Operational Description For the P7YSDIDD-101:

1. Overview

The device is a security sensor for doors. When the door is opened, a magnet is separated from the reed switch on the sensor which triggers a change of state on the sensor's microprocessor. The microprocessor then powers up the RF transmitter (Pulse Width Modulated OOK) and sends a series of 8 identical packets that flag the change of state to a receiver. The 8 packets are sent with a random delay between them.

When there is no change of state occurring, the device goes into a very low-power mode (on the order of 300nAmps) and wakes up once a second to check and see if there is a change of state on the reed switch. This is done with a Real Time Clock set to interrupt the microprocessor every second. The device also times out once every 64 minutes and transmits a "heartbeat" message to allow the receiver to know it is still operational. Further, a battery level (ok, or low) is sent with every message packet allowing a service technician to change the battery when it gets low.

2.Battery Section

The battery is a Lithium Coin cell CR2 size, and is replaceable in the package. The device consumes approx. 300 nanoamps in it's standby mode, approx. 300uAmps while the microprocessor is awake and checking for a change of state, and approx. 7 milliamps when the transmitter is on. The majority of the time the device is in a standby state, and this is the major contributor to battery life, which is expected to be around 10 years typical. C1 & C2 provide filtering on the device.

2. Microprocessor Section

The microprocessor is a TI MSP430F1101 (U3) with onboard Flash and RAM. It is turned on periodically by a Real Time Clock chip (U1) which runs off of a 32.768KHz watch crystal (Y2). As the RTC operates at less than 250 nanoamps, this allows the entire device to consume approx. 300nanoamps while it is in the standby mode, thus extending battery life.

Once a second the RTC transmits an interrupt to the microprocessor (U1 Pin 3 to U3 Pin 13). R11 is a pull-up resistor, and R6 is required for the microprocessor to program the interrupt period upon power up. R1 & R2 are required by the microprocessor for internal startup. S1 is the reed switch, which is only turned on once a second, which allows a reduction in power consumption, as no pull up or pull down is every on continuously.

R4 and R5 form a voltage divider circuit, which uses an internal comparator and reference voltage on the microprocessor to determine a low battery condition. The microprocessor is programmed during manufacturing using pins U3-1, U3-7, U3-10 & U3-14.

Finally, when a change of state is detected, or a "hearbeat timeout" occurs, the microprocessor powers on the RF transmitter (EN U1-18), and after a brief powerup time, data is sent out on U1-19, in a Pulse Width Modulation format, using On-Off Keying.

3. RF Transmitter

The RF transmitter is a TEMIC U2745B single frequency OOK transmitter. It uses a fixed Phase Locked Loop on chip to generate the transmit frequency from a crystal reference (Y1). The loop filter is set with components R8, C6 & C7. RF bypass capacitors C12, C5, C8, C13 & C4 are used to ensure clean spectrum on transmit. R9 is used as a power set reference to the output amplifier (on chip). L1 is used to provide an RF choke to the amplifier power supply. The transmit output is matched to the wire loop antenna through L1, C11 & C10. R7 is include to reduce the Q of the tuned circuit.

Note: the schematic for this part is SDI-0028-005