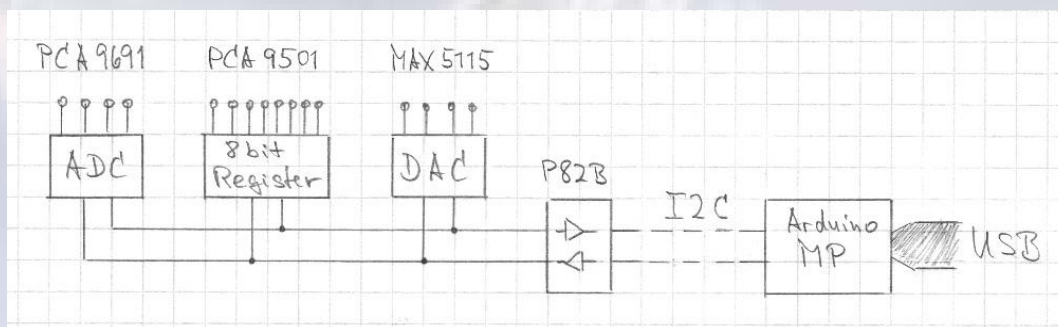


Studienarbeit / Bachelorarbeit

Control of Integrated Circuits through I2C-Bus using USB Interface and GUI in Matlab

Description

In our project MRexcite, a power amplifier for a 7 Tesla MR Imaging system will be designed using a number of commercial integrated circuits (ICs). Certain circuits, like D/A and A/D converters (DAC and ADC) require digital data input for the control of its functions. The digital data transfer will use a serial bus system, the 2-wire Inter-IC (I2C) bus. Remote control from a PC is planned to be realized through the USB interface which controls an Arduino microprocessor, programmed to function as the I2C bus master. Addressing the functions of the target ICs via the bus systems is realized in a Graphical User Interface (GUI) programmed in Matlab



Thesis Task

The thesis task is based on the present design of the power amplifier circuit with a number of ICs incorporating the I2C bus interface and takes advantage of earlier results of thesis work and development regarding the use of the Arduino microprocessor in combination with a control PC.

The task is to design a circuit board for the assembly of a number of ICs which are to be controlled via the I2C bus. The board is to be used as a demonstrator circuit to test the functions of the ICs under bus control and to demonstrate the functionality required for the power amplifier. The ICs are the MAX515 Quad DAC from Maxim, the PCA9691 Quad ADC and the PCA9501 8bit register, both from NXP. The bus is to be buffered by a P82B Bus Extender from NXP. For the interface of the I2C bus to the PC, the available Arduino hard- and software can be used and modified appropriately. A GUI is to be designed and tested which allows the setting of the functions of the board. Finally, the GUI is to be extended to the control of a larger number of boards with identical circuits, yet individually different addresses as this will be the case in our final MRI system incorporating 32 power amplifiers.

The task entails the following steps:

1. Set up the complete schematic for the demonstrator board circuit based on the data sheets of the IC manufacturers and based on earlier thesis reports.
2. Design a PCB layout which also includes suitable test points and assemble (after production of the PCB at our workshop) the circuit and test for DC consumption and correct operating points.
3. Create a program (in Matlab) to control the individual ICs in the circuit board via the I2C bus and the Arduino microprocessor; this can be done based on earlier thesis reports and available Arduino hard- and software.
4. Design and test a GUI for the control of the I2C bus for all functions of the ICs on the board taking into account the purpose of the circuits in our application of a power amplifier.
5. Extend the GUI to control a larger number of equal boards with the same circuits but different addresses as this will be the target application in our MRI system of 32 amplifiers.

At the end of the work, a public presentation of results is to be given.