Stepper motor driver

Design and implement in an FPGA device a unipolar stepper motor driver working in **half-step mode**. The stages of unipolar motor control in half-step mode are shown in Fig. 1. The designed driver should have 4 one-bit inputs:

- **SW[0] – enable** – start/stop signal;
- **SW[1] – direction** – changing the direction of rotation;
- **SW[3..2] – velocity** – selection of one of four speeds.

The designed driver should consist of the following elements:

- **MultiPrescaler** – prescaler module;
- **FreqDivider** – frequency divider generating 4 clock signals with frequencies equal to: 1/2, 1/4, 1/8 and 1/16 of the input signal frequency; implement the module based on the diagram in Fig. 3;
- **Mux4** – multiplexer (module from previous classes);
- **CntMod8EnDir** – modulo 8 counter with additional inputs controlling start/stop (enable) and changing the counting direction (direction);
- **HalfStepControl** – a combination circuit that generates stepper motor control signals based on the CntMod8EnDir counter value; implement the module based on the waveform in Fig. 2.

The general diagram of the driver is shown in Fig. 4. Connect the control signals to the GPIO pins: A (GPIO32); Bn(GPIO33); An (GPIO34) and B (GPIO35).

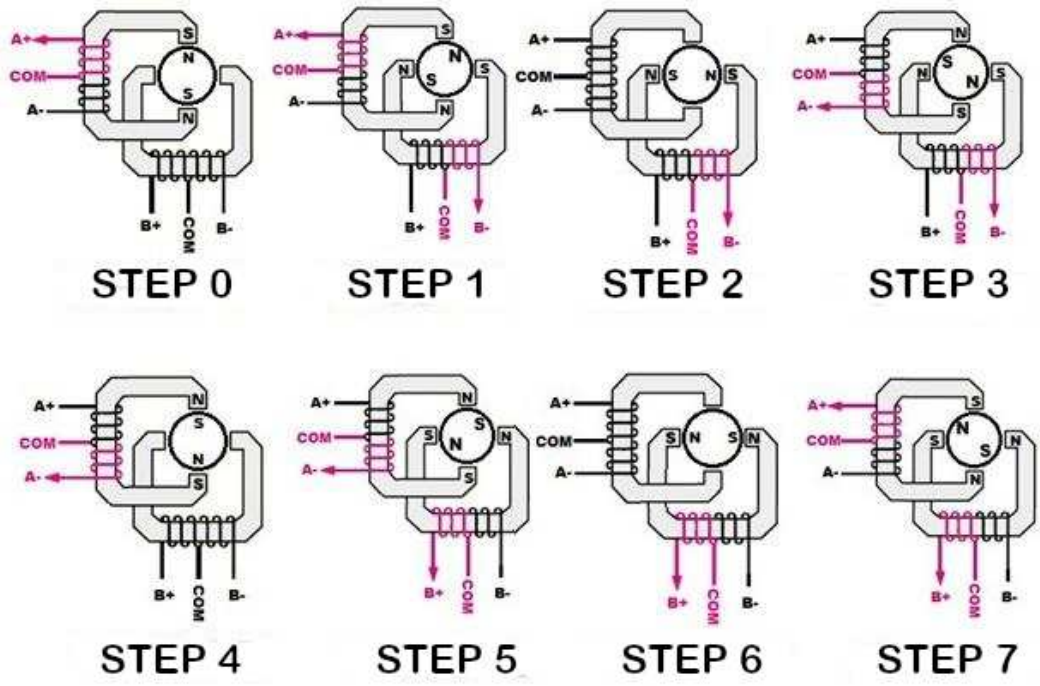

Fig. 1: Steps of controlling a unipolar motor in half-step mode

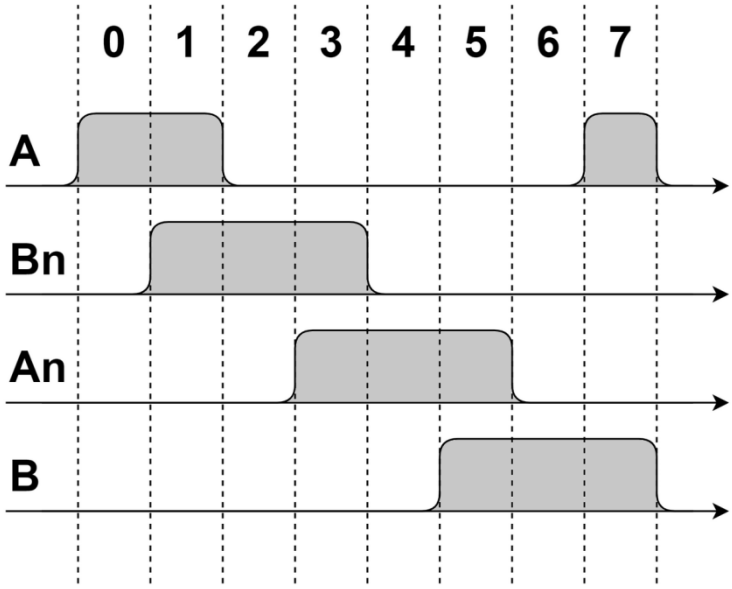

Fig. 2: Signals controlling a unipolar stepper motor in half-step mode

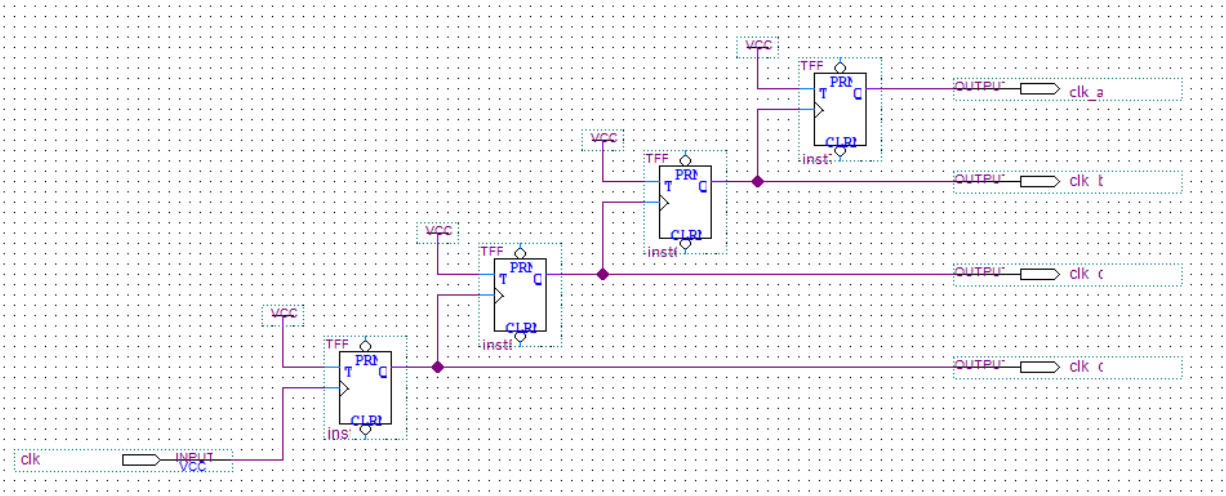

Fig. 3: Frequency divider (FreqDivider)

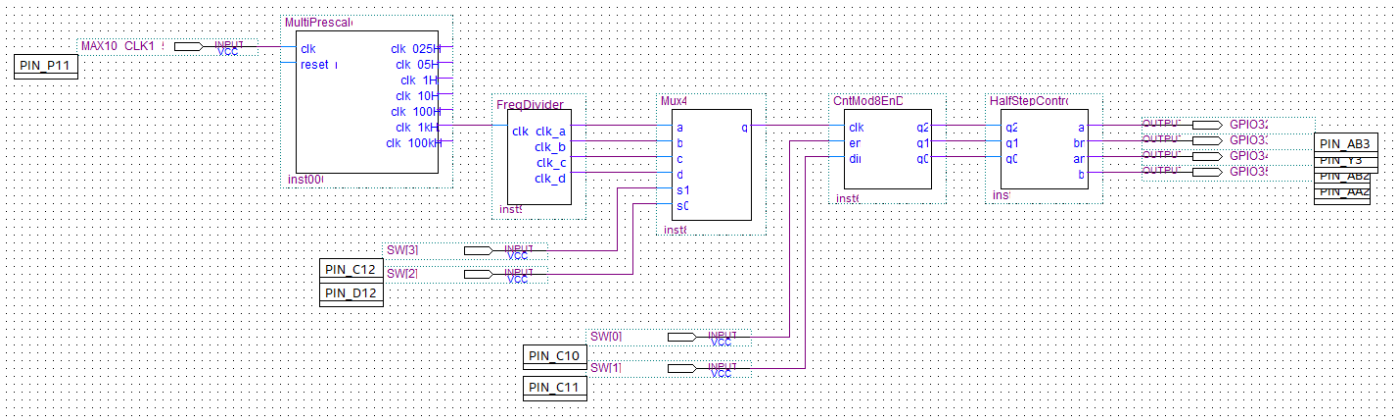

Fig. 4: Unipolar stepper motor driver in Quartus Prime software