A New Compact and High Efficiency Resonant Converter

Introduction:
Among all the three-element resonant converters, the LLC series resonant converter (LLC-SRC) is the most popular topology and widely used in offline power supplies. This is because the LLC-SRC has attractive features of wide soft-switching range, high converter efficiency and easy magnetic integration.

Existing system:
The converter efficiency of the LLCSRC, it is generally necessary to replace the output diodes with synchronous rectification (SR). However, SR control for the LLC-SRC is never a simple task and generally requires costly circuitry or high accuracy sensing ICs. A current transformer along with a current compensation inductor is applied to achieve primary current sensing SR control. This SR control method can provide roughly the same efficiency improvement as the commercially used MOSFET VDS sensing SR technique. A phase compensation network is proposed with MOSFET VDS sensing to optimize the ontime of the SR MOSFET, which gives a very good performance in high frequency applications. When compared with the simple self-driven SR control, the aforementioned SR control methods all require high circuit cost.

The reason that the LLC-SRC can’t use transformer winding voltages as SR MOSFETs’ on/off triggers in the self driven SR control is because that the LLC-SRC has a current-fed, capacitor-loaded structure. The voltage polarity of an output winding in a current-fed, capacitor-loaded structure is only changed when the SR is turned off,
hence, SR for a current-fed, capacitor-loaded structure can’t be driven by the winding voltage itself.

![Diagram of resonant converter](image)

**Proposed system:**

A new resonant converter which features compact size, high efficiency, and compatibility with self-driven synchronous rectifiers is proposed. The proposed resonant converter and the LLC series resonant converter (LLC-SRC) are in the same three-element resonant converter category and these two converters both consist of 2 inductors and one capacitor in their resonant tanks. While the LLC-SRC converter has all of its resonant elements on the input side, the proposed resonant converter has one of its resonant inductors on the output side. Utilizing the output resonant inductor allows the proposed resonant converter to implement self-driven synchronous rectifiers. When comparing the series resonant inductor in the LLC-SRC, the output inductor in the proposed resonant converter generally has lower cost and smaller size in
voltage step down applications. Operational analysis of the proposed resonant converter is made through sinusoidal approximation.

**Advantages:**

- Higher voltage gain.
- Lower magnetizing current.
- Smaller B-H hysteresis loop on the resonant inductor.
- Smaller size and lower cost components.
Block diagram:

- Input DC Supply
- 12V DC
- 5V DC
- Driver Circuit
- Buffer Circuit
- Micro Controller Circuit
- Half Bridge DC-AC Converter
- Resonant Tank
- Output LC Filter
- Load
- Synchronous Half Bridge Rectifier
- High Frequency Center Taped Transformer