

# How to Build a Microwave Electric Field Detector/Energy Harvester Using the RFD102A Module

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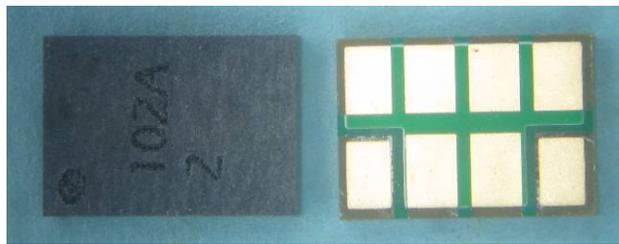
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The RFD102A (figure 1) is a 5mm x 7mm x 1.8mm RF-DC converter module developed by RF Diagnostics, LLC that has been optimized for 60Hz-6GHz broadband operation.

A datasheet is available at the following link:

[http://www.rfdiagnostics.com/RFD102A\\_latest.pdf](http://www.rfdiagnostics.com/RFD102A_latest.pdf)

The module accepts the wireless energy at the RF INPUT pin and converts the wireless energy to a useable DC voltage for low power electronics. Typical inputs of 1milliWatt (0dBm) are enough to light up a surface mount LED. The module has a maximum output current limit of ~18mA and is capable of driving low power electronics provided there is a strong enough stray wireless power source such as a microwave oven, wireless LAN router, power lines, high current lines near a dryer, RFID reader, transmitting cell phone, etc...



**Figure 1. RFD102A module top and bottom views. Pin 1 is the DC output and pin 4 is the RF input. All other pins are grounds and are tied together. The module can be used with an antenna to capture wireless energy and convert it to a useable DC voltage for low power applications.**

This article describes how to build a wireless harvesting device that will capture stray 2.4GHz energy from a microwave oven and convert it into a useable voltage that will light up a red light emitting diode (LED).

## **What you need:**

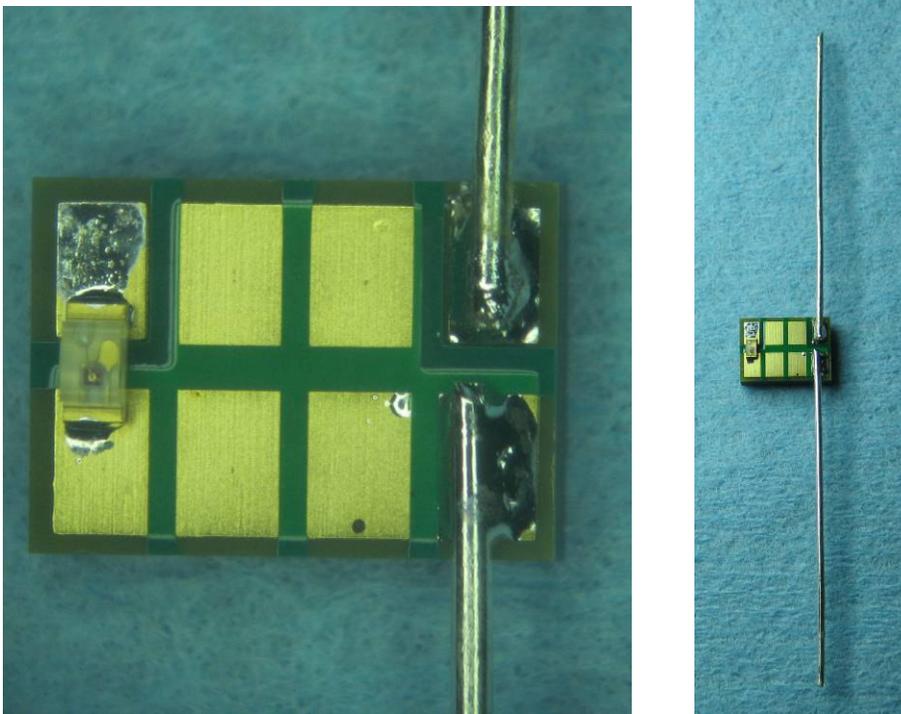
- 1 RFD102A module
- 1 ¼ watt leaded resistor (any value) or two wires that are 1 1/8 inches long (28.6mm)
- 1 Kingbright Surface mount red LED (part number: APT1608EC)
- Fine tipped soldering iron
- Solder paste

## **Assembly Instructions**

1. Cut the resistor wire leads off. These are just the right size at 1 1/8" long. Throw away the resistor and keep the wires.
2. Put solder paste on the module at pins 1 & 8 and at pins 4 and 5.

3. Place the wires on pins 4 and 5 and solder carefully at the lowest soldering temperature possible. If the iron is too hot then you may damage the internal connections inside the module. Use a minimum of time for soldering (<10secs). The wires work as a dipole antenna to collect the 2.4GHz energy into the RF Input of the module.
4. Place the LED with the anode (positive side) onto pin 1 and the cathode (negative side) on pin 8 and solder carefully. For those not familiar with LEDs, the triangle symbol of the diode should point to the ground pin of the module (pin 8).

Your final microwave harvester should look like figure 2.



**Figure 2. Microwave energy harvester device. Red LED is on the left and the dipole wires are on the right. Pin 1 is the upper left pin. Note that the LED needs to have the correct orientation to light up properly. Put the chip side on the GND pin and the wire side on the DC output pin as shown.**

Now put some water in a mug and put it in the microwave oven and cook on high for 2 minutes. While the microwave is running, hold the module near the LED and move the module antenna around to find a hot spot on the microwave. Tape the module on the ground wire to the microwave to keep it in place. If all is well then you will see the LED light up and dim as the electric fields change while the mug rotates in the microwave oven. See figure 3 for a microwave energy harvester in action. Experiment with antenna shapes and sizes. If you go too big or too small with the antenna then less energy will be collected. You can also put the assembled module near an 802.11b/g/n wireless LAN router and watch it flicker as the router transmits and receives 2.4-2.5GHz energy. Enjoy!



**Figure 3. Photo of the microwave oven energy scavenger using the RFD102A, red LED and a dipole antenna wires soldered to the module. The red LED lights up when the microwave is running.**