

ROSE-R2401

LTE Cat.1bis modules

Data Sheet

Abstract

Technical data sheet describing ROSE-R2 series modules. The ROSE-R2 Series offering up to 10Mbps downlink and 5Mbps uplink data rates with VoLTE supported under the LTE Cat.1bis network.



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1 Functional description

1.1 Overview

The ROSE-R2 Series module is an industry module embedding the UTA-R2 chipset, a 3GPP Release 14 LTE Cat.1bis cellular modem with VoLTE supported. The ROSE-R2 Series modules provides up to 10Mbps for download and 5Mbps for uplink with VoLTE supported under LTE Cat.1bis network.

With the eDRX and PSM feature supported, the power consumption of ROSE-R2 series module is ultra-low, and it is the ideal for battery-powered applications for the IoT use scenes. With the VoLTE support, the ROSE-R2 Series module can provide High Definition (HD) voice calls, offering significantly improved voice clarity and quality compared to standard voice calls. With the Wi-Fi Scan function, the module can provide the ability of indoor position location. It is the perfect choice for M2M and IoT applications such as eBike, wireless POS, smart metering, tracking etc.

The ROSE-R2 Series modules are in the very small 133-pin LGA form factor (**16.0 x 16.0 x 2.2mm**), which is easy to integrate in compact designs.

The ROSE-R2 Series modules support multi-band LTE radio access technology, and come in the following product variants to reduce logistics complexity:

- ROSE-R2001-10, data and voice LTE Cat.1bis module for Global region
- ROSE-R2401-10, data and voice LTE Cat.1bis module for North American region
- ROSE-R2801-10, data and voice LTE Cat.1bis module for EMEA, APAC, Brazil region

1.2 Block diagram

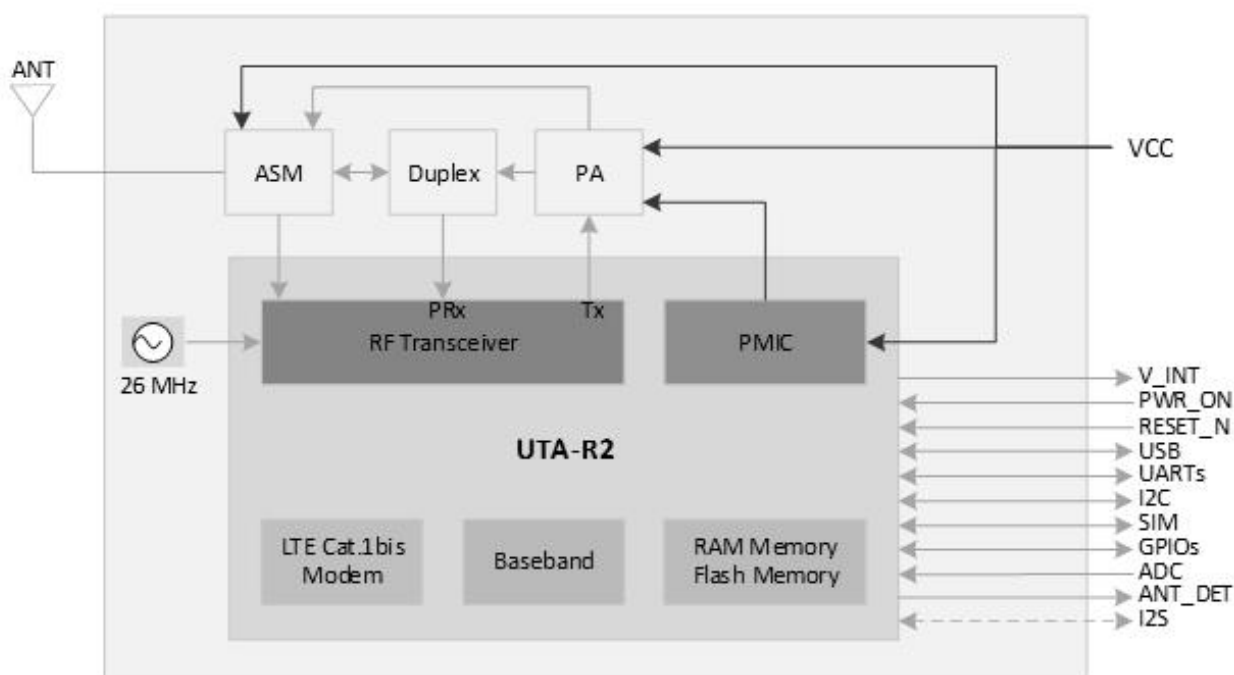


Figure 1: ROSE-R2 Series block diagram

- 1 x USB 2.0 (480Mbps)
- 10 x GPIOs¹
- 2 x UART
- 1 x I2C (DDC)
- 1 x SIM

¹ Four GPIOs are used as I2S interface for the "10" product variant.

- 1 x I2S/PCM Digital Audio
- 1 x ADC pins
- 1 x Antenna Detection
- 1 x Antenna (1x Cellular/Wi-Fi)

1.3 Product Description

Item	Features
LTE	3GPP Release 14, LTE Cat.1bis (10Mbps/DL, 5Mbps/UL) Support BW: 1.4/3/5/10/15/20MHz Support PSM, eDRX and cDRX power save mode
Voice	Support VoLTE function
SMS	MT/MO PDU/Text mode SMS via SMS-C
Wi-Fi Scan	Wi-Fi 2.4GHz RF signals receiving capability shared with LTE Cat.1bis RF signals over the same RF port.
Power Supply	3.8VDD (Normal), Range 3.3 VDD ~ 4.5 VDD
Power Consumption	• Power Off: TBD • PSM Mode: TBD • eDRX Mode: TBD
Protocols	Dual stack IPv4, IPv6, TCP/IP, UDP/IP, HTTP/HTTPS, MQTT, FTP, FTPS, TLS/DTLS, COAP, SNTP
USB Driver	• Windows 10/11 • Linux v2.6~v6.7 • Android 4.x ~ 13.x
Form Factor	133 LGA pins
Dimensions	16.0×16.0×2.2mm
Weight	TBD
Working Temperature	-35°C to +75°C (Normal) -40°C to +85°C (Extended)
Storage Temperature	-40°C to +90°C
RoHS	All hardware components are fully compliant with RoHS 3.0 directive.

Table 1: ROSE-R2 Series main characteristics summary

Product Type Number	Bands		Interfaces									Features																Grade			
	LTE	Category	UART	USB 2.0	SIM	DDC (I2C)	SPI	GPIO	ADC	I2S/PCM	OpenCPU	PSM	cDRX	eDRX	Wi-Fi Scan	VoLTE	FOTA	CoAP	MQTT	SMS	IPv4/IPv6	TCP/IP,UDP	HTTP/HTTPS	FTP/FTPS	TLS/DTLS	Smart Temperature Supervisor	SNTP	LwM2M	Antenna Dynamic tuning	Consumer Professional Automotive	
ROSE-R2001-10 <i>Global SKU</i>	1,2,3,4,5,7,8,12,13,20,25,26,28,34,38,39,40,41,66	Cat.1 bis	2	1	1	1		6	1	1		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
ROSE-R2401-10 <i>North America SKU</i>	2,4,5,12,13,14,17,25,66,71	Cat.1 bis	2	1	1	1		6	1	1		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
ROSE-R2801-10 <i>EMEA/APAC/Brazil SKU</i>	1,3,5,7,8,18,19,20,26,28	Cat.1 bis	2	1	1	1		6	1	1		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

Table 2: ROSE-R2 Series main features summary

Note:

The item marked as □ is under consideration

2 Interfaces

2.1 UART interfaces

2.1.1 Main UART interface (UART)

The ROSE-R2 Series modules include a main primary UART interface (UART) in the **V_INT** supply domain, with settings configurable by dedicated AT commands, supporting:

- AT commands and data communication
- Multiplexer protocol functionality as per 3GPP TS 27.010
- FW update by means of FOAT
- FW update by means of dedicated download tool

Some of the characteristics of the main primary UART interface (UART) are the following:

- 8-wire serial port with RS-232 functionality conforming to ITU-T v2.4 recommendation, with CMOS compatible signal levels (0V for low data bit / ON state, 1.8V for high data bit/OFF state)
 - Data lines (**RXD** as data output, **TXD** as data input)
 - HW flow control lines (**CTS** as flow control output, **RTS** as flow control input)
 - Modem status and control lines (**DTR** input, **DSR** output, **DCD** output, **RI** output)
- The default baud rate is 115200 bit/s, which can be changed by dedicated AT+IPR command to lower baud rates and to higher baud rates up to 3Mbit/s
- The default frame format is 8N1 (8 data bits, no parity, 1 stop bit)

 It is recommended to provide accessible test points directly connected to the main primary UART interface **RXD** data output and **TXD** data input pins, for FW update purposes, in case the USB interface is used for the communication with the host application processor.

2.1.2 Auxiliary UART interface (AUX UART)

The ROSE-R2 Series modules include an auxiliary second UART interface (AUX UART) in the **V_INT** supply domain, which can be enabled as alternative function, in a mutually exclusive way, over the **DTR**, **DSR**, **DCD** and **RI** pins of the main primary UART interface, with settings configurable by AT commands, supporting:

- AT commands and data communication
- Multiplexer protocol functionality
- Diagnostic trace logging

Some of the characteristics of the auxiliary second UART interface (AUX UART) are the following:

- 4-wire serial port with RS-232 functionality conforming to ITU-T v2.4 recommendation, with CMOS compatible signal levels (0V for low data bit / ON state, 1.8V for high data bit/OFF state)
 - Data lines (**DCD** as data output, **DTR** as data input)
 - HW flow control lines (**RI** as flow control output, **DSR** as flow control input)
- The default baud rate is 115200 bit/s, which can be changed by dedicated AT+IPR command to lower baud rates and to higher baud rates up to 3Mbit/s
- The default frame format is 8N1 (8 data bits, no parity, 1 stop bit)

 It is recommended to provide accessible test points directly connected to the auxiliary UART interface **DCD** data output and **DTR** data input pins, for diagnostic purposes, in case the USB interface is used for the communication with the host application processor.

2.2 USB interface

The ROSE-R2 Series modules include a USB High-Speed 2.0 interface with maximum 480Mbps data rate according to the Universal Serial Bus specification revision 2.0. The module itself acts as a USB device and can be connected to any compatible USB host. The USB interface include multiple virtual serial ports to support various functions such as:

- AT commands and data communication
- FW update by means of FOAT
- Diagnostic trace logging
- Ethernet over USB

The USB interface includes the following lines:

- The **USB_D+/USB_D-** lines, carrying the USB data and signaling
- The **USB_BOOT** input pin to enable the FW update over the USB interface.

 The **USB_BOOT** input pin must be set high, at the 1.8V voltage level of the **V_INT** supply output, to enable the FW update over the USB interface at the boot of the module, using the dedicated tool to execute the FW update. Only if the **USB_BOOT** pin is left floating (unconnected), or it is set low (grounded), the ROSE-R2 Series modules can boot in normal operating mode.

 It is recommended to provide accessible test points directly connected to the **USB_D+** and **USB_D-** pins, as well as the **USB_BOOT** pin, for FW update and for diagnostic purposes, in case the UART interfaces are used for communication with the host application processor.

2.3 SIM interface

The ROSE-R2 Series modules provide an interface on the **VSIM**, **SIM_IO**, **SIM_CLK**, **SIM_RST** pins to connect an external SIM card/chip. External 1.8V and 3.0V SIM card/chip types are supported. Activation and deactivation are implemented according to the ISO-IEC 7816-3 specification.

The GPIO6 pin of the ROSE-R2 Series modules is a 1.8V digital pin in the “always-on” supply domain, which can be configured as an external interrupt to detect the SIM card presence. This detection of an external SIM card presence is an option feature, not necessarily required to be implemented by properly connecting the line to the mechanical switch of an external SIM card holder. For more details, please refer the AT command manual of the ROSE-R2 Series modules.

2.4 I2C interface

The ROSE-R2 Series modules include a 1.8V I2C-bus compatible interface over the **SDA** and **SCL** pins, in the **V_INT** supply domain, with the ROSE-R2 Series module acting as an I2C host to communicate with external I2C devices in accordance with the I2C bus specifications [8].

2.5 I2S interface

The ROSE-R2 Series modules include a 1.8V I2S digital audio interface over the **I2S_TXD**, **I2S_RXD**, **I2S_WA**, and **I2S_CLK** pins to transfer digital audio data with an external digital audio device. For details regarding the I2S digital audio interface usage, please refer the AT commands for the ROSE-R2 Series modules.

2.6 GPIO

The ROSE-R2 Series modules include the GPIO pins that can be configured to provided different functions as summarized in Table 3. Note that the GPIO pins are in two different supply domains:

- The **GPIO1**, **GPIO5**, **GPIO7²**, **GPIO8³**, **GPIO9³** and **GPIO10³** pins are in the **V_INT** supply domain as the other generical digital interfaces (the UART interfaces, the I2C interface, and the antenna dynamic tuner interface), meaning that their functions is not available when the module is in ultra-low power deep-sleep mode, with the generic digital interface supply (**V_INT**) switched off.
- The **GPIO2**, **GPIO3**, **GPIO4** and **GPIO6** pins are in the “always-on” supply domain, meaning that their function is available also when the module is in ultra-low power deep-sleep mode, with the generical digital interface supply (**V_INT**) switched off.

² Not available for the “10” variant products.

 The GPIO pins (**GPIO7**, **GPIO8**, **GPIO9**, **GPIO10**) are used as I2S interface (**I2S_TXD**, **I2S_RXD**, **I2S_WA**, **I2S_CLK**) for the “10” variant products of the ROSE-R2 Series modules.

Function	Description	Default GPIO	Configurable GPIOs
Output	Output to set the high or the low digital level	-	All
Input	Input the sense high or low digital level	-	All
Network status indication	Output indicating cellular network status: registered, data transmission, no service	-	GPIO1, GPIO2, GPIO4, GPIO5, GPIO7 ³ , GPIO8 ³ , GPIO9 ³ , GPIO10 ³
Module status indication	Output indication module status: low when switched off, in deep-sleep, high when idle, active, or data connected mode	GPIO2	GPIO2, GPIO4
SIM card detection	Input for external SIM card physical presence detection, to optionally enable/disable the SIM interface in case the SIM hot insertion function is enabled.	GPIO6	GPIO6
Module wake-up and low power mode control	Input to wake-up and control the low power mode of the module once enabled by AT command	GPIO3	GPIO3, GPIO6
Faster power-off	Input with internal pull-down to trigger a faster emergency shutdown (as AT+CFUN=10) by applying a rising edge	-	GPIO3, GPIO6
Memory-safe power-off	Input with internal pull-down to trigger the fastest memory-safe emergency shutdown (as AT+CFUN=11) by applying a rising edge	-	GPIO3, GPIO6
Pin disabled	Pin is disabled with GPIO tri-state	GPIO1, GPIO4, GPIO5, GPIO7 ³ , GPIO8 ³ , GPIO9 ³ , GPIO10 ³	GPIO1,GPIO2, GPIO3, GPIO4, GPIO5, GPIO6, GPIO7 ³ , GPIO8 ³ , GPIO9 ³ , GPIO10 ³

Table 3: GPIO functions configuration

2.7 Antenna interface

2.7.1 Antenna RF interface (ANT)

The **ANT** pin is the cellular and Wi-Fi RF antenna I/O interface, designed with 50 Ω characteristic impedance , use 2 times the line width for keepouts.

- thickness: 1.58mm
- length: 730.71mil
- width: 5.13mil
- dielectric constant: 3.81

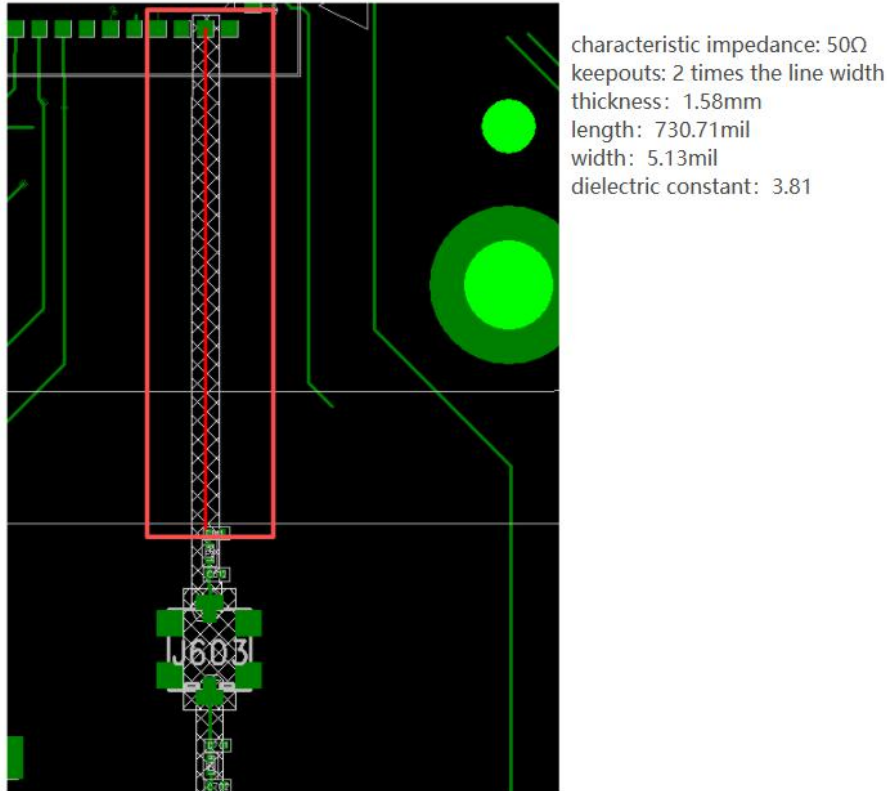


Figure 2: ROSE-R2 Series trace design

2.7.2 Antenna dynamic tuner interface

The ROSE-R2 Series modules include two 1.8V digital output pins (**RFCTRL1** and **RFCTRL2**), in the **V_INT** supply domain, that can optionally be used to control in real time an external antenna tuning IC, as the two pins change their output value dynamically according to the specific current LTE band in use by the module. The bands for antenna dynamic tuner feature can be configured by AT command, and this feature is disabled by default.

2.7.3 Antenna detection (ANT_DET)

The **ANT_DET** pin is an Analog to Digital Converter (ADC) input with a current source provided by ROSE-R2 Series modules to sense the external antenna presence (as an option feature), evaluating the DC resistance to GND by means of an externally implemented circuit.

2.8 ADC

The ROSE-R2 Series modules include an Analog-to Digital Converter input pin, **ADC**, configurable via a dedicated AT command.

2.9 Reserved pins (RSVD)

The ROSE-R2 Series modules include pins reserved for future use, marked as **RSVD**, which can be left unconnected on the application board.

3 Pin definition

3.1 Pin assignment

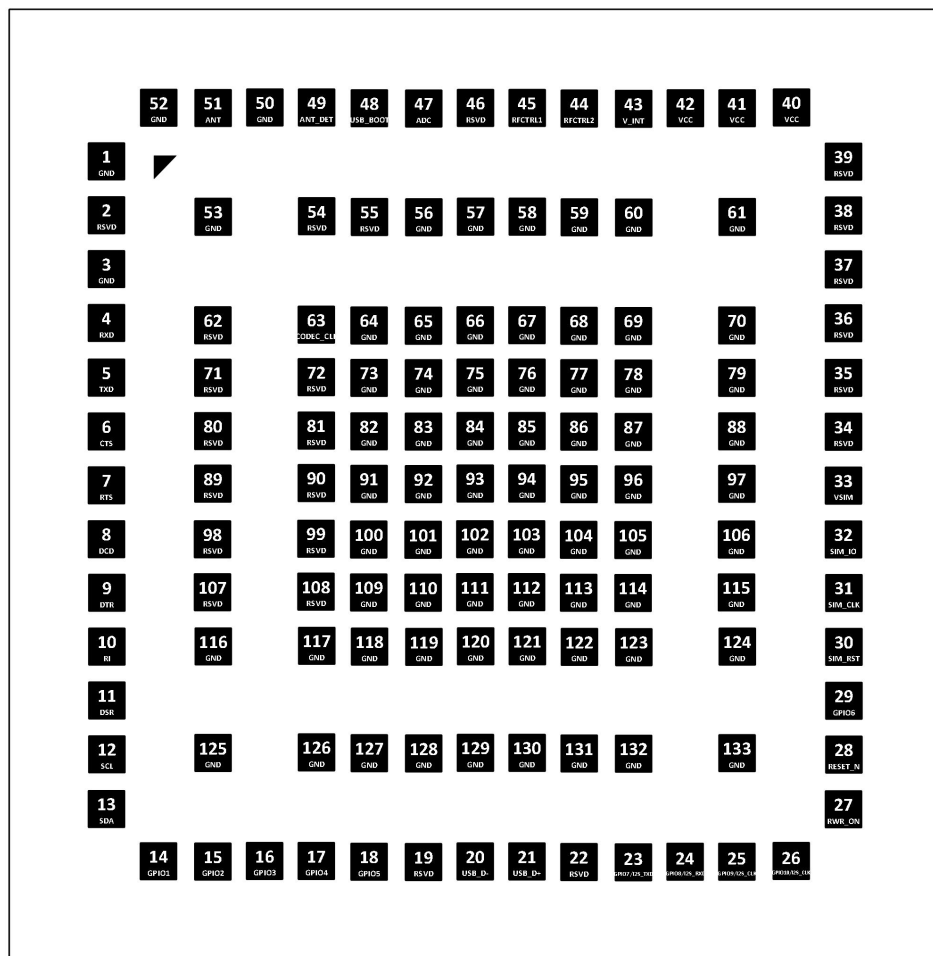


Figure 2: ROSE-R2 Series pin assignment ((top view: module through view)

No	Name	Power	I/O	Description	Remarks
1	GND	GND	N/A	Ground	All GND pins must be connected to ground.
2	RSVD	-	N/A	RESERVED pin	Leave unconnected.
3	GND	GND	N/A	Ground	All GND pins must be connected to ground.
4	RXD	GDI	O	UART data output	Circuit 104 (RxD) in ITU-T V.24. See section 2.1 for functional description See section 4.3.10 for detailed electrical specs. Provide test point for FW update and diagnostic purposes, if the USB and UART interfaces are used by the host processor.
5	TXD	GDI	I	UART data input	Circuit 103 (TxD) in ITU-T V.24. See section 2.1 for functional description See section 4.3.10 for detailed electrical specs. Provide test point for FW update and diagnostic purposes, if the USB and UART interfaces are used by the host processor.
6	CTS	GDI	O	UART clear to send	Circuit 106 (CTS) in ITU-T V.24. See section 2.1 for functional description See section 4.3.10 for detailed electrical specs.
7	RTS	GDI	I	UART ready to send	Circuit 105 (RTS) in ITU-T V.24. See section 2.1 for functional description

No	Name	Power	I/O	Description	Remarks
					See section 4.3.10 for detailed electrical specs.
8	DCD	GDI	O/O	UART data carrier detect / AUX UART data output	Circuit 109 (DCD) in ITU-T V.24, alternatively settable as Second Auxiliary UART RXD. See section 2.1 for functional description See section 4.3.10 for detailed electrical specs. Provide test point for FW update and diagnostic purposes, if the USB and UART interfaces are used by the host processor.
9	DTR	GDI	I/I	UART data terminal ready / AUX UART data input	Circuit 108/2 (DTR) in ITU-T V.24, alternatively settable as Second Auxiliary UART TXD. See section 2.1 for functional description See section 4.3.10 for detailed electrical specs. Provide test point for FW update and diagnostic purposes, if the USB and UART interfaces are used by the host processor.
10	RI	GDI	O / O	UART ring indicator / AUX UART clear to send	Circuit 125 (RI) in ITU-T V.24. Alternately settable as second auxiliary UART CTS. See section 2.1 for functional description See section 4.3.10 for detailed electrical specs.
11	DSR	GDI	O/I	UART data set ready / AUX UART request to send	Circuit 107 (DSR) in ITU-T V.24. Alternately settable as second auxiliary UART RTS. See section 2.1 for functional description See section 4.3.10 for detailed electrical specs.
12	SCL	I2C	O	I2C clock	I ² C bus serial clock line. Fixed open drain. Internal pull-up to V _{INT} . Idle high, active low. See section 2.4 for functional description See section 4.3.9 for detailed electrical specs.
13	SDA	I2C	I/O	I2C data	I ² C bus serial data line. Fixed open drain. Internal pull-up to V _{INT} . Idle high, active low. See section 2.4 for functional description See section 4.3.9 for detailed electrical specs.
14	GPIO1	GDI	I/O	GPIO	GPIO configurable as described in section 2.6 Internal pull-up can be set when configured as input. Push-pull output type with 10mA driver strength. See section 2.6 for functional description See section 4.3.10 for detailed electrical specs.
15	GPIO2	GDI	I/O	GPIO	GPIO configurable as described in section 2.6. Internal pull-up can be set when configured as input. Push-pull output type with 10mA driver strength. See section 2.6 for functional description See section 4.3.10 for detailed electrical specs.
16	GPIO3	GDI	I/O	GPIO	GPIO configurable as described in section 2.6. Internal pull-up can be set when configured as input. Push-pull output type with 10mA driver strength. See section 2.6 for functional description See section 4.3.10 for detailed electrical specs.
17	GPIO4	GDI	I/O	GPIO	GPIO configurable as described in section 2.6. Internal pull-up can be set when configured as input. Push-pull output type with 10mA driver strength. See section 2.6 for functional description See section 4.3.10 for detailed electrical specs.
18	GPIO5	GDI	I/O	GPIO	GPIO configurable as described in section 2.6. Internal pull-up can be set when configured as input. Push-pull output type with 10mA driver strength. See section 2.6 for functional description See section 4.3.10 for detailed electrical specs.
19	RSVD	-	N/A	RESERVED pin	Leave unconnected.
20	USB_D-	USB	I/O	USB High-Speed 2.0	90 Ω nominal differential characteristic impedance

No	Name	Power	I/O	Description	Remarks
				differential transceiver (–)	Pull-up, pull-down, series resistors as per USB 2.0 [7] are part of the pin driver: not needed externally. See section 4.3.12 for detailed electrical specs.
21	USB_D+	USB	I/O	USB High-Speed 2.0 differential transceiver (+)	90 Ω nominal differential characteristic impedance Pull-up, pull-down, series resistors as per USB 2.0 [7] are part of the pin driver: not needed externally. See section 4.3.12 for detailed electrical specs.
22	RSVD	-	N/A	RESERVED pin	Leave unconnected.
23	I2S_TXD	GDI	IO / O	GPIO/ I2S (I2S0) transmit data	I2S (I2S) transmit data. See section 4.3.10 for detailed electrical specs.
24	I2S_RXD	GDI	I	I2S (I2S0) receive data	I2S (I2S) receive data. See section 4.3.10 for detailed electrical specs.
25	I2S_WA	GDI	I/O	I2S (I2S0) word alignment	I2S (I2S) word alignment. See section 4.3.10 for detailed electrical specs
26	I2S_CLK	GDI	I/O	I2S (I2S0) clock	I2S (I2S) serial clock. See section 4.3.10 for detailed electrical specs.
27	PWR_ON	POS	I	Power-on/off input	Internal active pull-up, Active low. See section 4.3.6 for detailed electrical specs. Provide test point for FW update or diagnostic purpose.
28	RESET_N	ERS	I	External reset input	Internal active pull-up, Active low. See section 4.3.7 for detailed electrical specs. Provide test point for FW update or diagnostic purpose
29	GPIO6	AOI	I/O	Always-on GPIO	Configurable always-on GPIO, supporting module wake-up, and SIM card detection functions, aside others. Internal pull-down can be set when configured as input. Push-pull output type with 20 μ A driver strength. See section 4.3.11 for detailed electrical specs.
30	SIM_RST	SIM	O	SIM reset	See section 4.3.8 for detailed electrical specs.
31	SIM_CLK	SIM	O	SIM clock	See section 4.3.8 for detailed electrical specs.
32	SIM_IO	SIM	I/O	SIM data	Internal pull-up resistor to VSIM. See section 4.3.8 for detailed electrical specs.
33	VSIM	-	O	SIM supply output	VSIM = 1.8 V or 3.0 V generated by the module according to the external SIM card/chip voltage type. See section 4.3.8 for detailed electrical specs.
34	RSVD	-	N/A	RESERVED pin	Leave unconnected.
35	RSVD	-	N/A	RESERVED pin	Leave unconnected.
36	RSVD	-	N/A	RESERVED pin	Leave unconnected.
37	RSVD	-	N/A	RESERVED pin	Leave unconnected.
38	RSVD	-	N/A	RESERVED pin	Leave unconnected.
39	RSVD	-	N/A	RESERVED pin	Leave unconnected.
40	VCC	VCC	I	Module supply input	All VCC pins must be connected to external supply. See section 4.3.2 for detailed electrical specs.
41	VCC	VCC	I	Module supply input	All VCC pins must be connected to external supply. See section 4.3.2 for detailed electrical specs.
42	VCC	VCC	I	Module supply input	All VCC pins must be connected to external supply. See section 4.3.2 for detailed electrical specs.
43	V_INT	GDI	O	Generic Digital Interfaces supply output	1.8 V (typical) output voltage generated by the module when it is switched-on. See section 4.3.2 for detailed electrical specs.
44	RFCTRL2	GDI	O	RF GPIO for antenna tuning	Digital output to optionally control an antenna tuning IC. Pull-pull output type.

No	Name	Power	I/O	Description	Remarks
					See section 4.3.10 for detailed electrical specs.
45	RFCTRL1	GDI	O	RF GPIO for antenna tuning	Digital output to optionally control an antenna tuning IC. Pull-pull output type. See section 4.3.10 for detailed electrical specs.
46	RSVD	-	N/A	RESERVED pin	Leave unconnected.
47	ADC	ADC	I	ADC input	See section 4.3.13 for detailed electrical specs.
48	USB_BOOT	GDI	I	Force USB Boot	Input to force FW update over USB. Active high. See section 4.3.10 for detailed electrical specs. Provide test point for FW update purposes, in case main UART interface is used by the host processor.
49	ANT_DET	ADC	I	Antenna detection	Antenna presence detection function. See section 4.3.5 for details.
50	GND	GND	N/A	Ground	All GND pins must be connected to ground.
51	ANT	ANT	I/O	LTE and Wi-Fi antenna	50 Ω nominal characteristic impedance. Main Tx / Rx antenna interface. See section 2.7/ 4.3.4 for details.
52	GND	GND	N/A	Ground	All GND pins must be connected to ground.
53	GND	GND	N/A	Ground	All GND pins must be connected to ground.
54	RSVD	-	N/A	RESERVED pin	Leave unconnected.
55	RSVD	-	N/A	RESERVED pin	Leave unconnected.
56	GND	GND	N/A	Ground	All GND pins must be connected to ground.
57	GND	GND	N/A	Ground	All GND pins must be connected to ground.
58	GND	GND	N/A	Ground	All GND pins must be connected to ground.
59	GND	GND	N/A	Ground	All GND pins must be connected to ground.
60	GND	GND	N/A	Ground	All GND pins must be connected to ground.
61	GND	GND	N/A	Ground	All GND pins must be connected to ground.
62	RSVD	-	N/A	RESERVED pin	Leave unconnected.
63	CODEC_CLK	GDI	O	I2S codec clock pin	Master Clock output
64	GND	GND	N/A	Ground	All GND pins must be connected to ground.
65	GND	GND	N/A	Ground	All GND pins must be connected to ground.
66	GND	GND	N/A	Ground	All GND pins must be connected to ground.
67	GND	GND	N/A	Ground	All GND pins must be connected to ground.
68	GND	GND	N/A	Ground	All GND pins must be connected to ground.
69	GND	GND	N/A	Ground	All GND pins must be connected to ground.
70	GND	GND	N/A	Ground	All GND pins must be connected to ground.
71	RSVD	-	N/A	RESERVED pin	Leave unconnected.
72	RSVD	-	N/A	RESERVED pin	Leave unconnected.
73	GND	GND	N/A	Ground	All GND pins must be connected to ground.
74	GND	GND	N/A	Ground	All GND pins must be connected to ground.
75	GND	GND	N/A	Ground	All GND pins must be connected to ground.
76	GND	GND	N/A	Ground	All GND pins must be connected to ground.
77	GND	GND	N/A	Ground	All GND pins must be connected to ground.
78	GND	GND	N/A	Ground	All GND pins must be connected to ground.
79	GND	GND	N/A	Ground	All GND pins must be connected to ground.
80	RSVD	-	N/A	RESERVED pin	Leave unconnected.
81	RSVD	-	N/A	RESERVED pin	Leave unconnected.

No	Name	Power	I/O	Description	Remarks
82	GND	GND	N/A	Ground	All GND pins must be connected to ground.
83	GND	GND	N/A	Ground	All GND pins must be connected to ground.
84	GND	GND	N/A	Ground	All GND pins must be connected to ground.
85	GND	GND	N/A	Ground	All GND pins must be connected to ground.
86	GND	GND	N/A	Ground	All GND pins must be connected to ground.
87	GND	GND	N/A	Ground	All GND pins must be connected to ground.
88	GND	GND	N/A	Ground	All GND pins must be connected to ground.
89	RSVD	-	N/A	RESERVED pin	Leave unconnected.
90	RSVD	-	N/A	RESERVED pin	Leave unconnected.
91	GND	GND	N/A	Ground	All GND pins must be connected to ground.
92	GND	GND	N/A	Ground	All GND pins must be connected to ground.
93	GND	GND	N/A	Ground	All GND pins must be connected to ground.
94	GND	GND	N/A	Ground	All GND pins must be connected to ground.
95	GND	GND	N/A	Ground	All GND pins must be connected to ground.
96	GND	GND	N/A	Ground	All GND pins must be connected to ground.
97	GND	GND	N/A	Ground	All GND pins must be connected to ground.
98	RSVD	-	N/A	RESERVED pin	Leave unconnected.
99	RSVD	-	N/A	RESERVED pin	Leave unconnected.
100	GND	GND	N/A	Ground	All GND pins must be connected to ground.
101	GND	GND	N/A	Ground	All GND pins must be connected to ground.
102	GND	GND	N/A	Ground	All GND pins must be connected to ground.
103	GND	GND	N/A	Ground	All GND pins must be connected to ground.
104	GND	GND	N/A	Ground	All GND pins must be connected to ground.
105	GND	GND	N/A	Ground	All GND pins must be connected to ground.
106	GND	GND	N/A	Ground	All GND pins must be connected to ground.
107	RSVD	-	N/A	RESERVED pin	Leave unconnected.
108	RSVD	-	N/A	RESERVED pin	Leave unconnected.
109	GND	GND	N/A	Ground	All GND pins must be connected to ground.
110	GND	GND	N/A	Ground	All GND pins must be connected to ground.
111	GND	GND	N/A	Ground	All GND pins must be connected to ground.
112	GND	GND	N/A	Ground	All GND pins must be connected to ground.
113	GND	GND	N/A	Ground	All GND pins must be connected to ground.
114	GND	GND	N/A	Ground	All GND pins must be connected to ground.
115	GND	GND	N/A	Ground	All GND pins must be connected to ground.
116	GND	GND	N/A	Ground	All GND pins must be connected to ground.
117	GND	GND	N/A	Ground	All GND pins must be connected to ground.
118	GND	GND	N/A	Ground	All GND pins must be connected to ground.
119	GND	GND	N/A	Ground	All GND pins must be connected to ground.
120	GND	GND	N/A	Ground	All GND pins must be connected to ground.
121	GND	GND	N/A	Ground	All GND pins must be connected to ground.
122	GND	GND	N/A	Ground	All GND pins must be connected to ground.
123	GND	GND	N/A	Ground	All GND pins must be connected to ground.
124	GND	GND	N/A	Ground	All GND pins must be connected to ground.

No	Name	Power	I/O	Description	Remarks
125	GND	GND	N/A	Ground	All GND pins must be connected to ground.
126	GND	GND	N/A	Ground	All GND pins must be connected to ground.
127	GND	GND	N/A	Ground	All GND pins must be connected to ground.
128	GND	GND	N/A	Ground	All GND pins must be connected to ground.
129	GND	GND	N/A	Ground	All GND pins must be connected to ground.
130	GND	GND	N/A	Ground	All GND pins must be connected to ground.
131	GND	GND	N/A	Ground	All GND pins must be connected to ground.
132	GND	GND	N/A	Ground	All GND pins must be connected to ground.
133	GND	GND	N/A	Ground	All GND pins must be connected to ground.

Table 4: ROSE-R2 Series pin-out

4 Electrical specifications

4.1 Absolute Maximum Ratings

Symbol	Description	Condition	Min.	Max.	Unit
VCC	Module supply voltage	Input DC voltage at VCC pin	-0.3	5	V
USB	USB D+/D- pins	Input DC voltage at USB_D+ and USB_D- pins	-0.3	3.5	V
GDI	Generic digital interfaces	Input DC voltage at generic digital interfaces pins	-0.3	2.0	V
AOI	Always-on digital interfaces	Input DC voltage at always-on digital interfaces pins	-0.3	2.0	V
I2C	I2C interface	Input DC voltage at I2C interface pins	-0.3	2.0	V
SIM	(U)SIM card power supply	Input DC voltage at (U)SIM interface pins	-0.3	3.6	V
ERS	External reset signal	Input DC voltage at RESET_N pin	-0.3	3.6	V
POS	Power-on input signal	Input DC voltage at PWR_ON pin	-0.3	3.6	V
ADC	ADC pins	Input DC voltage at ANT_DET and ADC pins	-0.3	3.3	V
P_RF	RF Power	Input RF power at ANT pin		3	dBm
Tstg	Storage temperature		-40	+90	°C

Table 5: Absolute Maximum Ratings

4.2 Maximum ESD

ESD mode		Pin name	Min.	Max.	Unit
Human body model (HBM)		ALL pins	TBD	TBD	V
Charged device model (CDM)	JESD22-A114-F	All pins exclude RF pins	TBD	TBD	V
	JESD22-C101-D	RF pins	TBD	TBD	V

Table 6: Maximum ESD ratings

4.3 Operating conditions

4.3.1 Operating temperature range

Parameter	Min.	Norm.	Max.	Unit
Normal Operating Temperature Range ³	-35	+25	+75	°C
Extended Operating Temperature Range ⁴	-40		+85	°C

Table 7: Environmental conditions

4.3.2 Power Supply pins

Symbol	Description	Condition	Min.	Norm.	Max.	Unit
VCC	Module supply voltage	Module supply normal operating input voltage	3.3	3.8	4.5	V
V_INT	Generic Digital Interfaces supply output voltage	Output DC voltage at V_INT pins	-0.3	1.8	2.0	V
USB	USB D+/D- pins	Input DC voltage at USB_D+ and USB_D- pins	-0.3		3.5	V
GDI	Generic digital interfaces	Input DC voltage at generic digital interfaces pins	-0.3	1.8	2.0	V
AOI	Always-on digital interfaces	Input DC voltage at always-on digital interfaces pins	-0.3	1.8	2.0	V
I2C	I2C interface	Input DC voltage at I2C interface pins	-0.3	1.8	2.0	V

³ Operating within 3GPP/ETSI specifications

⁴ Within the extended temperature range, the module remains fully functional and the ability to establish and maintain functions such as voice, SMS, data transmission, without any unrecoverable malfunction. Radio spectrum and radio network are not influenced, while one or more specifications, such as Pout, may exceed the specified tolerances of 3GPP. When the temperature returns to the operating temperature range, the module meets 3GPP specifications again.

Symbol	Description	Condition	Min.	Norm.	Max.	Unit
SIM	(U)SIM card power supply	Input DC voltage at (U)SIM interface pins (1.8 V)	1.26	1.8	2.1	V
		Input DC voltage at (U)SIM interface pins (3.0 V)	2.10	3.0	3.3	V
ADC	ADC pins	Input DC voltage at ANT_DET and ADC pins	-0.3		3.3	V

Table 8: Power Supply Ratings

4.3.3 Current consumption

Mode	Condition	Min	Typical	Max	Unit
Power-off mode	Average value, Module switched off	-	TBD	-	μA
Deep-sleep mode (Using UART)	Average floor current, Hibernate Mode (maximum deep-sleep mode)	-	TBD	-	μA
	Average floor current, Sleep-2 Mode (medium deep-sleep mode)	-	TBD	-	μA
	Average floor current, Sleep-1 Mode (minimum deep-sleep mode)	-	TBD	-	μA
Deep-sleep mode (Using USB)	Average floor current, Sleep-1 Mode (minimum deep-sleep mode)	-	TBD	-	μA
Idle mode (AT+UPSV≠0) (Using UART)	Average value, Idle mode, eDRX = 655.36s, PTW = 20.48s, DRX = 2.56s	-	TBD	-	μA
	Average value, Idle mode, eDRX = 81.92s, PTW = 2.56s, DRX = 2.56s	-	TBD	-	μA
	Average value, Idle mode, DRX = 2.56s	-	TBD	-	μA
Idle mode (AT+UPSV≠0) (Using USB)	Average value, Idle mode, eDRX = 655.36s, PTW = 20.48s, DRX = 2.56s	-	TBD	-	μA
	Average value, Idle mode, eDRX = 81.92s, PTW = 2.56s, DRX = 2.56s	-	TBD	-	μA
	Average value, Idle mode, DRX = 2.56s	-	TBD	-	μA
Active mode (AT+UPSV=0) (Using UART)	Average value, Active mode, DRX = 2.56s	-	TBD	-	mA
Active mode (AT+UPSV=0) (Using USB)	Average value, Active mode, DRX = 2.56s	-	TBD	-	mA
Data Connected Mode	Average value, LTE data Tx/Rx, LTE active mode (Minimum Tx Power)	-	TBD	-	mA
	Average value, LTE data Tx/Rx, LTE active mode (Maximum Tx Power)	-	TBD	-	mA
	Average value, LTE data Tx/Rx, LTE active mode (Maximum Tx Power and Maximum Throughput)	-	TBD	-	mA

Table 9: Current consumption of the ROSE-R2 Series module

4.3.4 LTE RF characteristics

Parameter		Min	Max	Unit	Remarks
Frequency range FDD band 2 (1900 MHz)	Uplink	1850	1910	MHz	Module transmit
	Downlink	1930	1990	MHz	Module receivers
Frequency range FDD band 4 (1700 MHz)	Uplink	1710	1755	MHz	Module transmit
	Downlink	2110	2155	MHz	Module receivers
Frequency range FDD band 5 (850 MHz)	Uplink	824	849	MHz	Module transmit
	Downlink	869	894	MHz	Module receivers
Frequency range FDD band 12 (700 MHz)	Uplink	699	716	MHz	Module transmit
	Downlink	729	746	MHz	Module receivers
Frequency range FDD band 13 (700 MHz)	Uplink	777	787	MHz	Module transmit
	Downlink	746	756	MHz	Module receivers

Parameter		Min	Max	Unit	Remarks
Frequency range FDD band 14 (700 MHz)	Uplink	788	798	MHz	Module transmit
	Downlink	758	768	MHz	Module receivers
Frequency range FDD band 17 (700 MHz)	Uplink	704	716	MHz	Module transmit
	Downlink	734	746	MHz	Module receivers
	Downlink	791	821	MHz	Module receivers
Frequency range FDD band 25 (1900 MHz)	Uplink	1850	1915	MHz	Module transmit
	Downlink	1930	1995	MHz	Module receivers
	Downlink	746	756	MHz	Module receivers
Frequency range FDD band 66 (1700 MHz)	Uplink	1710	1780	MHz	Module transmit
	Downlink	2110	2200	MHz	Module receivers
Frequency range FDD band 71 (600 MHz)	Uplink	663	698	MHz	Module transmit
	Downlink	617	652	MHz	Module receivers

Table 10: LTE operating RF frequency band of the ROSE-R2 Series module

Module Name	Band	Maximum Conducted Output Power
ROSE-R2401	LTE Band 2	25.00dBm
	LTE Band 4	25.00dBm
	LTE Band 5	25.00dBm
	LTE Band 12	25.00dBm
	LTE Band 13	25.00dBm
	LTE Band 14	25.00dBm
	LTE Band 17	25.00dBm
	LTE Band 25	25.00dBm
	LTE Band 66	25.00dBm
	LTE Band 71	25.00dBm

Table 11: LTE maximum output power of the ROSE-R2 Series module

4.3.5 ANT_DET pin

Parameter	Min	Typical	Max	Unit	Remarks
Input DC current pulse value		TBD		μA	Triggered by AT command
Input DC current pulse time length		TBD		ms	

Table 12: ANT_DET pin characteristics

4.3.6 PWR_ON pin

Parameter	Min	Typical	Max	Unit	Remarks
Low-Level input	-0.3		1.1	V	
PWR_ON low time	0.005			ms	Low time to trigger module switch on from power off mode
	0.005			ms	Low time to trigger module wake-up from deep sleep mode
	2			s	Hold at least for the time and release to trigger module graceful switch off

Table 13: PWR_ON pin characteristics

4.3.7 RESET_N pin

Parameter	Min	Typical	Max	Unit	Remarks
Low-Level input	-0.3		0.3	V	
RESET_N low time	0.05			ms	Low time to trigger module abrupt emergency reset

Table 14: RESET_N pin characteristics

4.3.8 SIM pin

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 15 are for information only.

Parameter	Min	Typical	Max	Unit	Remarks
VSIM supply output		1.8		V	VSIM, with external 1.8V SIM type
		3.0		V	VSIM, with external 3.0V SIM type
Low-level input	-0.30		0.2*VSIM	V	
High-level input	0.7*VSIM		VSIM+0.3	V	
Low-level output		0		V	
High-level output		VSIM		V	
Clock frequency on SIM_CLK		3.25		MHz	

Table 15: SIM pins characteristics

4.3.9 I2C pins

I2C lines (SCL and SDA) are compliant to the I2C-bus standard mode specifications. See the I2C-bus specification [\[8\]](#) for detailed electrical characteristics.

Parameter	Min	Typical	Max	Unit	Remarks
Internal supply for I2C domain		1.8		V	Digital I/O Interfaces supply (V_INT)
Low-level input	-0.30		0.4	V	
High-level input	1.3		2.0	V	
Low-level output		0.0		V	

Table 16: I2C pins characteristics

4.3.10 Generic Digital Interfaces pins

Parameter	Min	Typical	Max	Unit	Remarks
Internal supply for GDI domain		1.8		V	Digital I/O Interfaces supply (V_INT)
Low-level input	-0.30		0.4	V	
High-level input	1.3		2.0	V	
Low-level output		0.0		V	
High-level output		1.8		V	

Table 17: GDI pins characteristics

4.3.11 Always-on Digital Interfaces pins

Parameter	Min	Typical	Max	Unit	Remarks
Internal supply for AOI domain		1.8		V	Always-on digital Interfaces internal rail
Low-level input	-0.30		0.4	V	
High-level input	1.3		2.0	V	
Low-level output		0.0		V	

Table 18: AOI pins characteristics

4.3.12 USB Interface pins

USB data lines (**USB_D+**/**USB_D-**) are compliant with the USB 2.0 High-Speed specification. See the Universal Serial Bus specification revision 2.0 [7] for detailed electrical characteristics. The values in related to USB 2.0 high-speed physical layer specifications are for information only.

Parameter	Min	Typical	Max	Unit	Remarks
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 19: USB High-Speed 2.0 pins characteristics

4.3.13 ADC pin

Parameter	Min	Typical	Max	Unit	Remarks
Resolution		12		Bits	
Input voltage range	0		3.3	V	

Table 20: Analog to Digital Converter input pin (ADC) characteristics

4.3.14 Smart temperature supervisor

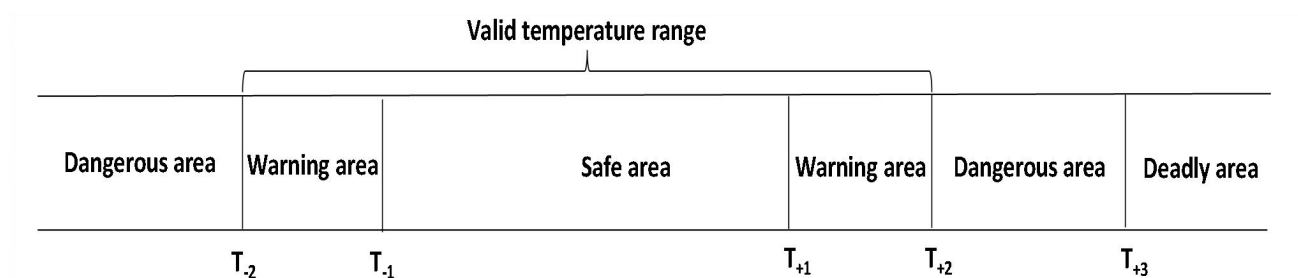


Figure 3: Temperature range and limits

Symbol	Parameter	Temperature
T_{-2}	Low temperature shutdown	-40°C
T_{-1}	Low temperature warning	-35°C
T_{+1}	High temperature warning	+75°C
T_{+2}	High temperature shutdown	+85°C
T_{+3}	Deadly junction temperature shutdown forcedly	+125°C

Table 21: Thresholds definition for the “Smart temperature supervisor” feature on ROSE-R2 Series module

 The sensor measures the board temperature inside the shield, which can differ from the ambient temperature.

5 Mechanical specifications

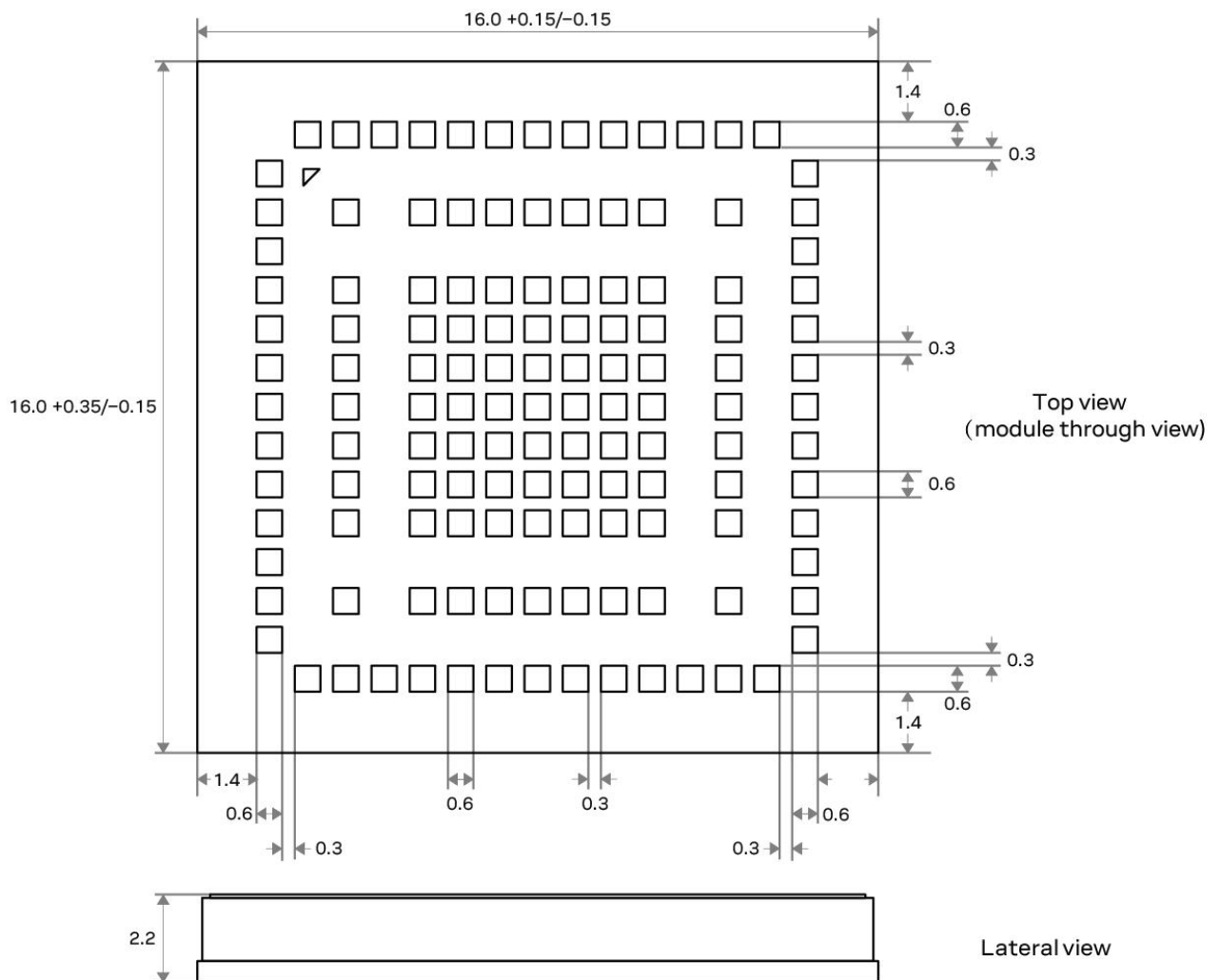


Figure 4: ROSE-R2 Series dimensions, typical values [mm]

6 Product handling & soldering

6.1 Packaging Specification

This chapter describes only the key parameters and process of packaging. All figures below are for reference only. The appearance and structure of the packaging materials are subject to the actual delivery.

6.1.1 Carrier Tape

The module adopts carrier tape packaging and details are as follow:

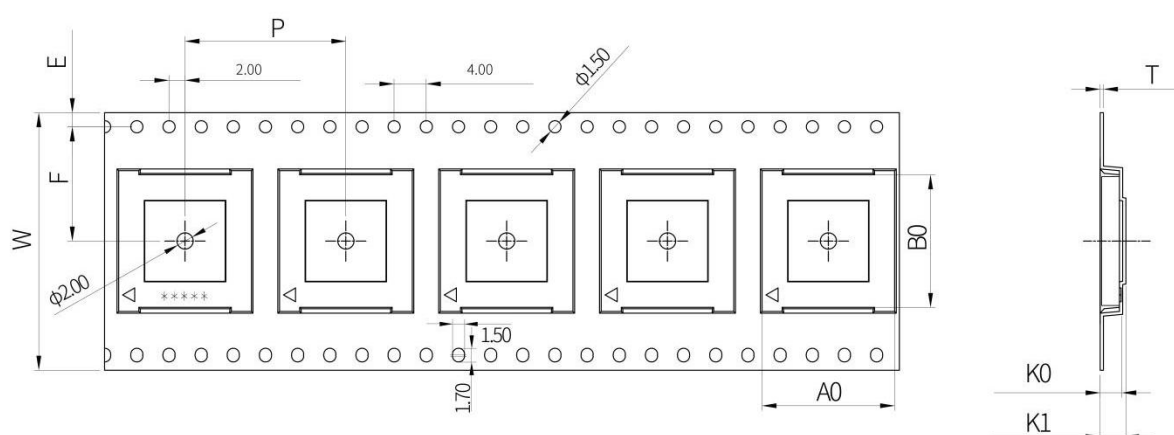


Figure 8: Carrier Tape Dimension Drawing

W	P	T	A0	B0	K0	K1	F	E
32	20	0.4	16.5	16.5	2.4	2.8	14.2	1.75

Table 22: Carrier Tape Dimension Table (Unit: mm)

6.1.2 Plastic Reel

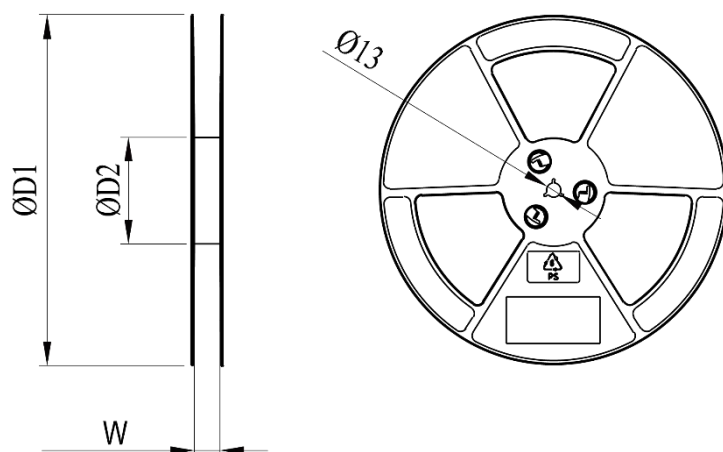


Figure 9: Plastic Reel Dimension Drawing

$\phi D1$	$\phi D2$	W
330	100	32.5

Table 23: Plastic Reel Dimension Table (Unit: mm)

6.1.3 Mounting Direction

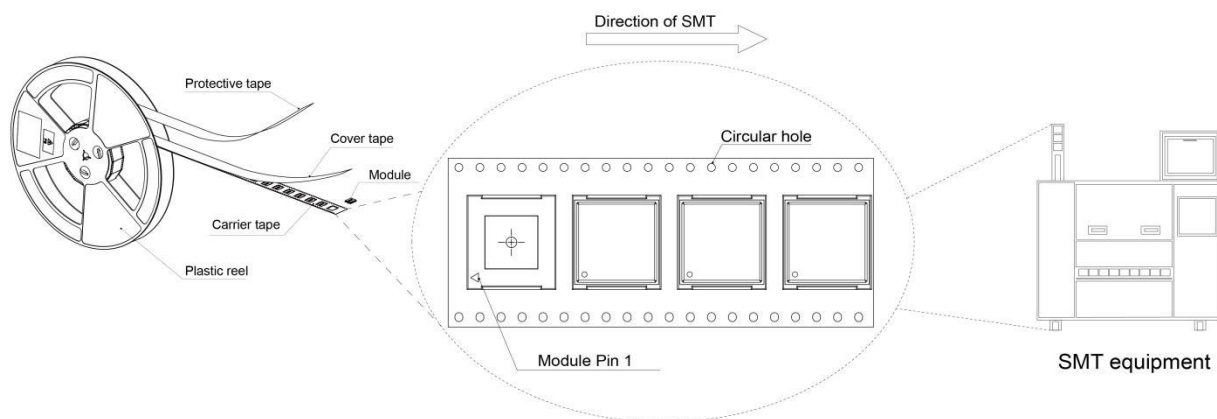
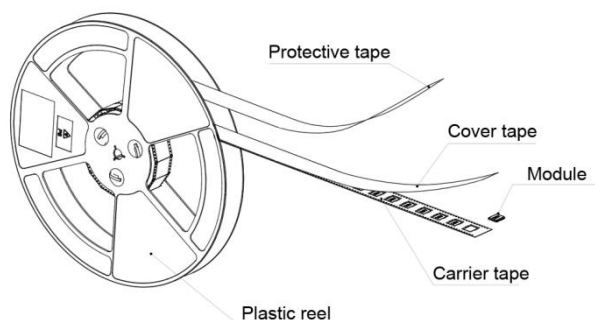


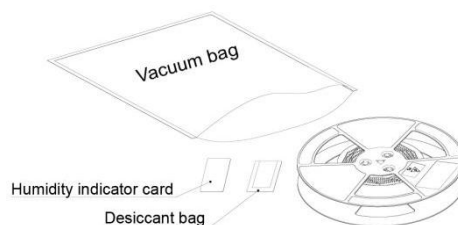
Figure 10: Mounting Direction

6.1.4 Packaging Process

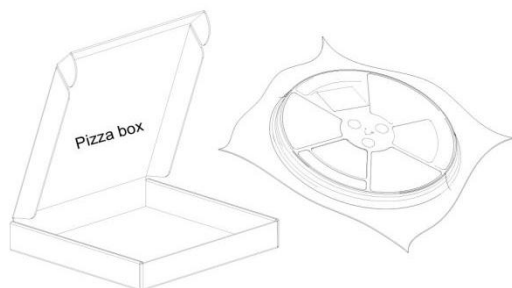


Place the module into the carrier tape and use the cover tape to cover it; then wind the heat-sealed carrier tape to the plastic reel and use the protective tape for protection. 1 plastic reel can load 1000 modules.

Place the packaged plastic reel, 1 humidity indicator card and 1 desiccant bag into a vacuum bag, vacuumize it.



Place the vacuum-packed plastic reel into the pizza box.



Put 5 packaged pizza boxes into 1 carton box and seal it.
1 carton box can pack 5000 modules.

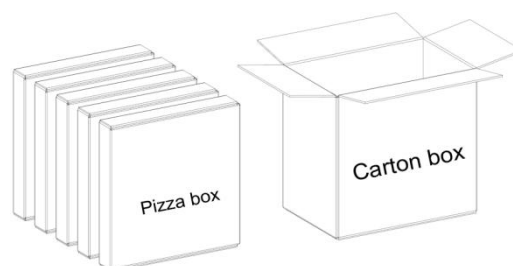


Figure 11: Packaging Process

7 FCC Notes

Important Notice to OEM integrators

1. This module is limited to OEM installation ONLY.
2. This module is limited to installation in mobile or fixed applications, according to Part 2.1091(b).
3. The separate approval is required for all other operating configurations, including portable configurations with respect to Part 2.1093 and different antenna configurations
4. For FCC Part 15.31 (h) and (k): The host manufacturer is responsible for additional testing to verify compliance as a composite system. When testing the host device for compliance with Part 15 Subpart B, the host manufacturer is required to show compliance with Part 15 Subpart B while the transmitter module(s) are installed and operating. The modules should be transmitting and the evaluation should confirm that the module's intentional emissions are compliant (i.e. fundamental and out of band emissions). The host manufacturer must verify that there are no additional unintentional emissions other than what is permitted in Part 15 Subpart B or emissions are complaint with the transmitter(s) rule(s).

The Grantee will provide guidance to the host manufacturer for Part 15 B requirements if needed.

End Product Labeling

When the module is installed in the host device, the FCC ID label must be visible through a window on the final device or it must be visible when an access panel, door or cover is easily re-moved. If not, a second label must be placed on the outside of the final device that contains the following text: "Contains FCC ID: 2BSS5ROSER2401"

The FCC ID can be used only when all FCC compliance requirements are met.

Manual Information to the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as show in this manual.

Federal Communication Commission Interference Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.

- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

List of applicable FCC rules

This module has been tested and found to comply with part 22, part 24, part 27, part 90, requirements for Modular Approval.

The modular transmitter is only FCC authorized for the specific rule parts (i.e., FCC transmitter rules) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuitry), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator & your body.

Conclusion

Based on FCC 47 CFR §2.1901, the analysis concludes that this product when transmitting in standalone within a host device, is compliant with the FCC RF exposure requirements in mobile exposure condition, provided the conducted power and antenna gain do not exceed the limits for each given frequency band per wireless technology as follow table:

Module Name	Band	Maximum Conducted Output Power	Standalone Maximum Antenna Gain(dBi)	Collocated Maximum Antenna Gain (dBi)
ROSE-R2401	LTE Band 2	25.00dBm	8.0	8.0
	LTE Band 4	25.00dBm	5.0	5.0
	LTE Band 5	25.00dBm	9.4	8.0
	LTE Band 12	25.00dBm	8.6	7.6
	LTE Band 13	25.00dBm	9.1	8.0
	LTE Band 14	25.00dBm	9.2	8.1
	LTE Band 17	25.00dBm	8.6	7.6
	LTE Band 25	25.00dBm	8.0	8.0
	LTE Band 66	25.00dBm	5.0	5.0
	LTE Band 71	25.00dBm	8.4	7.3

Appendix

A Glossary

Abbreviation	Definition
AI	Analog Input
AO	Analog Output
AIO	Analog Input/Output
DI	Digital Input
DO	Digital Output
DIO	Digital Input/Output
OD	Open Drain
PI	Power Input
PO	Power Output
ADC	Analog to Digital Converter
BER	Bit Error Rate
DDC	Display Data Channel (I2C compatible) Interface
DL	Down-link (Reception)
DRX	Discontinuous Reception
eDRX	Idle Mode Extended Discontinuous Reception
ESD	Electrostatic Discharge
FDD	Frequency Division Duplex
GMSK	Gaussian Minimum-Shift Keying modulation
GND	Ground
GNSS	Global Navigation Satellite System
GPIO	General Purpose Input Output
HTTP	HyperText Transfer Protocol
I2C	Inter-Integrated Circuit Interface
I2S	Inter-IC Sound Interface
LGA	Land Grid Array
LTE	Long Term Evolution
LwM2M	Lightweight Machine-to-Machine protocol
OEM	Original Equipment Manufacturer
PSM	Power Saving Mode
PTW	Paging Time Window
MQTT	Message Queuing Telemetry Transport
QPSK	Quadrature Phase-Shift Keying modulation
RMC	Reference Measurement Channel
SPI	Serial Peripheral Interface
TBD	To Be Defined
TDD	Time Division Duplex
UART	Universal Asynchronous Receiver-Transmitter serial interface
UDP	User Datagram Protocol
UE	User Equipment
UL	Uplink
USB	Universal Serial Bus

Table 22: Explanation of the abbreviations and terms used

Related documents

- [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 36.521-1 – Evolved Universal Terrestrial Radio Access; User Equipment conformance specification; Radio transmission and reception; Part 1: Conformance Testing
- [4] 3GPP TS 34.121-1 – User Equipment conformance specification; Radio transmission and reception (FDD); Part 1: Conformance specification
- [5] 3GPP TS 51.010-1 – Mobile Station conformance specification; Part 1: Conformance specification
- [6] ITU-T Recommendation V.24, 02-2000. List of definitions for interchange circuits between Data Terminal Equipment (DTE) and Data Circuit-terminating Equipment (DCE),
<https://www.itu.int/rec/T-REC-V.24-200002-I>
- [7] Universal Serial Bus Revision 2.0 specification, <https://www.usb.org/>
- [8] I2C-bus specification and user manual – NXP Semiconductors, <https://www.nxp.com/docs/en/user-guide/UM10204.pdf>

Revision history

Revision	Date	Name	Status / Comments
R01	25-May-2025	Pasding	Initial release
R02	23-July-2025	Herb	Add the B18, B19, B26 support for ROSE-R2801 variant product.
R03	03-Sep-2025	Herb	Update the SKU of the ROSE-R2 series product.
R04	03-Sep-2025	Herb	Update the Section 1.1 of the ROSE-R2 series product description.
R05	30-Sep-2025	Herb	Update the description about the eSIM SGP spec.
R06	03-Nov-2025	Herb	Update the related info about ROSE-R2 series product
R07	12-Nov-2025	ALI	Add the B18, B19, B26 support for ROSE-R2 variant product.
R08	15-Dec-2025	ALI	Add ROSE-R2 Series trace design（2.7.1）