[0006] According to at least one embodiment of the present invention, a wirelessly powered implantable medical device receiving time-division wireless power transfer signals is provided. The wirelessly powered medical device includes receiver circuitry for receiving the time-division wireless power transfer signals and a time division switching module. The time division switching module is coupled to the receiver for generating multiple supply voltages in response to the time-division wireless power transfer signals. The time division switching module includes a single-inductor multiple-output (SIMO) DC-DC converter and the SIMO DC-DC converter includes multiple switches for supplying each of the multiple supply voltages to different circuitry of the wirelessly powered implantable medical device. The SIMO DC-DC converter includes an envelope detector coupled to the multiple switches and configured to synchronize operation of the multiple switches to duty cycles of the time-division wireless power transfer signals for supplying one of the multiple supply voltages to a corresponding one of the different circuitry of the wirelessly powered implantable medical device during a corresponding one of the duty cycles of the time-division wireless power transfer signals having an amplitude corresponding to the one of the multiple supply voltages.

[0007] According to another embodiment of the present invention, a system for synchronized time-division wireless power transfer is provided. The system includes a wireless transmitter for generating and transmitting time-division wireless power transfer signals and a wirelessly powered device. The wirelessly powered device includes a wireless receiver for receiving the time-division wireless power transfer signals and a time division switching module. The time division switching module is coupled to the wireless receiver and supplies multiple supply voltages to different circuitry of the wirelessly powered device, wherein the time division switching module

is configured to synchronize the supply of the multiple supply voltages to the time-division wireless power transfer signals for powering different circuitry of the wirelessly powered device. The time division switching module includes multiple switches for supplying each of the multiple supply voltages to the different circuitry of the wireless receiver and an envelope detector coupled to the multiple switches for synchronizing the operation of the multiple switches to a duty cycle of the time-division wireless power transfer signals.

[0008]

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, wherein the time division switching module comprises a single-inductor multiple-output (SIMO) DC-DC converter, and 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, the SIMO DC-DC converter comprising an envelope detector coupled to the multiple switches and configured to synchronize operation of the multiple switches to duty cycles of the time-division wireless power transfer signals for supplying one of the multiple supply voltages to a corresponding one of the different circuitry of the wirelessly powered implantable medical device during a corresponding one of the duty cycles of the time-division wireless power transfer signals having an amplitude corresponding to the one of the multiple supply voltages.

2. The wirelessly powered implantable medical device in accordance with Claim 1 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.

3. The wirelessly powered implantable medical device in accordance with Claim 2 wherein the parameters comprise the duty cycle of the time-division wireless power transfer signals.

4. The wirelessly powered implantable medical device in accordance with Claim 3 wherein the parameters further comprise the amplitude of the time-division wireless power transfer signals.

5. The wirelessly powered implantable medical device in accordance with Claim ~~5~~ 2 wherein the transmission device transmits the voltage detection results to the wireless transmitter by backscattering (LSK).

6. The wirelessly powered implantable medical device in accordance with Claim 1 wherein each of the different circuitry of the wirelessly powered implantable medical device operates at a different one of the multiple supply voltages.

7. 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 supplying multiple supply voltages to different circuitry of the wirelessly powered device, wherein the time division switching module is configured to synchronize the supply of the multiple supply voltages to the time-division wireless power transfer signals for powering different circuitry of the wirelessly powered device, the time division switching module comprising:

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

an envelope detector coupled to the multiple switches for synchronizing the operation of the multiple switches to a duty cycle of the time-division wireless power transfer signals.

8. The system in accordance with Claim 7 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 configured to adjust 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.

9. The system in accordance with Claim 8 wherein the parameters comprise the duty cycle of the time-division wireless power transfer signals.

10. The system in accordance with Claim 9 wherein the parameters further comprise an amplitude of the time-division wireless power transfer signals.

11. The system in accordance with Claim 7 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.