detach, in this way:

- By the AT+CFUN command (see the u-blox AT commands manual [4]). This causes an "internal" or "software" reset of the baseband processor, excluding the integrated power management unit and the RTC internal block: the **V_INT** generic digital interfaces supply is enabled and each digital pin is set to its internal reset state (reported in Table 6), the **V_BCKP** supply and the RTC block are enabled.

An abrupt "external" or "hardware" reset occurs when a low level is applied to the **RESET_N** pin, which is normally set high by an internal pull-up, for a valid time period (see section 4.2.7). This causes a reset of the entire module, including the integrated power management unit, except for the RTC internal block: the **V_INT** generic digital interfaces supply is switched off and all the digital pins are tri-stated, but the **V_BCKP** supply and the RTC block are enabled. The current parameter settings are not saved in the module's non-volatile memory and a proper network detach is not performed.

2.4 SIM

2.4.1 (U)SIM interface

SARA-U2 modules provide a (U)SIM interface on the **VSIM**, **SIM_IO**, **SIM_CLK**, **SIM_RST** pins: the high-speed SIM/ME interface is implemented as well as automatic detection of the required SIM supporting voltage.

Both 1.8 V and 3 V SIM card/chip types are supported (1.8 V and 3 V ME). Activation and deactivation with automatic voltage switch from 1.8 V to 3 V is implemented, according to ISO-IEC 7816-3 specifications. The SIM driver supports the PPS (Protocol and Parameter Selection) procedure for baud-rate selection, according to the values proposed by the SIM card/chip.

2.4.2 SIM card detection (SIM_DET)

The **SIM_DET** pin of SARA-U2 modules is a 1.8 V digital input which is configured by default as an external interrupt to detect the SIM card presence (as a feature which can be optionally used) when it is properly connected to the mechanical switch of the SIM card holder (for more details, see the SARA-G3 and SARA-U2 series system integration manual [6]).

The **SIM_DET** pin of SARA-U2 modules can be configured via AT command to provide the "SIM card hot insertion/removal" function (see the u-blox AT commands manual [4], +UDCONF=50).

The **SIM_DET** pin of SARA-U2 modules can additionally be configured via AT command as GPIO (see section 2.7 and the u-blox AT commands manual [4], +UGPIOC, +UGPIOR, +UGPIOW).

2.5   Serial interfaces

SARA-U2 modules provide the following serial communication interfaces:

- Main primary UART interface: 9-wire unbalanced 1.8 V asynchronous serial interface supporting (see section 2.5.1)
  - AT command mode[18]
  - Data mode and Online command mode[18]
  - Multiplexer functionality, including dedicated GNSS tunneling and SIM Access Profile virtual channels
  - FW upgrades by means of the FOAT feature
  - FW upgrades by means of the u-blox EasyFlash tool
  - Trace log capture (diagnostic purpose)
- Auxiliary secondary UART interface[19]: 3-wire unbalanced 1.8 V asynchronous serial interface, available as alternative function, in mutually exclusive way, over the DDC (I2C) interface' pins, supporting (see section 2.5.2)
  - AT command mode
  - Trace log capture (diagnostic purpose)
- USB interface: High-Speed USB 2.0 compliant interface supporting (see section 2.5.3)
  - AT command mode
  - Data mode and Online command mode[18]
  - GNSS tunneling and SIM Access Profile virtual channels
  - Ethernet-over-USB[20] virtual channel
  - FW upgrades by means of the FOAT feature
  - FW upgrades by means of the u-blox EasyFlash tool
  - Trace log capture (diagnostic purpose)
- DDC interface: I2C-bus compatible 1.8 V interface supporting (see section 2.5.4)
  - Communication with u-blox GNSS positioning chips / modules
  - Communication with other external I2C devices as an audio codec

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[18] See the u-blox AT commands manual [4] for the definition of the command mode, data mode, and online command mode.
[19] SARA-U2 modules product versions "00", "03", "53", "63", "73" do not provide Auxiliary UART interface.
[20] SARA-U2 modules product versions "00" do not support Ethernet-over-USB.

2.5.1 Asynchronous serial interface (UART)

The UART interface is a 9-wire 1.8 V unbalanced asynchronous serial interface supporting AT command mode, Data mode and Online command mode, MUX functionality, including dedicated GNSS tunneling and SIM Access Profile virtual channels, FW upgrades by means of the FOAT feature, FW upgrades by means of the u-blox EasyFlash tool, and Trace log capture (diagnostic purpose).

The UART features are:

- Complete serial port with RS-232 functionality conforming to ITU-T V.24 Recommendation [10], 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 (**RXD** as output, **TXD** as input), hardware flow control lines (**CTS** as output, **RTS** as input), modem status and control lines (**DTR** as input, **DSR** as output, **DCD** as output, **RI** as output) are provided
- Hardware flow control (default value), software flow control, or none flow control are supported
- Power saving indication available[21] on the hardware flow control output (CTS line): the line is driven to the OFF state when the module is not prepared to accept data by the UART interface
- 1,200, 2,400, 4,800, 9,600, 19,200, 38,400, 57,600, 115,200, 230,400, 460,800 and 921,600 bit/s baud rates are supported for the AT interface
- Autobauding is enabled by default
- Frame format can be:
  - 8N2 (8 data bits, no parity, 2 stop bits)
  - 8N1 (8 data bits, no parity, 1 stop bit)
  - 8E1 (8 data bits, even parity, 1 stop bit)
  - 8O1 (8 data bits, odd parity, 1 stop bit)
  - 7E1 (7 data bits, even parity, 1 stop bit)
  - 7O1 (7 data bits, odd parity, 1 stop bit)
- Default frame configuration is 8N1

The UART serial interface can be conveniently configured through AT commands. For more details, see the u-blox AT commands manual [4] (+IPR, +ICF, +IFC, &K, \Q, +UPSV AT command) and the SARA-G3 and the SARA-U2 series system integration manual [6].

2.5.1.1 Autobauding feature

Only one shot autobauding is supported: the baud rate detection is performed only once, at module start-up.

After detection the module works at the fixed baud rate (the detected one) and the baud rate can only be changed via the appropriate AT command (+IPR, for more details, see the u-blox AT commands manual [4]).

- The module detects the followings baud rates (bit/s): 1,200, 2,400, 4,800, 9,600, 19,200, 38,400, 57,600, 115,200, 230,400
- The only detectable frame configurations are: 7E1, 7O1, 8N1, 8E1, 8O1

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[21] If enabled

2.5.1.2   Multiplexer protocol

SARA-U2 module has a software layer with MUX functionality, 3GPP TS 27.010 Multiplexer Protocol [3], available on the UART interface.

☞ The multiplexer protocol is supported only over the UART physical interface.

This is a data link protocol (layer 2 of OSI model) which uses HDLC-like framing and operates between the cellular module (Data Circuit-terminating Equipment) and the application processor (Data Terminal Equipment) allowing simultaneous sessions over the UART physical link: the user can concurrently use the AT command interface on one MUX channel and Data communication on another MUX channel. Each session consists of a stream of bytes transferring various kinds of data such as SMS, CBS, PSD, GNSS, AT commands in general.

SARA-U2 modules provide the following virtual channels:

- Channel 0: control channel
- Channel 1 – 5: AT commands / data connection
- Channel 6: GNSS tunneling
- Channel 7: SAP (SIM Access Profile)

For more details, see the Mux implementation application note [11].

2.5.2   Auxiliary asynchronous serial interface (AUX UART)

☞ Not supported by "00", "03", "53", "63", "73" product versions.

The auxiliary UART interface is a 3-wire 1.8 V unbalanced asynchronous serial interface supporting AT command mode and Trace log capture (diagnostic purpose).

The auxiliary UART interface is disabled by default, and it can be enabled by means of the +USIO AT command (for more details, see the u-blox AT commands manual [4]), as alternative function of the DDC (I2C) interface' pins, in mutually exclusive way with the DDC (I2C) interface.

The auxiliary UART features are:

- Only the RXD_AUX data output and the TXD_AUX data input are provided, 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 (**SCL** pin configured as RXD_AUX output, **SDA** pin configured as TXD_AUX input)
- Software flow control, or none flow control (default value) are supported
- 1,200, 2,400, 4,800, 9,600, 19,200, 38,400, 57,600, 115,200, 230,400, 460,800 and 921,600 bit/s baud rates are supported for the AT interface
- Autobauding is enabled by default
- Frame format can be:
    o 8N2 (8 data bits, no parity, 2 stop bits)
    o 8N1 (8 data bits, no parity, 1 stop bit)
    o 8E1 (8 data bits, even parity, 1 stop bit)
    o 8O1 (8 data bits, odd parity, 1 stop bit)
    o 7E1 (7 data bits, even parity, 1 stop bit)
    o 7O1 (7 data bits, odd parity, 1 stop bit)
- Default frame configuration is 8N1

The auxiliary UART serial interface can be conveniently configured through AT commands. For more details, see the u-blox AT commands manual [4] (+IPR, +ICF, +IFC, &K, \Q, +UPSV AT command) and the SARA-G3 and SARA-U2 series system integration manual [6].

2.5.2.1 Autobauding feature

Only one shot autobauding is supported: the baud rate detection is performed only once, at module start-up.

After detection the module works at the fixed baud rate (the detected one) and the baud rate can only be changed via the appropriate AT command (+IPR, for more details, see the u-blox AT commands manual [4]).

- The module detects the followings baud rates (bit/s): 1,200, 2,400, 4,800, 9,600, 19,200, 38,400, 57,600, 115,200, 230,400
- The only detectable frame configurations are: 7E1, 7O1, 8N1, 8E1, 8O1

2.5.3 Universal Serial Bus (USB)

SARA-U2 series modules include a high-speed USB 2.0 compliant interface with a maximum 480 Mbit/s data rate. The module itself acts as a USB device and can be connected to any USB host.

The USB is the suitable interface for transferring high speed data between SARA-U2 series and a host processor, available for AT commands, data communication, FW upgrade by means of the FOAT feature, FW upgrade by means of the u-blox EasyFlash tool and for diagnostic purpose.

The **USB_D+** / **USB_D-** lines carry the USB serial data and signaling. The USB interface is automatically enabled by an external valid USB VBUS supply voltage (5.0 V typical) applied on the **VUSB_DET** pin.

SARA-U2 series modules can provide the following functions over the USB interface:

- CDC-ACM for AT commands and data communication
- CDC-ACM for GNSS tunneling
- CDC-ACM for diagnostic
- CDC-ACM for SAP (SIM Access Profile)
- CDC-ECM for Ethernet-over-USB

☞ CDC-ECM for Ethernet-over-USB function is not supported by the "00" product version.

The default configuration of the USB interface provides 7 USB CDC-ACM modem COM ports:

- USB1: AT and data
- USB2: AT and data
- USB3: AT and data
- USB4: GNSS tunneling
- USB5: Primary Log (diagnostic purpose)
- USB6: Secondary Log (diagnostic purpose)
- USB7: SAP (SIM Access Profile)

The user can concurrently use the AT command interface on one CDC, and Packet-Switched / Circuit-Switched Data communication on another CDC.

The USB interface can be configured by the AT+UUSBCONF command to provide a different set of functions, including 1 CDC-ECM for Ethernet-over-USB and 4 CDC-ACM modem COM ports enumerated as follows:

- USB1: AT and data
- USB2: GNSS tunneling
- USB3: Primary Log (diagnostic purpose)
- USB4: SAP (SIM Access Profile)

☞ The default profile of the USB interface cannot be changed on the "00" product version.

For more details regarding the USB configurations and capabilities, see the SARA-G3 and SARA-U2 series system integration manual [6] and the u-blox AT commands manual [4] (+UUSBCONF AT command).

USB drivers are available for the following operating system platforms:

- Windows XP
- Windows Vista
- Windows 7
- Windows 8
- Windows 8.1
- Windows 10
- Windows CE 5.0
- Windows Embedded CE 6.0
- Windows Embedded Compact 7
- Windows Embedded Automotive 7
- Windows Mobile 5
- Windows Mobile 6
- Windows Mobile 6.1
- Windows Mobile 6.5

SARA-U2 modules are compatible with the standard Linux/Android USB kernel drivers.

2.5.4   DDC (I2C) bus interface

SARA-U2 modules include an I2C compatible DDC interface (**SDA**, **SCL**) available to communicate with a u-blox GNSS receiver and with external I2C devices as an audio codec: SARA-U2 module acts as an I2C host device which can communicate with I2C Local devices in accordance to the I2C bus specifications [12].

2.6   Audio

SARA-U2 modules have one 4-wire I2S digital audio interface (**I2S_CLK**, **I2S_RXD**, **I2S_TXD** and **I2S_WA**) that can be configured by AT commands in PCM or in normal I2S mode. (For more details, see the u-blox AT commands manual [4] and the SARA-G3 and SARA-U2 series system integration manual [6].)

SARA-U2 modules provide a digital clock output (**CODEC_CLK**) for an external audio codec.

2.7 GPIO

SARA-U2 modules provide nine pins (**GPIO1**, **GPIO2**, **GPIO3**, **GPIO4**, **I2S_RXD**, **I2S_TXD**, **I2S_CLK**, **I2S_WA**, **SIM_DET**) which can be configured as general purpose input/output, or to provide the custom functions listed in Table 5 via u-blox AT commands. For further details, see the SARA-G3 and SARA-U2 series system integration manual [6] and the u-blox AT commands manual [4], +UGPIOC, +UGPIOR, +UGPIOW, +UGPS, +UGPRF, +USPM, +UDCONF=50, +ULGASP AT commands.

Function	Description	Module	Default GPIO	Configurable GPIOs
GSM Tx-burst indication	GSM transmit slot indication	SARA-U201, SARA-U260, SARA-U270	--	GPIO1
GNSS supply enable	Enable/disable the supply of the u-blox GNSS receiver connected to the cellular module	All	GPIO2	GPIO1, GPIO2, GPIO3, GPIO4, SIM_DET
GNSS data ready	Input to sense when the u-blox GNSS receiver connected to the cellular module is ready for sending data over the DDC (I2C) interface	All	GPIO3	GPIO3
GNSS RTC sharing	RTC synchronization signal to the u-blox GNSS receiver connected to the cellular module	All	GPIO4	GPIO4
SIM card detection	SIM card physical presence detection	All	SIM_DET	SIM_DET
SIM card hot insertion	Enable/disable SIM interface upon detection of external SIM card physical insertion/removal	All	--	SIM_DET
Last gasp[22]	Input to trigger the delivery of a last alarm notification to a remote entity	SARA-U201, SARA-U270	--	GPIO3
Network status indication	Network status: registered 2G / 3G home network, registered 2G / 3G roaming, 2G / 3G data transmission, no service	All	--	GPIO1, GPIO2, GPIO3, GPIO4, SIM_DET
Module status indication	Module status: power off mode, i.e. module switched off, versus idle, active or connected mode, i.e. module switched on	All	--	GPIO1
Module operating mode indication	Module operating mode: idle mode versus active or connected mode	All	--	SIM_DET
I2S digital audio interface	I2S digital audio interface (I2S_RXD, I2S_TXD, I2S_CLK, I2S_WA respectively)	All	I2S_RXD, I2S_TXD, I2S_CLK, I2S_WA	I2S_RXD, I2S_TXD, I2S_CLK, I2S_WA
General purpose input	Input to sense high or low digital level	All	--	All
General purpose output	Output to set the high or the low digital level	All	--	All
Pin disabled	Tri-state with an internal active pull-down enabled	All	GPIO1	All

Table 5: GPIO custom functions configuration

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[22] Not supported by "00", "03", "53", "63", "73" product versions

3 Pin definition

3.1 Pin assignment
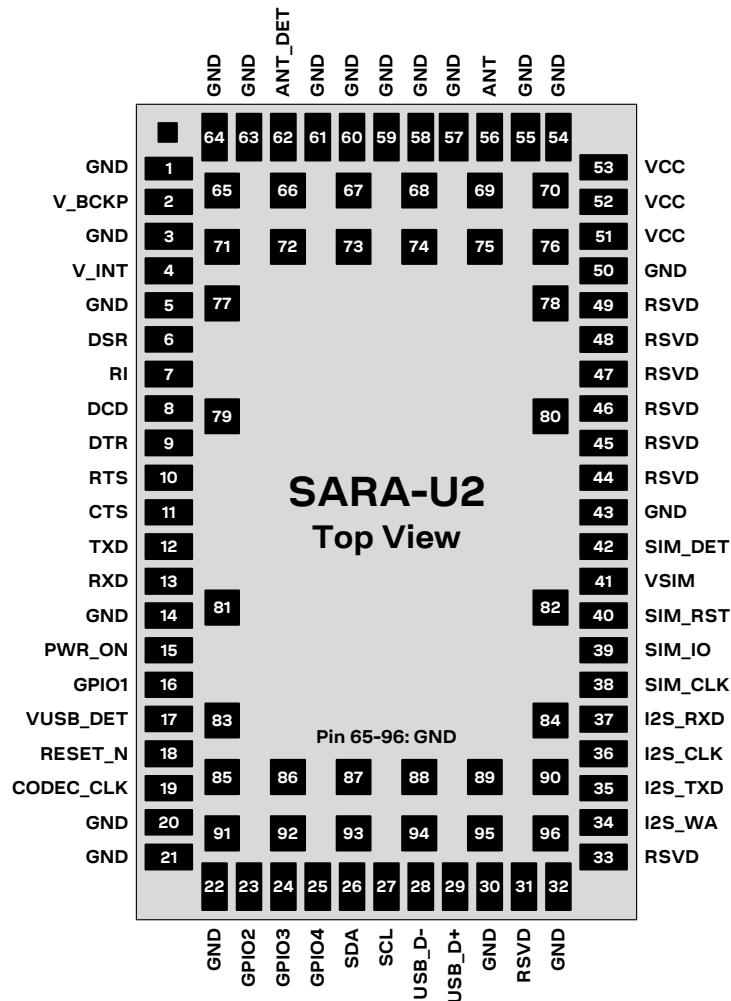
Figure 4: SARA-U2 series pin assignment

No	Name	Power domain	I/O	Description	Remarks
1	GND	-	N/A	Ground	All the GND pins must be connected to ground
2	V_BCKP	-	I/O	Real Time Clock supply input/output	V_BCKP = 1.8 V (typical) generated by the module to supply the Real Time Clock when VCC supply voltage is within valid operating range. See section 4.2.2 for detailed electrical specs.
3	GND	-	N/A	Ground	All the GND pins must be connected to ground
4	V_INT	-	O	Generic Digital Interfaces supply output	V_INT = 1.8 V (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. See section 4.2.2 for detailed electrical specs.
5	GND	-	N/A	Ground	All the GND pins must be connected to ground
6	DSR	GDI	O	UART data set ready	Circuit 107 (DSR) in ITU-T V.24. Output driver class D. PU/PD class a. Value at internal reset: T/PU. See section 4.2.9 for detailed electrical specs.

No	Name	Power domain	I/O	Description	Remarks
7	RI	GDI	O	UART ring indicator	Circuit 125 (RI) in ITU-T V.24. Output driver class C_0. PU/PD class c. Value at internal reset: T/PD. See section 4.2.9 for detailed electrical specs.
8	DCD	GDI	O	UART data carrier detect	Circuit 109 (DCD) in ITU-T V.24. Output driver class C_0. PU/PD class c. Value at internal reset: T/PD. See section 4.2.9 for detailed electrical specs.
9	DTR	GDI	I	UART data terminal ready	Circuit 108/2 (DTR) in ITU-T V. 24. Internal active pull-up to V_INT enabled. PU/PD class c. Value at internal reset: T/PD. See section 4.2.9 for detailed electrical specs.
10	RTS	GDI	I	UART ready to send	Circuit 105 (RTS) in ITU-T V.24. Internal active pull-up to V_INT enabled. PU/PD class a. Value at internal reset: T/PU. See section 4.2.9 for detailed electrical specs.
11	CTS	GDI	O	UART clear to send	Circuit 106 (CTS) in ITU-T V.24. Output driver class A. PU/PD class a. Value at internal reset: T/PU. See section 4.2.9 for detailed electrical specs.
12	TXD	GDI	I	UART data input	Circuit 103 (TxD) in ITU-T V.24. Internal active pull-up to V_INT enabled. PU/PD class a. Value at internal reset: T/PD. See section 4.2.9 for detailed electrical specs.
13	RXD	GDI	O	UART data output	Circuit 104 (RxD) in ITU-T V.24. Output driver class A. PU/PD class a. Value at internal reset: T/PU. See section 4.2.9 for detailed electrical specs.
14	GND	-	N/A	Ground	All the GND pins must be connected to ground
15	PWR_ON	POS	I	Power-on input	The PWR_ON pin has high input impedance: do not leave it floating in noisy environment (an external pull-up resistor is required) See section 4.2.6 for detailed electrical specs.
16	GPIO1	GDI	I/O	GPIO	GPIO configurable as described in Table 5. Output driver class A. PU/PD class a. Value at internal reset: T/PD. See section 4.2.9 for detailed electrical specs.
17	VUSB_DET	USB	I	USB detect input	Input for VBUS (5 V typical) USB supply sense. See section 4.2.10 for detailed electrical specs.
18	RESET_N	ERS	I	External reset input	Internal 10 kΩ pull-up resistor to V_BCKP. See section 4.2.7 for detailed electrical specs.
19	CODEC_CLK	GDI	O	Clock output	Output driver class B. PU/PD class b. Value at internal reset: T/PD. See section 4.2.9 for detailed electrical specs.
20	GND	-	N/A	Ground	All the GND pins must be connected to ground
21	GND	-	N/A	Ground	All the GND pins must be connected to ground
22	GND	-	N/A	Ground	All the GND pins must be connected to ground
23	GPIO2	GDI	I/O	GPIO	GPIO configurable as described in Table 5. Output driver class A. PU/PD class a. Value at internal reset: T/PD. See section 4.2.9 for detailed electrical specs.
24	GPIO3	GDI	I/O	GPIO	GPIO configurable as described in Table 5. Output driver class A. PU/PD class a. Value at internal reset: T/PD. See section 4.2.9 for detailed electrical specs.

No	Name	Power domain	I/O	Description	Remarks
25	GPIO4	GDI	I/O	GPIO	GPIO configurable as described in Table 5. Output driver class A. PU/PD class a. Value at internal reset: T/PD. See section 4.2.9 for detailed electrical specs.
26	SDA	DDC	I/O	I2C bus data line	Fixed open drain. No internal pull-up. Value at internal reset: T. See section 4.2.11 for detailed electrical specs.
		GDI	I	AUX UART data input	Not supported by "00","03","53","63","73" product versions Circuit 103 (TxD) in ITU-T V.24. Internal active pull-up to V_INT enabled. PU/PD class a. Value at internal reset: T. See section 4.2.9 for detailed electrical specs.
27	SCL	DDC	O	I2C bus clock line	Fixed open drain. No internal pull-up. Value at internal reset: T. See section 4.2.11 for detailed electrical specs.
		GDI	O	AUX UART data output	Not supported by "00","03","53","63","73" product versions Circuit 104 (RxD) in ITU-T V.24. Output driver class E. PU/PD class a. Value at internal reset: T. See section 4.2.9 for detailed electrical specs.
28	USB_D-	USB	I/O	USB Data Line D-	90 Ω nominal differential impedance. Pull-up, pull-down and series resistors as required by USB 2.0 specifications [15] are part of the USB pin driver and need not be provided externally. Value at internal reset: T. See section 4.2.10 for detailed electrical specs.
29	USB_D+	USB	I/O	USB Data Line D+	90 Ω nominal differential impedance. Pull-up, pull-down and series resistors as required by USB 2.0 specifications [15] are part of the USB pin driver and need not be provided externally. Value at internal reset: T. See section 4.2.10 for detailed electrical specs.
30	GND	-	N/A	Ground	All the GND pins must be connected to ground
31	RSVD	-	N/A	RESERVED pin	Leave unconnected.
32	GND	-	N/A	Ground	All the GND pins must be connected to ground
33	RSVD	-	N/A	RESERVED pin	This pin must be connected to GND.
34	I2S_WA	GDI	I/O / I/O	I2S word alignment / GPIO	Configurable as I2S word alignment (Input with internal active pull-down enabled in local device mode, Output in host mode), or as GPIO (see Table 5). Output driver class C. PU/PD class a. Value at internal reset: T/PD. See section 4.2.9 for detailed electrical specs.
35	I2S_TXD	GDI	O / I/O	I2S transmit data / GPIO	Configurable as I2S transmit data out, or as GPIO (see Table 5) Output driver class C. PU/PD class a. Value at internal reset: T/PD. See section 4.2.9 for detailed electrical specs.
36	I2S_CLK	GDI	I/O / I/O	I2S clock / GPIO	Configurable as I2S clock (Input with internal active pull-down in local device mode, Output in host mode), or as GPIO (see Table 5). Output driver class C. PU/PD class a. Value at internal reset: T/PD. See section 4.2.9 for detailed electrical specs.
37	I2S_RXD	GDI	I / I/O	I2S receive data / GPIO	Configurable as I2S receive data input (with internal active pull-down enabled), or as GPIO (see Table 5). Output driver class C. PU/PD class a. Value at internal reset: T/PD.

No	Name	Power domain	I/O	Description	Remarks
					See section 4.2.9 for detailed electrical specs.
38	SIM_CLK	SIM	O	SIM clock	Value at internal reset: L. See section 4.2.8 for detailed electrical specs.
39	SIM_IO	SIM	I/O	SIM data	Internal 4.7 kΩ pull-up resistor to VSIM. Value at internal reset: L/PD. See section 4.2.8 for detailed electrical specs.
40	SIM_RST	SIM	O	SIM reset	Value at internal reset: L. See section 4.2.8 for detailed electrical specs.
41	VSIM	-	O	SIM supply output	VSIM = 1.80 V typical or 2.90 V typical generated by the module according to the SIM card type. See section 4.2.2 for detailed electrical specs.
42	SIM_DET	GDI	I	SIM detection	Configurable for the SIM card presence detection function, or as GPIO (see Table 5). PU/PD class a. Value at internal reset: T/PD. See section 4.2.9 for detailed electrical specs.
43	GND	-	N/A	Ground	All the GND pins must be connected to ground
44	RSVD	-	N/A	RESERVED pin	Leave unconnected.
45	RSVD	-	N/A	RESERVED pin	Leave unconnected.
46	RSVD	-	N/A	RESERVED pin	Leave unconnected.
47	RSVD	-	N/A	RESERVED pin	Leave unconnected.
48	RSVD	-	N/A	RESERVED pin	Leave unconnected.
49	RSVD	-	N/A	RESERVED pin	Leave unconnected.
50	GND	-	N/A	Ground	All the GND pins must be connected to ground
51	VCC	-	I	Module supply input	All VCC pins must be connected to external supply. See sections 4.2.2 and 4.2.3 for detailed specs.
52	VCC	-	I	Module supply input	All VCC pins must be connected to external supply. See sections 4.2.2 and 4.2.3 for detailed specs.
53	VCC	-	I	Module supply input	All VCC pins must be connected to external supply. See sections 4.2.2 and 4.2.3 for detailed specs.
54	GND	-	N/A	Ground	All the GND pins must be connected to ground
55	GND	-	N/A	Ground	All the GND pins must be connected to ground
56	ANT	-	I/O	RF input/output	50 Ω nominal impedance See section 4.2.4 for detailed electrical specs.
57	GND	-	N/A	Ground	All the GND pins must be connected to ground
58	GND	-	N/A	Ground	All the GND pins must be connected to ground
59	GND	-	N/A	Ground	All the GND pins must be connected to ground
60	GND	-	N/A	Ground	All the GND pins must be connected to ground
61	GND	-	N/A	Ground	All the GND pins must be connected to ground
62	ANT_DET	ADC	I	Antenna detection	Antenna presence detection function. See section 4.2.5 for detailed electrical specs.
63	GND	-	N/A	Ground	All the GND pins must be connected to ground
64	GND	-	N/A	Ground	All the GND pins must be connected to ground
65-96	GND	-	N/A	Ground	All the GND pins must be connected to ground

Table 6: SARA-U2 series module pin-out

☞ For more information about pin-outs, see the SARA-G3 and SARA-U2 series system integration manual [6].

☞ For an explanation of the abbreviations and terms used, see Appendix A.

4 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 (section 4.2) of the specification should be avoided. Exposure to Absolute Maximum Rating conditions for extended periods may affect device reliability.

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

☞ Electrical characteristics are defined according to verification on a representative number of samples or according to simulation.

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

4.1 Absolute maximum rating

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

Symbol	Description	Condition	Min.	Max.	Unit
VCC	Module supply voltage	Input DC voltage at VCC pins	-0.30	5.50	V
VUSB_DET	USB detection pin	Input DC voltage at VUSB_DET pin	-0.30	5.35	V
USB	USB D+/D- pins	Input DC voltage at USB_D+ and USB_D- pins	-1.00	5.35	V
V_BCKP	RTC supply voltage	Input DC voltage at V_BCKP pin	-0.15	2.00	V
GDI	Generic digital interfaces	Input DC voltage at Generic digital interfaces pins	-0.30	3.60	V
DDC	DDC interface	Input DC voltage at DDC interface pins	-0.30	3.60	V
SIM	SIM interface	Input DC voltage at SIM interface pin	-0.30	3.60	V
ERS	External reset signal	Input DC voltage at RESET_N external reset pin	-0.15	2.10	V
POS	Power-on signal	Input DC voltage at PWR_ON power-on pin	-0.30	5.50	V
ADC	Antenna detection pin	Input DC voltage at ANT_DET pin	-0.15	3.00	V
P_ANT	Antenna power	Input in-band RF power at ANT pin		-10	dBm
Rho_ANT	Antenna ruggedness	Output RF load mismatch ruggedness at ANT pin		15:1	VSWR
Tstg	Storage temperature		-40	90	°C

Table 7: 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 the table above, must be limited to values within the specified boundaries by using appropriate protection devices.

4.1.1 Maximum ESD

Parameter	Module	Max.	Unit	Remarks
ESD sensitivity for all pins except ANT pin	All	1000	V	Human Body Model according to JESD22-A114F
ESD sensitivity for ANT pin	All	1000	V	Human Body Model according to JESD22-A114F
ESD immunity for ANT pin	SARA-U201	4000	V	Contact Discharge according to IEC 61000-4-2
		8000	V	Air Discharge according to IEC 61000-4-2
	All except SARA-U201	2000	V	Contact Discharge according to IEC 61000-4-2
		4000	V	Air Discharge according to IEC 61000-4-2

Table 8: Maximum ESD ratings

⚠ SARA-U2 modules are Electrostatic Sensitive Devices (ESD) and require special precautions when handling. See section 7.4 for ESD handling instructions.

4.2 Operating conditions

☞ Unless otherwise indicated, all operating condition specifications assume an ambient temperature of +25 °C.

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

4.2.1 Operating temperature range

Symbol	Parameter	Module	Min.	Typ.	Max.	Units	Remarks
Topr	Operating temperature range	All	-40		+85	°C	
	Normal operating temperature range	SARA-U201	-20		+65	°C	See section 4.2.1.1
		SARA-U260, SARA-U270, SARA-U280	-20		+55	°C	See section 4.2.1.1
	Extended operating temperature range	All	-40		-20	°C	Extended operating temperature range 1 See section 4.2.1.2
		SARA-U201	+65		+85	°C	Extended operating temperature range 2 See section 4.2.1.3
		SARA-U260, SARA-U270, SARA-U280	+55		+85	°C	Extended operating temperature range 2 See section 4.2.1.3

Table 9: Environmental conditions

4.2.1.1 Normal operating temperature range

The cellular module is fully functional and meets the 3GPP / ETSI specification across the specified temperature range.

4.2.1.2 Extended operating temperature range 1

The cellular module is fully functional across the specified temperature range. Occasional deviations from the 3GPP specification may occur.

4.2.1.3 Extended operating temperature range 2

The cellular module is functional across the specified temperature range. Occasional deviations from the 3GPP specification may occur. Thermal protection including automatic shutdown is implemented for protection against overheating. Thermal protection is disabled for emergency calls. For more details, see the u-blox AT commands manual [4], +USTS AT command).

4.2.2 Supply/Power pins

Pin Name	Parameter	Min.	Typ.	Max.	Unit
VCC	Module supply normal operating input voltage[23]	3.30	3.80	4.40	V
	Module supply extended operating input voltage[24]	3.10		4.50	V
V_BCKP	RTC supply input voltage	1.00	1.80	1.90	V
	RTC supply average current consumption, at V_BCKP = 1.8 V		2.00		µA

Table 10: Input characteristics of the Supply/Power pins

Pin Name	Parameter	Min.	Typ.	Max.	Unit
VSIM	SIM supply output voltage	1.76	1.80	1.83	V
		2.84	2.90	2.94	V
V_BCKP	RTC supply output voltage	1.71	1.80	1.89	V
	RTC supply output current capability			3	mA
V_INT	Digital I/O Interfaces supply output voltage	1.73	1.80	1.87	V
	Digital I/O Interfaces supply output peak-to-peak voltage ripple during active or connected mode			15	mV
	Digital I/O Interfaces supply output peak-to-peak voltage ripple during low power idle mode with power saving enabled by AT+UPSV command			70	mV
	Digital I/O Interfaces supply output current capability			70	mA

Table 11: Output characteristics of the Supply/Power pins

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[23] Input voltage at **VCC** must be above the normal operating range minimum limit to switch on the module.
[24] Occasional deviations from the 3GPP specifications may occur. Ensure that input voltage at **VCC** never drops below the extended operating range minimum limit during module operation: the module may switch off when the **VCC** voltage value drops below the extended operating range minimum limit.

4.2.3 Current consumption

Mode	Condition	Band	Module	Min	Typ[25]	Max[26]	Unit
Power Off Mode	Averaged current, module switched off		SARA-U201		55		µA
			SARA-U260, SARA-U270, SARA-U280		65		µA
Idle-Mode (Power Saving enabled by AT+UPSV, module in low power idle-mode, equivalent to +CFUN=0)	Averaged current over a 100 ms period, USB interface disconnected		All		0.5		mA
	Averaged current over a 100 ms period, USB interface connected and suspended		All		0.9		mA
2G Cyclic Idle/Active-Mode (Power Saving enabled by AT+UPSV, Module registered with network)	Averaged current over a 10 minute period, DRX = 9[27], +UPSV=2 or 3, USB disconnected	All	All		0.9		mA
	Averaged current over a 10 minute period, DRX = 5[28], +UPSV=1, USB disconnected	All	All		1.2		mA
	Averaged current over a 10 minute period, DRX = 5[28], +UPSV=1, USB suspended	All	All		1.6		mA
2G Active-Mode (Power Saving disabled by AT+UPSV=0, Module registered with network)	Averaged current over a 10 minute period, DRX = 5[28], USB disconnected	All	All		14.7		mA
	Averaged current over a 10 minute period, DRX = 5[28], USB connected and not suspended	All	All		34.3		mA
GSM Connected Mode (Tx / Rx call enabled)	Peak current[29] during a 1-slot Tx burst Maximum Tx power	850, 900	All		1.55	1.90	A
	Averaged current over a 10 s period, 1 Tx + 1 Rx slot, Minimum Tx power	All	SARA-U201, SARA-U260, SARA-U270		45		mA
	Averaged current over a 10 s period, 1 Tx + 1 Rx slot, Maximum Tx power	850, 900	SARA-U201		240		mA
			SARA-U260, SARA-U270		210		mA
		1800, 1900	SARA-U201		160		mA
			SARA-U260, SARA-U270		135		mA
GPRS Connected Mode (Tx / Rx call enabled)	Averaged current over a 10 s period, 4 Tx + 1 Rx slots, Maximum Tx power[30]	850, 900	SARA-U201		600		mA
			SARA-U260, SARA-U270		560		mA
		1800, 1900	SARA-U201		400		mA
			SARA-U260, SARA-U270		350		mA
EDGE Connected Mode (Tx / Rx call enabled)	Averaged current over a 10 s period, 4 Tx + 1 Rx slots, Maximum Tx power[30]	850, 900	SARA-U201		470		mA
		1800, 1900	SARA-U201		490		mA
3G Cyclic Idle/Active-Mode (Power Saving enabled by	Averaged current over a 10 minute period, DRX = 9[31], +UPSV=2 or 3, USB disconnected	All	All		0.9		mA

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[25] Typical values with a matched antenna
[26] Maximum values with a mismatched antenna
[27] Module is registered with the network, with a paging period of 2.12 s (2G network DRX setting = 9), with none neighbour cell.
[28] Module is registered with the network, with a paging period of 1.18 s (2G network DRX setting = 5), with 16 neighbour cells.
[29] It is recommended to use this figure to dimension maximum current capability of power supply.
[30] Condition for GPRS and EDGE multi-slot output power: Multi-Slot Power Reduction profile 2 (+UDCONF=40 AT command default value).
[31] Module is registered with the network, with a paging period of 5.12 s (3G network DRX setting = 9).

Mode	Condition	Band	Module	Min	Typ[25]	Max[26]	Unit
AT+UPSV, Module registered with network)	Averaged current over a 10 minute period, DRX = 7[32], +UPSV=1, USB disconnected	All	All		1.3		mA
	Averaged current over a 10 minute period, DRX = 7[32], +UPSV=1, USB suspended	All	All		1.7		mA
3G Active-Mode (Power Saving disabled by AT+UPSV=0, Module registered with network)	Averaged current over a 10 minute period, DRX = 7[32], USB disconnected	All	All		14.1		mA
	Averaged current over a 10 minute period, DRX = 7[32], USB connected and not suspended	All	All		33.7		mA
UMTS Connected Mode (Tx / Rx call enabled)	Averaged current over a 10 s period, 12.2 kbit/s UL, 12.2 kbit/s DL Minimum Tx power	1, 2	All		120		mA
		5, 8, 19	All		115		mA
	Averaged current over a 10 s period, 12.2 kbit/s UL, 12.2 kbit/s DL Tx power = 0 dBm	1, 2	All		140		mA
		5, 8, 19	All		135		mA
	Averaged current over a 10 s period, 12.2 kbit/s UL, 12.2 kbit/s DL Tx power = 12 dBm	1, 2	All		200		mA
		5, 8, 19	All		190		mA
	Averaged current over a 10 s period, 12.2 kbit/s UL, 12.2 kbit/s DL Tx power = 18 dBm	1, 2	All		350		mA
		5, 8, 19	All		325		mA
	Averaged current over a 10 s period, 12.2 kbit/s UL, 12.2 kbit/s DL Maximum Tx power	1, 2	SARA-U201		510		mA
			SARA-U260, SARA-U270, SARA-U280		625		mA
		5, 8, 19	SARA-U201		430		mA
			SARA-U260, SARA-U270, SARA-U280		565		mA
HSDPA Connected Mode (Tx / Rx call enabled)	Averaged current over a 10 s period, Maximum DL data rate (HSDPA) Maximum Tx power	1, 2	SARA-U201		550		mA
			SARA-U260, SARA-U270, SARA-U280		680		mA
		5, 8, 19	SARA-U201		500		mA
			SARA-U260, SARA-U270, SARA-U280		595		mA
HSUPA or HSPA Connected Mode (Tx / Rx call enabled)	Averaged current over a 10 s period, Maximum UL data rate (HSUPA) or Maximum both UL/DL data rate (HSPA) Maximum Tx power	1, 2	SARA-U201		425		mA
			SARA-U260, SARA-U270, SARA-U280		580		mA
		5, 8, 19	SARA-U201		390		mA
			SARA-U260, SARA-U270, SARA-U280		510		mA

Table 12: VCC current consumption

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[32] Module is registered with the network, with a paging period of 1.28 s (3G network DRX setting = 7).

4.2.4   RF characteristics

The 3G and 2G bands supported by each SARA-U2 series module are defined in Table 2, while the following Table 13 lists the Transmitting and Receiving frequencies for each 3G and 2G band, according to 3GPP TS 34.121-1 [13] and 3GPP TS 51.010-1 [14].

Parameter		Min.	Max.	Unit	Remarks
Frequency range GSM 850	Uplink	824	849	MHz	Module transmit
	Downlink	869	894	MHz	Module receive
Frequency range E-GSM 900	Uplink	880	915	MHz	Module transmit
	Downlink	925	960	MHz	Module receive
Frequency range DCS 1800	Uplink	1710	1785	MHz	Module transmit
	Downlink	1805	1880	MHz	Module receive
Frequency range PCS 1900	Uplink	1850	1910	MHz	Module transmit
	Downlink	1930	1990	MHz	Module receive
Frequency range UMTS Band 19 (800 MHz)	Uplink	830	845	MHz	Module transmit
	Downlink	875	890	MHz	Module receive
Frequency range UMTS Band 5 (850 MHz)	Uplink	824	849	MHz	Module transmit
	Downlink	869	894	MHz	Module receive
Frequency range UMTS Band 8 (900 MHz)	Uplink	880	915	MHz	Module transmit
	Downlink	925	960	MHz	Module receive
Frequency range UMTS Band 2 (1900 MHz)	Uplink	1850	1910	MHz	Module transmit
	Downlink	1930	1990	MHz	Module receive
Frequency range UMTS Band 1 (2100 MHz)	Uplink	1920	1980	MHz	Module transmit
	Downlink	2110	2170	MHz	Module receive

Table 13: Operating RF frequency bands

SARA-U2 series modules include a UE Power Class 3 transmitter for all the 3G bands, a GMSK Power Class 4 transmitter for the GSM/E-GSM 2G bands, and a GMSK Power Class 1 transmitter for the DCS/PCS 2G bands. SARA-U201 modules also include an 8-PSK Power Class E2 transmitter for all 2G bands. See Table 2.

Output power and characteristics comply with 3GPP TS 34.121-1 [13] and 3GPP TS 51.010-1 [14].

SARA-U2 series modules 3G and 2G receiver characteristics are compliant to 3GPP TS 34.121-1 [13] and 3GPP TS 51.010-1 [14], with conducted receiver sensitivity performance specified in Table 14.

Parameter	Min.	Typ.	Max.	Unit	Remarks
Receiver input sensitivity GSM 850 / E-GSM 900		-109.0		dBm	Downlink RF level @ BER Class II < 2.4%
Receiver input sensitivity DCS 1800 / PCS 1900		-109.0		dBm	Downlink RF level @ BER Class II < 2.4%
Receiver input sensitivity UMTS Band 19 (850 MHz)		-111.0		dBm	Downlink RF level for RMC @ BER < 0.1%
Receiver input sensitivity UMTS Band 5 (850 MHz)		-111.0		dBm	Downlink RF level for RMC @ BER < 0.1%
Receiver input sensitivity UMTS Band 8 (900 MHz)		-110.0		dBm	Downlink RF level for RMC @ BER < 0.1%
Receiver input sensitivity UMTS Band 2 (1900 MHz)		-110.0		dBm	Downlink RF level for RMC @ BER < 0.1%
Receiver input sensitivity UMTS Band 1 (2100 MHz)		-110.0		dBm	Downlink RF level for RMC @ BER < 0.1%

Condition: 50 Ω source

Table 14: Receiver sensitivity performance

4.2.5　ANT_DET pin

Pin name	Parameter	Min.	Typ.	Max.	Unit	Remarks
ANT_DET	Output DC current pulse value		10		µA	
	Output DC current pulse time length		128		µs	

Table 15: ANT_DET pin characteristics

4.2.6　PWR_ON pin

Pin name	Parameter	Min.	Typ.	Max.	Unit	Remarks
PWR_ON	Internal supply for Power-On Input Signal	1.71	1.80	1.89	V	RTC supply (V_BCKP)
	L-level input	-0.30		0.65	V	High input impedance (no internal pull-up)
	H-level input	1.50		4.40	V	High input impedance (no internal pull-up)
	L-level input current		-6		µA	
	PWR_ON low time to switch on the module	50		80	µs	
	PWR_ON low time to switch off the module	1000			ms	

Table 16: PWR_ON pin characteristics (POS domain)

4.2.7　RESET_N pin

Pin name	Parameter	Min.	Typ.	Max.	Unit	Remarks
RESET_N	Internal supply for External Reset Input Signal	1.71	1.80	1.89	V	RTC supply (V_BCKP)
	L-level input	-0.30		0.51	V	
	H-level input	1.32		2.01	V	
	L-level input current		-180		µA	
	Pull-up resistance		10		kΩ	Internal pull-up to RTC supply (V_BCKP)

Table 17: RESET_N pin characteristics (ERS domain)

The **RESET_N** input line has to be driven as described in Figure 5 to perform an abrupt "external" or "hardware" reset (reboot) of the SARA-U201 modules:

- **RESET_N** line has to be set to the LOW level for 50 ms (minimum)
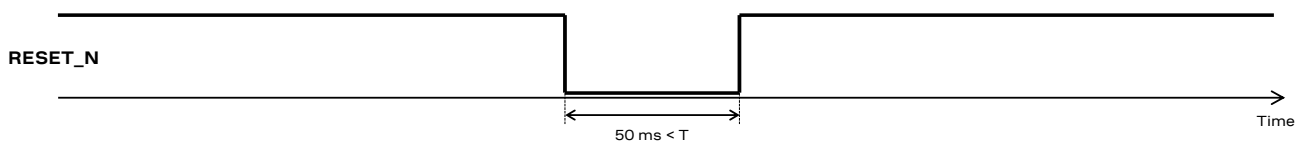
Figure 5: RESET_N line waveform timings to perform an abrupt reset of SARA-U201 modules

The **RESET_N** input line has to be driven as described in Figure 6 to perform an abrupt "external" or "hardware" reset (reboot) of the SARA-U260, SARA-U270 and SARA-U280 modules:

- First, **RESET_N** line has to be set to the LOW level for 100 µs (minimum) to 200 µs (maximum)
- Then, **RESET_N** line has to be released to the HIGH level for 2 ms (minimum) to 4 ms (maximum)
- Then, **RESET_N** line has to be set to the LOW level for 500 ms (minimum)
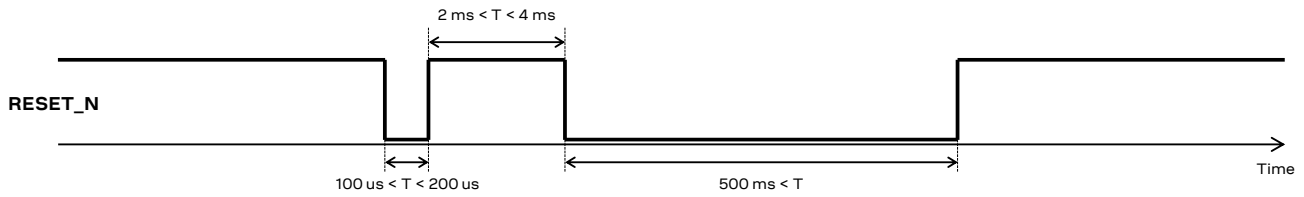
Figure 6: RESET_N line waveform timings to perform an abrupt reset of SARA-U260, SARA-U270 and SARA-U280 modules

4.2.8 (U)SIM pins

The SIM pins are a dedicated interface to the external SIM card/chip. The electrical characteristics fulfill the regulatory specification requirements. The values in Table 18 are for information only.

Parameter	Min.	Typ.	Max.	Unit	Remarks
Low-level input	0.00		0.35	V	VSIM = 1.80 V
	0.00		0.57	V	VSIM = 2.90 V
High-level input	1.29		3.30	V	VSIM = 1.80 V
	2.07		3.30	V	VSIM = 2.90 V
Low-level output		0.00	0.35	V	VSIM = 1.80 V, Max value at I_{OL} = +1.0 mA
		0.00	0.35	V	VSIM = 2.90 V, Max value at I_{OL} = +1.0 mA
High-level output	1.26	1.80		V	VSIM = 1.80 V, Min value at I_{OH} = -1.0 mA
	2.03	2.90		V	VSIM = 2.90 V, Min value at I_{OH} = -1.0 mA
Input/Output leakage current			0.7	µA	0.2V < V_{IN} < 3.3V
Internal pull-up resistor on SIM_IO to VSIM		4.7		kΩ	
Clock frequency on SIM_CLK		3.25		MHz	

Table 18: (U)SIM pin characteristics (SIM domain)

4.2.9 Generic Digital Interfaces pins

Parameter	Min.	Typ.	Max.	Unit	Remarks
Internal supply for GDI domain	1.73	1.80	1.87	V	Generic Digital Interfaces supply (V_INT)
Input characteristic: L-level input	-0.20		0.35	V	
Input characteristic: H-level input	1.31		1.93	V	
Output characteristics: L-level output		0.00	0.20	V	Max value at I_{OL} = +0.1 mA for driver class A
		0.00	0.35	V	Max value at I_{OL} = +6.0 mA for driver class A
		0.00	0.20	V	Max value at I_{OL} = +0.1 mA for driver class B
		0.00	0.35	V	Max value at I_{OL} = +4.0 mA for driver class B
		0.00	0.20	V	Max value at I_{OL} = +0.1 mA for driver class C
		0.00	0.35	V	Max value at I_{OL} = +2.0 mA for driver class C
		0.00	0.45	V	Max value at I_{OL} = +2.0 mA for driver class C_0
		0.00	0.20	V	Max value at I_{OL} = +0.1mA for driver class D
		0.00	0.35	V	Max value at I_{OL} = +1.0 mA for driver class D
		0.00	0.20	V	Max value at I_{OL} = +0.1 mA for driver class E
Output characteristics: H-level output	1.45	1.80		V	Min value at I_{OH} = -6.0 mA for driver class A
	1.60	1.80		V	Min value at I_{OH} = -0.1 mA for driver class A
	1.45	1.80		V	Min value at I_{OH} = -4.0 mA for driver class B
	1.60	1.80		V	Min value at I_{OH} = -0.1 mA for driver class B
	1.45	1.80		V	Min value at I_{OH} = -2.0 mA for driver class C
	1.60	1.80		V	Min value at I_{OH} = -0.1 mA for driver class C
	1.35	1.80		V	Min value at I_{OH} = -2.0 mA for driver class C_0
	1.45	1.80		V	Min value at I_{OH} = -1.0 mA for driver class D
	1.60	1.80		V	Min value at I_{OH} = -0.1 mA for driver class D
	1.60	1.80		V	Min value at I_{OH} = -0.1 mA for driver class E
Input/Output leakage current			0.7	µA	0.2 V < V_{IN} < 1.93 V
Pull-up input current			-240	µA	PU Class a
			-150	µA	PU Class b
			-125	µA	PU Class c
Pull-down input current			+200	µA	PD Class a
			+150	µA	PD Class b
			+45	µA	PD Class c

Table 19: Generic Digital Interfaces pin characteristics (GDI domain)

4.2.9.1 AC characteristics of digital audio interfaces pins

The 4-wire I2S digital audio interface can be configured in 4 different modes:

- Normal I2S mode – Host mode
- Normal I2S mode – Local device mode
- PCM mode – Host mode
- PCM mode – Local device mode

AC characteristics of the 4 different modes of the I2S digital audio interface are reported as follows.

Normal I2S mode – Host mode
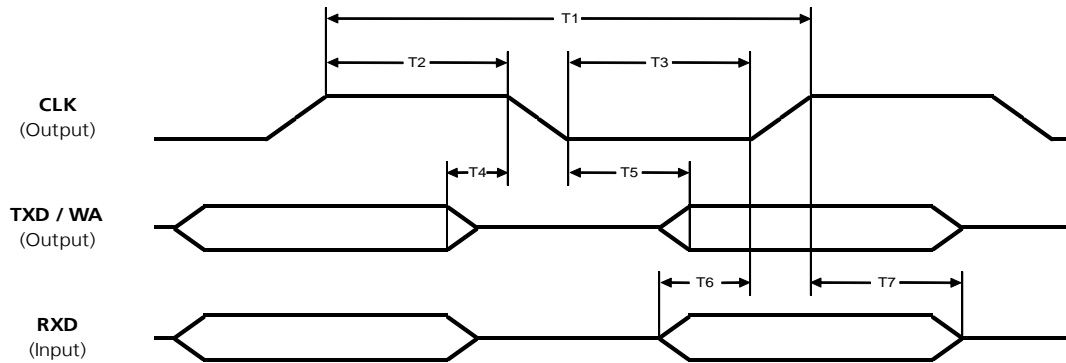
Figure 7: AC characteristics of digital audio interface in Normal I2S mode (<I2S_mode> = 2,4,6,8,10,12), host mode
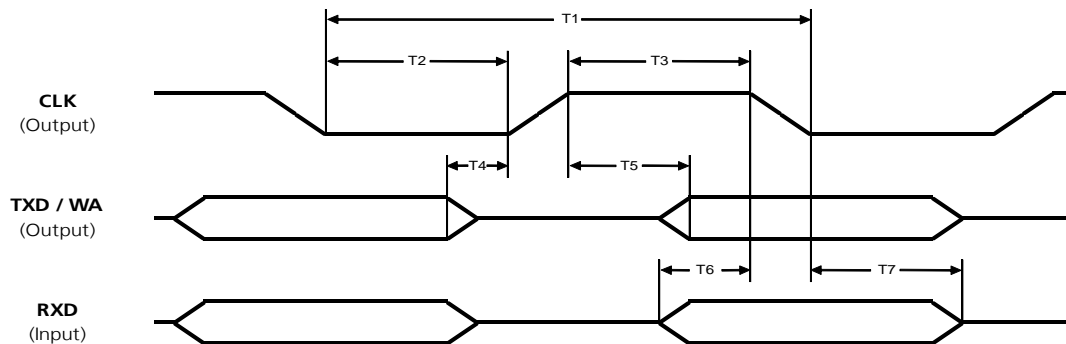
Figure 8: AC characteristics of digital audio interface in Normal I2S mode (<I2S_mode> = 3,5,7,9,11,13), host mode

Parameter	Description	Min.	Typ.	Max.	Unit	Remarks
T1	I2S clock period	3.902	3.906		µs	<I2S_sample_rate>=0
		2.830	2.834		µs	<I2S_sample_rate>=1
		2.600	2.604		µs	<I2S_sample_rate>=2
		1.949	1.953		µs	<I2S_sample_rate>=3
		1.413	1.417		µs	<I2S_sample_rate>=4
		1.298	1.302		µs	<I2S_sample_rate>=5
		0.973	0.977		µs	<I2S_sample_rate>=6
		0.705	0.709		µs	<I2S_sample_rate>=7
		0.647	0.651		µs	<I2S_sample_rate>=8

Parameter	Description	Min.	Typ.	Max.	Unit	Remarks
1/T1	I2S clock frequency		256.0	256.3	kHz	<I2S_sample_rate>=0
			352.8	353.3	kHz	<I2S_sample_rate>=1
			384.0	384.6	kHz	<I2S_sample_rate>=2
			512.0	513.1	kHz	<I2S_sample_rate>=3
			705.6	707.6	kHz	<I2S_sample_rate>=4
			768.0	770.4	kHz	<I2S_sample_rate>=5
			1024	1028	kHz	<I2S_sample_rate>=6
			1411	1419	kHz	<I2S_sample_rate>=7
			1536	1545	kHz	<I2S_sample_rate>=8
T2	I2S clock high time	1.933	1.953		µs	<I2S_sample_rate>=0
		1.397	1.417		µs	<I2S_sample_rate>=1
		1.282	1.302		µs	<I2S_sample_rate>=2
		0.957	0.977		µs	<I2S_sample_rate>=3
		0.689	0.709		µs	<I2S_sample_rate>=4
		0.631	0.651		µs	<I2S_sample_rate>=5
		0.468	0.488		µs	<I2S_sample_rate>=6
		0.334	0.354		µs	<I2S_sample_rate>=7
		0.306	0.326		µs	<I2S_sample_rate>=8
T3	I2S clock low time	1.933	1.953		µs	<I2S_sample_rate>=0
		1.397	1.417		µs	<I2S_sample_rate>=1
		1.282	1.302		µs	<I2S_sample_rate>=2
		0.957	0.977		µs	<I2S_sample_rate>=3
		0.689	0.709		µs	<I2S_sample_rate>=4
		0.631	0.651		µs	<I2S_sample_rate>=5
		0.468	0.488		µs	<I2S_sample_rate>=6
		0.334	0.354		µs	<I2S_sample_rate>=7
		0.306	0.326		µs	<I2S_sample_rate>=8
	I2S word alignment period		125.0		µs	<I2S_sample_rate>=0
			90.70		µs	<I2S_sample_rate>=1
			83.33		µs	<I2S_sample_rate>=2
			62.50		µs	<I2S_sample_rate>=3
			45.35		µs	<I2S_sample_rate>=4
			41.67		µs	<I2S_sample_rate>=5
			31.25		µs	<I2S_sample_rate>=6
			22.68		µs	<I2S_sample_rate>=7
			20.83		µs	<I2S_sample_rate>=8
	I2S word alignment frequency		8.000		kHz	<I2S_sample_rate>=0
			11.03		kHz	<I2S_sample_rate>=1
			12.00		kHz	<I2S_sample_rate>=2
			16.00		kHz	<I2S_sample_rate>=3
			22.05		kHz	<I2S_sample_rate>=4
			24.00		kHz	<I2S_sample_rate>=5
			32.00		kHz	<I2S_sample_rate>=6
			44.10		kHz	<I2S_sample_rate>=7
			48.00		kHz	<I2S_sample_rate>=8

Parameter	Description	Min.	Typ.	Max.	Unit	Remarks
T4	I2S TXD invalid before I2S CLK high end (before shifting edge of I2S CLK)			24	ns	<I2S_mode> = 2,4,6,8,10,12
	I2S TXD invalid before I2S CLK low end (before shifting edge of I2S CLK)			24	ns	<I2S_mode> = 3,5,7,9,11,13
T5	I2S TXD valid after I2S CLK low begin (after shifting edge of I2S CLK)			32	ns	<I2S_mode> = 2,4,6,8,10,12
	I2S TXD valid after I2S CLK high begin (after shifting edge of I2S CLK)			32	ns	<I2S_mode> = 3,5,7,9,11,13
T6	I2S RXD setup time before I2S CLK low enc (before latching edge of I2S CLK)	60			ns	<I2S_mode> = 2,4,6,8,10,12
	I2S RXD setup time before I2S CLK high end (before latching edge of I2S CLK)	60			ns	<I2S_mode> = 3,5,7,9,11,13
T7	I2S RXD hold time after I2S CLK high begin (after latching edge of I2S CLK)	10			ns	<I2S_mode> = 2,4,6,8,10,12
	I2S RXD hold time after I2S CLK low begin (after latching edge of I2S CLK)	10			ns	<I2S_mode> = 3,5,7,9,11,13

Table 20: AC characteristics of digital audio interface in Normal I2S mode and host mode enabled

Normal I2S mode – local device mode
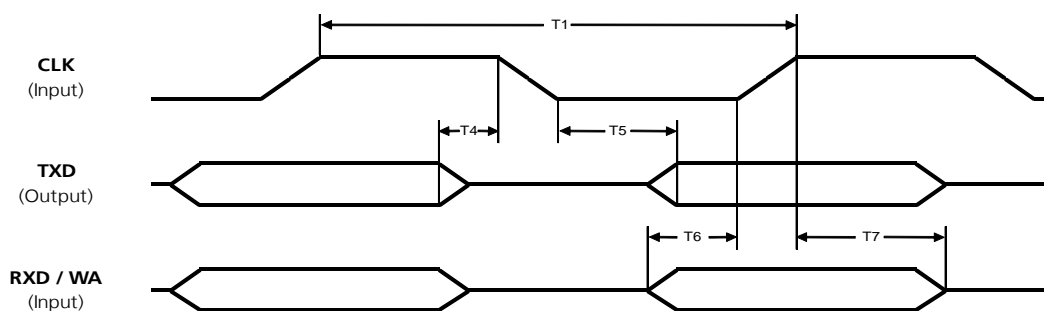

Figure 9: AC characteristics of digital audio interface in Normal I2S mode (<I2S_mode> = 2,4,6,8,10,12), local device mode
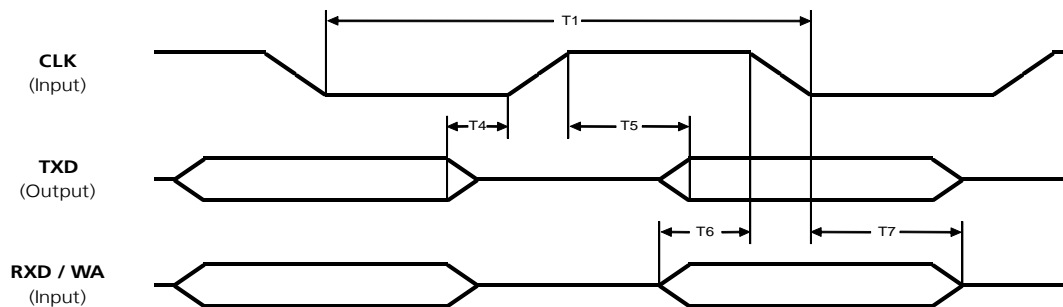
Figure 10: AC characteristics of digital audio interface in Normal I2S mode (<I2S_mode> = 3,5,7,9,11,13), local device mode

Parameter	Description	Min.	Typ.	Max.	Unit	Remarks
T1	I2S clock period	3.906			µs	<I2S_sample_rate>=0
		2.834			µs	<I2S_sample_rate>=1
		2.604			µs	<I2S_sample_rate>=2
		1.953			µs	<I2S_sample_rate>=3
		1.417			µs	<I2S_sample_rate>=4
		1.302			µs	<I2S_sample_rate>=5
		0.977			µs	<I2S_sample_rate>=6
		0.709			µs	<I2S_sample_rate>=7
		0.651			µs	<I2S_sample_rate>=8

Parameter	Description	Min.	Typ.	Max.	Unit	Remarks
1/T1	I2S clock frequency			256.0	kHz	<I2S_sample_rate>=0
				352.8	kHz	<I2S_sample_rate>=1
				384.0	kHz	<I2S_sample_rate>=2
				512.0	kHz	<I2S_sample_rate>=3
				705.6	kHz	<I2S_sample_rate>=4
				768.0	kHz	<I2S_sample_rate>=5
				1024	kHz	<I2S_sample_rate>=6
				1411	kHz	<I2S_sample_rate>=7
				1536	kHz	<I2S_sample_rate>=8
	I2S word alignment period	125.0			µs	<I2S_sample_rate>=0
		90.70			µs	<I2S_sample_rate>=1
		83.33			µs	<I2S_sample_rate>=2
		62.50			µs	<I2S_sample_rate>=3
		45.35			µs	<I2S_sample_rate>=4
		41.67			µs	<I2S_sample_rate>=5
		31.25			µs	<I2S_sample_rate>=6
		22.68			µs	<I2S_sample_rate>=7
		20.83			µs	<I2S_sample_rate>=8
	I2S word alignment frequency			8.000	kHz	<I2S_sample_rate>=0
				11.03	kHz	<I2S_sample_rate>=1
				12.00	kHz	<I2S_sample_rate>=2
				16.00	kHz	<I2S_sample_rate>=3
				22.05	kHz	<I2S_sample_rate>=4
				24.00	kHz	<I2S_sample_rate>=5
				32.00	kHz	<I2S_sample_rate>=6
				44.10	kHz	<I2S_sample_rate>=7
				48.00	kHz	<I2S_sample_rate>=8
T4	I2S TXD invalid before I2S CLK falling edge (before shifting edge of I2S CLK)			24	ns	<I2S_mode> = 2,4,6,8,10,12
	I2S TXD invalid before I2S CLK rising edge (before shifting edge of I2S CLK)			24	ns	<I2S_mode> = 3,5,7,9,11,13
T5	I2S TXD valid after I2S CLK falling edge (after shifting edge of I2S CLK)			32	ns	<I2S_mode> = 2,4,6,8,10,12
	I2S TXD valid after I2S CLK rising edge (after shifting edge of I2S CLK)			32	ns	<I2S_mode> = 3,5,7,9,11,13
T6	I2S RXD setup time before CLK rising edge (before latching edge of I2S CLK)	60			ns	<I2S_mode> = 2,4,6,8,10,12
	I2S RXD setup time before CLK falling edge (before latching edge of I2S CLK)	60			ns	<I2S_mode> = 3,5,7,9,11,13
T7	I2S RXD hold time after I2S CLK rising edge (after latching edge of I2S CLK)	10			ns	<I2S_mode> = 2,4,6,8,10,12
	I2S RXD hold time after I2S CLK falling edge (after latching edge of I2S CLK)	10			ns	<I2S_mode> = 3,5,7,9,11,13

Table 21: AC characteristics of digital audio interface in Normal I2S mode and local device mode enabled

PCM mode – Host mode

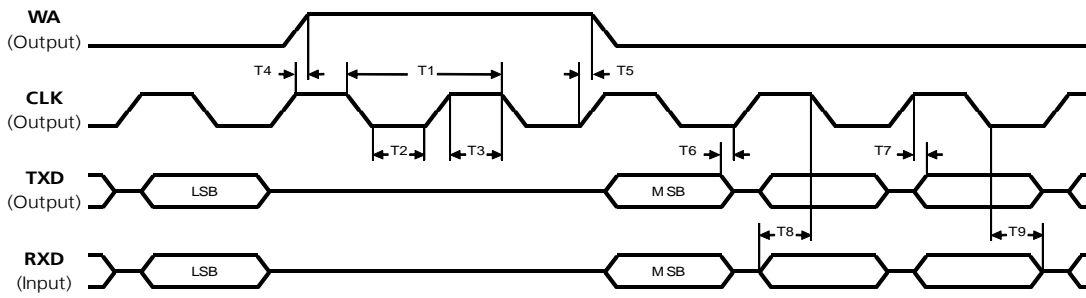**Figure 11: AC characteristics of digital audio interface in PCM mode (<I2S_mode> = 0), Host mode**
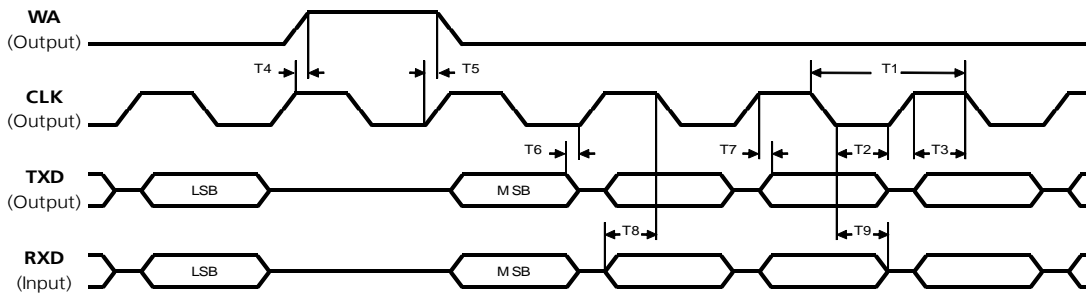

Figure 12: AC characteristics of digital audio interface in PCM mode (<I2S_mode> = 1), Host mode

Parameter	Description	Min.	Typ.	Max.	Unit	Remarks
T1	I2S clock period	6.940	6.944		µs	<I2S_mode>=0, <I2S_sample_rate>=0
		7.349	7.353		µs	<I2S_mode>=1, <I2S_sample_rate>=0
		5.035	5.039		µs	<I2S_mode>=0, <I2S_sample_rate>=1
		5.331	5.335		µs	<I2S_mode>=1, <I2S_sample_rate>=1
		4.626	4.630		µs	<I2S_mode>=0, <I2S_sample_rate>=2
		4.898	4.902		µs	<I2S_mode>=1, <I2S_sample_rate>=2
		3.468	3.472		µs	<I2S_mode>=0, <I2S_sample_rate>=3
		3.672	3.676		µs	<I2S_mode>=1, <I2S_sample_rate>=3
		2.516	2.520		µs	<I2S_mode>=0, <I2S_sample_rate>=4
		2.664	2.668		µs	<I2S_mode>=1, <I2S_sample_rate>=4
		2.311	2.315		µs	<I2S_mode>=0, <I2S_sample_rate>=5
		2.447	2.451		µs	<I2S_mode>=1, <I2S_sample_rate>=5
		1.732	1.736		µs	<I2S_mode>=0, <I2S_sample_rate>=6
		1.834	1.838		µs	<I2S_mode>=1, <I2S_sample_rate>=6
		1.256	1.260		µs	<I2S_mode>=0, <I2S_sample_rate>=7
		1.330	1.334		µs	<I2S_mode>=1, <I2S_sample_rate>=7
		1.153	1.157		µs	<I2S_mode>=0, <I2S_sample_rate>=8
		1.221	1.225		µs	<I2S_mode>=1, <I2S_sample_rate>=8

Parameter	Description	Min.	Typ.	Max.	Unit	Remarks
1/T1	I2S clock frequency		144.0	144.1	kHz	<I2S_mode>=0, <I2S_sample_rate>=0
			136.0	136.1	kHz	<I2S_mode>=1, <I2S_sample_rate>=0
			198.5	198.6	kHz	<I2S_mode>=0, <I2S_sample_rate>=1
			187.4	187.6	kHz	<I2S_mode>=1, <I2S_sample_rate>=1
			216.0	216.2	kHz	<I2S_mode>=0, <I2S_sample_rate>=2
			204.0	204.2	kHz	<I2S_mode>=1, <I2S_sample_rate>=2
			288.0	288.3	kHz	<I2S_mode>=0, <I2S_sample_rate>=3
			272.0	272.3	kHz	<I2S_mode>=1, <I2S_sample_rate>=3
			396.9	397.5	kHz	<I2S_mode>=0, <I2S_sample_rate>=4
			374.9	375.4	kHz	<I2S_mode>=1, <I2S_sample_rate>=4
			432.0	432.7	kHz	<I2S_mode>=0, <I2S_sample_rate>=5
			408.0	408.7	kHz	<I2S_mode>=1, <I2S_sample_rate>=5
			576.0	577.3	kHz	<I2S_mode>=0, <I2S_sample_rate>=6
			544.0	545.2	kHz	<I2S_mode>=1, <I2S_sample_rate>=6
			793.8	796.3	kHz	<I2S_mode>=0, <I2S_sample_rate>=7
			749.7	752.0	kHz	<I2S_mode>=1, <I2S_sample_rate>=7
			864.0	867.0	kHz	<I2S_mode>=0, <I2S_sample_rate>=8
			816.0	818.7	kHz	<I2S_mode>=1, <I2S_sample_rate>=8
T2	I2S clock low time	3.452	3.472		µs	<I2S_mode>=0, <I2S_sample_rate>=0
		3.656	3.676		µs	<I2S_mode>=1, <I2S_sample_rate>=0
		2.500	2.520		µs	<I2S_mode>=0, <I2S_sample_rate>=1
		2.648	2.668		µs	<I2S_mode>=1, <I2S_sample_rate>=1
		2.295	2.315		µs	<I2S_mode>=0, <I2S_sample_rate>=2
		2.431	2.451		µs	<I2S_mode>=1, <I2S_sample_rate>=2
		1.716	1.736		µs	<I2S_mode>=0, <I2S_sample_rate>=3
		1.818	1.838		µs	<I2S_mode>=1, <I2S_sample_rate>=3
		1.240	1.260		µs	<I2S_mode>=0, <I2S_sample_rate>=4
		1.314	1.334		µs	<I2S_mode>=1, <I2S_sample_rate>=4
		1.137	1.157		µs	<I2S_mode>=0, <I2S_sample_rate>=5
		1.205	1.225		µs	<I2S_mode>=1, <I2S_sample_rate>=5
		0.848	0.868		µs	<I2S_mode>=0, <I2S_sample_rate>=6
		0.899	0.919		µs	<I2S_mode>=1, <I2S_sample_rate>=6
		0.610	0.630		µs	<I2S_mode>=0, <I2S_sample_rate>=7
		0.647	0.667		µs	<I2S_mode>=1, <I2S_sample_rate>=7
		0.559	0.579		µs	<I2S_mode>=0, <I2S_sample_rate>=8
		0.593	0.613		µs	<I2S_mode>=1, <I2S_sample_rate>=8
T3	I2S clock high time	3.452	3.472		µs	<I2S_mode>=0, <I2S_sample_rate>=0
		3.656	3.676		µs	<I2S_mode>=1, <I2S_sample_rate>=0
		2.500	2.520		µs	<I2S_mode>=0, <I2S_sample_rate>=1
		2.648	2.668		µs	<I2S_mode>=1, <I2S_sample_rate>=1
		2.295	2.315		µs	<I2S_mode>=0, <I2S_sample_rate>=2
		2.431	2.451		µs	<I2S_mode>=1, <I2S_sample_rate>=2
		1.716	1.736		µs	<I2S_mode>=0, <I2S_sample_rate>=3
		1.818	1.838		µs	<I2S_mode>=1, <I2S_sample_rate>=3
		1.240	1.260		µs	<I2S_mode>=0, <I2S_sample_rate>=4
		1.314	1.334		µs	<I2S_mode>=1, <I2S_sample_rate>=4
		1.137	1.157		µs	<I2S_mode>=0, <I2S_sample_rate>=5

Parameter	Description	Min.	Typ.	Max.	Unit	Remarks
		1.205	1.225		µs	<I2S_mode>=1, <I2S_sample_rate>=5
		0.848	0.868		µs	<I2S_mode>=0, <I2S_sample_rate>=6
		0.899	0.919		µs	<I2S_mode>=1, <I2S_sample_rate>=6
		0.610	0.630		µs	<I2S_mode>=0, <I2S_sample_rate>=7
		0.647	0.667		µs	<I2S_mode>=1, <I2S_sample_rate>=7
		0.559	0.579		µs	<I2S_mode>=0, <I2S_sample_rate>=8
		0.593	0.613		µs	<I2S_mode>=1, <I2S_sample_rate>=8
	I2S word alignment period		125.0		µs	<I2S_sample_rate>=0
			90.70		µs	<I2S_sample_rate>=1
			83.33		µs	<I2S_sample_rate>=2
			62.50		µs	<I2S_sample_rate>=3
			45.35		µs	<I2S_sample_rate>=4
			41.67		µs	<I2S_sample_rate>=5
			31.25		µs	<I2S_sample_rate>=6
			22.68		µs	<I2S_sample_rate>=7
			20.83		µs	<I2S_sample_rate>=8
	I2S word alignment frequency		8.000		kHz	<I2S_sample_rate>=0
			11.03		kHz	<I2S_sample_rate>=1
			12.00		kHz	<I2S_sample_rate>=2
			16.00		kHz	<I2S_sample_rate>=3
			22.05		kHz	<I2S_sample_rate>=4
			24.00		kHz	<I2S_sample_rate>=5
			32.00		kHz	<I2S_sample_rate>=6
			44.10		kHz	<I2S_sample_rate>=7
			48.00		kHz	<I2S_sample_rate>=8
T4	I2S CLK high begin to WA high begin	-24		32	ns	<I2S_mode> = 0
T5	I2S CLK low end to IWA high end	-24		32	ns	<I2S_mode> = 0
T6	I2S TXD invalid before CLK low end			24	ns	<I2S_mode> = 0
T7	I2S TXD valid after CLK high begin			22	ns	<I2S_mode> = 0
T8	I2S RXD setup time before CLK high end	60			ns	<I2S_mode> = 0
T9	I2S RXD hold time after CLK low begin	12			ns	<I2S_mode> = 0

Table 22: AC characteristics of digital audio interface in PCM mode (<I2S_mode> = 0,1), host mode

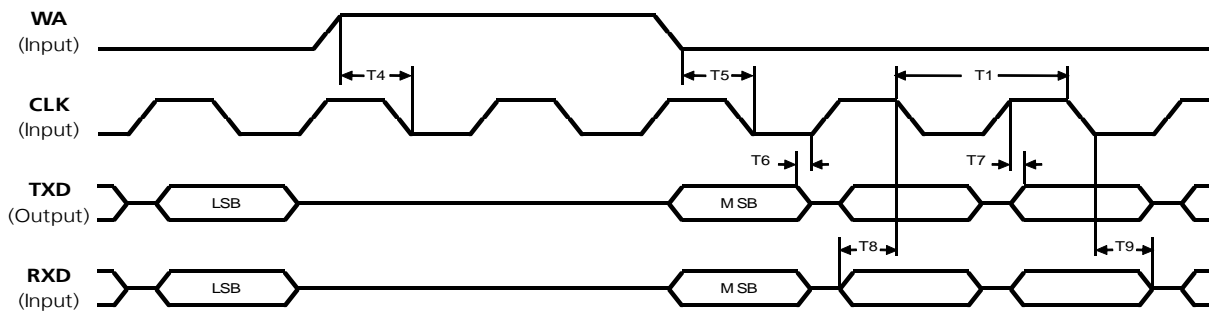## PCM mode – Local device mode

Figure 13: AC characteristics of digital audio interface in PCM mode (<I2S_mode> = 0), Local device mode
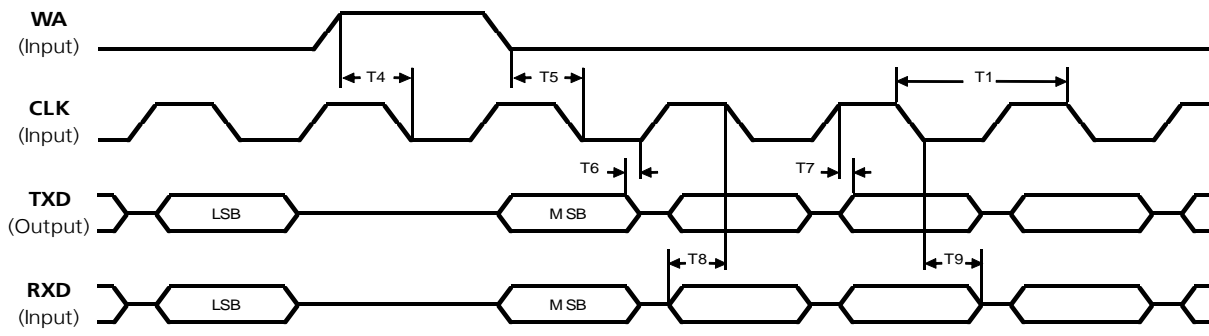

Figure 14: AC characteristics of digital audio interface in PCM mode (<I2S_mode> = 1), Local device mode

Parameter	Description	Min.	Typ.	Max.	Unit	Remarks
T1	I2S clock period	6.944			µs	<I2S_mode>=0, <I2S_sample_rate>=0
		7.353			µs	<I2S_mode>=1, <I2S_sample_rate>=0
		5.039			µs	<I2S_mode>=0, <I2S_sample_rate>=1
		5.335			µs	<I2S_mode>=1, <I2S_sample_rate>=1
		4.630			µs	<I2S_mode>=0, <I2S_sample_rate>=2
		4.902			µs	<I2S_mode>=1, <I2S_sample_rate>=2
		3.472			µs	<I2S_mode>=0, <I2S_sample_rate>=3
		3.676			µs	<I2S_mode>=1, <I2S_sample_rate>=3
		2.520			µs	<I2S_mode>=0, <I2S_sample_rate>=4
		2.668			µs	<I2S_mode>=1, <I2S_sample_rate>=4
		2.315			µs	<I2S_mode>=0, <I2S_sample_rate>=5
		2.451			µs	<I2S_mode>=1, <I2S_sample_rate>=5
		1.736			µs	<I2S_mode>=0, <I2S_sample_rate>=6
		1.838			µs	<I2S_mode>=1, <I2S_sample_rate>=6
		1.260			µs	<I2S_mode>=0, <I2S_sample_rate>=7
		1.334			µs	<I2S_mode>=1, <I2S_sample_rate>=7
		1.157			µs	<I2S_mode>=0, <I2S_sample_rate>=8
		1.225			µs	<I2S_mode>=1, <I2S_sample_rate>=8

Parameter	Description	Min.	Typ.	Max.	Unit	Remarks
1/T1	I2S clock frequency	144.0			kHz	<I2S_mode>=0, <I2S_sample_rate>=0
		136.0			kHz	<I2S_mode>=1, <I2S_sample_rate>=0
		198.5			kHz	<I2S_mode>=0, <I2S_sample_rate>=1
		187.4			kHz	<I2S_mode>=1, <I2S_sample_rate>=1
		216.0			kHz	<I2S_mode>=0, <I2S_sample_rate>=2
		204.0			kHz	<I2S_mode>=1, <I2S_sample_rate>=2
		288.0			kHz	<I2S_mode>=0, <I2S_sample_rate>=3
		272.0			kHz	<I2S_mode>=1, <I2S_sample_rate>=3
		396.9			kHz	<I2S_mode>=0, <I2S_sample_rate>=4
		374.9			kHz	<I2S_mode>=1, <I2S_sample_rate>=4
		432.0			kHz	<I2S_mode>=0, <I2S_sample_rate>=5
		408.0			kHz	<I2S_mode>=1, <I2S_sample_rate>=5
		576.0			kHz	<I2S_mode>=0, <I2S_sample_rate>=6
		544.0			kHz	<I2S_mode>=1, <I2S_sample_rate>=6
		793.8			kHz	<I2S_mode>=0, <I2S_sample_rate>=7
		749.7			kHz	<I2S_mode>=1, <I2S_sample_rate>=7
		864.0			kHz	<I2S_mode>=0, <I2S_sample_rate>=8
		816.0			kHz	<I2S_mode>=1, <I2S_sample_rate>=8
	I2S word alignment period		125.0		µs	<I2S_sample_rate>=0
			90.70		µs	<I2S_sample_rate>=1
			83.33		µs	<I2S_sample_rate>=2
			62.50		µs	<I2S_sample_rate>=3
			45.35		µs	<I2S_sample_rate>=4
			41.67		µs	<I2S_sample_rate>=5
			31.25		µs	<I2S_sample_rate>=6
			22.68		µs	<I2S_sample_rate>=7
			20.83		µs	<I2S_sample_rate>=8
	I2S word alignment frequency		8.000		kHz	<I2S_sample_rate>=0
			11.03		kHz	<I2S_sample_rate>=1
			12.00		kHz	<I2S_sample_rate>=2
			16.00		kHz	<I2S_sample_rate>=3
			22.05		kHz	<I2S_sample_rate>=4
			24.00		kHz	<I2S_sample_rate>=5
			32.00		kHz	<I2S_sample_rate>=6
			44.10		kHz	<I2S_sample_rate>=7
			48.00		kHz	<I2S_sample_rate>=8
T4	I2S WA high begin before I2S CLK low begin (latching edge of I2S CLK)	36			ns	<I2S_mode>= 0
T5	I2S WA low begin before I2S CLK low begin (latching edge of I2S CLK)	36			ns	<I2S_mode>= 0
T6	I2S TXD invalid before I2S CLK rising edge (shifting edge of I2S CLK)			12	ns	<I2S_mode>= 0
T7	I2S TXD valid after I2S CLK rising edge (shifting edge of I2S CLK)			79	ns	<I2S_mode>= 0
T8	I2S RXD setup time before I2S CLK falling edge (latching edge of I2S CLK)	22			ns	<I2S_mode>= 0
T9	I2S RXD hold time after I2S CLK falling edge (latching edge of I2S CLK)	24			ns	<I2S_mode>= 0

Table 23: AC characteristics of digital audio interface in PCM mode (<I2S_mode> = 0,1), Local device mode
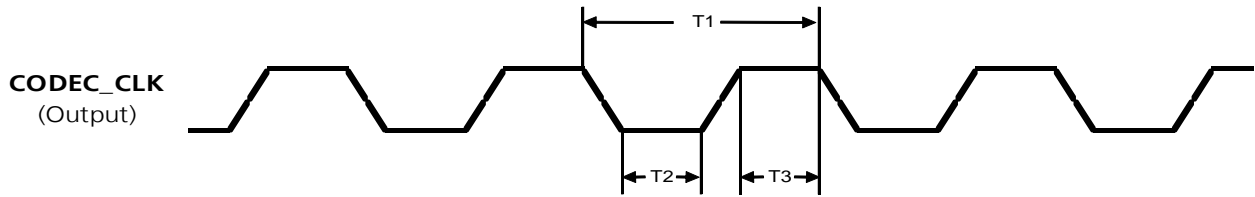
4.2.9.2 AC characteristics of Digital Clock Output pin

Figure 15: AC characteristics of CODEC_CLK digital clock output

Parameter	Description	Min.	Typ.	Max.	Unit	Remarks
T1	CODEC_CLK clock period		38		ns	CODEC_CLK output set to 26 MHz
			77		ns	CODEC_CLK output set to 13 MHz
1/T1	CODEC_CLK clock frequency		26		MHz	CODEC_CLK output set to 26 MHz
			13		MHz	CODEC_CLK output set to 13 MHz
T2	CODEC_CLK clock low time	10			ns	CODEC_CLK output set to 26 MHz
		26			ns	CODEC_CLK output set to 13 MHz
T3	CODEC_CLK clock high time	10			ns	CODEC_CLK output set to 26 MHz
		26			ns	CODEC_CLK output set to 13 MHz

Table 24: AC characteristics of CODEC_CLK digital clock output

4.2.10 USB pins

USB data lines (**USB_D+** and **USB_D-**) are compliant to the USB 2.0 high-speed specification. See the Universal Serial Bus Revision 2.0 specification [15] for detailed electrical characteristics. The values in Table 25 related to USB 2.0 high-speed physical layer specifications are for information only.

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		30		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 25: USB pins characteristics

4.2.11 DDC (I2C) pins

DDC (I2C) lines (**SCL** and **SDA**) are compliant to the I2C-bus standard mode specification. See the I2C-bus Specifications [12] for detailed electrical characteristics. The values in Table 26 related to I2C-bus standard mode specifications are for information only.

Parameter	Min.	Typ.	Max.	Unit	Remarks
Internal supply for DDC domain	1.73	1.80	1.87	V	Generic Digital 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_{OL} = +1.0 mA
Input/Output leakage current			0.7	µA	0.2 V < V_{IN} < 1.93 V
Clock frequency on SCL		100		kHz	

Table 26: DDC (I2C) pin characteristics (DDC domain)

5 Mechanical specifications
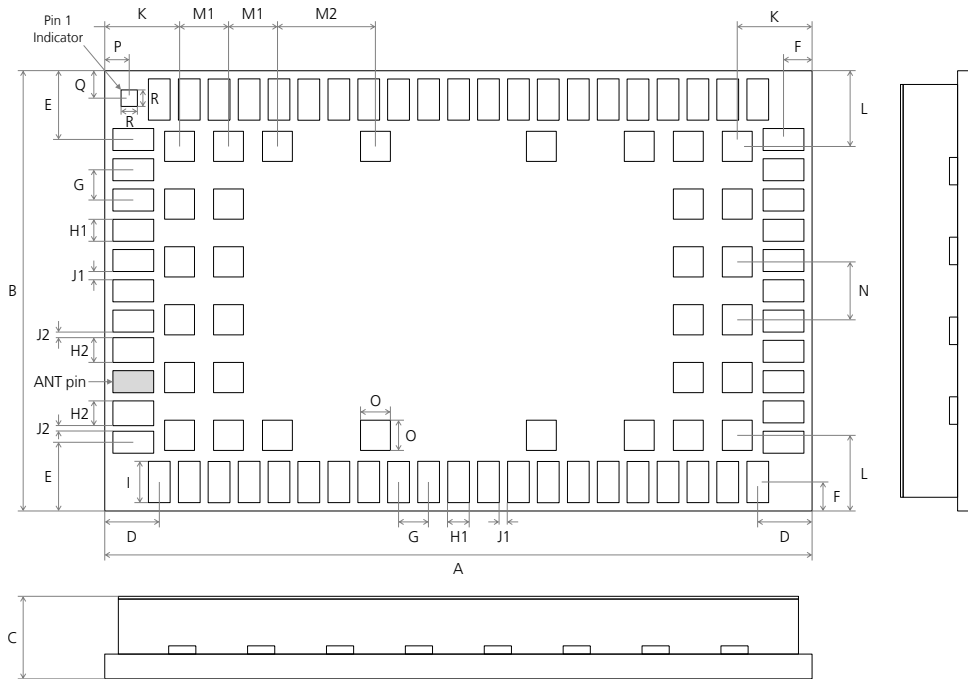
Figure 16: SARA-U2 series module dimensions (bottom and side views)

Parameter	Description	Typical		Tolerance	
A	Module Height [mm]	26.0	(1023.6 mil)	+0.20/-0.20	(+7.9/-7.9 mil)
B	Module Width [mm]	16.0	(629.9 mil)	+0.20/-0.20	(+7.9/-7.9 mil)
C	Module Thickness [mm]	3.0	(118.4 mil)	+0.25/-0.15	(+9.8/-5.9 mil)
D	Horizontal Edge to Lateral Pin Pitch [mm]	2.0	(78.7 mil)	+0.20/-0.20	(+7.9/-7.9 mil)
E	Vertical Edge to Lateral Pin Pitch [mm]	2.5	(98.4 mil)	+0.20/-0.20	(+7.9/-7.9 mil)
F	Edge to Lateral Pin Pitch [mm]	1.05	(41.3 mil)	+0.20/-0.20	(+7.9/-7.9 mil)
G	Lateral Pin to Pin Pitch [mm]	1.1	(43.3 mil)	+0.02/-0.02	(+0.8/-0.8 mil)
H1	Lateral Pin Height [mm]	0.8	(31.5 mil)	+0.02/-0.02	(+0.8/-0.8 mil)
H2	Lateral Pin close to ANT Height [mm]	0.9	(35.4 mil)	+0.02/-0.02	(+0.8/-0.8 mil)
I	Lateral Pin Width [mm]	1.5	(59.1 mil)	+0.02/-0.02	(+0.8/-0.8 mil)
J1	Lateral Pin to Pin Distance [mm]	0.3	(11.8 mil)	+0.02/-0.02	(+0.8/-0.8 mil)
J2	Lateral Pin to Pin close to ANT Distance [mm]	0.2	(7.9 mil)	+0.02/-0.02	(+0.8/-0.8 mil)
K	Horizontal Edge to Central Pin Pitch [mm]	2.75	(108.3 mil)	+0.20/-0.20	(+7.9/-7.9 mil)
L	Vertical Edge to Central Pin Pitch [mm]	2.75	(108.3 mil)	+0.20/-0.20	(+7.9/-7.9 mil)
M1	Central Pin to Pin Horizontal Pitch [mm]	1.8	(70.9 mil)	+0.02/-0.02	(+0.8/-0.8 mil)
M2	Central Pin to Pin Horizontal Pitch [mm]	3.6	(141.7 mil)	+0.02/-0.02	(+0.8/-0.8 mil)
N	Central Pin to Pin Vertical Pitch [mm]	2.1	(82.7 mil)	+0.02/-0.02	(+0.8/-0.8 mil)
O	Central Pin Height and Width [mm]	1.1	(43.3 mil)	+0.02/-0.02	(+0.8/-0.8 mil)
P	Horizontal Edge to Pin 1 Indicator Pitch [mm]	0.9	(35.4 mil)	+0.20/-0.20	(+7.9/-7.9 mil)
Q	Vertical Edge to Pin 1 Indicator Pitch [mm]	1.0	(39.4 mil)	+0.20/-0.20	(+7.9/-7.9 mil)
R	Pin 1 Indicator Height and Width [mm]	0.6	(23.6 mil)	+0.02/-0.02	(+0.8/-0.8 mil)
Weight	Module Weight [g]	< 3			

Table 27: SARA-U2 series module dimensions

☞ Module height tolerance +/–0.20 mm may be exceeded close to the corners of the PCB due to the cutting process: in the worst case, the height could be +0.40 mm longer than the typical value.

☞ For information regarding Footprint and Paste Mask recommended for the application board, see the SARA-G3 and SARA-U2 series system integration manual [6].

6 Reliability tests and approvals

6.1 Reliability tests

Tests for product family qualifications are according to ISO 16750 "Road vehicles - Environmental conditions and testing for electrical and electronic equipment", and appropriate standards.

6.2 Approvals

6.2.1 SARA-U2 series

SARA-U2 series modules comply with the Directive 2011/65/EU of the European Parliament and the Council on the Restriction of Use of certain Hazardous Substances in Electrical and Electronic Equipment (EU RoHS 2) and its amendment Directive (EU) 2015/863 (EU RoHS 3).

SARA-U2 series modules are RoHS 3 compliant.

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

Table 28 lists the SARA-U2 series main regulatory and mobile network operators' approvals.

Certification scheme	SARA-U201	SARA-U201 ATEX	SARA-U260	SARA-U270	SARA-U270 ATEX	SARA-U280
CE (European Conformity)	•	•		•	•	
FCC (United States Certification) FCC identification number	• XPY1CGM5NNN	• XPY1CGM5NNN	• XPYSARAU260			• XPYSARAU280
ISED (Canadian Certification) ISED certification number	• 8595A-1CGM5NNN	• 8595A-1CGM5NNN	• 8595A-SARAU260			• 8595A-SARAU280
ANATEL (Brazilian Certification)	•	•				
ICASA (South African Certification)	•	•		•	•	
IFT (Mexican Certification)			•			
RCM (Australian Certification)	•	•	•	•	•	•
GITEKI (Japanese Certification)	•	•				
KCC (Korean Certification)				•	•	
NCC (Taiwan Certification)	•	•		•	•	
CCC (China Compulsory Certification)	•	•		•	•	
AT&T (US Network Operator)	•	•	•			•
Rogers (Network Operator)	•	•	•			•
Telefonica (Network Operator)			•	•		
Vodafone (Network Operator)				•		
Deutsche Telekom (Network Operator)	•	•		•		
Vivo (Network Operator)	•	•				
KT (Korean Network Operator)				•		
SKT (Korean Network Operator)				•		
NTT DoCoMo (Network Operator)	•					
ATEX (ATmospheric EXplosives)		•			•	

Table 28: SARA-U2 series main regulatory and mobile network operators' approvals

☞ The above listed certifications might not be available for all the different ordering type numbers. Please contact the u-blox office or sales representative nearest you for the complete list of certification approvals available for the selected ordering type number.

6.2.2   SARA-U201 ATEX and SARA-U270 ATEX

SARA-U201 ATEX and SARA-U270 ATEX modules are certified as components intended for use in potentially explosive atmospheres compliant to the following standards:

- IEC 60079-0
- IEC 60079-11
- IEC 60079-26

The certification numbers of the modules according to the ATEX directive 2014/34/EU are:

- SARA-U201 ATEX: SIQ 16 ATEX 298 U
- SARA-U270 ATEX: SIQ 15 ATEX 017 U

The certification numbers of the modules according to the IECEx conformity assessment system are:

- SARA-U201 ATEX: IECEx SIQ 16.0006U
- SARA-U270 ATEX: IECEx SIQ 15.0001U

According to the standards listed above, the modules are certified with the following marking:

- SARA-U201 ATEX: Ex II 1G, Ex ia IIB
- SARA-U270 ATEX: Ex II 1G, Ex ia IIC/IIB

According to the marking stated above, the modules are certified as electrical equipment of:

- group 'II': intended for use in areas with explosive gas atmosphere other than mines susceptible to firedamp
- category '1G': intended for use in zone 0 hazardous areas, in which explosive atmospheres caused by mixtures of air and gases, vapors or mists are present continuously, for long periods or frequently
- level of protection 'ia': intrinsically safe apparatus with very high level of protection, not capable of causing ignition in normal operation and with the application of one countable fault or a combination of any two countable fault plus those non-countable faults which give the most onerous condition
- subdivision 'IIB': intended for use in areas where the nature of the explosive gas atmosphere is considered dangerous based on the Maximum Experimental Safe Gap or the Minimum Ignition Current ratio of the explosive gas atmosphere in which the equipment may be installed (a typical gas is ethylene), so that the modules are also suitable for applications intended for use in subdivision IIA (a typical gas is propane)
- subdivision 'IIC/IIB': intended for use in areas where the nature of the explosive gas atmosphere is considered very dangerous based on the Maximum Experimental Safe Gap or the Minimum Ignition Current ratio of the explosive gas atmosphere in which the equipment may be installed (a typical gas is hydrogen), so that the modules are also suitable for applications intended for use in subdivision IIB (typical gas is ethylene) and subdivision IIA (a typical gas is propane)

Section 4.2.1 defines the temperature range of use for SARA-U201 ATEX and SARA-U270 ATEX modules.

The RF radiating profile of the modules is compliant to all the applicable 3GPP / ETSI standards, with a maximum of 2 W RF pulse power (corresponding to 1.15 mJ RF pulse energy) and with a maximum average power of 250 mW according to the GSM/GPRS and WCDMA power class stated in Table 2. Section 9.1 describes the nameplate of the SARA-U201 ATEX and the SARA-U270 ATEX modules (see Figure 21 and Figure 22).

The following maximum input and equivalent parameters must be considered in sub-division IIC:

	SARA-U270 ATEX
Ui	3.8 V
Ii	1.6 A (burst)
Ci	132 µF
Li	9.8 µH

The following maximum input and equivalent parameters must be considered in sub-divisions IIB, IIA (two different configurations are allowed for SARA-U201 ATEX):

	SARA-U201 ATEX		SARA-U270 ATEX
Ui	3.8	4.2	4.2
Ii	2.5 A (burst)	1.6 A (burst)	2.5 A (burst)
Ci	169 µF	169 µF	132 µF
Li	9.4 µH	9.4 µH	9.8 µH

☞ For more information about the integration of the SARA-U201 ATEX and the SARA-U270 ATEX modules in applications intended for use in potentially explosive atmospheres, see the SARA-G3 / SARA-U2 Series system integration manual [6].

7 Product handling & soldering

7.1 Packaging

SARA-U2 modules are delivered as hermetically sealed, reeled tapes to enable efficient production, production lot set-up and tear-down. For more information about packaging, see the u-blox package information guide [16].

Figure 17: Reeled SARA-U2 modules

7.1.1 Reels

SARA-U2 modules are deliverable in quantities of 250 pieces on a reel. SARA-U2 modules are delivered using reel type B2 as described in the u-blox package information guide [16].

Parameter	Specification
Reel type	B2
Delivery quantity	250

Table 29: Reel information for SARA-U2 modules

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

7.1.2 Tapes

Figure 18 shows the position and the orientation of SARA-U2 series modules as they are delivered on the tape, while Figure 19 and Table 30 specify the tape dimensions.
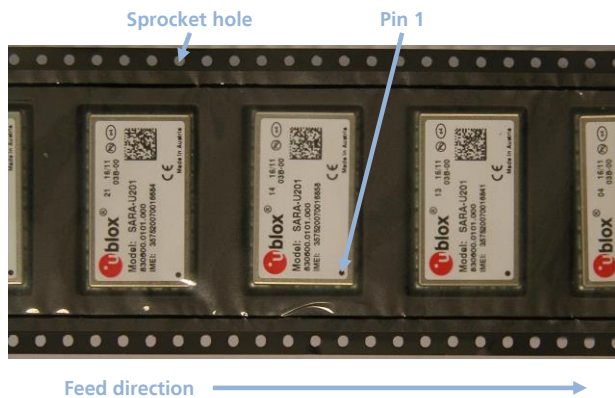
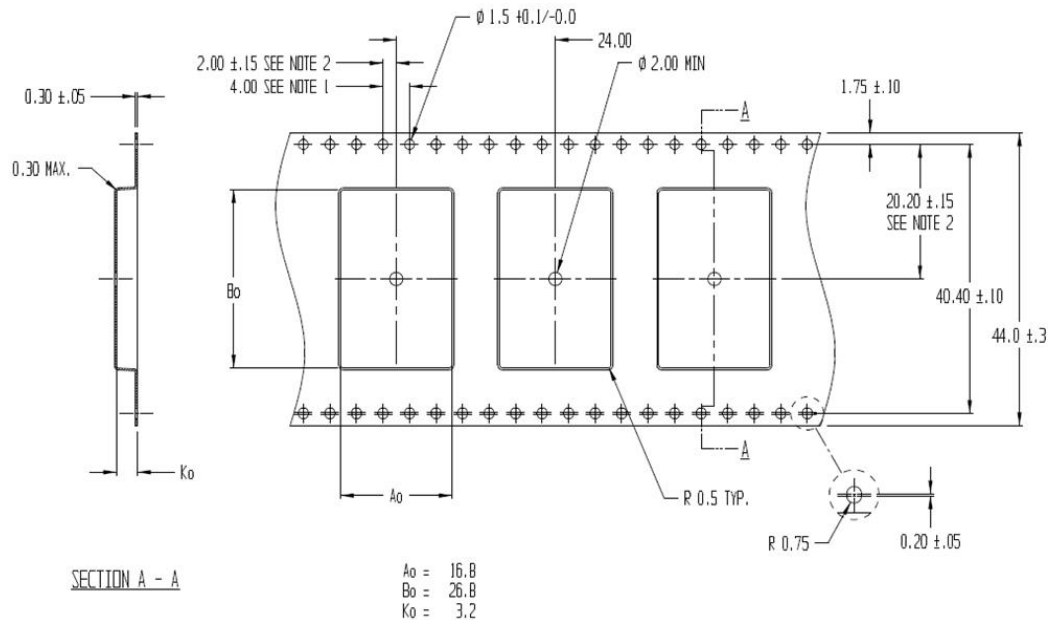**Figure 18: Orientation for SARA-U2 series modules on tape**

Figure 19: SARA-U2 series tape dimensions (mm)

Parameter	Typical value	Tolerance	Unit
A_0	16.8	0.2	mm
B_0	26.8	0.2	mm
K_0	3.2	0.2	mm

Table 30: SARA-U2 series tape dimensions (mm)

☞ Note 1: 10 sprocket hole pitch cumulative tolerance ± 0.2 mm.

☞ Note 2: pocket position relative to sprocket hole is measured as true position of pocket, not pocket hole.

☞ Note 3: A_0 and B_0 are calculated on a plane at a distance "R" above the bottom of the pocket.

7.2   Moisture Sensitivity Levels

⚠   SARA-U2 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. SARA-U2 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 [16].

☞   For the MSL standard, see IPC/JEDEC J-STD-020 (can be downloaded from www.jedec.org).

7.3   Reflow soldering

Reflow profiles are to be selected according to u-blox recommendations (see the SARA-G3 and SARA-U2 series system integration manual [6]).

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

7.4   ESD precautions

⚠   SARA-U2 modules contain highly sensitive electronic circuitry and are Electrostatic Sensitive Devices (ESD). Handling SARA-U2 modules without proper ESD protection may destroy or damage them permanently.

SARA-U2 modules are Electrostatic Sensitive Devices (ESD) and require special ESD precautions typically applied to ESD sensitive components.

Table 8 details the maximum ESD ratings of the SARA-U2 module.

Proper ESD handling and packaging procedures must be applied throughout the processing, handling and operation of any application that incorporates the SARA-U2 module.

ESD precautions should be implemented on the application board where the module is mounted, as described in the SARA-G3 and SARA-U2 series system integration manual [6].

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

8 Default settings

Interface	AT settings	Comments
UART interface	Enabled	Multiplexing mode can be enabled by AT+CMUX command providing following channels: • Channel 0: control channel • Channel 1 – 5: AT commands / data connection • Channel 6: GNSS tunneling • Channel 7: SAP (SIM Access Profile)
	AT+IPR=0	One-shot automatic baud rate detection enabled
	AT+ICF=3,1	Frame format: 8 bits, no parity, 1 stop bit ☞ Where AT+IPR=0 is the default value, the AT+ICF value in the profile is not applied (AT+IPR=0 overrules the AT+ICF setting) and the one-shot automatic frame detection is active.
	AT&K3	HW flow control enabled
	AT&S1	DSR line set ON in data mode and set OFF in command mode
	AT&D1	Upon an ON-to-OFF transition of DTR, the module enters online command state and issues an OK result code
	AT&C1	Circuit 109 changes in accordance with the Carrier detect status; ON if the Carrier is detected, OFF otherwise
AUX UART interface	Disabled	AT command interface is disabled by default on the AUX UART physical interface, and it can be configured by AT+USIO command (see the u-blox AT commands manual [4])
USB interface	Enabled	7 USB CDCs (Communications Device Class) by default available: • USB1: AT and data • USB2: AT and data • USB3: AT and data • USB4: GNSS tunneling • USB5: Primary Log (diagnostic purpose) • USB6: Secondary Log (diagnostic purpose) • USB7: SAP (SIM Access Profile)
	AT&K3	HW flow control enabled
	AT&S1	DSR line set ON in data mode and set OFF in command mode
	AT&D1	Upon an ON-to-OFF transition of DTR, the module enters online command state and issues an OK result code
	AT&C1	Circuit 109 changes in accordance with the Carrier detect status; ON if the Carrier is detected, OFF otherwise
Power saving	AT+UPSV=0	Disabled
Network registration	AT+COPS=0	Self network registration

Table 31: SARA-U2 series default settings

See the u-blox AT commands manual [4] and the SARA-G3 and SARA-U2 series system integration manual [6] for information about further settings.

9 Labeling and ordering information

9.1 Product labeling

The labels of SARA-U2 series modules include important product information as described in this section.

Figure 20 illustrates the label of all the SARA-U2 series modules except for SARA-U201 ATEX and SARA-U270 ATEX, and includes: u-blox logo, production lot, Pb-free marking, product Type Number, IMEI number, certification info and production country.
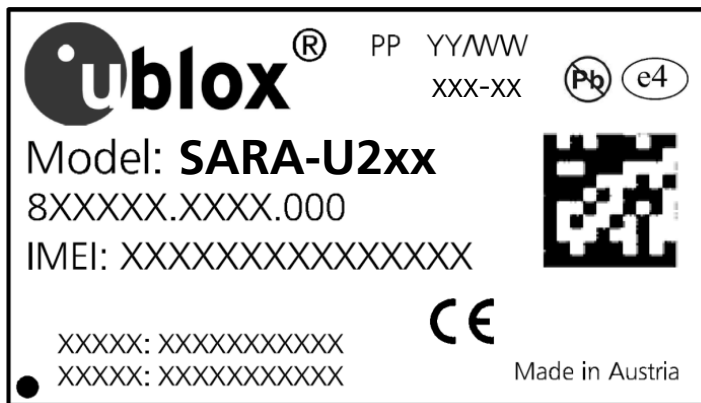

Figure 20: SARA-U2 series modules label

Figure 21 and Figure 22 illustrate the label of SARA-U201 ATEX and SARA-U270 ATEX modules respectively; these include: u-blox logo, production lot, Pb-free marking, product Type Number, IMEI number, ATEX marking with the IECEx and ATEX certificate numbers and category classification.
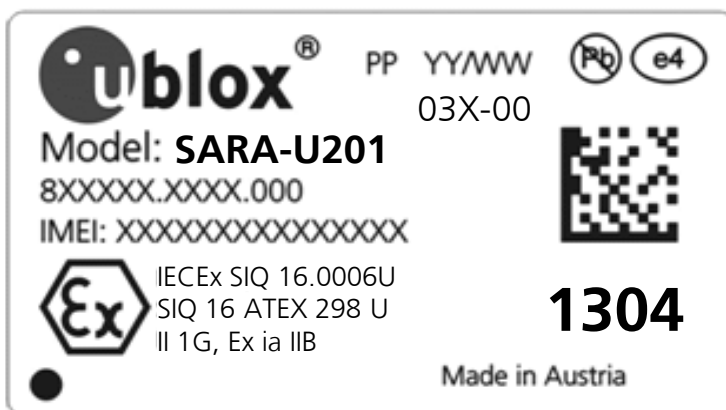

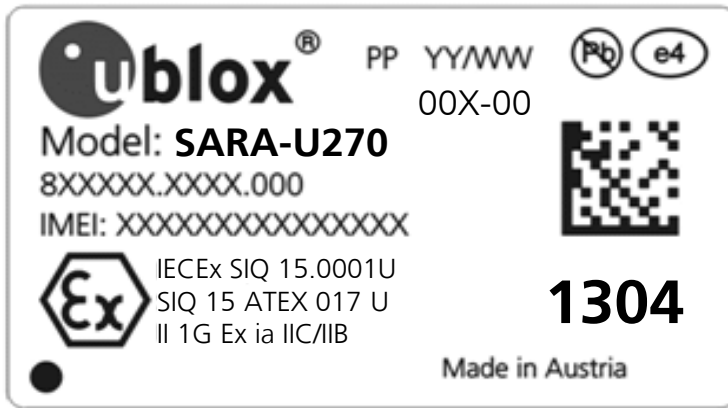**Figure 21: SARA-U201 ATEX modules label**

Figure 22: SARA-U270 ATEX modules label

☞ For more information about the certification approvals and for all the certificates of compliancy of all the SARA-U2 series modules product versions, see our website (www.u-blox.com) or contact the u-blox office or sales representative nearest you.

9.2 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 the 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 32 details these 3 different formats:

Format	Structure
Product Name	SARA-TGVV
Ordering Code	SARA-TGVV-TTQ
Type Number	SARA-TGVV-TTQ-XX

Table 32: Product code formats

Table 33 explains the parts of the product code.

Code	Meaning	Example
PPP(P)	Form factor (3 or 4 digit, typically 4 for cellular products)	SARA
TG	Platform (Technology and Generation) • Dominant technology: G: GSM/GPRS; U: UMTS/HSPA; C: CDMA 1xRTT; N: NB-IoT; R: LTE low data rate (Cat 1 and below); L: LTE high data rate (Cat 3 and above) • Generation: 1…9	U2
VV	Variant function set based on the same platform [00…99]	00
TT	Major product version [00…99]	00
Q	Quality grade/production site • A = automotive • B = professional • S = professional • X = ATEX	S
XX	Minor product version (not relevant for certification)	Default value is 00

Table 33: Part identification code

9.3   Ordering information

Ordering No.	Product
SARA-U201-03B	3G 800/850/900/1900/2100 MHz and 2G 850/900/1800/1900 MHz bands for worldwide use, 26.0 x 16.0 x 3.0 mm, 250 pcs/reel
SARA-U201-63B	3G 800/850/900/1900/2100 MHz and 2G 850/900/1800/1900 MHz bands for worldwide use, approved by NTT DoCoMo Japanese network operator 26.0 x 16.0 x 3.0 mm, 250 pcs/reel
SARA-U201-03X	3G 800/850/900/1900/2100 MHz and 2G 850/900/1800/1900 MHz bands for worldwide use, ATEX certified 26.0 x 16.0 x 3.0 mm, 250 pcs/reel
SARA-U201-04B	3G 800/850/900/1900/2100 MHz and 2G 850/900/1800/1900 MHz bands for worldwide use, 26.0 x 16.0 x 3.0 mm, 250 pcs/reel
SARA-U201-04X	3G 800/850/900/1900/2100 MHz and 2G 850/900/1800/1900 MHz bands for worldwide use, ATEX certified, 26.0 x 16.0 x 3.0 mm, 250 pcs/reel
SARA-U260-00S	3G 850/1900 MHz and 2G 850/1900 MHz bands for America, 26.0 x 16.0 x 3.0 mm, 250 pcs/reel
SARA-U260-03S	3G 850/1900 MHz and 2G 850/1900 MHz bands for America, 26.0 x 16.0 x 3.0 mm, 250 pcs/reel
SARA-U270-00S	3G 900/2100 MHz and 2G 900/1800 MHz bands for Europe, Asia and other countries, 26.0 x 16.0 x 3.0 mm, 250 pcs/reel
SARA-U270-00X	3G 900/2100 MHz and 2G 900/1800 MHz bands for Europe, Asia and other countries, ATEX certified, 26.0 x 16.0 x 3.0 mm, 250 pcs/reel
SARA-U270-03S	3G 900/2100 MHz and 2G 900/1800 MHz bands for Europe, Asia and other countries, 26.0 x 16.0 x 3.0 mm, 250 pcs/reel
SARA-U270-53S	3G 900/2100 MHz bands, approved by KT Korean network operator, 26.0 x 16.0 x 3.0 mm, 250 pcs/reel
SARA-U270-73S	3G 900/2100 MHz bands, approved by SKT Korean network operator, 26.0 x 16.0 x 3.0 mm, 250 pcs/reel
SARA-U270-04B	3G 900/2100 MHz and 2G 900/1800 MHz bands for Europe, Asia and other countries, 26.0 x 16.0 x 3.0 mm, 250 pcs/reel
SARA-U280-00S	3G 850/1900 MHz bands for America, 26.0 x 16.0 x 3.0 mm, 250 pcs/reel
SARA-U280-03S	3G 850/1900 MHz bands for America, 26.0 x 16.0 x 3.0 mm, 250 pcs/reel

Table 34: Product ordering codes

Appendix

A Glossary

Abbreviation	Definition
ACM	Abstract Control Model
ADC	Analog to Digital Converter
ATEX	Atmospheres Explosive
BER	Bit Error Rate
CDC	Communications Device Class
DDC	Display Data Channel (I2C compatible) Interface
DL	Down-link (Reception)
Driver Class	Output Driver Class: see Table 19 for definition
DRX	Discontinuous Reception
ECM	Ethernet networking Control Model
EDGE	Enhanced Data rates for GSM Evolution
ERS	External Reset Input Signal
GDI	Generic Digital Interfaces (V_INT supply power domain)
GND	Ground
GNSS	Global Navigation Satellite System
GPIO	General Purpose Input Output
GPRS	General Packet Radio Service
GSM	Global System for Mobile communications
H	High logic digital level
HSDPA	High Speed Downlink Packet Access
HSUPA	High Speed Uplink Packet Access
I2C	Inter-Integrated Circuit Interface
I2S	Inter-IC Sound Interface
L	Low logic digital level
LGA	Land Grid Array
N/A	Not Applicable
PCN / IN	Product Change Notification / Information Note
PD	Pull-Down
POS	Power-On Input Signal (power domain)
PU	Pull-Up
PU/PD Class	Pull-Up / Pull-Down Class: see Table 19 for definition
RMC	Reference Measurement Channel
SIM	SIM Interface (power domain)
SPI	Serial Peripheral Interface
T	Tristate (Output of the pin set to tri-state, i.e. high impedance state)
T/PD	Tristate with internal active Pull-Down enabled
T/PU	Tristate with internal active Pull-Up enabled
TBD	To Be Defined
UART	Universal Asynchronous Receiver-Transmitter serial interface
UL	Up-link (Transmission)
UMTS	Universal Mobile Telecommunications System
USB	Universal Serial Bus (power domain)

Table 35: Explanation of the abbreviations and terms used

Related documentation

[1]   3GPP TS 27.007 - AT command set for User Equipment (UE)
[2]   3GPP TS 27.005 - Use of Data Terminal Equipment - Data Circuit terminating Equipment (DTE - DCE) interface for Short Message Service (SMS) and Cell Broadcast Service (CBS)
[3]   3GPP TS 27.010 - Terminal Equipment to User Equipment (TE-UE) multiplexer protocol
[4]   u-blox AT commands manual, UBX-13002752
[5]   u-blox Android RIL source code application note, UBX-13002041
[6]   u-blox SARA-G3 series / SARA-U2 series system integration manual, UBX-13000995
[7]   u-blox GNSS implementation application note, UBX-13001849
[8]   3GPP TS 26.267 eCall Data Transfer; In-band modem solution; General description
[9]   3GPP TS44.031 Location Services (LCS); Mobile Station (MS) - Serving Mobile Location Centre (SMLC) Radio Resource LCS Protocol (RRLP)
[10]   ITU-T Recommendation V24, 02-2000. List of definitions for interchange circuits between Data Terminal Equipment (DTE) and Data Connection Equipment (DCE)
[11]   u-blox mux implementation application note, UBX-13001887
[12]   I2C-bus specification and user manual - NXP Semiconductors, http://www.nxp.com/documents/user_manual/UM10204.pdf
[13]   3GPP TS 34.121-1 - User Equipment conformance specification; Radio transmission and reception (FDD); Part 1: Conformance specification
[14]   3GPP TS 51.010-1 - Mobile Station conformance specification; Part 1: Conformance specification
[15]   Universal Serial Bus Revision 2.0 specification, http://www.usb.org/developers/docs/usb20_docs/
[16]   u-blox package information guide, UBX-14001652
[17]   3GPP TS 25.331 Radio Resource Control (RRC); Protocol specification
[18]   GSMA IoT Device Connection Efficiency Guidelines

☞   For regular updates to u-blox documentation and to receive product change notifications, register on our homepage (www.u-blox.com).

Revision history

Revision	Date	Name	Status / Comments
R01	22-Jan-2014	sfal, sses	Initial release
R02	29-Apr-2014	sses	Updated: receiver sensitivity performance, normal operating temperature range, maximum ESD ratings, USB audio device class support, GPIO configuration table.
R03	20-Jun-2014	sses	Advance Information document status. Added VCC current consumption characteristics.
R04	18-Jul-2014	sses	Early Production Information document status. Added VCC current consumption for 3G Tx/Rx connected modes.
R05	10-Apr-2015	sfal	Extended the document applicability to SARA-U270 ATEX; removed SARA-U290 and audio over USB feature; updated list of approvals and product labeling
R06	15-May-2015	sfal	Extended applicability to product version "03" and related features
R07	26-Jun-2015	lpah	Advance Information document status.
R08	10-Aug-2015	sfal	Early Production Information document status Extended applicability to SARA-U270-53S
R09	02-Dec-2015	sses	Document status reverted to Objective Specification Extended applicability to SARA-U201-03A and SARA-U201-03B
R10	25-May-2016	lpah, sfal	Added SARA-U260-00S-01, SARA-U270-00S-01 Removed SARA-U260-00S-00 Added SARA-U201 ATEX and updated SARA-U201 electrical specifications
R11	08-Jul-2016	lpah, sfal	Document status updated to Advance Information
R12	30-Aug-2016	lpah	Document status updated to Early Production
R13	07-Oct-2016	lpah	Document status reverted to Advance Information Extended applicability to SARA-U270-73S Removed the applicability to SARA-U201-03A
R14	14-Dec-2016	lpah	"Disclosure restriction" replaces "Document status" on page 2 and footer
R15	03-Aug-2017	lpah	Extended applicability to SARA-U270-53S-01 Updated label and approvals information
R16	20-Sep-2017	lpah, sses	Extended applicability to SARA-U201 modules "63" and "04" product versions
R17	31-Oct-2017	lpah, sses	Updated SARA-U201-04B / SARA-U201-04X product status
R18	02-Jan-2018	lpah	Extended document applicability to new SARA-U2 type numbers
R19	26-Feb-2018	lpah	Updated product status of new SARA-U2 type numbers Extended document applicability to SARA-U201-63B-01.
R20	15-Apr-2019	mbab, lpah, sses	Updated SARA-U201-63B-01 modem version Extended applicability to SARA-U270-04B Updated RESET_N specifications for SARA-U260, SARA-U270, SARA-U280 Updated approvals information
R21	26-Jan-2021	alos	Updated SARA-U260, SARA-U270, SARA-U280 product status

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