

Ultra low power DASH7 Modem

433MHz / 868MHz / 915MHz

1 Introduction

Features

- Full DASH7 modem (D7A v0.2, v1.x), optimized for power, targeted for battery powered sensor application.
- Connection to host application using standard UART link at 115200bps with DASH7 ALP command set.
- 433MHz, 868 MHz or 915 MHz ISM band operation (hardware option).
- Modulation schemes: 2-FSK, GFSK
- Output power up to +13 dBm (at RF pin)
- Data rates 9.6 / 55.6 / 167.7 kbps
- Operates from a single 2.4V to 3.6V supply.
- Operating temperature: -40 °C to 85 °C

Applications

- Wireless sensor network
- Data acquisition equipment
- Security systems
- Industrial monitor and control
- Internet of things (IoT)

Description

- The WM1001 is a fully integrated DASH7 modem operating in the 433MHz, 868 MHz and 915 MHz ISM bands (hardware option)
- Compatible with D7A 1.x specification (www.dash7-alliance.org)
- Controlled using an ALP command set over a serial link.
- Allows for bi-directional communication with battery operated sensor and actuators.
- WizziLab product line at www.wizzilab.com/products



Table of Contents

1 Introduction.....	1
2 Hardware specification.....	3
2.1 Recommended operating conditions.....	3
2.2 Absolute maximum ratings.....	3
2.3 I/O operating characteristics.....	3
2.4 Current consumption.....	3
2.5 Current consumption measurements.....	4
3 Operating modes.....	6
3.1 Data rates.....	6
3.2 RX Sensitivity.....	6
3.3 TX Power.....	6
4 Hardware design.....	7
4.1 Pin assignment.....	7
4.2 Pin placement.....	8
4.3 Typical application circuit.....	9
4.4 Package mechanical data.....	10
5 Ordering information.....	11
6 Revision history.....	12

List of tables

Table 1. Recommended operating conditions.....	3
Table 2. Absolute maximum ratings.....	3
Table 3. I/O operating characteristics.....	3
Table 4. Current consumption.....	3
Table 5. Test parameters.....	4
Table 6. Test results.....	4
Table 7. Data rates.....	6
Table 8. RX Sensitivity.....	6
Table 9. TX Power.....	6
Table 10. Pin assignment.....	7
Table 11. Document revision history.....	11

List of figures

Figure 1: Current consumption measurement.....	4
Figure 2: Idle/Stop current vs Power supply voltage.....	5
Figure 3. Pin placement (top view).....	8
Figure 4. Typical application circuit.....	8
Figure 5. Package mechanical data.....	9

2 Hardware specification

2.1 Recommended operating conditions

Table 1. Recommended operating conditions

Symbol	Parameter	Min.	Typ.	Max.	Units
T _A	Operating ambient temperature range	-40	-	85	°C
V _{CC}	Operating supply voltage	2.4 ⁽¹⁾	3.0V	3.6 ⁽²⁾	V

(1) SX1231H operation limit.

(2) Above 3.0V the Idle/Stop current consumption is increased. See Figure 2 for more details.

2.2 Absolute maximum ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Min.	Typ.	Max.	Units
T _{STG}	Storage temperature range	-40	-	85	°C
V _{CC}	Supply voltage	-0.3	-	3.9	V
V _{IO}	I/O pin voltage	-0.3	-	4.0	V

2.3 I/O operating characteristics

Table 3. I/O operating characteristics

Symbol	Parameter	Min.	Typ.	Max.	Units
V _{IL}	I/O input low level voltage	-0.3	-	0.3*V _{CC}	V
V _{IH}	I/O input high level voltage	0.7*V _{CC}	-	4.0	V

2.4 Current consumption

Table 4. Current consumption

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Units
I _{CC}	Supply current @VDD 2.4V	Operating mode TX	-	-	40 ⁽¹⁾	mA
		Operating mode RX	0.009 ⁽²⁾	0.042 ⁽³⁾	16 ⁽⁴⁾	mA
		Sleep	4	4	See Figure 2	µA

(1) TX output power 13 dBm

(2) Idle (no RX scan).

(3) RX scan on 2 channels with 200 KHz bandwidth, once per second, see Figure 1.

(4) Continuous RX

2.5 Current consumption measurements

Table 5. Test parameters

Parameter	Value
Supply Voltage	2.4 V
Operating mode	RX Scan (Clear Channel Assessment)
RX Scan period	1 s
Number of scanned D7A channels	2
D7A Channel width (normal rate mode)	200 kHz

Table 6. Test results

Result	Tool value (see Figure 1)	Value	Units
Average current consumption	DC	42.1	μA
Idle current consumption	Low	9.5	μA
Max current consumption	High	20.5	mA

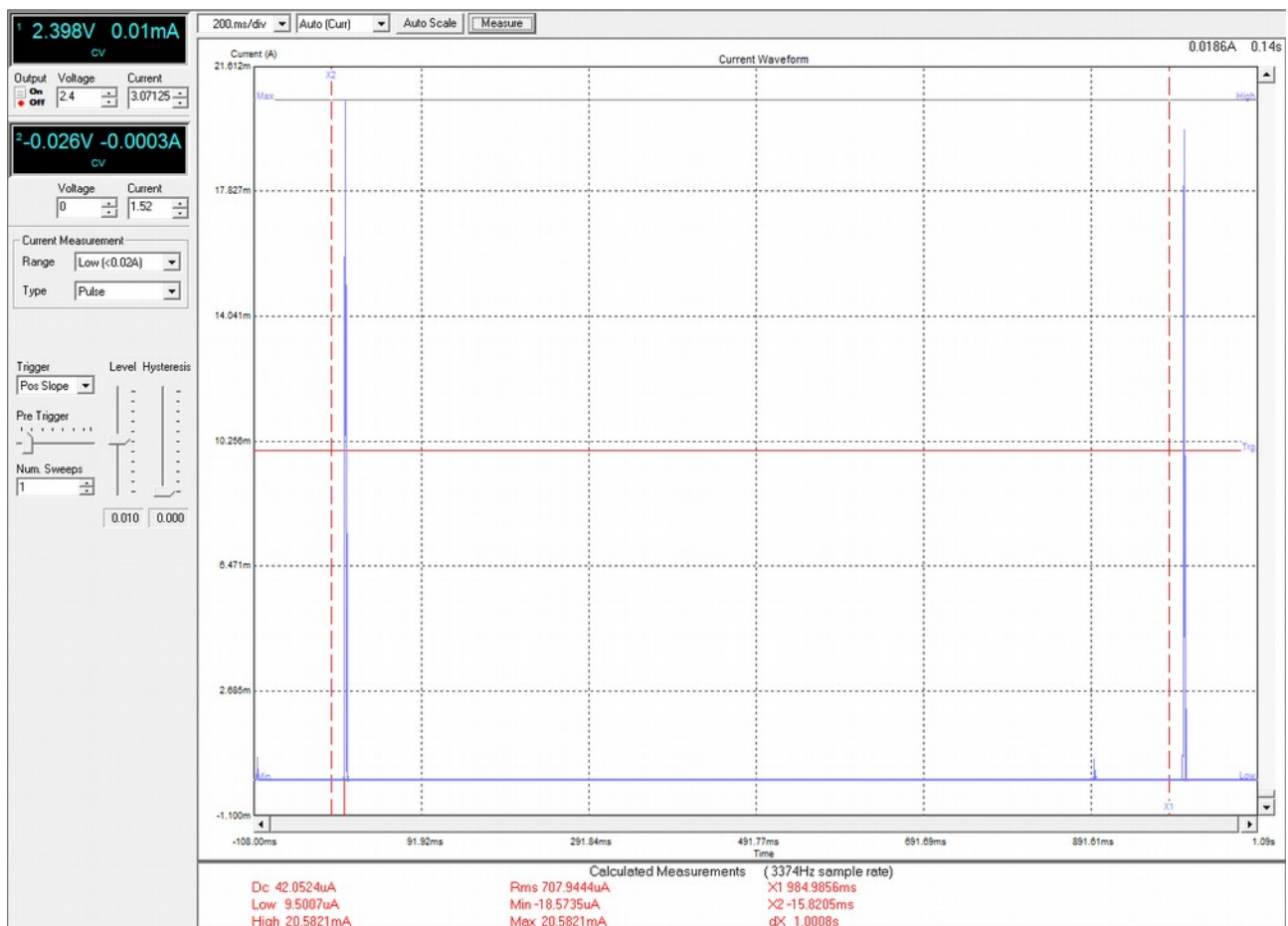
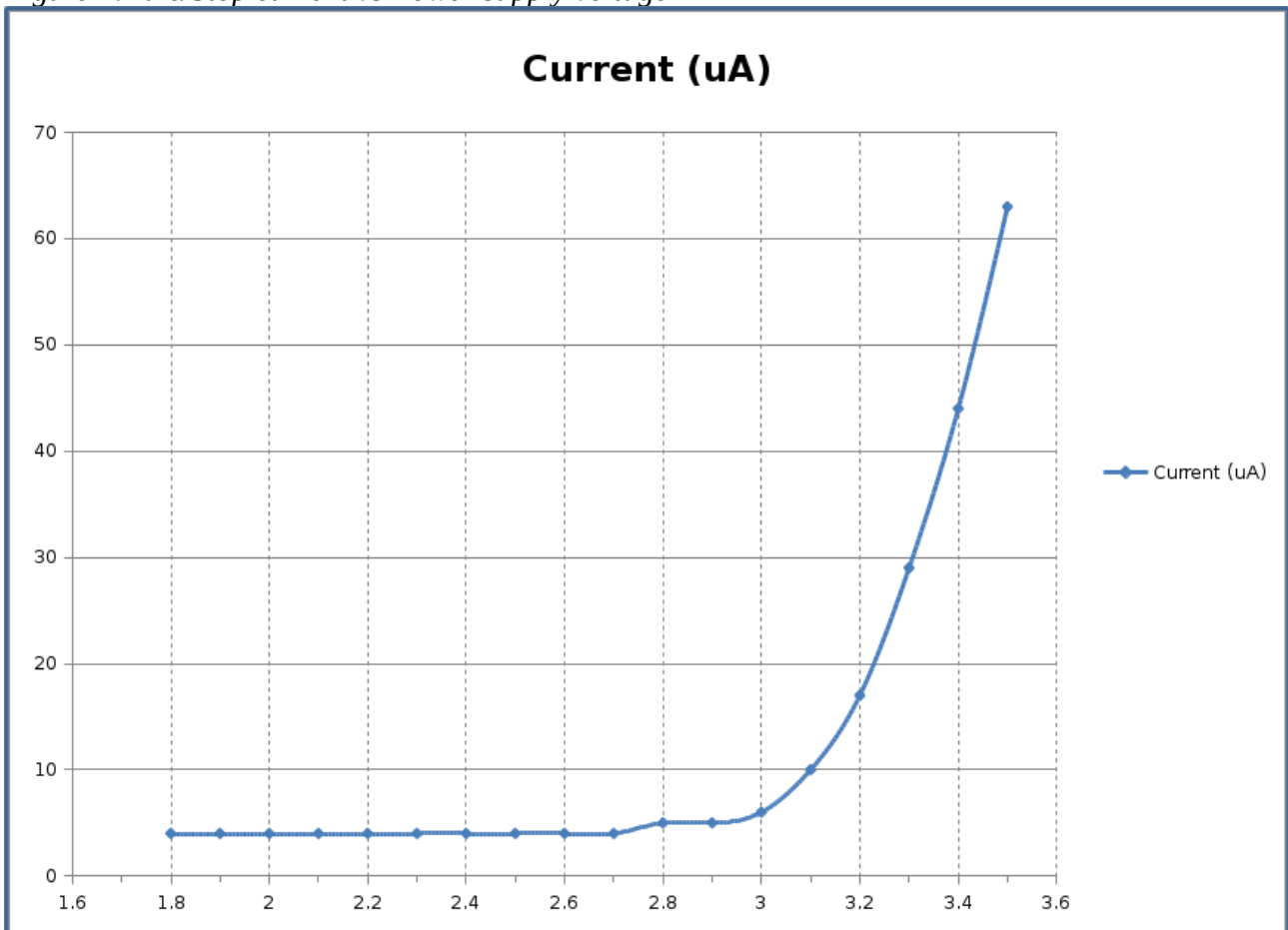


Figure 1: Current consumption measurement

Figure 2: Idle/Stop current vs Power supply voltage



3 Operating modes

3.1 Data rates

Table 7. Data rates

Parameter	Test conditions	Value	Units
Data Rate	Low rate mode	9 600	baud
	Normal rate mode	55 556	baud
	High rate mode	166 667	baud

3.2 RX Sensitivity

The test is performed in real conditions - the receiver and the transmitter are placed at a distance of 5 m in a non-anechoic room with dimensions of 10x10m and the transmission power is ramped up and down. The receiver is in continuous RX and receives D7A packets consisting of 27 uncoded payload bytes encoded with ½ Forward Error Correction channel coding, resulting in 60 encoded payload bytes + 2 bytes sync word + 8 bytes preamble. See the [D7A specification](#) for more details. The test sources are available [here](#). The following values are the RSSI sensitivity limits when 90% of the packets are still received.

Table 8. RX Sensitivity

Parameter	Test conditions	Min.	Typ.	Max.	Units
RX Sensitivity (10% PER)	Low rate mode with FEC	-	-109	-	dBm
	Normal rate mode with FEC	-	-102	-	dBm
	High rate mode with FEC	-	-88	-	dBm

3.3 TX Power

Table 9. TX Power

Parameter	Min.	Typ.	Max.	Units
TX Power	-18 ⁽¹⁾	-	13 ⁽¹⁾	dBm

(1) At the RF (I/O) pin. Antenna insertion loss not counted.

4 Hardware design

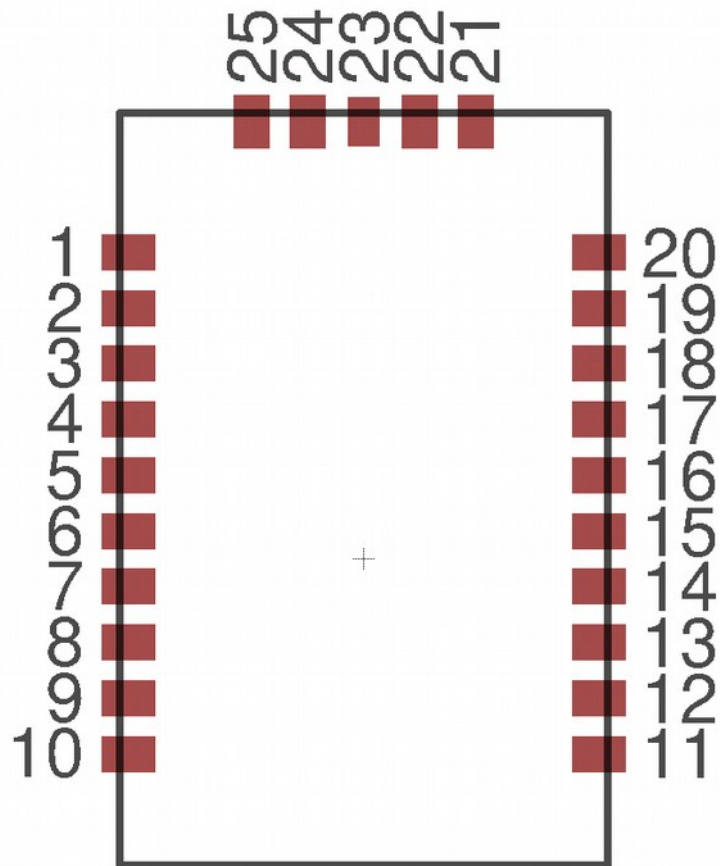
4.1 Pin assignment

Table 10. Pin assignment

Pin	Name	Type	Description
1	Vcc	Power	Supply input voltage
2	TX_1	O	Serial data out 1
3	RX_1	I	Serial data in 1
4	WKUP_1	I	Device wake-up pin 1
5	RST	I	Reset pin
6	HST_WKUP_1	O	Host wake-up pin 1
7	GPIO_0	I/O	General purpose input/output 0
8	GPIO_1	I/O	General purpose input/output 1
9	GPIO_2	I/O	General purpose input/output 2
10	GND_0	Power	Ground
11	GPIO_3	I/O	General purpose input/output 3
12	GPIO_4	I/O	General purpose input/output 4
13	GPIO_5	I/O	General purpose input/output 5
14	GPIO_6	I/O	General purpose input/output 6
15	GPIO_7	I/O	General purpose input/output 7
16	WKUP_2	I	Device wake-up pin 2
17	HST_WKUP_2	O	Host wake-up pin 2
18	GPIO_8	I/O	General purpose input/output 8
19	TX_2	O	Serial data out 2
20	RX_2	I	Serial data in 2
21	GND_1	Power	Ground
22	GND_2	Power	Ground
23	RF	RF	50Ω RF signal (I/O)
24	GND_3	Power	Ground
25	GND_4	Power	Ground

4.2 Pin placement

Figure 3. Pin placement (top view)



4.3 Typical application circuit

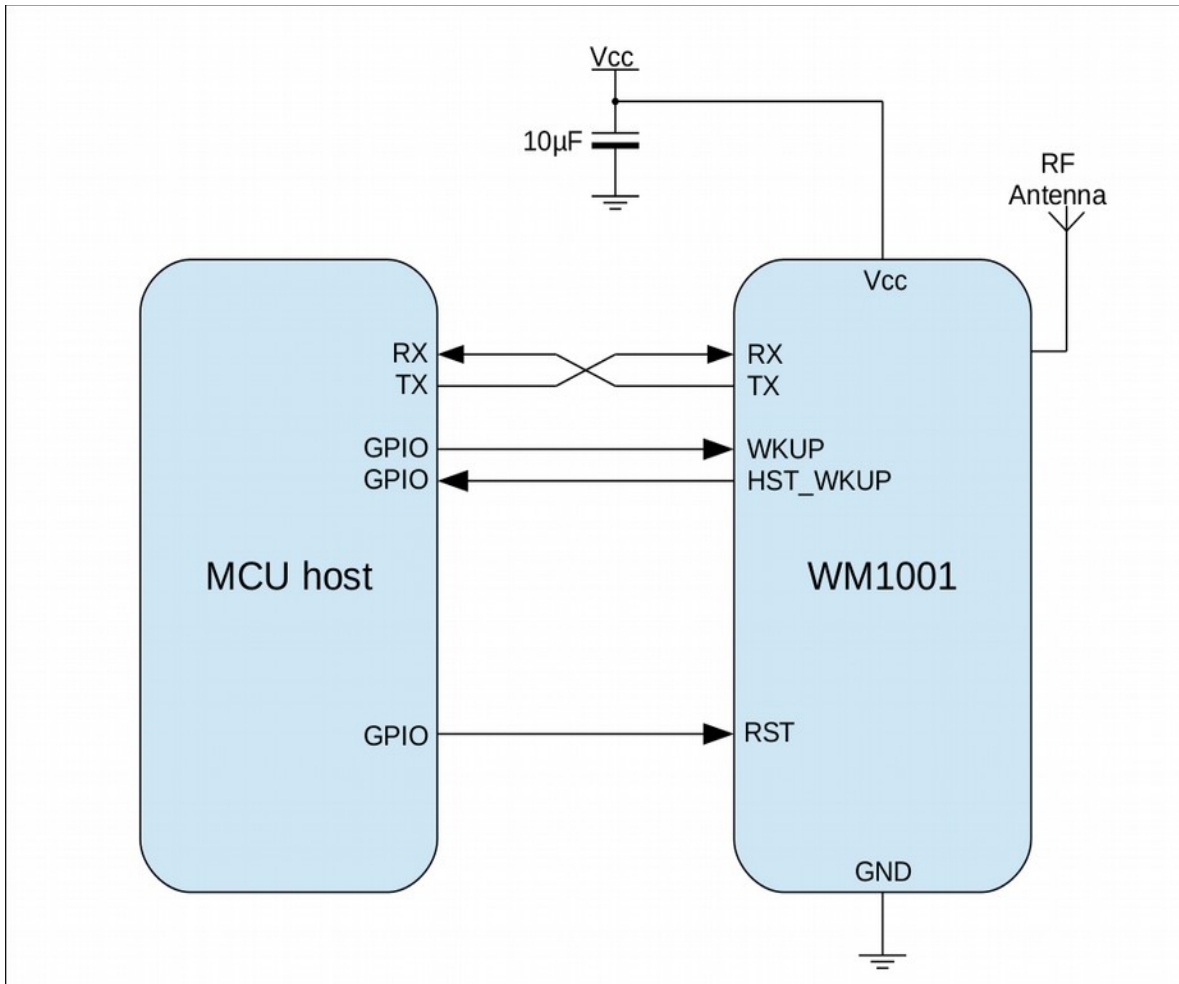
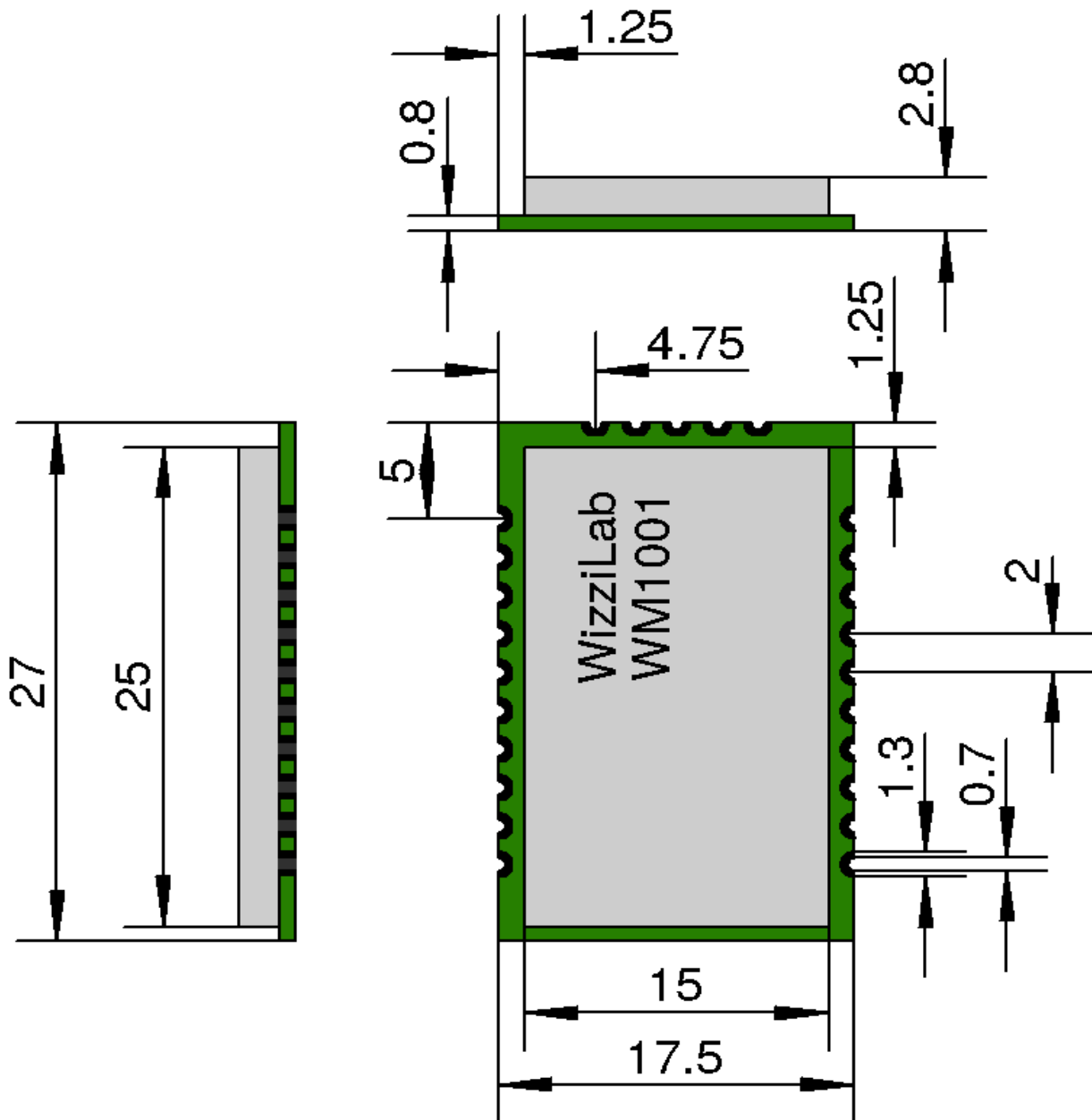


Figure 4. Typical application circuit

4.4 Package mechanical data

All dimensions are in millimeters $\pm 0.1\text{mm}$

Figure 5. Package mechanical data



5 Ordering information

Contact us at : contact@wizzilab.com

Or visit our website: <http://www.wizzilab.com/>

6 Revision history

Table 11. Document revision history

Date	Revision	Changes
11-Jun-2015	1.0	Document creation
08-Sep-2016	2.0	Added Dash7 V1.x compatibility
25-Oct-2016	2.1	Added Operating modes section.
28-Oct-2016	2.2	Added Current consumption measurements section.