

CLAIMS

What is claimed is:

1. An electric vehicle charging system comprising:

an interleaved DC-DC control system configured to facilitate providing electric charge to an electric vehicle battery from an energy storage device, the interleaved DC-DC control system comprising:

an inrush current limiting circuit;

three parallel boost converters, wherein each boost converter of the three parallel boost converters is configured to operate in a discrete phase, wherein the three parallel boost converters are communicatively coupled to the inrush current limiting circuit;

unidirectional current circuitry communicatively coupled to the three parallel boost converters; and

a controller communicatively coupled to the interleaved DC-DC control system, the controller comprising:

electronic control circuitry configured to control the interleaved DC-DC control system; and

vehicle communication circuitry configured to establish charging protocols between the interleaved DC-DC control system and the electric vehicle battery, wherein the vehicle communication circuitry is communicatively coupled to the electric control circuitry.

2. The electric vehicle charging system of claim 1, further comprising a safety circuit configured to discharge the electric vehicle charging system due to power failure, wherein the safety circuit comprises:

a resistor; and

multiple capacitors, wherein the multiple capacitors are in parallel with the resistor.

3. The electric vehicle charging system of claim 2, wherein the safety circuit further comprises an energy storage component, wherein the energy storage component is configured to automatically engage if the electric vehicle charging system loses power.

4. The electric vehicle charging system of claim 1, wherein the inrush current limiting circuit comprises multiple selectively switchable components that are controlled by the controller, wherein at least one switching component of the multiple selectively switchable components includes a higher impedance path than at least one other switching component of the multiple selectively switchable components.

5. The electric vehicle charging system of claim 1, wherein the unidirectional current circuitry is configured to prevent discharge from the electric vehicle battery.

6. The electric vehicle charging system of claim 1, wherein the electronic control circuitry is further configured to read sensor values of isolated current sensors of the interleaved DC-DC control system and configured to set a duty ratio for the three parallel boost converters at 120 degrees.

7. The electric vehicle charging system of claim 1, wherein the interleaved DC-DC control system includes an electromagnetic interference filter configured to inhibit transfer of noise to the electric vehicle battery.

8. The electric vehicle charging system of claim 1, wherein the interleaved DC-DC control system includes three additional parallel boost converters in addition to the three parallel boost converters such that there is a total of six boost converters, wherein each boost converter of the six boost converters is configured to operate 60 degrees out of phase of each other.

9. The electric vehicle charging system of claim 1, wherein the three parallel boost converters is a first set of three parallel boost converters, and wherein the

interleaved DC-DC control system includes a second set of three parallel boost converters and a third set of three parallel boost converters such that there is a total of nine boost converters, and wherein each boost converter of the nine boost converters is configured to operate 40 degrees out of phase of each other.

10. The electric vehicle charging system of claim 1, wherein the electric vehicle charging system is a transportable electric vehicle charging system, wherein the transportable electric vehicle charging system includes a multilayered printed circuit board stacked on the energy storage device, wherein the energy storage device includes DC battery modules, and wherein the multilayered printed circuit board comprises the interleaved DC-DC control system and the controller.

11. The electric vehicle charging system of claim 1, wherein each of the three parallel boost converters includes a 20kW converter configured to boost an input voltage to a higher voltage of the electric vehicle battery.

12. A method of manufacturing an electric vehicle charging system, the method comprising:

using electroplating to form an interleaved DC-DC control system that includes magnetic core inductors, a heatsink, and multistrand wire, wherein the electroplating produces a single printed circuit board that includes three parallel boost converters;

stacking the interleaved DC-DC control system on an energy storage device, wherein the stacking aligns the interleaved DC-DC control system such that the single printed circuit board is a same length and width as the energy storage device.

13. The method of manufacturing of claim 12, further comprising forming a controller comprising:

electronic control circuitry configured to control the interleaved DC-DC control system; and

vehicle communication circuitry configured to establish charging protocols between the interleaved DC-DC control system and the electric vehicle battery.

14. The method of manufacturing of claim 12, wherein the interleaved DC-DC control system formed by the electroplating further comprises:

an inrush current limiting circuit;

an electromagnetic interference filter configured to inhibit transfer of noise to an electric vehicle battery; and

unidirectional current circuitry configured to prevent discharge from the electric vehicle battery.

15. The method of manufacturing of claim 12, wherein the method further comprises forming a safety circuit configured to discharge the electric vehicle charging system due to power failure, wherein the safety circuit comprises:

a resistor; and

multiple capacitors, wherein the multiple capacitors are in parallel with the resistor.

16. A method of charging an electric vehicle battery, the method comprising:

receiving, by an interleaved DC-DC control system, an electrical power input from an energy storage device, the electrical power input being received at an inrush current limiting circuit of the interleaved DC-DC control system, wherein the inrush current limiting circuit includes multiple switching components;

switching, by a controller communicatively coupled to the interleaved DC-DC control system, the multiple switching components on and off during an inrush current phase so that an electrical current flows continuously to three parallel boost converters of the interleaved DC-DC control system;

boosting, by the three parallel boost converters, an input voltage of the electrical power input to a higher voltage of the electric vehicle battery;

filtering out, by an electromagnetic interference filter of the interleaved DC-DC control system, noise from the electrical power input; and

transmitting, via unidirectional current circuitry, the electrical power input to the electric vehicle battery.

17. The method of claim 16, wherein each of the three parallel boost converters operate in discrete phase offsets, each phase being offset by 120 degrees.

18. The method of claim 16, wherein the method further comprises activating, based on detecting a power failure, a safety circuit configured to discharge the electrical power input, wherein the safety circuit comprises a resistor in parallel with capacitors.

19. The method of claim 16, wherein one switching component of the multiple switching components comprises a higher impedance path than another switching component of the multiple switching components.

20. The method of claim 16, wherein converter control circuitry of the controller reads sensor values from current sensors of the three parallel boost converters and based thereon sets a duty ratio for the three parallel boost converters.

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