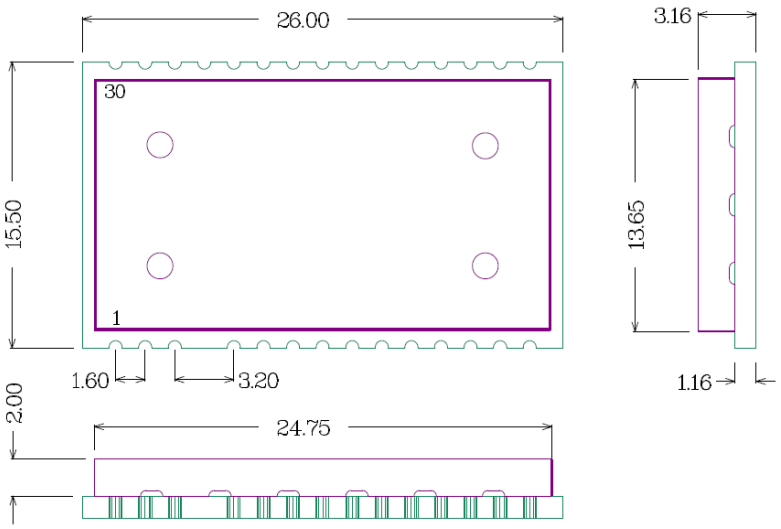
WIRELESS M-BUS
868 MHz BAND TRX MODULE

Product Code: **32001324**

PRODUCT SUMMARY:

The 32001324 is a Wireless M-Bus transceiver operating in the 868 MHz SRD Band.
Thanks to its small LCC form factor (15 x 25 mm only) and its low power consumption, this module allows the implementation of highly integrated low power (battery operated) solutions for water, gas, heat or electricity metering applications, both on meter or concentrator devices.
The module supports various operating modes (S, T, R, C) to meet the requirements of one-way and two-way data communication, in stationary and mobile systems.
The embedded stack implemented according to EN13757-4 Standard provides the physical access to the Wireless M-Bus communication.
SPI and UART allow integration flexibility and easy development of customer products.
The module meets all the requirements in the industrial temperature range -40 / 85 °C.
Developed according to **ETSI EN 300 220** European Standard.
The module meets with the Radio Equipment Directive **(RED) 2014/53/EU.**
Compliant with **REACH** and **RoHS** directives.

MECHANICAL CHARACTERISTICS



ALL DIMENSIONS ARE IN MILLIMETERS
GENERAL TOLERANCE +/-0.1MM

MIPOT S.P.A.
Via Corona, n. 5
(Zona Ind.)
34071 Cormons (GO)
Italy
Tel. +39 0481 630200 r.a.
Fax +39 0481 62387
mipot@mipot.com

PIN DESCRIPTION

Pin	Name	Pin Type	Description	Notes
1	GND	Power Supply	Ground (0 V)	
2	RF I/O	A IN/OUT	Tx: output RF / Rx: input RF	3
3	GND	Power Supply	Ground (0 V)	
5	INTERFACE_SELECTION	Data IN	Select UART / SPI. Input Pull-Up	5
6	/DATA_INDICATE	Data OUT	Data Indicate Pin	
7	NSS	Data IN	SPI Interface	
8	SCLK	Data IN	SPI Interface	
9	MISO	Data OUT	SPI Interface	
10	MOSI	Data IN	SPI Interface	
11	UART TX	Data OUT	UART TX Pin	
12	UART RX	Data IN	UART RX Pin	
13	CTS	Data IN	UART CTS	
14	RTS	Data OUT	UART / SPI RTS	
15	GND	Power Supply	Ground (0 V)	
16	GND	Power Supply	Ground (0 V)	
17	Vcc	Power Supply	Power Supply	
18	SWDAT	NC	Reserved for programming – do not connect	
19	SWCLK	NC	Reserved for programming – do not connect	
20	SWV	NC	Reserved for programming – do not connect	
21	NRST	Data IN	Reset. Input Pull-Up	
22	NU	NC	Not Used Pin – do not connect	
23	NU	NC	Not Used Pin – do not connect	
24	NU	NC	Not Used Pin – do not connect	
25	NU	NC	Not Used Pin – do not connect	
26	NU	NC	Not Used Pin – do not connect	
27	NU	NC	Not Used Pin – do not connect	
28	NU	NC	Not Used Pin – do not connect	
29	NU	NC	Not Used Pin – do not connect	
30	GND	Power Supply	Ground (0 V)	

ABSOLUTE MAXIMUN RATINGS

Transceiver Power Supply Vcc (pin 15)	-0.3 ÷ 3.8 V
Max. Voltage allowed on input pins	Vcc
Storage Temperature (excl. package)	-40 ÷ 85 °C
Storage Temperature (incl. package)	-10 ÷ 65 °C
Operating Temperature	-40 ÷ 85 °C
Radio Frequency Input, pin 2:	10 dBm

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ELECTRICAL CHARACTERISTICS @ 25°C TEMPERATURE

Parameter	*Min.*	*Typ.*	*Max.*	*Unit*	*Notes*
Supply Voltage (Vcc)	2.1	3.0	3.6	V	
Current drain Tx mode	-	37	-	mA	1
Current drain Rx mode	-	25	-	mA	1
Current drain Sleep UART	-	1.6	-	µA	1
Current drain Sleep SPI	-	90	-	µA	1
Operating frequency range	868.03	-	868.95	MHz	2
Sensitivity mode S	-	-105	-	dBm	3,6
Sensitivity mode T	-	-103	-	dBm	3,6
Sensitivity mode R	-	-112	-	dBm	3,6
Sensitivity mode C	-	-103	-	dBm	3,6
Output Power (on 50 Ω load)	-	13	-	dBm	3
Modulation		2-FSK / GFSK			2
UART Interface Data rate	-	-	115.2	kbps	
SPI Interface Data rate	0.125	1	8	MHz	
SPI Delay between Bytes	8	-	-	µs	4
EEPROM Write Cycling	100000	-	-	cycles	
INTERFACE_SELECTION Pull-up	30	45	60	kΩ	4,5
NRST Pull-up	30	45	60	kΩ	

Note 1: Current consumption measured at power supply level of 3.3 V.
Note 2: According to EN13757-4, modes S, T, R, C.
Note 3: All RF parameters are measured with Input/output (pin 2) connected to 50 Ω impedance signal source or load.
Note 4: SPI minimum delay between single bytes (from the end of byte to the start of next byte).
Note 5: INTERFACE_SELECTION input pin selects UART (1) or SPI (0) interface.
Note 6: Some M-Bus modes require response timings which cannot be satisfied with an external host controller due to long transmission times on the wired interface.

UART SPI INTERFACE SELECTION

At start-up time, the Module reads INTERFACE_SELECTION input pin state. Should this pin be left unconnected or set to high state then the UART interface is selected; on the other hand, if the pin is set to low state, the SPI interface is selected.

INTERFACE DATA FRAME FORMAT

Physical SPI

Used Lines:

Line	**Description**
MISO	SPI, Master Input Slave Output
MOSI	SPI, Master Output Slave Input
SCLK	SPI Clock
/SS	SPI Slave Select
/DATA_INDICATE	Module Digital Output, Indicate WM-Bus Frame Received
/RTS	Module Digital Output, 0 = Module Ready

SPI Clock IDLE LOW, the single bits are provided on the falling edge from SCLK (or STE) and can be read on the rising edge. The communication is always initiated by master.

MIPOT S.P.A.
Via Corona, n.5
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mipot@mipot.com

Host can configure the module through SPI interface and can also receive and transmit WM-Bus frame data.

The structure of the frame is the following:

HEADER	CMD	LENGTH	Payload (n Bytes)	Checksum

Where:
HEADER = 0xAA
CMD = Command code to module, see following table.
LENGTH = Payload length
Checksum = XOR of all preceding bytes

Each command from the host invokes an answer from the module in the same format. The answer to the host has the CMD field equal to host request OR 0x80.
When the module receives a command and the checksum is correct then the module sets /RTS pin to HIGH, and when answer is ready it sets /DATA_INDICATE LOW. Afterwards host microcontroller can set /SS LOW and drive SPI Clock line to read the answer. A configurable timeout is provided (DATA_INDICATE_TIMEOUT_LSB). If host microcontroller doesn't read the answer, and timeout is expired the module releases /RTS and /DATA_INDICATE.

NOTE FOR RF_AUTOSLEEP ENABLED (RF_AutoSleep = 1):
If RF_AutoSleep parameter is set to 1 (AutoSleep Enabled) host microcontroller has to wait 300us after /SS LOW to drive SPI clock in order to allow the module to wake up from sleep state. In alternative host microcontroller has to send a dummy byte, wait 300 us and then send the command.

Physical UART

Used Lines:

Line	**Description**	**Notes**
TX UART	Uart Tx pin. Output Push-pull.	
RX UART	Uart Rx pin. Input Pull-up.	Pull-up equivalent resistor 30 to 60 kΩ.
CTS	Uart CTS pin. Input Pull-down.	Pull-down equivalent resistor 30 to 60 kΩ.
RTS	Uart RTS pin. Output Push-pull.	
/DATA_INDICATE	Module Digital Output, indicates WM-Bus Frame Received.	
/SS	Input to wake up module when sleep state is enabled. Input Pull-up.	Pull-up equivalent resistor 30 to 60 kΩ.

Default UART configuration is 115200 8n1.
Frame structure is the same of the SPI interface. The main difference in communication occurs when the module transfers a received WM-Bus frame to the host microcontroller. In this case, the slave module sets /DATA_INDICATE to low and then DATA_INDICATE_TIMEOUT sends the UART message containing the WM-Bus frame message. So, in UART interface, DATA_INDICATE_TIMEOUT has a different meaning and represents the time between /DATA_INDICATE pin goes low and the start of UART transmission.

***NOTE FOR RF_AUTOSLEEP ENABLED (RF_AutoSleep = 1)**:*
In UART interface, /SS pin has the function to wake up the module when RF_AUTOSLEEP is enabled.
If RF_AUTOSLEEP parameter has set to 1 (AutoSleep Enabled), host microcontroller shall wait 300 µs after /SS LOW before to send an UART message, in order to allow the module wake up from the sleep state.

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Italy
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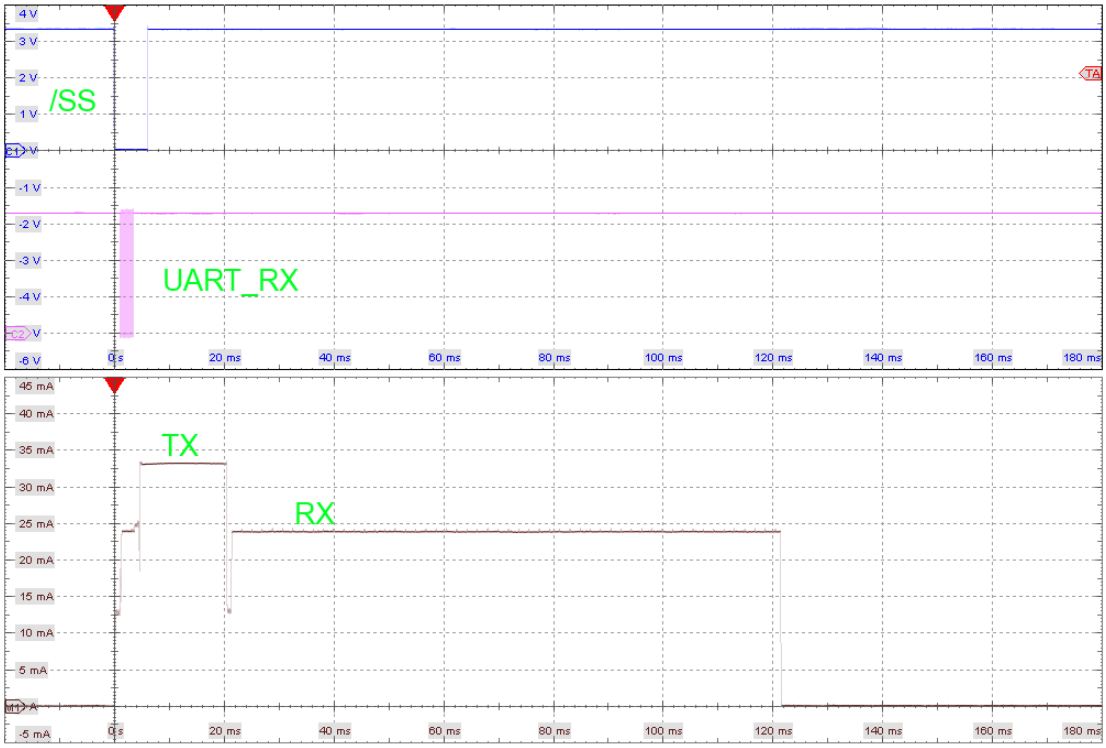
Fax +39 0481 62387
mipot@mipot.com

Example of Sleep Signal Flow:



1) Host controller sets NSS to 0 in order to wake-up the module.
2) After 300 µs, host controller sends via UART the W-MBus message.
3) Module starts RF transmission.
4) At the end of the transmission, the module is set in reception mode for the time set through the Rx_Window parameter (100 ms in the example).

Data Format

Command (CMD)	Value	Description
RESET_CMD	0x30	SW Reset
FACTORY_RESET_CMD	0x31	Restore EEPROM to default values
SET_MODE_CMD	0x32	Change Wm-BUS mode.
EEPROM_WRITE_CMD	0x33	Write EEPROM parameter
EEPROM_READ_CMD	0x34	Read EEPROM parameter
TX_MSG_CMD	0x35	Transmission of Wm-Bus Message
RX_MSG_IND	0x36	Indicate reception of Wm-Bus Message
GET_FW_VERSION_CMD	0x37	Get FW Version
GET_SERIALNO_CMD	0x38	Get Serial Number stored in the Module
GET_RSSI_CMD	0x39	Get last RSSI value
SET_C_FIELD_CMD	0x40	Set C-Field Wm-BUS value.

RESET_CMD (0x30)
Host: 0xAA, 0x30, 0x00, 0x9A
Reply: 0xAA, 0xB0, 0x01, status, cks
Status: 0x00: success
0xFF: failure

FACTORY_RESET_CMD (0x31)
Host: 0xAA, 0x31, 0x00, 0x9B
Reply: 0xAA, 0xB1, 0x01, status, cks
Status: 0x00: success
0xFF: failure

MIPOT S.P.A.
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Italy
Tel.+39 0481 630200 r.a.
Fax +39 0481 62387
mipot@mipot.com

SET_MODE_CMD (0x32)
Host: 0xAA, 0x32, 0x02, Mem_Type, mode, cks
Reply: 0xAA, 0xB2, 0x01, status, cks
Status: 0x00: success
0xFF: failure
Mode: WM-bus mode
Mem_Type: 0x00 Set value in RAM memory
0xFF Set value in EEPROM memory

EEPROM_WRITE_CMD (0x33)
Host: 0xAA, 0x33, Length, Start Address, <Data>, cks
Reply: 0xAA, 0xB3, 0x01, status, cks
Status: 0x00: success
0xFF: failure
Note: Invalid data will not be stored in EEPROM.

EEPROM_READ_CMD (0x34)
Host: 0xAA, 0x34, 0x02, Start Address, Number of bytes, cks
Reply: 0xAA, 0xB4, Length, Status, Data, cks
Status: 0x00: success, Data contains EEPROM values
0xFF: failure, Data is empty and Length is equal to 1

TX_MSG_CMD (0x35)
Host: 0xAA, 0x35, Length, <Payload>, cks
Reply: 0xAA, 0xB5, 0x01, status, cks
Status: 0x00: success (SPI transfer OK).
0xFF: failure

The content of Payload depends on Block1_From_Module_Enable field as following:

If Block1_From_Module_Enable = 0:

Block1 (9 Bytes)	CI Field (1 Byte)	Payload (n Bytes)

If Block1_From_Module_Enable = 1:

CI Field (1 Byte)	Payload (n Bytes)

RX_MSG_IND (0x36)
There are two cases:
When module receives a valid WM-BUS frame then the module sets /DATA_INDICATE pin low and then if polled from master sends on MISO line the following frame:

If RSSI_Enable = 0:

0xAA	0x36	Length (n+10)	Block1 (9 Bytes)	CI Field (1 Byte)	Payload (n Bytes)	Checksum (1 Byte)

If RSSI_Enable =1:

0xAA	0x36	Length (n+11)	Block1 (9 Bytes)	CI Field (1 Byte)	Payload (n Bytes)	RSSI (1 Byte)	Checksum (1 Byte)

In this configuration and if WM-Bus selected mode has a frame format A then the WM-BUS maximum length is limited to 254 bytes (SPI Maximum length – 1).

GET_SERIALNO_CMD (0x38)
Host: 0xAA, 0x38, 0x00, 0x92
Reply: 0xAA, 0xB8, 0x04, SN0, SN1, SN2, SN3, cks

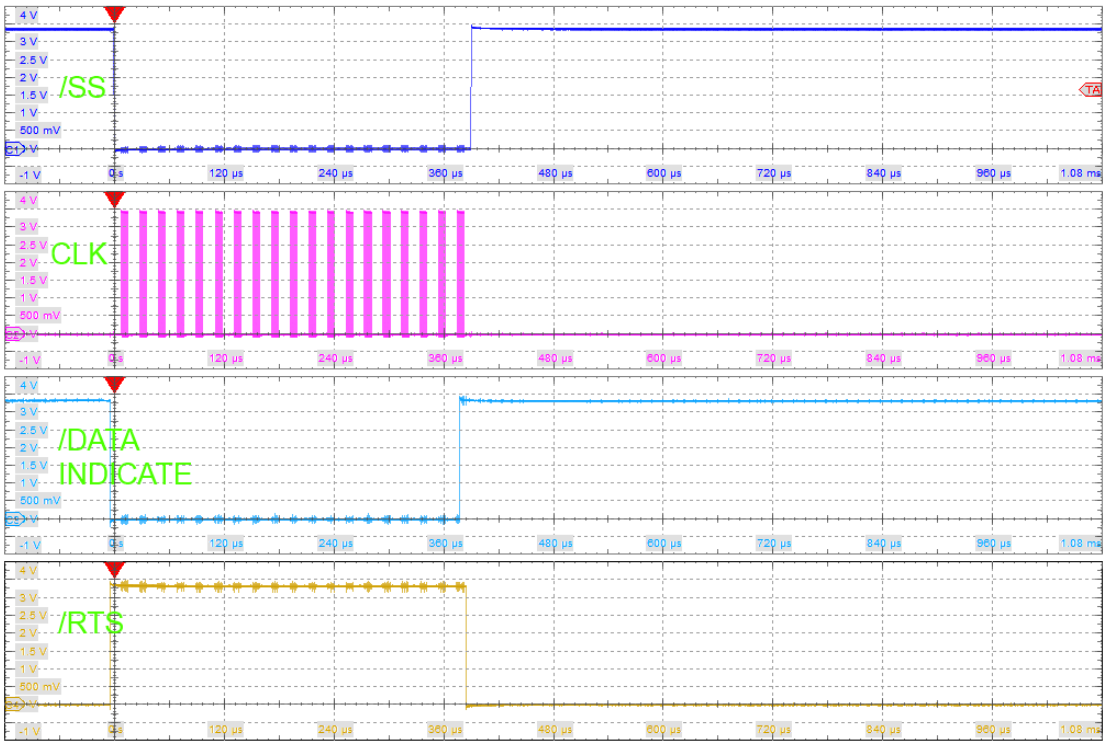
GET_RSSI_CMD (0x39)
Host: 0xAA, 0x39, 0x00, 0x93
Reply: 0xAA, 0xB9, 1, RSSI, cks

SET_C_FIELD_CMD (0x40)
Host: 0xAA, 0x40, 0x02, Mem_Type, C-field, cks
Reply: 0xAA, 0xC0, 0x01, status, cks
Status: 0x00: success
0xFF: failure
C-field: C-Field value
Mem_Type: 0x00 Set value in RAM memory
0xFF Set value in EEPROM memory

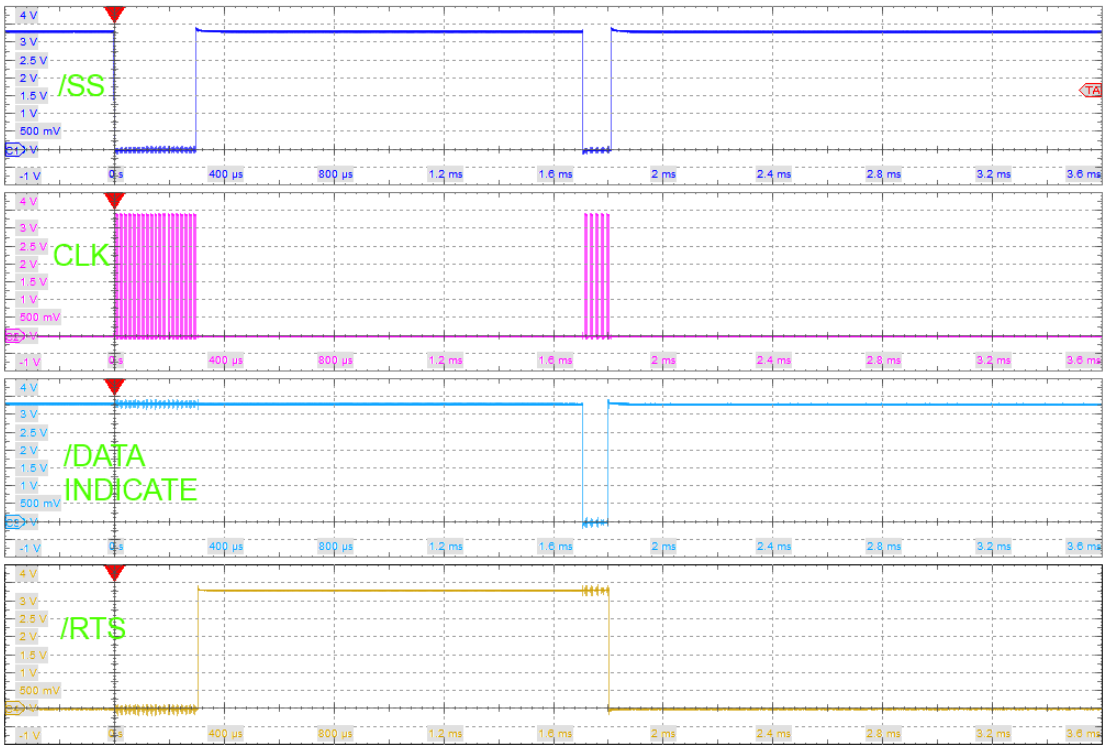
MIPOT S.P.A.
Via Corona, n. 5
(Zona Ind.)
34071 Cormons (GO)
Italy
Tel. +39 0481 630200 r.a.
Fax +39 0481 62387
mipot@mipot.com

Detailed Signal Flow

Example of SPI Data Reception



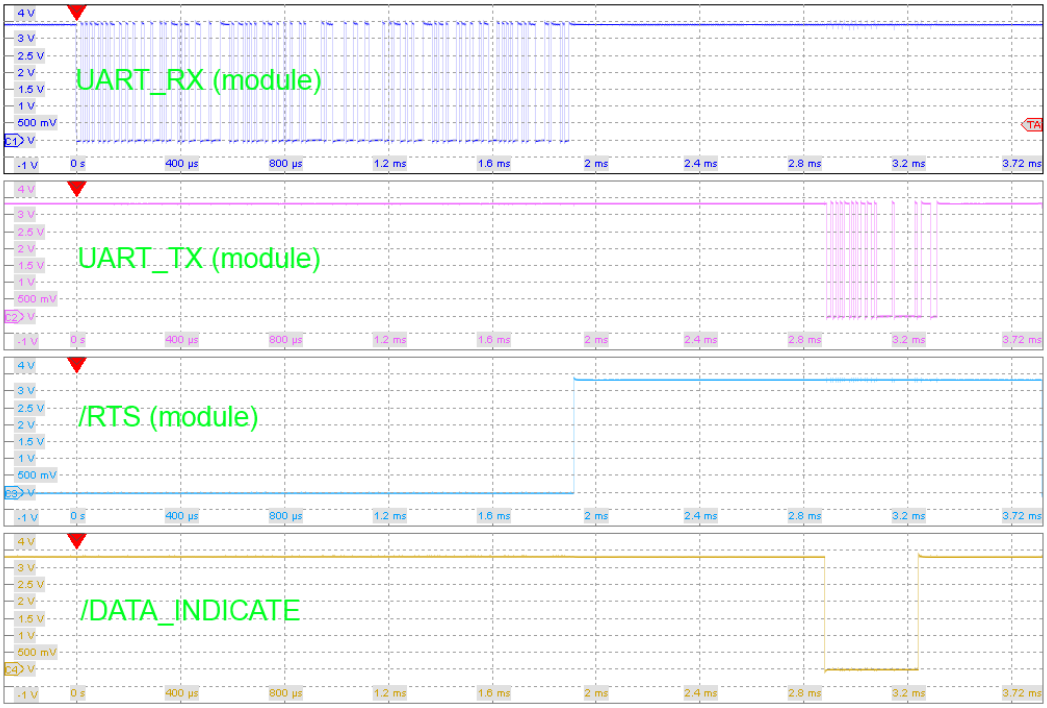
Example of SPI Command exchange



MIPOT S.P.A.
Via Corona, n. 5
(Zona Ind.)
34071 Cormons (GO)
Italy
Tel. +39 0481 630200 r.a.
Fax +39 0481 62387
mipot@mipot.com

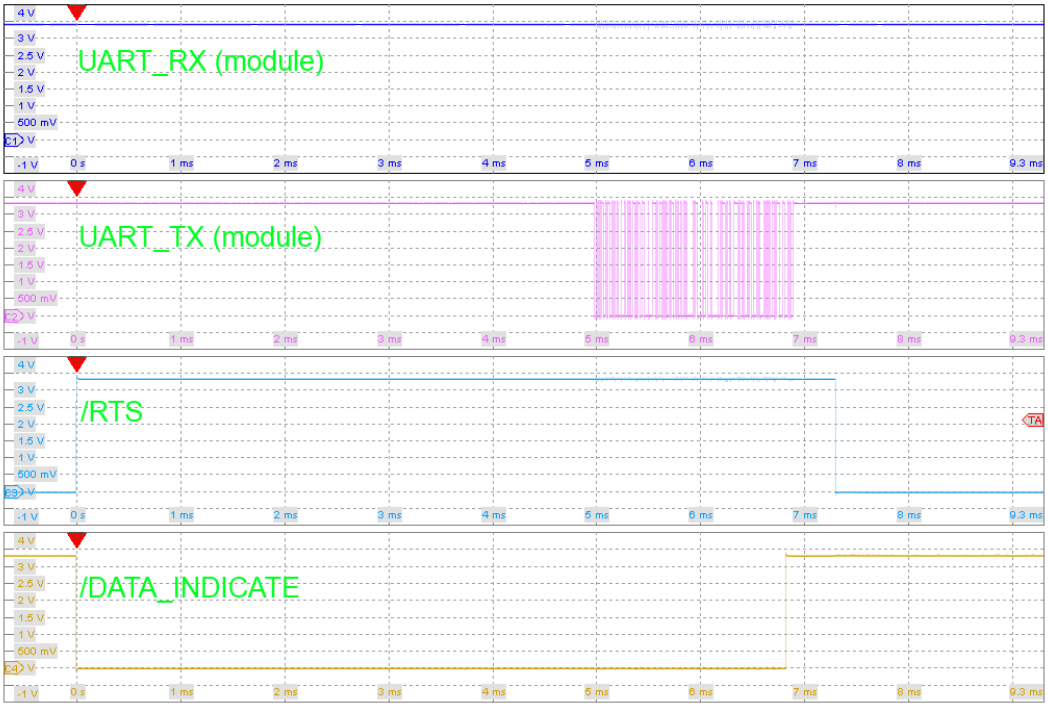
Example of UART TX command session:

Frame sent by Host: AA351244AE0C7856341201078C2027780B134365872F
Module response: AAB501001E



Example of UART RX Command session:

Frame sent by module to host after RF frame reception:
AA361244AE0C7856341201078C2027780B134365872C



MIPOT S.P.A.
Via Corona, n. 5
(Zona Ind.)
34071 Cormons (GO)
Italy
Tel. +39 0481 630200 r.a.
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mipot@mipot.com

MODULE CONFIGURATION

MBUS Radio Parameters

Parameter	Description	Address	Values Range	Default	Notes
WM_BUS_Mode	WM-BUS Mode	0x00	0x00 – 0x0E	0 = S2 Short preamble	0x00 = S2 Short preamble 0x01 = S2 Long preamble 0x02 = S1 0x03 = S1-m 0x04 = T1 meter 0x05 = T2 meter 0x06 = T2 other 0x07 = R2 meter 0x08 = R2 other 0x09 = C1 meter Frame A 0x0A = C1 meter Frame B 0x0B = C2 meter Frame A 0x0C = C2 meter Frame B 0x0D = C2 other Frame A 0x0E = C2 other Frame B 0x0F = T2/C2 other
RF_Channel	RF Channel (Used only in R mode)	0x01	0 – 9	0	0 = 868.03 MHz 1 = 868.09 MHz 2 = 868.15 MHz 3 = 868.21 MHz 4 = 868.27 MHz 5 = 868.33 MHz 6 = 868.39 MHz 7 = 868.45 MHz 8 = 868.51 MHz 9 = 868.57 MHz
RF_Power	RF Power	0x02	0 – 4	4	0 = 0 dBm 1 = +5 dBm 2 = +7 dBm 3 = +10 dBm 4 = +12 dBm
RF_AutoSleep	Configure Sleep	0x03	0-1	0	0 = Sleep Disable 1 = Sleep Enable
Rx_Window	RxWindow (ms)	0x04	0x00 – 0xFF	0	

MBUS Medium Access Parameters

Parameter	Description	Address	Values Range	Default	Notes
WM-Bus C Field	C Field	0x10	0x00-0xFF	0x44	
WM-Bus Man ID0	Manufacturer ID	0x11	0x00-0xFF	0x00	
WM-Bus Man ID1	Manufacturer ID	0x12	0x00-0xFF	0x00	
WM-Bus Device ID0	Device ID	0x13	0x00-0xFF	0x00	
WM-Bus Device ID1	Device ID	0x14	0x00-0xFF	0x00	
WM-Bus Device ID2	Device ID	0x15	0x00-0xFF	0x00	
WM-Bus Device ID3	Device ID	0x16	0x00-0xFF	0x00	
WM-Bus Version	Version	0x17	0x00-0xFF	0x00	
WM-Bus Device Type	Device Type	0x18	0x00-0xFF	0x00	

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Module Parameters

Parameter	Description	Address	Range	Default	Notes
Block1_From_Module_ Enable	Enable management of WM-Bus from Module	0x20	0-1	0	
RSSI_Enable	Enable RSSI Indication in communication frame	0x21	0-1	0	
DATA_INDICATE_TIM EOUT_LSB	LSB Timeout in ms	0x22	0-255	5	Note #
DATA_INDICATE_TIM EOUT_MSB	LSB Timeout in ms	0x23	0 - 3	0	Note #
UART BAUDRATE	Uart baud rate selection	0x24	0 – 5	4	0 = 9600 1 = 19200 2 = 38400 3 = 57600 4 = 115200

Note #: DATA_INDICATE_TIMEOUT RANGE from 1 to 1023 ms

Internal DATA (Read Only)

Parameter	Description	Notes
SerialNumber0	LSB SN	Serialization at 32 bit
SerialNumber1	Byte 1 SN	Serialization at 32 bit
SerialNumber2	Byte 2 SN	Serialization at 32 bit
SerialNumber3	MSB SN	Serialization at 32 bit
FwVersion0	LSB FW Version	
FwVersion1		
FwVersion2		
FwVersion3	MSB FW Version	
FwRevision0	LSB FW Revision	
FwRevision1		
FwRevision2		
FwRevision3	MSB FW Revision	

NOTE FOR MODE T2/C2 OTHER (0x0F)
When module is used in this configuration it will be able to receive and decode frames from T-meters and C-meters (format A and format B). After reception of the sync word, module detects if the frame is transmitted from a meter configured in T mode, C frame format A mode or C frame format B mode. The next transmission through TX_MSG_CMD (0x35) will have the radio parameters in accordance to received frame. The following table summarizes the configuration:

RX FRAME	NEXT TX FRAME	NOTES
T2 from Meter	T2 from Other	-
C2 Format A from Meter	C2 Format A from Other	-
C2 Format B from Meter	C2 Format B from Other	-

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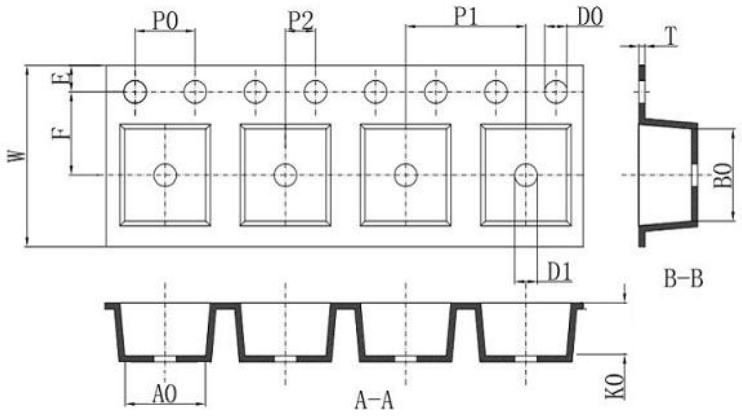
Via Corona, n. 5
(Zona Ind.)
34071 Cormons (GO)
Italy
Tel. +39 0481 630200 r.a.
Fax +39 0481 62387
mipot@mipot.com

DELIVERY

32001324 modules are delivered in tape/reel packaging of 250 units.



Dimensions are:
W = 44 mm
P = 20 mm
T = 0.35 mm
Ao = 16 mm
Bo = 26.5 mm
Ko = 3.6 mm
D0 = 1.5 mm
D1 = 1.5 mm

STORAGE AND HANDLING

Moisture Sensitivity Level (MSL)

The Moisture Sensitivity Level (MSL) relates to the packaging and handling precautions for devices that are sensitive to moisture-induced stress. The MSL standard is IPC/JEDEC J-STD-020 and can be downloaded from www.jedec.org.
Following table summarizes the dry pack requirements for different MSL levels in the IPC/JEDEC specification.

Dry Pack Requirement

MSL LEVEL	Dry Pack Requirement
1	Optional
2	Required
3	Required
4	Required

According to IPC/JEDEC specification J-STD-020, if a device passes MSL level 1, it is classified as not moisture sensitive and does not require dry pack. If a device fails level 1 but passes a higher level, it is classified as moisture sensitive and must be dry packed in accordance with J-STD-033.

The **32001324 is qualified for MSL level = 3.**

Dry Bag

Products with an MSL level of 2 or above are shipped dry packed in a Moisture Barrier Bag (MBB). Carrier materials such as trays, tubes, reels, etc., that are placed in the MBB can affect the moisture level within the dry bag. The effect of these materials is compensated by adding additional desiccant in the MBB to ensure the shelf life of the SMT packages.
IPC/JEDEC specifications require that MSD sensitive devices be packaged together with a Humidity Indicator Card (HIC) and desiccant to absorb humidity. If no moisture has been absorbed, the three fields in the HIC indicate blue colour.

MIPOT S.P.A.
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Italy
Tel. +39 0481 630200 r.a.
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mipot@mipot.com

Storage and floor life

The calculated shelf life for dry packed SMT packages is a minimum of 12 months from the bag seal date, when stored in a non-condensing atmospheric environment of <40°C/90% RH.
Following table lists floor life for different MSL levels in the IPC/JDEC specification.

Floor life	
MSL level	**Floor life (out of bag) at factory ambient ≤30°C/60% RH or as stated**
1	Unlimited at ≤30 °C/85 % RH
2	1 year
2a	4 weeks
3	168 hours
4	72 hours

The parts must be processed and soldered within the time specified for the MSL level. If this time is exceeded, or the humidity indicator card in the sealed package indicates that they have been exposed to moisture, the devices need to be pre-baked before the reflow solder process.

Drying

Both encapsulate and substrate materials absorb moisture. IPC/JEDEC specification J-STD-020 must be observed to prevent cracking and delamination associated with the “popcorn” effect during reflow soldering. The popcorn effect can be described as miniature explosions of evaporating moisture. Baking before processing is required in the following cases:

- Humidity indicator card: At least one circular indicator is no longer blue
- Floor life or environmental requirements after opening the seal have been exceeded, e.g. exposure to excessive seasonal humidity.
-

Refer to Section 4 of IPC/JEDEC J-STD-033 for recommended baking procedures. Table 4-1 of the specification lists the required bake times and conditions for drying.

Following table provides a summary of specified recommendations:

Bake Time							
		Bake @ 125 °C		**Bake @ 90 °C and ≤ 5% RH**		**Bake @ 40°C and ≤ 5% RH**	
Package Body	**MSL Level**	**Exceeding Floor Life by > 72 h**	**Exceeding Floor Life by ≤ 72 h**	**Exceeding Floor Life by >72 h**	**Exceeding Floor Life by ≤ 72 h**	**Exceeding Floor Life by > 72 h**	**Exceeding Floor Life by ≤ 72 h**
Thickness ≤ 1.4 mm	2	5 hours	3 hours	17 hours	11 hours	8 days	5 days
	2a	7 hours	5 hours	23 hours	13 hours	9 days	7 days
	3	**9 hours**	**7 hours**	**33 hours**	**23 hours**	**13 days**	**9 days**
	4	11 hours	7 hours	37 hours	23 hours	15 days	9 days
	5	12 hours	7 hours	41 hours	24 hours	17 days	10 days
	5a	16 hours	10 hours	54 hours	24 hours	22 days	10 days
Thickness >1.4 mm ≤ 2.0 mm	2	18 hours	15 hours	63 hours	2 days	25 days	20 days
	2a	21 hours	16 hours	3 days	2 days	29 days	22 days
	3	27 hours	17 hours	4 days	2 days	37 days	23 days
	4	34 hours	20 hours	5 days	3 days	47 days	28 days
	5	40 hours	25 hours	6 days	4 days	57 days	35 days
	5a	48 hours	40 hours	8 days	6 days	79 days	56 days
Thickness >2.0 mm ≤ 4.5 mm	2	48 hours	48 hours	10 days	7 days	79 days	67 days
	2a	48 hours	48 hours	10 days	7 days	79 days	67 days
	3	48 hours	48 hours	10 days	8 days	79 days	67 days
	4	48 hours	48 hours	10 days	10 days	79 days	67 days
	5	48 hours	48 hours	10 days	10 days	79 days	67 days

MIPOT S.P.A.
Via Corona, n. 5
(Zona Ind.)
34071 Cormons (GO)
Italy
Tel. +39 0481 630200 r.a.
Fax +39 0481 62387
mipot@mipot.com

	5a	48 hours	48 hours	10 days	10 days	79 days	67 days

Packages of sensitive components in **32001324 have a thickness ≤1.4 mm.**

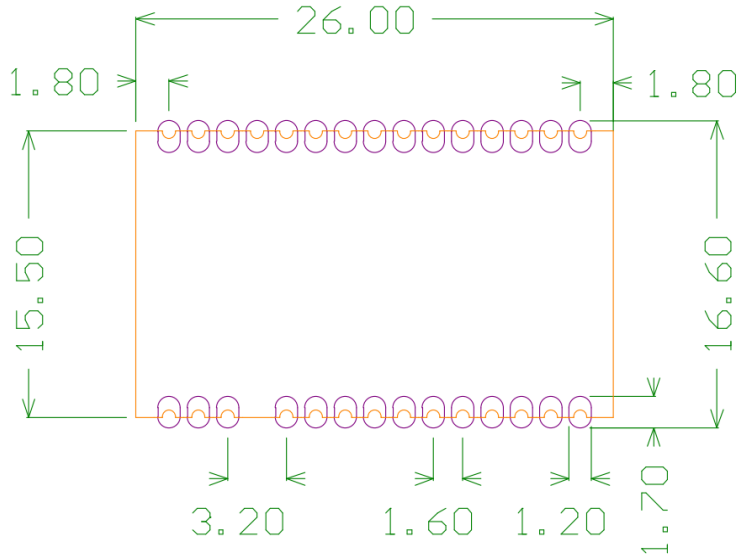
- **Do not attempt to bake modules at temperatures higher than 60°C while contained in tape and rolled up in reels. If baking at higher temperature is required, remove modules from packaging and place them individually onto oven tray.**

- **Oxidation Risk: Baking SMT packages may cause oxidation and/or intermetallic growth of the terminations, which if excessive can result in solderability problems during board assembly. The temperature and time for baking SMT packages are therefore limited by solderability considerations. The cumulative bake time at a temperature greater than 90°C and up to 125°C shall not exceed 96 hours. If the bake temperature is not greater than 90°C, there is no limit on bake time. Bake temperatures higher than 125°C are not allowed.**

SOLDERING INFORMATION

Soldering pad pattern

The finished surface on the printed circuit board pads should be made of Nickel/Gold.
The recommended soldering pad layout on the host board for the 32001324 is shown in the diagram below (purple lines):



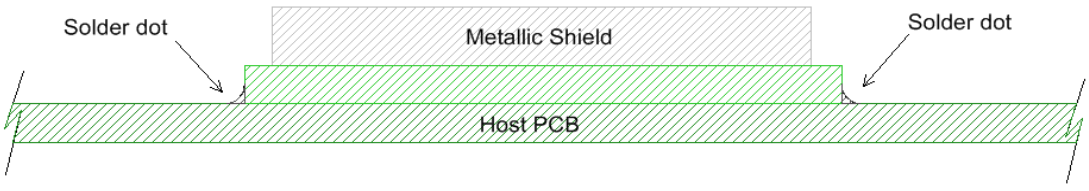
All dimensions in mm

Neither via-holes nor wires are allowed on the PCB upper layer in area occupied by the module.

Solder Paste

32001324 module is designed for surface mounting using half-moon solder joints (see diagram below). For proper module assembly, solder paste must be printed on the target surface of the host board. The suggested solder paste height should be within 150 µm and 180 µm.

The following diagram shows mounting characteristics for Module integration on host PCB:



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Placement

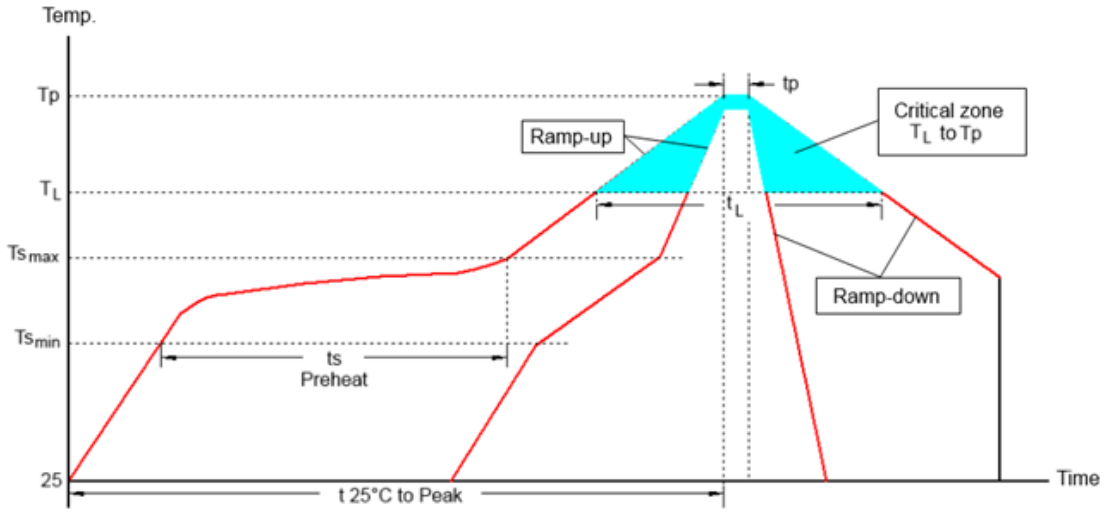
The 32001324 module can be automatically placed on host boards by pick&place machines like any integrated circuit.

Soldering Profile (RoHS Process)

It must be noted that 32001324 module should not be allowed to be hanging upside down during the reflow operation. This means that the module has to be assembled on the side of the printed circuit board that is soldered last.
The recommendation for lead-free solder reflow in IPC/JEDEC J-STD-020D Standard should be followed.

Profile Feature	Sn-Pb Assembly	Pb-Free Assembly
Average Ramp-UP Rate (Ts max to Tp)	3 °C/s max	3 °C/s max
Preheat -Temperature Min (Ts min) -Temperature Max (Ts max) -Time (ts min to ts max)	100 °C 179 °C 80-135 s	130 °C 217 °C 80-135 s
Time maintained above: -Temperature (TL) -Time (tL)	183 °C 30-90 s	220 °C 30-90 s
Peak/Classification Temperature (Tp)	Max. Peak Temp. 220 °C	Max. Peak Temp. 250 °C
Time within 5 °C of actual Peak Temperature (tp)	10-15 s	10-15 s
Ramp-Down Rate	4 °C/s max	4 °C/s max
Time 25 °C to Peak Temperature	6 minutes max	8 minutes max

Note: All temperatures refer to topside of the package, measured on the package body surface



CAUTION – Please note that if the host board is submitted to a wave soldering after the reflow operation, a solder mask must be used in order to protect the 32001324 module's metal shield from being in contact with the solder wave.

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REVISION HISTORY

Revision	Date	Description
1.1	20-07-2015	Preliminary
1.2	29-02-2016	Revised electrical parameters, added process information
1.3	15-12-2016	Added mode C2 + T2
1.4	27-08-2019	Final release

DECLARATION OF CONFORMITY:

Hereby MIPOT S.p.A. declares that the product WIRELESS M-BUS TRX MODULE meets the essential requirements and other relevant provisions of Directives:

- 2014/53/CE
- Directive 2011/65/EU (RoHS)
- REGULATION (EC) No. 1907/2006 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 18 December 2006 (REACH)

The declaration of conformity can be requested to Mipot at: support@mipot.com.

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