

RIPPLE CANCELLATION CIRCUIT IN SWITCHING DC-DC CONVERTERS

IITM Technology Available for Licensing

Problem Statement

- Switching regulator suffers from large output ripple which makes it **unsuitable for noise sensitive applications** such as analog and RF.
- Prior techniques used to reduce the output ripple include increasing switching frequency, using large output capacitors or active ripple cancellation.
- Therefore, **increasing switching frequency reduces overall efficiency**, larger capacitor increase area and increases cost of the module.
- However, this technique requires perfect matching between main inductor and ripple cancellation inductor. Since inductors may easily have 10-20% tolerances, large mismatch between two inductors may result in negligible or no reduction in the output ripple.
- Therefore a **control technique to cancel the effect of mismatch between two inductors** and thereby achieve perfect ripple cancellation in the output voltage is essential.

Technology Category/ Market

Category - Electronics & Circuits, Integrated Circuits (ICs)

Applications - Switching DC-DC converter for power management Integrated Circuits, Voltage regulators.

Market- The global DC-DC converter market is projected to grow from \$10.04 billion in 2022 to \$21.92 billion by 2029, at a **CAGR of 11.79%**.

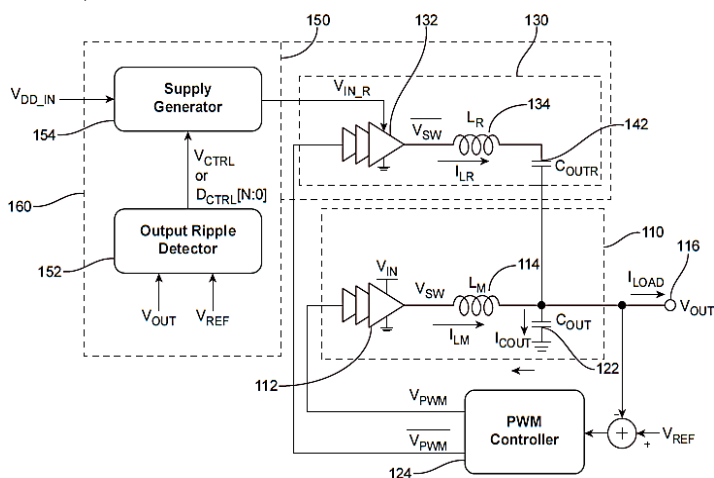


FIG. 1. shows the architecture level block diagram of the proposed voltage regulator with ripple cancellation circuitry.

Intellectual Property

- IITM IDF Ref. **1698**
- IN 201841033931**
- PCT/IN2019/050656**

Technology

- The present invention relates to circuitry and methods for ripple cancellation in switching voltage regulators (refer Fig. 1).
- The **ripple cancelling circuit 160** includes an inductor mismatch compensator circuit 150, a ripple cancellation circuit 130, and a **pulse width modulation (PWM) controller 124**.
- The method of ripple cancellation is based on detecting output ripple and varying supply voltage.
- The method uses a separate supply voltage for the cancellation path.
- The method involves a **control technique to cancel mismatch between a ripple cancellation inductor 134 and the main inductor 114** in the circuit to achieve perfect ripple cancellation in the output voltage.
- Since inductor ripple current is proportional to input voltage, any mismatch between the inductors 114, 134 is corrected by increasing or decreasing the input supply voltage.

Key Features / Value Proposition

- The proposed method may be implemented in a **multiphase DC-DC converter**.
- The advantage of the invention is that the **ripple cancellation path may be operated at low voltage resulting in low cost** and lesser area high voltage converters.
- Also small inductors and low voltage devices may be used in the ripple cancellation path.

TRL (Technology Readiness Level)

TRL - 3, Proof of concept stage

Research Lab

Prof. Qadeer Ahmad Khan

Dept. of Electrical Engineering, IIT Madras

CONTACT US

Dr. Dara Ajay, Head

Technology Transfer Office,
IPM Cell- IC&SR, IIT Madras

IITM TTO Website:

<https://ipm.icsr.in/ipm/>

Email: smipm-icsr@icsrpis.iitm.ac.in

sm-marketing@imail.iitm.ac.in

Phone: +91-44-2257 9756/ 9719