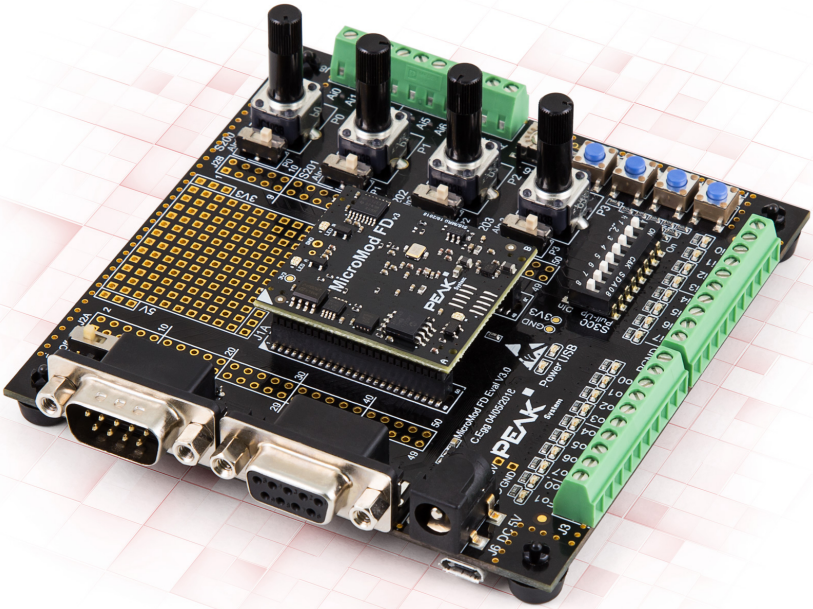
PCAN-MicroMod FD Evaluation

User Manual



PEAK System

Relevant products

Product name	Model	Part number
PCAN-MicroMod FD Evaluation Board	with PCAN-MicroMod FD	IPEH-003081
PCAN-MicroMod FD Evaluation Kit	with PCAN-MicroMod FD, PC-CAN-Interface PCAN-USB FD, and terminated CAN cable	IPEH-003082

The front page shows the Evaluation Board with plugged-in PCAN-MicroMod FD.

Imprint

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Document version 1.0.0 (2019-07-10)

Contents

1 Introduction

The PCAN-MicroMod FD Evaluation Board is a development board for the PCAN-MicroMod FD and allows the conception and development of own circuits with CAN connection and I/O functionality. Via pick-offs, screw terminals, switches, and potentiometers, the user can access the resources of the attached PCAN-MicroMod FD and check configurations or test circuits.

The configuration is done with a supplied Windows software which transfers the configuration data to the module via CAN. The optionally available Evaluation Kit also includes the CAN interface and cable required for this purpose.

This document describes the hardware and function of the Evaluation Board. A separate document is available for the plug-in board PCAN-MicroMod FD itself.

1.1 Features Overview

- Screw terminal connections for all I/Os
- CAN bus connection via D-Sub, 9-pin (in accordance with CiA® 303-1)
- Switchable CAN termination of 120 Ohm
- Pick-offs for all pins of the PCAN-MicroMod FD
- Low-side switches for the digital outputs
- DIP switches for status change of the digital inputs
- Protected digital inputs
- LEDs for digital inputs and outputs
- 4 potentiometers for analog inputs
- Soldering fields for individual additional wiring
- RS-232 connection with V.24 signal levels for direct access to the microcontroller
- 4-bit rotary coding switch for setting the module ID

- Configuration via the CAN bus with the Windows software PCAN-MicroMod FD Configuration
- Firmware upload via CAN, USB, or RS-232; switchable via 3 buttons
- Reset button for restarting the board
- Voltage supply 5 V via Micro-USB connection or barrel connector
- Operating temperature range from 0 to 70 °C (32 to 185 °F)
- Board 100 x 102 mm with rubber feet

1.2 Operation Requirements

- Plugged-in PCAN-MicroMod FD
- Power supply 5 V DC, either via the provided USB cable or via the barrel connector (separate power supply unit required).
- For the creation and transfer of a configuration:
  Computer with Windows 10, 8.1, 7 (32/64-bit) and a CAN interface of the PCAN series*

* The CAN interface PCAN-USB FD is included with the purchase of the PCAN-MicroMod Evaluation Kit.

1.3 Scope of supply Board (IPEH-003081)

- Plug-in board PCAN-MicroMod FD (IPEH-003080)
- PCAN-MicroMod FD Evaluation Board (motherboard)
- USB cable for power supply
- Configuration software for Windows
- Manuals in PDF format

1.4 Scope of supply Kit (IPEH-003082)

As above (IPEH-003081) and in addition:

- PC-CAN interface PCAN-USB FD (IPEH-004022)
- CAN cable, terminated with 2 x 120 Ω, 2 m (IPEK-003001)

2 Setting Up the Evaluation Kit for Operation

This chapter gives a quick overview of the needed steps for the straightforward startup of the Evaluation Kit.

Attention! Electrostatic discharge (ESD) can damage or destroy components on the circuit board. Take precautions to avoid ESD when handling the circuit board.

Do the following for the setup:

1. On the PC under Windows, install the device driver for the PCAN-USB FD from the supplied data carrier.
2. Use the CAN cable to connect the PCAN-USB FD to the Evaluation Board (connector J4 CAN).
3. Plug the PCAN-USB FD into a USB port of the PC.
4. In order to supply the Evaluation Board with power, use the USB cable to connect the Evaluation Board to a USB port on the computer or to a power supply unit.
5. Under Windows, install the program PCAN-MicroMod FD Configuration from the provided data carrier (Tools section).
6. Start PCAN-MicroMod FD Configuration, create a configuration, and eventually transfer it to the PCAN-MicroMod FD (see program help).

You can now work with signals at the I/O ports as defined in the configuration. Please observe the explanations in the following chapter. On the PC, you can use the CAN monitor PCAN-View to watch and send CAN messages.

3 Components of the Evaluation Board

This chapter describes the function units and connectors of the Evaluation Board. For details you can also refer to the circuit diagram, Appendix B *Circuit Diagram Evaluation Board* on page 30.

3.1 Socket for PCAN-MicroMod FD (J1A/J1B)

For orientation when plugging the MicroMod FD onto the evaluation board, white triangular markings are provided both on the MicroMod FD (upper left corner) and on the Evaluation Board. These markings must align.

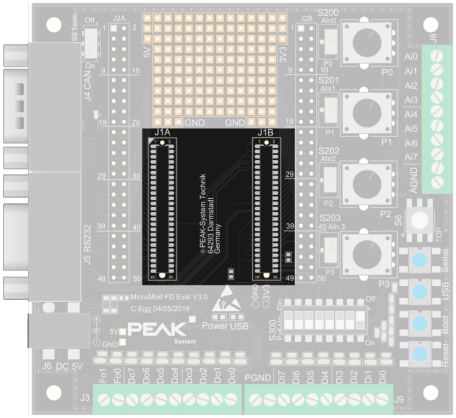


Figure 1: Socket for the PCAN-MicroMod FD

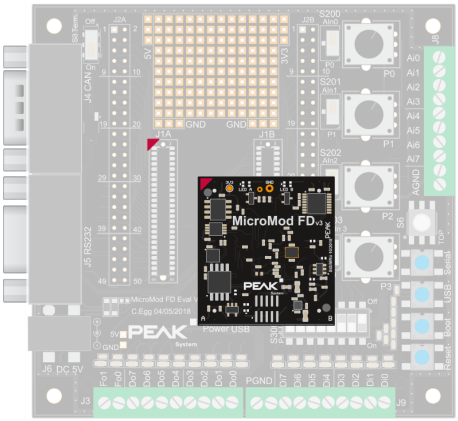


Figure 2: Positionining marking on the PCAN-MicroMod FD and on the Evaluation Board

Via the test points of the fields J2A and J2B, which are arranged laterally to the socket strips for the MicroMod FD, each pin of the plugged-on MicroMod FD can be accessed directly.

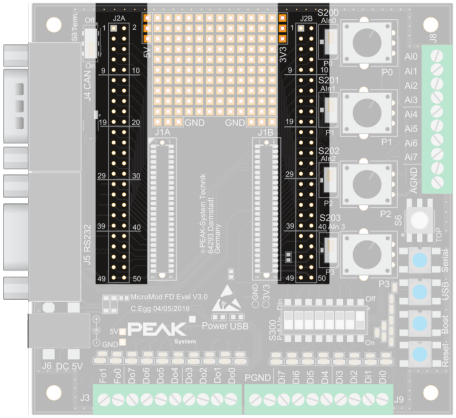


Figure 3: Test point fields J2A and J2B for all pins of the PCAN-MicroMod FD

3.2 Power Supply (J6, J7)

The Evaluation Board requires a supply voltage of 5 V DC. It can be applied either via the Micro USB connector or the barrel connector.

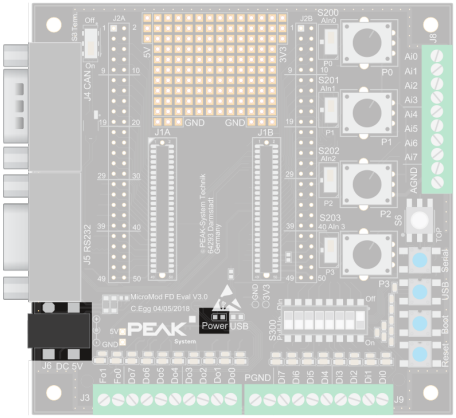


Figure 4: Barrel connector J6 for voltage supply, Power LED,
Micro USB connector J7 in the same area on the bottom side of the board (not visible in this figure)

Figure 5: Polarity of the supply socket

Figure 6: Diameter of barrel connector: a = 5.5 mm, b = 2.5 mm; minimum length: 11 mm

The Power LED indicates that the Evaluation Board is supplied.

3.3 CAN Connection (J4)

The 9-pin D-Sub male connector J4 is used for CAN connection, positioned on the upper right of the Evaluation Board. The pin assignment of the CAN connector

corresponds to the specification CiA® 303-1.

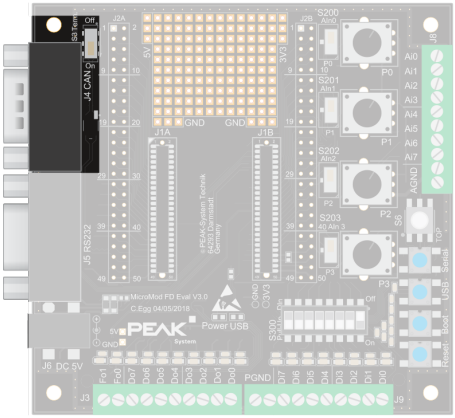


Figure 7: CAN connector and switch for the CAN bus termination

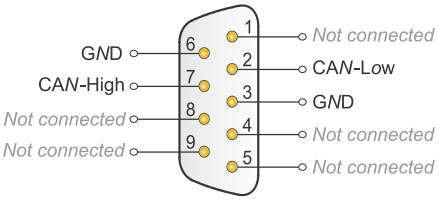


Figure 8: Assignment of the D-Sub male connector for CAN

CAN Bus Termination

If the Evaluation Board is connected to one end of the High-speed CAN bus and the CAN bus is not terminated at that end, a termination can be activated on the Evaluation Board. For this purpose, switch S3 (next to the CAN connector) must be set to the *On* position.

For better electromagnetic compatibility, a split termination is implemented.

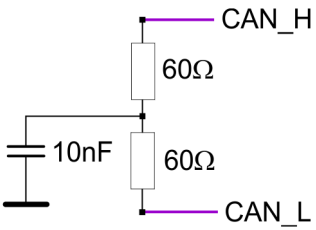


Figure 9: Split termination for the High-speed CAN bus

3.4 Analog Inputs (J8) and Potentiometers

The Evaluation Board has 8 analog inputs (Ai0 to Ai7). The corresponding connector is J8 (screw terminals on the upper right).

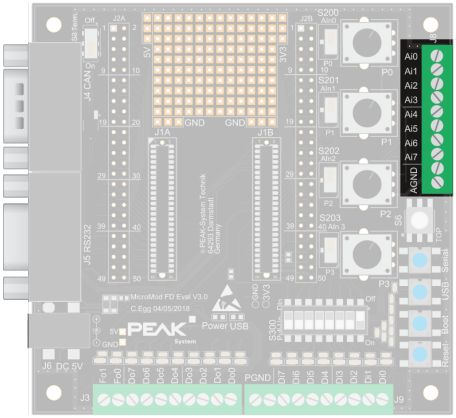


Figure 10: Screw terminals J8 for analog inputs

The analog reference voltage is 3.0 V. The input impedance is 11 kΩ.

The Evaluation Board has 4 potentiometers (P0 to P3) which can be used for simulating input signals. Using the switches S200 to S203, the analog inputs Ai0 to Ai3 are disconnected from the screw terminals and connected to the respective potentiometer.

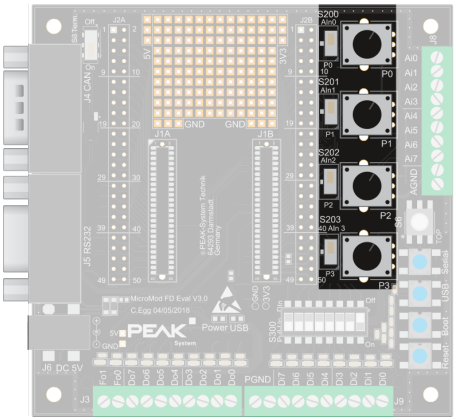


Figure 11: Potentiometers for analog inputs Ai0 to Ai3

3.5 Digital Inputs (J9)

The Evaluation Board has 8 digital inputs with TTL levels (Di0 – Di7). The corresponding connector is J9 (screw terminals, bottom right).

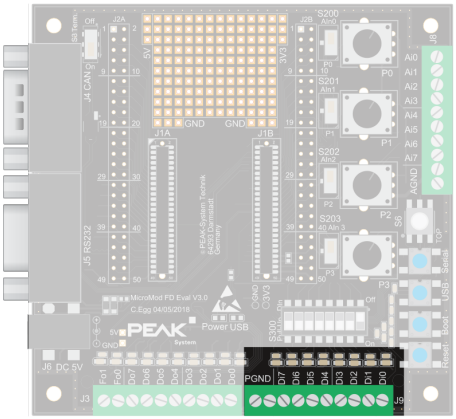


Figure 12: Screw terminals for digital inputs with associated DIP switches and LEDs

The inputs each have a pull-down resistor and are High-active. The switching thresholds are below 2.2 V to the Low state and above 3.3 V to the High state. Each input status is indicated by an LED.

For test purposes, the individual input signals can be switched via the DIP switches S300. A DIP switch activates a pull-up resistor with 2.7 kΩ to the 5-Volts supply. It can be permanently activated if a low-active signal is fed to the input via the screw terminal (e.g. push button connected to ground).

Signals that directly lead to the MicroMod FD can be accessed on the following points of the field J2B:

Pin on J2B	Processed input signal (inverted)
31	Di0
33	Di1
35	Di2
37	Di3
39	Di4
41	Di5
43	Di6
45	Di7

3.6 Digital and Frequency Outputs (J3)

The Evaluation Board has 8 digital outputs (Do0 to Do7) and two frequency outputs (Fo0 and Fo1). Each output status is indicated by an LED. An illuminated LED corresponds to the active state.

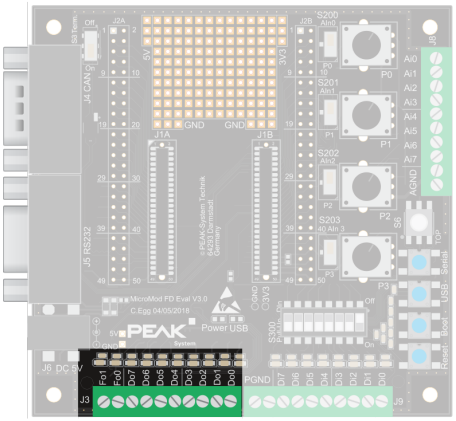


Figure 13: Screw terminals J3 for digital outputs and frequency outputs with associated LEDs

3.7 Module Number (S2)

The module number is used for the identification of a single MicroMod FD on the CAN bus when configurations are sent and received. The rotary switch can be used to set a module number from 0 to 15 (hexadecimal 0 to F).

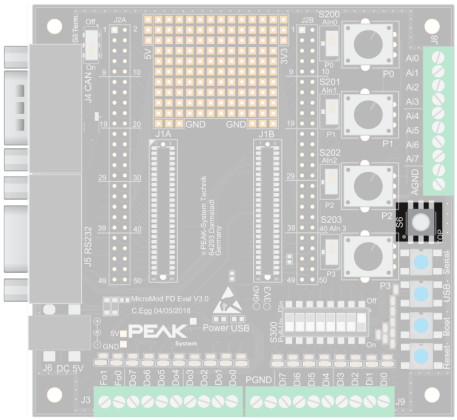


Figure 14: Rotary switch for module number, position 0 on the left

Each MicroMod FD connected to the CAN bus must have a unique module number for the configuration process, else unpredictable configuration results may occur.

The set module number has no influence on the CAN communication during normal operation. If there are several MicroMod FD on the CAN bus, various configurations must be used to ensure that there is no overlap in the transmit CAN IDs.

3.8 RS-232 Connector (J5)

The RS-232 connector can alternatively be used for transferring firmware to the PCAN-MicroMod FD. You need a suitable flashing tool, e.g. Flash Magic (www.-flashmagic-tool.com), and a firmware file in hex format.

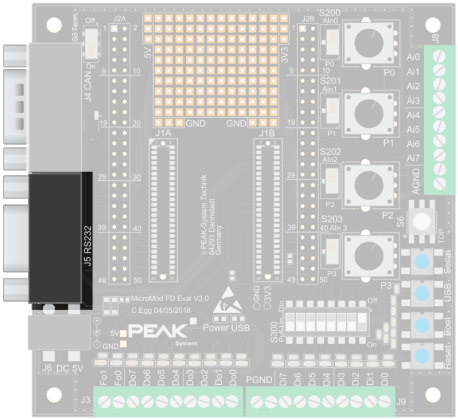


Figure 15: RS-232 connector

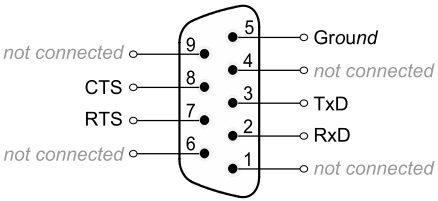


Figure 16: Pin assignment of the D-Sub socket for RS-232

3.9 USB Connector (J7)

The Micro USB connector is located on the left edge of the Evaluation Board, on the bottom side of the board. Primarily, it is used for voltage supply of the Evaluation Board with 5 V DC.

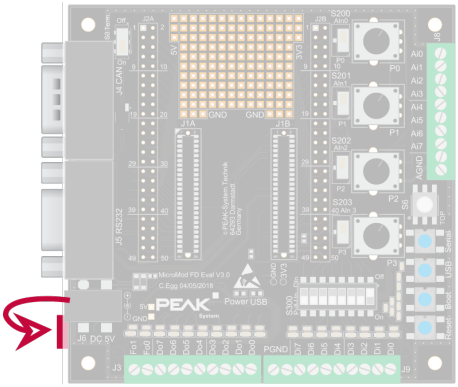


Figure 17: Micro USB socket on the bottom side of the Evaluation Board

In addition, the USB connector can be used as one possibility to transfer firmware to the PCAN-MicroMod FD.

3.10 Push Buttons for Reset and Flash Mode

The four blue push buttons located on the lower right side have the following functions:

Push button	Function
Reset	Reset of the PCAN-MicroMod FD, restart of the firmware
Boot	Flash mode for a firmware update via CAN
USB	Flash mode for a firmware update via USB
Serial	Flash mode for a firmware update via RS-232

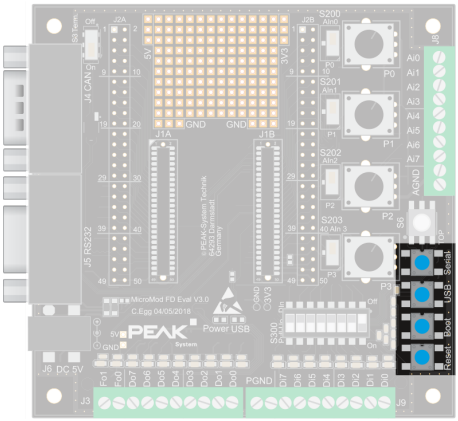


Figure 18: Blue push buttons

More information about the procedure for firmware update is available in chapter 4 *Firmware Update of the PCAN-MicroMod FD* on the next page.

4 Firmware Update of the PCAN-MicroMod FD

The PCAN-MicroMod FD can be equipped with new firmware in three different ways:

- via CAN bus
- via USB connection (easiest way on the Evaluation Board)
- via serial RS-232 interface (only for special purposes)

The following sections describe the procedures. Step through all subsections in a section.

4.1 Firmware Update via CAN Bus

4.1.1 System Requirements

- Computer with operating system Windows 10, 8.1, 7 (32/64-bit)
- CAN interface of the PCAN series installed in/attached to the computer
- CAN cabling between the CAN interface and the Evaluation Board with proper termination (120 Ω on each end of the CAN bus)

4.1.2 Activating the Flash Mode

Do the following to set the PCAN-MicroMod FD to flash mode for CAN:

1. Make sure that the Evaluation Board is supplied with power (*Power* LED on the Evaluation Board is on).
2. Press and hold the button for the *Boot* flash mode.
3. Briefly press the *Reset* button.

4. Keep the button for the flash mode pressed for at least 1 second and then release it.

   LED B on the MicroMod FD blinks quickly orange.

4.1.3 Preparing the Software

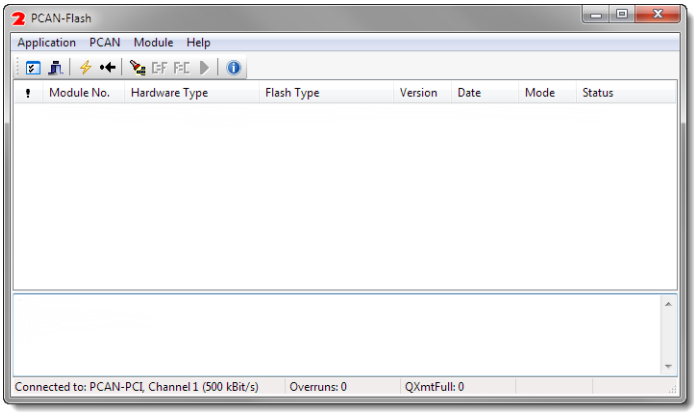
PCAN-Flash must be started from a data carrier which is also writable, otherwise the program's configuration (`PcanFlash.ini` file) cannot be saved. The program doesn't work properly if it is run from a DVD. This is reflected, for example, by and error message when selecting a CAN connection.

Make sure that the PCAN-Flash directory is located on a local hard disk, for example, (if necessary, copy it from DVD) and that there are write permissions in the directory, and execute PCAN-Flash from there.

4.1.4 Uploading the Firmware

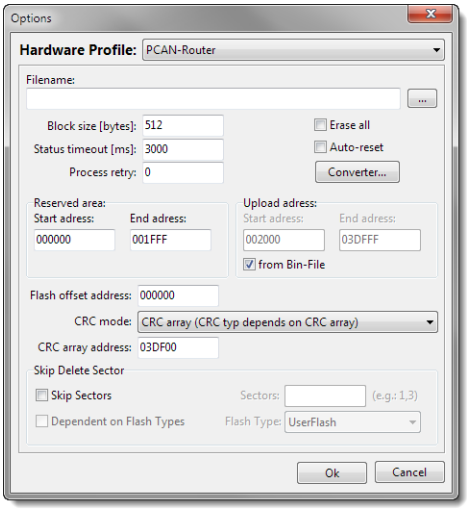
Do the following to update the firmware:

1. Under Windows, run the `PcanFlash.exe`program from the local hard disk.

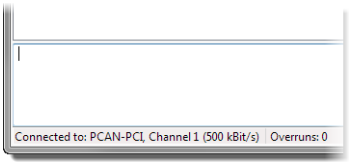


2. Click on the (Options) button in order to open the corresponding dialog box.

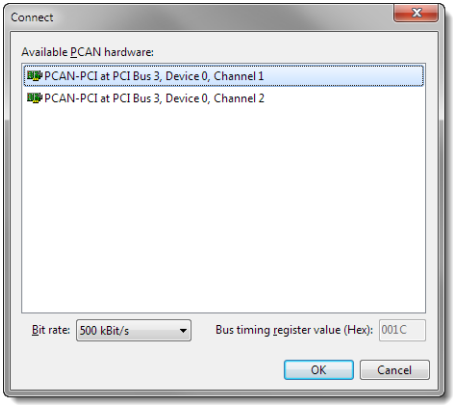
3. In the drop-down list *Hardware Profile*, select the *PCAN-MicroMod FD* entry.



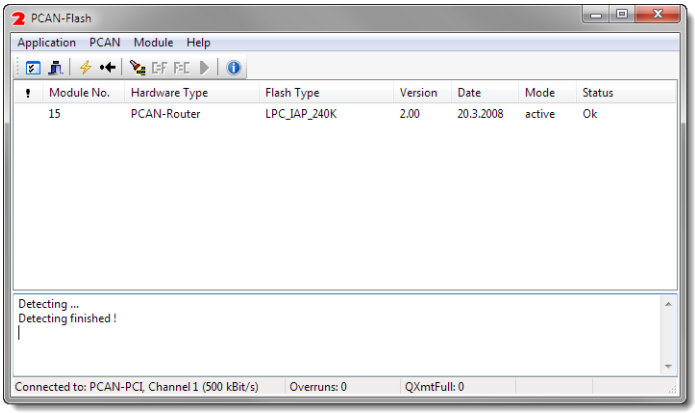
4. Click on the … (3 dots) button next to the *File name* field in order to select the desired firmware file (`*.bin`) for the update.
5. Click on *OK*.
6. Make sure that the PCAN-Flash program is connected with 500 kbit/s to the available CAN interface on the computer.



If not, click the ⚡ (Connect) button in order to change the selection in the according dialog box.



7. Click the (Detect) button in order to detect the PCAN-MicroMod FDbeing connected to the CAN bus. A corresponding entry appears in the main window.



8. Select the entry for the PCAN-MicroMod FD.
9. Click the (Program) button in order to start update process.

   The process was successful if as last message ”Flashing of module(s) finished!" appears in the status area.

10. Restart the MicroMod FD (e.g. with the blue Reset button).

4.2 Firmware Update via USB Connection

4.2.1 System Requirements

- Any operating system on the PC
- USB connection between Evaluation Board and PC

4.2.2 Activating the Flash Mode

Do the following to set the PCAN-MicroMod FD to flash mode for USB:

1. Make sure that the Evaluation Board is supplied with power (*Power* LED on the Evaluation Board is on).
2. Press and hold the button for the *USB* flash mode.
3. Briefly press the *Reset* button.
4. Keep the button for the flash mode pressed for at least 1 second and then release it.

   LEDs A and B on the MicroMod FD stay off.

   In the operating system of the connected PC, the MicroMod FD appears as USB mass storage device "CRP DISABLD".

4.2.3 Uploading the Firmware

1. On the PC, open the folder of the connected USB mass storage device.

   The folder contains the (virtual) file `firmware.bin` as the only entry.
2. Delete the `firmware.bin` file on the USB mass storage device.
3. On the PC, rename the file with the new firmware for the MicroMod FD to `firmware.bin` (observe lower case).
4. Copy the new firmware file to the USB mass storage device and wait for the end of the copy process (takes up to 10 seconds).

5. Disconnect the USB cable between PC and evaluation board.
6. Restart the MicroMod FD (e.g. with the blue Reset button).

4.3 Firmware Update via Serial RS-232 Interface

4.3.1 System Requirements

- Serial RS-232 port on the computer (D-Sub, 9-pin, m)
- Serial 1:1 cable with D-Sub connectors, 9-pin, m-f (not included in the scope of supply of the Evaluation Board)
- Operating system Windows 10, 8.1, 7 (32/64-bit)
- Freely available Windows program Flash Magic (www.flashmagictool.com)
- Firmware file in Hex format (`*.hex`)

4.3.2 Activating the Flash Mode

Do the following to set the PCAN-MicroMod FD to flash mode for RS-232:

1. Make sure that the Evaluation Board is supplied with power (*Power* LED on the Evaluation Board is on).
2. Press and hold the button for the *Serial* flash mode.
3. Briefly press the *Reset* button.
4. Keep the button for the flash mode pressed for at least 1 second and then release it.

   LEDs A and B on the MicroMod FD stay off.

4.3.3 Uploading the Firmware

1. On the PC, start the Windows program Flash Magic.
2. In the *Device* area, click on *Change* and select *LPC54000* > *UART* > *LPC54618J512*.

3. For *Serial Port*, select the RS-232 interface being used on the PC and set the *Baudrate* to *57600*.
4. In the *Erase* area, select the entry *Sectors used by file* entry from the dropdown list.
5. In the *Options* area, enable *Verify after Programming*.
6. In the *Firmware* area, specify the desired firmware file (`*.hex`), either by typing or via *Browse*.
7. Click on *Start* in order to initiate the firmware update.
8. As soon as the update procedure is completed (*Finished* message), close the Flash Magic program and restart the MicroMod FD (e.g. with the blue Reset button).

5 Technical Specifications Evaluation Board

Supply	
Supply voltage	5 V DC
Connection options	Supply socket for barrel plug 5.5 mm outside/2.5 mm inside Micro USB socket
Current consumption	max. 300 mA (incl. PCAN-MicroMod FD)

Digital inputs	
Count	8
Levels	Low-active
Switching thresholds	1: U > 3.3 V typ. 0: U < 2.2 V typ.
Additional circuits	DIP switches

Analog inputs	
Count	8
Input voltage	0 – 33 V
Resolution	12 bits
Sample rate	1 kHz
Input impedance	11 kΩ
Additional circuits	Inputs Ai0 to Ai3 individually switchable to potentiometers P0 to P3

Digital outputs	
Count	8
Type	Low-side switch
Load	max. 900 mA per output

Frequency/PWM outputs

Count	2
Maximum frequency	10 kHz

CAN

Transmission standard	High-speed CAN ISO 11898-2
Termination	120 Ω, can be enabled with switch
Connection	D-Sub 9-pin m, assignment according to CiA® 303-1

Measures

Size of circuit board	100 x 102 mm
Weight	83 g without PCAN-MicroMod FD 92 g with PCAN-MicroMod FD

Environment

Operating temperature	0 – +85 °C (32 – 185 °F)
Temperature for storage and transport	–40 – +100 °C (–40 – +212 °F)
Relative humidity	15 – 90 %, not condensing

Appendix A Dimension Drawing

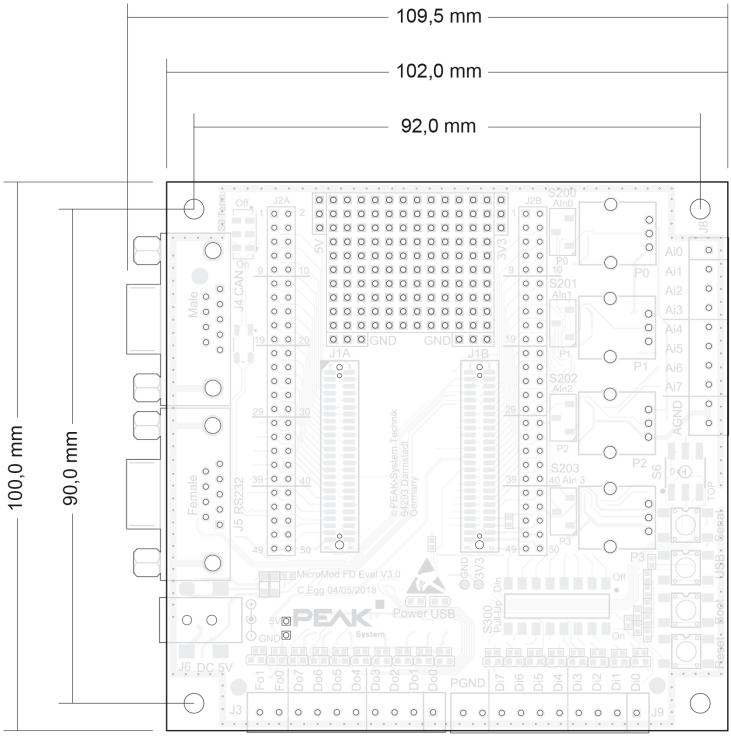
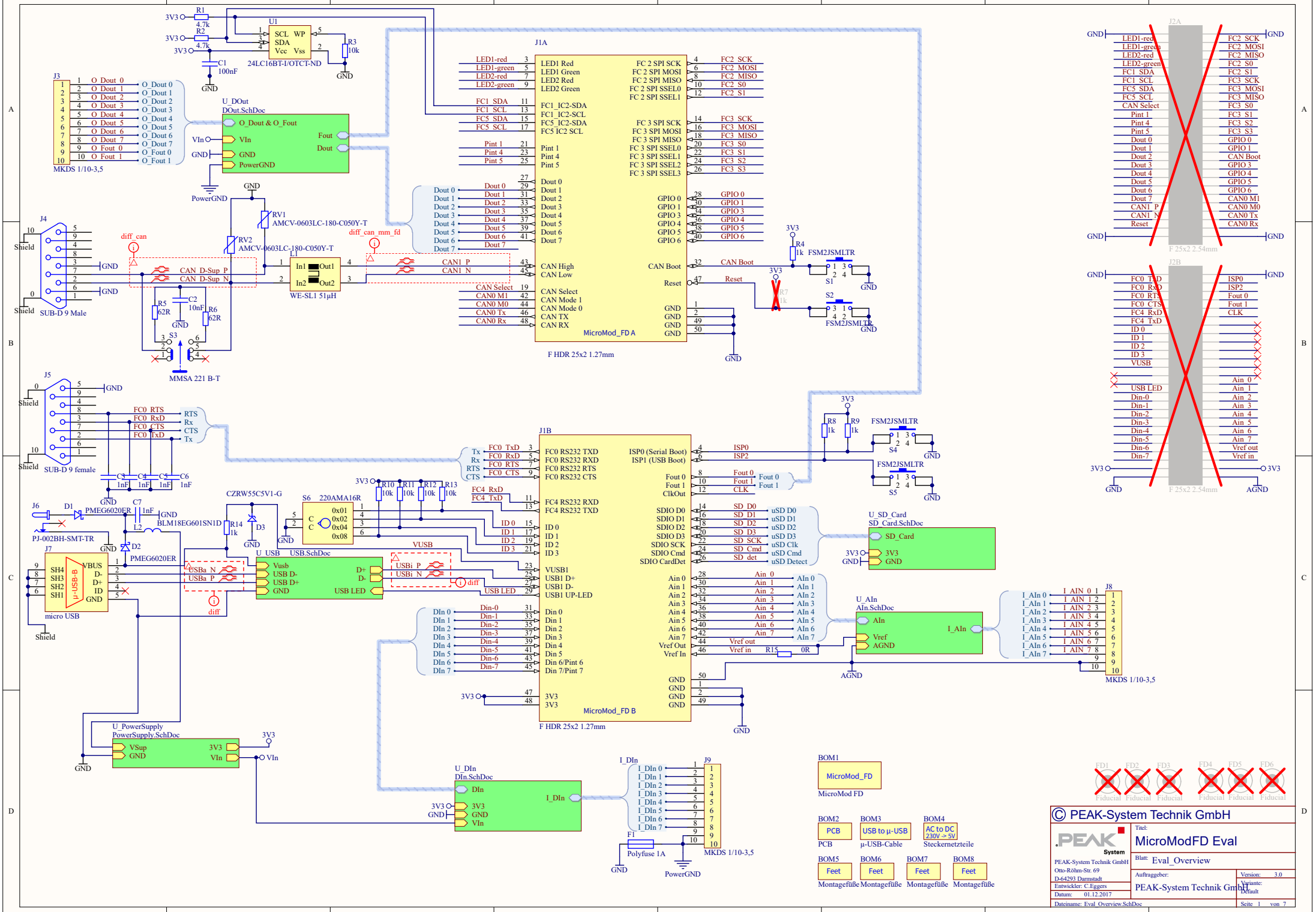


Figure 19: The scale of the drawings differs from an 1-to-1 representation.

Appendix B Circuit Diagram Evaluation Board

The following pages show the electronic circuit diagram of the Evaluation Board for the PCAN-MicroMod FD. For example, it can be used as a reference for your own MicroMod FD circuitry.


J1A
MicroMod_FD A
F HDR 25x2 1.27mm
J1B
MicroMod_FD B
F HDR 25x2 1.27mm
J2A
J2B
F 25x2 2.54mm
U_DOut
DOut.SchDoc
O_Dout & O_Fout
MKDS 1/10-3,5
SUB-D 9 Male
SUB-D 9 female
WE-SL1 51µH
MMSA 221 B-T
24LC16BT-I/OTCT-ND
U_USB
USB.SchDoc
micro USB
U_SD_Card
SD_Card.SchDoc
U_AIn
AIn.SchDoc
U_DIn
DIn.SchDoc
U_PowerSupply
PowerSupply.SchDoc
Polyfuse 1A
FSM2JSMLTR
220AMA16R
PMEG6020ER
BLM18EG601SN1D
CZRW55C5V1-G
PJ-002BH-SMT-TR
AMCV-0603LC-180-C050Y-T
diff_can
diff_can_mm_fd
CAN_D-Sup_P
CAN_D-Sup_N
MicroMod FD
PCB
µ-USB-Cable
Steckernetzteile
Montagefüße
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Otto-Röhm-Str. 69
D-64293 Darmstadt
Titel: MicroModFD Eval
Blatt: Eval_Overview
Auftraggeber: PEAK-System Technik GmbH
Entwickler: C.Eggers
Datum: 01.12.2017
Dateiname: Eval_Overview.SchDoc
Version: 3.0
Variante: Default
Seite 1 von 7

D1/D2 (PMEG6020ER)

Max limits
V r max = 60V
I f max = 2A

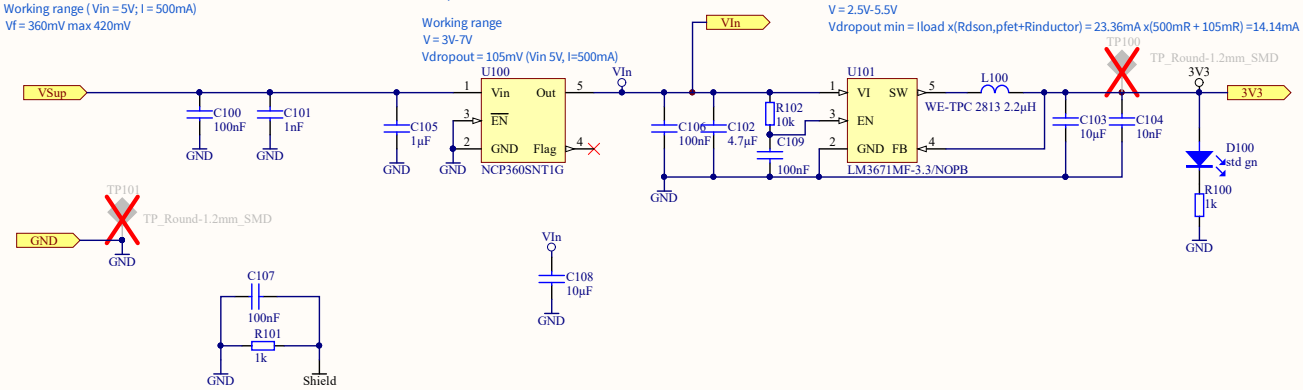
Working range (Vin = 5V; I = 500mA)
Vf = 360mV max 420mV

Max limits values +85°C; Vin = 5V; I = 500mA
Vin = 1.2V-20V
Imax = 500mA
Vdropout max = 200mV

Working range
V = 3V-7V
Vdropout = 105mV (Vin 5V, I=500mA)

Max limits values +85°C; Vin = 5V; I = 500mA
Vmax = 6V
Imax = 600mA
Vdropout max = Iload x(Rdson,pfet+Rinductor) = 500mA x(500mR + 105mR) =302.5mA

Working range
V = 2.5V-5.5V
Vdropout min = Iload x(Rdson,pfet+Rinductor) = 23.36mA x(500mR + 105mR) =14.14mA



Imin = 23.36mA

Imax = 162.75+MicroMod_FD

VIn Max = 5V + Vf + U100 Vdropout + U101 Vdropout
VIn Max = 5V + 0.36V + 0.105V + 0.01414V
VIn Max =5.47V

VIn min = 3.3V +Vfmax + U100 Vdropout max + U101 Vdropout max
VIn min = 3.3V +0.42V+0.2V+0.302V
VIn min = 4.22V

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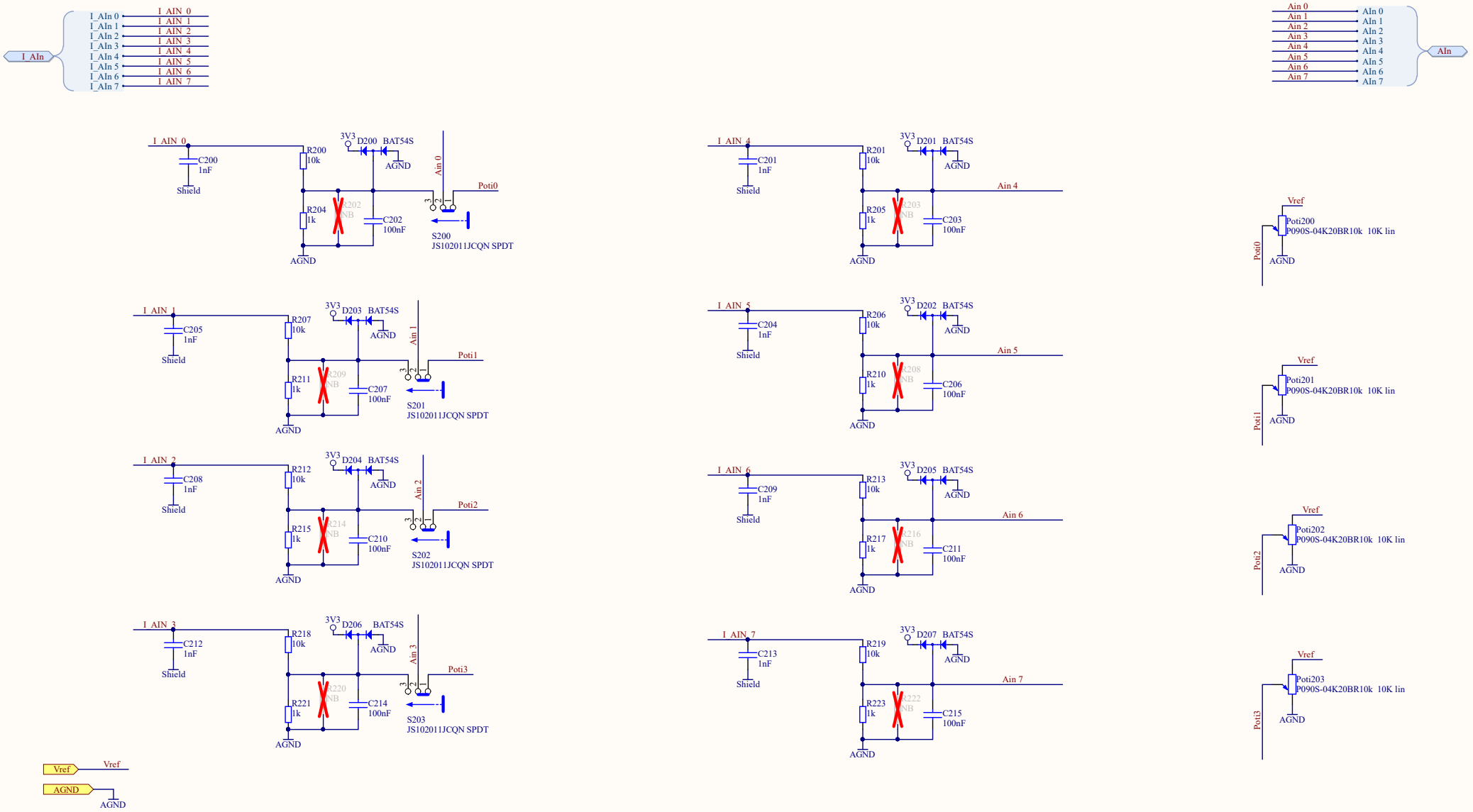
Entwickler: C.Eggers
Datum: 01.12.2017
Dateiname: PowerSupply.SchDoc

Titel: MicroModFD Eval
Blatt: PowerSupply
Auftraggeber: PEAK-System Technik GmbH
Version: 3.0
Variante: Default
Seite 2 von 7



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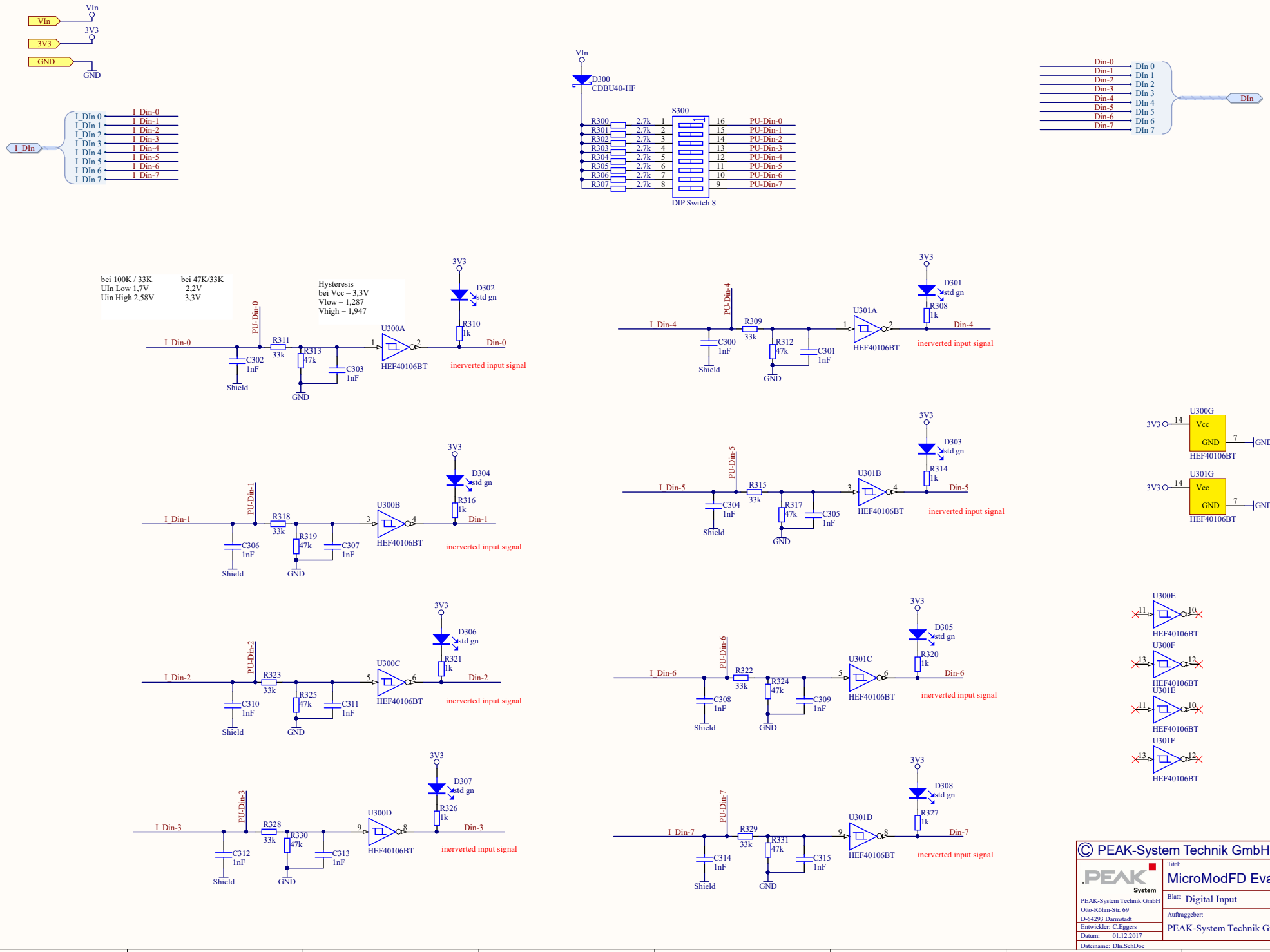
Entwickler: C.Eggers
Datum: 01.12.2017
Dateiname: AIn.SchDoc

Titel: MicroModFD Eval
Blatt: Analog Input
Auftraggeber: PEAK-System Technik GmbH
Version: 3.0
Variante: Default
Seite 3 von 7


VIn
3V3
GND
I_DIn
I_Din-0
I_Din-1
I_Din-2
I_Din-3
I_Din-4
I_Din-5
I_Din-6
I_Din-7
D300
CDBU40-HF
S300
DIP Switch 8
PU-Din-0
PU-Din-1
PU-Din-2
PU-Din-3
PU-Din-4
PU-Din-5
PU-Din-6
PU-Din-7
DIn
bei 100K / 33K
ULn Low 1,7V
Uin High 2,58V
bei 47K/33K
2,2V
3,3V
Hysteresis
bei Vcc = 3,3V
Vlow = 1,287
Vhigh = 1,947
HEF40106BT
inverted input signal
Shield
GND
U300A
U300B
U300C
U300D
U300E
U300F
U300G
U301A
U301B
U301C
U301D
U301E
U301F
U301G
Vcc
D302
D301
D304
D303
D306
D305
D307
D308
std gn
R310
R308
R316
R314
R321
R320
R326
R327
1k
R311
R309
R318
R315
R323
R322
R328
R329
33k
R313
R312
R319
R317
R325
R324
R330
R331
47k
C302
C300
C306
C304
C310
C308
C312
C314
C303
C301
C307
C305
C311
C309
C313
C315
1nF
R300
R301
R302
R303
R304
R305
R306
R307
2.7k
Din-0
Din-1
Din-2
Din-3
Din-4
Din-5
Din-6
Din-7
DIn 0
DIn 1
DIn 2
DIn 3
DIn 4
DIn 5
DIn 6
DIn 7
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PEAK System
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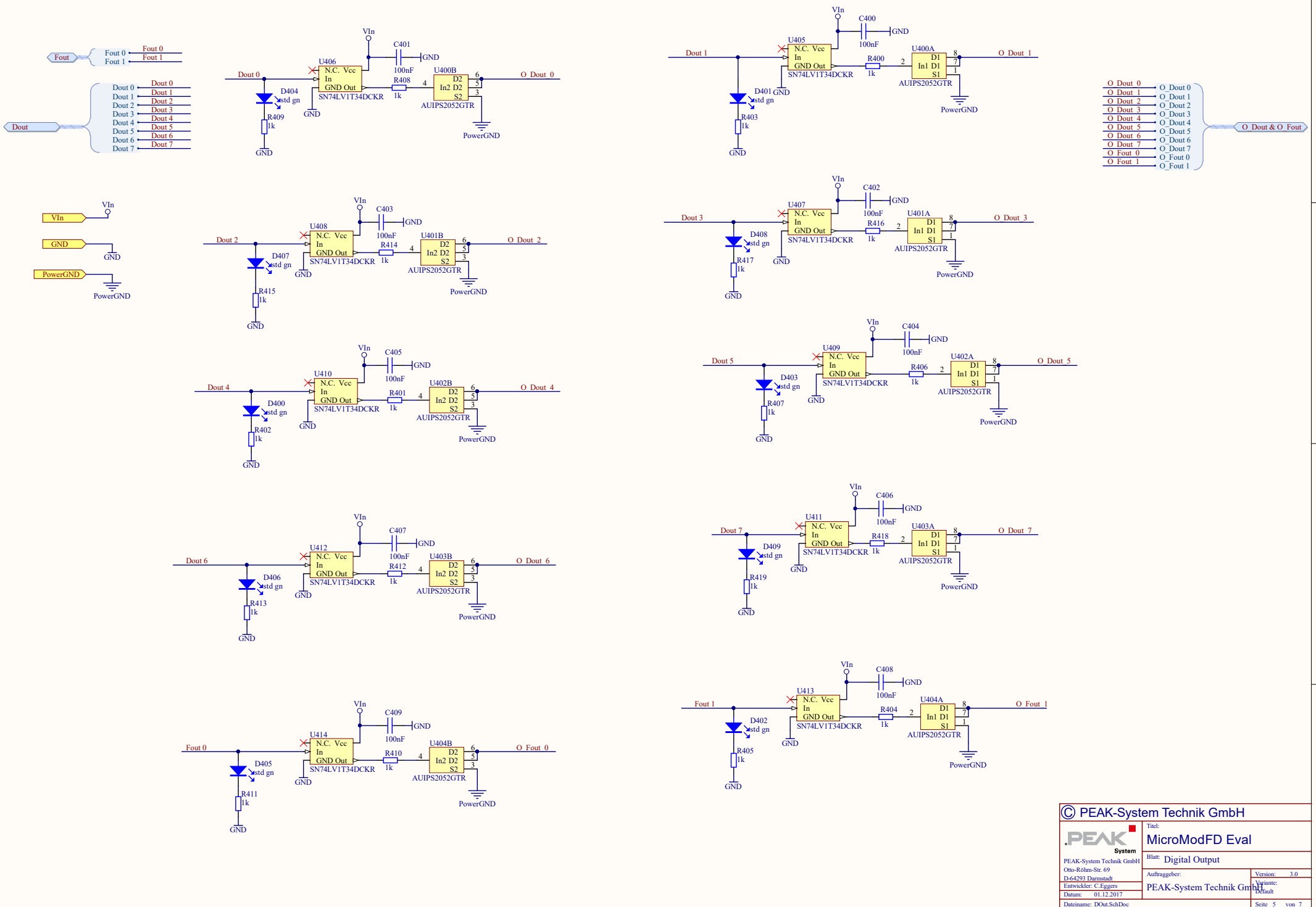
Entwickler: C.Eggers
Datum: 01.12.2017
Dateiname: DIn.SchDoc
Titel:
MicroModFD Eval
Blatt: Digital Input
Auftraggeber:
PEAK-System Technik GmbH
Version: 3.0
Variante: Default
Seite 4 von 7


Fout
Fout 0
Fout 1
Dout
Dout 0
Dout 1
Dout 2
Dout 3
Dout 4
Dout 5
Dout 6
Dout 7
VIn
GND
PowerGND
U406
N.C. Vcc
In
GND Out
SN74LV1T34DCKR
C401
100nF
R408
1k
U400B
D2
In2 D2
S2
AUIPS2052GTR
D404
std gn
R409
O_Dout_0
U405
C400
R400
U400A
D401
R403
O_Dout_1
U408
C403
R414
U401B
D407
R415
O_Dout_2
U407
C402
R416
U401A
D408
R417
O_Dout_3
U410
C405
R401
U402B
D400
R402
O_Dout_4
U409
C404
R406
U402A
D403
R407
O_Dout_5
U412
C407
R412
U403B
D406
R413
O_Dout_6
U411
C406
R418
U403A
D409
R419
O_Dout_7
U414
C409
R410
U404B
D405
R411
O_Fout_0
U413
C408
R404
U404A
D402
R405
O_Fout_1
O_Dout_0
O_Dout_1
O_Dout_2
O_Dout_3
O_Dout_4
O_Dout_5
O_Dout_6
O_Dout_7
O_Fout_0
O_Fout_1
O_Dout & O_Fout
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Entwickler: C.Eggers
Datum: 01.12.2017
Dateiname: DOut.SchDoc
Titel:
MicroModFD Eval
Blatt: Digital Output
Auftraggeber:
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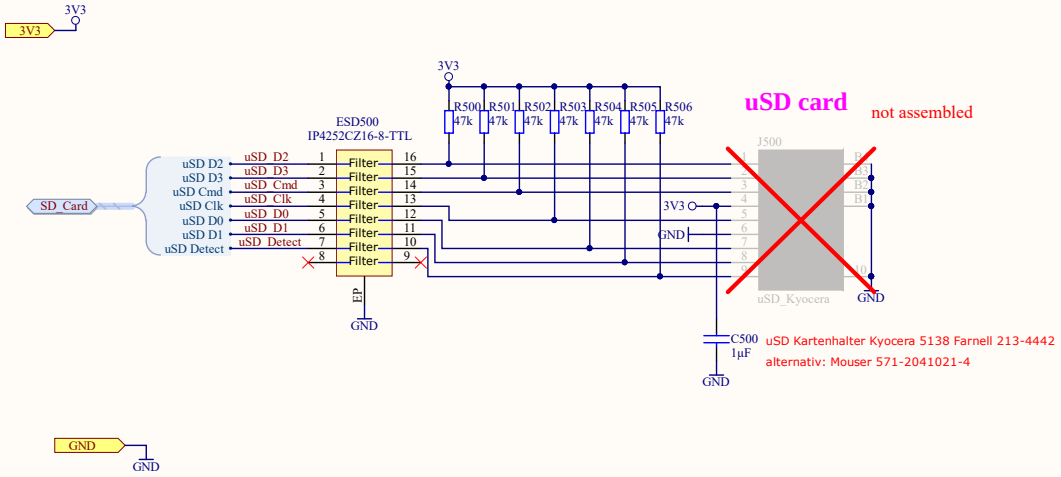
Version: 3.0
Variante: Default
Seite 5 von 7



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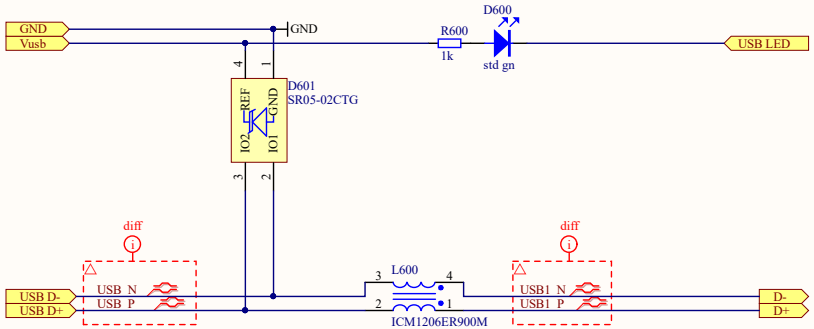
Entwickler: C.Eggers
Datum: 01.12.2017
Dateiname: SD_Card.SchDoc

Titel: MicroModFD Eval
Blatt: SD_Card
Auftraggeber: PEAK-System Technik GmbH
Version: 3.0
Variante: Default
Seite 6 von 7



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Entwickler: C.Eggers
Datum: 01.12.2017
Dateiname: USB.SchDoc

Titel: MicroModFD Eval

Blatt: USB Port

Auftraggeber: PEAK-System Technik GmbH

Version: 3.0

Variante: Default