

the transmitting frequency uncertainty is large compared to typical modern systems. Compared to other RF systems, ingestible sensors have extremely limited size available for both the coils that transmit the signals and any capacitors that might be used to store energy between communications. In addition, health concerns and opinions of regulatory agencies such as the FDA limit the amount of certain metals that may be digested by a patient, thus placing a cap on the total available power for both sensing and communication. These communication protocols effectively improve the signal levels available for external detection and decoding. There is incentive to increase the signal levels received from ingestible identifiers such that the ingestible identifier can be detected more readily, and by receivers placed on various parts of the body, or worn by a patient.

SUMMARY

[0003a] In an aspect, the present disclosure refers to an electronic device comprising: a control device; a driver circuit coupled to the control device, the driver circuit configured to alter conductance; a partial power source coupled to the control device, the partial power source is configured to provide a voltage potential difference to the control device and the driver circuit as a result of the partial power source being in contact with a conductive fluid, the partial power source comprising: a first material electrically coupled to the control device; and a second material electrically coupled to the control device and electrically isolated from the first material; an inductor coupled to the driver circuit, wherein the driver circuit is configured to develop a current through the inductor, and wherein a magnitude of the current developed through the inductor is varied to produce an encoded signal that is remotely detectable by a receiver.

[0004] In one example, an electronic device is provided. The electronic device comprises a control device, a driver circuit coupled to the control device, a partial power source coupled to the control device, the partial power source is configured to provide a voltage potential difference to the control device and the driver circuit as a result of the partial power source being in contact with a conductive fluid. The partial power source comprises a first material electrically coupled to the control device and a second material electrically coupled to the control device and electrically isolated from the first material. An inductor is coupled to the driver circuit, wherein the driver circuit is configured to develop a current through the inductor, and wherein a magnitude of the current developed through the inductor is varied to produce an encoded signal that is remotely detectable by a receiver.

[0005] In another example, a receiver circuit is provided. The receiver circuit comprises a resonant circuit, a low noise voltage amplifier coupled to the resonant circuit,

and a receiver processor circuit coupled to an output of the low noise voltage amplifier, the receiver processor configured to receive an analog signal representative of an impulse communication signal, convert the analog signal to a digital signal, and decode the digital signal to reproduce data transmitted as the impulse communication signal. In addition, the receiver is intended to be worn by a patient on a daily basis for extended periods of time. Therefore, its size and power consumption are both limited.

[0006] In yet another example, a receiver circuit is provided. The receiver circuit comprises a receiving inductor, a transimpedance amplifier coupled to the receiving coil, an amplifier coupled to an output of the transimpedance amplifier, and a receiver processor circuit coupled to an output of the amplifier, the receiver processor configured to receive an analog signal representative of an impulse communication signal, convert

CLAIMS

1. An electronic device comprising:
 - a control device;
 - a driver circuit coupled to the control device, the driver circuit configured to alter conductance;
 - a partial power source coupled to the control device, the partial power source is configured to provide a voltage potential difference to the control device and the driver circuit as a result of the partial power source being in contact with a conductive fluid, the partial power source comprising:
 - a first material electrically coupled to the control device; and
 - a second material electrically coupled to the control device and electrically isolated from the first material;
 - an inductor coupled to the driver circuit, wherein the driver circuit is configured to develop a current through the inductor, and wherein a magnitude of the current developed through the inductor is varied to produce an encoded signal that is remotely detectable by a receiver.
2. The electronic device of claim 1, wherein the driver circuit comprises a single ended driver circuit.
3. The electronic device of claim 1, wherein the driver circuit comprises a push-pull H-bridge driver circuit.
4. The electronic device of claim 1, wherein the driver circuit comprises:
 - cross-coupled transistors; and
 - a capacitor coupled between drains of the cross-coupled transistors;wherein the inductor is coupled between the drains of the cross-coupled transistors.
5. The electronic device of claim 1, further comprising:
 - a battery voltage doubler circuit;
 - a pulse generator circuit coupled to the battery voltage doubler circuit; and
 - an inductor discharge circuit coupled to the pulse generator circuit.
6. The electronic device of claim 5, wherein the battery voltage doubler circuit comprises:

a switched capacitor stage comprising first and second switched capacitors, wherein the switched capacitor stage receives an input voltage and outputs an output voltage having a magnitude of twice the input voltage; and

a clock stage;

wherein the clock stage receives a pulse train and produces clock pulses of opposite phases, wherein the clock pulses of opposite phases cause the first and second capacitors to alternately charge to a voltage equal to twice the input voltage.

7. The electronic circuit of claim 5, wherein the pulse generator circuit comprises: first and second trigger circuits;

an RC timing circuit comprising a resistor R and a capacitor C to set a time constant delay τ at the input of the second delayed trigger circuit;

an inverter coupled to the output of the first undelayed trigger circuit; and

a logic gate having a first input coupled to an output of the inverter, a second input coupled to an output of the second trigger circuit, and an output coupled to the inductor trigger circuit;

a first oscillator coupled to the input of the first trigger circuit and coupled to the RC timing circuit; and

a second oscillator coupled to the inductor trigger circuit.

8. The electronic circuit of claim 5, wherein the inductor discharge circuit comprises:

a capacitor charging circuit;

a coupling circuit; and

charging and discharging circuits for charging and discharging the inductor.

9. The electronic circuit of claim 1, wherein the driver circuit is configured to implement an impulse communication protocol.

10. The electronic device of claim 1, wherein the first and second materials are selected to provide the voltage potential difference as a result of the first and second materials being in contact with the conductive fluid.

11. The electronic device of claim 1, comprising an electronic switch, wherein the electronic switch comprises first and second terminals and a control terminal, and wherein the control terminal is operatively coupled to the driver circuit, the first terminal is coupled to the inductor, and the second terminal is coupled to the second material, and

wherein the inductor is coupled between the first material and the first terminal of the electronic switch, wherein the driver circuit is configured to alter the conductance of the electronic switch between the first and second materials such that the current is developed through the inductor.

12. The electronic device of claim 1, wherein the inductor comprises at least two inductive elements formed on separate insulating substructures of a semiconductor integrated circuit.

13. The electronic device of claim 12, wherein the at least two inductive elements are coupled through a via formed between the separate insulating substructures.