SARA-G3 series

Dual and quad-band GSM/GPRS modules

Data Sheet



Abstract

Technical data sheet describing SARA-G3 series GSM/GPRS cellular modules. These modules are complete and cost efficient solutions offering two-band or quad-band GSM/GPRS voice and/or data transmission technology in a compact form factor.

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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-G300	SARA-G300-00S-01	08.58	A01.01	UBX-16010060	End of Life
SARA-G310	SARA-G310-00S-01	08.58	A01.01	UBX-16010060	End of Life
SARA-G340	SARA-G340-00S-00	08.49	N.A.	UBX-14000382	End of Life
	SARA-G340-01S-00	08.70	A00.02	UBX-14039634	End of Life
	SARA-G340-02S-00	08.90	A00.02	UBX-16001074	End of Life
	SARA-G340-02S-01	08.90	A01.13	UBX-18008871	Mass Production
SARA-G340 ATEX	SARA-G340-02X-00	08.90	A00.02	UBX-16017766	End of Life
	SARA-G340-02X-01	08.90	A01.13	UBX-18008871	Mass Production
SARA-G350	SARA-G350-00S-00	08.49	N.A.	GSM.G2-TN-13002	End of Life
	SARA-G350-01S-00	08.70	A00.02	UBX-14039634	End of Life
	SARA-G350-01B-00	08.70	A00.02	UBX-14039634	End of Life
	SARA-G350-02S-00	08.90	A00.02	UBX-16001074	End of Life
	SARA-G350-02S-01	08.90	A01.13	UBX-18008871	Mass Production
SARA-G350 ATEX	SARA-G350-00X-00	08.49	N.A.	GSM.G2-TN-13002	End of Life
	SARA-G350-02X-00	08.90	A00.02	UBX-17048555	End of Life
	SARA-G350-02X-01	08.90	A01.13	UBX-18008871	Mass Production

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1 Functional description

1.1 Overview

SARA-G3 series modules are versatile 2.5G GSM/GPRS cellular modules in a miniature LGA (Land Grid Array) form factor. Featuring low power consumption, the SARA-G3 series combines baseband, RF transceiver, power management unit, and power amplifier in a single, easy-to-integrate solution.
SARA-G3 modules provide a fully qualified and certified solution, reducing cost and enabling short time to market. These modules are ideally suited for M2M applications such as: Automatic Meter Reading (AMR), Remote Monitoring Automation and Control (RMAC), surveillance and security, eCall, road pricing, asset tracking, fleet management, anti-theft systems and Point of Sales (PoS) terminals.
SARA-G340 (dual-band) and SARA-G350 (quad-band) are full feature GSM/GPRS cellular modules with a comprehensive feature set including an extensive set of internet protocols. The modules also provide fully integrated access to u-blox GNSS positioning chips and modules, with embedded A-GPS (AssistNow Online and AssistNow Offline) functionality. Any host processor connected to the cellular module through a single serial port can control both the cellular module and the positioning chip / module.
SARA-G310 (quad-band) and SARA-G300 (dual-band) are GSM/GPRS cellular modules targeted for high volume cost-sensitive applications, providing GSM/GPRS functionalities with a reduced set of additional features to minimize the customer's total cost of ownership. The SARA-G3 series' compact form factor and LGA pads allow fully automated assembly with standard pick & place and reflow soldering equipment for cost-efficient, high-volume production.

1.2 Product features

Module	Data Rate	Bands		Positioning				Interfaces					Audio		Features											Grade		
	GPRS multi-slot class 10	GSM/GPRS 4-band	GSM/GPRS 2-band 900/1800	GNSS receiver	GNSS via modem	AssistNow Software	CellLocate®	UART	SPI	USB 2.0	GPIO	DDC for u-blox GNSS receivers	Analog Audio	Digital Audio	Network indication	Antenna supervisor	Jamming detection	Embedded TCP/UDP stack	Embedded FTP, HTTP, SMTP	Embedded SSL	Dual stack IPv4/IPv6	FW update via serial interface	eCall / ERA-GLONASS	Low power idle-mode	ATEX certification	Standard	Professional	Automotive
SARA-G300	•		•					2														•		■			•	
SARA-G310	•	•						2														•		■			•	
SARA-G340	•		•		•	•	•	2			4	•	•	•	•	•	•	•	•	•	○	□	•	•	•			•	
SARA-G340 ATEX	•		•		•	•	•	2			4	•	•	•	•	•	•	•	•	•	○	□	•	•	•	•		•	
SARA-G350	•	•			•	•	•	2			4	•	•	•	•	•	•	•	•	•	○	□	•	•	•			•	
SARA-G350 ATEX	•	•			•	•	•	2			4	•	•	•	•	•	•	•	•	•	□	□	•	•	•	•		•	

● = supported by all product versions
○ = supported by product versions "01" onwards
■ = 32 kHz signal at EXT32K input is required for low power idle-mode
□ = supported by product versions "02" onwards

Table 1: SARA-G3 series – summary of modules' main features[1]

[1] SARA-G340 ATEX and SARA-G350 ATEX modules provide the same feature set as the SARA-G340 and SARA-G350 modules respectively, with the additional certification for use in potentially explosive atmospheres. Unless otherwise specified, SARA-G340 refers to all SARA-G340 ATEX and SARA-G340 modules; in the same way SARA-G350 refers to both SARA-G350 ATEX and SARA-G350 modules.

1.3 Block diagram

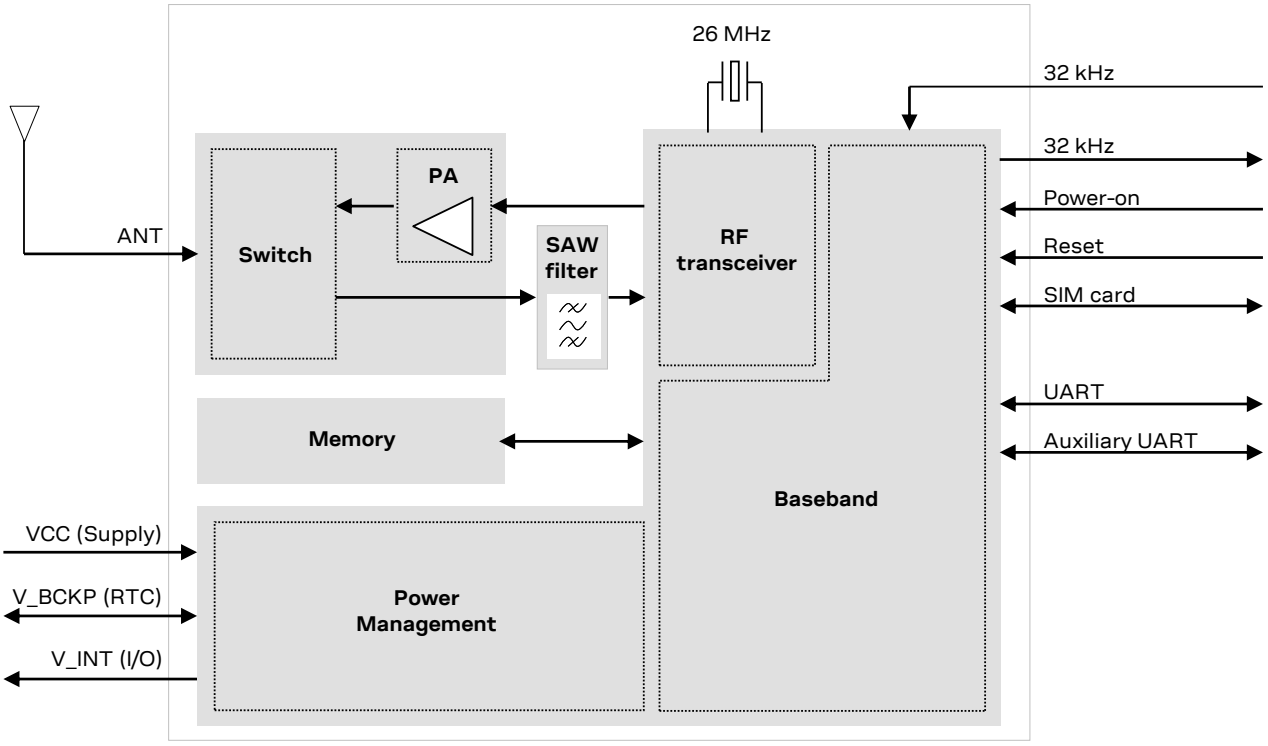


Figure 1: SARA-G300 and SARA-G310 block diagram

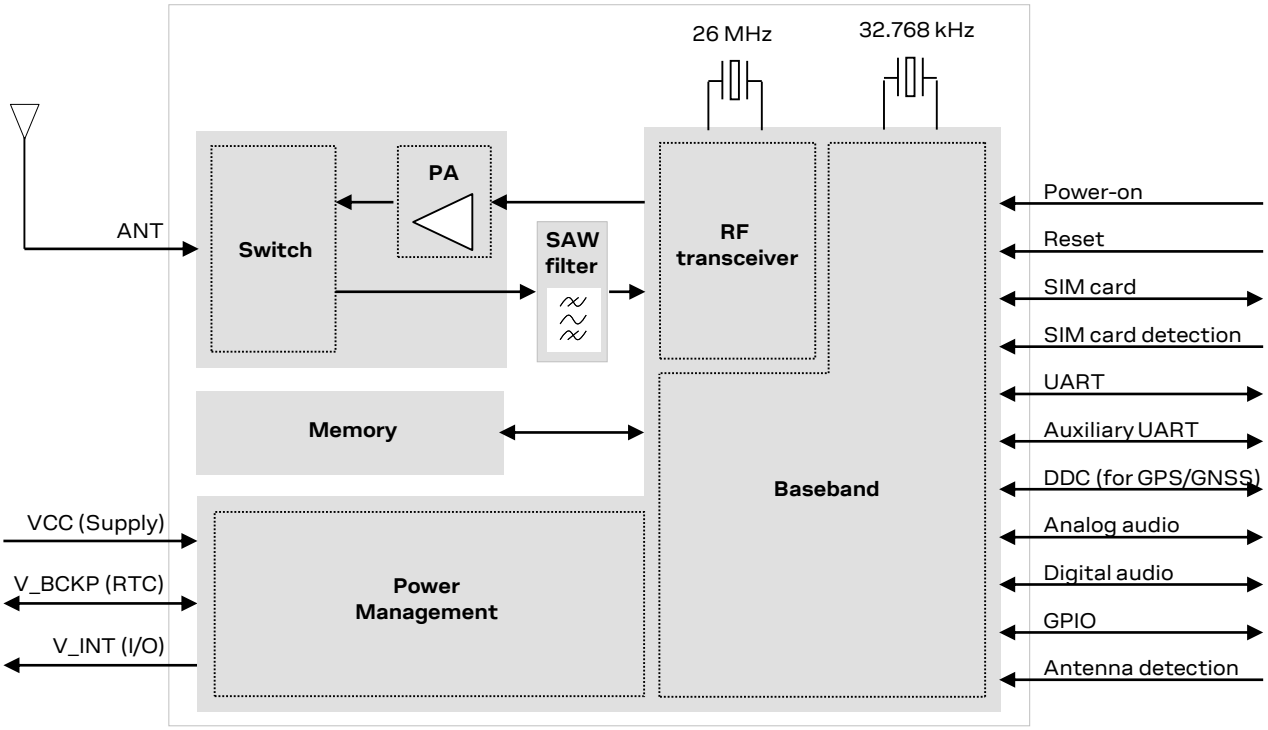


Figure 2: SARA-G340 and SARA-G350 block diagram

1.4 Product description

Item	SARA-G300	SARA-G310	SARA-G340	SARA-G350
GSM/GPRS Protocol Stack	3GPP Release 99	3GPP Release 99	3GPP Release 99	3GPP Release 99
Mobile Station Class	Class B [2]	Class B [2]	Class B [2]	Class B [2]
GSM/GPRS Bands	E-GSM 900 MHz DCS 1800 MHz	GSM 850 MHz E-GSM 900 MHz DCS 1800 MHz PCS 1900 MHz	E-GSM 900 MHz DCS 1800 MHz	GSM 850 MHz E-GSM 900 MHz DCS 1800 MHz PCS 1900 MHz
GSM/GPRS Power Class	Class 4 (33 dBm) for 900 band Class 1 (30 dBm) for 1800 band	Class 4 (33 dBm) for 850/900 bands Class 1 (30 dBm) for 1800/1900 bands	Class 4 (33 dBm) for 900 band Class 1 (30 dBm) for 1800 band	Class 4 (33 dBm) for 850/900 bands Class 1 (30 dBm) for 1800/1900 bands
Packet Switched Data Rate	GPRS multi-slot class 10 [3] Coding scheme CS1-CS4 Up to 85.6 kb/s DL [4] Up to 42.8 kb/s UL [4]	GPRS multi-slot class 10 [3] Coding scheme CS1-CS4 Up to 85.6 kb/s DL [4] Up to 42.8 kb/s UL [4]	GPRS multi-slot class 10 [3] Coding scheme CS1-CS4 Up to 85.6 kb/s DL [4] Up to 42.8 kb/s UL [4]	GPRS multi-slot class 10 [3] Coding scheme CS1-CS [4] Up to 85.6 kb/s DL [4] Up to 42.8 kb/s UL [4]
Circuit Switched Data Rate	Up to 9.6 kb/s DL/UL [4] Transparent mode Non-transparent mode	Up to 9.6 kb/s DL/UL [4] Transparent mode Non-transparent mode	Up to 9.6 kb/s DL/UL [4] Transparent mode Non-transparent mode	Up to 9.6 kb/s DL/UL [4] Transparent mode Non-transparent mode
Network Operation Modes	I to III	I to III	I to III	I to III

Table 2: SARA-G3 series GSM/GPRS characteristics summary

The network automatically configures the channel encoding used by the module, depending on conditions and the quality of the radio link between cell phone and base station. If the channel is very noisy, the network may use the most robust coding scheme (CS-1) to ensure higher reliability. If the channel provides good conditions, the network can use the least robust but fastest coding scheme (CS-4) to obtain optimum speed.

Basic features	Supplementary services	Short Message Service (SMS)
Display of Called Number [5]	Call Hold/Resume (HOLD) [5]	Text and PDU mode supported
Indication of Call Progress Signals [5]	Call Waiting (CW) [5]	Mobile-Originating SMS (MO SMS)
Country/PLMN Indication	Call Forwarding (CFU, CFB, CFNRy, CFNRc) [5]	Mobile-Terminating SMS (MT SMS)
Country/PLMN Selection	Call Barring (BAOC, BOIC, BOIC-exHC, BAIC, BIC_Roam) [5]	SMS indication and acknowledgement
International Access Function [5]	Call Deflection (CD) [5]	SMS Cell Broadcast (CBS)
Service Indicator	Explicit Call Transfer (ECT) [5]	SMS during circuit-switched calls [5]
Emergency Calls Capabilities [5]	Multi-Party (MTPY) [5]	SMS over CSD
Dual Tone Multi Frequency (DTMF) [5]	Calling Line Identification Presentation (CLIP) [5]	SMS over PSD
Subscription Identity Management	Calling Line Identification Restriction (CLIR) [5]	SMS storage on SIM
Service Provider Indication	Connected Line Identification Presentation (CoLP) [5]	SMS storage on module memory [5]
Abbreviated Dialing [5]	Connected Line Identification Restriction (CoLR) [5]	Concatenated SMS

[2] Device can be attached to both GPRS and GSM services (i.e. Packet Switch and Circuit Switch mode) using one service at a time.
[3] GPRS multi-slot class 10 implies a maximum of 4 slots in DL (reception) and 2 slots in UL (transmission) with 5 slots in total.
[4] The maximum bit rate of the module depends on the current network settings.
[5] Supported only by SARA-G340 and SARA-G350 modules

Basic features	Supplementary services	Short Message Service (SMS)
Fixed Number Dialing [5]	Unstructured Supplementary Services Data (USSD)	
Barring of Dialed Numbers [5]	Advice of Charge Charging (AoCC, AoCI) [5]	
SIM Application Toolkit [5]	Calling Name Presentation (CNAP) [5]	
ME-SIM lock	Network Identify and Time Zone (NITZ)	

Table 3: SARA-G3 series mobile stations: basic features, supplementary services, and SMS service summary[6]

1.5 AT command support

The module supports AT commands according to 3GPP standards: TS 27.007 [9], 27.005 [10], 27.010 [11], and the u-blox AT command extension.

☞ For the complete list of the supported AT commands and their syntax, see the document u-blox AT Commands Manual [1].

RIL (Radio Interface Layer) software for Android and Embedded Windows is available for SARA-G3 modules free of charge; see the Android RIL Production delivery [6] application note for more information.

1.6 Supported features

Table 4 describes the main features supported by SARA-G3 modules. For more details, see the SARA-G3 / SARA-U2 Series System Integration Manual [2] and the u-blox AT commands manual [1].

Feature	Module	Description
Network Indication	SARA-G340 / SARA-G350	GPIO configured to indicate the network status: registered home network, registered roaming, voice or data call enabled, no service. The network indication feature can be enabled through a custom AT command (see the u-blox AT commands manual [1], +UGPIOC AT command).
Antenna Detection	SARA-G340 / SARA-G350	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 a custom AT command (see the u-blox AT commands manual [1], +UANTR AT command).
Jamming detection	SARA-G340 / SARA-G350	Detects “artificial” interference that obscures the operator’s carriers providing access to the GSM service and reports the start and stop of such conditions to the application processor (AP). The AP can react appropriately, e.g. by switching off the radio transceiver to reduce power consumption and monitoring the environment at constant periods. The jamming detection feature can be enabled and configured through a custom AT command (see the u-blox AT commands manual [1], +UCD AT command).
Jamming condition indication over GPIO [7]	SARA-G340 / SARA-G350	The jamming condition can be reported by a GPIO of the module as enabled and configured through a custom AT commands (see the u-blox AT commands manual [1], +UCD and +UGPIOC AT commands).
Second AT interface [7]	SARA-G340 / SARA-G350	AT command mode available on both the UART and the Auxiliary UART interfaces. See the u-blox AT commands manual [1], +USIO AT command for further details regarding serial interfaces configuration selection.
Embedded TCP/IP and UDP/IP	SARA-G340 / SARA-G350	Embedded TCP/IP and UDP/IP stack including direct link mode for TCP and UDP sockets. The sockets can be configured in Direct Link mode to establish a transparent end-to-end communication with an already connected TCP or UDP socket via serial interface.

[6] These functionalities are supported via AT commands (for more details see the u-blox AT Commands Manual [1]).
[7] Supported by “02” product versions onwards

Feature	Module	Description
FTP, FTPS [8]	SARA-G340 / SARA-G350	File Transfer Protocol as well as Secure File Transfer Protocol (SSL encryption of FTP control channel) functionalities are supported via AT commands.
HTTP, HTTPS [8]	SARA-G340 / SARA-G350	Hyper-Text Transfer Protocol as well as Secure Hyper-Text Transfer Protocol (SSL encryption) functionalities are supported via AT commands. HEAD, GET, POST, DELETE and PUT operations are available. Up to 4 client contexts can be simultaneously used.
Embedded TLS 1.2 [7]	SARA-G340 / SARA-G350	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 [9]	SARA-G340 / SARA-G350	Capability to move between IPv4 and dual stack network infrastructures. IPv4 and IPv6 addresses can be used.
GPS/GNSS via Modem	SARA-G340 / SARA-G350	Full access to u-blox positioning chips and modules is available through a dedicated DDC (I^2C) interface. A single serial port from any host processor can control both the cellular module and the positioning chips / modules. For more details, see the GNSS Implementation Application Note [3].
AssistNow Software	SARA-G340 / SARA-G350	Embedded AssistNow Online and AssistNow Offline clients to provide full developed to provide better GNSS performance and faster Time-to-First-Fix. The clients can be enabled / disabled with an AT command.
CellLocate®	SARA-G340 / SARA-G350	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: parameters of the visible home network cells are only sent • Deep scan: parameters of all surrounding cells of all mobile operators are sent CellLocate® is implemented using a set of AT commands for CellLocate® service configuration and position request.
Hybrid Positioning	SARA-G340 / SARA-G350	Provides the module's current position using a u-blox positioning chip or module or the estimated position from CellLocate®, depending on which positioning method provides the best and fastest solution according to the user configuration. Hybrid positioning is implemented through a set of AT commands that allow the configuration and the position request.
Firmware update Over AT commands (FOAT)	All	Firmware module upgrade over the UART interface using AT command.
BIP [9]	SARA-G340 / SARA-G350	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	SARA-G340 / SARA-G350	In-Band modem solution for eCall and ERA-GLONASS emergency call applications over cellular networks implemented according to the 3GPP TS 26.267 specification [12]. 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	SARA-G340 / SARA-G350	During a voice call, the Dual-Tone Multi-Frequency detector analyses the RX speech (coming from remote party). The detected DTMF symbols can be output via related URC. For more details, see the +UDTMFD AT command.
Automatic selection of authentication type [9]	SARA-G340 / SARA-G350	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.

[8] FTPS and HTTPS supported by "01" product versions onwards
[9] Supported by "02" product versions onwards

Feature	Module	Description
Signal quality report for PS calls [9]	SARA-G340 / SARA-G350	The quality of the GPRS UL and/or DL connection is returned by the AT+CSQ command.
Network Friendly Mode [9]	SARA-G340 / SARA-G350	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 [13]. The feature can be enabled through the +UNFM, +UNFMCONF, +URPM AT commands.
Smart Temperature Supervisor	SARA-G340 / SARA-G350	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 Smart Temperature Supervisor feature can be enabled or disabled through an AT command (see the u-blox AT commands manual [1], +USTS AT command) The sensor measures board temperature inside the shields, which can differ from ambient temperature.
Power saving	All	The power saving configuration is by default disabled, 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, which is generated by: • The internal 32 kHz oscillator, in case of SARA-G340 and SARA-G350 modules • The 32 kHz signal provided at the EXT32K input pin, in case of SARA-G300 and SARA-G310 modules For more details, see the SARA-G3 / SARA-U2 Series System Integration Manual [2] and the u-blox AT commands manual [1], +UPSV AT command.

Table 4: SARA-G3 series' main supported features

☞ 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 used or the specific device.

2 Interfaces

2.1 Power management

2.1.1 Module supply input (VCC)

SARA-G3 modules must be supplied through the three **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 / SARA-U2 Series System Integration Manual [2]). It is important that the system power supply circuit is able to support peak power.

SARA-G3 modules product versions "02" onwards provide separate supply inputs over the three **VCC** pins:

- **VCC** pins #52 and #53 represent the supply input for the internal RF power amplifier, demanding most of the total current drawn of the module when RF transmission is enabled during a voice/data call
- **VCC** pin #51 represents the supply input for the internal baseband Power Management Unit and the internal transceiver, demanding minor part of the total current drawn of the module when RF transmission is enabled during a voice/data call

2.1.2 RTC supply input/output (V_BCKP)

V_BCKP is the Real Time Clock (RTC) supply of SARA-G3 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 Digital I/O interfaces supply output (V_INT)

SARA-G3 modules provide an internally generated supply rail output for digital interfaces (**V_INT**). This can be used in place of an external discrete regulator to supply pull-up resistors on the DDC interface. This optimizes the bill of material for various applications, e.g. with u-blox positioning modules 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-G3 modules.

2.2.2 Antenna detection (ANT_DET)

The **ANT_DET** pin is an Analog to Digital Converter (ADC) input provided only by SARA-G340 and SARA-G350 modules 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 the SARA-G3 / SARA-U2 Series System Integration Manual [2] and the u-blox AT Commands Manual [1], +UANTR.

2.3 System functions

2.3.1 Module power-on (PWR_ON)

SARA-G3 modules can be switched on in one of the following ways:

- Rising edge on the VCC pin to a valid voltage for module supply, i.e. applying module supply
- Low level on the PWR_ON input pin, i.e. forcing the pin (normally high with external pull-up) to a low level for a valid time period (see section 4.2.7). The PWR_ON pin requires an external pull-up resistor to set its value to logic high and may not be left floating
- RTC alarm, i.e. pre-programmed scheduled time (see the u-blox AT Commands Manual [1], AT+CALA)

☞ SARA-G300 and SARA-G310 cannot be switched on with RTC alarm.

2.3.2 Module power-off

SARA-G3 modules can be properly switched off, with storage of current settings and network detach, by:

- AT+CPWROFF command

An abrupt under-voltage shutdown occurs on SARA-G3 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-G3 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 / SARA-U2 Series System Integration Manual [2] and the u-blox AT commands manual [1], +USTS AT command.

2.3.3 Module reset (RESET_N)

SARA-G3 modules can be properly reset (rebooted), with storage of current parameter settings in the module's non-volatile memory and proper network detach, in this way:

- AT+CFUN command (see the u-blox AT Commands Manual [1]). This causes an "internal" or "software" reset of the module.

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 4.2.8), but in this case it is not possible to perform the storing of the current parameter settings as well as the proper network detach.

2.3.4 External 32 kHz signal input (EXT32K)

SARA-G300 and SARA-G310 provide the **EXT32K** input pin that must be fed by a proper 32 kHz signal to furnish the reference clock for the RTC, allowing very low power idle-mode and RTC functions support. See section 4.2.9 for detailed electrical specifications for the 32 kHz signal.

SARA-G340 and SARA-G350 do not provide the **EXT32K** input pin. An internal 32 kHz oscillator automatically generates the reference clock for the RTC, allowing very low power idle-mode and RTC functions support.

2.3.5 Internal 32 kHz signal output (32K_OUT)

SARA-G300 and SARA-G310 provide the **32K_OUT** output pin which gives a 32 kHz reference signal suitable only to feed the **EXT32K** input pin of SARA-G300 / SARA-G310 modules, furnishing the reference clock for the RTC, allowing low power idle-mode and RTC functions support with modules switched on.

SARA-G340 and SARA-G350 do not provide the **32K_OUT** output; there is no **EXT32K** input on these modules.

2.4 SIM

2.4.1 (U)SIM interface

A (U)SIM card interface is available via the **VSIM**, **SIM_IO**, **SIM_CLK**, **SIM_RST** pins of SARA-G3 series modules: the high-speed SIM/ME interface is implemented as well as the automatic detection of the required SIM supporting voltage.

Both 1.8 V and 3 V SIM types are supported: activation and deactivation with automatic voltage switch from 1.8 V to 3 V are implemented, according to ISO-IEC 7816-3 Specifications. The SIM driver supports the PPS procedure for baud-rate selection, according to the values proposed by the SIM Card.

2.4.2 SIM card detection (SIM_DET)

☞ Not supported by SARA-G300-00S and SARA-G310-00S modules.

The **SIM_DET** pin of SARA-G3 modules is a digital input provided to sense the SIM card presence (as an optional feature), when it is properly connected to the mechanical switch of the SIM card holder (for more details, see the SARA-G3 / SARA-U2 Series System Integration Manual [2]).

2.5 Serial interfaces

SARA-G3 modules provide the following serial communication interfaces:

- UART interface: 9-wire unbalanced 1.8 V asynchronous serial interface supporting
  - AT command mode
  - Data mode and Online command mode [10]
  - MUX functionality, including dedicated GNSS tunneling virtual channel [11]
  - FW upgrades by means of the FOAT feature
- Auxiliary UART interface: 3-wire unbalanced 1.8 V asynchronous serial interface supporting
  - AT command mode [12]
  - GNSS tunneling [12]
  - FW upgrades by means of the u-blox EasyFlash tool
  - Trace log capture (diagnostic purpose)
- DDC interface [13]: I²C-bus compatible interface supporting
  - Communication with u-blox GPS/GNSS positioning chips / modules

[10] See the u-blox AT Commands Manual [1] for the definition of the interface data mode and online command mode.
[11] GNSS tunneling is not supported by SARA-G300 and SARA-G310 modules.
[12] AT command mode and GNSS tunneling are not supported over the Auxiliary UART of SARA-G3 modules product versions "00" and "01".
[13] DDC I²C-bus compatible interface is not supported by SARA-G300 and SARA-G310 modules.

2.5.1 Asynchronous serial interface (UART)

The UART interface is a 9-wire unbalanced 1.8 V asynchronous serial interface provided on all SARA-G3 modules for communication with an application processor, supporting:

- AT command mode
- Data mode and Online command mode [14]
- MUX functionality, including dedicated GNSS tunneling virtual channel [15]
- FW upgrades by means of the FOAT feature

UART characteristics are:

- Complete serial port with RS-232 functionality conforming to the ITU-T V.24 Recommendation [8], 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 on the hardware flow control output (CTS line): the line is driven to the OFF state when the module is not ready to accept data signals
- 2'400, 4'800, 9'600, 19'200, 38'400, 57'600, 115'200 b/s baud rates are supported
- Auto baud rate detection (autobauding) is the default configuration
- Frame format can be: 8N1 (8 data bits, no parity, 1 stop bit), or 8N2 (8 data bits, no parity, 2 stop bits), or 8E1 (8 data bits, even parity, 1 stop bit), or 8O1 (8 data bits, odd parity, 1 stop bit), or 7E1 (7 data bits, even parity, 1 stop bit), or 7O1 (7 data bits, odd parity, 1 stop bit)
- Automatic frame recognition is supported: this feature is the default configuration and it is enabled in conjunction with the auto baud rate detection only
- Default frame configuration with fixed baud is 8N1 (8 data bits, no parity, 1 stop bit),

2.5.1.1 Multiplexer protocol

SARA-G3 module has a software layer with MUX functionality, 3GPP TS 27.010 [11], available on the UART physical link.

This is a data link protocol (layer 2 of OSI model) which uses HDLC-like framing and operates between the module (DCE) and the application processor (DTE), and allows a number of simultaneous sessions over the physical link (UART): the user can concurrently use AT command interface on one MUX channel and data communication on another MUX channel.

SARA-G340 and SARA-G350 modules define the following virtual channels:

- Channel 0: control channel
- Channel 1 – 5: AT commands / data connection
- Channel 6: GNSS tunneling

SARA-G300 and SARA-G310 modules define the following virtual channels:

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

For more details, see the Mux Implementation Application Note [4].

[14] See the u-blox AT Commands Manual [1] for the definition of the interface data mode and online command mode.
[15] GNSS tunneling is not supported by SARA-G300 and SARA-G310 modules.

2.5.2 Auxiliary asynchronous serial interface (AUX UART)

The auxiliary UART interface is a 3-wire unbalanced 1.8 V asynchronous serial interface available on all SARA-G3 modules, supporting [16]

- AT command mode [17]
- GNSS tunneling mode [17]
- FW upgrades by means of the u-blox EasyFlash tool
- Trace log capture (diagnostic purpose)

Auxiliary UART characteristics 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)
- Characteristics in AT command mode [17]:
  - Baud rate can be: 2'400, 4'800, 9'600, 19'200, 38'400, 57'600, 115'200 b/s, with default value 115'200 b/s
  - Frame format can be: 8N1, or 8N2, or 8E1, or 8O1, or 7E1, or 7O1, with default value 8N1
  - Automatic baud rate detection (autobauding) and automatic frame recognition are not supported
  - Software flow control, or None flow control (default value) are supported
- Characteristics in GNSS tunneling mode [17]:
  - Baud rate is 115'200 b/s
  - Frame format is 8N1 (8 data bits, no parity, 1 stop bit)
  - None flow control is supported
- Characteristics for FW upgrade and diagnostic trace modes:
  - 115'200, 230'400, 460'800, 921'600 b/s baud rates are supported
  - Frame format is 8N1 (8 data bits, no parity, 1 stop bit)
  - None flow control is supported

2.5.3 DDC (I²C compatible) interface

SARA-G340 and SARA-G350 modules provide an I²C compatible DDC interface on the **SCL** and **SDA** pins exclusively for the communication with u-blox GNSS positioning chips / modules.

[16] See the u-blox AT Commands Manual [1], +USIO AT command for further details regarding serial interfaces configuration selection.

[17] AT command mode and GNSS tunneling are not supported over the Auxiliary UART of SARA-G3 modules product versions "00" and "01".

2.6 Audio

SARA-G340 and SARA-G350 modules provide analog and digital audio interfaces:

- Analog audio input:
  - Differential analog audio input (**MIC_P**, **MIC_N**) shared for all the analog audio path modes: the pins can be connected to the output of an external analog audio device or can be connected to an external microphone by means of a simple circuit implemented on the application board
  - Supply output for an external microphone (**MIC_BIAS**): the pin can provide the bias to an external microphone by means of a simple circuit implemented on the application board
  - Local ground for the external microphone (**MIC_GND**): the pin can provide the reference for the differential analog audio input as sense ground line for the external microphone circuit
- Analog audio output:
  - Differential audio output (**SPK_P**, **SPK_N**) shared for all the analog audio path modes: the pins can be connected to the input of an external analog audio device or can be connected to an external speaker
- I^2S digital audio interface:
  - 4-wire digital audio interface (**I2S_TXD**, **I2S_RXD**, **I2S_CLK**, **I2S_WA**) that can be configured by AT command in PCM or in normal I^2S mode

For more details regarding audio interfaces configuration and usage, see the u-blox AT Commands Manual [1] and the SARA-G3 / SARA-U2 Series System Integration Manual [2].

2.7 GPIO

SARA-G340 and SARA-G350 modules provide 4 GPIO pins (**GPIO1**-**GPIO4**) that can be configured for general purpose input/output, or to provide custom functions via u-blox AT commands (for further details, see the SARA-G3 / SARA-U2 Series System Integration Manual [2] and to u-blox AT Commands Manual [1], +UGPIOC, +UGPIOR, +UGPIOW, +UGPS, +UGPRF).

Table 5 summarizes the custom functions available on the GPIO pins of SARA-G340 / SARA-G350 modules.

Function	Description	Default GPIO	Configurable GPIOs
GNSS supply enable	Enable/disable the supply of u-blox positioning chips and modules connected to cellular module	GPIO2	GPIO1, GPIO2, GPIO3, GPIO4
GNSS data ready	Sense when u-blox positioning chip / module connected to cellular module is ready for sending data by the DDC (I^2C)	GPIO3	GPIO3
GNSS RTC sharing	RTC (Real Time Clock) synchronization signal to u-blox positioning chips and modules connected to cellular module	GPIO4	GPIO4
Network status indication	Indicates network status: registered home network, registered roaming, data transmission, no service	--	GPIO1, GPIO2, GPIO3, GPIO4
GSM Tx-burst indication	Indicates when a GSM Tx burst/slot occurs	--	GPIO1
Jamming condition indication	Indicates when a jamming condition occurs	--	GPIO1, GPIO2, GPIO3, GPIO4
General purpose input	Input to sense high or low digital level	--	GPIO1, GPIO2, GPIO3, GPIO4
General purpose output	Output to set the high or the low digital level	--	GPIO1, GPIO2, GPIO3, GPIO4
Pad disabled	Tri-state with an internal active pull-down enabled	GPIO1	GPIO1, GPIO2, GPIO3, GPIO4

Table 5: GPIO custom functions configuration

3 Pin definition

3.1 Pin assignment

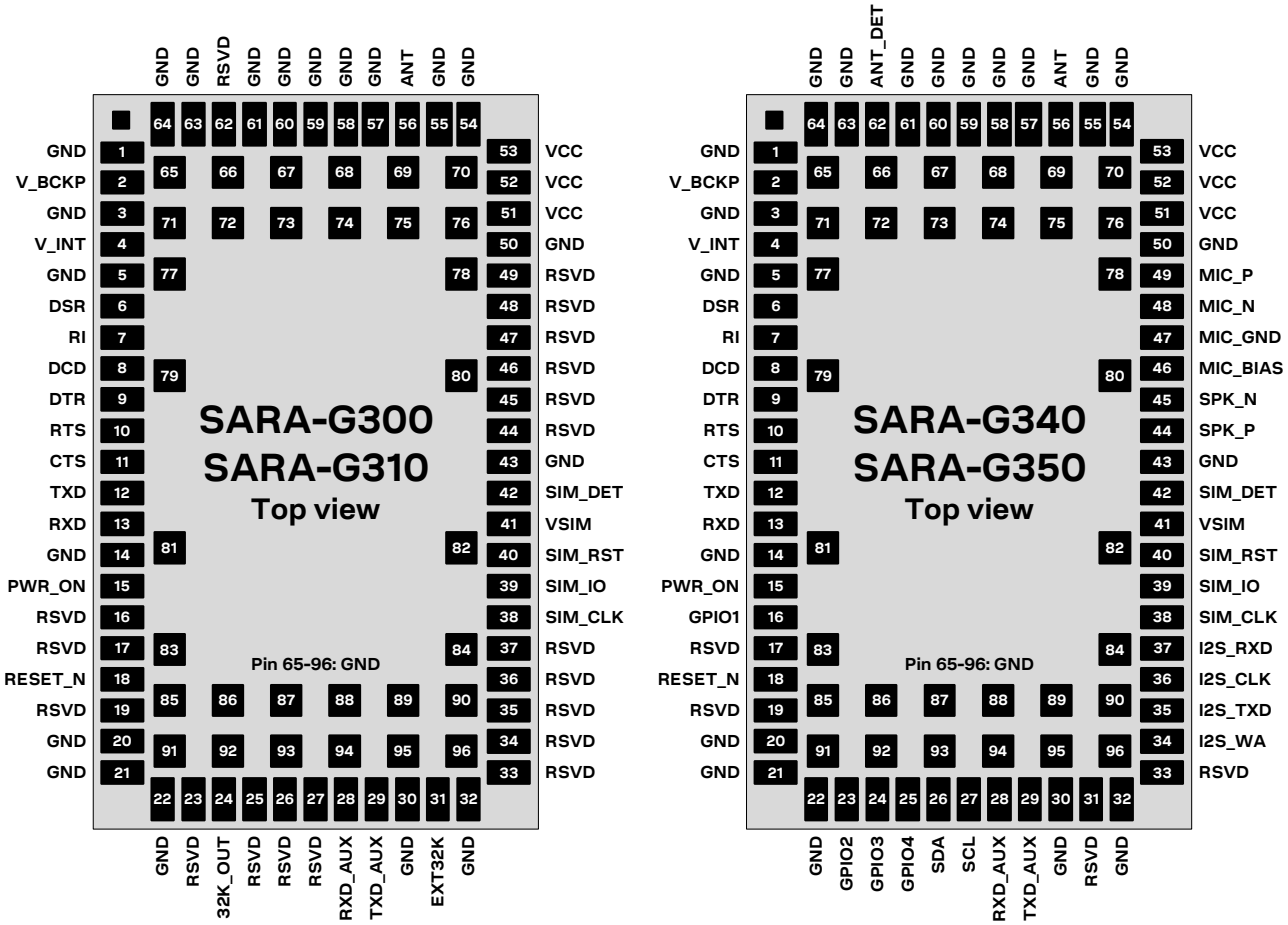


Figure 3: SARA-G3 series modules – pin assignments

No	Module	Name	Power domain	I/O	Description	Remarks
1	All	GND	-	N/A	Ground	All the GND pads must be connected to ground.
2	All	V_BCKP	-	I/O	Real Time Clock supply input/output	V_BCKP = 2.3 V (typical) generated by the module to supply the Real Time Clock when VCC supply voltage is within valid operating range. See section 4.2.3 for detailed electrical specs.
3	All	GND	-	N/A	Ground	All the GND pads must be connected to ground.
4	All	V_INT	-	O	Digital I/O Interfaces supply output	V_INT = 1.8V (typical) generated by the module when it is switched-on. See section 4.2.3 for detailed electrical specs.
5	All	GND	-	N/A	Ground	All the GND pads must be connected to ground.
6	All	DSR	GDI	O	UART data set ready	Circuit 107 (DSR) in ITU-T V.24. Output driver class A. PU/PD class a. Value at reset: T/PU. See section 4.2.11 for detailed electrical specs.
7	All	RI	GDI	O	UART ring indicator	Circuit 125 (RI) in ITU-T V.24. Output driver class A. PU/PD class b. Value at reset: T/PU. See section 4.2.11 for detailed electrical specs.
8	All	DCD	GDI	O	UART data carrier detect	Circuit 109 (DCD) in ITU-T V.24. Output driver class A. PU/PD class a. Value at reset: T/PU. See section 4.2.11 for detailed electrical specs.
9	All	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 b. Value at reset: T/PU. See section 4.2.11 for detailed electrical specs.
10	All	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 c. Value at reset: T/PU. See section 4.2.11 for detailed electrical specs.
11	All	CTS	GDI	O	UART clear to send	Circuit 106 (CTS) in ITU-T V.24. Output driver class A. PU/PD class c. Value at reset: T/PD. See section 4.2.11 for detailed electrical specs.
12	All	TXD	GDI	I	UART transmitted data	Circuit 103 (TxD) in ITU-T V.24. Internal active pull-up to V_INT enabled. PU/PD class a. Value at reset: T/PU. See section 4.2.11 for detailed electrical specs.
13	All	RXD	GDI	O	UART received data	Circuit 104 (RxD) in ITU-T V.24. Output driver class B. PU/PD class a. Value at reset: T/PU. See section 4.2.11 for detailed electrical specs.
14	All	GND	-	N/A	Ground	All the GND pads must be connected to ground.
15	All	PWR_ON	POS	I	Power-on input	The PWR_ON pin has high input impedance: don't leave it floating in noisy environment (an external pull-up resistor is required). See section 4.2.7 for detailed electrical specs.
16	SARA-G350 SARA-G340	GPIO1	GDI	I/O	GPIO	Configurable GPIO: see Table 5 for the available custom functions. Output driver class A. PU/PD class b. Value at reset: T/PD. See section 4.2.11 for detailed electrical specs.
	SARA-G310 SARA-G300	RSVD	-	N/A	RESERVED pin	Pin disabled. Leave unconnected.

No	Module	Name	Power domain	I/O	Description	Remarks
17	All	RSVD	-	N/A	RESERVED pin	Leave unconnected.
18	All	RESET_N	ERS	I	Reset signal	A series Schottky diode is integrated in the module as protection, and then an internal 10 kΩ pull-up resistor to V_INT is provided. See section 4.2.8 for detailed electrical specs. For more details regarding module reset, see [2].
19	All	RSVD	-	N/A	RESERVED pin	Leave unconnected.
20	All	GND	-	N/A	Ground	All the GND pads must be connected to ground.
21	All	GND	-	N/A	Ground	All the GND pads must be connected to ground.
22	All	GND	-	N/A	Ground	All the GND pads must be connected to ground.
23	SARA-G350 SARA-G340	GPIO2	GDI	I/O	GPIO	By default, the pin is configured to provide the GNSS supply enable function. Output driver class A. PU/PD class b. Value at reset: T/PD. See section 4.2.11 for detailed electrical specs.
	SARA-G310 SARA-G300	RSVD	-	N/A	RESERVED pin	Pin disabled. Leave unconnected.
24	SARA-G350 SARA-G340	GPIO3	GDI	I/O	GPIO	By default, the pin is configured to provide the GNSS data ready function. Output driver class B. PU/PD class c. Value at reset: T/PD. See section 4.2.11 for detailed electrical specs.
	SARA-G310 SARA-G300	32K_OUT	-	O	32 kHz output	32 kHz output suitable only to feed the EXT32K input giving the RTC reference clock, allowing low power idle-mode and RTC functions support.
25	SARA-G350 SARA-G340	GPIO4	GDI	I/O	GPIO	By default, the pin is configured to provide the GNSS RTC sharing function. Output driver class A. PU/PD class b. Value at reset: T/PD. See section 4.2.11 for detailed electrical specs.
	SARA-G310 SARA-G300	RSVD	-	N/A	RESERVED pin	Pin disabled. Leave unconnected.
26	SARA-G350 SARA-G340	SDA	DDC	I/O	I²C bus data line	Fixed open drain. No internal pull-up. Value at reset: T. See section 4.2.12 for detailed electrical specs.
	SARA-G310 SARA-G300	RSVD	-	N/A	RESERVED pin	Pin disabled. Leave unconnected.
27	SARA-G350 SARA-G340	SCL	DDC	O	I²C bus clock line	Fixed open drain. No internal pull-up. Value at reset: T. See section 4.2.12 for detailed electrical specs.
	SARA-G310 SARA-G300	RSVD	-	N/A	RESERVED pin	Pin disabled. Leave unconnected.
28	All	RXD_AUX	GDI	O	Auxiliary UART received data	Circuit 104 (RxD) in ITU-T V.24. Output driver class B. PU/PD class a. Value at reset: T/PU. See section 4.2.11 for detailed electrical specs.
29	All	TXD_AUX	GDI	I	Auxiliary UART transmitted data	Circuit 103 (TxD) in ITU-T V.24. Internal active pull-up to V_INT enabled. PU/PD class a. Value at reset: T/PU. See section 4.2.11 for detailed electrical specs.
30	All	GND	-	N/A	Ground	All the GND pads must be connected to ground.
31	SARA-G350 SARA-G340	RSVD	-	N/A	RESERVED pin	Internally not connected. Leave unconnected.

No	Module	Name	Power domain	I/O	Description	Remarks
	SARA-G310 SARA-G300	EXT32K	-	I	32 kHz input	Input for RTC reference clock, needed to enter the low power idle-mode and provide RTC functions. See section 4.2.9 for detailed electrical specs.
32	All	GND	-	N/A	Ground	All the GND pads must be connected to ground.
33	All	RSVD	-	N/A	RESERVED pin	This pin must be connected to GND.
34	SARA-G350 SARA-G340	I2S_WA	GDI	O	I²S word alignment	Output driver class A. PU/PD class c. Value at reset: T/PU. See section 4.2.11 for detailed electrical specs.
	SARA-G310 SARA-G300	RSVD	-	N/A	RESERVED pin	Pin disabled. Leave unconnected.
35	SARA-G350 SARA-G340	I2S_TXD	GDI	O	I²S transmit data	Output driver class B. PU/PD class c. Value at reset: T/PD. See section 4.2.11 for detailed electrical specs.
	SARA-G310 SARA-G300	RSVD	-	N/A	RESERVED pin	Pin disabled. Leave unconnected.
36	SARA-G350 SARA-G340	I2S_CLK	GDI	O	I²S clock	Output driver class B. PU/PD class a. Value at reset: T/PU. See section 4.2.11 for detailed electrical specs.
	SARA-G310 SARA-G300	RSVD	-	N/A	RESERVED pin	Pin disabled. Leave unconnected.
37	SARA-G350 SARA-G340	I2S_RXD	GDI	I	I²S receive data	Internal active pull-down enabled. PU/PD class a. Value at reset: T/PD. See section 4.2.11 for detailed electrical specs.
	SARA-G310 SARA-G300	RSVD	-	N/A	RESERVED pin	Pin disabled. Leave unconnected.
38	All	SIM_CLK	SIM	O	SIM clock	Value at reset: L. See section 4.2.10 for detailed electrical specs.
39	All	SIM_IO	SIM	I/O	SIM data	Internal 4.7k pull-up to VSIM. Value at reset: L. See section 4.2.10 for detailed electrical specs.
40	All	SIM_RST	SIM	O	SIM reset	Value at reset: L. See section 4.2.10 for detailed electrical specs.
41	All	VSIM	-	O	SIM supply output	VSIM = 1.80 V typical if SIM card = 1.8V type. VSIM = 2.85 V typical if SIM card = 3.0V type. See section 4.2.3 for detailed electrical specs.
42	All	SIM_DET	GDI	I	SIM detection	SIM card presence detection function. PU/PD class a. Value at reset: T/PU. See section 4.2.11 for detailed electrical specs.
43	All	GND	-	N/A	Ground	All the GND pads must be connected to ground.
44	SARA-G350 SARA-G340	SPK_P	AUDIO	O	Differential analog audio output (positive)	Differential analog audio output shared for all the analog audio path modes. See section 4.2.13 for detailed electrical specs.
	SARA-G310 SARA-G300	RSVD	-	N/A	RESERVED pin	Leave unconnected.
45	SARA-G350 SARA-G340	SPK_N	AUDIO	O	Differential analog audio output (negative)	Differential analog audio output shared for all the analog audio path modes. See section 4.2.13 for detailed electrical specs.
	SARA-G310 SARA-G300	RSVD	-	N/A	RESERVED pin	Leave unconnected.
46	SARA-G350 SARA-G340	MIC_BIAS	AUDIO	O	Microphone supply output	Supply output for the external microphone. See section 4.2.13 for detailed electrical specs.

No	Module	Name	Power domain	I/O	Description	Remarks
	SARA-G310 SARA-G300	RSVD	-	N/A	RESERVED pin	Leave unconnected.
47	SARA-G350 SARA-G340	MIC_GND	AUDIO	I	Microphone analog reference	Local ground for the external microphone (reference for the differential analog audio input). See section 4.2.13 for detailed electrical specs.
	SARA-G310 SARA-G300	RSVD	-	N/A	RESERVED pin	Leave unconnected.
48	SARA-G350 SARA-G340	MIC_N	AUDIO	I	Differential analog audio input (negative)	Differential analog audio input shared for all the analog audio path modes. See section 4.2.13 for detailed electrical specs.
	SARA-G310 SARA-G300	RSVD	-	N/A	RESERVED pin	Leave unconnected.
49	SARA-G350 SARA-G340	MIC_P	AUDIO	I	Differential analog audio input (positive)	Differential analog audio input shared for all the analog audio path modes. See section 4.2.13 for detailed electrical specs.
	SARA-G310 SARA-G300	RSVD	-	N/A	RESERVED pin	Leave unconnected.
50	All	GND	-	N/A	Ground	All the GND pads must be connected to ground.
51	All	VCC	-	I	Module supply input	All VCC pins must be connected to external supply. Supply input for internal BB PMU and transceiver on SARA-G3 modules product versions '02' onward. See section 4.2.3, 4.2.4 for detailed electrical spec.
52	All	VCC	-	I	Module supply input	All VCC pins must be connected to external supply. Supply input for the internal RF power amplifier on SARA-G3 modules product versions '02' onward. See section 4.2.3, 4.2.4 for detailed electrical spec.
53	All	VCC	-	I	Module supply input	All VCC pins must be connected to external supply. Supply input for the internal RF power amplifier on SARA-G3 modules product versions '02' onward. See section 4.2.3, 4.2.4 for detailed electrical spec.
54	All	GND	-	N/A	Ground	All the GND pads must be connected to ground.
55	All	GND	-	N/A	Ground	All the GND pads must be connected to ground.
56	All	ANT	-	I/O	RF antenna	50 Ω nominal impedance See section 4.2.5 for detailed electrical specs.
57	All	GND	-	N/A	Ground	All the GND pads must be connected to ground.
58	All	GND	-	N/A	Ground	All the GND pads must be connected to ground.
59	All	GND	-	N/A	Ground	All the GND pads must be connected to ground.
60	All	GND	-	N/A	Ground	All the GND pads must be connected to ground.
61	All	GND	-	N/A	Ground	All the GND pads must be connected to ground.
62	SARA-G350 SARA-G340	ANT_DET	ADC	I	Antenna detection	Antenna presence detection function. See section 4.2.6 for detailed electrical specs.
	SARA-G310 SARA-G300	RSVD	-	N/A	RESERVED pin	Leave unconnected.
63	All	GND	-	N/A	Ground	All the GND pads must be connected to ground.
64	All	GND	-	N/A	Ground	All the GND pads must be connected to ground.
65-96	All	GND	-	N/A	Ground	All the GND pads must be connected to ground.

Table 6: SARA-G3 series module pin-out

☞ For more information about pin-out, see the SARA-G3 / SARA-U2 Series System Integration Manual [2].

☞ For an explanation of 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 (chapter 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 the verification on a representative number of samples or according to the 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 the Absolute Maximum Rating System (IEC 134).

Symbol	Description	Condition	Min	Max	Unit
VCC	Module supply voltage	Input DC voltage at VCC pins	-0.15	5.5	V
V_BCKP	RTC supply voltage	Input DC voltage at V_BCKP pin	-0.15	2.5	V
GDI	Generic digital interfaces	Input DC voltage at Generic digital interfaces pins	-0.15	2.2	V
DDC	DDC interface	Input DC voltage at DDC interface pins	-0.15	3.6	V
SIM	SIM interface	Input DC voltage at SIM interface pins	-0.30	3.6	V
ERS	External reset signal	Input DC voltage at RESET_N pin	-0.15	6.0	V
POS	Power-on signal	Input DC voltage at PWR_ON pin	-0.15	6.0	V
AUDIO	Audio pins	Input DC voltage at Audio pins	-0.15	3.0	V
ADC	Antenna detection pin	Input DC voltage at ANT_DET pin	-0.15	3.0	V
P_ANT	Antenna power	In-band input RF power at ANT pin		-8	dBm
Rho_ANT	Antenna ruggedness	Output RF load mismatch ruggedness at ANT pin		20:1	VSWR
Tstg	Storage temperature range		-40	+85	°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 table above, must be limited to values within the specified boundaries by using appropriate protection devices.

4.1.1 Maximum ESD

Parameter	Min	Typical	Max	Unit	Remarks
ESD sensitivity for all pins except ANT pin			1000	V	Human Body Model according to JESD22-A114
ESD sensitivity for ANT pin			1000	V	Human Body Model according to JESD22-A114
ESD immunity for ANT pin			4000	V	Contact Discharge according to IEC 61000-4-2
			8000	V	Air Discharge according to IEC 61000-4-2

Table 8: Maximum ESD ratings

⚠ u-blox cellular 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 specified, all operating condition specifications are at an ambient temperature of +25 °C.

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

4.2.1 Operating temperature range

Symbol	Parameter	Module	Min	Typical	Max	Units	Remarks
Topr	Operating temperature range	All	-40	+25	+85	°C	
		All	-30		+85	°C	Normal operating range see chapter 4.2.1.1
		All	-40		+85	°C	Extended operating range see chapter 4.2.1.2

Table 9: Environmental conditions

4.2.1.1 Normal operating temperature range

SARA-G3 series modules are fully functional and meet 3GPP specifications across the specified temperature range.

4.2.1.2 Extended operating temperature range

SARA-G3 series modules are fully functional across the specified temperature range. RF performance may be affected outside the normal operating temperature range.

4.2.2 Module thermal resistance

Symbol	Parameter	Min	Typical	Max	Unit	Remarks
$R_{th,M-A}$	Module-to-Ambient thermal resistance		10.6		°C/W	Thermal resistance from the module internal temperature sensor to the ambient, with the module mounted on a 79 mm x 62 mm x 1.41 mm 4-layer PCB with a high coverage of copper in still air conditions
$R_{th,M-C}$	Module-to-Case thermal resistance		1.7		°C/W	Thermal resistance from the module internal temperature sensor to the module case, evaluated as the thermal resistance from the module internal temperature sensor to the ambient, with the module mounted on a 79 mm x 62 mm x 1.41 mm 4-layer PCB with a high coverage of copper, with a robust aluminum heat-sink on the back of the application board, with forced air ventilation.

Table 10: SARA-G3 series modules thermal resistance

4.2.3 Supply/Power pins

Symbol	Parameter	Min	Typical	Max	Unit
VCC	Module supply normal operating voltage [18]	3.35	3.80	4.50	V
	Module supply extended operating voltage [19]	3.00		4.50	V
	Module supply extended operating voltage [20]	2.80		4.50	V
ICC_PEAK [21]	Module peak of current consumption through all the VCC pins, during a GSM 1-slot transmit burst at maximum power level, with a matched antenna		1.50	1.60	A
	Module peak of current consumption through all the VCC pins, during a GSM 1-slot transmit burst at maximum power level, with a mismatched antenna			1.90	A
	Module peak of current consumption through the VCC pin #51 of SARA-G3 modules product versions “02” onwards			300	mA
V_BCKP	Real Time Clock Supply input voltage	1.00	2.30	2.40	V
I_BCKP	Real Time Clock Supply average current consumption, at V_BCKP = 2.3 V		2.00		µA

Table 11: Input characteristics of Supply/Power pins

Symbol	Parameter	Min	Typical	Max	Unit
VSIM	SIM Supply	1.76	1.80	1.84	V
		2.78	2.85	2.91	V
V_BCKP	Real Time Clock Supply output voltage	2.19	2.30	2.42	V
I_BCKP	Real Time Clock Supply output current capability			2	mA
V_INT	Digital I/O Interfaces supply output voltage	1.75	1.80	1.85	V
V_INT_RIPPLE	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			90	mV
I_INT	Digital I/O Interfaces supply output current capability			70	mA

Table 12: Output characteristics of Supply/Power pins

[18] The input voltage at all the **VCC** must be above the normal operating range minimum limit to switch-on the module. Module is still fully functional when the input voltage at the **VCC** pins drops below the herein stated normal operating range minimum limit, but RF performance may be affected.
[19] Range defined for all the **VCC** pins of product versions “00” and “01”, and the **VCC** pin #51 (supply input for internal baseband Power Management Unit and the internal transceiver) of product versions “02” onwards. Module may switch off when the input voltage at the related pins drops below the herein stated extended operating range minimum limit.
[20] Range defined for the **VCC** pins #52 and #53 (supply input for the internal power amplifier) of product versions “02” onwards.
[21] Use this figure to dimension maximum current capability of power supply.

4.2.4 Current consumption

Mode	Module	Band	Condition	Min	Typ	Max	Unit
Power Off Mode	All	-	Module is switched off by AT+CPWROFF		36	40	µA
Idle-Mode (Power Saving enabled by AT+UPSV, module in low power idle-mode, equivalent to +CFUN=4 or +COPS=2)	SARA-G300 SARA-G310	-	Averaged current over a 100-ms period, EXT32K fed by external 32.768 kHz signal		0.3	0.4	mA
			Averaged current over a 100-ms period, EXT32K fed by 32K_OUT output signal		3.9	4.0	mA
	SARA-G340 SARA-G350	-	Averaged current over a 100-ms period		0.3	0.4	mA
Cyclic Idle/Active-Mode (Power Saving enabled by AT+UPSV, Module registered with network)	SARA-G300 SARA-G310	All	Averaged current over a 10-minute period, DRX = 9[22], AT+UPSV=2 EXT32K fed by external 32.768 kHz signal		0.6	0.8	mA
			Averaged current over a 10-minute period, DRX = 9[22], AT+UPSV=2 EXT32K fed by 32K_OUT output signal		4.2	4.4	mA
			Averaged current over a 10-minute period, DRX = 5[23], AT+UPSV=1 EXT32K fed by external 32.768 kHz signal		0.9	1.1	mA
			Averaged current over a 10-minute period, DRX = 5[23], AT+UPSV=1 EXT32K fed by 32K_OUT output signal		4.5	4.7	mA
	SARA-G340 SARA-G350	All	Averaged current over a 10-minute period, DRX = 9[22], AT+UPSV=2		0.6	0.8	mA
			Averaged current over a 10-minute period, DRX = 5[23], AT+UPSV=1		0.9	1.1	mA
Active-Mode (Power Saving disabled by AT+UPSV, Module registered with network)	SARA-G300 SARA-G310	All	Averaged current over a 10-minute period, DRX = 5[23], AT+UPSV=0 (default) EXT32K fed by external 32.768 kHz signal		4.2	4.4	mA
			Averaged current over a 10-minute period, DRX = 5[23], AT+UPSV=0 (default) EXT32K fed by 32K_OUT output signal		4.5	4.7	mA
			Averaged current over a 10-minute period, DRX = 5[23], AT+UPSV=0 (default) EXT32K not fed		18.0	18.2	mA
	SARA-G340 SARA-G350	All	Averaged current over a 10-minute period, DRX = 5[23], AT+UPSV=0 (default)[24]		2.9	3.1	mA
GSM Connected Mode (Call enabled)	All	850, 900	Averaged current over a 10-second period, 1 Tx + 1 Rx slot Maximum Tx power (32.2 dBm typ.)		200	250	mA
		1800, 1900	Averaged current over a 10-second period, 1 Tx + 1 Rx slot Maximum Tx power (29.2 dBm typ.)		150	200	mA
GPRS Connected Mode (Call enabled)	All	850, 900	Averaged current over a 10-second period, 2 Tx + 3 Rx slots Maximum Tx power (30.5 dBm typ.)		300	350	mA
		1800, 1900	Averaged current over a 10-second period, 2 Tx + 3 Rx slots Maximum Tx power (27.5 dBm typ.)		210	260	mA

Table 13: VCC current consumption[25]

[22] Module is registered with the network, with a paging period of 2.12 s (2G network DRX setting = 9), with none neighbour cell.
[23] Module is registered with the network, with a paging period of 1.18 s (2G network DRX setting = 5), with 16 neighbour cells.
[24] 18.2 mA typical, 18.4 mA maximum for SARA-G340 and SARA-G350 modules product versions "00"
[25] Averaged values for module current consumption through **VCC** pins in the listed modes/conditions

4.2.5 RF performance

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

Table 14: Operating RF frequency bands

Parameter	Min	Typical	Max	Unit	Remarks
Receiver input sensitivity - GSM 850		-109		dBm	Downlink RF level @ BER Class II < 2.4 %
Receiver input sensitivity - E-GSM 900		-109		dBm	Downlink RF level @ BER Class II < 2.4 %
Receiver input sensitivity - DCS 1800		-109		dBm	Downlink RF level @ BER Class II < 2.4 %
Receiver input sensitivity - PCS 1900		-109		dBm	Downlink RF level @ BER Class II < 2.4 %

Condition: 50 Ω source

Table 15: Receiver sensitivity performance

Parameter	Min	Typical	Max	Unit	Remarks
Maximum output power GSM 850 / E-GSM 900		32.2		dBm	Uplink burst RF power for GSM or GPRS 1-slot TCH at maximum output power control level (PCL 5 or Gamma 3)
		30.5		dBm	Uplink burst RF power for GPRS 2-slot TCH at maximum output power control level (Gamma 3)
Maximum output power DCS 1800 / PCS 1900		29.2		dBm	Uplink burst RF power for GSM or GPRS 1-slot TCH at maximum output power control level (PCL 0 or Gamma 3)
		27.5		dBm	Uplink burst RF power for GPRS 2-slot TCH at maximum output power control level (Gamma 3)

Condition: 50 Ω output load

Table 16: Transmitter maximum output power

4.2.6 ANT_DET pin

Pin name	Parameter	Min	Typical	Max	Unit	Remarks
ANT_DET	Output DC current pulse value		20		µA	
	Output DC current pulse time length	3.7	5.4	8.1	ms	

Table 17: ANT_DET pin characteristics

4.2.7 PWR_ON pin

Pin name	Parameter	Min	Typical	Max	Unit	Remarks
PWR_ON	Internal supply for Power-On Input Signal	2.19	2.30	2.42	V	Real Time Clock supply (V_BCKP)
	L-level input	-0.10		0.65	V	High input impedance (no internal pull-up)
	H-level input	2.00		4.50	V	High input impedance (no internal pull-up)
	L-level input current		-8		µA	
	PWR_ON low time to switch-on the module	5			ms	

Table 18: PWR_ON pin characteristics

4.2.8 RESET_N pin

Pin name	Parameter	Min	Typical	Max	Unit	Remarks
RESET_N	Internal supply for External Reset Signal	1.75	1.80	1.85	V	Digital I/O Interfaces supply (V_INT)
	L-level input	-0.10		0.15	V	A series Schottky diode is integrated in the module as protection: the module senses a low level when the RESET_N pin is forced low.
	H-level input	1.40		4.50	V	A series Schottky diode is integrated in the module as protection: the module senses a low level when the RESET_N pin is forced low.
	Pull-up resistance		10		kΩ	Internal pull-up to V_INT after the internal series Schottky diode
	L-level input current		-180		µA	
	RESET_N low time to perform a proper reset	50			ms	SARA-G340, SARA-G350
	RESET_N low time to perform a proper reset	3000			ms	SARA-G300, SARA-G310

Table 19: RESET_N pin characteristics

4.2.9 EXT32K pin

Pin name	Parameter	Min	Typical	Max	Unit	Remarks
EXT32K	L-level input	-0.25		0.20	V	
	H-level input	V_BCKP – 0.20		V_BCKP + 0.25	V	V_BCKP = 2.3 V (typical) generated by the internal LDO linear regulator when valid VCC supply is present.
	Input clock frequency	32.765	32.768	32.771	kHz	Frequency tolerance: +/- 100 ppm

Table 20: EXT32K pin characteristics

4.2.10 SIM pins

Parameter	Min	Typical	Max	Unit	Remarks
Low-level input			0.37	V	VSIM = 1.80 V
			0.60	V	VSIM = 2.85 V
High-level input	1.22		3.30	V	VSIM = 1.80 V
	1.95		3.30	V	VSIM = 2.85 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 = 2.85 V, Max value at I_{OL} = +1.0 mA
High-level output	1.45	1.80		V	VSIM = 1.80 V, Min value at I_{OH} = -1.0 mA
	2.50	2.85		V	VSIM = 2.85 V, Min value at I_{OH} = -1.0 mA
Input/Output leakage current			0.7	µA	0.2 V < V_{IN} < 3.3 V
Internal pull-up resistor on SIM_IO to VSIM		4.7		kΩ	
Clock frequency on SIM_CLK		3.25		MHz	

Table 21: SIM pins characteristics

4.2.11 Generic Digital Interfaces pins

Parameter	Min	Typical	Max	Unit	Remarks
Internal supply for GDI domain	1.75	1.80	1.85	V	Digital I/O Interfaces supply (V_INT)
Input characteristic: L-level input	-0.20		0.35	V	
Input characteristic: H-level input	1.30		1.95	V	
Output characteristics: L-level output		0.00	0.20	V	Max value at I_{OL} = +3.0 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} = +2.5 mA for Driver Class B
		0.00	0.35	V	Max value at I_{OL} = +5.0 mA for Driver Class B
Output characteristics: H-level output	1.60	1.80		V	Min value at I_{OH} = -3.0 mA for Driver Class A
	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} = -2.5 mA for Driver Class B
	1.45	1.80		V	Min value at I_{OH} = -5.0 mA for Driver Class B
Input/Output leakage current			0.7	µA	0.2 V < V_{IN} < 1.95 V
Pull-up input current		-102		µA	PU Class a
		-55		µA	PU Class b
		-31		µA	PU Class c
Pull-down input current		103		µA	PD Class a
		51		µA	PD Class b
		27		µA	PD Class c

Table 22: GDI pins characteristics

4.2.11.1 AC characteristics of digital audio interfaces pins

The 4-wire I²S digital audio interfaces can be configured in 2 different modes:

- Normal I²S mode with Master role
- PCM mode with Master role

4.2.11.1.1 Normal I²S mode with Master role

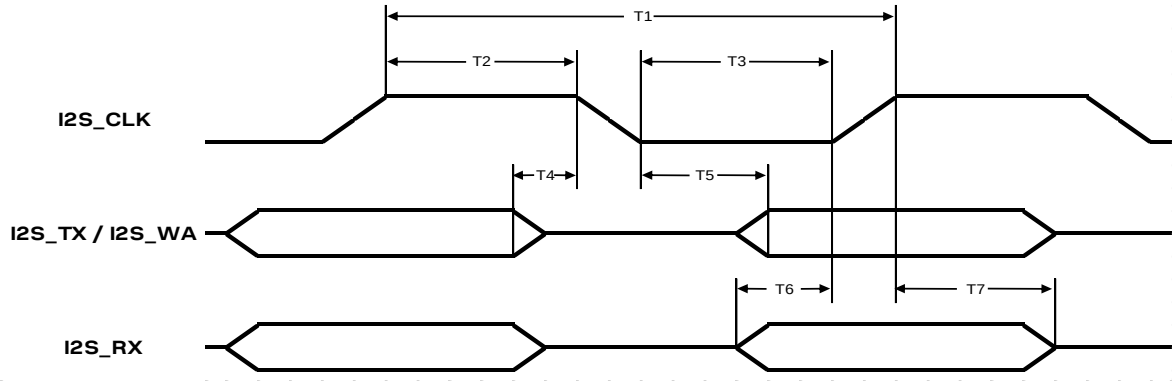


Figure 4: AC characteristics of digital audio interface in normal I2S mode (<I2S_mode> = 2, 4, 6, 8, 10, 12)

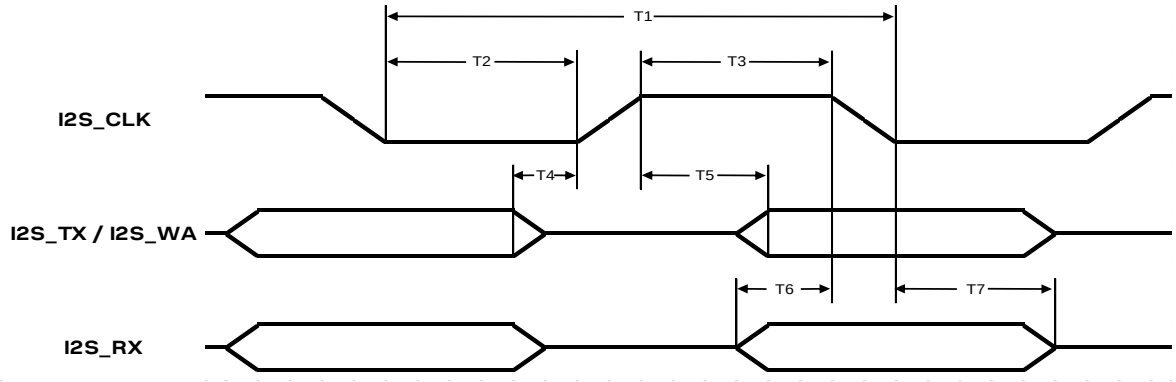


Figure 5: AC characteristics of digital audio interface in normal I2S mode (<I2S_mode> = 3, 5, 7, 9, 11, 13)

Parameter	Description	Min	Typical	Max	Unit	Remarks
T1	I2S_CLK period	3.902	3.906		µs	<I2S_mode> = 2,..,13
1/T1	I2S_CLK frequency		256		kHz	<I2S_mode> = 2,..,13
T2	I2S_CLK high time	1.933	1.953		µs	<I2S_mode> = 2,..,13
T3	I2S_CLK low time	1.933	1.953		µs	<I2S_mode> = 2,..,13
	I2S_WA period		125.0		µs	<I2S_mode> = 2,..,13
	I2S_WA frequency		8		kHz	<I2S_mode> = 2,..,13
T4	I2S_TX invalid before I2S_CLK low end			24	ns	<I2S_mode> = 2,4,6,8,10,12
	I2S_TX invalid before I2S_CLK high end			24	ns	<I2S_mode> = 3,5,7,9,11,13
T5	I2S_TX valid after I2S_CLK high begin			31	ns	<I2S_mode> = 2,4,6,8,10,12
	I2S_TX valid after I2S_CLK low begin			31	ns	<I2S_mode> = 3,5,7,9,11,13
T6	I2S_RX setup time before I2S_CLK high end	60			ns	<I2S_mode> = 2,4,6,8,10,12
	I2S_RX setup time before I2S_CLK low end	60			ns	<I2S_mode> = 3,5,7,9,11,13
T7	I2S_RX hold time after I2S_CLK low begin	12			ns	<I2S_mode> = 2,4,6,8,10,12
	I2S_RX hold time after I2S_CLK high begin	12			ns	<I2S_mode> = 3,5,7,9,11,13

Table 23: AC characteristics of digital audio interface in normal I2S mode (<I2S_mode> = 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13)

4.2.11.1.2 PCM mode with Master role

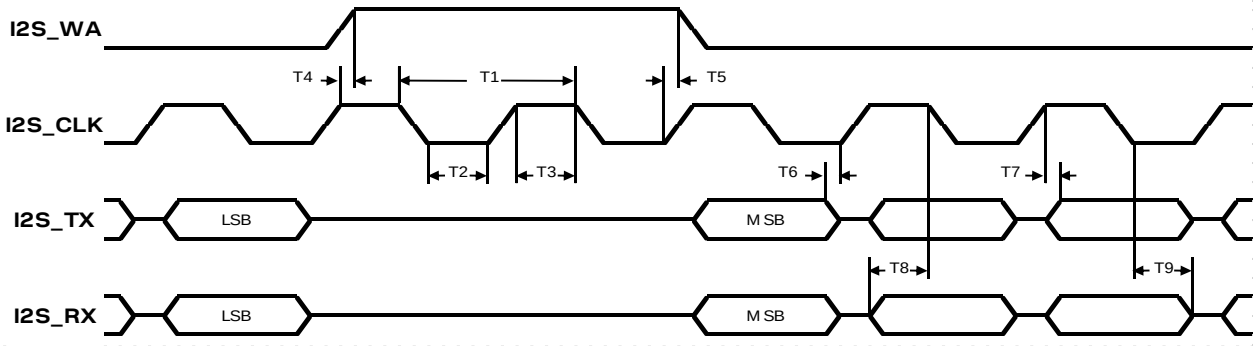


Figure 6: AC characteristics of digital audio interface in PCM mode (<I2S_mode> = 0)

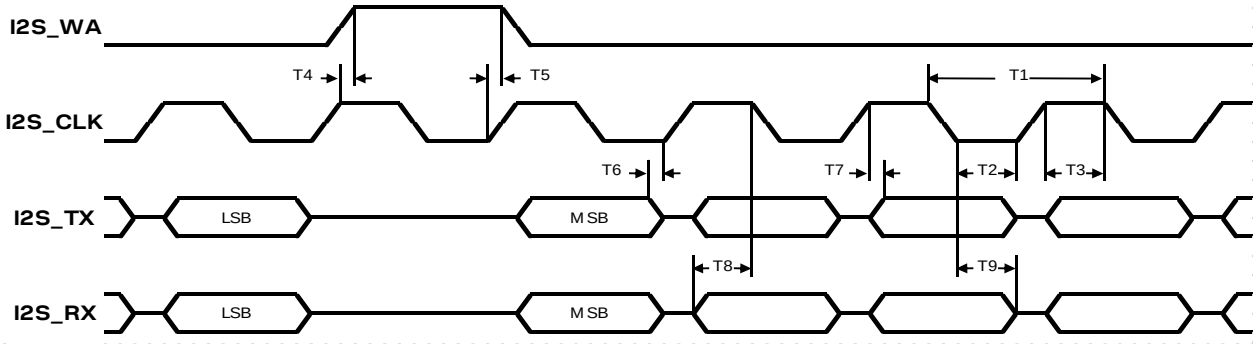


Figure 7: AC characteristics of digital audio interface in PCM mode (<I2S_mode> = 1)

Parameter	Description	Min	Typical	Max	Unit	Remarks
T1	I2S_CLK period	6.940	6.944		µs	<I2S_mode> = 0
		7.349	7.353		µs	<I2S_mode> = 1
1/T1	I2S_CLK frequency		144		kHz	<I2S_mode> = 0
			136		kHz	<I2S_mode> = 1
T2	I2S_CLK low time	3.452	3.472		µs	<I2S_mode> = 0
		3.656	3.676		µs	<I2S_mode> = 1
T3	I2S_CLK high time	3.452	3.472		µs	<I2S_mode> = 0
		3.656	3.676		µs	<I2S_mode> = 1
	I2S_WA period		125.0		µs	<I2S_mode> = 0,1
	I2S_WA frequency		8		kHz	<I2S_mode> = 0,1
T4	I2S_CLK high begin to I2S_WA high begin	-24		31	ns	<I2S_mode> = 0,1
T5	I2S_CLK low end to I2S_WA high end	-24		31	ns	<I2S_mode> = 0,1
T6	I2S_TX invalid before I2S_CLK low end			24	ns	<I2S_mode> = 0,1
T7	I2S_TX valid after I2S_CLK high begin			22	ns	<I2S_mode> = 0,1
T8	I2S_RX setup time before I2S_CLK high end	60			ns	<I2S_mode> = 0,1
T9	I2S_RX hold time after I2S_CLK low begin	12			ns	<I2S_mode> = 0,1

Table 24: AC characteristics of digital audio interface in PCM mode (<I2S_mode> = 0, 1)

4.2.12 DDC (I²C) pins

Parameter	Min	Typical	Max	Unit	Remarks
Internal supply for DDC domain	1.75	1.80	1.85	V	Digital I/O Interfaces supply (V_INT)
L-level input	-0.20		0.35	V	In accordance with I²C bus specification
H-level input	1.30		3.30	V	In accordance with I²C bus specification
L-level output		0.00	0.40	V	Max value at I_{OL} = +3.0 mA
Input/Output leakage current			0.7	µA	0.2 V < V_{IN} < 3.3 V
Clock frequency on SCL		100		kHz	

Table 25: DDC pins characteristics

4.2.13 Audio pins

Pin name	Parameter	Min	Typical	Max	Unit	Remarks
MIC_BIAS	Microphone supply output voltage		2.2		V	Provided by MIC_BIAS output pin with MIC_GND pin as reference.
	Microphone supply output current			4.0	mA	Provided by MIC_BIAS output pin with MIC_GND pin as reference
	Load capacitance			0	nF	Proper internal bypass capacitor is already provided to guarantee stable operation: an external capacitor cannot be directly connected to MIC_BIAS pin, but can be provided after a proper series resistor.
	Load resistance	1			kΩ	
MIC_GND	Microphone ground		0		V	MIC_GND pin is internally connected to GND as a sense line

Table 26: Microphone supply (MIC_BIAS) characteristics

Pin name	Parameter	Min	Typical	Max	Unit	Remarks
MIC_P/MIC_N	Differential input voltage			0.8	Vpp	Full scale differential voltage
	Differential input resistance		50		kΩ	
	Common mode DC voltage		0.5		V	No internal DC blocking capacitor
	Input capacitance		5	10	pF	No internal DC blocking capacitor
	Signal to noise	75			dB	Gain stage = +12 dB, Bandwidth 300-3900 Hz
	Signal to distortion (THD)	65			dB	
	Power supply rejection	49	85		dB	

Table 27: Differential audio transmit path (MIC_P, MIC_N) input characteristics

Pin name	Parameter	Min	Typical	Max	Unit	Remarks
SPK_P/SPK_N	Maximum differential output voltage	4.0	4.1	4.2	Vpp	Full scale differential open circuit voltage
	Common mode output voltage		1.25		V	
	Output current limit			200	mA	
	Output load resistance	14			Ω	
	Single-ended output load capacitance			250	pF	
	Signal to noise	70	80		dB	Load = 16 Ω, Gain stage = +0 dB, Input signal = 0 dBFS, Code 0, A-weighted
	Signal to distortion (THD)	60	70		dB	Load = 16 Ω, Input signal = 0 dBFS

Table 28: Differential audio receive path (SPK_P, SPK_N) output characteristics

5 Mechanical specifications

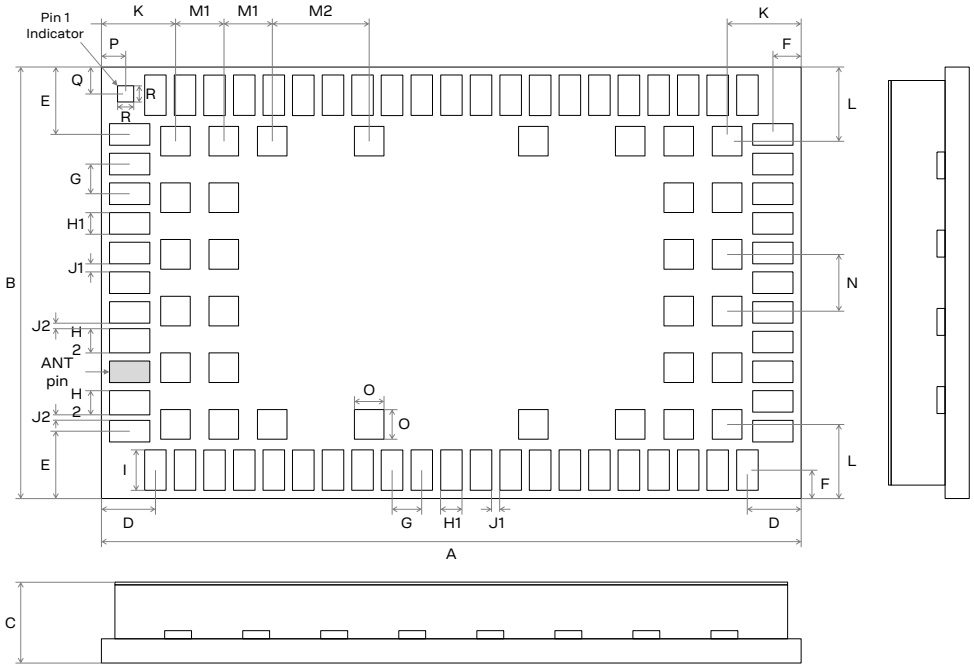


Figure 8: SARA-G3 series dimensions (bottom and sides views)

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 [26] [mm]	2.4	(94.5 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)	+0.05/-0.05	(+2.0/-2.0 mil)
H1	Lateral Pin Height [mm]	0.8	(31.5 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
H2	Lateral Pin close to ANT Height [mm]	0.9	(35.4 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
I	Lateral Pin Width [mm]	1.5	(59.1 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
J1	Lateral Pin to Pin Distance [mm]	0.3	(11.8 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
J2	Lateral Pin to Pin close to ANT Distance [mm]	0.2	(7.9 mil)	+0.05/-0.05	(+2.0/-2.0 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)	+0.05/-0.05	(+2.0/-2.0 mil)
M2	Central Pin to Pin Horizontal Pitch [mm]	3.6	(141.7 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
N	Central Pin to Pin Vertical Pitch [mm]	2.1	(82.7 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
O	Central Pin Height and Width [mm]	1.1	(43.3 mil)	+0.05/-0.05	(+2.0/-2.0 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)	+0.05/-0.05	(+2.0/-2.0 mil)
Weight	Module Weight [g]	< 3			

Table 29: SARA-G3 series dimensions

[26] 3.0 mm typical module thickness for SARA-G3 modules product versions “00” and “01”

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

☞ For information regarding suggested footprint (i.e. copper mask) and stencil (i.e. paste mask) layout to be implemented on the application board, see SARA-G3 / SARA-U2 series System Integration Manual [2].

6 Qualification 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-G3 series

SARA-G3 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-G3 series modules are RoHS 3 compliant.

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

Table 30 lists the SARA-G3 series modules main approvals.

Certification Scheme	SARA-G300	SARA-G310	SARA-G340	SARA-G350
GCF (Global Certification Forum)	•	•	•	•
PTCRB (PCS Type Certification Review Board)		•		•
CE (Conformité Européenne)	•	•	•	•
FCC (US Federal Communications Commission) FCC Identification number		• XPYSARAG350		• XPYSARAG350
ISED (Innovation, Science and Economic Development Canada)[2] IC certification number		• 8595A-SARAG350		• 8595A-SARAG350
Anatel (Agência Nacional de Telecomunicações Brazil)		•		•
A-tick / RCM (Australia Regulatory Compliance Mark)		•		•
EurAsEC (Eurasian Economic Community Certification)	•			•
Ukraine Certification	•	•	•	•
Israel Certification				•
China Certification			•	•
NCC (National Communications Commission Taiwan)			•	•
ICASA (Ind. Communications Authority South Africa)			•	•
Vodafone (Network Operator)	•	•		•
Orange (Network Operator)				•
TIM (Telecom Italia Mobile Network Operator)				•
Rogers (Canadian Network Operator)				•

Table 30: SARA-G3 series main certification approvals

☞ The above listed certifications might not be available for all the different product type numbers. Please contact the u-blox office or sales representative nearest you for the full comprehensive list of approvals and for further specific info about all country, conformance and network operators’ certifications currently in place for the selected product ordering number.

[27] Formerly known as IC (Industry Canada)

6.2.2 SARA-G340 ATEX and SARA-G350 ATEX

SARA-G340 ATEX and SARA-G350 ATEX modules, in addition to the approvals for main certification schemes (see section 6.2.1), are certified as components intended for use in potentially explosive atmospheres compliant to the following standards:

- IEC 60079-0: 2011
- IEC 60079-11: 2011
- IEC 60079-26: 2006

The certification number of SARA-G340 ATEX and SARA-G350 ATEX modules according to the ATEX directive 2014/34/EU is:

- SIQ 13 ATEX 032 U

The certification number of SARA-G340 ATEX and SARA-G350 ATEX modules according to the IECEx conformity assessment system is:

- IECEx SIQ 13.0004U

According to the standards listed above, the SARA-G340 ATEX and SARA-G350 ATEX modules are certified with the following marking:

- Ex II 1G, Ex ia IIC/IIB

According to the marking stated above, the SARA-G340 ATEX and SARA-G350 ATEX 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 '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 of SARA-G340 ATEX and SARA-G350 ATEX modules.

The RF radiating profile of SARA-G340 ATEX and SARA-G350 ATEX modules is compliant to all the applicable 3GPP / ETSI standards, with a maximum of 2 W RF pulse power and 1.15 mJ RF pulse energy according to the GSM/GPRS power class stated in Table 2.

Section 9.1 describes the nameplate of SARA-G340 ATEX and SARA-G350 ATEX modules (see Figure 12 and Figure 13).

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

- Ui = 3.8 V
- Ii = 1.6 A (burst)
- Pi = 2.5 W
- Ci = 103 µF
- Li = 4.1 µH

The following maximum input and equivalent parameters must be considered in sub-divisions IIB, IIA:

- Ui = 4.2 V
- Ii = 2.5 A (burst)
- Pi = 2.5 W
- Ci = 103 µF
- Li = 4.1 µH

☞ For more information about the integration of SARA-G340 ATEX and SARA-G350 ATEX modules in applications intended for use in potentially explosive atmospheres, see the SARA-G3 / SARA-U2 Series System Integration Manual [2].

7 Product handling

7.1 Packaging

SARA-G3 series 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 [5].



Figure 9: Reeled SARA-G3 series modules

7.1.1 Reels

SARA-G3 series modules are deliverable in quantities of 250 pieces on a reel. SARA-G3 series modules are delivered using reel Type B as described in the u-blox Package Information Guide [5].

Parameter	Specification
Reel type	B
Delivery quantity	250

Table 31: Reel information for SARA-G3 series modules

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

7.1.2 Tapes

Figure 10 specifies the dimensions and orientations of the tapes for SARA-G3 series module.

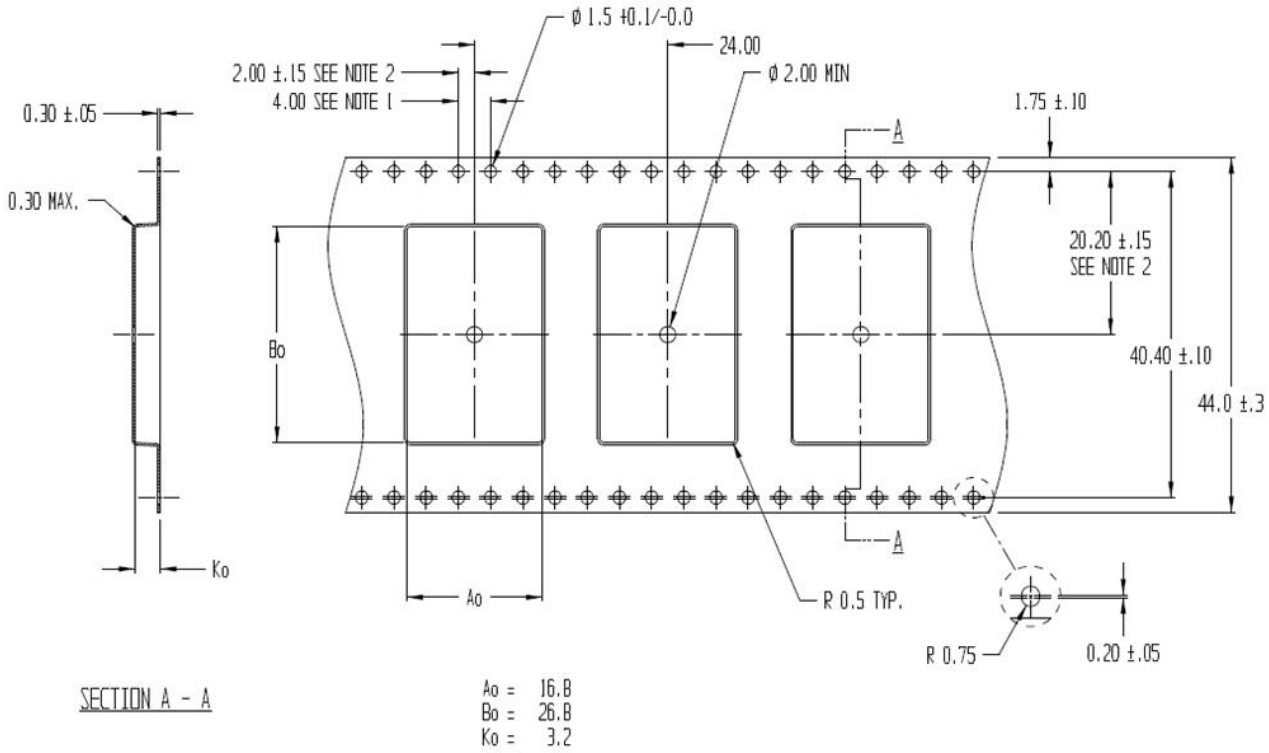


Figure 10: Dimensions for SARA-G3 series on tape

Parameter	Value
A_0	16.8
B_0	26.8
K_0	3.2

Table 32: SARA-G3 series tape dimensions (mm)

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

Note 2: Pocket position relative to sprocket hole 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-G3 series modules are Moisture Sensitive Devices (MSD) in accordance to the IPC/JEDEC specification.

The Moisture Sensitivity Level (MSL) relates to the packaging and handling precautions required. SARA-G3 series modules are rated at MSL level 4. For more information regarding moisture sensitivity levels, labeling, storage and drying, see the u-blox Package Information Guide [5].

For 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 SARA-G3 / SARA-U2 Series System Integration Manual [2]).

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

7.4 ESD precautions

⚠ SARA-G3 series modules contain highly sensitive electronic circuitry and are Electrostatic Sensitive Devices (ESD). Handling SARA-G3 series modules without proper ESD protection may destroy or damage them permanently.

SARA-G3 series modules are Electrostatic Sensitive Devices (ESD) and require special ESD precautions typically applied to ESD sensitive components.

Table 8 reports the maximum ESD ratings of the SARA-G3 modules.

Proper ESD handling and packaging procedures must be applied throughout the processing, handling and operation of any application that incorporates SARA-G3 series modules.

ESD precautions should be implemented on the application board where the module is mounted, as described in the SARA-G3 / SARA-U2 Series System Integration Manual [2].

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

8 Default settings

Interface	Settings	Comments
UART interface	AT interface: enabled	AT command interface is by default enabled on the UART physical interface
	AT+IPR=0	Automatic baud rate detection enabled by default
	AT+ICF=0	Automatic frame format recognition enabled by default
	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 DCE 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
	MUX protocol: disabled	Multiplexing mode is by default disabled and it can be configured by AT+CMUX command. SARA-G340 and SARA-G350 modules define the following virtual channels: • Channel 0: control channel • Channel 1 – 5: AT commands / data connection • Channel 6: GNSS tunneling SARA-G300 and SARA-G310 modules define the following virtual channels: • Channel 0: control channel • Channel 1 – 2: AT commands / data connection
AUX UART interface	AT interface: disabled	AT command interface is by default disabled on the AUX UART physical interface, and it can be configured by AT+USIO command (see the u-blox AT Commands Manual [1])
Power Saving	AT+UPSV=0	Disabled
Network registration	AT+COPS=0	Self network registration

Table 33: SARA-G3 series default settings

9 Labeling and ordering information

9.1 Product labeling

The labels of SARA-G3 series modules include important product information as described in this section.

Figure 11 illustrates the label of all the SARA-G3 series modules except for SARA-G340 ATEX and SARA-G350 ATEX, and includes: u-blox logo, production lot, Pb-free marking, product Type Number, IMEI number, certification info and production country.

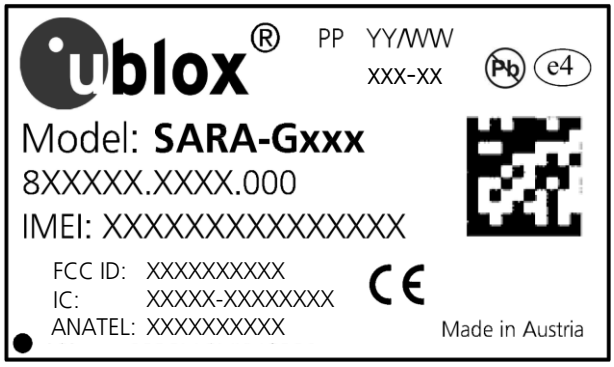


Figure 11: Label of SARA-G3 modules (except for SARA-G340 ATEX and SARA-G350 ATEX)

Figure 12 illustrates the label of SARA-G350 ATEX modules, and includes: 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, FCC and IC certification numbers and production country.



Figure 12: Label of SARA-G350 ATEX modules

Figure 13 illustrates the label of SARA-G340 ATEX modules, and includes: 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, Notified Body number and production country.



Figure 13: Label of SARA-G340 ATEX modules

For information about the approval codes and for all the certificates of compliancy of SARA-G3 series modules, 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 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 34 below details these three different formats:

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

Table 34: Product code formats

Table 35 explains the parts of the product code.

Code	Meaning	Example
SARA	Form factor	SARA
T	Platform [G: GSM; U: HSUPA; C: CDMA 1xRTT; N: NB-IoT; R: LTE low data rate (Cat 1 and below); L: LTE high data rate (Cat 3 and above)]	G: GSM
G	Platform generation, e.g. chip or function set [1...9]	3
VV	Variant based on the same platform [00...99]	50
TT	Product Version [00...99]	00
Q	Quality grade / Production site • S = professional / made in Austria • A = automotive / made in Austria • X = ATEX / made in Austria • B = professional / made in Brazil	S
XX		Default value is 00

Table 35: Part identification code

9.3 Ordering information

Ordering No.	Description
SARA-G300-00S	2-band GSM/GPRS class 10 module 26.0 x 16.0 x 3.0 mm, 250 pcs/reel
SARA-G310-00S	4-band GSM/GPRS class 10 module 26.0 x 16.0 x 3.0 mm, 250 pcs/reel
SARA-G340-00S	2-band GSM/GPRS class 10 module Supporting Audio, I²C for u-blox GNSS receivers, AssistNow, CellLocate®, Embedded TCP/UDP, FTP/HTTP/SMTP, eCall / ERA-GLONASS, Network indication, Antenna supervisor, Jamming detection and other features 26.0 x 16.0 x 3.0 mm, 250 pcs/reel
SARA-G340-01S	2-band GSM/GPRS class 10 module Supporting the same feature-set of the “00” product version plus SSL for FTP and HTTP, Multi GNSS Assistance (MGA) server and other features 26.0 x 16.0x 3.0 mm, 250 pcs/reel
SARA-G340-02S	2-band GSM/GPRS class 10 module Supporting the same feature-set of the “01” product version plus second AT interface, improved SSL/TLS, IPv4/IPv6 dual-stack, Bearer Independent Protocol, Network Friendly Mode and other features 26.0 x 16.0 x 2.4 mm, 250 pcs/reel
SARA-G340-02X	2-band GSM/GPRS class 10 module Supporting the same feature-set of the “02S” product version ATEX / IECEx certified 26.0 x 16.0 x 2.4 mm, 250 pcs/reel
SARA-G350-00S	4-band GSM/GPRS class 10 module Supporting Audio, I²C for u-blox GNSS receivers, AssistNow, CellLocate®, Embedded TCP/UDP, FTP/HTTP/SMTP, eCall / ERA-GLONASS, Network indication, Antenna supervisor, Jamming detection and other features 26.0 x 16.0 x 3.0 mm, 250 pcs/reel
SARA-G350-00X	4-band GSM/GPRS class 10 module Supporting the same feature-set of the “00S” product version ATEX / IECEx certified 26.0 x 16.0 x 3.0 mm, 250 pcs/reel
SARA-G350-01S	4-band GSM/GPRS class 10 module Supporting the same feature-set of the “00” product version plus SSL for FTP and HTTP, Multi GNSS Assistance (MGA) server and other features 26.0 x 16.0 x 3.0 mm, 250 pcs/reel
SARA-G350-01B	4-band GSM/GPRS class 10 module Supporting the same feature-set of the “01S” product version Made in Brazil 26.0 x 16.0 x 3.0 mm, 250 pcs/reel
SARA-G350-02S	4-band GSM/GPRS class 10 module Supporting the same feature-set of the “01” product version plus second AT interface, improved SSL/TLS, IPv4/IPv6 dual-stack, Bearer Independent Protocol, Network Friendly Mode and other features 26.0 x 16.0 x 2.4 mm, 250 pcs/reel
SARA-G350-02X	4-band GSM/GPRS class 10 module Supporting the same feature-set of the “02S” product version ATEX / IECEx certified 26.0 x 16.0 x 2.4 mm, 250 pcs/reel

Table 36: Product ordering codes

Appendix

A Glossary

Abbreviation	Definition
ADC	Analog to Digital Converter
AT	AT Command Interpreter Software Subsystem, or attention
ATEX	Atmospheres Explosive
BB	Base-Band
BER	Bit Error Rate
DCE	Data Communication Equipment
DDC	Display Data Channel (I^2C compatible) Interface
DL	Down-link (Reception)
Driver Class	Output Driver Class: see Table 22 for definition
DRX	Discontinuous Reception
DTE	Data Terminal Equipment
ERS	External Reset Input Signal
GDI	Generic Digital Interfaces (power domain)
GND	Ground
GNSS	Global Navigation Satellite System
GPIO	General Purpose Input Output
GPRS	General Packet Radio Service
GPS	Global Positioning System
GSM	Global System for Mobile Communication
H	High logic digital level
HBM	Human Body Model
I^2C	Inter-Integrated Circuit Interface
I^2S	Inter-IC Sound Interface
L	Low logic digital level
LGA	Land Grid Array
N/A	Not Applicable
OD	Open Drain
PA	Power Amplifier
PCN / IN	Product Change Notification / Information Note
PD	Pull-Down
PMU	Power Management Unit
POS	Power-On Input Signal
PU	Pull-Up
PU/PD Class	Pull-Up / Pull-Down Class: see Table 22 for definition
RMC	Reference Measurement Channel
SIM	Subscriber Identity Module
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

Abbreviation	Definition
UART	Universal Asynchronous Receiver-Transmitter serial interface
UL	Up-link (Transmission)
USB	Universal Serial Bus interface

Table 37: Explanation of the abbreviations and terms used

Related documents

[1] u-blox AT Commands Manual, Doc. No. UBX-13002752
[2] u-blox SARA-G3 / SARA-U2 series System Integration Manual, Doc. No. UBX-13000995
[3] u-blox GNSS Implementation Application Note, Doc. No. UBX-13001849
[4] u-blox Mux Implementation for cellular modules Application Note, Doc. No. UBX-13001887
[5] u-blox Package Information Guide, Doc. No. UBX-14001652
[6] u-blox Android RIL Source code Application note, Doc. No. UBX-13002041
[7] u-blox Windows Embedded RIL Production delivery Application note, Doc. No. UBX-13002043
[8] ITU-T Recommendation V24, 02-2000. List of definitions for interchange circuits between Data Terminal Equipment (DTE) and Data Connection Equipment (DCE)
[9] 3GPP TS 27.007 – Technical Specification Group Core Network and Terminals; AT command set for User Equipment (UE)
[10] 3GPP TS 27.005 – Technical Specification Group Terminals; Use of Data Terminal Equipment – Data Circuit terminating Equipment (DTE-DCE) interface for Short Message Services (SMS) and Cell Broadcast Service (CBS)
[11] 3GPP TS 27.010 – Terminal Equipment to User Equipment (TE-UE) multiplexer protocol
[12] 3GPP TS 26.267 – Technical Specification Group Services and System Aspects; eCall Data Transfer; In-band modem solution; General description
[13] GSM Association - Official Document CLP.03 - 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	Comments
-	Jun. 22, 2012	lpah / sses	Initial release
1	Sep. 05, 2012	sses	Corrected module pin numbering and dimensions
2	Oct. 19, 2012	sses	Added ESD immunity rating for ANT pin; Added current consumption ratings
3	Nov. 07, 2012	sses	Added the technical description of SARA-G300 and SARA-G310 modules Updated current consumption ratings
4	Mar. 08, 2013	lpah / sses	Updated status to Advance Information
5	Apr. 12, 2013	lpah	Updated status to Preliminary
6	May 23, 2013	lpah	Updated status to Objective Specification; CSD supported by SARA-G300 / G310
7	May 27, 2013	lpah	GPRS multi-slot class 10 supported by SARA-G300 / SARA-G310 Last revision with docu number GSM.G2-HW-12001
A	Jul. 05, 2013	sses	Updated status to Advance Information Added the technical description of SARA-G350 ATEX modules and description of 32K_OUT pin for SARA-G300 / G310; Updated current consumption ratings
A1	Jul. 31, 2013	lpah	Updated status to Preliminary SIM detection not supported by SARA-G300 and SARA-G310 modules Last revision with old document number GSM.G2-HW-12001
R11	23-Jan-2014	lpah	Updated status to Objective Specification Extended the document applicability to SARA-G340 modules
R12	30-Jun-2014	mrod	Updated document status to Advance Information. Extended the document applicability to the SARA-G340-01S, SARA-G350-01S and SARA-G350-01B modules versions. Updated information about RIL and USSD. Updated current consumption ratings with AT+UPSV=0.
R13	17-Oct-2014	mrod	Updated document status to Early Preliminary Information.
R14	14-May-2015	lpah	Updated document status to Preliminary Information. Updated allowed baud rates for AT interface
R15	15-Dec-2015	sses	Reverted status to Advanced Information Extended the document applicability to SARA-G3 modules “02” product versions
R16	29-Jan-2016	sses	Updated document status to Early Preliminary Information. Added detailed VCC current consumption characteristics and enlarged VCC supply extended operating voltage range for SARA-G3 “02” product versions.
R17	12-May-2016	sses	Extended the document applicability to SARA-G300-00S-01 / SARA-G310-00S-01. Updated the ATEX label.
R18	21-Jul-2016	lpah	Extended the document applicability to SARA-G340 ATEX module
R19	24-Apr-2017	lpah	"Disclosure restriction" replaces "Document status" on pg 2 and document footer
R20	03-Aug-2017	lpah	Extended document applicability to SARA-G350-02X Updated label and approvals information
R21	16-Feb-2018	lpah	Extended document applicability to SARA-G340-02S-01, SARA-G340-02X-01, SARA-G350-02S-01, SARA-G350-02X-01
R22	03-Jul-2019	lpah	Updated SARA-G300-00S / SARA-G310-00S product status Updated mechanical tolerance.

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