CLAIMS

What is claimed is:

1. A bidirectional power transfer system comprising:

a multiterminal power switching device comprising at least one DC terminal, at least one AC terminal, and at least one control terminal, the multiterminal power switching device adjustable between an amplifying condition and a rectifying condition, and arranged for:

bidirectionally communicating via the at least one DC terminal a DC voltage and a DC current, and

bidirectionally communicating via the at least one AC terminal a power signal having an amplitude, a frequency, and a phase;

a controller arranged for:

establishing at the at least one control terminal of the power switching device an oscillating signal having the frequency and the phase of the power signal, and for

adjusting the power switching device between the amplifying condition and the rectifying condition by adjusting the phase of the oscillating signal; and

a phase, frequency, and duty cycle adjustment circuit in wired data communication with the controller and in wired electrical communication with the power switching device via the at least one control terminal.

2. The bidirectional power transfer system of claim 1, wherein:

the power signal has a duty cycle;

the phase, frequency, and duty cycle adjustment circuit comprises a oscillator for producing under instruction from the controller the oscillating signal; and

the phase, frequency, and duty cycle adjustment circuit is further arranged for adjusting the duty cycle of the power signal by adjusting a duty cycle of the oscillating signal.

3. The bidirectional power transfer system of claim 1, further comprising a tuning network in wired data communication with the controller and in wired electrical communication with the power switching device via the at least one AC terminal, wherein the tuning network is arranged for adjusting under instruction from the controller the power signal to a tuned power signal.

4. The bidirectional power transfer system of claim 3, further comprising an amplitude/frequency/phase detector in wired data communication with the controller and in wired electrical communication with the tuning network wherein the amplitude/frequency/phase detector is arranged to determine an amplitude, a frequency and a phase of any power signal communicated between the tuning network and an AC load/source external to the bidirectional power transfer system.

5. The bidirectional power transfer system of claim 4, wherein the phase, frequency, and duty cycle adjustment circuit is arranged to adjust the oscillating signal based on measurement information received from the amplitude/frequency/phase detector one of directly and via the controller.

6. The bidirectional power transfer system of claim 4, wherein the tuning network comprises a voltage-current tuner for adjusting a phase difference between a voltage and a current of the tuned power signal based on measurement data from the amplitude/frequency/phase detector when the power switching device is in the amplifying condition.

7. The bidirectional power transfer system of claim 4, further comprising in wired data communication with the controller and in wired electrical communication between the power switching device and a DC power source/load external to the bidirectional power transfer system a power management circuit arranged for impedance matching the power switching device and the external DC power source/load and for adjusting DC power

communicated between the power switching device and the DC power source/load based on measurement information received from the amplitude/frequency/phase detector one of directly and via the controller.

8. The bidirectional power transfer system of claim 7, further comprising in wired data communication with the controller a voltage/current-detector disposed to determine a DC voltage and DC current passed between the power switching device and the power management circuit.

9. The bidirectional power transfer system of claim 8, wherein the phase, frequency, and duty cycle adjustment circuit is arranged to adjust the oscillating signal based on a feedback signal received from the voltage/current-detector one of directly and via the controller.

10. The bidirectional power transfer system of claim 8, further comprising a memory in wired data communication with the controller, with the amplitude/frequency/phase detector, and with the voltage/current detector wherein the memory is arranged to receive and store data received from the two detectors and to provide data communication from the two detectors to the controller.

11. The bidirectional power transfer system of claim 4, wherein the tuning network further comprises one or more of a compensation network, a matching network, and a filter.

12. The bidirectional power transfer system of claim 3, comprising a modulator configured for modulating information onto at least one of the power signal and the DC voltage.

13. The bidirectional power transfer system of claim 12, wherein the modulator comprises at least one of the power switching device and the tuning network.

14. The bidirectional power transfer system of claim 4, wherein the AC load/source external to the bidirectional power transfer system comprises a transmitter-receiver resonator configured for:

resonating at the frequency of the power signal; and for

bimodal transferring of power.

15. The bidirectional power transfer system of claim 1, wherein bidirectional power transfer system is configured for modulating at least one of digital and analog information onto at least one of the DC voltage, the power signal, and a harmonic of the power signal.

16. The bidirectional power transfer system of claim 1, wherein all circuit elements of the system are monolithically integrated in a silicon single crystal wafer.

17. The bidirectional power transfer system of claim 1, wherein at least a portion of circuit elements of the system are integrated by microelectronic chip technology.

18. The bidirectional power transfer system of claim 4, wherein the AC load/source comprises a utility AC power grid.

19. The bidirectional power transfer system of claim 1, wherein the multiterminal power switching device comprises a differential switched-mode self-synchronous power amplifier/rectifier.

20. A bidirectional power transfer system comprising:

a multiterminal power switching device comprising at least one DC terminal, at least one AC terminal, and at least one control terminal, the multiterminal power switching device adjustable between an amplifying condition and a rectifying condition, and arranged for:

bidirectionally communicating via the at least one DC terminal a DC voltage and a DC current, and

bidirectionally communicating via the at least one AC terminal a power signal having an amplitude, a frequency, and a phase;

a controller arranged for:

establishing at the at least one control terminal of the power switching device an oscillating signal having the frequency and the phase of the power signal, and for

adjusting the power switching device between the amplifying condition and the rectifying condition by adjusting the phase of the oscillating signal;

an amplitude/frequency/phase detector in wired data communication with the controller and in wired electrical communication with the power switching device wherein the amplitude/frequency/phase detector is arranged to determine an amplitude, a frequency and a phase of any power signal communicated between the power switching device and a utility AC power grid external to the bidirectional power transfer system; and

a phase, frequency, and duty cycle adjustment circuit in wired data communication with the controller and in wired electrical communication with the power switching device via the at least one control terminal.