MSD P11032 Future Work Quick Reference Guide

P11032 Stopping Point

At the end of the MSD II process, P11032 delivered a functional proof-of-concept prototype to the customer which contained a modified circuit board from an existing PowerPoint remote. The reliable operational range is approximately 31 ft, with an extended range of 45 ft. Beyond 31 ft the device does not work consistently. P11032 has left behind price quotes and feasibility recommendations for mass production, which will be covered in the following Production Notes sections. Mechanical and electrical lessons learned will be shared in the Recommendations sections.

Mechanical Recommendations

Future teams should consider making the device closed on one end, such that only one cover is needed to enclose the internals of the watch. This will eliminate cost and number of pieces. It will also allow for easier injection molding. If the team is able to create their own board, they can choose a circuit board footprint geometry that is easy to package in a one cover design.

Mechanical Mass Production Notes

For mass producing 1000 parts, plastic injection molding would be recommended for the housing. In order to decrease tool and die costs, a standard injection mold with a rapid prototype insert could be used, estimated at $1500 to make. For additional questions regarding manufacturability, a great reference textbook is “Design for Manufacturability,” by James G. Bralla. Also, Dr. Cormier, a professor in the Industrial Engineering department and Rapid Prototyping expert, is a great resource. When designing the part for injection molding, careful consideration should be given to mold parting line location and proper draft angles to aid in part removal.

It will be very expensive to produce custom bands for each unit. A better alternative would be to find a wholesale distributor and try to slash the price down on the ground of making a large order.

Electrical Recommendations & Production Notes

It is recommended that future groups design their own circuits and associated receiver and transmitter PCBs for use in a production model. A preliminary circuit design was made, but due to time constraints was never successfully tested. Certain design considerations concerning circuit design are laid out below.

1. Use of an in-board PCB antenna is highly recommended. The modified PCB used in the proof-of-concept prototype had a range of 50 + ft with no latency or functionality problems before the PCB antenna was removed to save space. This was replaced with a wire loop antenna, which never regained the previous range or reliability at longer range which was present on the original device, The wire loop antenna also was cumbersome when assembling the final prototype.

2. Consider a circuit design which does not use a micro-controller. It may prove to save power and layout space if the transmitter/receiver pair designed utilizes a simple encoder-transmitter and decoder-receiver topology. Our most common feedback comment centered around a desire for a smaller device, so a smaller board and in turn, a smaller transmitter would go a long way towards satisfying the customer.

3. Consider the pros and cons of using TX and RX chips with internal crystal oscillators. Along the

same lines as the previous point, transmit and receive chips are available which require no external oscillator. These however come at a higher cost than those that do. Consider the trade-offs between price and device size when choosing your components.

4. Consider using PCB mounted buttons. One of the most difficult assembly steps we encountered was using jumper wires to solder our buttons. This adds an element of fragility which may be eliminated with board mounted buttons. Large scale assembly would also be much more efficient with little or no need for jumper wires to be manually soldered to the device.

5. Consider adding features. Another common point of feedback was the desire for a laser pointer to be included in the device. Consider if this would add enough value to the customer to include it in the transmitter device, as well as perhaps other customer requested features.

6. Design your custom PCB and housing concurrently, to avoid assembly or packaging complications. Our housing was designed around our board, limiting our options in terms of device size and look.

Below are some simple transmitter and receiver designs which may be useful as a reference. These were taken from the datasheets of Linx Technologies LC series RF modules, as well as Micrel Quik Radio modules.

http://www.micrel.com/_PDF/micrf112.pdf

http://www.micrel.com/_PDF/micrf002-022.pdf

http://www.linxtechnologies.com/resources/data-guides/txm-xxx-lc.pdf

http://www.linxtechnologies.com/resources/data-guides/rxm-xxx-lc-s.pdf

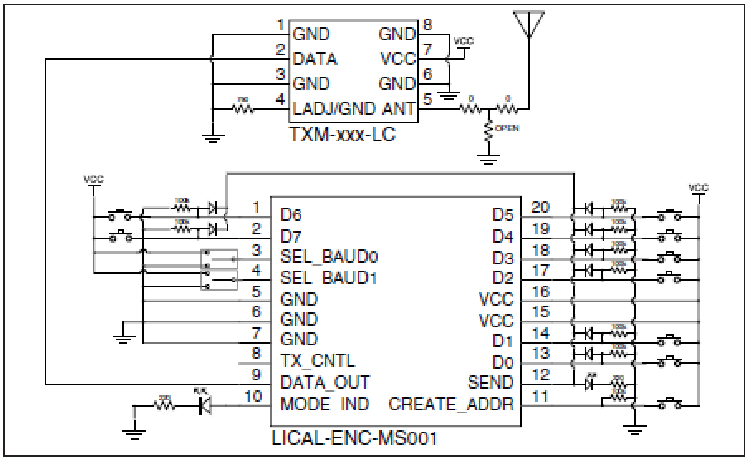


Figure 12: Typical Remote Control Example

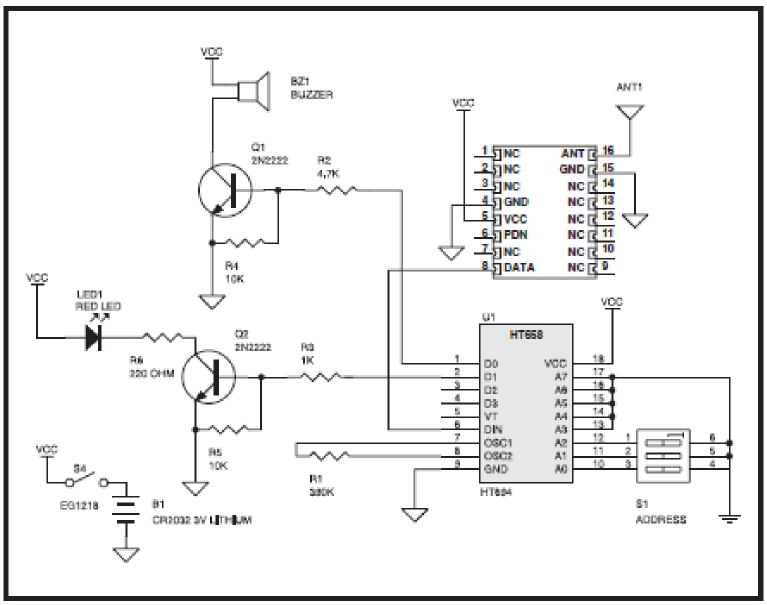


Figure 16: Basic Remote Control Receiver

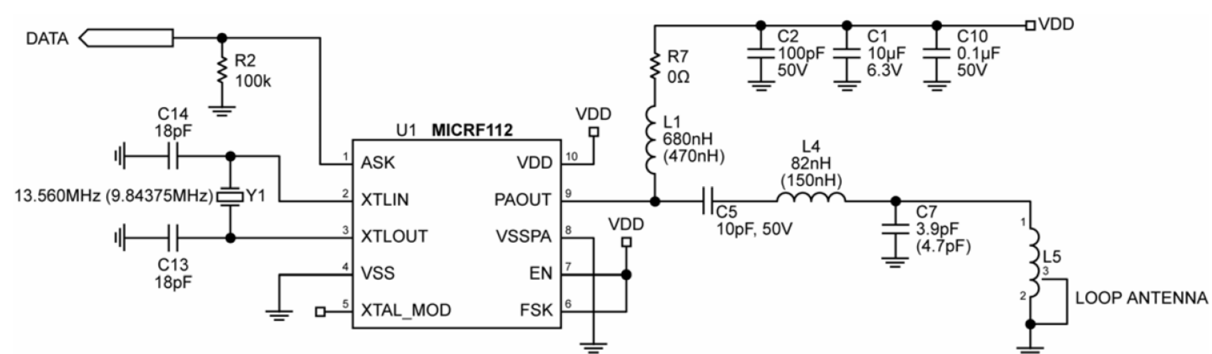
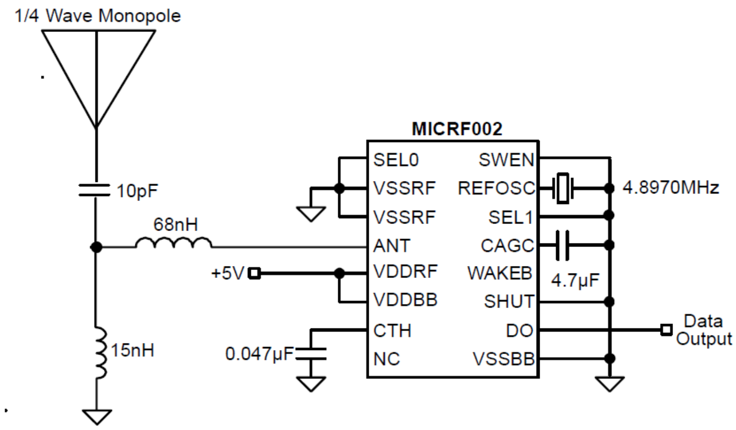


Figure 1. MICRF112 ASK Key Fob Design

Note: Values in parenthesis are for 315MHz



315MHz 800bps On-Off Keyed Receiver