PE3011 HF Logger

Application Note

Wireless battery-less temperature sensing

SERMA PRODUCTIVITY ENGINEERING

General

The PE3011 can be used for temperature monitoring without a battery, supplied by the HF field only, for certain applications. No maintenance will be required and the temperature range is not limited by environmental conditions of the battery. Although it is essential to have a permanent HF field that supplies the circuit. The PE3011 is supplied from a charged capacitor during a measurement cycles. In non-measurement cycles the capacitor will be charged from the HF field through the rectifier of the PE3011. Although the standard calibration allows measurements in the range of -35 °C to 67 °C, a temperature range of -40 °C to 85 °C is feasible using a different calibration (even temperatures up to 120 °C, causing acceptable lower EEPROM data retention time).

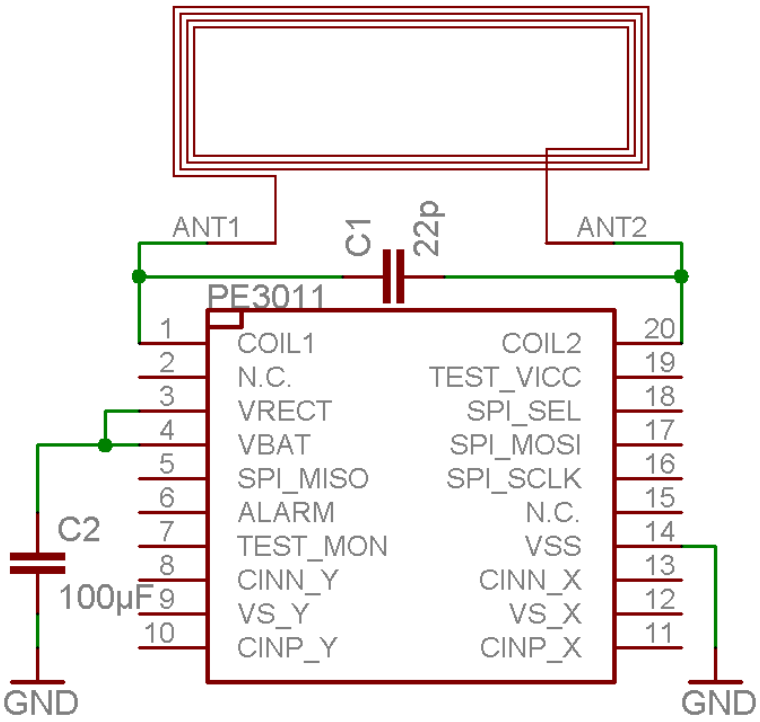

Figure 1: Application Schematic

Application software, source codes, eagle schematic and layout database is available for evaluation and customer developments.

Parameters

The distance between the reader to the tag (PE3011) and the number of measurements per minute depends on the reader power and chosen buffer capacity C2.

Figure 1 shows the basic configuration. All used devices need to meet the requirements for temperature stability when used at higher temperatures. It should be possible to reach higher reading distances with more reader output power. Also the number of measurements can be increased with more reader power.

Table 1: Parameters Scemtec SIR-2700 in PE lab

Parameter	Symbol	Min	Max	Unit	Comment
Reader Power	P_{HF}		1400	mW	Scemtec SIR-2710
Number of measurements			6	1/min	
Temperature	T	-35	67	°C	Standard calibration
Distance	d	0	20	cm	Reader to Tag
Voltage drop on capacity	V_{DROP}		1	V	For capacity = 100 µF (during measurement cycle)

Reader commands

Most readers do not naturally support a continuous HF field. They frequently go in “quiet” mode after communication sequences. Follow the sequence below when running a measurement cycle. It is necessary to have enough time between “start monitor” and “stop monitor” to conduct a measurement (time between start and stop command should be 500ms or more).

Table 2: General sequence for monitoring

Step	Order
1	Activate permanent field
2	Configure PE3011 (clear address 0x15)
3	Start measurement and wait 1s
4	Stop measurement
5	Read out results (address: 0x1C)
6	Wait 2 sec (with activated field) [depending on reader power]
7	repeat measurement at step 3

Demonstration Setup

The standard EVA3011-Kit (Figure 2) can be configured for battery-less temperature-measurement. This is done by shorting Pins 3 & 4 of the PE3011 (e.g. with a tin bridge, see Figure 3).
The standard block-capacitor on the EVA3011 (also shown in Figure 3) must be replaced by a larger one to increase the amount of energy harvested. 100 µF (ceramic or electrolytic) is a good start, delivering enough power for larger reading distances. Reading distances of up to 20 cm have been observed in the lab. Smaller capacitors decrease reading range but increase the number of readings per Minute due to faster charging. Nevertheless, the measurement also works with the on-board 100 nF capacitor, but only at very small distances below 2cm.

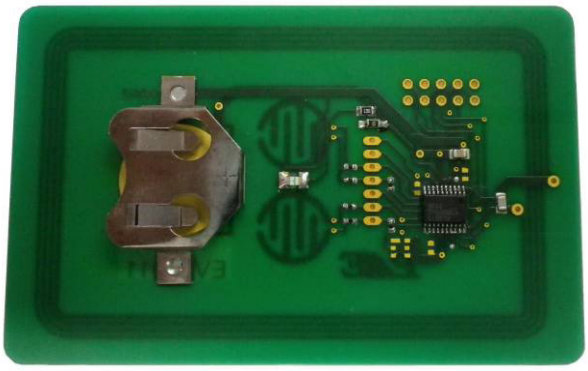

Figure 2: EVA3011-Kit

Figure 3: Configuring EVA3011 for battery-less temperature measurements

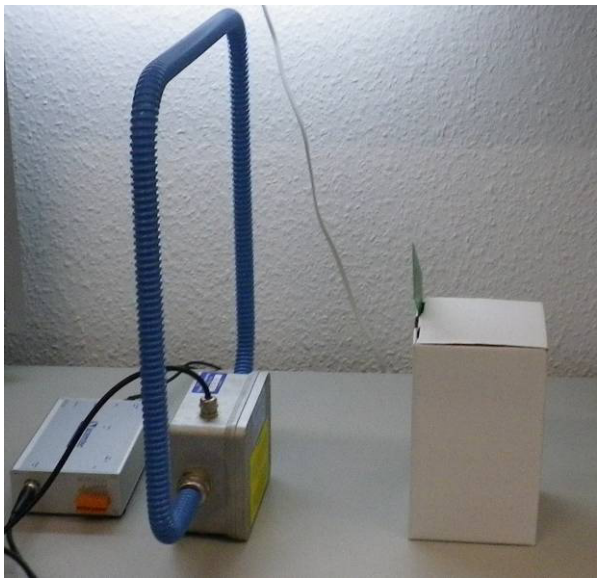

Figure 4: Demonstration Setup

Demonstration Software

The Software and source codes used in this Demonstration are available for download through the web site.
Multi tag reading is not supported by this software, but could be implemented.
For details concerning the Software, please refer to the similar User Manual of the PE3001 battery-less Reference-Design, also available through the web site.

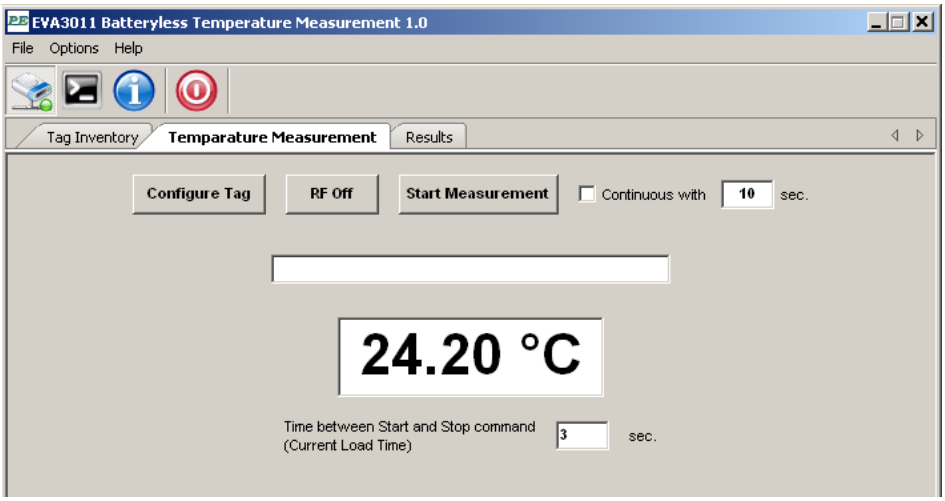

Figure 5: Example for application software of battery-less temperature sensing

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