TRASNA

ADAM-R11 series

LTE Cat 1bis modules data sheet

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Abstract

This technical data sheet describes the ADAM-R11 series modules, a complete and cost-optimized solution offering multi-band LTE Cat 1bis data transmissions in the compact ADAM LGA form factor (18 x 18 mm, 133-pin).

Document information

Title	ADAM-R11 series
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Mass production / End of life	Production information	Document contains the final product specification.

This document applies to the following products:

Product name	**Type number**	**Firmware version**	**Notification reference**	**Product status**
ADAM-R11001D	ADAM-R11001D-00C-00	01.00.A01.00	TRSC-437461976-3986	Initial production
ADAM-R11801D	ADAM-R11801D-00C-00	01.00.A01.00	TRSC-437461976-3986	Initial production

Confidentiality

1. Functional description

1.1. Overview

ADAM-R11 series are LTE Cat 1bis modules in the compact ADAM LGA form factor (18.0 x 18.0 mm, 133-pin), featuring medium capacity data connectivity (up to 10 Mbit/s downlink, up to 5 Mbit/s uplink) with very low energy consumption.

Thanks to connectivity to ubiquitous LTE Cat 1 networks, ADAM-R11 series modules are ideally suited to a wide range of value-oriented applications that require medium data speed and superior coverage. Typical applications are asset tracking, telematics, healthcare, and wearables.

ADAM-R11 series modules complement the R10 series and are primarily intended as a cost-optimized solution for applications that do not require US Mobile Network Operators approvals or permanent roaming in the region.

ADAM-R11 series modules support multi-band LTE radio access technology, and come in the following product variants to reduce logistics complexity:

- ADAM-R11001D data-only LTE Cat 1bis module for global use, with a complete set of supported bands and all relevant regulatory approvals.
- ADAM-R11801D data-only LTE Cat 1bis module provides an ideal solution for Europe, Middle East, Africa, Brazil and Asia-Pacific regions, with related supported bands and regulatory approvals

Dedicated variants of the modules are available with an internal eSIM for cellular network connectivity.

ADAM-R11 series modules are very small in size (18 x 18 mm, 133-pin) and have the same footprint of our cellular modules in the LEXI form factor (16 x 16 mm, 133-pin), thereby simplifying migration to LTE Cat 1bis from LTE-M / NB-IoT / 2G cellular radio access technologies.

ADAM-R11 series modules are qualified according to proprietary qualification policy for standard grade products.

Table 1 summarizes the main features the modules.

Table 1: ADAM-R11 series main features summary

	ADAM-R11001D	**ADAM-R11801D**
Region		
	Global	EMEA, APAC, Brazil
Radio Access Technology		
LTE category	LTE Cat 1bis	LTE Cat 1bis
LTE FDD bands	1, 2, 3, 4, 5, 7, 8, 12, 20, 28, 66	1, 3, 5, 7, 8, 20, 28
LTE TDD bands	34, 38, 39, 40, 41	
Interfaces		
UARTs	●	●
USB	●	●
I2C	●	●
SIM	●	●
GPIOs	●	●
Digital audio (I2S)		
Features		
Secure boot and updates	●	●
Internal eSIM	○	○
Wi-Fi scan	●	●
PSM	●	●
eDRX	●	●
Embedded TCP/IP, UDP/IP	●	●
Embedded HTTP, HTTPS	●	●
Embedded FTP, FTPS	●	●
Embedded TLS, DTLS	●	●
Embedded MQTT	●	●
Dual stack IPv4 / IPv6	●	●
FW update Over the Air (FOTA)	●	●
Antenna dynamic tuning	●	●
Antenna and SIM detection	●	●
Grade		
Standard	●	●
Professional		
Automotive		
	● = supported ○ = with dedicated ordering code	

1.2. Block diagram

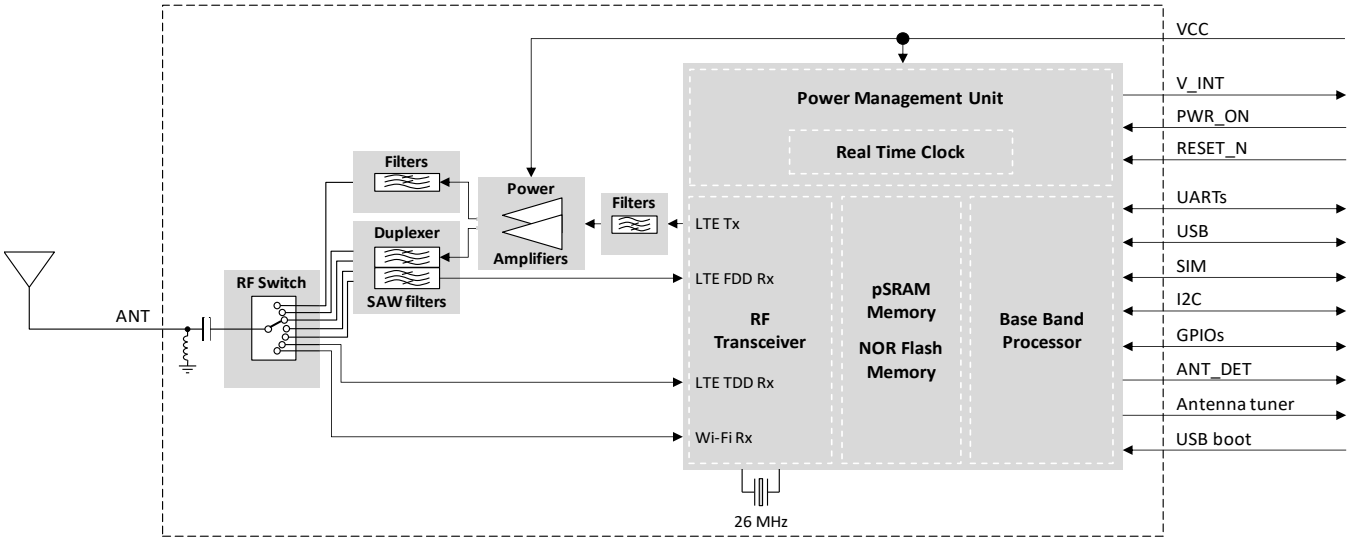

Figure 1: ADAM-R11 series block diagram

1.3. Product description

Table 2 summarizes cellular radio access technologies characteristics and features of the modules, and Table 3 summarizes Wi-Fi receiver scan capabilities of the modules.

Table 2: ADAM-R11 series cellular main characteristics

	ADAM-R11001D	**ADAM-R11801D**
Protocol stack	3GPP Release 13	3GPP Release 13
Radio Access Technology	LTE Cat 1bis	LTE Cat 1bis
LTE FDD operating bands	Band 1 (2100 MHz) Band 2 (1900 MHz) Band 3 (1800 MHz) Band 4 (1700 MHz) Band 5 (850 MHz) Band 7 (2600 MHz) Band 8 (900 MHz) Band 12 (700 MHz) Band 20 (800 MHz) Band 28 (700 MHz) Band 66 (1700 MHz)	Band 1 (2100 MHz) Band 3 (1800 MHz) Band 5 (850 MHz) Band 7 (2600 MHz) Band 8 (900 MHz) Band 20 (800 MHz) Band 28 (700 MHz)
LTE TDD operating bands	Band 34 (2000 MHz) Band 38 (2600 MHz) Band 39 (1900 MHz) Band 40 (2300 MHz) Band 41 (2600 MHz)	
LTE Power class	Class 3 (23 dBm)	Class 3 (23 dBm)
Data rate	LTE category 1bis: up to 10.3 Mbit/s DL, up to 5.2 Mbit/s UL	LTE category 1bis: up to 10.3 Mbit/s DL, up to 5.2 Mbit/s UL

Table 3: ADAM-R11 series Wi-Fi receiver main characteristics

	ADAM-R11 series
IEEE standard	802.11b with DSSS (Direct-Sequence Spread Spectrum) beacon
Operating band	2.4 GHz, all 14 channels
Modulation	DBPSK (Differential Binary Phase Shift Keying) at 1 Mbit/s DQPSK (Differential Quadrature Phase Shift Keying) at 2 Mbit/s

Considering the supported DSSS PHY scrambler initialization vectors are normally not specified by Wi-Fi Access Points manufacturers, if a specific Wi-Fi Access Point must be found, it is recommended to test the compatibility of the selected Access Point with ADAM-R11 series modules in advance.

1.4. AT command support

The ADAM-R11 series module supports AT commands according to the 3GPP standards TS 27.007 [4], TS 27.005 [5], TS 27.010 [6], and the proprietary AT commands extension.

For the complete list of AT commands and their description, see the AT commands manual [1].

1.5. Supported features

Table 4: Main features supported by ADAM-R11 series modules

Feature	**Description**
Device security	Hardware-based security functions of the chipset are used to provide: • Secure boot: guarantees software authenticity and integrity • Secure update: supervise the secure delivery of the correct FW to the module
Wi-Fi scan	Wi-Fi 2.4 GHz RF signals receiving capability (see Table 3) shared with LTE Cat 1bis RF signals receiving and transmitting capability over the same **ANT** RF port of the modules. The Wi-Fi receiver scan functionality consists in detecting available Wi-Fi networks using the antenna connected to the **ANT** RF port of the modules. The Wi-Fi subsystem inside the modules consists in a receiver radio circuitry only. No Wi-Fi transmitter radio circuitry is implemented. The Wi-Fi scan feature can be activated by dedicated AT command, retrieving the information about the Wi-Fi access points in area, to determine device location.
Antenna dynamic tuning	Real-time control of an external antenna matching IC via four dedicated pins of the module according to the LTE band used by the module.
Embedded TCP and UDP stack	Embedded TCP/IP and UDP/IP stack including direct link mode for TCP and UDP sockets. Sockets can be set in Direct Link mode to establish a transparent end-to-end communication with an already connected TCP or UDP socket via the serial interface.
FTP and FTPS	File Transfer Protocol as well as Secure File Transfer Protocol (SSL encryption of FTP control channel) functionalities are supported via AT commands.
HTTP (v1.0) and HTTPS	Hyper-Text Transfer Protocol as well as Secure Hyper-Text Transfer Protocol (SSL encryption) functionalities are supported via AT commands.
MQTT (v3.1.1)	Embedded Message Queuing Telemetry Transport (MQTT) publish-subscribe messaging protocols designed for lightweight M2M communications over TCP. These allow one-to-one, one-to-many and many-to-one communications over a TCP connection.
TLS (v1.3) and DTLS (v1.2)	Transport Layer Security (TLS) provides security for HTTP, FTP, MQTT and TCP communications. Datagram Transport Layer Security (DTLS) provides security for UDP communications.
Network indication	GPIO configured to indicate the network status: registered home network, registered roaming, data call enabled, no service. The feature can be enabled through the +UGPIOC AT command.
Antenna detection	The **ANT_DET** pin provides antenna presence detection capability, evaluating the resistance from the **ANT** pin to GND by means of an external antenna detection circuit implemented on the application board. The feature can be enabled through the +UANTR AT command.
GSMA SGP.32 ready	Bearer Independent Protocol (BIP) for over-the-air remote SIM provisioning and management in IoT network constrained and/or user interface constrained devices.

Feature	Description
Dual stack IPv4/IPv6	Capability to move between IPv4 and dual stack network infrastructures. IPv4 and IPv6 addresses can be used.
Firmware update Over The Air (FOTA)	Module firmware update over the air interface.
Low power idle mode	The low power idle mode allows reduction of the module current consumption while the module periodically monitors the signal received from the network in discontinuous reception. Once the feature is enabled by the dedicated +UPSV AT command, the module enters the low power idle mode whenever possible, reducing the current consumption (see Table 12).
Ultra-low power deep-sleep mode	The ultra-low power deep-sleep mode allows reduction of the module current consumption to the minimum possible value, as when the module is switched off. Once the feature is enabled by the dedicated +SCCFG AT command, the module enters the ultra-low power deep-sleep mode whenever possible, after having entered the PSM, reducing the current consumption down to the microampere range (see Table 12).
Power Saving Mode (PSM)	The ultra-low power PSM mode, defined by 3GPP specifications, allows further reduction of the module current consumption compared to the idle mode, keeping the module registered with the network, but temporarily not reachable for mobile services.
eDRX	The idle mode extended discontinuous reception, defined by 3GPP specifications, allows the module to decrease the frequency of the periodical monitoring of the signal received from the network. This in turn leads to a reduction in the module consumption while maintaining a perpetual connection with the base station.
cDRX	The connected mode discontinuous reception, defined by 3GPP specifications, allows reduction of the consumption and LTE network use during periods of inactivity. Both Long DRX Cycle and Short DRX cycle are supported for LTE Connected Discontinuous Reception, reducing consumption and LTE network use during periods of inactivity.

2. Interfaces

2.1. Power management

2.1.1. Module supply input (VCC)

ADAM-R11 series modules must be supplied through the **VCC** pins by a proper external DC power supply providing a nominal voltage within the normal operating range (see Table 10). Voltage must be stable, because during operation the current drawn from **VCC** may vary significantly, based on the power consumption profile of the LTE radio access technology.

The internal baseband Power Management Unit, fed from the **VCC** supply input pins as illustrated in Figure 1, integrates voltage regulators generating all internal supply voltages needed by the module for its intended operations, including supply voltage for:

- The generic digital interfaces, which supply voltage is available at the **V_INT** output pin (see 2.1.2),
- The SIM interface, which supply voltage is available at the **VSIM** output pin (see 2.4.1),
- Other internal sub-systems.

It is important that the system power supply circuit can withstand with adequate safe design margin the maximum current during transmission at maximum power level (see Table 12).

2.1.2. Generic digital interfaces supply output (V_INT)

ADAM-R11 series modules provide a 1.8 V supply rail output on the **V_INT** pin, which is internally generated by an LDO linear regulator when the module is switched on and outside the ultra-low power deep-sleep mode, which can be entered by ADAM-R11 series modules after having entered the PSM mode with these features enabled by related dedicated AT commands.

The **V_INT** voltage domain is used internally to supply the generic digital interfaces of the module, as:

- The UART interfaces (see 2.5.1),
- The I2C interface (see 2.5.3),
- The antenna dynamic tuner interface (see 2.7),
- The GPIOs (see 2.6).

The **V_INT** supply output can be used in place of an external discrete regulator.

It is recommended to provide test point directly connected to **V_INT** pin for diagnostic purposes.

2.2. Antenna interface

2.2.1. Antenna RF interface (ANT)

The **ANT** pin is the RF input / output of ADAM-R11 series modules, designed with 50 Ω characteristic impedance, available to connect an external antenna for the transmission and the reception of LTE RF signals, and for the reception of Wi-Fi RF signals.

2.3. System functions

2.3.1. Module power-on

When the ADAM-R11 series modules are not powered, the modules' switch on can be triggered by:

- Applying a voltage at the **VCC** module supply input within the operating range (see Table 10), and then forcing a low level at the **PWR_ON** input pin, which is normally set high by an internal pull-up, for a valid time period (see section 4.2.6, module switch on), or
- Applying a voltage at the **VCC** module supply input within the operating range (see Table 10), and then forcing a low level at the **RESET_N** input pin, which is normally set high by an internal pull-up, for a valid time period (see section 4.2.7, module switch on).

When the modules are in power-off mode (i.e. switched off, but with a valid voltage present at the **VCC** module supply input within the operating range reported in Table 10), the modules' switch on can be triggered by:

- Forcing a low level at the **PWR_ON** input pin, which is normally set high by an internal pull-up, for a valid time period (see section 4.2.6, module switch on), or
- Forcing a low level at the **RESET_N** input pin, which is normally set high by an internal pull-up, for a valid time period (see section 4.2.7, module switch on).

When the modules are in ultra-low power deep-sleep mode, the modules' wake-up can be triggered by:

- Forcing a low level at the **PWR_ON** input pin, which is normally set high by an internal pull-up, for a valid time period (see section 4.2.6, module wake-up from deep-sleep mode), or
- Forcing a low level at the **RESET_N** input pin, which is normally set high by an internal pull-up, for a valid time period (see section 4.2.7, module wake-up from deep-sleep mode).

The **PWR_ON** input line is intended to be driven by open drain, open collector or contact switch.

It is recommended to provide accessible test point directly connected to the **PWR_ON** pin.

2.3.2. Module power-off

The proper graceful switch off procedure of the ADAM-R11 series modules, with storage of user data in module's non-volatile memory and a clean network detach, can be triggered by:

- AT+CPWROFF command (see the AT commands manual [1]), or
- Forcing a low level at the **PWR_ON** input pin, for a valid time period (see section 4.2.6, graceful switch off).

A faster switch off procedure of the ADAM-R11 series modules, with storage of user data in module's non-volatile memory but skipping network detach, can be triggered by:

- AT+CPWROFF=1 command (see the AT commands manual [1]).

An abrupt under-voltage shutdown occurs on the modules when the **VCC** supply is removed.

2.3.3. Module reset

The graceful reset of ADAM-R11 series modules, with storage of user data in module's non-volatile memory and a clean network detach before the reboot of the module, can be triggered by:

- AT+CFUN=1,1 command (see the AT commands manual [1]).

A faster reset of ADAM-R11 series modules, with storage of user data in module's non-volatile memory but skipping network detach before the reboot of the module, can be triggered by:

- AT+CFUN=6 command (see the AT commands manual [1]).

An abrupt HW emergency reset is triggered on the modules, with shutdown followed by a reboot of internal power management unit, without storage of current parameter settings and without a clean network detach, when:

- A low level is applied on **RESET_N** pin for a valid time period (see section 4.2.7, abrupt emergency reset).

The **RESET_N** line is intended to be driven by open drain, open collector or contact switch.

It is recommended to provide accessible test point directly connected to the **RESET_N** pin.

2.4. SIM

2.4.1. SIM interface

ADAM-R11 series modules provide an interface on the **VSIM**, **SIM_IO**, **SIM_CLK**, **SIM_RST** pins to connect an external SIM card/chip. External 1.8 V and 3.0 V SIM card/chip types are supported. Activation and deactivation are implemented according to the ISO-IEC 7816-3 specifications.

2.5. Serial communication

ADAM-R11 series modules include the following serial communication interfaces:

- A main primary UART interface (see 2.5.1.1), for communication with a host controller, supporting:
  - AT commands and data communication up to 3.6 Mbit/s
  - Multiplexer protocol functionality (see 2.5.1.3)
- An auxiliary second UART interface (see 2.5.1.2), for communication with a host controller, supporting:
  - AT commands and data communication up to 3.6 Mbit/s
  - Diagnostic trace logging
- A USB High-Speed 2.0 interface (see 2.5.2), for communication with a host controller, supporting:
  - AT commands and data communication up to 480 Mbit/s
  - FW update by dedicated tool running on an external PC
  - Diagnostic trace logging
  - Ethernet over USB
- An I2C-bus compatible interface (see 2.5.3), for communication with I2C devices, supporting:
  - data communication up to 100 kHz

2.5.1. UART interfaces

2.5.1.1. Main UART interface (UART)

ADAM-R11 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 (see 2.5.1.3)

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 V.24 recommendation [8], with CMOS compatible signal levels (0 V for low data bit / ON state, 1.8 V 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)[1]
- Automatic baud rate detection and baud rates up to 3.6 Mbit/s can be configured
- The default frame format is 8N1 (8 data bits, no parity, 1 stop bit)

2.5.1.2. Auxiliary UART interface (AUX UART)

ADAM-R11 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 dedicated AT commands, supporting:

- AT commands and data communication
- 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 V.24 recommendation [8], with CMOS compatible signal levels (0 V for low data bit / ON state, 1.8 V 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)
- Automatic baud rate detection and baud rates up to 3.6 Mbit/s can be configured
- 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, for diagnostic purposes, in case the USB is used by the external processor.

2.5.1.3. Multiplexer protocol

The modules include multiplexer functionality as per 3GPP TS 27.010 [6] on the main primary UART interface physical link. This is a data link protocol usings HDLC-like framing between the module (DCE) and the application processor (DTE), emulating several virtual connection channels on the single main primary UART physical interface to access the module concurrently.

[1] **DTR**, **DSR**, **DCD** and **RI** pins can be alternatively configured, in a mutually exclusive way, as secondary auxiliary UART interface. The Ring Indicator (RI) function can be alternatively configured over GPIO (see section 2.6).

The multiplexer function over the primary UART interface is by default disabled and can be enabled by means of the dedicated +CMUX AT command. Once the multiplexer is enabled, four virtual ports can be used as AT command port or modem port.

2.5.2. USB interface

ADAM-R11 series modules include a USB High-Speed 2.0 interface with maximum 480 Mbit/s data rate according to the Universal Serial Bus specification revision 2.0 [9]. 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 dedicated tool running on an external PC
- Diagnostic trace logging
- Ethernet over USB

The USB interface includes the following lines:

- **USB_D+** / **USB_D-** lines, carrying the USB data and signaling
- **VUSB_DET** input pin, to enable the USB interface by applying an external voltage (5.0 V typical)
- **USB_BOOT** input pin, to let the boot in normal operating mode, or to force a FW update over USB.

☞ The **USB_BOOT** input pin must be left floating (unconnected) or can be connected to the **V_INT** supply output to let the module boot in normal operating mode. If the **USB_BOOT** pin is set low, externally connected to GND, the normal operating mode is prevented, and a FW update over USB can be forced at the boot of the module.

☞ It is recommended to provide accessible test points directly connected to the USB interface **VUSB_DET**, **USB_D+** and **USB_D-** pins, as well as to the **USB_BOOT** pin, for FW update and for diagnostic purposes.

2.5.3. I2C interface

ADAM-R11 series modules include a 1.8V I2C-bus compatible interface over the **SDA** and **SCL** pins, in the **V_INT** supply domain, with the ADAM-R11 series module acting as an I2C host to communicate in I2C standard-mode with external I2C devices in accordance with the I2C bus specifications [10].

2.6. GPIO

ADAM-R11 series modules include ten GPIO pins (**GPIO1**-**GPIO10**) that can be configured as input, output, or with custom functions as summarized in Table 5. For details, see the GPIO section of the AT commands manual [1].

Table 5: GPIO custom functions configuration

Function	Description	Default GPIO	Configurable GPIOs
Output	Output to set the high or the low digital level	--	All
Input	Input to 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, GPIO8, GPIO9, GPIO10
Module status indication	Output indicating module status: low when switched off or in deep-sleep mode; high when in idle, active, or connected mode	--	GPIO2, GPIO4
SIM card detection	Input for external SIM card physical presence detection	--	GPIO6

Function	Description	Default GPIO	Configurable GPIOs
Power saving control	Input to control the low power idle mode of the module once enabled by +UPSV AT command	--	GPIO3, GPIO6
Ring indicator	Output providing events indicator (as the UART RI line)	--	GPIO1, GPIO2, GPIO4, GPIO5, GPIO7, GPIO8, GPIO9, GPIO10
Pin disabled	Tri-state with an internal active pull-down enabled	All	All

2.7. Antenna dynamic tuner interface

ADAM-R11 series modules include four 1.8 V digital output pins (**RFCTRL1**, **RFCTRL2**, **RFCTRL3** and **RFCTRL4**), in the **V_INT** supply domain, that can optionally be used to control in real time an external antenna tuning IC, as the pins change their output value dynamically according to the specific current LTE band in use by the module.

RFCTRL3 and **RFCTRL4** pins are not supported by “00C” product version.

2.8. Reserved pins (RSVD)

ADAM-R11 series modules include pins reserved for future use, marked as **RSVD**, which can all be left unconnected on the application board.

3. Pin definition

3.1. Pin assignment

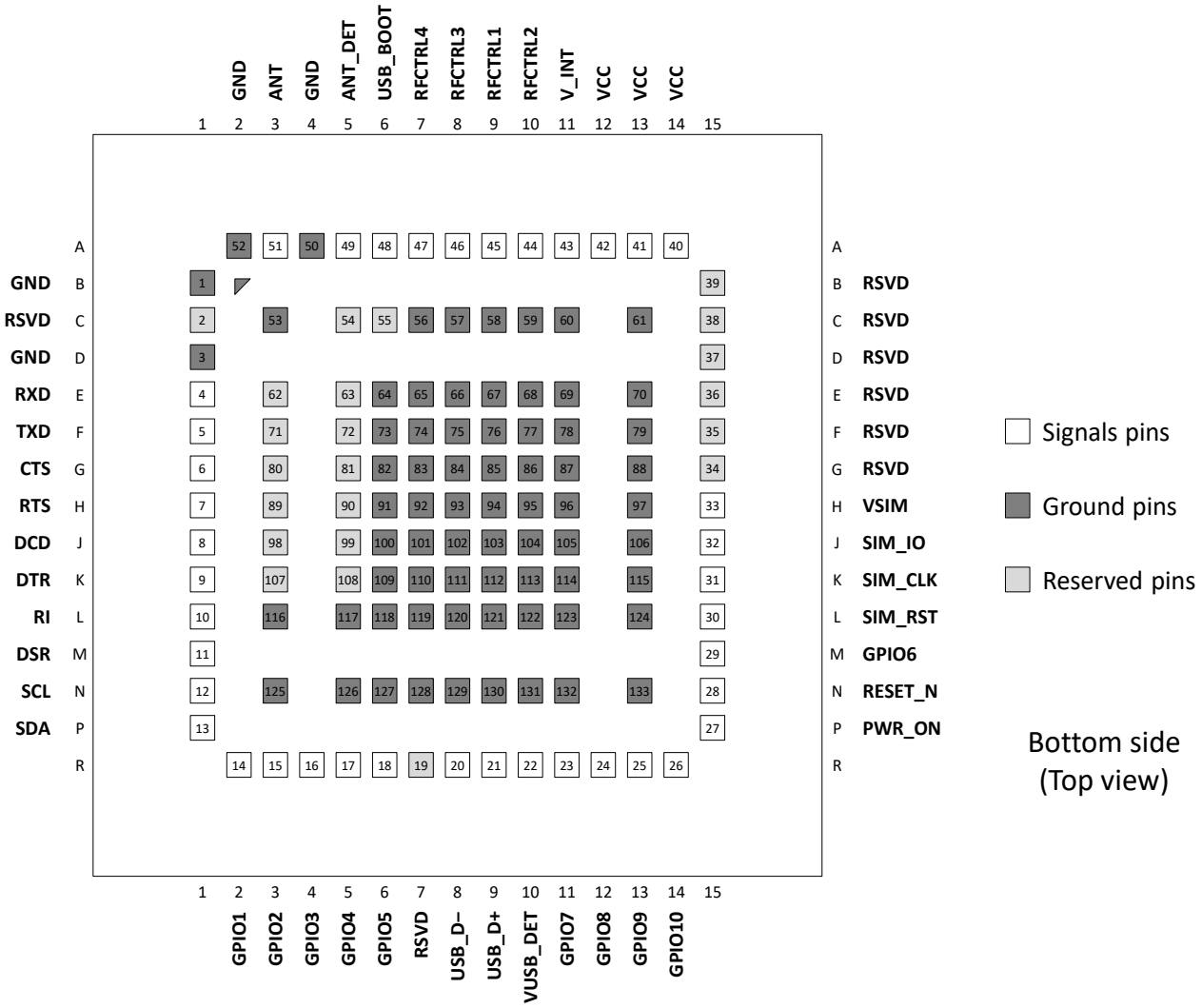

Figure 2: ADAM-R11 series module pin assignment (top view)

Table 6: ADAM-R11 series pin-out

ID	No	Name	Power domain	I/O	Description	Remarks
A2	52	GND	-	N/A	Ground	All the GND pins must be connected to ground.
A3	51	ANT	-	I/O	RF antenna I/O	RF input/output for the external antenna. 50 Ω nominal impedance. See section 2.2.1 and 4.2.4 for details.
A4	50	GND	-	N/A	Ground	All the GND pins must be connected to ground.
A5	49	ANT_DET	ADC	I	Antenna detection	Antenna presence detection function. See section 4.2.5 for detailed electrical specs.
A6	48	USB_BOOT	GDI	I	Force USB boot	Input to force FW update over USB. Active low. See section 2.5.2 for functional description. See section 4.2.10 for detailed electrical specs. Provide test point for FW update purposes.

ID	No	Name	Power domain	I/O	Description	Remarks
A7	47	RFCTRL4	GDI	O	RF GPIO for antenna tuning	No function supported by current product version. See section 2.7 for functional description. See section 4.2.10 for detailed electrical specs.
A8	46	RFCTRL3	GDI	O	RF GPIO for antenna tuning	No function supported by current product version. See section 2.7 for functional description. See section 4.2.10 for detailed electrical specs.
A9	45	RFCTRL1	GDI	O	RF GPIO for antenna tuning	Digital output to optionally control an antenna tuning IC. Push-pull output type. See section 2.7 for functional description. See section 4.2.10 for detailed electrical specs.
A10	44	RFCTRL2	GDI	O	RF GPIO for antenna tuning	Digital output to optionally control an antenna tuning IC. Push-pull output type. See section 2.7 for functional description. See section 4.2.10 for detailed electrical specs.
A11	43	V_INT	-	O	Generic Digital Interfaces supply output	V_INT = 1.8 V (typical) supply generated by the module when is switched on, outside low power deep sleep mode. See section 2.1.2 for functional description. See section 4.2.2 for detailed electrical specs. Provide test point for diagnostic purposes.
A12	42	VCC	-	I	Module supply input	All VCC pins must be connected to external supply. See section 2.1.1 for functional description. See section 4.2.2 and 4.2.3 for detailed electrical specs.
A13	41	VCC	-	I	Module supply input	All VCC pins must be connected to external supply. See section 2.1.1 for functional description. See section 4.2.2 and 4.2.3 for detailed electrical specs.
A14	40	VCC	-	I	Module supply input	All VCC pins must be connected to external supply. See section 2.1.1 for functional description. See section 4.2.2 and 4.2.3 for detailed electrical specs.
B1	1	GND	-	N/A	Ground	All the GND pins must be connected to ground.
B15	39	RSVD	-	N/A	Reserved pin	Pin reserved for future use, internally not connected. Leave unconnected externally.
C1	2	RSVD	-	N/A	Reserved pin	Pin reserved for future use, internally not connected. Leave unconnected externally.
C3	53	GND	-	N/A	Ground	All the GND pins must be connected to ground.
C5	54	RSVD	-	N/A	Reserved pin	Pin reserved for future use, internally not connected. Leave unconnected externally.
C6	55	RSVD	-	N/A	Reserved pin	Pin reserved for future use, internally not connected. Leave unconnected externally.
C7	56	GND	-	N/A	Ground	All the GND pins must be connected to ground.
C8	57	GND	-	N/A	Ground	All the GND pins must be connected to ground.
C9	58	GND	-	N/A	Ground	All the GND pins must be connected to ground.
C10	59	GND	-	N/A	Ground	All the GND pins must be connected to ground.
C11	60	GND	-	N/A	Ground	All the GND pins must be connected to ground.
C13	61	GND	-	N/A	Ground	All the GND pins must be connected to ground.
C15	38	RSVD	-	N/A	Reserved pin	Pin reserved for future use, internally not connected. Leave unconnected externally.
D1	3	GND	-	N/A	Ground	All the GND pins must be connected to ground.
D15	37	RSVD	-	N/A	Reserved pin	Pin reserved for future use, internally not connected. Leave unconnected externally.
E1	4	RXD	GDI	O	UART data output	Circuit 104 in ITU-T V.24 (RxD data output, push-pull, idle high, active low). See section 2.5.1 for functional description. See section 4.2.10 for detailed electrical specs.
E3	62	RSVD	-	N/A	Reserved pin	Leave unconnected externally.

ID	No	Name	Power domain	I/O	Description	Remarks
E5	63	RSVD	-	N/A	Reserved pin	Pin reserved for future use, internally not connected. Leave unconnected externally.
E6	64	GND	-	N/A	Ground	All the GND pins must be connected to ground.
E7	65	GND	-	N/A	Ground	All the GND pins must be connected to ground.
E8	66	GND	-	N/A	Ground	All the GND pins must be connected to ground.
E9	67	GND	-	N/A	Ground	All the GND pins must be connected to ground.
E10	68	GND	-	N/A	Ground	All the GND pins must be connected to ground.
E11	69	GND	-	N/A	Ground	All the GND pins must be connected to ground.
E13	70	GND	-	N/A	Ground	All the GND pins must be connected to ground.
E15	36	RSVD	-	N/A	Reserved pin	Pin reserved for future use, internally not connected. Leave unconnected externally.
F1	5	TXD	GDI	I	UART data input	Circuit 103 in ITU-T V.24 (TxD data input, idle high, active low, with internal active pull-up enabled). See section 2.5.1 for functional description. See section 4.2.10 for detailed electrical specs.
F3	71	RSVD	-	N/A	Reserved pin	Pin reserved for future use, internally not connected. Leave unconnected externally.
F5	72	RSVD	-	N/A	Reserved pin	Pin reserved for future use, internally not connected. Leave unconnected externally.
F6	73	GND	-	N/A	Ground	All the GND pins must be connected to ground.
F7	74	GND	-	N/A	Ground	All the GND pins must be connected to ground.
F8	75	GND	-	N/A	Ground	All the GND pins must be connected to ground.
F9	76	GND	-	N/A	Ground	All the GND pins must be connected to ground.
F10	77	GND	-	N/A	Ground	All the GND pins must be connected to ground.
F11	78	GND	-	N/A	Ground	All the GND pins must be connected to ground.
F13	79	GND	-	N/A	Ground	All the GND pins must be connected to ground.
F15	35	RSVD	-	N/A	Reserved pin	Pin reserved for future use, internally not connected. Leave unconnected externally.
G1	6	CTS	GDI	O	UART clear to send	Circuit 106 in ITU-T V.24 (CTS hardware flow control output, push-pull, idle high, active low). See section 2.5.1 for functional description. See section 4.2.10 for detailed electrical specs.
G3	80	RSVD	-	N/A	Reserved pin	Pin reserved for future use, internally not connected. Leave unconnected externally.
G5	81	RSVD	-	N/A	Reserved pin	Pin reserved for future use, internally not connected. Leave unconnected externally.
G6	82	GND	-	N/A	Ground	All the GND pins must be connected to ground.
G7	83	GND	-	N/A	Ground	All the GND pins must be connected to ground.
G8	84	GND	-	N/A	Ground	All the GND pins must be connected to ground.
G9	85	GND	-	N/A	Ground	All the GND pins must be connected to ground.
G10	86	GND	-	N/A	Ground	All the GND pins must be connected to ground.
G11	87	GND	-	N/A	Ground	All the GND pins must be connected to ground.
G13	88	GND	-	N/A	Ground	All the GND pins must be connected to ground.
G15	34	RSVD	-	N/A	Reserved pin	Pin reserved for future use, internally not connected. Leave unconnected externally.
H1	7	RTS	GDI	I	UART request to send	Circuit 105 in ITU-T V.24 (RTS flow control input, idle high, active low, with internal active pull-down enabled). See section 2.5.1 for functional description. See section 4.2.10 for detailed electrical specs.
H3	89	RSVD	-	N/A	Reserved pin	Leave unconnected externally.
H5	90	RSVD	-	N/A	Reserved pin	Pin reserved for future use, internally not connected. Leave unconnected externally.
H6	91	GND	-	N/A	Ground	All the GND pins must be connected to ground.

ID	No	Name	Power domain	I/O	Description	Remarks
H7	92	GND	-	N/A	Ground	All the GND pins must be connected to ground.
H8	93	GND	-	N/A	Ground	All the GND pins must be connected to ground.
H9	94	GND	-	N/A	Ground	All the GND pins must be connected to ground.
H10	95	GND	-	N/A	Ground	All the GND pins must be connected to ground.
H11	96	GND	-	N/A	Ground	All the GND pins must be connected to ground.
H13	97	GND	-	N/A	Ground	All the GND pins must be connected to ground.
H15	33	VSIM	-	O	SIM supply output	VSIM = 1.8 V (typical) or 3 V (typical) supply generated by the module according to the external SIM card type, when it is switched on, after the internal boot sequence, outside the low power deep sleep mode. See section 2.4.1 for functional description. See section 4.2.8 for detailed electrical specs.
J1	8	DCD	GDI	O / O	UART data carrier detect / AUX UART data output	Circuit 109 in ITU-T V.24 (DCD output, push-pull, idle high, active low), alternatively settable as Second Auxiliary UART RXD (data output, push-pull, idle high, active low). See section 2.5.1 for functional description. See section 4.2.10 for detailed electrical specs. Provide test point for diagnostic purposes, if USB is used by the host processor.
J3	98	RSVD	-	N/A	Reserved pin	Pin reserved for future use, internally not connected. Leave unconnected externally.
J5	99	RSVD	-	N/A	Reserved pin	Pin reserved for future use, internally not connected. Leave unconnected externally.
J6	100	GND	-	N/A	Ground	All the GND pins must be connected to ground.
J7	101	GND	-	N/A	Ground	All the GND pins must be connected to ground.
J8	102	GND	-	N/A	Ground	All the GND pins must be connected to ground.
J9	103	GND	-	N/A	Ground	All the GND pins must be connected to ground.
J10	104	GND	-	N/A	Ground	All the GND pins must be connected to ground.
J11	105	GND	-	N/A	Ground	All the GND pins must be connected to ground.
J13	106	GND	-	N/A	Ground	All the GND pins must be connected to ground.
J15	32	SIM_IO	SIM	I/O	SIM data	Internal pull-up resistor to VSIM. See section 2.4.1 for functional description. See section 4.2.8 for detailed electrical specs.
K1	9	DTR	GDI	I / I	UART data terminal ready / AUX UART data input	Circuit 108/2 in ITU-T V. 24 (DTR input, idle high, active low, with internal active pull-up enabled), alternatively settable as second auxiliary UART TXD (data input, idle high, active low, with internal active pull-up enabled). See section 2.5.1 for functional description. See section 4.2.10 for detailed electrical specs.
K3	107	RSVD	-	N/A	Reserved pin	Pin reserved for future use, internally not connected. Leave unconnected externally.
K5	108	RSVD	-	N/A	Reserved pin	Pin reserved for future use, internally not connected. Leave unconnected externally.
K6	109	GND	-	N/A	Ground	All the GND pins must be connected to ground.
K7	110	GND	-	N/A	Ground	All the GND pins must be connected to ground.
K8	111	GND	-	N/A	Ground	All the GND pins must be connected to ground.
K9	112	GND	-	N/A	Ground	All the GND pins must be connected to ground.
K10	113	GND	-	N/A	Ground	All the GND pins must be connected to ground.
K11	114	GND	-	N/A	Ground	All the GND pins must be connected to ground.
K13	115	GND	-	N/A	Ground	All the GND pins must be connected to ground.
K15	31	SIM_CLK	SIM	O	SIM clock	See section 2.4.1 for functional description. See section 4.2.8 for detailed electrical specs.

ID	No	Name	Power domain	I/O	Description	Remarks
L1	10	RI	GDI	O / O	UART ring indicator / AUX UART clear to send	Circuit 125 in ITU-T V.24 (RI output, push-pull, idle high, active low), alternatively configurable as second auxiliary UART CTS (HW flow control output, push-pull, idle high, active low). See section 2.5.1 for functional description. See section 4.2.10 for detailed electrical specs.
L3	116	GND	-	N/A	Ground	All the GND pins must be connected to ground.
L5	117	GND	-	N/A	Ground	All the GND pins must be connected to ground.
L6	118	GND	-	N/A	Ground	All the GND pins must be connected to ground.
L7	119	GND	-	N/A	Ground	All the GND pins must be connected to ground.
L8	120	GND	-	N/A	Ground	All the GND pins must be connected to ground.
L9	121	GND	-	N/A	Ground	All the GND pins must be connected to ground.
L10	122	GND	-	N/A	Ground	All the GND pins must be connected to ground.
L11	123	GND	-	N/A	Ground	All the GND pins must be connected to ground.
L13	124	GND	-	N/A	Ground	All the GND pins must be connected to ground.
L15	30	SIM_RST	SIM	O	SIM reset	See section 2.4.1 for functional description. See section 4.2.8 for detailed electrical specs.
M1	11	DSR	GDI	O / I	UART data set ready / AUX UART request to send	Circuit 107 in ITU-T V.24 (DSR function not supported), alternatively configurable as second auxiliary UART RTS (HW flow control input, idle high, active low, with internal active pull-down enabled). See section 2.5.1 for functional description. See section 4.2.10 for detailed electrical specs.
M15	29	GPIO6	GDI	I/O	GPIO	Configurable GPIO. Push-pull output type. See section 2.6 for functional description. See section 4.2.10 for detailed electrical specs.
N1	12	SCL	I2C	O	I2C bus clock line	Fixed open drain. Internal pull-up to V_INT. Idle high, active low. See section 2.5.3 for functional description. See section 4.2.9 for detailed electrical specs.
N3	125	GND	-	N/A	Ground	All the GND pins must be connected to ground.
N5	126	GND	-	N/A	Ground	All the GND pins must be connected to ground.
N6	127	GND	-	N/A	Ground	All the GND pins must be connected to ground.
N7	128	GND	-	N/A	Ground	All the GND pins must be connected to ground.
N8	129	GND	-	N/A	Ground	All the GND pins must be connected to ground.
N9	130	GND	-	N/A	Ground	All the GND pins must be connected to ground.
N10	131	GND	-	N/A	Ground	All the GND pins must be connected to ground.
N11	132	GND	-	N/A	Ground	All the GND pins must be connected to ground.
N13	133	GND	-	N/A	Ground	All the GND pins must be connected to ground.
N15	28	RESET_N	ERS	I	Reset input	Internal active pull-up to VCC. Active low. See section 2.3.3 for functional description. See section 4.2.7 for detailed electrical specs. Provide test point for diagnostic purposes.
P1	13	SDA	I2C	I/O	I2C bus data line	Fixed open drain. Internal pull-up to V_INT. Idle high, active low. See section 2.5.3 for functional description. See section 4.2.9 for detailed electrical specs.
P15	27	PWR_ON	POS	I	Power on/off input	Internal active pull-up to VCC. Active low. See section 2.3.1 and 2.3.2 for functional description. See section 4.2.6 for detailed electrical specs. Provide test point for FW update or diagnostic purposes.

ID	No	Name	Power domain	I/O	Description	Remarks
R2	14	GPIO1	GDI	I/O	GPIO	Configurable GPIO. Push-pull output type. See section 2.6 for functional description. See section 4.2.10 for detailed electrical specs.
R3	15	GPIO2	GDI	I/O	GPIO	Configurable GPIO. Push-pull output type. See section 2.6 for functional description. See section 4.2.10 for detailed electrical specs.
R4	16	GPIO3	GDI	I/O	GPIO	Configurable GPIO. Push-pull output type. See section 2.6 for functional description. See section 4.2.10 for detailed electrical specs.
R5	17	GPIO4	GDI	I/O	GPIO	Configurable GPIO. Push-pull output type. See section 2.6 for functional description. See section 4.2.10 for detailed electrical specs.
R6	18	GPIO5	GDI	I/O	GPIO	Configurable GPIO. Push-pull output type. See section 2.6 for functional description. See section 4.2.10 for detailed electrical specs.
R7	19	RSVD	-	N/A	Reserved pin	Leave unconnected.
R8	20	USB_D-	USB	I/O	USB Data Line D-	90 Ω nominal differential impedance. Pull-up, pull-down, series resistors as per USB specs [9], are part of pin driver and shall not be provided externally. See section 2.5.2 for functional description. See section 4.2.11 for detailed electrical specs. Provide test point for FW update and diagnostic purposes.
R9	21	USB_D+	USB	I/O	USB Data Line D+	90 Ω nominal differential impedance. Pull-up, pull-down, series resistors as per USB specs [9], are part of pin driver and shall not be provided externally. See section 2.5.2 for functional description. See section 4.2.11 for detailed electrical specs. Provide test point for FW update and diagnostic purposes.
R10	22	VUSB_DET	VBUS	I	USB VBUS detect input	VBUS 5 V typical voltage must be connected to this input pin to enable the USB interface. See section 4.2.11 for detailed electrical specs. Provide test point for FW update and diagnostic purposes.
R11	23	GPIO7	GDI	I/O	GPIO	Configurable GPIO. Push-pull output type. See section 2.6 for functional description. See section 4.2.10 for detailed electrical specs.
R12	24	GPIO8	GDI	I/O	GPIO	Configurable GPIO. Push-pull output type. See section 2.6 for functional description. See section 4.2.10 for detailed electrical specs.
R13	25	GPIO9	GDI	I/O	GPIO	Configurable GPIO. Push-pull output type. See section 2.6 for functional description. See section 4.2.10 for detailed electrical specs.
R14	26	GPIO10	GDI	I/O	GPIO	Configurable GPIO. Push-pull output type. See section 2.6 for functional description. See section 4.2.10 for detailed electrical specs.

See appendix A for an explanation of the abbreviations and terms used.

4. Electrical specifications

⚠ Stressing the device above one or more of the ratings listed in the Absolute Maximum Rating section may cause permanent damage. These are stress ratings only. Operating the module at these or at any conditions other than those specified in the Operating Conditions sections (section 4.2) of the specification should be avoided. Exposure to Absolute Maximum Rating conditions for extended periods may affect device reliability.

☞ 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 Absolute Maximum Rating System (IEC 134).

Table 7: Absolute maximum ratings

Symbol	Description	Condition	Min.	Max.	Unit
VCC	Module supply voltage	Input DC voltage at VCC pins	-0.3	4.8	V
VUSB_DET	USB detection pin	Input DC voltage at VUSB_DET pin	-0.3	5.4	V
USB	USB D+/D- pins	Input DC voltage at USB_D+ and USB_D- pins	-0.3	3.6	V
GDI	Generic digital interfaces	Input DC voltage at generic digital interfaces pins	-0.3	2.0	V
I2C	I2C interface	Input DC voltage at I2C interface pins	-0.3	2.0	V
SIM	SIM interface	Input DC voltage at SIM interface pins	-0.3	3.3	V
ERS	External reset signal	Input DC voltage at RESET_N pin	-0.3	4.8	V
POS	Power-on input signal	Input DC voltage at PWR_ON pin	-0.3	4.8	V
ADC	Antenna detection input	Input DC voltage at ANT_DET pin	-0.3	2.0	V
Tstg	Storage temperature		-40	+85	°C

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

4.1.1. Maximum ESD

Table 8: Maximum ESD ratings

Parameter	Min	Max	Unit	Remarks
ESD sensitivity for all pins		1000	V	Human Body Model according to JS-001-2017
		500	V	Charged Device Model according to JS-002-2018

⚠ The cellular modules are electrostatic sensitive devices and require special precautions when handling. See section 7.3 for ESD handling instructions.

4.2. Operating conditions

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

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

4.2.1. Operating temperature range

Table 9: Environmental conditions

Parameter	Min.	Typ.	Max.	Unit	Remarks
Normal operating temperature	–20	+25	+65	°C	Operating within 3GPP / ETSI specifications
Extended operating temperature	–40		+85	°C	Operating with possible slight deviation in RF performance outside normal operating range

4.2.2. Supply/power pins

Table 10: Input characteristics of the supply/power pins

Symbol	Parameter	Min.	Typical	Max.	Unit
VCC	Module supply normal operating input voltage	3.3	3.8	4.5	V

Table 11: Output characteristics of the supply/power pins

Symbol	Parameter	Min.	Typical	Max.	Unit
VSIM	SIM supply output voltage with 1.8 V external SIM		1.8		V
	SIM supply output voltage with 3.0 V external SIM		3.0		V
V_INT	Generic Digital Interfaces supply output voltage		1.8		V
	Generic Digital Interfaces supply output current capability			50	mA

4.2.3. Current consumption

Table 12: Indicative VCC current consumption of the ADAM-R11 series modules [2]

Mode	Condition	Tx power	Min.	Typical [3]	Max.[4]	Unit
Power-off mode	Averaged value, Module switched off	--		4		µA
Deep-sleep mode [5]	Averaged value, Module in deep-sleep mode	--		4		µA
Low power mode using UART [5]	Averaged value, AT+UPSV≠0 eDRX = 81.92 s, PTW = 2.56 s, DRX = 2.56 s	--		0.9		mA
	Averaged value, AT+UPSV≠0 DRX = 2.56 s	--		1.0		mA

[2] Indicative current consumption values with VCC = 3.8 V
[3] Typical values with a matched antenna
[4] Maximum values with a mismatched antenna
[5] USB not connected.

Mode	Condition	Tx power	Min.	Typical [3]	Max.[4]	Unit
Low power mode using USB [6]	Averaged value, eDRX = 81.92 s, PTW = 2.56 s, DRX = 2.56 s	--		1.1		mA
	Averaged value, DRX = 2.56 s	--		1.2		mA
Active mode using UART [5]	Averaged value DRX = 2.56 s	--		10		mA
Active mode using USB [7]	Averaged value DRX = 2.56 s	--		19		mA
Connected mode	Averaged value along LTE data Tx/Rx	Minimum		130		mA
		Maximum		590	900	mA

4.2.4. LTE RF characteristics

LTE Cat 1bis RF bands and RF output power class supported by ADAM-R11 series modules are defined in Table 2, while Table 13 describes the frequency ranges for each LTE band as per 3GPP TS 36.521-1 [7].

Table 13: ADAM-R11 series LTE operating RF frequency bands

Parameter		Min.	Max.	Unit	Remarks
Frequency range FDD band 12 (700 MHz)	Uplink	699	716	MHz	Module transmits
	Downlink	729	746	MHz	Module receives
Frequency range FDD band 28 (700 MHz)	Uplink	703	748	MHz	Module transmits
	Downlink	758	803	MHz	Module receives
Frequency range FDD band 20 (800 MHz)	Uplink	832	862	MHz	Module transmits
	Downlink	791	821	MHz	Module receives
Frequency range FDD band 5 (850 MHz)	Uplink	824	849	MHz	Module transmits
	Downlink	869	894	MHz	Module receives
Frequency range FDD band 8 (900 MHz)	Uplink	880	915	MHz	Module transmits
	Downlink	925	960	MHz	Module receives
Frequency range FDD band 4 (1700 MHz)	Uplink	1710	1755	MHz	Module transmits
	Downlink	2110	2155	MHz	Module receives
Frequency range FDD band 66 (1700 MHz)	Uplink	1710	1780	MHz	Module transmits
	Downlink	2110	2200	MHz	Module receives
Frequency range FDD band 3 (1800 MHz)	Uplink	1710	1785	MHz	Module transmits
	Downlink	1805	1880	MHz	Module receives
Frequency range FDD band 2 (1900 MHz)	Uplink	1850	1910	MHz	Module transmits
	Downlink	1930	1990	MHz	Module receives
Frequency range TDD band 39 (1900 MHz)	Uplink	1880	1920	MHz	Module transmits
	Downlink	1880	1920	MHz	Module receives
Frequency range TDD band 34 (2000 MHz)	Uplink	2010	2025	MHz	Module transmits
	Downlink	2010	2025	MHz	Module receives
Frequency range FDD band 1 (2100 MHz)	Uplink	1920	1980	MHz	Module transmits
	Downlink	2110	2170	MHz	Module receives
Frequency range TDD band 40 (2300 MHz)	Uplink	2300	2400	MHz	Module transmits
	Downlink	2300	2400	MHz	Module receives
Frequency range TDD band 38 (2600 MHz)	Uplink	2570	2620	MHz	Module transmits
	Downlink	2570	2620	MHz	Module receives

[6] USB connected and suspended.
[7] USB connected and not suspended.

Parameter		Min.	Max.	Unit	Remarks
Frequency range TDD band 41 (2600 MHz)	Uplink	2496	2690	MHz	Module transmits
	Downlink	2496	2690	MHz	Module receives
Frequency range FDD band 7 (2600 MHz)	Uplink	2500	2570	MHz	Module transmits
	Downlink	2620	2690	MHz	Module receives

ADAM-R11 series modules include a UE Power Class 3 LTE transmitter (see Table 2), with RF Tx output power and characteristics as per 3GPP TS 36.521-1 [7], and one LTE Cat 1bis receiver compliant with 3GPP TS 36.521-1 [7], with LTE conducted receiver sensitivity performance described in Table 14.

Table 14: ADAM-R11 series LTE receiver sensitivity performance

Parameter	Min.	Typical	Max.	Unit	Remarks
Receiver input sensitivity Band 12 (700 MHz)		–107		dBm	Channel bandwidth = 1.4 MHz
		–101		dBm	Channel bandwidth = 5 MHz
		–99		dBm	Channel bandwidth = 10 MHz
Receiver input sensitivity Band 28 (700 MHz)		–104		dBm	Channel bandwidth = 3 MHz
		–102		dBm	Channel bandwidth = 5 MHz
		–96		dBm	Channel bandwidth = 20 MHz
Receiver input sensitivity Band 20 (800 MHz)		–102		dBm	Channel bandwidth = 5 MHz
		–96		dBm	Channel bandwidth = 20 MHz
Receiver input sensitivity Band 5 (850 MHz)		–107		dBm	Channel bandwidth = 1.4 MHz
		–101		dBm	Channel bandwidth = 5 MHz
		–98		dBm	Channel bandwidth = 10 MHz
Receiver input sensitivity Band 8 (900 MHz)		–109		dBm	Channel bandwidth = 1.4 MHz
		–103		dBm	Channel bandwidth = 5 MHz
		–100		dBm	Channel bandwidth = 10 MHz
Receiver input sensitivity Band 4 / 66 (1700 MHz)		–108		dBm	Channel bandwidth = 1.4 MHz
		–102		dBm	Channel bandwidth = 5 MHz
		–97		dBm	Channel bandwidth = 20 MHz
Receiver input sensitivity Band 3 (1800 MHz)		–107		dBm	Channel bandwidth = 1.4 MHz
		–101		dBm	Channel bandwidth = 5 MHz
		–96		dBm	Channel bandwidth = 20 MHz
Receiver input sensitivity Band 2 (1900 MHz)		–107		dBm	Channel bandwidth = 1.4 MHz
		–101		dBm	Channel bandwidth = 5 MHz
		–95		dBm	Channel bandwidth = 20 MHz
Receiver input sensitivity Band 39 (1900 MHz)		–102		dBm	Channel bandwidth = 5 MHz
		–97		dBm	Channel bandwidth = 20 MHz
Receiver input sensitivity Band 34 (2000 MHz)		–102		dBm	Channel bandwidth = 5 MHz
		–96		dBm	Channel bandwidth = 15 MHz
Receiver input sensitivity Band 1 (2100 MHz)		–104		dBm	Channel bandwidth = 5 MHz
		–98		dBm	Channel bandwidth = 20 MHz
Receiver input sensitivity Band 40 (2300 MHz)		–102		dBm	Channel bandwidth = 5 MHz
		–97		dBm	Channel bandwidth = 20 MHz
Receiver input sensitivity Band 41 (2600 MHz)		–102		dBm	Channel bandwidth = 5 MHz
		–97		dBm	Channel bandwidth = 20 MHz
Receiver input sensitivity Band 38 (2600 MHz)		–102		dBm	Channel bandwidth = 5 MHz
		–97		dBm	Channel bandwidth = 20 MHz
Receiver input sensitivity Band 7 (2600 MHz)		–102		dBm	Channel bandwidth = 5 MHz
		–96		dBm	Channel bandwidth = 20 MHz
Condition: 50 Ω, throughput > 95%, QPSK modulation, other settings as per clause 7.3EB of 3GPP TS 36.521-1 [7]					

4.2.5. ANT_DET pin

Table 15: ANT_DET pin characteristics as antenna detection function with AT+UANTR command

Parameter	Min.	Typical	Max.	Unit	Remarks
Output DC current pulse value		30		µA	Triggered by AT+UANTR command
Output DC current pulse time length		200		ms	Triggered by AT+UANTR command

Table 16: ANT_DET pin characteristics as Analog-to-Digital Converter (ADC) function with AT+UADC2 command

Parameter	Min.	Typical	Max.	Unit	Remarks
Resolution		12		Bits	
Input voltage range	0		1.2	V	
Input impedance		Hi-Z			

4.2.6. PWR_ON pin

Table 17: PWR_ON pin characteristics

Parameter	Min.	Typical	Max.	Unit	Remarks
Low-level input	0		0.5	V	
Pull-up resistance		50		kΩ	Integrated pull-up to VCC
PWR_ON low time	10			ms	Low time to trigger module switch on from power off mode
	10			ms	Low time to trigger module wake-up from deep sleep mode
	2.5			s	Low time to trigger module graceful switch off

4.2.7. RESET_N pin

Table 18: RESET_N pin characteristics

Parameter	Min.	Typical	Max.	Unit	Remarks
Low-level input	0		0.5	V	
Pull-up resistance		50		kΩ	Integrated pull-up to VCC
RESET_N low time	2.5			s	Low time to trigger module abrupt emergency reset
	20			ms	Low time to trigger module switch on from power off mode
	20			ms	Low time to trigger module wake-up from deep sleep mode

4.2.8. SIM pins

SIM interface electrical characteristics fulfil related specifications. The values in Table 19 are for information only.

Table 19: SIM pins characteristics

Parameter	Min.	Typ.	Max.	Unit	Remarks
VSIM supply output		1.8		V	VSIM, with external 1.8 V SIM type
		3.0		V	VSIM, with external 3.0 V SIM type
Low-level input	-0.3		0.2*VSIM	V	
High-level input	0.7*VSIM		VSIM+0.3	V	
Low-level output		0		V	
High-level output		VSIM		V	
Internal pull-up resistor on SIM_IO		4.7		kΩ	Internal pull-up to VSIM supply
Clock frequency on SIM_CLK		3.375		MHz	

4.2.9. I2C pins

I2C lines (**SCL** and **SDA**) are compliant to the I2C-bus standard mode specification. See the I2C-bus specification [10] for detailed electrical characteristics.

Table 20: I2C pins 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	-0.3		0.63	V	
High-level input	1.17		1.98	V	
Low-level output		0.0		V	
Internal pull-up resistance		4.7		kΩ	

4.2.10. Generic Digital Interfaces pins

Table 21: GDI pins characteristics

Parameter	Min	Typical	Max	Unit	Remarks
Internal supply for GDI domain		1.8		V	Digital I/O interfaces supply (V_INT)
Low-level input	-0.3		0.63	V	
High-level input	1.17		1.98	V	
Low-level output		0.0		V	
High-level output		1.8		V	
Internal pull-up resistance	55		121	kΩ	Internal active pull-up, when enabled
Internal pull-down resistance	51		169	kΩ	Internal active pull-down, when enabled

4.2.11. USB 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 [9] for detailed electrical characteristics. The values in Table 22 related to USB 2.0 high-speed physical layer specifications are for information only.

Table 22: USB pins characteristics

Parameter	Min.	Typical	Max.	Unit	Remarks
VUSB_DET pin, High-level input	3.3	5.0	5.2	V	Voltage needed for valid USB detection
High-speed squelch detection threshold	100		150	mV	Input differential signal amplitude
High speed disconnect detection threshold	525		625	mV	Input differential signal amplitude
High-speed data signaling input	–50		500	mV	Common mode voltage range
High-speed idle output level	–10		10	mV	
High-speed data signaling output	360		440	mV	High level
	–10		10	mV	Low level
Chirp J level	700		1100	mV	Output differential voltage
Chirp K level	–900		–500	mV	Output differential voltage

4.2.12. Smart temperature supervisor

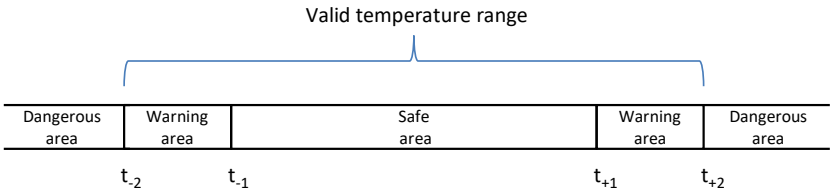

Figure 3: Temperature range and limits

Table 23: Thresholds definition for the "Smart temperature supervisor" feature on the ADAM-R11 series modules

Symbol	Parameter	Temperature
t_{-2}	Low temperature shutdown	–40 °C
t_{-1}	Low temperature warning	–30 °C
t_{+1}	High temperature warning	+80 °C
t_{+2}	High temperature shutdown	+97 °C

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

4.3. Parameters for ATEX applications

This section provides useful parameters and information to integrate ADAM-R11 series modules in applications intended for use in areas with potentially explosive atmospheres (ATEX), including:

- Total internal capacitance and inductance of the modules, considering internal parts tolerance worst-case (see Table 24)
- Maximum RF output power at the antenna (**ANT**) pin of the modules, as Power Class 3 User Equipment for the LTE bands, considering tune-up tolerance worst-case (see Table 25)

For any device intended for use in potentially explosive atmospheres, check the detailed requisites on the pertinent normative for the application, as for example the IEC 60079-0 [11], IEC 60079-11 [12], and IEC 60079-26 [13] standards. The requirements must be fulfilled according to the exact applicable standards.

The certification of the application device that integrates an ADAM-R11 series module and the compliance of the application device with all the applicable certification schemes, directives and standards required for use in potentially explosive atmospheres are under the sole responsibility of the application device manufacturer.

Table 24: ADAM-R11 series maximum total internal capacitance and maximum total internal inductance

Module	Parameter	Description	Value	Unit
ADAM-R11001D	Ci	Maximum total internal capacitance	43.5	µF
	Li	Maximum total internal inductance	1.6	µH
ADAM-R11801D	Ci	Maximum total internal capacitance	43.5	µF
	Li	Maximum total internal inductance	1.5	µH

Table 25: ADAM-R11 series maximum RF output power

Module	Parameter	Description	Value	Unit
All	ANT Pout	Maximum RF output power from ANT pin	24	dBm

The modules do not contain internal blocks that increase the input voltage (such as step-up, duplicators, or boosters) except for the antenna (**ANT**) pin, for which the maximum RF output power shown in Table 25.

5. Mechanical specifications

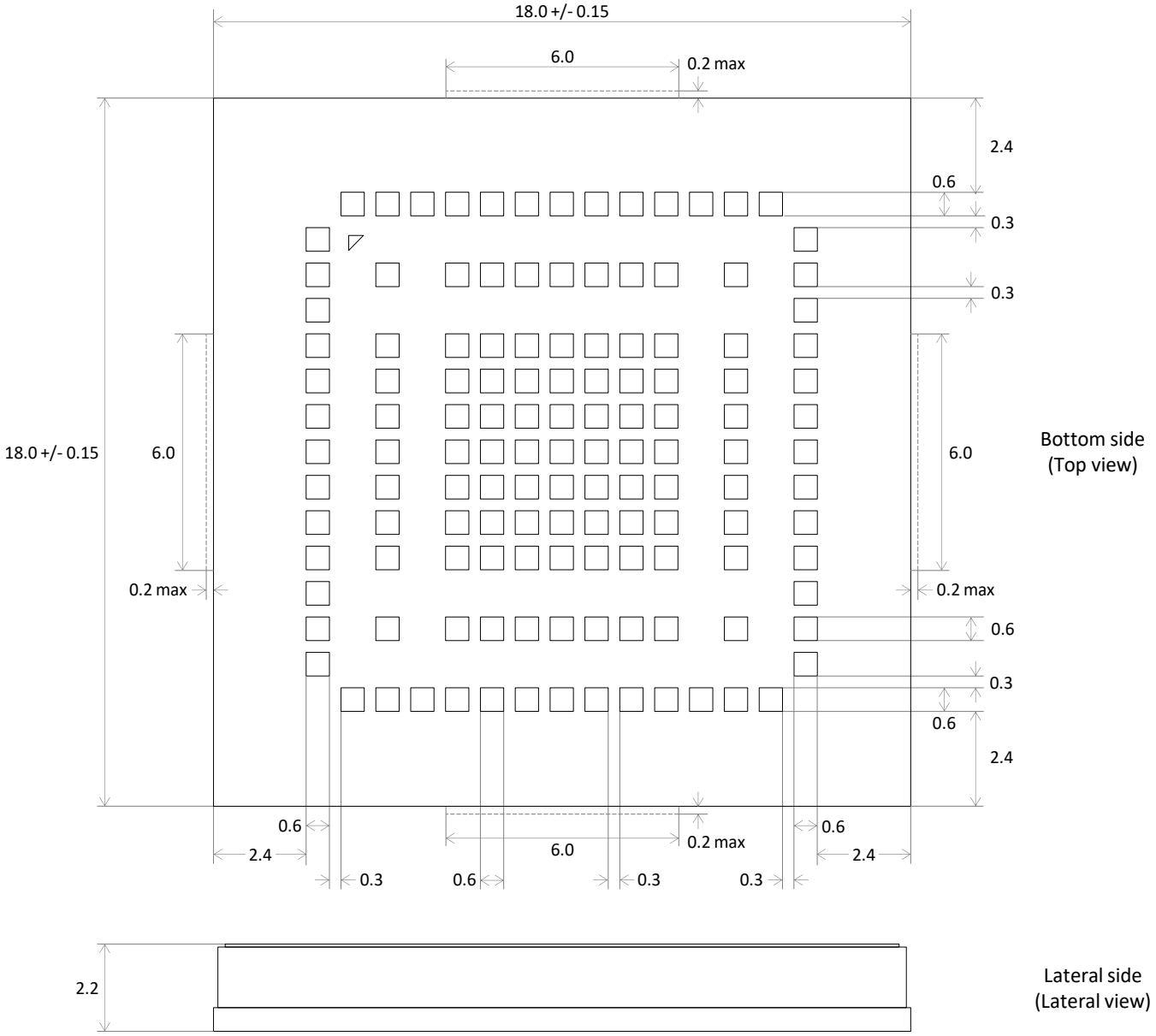

Figure 4: ADAM-R11 series dimensions, typical values [mm]

Actual geometries of the pads may depend on related implementation of the solder resist mask openings and the underlying copper layer.

Actual side-to-side dimensions of the modules may exceed the corner-to-corner ones, as shown in Figure 4, due to some possible residual present after the PCB panel cutting process.

The weight of an ADAM-R11 series module is 1.5 g typical.

6. Qualification and approvals

6.1. Reliability tests

Reliability tests for the ADAM-R11 series modules are executed according to proprietary qualification policy for standard grade products.

6.2. Approvals

ADAM-R11 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).

ADAM-R11 series modules are RoHS 3 compliant.

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

Table 26: ADAM-R11 series main certification approvals summary

Certification	ADAM-R11001D	ADAM-R11801D
CE Europe	●	●
FCC United States	●	
ISED Canada	●	
NCC Taiwan	●	●
ANATEL Brazil	●	●

For the complete list of achieved or planned approvals, and for specific details on all certifications available for all ADAM-R11 series module ordering numbers, including related certificates of compliancy, please contact us.

7. Product handling & soldering

7.1. Packaging

ADAM-R11 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 product packaging reference guide [3].

7.1.1. Reels

ADAM-R11 series modules are delivered in quantities of 500 pieces on a reel, using reel type A5, which is illustrated in Figure 5 and in the product packaging reference guide [3]. Quantities of less than 500 pieces are also available. Contact us for more information.

7.1.2. Tapes

ADAM-R11 series modules are delivered on a tape come on reel. Figure 5 illustrates the characteristics of the reel, the tape, and the orientation of the modules on the tape.

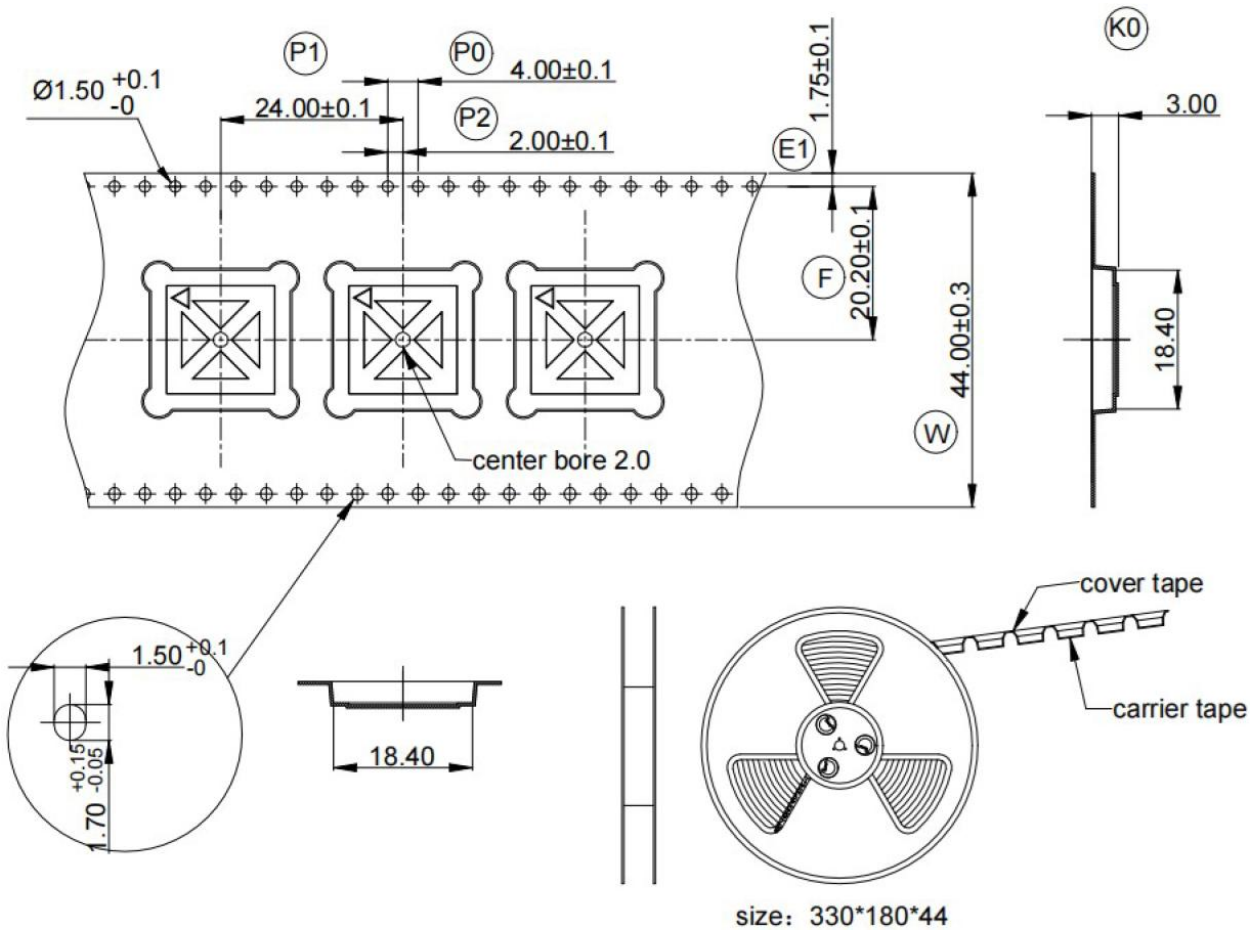

Figure 5: ADAM-R11 series modules' tape and reel (all dimensions in mm)

7.2. Moisture sensitivity levels

⚠ The modules are moisture sensitive devices (MSD) in accordance to the related IPC/JEDEC specifications.

The Moisture Sensitivity Level (MSL) relates to the packaging and handling precautions required. ADAM-R11 series modules are rated at MSL level 4. For more information regarding moisture sensitivity levels, labeling, storage and drying, see the product packaging reference guide [3].

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

7.3. ESD precautions

⚠ The modules contain highly sensitive electronic circuitry and are Electrostatic Sensitive Devices (ESD). Handling ADAM-R11 series modules without proper ESD protection may destroy or damage them permanently.

⚠ Ensure ESD precautions are implemented during handling of the module.

Electrostatic discharge (ESD) is the sudden and momentary electric current that flows between two objects at different electrical potentials caused by direct contact or induced by an electrostatic field. The term is usually used in the electronics and other industries to describe momentary unwanted currents that may cause damage to electronic equipment.

Table 8 details the maximum ESD ratings of the ADAM-R11 series modules.

Proper ESD handling and packaging procedures must be applied throughout the processing, handling and operation of any application that incorporates ADAM-R11 series modules.

ESD precautions should be appropriately implemented on the application board where the module is mounted.

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

7.4. Reflow soldering

Reflow profiles are to be selected according to our recommendations, as illustrated in detail in the system integration manual [2].

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

8. Labeling and ordering information

8.1. Product labeling

Figure 6 provides an illustrative example of ADAM-R11 series modules' labels, which include important product information, as for example: the pin 1 indicator, product name, IMEI number, production date, certification info, and production country of the module.

Figure 6: Illustrative examples of ADAM-R11 series modules' label

8.2. Explanation of codes

Three different product code formats are used. The **Product name** is used in documentation such as this data sheet and identifies all the products, independent of packaging and quality grade. The **Ordering code** includes options and quality, while the **Type number** includes the minor product versions. Table 27 details these 3 different formats and Table 28 explains the parts of the product code.

Table 27: Product code formats

Format	Structure
Product name	PPPP-TGVV(L)(F)
Ordering code	PPPP-TGVV(L)(F)-MMQ
Type number	PPPP-TGVV(L)(F)-MMQ-XX

Table 28: Part identification code

Code	Meaning	Example
PPPP	Form factor	ADAM
TG	Platform (Technology and Generation) • Dominant technology: G = GSM, U = UMTS, C = CDMA, N = NB-IoT (LTE Cat NB1/NB2), R = LTE low data rate (Cat M1, Cat 1, Cat 1bis), L = LTE high data rate (Cat 3 and above) • Generation: 1…99	R11
VV	Variant function set based on the same platform: 00…99	00
(L)	LTE category (optionally indicated): M = Cat M1, 1 = Cat 1 or Cat 1bis, 4 = Cat 4, …	1
(F)	Additional features (optional): D = data-only, …	D
MM	Major product version: 00…99	00
Q	Product grade: C = standard, B = professional, A = automotive	C
XX	Minor product version: 00…99	Default value: 00

8.3. Ordering information

Table 29: Product ordering code

Ordering No.	Product
ADAM-R11001D-00C	LTE Cat 1bis module Designed for global operation, supporting LTE bands 1, 2, 3, 4, 5, 7, 8, 12, 20, 28, 34, 38, 39, 40, 41, 66 18.0 x 18.0 mm, 500 pieces/reel
ADAM-R11801D-00C	LTE Cat 1bis module Mainly designed for operation in EMEA / APAC / Brazil regions, supporting LTE bands 1, 3, 5, 7, 8, 20, 28 18.0 x 18.0 mm, 500 pieces/reel

Appendix

A Glossary

Abbreviation	Definition
3GPP	3rd Generation Partnership Project
ACMA	Australian Communications and Media Authority
ADC	Analog to Digital Converter
ANATEL	Agência Nacional de Telecomunicações - National Telecommunications Agency (Brazil)
APAC	Asia-Pacific
ATEX	Atmospheres Explosive
BPSK	Binary Phase Shift Keying modulation
Cat	Category
cDRX	Connected mode Discontinuous Reception
CE	European Conformity
CMOS	Complementary Metal-Oxide-Semiconductor
CTS	Clear To Send
DC	Direct Current
DCD	Data Carrier Detect
DL	Down Link (Reception)
DRX	Discontinuous Reception
DSR	Data Set Ready
DSSS	Direct Sequence Spread Spectrum
DTE	Data Terminal Equipment
DTR	Data Terminal Ready
eDRX	Idle mode Extended Discontinuous Reception
EMEA	Europe, Middle-East, Africa
ERS	External Reset Signal
ESD	Electrostatic Discharge
FCC	Federal Communications Commission United States
FDD	Frequency Division Duplex
FOTA	Firmware update Over-The-Air
FTP	File Transfer Protocol
GCF	Global Certification Forum
GDI	Generic Digital Interface
GITEKI	Gijutsu kijun tekigō shōmei – technical standard conformity certification (Japan)
GND	Ground
GPIO	General Purpose Input/Output
GSMA	GSM Association
HDLC	High-level Data Link Control
Hi-Z	High impedance
HTTP	HyperText Transfer Protocol
ID	Identifier
IEC	International Electrotechnical Commission
I2C	Inter-Integrated Circuit
I2S	Inter-IC Sound
I/O	Input/Output
IEEE	Institute of Electrical and Electronics Engineers

Abbreviation	Definition
IMEI	International Mobile Equipment Identity
IMSI	International Mobile Subscriber Identity
ISED	Innovation, Science and Economic Development Canada
ISO	International Organization for Standardization
ITU	International Telecommunications Union
LGA	Land Grid Array
LTE	Long-Term Evolution
M2M	Machine to Machine
MCC	Mobile Country Code
MNO	Mobile Network Operator
MQTT	Message Queuing Telemetry Transport
N/A	Not Applicable
NCC	National Communications Commission Taiwan
No	Number
PC	Personal Computer
PMU	Power Management Unit
POS	Power On Signal
PSM	Power Saving Mode
PTCRB	PCS Type Certification Review Board
PTW	Page Time Window
QPSK	Quadrature Phase Shift Keying modulation
RAT	Radio Access Technology
RCM	Regulatory Compliance Mark (Australia)
RED	Radio Equipment Directive (European Union)
RF	Radio Frequency
RI	Ring Indicator
RIL	Radio Interface Layer
RTC	Real Time Clock
RTS	Request To Send
Rx	Reception
SAW	Surface Acoustic Wave
SCL	Serial Clock
SDA	Serial Data
SIM	Subscriber Identity Module
SSL	Secure Socket Layer
TCP	Transmission Control Protocol
TDD	Time Division Duplex
TLS	Transport Layer Security
TS	Technical Specification
Tx	Transmission
UART	Universal Asynchronous Receiver/Transmitter
UDP	User Datagram Protocol
UE	User Equipment
UL	Uplink (Transmission)
USB	Universal Serial Bus
VSWR	Voltage Standing Wave Ratio

Related documentation

Visit Trasna cellular IoT modules support page, for the full list of documentation.

[1] ADAM-R11 series AT commands manual, TRSC-686885345-2160
[2] ADAM-R11 series system integration manual, TRSC-437461976-171
[3] Product packaging reference guide, TRSC-437461976-3901
[4] 3GPP TS 27.007 – AT command set for User Equipment (UE)
[5] 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)
[6] 3GPP TS 27.010 – Terminal Equipment to User Equipment (TE-UE) multiplexer protocol
[7] 3GPP TS 36.521-1 – Evolved Universal Terrestrial Radio Access; User Equipment conformance specification; Radio transmission and reception; Part 1: Conformance Testing
[8] ITU-T Recommendation V24 – List of definitions for interchange circuits between Data Terminal Equipment (DTE) and Data Connection Equipment (DCE)
[9] Universal Serial Bus Revision 2.0 specification, https://www.usb.org/
[10] I2C-bus specification and user manual – UM10204 – NXP semiconductors, https://www.nxp.com/docs/en/user-guide/UM10204.pdf
[11] IEC 60079-0 - Explosive atmospheres, part 0: equipment general requirements
[12] IEC 60079-11 - Explosive atmospheres, part 11: equipment protection by intrinsic safety 'i'
[13] IEC 60079-26 - Explosive atmospheres, part 26: equipment with EPL Ga

Revision history

Revision	Date	Name	Comments
R01	15-Sep-2025	sses	Initial release.
R02	12-Nov-2025	sses	Updated disclosure restriction to Public. Updated setting of UART interfaces' HW flow control input pins to internal pull-down. Added DTLS support. Added parameters for ATEX applications. Minor clarifications, corrections, editorial and template changes.
R03	11-Dec-2025	sses	Updated ADAM-R11001D-00C / ADAM-R11801D-00C product status to Engineering Sample. Added faster shutdown and reset. Added Smart temperature supervisor characteristics. Minor clarifications, editorial and template changes.
R04	24-Apr-2026	sses	Updated ADAM-R11001D-00C / ADAM-R11801D-00C product status to Initial Production. Remarked no function supported by current product version on RFCTRL3 and RFCTRL4 pins. Revised ultra-low power deep-sleep mode description. Minor editorial and template changes.

Contact details

For any questions on this document, please contact Trasna on:

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