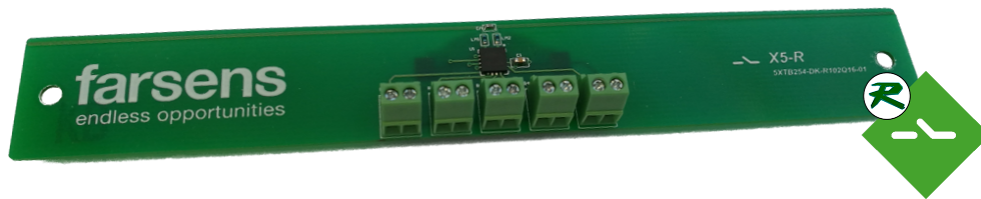


EPC C1G2 BATTERYLESS SWITCH MONITOR

Check for samples: [EVAL01-X5-R](#)



FEATURES

- EPC C1G2 compliant
- ISO 18000-6 Type C compliant
- 160-bit EPC Bank: Up to 128-bit EPC
- 96-bit TID Bank: Up to 48-bit Serial Number
- Available User Memory: Up to 1008-bit Non Volatile User Data
- Long range in passive mode: 5m
- Extended range in battery assisted passive mode: 20m
- 5 channel switch monitoring
 - Detects open/short circuit
 - Internal pulls for unused channels

DESCRIPTION

X5-R is an EPC Class-1 Generation-2 (C1G2) RFID tag based on Farsens' batteryless sensor technology. Built in a compact PCB format, the tag includes a 5 channel switch monitor.

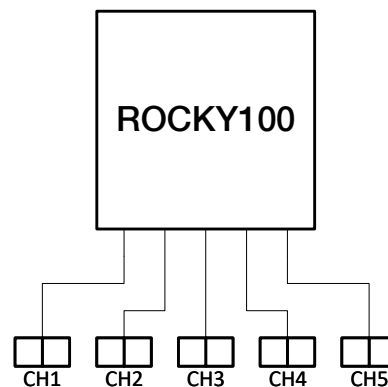
These RFID sensor tags are compatible with commercial UHF RFID readers (EPC C1G2). With a

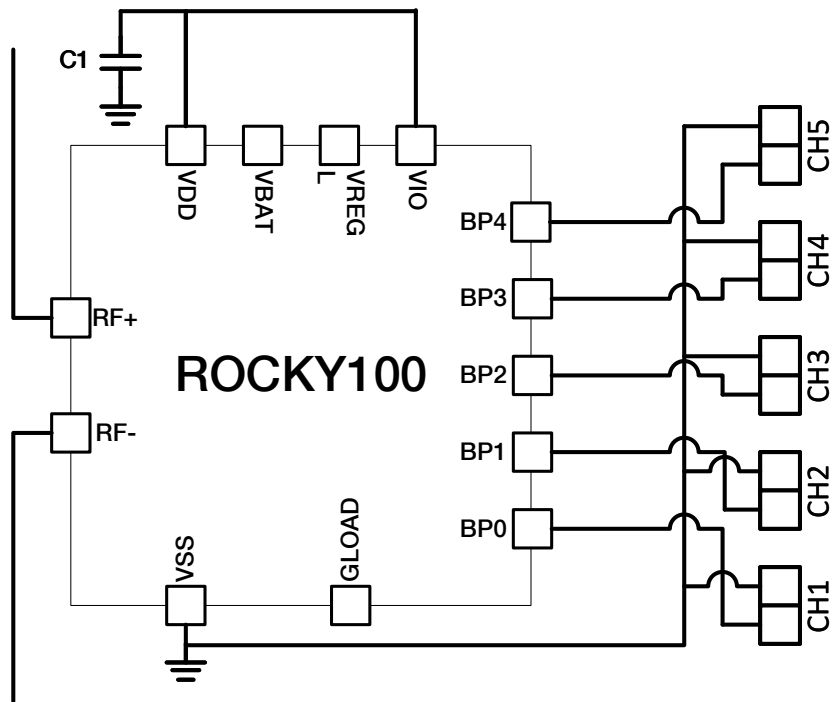
2W ERP setup the battery-less resistance meter can communicate to over 5 meters - 16 feet.

The X5-R can be customized with different antenna design and sizes, depending on the specific application. It can be encapsulated in an IP67 or IP68 casing for usage in harsh environments.

BLOCK DIAGRAM

The X5-R tag consists of a ROCKY100 IC for energy harvesting, wireless communication and GPIO monitorin. Additionally, a standard 2.54mm pitch connector is included for each channel.





The ROCKY100 IC includes the RF frontend for UHF RFID power harvesting and communication, a power supply module to generate the required voltage levels, and an EPC C1G2/ISO18000-6C digital processor including a GPIO module. The GPIO module can be controlled via EPC C1G2 standard memory access commands.

The detection of electrical open or short circuit is performed reading the values of the different GPIOs. All five GPIOs are configured as digital inputs with internal pull-up resistors. Thus, if the GPIO is not connected to any other signal, it will read as a logic one.

Each switch monitoring channel is driven to a two pin connector. One of the pins is the corresponding GPIO and the other pin is connected to VSS. In case an external short circuit is applied to the channel, the GPIO value will read as a logic zero.

In order to read the values of the GPIOs, standard EPC C1G2 commands can be used in the RFID reader side.

CHARACTERISTICS

SYMBOL	PARAMETER	MIN	TYP	MAX	UNIT
RFID					
$r_{operation}$	Operation range full passive		5		m
	Operation range BAP		15		m
	Operation range EBAP		20		m
OPERATING CONDITIONS					
T_{OP_TOP}	Operating temperature range	-40		85	°C
SWITCH MONITOR					
R_{open}	Resistance for OPEN detection	10M			Ω
R_{short}	Resistance for SHORT detection			10	Ω

OPERATION

EPC READING

In order to read the EPC of the tag, commercial EPC C1G2 readers can be used. However, some considerations have to be taken into account.

As the tag has a significant supply capacitor connected to VDD, the power-up of the system will be slow. It can last several seconds. In order to speed up the charge process, the reader shall be configured to send power as continuously as possible.

Once the supply capacitor is charged, the tag will respond with its EPC. From this point on, memory access commands can be used to control additional functionalities via the SPI bridge.

SWITCH READING

The state of the switches connected to X5-R can be read using standard EPC read commands. The answer to such command will include the value of the current state of the switches.

Read input GPIOs Operation: Read
 Memory bank: User Memory
 Word Pointer: 0x92
 Word Count: 1

The answer from the tag to such a request will contain 2 bytes of data. Assuming that the reader returns the received data in the buffer of bytes *rawdata*, the content of the answer is defined as follows:

rawdata	Byte 0	Byte 1
content	RFU	GPIO_IN[4:0]

- GPIO_IN (uint5): each bit indicates the state of the corresponding GPIO.
 - 1: A high logic value means that the switch connected to the corresponding channel is open.
 - 0: A low logic value means that the switch connected to the corresponding channel is closed.

EXAMPLE OPERATION LOG

```
[14/11/2017 17:17:14] Start inventory... OK
[14/11/2017 17:17:15] Stop continuous inventory... OK
[14/11/2017 17:17:15] Read command. Bank = User WordPtr = 0x00000092 WordCount = 1
                        Data Read = 0x0016
[14/11/2017 17:17:15] Extract switch values. Binary representation : 0b10110
                        [SW0 : Closed], [SW1 : Open], [SW2 : Open],
                        [SW3 : Closed], [SW4 : Open]
[14/11/2017 17:17:15] Start inventory... OK
```

In this example operation, continuous inventory is triggered by default to send power over the air. Every second, the continuous inventory is stopped, a GPIO_IN read command is sent and the response is interpreted. When done, the continuous inventory is triggered again to keep on sending power over the air so that X5-R is energized.

DEMO SOFTWARE

Demonstration software to read and control the X5-R is available in the web. Download the latest software and user guide at: <http://www.farsens.com/software.php>. Check the website for updated reader compatibility list. Up to the date of writing this document, this is the status of the compatibility list:

Fixed readers			
Manufacturer	Model	Tested HW rev.	Tested FW rev.
Impinj	R420	HLA: 1.00 PCBA: 4.00	5.12.1
Impinj	R220	-	-
Impinj	R120	-	-
Nordic ID	Sampo	PWM00282	5.4 A
Nordic ID	Stix	PWM00226	5.10 A

REFERENCES

The next table shows the available references of the X5-R.

Ref.	Name	Description
41302	EVAL01-X5-R-DKWB	X5-R, dipole wideband antenna, PCB format

For custom references with other antennas and housings, please contact us at sales@farsens.com.

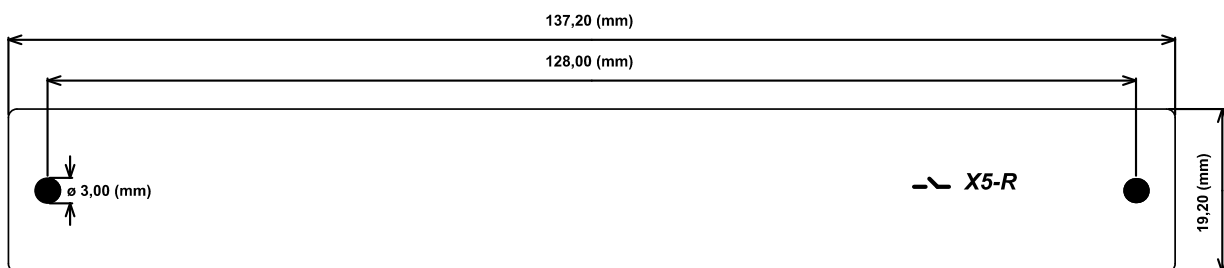
MECHANICAL DIMENSIONS

All dimensions are in millimeters.

DKWB

Valid for reference(s): 41302

2D VIEW



Maximum height: 10mm

3D VIEW

