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HIGHLIGHTS OF EFFICIENCY IMPROVEMENTS IN DC/DC CONVERTERS

There is a large number of primary sources of electricity generating it in the form of direct current. These are photovoltaic solar cells, thermoelectric generators, magnetohydrodynamic generators, fuel cells that use the energy of chemical reactions, accumulators and electric motors of constant voltage. To convert DC voltages to the required level, stabilization and regulation, it is necessary to use constant voltage converters in DC / DC [1, p. 9].

Modern power consumption systems consist of pulsed switches with pulse width modulation (PWM) of serial and parallel types, whose energy and specific characteristics depend, in most cases, on the frequency of switching of power transistors, the effect of which on these characteristics has the opposite character. So the increase in the frequency of the IP reduces the efficiency (efficiency), but improves their specific characteristics. An efficient solution that can significantly increase the frequency of IP (up to 10 MHz) and thus reduce dynamic power losses is the use of quasi-resonance pulsed transducers (CRIPs) as IEs. This solution is possible if the resonant circle is connected in parallel or in series with the transistor key [2, 1-3 p.]. When the MOSFET switches on, the element generates a resonant pulse, which is then filtered on the LC output, as the traditional switching transducer. In KRIP, the width and amplitude of the pulse are fixed, and the transducer is guided by a variable frequency (that is, more pulses per second provide greater power). Using a resonance pulse, the switching element will pass to the state of zero current, at which moment the MOSFET transistor is turned off, avoiding switching losses [3].

Switching CRIP, compared with traditional switching processes in back-turn transducers, cut off / minimize losses when switching the power key, thereby reducing its temperature and increasing the efficiency of the entire circuit [4].

In the quasi-resonant circuit, unlike the resonant, the oscillatory circuit does not accumulate energy, but only takes part in the transfer of energy to the load. But such a scheme is not without disadvantages: when the load is reduced, the circuit goes into a rigid switching mode and the efficiency falls. In the range of loads, in which there is a mild switch, the circuit generates a narrow range of interferences that are easier to suppress. Losses in the output rectifier in the range of units to hundreds of watts, at output voltages 1.8-80V can be significantly reduced due to synchronous straightening [5].

Synchronous straightening methods can be used to eliminate the need for radiators. However, the control signals for MOSFETs are not easy to generate [6].

Quasi-resonance transducers usually operate in the frequency range of 300 kHz to 2 MHz.

The advantages of a quasi-resonant converter over a classic PWM converter are smaller and generally more efficient. However, a smaller size is achieved by increasing its operating frequency, and improved efficiency is sacrificed due to other frequency-dependent losses.

The disadvantage is large currents or voltages applied to power components. This forces the designer to use more powerful keys and rectifiers, which may have worse conductivity characteristics [7, 151 p.].

It is important to note the important points to consider when designing a quasi-resonant converter:

- Voltage on the resonant circuit should be greater than or equal to the voltage supply. It is necessary to choose transistors with the lowest value of the output capacitance, and the inductance to choose the largest one. This will reduce the minimum load power at which the circuit operates in a "soft" switching mode. Limit condition in which the circuit still works in a "soft" switching mode $V = \frac{I}{2N}\sqrt{\frac{L}{C}}$.
- As a resonant choke, you can use the transformer's scattering inductance or use an external throttle. The choke can stand in both the primary winding and in the secondary.
- Quasirezonance method with phase control, in contrast to the classical PWM, can be effectively used when dynamic losses are rather high and comparable to static.
- Having conducted a comparative analysis of two types of rectifier circuits - with Schottky diodes and synchronous rectifier circuits - it should be noted that with the use of Schottky diodes and transistors of approximately the same order (allowable voltage and limiting current), static loss power practically does not differ. The gain in the synchronous straightening scheme can only be obtained by using the parallel switching of transistors. This will reduce the total

resistance of the drain-drain of transistors, but this will lead to an additional increase in the cost of the product [4].

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