

CLAIMS

What is claimed is:

1. A wirelessly powered implantable medical device receiving time-division wireless power transfer signals, the wirelessly powered medical device comprising:
receiver circuitry for receiving the time-division wireless power transfer signals; and
a time division switching module coupled to the receiver for generating multiple supply voltages in response to the time-division wireless power transfer signals.
2. The wirelessly powered implantable medical device in accordance with Claim 1 wherein the time division switching module comprises a single-inductor multiple-output (SIMO) DC-DC converter.
3. The wirelessly powered implantable medical device in accordance with Claim 2 wherein the SIMO DC-DC converter comprises multiple switches for supplying each of the multiple supply voltages to different circuitry of the wirelessly powered implantable medical device.
4. The wirelessly powered implantable medical device in accordance with Claim 3 wherein the SIMO DC-DC converter further comprises a switch timing module coupled to the multiple switches for controlling the operation of the multiple switches in response to the time-division wireless power transfer signals to supply

each of the multiple supply voltages to the different circuitry of the wirelessly powered implantable medical device.

5. The wirelessly powered implantable medical device in accordance with Claim 4 wherein the SIMO DC-DC converter further comprises:

a voltage detector coupled to the multiple switches for detecting the multiple supply voltages and generating voltage detection results; and

a transmission device coupled to the voltage detector for transmitting the voltage detection results to a wireless transmitter transmitting the time-division wireless power transfer signals for adjusting parameters of the time-division wireless power transfer signals for synchronization with operation of the multiple switches.

6. The wirelessly powered implantable medical device in accordance with Claim 5 wherein the parameters comprise one or both of amplitude and duty cycle of the time-division wireless power transfer signals.

7. The wirelessly powered implantable medical device in accordance with Claim 5 wherein the transmission device transmits the voltage detection results to the wireless transmitter by backscattering (LSK).

8. The wirelessly powered implantable medical device in accordance with any of Claims 3 to 7 wherein each of the different circuitry of the wirelessly powered implantable medical device operates at a different one of the multiple supply voltages.

9. A system for synchronized time-division wireless power transfer comprising:

a wireless transmitter for generating and transmitting time-division wireless power transfer signals; and

a wirelessly powered device comprising:

a wireless receiver for receiving the time-division wireless power transfer signals; and

a time division switching module coupled to the wireless receiver and generating multiple supply voltages synchronized to the time-division wireless power transfer signals for powering different circuitry of the wirelessly powered device.

10. The system in accordance with Claim 9 wherein the time division switching module comprises:

multiple switches for supplying each of the multiple supply voltages to the different circuitry of the wireless receiver; and

a switch timing module coupled to the multiple switches for controlling the operation of the multiple switches for synchronizing the multiple supply voltages to the time-division wireless power transfer signals.

11. The system in accordance with Claim 10 wherein the time division switching module further comprises a voltage detector coupled to the multiple switches for detecting the multiple supply voltages and generating voltage detection results, the wirelessly powered device further comprising a transmission device

coupled to the voltage detector for transmitting the voltage detection results to the wireless transmitter, and

wherein the wireless transmitter comprises:

transmitter circuitry for transmitting the time-division wireless power transfer signals; and

a digital block coupled to the transmitter circuitry and adjusting parameters of the time-division wireless power transfer signals in response to the voltage detections results for synchronization of the time-division wireless power transfer signals with operation of the multiple switches.

12. The system in accordance with Claim 11 wherein the parameters comprise one or both of amplitude and duty cycle of the time-division wireless power transfer signals.

13. The system in accordance with any of Claims 9 to 12 wherein the wirelessly powered device comprises a wirelessly powered implantable medical device and wherein the different circuitry performs various operations of the wirelessly powered implantable medical device.

14. A method for closed-loop carrier waveform adaption for wireless power control, the method comprising:

generating time-division wireless power transfer signals having a carrier waveform adapted for wireless power transfer;

receiving the wireless power transfer signals and generating multiple supply voltages synchronized to the carrier waveform of the wireless power transfer signals;

generating voltage detection results in response to the multiple supply voltages; and

adjusting the carrier waveform of the wireless power transfer signals in response to the voltage detection results.

15. The method in accordance with Claim 14 wherein adjusting the carrier waveform comprises adjusting one or more parameters of the carrier waveform of the wireless power transfer signals in response to the voltage detection results, the parameters comprising at least an amplitude of the carrier waveform and a duty cycle of the carrier waveform.