etatronix

exm10Rx
Integration Manual

Introduction

The exm module series provides easy to use plug and play solutions for high performance wireless power transmission between a power transmitter (Tx) and a power receiver (Rx). In combination with a proprietary data transmission channel, the series provides a fast regulation loop and the ability to transfer customer data in parallel. Compliance to global safety and EMC standards qualifies the series for worldwide markets.

The exm10 series contains easy to use power receiver modules that can be wirelessly powered with any etatronix exm10 power receiver. They provide up to 10 W at the DC output. A LiIon charge function as well as a battery management system including a state of charge algorithm is available.

In combination with an exm10 power transmitter, the system complies to CE and FCC regulations. It has a modular approval which minimizes the certification effort of the application containing the module.
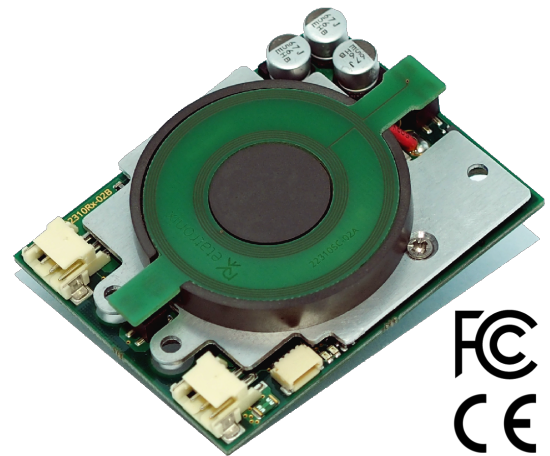
Table of Contents

Revision History

Revision	Date	Changes
Draft-01	8/2018	First draft released

1 Electrical Specification

1.1 Operating Conditions

Parameter	Min	Typ	Max	Unit
Output voltage[1,3]	-	-	20	V
Output current[1,2]	-	-	2.7	A
Ambient temperature	-25	-	70	°C
Standby current [3]	-	tbd.	-	mA
Data transmission frequency	-	2	-	MHz

[1] In case of a connected battery, output current and voltage depend on actual charge state. The module works in CC/CV mode.
[2] Output current and voltage limitation can be tailored to specific load and battery requirements.
[3] Receiver module not connected with power transmitter, BMS active.

1.2 Interface

Parameter	Min	Typ	Max	Unit
Low level digital interface [1]	-0.1	-	0.6	V
High level digital interface [1]	2.7	-	3.4	V
Maximum voltage at PG [1,2]	-	-	4.2	V
Maximum current PG [1]	-	-	10	mA
Output Capacity	-	-	440	µF
Battery Fuse Rating	-	T7	-	A
Battery Fuse Melting Integral	-	8.7	-	A^2Sec

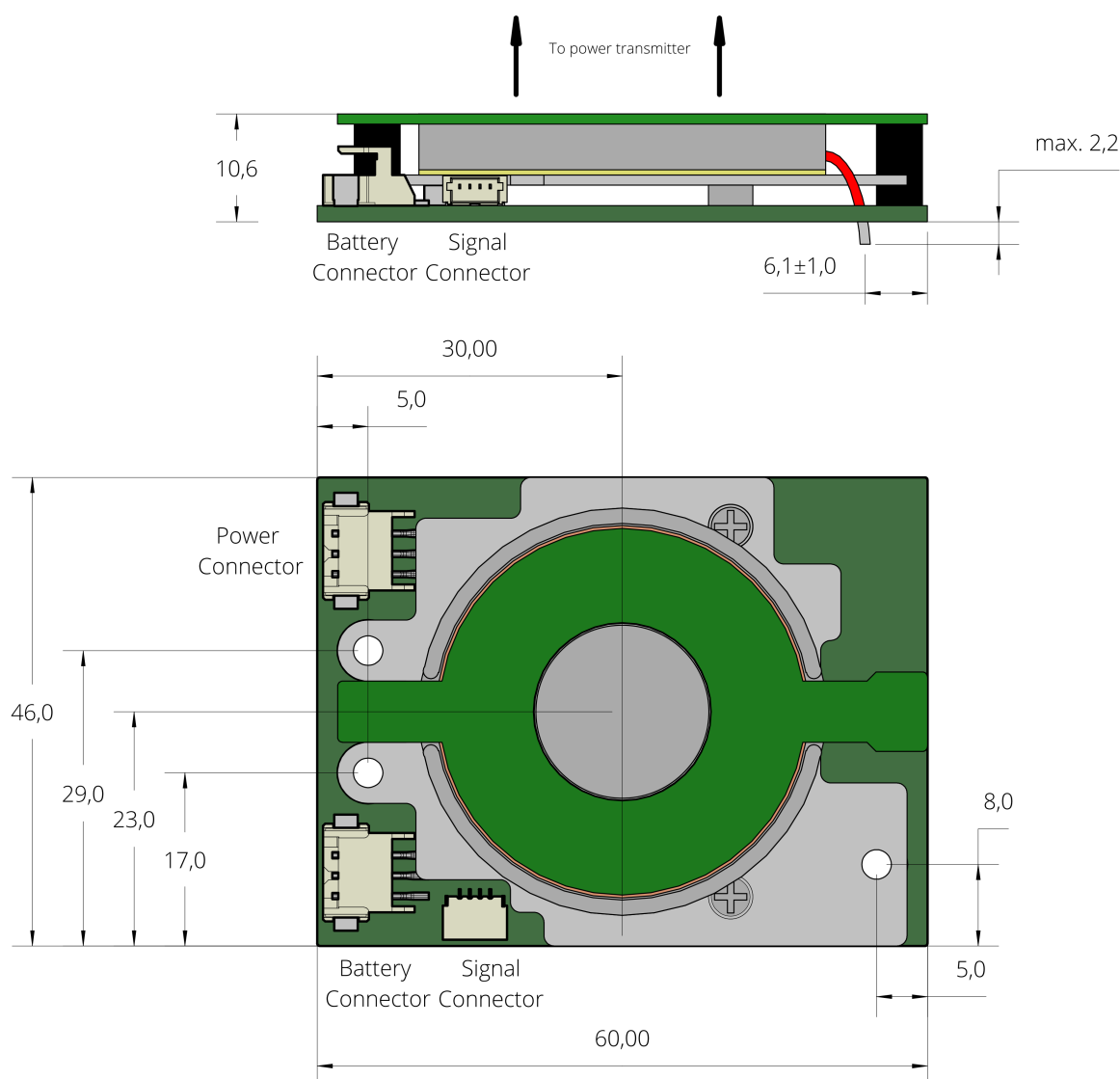[1] Internal limiting series resistor: $330\,\Omega$.
[2] Voltage at PG-pin shall not exceed the output voltage.

1.3 Compliance

Regulation	Description
EN 55011 class B	EMI regulation for home equipment

2 Mechanical Specification

2.1 Dimensions

To power transmitter

10,6

max. 2,2

Battery Connector   Signal Connector

6,1±1,0

30,00

5,0

Power Connector

46,0

29,0

23,0

17,0

8,0

5,0

Battery Connector   Signal Connector

60,00

Figure 1: Dimensions

Length	Width	Height	Weight
60.0mm +/-0.2	46.0mm +/-0.2	10.6mm +/-0.2[1]	tbd

[1] Notice that the height varies and will be higher at the solder points.

2.2 Mounting

Figure 2 shows two possible examples for the mounting of the exm module. Using the provided holes, the module can be mounted on a separate carrier (a) or on the surface which faces the power coil (b). In order to fit onto the module, the screw-head should have a maximum diameter of 5.5mm. The height of the standoffs should be at least 6mm.
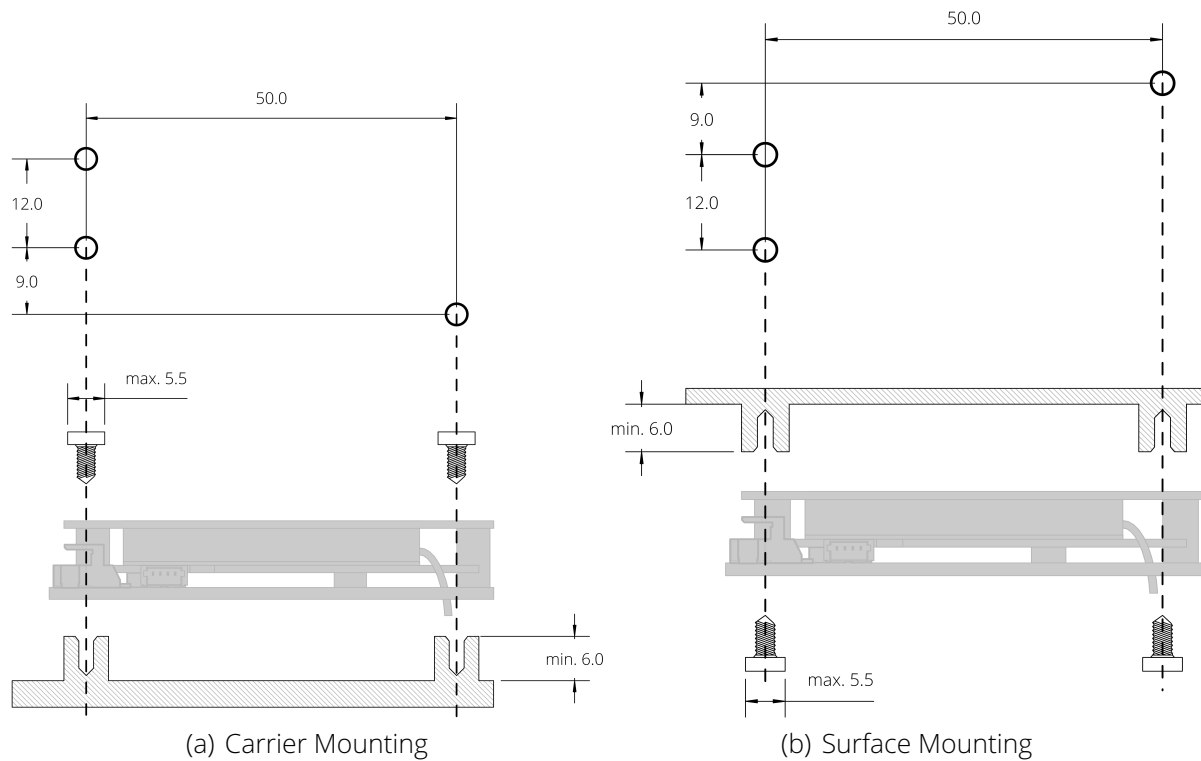

(a) Carrier Mounting (b) Surface Mounting

Figure 2: Mounting Examples

3 Interfaces

The interface of the exm module consists of a power output to connect the load, a signal output for communication with the module or via the wireless link and a separate battery connector.
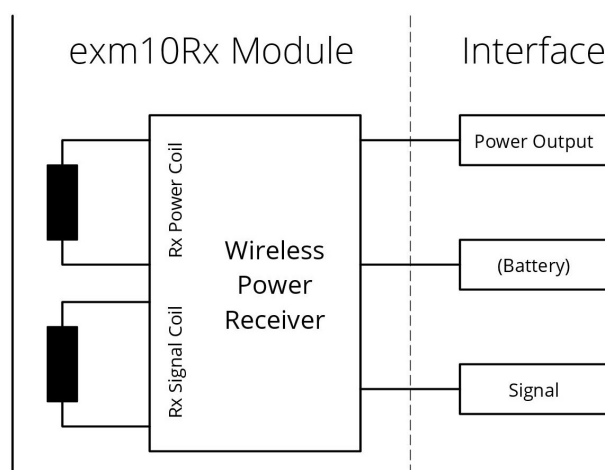

Figure 3: Interfaces

3.1 Power Connector

Type: TE Connectivity 1-292173-3

Pin	Name	Function
1	Vout-	Output GND
2	PG	Power Good[1]
3	Vout+	Output Voltage

[1] Open collector to GND

3.2 Battery Connector

Type: TE Connectivity 1-292173-3

Pin	Name	Function
1	GND	Battery -
2	NTC	Thermistor of the battery to GND[1]
3	Vbat+	Battery +[2]

[1] Open collector to GND
[2] Protected by an internal Fuse

3.3 Signal Connector

Connection to the signal connector is not necessary for power transmission but can be used for status updated and customer-specific data transmission. More details are specified in [1].

Type: JST SM04B-SRSS-TB

Pin	Name	Function
1	VCCint	Internal Supply Voltage
2	COM1	I^2C SDA, UART Tx[1]
3	COM2	I^2C SCL, UART Rx[1]
4	GNDint	Internal GND

[1] Depending on configuration
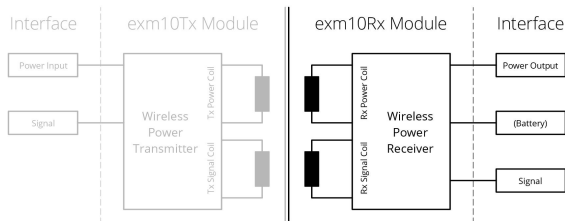
4 Functional Description

Figure 4: Block Diagram

To maximize the power transmission efficiency, the power transmission between transmitter and receiver modules of the exm10 series is realized using resonant circuits. These resonant circuits additionally provide the ability to vary the transmitted power by changing the switching frequency. By increasing the switching frequency, the available power in the receiver side decreases.

For the accurate output voltage regulation, a control loop is necessary. The output conditions like output current, voltage and power are measured on the receiver side and sent to the power transmitter. If corrections are necessary, the transmitter will change the switching frequency to the desired value.

An appropriate control loop needs a fast signal transmission with little delay. Often it's advantageous to trans-

fer status or customer-specific information between both units. To meet these two demands, the exm10 series provides a data channel that allows the parallel transmission of analog regulation information as well as digital status and customer-specific information. This transmission is done using a second pair of coupled coils. Like the power transmission coils, the signal coils are forming a near field coupling system thus the intended use of radio waves isn't necessary.

The efficiency of the whole power transmission system (input connector to battery connector) depends on the setup such as distance, lateral displacement and output power. Figure 5 depicted the efficiency with a varying distance, measured with exm10Rx4V2C and exm10Tx24.
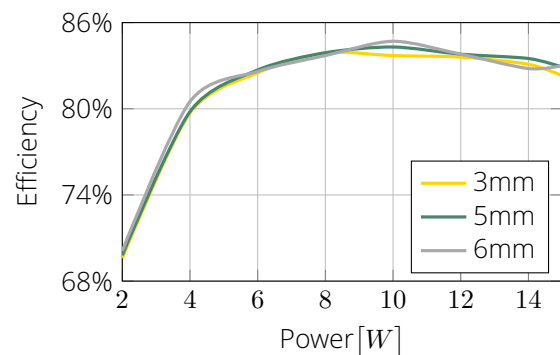

Figure 5: Efficiency over distance

etatronix

5 Compliance

The integrator must ensure that the FCC label is clearly visible outside of the OEM enclosure. The label has to contain the FCC-ID as well as the following statement:

This device complies with Part 15 of the FCC Rules [and with Industry Canada licence-exempt RSS standard(s)]. Operation is subject to the following two conditions:

1. this device may not cause harmful interference, and

2. this device must accept any interference received, including interference that may cause undesired operation.

FCC ID for exm10Rx serie: **2AOR8EXM10RXLINK**

References

[1] etatronix GmbH, *FDD - Kommunikation über UART mit WirelessPower Modul - Beschreibung der UART Kommunikation mit einem etatronix Lademodul*, Jun. 14, 2017.