An Improved Class-E Current Inverter with Two Coupled Inductors for Isolation and Power Scaling without Affecting Switch Voltage Stress

This work introduces the Class-E Coupled-Inductors Current Inverter (ECICI) shown in Fig. 1 as a Class-E current source zero-voltage switching (ZVS) topology, but with minimal part count. Only one magnetic core and two windings are needed to realize the coupled inductors. The maximum output power (or voltage) can be scaled up at a constant duty ratio and virtually constant voltage stress by designing the equivalent turns ratio of the coupled inductors. The inverter offers a common ground or galvanic isolation between the load and source. An equivalent circuit shown in Fig. 1 is also introduced to simplify the design process of the inverter. The input network can be represented by a current source i_{nt} in parallel with an equivalent inductor L_{nt}. The parallel resonant network is designed to compensate L_{nt} so that the current through the load resistance is always constant.

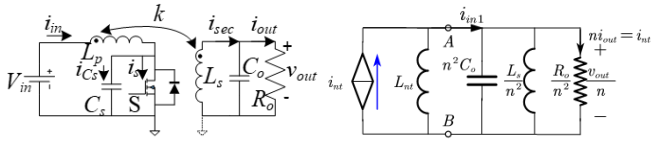
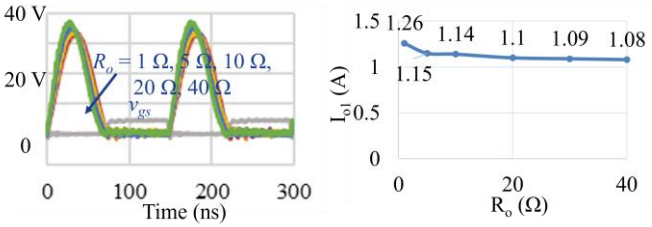


Fig.1. Topology and equivalent circuit of the ECICI



(a) v_{ds} (b) I_o

Fig. 2. Experimental results

Fig. 2 shows the experimental results. It was validated by a design with 6.78-MHz, 10-V input voltage, 1-A output current, and 23.6-W maximum output power. Load resistance was varied from 1 Ω to 40 Ω to verify load independence. A constant D at 0.5 and ZVS at all load conditions can be seen from the v_{ds} waveform in Fig. 2(a). The fundamental component of the output current and efficiency are shown in Fig. 2(b). The variation of Lout between 5 Ω and 40 Ω is within 7%. In summary, the proposed topology shows a constant current behavior within a wide load range.