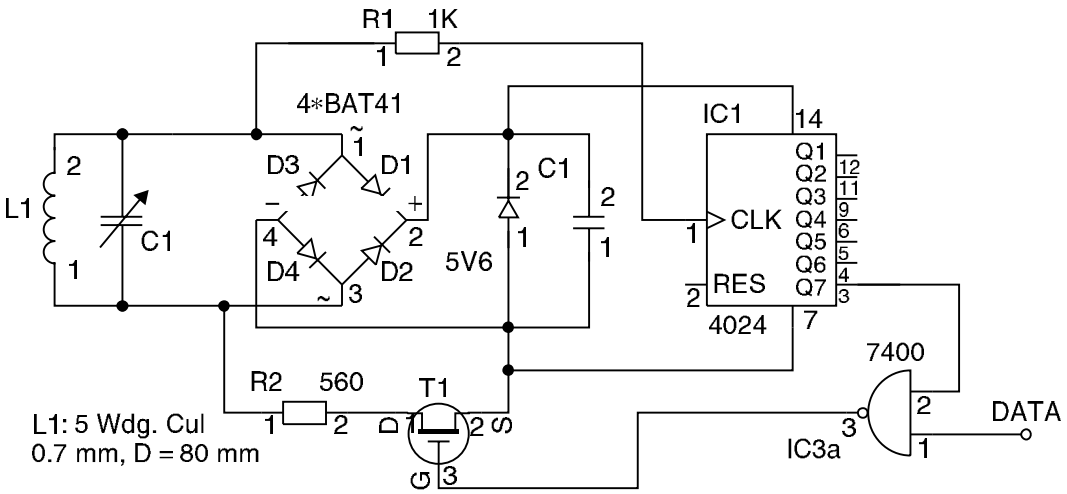

Figure 3.18 Example circuit for the generation of load modulation with subcarrier in an inductively coupled transponder

The voltage induced at the antenna coil L1 by the magnetic alternating field of the reader is rectified using the bridge rectifier (D1–D4) and after additional smoothing (C1) is available to the circuit as supply voltage. The parallel regulator (ZD 5V6) prevents the supply voltage from being subject to an uncontrolled increase when the transponder approaches the reader antenna.

Part of the high frequency antenna voltage (13.56 MHz) travels to the frequency divider's timing input (CLK) via the protective resistor (R1) and provides the transponder with the basis for the generation of an internal clocking signal. After division by $2^6 (= 64)$ a subcarrier clocking signal of 212 kHz is available at output Q7. The subcarrier clocking signal, controlled by a serial data flow at the data input (DATA), is passed to the switch (T1). If there is a logical HIGH signal at the data input (DATA), then the subcarrier clocking signal is passed to the switch (T1). The load resistor (R2) is then switched on and off in time with the subcarrier frequency.

Optionally in the depicted circuit the transponder resonant circuit can be brought into resonance with the capacitor C1 at 13.56 MHz. The range of this 'minimal transponder' can be significantly increased in this manner.

Subharmonic procedure The subharmonic of a sinusoidal voltage A with a defined frequency f_A is a sinusoidal voltage B, whose frequency f_B is derived from an integer division of the frequency f_A. The subharmonics of the frequency f_A are therefore the frequencies $f_A/2$, $f_A/3$, $f_A/4 \ldots$.

In the subharmonic transfer procedure, a second frequency f_B, which is usually lower by a factor of two, is derived by digital division by two of the reader's transmission frequency f_A. The output signal f_B of a binary divider can now be modulated with the data stream from the transponder. The modulated signal is then fed back into the transponder's antenna via an output driver.

One popular operating frequency for subharmonic systems is 128 kHz. This gives rise to a transponder response frequency of 64 kHz.

The transponder's antenna consists of a coil with a central tap, whereby the power supply is taken from one end. The transponder's return signal is fed into the coil's second connection (Figure 3.19).