**APPLICATIONS**

* Medical Asset Tracking and Monitoring
* Smart Grid
* Building Automation
* Logistics
* Asset Monitoring
* Supply Chain Management
* Materials Management
* Industrial Monitoring



**FUNCTIONAL BLOCK DIAGRAM**



**DESCRIPTION**

The PCT100 SuperTag is a high-function RFID tag capable of measuring temperature, humidity, and light level with high accuracy. The tag harnesses the capability of the Powercast Powerharvester® Chipset to enable long range, high-function RFID all without the need for an on-board battery. The tags are designed to maximize the RF to DC conversion efficiency of the energy provided by an RFID reader. Using this energy, sensor measurements can be taken and then read back out of the tag’s memory using any standard UHF RFID reader. Powercast’s technology enables a completely maintenance-free and battery-free sensing and tracking solution for UHF RFID applications.

**FEATURES**

* EPC Class 1 Gen 2 compliant
* ISO/IEC 18000-6C compliant
* 10 meter read range
* High sensor accuracy
* “Find Tag” feature – locate one specific tag by illuminating an on-board LED
* Wide RF range: -17dBm to +20dBm
* Frequency range: 860MHz to 960MHz
* Compact hard case packaging
* RoHS compliant
* High RF to DC conversion efficiency – up to 75%
* -40 to +85C operational temperature range
* Completely batter-free
* Data accessible in user memory
* Fast read rate

***Powercast products and technology are covered by one or more patents with other patents pending. All patent and trademark information can be found at*** [***http://www.powercastco.com/IP/***](http://www.powercastco.com/IP/)***.***

**![C:\Users\Maria\AppData\Local\Microsoft\Windows\INetCache\IE\2UPGG1EC\180px-Achtung.svg[1].png]()**

**SPECIFICATIONS**

**TA = 25°C, RFIN = 915MHz, unless otherwise noted**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | **Min** | **Typ** | **Max** | **Unit** |
| RF Characteristics Input Power Frequency | -17860 | 915 | 20960 | dBmMHz |
|  Read Distance | 0 | 5 | 10 | m |
|  Read Time | 4 | 5 | 15 | s |
|  Temperature Range Accuracy | -40- | -±2% | 85- | °C°C |
| Light Range Accuracy | 0- | -±10% | 1000- | LuxLux |
| Humidity Operating Temperature Range Accuracy 11% to 89% 0% to 10% or 90% to 100% | -20- | -±4%±8% | 85- | °C%RH%RH%RH |

**ABSOLUTE MAXIMUM RATINGS**

**TA = 25°C, unless otherwise noted.**

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Rating** | **Unit** |
| RF Input Power | 23 | dBm |
| Operating Temperature Range | -40 to 85 | °C |
| Storage Temperature Range | -40 to 85 | °C |

\*Humidity Sensor operates from -20°C to 85°C

Exceeding the absolute maximum ratings may cause permanent damage to the device.

**LOCATE TAG**

The PCT100 is equipped with a locate tag feature. This helps to find a tag in the field when there are multiple tags. It causes the LED on the tag to blink. The closer you are to the reader, the faster the LED will blink. To set the tag into locate mode, you must set the appropriate flag high. To go back to normal operation, you must clear this flag.

**DESCRIPTION OF MEMORY**

**MEMORY MAP**

The tags are compatible with EPC Gen2 commands. Data should be read in 16 bit words. The user data is stored in the user memory locations (memory bank 3) starting at byte 00h.

**Table 1: Memory Map**

|  |  |  |  |
| --- | --- | --- | --- |
| **Word** | **Memory Address** | **Content** | **Data Source** |
| 0 | 00h | Product ID | PCT100 |
| 1 | 02h | Product Configuration | PCT100 |
| 2 | 04h | Flags | PC |
| 3 | 06h | RESERVED | - |
| 4 | 08h | Temperature | PCT100 |
| 5 | 0Ah | Light | PCT100 |
| 6 | 0Ch | Humidity | PCT100 |

**FUNCTIONAL DESCRIPTION**

**POWER**

The PCT100 tag is passive and completely battery free. It utilizes Powercast’s harvesting technology to harvest the RF energy produced by an RFID reader and converts it into usable DC Power. Because of this harvesting technology, the tag is able to power multiple sensors at one time. The tag stores the DC power until it is significant enough to take a sensor reading and write the values to the RFID chip. This can cause the time between sensor reads to vary with distance. The minimum read time will be around 5s when close to the reader and increase as you move away from the reader.

**FLAGS**

The PCT100 is equipped with a flag byte to switch between locate and run modes.

**SENSOR READS**

The PCT100 has the option to sense temperature, light, humidity, or any combination of the three. There is also a locate tag only version. Every time the tag takes a sensor read, it writes the values to the same memory locations on the RFID chip. Therefore, only the most recent sensor values will be stored and read. The memory location for the sensor reads are listed in Table 1.

**PRODUCT ID AND CONFIGURATION**

The product ID code for the PCT100 is 100 (64h). For the PCT200 tag, it will be 200 (C8h). The product configuration is dependent upon which sensors are populated. It is a binary code where 1 represents the sensor being populated and 0 represents the sensor being absent.

**Table 2: Product Configuration**

|  |  |  |
| --- | --- | --- |
| Bit 2 | Bit 1 | Bit 0 |
| Temperature | Light | Humidity |

For Example, if temperature and humidity are populated and light is not, the product ID would be 101b or 5h.

**FLAGS**

The flags are what control the function of the tag. Currently, the two options are run and locate. To set the tag in locate mode, 0001h must be written to the flag word. To set it back into run mode, 0000h must be written to the tag

**SENSOR READS**

The sensor read results are integers between 0 and 1023 and can be converted using the equations below. If a sensor is not populated, the ADC value will be read as FFFFh.

|  |  |  |  |
| --- | --- | --- | --- |
| **Resistance****(kΩ)** | **Temperature****(⁰C)** | **Resistance****(kΩ)** | **Temperature****(⁰C)** |
| 195.652 | -40 | 4.917 | 45 |
| 148.171 | -35 | 4.161 | 50 |
| 113.347 | -30 | 5.535 | 55 |
| 87.559 | -25 | 3.014 | 60 |
| 68.237 | -20 | 2.586 | 65 |
| 53.65 | -15 | 2.228 | 70 |
| 42.506 | -10 | 1.925 | 75 |
| 33.892 | -5 | 1.669 | 80 |
| 27.219 | 0 | 1.452 | 85 |
| 22.021 | 5 | 1.268 | 90 |
| 17.926 | 10 | 1.11 | 95 |
| 14.674 | 15 | 0.974 | 100 |
| 12.081 | 20 | 0.858 | 105 |
| 10 | 25 | 0.758 | 110 |
| 8.315 | 30 | 0.672 | 115 |
| 6.948 | 35 | 0.596 | 120 |
| 5.834 | 40 | 0.531 | 125 |

**Table 1: Resistance to Temperature**

**CONVERSION FORMULAS**

The values for each sensor read will be integers between 0 and 1023 in decimal and stored on the RFID chip as hexadecimal values. The following are the formulas to convert these values into their respective sensor values.

**TEMPERATURE**

For temperature, the formula will convert the values read into a resistance.

$$R(kΩ)=\frac{10\*X}{1024-X}$$

Where X is the decimal value read from the tag. The resistance value must then convert into temperature using the look up table in **Table 1**. If the resistance falls between two values, a linear approximation between the two closest values should be made.

**LIGHT**

$$III. \left(Lux\right)=-1.3913\*X+1345.4$$

Where X is the decimal value read from the Tag.

*Note: The Light equations for the PCT100 and PCT200 are different.*

**HUMIDITY**

$$\%RH=\frac{1}{0.00636}\left(\frac{X}{1024}-0.1515\right)$$

Where X is the decimal value read from the tag.

Please see the PCT Conversions document.



**DIMENSIONS**

**P2110 MODULE SERIES**

PCT 1 00 - XYZ

|  |  |  |
| --- | --- | --- |
| **PCT**Tag series | Version**100** = Battery Free**200** = Datalogging | XYZ (Sensors Desired) **T**= Temperature **H**=Humidity**L** = Light**F** = Find Tag Only |

|  |  |
| --- | --- |
| PCT100-T | Temperature |
| PCT100-L | Light |
| PCT100-H | Humidity |
| PCT100-TL | Temperature and Light |
| PCT100-TH | Temperature and Humidity |
| PCT100-LH | Light and Humidity |
| PCT100-TLH | Temperature, Light and Humidity |
| PCT100-F | Find Tag Only |
| PCT200-T | Temperature |
| PCT200-L | Light |
| PCT200-H | Humidity |
| PCT200-TL | Temperature and Light |
| PCT200-TH | Temperature and Humidity |
| PCT200-LH | Light and Humidity |
| PCT200-TLH | Temperature, Light and Humidity |
| PCT200-F | Find Tag Only |

All Dimensions in inches



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