

System and Method For Enhancing Lifespan Of Multi-Stage Constant Current Based Gallium Nitride Switch

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ABSTRACT

A method (200) and system (100) for enhancing lifespan of multistage constant current (MSCC) based gallium nitride (GaN) switching converter (102) is disclosed. The system (100) comprises a current transition capture module (104) and a voltage transition capture module (106) for measuring current and voltage transitions of each GaN transistor in the converter (102). A junction temperature unit (108) monitors temperature fluctuations during switching events, while a sensor unit collects data from the converter (102) and battery system (122). The collected data is stored in a storage unit (114) and analyzed by a processor (116) to optimize charging current steps. A controller module (118) then adjusts the charging current based on this analysis, while a battery module (120) manages charging and discharging. A display unit (124) shows real-time sensor data, allowing for dynamic modifications.

KEY APPLICATION AREAS

1. Electric vehicle (EV) battery charging systems.
2. Battery Management Systems (BMS).
3. GaN-based power converters and power electronics.
4. Renewable energy storage systems.
5. Fast chargers for consumer electronics.
6. Industrial power supply systems.
7. Potential Use Cases.

POTENTIAL USE

- 1.Fast battery charging with reduced charging time.
- 2.Extending GaN converter lifespan through real-time optimization.
- 3.Adaptive charging based on current, voltage, and temperature monitoring.
- 4.Thermal stress and damage reduction in high-frequency converters.
- 5.Predictive health monitoring of power converters.
- 6.High-efficiency charging for EVs, energy storage, and industrial batteries.