no transformer is needed, which increases the efficiency of this concept further, especially under part-load conditions.

19.2.4.3.6 Integration of the step-down principle into the inverting process

The four switches of the H-type bridge itself can also be used to form the desired sine-shape of the AC output. In this case a choke has to be inserted between the bridge and the AC output as shown in Figure 19.36. As has been shown in the concepts before, the switches S1 and S2 and therefore S3 and S4 act synchronously, but their switching frequency becomes very much higher than the desired AC output frequency that is called the fundamental frequency. During the first half-period of the fundamental frequency (10 ms for 50 Hz), the switches S1 and S2 change their on and off state in such a way that the relation t_{on}/t becomes proportional to the actual desired voltage similar to the step-down converter principle shown in Figure 19.23. In fact, the step-down converter principle has been extended to work under both positive and negative polarities.

The configuration shown in Figure 19.36 has become popular since only a very few components are needed, resulting in high efficiency and low cost. One possible disadvantage of this concept is the high DC input voltage necessary for proper working, for example, 358 V DC for 230 V at the AC side. Adding a transformer between the load and the inverter's output allows reducing the DC input voltage according to its transformation ratio. This combination can be found in many products that are in the market today. Compared to the transformer-less version, separation of the potential between source and load becomes feasible. Reduced efficiency and increased investment costs are the consequences, however.

The concept shown in Figure 19.36 allows further operation in a reversed power flow. This situation may occur for inverters in the stand-alone mode if the load is of a reactive type or if surplus power from the AC side is used to charge the battery. In both cases, the variable AC voltage must be transformed to the DC voltage level, which is always higher than any value of the AC voltage as shown in Figure 19.37. By combining S2 and D3 in Figure 19.36, a complete step-up converter can be realised for the positive part of the AC voltage. For the negative part, the combination of S1 and D4 forms the step-up converter for inverse power flow.

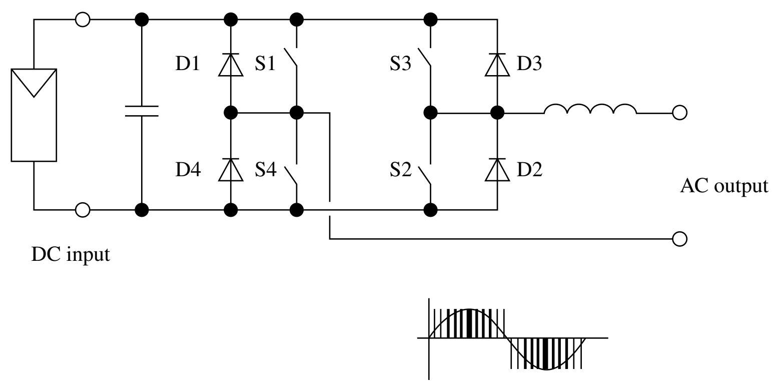

Figure 19.36 Pulse-width modulated (7-phase chopping) H-type bridge inverter