

Topic Area: 1

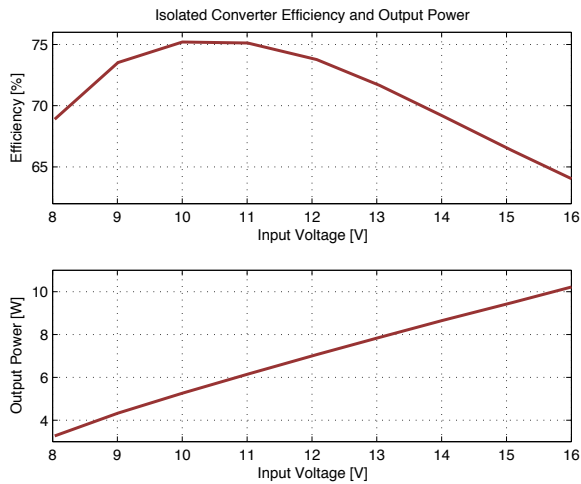


Fig. 6. Experimental power and efficiency for the isolated Φ_2 converter.

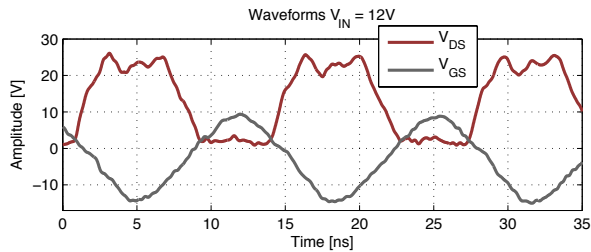


Fig. 7. Measured waveforms for the isolated Φ_2 converter.

down efficiency and output power. However, since this inductance appears in series with the primary leakage, L_{l1} , it can be compensated by reducing L_{l1} in a second iteration of the transformer design.

Figure 6 shows the experimental output power and efficiency of the converter. At the nominal operating point of

TABLE II
CONVERTER LOSS BREAKDOWN

Loss	Value ($V_{IN}=12$ V)
Switch	928 mW
Diode	379 mW
L_{2F}	85 mW
Transformer	620 mW

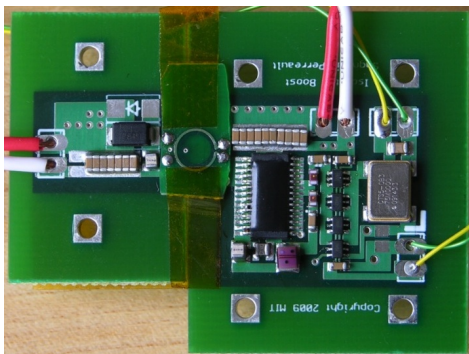


Fig. 8. Prototype Isolated Φ_2 Converter

$V_{IN} = 12$ V, the power is about 7 W and drain efficiency 74%. The estimated transformer loss is listed in Table II, the loss breakdown for the converter operating at the nominal V_{IN} . This corresponds to a transformer efficiency of 91% in the converter. Finally, the converter drain and gate voltage waveforms (Figure 7) show the desired characteristics of the resonant Φ_2 power stage including near ZVS operation.

IV. CONCLUSION

The synthesis of air-core magnetic components to realize a specified inductance matrix is feasible with current numerical simulation techniques. For the planar transformer design demonstrated here, an augmented grid search can reach a solution in less than 48 hours when run as a single thread. The nature of the search algorithm allows it to be readily parallelized, and solution times an order of magnitude shorter have been achieved. The maximum transformer parameter deviations are small enough to permit reasonable converter operation with minimal retuning. An experimental transformer 7.8 mm in diameter is able to transfer 7 watts at 91% efficiency in an isolated Φ_2 converter operating at 75 MHz with an overall power-stage efficiency of 74%.

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